SIEMENS

SIMATIC Ident

**Optical Identification
SIMATIC MV500**

Operating Instructions

10/2023
C79000-G8976-C494-08

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Validity of these operating instructions

This document contains information on the reader types listed below.

Table 1   Valid for devices/licenses with the following article numbers

Devices	Article number
SIMATIC MV530 S	6GF3530-0CD10
SIMATIC MV530 H	6GF3530-0GE10
SIMATIC MV540 S	6GF3540-0CD10
SIMATIC MV540 H	6GF3540-0GE10
SIMATIC MV550 S	6GF3550-0CD10
SIMATIC MV550 H	6GF3550-0GE10
SIMATIC MV560 U	6GF3560-0LE10
SIMATIC MV560 X	6GF3560-0HE10
Licenses	
Veri-Genius license	6GF3400-0SL02
PAT-Genius license	6GF3400-0SL03
Pat-Genius license (OSD version)	6GF3400-1SL03

The optical readers of the SIMATIC MV500 series can be used for optical identification applications in manufacturing and logistics. Typical applications are product tracking and production control.

These operating instructions apply to firmware V3.3.5.

Product designation

In the remainder of this document, the term "optical reader" is also used instead of the full product name, "SIMATIC MV540".

Purpose of the operating instructions

These operating instructions contain all the information you need for commissioning and using the device.

They are intended for persons installing the device mechanically, connecting it electrically, assigning the parameters and commissioning it, as well as for service and maintenance engineers.

Note

The operating instructions contain all the important information about the device

Read the operating instructions before starting to work with this device. The operating instructions contain all the important information about the device.

Current operating instructions on the Internet

You can also find the latest version of these operating instructions on the Web pages of Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/de/ps/15147/man).

You can find additional information on the blocks described in this manual in the manual "Ident profile and Ident blocks, standard function for Ident systems (https://support.industry.siemens.com/cs/ww/en/view/109746389)" as well as in the manual "FB 45 (https://support.industry.siemens.com/cs/ww/en/view/21738808)".

New in this document version

This document version has been expanded by the following contents:

- Update of firmware version to V3.3.5 (see online help):
  - Enhanced usability (WBM interface)
  - Improved auto-setup
  - Improved DMC decoder
  - Customer-specific program templates
  - Dynamic lighting

Information

We point out that the contents of this product documentation shall not become a part of or modify any prior or existing agreement, commitment or legal relationship. The Purchase Agreement contains all obligations of Siemens AG and the complete and exclusive warranty conditions. Any statements on the device versions described in the manual do not create new warranties or modify the existing warranty.

The contents reflect the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

Contacts worldwide

If you require further information or if unexpected problems occur, you can request the necessary information from your contact. You will find details of your local contact on the Internet.

Screenshots in the operating instructions

The screenshots shown in these operating instructions are based on the view of Web Based Management (WBM) from SIMATIC MV540.

Recycling and disposal

The products are low in harmful substances, can be recycled and meet the requirements of the Directive 2012/19/EU for disposal of waste electrical and electronic equipment (WEEE).

Do not dispose of the products at public disposal sites.

For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste or your Siemens representative.

Note the different country-specific regulations.

License conditions

Note

Open source software

Read the license conditions for open source software carefully before using the product.

You can find the license conditions in the following document:

• OSS License Summary.pdf

Trademarks

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Description

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1.1 Area of application

The products of the SIMATIC MV500 series are optical readers designed specifically for the recognition and processing of numerous machine-readable codes and plain text in industrial production.

The optical readers provide a wide range of options for identification:

- Reading numerous machine-readable 1D and 2D codes
- Model-based object recognition and classification
- A combination of the options listed above

Over and above this, the optical readers provide important functions for:

- Verification of the marking quality of machine-readable codes based on the relevant standards (not supported by SIMATIC MV530)
- "OK"/"N_OK" evaluation based on numerous criteria
- Position and orientation recognition, for example for "pick & place" tasks

In the SIMATIC MV500 device series, particular emphasis was placed on:

- Ruggedness
- Reliability
- Easy installation
- Browser-based, no-installation, user interface / Web Based Management (WBM)
- Ease of operation

Key functions of the optical reader

- Reading machine-readable markings
  The list of readable codes includes all common matrix and barcodes that can usually be detected reliably regardless of the print technique or the carrier medium used.

- "OK"/"N_OK" evaluation
  Whether for checking quality criteria, match criteria, position or angle of rotation deviation using SIMATIC MV500, actuators can be controlled directly to take workpieces that do not meet the requirements out of the production process.

- Model-based object recognition
  With the integrated object recognition, objects can be recognized, distinguished and checked. In addition to this, extremely precise position and orientation recognition is possible. Objects can be stored and are then available for a variety of recognition and checking tasks.

- Position and orientation recognition
  The model-based object recognition PAT Genius returns extremely precise position and angle information relating to the detected object position.

Industrial applications

Due to their ruggedness and high degree of protection, the optical readers are suitable for industrial applications in which optical identification tasks are necessary. This applies equally to production processes and logistics processes.

Communication interfaces

The optical readers have all the conventional communications interfaces of industrial sensors and can therefore be connected to a wide variety of systems. Through the communications module interface, they can also be seamlessly combined with the communications modules (ASM/CM), for example, via PROFIBUS.

Simple operation and commissioning

The optical readers are particularly easy to use and commission, despite the wide variety of possible applications. For most applications, the parameters are set automatically. If, however, readjustment becomes necessary, the parameters can be assigned using the integrated Web server and an Internet browser without prior software installation.

1.2　　Product characteristics

The optical readers are a compact camera system with an integrated processing unit for industrial applications. The different device types share many product features, but differ in the following core points:

Table 1-1　　Distinguishing features of the different device versions

	MV530	MV540	MV550	MV560
Type of delivery	Premounted incl. lens, ring light and lens barrel	Basic devices The corresponding lens, ring light and lens barrel, which can be freely selected, must be ordered.		
Lens options	Premounted (Aperture: 1:12; Focus: mechanically adjustable; Focal length: 5.6)	• Mini-lenses, focus mechanically adjustable • Fixed-focus lenses (FF), focus not adjustable • Electronic focus lenses (EF), focus electronically adjustable		

	MV530	MV540	MV550	MV560
Ethernet interfaces	• 1x Ethernet interface (PoE; 10/100 Mbps)		• 1x Ethernet interface (PoE; 10/100 Mbps) • 1x Ethernet interface (10/100/1000 Mbps)	

Device versions	• S
	  – Resolution:
	    800 x 600 pixels
	  – Image acquisition frequency:
	    100 Hz
	  – Code reading speed:
	    100 1/s
	• H
	  – Resolution:
	    1280 x 1024 pixels
	  – Image acquisition frequency:
	    70 Hz
	  – Code reading speed:
	    70 1/s
				• U
				  – Resolution:
				    1920 x 1200 pixels
				  – Image acquisition frequency:
				    60 Hz
				  – Reading speed:
				    60 1/s
				• X
				  – Resolution:
				    2592 x 2048 pixels
				  – Image acquisition frequency:
				    30 Hz
				  – Reading speed:
				    30 1/s

The SIMATIC MV530 optical reader has functionally the same design as the SIMATIC MV540 reader, but is supplied with a premounted lens, ring light and lens barrel.

The optical readers have the following product features:

Reading code

- For codes with maximum quality, the reading reliability for data matrix code is 99.999 % (compare quality grading).
- A variable object distance is possible (software controlled) when using EF lenses
- Auto-trigger and scan mode
- Up to 15 parameter sets and code reading settings can be saved and selected.
- Object speed up to 10 m/s
- Code sizes (example: DMC) from 1 mm^2 to 200 mm^2
- Maximum image acquisition frequency of 100 Hz with SIMATIC MV500 S
- Maximum code reading speed of 80 reads per second with SIMATIC MV500 S
- Code verification according to ISO/IEC 16022, ISO/IEC 29158 a.o.

Integrated communications interfaces

- Ethernet 10/100/1000 Mbps for TCP/IP and PROFINET IO depending on the device version
- 1 trigger input and 1 flash output
  - Response time of the trigger input: 50-70 us
  - Jitter (fluctuation of response time): max. 40 ns

  Incoming triggers during a running image acquisition do not interrupt it. Triggers that are incoming during an image acquisition are handled as N_OK processing and included in the processing statistics.
- Communication module interface for extended communication via communication modules
  - PROFINET: SIMATIC RF120C, RF170C, RF180C and RF185C/RF186C/RF188C
  - PROFIBUS DP/V1: ASM 456
- RS232 with TxD and RxD
- 2 configurable digital inputs/outputs

Power supply using Power over Ethernet

Integrated power supply via the Ethernet interface (POE)

Construction and degree of protection

- Robust construction, suitable for industry
- IP67 with the protective lens barrel screwed on and all interfaces closed by cable connections or protective caps.

Protective lens barrel

Suitable protective lens barrels with filter thread

Optical system

- Mechanical mini-lenses
- Electronic focus lenses (via software-controlled focal plane)
  - Fast change of focal plane
  - Wear-free (without moving mechanics)
  - temperature stabilized

Lighting

- High-intensity built-in ring lights with up to 12 LEDs
  - In the versions: Multi, basic or remote in the colors white, red and infrared
  - With switchable lighting segments
  - With switchable polarization filter
  - With integrated reflection protection
- External ring lights

Operation on the device

Fast, uncomplicated connection between PC and reader without installed software using the "CONNECT" button.

Quick adaption to the reading situation using the "READ" button.

Web Based Management (WBM)

- Completely installation-free
- Modern HTML5 design
- Fast response times
- Auto-adaption function
- Secure communication over https
- Login and user management
- Versatile HTML pages for monitoring the reader
- Extensive operator control and monitoring functions even in processing mode
- Wide-ranging diagnostics and logging functions:
  - Error image memory
  - Event logging
- Firmware update
- System backup and restoration

Firmware update options

- WBM
- SINEC PNI (as of V1.0, Service Pack 2)
  This allows a centrally controlled firmware update to be carried out simultaneously on a large number of MV500 readers (as of FW 3.3.0).

Security standards

The readers already offer a high security standard in their factory state. Among other things, user management with secure passwords and the deactivation of unused communication protocols are part of the initial commissioning. The security settings can be changed or disabled individually.

Configuration backup

Allows automatic saving of complete device configuration on micro SD card.

1.3   Setup of the SIMATIC MV500

The following figure shows an example of the setup of the optical reader using a SIMATIC MV550.
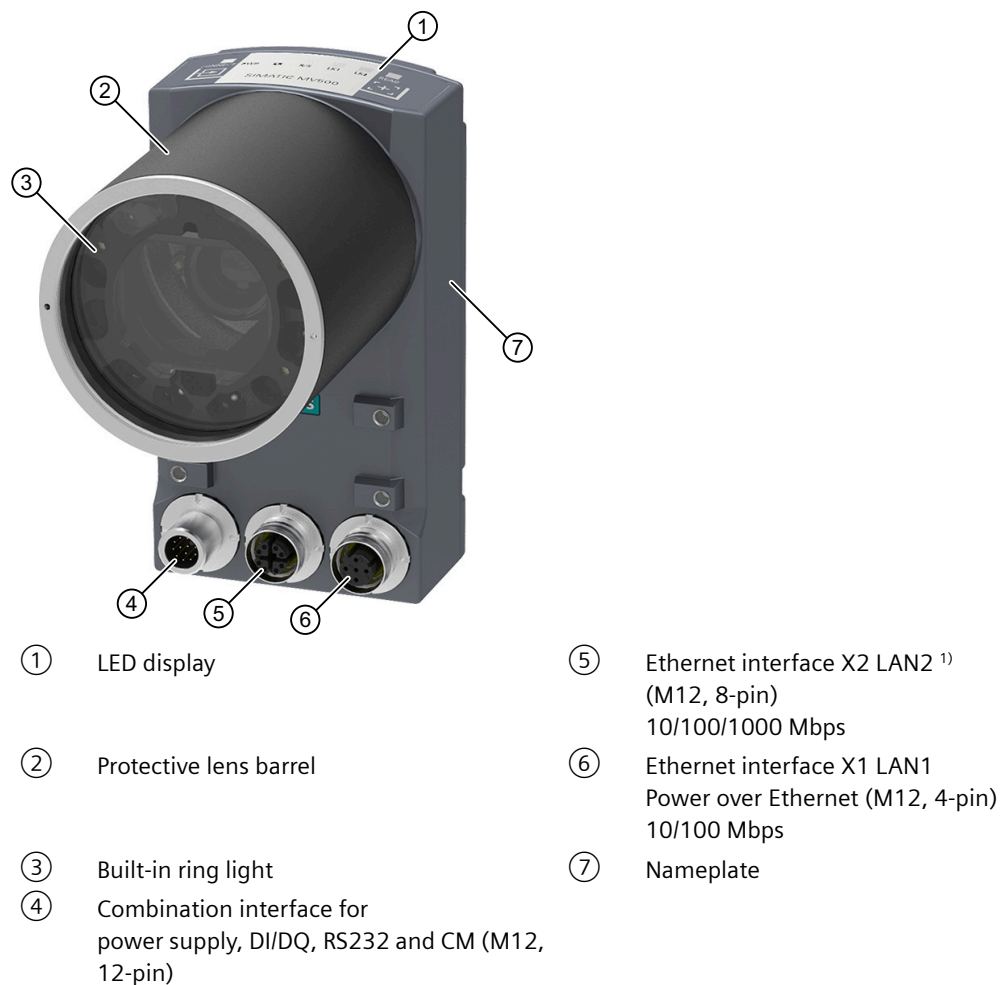
①	LED display	⑤	Ethernet interface X2 LAN2 [1] (M12, 8-pin) 10/100/1000 Mbps
②	Protective lens barrel	⑥	Ethernet interface X1 LAN1 Power over Ethernet (M12, 4-pin) 10/100 Mbps
③	Built-in ring light	⑦	Nameplate
④	Combination interface for power supply, DI/DQ, RS232 and CM (M12, 12-pin)		

[1] Please note that the MV530 and MV540 optical readers do not have a 2nd Ethernet interface.

Figure 1-1   Setup of the SIMATIC MV550

1.4 Structure of the nameplate

The nameplate is located on the housing of the optical reader and shows the article number and other important product information. The following graphic shows an example of the configuration and possible elements of a nameplate. Note that the reader has only those certificates and approvals which are shown on the nameplate of the respective reader.

①	Manufacturer	⑧	Disposal label
②	Product designation	⑨	Data matrix code
③	Product version of the device	⑩	Article number, production code/serial number and MAC address (12 digits)
④	IP rating	⑪	Technical specifications
⑤	CE mark	⑫	Warning symbols
⑥	RCM mark	⑬	EAC mark
⑦	UL Listing mark	⑭	KCC mark
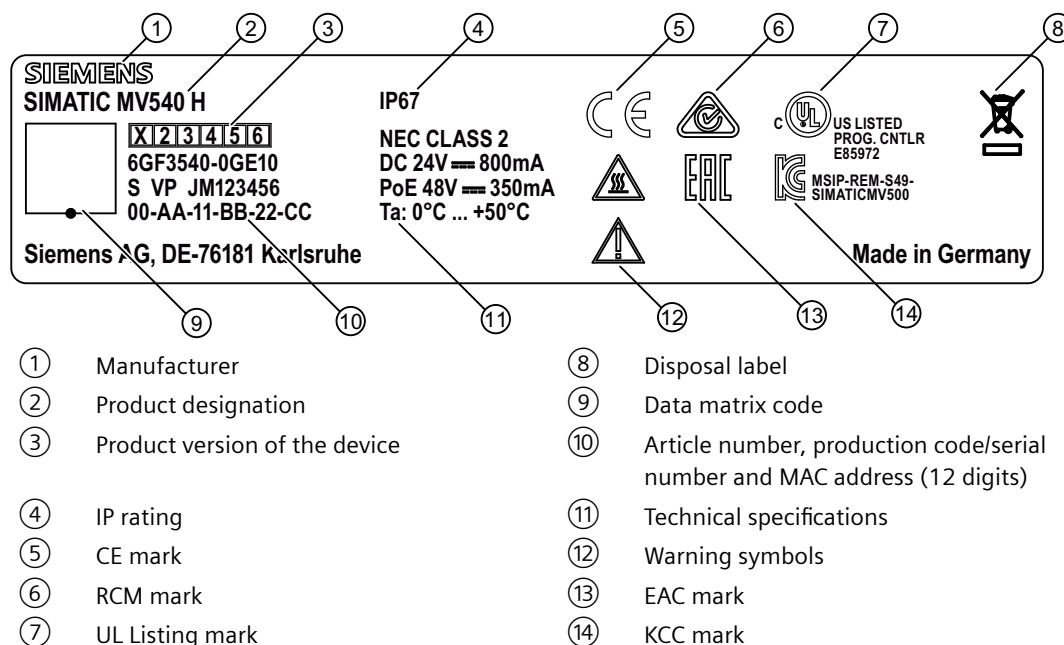
Figure 1-2   Example of the SIMATIC MV540 nameplate

Note

Reserved MAC address

One or two MAC addresses are reserved ex factory. The MAC address of the interface "X1 LAN1" is shown on the nameplate, the MAC address of the interface "X2 LAN2" is +2 higher as the "X1 LAN1" interface.

1.5 System configuration

The following figure shows a typical system configuration with a SIMATIC MV540 optical reader.
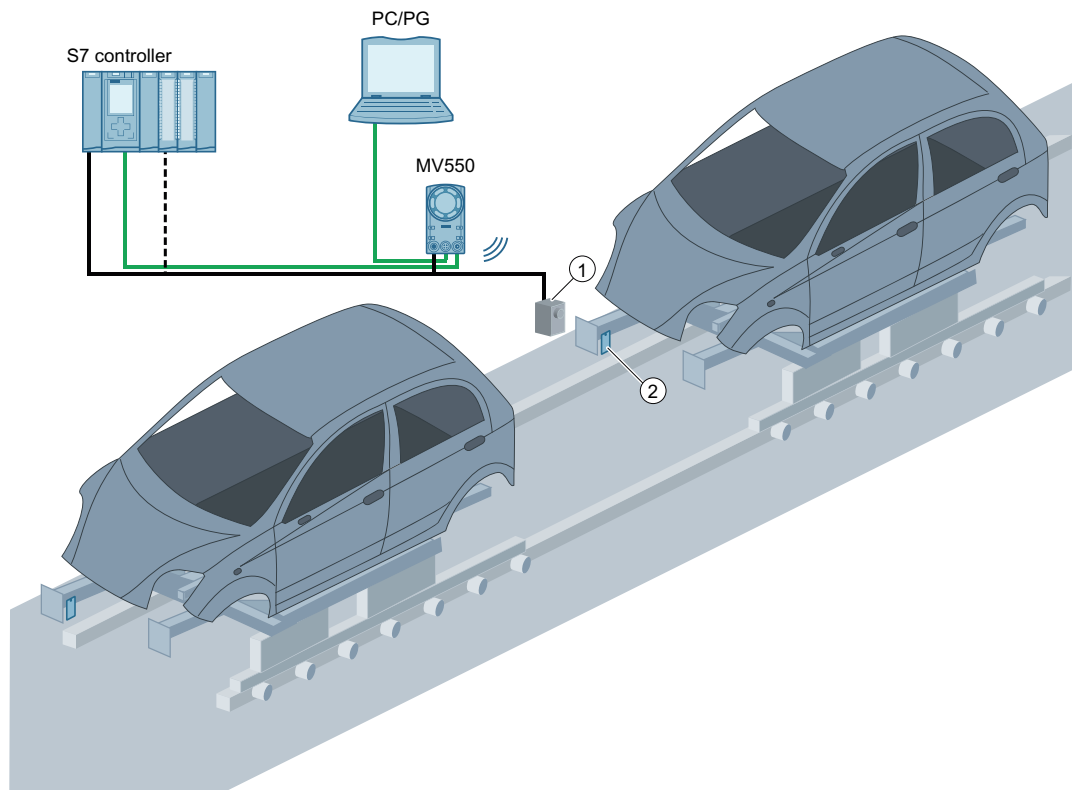
①   Optical sensor or light barrier (for trigger signal)
②   Object with code

Figure 1-3   Example of a system configuration on a production line (illustrated with SIMATIC MV540)

1.6 System components

Optical reader

To equip an application with optical readers, you need the following hardware components:

- SIMATIC MV500 optical reader
- Lens suitable for code size and read distance
- Ring light
- Protective lens barrel

- 24 V DC power supply (tolerance: 19.2 ... 28.8 V):
  - Alternatively via I/O / CM cable
  - Alternatively via Power over Ethernet
- Communication connection:
  - RS232/RS422 integrated in the I/O / CM cable
  - Ethernet cable

PC/PG

Apart from the components for operating the optical reader, you also require a PC/PG to commission the device:

- PC/PG minimum configuration:
  - Ethernet interface with at least 100 Mbps
  - CPU: DualCore with 3 GHz
  - RAM: 4 GB
- Software:
  - Microsoft Windows 7 operating system or newer
  - Web browser with HTML5 support
    Tested Web browsers: Google Chrome and Microsoft Edge

The system requirements of SIMATIC MV500 optical readers for communication partners in the process depend on the selected communication connection. You can find more information on communication connections in the section "Network and system integration (Page 97)".

1.7 Functional description

Image acquisition

The optical readers detect the object characteristics required for the task using digital image acquisition.

Following image acquisition, the image is analyzed by a powerful digital signal processor.

Depending on the application, multilevel complex algorithms are used during the analysis:

- To find and decode the codes contained in the image.
- To verify codes.
- To find any previously stored objects in the image and determine their position.

The results of the evaluation are transferred to an automation system connected via the communications interfaces.

The user is supported in the use of the optical reader by a variety of feedback messages:

- Live image display

- Auto-detection for code type recognition

- Result and quality preview

- Display of diagnostic images

- Warning and error messages

- 3-language online help in the optical reader

Web Based Management (WBM)

The WBM is based on Web server technology. This means that only a computer with an Internet browser connected with an optical reader via Ethernet is necessary. The optical reader is then called using its IP address. The display of the WBM appears in the display window of the Internet browser. Display via Ethernet allows convenient setting and control of all parameters of the optical reader. Operator control of the optical readers is supported by context-sensitive online help.

If automatic adjustment does not lead to an optimum result due to special conditions, you can use the WBM to readjust individual parameters of the optical reader manually. You can save 15 different settings in the optical reader.

Depending on the task, up to 12 processing steps can be set as a sequence in one program. The following processing steps are available:

- "Reading code" program step for reading 1D/2D codes

- "Recognize object" program step for localizing any objects

You can store up to 15 different programs on the reader.

The settings for communication with other devices must be made in the WBM.

Processing

The actual processing is triggered by different events.

- In the simplest situation, the optical reader generates the trigger event itself. Optical readers have an auto-trigger function for this purpose.

- Depending on the application, it may be advisable to provide the trigger event via the I/O cable. In this case, the optical reader obtains the signal, for example, from a light barrier. The trigger signal immediately triggers image acquisition followed by evaluation. The result of the evaluation is then transferred to the higher-level control system through the selected communications connection. Once the evaluation result has been transferred, reading can be started again.

User management and access protection

The functions of the optical reader can be protected from unauthorized access and manipulation. The access rights can be assigned to various personified users in the form of user roles.

Configuration via remote client

The configuration of the optical reader can be backed up and restored automatically, for example, when there is a shift change, using a connected PC. This means the configuration of your production plant can be restored at the press of a button.

Diagnostics functions

The optical reader has comprehensive diagnostics functions. If incorrect readings are made, the diagnostics functions can be used to find reasons for the errors based on the recorded images. This is necessary, for example, if problems occurred in the prior marking process.

Compatibility with MV400

The functions, communication protocols and configurations are largely compatible with the devices of the SIMATIC MV400 series. The device configurations for these devices can be imported into the readers of the SIMATIC MV500, enabling a seamless transition from SIMATIC MV400 to MV500.

Note that after importing an MV400 device configuration, the program must be saved again.

Table 1-2   Differences / possible incompatibilities

	SIMATIC MV400	SIMATIC MV500
Digital inputs /outputs	DI trigger, DQ strobe, 4 configurable DI/DQs	DI trigger, DQ strobe, 2 DQs
RS232 interface	9.6 ... 115 KB 1 / 1.5 / 2 stop bits	9.6 ... 115 KB 1 / 2 stop bits
DISA bit (via)	RS232, CM, TCP/IP, PN, DI	RS232, CM, TCP/IP, PN
DHCP modes	Client and server	Client (CONNECT button)
WebAPI	✓	✓ (incompatible with MV400)

The MV400 "Resolution, half" function is no longer available on MV500 due to faster image acquisition times.

NOTICE

Compatibility restrictions

Note that the following functions are not supported by MV400:

• Vericode and

• OCR (Text-Genius)

Note that the following functions are not supported by MV400 in the software versions ≤ V2.0:

• Calibrated verification (Veri-Genius license) and

• "Recognize object" function (Pat Genius)

Safety notes

2

2.1   Security recommendations

To prevent unauthorized access, observe the following security recommendations when working with the optical readers and WBM (Web Based Management).

General

- Check regularly that the device complies with these recommendations and/or other internal security policies.

- Evaluate your plant as a whole in terms of security. Use a cell protection concept with suitable products.

- Keep the software up to date. Always use the latest firmware/software version of the device. Check regularly for security updates of the products and install them. After the release of a new version, previous versions are no longer supported and are not maintained.
Information on new products and new software versions can be found at the following address:
Link: (https://support.industry.siemens.com/cs/ww/en/ps/15147)

- Do not connect the device directly to the Internet. Operate the device within a protected network area. Use a firewall to connect the internal protected network to external networks. Configure it with restrictive rules.

- For data transmission via a non-secure network, use additional security components that provide an encrypted VPN tunnel (IPsec, OpenVPN).

- Terminate connections properly (e.g. logout in WBM).

Physical access

- Restrict physical access to the device to qualified and authorized personnel.

Security functions

- Activate only protocols that you actually need to use the device.

- Use the latest Web browser version compatible with the product to ensure you are using the most secure encryption methods available.

- Use a firewall or rules in an access control list (ACL) to limit access to the device from an external device. The firewall and access list can only be configured via an external device.

- The device has protection against brute force attacks to protect the system against trying out different passwords. Restrict the maximum possible number of permitted failed login attempts.

- Lock unused hardware ports on the device. Unused ports can be used to access the system without authorization.

- The configuration files are available in XML format for simple use. Make sure that the configuration files are adequately protected. You can, for example, digitally sign and encrypt the files, store them at a safe location or transfer configuration files only via secure communication channels.

- We recommend that you disable the "CONNECT" function after initial commissioning.

- The functions for archiving as well as the remote functions (MMI) may only be activated in networks protected by a firewall.

Authentication

- Always use the user management and create new user profiles.

- Change the default passwords for all user accounts, access modes and applications (if applicable) before you use the device.

- Use passwords with a high password strength. Avoid weak passwords (such as "Password1", "123456789", "abcdefgh").

- Define rules for using devices and assigning passwords.

- Make sure that all passwords are protected and inaccessible to unauthorized personnel.

- Do not use the same password for different users and systems.

- Store the passwords in a safe location (not online) to have them available if they are lost.

- Update passwords and keys regularly to improve security.

- A password must be changed if it is known or suspected to be known by unauthorized persons.

- You can find information on the encryption methods supported by the device in section "encryption methods (ciphers)".

Firmware/software

The firmware itself is signed and encrypted. This ensures that only firmware created by Siemens can be downloaded to the device.

Check regularly for new firmware/software versions or security updates and install them. After the release of a new version, previous versions are no longer supported and are not maintained.

Decommissioning

Decommission the device properly to prevent unauthorized persons from accessing confidential data in the device memory.
Reset the device to factory settings for this purpose.

Remove the inserted storage media from the device and delete all data by formatting the storage medium.

See also

Encryption methods (ciphers) (Page 283)

Secure/non-secure protocols

- Check whether it is necessary to use SNMPv1. SNMPv1 is classified as non-secure. Make use of the possibility to prevent write access. The product offers corresponding settings for this.

- If SNMP is activated, change the community names. If unrestricted access is not necessary, limit access via SNMP.

- Use secure protocols if access to the device is not protected by means of physical safeguards. The following protocols provide secure alternatives:
  HTTP → HTTPS

- To prevent unauthorized access to the device or network, set up appropriate safeguards against non-secure protocols.

- Enable only the services (protocols) that will actually be used on the device. The same applies to the installed interfaces/ports. Unused ports could be used to access the network downstream from the device.

List of available protocols

All available protocols and their ports that are used with SIMATIC MV500 are listed below.

Table 2-1   List of available protocols

Service/ Protocol	Protocol/ Port number	Preset port status	Port configurable	Authentication	Encryption
HTTP	TCP/80	Closed	✓	--	--
HTTPS	TCP/443	Open	--	✓	✓
NTP	UDP/123	Open	--	--	--
TCP	TCP Config	Closed	✓	--	--
DNS server [1]	UDP/53	Closed [2]	--	--	--
DHCP	UDP/68	Open	--	--	--
DHCP server [1]	UDP/67	Closed [2]	--	--	--
SNMP [1]	UDP/161	Open	--	✓	--
PROFINET [1]	UDP/34964 UDP/49152-65535	Open	--	--	--
Syslog Client	UDP/514	Closed	✓	--	--
Scanner portal	TCP/666	Closed	✓	--	--
MMI	TCP dynamic	Closed	✓	--	--
ALM LIC	TCP/65278	Closed [3]	--	--	--

[1] These services/protocols are not available for the "X2 LAN2" Ethernet interface.

[2] This protocol is only used when the "CONNECT" button is used.

[3] Port is opened when the certificate transfer has been activated (homepage of the WBM).

Explanation of the table:

- Authentication
  Specifies whether authentication of the communication partner takes place.

- Encryption
  Specifies whether the transfer is encrypted.

NOTICE
Opening ports by changing the parameter settings
Make sure that port "TCP/8765" is open when enabling the "Archiving/MMI" parameter.
Make sure that the "TCP/8020" port is open when enabling the "TCP" parameter.
You can find additional information about these parameters in the section "Communication > Interfaces" of the WBM online help.

2.2 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/global/en/products/services/cert.html.

2.3 Cell protection concept

The following graphic shows an example of how a cell protection concept for the MV500 optical reading systems can look like.
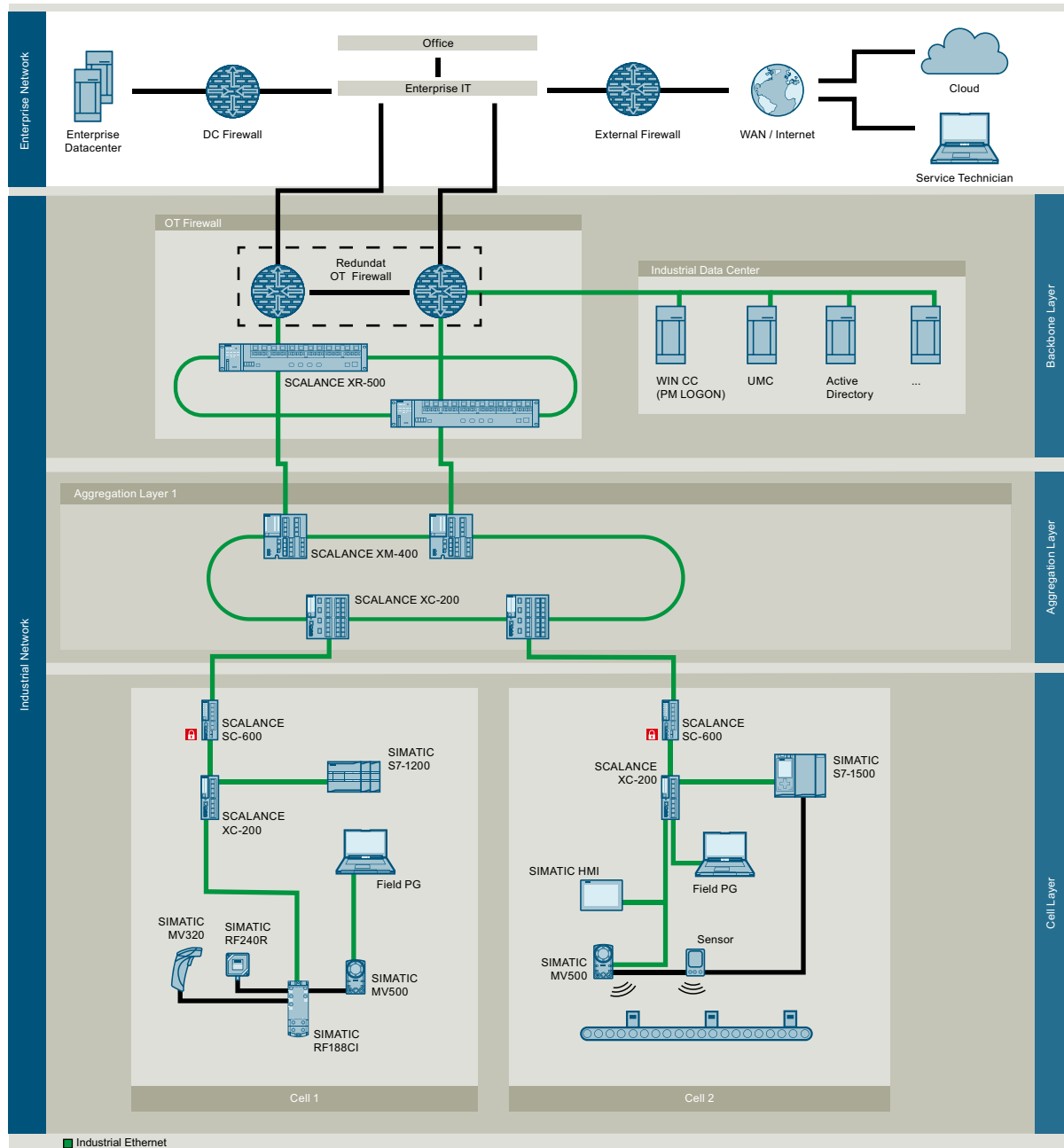
Figure 2-1   Schematic display of a cell protection concept for the MV500 optical readers

2.4 General safety information

This device conforms to the pertinent safety regulations according to IEC, VDE and EN. If you have questions about whether it is permissible to install the device in the planned environment, please contact your service representative.

Qualified personnel

Startup and operation of the device/system in question must only be performed using this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Qualified personnel as referred to in the safety guidelines in this documentation are those who are authorized to start up, earth and label units, systems and circuits in accordance with the relevant safety standards.

Proper use

The unit may be used only for the applications described in the catalog or the technical description, and only in combination with the equipment, components and devices of other manufacturers where recommended or permitted by Siemens. This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Repairs

Repairs to the device may only be performed by authorized specialists.

⚠ WARNING
Risk of injury/material damage
Unauthorized opening or improperly performed repairs can cause considerable damage to property or danger to users.

System expansions

Install only system expansions that are intended for this device. Installing other expansions can damage the system or violate the safety provisions and regulations for radio interference suppression. You can obtain information on system expansions suitable for installation from the technical customer service or from the sales office responsible for your area.

NOTICE
Invalidation of the warranty
Any damage to the device caused by installing or replacing system expansion products will void the warranty.

NOTICE
Voltage can destroy electrostatic-sensitive modules
The device contains modules that are sensitive to electrostatic discharge. ESD devices can be destroyed by voltages well below the threshold of human perception. Such voltages occur if you touch a component or electrical connectors of a module without first discharging the static from your body. The damage caused by overvoltage on a module cannot normally be detected immediately and only becomes apparent after a longer period of operation.
Measures for protecting against discharge of static electricity:
• Before working with modules, make sure that you discharge static from your body, for example by touching a grounded object.
• The devices and tools used must also be free of static charges.
• Interrupt the power supply.
• Pick up the modules only on their edges and do not touch any pins or printed conductors.

Connecting the 24 V DC power supply

⚠ WARNING
Requirement: Safe extra low voltage
The device should only be connected to a 24 V DC power supply which satisfies the requirements of safe extra low voltage (SELV).
When the device is operated on a wall, in an open rack or other similar locations, an NEC Class 2 current source is needed for compliance with UL requirements (according to UL 60950-1). In all other cases (according to IEC/EN/DlN EN 60950-1), a current source with limited power (LPS = Limited Power Source) is required.
24 V DC power supply (19.2 to 28.8 V)
The generation of the 24 V DC supply voltage by the line-side power supply must be implemented as functional extra-low voltage with safe electrical isolation (floating) according to IEC 80364-4-41, or as SELV according to IEC/EN/DlN EN 60950-1 and LPS/NEC class 2.

Overvoltage protection

NOTICE
Protection of the external power supply
If the optical reader is supplied via extensive supply lines or networks, interference by strong electromagnetic pulses on the supply lines is possible, e.g. from lightning or the switching of large loads.
The connection of the external power supply is not protected against strong electromagnetic pulses. An external overvoltage protection module is required for this purpose. The requirements according to EN 61000-4-5, Surge test on power supply lines, are only met when a suitable protective element is used. A suitable device would be, for example, the Dehn Blitzductor BVT AVD 24, article number 918 422, or a comparable protective element.
Manufacturer: DEHN+SOEHNE GmbH+Co.KG, Hans-Dehn-Str.1, P.O. Box 1640, D-92306 Neumarkt, Germany

Use in an area of plants with high-energy radiation

NOTICE
Protection of the image sensor from damaging radiation
When the SIMATIC MV500 optical reader is used in an environment of plants with high-energy radiation, for example, laser light or arcs, the image sensor of the optical reader must be protected from damaging radiation.
The image sensor is protected by means of suitable daylight filters: • Radiation outside the visible light spectrum (IR and UV radiation) is filtered out. • Visible light can pass without problem.

Danger of burns

NOTICE
Warning of hot surface
Electrical devices have hot surfaces. Do not touch these surfaces. Severe burns could be caused.
Let the device cool down before you start work on the device.

3

Image processing

3.1 Code reading (1D/2D codes)

3.1.1 Area of application and examples

The optical reader reads the types of code listed below.

Two-dimensional codes

- DMC
- PDF417
- QR
- DotCode
- Aztec

One-dimensional codes

- Codabar
- Code 32
- Code 39 (without checksum)
- Code 39+CS (with checksum)
- Code 93
- Code 128
- EAN 8
- EAN 13
- GS1 Databar Expanded
- GS1 Databar Limited
- GS1 Databar Omnidirectional
- GS1 Databar Stacked
- Int. 2/5 (without checksum)
- Int. 2/5+CS (with checksum)
- Pharmacode
- Postnet

- UPC-A
- UPC-E

3.1.1.1 Applications for two-dimensional codes

Some examples of two-dimensional codes are provided below:

Printed code

Laser code (plastic surface)
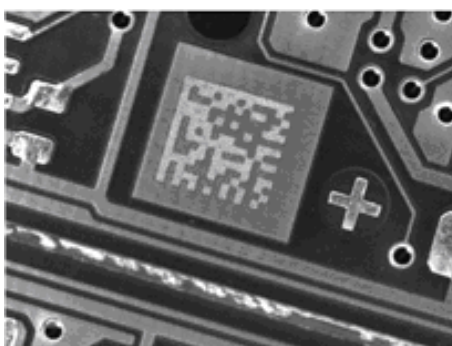
Laser code (pcb)
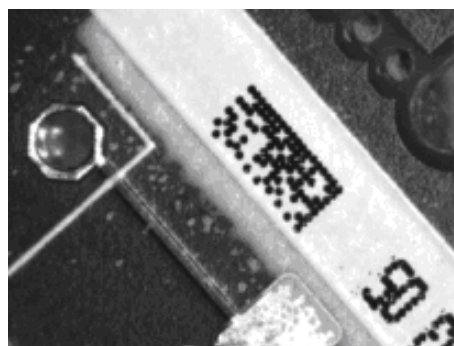
Code created with an ink jet printer.

Punched code
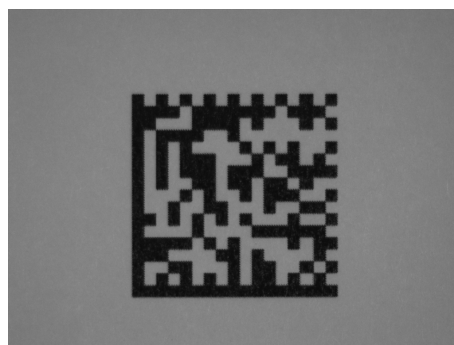
Data Matrix ECC0100

Printed QR code

Printed PDF417 code
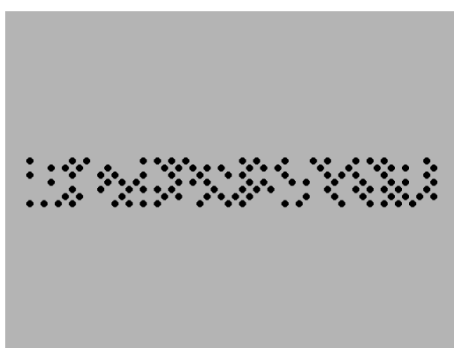
DotCodes

Aztec code

3.1.1.2   Applications for one-dimensional codes

Some examples of one-dimensional codes are provided below:

Codabar
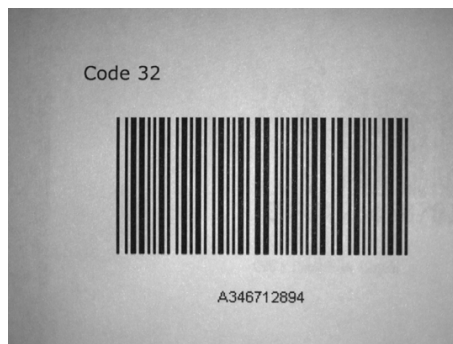
Code 32
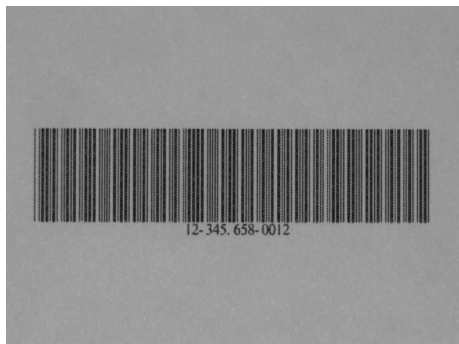
Code 39

Code 93

Code 128

EAN 8

EAN 13
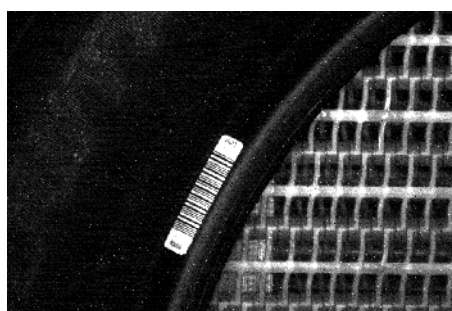
Interleaved 2/5

GS1 Databar Expanded

GS1 Databar Stacked

Postnet

Pharmacode

UPC A
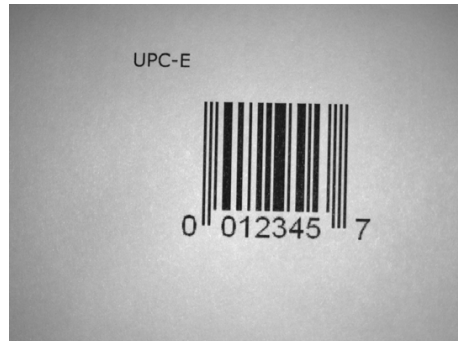
UPC E

3.1.2   Performance characteristics when reading codes

3.1.2.1   Complex data matrix codes with "ID-Genius" detection

The self-adaptive recognition technique of the "ID-Genius" optical reader allows reliable and robust reading of the most difficult codes. The most reliable recognition is reached by the optical reader when you make adequate time available for the device to adapt itself by setting a high cycle time limit.

The "Reading reliability" shown in the WBM gives you immediate feedback on the reliability of the recognition. You can increase the reliability and accuracy of the quality calculation via the WBM parameter "Read with highest quality".

Range of application

- Any alignment and position of the code in the image.
- The code can be printed both dark on a light background and light on a dark background.
- Reading codes even when cells overlap or are largely isolated.
- Reading of mirror-inverted codes.

- Tolerance of distortion due, for example, to inclined installation of the image sensor (viewing angle down to a lower limit of approximately 40 degrees to the printed surface).

- Resistant to similar-looking foreign objects in the area of the code.

- Resistant to interference patterns (grooves, granularity) in the area of the code

- Wide tolerance of contrast fluctuations.

- Wide range of imaging sizes from 5 to 35 pixels per cell.

- Process-reliable reading of data matrix codes with an image size of only 3 pixels is possible under the following conditions:

  - Data matrix codes that meet the specifications of ISO 16022, i.e. have a homogeneous background and high symbol contrast.

  - Codes that achieve overall quality A or B (4 or 3) during calibrated verification according to ISO 16022.

  - The "Read with highest quality" option is enabled to ensure a process-reliable evaluation of the quality.

- Light shadows or shiny areas in cells are tolerated. The polarity of the cells compared with the background must not, however, become inverted within a code.

- The ratio of the distance to the closest neighbor and the diameter of any cell can be between 2 and 0.8.

- Although code dots must be printed according to a regular square grid pattern, individual points can be displaced from their ideal position by up to 1/3 of the grid unit. Even slight parallelogram-shaped distortions during printing are tolerated.

- With large-image but small-dimensioned codes, slight curves in the printed material surface are tolerated. With larger dimension codes (for example, more than 14 x 14) or a strongly inclined sensor axis, curves are not allowed.

- Large tolerance of background disturbances that cannot be described quantitatively

- Large tolerance of poor contrast conditions

- The optical reader reads codes with a maximum code dimension of 72 x 72 cells.

3.1.2.2 Fast Data Matrix code reading with "standard" recognition

The standard recognition process of the optical reader allows reliable and fast reading of printed data matrix codes of good quality.

The "Reading reliability" shown in the WBM gives you immediate feedback on the reliability of the recognition.

Range of application

- In this mode, the read rates achieved are higher than those when reading complex codes.

- The range of image sizes is from 1.5 to 35 pixels per cell. The range is static.

- The cells do not overlap or only slightly, nor are the majority isolated.

- The distortions are minimal, for example due to installation of the optical reader at an angle.

- There are no or only a few foreign objects in the area of the code.

- There are no interference patterns (grooves, granularity) in the area of the code.

- Fluctuations in contrast are slight.

3.1.2.3 QR codes

> **Note**
>
> **Maximum code dimension/unsupported code types**
> - Support of all QR Model 2 codes (in the latest version 40), with a maximum code dimension of 177 x 177 cells.
> - The following code types are not supported: Micro QR code, iQR code, QR Model 1 code.

The recognition process of the optical reader allows reliable and fast reading of printed QR codes of good quality.

The "Reading reliability" shown in the WBM gives you immediate feedback on the reliability of the recognition.

Range of application

- The codes can have any alignment in the image.

- The code can be printed both dark on a light background and light on a dark background.

- The "Reading code" program step exposure filters so that dark and light codes with unbalanced light can be read without additional effort.

- Cell sizes smaller than 3 pixels are supported.

- Cell sizes smaller than 56 pixels are supported.

- The following formats are supported: Numeric, alphanumeric, byte and kanji format.

Range of application: QR decoder with calibrated verification

The new QR decoder offers a significant increase in performance when reading QR codes, as well as an improved application bandwidth:

- The codes can have any rotational position in the image and may be tilted up to 45° with respect to the image plane.

- Even codes with irregular brightness are read.

- Cell sizes from 3 to 56 pixels are supported.

Quality check of the ID link frame

In addition to the code quality, the QR decoder can also check the quality of the ID-Link border. Readability of the IO-Link symbol can be ensured in this way and incorrectly marked parts can be sorted out.

3.1.2.4 PDF417 codes

> **Note**
>
> **Unsupported code types**
>
> The following code types are not supported: Truncated PDF417, Macro PDF417, Micro PDF417.

The recognition process of the optical reader allows reliable and fast reading of printed PDF417 codes of good quality.

Range of application

- The codes can have any alignment in the image.

- The code can be printed both dark on a light background and light on a dark background.

- Codes with a bar width ≥ 3 pixels and in which the height of a single row of symbols is ≥ 9 pixels can be read.

- The width of the black and white bars must be uniform over the entire code field.

- The viewing angle of the sensor to the surface can be between 70° and 90°.

- The code should not make contact with any other objects in the image, you can do this, for example by keeping the quiet zone free with twice the column width.

- Within the code, the ratio of contrast (in other words, the difference between black and white) to noise should be at least three. This ratio must be similar over the entire code field.

- The image background must have a homogeneous brightness, for example no texture such as stripes.

- The error correction codes (in other words, the lower part of the barcode) must not be covered.

- At the minimum bar width, each symbol column requires 51 pixels. Along with the four start and stop patterns, the width of the code with n code columns is at least: Width = 51 x (n + 4) pixels.
  Due to the limited image resolution, codes can be read as follows:

  - SIMATIC MV500 S up to 50 code lines and up to 8 code columns.

  - SIMATIC MV500 H up to 85 code lines and up to 17 code columns.

  - SIMATIC MV500 U up to 90 code lines and up to 29 code columns.

  - SIMATIC MV500 X up to 90 code lines and up to 30 code columns.

3.1.2.5 DotCodes

The recognition process of the optical reader allows reliable and fast reading of printed dot codes of good quality.

Range of application

- The range of image sizes is from 4 to 40 pixels per cell. The range is static.

- The cells are isolated.

- The distortions are minimal, for example due to installation of the optical reader at an angle.

- There are no or only a few foreign objects in the area of the code.

- There are no interference patterns (grooves, granularity) in the area of the code.

- Fluctuations in contrast are slight.

3.1.2.6 Aztec codes

The recognition process of the optical reader allows reliable and fast reading of printed Aztec codes of good quality.

Range of application

- The range of imaging sizes is from 3 to 14 pixels per cell. The range is static.

- There are no or only a few foreign objects in the area of the code.

- There are no interference patterns (grooves, granularity) in the area of the code.

- Fluctuations in contrast are slight.

3.1.2.7 One-dimensional codes

The recognition process of the optical reader allows reliable and fast reading of printed one-dimensional codes of good quality.

- If the code type has a checksum, the checksum is also transferred in the read result (text).

- Do not work with variable string lengths with "Interleaved 2/5" or "Code 39".
  To avoid incomplete codes being read, set the "Number of bars" parameter to "Saved" in thedecoder options ("Program > Reading code > Decoder options").

- The "Full ASCII" coding of the code type "Code 39" is not supported.

  – To read this code type with the optical reader, use code type "Code 39".

  – To obtain the original text with the additional "Full ASCII" characters, you need to post-edit the textual read result.

Reliable reading of Pharmacode

- Due to the simple structure of Pharmacode, set the following parameters to "Dynamic" in the Decoder options ("Program > Reading code > Decoder options").

  – Height

  – Length

  – Number of bars

  – Min. quiet zone length

  – Sample spacing

- Save the program before reading. For the program to be successfully saved, the Pharmacode to be saved must have both narrow and wide elements. This avoids reading errors due to the absence of error correction of this code type.

- Since an upside-down Pharmacode cannot be detected automatically, select the code type "Pharmacode (0°)" or "Pharmacode (180°)", depending on requirements.

- Standard code generators allow a maximum of 63 bars for a Pharmacode. The integrated Pharmacode decoder is therefore also limited to maximum of 63 bars per code.

Range of application

Boundary conditions:

- The codes can have any alignment in the image.

- The code can be printed both dark on a light background and light on a dark background.

- Codes with a height of 25 pixels and height/length ratio ≥ 0.15 are read.

- The viewing angle of the sensor to the surface can be between 50° and 90°.

- The codes must not be printed on a curved surface.

- The quiet zone around the code must be undisturbed.

- Code and background must have a homogeneous brightness.

- The following limit values for the bar width must not be exceeded:

  – Code 39: 8 pixels

  – Code128: 12 pixels

  – Int. 2/5: 5 pixels

  – EAN 13/UPC-A/UPC-E/EAN 8: 12 pixels

  – Code 93: 14 pixels

  – Codabar: 9 pixels

Range of applications for "low" codes

For special applications in the printing industry, optimization is available for 1D codes with extremely low bar heights. It can be enabled in the Decoder options ("Program > Reading code > Decoder options") .

The range of applications for 1D codes is to be limited with the following constraints:

- Height must be > 20 pixels.

- Height > 2x minimum width (1x width).

- The codes must be parallel to the axis (horizontal or vertical): Tolerance < ±5°.

- The print quality must be extremely good.

- The minimum quiet zone length must be > 5.5x the minimum width (1x width).

3.1.3   Reading multiple codes in the image

Note

Restricted availability of multicode

Multicode functionality is not available for:
- QR codes
- DotCodes
- PDF417 codes

Note

Order of output

Output is line by line starting with the code of the top left and finishing at the bottom right.

If the order of the codes is required for an application, make sure that the position and rotation of the marked object remain constant during every image acquisition.

Up to 50 codes per image acquisition can be decoded using the "Multicode" parameter. SIMATIC MV500 U/X can decode up to 150 codes per image acquisition.

Range of application

- Different code types can also be read in one image.

- Available for data matrix codes that can be read with standard methods.

- The maximum number of codes and the code types used are specified when the program is saved. Depending on the configuration, the actual number and the code types found in processing mode can vary.

- Due to the multiple decoding, the processing time is extended approximately proportional to the number of codes per image.

Example

With this function, you can record a one-dimensional code and a data matrix code on packaging with one image acquisition and output the read result of both codes in the same cycle.

Figure 3-1   Example: Reading multiple codes in the image

3.2   Code verification

3.2.1   Overview

Note

"Veri-Genius" license

You need a "Veri-Genius" license to use code verification.

Note

Support of function depending on device type and lens

Please note that the SIMATIC MV530 optical readers do not support code verification.

Note that code verification currently does not support any EF lenses. Therefore, only use lenses with manual focus for code verification.

The readability of a 1D or 2D barcode will never be better than at the time the barcode leaves the marking device. With the help of code verification, it is possible to make sure during the marking process that the markings are correctly applied and that readability is good enough that it will remain ensured throughout the entire life cycle. Verification makes sure that corrections can be made to the marking procedure before it leaves a range of tolerance and produces unusable or incomplete markings.

Calibration card and calibration certificate of the calibration card

A calibrated calibration card is required to calibrate the reader. A calibration card is included with each Veri-Genius license. Due to the special surface properties, the calibration cards are subject to an ageing process, which is noticeable, among other things, by yellowing of the card. An outdated card is no longer suitable for calibration and can falsify the readings of the reader. To slow down the aging process, the calibration card should be stored in an opaque container. A certificate is available for each calibration card, specifying the serial number, which contains information on the calibration and durability of the card. You receive this certificate from the support of the manufacturer Applied Image (info@appliedimage.com).

Marking quality

To recognize and ensure the readability and quality of a marking, a verifier is required instead of a pure optical reader. A purely optical reader (without verifier) outputs only the "read"/"not read" result. This means the optical reader does not provide any trend data to the marking device.
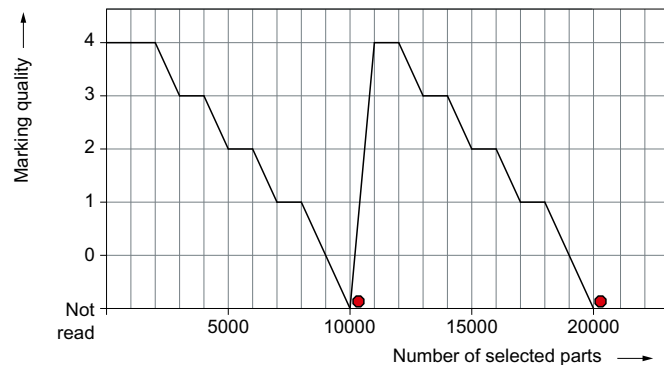
Figure 3-2   Course of marking quality when using a reader without a verifier

The verifier, in contrast, assigns a quality grade from 4 to 0 to the readable marking. These levels provide information to the marking device to detect when preventive maintenance is required. Based on this knowledge, maintenance can be planned at a suitable time before the device actually becomes defective.
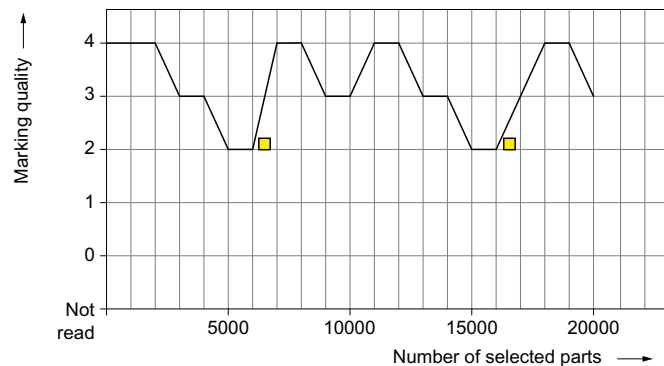
Figure 3-3   Sequence involved in marking quality when using a verifier

Make sure that the measuring procedure and marking quality are suitable for the marking method used. Depending on the particular requirements there are several test standards that define the quality of a marking using a combination of different quality features. Data matrix codes on labels can be tested, for example, with test systems according to ISO/IEC 16022.

With direct part marking (DPM), the data matrix code is applied directly to the surface of the object. Here, other marking errors occur that make it necessary to use verification specially designed for this purpose. A test system according to ISO/IEC 29158 is usually used.

The verifiers of the SIMATIC MV500 series support these and other verification standards for a wide range of applications and marking processes.

3.2.2 Grading

Quality grades

The verifier reports the marking quality in five grades known as "quality grades".

Older verifiers frequently identify these grades based on a single letter from A to F (without E). Verifiers of the newer generations evaluate the range numerically from 4 to 0. With SIMATIC MV500 series verifiers, you can switch between the two designation types in the WBM user interface.

Evaluation

In addition to this, each quality grade is assigned one of three evaluation levels (good/adequate/poor) on the readers of the SIMATIC MV500 series. This evaluation not only allows for rapid visual quality checks using the color coding in the user interface, but also automatic rejection of the read result as "N_OK" if it falls below a certain quality grade.

Table 3-1   Quality grades

Quality grades	Defaults for quality grading	Color identification	Defaults for the read result
4 (A)	Good	Green	OK
3 (B)	Good (adjustable) [1]		
2 (C)	Fair (adjustable) [1]	Yellow	OK
1 (D)	Bad (adjustable) [1]	Red	N_OK (adjustable)
0 (F)	Poor		

[1]   The user-specific setting is only for ascending or descending order.

The levels can be set for the quality of the code as a whole and for individual quality features separately.

Example

In an application in which only very good markings are acceptable, all grades below 4 are set to "Poor". This allows the rejection of all unacceptable specimens.

Deactivation of features

It is also possible to deactivate the evaluation of individual quality features, for example, when these are generally evaluated with a low quality grade due to the conditions of the application.

Note that by deactivating the quality features the determined code quality no longer fully meets the definition of the underlying standard. This means a deactivation of the quality features is not possible for applications that require verification according to a specific ISO standard.

Example

The reader is aligned at an angle to the surface of the marked object which distorts the marking in the image acquisition. The quality feature "Axial non-uniformity" is therefore generally evaluated with a quality grade 1, which means the quality of the entire marking can never be better than 1. If compliance with an ISO standard is not required, however, "Axial non-uniformity" can be removed from the evaluation to make a meaningful statement about the marking quality using the remaining quality features.

3.2.3 Verification methods for different application scenarios

3.2.3.1 Verification of printed labels

In 1996, the "Association for Automatic Identification and Mobility" (AIM) published the data matrix symbology specification with an evaluation procedure for print quality. According to this evaluation procedure, test systems could evaluate a symbol according to its degree of acceptability (4 to 0).

The specification later became the ISO/IEC 16022 standard. This type of test was developed for paper labels with high contrast.

It allows a quantitative measurement of the print quality and allows the testing of printed 2D codes based on a quality standard. Here, the important fact is that the printing of a data matrix code on paper is a high-quality process.

White paper is printed with black ink to achieve a high contrast. With this background, the threshold values for grading in the ISO/IEC 16022 standard are very restrictive because the marking quality is so high.

Less exacting requirements are neither suitable nor useful in the printing industry. The AIM standard identifies the following typical errors:

- Blocked ink jets

- Too much or too little ink

- Inconsistent application of the ink

- Inadequate contrast due to a combination of ink color and background color

3.2.3.2   Verification of direct part marks

Test procedure

In contrast to printed labels, most workpieces are not optimized for marking but rather for their primary purpose. It is, for example, more difficult to apply a laser marking to bare aluminum than to stainless steel. Aluminum is, however, more suitable in the production of parts for aircraft because it is lighter. The weight is therefore more important than markability. A test object with a marking on aluminum does not normally pass the test according to the ISO/IEC 16022 standard due to the low degree of contrast.

Here, a verification method suitable for DPM must be used. For open applications, a public standard such as ISO/IEC 15415, ISO/IEC 29158 or AS9132A is normally used, whereby ISO/IEC 29158 has become the preferred standard in recent years.

For applications with demanding lighting conditions, use ISO/IEC 29158. To obtain an ideal image of the code to be verified, automatic exposure control is used here, in contrast to all other verification standards.

Siemens DPM

For closed applications with a focus on checking the marking quality, Siemens DPM verification is the best choice. Siemens DPM is based on the quality features of ISO/IEC 16022 and AS9132 Rev. A, can be configured very flexibly to test markings applied with a variety of marking methods on different materials.

Measuring the marking

Each marking is measured based on the quality characteristics defined in the relevant verification process and assigned to a quality level. Deviations in the quality grade can usually be attributed to the following causes:

- Changed marking parameters or errors in the marking device

- Changed material concepts or surface structure

- Parts incorrectly secured or traced

- Changes in a disturbed environment such as oil or light on the part

Provided with the data of the verifier, the production line remains operational because necessary maintenance or modifications to improve the marking can be performed before the markings become unreadable.

