

## C2 Series

### High Speed 3D Sensors by Means of Laser Triangulation

- High Speed CMOS Camera for Laser Triangulation
- Integrated High Precision 3D Profile Algorithms
- Profile Speed up to 25,000 Profiles/s
- Enhanced 3D Imaging with HDR-3D Profiling Technology
- Sophisticated 3D Scan Features like Autostart, Automatic AOI-Search, Automatic AOI-Tracking, Multiple AOIs (Laser Lines) and many more
- Flexible Trigger Interface
- Integrated Illumination Control
- GigE Vision and GenICam Compliant



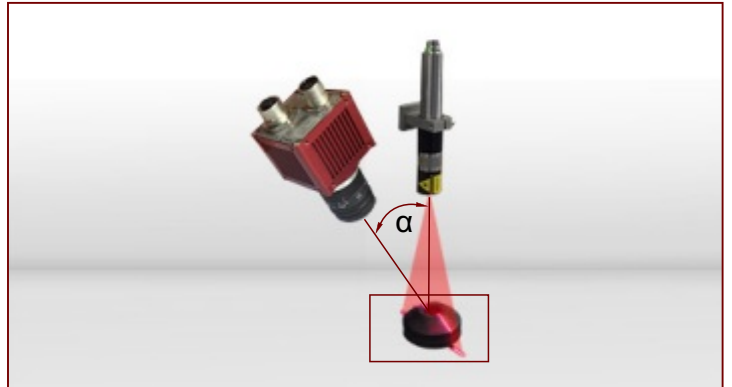
# C2 Series

## High Speed Sensors for Three-Dimensional Measuring Tasks with High Precision

C2 sensors scan objects by means of the sheet of light method. This occurs through a projected laser line that migrates along the surface. With the help of a C2 camera, an image of the laser line is acquired from the triangulation angle  $\alpha$ . As a result of this arrangement, the 3D profile of the object is captured.

Through an internal processing of the line images performed by different evaluation algorithms (TRSH, MAX, COG or FIR-PEAK), the C2 camera generates the 3D scan data. Using state-of-the-art FPGA technology, the C2 sensors can operate at profile speeds of up to 25 kHz, independently of the chosen algorithm.

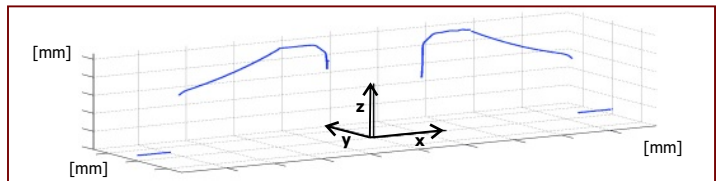
The transmission of the 3D data is carried out via a Gigabit Ethernet interface that complies with the GigE Vision standard and generic GenICam protocol. Once the C2 camera is connected, the vision software will automatically load an XML file with all camera functions. This is why the integration of AT's 3D sensors requires no more effort than setting up a conventional 2D camera.



The C2 Sensor records the Shape of the Laser Line.



Captured Laser Line in the Sensor Image



Display of 3D Data in a Vision Software

## Features at a Glance



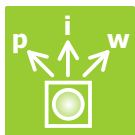
### AOI-Functions

Automatic AOI-Tracking, Automatic AOI-Search, Autostart



### Multiple Sensor-AOIs

Define up to 8 AOIs for dividing the sensor in separate subwindows for detection of multiple lines



### Multiple Feature Output

Sensor output delivers data of position, intensity, line width, etc.



### High Dynamic Range (HDR-3D)

HDR-3D enables the scanning of objects with inhomogeneous reflection properties



### Chunk Data

Additional information output, e.g. timestamps, trigger/encoder coordinate, frame index, etc.



### Advanced Triangulation Algorithms

Wide variety of evaluation algorithms (COG, FIR-PEAK, TRSH, MAX) and filters (smoothing and derivative)



### In1/IN2 for RS422 Encoder Interface

Enables asymmetric signal transmission, supports differential (RS422) and single-ended/single-channel encoders



### GEV Events & Packet Resend

Secure data transmission according to the GigE Vision standard

# 3D Imaging Applications

## Examples of Typical Applications with CX Sensors

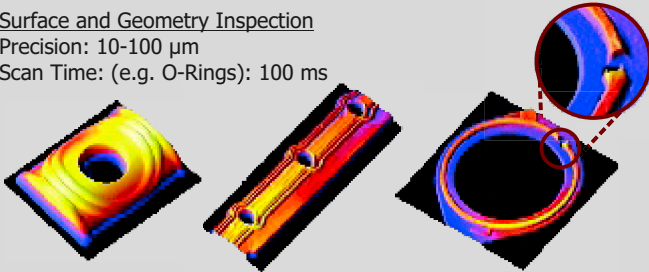
### Inspection of Elastomer Parts

(e.g. Radial Shaft Seals, Gaskets, Tyres)

