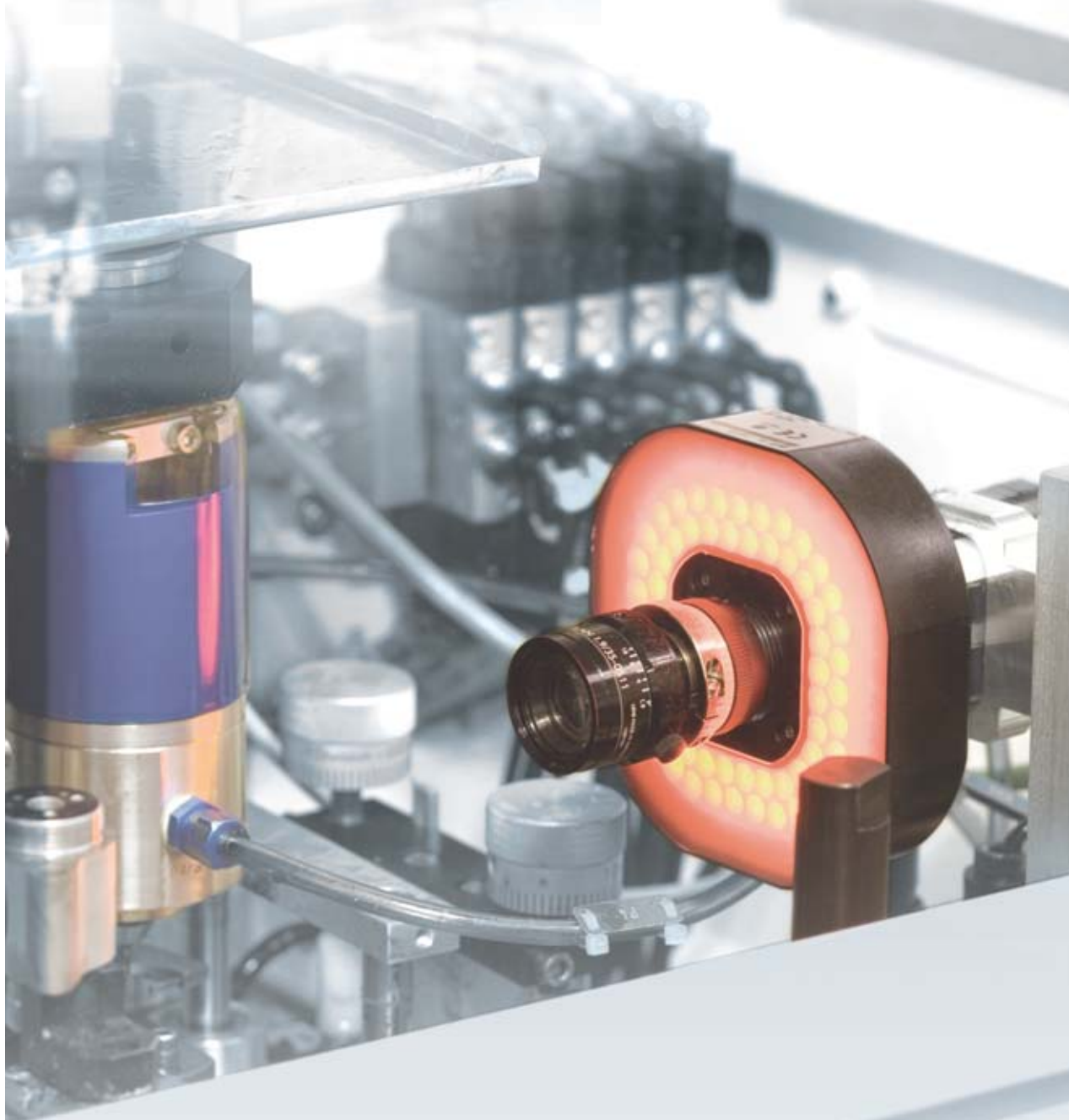


# Machine Vision Systems SIMATIC MV

for quality assurance and increased productivity

Technical Brochure · April 2008



## SIMATIC Sensors

[www.siemens.com/simatic-sensors/mv](http://www.siemens.com/simatic-sensors/mv)

**SIEMENS**

# Machine Vision Systems

for quality assurance and increased productivity

**Productive manufacturing processes have to be flexible. Batch sizes are getting smaller, cycles faster and quality requirements ever more stringent. Conventional inspection techniques are at their limits here. This is not the case with industrial image processing. Thanks to its enormous potential, it is becoming a standard discipline in automation engineering – especially since intelligent vision systems have made them easier to use.**

A broad spectrum is available for all fields of application – from code reading systems for 1D/2D codes, vision sensors for application-specific machine vision, intelligent cameras for universal applications through to PC-based machine vision systems for extremely fast applications using several cameras.

## Highlights

- Quality assurance
  - Fewer rejects
  - Automatic visual inspection objective, fast, and reliable: Checks dimensions, shapes, and detects whether parts are missing, checks correct mounting, position and completeness of parts, which can even be microscopically small (e.g. chip structures)
- Increased productivity
  - Automatic component recognition: The components are assigned to different pre-defined categories on the basis of shape, dimension, patterns, codes and markings
  - Even suitable for use at high clock-pulse rates



## NERLITE – precise lighting for image processing

The better the lighting solution the better your machine vision system will work. Precise, reliable and repeatable performance means greater productivity at lower costs. Thanks to innovative NERLITE lighting products, machine vision and auto-ID systems work reliably in simple as well as complex applications

Our NERLITE product range includes:

- Area arrays, spot lights, linear arrays, ring lights or dome illuminators
- Backlight and dark-field illuminators
- DOAL & COAL (Diffuse On-Axis Light & Collimated On-Axis Light) lights
- SCDI (Square Continuous Diffuse Illuminator)
- CDI (Continuous Diffuse Illuminator)
- MAXlite – Multi-axis lights and customer-specific solutions for OEMs

## Highlights

- Cost-effective: Complete lighting solutions offer savings in the areas of research and installation
- Turnkey: Standard solutions for hundreds of applications
- Proven: Thousand of NERLITE lighting solutions find application on a worldwide basis
- Modular and compact: Saves installation effort and space in the machine
- Reliable: Durable, minimal service, LED-based design and worldwide support



## Portfolio overview

### Code reading systems – Flexible reading and verification of 1D/2D codes

Stationary code reading systems, hand-held reading systems, sector-specific code reading systems and verification systems are available for reading and verifying 1D/2D codes (e.g. barcode, data matrix code). Reading and verifying of codes located on directly marked parts (Direct Part Marking) is also possible with these reading systems.



### Vision Sensors – Simple and intelligent

The intelligent vision sensors of the SIMATIC VS100 series as well as the SIMATIC MV220 color mark sensor and the SIMATIC MV230 surface profile sensor are specially designed for application-specific image processing.

The product line impresses customers by a simple operating concept and easy teaching of the inspection tasks.



### Intelligent cameras – For universal applications

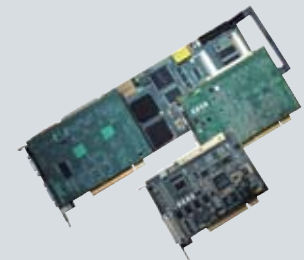
These general-purpose image processing systems are ideal for flexible manufacturing. They allow the user to keep an eye on the production process for reliable round-the-clock production. The intelligent cameras offer scalability for different inspection tasks, analysis rates, resolutions, applications with monochrome or color recognition – the perfect image processing solution for every sector.



### Vision systems – Quality inspection at maximum speed

Constantly increasing production speeds, identification of smaller and smaller faults, inspection of complex objects or inspection from several perspectives place more and more stringent demands on today's image processing systems. This is where the SIMATIC Visionscape product line comes in, designed for extremely high-speed applications requiring several cameras and/or powerful image processing.

The powerful SIMATIC Visionscape software with an extensive range of proven image processing tools and the graphic user interface support the simple and quick implementation of PC-based image processing applications, e.g. with SIMATIC PC.



# Code reading systems

## Marking – verifying – reading – communication (MVRC)

Four key elements are required for implementing DPM traceability: Marking, verification, reading and communication – MVRC. Siemens covers all four key elements with a variety of products, 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 following steps can be controlled using the product identity. Marks are often applied to parts with a method called *Direct Part Marking (DPM)*.

### Verification

By using verification systems, the readability of marks is ensured throughout the entire production process regardless of any possible contamination or when using different read devices. Moreover, the marking can continue to be read after the production process throughout the lifespan of the product.

For example, the SIMATIC HawkEye 1500 series provides the capability to monitor marks in real-time with its DPM verification options. Measuring the code quality results in cost advantages due to marking cycle time optimization, the prevention of plant downtimes and the prevention of additional handling overhead. The Vision Sensor VS130-2 can also measure code quality according to the AIM standard.

### Reading

If ease of use and safe function are the priorities, then the reading devices must have a high degree of flexibility regarding design, interfaces, etc. to satisfy the various sector-specific requirements. In this area, the SIMATIC range with the compact HawkEye 1500 series, the Vision Sensor VS130-2 with separate sensor head and the HawkEye hand-held readers are the ideal choice.

### Communication

For communication between reading device and process control, the reading devices have different interfaces such as PROFIBUS, PROFINET, Ethernet, RS232 as well as expanded digital inputs and outputs as standard features. These interfaces not only ensure fast and secure transmission of the trigger signal to start the read process but they also ensure fast and reliable transmission of the reading results.

#### MVRC means:

- **Marking:**  
Placing the code directly on the object (DPM)
- **Verifying:**  
Checking the quality of the marks on the object
- **Reading:**  
Reading the mark in production or when servicing
- **Communication:**  
Visualizing and interpreting the reading results

#### What is Direct Part Marking (DPM) ?

Direct Part Marking (DPM) refers to the application of a mark directly on 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 to trace them after delivery as well. With 2D codes a coding method is available that meets these user requirements. 2D codes consist of easy to implement, point-shaped basic elements. Laser and needle marking technologies are outstanding regarding durability, marking speed and material independence. For example, because of mechanical deformation, 2D codes can still be read after multiple processing steps on metallic work pieces. 2D codes also provide the advantage of being able to encode data in more limited spaces than with comparable barcodes or plain text.



