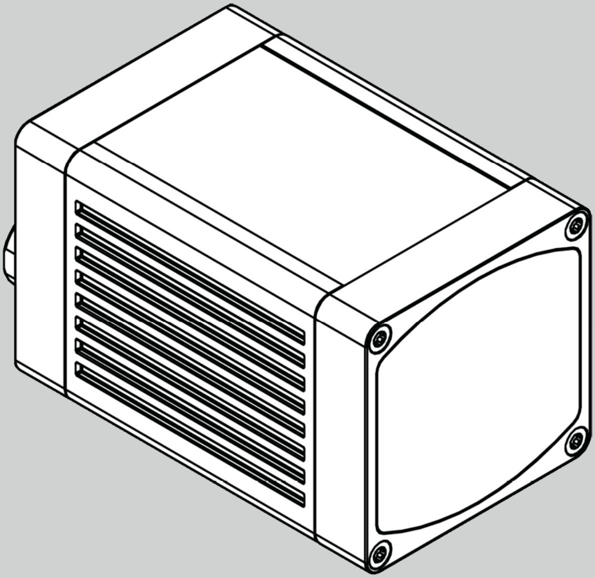
SBSA/SBSX

Vision sensor

Communications manual
Software version 2.4



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- Original operating instructions -

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c UL US
LISTED
IND. CONT. EQ.
77HA
For use in class 2 circuits

For use in NFPA 79 Applications only

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1 Information on this document

1.1 Explanation of symbols

Warnings

CAUTION / WARNING / DANGER
This symbol is used to indicate a potentially hazardous situation that, if not avoided, could result in death or serious injury.

WARNING
This symbol is used to indicate potentially hazardous situations arising from laser beams.

ATTENTION:
This symbol is used to indicate text that must be observed without fail. Failure to do so may result in bodily injury or property damage.

NOTE:
This symbol is used to highlight useful tips and recommendations, as well as information intended to help ensure efficient operation.

Detectors

- Pattern matching
- Contour
- Contrast
- Brightness
- Gray
- Caliper
- BLOB
- Contour 3D
- Barcode
- Datacode
- OCR
- Color Value
- Color List
- Color Area
- Result processing
- Target Mark 3D

Alignment

Alignment
Includes the position detectors: Contour matching, Pattern matching, and Edge detector

1.2 Additional documents

The following documents for the SBS vision sensor are available for download in the Download area of the Festo website.

- SBS Communications manual
- SBS User Manual
- SBS Operating instructions

Furthermore, these documents are part of the software installation and can be found in the subfolder "...\Documentation\", as well as via the Windows Start menu.

1.3 Document version

This manual describes the SBS software version 2.4.

2 Network connection

2.1 Integrating the SBS into the network / gateway

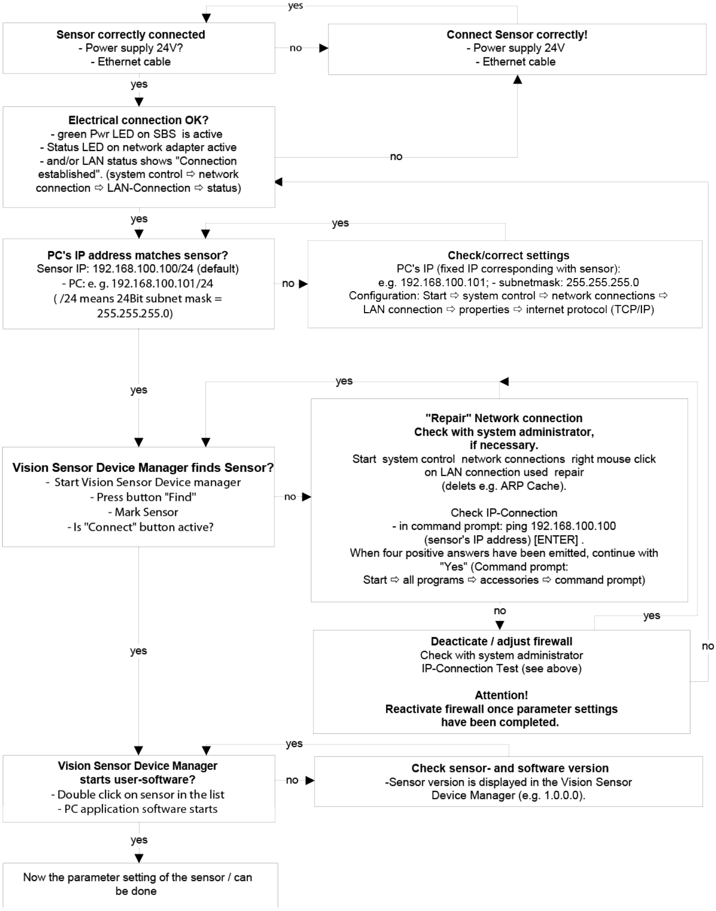
Vision Sensor Device Manager/Active sensors will show a list with all the SBS vision sensors that are found on the same network segment on the PC on which is running Vision Sensor Device Manager. To update the list, press the "Find" button, e.g. for sensors that were only activated after viewing Vision Sensor Device Manager.

For sensors which are installed in the network but are located in a different network segment via a gateway, please enter the corresponding sensor IP address under "Add active sensor" and press the button "Add". The corresponding sensor will now also appear in the "Active sensors" list, and you will be able to access it and work with it.

2.2 Network connection: Direct connection

Establishing a direct Ethernet connection between the SBS vision sensor and the PC

Important:
To configure the PC via **direct connection**, the PC's IP configuration must be changed. Inform the system administrator of this change in advance!



Sensor correctly connected
- Power supply 24V?
- Ethernet cable

Connect Sensor correctly!
- Power supply 24V
- Ethernet cable

Electrical connection OK?
- green Pwr LED on SBS is active
- Status LED on network adapter active
- and/or LAN status shows "Connection established". (system control ⇨ network connection ⇨ LAN-Connection ⇨ status)

PC's IP address matches sensor?
Sensor IP: 192.168.100.100/24 (default)
- PC: e. g. 192.168.100.101/24
(/24 means 24Bit subnet mask = 255.255.255.0)

Check/correct settings
PC's IP (fixed IP corresponding with sensor):
e.g. 192.168.100.101; - subnetmask: 255.255.255.0
Configuration: Start ⇨ system control ⇨ network connections ⇨ LAN connection ⇨ properties ⇨ internet protocol (TCP/IP)

Vision Sensor Device Manager finds Sensor?
- Start Vision Sensor Device manager
- Press button "Find"
- Mark Sensor
- Is "Connect" button active?

"Repair" Network connection
Check with system administrator,
if necessary.
Start system control network connections right mouse click on LAN connection used repair
(deletes e.g. ARP Cache).

Check IP-Connection
- in command prompt: ping 192.168.100.100
(sensor's IP address) [ENTER] .
When four positive answers have been emitted, continue with "Yes" (Command prompt:
Start ⇨ all programs ⇨ accessories ⇨ command prompt)

Deacticate / adjust firewall
Check with system administrator
IP-Connection Test (see above)

Attention!
Reactivate firewall once parameter settings have been completed.

Vision Sensor Device Manager starts user-software?
- Double click on sensor in the list
- PC application software starts

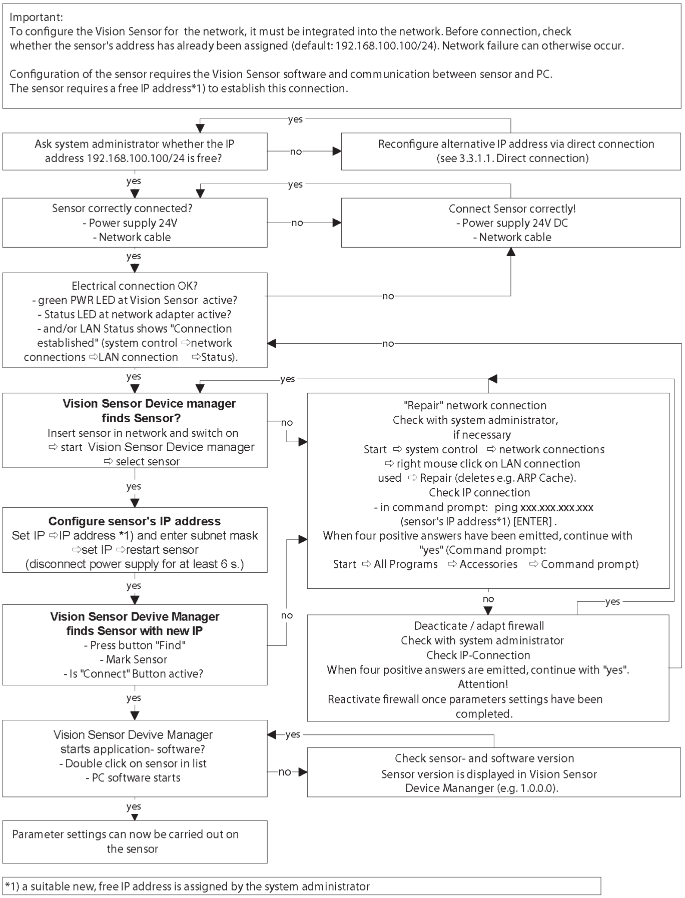
Check sensor- and software version
-Sensor version is displayed in the Vision Sensor Device Manager (e.g. 1.0.0.0).

Now the parameter setting of the sensor / can be done

Fig. 1: Direct connection sensor / PC, procedure and troubleshooting

2.3 Network connection: Connection via network

Establishing an Ethernet connection between the SBS vision sensor and the PC through a network.



Important:
To configure the Vision Sensor for the network, it must be integrated into the network. Before connection, check whether the sensor's address has already been assigned (default: 192.168.100.100/24). Network failure can otherwise occur.

Configuration of the sensor requires the Vision Sensor software and communication between sensor and PC.
The sensor requires a free IP address*1) to establish this connection.

Ask system administrator whether the IP address 192.168.100.100/24 is free?

Reconfigure alternative IP address via direct connection (see 3.3.1.1. Direct connection)

Sensor correctly connected?
- Power supply 24V
- Network cable

Connect Sensor correctly!
- Power supply 24V DC
- Network cable

Electrical connection OK?
- green PWR LED at Vision Sensor active?
- Status LED at network adapter active?
- and/or LAN Status shows "Connection established" (system control ⇨network connections ⇨LAN connection ⇨Status).

Vision Sensor Device manager finds Sensor?
Insert sensor in network and switch on
⇨ start Vision Sensor Device manager
⇨ select sensor

"Repair" network connection
Check with system administrator, if necessary
Start ⇨ system control ⇨ network connections
⇨ right mouse click on LAN connection used ⇨ Repair (deletes e.g. ARP Cache).
Check IP connection
- in command prompt: ping xxx.xxx.xxx.xxx (sensor's IP address*1) [ENTER] .
When four positive answers have been emitted, continue with "yes" (Command prompt:
Start ⇨ All Programs ⇨ Accessories ⇨ Command prompt)

Configure sensor's IP address
Set IP ⇨IP address *1) and enter subnet mask ⇨set IP ⇨restart sensor
(disconnect power supply for at least 6 s.)

Vision Sensor Devive Manager finds Sensor with new IP
- Press button "Find"
- Mark Sensor
- Is "Connect" Button active?

Deacticate / adapt firewall
Check with system administrator
Check IP-Connection
When four positive answers are emitted, continue with "yes".
Attention!
Reactivate firewall once parameters settings have been completed.

Vision Sensor Devive Manager starts application- software?
- Double click on sensor in list
- PC software starts

Check sensor- and software version
Sensor version is displayed in Vision Sensor Device Mananger (e.g. 1.0.0.0).

Parameter settings can now be carried out on the sensor

*1) a suitable new, free IP address is assigned by the system administrator

Fig. 2: Connection via network sensor / PC, procedure and troubleshooting

2.4 Used Ethernet ports

If you are integrating the SBS into a network, make sure that an admin opens the following ports if necessary. This is only the case if these ports were previously explicitly blocked in the company network or by a firewall installed on the PC.

The following ports are used for communications between the SBS software (PC) and the SBS:

- Port 2000, TCP
- Port 2001, UDP Broadcast (to find sensors via Vision Sensor Device Manager)
- Port 2002, TCP
- Port 2003, TCP
- Port 2004, TCP

The following ports are used for communications between the PLC (PLC or control PC) and SBS vision sensor:

Process interfaces:

- Ethernet
  - Port 2005, TCP (Implicit results, i.e. user-configured result data)
  - Port 2006, TCP (Explicit requests, e.g. trigger or job switch)
- EtherNet/IP:
  - Port 2222, UDP
  - Port 44818, TCP
- PROFINET:
  - Port 161, UDP
  - Port 34962, UDP
  - Port 34963, UDP
  - Port 34964, UDP
- Service:
  - Port 22, TCP
  - Port 1998, TCP
- SBSxWebViewer:
  - Port 80

NOTE:
If Ports 2005 or 2006 are changed in the configuration software, they must also be changed accordingly in the firewall by an administrator.

2.5 Access to SBS through network

Exemplary values for IP, etc.

Access to SBS 1 from PC 1, if on the same subnet

- Via Vision Sensor Device Manager (/find)

Access to SBS 2 from PC 1, if on a different subnet

Only if:

- Gateway is set correctly in Sensor 2 (here to 192.168.30.1) - and
- in Vision Sensor Device Manager via Add IP, the sensor IP of Sensor 2 is set correctly
  > after this, SBS 2 will also appear in the "Active sensors" list in Vision Sensor Device Manager!

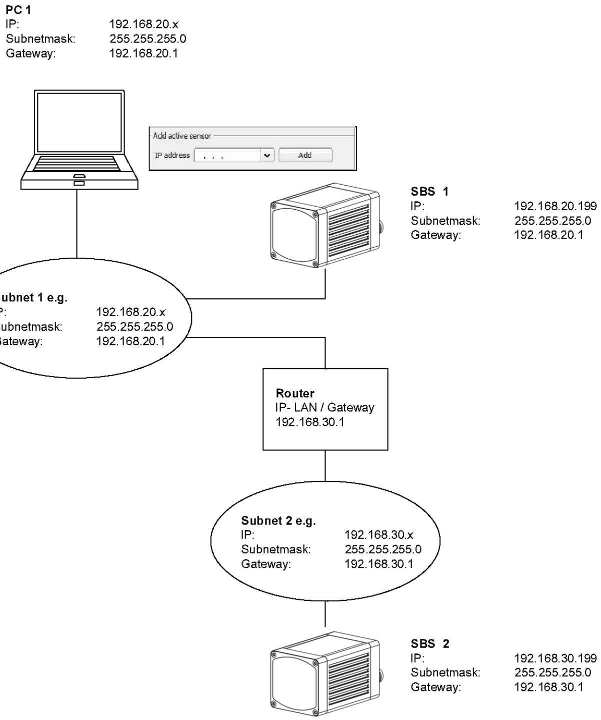


Fig. 3: Access to SBS through network, same or other subnet

2.6 Access to SBS through the Internet / World Wide Web

Exemplary values for IP, etc.

Access from PC 1 (company network 1), through the Word Wide Web, to company network 2 to SBS 1.

1. On PC 1 (company network 1Vision Sensor Device Manager) enter and add the IP WAN of Router 2 (company network 2) under "Add active sensor" in (here in this example: 62.75.148.101)
2. On router 2, open the ports that the sensor will be using (please refer to section: Used Ethernet ports).See Chapter:

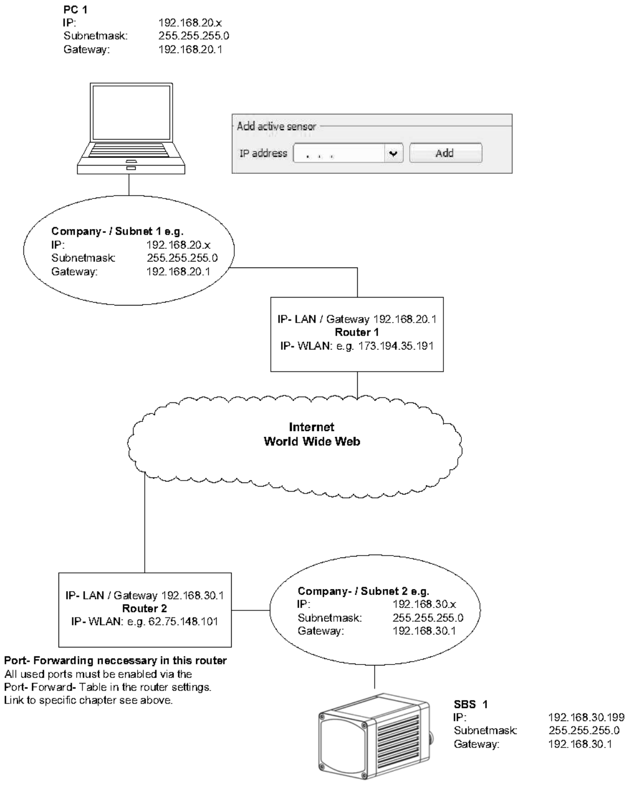

PC 1
IP: 192.168.20.x
Subnetmask: 255.255.255.0
Gateway: 192.168.20.1
Add active sensor
IP address
Add
Company- / Subnet 1 e.g.
IP: 192.168.20.x
Subnetmask: 255.255.255.0
Gateway: 192.168.20.1
IP- LAN / Gateway 192.168.20.1
Router 1
IP- WLAN: e.g. 173.194.35.191
Internet
World Wide Web
IP- LAN / Gateway 192.168.30.1
Router 2
IP- WLAN: e.g. 62.75.148.101
Company- / Subnet 2 e.g.
IP: 192.168.30.x
Subnetmask: 255.255.255.0
Gateway: 192.168.30.1
Port- Forwarding neccessary in this router
All used ports must be enabled via the
Port- Forward- Table in the router settings.
Link to specific chapter see above.
SBS 1
IP: 192.168.30.199
Subnetmask: 255.255.255.0
Gateway: 192.168.30.1

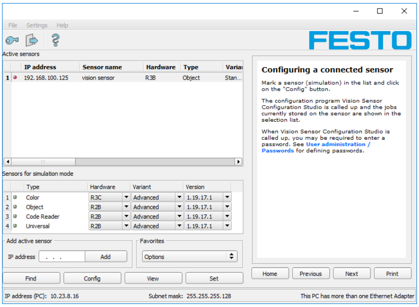
Fig. 4: Access to SBS through the Internet / World Wide Web

3 Configuration SBS vision sensor

In order to configure the vision sensor, follow the steps below.

Settings in Vision Sensor Device Manager

1. Start the SBS software. Vision Sensor Device Manager is opened.



Active sensors

	IP address	Sensor name	Hardware	Type	Variai
1	192.168.100.125	vision sensor	R3B	Object	Stan...

Configuring a connected sensor

Mark a sensor (simulation) in the list and click on the "Config" button.

The configuration program Vision Sensor Configuration Studio is called up and the jobs currently stored on the sensor are shown in the selection list.

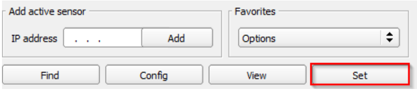
When Vision Sensor Configuration Studio is called up, you may be required to enter a password. See User administration / Passwords for defining passwords.

Sensors for simulation mode

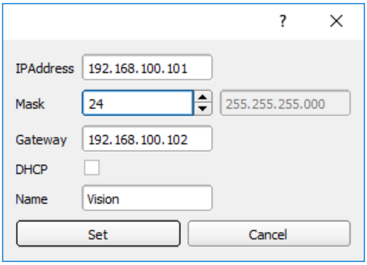
	Type	Hardware	Variant	Version
1	Color	R3C	Advanced	1.19.17.1
2	Object	R2B	Advanced	1.19.17.1
3	Code Reader	R2B	Advanced	1.19.17.1
4	Universal	R2B	Advanced	1.19.17.1

IP address (PC): 10.23.8.16 Subnet mask: 255.255.255.128 This PC has more than one Ethernet Adapter

2. Click on the "Find" button. The vision sensor will be listed in the "Active sensors" window.



3. Click on the "Set" button. The dialog box for configuring the IP address and the sensor name will appear.



IPAddress 192.168.100.101

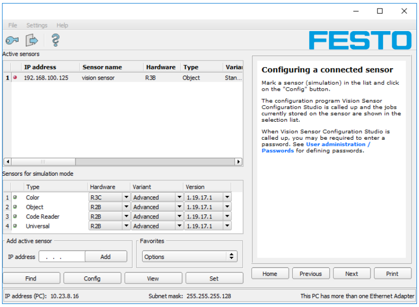
Mask 24 255.255.255.000

Gateway 192.168.100.102

DHCP □

Name Vision

4. Assign an IP address and a name to the sensor.
5. Click on the "Set" button. The IP address and the name have now been updated.



Active sensors

		IP address	Sensor name	Hardware	Type	Variai
1	●	192.168.100.125	vision sensor	R3B	Object	Stan...

Sensors for simulation mode

		Type	Hardware	Variant	Version
1	●	Color	R3C	Advanced	1.19.17.1
2	●	Object	R2B	Advanced	1.19.17.1
3	●	Code Reader	R2B	Advanced	1.19.17.1
4	●	Universal	R2B	Advanced	1.19.17.1

Add active sensor

IP address . . .

Favorites

Configuring a connected sensor

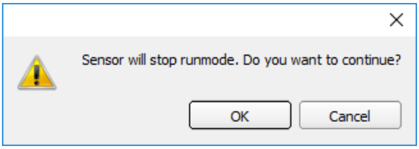
Mark a sensor (simulation) in the list and click on the "Config" button.

The configuration program Vision Sensor Configuration Studio is called up and the jobs currently stored on the sensor are shown in the selection list.

When Vision Sensor Configuration Studio is called up, you may be required to enter a password. See **User administration / Passwords** for defining passwords.

IP address (PC): 10.23.8.16 Subnet mask: 255.255.255.128 This PC has more than one Ethernet Adapter

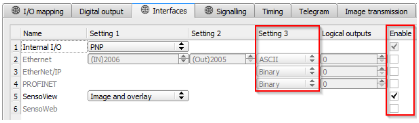
6. Open Vision Sensor Configuration Studio by selecting the sensor you want and then clicking on the "Config" button.



Sensor will stop runmode. Do you want to continue?

7. Confirm the following dialog box with "OK" to stop Vision Sensor Device Manager and start the configuration in Vision Sensor Configuration Studio.

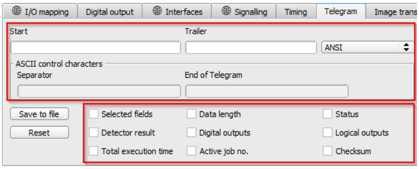
Select an interface in Vision Sensor Configuration Studio



	Name	Setting 1	Setting 2	Setting 3	Logical outputs	Enable
1	Internal I/O	PNP				☑
2	Ethernet	(IN)2006	(Out)2005	ASCII	0	□
3	EtherNet/IP			Binary	0	□
4	PROFINET			Binary	0	□
5	SensoView	Image and overlay				☑
6	SensoWeb					□

1. Use the "Output" setup step to open the "Interfaces" tab.
2. Enable the interface by enabling the corresponding checkbox in the "Enabled" column.
3. In the "Setting 3" column, select the format for the data output.

Defining telegrams / data output in Vision Sensor Configuration Studio



Start

Trailer

ANSI

ASCII control characters

Separator

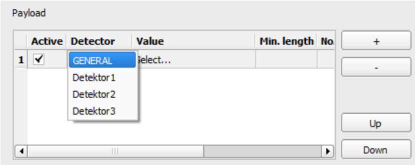
End of Telegram

□ Selected fields □ Data length □ Status

□ Detector result □ Digital outputs □ Logical outputs

□ Total execution time □ Active job no. □ Checksum

1. Use the "Output" setup step to open the "Telegram" tab.
2. Set the control characters you want for the data output.
3. Select the Checkboxes you want.



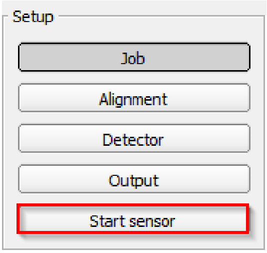
Payload

	Active	Detector	Value	Min. length	No.
1	☑	GENERAL	Select...		

4. Configure the data you want to be output.
   Use the "+" button to generate new entry.
   What the buttons do:
   - "+": Insert new entry
   - "-": Delete marked entry
   - "Up", "Down": Displace marked entry
5. Select the detector you want in the "Detector" column.
6. Select the detector value you want in the "Value" column so that this value will be output through the enabled interface.

Additional information:: Data output (ASCII / binary)

Start sensor



1. Click on the "Start sensor" setup step.
   The data will be transferred to the vision sensor and the vision sensor will be started.

NOTE:
Detector must be generated.

4 Ethernet TCP/IP, port 2005 / 2006

Numerical data, which has been configured under Output/Telegram, can be output in a separate ASCII/BINARY format.

The sensor here is the (socket) "server", and provides the data via a "server socket" interface. This is mainly a "programming interface".

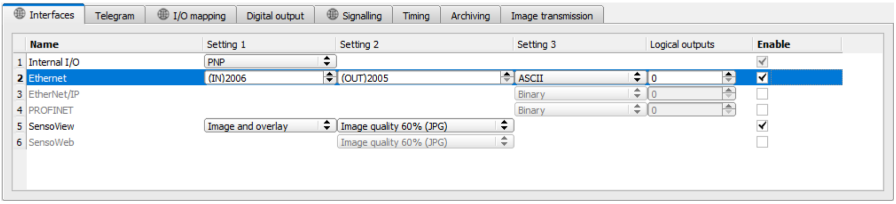
To read / process the data, a "socket client" (PC, PLC, etc.) must establish a (socket) connection (active) to the sensor, and then receives the data.

Handling, Settings

4.1 Example: Data output from SBS to PC / PLC

Step 1:

After the job with all necessary detectors, Alignment, etc. is set, the Ethernet interface for data output is activated and, if necessary, parameterized.



	Name	Setting 1	Setting 2	Setting 3	Logical outputs	Enable
1	Internal I/O	PNP				☑
2	Ethernet	(IN)2006	(OUT)2005	ASCII	0	☑
3	EtherNet/IP			Binary	0	☐
4	PROFINET			Binary	0	☐
5	SensoView	Image and overlay	Image quality 60% (JPG)			☑
6	SensoWeb		Image quality 60% (JPG)			☐

Fig. 5: Data output, Ethernet

In the example, the Ethernet interface is activated in the parameter field in the tab "Interfaces" by marking the checkbox "Enable". The default settings for input port (IN) = 2006 and output port (OUT) = 2005 are adopted in this way. Any other settings can be made here to adapt the data output to your network environment. If necessary, contact your network administrator.

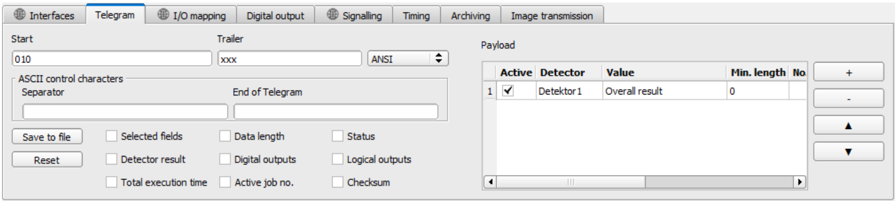
Step 2:

The "Telegram" tab configures the payload to be output via Ethernet Port 2005.

In this example, it is the:

- Start "010"
- Overall result of Detector 1
- Trailer "xxx"

"ASCII" is defined as a data format, which facilitates the traceability of this example. The function with other data or in binary is analogous to settings made here by way of example.



Start: 010

Trailer: xxx

ANSI

ASCII control characters

Separator:

End of Telegram:

□ Selected fields □ Data length □ Status

□ Detector result □ Digital outputs □ Logical outputs

□ Total execution time □ Active job no. □ Checksum

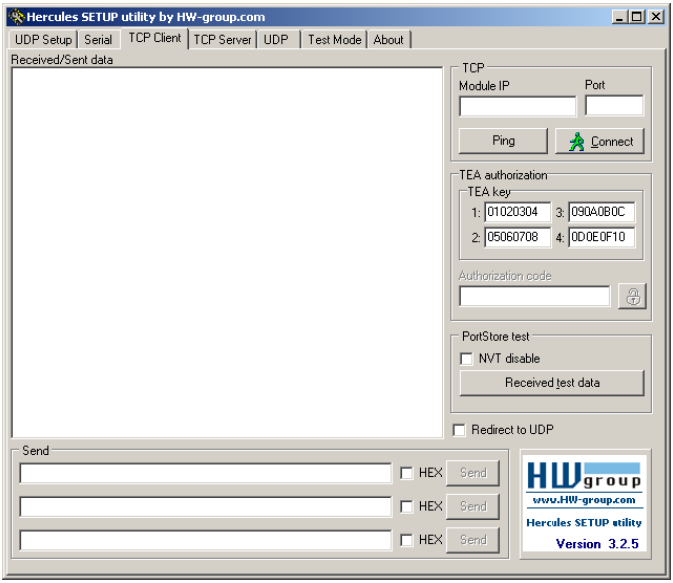
Payload

	Active	Detector	Value	Min. length	No.
1	☑	Detektor1	Overall result	0	

Fig. 6: Telegram, configure output data

Step 3:

After opening the Hercules Ethernet tool, you will need to open the "TCP-Client" tab to communicate with the SBS socket server via Ethernet.



TCP

Module IP: Port:

TEA authorization

TEA key

1: 01020304 3: 090A0B0C

2: 05060708 4: 0D0E0F10

Authorization code:

PortStore test

□ NVT disable

□ Redirect to UDP

□ HEX

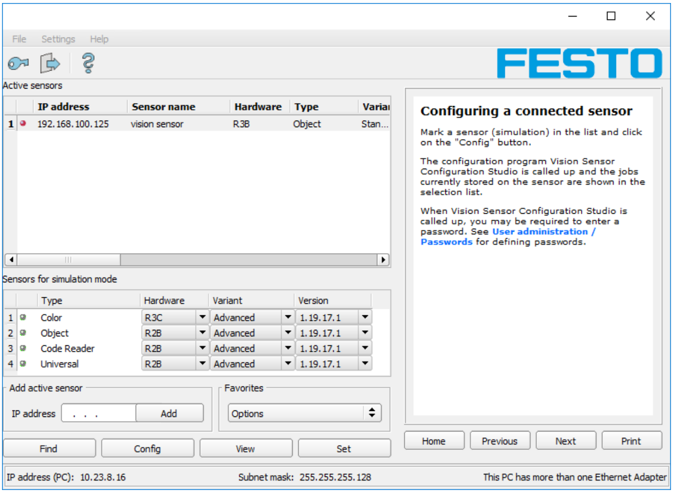
□ HEX

□ HEX

Fig. 7: Data output, Ethernet Tool / 1

You will need to enter the IP address of the SBS and the correct port in order to receive data.

The IP address of the SBS can be found in Vision Sensor Device Manager. See the first line in the window "Active sensors" = 192.168.60.199



Active sensors

		IP address	Sensor name	Hardware	Type	Variai
1	●	192.168.100.125	vision sensor	R3B	Object	Stan...

Sensors for simulation mode

		Type	Hardware	Variant	Version
1	●	Color	R3C	Advanced	1.19.17.1
2	●	Object	R2B	Advanced	1.19.17.1
3	●	Code Reader	R2B	Advanced	1.19.17.1
4	●	Universal	R2B	Advanced	1.19.17.1

Add active sensor

IP address . . .

Favorites

Options

Configuring a connected sensor

Mark a sensor (simulation) in the list and click on the "Config" button.

The configuration program Vision Sensor Configuration Studio is called up and the jobs currently stored on the sensor are shown in the selection list.

When Vision Sensor Configuration Studio is called up, you may be required to enter a password. See **User administration / Passwords** for defining passwords.

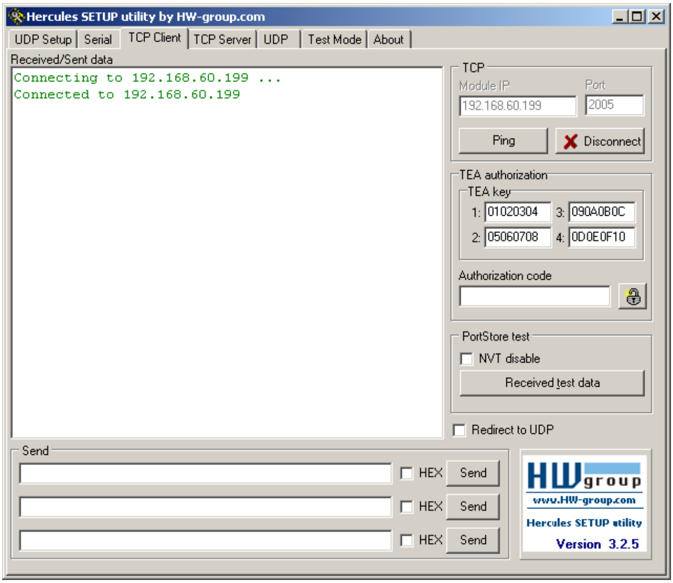
IP address (PC): 10.23.8.16 Subnet mask: 255.255.255.128 This PC has more than one Ethernet Adapter

Fig. 8: Vision Sensor Device Manager, IP address ...

The port number for the output port was adopted under Step 1 with Port 2005.

Step 4:

Therefore, the following settings are made in Hercules: Module IP = 192.168.60.199, Port = 2005. All other settings remain in the default values. Clicking on the "Connect" button will establish a connection to the SBS and the connection will be shown in green letters in the main window.



