

## C5 Series

### High Speed 3D Sensors with High Speed and Ultra High Resolution

- Profile Speed up to 200 kHz (200,000 Profiles/s)
- Resolution up to 12 Megapixel
- Ruggedized Enclosure (IP67)
- Integrated High Precision 3D Profile Algorithms
- Enhanced 3D Imaging with HDR-3D Technology
- Integrated Illumination Control
- GigE Vision and GenICam Compliant
- Sophisticated 3D Scan Features like Autostart, Automatic AOI-Tracking, Multiple AOIs, etc.



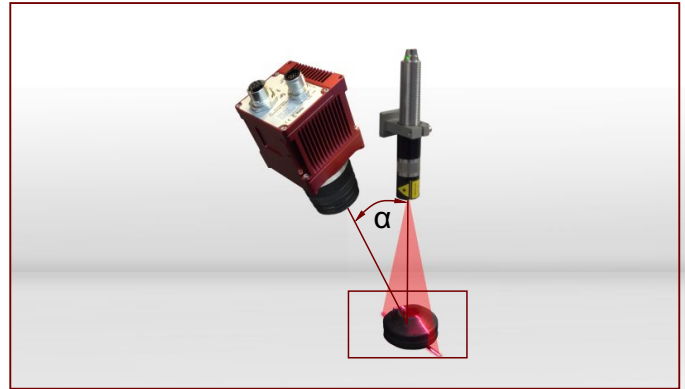
# C5 Series

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

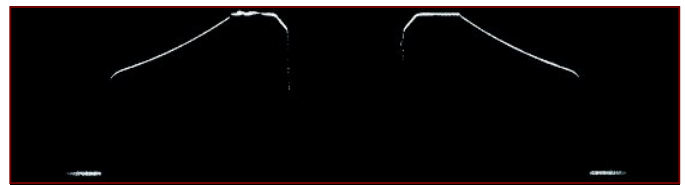
C5 sensors scan objects by means of the sheet of light method. This occurs through a projected laser line that migrates along the surface. With the help of a C5 camera, an image of the laser line is acquired from the triangulation angle alpha ( $\alpha$ ). As a result of this arrangement, the 3D profile of the object is captured.

Through an internal processing of the line images performed by different evaluation algorithms, the C5 camera generates the 3D scan data. Using state-of-the-art FPGA technology, the C5 sensors can operate at profile speeds of up to 200 kHz, independently of the chosen algorithm.

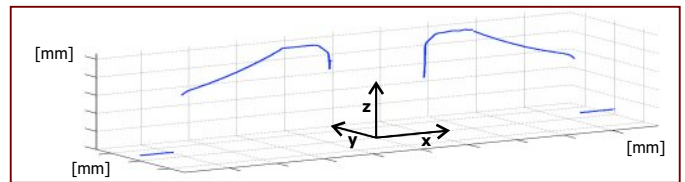
The transmission of the 3D data is carried out via a Gigabit Ethernet interface that complies with the GigE Vision standard and GenICam protocol. Once the C5 camera is connected, the vision software will automatically load an XML file with all camera functions. This is why the integration of AT's 3D sensors requires no more effort than setting up a conventional 2D camera.



The C5 Sensor records the Shape of the Laser Line.



Captured Laser Line in the Sensor Image



Display of 3D Data in a Vision Software

## Special Features



### AOI-Functions

Automatic AOI-Tracking, Automatic AOI-Search, Autostart



### Multiple Feature Output

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



### Multiple Sensor-AOIs

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



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

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



### Advanced Triangulation Algorithms

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



### Chunk Data

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



### Enhanced Encoder Interface

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



### GEV Events & Packet Resend

Secure data transmission according to the GigE Vision® standard

## Options at a Glance



### Starter-Kit

Complete 3D measuring setup with C5 sensor, laser, I/O panel and mounting



### 3D Calibration Software

Calibration tool for laser triangulation setup with optimum capturing quality



### C-Mount / F-Mount

Suitable adapters for several lenses



### 3D Matching Software

Variance comparison between scanned objects and prime examples



### Lens Cover

Robust tube with protection class IP 67 for use in production areas with harsh environments



### Scheimpflug Adapter

Angled adapter for sharper profile capturing by means of the Scheimpflug principle