## Flexible reading and verification of 1D/2D codes

For state-of-the-art production systems, tracing products and parts with machine-readable identification is a central requirement. A unique coding system permits the planning of each and every step of production for every part manufactured and changes within the production process or in the materials used can be documented. Direct marking of products also allows the implementation of specified legal requirements for tracing production batches throughout the production system.

Marking plays an important role not only in the production process, but also for liability issues, for example. Other special applications, e.g. military inventories, are covered by other products (UID).

### Highlights

- Unique identification of products or product parts – Direct Part Marking is the key technology for tracing products
- Part-specific documentation of the production process
- Automation of the manufacturing process
- Verification for product liability cases (e.g. recall actions)

### Stationary code reading systems

The stationary code reading systems either consist of high-performance read devices or a PC-based code reading system. The devices read various two-dimensional (2D) codes as well as one-dimensional (1D) barcodes. The PC-based system is a fast, powerful code reading system for various two-dimensional (2D) codes, one-dimensional (1D) barcodes, and OCR (text recognition). Many readers, including the PC-based code reading system, use data matrix print-quality monitoring (verification) of the codes for process control.



### Hand-held reading systems

These hand-held reading systems are powerful, high-resolution read devices for either two-dimensional (2D) data matrix codes and/or one-dimensional bar codes (1D). The devices can communicate with a host computer using RS232, USB, PS2 and Bluetooth depending on the selected variant.



### Verification systems

By using verification systems, the readability of marks is ensured throughout the entire production process regardless of any possible contamination or when using different read devices. Moreover, the marking can continue to be read after the production process throughout the lifespan of the product. Verification systems also make it possible to increase or optimize the marking speed because readability is constantly verified.



# Code reading systems

## Stationary code reading systems overview

The stationary code reading systems are powerful, intelligent reading devices for many different two-dimensional (2D) codes and one-dimensional (1D) barcodes. They can read printed, laser-inscribed, drilled, stamped or needled codes on many different surfaces. Reading the codes is possible on moving and stationary parts, regardless of the orientation of the object (360°).

### Application areas

- Automotive industry
  - Marks on various power train components (cylinder heads, cylinder blocks, manifolds, etc.)
  - Laser marks on various power train components (cam shafts, crankshafts, pistons, piston rods, gearbox components, etc.)
  - Laser marks on electronic components, PCBs or enclosures
- Aerospace industry
  - Marks on gas turbine blades or on different aluminum driving gear components, e.g. to protect against counterfeit parts
- Medical devices
  - Laser marks on pacemakers and other implantable devices, e.g. to protect against counterfeits
  - Laser marks on various medical equipment components and enclosures
- Electronics
  - Laser marks on PCBs, parts or components
- Semiconductors
  - Laser marks on enclosed semiconductor components, heat sinks or heat dissipaters

### SIMATIC DMx AutoID+ PC-based code reading system

SIMATIC DMx AutoID+ is a fast, high-performance code reading system for various two-dimensional (2D) codes, one-dimensional (1D) barcodes and OCR (text recognition). It has a built-in verification option for all data matrix symbols which is used for analyzing all important code parameters from each individual data matrix code in real time.

Fast image processing and a software interface for Windows 2000/XP makes DMx AutoID+ a system that is flexible, powerful, and still easy to operate, ideal for any application in which a PC is used.

### Highlights

- Fast, powerful code reading system for various two-dimensional (2D) codes, one-dimensional (1D) barcodes, and OCR (text recognition).
- Up to 1800 reads per minute in high-resolution mode, and even faster in low-resolution mode
- Reads multiple symbols in the same field of view
- Supports up to four cameras individually, triggered or synchronously triggered, via I/O board, with flash-light output
- Real-time verification of the data matrix symbols
- Screen display and data display for each camera input



## SIMATIC HawkEye 1500

The SIMATIC HawkEye 1500 devices are powerful, stationary read devices for data matrix codes and barcodes. The special format in the size of an intelligent camera makes the HawkEye 1500 the perfect replacement for a barcode scanner. Uncomplicated setup and the advanced programming capabilities ensure user-friendliness and universal application at the same time.

### Highlights

- Compact configuration for easy integration in plants
- Universally usable
- Unique direct part mark verification options for in-process mark quality monitoring.
- Automatic photometry and automatic training for accommodating a wide variety of parts without any parameter adjustments or programming
- Powerful graphical user interface (GUI) for advanced setup and remote monitoring of several readers
- Extended saved image diagnostics for highest possible read rates
- QuicSet function: audio-visual alignment for fast startup without PC

## SIMATIC VS130-2

The SIMATIC VS130-2 code reading system was developed especially for reading data matrix codes (DMC) ECC200 and various 1D/2D codes in an industrial environment. The complete package comprises lighting, evaluation unit, sensor and cables. They are installed and commissioned with a flick of the wrist. They are so easy to operate that no training is necessary and the system is "trained" instead of programmed, so even untrained personnel can use it instantly. Thanks to standardized interfaces, the systems can be flexibly integrated into the plant automation. For simple conveyor units, a stand-alone solution is available without an additional PLC.

### Highlights

- Separate lighting unit for extended reading distances
- PROFIBUS, Ethernet and DI/DO on board; PROFINET I/O functionality
- Web-based user interface
- Commissioning without software installation on the PC
- Web-based remote maintenance concept
- Integrated error image memory
- Access protection with password.

## Stationary code reading systems

|                                    | HawkEye 1500  | VS130-2   |
|------------------------------------|---|---|
|                                    |  |                      |
| <b>Enclosure</b>                   | Compact (IP40) with integrated lighting   | Modular (sensor head and lamps), IP65   |
| <b>Commissioning and operation</b> | Setup software, QuicSet, alignment tools, language: E                               | Integrated web server, on-board operator controls, auto-optimizing of parameters, languages: E/G/F/I/S/CH |
| <b>Communication</b>               | Ethernet (ASCII), RS232   | PROFIBUS, PROFINET, Ethernet  |
| <b>Verification standards</b>      | AIM, Siemens-DPM-Verification   | AIM   |

# Code reading systems

## Hand-held reading systems overview

### SIMATIC HawkEye 40/40T

- Hand-held reading devices that are powerful and suitable for high resolutions
- Reading (2D) data matrix codes and barcodes (1D)
- Complex image processing functions and lighting technology to read codes on many different surfaces
- HawkEye 40 is suitable for labels with high contrasts
- SIMATIC HawkEye 40T is designed for codes with low contrasts, such as are made by dot peen, laser printers or inkjet printers
- Versatile interfaces: RS232, USB, PS2 and Bluetooth
- The HawkEye 40T is also certified as a "Department of Defense Unique Identifier (UID) String Validator"



### SIMATIC HawkEye 45/45T

- Hand-held reading devices with display for read data and settings
- Reads large linear and highly compressed data matrix codes as well as barcodes without any time delay
- Continuous adaptation of resolution, lighting and image field to any code and to the scanned surface, the size of the characters, and to the ambient light
- High reading speed when decoding data matrix symbols
- HawkEye 45 is suitable for labels with high contrasts
- SIMATIC HawkEye 45T is designed for codes with lower contrasts, such as are made by dot peen, laser printers or inkjet printers
- Versatile interfaces: RS232, USB, PS2 and Bluetooth
- The HawkEye 45T is also certified as a "Department of Defense Unique Identifier (UID) String Validator"



### SIMATIC HawkEye 50T/51T

- Powerful, high-resolution reading devices for detecting low-contrast two-dimensional (2D) direct-part-mark (DPM) data matrix codes
- Reading codes that e.g. are applied by lasers, print or needles on a wide variety of surfaces
- Contact or near-contact readers
- The LytePype lighting system enables increased reading power and reading speed for data matrix codes
- Connectable via USB or RS232
- Models with ESD protection: Suitable for applications in environments that react with sensitivity to electrostatic discharge



### SIMATIC HawkEye 52T/53T

- Powerful, high-resolution read devices for detecting low-contrast two-dimensional (2D) direct-part-mark (DPM) data matrix codes and larger barcodes (1D)
- Reads symbols that are applied with lasers and inkjet on many different surfaces, as well as barcodes with the built-in laser scanner
- Contact or near-contact readers
- The LytePype lighting system enables increased reading power and reading speed for data matrix codes
- The user can switch over between DPM and barcode reading
- Easily connectable to RS232



| SIMATIC HawkEye hand-held reading systems |   |   |  |  |
|---|---|---|--|--|
|   | HawkEye 40/45   | HawkEye 40T/45T   | HawkEye 50T/51T  | HawkEye 52T/53T  |
| <b>Operating range</b>                    |   |   |  |  |
| ■ Minimum (code-dependent)                | 50 mm (1.9")  | 50 mm (1.9")  | HawkEye 50T: 0 mm (0")<br>HawkEye 51T: 3 mm (0.125")   | 0 mm (0")  |
| ■ Maximum (code-dependent)                | 375 mm (14.8")  | 375 mm (14.8")  | HawkEye 50T: 25 mm (1")<br>HawkEye 51T: 51 mm (2")   | 51 mm (2")   |
| <b>Image field</b>                        |   |   |  |  |
| ■ Near                                    | 25 mm x 15 mm (0.98" x 0.6")<br>at 50 mm (1.9") distance  | 25 mm x 15 mm (0.98" x 0.6")<br>at 50 mm (1.9") distance                      | HawkEye 50T:<br>13 mm x 13 mm (0.5" x 0.5")<br>with contact<br>HawkEye 51T:<br>19 mm x 19 mm (0.75" x 0.75")<br>at 3 mm (0.125") distance        | HawkEye 52T:<br>24 mm x 24 mm (0.95" x 0.95")<br><br>HawkEye 53T:<br>19 mm x 19 mm (0.75" x 0.75") |
| ■ Far                                     | 150 mm x 90 mm (5.9" x 3.5")<br>at 375 mm (14.8") distance  | 150 mm x 90 mm (5.9" x 3.5")<br>at 375 mm (14.8") distance                    | HawkEye 50T:<br>19 mm x 19 mm (0.75" x 0.75")<br>at 25 mm (1") distance<br>HawkEye 51T:<br>36 mm x 36 mm (1.4" x 1.4")<br>at 51 mm (2") distance | HawkEye 52T:<br>43 mm x 43 mm (1.7" x 1.7")<br><br>HawkEye 53T:<br>28 mm x 28 mm (1.1" x 1.1")     |
| <b>Decoding capability</b>                |   |   |  |  |
| ■ 1D                                      | Code 128, Code 39, Code 93, Int 2 of 5, Codabar, UPC/EAN/JAN, RSS, Composite, Postal, Codablock F, Code 11, Matrix 2 of 5, MSI Plessey, NEC 2 of 5, Pharmacode, Telepen | Code 39, Code 128, Codabar, Code 93, I2of5, UPC/EAN, UPC-E, UPC Supplementals | –  | Code 39, Code 93, Code 128, UPC/EAN/JAN/SUP, I2of5   |
| ■ 2D                                      | Data Matrix, PDF417, Micro PDF 417, QR Code, MicroQR Code, Maxicode, Aztec, GoCode  | Data Matrix, PDF417, QR Code  | 2D codes   | Data matrix  |
| <b>Code generation</b>                    | Laser, print  | Laser, print or needles   | Laser, print or needles  | Laser, print or needles  |
| <b>Interfaces</b>                         | USB, RS232, PS2, Bluetooth Class 1 (90 m, 300 ft)   | USB, RS232, PS2, Bluetooth Class 1 (90 m, 300 ft)                             | USB, RS232   | RS232  |

