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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 security concept. Siemens' products and solutions only form one element of such a concept.

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SIEMENS
Ingenuity for life

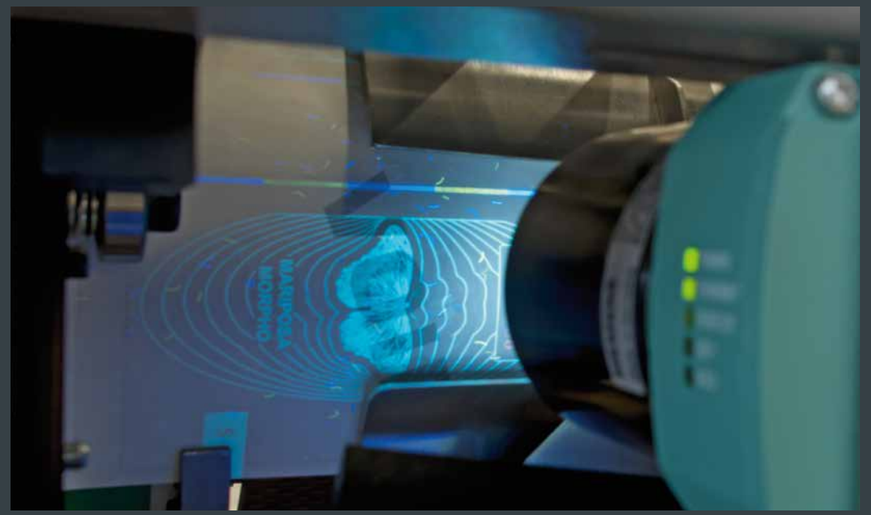
Optical identification

SIMATIC MV – The Eyes of Digitalization

siemens.com/optical-identification

Optical identification: a watchful eye on production and logistics

As automation rapidly advances, the demands placed on industrial identification are steadily growing. Siemens' response to these requirements is SIMATIC Ident, a uniquely comprehensive and scalable portfolio of RFID and optical identification systems for the flexible implementation of efficient, economical identification solutions in manufacturing and logistics. SIMATIC Ident is the top choice for meeting today's requirements and one of the key technologies on the road to digitalization.



"Always keeping an eye on the entire product life cycle"

Identification systems: optical readers and RFID

Whether Data Matrix Codes (DMC) or radio frequency identification (RFID): Both marking and recognition systems feature high data security, have been proven in a variety of applications – including in harsh industrial environments – and meet the growing demand for seamless tracking and tracing of products and processes. At the same time, they require less time and effort than manual marking and reading systems. For the precise reading and verification of 1D/2D codes, text recognition (Optical Character Recognition, OCR), and object recognition, Siemens offers both stationary optical readers and optical handheld readers.

Highlights

- Complete, scalable portfolio of high-performance stationary optical readers
- Simple integration into the SIMATIC automation environment
- Various communication and connection options
- Verification of 1D/2D codes according to open standards – even during ongoing production
- Text recognition (Optical Character Recognition)
- Object recognition

The future is in the cloud – SIMATIC MV500 supplies production data to MindSphere

Maintaining a constant overview of the entire production and supply chain means dealing with staggering volumes of data that flow together into virtual clouds to the Internet of Things (IoT). The analysis and utilization of this data opens up unimagined potential. Siemens has developed a solution that allows this potential to be fully exploited. MindSphere supports the digital transformation of enterprises of any size and in any sector, and in the shortest possible time.

Embrace the digital future with SIMATIC MV500 optical readers

The optical readers in the SIMATIC MV500 series and MindSphere – Siemens' cloud-based, open operating system for the Internet of Things – are essential components in a successful digitalization strategy. They are also the basis for data-based services from Siemens. The optical readers can easily be connected to MindSphere with an S7-1500 controller – already resulting in brand-new opportunities for using data acquired from 1D/2D codes.