Hercules SETUP utility by HW-group.com
UDP Setup | Serial | TCP Client | TCP Server | UDP | Test Mode | About
Ping
Disconnect
Received test data
HEX
Send
HW group
www.HW-group.com
Hercules SETUP utility
Version 3.2.5

Received/Sent data

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
```

TCP
Module IP: 192.168.60.199
Port: 2005

TEA authorization
TEA key
1: 01020304
2: 05060708
3: 090A0B0C
4: 0D0E0F10
Authorization code

PortStore test
□ NVT disable

□ Redirect to UDP

Send
□ HEX
□ HEX
□ HEX

Fig. 9: Data output, Ethernet Tool / 2

Step 5:

You will now need to start the SBS from the PC application with "Start sensor" (later during operation, the SBS will run normally after being turned on and will transmit data if configured). In this example, Trigger mode = continuous is set, i.e. evaluations are made continuously and data is sent. These are only visible in the main window of Hercules.

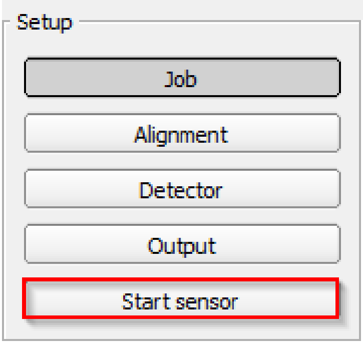
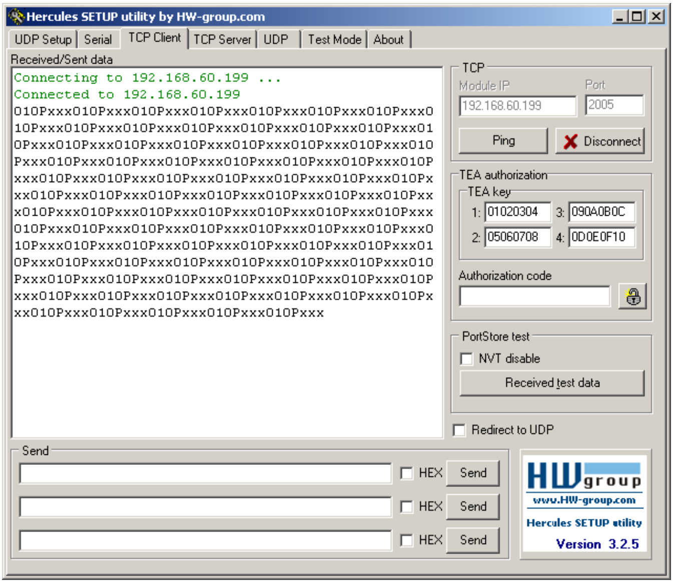


Fig. 10: Start sensor



```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx0
10Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx01
0Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010
Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010P
xxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Px
xx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxx
x010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx
010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx0
10Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx01
0Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010
Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010P
xxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx010Px
xx010Pxxx010Pxxx010Pxxx010Pxxx010Pxxx
```

Module IP: 192.168.60.199
Port: 2005

TEA key:
1: 01020304
2: 05060708
3: 090A0B0C
4: 0D0E0F10

Fig. 11: Data output, Ethernet, Tool / 3

The data visible here are set under "Telegram":

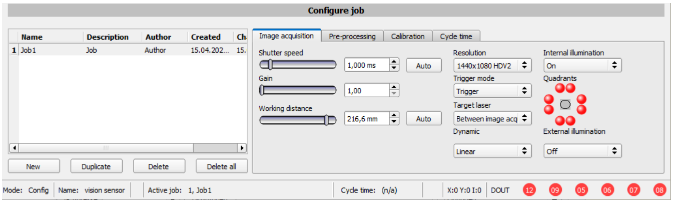
- Start "010"
- Overall result of Detector 1 (here, a "P" for positive, since test condition: brightness fulfilled)
- Trailer "xxx"

4.2 Example: Commands (requests) from PC / PLC SBS

With acknowledgement / data output from SBS

Step 1

For better clarity, the triggered operation is switched to here for Example 2. This can be done as follows: In Vision Sensor Configuration Studio under Job/Image Acquisition/Trigger mode = Set "Trigger". All other settings from Ethernet example 1 in the SBS remain unchanged.



Configure job

	Name	Description	Author	Created	Ch
1	Job1	Job	Author	15.04.202...	15.

Image acquisition

Shutter speed: 1,000 ms

Gain: 1,00

Working distance: 216,6 mm

Resolution: 1440x1080 HDV2

Trigger mode: Trigger

Target laser: Between image acq

Dynamic: Linear

Internal illumination: On

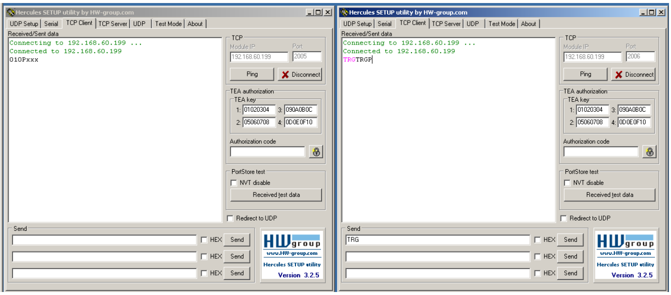
External illumination: Off

Mode: Config | Name: vision sensor | Active job: 1, Job1 | Cycle time: (n/a) | X:0 Y:0 I:0 | DOUT

Fig. 12: Data output, Ethernet, Trigger

Step 2

In order to transmit commands to the SBS, the Hercules application needs to be opened again. This time with port 2006 as the SBS input port through which it can receive commands. All telegrams (commands and response strings) to and from the SBS are described in section Overview telegrams.



Hercules SETUP utility by HW-group.com

Received/Sent data:

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
010Pxxx
```

TCP – Module IP: 192.168.60.199 Port: 2005

TEA key: 1: 01020304 2: 05060708 3: 090A0B0C 4: 0D0E0F10

Hercules SETUP utility by HW-group.com

Received/Sent data:

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
TRGTRGP
```

TCP – Module IP: 192.168.60.199 Port: 2006

TEA key: 1: 01020304 2: 05060708 3: 090A0B0C 4: 0D0E0F10

Send: TRG

Fig. 13: Data output, Ethernet Tool / 4

In the right window, the "TRG" command (for Trigger; see first line on the bottom for command) was sent from port 2006 to the SBS by clicking on the corresponding "Send" button. This command is shown in the main window in red letters when being sent. The SBS responds to port 2006 with an acknowledge to the "TRG" command and, in this case, "P" for a positive detector 1 result (black letters in right pane).

In the left window, the SBS uses output port 2005 to send the "010Pxxx" value defined in Data output the same way as in the Ethernet 1 example.

4.3 Example: Job change from PC / PLC to SBS

With acknowledgement / data output from SBS

Function of both Ethernet ports for in- and output:

*A: Port 2005, only one direction: Sensor ›› PC, all payload, defined under "Data output"

*B: Port 2006, both directions: Sensor ‹› PC, commands to with acknowledge, + all response data to commands (no payloads)

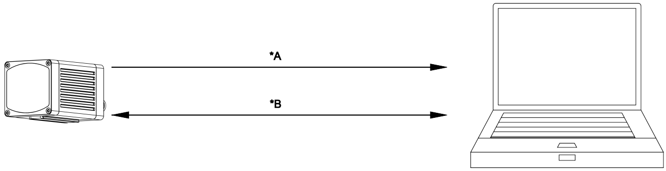


Fig. 14: Ethernet ports

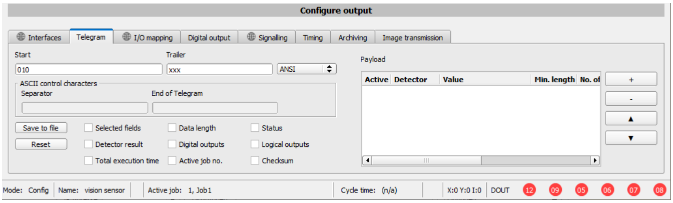
Step 1

For better clarity, it is switched here to the triggered mode. This can be done as follows: In Vision Sensor Configuration Studio under Job/Image Acquisition/Trigger mode = Set "Trigger". All other settings from Ethernet example 1 in the SBS remain unchanged. All data output definitions are made here in "ASCII" for better traceability of the examples.

For this example, at least two jobs must be created on the SBS vision sensor. To create a new job based on an existing job, you can use the "Duplicate" function. Adjust the following parameters to easily check the job change. Later you can freely define the output.

For this example, Job 1 was defined with the data output:

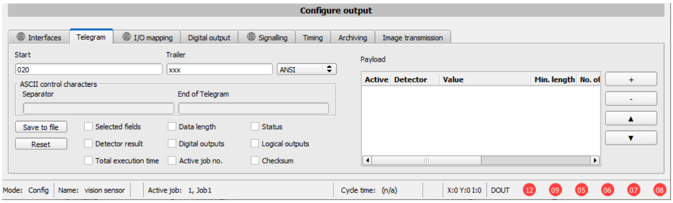
- Start: "010" and
- Trailer: "xxx"



Start: 010
Trailer: xxx
ANSI
ASCII control characters
Separator:
End of Telegram:
□ Selected fields □ Data length □ Status
□ Detector result □ Digital outputs □ Logical outputs
□ Total execution time □ Active job no. □ Checksum

Mode: Config | Name: vision sensor | Active job: 1, Job1 | Cycle time: (n/a) | X:0 Y:0 I:0 | DOUT 12 09 05 06 07 08

Fig. 15: Data output, Ethernet, Job switch Job 1



Start: 020
Trailer: xxx
ANSI
ASCII control characters
Separator:
End of Telegram:
□ Selected fields □ Data length □ Status
□ Detector result □ Digital outputs □ Logical outputs
□ Total execution time □ Active job no. □ Checksum

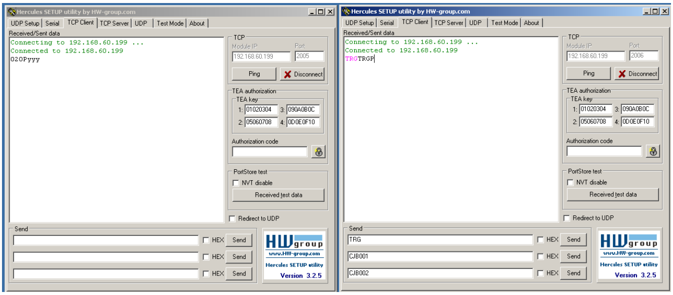
Mode: Config | Name: vision sensor | Active job: 1, Job1 | Cycle time: (n/a) | X:0 Y:0 I:0 | DOUT 12 09 05 06 07 08

Fig. 16: Data output, Ethernet, Job switch, Job 2

Step 2

Here, the application Hercules was opened twice. Once with port 2005 (receiving of results as defined in "Data output") and port 2006 (commands + acknowledge) as SBS input port through which it can receive commands.

All telegrams (commands and response strings) to and from the SBS are described in section Overview telegrams.



Left window: Hercules SETUP utility by HW-group.com, TCP Client, Module IP 192.168.60.199, Port 2005

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
020Pyyy
```

Right window: Hercules SETUP utility by HW-group.com, TCP Client, Module IP 192.168.60.199, Port 2006

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
TRGTRGP
```

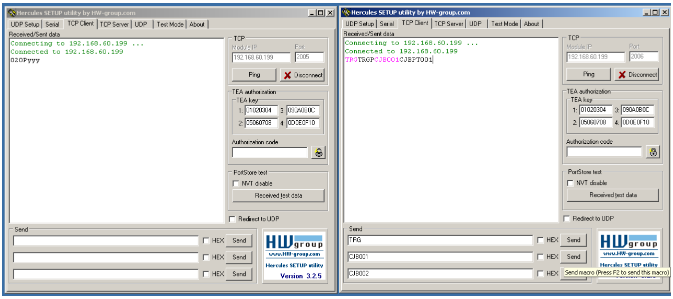
Send: TRG, CJB001, CJB002

TEA key: 1: 01020304, 2: 05060708, 3: 090A0B0C, 4: 0D0E0F10

Fig. 17: Data output, Ethernet, Job switch, Tool / 1

In the right window (Port 2006), the command TRG (Trigger, see "Send" below, first line) was issued. This is displayed in the main window in red letters with "TRG". The SBS responds immediately with the "TRGP" acknowledge (repetition of "TRG" command and "P" for positive, in black letters in the right pane)

In the left window (Port2005), the SBS on which Job 2 is currently active sends the corresponding result string, which is defined in Data output in Job 2 with "020Pyyy".



Left window: Hercules SETUP utility by HW-group.com, TCP Client, Module IP 192.168.60.199, Port 2005

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
020Pyyy
```

Right window: Hercules SETUP utility by HW-group.com, TCP Client, Module IP 192.168.60.199, Port 2006

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
TRGTRGPCJB001CJBPT001
```

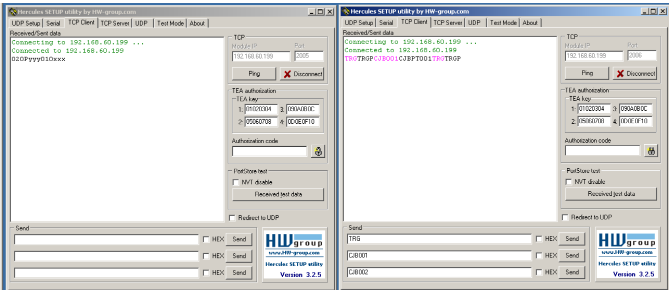
Send: TRG, CJB001, CJB002

TEA key: 1: 01020304, 2: 05060708, 3: 090A0B0C, 4: 0D0E0F10

Send macro (Press F2 to send this macro)

Fig. 18: Data output, Ethernet, Job switch, Tool / 2

Now the command CJB001 (Change Job 001, 001 = job no. 1, see below at "Send", second line) was sent in the right window (Port2006). This is displayed in the main window in red letters with "CJB001". The SBS responds immediately with the "CJBPT001" acknowledge (repetition of "CJB" command, "P" for positive, "T" = Triggered, 001 job number to which the change was made)



Left window:

Received/Sent data

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
020Pyyy010xxx
```

TCP: Module IP 192.168.60.199, Port 2005

TEA authorization, TEA key: 1: 01020304, 2: 05060708, 3: 090A0B0C, 4: 0D0E0F10

Authorization code:

PortStore test: □ NVT disable

□ Redirect to UDP

Send: □ HEX, □ HEX, □ HEX

Right window:

Received/Sent data

```
Connecting to 192.168.60.199 ...
Connected to 192.168.60.199
TRGTRGPCJB001CJBPT001TRGTRGP
```

TCP: Module IP 192.168.60.199, Port 2006

TEA authorization, TEA key: 1: 01020304, 2: 05060708, 3: 090A0B0C, 4: 0D0E0F10

Authorization code:

PortStore test: □ NVT disable

□ Redirect to UDP

Send:
TRG □ HEX
CJB001 □ HEX
CJB002 □ HEX

Fig. 19: Data output, Ethernet, Job switch, Tool / 3

After the next Trigger command TRG (see "Send" below, third line) is displayed again in the main window in red letters. The SBS immediately responds again with the "TRGP" acknowledge (repetition of "TRG" command and "P" for positive)

In the left window (Port2005), after the job has changed to Job 1, the SBS sends the corresponding result string, which is defined in Data output in Job 1 with "010xxx"!

5 Service / Visualization

There is a service port (Ethernet TCP/IP port 1998) available for the SBS vision sensor. This port will be available regardless of how you configure the various steps.

5.1 Backup creation

The following telegrams can be used for automatic backups and restores

- **Read job set** (ASCII)
  The "Set job set" telegram can be used to change the SBS vision sensor's job set. The job set file must first be loaded onto the SBS.
- **Save job set** (ASCII)
  The "Save job set" telegram can be used to read the SBS vision sensor's job set.

5.2 Visualization

The SBS vision sensor provides all data for the visualization of the applications via the service port.

Additional information: Update visualization data (ASCII)

6 SBS telegrams for PROFINET and EtherNet/IP

6.1 Module 1: "Control" (From PLC to SBS)

Name in PLC "CTRL (3 bytes)"

Byte Offset	Bit Adr..	Name	Data type	Meaning
0	0	Reset error	1 bit	Reset Error clears the 4 bit error code in the "Status" module. Rising edge (False → True) clears error code.
	1	Trigger Disable	1 bit	This bit is used to disable the trigger. Valid for Trigger mode Trigger and Free run. • False (0): Trigger activated. • True (1): Trigger disabled. If the digital input "Trigger enable" is used, both conditions (digital input "Hardware Trigger" and "Trigger Disable Bit") must be set to "Enable" to accept a trigger.
	2	Trigger	1 bit	Rising edge (false → true): Trigger is executed immediately. If the trigger could not be executed, the Trigger acknowledge Bit stays false and "Error status" module has the error code "1: Failure trigger request". See also Timing diagram, Chapter Case: Trigger not possible (not ready)
	3	Change job	1 bit	Rising edge (false → true): Switch to job with number "Job number" from Control module. When executing this request, delays may occur. After a successful job change, the "Job number" byte in the "Status" module shows the same value as in the Control module. If the job change could not be executed due to error (due to an error, e.g. wrong job number), the "Error status" module has the error code "2: Failure change job" (and Ready stays false!). See also Timing diagram, Chapter Case: Job change not possible (e.g. wrong job number)

Byte Offset	Bit Adr..	Name	Data type	Meaning
	4	Switch-to-Run	1 bit	Rising edge (false → true) "Switch to Run" is executed. Success or failure of Switch to Run request is shown in the "Error status" module (error code "3: Failure Switch to run request") and bit "Operation Mode". See also Timing diagram, Chapter Case: Switch to run not possible
	5-7	Reserve		
1		Reserve	1 byte	
2		Job number	U8	Job number to be switched to, on the rising edge of the change job bit. Binary value 1-255 for "Job number change". 0 stands for "No switching", even if the Change Job Bit changes.

Timing diagrams for SBS communication

6.2 Module 2: “Status” (from SBS to PLC)

Name in PLC "STAT (6 bytes)"

Byte Offset	Bit Addr.	Name	Data type	Description
0	0	Ready	1 bit	SBS ready for next evaluation. Ready=1. ⚠ **Attention:** The Ready bit is exclusively reserved for indicating the readiness of the SBS vision sensor for the next evaluation. It is not suitable for indicating that an evaluation has been completed or the results of an evaluation are available!
	1	Reserve	1 bit	
	2	Trigger acknowledge	1 bit	Acknowledge (confirmation) for successful trigger request (via Trigger Bit in Control module). Acknowledge is deleted as a response to the deletion of the trigger bit. If the trigger could not be executed, the Trigger Acknowledge Bit stays false.
	3	Change Job acknowledge	1 bit	Acknowledge (confirmation) for the Change Job Request (via Change Job Bit in Control module) – independent of its success. Acknowledge is deleted as soon as the Change Job Request Bit has been deleted. Success or failure of Change Job Request is shown in the bitfield "Error" (error code "2: Failure change job") and in the byte "Job number" in the Status module. If there are delays in executing the job change, this acknowledge bit can also be set with a delay.

Byte Offset	Bit Addr.	Name	Data type	Description
	4	Switch to run acknowledge	1 bit	Acknowledge (confirmation) for the Switch to Run Request (via Switch to Run Request Bit in the Control module). Acknowledge is deleted as soon as the Request Bit is deleted. Success or failure of Switch to Run Request is shown in the bitfield "Error" (error code "3: Failure Switch to run request") and bit "Operation Mode". Acknowledge is set after Vision Sensor Configuration Studio is closed and the job has been loaded from the flash or if an error has occurred.
	5-7	Reserve		
1		Reserve	1 byte	
2	0	Digital Results	1 bit	12 RDBU
	1		1 bit	09 RD
	2		1 bit	05 PK
	3		1 bit	06 YE
	4		1 bit	07 BK
	5		1 bit	08 GY
	6	Reserve	1 bit	This byte is filled with the results of the digital switching outputs. The bit position is fixed. The value of the output is defined in the tab: Output/Digital output, Column: "Logical expression" in Vision Sensor Configuration Studio. If not selected as result output pin, or if no valid logical expression is assigned, the value is = 0.
	7	Reserve	1 bit	
3		Job number	U8	Number of current job: Job number 1-255
4		Image ID	U8	Image ID (0 - 255) is incremented by 1 with each job execution, independent of the trigger source.

Byte Offset	Bit Addr.	Name	Data type	Description
5	0-3	Error	4 bit	4 bit error code (decimal). Used to indicate errors in requests via the control module or system errors. The error code can be reset by "Reset error" or is overwritten by the next error. In case of an archiving error (8), you can continue without a "Reset error". 0: No error 1: Error: Trigger request error (sensor not Ready) 2: Error: Change job 3: Error: Switch-to-Run 4: Request rejected 5: Error: Interface not active in job 7: Focus lock time 8: Error: Archiving 15: System error
	4	Trigger Mode	1 bit	1 = Free run 0 = Trigger
	5	Reserve	1 bit	
	6	Operation mode	1 bit	1 = Run 0 = Config
	7	Reserve	1 bit	

6.3 Module 3: "Data" (from SBS to PLC)

Name in PLC "DATA (2 + 8 / 16 / ... / 192 / 252 Bytes)"

Byte Offset	Bit Addr.	Name	Data type	Description
0		Image ID	U8	Image ID (0 - 255) is incremented by 1 with each job execution, independent of the trigger source.
1	0	Result data overrun	1 bit	Result data has been truncated. 1: Data overrun = truncated 0: No overrun
	1 - 7	Reserve	7 Bit	
2		Result data	Byte array	Data as defined in Vision Sensor Configuration Studio in "Output/Data Output/Detector-Specific payload". When using PROFINET "binary" must be enabled in the Interfaces tab.

6.4 Module 4: "Request" (From PLC to SBS)

Name in PLC "REQU (4 + 8 / 16 / ... / 192 / 250 Bytes)"

Byte Offset	Bit Addr.	Name	Data type	Meaning
0	1	Key	1 byte	Request key (Request counter)
1	1	Reserve	1 byte	Reserve
2	1	Reserve	1 byte	Reserve
3	1	Reserve	1 byte	Reserve
4		Request Data	Byte array	Additional information: Overview telegrams

6.5 Module 5: "Response" (from PLC to SBS)

Name in PLC "RESP (4 + 8 / 16 / ... / 192 / 250 Bytes)"

Byte Offset	Bit Addr.	Name	Data type	Description
0		Key	U8	Response key = mirrored from request
1	0	Result Data overrun	1 bit	Response data has been truncated
	1-7	Reserve	7 Bit	
2		Reserve	1 byte	
3		Reserve	1 byte	
4		Result Data	Byte array	Additional information: Overview telegrams

6.6 Start / end criteria for each telegram

Telegram ("Control" module)	**Start condition ("Status" module)**	**Acceptance confirmation ("Status" module)**	**Execution confirmation ("Status" module)**
Trigger	Ready = True	Trigger acknowledge = True	Image ID changed
Change job	/	Change Job acknowledge = True	Job number changes
Switch-to-Run	Operation Mode = False	Switch-to-Run acknowledge = True	Operation Mode = True

7 Timing diagrams for SBS communication

Case: Trigger ok

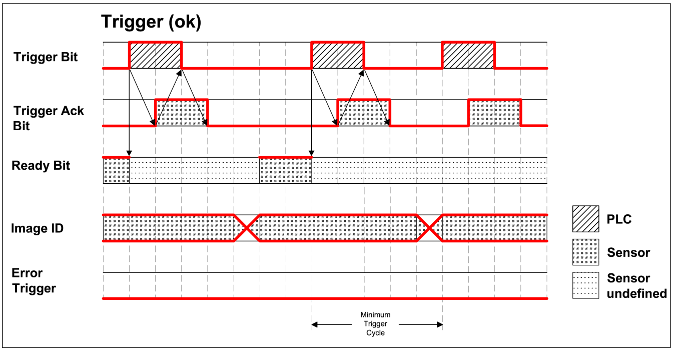


Fig. 20: Timing Trigger ok

Case: Trigger not possible (not ready)

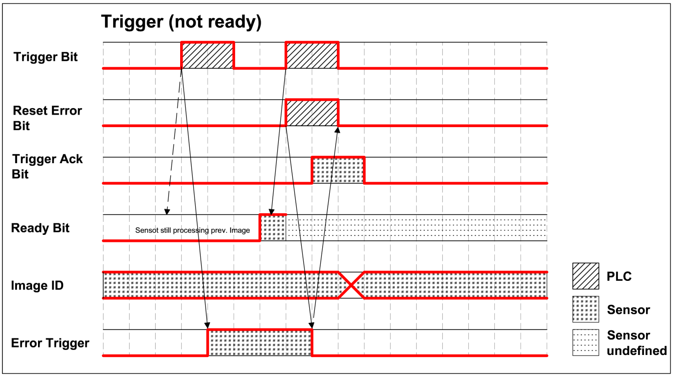


Fig. 21: Timing Trigger not ready

Case: Job change ok

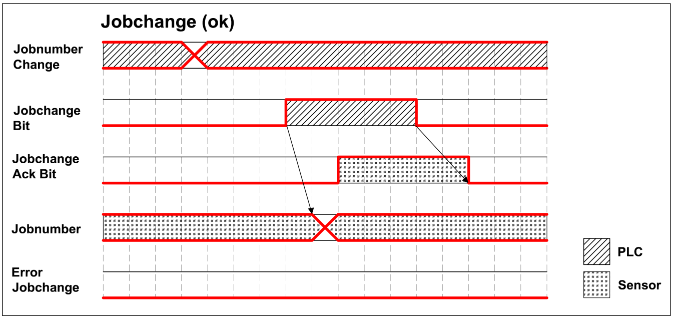


Fig. 22: Timing Job change ok

Case: Job change delayed

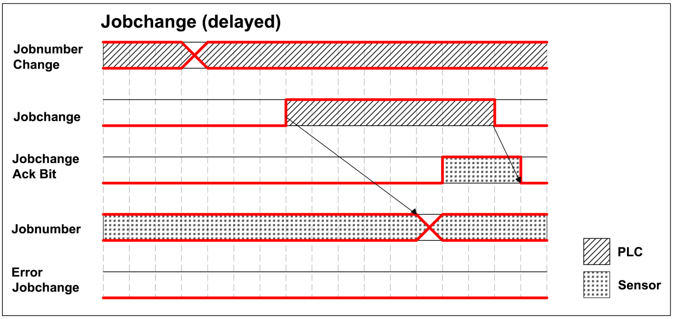


Fig. 23: Timing Job change delayed

Case: Job change not possible (e.g. wrong job number)

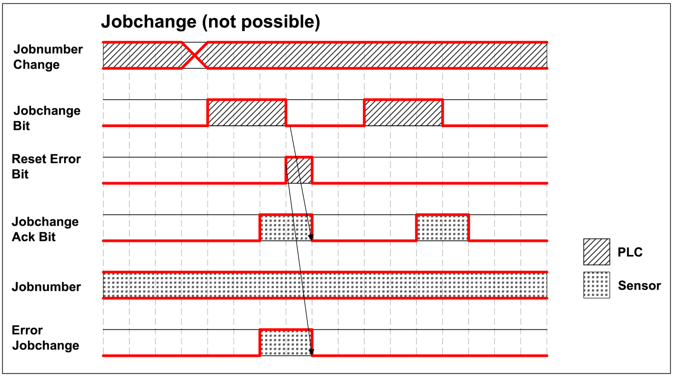


Fig. 24: Timing Job change not possible

Case: Switch to run ok

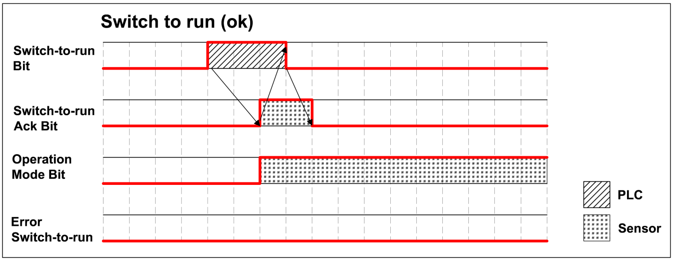


Fig. 25: Timing Switch to run ok

Case: Switch to run not possible

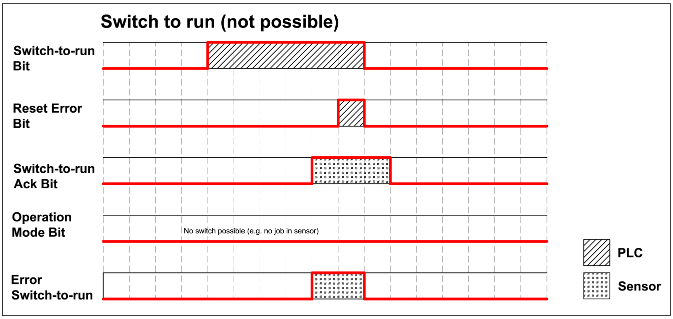


Fig. 26: Switch to run not possible

8 Request sequences

Important recommendations for PLC programmers

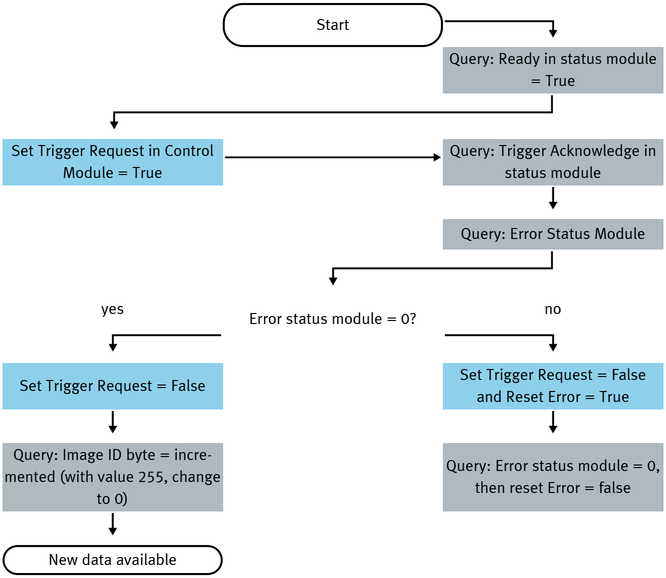
1. Follow the sequence of requests
2. Wait for complete execution of an action before sending the next one. Complete execution takes place when the image ID changes in the trigger request, or the corresponding acknowledge bit is set for the other requests.

   NOTE:
   The complete execution of an action cannot be recognized as safe due to the low/high change of READY, since due to possibly long cycle times between PLC and (e.g. 32ms), READY may never become low.
3. READY should always be high before a trigger request is sent

Accepting / discarding of requests of the control module

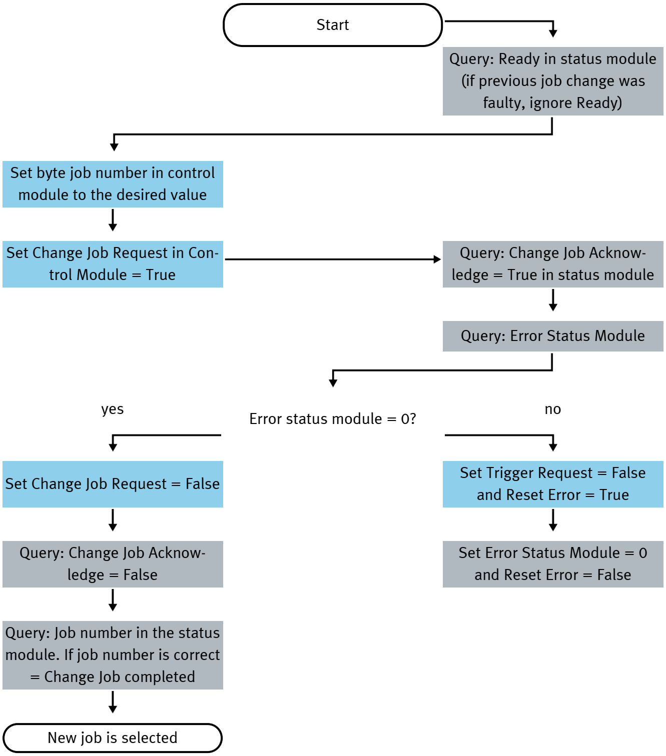
1. Request is accepted with an increasing acknowledge bit
2. Request is discarded if the error bit is set.
3. Request is discarded without an error bit and acknowledge bit if the sensor is still processing the previous request and no acknowledgment has yet been set for it. (i.e. not following the recommended handshake)

8.1 Trigger Request Sequence


Start
Query: Ready in status module = True
Set Trigger Request in Control Module = True
Query: Trigger Acknowledge in status module
Query: Error Status Module
yes
Error status module = 0?
no
Set Trigger Request = False
Set Trigger Request = False and Reset Error = True
Query: Image ID byte = incremented (with value 255, change to 0)
Query: Error status module = 0, then reset Error = false
New data available

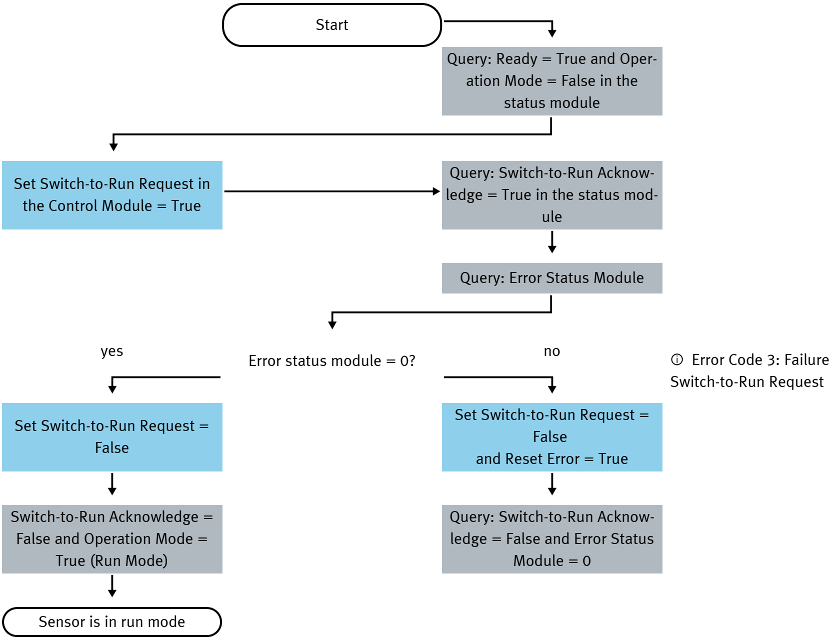
ⓘ Error Code 1: Failure Trigger Request and Trigger Acknowledge = False

8.2 Change job request sequence

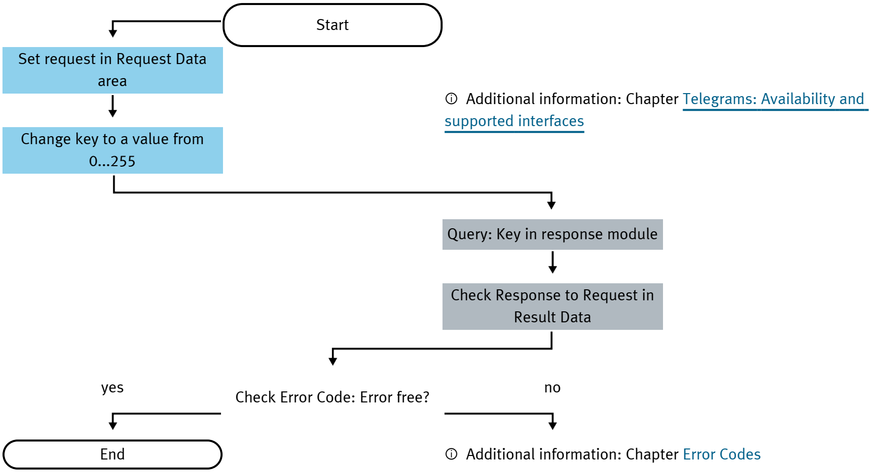

Start
Query: Ready in status module (if previous job change was faulty, ignore Ready)
Set byte job number in control module to the desired value
Set Change Job Request in Control Module = True
Query: Change Job Acknowledge = True in status module
Query: Error Status Module
Error status module = 0?
yes
no
Set Change Job Request = False
Query: Change Job Acknowledge = False
Query: Job number in the status module. If job number is correct = Change Job completed
New job is selected
Set Trigger Request = False and Reset Error = True
Set Error Status Module = 0 and Reset Error = False

ⓘ Error Code 2: Failure Change Job

8.3 Switch to Run sequence


Start
Query: Ready = True and Operation Mode = False in the status module
Set Switch-to-Run Request in the Control Module = True
Query: Switch-to-Run Acknowledge = True in the status module
Query: Error Status Module
yes
Error status module = 0?
no
ⓘ Error Code 3: Failure Switch-to-Run Request
Set Switch-to-Run Request = False
Set Switch-to-Run Request = False and Reset Error = True
Switch-to-Run Acknowledge = False and Operation Mode = True (Run Mode)
Query: Switch-to-Run Acknowledge = False and Error Status Module = 0
Sensor is in run mode

8.4 Sequence for requests via request/response module


Start
Set request in Request Data area
Change key to a value from 0...255
ⓘ Additional information: Chapter Telegrams: Availability and supported interfaces
Query: Key in response module
Check Response to Request in Result Data
Check Error Code: Error free?
yes
no
End
ⓘ Additional information: Chapter Error Codes

Additional information:

Telegrams: Availability and supported interfaces

Error codes

Error Reset (depicted in the use case "Job change not possible")

1. Reset with "Reset Error Bit"
2. Error bits are overwritten by new error bits.

9 PROFINET

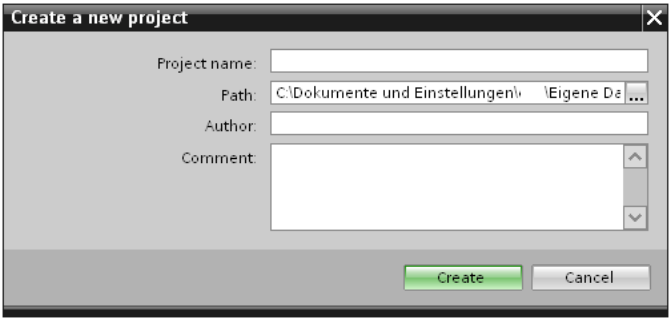
This section explains how to operate the SBS vision sensor with PROFINET.