## Applications

Applications of the hand-held reading systems include industrial and commercial applications in which individual parts must be identified/localized and in which the part is identifiable through a hand-held reader for data matrix codes or barcodes.



This applies for a wide range of applications in many industries:

- Automotive industry:  
Identification of various power train components (e.g cylinder heads, cylinder blocks, manifolds, etc.)
- Aerospace industry:  
e.g. codes on turbine blades
- Medical devices:  
e.g. laser marks on a wide variety of medical components and enclosures
- Electronics industry  
e.g. laser marks on hard disks, PCBs, and other components.

# Code reading systems

## Verification systems overview

By using verification systems, the readability of marks is ensured throughout the entire production process regardless of any possible contamination or when using different reading devices. Moreover, the marking can continue to be read after the production process throughout the lifespan of the product.

For example, the SIMATIC HawkEye 1500 series provides the capability to monitor marks in real-time with its DPM verification options. Measuring code quality generates cost advantages through optimization of cycle times in the marking process, prevention of plant stoppage or avoidance of additional handling expense. The VS130-2 Vision Sensor likewise has a function for measuring the code quality in accordance with the AIM standard.

### HawkEye Direct Part Mark Verifier

SIMATIC HawkEye Direct Part Mark (DPM) Verifier assures the quality of data matrix codes on directly marked parts. This involves a software option for the cameras of the SIMATIC HawkEye 1500 series. Siemens Direct Part Marking (DPM) technology is utilized here. Thus a 100% check for DPMs can be executed and the marking system can be set correctly before illegible marks are applied to the parts.

### Highlights

- Wide application range through support of the following verification standards: Siemens DPM, AS9132, ISO 15415 and ISO 16022 (AIM)
- Unique SIEMENS DPM quality measurements overcome the limitations of other verification standards.
- Integrated (A/B/C/D/F) grading levels enable easy interpretation of results.
- User-configurable good/fair/poor quality alarm ranges for each measurement
- Direct connection to a PLC or stack lights through on-board I/O
- Graphic interface for advanced setup and in-line monitoring of the verification results and output of statistics.



## SIMATIC DMx Verifier+

SIMATIC DMx Verifier+ is a data matrix verification system that supplies data on the code quality. DMx Verifier+ verifies printed, etched, lasered, or data matrix codes printed with ink jet on paper, metal, plastic and many other materials.

The DMx Verifier+ is a software package that is used together with half-length PCI modules. The PCI module is connected with external cameras via cables. Up to four cameras can be connected with the PCI card.

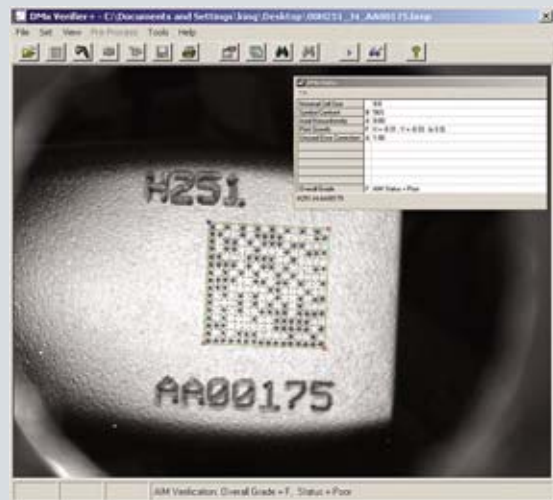
High-performance testing systems are possible with this system. By adding an optional, external I/O module, the functionality can be expanded and the system can be integrated into an automated system.

### Applications

- Pharmaceutical labels verification (in accordance with FDA)
- Identification and serialization of small parts
- Part tracing in difficult environments
- Anti-counterfeit/permanent identification of parts
- Verification and reading, even at low contrast

### Highlights

- Verifies data matrix codes, based on the standards AIM / ISO 16022, IAQG / AS9132, ISO 15415, AIM DPM and Siemens DPM Verification (parameters such as symbol contrast, print growth<sup>1)</sup>, axial deviations, unused error correction, etc.)
- Flexible, user-friendly button operation, optional high-resolution camera and lens, stand, decoder/analyzer, printer and special light source
- Graphic display of the measured parameters
- Reports element resolution used for analysis, cell placement errors, cell size variations, and overall matching
- Interchangeable Siemens light sources and lenses available to meet all application requirements
- Provides summary and detailed analysis reports, both on screen and as hard copy
- Enables development of quality control and assurance programs



<sup>1)</sup> The size ratio of black cells to white cells should ideally be 1:1. If the black cells increase in size, due to bad printing, readability is impaired. This effect is referred to as print growth.

# Vision Sensors

## User-friendly and intelligent

### SIMATIC MV220 color area sensor

The SIMATIC MV220 compact color area sensor is a complete image processing system for automatic inspection of colored objects. It is optimized for use under harsh industrial conditions thanks to degree of protection IP65, and is used for applications in manufacturing, the packaging industry, and food and beverages industry. It is integrated in the plant automation using digital inputs and outputs.

- Optimized for use under harsh industrial conditions thanks to degree of protection IP65
- High-speed procedures can be controlled thanks to the short inspection time of the sensor (approx. 30 inspections per second)
- Fast changeover thanks to easy model switchover
  - 16 inspection models can be taught
  - The inspection models are switched over by means of digital inputs
- Flexible adaptation to the application is possible
  - Flexible adjustment of image window and reading distance
  - Flexible adjustment of parameters
- Fast commissioning
  - No image processing knowledge necessary
  - No programming necessary



### SIMATIC MV230 height profile sensor

The compact SIMATIC MV230 height profile sensor is a complete image processing system for automatic inspection of objects based on their height contour and/or surface profile. Thanks to degree of protection IP65 it is eminently suited for use in harsh industrial environments and is used for applications in the manufacturing industry, packaging industry and food and beverages industry. It is integrated in the plant automation using digital inputs and outputs.

- Optimized for use under harsh industrial conditions thanks to degree of protection IP65
- Shielding against ambient light is not usually necessary due to its high degree of immunity to ambient light
- Fast changeover thanks to easy model switchover
  - 16 inspection models can be taught
  - The inspection models are switched over by means of digital inputs
- Flexible adaptation to the application is possible
  - Flexible adjustment of the laser line range that can be evaluated
  - Flexible adjustment of parameters
- Fast commissioning
  - No image processing knowledge necessary
  - No programming necessary



## SIMATIC VS100 Vision Sensors

Our intelligent VS100 vision sensors are the perfect choice for checking small components for shape, type or position. The complete package comprises lighting, processing unit, sensor and cables. They are installed and commissioned with a flick of the wrist. No training is required for operation, the system is "trained" instead of programmed. The compact design enables implementation in a wide variety of infeed systems such as vibratory conveyors, conveyor belts, or grippers. Thanks to standardized interfaces, the vision sensors can be flexibly integrated into the plant automation. For simple conveyor units, a stand-alone solution is available without an additional PLC.

- Extremely easy operation
- Special image processing expertise is not required
- The system is commissioned by teaching it, not programming it
- Simple connection with PROFIBUS DP/PROFINET or serial interface
- WinCC integration
- Remote diagnostics



# Vision Sensors

## Functionality overview

|  |  |   |
|--|--|---|
| <b>Object inspection with SIMATIC MV220</b>  |  |   |
| <ul style="list-style-type: none"> <li>■ Inspection task</li> <li>■ Applications</li> <li>■ Type of parts to be inspected</li> </ul> | <p>Color inspection tasks in manufacturing and assembly systems</p> <p>Manufacturing, packaging industry and food and beverages industry</p> <p>e.g. completeness of colored parts, blister packs, cups, bottles, labels and covers.</p>   |    |
| <b>Object inspection with SIMATIC MV230</b>  |  |   |
| <ul style="list-style-type: none"> <li>■ Inspection task</li> <li>■ Applications</li> <li>■ Type of parts to be inspected</li> </ul> | <p>Inspection of surface contours and profiles in manufacturing and assembly</p> <p>Manufacturing, the packaging industry and mechanical engineering</p> <p>Inspection, parts recognition and position checking of parts based on their geometric surface contour or profile</p>   |    |
| <b>Form inspection with SIMATIC VS110</b>  |  |   |
| <ul style="list-style-type: none"> <li>■ Inspection task</li> <li>■ Applications</li> <li>■ Type of parts to be inspected</li> </ul> | <p>Correct or defective part and checking of infeed direction</p> <p>Vibrating conveyors, conveyor belts, workpiece holder carousels, gripper units</p> <p>e.g. screws, bolts, molded parts, pharmaceutical products, confectionery, etc.</p>  |  |
| <b>Object inspection with SIMATIC VS120</b>  |  |   |
| <ul style="list-style-type: none"> <li>■ Inspection task</li> <li>■ Applications</li> <li>■ Type of parts to be inspected</li> </ul> | <p>Correctness, lack of damage and position of a part or pattern; position of the part with x/y coordinates and angle of rotation in degrees, presence inspection</p> <p>Conveyor belts, workpiece holder carousels, gripper units, production machines</p> <p>e.g. screws, bolts, molded parts, pharmaceutical products, confectionery, logos, patterns, etc.</p> |  |