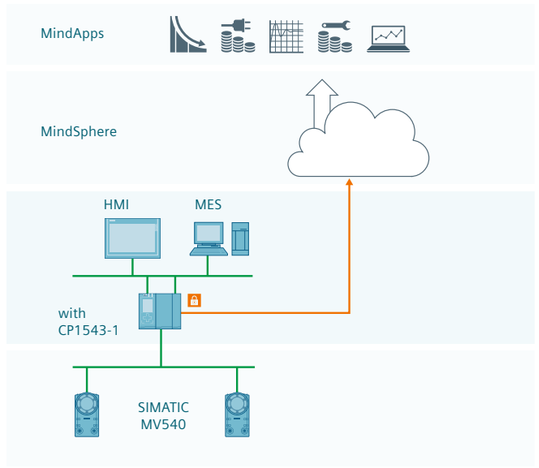
As a link between the real and digital world, optical readers read operating data such as product ID with position and time in production and ensure that the results of tracking are available worldwide. All this is made possible by a function block integrated into the controller. The S7 controller is the only device needed to transmit values from the optical reader to MindSphere.

The result: maximum transparency, optimal processes

The analysis of data, which is transferred from the production line to MindSphere with the help of SIMATIC MV500, renders the production process transparent across manufacturers. This transparency allows the optimization of production processes and supply chains with a view to improving efficiency and quality in production, logistics, asset management, and other areas in all industries.

Highlights

- Simple connection to MindSphere via a standard function block in the S7-1500 controller
- Simple configuration of the connection using drag & drop in the TIA Portal
- MindSphere app: analysis and visualization of SIMATIC MV500 track & trace information
- Worldwide availability of the results of analysis



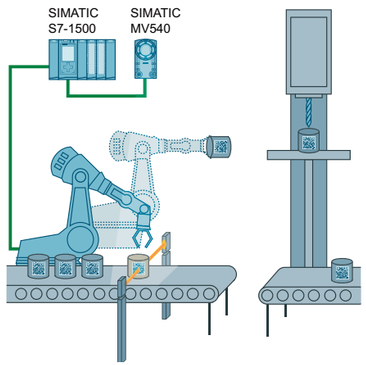
SIMATIC MV500 and MindSphere are essential components of a successful digitalization strategy and the basis for data-based services from Siemens.

Optical identification in practice

Pick & place: random picking of product blanks by robots

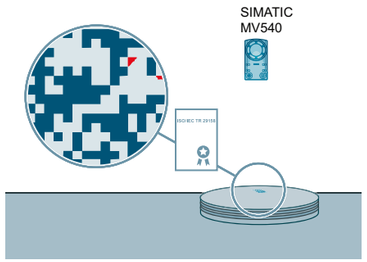
Industry: any

Task	Detecting the position of product blanks for pick & place by means of robots
Solution	• Reading of workpiece position, detection and ejection of defective parts • Communication of position of correct workpieces to robots • Transportation of workpiece to processing position when this position is free
Benefits	• Large image field – one camera precisely covers the entire range • High processing speed for complex structures • Reduced glare thanks to flexible lighting • Connection to SINUMERIK • Simple learning procedures through web-based management (WBM)



Verification: checking of marking quality in the supply and production chain

Industry: automotive supplier

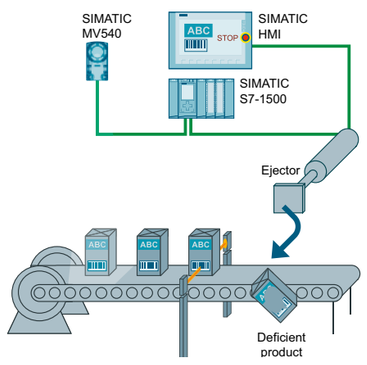


Task	Measuring marking quality according to supplier specifications
Solution	• Testing stations in the production and delivery chain according to applicable standards, such as ISO TR 29158 • Checking and documentation of markings for readability • Implemented test algorithms and calibratable lighting units according to standard
Benefits	• Large high-resolution image sensors according to standard • Trend information via uncalibrated Q-measurement • Product includes test algorithms and calibration card • Checking on production line thanks to SIMATIC/TIAP-connection • Product-specific test protocol through WBM

Track & trace: tracking of uniquely marked products on the production line – discarding if applicable

