

**COGNEX®**

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# DS1000 Series Displacement Sensors

## Technical Reference

1/21/2014  
Version 1.1.0

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## VisionPro

5481712, 5495537, 5548326, 5583954, 5602937, 5640200, 5751853, 5768443, 5825913, 5850466, 5872870, 5901241, 5943441, 5978080, 5978521, 5987172, 6005978, 6039254, 6064388, 6075881, 6137893, 6141033, 6167150, 6215915, 6240208, 6324299, 6381366, 6381375, 6411734, 6421458, 6459820, 6490375, 6516092, 6563324, 6658145, 6687402, 6690842, 6697535, 6718074, 6748110, 6771808, 6804416, 6836567, 6850646, 6856698, 6920241, 6959112, 6963338, 6973207, 6975764, 6985625, 6993177, 6993192, 7006712, 7016539, 7043081, 7058225, 7065262, 7088862, 7164796, 7190834, 7242801, 7251366, 7313761, EP0713593, JP3522280, JP3927239

## DataMan

5742037, 5943441, 6215915, 6236769, 6282328, 6381375, 6408109, 6457032, 6690842, 6941026, 7175090, 7181066, 7412106, 7427028, 7549582, 7604174, 7614563, 7617984, US-2005-0087601-A1, US-2006-0131418-A1, US-2006-0131419-A1, US-2006-0133757-A1, US-2007-0090193-A1, US-2007-0091332-A1, US-2007-0152064-A1, US-2007-0170259-A1, US-2008-0004822-A1, US-2008-0011855-A1, US-2008-0142604-A1, US-2008-0143838-A1, US-2008-0158365-A1, US-2009-0090781-A1, US-2009-0108073, US-2009-0121027-A1, US-2009-0166424-A1, US-2009-0294541-A1, WO06065619A1, EP1687752

## CVL

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## VGR

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## OMNIVIEW

6215915, 6381375, 6408109, 6421458, 6457032, 6459820, 6594623, 6804416, 6959112, 7383536

## CVL Vision Library

5495537, 5548326, 5583954, 5602937, 5640200, 5717785, 5751853, 5768443, 5825483, 5825913, 5850466, 5859923, 5872870, 5901241, 5943441, 5949905, 5978080, 5987172, 5995648, 6002793, 6005978, 6064388, 6067379, 6075881, 6137893, 6141033, 6157732, 6167150, 6215915, 6240208, 6240218, 6324299, 6381366, 6381375, 6408109, 6411734, 6421458, 6457032, 6459820, 6490375, 6516092, 6563324, 6658145, 6687402, 6690842, 6718074, 6748110, 6751361, 6771808, 6798925, 6804416, 6836567, 6850646, 6856698, 6920241, 6959112, 6975764, 6985625, 6993177, 6993192, 7006712, 7016539, 7043081, 7058225, 7065262, 7088862, 7164796, 7190834, 7242801, 7251366, EP0713593, JP3522280, JP3927239

## SMD 4

5995648, 5850466, 6751361, 6690842, 6563324, 6490375, 5949905, 5978080, 6137893, 6167150, 6075881, 6748110, 5859923, 6411734, 6324299, 6516092, 7190834, 6658145, 6836567, 6850646, 6975764, 6985625, 6993192, 7006712, 7043081, 7058225, 7065262, 7088862, 7164796, 7251366, 6856698, 6002793, 6005978, 6771808, 6804416, 7016539, 6959112, 5602937, 7242801, 5640200, 5495537, 5768443, 5825483, 6421458, 6459820,

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## BGA II and BGA III

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## Wire Bonder

5495537, 5532739, 5581632, 5602937, 5640199, 5640200, 5642158, 5676302, 5754679, 5757956, 5768443, 5825483, 5835622, 5850466, 5859923, 5861909, 5949905, 5978080, 5991436, 5995648, 6002793, 6005978, 6035066, 6061467, 6075881, 6137893, 6141033, 6157732, 6167150, 6215915, 6289492, 6324299, 6381375, 6408109, 6411734, 6421458, 6457032, 6459820, 6490375, 6516092, 6563324, 6658145, 6690842, 6748110, 6751361, 6771808, 6804416, 6836567, 6850646, 6856698, 6959112, 6975764, 6985625, 6993192, 7006712, 7016539, 7043081, 7058225, 7065262, 7088862, 7164796, 7171036, 7190834, 7242801, 7251366

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### About this Manual

The *DS1000 Series Displacement Sensors Technical Reference* provides information on the configuration and operation of the Cognex DS1000 Series Sensors.

### For More Information...

This document provides information about how you can set up your sensor, how it works, and how to connect it to your network.

You must use the VisionPro acquisition software together with the sensor to acquire images to determine the height profile of objects passing under the device. You can use the range image particularly to determine the 3D shape of objects. Vision applications can use this 3D shape information to determine whether a certain 3D feature appears in the expected manner on the surface of the object.

To set up your sensor for range image acquisition using VisionPro quickly, see the DS1000 Series – Getting Started acquisition topic in the CHM file mentioned hereinafter.

Additional information is available through the Windows Start menu:



#### **VisionPro Documentation Set**

Cognex->VisionPro->Documentation



#### **DS 1000 Series Displacement Sensor Quick Reference Guide**

(provides specific setup guidelines)

Cognex->VisionPro->Documentation->English

You can also use the Help inside the VisionPro software by clicking **Help -> QuickBuild Help -> How to... -> Use QuickBuild**.

### Warnings and Notices



**LASER LIGHT, DO NOT STARE INTO BEAM: CLASS 2M LASER PRODUCT**  
**LASER LIGHT, DO NOT LOOK INTO BEAM: CLASS 3R LASER PRODUCT**  
**FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY**

- Do not stare into the beam.
- Do not view directly with optical instruments (magnifiers).
- Do not place optical components (mirrors) into the beam.
- Design test fixtures in such a way that unintentional viewing of the beam is prevented.
- Switch off the laser when not in use.
- Avoid the use of highly reflective materials. If you cannot, try to angle the part so unintentional viewing of the reflection is prevented.
- Terminate (block) unused beams.
- Keep the laser plane horizontal or pointing downwards.
- Report any issues that may have an impact on laser safety to your supervisor or Laser Safety Officer.
- There is no scheduled maintenance necessary to keep the product in compliance.
- Under no circumstances should you operate the sensor if the unit is defective or the seal damaged. Cognex Corporation cannot be held responsible for any harm caused by operating a faulty unit.
- Under no circumstance should you modify in any way the sensor or its housing.
- Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.



**In addition to the instructions above, if you are using a sensor that has a Class 3R laser:**

- Do not look into the beam.

## Labels

For DS1000 Series Sensors with Class 2M laser:



For DS1000 Series Sensors with Class 3R laser:



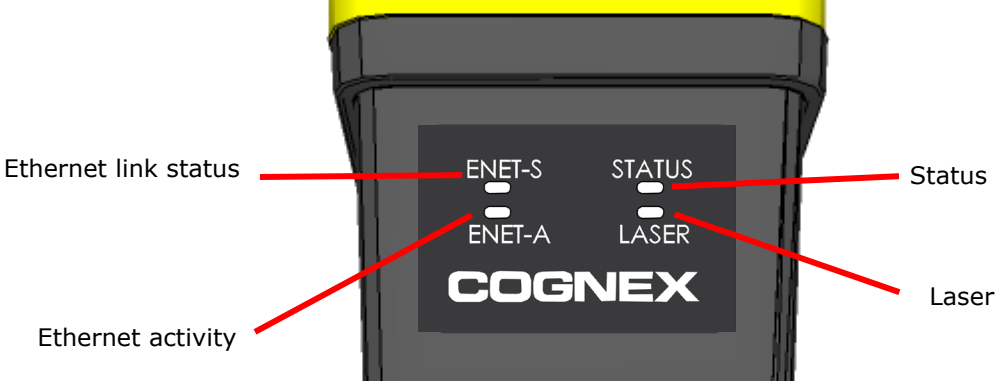
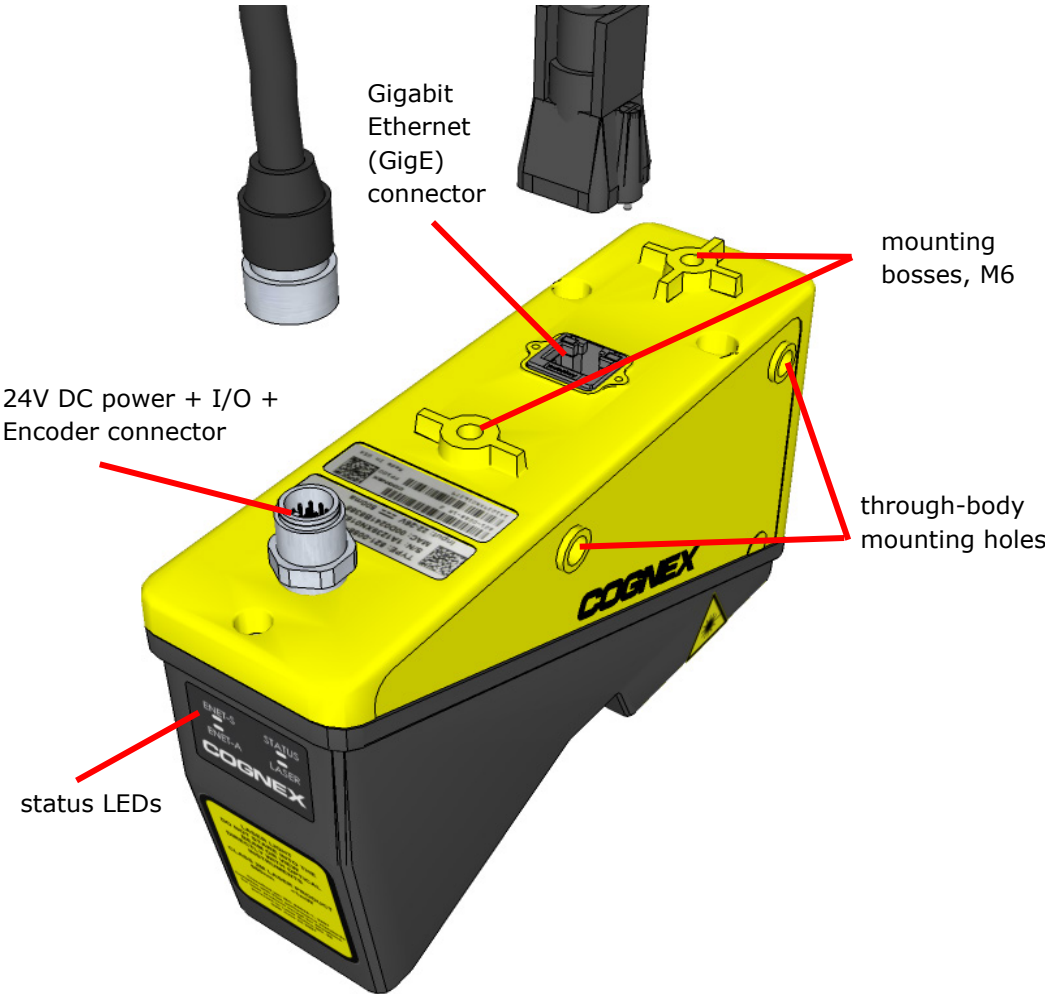
**FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY**

