

# C4-1280-GigE

## 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 71,500 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

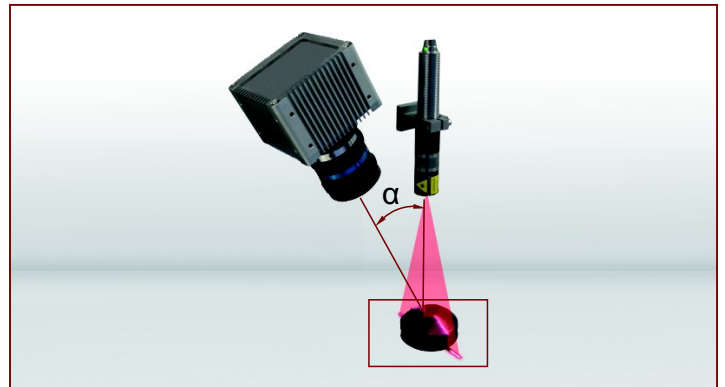
# C4-1280-GigE

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

The C4-1280-GigE scans 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 the C4-1280-GigE, 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 C4-1280-GigE generates the 3D scan data. Using state-of-the-art FPGA technology, the C4-1280-GigE can operate at profile speeds of up to 71.5 kHz, independently of the chosen algorithm.

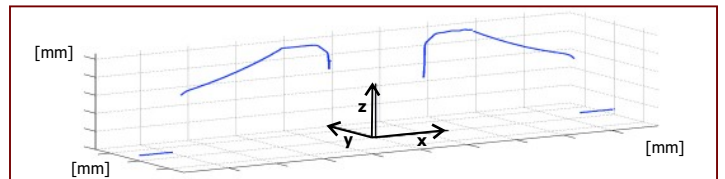
The transmission of the 3D data is carried out via a Gigabit Ethernet interface that complies with the GigE Vision standard and generic GenICam protocol. Once the C4-1280-GigE is connected, the vision software will automatically load an XML file with all camera functions. This is why the integration of AT's 3D sensors requires no more effort than setting up a conventional 2D camera.



The C4 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



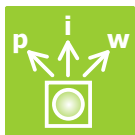
### AOI-Functions

Automatic AOI-Tracking, Automatic AOI-Search, Autostart



### Multiple Sensor-AOIs

Define up to 4 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)



### 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

# 3D Imaging Applications

## Examples of Typical Applications with CX Sensors

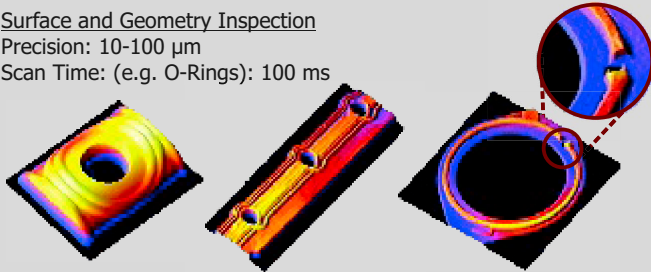
### Inspection of Elastomer Parts

(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



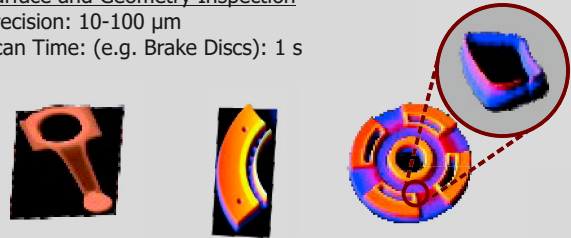
### Inspection of Metal Parts

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

Surface and Geometry Inspection

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

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



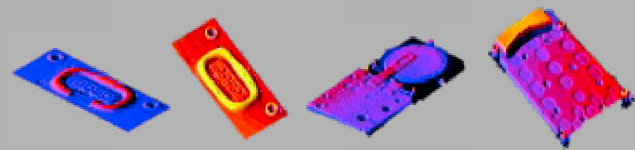
### In-Line Inspection in Assembly Lines

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

Assembly Verification, Flatness & Geometry Inspection

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

Scan Time: <1 s



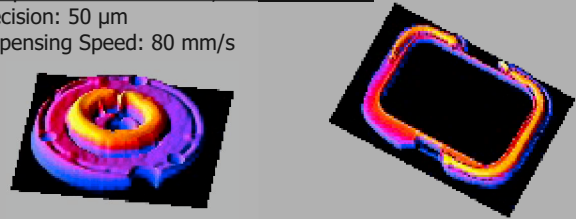
### Inspection of Adhesive and Sealing Beads

(e.g. Automotive Parts)

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

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

Dispensing Speed: 80 mm/s



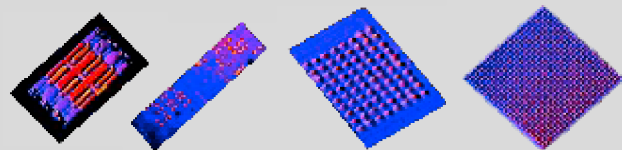
### Inspection of Electronic Components

(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



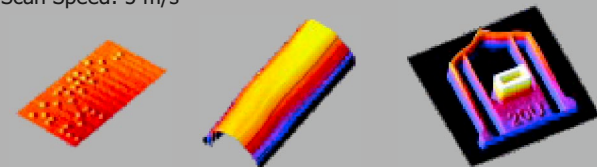
### Automatic Text Recognition

(e.g. Tyre Specification, Braille Characters)

OCR (Optical Character Recognition)

