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TELEDYNE DALSA
Everywhereyoulook™

SINGLE AND MULTIPLE CAMERA SOLUTIONS
FOR AUTOMATED MACHINE VISION APPLICATIONS

INDUSTRIAL VISION SOLUTIONS

POSITIONING
IDENTIFICATION
VERIFICATION
MEASUREMENT
FLAW DETECTION

TELEDYNE DALSA
Everywhereyoulook™

SERVICING THE **MACHINE VISION INDUSTRY** FOR OVER 30 YEARS

Teledyne DALSA has focused on providing machine vision components and solutions for over 30 years. As a world leader we continue to help manufacturers apply vision technology, from image sensors, cameras, and acquisition boards, to sophisticated vision software and intelligent vision systems. Our technology is used in thousands of automated inspection systems around the world and across multiple industries including semiconductor, flat panel display, electronics, automotive, medical, packaging, and general manufacturing.

www.teledynedalsa.com/visionsystems

INDUSTRIAL **VISION SOLUTIONS**

We are committed to helping manufacturers improve product quality, lower costs, and increase production yields by providing automated machine vision solutions that meet the diverse needs of industry and end user alike. Designed specifically for factory floor deployment, our innovative vision systems and smart cameras offer scaleable solutions that satisfy a wide range of application needs, from positioning robotic handlers to complete assembly verification.

FULL RANGE OF VISION CAPABILITIES

Teledyne DALSA vision solutions provide a full suite of vision tools and capabilities for performing the following inspection tasks:

01. **POSITIONING**
Guide robotic handlers or adjust vision tools for part movement

02. **IDENTIFYING**
Identify product for verification or traceability

03. **VERIFYING**
Verify parts for correctness, assembly, or packaging

04. **MEASURING**
Measure parts for dimensional accuracy

05. **FLAW DETECTING**
Check part surfaces for scratches and other defects

POWERFUL TOOLS, EASY TO USE

Designed specifically for easy deployment and usability, our innovative smart cameras, vision systems, and software satisfy a wide range of application needs.

READY FOR ANY CHALLENGE

Teledyne DALSA's vision systems are available in a range of cost-effective models to satisfy a broad variety of user requirements. These include single 640 x 480 standard camera configurations to high-performance multi-camera models with 2560 x 2048 color resolution. In addition, Teledyne DALSA vision systems support line scan technology to address challenging large format or cylindrical unwrapping applications.

BOA VISION SYSTEMS

SINGLE POINT INSPECTION

BOA is a highly integrated vision system in a compact "smart" camera format engineered specifically for factory floor automation. With application software embedded, BOA offers new and experienced users alike, an easy-to-deploy, cost-effective vision solution for single point industrial inspections.

BOA FEATURES

- » Tightly Integrated Vision System
- » Easy to use Embedded Software
- » Multiple Processing Engines
- » Factory Communications
- » Industrial Enclosure
- » 360° Direct Mounting
- » Factory Style Connectors
- » Ideal for Single Point Inspections

BOA GIVES YOU MORE

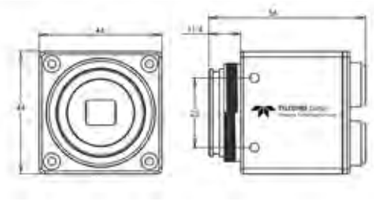
The BOA vision system comprises all the elements of an industrial machine vision solution:

- Light Control
- Processing I/O
- Factory Communications
- Developer and Operator Application Interfaces
- Protective Enclosure

Unlike traditional smart cameras, BOA incorporates multiple processing technologies—DSP, CPU and FPGA—for algorithm, communication and control optimization. Its onboard application is accessed through a standard web browser for both setup and runtime monitoring.

With BOA, there is no need to install software on a PC and no need to maintain version control between the vision system and the connecting PC or factory network.

BOA's small, rugged enclosure makes it easy for you to integrate tight-fit applications and harsh factory environments knowing that heat, vibration or moisture will not affect performance.



BOA INS

The standard product is offered with our iNspect Express application software. This interface combines ease-of-use with a common set of tools and capabilities that can be applied to a multitude of inspection applications.

BOA IDR

The IDR version is offered with a subset of iNspect Express tools that apply only to identification, tracking and associated verification applications. BOA IDR is a good choice for manufacturers who need to inspect product markings for correctness or traceability.

BOA PRO

The PRO version is offered with our advanced Sherlock application software. Ideal for vision integrators, Sherlock provides the flexibility and tools to tackle a diverse range of applications across all industrial segments.

SENSOR	640 x 480						1024 x 768						1280 x 960						1600 x 1200					
PERFORMANCE	BOA		BOA50		BOA200		BOA		BOA50		BOA200		BOA		BOA50		BOA200		BOA		BOA50		BOA200	
MONO/COLOR	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C
BOA INS	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓		✓	
BOA IDR	✓		✓		✓		✓		✓		✓		✓		✓		✓				✓		✓	
BOA PRO			✓	✓	✓	✓			✓	✓	✓	✓			✓	✓	✓	✓			✓		✓	

PANEL LINK MOUNT

Our panel link products are optional modules that provide integration convenience, expandability and protection against incorrect wiring. Panel Link products are DIN mountable and support standard M12 factory cabling to minimize costs. Depending on your application, these modules are designed for single cable applications as well as facilitating Ethernet communication for up to four BOA cameras.

PL-200-IO

PL-200-E

PL-100

NEW **BOA2** VISION SYSTEMS

NEXT GENERATION BOA OFFERS MORE RESOLUTION, PERFORMANCE AND INTEGRATION

BOA2 vision systems are designed for applications that require higher image resolution and performance. These systems are well suited for precision part measuring and can detect small defects that are lost or difficult to distinguish with lower resolution sensors. BOA2 systems can image and inspect large parts or large surface areas, thus reducing the number of sensors and overall cost of deployment. Three resolution models are offered with two, three or five megapixel sensor formats.

