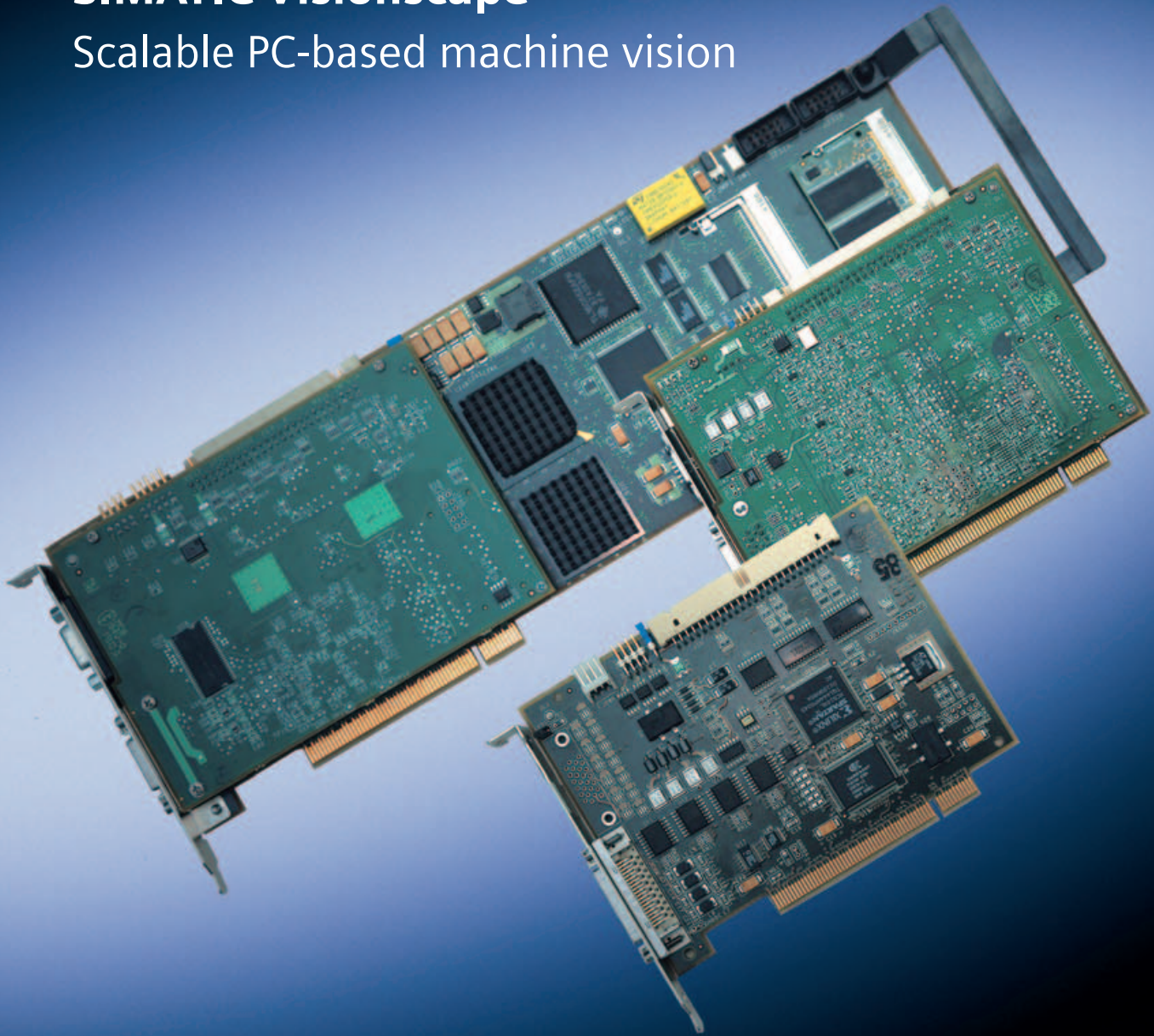


# **SIMATIC Visionscape**

Scalable PC-based machine vision



Brochure · November 2005

# simatic sensors



## **SIEMENS**

# SIMATIC Visionscape

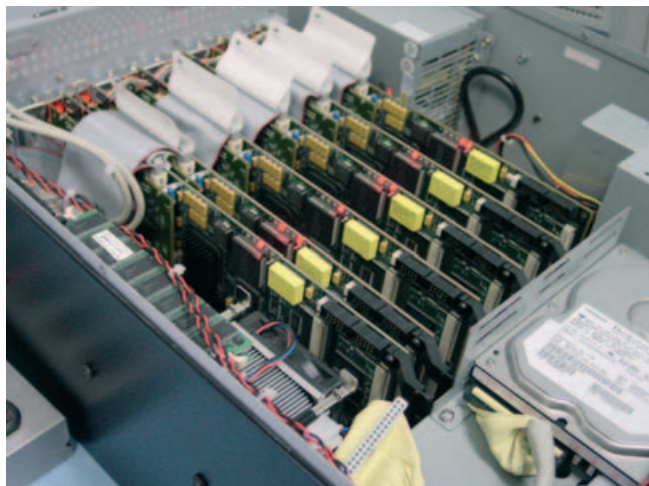
## Scalable PC-based machine vision

The need to accommodate faster production rates, identify finer defects, and inspect complex objects or assemblies from multiple points of view is pushing the limits of today's machine vision systems.

SIMATIC Visionscape line is uniquely situated to address high speed applications requiring multiple cameras or extensive vision processing.

An extensive collection of intelligent tools coupled with a common application development and deployment environment ship with each board, significantly decreasing the amount of time it takes to get your application up and running.

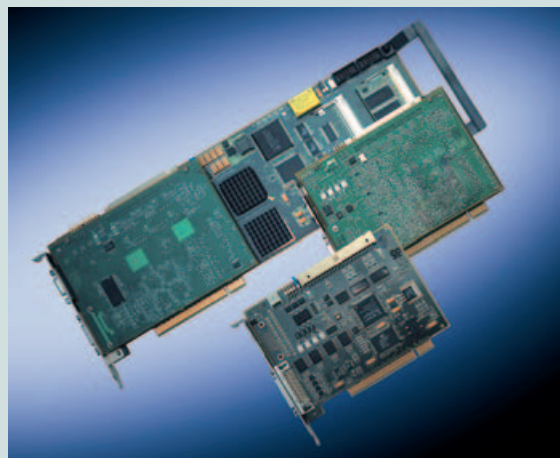
Whether you need to deliver a stand alone system or one integrated into a machine controller, the ability to embed one or more SIMATIC Visionscape boards into an industrial computer allows the flexibility and extensibility you're looking for.



*Multiple vision processors in a single PC*

## Highlights

- Scalable line of high-performance vision processors, accelerators & frame grabber boards
- Support variety of analog or digital cameras and special camera features including high resolution, partial scan, line scan, etc.
- Address complex multi-camera applications by connecting several cameras per board and/or adding multiple boards in a single PC
- On-board dedicated digital I/O for fast image acquisition triggering, strobe control and general purpose I/O
- Powerful software environment ships with all Visionscape boards for fast machine vision application development & deployment
- Graphical user interface (GUI) on host PC allows simple setup and monitoring of applications without any conventional programming
- Common software allows an application to run on any board leveraging user training and application development investment



# SIMATIC Visionscape

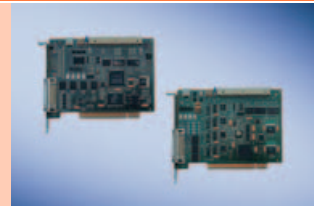
## Portfolio overview

The SIMATIC Visionscape family of products features a scalable line of high performance vision processors, accelerators and frame grabbers. A unique advantage of this product line is that all of the boards are configured using the same development and deployment environment as well as the same extensive

set of intelligent tools. The end result is that an application configured for one board can run unmodified and without recompilation on any other board, thus allowing users to easily scale as well as select the right price / performance point for each application.