3.2.3.3 Examples of defects in the marking quality

The following pictures show examples of defects in the marking quality:
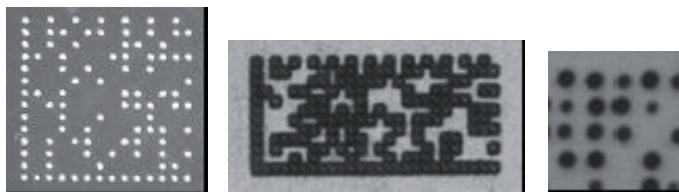
Figure 3-4   Incorrect or non-uniform cell size in the marking
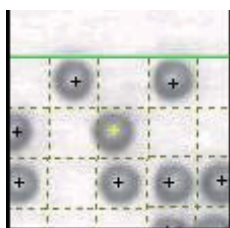
Figure 3-5   Incorrect or non-uniform cell position in the marking
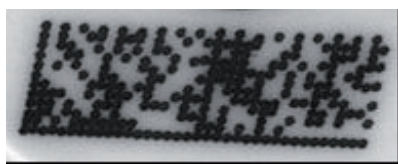
Figure 3-6   Incorrect overall geometry of the marking

Figure 3-7   Damaged surface of the marking or part

Figure 3-8   Very little or non-uniform contrast in the marking

3.2.3.4 Verification standards supported

The optical readers without a verification license support the following verification standards:

- Uncalibrated verification according to ISO/IEC 29158 and ISO/IEC 16022 for data matrix
- Uncalibrated verification according to ISO/IEC 15416 for various 1D bar codes

The optical readers with a "Veri-Genius" license also support the following verification standards:

- Data matrix verification to ISO/IEC 15415:2004

- Data matrix verification according to AS9132 Rev A:2005 (previously IAQG) for dot peen markings

- Siemens DPM

- DMC verification according to ISO/IEC 29158:2011

- Barcode verification to ISO/IEC 15416:2000 (previously ANSI X3.182-1990)

Note

Veri-Genius license

For productive use, you require a Veri-Genius license (article number "6GF3400-0SL02").

3.2.4 Calibration and activating the verification

Calibrate

To use the optical reader as a verifier, a calibration must be performed. Calibrating the optical reader ensures that with every test setup, correct and reproducible results are returned in keeping with the selected standard.

You will need to calibrate the optical reader the first time you commission it in your production area.

Verification library

Calibrations are created as elements of the verification library according to the procedure described below. You can then reference a stored calibration in one or more programs.

Requirement: Stable lighting conditions

The conditions must be stable in the operating environment of the verifier. If the position of the device or the ambient lighting or ambient temperature changes, recalibration is necessary. Without calibration, the results may fluctuate considerably. Regular recalibration it is necessary for stable results.

After successful recalibration of an element of the verification library, all programs that reference this element can be used immediately.

Siemens AG recommends that you operate the optical reader with its own lighting. You should also shield the optical reader and the code to be measured from the surrounding light. Some verification procedures (e.g. ISO/IEC 15415 and ISO/IEC 29158) require the use of certain lighting types and lighting equipment. You will find detailed information on this in the relevant documents from ISO/IEC.

Performing system normalization and reflectance calibration

Once you have set up the optical reader in the location where it will be used, the system needs to be calibrated with the calibration card.

The Veri-Genius license is supplied with a calibration card.

3.2.4.1 Calibrating the optical reader

The calibration determines suitable lighting parameters and obtains the correct calculation of the contrast and the size measurements of the test system.

Procedure

To calibrate the optical reader, follow these steps:

1. Make sure that you have stable and uniform illumination of the working area of the optical reader in particular the surrounding lighting.
   For this purpose, read the information in the section introduction.

2. Place the calibration plate in the viewing range of the optical reader.

3. From the codes available on the calibration card, select the one whose cell size comes closest to the codes to be verified.
   If calibration codes with different cell sizes are used, select the code whose cell size comes closest to the cell size of the codes to be verified. If you are unsure about the size, use the next smaller code in case of doubt.
   Note: During verification according to ISO/IEC 15415 of codes with a cell size that differs significantly from the cell size of the code used for calibration, deviations occur when determining the code contrast. This is due to the contrast determination process specified in the standard and is not an error.

4. Position the selected data matrix code in the center below the optical reader.
   Select a matrix code with a cell size > 10 pixels.

5. Align the borders of the code parallel to the borders of the image.
   The centering aid drawn into the image serves as an aid.
   If, during processing, the code to be read is always positioned in a region below the optical reader that is clearly offset from the center, you should also position the calibration code in this region.

6. Check the image of the code and optimize the image quality.
   As an aid, you can enable the sharpness display in the "Image view" group.
   Using a small aperture achieves a greater depth of focus. A small aperture is also advisable if the optical reader cannot be protected from surrounding light. A large aperture, however, allows shorter exposure times and is therefore useful for fast applications and for verification according to ISO/IEC 29158.

7. When there are other data matrix codes in the image field or the illumination is not uniform across the entire image surface or the code is not located in the center of the image due to the application, the calibration ROI will need to be adapted.
   To this end, adjust the ROI so that the code is located in the center. The exact size of the ROI is unimportant but must contain the complete code and the quiet zone (minimum width: 1 code cell).

8. If required to meet the requirements of your application, configure the maximum exposure time and brightness.
   To achieve a good image quality, the maximum brightness for the verification is more restricted than when using the device as an optical reader.

   – To minimize any possible deterioration of the measured code quality due to the image acquisition procedure, the brightness is set to as low a value as possible during calibration. The required exposure time is therefore relatively high in many cases. For applications with direct part marking (DPM) a lower calibrated exposure time should be selected under certain circumstances. This applies in particular if active exposure control is used with ISO/IEC 29158. The exposure time can then be corrected during processing mode to be able to verify parts with weak reflectance.

   – To achieve a shorter exposure time, set a lower value for the maximum exposure time. The maximum exposure time allowed in processing mode can be adapted in the program settings (only ISO/IEC 29158).

9. Enter the values for contrast and maximum reflectance specified on the calibration card for the selected code in the appropriate boxes.

10. Start the calibration and, if necessary, follow the instructions for eliminating errors.

3.2.4.2 Basic requirements

Recommended cell sizes for verification of 2D codes

The following basic requirements must be met to ensure a reliable verification:

• Recommended cell size calibration code:
  10 pixels (min. 5 pixels)

• Recommended cell size target code:
  10 pixels (min. 5 pixels)

• Recommended quiet zone:
  Double cell height all around the code in the image

If the target code differs significantly from the available calibration codes in terms of its cell size, you must make sure to select a sufficiently high resolution when you select the camera model.

3.2.4.3 Using the verification

Once calibration is completed, it can be saved on the reader and applied. To this end, open or create a program and the select the saved calibration as reference in the program step "Image acquisition".

The verification standard selected for the calibration is then applied in all "Reading code" program steps for all code types that support this standard.

Note

Uncalibrated verification

When you select the "Uncalibrated" verification reference, depending on the selection in the settings of the "Reading code" program step, data matrix codes are evaluated according to ISO/IEC 16022 or ISO/IEC 29158 and barcodes are evaluated according to ISO/IEC 15416. The evaluation is, however, made without any basic calibration. The standard report corresponds to the Standard report for ISO/IEC 16022:2011 "Standard / ID-Genius" decoder (Page 74) or Standard report for ISO/IEC 29158:2011 (Page 75) for data matrix codes or the Standard report for ISO/IEC 15416:2000 (Page 78) for verifiable barcodes.

Note

Verification with the "ID-Genius" decoder

If you select the "ID-Genius" decoder (Standard report for ISO/IEC 16022:2011 "Standard / ID-Genius" decoder (Page 74)), only uncalibrated verification is possible. The verification standard to be used for this (ISO/IEC 16022 or ISO/IEC 29158) can be selected in the settings of the Reading code program step. Please note that the ID-Genius implementation of the quality calculation according to ISO/IEC 16022 deviates from the standard.

Note

Demo mode

To evaluate the verification standards, the optical readers of the SIMATIC MV500 series support a demo mode. The demo mode is indicated in the verification library by the addition of "Demo" in the "Verification standard" group.

In the demo mode, remember the following restrictions:

- When you select a verification reference other than "Uncalibrated", the check box "Evaluate 'Bad' evaluation as 'N_OK'" is disabled. No N_OK reads will be generated due to the quality evaluation.
- In the verification report, the four-digit quality values are replaced by the word "DEMO". All quality grades are output as "0" or "F".

Note

Manually readjusting exposure settings

You can readjust the read settings manually following normalization and calibration.

- Deselect the "From reference" check box in the image settings.
  Please note that the quality values calculated will no longer comply with the standard.
- For documentation, use the "Formatted output of the verification" that contains the read settings used for image acquisition.

3.2.5 Data matrix verification

3.2.5.1 ISO/IEC 16022:2011

This standard is based on data for printing data matrix codes with black ink on white paper and can normally only be used in such scenarios.

Note

Basis of the standard

As the second edition of the ISO/IEC 16022 standard, the ISO/IEC 16022:2006 document refers to the ISO/IEC 15415 standard as a guideline for print quality.

Quality features

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid.

- Contrast:
  Difference between the average reflectance of the lightest pixels and the darkest pixels.

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

Table 3-2   Assignment of the numeric grade of ISO/IEC 16022:2011 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Axial non-uniformity (AN_)	≤ 6 %	≤ 8 %	≤ 10 %	≤ 12 %	> 12 %	--
Print growth (PG_)	≤ 15 %	≤ 21 %	≤ 26 %	≤ 30 %	> 30 %	Absolute value for x and y
Contrast (SC_)	≥ 70 %	≥ 55 %	≥ 40 %	≥ 20 %	< 20 %	--
Unused error correction (UEC)	≥ 62 %	≥ 50 %	≥ 37 %	≥ 25 %	< 25 %	--

3.2.5.2 ISO/IEC 15415:2005

This standard is a specification for testing the print quality of barcodes for two-dimensional symbols.

The ISO/IEC 16022:2006 document relates to this standard in the guidelines for print quality. The "5 Scan Average" and "Extended Reflectance Check" functions described in the ISO/IEC 15415 standard are not supported by the verifiers of the SIMATIC MV500 series.

Quality features

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Fixed pattern damage:
  Measure of the errors in the borders of the data matrix and all errors in the quiet zone around the code necessary for decoding.

- Grid deviation:
  This is the deviation of the measured grid relative to the ideal grid starting from the four corners of a data matrix.

- Modulation:
  Measurement of the uniformity of the reflectance of the dark and light cells of the data matrix.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid. Is only calculated as a reference, no quality grade is assigned.

- Reference decode:
  Based on a binary image of the code according to ISO/IEC 16022:2006, a code is decoded using the decoder described in the data matrix standard. If the code can be successfully decoded, the quality grade "4" is assigned; if not, the quality grade "0".

- Symbol contrast:
  Difference between the highest and lowest reflectance of the data matrix surface.

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

Table 3-3   Assignment of the numeric grade of ISO/IEC 15415:2005 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Axial non-uniformity (AN_)	≤ 0.06	≤ 0.08	≤ 0.10	≤ 0.12	> 0.12	--
Fixed pattern damage (FPD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					--
Grid deviation (GN_)	≤ 0.38	≤ 0.50	≤ 0.63	≤ 0.75	> 0.75	--
Modulation (MOD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					--
Print growth	Reference only, no grading					X and Y
Reference decode (RD_)	pass	--	--	--	Failed	--
Symbol contrast (SC_)	≥ 0.70	≥ 0.55	≥ 0.40	≥ 0.20	< 0.20	--
Unused error correction (UEC)	≥ 0.62	≥ 0.50	≥ 0.37	≥ 0.25	< 0.25	--

3.2.5.3 **ISO/IEC 29158:2011**

This standard is based on ISO/IEC 15415 but includes modifications for more robust measurements of Direct Part Marks. The standard can be used for a wide range of applications, sectors and marking technologies.

The most noticeable differences are the use of automatic exposure control and a much greater contrast tolerance.

Note

ISO/IEC 29158 uses its own algorithm for exposure control

The ISO/IEC 29158 standard uses its own algorithm for exposure control. With this, the exposure time is adjusted so that the average gray scale value of the code to be verified is between 70% and 86%. If such an exposure is not possible for a particular code, a verification error (4707, 4708, or 4709) is generated.

Automatic exposure control requires multiple decodings of the code to be verified. The time needed for this can vary significantly depending on the type and marking quality of the code. The "Time limit" parameter in the exposure settings of a program can be used to limit the time available for exposure. Occurrence of the verification error 4709 and, in particular, 4708 indicates that the value is too low.

Checking of the average gray scale value can be disabled by clearing the "From reference" check box in the exposure settings of a program (not recommended). The verification no longer conforms to the standards in this case.

Note

Uncalibrated verification or verification not conforming to standards according to ISO/IEC 29158

Because the "Cell contrast" quality parameter in ISO/IEC 29158 is calculated depending on the average gray value:
If the average gray value fluctuates from one image acquisition to another, the calculated value is not informative. See also the note above on exposure control.

Therefore, when ISO/IEC 29158 is used for uncalibrated verification, the "Cell contrast" quality parameter is not used by default for determining the overall quality. A poor grade for cell contrast thus does not affect the overall quality grade. The same applies if the "From reference" check box is cleared for calibrated verification. If the "Cell contrast" quality parameter is to be used for the overall quality, you must use the "Symbol contrast" in the "Read code" step in the "Evaluations" group.

Note

Verification report

You can create a verification report according to ISO/IEC 29158 using the WBM. For detailed information refer to the online help of the WBM.

Note

Orientation of the code to be verified

The verification according to ISO/IEC 29158 uses an algorithm for quality calculation to connect the separate code cells typically generated in the image when using the DPM method. This algorithm requires the code to be aligned parallel to the borders of the image. A twisted code can affect the quality calculation and, in extreme cases, even result in verification errors.

Quality parameters

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Cell contrast:
  Measure of the uniformity of the average reflectance of the light pixels and the dark pixels. This corresponds to "symbol contrast" according to ISO/IEC 15415, however with different details in the implementation.

- Cell modulation:
  Measurement of the uniformity of the reflectance of the dark and light areas of the data matrix. Similar to "Modulation" according to ISO/IEC 15415, however with different details in the implementation and lower limits for the quality levels.

- Fixed pattern damage:
  Measure of the errors in the borders of the data matrix and all errors in the quiet zone around the code necessary for decoding.

- Grid deviation:
  This is the deviation of the measured grid relative to the ideal grid starting from the four corners of a data matrix.

- Minimum reflectance:
  The lowest reflectance of any area in the data matrix.

- Reference decode:
  Based on a binary image of the code according to ISO/IEC 16022:2006, a code is decoded using the decoder described in the data matrix standard. If the code can be successfully decoded, the quality grade "4" is assigned; if not, the quality grade "0".

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid. Calculated only as a reference.

Table 3-4   Assignment of the numeric grade of ISO/IEC 29158:2011 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	**3**	**2**	**1**	**0**	
Axial non-uniformity (AN_)	≤ 6 %	≤ 8 %	≤ 10 %	≤ 12 %	>12 %	--
Cell contrast (SC_)	≥30 %	≥ 25 %	≥ 20 %	≥ 15 %	< 15 %	Calculation different from ISO 15415

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Cell modulation (MOD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					Calculation different from ISO 15415
Fixed pattern damage (FPD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					Calculation different from ISO 15415
Grid deviation (GN_)	≤ 0,38	≤ 0,50	≤ 0,63	≤ 0,75	> 0,75	--
Minimum reflectance (RMI)	≥ 5 %	--	--	--	< 5 %	--
Reference decode (RD_)	pass	--	--	--	fail	--
Unused error correction (UEC)	≥ 62 %	≥ 50 %	≥ 37 %	≥ 25 %	< 25 %	--
Print growth	Reference only, no grading					--

Note

Deactivation of reference decoding

The ISO/IEC 29158 standard allows for the use of a proprietary decoder instead of a reference decoder. This means successful verification is also possible for codes that cannot be read by the reference decoder.

Note that some quality features are calculated based on the reference decoding. If the quality feature reference decoding is disabled in the user interface, these quality features are calculated based on the proprietary decoder. As a result, the calculated values can deviate and it is no longer guaranteed that they match a quality measurement conducted with a verifier from a different manufacturer.

The affected quality features are:

- Pressure deviation (not evaluated)
- Unused error correction
- Grid deviation
- Cell modulation

3.2.5.4 AS9132 A

This standard first appeared as a data matrix standard of the IAQG (International Aerospace Quality Group).

This standard applies directly to three specific types of marking:

- Dot peen markings
- Laser marking
- Electrochemical etched markings

The optical readers of the SIMATIC MV500 series focus on the quality criteria of dot peen markings that are the most frequently used. Module fill and contrast are calculated as a reference but are not included in the overall grading.

Quality features of the dot peen marking

- Angle of distortion: Difference between the two solid edges of the data matrix and the vertical edges measured in degrees.

- Module center offset:
  Linear deviation of the location of the center point of the cell compared with the center of the ideal grid calculated as a percentage of the nominal cell size.

- Module size offset:
  Difference in the apparent size of each individual data element in the data matrix.

- Module fill:
  Measurement of the completeness of the ideal grid as a percentage.

- Nominal module size:
  Average value of the two values nominal module size X and nominal module size Y.

  – Nominal module size X: Width of the data matrix code in pixels divided by the number of columns.

  – Nominal module size Y: Height of the data matrix code in pixels divided by the number of rows.

- Ovality:
  Difference between the widest part of the round cell and the narrowest part of the round cell.

- Contrast:
  Difference between the average reflectance of the lightest pixels and the darkest pixels. Calculated only as a reference

Note

Support for advanced quality features

No expanded quality parameters are used for laser marking and electrochemical etched marking.

Table 3-5   Assignment of the numeric grading of AS9132 Rev. A to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Angle of distortion (AOD)	< 3.5	< 7	--	--	>7	--
Module center offset (CO_)	C1 < 2 %	C2 < 2 %	--	--	C2 > 2 %	C1 is the number of modules with a center offset less than 10% of the module size
						C2 is the number of modules with a center offset less than 20% of the module size

Quality features (abbreviation)	Quality grades					Comment
	4	**3**	**2**	**1**	**0**	
Module size offset (SO_)	C1 < 2 %	C2 < 2 %	--	--	C2 > 2 %	C1 is the number of modules with a size offset between 70% and 90% of the module size
						C2 is the number of modules with a size offset between 60% and 105% of the module size
Module fill (MF_)	65% ... 105 %	--	--	--	< 65 % or >105 %	Reference only, 80% is ideal
Nominal module size (NMS)	Reference only, no grading					--
Ovality (OV_)	C1 < 2 %	C2 < 2 %	--	--	C2 > 2 %	C1 and C2 is the number of modules with an ovality greater than 20% of the module size
Contrast	Reference only, no grading					

3.2.5.5 Siemens DPM

In Siemens DPM verification, you can select the quality features to be used and configure the levels "Good", "Fair", and "Poor" for each individual quality feature.

The range of options for verification is ideal for process control in data matrix applications in which no public standard needs to be adhered to.

Note

Quality features disabled in the default setting

The quality features "Symbol contrast" and "Cell size" are not enabled in the default setting because these quality features are of limited significance for direct part marks.
The quality features can be activated in the WBM.

Quality features

- Cell size:
  The overall width divided by the number of columns or the overall height divided by the number rows. The value output is the cell size in mils (milli-inches). The assignment to the quality level is based on the number of pixels (see table below).

- Center offset:
  Measurement of the offset of the cell center to the center of the ideal grid starting at the four corners of the codes.

- Size offset:
  Measurement of the difference in cell sizes compared with each other.

- Cell modulation:
  Measurement of the uniformity of the reflection values of the dark cells compared with the light cells.

- Border match:
  Percentage of border cells that match the pattern formed by the four borders of the data matrix.

- Symbol contrast:
  Difference between the average reflectance of the lightest pixels and the darkest pixels.

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid.

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

- Angle of distortion:
  Difference between the two solid edges of the data matrix and the vertical edges measured in degrees.

Table 3-6   Assignment of the numeric grade of Siemens DPM to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	**3**	**2**	**1**	**0**	
Cell size (CS_)	≥ 10	≥ 9	≥ 7	≥ 5	< 5	In pixels
Center offset (CO_)	≤ 2.5	≤ 5.0	≤ 7.5	≤ 10.0	> 10.0	Without unit
Size offset (SO_)	≤ 2.5	≤ 5.0	≤ 7.5	≤ 10.0	> 10.0	Without unit
Cell modulation (MOD)	≥ 90%	≥ 80 %	≥ 70 %	≥ 60 %	< 60 %	--
Border match (BM_)	≥ 95 %	≥ 90 %	≥ 85 %	≥ 80 %	< 80 %	--
Symbol contrast (SC_)	≥ 70 %	≥ 55 %	≥ 40 %	≥ 20 %	< 20 %	--
Axial non-uniformity (AN_)	≤ 6 %	≤ 8 %	≤ 10 %	≤ 12 %	> 12 %	--
Print growth (PG_)	≤ 10 %	≤ 20 %	≤ 30 %	≤ 40 %	> 40 %	--
Unused error correction (UEC)	≥ 62 %	≥ 50 %	≥ 37 %	≥ 25 %	< 25 %	Code words in ECC 200
Angle of distortion (AOD)	≤ 2 %	≤ 4 %	≤ 6 %	≤ 7 %	> 7 %	--

3.2.5.6   Graphical support for analysis of verification errors

Searching for cause of marking problems

The information used by the reference decoder can be displayed to simplify troubleshooting for marking problems.

You enable the details view in the WBM under "Options > Extras > Verification > Verification details". You can read out the results in the user interface if the display of the "Features" is enabled in the result display and via the "Monitor" link on the device start page.

The displayed information contains:

- The grid lines by which the cells are separated.

- The incorrectly marked cells (shown in red).

- The correctly marked cells (shown in green).

Note

Quality parameters for lowering the grade are not displayed

The identification of the incorrectly marked cells only takes into account cells that were recognized as being incorrectly set based on the error correction information. Other quality parameters that cause lowering of the grade, such as inadequate modulation or errors in the quiet zone, are not displayed.

Example
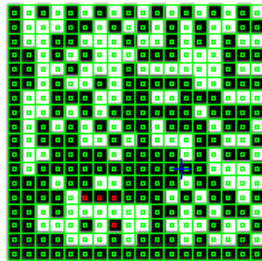
3.2.6 QR verification

3.2.6.1 ISO/IEC 16022:2011

This standard is based on data for printing data matrix codes with black ink on white paper and can normally only be used in such scenarios.

Note

Basis of the standard

As the second edition of the ISO/IEC 16022 standard, the ISO/IEC 16022:2006 document refers to the ISO/IEC 15415 standard as a guideline for print quality.

Quality features

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid.

- Contrast:
  Difference between the average reflectance of the lightest pixels and the darkest pixels.

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

Table 3-7   Assignment of the numeric grade of ISO/IEC 16022:2011 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Axial non-uniformity (AN_)	≤ 6 %	≤ 8 %	≤ 10 %	≤ 12 %	> 12 %	--
Print growth (PG_)	≤ 15 %	≤ 21 %	≤ 26 %	≤ 30 %	> 30 %	Absolute value for x and y
Contrast (SC_)	≥ 70 %	≥ 55 %	≥ 40 %	≥ 20 %	< 20 %	--
Unused error correction (UEC)	≥ 62 %	≥ 50 %	≥ 37 %	≥ 25 %	< 25 %	--

3.2.6.2   ISO/IEC 15415:2005

This standard is a specification for testing the print quality of barcodes for two-dimensional symbols.

The ISO/IEC 16022:2006 document relates to this standard in the guidelines for print quality. The "5 Scan Average" and "Extended Reflectance Check" functions described in the ISO/IEC 15415 standard are not supported by the verifiers of the SIMATIC MV500 series.

Quality features

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Fixed pattern damage:
  Measure of the errors in the borders of the data matrix and all errors in the quiet zone around the code necessary for decoding.

- Grid deviation:
  This is the deviation of the measured grid relative to the ideal grid starting from the four corners of a data matrix.

- Modulation:
  Measurement of the uniformity of the reflectance of the dark and light cells of the data matrix.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid. Is only calculated as a reference, no quality grade is assigned.

- Reference decode:
  Based on a binary image of the code according to ISO/IEC 16022:2006, a code is decoded using the decoder described in the data matrix standard. If the code can be successfully decoded, the quality grade "4" is assigned; if not, the quality grade "0".

- Symbol contrast:
  Difference between the highest and lowest reflectance of the data matrix surface.

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

- Format damage:
  Damage to the format information contained in the QR code

- Version damage:
  Damage to the version information contained in the QR code

- Contrast uniformity:
  Worst cell contrast value

- Reflectance margin:
  Measurement of the uniqueness of the reflectance grade (light vs. dark) of the cells.

Table 3-8   Assignment of the numeric grade of ISO/IEC 15415:2005 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Axial non-uniformity (AN_)	≤ 0.06	≤ 0.08	≤ 0.10	≤ 0.12	> 0.12	--
Fixed pattern damage (FPD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					--
Grid deviation (GN_)	≤ 0.38	≤ 0.50	≤ 0.63	≤ 0.75	> 0.75	--
Modulation (MOD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					--
Print growth	Reference only, no grading					X and Y
Reference decode (RD_)	pass	--	--	--	Failed	--
Symbol contrast (SC_)	≥ 0.70	≥ 0.55	≥ 0.40	≥ 0.20	< 0.20	--
Unused error correction (UEC)	≥ 0.62	≥ 0.50	≥ 0.37	≥ 0.25	< 0.25	--
Format damage (QFD)	This measurement is made in a two-stage process. There is no direct correlation between the intermediate results and the quality grade.					
Version damage (QVD)	This measurement is made in a two-stage process. There is no direct correlation between the intermediate results and the quality grade.					Quality is output as "4" if there is no version information in the code.
Contrast uniformity (QCU)	Reference only, no grading					--
Reflectance margin (QRM)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					--

3.2.6.3   ISO/IEC 29158:2011

This standard is based on ISO/IEC 15415 but includes modifications for more robust measurements of Direct Part Marks. The standard can be used for a wide range of applications, sectors and marking technologies.

The most noticeable differences are the use of automatic exposure control and a much greater contrast tolerance.

Note

ISO/IEC 29158 uses its own algorithm for exposure control

The ISO/IEC 29158 standard uses its own algorithm for exposure control. With this, the exposure time is adjusted so that the average gray scale value of the code to be verified is between 70% and 86%. If such an exposure is not possible for a particular code, a verification error (4707, 4708, or 4709) is generated.

Automatic exposure control requires multiple decodings of the code to be verified. The time needed for this can vary significantly depending on the type and marking quality of the code. The "Time limit" parameter in the exposure settings of a program can be used to limit the time available for exposure. Occurrence of the verification error 4709 and, in particular, 4708 indicates that the value is too low.

Checking of the average gray scale value can be disabled by clearing the "From reference" check box in the exposure settings of a program (not recommended). The verification no longer conforms to the standards in this case.

Note

Uncalibrated verification or verification not conforming to standards according to ISO/IEC 29158

Because the "Cell contrast" quality parameter in ISO/IEC 29158 is calculated depending on the average gray value:
If the average gray value fluctuates from one image acquisition to another, the calculated value is not informative. See also the note above on exposure control.

Therefore, when ISO/IEC 29158 is used for uncalibrated verification, the "Cell contrast" quality parameter is not used by default for determining the overall quality. A poor grade for cell contrast thus does not affect the overall quality grade. The same applies if the "From reference" check box is cleared for calibrated verification. If the "Cell contrast" quality parameter is to be used for the overall quality, you must use the "Symbol contrast" in the "Read code" step in the "Evaluations" group.

Note

Verification report

You can create a verification report according to ISO/IEC 29158 using the WBM. For detailed information refer to the online help of the WBM.

Note

Orientation of the code to be verified

The verification according to ISO/IEC 29158 uses an algorithm for quality calculation to connect the separate code cells typically generated in the image when using the DPM method. This algorithm requires the code to be aligned parallel to the borders of the image. A twisted code can affect the quality calculation and, in extreme cases, even result in verification errors.

Quality parameters

- Axial non-uniformity:
  Difference between the height and width relative to the rows and columns.

- Cell contrast:
  Measure of the uniformity of the average reflectance of the light pixels and the dark pixels. This corresponds to "symbol contrast" according to ISO/IEC 15415, however with different details in the implementation.

- Cell modulation:
  Measurement of the uniformity of the reflectance of the dark and light areas of the data matrix. Similar to "Modulation" according to ISO/IEC 15415, however with different details in the implementation and lower limits for the quality levels.

- Fixed pattern damage:
  Measure of the errors in the borders of the data matrix and all errors in the quiet zone around the code necessary for decoding.

- Grid deviation:
  This is the deviation of the measured grid relative to the ideal grid starting from the four corners of a data matrix.

- Minimum reflectance:
  The lowest reflectance of any area in the data matrix.

- Reference decode:
  Based on a binary image of the code according to ISO/IEC 16022:2006, a code is decoded using the decoder described in the data matrix standard. If the code can be successfully decoded, the quality grade "4" is assigned; if not, the quality grade "0".

- Unused error correction:
  Proportion of error correction information not used for correction of the read result.

- Print growth:
  Positive or negative size ratio of the printed cells relative to the ideal grid. Calculated only as a reference.

- Format damage:
  Damage to the format information contained in the QR code

- Version damage:
  Damage to the version information contained in the QR code

Table 3-9   Assignment of the numeric grade of ISO/IEC 29158:2011 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Axial non-uniformity (AN_)	≤ 6 %	≤ 8 %	≤ 10 %	≤ 12 %	>12 %	--
Cell contrast (SC_)	≥30 %	≥ 25 %	≥ 20 %	≥ 15 %	< 15 %	Calculation different from ISO 15415
Cell modulation (MOD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					Calculation different from ISO 15415
Fixed pattern damage (FPD)	This measurement is made in a three-stage process. There is no direct correlation between the intermediate results and the quality grade.					Calculation different from ISO 15415

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Grid deviation (GN_)	≤ 0,38	≤ 0,50	≤ 0,63	≤ 0,75	> 0,75	--
Minimum reflectance (RMI)	≥ 5 %	--	--	--	< 5 %	--
Reference decode (RD_)	pass	--	--	--	fail	--
Unused error correction (UEC)	≥ 62 %	≥ 50 %	≥ 37 %	≥ 25 %	< 25 %	--
Print growth	Reference only, no grading					--
Format damage (QFD)	This measurement is made in a two-stage process. There is no direct correlation between the intermediate results and the quality grade.					
Version damage (QVD)	This measurement is made in a two-stage process. There is no direct correlation between the intermediate results and the quality grade.					Quality is output as "4" if there is no version information in the code.

Note

Deactivation of reference decoding

The ISO/IEC 29158 standard allows for the use of a proprietary decoder instead of a reference decoder. This means successful verification is also possible for codes that cannot be read by the reference decoder.

Note that some quality features are calculated based on the reference decoding. If the quality feature reference decoding is disabled in the user interface, these quality features are calculated based on the proprietary decoder. As a result, the calculated values can deviate and it is no longer guaranteed that they match a quality measurement conducted with a verifier from a different manufacturer.

The affected quality features are:

- Pressure deviation (not evaluated)
- Unused error correction
- Grid deviation
- Cell modulation

3.2.6.4 Quality check of the ID link

For QR codes, the quality check can be extended to ID link symbols. Enable the corresponding setting in the decoder program step.

When the ID link frame check is enabled, the print quality of the frame is evaluated and included in the overall quality of the symbol. The evaluation is based on the procedure for evaluating a fixed pattern damage.

Figure 3-9   Example: ID-Link (QR code)

3.2.7   Barcode verification

The principles underlying barcode verification are similar to those of data matrix verification. These principles are, however, diversified to make full use of the characteristics of one-dimensional barcodes.

The code is scanned in several parallel scan lines to obtain a reliable measured value for the marking quality of a barcode.

Each scan line has its own set of quality grades and the lowest of these decides the overall quality grade of the reflectance profile of the scan line. The average value of the quality values of the reflectance profile is the overall quality grade of the code.

The optical reader uses ten scan lines with individual results for each of the following quality features.

Quality features

- Overall scan line:
  Lowest grade of all characteristics of the reflectance profile for a scan line.

- Edge determination:
  Clarity of the identification of element edges in the scan reflectance profile.

- Reference decode:
  A code is decoded using the respective reference decoder. If the code can be successfully decoded, the quality grade "4" is assigned; if not, the quality grade "0".

- Maximum reflectance:
  Percentage of the reflectance of the lightest gap.

- Minimum edge contrast:
  Lowest value of the edge contrast. The edge contrast is the difference between the bar reflectance and the gap reflectance of two adjacent elements.

- Minimum reflectance:
  Percentage of the reflectance of the darkest bar.

- Symbol contrast:
  Difference between the maximum and minimum reflectance.

- Decodability:
  The proportion of the available surrounding space (between the ideal dimension of an element or a combination of elements and the relevant reference threshold value) that is not used by the element or the combination of elements. The ratio is calculated for the element or the combination of elements that deviates most from the ideal dimension.

- Defects:
  Irregularities in elements and quiet zones measured based on the non-uniformity of the reflectance of the elements.

- Modulation:
  Ratio of the minimum edge contrast to the symbol contrast.

- Start quiet zone:
  Area outside the start code word with a length of 10 modules.

- Stop quiet zone:
  Area outside the stop code word with a length of 10 modules.

Table 3-10   Assignment of the numeric grade of ISO/IEC 15416:2000 to the quality grades

Quality features (abbreviation)	Quality grades					Comment
	4	3	2	1	0	
Overall scan line:	Lowest single grade per scan line					--
Edge determination	pass	--	--	--	fail	--
Reference decoding	pass	--	--	--	fail	--
Minimum edge contrast (MEC)	≥ 0.15	--	--	--	< 0.15	--
Minimum reflectance (RMI)	$\leq 0.5R_{max}$	--	--	--	$> 0.5R_{max}$	R_{max} is the maximum reflectance.
Symbol contrast (SC_)	≥ 0.70	≥ 0.55	≥ 0.40	≥ 0.20	< 0.20	--
Decodability (DEC)	≥ 0.62	≥ 0.50	≥ 0.38	≥ 0.25	< 0.25	--
Defects (DEF)	≤ 0.15	≤ 0.20	≤ 0.25	≤ 0.30	> 0.30	--
Modulation (MOD)	≥ 0.70	≥ 0.60	≥ 0.50	≥ 0.40	< 0.40	--
Quiet zone (QZ_)	≥ 10 modules	--	--	--	< 10 modules	--

3.2.8   DotCode verification

The quality evaluation of DotCodes is based on ISO/IEC 16022 but has been adapted to the specific properties of this code type. As a result of the adaptation, "Axial non-uniformity" has been replaced with "Grid non-uniformity".

Quality characteristics

- Symbol contrast:
The symbol contrast is the difference between the average brightness of the points of the DotCode and the average brightness of the background.

- Grid non-uniformity:
The value indicates the average deviation of the position of the points from an ideal grid with same distances of grid points in parallel and vertical alignment to the code in each case.

- Unused error correction:
Proportion of error correction information not used for correction of the read result.

- Print growth:
The print growth specifies the ratio (subtracted from 1) of the average diameter of the points to the average spacing of the points from each other.

- Cell size:
Average diameter of the points in pixels.

Table 3-11   Assignment of the numeric grading of DotCode to the quality grades

Quality features (abbreviation)	Quality grades				
	4	3	2	1	0
Symbol contrast	≥ 35%	≥ 21%	≥ 14%	≥ 7%	< 7%
Grid non-uniformity	≤ 0.1	≤ 0.3	≤ 0.4	≤ 0.5	> 0.5
Unused error correction	≥ 0.62	≥ 0.50	≥ 0.37	≥ 0.25	< 0.25
Print growth	≥ 0.8 and ≤ 1.1	≥ 0.7 and ≤ 1.2	≥ 0.6 and ≤ 1.3	≥ 0.5 and ≤ 1.4	< 0.5 or > 1.4
Cell size	≥ 6 and ≤ 9	≥ 5 and ≤ 10	≥ 4 and ≤ 20	≥ 3 and ≤ 30	< 3 or > 30

3.2.9   Formatted output of the verification

3.2.9.1   Overview

One important feature of a verifier is the ability to document results. To allow this, the optical reader provides verification reports that can be accessed over the various interfaces. If a verification report has been configured, this is generated and output each time a read was successful.

For some verification standards, the standard defines a verification report that can be regarded as a summary of the verification result.

A detailed verification report consists of the following two parts:

- Verification settings

- Verification result

Verification report

Through the input of "%R" in the format string, you receive a verification report containing the overall quality and information on the lighting used. The precise formatting and the values contained depend on the verification standard that was used and are defined in the specific standard.

Note

Availability of the verification report

Values enclosed in square brackets are optional.

The verification report is not available for verification according to ISO/IEC 16022, AS 9132 Rev. A and Siemens DPM.

- Output for ISO/IEC 15415:
  <overall grade>/<aperture or cell size>/<wavelength>/[<radiation angle ≠ 45°>]

- Output for ISO/IEC 29158:
  DPM<overall grade>/<percentage aperture>/<wavelength>/[<radiation angle ≠ 45°>]

- Output for ISO/IEC 15416:
  <overall grade>/<module size>/<wavelength>/

Verification settings

Through the input of "%v" in the format string, you receive an output of all output parameters relevant for verification in the printed order.

All field values are separated by semicolons. The field names are not part of the report.

Table 3-12   Output parameters of the verification

Field name	Value
Exposure time	0000 ... 9999
Brightness	0000 ... 0999
Brightness offset (coarse)	-255 ... 0255
Brightness offset (fine)	-25 ... 0255
Histogram peak low	0000 ... 0255
Histogram peak high	0000 ... 0255
Cell scaling * 100	0000 ... 9999
Target contrast	0000 ... 0100
Maximum reflectance	0000 ... 0100
Minimum X dimension	0000 ... 0999
Maximum X dimension	0000 ... 0999
Avg. gray scale value	0000 ... 0255
Calibrated exposure time	0000 ... 9999
Calibrated brightness	0000 ... 0999
Light source	Name of the lamp
Radiation angle	0000 ... 9999

Field name	Value
Wavelength	0000 ... 9999
List of characteristics	Abbreviation: G[GFP][GFP][GFP]P

Note

Calibrated verification according to ISO/IEC 29158

Calibrated verification in compliance with the ISO/IEC 29158 standard works with automatic exposure control. The value output for "Exposure time" in the verification settings therefore differs from the value of the "calibrated exposure time" and corresponds to the value selected by the exposure control.

List of characteristics

The characteristics list consists of the abbreviation of a quality feature followed by five letters. The five letters represent the quality evaluation ([G]ood, [F]air, [P]oor) associated with the possible grades 4, 3, 2, 1, 0 or A, B, C, D, F.

The first entry in the characteristics list is always the overall quality. If the configuration of the quality features has been adapted with regard to the default setting or Siemens DPM is used, the other quality features are set accordingly.

3.2.10 Verification result

Through the input of "%V" in the format string you receive a standard test report with all valid grades and evaluations. This report is automatically adapted to the verification standard stored in the program.

All field values (grades and evaluations) are separated by a semicolon. The field names are not part of the standard report.

If you do not require all grades and/evaluations, you can compose the test report from the individual tags "%Q" or "%q".

Note

Combination of multicode and verification

- If you select "Uncalibrated" for the verification task, all the data matrix codes found are evaluated according to ISO/IEC 16022 or ISO/IEC 29158 and all barcodes are evaluated according to ISO/IEC 15416. The evaluation is, however, made without any basic calibration. The standard test report is automatically adapted to the standard being used for each code.
- If you select a specific verification method, it is used for all matching code types; other code types are not evaluated.
- If a read code has not been evaluated, the output of the verification report for this code is skipped.

Note

Verification error

Whenever a verification error occurs, all quality grades are output as "E" and the error number is output instead of the quality values. For information on the meaning of error numbers, see the section "Read and verification error messages (Page 232)".

3.2.10.1 Standard report for ISO/IEC 16022:2011 "Standard / ID-Genius" decoder

Table 3-13   Output parameters: ISO/IEC 16022:2011 "Standard / ID-Genius" decoder

Field name (String input)	Value
Verification type (Qt)	4 If the exposure settings do not conform to the standard or uncalibrated verification is active: E
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 ... 0
Contrast grade (Q1)	4 ... 0
Contrast (q1)	0 ... 100
Axial non-uniformity grade (Q2)	4 ... 0
Axial non-uniformity (q2)	0.00 ... 1.00
Print growth grade (Q9)	4 ... 0
Print growth X (q9)	-100 ... 100
Print growth Y (q9)	-100 ... 100
Unused error correction grade (Q4)	4 ... 0
Unused error correction (q4)	0.00 ... 1.00
Cell size (q10)	0 to 99.9 mil Uncalibrated verification: Output in pixels [px]
ECC level (q14)	200
Height (q15)	0 to 9.99 inches Uncalibrated verification: Output in pixels [px]
Width (q16)	0 to 9.99 inches Uncalibrated verification: Output in pixels [px]
Angle (q17)	0 ... 360°

3.2.10.2 Standard report for ISO/IEC 15415:2005

Table 3-14   Output parameters: ISO/IEC 15415:2005

Field name (String input)	Value
Verification type (Qt)	2 If the exposure settings do not comply with the standard: C
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 ... 0

Field name (String input)	Value
Reference decode grade (Q7)	4 ... 0
Contrast grade (Q1)	4 ... 0
Contrast (q1)	0 ... 100
Axial non-uniformity grade (Q2)	4 ... 0
Axial non-uniformity (q2)	0.00 ... 1.00
Grid deviation grade (Q3)	4 ... 0
Grid deviation (q3)	0.00 ... 1.00
Unused error correction grade (Q4)	4 ... 0
Unused error correction (q4)	0.00 ... 1.00
Fixed pattern damage grade (Q5)	4 ... 0
Format damage grade (Q60) [1]	4 ... 0
Version damage grade (Q61) [1]	4 ... 0
Contrast uniformity (Q62) [1]	0 ... 100
Reflectance margin grade (Q63) [1]	4 ... 0
Modulation grade (Q6)	4 ... 0
Print growth X (q9)	-100 ... 100
Print growth Y (q9)	-100 ... 100
Cell size (q10)	0 ... 99.9 mil
Aperture (q12)	0, 4 ... 20 mils (0 corresponds to automatic)
ECC level (q14)	200
Height (q15)	0 ... 9.99 inch
Width (q16)	0 ... 9.99 inch
Angle (q17)	0 ... 360°

[1] Only with QR codes

3.2.10.3 Standard report for ISO/IEC 29158:2011

Table 3-15   Output parameters: ISO/IEC 29158:2011

Field name (String input)	Value
Verification type (Qt)	1 If the exposure settings do not conform to the standard or uncalibrated verification is active: B
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 ... 0
Reference decode grade (Q7)	4 ... 0
Cell contrast grade (Q1)	4 ... 0
Cell contrast (q1)	0 ... 100
Axial non-uniformity grade (Q2)	4 ... 0
Axial non-uniformity (q2)	0.00 ... 1.00
Grid deviation grade (Q3)	4 ... 0
Grid deviation (q3)	0.00 ... 1.00

Field name (String input)	Value
Unused error correction grade (Q4)	4 ... 0
Unused error correction (q4)	0.00 ... 1.00
Fixed pattern damage grade (Q5)	4 ... 0
Format damage grade (Q60) [1]	4 ... 0
Version damage grade (Q61) [1]	4 ... 0
Cell modulation grade (Q6)	4 ... 0
Minimum reflectance grade (Q8)	4 ... 0
Minimum reflectance (q8)	0 ... 100
Print growth X (q9)	-100 ... 100
Print growth Y (q9)	-100 ... 100
Cell size (q10)	0 to 99.9 mil Uncalibrated verification: Output in pixels [px]
Current average gray scale value (q11)	0 ... 255
Aperture (q12)	0 ... 999
Percentage aperture value (q13)	50, 80, 0
ECC level (q14)	200
Height (q15)	0 to 9.99 inches Uncalibrated verification: Output in pixels [px]
Width (q16)	0 to 9.99 inches Uncalibrated verification: Output in pixels [px]
Angle (q17)	0 ... 360°

[1]   Only with QR codes

3.2.10.4   Standard report for AS9132 A

Table 3-16   Output parameters: AS9132 A

Field name (String input)	Value
Verification type (Qt)	3 If the exposure settings do not comply with the standard: D
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 ... 0
Module size offset grade (Q20)	4, 3, 0
Module size offset 1 (q20)	0 ... 99.9
Module size offset 2 (q20)	0 ... 99.9
Module center offset grade (Q19)	4, 3, 0
Module center offset 1 (q19)	0 ... 99.9
Module center offset 2 (q19)	0 ... 99.9
Angle of distortion grade (Q22)	4, 3, 0
Angle of distortion (q22)	-45 ... 45
Ovality grade (Q23)	4, 3, 0
Ovality (q23)	0.00 ... 99.9

Field name (String input)	Value
Module fill X (q9)	0 … 200
Module fill Y (q9)	0 … 200
Contrast (q1)	0 … 100
Nominal module size (q10)	0 … 99.9 mil
ECC level (q14)	200
Height (q15)	0 … 9.99 inch
Width (q16)	0 … 9.99 inch
Angle (q17)	0 … 360°

3.2.10.5   Standard report for Siemens DPM

Note

Grades and evaluations in the standard report for Siemens DPM

The standard report for Siemens DPM only contains the grades and evaluations whose quality characteristics are activated in the WBM.
With the default setting, activated quality characteristics include all characteristics except for "Symbol contrast" and "Cell size".

Table 3-17   Output parameters: Siemens DPM

Field name (String input)	Value
Verification type (Qt)	5 If the exposure settings do not comply with the standard: F
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 … 0
Contrast grade (Q1)	4 … 0
Contrast (q1)	0 … 100
Axial non-uniformity grade (Q2)	4 … 0
Axial non-uniformity (q2)	0.00 … 1.00
Unused error correction grade (Q4)	4 … 0
Unused error correction (q4)	0.00 … 1.00
Cell modulation grade (Q6)	4 … 0
Cell modulation 1 (q6)	0 … 100
Cell modulation 2 (q6)	0 … 100
Print growth grade (Q9)	4 … 0
Print growth X (q9)	-100 … 100
Print growth Y (q9)	-100 … 100
Cell size grade (Q10)	4 … 0
Cell size (q10)	0.0 … 99.9 mil
Center offset grade (Q19)	4 … 0

Field name (String input)	Value
Center offset (q19)	0.0 ... 99.9
Size offset grade (Q20)	4 ... 0
Size offset (q20)	0.0 ... 99.9
Border match grade (Q21)	4 ... 0
Border match (q21)	0 ... 100
Angle of distortion grade (Q22)	4, 3, 0
Angle of distortion (q22)	-45 ... 45.0
ECC level (q14)	200
Height (q15)	0 ... 9.99 inch
Width (q16)	0 ... 9.99 inch
Angle (q17)	0 ... 360°

3.2.10.6 Standard report for ISO/IEC 15416:2000

The verification report for barcode verification according to ISO 15416 is significantly larger than the reports of other standards because the results are output separately for each of the 10 scan lines.

With a standard report (%V), the values are output sorted according to scan lines. This means that the fields "Entire scan line", "Edge detection", "Minimum reflectance grade", "Maximum reflectance value", ... are first output for the scan line 1, followed by the same fields for scan line 2, etc.

The "Verification type" to "Overall quality" and "Module size " to "Angle" fields are output only once in the standard report either at the very beginning or at the very end.

In an individually formatted verification report, the fields are sorted according to scan lines as long as they follow each other directly without a separator in the formatting instruction.

Example

- "%Qt;%Q24%Q25" generates a report in the form:
  Verification type;\r10 x [Overall scan line; Edge detection grade\r];

- "%Qt;%Q24;%Q25" generates a report in the form:
  Verification type;\r10 x [Overall scan line \r]; 10 x [Edge detection grade\r];

Table 3-18   Output parameters: ISO/IEC 15416:2000

Field name (String input)	Value
Verification type (Qt)	6 If the exposure settings do not comply with the standard: G
Status (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality grade (Q0)	4 ... 0
Overall quality (q0)	4.0 ... 0.0
Overall scan line (Q24)	10 values: 4 ... 0
Edge determination grade (Q25)	10 values: 4 ... 0

Field name (String input)	Value
Reference decode grade (Q7)	10 values: 4 … 0
Minimum edge contrast grade (Q26)	10 values: 4 … 0
Minimum edge contrast (q26)	10 values: 0 … 100
Minimum reflectance grade (Q8)	10 values: 4 … 0
Minimum reflectance value (q8)	10 values: 0 … 100
Symbol contrast grade (Q1)	10 values: 4 … 0
Symbol contrast (q1)	10 values: 0 … 100
Modulation grade (Q6)	10 values: 4 … 0
Modulation (q6)	10 values: 0.00 … 1.00
Defects grade (Q27)	10 values: 4 … 0
Defects (q27)	10 values: 0.00 … 1.00
Decodability grade (Q28)	10 values: 4 … 0
Decodability (q28)	10 values: 0.00 … 1.00
Maximum reflectance value (q18)	10 values: 0 … 100
Start quiet zone (q29)	10 values: 0.00 … 10.00
Stop quiet zone (q30)	10 values: 0.00 … 10.00
Nominal module size (q10)	0 to 99.9 mil
Aspect ratio 1 (q31)	1.00 … 5.00
Aspect ratio 2 (q32)	1.00 … 5.00
Aspect ratio 3 (q33)	1.00 … 5.00
Height (q15)	0 to 9.99 inches
Width (q16)	0 to 9.99 inches
Angle (q17)	0 … 360°

3.2.10.7 Standard report for DotCode

Table 3-19   Output parameters: DotCode

Field name (String input)	Value
Verification type (Qt)	9
Evaluation (Qs)	3 (Good), 2 (Fair), 1 (Poor)
Overall quality (Q0)	4 … 0
Contrast grade (Q1)	4 … 0
Contrast (q1)	0 … 100%
Grid deviation grade (Q3)	4 … 0
Grid deviation (q3)	0.00 … 1.00
Unused error correction grade (Q4)	4 … 0
Unused error correction (q4)	0.00 … 1.00
Print growth grade (Q9)	4 … 0
Print growth (q9)	0.00 … 1.40
Cell size grade (Q10)	4 … 0
Cell size (q10)	0.0 … m.n pixels

3.2.10.8   Standard report for Locator

The standard report uses locator grades when "Recognize object" program steps are used.

Table 3-20   Output parameters: Locator

Field name (String input)	Value
Verification type (Qt)	8
Match (q50)	0 … 100
Conformity (q51)	0 … 100

Combination of program steps

Note the following points when you use "Read code" program steps as well as the "Recognize object" program steps in a program:

- The standard report belonging to the selected verification standard or, for "Uncalibrated", to the read code type, is used.

- The OCR/locator grades can also be output via the relevant String inputs.

3.3   Object recognition with PAT Genius

Definition

The term "object recognition" describes methods for identifying a known object within an object space using optical, acoustic or other physical recognition processes. The presence of an object and its position and orientation are determined in an image or section of the image.

Optical recognition process PAT Genius

PAT Genius is an optical recognition process for object recognition. Prior to recognition, the object is stored as a model in a so-called model library. With the help of this model, the object can then be searched for and recognized in the image.

Application

Object recognition is a function often required in industrial image processing. With PAT Genius object recognition, the SIMATIC MV500 reader has a very extensive, powerful and flexible image processing library.

3.3.1 PAT Genius object recognition

As of firmware V2.1, PAT Genius object recognition can be integrated seamlessly into the existing operator control and application concept of the SIMATIC MV500 optical readers.

- For objects to be recognized, you can create so-called models in the WBM of the reader ("Program > Recognize object"). These models are stored in a model library that can be used in all steps of a program.
  In compatibility mode, a model library can also be used for multiple programs.
  Depending on their size, several models and also very different objects can be stored in each model library.

- With the license-free version of the locator ("Locator light"), simple applications with a reduced scope of functions can be created. For example, only one model can be created per program step.

- In one program, up to twelve object recognition steps can activate different models of a model library. This means that a single program can flexibly implement a task that can be divided into a maximum of twelve subtasks. The subtasks can be very different and versatile. You can find detailed information on this in the section "Performance features of PAT Genius object recognition (Page 82)".

- Apart from the normal functions for object recognition such as determining the object position, angle of rotation and quality, the PAT Genius algorithm has the following properties:

  - Invariance (= insensitivity) to size scaling (selectable range)

  - Very high accuracy

  - Simultaneous recognition of up to 200 instances of one or more models in one step

  - Simultaneous search for different models

  - Important for classification tasks: Very good selectivity even with very similar objects.

- By means of comparisons with desired specifications in the form of the processing result when saving the program, even complex presence checks can be created very quickly and simply.

- A preview function is available in the "Recognize object" program steps. At all times, the preview function provides feedback about the effects of the currently active settings.

- The very flexible parameter assignment of the result output using format tags also provides many options for representing the object recognition results. This means that results that are important for your application can always be transferred to the process.

3.3.2 Performance features of PAT Genius object recognition

Requirements for using the PAT Genius license

> **Note**
>
> **No PAT Genius license necessary for tracking search ROIs**
>
> To use locator results for tracking search ROIs with "ROI-oriented", no PAT Genius license is necessary.

- SIMATIC MV500 optical reader

- Firmware as of version V2.1

- A PAT Genius license was transferred to the optical reader (see section "Transferring optional licenses (Page 138)")

- The setting "Use license-free version" ("Options > Extras > PAT Genius") has been disabled.

Performance features

PAT Genius object recognition is based on fully developed, powerful and versatile implementation on the reader. This means that many extremely different tasks can be solved. The most important performance features of PAT Genius object recognition are:

- Precise location of objects in the image, output or checks for:
  - Position
  - Angle of rotation
  - Scaling
  - Quality
  - Number
  - Object class
- Identification (classification)
  - Reliable distinction of similar objects
  - OK/N_OK distinction
  - Tracking function e.g. for OCR
  - OCR for any symbol
  - Presence check
  - Complex check for completeness
  - Flexible combination of up to twelve subtasks

3.3.3 Examples of object recognition tasks with Pat-Genius

The following examples illustrate which object recognition tasks can be implemented with the Pat-Genius license.

Examples of locating objects
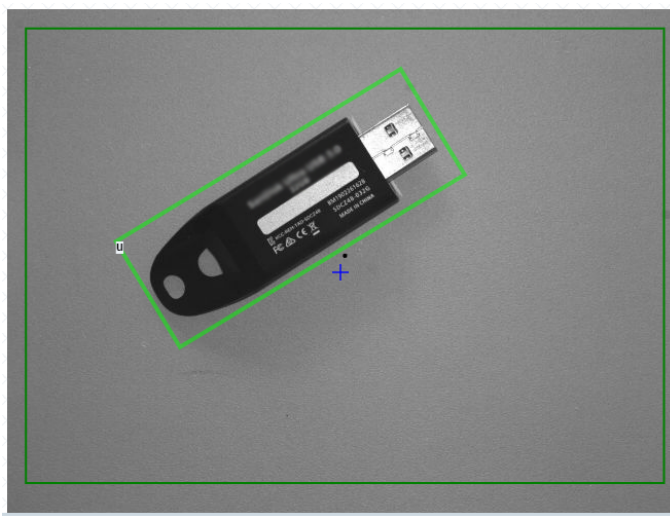
Figure 3-10   Locating a USB stick including position output based on the shape
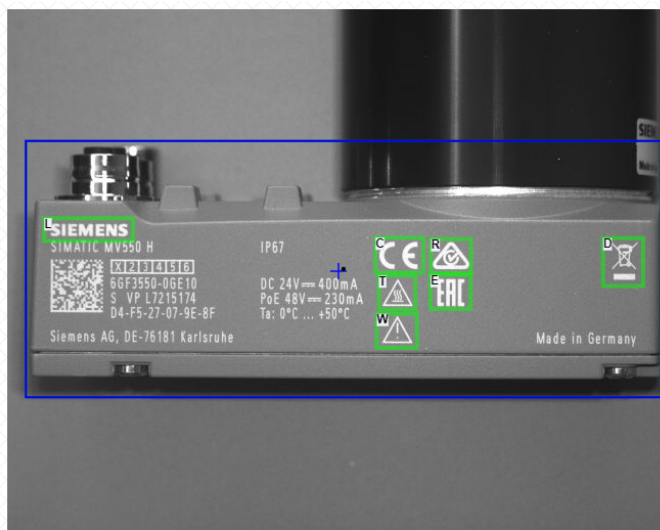
Figure 3-11   Locating logos and symbols

Examples of identification (classification)
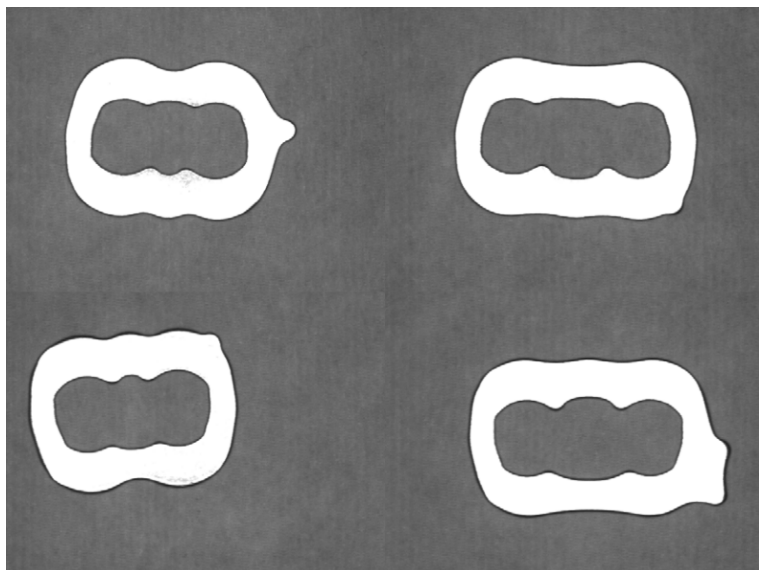
Figure 3-12   Template of chain link variants that need to be reliably identified
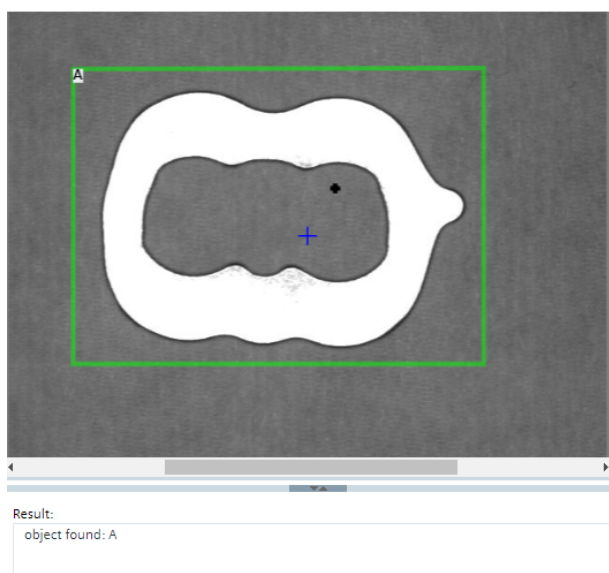
Figure 3-13   Reliable identification of a chain link with result
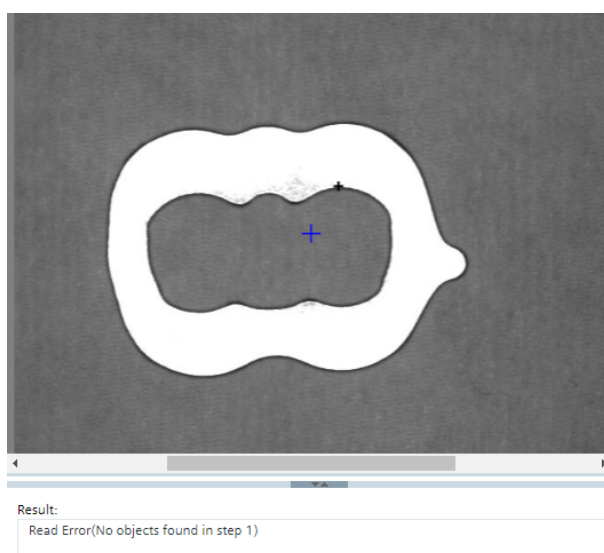
Figure 3-14   Unidentified chain link (N_OK) due to mirrored arrangement

Examples of OCR for random symbols

Figure 3-15   Recognition of random symbols

Figure 3-16   Recognition of Chinese characters

Example of a presence check
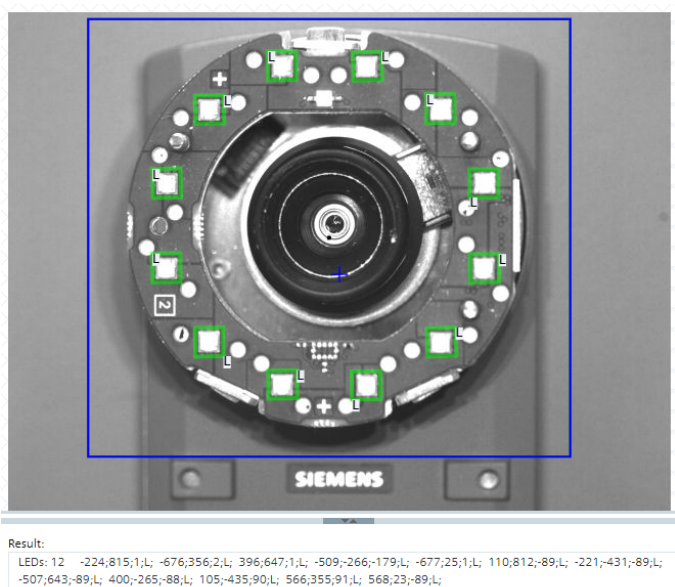
Figure 3-17   Presence check of LEDs including position output

3.3.4   Operation

Object recognition with PAT Genius is realized by inserting the step of the "Insert 'Recognize object' step" type.

For a detailed description of the parameters and possible values, refer to the online help.