## The technology at a glance

| Vision Sensors                                      |   |   |  |  |
|---|---|---|--|--|
| Vision Sensors                                      | MV220   | MV230   | VS110  | VS120  |
| <b>Sensor type</b>                                  | CMOS sensor (color),<br>640 x 480 pixels  | CMOS sensor (color),<br>750 x 480 pixels                              | CCD chip,<br>640 x 480 quadratic pixels  | CCD chip,<br>640 x 480 quadratic pixels  |
| <b>Image capture</b>                                | Digital, max. 33 frames/second  | Digital, 20 frames/second   | Digital, max. 58 frames/second   | Triggered frame transfer   |
| <b>Sensor head type</b>                             | Variable display field size   | Fixed display field size  | 2 x fixed focus<br>(fixed display field size)  | 2 x fixed focus with fixed display<br>field size,<br>1 x C/CS mount with<br>variable display field size  |
| ■ Available versions                                | Complete system   |   |  |  |
| ■ Enclosure   | see below   | see below   | Extruded aluminum enclosure  | Extruded aluminum enclosure  |
| ■ Degree of protection                              | IP65  | IP65  | IP65   | IP65   |
| <b>Parts size (W x H)</b>                           | Display field size (infinitely)<br>adjustable<br>- For object distance of 50 mm:<br>Display field size 40 x 30 mm<br>- For object distance of 250 mm:<br>Display field size<br>200 x 150 mm | - For object distance of 310<br>mm:<br>Display field size 75 x 100 mm | - Objects up to 59 mm x 45 mm,<br>inspection window: 70 mm x<br>50 mm<br>- Objects up to 35 mm x 25 mm,<br>inspection window: 40 mm x<br>30 mm | - Objects up to 60 mm x 40 mm,<br>inspection window:<br>70 mm x 50 mm<br>- Objects up to 34 mm x 24 mm,<br>inspection window:<br>40 mm x 30 mm<br>- Variable size of object with<br>C/CS mount |
| <b>Environment</b>                                  | 0 ... 45 °C, no condensation  |   | 0 ... 50 °C, without fan   |  |
| Lighting  |   |   |  |  |
| ■ Illuminant  | Integrated white LEDs   | Laser diode, red light  | Infrared LEDs  | Red LEDs   |
| ■ Enclosure   | see below   | see below   | Metal with plastic<br>diffusing panel  | Plastic ring light with<br>plastic diffusing panel   |
| ■ Degree of protection                              | IP65  | IP65  | IP40   | IP65   |
| Processing unit                                     |   |   |  |  |
| ■ Operator controls                                 | 4-character text display with<br>4 operator buttons   | Input keys  | LCD display panel (4 lines/10 characters) and 6 operator<br>buttons for menu operation   |  |
| ■ Number of types to be<br>saved                    | up to 16  | up to 16  | up to 15   | up to 64   |
| ■ Inspection triggering                             | External  | External or internal<br>freewheeling trigger                          | External or automatic  | External   |
| ■ Permissible parts rate                            | 33 inspections/s  | 20 inspections/s  | 25 items/s   | 20 items/s (object-dependent)  |
| ■ Infeed direction<br>- For automatic<br>triggering | Any for external triggering<br>–  | Any   | From left to right<br>or vice-versa  | –  |
| <b>Enclosure<br/>(degree of protection)</b>         | Plastic, aluminum (IP65)  |   | Plastic, suitable for cabinet-free installation (IP40)   |  |
| Interfaces on processing unit                       |   |   |  |  |
| ■ Digital inputs for 24 V<br>DC                     | 6 (of which 1 trigger input)  |   | 8 (of which 1 trigger input)   |  |
| ■ Digital outputs<br>for 24 V DC                    | 5   | 4   | 6 (including 3 x 0.5 A)  |  |
| ■ Integrated interface                              | –   | –   | RS232  | PROFIBUS DP / Ethernet /<br>PROFINET IO  |
| ■ Sensor head                                       | –   | –   | Digital interface  |  |
| ■ Supply voltage                                    | 24 V DC   | 24 V DC   | 24 V DC  | 24 V DC  |
| <b>Power consumption<br/>max.</b>                   | 2 A   | 2 A   | 2.5 A  | 4 A  |

# Intelligent cameras

## For universal use

100% quality control in manufacturing reduces costs and ensures a high level of customer satisfaction. Intelligent cameras play an important part in achieving this goal.

Individual requirements and demanding tasks can be resolved easily and cleverly with the versatile and universally implementable intelligent cameras of the SIMATIC VS720 and SIMATIC HawkEye 1600T series. All the main functions, such as image capture, image processing, provision of results and communication are combined in a compact housing. These cameras are ideally suited for applications in which several inspection tasks must be performed in a single test cycle.

The cameras are characterized by a high degree of accuracy and can be integrated seamlessly into the manufacturing process through their fast program execution. Thanks to their high-performance hardware architecture, they can directly evaluate the captured images in accordance with the selectable test program.

A broad spectrum of intelligent cameras is available for satisfying the wide range of different requirements in the areas of automatic inspection, quality monitoring or component recognition.

With the device series SIMATIC VS720 and SIMATIC HawkEye 1600T, your production area is securely under observation round-the-clock and your manufacturing process is firmly under control thanks to a 100% quality check.

### Applications

- Automotive industry
- Electrical engineering
- Semiconductor industry
- Food and beverages industry
- Packaging industry
- Pharmaceuticals
- Mechanical engineering
- Printing industry

### Highlights

- Performs several inspection tasks in one inspection cycle
- Stand-alone operation or integration in flexible factory automation environments is possible
- All-in-one enclosure for image capture, image processing and communication interface
- Simple and fast operation through assignment of parameters
- High-performance online and offline configuration
- Visualization of live/warning/error images, frame/detail and result tables

### SIMATIC VS72xA series

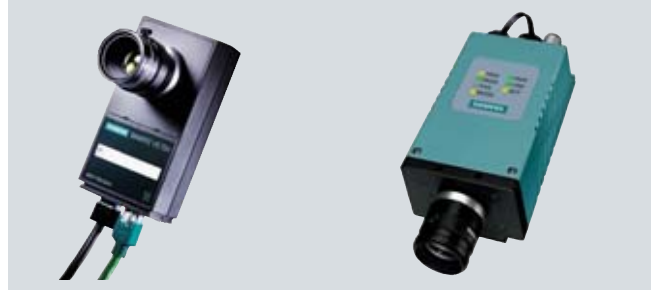
- WinCC flexible and WinCC integration with HMI Controls
- Variants are available in a stainless steel version (with a high degree of protection IP68)
- PROFINET IO Communication
- PROFIBUS DP Communication with VS Link PROFIBUS

### SIMATIC HawkEye 1600T series:

- Rugged metal enclosure with degree of protection IP67
- Intellifind high-performance object locating tool.

SIMATIC VS72xA series

SIMATIC HawkEye 1600T series



It depends on the inspection task

| SIMATIC VS72x und HawkEye 1600T intelligent cameras  |  | VS721A | VS722A | VS723A<br>VS723-S | VS724A<br>VS724-S | VS725 | VS726A<br>VS725-S | HawkEye<br>1600T |
|--|--|--------|--------|-------------------|-------------------|-------|-------------------|------------------|
| <input type="checkbox"/> Complex inspection, high speed<br>   |  |        |        | •                 | •                 |       | •                 | •                |
| <input type="checkbox"/> Check for completeness<br>           |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Shape inspection<br>                 |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Pattern comparison<br>              |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Measurement<br>                    |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Position/angle detection<br>       |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Plain text reading, comparison<br> |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> 1D/2D code reading<br>             |  | •      | •      | •                 | •                 | •     | •                 | •                |
| <input type="checkbox"/> Color recognition<br>              |  |        |        |                   |                   | •     | •                 |                  |

# Intelligent cameras

## SIMATIC HawkEye 1600T series – for a broad range of applications

The SIMATIC HawkEye 1600T is an intelligent camera that combines compact dimensions with a broad range of applications and the high degree of flexibility of the proven Visionscape machine vision toolkit.

Suitable for a variety of image processing applications, the HawkEye 1600T makes a cost-effective, easy-to-implement solution available to users for quality control, process control, identification and tracing of parts on their production lines.

### Models

- SIMATIC HawkEye 1610TS VGA without Intellifind
- SIMATIC HawkEye 1610TIS VGA with Intellifind
- SIMATIC HawkEye 1610TH XGA without Intellifind
- SIMATIC HawkEye 1610TIH XGA with Intellifind

### Typical applications

- Assembly verification (automotive industry, medical equipment)
- Inspecting print quality (e.g. packaging)
- Quality inspection of packages
- Presence/absence check of components (electronics industry)
- Object locating (mechanical engineering)
- Part identification (e.g. automotive industry)

### Configuration

The SIMATIC Visionscape software offers a variety of image processing tools and a powerful graphic user interface and thus supports creation and implementation of applications in intelligent cameras and PC-based systems.

The *Visionscape Toolset* contains powerful tools for image transformation and analysis, including the Intellifind pattern recognition tool, high-level tools for character verification (OCR and OCV) and tools for reading and verifying 1D and 2D codes.

### Highlights

- Compact, intelligent camera for SIMATIC Visionscape
- Rugged and suitable for industry: degree of protection IP67 and M12 connector
- Fast and simple application creation with SIMATIC Visionscape – including Intellifind, OCR and OCV
- Inspection of up to 3600 parts per minute
- Versatile interfaces: Ethernet, RS232, eight digital and configurable inputs/outputs
- Different lighting components can be directly connected to the camera and can be directly triggered.



