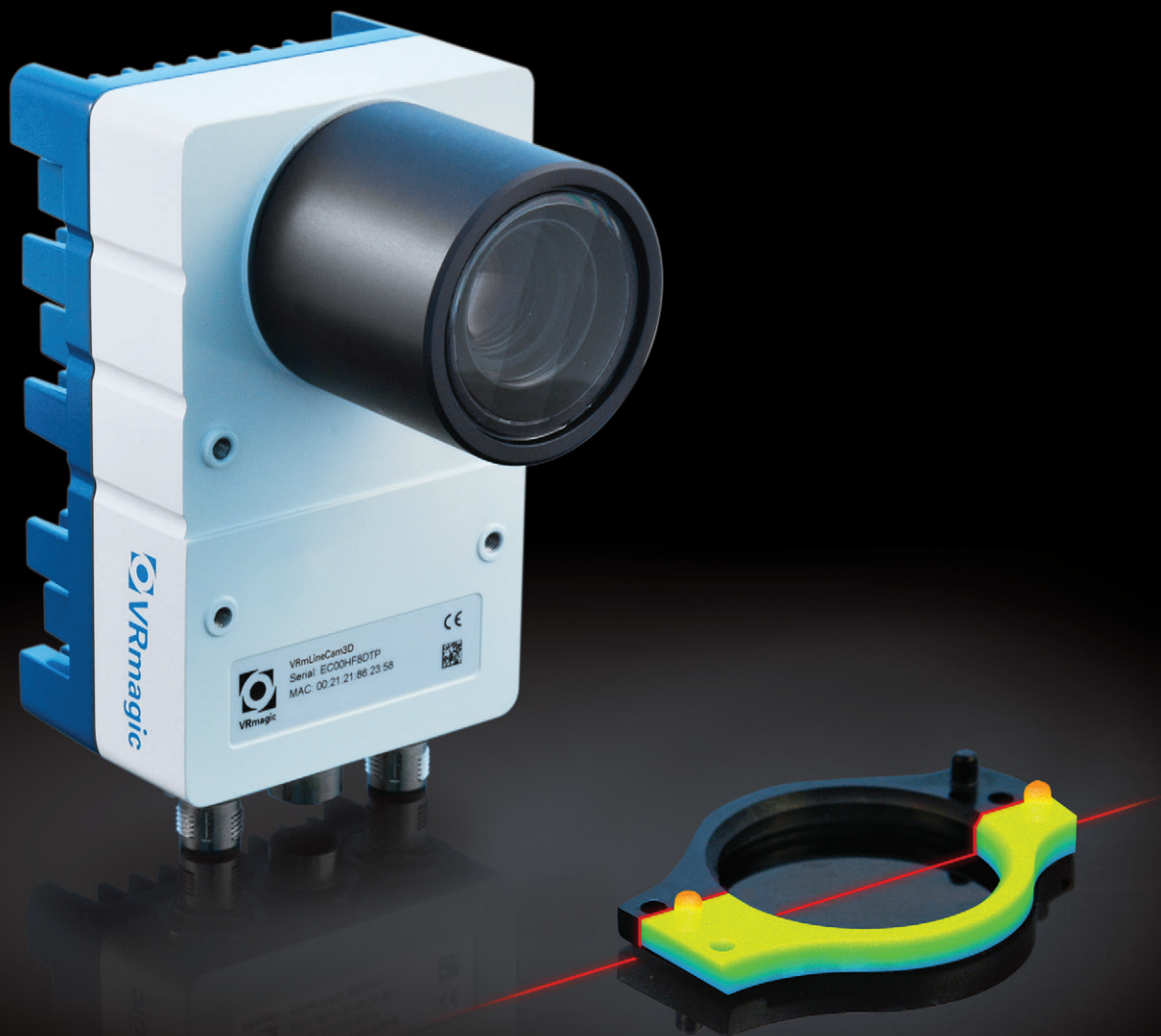


Rugged 3D Laser Triangulation Camera

LineCam3D for High-Resolution
Surface Inspection with Line Lasers



The LineCam3D – High-Speed Laser Line Extraction, GigE Vision Compliant



The LineCam3D has a rigid aluminum body and industry-standard M12 interfaces for power supply, Gigabit Ethernet, and digital IOs.

Flexible Laser Triangulation Camera

The LineCam3D by VRmagic Imaging uses the principle of laser triangulation to create precise 3D profile measurements. It works in combination with a variety of line lasers and, depending on the optics, distance, and triangulation angle, forms a flexible system with user defined scan volume.

GigE Vision Compliant

By using the industry standard GigE Vision interface, integration of the LineCam3D into image processing applications is straightforward. The 16 bit laser line coordinates, which are extracted in real-time using the camera's FPGA, are transmitted at up to 1000 profiles per second at an AOI of 360 lines (1/3 sensor height).