Specifications	BOA2 XA2	BOA2 XA3	BOA2 XA5
Memory	Storage 4GB, Program 1GB		
Speed	1.5GHz Dual Core		
Sensor	1664x1216	1920x1440	2560x2048
Pixel Size	5 µm	5 µm	5 µm
Max Frame rate	up to 80 fps	up to 60 fps	up to 40 fps
Lens	C-mount 2/3"	C-mount 1"	C-mount 1"
Lamp Internal	Optional ring	N/A	N/A
Lamp External	Direct connect		
Trigger	1 opto-isolated input or via software		
Inputs	3 opto-isolated inputs (including trigger)		
Outputs	3 opto-isolated outputs		
Strobe	1 strobe output for external lamp		
Status	1 network + 2 application LEDs		
Interfaces	Ethernet: 1000 BaseT, Serial: RS-232		
Power	12-30V @ 300mA		
Environment	Operating: 0-50 °C, IP67 protection		
Dimensions	83 mm x 66 mm x 48 mm (without lens cover)		

LIGHTING OPTIONS

Like all BOA smart cameras, BOA2 provides a direct connection to external 24V light sources with built-in strobe control. The BOA2 XA2 and XA3 models can optionally be equipped with a high intensity ring light with built-in collimators that provide uniform illumination across the target.

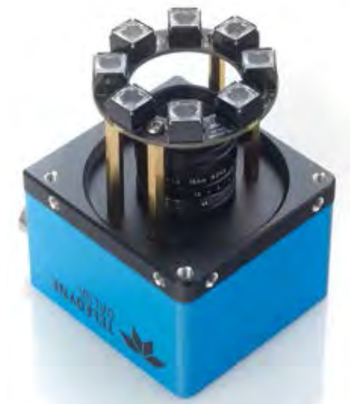
MOUNTING OPTIONS

M4 holes located on the sides, front, and back of the camera offer convenient mounting.

TOP

FRONT

BACK



EMBEDDED SOFTWARE

The BOA2 XA5 will be initially offered with iNspect Express 1.9 offering new features and tools such as:

- Multi-point calibration
- Variable (unimportant) pattern masking
- Acceptable feature variation learning
- Thread inspection
- Additional preprocessors, tool features and scripting functions

ACCESSORIES

BOA2 is offered with a new PL-101 Panel Link module. This DIN mountable interface provides convenient wiring and I/O isolation at the control panel through a standard M12 cordset.

Other optional accessories include lenses, lens protection caps, filters, lights, interface cables, power supplies, display controllers and HMI touch panels.

GEVA VISION SYSTEMS

MULTI POINT INSPECTION

GEVA vision systems offer the ease-of-use, performance and flexibility to meet the diverse requirements of industrial inspection. Integrated with high-speed camera ports, multi-core processing, and choice of application software, these systems provide the capabilities and the versatility to suit a wide range of multi-camera applications.

GEVA-300

The GEVA-300 is our entry-performance vision system. It includes a dual-core processor and 6 GigE ports for camera interfacing. The low-cost GEVA-300 is a fanless, rugged system that easily integrates into tight-fitting environments and tolerates harsh factory conditions. Factory I/O is supported through an external DIN mountable module.

GEVA-312T

The GEVA-312T has similar performance to the GV-300, but is packaged as an HMI touch panel. The system includes two Gigabit ports for camera and network interfacing, USB and serial ports for I/O control, and front accessible USB for easy maintenance access. The GEVA-312T supports panel or VESA mounting options.

GEVA-1000

The GEVA-1000 is our mid-performance vision system. It has three times the processing power of the GEVA-300 and includes two dedicated GigE camera ports. The GEVA-1000 has integrated I/O that includes camera trigger inputs, lighting control and opto-isolated inputs and outputs for associated equipment interfacing.

GEVA-3000

GEVA 3000 is our high-performance vision system. It offers six times the processing performance of the entry level GEVA 300 and up to three times the performance of the GEVA 1000. The ruggedized GEVA 3000 provides a robust and highly capable industrial vision system for applications on the factory floor. Six Gigabit compliant Ethernet ports internally connect through independent data lanes to alleviate bandwidth bottlenecks often associated with multi-camera acquisition. Like the GEVA-300, factory I/O is supported through an external DIN mountable module.

GEVA-3000CL

GEVA-3000CL is a variant of the GEVA-3000 that supports the industry standard Camera Link interface. It allows simultaneous acquisition from two base style cameras or one medium style camera. The GEVA-3000CL is primarily targeted for line scan applications, but it can also be used with high-resolution or high-frame rate area cameras that support the Camera Link interface.

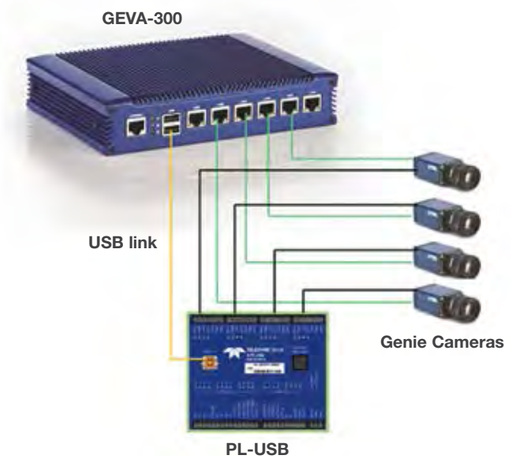
GEVA – GIGABIT ETHERNET

The GEVA platform offers camera expandability with low overall system cost. Multiple GigE camera ports are compatible with a resolution range of mono or color, area and line scan cameras. Camera expansion is easily accommodated using commercially available network technologies, allowing large configurations to be realized for a variety of applications such as final inspection of large assemblies. Configurations from four to 32 cameras are easily achievable.

GENIE™
AREA CAMERAS

GEVA - I/O SOLUTIONS

The GV-1000 and GV-3000CL systems provide I/O directly, whereas the GV-300, GV-312T and GV-3000 systems support I/O externally through the PL-USB. The DIN mountable PL-USB module offers electrical interfacing and I/O expansion for up to four Genie cameras. Multiple PL-USB modules can be used in a single application and they can be used with GEVA or any industrial PC platform using our software to simplify vision system integration.