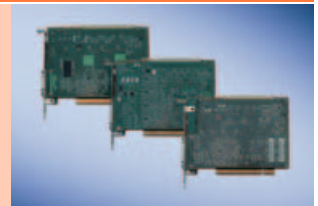
### Frame grabbers

The Visionscape frame grabbers are used to capture images from a variety of machine vision cameras into the host PC memory. All Visionscape frame grabber boards offer on-board dedicated digital I/O for triggering, strobe control and general purpose I/O.



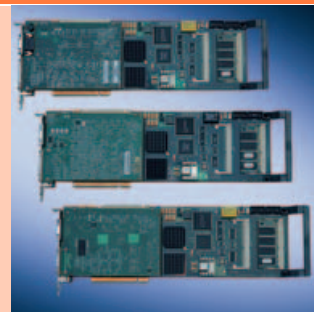
### Vision accelerators

The Visionscape 1000 series vision accelerators are frame grabbers with an on-board vision acceleration ASIC, high-speed image memory and dedicated digital I/O. These boards support a variety of machine vision cameras through interchangeable plug-in camera interface daughter cards. The ASIC accelerates all common low-level image processing and analysis operations and substantially off-loads the host PC Optical Character Verification, etc.



### Vision processors

The Visionscape 4000 series vision processors are complete high-performance vision systems in a single PCI slot. These boards feature an on-board CPU, vision acceleration ASIC, memory, and display. Therefore, they completely off-load all vision processing operations from the host PC CPU. These boards also feature on-board dedicated digital I/O and support a variety of machine vision cameras through interchangeable plug-in camera interface daughter cards. An on-board real-time multitasking operating system assures deterministic operation. System configurations can be scaled up without affecting performance or footprint by simply adding more processor boards in the same PCI backplane.



### Camera Interface Options

A wide variety of camera interface options are supported by the Visionscape family of boards through interchangeable daughter cards or frame grabbers including:

#### x300 series

- Standard interlaced analog cameras
- 4 multiplexed channels

#### x740 series

- Flexible analog cameras supporting special features such as electronic shuttered, frame reset, or partial scan cameras
- High resolution up to 2K x 2K

#### x800 series

- High performance Camera Link digital cameras for high speed, high resolution, line scan or color applications

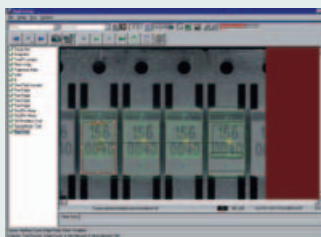


# SIMATIC Visionscape

## High-speed or complex vision applications

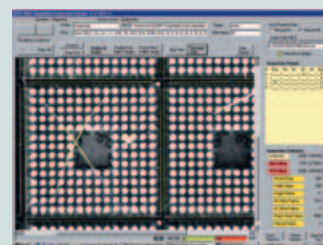
### Electronics Manufacturing

High-speed, multi-camera inspection of tantalum capacitors at up to 2400 parts/min. Inspections include various mold and mark defects on both top and bottom sides of each capacitor, excess flash, discoloration and other processing defects.



### Semiconductor Manufacturing

Package singulation (chip array) inspection including dimensional checks, defect detection and detailed Ball Grid Array (BGA) inspection at up to 10,000 balls/s using a high resolution camera and special multi-light illumination.



### Food & Beverage Industry

High-speed, multi-camera inspection of beverage cans for detailed internal defect detection at up to 3600 parts/min utilizing multiple vision processor boards in each PC controller and one or more cameras per vision board.



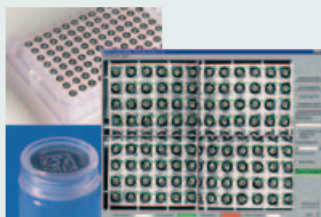
### Pharmaceutical Packaging

Validated date and lot code inspection using Optical Character Verification (OCV) and label identification by reading 1D or 2D codes at 300 to 600 parts/min. Often also combined with other package or product inspections on other camera views.