HDR Mode and Intensity Image

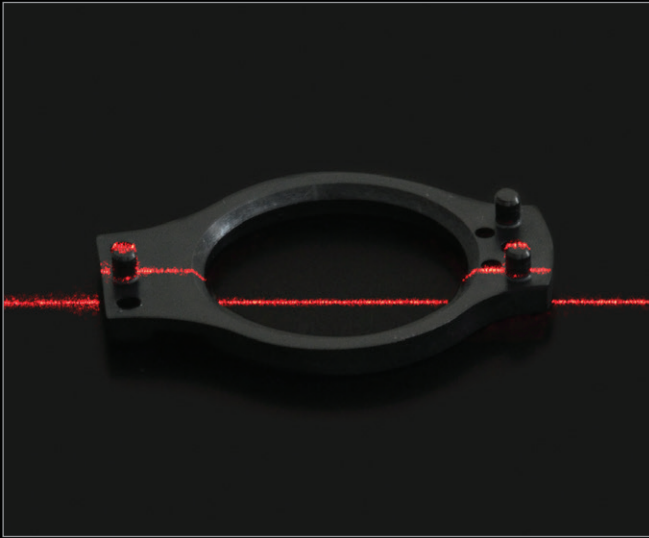
If the scanned objects have a wide dynamic range, an optional high dynamic range (HDR) mode enhances the laser line extraction through alternating longer and shorter exposure times. Additionally, 2D information printed on the scanned component may be simultaneously captured with an intensity image.

IP65/67 Housing for Harsh Environments

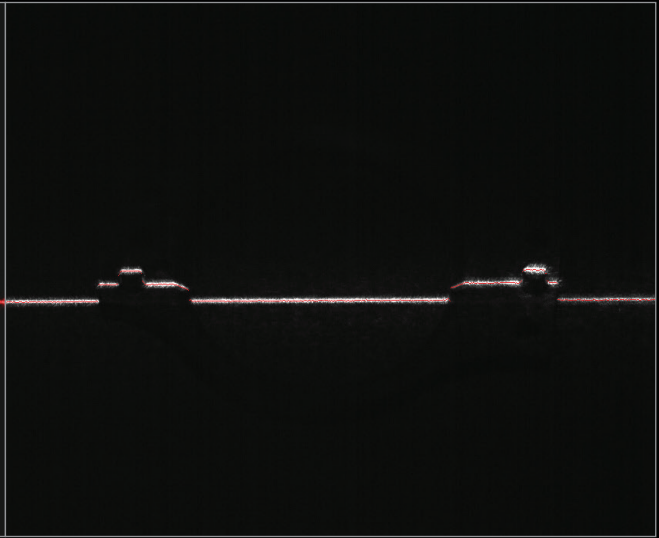
The LineCam3D is made for applications in industrial environments, and its compact aluminum enclosure is made to last. All camera components including the lens and the connectors are dust tight, protected against water jets, and water immersion resistant.

Easy Integration into Industry Applications

With its 24 V power supply, Gigabit Ethernet, digital IOs, and standard M12 connectors, the LineCam3D allows for a hassle-free integration into your existing infrastructure.



⚡ Photo of an object scanned under the laser line



⚡ Laser line extracted by the LineCam3D

Robust, FPGA-Accelerated Laser Line Extraction

Laser Line Extraction Using Center of Gravity (COG) Based Algorithm

The LineCam3D ensures a robust laser line extraction with the VRmLineExtractor, which is a COG-based, optimized, and configurable algorithm. As the sensor scans the laser lines, 16 bit coordinates of the line profiles are calculated in real-time and with 1/64 sub-pixel accuracy using the camera's FPGA, thereby making the measured data quickly available for further processing.

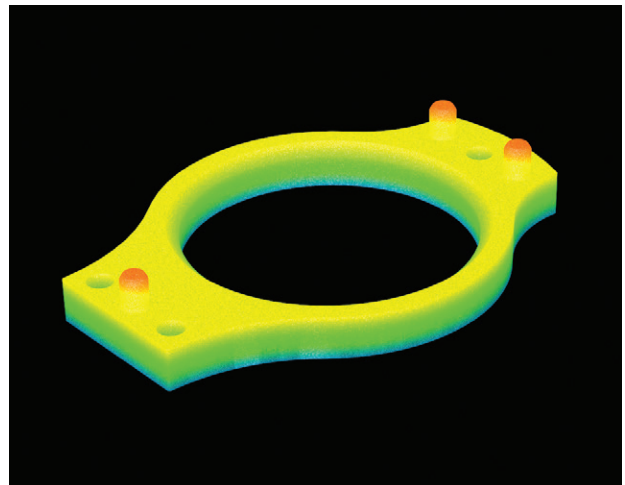
Less Data is More Data

Large amounts of data are acquired by the LineCam3D's image sensor. Transmitting all images via the Gigabit Ethernet interface would unnecessarily slow down the measuring process. For this reason, laser line extraction is performed on the camera and only the profiles are transmitted, thereby saving bandwidth and enabling a scan rate of up to 1 kHz@360 lines with 2,048 points per profile.