If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

You may also contact your supplier for more information on the environmental performance of this product.

Hereinafter, images of DS1000 Series Sensors with Class 2M laser are shown unless otherwise noted.

System Layout





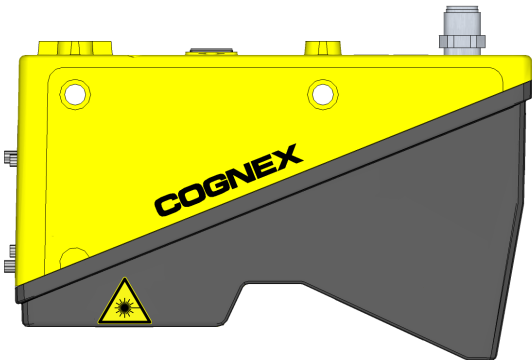
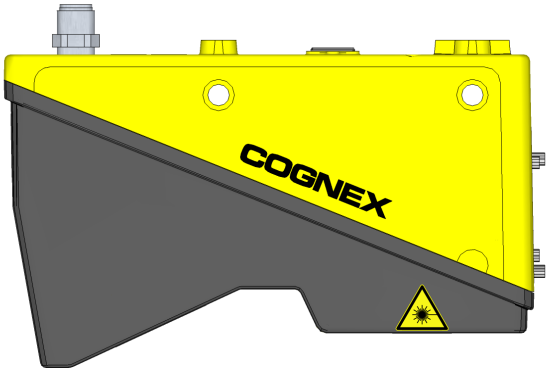
**LASER LIGHT, DO NOT STARE INTO BEAM: CLASS 2M LASER PRODUCT**



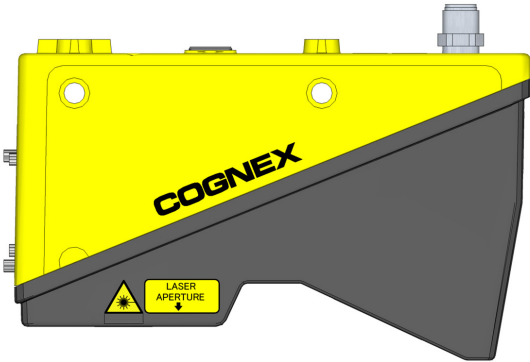
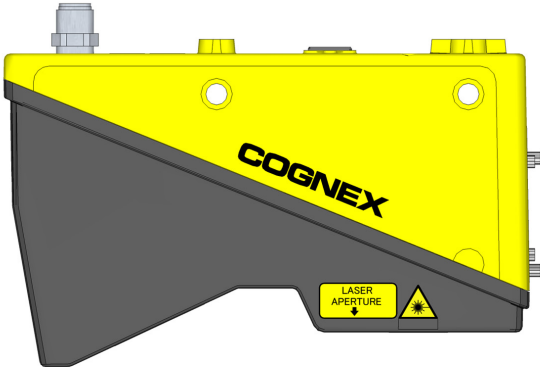
The high-accuracy mounting pins establish parallelism to the laser plane.

Label Locations

Sensor with Class 2M laser



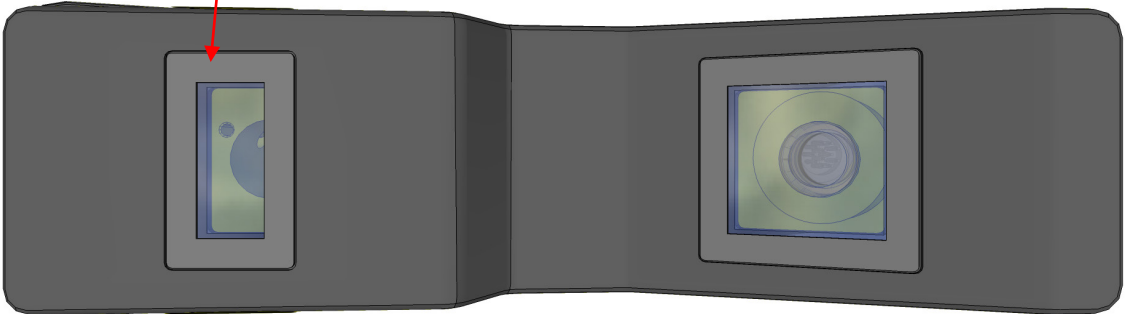
Sensor with Class 3R laser



Manufacturer's ID labels

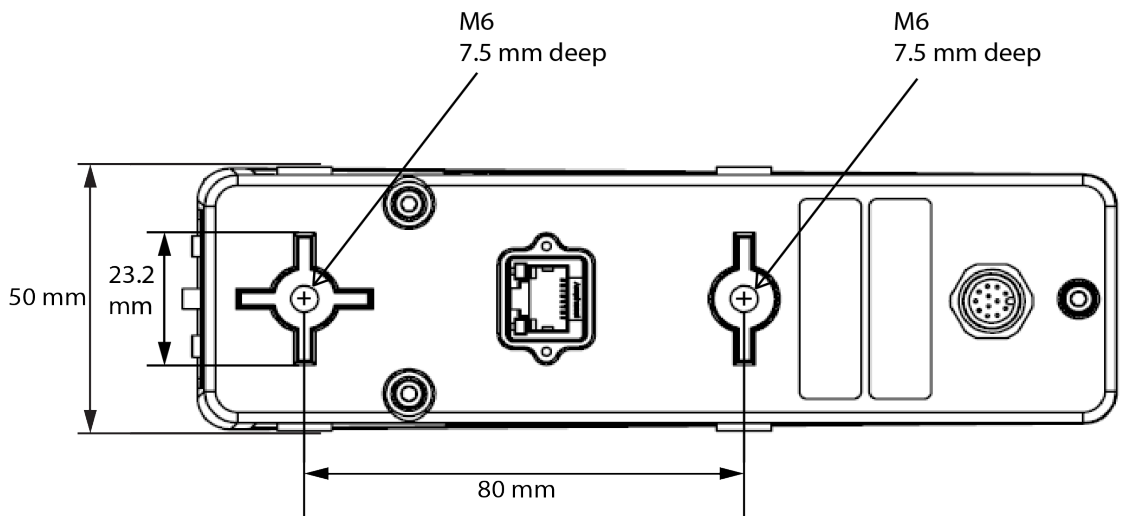
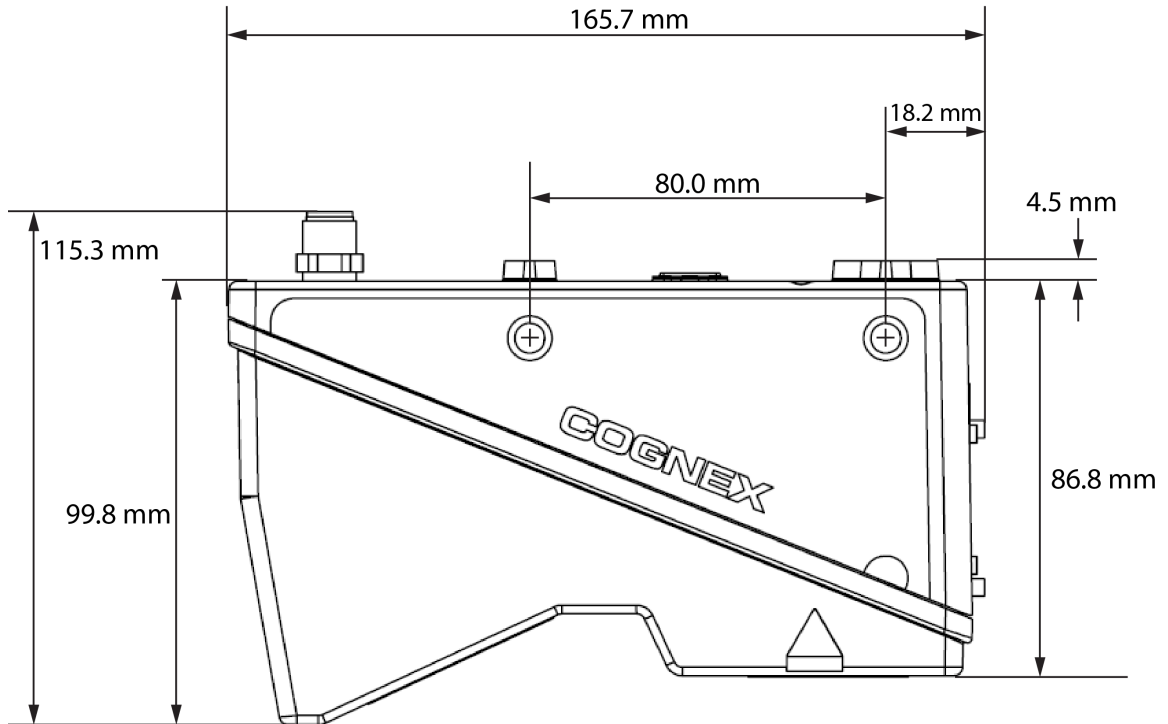