Surface and Geometry Inspection

Precision: 10-100  $\mu\text{m}$

Scan Time: (e.g. O-Rings): 100 ms



### Inspection of Metal Parts

(e.g. Brake Discs, Conrods, Pistons)

Surface and Geometry Inspection

Precision: 10-100  $\mu\text{m}$

Scan Time: (e.g. Brake Discs): 1 s



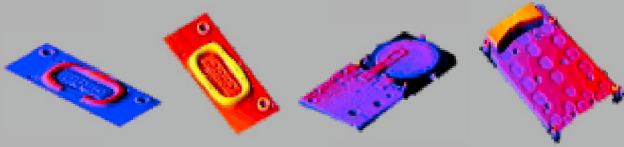
### In-Line Inspection in Assembly Lines

(e.g. Glue Beads, Rivets, Screws, PCBs, Batteries, Contacts)

Assembly Verification, Flatness & Geometry Inspection

Precision: 20  $\mu\text{m}$

Scan Time: <1 s



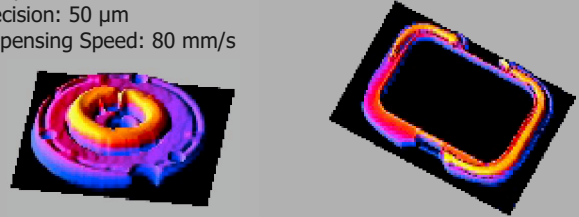
### Inspection of Adhesive and Sealing Beads

(e.g. Automotive Parts)

Online Inspection during Dispensing, Volumetric Measurement, Completeness Verification, Robot Guidance

Precision: 50  $\mu\text{m}$

Dispensing Speed: 80 mm/s



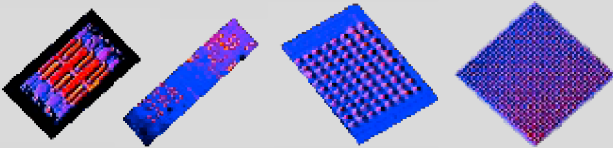
### Inspection of Electronic Components

(e.g. PCBs, BGAs, Connectors)

Inspection of Solder Paste, Assembly Verification, Coplanarity Inspection, Pin Inspection

Precision: 5  $\mu\text{m}$

Scan Speed (e.g. BGA): 300 mm/s



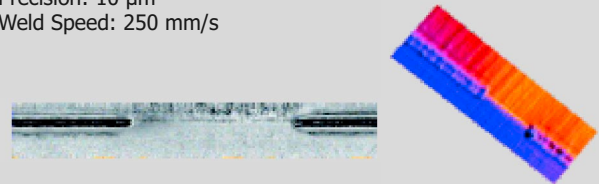
### Weld Seam Inspection

(e.g. Steel Blank Welding)

Surface and Geometry Inspection

Precision: 10  $\mu\text{m}$

Weld Speed: 250 mm/s



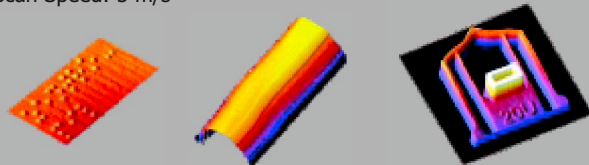
### Automatic Text Recognition

(e.g. Tyre Specification, Braille Characters)

OCR (Optical Character Recognition)

Precision: 10-100  $\mu\text{m}$

Scan Speed: 5 m/s



### Inspection of Wood Surfaces

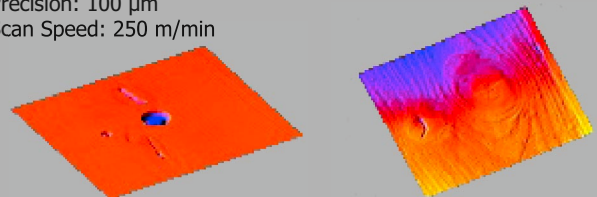
(e.g. Plywood)

