TECHNICAL DESCRIPTION

Industrial Vision Camera
IVC-3D

SICK | IVP

1 Introduction

The IVC-3D is a Smart Camera that combines imaging and analysis into one camera housing. The camera performs inspection, location or measurement of objects in order to enhance production yield, control production or perform quality control.

When your application needs measurement or verification of non-flat dimensions, a smart camera that highlights height differences in the captured images is preferable compared to traditional two dimensional imaging. The IVC-3D is a smart camera in every aspect such as easy configuration via a pc user interface, a set of image processing tools generally applicable to your application, easy connection to I/O as well as serial and Ethernet communication. The IVC-3D has a major advantage – it can see three dimensions. Highlighting of surface defects depending on topography is now already done in the image capturing. With tools that are defined to measure heights, volume, shapes etc previously tricky measurement tasks now are easily solved with the calibrated 3D smart camera.

Features

- Contrast-independent measurements in 3D images
- Ambient light robustness
- Choice of field-of-views; IVC-3D 50 and IVC-3D 200
- Short development time with IVC Studio graphical user interface
- About 110 general programming and image processing tools
- Industrial robust IP65 housing
- Industrial cables and connectors
- Output signals short circuit protected NPN and PNP
- 24 V supply voltage

2 IVC-3D Camera

3D imaging in the IVC-3D is based on a unique CMOS chip optimized for trianglulation with a laser and fast data processing. The field-of-view, imaging accuracy, resolution and image capture rate are dependent on the camera type and can be optimized in the measurement set-up for each application.

The IVC-3D contains a linear laser and a camera with optics. The third dimension is determined by triangulation. The laser draws a line on the object, while the camera, which views the line from a different angle, sees a curve that follows the height profile of the object. The height of the object is measured as the deviation from the straight line. As the object to be measured passes through the laser beam a three-dimensional image of the entire object is built up.

2.1 Real measurement in calibrated units

The IVC-3D is factory calibrated and outputs mm units by default. The height values are always given in mm, but the length and width values can be given in pixels or converted to calibrated units. The camera automatically compensates a varying conveyor speed if connected to an encoder to ensure accurate length measurements. The encoder input is compatible with RS 422 and includes support for both forward and backward movements.

2.2 Field-of-view

The FOV is a trapezoid shaped area where the maximum possible object height and width in a defining rectangle are related. It also depends on the distance between the object and the device. The stand-off is the distance between object and camera and there is a defined minimum stand-off depending on camera type.

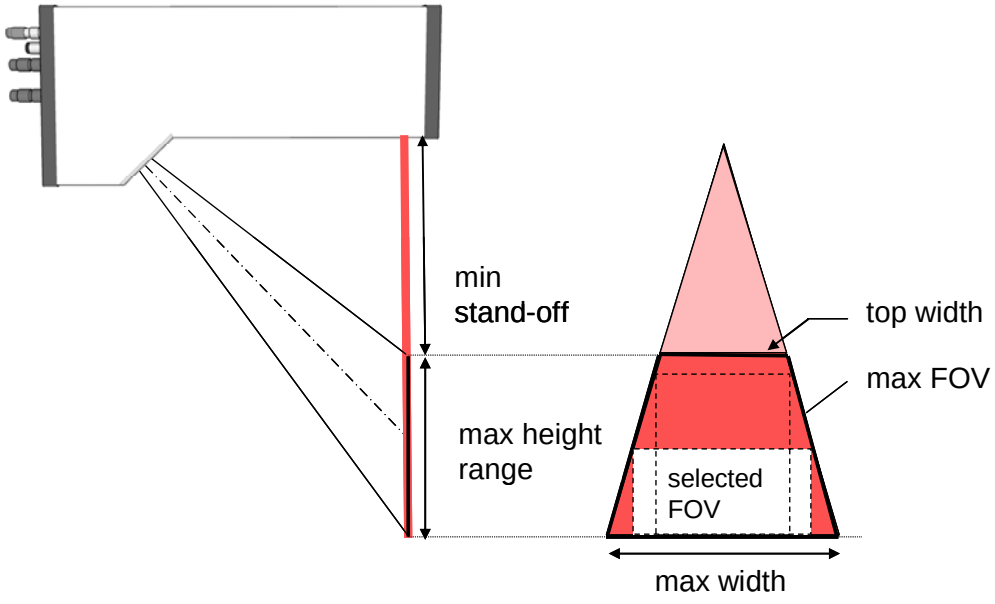


Table 2.1- Measurement details.

	IVC-3D 200	**IVC-3D 50**	**Remarks**
Selected FOV	200 mm x 600 mm	50 mm x 150 mm	Example of typical height x width.
Max height range	< 400 mm (typical 395 mm)	< 100 mm (typical 84 mm)	Individual deviation may occur.
Max width	810 mm	180 mm	Typical at zero level.

	IVC-3D 200	IVC-3D 50	Remarks
Top width	440 mm	135 mm	Typical at maximum height.
Max profile width	1024 points	1024 points	
Min stand-off	265 mm	184 mm	Typical.
Height resolution	0,2 mm	0,04 mm	Represents what may be achieved but depends on the measurement setup for each application program.
Profile rate	< 5000 profiles/s	< 5000 profiles/s	Dependent on grab setup.