3.3.5 Quality features during object detection

Fast feedback on the reliability of the object recognition

To obtain fast feedback about the reliability of the object recognition, diverse quality characteristics are calculated with activated results formation. The values of the object evaluated worst are always displayed. To view the quality characteristics of individual objects, you can move the mouse over the respective model in the image display. The following quality characteristics are available:

Table 3-21   Quality characteristic of object recognition

Quality characteristic	Value output
Conformity (LFI)	The output value indicates the normalized, average deviation from matched model features and the currently found features of the object instance. • A value of 100 means an average deviation of zero. • Accordingly, the value 0 signifies: No match.
Match (LMA)	The output value indicates the proportion of matched model features (edges). • A value of 100 means that 100% of the required model features were successfully matched. • A value of 0 means that none of the required model features were matched.
Clear percentage (LCL)	The output value describes the clear percentage of the instance. • A value of 100 means that the found object instance is free of disturbances. **Note** This value is calculated only if "Minimum clear percentage" is activated in the "Recognition" group of the relevant "Recognize object". Otherwise, the value 100 is output.

Quality characteristic	Value output
Rotation tolerance (LRT)	The output value describes the adherence to the limit value set for rotation deviation. • A value of 100 means that the rotation of the found object instance corresponds exactly to the stored rotation. • A value of 0 means that the angle deviation was well off target (but not exceeded). **Note** This value is calculated only if "Max. angle deviation" is activated in the "MATCH" tab of the relevant "Recognize object". Otherwise, the value 100 is output.
Position tolerance (LPT)	The output value describes the adherence to the limit value set for position deviation. • A value of 100 means that the position of the found object instance corresponds exactly to the stored position. • A value of 0 means that the position deviation in the x or y direction was well off target (but not exceeded). **Note** This value is calculated only if "Max. position deviation" is activated in the "MATCH" group of the relevant "Recognize object". Otherwise, the value 100 is output.

Table 3-22   Assignment of the numeric evaluation of locator to the quality levels

Grade	4	3	2	1	0
Conformity (LFI)	≥ 84	≥ 63	≥ 42	≥ 21	< 21
Match (LMA)	≥ 84	≥ 63	≥ 42	≥ 21	< 21
Clear percentage (LCL)	≥ 84	≥ 63	≥ 42	≥ 21	< 21
Rotation tolerance (LRT)	≥ 84	≥ 63	≥ 42	≥ 21	< 21
Position tolerance (LPT)	≥ 84	≥ 63	≥ 42	≥ 21	< 21

3.4 Options for image acquisition and image processing

Image acquisition options

The image acquisition options of the optical reader were developed for a wide range of applications.

There are three different ways of controlling image acquisition and processing:

• Individual trigger

• Auto-trigger

• Scan

Architecture of the internal processing sequence

The principle underlying the processing performed by the optical reader is a buffered processing method in three steps:

- Image acquisition (including recording buffer)
- Decoding (including result buffer)
- Result output

Between each processing step, the optical reader has a buffer and you can configure the size of the buffer depending on the application.

This allows the ideal throughput to be achieved in every processing step, resulting in the maximum overall throughput for the optical reader and flexible application.

3.4.1   Image acquisition option "Individual trigger"

How it works

With this setting, one image is acquired per trigger followed by one read.

If several objects need to be acquired in a very short time, acquired images can be buffered before they are processed.

To allow this, image acquisition with up to 50 images can be buffered and the image buffer size can be set.

The optical reader transfers the results of the reads as soon as it has processed them.

"Image buffer size = 1" setting

If the buffer size is set to the value 1, this mode corresponds to a sequential processing chain:

Trigger → Image acquisition → Decoding/processing → Result transfer.

New triggering can be performed only when the decoding/processing has been completed.
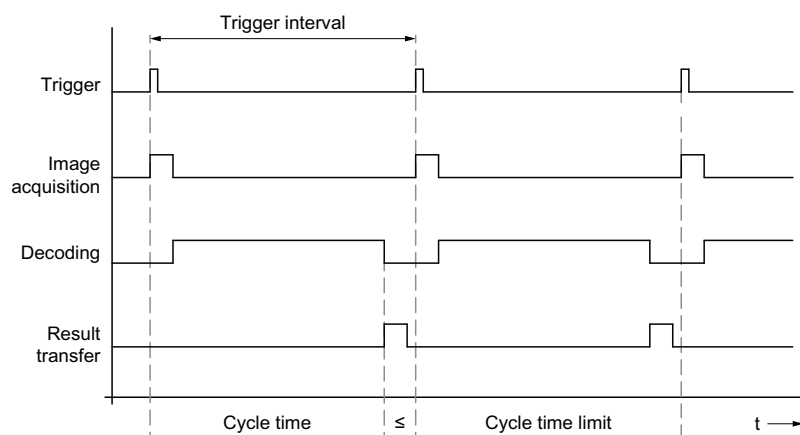
Figure 3-18   Time diagram: Individual trigger with image buffer size = 1

"Image buffer size > 1" setting

With image buffer sizes greater than 1, intermediate buffering takes place between image acquisition and processing and between processing and result output.

Image acquisition can at times be performed in a faster sequence and processing can also buffer results briefly prior to transfer. This allows brief periods of peak load to be handled.
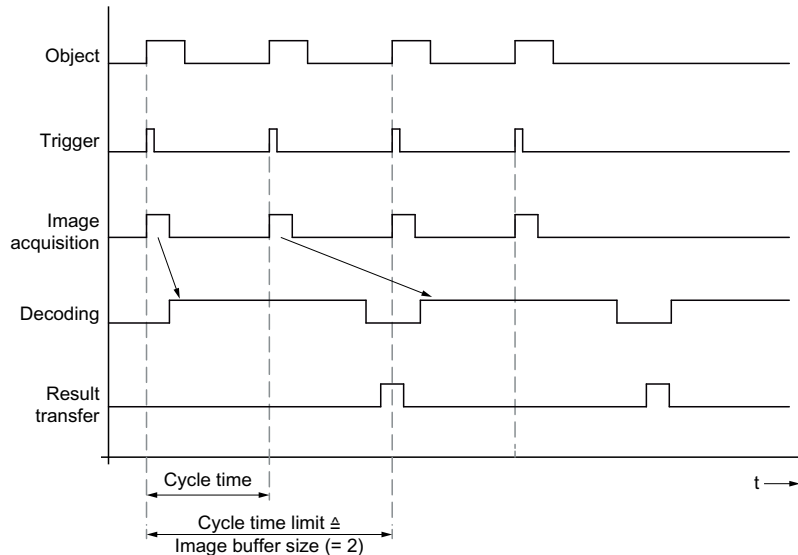
Figure 3-19   Time diagram: Individual trigger for image buffer size > 1; in the example: Image buffer size = 2

3.4.2   Image acquisition option "Auto-trigger"

How it works

With this setting, codes entering the viewing field of the optical reader are read automatically. In this case, the optical reader does not require any external trigger signals, for example from a light barrier.

This option is particularly useful for the following objects for which accurate triggering via a light barrier is difficult.

The "Auto-trigger" option works on a step-for-step basis. The acquired images are decoded in the same clock cycle. The "Auto-trigger" option can therefore be used continuously without any time limit.
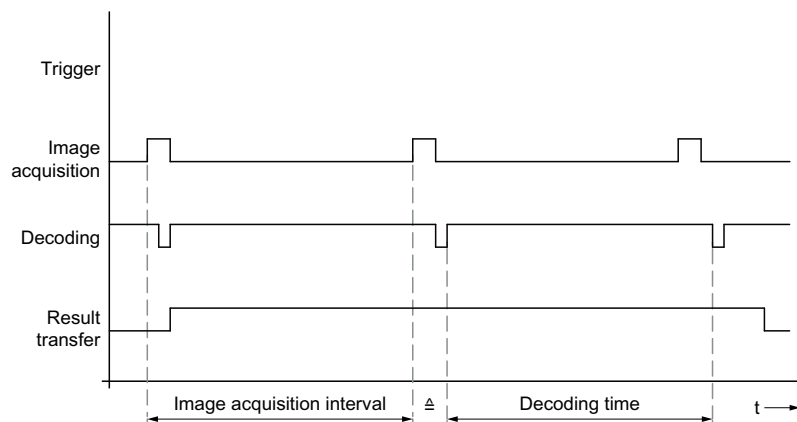
Figure 3-20   Time diagram: Auto-trigger

Auto-trigger with initial trigger and timeout

To optimize the power used by this function, the monitoring can be started by an initial trigger and can then terminate itself after a selectable time (timeout) or at a falling trigger edge. Rising trigger edges after the procedure has started are ignored until the result has been transferred.

In the following example, images are acquired by the trigger until an image has been recognized and decoded, or until the timeout stops image acquisition.

①	Trigger initiates the operation.
②	Trigger signal is ignored.
a	Image acquisition time
b	Image acquisition interval
c	Limit of the decoding time
🔴	No code found.
🟩	Code found.
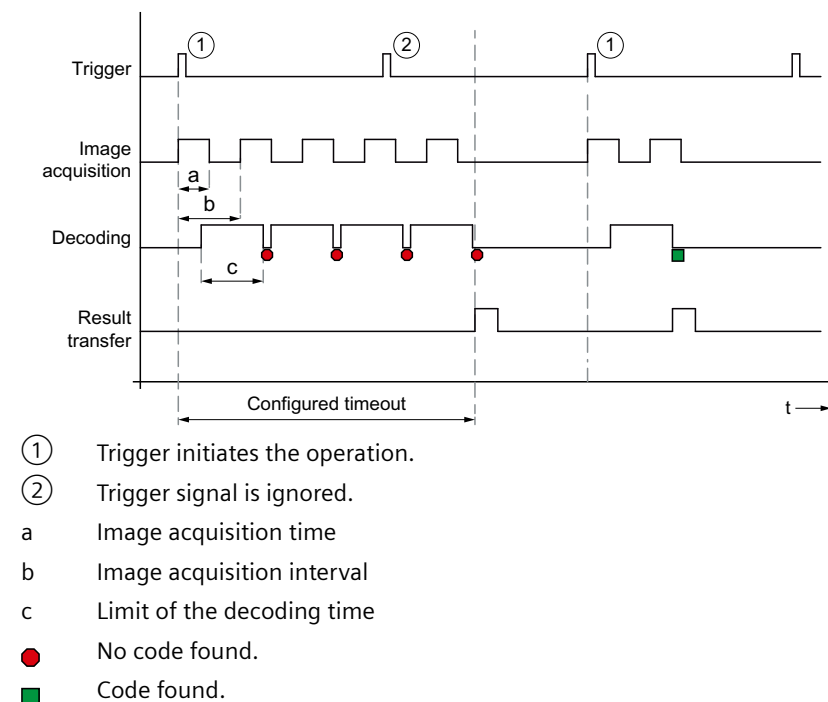
Figure 3-21   Time diagram: Auto-trigger with initial trigger and timeout

Note

Duration of image acquisition interval and decoding time

Note that the image acquisition interval (b) is always the same length as the decoding time limit (c).

Number of acquired images = {(Timeout/Acquisition interval) - 1}

Auto-trigger edge-triggered with timeout

In the following example, images are acquired with a rising edge of the trigger until an image can be recognized and decoded, or until the timeout stops image acquisition.

①	Trigger initiates the operation.
②	Trigger signal is ignored.
a	Image acquisition time
b	Image acquisition interval
c	Limit of the decoding time
🔴	No code found.
🟩	Code found.
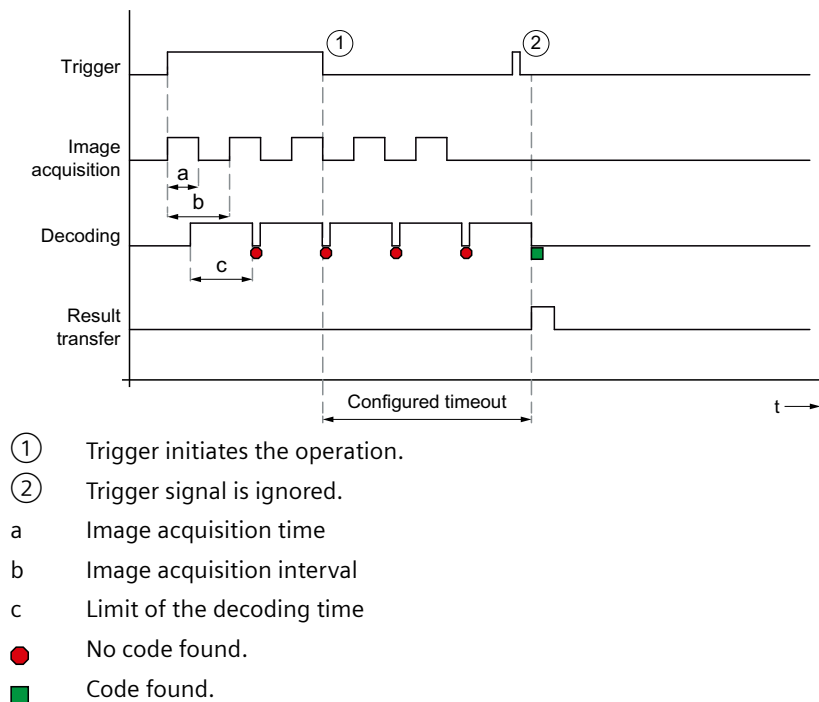
Figure 3-22   Time diagram: Auto-trigger with the "edge-triggered start/stop" option

Note

Duration of image acquisition interval and decoding time

Note that the image acquisition interval (b) is always the same length as the decoding time limit (c).

Number of acquired images = {(Timeout/Acquisition interval) - 1}

3.4.3 "Scan" image acquisition option

How it works

With this setting, the optical reader is suitable for scanning codes located, for example, on a rotating axle.

In contrast to the "Auto-trigger" option, acquired images can also be buffered and processed later. Only one code is read per trigger signal. The code must be fully visible in one of the acquired images.

If a code is not decodable in any of the acquired images, an "N_OK" read is output.

With the default settings, with first read success following triggering, the read result is output and further processing of the scan sequence is exited. Using the "Communication > Extras > Program sequences" function, you can change this behavior as follows:

- All configured image acquisitions are taken and processed by selecting the result output "Best read result". Following this, the qualitatively best read result is output.

- If you select "All read results", all the configured image acquisitions are taken and processed, and all successfully processed image acquisitions are output.

By using the "Edge-triggered start/stop" option, you can adapt the image acquisition sequence dynamically to your process using a trigger signal.

①   Trigger initiates the operation.
②   Trigger signal is ignored.
a   Image acquisition time
b   Image acquisition interval
c   Limit of the decoding time
🔴   No code found.
🟩   Code found.
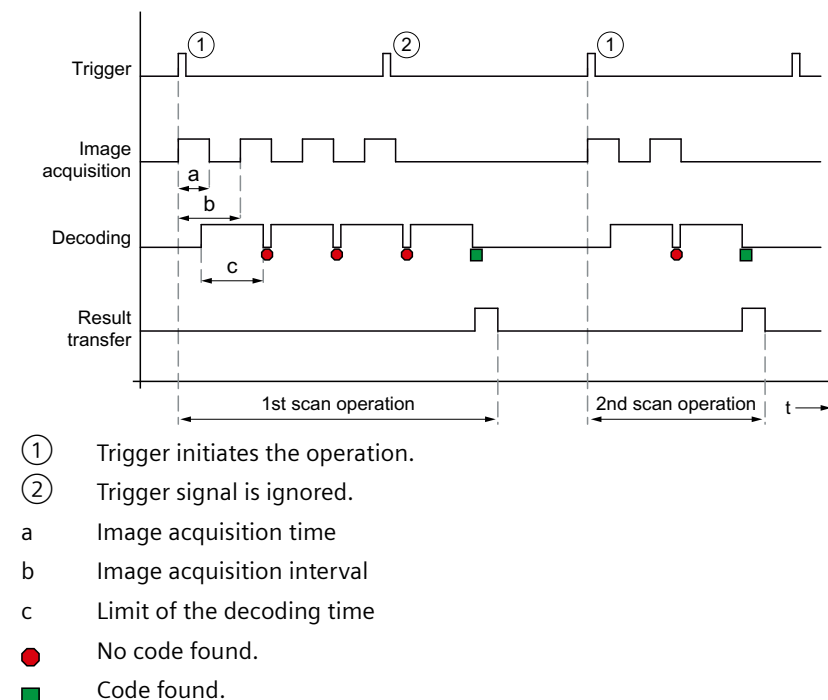
Figure 3-23   Time diagram: Scan with multiple trigger signals

①   Trigger initiates the operation.

②   Trigger signal is ignored.

a   Image acquisition time

b   Image acquisition interval

c   Limit of the decoding time

🔴   No code found.

🟩   Code found.
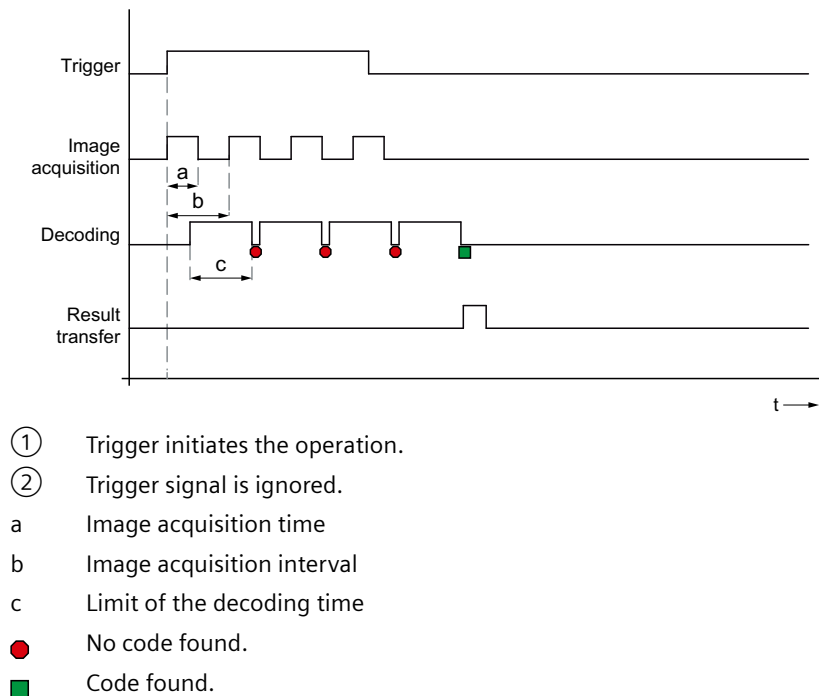
Figure 3-24   Time diagram: Scan with the "Edge-triggered start/stop" option

3.4.4   Image acquisition in program sequence mode

How it works

You can enable the "Program sequence" option under "Options > Extras". With this option, you can evaluate several image acquisitions with different image settings for each trigger, if, for example:

- Objects have a very large dynamic range in terms of contrast and reflectance, that cannot be covered with one image acquisition setting.

- Codes or plain text must be searched for and read at different, defined positions.

- Multiple (different) processing procedures (for example, with different program settings) are to be performed for each object.

- The number of definable program steps of an individual program is not sufficient.

Processing attempts

In "Program sequence" mode, processing is attempted with up to five saved codes for each trigger. With the default setting, a separate image is acquired and evaluated with the settings saved in this program for each program in the program sequence. Following the first successful processing, processing of the trigger is stopped and the result is output.

Each evaluated program uses the cycle time limit specified in this program. The maximum cycle time for the complete program sequence thus corresponds to the sum of the maximum cycle times of the activated programs.

"Best read result" and "All read results" settings

In program sequence mode, as with the image acquisition option "Scan", you can use the "Best read result" and "All read results" settings.

Differences between "Best read result" and "All read results" settings:

- If you select "Best read result", a processing attempt is always made with all activated programs. All successful evaluations are compared based on a selectable quality criterion. The qualitatively best result is output.

- If you select "All read results", a processing attempt is also made with all activated programs. All successful evaluations are output.

Same image settings for all programs to be evaluated

If you want the same image settings to be used for all programs to be evaluated, you can also activate the "Use 1st image" option. In this case, only one image acquisition is made for each trigger. The settings of the program in the program sequence that has the lowest number are used. The image acquired is then used for processing for all programs in the program sequence.

3.4.5 Simple comparison for Track&Trace (MATCH mode/command)

Note

MATCH command not suitable for changing during production

The MATCH command is not suitable for switching during ongoing production.

The match string can already be pre-defined for non-complex match tasks when saving the program. For a simple MATCH command, this can be done by a connected controller or a PC.

MATCH is available via the interface for PROFINET (Ident), TCP, RS232 and communication module. The MATCH command and its structure are described in detail in the section "Process interfacing via an automation system (PLC, PC) (Page 149)".

Static match default when saving a program

For applications in which the match default is already known during commissioning, the match can be defined and activated when the program is saved. You can enable the comparison mode for 1D/2D codes in the "Compare" drop-down list from the "Program > Decoder > MATCH" menu in the WBM.

Simple comparison default by the connected controller/PC

The use of the MATCH command it is practical if, for example, the current date, the batch number or similar needs to be updated prior to the start of production. The MATCH command can be sent to the optical reader via the interface for PROFINET (Ident), TCP, RS232 and communication module.

The match string received by the optical reader is valid as of the next trigger.

The sent match string remains valid:

- Until another match string is sent

- until processing mode is ended (for example by a fault)

If a further match string was sent and no processing was triggered in the meantime, the previously sent match string is overwritten.

When compare mode is enabled, a match string comparison is performed in the following cases:

- For single 1D/2D codes

- For each individual 1D/2D code (with multicode)

- For each OCR step

Logging the received match strings

If the received match strings are not deactivated, the match strings are logged in the diagnostics data records. With a suitable format text, used match strings can be output as the result string and also logged in the diagnostics data records.

Network and system integration

4

4.1 Overview

For the system configuration of the optical reader, you have the following system integration options for the acquisition and processing of recognition values via:

- PROFINET IO with FB 79 or Ident profile
- PROFINET IO with RF180C or RF185C/RF186C/RF188C
- PROFIBUS DP-V1 with ASM 456
- RS232 (combination interface)
- Ethernet interface (TCP/IP)
- SIMATIC S7-300 with ASM 475
- SIMATIC S7-1200 with RF120C
- SIMATIC ET 200M with ASM 475
- SIMATIC ET 200pro with RF170C
- Ethernet/IP with RFID 181EIP

Other possible combinations include:

- Optical reader and RFID reader on an ASM 456
- Image display via WinCC flexible
- Optical reader with external ring light

NOTICE

Operation in VLANs

Note that the optical reader cannot be operated in VLANs whose ID is ≠ 0.

NOTICE

Operation via PROFINET IO

Note that operation via PROFINET IO can only be performed via the "X1 LAN1" Ethernet interface.

NOTICE
Simultaneous use of both Ethernet interfaces with MV550/MV560
Note that both Ethernet interfaces "X1 LAN1" and "X2 LAN2" must be connected to physically separated networks if you want to use both interfaces at the same time. A purely logical separation using different subnets is not sufficient and can cause network problems in some cases.
This also applies to other devices that are connected to both networks and forward data packets from or for the MV550/MV560 from one of the networks to the other network.

4.2   System configuration via PROFINET/PROFIBUS with CM

① Optical sensor or light barrier (for trigger signal)

② Object with code
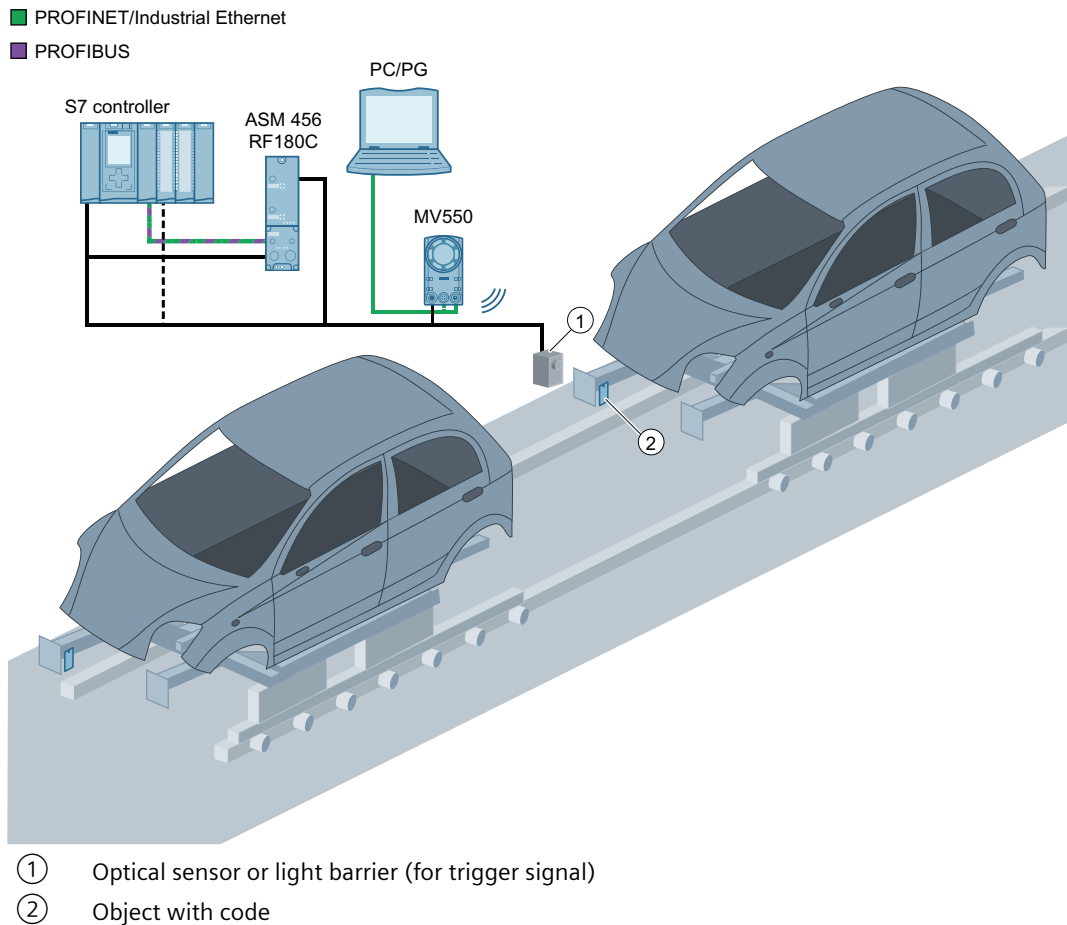
Figure 4-1   Example: System configuration via PROFINET IO/PROFIBUS DP-V1 with communication module

System characteristics

- The PROFINET/PROFIBUS connection is made via the CM interface of the optical reader and a communication module.

- PROFINET IO/PROFIBUS DP-V1 is connected to an S7 controller.

- The optical reader is controlled via PROFINET IO/PROFIBUS DP-V1 using the Ident profile block by the S7 controller.
- The result is output via PROFINET IO/PROFIBUS DP-V1 to the S7 controller.
- The optical reader is supplied with power via the communication module.
- The optical reader is triggered either via digital I/O, S7 controller or via the built-in auto-trigger function.
- A PC/PG is connected via the Ethernet interface to allow adjustment of the device.

4.3 System configuration of the optical reader as PROFINET IO device with switch and FB 79 or Ident profile

Note

Power supply using "Power over Ethernet" (PoE)

If the optical reader is supplied by PoE, for example when connected to a SCALANCE X108POE, the Power IO RS232 cable is not needed.

①   Optical sensor or light barrier (for trigger signal)

②   Object with code
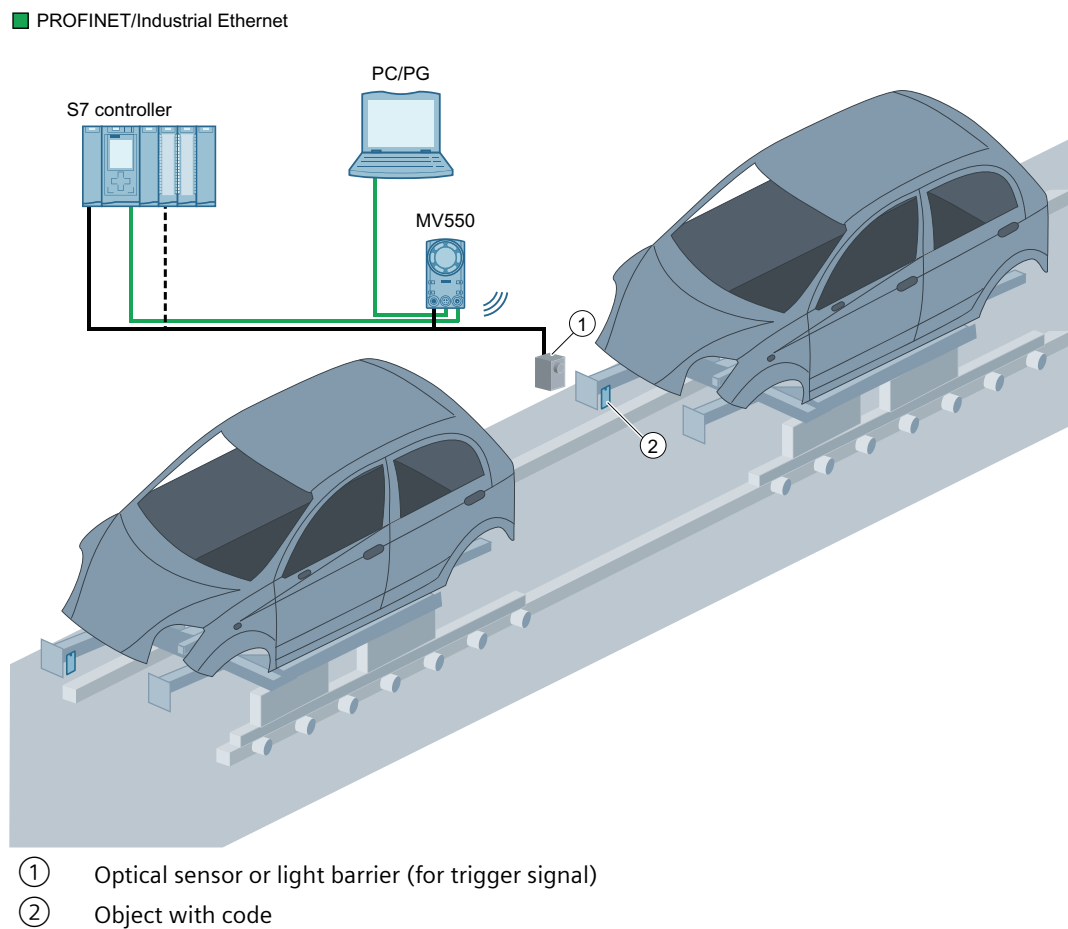
Figure 4-2   Example: System configuration of the optical reader as PROFINET IO device and FB 79 or Ident profile

System characteristics

- A connection to a PROFINET IO-capable S7 controller is established via Ethernet.

- The optical reader is controlled by the S7 controller.

- The result output of the test objects takes place via PROFINET IO to the S7 controller.

- The optical reader is triggered either via digital I/O, PROFINET or via the built-in auto-trigger function.

- A PC/programming device is connected via Ethernet for the adjustment procedure.

4.4 System setup via the Ethernet interface

Note

Power supply using "Power over Ethernet" (PoE)

If the optical reader is supplied by PoE, for example when connected to a SCALANCE X108POE, the Power IO RS232 cable is not needed.
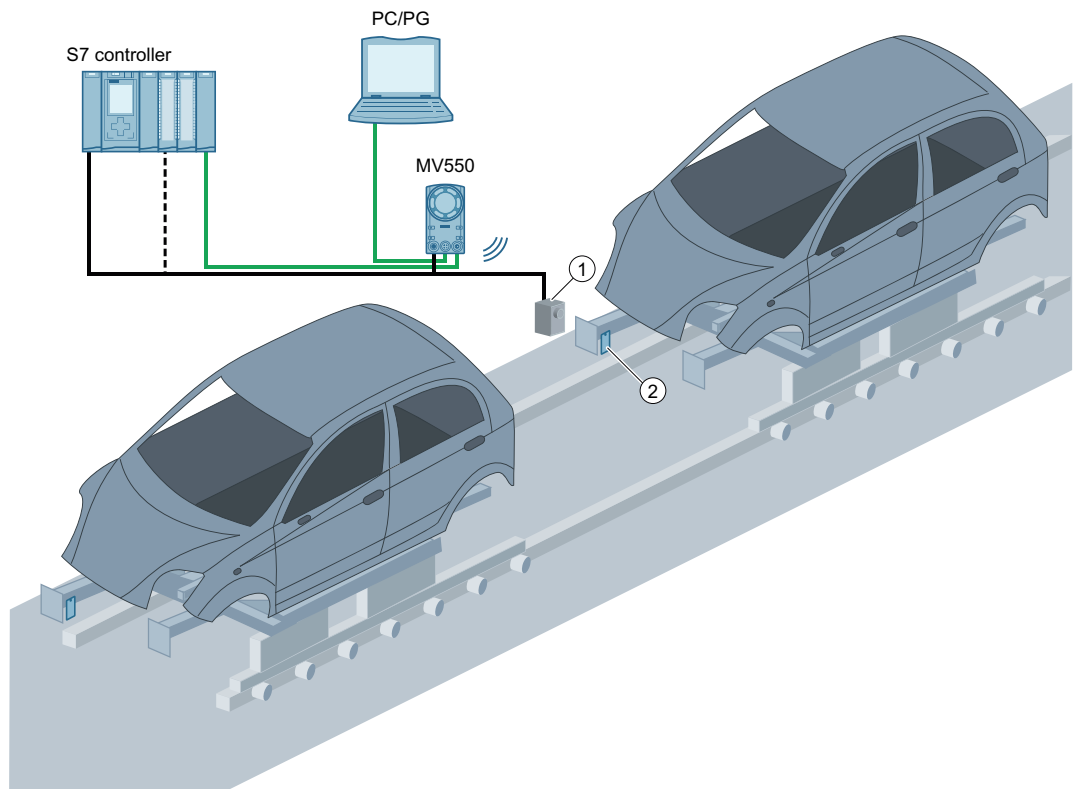
①   Optical sensor or light barrier (for trigger signal)
②   Object with code

Figure 4-3   Example: System configuration via the Ethernet interface

System characteristics

- The result output of the optical reader takes place via the Ethernet interface.

- The optical reader can be triggered via either:

  – Digital I/O

  – TCP/IP

  – The built-in auto-trigger function

- A PC/programming device is connected via Ethernet for the adjustment procedure.

4.5   System setup via the RS-232 interface

①   Optical sensor or light barrier (for trigger signal)
②   Object with code
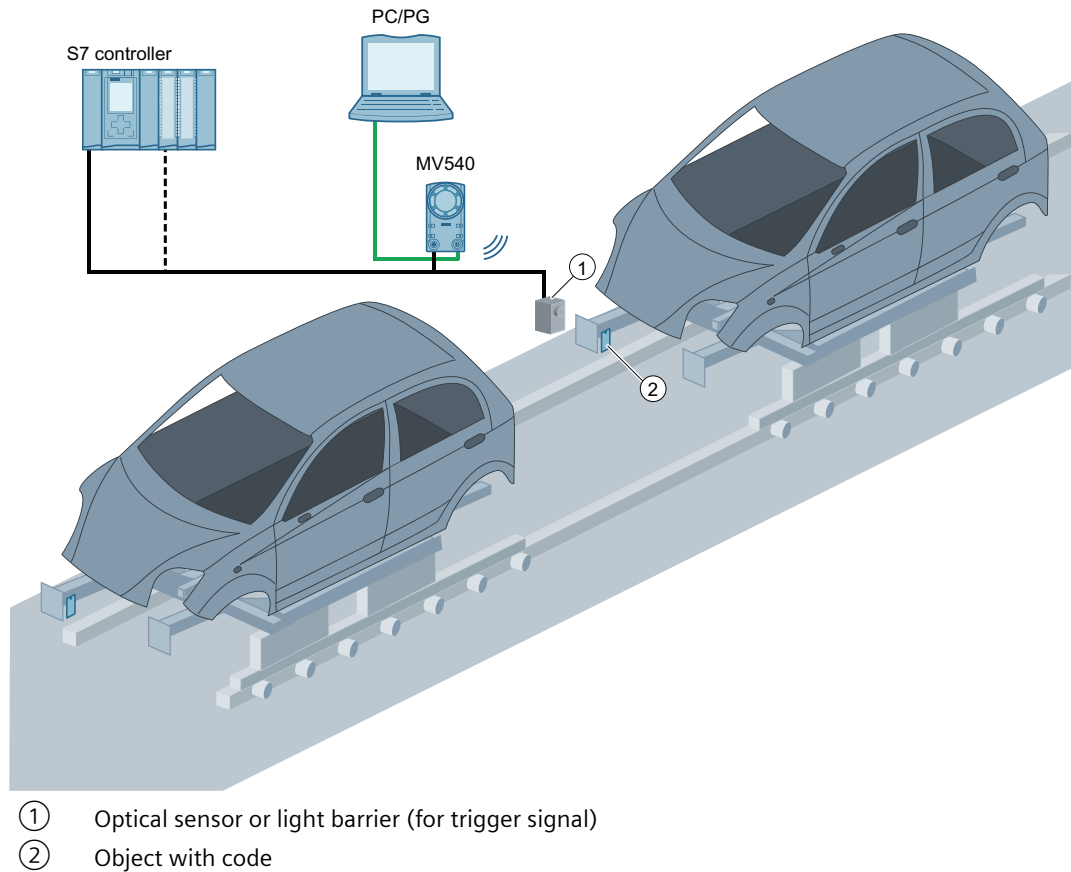
Figure 4-4   Example: System configuration via the RS232 interface

System characteristics

- The results of the optical reader are output to the controller via the RS232 interface.

- The optical reader is triggered either via digital I/O, RS232 or via the built-in auto-trigger function.

- A PC/programming device is connected via Ethernet for the adjustment procedure.

4.6 System configuration with CM and RFID reader

① Optical sensor or light barrier (for trigger signal)

② Object with code
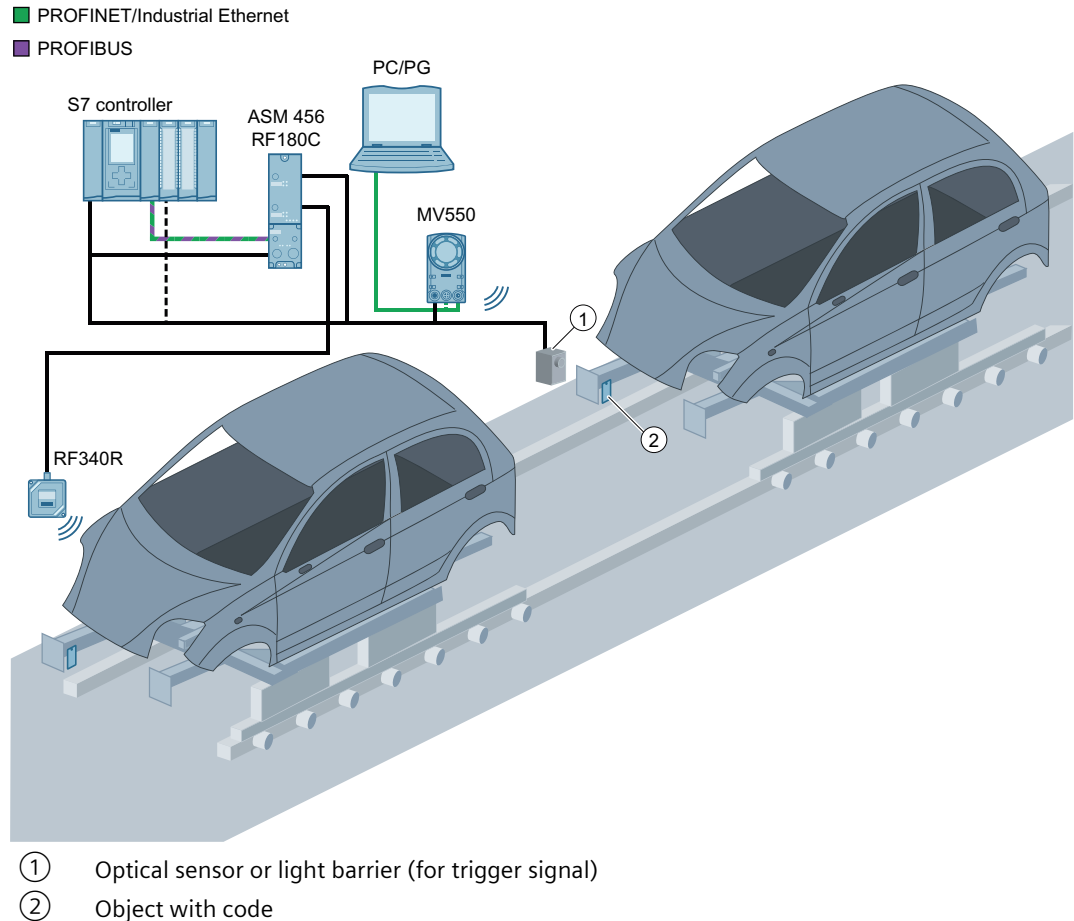
Figure 4-5 Example: System configuration of optical reader with RFID reader on a communication module

System characteristics

- In mixed operation with an RFID reader, e.g. from the SIMATIC RF300 series, the optical reader can be connected to a communication module and operated.

- Both the optical reader and the RFID reader are integrated in STEP 7 by the Ident profile block.

- A PC/programming device is connected via Ethernet to allow adjustment of the device.

4.7 System configuration with CM and auto-trigger
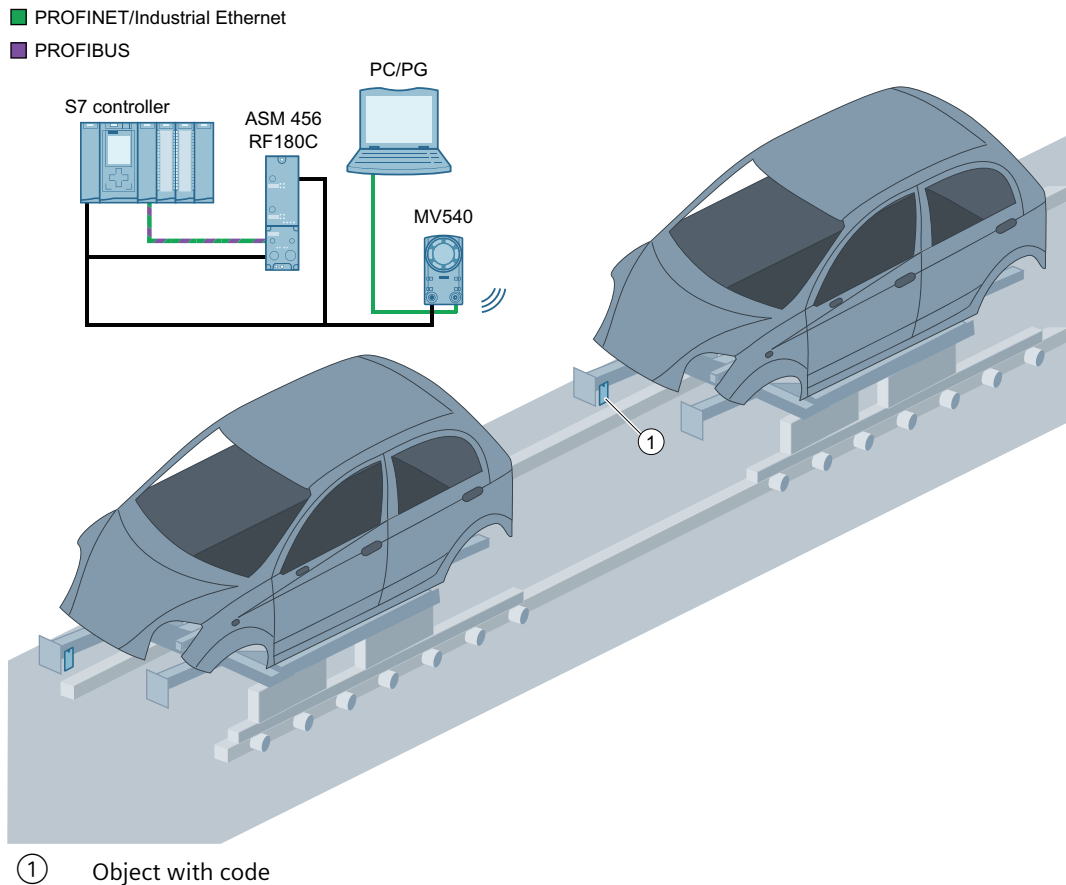
①   Object with code

Figure 4-6   Example: System configuration of optical reader with auto-trigger function

System characteristics

- Power supply and system integration are provided through a communication module or over Ethernet.

- To trigger the reader, no light barrier or similar must be installed. The triggering is performed in the optical reader itself, as soon as a readable code comes into the field of view of the optical reader (auto-trigger).

- A PC/programming device is connected via Ethernet to allow adjustment of the device.

4.8 System configuration with WinCC flexible / HTML browser
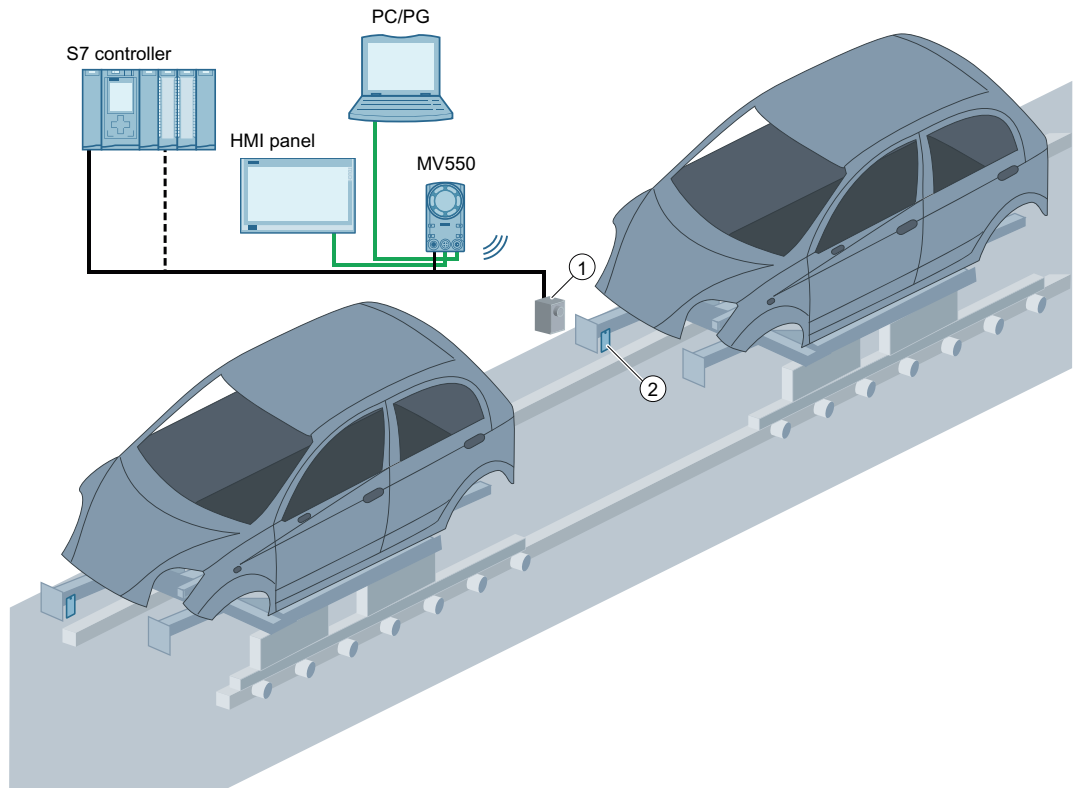
①   Optical sensor or light barrier
②   Object with code

Figure 4-7   Example: System configuration with WinCC flexible or HTML browser

System properties - WinCC flexible

- Visualization takes place via the Web pages of the optical reader, for WinCC flexible on a PC/PG with WinCC flexible or an HMI panel.

- The results of the optical reader are obtained and displayed by WinCC flexible via a connection to the S7 controller.

- A PC/programming device is connected via Ethernet to allow adjustment of the device.

System properties - HTML browser

- Visualization takes place via an HTML browser (e.g. Microsoft Internet Explorer) on a PC/PG, Panel PC or similar device.

- The optical reader can be monitored via the live image of the diagnostic pages, without the need for a Java VM on the PC/PG.

- A PC/programming device is connected via Ethernet to allow adjustment of the device.

You can find additional information about visualization with an HTML browser in the WBM online help.

4.9 System configuration with external ring light

The external ring lights do not require an additional power supply unit for the power supply. Power is supplied via the S7 controller using a corresponding adapter cable.

An external ring light can be controlled via the stroboscope signal of the optical reader. In this case, the ring light must be supplied with power by an external power supply.

4.10 Other system extensions

System integration via Ethernet/IP connection

System integration via Ethernet/IP connection is possible with the RFID 181EIP communication module.

Mounting

<div style="text-align: right">

5

</div>

5.1 Notes on installation

> **Note**
>
> **Creating optimal reading conditions**
>
> When you install the optical reader, make sure that the code to be read is visible to the optical reader with the best possible quality. You can optimally set up and align the reader using the WBM ("Program > Image acquisition").

When installing the reader, pay attention to the following points:

- The viewing angle to the code may vary between 40° to 90° and 80° to 90° depending on the code type.
  You can find more information on the viewing angle in the section "Performance characteristics when reading codes (Page 38)". You can find information on optimal setup and alignment of the reader in the section "Connecting and setting up the reader (Page 134)".

- Note that the mounting location and viewing angle may affect the readability of the code.

  - There must be as few reflections as possible in the code field.

  - The code field must be uniformly lit without shadows.

- Keep enough distance between the individual codes.

- The distance between a two-dimensional code and image border must be at least 2 cell widths (dot width or line width).

> ⚠️ **CAUTION**
>
> **Infrared radiation via built-in infrared ring light**
>
> Infrared radiation occurs when using the built-in ring light "6GF3540-8DA4x". Use appropriate shielding or eye protection. Do not look into the lamp for a long period during operation.

> **Note**
>
> **Premounted SIMATIC MV530 complete units**
>
> Note that the SIMATIC MV530 readers are premounted complete units. They are supplied with premounted lens, ring light and lens barrel and do not need to be assembled.

Reader components and their assembly

The optical readers are autonomous compact devices that need to be mounted in a suitable location and only require a lens, a power supply cable and a communications connection. The SIMATIC MV500 optical readers have threaded holes on the front and back, allowing flexible mounting options.

To provide lighting when reading the codes, you have several options available. The simplest and most space-saving option is a ring light that can be integrated in the protective lens barrel.

You also have the choice between the different lens types. You can use mini/FF lenses with fixed focal length and adjustable aperture/focus and EF lenses with adjustable focal length. The following describes mounting based on the ring light or lens used.

NOTICE
Compatibility of MV500 built-in ring light and MV440 protective lens barrel
Note that you may only use the MV500 built-in ring lights in conjunction with the SIMATIC MV500 optical readers and the protective lens barrel (article number 6GF3540-8AC11).
The protective lens barrels of the SIMATIC MV440 readers are not compatible with the SIMATIC MV500 readers in conjunction with the SIMATIC MV500 built-in ring light.

Selecting the components

It is important to select the appropriate components to suit the ambient conditions in which your optical reader is operated and the associated requirements of your reading environment. You can find more detailed information on this in section "Selection of suitable components (Page 281)".

5.2 Mounting with built-in ring light and mini/FF lens

⚠ CAUTION
Disconnecting SIMATIC MV500 from the power supply
Make sure that the power supply is switched off when installing/uninstalling the devices as well as the internal ring light, EF lens and micro SD adapter.

①	Lens	④	M2.5 hexagon socket-head screws (3x)
②	MV540 optical reader	⑤	Micro SD adapter
③	Right light / Ring light holder	⑥	Protective lens barrel

Figure 5-1   Setup of SIMATIC MV540 optical reader with built-in ring light, mini-lens and protective lens barrel

Proceed as follows to mount the SIMATIC MV540/MV550/MV560 optical reader with built-in ring light, mini/FF lens and protective lens barrel:

1. Remove the protective foil from the reader.

2. Mount the ring light/ring light holder ③.

   – Make sure that the ring light holder is aligned correctly and fully flush when it is mounted.

   – Fasten the ring light holder ③ with the three hexagon socket screws ④ onto the reader (≤ 0.45 Nm).

3. Screw the desired lens ① into the lens mount of the reader ②.

4. Insert the micro SD adapter ⑤ into the reader interface provided ②.
   If needed, insert a micro SD card into the adapter

5. If needed, replace the attachment of the built-in ring light.
   The attachments can be easily removed from the ring light or placed on it. Ensure that the attachment is correctly aligned.
   You can find detailed information on the ring light attachments in the following section.

6. Depending on the lens used, screw the appropriate protective lens barrel ⑥ onto the reader ③.
   Note: Depending on the lens/protective lens barrel used, a protective lens barrel extension may be needed.

7. Mount the reader on a suitable mounting fixture or holder (4x M4, 1-2 Nm).
   Use the mounting plate for SIMATIC MV500, the mounting bracket for MV500 or a mounting device with matching holes.
   Note that the reader has two different drilling templates (50 x 60/57 x 57).
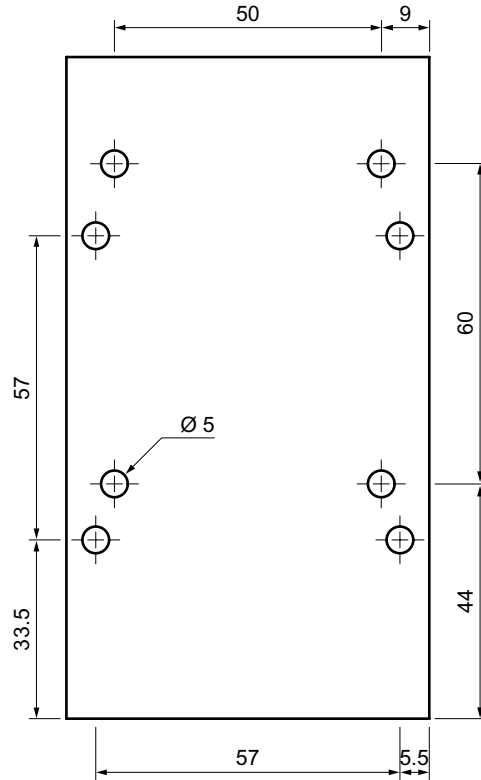
Figure 5-2   Drilling templates for mounting the SIMATIC MV500 optical reader

8. Select a suitable location to install the device.

5.3 Mounting with built-in ring light and EF lens

Mounting the optical reader in conjunction with an EF lens (Electronic Focus Lens) is done in two steps:

1. Disassembling the built-in ring light

2. Mounting the individual components

> ### ⚠ CAUTION
>
> **Disconnecting SIMATIC MV500 from the power supply**
>
> Make sure that the power supply is switched off when installing/uninstalling the devices as well as the internal ring light, EF lens and micro SD adapter.

Disassembling the built-in ring light
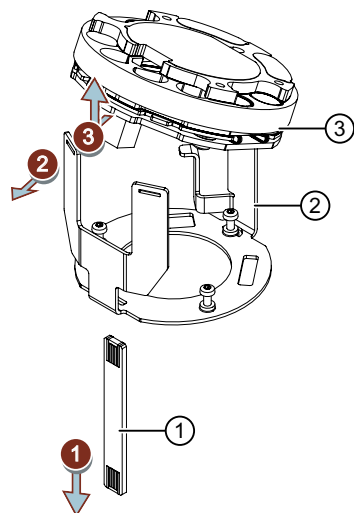
Figure 5-3   Disassembling the built-in ring light

Follow the steps below to disassemble the built-in ring light:

1. If necessary, remove the connection board ① from the ring light ③.

2. Loosen the ring light from the ring light holder by unhooking the ring light ③ from the ring light holder ②.

Mounting the individual components

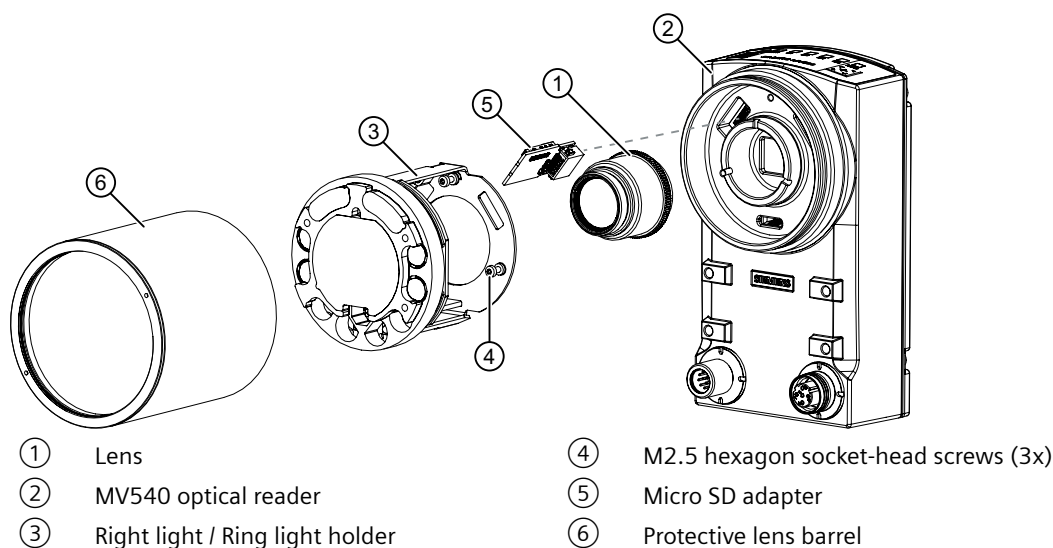| ①	Lens	⑤	Micro SD adapter
②	Ring light holder	⑥	Connection board
③	MV540 optical reader	⑦	Built-in ring light (including attachment)
④	M2.5 hexagon socket-head screws (3x)	⑧	Protective lens barrel
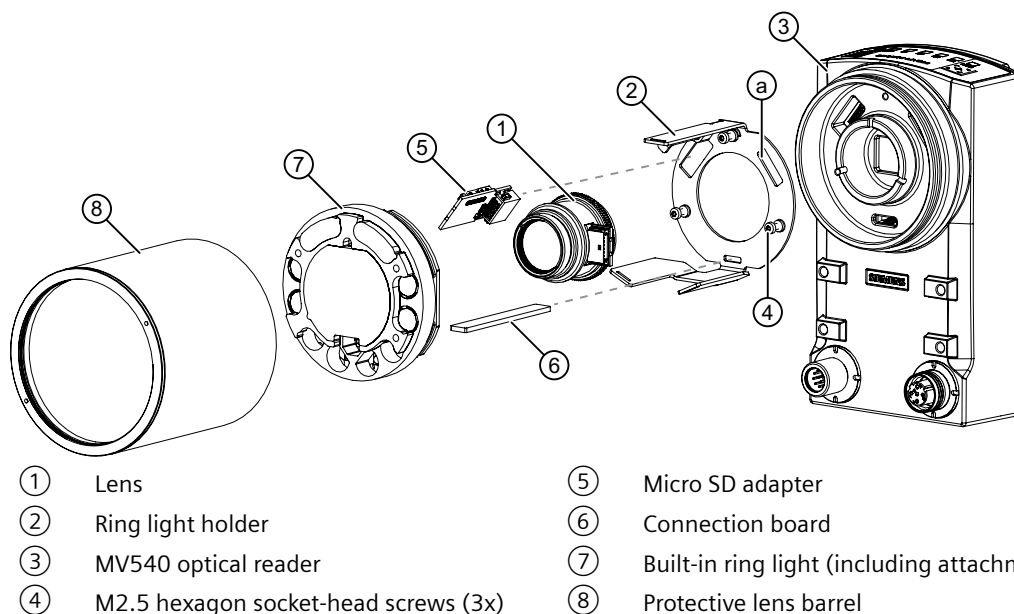
Figure 5-4   Setup of SIMATIC MV540 optical reader with built-in ring light, EF lens and protective lens barrel

Proceed as follows to mount the SIMATIC MV540/MV550/MV560 optical reader with built-in ring light, lens and protective lens barrel:

1. Remove the protective foil from the reader.

2. Mount the ring light holder ②.

   – When using a 50 mm EF lens, make sure that you use the suitable ring light holder and protective lens barrel.

   – Make sure that the ring light holder is aligned correctly and fully flush when it is mounted.

   – Fasten the ring light holder ② with the three hexagon socket screws ④ onto the reader (≤ 0.45 Nm).

3. Insert the straight connector of the lens cable into the interface of the reader (a).

4. When using EF lenses with 12 and 16 mm focal length (6GF3540-8EA01-0LL0 and 6GF3540-8EA02-0LL0):
   Screw the spring/lock ring into the lens mount of the reader.

5. Screw the desired lens ① into the lens mount of the reader ③.
   Ensure the correct alignment of the lens so that the interface is close to the cutout/interface (a). If needed, unscrew the lens slightly. If needed, align the lens using the knurled nut/ spring/counter ring.

6. Use the lens cable to connect the EF lens to the reader ③.
   Insert the angled connector of the lens cable into the interface of the lens and the straight connector into the interface of the reader. Ensure that the cable does not become twisted.

7. Insert the micro SD adapter ⑤ into the reader interface provided.
   If needed, insert a micro SD card into the adapter

8. Insert the connection board ⑥ into the reader interface provided.

9. Mount the ring light ⑦ by hooking it into the ring light holder ②. First, hook the side that has a single mounting bracket, then the side with the two mounting bracket.
   When installing, make sure that the connection board is properly inserted into the interface of the lens.

NOTICE

Minimum clearance between EF lens and the object to be read

Observe the minimum distance to be maintained between the EF lens and the object to be read. If the object distance in your application cannot be maintained, rotate the lens one turn out (ensure the lens is firmly seated) and secure it with the knurled nut or the spring/ lock ring.

You may want to unscrew the lens a little further to reduce the minimum operating distance more. You can find detailed information on the operating distances in the section "Selection of suitable components (Page 281)".

---

10. If needed, replace the attachment of the built-in ring light.
    The attachments can be easily removed from the ring light or placed on it. Ensure that the attachment is correctly aligned.
    You can find detailed information on the ring light attachments in the following section.

11. Depending on the lens used, screw the appropriate protective lens barrel ⑧ onto the reader ③. Ensure that the lens cable is not pinched.