AVOID EXPOSURE – LASER RADIATION IS EMITTED FROM THIS APERTURE



## Mechanical Information

### Dimensions



## About The DS1000 Series Sensor

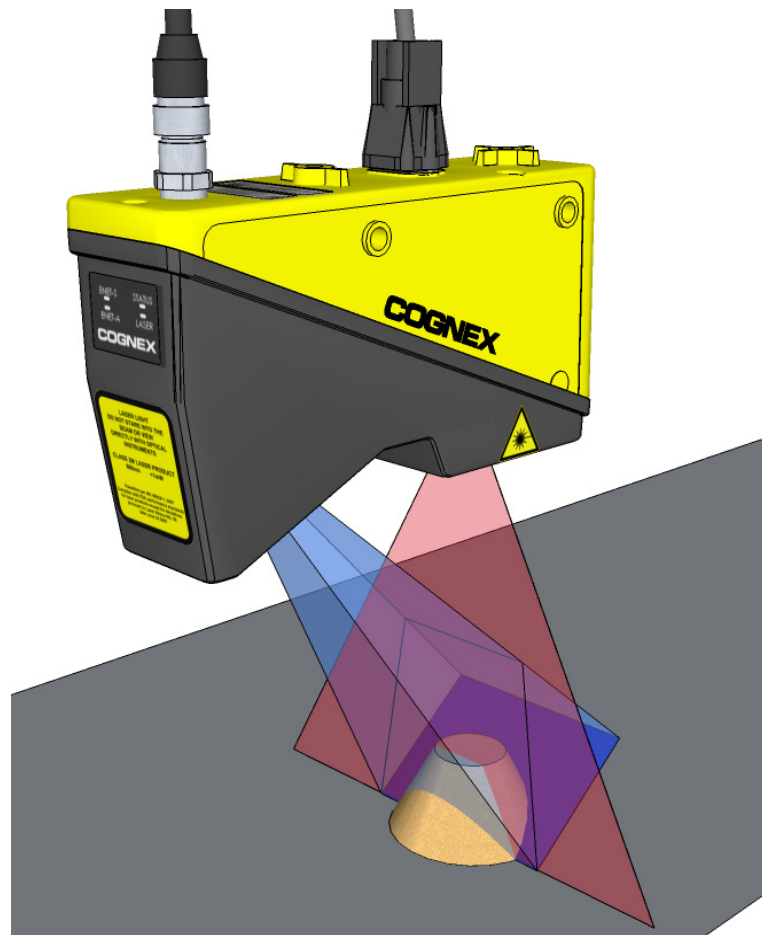
The DS1000 Series Sensor (from now on: sensor) is an integrated digital camera and laser stripe illuminator, mounted in a single mechanically robust package. The sensor uses two-dimensional surface profiling to create range images which provide three dimensional data.

The sensor offers the following advanced features:

- Highly accurate physical object measurements
- High-speed operation
- Flexible mounting options

The sensor works by analyzing the shape of the laser stripe as it appears to the camera (which is positioned at an angle to the laser). The software running in the device can determine the 3D location of the points through which the laser stripe passes.

The sensor acquires several of these images while the scene in front of the sensor is moving, and by stitching them together, provides a 3D height image of the inspected object.



# Safely Handling Your DS 1000 Series Sensor

## Safely Handling Your DS 1000 Series Sensor

- Your sensor is a sensitive, precision instrument. Subjecting the unit to shock, vibration, or rough handling in excess of the limits specified hereinafter may cause the unit to fail to operate correctly.
- Whenever you transport or ship your sensor, use the packaging supplied by Cognex when you received your unit. Do not discard this packaging.
- Do not store or install your sensor in excessively hot, cold, dusty, or damp environments. Observe the environmental limits specified hereinafter.
- Follow the instructions in the section "Sensor Maintenance" to clean your sensor.
- Refer to the section "Warnings and Notices" for laser safety information.
- Refer to the section "Electrical Information" for electrical safety information.

## Product Specifications






### Thermal and Environmental Requirements

Weight	165 g	
Operating Temperature	0°C — 50°C (32°F — 113°F)	
Storage Temperature	-10°C — 60°C (-14°F — 140°F)	
Maximum Humidity	95% (non-condensing)	
Environmental	IP65 (with Cognex recommended IP65 Ethernet and Power I/O cables)	
Power Supply Requirements	Voltage: +24 VDC (22-26 VDC)	
Current	500 mA max	
Discrete I/O operating limits	Trigger	Input voltage limits: -24 VDC — +24 VDC Input ON: > 10 VDC (> 6 mA) Input OFF: < 2 VDC (< 1.5 mA)
Encoder Input Specification	Differential: A+/B+: 5-24V (50 kHz max) A-/B-: Inverted (A+/B+) Single Ended: A+/B+: 5-24V (50 kHz max) A-/B-: VDC = 1/2 (A+/B+)	
Field of View and Working Section	working distance	140-315 mm
Ethernet	<ul style="list-style-type: none"> <li>• Gigabit Ethernet interface</li> <li>• Integrated link and traffic LEDs</li> <li>• Standard RJ-45 connector</li> </ul>	
Shock	10 gs for 5ms (any axis)	
Vibration	8 gs (any axis, any frequency)	






# Product Specifications

## Laser

This Laser Product is designated either as Class 2M or Class 3R during all procedures of operation. For Class 2M:

Wavelength		658 nm
Laser power for classification		< 1 mW
Laser Maximum Total Power		< 9.3 mW
Minimum Divergence		vertical: < 1.5 mrad horizontal: 30 – 32 degrees
Certification		    
Laser Line Thickness (FWHM)		< 0.5 mm at 140 – 340 mm
Sensor Size		1024x768 pixels
X Resolution	Top	0.070 mm
	Middle	0.110 mm
	Bottom	0.150 mm
Z Resolution	Top	0.007 mm
	Middle	0.020 mm
	Bottom	0.040 mm
Y Resolution	This value depends on the Encoder Resolution, the Distance per Cycle and the Steps per Line settings.	

For Class 3R:

Wavelength		658 nm
Laser power for classification		< 5 mW
Laser Maximum Total Power		< 33 mW
Minimum Divergence		vertical: < 1.5 mrad horizontal: 30 – 32 degrees
Certification		    
Laser Line Thickness (FWHM)		< 0.5 mm at 140 – 340 mm
Sensor Size		1024x768 pixels
X Resolution	Top	0.070 mm
	Middle	0.110 mm
	Bottom	0.150 mm
Z Resolution	Top	0.007 mm
	Middle	0.020 mm
	Bottom	0.040 mm
Y Resolution	This value depends on the Encoder Resolution, the Distance per Cycle and the Steps per Line settings.	

## Controls

The DS 1000 Series Sensor is controlled through the Ethernet cable, and thus there are no controls on the sensor itself.

## Sensor Maintenance

The sensor windows should be kept clean, so avoid touching the windows and, if possible, keep the sensor in a clean area. If the windows are touched, scratched or have a large amount of dust, the accuracy of the sensor may be impacted.

If the windows collect significant dust or become dirty, *clean them with great care* as they have a coating that can be easily damaged. Use minimal pressure, rotate the swab during cleaning so dirt is not dragged across the surface, start at the center of the window and spiral out to the edges, and use several swabs.

1. Unplug the power to the unit so the laser is not fired by mistake. Cognex recommends doing a drag wipe with lens tissue and isopropyl alcohol.
2. Saturate a piece of lint-free tissue with reagent-grade isopropyl alcohol and drag it across the surface. If done properly, the alcohol will evaporate uniformly and without leaving streaks or spots. An alternative is to use an optical grade cotton swab ("Qtip") saturated with isopropyl alcohol.