# 3D Imaging Applications

## Examples of Typical Applications with CX Sensors

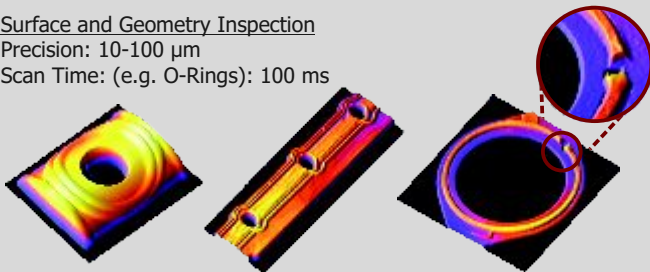
### Inspection of Elastomer Parts

(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



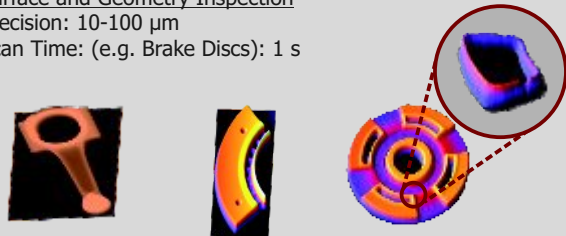
### Inspection of Metal Parts

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

Surface and Geometry Inspection

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

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



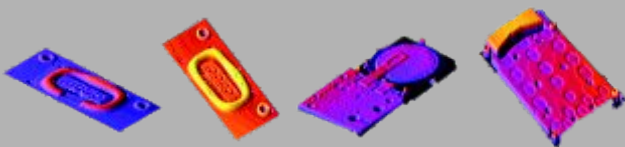
### In-Line Inspection in Assembly Lines

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

Assembly Verification, Flatness & Geometry Inspection

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

Scan Time: <1 s



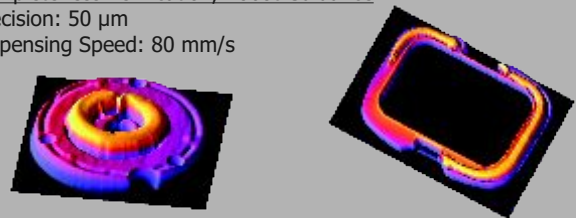
### Inspection of Adhesive and Sealing Beads

(e.g. Automotive Parts)

Online inspection During Dispensing, Volumetric Measurement, Completeness Verification, Robot Guidance

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

Dispensing Speed: 80 mm/s



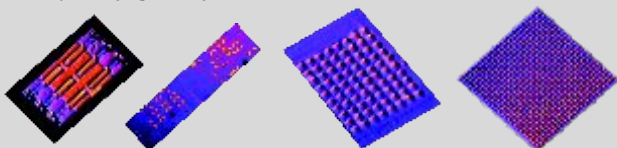
### Inspection of Electronic Components

(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



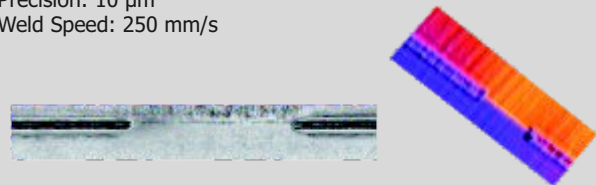
### Weld Seam Inspection

(e.g. Steel Blank Welding)

Surface and Geometry Inspection

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

Weld Speed: 250 mm/s



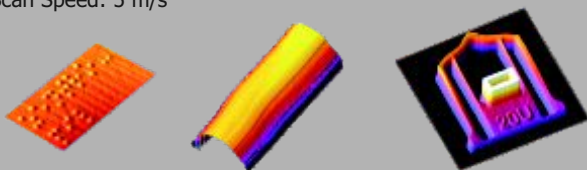
### Automatic Text Recognition

(e.g. Tyre Specification, Braille Characters)

OCR (Optical Character Recognition)