12. Mount the reader on a suitable mounting fixture or holder (4x M4, 1-2 Nm).
   Use the mounting plate for SIMATIC MV500, the mounting bracket for MV500 or a mounting device with matching holes.
   Note that the reader has two different drilling templates (50 x 60/57 x 57).

Figure 5-5   Hole template for mounting the SIMATIC MV500 optical reader

13. Select a suitable location to install the device.

5.4   Mounting attachments for built-in ring lights

The built-in ring lights are delivered fully assembled with the corresponding attachments. The attachments that are included depend on the following factors:
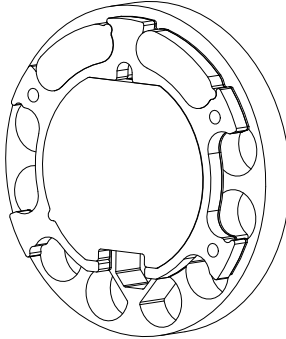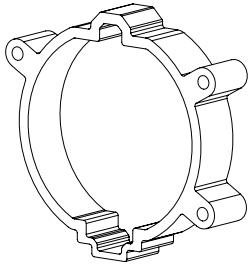
- Built-in ring light (Basic, Remote, Multi)
- LED color of the ring light

The following table gives you an overview of the various attachments and the included filters, as well as the corresponding built-in ring lights.

Table 5-1   Ring light attachments

Attachment	Suitable built-in ring lights	Attachment properties
 Attachment with polarization filter	Built-in ring light (red/white, basic)	This attachment is equipped with a polarization filter. It was specially developed for flexible use in the near field and far field with white and red LEDs.
 Anti-glare attachment	Built-in ring light (red/white, multi), (red/infrared, basic)	This attachment allows unimpeded light propagation with large radiation angles. The anti-glare attachment was developed for applications with lenses with focal length ≤ 16 mm that have to illuminate a wide field. This attachment prevents illumination reflections on the cover glass of the protective lens barrel.

In addition, all built-in ring lights are supplied with the anti-glare attachment. When mounting the screen, be careful not to squeeze it too tightly and ensure that it is flush with the front pane.

Change ring light attachment

You can easily change the attachments by installing or removing them from the ring light. When installing, make sure that the ring light and ring light attachment are aligned with each other.
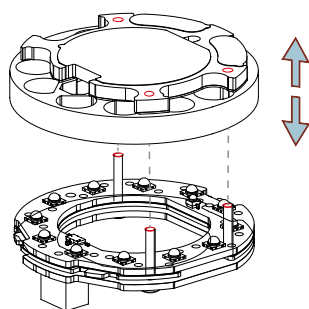
Figure 5-6   Changing a ring light attachment

5.5 Mounting with external ring light

If a lot of light is required for the applications, you can mount and connect an external ring light. The external ring light is also used, for example, when the lighting is not parallel to the viewing direction with strongly reflecting objects.
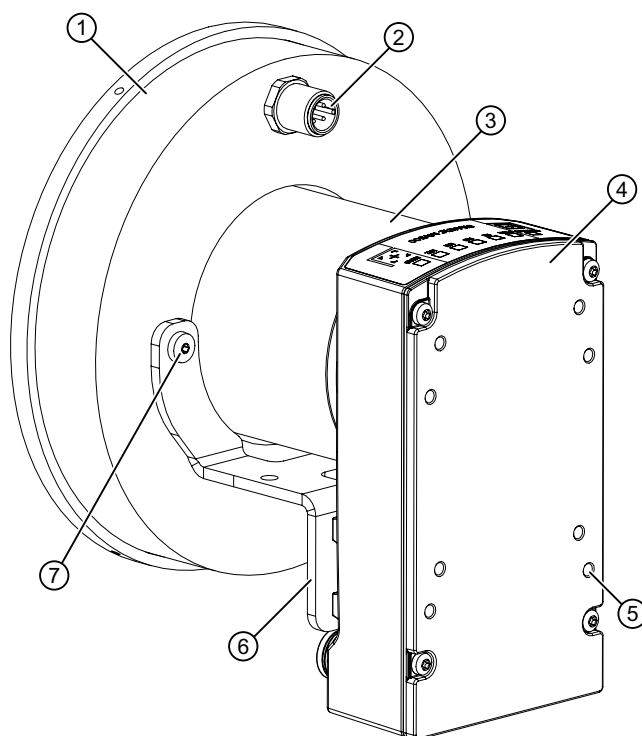
①	External ring light MV500	⑤	Mounting/fastening hole
②	Socket for lighting unit	⑥	External ring light holder
③	Protective lens barrel (∅ 65)	⑦	Securing screws
④	Optical reader		

Figure 5-7   Setup of SIMATIC MV500 optical reader with external ring light

Proceed as follows to mount the SIMATIC MV540 optical reader with an external ring light:

1. Remove the protective foil from the reader.

2. When using an E-focus lens: Insert the straight connector of the lens cable into the interface of the reader (a).

3. Screw the desired lens into the lens mount of the reader.
   Ensure the correct alignment of the lens so that the interface is close to the cutout/interface (a). If needed, unscrew the lens slightly. If needed, align the lens using the knurled nut/ spring/counter ring.

4. When using an E-focus lens: Use the lens cable to connect the E-focus lens to the reader. Insert the angled connector of the lens cable into the interface of the lens and the straight connector into the interface of the reader. Ensure that the cable does not become twisted.

5. Insert the micro SD adapter into the reader interface provided.
   If needed, insert a micro SD card into the adapter

6. Screw the protective lens barrel (article number 6GF3540-8AC11) onto the reader.

7. Mount the ring light holder on the reader with the 4 screws (1-2 Nm) that are supplied.

8. Mount the external ring light to the ring light holder (1-2 Nm) with the 2 supplied fastening screws.

9. Mount the reader on a suitable mounting fixture or holder (4x M4, 1-2 Nm).
    Use the mounting plate for SIMATIC MV500 or a mounting device with matching holes.
    Note that the reader has two different drilling templates (50 x 60/57 x 57).

10. Select a suitable location to install the device.

5.6 Setting mini-lenses or replacing the SD card

The focus of mini-lenses must be set manually on the lens of the reader. To set the lens or change the SD card of the reader, you need to remove the protective lens barrel and possibly the ring light.

Note that the MV530 readers are delivered with a premounted and preset lens. These readers are designed for an operating distance of 30 to 250 mm and the lenses should not be changed later. You can find detailed information about the viewing field size depending on the operating distance in section "MV530: Operating distance and viewing field size (Page 281)".

Focusing the mini-lens

Proceed as follows to focus the mini-lens:

1. Unscrew the protective lens barrel from the reader.

2. Remove the ring light/ring light holder.

    –   With an MV530, you can easily remove the ring light/ring light holder from the optical reader.

    –   With all other reader types, you need to loosen the three hexagon socket screws (M2.5) to remove the ring light/ring light holder.

3. Focus the mini-lens.

4. Then mount the ring light/ring light holder again.

5. Screw the protective lens barrel onto the reader.

Replacing the SD card

Proceed as follows exchange the SD card:

1. Unscrew the protective lens barrel from the reader.

2. Change the SD card.

3. Screw the protective lens barrel onto the reader.

Connection 6

6.1 Guidelines for installation free of electrical interference

To prevent interference, you will need to provide shielding for your system. Low-frequency (LF) and high-frequency (HF) interference signals can result in an incorrect response if the system is badly grounded or not shielded.

Interfering signals can be caused by:

- Switching relays or contactors (large, rapid changes in current or voltage and HF interfering signals).

- Different ground potentials between two parts of the system (LF interfering signals).

NOTICE
Grounding the device
Make sure that the device is grounded through one of the screw points in the housing.

Use/installation of interference-proof cables

- Only use the recommended cable to connect the optical reader.

- Use only shielded cables to power the optical readers.

- Note that the maximum permitted cable length for the power supply is 30 m.

- Note that a maximum cable length of 30 m is permitted for the network cable (Ethernet).

- Do not lay signal lines and heavy current lines together. Use a separate cable duct at least 50 cm from the heavy current lines.

- The power IO cable must withstand an ambient temperature of at least 80 °C during operation.

- Screw in all cable connectors correctly.

Note

Observance of installation guidelines

Observe the information on installation guidelines in the installation manual of the automation system (https://support.industry.siemens.com/cs/ww/en/ps/13616/man) being used (S7-300/-400/-1200/-1500).

Only connect safety extra-low voltage (SELV) according to IEC 62368-1

> ⚠️ **WARNING**
>
> **Operation with safety extra-low voltage**
>
> The device is designed for operation with safety extralow voltage (SELV). This means that only safety extra-low voltages (SELV) according to IEC 62368-1 can be connected to the power supply terminals.
>
> The power unit for supplying the device must comply with NEC Class 2 as described by the National Electrical Code(r) (ANSI/NFPA 70).
>
> The power of all connected power supply units must total the equivalent of a power source with limited power (LPS limited power source).

6.2 Power supply using Power over Ethernet (PoE)

"Power over Ethernet" (PoE) is a power supply technology for network components complying with IEEE 802.3af.

- The power is supplied over the Ethernet cables used to connect the individual network components (corresponding to IEEE 802.3af) with one another. This makes an additional power cable unnecessary.

- SIMATIC MV500 is a PD (Powered Device), Type 1, Class 3 (max. 12.95 W)

Note that the power supply via PoE is only possible via the "X1 LAN1" Ethernet interface. When using the PoE power supply, you must enable the "Options > Lighting > Power via PoE or CM" setting.

> **NOTICE**
>
> **Restricted functionality**
>
> Note that with the power supply via PoE, the full functionality of the reader may not be fully exploited due to the low power available. For example, it may not be possible to operate all LEDs simultaneously with the built-in "Multi" and "Remote" type ring lights. The maximum image acquisition frequency is lower as well. In addition to the acquisition interval that can be achieved in evaluation mode, this also affects setup operations such as automatic exposure control or automatic setup.

Restriction of the power supply type

The IEEE standard 802.3af specifies two types of power supplies:

- Voltage via wire pairs that are not used for data transmission (redundant wires).

- Voltage via wire pairs that are used for data transmission (phantom power).

The Ethernet connection of the SIMATIC MV500 optical readers is four-wire. Power can only be supled via these four wires with phantom power. The voltage feeding device must provide the phantom power.

The following Siemens switches with PoE provide phantom power:

- SCALANCE X108 PoE

- SCALANCE XP208 PoE EEC

- SCALANCE XP216 PoE EEC

- SCALANCE X308-2M PoE

- SCALANCE XR324-4M PoE

- SCALANCE XR324-4M PoE TS

- SCALANCE XM-400 with Port Extender PE408 PoE and
  PoE power supply SCALANCE PS9230 PoE or SCALANCE PS924 PoE

- SCALANCE XR-500M with media module MM992-4PoE or MM992-4PoEC

6.3 Connecting the reader

Connecting the power supply

⚠ WARNING
Permissible power supply
The device should only be connected to a 24 V DC power supply which satisfies the requirements of safe extra low voltage (SELV).
When the device is operated on a wall, in an open rack or other similar locations, an NEC Class 2 voltage source is needed for compliance with UL requirements (according to UL 62368-1). In all other cases (according to IEC/EN/DIN EN 62368-1), a voltage source with limited power (LPS = Limited Power Source) is required.
Line-side power supply
The generation of the 24 V DC power supply by a line-side power supply must be implemented as functional extra-low voltage with safe electrical isolation (floating) according to IEC 60364-4-41, or as SELV according to IEC/EN/DIN EN 62368-1 and LPS/NEC Class 2.

NOTICE

Protection of the external power supply

If the optical reader is supplied via extensive supply lines or networks, interference by strong electromagnetic pulses on the supply lines is possible, e.g. from lightning or the switching of large loads.

The connection of the external power supply is not protected against strong electromagnetic pulses. An external overvoltage protection module is required for this purpose. The requirements according to EN 61000-4-5, Surge test on power supply lines, are only met when a suitable protective element is used. A suitable device would be, for example, the Dehn Blitzductor BVT AVD 24, article number 918 422, or a comparable protective element.

Manufacturer:
DEHN+SOEHNE GmbH+Co.KG, Hans-Dehn-Str.1, P.O. Box 1640, D-92306 Neumarkt, Germany

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NOTICE

Do not change the power supply during operation

Note that simultaneous or alternating operation (power supply) via the combination interface and/or via the Ethernet interface (Power over Ethernet) is not guaranteed. If the power supply is changed during operation, this can lead to malfunctions.

Note

Power supply for SIMATIC MV500 via Power over Ethernet

Power can also be supplied to the optical readers via Power over Ethernet (PoE). You can find information on PoE switches in the section "Power supply using Power over Ethernet (PoE) (Page 118)".

NOTICE

Maximum torque for M12 knurled screws

Make sure to tighten the knurled screw of the M12 connector with ≈ 1 Nm to prevent ingress of moisture.

Note

Maximum CM cable length

You can connect a communication module to the optical reader with a max. cable length of 50 m.

In some situations, longer connecting cables up to 1000 m are possible. In this case, consider the power consumption of the optical reader.

Avoid connecting more than two cable sections to create a long cable, because this increases the cable resistance.

The reader is supplied with voltage via the combination interface or the Ethernet interface, depending on your system configuration. Connect the reader to the power supply via the

appropriate interface using the appropriate cable. The following power supply options are available:

- To an external power supply using the Power-IO-RS232 cable / Power-IO cable (UL) through the combination interface

- To a communication module using the communication module cable over the combination interface [1]

- To a PoE switch using the Industrial Ethernet connection cable via the Ethernet interface

[1] When connecting to a communication module, power can also be supplied via an external power supply, however. This has the advantage that both the digital outputs and the trigger can be used through the digital inputs.

Interfaces / cable connection sockets

① Combination interface for
Power supply, DI/DQ, RS232 and CM (M12, 12-pin)

② Ethernet interface X2 LAN2 [1]
(M12, 8-pin)
10/100/1000 Mbps

③ Ethernet interface X1 LAN1
Power over Ethernet (M12, 4-pin)
10/100 Mbps

[1] Please note that the MV530 and MV540 optical readers do not have a 2nd Ethernet interface.

Figure 6-1   Interfaces / cable connection sockets of the SIMATIC MV550

Pin assignment of the cables

You can power the optical reader either through the Power-IO-RS232 cable, Power-IO cable (UL) or through the communication module cable. Note that the DI/DQ functions cannot be used if the reader is operated through a communication module.

Power-IO-RS232 cable und Power-IO cable (UL)

The Power-IO cable is used for the power supply, for connection to the DI/DO connections and, for example, for the communication connection of an S7 controller via the RS232 interface. The Power-IO-RS232 cable can be used for operation via an RS232 interface, while the Power-IO cable (UL) has certification from Underwriters Laboratories compared to the Power-IO-RS232 cable and is trailing-capable.

When connecting the power supply cable, take care not to damage the pins.

Proceed as follows to connect the power supply cable:

1. Place the angled connector of the power supply cable on the combi interface so that the groove and lug interlock and the angled connector points downwards.

2. Hold the angled connector with one hand.

3. With the other hand, tighten the knurled screw of the connector (≈ 1 Nm).
   Make sure that the connector does not twist.
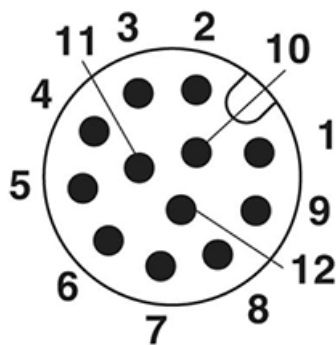
Figure 6-2   Pin assignment of Power-IO connector on the optical reader ①

NOTICE
Connect "IN_COMMON" or "OUT_COMMON"
In order to be able to use the inputs and outputs described below, you must connect the "IN_COMMON" or "OUT_COMMON" signals.

Table 6-1   Pin assignment Power-IO-RS232 cable, M12 (female, 12-pin), 12-wire

Pin		Color	Signal name	Meaning
1	A	White	INPUT - COMMON	Reference point 0 V or 24 V for inputs
2	B	Brown	RS422 TxD_P	Send line RS422 TxD positive
3	C	Green	RS422 TxD_N	Send line RS422 TxD negative
4	D	Yellow	OUTPUT 2	Digital output 2
5	E	Gray	OUTPUT - COMMON	Reference point 0 V or 24 V for outputs
6	F	Pink	RS232 TxD / RS422 RxD_P	Send line RS232 / Receive line RS422 RxD positive
7	G	Blue	DC 0V	0 V DC power supply
8	H	Red	DC 24V	24 V DC power supply

Pin		Color	Signal name	Meaning
9	J	Black	STROBE (OUTPUT)	Signal output for connecting the external ring light
10	K	Violet	TRIGGER / INPUT 1	Trigger input / digital input 1
11	L	Gray/pink	OUTPUT 3	Digital output 3
12	M	Red/blue	RS232 RxD / RS422 RxD_N	Receive line RS232 / RS422 RxD negative

Table 6-2　　Pin assignment Power-IO cable (UL), M12 (female, 12-pin), 8-wire

Pin		Color	Signal name	Meaning
1	A	White/orange	INPUT - COMMON	Reference point 0 V or 24 V for inputs
2	B	--	--	Not assigned
3	C	--	--	Not assigned
4	D	Orange	OUTPUT 2	Digital output 2
5	E	White/green	OUTPUT - COMMON	Reference point 0 V or 24 V for outputs
6	F	--	--	Not assigned
7	G	Blue	DC 0V	0 V DC power supply
8	H	Green	DC 24V	24 V DC power supply
9	J	White/blue	STROBE (OUTPUT)	Signal output for connecting the external ring light
10	K	Brown	TRIGGER / INPUT 1	Trigger input / digital input 1
11	L	White/brown	OUTPUT 3	Digital output 3
12	M	--	--	Not assigned

Communication module cable

You use the CM adapter cable to connect the communication modules (e.g. RF180C and ASM 456) to the optical reader. The communication module cable is pre-fabricated.

Note that when using the power supply via the communication module, you must enable the "Options > Lighting > Power supply via PoE or CM" setting.
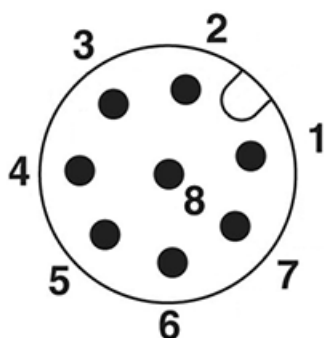
Figure 6-3　　Pin assignment of communication module plug

Table 6-3   Communication module cable, M12 (female, 12-pin) / M12 (male, 8-pin)

Pin	Wire color	Signal name	Meaning
1	White	24 V	24 V DC power supply
2	Brown	TxD_N	Send data -
3	Green	0 V	0 V DC power supply
4	Yellow	TxD_P	Send data +
5	Gray	RxD_P	Received data +
6	Pink	RxD_N	Received data -
7	Blue	Not connected	--
8	Red	Shield	--

Pin assignment ↔ socket/wire color of the cable/signal connector of the optical reader

Industrial Ethernet connecting cable

Connect a PC/PG (for control and operation) to the optical reader using a prefabricated Ethernet cable.

Attach the Ethernet cable to a switch to connect the optical reader to an S7 controller via PROFINET IO.
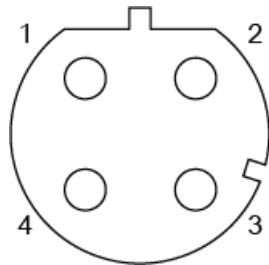
Figure 6-4   Pin assignment of "X1 LAN1" Ethernet socket (M12, 4-pin) ③

Table 6-4   Industrial Ethernet connecting cable M12 (male, 4-pin) / M12 (male, 4-pin)

Pin	Wire color	Signal name	Meaning
1	Yellow	TxD_P	Send data +
2	White	RxD_P	Received data +
3	Orange	TxD_N	Send data -
4	Blue	RxD_N	Received data -
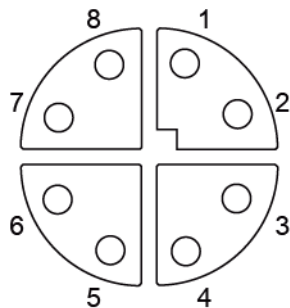
Figure 6-5   Pin assignment of "X2 LAN2" Ethernet socket (M12, 8-pin) ②

Table 6-5   Industrial Ethernet connecting cable M12 (male, 8-pin) / M12 (male, 8-pin)

Pin	Wire color	Signal name
1	Orange/white	TxD/RxD+2
2	Orange	TxD/RxD-2
3	Green/white	TxD/RxD+1
4	Green	TxD/RxD-1
5	Brown/white	TxD/RxD+3
6	Brown	TxD/RxD-3
7	Blue/white	TxD/RxD+4
8	Blue	TxD/RxD-4

Note

Cable assembly for connection to IE RJ45 interface

To connect the "X2 LAN2" interface (M12, 8-pin) with an IE RJ45 interface, you need to replace one of the M12 connectors of the cable "6XV1878-5Gxxx" with the IE connector FC RJ45 ("6GK1901-1BB12-2AA0"). For strain relief to be guaranteed, you need to enlarge the assembled cable to a length of approx. 5 - 10 cm behind the replaced connector using an adhesive tape to Ø 8.

Connecting cable for external ring lights
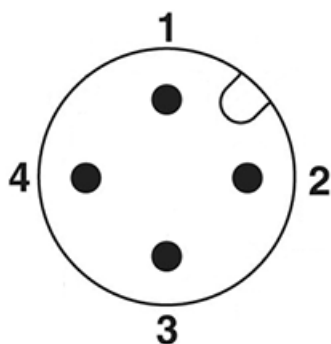
Figure 6-6   Pin assignment connecting cable plug

Table 6-6   Connecting cable for external ring lights M12 (male, 4-pin) / open end

Pin	Wire color	SIMATIC MV500 signal
1	Brown	24 V DC power supply
2	White	Trigger input
3	Blue	NC
4	Black	Ground

6.4 Wiring examples

I/O interface

Wire the "Output Common" signal with + 24 V DC and the "Input Common" signal with 0 V.
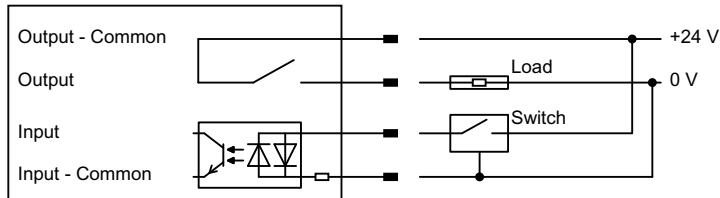
Figure 6-7   I/O interface as P type

Wire the "Output Common" signal with 0 V and the "Input Common" signal with + 24 V DC.
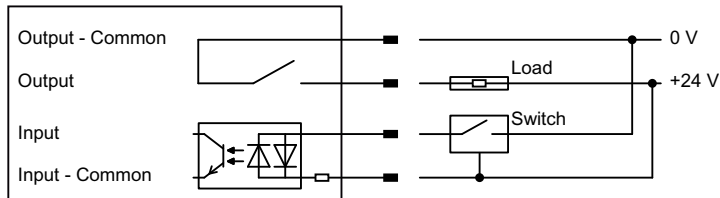
Figure 6-8   I/O interface as N type

Connecting up the Power IO RS232 interface

Note that only the Power-IO-RS232 cable can be wired as described below. The Power-IO cable (UL) cannot be connected.
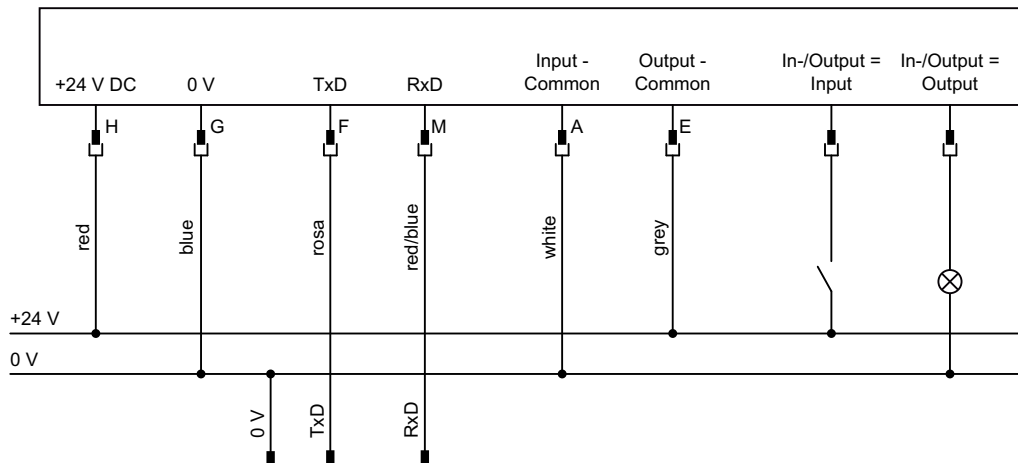
Figure 6-9   Connecting up the power IO RS-232 interface as P type
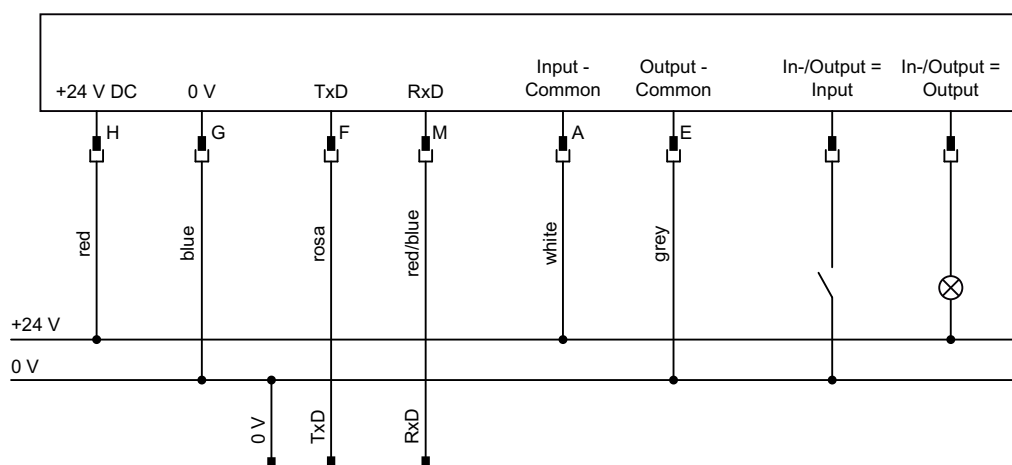
Figure 6-10   Connecting up the power IO RS-232 interface as N type

6.5   Connection of external ring lights/floodlights

You can operate the optical reader with an external ring light or floodlight. Note that when operating a SIMATIC MV500 with an external ring light / external floodlight, the power supply must not be provided via a communication module.

Connecting an external ring light

Note

Use the "Strobe" output signal to operate external ring lights

You can operate external ring lights using the "Strobe" output signal. The strobe signal is high active. The "high active" time corresponds to the on-load factor of the external ring light.

When you use an optical reader with an external ring light in your application, wire up your application according to the following wiring diagrams.

① External ring light

② External ring light holder

③ SIMATIC MV500 optical reader

④ Power-IO-RS232 cable or   RS232 IO cable (UL)

   a: Red   a: Green

   b: Blue   b: Blue

   c: black   c: White/blue

⑤ Connecting cable external ring light

Figure 6-11   Connection and wiring for external ring light

① External ring light

② External ring light holder

③ SIMATIC MV500 optical reader

④ Power-IO-RS232 cable or   RS232 IO cable (UL)
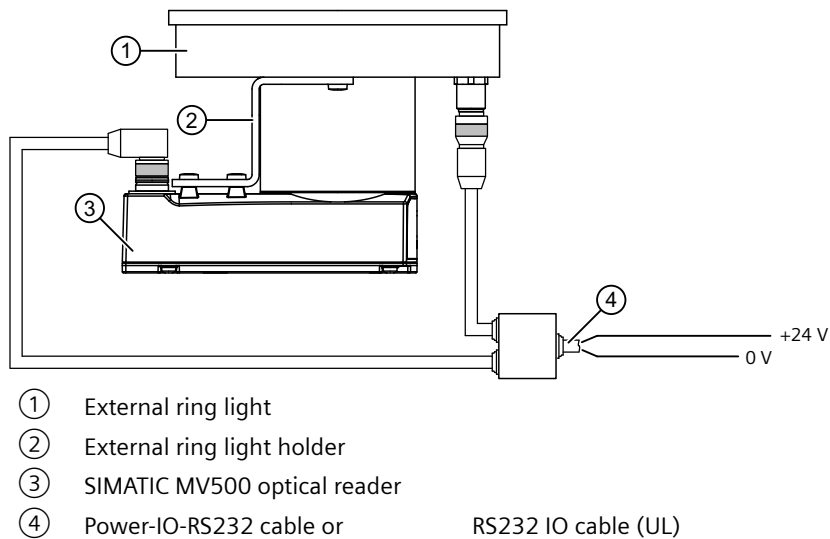
Figure 6-12   Connection and wiring for external ring light, with Y adapter

Connection of an external floodlight

When you use an optical reader with an external floodlight in your application, wire up your application according to the following wiring diagrams.
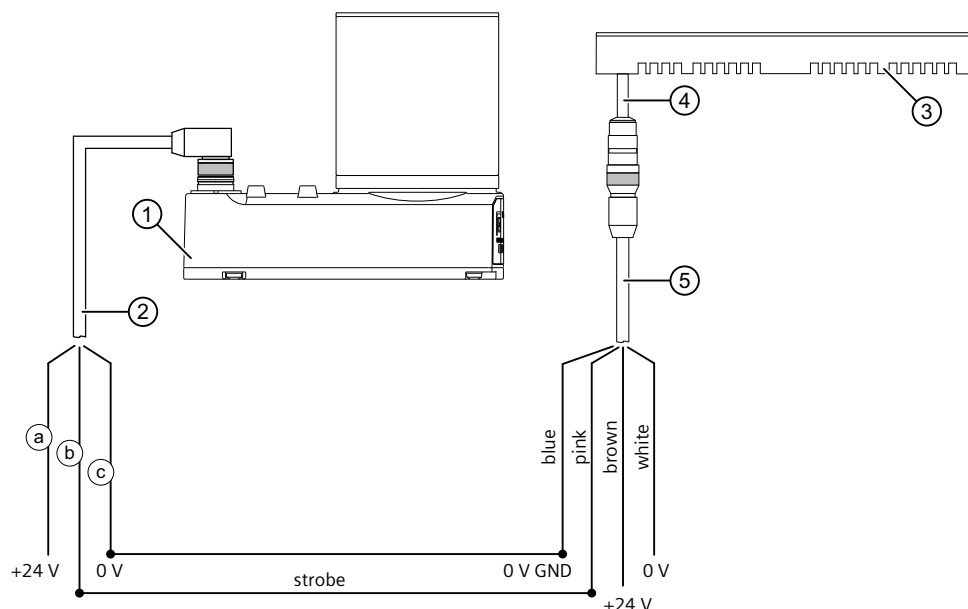
① SIMATIC MV500 optical reader

② Power-IO-RS232 cable or   RS232 IO cable (UL)

a: Red   a: Green

b: black   b: White/blue

c: Blue   c: Blue

③ Floodlight

④ Floodlight connecting cable (15 cm) with M16 plug (12-pin)

⑤ Connecting cable (10 m), pre-assembled on one side with M16 socket (12-pin)

Figure 6-13   Connection and wiring for external floodlight

NOTICE

Using the enclosed connecting cable

Only use the connecting cable (10 m) shipped with the product to connect the floodlight.

Floodlights are suitable for permanent operation as well as switching operation.

You can control the brightness using the potentiometer or the analog VC input.

- Brightness control using the potentiometer:
  All the way to the left = 0%; all the way to the right = 100% brightness
  Make sure that the brightness control using the potentiometer is disabled when the voltage at VC is greater than 1 V DC.

- Optional brightness control using the analog VC input:
  VC (Pin D, yellow) = 2 V DC ... 10 V DC
  Note that the potentiometer must always be turned all the way to the left for this.

All relevant information for connecting and operating the external floodlight can be found in the Product Information shipped with the product.

Commissioning 7

7.1 Prerequisites

For commissioning, you need a PC with the following requirements:

- CPU: DualCore with 3 GHz
- RAM: 4 GB
- Operating system: Microsoft Windows 7 operating system or newer
- .NET Framework V4.0
- Web browser
  Tested Web browsers: Google Chrome
- Recommended screen resolution: 1920 × 1080 or higher
- Network connection via Ethernet TCP/IP
- Optional: SINEC PNI
  You can find SINEC PNI in your SIMATIC installation or as a free download on the pages of the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/ps/26672/dl).

7.2 Connecting using the "CONNECT" button

Using the "CONNECT" button, you can quickly and easily establish the initial connection between the SIMATIC MV500 and the PC. Note that this function is only possible if the optical reader is connected via the "X1 LAN1" Ethernet interface.

Follow the steps below to connect the optical reader and establish the connection using the "CONNECT" button:

1. Connect the power supply cable to the combination interface and the Ethernet cable directly (without a switch) to the Ethernet interface of the PC.
2. Wait until the "CONNECT" LED goes out.
3. Press the "CONNECT" button.
4. Wait until the "CONNECT" LED is continuously lit.
5. Open your Internet browser, enter the IP address "https://192.168.100.100" and confirm by pressing the <Enter> key.

Result: Web Based Management (WBM) opens.

Once the initial connection has been established, assign an IP address to the reader ("Communication > Interfaces > Ethernet"). To continue working with the reader, start the WBM by entering the IP address in your Web browser.

Connecting an optical reader and establishing a connection (point-to-point connection to PC)		
1st		2nd
3rd	4th	5th
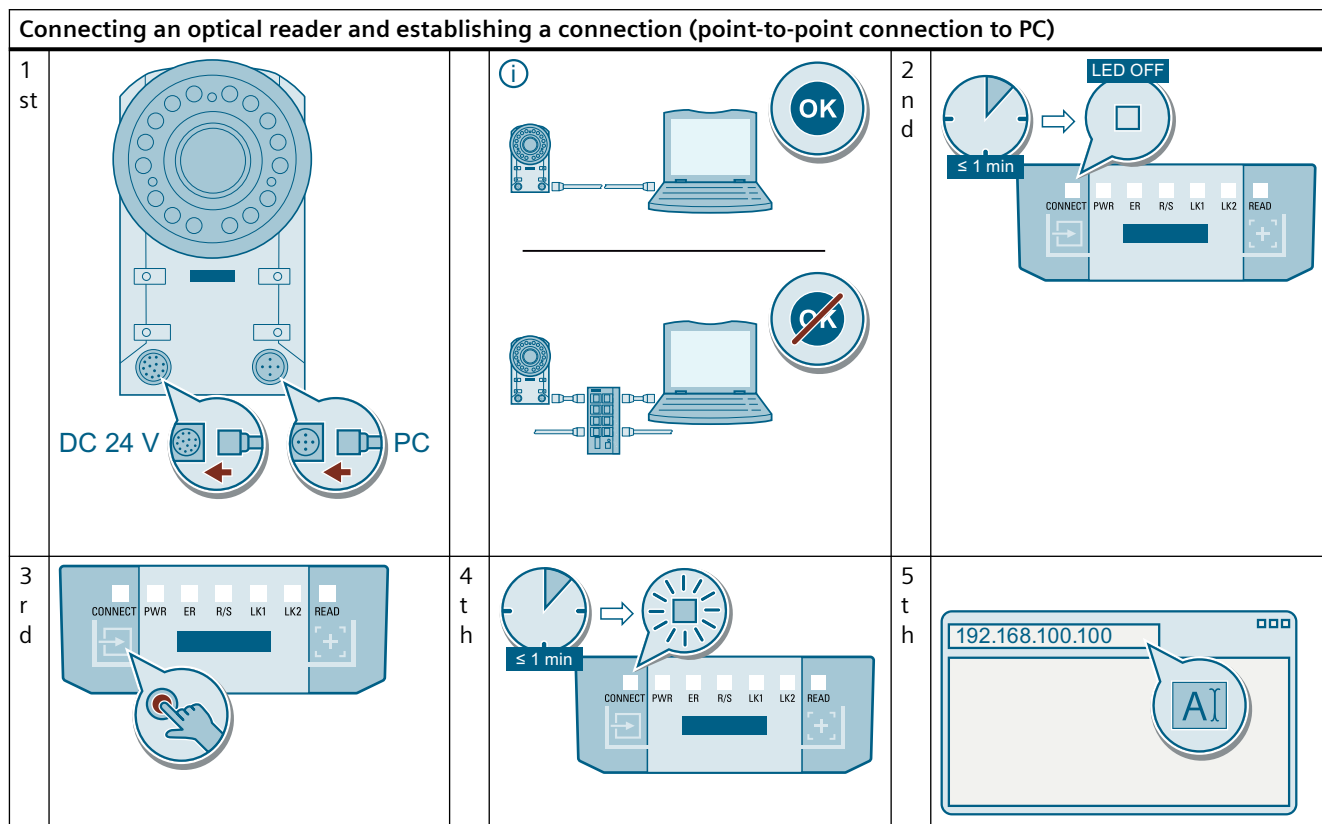
NOTICE
Possible faults when operating as a DHCP/DNS server
Note that the optical reader is set up as a DHCP/DNS server when establishing a connection via the "CONNECT" button. This may interfere with communication in an existing network. Another DHCP/DNS server in the network must not be enabled.
If the IP address of the reader is changed after the connection has been established, the connection is aborted. In addition, the "CONNECT" function is disabled. This function can be enabled again via the "Options > Extras" menu.

7.3 Performing automatic adaption

Automatic adaption using the "READ" button

Using the "READ" button, you can align the optical reader and automatically adapt all relevant program settings. This function basically corresponds to the "Quick Start" function of the WBM.

Requirements

- To use the function, you need a code in the target area of the reader.

- The WBM of the reader is closed.

Function description

The first time you press the "READ" button, the reader changes to "Adaption" status and an "Alignment" LED is switched on. You can optimally align the reader to its target area using the LED.

If the "READ" button is pressed again, the reader automatically adapts the reader settings to the prevailing ambient conditions. You can find detailed information on this function in the "Setup" section of the online help. The process can take up to five minutes depending on the model version and the code used. During this process, the "READ" LED flashes green.

When the process has been completed successfully, the "READ" LED lights up in green for 5 seconds. If the process could not be completed, the "READ" LED lights up red for 5 seconds. After the adaption has been successfully completed, the settings are saved in the specified target program. Finally, the reader returns to processing mode.

If errors occur during the process, they are indicated by a yellow or red flashing "READ" LED. You can find detailed information on the errors in the section "Diagnostics via the LED display (Page 237)".

You can find additional information about the functions and settings of the "READ" button in the "Options > Extras" section of the online help.

Aborting automatic adaptation

You can cancel running automatic adaption in the following way:

- With open WBM: by pressing the "Cancel" button in the progress bar, by a page change or by closing the WBM.

- With closed WBM: by pressing the "READ" button again. Note that during the first adaptation step, the "Alignment", pressing the "READ" button signals the completion of the alignment to the reader.

Additional function of the "READ" button

When the "Program" page of the reader's WBM is open, you can press the "READ" button to switch result generation on or off.

Automatic adaption with the help of the "Quick Start" function

As an alternative to the "READ" button, you can perform the adaption via the WBM using the "Quick Start" function in the "Program > Overview > Setup" menu.

However, the "Quick Start" function differs in the following points to the adaption using the "READ" button:

- No "Align" LED is switched on, because alignment can be performed via the image display of the WBM.

- The adaption progress is displayed in the "Status setup" area.

- Once the adaption is completed, the reader automatically changes to edit mode ("Edit").

- Once the adaption is completed, the changes must be manually saved in the desired target program.

You can find detailed information on this function in the "Program > Overview > Setup" section of the online help.

7.4 Connecting and setting up the reader

Requirements

- The reader has been connected to the power supply via the combination interface.

- SINEC PNI is installed.

Table 7-1   Steps for initial commissioning

Step	Activity
1	Connect the optical reader and PC/programming device using an Ethernet cable.
2	Switch on power supply.
3	Select network adapter. Configure the Ethernet connection between the optical reader and the PC.
4	Start Web Based Management (WBM).
5	Configure the optical reader using the WBM.

Note that, in principle, the reader can also be operated without Ethernet connection with a PC/PG. In this case, startup of the device will be delayed by a few seconds. If an Ethernet connection is established after startup, you then need to restart the reader (pull/plug power supplies).

Step 1: Connect the reader and PC using an Ethernet cable

Connect the reader directly to your PC/programming device over an Ethernet cable.

Step 2: Switch on power supply

Disconnect the power supply of the optical reader. The optical reader is supplied with power either via a connected CM cable or via the Power-IO-RS232 cable, Power-IO (UL) cable or PoE cable. You can find more detailed information on the connection in the section "Connecting the reader (Page 119)".

Note that a self-test is performed each time the optical reader is started. The self-test is indicated by the power LED flashing and lasts from a few seconds to 2 minutes. If the test has been completed successfully, the power LED lights up in constant green and the optical reader is ready for operation. If an error occurs during the test, the error LED lights up red.

Step 3: Configure the Ethernet connection between reader and PC

To configure the Ethernet connection between the reader ("X1 LAN1" interface) and the PC, follow these steps:

1. Start SINEC PNI.

2. In the "Settings" menu, select the "network adapter" via which the reader is connected to the PC.

3. Make sure that the "Scan protocol > PROFINET devices" is activated.
   Note: Note that the function "Fetch additional information" can take some time when the network includes many devices.

4. Click the "Save" button.

5. Switch to the "Device list" menu.

6. Click on the "Start network scan" button in the toolbar.
   Reaction: The network is scanned for connected devices and all recognized devices are displayed in the device list.

7. Select the desired reader in the device list.

8. Click on the "Configure device" button in the toolbar.
   Reaction: The "Device configuration" window opens.

9. Enter a new, unique IP address for the reader in the "IP address" input box.

10. Enter the subnet mask of your network in the "Subnet mask" input box.

11. Switch to the "PROFINET" tab.

12. Enter a device name in the "PROFINET device name" input box.

13. Click the "Load" symbol to transfer the settings to the reader.

Result: The reader is assigned the new IP address, subnet mask, and a new device name.

Note

Restart may be required

Depending on the mode being used, you may need to restart the reader by turning the power off and on again.

Note

Ethernet connection via the "X2 LAN2" interface

Note that you can only establish a connection to the optical reader via the "X1 LAN1" Ethernet interface using SINEC PNI. You can configure the "X2 LAN2" Ethernet interface via the WBM "Communication > Interface > Ethernet" or using a DHCP server.

Device flash test

If several readers are connected to the network/PC, it is possible to make the LK LEDs of the device selected in the output window flash. Using the device flash test, you can identify the required reader quickly and simply.

Follow the steps below to identify the relevant reader using the flash test:

1. Select the desired module from the device list in the "Device list" menu.

2. Click on the "Flash LED" button in the toolbar.
Reaction: The LK LED flashes at a frequency of 1 Hz (1 s) on the selected reader.

3. Click the "Stop" button to stop the flashing.

Step 4: Start Web Based Management (WBM)

Follow the steps below to start the WBM:

1. Start your Web browser.

2. Enter the IP address (HTTPS) of the reader in the address bar of your browser.

3. Confirm your entry by pressing the <Enter> key.
Reaction: The upstream setup page of the WBM opens.

4. Click "Start page".
Reaction: The WBM of the reader opens.
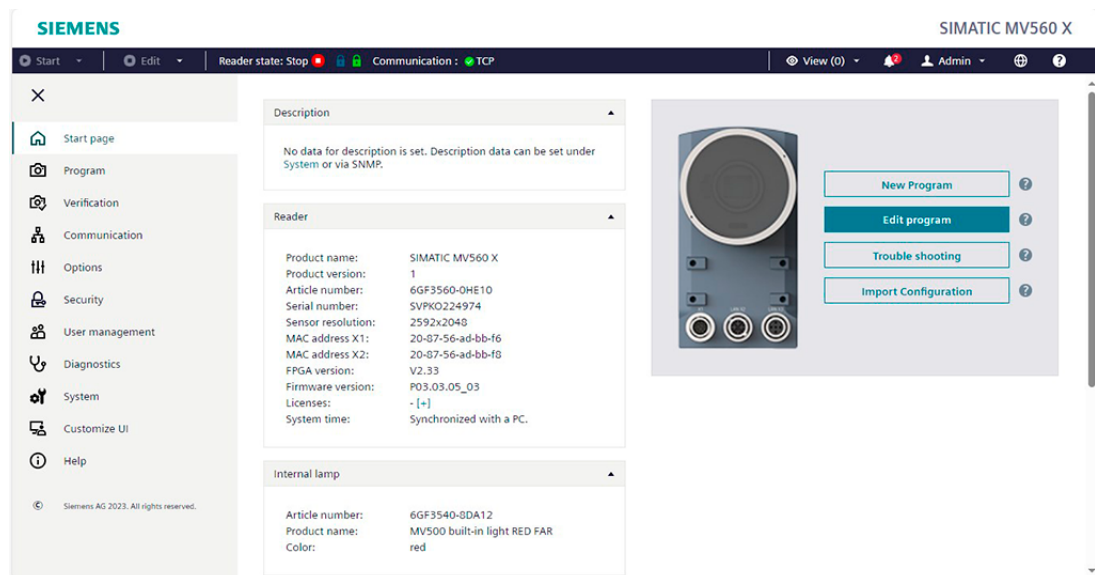
Figure 7-1   The homepage of the WBM

Result

You are connected to the reader and the reader can be operated via the WBM. Below, you can perform the next steps to configure the reader and see initial read results.

Step 5: Align the optical reader

Before you put the optical reader into productive operation, you must first align it correctly and configure it. Use the image display in the "Program" menu. In the image display, the image section is displayed as the optical reader sees it.

Also note the information on installing the reader in the section "Notes on installation (Page 107)".
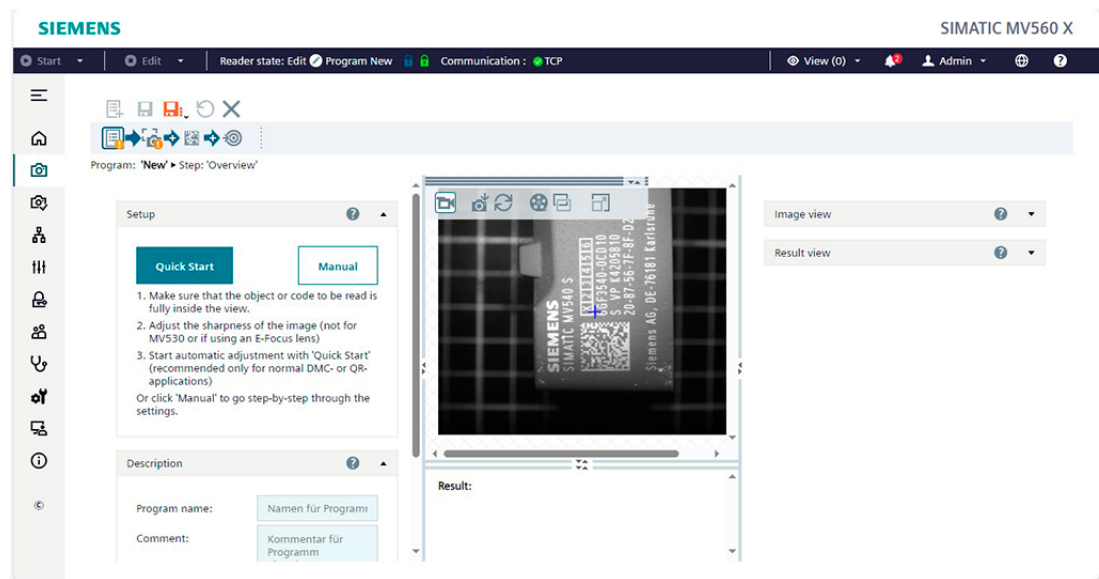
Figure 7-2   The "Overview" program step in the "Program" menu of the WBM

Note

Focus image

Depending on the lens used, the image must be focused manually. When using a mini-lens, you may need to loosen the fixing screws on the lens and then use the knurled screw to focus the image. When using an EF lens, the focus setting is performed automatically.

Note

Always perform the alignment without the protective lens barrel

The orientation and basic configuration of the optical reader should always be performed without a screw-on protective lens barrel.

To align and configure the reader, follow these steps:

1. Position the optical reader so that the code to be read appears in the center of the image and is focused sharply.

2. Click the "Quick Start" button to automatically generate a basic configuration of all relevant parameters for simple reading tasks.
   If necessary, you can also restart individual steps in the "Setup" group, or you can set individual parameters manually in the WBM.

Note

Automatic exposure

If the parameter "Exposure = Auto" is set, the code must be completely in the image after the triggering until the automatic exposure is completed (approximate value: 50 ms).

3. Check the read result by enabling the "Formation of result" parameter in the "Result view" group ("Program" menu).

4. Save the settings using the "Save program" or "Save program as" button.

Result

The optical reader has been commissioned successfully. Then you can read codes for your application, make special settings and save them under individual programs.

Note

Access online help with the "?" button

In the WBM, you can use the "?" button at the top right to access the online help at any time. The online help opens with the context-sensitive help text relating to your current task.

7.5 Transferring optional licenses

7.5.1 Installing a license

Procedure

Proceed as follows to transfer an optional license to an optical reader:

1. Install the "Automation License Manager".

2. Install the MV plug-in for code reader devices.

3. Transfer a license to an optical reader.

Requirement

Note that you can only transfer licenses that are released for the target device (MV500).

Step 1: Installing the Automation License Manager

To install the Automation License Manager (ALM), follow these steps:

1. Install the Automation License Manager (ALM).
   You can find the Automation License Manager (https://support.industry.siemens.com/cs/ww/en/view/114358) on the pages of the Siemens Industry Online Support.

2. Follow the instructions in the setup program.

Reboot the PC if necessary.

Step 2: Installing the MV plug-in for optical readers

Follow the steps below to install the MV plug-in for optical readers:

1. Install the MV PlugIn ("ALM MV PlugIn").
   The MV plug-in is stored in the "UserDoc.zip" file on the reader. You can download this file via the "Help > User documentation" menu.

2. Follow the instructions in the setup program.

Result: Your PC is now ready for the transfer of licenses to the optical reader.

Requirements for step 3

- The optical reader cannot have the reader status "Run".

- The optical reader only accepts one Automation License Manager connection at a given time. You cannot connect two PCs to the optical reader at once.

- You can only transfer licenses that are released for the target device (MV500). You cannot transfer a STEP 7 license to the reader, for example.

Step 3: Transferring a license to an optical reader

Proceed as follows to transfer a license to an optical reader:

1. Start the WBM of the relevant reader.

2. Click on the [+] symbol in the "Start page" menu in the "Reader" area.

3. Start the Automation License Manager (ALM).

4. Open the MV plug-in via the menu command "Edit → Connect target systems → Connect code reading system".
   Reaction: The "Connect Target System" dialog opens.

5. Enter the IP address of the optical reader and click on the "OK" button.
   Reaction: The optical reader will now appear in the structure tree in the left half of the window.

6. Click on the drive that contains the license to be transferred.

7. Select the license to be transferred.

8. Select the "License key > Transfer" menu command to transfer the license to the optical reader.
   Reaction: The "Transfer License Key" dialog opens.

9. In the dialog that opens, select the optical reader as the destination drive and confirm the entry with "OK".
   Following the successful transfer of the license, the license is displayed on the optical reader.

10. In the structure tree, right-click on the optical reader and select the "Disconnect target system" menu command in the shortcut menu.

Result

The license was successfully transferred and the license is now available on the optical reader.

If the WBM was open during the transfer, you may need to restart the WBM.

7.5.2 Removing a license

If a license is no longer required on an optical reader, transfer the license from the optical reader to a different destination drive, if appropriate.

Please note that the functionality according to the license is available only in demo mode after the license is removed.

7.6 Selecting connection alternatives

Note

Communication disruptions due to additional DHCP server

If you want to operate the optical reader as a DHCP server, there must be no other DHCP/DNS servers in the network. Any additional DHCP/DNS servers disrupt communication in the network.

In the delivery state, the optical reader is set to DHCP client and does not interfere with communication in the network.

If the optical reader is connected using the "CONNECT" button, the optical reader is automatically operated as a DHCP server.

Selecting the network configuration requires precise knowledge of the network environment in which the optical reader will be used. In the simplest situation, the optical reader is connected directly to a PC as described in the section "Connecting and setting up the reader (Page 134)".

Operating modes

You can operate the optical reader in the following modes:

*   DHCP client (via "X1 LAN1" and "X2 LAN2")
*   Manual (via "X1 LAN1" and "X2 LAN2")
*   DHCP server (when using the "CONNECT" button via "X1 LAN1")
*   PROFINET mode (via "X1 LAN1")

These operating modes enable operation of the optical reader:

*   As a direct connection with a PC with or without a DHCP server.
*   In a network with several nodes with or without a DHCP server.
*   As a PROFINET device in a PROFINET network (via "X1 LAN1").

You can change the network settings in the "Communication" menu of the WBM after initial commissioning of the device.

Operating optical readers as DHCP clients ("X1 LAN1"/"X2 LAN2")

In "DHCP" IP mode, the optical reader obtains its network address from a DHCP server. To do this, specify the Ethernet interfaces to be used as the default gateway in WBM ("Communication > Interfaces > Ethernet").

NOTICE

MAC address must be known to DHCP server

Note that, depending on the network structure, the DHCP server must be informed of the MAC address, the unique device identifier of the optical reader. You can find the MAC address of the "X1 LAN1" interface on the nameplate of the optical reader, for example. The MAC address of the "X2 LAN2" interface is +2 higher than the "X1 LAN1" interface.

NOTICE

Ethernet interfaces in different subnets

Note that you must operate the Ethernet interfaces "X1 LAN1" and "X2 LAN2" in two different subnets. If you do not comply, you cannot save the changes in the WBM, or if you use SINEC PNI, the IP address of the "X2 LAN2" interface is discarded.

If your network administrator has assigned a DNS name (Domain Name Service) for the optical reader, you can address the device using its name via the Intranet server.

Operating the optical reader with a static IP address ("X1 LAN1"/"X2 LAN2")

Assign the network address manually in "Manual" IP mode. Enter the IP address and the subnet mask to suit your network configuration and, if applicable, a gateway address. To do this, specify the Ethernet interfaces to be used as the default gateway in WBM ("Communication > Interfaces > Ethernet").

NOTICE

Requirement for the IP address

Note that you can only set the IP address for the "X2 LAN2" interface via the WBM.

NOTICE

Ethernet interfaces in different subnets

Note that you must operate the Ethernet interfaces "X1 LAN1" and "X2 LAN2" in two different subnets. If you do not comply, you cannot save the changes in the WBM, or if you use SINEC PNI, the IP address of the "X2 LAN2" interface is discarded.

A gateway is not necessary for a direct connection between the optical reader and a PC/PG.

Operating an optical reader as a DHCP/DNS server ("X1 LAN1")

NOTICE
Possible faults when operating as a DHCP/DNS server
Note that operating the optical reader as a DHCP/DNS server can interfere with communication in an existing network! Another DHCP/DNS server in the network must not be enabled.
Note that the optical reader automatically operates as a DHCP/DNS server when connected using the "CONNECT" button.

Operating the optical reader in PROFINET mode ("X1 LAN1")

In PROFINET mode, you can do the following with the optical reader:

- Connect to the PC or the PG in your existing PROFINET IO network.

- Integrate as a device in a PROFINET IO network.

- Integrate as a device in a PROFINET IO network with an existing IP address (can be set in the configuration software, e.g. TIA Portal).

- Assign the IP configuration of the PROFINET IO controller.

NOTICE
Setting the IP address for "X2 LAN2"
Note that you can only set the IP address for the "X2 LAN2" interface via the WBM.

NOTICE
Ethernet interfaces in different subnets
Note that you must operate the Ethernet interfaces "X1 LAN1" and "X2 LAN2" in two different subnets. If you do not comply, you cannot save the changes in the WBM, or if you use SINEC PNI, the IP address of the "X2 LAN2" interface is discarded.

Operator control and monitoring

8

The MV500 optical readers are equipped with a Web server that provides Web-Based Management (WBM). You can set up and configure your readers using the WBM. You can create reader-specific programs and program sequences and perform diagnostics, among other things.

The connection is via Ethernet. The WBM can be accessed via a Web browser, such as Google Chrome or Microsoft Edge.

This device version has the following advantages:

- You do not have to install the software on your PC.

- You can start the WBM from any PC.

- The WBM is always designed to fit your optical reader. This means that no version conflicts occur.

Starting WBM

Start the WBM as described in the section "Connecting and setting up the reader (Page 134)".

Layout of the WBM

After successfully establishing a connection to the reader and switching to the start page, the WBM start window appears:
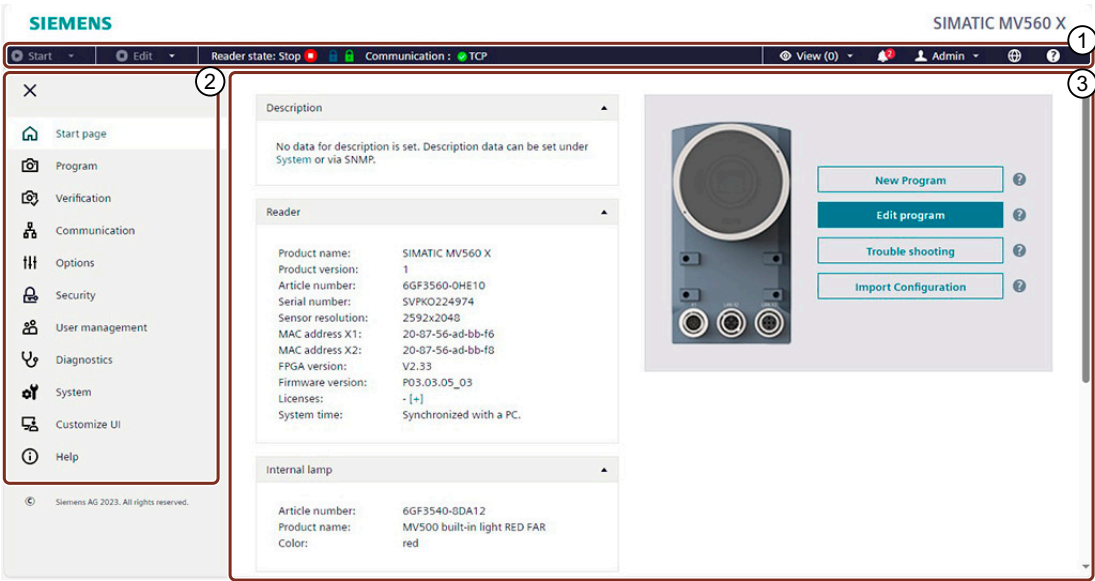
①   Status bar/toolbar
②   Menu tree
③   Main window

Figure 8-1   Start window of the WBM

Status bar/toolbar ①

Above the main window there is a three-part status bar/toolbar.

Table 8-1   Areas of the status bar/toolbar

Area	Description
Left area	Selection and control of a program / a program sequence
Middle area	Display of the reader status and access status
Right area	WBM functions: • Display and selection of the view • Login area • Selection of user interface language • Help function

A menu-specific toolbar may be located below the status bar/toolbar and above the main window. This toolbar is only displayed in the "Program" and "Verification" menus and has different functions depending on the menu.

The specific toolbar and its individual functions are described at the start of each section related to the menu.

Left area: Program/program sequence control

Table 8-2   Program/program sequence control

Icon	Description
Start/Stop	Click this button to start/stop the selected program or program sequence. [1]
	Via the drop-down list, you can choose the program or program sequence that you want to start/stop.
Edit	Click this button to edit the selected program.
	Via the drop-down list, you can choose the program or program sequence that you want to edit.

[1]   Note that the preselection of whether programs or program sequences are displayed depends on the "Options > Extras > Program sequence" setting.

Middle area: Reader status and access status

The reader status indicates the status of the reader at the current time. The access status shows the current status of the WBM.

Table 8-3   Reader status and access status

Icon	Description
Reader status	
Run	The reader has the "Run" status. The status shows that the device is currently in processing mode (RUN).
	Note that not all menu items can be accessed in processing mode.
Stop	The reader has the status "Stop". This means the device is currently neither in processing mode nor in productive mode. There is no operation (STOP).
	The display of this status depends on the menu item in which you are currently working.
Edit	The reader has the "Edit" status. The status shows that the device is currently in edit mode and changes can be made to the configuration.
	This status is only shown within the "Program" menu item.
Calibrate	The reader has the "Calibrate" status. The status shows that the device is currently in calibration mode and changes can be made to the configuration. Calibration is used to be able to calculate the quality of 1D and 2D bar codes according to international standards.
	This status is only shown within the "Verification" menu item.
View	The reader has the "View" status. The status shows that the device is currently in edit mode and changes have been made in another, not currently selected, program and not yet saved.
	This status is only shown within the "Program" menu item.
Adapt	The reader has the "Adapt" status. The status shows that the device is currently in adapt mode. This mode is started either by the "READ" button or by the "Quick Start" function in the program step "Overview > Setup".

Icon	Description
Access status	
DISA is active Red-gray padlock 	Operation is not possible in this status because an automation system is in control of the optical reader. Only users that have the "Take control" right are capable of taking over control of the optical reader from the automation system.
Access denied Red padlock 	No operation is possible in the "Read only" status. Either the logged-on user does not have write rights or the WBM of another PC has control over the reader.
Access protection active Blue padlock 	The user management of the WBM is active.
'Take control' active Green padlock 	The currently logged on user has taken control of the optical reader. During this time, the connected controller cannot access the optical reader.

NOTICE
Parallel operation not possible through users and connected automation system
Note that users that have been assigned a role with the "Take control" right may take over control of the optical reader from the automation system through their login. In this case, the automation system cannot change the status or program during this time.