The body of the sensor does not require a specific cleaning method.

## Product Service

The sensor cannot and should not be allowed to be serviced by the customer, so bring any performance issues to the attention of your local Cognex representative.



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In case of any necessary service or repairing processes, return the unit to the factory.

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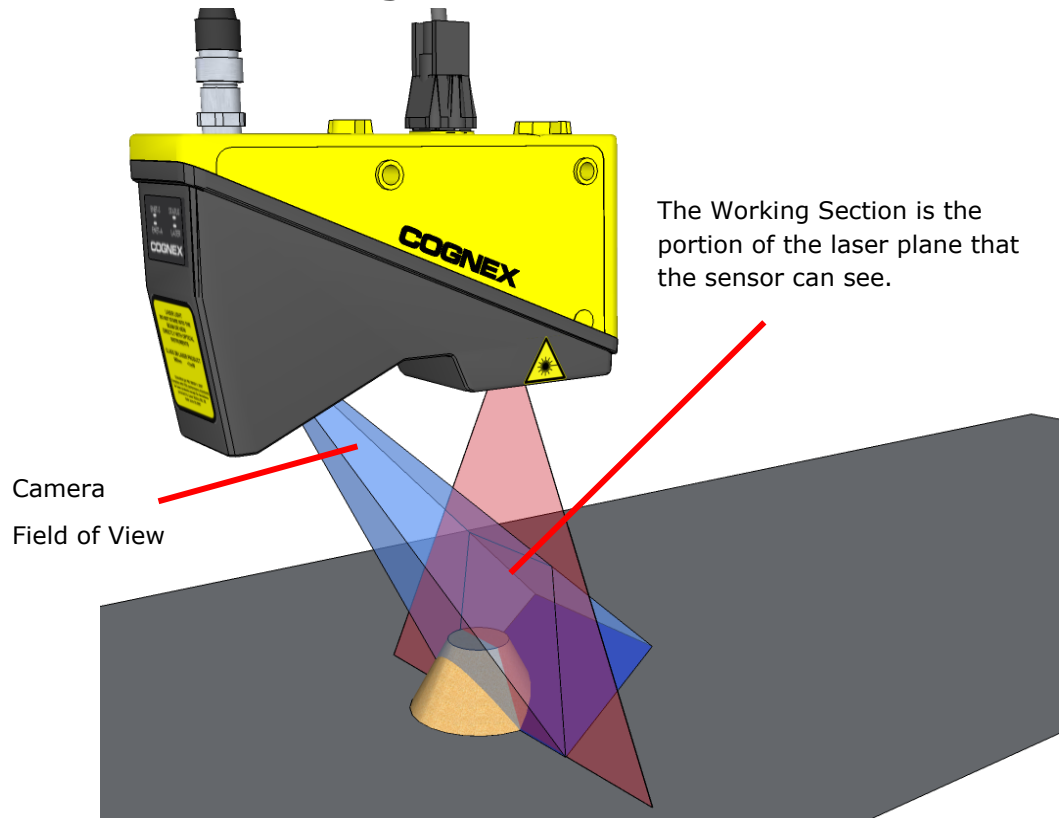
Service is only to be handled by authorized factory trained technicians. The sensor does not contain parts that are user-serviceable.

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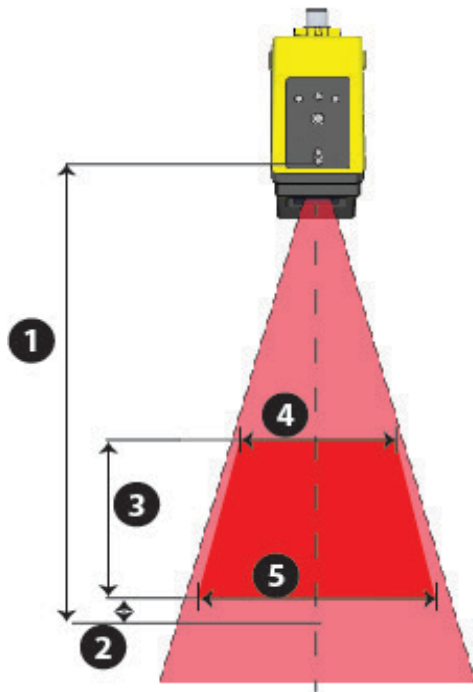
## Precision Protection

The DS 1000 Series Sensor is a precision instrument and thus should be treated with care in order to avoid any injuries occurring from physical mistreatment.

## Field of View and Working Section



## Field of View and Working Section



1. Master Pin to zOrigin Distance: 350.00 mm
2. Bottom of Working Section in mm from zOrigin: 35 mm
3. Height of Working Section: 175.00 mm
4. Width of working section: 60 mm@140.00 mm (at minimum working distance)
5. Width of working section: 132 mm@315 mm (at maximum working distance)

## Electrical Information

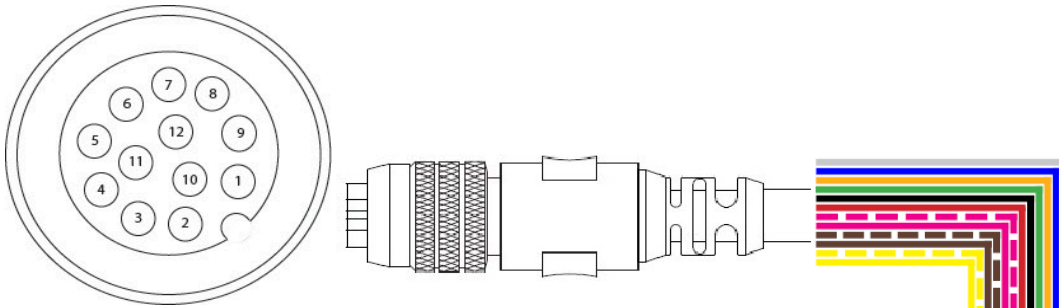
### Power

When wiring the sensor, observe the following precautions:

- Cognex recommends cold-plugging. Turn the power off when connecting or disconnecting the sensor. Turn on the power only when the cable has already been attached.
- Use a listed power supply with an output rated 24 VDC, at least 500 mA, and marked Class 2, Limited Power Source (LPS). Any other voltage creates a risk of fire or shock and can damage the sensor.
- Connect the cable or connector shield to earth ground.
- To reduce the risk of damage or malfunction, route all cables and wires away from high-voltage power sources.
- If you want to connect your sensor to the network using a network interface controller (NIC), because the sensor is not Power over Ethernet (PoE) compliant, only use a non-PoE NIC or a smart PoE NIC that detects the sensor being a non-PoE load. Otherwise, a non-smart PoE NIC may apply 48 V DC, which would damage the sensor.

## Discrete I/O Connector

The I/O cable provides access to trigger and inputs. Unused wires can be clipped short or tied back using a tie made of non-conductive material. The drawing on the left shows the plug on the device.



Pin #	Signal Name	Notes	Wire Color
1	PHB+	Encoder "B" input (twisted pair)	Yellow
2	PHB-		White/Yellow
3	PHA+	Encoder "A" input (twisted pair)	Brown
4	PHA-		White/Brown
5	Trig+	Trigger	Violet
6	Trig-		White/Violet
7	+24VDC	Power	Red
8	GND	Ground	Black
9	Laser+	not used	Green
10	Laser-	laser	Orange
11	Ctrl+	not used	Blue
12	Ctrl-	not used	Grey