APPLICATION		GV-300	GV-312T	GV-1000	GV-3000	GV-3000CL
Processing Scale	Relative	1X	1X	3-4X	6-8X	6-8X
Memory	Program	2GB	2GB	2GB	8GB	8GB
	Storage	40 GB SS	32 GB CFAST	40 GB SS	60 GB SS	60 GB SS
Image	Sensor Type	GigE	GigE	GigE	GigE	Camera Link
	# Sensors	Expandable	Expandable	Expandable	Expandable	2
	Sensor Format	Area	Area	Area	Area/Line	Line/Area
	Color Support	Yes	Yes	Yes	Yes	Yes
	Sensor Size Min	640x480	640x480	640x480	640x480	1024x1
	Sensor Size Max	Variable	Variable	Variable	Variable	Variable
Communication	USB	3 (2.0)	5 (2.0)	2 (2.0)	6 (2.0))	6 (2.0)
	Ethernet (Mbps)	6 x 1000	2 x 1000	3 x 1000	6 x 1000	2 x 1000
	Serial (RS232)	1	4	1	2	2
	Visual (LEDs)	3	1	3	2	2
Display Options	Display	External	Embedded Touch	External	External	External
	Setup GUI	Local	Local	Local	Local	Local
	Operator	Local	Local	Local	Local	Local
I/O	Access	Breakout	Breakout	Local	Breakout	Breakout
	Type	24V Opto	24V Opto	24V Opto	24V Opto	24V Opto
	# Inputs	8	8	8 + 2 triggers	8	4 + 2 triggers
	# Outputs	12	12	8 + 2 strobes	12	4 + 2 strobes
Software	Application	iNspect Express Sherlock	iNspect Express Sherlock	iNspect Express Sherlock	iNspect Express Sherlock	iNspect Express Sherlock
Power		24V @ 2.5A	24V @ 2.5A	24V @ 2.5A	24V @ 2.5A	24V @ 2.5A

SHERLOCK
SOFTWARE

THE CHOICE AMONG INTEGRATORS

Sherlock is advanced machine vision software that can be applied to a wide variety of automated inspection tasks. This graphical design environment provides a rich suite of proven tools and capabilities that have been deployed in thousands of installations worldwide. Recognized throughout the machine vision industry, Sherlock offers the flexibility to satisfy the full spectrum of vision applications in industry. Sherlock is supported on 32-bit and 64-bit Windows machines as well as BOA smart cameras.

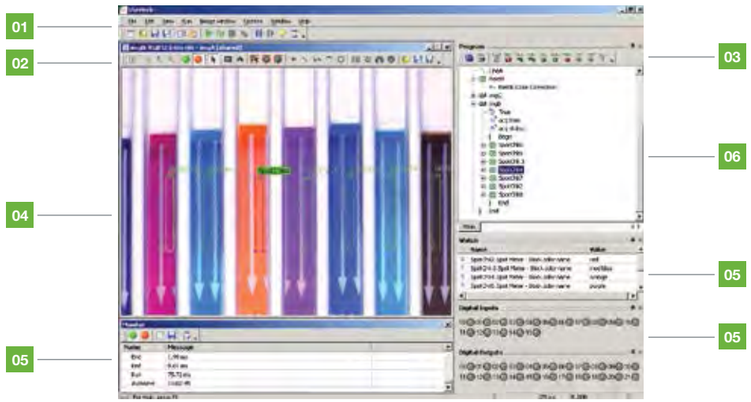
USER DEVELOPMENT INTERFACE

01. SOLUTION MANAGEMENT
Open and save solutions, start and stop inspection. Includes single-step debug operations.

02. IMAGE WINDOW CONTROLS
Load, acquire, save and zoom images. Select region-of-interest shapes and apply image preprocessors and algorithms.

03. PROGRAM INSTRUCTION TOOLBAR
Provides quick access to commonly used instructions. These include acquisition, subroutine creation, program steering, conditional statements, and scripting.

04. IMAGE WINDOW
Displays image during setup and live image at runtime. Images are acquired from cameras, files, or sequence of files.



05. FEEDBACK WINDOWS
Viewing windows provide immediate status of program events. They provide feedback of instruction timing, algorithm results, variables, hardware I/O, and result reporting.

06. PROGRAM
The program window displays the sequence of instructions or actions that comprise an inspection. Program snippets can be copied and paste back into the program or a subroutine.

SHERLOCK FEATURES

- Flexible Region of Interest Selection
- Extensive Set of Conditioning Functions
- Advance Pattern Finding Tools for Object Alignment and Robot Guidance
- Precise Tools for Computing the Dimensions

RICH SUITE OF TOOLS FOR ANY APPLICATION

Sherlock provides a comprehensive set of vision tools and capabilities that can be applied to applications across all industries. You can quickly build a solution using Sherlock's extensive library of preprocessors and advanced algorithms or if you need something special, you can write custom scripts, import proprietary tools and develop your own custom operator interfaces.

SPECIALTY TOOLS

Sherlock tools and capabilities allow you to tackle a wide range of industrial applications. Included are a variety of specialty tools that have been specifically designed to simplify difficult inspection tasks.

BEAD TOOL

The bead tool algorithm inspects a bead (thin line) of material. A typical application is inspecting beads of glue that attach gaskets to automotive assemblies.

BEAD TOOL

CORNER FINDER TOOL

The corner finder tool generates an array of "corner points" that can be manipulated by Sherlock formulas to measure the space between "peaks and valleys" of machined parts, such as bolt threads.

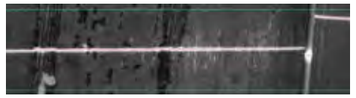
CORNER FINDER TOOL

COLOR TOOL

Sherlock provides tools for color correction, classification and presence. It also supports color mapping, a technique which allows you to segment the image by color in order to apply monochrome tools to the task.

LASER LINE TOOL

Laser tools are used to measure the profile of parts or to detect irregularities such as the placement of protective wrapping on this high-pressure pipe. At the right, a gap in the wrapping is followed by lifting of the wrapping, as shown by the upward step in the reflected laser line points.