Right area: WBM functions

Table 8-4   WBM functions

Icon	Description
View	Display and drop-down list for selecting the view.
	The WBM has two view modes. In the extended view, all parameters and function of the optical reader are displayed. This view is intended for trained and experienced users and is recommended for the initial configuration of the reader.
	In the simplified view, those parameters and function are hidden that are not required for monitoring and diagnostics (of an already configured reader).
	If the simplified view does not show you all the parameters in one area, you can recognize this by the "More" buttons that are displayed within the respective areas. By clicking on one of these buttons you automatically switch to the extended view.
Login area	If user management is enabled, you must log on in this area to be able to make changes in the WBM with your login. Your user name is displayed as soon as you are logged in. If you are already logged in, you can log out in this area.
	If the user management is disabled, then a button to enable user management is displayed here.
User interface language	Selection of user interface language
Help	You can call up the online help for the WBM using the question mark symbols "?" in the status bar/toolbar, as well as in the individual areas. The help is context-sensitive. The corresponding help page for the menu/area in which you are currently working is called.
	In some menus, the help is displayed integrated in the main window ("Communication", "Options", "System").

NOTICE

**Parallel operation not
possible through users and connected automation system**

Note that users that have been assigned a role with the "Take control" right may take over control of the optical reader from the automation system through their login. In this case, the automation system cannot change the status or program during this time.

Main window ③

The main window shows the contents of the selected menu items. Here, you can configure the various menu-dependent parameters. The main window is divided up into three columns in the "Program" and "Verification" menu items.

Message area

The message area displays all WBM-related error messages and warnings (e.g. transfer errors). If messages or warnings are present, they are displayed at the top of the main window. Note that the message area is only displayed on the homepage of the WBM.

WBM login when accessing via an automation system (DISA active)

Requirements

The user management is enabled and a user with administrator rights and the "Take control" right has been created.

Procedure

If the optical reader is controlled via an automation system, i.e. with the DISA bit set, you will need to log on to the optical reader as follows:

1. Make sure that only one PC is accessing the optical reader (Access status: red-grey lock icon).

2. Click on the user name (login area) in the status bar/toolbar in the top right-hand corner and check whether the user profile currently logged in has administrator rights and the "Take control" right.

3. If this is not the case, log off and log on with a user profile that has administrator rights and the "Take control" right.

Note that the automation system can only control the device to a limited extent when you take over control with "Take control". Functions that require the DISA bit, such as "Program change" and "Save program", can no longer be executed by the automation system in this case.

Function of the DISA bit

By setting the DISA bit, you ensure that the connected automation system is in control of the optical reader. When the DISA bit is set, users have only limited access to the reader via the WBM. Only users that have been assigned a role with the "Take control" right are able to take over control of the optical reader from the automation system.

Note that the DISA bit must be set so that the automation system can execute the functions "Program change" and "Save program". As soon as a user with the "Take control" right accesses the optical reader, control of the device by the automation system is limited and it can no longer execute these functions.

Process interfacing via an automation system (PLC, PC)

9

You can operate the optical reader with either the WBM or an automation system. Using an automation system (e.g. S7 controller), you can control the optical reader and view read results and verification results.

Note

Controlling the readers via an automation system

Note that when the WBM is active, you can only control the readers via an automation system (e.g. Saving and changing programs), if the "Take control" check box in the "Security" tab is disabled for the current user in the "Options" menu of the WBM.

Table 9-1   Overview: Compatible communication modules, controllers and program blocks

Ident systems and MV interface	Compatible program blocks in conjunction with ...			
	Ident profile with S7-300/400/ 1200/1500	FB 45 with S7-300/-400 [1]	FB 79 with S7-300/-400	Without a dedicated FB
SIMATIC MV500 (without CM)				
PROFINET IO	✔	--	✔	✔
TCP/IP	--	--	--	✔
RS232	--	--	--	✔
SIMATIC MV500 via ASM 456	✔	✔	--	--
SIMATIC MV500 via ASM 475	--	✔	--	--
SIMATIC MV500 via RF120C	✔ [2]	--	--	--
SIMATIC MV500 via RF170C	✔	✔	--	--
SIMATIC MV500 via RF180C	✔	✔	--	--
SIMATIC MV500 via RF185C/RF186C/ RF188C	✔	✔	--	--
SIMATIC MV500 via RFID 181EIP	--	--	--	✔ [3]

[1]   Not recommended for designing new configurations.

[2]   Only in conjunction with the S7-1200 controller

[3]   An FB based on the Ident profile is available for connection via Rockwell controllers.

You have a variety of options available to integrate the optical reader into your automation system.

Via the combination interface (DI/DQ, RS232 and CM):

- Integration via a communication module and Ident profile

- Integration via RS232

- Integration via DI/DQ

Via the Ethernet interface (PROFINET IO, TCP/IP):

- Integration using the Ident profile and FB 79 via PROFINET IO without an additional communication module.

- Integration via TCP/IP

This section explains the various options for process connection.

9.1 Integration via PROFINET IO without CM

You can use the MAC address to operate the optical reader via PROFINET IO without using a communication module. The reader has two MAC addresses. The MAC address printed on the housing is the interface MAC address. The port MAC address corresponds to the interface MAC address +1.

Note

Compatibility and device replacement of SIMATIC MV440 and SIMATIC MV540

Note that the SIMATIC MV440 and SIMATIC MV540 devices are mutually compatible and can be exchanged in a PROFINET IO network without any problems.

You can find detailed information on the compatibility of the devices in the section "Functional description (Page 21)".

Integrating using the GSD file

The properties of the reader are stored as PROFINET IO devices in the GSD file provided. You can integrate the reader into controllers using the GSD file.

Note

Configuration software

The following description was created with STEP 7 Professional (TIA Portal). Alternatively, you can integrate and configure the reader in STEP 7 Classic (HW Config) or in third-party controllers.

As of STEP 7 V15, the SIMATIC MV500 optical readers are already integrated in the TIA Portal.
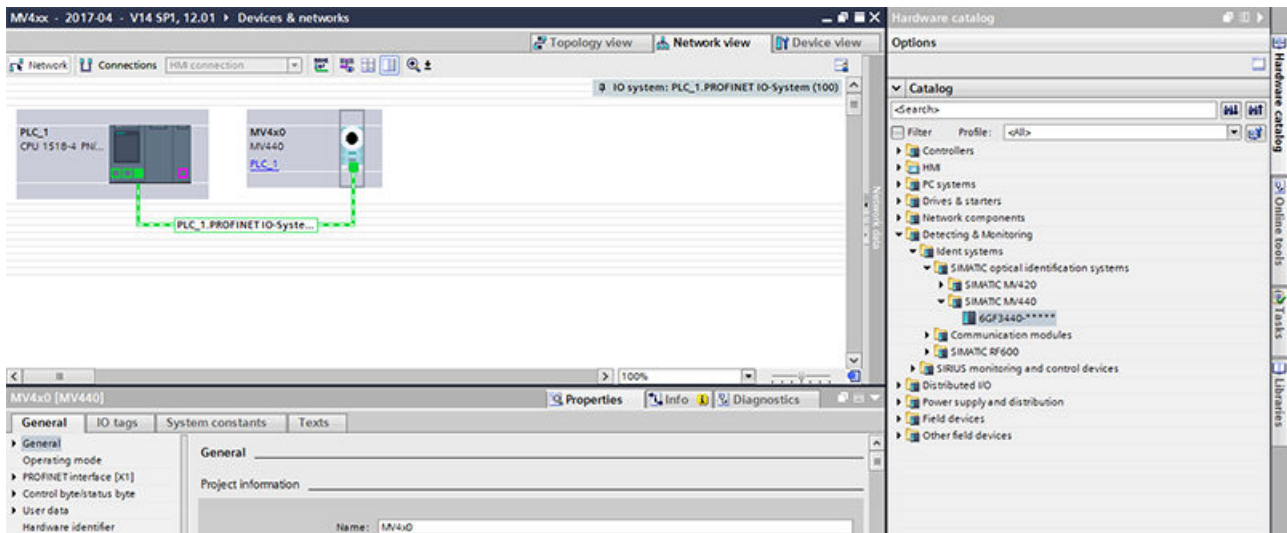
Figure 9-1   STEP 7 TIA Portal: Optical readers in the hardware catalog

To integrate the GSD file of the reader into controllers, follow these steps:

1. Copy the installation file (*.zip) locally to your PC.
   You can find the file on the Internet on the pages of the Siemens Industry Online Support
   (https://support.industry.siemens.com/cs/ww/en/ps/15147/dl).

2. Extract the *.zip file and copy the files it contains to a directory that you can access with STEP
   7 Basic / Professional.

3. Open the TIA Portal and change to the project view.

4. Open with the "Extras > Manage device description files (GSD)" menu.
   After opening this dialog, the "Installed GSDs" tab is displayed by default and the window
   shows the GSDs installed to date.

5. Click the "..." button and navigate to the folder where you stored the files.

6. Select the desired GSD file and confirm the entry with "OK".

7. Select the check box in front of the corresponding GSD file and click the "Install" button.

8. In the next dialog, click the "Continue" button to start the installation.
   At the end of the installation, a message appears indicating that the installation was
   successful.

9. Click the "Finish" button and restart the TIA Portal.

Result: Your hardware catalog in the TIA Portal has now been updated and the reader is
included. You can find the optical readers under the following path in the hardware catalog:
"Additional field devices > PROFINET IO > Ident systems > SIEMENS AG > SIMATIC Code
Reading Systems > MV500".

Assigning PROFINET device names

The optical reader detects the transmission speed of PROFINET automatically. PROFINET
operates in 100 Mbps full duplex mode.

To assign the reader a unique PROFINET device name, follow these steps:

1. Open the TIA Portal with "Start > All Programs > Siemens Automation > TIA Portal Vxx".

2. Create a new project.

3. Change to the Project view.

4. Using the project tree, insert an S7 controller in the project using the "Add new device" menu command.
   The device view opens and the S7 controller is displayed.

5. Drag the optical reader from the hardware catalog into the project.

6. Switch to the network view and connect the reader to the S7 controller.

7. Optional: Enter a PROFINET device name in the properties of the reader in the tab "General" > Parameter group "PROFINET interface [X1] > Ethernet addresses", "PROFINET" area.

8. Right-click on the reader.

9. In the shortcut menu, select the menu command "Assign device name".
   Reaction: The "Assign PROFINET device name" window opens.
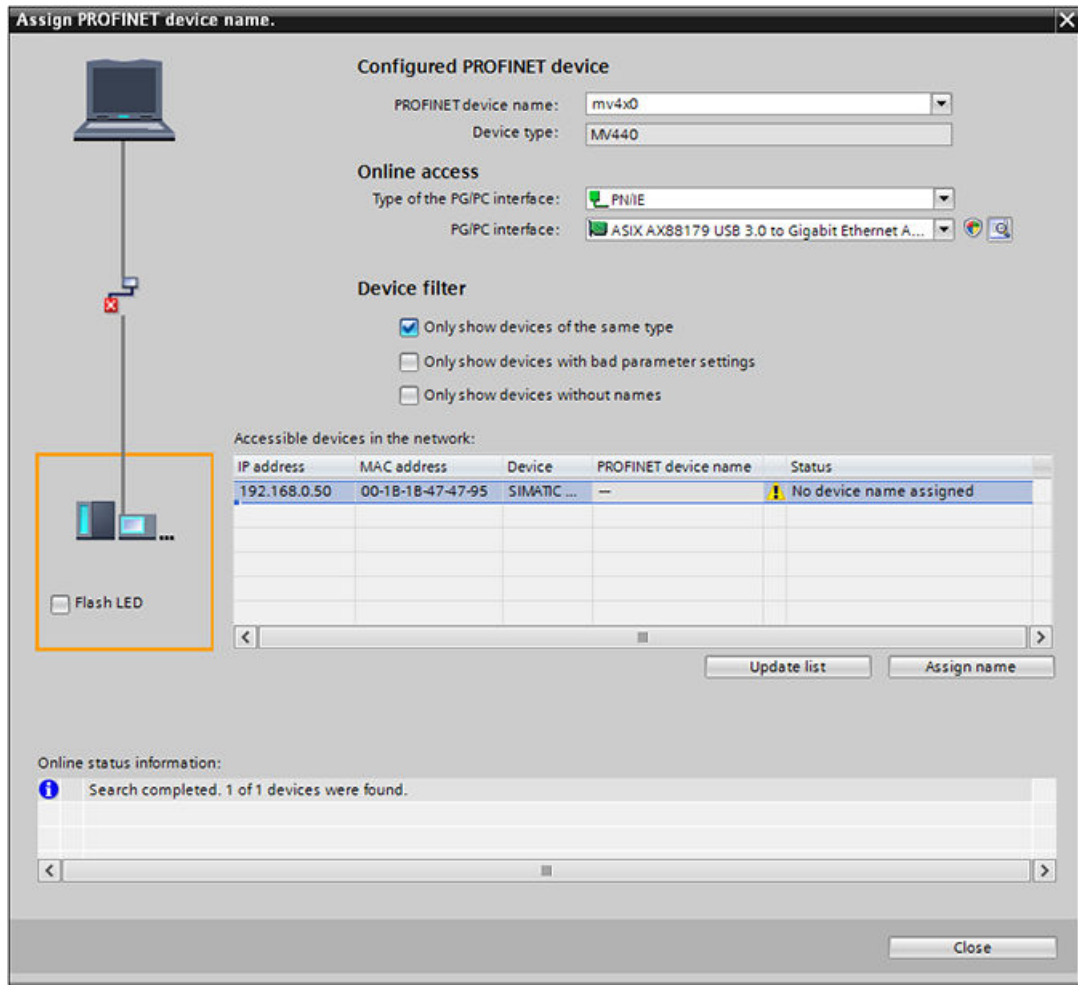
Figure 9-2   STEP 7 TIA Portal: Assigning PROFINET device names

10. Select the connection type in the "Online access" in the "Type of the PG/PC interface" drop-down list.

11. In the "PG/PC interface" drop-down list in the "Online access" area, select the network adapter via which the optical reader is connected to the PC.

12. Click the "Update list" button to display all reachable devices in the network.

13. Select the required device from the list.

14. Now click the "Assign name" button to assign the PROFINET device name to the optical reader.

Result: The reader is assigned the configured PROFINET device name from the project.

Alternatively, you can use SINEC PNI or the WBM ("Settings > Communication > Interfaces > Device/host name") to assign the reader a unique PROFINET device name.

Configuration with FB 79 or the Ident profile

Depending on the function block you are using, you must select the required function block in the properties of the reader in the tab "General" > Parameter group "Mode".

9.2 Integration via communication modules

The optical reader supports a subset of communication module parameters.
Via the RS422 interface, the optical reader can be integrated in a control system using a communication module (CM). Integration via a communication module is described in the respective operating instructions of the relevant CM.
When configuring the communication module in conjunction with the optical reader, you can set the following parameters in the hardware configuration:

Table 9-2   Configuration parameters

Parameter	Parameter value	Note
User mode	Ident profile	--
	FB 45 / FC 45	--
MOBY mode	RF200/RF300/RF600; MV4x0; MV5x0; MOBY U/D	--
Transfer speed	19.2 kBd	Selection must be identical to the configuration of the optical reader.
	57.6 kBd	
	115.2 kBd	
Diagnostics messages	None	Standard diagnostics. Diagnostics of the optical reader takes place via a separate mechanism.

9.3 Control with Ident profile

This section explains a process connection using the Ident profile. The use of the FB 45 via a communication module is still possible, but is no longer recommended. With the FB 45, systems that are already operated with the FB 45 today can continue to be operated compatibly with MV500. You can find information on operation with FB 45 in the manuals "SIMATIC MV420 / SIMATIC MV440 (https://support.industry.siemens.com/cs/ww/en/view/84553392)" and "FB 45 for MOBY U, MOBY D, RF200, RF300 (https://support.industry.siemens.com/cs/ww/en/view/21738808)".

You can find an overview of the compatible communication modules in the section "Process connection via an automation system (PLC, PC) (Page 149)".

Note

Knowledge of program blocks

To understand the following description, you require knowledge of the program blocks involved.

Note

Stable synchronization after error

To be able to guarantee stable synchronization after an error has occurred, we recommend that you check the "ERROR" bit of the Ident profile after each command has been executed.

If an error occurs, you may need to perform an initialization again. This is achieved by setting the "INIT" bit.

9.3.1 Assigning parameters to the Ident profile (standard profile V1.19)

A detailed description of the Ident profile can be found in the corresponding function manual.

The following function modules are required in the STEP 7 project:

- Ident profile (Ident_Profile)
  The Ident profile is a single complex block containing all the commands and functions for RFID systems and optical reader systems.

- Ident blocks
  The Ident blocks represent a simplified interface of the Ident profile. Each Ident block contains a single command of the Ident profile.

The "TXBUF" and "RXBUF" data buffers for send and receive data (memory area of the receive data).

The following input and output parameters have a meaning different from the description in the function manual of the Ident profile.

Table 9-3   Assignment of input parameters

Variable	Value/description
INIT	For initializing the CM or to acknowledge a group error of the optical reader. You can find additional information about acknowledgment of the group error of the optical reader in the section "Group error (Page 175)" of the online help.

Table 9-4   Assignment of output parameters

Variable	Value/description
RPTACT	Not supported
TPC	No significance
TP	No significance
UIN0	For a description, refer to the section "Status display of the optical reader (Page 156)".

Initialization

During initialization (INIT), the Ident profile automatically executes the "WRITE-CONFIG" command. The parameter values of the "WRITE-CONFIG" command depend on whether the Ident profile is used with or without a communications module.

WRITE-CONFIG

Table 9-5   WRITE-CONFIG

CMD	OFFSET BUFFER	LEN_DATA	CONFIG	TXREF
0x78	Offset in send buffer "TXREF"	Length of the parameter data	• 0x01 ≙ communication reset without configuration data (LEN_DATA = 0) • 0x03 ≙ communication reset with configuration data to be sent	Configuration data to be sent

Note that the communication reset without configuration data (CONFIG = 0x01) can only be used if you operate the reader without communication module via PROFINET IO. Reset without configuration data corresponds to the "INIT" command without program selection.

Structure of the configuration data attachment of WRITE-CONFIG

Table 9-6   MV400 with CONFIG = 0x03; LEN_DATA = 0x10

Byte	1	2...5	6	7...8	9	10	11	12 ... 13	14	15	16
Value	0x04	0x00	0x0A	0x00	0x00	0x25	0x02	0x00	0x01	0x00	0x00 ... 0x0F [1]

[1]   0x00: "INIT" without program selection

0x01 ... 0x0F: Number of the program to be started ("INIT" with program selection)

9.3.2   Control with MV commands via Ident profile

The optical reader is controlled by the "PHYSICAL WRITE" and "PHYSICAL READ" commands. Chaining of commands is not supported.

An RFID system typically has a linear memory area for each transponder from which data can be read or to which data can be written. The address space (in this case purely virtual) is used in an optical reader to map certain MV commands (machine vision commands). In addition, the data that is "written" to a specific address, for example, has a defined semantic meaning.

This section explains which address space must be written to or which address must be read from in order to cause specific behavior of the optical reader. The semantic meaning of the read data or data to be written is also explained.

9.3.2.1   Status display of the optical reader

Note

Startup of the optical reader with Ident profile

You need to perform the following steps after the power "ON" when starting up the optical reader while using the Ident profile (with or without a communication module):

1. Set a startup flag in OB100 of the controller.

2. Repeat the initialization ("init_run" or "INIT" command) until the initialization receives a positive acknowledgment.

3. To generate an error in the automation system, also monitor the maximum wait time for positive acknowledgment of the initialization and expected status bit values (only necessary if there is initialization without program selection).

The status bits "IN_OP" (in operation) and "RDY" (ready) of the optical reader indicate whether the device has a group error, is in processing mode or is in STOP mode:

Table 9-7   States of the optical reader

RDY (ready)	IN_OP (in operation)	Description
X	0	Group error
1	1	Processing mode
0	1	Stop or adjustment mode

Depending on the state of the optical reader, different MV commands are permissible (see section "Preconditions for the commands (Page 174)") or an acknowledgment of an error (see section "Group error (Page 175)") is required before the next MV command can be issued.

When there is a group error, this error must be acknowledged before further operation is possible. The acknowledgment mechanism is explained in the section ""PHYSICAL WRITE" commands / MV command interface (Page 158)".

The status display is only valid after successful initialization. The "INIT" bit must be set for this.

Table 9-8   Output parameters of the Ident profile

Bit	Description
UIN0	Corresponds to "IN_OP" bit of the optical reader
UIN1	Corresponds to "RDY" bit of the optical reader
UIN2	These two bits are interpreted as an 'unsigned' value (bit 2 is the less significant bit) that represents the number of available decoded codes. If the value = 3, three or more decoded codes are available.
UIN3	

9.3.2.2   Initialization

When performing an initialization ("INIT"), you have the choice between an initialization with program selection and initialization without program selection.

Monitor the operating state of the optical reader regardless of the initialization method selected by the automation system (see section "Status display of the optical reader (Page 156)"), in order to be able to react to a change of operating state and to check the required preconditions (see section "Preconditions for the commands (Page 174)").

Initialization with program selection

Initialization with program selection enables:

* Initialization after startup

    – After the self-test, the optical reader switches to processing mode with the selected program number.

    – With initialization during self-test, the initialization receives a negative acknowledgment. Wait for the end of the self test and repeat the initialization until you receive a positive acknowledgment.

* Reset of pending error with the subsequent start of the selected program. If the selected program does not exist, the initialization receives a negative acknowledgment.

Initialization without program selection

Initialization without program selection enables:

- Initialization after startup

  - After the self-test, the optical reader changes to the operating mode that it was in prior to shutdown.

  - Initialization is acknowledged positively as early as during the self-test. This means that you need to determine the operating state using the status display (see section "Status display of the optical reader (Page 156)").

- Identification of pending errors (see section "Group error (Page 175)").

- Reset of pending error

9.3.2.3   "PHYSICAL WRITE" commands / MV command interface

Supported MV commands

You can use the "PHYSICAL WRITE" command to send various MV commands (Machine Vision commands). This is used to make settings in the reader.

An MV command is always a write command to the address "0x0000" ("CMD_STRUCT.StartAddress = 0") with a command-dependent length ("CMD_STRUCT.Length").

The first byte in the memory area of the receive data codes the relevant MV command and determines the meaning of any bytes that follow.

The following commands are supported:

Table 9-9   PHYSICAL-WRITE

CMD	OFFSET BUFFER	ADDR_ TAG	LEN_DATA	TXREF
0x71	Offset in the "TXREF" send buffer	0x0000	Length of data to be sent to the reader:	Sub-command with data to be sent to the reader. The first SINT contains the command identifier:
			• 02	• 01 = Program change (write program number)
			• 01	• 02 = Activate read program number (once)
			• Match string length + 3	• 03 = Write match string
			• 01	• 04 = Activate read match string (once)
			• 01	• 05 = Set DISA bit
			• 01	• 06 = Reset DISA bit
			• 07	• 08 = Set digital Out
			• Command length +3	• 09 = Set image acquisition
			• Command length +3	• 0A = Automatic Setup
			• 01	• 0B = Trigger

Command: Program change (write program number)

You can perform a program change using the "PHYSICAL WRITE" command. The command contains the data of the following table. If the program change is successful, the "WRITE" command receives a positive acknowledgment; otherwise, it receives a negative acknowledgment.

Before the program change, the "DISA" bit in the optical reader is automatically set and reset after the program change. If the "DISA" bit was set manually prior to the program change, it will remain set.

The "WRITE" command must specify the length "0x02" ("CMD_STRUCT.LEN_DATA = 0x02"); otherwise, the command receives a negative acknowledgment. If an attempt is made to change to an unsaved program or a program number > "0x0F", the command will also be denied and receive a negative acknowledgment.

Table 9-10   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x02
ADDR_TAG	0x00

Table 9-11   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x01	"Program change" command identifier
0x0001	0x00 ... 0x0F	Number of the program

Command: Read program number

You can prepare to read the current program number using the "Read program number" command.

The MV command itself does not perform the actual read. Therefore, the data of the "PHYSICAL WRITE" command only includes the MV command itself.

Before performing the "PHYSICAL READ" command, you need to execute the MV command "Read program number" with the "PHYSICAL WRITE" command. If this receives positive acknowledgment, you must then read out the actual program number with a "PHYSICAL READ" command. You can find more detailed information on the "PHYSICAL READ" command in the section ""PHYSICAL READ" commands (Page 169)".

The "PHYSICAL WRITE" command must specify the length "0x01" ("CMD_STRUCT.LEN_DATA = 0x01"); otherwise, the command receives a negative acknowledgment.

Table 9-12   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x01
ADDR_TAG	0x00

Table 9-13   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x02	"Read program number" command identifier

Match string

> **Note**
>
> **Sent match string takes effect immediately**
>
> A sent match string takes effect immediately. The sent match string is not synchronized with the trigger signal or the processing of buffered acquired images.
>
> Therefore, ensure that the match string is sent when no image acquisition is running.

Requirement for matching with 1D/2D codes

All match options ("All", "Position", "ID", "GS1") are supported for 1D/2D codes. The match string that is sent must be formatted in such a way that the information required for the match can be extracted.

Command: Write match string

- This MV command allows the match string of the currently loaded program (non-persistent) to be overwritten. This command can only be executed when the optical reader is in processing mode. If the reader exits processing mode, for example by changing to STOP mode or to the group error status, the overwritten match string is discarded. This also applies to a program change.

- The structure of the memory area is outlined in the table below.

- The total length of the data to be written is the overall length of the match string + 3 bytes for the length and the command identifier ("CMD_STRUCT.LEN_DATA = n + 3").

- If the new match string is applied to the current program, the command receives positive acknowledgment.
  If the match string cannot be overwritten, an extra entry is made in the diagnostic data.

Table 9-14   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	Match string length + 3
ADDR_TAG	0x00

Table 9-15   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x03	Command identifier "Write match string"
0x0001	0x00 ... 0xFF	Length of match string high byte
0x0002	0x00 ... 0xFF	Length of match string low byte
0x0003	--	1st character of the match string
...	--	...
n + 2	--	(n-1)th Characters of the match string
n + 3	--	nth Characters of the match string

Command: Read match string

- The "Read match string" MV command is used to prepare reading of the match string. The actual read operation is not performed with the "PHYSICAL WRITE" command.

- The memory area of the receive data of the "PHYSICAL WRITE" command only contains the command identifier itself.

- Send the "Read match string" command with the "PHYSICAL WRITE" command and wait for the positive response. Then read out the actual string with a "PHYSICAL READ" command.

- The "PHYSICAL WRITE" command must specify the length "0x01" ("CMD_STRUCT.Length = 0x01"); otherwise, the command receives a negative acknowledgment.

Table 9-16   CMD_STRUCT

Parameter	Value
CMD	0x71
OffsetBuffer	0x00
UID	0x00
Length	0x01
StartAddress	0x00

Table 9-17   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x04	Command identifier "Read match string"

DISA bit

Command: Set DISA bit

The command data to be "written" in the "PHYSICAL WRITE" command only contains the command identifier "Set DISA bit".

If the "DISA" bit of the optical reader has been set, the command receives positive acknowledgment. If the "DISA" bit has already been set, it remains set.

The "PHYSICAL WRITE" command must specify the length "0x01" ("CMD_STRUCT.LEN_DATA = 0x01"); otherwise, the command receives a negative acknowledgment.

Table 9-18   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x01
ADDR_TAG	0x00

Table 9-19   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x05	Command identifier "Set DISA bit"

Command: Reset DISA bit

The command data to be "written" in the "PHYSICAL WRITE" command only contains the command identifier "Reset DISA bit".

If the "DISA" bit of the optical reader has been reset, the command receives positive acknowledgment. If it was already reset, this command has no effect but is nevertheless positively acknowledged.

The "PHYSICAL WRITE" command must specify the length "0x01" ("CMD_STRUCT.Length = 0x01"); otherwise, the command receives a negative acknowledgment.

Table 9-20   CMD_STRUCT

Parameter	Value
CMD	0x71
OffsetBuffer	0x00
UID	0x00
Length	0x01
StartAddress	0x00

Table 9-21   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x06	Command identifier "Reset DISA bit"

Command: Set digital out

Writing command data

The command data to be "written" in the "PHYSICAL WRITE" command contains the command identifier and six parameters.

With this command, the four logical signals "EXT_1", "EXT_2", "EXT_3" and "EXT_4" can be set and linked to other logical signals. These signals can only be set through an automation system. In addition, these signals can be applied to the available digital output pins via the WBM.

Receipt of this command is logged in the diagnostics data records. If the command contains an invalid parameter, a negative acknowledgement is sent.

The "PHYSICAL WRITE" command must specify the length "0x07" ("CMD_STRUCT.LEN_DATA = 0x07"); otherwise, the command receives a negative acknowledgment.

Table 9-22   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x07
ADDR_TAG	0x00

Table 9-23   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x08	Command identifier "Set digital out".
0x0001	0x01 ... 0x04	Number of the logical external signal. Corresponds to "EXT_1", "EXT_2", "EXT_3" and "EXT_4".
0x0002	0x00 ... 0x02	Level of the signal • 0x00: Set level statically to "low". • 0x01: Set level statically to "high". • 0x02: Set level for configured pulse time to "high".
0x0003	0x01 ... 0x07	Link type • 0x01: Logical "OR" • 0x02: Logical "AND" • 0x03: Logical "Exclusive OR" • 0x04: no link • 0x05: Logical "OR not" • 0x06: Logical "AND not" • 0x07: Logical "Exclusive OR not"
0x0004	0x00 ... 0x05	Logical signal for linking. If the link type is 0x4, the parameter has no significance. • 0x00: Logical signal "IN_OP" • 0x01: Logical signal "TRD" • 0x02: Logical signal "RDY" • 0x03: Logical signal "READ" • 0x04: Logical signal "MATCH" • 0x05: Logical signal "N_OK"
0x0005	0x00	Reserved. Must be "0x00" to maintain upwards compatibility.
0x0006	0x00	Reserved. Must be "0x00" to maintain upwards compatibility.

Command: Set image acquisition

You can use the "Set image acquisition" command to adjust the focus setting, exposure time and brightness, as well as the image acquisition speed for the "Scan" and "Auto-trigger" modes, during processing. The command can only be used while the reader is in processing mode. The focus adjustment command only works in conjunction with a calibrated EF lens.

If the exposure parameters are changed in this way and a trigger signal occurs, image acquisition starts with a delay of up to one millisecond due to application of the parameters. When the focus setting is changed, the EF lens needs adequate time to focus to the new

distance. The time required for focusing is at least 40 ms, but a time interval of 350 ms until the next trigger signal is required.

NOTICE

Interruption of processing mode in case of incorrect use

Only use this command if it is ensured that there is sufficient time to apply the new settings before the next trigger signal. If these restrictions are disregarded, processing mode may be disrupted in the form of ignored or rejected trigger signals.

Note

Delay between trigger signal and start of image acquisition

Note that the use of this command results in larger and more strongly fluctuating delays between the occurrence of a trigger signal and the start of image acquisition. This effect is stronger when trigger takes place via the DI interface.

Note

Delayed transfer

Note that the write job for this command is only acknowledged as ended when the changes have been applied in full. In the case of a change to the distance value, this can take up to 350 ms. It is not possible to abort the command.

Table 9-24   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	Length of the "Set image acquisition" command + 3
ADDR_TAG	0x00

Table 9-25   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x09	"Set image acquisition" command
0x0001	0x00 ... 0xFF	Payload length (high byte)
0x0002	0x00 ... 0xFF	Payload length (low byte)
0x0003	--	Payload (byte 1)
...	--	Payload (byte n)

Command syntax

The command consists of one or more blocks with the following syntax:

P:m ; FOCUS | GAIN | EXPOSURE | INTERVAL : a&

Table 9-26   String structure

Characters	Description
P:m	"P:m" is optional and can be used to identify the program(s) to which the settings in the block are applied. In this case, "m" can consist of up to 5 program numbers (binary value) with 1 byte each.
	If a block does not contain a "P:m" entry, the settings are used for each currently running program.
;	Delimiter character that divides the individual blocks of the string into subsections.
FOCUS | GAIN | EX-POSURE | INTERVAL	Subsection identifiers that indicate which value is to be set.
a	The value to be set is a number (2-byte binary notation) whose meaning depends on the preceding subsection identifier.
	• For FOCUS, this is a distance value in [mm]
	• For GAIN, this is a gain value
	• For EXPOSURE, this is an exposure time in [μs]
	• For INTERVALL, this is an image acquisition interval in [ms] Only valid for the "Auto-trigger" or "Scan" mode.
&	Delimiter needed to divide the payload into blocks.

NOTICE

Interruption of image acquisition through acquisition interval = 0

If an acquisition interval of "0" is set using the "INTERVAL" section, the image acquisition is aborted. The device remains in processing mode but does not take any more images until an INTERVAL > 0 is set, a new trigger signal is applied or a program change takes place.

In the "Scan" mode, the image counter is retained. This means that, if a new INTERVAL value is set, the remaining images are continued until the "Number of acquired images" has been reached.

If an acquisition interval of "1" is set using the "INTERVAL" section, the interval is reset to the value stored in the program.

Example

"Scan" mode, acquisition interval "2000 ms", number of acquired images: 20.

An INTERVAL = 0 is set ten seconds (i.e. 5 acquired images) after a trigger signal. An INTERVAL = 1000 is set after a pause of one minute. This has the result that the remaining 15 acquired images are set with an interval of 1000 ms.

Examples

<0xnn> is a number in bit notation

- <0x09><0x000F>P:<0x01>;EXPOSURE:<0x2328>
  Exposure is set to 9000 μs for program 1.

- <0x09><0x001C>FOCUS:<0x0028>;EXPOSURE:<0x2328>;GAIN:<0x00C8>
  Focus is set to 40 mm, exposure is set to 9000 μs, and gain is set to 200 for all currently running programs.

- <0x09><0x001A>P:<0x01>;FOCUS:<0x0028>&P:<0x02>;FOCUS:<0x012C>
  The focus is set to 40 mm for program 1 and 300 mm for program 2.

- <0x09><0x0015>FOCUS:<0x02BC>&P:<0x03>;FOCUS:<0x0258>
  The focus is set to 700 mm for all currently running programs, except for program 3, where the focus is set to 600 mm.

- <0x09><0x000B>INTERVAL:<0x0000>
  The image acquisition of the currently running program (incl. "Auto-trigger" or "Scan") is interrupted.

- <0x09><0x000B>INTERVAL:<0x01FA>
  The image acquisition of the currently running program (incl. "Auto-trigger" or "Scan") is set to 500 ms. If image acquisition was aborted previously, it is resumed.

Command: Automatic Setup

Using the "Automatic Setup" command, you can trigger complete program adaption. This command can be used at any time and creates a new, optimized program based on the object currently located in the image. Then the reader returns to processing mode with this program (or the program sequence with the same number). If creation of the program fails (e.g. no code in the image), the device switches to error state.

The function of the command corresponds to the "READ" button on the front of the device or the "Start Automatic Setup" button in WBM. The exact behavior of the function can be preset in the "Options > Extras > Operation on device > READ" or sent directly with the command. Parameters that are not sent with the command are used according to the setting in the options.

NOTICE

Interruption of processing mode

Note that the reader exits processing mode when executing this command. This is true even when "Allow use of READ function" is set to "Never" or "Not in processing mode".

Note

Long-running command

Note that, depending on the program template and device version (image resolution), the complete execution of this command may take several minutes, even when successful. The progress of this command can be obtained by querying the device status: After completion, the device is either in processing mode ("RDY" bit set) or in error state ("IN_OP" bit no longer set).

Table 9-27   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	Length of the "Automatic Setup" command + 3
ADDR_TAG	0x00

Table 9-28   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x0A	"Automatic Setup" command identifier
0x0001	0x00 ... 0xFF	Payload length (high byte)
0x0002	0x00 ... 0xFF	Payload length (low byte)
0x0003	--	Payload (byte 1)
...	--	Payload (byte n)

Command syntax

The command consists of up to six blocks of 5 bytes each with the following syntax:

[option] : [setting]

Table 9-29   String structure

[option] (3 bytes)	[einstellung] (1 byte)	Description
SRC	0...15	Number of the source program • 0: New program
TGT	0...15	Number of the target program • 0: Next free program
EXP	0, 1	Optimization of exposure • 1: Perform • 0: Do not perform
LMP	0, 1	Lighting scenario • 1: Run through • 0: Do not run through
FCS	0, 1	Focus setting • 1: Re-determine • 0: Do not determine
DEC	0, 1, 2	Code type detection • 2: Perform completely • 1: Perform quickly • 0: Do not perform

Every option sent with the command takes precedence over the corresponding setting in the device options, but only for the duration of this command. If all settings in the device options are preset as needed, the command can be sent without options.

Examples

<0xnn> is a number in bit notation

- <0x0A><0x0000>
  The command is started with full use of the device options.

- <0x0A><0x0005>TGT:<0x01>
  The command is started as set in the options. However, the created program is saved as "Program 1" depending on the set options.

- <0x0A><0x0024>SRC:<0x01>;TGT:<0x01>;EXP:<0x01> ;EXP:<0x00>;LMP:<0x00>;FCS:<0x01>; DEC:<0x02>
  The command is started by re-creating "Program 1". The exposure and lamp settings are not changed, only the focus setting and the code type to be read are determined again.

Command: Trigger

You can use the "Trigger" command to trigger image acquisition if "DI/DO" is set as the trigger source.

Table 9-30   CMD_STRUCT

Parameter	Value
CMD	0x71
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x01
ADDR_TAG	0x00

Table 9-31   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x0B	"Trigger" command identifier:

9.3.2.4   "PHYSICAL READ" commands

Supported MV commands

Using the "PHYSICAL READ" command, you can read out various MV commands (Machine Vision commands).

The following commands are supported:

Table 9-32   PHYSICAL-READ

CMD	OFFSET BUFFER	ADDR_ TAG	LEN_DATA	RXREF
0x70	Offset in the "TXREF" send buffer	0x0000	Length of the data to be fetched from the reader:	Data fetched from the reader:
			• ≥ code length +2	• Trigger and result string
			• = 01	• Program number
			• ≥ match string length +2	• Match string

Command: Trigger and read result string

To activate a trigger and read the result string, you will need to send a "READ" command with address "0x0000". The table below shows the content of the memory area of the receive data specified in the command ("CMD-STRUCT").

The total length of the result string is stored at the (virtual) addresses "0x0000" and "0x0001".

Note that if the result string is longer than the number of characters to be read ("CMD_STRUCT.LEN_DATA"), the end of the string is truncated. If the result string is shorter than the number of characters to be read, the string is padded with the value "0x00".

You can also configure the format text so that the result bits "READ", "MATCH", "N_OK" are inserted in the string.

If you do not want to know the total length of the result text, send a "PHYSICAL READ" command starting at the address "0x0002" ("CMD_STRUCT.ADDR_TAG = 2").

You can also start to read from any start address, for example, when the result string is only relevant starting at the 10th character in the code.

Table 9-33   CMD_STRUCT

Parameter	Value
CMD	0x70
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	≥ length of the result string
ADDR_TAG	0x00

Table 9-34   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x00 ... 0xFF	Length of the entire result string (more significant byte)
0x0001	0x00 ... 0xFF	Length of the result string (less significant byte)
0x0002	--	1st character of the result string

Address	Value	Meaning
0x0003	--	2nd character of the result string
...	--	...
(n + 1)	--	(n−1)th character of the result string
(n + 2)	--	nth character of the result string

Command: Read result string

Using the same mechanism as "Read trigger + result string", it is possible to read out the decoded text of a code via CM.

Note that if "CM" was not selected as the trigger source in the WBM, the "PHYSICAL READ" command will not trigger, it only returns the result of the decoding. If a result is already available, this is returned. If there is not yet a result string available, the system waits until a result string is available.

After processing of the command, the result string is available in the memory area of the receive data specified in the command ("RXREF").

You can abort the execution of the command by setting the "INIT" bit.

Command: Read program number

When a "PHYSICAL READ" command is received, the MV command "Read program number" ("PHYSICAL WRITE" command) must have been issued immediately beforehand in order for the current program number to be returned. You can find more information on this subject in the section ""PHYSICAL WRITE" commands / MV command interface (Page 158)".

The "PHYSICAL READ" command must specify the start address "0x0000" and a length "0x01" ("CMD_STRUCT.ADDR_TAG = 0", "CMD_STRUCT.LEN_DATA = 1").

The byte read at address "0x0000" contains the number of the program currently selected and is stored in the memory area of the receive data after the command is processed.

Table 9-35   CMD_STRUCT

Parameter	Value
CMD	0x70
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	0x01
ADDR_TAG	0x00

Table 9-36   Command data area (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x00 ... 0x0F	Current program number

Command: Read match string

To have the current match string returned when the "READ" command is received, the MV command "Read match string" ("PHYSICAL WRITE" command) must be sent immediately before. You can find more information on this subject in the section ""PHYSICAL WRITE" commands / MV command interface (Page 158)".

After processing of the "PHYSICAL READ" command, the following data is available in the memory area of the receive data:

If the length of the data to be read ("CMD_STRUCT.LEN_DATA") is not n + 2 bytes (n = total length of the match string), the match string is truncated or the command data area is padded with "0x00".

Table 9-37   CMD_STRUCT

Parameter	Value
CMD	0x70
OFFSETBUFFER	0x00
EPCID_UID	0x00
LEN_DATA	≥ total length of the match string + 2
ADDR_TAG	0x00

Table 9-38   Memory area of the receive data (TXREF or RXREF)

Address	Value	Meaning
0x0000	0x00 ... 0x0F	Length of the total match string (more significant byte)
0x0001	0x00 ... 0x0F	Length of the total match string (less significant byte)
0x0002	--	1st character of the match string
...	--	...
n + 2	--	nth Characters of the match string

9.3.2.5   Result evaluation of a command

The result of processing a command is indicated by the output double word "STATUS".

In addition to the description in the relevant function manuals of the Ident profile, the following values have a specific meaning for the optical reader:

Table 9-39   Result processing in the Ident profile

STATUS	Meaning
0xE1FE03	Bad parameter in MV command
	Command is incorrectly structured, for example:
	• The specified address for a "WRITE" command is ≠ "0x0000".
	• MV command program change
	– Length of the data to be written is > "0x01".
	– Program number transferred is > "0x0F".
	Program number transferred is not saved.
0xE6FE01	Command not allowed (see section "Preconditions for the commands (Page 174)") or the command was aborted.
	The precise error message can be obtained with "INIT" without program selection. Possible causes:
	• The send buffer is full.
	• The program is damaged.
	• Ethernet interface is in operation and there is a problem.
	• The connected external ring light or power supply is overloaded.
	• Match string access if there is no match parameter assignment (") in the program.
	• Unknown command (00000000) A "WRITE-CONFIG" with "INIT" is executed.
	You can find more information on error messages in the "Error messages (Page 227)" section.
0xE6FE03	Initialization with program selection (init_run/INIT) is not possible:
	• Program number transferred is not saved.
	• Optical reader is still in self-test.
	• A user with the "Take control" right has logged in via WBM and has taken over exclusive control from the automation system.

9.3.2.6 Preconditions for the commands

If you want to issue a command, make sure that the preconditions are met. If the preconditions are not met, the command receives a negative acknowledgment. The following table provides an overview of the requirements that must be fulfilled.

Table 9-40   Overview of preconditions to be met

Command	Trigger source	Result (binary)	Result string	Control	DISA	No group error	Processing mode	Stop mode
Program change (write program number)	~	~	~	CM or PRO-FINET IO	~	☑	☑	☑
Read program number	~	~	~	CM or PRO-FINET IO	~	☑	~	~
Write match string	~	~	~	CM or PRO-FINET IO	~	☑	☑	☐
Read match string	~	~	~	CM or PRO-FINET IO	~	☑	☑	☐
Set DISA bit	~	~	~	CM or PRO-FINET IO	~	☑	~	~
Reset DISA bit	~	~	~	CM or PRO-FINET IO	~	☑	~	~
Set digital out	~	~	~	CM or PRO-FINET IO	~	~	~	~
Read result	~	~	CM or PROFI-NET IO	~	~	☑	☑	☐
Trigger + read result string	CM or PROFI-NET IO	~	CM or PROFI-NET IO	~	~	☑	☑	☐
Acknowledge group error	~	~	~	CM or PRO-FINET IO	~	☐	☐	☐
Set image acquisition	~	~	~	~	~	☑	☑	☐
Automatic Set-up	~	~	~	~	~	☑	~	~
Trigger	DI/DO	~	~	~	~	☑	☑	☐

~	Selection is unimportant.
☑	State must be satisfied.
☐	State is not permitted.
CM	If the "PROFINET (Ident profile)" IP mode is set, you must select PROFINET IO; otherwise, select CM.

The "Trigger source", "Result", "Result text" and "Control" columns can be configured using the WBM ("Communication > Use > Connection").

As a general rule, "CM" must be selected for at least one option so that the optical reader is accessible via the RS422 interface.

Note

The following applies to all commands:

- The state of the DISA bit is irrelevant.

- There is no group error.
  If a group error is still pending, first acknowledge the error.

9.3.2.7 Group error

If a correct command receives a negative acknowledgment even though all the preconditions are met, there is a group error ("IN_OP" bit not set).

Acknowledging the group error

To acknowledge a group error via CM or PROFINET IO, "CM" or "PROFINET IO" must be configured as the controller in the WBM ("Communication > Use > Connection").

Initialization with program selection

Acknowledge the error by "initializing with program selection".

The optical reader changes to processing mode again with the required program. To change to processing mode, the DISA bit is set automatically and reset again after the status change. If the DISA bit was set manually before, it remains set after the status change.

Initialization without program selection

If the cause of the group error is to be identified using the Ident profile, initialization without program selection needs to be used. Note that when using the Ident profile without a communication module, PROFINET diagnostics can be used.

To initialize without program selection, follow these steps:

1. Start the initialization without program selection.
   The group error is not acknowledged by this. There is a value that identifies the group error in the "STATUS" output double word, however. You can find a list of possible group errors and the corresponding error codes in section "Error and diagnostics messages (Page 227)".

2. Finally, repeat the initialization (if required with program selection) to acknowledge the group error.
   After the acknowledgment, the optical reader returns to processing mode. To change to processing mode, the "DISA" bit is set automatically and reset again after the status change. If the "DISA" bit was set manually before, it remains set after the status change.

3. Check the "IN_OP" status bit.
   This bit is normally set automatically.

9.4 Control with FB 79

Principle of data transmission via PROFINET IO

The following figure shows the interfaces of the optical reader that are relevant for data transmission via PROFINET IO (FB 79).
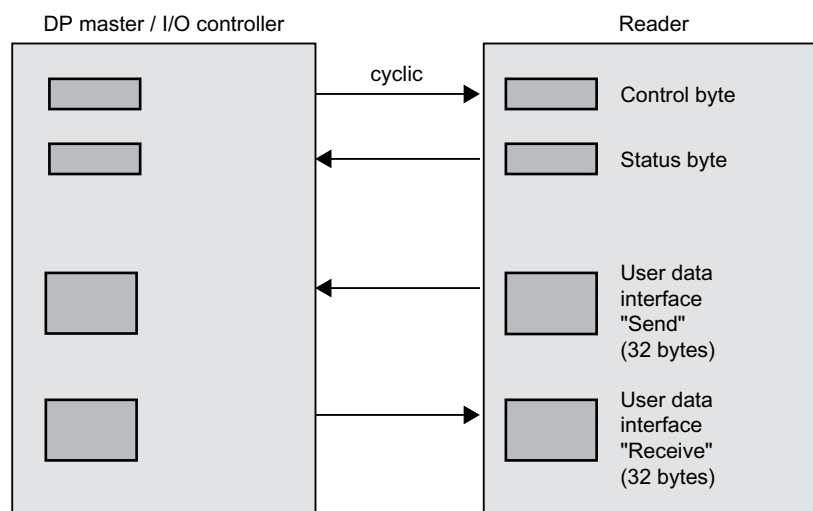
Figure 9-3   Principle of data transmission via PROFINET IO (FB79)

Note

Relevant bytes of the user data

Bytes 1 to 31 of the "Send" user data interface are relevant. Only bytes 1 to 4 of the "Receive" user data interface are relevant.

9.4.1 Assignment of the interfaces relevant to PROFINET IO

Control/status byte

Table 9-41   Assignment of control bytes (input signals)

Bit	Signal	Description
0	DISA	Disable Disables manual keyboard input, program selection and program saving, error acknowledgment, starting the optical reader
1	SEL0 [1]	Select 0 Program selection bit 0
2	SEL1 [1]	Select 1 Program selection bit 1 (with TRN = 0) / save program (with TRN = 1)

Bit	Signal	Description
3	SEL2 [1]	Select 2 Program selection bit 2
4	SEL3 [1]	Select 3 Program selection bit 3
5	TRN [1]	Save program Saves new program.
6	TRG	Trigger Processing starts on a positive edge.
7	RES	Reset Reset error.

[1] The signals only work if "DISA = 1".

You can find detailed information about program selection, as well as saving and evaluating programs in the following section.

Table 9-42   Assignment of status byte (output signals)

Bit	Signal	Description
0	IN_OP	In operation • 0: Error message is displayed. • 1: Optical reader functional, no error

1	TRD	Program saved
		 • In run:
		   – 0: Selected program is not saved.
		   – 1: Selected program has been saved.
		 • With Save program (TRN = 1)
		   – 0: Save program active
		   – 1: Acknowledgment signal (RDY = 0)

2	RDY	Ready • 0: Startup of the optical reader or optical reader in the "Stop" • 1: Optical reader in "Start"
3	READ	Processing result Code was localized and decoded.
4	MATCH	Processing result Code matches the trained code.
5	N_OK	Code was not legible.
6	-	Current status of the trigger input
7	-	Reserved

Note

Reading and processing analogous to the time diagrams

Writing the control byte and reading and evaluating the status byte must be performed in the same way as in the time diagrams shown under "Select program".

Note

Using the FB79 with a very short trigger interval

When using the FB79 in combination with a trigger interval in which the distance of the trigger signals corresponds almost to the image acquisition time, you should only use the "DONE" bit of the FB79 for processing (not the "READ" bit or the "N_OK" bit).

"Send/Receive" user data interface

Table 9-43   Send

Byte	Description
0	Reserved
1	Consecutive number of the data packet to be transferred to the I/O controller.
2	Total net length of the data to be transferred in bytes in STEP 7 format.
3	--
4	Data ID of the supplied data
5	1st user data byte
...	...
31	27th user data byte

Note

Coding of the sent data

The "4 Data ID of the supplied data" byte defines the transferred data. The coding matches byte 4 of the "Receive" user data interface. With a read job on the "Receive" user data interface, the ID of the data currently being transferred is entered here.

Table 9-44   Receive

Byte	Description
0	Reserved
1	Consecutive number of the current data packet received correctly by the I/O controller
2	Reserved
3	Reserved
4	Data ID of the requested data
5	Reserved
...	...
31	Reserved

Data ID of the requested data

The "4 Data ID of the supplied data" byte defines the data to be read. The data ID can have the following values:

Table 9-45   Data ID of the requested data

ID (B#16#)	Description
09	User data byte 1: Output the program number selected on the optical reader. User data byte 2: If the "DISA" bit is set, it indicates whether a user who has the right to override the "DISA" signal is logged in via the WBM: • 00H: "Take control" is enabled, • 01H: "Take control" is disabled.
81	Result string
82	Quality characteristics
83	Quality characteristics as absolute values and result string
84	Quality characteristics in classes
85	Quality characteristics in classes and result string
86	Quality characteristics in classes and absolute quality characteristics
87	Quality characteristics in classes, absolute quality characteristics and result string
88	Position of the data matrix code
89	Position and result string
8A	Position and absolute quality characteristics
8B	Position, quality characteristics as absolute values and result string
8C	Position and quality characteristics in classes
8D	Position, quality characteristics in classes and result string
8E	Position, quality characteristics in classes and absolute quality characteristics
8F	Position, quality characteristics in classes, absolute quality characteristics and result string

Note

Requirement for optimum code quality

The code qualities are only output correctly when a program is set with the "Read code" task with calibrated or uncalibrated verification according to ISO 16022. Otherwise, the quality codes are not calculated when the code is read and cannot be output.

In the WBM, use the definition of the format string "Format text" under "Program > Result > Program format text" to output the quality values for other selected verification types. The quality values are then output according to the parameter settings along with the read result.

Note

Enable data recognition

If no data ID is entered, processing takes place but no data is transferred.

Note that no trigger is required for the "B#16#09" data identifier.

The following table gives you an overview of the contents and data types provided by the data ID. This requires that the data identifier contains the position or quality characteristics.

The order of the code properties in the table is identical to the order of the code properties in the data packet. If applicable, the result string is returned after the code properties.

Table 9-46   Possible contents and data types of the data identifier

Data to be read	consists of ...	Data type
Position of the data matrix code [1]	• X position • Y position • Roll angle • Viewing angle	INT
Absolute quality characteristics	• Symbol contrast • Print growth • Axial non-uniformity • Unused error correction	REAL
Quality characteristics as classes	• Symbol contrast • Print growth • Axial non-uniformity • Unused error correction • Overall quality	CHAR

[1]   Viewing angle is only output for DMC quality = "Ambitious"

Note

Absolute quality characteristics

If the data to be read outputs the quality characteristics as absolute, check the "Swap" parameter in the WBM ("Communication > Interfaces > PROFINET IO").

9.4.2   Select operating modes using the control/status byte

The following modes are available:

• Select program

• Save program

• Start processing

You can find a description of the modes under Operation of the optical reader.

Select program

To select a program, apply the relevant bit pattern at the inputs "SEL0" to "SEL3". You can select programs 1 to 15. When you select program 0, the program last selected is retained.
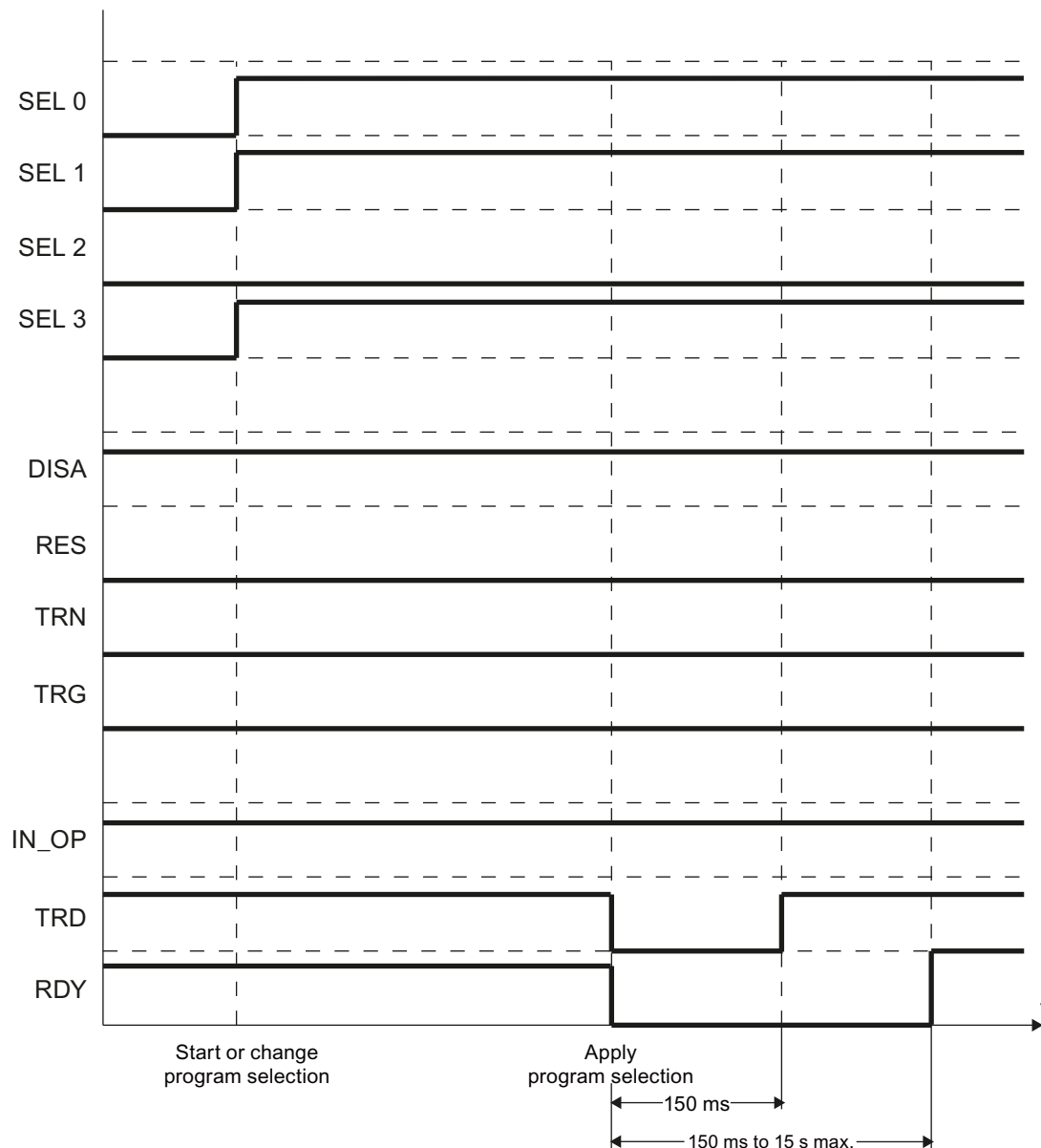
Figure 9-4   Time diagram: Select program

Table 9-47   Program selection procedure

Step	Input	Output	Description
1	DISA = 1 TRN = 0 TRG = 0 RES = 0		Program selection is prepared. DISA must have the value "1". No edge change is necessary.
2	SEL0 = 1 SEL1 = 1 SEL2 = 0 SEL3 = 1		Select program, for example, program 11.
3		TRD = 0 RDY = 0	Program selection is started.
5		TRD = 1 RDY = 1	Program change is completed after approximately 150 ms to 15 s.

If the selected program is not saved, "TRD" and "RDY" will retain the value "0".

Save program

The diagram below shows the program saving procedure, using program 11 as an example. Note that the trigger signal must be present for at least 5 ms.

Figure 9-5   Time diagram: Save program

Note

Reaction when an error occurs

After an error has occurred, you will need to set the "SEL0" to "SEL3" signals and the "TRN" signal to "0" and then reset the error with the "RES" signal. The "DISA" signal must have the value "1" (no edge change).

Table 9-48   Sequence when saving the program

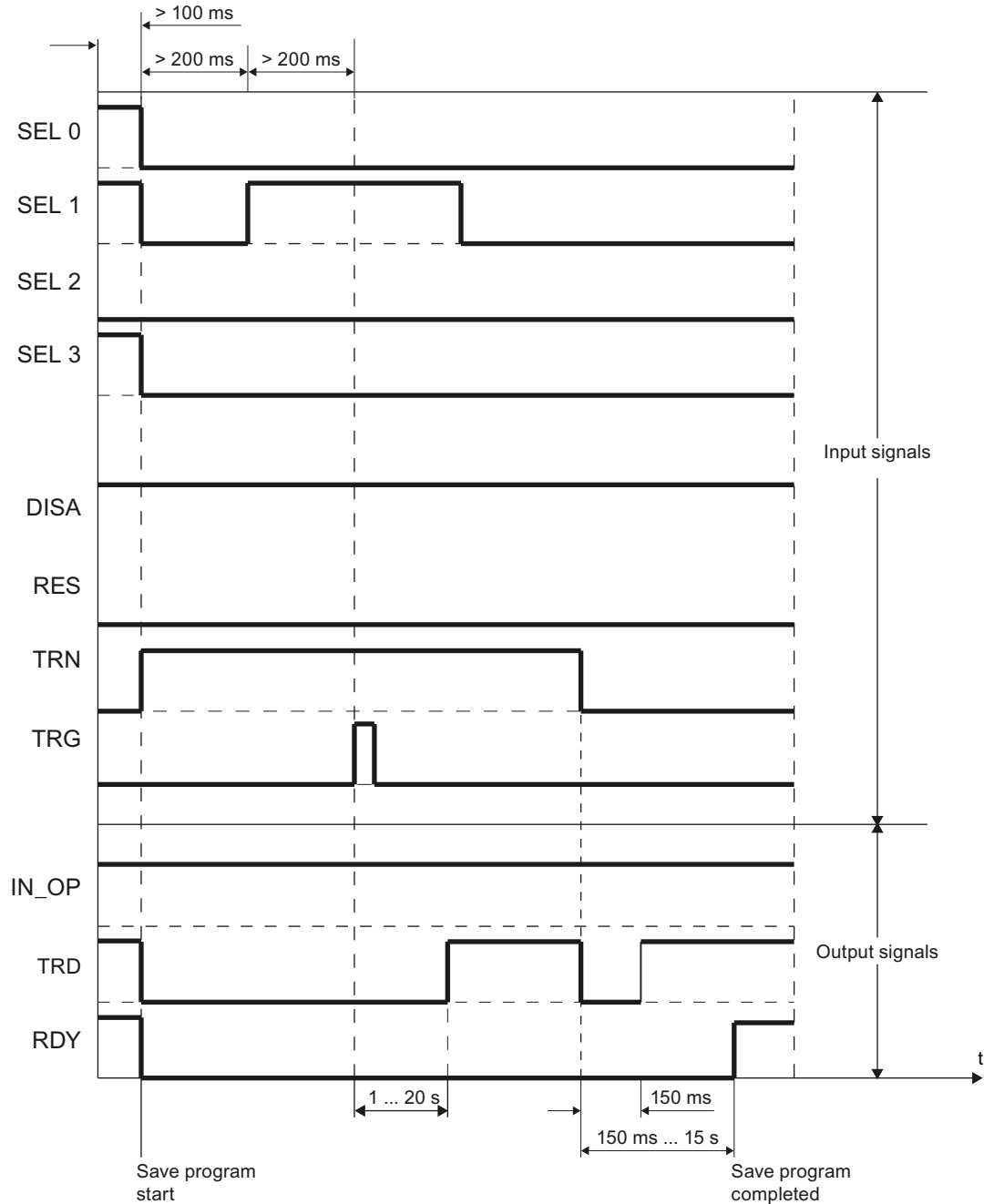| Step	Input	Output	Description
1	DISA = 1 Apply for at least 100 ms: SEL0 = 1 SEL1 = 1 SEL2 = 0 SEL3 = 1		Disable keyboard control. DISA must have the value 1. No edge change is necessary. Select program to be saved, for example code 11.
2	TRN = 1 SEL0, SEL1, SEL2, SEL3 = 0		Start program saving
		TRD = 0	TRD signal changes to FALSE
		RDY = 0	RDY signal changes to FALSE
3	Wait at least 200 ms SEL1 = 1		Feed in object with data matrix code. Save program
	Apply for at least 5 ms: TRG = 1		Trigger signal
4		TRD = 1	Selected program has been saved.
	SEL1=0		Reset signals.
5	TRN = 0		Exit program saving.
		TRD = 0	TRD signal changes to FALSE for 150 ms.
		TRD = 1	TRD signal changes to TRUE.
		RDY = 1	Program saving is exited.