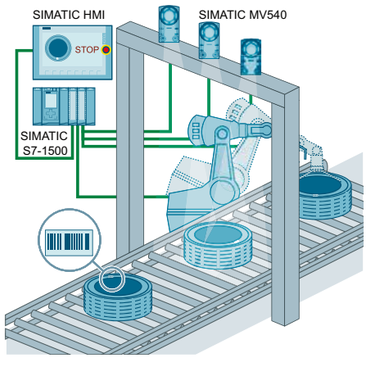
Industry: food & beverage

Task	Determining unreadable or incorrect barcodes/packaging types – to stop system or discard product
Solution	• Reading of products just before packaging • Processing of several jobs simultaneously, independently of conditions • Checking for legally required content ID (batch number) and readability of EAN code followed by verification of product labeling
Benefits	• Large image field – one camera precisely covers the entire range • High processing speed for multi-stage jobs • Reduced glare thanks to flexible lighting • Integration of SIMATIC into S7 controller and SIMATIC HMI • Engineering, documentation, and service via TIA Portal • Simple configuration via WBM



Tires: identification by barcode

Industry: tire



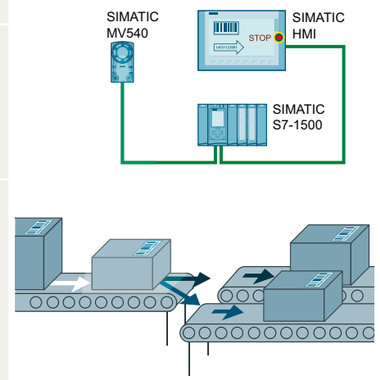
Task	Tracking and tracing production and detecting position for robot handling
Solution	• Identification of very small markings on the tire beed at high speeds • Reading of product position and the rotational position of the marking • Selective removal of product from moving belt, for example for further production or test steps
Benefits	• Large image field • Three cameras precisely cover the entire range • High image capture rate and high processor performance ensure extremely high belt speed • Optimal illumination with IP67 built-in ring lights • Connection to SIMATIC • Simple configuration using WBM

More example applications

Routing: recording of product ID to control transport systems

Industry: Food & Beverage, Pharma, Tobacco

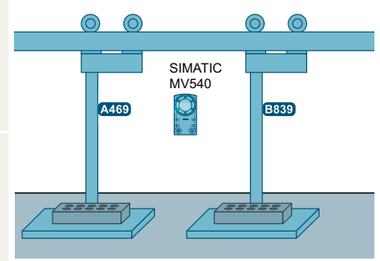
Task	Controlling transport systems (routing) based on product ID
Solution	• Flexible reading of ID for different products • Selective activation of transport system for the specific product • Control of highly flexible logistics processes, for example to perform specific product picking
Benefits	• Large image field – with extreme accuracy • High image capture rate and high processor performance ensure extremely high belt speed • Flexible, high-performance IP67 built-in ring lights • Food-compatibility thanks to Plexiglas faceplate • Connection to SIMATIC and SIMOTION • Simple learning procedures through WBM • Remote support concept for remote maintenance



SKID: reading the IDs of product carrier systems to establish control within the production process

Industry: any

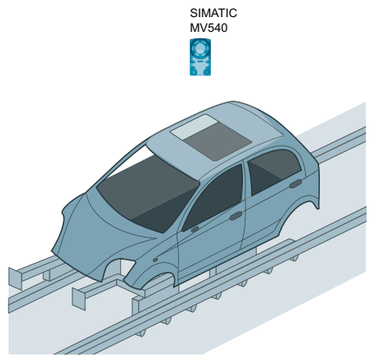
Task	Skid identification – recognition of IDs on carrier systems
Solution	• Detection of IDs on carrier systems despite changes caused by processing (such as painting or discoloration) • Reliable reading over greater reading distances for large products, such as car bodies
Benefits	• Large image field – for large ranges • E-focus for simple commissioning and alternating product heights • Multi-job for code reading and shape recognition in the same image • High image capture rate and high processor performance ensure extremely high belt speed • Flexible, high-performance IP67 built-in ring lights • Food-compatibility thanks to Plexiglas faceplate • Connection to SIMATIC and SIMOTION • Simple learning procedures through WBM • Remote support concept for remote maintenance