LASER LINE TOOL

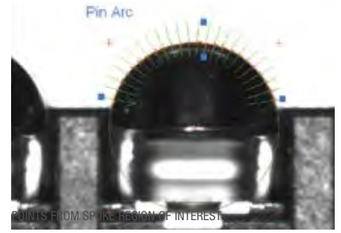
CALIBRATION TOOL

Sherlock offers several methods for translating pixel to real-world coordinates. Calibration tools also correct for lens and perspective distortion.

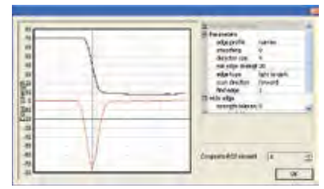
CALIBRATION TOOL

COMMUNICATION

Sherlock provides interfaces to a variety of communication mediums and supports standard factory protocols such as Modbus and Ethernet / IP.



Many of the tools provide graphical feedback that allows you to tune the algorithm to match your application needs.



EDGE GUI TOOL

CUSTOMIZATION

Sherlock's JavaScript-based scripting tool, complete with drag and drop instruction editing, allows you to develop custom formulas for in-line and background operations.

CUSTOM OPERATOR INTERFACE

A complete Visual Basic interface is provided for developing custom operator interfaces.

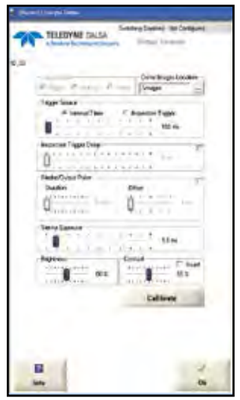
iNSPECT EXPRESS
SOFTWARE

MACHINE VISION MADE SIMPLE

iNspect Express is a vision application specifically designed to simplify the design and deployment of automated inspection on the factory floor. iNspect Express offers new and experienced users alike, a practical tool delivering uncompromised functionality that can be readily applied to a wide range of manufacturing tasks.

QUICK TO SET-UP

1. PREPARE IMAGE



- SYNCHRONIZE TIMING
- ADJUST LIGHTING AND EXPOSURE
- CALIBRATE COORDINATES

2. APPLY TOOLS

- CLICK AND APPLY INSPECTION TOOLS TO IMAGE
- ASSIGN LOCATORS FOR ALIGNMENT IF REQUIRED
- ADJUST PASS/FAIL TOLERANCES

3. INTEGRATE

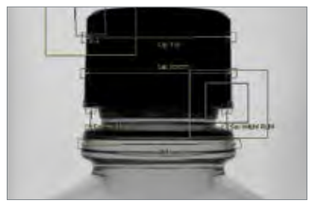
- SETUP COMMUNICATION CHANNEL
- CREATE SCRIPTS IF REQUIRED
- ASSIGN INPUTS AND OUTPUTS

NEW IN INSPECT EXPRESS 1.9

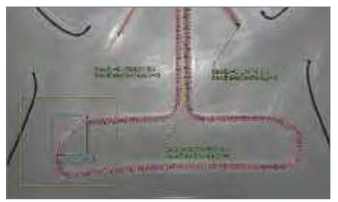
- Multi-point calibration
- Match tool masking and edge control
- Trainable tool (verify) for defect detection
- Measurement tool for thread inspection
- Tool cloning and much more…

iNspect Express FEATURES

- Multiple cameras and image sizes
- Emulator for offline development
- Same interface for setup and runtime
- Support for custom local interfaces
- Access control
- Direct connect to 3rd-party interfaces
- Solution switching via I/O or network
- Image logging and playback
- FREE updates



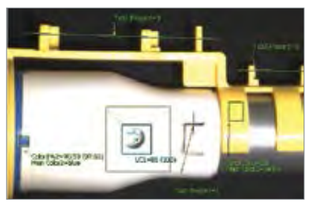
CAP VERIFICATION



BEAD MEASUREMENT

PRODUCT IDENTIFICATION

POSITIONING



COLOR VERIFICATION

CHARACTER READING

INSPECTION CAPABILITIES

iNspect Express offers a flexible tool set that is relevant for many different applications across the spectrum of industries it serves.

Inspection capabilities include:

- Pattern matching
- Color matching
- Feature finding
- Feature counting
- Feature measuring
- Barcode reading
- 2D Matrix reading
- 2D Matrix grading
- Character reading (OCR)
- Character verification (OCV)

iNspect Express also offers a very capable scripting tool. This tool allows users to develop their own programs using predefined or custom functions with tool variables. Scripts can be defined based on external, processing or timed events. This method of programming provides maximum flexibility to solve more demanding applications.

ADMINISTRATION

Operator access is an important consideration in factories. iNspect Express provides the capability to restrict or lockout unauthorized users.

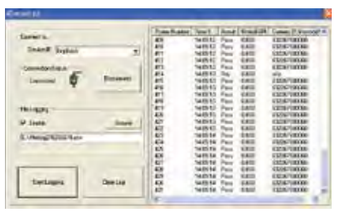
For highly controlled manufacturing environments like pharmaceutical, it is also required to log access and any changes made to the system. iNspect Express offers the ability to log access and change information to a secure drive on the company network.

FACTORY INTEGRATION

iNspect Express supports digital I/O, serial and Ethernet communications for interfacing 3rd-party equipment, operators and the factory enterprise. Compatible protocols, such as Modbus, Profinet and Ethernet / IP, provide standard languages for connecting complementary factory devices. Teledyne DALSA is proud to be an Encompass Partner of Rockwell Automation.

CUSTOM AND MULTI-LANGUAGE INTERFACE

iNspect Express offers a Visual Basic API for advanced users wishing to develop custom operator interfaces. The standard operator interface provided with the product is available in various languages such as English, Chinese, French, Italian, Japanese, and Spanish.



INSPECT EXPRESS PROVIDES LOGGING OF IMAGES AND INSPECTION RESULTS

01.

POSITIONING

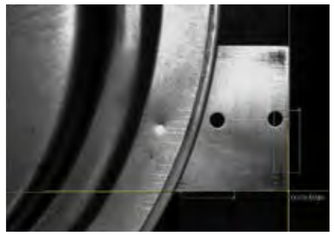
For inspection on high-speed production lines, offline verification audits or robot-guided pick and place, positioning tools are critical to successful machine vision. Positioning tools, locators, or pattern finders recognize and determine exact position and orientation of parts. Results can be transferred directly to material handling devices or used to position other tools required for inspection.