9.1 Siemens S7-1200 TIA 12 configuration example

This description shows all PLC screenshots in English; switch the TIA software to English if necessary.

9.1.1 Creating a new project

New project with: Project / Create new project



Create a new project

Project name:

Path: C:\Dokumente und Einstellungen\ \Eigene Da

Author:

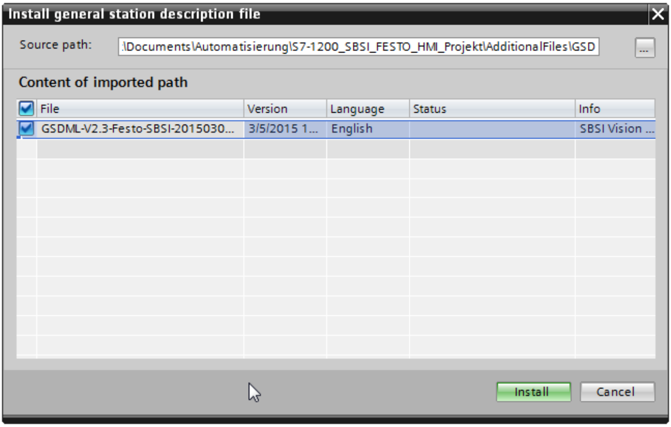
Comment:

Fig. 27: PROFINET Create new project

9.1.2 Selecting the GSD file

First a PROFINET PLC must be added to the project.

In order to be able to use the PROFINET functions of the SBS vision sensor, the latest version of the corresponding SBS GSD file must be installed. This is done at: Options/Install general station description file. The EDS file can be found in the installation path for the SBS in: ...\Festo\SBS vision sensor\Tools\PROFINET and is also available for download at www.festo.com.



Install general station description file

Source path: :\Documents\Automatisierung\S7-1200_SBSI_FESTO_HMI_Projekt\AdditionalFiles\GSD

Content of imported path

☑ File	Version	Language	Status	Info
☑ GSDML-V2.3-Festo-SBSI-2015030...	3/5/2015 1...	English		SBSI Vision ...

Fig. 28: Selecting and installing the GSD file

9.1.3 Adding the SBS vision sensor to the project

The SBS modules are added in the hardware catalog: Other field devices/PROFINET IO/sensors/Festo Corporation.

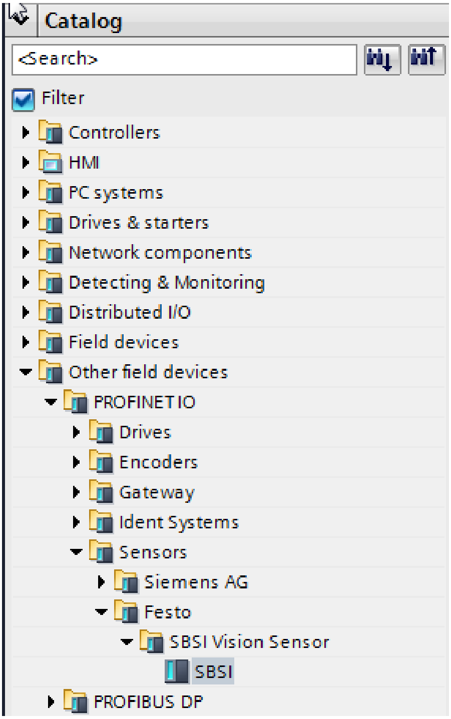
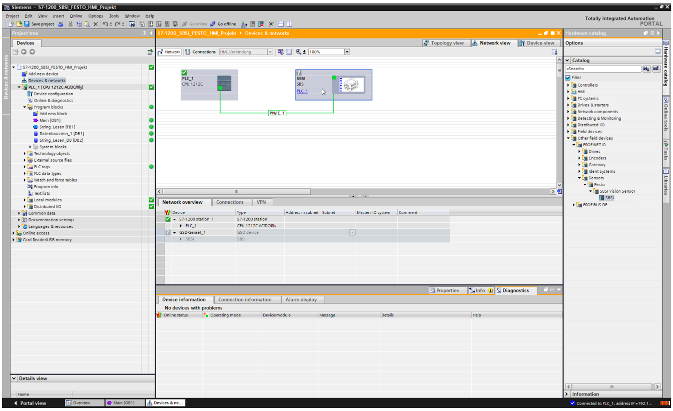


Fig. 29: Adding the SBS to the project

Connecting the to the PLC

You can now drag a module from the catalog and drop it in the Network View. The is connected to the PLC via PROFINET (Network View tab).



Siemens - S7-1200_SBSI_FESTO_HMI_Projekt
S7-1200_SBSI_FESTO_HMI_Projekt ▸ Devices & networks
Topology view
Network view
Device view
PLC_1
CPU 1212C
SBSI
PN/IE_1
Hardware catalog
Totally Integrated Automation PORTAL

Network overview | Connections | VPN

Device	Type	Address in subnet	Subnet	Master / IO system	Comment
S7-1200 station_1	S7-1200 station				
PLC_1	CPU 1212C AC/DC/Rly				
GSD-Geraet_1	GSD device				
SBSI	SBSI				

Device information | Connection information | Alarm display

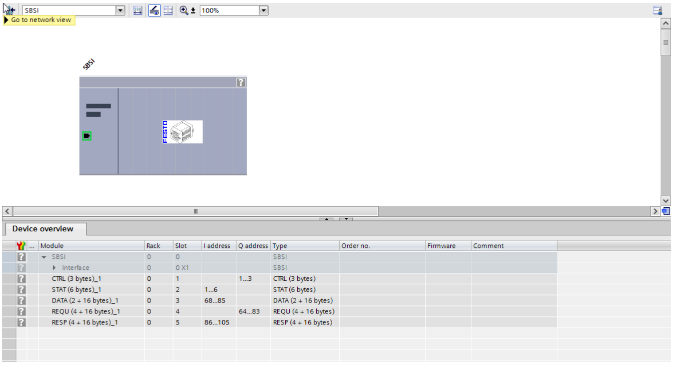
No devices with problems

Fig. 30: Connecting the SBS to the PLC

Definition of I/O data

In the tab "Device view", the modules CTRL (Control) and STAT (Status) are active by default. As an option, the module DATA (Data module) can be added with a certain use size.

In this example: 2 bytes + 16 bytes of payload (1 byte: Image ID, 1 byte: Result data overrun (see Module 3: "Data" (from SBS to PLC)), + 16 bytes of data). If the data are longer than the defined range, these are truncated (in this case: Result data overrun = 1); if it's shorter, the rest of the 16 bytes are filled with 00h.



Device overview

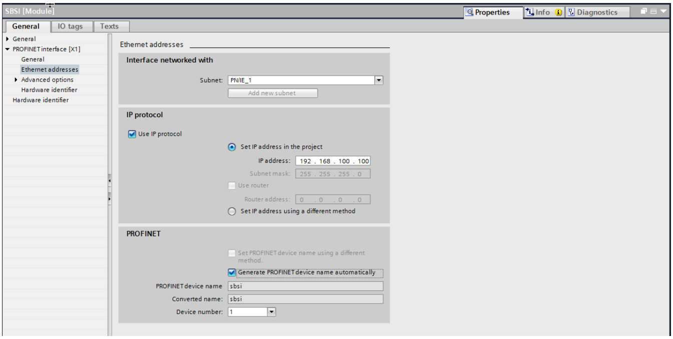
Module	Rack	Slot	I address	Q address	Type	Order no.	Firmware	Comment
SBSI	0	0			SBSI			
Interface	0	0 X1			SBSI			
CTRL (3 bytes)_1	0	1		1...3	CTRL (3 bytes)			
STAT (6 bytes)_1	0	2	1...6		STAT (6 bytes)			
DATA (2 + 16 bytes)_1	0	3	68...85		DATA (2 + 16 bytes)			
REQU (4 + 16 bytes)_1	0	4		64...83	REQU (4 + 16 bytes)			
RESP (4 + 16 bytes)_1	0	5	86...105		RESP (4 + 16 bytes)			

Fig. 31: Enter I/O data

Configuring the IP address

Option 1: In the project

The IP address for the can be assigned through the project in the PLC. Select option "Set IP address in the project" and enter IP address. The address from the "IP address" field will be written to the . The IP addresses of the PLC and the must be different from each other but correspond to each other, i.e., fall within the same address space.



Ethernet addresses

Interface networked with

Subnet: PN/IE_1

IP protocol

☑ Use IP protocol

● Set IP address in the project

IP address: 192 . 168 . 100 . 100

Subnet mask: 255 . 255 . 255 . 0

□ Use router

Router address: 0 . 0 . 0 . 0

○ Set IP address using a different method

PROFINET

□ Set PROFINET device name using a different method.

☑ Generate PROFINET device name automatically

PROFINET device name: sbsi

Converted name: sbsi

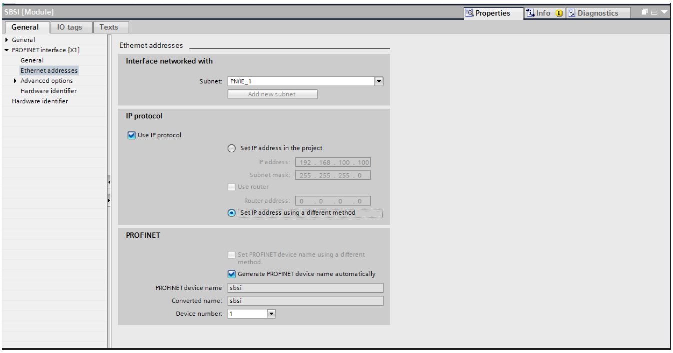
Device number: 1

Fig. 32: Configuring the IP address in the project

The can also be used without a running PROFINET, and accordingly can be configured via Vision Sensor Device Manager. If the IP address of the does not match the one in the TIA project, the PLC will configure the IP address instead. In this case, the original configuration in the will be overwritten with 0.0.0.0. This means that the IP address is set correctly but the IP configuration is deleted (this is important for a restart, possibly without a connected PLC).

Option 2: In Vision Sensor Device Manager

The IP address of the can also be configured via Vision Sensor Device Manager. Select option "Set IP address using a different method" in the PLC / TIA interface. Configure the IP address via Vision Sensor Device Manager (See Chapter: Settings in Vision Sensor Device Manager).



Ethernet addresses

Interface networked with

Subnet: PN/IE_1

IP protocol

☑ Use IP protocol

○ Set IP address in the project

IP address: 192 . 168 . 100 . 100

Subnet mask: 255 . 255 . 255 . 0

□ Use router

Router address: 0 . 0 . 0 . 0

● Set IP address using a different method

PROFINET

□ Set PROFINET device name using a different method.

☑ Generate PROFINET device name automatically

PROFINET device name: sbsi

Converted name: sbsi

Device number: 1

Fig. 33: Configure the IP address for the SBS in Vision Sensor Device Manager; the corresponding settings can be found in the PLC/TIA interface

Set the name with TIA interface

There are two ways to configure the name for the from the TIA Portal.

Generate name automatically

The PROFINET name for the SBS can be generated automatically in the PLC. Option: "Generate PROFINET device name automatically" takes the name from the project.

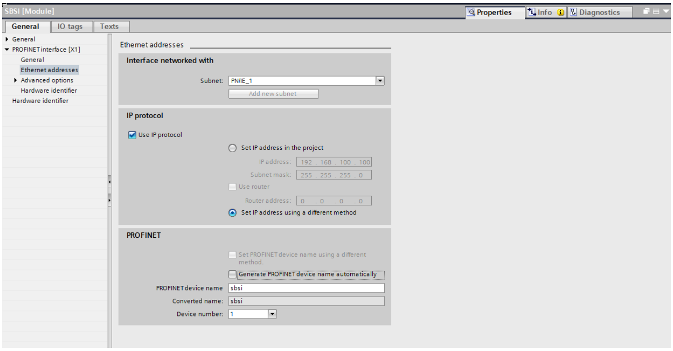
Set name manually

If the option "Set PROFINET device name using a different method" is selected any name can be set.

Information: In the field "Converted name", a different name than entered is displayed, which is then also used. Since not all characters can be used in PROFINET, a conversion may be necessary and is done automatically (names must be DNS compatible, see also chapter Settings in Vision Sensor Device Manager).

If the SBS's name is configured using the TIA Portal, it must be written to the sensor with the "PROFINET device name" tool (as described in section Writing a name to SBS).

The PROFINET name in the project and in the must match.



Ethernet addresses

Interface networked with

Subnet: PN/IE_1

IP protocol

☑ Use IP protocol

○ Set IP address in the project

IP address: 192 . 168 . 100 . 100

Subnet mask: 255 . 255 . 255 . 0

□ Use router

Router address: 0 . 0 . 0 . 0

● Set IP address using a different method

PROFINET

□ Set PROFINET device name using a different method.

□ Generate PROFINET device name automatically

PROFINET device name: sbsi

Converted name: sbsi

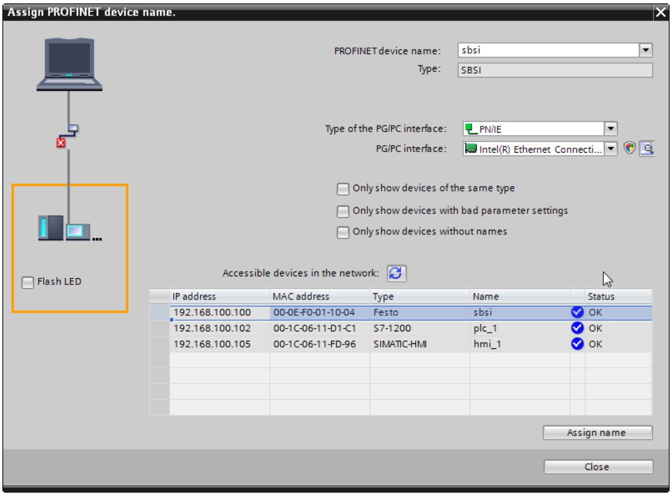
Device number: 1

Fig. 34: Set name in project

9.1.4 Writing a name to SBS

In order to be able to establish communications, the PROFINET name must be written to the SBS in case it needs to be updated.

This is done with the tool: Online/Assign PROFINET device name. Select the corresponding device (SBS) and apply the name with "Assign name."


Assign PROFINET device name.
Flash LED
Accessible devices in the network:
Assign name
Close

PROFINET device name: sbsi

Type: SBSI

Type of the PG/PC interface: PN/IE

PG/PC interface: Intel(R) Ethernet Connecti...

□ Only show devices of the same type

□ Only show devices with bad parameter settings

□ Only show devices without names

□ Flash LED

IP address	MAC address	Type	Name	Status
192.168.100.100	00-0E-F0-01-10-04	Festo	sbsi	✓ OK
192.168.100.102	00-1C-06-11-D1-C1	S7-1200	plc_1	✓ OK
192.168.100.105	00-1C-06-11-FD-96	SIMATIC-HMI	hmi_1	✓ OK

Fig. 35: Writing a name to SBS

9.1.5 Loading the project onto the PLC

To finish the configuration and apply the changes, 1. compile the project, and 2. load it to the PLC.

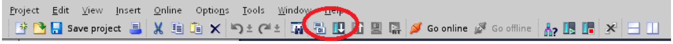
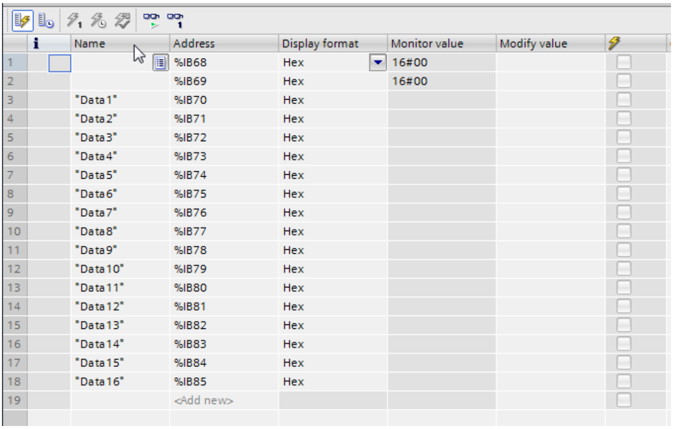


Fig. 36: Translate project and write to PLC

9.1.6 Mapping of output data

The SBS vision sensor’s output data can be mapped to the data in the PROFINET log as follows:

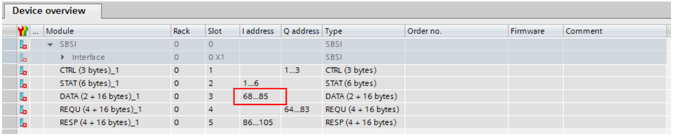
Step 1) The start address for an input variable can be taken from "Device Overview".



	i	Name	Address	Display format	Monitor value	Modify value	
1			%IB68	Hex	16#00		□
2			%IB69	Hex	16#00		□
3		"Data1"	%IB70	Hex			□
4		"Data2"	%IB71	Hex			□
5		"Data3"	%IB72	Hex			□
6		"Data4"	%IB73	Hex			□
7		"Data5"	%IB74	Hex			□
8		"Data6"	%IB75	Hex			□
9		"Data7"	%IB76	Hex			□
10		"Data8"	%IB77	Hex			□
11		"Data9"	%IB78	Hex			□
12		"Data10"	%IB79	Hex			□
13		"Data11"	%IB80	Hex			□
14		"Data12"	%IB81	Hex			□
15		"Data13"	%IB82	Hex			□
16		"Data14"	%IB83	Hex			□
17		"Data15"	%IB84	Hex			□
18		"Data16"	%IB85	Hex			□
19			<Add new>				□

Fig. 37: Table of variables

Step 2) Creating a tag table in the PLC

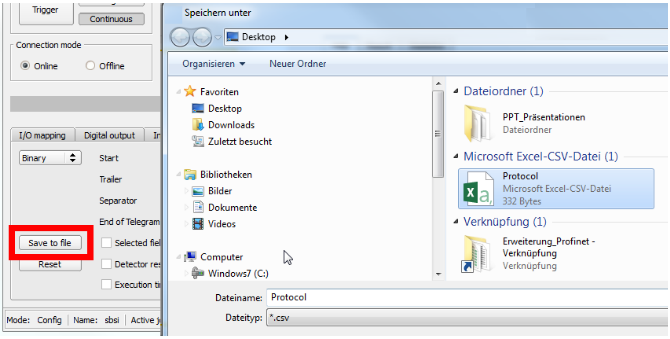


Device overview

	...	Module	Rack	Slot	I address	Q address	Type	Order no.	Firmware	Comment
		SBSI	0	0			SBSI			
		Interface	0	0 X1			SBSI			
		CTRL (3 bytes)_1	0	1		1...3	CTRL (3 bytes)			
		STAT (6 bytes)_1	0	2	1...6		STAT (6 bytes)			
		DATA (2 + 16 bytes)_1	0	3	68...85		DATA (2 + 16 bytes)			
		REQU (4 + 16 bytes)_1	0	4		64...83	REQU (4 + 16 bytes)			
		RESP (4 + 16 bytes)_1	0	5	86...105		RESP (4 + 16 bytes)			

Fig. 38: Device overview

Step 3) Creating the configuration in Vision Sensor Device Manager and saving the configured log as a CSV file.

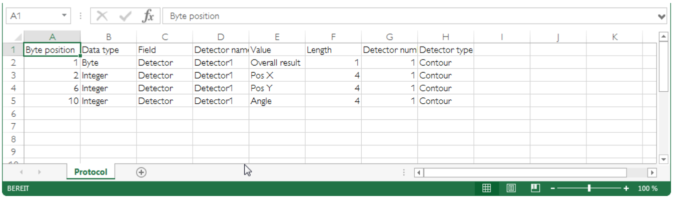


Dateiname: Protocol

Dateityp: *.csv

Fig. 39: Output format saved as CSV file

Step 4) Opening the file with the text program

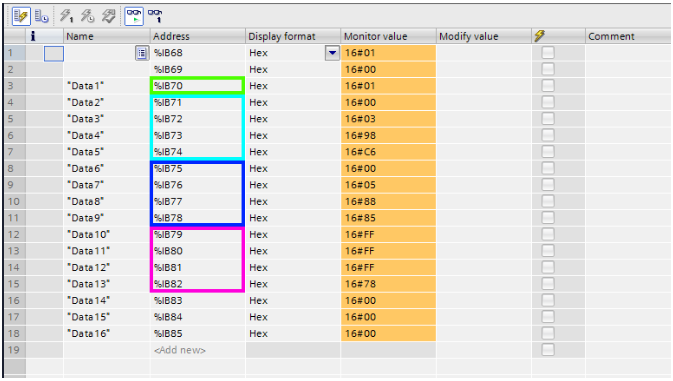


	A	B	C	D	E	F	G	H
1	Byte position	Data type	Field	Detector nam	Value	Length	Detector num	Detector type
2	1	Byte	Detector	Detector1	Overall result	1	1	Contour
3	2	Integer	Detector	Detector1	Pos X	4	1	Contour
4	6	Integer	Detector	Detector1	Pos Y	4	1	Contour
5	10	Integer	Detector	Detector1	Angle	4	1	Contour

Fig. 40: Output protocol in Excel representation

For a description of the format of the PROFINET Data module, please refer to Module 3: "Data" (from SBS to PLC)

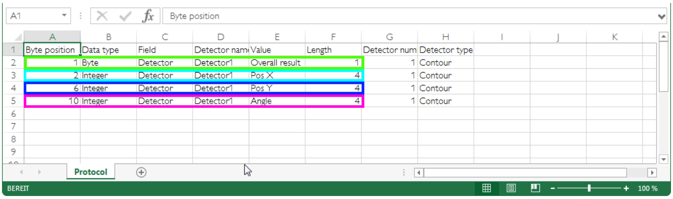
Step 5) The result is the following assignment between the input data of the PLC



	i	Name	Address	Display format	Monitor value	Modify value		Comment
1			%IB68	Hex	16#01		□	
2			%IB69	Hex	16#00		□	
3		"Data1"	%IB70	Hex	16#01		□	
4		"Data2"	%IB71	Hex	16#00		□	
5		"Data3"	%IB72	Hex	16#03		□	
6		"Data4"	%IB73	Hex	16#98		□	
7		"Data5"	%IB74	Hex	16#C6		□	
8		"Data6"	%IB75	Hex	16#00		□	
9		"Data7"	%IB76	Hex	16#05		□	
10		"Data8"	%IB77	Hex	16#88		□	
11		"Data9"	%IB78	Hex	16#85		□	
12		"Data10"	%IB79	Hex	16#FF		□	
13		"Data11"	%IB80	Hex	16#FF		□	
14		"Data12"	%IB81	Hex	16#FF		□	
15		"Data13"	%IB82	Hex	16#78		□	
16		"Data14"	%IB83	Hex	16#00		□	
17		"Data15"	%IB84	Hex	16#00		□	
18		"Data16"	%IB85	Hex	16#00		□	
19			<Add new>				□	

Fig. 41: Input data PLC

... and the configured protocol:



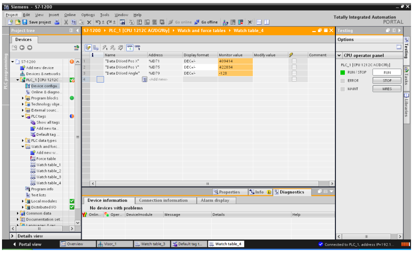
A1 Byte position

	A	B	C	D	E	F	G	H
1	Byte position	Data type	Field	Detector nam	Value	Length	Detector num	Detector type
2	1	Byte	Detector	Detector1	Overall result	1	1	Contour
3	2	Integer	Detector	Detector1	Pos X	4	1	Contour
4	6	Integer	Detector	Detector1	Pos Y	4	1	Contour
5	10	Integer	Detector	Detector1	Angle	4	1	Contour

Fig. 42: In the vision sensor configured protocol

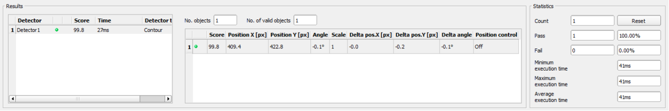
Conversion of binary values

All detector-specific payloads with decimal places will be transmitted as integers multiplied by 1000, and accordingly must be divided by 1000 after the data is received. The values are transferred in the format "Big-endian". The length is based on the value, e.g., score 32 bits (DWord).



S7-1200 ▸ PLC_1 [CPU 1212C AC/DC/Rly] ▸ Watch and force tables ▸ Watch table_4

	i	Name	Address	Display format	Monitor value	Modify value		Comment
1		"Data DWord Pos X"	%ID71	DEC+/-	409414		□	
2		"Data DWord Pos Y"	%ID75	DEC+/-	422834		□	
3		"Data DWord Angle"	%ID79	DEC+/-	-128		□	
4			<Add new>				□	



Results

	Detector			Score	Time	Detector t
1	Detector1	●		99.8	27ms	Contour

No. objects 1 No. of valid objects 1

		Score	Position X [px]	Position Y [px]	Angle	Scale	Delta pos.X [px]	Delta pos.Y [px]	Delta angle	Position control
1	●	99.8	409.4	422.8	-0.1°	1	-0.0	-0.2	-0.1°	Off

Statistics

Count	1	Reset
Pass	1	100.00%
Fail	0	0.00%
Minimum execution time		41ms
Maximum execution time		41ms
Average execution time		41ms

10 EtherNet/IP

This section explains how to operate the SBS vision sensor with EtherNet/IP.

10.1 Rockwell CompactLogix^{TM} configuration example

Following is a description of the PLC settings required for data transfers between the SBS vision sensor and the PLC via EtherNet/IP (using Rockwell CompactLogix^{TM} as an example).

Rockwell Studio 5000

This description shows all PLC screenshots (Studio 5000, version 30 under Windows 7) in English language. Switch Rockwell software to English if necessary.

1. Create a new project: "Create" / "New Project

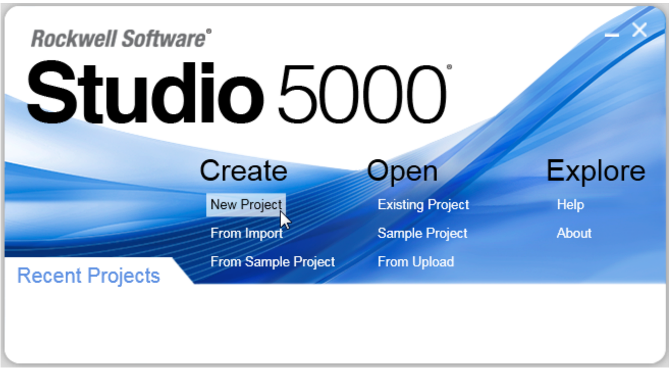
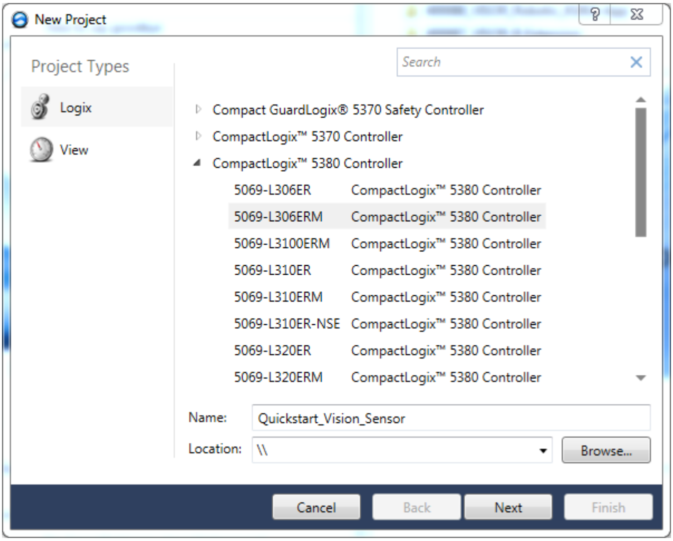


Fig. 43: EtherNet/IP Create new project

2. Select the appropriate PLC type and assign a name.



New Project

Project Types

- Logix
- View

Search

- Compact GuardLogix® 5370 Safety Controller
- CompactLogix™ 5370 Controller
- CompactLogix™ 5380 Controller

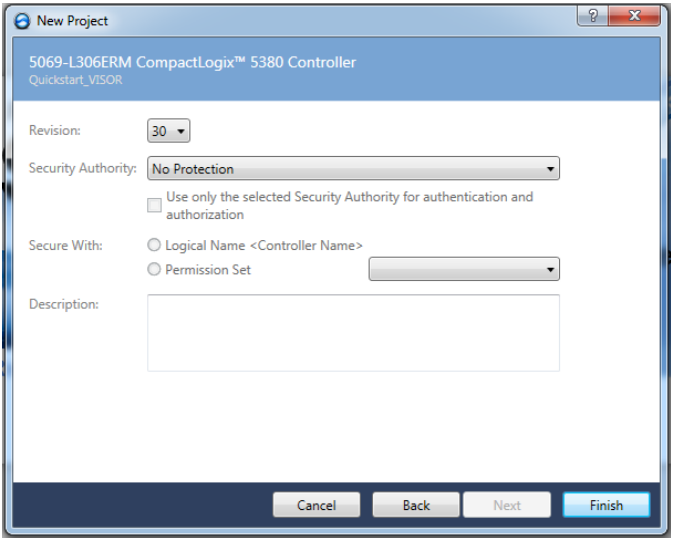
5069-L306ER	CompactLogix™ 5380 Controller
5069-L306ERM	CompactLogix™ 5380 Controller
5069-L3100ERM	CompactLogix™ 5380 Controller
5069-L310ER	CompactLogix™ 5380 Controller
5069-L310ERM	CompactLogix™ 5380 Controller
5069-L310ER-NSE	CompactLogix™ 5380 Controller
5069-L320ER	CompactLogix™ 5380 Controller
5069-L320ERM	CompactLogix™ 5380 Controller

Name: Quickstart_Vision_Sensor

Location: \\

Fig. 44: EtherNet/IP Select the PLC type.

3. Apply the default settings. Click on "Finish" to create the project.



New Project

5069-L306ERM CompactLogix™ 5380 Controller
Quickstart_VISOR

Revision: 30

Security Authority: No Protection

□ Use only the selected Security Authority for authentication and authorization

Secure With: ○ Logical Name <Controller Name> ○ Permission Set

Description:

Fig. 45: EtherNet/IP Apply the default settings.

10.2 Installation of EDS file

The project view opens. In order to be able to use the EtherNet/IP functions of the SBS vision sensor, the latest version of the corresponding SBS EDS file must be installed.

If the controller does not support EDS file, follow instructions in chapter Create module/Using a Generic Device (without EDS file).