Combine 3D with 2D

The standard output format of the LineCam3D are 16 bit coordinates of the measured profile lines. Scale and X-Z offset of the coordinate system can be transformed for added flexibility and accuracy of the transmitted data.

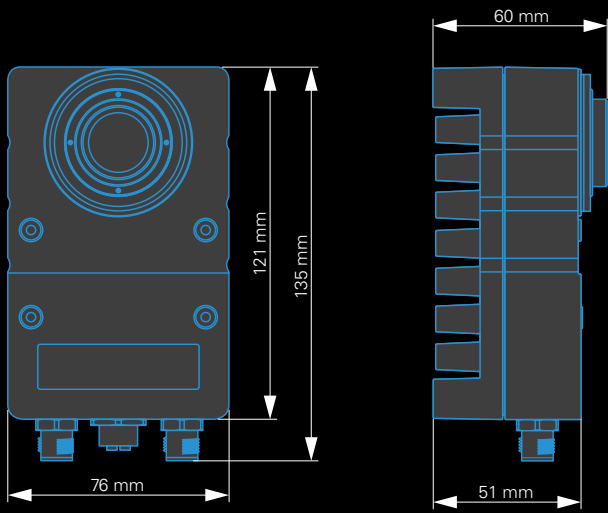
An optional intensity image may be calculated simultaneously while the object is scanned. This way you can obtain additional 2D information, for example printed text barcodes, which normally would not be visible in the 3D image. For setup and commissioning purposes, the raw sensor image may also be accessed.



⚡ 3D object generated from the profile coordinates

Tilt-Shift Adapter for Increased Depth

In laser triangulation setups, the lens plane of the camera is not parallel to the image plane of the scanned object, so only a relatively small part of the image is in focus. The LineCam3D can be ordered with an integrated 10° tilt-shift adapter (Scheimpflug adapter) to reduce this effect thus expanding the systems depth of focus. Depending on system requirements, other tilt-shift angles may be realized. This yields a perfectly focused laser line over a much wider object height.



Product Highlights

- GigE Vision compliant
- 1 kHz@360 lines scan rate, 2,048 points per profile
- On-board laser line extraction using the FPGA based configurable VRmLineExtraction algorithm
- Optional intensity image and HDR mode
- 24 V power supply, Gigabit Ethernet and IOs on industry-standard M12 connectors
- Rugged IP65/67 aluminum housing with C-Mount
- 1 GHz ARM® Cortex™-A8, 700 MHz DSP, Xilinx 7 series FPGA, 2 GB DDR3-800 RAM
- CVB Camera Suite license included

Technical Data

Interfaces	
Ethernet	1000 Mbit Ethernet
IO	6x digital Out (1 laser, 5 GPOs), 24 V push-pull IO 4x digital In (ABZ-encoder, trigger/ gate), TTL input, 24 V tolerant
Power	24 V DC, +/- 10% Typical power consumption 9 W

3D Measurement	
Profile Speed	1 kHz@360 lines (1/3 AOI) 338 Hz@1088 lines (full AOI)
Profile Resolution	2,048 points per profile
Output Format	16 bit profile coordinates 16 bit intensity image
Line Extraction	Integrated, robust, configurable profile algorithm, HDR mode option, 1/64 sub-pixel calculation

Measurement Fields*	Small	Medium	Large
FOV X near	41 mm	130 mm	800 mm
FOV X far	63 mm	249 mm	1524 mm
FOV Height	40 mm	282 mm	1200 mm
Working Distance	100 mm	380 mm	1290 mm
Lens Focal Length	25 mm	25 mm	16 mm
Tilt-Shift Adapter	10°	10°	0°
X Resolution center	28 µm/px	84 µm/px	512 µm/px
Z Resolution center	37 µm/px	240 µm/px	994 µm/px
Z Resolution center, 1/64 sub-pixel calculation	0.6 µm/px	3.7 µm/px	15.5 µm/px

* The measurement fields are examples. The actual size depends on the measurement setup (e.g. used lens and triangulation angle).

Physical Characteristics	
Dimensions	135x76x60 mm
Connectors	Power: M12 4-pin A-coded male IO: M12 17-pin A-coded male Ethernet: M12 8-pin X-coded female
Certification	CE
IP Rating	IP65/IP67 with optional tube IP40 without optional tube

Image Sensor	
Sensor Type	CMOSIS CMV2000
Sensor / Shutter Type	CMOS / global
Chromaticity	monochrome
Sensor Size	2/3"
Resolution	2048x1088 px
Pipelined Trigger	yes
Pixel Size	5.5 x 5.5 µm
Max. Frame Rate	338 fps at full AOI

Accessories	
DIN rail power supply 40.8 W, 24 V DC, 1.7 A	
IP67 tube	
IP67 tube extension	
0 or 90 degree mounting plate	
Camera power cable, 5 m	
CAT6A Ethernet cable, 5 m	
I/O cable, 5 m	
Sealing caps for the M12 connectors	

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