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

Scan Speed: 5 m/s



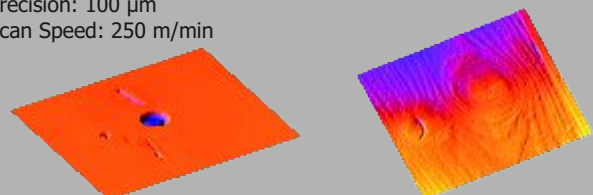
### Inspection of Wood Surfaces

(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



# C5 Series

## Technical Specifications

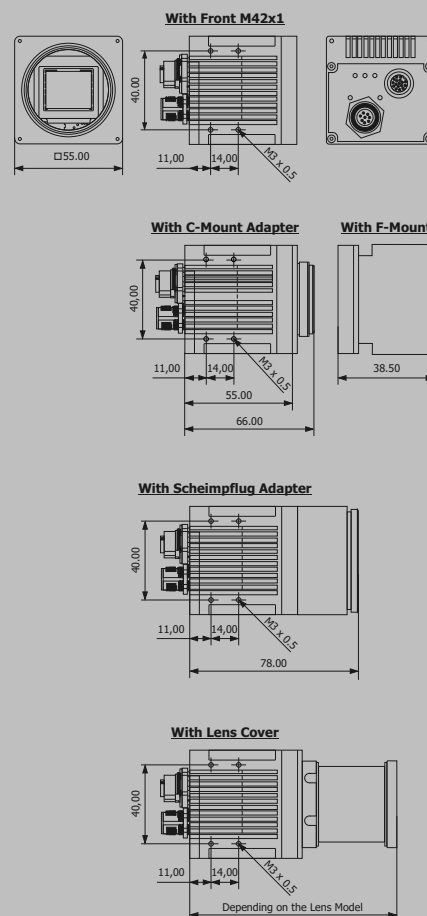
	C5-1280-GigE			C5-2040(-4M*)-GigE		C5-3360-GigE		C5-4090-GigE	
Sensor Resolution	1280 (H) x 1024 (V)			2048 (H) x 1088 (V) 2048 (H) x 2048 (V)*		3360 (H) x 2496 (V)		4096 (H) x 3072 (V)	
Pixel Size	6.6 µm x 6.6 µm			5.5 µm x 5.5 µm		5.5 µm x 5.5 µm		5.5 µm x 5.5 µm	
Dynamic Range (*with HDR-3D)	90 dB			90 dB		90 dB (with HDR-3D)		90 dB (with HDR-3D)	
Digitization	10 Bit			10 Bit		10 Bit		10 Bit	
Sensitivity	9.6 V/lux.s @ 525 nm			5.56 V/lux.s @ 550 nm		5.56 V/lux.s @ 550 nm		4.64 V/lux.s @ 550 nm	
Sensor Algorithm	MAX, TRSH, COG, FIR-PEAK			MAX, TRSH, COG, FIR-PEAK		MAX, TRSH, COG, FIR-PEAK		MAX, TRSH, COG, FIR-PEAK	
Profile Length in 3D-Mode	1280 Pixel per Profile			2048 Pixel per Profile		3360 Pixel per Profile		4096 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		Sensor Rows	Profile Speed (with 2048 Pixel)	Sensor Rows	Profile Speed (with 3360 Pixel)	Sensor Rows	Profile Speed (with 4096 Pixel)
		with 1280 Pixel	with 688 Pixel						
	1024	1.07 kHz	1.86 kHz	2048*	180 Hz*	2496	105 Hz	3072	75 Hz
	256	4.26 kHz	7.40 kHz	1088	340 Hz	1024	255 Hz	512	450 Hz
	128	8.48 kHz	14.7 kHz	256	1.4 kHz	128	1.8 kHz	128	1.7 kHz
	32	32.8 kHz	59.1 kHz	64	5.2 kHz	32	5.4 kHz	32	5.8 kHz
16	63.0 kHz	110 kHz	16	16.0 kHz	16	8.0 kHz	16	9.7 kHz	
8	116 kHz	192 kHz	8	25.0 kHz	8	10.0 kHz	8	14.5 kHz	
Max. Frame Rate for Image Mode (Full Frame)	- 288 fps (Internal Recording)			- 90 fps (Internal Recording)		- 52 fps (Internal Recording)		- 32 fps (Internal Recording)	
	- 94 fps (via GigE Vision)			- 25 fps (via GigE Vision)		- 12 fps (via GigE Vision)		- 9 fps (via GigE Vision)	

\* = only with Model C5-2040-4M-GigE

### General C5 Camera Specifications

Interface Specifications	
Digital Input	2 Electrical Isolated Inputs (5 -24 V DC)
Digital Output	2 Electrical Isolated Outputs (5 -24 V DC)
Encoder / Resolver Input	Resolver Interface with Signals A <sub>r</sub> /A <sub>r</sub> , B <sub>r</sub> /B <sub>r</sub> , Z <sub>r</sub> /Z <sub>r</sub> High Speed, Triple RS-422 / RS-485 Receiver Max. Input Voltage TTL (optional HTL ± 24 V DC)
Analog Output	Range: 0 - 5 V DC
Data Interface	GigE Vision with GenICam Protocol
Power Requirements	
Power Supply	10 - 24V DC
Power Consumption	<6 W
Mechanical Specifications	
Lens Mount	C-Mount / M42 with F-Mount Adapter
Size	55 mm x 55 mm x 55 mm
Mass (without Lens & Adaptor)	200 g
Housing Mount	M3 + Adaptor Plate with Metric and Inch Threads
Environmental Specifications	
Operating Temperature	0°C to +50°C (Non-Condensing)
Storage Temperature	-30°C to +70°C
General	
PC Requirements	Gigabit Ethernet NIC
Operating Systems	Windows 10 / 8 / 7 / XP, Vista, 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

### Mechanical Size



Version 1.2 | Status: March 2019 | Subject to modification and errors



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