### Laboratory Automation

Reading racks of 96 Data Matrix coded microtubes for high throughput screening in less than a second using a special reading unit incorporating four cameras and special illumination.



### Automotive Assembly

Multi-camera inspection system for fuel tank assembly validation. Up to four cameras per board and multiple vision processors in each PC used to perform a large variety of presence/absence checks.



# SIMATIC Visionscape

## Applications in all industries

### Cosmetics & Consumer Goods Packaging

Variety of cosmetic package and label date & lot code inspections speeds of up to 125 parts/min using 1 to 4 cameras per board. Other higher-speed package inspection applications at 400 to 700 parts per minute using up to 4 cameras per board.



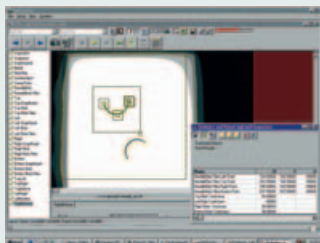
### Semiconductor Test & Packaging

Final mark and package visual inspection for detection of variety of defects on semiconductor devices at up to 10,000 units/hour. Multi-light illumination allows inspection of both laser marks and underlying package surface defects with the same camera.



### Medical Device Manufacturing

Shown is a surgical needle vision-guided pick-and-place application. Other sample applications in this industry include detailed high speed inspection of diagnostic test kits or medical device package inspection and identification.



### Material Handling

This non-manufacturing application involves detection of parcels on slides in a distribution center using multiple cameras connected onto a single board. Other sample applications in this industry include package detection on tilt-trays.



### Food Packaging

High-speed can identification at 1800 parts/min to avoid misapplication of labels. Application involves detection of a randomly oriented alphanumeric ink jet mark and Optical Character Verification (OCV) for ID verification.








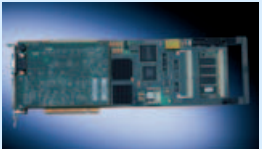
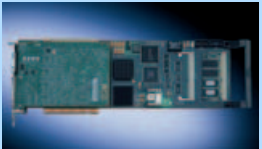
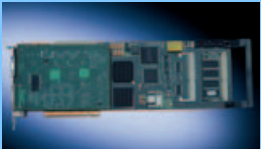
### Electronics Assembly

Reading and verification of laser-marked Data Matrix codes on cell phone printed circuit boards. Integrated imagers incorporating a camera, lens and lighting in a single package are used with up to four imagers connected to a single vision board.





# SIMATIC Visionscape

## Product Selection Guide

		Cameras			
		Analog		Digital	
		Standard interlaced	Others	Camera Link	
Processing	Host PC Not Accelerated			–	Frame grabbers
		Frame grabber 0300	Frame grabber 0740		
	Accelerated				Vision accelerators
		Vision accelerator 1304	Vision accelerator 1744	Vision accelerator 1804	
	Onboard CPU & Acceleration				Vision processors
		Vision processor 4300	Vision processor 4740	Vision processor 4800	