1. Install EDS file under "Tools" / "EDS Harware Installation Tool".

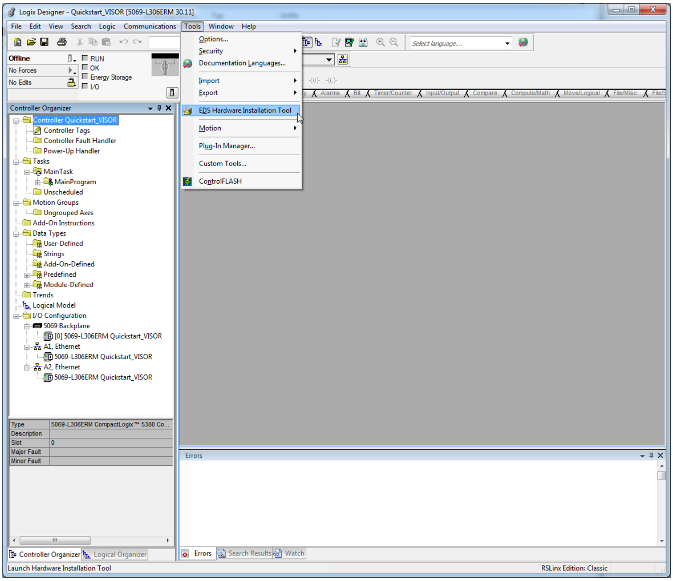
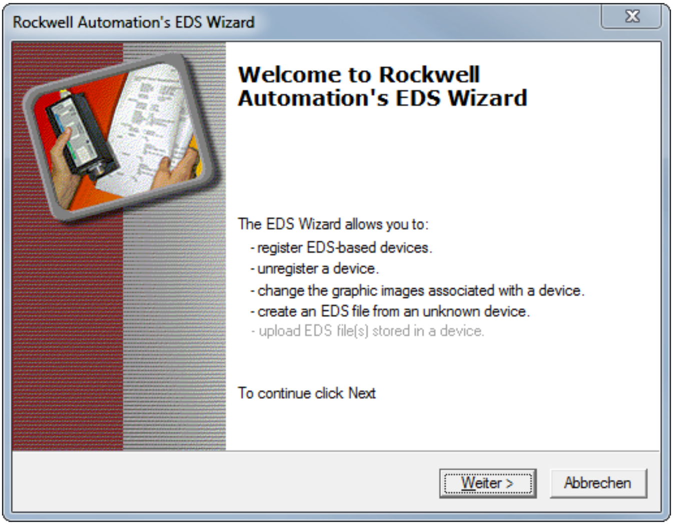


Fig. 46: Project view, Tool, EDS Hardware Installation Tool

2. Confirm information with "Next".



Rockwell Automation's EDS Wizard

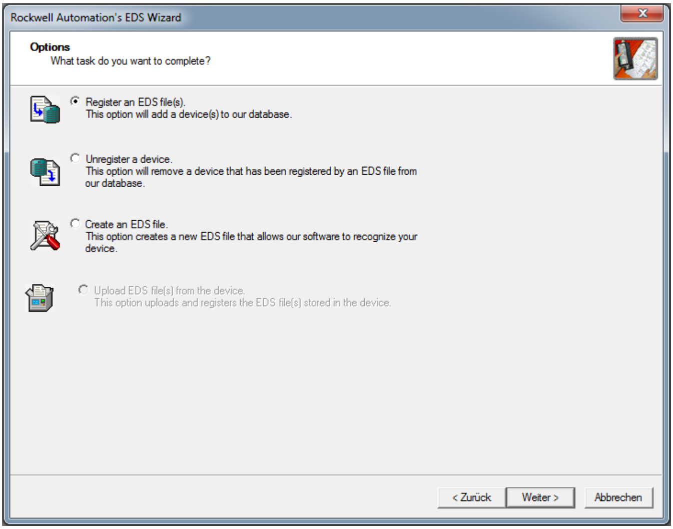
Welcome to Rockwell Automation's EDS Wizard

The EDS Wizard allows you to:
- register EDS-based devices.
- unregister a device.
- change the graphic images associated with a device.
- create an EDS file from an unknown device.
- upload EDS file(s) stored in a device.

To continue click Next

Fig. 47: Confirming information

3. Select "Register to EDS file(s)" in the options



Rockwell Automation's EDS Wizard

Options
What task do you want to complete?

● Register an EDS file(s).
This option will add a device(s) to our database.

○ Unregister a device.
This option will remove a device that has been registered by an EDS file from our database.

○ Create an EDS file.
This option creates a new EDS file that allows our software to recognize your device.

○ Upload EDS file(s) from the device.
This option uploads and registers the EDS file(s) stored in the device.

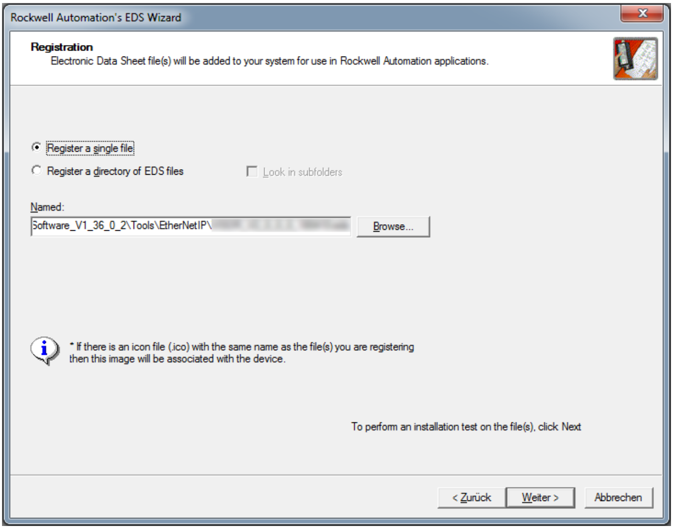
Fig. 48: Register an EDS File(s)

4. Select "Register a single file"

NOTE:
The exact same EDS file can be used for all SBS vision sensors.

5. Specify the path to the EDS file.

The EDS file can be found in the installation path of the SBS under: \Festo\SBS Vision-Sensor\Tools\EtherNet/IP and is also available for download at www.festo.com



Rockwell Automation's EDS Wizard

Registration
Electronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.

● Register a single file

○ Register a directory of EDS files   □ Look in subfolders

Named:
Software_V1_36_0_2\Tools\EtherNetIP\[redacted]   Browse...

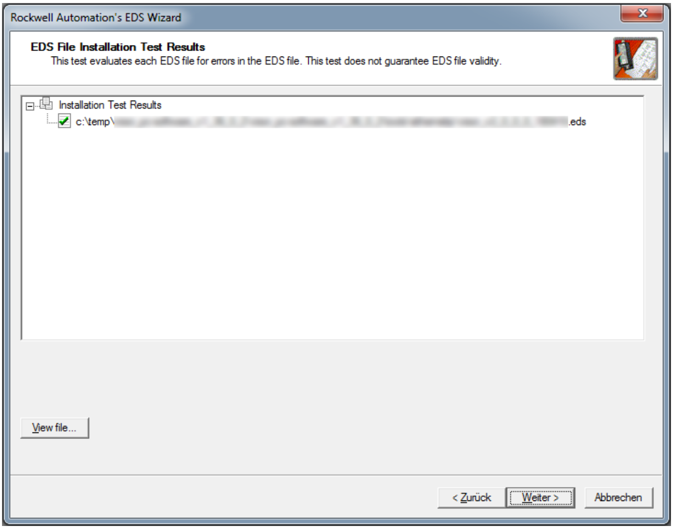
* If there is an icon file (.ico) with the same name as the file(s) you are registering then this image will be associated with the device.

To perform an installation test on the file(s), click Next

< Zurück   Weiter >   Abbrechen

Fig. 49: Select EDS file

6. Confirm EDS file test.



Rockwell Automation's EDS Wizard

EDS File Installation Test Results

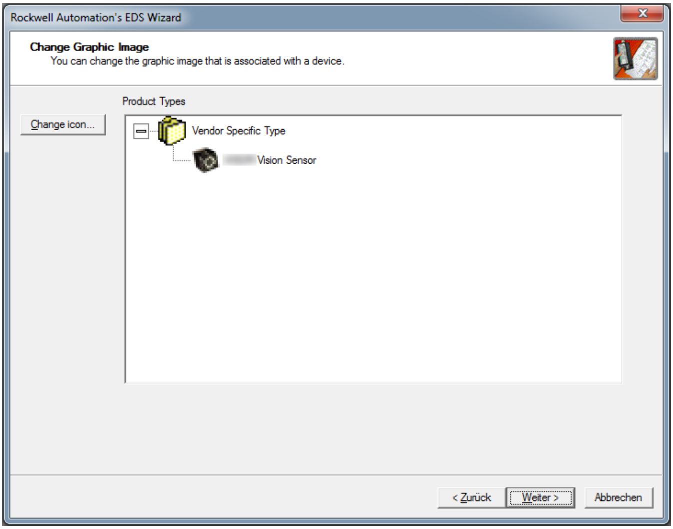
This test evaluates each EDS file for errors in the EDS file. This test does not guarantee EDS file validity.

Installation Test Results

☑ c:\temp\ .eds

Fig. 50: EDS file test

7. Select icon if required or continue with standard icon.



Rockwell Automation's EDS Wizard

Change Graphic Image

You can change the graphic image that is associated with a device.

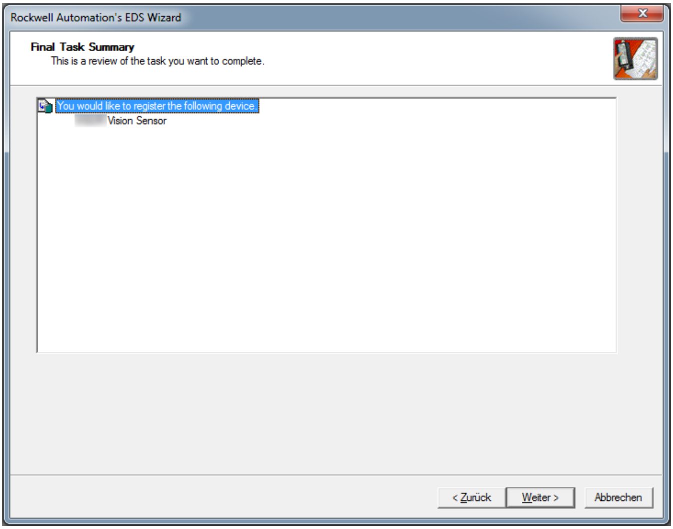
Product Types

Vendor Specific Type

Vision Sensor

Fig. 51: Icon

8. Confirm the installation.



Final Task Summary

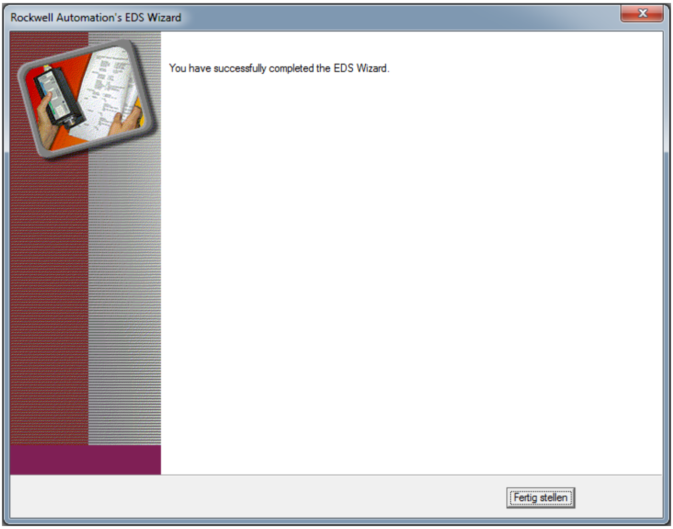
This is a review of the task you want to complete.

You would like to register the following device.

Vision Sensor

Fig. 52: Confirming the installation

9. Complete the installation with "Finish".



You have successfully completed the EDS Wizard.

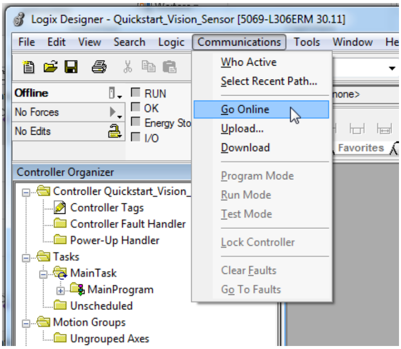
Fig. 53: Finishing the installation

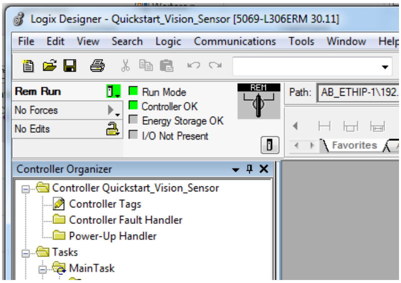
10.3 Create module

10.3.1 Selection via hardware catalog (with EDS file)

1 To go online with the project, select Communications / "Go Online".

NOTE:
Before this, the project path must be configured correctly.





2. Create a new module by right clicking on the desired network connection.

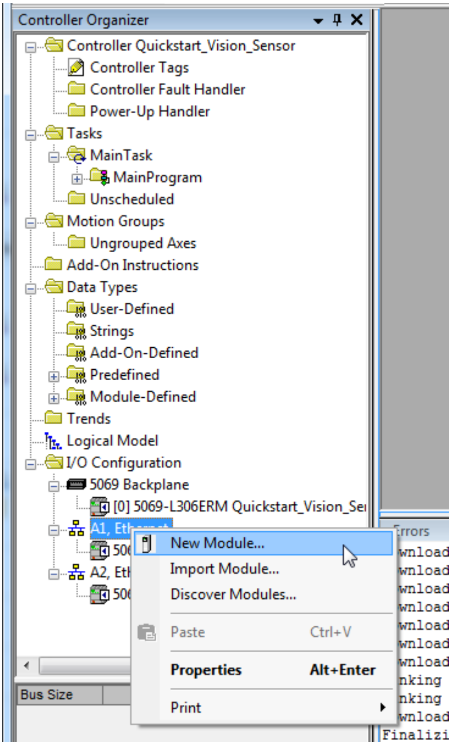
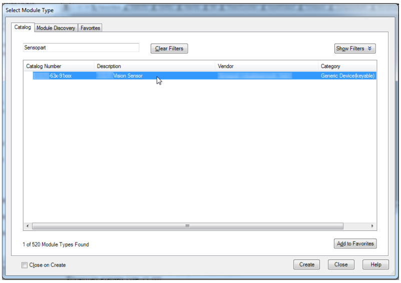


Fig. 54: Creating a new module

3. Select SBS from the catalog or search for available devices online.

NOTE:
For the option "Search online" the software must already be online (see Create module / step 1).

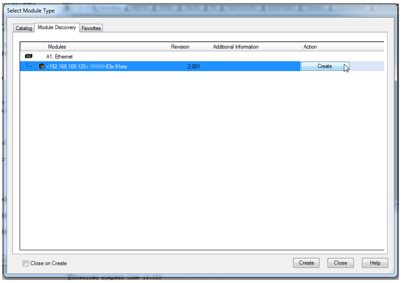


Select Module Type

Sensopart

Catalog Number	Description	Vendor	Category
-63x-91xxx	Vision Sensor		Generic Device(keyable)

1 of 520 Module Types Found



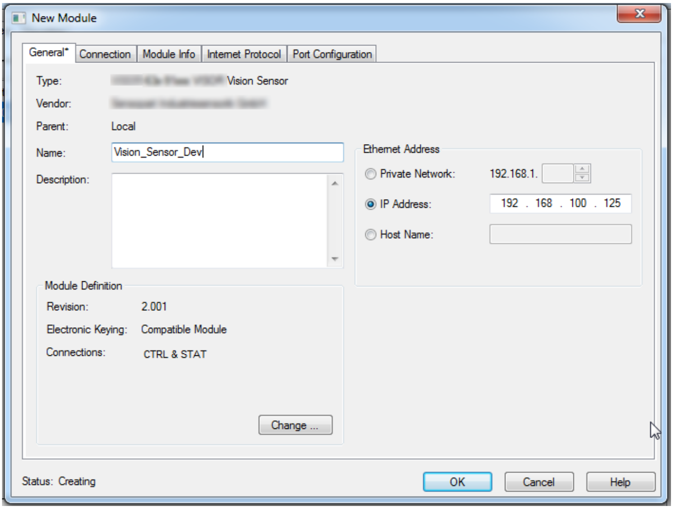
Select Module Type

Modules	Revision	Additional Information	Action
A1, Ethernet			
<192.168.100.125> -63x-91xxx	2.001		Create

You can search for "Festo" in the hardware catalog. The corresponding devices are listed. Alternatively, the "Module Discovery" tab can be used to search for accessible participants.

4. Assign device name and IP address of the SBS.

- The device name will be used as a variable name for the data later on.
- The IP address can be read out via Vision Sensor Device Manager.



Type: [redacted] Vision Sensor

Vendor: [redacted]

Parent: Local

Name: Vision_Sensor_Dev

Description:

Ethernet Address

○ Private Network: 192.168.1.

● IP Address: 192 . 168 . 100 . 125

○ Host Name:

Module Definition

Revision: 2.001

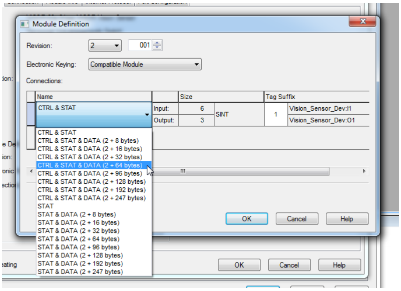
Electronic Keying: Compatible Module

Connections: CTRL & STAT

Status: Creating

Fig. 55: Configure the device name and IP address

5. the desired modules and module sizes can be selected via "Change ...".



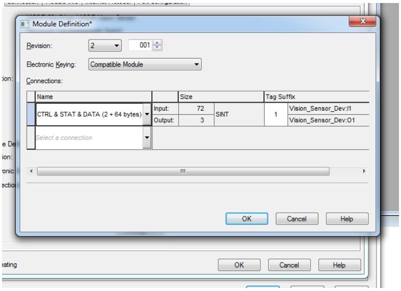
Revision: 2 001

Electronic Keying: Compatible Module

Connections:

Name		Size			Tag Suffix
CTRL & STAT	Input:	6	SINT	1	Vision_Sensor_Dev:I1
	Output:	3			Vision_Sensor_Dev:O1

- CTRL & STAT
- CTRL & STAT & DATA (2 + 8 bytes)
- CTRL & STAT & DATA (2 + 16 bytes)
- CTRL & STAT & DATA (2 + 32 bytes)
- CTRL & STAT & DATA (2 + 64 bytes)
- CTRL & STAT & DATA (2 + 96 bytes)
- CTRL & STAT & DATA (2 + 128 bytes)
- CTRL & STAT & DATA (2 + 192 bytes)
- CTRL & STAT & DATA (2 + 247 bytes)
- STAT
- STAT & DATA (2 + 8 bytes)
- STAT & DATA (2 + 16 bytes)
- STAT & DATA (2 + 32 bytes)
- STAT & DATA (2 + 64 bytes)
- STAT & DATA (2 + 96 bytes)
- STAT & DATA (2 + 128 bytes)
- STAT & DATA (2 + 192 bytes)
- STAT & DATA (2 + 247 bytes)



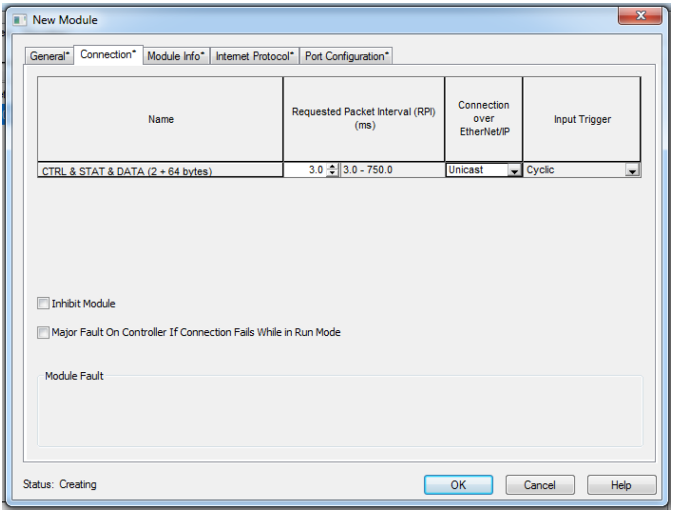
Revision: 2 001

Electronic Keying: Compatible Module

Connections:

Name		Size			Tag Suffix
CTRL & STAT & DATA (2 + 64 bytes)	Input:	72	SINT	1	Vision_Sensor_Dev:I1
	Output:	3			Vision_Sensor_Dev:O1
Select a connection					

6. Set the desired refresh rate (RPI) in the "Connection" tab.



New Module

Name	Requested Packet Interval (RPI) (ms)		Connection over EtherNet/IP	Input Trigger
CTRL & STAT & DATA (2 + 64 bytes)	3.0	3.0 - 750.0	Unicast	Cyclic

□ Inhibit Module

□ Major Fault On Controller If Connection Fails While in Run Mode

Module Fault

Status: Creating

Fig. 56: Set the refresh rate.

7. Complete the participant's settings via "OK".

10.3.2 Using a Generic Device (without EDS file)

If the controller does not support EDS files, continue with the following steps.

1. Create a new module by right-clicking on the desired network connection.

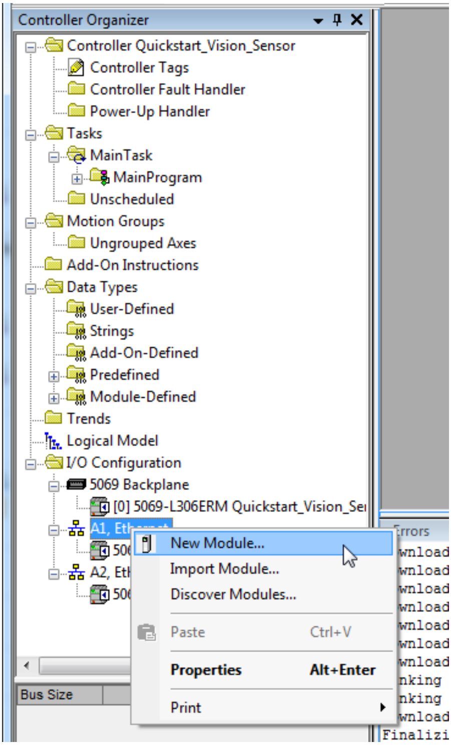
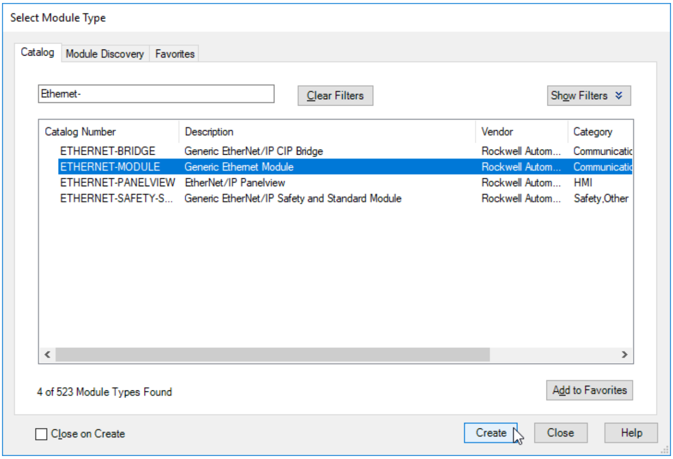


Fig. 57: Creating a new module

2. Select a module of type Ethernet Module - "Generic Ethernet Module" from the catalog



Select Module Type

Ethernet-

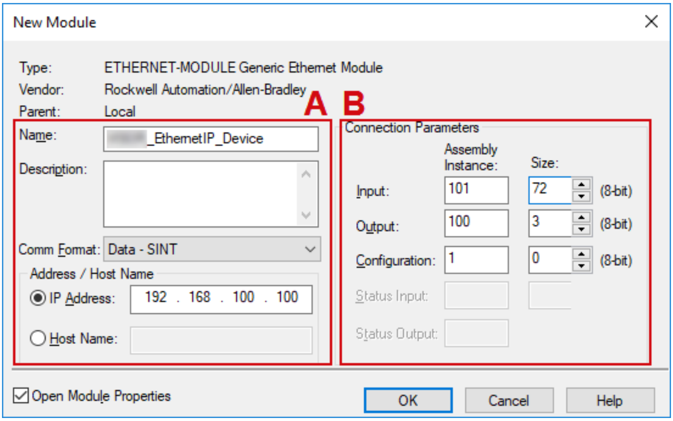
Catalog Number	Description	Vendor	Category
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge	Rockwell Autom...	Communicatic
ETHERNET-MODULE	Generic Ethernet Module	Rockwell Autom...	Communicatic
ETHERNET-PANELVIEW	EtherNet/IP Panelview	Rockwell Autom...	HMI
ETHERNET-SAFETY-S...	Generic EtherNet/IP Safety and Standard Module	Rockwell Autom...	Safety,Other

4 of 523 Module Types Found

Fig. 58: Selection of "Generic Ethernet Module"

3. Assign device name and IP address of the SBS (**A**).

- The device name will be used as a variable name for the data later on.
- The IP address can be read out via Vision Sensor Device Manager.



New Module

Type: ETHERNET-MODULE Generic Ethernet Module
Vendor: Rockwell Automation/Allen-Bradley
Parent: Local

Name: [redacted]_EthernetIP_Device
Description:
Comm Format: Data - SINT
Address / Host Name
● IP Address: 192 . 168 . 100 . 100
○ Host Name:

Connection Parameters

	Assembly Instance:	Size:	
Input:	101	72	(8-bit)
Output:	100	3	(8-bit)
Configuration:	1	0	(8-bit)
Status Input:			
Status Output:			

Fig. 59: Assignment of the device name and IP address

4. Change the data format to "Data - SINT" (8 bit format) with the "Comm Format" parameter (**A**).

5. Enter connection parameters (**B**) (see following table).

	Assembly instance (dec)	Size (dec)	Assembly instance (hex)	Size (hex)
Control + Status				
Input	101	6	0x65	0x06
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+8)				
Input	102	16	0x66	0x10
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+16)				
Input	103	24	0x67	0x18
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+32)				
Input	104	40	0x68	0x28
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+64)				
Input	105	72	0x69	0x48
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+96)				
Input	105	104	0x69	0x68
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+128)				
Input	105	136	0x69	0x88
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00
Control + Status + Data (2+192)				
Input	105	200	0x69	0xCB
Output	100	3	0x64	0x03

	Assembly instance (dec)	Size (dec)	Assembly instance (hex)	Size (hex)
Configuration	1	0	0x01	0x00
Control + Status + Data (2+247)				
Input	105	255	0x69	0xFF
Output	100	3	0x64	0x03
Configuration	1	0	0x01	0x00

10.4 Load the project onto the PLC

1. Download the project to the PLC via "Communications" / "Download" .

NOTE:
For this the software must already be online (see Create module / step 1).

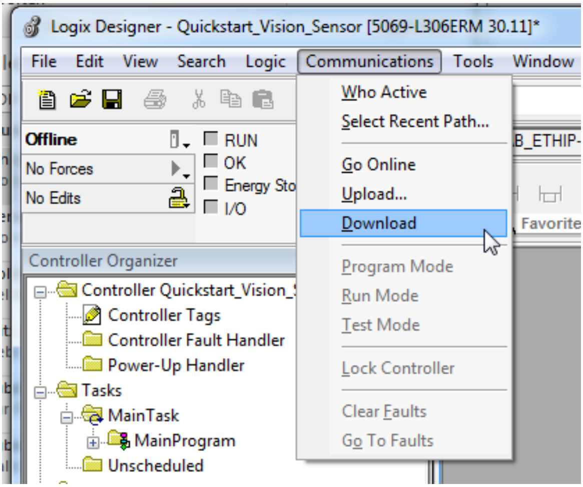
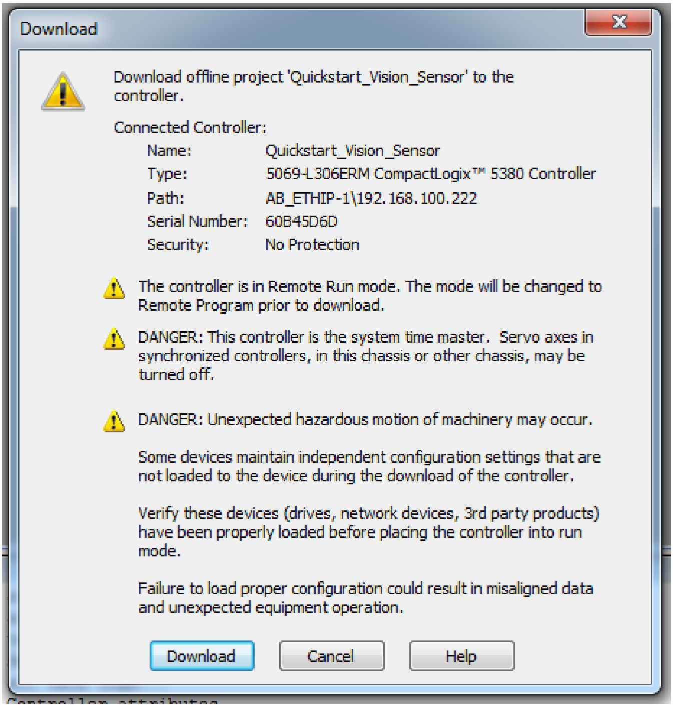


Fig. 60: Download

2. Check the notes and confirm with "Download".



Download

Download offline project 'Quickstart_Vision_Sensor' to the controller.

Connected Controller:

Name:	Quickstart_Vision_Sensor
Type:	5069-L306ERM CompactLogix™ 5380 Controller
Path:	AB_ETHIP-1\192.168.100.222
Serial Number:	60B45D6D
Security:	No Protection

⚠ The controller is in Remote Run mode. The mode will be changed to Remote Program prior to download.

⚠ DANGER: This controller is the system time master. Servo axes in synchronized controllers, in this chassis or other chassis, may be turned off.

⚠ DANGER: Unexpected hazardous motion of machinery may occur.

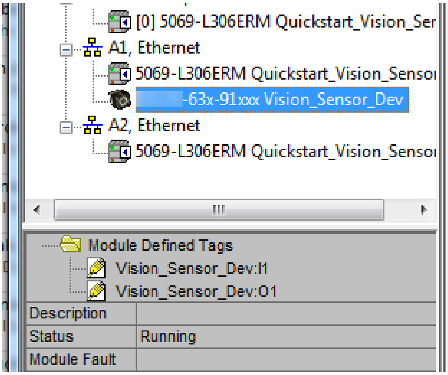
Some devices maintain independent configuration settings that are not loaded to the device during the download of the controller.

Verify these devices (drives, network devices, 3rd party products) have been properly loaded before placing the controller into run mode.

Failure to load proper configuration could result in misaligned data and unexpected equipment operation.

Fig. 61: Information

3. After a successful download, the SBS status is "Running".



[0] 5069-L306ERM Quickstart_Vision_Ser

A1, Ethernet

5069-L306ERM Quickstart_Vision_Sensoı

-63x-91xxx Vision_Sensor_Dev

A2, Ethernet

5069-L306ERM Quickstart_Vision_Sensoı

Module Defined Tags

Vision_Sensor_Dev:I1

Vision_Sensor_Dev:O1

Description	
Status	Running
Module Fault	

Fig. 62: Status "Running"

10.5 Mapping of output data

The input data is assigned as follows: (select module CNTL + STAT + Data (2+128))

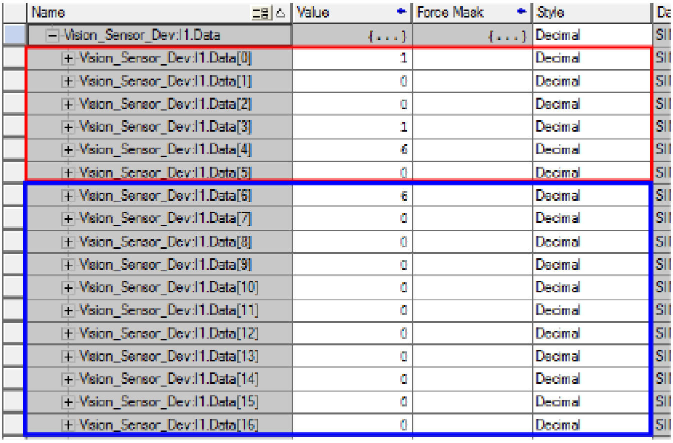
.... I1.Data[0] – .... I1.data [5] "Status" module (see description Module 2: “Status” (from SBS to PLC))

e.g. ... I1.Data [3] = Job number

.... I1.Data[4] = Image_ID

The data module is appended directly. Start of Data module from ... I1.Data[6] - .... I1.Data[135]

Here the data is inserted as indicated in Vision Sensor Configuration Studio under "Output" / "Telegram".
Additional information: Defining telegrams / data output in Vision Sensor Configuration Studio

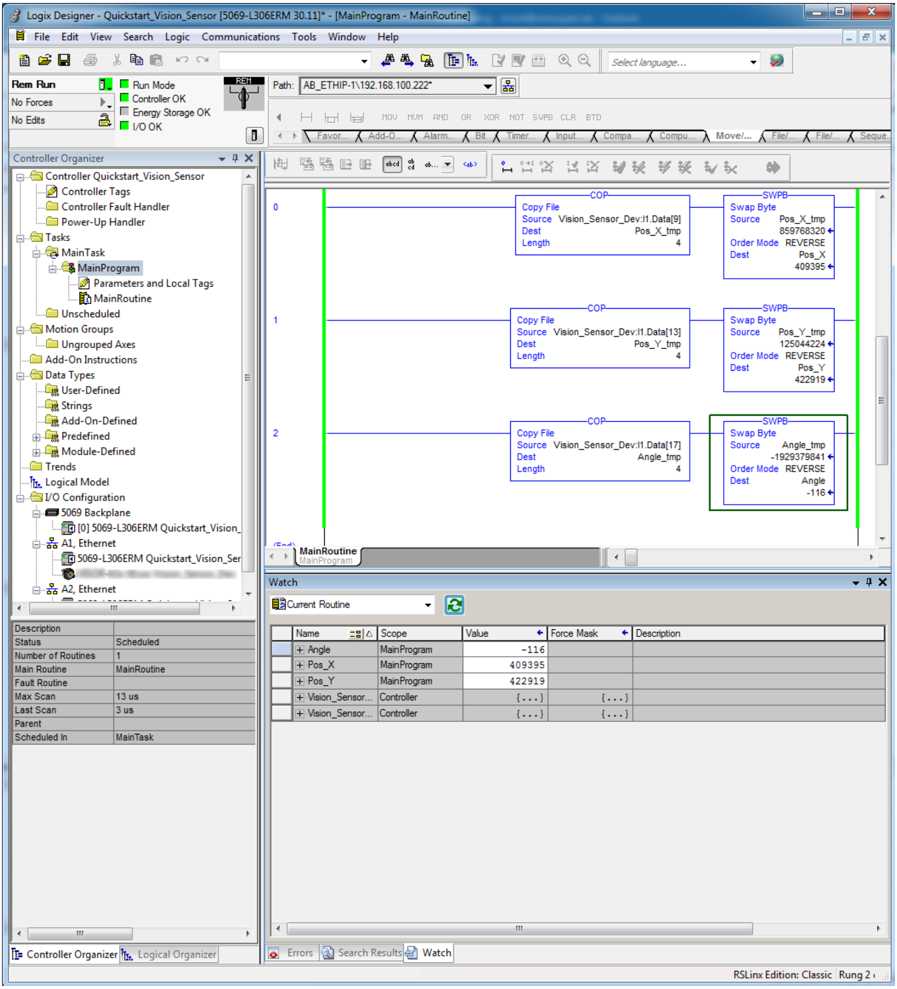


Name	Value	Force Mask	Style	De
− Vision_Sensor_Dev:I1.Data	{...}	{...}	Decimal	SI
+ Vision_Sensor_Dev:I1.Data[0]	1		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[1]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[2]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[3]	1		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[4]	6		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[5]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[6]	6		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[7]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[8]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[9]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[10]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[11]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[12]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[13]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[14]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[15]	0		Decimal	SI
+ Vision_Sensor_Dev:I1.Data[16]	0		Decimal	SI

Fig. 63: Output data

Conversion of binary values

All detector-specific payloads with decimal places will be transmitted as integers multiplied by 1000, and accordingly must be divided by 1000 after the data is received. The values are transferred in the format "Big-endian". The length is based on the value, e.g., score 32 bits (DWord).