Assembly: detection of installation status

Industry: automotive

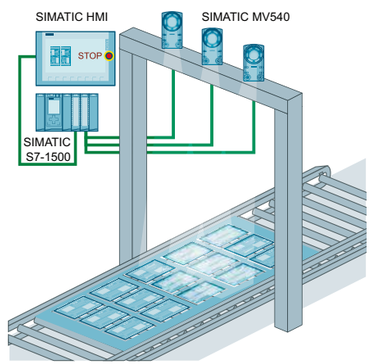
Task	Ensuring correct built-in parts by measuring slight differences in shape
Solution	• Checking the correct position of an installed element using the optical reader, based on preceding assembly stage • Alternatively: checking a product property before an assembly stage as prerequisite for the next step • Preventing the installation of damaged and/or semi-finished products and protecting production plants against damage
Benefits	• Large image field for large objects • E-focus for simple commissioning and distances from product • Multi-job for code reading and object recognition in the same image • High image capture rate for adaptive lighting adjustment on the production line • Flexible, high-performance IP67 built-in ring lights • Exchangeable faceplate on protective barrel for use in welding • Connection to SIMATIC and SIMOTION • Simple learning procedures through WBM • Remote support concept for remote maintenance



Assembly: reading of all markings on a multi-purpose PCB

Industry: electronics

Task	Prevention product mix-ups during assembly
Solution	• Seamless code reading with different track widths on production line • Reading of all markings on a PCB (e.g. PCB ID, MAC address of each individual application) • Read portal for reading in motion
Benefits	• Multiple cameras (master/slave) – permit portal operation for varying board widths • E-focus for simple configuration and distances from product • Multi-job for code reading and object recognition in the same image • High image capture rate for high belt speed • High-performance IP67 built-in ring lights • Connection to SIMATIC and SIMOTION • Simple learning procedures through WBM • Remote support concept for remote maintenance



Everything necessary for Marking, Verifying, Reading, and Communication

Four key elements are required for DPM traceability applications that we combine under MVRC: Marking, Verification, Reading, and Communication. Marking is placing the code directly on the object, verification is checking the quality of the mark located on the object, reading is reading the mark in the production domain or when servicing, and communication is reliably transmitting the read result. Siemens covers all four key elements with a variety of products and systems and provides support for the creation of applications.

Marking

Marking a product is normally done very early on in the production process so that all subsequent steps can be controlled using the product identity. Wherever possible, marks are applied to parts using a method called Direct Part Marking (DPM). DPM is the application of a mark directly onto the surface of a product without the use of a separate carrier material, such as an adhesive label. This makes it possible to identify products in production and trace them after delivery. A coding method that meets these user requirements has been available for years using 2D codes.

Verification

Verification systems guarantee the readability of marks throughout the entire production process, regardless of any contamination or the use of different reading devices. In addition, the mark is guaranteed to remain readable company-wide after the production process and throughout the life span of the product.

SIMATIC MV, for example, offers verification according to ISO TR 29158 for the monitoring of marking. The measurement of marking quality is already standard in many industries and prescribed in supplier agreements. Marking quality, and thus the correct reading of the product ID, is now as important as the dimensional accuracy of a component. Both prevent production downtimes and additional handling effort.

Reading

Reading in the production domain or when servicing requires extremely reliable optical reading systems. With the aid of convenient algorithms, the SIMATIC MV optical readers ensure a maximum of reliable reading and easy handling for parameter assignment and configuration.

Communication

The communication between a reading device and process control is performed via standard interfaces such as PROFINET, Ethernet, and RS232, and via digital inputs and outputs. SIMATIC MV readers can also use RFID communication modules (ASMs). This permits fast and secure communication via additional fieldbus protocols such as PROFIBUS, Ethernet/IP, and IO-Link for connecting to process control.

Marking

Applying the code directly to the object (DPM)

Verifying

Checking the quality of the mark located on the object

Reading

Reading the mark in the production domain or when servicing

Communication

Transmitting the read results

SIMATIC MV

Optical readers

The SIMATIC MV optical readers are high-performance, intelligent readers both for easy, high-contrast 1D/2D codes and for difficult-to-read DPM codes on different surfaces on the product itself. The optical readers also permit text recognition, object recognition, and the checking of marking quality. Readers in the SIMATIC MV family also feature high-performance image capture at different resolutions and integrated lighting, which makes them flexibly usable in production and logistics. Device configuration via Web-Based Management and system integration via the TIA Portal ensure easy handling.