## How the DS 1000 Series Sensor Works

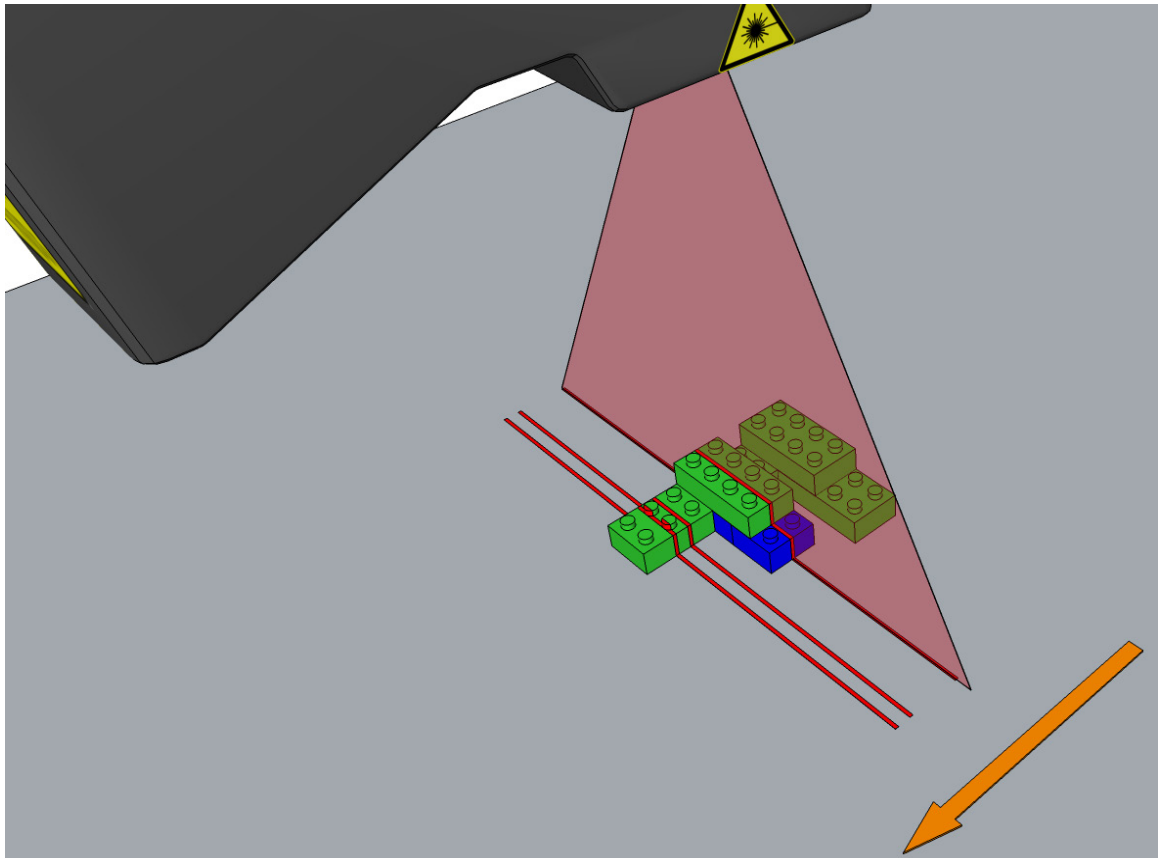
### Basic Operation

A DS 1000 Series Sensor can return information about the 3D shape or size of objects that are difficult to visualize using regular 2D cameras.

From a sensor, the VisionPro acquisition system can acquire the Range images that can be used to determine the three-dimensional (typically height, volume, or tilt) profile of objects passing under the sensor. The following overview illustrates how the sensor works with a typical application.

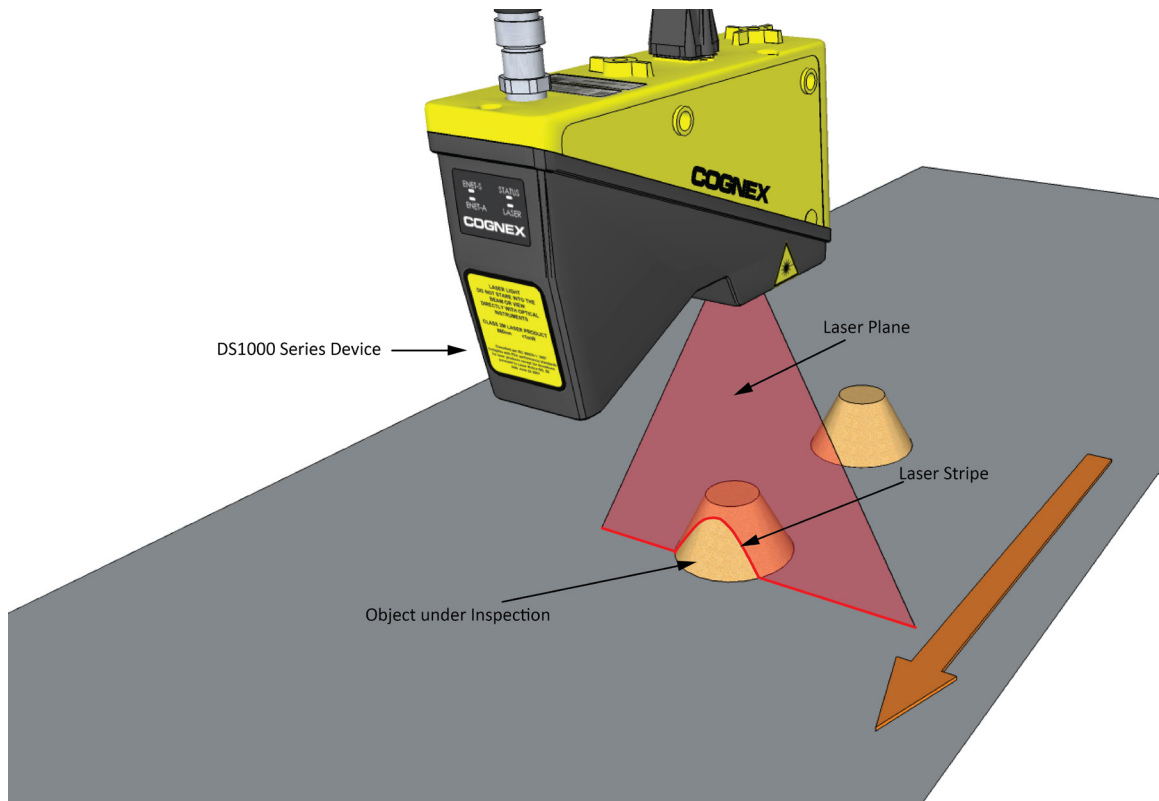
The following overview illustrates how the sensor works with a typical application.

1. Place the object you want to measure on a conveyor belt equipped with an encoder.
2. As the object passes under the sensor, it acquires a series of images (**intensity images**).



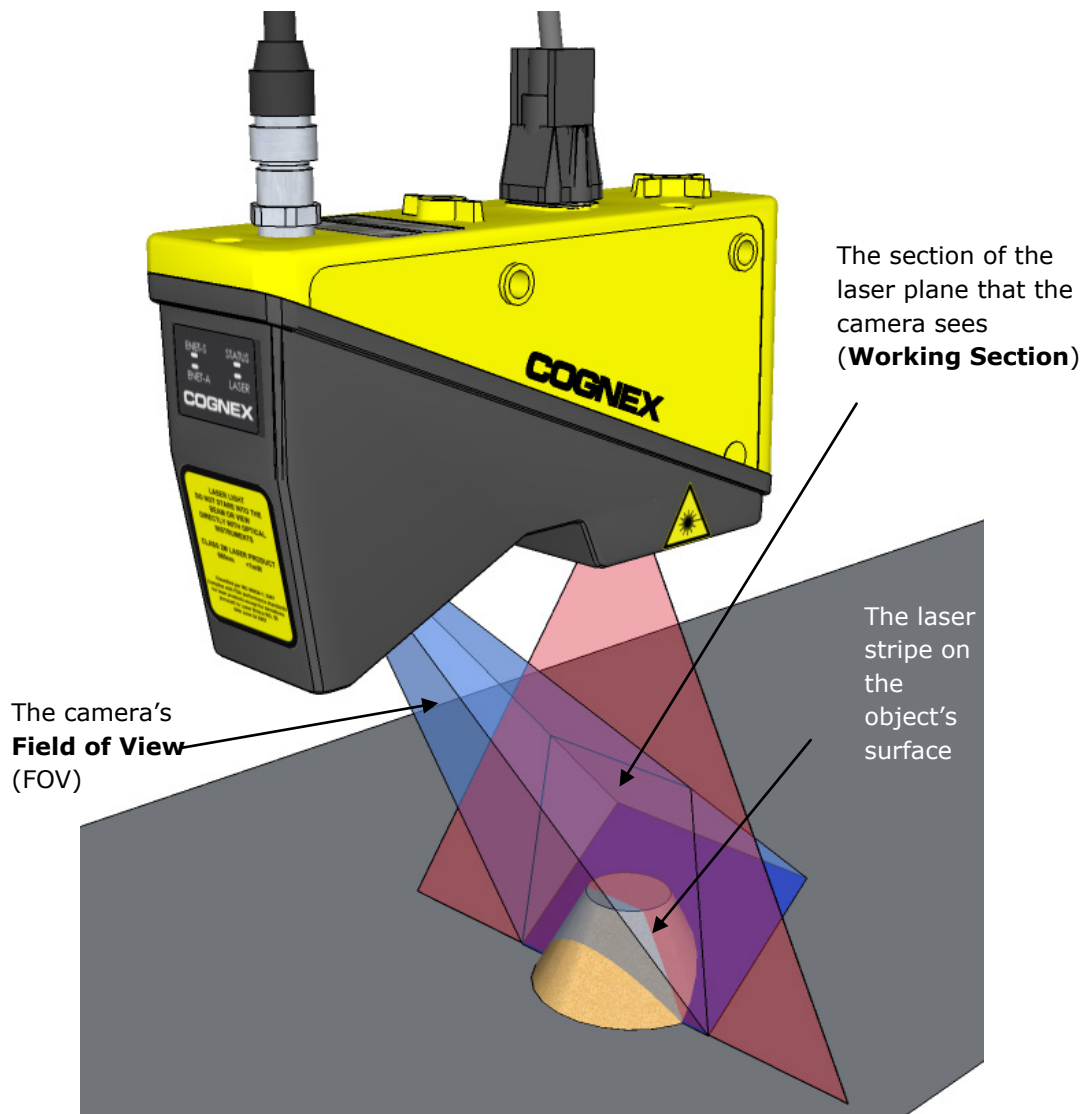
## How the DS 1000 Series Sensor Works

3. In each acquired image, the sensor locates and measures the position of the apparent laser line (the brightest pixels).



4. The sensor then transforms each **intensity image** into the corresponding rows of the range image (see the following sections). Each individual row at this step is stitched together thus forming the **range image**.

# How the DS 1000 Series Sensor Works



There are certain image distortions that derive from the fact that the camera has a fixed-point aspect, it has a lens, and that the object is moving under the sensor. However, Cognex's VisionPro software makes various adjustments (calibration) and, as a result, the range image does not show these unwanted optical effects.

