C5 Series

High Speed 3D Sensors with Ultra High Resolution

- Profile Speed up to 14,500 Profiles/s
- 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 14.5 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 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.

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

**Weld Seam Inspection**
(e.g. Steel Blank Welding)
- Surface and Geometry Inspection
  Precision: 10 µm
  Weld Speed: 250 mm/s

**Automatic Text Recognition**
(e.g. Tyre Specification, Braille Characters)
- OCR (Optical Character Recognition)
  Precision: 10-100 µm
  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 µm
  Scan Speed: 250 m/min
C5 Series
Technical Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>C5-2040-HS-GigE</th>
<th>C5-3360-GigE</th>
<th>C5-4090-GigE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Resolution</td>
<td>2048 (H) x 1088 (V)</td>
<td>3360 (H) x 2496 (V)</td>
<td>4096 (H) x 3072 (V)</td>
</tr>
<tr>
<td>Pixel Size</td>
<td>5.5 µm x 5.5 µm</td>
<td>5.5 µm x 5.5 µm</td>
<td>5.5 µm x 5.5 µm</td>
</tr>
<tr>
<td>Dynamic Range (with HDR-3D)</td>
<td>90 dB</td>
<td>90 dB (with HDR-3D)</td>
<td>90 dB (with HDR-3D)</td>
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<tr>
<td>Digitzation</td>
<td>10 Bit</td>
<td>10 Bit</td>
<td>10 Bit</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>16000 LSB/µJ cm² @ 550 nm</td>
<td>5.56 V/lux.s @ 550 nm</td>
<td>4.64 V/lux.s @ 550 nm</td>
</tr>
<tr>
<td>Sensor Algorithm</td>
<td>MAX, TRSH, COG, FIR-PEAK</td>
<td>MAX, TRSH, COG, FIR-PEAK</td>
<td>MAX, TRSH, COG</td>
</tr>
<tr>
<td>Length of Profile in 3D-Mode</td>
<td>2048 Pixel per Profile</td>
<td>3360 Pixel per Profile</td>
<td>4096 Pixel per Profile</td>
</tr>
<tr>
<td>Typical Profile Speed depending on Number of Sensor Rows</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height Resolution can be increased by using TRSH (1/2 pixel) or COG/FIR-PEAK (1/64 pixel) without Loss of Speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Frame Rate for Image Mode (Full Frame)</td>
<td>- 170 fps (Internal Recording Memory)</td>
<td>- 52 fps (Internal Recording Memory)</td>
<td>- 37 fps (Internal Recording Memory)</td>
</tr>
<tr>
<td></td>
<td>- 50 fps (via GigE Vision)</td>
<td>- 12 fps (via GigE Vision)</td>
<td>- 8 fps (via GigE Vision)</td>
</tr>
<tr>
<td>General C5 Camera Specifications</td>
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</tbody>
</table>

**Interface Specifications**

- 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
- Additional I/O Signals on External Terminal Unit: Resolver Interface with Signals A, /A, B, /B, Z, /Z
- Integrated Illumination Control Interface: Analog and Digital Modulation, I²C, RS232
- 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 / Optics): 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 8, Windows 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

**Mechanical Size**

- With Front M42x1
- With C-Mount Adapter
- With F-Mount
- With Lens Cover

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