FIND AND VERIFY PARTS

MODEL EDITING

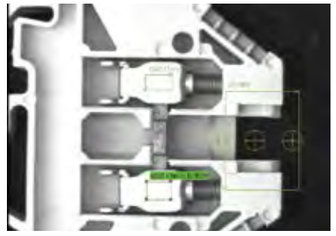
Advanced tools in Teledyne DALSA's Sherlock software support editing of the trained models that positioning tools look for. This has the benefit of eliminating noise or unimportant detail and improving speed and robustness.

EDGE POSITIONING TOOLS



Edge positioning tools provide very fast location of objects that have well-defined straight lines. They calculate the intersection point between the horizontal and vertical edges along with the rotation.

PATTERN POSITIONING TOOLS



Pattern positioning is better for complex images with irregular shapes, low contrast, or process variations. These tools support patterns defined by pixel intensity or geometric shape.

POSITIONAL CHECKS ON ASSEMBLY

In this application, the black rectangle is found and its position used as a landmark for finding the position and angle of arrow buttons on a final assembly. The position and angle of the arrows are found despite changes in intensity, orientation, contrast, shading and shadows.

Pattern finding tools return a score for how closely they match the trained model under varying conditions. Positioning tools are often used to verify irregular shaped objects or features that are difficult to inspect with other tools.

POSITIONING APPLICATIONS

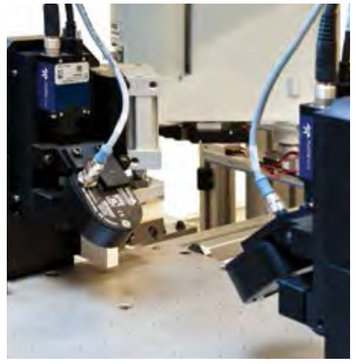
- Locating part position for material handling
- Locating part feature for tool landmarking
- Part counting
- Part sorting
- Verification of part or feature orientation

RELIABILITY AND PERFORMANCE

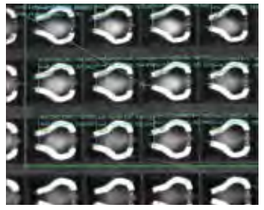
Robust positioning tools suitable for any kind of machine vision application. For reliability and performance in today's demanding manufacturing environments, Teledyne DALSA provides superior geometric pattern finding capabilities that are tolerant to most industrial process variations.

GEVA 3000

PRECISION ALIGNMENT CAPABILITIES



PCB ALIGNMENT FOR PICK AND PLACE APPLICATION



AUTOMOTIVE PART ALIGNMENT FOR PRECISION MEASUREMENT

Our solutions provide a variety of positioning tools that range from simple edge finders to sophisticated pattern finding algorithms.

Selecting the appropriate positioning tool (or tools) for a specific application is typically based on the following criteria:

- Part Features – high contrast unique features or complex similar patterns
- Part Movement – XY only or with rotation
- Part Appearance – pattern variation due to process or environment changes
- Part Orientation – small rotation or 360° rotation
- Line Speed

01. CASE STUDY

PACKAGING MACHINE APPLICATION

A custom assembly machine applies lids—clear plastic strips that come on a roll and peel off like labels—to sheets of plastic substrates. Each sheet has six silk-screened substrates, or coupons, on it. To apply the lids reliably and accurately to meet production goals, a series of features on each lid must be aligned with each corresponding coupon.

Four high-resolution GigE cameras connected to a GEVA industrial controller is designed into the assembly machine. Our positioning tools identify and locate the six coupons as well as the corresponding features on each lid. An Epson robot positions the lid on each coupon accordingly. Heat sealers then attach each lid. Once all six coupons are complete, the sheet is offloaded to a stack for further processing.

02.

IDENTIFICATION

Identification encompasses a range of machine vision applications that involve reading printed characters and decoding 1D or 2D symbols on products or parts. For traceability of production parts, verification of product lots or grading of print codes, our Identification tools are designed for accurate results in the toughest of manufacturing environments.

IDENTIFICATION APPLICATIONS

- Work in process inventory management – verify moving parts through a fabrication process
- Cradle to grave part traceability
- Product verification: Assure 1D or 2D code matches printed text
- Product identification and sorting
- Date and lot code verification
- Code verification: Detect problems with the marking system for preventive maintenance

ENGINEERED FOR INDUSTRY

Direct part marking of data matrix codes present many challenges for industrial identification. With a range of printing methods available, from direct etching and stamping to laser scribing and peening, direct part marking on metal, plastic and other materials offer manufacturers extensive printing flexibility together with variation in print quality.

Teledyne DALSA meets this challenge by providing robust identification tools that can handle the wide variation in print appearance and part position. Our tools also provide grading of printed codes that allows manufacturers to detect and correct deteriorating print quality.

BOA SMART CAMERAS

2D MATRIX CODE READERS

2D Matrix codes are widely used across many industries for part traceability and process control. The codes are popular for their small footprint, built-in error correction and large data capacity.

Teledyne DALSA 2D matrix algorithms provide decoding and grading of ECC 000, 050, 080, 100, 140 and 200, QR. MicroQR and PDF 417 matrix codes.

2D CODE PRINTED ON PHARMACEUTICAL VIAL

2D CODE PRINTED ON UNDERSIDE OF PLASTIC BOTTLE

1D BARCODE READERS

1D barcodes are commonly used on products for traceability and sorting. Machine vision verifies that the barcode matches the product that it is printed on.

Teledyne DALSA's barcode product supports UPC, EAN, Code 39, Code 93, Code 128, Codabar, Interleaved 2 of 5, Pharmacode, BC412, Postnet, Planet, OneCode, and RSS14 (Limited, Composite, Expanded).

PHARMACEUTICAL LABEL WITH RSS CODE

CONSUMER PRODUCT WITH UPC CODE

CHARACTER AND OBJECT READERS

Date codes and lot codes printed on products provide critical expiration and traceability information. Products with unreadable codes become defective as consumers cannot verify product quality.

Character or symbol recognition is common in many manufacturing or production environments.