SIMATIC MV500

- Highest reading performance of 1D/2D codes with up to 100 reads per second or up to 300 codes per image (bulk reading)
- Flexible, high-performance accessories (lighting, lenses)
- Easy handling thanks to one-button configuration
- Maximum system security and reliability

SIMATIC MV400

- Simultaneous code reading, text reading, and object recognition in one image
- High processing speed of up to 70 reads per second
- Numerous accessories (lighting, lenses)
- Configuration via WBM
- Proven IT security

SIMATIC MV300

- High-performance 1D/2D code reading, even of low-contrast codes
- Flexible interface connection (RS232, USB, Bluetooth, ASM module connection)
- Sturdy, ergonomic design for manual workstations

AutoTrigger

With AutoTrigger, codes that enter the reader's image field are automatically read. The reader itself searches a sequence of images over any preferred time span for code visibility. It does not require any external trigger signals, such as from a light barrier.

Multi-code reading

With multi-code reading, up to 300 codes can be decoded for each image capture, for example when several objects are bulk-read in one stack.

Verification

Only high-quality marking can ensure maximum readability in the case of contamination in the production process. Verification also reduces production costs because the demands on material quality and marking quality are not as stringent. With the "Veri-Genius" verification license, SIMATIC MV440 can also be employed for checking marking quality. The license can be copied to the reader with the SIMATIC Automation License Manager.

Object recognition

With the "Pat-Genius" object recognition license, SIMATIC MV440 can also perform object recognition (object classification, position detection, presence check, completeness check) in addition to reading 1D and 2D codes. This function is also possible in combination with text recognition, for example. It is thus possible to check the position of a label and the inscription (reading and comparing) of plain text in an image field. Object recognition is used to search for and detect trained patterns in an image. Areas of application include pick & place, quality control in production, position detection in infeed systems, and quantity monitoring in infeed systems and production. The license can be copied to the reader with the SIMATIC Automation License Manager.

Code quality evaluation

Depending on the model, either uncalibrated or calibrated quality evaluation is integrated. The uncalibrated method helps to reliably configure the reader and continuously monitors the code quality. The calibrated method also permits the comparison of quality values over a large number of readers (for example, company-wide, worldwide, or over the entire supplier chain).

Installation and startup

For most applications, the parameters are set automatically. If changes become necessary, however, parameters can be set using the integrated Web server and a Web browser without separate software installation. In the standard case, products in the SIMATIC MV500 series can be installed and started up without the aid of an additional Web browser using one-button configuration available on the reader itself.

Web-based user interface

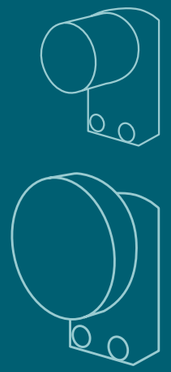
The reader's user interface uses the Microsoft Internet Explorer on the PC. The user interface is also stored on the reader. It is downloaded during startup and executed in Internet Explorer. There is no need to install software on the PC. The user interface can be started from any PC or other Windows-based device and is available in German, English, French, Italian, Spanish, and Simplified Chinese.

Visualization

In addition to the web-based user interface, pre-existing HMI units in the plant can also be used to display the image information. In the case of a decoding error, it is extremely helpful when the user can read the image information directly on the HMI unit. The programmer can create the user interface as an integral component of a machine's user interface using professional software such as SIMATIC WinCC and WinCC flexible as a customized user interface.

Diagnostics and logging

The diagnostics and logging functions support, among other things, the transfer of time stamps, fault patterns, and results to database systems or a file system for the purpose of generating trend analyses or statistics. The diagnostic data (such as fault patterns or configuration data) can also be used for remote maintenance purposes.



SIMATIC MV500: high-end reader with extremely powerful image capture

SIMATIC MV540 is the first reader of the SIMATIC MV500 high-end generation. The higher computing power significantly accelerates the reading process to up to 100 reads per second. Reading reliability can also be improved under difficult conditions thanks to a more in-depth analysis of image information. High-performance accessories such as lenses (with electronic focus) permit focus changes within 200 milliseconds. Other accessories include new, flexibly controllable, built-in ring lights with separately configurable ring light segments. One-button configuration enables fast, uncomplicated installation and startup. The large working memory (1 GB) also permits extended use of the AutoTrigger function, which makes it possible to save money when installing high-precision mechanical components in the system. Despite its many innovations, SIMATIC MV540 is compatible with its predecessor model SIMATIC MV440 both mechanically and in terms of programming and interfaces.