# SIMATIC Visionscape

## Frame grabbers

Technology overview		0300	0740
			
Configuration	■ Single-slot half-length 5 V PCI 2.2 compliant bus board; 5.5" x 4.2" (140 mm x 107 mm)		
Video Input	■ Up to 4 multiplexed externally synchronized RS170 or CCIR cameras		■ Up to 4 independent analog interlaced or progressive scan cameras
	■ RS170: up to 640 x 480, 60 Hz; CCIR: up to 768 x 576, 50 Hz interlaced		
	■ 8 bit ADC quantization		
	■ Flexible chained bus master DMA		
Video control			■ Simultaneous asynchronous capture on all channels
			■ Analog progressive scan up to 2k x 2k image size
			■ Supports acquisition from two different camera types at a time via two independent pixel clock generators, allowing mixing of high and low resolution cameras on any of the four channels
			■ Support for shuttered, frame reset & partial scan, double speed & quad speed cameras
Host Based Display	■ External camera sync		
	■ Master/slave interface for multi-board synchronization and triggering		
	■ 4 Hsync; 4 Vsync		■ 4 Hsync; 4 Vsync/Vinit
On-Board Digital I/O	■ 4 Inject/Inhibit (for simultaneous exposure)		■ 4 Camera control in or out
Host Based Display	■ PCI bus master		
On-Board Digital I/O	■ Color graphics overlay		
	■ 4 sensor inputs with user-supplied reference voltage thresholds and 5 to 24 V input range		
	■ 4 strobe outputs		
	■ 16 programmable bi-directional I/O		
Analog Output Support	■ Standard 50 pin I/O connection to external termination/isolation board (Visionscape Combo I/O board)		
Power Consumption	■ On-board I2C serial bus capability (for analog output)		
Environmental	■ 8 channels of analog output through external termination/isolation board		
Host PC Requirements (Recommended)	■ +12 V @ 1 A maximum		
	■ +5 V @ 1.25 A maximum		
Host PC Requirements (Recommended)	■ Dissipates approximately 10 W		
Host PC Requirements (Recommended)	■ Operating temperature: 0 °C to 50 °C		
	■ Humidity: 10-90%, non-condensing		
Host PC Requirements (Recommended)	■ Pentium 4, 2.4 GHz class CPU or higher with minimum 256 MB memory		
	■ VGA display adapter – 64K or True color		
Host PC Requirements (Recommended)	■ One open +5 V/32 bit PCI expansion slot		
	■ Microsoft Windows 2000 SP4 or later		

# SIMATIC Visionscape

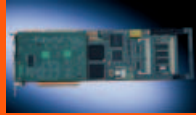
## Vision accelerators

Technology overview	1304	1744	1804
			
<b>Configuration</b>	■ Single-slot half-length 5 V PCI 2.2 compliant bus board; 5.5" x 4.2" (140 mm x 107 mm)		
<b>On-Board ASIC</b>	■ Vision Acceleration ASIC; accelerates all low-level image processing & analysis operations		
<b>On-Board Memory</b>	■ 32 MB SDRAM image memory		
<b>Video Input</b>	■ Interchangeable plug-in camera & I/O interface daughter card configuration		
	■ Flexible chained bus master DMA; DMA to on-board image memory or to host PC or video memory		
	■ RS170: up to 640 x 480, 60 Hz; CCIR: up to 768 x 576, 50 Hz interlaced		–
	■ 8 bit ADC quantization		–
	■ Up to 4 multiplexed externally synchronized RS170 or CCIR cameras	■ Up to 4 externally synchronized analog interlaced or progressive scan cameras	■ One Camera Link digital camera; Camera Link Base level standard
	–	■ Simultaneous asynchronous capture	■ Hi-resolution area, TDI, or line scan (up to 16k pixels/line)
		■ Analog progressive scan up to 2k x 2k	■ 32 MB SDRAM FIFO Buffer
		■ Support for two different camera types via two independent pixel clock generators, allowing mixing of high and low resolution cameras	■ Configurable - one tap 8...24 bits/pixel or two taps 8...12 bits/pixel; taps may be interleaved or sequential
		■ Support for shuttered, frame reset, exposure control, partial scan, double speed & quad speed cameras	■ Pixels scaled up to eight places
		■ External camera sync	■ Pixel clock rate 20 to 85 MHz
<b>Video control</b>	■ Master/slave interface for multi-board synchronization and triggering		
	■ 4 Hsync; 4 Vsync	■ 4 Hsync; 4 Vsync/Vinit	■ Four LVDS control outputs
	■ 4 Inject/Inhibit (for simultaneous exposure)	■ 4 Camera control in or out	■ LVDS serial communication
			■ Asynchronous reset, exposure control (PRIN) & ROI capture
			■ Multiple triggering modes
<b>Encoder Interface</b>	–		■ Select from 3 RS422 or TTL inputs on the encoder connector or 4 TTL to 24 V sensor inputs
			■ Two phases for 1x, 2x, 4x pitch plus index input with direction sensing
			■ 8 bit prescaler
<b>Host Based Display</b>	■ PCI bus master; Color graphics overlay		
<b>On-Board Digital I/O</b>	■ 4 sensor inputs with user-supplied reference voltage thresholds and 5 to 24 V input range; 4 strobe outputs		
	■ 16 programmable bi-directional I/O		
	■ Standard 50 pin I/O connection to external termination/isolation board		
<b>Analog Output</b>	■ On-board I2C serial bus capability; 8 channels of analog output through Visionscape Combo I/O board		
<b>Power Consumption</b>	■ +12 V @ 1 A; +5 V @ 1.25 A max		■ +12 V @ 0.2 A; +5 V @ 1.25 A max
	■ Dissipates approx. 10 W		■ Dissipates approx. 7 W
<b>Environmental</b>	■ Operating temperature: 0 °C to 50 °C; Humidity: 10-90%, non-condensing		
<b>Host PC Requirements</b>	■ Pentium 4, 2.4 GHz or higher with minimum of 256 MB memory; one open +5 V/32 bit PCI expansion slot		
	■ VGA display adapter – 64K or true color		
	■ Microsoft Windows 2000 SP4 or Windows XP SP2 or later		