Start processing

Processing starts immediately on completion of the program saving.

Table 9-49   Processing of program memory

Step	Input	Output	Description
1			You select a program, for example, program 11.
2			The outputs are set as follows depending on the processing result:
		READ	Code was localized and decoded.
		MATCH	Code matches the trained code.
		N_OK	Code was not legible.

9.4.3 Sample program for data exchange if code length ≤ 27 bytes

Below, you will find a sample program for data exchange when the code length is a maximum of 27 bytes.

Note

Compatible S7 controllers

The example program can only run on the following S7 controllers:

- On a CPU 318 and all S7-400 CPUs.
- On all S7-300 CPUs with MMC

On all other S7-300 and S7-400 CPUs, you must use SFCs 14 and 15 for all access to the two user data interfaces.

Explanation of the program

The example program has the following properties:

- Only the pure result string with data ID "B#16#81" is output.

- The I/O controller does not check how many bytes the optical reader has returned but always reads 27 bytes.
  The I/O controller does not monitor anything.

- The start of the "Send" user data interface is at address 4 of the process image input.
  The start of the "Receive" user data interface is at address 4 of the process image output.

- To ensure the consistency over the entire area of 32 bytes, there must be no update of the process image during the program shown here.

- The user data is stored in data block DB17 starting at byte 4.

STL program

Table 9-50   Structure of the STL program

	//Enter data ID (in principle only necessary in the first cycle)		
	L	B#16#81	// Only result string
	T	AB 8	
	// Check number of data packet for 1		
	L	EB 5	// No. of the data packet from the optical reader
	L	1	
	<>	I	// If no. ≠ 1
	SPB	m001	// ... user data is not available yet
	// Import user data from the optical reader		
	L	ED 9	// Read first 4 bytes of user data
	T	DB17.DBD 4	// Store in DB

		//Enter data ID (in principle only necessary in the first cycle)	
	L	ED 13	// Read next 4 bytes of user data
	T	DB17.DBD 8	// Store in DB
	L	ED 17	// Read next 4 bytes of user data
	T	DB17.DBD 12	// Store in DB
	L	ED 21	// Read next 4 bytes of user data
	T	DB17.DBD 16	// Store in DB
	L	ED 25	// Read next 4 bytes of user data
	T	DB17.DBD 20	// Store in DB
	L	ED 29	// Read next 4 bytes of user data
	T	DB17.DBD 24	// Store in DB
	L	EW 33	// Read second last 2 bytes of user data
	T	DB17.DBW 28	// Store in DB
	L	EB 35	// Read last byte of user data
	T	DB17.DBB 30 /	// Store in DB
	// Acknowledge with no. of data packet		
m001:	L	EB 5	// Number of data packet
	T	AB 5	// Send as acknowledgment to optical reader
		BEA	

9.4.4 Programming data fragmentation

Handshaking

The following sections introduce a handshaking procedure that ensures the consistency of all the data transferred from the optical reader to the I/O controller regardless of any configured consistency mechanisms in PROFINET. This procedure must be used with every data transfer, even if the transfer only consists of one data block, for example when reading out the program number selected on the optical reader.

Remember that you need to enter the required data ID in byte 4 of the "Receive" user data interface.

Note

Compatible S7 controllers

The example program can only run on the following S7 controllers:

- On a CPU 318 and all S7-400 CPUs.

- On all S7-300 CPUs with MMC

On all other S7-300 and S7-400 CPUs, you must use SFCs 14 and 15 for all access to the two user data interfaces.

Table 9-51   Steps in the handshake procedure

Step	Activity in the user program of the PROFINET IO controller
1	Scan byte 1 of the "Send" user data interface cyclically. As long as this byte has the value "0", there is no new data available. If the byte has the value "1", continue with step 2.
2	The value "1" in byte 1 of the "Send" user data interface means that the optical reader has started data transmission. Read out the net total length of the data to be transferred from bytes 2 and 3 of the "Send" user data interface and the user data of the 1st data packet from bytes 5 to 31.
3	Acknowledge correct receipt of the 1st data packet by writing the value "1" to byte 1 of the "Receive" user data interface. The optical reader scans byte 1 of the "Receive" user data interface cyclically. As soon as it reads the value "1", it fills bytes 5 to 31 of the "Send" user data interface with the user data of the 2nd data packet and enters the number (value 2) of this data packet in byte 1.
4	Scan byte 1 of the "Send" user data interface cyclically. As long as this byte contains the number of the previously transferred data packet (1), there is no new data available. As soon as byte 1 has the value "2" (number of the next data packet), proceed to step 5.
5	Read the user data of the 2nd data packet from bytes 5 to 31.
6	Acknowledge correct receipt of the 2nd data packet by writing the value "2" to byte 1 of the "Receive" user data interface.
...	...
Last - 4	Scan byte 1 of the "Send" user data interface cyclically. As long as byte 1 contains the number of the second last data packet, the data of the last data packet is not yet available. As soon as byte 1 contains the number of the last data packet, continue with the next step.
Last - 3	Read the user data of the last data packet from bytes 5 to 31.
Last - 2	Acknowledge receipt of the last data packet by writing the number of the last data packet to byte 1 of the "Receive" user data interface. The optical reader scans byte 1 of the "Receive" user data interface cyclically. As soon as it reads the number of the last data packet, it writes the value "0" in the bytes 2 and 3 of the user data interface and also in the byte 1. The end of the current data transfer is signaled to the I/O controller with the value "0" in byte 1.
Last -1	Scan byte 1 of the "Send" user data interface cyclically. As soon as this byte has the value "0", continue to the next step.
Last	Acknowledge correct receipt of all data by writing the value "0" to byte 1 of the "Receive" user data interface.

Reaction to disruptions, timeouts and errors

The optical reader performs the following monitoring functions:

- The time between the arrival of two acknowledgments of the I/O controller is monitored based on the configured value setting in the WBM under "Communication > Interfaces > PROFINET IO > Time limit".

- The correct order of the data packets acknowledged by the I/O controller is monitored.

If an error occurs, the optical reader enters the value "B#16#FF" in byte 1 of the "Send" user data interface, which causes the current data transfer to abort.

We recommend that you monitor the following in the user program of the I/O controller:

- Monitor the time between the arrival of two consecutive data packets.

- Monitor the correct order of the data packets sent by the optical reader.

- Check whether the total length of the user data actually transferred matches the net total length indicated by the optical reader at the beginning of the data transfer.

If an error occurs, you can abort the current data transfer by writing "B#16#FF" to byte 1 of the "Receive" user data interface.

9.4.5 FB 79 "VS130-2_CONTROL"

The function block FB 79 for PROFINET IO operations is provided for operating the functions of the optical reader.

In addition to the SIMATIC S7 system mechanisms for integrating the optical reader into a PROFINET IO environment, the FB 79 facilitates software integration in control programs.

Note

FB 79 for VS130-2 readers

Note that FB 79 should only be used to connect VS130-2 optical readers for reasons of compatibility. We recommend the use of the Ident profile for all other readers.

Functional scope of FB 79

Note that the function block only monitors the pure data traffic between the optical reader and the controller. This means that the "DONE" parameter does not allow any conclusion to be made on the actual read result. To obtain a good/bad read evaluation, you need to process the following result bits of the status byte:

- READ

- MATCH

- N_OK

The following bits of the control byte must be edited outside the function block:

- TRG (Trigger)
  Start processing

- RES (Reset)
  Acknowledgment of an error (see section "Error messages (Page 227)").

The following commands can be executed with FB 79:

- Cancel current job.

- Select program.

- Save a program.

- Output the result strings.

- Output the position of the code.

- Output the quality characteristics of the currently read code.

- Output the number of the currently selected program.

- Output the current operating state of the optical reader.

- Reset the "DISA" control signal.

Whether or not a job can be executed successfully depends on the current operating state of the optical reader and its parameter settings. A description of which jobs are possible in which operating states of the optical reader is provided below.

The FB 79 sets the "DISA" control signal on the optical reader to "TRUE" for almost all jobs. This is intended to prevent the optical reader being controlled from an additional HMI device at the same time. This does not apply to the following four commands:

- Reset the "DISA" control signal.

- Cancel current job. The "DISA" function block does not change with this.

- Output the number of the currently selected program. The "DISA" function block does not change with this.

- Output the current operating state of the optical reader. The "DISA" function block does not change with this.

When a new job is started, the output parameters are reset.

Note

Multiple calls of FB 79 with the same instance is not permitted

Note that making multiple calls of FB 79 with the same instance is not permitted

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Note that you can use the parameters in the "Communication > Use" menu of the WBM to influence the sequence of command execution of the function block:

- If you want to read out a result string using the function block, the output of the result string must be set to PROFINET IO. With the jobs "Select program" (COMMAND =W#16#0001), "Save a program" (COMMAND =W#16#0002) and "Output currently selected program" (COMMAND =W#16#0003), the number of the selected program is queried by the optical reader. For this reason, output of the result string must also be set to PROFINET IO in these cases.

- The interface for the "DISA", "SEL0" to "SEL3", "TRN", "RES", "IN_OP", "TRD", "RDY" signals must always be set to PROFINET IO.

- The setting of the interface for the result bits "READ", "MATCH", "N_OK" is irrelevant for the function block.

9.4.5.1 How it works

FB 79 "VS130-2_CONTROL" is an asynchronous block. This means the processing can extend over several block calls. You start job execution by calling the FB with a job number > "0".

Job execution is completed when the "ACTIVE" parameter changes to the value "FALSE" and either "DONE" or "ERROR" has the value "TRUE" (positive edge). Note that various jobs can be handled in one CPU cycle and the "ACTIVE" parameter does not therefore change to the value "TRUE". This involves the "Read out status" and "Reset DISA bit" jobs. In this case, it may also not be possible to detect an edge change at "DONE" or "ERROR".

You should therefore process the "DONE" and "ERROR" parameters at each block call. If the job was completed without error, "DONE = TRUE" is set. Always process the "ERRCODE" parameter to get warnings from the FB.

As long as the "ACTIVE" parameter has the value "TRUE", you must call the FB with identical assignment of the "COMMAND" input parameter. It is also not possible to start a new job during this time.

Read jobs are cyclic jobs. This means that after starting a job with "COMMAND = W#16#0081 ... 008F", the "ACTIVE" parameter assumes the value "TRUE". "ACTIVE" retains this value until the job is canceled or stopped.

The read cycle (in other words, the transfer of a complete result string) is completed when the "ACTIVE" parameter has assumed the value "TRUE" and either "DONE" or "ERROR" has assumed the value "TRUE" (positive edge). If you want to start a different job while a read job is running, you will need to cancel the read job first. This is done by calling the FB with "COMMAND = W#16#0000". In this case, the "ACTIVE" parameter assumes the value "FALSE". Depending on whether a result string is currently being transferred, either "DONE"

or "ERROR" has the value "TRUE". If "ERROR" has the value "TRUE", "ERRCODE" has the value "DW#16#00010007".

Note

Changing the mode "Stop > Run"

If an error has occurred that changes the optical reader to "Stop", eliminate and acknowledge the error. You can then return the optical reader to "Run" mode by changing program (COMMAND = W#16#0001).

9.4.5.2 Parameter overview

Table 9-52   Overview of FB 79 parameters

Parameter	Declaration	Data type	Address (instance DB)	Default	Description
LADDR_STEUER	INPUT	WORD	0.0	W#16#0000	Address of the control byte of the optical reader. The address must be in the process image of the CPU you are using.
LADDR_STATUS	INPUT	WORD	2.0	W#16#0000	Address of the status byte of the optical reader. The address must be in the process image of the CPU you are using.
LADDR_SEND	INPUT	WORD	4.0	W#16#0000	Start address of the "Send" user data interface of the optical reader.
LADDR_RECV	INPUT	WORD	6.0	W#16#0000	Start address of the "Receive" user data interface of the optical reader.
COMMAND	INPUT	WORD	8.0	W#16#0000	Job number: The permitted values are described following this table.
PARAM1	INPUT	BYTE	10.0	B#16#00	Number of the program to be selected (relevant only for jobs "W#16#0001" and "W#16#0002").
RESET	INPUT	BOOL	11.0	FALSE	Reset pending error and FB initialization.
RECV	INPUT	ANY	12.0		Receive area for the result string. Only data block areas and the "BYTE" data type are permitted. You must interconnect this parameter and the data block must be at least as large as the maximum DMC string that can be expected.
ACTIVE	OUTPUT	BOOL	22.0	FALSE	ACTIVE = TRUE: Editing of the last job has not yet completed.

Parameter	Declaration	Data type	Address (instance DB)	Default	Description
DONE	OUTPUT	BOOL	22.1	FALSE	DONE = TRUE: Job was completed without errors. With read jobs ("COMMAND = W#16#0081 ... 008F"), this simply means that the transfer between the optical reader and FB (CPU) was error-free. To find out whether the DMC processing was successful, you will need to process bits "READ" (bit 3), "MATCH" (bit 4) and "N_OK" (bit 5) in the status byte of the optical reader.
ERROR	OUTPUT	BOOL	22.2	FALSE	ERROR = TRUE: An error has occurred.
ERRCODE	OUTPUT	DWORD	24.0	DW#16#00000000	Error information: • DW#16#0000 0000: No error • DW#16#0000 wxyz: Warning • DW#16#0001 wxyz: Internal FB error • DW#16#0002 wxyz: Optical reader error (see table below for error information)
STATE	OUTPUT	WORD	28.0	W#16#0000	Operating state of the optical reader: • W#16#0000: Status not up to date • W#16#0001: RUN (processing mode with output of the result string), in other words, the "IN_OP" and "RDY" bits in the status byte are set. • W#16#0002: STOP including Save program and Adjustment mode, i.e. the "IN_OP" bit in the status byte is set, but the "RDY" bit is not. • W#16#0003: ERROR The "IN_OP" bit in the status byte is not set.
CODE_OUT	OUTPUT	BYTE	30.0	B#16#00	Number of the program currently selected by the optical reader
LENGTH	OUTPUT	WORD	32.0	W#16#0000	Length of the result string in bytes

Table 9-53   Possible values of the "COMMAND" parameter

Value (W#16#...)	Meaning
0000	Cancel current job or no job
0001	Change program
0002	Save program
0003	Output the number of the program currently selected on the optical reader
0004	Output the current operating state of the optical reader
0005	Reset DISA control signal
0081	Output the (possibly modified) result string
0082	Output absolute quality characteristics

Value (W#16#...)	Meaning
0083	Output absolute quality characteristics and output result string
0084	Output quality characteristics as classes
0085	Output quality characteristics as classes and output result string
0086	Output quality characteristics as classes and in absolute format
0087	Output quality characteristics as classes and in absolute format and output result string
0088	Output code position
0089	Output code position and result string
008A	Output code position and output absolute quality characteristics
008B	Output absolute code position and quality characteristics and output result string
008C	Output code position and quality characteristics as classes
008D	Output code position and quality characteristics as classes and output result string
008E	Output code position and quality characteristics as classes and in absolute format
008F	Output code position and quality characteristics as classes and in absolute format and output result string

Note

Requirements

To edit this job, the following parameters must be set in the "Communication > Use > Connections" menu in the WBM:

- Text: PROFINET IO
  Output of the result string (except commands 4 and 5)

- Controller: PROFINET IO
  Interface for the "DISA", "SEL0 ... SEL3", "TRN", "RES", "IN_OP", "TRD", "RDY" signals

Table 9-54   Parameters not interconnected with the block (static local data)

Parameter	Declaration	Data type	Address (instance DB)	Default	Description
X_POSITION	STATIC	INT	34.0	0	X position of the center point of the code relative to the center of the image. Normalized to the full resolution for the current image.
Y_POSITION	STATIC	INT	36.0	0	Y position of the center point of the code relative to the center of the image. Normalized to the full resolution for the current image.
ROT_ANGLE	STATIC	INT	38.0	0	Rotation angle of the code center point
INCLINE	STATIC	INT	40.0	0	Viewing angle (angle between the axis of the optical reader and the surface of the code field)
CONTRAST_F	STATIC	CHAR	42.0	..	Symbol contrast as class (value valid if ≠ ' ')

Parameter	Declaration	Data type	Address (instance DB)	Default	Description
GROWTH_F	STATIC	CHAR	43.0	..	Print growth as class (value valid ≠ ' ')
NONUNIF_F	STATIC	CHAR	44.0	..	Axial non-uniformity as class (value valid if not equal to ' ')
ERR_CORR_F	STATIC	CHAR	45.0	..	Unused error correction (value valid, if ≠ ' ') Note: If a "ReadErr" occurs, the old result data is retained because no new data is available.
QUALITY_F	STATIC	CHAR	46.0	..	Overall quality as class (value valid, if ≠ ' ')
CONTRAST	STATIC	REAL	48.0	-1.0e+0	Symbol contrast as absolute value (value valid, if ≠ "-1.0e+0")
GROWTH	STATIC	REAL	52.0	-1.0e+0	Print growth as absolute value (value valid, if ≠ "-1.0e+0")
NONUNIF	STATIC	REAL	56.0	-1.0e+0	Axial non-uniformity as absolute value (value valid, if ≠ "-1.0e+0")
ERR_CORR	STATIC	REAL	60.0	-1.0e+0	Unused error correction (value valid, if ≠ "-1.0e+0")

9.4.5.3 Job execution

Whether or not a job can be executed successfully depends on the current operating state of the optical reader. The following table shows which jobs are possible in the various states of the optical reader. You can find the job number in the parameter table.

Table 9-55 Possible jobs depending on the operating state

Operating state of the reader	Job number = (hexadecimal)						
	0000	0001	0002	0003	0004	0005	0081 ... 008F
RUN (RDY=1) (processing mode with output of the result strings)	X	X	X	X	X	X	X
STOP	X	X	X	X	X	X	-
ERROR (IN_OP=0)	X	X	-	X	X	X	-

Sequence when canceling a job ("COMMAND" = W#16#0000)

Job cancellation is only possible with the "COMMAND = W#16#0081...W#16#008F" read jobs.

The block signals completion of the job termination with "ACTIVE = FALSE".

If a transfer is active when the job is canceled, the transfer aborts and the error is reported with an appropriate error message in the "ERRCODE" parameter. "ERROR" then has the value "TRUE" and "DONE" has the value "FALSE". A transfer is active when "DONE" and "ERROR" show the value "FALSE".

If no transfer is active during the cancellation and once the job is completed, the "ERRCODE" parameter has the value "0", "ERROR" has the value "FALSE" and "DONE" has the value "TRUE".

Sequence when changing jobs

If you want to change to a different job from a read job, the currently active job must be canceled.

Sequence when changing a program ("COMMAND" = W#16#0001)

To perform a program change while the optical reader is actively executing a read job, follow these steps:

1. Call FB79 with "COMMAND = W#16#0000".
   This cancels the output of the result string (job "W#16#0081").

2. Run the program change by calling FB 79 with "COMMAND = W#16#0001" and "PARAM = new program no.".
   When the job is triggered, the parameters "DONE" and "ERROR" have the value "FALSE". The "ACTIVE" parameter has the value "TRUE". The block changes the program selected on the optical reader to the value at the "PARAM1" parameter. The module then queries the program selected now on the optical reader and outputs it via the "CODE_OUT" parameter.
   If the program now selected matches the program specified at the "PARAM1" parameter, the "ACTIVE" parameter has the value "FALSE" and the "DONE" parameter the value "TRUE". If the program now selected does not match the program specified at the "PARAM1" parameter, the "ACTIVE" parameter has the value "FALSE" and the "ERROR" parameter the value "TRUE". The "ERRCODE" parameter contains an appropriate error message. The system also checks whether the program change is being blocked by a "Service" or "S-user" user logged on in the WBM who has taken control of the optical reader, and whether the newly selected program has been saved.
   If an error is detected, the "ACTIVE" parameter has the value "FALSE" and the "ERROR" parameter has the value "TRUE". The "ERRCODE" parameter contains an appropriate error message.

3. Call FB 79 again cyclically with "COMMAND=W#16#0081".

If you attempt to cancel a current change program job, the "ERRCODE" parameter will change to "DW#16#00000002"; however, processing for the job will be completed.

Note

Notes on the program change

Note the following points when changing programs:

- When there is a program change, the optical reader changes to "STOP" for at least 150 ms. In isolated cases, a program change can take up to 15 s.
- If you specify the value "0" in the "PARAM1" parameter, the previously selected program will be retained.
- The value of "PARAM1" must not be changed before the job is completed.

Sequence when saving a program ("COMMAND" = W#16#0002)

In order for the FB to initiate saving of a code, the "Control" parameter must have the value "PROFINET IO" in the "Communication > Use > Connection" menu of the WBM.

The job can only be sent when the optical reader does not have the "ERROR" state (see also the operating state table following the parameter table).

When the job is triggered, the parameters "DONE" and "ERROR" have the value "FALSE". The "ACTIVE" parameter has the value "TRUE". The block saves the program specified at the "PARAM1" parameter.

Note

Notes on saving

Note the following points when saving:

- In isolated cases, saving a program can take up to 35 s.
- The value of "PARAM1" must not be changed before the job is completed.

It then queries the program now selected on the optical reader and outputs it at the "CODE_OUT" parameter.

If the program now selected matches the program specified at the "PARAM1" parameter, the "ACTIVE" parameter has the value "FALSE" and the "DONE" parameter the value "TRUE". If the program now selected does not match the program specified at the "PARAM1" parameter, the "ACTIVE" parameter has the value "FALSE" and the "ERROR" parameter the value "TRUE". The "ERRCODE" parameter contains an appropriate error message. The system also checks whether program saving is being blocked by a "Service" or "S-user" user logged on in the WBM who has taken over control of the optical reader, and whether the program was saved successfully.

If an error is detected, the "ACTIVE" parameter has the value "FALSE" and the "ERROR" parameter has the value "TRUE". The "ERRCODE" parameter contains an appropriate error message.

If you attempt to cancel a current save program job, the "ERRCODE" parameter will change to "DW#16#00000002"; however, processing for the job will be completed.

Sequence when outputting the currently selected program ("COMMAND" = W#16#0003)

When the job is triggered, the parameters "DONE" and "ERROR" have the value "FALSE". The "ACTIVE" parameter has the value "TRUE".

The block then queries the program now selected on the optical reader and outputs this program at the "CODE_OUT" parameter.

If no error occurs in the transfer of the program number, the "ACTIVE" parameter will have the value "FALSE" and the "DONE" parameter the value "TRUE".

Sequence when outputting the operating state of the optical reader ("COMMAND = W#16#0004")

Based on the status byte of the optical reader, the block recognizes the current state and outputs this in the "STATE" parameter. Note the following points:

- If the "IN_OP" bit is not set, status 3 ("ERROR") is output.
- If the "IN_OP" bit is set but not the "RDY" bit, status 2 ("STOP") is output.
- If the "IN_OP" bit and the "RDY" bit are set, status 1 ("RUN") is output.

The "DONE" parameter then has the value "TRUE" and "ACTIVE" the value "FALSE".

Note

No edge change detected

Because the job completes in one CPU cycle, no edge change can be detected at the "ACTIVE" parameter. If the "DONE" parameter already has the value "TRUE" from a previous job, it is also not possible to detect an edge change.

Sequence when resetting the DISA bit ("COMMAND" = W#16#0005)

The block resets the "DISA" bit in the control byte of the optical reader. The "DONE" parameter then has the value "TRUE" and "ACTIVE" the value "FALSE".

Note

No edge change detected

Because the job completes in one CPU cycle, no edge change can be detected at the "ACTIVE" parameter. If the "DONE" parameter already has the value "TRUE" from a previous job, it is also not possible to detect an edge change.

Sequence of the read jobs ("COMMAND = W#16#0081 ... W#16#008F")

Table 9-56   Possible values of the "COMMAND" parameter for the read jobs

Value (W#16#...)	Meaning
0081	Output result string
0082	Output absolute quality characteristics
0083	Output absolute quality characteristics and output result string
0084	Output quality characteristics as classes
0085	Output quality characteristics as classes and output result string
0086	Output quality characteristics as classes and in absolute format
0087	Output quality characteristics as classes and in absolute format and output result string
0088	Output code position
0089	Output code position and result string
008A	Output code position and output absolute quality characteristics
008B	Output absolute code position and quality characteristics and output result string

Value (W#16#...)	Meaning
008C	Output code position and quality characteristics as classes
008D	Output code position and quality characteristics as classes and output result string
008E	Output code position and quality characteristics as classes and in absolute format
008F	Output code position and quality characteristics as classes and in absolute format and output result string

The read jobs can only be sent when the optical reader is not in RUN mode (see also the operating state table following the parameter table).

In contrast to all other jobs, the read jobs are "permanent jobs". This means that the "ACTIVE" parameter retains the value "TRUE" even after fetching the current read result and/or the current position and/or the quality characteristics from the optical reader.

You should therefore process the "DONE" and "ERROR" parameters at each block call. If the transfer was successful, "DONE" = "TRUE" is set. However, this only means that the transfer between the optical reader and the FB (CPU) was error-free. To find out whether the DMC processing was successful, you will need to process bits "READ" (bit 3), "MATCH" (bit 4) and "N_OK" (bit 5) in the status byte of the optical reader. In this case, refer to the following table for the behavior of FB 79. Always process the "ERRCODE" parameter to get warnings from the FB.

Table 9-57   Effects of the behavior of the optical reader on the FB 79

Behavior of the optical reader	Effect on FB 79 ("RECV" target area)
The code could not be decoded.	FB 79 enters the string set in the "ReadErr" parameter.
The code was successfully decoded; however, you have not set any specifications.	FB 79 enters the result string.
The code was successfully decoded but does not match your specifications.	FB 79 enters the string set in the "MatchErr" or "FilterMsg" parameter if the Match or Filter function is set. If both these functions are selected, FB79 enters the string set under "MatchErr".
The code was successfully decoded and matches your specifications.	FB 79 enters the result string.

Process the data entered in "RECV" before the next trigger; otherwise, the consistency of this data cannot be guaranteed. At the same time, you should also process the "LENGTH" parameter because the receive area is written only up to this length.

You can abort an active read job by calling FB79 with "COMMAND = W#16#0000".

If an error occurs when processing a job or when a current read job is canceled, "ERROR = TRUE" is set. In this case, the "ERRCODE" parameter contains an ID indicating the cause of the error. FB 79 writes "B#16#00" to the "RECV" target area.

Startup behavior

If an error occurs ("ERRCODE <> DW#16#0000 0000"), you need to initialize the FB once with "RESET=TRUE" after calling an interrupt OB (for example, OB 82) and after a "STOP-RUN" change on the CPU. Please include a suitable first call in your user program.

9.4.5.4 Error information

If an error has occurred, the "ERROR" parameter is set to "TRUE". The precise cause of the error is then displayed in "ERRCODE". There are also warnings for which "ERROR" is set to "FALSE". They indicate error situations that do not cause the current job to be canceled.

If "ERRCODE" <> DW#16#0000 0000" following an FB call, you will need to call the FB again with "RESET = TRUE" to reset the error information in the FB.

Note

Acknowledging the error of the optical reader

By calling the FB with "RESET = TRUE", you only acknowledge error displays of the FB. To acknowledge errors of the optical reader (e.g. "Transmit error"), you must set the "RES" bit of the control byte.

Table 9-58   Error information of FB 79

ERRCODE (DW#16#)	ERROR	Description
0000 0000	0	No error
0000 0001	0	New job inactive as long as old job is active.
0000 0002	0	Job cannot be canceled.
0001 0001	1	Invalid job number ("COMMAND" parameter).
0001 0002	1	The job cannot be processed in the current state of the optical reader.
0001 0003	1	The FB was called with "RESET = TRUE" during normal operation (not startup and no error present) or the user data interface is already occupied by a different FB instance.
0001 0004	1	Send/receive user data interface not available or incomplete
0001 0005	1	The selected program number does not correspond to that specified on the FB because the control of the optical reader may have been taken over by the WBM.
0001 0006	1	Invalid program number ("PARAM1" parameter). Program numbers 1 to 14 (save program) and 0 to 15 (change program) are permitted.
0001 0007	1	Job canceled by user.
0001 0008	1	Saving a program is not possible because the control of the optical reader may have been taken over by the WBM.
0001 0009	1	Illegal receive area. Only data blocks and the "BYTE" data type are permitted.
0001 8092	1	The receive area does not exist.
0001 8323	1	The receive area is too short.
0001 8325	1	Illegal data area.
0001 8330	1	The receive area is write-protected.
0002 0003	1	The selected program number is not saved.
0002 0004	1	Program cannot be saved. Position the code within the image or improve the image quality.
0002 0005	1	Job canceled by the optical reader.

Note

Error information not included

If you receive error information that differs from that listed above, this originates from SFC 20 "BLKMOV" that is used to enter the result string in the receive area. You will find its error information in the online help of the system functions/function blocks.

9.5 Controlling the I/O interface "DI/DQ"

Control signals

Note

Range of functions depends on the settings in WBM

Note that the control of the reader via the digital inputs/outputs depends on the settings in the "Communication > Digital I/O" menu of the WBM.

Table 9-59   Assignment of control bytes (input signals)

Name	Description
TRG	Trigger
	Processing starts on a positive edge.

The optical reader has two freely assignable digital outputs. The following table provides an overview of the possible output signals.

Table 9-60   Assignment of status byte (output signals)

Name	Description
IN_OP	In operation • 0: Error message is displayed. • 1: Optical reader functioning, no error
TRD	Trained • In run: – 0: Selected program is not saved. – 1: Selected program has been saved. • With Save program (TRN = 1): – 0: Save program active. – 1: Acknowledgment signal (RDY = 0)
RDY	Ready: • 0: Startup of the optical reader or optical reader in STOP • 1: Optical reader in run

Name	Description
READ	Processing result
	Code was localized and decoded.
MATCH	Processing result
	Code matches the trained code.
N_OK	Code was not legible.

9.6 Control via TCP/IP and RS232

You can control the optical reader using a TCP/IP or RS232 connection.

Note

Upload process not yet completed: Control commands are discarded

Note that all control commands are discarded until the optical reader completes power-up. To determine whether the optical reader is ready for operation, you need to query the status until the optical reader sends a response frame.

This applies even when you use a TCP/IP connection. In this case, an existing TCP/IP connection does not mean that the optical reader has already completed the restart.

Requirement

To control the reader via TCP/IP or RS232, the respective transport connection in the WBM must be configured as a trigger source. The appropriate transport connection must be configured as a source for the controller for all other commands ("Communication > Use > Connection").

When using the TCP/IP transport connection, the optical reader is either a client or server ("Communication > Interfaces > TCP").

- As client, the optical reader actively establishes the connection to the partner. In this case, the partner must be the server and accept an incoming connection at the configured port.

- As server, the optical reader accepts an incoming connection of a client at the configured port.

If the reader used has two Ethernet interfaces, the TCP connection is automatically established to the interface which is located in the same subnet as the TCP client/ server.

Note

Restriction with identical transport connection for trigger and control

If an identical transport connection is configured as the source for trigger and control in the WBM, the following restrictions apply:
- When "M" is configured as trigger text, the remaining control commands can no longer be used.
- When "MATCH" is configured as trigger text, the command to overwrite the match string can no longer be used.

Using the TCP/IP and RS232 connection, you can perform the following functions:

- Trigger the reader.
- Overwrite the match string of the current program (non-persistent).
- Set and reset the DISA bit.
- Query the status of the optical reader and acknowledge a group error.
- Change the program.
- Saving programs.
- Setting "Digital out".

A control command is triggered in each case by the corresponding string.

Table 9-61   Overview of all commands with a string

Command	String
Trigger	Identical to the configured string in the WBM
Write match string	You can find a description of the command in the section "Write match string (Page 203)".
Set DISA bit	MDIH
Reset DISA bit	MDIL
Query status	MGST
Program change (select program number)	MR<programnr>
Save program with internal trigger	MI<programnr>
Save program with external trigger	MT<programnr>
Reset command	MRES
Set digital out	MO<p1><p2><p3><p4><p5><p6>

9.6.1   Trigger

When the optical reader receives a character string that is identical to the configured character string in the WBM, it triggers image acquisition and processing.

9.6.2 Write match string

Note

Sent match string takes effect immediately

A sent match string takes effect immediately. The sent match string is not synchronized with the trigger signal or the processing of buffered acquired images.

Therefore, ensure that the match string is sent when no image acquisition is running.

Requirement for matching with 1D/2D codes

All match options ("All", "Position", "ID", "GS1") are supported for 1D/2D codes. The match string that is sent must be formatted in such a way that the information required for the match can be extracted.

It is only possible to overwrite a match string if the optical reader is in processing mode and matching was activated during program saving for the current program. If the match string cannot be overwritten, an entry is made in the diagnostic data.

The following command must be sent to overwrite the match string:

Table 9-62   Command for overwriting the match string

Structure / description										
Character no.	0	1	2	3	4	5	6	7	...	n-1	n
Meaning	Command identifier					More significant byte of the length "m" of the following match string	Less significant byte of the length "m" of the following match string	New match string with a length "m"		
Value/charac-ter	M	A	T	C	H	0x00 ... 0xFF	0x00 ... 0xFF	All printable characters		

Note that saving the new match string is not persistent. If the reader exits processing mode, for example by changing to STOP mode or to the group error status, the overwritten match string is discarded. This also applies to a program change.

The characters of the command must be sent as a contiguous command. If the spacing between the individual characters is too large, receipt of the new match string is aborted.

The characters 5 and 6 are interpreted as an unsigned 16-bit word and form the overall length of the new match string starting at character 7.

9.6.3 Setting/resetting DISA bit

Set DISA bit

Use this command to set the DISA bit.

String: "MDIH" (Machine command set DIsable signal High)

Reset DISA bit

Use this command to reset the DISA bit.

String: "MDIL" (Machine command set DIsable signal Low)

9.6.4 Query status

This command returns the status byte, the current program number and an error number in the response string.

Command string: "MGST" (Machine command Get STate)

Response syntax

"RGST<status_byte><current_program_no><err_no><end_ID>" (Reply Get STate)

Table 9-63   Format of the response string

Characters	Description
<status_byte>	Non-printable ASCII character corresponding to the status byte. You can find additional information in the section "Assignment of the interfaces relevant to PROFINET IO (Page 176)".
<current_program_no>	Currently selected program number. • Two printable ASCII characters with the value "0" to "9". • Valid range of values: 00 ... 15.
<error_no>	Error code of the currently pending error You can find additional information in the section "Error messages (Page 227)". • Coding corresponding to <current program number> • There is no error if the value is "00".
<end_ID>	- Non-printable ASCII character with the value "0x04".

9.6.5 Select program number

This command changes the program or switches to the processing mode with the specified program number, provided this was assigned.

Command syntax

"MR<program_no>" (Machine command Run program <programnr>)

Table 9-64   String structure

Characters	Description
<program_no>	Number of the program saved.
	• Two printable ASCII characters with the value "0" to "9".
	• Valid range of values: 00 ... 15.
	This command returns no response string.
	• Using the "Query status" command, you then check if the program change has been successful. If, for example, program number "5" is selected and the status is queried, the string "MR05MGST" can be sent.
	• Using <statusbyte> and <currentcodeno>, you can check whether the optical reader is in processing mode with the new program number.
	If the DISA bit is not set already, the optical reader will set it automatically to save the program and then reset it.

9.6.6   Save program with internal trigger

Note

Requirement

To be able to execute this command, you first have to configure the identical transport connection as the trigger and control source.

This command starts the program saving procedure and internally generates a trigger for image acquisition. The code is saved with the specified number.

Note that if a program has already been saved with this number and no error occurred during the save procedure, this program is overwritten. If the save procedure is successful, the optical reader then goes into processing mode with the relevant program number.

Command syntax

"MI<program_no>" (Machine command Immediate store program <programnr>)

Table 9-65   String structure

Characters	Description
<program_no>	Number of the program saved. • Two printable ASCII characters with the value "0" to "9". • Valid range of values: 00 ... 15. This command returns no response string. • Using the "Query status" command, you then check if the program change has been successful. If, for example, program number "5" is selected and the status is queried, the string "MR05MGST" can be sent. • You check whether the optical reader has successfully stored the program and is in processing mode based on <statusbyte> and <currentcodeno>. If the DISA bit is not set already, the optical reader will set it automatically to save the program and then reset it.

9.6.7   Save program with external trigger

Note

Requirement

To execute this command, you must first set the DISA bit.

This command starts the program saving procedure. Note that you will then need to separately send/set a trigger signal at the earliest after receiving the response string.

The program is saved with the specified number.

Note that if a program has already been saved with this number and no error occurred during the save procedure, this program is overwritten. If the save procedure is successful, the optical reader then goes into processing mode with the relevant program number.

Command syntax

"MT<program_no>" (Machine command sTore code <programnr>)

Table 9-66   String structure

Characters	Description
<program_no>	Number of the program saved. • Two printable ASCII characters with the value "0" to "9". • Valid range of values: 00 ... 15.

Response syntax

"RTRDY<end_ID>" (Reply sTore program ReaDY)

Table 9-67   String structure

Characters	Description
<end_ID>	- Non-printable ASCII character with the value "0x04".

After this response string is received, a trigger can be sent via an external source.

Note the following:

- If this response string is not sent, either the DISA bit has not been set or <program no> is outside the valid range.

- If "RTRDY" is received and the trigger is sent, the status must be queried cyclically with "MGST". The query is used to check whether the save procedure is completed.

- When the save procedure is completed, the optical reader will be in processing mode with <program no>.

- If the optical reader is not in processing mode and there is no error state, the save procedure is not yet finished or it is still waiting for the trigger signal.

Once the save procedure is completed, the DISA bit is reset.

The save procedure can be canceled with "Reset command (Page 208)" (upon receipt of "RTRDY").

Example sequence

Table 9-68   Example sequence of a command execution

Send (string)	Receive (string)	Description
MDIH	--	Set DISA bit.
MGST	--	Status query
--	RGST ...	If there is no error, the saving process can be started.
MT05	--	Start the save procedure.
--	RTRDY	Wait for acknowledgment.
T	--	Trigger with the standard trigger text Trigger source = Control source. Note: Triggering is also possible via DI/DQ, for example.

Send (string)	Receive (string)	Description
...	...	Cyclic status query; recommended time interval: 1 s.
MGST	--	
--	RGST ...	If the optical reader is in processing mode with program no. 05, the saving process was successful. If an error occurred, the program could not be saved (e.g. no code in the image). If the optical reader is not in processing mode or there is no group error, the saving process has not finished.
...	...	...

9.6.8 Reset command

This command acknowledges an error or cancels "Save program with external trigger".

Command syntax

Command string: "MRES" (Machine command RESet)

This command returns no response string.

Send "MRESMGST" to get acknowledgment.

If "Save program with external trigger" is canceled with the reset command, the optical reader will briefly be in an error state (error in sequence). The error state is automatically quit or acknowledged.

9.6.9 Set digital out

Writing command data

With this command, you can set the four logic signals "EXT_1", "EXT_2", "EXT_3" and "EXT_4" and link them to other logic signals. Note that these signals can only be set via an automation system.

In addition, you can apply these signals to the available digital output pins via the WBM.

Receipt of this command is logged in the diagnostics data records.

Command syntax

"MO<p1><p2><p3><p4><p5><p6>" (Machine command set digital out)

Table 9-69   String structure

Characters	Description
p1	Number of the logical external signal • ASCII characters with the value "1" to "4" The values correspond to "EXT_1", "EXT_2", "EXT_3" and "EXT_4".

p2	Level of the signal
	 • ASCII characters with the value "0" to "2".
	   – 0: Set level statically to "low".
	   – 1: Set level statically to "high".
	   – 2: Set level for configured pulse time to "high".

p3	Link type
	 • ASCII characters with the value "1" to "7"
	   – 1: Logical "OR"
	   – 2: Logical "AND"
	   – 3: Logical "Exclusive OR"
	   – 4: no link
	   – 5: Logical "OR not"
	   – 6: Logical "AND not"
	   – 7: Logical "Exclusive OR not"

p4	Logical signal for linking.
	 When "p3 = 4", the parameter has no meaning.
	 • ASCII characters with the value "0" to "5"
	   – 0: Logical signal "IN_OP"
	   – 1: Logical signal "TRD"
	   – 2: Logical signal "RDY"
	   – 3: Logical signal "READ"
	   – 4: Logical signal "MATCH"
	   – 5: Logical signal "N_OK"

p5	Reserved The value must be "0" to retain upwards compatibility.
p6	

Example

MO114000 ≙ The level of the external signal "EXT_1" was set statically to "high" and no link was created for the signal.

9.6.10 Set image acquisition

You can use the "Set image acquisition" command to adjust the focus setting, exposure time and brightness, as well as the image acquisition speed for the "Scan" and "Auto-trigger" modes, during processing. The command can only be used while the reader is in processing mode. The focus adjustment command only works in conjunction with a calibrated EF lens.

If the exposure parameters are changed in this way and a trigger signal occurs, image acquisition starts with a delay of up to one millisecond due to application of the parameters. When the focus setting is changed, the EF lens needs adequate time to focus to the new distance. The time required for focusing is at least 40 ms, but a time interval of 350 ms until the next trigger signal is required.

NOTICE

Interruption of processing mode in case of incorrect use

Only use this command if it is ensured that there is sufficient time to apply the new settings before the next trigger signal. If these restrictions are disregarded, processing mode may be disrupted in the form of ignored or rejected trigger signals.

Note

Delay between trigger signal and start of image acquisition

Note that the use of this command results in larger and more strongly fluctuating delays between the occurrence of a trigger signal and the start of image acquisition. This effect is stronger when trigger takes place via the DI interface.

Note

Delayed transfer

With respect to the wait times to be adhered to, note that delays can occur when transferring the command. This can be minimized by suitable configuration of the program to be controlled (e.g. with use of "TCP_NODELAY").

Command syntax

IMGACQ[nn][Payload]

- [Payload] consists of one or more blocks with the following syntax:
  P:m ; FOCUS | GAIN | EXPOSURE | INTERVAL : a&

- [nn] designates the entire length of the [payload] in bytes (2-byte binary notation)

Table 9-70   String structure

Characters	Description
P:m	"P:m" is optional and can be used to identify the program(s) to which the settings in the block are applied. In this case, "m" can consist of up to 5 program numbers (binary value) with 1 byte each.
	If a block does not contain a "P:m" entry, the settings are used for each currently running program.
;	Delimiter character that divides the individual blocks of the string into subsections.
FOCUS | GAIN | EX-POSURE | INTERVAL	Subsection identifiers that indicate which value is to be set.
a	The value to be set is a number (2-byte binary notation) whose meaning depends on the preceding subsection identifier. • For FOCUS, this is a distance value in [mm] • For GAIN, this is a gain value • For EXPOSURE, this is an exposure time in [µs] • For INTERVALL, this is an image acquisition interval in [ms] Only valid for the "Auto-trigger" or "Scan" mode.
&	Delimiter needed to divide the payload into blocks.

NOTICE

Interruption of image acquisition through acquisition interval = 0

If an acquisition interval of "0" is set using the "INTERVAL" section, the image acquisition is aborted. The device remains in processing mode but does not take any more images until an INTERVAL > 0 is set, a new trigger signal is applied or a program change takes place.

In the "Scan" mode, the image counter is retained. This means that, if a new INTERVAL value is set, the remaining images are continued until the "Number of acquired images" has been reached.

If an acquisition interval of "1" is set using the "INTERVAL" section, the interval is reset to the value stored in the program.

Example

"Scan" mode, acquisition interval "2000 ms", number of acquired images: 20.

An INTERVAL = 0 is set ten seconds (i.e. 5 acquired images) after a trigger signal. An INTERVAL = 1000 is set after a pause of one minute. This has the result that the remaining 15 acquired images are set with an interval of 1000 ms.

Examples

<0xnn> is a number in bit notation

• IMGACQ<0x000F>P:<0x01>;EXPOSURE:<0x2328>
  Exposure is set to 9000 µs for program 1.

• IMGACQ<0x001C>FOCUS:<0x0028>;EXPOSURE:<0x2328>;GAIN:<0x00C8>
  Focus is set to 40 mm, exposure is set to 9000 µs, and gain is set to 200 for all currently running programs.

- IMGACQ<0x001A>P:<0x01>;FOCUS:<0x0028>&P:<0x02>;FOCUS:<0x012C>
The focus is set to 40 mm for program 1 and 300 mm for program 2.

- IMGACQ<0x0015>FOCUS:<0x02BC>&P:<0x03>;FOCUS:<0x0258>
The focus is set to 700 mm for all currently running programs, except for program 3, where the focus is set to 600 mm.

- IMGACQ<0x000B>INTERVAL:<0x0000>
The image acquisition of the currently running program (incl. "Auto-trigger" or "Scan") is interrupted.

- IMGACQ<0x000B>INTERVAL:<0x01FA>
The image acquisition of the currently running program (incl. "Auto-trigger" or "Scan") is set to 500 ms. If image acquisition was aborted previously, it is resumed.

9.6.11 Automatic Setup

Using the "Automatic Setup" command, you can trigger complete program adaption. This command can be used at any time and creates a new, optimized program based on the object currently located in the image. Then the reader returns to processing mode with this program (or the program sequence with the same number). If creation of the program fails (e.g. no code in the image), the device switches to error state.

The function of the command corresponds to the "READ" button on the front of the device or the "Start Automatic Setup" button in WBM. The exact behavior of the function can be preset in the "Options > Extras > Operation on device > READ" or sent directly with the command. Parameters that are not sent with the command are used according to the setting in the options.

NOTICE
Interruption of processing mode
Note that the reader exits processing mode when executing this command. This is true even when "Allow use of READ function" is set to "Never" or "Not in processing mode".

Note

Long-running command

Note that, depending on the program template and device version (image resolution), the complete execution of this command may take several minutes, even when successful. The progress of this command can be obtained by querying the device status: After completion, the device is either in processing mode ("RDY" bit set) or in error state ("IN_OP" bit no longer set).

Command syntax

AUTOSnnCommand

Response

The reader responds to the command with the string "AUTOSRUN" if automatic startup was started, or "AUTOSERR" if the command was faulty or could not be executed.

The payload consists of up to six blocks of 5 bytes each with the following syntax:

[option] : [setting]

Table 9-71   String structure

[option] (3 bytes)	[einstellung] (1 byte)	Description
SRC	0...15	Number of the source program • 0: New program
TGT	0...15	Number of the target program • 0: Next free program
EXP	0, 1	Optimization of exposure • 1: Perform • 0: Do not perform
LMP	0, 1	Lighting scenario • 1: Run through • 0: Do not run through
FCS	0, 1	Focus setting • 1: Re-determine • 0: Do not determine
DEC	0, 1, 2	Code type detection • 2: Perform completely • 1: Perform quickly • 0: Do not perform

Every option sent with the command takes precedence over the corresponding setting in the device options, but only for the duration of this command. If all settings in the device options are preset as needed, the command can be sent without options.

Examples

<0xnn> is a number in bit notation

- AUTOS<0x0000>
  The command is started with full use of the device options.

- AUTOS<0x0005>TGT:<0x01>
  The command is started as set in the options. However, the created program is saved as "Program 1" depending on the set options.

- AUTOS<0x0024>SRC:<0x01>;TGT:<0x01>;EXP:<0x01> ;EXP:<0x00>;LMP:<0x00>;FCS:<0x 01>; DEC:<0x02>
  The command is started by re-creating "Program 1". The exposure and lamp settings are not changed, only the focus setting and the code type to be read are determined again.

9.7 Scanner portal application

This section explains how to use multiple optical readers to implement a scanner portal application.

In a scanner portal application, there is a large field of view that is covered by several individual readers. The fields of view of the readers overlap. To prevent the same code being output more than once, the individual readers (slaves) send their read result to a master reader. The master reader synchronizes the individual results and prevents the output of multiple read results. The master reader itself is also a slave that searches for 1D/2D codes in the field of view.

Restrictions of the scanner portal application

The scanner portal application is subject to the following restrictions:

- All optical readers must operate in the untriggered image acquisition mode "Auto-trigger".
- If several different 1D/2D codes with identical contents are read one after the other, the content is output only once.
- The master reader can only output the synchronized result via the TCP interface.
- The formatting options of the result string of the master reader are restricted.
- A maximum of five optical readers (4 slaves, 1 master) are supported.
- If a slave reader is in an error state, the master reader does not change to an error state.
- The master reader does not monitor the number of connected slave readers.
- Maximum results of 2048 characters including a formatting instruction required for synchronization can be synchronized.

9.7.1 Configuration

The WBM configuration for the optical readers if you want to set up a scanner portal with them is described below. A distinction is made between master device and slave devices for the configuration.

Configuration of the master device

Make the following settings in the WBM for the master device:

- Menu: "Program > Image acquisition > Trigger"
  To control the image acquisition, select the mode "Auto-trigger" (without "Initial trigger").
  Make sure to enter the value "1" in the "Recognize double read" input box.
  The acquisition interval must be sufficiently long for the 1D/2D codes in the image to be read.
  The interval must be identical on all slave and master devices.

- Menu: "Program > Result > Program format text"
  Enter the value "\02[CamId]\03%s\04" in the "Format text" input box.

  - [CamId] can be selected freely and is used to identify the optical reader that read the 1/2D code in the field of view.

  - The value "\02\03%s\04" is also allowed if no identification of the optical reader is desired in the result output.

- Menu: "Communication > Interfaces > TCP"

  - Enter the IP address of the TCP partner of the master device.

  - Enter the port number of the TCP partner of the master device.

- Menu: "Communication > Use > Connection"
  Select the value "TCP" in the "Text" drop-down list.

- Menu: "Options > Extras > Scanner portal"
  Select the "Master reader" check box.

Configuration of the slave devices

Make the following settings in the WBM for the slave devices:

- Menu: "Program > Image acquisition > Trigger"
  To control the image acquisition, select the mode "Auto-trigger" (without "Initial trigger").
  Make sure to enter the value "1" in the "Recognize double read" input box.
  The acquisition interval must be sufficiently long for the 1D/2D codes in the image to be read.
  The interval must be identical on all slave and master devices.

- Menu: "Program > Result > Program format text"
  Enter the value "\02[CamId]\03%s\04" in the "Format text" input box.

  - [CamId] can be selected freely and is used to identify the optical reader that read the 1/2D code in the field of view.

  - The value "\02\03%s\04" is also allowed if no identification of the optical reader is desired in the result output.

- Menu: "Communication > Interfaces > TCP"

  - Enter the IP address of the master device.

  - Enter the port number "666".

  - Enter a time limit of "3 s".

  - Enter the value "\04" in the "Idling string" input box.

- Menu: "Communication > Use > Connection"
  Select the value "TCP" in the "Text" drop-down list.

- Menu: "Options > Extras > Scanner portal"
  Clear the "Master reader" check box.

9.7.2 Output of the synchronized read result by the master reader

Output via the TCP interface

The master device synchronizes the results of the slave devices and outputs the synchronized result via the TCP interface. The result string of the slave device that read the 1D/2D code first is output. For this purpose, the master device compares the string between "\03" and "\04" of the read 1D/2D codes. The entire result string is output, whereby the "\02", "\03" and "\04" texts are first removed.

If a slave device sends the result string "\02Slave01:\03DMC123\04" and read the"DMC123" code first, the master device sends the "Slave01:DMC123" string to its TCP partner.

9.8 Remote client

The remote client interface is an HTTP-based interface. The remote client can trigger functions using HTTP requests sent to the optical reader. To make this possible, you need to configure an IP address in the WBM that corresponds to the address of the client. The optical reader only processes the HTTP requests that have the configured IP address as the sender.

NOTICE
Security vulnerabilities due to remote interface
This interface is still supported for compatibility reasons. For security reasons, it is strongly recommended to disable the interface.
To disable the interface, enter the IP address "0.0.0.0" in the "Remote client" parameter in the "Communication > Interfaces > Archiving/MMI" menu. The interface is disabled in the factory setting.

9.8.1 XML backup and XML restore

Note

Do not control at the same time via the control interface

Ensure throughout the entire automation process that nothing is controlled via the control interface while the XML Backup and XML Restore functions are running. If control is performed via the control interface, by setting the DISA bit for example, the "XML Backup" and "XML Restore" functions cannot be executed.

Note

Backing up the diagnostic images before execution of the "XML Backup" and "XML Restore" functions

Executing the "XML Backup" and "XML Restore" functions may delete any diagnostics images in the optical reader memory.

If required, save the diagnostic images before you execute one of these functions.

Note

Keep "XML Backup" file safe

The "XML Backup" file contains sensitive data (password hash). For security reasons, keep the "XML Backup" file in a safe place.

In order to be able to use these functions, an IP address for the remote client must be stored in the WBM ("Communication > Interfaces > Archiving/MMI").

The "XML Backup" and "XML Restore" functions each have their own HTTP requests. After the reader has received one of these HTTP requests, if the requirements have been met, the following tasks are first performed in both cases:

1. The connection to the WBM is terminated.
   While the HTTP request is being processed by the optical reader, you can only open the WBM in READ ONLY mode.

2. The optical reader changes to "Stop" mode.

3. The IN_OP bit is set to "0".

9.8.2 XML backup

Once the optical reader has sent the HTTP response, the "IN_OP" bit is set and access via the WBM is permitted again.

Request

Stucture and properties of the request:

- URI: https://<IP address of the optical reader>/xml/backup.cgi
  e.g. https://192.168.0.42/xml/backup.cgi

- HTTP method: GET

Response

Structure and properties of the response:

- HTTP status code 200 (OK)

- Content type: text/xml
  name = "<file name>.xml"

- Content disposition: attachment
  filename="<file name>.xml"

Note

Structure of the "<File name>" parameter

The file name consists of the name of the optical reader and the firmware version.

The data corresponds to the file content of an xml file that is used to restore the settings and programs.

9.8.3   XML restore

Note

Frequent use of "XML Restore" can reduce the service life of the optical reader

Note that each "XML Restore" performs write operations in Flash memory. If the "XML Restore" function is used frequently, this can reduce the service life of the optical reader.

Disable import of the remote client IP address

If the remote client IP address currently set on the optical reader does not match the IP address of the imported XML Restore file, remote client connection and data transfer are not possible.

Ensure that the remote client IP address is not imported by disabling the "form-data" date in the "XML Restore" file, "importremoteclientip".

Request

Stucture and properties of the request:

- URI: https://<IP address of the optical reader>/xml/restore.cgi
  e.g. https://192.168.0.42/xml/restore.cgi

- HTTP method: POST

- Content Type: `"multipart/form-data; boundary=[REMOTEXMLUPLOADPARA] \r\n"`

POST data

Note

Notation

`<xmlFile>`

Corresponds to the string containing the contents of an "XML Backup" file.

`<on|off>`

- If the parameter group is to be imported, use the string `"on"`
- If the parameter group is not to be imported, use the string `"off"`.

```
"[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="xmlfile"
Content-Type: text/xml

<xmlFile>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importtcp"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importdp"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importserial"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importsec"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importcodes"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importcustomgui"

<on|off>
[REMOTEXMLUPLOADPARA]
Content-Disposition: form-data; name="importremoteclientip"
```

```
<on|off>
[REMOTEXMLUPLOADPARA]
"
```

Response

Structure and properties of the response:

- HTTP status code 200 (OK)

- Data:

  – "2": XML upload and import were only partially successful.
    The optical reader restarts. The XML import must be performed again via the WBM to obtain error analysis.

  – "1": XML upload and import was successful.
    The optical reader restarts.

  – "0": Import error.
    The XML import must be performed again via the WBM to obtain error analysis. The "IN_OP" bit is set and access via the WBM is allowed again.

9.9 SNMP

Simple Network Management Protocol (SNMP) is a protocol for managing networks and devices in the network. To transmit data, SNMP uses the connectionless "UDP" protocol.

Information about the properties of SNMP-enabled devices is stored in Management Information Base (MIB) files.

You can find basic information on this topic in the "Diagnostics and configuration with SNMP" manual on the Web pages of the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/103949062).

Scope of performance of the optical reader as an SNMP agent

The optical reader supports data query in the following SNMP versions:

- SNMPv1 (standard)

For the optical reader, only SNMP variables from the following MIBs are supported:

- LLDP-MIB

- Standard MIB II (according to RFC1213)

  – Group "System"

  – Group "Interfaces"

Write access is permitted only for the following MIB objects of the "System" group:

- sysContact

- sysLocation

- sysName

For all other MIB objects / MIB object groups, only read access is possible for security reasons.

Traps are not supported by the optical reader.

Access permissions using community names

The optical reader uses the following community strings to control the access rights to the SNMP agent:

Table 9-72   Access rights in the SNMP agent

Type of access	Default community string
Read access	public
Read and write access	private

NOTICE
Change community string
Note that the default community string is generally known and therefore does not provide effective protection.
To make sure that no unauthorized persons can access the device, we recommend that you change the community string when the device is first set up.

Note

Write access via SNMP disabled in the factory state.

For security reasons, write access via SNMP is deactivated in the factory state.

9.10   Example programs

This section describes various examples of process connection.

Examples

- Example 1:
  Program for connecting the optical reader with a SIMATIC controller using FB79.

- Example 2:
  Program for archiving diagnostic information on a PC using MMI diagnostics.

- Example 3:
  You can find an application example for the communication of an optical reader with a SIMATIC S7-1200-/S7-1500 controller on the Web pages of Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/103528928).

9.10.1 Connection of the optical reader to a SIMATIC controller using FB 79

You can find the program described in this section on the Web pages of Siemens Online Product Support (https://support.industry.siemens.com/cs/ww/en/ps/15147/ae).

Integration of FB 79 into a STEP 7 program

In the accompanying STEP 7 program, the FC1 function contains a simple example for outputting the result string. You can execute a program change using the FC2 function. When supplied, only FC1 is called in OB1. To activate FC2, you will need to either delete the first network with the FC1 call or skip it.

Note

Requirement

You may only assign the value "W#16#0081" for the "COMMAND" parameter (output result string) when bit 2 is set to TRUE in the status byte (corresponds to the "RDY" signal). If this condition is not met, the "Invalid operating mode" error is output.

Process interfacing

The optical reader is connected with a programmable logic controller via PROFINET IO. A light barrier or sensor is used additionally for triggering and must be read in via a digital input module. The received data is stored in data block DB48 in bytes 0 to 500.

Adding program change

Specify the number of the required program in memory byte MB200. The program change runs automatically. The correct order of the commands is adhered to. The FB changes to the program specified in the "PARAM1" parameter.

⚠️ **CAUTION**

Avoiding undefined plant states

To avoid undefined plant states, you should only change programs when the plant is in manual mode or is not in operation.

Startup OB OB100

In OB100, you set the RESET input of FB 79 to initialize the FB. This input is reset by the FB 79 call.

Bits of the control and status bytes used

You must edit the following control and status bytes in addition to the FB 79 call in your program:

Table 9-73   Control and status bytes for FB 79 call

Bit	Byte	Signal	Description
A x.6	Control byte	TRG	Processing is started with a positive edge.
A x.7	Control byte	RES	Reset sensor error
E x.0	Status byte	IN_OP	0: Error or startup 1: Sensor is functional
E x.2	Status byte	RDY	1: Sensor is in "RUN" mode, i.e. it is ready to process codes. You can use this signal to enable the feed of work pieces.

9.10.2   Archiving of images and diagnostic information on a PC

You can find the program described in this section, "MMI Diagnostic Recorder", on the web pages of Siemens Online Product Support (https://support.industry.siemens.com/cs/ww/en/ps/15147/ae).

The MMI Diagnostic Recorder supports you with the diagnostics and maintenance of your application. Among other things, it saves diagnostic data records as CSV files and saves all images taken by the reader and corresponding to the set filters (e.g. "only bad reads", "match errors" or "only successful reads") on an external PC. Please note that this function can affect the network load if you have set a fast acquisition interval. If the image packets cannot be sent on time, there is a buffer of up to 50 images. If this buffer is full, the corresponding images are discarded.

Please note that there is only one common setting for MMI transfer and the internal error image memory. It is not possible to make separate and therefore different settings here.

Requirements

- .NET Framework v4.0 must be installed to run the demo program.

- The PC must be connected with the optical reader over the Ethernet interface.

- The Ethernet interface involved and the PC must be located in the same subnet.

Settings in WBM

Make the following settings in the WBM:

- "Communication > Interfaces > Archiving/MMI" menu:
  Enter the IP address and the port of the PC on which you want to archive the diagnostic information.

- "Communication > Use > Diagnostics transfer" menu:
  Select from the drop-down lists which data you want to archive: Diagnostics data sets, diagnostic images or both.