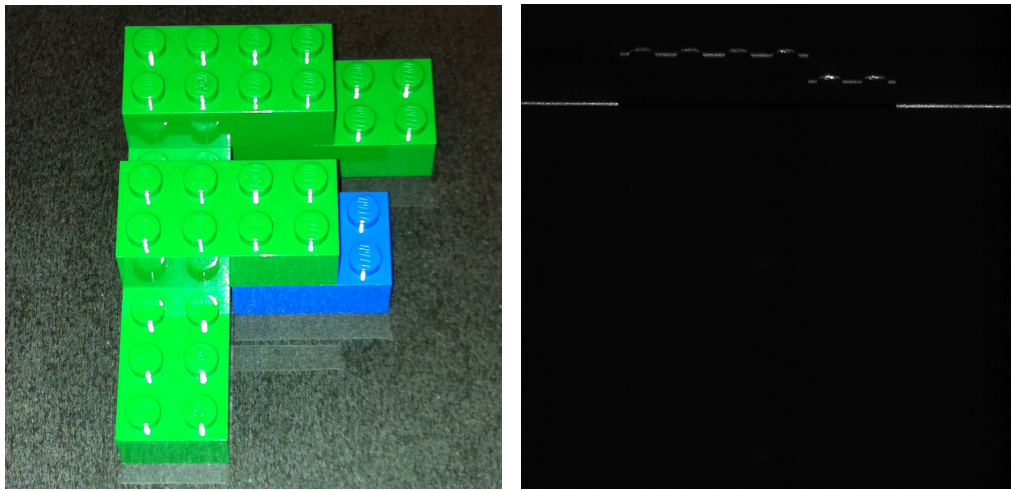
## Intensity Image

The sensor projects a triangular laser plane onto the object under inspection, illuminating its surface. The illumination results in a laser stripe, the shape of which is determined by the surface of the object.

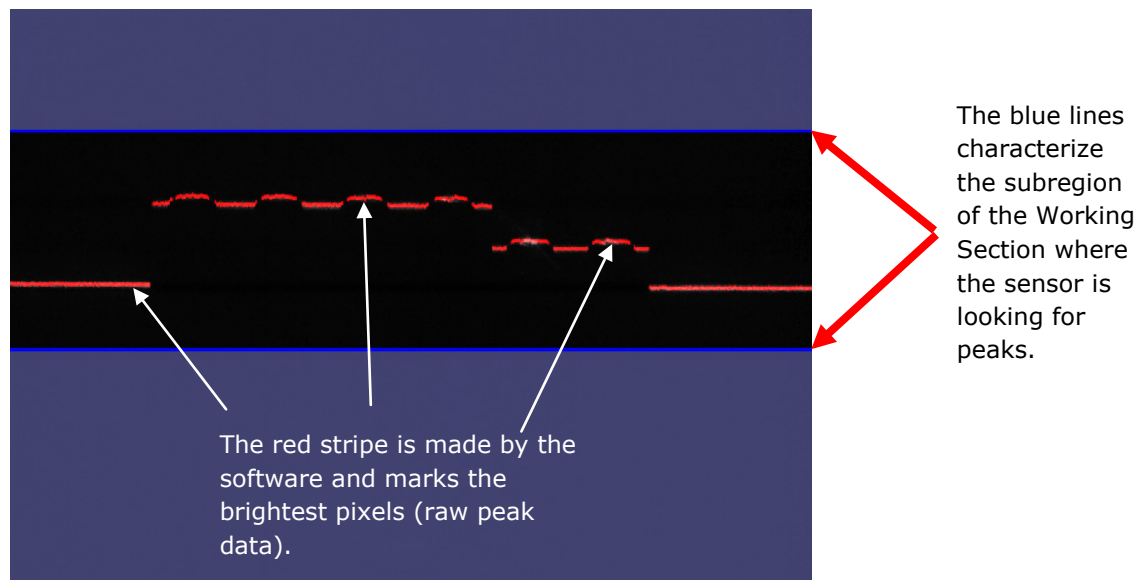
The shape of the laser stripe provides exact height profile information of the object.

## How the DS 1000 Series Sensor Works

The left figure illustrates the laser stripe as seen from the position of the camera; the right one is one actual Intensity Image (of a part of the object on the left). This is an image that the camera sees through its filter:



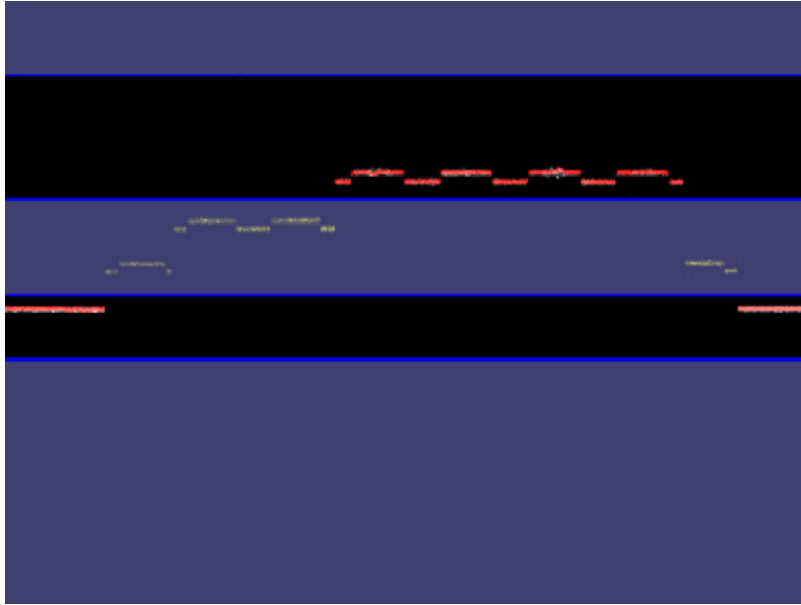
The DS 1000 Series Sensor gets the raw (uncalibrated) peak data from the bright stripe curve finding algorithm, which seeks for the brightest pixels that correlate to the tallest heights and marks them with red.



*For best results, the laser line in the image should not extend outside the red overlay graphics.* For this, reduce the **acquisition exposure parameter** until the laser line does not extend outside the red overlay.

Recommended default acquisition setting: Contrast = 0

## How the DS 1000 Series Sensor Works



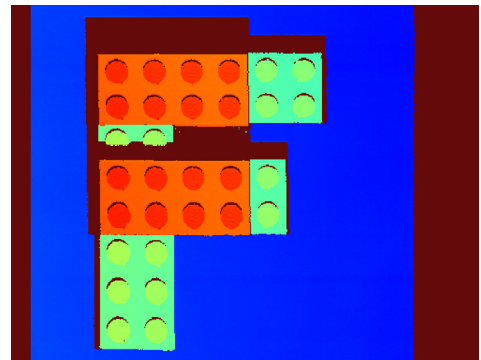
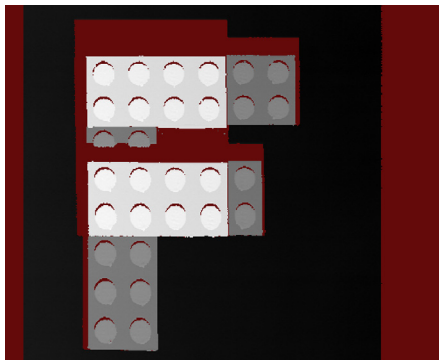
If you are interested in two separate height ranges and not in the gap separating them, you may increase the acquisition speed of your sensor by specifying a gap in which bright stripe curve finding should not be performed.

You can specify the two height ranges of interest as two detection zones in which bright stripe curve finding should be performed. You can choose whether there should be a gap between them or they should be bridged (that is, the bottom of the lowest zone and the top of the highest zone define a united detection zone without any gap).

# How the DS 1000 Series Sensor Works

## Range Image

A range image is a 16-bit greyscale image containing height profile information in real world coordinates. This is an actual range image with different color maps applied (color maps in the second row):



## How Range Images Are Created

A range image is generated from a series of acquired intensity images. *Each row of the range image corresponds to one intensity image.* A row of the range image is generated by expressing the calibrated peak data obtained from the intensity image in greyscale pixel values.

Factory calibration transforms the raw peak data into real-world coordinates as well as removes distortions such as camera lens and perspective distortion.

For example, this is a row of height values (in millimeters) from a single intensity scan:

0	0	0	0	0	0	3	5	7	9	11	13	15	15	15	15	15	13	11	9	7	5	3	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	---	---	---	---	---	---	---	---	---

These values are then turned into one row of the greyscale range image:

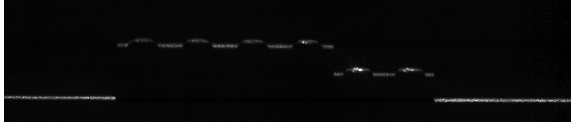


These images are then assembled and the whole picture of the object passing under the laser is created. This is called a range image.