SIMATIC MV400: high reading reliability and speed

The stationary optical readers in the SIMATIC MV400 series feature high reading reliability and speed. The readers identify both easy, high-contrast 1D/2D codes and difficult-to-read DPM codes on the product itself. In addition to code reading, SIMATIC MV440 provides other functions such as measurement of marking quality (verification) for process control, text recognition (OCR/OVC), and object recognition. All readers in the SIMATIC MV400 series can be easily and flexibly integrated into automation systems thanks to standardized, industry-compatible interfaces and function blocks. Flexible lighting options and a compact design with IP67 degree of protection mean that the optical reader can be used in many industrial applications.

Highlights

Different device versions and accessories

- Optical readers with different sensor resolutions from 0.5 to 5.3 MP
- Flexible, high-performance accessories
- Flexibly controllable, built-in ring lights with separately configurable ring light segments
- Lenses with electronic focus enable fast focus change (200 ms)

Very high reading speed and reading performance

- Up to 100 reads per second
- Reading of 1D/2D codes, such as Data Matrix Codes
- Multi-code reading

Easy operation

- One-button configuration for network parameter assignment without administrator rights
- One-button reading configuration makes is possible to set read parameters without WBM
- E-focus: electrically adjustable lens focus
- Engineering, documentation, and service with the aid of the industry-compatible software platform TIA Portal

Various connections to automation and MindSphere

- On-board PROFINET and PoE
- Communication modules for direct connection to PROFIBUS, Ethernet/IP, or IO-Link
- Connection to MindSphere with the S7-1500 controller and corresponding function block

Extreme reliability

- High degree of protection (IP67) for use in harsh industrial environments
- Maximum system security and reliability through Siemens IT security tests

Worldwide deployment

- Support for all relevant standards
- Language switching
- International support

Different device versions and accessories

- Models in different performance classes (such as reading speed)
- Resolutions from 0.3 to 2.0 MP
- Flexible, high-performance, integrated lighting
- Flexible lenses

Interfaces

- Standardized, industry-compatible interfaces and function blocks for easy and flexible connection to automation
- Mixed mode possible with RFID and MV420/MV440 on the same communication module

Functionality of the user interface

- Installation and startup via configuration support on the PG/PC with Internet Explorer installed
- Web-based user interface

Expanded functionality for SIMATIC MV440 and MV420 SR-P

- Multi-code reading
- AutoTrigger: image recording without the need for external triggers
- ID-Genius algorithm: reading of low-contrast DPM codes (such as dot-peening)

Additional licenses for SIMATIC MV440

- Pat-Genius for object recognition
- Veri-Genius for checking marking quality
- Text-Genius and Text-Genius Plus for text recognition (OCR)

Object recognition with Pat-Genius

With the “PAT-Genius” object recognition license, SIMATIC MV440 can also be used for finding structures in an image in addition to reading 1D barcodes and 2D matrix codes. This function can be used separately in order, for example, to check the presence of a trained structure. The object recognition function can also be used in combination with the code reading and text recognition functions in the same image field.

The “PAT-Genius” object recognition license enables the flexible recognition (finding) of trained objects based on their contours in the image, and without complex learning procedures. Only a few user inputs are required to achieve stable read results. The edge points assigned to a pattern are taken from a selected image region and parameterized with respect to the fineness of the resolution and possible changes in size and rotational position. An object thus specified is stored in the pattern library and assigned an index. The result of a test using object recognition is then the x/y position and rotational position found in the image and the assigned index letter.

The licenses for “Pat-Genius” are supplied as a “Single License” on a USB flash drive and can be installed to the reader and to replacement devices with the SIMATIC Automation License Manager (ALM) using a plug-in. The “Pat-Genius” license is executable on a SIMATIC MV440 with firmware version 6.0 and higher.