Our products include trainable Object Character Recognition (OCR) tools that can handle the variation and diversity of most printing methods in use today.

OCR is based on pattern matching and so can be applied to a diverse range of verification applications outside of character reading. Often manufacturers will use OCR to build a library of parts that can later be identified and sorted.

CHARACTERS PRINTED ON CAST METAL PART

PRINTED DATE AND LOT CODE ON PRODUCT LABEL

DETECTING PRINT VARIATION

DOT PEEN 2D CODES ON PLASTIC

LASER-ETCHED 2D CODE ON METAL

Teledyne DALSA OCR tools can read a variety of printed characters and symbols under equally challenging conditions. New font variations can be quickly trained and saved to a pattern data base. Similarity scores are provided for the character verification process to indicate match quality.

BACKGROUND INTERFERENCE

CIRCULAR PRINT

POOR CONTRAST

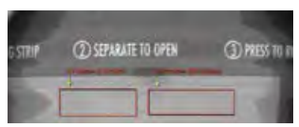
02. CASE STUDY

DATE AND LOT CODE PACKAGE

A manufacturer of medicinal products needed to inspect printed-ink lot and date codes on packages coming down a hanging assembly chain. The hanging packages are traveling on an indexing chain at about four to five packages per second.

Each lot and date code, after being read, must be logged and sent via Ethernet (TCP/IP) to an online computer server. The manufacturer produces six colored variations of the packages, and the BOA vision system's OCR tools are used to easily differentiate printed ink characters.

It is necessary to send and log the lot and date codes, time/date stamp, inspection count and status to a networked computer To send inspection data to the networked computer, a script routine is necessary to format and organize the information to be transferred to a PLC.



03.

VERIFICATION

Machine vision systems are widely used for the verification of parts, assemblies and packaged goods. The range of verification applications generally broad, but they utilize the same tools for positioning, measurement, identification and flaw detection. Verification is often combined with other tasks, such as measurement of part dimensions or reading of product barcodes, to render 100% product inspection.

ALUMINUM LID VERIFICATION

Pop-top can lids are checked to verify that they are 'top side up' and have the pull ring in place before they are joined to beverage cans.

The low contrast of this image might make for a difficult inspection, but our geometric pattern tools are easily able to distinguish the pull ring from the background.

PART VERIFICATION

Defects found at part assembly are easier and much less expensive to fix than in the finished product. For example, a vision system prevents these two similar parts from being interchanged.

SYMMETRICAL

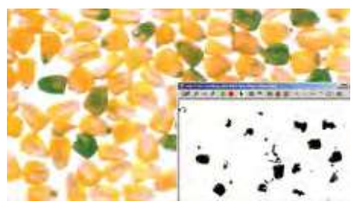
NON-SYMMETRICAL

TEETH VERIFICATION ON GEAR

FOOD VERIFICATION

Machine vision is used by the food industry to verify product content as well as processing and packaging.

Often, presence of product is detected by color as the position and extent of component foods vary too much to be reliably measured.



VERIFICATION OF CORN KERNEL GRADE

VERIFICATION OF PACKAGE SEAL

VERIFICATION APPLICATIONS

- Blister pack verification
- Solder joint verification
- Print verification
- Cable wiring verification
- Feature (thread, hole, notch) verification
- Molded part verification
- Bottle cap and safety seal verification
- PCB assembly verification
- Package verification

EASY SET-UP AND TRAINABILITY

Teledyne DALSA's vision systems are easy to set-up and simple to train. In the case of verification the primary concern is with presence and correctness of assemblies and parts. A trained machine vision system will evaluate a number of characteristics such as brightness, shape, dimension, orientation and color to achieve reliable inspection results.

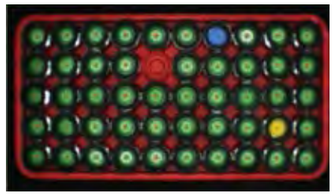
Verification has many uses in the production and packaging of products, and in automotive, electronics, pharmaceutical and medical manufacturing.

GEVA300

ASSEMBLY VERIFICATION USING COLOR

Color tools are often used to detect the presence and order of parts on an assembly, such as the blue and red plastic components on this medical instrument.

PACKAGE VERIFICATION OF WATER AERATORS



Ensuring that a correct type and quantity of aerator heads are correctly packed into this crate would be much more challenging without color verification tools.

SOFTWARE CAPABILITIES

- Search and match tools to find parts and verify assemblies
- Edge, corner, line, circle and line segment detection tools to find part "features"
- Blob analysis tools for counting and dimensioning areas of similar color or contrast on the part
- Counting tools to determine number of parts and indicate missing parts
- Color tools to measure amount and location of colored elements such as automotive fuses, wire, foodstuffs, and pills
- Measuring tools for further qualifying parts and assemblies

03. CASE STUDY

MEDICAL PACKAGING CONTENT

A medical package needs to be inspected for proper contents. The package contains a divider where a pamphlet insert is placed in the l eft pocket and 20 ointment tubes are placed in the right pocket.

The packages are traveling on a small conveyor about 2-3 second, with small varying degrees of orientation. Each package must be inspected for its proper contents, and ensure that the ointment tubes are only placed in the right pocket.

A BOA vision system is used to verify tube count and the presence of the pamphlet insert. Verifying the proper number of tubes is done by counting each white tube cap. A blue flat dome light is used for its effectiveness to create an even illumination on the cap surface. The presence of the insert is verified, as well as package movement and orientation.

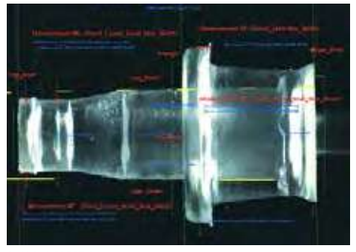
04.

MEASUREMENT

Manufacturing requirements for measurement range from presence verification to checking high-precision dimensional accuracy and geometrical tolerances. Attention to the inspection environment and image quality is as important as the vision algorithms themselves. Our sub-pixel measurement tools, combined with the right optics and stable lighting, provide the precision and repeatability to ensure manufacturing accuracy.