Logix Designer - Quickstart_Vision_Sensor [5069-L306ERM 30.11]* - [MainProgram - MainRoutine]

Rem Run · No Forces · No Edits · Run Mode · Controller OK · Energy Storage OK · I/O OK

Path: AB_ETHIP-1\192.168.100.222*

Controller Organizer

- Controller Quickstart_Vision_Sensor
  - Controller Tags
  - Controller Fault Handler
  - Power-Up Handler
- Tasks
  - MainTask
    - MainProgram
      - Parameters and Local Tags
      - MainRoutine
  - Unscheduled
- Motion Groups
  - Ungrouped Axes
- Add-On Instructions
- Data Types
  - User-Defined
  - Strings
  - Add-On-Defined
  - Predefined
  - Module-Defined
- Trends
- Logical Model
- I/O Configuration
  - 5069 Backplane
    - [0] 5069-L306ERM Quickstart_Vision_
  - A1, Ethernet
    - 5069-L306ERM Quickstart_Vision_Ser
    - [redacted]
  - A2, Ethernet

Description	
Status	Scheduled
Number of Routines	1
Main Routine	MainRoutine
Fault Routine	
Max Scan	13 us
Last Scan	3 us
Parent	
Scheduled In	MainTask

Rung 0:
COP – Copy File – Source Vision_Sensor_Dev:I1.Data[9] – Dest Pos_X_tmp – Length 4
SWPB – Swap Byte – Source Pos_X_tmp 859768320 – Order Mode REVERSE – Dest Pos_X 409395

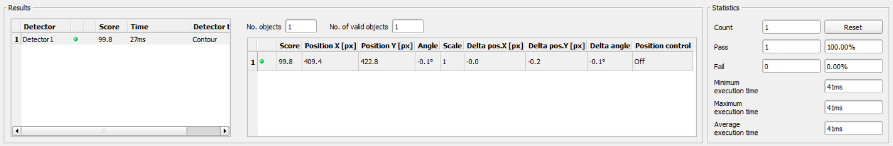
Rung 1:
COP – Copy File – Source Vision_Sensor_Dev:I1.Data[13] – Dest Pos_Y_tmp – Length 4
SWPB – Swap Byte – Source Pos_Y_tmp 125044224 – Order Mode REVERSE – Dest Pos_Y 422919

Rung 2:
COP – Copy File – Source Vision_Sensor_Dev:I1.Data[17] – Dest Angle_tmp – Length 4
SWPB – Swap Byte – Source Angle_tmp -1929379841 – Order Mode REVERSE – Dest Angle -116

Watch – Current Routine

Name	Scope	Value	Force Mask	Description
+ Angle	MainProgram	-116		
+ Pos_X	MainProgram	409395		
+ Pos_Y	MainProgram	422919		
+ Vision_Sensor...	Controller	{...}	{...}	
+ Vision_Sensor...	Controller	{...}	{...}	

Fig. 64: Swapping the byte order



Results

	Detector		Score	Time	Detector t
1	Detector1	●	99.8	27ms	Contour

No. objects 1 No. of valid objects 1

		Score	Position X [px]	Position Y [px]	Angle	Scale	Delta pos.X [px]	Delta pos.Y [px]	Delta angle	Position control
1	●	99.8	409.4	422.8	-0.1°	1	-0.0	-0.2	-0.1°	Off

Statistics

Count	1	Reset
Pass	1	100.00%
Fail	0	0.00%
Minimum execution time		41ms
Maximum execution time		41ms
Average execution time		41ms

11 Telegrams and data output

11.1 Overview telegrams ... 81
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11.5 Description Telegrams BINARY ... 190

This section describes the telegrams available for the SBS vision sensor. These telegrams can be sent to the SBS vision sensor through various interfaces.

- EtherNet/IP
- TCP/IP
- PROFINET (Request / Response module)

The telegrams are available in ASCII and Binary format. The format is defined in the module "Vision Sensor Configuration Studio", in the tab "Telegram" of the setup "Output".

The following settings are possible:

Communication	**TCP / IP**	**EtherNet/IP**	**PROFINET**
Telegram format	ASCII / Binary	Binary	Binary

11.1 Overview telegrams

Telegrams: Availability and supported interfaces

SBS General

- **Reset statistics (RST)** (ASCII / Binary)
  The "Reset statistics" telegram can be used to reset the SBS vision sensor’s internal statistics counter.
- **Process image from file (PIF)** (ASCII / Binary)
  With the "Process image from file" telegram, the SBS vision sensor can process an image file instead of a live image for simulation and test purposes.

SBS Control

- **Trigger (TRG)** (ASCII / binary)
  With the telegram "Trigger", an image can be acquired. Some commands need additional

image acquisition. The result data of the evaluation are output via the "Out" port.

- **Extended trigger (TRX)** (ASCII / binary)
  This telegram "Extended trigger" is an expansion of the "trigger" telegram. Besides the result data, there is also the option to assign an ID or to receive information about the operating mode (run/config). Unlike the "trigger" telegram, the result data of the "Extended trigger" telegram are also transferred via the "In" port.
- **Trigger Robotics (TRR)** (ASCII / Binary)
  With the telegram "Trigger Robotics" an image acquisition can be started. In addition to image acquisition, the robot tool center point (TCP) can be transferred. The TCP is used to calculate the position values.
- **Set Trigger ID (STI)** (ASCII / Binary)
  With the telegram "Set Trigger ID" a Trigger Identifier can be set. The identifier is used for the next image acquisition and can be set, for example, as a file name.
- **Job change (CJB)** (ASCII / binary)
  The "Job change" telegram will trigger a job change on the SBS vision sensor.
- **Job change permanent (CJP)** (ASCII / Binary)
  The "Job change permanent" telegram will trigger a permanent job change on the SBS vision sensor. The job is run again after restarting.
- **Job change by job name (CJN)** (ASCII / Binary)
  The "Job change by job name" telegram will trigger a job change on the SBS vision sensor. The job will be run by job name. You can read the job names by using the "Read job list" telegram, for example.

SBS Job settings

- **Auto Working distance (AFC)** (ASCII / Binary)
  The "Auto operating distance" telegram can be used to have the working distance for the job be automatically determined.
- **Set working distance (SFC)** (ASCII / Binary)
  The "Set working distance" telegram can be used to change the working distance for the job.
- **Read working distance (GFC)** (ASCII / binary)
  The "Read working distance" telegram can be used to read the current working distance for the job.
- **Auto shutter speed (ASH)** (ASCII / Binary)
  The "Auto shutter speed" telegram can be used to have the shutter time for the job be automatically determined.

- **Set shutter speed (SSP/SST)** (ASCII / Binary)
  With the telegram "Set shutter speed", the shutter speed of the job can be changed. This telegram can, for example, be used for brightness compensation.
- **Read shutter speed (GSH)** (ASCII / Binary)
  With the telegram "Read shutter speed", the set shutter speed of the job can be read.
- **Set gain (SGA)** (ASCII / binary)
  With the telegram "Set gain", the gain of the job can be changed. This telegram can, for example, be used for brightness compensation.
- **Read gain (GGA)** (ASCII / binary)
  With the telegram "Read gain", the set gain of the job can be read.
- **Set parameters (SPP/SPT)** (ASCII / binary)
  With the telegram "Set parameter", the detector parameters can be adjusted, e.g. reference strings, detector thresholds.
- **Read parameter (GPA)** (ASCII / binary)
  With the telegram "Read parameter", the set parameters of the detectors can be read.
- **Set search range / ROI (SRP/SRT)** (ASCII / binary)
  With the telegram "Set ROI", the position of the selected detector can be changed.
- **Read search range / ROI (GRI)** (ASCII / Binary)
  With the telegram "Read ROI", the position of the selected detector can be read.
- **Set ROI content (SRC)** (ASCII / Binary)
  With the telegram "Set ROI content" the image to be taught in can be defined, the mask can be set and for the detector "Contour" the taught-in contour can be set.
- **Read ROI content (GRC)** (ASCII / Binary)
  With the telegram "Read ROI content" a mask, pattern or contour file can be read in.
- **Read job list (GJL)** (ASCII / binary)
  The "Get job list" telegram can be used to output a list of all available jobs on the SBS vision sensor.
- **Read detector list (GDL)** (ASCII / binary)
  With the telegram "Read detector list", a list of all detectors in the current job will be displayed.
- **Teach-in detector (TED)** (ASCII / binary)
  The "Teach detector" telegram will result in the specified detector being re-taught (available only for Pattern matching, Contour and Barcode).
- **Set trigger delay (STD)** (ASCII / Binary)
  With the telegram "Set trigger delay", a delay for starting a trigger can be set (in time (ms) or encoder steps).
- **Read trigger delay (GTD)** (ASCII / Binary)
  With the telegram "Read trigger delay", the set delay for starting a trigger can be read.

- **Save Job Permanently (SJP)** (ASCII / binary)
  The "Save job permanently" telegram will take all the parameters that were previously set temporarily and copy them to a job set.

SBS Calibration

- **Calibration: Initialize (CCD)** (ASCII / binary)
  The point pair list is initialized with the telegram "Calibration: Initialize point pair list".
- **Calibration: Add world point (CAW)** (ASCII / binary)
  With the telegram "Calibration: Add world point" a world point (fiducial or point pair) is added to the point pair list. The telegram can be used for the calibration method Point pair list (Robotics) and Calibration plate (Robotics).
- **Calibration: Point pair list (CCL)** (ASCII / binary)
  With the telegram "Calibration: Point pair list" the calibration is carried out using the point pair list in the current job.
- **Calibration: Validate point pair list** (ASCII / binary)
  With the telegram "Calibration: Validate point list", the calibration is validated using the point list.
- **Calibration: Calibration Plate (CCP)** (ASCII / Binary)
  With the telegram "Calibration: Calibration plate", the calibration is carried out using the calibration plate.
- **Set fiducial (CSF)** (ASCII / binary)
  With the telegram "Set fiducial", the fiducials are set using the point list in the current job.
- **Calibration: Add Image (CAI)** (ASCII / Binary)
  The "Add image" telegram triggers an image acquisition and if a calibration plate is found, an image is added to the calibration object. The telegram can be used for calibration method Multi-image calibration and calibration method Calibration plate (Robotics).
- **Calibration: Multi-image (CMP)** (ASCII / binary)
  With the telegram "Calibration: Multi-image" a calibration is carried out and an existing calibration object is accessed.
- **Calibration: Robotics Multi-image (CRP)** (ASCII / Binary)
  With the telegram "Multi-image, robot" a calibration is carried out using the calibration plate.
- **Calibration: Copy calibration (CCC)** (ASCII / binary)
  With the telegram "Calibration: Copy calibration", the calibration of the current job is copied to the selected destination.
- **Calibration: Set parameters (CSP)** (ASCII / binary)
  With the telegram "Calibration: Set parameter", the parameter values for the calibration can be set.

- **Calibration: read parameters (CGP)** (ASCII / binary)
  With the telegram "Calibration: Read parameter", the set parameter values of the calibration can be read.

SBS Visualization

- **Get image (GIM)** (ASCII / binary)
  The "Get image" telegram can be used to get the image from the SBS vision sensor.

SBS Service (available only on port 1998 and in ASCII format)

- **Update visualization data (UVR)** (ASCII)
  The "Update visualization data" telegram is used to update visualization data such as image, detector information and results.
- **Read sensor identity (GSI)** (ASCII)
  With the telegram "Read sensor identity", the current firmware status as well as the hardware type can be queried.
- **Update firmware (UFW)** (ASCII)
  With the telegram "Update firmware", a firmware update is started. The firmware file must first be loaded onto the SBS vision sensor.
- **Set jobset (SJS)** (ASCII)
  The "Set job set" telegram can be used to change the SBS vision sensor’s job set. The job set file must first be loaded onto the SBS.
- **Get jobset (GJS)** (ASCII)
  The "Get job set" telegram can be used to read the SBS vision sensor’s job set.

Data output

This section contains information about the data output (e.g. which format the individual results will have).

Data output ASCII

- General
- Base values
- Position
- Measurement
- Identification
- Identification - quality
- Color
- Counting / number
- Extended

Data output Binary

- General
- Base values
- Position
- Measurement
- Identification
- Identification - quality
- Color
- Counting / number
- Extended

NOTE:
The directory **/tmp** on the SBS vision sensor is used for transferring files from or to the SBS. Files can be transferred from here / to here with an SFTP client. Access data for SFTP client:
Username: *user*, Password: *user*.

11.2 Telegrams: Availability and supported interfaces

Device variant		**Device type**		**Interfaces**	
U	Universal		Standard	**1**	Ethernet TCP IN (2006)
Q	Object	**AF**	Extended	**2**	PROFINET
B	Code reader	**PF**	Professional	**3**	EtherNet/IP
R	Robotic			**4**	Service Port (1998)

✓ available

[ ] Limited availability: differences between versions ‹ 2 and ≥ 2

Telegram	**U**		**Q**		**B**			**R**		**Interfaces**				**From version**
	AF	**PF**		**AF**		**AF**	**PF**	**AF**	**PF**	**1**	**2**	**3**	**4**	
SBS General														
Reset statistics (RST)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.18

Telegram	U		Q		B			R		Interfaces				From version
	AF	PF		AF		AF	PF	AF	PF	1	2	3	4	
Process image from file (PIF)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
SBS Control														
Trigger (TRG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Extended trigger (TRX)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			1.6
Trigger Robotics (TRR)		✓						✓	✓	✓	✓	✓		2.2
Set Trigger ID (STI)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.2
Job change (CJB)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Job Change Permanent (CJP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.18
Job change by name (CJN)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
SBS Job settings														
Auto working distance (AFC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Set working distance (SFC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Read working distance (GFC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Auto Shutter Speed (ASH)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Set Shutter Speed (SSP/SST)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0

Telegram	U		Q		B			R		Interfaces				From version
	AF	PF		AF		AF	PF	AF	PF	1	2	3	4	
Read shutter speed (GSH)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Set gain (SGA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.6
Read gain (GGA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.6
Set Parameter (SPP/SPT)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Read Parameter (GPA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Set ROI (SRP/SRT)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Read ROI (GRI)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Set ROI content (SRC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Read ROI content (GRC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0
Read job list (GJL)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.18
Read Detector List (GDL)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.18
Teach detector (TED)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.0
Set trigger delay (STD)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.22
Read Trigger Delay (GTD)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.22
Save Job Permanently (SJP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2.0

Telegram	U		Q		B			R		Interfaces				From version
	AF	PF		AF		AF	PF	AF	PF	1	2	3	4	
SBS Calibration														
Initialization (CCD)	✓	✓						✓	✓	✓	✓	✓		1.18
Add world point (CAW)	✓	✓						✓	✓	✓	✓	✓		1.22
Calibration: Point Pair List (CCL)	✓	✓						✓	✓	✓	✓	✓		1.18
Validate calibration (CVL)	✓	✓						✓	✓	✓	✓	✓		1.18
Calibration: Calibration Plate (CCP)	[ ]	✓		[ ]				✓	✓	✓	✓	✓		1.19
Set fiducials (CSF)		✓						✓	✓	✓	✓	✓		1.22
Add image (CAI)	✓	✓						✓	✓	✓	✓	✓		2.2
Multi-Image (CMP)	✓	✓						✓	✓	✓	✓	✓		2.2
Robotics Multi-Image (CRP)		✓							✓	✓	✓	✓		2.2
Copy calibration (CCC)		✓						✓	✓	✓	✓	✓		1.19
Set parameters (CSP)	[ ]	✓		[ ]				✓	✓	✓	✓	✓		1.22
Read parameters (CGP)	[ ]	✓		[ ]				✓	✓	✓	✓	✓		1.22
SBS Visualization														
Get Image (GIM)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				1.0

Telegram	U		Q		B			R		Interfaces				From version
	AF	PF		AF		AF	PF	AF	PF	1	2	3	4	
SBS Service														
Update visualization data (UVR)	✓	✓		✓		✓	✓	✓	✓				✓	1.22
Read sensor identity (GSI)	✓	✓		✓		✓	✓	✓	✓				✓	1.19
Update firmware (UFW)	✓	✓		✓		✓	✓	✓	✓				✓	1.19
Set jobset (SJS)	✓	✓		✓		✓	✓	✓	✓				✓	1.19
Get jobset (GJS)	✓	✓		✓		✓	✓	✓	✓				✓	1.19

Please refer to the following as well: Overview telegrams

11.3 Error codes

Error code	Error code HEX	Description
000	0x00	Successful
001	0x01	Error
003	0x03	Invalid parameter data
005	0x05	Invalid telegram
006	0x06	Input parameters with invalid size or invalid value
007	0x07	File does not exist
008	0x08	Recorder off
009	0x09	Matching image of requested type not found
010	0x0A	Invalid file name or length
011	0x0B	Invalid data length
012	0x0C	Not allowed due to jobset mismatch
013	0x0D	Failed to start new job from job set
016	0x10	Firmware version mismatch
018	0x12	Calibration plate data not available

Error code	Error code HEX	Description
020	0x14	More than one vis file present
021	0x15	Sensor type not suitable for vis-file
029	0x1D	Temporary job change rejected because job checksum is active.
030	0x1E	Calibration not activated / Calibration not supported
031	0x1F	Error while copying
032	0x20	Mismatched input conditions for destination job
033	0x21	Calibration / validation error
034	0x22	Invalid number of points
035	0x23	Calibration error: Add point (e.g. last job result failed)
036	0x24	Invalid fiducial
037	0x25	Jobset protected: permanent changes to job not allowed
038	0x26	Parameter values are not available to write / read
039	0x27	Sensor is in configuration mode, telegram was rejected
040	0x28	Error while writing / reading parameter value
041	0x29	No matching job found
042	0x2A	Format error
043	0x2B	Jobset / job saving error
044	0x2C	Focus lock time exceeded
045	0x2D	Error with multiple files
046	0x2E	Working distance could not be determined
047	0x2F	"Min. processing time per image" was not observed
048	0x30	Search range size (ROI) does not match
049	0x31	Search range (ROI) Freeform not selected
050	0x32	Calibration method does not match
051	0x33	No calibration plate found
052	0x34	Number of images too low
053	0x35	No calibration possible: distance between tool positions not plausible
054	0x36	Rotation between images not sufficient
055	0x37	Tilt between the images not sufficient

11.4 Description Telegrams ASCII

11.4.1 General

Reset statistics (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Reset Statistics (RST) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**R**	Reset statistics
2	**S**	
3	**T**	
Example:	RST	
Reset Statistics (RST) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**R**	Reset statistics
2	**S**	
3	**T**	
4	P F	P: (Pass) Success F: (Fail) Error
Example:	RSTP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

NOTE:
Statistics values can be output in the operating step Output / tab Telegram / "Payload", selection "GENERAL".
Additional information: see data output ASCII / GENERAL

Process image from file (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Process image from file (PIF) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**P**	Process image from file
2	**I**	
3	**F**	
4	X	Request version
5	0	Reserved
6	X	Reserved
7-9	X	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes)
10 … n	X	File name (UTF-8) and format available on the device in the directory "/tmp/". Allowed extensions: Monochrome sensor: .pgm Color sensor: .ppm (RGB) or .pgm (Bayer)
Example:	PIF1 0 1 009 Image.pgm PIF1 0 1 008 test.pgm	
Process image from file (PIF) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**P**	Process image from file
2	**I**	
3	**F**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
8	0	Reserved
9-16	X	Length of the implicit result output
17 … n	X	Output of the implicit result

Example:	PIF P 000 00000010 0123456789 PIF P 000 0 00000014 [15;P;1;53371] PIF P 000 1 00000005 [2;7]
Additional information:	
Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

NOTE:
Image size of the test image must match the image size of the currently active job on the device.

11.4.2 Control

Trigger (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Trigger (TRG) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Trigger (simple trigger, in-port)
2	**R**	
3	**G**	
Example:	TRG	
Trigger (TRG) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Trigger (response to command trigger without index, via port 2006. If defined: Result data without index via port 2005)
2	**R**	
3	**G**	
4	P F	P: (Pass) Success F: (Fail) Error
Example:	TRGP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		Yes
Accepted when Ready is low:		No
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Extended trigger (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Extended Trigger (TRX) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Extended trigger, (trigger with index, for correlation of trigger to corresponding result data, via port 2006)
2	**R**	
3	**X**	
4 - 5	X	Length of following data (0-99)
6 … n	X	Data
Example:	TRX06MyPart	
Extended Trigger (TRX) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Extended trigger, (response to trigger with index and result data, via port 2006, for correlation of trigger to corresponding result. Result data without index via port 2005)
2	**R**	
3	**X**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 6	X	Length of following data (n)
7 … n	X	Data of sending command

n+1	C
	R
		C = Config
		R = Run

n+2 … n+9	X	Length of following result data (n)
n+9 … m	X	Result data
Example:	TRX06MyPartR00000000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		Yes
Accepted when Ready is low:		No
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Trigger Robotics (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Trigger Robotics (TRR) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Trigger Robotics
2	**R**	
3	**R**	
4	1	Request version
5-6	X	Length of trigger identifier
7 … n	X	Trigger Identifier
n+1…n+8	X	Pose_TCP Pos. X (in user unit * 1000)
n+9…n+16	X	Pose_TCP Pos. Y (in user unit * 1000)
n+17…n+24	X	Pose_TCP Pos. Z (in user unit * 1000)
n+25…n+32	X	Pose_TCP Angle X (in degrees * 1000)
n+33…n+40	X	Pose_TCP Angle Y (in degrees * 1000)
n+41…n+48	X	Pose_TCP Angle Z (in degrees * 1000)
Example:	TRR104Part000040040000500500006006000070070000800800009009	
Trigger Robotics (TRR) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Trigger (response to command trigger without index, via port 2006. If defined: Result data without index via port 2005)
2	**R**	
3	**R**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
7-8	X	Length of trigger identifier
9 … n	X	Trigger Identifier

n+1	X	Operation Mode
		C = Config
		R = Run

n+2...n+9	X	Length of result data
n+10...m	X	Result data
Example:	TRRP00004PartR00000000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		Yes
Accepted when Ready is low:		No
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		

Note: For "Calibration plate (Robotics)" and "Point pair list (Robotics)" only the X and Y position are taken into account. The other values (position Z and rotations) must be 0.

Set Trigger ID (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set Trigger ID (STI) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Trigger ID
2	**T**	
3	**I**	
4	1	Request version
5-6	x	Length of the following data (max 99)
7 … n	x	Trigger ID
Example:	STI106MyPart	
Set Trigger ID (STI) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Trigger ID
2	**T**	
3	**I**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	x	Error codes
Example:	STIP000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		Yes
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		

Job change (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Job change (CJB) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change
2	**J**	
3	**B**	
4 - 6	X	Job number
Example:	CJB005	
Job change (CJB) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change
2	**J**	
3	**B**	
4	P F	P: (Pass) Success F: (Fail) Error
5	T F	Triggered Freerun
6 - 8	X	Job number
Example 1:	CJBPT005	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

NOTE:
If an error occurs during the job change, it is possible to change to Job 1.

Job Change Permanent (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Job Change Permanent (CJP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change permanent (Change Job Permanently)
2	**J**	
3	**P**	
4 - 6	X	Job number
Example:	CJP005	
Job Change Permanent (CJP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change permanent (Change Job Permanently)
2	**J**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
5	T F	Triggered Freerun
6 - 8	X	Job number
Example 1:	CJPPT005	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

NOTE:
If an error occurs during the job change, it is possible to change to Job 1.

Job change by job name (ASCII)

[Telegrams: Availability and supported interfaces](#)

[Overview telegrams](#)

Job change by job name (CJN) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change by name
2	**J**	
3	**N**	
4	1	Request version
5 - 7	X	Job name length
8 … n	X	Job name
Example:	CJN1005Myjob	
Job change by job name (CJN) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Job change by name
2	**J**	
3	**N**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8	X	Trigger mode T: Trigger F: Free run
Example:	CJNP000T	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

11.4.3 Job settings

Auto working distance (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Auto working distance (AFC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**A**	Auto Working Distance (Auto Focus)
2	**F**	
3	**C**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6	X	Step size 1-5
7 - 9	X	Focus selection 0: Maximum score 1: Min. working distance 2: Max. working distance 3: Average working distance 4: Median working distance 5: Maximum score and all planes
10	X	Focus unit 0: Millimeters 1: Steps
11	X	Working distance selection 0: Default range 1: Specified range
	ℹ **NOTE:** The following byte sequence is only relevant if "Distance range selection" has been set to 1.	
12 - 19	X	Start of working area (close)
20 - 27	X	End of working area (far)
Example:	Example 1: AFC11100500 Example 2: AFC111005010001000000100000	
Auto working distance (AFC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning

1	**A**	Auto Working Distance (Auto Focus)
2	**F**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 10	X	Focus selection = 5 ; Number of Focus selection distances found = 1-4 ; 1
	NOTE: The following fields [Distance value / Score value] are repeated for each number of distances found.	
11 - 18	X	Distance value (in mm *1000) or in steps
19 - 26	X	Score value in %*1000
Example:	AFCP00000200000095000000900009300000089000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set working distance (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set working distance (SFC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Working distance (Set Focus)
2	**F**	
3	**C**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6	X	Movement 0: Absolute 1: Relative 2: Absolute with reinitialization
7	X	Unit 0: 1/1000 millimeters 4: Steps
8 - 15	X	Distance value (in mm *1000) or in steps
Example:	SFC111400000010	
Set working distance (SFC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Working distance (Set Focus)
2	**F**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 15	X	Distance value (in mm *1000) or in steps
Example:	SFCP00000000050	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes

Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

Read working distance (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read working distance (GFC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read working distance (Get Focus)
2	**F**	
3	**C**	
4	1	Request version
5	X	Unit 0 - 1/1000 millimeters 4 - steps
Example:	GFC10	
Read working distance (GFC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read working distance (Get Focus)
2	**F**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 15	X	Distance value (in mm *1000) or in steps
Example:	GFCP00000092500	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Auto shutter speed (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Auto shutter speed (ASH) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**A**	Auto shutter speed
2	**S**	
3	**H**	
4	1	Request version
5	X	0: Temporary 1: Permanent
Example:	ASH11	
Auto shutter speed (ASH) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**A**	Auto shutter speed
2	**S**	
3	**H**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 15	X	Auto shutter speed value (in mm *1000)
16 - 23	X	Score in % * 1000
Example:	ASHP0000000178000057500	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set shutter speed (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set shutter speed (SSP/SST) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Shutter Speed
2	**S**	
3	**P** **T**	Permanent Temporary
4 - 5	X	Number of digits of the shutter speed value, e.g. 04
6 - 9	X	New shutter speed value in ms * 1000 e.g. 8000 = 8 ms
Example:	SSP048000	
Set shutter speed (SSP/SST) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Shutter Speed
2	**S**	
3	**P** **T**	Permanent Temporary
4	P F	P: (Pass) Success F: (Fail) Error
Example:	SSPP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read shutter speed value (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read Shutter Speed Value (GSH) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read Shutter Speed value (Get Shutter) (from active job)
2	**S**	
3	**H**	
Example:	GSH	
Read Shutter Speed Value (GSH) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read Shutter Speed Value (Get Shutter)
2	**S**	
3	**H**	
4	P F	P: (Pass) Success F: (Fail) Error
5	X	Shutter speed value, length
6 … n	X	Shutter speed value in ms * 1000
Example Run Mode:	GSHP41200	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set gain (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set gain (SGA) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Gain
2	**G**	
3	**A**	
4	X	0: Temporary 1: Permanent
5 - 9	X	New gain value (in value * 1000), e.g. 2.0 = 02000
Example:	SGA102000	
Set gain (SGA) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Gain
2	**G**	
3	**A**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 9	X	Current gain value * 1000
Example:	SGAP02000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read gain value (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read gain value (GGA) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read gain value (Get Gain)
2	**G**	
3	**A**	
Example:	GGA	
Read gain value (GGA) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read gain value (Get Gain)
2	**G**	
3	**A**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 9	X	Current gain value (value *1000), e.g. 1.0 = 01000
Example:	GGAP01000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set parameters (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set parameters (SPP/SPT) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set parameters
2	**P**	
3	**P** **T**	P: Permanent T: Temporary
4 - 6	X	Detector number
7 - 9	X	Command: Parameter number, see Overview Detector Parameters (set / read)
10 - 14	X	Length of value (max. 512 bytes)
15 ... n	X	Value
Example:	SPP0010010000560000	
Set parameters (SPP/SPT) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set parameters
2	**P**	
3	**P** **T**	P: Permanent T: Temporary
4	P F	P: (Pass) Success F: (Fail) Error

5 - 8	X	SI08 - Signed Integer 08 UI08 - Unsigned Integer 08 SI16 - Signed Integer 16 UI16 - Unsigned Integer 16 SI32 - Signed Integer 32 UI32 - Unsigned Integer 32 SI40 - Signed Integer 40 UI40 - Unsigned Integer 40 FLOT - Float DOBL - Double STRG - String BOOL - Boolean SP08 - Special Signed 8 UDEF - Undefined IARR - Integer Array ZERO - Default Zero Parameter
Example:	SPPPSTRG	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read parameter (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read parameter (GPA) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read parameter (Get Parameter)
2	**P**	
3	**A**	
4 - 6	X	Detector number e.g. 001
7 - 9	X	Command: Parameter number, see Overview Detector Parameters (set / read)
Example:	GPA001001	
Read parameter (GPA) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read parameter (Get Parameter)
2	**P**	
3	**A**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 8	X	SI08 - Signed Integer 08 UI08 - Unsigned Integer 08 SI16 - Signed Integer 16 UI16 - Unsigned Integer 16 SI32 - Signed Integer 32 UI32 - Unsigned Integer 32 SI40 - Signed Integer 40 UI40 - Unsigned Integer 40 FLOT - Float DOBL - Double STRG - String BOOL - Boolean SP08 - Special Signed 8 UDEF - Undefined IARR - Integer Array ZERO - Default Zero Parameter

9 - 13	X	Length of value (n) e.g. 00005
14 … n	X	Value
Example:	GPAPSTRG00005Test1	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Overview Detector Parameters (set / read)

Detector	Function	Value	Multiplier	Length
Alignment				
Pattern matching Contour matching	Threshold value Min.	1	1000	n
	Threshold value Max.	2	1000	n
	Result offset 0: "Off" 1: "Image plane (in pixels)" 2: "Align (2D)" 3: "Robot (3D)"	30	1	n
	Result offset Image plane: Pos. X	31	1000	n
	Result offset Image plane: Pos. Y	32	1000	n
	Result offset Image plane: angle	33	1000	n
	Result offset Align (2D), Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	34	1000	48 (6 * 8 bytes per value)
	Calculate Result offset* with transmitted position • Align (2D): Pos. X, Pos. Y, 0, 0, 0, Angle Z • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	35	1000	48 (6 * 8 bytes per value)
Edge detector	Probe 1: Transition 0: Any 1: Dark to light 2: Light to dark	101	1	n
	Probe 2: Transition 0: Any 1: Dark to light 2: Light to dark	102	1	n

Detector	Function	Value	Multiplier	Length
	Probe 3: Transition 0: Any 1: Dark to light 2: Light to dark	103	1	n
	Probe 1: Threshold value Min.	104	1000	n
	Probe 2: Threshold value Min.	105	1000	n
	Probe 3: Threshold value Min.	106	1000	n
Detector				
Pattern matching Contour Contour 3D	Threshold value Min.	1	1000	n
	Threshold value Max.	2	1000	n
	Result offset 0: "Off" 1: "Image plane (in pixels)" 2: "Align (2D)" 3: "Robot (3D)"	30	1	n
	Result offset Image plane: Pos. X	31	1000	n
	Result offset Image plane: Pos. Y	32	1000	n
	Result offset Image plane: angle	33	1000	n
	Result offset • Align (2D): Pos. X, Pos. Y, 0, 0, 0, Angle Z • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	34	1000	48 (6 * 8 bytes per value)
	Calculate Result offset* with transmitted position • Align (2D): Pos. X, Pos. Y, 0, 0, 0, Angle Z • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	35	1000	48 (6 * 8 bytes per value)

Detector	Function	Value	Multiplier	Length
Target Mark 3D	Result offset • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	34	1000	48 (6 * 8 bytes per value)
	Calculate Result offset* with transmitted position • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	35	1000	48 (6 * 8 bytes per value)
	ID of the active Target Mark	101	-	n
	Target Mark name	102	-	n
	Add current Target Mark to the list of Target Marks (parameter can only be set!) A Target Mark must have been detected.	103	-	n
Gray	Threshold value Min.	1	1000	n
	Threshold value Max.	2	1000	n
	Grayscale value Min.	101	1000	n
	Grayscale value Max.	102	1000	n
	Invert grayscale value	103	1	n
Contrast Brightness	Threshold value Min.	1	1000	n
	Threshold value Max.	2	1000	n
Caliper	Threshold value Distance Min.	101	1000	n
	Threshold value Distance Max.	102	1000	n
	Invert distance threshold value 0: not inverted 1: inverted	103	1	1

Detector	Function	Value	Multiplier	Length
	Distance mode 0: Minimum 1: Maximum 2: Mean 3: Median 4: Smallest opposite 5: Largest opposite	104	1	n
	Probe 1: Threshold value Min.	105	1000	n
	Probe 2: Threshold value Min.	106	1000	n
	Probe 1: Smoothing	107	1000	n
	Probe 2: Smoothing	108	1000	n
	Probe 1: Transition 0: Any 1: Dark to light 2: Light to dark	109	1	n
	Probe 2: Transition 0: Any 1: Dark to light 2: Light to dark	110	1	n
	Probe 1: Number of search stripes	111	1	n
	Probe 2: Number of search stripes	112	1	n
BLOB	Grayscale value Min.	101	1000	n
	Grayscale value Max.	102	1000	n
	Invert grayscale value 0: not inverted 1: inverted	103	1	1
	Threshold value Number of BLOBs Min.	120	1	n
	Threshold value Number of BLOBs Max.	121	1	n
	Invert number threshold value 0: not inverted 1: inverted	122	1	1
	Number of set features (read only)	123	1	n

Detector	Function	Value	Multiplier	Length
	Selection of a feature from the list	124	1	n
	Feature threshold value Min.	125	1000	n
	Feature threshold value Max.	126	1000	n
	Invert feature threshold value	127	1	1
Barcode Datacode OCR	Reference string	101	-	n (length of string)
Color Value Color Area	Color space (read only)	21	0 = RGB 1 = HSV 2 = LAB	3
	Channel selection (read only)	22	Bit field one digit per color channel	4
	Color channel 1: Threshold value Min.	101	1000	n
	Color channel 1: Threshold value Max.	102	1000	n
	Color channel 1: Invert threshold value	103	1	n
	Color channel 2: Threshold value Min.	104	1000	n
	Color channel 2: Threshold value Max.	105	1000	n
	Color channel 2: Invert threshold value	106	1	n
	Color channel 3: Threshold value Min.	107	1000	n
	Color channel 3: Threshold value Max.	108	1000	n
	Color channel 3: Invert threshold value	109	1	n
Color List	Color space (read only)	21	0 = RGB 1 = HSV 2 = LAB	3

Detector	Function	Value	Multiplier	Length
	Channel selection (read only)	22	Bit field one digit per color channel	4
	Color distance threshold value	101	1000	n
	Set color distance threshold value active	102	1	n
	Number of colors in list	103	1	n
	Selection of a color from the list	104	1	n
	Color value of the selected color (color channel 1, color channel 2, color channel 3, color channel 4 [constantly 0])	105	1000	32
Busbar Wafer	Threshold value Min.	1	1000	n
	Threshold value Max.	2	1000	n
Result processing	Name of the active expression	122	-	n (length of string)
	Current expression	124	-	n (length of string)

Set search range (ROI) (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set ROI (SRP/SRT) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set search range (Set ROI)
2	**R**	

3	**P**
	T
		P = Permanent
		T = Temporary

4 - 11	X	ROI Info Length in bytes, from byte 5 to end 39 Byte: circle 55 bytes: rectangle, ellipse, free shape
12 - 14	X	Detector no. e.g. 001
15 - 16	X	ROI Index 00: for yellow search range 01: for red teach range 02: Position control
17 - 18	X	ROI shape 01: Circle 02: Rectangle 03: Ellipse 04: Free shape
19 - 26	X	Center X (value in pixels * 1000), e.g. 160 pixels = 00160000
27 - 34	X	Center Y (value in pixels * 1000), e.g. 120 pixels = 00120000
35 - 42	X	Half width / X-radius (value in pixels * 1000), e.g. 80 pixels = 00080000
43 - 50	X	Half height (not for circle) (value in pixels * 1000), e.g. 40 pixels = 00040000
51 - 58	X	Angle (not for circle) (value in ° * 1000), e.g. 180° = 00180000
Example:	SRP0000005500100020016000000120000000800000004000000180000 Length=55, detector=1, yellow search range, rectangle, center X=160, center Y=120, half width= 80, half height=40, orientation=180	

Set ROI (SRP/SRT) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set search range (Set ROI)
2	**R**	
3	**P** **T**	Permanent Temporary
4	P F	P: (Pass) Success F: (Fail) Error
Example:	SRPP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)
Parameter:		The parameters are given in the coordinate system of the Alignment and not in the coordinate system of the image.