2.3 Imaging speed and accuracy

The imaging speed is a trade-off between accuracy in the measurement set-up and is dependent on the height in the selected FOV. Decreasing the maximum object height setting increases the profile rate.

2.4 Image capture

The IVC-3D can either work on single profiles or 3D images generated by combining a user defined number of profiles. The number of profiles defines the image size and thereby sets the maximum length of an object in the moving direction. The 3D image rate is the result of the profile rate and the viewing length of the object.

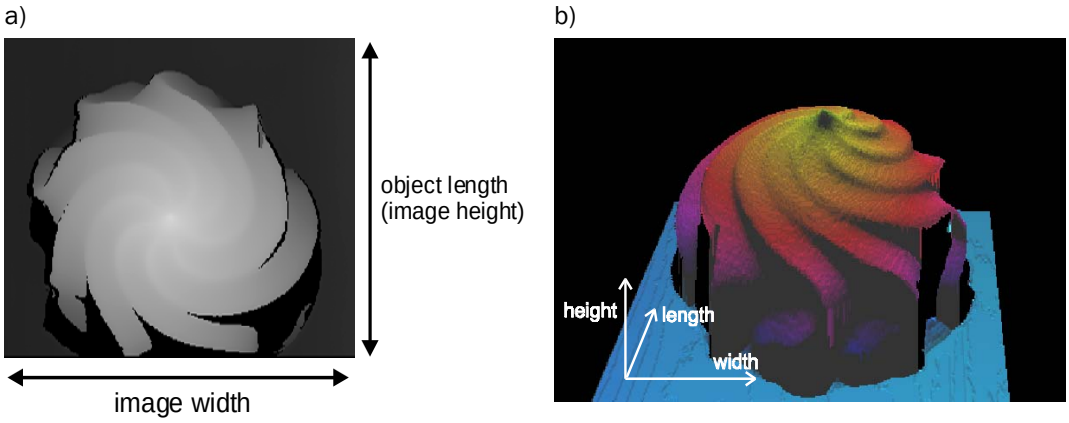


Figure 2.1- 3D image with height information in grayscale a) and 3D visualization of the 3D image to the left b).

2.5 Built-in triggering

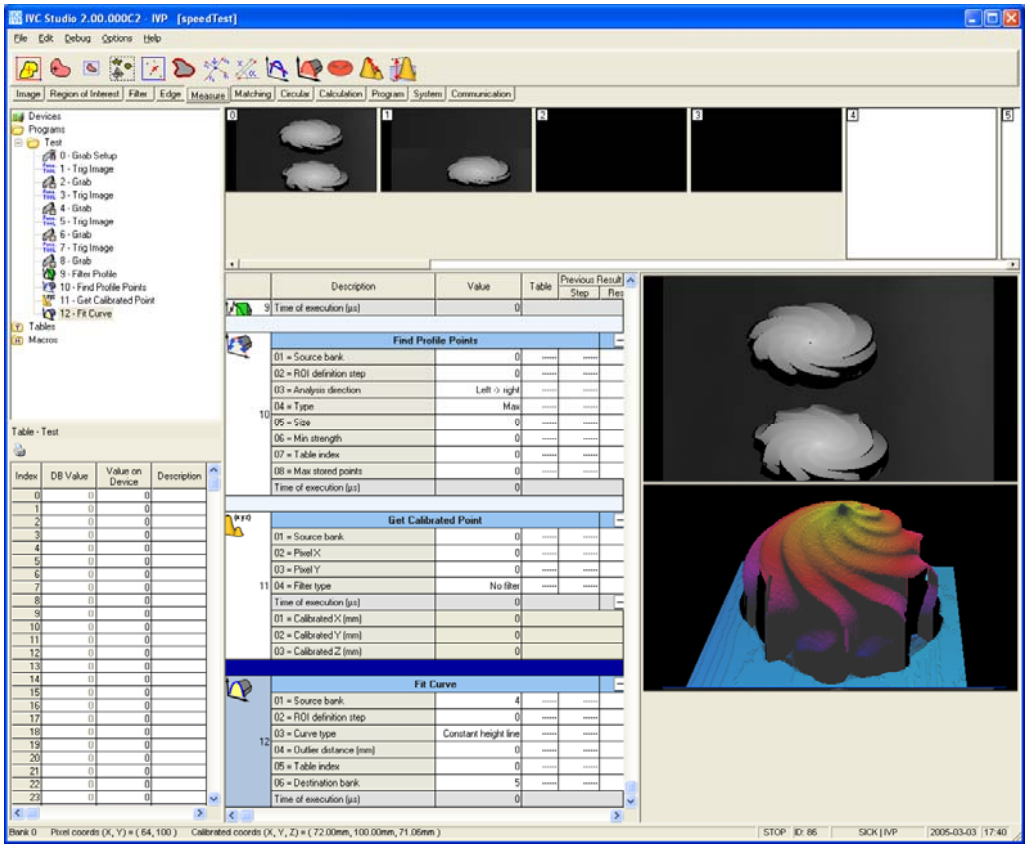
The image triggering when the objects are passing by, is built-in to the image grab software tool. A simple lightswitch is easily connected to the triggering input of the camera ensuring repeatable images of the objects passing by.