## SIMATIC HawkEye 1600T series – technology overview

| SIMATIC HawkEye 1600T intelligent cameras     |  |   |
|---|--|---|
| Type  | SIMATIC HawkEye 1610TS<br>SIMATIC HawkEye 1610TIS  | SIMATIC HawkEye 1610TH<br>SIMATIC HawkEye 1610TIH |
| Processor                                     | High-performance RISC processor with integrated Floating Point Unit (FPU)  |   |
| Memory  | 16 MB non-volatile flash memory/64 MB SDRAM  |   |
| Image capture                                 | Progressive scan, full frame and partial frame   |   |
| Repetition frequency                          | 60 full-frame images per second  | 30 full-frame images per second                   |
| Image resolution                              | VGA<br>640 x 480 pixels  | XGA<br>1024 x 768 pixels                          |
| Sensor  | 1/3 inch CCD   |   |
| Additional image processing modes             | Half frame, quarter frame, binned half frame   |   |
| Exposure time                                 | 64 µs to 50 ms   |   |
| Lens  | C-Mount  |   |
| I/O   | 1 permanently assigned input for image capture trigger, 3 permanently assigned outputs (50 mA), 4 universal inputs/outputs (selectable through software) (20 mA) – all optically isolated, 24 V DC |   |
| Power supply and control signals for lighting | One supply connection for lighting (12 V, 300 mA), one permanently assigned flash output (strobe)  |   |
| Standards and approvals                       | CE and ROHS  |   |
| Communication                                 | Ethernet 10/100 MB; supports TCP/IP, DHCP, APIPA and static IP address<br>Serial RS232-software flow control   |   |
| Gain and offset                               | Automatic or manual – software controllable  |   |
| Enclosure                                     | Rugged two-part cast-alloy housing   |   |
| Degree of protection                          | IP67 with M12 plugs and sockets – lens protection available as an option   |   |
| Power consumption                             | 24 V at 300 mA (7 W)<br>Supply voltage 20.4 ... 28.8 V   |   |
| <b>Ambient temperatures</b>                   |  |   |
| ■ Operating temperature                       | 0 °C ... 50 °C   |   |
| ■ Storage temperature                         | -10 °C ... 70 °C   |   |
| ■ Humidity                                    | 10 ... 95% non-condensing  |   |
| Accessories                                   | Lens, directly supplied lighting, lens holders, cable, camera holders, etc.  |   |
| Indicator lights                              | Trigger, Pass, Fail, Mode, Power, Link, Activity   |   |

# Intelligent cameras

## SIMATIC VS720A series – for universal use

The SIMATIC VS720A series enables you to monitor production round the clock and keep your production process firmly under control. A wide range of intelligent cameras is available to suit the different requirements in the fields of automatic inspection, quality checking, production monitoring or parts recognition.

Individual requirements and demanding tasks can be solved with particular ease and efficiency using the smart, universally implementable, intelligent cameras of the SIMATIC VS720A series.

All the important functions such as image capture, image processing, preparation of results and communication are combined in a compact housing. They are ideal when several inspection tasks must be performed in an inspection cycle.

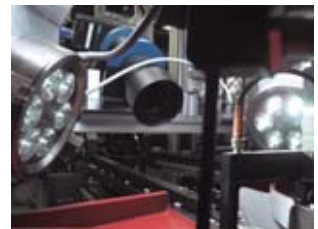
The cameras are characterized by their precision and fast response. The different camera types offer scalable performance, resolution, color and monochrome image processing. Thanks to their fast, high-performance hardware architecture, they can directly evaluate the captured images in accordance with the memory-resident inspection program.

### Flexible communication options – through to PROFINET IO

Apart from the well-proven PROFIBUS DP communication, all VS720A cameras also offer PROFINET IO functionality for high-performance real-time communication on Ethernet basis. Standard function blocks support easy communication to the PN/PB CPUs of SIMATIC S7-300 and S7-400. Alternatively, communication is possible via Ethernet to the CPs of SIMATIC S7-300 and S7-400. Standard function blocks also support easy communication between the camera and SIMATIC S7 PLC.

### Highlights

- Small, compact design
- Stand-alone operation or integration in flexible factory automation environments
- All-in-one enclosure for image capture, image processing and communication interface
- Performs several inspection tasks in one inspection cycle
- High-performance online and offline configuration with SIMATIC Spectation
- Simple and fast operation through configuration and parameter assignment
- Visualization of live or error images, frame/detail and result tables
- WinCC flexible and WinCC integration with HMI Controls VS720
- Scalable: Performance, resolution, monochrome or color image processing.



## SIMATIC VS720-S series – for harsh industrial applications

The SIMATIC VS720-S series has a high-quality stainless-steel enclosure with all-round protection for the camera, lens and connected cables. This ensures that the cameras are resistant to harsh environmental conditions.

In the food and beverage industry, no foreign matter is permitted to enter the food products. A high degree of protection as well as ruggedness is demanded due to the cleaning process.

Ruggedness is also required in the production systems. It is recommended that the VS720-S is used in degree of protection IP68 for situations where flying sparks are a problem or machining is performed that involves the removal of chips.

The cameras are characterized by their precision and fast response. Three camera types offer scalable resolution, color and monochrome image processing. Thanks to their fast, high-performance hardware architecture, they can directly evaluate the captured images in accordance with the memory-resident inspection program.

### Flexible communication options – through to PROFINET IO

Apart from the well-proven PROFIBUS DP communication, all VS720-S cameras also offer PROFINET IO capability for high-performance real-time communication on Ethernet basis. Standard function blocks support easy communication to the PN/PB CPUs of SIMATIC S7-300 and S7-400. Alternatively, communication is possible via Ethernet to the CPs of SIMATIC S7-300 and S7-400. Standard function blocks also support easy communication between the camera and SIMATIC S7 PLC.

### Highlights

- Rugged stainless-steel enclosure made of V4A steel
- Compact, space-saving construction
- Lens protection barrel made of plastic or stainless steel with optical glass
- Insensitive to humidity – high degree of protection IP68
- Highly flexible cables with rugged connector system.



# Intelligent cameras

## SIMATIC VS720A series and VS720-S series – technology overview

| SIMATIC VS72x series intelligent cameras |  |   |   |   |  |   |   |   |
|--|--|---|---|---|--|---|---|---|
|  | VS721A   | VS722A  | VS723A  | VS724A  | VS726A   | VS723-S   | VS724-S   | VS725-S   |
|  |   |  |  |  |  |  |  |  |
|  | CMOS   | Basic   | Performance   | High Resolution   | High Speed/Color   | High Speed  | High Speed/Resolution   | High Speed/Color  |
| <b>Camera</b>                            |  |   |   |   |  |   |   |   |
| ■ Performance                            | Basic  | Basic   | Medium  | Medium  | Medium   | High  | High  | High  |
| ■ Resolution                             | VGA  | VGA   | VGA   | SXGA  | VGA  | VGA   | SXGA  | VGA   |
| ■ Image capture                          | CMOS 1/3"<br>6.0 x 6.0 µm  | CCD 1/3"<br>7.4 x 7.4 µm  | CCD 1/3"<br>7.4 x 7.4 µm  | CCD 1/2"<br>4.65 x 4.65 µm  | CCD 1/4"<br>5.6 x 5.6 µm   | CCD 1/3"<br>7.4 x 7.4 µm  | CCD 1/2"<br>4.65 x 4.65 µm  | CCD 1/4"<br>5.6 x 5.6 µm  |
| ■ Exposure time                          | 10 µs to 1 s (electronic shutter)  |   |   |   |  |   |   |   |
| ■ Frame transfer                         | 60 fps   | 60 fps  | 60 fps  | 8 fps   | 30 fps   | 75 fps  | 8 fps   | 30 fps  |
| ■ Lens mount                             | CS-Mount (C-Mount adapter ring optional)   |   |   |   |  |   |   |   |
| ■ Optional equipment                     | Partial scan, integrated flash control of up to 4 light sources  |   |   |   |  |   |   |   |
| <b>Interfaces</b>                        |  |   |   |   |  |   |   |   |
| ■ Integrated interfaces                  | 1 x IE (RJ45, 10/100 Mbit/s)<br>1 x power supply / digital I/O (RJ45)  |   |   |   |  | 1 x IE (M12x8, 10/100 Mbit/s)<br>1 x power supply / digital I/O (M12x8)             |   |   |
| ■ Digital inputs<br>Industrial Ethernet  | 32   |   |   |   |  |   |   |   |
| ■ Digital outputs<br>Industrial Ethernet | 64   |   |   |   |  |   |   |   |
| ■ Digital channels<br>(24 V DC)          | 8 freely configurable non-floating channels  |   |   |   |  | 6 freely configurable non-floating channels   |   |   |
| ■ Digital inputs                         | Input current up to 1.5 mA (current-sinking)   |   |   |   |  |   |   |   |
| ■ Digital outputs                        | 50 mA, short-circuit-proof (current source), active high signal  |   |   |   |  |   |   |   |
| ■ Monitor connection                     | via VS Link or VS Link PROFIBUS  |   |   |   |  |   |   |   |
| ■ HMI operation                          | HMI Controls VS720 for WinCC flexible, ProTool/Pro and WinCC   |   |   |   |  |   |   |   |
| ■ PROFINET                               | PROFINET IO real-time onboard interface  |   |   |   |  |   |   |   |
| ■ PROFIBUS                               | via VS Link PROFIBUS   |   |   |   |  |   |   |   |
| ■ Protocols                              | TCP/IP native, MODBUS, VDX, PROFIBUS DP (DPV0, VS Link PROFIBUS required)  |   |   |   |  | TCP/IP native, MODBUS, VDX, DPV0<br>(with VS Link PROFIBUS DP)                      |   |   |
| ■ Power supply                           | 24 V DC / 300 mA   |   |   |   |  | 24 V DC / 300 mA  |   |   |
| <b>Enclosure</b>                         |  |   |   |   |  |   |   |   |
| ■ Degree of protection                   | IP51   |   |   |   |  | IP68  |   |   |
| ■ Protective enclosure                   | optional   |   |   |   |  |   |   |   |
| ■ Enclosure material                     | Plastic  |   |   |   |  | Stainless steel V4A   |   |   |
| Environment                              | 0 ... 45 °C (32 to 113 °F), no condensation  |   |   |   |  |   |   |   |
| Dimensions (W x H x D)<br>in mm          | 60 x 112 x 30 (without lens) and additional 50 mm cable connection,<br>for stainless steel variants: 66 x 120 x 73.2 (including lens barrel) and additional 50 mm cable connection |   |   |   |  |   |   |   |

# Software for SIMATIC VS720A/-S series

## Configuration and visualization

### SIMATIC Spectation

The intelligent cameras of the VS 720 series are configured easily and conveniently with SIMATIC Spectation. A number of ready-made testing and recognition functions are already integrated. Inspection programs can be created, tested and loaded on the camera – online or offline, on a PG or PC, under Windows 2000 and Windows XP. Even several of these inspection programs can be stored on these cameras and called selectively via interfaces. Optimizing the parameters and training for patterns can be done online and offline using an emulator. Several cameras can be configured via Industrial Ethernet using a programming device or PC.