Read search range (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read search range (GRI) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read search range (Get ROI)
2	**R**	
3	**I**	
4 - 6	X	Detector no. e.g. 001
7 - 8	X	ROI Index 00: for yellow search range 01: for red teach range 02: Position control
Example:	GRI00100	
Read search range (GRI) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read search range (Get ROI)
2	**R**	
3	**I**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 12	X	ROI Info Length in bytes, from byte 5 to end 39 Byte: circle 55 bytes: rectangle, ellipse, free shape
13 - 15	X	Detector no. e.g. 001
16 - 17	X	ROI Index 00: for yellow search range 01: for red teach range 02: Position control

18 - 19	X	ROI shape 01: Circle 02: Rectangle 03: Ellipse 04: Free shape
20 - 27	X	Center X (value in pixels * 1000)
28 - 35	X	Center Y (value in pixels * 1000)
36 - 43	X	Half width / X-radius (value in pixels * 1000)
44 - 51	X	Half height (not for circle) (value in pixels * 1000), e.g. 40 pixels = 00040000
52 - 59	X	Angle (not for circle) (value in ° * 1000), e.g. 180° = 00180000
Example:	GRIP0000005500100020016000000120000000800000004000000090000 (Length= 55, detector 1, search range, rectangle, center X= 160, center Y= 120, half width= 80, half height= 40, angle= 90)	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set ROI content (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set ROI content (SRC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set ROI content
2	**R**	
3	**C**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6-8	X	Detector no. 0: Alignment ›0: Default detector in job
9-10	00	Reserved
11	X	0: Do not use mask file 1: Use mask file
12-16	00000	Reserved
17-19	X	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes) Or for 000: default name mask.pgm
20 ... n	X	File name (UTF-8) and format available on the device in the directory "/tmp/". Default name mask.pgm File format: PGM
Example:	SRC11001000008Test.pgm (for file "Test.pgm") SRC11001000000 (for file: "mask.pgm")	
Set ROI content (SRC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set ROI content
2	**R**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes

Example:	SRCP000
Additional information:	
Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

Read ROI content (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read ROI content (GRC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read ROI content (Get ROI content)
2	**R**	
3	**C**	
4	1	Request version
5-7	X	Detector no. 0: Alignment ›0: Default detector in job
8-9	00	Reserved
10	X	0: Do not create mask file 1: Create mask file (if mask is available in job)
11	X	0: Do not create pattern file 1: Create pattern file
12	X	0: Do not create contour file 1: Create contour file
13-15	000	Reserved
16-18	X	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes) Or for 000: default name mask.pgm / pattern.pgm / contour.pgm
19 … n	X	File name (UTF-8) and format available on the device in the directory "/tmp/". Default name mask.pgm / pattern.pgm / contour.pgm File format: PGM
Example:	GRC100100100000008Test.pgm (file with standard extension: Testmask.pgm) GRC100100111000008Test.pgm (files with standard extension: Testmask.pgm, Testpattern.pgm & Testcontour.pgm) GRC100100111000000 (file only with standard extension: mask.pgm, pattern.pgm & contour.pgm)	

Read ROI content (GRC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read ROI content (Get ROI content)
2	**R**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
8-12	X	Width of the search region
13-17	X	Height of the search region
Example:	GRCP0000108001440	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read job list (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read job list (GJL) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read job list (Get Job List)
2	**J**	
3	**L**	
Example:	GJL	
Read job list (GJL) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read job list (Get Job List)
2	**J**	
3	**L**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Response version
8 - 10	X	Number of jobs
11 - 13	X	Active job number
NOTE: The following byte sequence is repeated for each job from 1 to "Number of jobs". The byte numbers shift accordingly.		
14 - 16	X	Number of characters for the job name. This can be used to specify a unique name for job n.
17 ... n	X	From this position, the name for job n follows in the specified length.
n+1 ... n + 3	X	Number of subsequent bytes. A description for job n can be specified.
n + 4 ... m	X	From this position, the description for job n follows in the specified length.
m + 1 ... m + 3	X	Number of subsequent bytes. This can be used to specify a unique name for the author of job n.

m + 4 ... k	X	From this position, the name for the author of job n follows in the specified length.
k + 1 ... k + 19	X	Date of creation of Job n (19 bytes)
k + 20 ... k + 39	X	Date of last modification of job n (19 bytes)
Example:	GJLP001001001007testjob010DefaultJob004Test2014112720141128	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read detector list (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read detector list (GDL) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get Detector List
2	**D**	
3	**L**	
Example:	GDL	
Read detector list (GDL) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get Detector List
2	**D**	
3	**L**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Job number of the current job
8 - 10	X	Number of detectors in the current job
	ℹ **NOTE:** The following byte sequence is repeated for each detector in the job. The byte numbers shift accordingly.	
11 - 13	X	Number of subsequent bytes. This allows a unique name for the detector n to be specified.
14 ... n	X	From this position, the name for detector n follows, in the given length.

n + 1 ... n+ 5	X	001 - Pattern matching 004 - Contour 005 - Gray 006 - Contrast 007 - Brightness 011 - OCR 013 - Datacode 014 - Barcode 018 - Color Value 019 - Color Area 020 - Color List 021 - Caliper 022 - BLOB 024 - Contour 3D 027 - Result processing 028 - Target Mark 3D
Example:	GDLP001001012testdetector00005	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Teach detector (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Teach detector (TED) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Teach detector
2	**E**	
3	**D**	
4 - 6	X	0 = Alignment ≥ 1 Detectors
7	X	0: Temporary 1: Permanent
8	X	0: No trigger, teach-in with next image acquisition 1: Trigger is executed for teach-in
Example:	TED00111	
Teach detector (TED) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**T**	Teach detector
2	**E**	
3	**D**	
4	P F	P: (Pass) Success F: (Fail) Error
Example:	TEDP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Set trigger delay (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Set trigger delay (STD) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Trigger Delay
2	**T**	
3	**D**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6 - 13	X	Trigger delay in msec (max. 3000 msec) in encoder steps (max. 65535 steps)
Example:	STD1100001000	
Set trigger delay (STD) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set Trigger Delay
2	**T**	
3	**D**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
Example:	STDP000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Read trigger delay (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read trigger delay (GTD) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read Trigger Delay (Get Trigger Delay)
2	**T**	
3	**D**	
4	1	Request version
Example:	GTD1	
Get trigger delay (GTD) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read Trigger Delay (Get Trigger Delay)
2	**T**	
3	**D**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error code
8 - 15	X	Trigger delay in msec (max. 3000 msec) in encoder steps (max. 65535 steps)
Example:	GTDP00000001000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Save job permanently (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Save Job Permanently (SJP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Save Job Permanently (Store Job Permanently)
2	**J**	
3	**P**	
Example:	SJP	
Save Job Permanently (SJP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Save Job Permanently (Store Job Permanently)
2	**J**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
Example:	SJPP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

11.4.4 Calibration

Calibration: Initialization (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Initialize (CCD) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Initialize (Calibration: Clear Data)
2	**C**	
3	**D**	
Example:	CCD	
Initialize (CCD) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Initialize (Calibration: Clear Data)
2	**C**	
3	**D**	
4	P F	P: (Pass) Success F: (Fail) Error
Example:	CCDP	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Add world point (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Add world point (CAW) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Add World Point
2	**A**	
3	**W**	
4	1	Request version
5	X	1: Calibration plate (Robotics) Fiducials only 4: Point pair list (Robotics) World point and image point
6 - 10	0	Constant (5 bytes)
11 - 18	X	World X (in user unit * 1000)
19 - 26	X	World Y (in user unit * 1000)
27 - 34	0	Constant (8 bytes)
Example:	CAW1000010010000000200000000000000 (World X = 100 mm; World Y = 200mm)	
Calibration: Add world point (CAW) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Add World Point
2	**A**	
3	**W**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 12	X	Current number of points
13 - 20	X	Image point X
21 - 28	X	Image point Y
Example:	CAWP000000010028800000566000 (Reference point 1; Image X = 288; Image Y = 566)	
Additional information:		
Accepted in run mode:		Yes

Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

Note: For the CAW request, the overall job result must be positive.

Calibration: Point pair list (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration by point pair list (CCL) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Point pair list
2	**C**	
3	**L**	
4	X	0: Temporary 1: Permanent
Example:	CCL1	
Calibration: Point pair list (CCL) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Point pair list
2	**C**	
3	**L**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 9	X	Current highest point pair index
10 - 17	X	Deviation calibration, RMSE
18 - 25	X	Deviation calibration, mean
26 - 33	X	Deviation calibration, max.
34 - 41	X	Deviation calibration, min.
Example:	CCLP0001012345678123456781234567812345678	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Validate point pair list (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Validate point pair list (CVL) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Validate Point Pair List
2	**V**	
3	**L**	
Example:	CVL	
Calibration: Validate point pair list (CVL) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Validate Point Pair List
2	**V**	
3	**L**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 9	X	Current highest point pair index
10 - 17	X	Deviation calibration, RMSE
18 - 25	X	Deviation calibration, mean
26 - 33	X	Deviation calibration, max.
34 - 41	X	Deviation calibration, min.
Example:	CVLP0001012345678123456781234567812345678	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Calibration plate (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Calibration Plate (CCP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Calibration plate
2	**C**	
3	**P**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6	X	0: No fiducials are used. Origin of Measuring coordinate system identical to origin of Calibration Plate Coordinate System. 1: No fiducials are used. Measuring coordinate system identical with Camera coordinate system. 2: Uses world system, fiducial job 3: Uses world system, fiducial command **CAW**
7	X	0: Calibration (internal and external parameters) 1: Validation of calibration 2: Calibration (internal parameters only) 5: Calibration transformation Measuring coordinate system
Example:	CCP1110	
Calibration: Calibration Plate (CCP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Calibration plate
2	**C**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes

8 - 12	X	Number of currently detected calibration points
13 - 20	X	Deviation calibration, RMSE
21 - 28	X	Deviation calibration, mean
29 - 36	X	Deviation calibration, max.
37 - 44	X	Deviation calibration, min.
45 - 52	X	CPF_MF X (in user unit * 1000)
53 - 60	X	CPF_MF Y (in user unit * 1000)
61 - 68	0	CPF_MF Z (in user unit * 1000)
69 - 76	0	CPF_MF Angle X (in degrees * 1000)
77 - 84	0	CPF_MF Angle Y (in degrees * 1000)
85 - 92	X	CPF_MF Angle Z (in degrees * 1000)
93 - 100	X	Deviation fiducials, mean
101 - 108	X	Deviation fiducials, max.
109 - 116	X	Deviation fiducials, min.
Example:	CCPP00000012000010010000200200003003000040040 00050050000600600007007000080080000900900001001	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Set fiducial (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Set fiducial (CSF) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Set fiducial
2	**S**	
3	**F**	
4	1	Request version
5	X	0: Temporary 1: Permanent
Example:	CSF11	
Calibration: Set fiducial (CSF) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Set fiducial
2	**S**	
3	**F**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 15	X	X value (in user unit * 1000)
16 - 23	X	Y value (in user unit * 1000)
24 - 31	X	Z value (in user unit * 1000)
32 - 39	X	Angle X value (in degrees * 1000)
40 - 47	X	Angle Y value (in degrees * 1000)
48 - 55	X	Angle Z value (in degrees * 1000)
56 - 63	X	Deviation fiducials, mean
64 - 71	X	Deviation fiducials, max.
72 - 79	X	Deviation fiducials, min.
Example:	CSFP000000010010000200200003003000040040 00050050000600600001001000020200003003	
Additional information:		
Accepted in run mode:		Yes

Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

Calibration: Add image (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Add image (CAI) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Add Image
2	**A**	
3	**I**	
4	1	Request version
5	X	Mode 1: Multi-image calibration 2: Hand-Eye calibration (Robotics) 3: Base-Eye calibration (Robotics)
6-8	0	Append at the end of the list (3 bytes)
9	X	Define Measurement plane 0: Do not use image to define Measurement plane 1: Use image to define Measurement plane
10-11	X	"Robot: Order of rotation" 00: Use rotation order specified in job 01: Yaw-Pitch-Roll (e.g. Stäubli) 02: Roll-Pitch-Yaw (e.g. Kuka, Fanuc, Hanwha, ABB**, UR**) ** when using the corresponding conversion function
12-19	X	Pose_TCP Pos. X (in user unit * 1000)
20-27	X	Pose_TCP Pos. Y (in user unit * 1000)
28-35	X	Pose_TCP Pos. Z (in user unit * 1000)
36-43	X	Pose_TCP Angle X (in degrees * 1000)
44-51	X	Pose_TCP Angle Y (in degrees * 1000)

52-59	X	Pose_TCP Angle Z (in degrees * 1000)
Example:	CAI11001102000040040000500500006006000070070000800800009009	
Calibration: Add image (CAI) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Add Image
2	**A**	
3	**I**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
8-10	X	Current number of images in list
11-15	X	Total number of detected points
Example:	CAIP00000100021	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Multi-image (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Multi-image (CMP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration Calibrate Multi-Image Plate
2	**M**	
3	**P**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6	X	Origin of the world coordinate system: 0: World coordinate system identical with the Calibration Plate Coordinate System (center of the plate). 1: Origin of the world coordinate system so that it is identical with the origin of the image coordinate system (upper left pixel).. 2: Use World coordinate system of fiducials, as specified in the job file. 3: Use World coordinate system of fiducials as set in request CAW.

7	X	Mode 0: Calibration (internal and external parameters) 1: Validate (use existing calibration; at least one calibration point is added. Via back projection it can be inferred whether the point fits to the current calibration or is shifted). 2: Calibration (internal parameters only) 3: Calibration (external parameters only using new internal parameters) 4: Calibration (external parameters only) 5: Calibrate Measurement plane only (CPF_MF)
Example:	CMP1105	
Calibration: Multi-image (CMP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration Calibrate Multi-image
2	**M**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
8-10	X	Field of view coverage (%)
11-15	X	Total number of detected points
16-18	X	Number of images used
19-21	X	Number of invalid images
22	X	Tilt between calibration plate poses 0: sufficient 1: not sufficient
23-30	X	Deviation calibration, RMSE [px]
31-38	X	Deviation calibration, max. [px]
39-46	X	Deviation fiducials, RMSE (in user unit * 1000)
47-54	X	Deviation fiducials, max. (in user unit * 1000)

Example:	CMPP000089003120110020000010010000200200003003000040 04
Additional information:	
Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces
End of telegram:	Max. 4 bytes (optional)

Calibration: Robotics multi-image (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Robotics multi-image (CRP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Robotics multi-image (Calibrate Robotics Plate)
2	**R**	
3	**P**	
4	1	Request version
5	x	0: Temporary 1: Permanent
6	X	Origin of the world coordinate system: 4: Set world frame to User Robot Frame
7	X	Mode 0: Calibration (internal and external parameters) 1: Validate (use existing calibration; at least one calibration point is added. Via back projection it can be inferred whether the point fits to the current calibration or is shifted). 2: Calibration (internal parameters only) 3: Calibration (external parameters only using new internal parameters) 4: Calibration (external parameters only) 5: Calibrate Measurement plane only (CPF_MF) 6: Calibrate Hand-Eye (TCP_CF) / Base-Eye (RF_CF) only
Example:	CRP1140	
Calibration: Robotics multi-image (CRP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Robotics multi-image (Calibrate Robotics Plate)
2	**R**	
3	**P**	

4	P F	P: (Pass) Success F: (Fail) Error
5-7	X	Error codes
8-10	X	Field of view coverage (%)
11-15	X	Total number of detected points
16-18	X	Number of images used
19-21	X	Number of invalid images
22-29	X	Deviation calibration, RMSE [px]
30-37	X	Deviation calibration, max. [px]
38-45	X	Deviations calibration plate pose Translation RMSE (in user unit * 1000)
46-53	X	Deviations calibration plate pose Translation Max. (in user unit * 1000)
54-61	X	Deviations calibration plate pose Rotation RMSE (in degrees * 1000)
62-69	X	Deviations calibration plate pose Rotation Max. (in degrees * 1000)
Example:	CRPP00009201349012004000010010000200200003003000040040000500500006006	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Copy Calibration (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Copy calibration (CCC) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Copy calibration
2	**C**	
3	**C**	
4	1	Request version
5	1	Constant
6 - 8	X	Destination 0 : Copy to all jobs ›0: Copy to specified job
9	X	0: Always copy when the calibration is active. 1: Only copy if the calibration method is the same.
Example:	CCC110021	
Calibration: Copy calibration (CCC) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Copy calibration
2	**C**	
3	**C**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 10	X	Job number of the job where the error occurred 00: Successful ›0 - Job number of the job where the error first occurred
Example:	CCCP000000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes

Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration: Set parameter (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Set parameter (CSP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Set Parameter
2	**S**	
3	**P**	
4	1	Request version
5	X	0: Temporary 1: Permanent
6 - 8	X	Parameter number, see Calibration parameters for telegrams CSP and CGP
9 - 16	X	Length of value
17 ... n	X	Value for selected parameter, see Calibration parameters for telegrams CSP and CGP
Example:	CSP11002000000019	
Calibration: Set parameter (CSP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Set Parameter
2	**S**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
Example:	CSPP000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration parameters: see Calibration parameters for telegrams CSP and CGP

Calibration: Read parameter (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Read parameter (CGP) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Read Parameter
2	**G**	
3	**P**	
4	1	Request version
5 - 7	X	Parameter number, see Calibration parameters for telegrams CSP and CGP
Example:	CGP1001	
Calibration: Read parameter (CGP) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**C**	Calibration: Read Parameter
2	**G**	
3	**P**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 10	X	Parameter number, see Calibration parameters for telegrams CSP and CGP
11 - 18	X	Length of the following data
19 … n	X	Parameter values, depending on the selected parameter
Example:	CGPP000001000000011	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Calibration parameters: see Calibration parameters for telegrams CSP and CGP

Calibration parameters for telegrams CSP and CGP

Parameter description	**Parameter number**	**Value**	**Length**	**Calibration status after CSP**
Status calibration	001	0: Invalid 1: Valid	1 byte	–*
Calibration method	002	0: None 2: Point pair list (Robotics) 3: Calibration plate (Measurement) 4: Calibration plate (Robotics) 5: Hand-Eye calibration (Robotics) 6: Base-Eye calibration (Robotics)	1 byte	invalid
Unit (user unit)	004	0: Millimeter [mm] 1: Centimeter [cm] 2: Meter [m] 3: Inch ["] 4: Arbitrary unit [au]	1 byte	no change
Internal parameters	010	Focal length (in mm *1000) Kappa (*1000) Pixel pitch X (in µm * 1000) Pixel pitch Y (in µm * 1000) Coordinate origin X (in pixels * 1000) Coordinate origin Y (in pixels * 1000) Image size X (number of pixels) Image size Y (number of pixels)	64 (8 * 8 bytes per value)	–*
Reference Camera- to Measuring coordinate system (CF_MF)	011	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*
Reference Camera- to Calibration Plate Coordinate System (CF_CPF)	012	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*

Parameter description	Parameter number	Value	Length	Calibration status after CSP
Reference Robot- to Camera coordinate system (RF_CF)	013	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*
Reference Calibration plate- to Measuring coordinate system (CPF_MF)	014	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*
Reference Robot- to Measuring coordinate system (RF_MF)	015	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*
Reference TCP- to Camera coordinate system (TCP_CF)	016	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	–*
Reference robot- to TCP coordinate system (RF_TCP)	017	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	48 (6 * 8 bytes per value)	no change
Z-shift of Measurement plane	021	Value (in user unit * 1000)	8 bytes	no change
Focal length in [mm]	022	[mm * 1000]	8 bytes	invalid (CSP for C-Mount only)
Calibration plate type	023	Character string with name of the description file	n	invalid
Fiducial 1	024	Translation X, Y, Z (in user unit * 1000)	24 (3 * 8 bytes per value)	invalid
Fiducial 2	025			
Fiducial 3	026			
Fiducial 4	027			

Parameter description	Parameter number	Value	Length	Calibration status after CSP
Number of existing calibration plate types	037	Request - Selection of type: 0: All 1: Measurement 2: Robotics Response: Number of plates	Request: 1 Response: 5	–*
Available calibration plate types (file names)	038	Request - Selection of type: 0: All 1: Measurement 2: Robotics Request - Index: 0: All file names ›0: Index selection Response: File names of Calibration plates	Request: 1 / 5 Response: n (String)	–*
Robot: Order of rotation	039	"Robot: Order of rotation" 00: Use rotation order specified in job 01: Yaw-Pitch-Roll (e.g. Stäubli) 02: Roll-Pitch-Yaw (e.g. Kuka, Fanuc, Hanwha, ABB**, UR**) ** when using the corresponding conversion function	1	invalid
Average sensor resolution	041	Value (in user unit/pixel * 1000)	8 bytes	–*

* CSP not possible (parameter is read-only and cannot be set).

11.4.5 Visualization

Get image (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Get image (GIM) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get Image
2	**I**	
3	**M**	
4	X	0: Last image 1: Last bad image 2: Last good image
Example:	GIM1	
Get image (GIM) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get Image
2	**I**	
3	**M**	
4	P F	P: (Pass) Success F: (Fail) Error
5	X	Error codes
6	X	Image type 0: Grayscale 3: Bayer-Pattern_BG When converting the color image from Bayer into RGB, the appropriate image type must be considered. Pre-processing filters of the category "Arrangement" have an influence on the Bayer type. Bayer Pattern begins with blue - green.
7	X	Image result 1: Good image 0: Failed image
8 - 11	X	Number of rows e.g. 0480 / 0200

12 - 15	X	Number of columns e.g. 0640 / 0320
16 - 19	X	End of the message string if specified. Otherwise start image data from Byte no. 16.
20 ... n	X	Binary image data (rows * columns)
Example:	GIMP0004800640...	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

11.4.6 Service (available only on port 1998 and in ASCII format)

Update visualization data (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Update visualization data (UVR) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**U**	Update visualization data (Update Visualization Results)
2	**V**	
3	**R**	
4	1	Request version
5	X	Image: 0: No image is created 1: Grayscale / RGB image without filter, BMP format 2: Grayscale image / Bayer pattern without filter, BMP format 3: Grayscale / RGB image with filter, BMP format 4: Grayscale image / Bayer pattern with filter, BMP format 5: Grayscale / RGB image without filter, JPEG format (low compression) 6: Grayscale / RGB image with filter, JPEG format (low compression) 7: Grayscale / RGB image without filter, JPEG format (compression high) 8: Grayscale / RGB image with filter, JPEG format (compression high)
6	X	Result XML: 0: Result file is not created 1: Result file is created
7	X	Statistic XML: 0: Statistics file is not created 1: Statistics file is created

8	X	Image type: 0: Last image (Any) 1: Last fail image (Fail) 2: Last pass image (Pass) 3: Next image (Any) 4: Next fail image (Fail) 5: Next pass image (Pass)
9 - 11	X	Directory number (constant) 001: visu001
Example:	UVR11110001	
Update visualization data (UVR) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**U**	Update visualization data (Update Visualization Results)
2	**V**	
3	**R**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8	X	Reserved
9 - 11	X	Directory number (constant) 001: visu001
Example:	UVRP0000001	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Status of Ready signal during processing:		No change
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

The created files are available for download in the directory /tmp/[Directory number]:

- image.bmp
- overlay.xml

With the file "overlay.xml", all relevant information for creating the overlay can be obtained. The file is created in XML format. The most important elements are described in the table below

Name		Value	Description
detector	type	pattern_matching contour contrast brightness gray caliper blob ocr datacode barcode	Detector Type
	number	Integer	Position in detector list
	name	String	Name of the detector defined in the configuration
roi	purpose	Search teach position_control result	Type of overlay element. The different types have different colors.
	shape	rectangle rectangle_mask ellipse	Shape of the overlay element
center	x	Float	Center position in X (pixels)
	y	Float	Center position in Y (pixels)
size	half_width	Float	Half width of overlay element
	half_height	Float	Half height of overlay element
angle	angle	Float	Angle of overlay element (degrees)
number	value	Float	Number of element types in this detector
line	x1	Float	Start point X line 1 (pixels)
	y1	Float	Start point Y line 1 (pixels)
	x2	Float	Start point X line 2 (pixels)
	y2	Float	Start point Y line 2 (pixels)

Depending on the detector type (detector → type), there are different elements that can be displayed. The following table indicates which element can be displayed on which detector.

Detector	Search	teach	position_control	result
Pattern matching	Yes	Yes	Yes	1

Detector	Search	teach	position_control	result
Contour	Yes	Yes	Yes	200
Contour 3D	Yes	Yes	No	20
Target Mark 3D	Yes	Yes	No	1
Contrast	Yes	No	No	No
Brightness	Yes	No	No	No
Gray	Yes	No	No	No
Caliper	Yes	No	No	No
BLOB	Yes	No	No	1000
OCR	Yes	No	No	1
Datacode	Yes	No	No	5
Barcode	Yes	No	No	5

Read sensor identity (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read sensor identity (GSI) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read sensor identity (Get Sensor Identity)
2	**S**	
3	**I**	
4	1	Request version
Example:	GSI1	
Read sensor identity (GSI) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Read sensor identity (Get Sensor Identity)
2	**S**	
3	**I**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 10	X	Length of the following data
11 ... n	X	Version of the firmware as well as information about the hardware. Areas are clearly separated by a semicolon.
Example:	GSIP0000262.0.0.3; SBSA-B-AF-R6-B-FW-W	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

Update firmware (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Update firmware (UFW) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**U**	Update firmware
2	**F**	
3	**W**	
4	1	Request version
Example:	UFW1	
Update firmware (UFW) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**U**	Update firmware
2	**F**	
3	**W**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
Example:	UFWP000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

After the command is sent, the /tmp/ on the SBS vision sensor will be checked for a valid firmware file. The name must correspond to the typical name allocation (e.g. as after the download from the Festo homepage). The end is reached as soon as the camera signals ready (pin 4 GN) again. Alternatively, the telegram "GSI1" can be used to check whether a valid response is being sent.

NOTE:
The voltage supply must be ensured during the firmware update. An update may take up to 10 minutes.

Read job set (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Read job set (SJS) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set job set
2	**J**	
3	**S**	
4	1	Request version
5 - 7	X	Length of subsequent file name. Maximum length 250 characters.
8 ... n	X	Optional file name. If no file name is specified, the default name "Jobset.job" is used.
Example:	SJS1010jobset.job	
Read job set (SJS) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**S**	Set job set
2	**J**	
3	**S**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
8 - 10	X	Active job number in the loaded job set
Example:	SJSP000001	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		No
Status of Ready signal during processing:		Low
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

The job set with the specified name will be searched for in the /tmp/ directory on the SBS vision sensor. If the file exists, this job set is activated. The file is then removed.

Save job set (ASCII)

Telegrams: Availability and supported interfaces

Overview telegrams

Save job set (GJS) Request string to sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get jobset
2	**J**	
3	**S**	
4	**1**	Request version
5 - 7	X	Length of subsequent file name. Maximum length 250 characters.
8 … n	X	Optional file name. If no file name is specified, the default name "Jobset.job" is used.
Example:	GJS1010jobset.job	
Save job set (GJS) Response string from sensor (ASCII)		
Byte no.	Content	Meaning
1	**G**	Get jobset
2	**J**	
3	**S**	
4	P F	P: (Pass) Success F: (Fail) Error
5 - 7	X	Error codes
Example:	GJSP000	
Additional information:		
Accepted in run mode:		Yes
Accepted in configuration mode:		No
Accepted when Ready is low:		Yes
Supported interfaces:		Telegrams: Availability and supported interfaces
End of telegram:		Max. 4 bytes (optional)

The jobset is stored with the specified name in the /tmp/ directory on the SBS vision sensor.

11.4.7 Data output ASCII

Output data (ASCII), dynamically composed according to user settings in the software under: Vision Sensor Configuration Studio / Output / Data output.