CRITICAL THRESHOLDS FOR MEDICAL IMAGING

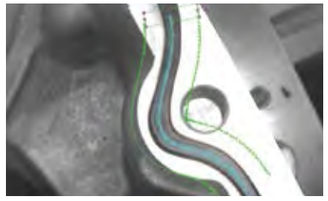
Manufacturers of medical instruments measure each part of the assembly process to strict tolerances. An incorrectly manufactured part could have dire consequences.



GLAND INSPECTION

STAPLE INSPECTION

GAUGING FOR QUALITY CONTROL



BEAD INSPECTION

The automotive industry has many applications that require online and offline measuring systems.

Using Teledyne DALSA measurement solutions, production quality can be monitored at any stage in the body shop. Results can be sent to the factory enterprise and documented for step-by-step quality control.

PRODUCTIVITY IMPROVEMENTS FOR A MULTITUDE OF APPLICATIONS

For general manufacturing needs, machine vision measurement provides a fast, highly accurate and cost-effective way to assure product quality and customer satisfaction

FILL LEVEL MEASUREMENT

3D PROFILE MEASUREMENT

CONNECTOR INSPECTION

MEASUREMENT APPLICATIONS

- Presence/absence
- Dimensional accuracy – geometrical tolerances
- Thickness and uniformity of parts

IMAGE CAPTURE TO IMAGE ANALYSIS

Teledyne DALSA offers image capture, acquisition, processing, and analysis solutions. From both area and line scan technology, bundled with our vision systems to standalone all-in-one smart camera vision systems, there is a solution to suit almost any application.

GEVA MULTI-CAMERA VISION SYSTEM

SOFTWARE CAPABILITIES

- Positioning (search) tools to accurately landmark measurements on moving parts
- Calibration tools to remove camera distortion and translate sub-pixel measurements locally or globally into real world units
- Preprocessing tools to manipulate or enhance the camera image to highlight features to measure
- Edge finding tools to accurately find edge transitions on parts for gauging
- Shape finding tools to locate distinct shapes like corners on parts
- Geometric fitting tools to fit lines, angles, arcs and circles to edge points
- Caliper tools to measure between edge points
- Math tools to create custom measurements that span multiple cameras
- Laser tools for measuring height on parts determined by angle of projected laser lines
- Bead tool to measure thickness and uniformity of adhesive beads or similar applications

IMAGING FOR MEASUREMENT ACCURACY

Selecting the correct resolution is critical to distinguishing the smallest feature for measuring. In the application below, a Teledyne DALSA 1024-pixel line scan camera is used to image different sized horse shoes. In applications where the part being gauged is large, images may be sourced and combined from multiple cameras to perform measurements.

1024 X 1200 LINE SCAN IMAGE

04. CASE STUDY

INTERCONNECT PIN INSPECTION

Tens-of-millions of interconnect pins measuring approximately .040" diameter x .472" long are manufactured tip-to-tail in a continuous chain, taken up onto a large reel and shipped directly to customers.

With the presses running at 350ppm, Genie cameras connected to three multi-camera vision systems are used to verify the diameter, thickness and length of the flange, and to measure the overall length of each pin as it came out of the die-set.
With these precise measurements, trends can be identified that may lead to non-conformances.

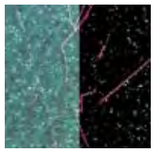
Each vision inspection station is networked to the manufacturer's database allowing analysis of raw dimensional data and providing insight into process variables such as tool wear.

05.

FLAW DETECTION

Flaws, such as contamination, scratches, cracks, discoloration and burn marks, are small changes in the appearance of a product that might indicate defects. Flaws are usually random, so machine vision looks for pattern changes, changes in color or texture, or for a particular type of connected structure.

SPLIT IMAGE SHOWING FLAW DETECTION ON TEXTURED TILE INSPECTION



Connected line patterns indicate surface scratches or cracks. Machine vision differentiates these from the irregular patterns associated with good quality tiles.

Defects like these can be further graded as acceptable or unacceptable according to feature characteristics such as area, length, direction, and brightness.

IMAGE SHOWING CONTAMINATION SPOTS ON A MEDICAL INSTRUMENT

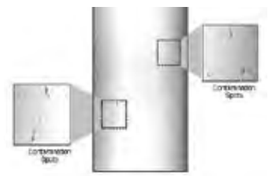
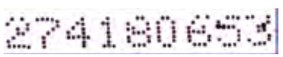


IMAGE SHOWING CONTAMINATION SPOTS ON MEDICAL INSTRUMENT

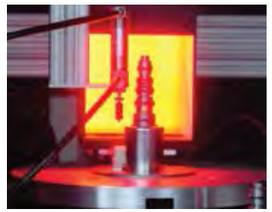
Tiny contamination marks on the instrument surface are segmented from the background using high resolution Teledyne DALSA cameras and diffuse illumination.

Teledyne DALSA surface flaw tools are able to adjust for natural discoloration of surface coatings to extract true defects.



Dot-matrix barcodes and lot numbers are printed along edges of rolled mylar. The ink-jet printer can fail to print dots, print extra dots, or put down too much ink, which causes the dots to merge and potentially contaminate the product with wet ink.

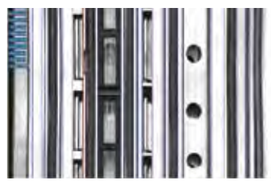
AUTOMOTIVE VALVE INSPECTION



VALVE BEING IMAGED

Line scan cameras are commonly used to unwrap cylindrical surfaces, such as automotive parts for inspection.

In this application, many inspections are performed to ensure that the valve surface is free of cracks and that all gaskets and filters are correctly installed and defect free.



UNWRAPPED IMAGE INSPECTED

FLAW DETECTION APPLICATIONS

- Surface scratch and crack detection
- Break in uniformity of texture
- Discoloration
- Burn detection
- Label Inspection

SUPPORT CRITICAL COMPONENT INTEGRATION

Teledyne DALSA's vision solutions allow easy integration of critical components like lighting. Surface flaws are often hard to detect, even by humans. Often they are low-contrast and random in their patterns. Proper lighting must be used to "amplify" flaws if they are to be detected by the machine vision system. In some cases multiple types of lighting are needed to show all classes of flaws.