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

Scan Speed: 5 m/s



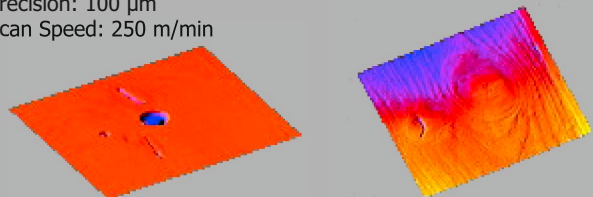
### Inspection of Wood Surfaces

(e.g. Plywood)

Surface Inspection, Detection of Branch Holes, Detection of Glue Stains, Texture inspection

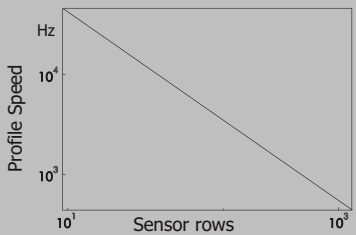
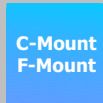

Precision: 100  $\mu\text{m}$

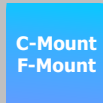

Scan Speed: 250 m/min







# C4-1280-GigE

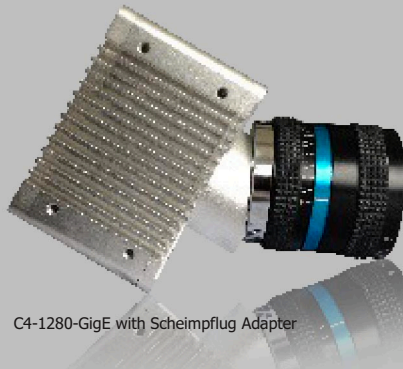
## Technical Specifications

| Sensor Specifications   |  |                                    |                                   |   |
|---|--|------------------------------------|-----------------------------------|---|
| Sensor Resolution   | 1280 (H) x 1024 (V)  |                                    |                                   |   |
| Pixel Size  | 14 µm x 14 µm  |                                    |                                   |   |
| Dynamic Range   | 90 dB (with High Dinamic Range (HDR-3D))   |                                    |                                   |   |
| Digitization  | 10 Bit   |                                    |                                   |   |
| Shutter   | Global Shutter with Multiple Slopes and Non-Destructive Readout  |                                    |                                   |   |
| Sensitivity   | 20,000 LSB/(µJ cm²) @ 680 nm   |                                    |                                   |   |
| Sensor Algorithm  | MAX, TRSH, COG, FIR-PEAK   |                                    |                                   |   |
| Length of Profile in 3D-Mode  | 48 - 1280 Pixel per Profile  |                                    |                                   |   |
| Typical Profile Speed depending on Number of Sensor Rows<br><br>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 (Hz) with 1280 Pixel | Profile Speed (Hz) with 128 Pixel |    |
|   | 1024   | 490                                | 2200                              |   |
|   | 256  | 2000                               | 8000                              |   |
|   | 128  | 3800                               | 15000                             |   |
|   | 64   | 7500                               | 26000                             |   |
|   | 32   | 14000                              | 40000                             |   |
|   | 16   | 25500                              | 59000                             |   |
|   | 8  | 39000                              | 71500                             |   |
| Max. Frame Rate for Image Mode (full frame)   | 500 fps (internal memory)  |                                    |                                   |   |
| Interface Specifications  |  |                                    | C4 Camera Options                 |   |
| Digital Camera I/Os   | 2 Opto-Coupled Inputs, 2 Opto-Coupled Outputs, Inputs can be Configured as Image and Profile Trigger, RS422 Encoder Interface with Signals A <sub>r</sub> /A, B, /B, Tick Divider and Direction Evaluation |                                    |                                   | <br>C-Mount / F-Mount <br>Scheimpflug Adapter |
| Illumination Interface (5-pin M9 Connector)   | To Control Laser Line Projectors   |                                    |                                   |   |
| Video Output  | GigE Vision with GenICam Protocol  |                                    |                                   |   |
| Power Requirements  |  |                                    |                                   |   |
| Power Supply  | 10 - 24 V DC   |                                    |                                   |   |
| Power Consumption   | <10 W  |                                    |                                   |   |
| Mechanical Specifications   |  |                                    |                                   |   |
| Lens Mount  | M42 x 1 with Back Focal Distance 6.52 mm (Requires Adapter for C-/F-Mount Lens)  |                                    |                                   |   |
| Size  | 68 mm x 68 mm x 59 mm (C-Mount) / 88 mm (F-Mount)  |                                    |                                   |   |
| Mass (without Optics)   | 340 g (C-Mount) / 410 g (F-Mount)  |                                    |                                   |   |
| Housing Mount   | 4 x M3 on each Side  |                                    |                                   |   |
| Enviromental Specifications   |  |                                    |                                   |   |
| Operating Temperature   | 0 °C to +50 °C (Non-Condensing)  |                                    |                                   |   |
| Storage Temperature   | -30 °C to +70 °C (Non-Condensing)  |                                    |                                   |   |
| Software Integration  |  |                                    |                                   |   |
| PC Requirements   | Gigabit Ethernet NIC   |                                    |                                   |   |
| Operating System  | Windows 8, Windows 7, XP, Vista, Linux   |                                    |                                   |   |
| Software Environment  | Configuration Tool CX-Explorer, GenICam API, Compatible with any GigE Vision compliant Image Processing Library, e.g. CVB, NI-IMAQ, HALCON, MIL, VisionPro   |                                    |                                   |   |

  
C-Mount / F-Mount  
Scheimpflug Adapter

  
3D-Calibration Software  
3D-Matching Software

  
Starterkit  
CompactSensor

  
C4-1280-GigE with Scheimpflug Adapter