Surface Inspection, Detection of Branch Holes,

Detection of Glue Stains, Texture Inspection

Precision: 100  $\mu\text{m}$

Scan Speed: 250 m/min

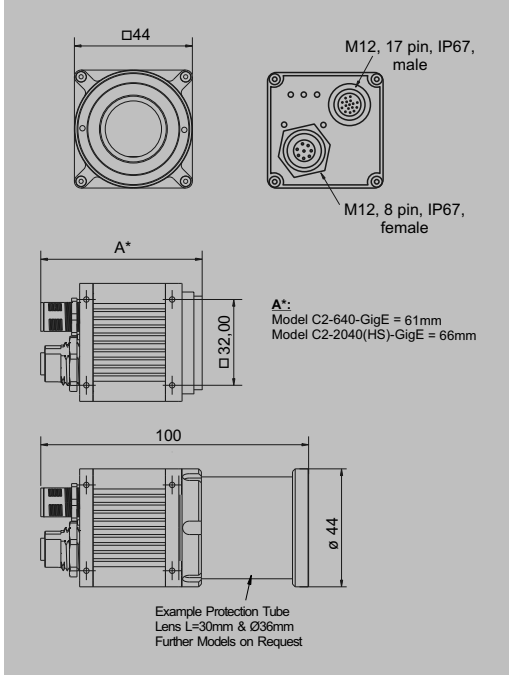
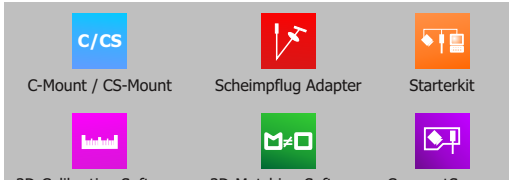


# C2 Series

## Technical Specifications

	C2-2040-HS-GigE		C2-2040-GigE		C2-640-GigE	
Sensor Resolution	2048 (H) x 1088 (V)		2048 (H) x 1088 (V)		648 (H) x 488 (V)	
Pixel Size	5.5 µm x 5.5 µm		5.5 µm x 5.5 µm		7.4 µm x 7.4 µm	
Dynamic Range (*with HDR-3D)	90 dB		90 dB		90 dB	
Digitization	10 Bit		10 Bit		10 Bit	
Sensitivity	16000 LSB/(µJ cm <sup>2</sup> ) @ 550 nm		16000 LSB/(µJ cm <sup>2</sup> ) @ 550 nm		20000 LSB/(µJ cm <sup>2</sup> ) @ 550 nm	
Sensor Algorithm	MAX, TRSH, COG, FIR-PEAK		MAX, TRSH, COG, FIR-PEAK		MAX, TRSH, COG, FIR-PEAK	
Length of Profile in 3D-Mode	2048 Pixel per Profile		2048 Pixel per Profile		648 Pixel per Profile	
Typical Profile Speed depending on Number of Sensor Rows  Height Resolution can be increased by using TRSH (1/2 pixel) or COG/FIR-PEAK (1/64 pixel) without Loss of Speed	Sensor Rows	Profile Speed with 2048 Pixel	Sensor Rows	Profile Speed with 2048 Pixel	Sensor Rows	Profile Speed with 648 Pixel
	1088	340	1088	340	488	550
	256	1400	512	710	256	1000
	128	2700	256	1400	128	1900
	32	9500	128	1400	32	6300
	16	16000	64	1400	16	10300
	8	25000	16	1400	8	15100
Max. Frame Rate for Image Mode (Full Frame)	- 170 fps (Internal Recording Memory) - 50 fps (via GigE Vision)		- 170 fps (Internal Recording Memory) - 50 fps (via GigE Vision)		- 550 fps (Internal Recording Memory) - 320 fps (via GigE Vision)	

### General C2 Camera Specifications

Interface Specifications		Mechanical Size	
Digital Camera I/Os	2 TTL Inputs, 2 TTL Outputs, Inputs can be configured as Image and Profile Trigger with Tick Divider and Direction Evaluation	 <p>M12, 17 pin, IP67, male M12, 8 pin, IP67, female</p> <p>A*: Model C2-640-GigE = 61mm Model C2-2040(HS)-GigE = 66mm</p> <p>Example Protection Tube Lens L=30mm &amp; Ø36mm Further Models on Request</p>	
Additional I/O Signals on External Terminal Unit	Resolver Interface with Signals A, /A, B, /B, Z, /Z		
Integrated Illumination Control Interface	Analog Output, Analog Input and Trigger Line for Laser Control		
Video Output	GigE Vision with GenICam Protocol		
Power Requirements			
Power Supply	10 - 24V DC		
Power Consumption	<6 W		
Mechanical Specifications			
Lens Mount	CS-Mount / C-Mount with 5mm adapter		
Size	44 mm x 44 mm x 66 mm		
Mass (without Optics)	125 g		
Housing Mount	4 x M2.5 on each Side		
Environmental Specifications			
Operating Temperature	0°C to +50°C (Non-Condensing)		
Storage Temperature	-30°C to +70°C		
General		General	
PC Requirements	Gigabit Ethernet NIC	 <p>C-Mount / CS-Mount    Scheimpflug Adapter    Starterkit 3D-Calibration Software    3D-Matching Software    CompactSensor</p>	
Operating Systems	Windows 10, 8, 7, XP, Linux		
Software Environments	Configuration Tool CX-Explorer, GenICam API, Compatible with any GigE Vision compliant Image Processing Library, e.g. CVB, NI-IMAQ, HALCON, MIL, VisionPro, EyeVision, GOM		



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