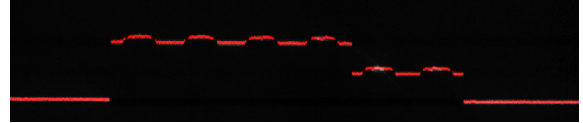
# How the DS 1000 Series Sensor Works

The following illustration describes the process of range image generation:

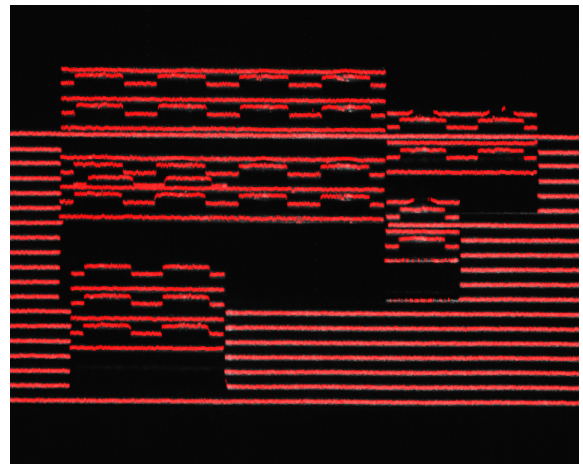
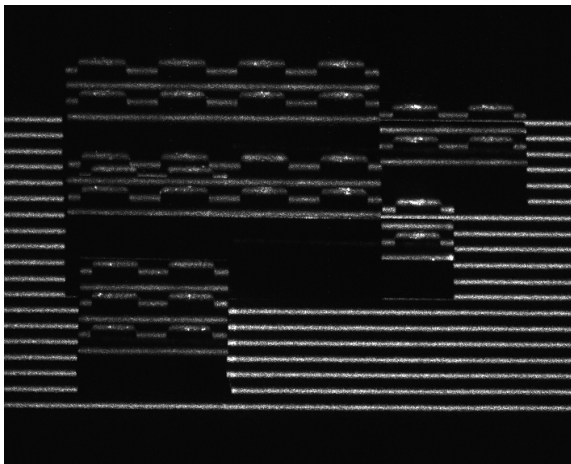
The **intensity images** are acquired as the object passes under the device.



The bright stripe curve algorithm finds the brightest pixels (**intensity with graphics**).

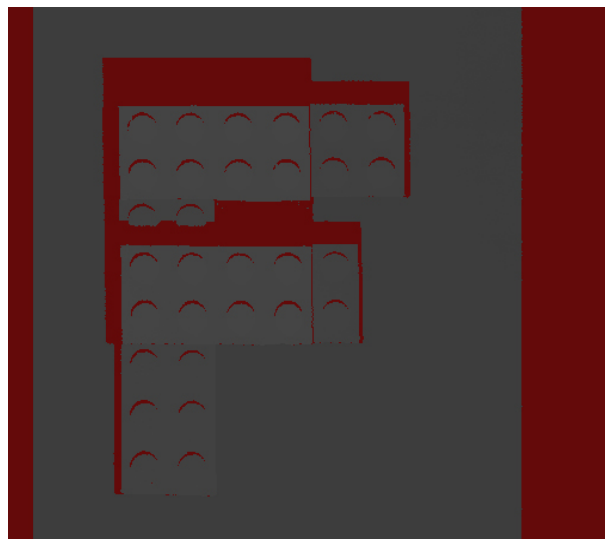


These rows together build up the shape of the object.



VisionPro then creates the **range image** with the appropriate correction (lens, perspective).

The final range image contains all 3D information about the object that have been acquired during the scanning process.

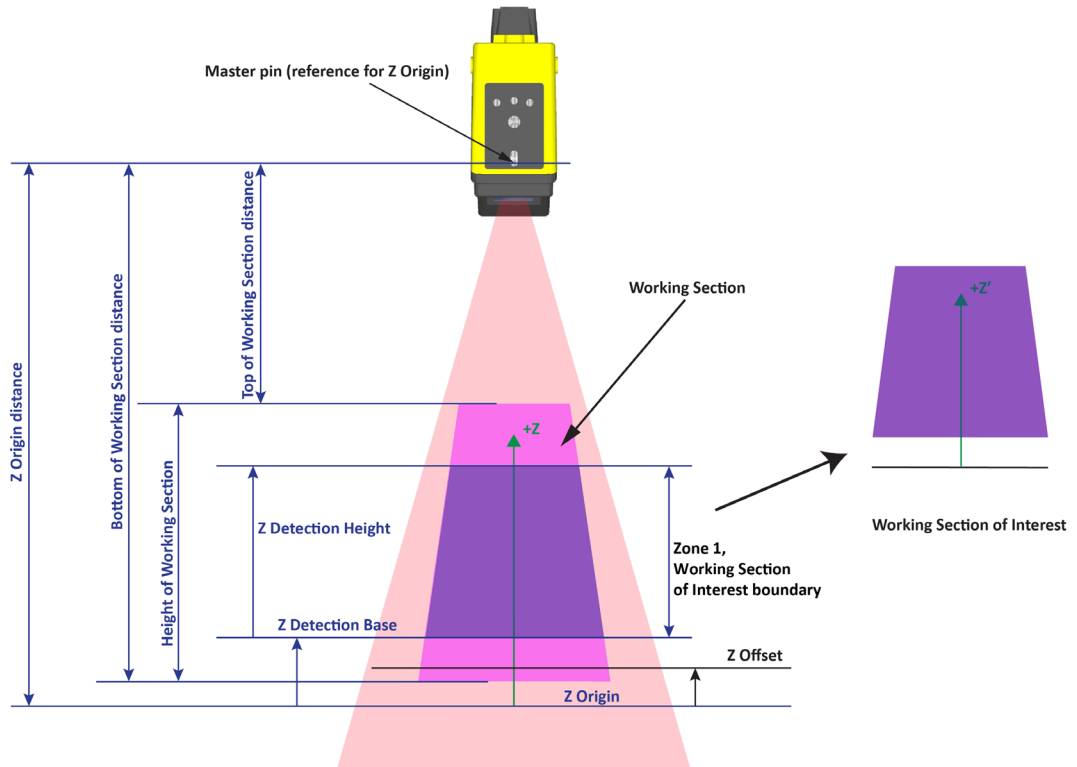


**NOTE:** The intensity image and the raw image data are processed by the sensor itself, while the range image is created on your PC, using VisionPro software tools.

# How the DS 1000 Series Sensor Works

## Reading Distance and Field of View

All sensors have the same range of working distances (minimum and maximum detectable surface distance from sensor). Surfaces that are further or closer than the documented maximum and minimum distance will not be seen by the camera (invisible pixels will be replaced with the zero value by default).

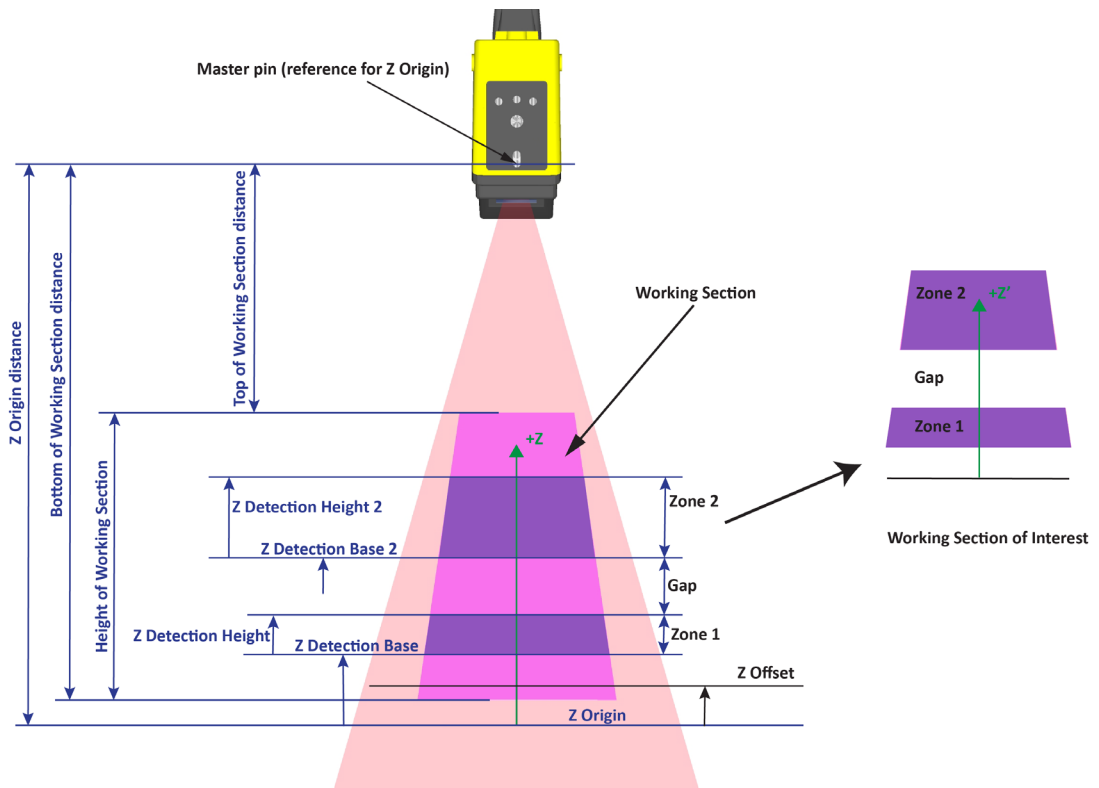


The Z Origin is at a fixed distance measured in the Z direction from the center of the Master Pin of the sensor as specified in the DS1000 Series Displacement Sensors Quick Reference Guide. The distance between Z Origin and the Master Pin is 350 mm.