Basic string structure:

‹START› (((‹OPTIONAL FIELDS› ‹SEPARATOR› ‹PAYLOAD›))) ‹CHKSUM› ‹TRAILER›

Output data (ASCII):

‹OPTIONAL FIELDS›				
Parameter	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Selected fields	With this checkbox all selected fields are displayed. The checkbox "Selected fields" itself is not displayed.	16	The output sequence is from left to right and from top to bottom, i.e. one byte is set per active checkbox, starting with the LSB.	All types
Telegram length	Number of characters including the characters for the telegram length itself.	1 ... 10	E.g. output string with 10 characters; telegram length 10 + 2 characters (one byte per decimal place) = 12	All types

Status byte	Returns the Trigger mode.	3	PPF = Trigger
			PFP = Free run
				All types

‹OPTIONAL FIELDS›				
Parameter	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Detector results	Output of overall result for each detector.	4 ... 261	Byte 1 = AND conjunction of all detectors Byte 2 = Overall Alignment result Byte 3 = Overall result of current job Followed by the number of detectors; one byte per decimal place Followed by one byte for each detector; P = Detector pass F = Detector fail	All types
Digital outputs	Returns the logic gate result for each digital output.	2 ... 7	Byte 1 Number of active outputs (logic gate result assigned) Followed by bytes 2 – 7; one byte per output P = Detector pass F = Detector fail 0 = Inactive output (gap between two active outputs)	All types
log. Outputs	Returns the logic gate result for each logic output.	1 ... 259	Starting from byte 1 Number of active outputs (logic gate result assigned); 1 byte per decimal place Following bytes: One byte per logic output P = Detector pass F = Detector fail 0 = Inactive output (gap between two active outputs)	All types

‹OPTIONAL FIELDS›				
Parameter	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Execution time	Returns the execution time for the last evaluation.	1 … 3	Signed integer	All types
Active job	Returns the job for the last evaluation.	1 … 3	Unsigned int U8	All types

‹PAYLOAD›

Overview of detector-specific payload - Values

GENERAL

‹PAYLOAD› General				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
"All evaluations" counter	Total number of checks	1 … 11	Signed integer	GENERAL
Pass parts counter	Number of inspections with result "OK"	1 … 11	Signed integer	GENERAL
Fail parts counter	Number of inspections with result "Error"	1 … 11	Signed integer	GENERAL
Timeout	Indicates that the maximum cycle time has been exceeded.	1	BOOL	GENERAL
Recording	Indicates the number of image acquisition repetitions for the last evaluation Only in combination with repeat mode.	1 … 3	INT	GENERAL

<PAYLOAD> General				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
String	This field can be used to enter a constant string into the data output.	1 ... 50	STRING	GENERAL
Job checksum	Calculates a checksum over the active job. This takes into account all job-specific settings except the "Changed" date. Changing settings that are global for the jobset will change the checksum in all jobs. If the checksum is determined for a job, no temporary changes can be made for this job in run mode.	8	STRING	GENERAL

Base values

<PAYLOAD> Base values				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Score	[%]	1 ... 6	Signed integer	All detectors
Overall result	Boolean detector result **	1	BOOL	All detectors
Execution time	Execution time of individual detector in [msec].	1 ... 11	Signed integer	All detectors

Position

‹PAYLOAD› Position / location				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Pos. X	X coordinate for the found position, 1/1000 [user unit] **	1 ... 11	Signed integer	⚓ ✚ ⬡ ⛁ 3D ‖‖‖ ▦ A F
Pos. Y	Y coordinate for the found position, 1/1000 [user unit] **	1 ... 11	Signed integer	⚓ ✚ ⬡ ⛁ 3D ‖‖‖ ▦ A F
Pos. Z	Z coordinate of the found position, 1/1000 [user unit]	1 ... 11	Signed integer	⛁ 3D With Result off-set: ⚓ ✚ ⬡
Delta Pos. X	X position delta between the taught object and the found object, 1/1000 [user unit]	1 ... 11	Signed integer	⚓ ✚ ⬡ ⛁ 3D
Delta Pos. Y	Y position delta between the taught object and the found object, 1/1000 [user unit]	1 ... 11	Signed integer	⚓ ✚ ⬡ ⛁ 3D
Delta Pos. Z	Z position delta between the taught object and the found object, 1/1000 [user unit]	1 ... 11	Signed integer	⛁ With Result off-set: ⚓ ✚ ⬡
Angle X	Orientation of the found object, relative to the X-axis, 1/1000 [°]	1 ... 11	Signed integer	⛁ 3D With Result off-set: ⚓ ✚ ⬡

‹PAYLOAD› Position / location				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Angle Y	Orientation of the found object, relative to the Y-axis, 1/1000 [°]	1 … 11	Signed integer	⛁ 3D With Result offset: ⚓ ✚ ⬡
Angle Z	Orientation of the found object, relative to the Z-axis, 1/1000 [°]	1 … 11	Signed integer	⚓ ✚ ⬡ 3D ▥ A
Angle (45)	Orientation of bounding box for found code [°], Value range: -45° to 45°	1 … 6	Signed integer	▦
Angle (180)	Orientation of object width (long axis) [°], Value range: -90° to 90° 0° = East, counterclockwise	1 … 7	Signed integer	C
Angle (360)	Orientation of object width (long axis) [°], Value range: -180° to 180° 0° = East, counterclockwise	1 … 7	Signed integer	C
Delta Angle X	Angle between taught-in and found object, referred to the X-axis, 1/1000 [°]	1 … 7	Signed integer	⛁ 3D With Result offset: ⚓ ✚ ⬡

<PAYLOAD> Position / location				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Delta Angle Y	Angle between taught-in and found object, referred to the Y-axis, 1/1000 [°]	1 … 7	Signed integer	⛁ 3D With Result offset: ⚓✚⬡
Delta Angle Z	Angle between taught-in and found object, referred to the Z-axis, 1/1000 [°]	1 … 7	Signed integer	⚓✚⬡⛁ 3D
Pose 3D (X, Y, Z, Angle X, Angle Y, Angle Z)	Coordinates of the found object, 1/1000 [user unit] Angle: 1/1000 degrees	1…7 bytes per value; separated by specified separator	Signed integer	⛁ 3D With Result offset: ⚓✚⬡
Delta Pose 3D (X, Y, Z, Angle X, Angle Y, Angle Z)	Delta coordinates of the found object, 1/1000 [user unit] Angle: 1/1000 degrees	1…7 bytes per value; separated by specified separator	Signed integer	⛁ 3D With Result offset: ⚓✚⬡
Position control		1	BOOL	✚⬡

Measurement

<PAYLOAD> Measurement				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
height	Height of geometric element [user unit]*, Height ≥ 0, height ≤ width	1 … 11	Signed integer	C ▦

<PAYLOAD> Measurement				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Width	Width of geometric element [user unit]*, Width ≥ 0, width ≥ height	1 ... 11	Signed integer	C ▨
Radius	Radius of fitted circle [user unit]	1 ... 11	Signed integer	C
Area	Area of BLOB without holes, 1/1000 [pixels]	1 ... 11	Signed integer	C
Area (incl. holes)	Area of BLOB including holes, 1/1000 [pixels]	1 ... 11	Signed integer	C
Distance	Calculated distance [user unit] **	1 ... 11	Signed integer	F

Identification

<PAYLOAD> Identification				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
String Target Mark ID Target Mark name	Content of the read code or content of the Target Mark or assigned Target Mark name. If a fixed string length is desired, the minimum string length (detector-specific payload) and the maximum string length (detector settings) must be set to the same value (e.g. 127).	0 ... 255	STRING	▥ ▦ A 3D
String length Length of Target Mark name (characters)	Length of read code [characters]	1 ... 6	Signed integer	▥ ▦ A 3D
String length (bytes) Length of Target Mark name (bytes) Length of Target Mark ID (bytes)	Length of read code [bytes]	1 ... 6	Signed integer	▥ ▦ A 3D

<PAYLOAD> Identification				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
String comparison	Content check for the read information. The content of the read information is checked on the basis of regular expressions (see detector Datacode, Reference string tab)	1	BOOL	‖‖‖ ▦ A
Truncated	Code complete or truncated F: Code complete P: Code truncated	1	BOOL	‖‖‖ ▦ A

Identification - quality

<PAYLOAD> Identification - Quality				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**

Quality - overall	Output of all Q parameters. Depending on the selected code type and standard.	1 byte per value; separated by specified separator
		For 2D code parameter Q9 (mean light): 1...3
			Unsigned Char;
			for 2D Code Q9 (Meanlight) Unsigned Short
				‖‖‖ ▦

<PAYLOAD> Identification - Quality				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**

Quality - individual	Output of individual quality values: Selection Q1-Q24 depending on the selected code type and standard.
	Numbers: 1-4
	Letters: A-F
		1
		For 2D code parameter Q9 (mean light): 1...3
			Unsigned Char;
			for 2D Code Q9 (Meanlight) Unsigned Short
				▥ ▦

Min. Quality	Used to check whether the minimum required quality is being met	1 ... 7	Unsigned int	A

Color

<PAYLOAD> Color				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Color value: • Red, green, blue • Hue, saturation, lightness • Luminance, a, b	Value for color parameter	0 ... 7	Signed integer	✺ 🟥🟦🟩
Color distance	Distance of the current color versus the taught-in color	0 – 7	Signed integer	🟥🟦🟩

Counting / number

<PAYLOAD> Counting / number				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Number of objects	Number of objects found [units]	1 … 5	Signed integer	⬡ C
Number of valid objects	Number of valid objects found [units]	1 … 5	Signed integer	⬡
Number of search stripes	Number of parallel search stripes into which the width of the search range is divided. [units]	1 … 5	Signed integer	⚓ (Edge detector only) F
Number of valid search stripes	Number of search stripes used to generate results [units]	1 … 3	Signed integer	⚓ (Edge detector only) F
Result vector	Vector containing the result (1/0) of the instances found			C ⬡ ✚
Too many BLOBs		1	BOOL	C

Extended

<PAYLOAD> Extended				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Scaling	Current scaling factor to the taught-in reference. 1/1000 (factor). Value range of 0.5 to 2	3 ... 4	Unsigned int	⚓ (Contour matching only) ⬡
Eccentricity	Numerical eccentricity Value range of 0.0 to 1.0	N	Signed integer	
Security	Output of the security values of the individual characters. The reliability value specifies how reliably the reader was able to interpret a character. Value range of 0 to 100 [%]	N	Unsigned int	A
Reference string met	The output string matches the reference string.	1	BOOL	A
contrast	Code contrast Value range of 0 to 100 [%]	N	Unsigned int	▦
Correction	Number of modules corrected by error corrections [units]	N	Unsigned int	▦
Contour length	Number of pixels of outer contour, 1/1000 [pixels]	N	Signed integer	C

<PAYLOAD> Extended				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Compactness	BLOB compactness (circle =1; other > 1). The more the shape of the BLOB deviates from a circle, the greater the compactness value will be.	N	Signed integer	C
Center of gravity X	X coordinate of centroid, 1/1000	N	Signed integer	C
Center of gravity Y	Y coordinate of centroid, 1/1000	N	Signed integer	C
Gray scale value, average	Average gray scale value of all the pixels that belong to the BLOB.	N	Signed integer	C
Min. signal threshold	Lower threshold for the binarization of the objects. 0...255	1 ... 3	Unsigned int	C
Max. signal threshold	Upper threshold for the binarization of the objects. 0...255	1 ... 3	Unsigned int	C
Inverted signal threshold	Specifies whether the range Min <-> Max is inverted. P: inverted F: not inverted	1	Unsigned Char	C

<PAYLOAD> Extended				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Deviation, inside	Returns the largest deviation between the BLOB contour and the contour of the geometric element (deviation inside the fitted circle). [User unit * 1000]	1 ... 7	Signed integer	●
Deviation, outside	Returns the largest deviation between the BLOB contour and the contour of the geometric element (deviation outside the fitted circle). [user unit]	1 ... 7	Signed integer	●
Deviation, mean	Returns the mean of the absolute "inside" and "outside" deviation values between the BLOB contour and the contour of the geometric element.	1 ... 7	Signed integer	●
Axial ratio	Ratio of the long to the short axis (a / b)	1 ... 7	Signed integer	●
Face up / down, area	Face up / down position, based on: area, position indicated by sign, 1/1000	N	Signed integer	●
Result index	List index	N	Signed integer	🟥🟦🟩

<PAYLOAD> Extended				
Value	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Search stripe distance	Calculated distance [user unit] / 1000 per pair of search stripes	1 ... 11	Signed integer	F

<CHKSUM>				
Parameter	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Check sum	XOR check sum of all bytes in the telegram. Is transmitted as the last byte.	1	Unsigned int	All types

<TRAILER>				
Parameter	**Description**	**Length ASCII [Byte]**	**Data type**	**Available for**
Start	User-defined, up to a max. of 8 characters	0 ... 8	Unsigned int	All types

***NOTE:**
If no calibration has been performed, all values refer to pixels.

**Detector Caliper: Depending on the selected Distance mode. "Minimum/Maximum by search stripe" = vector with two elements [min; max].

11.5 Description Telegrams BINARY

11.5.1 General

Reset statistics (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Reset Statistics (RST) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x04	Reset statistics
Reset Statistics (RST) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x04	Reset statistics
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

NOTE:
Statistics values can be output in the operating step Output / tab Telegram / "Payload", selection "GENERAL".
Additional information: see data output BINARY / GENERAL

Process image from file (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Process image from file (PIF) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 9 bytes + length of subsequent data (n)
5	Unsigned Char	0x2D	Process image from file
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0x00	Reserved
8	Unsigned Char	0x01	Reserved
9	Unsigned Char	0xXX	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes)
10 ... n	Unsigned Char	0xXX	File name (UTF-8) and format available on the device in the directory "/tmp/". Allowed extensions: Monochrome sensor: .pgm Color sensor: .ppm (RGB) or .pgm (Bayer)
Process image from file (PIF) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length
5	Unsigned Char	0x2D	Process image from file
6-7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0x00	Reserved
9-12	Unsigned int	0xXX	Length of the implicit result output
13 ... n	Unsigned Char	0xXX	Output of the implicit result
Additional information:			

Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces

NOTE:
Image size of the test image must match the image size of the currently active job on the device.

11.5.2 Control

Trigger (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Trigger (TRG) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x01	Trigger, (simple trigger without index, via port 2006)
Trigger (TRG) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x01	Trigger, (response to trigger command without index, via port 2006. If defined: Result data without index via port 2005)
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			Yes
Accepted when Ready is low:			No
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Extended trigger (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Extended Trigger (TRX) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 6 bytes + length of subsequent data (n)
5	Unsigned Char	0x13	Extended trigger (trigger with index, for correlation of trigger to corresponding result data, via port 2006)
6	Unsigned Char	0xXX	Length of following data (0-99)
7 … n	Unsigned Char	0xXX	Data
Extended Trigger (TRX) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length
5	Unsigned Char	0x13	Extended Trigger command, (response to trigger with index and result data, via port 2006, for correlation of trigger to corresponding result, Result data without index, via port 2005 also)
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Length of following data (n)
9 … n	Unsigned Char	0xXX	Data of sending command
n+1	Unsigned Char	0xXX	Operating mode 0 = Config mode 1 = Run mode
n + 2 … n + 5	Unsigned int	0xXX	Length of result data
n + 6 … m	Unsigned Char	0xXX	Result data
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			Yes

Accepted when Ready is low:	No
Status of Ready signal during processing:	Low
Supported interfaces:	Telegrams: Availability and supported interfaces

Trigger Robotics (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Trigger Robotics (TRR) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 31 (0x1F) + Length of trigger identifier in Bytes
5	Unsigned Char	0x37	Trigger Robotics
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Length of trigger identifier in bytes
8 … n	Unsigned Char	0xXX	Trigger Identifier
n+1…n+4	Unsigned int	0xXX	Pose_TCP Pos. X (in user unit * 1000)
n+5…n+8	Unsigned int	0xXX	Pose_TCP Pos. Y (in user unit * 1000)
n+9…n+12	Unsigned int	0xXX	Pose_TCP Pos. Z (in user unit * 1000)
n+13…n+16	Unsigned int	0xXX	Pose_TCP Angle X (in degrees * 1000)
n+17…n+20	Unsigned int	0xXX	Pose_TCP Angle Y (in degrees * 1000)
n+20…n+24	Unsigned int	0xXX	Pose_TCP Angle Z (in degrees * 1000)
Trigger Robotics (TRR) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length 8 (0x08) + Length of trigger identifier in Bytes
5	Unsigned Char	0x37	Trigger Robotics, (Response to command Trigger without index, via port 2006. If defined: Result data without index via port 2005)
6 - 7	Unsigned Short	0xXX	Error codes

8	Unsigned Char	0xXX	Length of trigger identifier
9 … n	Unsigned Char	0xXX	Trigger Identifier
n+1	Unsigned Char	0xXX	Operation Mode 0x00 = Config 0x01 = Run
n+2…n+5	Unsigned int	0xXX	Length of the result data in bytes
n+6…m	Unsigned int	0xXX	Result data
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		Yes	
Accepted when Ready is low:		No	

Note: For "Calibration plate (Robotics)" and "Point pair list (Robotics)" only the X and Y position are taken into account. The other values (position Z and rotations) must be 0.

Set Trigger ID (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set Trigger ID (STI) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 7 Bytes + length of Trigger ID
5	Unsigned Char	0x2E	Set trigger ID
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Length of the following data (max 99)
8 ... n	Unsigned Char	0xXX	Trigger ID
Example:	0x00 0x00 0x00 0x0D 0x2E 0x01 0x06 0x30 0x31 0x32 0x33 0x34 0x35		
Set Trigger ID (STI) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x2E	Set trigger ID
6 - 7	Unsigned Short	0xXX	Error codes
Example:	0x00 0x00 0x00 0x07 0x2E 0x00 0x00		
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			Yes
Accepted when Ready is low:			Yes

Job change (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Job change (CJB) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x06	Telegram length
5	Unsigned Char	0x02	Change job
6	Unsigned Char	0xXX	Job no. XX = 1 … n
Job change (CJB) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length
5	Unsigned Char	0x02	Change job
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Trigger mode 0x00: Trigger 0x01: Free run
9	Unsigned Char	0xXX	Job no. XX = 1 … n
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

NOTE:
If an error occurs during the job change, it is possible to change to Job 1.

Job Change Permanent (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Job Change Permanent (CJP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x06	Telegram length
5	Unsigned Char	0x22	Job change permanent
6	Unsigned Char	0xXX	Job no. XX = 1 … n
Job Change Permanent (CJP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length
5	Unsigned Char	0x22	Job change permanent
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Trigger Mode 0x00: Trigger 0x01: Free run
9	Unsigned Char	0xXX	Job no. XX = 1 … n
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		Low	
Supported interfaces:		Telegrams: Availability and supported interfaces	

NOTE:
If an error occurs during the job change, it is possible to change to Job 1.

Job change by job name (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Job change by job name (CJN) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 7 bytes + length job name (n)
5	Unsigned Char	0x2C	Job change by job name
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Job name length (n)
8 … n	Unsigned Char	0xXX	Job name
Job change by job name (CJN) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x08	Telegram length
5	Unsigned Char	0x2C	Job change by job name
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Trigger mode 0x00: Trigger 0x01: Free run
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		Low	
Supported interfaces:		Telegrams: Availability and supported interfaces	

11.5.3 Job settings

Auto working distance (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Auto working distance (AFC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 11 Bytes (0x0B) + selected options 8 Bytes (0x08)
5	Unsigned Char	0x32	Auto working distance
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	Step size of search (0x01 - 0x05)
9	Unsigned Char	0xXX	Selection of distance value 0x00: Highest score 0x01: Min. working distance 0x02: Max. working distance 0x03: Average working distance 0x04: Median working distance 0x05: Highest score - output of all working distances found
10	Unsigned Char	0xXX	Unit 0x00: 1/1000 millimeters (µm) 0x01: Motor steps
11	Unsigned Char	0xXX	Selection of search range 0x00: Entire range 0x01: Selected range
12...15	Unsigned int	X	Start of search range (only if search range selection == 0x01)
16...19	Unsigned int	X	End of search range (only if selection Search range == 0x01)
Auto working distance (AFC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning

1 - 4	Unsigned int	0xXX	Telegram length 11 Bytes (0x0B) + working distances + score values
5	Unsigned Char	0x32	Auto working distance
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	X	Number of output working distances
12 ... n	Unsigned int	X	Distance value in 1/1000 mm or motor steps (4 bytes per output working distance)
n-m	Unsigned int	X	Score value to distance value multiplied by 1000 (4 bytes per output working distance)
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Set working distance (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set working distance (SFC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0D	Telegram length
5	Unsigned Char	0x31	Set working distance
6	Unsigned Char	0xX1	Request version
7	Unsigned Char	0xXX	0: Temporary 1: Permanent
8	Unsigned Char	0xXX	Movement 0: Absolute 1: Relative 2: Absolute with reinitialization
9	Unsigned Char	0xXX	Unit 0: 1/1000 millimeters 4: Steps
10 - 13	Signed integer	0xXX	Working distance
Set working distance (SFC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x31	Set working distance
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	INT	0xXX	Current working distance
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Read working distance (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read working distance (GFC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x30	Read working distance
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Unit 0x00: 1/1000 millimeter 0x04: Steps
Read working distance (GFC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x30	Read working distance
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	INT	0xXX	Current working distance
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Auto shutter speed (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Auto shutter speed (ASH) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x07	Auto shutter speed
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
Auto shutter speed (ASH) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0F	Telegram length
5	Unsigned Char	0x07	Auto shutter speed
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	INT	0xXX	Auto shutter speed value
12 - 15	INT	0xXX	Score
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Set shutter speed value (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set shutter speed (SSP/SST) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length
5	Unsigned Char	0xXX	0x0E Set shutter speed temporarily 0x0F Set shutter speed permanently
6 - 9	Unsigned int	0xXX	Shutter speed value in 1/1000 ms
Set shutter speed (SSP/SST) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0xXX	0x0E Set shutter speed temporarily 0x0F Set shutter speed permanently
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		Low	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Read shutter speed value (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read Shutter Speed Value (GSH) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x17	Read shutter speed value
Read Shutter Speed Value (GSH) Response string from sensor (BINARY)			
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x17	Read shutter speed value
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	0xXX	Shutter speed value
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode::			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Set gain value (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set gain value (SGA) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0A	Telegram length
5	Unsigned Char	0x1B	Set gain value
6	Unsigned Char	0xXX	0: Temporary 1: Permanent
7 - 10	Unsigned int	0xXX	Gain value * 1000
Set gain value (SGA) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x1B	Set gain value
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	0xXX	Current gain value (value *1000)
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Read gain value (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read gain value (GGA) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x1C	Read gain value
Read gain value (GGA) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x1C	Read gain value
6	Unsigned Short	0xXX	Error codes
7		0xXX	
8 - 11	Unsigned int	0xXX	Current gain value * 1000
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Set parameter (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set parameters (SPP/SPT) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length = 9 bytes + length of the selected parameter
5	Unsigned Char	0xXX	0x05: Set parameter permanently 0x06: Set parameter temporarily
6	Unsigned Char	0xXX	Detector no., XX = 1 ... n
7	Unsigned Char	0xXX	Command: Set reference string / value, see Overview Detector Parameters (set / read)
8 - 9	Unsigned Short	0xXX	Length of new reference string / value (n), see Overview Detector Parameters (set / read)
10 ... n	Unsigned Char	0xXX	Reference string / value
Set parameters (SPP/SPT) Response string from sensor (BINARY)			
(may be delayed up to 4-5 seconds)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x08	Telegram length + length of the selected parameter in bytes
5	Unsigned Char	0xXX	0x05: Set parameter permanently 0x06: Set parameter temporarily
6 - 7	Unsigned Short	0xXX	Error codes

8	Unsigned Char	0xXX	Parameter type 0x00: I8 0x01: U8 0x02: I16 0x03: U16 0x04: I32 0x05: U32 0x06: I40 0x07: U40 0x08: Float 0x09: Double 0x0A: String 0x0B: Boolean 0x0C: Special signed8 0x0D: Undefined
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Read parameter (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read parameter (GPA) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x0A	Get parameter
6	Unsigned Char	0xXX	Detector no., XX = 1... n
7	Unsigned Char	0xXX	Command: Read reference string / value, see Overview Detector Parameters (set / read)
Read parameter (GPA) Response string from sensor (BINARY)			
(may be delayed up to 4-5 seconds)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length = 10 Bytes + length of the selected parameter in Byte
5	Unsigned Char	0x0A	Get parameter
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Parameter type string
9 - 10	Unsigned Short	0xXX	Length of read parameter (n)
11 ... n + n	Unsigned Char	0xXX	Reference string / value
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Overview Detector Parameters (set / read)

Detector	Function	Value	Multiplier	Length
Alignment				
Pattern matching Contour matching	Threshold value Min.	0x01	1000	4
	Threshold value Max.	0x02	1000	4
	Result offset 0: "Off" 1: "Image plane (in pixels)" 2: "Align (2D)" 3: "Robot (3D)"	0x1E	1	1
	Result offset Image plane: Pos. X	0x1F	1000	4
	Result offset Image plane: Pos. Y	0x20	1000	4
	Result offset Image plane: angle	0x21	1000	4
	Result offset Align (2D), Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	0x22	1000	24 (6 * 4 bytes per value)
	Calculate Result offset* with transmitted position • Align (2D): Pos. X, Pos. Y, 0, 0, 0, Angle Z • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	0x23	1000	24 (6 * 4 bytes per value)
Edge detector	Probe 1: Transition 0: Any 1: Dark to light 2: Light to dark	0x65	1	1
	Probe 2: Transition 0: Any 1: Dark to light 2: Light to dark	0x66	1	1

Detector	Function	Value	Multiplier	Length
	Probe 3: Transition 0: Any 1: Dark to light 2: Light to dark	0x67	1	1
	Probe 1: Threshold value Min.	0x68	1000	4
	Probe 2: Threshold value Min.	0x69	1000	4
	Probe 3: Threshold value Min.	0x6A	1000	4
Detector				
Pattern matching Contour Contour 3D	Threshold value Min.	0x01	1000	4
	Threshold value Max.	0x02	1000	4
	Result offset 0: "Off" 1: "Image plane (in pixels)" 2: "Align (2D)" 3: "Robot (3D)"	0x1E	1	1
	Result offset Image plane: Pos. X	0x1F	1000	4
	Result offset Image plane: Pos. Y	0x20	1000	4
	Result offset Image plane: angle	0x21	1000	4
	Result offset Align (2D), Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	0x22	1000	24 (6 * 4 bytes per value)
	Calculate Result offset* with transmitted position • Align (2D): Pos. X, Pos. Y, 0, 0, 0, Angle Z • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	0x23	1000	24 (6 * 4 bytes per value)
Target Mark 3D	Result offset • Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z	0x22	1000	24 (6 * 4 bytes per value)

Detector	Function	Value	Multiplier	Length
	Calculate Result offset* with transmitted position - Robot (3D): Pos. X, Pos. Y, Pos. Z, Angle X, Angle Y, Angle Z *A valid position for the detector must be available	0x23	1000	24 (6 * 4 bytes per value)
	ID of the active Target Mark	0x65	-	n
	Target Mark name	0x66	-	n
	Add current Target Mark to the list of Target Marks (parameter can only be set!) A Target Mark must have been detected.	0x67	-	n
Gray	Threshold value Min.	0x01	1000	4
	Threshold value Max.	0x02	1000	4
	Grayscale value Min.	0x65	1000	4
	Grayscale value Max.	0x66	1000	4
	Invert grayscale value	0x67	1	4
Contrast Brightness	Threshold value Min.	0x01	1000	4
	Threshold value Max.	0x02	1000	4
Caliper	Threshold value Distance Min.	0x65	1000	4
	Threshold value Distance Max.	0x66	1000	4
	Invert distance threshold value	0x67	1	1
	Distance mode 0: Minimum 1: Maximum 2: Mean 3: Median 4: Smallest opposite 5: Largest opposite	0x68	1	1
	Probe 1: Threshold value Min.	0x69	1000	4
	Probe 2: Threshold value Min.	0x6A	1000	4
	Probe 1: Smoothing	0x6B	1000	4
	Probe 2: Smoothing	0x6C	1000	4

Detector	Function	Value	Multiplier	Length
	Probe 1: Transition 0: Any 1: Dark to light 2: Light to dark	0x6D	1	1
	Probe 2: Transition 0: Any 1: Dark to light 2: Light to dark	0x6E	1	1
	Probe 1: Number of search stripes	0x6F	1	1
	Probe 2: Number of search stripes	0x70	1	4
BLOB	Grayscale value Min.	0x65	1000	4
	Grayscale value Max.	0x66	1000	4
	Invert grayscale value 0: not inverted 1: inverted	0x67	1	1
	Threshold value Number of BLOBs Min.	0x78	1	1
	Threshold value Number of BLOBs Max.	0x79	1	1
	Invert number threshold value 0: not inverted 1: inverted	0x7A	1	1
	Number of set features (read only)	0x7B	1	1
	Selection of a feature from the list	0x7C	1	1
	Feature threshold value Min.	0x7D	1000	4
	Feature threshold value Max.	0x7E	1000	4
	Invert feature threshold value	0x7F	1	1
Barcode Datacode OCR	Reference string	0x65	-	n (length of string)
	Reference string	0x65	-	n (length of string)
	Reference string	0x65	-	n (length of string)

Detector	Function	Value	Multiplier	Length
Color Value Color Value	Color space (read only)	0x15	0x00 = RGB 0x01 = HSV 0x02 = LAB	1
	Channel selection (read only)	0x16	Bit field one digit per color channel	1
	Color channel 1: Threshold value Min.	0x65	1000	4
	Color channel 1: Threshold value Max.	0x66	1000	4
	Color channel 1: Invert threshold value	0x67	1	1
	Color channel 2: Threshold value Min.	0x68	1000	4
	Color channel 2: Threshold value Max.	0x69	1000	4
	Color channel 2: Invert threshold value	0x6A	1	1
	Color channel 3: Threshold value Min.	0x6B	1000	4
	Color channel 3: Threshold value Max.	0x6C	1000	4
	Color channel 3: Invert threshold value	0x6D	1	1
Color List	Color space (read only)	0x15	0 = RGB 1 = HSV 2 = LAB	3
	Channel selection (read only)	0x16	Bit field one digit per color channel	4
	Color distance threshold value	0x65	1000	n
	Set color distance threshold value active	0x66	1	n
	Number of colors in list	0x67	1	n
	Selection of a color from the list	0x68	1	n

Detector	Function	Value	Multiplier	Length
	Color value of the selected color (color channel 1, color channel 2, color channel 3, color channel 4 [constantly 0])	0x69	1000	32
Busbar Wafer	Threshold value Min.	0x01	1000	n
	Threshold value Max.	0x02	1000	n
Result processing	Name of the active expression	0x7A	-	n (length of string)
	Current expression	0x7V	-	n (length of string)

Set search range (ROI) (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set ROI (SRP/SRT) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length in bytes 24 bytes: circle 32 bytes: rectangle, ellipse, free form
5	Unsigned Char	0xXX	0x10: Set parameter temporarily 0x11: Set parameter permanently
6 - 9	Unsigned int	0xXX	19 bytes: circle 27 bytes: rectangle, ellipse, free form
10	Unsigned Char	0xXX	Detector no.
11	Unsigned Char	0xXX	Search range (ROI) Type 0x00: Search area (yellow) 0x01: Teach area (red) 0x02: Position control (blue)
12	Unsigned Char	0xXX	Search range (ROI) Shape 0x01: Circle 0x02: Rectangle 0x03: Ellipse 0x04: Free shape
13 - 16	Unsigned int	0xXX	ROI parameter: Center X (value in [px] * 1000)
17 - 20	Unsigned int	0xXX	ROI parameter: Center Y (value in [px] * 1000)
21 - 24	Unsigned int	0xXX	ROI parameter: half width or radius X (value in [px] * 1000)
	Only for ellipse / rectangle / free form:		
25 - 28	Unsigned int	0xXX	ROI parameter: half height or radius Y (value in pixels * 1000)
29 - 32	Unsigned int	0xXX	ROI parameter: Angle in ° degree (value in ° [degrees] * 1000)
Set ROI (SRP/SRT) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1	Unsigned int	0x07	Telegram length

5	Unsigned Char	0xXX	0x10: Set parameter permanently 0x11: Set parameter temporarily
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces
Parameter:			The parameters are given in the coordinate system of the Alignment and not in the coordinate system of the image.