Highlights

- Fast and reliable object recognition regardless of rotational position in the image region (up to 2,500 checks/minute) for high-speed applications
- Simultaneous reading and comparison of plain text and machine-readable codes in the same image field plus object recognition
- Several different test patterns can be used simultaneously
- Object recognition is a cascadable function – the result of object recognition can shift the image region of the subsequent check (object recognition, text recognition, code reading)
- Test patterns can be scaled – recognition is independent of changes in size (e.g. shrinkage of the object)
- Filter and comparison functions (target/actual comparison in the camera) are available for programming
- Flexible retrofitting of the object recognition function via the SIMATIC Automation License Manager
- Simple integration into the automation environment, for example via the function block of the SIMATIC MV440 devices

Checking marking quality using Veri-Genius

With the “Veri-Genius” license, SIMATIC MV440 can be used for checking marking quality (e.g. of Data Matrix Codes) in addition to reading 1D barcodes and 2D matrix codes. Several test methods are available for 1D and 2D codes. The most important in the automation environment is the test according to ISO TR 29158. It allows checking the quality of the particular code type by means of specific algorithms. At this point it is important to note that the design standards of the test specifications must also be adhered to in addition to the software. Verification can be combined with all the other functions, including text recognition and object recognition.

The “verification” function is basically available for any image with readable 1D/2D codes. The lighting and image condition must be uniform to achieve an objective evaluation of marking quality. Normally, a position in the production process that meets these requirements is selected for verification purposes. The most important position is immediately after the product is marked by labeling, dot-peening, or lasering. Checking the marking for minimum quality ensures readability even if marking quality is compromised due to scratches or contamination. If the marking has been applied by the supplier, it is recommended that this check be performed at the start of the production line.

Even if the design standards of the test specifications of the individual standard do not have to be adhered to, it is useful to employ the test algorithms. Although the test results are not objective, they can still be used as a meaningful trend indicator for marking quality.

The “Veri-Genius” license is supplied as a “Single License” on a USB flash drive and can be installed to the reader as well as to replacement devices with the SIMATIC Automation License Manager (ALM) using a plug-in. The license is executable on a SIMATIC MV440 with firmware version 4.0 and higher. The scope of delivery includes a standardized calibration card for calibrating the lighting system for objective test results.

Highlights

- Checking of marking quality according to a number of internationally recognized test specifications, especially ISO TR 29158
- Complete test report accessible as an HTML page that can also be archived or sent
- Standardized calibration card included in scope of delivery
- Trend forecast using verification on SIMATIC MV440 devices without calibration and/or without adhering to design test specifications
- Simple integration into the automation environment, for example using the function block of the TIA Portal standard library for SIMATIC MV440 devices

Text recognition with Text-Genius and Text-Genius Plus

With the “Text-Genius” and “Text-Genius Plus” licenses, SIMATIC MV440 can also be used for text recognition in addition to reading 1D barcodes and 2D matrix codes. Text recognition is also referred to as Optical Character Recognition (OCR). With “Text-Genius Plus,” text recognition is always possible regardless of the font used for marking (Polyfont) or the marking method. Text recognition can be combined with all the other functions, including object recognition and verification.

The “Text-Genius Plus” license includes all the functions of the “Text-Genius” license and additionally enables the training of further fonts and characters, including special characters and graphic symbols. Particularly worth mentioning is the simple and self-explanatory character training using thumbnails. The convenient algorithm provided by “Text-Genius” minimizes training effort. Only characters with a poor recognition rate or print images that can change greatly require training. The result: extremely flexible usage and an especially high recognition rate.

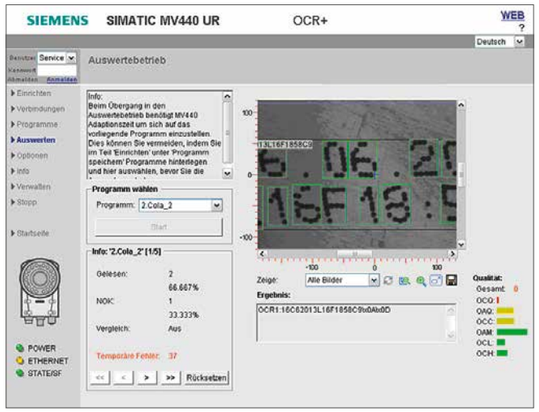
The licenses are supplied as a “Single License” on a USB flash drive and can be installed to the reader as well as to replacement devices with the SIMATIC Automation License Manager (ALM) using a plug-in. The “Text-Genius“ license is executable on a SIMATIC MV440 with firmware version 3.0 and higher and the “Text-Genius Plus” license with firmware version 5.0 and higher.