GEVA 3000 CL

COLOR AND TEXTURE FLAW DETECTION

Flaws in the manufacturing process can often be detected by color or texture change. For these applications, defective product must be differentiated from normal process variation.

LABEL OR PRINT FLAWS

Printed material, such as labels on packages, are often vulnerable to print and structural flaws such as scuffs, folds, flags, and tears. Teledyne DALSA software is quick to learn and detect these process defects.

SOFTWARE CAPABILITIES

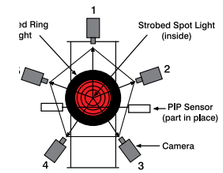
- Edge and segment finders for crack and scratch detection
- Color measurement and monitoring tools for detecting discoloration
- Texture analysis tools used to detect changes in visual texture, usually caused by flaws, process problems, or mismatched parts
- Label inspection tools for detecting print or application flaws (statistical differences)
- Burn detection using a large "ramp" edge detector

05. CASE STUDY

ROLLED STEEL RING INSPECTION

The customer manufactures cold-formed, steel coupling rings. Machine vision finds seam defects on the outer surface and missing threads on the inner ring.

Two networked multi-camera vision systems connected to 5 VGA cameras are used to ensure 360° inspection at 80 parts per minute.



Configuration

Strobed ring and spot lights illuminate parts as they are inspected. The relevant defects are found and reported along with images on the operator interface.

COMPLIMENTARY TECHNOLOGY

A vision application requires the integration of several components including the vision system, cameras, optics and lighting. Our expertise is in building vision systems and cameras. We source the related components from reputable 3rd-party companies. This strategy allows us to concentrate on what we do best, while providing our customers with complete, high quality solutions from a single source.

OPTICS

A good camera is dependent upon a good lens. In essence, the lens is the looking glass through which our cameras see. There are many factors to consider when selecting a lens, such as focal length, sensor size and field of view.

LIGHTING

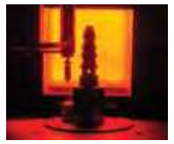
For any machine vision application, lighting should be a top consideration. Selecting the right light can make a difficult application simple, or conversely, selecting the wrong light can make a simple application difficult. Our sales channel partners are experienced in lighting techniques and can recommend the best choice for your inspection need.

LED LIGHTING

Teledyne DALSA offers a range of LED lighting solutions to satisfy your application requirements. These include:

- Ring lights
- DOAL
- Dome lights
- Spot lights
- Back lights
- Indirect ring lights
- Line lights
- Low angle ring lights

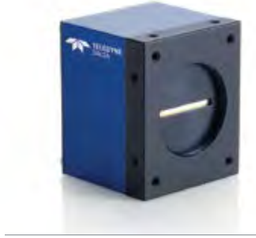
LED lighting is the preferred method for machine vision applications due to its long life and available choices. Camera sensors are generally more sensitive to red wavelengths, making red LEDs the most common choice, but other colors are often used to accentuate like colors on the part being impacted.



CAMERAS AND INTEGRATED VISION SYSTEMS

The Linea line scan camera series sets a new pace in the race to deliver a low cost camera that does not compromise image quality or responsivity. The Linea series combines the best of our advanced CMOS line scan sensor technology in a compact form factor. These small, affordable, low power cameras are designed for applications such as materials grading and inspection, transportation safety, automated optical inspection, and general-purpose machine vision.

- Multiple user coefficient sets and multiple FFC sets
- Programmable triggering with wide tolerance (5-24V)
- Binning 1x1, 2x1, 2x2
- AOI calibration: independent calibration for each AOI region, ensures best image quality for dissimilar areas
- Windowing feature: Up to four regions of interest, data reduction and line rate increase
- High sensitivity, High QE, low noise and high NIR responsivity



Spyder3 line scan cameras bring unprecedented responsivity and throughput to bear on your industrial inspection challenges. With our proprietary dual line scan sensor technology for a 3x sensitivity boost and double the line rates from previous Spyders, Spyder3 offers easy programmability, flat field correction, and a GigE Vision standard interface.

- 1k, 2k, and 4k resolutions, 100% fill factor
- Broadband responsivity up to 408 DN /(nJ/cm2) @ 10 dB gain
- Line rates up to 68 kHz
- Fully programmable gain, offset
- Flat field correction

Genie cameras are based on high quality, highly sensitive CCD and CMOS image sensors with global shutter and are available in a variety of resolutions ranging from VGA to 4096 x 3072 in both color and monochrome. Color Genie cameras feature white balancing and advanced Bayer conversion to produce crisp and accurate color images. With lensing options that include mounts for C- or CS-type lenses and right-angle lens, the Genie family offers flexibility for almost any application.

TELEDYNE DALSA GENIE CAMERA SERIES

MONOCHROME / COLOR SERIES

Genie M640-1/3 / C640	640 x 480 @ 64 fps - 7.4 µm
Genie M640-1/2 / C640	640 x 480 @ 64 fps - 9.9 µm
Genie M1024 / C1024	1024 x 768 @ 20 fps - 4.65 µm
Genie M1280 / C1280	1280 x 960 @ 24 fps - 3.75 µm
Genie M1400-1/2 / C1400	1360 x 1024 @ 15 fps - 4.65 µm
Genie M1410-2/3 / C1410	1360 x 1024 @ 22 fps - 6.45 µm
Genie M1600 / C1600	1600 x 1200 @ 15 fps - 4.4 µm

HIGH SPEED SERIES (MONOCHROME & COLOR)

Genie HM640 / HC640	640 x 480 @ 300 fps - 7.4 µm
Genie HM1024 / HC1024	1024 x 768 @ 117 fps - 7.4 µm
Genie HM1400 / HC1400	1400 x 1024 @ 75 fps - 7.4 µm
Genie HM1400 XDR	1400 x 1024 @ 75 fps - 7.4 µm
Genie TS-M2500 / C2500	2560 x 2048 @ 29 fps - 6 µm
Genie TS-M3500 / C3500	3520 x 2200 @ 19 fps - 6 µm
Genie TS-M4096 / C4096	4096 x 3072 @ 12 fps - 6 µm

See the full range of models available here: **www.teledynedalsa.com/cameras**