# SIMATIC Visionscape

## Vision processors

Technology overview	4300	4740	4800
			
<b>Configuration</b>	■ Single-slot full-length 5V PCI 2.2 compliant bus board; 12.3" x 4.2" (312 mm x 107 mm)		
<b>On-Board CPU</b>	■ High-performance 64 Bit MIPS RISC CPU ■ VxWorks Real Time Multitasking Operating System		
<b>On-Board ASIC</b>	■ Vision Acceleration ASIC; Accelerates all low-level image processing & analysis operations		
<b>On-Board Memory</b>	■ 128 MB CPU program & data memory expandable to 384 MB (144 pin PC100 SDRAM SODIMM configuration) ■ 32 MB SDRAM image memory; 32 MB SDRAM VGA display memory		
<b>Video Input</b>	■ Interchangeable plug-in camera & I/O interface daughter card ■ Flexible chained bus master DMA; DMA to on-board CPU or image memory or to host PC or video memory ■ RS170: up to 640 x 480, 60 Hz; CCIR: up to 768 x 576, 50 Hz interlaced ■ 8 bit ADC quantization		
	■ Up to 4 multiplexed externally synchronized analog cameras (RS170 or CCIR)	■ Up to 4 externally synchronized analog interlaced or progressive scan cameras	■ One Camera Link digital camera; Camera Link Base level standard
	–	■ Simultaneous asynchronous capture on all four channels ■ Progressive scan up to 2k x 2k ■ Support for two different camera types allowing mixing of high and low resolution cameras ■ Support for shuttered, frame reset, partial scan, double speed & quad speed cameras ■ External camera sync	■ Hi-resolution area, TDI, or line scan (up to 16k pixels/line) ■ 32 MB SDRAM FIFO buffer ■ Configurable - one tap 8...24 bits/pixel or two taps 8...12 bits/ pixel; taps interleaved or sequential ■ Pixels scaled up to eight places ■ Pixel clock rate is 20 to 85 MHz
<b>Video control</b>	■ Master/slave interface for multi-board synchronization and triggering		
	■ 4 Hsync; 4 Vsync ■ 4 Inject/Inhibit (for simultaneous exposure)	■ 4 Hsync; 4 Vsync/Vinit ■ 4 Camera control in or out	■ Four LVDS control outputs ■ LVDS serial communication ■ Asynchronous reset, exposure control (PRIN) & ROI capture ■ Multiple triggering modes
<b>Encoder Interface</b>	–	–	■ Same as on 1804 board
<b>On-Board SVGA Display</b>	■ Graphics/ video accelerator; up to 1024 x 768 display resolution; Color graphics overlay; VGA connector		
<b>Host Display</b>	■ PCI bus master; Color graphics overlay		
<b>On-Board Digital I/O</b>	■ 4 sensor inputs with user-supplied reference voltage thresholds and 5 to 24 V input range; 4 strobe outputs ■ 16 programmable bi-directional I/O ■ Standard 50 pin I/O connection to external termination/isolation board		
<b>Analog Output</b>	■ On-board I2C serial bus capability; 8 channels of analog output through Visionscape Combo I/O board		
<b>On-Board Serial I/O</b>	■ 2 RS232 ports with Hardware flow control; Baud rates up to 115.2 K		
<b>Power Consumption</b>	■ +12 V @ 1 A; +5 V @ 5 A max; Maximum Power 30 W		■ +12 V @ 0.2 A; +5 V @ 5 A max; 28 W
<b>Environmental</b>	■ Operating temperature: 0 °C to 50 °C; Humidity: 10-90%, non-condensing		
<b>Min Host PC Requirements (Recommended)</b>	■ Pentium 4, 2.4 GHz or higher with minimum of 256 MB memory; one full-length +5 V/32 bit PCI expansion slot ■ VGA display adapter – 64K or True color ■ Microsoft Windows 2000 SP4 or Windows XP SP2 or later		