#### Highlights

- Simple development of inspection programs for solving inspection tasks – selection from an existing range of inspection tools
- User-friendly handling of parameters
- Fast placement of test elements on the frame section under consideration using drag & drop
- Integrated offline configuration (emulator) using process images saved previously
- Logical linking of soft sensors via scripts.

### SIMATIC HMI Controls

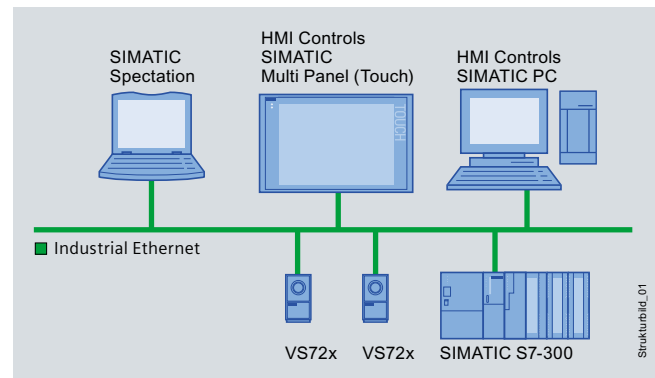
Images from SIMATIC VS720 intelligent cameras can be easily displayed and processed with HMI Controls VS720 with HMI (Human Machine Interface) systems. HMI Controls VS720 use Microsoft DCOM and ActiveX technology and were developed specially for SIMATIC Multi Panels and PC-based solutions with the WinCC, WinCC flexible and ProTool/Pro visualization systems. They are integrated in the visualization system like standard HMI functions and connected to the HMI system via Industrial Ethernet.

#### Highlights

- Central operation and monitoring by one or more VS720 intelligent cameras during operation
- Image processing is linked to HMI functions of SIMATIC HMI
- Visualization and saving of live images
- Displaying and saving of inspection results
- Error diagnostics during operation or subsequently
- Operation of the VS720 intelligent cameras in the Industrial Ethernet network



Example for color analysis:  
Assignment, segmentation and preprocessing of objects of different colors, e.g. for checking the presence/type of automobile fuses



# Vision systems

## High-speed quality inspection

Constantly increasing production speeds, detection of increasingly smaller faults, inspection of complex objects or inspection from several perspectives place more and more stringent demands on today's image processing systems.

The SIMATIC Visionscape product family can be implemented in these areas. It is designed for extremely fast applications that require multiple cameras or high-performance image processing. Whether as stand-alone system or integrated in a complete machine controlling system, the possibility of installing one or multiple SIMATIC Visionscape boards in an industrial PC enables the necessary flexibility and extensibility.

### Frame grabbers SIMATIC Visionscape 0xx0

With the Visionscape frame grabbers, the images captured by different cameras are transferred into memory or to the main computer for further processing.

### Vision processors SIMATIC Visionscape 4xx0

The Visionscape 4000 series of vision processors comprises complete, high-performance image processing systems on a single PCI slot. The modules have an integrated CPU, an image acceleration ASIC and a separate memory – thus the PC processor is offloaded from all image processing functions. The integrated multitasking real-time operating system ensures determinism. System configurations can be extended – without influencing performance – simply by inserting additional vision processors in the same PC.

### Options of the camera interface

#### SIMATIC Visionscape x300:

- Interlaced analog cameras
- Four multiplexed channels.

#### SIMATIC Visionscape x740:

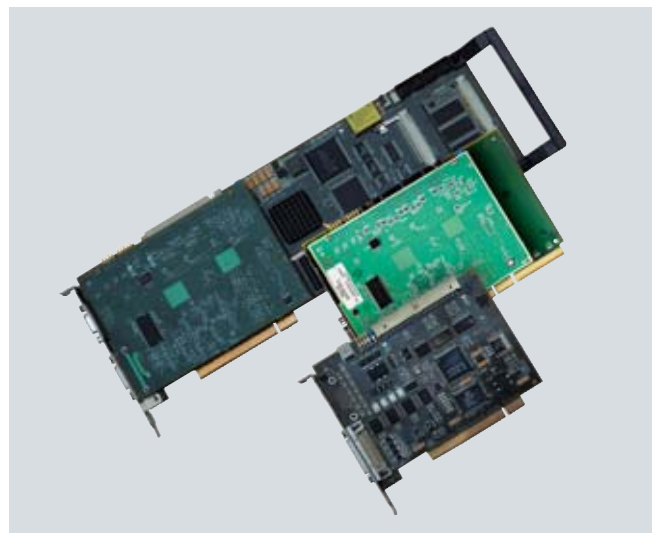
- Progressive scan and analog interlaced cameras
- Four independent channels
- High resolution up to 2K x 2K
- Supports special functions such as electronic shutter, frame reset or partial scan cameras.

#### SIMATIC Visionscape x800:

- One CameraLink Base Level channel as standard
- Supports planar cameras and line scan cameras
- Fast and high-resolution image capture.

### Highlights

- Scalable line of high-performance vision processors to cost-effective frame grabbers
- Supports a variety of analog or digital cameras as well as special camera features including line scan, high resolution, partial scan etc.
- Supports complex multi-camera applications through the connection of multiple cameras per slot and/or through the use of multiple boards in one PC, such as a SIMATIC Rack PC 547B
- Integrated digital I/O on the boards for triggering fast image capture, flash control and universal I/O functions
- Powerful development environment with an extensive collection of tried and tested image processing tools
- Easy application creation via graphic PC user interface without conventional programming
- A common software enables use of an application on all boards and on the intelligent SIMATIC HawkEye 1600T camera which reduces the investment in training and application development.



## Scalable and flexible in all applications

### Applications

SIMATIC Visionscape machine vision systems are used in all industries in which industrial image processing is applied, e.g.:

- Automotive assembly (particularly in final assembly, components and body shop)
- General manufacturing assembly and quality control
- Semiconductors (backend production)
- Electronics assembly
- Pharmaceutical industry, packaging inspection and date and lot code verification
- Food and luxury goods package inspection

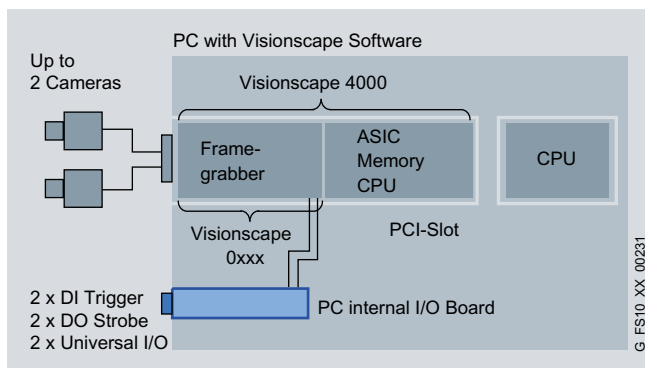
Other applications include traceability applications involving verification and reading of one-dimensional barcodes and data matrix codes.

### Integration in SIMATIC PC

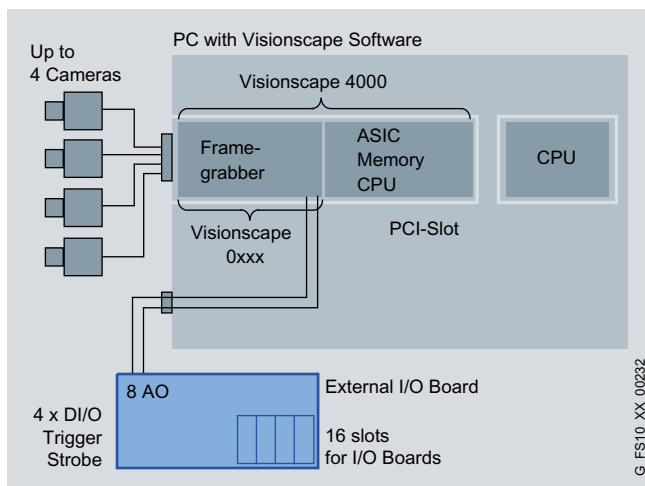
For PC-based implementation the system-tested SIMATIC PCs with Intel Core2 Duo processors are recommended:

| Industrial PC configuration | Number of Visionscape boards | Associated I/O modules |
|-----------------------------|------------------------------|------------------------|
| SIMATIC Rack PC 547B*       | 3                            | 3                      |
| SIMATIC Rack PC 847B*       | 5                            | 5                      |
| SIMATIC Box PC 627B         | 1                            | 1                      |
| SIMATIC Box PC 827B         | 2                            | 2                      |

\*SIMATIC Rack PC is suitable for the integration of longer Visionscape boards (4300 and 4740).