Operation of the example program

Start the example program by double-clicking "MMIDiagnosticsGUI.exe".
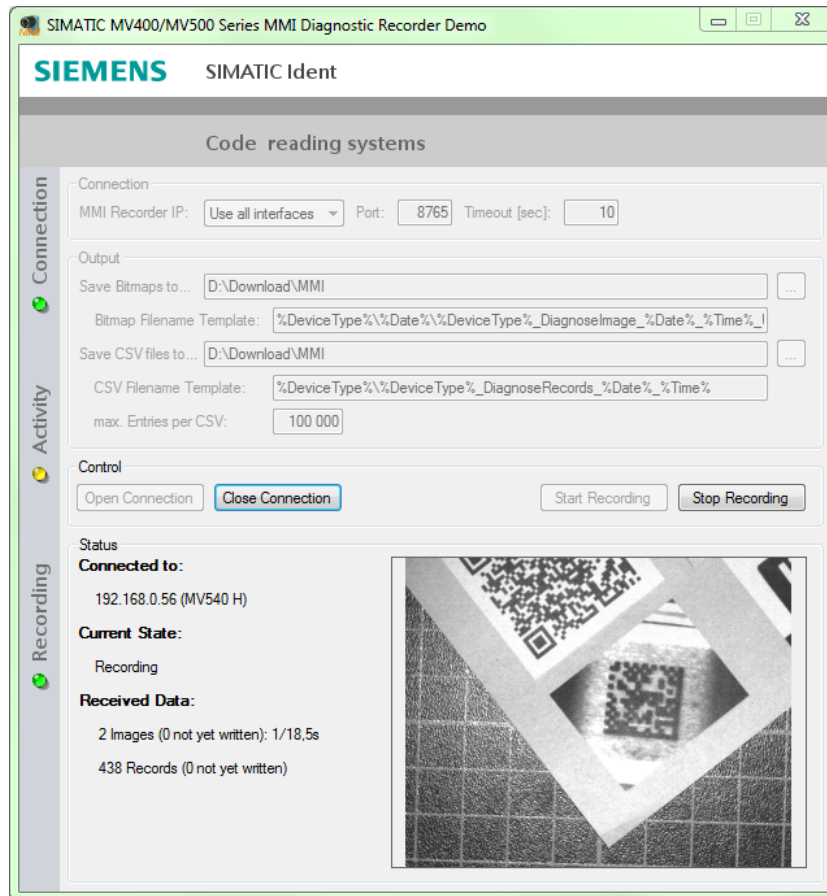
Area: Connection

Apply the entries for the IP address and port that you have configured under "Communication > Interfaces > Archiving/MMI" in the WBM.

- Select the IP address from the "Local IP Address" drop-down list.

- Enter the port in the "Port" text box.

- Enter the desired time in the "Timeout [sec]" text box.
  If the example program has not received a response from the optical reader for the specified amount of time, the example program terminates the connection to the optical reader. Enter the value "0" in the input box to disable Timeout monitoring.

Area: Output

"Save Bitmaps to ..." and "Save CSV files to ...":

- Specify the storage path under which the diagnostic images and CSV files are saved.

"Bitmap Filename Template" and "CSV Filename Template":

In these input boxes, you can define specifications for naming the generated files.
You can use the following placeholders:

- %Date%
  Is replaced with the current date or the date stamp of the image acquisition in the "Year-Month-Day" format.

- %Time%
  Is replaced with the current time or the time stamp of the image acquisition in the "Hours-Minutes-Seconds-Milliseconds" format.

- %DeviceType%
  Replaced by the device type of the connected optical reader, e.g. "MV540-H".

- %Uid%
  Replaced by a random unique ID of the image (24 digits).

Use a backslash ("\") to define subfolders. The subfolders are created below the output folders.

"max. Entries per CSV"

- In the input box, enter the maximum number of lines a CSV file is to contain.
  A new CSV file is created as soon as the maximum number of lines is exceeded.

Area: Control

In this area, you can establish/terminate the connection to the reader and start/stop the transmission of the diagnostic data.

Click the "Open Connection" button to set up the connection between the PC and the optical reader. After the optical reader has established the connection with the PC, start sending the diagnostic data by clicking the "Start Recording" button.

Note

Connection cannot be set up

If the optical reader cannot set up a connection to the PC, the message "Waiting for Connection..." appears on the screen.

First check whether the connection settings are configured correctly in the example program and in the optical reader. Check the firewall settings if the optical reader cannot set up a connection despite correct configuration.
In this case, contact the network administrator, if necessary.

To stop transferring the diagnostic data, click on the "Stop Recording" button. Click the "Close Connection" button to terminate the connection between the PC and the optical reader.

Area: Status

This area displays the current status of the example program.

You can see the following information when recording is active:

- Last image received in 320 x 240 pixel format.

- The number of images and diagnostic entries already received.

The program status is also shown in the left sheet bar of the dialog box.

Automatic start

If the example program is started with the "-auto" call parameter, a connection is opened immediately and diagnostic recording is started automatically once the connection has been established. The most recently used last program configuration is applied again here.

Service and maintenance

10

10.1 Error and diagnostics messages

If there are operator errors or errors in processing mode, the optical reader outputs diagnostic information. The diagnostic information can be read out as follows:

- As a message via the WBM
- Via the LED display on the reader
- When using PROFINET with the Ident profile (or FB 79), in the device diagnostics
- When using the technology object "SIMATIC Ident" in the diagnostic function of the technology object (TIA Portal).

10.1.1 Message types

For the messages, a distinction is made between the following message types:

- Error messages
- Warnings/notes
- Read results

All three message types are displayed in the WBM.

Most messages of the "error message" type trigger a diagnostic interrupt on the relevant PROFINET controller.

The following sections "Error messages" and "Error output of read results" describe all messages, their meaning and the corresponding corrective measures.

10.1.2 Error messages

With error messages, the "IN_OP" signal (in operation) is reset and the "ER" LED is continuously lit red. When connecting via the Ident profile, this is done via the "UIN0" output. In addition, the "Ready" or "Done" bit ("UIN1" output) is reset and the "Error" bit is set.

If the optical reader is connected to PROFINET IO, these error messages trigger a diagnostics interrupt on the relevant I/O controller. Refer to I/O diagnostics for a description of how to read out and evaluate the diagnostic information made available on the optical reader.

Table 10-1　　Error messages of the optical reader

Error message	Value FB 79 (ERRCODE)	Value TCP/IP and RS232	Value Ident profile (STATUS)	Description	Corrective measures
Fault in internal interface to the image sensor	W#16#5000 W#16#5001	01	E1FE02	There is a fault in the connection of the internal interface to the image sensor.	If the error continues to occur after the device has been turned on again, contact technical support.
Error during DISA signal change	W#16#5003	03	E6FE04	When the program is saved, the DISA signal is changed at an invalid location.	Check the sequence of applied signals. Start the program saving process again.
Error in sequence	W#16#5004	04	E6FE04	While the program is being saved, the time sequence of applied signals is not adhered to.	Check the sequence of applied signals. Start the program saving process again.
Program cannot be started	W#16#5005	05	E1FE06	Not enough memory or program damaged.	Reduce the memory requirements and repeat "Save program".
Internal file error	W#16#5005	05	E4FE04	An error occurred while saving to read-only memory.	Please contact technical support if this error occurs frequently.
Temperature of a module is too high	W#16#5006	06	E2FE01	The temperature of the processor is outside the permissible range.	Reduce the ambient temperature, e.g. by air circulation, or dissipate the heat and ensure that the ambient temperature is within the permissible range. Reduce the triggering frequency.
Transfer error TCP or RS232	W#16#5007	07	E1FE04	The send buffer is full because the data cannot be sent in an adequately short time.	Reduce the trigger frequency. With TCP: Process the results on the server side faster. A high load on the network to which the optical reader is connected can also block the transfer of the data. If necessary, check the network connection. With RS-232: Increase the transmission speed. In addition, the size of the image buffer in the WBM can be increased under "Program > Image acquisition > Mode".

Error mes-sage	Value FB 79 (ERRCODE)	Value TCP/IP and RS232	Value Ident pro-file (STA-TUS)	Description	Corrective measures
Transfer error archiving/ MMI	W#16#5007	07	E1FE04	The send buffer is full be-cause the data cannot be sent in an adequately short time or the server is not con-firming receipt of the data in time.	Reduce the trigger frequency or reduce the amount of diagnostic data to be archived. Process the results on the server side faster. A high load on the network to which the optical reader is con-nected can also block the transfer of the data. If necessary, check the network connection.
Transfer error PROFINET IO	W#16#5007	07	E1FE04	The send buffer is full be-cause the data cannot be queried in an adequately short time.	Reduce the trigger frequency or process the results faster. If nec-essary, change the update time in the PROFINET configuration.
Transfer error CM/PROFI-NET IO	W#16#5007	07	E1FE04	The send buffer is full be-cause the data cannot be queried in an adequately short time.	Reduce the trigger frequency or process the results more quickly on the CPU. The transmission speed of the communication module connection can possibly be increased. To cover short-term peak loads, the size of the image buffer in the WBM can be increased under"Pro-gram > Image acquisition > Mode".
Save program	W#16#500A	10	E6FE04	The program could not be created.	Adapt the parameter assignment, the placement of test objects in the image or the image quality.
Match error	W#16#500B	11	E1FE07	The program could not be created due to faulty match settings.	Adapt the match settings or use a suitable test object.
Timeout dur-ing saving	W#16#500D	13	E6FE04	The "Save program" process was canceled because it took too long.	Check the program settings and start the "Save program" process via the WBM, if necessary.
TCP commu-nication	W#16#500E	14	E1FE01	Connection error in commu-nication over a TCP connec-tion or when using an Ether-net RS-232 converter: There is no TCP connection or the data transfer cannot be com-pleted within the set time lim-it.	Make sure that the connected TCP partner is correctly configured and ready to receive.
Archiving/ MMI commu-nication	W#16#500E	14	E1FE01	Error in communication over the archiving connection: There is no TCP connection, the server does not respond within the set time limit or vi-olates the archiving protocol.	Check the connection to the serv-er. Make sure that the data is pro-cessed by the server in an ade-quately short time and that the protocol is maintained.

Error mes-sage	Value FB 79 (ERRCODE)	Value TCP/IP and RS232	Value Ident pro-file (STA-TUS)	Description	Corrective measures
Overload pro-tection	W#16#500F	15	E4FE06	The processing mode has been interrupted to protect against thermal or electrical overload. The configured or specified "Maximum duty cycle" under "Options > Lighting" may have been exceeded.	Switch off ring light elements, re-duce the trigger frequency, re-duce the exposure time or use a more powerful ring light. If the power supply is via PoE, switch to an external power sup-ply via the combination interface.
Invalid pro-gram number	W#16#5010	16	E6FE04	An attempt is being made to save a program under an in-valid number via the inter-face set in "Controller".	Select a program number be-tween 1 and 15.
Program re-quires EF lens	W#16#5011	17	--	No EF lens is connected.	Reconnect the EF lens or change the program settings accordingly.
PROFINET IO connection error	W#16#5012	18	--	PROFINET IO connection ter-mination	The connection to the PROFINET IO controller was interrupted. Check the connection to the I/O controller.
PROFINET I/O configuration error	W#16#5016	22	--	Faulty PROFINET IO configu-ration	The PROFINET IO configuration of the optical reader and that of the communication partner do not match. Check the PROFINET mode in the optical reader and in the I/O controller.
PROFINET IO compatibility error	W#16#5017	23	--	Version incompatibility of the PROFINET IO controller to the I/O device (optical reader)	The version of the I/O controller is out of date and not compatible with the current version of the optical reader. To correct this error, we recom-mend that you upgrade the I/O controller.
CPU tempera-ture too high	W#16#5018	24	E2FE01	The temperature of the CPU is outside the valid range. This can lead to incorrect read results, shortened serv-ice life or destruction of the reader.	Ensure there is adequate ventila-tion or cooling of the reader and ensure that the ambient temper-ature is within the permissible range.
Lens temper-ature too high	W#16#5019	25	E2FE01	The temperature of the lens is outside the valid range. This can lead to incorrect read results, shortened serv-ice life or destruction of the reader.	Reduce the ambient temperature, e.g. by air circulation, or dissipate the heat and ensure that the am-bient temperature is within the permissible range.
Sensor tem-perature too high	W#16#501A	26	E2FE01	The temperature of the sen-sor is outside the permissible range. The probable cause is an excessively high ambient temperature.	Reduce the ambient temperature, e.g. by air circulation, or dissipate the heat and ensure that the am-bient temperature is within the permissible range.

Error mes-sage	Value FB 79 (ERRCODE)	Value TCP/IP and RS232	Value Ident pro-file (STA-TUS)	Description	Corrective measures
Command not supported	--	--	E1FE09	The command is not suppor-ted	--
No message	--	--	E4FE84	Error in last command se-quence Note: No diagnostic interrupt is sent to the I/O controller.	May occur if triggering is too fast. The Ident profile can only process one command at a time before a new command can be executed.
No message	--	--	E6FE01	A user with the "Take control" right has logged in via WBM and has taken over exclusive control from the automation system.	Make sure that no user with the "Take control" right logs in to the reader during ongoing operation.
				The automation system has not been assigned any con-trol rights.	Assign control rights to the auto-mation system ("Communication > Use > Connection").

Self-acknowledging connection errors

The following connection errors are self-acknowledging:

- Error "TCP communication"

- Error "Archiving/MMI communication"

- Error "PROFINET IO connection error"

- Error "PROFINET IO controller status 'Stop'"

As soon as the connection is re-established after an interruption, the optical reader exits the error state. The optical reader returns to the mode prior to the occurrence of the error, for example, back to processing mode.

The occurrence of these errors and their automatic acknowledgment are stored in the diagnostic data records. Stored error messages are not overwritten by newer errors.

If there are error entries, a corresponding note appears in the WBM during processing mode in the "Program > Info statistics" area.

Note

PROFINET IO error ("OB 86") not programmed

Note that the occurrence of a PROFINET IO error in a SIMATIC S7 controller causes "OB 86" (rack failure OB) to be called. If you have not programmed the "OB 86" in the SIMATIC S7-300 controllers, the controller goes into the "STOP" state.

10.1.3 Error output of the read results

Table 10-2   Error output of the read results

Message number	Error message	Description	Corrective measures
1	**Read Error (<Grund>)**	The processing was not successful in processing mode.	For possible causes, refer to "Read and verification error messages" for the error messages.
2	**Filter Error (<Grund>)**	The selected result string filtering was not possible with the read code.	1. Check whether the code just read is correct. 2. Check and, if necessary, correct the selected result settings in the "Reading code" program step in the "Result" area.
3	**Match Error (<Leseergebnis> ! <Matchstring>)**	• The configured comparison option was not found in the code to be compared. • The string defined for training does not match the current string of the code or the plain text.	Check the selected result settings.
4	**Format Error (<Grund>)**	The configured format text does not match the definition.	Check the selected settings. You can find additional information in "Overall result" in the online help. The undefined formatting command is issued as <reason>.

Note

Changing error texts

Note that the error messages in the WBM can be changed under "Program > Result > Error messages".

10.1.4 Read and verification error messages

If a read error or verification error occurs, the following error codes and error messages are output. You can find additional information in the section "Overall result" of the online help.

Note

The causes of error 4700 to 4722 are also output in the verification report if there is a verification error

All verification grades are output in the report as "E". The verification values correspond to the error code.

Note

Evaluating verification errors as read errors

If the "Evaluate 'Poor' evaluation as 'N_OK'" check box has been selected in the decoding settings, a verification error will also be evaluated as "N_OK".

Table 10-3   Read/verification error messages

Error code (%c)	Error message (%s)	Description
0001	No 1D/2D code found in step n	No code was found in step #n.
0002	Cycletime too short	The processing was not completed within the cycle time limit.
0003	Trigger too fast	The processing was interrupted by a trigger signal.
0004	Non ECC200 Code in step n	A DMC has been found in step #n that does not correspond to ECC200. Note: The check for ECC200 is performed only in adjustment mode and during "Save program".
0005	Step n: Structured Append DMC not supported	In step #n, a "Structured Append" DMC type was found. This DMC type is not supported.
0006	Step n: Reader Programming DMC not supported	In step #n, a "Reader Programming Code" DMC type was found. This DMC type is not supported.
0007	Step n: QR ECI encoding not supported	In step #n, a QR code with "ECI encoding" was found. This QR type is not supported.
0008	Step n: QR Byte encoding not supported	In step #n, a QR code with "Byte encoding" was found. This QR type is not supported.
0009	Step n: QR Kanji encoding not supported	In step #n, a QR code with "Kanji encoding" was found. This QR type is not supported.
0010	Step n: Structured Append QR code not supported	In step #n, a "Structured Append" QR type was found. This QR type is not supported.
0012	Code quality is poor in step n	A code with "poor" quality evaluation was read in step #n during verification.
0013	Nothing found	In "Scan" or "Auto-trigger" mode (edge-controlled): All image acquisitions were decoded without result.
0014	Found m instead of the expected number of 1D/2D codes in step n	Only m codes instead of the expected number of codes were found in step # n during multicode decoding.
0015	Maximum number of codes per image (m) was exceeded in step n	More than the maximum possible number of codes per image was found with multicode decoding (50, MV500 U: 150).
0016	The maximum amount of data which can be decoded was exceeded in code m of step n	A maximum of 3001 bytes can be decoded per step. This length was exceeded in step #n for code #m.
0017	Trigger during image acquisition	The trigger signal was applied during image acquisition. In this case, no additional image acquisition is started. Instead, image acquisition and processing are continued and an "N_OK" result is generated immediately upon completion.
0018	Step timeout reached in step n	In step #n, the defined time limit was reached.

Error code (%c)	Error message (%s)	Description
0100	No new code in image, n codes already read in current sequence	Only in "Inventory" mode: The last image did not contain a code that has not yet been output. 'n' codes have already been read.
1006	No text found in step n	OCR: No text was found in step #n.
1007	Text length is less than minimum specified in step n	OCR: The text found in step #n is shorter than the minimum setting.
1008	Text length exceeds the maximum specified in step n	OCR: The text found in step #n is longer than the maximum setting.
1009	Quality violates limit values in step n	OCR: The text found in step #n is below the quality threshold setting.
1010	Match failed in step n	OCR: The match performed in step #n was not successful.
1011	Reference text missing in step n	OCR: There is no string specification available for step #n.
4700	Verification failed in step n	The read code could not be verified.
4701	Verification for code type found in step n not supported	The selected verification method is not supported for the code type found in step #n.
4707	Mean light outside of range in step n: Maximum exposure time reached	The average brightness needed for ISO/IEC 29158 is outside the valid range (see Error code 4709). The specified maximum value for the exposure time was reached during automatic exposure control. To resolve this error: 1. Use brighter lighting or enlarge the aperture of the objective (lower aperture number). 2. Perform a new calibration.
4708	Mean light outside of range in step n: Cycle time limit of the automatic exposure control reached	The average brightness needed for ISO/IEC 29158 is outside the valid range (see Error code 4709). The automatic exposure control was unsuccessful because the necessary decodings could not be completed within the time limit. To resolve this error: • Reduce the exposure ROI of the program. • Increase the time limit of the exposure control. • Also ensure that the code is completely within the exposure ROI until conclusion of the image acquisition process.
4709	Mean light outside of range in step n	The average brightness needed for ISO/IEC 29158 is outside the valid range (70% to 86%) in step #n.
4710	Verification failed in step n: Data Matrix ECC200 required	Verification requires a data matrix code according to ECC200 specification (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4711	Verification failed in step n: Aperture too small	The cell size of the data matrix code in step #n is too large for the configured aperture (only for verification according to ISO/IEC 15415).
4712	Verification failed in step n: Aperture too large	The cell size of the data matrix code in step #n is too small for the configured aperture (only for verification according to ISO/IEC 15415).

Error code (%c)	Error message (%s)	Description
4713	Verification failed in step n: Not enough space around the Data Matrix	The quiet zone around the data matrix contained in the image is too small. For verification, a quiet zone of at least the size of two cells is required (only for verification according to ISO/IEC 15415 or 29158).
4714	Verification failed in step n: RDA could not find the horizontal timing pattern	The reference decoding according to ISO/IEC 16022:2006 signals an error when searching for the horizontal timing pattern (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4715	Verification failed in step n: RDA could not find the vertical timing pattern	The reference decoding according to ISO/IEC 16022:2006 signals an error when searching for the vertical timing pattern (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4716	Verification failed in step n: RDA found an incorrect number of rows and columns	The reference decoding according to ISO/IEC 16022:2006 signals an error when determining the number of rows or columns (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4717	Verification failed in step n: RDA could not locate the finder pattern	The reference decoding according to ISO/IEC 16022:2006 signals an error when searching for the finder pattern (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4719	Verification failed in step n: RDA error correction failed	The reference decoding according to ISO/IEC 16022:2006 signals an error when determining the error correction (only for verification according to ISO/IEC 15415 or ISO/IEC 29158).
4720	Verification failed in step n: Number of Data Matrix rows/columns is too high	The maximum supported code size for verification according to ISO/IEC 15415 or ISO/IEC 29158 is 104x104 cells.
4721	Verification failed in step n: Cell size is smaller than the specified Min.X Dim.	During verification, a cell size was measured that is less than the minimum X-dimension setting (only for verification according to ISO/IEC 29158).
4722	Verification failed in step n: Cell size is larger than the specified Max.X Dim.	During verification, a cell size was measured that is greater than the maximum X-dimension setting (only for verification according to ISO/IEC 29158).
5000	Not enough resources to process step n	Step #n could not be executed due to a lack of resources (memory).
5001	No objects found in step n	Locator: No objects were found in step #n.
5001	No objects found in step n	Locator: No objects were found in step #n.
5002	Too few objects found in step n	Locator: The number of objects found in step #n is lower than the set minimum.
5003	Too few objects found in step n: Required feature is missing	Locator: The number of objects found in step #n is lower than the set minimum. At least one object was rejected because of a missing required feature.
5004	Too few objects found in step n: Rotation range exceeded	Locator: The number of objects found in step #n is lower than the set minimum. At least one object was rejected because it did not comply with the rotation constraint.
5005	Too few objects found in step n: Scaling range exceeded	Locator: The number of objects found in step #n is lower than the set minimum. At least one object was rejected because it did not comply with the scale constraint.

Error code (%c)	Error message (%s)	Description
5006	Too few objects found in step n: Contours not adequate	Locator: The number of objects found in step #n is lower than the set minimum. At least one object was rejected because insufficient contours were found.
5008	Too few objects found in step n: Details not recognized	Locator: The number of objects found in step #n is lower than the set minimum. At least one object that was identified at the outline level was rejected at the detail level.
5009	Too few objects found in step n: Outline not recognized	Locator: The number of objects found in step #n is lower than the set minimum. No object was found at the outline level.
5010	Too few objects found in step n: Clear percentage violated	Locator: The number of objects found in step #n is lower than the set minimum. At least one object was rejected because it did not comply with the clear percentage constraint.
5011	Too many objects found in step n	Locator: The number of objects found in step #n is higher than the set maximum.
5012	Quality too poor in step n	Locator: The objects found in step #n are below the set quality threshold.
5013	Average Quality too poor in step n	Locator: The objects found in step #n are below the set average quality threshold.
5014	Match error tolerance exceeded in step n	Locator: The match performed in step #n was not successful because the number of match errors was higher than the maximum number permitted.
5015	Position tolerance exceeded for object m in step n	Locator: The position of object m in step #n is outside the maximum permitted deviation.
5016	Rotation tolerance exceeded for object m in step n	Locator: The rotation angle of object m in step #n is outside the maximum permitted deviation.
5017	Too few objects found in step n: Alignment failed	Locator: The number of objects found in step #n is smaller than the set minimum. At least one object was filtered out through the "Alignment".

10.1.5 Filter error messages

If a filter error occurs, the following error messages are output. You can find additional information in the section "Overall result" of the online help.

Table 10-4   Filter error messages

Error message (%s)	For filter mode only	Description
Symbol does not use GS1-encoding	GS1	The code read does not begin with the GS1 start symbol "]d2".
"[Number]" is no valid GS1 Application Identifier	GS1	The string selected in the "Filter ID" box contains an invalid application identifier tag.
GS1 Application Identifier "[Number]" not found in symbol content	GS1	An application identifier specified in the "Filter ID" box was not found in the read code.

Error message (%s)	For filter mode only	Description
Symbol content shorter than given "start position"	Position	The read code is shorter than the selected "Start position"
ID or separator not found in symbol content	ID	An ID (field: "Filter ID") or a separator character (field: "Separators") was not found in the read code.

10.1.6 Diagnostics via the LED display

The operating states of the optical reader are indicated by the LEDs "POWER" (PWR), "ERROR" (ER), "RUN/STOP" (R/S), "LINK" (LK), "CONNECT" and "READ". The LEDs can adopt the colors green, red or yellow and the states off ☐, on ▦, flashing ▦:

Table 10-5   Display of operating states

LED labeling	Meaning	Description and corrective measures
PWR	▦ Green flashing: • Signals the startup phase after switching on the optical reader. • Indicates an active firmware update that must not be interrupted.	Wait until this is completed and the optical reader is operational.
	▦ Green, permanently on: The optical reader is ready for operation	No error
ER	▦ Red, permanently on: The optical reader is in "Group error" mode Possible causes when working with PROFINET IO: • Bus communication is interrupted. • Bus error (no physical connection to a subnet / switch). • The write access via DCP protocol is deactivated and therefore no IP address can be assigned. • Wrong transmission speed, Full duplex transmission is not enabled. • The IP address is incorrect. • Bad configuration. • Bad parameter assignment. • Bad or missing device name. • I/O controller not available / switched off.	Start the WBM to view the error message. Perform the suggested corrective measures in the section "Error messages (Page 227)". • Check whether the IP address or device name occurs more than once in the network. • Check the settings of the I/O controller. • Reset the device (manually) to factory settings.
R/S	☐ Permanently off: The optical reader is in "Stop" mode.	No error
	▦ Green, permanently on: The optical reader is in "RUN" mode.	No error

LED labeling	Meaning	Description and corrective measures
LK	▫ Permanently off: There is no Ethernet connection to the optical reader.	• Check the connection to the Ethernet cable. • Check whether the connected switch or other communications partner is operational. • Check or replace the Ethernet cable.
	▪ Green, permanently on: An Ethernet connection without data traffic is available.	In order to start the WBM of the optical reader, you also need a valid network configuration for TCP/IP. Here, for example, you can use the SINEC PNI to create a valid network configuration for TCP/IP.
	▪ Green flashing: The optical reader is exchanging data.	No error
READ	▪ Green flashing: The read result is valid (OK).	No error The reading was successful and the read result is valid (OK).
	▪ Yellow, flashing: The read operation was terminated with a MATCH error.	The reading was successful, but the result comparison showed a deviation from the default (MATCH error).
	▪ Red, flashing: The read result is invalid (N_OK).	The reading was unsuccessful or the read result is not valid (N_OK). Possible causes: • The expected codes were not in the image. • The processing time was not sufficient. • A test condition could not be fulfilled.

10.1.7 Diagnostics during the "READ" function

The following table shows possible errors displayed by the "READ" LED during execution of the "READ" function.

Table 10-6   Display of operating states

LED labeling	Meaning	Description and corrective measures
READ	⬚ Green flashing: The "READ" function is bring executed.	The "READ" function is currently running and the reader is going through the steps of automatic adaptation.
	⬚ Red, flashing (frequency 0.5 s): The "READ" function setting was not successful.	The "READ" function was not successful. The error is displayed for 5 s, the "READ" function is then terminated. Possible cause: • The lighting conditions are not sufficient for an automatic adjustment. • (b) The object to be read does not have sufficient contrast to adjust the focus (EF lens). • (c) The code to be read is not fully in the image. • (d) The code to be read is neither of the "DMC" type nor a 1D barcode and the "Fast code type detection" parameter is enabled. • (e) The source program has unsuitable settings for the code to be read - e.g. the number of "Reading code" program steps, their ROI or the number of codes to be read. Solutions: • (a) Make sure you have suitable lighting. • (a) Use a built-in ring light with polarization filter to reduce reflections. • (b) Make sure that there is an object with sufficient contrast in the field of view of the reader, that the object is sufficiently far away from the reader (at least 30 - 60 cm depending on the lens) and that the object is sufficiently illuminated. • (c) Ensure that the code is located completely in the reader's ROI. • (d) Disable the parameter "Fast code type detection". • (e) Change the source program or select another source program in the options.
	⬚ Red, flashing (frequency 1 s): The function was canceled.	The function is not allowed/possible and has been canceled. The error is displayed for 5 s, the "READ" function is then terminated. Possible causes: • The function is not allowed. • The WBM is open. • The reader is in processing mode. • The settings under "Options > Extras > Operation on device" are incorrect. • A controller has control of the reader (DISA bit is set). • The WBM is open.

10.1.8 IO device diagnostics

Errors, for example, "Error - transfer error PROFINET IO connection error", trigger I/O device diagnostics. The diagnostic information is read out using STEP 7 depending on the I/O controller.

How to read out I/O device diagnostic information and how it is structured is described briefly below. You can find a detailed description in the programming manual "PROFINET IO – From PROFIBUS DP to PROFINET IO".

10.1.8.1 Reading out the diagnostics information with STEP 7

If, for example, the error "Error - transfer error PROFINET IO connection error" occurs on the optical reader and you are using an S7 controller as the I/O controller, the diagnostic interrupt OB (OB82) is started on the I/O controller.

The local variables "OB_82_EV_CLASS", "OB_82_MDL_DEFECT" and "OB82_EXT_FAULT" of the OB have the following values:

Table 10-7   Tags of the diagnostic interrupt OB (OB 82) in the event of an error

Variable	Value	Meaning
OB_82_EV_CLASS	B#16#39	Event entering state
OB_82_MDL_DEFECT	TRUE	Module problem
OB_82_EXT_FAULT	TRUE	External problem

Unfortunately, you cannot identify the actual cause of the problem in the local variables of OB82. You can determine this with PROFINET IO by calling SFB 54 "RALRM" in OB 82. The entry "Faulty module" appears in the diagnostic buffer and the corresponding text from the GSD file, for example, "Error - transfer error PROFINET IO" appears in the module information of the optical reader.

When the error has been corrected and you have acknowledged this in the WBM of the optical reader, the diagnostics interrupt OB (OB 82) is restarted on the I/O controller.

The local variables "OB_82_EV_CLASS", "OB_82_MDL_DEFECT" and "OB82_EXT_FAULT" of the OB have the following values:

Table 10-8   Tags of the diagnostic interrupt OB (OB 82) after error correction

Variable	Value	Meaning
OB_82_EV_CLASS	B#16#38	Event exiting state
OB_82_MDL_DEFECT	FALSE	No module problem
OB_82_EXT_FAULT	FALSE	No external error

The entry "Module OK" now appears in the diagnostics buffer. The text from the GSD file relating to the previous error no longer appears in the module information of the optical reader.

10.1.8.2 Diagnostics with PROFINET IO

SFB 54 "RALRM" returns the following diagnostics information with PROFINET IO in the "TINFO" parameter (task information):

Table 10-9 Diagnostic information of SFB 54 "RALRM"

Byte	Value	Meaning
0 … 19	See OB description	Start information of the OB in which SFB 54 was called.
20 … 21	Depending on the configuration	Address: • Bit 0 … 10: Station number (according to configuration) • Bit 11 … 14: I/O system ID (according to configuration) • Bit 15: 1
22	B#16#08	• Bit 0 … 3: Slave type: 1000 = PNIO • Bit 4 … 7: Profile type: 0000
23	B#16#00	• Bit 0 … 3: Alarm info type: 0000 • Bit 4 … 7: Structure version: 0000
24	B#16#00 / B#16#01	Flags of the PNIO controller interface module: • Bit 0 = 0: Alarm from an integrated interface module • Bit 0 = 1: Alarm from an external interface module • Bits 1 … 7: all 0
25	B#16#01 / B#16#00	Flags of the PNIO controller interface module: • Bit 0 = 1 with incoming alarm • Bit 0 = 0 with outgoing alarm • Bits 1 … 7: all 0
26 … 27	W#16#8111	PNIO device ident number (fixed).
28 … 29	W#16#002A	Vendor ID (fixed).
30 … 31	W#16#0001	Identification number of the instance.

SFB 54 "RALRM" returns the following diagnostics information with PROFINET IO in the "AINFO" parameter (additional alarm information):

Note

Only the bytes 0 to 25 are written for outgoing alarms

Only bytes 0 to 25 of the "AINFO" parameter are written for outgoing alarms. Compare the meaning of bytes 2 and 3 of "AINFO".

Table 10-10 Diagnostic information of SFB 54 "RALRM" - "AINFO" parameter

Byte	Value	Meaning
0 … 1	According to PNIO standard	Block type
2 … 3	W#16#001A / W#16#0016	Length of the diagnostics data with an incoming / outgoing alarm.
4 … 5	W#16#0100	Version (fixed)

Byte	Value	Meaning
6 ... 7	W#16#0001 / W#16#000C	ID for the alarm type: Diagnostics alarm incoming / diagnostics alarm outgoing.
8 ... 11	DW#16#00000000	API (fixed)
12 ... 13	W#16#0000	Slot (fixed)
14 ... 15	W#16#0001	Subslot (fixed)
16 ... 19	DW#16#00000300	Module identification (fixed)
20 ... 23	DW#16#00000000	Submodule identification (fixed)
24 ... 25	W#16#Bxxx / W#16#xxx	Alarm specification for incoming / outgoing alarm: • Bits 0 to 10: Sequence number • Bit 11: Channel diagnostics: 0 (fixed) • Bit 12: Status of vendor-specific diagnostics • Bit 13: Status of diagnostics for submodule • Bit 14: Reserved: 0 • Bit 15: Diagnostics status
26 ... 27	W#16#0004	ID for vendor-specific diagnostics (fixed).
28 ... 29	See value with the section "Error messages (Page 227)"	ID of the error that occurred.

In addition to the event-related readout of the diagnostic data with the SFB 54, you also have the option of reading out status-related diagnostics data.

You read out status-related diagnostics data using SFB 52 "RDREC".

Proceed as follows to call the SFB 52:

1. Assign the diagnostic address of the optical reader in hexadecimal form to the "ID" parameter.

2. Assign the value 2 to the "INDEX" parameter.

Table 10-11   Diagnostic information of SFB 52 "RDREC"

Byte	Value	Meaning
0 ... 1	W#16#0010	Data record type: Diagnostics data record
2 ... 3	W#16#0012	Data record length starting at byte 4: 18 bytes
4 ... 5	W#16#0100	Version
6 ... 7	W#16#0000	Slot
8 ... 9	W#16#0000	Subslot
10 ... 11	W#16#0000	Channel
12	B#16#08 / B#16#10	Error occurred / no error occurred
13	B#16#05	Identifier indicating that all variables are stored in words starting at byte 14.
14 ... 15	W#16#0004	ID for vendor-specific diagnostics (fixed)
16 ... 17	W#16#0000	Channel number
18 ... 19	W#16#0805 / W#16#1005	Content identical to that of bytes 12 and 13.
20 ... 21	See value with the section "Error messages (Page 227)"	ID of the error that occurred.

10.1.9   Error messages from automatic data backup

If you have activated Automatic data backup ("Options > Extras") and a data backup situation occurs, errors may occur that prevent you from creating a backup. These errors are displayed in the "Important Information" window when the WBM is opened and logged in the diagnostic data records.

Table 10-12   Error messages from automatic data backup

Error message	Description
No microSD card available	For automatic data backup, a MicroSD card must be inserted in the reader. Solution: Ensure that the MicroSD adapter is correctly installed and that a MicroSD card is inserted.
The microSD card has the wrong format	The inserted MicroSD card does not have the required format. Only MicroSD cards with the "FAT32" file system are supported. Solution: Ensure that the MicroSD card is correctly formatted.
Unable to free sufficient space on the microSD card	There is not enough space available on the MicroSD card and the deletion of old data backups could not free up enough space. Solution: • Use a MicroSD card with a larger memory capacity. • Reduce the amount of memory to be kept free ("Options > Extras"). • Free up space on the MicroSD card by deleting unnecessary files.
Could not create backup file	No backup file could be created. Solution: • Ensure that the MicroSD card is not faulty or write-protected. • Use another MicroSD card.

10.2   Firmware update

With the help of SINEC PNI (as of V1.0, Service Pack 2), you can perform a firmware update on one or a centrally controlled firmware update on a large number of MV500 readers (as of FW 3.3.0) simultaneously.

Alternatively, you can perform firmware updates on individual MV500 readers via the WBM. Detailed information on this can be found in the WBM help of the reader.

Requirements

• The readers are connected to the PC/PG via Industrial Ethernet or PROFINET.

• The readers do not currently perform a self-test.

NOTICE

Prerequisite with user management enabled

If user management is switched on in the WBM of the readers, you must log on in SINEC PNI in the "Device logon data" menu with a user profile stored in the WBM. The logged-in user must have administrator rights and the "System" right in the WBM.

If you want perform a firmware update on multiple MV500 readers, then an identical user profile (user name, password, rights) must be stored on all relevant devices.

Procedure

Proceed as follows to perform firmware update using SINEC PNI:

1. Start SINEC PNI.

2. Click on the "Start network scan" button in the toolbar.
   Reaction: The network is scanned for connected devices and all recognized devices are displayed in the device list.

3. Select the desired readers in the device list.

4. Click the "Update firmware" entry in the "Device management" drop-down list in the toolbar.

5. Select the "IDENT" entry in the "Device family" drop-down list, as well as the path to the update file (*.sfw).

6. Click the "Update firmware" button.
   Reaction: The firmware is transferred to the relevant readers. After the firmware has been successfully transferred, the "Restart pending" status is displayed in the device list.

7. Select the relevant readers in the device list.

8. Click the "Restart device" entry in the "Device management" drop-down list in the toolbar.

Result: The selected readers perform a restart during which the firmware update is executed. This can take several minutes.

The updated firmware is active following the restart.

10.3 Factory settings

You can restore the configuration of the communication modules to the factory settings at any time. To reset to the factory settings, you have the following options available:

• Using WBM

• Manually via the reader button

Alternatively, using SINEC PNI, you can also restore only the settings of the Ethernet interface to the factory settings.

These alternative methods are described below.

10.3.1   Restoring the factory settings via WBM

Requirement

The reader is connected to the PC/PG via Industrial Ethernet.

Procedure

Proceed as follows to reset all settings to the factory settings:

1. Open the "Device > System" menu in the Web Based Management (WBM).

2.   In the "Version" group, click "Reset to factory settings".

Result: The reader is reset to factory settings and restarted after about 2 seconds.

Note that restoring to factory settings assigns the factory-set IP address to the reader. After restarting the reader, you may have to assign a new IP address or a new device name to the reader.

10.3.2   Restoring the factory settings manually

Requirements

*   The reader is switched off.

*   The reader is not connected to the PC/PG via Industrial Ethernet.

Procedure

Proceed as follows to reset all settings to the factory settings:

1. Connect the power supply cable to the combi port.

2. Within 5 seconds, press the "READ" and "CONNECT" buttons and hold both buttons down. Reaction: The "CONNECT" LED flashes green at short intervals and a short signal sound is made. All other LEDs initially behave as during a normal startup and are not relevant.

3. Wait until the "CONNECT" LED flashes red for three seconds and a continuous signal sound is made.

4. Release both buttons while the continuous signal sound is taking place.

Result: The reader is reset to factory settings and restarted after about 2 seconds.

You can also cancel the process if necessary by releasing the button before the continuous signal sound.

Note that restoring to factory settings assigns the factory-set IP address to the reader. After restarting the reader, you may have to assign a new IP address or a new device name to the reader.

10.3.3   Reset the Ethernet interface via SINEC PNI

Requirement

The reader is connected to the PC/PG via Industrial Ethernet or PROFINET.

Procedure

Proceed as follows to restore the Ethernet interface to the factory settings using SINEC PNI:

1. Start SINEC PNI.

2. Click on the "Start network scan" button in the toolbar.
   Reaction: The network is scanned for connected devices and all recognized devices are displayed in the device list.

3. Select the desired reader in the device list.

4. Click on the "Reset device" button on the toolbar.

Result: The Ethernet interface of the reader is reset to factory settings.

10.4   Maintenance and repair

Maintenance

The devices are maintenance-free. Cleaning is usually not necessary.

If the protective lens barrel becomes dirty, we recommend that you clean it professionally in order to achieve a consistent reading performance.

Repair

For repairs, send the optical reader to Siemens without its protective lens barrel, lighting unit, and other accessories. The current contact details are available via the Siemens Industry Online Support.

10.5 Module replacement

Before replacing a module

⚠ WARNING
Read the manual of the SIMATIC controller you using
Prior to installation, connecting up and commissioning, read the relevant sections in the manual of the SIMATIC controller you are using. When installing and connecting up, keep to the procedures described in the manual.

⚠ CAUTION
Installation/removal with the power off
Wire up the SIMATIC controller and the modules and readers to be connected only when the power is off. Make sure that the power supply is switched off when installing/uninstalling the devices as well as the built-in ring light, EF lens and micro SD adapter.

NOTICE
Backing up the configuration
Prior to replacing the module, make sure that you back up the configuration stored on the optical reader so that you can transfer this to the newly connected reader following module replacement. The backup (* .xml) is made using the WBM via the "System > Full device configuration" menu.
You can save the configuration on the PC or on an SD card.

Note

Compatibility and device replacement of SIMATIC MV440 and SIMATIC MV540

Note that the SIMATIC MV440 and SIMATIC MV540 devices are mutually compatible and can be exchanged in a PROFINET IO network without any problems.

Note

The topology of the plant must be correctly configured

To replace the device without a removable medium, the topology of the system must be correctly configured. Use the topology editor for this.

Backing up configuration

In the WBM, you can use the "System > Full device configuration" menu to backup, reload and transfer the configurations to other readers. You can find additional information about saving and loading the configuration to or from the PC/PG or the micro SD card in the online help of the WBM.

Procedure

Proceed as follows to exchange a reader (PROFINET connection):

1. Make sure that the reader is disconnected from the power supply.
   If you work via a SIMATIC controller, make sure that this is disconnected from the power supply.

2. Disconnect the cables from the reader.

3. Uninstall the optical reader.

4. Install the new reader.

5. Connect the reader to the PC or to the SIMATIC controller.

6. Connect the reader to the power supply using the connecting cable.
   Wait until the reader has started up and is ready for operation ("PWR" LED is green).

7. Wait until the new reader is automatically assigned the IP address of the replacement device.
   If necessary, assign a unique IP address and a unique device name to the reader.

8. Start the WBM.

9. Load the configuration onto the reader using the saved XML parameter file.

10. Wait until the parameters have been restored.

Result: Following the automatic restart, the reader is ready for operation.

Technical data

<div style="text-align: right; font-size: 2em; font-weight: bold;">11</div>

11.1   Technical specifications of SIMATIC MV500

Table 11-1   Technical specifications of the SIMATIC MV500 optical reader

	6GF3530-0xx10 **6GF3540-0xx10** **6GF3550-0xx10** **6GF3560-0xx10**
Product type designation	SIMATIC MV530 SIMATIC MV540 SIMATIC MV550 SIMATIC MV560
Suitability	
Suitability in use	1D codes: Int. 2/5, Code 128, Code 93, Code 39, Code 32, Codebar, EAN 13, EAN 8, UPC-A, UPC-E, GS1, Pharmacode, Postnet 2D codes: DMC, dot code, PDF417 (without: Truncated, Micro and Macro), QR (without: Micro and Macro), Aztec
Interfaces	
Combination interface	Power supply, DI/DQ, RS232 and CM (M12, 12-pin)
Ethernet interface	• 1x Power over Ethernet (M12, 4-pin) • MV550/MV560: 1x Ethernet interface (M12, 8-pin)
Number of digital inputs	1
Number of digital outputs	3
Design of digital inputs	1 fast trigger input
Design of digital outputs	1 high-speed strobe output for external lighting, 2 isolated outputs, short-circuit-proof, max. 100 mA,
Optical data	

	6GF3530-0xx10 6GF3540-0xx10 6GF3550-0xx10 6GF3560-0xx10
Design of image sensor/camera	• Device version S: CMOS 0.5 Megapixel; 800 × 600 • Device version H: CMOS 1.3 Megapixel; 1280 × 1024 • Device version U: CMOS 2.3 Megapixel; 1920 × 1200 • Device version X: CMOS 5.3 Megapixel; 2592 × 2048
Type of image capture	Global shutter with manual or automatic exposure time
Operating distance	
Mini-lenses [1]	• 6 mm: ≥ 20 cm • 8.5 mm: ≥ 20 cm • 12 mm: ≥ 25 cm • 16 mm: ≥ 25 cm • 25 mm: ≥ 25 cm • 35 mm: ≥ 40 cm • 50 mm: ≥ 90 cm • 75 mm: ≥ 70 cm
EF lenses	• 12 mm: 9 - 38 cm • 16 mm: 12 - 51 cm • 25 mm: 20 - 83 cm • 35 mm: 29 - 112 cm • 50 mm: 43 - 165 cm
FF lenses	• 12.5 mm: ≥ 30 cm • 16 mm: ≥ 10 cm • 25 mm: ≥ 15 cm
MV530 lens	30 … 250 mm
Mounting type of lens	C-mount lens connection
Type of light source	Built-in ring lights or external ring lights
Image acquisition frequency (max.)	• Device version S: 100 Hz • Device version H: 70 Hz • Device version U: 60 Hz • Device version X: 30 Hz
Code reading speed (max.)	• Device version S: 80 1/s • Device version H: 70 1/s • Device version U: 60 1/s • Device version X: 30 1/s

	6GF3530-0xx10 6GF3540-0xx10 6GF3550-0xx10 6GF3560-0xx10
Type of focusing	• Mini-lens: Manual adjustment on the lens • EF lens: Automatic setting via WBM • FF lenses: Fixed focus • MV530 lens: Manual adjustment on the lens [2]

Supply voltage, current consumption, power loss

Supply voltage	24 V DC (19.2 to 28.8 V DC)
Current consumption (at 24 V DC)	
• Typical	• 0.2 A • 0.4 A with built-in ring light (continuous light)
• Maximum	• 0.6 A • 0.8 A with built-in ring light (continuous light)

Mechanical specifications

Housing	
• Material	• Die-cast aluminum (silicone-free)
• Color	• TI-Grey

Permitted ambient conditions

Ambient temperature	
• During operation	• 0 ... +50 °C
• During transportation and storage	• -30 ... +70 °C
Relative humidity (max.)	95%
Degree of protection	IP67 (according to IEC 60529) [3]
Shock resistance	IEC 60068-2
Shock acceleration	300 m/s²
Vibration acceleration	40 m/s²

Design, dimensions and weight

Dimensions (W × H × D)	
• MV540, MV550, MV560	• 68 × 124 × 46.4 mm
• MV530	• 68 × 124 × 72 mm
Weight	0.55 kg
Type of mounting	4 x M4 screws
LED display design	7 LEDs

Standards, specifications, approvals

	6GF3530-0xx10 6GF3540-0xx10 6GF3550-0xx10 6GF3560-0xx10
Approvals	CE
MTBF	• MV530: 31 years • MV540: 31 years • MV550/MV560: 30 years

[1] Using C-mount lenses and lens accessories, the range can be exactly matched to the application.

[2] Note that the MV530 lenses are preset and should not be changed.

[3] Not tested by UL. The device was tested by UL only for indoor use.

11.2 Technical specifications of the EF lens

Table 11-2 Technical specifications of the mini EF lenses

	6GF3540-8EAxx-0LL0
Product type designation	EF lens
Permitted ambient conditions	
Ambient temperature	
• During operation	• 0 ... +50 °C
• During transportation and storage	• -20 ... +70 °C
Relative humidity (max.)	95%
Design, dimensions and weight	
Dimensions (Ø × H)	• 8EA01: 27.4 × 31 mm • 8EA02: 27.4 × 41.7 mm • 8EA03: 27.4 × 28.1 mm • 8EA04: 30 × 39.7 mm • 8EA05: 32.5 × 55 mm
Weight	• 8EA01: 36 g • 8EA02: 40 g • 8EA03: 34 g • 8EA04: 60 g • 8EA05: 95 g
Standards, specifications, approvals	
MTBF	735 years

11.3   Technical specifications built-in ring light

Table 11-3   Technical specifications of the built-in ring lights for SIMATIC MV500

	6GF3540-8DAxx
Product type designation	Built-in ring light for SIMATIC MV500
Optical data	
Lighting distance (max.)	• 8DA11: 0.8 m • 8DA12: 3.0 m • 8DA13: 1.5 m • 8DA33: 1.5 m • 8DA41: 0.8 m • 8DA42: 3.0 m
Light color / wavelength (relative luminosity 0.2 ... 1.0)	• 8DA11: Red / 625 nm • 8DA12: Red / 625 nm • 8DA13: Red / 625 nm • 8DA33: White / 6500 K • 8DA41: IR / 850 nm • 8DA42: IR / 850 nm
Flash mode	
• Duty cycle	• 8%
• Max. exposure time	• 10 ms
Permitted ambient conditions	
Ambient temperature	
• During operation	• 0 ... +50 °C
• During transportation and storage	• -20 ... +70 °C
Relative humidity (max.)	95%
Design, dimensions and weight	
Dimensions (Ø × H)	54 × 54 mm
Weight	Approx. 40 g
Standards, specifications, approvals	
MTBF	• 8DA11: 283 years • 8DA12: 150 years • 8DA13: 150 years • 8DA33: 151 years • 8DA41: 289 years • 8DA42: 155 years

11.4 Technical specifications of ring light (external)

Table 11-4   Technical specifications of the external ring lights for SIMATIC MV500

	6GF3400-0LT01-8DA1 6GF3400-0LT01-7BA1
Product type designation	External ring light MV400/MV500
Optical data	
Lighting distance (max.)	3.0 m
Light color / wavelength (relative luminosity 0.2 … 1.0)	• 8DA1: Red / 625 nm • 7BA1: Infrared / 850 nm
Flash mode	
• Duty cycle	• 40%
• Max. exposure time	• 10 ms
Supply voltage, current consumption, power loss	
Supply voltage	24 V DC (18 to 30 V DC)
Current consumption (at 24 V DC)	• 8DA1 (Red): 0.6 A • 7BA1 (Infrared): 1.0 A
Permitted ambient conditions	
Ambient temperature	
• During operation	• 0 … +50 °C
• During transportation and storage	• -30 … +80 °C
Relative humidity (max.)	95%
Degree of protection	IP67
Design, dimensions and weight	
Dimensions (Ø × H)	142 × 42.5 mm
Weight	450 g

11.5 Technical specifications of the floodlight (external)

Table 11-5   Technical specifications of the external floodlights for SIMATIC MV500

	6GF3500-8DF30-xDA0
Product type designation	Floodlight MV500
Optical data	
Lighting distance and irradiance	

	6GF3500-8DF30-xDA0
• 1DA0	0.0 m - 214.8 W/m²
	0.1 m - 108.9 W/m²
	0.2 m - 49.0 W/m²
	0.5 m - 10.2 W/m²
• 2DA0	0.0 m - 312.9 W/m²
	0.1 m - 164.6 W/m²
	0.2 m - 83.7 W/m²
	0.5 m - 19.4 W/m²
• 3DA0	0.0 m - 233.1 W/m²
	0.1 m - 147.1 W/m²
	0.2 m - 93.8 W/m²
	0.5 m - 27.4 W/m²
Light color / wavelength (relative luminosity 0.2 ... 1.0)	White / 6000 K
Operating mode	Permanent and switching operation
Irradiance	• 1DA0: 49 W/m² @ 0.2 m
	• 2DA0: 84 W/m² @ 0.2 m
	• 1DA0: 94 W/m² @ 0.2 m

Supply voltage, current consumption, power loss

Supply voltage	24 V DC (19 to 30 V DC)
Current consumption (at 24 V DC)	• 1DA0: 1.5 A
	• 2DA0: 2.7 A
	• 3DA0: 3.9 A
Max. electrical power at the light source	• 1DA0: 30 W
	• 2DA0: 57 W
	• 3DA0: 81 W

Permitted ambient conditions

Ambient temperature	
• During operation	• 5 ... 45 °C
• During transportation and storage	• 5 ... 45 °C
Max. operating temperature (at 21 °C)	• 1DA0: 48 °C
	• 2DA0: 54 °C
	• 3DA0: 51 °C
Relative humidity (max.)	95%
Degree of protection	IP64

Design, dimensions and weight

	6GF3500-8DF30-xDA0
Dimensions (L × W × H)	• 1DA0: 240 × 220 × 22 mm • 2DA0: 320 × 240 × 22 mm • 3DA0: 420 × 340 × 22 mm
Weight	• 1DA0: 1570 g • 2DA0: 2200 g • 3DA0: 3900 g
Material	
• Housing	• Anodized aluminum
• Washer	• PMMA

Dimension drawings

All dimensions in mm.

12.1 SIMATIC MV500 optical readers
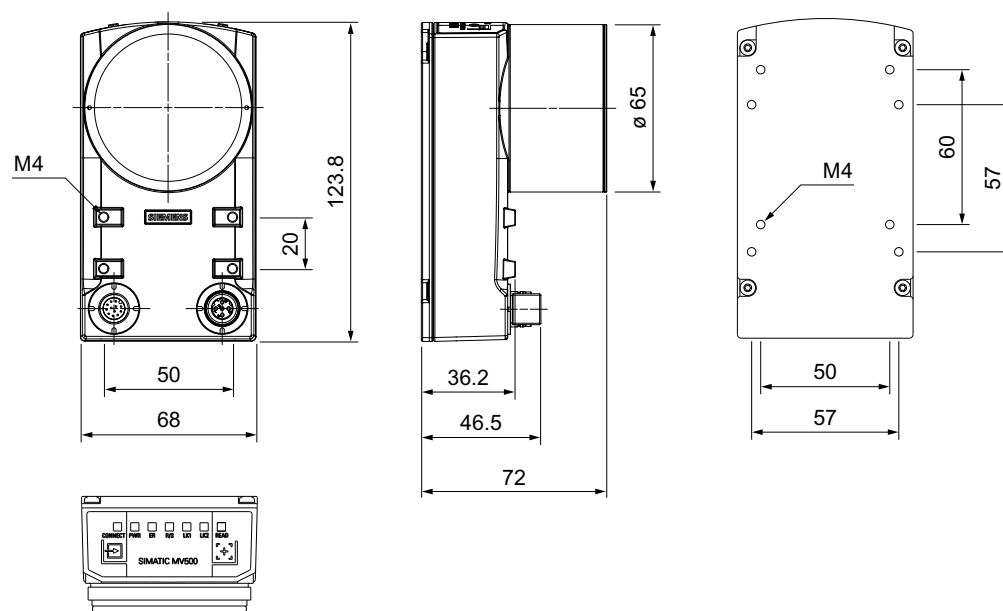
Figure 12-1   SIMATIC MV530 optical reader
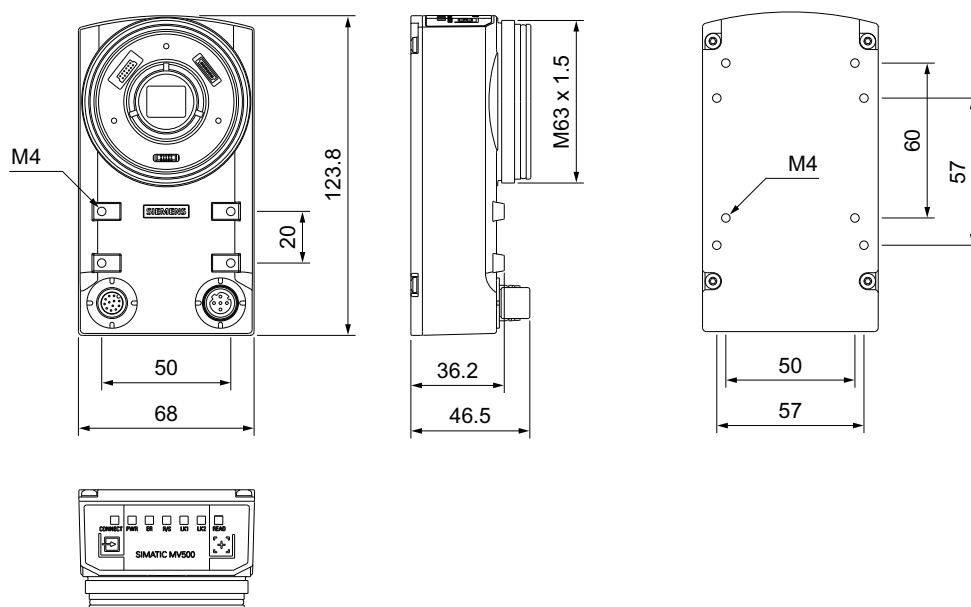
Figure 12-2   SIMATIC MV540 optical reader
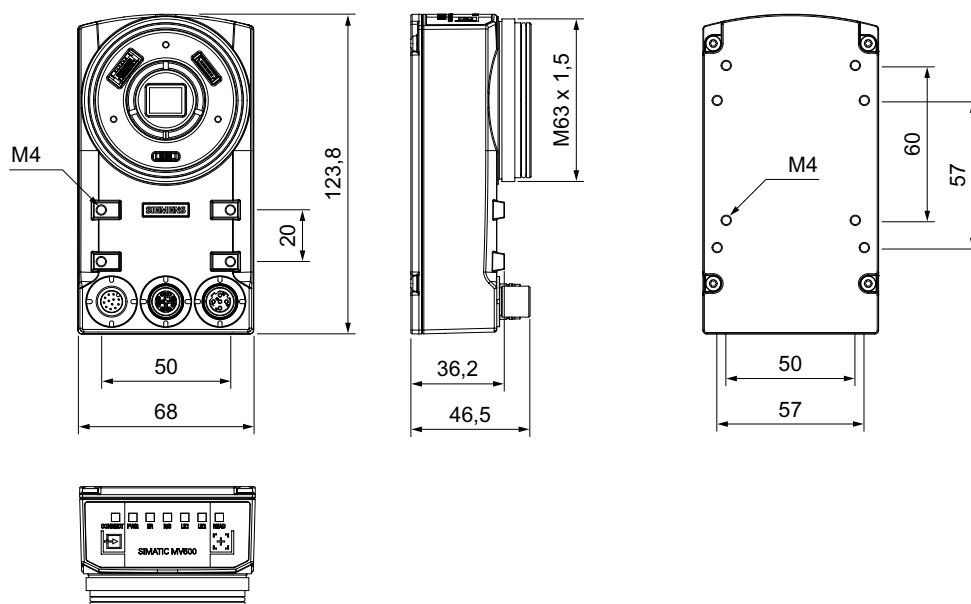
Figure 12-3   SIMATIC MV550 / MV560 optical reader

12.2 Protective lens barrels for MV500
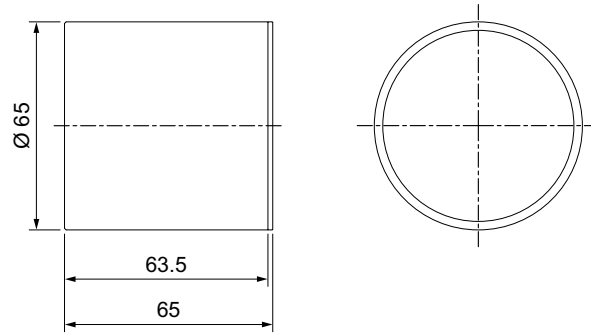
Figure 12-4   Protective lens barrel for SIMATIC MV500
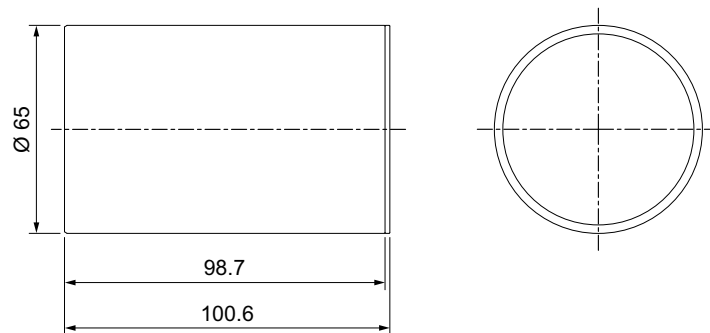
Figure 12-5   Protective lens barrel long for SIMATIC MV500

12.3 Protective lens barrel extension for MV500
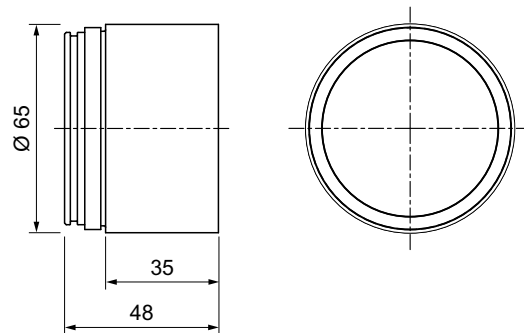
Figure 12-6   Protective lens barrel extension (35 mm)

Figure 12-7   Protective lens barrel extension (15 mm)

12.4   Mounting plate for MV500
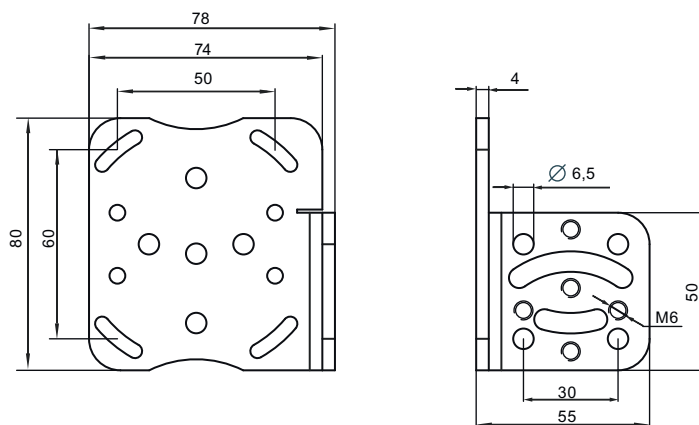
Figure 12-8   Mounting plate for SIMATIC MV500

12.5 Mounting bracket for MV500 and floodlights
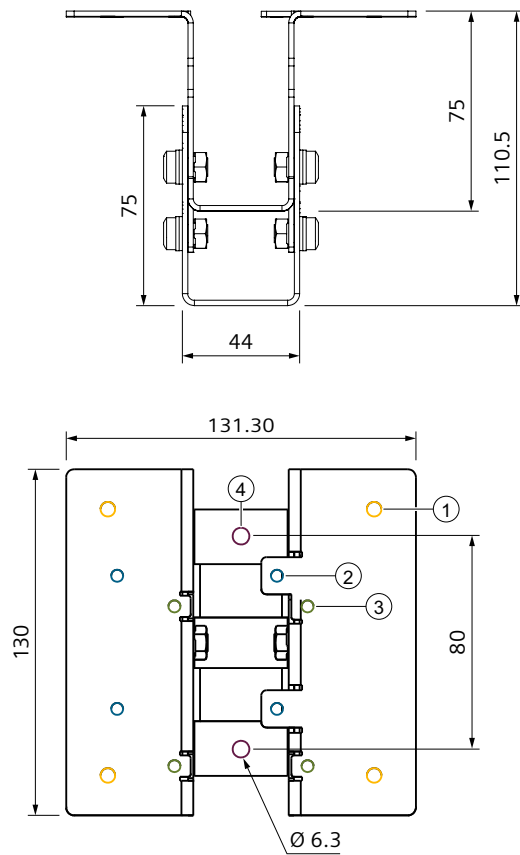
① Yellow Mounting holes for floodlights (100 x 100 mm)
② Blue Mounting holes for MV500 (Option 1: 60 x 50 mm)
③ Green Mounting holes for MV500 (Option 2: 50 x 60 mm)
④ Red Mounting holes for mounting the bracket (e.g. on a mounting rail)

Figure 12-9 Mounting bracket for SIMATIC MV500 and floodlights

12.6   SIMATIC MV500 with external ring light
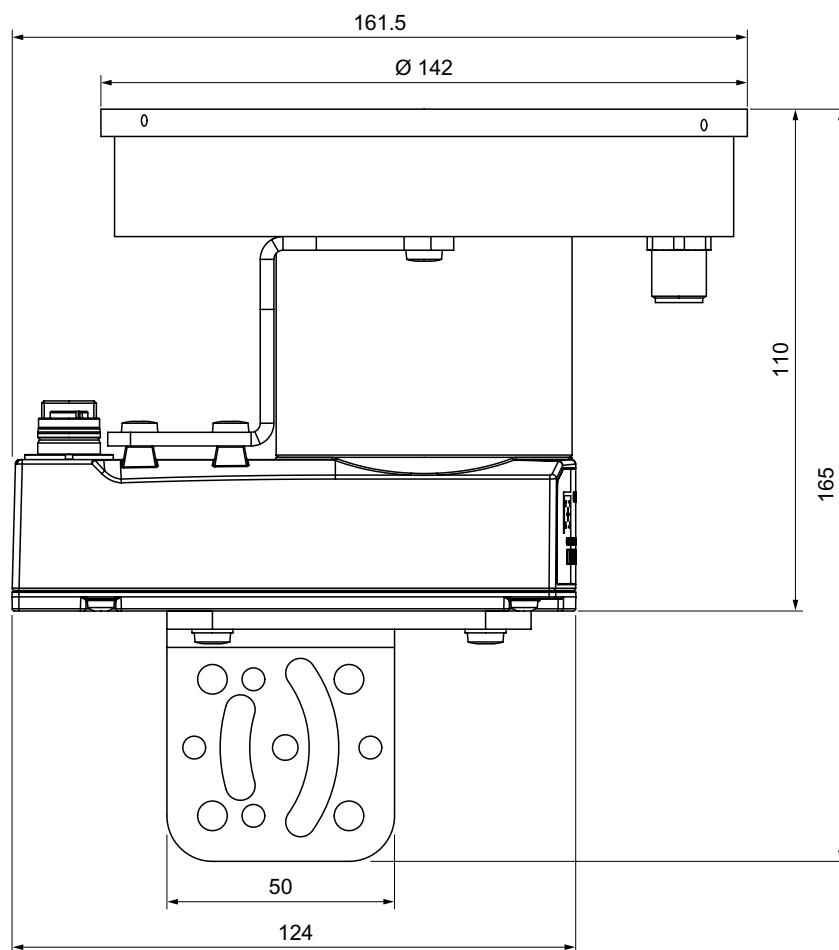
Figure 12-10   SIMATIC MV500 optical reader with external ring light and mounting plate

12.7 Ring light (external)
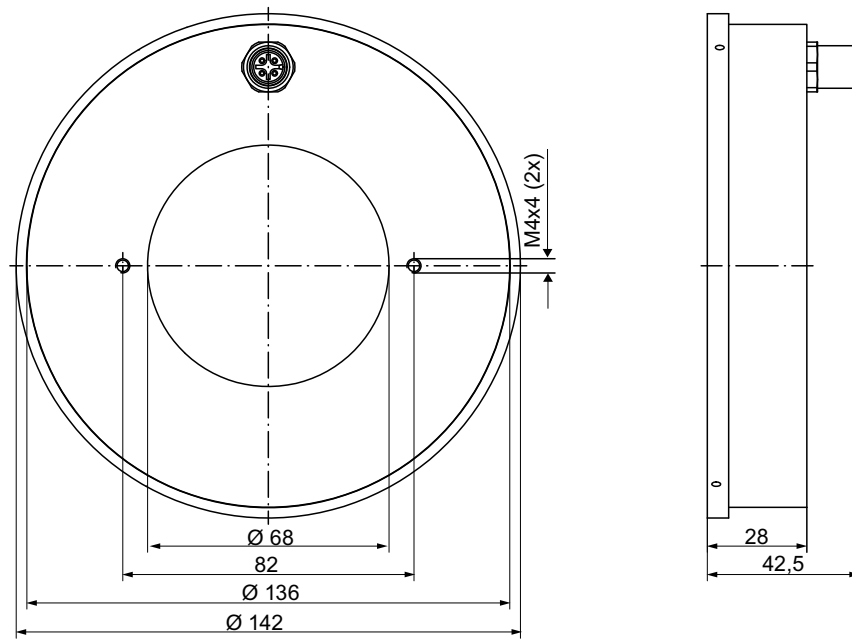
Figure 12-11   Ring light (external)

12.8 Ring light holder for external ring light
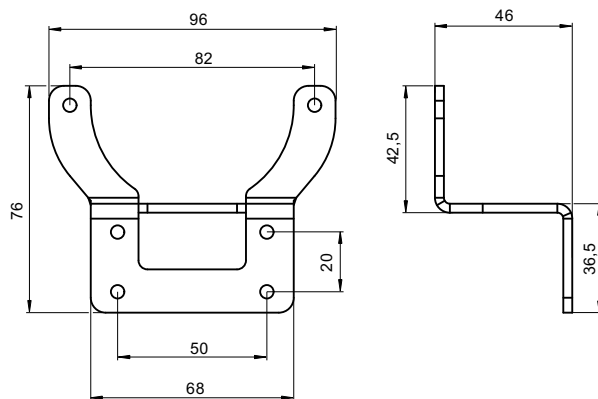
Figure 12-12   Ring light holder for external ring light

Scope of delivery and ordering data

13

13.1 Ordering data

In this section, you can find an overview of the complete product range of the SIMATIC MV500 optical reader including the order data. This includes the readers and any accessories.