# SIMATIC Visionscape Software

## Common vision application development & deployment environment

SIMATIC Visionscape software substantially speeds up vision application setup by offering users a broad collection of vision processing tools and a powerful Graphical User Interface (GUI) for application development and deployment.

The standard GUI enables the user to easily select one of the many application specific configurations that comes with the tool that can be downloaded to any of the boards depending on specific application needs. From the runtime environment, the user can start / stop the application, collect and review failed image data, communicate collected data to the host PC as well as present other diagnostic information, thus providing the user with complete system status.

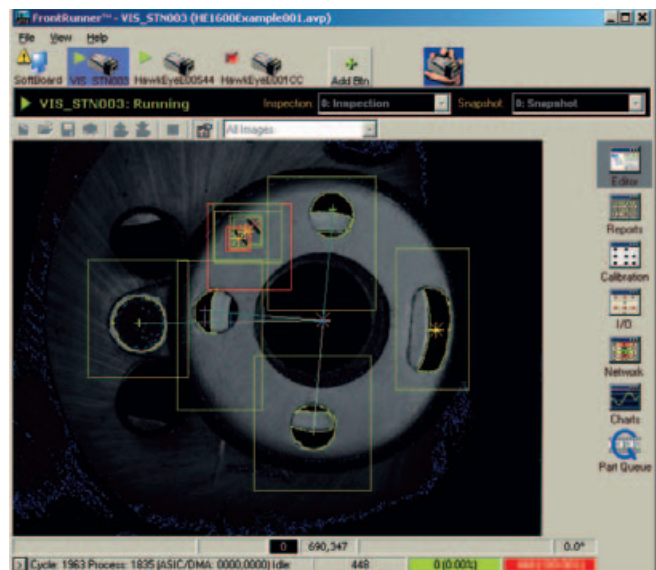
User levels are almost as varied as the applications that can benefit from a visionscape solution as such, the configuration environment can be tailored to different user types to allow for the maximum productivity.

- Application engineers and system integrators to quickly develop and deploy complex vision applications without any conventional programming by dragging and dropping standard tools into jobs configured as a sequence of processing steps
- Application developers, machine builders and OEMs to create customized applications with custom graphical user interfaces fully integrated with the machine controller interface
- Installers and factory floor operators to select, set-up, and try-out preprogrammed applications and start, stop and monitor such applications on the factory floor

The SIMATIC Visionscape family of products features a scalable line of high performance vision processors, accelerators and frame grabbers. A unique advantage of this product line is that all of the boards are configured using the same development and deployment environment as well as the same extensive set of intelligent tools. The end result is that an application configured for one board can run unmodified and without recompilation on any other board, thus allowing users to easily scale as well as select the right price / performance point for each application.