Read search range (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read search range (GRI) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x12	Get ROI
6	Unsigned Char	0xXX	Detector no.
7	Unsigned Char	0xXX	Search range (ROI) Type 0x00: Search area (yellow) 0x01: Teach area (red) 0x02: Position control (blue)
Read search range (GRI) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length
5	Unsigned Char	0x12	Get ROI
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	0xXX	Search range (ROI) Info Length in bytes from Byte 8
12	Unsigned Char	0xXX	Detector no.
13	Unsigned Char	0xXX	Search range (ROI) Type 0x00: Search area (yellow) 0x01: Teach area (red) 0x02: Position control (blue)
14	Unsigned Char	0xXX	Search range (ROI) Shape 0x01: Circle 0x02: Rectangle 0x03: Ellipse 0x04: Free form
15 - 18	Unsigned int	0xXX	ROI parameter: Center X (value in pixels * 1000)
19 - 22	Unsigned int	0xXX	ROI parameter: Center Y (value in pixels * 1000)

23 -26	Unsigned int	0xXX	ROI parameter: Half width / radius X (value in pixels [px] * 1000)
	Only for ellipse / rectangle / free form:		
27 - 30	Unsigned int	0xXX	ROI parameter: Half height / radius Y (value in pixels [px] * 1000)
31 - 34	Unsigned int	0xXX	ROI parameter: Angle in ° (value in ° * 1000)
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Set ROI content (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set ROI content (SRC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 11 bytes + length of subsequent data (n)
5	Unsigned Char	0x39	Set ROI content
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Set parameter temporarily 0x01: Set parameter permanently
8	Unsigned Char	0xXX	Detector no. 0: Alignment ›0: Default detector in job
9	Unsigned Char	0x00	Reserved
10	Unsigned Char	0xXX	Bit 0: Use mask file Bit 1 - 7: reserved
11	Unsigned Char	0xXX	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes) Or for 000: default name mask.pgm
12 ... n	Char	0xXX	File name (UTF-8) and format available on the device in the directory "/tmp/". Default name mask.pgm File format: PGM
Set ROI content (SRC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x39	Set ROI content
6-7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:		Yes	

Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces

Read ROI content (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read ROI content (GRC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length 10 bytes + length of subsequent data (n)
5	Unsigned Char	0x3A	Read ROI content (Get ROI content)
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Detector no. 0: Alignment ›0: Default detector in job
8	Unsigned Char	0x00	Reserved
9	Unsigned Char	0xXX	Bit 0: Use mask file (if available) Bit 1: Use pattern file Bit 2: Use contour file Bit 3-7: reserved
10	Unsigned Char	0xXX	Length of the following file name of the file (actual number of bytes with file extension, max. 255 bytes) Or for 000: default name mask.pgm / pattern.pgm / contour.pgm
11 ... n	Char		File name (UTF-8) and format available on the device in the directory "/tmp/". Default name mask.pgm / pattern.pgm / contour.pgm File format: PGM
Read ROI content (GRC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x3A	Set ROI content
6-7	Unsigned Short	0xXX	Error codes

8-9	Unsigned Short	0xXX	Width of the search region
10-11	Unsigned Short	0xXX	Height of the search region
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Read job list (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read job list (GJL) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x14	Read job list
Read job list (GJL) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length
5	Unsigned Char	0x14	Read job list
6	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0x01	Constant
9	Unsigned Char	0xXX	Number of jobs
10	Unsigned Char	0xXX	Active job number
ℹ	**NOTE:** The following byte sequence is repeated for each job from 1 to "Number of jobs". The byte numbers shift accordingly.		
11	Unsigned Char	0xXX	Number of subsequent bytes. This can be used to specify a unique name for job n.
11 ... n	Char	0xXX	From this position, the name for job n follows in the specified length.
n + 1 ... n + 3	Unsigned Char	0xXX	Number of subsequent bytes. A description for job n can be specified.
n + 4 ... m	Char	0xXX	From this position, the description for Job 1 follows in the specified length.
m + 1 ... m+ 3	Unsigned Char	0xXX	Number of subsequent bytes. This can be used to specify a unique name for the author of job n.

m + 4 ... k	Char	0xXX	From this position, the name for the author of job n follows in the specified length.
k + 1 ... k + 7	Unsigned int	0xXX	Date of creation of Job n (7 bytes)
k + 8 ... k + 14	Unsigned int	0xXX	Date of last modification of job n (7 bytes)
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Read detector list (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Read detector list (GDL) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x15	Read detector list
Read detector list (GDL) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length
5	Unsigned Char	0x18	Read detector list
6	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Job number of current job
9	Unsigned Char	0xXX	Number of detectors in the current job
	ℹ	**NOTE:** The following byte sequence is repeated for each detector in the job. The byte numbers shift accordingly.	
10	Unsigned Char	0xXX	Number of subsequent bytes. This allows a unique name for the detector n to be specified.
11 ... n	Unsigned Char	0xXX	From this position, the name for detector n follows, in the given length.

n + 1 … n + 2	Unsigned Char	0xXX	Detector 0x01: Pattern matching 0x04: Contour 0x05: Gray 0x06: Contrast 0x07: Brightness 0x0B: OCR 0x0D: Datacode 0x0E: Barcode 0x12: Color Value 0x13: Color Area 0x14: Color List 0x15: Caliper 0x16: BLOB 0x18: Contour 3D 0x1B: Result processing 0x1C: Target Mark 3D

Additional information:	
Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	No change
Supported interfaces:	Telegrams: Availability and supported interfaces

Teach detector (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Teach detector (TED) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x08	Telegram length
5	Unsigned Char	0x18	Teach detector
6	Unsigned Char	0xXX	0x00: Alignment ≥ 0x01: Detector selection
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	0x00: No trigger, teach-in with next image acquisition 0x01: Trigger is executed for teach-in
Teach detector (TED) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x00	Telegram length
5	Unsigned Char	0x18	Teach detector
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Set trigger delay (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Set trigger delay (STD) Request string to sensor (BINARY)			
Byte no..	Data type	Content	Meaning
1 - 4	Unsigned int	0x08	Telegram length
5	Unsigned Char	0x27	Set trigger delay
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8 - 11	Unsigned int	0xXX	Trigger delay in msec (max. 3000 msec) in encoder steps (max. 65535 steps)
Set trigger delay (STD) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x27	Set trigger delay
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Get trigger delay (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Get trigger delay (GTD) Request string to sensor (BINARY)			
Byte no..	Data type	Content	Meaning
1 - 4	Unsigned int	0x06	Telegram length
5	Unsigned Char	0x28	Get trigger delay
6	Unsigned Char	0xX1	Request version
Get trigger delay (GTD) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x28	Get trigger delay
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	0xXX	Trigger delay in msec (max. 3000 msec) in encoder steps (max. 65535 steps)
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Save job permanently (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Save Job Permanently (SJP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x0D	Saving of all telegrams that were previously executed temporarily
Save Job Permanently (SJP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x0B	Telegram length
5	Unsigned Char	0x0D	Save job permanently
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

11.5.4 Calibration

Calibration: Initialization (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Initialization (CCD) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x1F	Initialize (Calibration: Clear Data)
Calibration: Initialization (CCD) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x1F	Initialize (Calibration: Clear Data)
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Add world point (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Add world point (CAW) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x15	Telegram length
5	Unsigned Char	0x26	Calibration: Add world point
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x01: Fiducials only Calibration plate (Robotics) 0x04: World point and pixel Point pair list (Robotics)
8 - 9	Unsigned Short	0x00	Constant (2 bytes)
10 - 13	Unsigned int	0xXX	World X (in mm *1000)
14 - 17	Unsigned int	0xXX	World Y (in mm *1000)
18 - 21	Unsigned Char	0x00	Constant (4 bytes)
Calibration: Add world point (CAW) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x11	Telegram length
5	Unsigned Char	0x26	Calibration: Add world point
6 - 7	Unsigned Short	0xXX	Error codes
8 - 9	Unsigned Short	0xXX	Current number of points
10 -13	Unsigned int	0xXX	Image point X
14 - 17	Unsigned int	0xXX	Image point Y
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Note: For the CAW request, the overall job result must be positive.

Calibration: Point pair list (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Point pair list (CCL) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x06	Telegram length
5	Unsigned Char	0x1E	Calibration: Point pair list
6	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
Calibration: Point pair list (CCL) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x19	Telegram length
5	Unsigned Char	0x1E	Calibration: Point pair list
6 - 7	Unsigned Short	0xXX	Error codes
8 - 9	Unsigned Short	0xXX	Current highest point pair index
10 - 13	Unsigned int	0xXX	Deviation calibration, RMSE
14 - 17	Unsigned int	0xXX	Deviation calibration, mean
18 - 21	Unsigned int	0xXX	Deviation calibration, max.
22 - 25	Unsigned int	0xXX	Deviation calibration, min.
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Calibration: Validate point pair list (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Validate point pair list (CVL) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x05	Telegram length
5	Unsigned Char	0x20	Calibration: Validate point pair list
Calibration: Validate point pair list (CVL) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x19	Telegram length
5	Unsigned Char	0x20	Calibration: Validate point pair list
6	Unsigned Short	0xXX	Error codes
8 - 9	Unsigned Short	0xXX	Current highest point pair index
10 - 13	Unsigned int	0xXX	Deviation calibration, RMSE
14 - 17	Unsigned int	0xXX	Deviation calibration, mean
18 - 21	Unsigned int	0xXX	Deviation calibration, max.
22 - 25	Unsigned int	0xXX	Deviation calibration, min.
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Calibration plate (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Calibration Plate (CCP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length
5	Unsigned Char	0x24	Calibration: Calibration plate
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	0x00: No fiducials are used. Origin of Measuring coordinate system identical to origin of Calibration Plate Coordinate System. 0x01: No fiducials are used. Measuring coordinate system identical with Camera coordinate system. 0x02: Uses world system, fiducial Job 0x03: Uses world system, fiducial Command CAW
9	Unsigned Char	0xXX	0x00: Calibration (internal and external parameters) 0x01: Validation of calibration 0x02: Calibration (internal parameters only) 0x05: Calibration Transformation Measuring coordinate system
Calibration: Calibration Plate (CCP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x3D	Telegram length
5	Unsigned Char	0x24	Calibration: Calibration plate
6 - 7	Unsigned Short	0xXX	Error codes
8 - 9	Unsigned Short	0xXX	Number of currently detected calibration points
10 - 13	Unsigned int	0xXX	Deviation calibration, RMSE
14 - 17	Unsigned int	0xXX	Deviation calibration, mean
18 - 21	Unsigned int	0xXX	Deviation calibration, max.

22 - 25	Unsigned int	0xXX	Deviation calibration, min.
26 -29	Unsigned int	0xXX	CPF_MF X (in user unit * 1000)
30 - 33	Unsigned int	0xXX	CPF_MF Y (in user unit * 1000)
34 - 37	Unsigned int	0x00	CPF_MF Z (in user unit * 1000)
38 - 41	Unsigned int	0x00	CPF_MF Angle X (in degrees * 1000)
42 - 45	Unsigned int	0x00	CPF_MF Angle Y (in degrees * 1000)
46 - 49	Unsigned int	0xXX	CPF_MF Angle Z (in degrees * 1000)
50 - 53	Unsigned int	0xXX	Deviation fiducials, mean
54 - 57	Unsigned int	0xXX	Deviation fiducials, max.
58 - 61	Unsigned int	0xXX	Deviation fiducials, min.
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Set fiducial (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Set fiducial (CSF) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x2B	Calibration: Set fiducial
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
Calibration: Set fiducial (CSF) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x2B	Telegram length
5	Unsigned Char	0x2B	Calibration: Set fiducial
6 - 7	Unsigned Short	0xXX	Error codes
8 - 11	Unsigned int	0xXX	X value
12 - 15	Unsigned int	0xXX	Y value
16 - 19	Unsigned int	0xXX	Z value
20 - 23	Unsigned int	0xXX	Angle X value
24 - 27	Unsigned int	0xXX	Angle Y value
28 - 31	Unsigned int	0xXX	Angle Z value
32 - 35	Unsigned int	0xXX	Deviation fiducials, mean
36 - 39	Unsigned int	0xXX	Deviation fiducials, max.
40 - 43	Unsigned int	0xXX	Deviation fiducials, min.
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Add image (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Add image (CAI) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x22	Telegram length 34 (0x22) Bytes
5	Unsigned Char	0x34	Calibration: Add image
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Mode 0x01: Multi-image calibration 0x02: Hand-Eye calibration (Robotics) 0x03: Base-Eye calibration (Robotics)
8	Unsigned Short	0x00	Constant
9	Unsigned Char	0xXX	Define Measurement plane 0x00: Do not use image to define Measurement plane 0x01: Use image to define Measurement plane
10	Unsigned Char	0xXX	"Robot: Order of rotation" 0x00: Use order of rotation specified in job 0x01: Yaw-Pitch-Roll (e.g. Stäubli) 0x02: Roll-Pitch-Yaw (e.g. Kuka, Fanuc, Hanwha, ABB**, UR**) ** when using the corresponding conversion function
11-14	Unsigned Char		Pose_TCP Pos. X (in user unit * 1000)
15-18	Unsigned Char		Pose_TCP Pos. Y (in user unit * 1000)
19-22	Unsigned Char		Pose_TCP Pos. Z (in user unit * 1000)
23-26	Unsigned Char		Pose_TCP Angle X (in degrees * 1000)
27-30	Unsigned Char		Pose_TCP Angle Y (in degrees * 1000)

31-34	Unsigned Char		Pose_TCP Angle Z (in degrees * 1000)
Calibration: Add image (CAI) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1-4	Unsigned int	0x0A	Telegram length
5	Unsigned Char	0x34	Calibration: Add image
6-7	Unsigned Short	0xXX	Error codes
8	Unsigned Short	0xXX	Current number of images in list
9-10	Unsigned Char	0xXX	Total number of detected points
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			Yes
Accepted when Ready is low:			No
Status of Ready signal during processing:			Low
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Multi-image (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Multi-image (CMP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length 9 (0x09) Bytes
5	Unsigned Char	0x35	Calibration: Multi-image
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	Origin of the world coordinate system: 0x00: World coordinate system identical with the Calibration Plate Coordinate System (center of the plate). 0x01: Origin of the world coordinate system so that it is identical with the origin of the image coordinate system (upper left pixel).. 0x02: (only for Calibration plate (Robotics)) Use World coordinate system of fiducials, as specified in the job file. 0x03: (only for Calibration plate (Robotics)) Use World coordinate system of fiducials as set in request CAW.
9	Unsigned Char	0xXX	Mode 0x00: Calibration (internal and external parameters) 0x01: Validate (use existing calibration; at least one calibration point is added. Via back projection it can be inferred whether the point fits to the current calibration or is shifted). 0x02: Calibration (internal parameters only) 0x03: Calibration (external parameters only using new internal parameters) 0x04: Calibration (external parameters only) 0x05: Calibrate Measurement plane only (CPF_MF)
Calibration: Multi-image (CMP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning

1-4	Unsigned int	0x1D	Telegram length 29 (0x1D) Bytes
5	Unsigned Char	0x35	Calibration: Multi-image
6-7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Field of view coverage (%) 0x00: no coverage 0x64: Coverage 100%
9-10	Unsigned Short	0xXX	Total number of detected points
11	Unsigned Char	0xXX	Number of images used
12	Unsigned Char	0xXX	Number of invalid images
13	Unsigned Char	0xXX	Tilt between calibration plate poses 0x00: sufficient 0x01: not sufficient
14-17	Unsigned int	0xXX	Deviation calibration plate RMSE [px]
18-21	Unsigned int	0xXX	Deviation calibration plate Max. [px]
22-25	Unsigned int	0xXX	Deviation fiducials, RMSE (in user unit * 1000)
26-29	Unsigned int	0xXX	Deviation fiducials, max. [px]
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Calibration: Robotics multi-image (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Robot multi-picture (CRP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length (bytes) 9 Byte
5	Unsigned Char	0x36	Calibration: Calibration plate robotics
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	Origin of the world coordinate system: 0x04: Set origin of coordinate system equal to Robot Coordinate System
9	Unsigned Char	X	Mode 0x00: Calibration (internal and external parameters) 0x01: Validate (use existing calibration; at least one calibration point is added. Via back projection it can be inferred whether the point fits to the current calibration or is shifted). 0x02: Calibration (internal parameters only) 0x03: Calibration (external parameters only using new internal parameters) 0x04: Calibration (external parameters only) 0x05: Calibrate only Measurement plane (CPF_MF) 0x06: Calibrate Hand-Eye (TCP_CF) / Base-Eye (RF_CF) only
Calibration: Robot multi-picture (CRP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1-4	Unsigned int	0x2C	Telegram length 44 (0x2C) Bytes
5	Unsigned Char	0x36	Calibration: Calibration plate robotics
6-7	Unsigned Short	0xXX	Error codes

8	Unsigned Char	0xXX	Field of view coverage 0x00: not sufficient 0x01: sufficient
9-10	Unsigned Short	0xXX	Total number of detected points
11	Unsigned Char	0xXX	Number of images used
12	Unsigned Char	0xXX	Number of invalid images
13-16	Unsigned int	0xXX	Deviation calibration plate RMSE [px]
17-20	Unsigned int	0xXX	Deviation calibration plate Max. [px]
21-24	Unsigned int	0xXX	Deviations calibration plate pose Translation RMSE (in user unit * 1000)
25-28	Unsigned int	0xXX	Deviations calibration plate pose Translation Max. (in user unit * 1000)
29-32	Unsigned int	0xXX	Deviations calibration plate pose Rotation RMSE (in degrees * 1000)
33-36	Unsigned int	0xXX	Deviations calibration plate pose Rotation Max. (in degrees * 1000)
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes

Calibration: Copy Calibration (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Copy calibration (CCC) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x09	Telegram length
5	Unsigned Char	0x25	Calibration: Copy Calibration
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0x01	Constant
8	Unsigned Char	0xXX	Destination 0 : Copy to all jobs >0: Copy to specified job
9	Unsigned Char	0xXX	0: Always copy when the calibration is active. 1: Only copy if the calibration method is the same.
Calibration: Copy calibration (CCC) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x08	Telegram length
5	Unsigned Char	0x25	Calibration: Copy Calibration
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	00: Successful >0 : Job number at which the error occurs.
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration: Set parameter (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Set parameter (CSP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length in Byte, 16 Bytes (0x13) + length of selected parameter
5	Unsigned Char	0x29	Calibration: Set parameter
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	0x00: Temporary 0x01: Permanent
8	Unsigned Char	0xXX	Parameter number, see Calibration parameters for telegrams CSP and CGP
9 - 12	Unsigned int	0xXX	Length of the following data
13 ... n	Unsigned Char	0xXX	Parameter value, see Calibration parameters for telegrams CSP and CGP
Calibration: Set parameter (CSP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x29	Calibration: Set parameter
6 - 7	Unsigned Short	0xXX	Error codes
Additional information:			
Accepted in run mode:			Yes
Accepted in configuration mode:			No
Accepted when Ready is low:			Yes
Status of Ready signal during processing:			No change
Supported interfaces:			Telegrams: Availability and supported interfaces

Calibration parameters, see Calibration parameters for telegrams CSP and CGP

Calibration: Read parameter (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Calibration: Read parameter (CGP) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x07	Telegram length
5	Unsigned Char	0x2A	Calibration: Read parameter
6	Unsigned Char	0x01	Request version
7	Unsigned Char	0xXX	Parameter number, see Calibration parameters for telegrams CSP and CGP
Calibration: Read parameter (CGP) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length in bytes, 12 bytes (0x0C) + length of selected parameter
5	Unsigned Char	0x2A	Calibration: Read parameter
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Parameter number, see Calibration parameters for telegrams CSP and CGP
9 - 12	Unsigned int	0xXX	Length of the following data
13 ... n	Unsigned Char	0xXX	Parameter value, see Calibration parameters for telegrams CSP and CGP
Additional information:			
Accepted in run mode:		Yes	
Accepted in configuration mode:		No	
Accepted when Ready is low:		Yes	
Status of Ready signal during processing:		No change	
Supported interfaces:		Telegrams: Availability and supported interfaces	

Calibration parameters, see Calibration parameters for telegrams CSP and CGP

Calibration parameters for telegrams CSP and CGP

Parameter description	Parameter number	Parameter value	Length	Calibration status after CSP
Status calibration	0x01	0x00: Invalid 0x01: Valid	1 byte	–*
Selection of calibration method	0x02	0x00: None 0x02: Point pair list (Robotics) 0x03: Calibration plate (Measurement) 0x04: Calibration plate (Robotics) 0x05: Hand-Eye calibration (Robotics) 0x06: Base-Eye calibration (Robotics)	1 byte	invalid
User unit	0x04	0x00: Millimeter [mm] 0x01: Centimeter [cm] 0x02: Meter [m] 0x03: Inch ["] 0x04: Arbitrary unit [au]	1 byte	no change
Internal parameters	0x0A	Focal length (in mm *1000) Kappa (*1000) Pixel pitch X (in µm * 1000) Pixel pitch Y (in µm * 1000) Coordinate origin X (in pixels * 1000) Coordinate origin Y (in pixels * 1000) Image size X (number of pixels) Image size Y (number of pixels)	0x20 (8 * 4 bytes per value)	–*
Reference Camera- to Measuring coordinate system (CF_MF)	0x0B	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*
Reference Camera- to Calibration Plate Coordinate System (CF_CPF)	0x0C	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*

Parameter description	Parameter number	Parameter value	Length	Calibration status after CSP
Reference Robot- to Camera coordinate system (RF_CF)	0x0D	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*
Reference Calibration plate- to Measuring coordinate system (CPF_MF)	0x0E	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*
Reference Robot- to Measuring coordinate system (RF_MF)	0x0F	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*
Reference TCP- to Camera coordinate system (TCP_CF)	0x10	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	–*
Reference robot- to TCP coordinate system (RF_TCP)	0x11	Translation X, Y, Z (in user unit * 1000) Angle X, Y, Z (in degrees * 1000)	0x18 (6 * 4 bytes per value)	no change
Z-shift of Measurement plane	0x15	(in user unit * 1000)	4 bytes	no change
Focal length in [mm]	0x16	[mm * 1000]	4 bytes	invalid (CSP for C-Mount only)
Calibration plate type	0x17	Character string with name of the description file	n	invalid
Fiducial 1	0x18	Translation X, Y, Z (in user unit * 1000)	0x0C (3* 4 bytes per value)	invalid
Fiducial 2	0x19			
Fiducial 3	0x1A			
Fiducial 4	0x1B			

Parameter description	Parameter number	Parameter value	Length	Calibration status after CSP
Number of existing calibration plate types	0x25	Request - Selection of type: 0x00: All 0x01: Measurement 0x02: Robotics Response: Number of plates	Request: 1 Response: 2	–*
Available calibration plate types (file names)	0x26	Request - Selection of type: 0x00: All 0x01: Measurement 0x02: Robotics Request - Index: 0: All file names >0: Index selection Response: File names of Calibration plates	Request: 1 Response: 5 (String)	–*
Robot: Order of rotation	0x27	"Robot: Order of rotation" 0x00: Use order of rotation specified in job 0x01: Yaw-Pitch-Roll (e.g. Stäubli) 0x02: Roll-Pitch-Yaw (e.g. Kuka, Fanuc, Hanwha, ABB**, UR**) ** when using the corresponding conversion function	1 byte	invalid
Average sensor resolution	0x29	Value (in user unit/pixel * 1000)	4 bytes	–*

* CSP not possible (parameter is read-only and cannot be set).

11.5.5 Visualization

Get image (BINARY)

Telegrams: Availability and supported interfaces

Overview telegrams

Get image (GIM) Request string to sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0x06	Telegram length
5	Unsigned Char	0x03	Get image
6	Unsigned Char	0xXX	0x00: Last image 0x01: Last failed image 0x02: Last good image
Get image (GIM) Response string from sensor (BINARY)			
Byte no.	Data type	Content	Meaning
1 - 4	Unsigned int	0xXX	Telegram length in bytes, 13 bytes (0x0D) + number of bytes depending on the image format e.g. 00 04 B0 0D (Dez. 307213)
5	Unsigned Char	0x03	Get image
6 - 7	Unsigned Short	0xXX	Error codes
8	Unsigned Char	0xXX	Image type 0: Grayscale 3: Bayer Pattern_BG When converting the color image from Bayer into RGB, the appropriate image type must be considered.
9	Unsigned Char	0xXX	Image result 00: Failed image 01: Good image
10 - 11	Unsigned Short	0xXX	Number of rows e.g. 01 E0 = 480
12 - 13	Unsigned Short	0xXX	Number of columns e.g. 02 80 = 640
14 ... n	Unsigned Char	0xXX	Binary image data (rows * columns)

Additional information:	
Accepted in run mode:	Yes
Accepted in configuration mode:	No
Accepted when Ready is low:	Yes
Status of Ready signal during processing:	Low
Supported interfaces:	Telegrams: Availability and supported interfaces

11.5.6 Data output BINARY

Output data (BINARY), dynamically composed according to user settings in the software under: Vision Sensor Configuration Studio / Output / Telegram.

Basic string structure:

<START> (((<OPTIONAL FIELDS> <PAYLOAD>))) <CHKSUM> <TRAILER>

NOTE:
The length and data types of the payload are standard values. The factor and bit depth can be set via "Telegram" / "Payload".

Output data (BINARY):

<OPTIONAL FIELDS>				
Parameter	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Selected fields	With this checkbox all selected fields are displayed. The checkbox "Selected fields" itself is not displayed.	2	The output sequence is from left to right and from top to bottom, i.e. one bit is set per active checkbox, starting with the lowest-value one.	All types
Telegram length	Number of characters including the characters for the telegram length itself.	2	Unsigned Short	All types
Status byte	Returns the Trigger mode.	2	0x06 0x00 = Trigger; 0x05 0x00 = Free run	All types
Detector results	Output of overall result for each detector. Byte 1 Bit 1 (LSB) = Global job result (1 = Pass, 0 = Fail) Bit 2 = Boolean result Alignment only, Alignment inactive = True	3 ... 35		All types

‹OPTIONAL FIELDS›				
Parameter	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Digital outputs	Returns the logic gate result for each digital output.	N	Bytes 1 and 2: Number of active Outputs Bytes 3 – n: Outputs, bit-coded	All types
log. Outputs	Returns the logic gate result for each logic output.	N	Byte 1 and byte 2: Number of active log. Outputs Byte 3 – n All active logic outputs,	All types
Execution time	Returns the execution time for the last evaluation.	4	Signed integer	All types
Active job	Returns the job for the last evaluation.	1	Unsigned int U8	All types

‹PAYLOAD›

Overview of detector-specific payload - Values

GENERAL

‹PAYLOAD› General				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
"All evaluations" counter	Total number of checks	4	Signed integer	GENERAL
Pass parts counter	Number of inspections with result "OK"	4	Signed integer	GENERAL
Fail parts counter	Number of inspections with result "Error"	4	Signed integer	GENERAL

<PAYLOAD> General				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Timeout	Indicates that the maximum cycle time has been exceeded.	1	BOOL	GENERAL
Recording	Indicates the number of image acquisition repetitions for the last evaluation Only in combination with repeat mode.	4	INT	GENERAL
String length	This field can be used to enter a constant string into the data output.	0 ... 5	STRING	GENERAL
Job checksum	Calculates a checksum over the active job. This takes into account all job-specific settings except the "Changed" date. Changing settings that are global for the jobset will change the checksum in all jobs. If the checksum is determined for a job, no temporary changes can be made for this job in run mode.	8	STRING	GENERAL

Base values

<PAYLOAD> Base values				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Score	[%]	4	Signed integer	All detectors
Overall result	Boolean detector result **	1	BOOL	All detectors
Execution time	Execution time of individual detector in [msec].	4	Signed integer	All detectors

Position

<PAYLOAD> Position / location				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Pos. X	X coordinate for the found position, 1/1000 [user unit] **	4	Signed integer	⚓ ✚ ⬡ ⛁ 3D ▥ ▦ A F
Pos. Y	Y coordinate for the found position, 1/1000 [user unit] **	4	Signed integer	⚓ ✚ ⬡ ⛁ 3D ▥ ▦ A F
Pos. Z	Z coordinate of the found position, 1/1000 [user unit]		Signed integer	⛁ 3D With Result offset: ⚓ ✚ ⬡

<PAYLOAD> Position / location				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Delta Pos. X	X position delta between the taught object and the found object, 1/1000 [user unit]	4	Signed integer	⚓ ✚ ⬡ ⬢ 3D
Delta Pos. Y	Y position delta between the taught object and the found object, 1/1000 [user unit]	4	Signed integer	⚓ ✚ ⬡ ⬢ 3D
Delta Pos. Z	Z position delta between the taught object and the found object, 1/1000 [user unit]	4	Signed integer	⬢ 3D With Result offset: ⚓ ✚ ⬡
Angle X	Orientation of the found object, relative to the X-axis, 1/1000 [°]	4	Signed integer	⬢ 3D With Result offset: ⚓ ✚ ⬡
Angle Y	Orientation of the found object, relative to the Y-axis, 1/1000 [°]	4	Signed integer	⬢ 3D With Result offset: ⚓ ✚ ⬡
Angle Z	Orientation of the found object, relative to the Z-axis, 1/1000 [°]	4	Signed integer	⚓ ✚ ⬡ 3D ‖‖ A
Angle (45)	Orientation of bounding box for found code [°], value range: -45° to 45°	4	Signed integer	▦

<PAYLOAD> Position / location				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Angle (180)	Orientation of object width (long axis) [°], Value range: -90° ... +90° 0° = East, counterclockwise	4	Signed integer	C
Angle (360)	Orientation of object width (long axis) [°], Value range -180° ... +180°. 0° = East, counterclockwise	4	Signed integer	C
Delta Angle X	Angle between taught object and found object, 1/1000 [°]	4	Signed integer	⬮ 3D With Result offset: ⚓+⬡
Delta Angle Y	Angle between taught object and found object, 1/1000 [°]	4	Signed integer	⬮ 3D With Result offset: ⚓+⬡
Delta Angle Z	Angle between taught object and found object, 1/1000 [°]	4	Signed integer	⚓+⬡ ⬮ 3D
Pose 3D (X, Y, Z, Angle X, Angle Y, Angle Z)	Coordinates of the found object, 1/1000 [user unit] Angle: 1/1000 degrees	4 bytes per value each	Signed integer	⬮ 3D With Result offset: ⚓+⬡
Delta Pose 3D (X, Y, Z, Angle X, Angle Y, Angle Z)	Delta coordinates of the found object, 1/1000 [user unit] Angle: 1/1000 degrees	4 bytes per value each	Signed integer	⬮ 3D With Result offset: ⚓+⬡

<PAYLOAD> Position / location				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Position control		1	BOOL	✚ ⬡

Measurement

<PAYLOAD> Measurement				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Height	Height of geometric element [user unit], Height ≥ 0, height ≤ width	4	Signed integer	C ▦
Width	Width of geometric element [user unit]* Width ≥ 0, width ≥ height	4	Signed integer	C ▦
Radius	Radius of fitted circle [user unit]	4	Signed integer	C
Area	Area of BLOB without holes, 1/1000 [pixels]	4	Signed integer	C
Area (incl. holes)	Area of BLOB including holes, 1/1000 [pixels]	4	Signed integer	C
Distance	Calculated distance [user unit] **	4	Signed integer	F

Identification

<PAYLOAD> Identification				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
String length Target Mark ID Target Mark name	Content of the read code or content of the Target Mark or assigned Target Mark name. If a fixed string length is desired, the minimum string length (detector-specific payload) and the maximum string length (detector settings) must be set to the same value (e.g. 127).	N	STRING	▥ ▦ A 3D
String length Length of Target Mark name (characters)	Length of read code [bytes]	4	Signed integer	▥ ▦ A 3D
String length (bytes) Length of Target Mark name (bytes) Length of Target Mark ID (bytes)	Length of read code [bytes]	4	Signed integer	▥ ▦ A 3D

<PAYLOAD> Identification				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
String comparison	Content check for the read information. The content of the read information is checked on the basis of regular expressions (see detector Datacode, Reference string tab)	1	BOOL	▥ ▦ A
Truncated	Code complete or truncated 0: Code complete 1: Code truncated	1	BOOL	▥ ▦ A

Identification - quality

<PAYLOAD> Identification - Quality				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**

Quality - overall	Output of all Q parameters. Depending on the selected code type and standard.	1 byte per value; separated by specified separator
		For 2D code parameter Q9 (mean light): 1...3
			Unsigned Char;
			for 2D Code Q9 (Meanlight) Unsigned Short
				▥ ▦

<PAYLOAD> Identification - Quality				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**

Quality - individual	Output of individual quality values: Selection Q1-Q24 depending on the selected code type and standard.
	Numbers: 1-4
	Letters: A-F
		1	Unsigned Char;
			for 2D Code Q9 (Meanlight) Unsigned Short
				▥ ▦

Min. Quality	Used to check whether the minimum required quality is being met	4	Unsigned int	A

Color

<PAYLOAD> Color				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Color value: • Red, green, blue • Hue, saturation, lightness • Luminance, a, b	Value for color parameter	4	Signed integer	✿ 🟥🟦🟩
Color distance	Distance of the current color versus the taught-in color	4	Signed integer	🟥🟦🟩

Counting / number

‹PAYLOAD› Counting / number				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Number of objects	Number of objects found [units]	4	Signed integer	⬡ ✚ C 🛢
Number of valid objects	Number of valid objects found [units]	4	Signed integer	⬡ ✚
Number of search stripes	Number of parallel search stripes into which the width of the search range is divided. [units]	4	Signed integer	⚓ (Edge detector only) F
Number of valid search stripes	Used to check whether the number of search stripes found falls within a specific range. [Good/Bad or units]	4	Signed integer	⚓ (Edge detector only) F
Result vector	Vector containing the result (1/0) of the instances found	N	BOOL	C ⬡ ✚
Too many BLOBs		1	BOOL	C

Extended

<PAYLOAD> Extended				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Scaling	Outputs the scaling range, 1/1000. Within the scaling range, scaled-up or scaled-down objects will be detected. Value range of 0.5 to 2	4	Signed integer	⚓ (Contour matching only) ⬡
Eccentricity	Numerical eccentricity Value range of 0.0 to 1.0	4	Signed integer	
Security	Output of the security values of the individual characters. The reliability value specifies how reliably the reader was able to interpret a character. Value range of 0 to 100 [%]	4	Signed integer	A
Reference string met	The output string matches the reference string.	1	BOOL	A
contrast	Code contrast Value range of 0 to 100 [%]	4	Signed integer	▦
Correction	Number of modules corrected by error corrections [units]	4	Signed integer	▦

‹PAYLOAD› Extended

Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Contour length	Number of pixels of outer contour, 1/1000 [pixels]	4	Signed integer	C
Compactness	BLOB compactness (circle =1; other › 1). The more the shape of the BLOB deviates from a circle, the greater the compactness value will be.	4	Signed integer	C
Center of gravity X	X coordinate of centroid, 1/1000	4	Signed integer	C
Center of gravity Y	Y coordinate of centroid, 1/1000	4	Signed integer	C
Gray scale value, average	Average gray scale value of all the pixels that belong to the BLOB.	4	Signed integer	C
Min. threshold	Lower threshold for the binarization of the objects. 0...255	4	Signed integer	C
Max. threshold	Upper threshold for the binarization of the objects. 0...255	4	Signed integer	C
Inverted threshold	Specifies whether the range Min ‹-› Max is inverted. P: inverted F: not inverted	1	Unsigned Char	C

<PAYLOAD> Extended				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Deviation, inside	Returns the largest deviation between the BLOB contour and the contour of the geometric element (deviation inside the fitted circle). [user unit]	4	Signed integer	C
Deviation, outside	Returns the largest deviation between the BLOB contour and the contour of the geometric element (deviation outside the fitted circle). [user unit]	4	Signed integer	C
Deviation, mean	Returns the mean of the absolute "inside" and "outside" deviation values between the BLOB contour and the contour of the geometric element.	4	Signed integer	C
Axial ratio	Ratio of the long to the short axis (a / b)	4	Signed integer	C
Face up / down, area	Face up / down position, based on: area, position indicated by sign, 1/1000	4	Signed integer	C
Result index	List index	4	Signed integer	🟥🟦🟩

<PAYLOAD> Extended				
Value	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Search stripe distance	Calculated distance [user unit] / 1000 per pair of search stripes	4	Signed integer	F

<CHKSUM>				
Parameter	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Check sum	XOR check sum of all bytes in the telegram. Is transmitted as the last byte.	1	Unsigned int	All types

<TRAILER>				
Parameter	**Description**	**Length BINARY [Byte]**	**Data type**	**Available for**
Start	Characters appended at the end of the string	0 ... 8	Unsigned int	All types

***NOTE:**
If no calibration has been performed, all values refer to pixels.

**Detector Caliper: Depending on the selected Distance mode. "Minimum/Maximum by search stripe" = vector with two elements [min; max].

All detector-specific data with decimal places is transmitted as integers (multiplied by 1000) and must accordingly be divided by 1000 after the data is received. The values are transferred in the format "Big-endian".

Example: "Score" value (BINARY protocol)

In Vision Sensor Configuration Studio/Vision Sensor Visualisation Studio "Score" = 35 is displayed.
Via Ethernet, the following four bytes, for example, are received: 000,000,139,115
Formula for conversion: (Byte4*256 + Byte3) *65536 + Byte2*256 + Byte1 = Value

Because big-endian (from the sensor) is sent, the following applies:
000 = HiWordByte, 000 = HiLowByte, 139 = HiByte, 115 = LoByte
(0*256 + 0) * 65536 + (139 * 256) + 115 = 35699 / 1000 = 35.699 (= real score value)
Angle data or other negative values are represented in two's complement.

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