The optical readers can be ordered with various performance characteristics, for example with standard resolution or high resolution. You can equip the readers with accessories, depending on your needs and application.

Product range of the SIMATIC MV500 optical reader

The product range of the MV500 includes the following product categories:

- Optical readers
- Licenses
- Optical accessories
  - Lenses
  - Filters
- Ring lights
  - Built-in ring lights
  - External ring lights
  - Support for external ring lights
- Protective lens barrels and protective lens barrel extensions
- PoE switches for power supply
- Cables
  - Freely configurable cables for Ethernet/PROFINET
  - Cable for connection via communication modules
- Holders & cards for mounting/calibration

You can also find an overview of the product range and the order data:

- In catalog "ID 10"
- On the Internet at "SIMATIC Ident home page (https://siemens.com/ident)" or at "Industry Mall homepage (https://mall.industry.siemens.com)".

Selecting the components

It is important to select the appropriate components to suit the ambient conditions in which your optical reader is operated and the associated requirements of your reading environment. You can find more detailed information on this in section "Selection of suitable components (Page 281)".

Product compatibility from MV440 to MV540

Note that the range of accessories for SIMATIC MV440 products is partially compatible with the SIMATIC MV500 optical readers. The following MV440 components can be used with MV500:

- Mini-lens (without electronic focus)

- Built-in ring lights (without simultaneous use of micro SD card and EF lens)
  In this case, it is recommended to use an MV440 protective lens barrel.

Accessories for MV530

Note that the MV530 readers are delivered with a premounted and preset lens, as well as ring light and lens barrel. The reader has been designed for use with these components and exchanging these components for other accessory parts is not intended.

13.2 Optical readers and licenses

Note

Scope of delivery of the optical readers

The optical readers come with an adapter for the micro SD card.

The scope of delivery of the optical readers does not include protective lens barrel, lens, lighting, micro SD card and connecting cable.

Table 13-1   SIMATIC MV500 optical readers

Optical reader	Description	Article number
SIMATIC MV530 S	- Incl. lens, ring light and lens barrel - 1x Ethernet interface (POE; 10/100 Mbps) - Resolution: 800 x 600 pixels	6GF3530-0CD10
SIMATIC MV530 H	- Incl. lens, ring light and lens barrel - 1x Ethernet interface (POE; 10/100 Mbps) - Resolution: 1280 x 1024 pixels	6GF3530-0GE10
SIMATIC MV540 S	- 1x Ethernet interface (POE; 10/100 Mbps) - Resolution: 800 x 600 pixels	6GF3540-0CD10
SIMATIC MV540 H	- 1x Ethernet interface (POE; 10/100 Mbps) - Resolution: 1280 x 1024 pixels	6GF3540-0GE10

Optical reader	Description	Article number
SIMATIC MV550 S	• 1x Ethernet interface (POE; 10/100 Mbps) • 1x Ethernet interface (10/100/1000 Mbps) • Resolution: 800 x 600 pixels	6GF3550-0CD10
SIMATIC MV550 H	• 1x Ethernet interface (POE; 10/100 Mbps) • 1x Ethernet interface (10/100/1000 Mbps) • Resolution: 1280 x 1024 pixels	6GF3550-0GE10
SIMATIC MV560 U	• 1x Ethernet interface (POE; 10/100 Mbps) • 1x Ethernet interface (10/100/1000 Mbps) • Resolution: 1920 x 1200 pixels	6GF3560-0LE10
SIMATIC MV560 X	• 1x Ethernet interface (POE; 10/100 Mbps) • 1x Ethernet interface (10/100/1000 Mbps) • Resolution: 2592 x 2048 pixels	6GF3560-0HE10

Table 13-2   Licenses for SIMATIC MV500

Licenses	Description	Article number
Veri-Genius license	Verification license Single license (on USB flash drive) and calibration card	6GF3400-0SL02
PAT-Genius license	Object recognition license Suitable for MV500 as of firmware V2.0; Single license (on USB flash drive)	6GF3400-0SL03
Pat-Genius license (OSD version)	Object recognition license Suitable for MV500 as of firmware V2.0; Single license (via Online Software Delivery)	6GF3400-1SL03

13.3   Accessories

13.3.1   Lens

Note

Finding the suitable lens

You can find information on determining the suitable lens in the section "Selection of suitable components (Page 281)".

Table 13-3   Mini-lens for SIMATIC MV500

Lenses	Description	Article number
Mini-lens 6 mm, PENTAX C60636 (KP)	• Aperture: 1:1.4 • Focus (mechanically) adjustable • Dimensions (Ø × L): 32 × 37.5 mm	6GF9001-1BB01
Mini-lens 8.5 mm, PENTAX C815B (TH)	• Aperture: 1:1.5 • Focus (mechanically) adjustable • Dimensions (Ø × L): 42 × 47 mm	6GF9001-1BE01
Mini-lens 12 mm, PENTAX H1214-M (KP)	• Aperture: 1:1.4 • Focus (mechanically) adjustable • Dimensions (Ø × L): 29.5 × 35.7 mm	6GF9001-1BL01
Mini-lens 16 mm, PENTAX C1614-M (KP)	• Aperture: 1:1.4 • Focus (mechanically) adjustable • Dimensions (Ø × L): 29.5 × 37.2 mm	6GF9001-1BF01
Mini-lens 25 mm, PENTAX C2514-M (KP)	• Aperture: 1:1.4 • Focus (mechanically) adjustable • Dimensions (Ø × L): 29.5 × 38.9 mm	6GF9001-1BG01
Mini-lens 35 mm, PENTAX C3516-M (KP)	• Aperture: 1:1.6 • Focus (mechanically) adjustable • Dimensions (Ø × L): 29.5 × 41.4 mm	6GF9001-1BH01
Mini-lens 50 mm, PENTAX C5028-M (KP)	• Aperture: 1:2.8 • Focus (mechanically) adjustable • Dimensions (Ø × L): 29.5 × 38 mm	6GF9001-1BJ01
Mini-lens 75 mm, PENTAX C7528-M (KP)	• Aperture: 1:2.8 • Focus (mechanically) adjustable • Dimensions (Ø × L): 34 × 63.6 mm	6GF9001-1BK01

Table 13-4   EF lenses for SIMATIC MV500

Lenses	Description	Article number
EF lens 12 mm	• Aperture: 1:6.1 • Focus (electrically) adjustable • Dimensions (Ø × L): 27.4 × 31 mm	6GF3540-8EA01-0LL0
EF lens 16 mm	• Aperture: 1:5.7 • Focus (electrically) adjustable • Dimensions (Ø × L): 27.4 × 41.7 mm	6GF3540-8EA02-0LL0
EF lens 25 mm	• Aperture: 1:5.5 • Focus (electrically) adjustable • Dimensions (Ø × L): 27.4 × 28.1 mm	6GF3540-8EA03-0LL0

Lenses	Description	Article number
EF lens 35 mm	• Aperture: 1:4.8 • Focus (electrically) adjustable • Dimensions (Ø × L): 30 × 39.7 mm	6GF3540-8EA04-0LL0
EF lens 50 mm	• Aperture: 1:7.5 • Focus (electrically) adjustable • Dimensions (Ø × L): 32.5 × 55 mm	6GF3540-8EA05-0LL0

Table 13-5   FF lenses for SIMATIC MV560

Lenses	Description	Article number
FF lens 12.5 mm	• Aperture: 1:1.4 • Fixed focus • Dimensions (Ø × L): 43 × 52.8 mm	6GF3560-8EA01-0FF0
FF lens 16 mm	• Aperture: 1:1.8 • Fixed focus • Dimensions (Ø × L): 48 × 60.4 mm	6GF3560-8EA02-0FF0
FF lens 25 mm	• Aperture: 1:1.8 • Fixed focus • Dimensions (Ø × L): 37.5 × 45.3 mm	6GF3560-8EA03-0FF0

13.3.2   Built-in ring lights

Note

Achievement of IP67 protection

To achieve IP67 degree of protection, a protective lens barrel must be screwed on and all interfaces must be closed by cable connections or protective caps.

If no protective lens barrel is used or the interfaces are closed, the reader only achieves IP20 degree of protection.

Note

Compatibility of the built-in ring lights for SIMATIC MV440

Note that SIMATIC MV440 built-in ring lights are compatible with SIMATIC MV500 optical readers. However, using the MV440 built-in ring lights on MV500 does not support the micro SD card and E-focus function.

Table 13-6   Built-in ring lights for SIMATIC MV500

Built-in ring light	Description	Article number
Built-in ring light (red, basic) for SIMATIC MV500	• Light source: LED red (625 nm) • Lighting distance up to 0.8 m • Including anti-glare attachment	6GF3540-8DA11
Built-in ring light (red, far) for SIMATIC MV500	• Light source: LED red (625 nm) • Lighting distance up to 3.0 m • Including anti-glare attachment	6GF3540-8DA12
Built-in ring light (red, multi) for SIMATIC MV500	• Light source: LED red (625 nm) • Lighting distance up to 1.5 m • including attachment with polarization filter • Including anti-glare attachment	6GF3540-8DA13
Built-in ring light (white, multi) for SIMATIC MV500	• Light source: LED white (6500 K) • Lighting distance up to 1.5 m • including attachment with polarization filter • Including anti-glare attachment	6GF3540-8DA33
Built-in ring light (infrared, basic) for SIMATIC MV500	• Light source: LED infrared (850 nm) • Lighting distance up to 0.8 m • Including anti-glare attachment	6GF3540-8DA41
Built-in ring light (infrared, far) for SIMATIC MV500	• Light source: LED infrared (850 nm) • Lighting distance up to 3.0 m • Including anti-glare attachment	6GF3540-8DA42

13.3.3   External ring lights and floodlights

Note

Scope of delivery of the external ring lights

Ring light holders are not included in the scope of delivery.

Table 13-7   External ring lights and floodlights for SIMATIC MV500

External ring lights and floodlights	Description	Article number
Ring light, external (metal, infrared, clear)	• Power supply: 24 V (18 ... 30 V) • Light source: 850 nm • Lighting distance: 500 ... 3000 mm • Dimensions (Ø × L): 142 × 43 mm • Inner diameter: 68 mm • Degree of protection IP67	6GF3400-0LT01-7BA1
Ring light, external (metal, red, clear)	• Power supply: 24 V (18 ... 30 V) • Light source: 625 nm • Lighting distance: 500 ... 3000 mm • Dimensions (Ø × L): 142 × 43 mm • Inner diameter: 68 mm • Degree of protection IP67	6GF3400-0LT01-8DA1
Floodlight, external (20 x 20)	• Power supply: 24 V (19 ... 30 V) • Irradiance: 49 W/m² @ 0.2 m • Irradiance: 0.5 m - 10.2 W/m² • Dimensions (L × W × H) 240 × 220 × 22 mm • Degree of protection IP64 • Including connecting cable, 10 m	6GF3500-8DF30-1DA0
Floodlight, external (30 x 20)	• Power supply: 24 V (19 ... 30 V) • Irradiance: 84 W/m² @ 0.2 m • Irradiance: 0.5 m - 19.4 W/m² • Dimensions (L × W × H) 320 × 240 × 22 mm • Degree of protection IP64 • Including connecting cable, 10 m	6GF3500-8DF30-2DA0
Floodlight, external (40 x 30)	• Power supply: 24 V (19 ... 30 V) • Irradiance: 94 W/m² @ 0.2 m • Irradiance: 0.5 m - 27.4 W/m² • Dimensions (L × W × H) 420 × 340 × 22 mm • Degree of protection IP64 • Including connecting cable, 10 m	6GF3500-8DF30-3DA0

Table 13-8   Support for external ring lights/floodlights

Ring light holder	Description	Article number
Ring light holder for external ring light	• Dimensions (W × H × D): 96 × 76 × 46 mm • Screws are supplied.	6GF3440-8CD01
Mount for MV500 and floodlights	• Dimensions (W × H × D): 131.3 × 130 × 110.5 mm • Screws are supplied.	6GF3500-8CD

Table 13-9   Connecting cable for external ring lights

Cables	Description	Article number
Adapter cable for external ring lights M12, 12-pin	• Power supply via combination interface M12, 12-pin double-sided • Length: 25 cm	6GF3500-8BD10

13.3.4   Protective lens barrels

The following protective lens barrels are compatible with the lenses and ring lights mentioned in this manual. Please note that, when using some lenses, you need a protective lens barrel extension or a "protective lens barrel long" in addition.

Table 13-10   Protective lens barrel for built-in ring lights for SIMATIC MV500

Protective lens barrel	Description	Article number

Protective lens barrel (glass)
for SIMATIC MV500
	• Degree of protection: IP67
	• Front pane: Glass
	• Dimensions (Ø × L): 65 × 65 mm
	• Inner diameter: 60.4 mm
	• Max. lens length
	  with built-in ring light: 44.7 mm
	  without built-in ring light: 47.9 mm
	• Suitable for filters
	  M58 × 0.75; with IP67
	  M62 × 0.75; without IP67
		6GF3540-8AC11

Protective lens barrel (PMMA) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Front pane: PMMA	6GF3540-8AC21
Protective lens barrel (red) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Wave length of protective lens barrel: 615 - 645 nm	6GF3540-8AC51

Protective lens barrel	Description	Article number
Protective lens barrel (IR) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Wave length of protective lens barrel: 845 - 885 nm	6GF3540-8AC41
Protective lens barrel (IR, UV, cut) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Wave length of protective lens barrel: 390 - 690 nm	6GF3540-8AC31
Protective lens barrel (long)		
Protective lens barrel long (glass) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Dimensions (Ø × L): 65 × 100.6 mm	6GF3540-8AC12
Protective lens barrel long (PMMA) for SIMATIC MV500	Features same as protective lens barrel (PMMA) with the following differences: • Dimensions (Ø × L): 65 × 100.6 mm	6GF3540-8AC22
Protective lens barrel long (red) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Dimensions (Ø × L): 65 × 100.6 mm • Wave length of protective lens barrel: 615 - 645 nm	6GF3540-8AC52
Protective lens barrel long (IR) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Dimensions (Ø × L): 65 × 100.6 mm • Wave length of protective lens barrel: 845 - 885 nm	6GF3540-8AC42
Protective lens barrel long (IR, UV, cut) for SIMATIC MV500	Features same as protective lens barrel (glass) with the following differences: • Dimensions (Ø × L): 65 × 100.6 mm • Wave length of protective lens barrel: 390 - 690 nm	6GF3540-8AC32

Table 13-11   Protective lens barrel extension for built-in ring lights for SIMATIC MV500

Protective lens barrel extension	Note	Article number
Protective lens barrel extension (15 mm) for SIMATIC MV500	• Degree of protection: IP67 • Dimensions (Ø × L): 65 × 27.5 mm • Inner diameter: 57 mm • Effective protective lens barrel extension: 15 mm	6GF3540-8AC03
Protective lens barrel extension (35 mm) for SIMATIC MV500	• Degree of protection: IP67 • Dimensions (Ø × L): 65 × 48 mm • Inner diameter: 57 mm • Effective protective lens barrel extension: 35 mm	6GF3440-8AC13

13.3.5 PoE switches for power supply

The following PoE switches are suitable for powering the SIMATIC MV500 optical readers via the Ethernet cable.

Table 13-12   PoE switches

PoE switches	Article number
SCALANCE X108 POE	6GK5108-0PA00-2AA3
SCALANCE XP208 POE EEC	6GK5208-0UA00-5ES6
SCALANCE XP216 POE EEC	6GK5216-0UA00-5ES6
SCALANCE X308-2M POE	6GK5308-2QG10-2AA2
SCALANCE XR324-4M POE	6GK5324-4QG10-1AR2
	6GK5324-4QG10-1HR2
	6GK5324-4QG10-3AR2
	6GK5324-4QG10-3HR2
SCALANCE XR324-4M POE TS	6GK5324-4QG00-1CR2
	6GK5324-4QG10-1CR2

13.3.6 Cables and other accessories

Note

Ordering information

Either one or two cables are required, depending on the application. The cables are not part of a complete package and must always be ordered separately.

There is more than one version of each cable type. In this case, you simply need to order one version per optical reader.

Industrial Ethernet connecting cable

Table 13-13   Industrial Ethernet connecting cable

Cables	Description		Article number
For Ethernet interface "X1 LAN1"			
Industrial Ethernet connecting cable M12-90 / M12-90	• Pre-fabricated IE FC trailing cable GP 2 x 2 (PROFINET Type C) • M12 connector, 4-pin (D-coded) double-sided • Degree of protection IP65/IP67	0.3 m	6XV1870-8GE30
		0.5 m	6XV1870-8GE50
		1 m	6XV1870-8GH10
		1.5 m	6XV1870-8GH15
		2 m	6XV1870-8GH20
		3 m	6XV1870-8GH30
		5 m	6XV1870-8GH50
		10 m	6XV1870-8GN10
		15 m	6XV1870-8GN15
Industrial Ethernet connecting cable M12-180 / M12-180	• Pre-fabricated IE FC trailing cable GP 2 x 2 (PROFINET Type C) • M12 connector, 4-pin (D-coded) double-sided • Degree of protection IP65/IP67	0.3 m	6XV1870-8AE30
		0.5 m	6XV1870-8AE50
		1 m	6XV1870-8AH10
		1.5 m	6XV1870-8AH15
		2 m	6XV1870-8AH20
		3 m	6XV1870-8AH30
		5 m	6XV1870-8AH50
		10 m	6XV1870-8AN10
		15 m	6XV1870-8AN15
Industrial Ethernet connecting cable M12-180 / RJ45-180	• Pre-fabricated IE FC TP trailing cable GP 2 x 2 (PROFINET Type C) • M12 connector, 4-pin (D-coded) • IE FC RJ45 connector • Degree of protection IP65/IP67	2 m	6XV1871-5TH20
		3 m	6XV1871-5TH30
		5 m	6XV1871-5TH50
		10 m	6XV1871-5TN10
		15 m	6XV1871-5TN15
For Ethernet interface "X2 LAN2"			
Industrial Ethernet connecting cable M12-90 / M12-90	• Pre-fabricated flexible IE cable 4 x 2 • M12 connector, 8-pin (X-coded) double-sided • Degree of protection IP65/IP67	0.3 m	6XV1878-5GE30
		0.5 m	6XV1878-5GE50
		1 m	6XV1878-5GH10
		1.5 m	6XV1878-5GH15
		2 m	6XV1878-5GH20
		3 m	6XV1878-5GH30
		5 m	6XV1878-5GH50
		10 m	6XV1878-5GN10
		15 m	6XV1878-5GN15

The cables are supplied with M12 plugs fitted at both ends. When necessary, the cables can be shortened at the other end from the optical reader and adapted with the following connectors, for example, for an RJ45 infrastructure:

Table 13-14   Industrial Ethernet connector FC RJ45

Connector	Description		Article number
IE connector FC RJ45 connector 180° (2x2)	• RJ45 plug-in connector for Industrial Ethernet (10/100 Mbps) • With integrated insulation displacement contacts • 180° cable outlet • For network components and CPs/CPUs	1 unit	6GK1901-1BB10-2AA0
		10 units	6GK1901-1BB10-2AB0
		50 units	6GK1901-1BB10-2AE0
IE connector FC RJ45 connector 180° (4x2)	• RJ45 plug-in connector for Industrial Ethernet (10/100/1000/10000 Mbps) • With integrated insulation displacement contacts • 180° cable outlet • For network components and CPs/CPUs	1 unit	6GK1901-1BB12-2AA0
		10 units	6GK1901-1BB12-2AB0
		50 units	6GK1901-1BB12-2AE0

Note

Other plugs and cables

You can find other plugs and cables, also with special lengths and 90° or 180° cable outlet, on the pages of the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/26999294).

Adapter cable

Table 13-15   Communication module cable

Cables	Description		Article number
CM adapter cable for SIMATIC MV500	• For connecting communication modules • M12 connector, 12-pin to M12 connector, 8-pin	0.5 m	6GF3500-8BA11
		5 m	6GF3500-8BA12
Adapter cable for external lamp	• For connecting external lamps		6GF3500-8BD10

Power IO cable

Table 13-16   Power IO cable

Cables	Description		Article number
Power IO RS232 cable	• M12, prefabricated at one end, open at one end (12-wire)	10 m	6GF3500-8BA21
		30 m	6GF3500-8BA41
Power-IO-RS232 adapter for SIMATIC MV500	• For connection to the Power-IO RS232 cable of MV400 • M12 connector, 12-pin to M16 connector, 12-pin	50 cm	6GF3500-8BA20
Power IO cable (UL)	• M12, prefabricated at one end, open at one end (8-wire) • UL-certified • Trailing capability	10 m	6GF3500-8BA23
		30 m	6GF3500-8BA43

Protective caps

Table 13-17   Protective caps

Connector	Description	Article number
SCALANCE XP-200 M12 Dust cover	10 pieces, for closing unused interfaces Consisting of 8 x M12 dust cover with external thread and 2 x M12 dust cover with internal thread	6GK5108-0PA00-2AA3

Micro SD cards

Table 13-18   Micro SD cards

Card	Description		Article number
Micro SD adapter	Adapter for MicroSD cards		6GF3500-8HA01
Micro SD card	Suitable for use with increased requirements	1 GB	6GK6000-8HT01-0SA0
		4 GB	6GK6000-8HT01-0SA2

13.3.7 Mounting plates, brackets and calibration card

Table 13-19   Mounting plates and brackets for SIMATIC MV500

Mounting plates/brackets	Description	Article number
Mounting plate	• W × H × D: 80 × 80 × 60 mm • Material: Stainless steel • Thickness: 4 mm • Mounting: Metric thread, photo thread (1/4", 2 x center)	6GF3440-8CA
Support system, tri-plate	• W × H × D: 165 × 175 × 65 mm • Material: Stainless steel • Thickness: 4 mm • For mounting SIMATIC MV500 via mounting plate	6GF9002-7AD
Mounting bracket for MV500 and floodlights	• W × H × D: 131.3 × 130 × 110.5 mm • Material: Stainless steel • Thickness: 2 mm • For mounting SIMATIC MV500 or flood-lights	6GF3500-8CD

Table 13-20   Calibration card for SIMATIC MV500

Calibration card	Description	Article number
Calibration card [1]	For calibration and operation of the optical readers with verification function.	6GF3440-8CE

[1]   The calibration card is supplied with the SIMATIC MV500 Veri-Genius license.

Appendix

A

A.1 Selection of suitable components

It is important to select the appropriate components to suit the ambient conditions in which your optical reader is operated and the associated requirements of your reading environment. These usually comprise:

- Optical reader
- Lens
- Ring light
- Protective lens barrel
- Micro SD adapter
- Accessories (e.g. switch, communication module, connecting or Ethernet cable, etc.)

You can learn which components are right for your requirements using the SIMATIC Ident Configuration Guide. The guide is available at the following link:

SIMATIC Ident Configuration Guide (https://support.industry.siemens.com/cs/ww/en/view/67384964)

The tools support you with the following questions, among others:

- Which lens (focal length, aperture, focus, operating distances) is the best option for my ambient conditions/requirements?
- Which lenses can be used with which reader?
- Which protective lens barrel needs to be used for which lens?
- Which lenses can be used with the internal ring lights?

The readers can also be operated with third-party external lamps/ring lights. In this case, the ring light must be adjusted accordingly.

A.2 MV530: Operating distance and viewing field size

The MV530 readers are delivered with a premounted and preset lens (aperture: 1:12; Focus: mechanically adjustable; Focal length: 5.6), as well as ring light and lens barrel. These readers are designed for an operating distance of 30 to 250 mm and the lenses should not be changed later.

Note that the built-in ring light radiates in the green color spectrum. This means that blue codes and red codes on black background, for example, cannot be read.

Operating distances

The following table provides an overview of the operating distances of the MV530 depending on the code type used.

Table A-1   Operating distances of the MV530

Code type	Minimum distance	Maximum distance
DMC, 35 mil	30	250
DMC, 15 mil	30	130
DMC, 8 mil	30	60
Interleaved 2/8, 0.3 mm	30	130
Interleaved 2/8, 0.2 mm	30	90

1 mil = 0.0254 mm

Size of viewing field

The following diagrams provide an overview of the viewing field size of the MV530 optical readers depending on the operating distance (distance between the front edge of the protective lens barrel and object to be read).

Note

Values in the diagrams are subject to tolerances

Note that the specified values of the two diagrams are subject to tolerance.

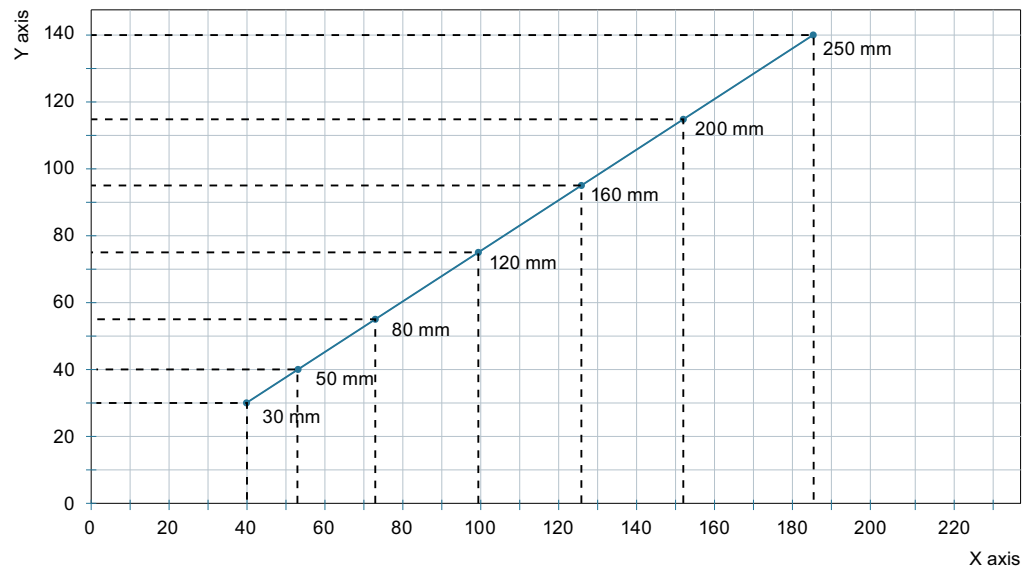| X axis	Width of the viewing field in [mm]
Y axis	Height of the viewing field in [mm]
Diagonal	Operating distance (distance between the front edge of the protective lens barrel and the object to be read) in [mm]

Figure A-1   Viewing field size depending on the operating distance with an MV530 S
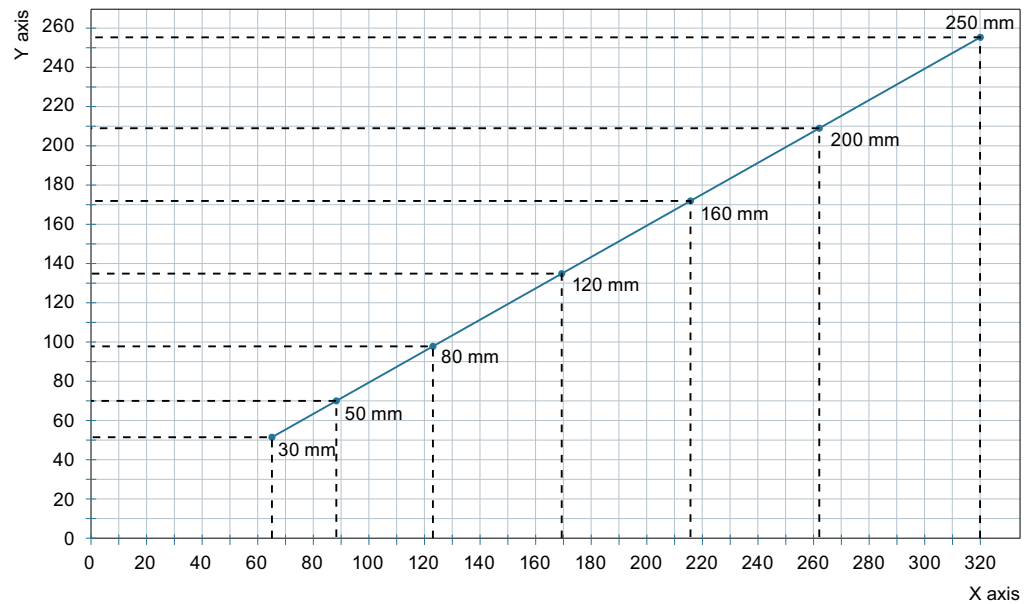

Figure A-2   Viewing field size depending on the operating distance with an MV530 H

A.3   Encryption methods (ciphers)

The following tables list the encryption methods (ciphers) that the device uses.

SSL

Table A-2 Supported encryption methods (cipher suites) for HTTPS WBM server

Category	Method	Value (hex)	Enabled by default
Cipher suite	TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	0xC02F	✓
Cipher suite	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	0xC027	✓
Cipher suite	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	0xC028	✓
Cipher suite	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	0xC030	✓
Cipher suite	TLS_AES_256_GCM_SHA384	0x1302	✓
Cipher suite	TLS_CHACHA20_POLY1305_SHA256	0x1303	✓
Cipher suite	TLS_AES_128_GCM_SHA256	0x1301	✓
Protocol version	TLSv1.2	--	✓
Protocol version	TLSv1.3	--	✓

A.4 Certificates, approvals & guidelines

A.4.1 Certificates & approvals

CE mark

SIMATIC MV500 optical readers fulfill the requirements and protection objectives of the EU directive.

Mark	Description
CE	• 2014/30/EU (EMC) EMC Directive of the European Parliament and of the Council of 26 February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility; Official Journal of the European Union L96, 29/03/2014, pages 79-106. • 2011/65/EU (RoHS) Directive of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

DIN ISO 9001 certificate

The quality assurance system for the entire production process (development, production, and marketing) at Siemens fulfills the requirements of ISO 9001 (corresponds to EN29001: 1987).

This has been certified by DQS (the German society for the certification of quality management systems).

EQ-Net certificate no.: 1323-01

EMC Directive

The SIMATIC NET products described in these operating instructions meet the requirements of the EC Directive 2004/108/EC "Electromagnetic Compatibility" (EMC Directive) up to 19 April 2016 and of the EU Directive 2014/30/EU as of 20 April 2016.

Requirement:

- Emitted interference: EN 61000-6-4

- Immunity to interference: EN 61000-6-2

You can find the current version of the directives in the currently valid EU Declaration of Conformity.

Country-specific approvals

Table A-3   Country-specific approvals

Approval	Description
c(UL)us	Underwriters Laboratories, Inc.: UL 61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements)
	IEC/UL 61010-2-201 (Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for control equipment)
CSA	Canadian Standards Association: CSA C22.2 No. 142 (Process Control Equipment) Certificate number: E85972
(RCM)	This product meets the requirements of the EN61000-6-4 Norm.
EAC	EAC (Eurasian Conformity)
	Eurasian Economic Union of Russia, Belarus, Armenia, Kazakhstan and Kyrgyzstan
	Declaration of conformity according to the technical regulations of the customs union (TR CU)

Declaration of Conformity

The EC Declarations of Conformity and corresponding documentation is available to the responsible authorities according to the above-mentioned EC directive at the following address:

Siemens Aktiengesellschaft
Division Process Industries and Drives
Process Automation

DE-76181 Karlsruhe

Germany

Your marketing contact can provide these if requested.

Installation guidelines

The installation guidelines and safety notices specified in the documentation must be adhered to during commissioning and operation.

License agreement for supplied software

The device is supplied with software installed. Please note the corresponding license agreements.

A.4.2 ESD Guidelines

Definition of ESD

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

The "electrostatic sensitive components/modules" are commonly referred to as "ESD". "ESD" is the international abbreviation for "electrostatic sensitive devices".

Electrostatic sensitive modules are identified by the following symbol:

NOTICE
Voltage can destroy ESD
ESD devices can be destroyed by voltages well below the threshold of human perception. Such voltages occur if you touch a component or electrical connectors of a module without first discharging the static from your body. The electrostatic discharge current may lead to latent failure of a module, that is, this damage may not be significant immediately, but in operation may cause malfunction.

Electrostatic charging

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The figure below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials indicated. These values correspond to IEC 801-2 specifications.
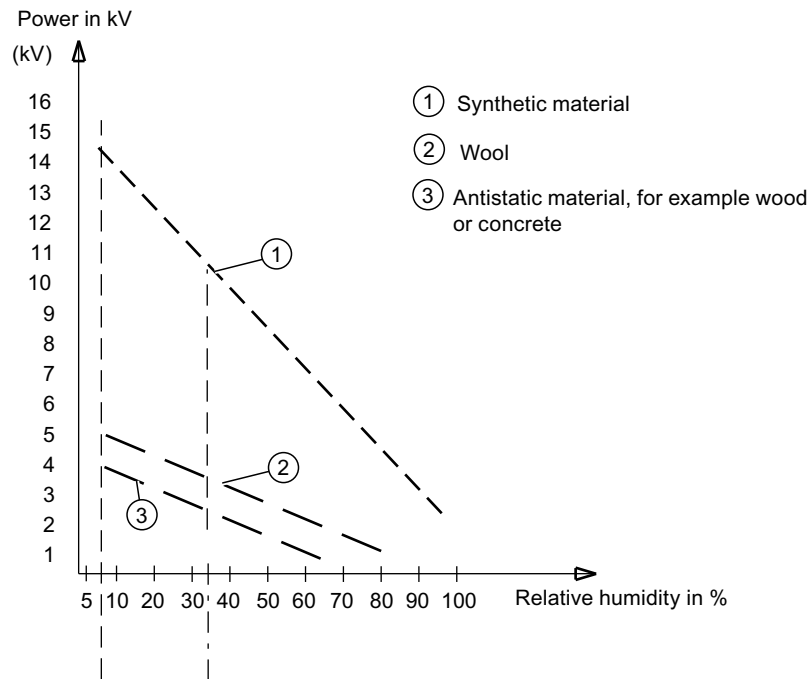
Figure A-3   Electrostatic voltages on an operator

Basic protective measures against electrostatic discharge

- Make sure the grounding is good;
  Make sure all persons, workplaces and packaging are sufficiently grounded when ESD components are being handled. This prevents electrostatic charge.

- Avoid direct contact:
  You should only touch ESD components if it is unavoidable (for example, during maintenance work). Handle the modules without touching any chip pins or PCB traces. In this way, the discharged energy can not affect the sensitive devices.
  Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

A.5   Alternative user interfaces

A.5.1   Integrated HTML pages

The HTML pages integrated in the optical reader offer an option that can be integrated into many environments to obtain important information from the optical reader and to monitor the recognition process. Up to 49 HTTP connections to the reader can be established simultaneously.

Benefits

- Independent of the operating system and the Web browser you are using.
- Does not require Java Runtime on the visualization device.
- Requires little memory and performance on the visualization device.
- Can be integrated easily in existing applications.
- Display normally available in three languages, language can be changed online.

Overview of available URLs

The following URLs provide access to the pages described below in their respective language. Access via an unencrypted connection (http) is only possible for the following pages when user management is enabled and http has been enabled.

- Example URL for the page "Live Image with links" in the English user interface:
  http://<IP address of the optical reader>/peeklive.html
- Example URL for the encrypted page "Live Image with links" in the English user interface:
  https://<IP address of the optical reader>/peeklive.html

Overview of the HTML pages for monitoring the optical reader

Table A-4   English, Chinese, German

Page	English	Chinese	German
Homepage [1]	index_en.html	index_zh.html	index_de.html
Setup (user interface) [1]	adj_en.cgi	adj_zh.cgi	adj_de.cgi
Diagnostic recordings [2]	diagrecs.cgi?rg=65535	diagrecs.cgi?rg=65535	diagrecs.cgi?rg=65535
Diagnostic images [2]	diagimgs.cgi?tn=1	diagimgs.cgi?tn=1	diagimgs.cgi?tn=1
Extended diagnostic images [2]	ediagimghtml.cgi	ediagimghtml.cgi	ediagimghtml.cgi
Live image with links [3]	peeklive.html	peeklive_zh.html	peeklive_de.html
Live image without links [2][3]	epeeklive.html	epeeklive.html	epeeklive.html
Last image [2]	live.cgi?d=0 (d=0: not-down sampled, d=1 down sampled)	live.cgi?d=0 (d=0: not-down sampled, d=1 down sampled)	live.cgi?d=0 (d=0: not-down sampled, d=1 down sampled)
Monitoring [2]	drawresults.cgi	drawresults.cgi	drawresults.cgi
Verification report	verifireport/verifire-port_en.html	verifireport/verifire-port_en.html	verifireport/verifire-port_de.html
Help on verification report	verifireport/verifire-port_info_en.html	verifireport/verifire-port_info_en.html	verifireport/verifire-port_info_de.html

[1]   The language in which the HTML page is displayed is independent of the language abbreviation used. The HTML pages are always displayed in the language set in the WBM.

[2]   These HTML pages are displayed only in English.

[3]   These HTML pages integrated in the readers are not functional on a visualization device without JavaScript support.

Available HTML pages

Live image display with links

Displays the images acquired by the optical reader in adjustment mode or processing mode. If the visualization device provides Java script support, the displayed image is automatically updated. With the displayed links, you can call up other pages.
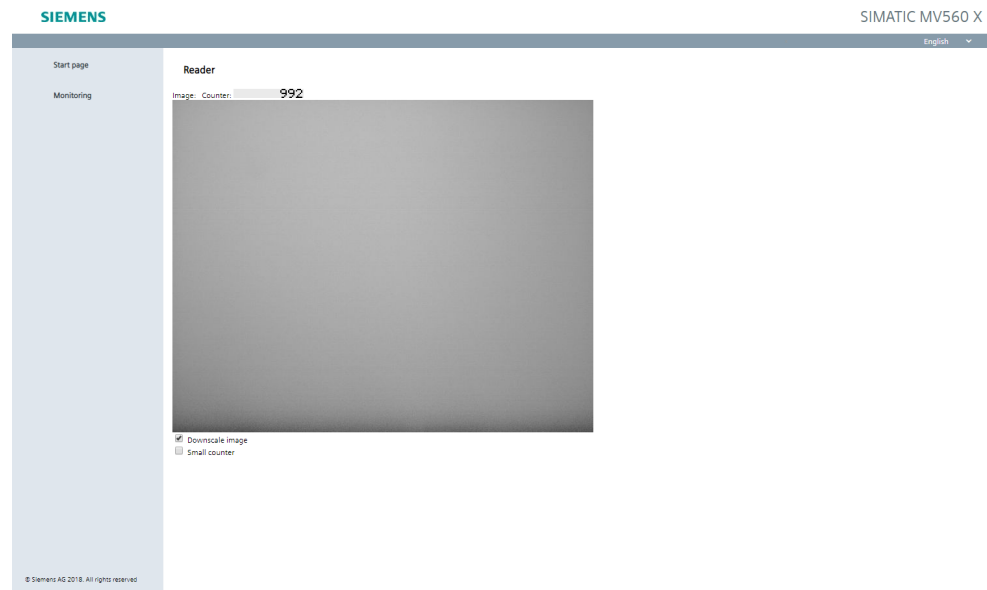

Figure A-4   Live image display with links

Live image display without links

Displays the images acquired by the optical reader in adjustment mode or processing mode. The image display is updated automatically. This page does not provide any links to other pages.
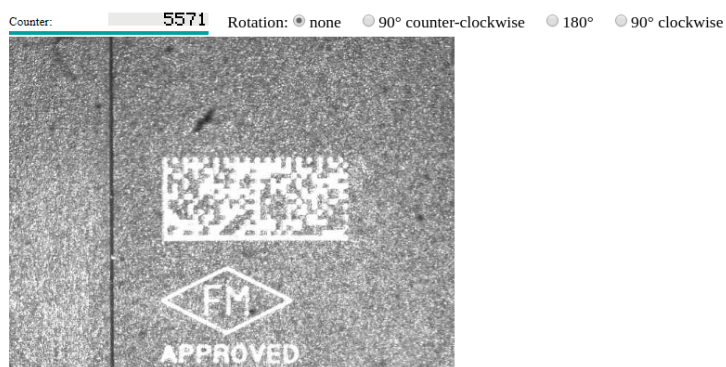
Figure A-5   Live image display without links

Last image

Pure display of the last recorded image without any additional information and without automatic image updating.

Figure A-6   Last image

Monitoring

Non-embedded display of the last image processed in processing mode with colored overlay showing the results of processing (ROIs and detail view).
Requires JavaScript support and Internet Explorer as of Version 8.

With a multi-code application, only the Grid and the Cells of the first recognized code are displayed.
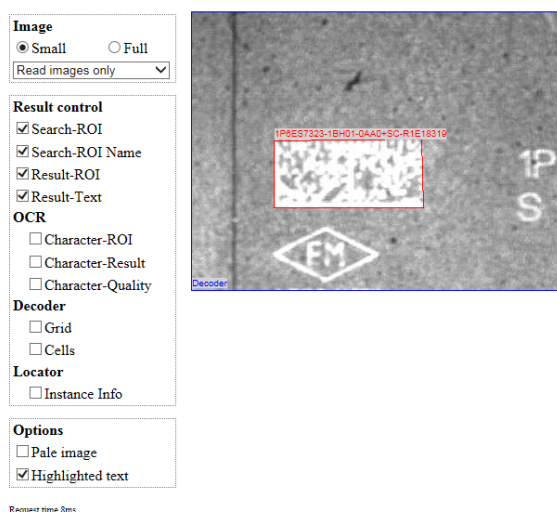
Figure A-7   Monitoring

Diagnostic images

Provides a dynamically created HTML page with which you can display diagnostic images buffered on the reader along with additional information. In the Options/Diag. & monitoring tab in the user interface, you specify which images are buffered and displayed.

Figure A-8   Diagnostic images

Extended diagnostic images (optimized for Touch Panels)

Provides a dynamically created HTML page with which you can display diagnostic images buffered on the optical reader along with additional information. In the Options/ Diag. & monitoring tab in the user interface, you specify which images are buffered and displayed.
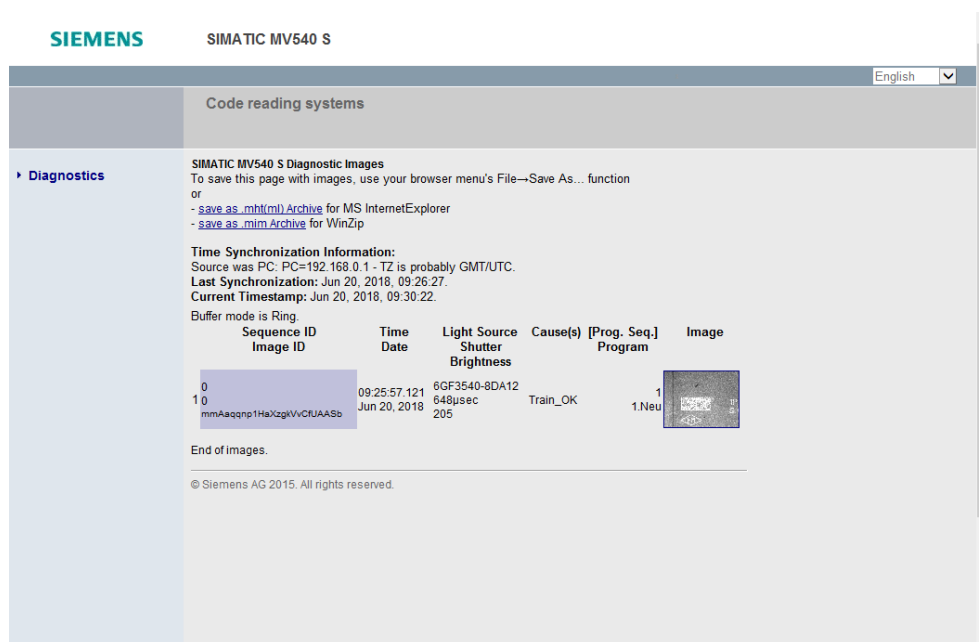
This page combines a large format image display with the most important additional information about the image such as the read result and display of the quality values.

This page is particularly suitable when using Touch Panels.

Navigation is made easier by the large area navigation symbols at the left edge.
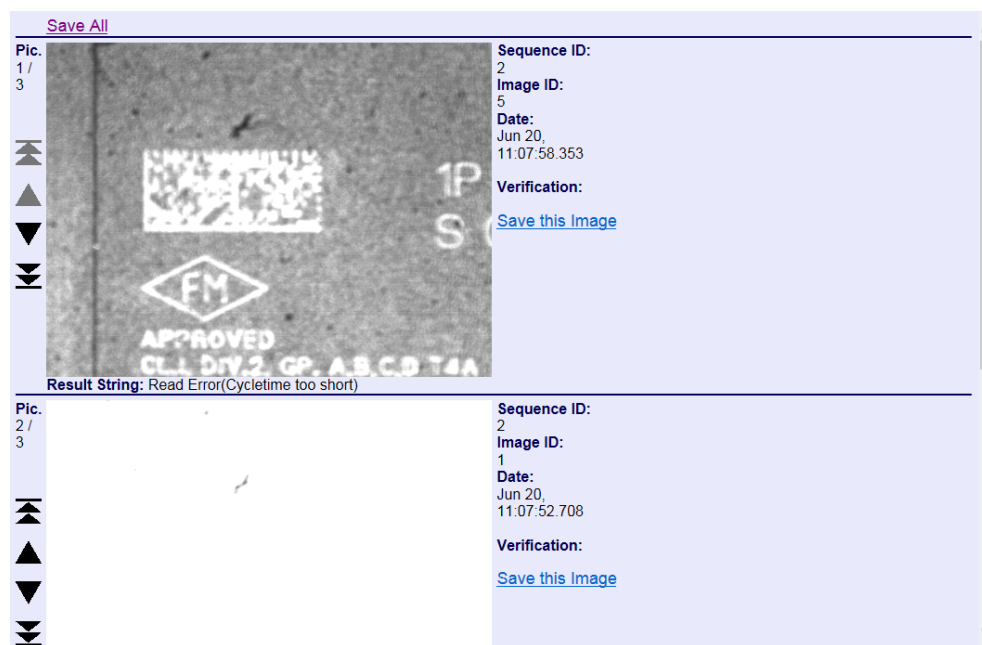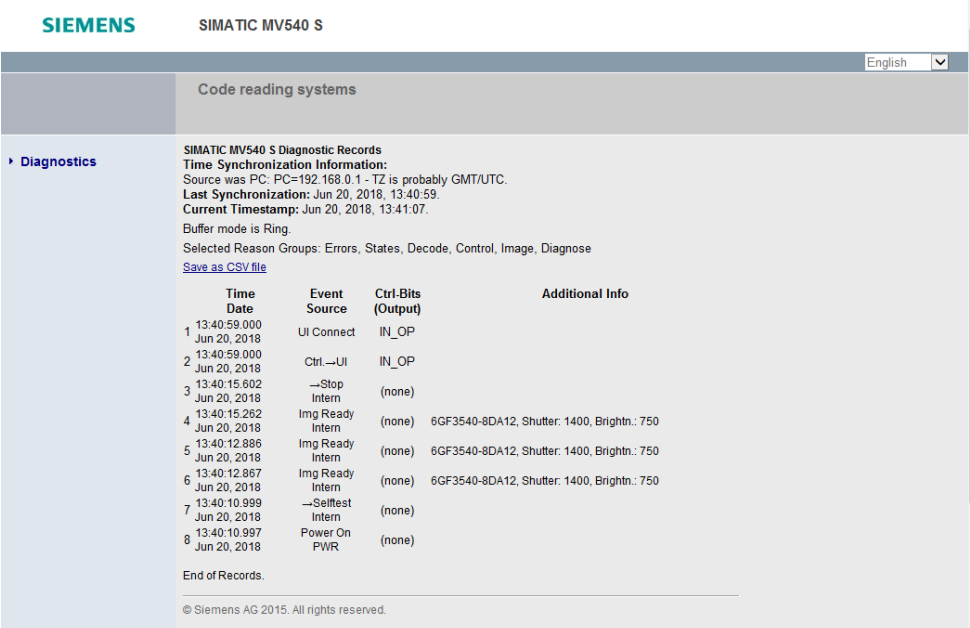

Figure A-9   Extended diagnostic images (optimized for Touch Panels)

Diagnostic recordings

Provides a dynamically created HTML page with which you can display diagnostic recordings buffered on the optical reader relating to errors that occurred, signal changes etc.

Figure A-10   Diagnostic recordings

A.5.2   Use of saved images

The optical reader user interface provides the option of using the images stored on the PC for the purpose of parameter assignment or for trial mode ("Load image" function).

The resolution and format of the images must match the program selected at this time. Possible image sources are, for example, the diagnostic images saved via the user interface or images archived using diagnostics transfer (MMI).

An HTML5 capable web browser is required to use the function, for example, Microsoft Internet Explorer version 10 or higher, Mozilla Firefox version 28 or higher or Google Chrome version 38 or higher.

List of abbreviations

<div align="right">

B

</div>

Abbreviation/symbol	Explanation
°	Degree
°C	Degrees Celsius
A	**A**mpere (SI unit of electric current)
AIM	**A**ssociation for Automatic **I**dentification and **M**obility
ANSI	**A**merican **N**ational **S**tandards **I**nstitute - the name of the US institute for standardizing industrial processes.
ASCII	**A**merican **S**tandard **C**ode for Information Interchange
ASM	Interface module, synonym of communication module
STL	**St**atement **L**ist
BF	**B**us **f**ault
Bit	**Bi**nary digi**t**
Byte	**Bi**nary **t**erm (1 byte = 8 bits)
approx.	approximately
CD	**C**ompact **D**isc
CCD	**C**harge **C**oupled **D**evice
CE	**C**ommunautés **E**uropéenes (French for European Communities)
CM	**C**ommunication **m**odule
cm²	Square centimeters
CPU	**C**entral **P**rocessing **U**nit
CSV	**C**haracter **S**eparated **V**alues
DB	**D**ata **b**lock
DC	**D**irect **C**urrent
DHCP	**D**ynamic **H**ost **C**onfiguration **P**rotocol
DI	**D**igital **I**nput
DIN	**D**eutsches **I**nstitut für **N**ormung e. V. (German standards association)
DISA	**Disa**ble
DMC	**D**ata **M**atrix **C**ode
DNS	**D**omain **N**ame **S**ystem
DO	**D**igital **O**utput
DP	**D**istributed **P**eripheral I/O
DPM	**D**irect **P**art **M**arking
DVD	**D**igital **V**ersatile **D**isc
EEPROM	**E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory
EIA	**E**lectronic **I**ndustries **A**lliance
EMC	**E**lectro **M**agnetic **C**ompatibility
EN	**E**uropäische **N**orm (European standard)
ES	**P**roduct **v**ersion
ESD	**E**lectro**s**tatic **D**ischarge

Abbreviation/symbol	Explanation
FB	**F**unction **B**lock
FBD	**F**unction **B**lock **D**iagram
GND	**Gr**ou**nd**
GSD	**G**eneric **S**tation **D**escription
IAQG	**I**nternational **A**erospace **Q**uality **G**roup
I/O	**I**nput/**O**utput
ISO	International Standards Organization (from Greek: "**iso**s"; Engl. "equal")
IEC	**I**nternational **E**lectrotechnical **C**ommission
IEEE	**I**nstitute of **E**lectrical and **E**lectronics **E**ngineers
IP	**I**nternet **P**rotocol or International Protection
HF	**H**igh **F**requency
H_2S	Hydrogen sulfide
hPa	**H**ecto**pa**scal
HR	**H**igh **R**esolution
HTML	**H**yper**t**ext **M**arkup **L**anguage
HTTP	**H**yper**t**ext **T**ransfer **P**rotocol
kg	**K**ilo**g**ram
LAD	**La**dder **D**iagram
LAN	**L**ocal **A**rea **N**etwork
LCD	**L**iquid **C**rystal **D**isplay
LED	**L**ight **e**mitting **d**iode
MAC	**M**edia **A**ccess **C**ontrol
max.	**Max**imum
MB = Mbit	10^6 bits
MHz	**M**ega**hert**z
mil	milli-inches
min	**Min**ute
m	**M**eter
mm²	Square millimeter
MTBF	**M**ean operating **T**ime **B**etween **F**ailures
MTTR	**M**ean **T**ime **T**o **R**ecover
LF	**L**ow **F**requency
OCR	**O**ptical **C**haracter **R**ecognition
OCV	**O**ptical **C**haracter **V**erification
PC	**P**ersonal **C**omputer, a stationary single-user computer
PELV	**P**rotective **E**xtra **L**ow **V**oltage
PG	Programming device
PIB	**P**roxy **I**dent Function **B**lock
PROFIBUS	**Pro**cess **Fi**eld **Bus**, international fieldbus standard to EN 50170/IEC 61158
PTB	**P**hysikalisch-**T**echnische **B**undesanstalt (German technical inspectorate)
RAM	**R**andom **A**ccess **M**emory
RFID standard profile	Implementation of the "Proxy Ident Function Block" (PIB), synonym of Ident profile

Abbreviation/symbol	Explanation
ROI	**R**egion **O**f **I**nterest
RH	**R**elative **H**umidity
Rps	**R**eads **p**er **s**econd
RS	**R**ecommended **S**tandard
RS232	(also EIA-232) Identifies an interface standard for a sequential, serial data transmission.
RS422	(also EIA-422) Identifies an interface standard for a differential, serial data transmission.
RS485	(also EIA-485) Identifies an interface standard for a differential, serial data transmission.
ROM	**R**ead **O**nly **M**emory
Rx	Receive (Rx) identifies a receiver
s	**S**econd
SELV	**S**afety **E**xtra **L**ow **V**oltage
SF	Group error (German **S**ammel**f**ehler)
SNTP	**S**imple **N**etwork **T**ime **P**rotocol
SO$_2$	Sulfur dioxide
PLC	**P**rogrammable **L**ogic **C**ontroller
SR	**S**tandard **R**esolution
t	**T**ime
T	**T**emperature
TCP	**T**ransmission **C**ontrol **P**rotocol
TCP/IP	**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol; a reference model for communication on the Internet
Tx	Transmit (Tx) identifies a transmitter
URL	**U**niform **R**esource **L**ocator
V	**V**olt (SI unit of voltage)
VDE	**V**erband **d**er **E**lektrotechnik, Elektronik und Informationstechnik (German Association for Electrical, Electronic and Information Technologies)
WAN	**W**ide **A**rea **N**etwork
WBM	**W**eb **B**ased **M**anagement
XML	E**X**tensible **M**arkup **L**anguage
e. g.	for example

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Service & Support

C

Industry Online Support

In addition to the product documentation, you are supported by the comprehensive online information platform of Siemens Industry Online Support at the following Internet address:
Link: (https://support.industry.siemens.com/cs/de/en/)

Apart from news, you will also find the following there:

- Project information: Manuals, FAQs, downloads, application examples etc.

- Contacts, Technical Forum

- The option to submit a support request:
  Link: (https://support.industry.siemens.com/My/ww/en/requests)

- Our service offer:
  Right across our products and systems, we provide numerous services that support you in every phase of the life of your machine or system - from planning and implementation to commissioning, through to maintenance and modernization.

You will find contact data on the Internet at the following address:
Link: (https://www.automation.siemens.com/aspa_app/?ci=yes&lang=en)

"Industrial Identification" homepage

You can find the latest general information about our identification systems on the Internet at our Homepage (www.siemens.com/ident).

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall home page (https://mall.industry.siemens.com).

SITRAIN - Training for Industry

The training offer includes more than 300 courses on basic topics, extended knowledge and special knowledge as well as advanced training for individual sectors - available at more than 130 locations. Courses can also be organized individually and held locally at your location.

You will find detailed information on the training curriculum and how to contact our customer consultants at the following Internet address:

Link: (https://new.siemens.com/global/en/products/services/industry/sitrain.html)

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