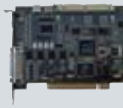
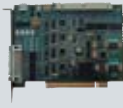

Configuration of a Visionscape system with PC-internal I/O board for up to two cameras





Configuration of a Visionscape system with external combination I/O board for up to four cameras

# Vision systems

## Frame grabber – technology overview

| SIMATIC Visionscape                 |  |   |  |
|-------------------------------------|--|---|--|
|                                     | 0300   | 0740  | 0800   |
|                                     |   |    |   |
| Design                              | <ul style="list-style-type: none"> <li>■ PCI 2.2-compatible bus module, 5 V, occupies one half-length slot; 140 mm x 107 mm (5.5" x 4.2")</li> </ul>   |   | <ul style="list-style-type: none"> <li>■ Universal PCI 2.3-compatible bus module, occupies one half-length slot; 168 mm x 107 mm (6.6" x 4.2")<br/>– suitable also for bus system PCI 2.2</li> </ul>   |
| Video input                         | <ul style="list-style-type: none"> <li>■ Up to four multiplexed, externally synchronized RS170 or CCIR cameras</li> <li>■ RS170: max. 640 x 480 pixels, 60 Hz; CCIR: max. 768 x 576 pixels, 50 Hz interlaced</li> <li>■ 8-bit ADC quantization</li> <li>■ Flexible chained bus master DMA</li> </ul>   | <ul style="list-style-type: none"> <li>■ Up to 4 independent analog interlaced or progressive scan cameras</li> <li>■ Simultaneous, asynchronous capture on all channels</li> <li>■ Analog progressive scan with image sizes up to 2K x 2K</li> <li>■ Supports 2 camera types concurrently via two independent pixel clock signal generators: Cameras with higher or lower resolution can be used combined in each of the four channels</li> <li>■ Supports shutter, frame reset, partial scan, double-speed and quad speed cameras</li> <li>■ External camera synchronization</li> </ul> | <ul style="list-style-type: none"> <li>■ One Camera-Link Digital camera; Camera-Link standard</li> <li>■ High-resolution planar camera</li> <li>■ Linescan (max. 16k pixels/line)</li> <li>■ TDI cameras (time delay and integration)</li> <li>■ 32 MB SDRAM FIFO buffer</li> <li>■ Configurable: <ul style="list-style-type: none"> <li>One tap with 8 to 24 bit/pixels or two tap with 8 to 12 bit/pixels; taps can be encapsulated or sequential</li> </ul> </li> <li>■ Pixels scaled up to eight points</li> <li>■ Pixel clock frequency 20 to 85 MHz</li> </ul> |
| Encoder interface                   | –  | –   | <ul style="list-style-type: none"> <li>■ Selection of 3 RS422 or TTL inputs on the encoder plug-in connector or 4 TTL to 24 V sensor inputs</li> <li>■ Two phases for 1x, 2x, 4x pitch and index input with direction sensing</li> <li>■ 8-bit prescaler</li> </ul>  |
| Video control                       | <ul style="list-style-type: none"> <li>■ Master/slave interface for multi-board synchronization and triggering</li> <li>■ 4 <math>H_{sync}</math>; 4 <math>V_{sync}</math></li> <li>■ 4 injection/blocking (for simultaneous exposure)</li> </ul>  | <ul style="list-style-type: none"> <li>■ 4 <math>H_{sync}</math>; 4 <math>V_{sync}</math>; <math>V_{init}</math></li> <li>■ 4 inputs or outputs for camera control</li> </ul>   | <ul style="list-style-type: none"> <li>■ 4 LVDS control outputs</li> <li>■ LVDS with serial communication</li> <li>■ Asynchronous reset, lighting control (PRIN) &amp; ROI capture</li> <li>■ Multiple trigger modes</li> </ul>  |
| Host PC display                     | <ul style="list-style-type: none"> <li>■ PCI bus master</li> <li>■ Color graphics overlay</li> </ul>   |   |  |
| Digital onboard inputs/outputs      | <ul style="list-style-type: none"> <li>■ 4 sensor inputs with application-specific reference voltage thresholds and one input voltage range</li> <li>■ 4 flash outputs</li> <li>■ 16 programmable bidirectional inputs/outputs</li> <li>■ Standard 50-pin input/output connection to connect one of the two additional I/O boards</li> <li>■ PC-internal 10-point I/O board for max. two cameras</li> <li>■ External 16-point I/O board for max. four cameras</li> </ul> |   |  |
| Analog output support               | <ul style="list-style-type: none"> <li>■ Serial I2C bus on the board (for analog output)</li> <li>■ 8 analog output channels through external I/O board</li> </ul>   |   |  |
| Power consumption                   | <ul style="list-style-type: none"> <li>■ +12 V at 1.0 A max.; +5 V at 1.25 A max.; approx. 9 W</li> </ul>  |   | <ul style="list-style-type: none"> <li>■ +12 V at 1.0 A; +5 V at 1.5 A; 3.3 V at 0.2 A max.; approx. 8 W</li> </ul>  |
| Environmental conditions            | <ul style="list-style-type: none"> <li>■ Operating temperature: 0 °C ... 50 °C, humidity: 10% ... 90 %, no condensation</li> </ul>   |   |  |
| Host PC prerequisites <sup>1)</sup> | <ul style="list-style-type: none"> <li>■ Pentium 4, 2.4 GHz or higher with at least 256 MB RAM; VGA adapter, 64K or TrueColor; Win 2000 SP4 or higher, Win XP SP2 or higher</li> <li>■ One free +5 V/32-bit PCI expansion slot and one free slot for internal I/O board of the slot closer for I/O connections to the external I/O board (only if I/O is required)</li> </ul>  |   | <ul style="list-style-type: none"> <li>■ One free slot: <ul style="list-style-type: none"> <li>- +3.3 V/64-bit Universal-PCI 2.3 expansion slot</li> <li>- +5 V/32-bit PCI 2.2 slot (additional connector contacts for universal PCI)</li> </ul> </li> </ul>   |
|                                     | 1) See recommended configurations of SIMATIC PCs in the Readme file  |   |  |

## Vision processors – technology overview

| SIMATIC Visionscape                 |   |  |
|-------------------------------------|---|--|
|                                     | 4300  | 4740   |
|                                     |    |   |
| Design                              | <ul style="list-style-type: none"> <li>■ PCI 2.2-compatible bus module, 5 V, occupies one full-length slot; 312 mm x 107 mm (12.3" x 4.2")</li> </ul>   |  |
| Onboard CPU                         | <ul style="list-style-type: none"> <li>■ High-performance 64-bit MIPS RISC CPU</li> <li>■ Real-time multitasking VxWorks operating system</li> </ul>  |  |
| Onboard ASIC                        | <ul style="list-style-type: none"> <li>■ Vision-Acceleration-ASIC; accelerates all low-level image processing and analysis functions</li> </ul>   |  |
| Onboard memory                      | <ul style="list-style-type: none"> <li>■ 128 MB CPU program/data memory, expandable to 384 MB (144-pin PC100 SDRAM SODIMM configuration)</li> <li>■ 32 MB SDRAM image memory; 32 MB SDRAM VGA display memory</li> </ul>   |  |
| Video input                         | <ul style="list-style-type: none"> <li>■ Flexible, chained bus master DMA; DMA to onboard CPU memory, image memory, host PC or video memory</li> <li>■ RS170: max. 640 x 480 pixels, 60 Hz; CCIR: max. 768 x 576 pixels, 50 Hz interlaced</li> <li>■ 8-bit ADC quantization</li> </ul>  |  |
|                                     | <ul style="list-style-type: none"> <li>■ Up to 4 multiplexed, externally synchronized analog cameras (RS170 or CCIR)</li> </ul>   | <ul style="list-style-type: none"> <li>■ Up to 4 externally synchronized analog interlaced or progressive scan cameras</li> <li>■ Simultaneous, asynchronous capture on all four channels</li> <li>■ Progressive scan up to 2k x 2k</li> <li>■ Support for two different camera types, this means that cameras with high resolution and low resolution can be combined</li> <li>■ Supports shutter, frame reset, partial scan, double-speed and quad speed cameras</li> <li>■ External camera synchronization</li> </ul> |
| Video control                       | <ul style="list-style-type: none"> <li>■ Master/slave interface for multi-board synchronization and triggering</li> </ul>   |  |
|                                     | <ul style="list-style-type: none"> <li>■ 4 <math>H_{sync}</math>; 4 <math>V_{sync}</math></li> <li>■ 4 injection/blocking (for simultaneous exposure)</li> </ul>  | <ul style="list-style-type: none"> <li>■ 4 <math>H_{sync}</math>; 4 <math>V_{sync}/V_{init}</math></li> <li>■ 4 inputs or outputs for camera control</li> </ul>  |
| Encoder interface                   | -   |  |
| Onboard SVGA display output         | <ul style="list-style-type: none"> <li>■ Graphics/video accelerator; up to 1024 x 768 display resolution; color graphical overlay; VGA plug-in connector</li> </ul>   |  |
| Host PC display                     | <ul style="list-style-type: none"> <li>■ PCI bus master; color graphic overlay</li> </ul>   |  |
| Digital onboard inputs/outputs      | <ul style="list-style-type: none"> <li>■ 4 sensor inputs with application-specific reference voltage thresholds and an input range from 5 ... 24 V; 4 flash outputs</li> <li>■ 16 programmable bidirectional inputs/outputs</li> <li>■ Standard 50-pin input/output connection to connect one of the two additional I/O boards</li> <li>■ PC-internal 10-point I/O board for max. two cameras</li> <li>■ External 16-point I/O board for max. four cameras</li> </ul> |  |
| Analog output                       | <ul style="list-style-type: none"> <li>■ Serial I2C bus on the board: 8 analog output channels through external I/O board</li> </ul>  |  |
| Serial I/O on the board             | <ul style="list-style-type: none"> <li>■ 2 RS232 ports with hardware flow control: Baud rates to 115.2 K</li> </ul>   |  |
| Power consumption                   | <ul style="list-style-type: none"> <li>■ +12 V at 1 A; +5 V at 5 A max.; power loss 30 W</li> </ul>   |  |
| Ambient conditions                  | <ul style="list-style-type: none"> <li>■ Operating temperature: 0 °C ... 50 °C, humidity: 10% ... 90 %, no condensation</li> </ul>  |  |
| Host PC prerequisites (recommended) | <ul style="list-style-type: none"> <li>■ Pentium 4, 2.4 GHz or higher with at least 256 MB RAM</li> <li>■ One +5 V/32 bit full-length PCI slot and one free slot for internal I/O board of the slot closer for I/O connections to the external I/O board (only if I/O is required)</li> <li>■ VGA graphic adapter – 64K or TrueColor (only if host PC display is required)</li> <li>■ Microsoft Windows 2000 SP4 or higher or Windows XP SP2 or higher</li> </ul>     |  |

# Vision systems

## A software for easy and fast application development & deployment

The powerful SIMATIC Visionscape software with an extensive collection of proven image processing tools and the graphic user interface supports simple and quick creation and implementation of applications (Frontrunner).