## Highlights

- Common software environment for fast application development & deployment with all SIMATIC Visionscape boards
- Powerful graphical user interface and step program architecture for easy drag-and-drop application development
- Extensive collection of vision processing tools for image processing and analysis, calibrated dimensional measurements, automatic identification and application-specific processing tasks
- Scripting language for custom measurements or custom vision processing
- Open ActiveX control based software component architecture for custom application-specific GUI development
- Application-specific configurations for the pharmaceutical, packaging, semiconductor and electronics industries



SIMATIC Visionscape Software

# SIMATIC Visionscape Software

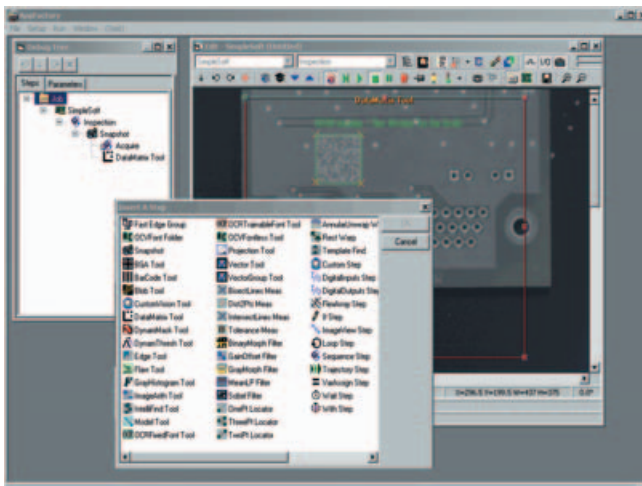
## Comprehensive collection of intelligent tools

### Highlights

- Very comprehensive collection of vision processing and automatic identification tools
- Tools have been refined over multiple generations of machine vision systems and proven in thousands of production installations worldwide
- Default tool parameters and built-in intelligence allow tools to deal with real part variability
- Can accommodate part translation, rotation, occlusion and lighting or contrast changes
- All dimensional measurements can be in pixels or calibrated real world units (also accounting for camera perspective)
- Low-level image processing and analysis tools take advantage of on-board hardware acceleration when available – as on the 1x00 and 4x00 board families
- High-level tools combine many operations and logic for application-specific tasks




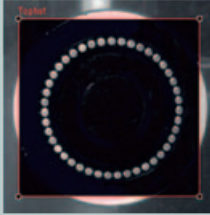

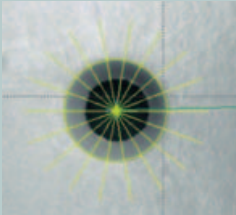

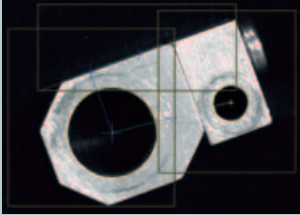


The broad collection of vision processing tools delivered with the SIMATIC Visionscape software includes:

- Image processing tools
  - Image arithmetic, image rotation and warping, binary & gray scale morphology, edge enhancement, other image filtering, etc.
- Image analysis tools
  - Flaw detection, histogram analysis, blob analysis, edge detection & fitting, vector edge detection and fitting, template & pattern recognition, object location & orientation detection, etc.
- Calibrated dimensional measurements
  - Variety of preconfigured measurements such as line intersection, point to point distance, point-to-line normal, etc.
- Automatic identification tools
  - Data Matrix and other 2D and 1D bar code reading, Optical Character Recognition (OCR), etc.
- Application specific high-level tools
  - Optical Character Verification (OCV) for print/mark inspection, Ball Grid Array (BGA) inspection, etc.
- Custom tools
  - User-defined expressions & math, custom measurements & custom scripted vision processing tools



# SIMATIC Visionscape Software

## Comprehensive collection of intelligent tools

			
	<p>Image rotation or circular arc unwrapping</p>		<p>Finding defects in irregularly shaped/masked image regions</p>
	<p>Template / pattern finding &amp; object location orientation detection</p>		<p>Making calibrated real-world measurements</p>
	<p>Optical Character Verification (OCV) and Optical Character Recognition (OCR)</p>		<p>Reading of multiple Data Matrix codes in a single image</p>

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