The “Text-Genius” license permits the flexible reading of many fonts without complex learning. Only a few simple parameters need to be set to achieve stable read results in text recognition. The following fonts are especially suitable:

- OCR-A and OCR-B
- Semifont M13
- Arial and similar fonts
- All characters in the ASCII character set

Highlights

- Fast and reliable reading (up to 2,500 reads/minute) for high-speed applications
- Simultaneous reading and comparison of plain text and machine-readable codes in the same image field
- Automatic text localization without the use of predefined areas, meaning that text can be read even when its position varies
- Automatic line detection for max. five freely definable image regions of max. 15 lines each
- Automatic character height recognition between 15 and 55 pixels
- Individual parameter assignment for max. five freely definable image regions
- Reading of mirrored, rotated, and inverted text
- Filter and comparison functions available for programming
- Flexible retrofitting of the text recognition function via the SIMATIC Automation License Manager
- Simple integration into the automation environment, for example via the function block of the SIMATIC MV440 devices



Highlights

- Freely trainable text recognition
- Computer-aided training: the user is offered untrained characters during production for subsequent assignment (training)
- Use of Text-Genius algorithms to support the training process

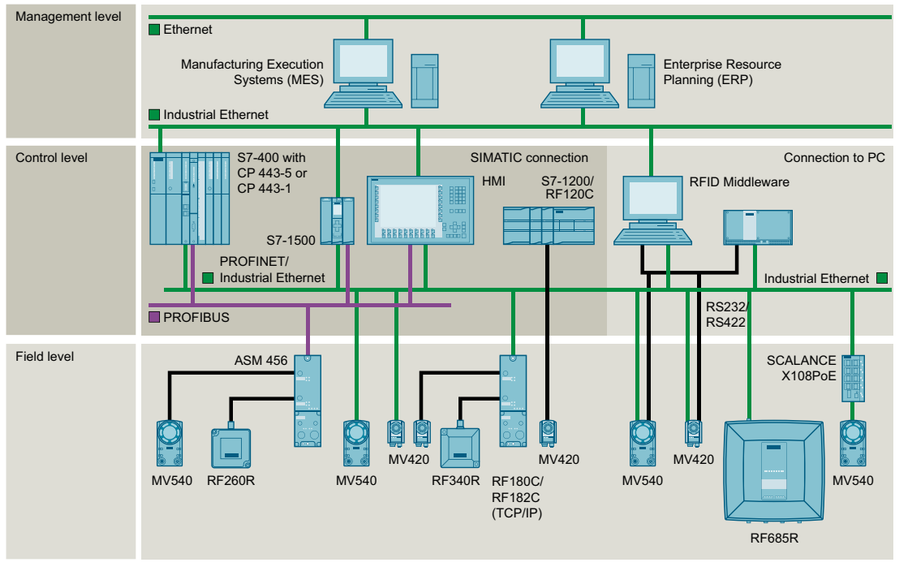
Optical identification at a glance

SIMATIC MV

Compact optical readers in different designs and performance classes with flexibly selectable, high-performance accessories

- Integrated and external ring lights in different performance classes
- Large selection of lenses, from small and simple to the electronically controlled lens
- On-board, industry-compatible communication (PROFINET, PoE)
- Optional communication modules for connecting to automation in the case of special requirements: for direct connection to PROFIBUS, Ethernet/IP, or IO-Link

Simple integration into the automation or IT level



The following communication options are available for connecting SIMATIC MV400/MV500 optical readers to the automation or IT level:

- Direct connection to PROFINET (via FB79)
- Direct connection to Ethernet (TCP/IP native)
- Direct serial connection via RS232 or to RS422 with an interface converter
- Connection to PROFIBUS and PROFINET, TCP/IP-XML and IO-Link via communication modules. It is also possible to combine an optical reader and an RFID reader on the same communication module.

Convenient function blocks are available for end-to-end integration into STEP 7. The web-based user interface permits simple parameter assignment and monitoring without additional installation effort.