In the runtime environment the user can start/stop the application, collect and verify captured image data, forward collected data to the host PC as well as consider additional diagnostics information – the user obtains an overview of the entire system status.

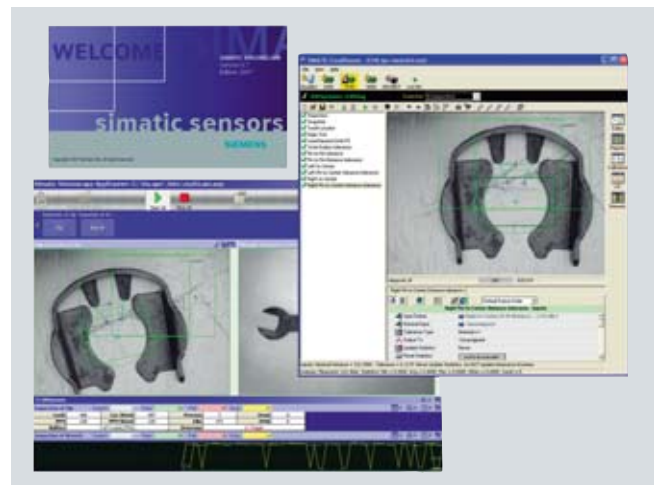
The user levels are so variable that they fit for any application. The configuration environment can be adapted to different users to achieve maximum productivity.

- For fast creation of complex image processing applications standard tools are available to the application engineer or system integrator that enable fast and easy creation of a flow diagram per drag&drop – without any conventional programming
- Application developers, machine manufacturers and OEMs create customer-specific applications with custom-tailored graphic user interfaces that are completely integrated in the machine user interface
- Installation engineers and machine operators select and configure pre-programmed applications and start/stop and monitor such applications in the plant.

The SIMATIC Visionscape product line offers scalable, high-performance vision processors as well as cost-efficient frame grabbers. The advantage is that all boards as well as the intelligent HawkEye 1600T camera can be configured using the same development and implementation environment, as well as the same extensive spectrum of intelligent tools. The end result is that an application configured for one system can be executed unchanged and without recompiling on a different system, which enables simple selection for each application taking the price/performance ratio into account. In addition users require training for only one environment and are only required to know one environment.

### Highlights

- Common software environment for fast application development & deployment and implementation for all SIMATIC Visionscape boards as well as the intelligent SIMATIC HawkEye 1600T camera
- High-performance, graphic user interface and flow diagram architecture for easy drag&drop application creation
- Extensive range of image processing tools for image processing and image analysis, calibrated measurements, automatic identification and application-specific tasks
- Script language for creation of custom functions and algorithms (thus integration of external algorithms is possible by call)
- Open ActiveX control component architecture for tailored, application-specific user interfaces
- Pre-fabricated application-specific configurations for the pharmaceuticals, packaging, semiconductor and electronics industries.



## Visionscape – extensive collection of intelligent tools

The extensive collection of image processing tools offered by the SIMATIC Visionscape software includes:

- Image processing tools:  
Image arithmetic, image rotation and correction, binary and gray scale morphology, edge enhancement, other image filters, etc.
- Image analysis tools:  
Flaw detection, histogram analysis, blob analysis, edge detection and fitting, vector-based edge detection and fitting, template and pattern recognition/matching, object location and orientation detection, etc.
- Calibrated measurements:  
Variety of pre-configured measurements such as line intersection, point-to-point distance, point-to-line normal, etc.
- Automatic identification tools:  
Reading of data matrix codes and other 1D/2D barcodes, optical character recognition (OCR), etc.
- Application-specific high-level tools:  
Optical Character Verification (OCV) for print/marketing inspection, Ball Grid Array (BGA) inspection, etc.
- User-specific tools:  
User-defined arithmetic functions and expressions, script language for creating own functions.

### Highlights

- Extensive collection of image processing tools and automatic identification tools
- The tools have been improved over multiple generations of image processing systems and have proven themselves in thousands of installations worldwide
- Due to highly developed tools, even fluctuations and inaccuracies can be detected
- Adapts to part shifts, rotations, coverings as well as changes in contrast or lighting
- All measurements are either in pixels or units that can be calibrated (consideration of the camera perspective is also possible)
- Low-level image processing and hardware acceleration (e.g. for the 4x00 board family)
- High-level tools combine processes and logic for application-specific tasks (e.g. BGA inspection)

# Vision systems

## SIMATIC MV860/MV860S Visionscape I-PAK

The SIMATIC MV860 Visionscape I-PAK inspection system is designed for stringent requirements. It reliably, accurately and verifiably inspects and reads, for example expiration, article and batch data, NDC, label IDs, 1D and 2D codes (e.g. data matrix) and RSS codes. SIMATIC MV860 Visionscape I-PAK can also check finished products, e.g. for presence, or the correct seating of a screw cap or label.

### Applications

SIMATIC MV860 Visionscape I-PAK is suitable for specific applications in the pharmaceuticals industry, food processing industry, cosmetic industry or in the packaging industry.

A number of industrially proven image processing tools are available for these applications, e.g.:

- Label inspection: expiration, article and batch data, label ID, National Drug Code (NDC)
- Checking inserts/outserts<sup>1)</sup> and cartons
- Inspection of print quality and readability of labels
- Fast reading and verification of print quality for 1D, RSS and data matrix codes

<sup>1)</sup> An outsert is a folded sheet that is externally attached to a package (e.g. bottle). This means that the carton is no longer necessary. The insert is a sheet that is placed inside a box.

### Highlights

- Complies with GMP/FDA requirements
  - Audit trail function
  - Access protection and user administration
  - Recovery function (backup/restore)
  - Reconcile function
- Complete system in stainless steel design in degree of protection IP65
- HMI specially designed for batch-oriented packaging processes in the pharmaceuticals industry, cosmetics industry, and food and beverages industry
- User-friendly runtime HMI design
- Consideration of multiple camera images simultaneously in runtime mode
- Data backup in the case of voltage dip by means of UPS

### GMP/FDA requirements

#### Audit trail function

SIMATIC Visionscape I-PAK V3.7 comes equipped with an audit-trail function. This control mechanism ensures the traceability of data entries and changes and is especially necessary for keeping GMP/FDA-compliant electronic records. This audit trail is automatically generated and includes all associated metadata (time stamps, users, before/after values, etc.).

Specifically, the following data are monitored: system settings, product settings, the test program and its settings as well as pattern data (image, fonts, patterns).

#### Access protection and user administration

SIMATIC Visionscape I-PAK V3.7 also has an access protection function that only allows defined access for authorized users, such as operators, supervisors or programmers. These access rights are issued and managed by an administrator. This system ensures the uniqueness of any combination of user ID and password. In fact, every password becomes invalid after a set number of days (configurable). If necessary, user accounts can also be disabled.

### Recovery function (backup / restore)

Data backups ensure that the system can be restored in the event the original data is lost or the entire system is lost or stolen. SIMATIC Visionscape I-PAK V3.7 allows test programs, images and fonts to be saved to an archive and restored from it.

### Storage, protection, reproducibility and retrievability of data

Automated systems must be able to archive and secure records for defined periods of time and then make them available upon request. In addition, electronic records must be reproducible in both human-readable and machine-readable forms. SIMATIC Visionscape I-PAK V3.7 supports functions that allow all data pertaining to system operation to be generated as PDF documents or printed out, such as runtime statistics, the configuration file including the test program, fault statistics, product settings and the audit trail.

### Reconcile function

The ability to detect fine, subtle, detailed differences between different test programs or program versions can be very helpful in making operational decisions. In SIMATIC Visionscape I-PAK V3.7, such differences can be detected with the reconcile function, which allows two configuration files to be efficiently compared to each other.

### Design

Two Visionscape I-PAK configurations are available:

#### SIMATIC MV860 Visionscape I-PAK

SIMATIC MV860 Visionscape I-PAK is typically installed in an existing PC in the packaging machine.

The package consists of:

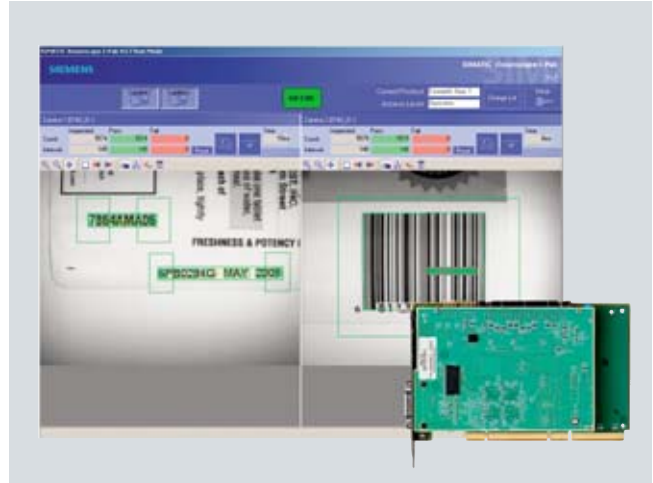
- SIMATIC Visionscape Framegrabber/vision processor
- SIMATIC Visionscape I-Pak software
- Accessories

#### SIMATIC MV860S Visionscape

With SIMATIC MV860S Visionscape I-PAK, a configuration is available with industrial-standard Panel PC 677, preinstalled in a closed stainless steel enclosure.

The package contains:

- SIMATIC Panel PC677 15" Touch in stainless steel design
- SIMATIC Visionscape I-PAK software
- Stainless steel TouchPad
- Additional accessories



SIMATIC MV860 Visionscape I-PAK



SIMATIC MV860S Visionscape I-PAK

## Get more information

Product information on SIMATIC Sensors:  
[www.siemens.com/simatic-sensors](http://www.siemens.com/simatic-sensors)

References for SIMATIC sensors:  
[www.siemens.com/simatic-sensors/reference](http://www.siemens.com/simatic-sensors/reference)

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[www.siemens.com/automation/mall](http://www.siemens.com/automation/mall)

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