3 Image processing tools

All IVC devices can easily be configured in the IVC Studio, which is a graphical user interface run on a PC with Windows XP or Windows 2000. Many image processing tools included in the IVC-3D product are the same as for the IVC-2D product which enables very fast prototyping and short development times.

3.1 User-friendly programming in IVC Studio

In IVC Studio the IVC devices are programmed by selecting available tools in the camera shown as icons in the toolbar. The actual parameters are set either by movement of the mouse or by entering values in parameter fields. The settings are simplified by the graphical feedback in the images. Input and result values can be stored in a table for easy access for later adjustments.



3.2 IVC Tools

The IVC-3D toolbox contains tools both for image processing on standard grayscale imaging and special tools used in 3D measurements. There are tools to work on single profile images as well as 3D images.

Image

The image tool group contains tools that are used for grabbing an image to work with, to add graphics in the images and edit the image banks which is the image memory in the camera.

Region of interest

The region of interest (ROI) tools are used to define an area where other tools should work in. These tools speed up the image processing since the entire image is not processed.

Edge

The edge tools are used to find object edges in the pictures and the coordinates of the objects. It is possible to scan the image from all different directions and also to find multiple edges on one specific line

Measure

This category contain tools that measure area, cross-section area, volume, center of mass, find and measure blobs and measure distances both in reference to a plane and the 3D volume.

Filter

The filter tools can be applied to enhance features in the image. There are erode and dilate tools as well as binarization tools to transform grayscale images to binary.

Calculation

Calculation tools are used to find if values are in correct ranges, fit surfaces to predefined planes, deviation of round objects from circles etc.

Circular

In the circular tool category a specific set of tools is available. It is possible to check perimeters of objects, diameters, the surface and outer shape of objects.

Matching

The IVC matching tools can be taught a rotation of an object and then match the object rotation to the stored original. The matching tools can also match, locate and count shapes of taught objects in the images.

Program

The step programming tools are used for defining loops and conditions in programs.

Communication

The communication tools are used to set outputs and read inputs, to send values over RS485 and Ethernet.

System

The system group contains tools to insert delays in the program, to save values or results to a permanent flash memory, and to write and read result or parameter values to a memory separate from the actual program (the Table).

4 Technical information

Specification	IVC-3D 200	IVC-3D 50
Imager	CMOS	CMOS
Imaging angle	58°	53°
Laser filter	60 nm FWHM	60 nm FWHM
Laser wavelength	660 +/- 10 nm	660 +/- 10 nm
Laser class	2M IEC 60825-1: 2001-8 2 21CFR 1040.10/11	2M IEC 60825 2 21CFR 1040
Laser modes	DC and flash software programmed	DC and flash software programmed
Interfaces	RS485 Ethernet: 100Mbit/s Encoder: RS 422 compatible	RS485 Ethernet: 100Mbit/s Encoder: RS 422 compatible
Digital inputs	3 x HIGH = 10V ... 28.8V (one defined trigger input)	3 x HIGH = 10V ... 28.8V (one defined trigger input)
Digital outputs	3 x B - types; <100mA total current of all digital outputs	3 x B - types; <100mA total current of all digital outputs
Weight	Approximately 4 kg	Approximately 3,2 kg
Dimensions	387 mm x 163 mm x 69 mm L x H x D	294 mm x 163 mm x 69 mm L x H x D

Technical Data		
Power supply	DC 24 V ± 20%	
Current consumption	< 1 A	
Ripple	< $5V_{PP}$	
Connectors	Power I/O: Ethernet: RS485 I/O: Encoder:	M12, 8-pin, male M12, 4-pin, D- coded, female M12, 8-pin, female M12, 5-pin, male
Operating temperature	0°C ... 40° C	
Storage temperature	-20° C ... 70° C	
Shock load	15 g, 3 x 6 directions	
Vibration load	5 g, 58 ... 150 Hz	
Enclosure rating	IP 65	
Housing material	Aluminum: Connectors: Windows:	surface anodized nickel plated brass compound glass

5 Ordering information

	Type	Part no
IVC-3D 200	IVC-3D11111	1 027 539
IVC-3D 50	IVC-3D21111	1 027 538
Included:		
Operating instructions		8 011 007
CD with IVC Studio and manuals		8 010 923
Cables[1]		
Power I/O, L=2m	DOL-1208-G02MA	6 020 633
Power I/O, L=5m	DOL-1208-G05MA	6 020 993
Ethernet, L=3m	SSL-2J04-G03ME	6 029 630
Encoder, L=2m	DOL-1205-G02M	6 008 899
Encoder, L=5m	DOL-1205-G05M	6 009 868
Encoder, L=10m	DOL-1205-G010M	6 010 544
RS485 and additional outputs, L=2m	STL-1208-G02MA	6 029 330
RS485 and secondary outputs, L=5m	STL-1208-G05MA	6 029 331

[1] For additional information on available cables check www.sick.com.