By default, Zone 1 is the height range in which heights will be detected (in mm); the **Z Detection Base** and **Z Detection Height** parameters define this height range. The intersection of this height range and the Working Section defines the Working Section of Interest, which is typically the subregion of the Working Section. The overlap of the Working Section and the Working Section of Interest defines the region in which the bright stripe curve finding algorithm is performed. Pixels beyond this region are ignored.

# How the DS 1000 Series Sensor Works

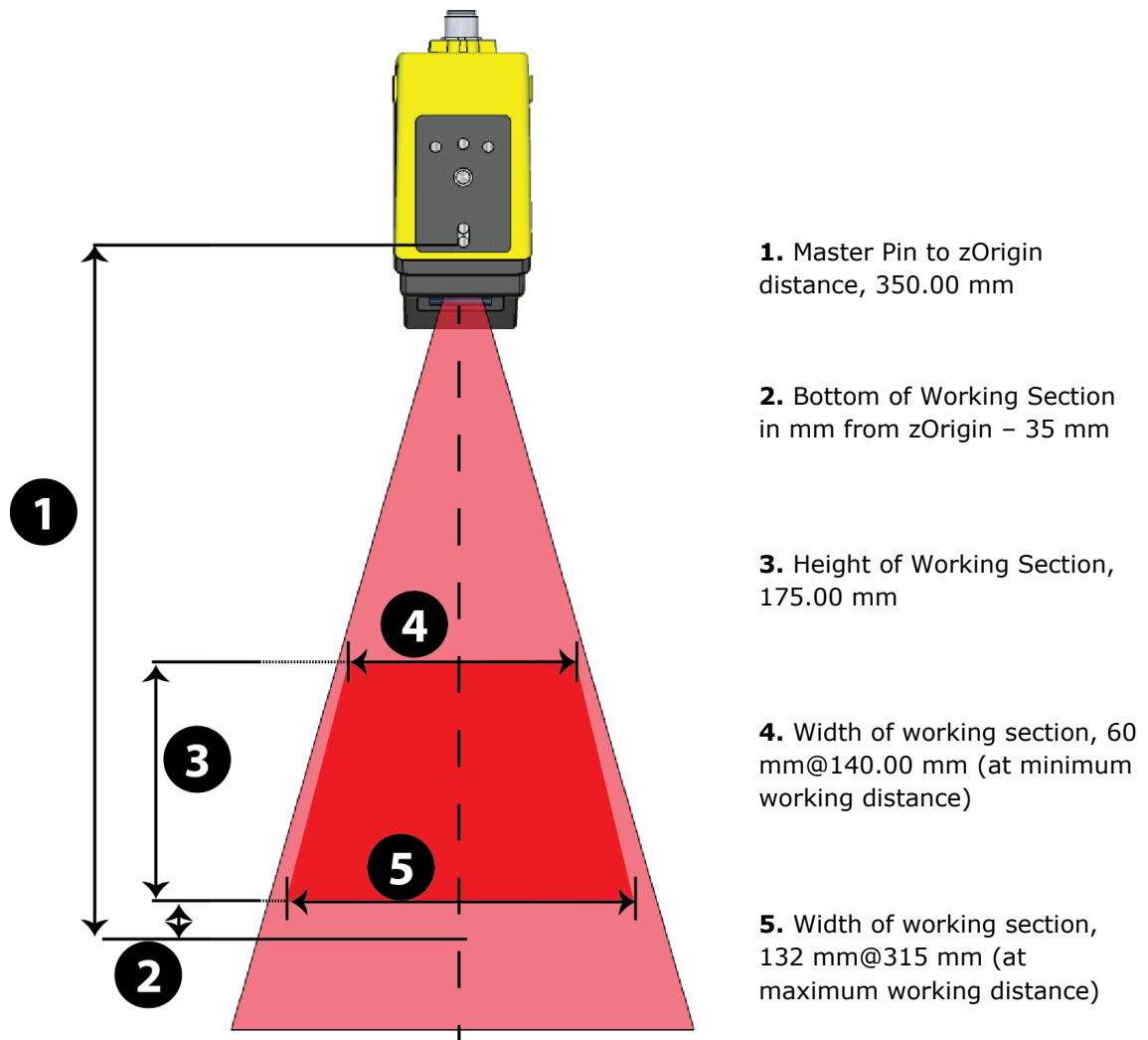
You may define a second height range for the Working Section of Interest, Zone 2, by enabling it and setting the **Z Detection Base 2** and **Z Detection Height 2** parameters. This is useful when you are interested in two height ranges separated by a gap, and you are not interested in the height ranges of the gap. By specifying a gap in the Working Section of Interest, the acquisition speed of the sensor may be increased. Heights in the gap are not detected by the sensor.



If Zone 1 and Zone 2 are enabled, the Working Section of Interest is defined as follows:

- If Zone 1 and Zone 2 are not bridged (default), a gap exists between the two zones in which detection is not performed.
- If Zone 1 and Zone 2 are bridged, Zone 1 and Zone 2 are combined into a single zone starting at the bottom of the lowest zone and ending at the top of the highest zone.

# How the DS 1000 Series Sensor Works



## Missing Pixels in the Range Image

Due to sensor-to-sensor variations, when used in **Intensity** or **Intensity-with-Graphics** mode, certain working distances may appear to be visible in the intensity image (i.e. you can see the laser line on a surface) that are not actually within the specified range, and consequently will not appear in the range image. This may confuse users, since in **Intensity** mode they can visually see that the camera lens can see the laser line, yet the range image shows missing pixels.

*Only surfaces within the specified working section will appear in the range image.*

# How the DS 1000 Series Sensor Works

## Coordinate Systems

We define the following coordinate systems in connection with the DS 1000 Series Sensors:

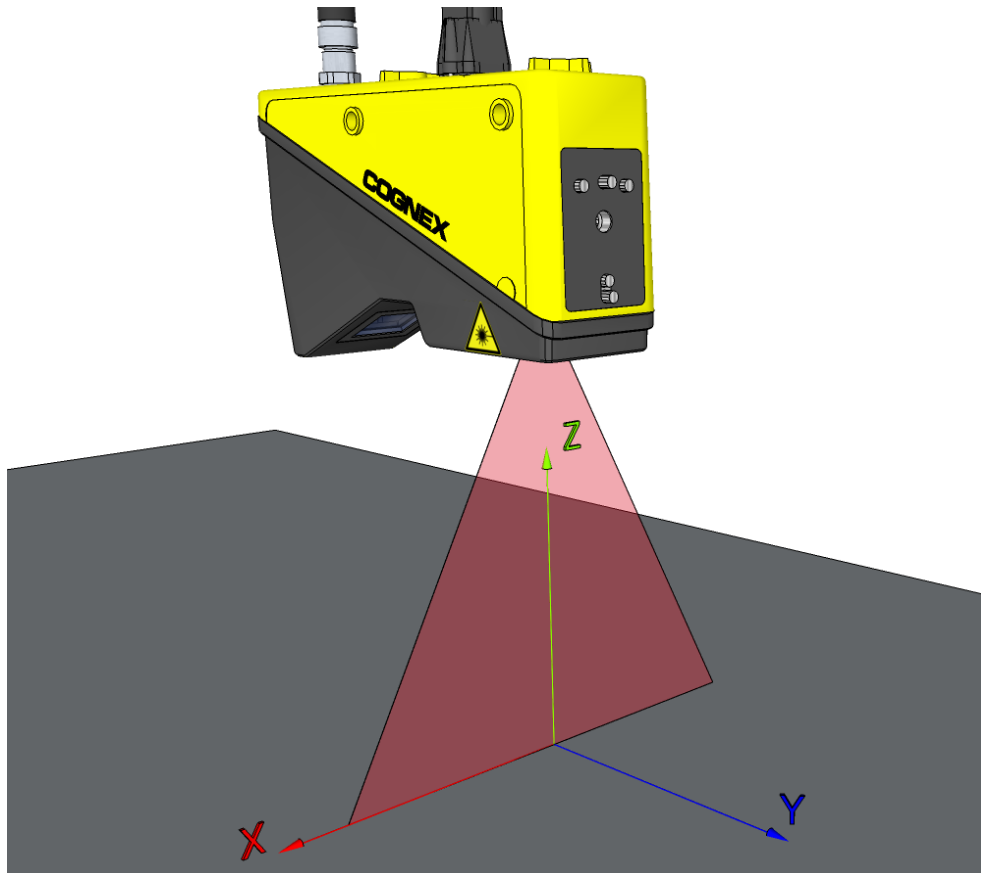
<b>(1) Sensor 3D Space</b>	Physically accurate / right-handed 3D coordinate system rigidly affixed to the sensor. Units: mm
<b>(2) Image 3D Space</b>	Left-handed, the origin is at the upper-left corner of first pixel in image. Units: pixels (X/Y) pixel values (Z)

### Sensor 3D Space

The DS 1000 Series Sensor's *Sensor 3D* coordinate system is defined by:

- the *laser plane* (X and Y axes)
- the extrapolated position of the *mounting pins*

The projected laser plane is measured and it defines the X-axis. The Y-axis is perpendicular to the X-axis – therefore to the laser plane as well.



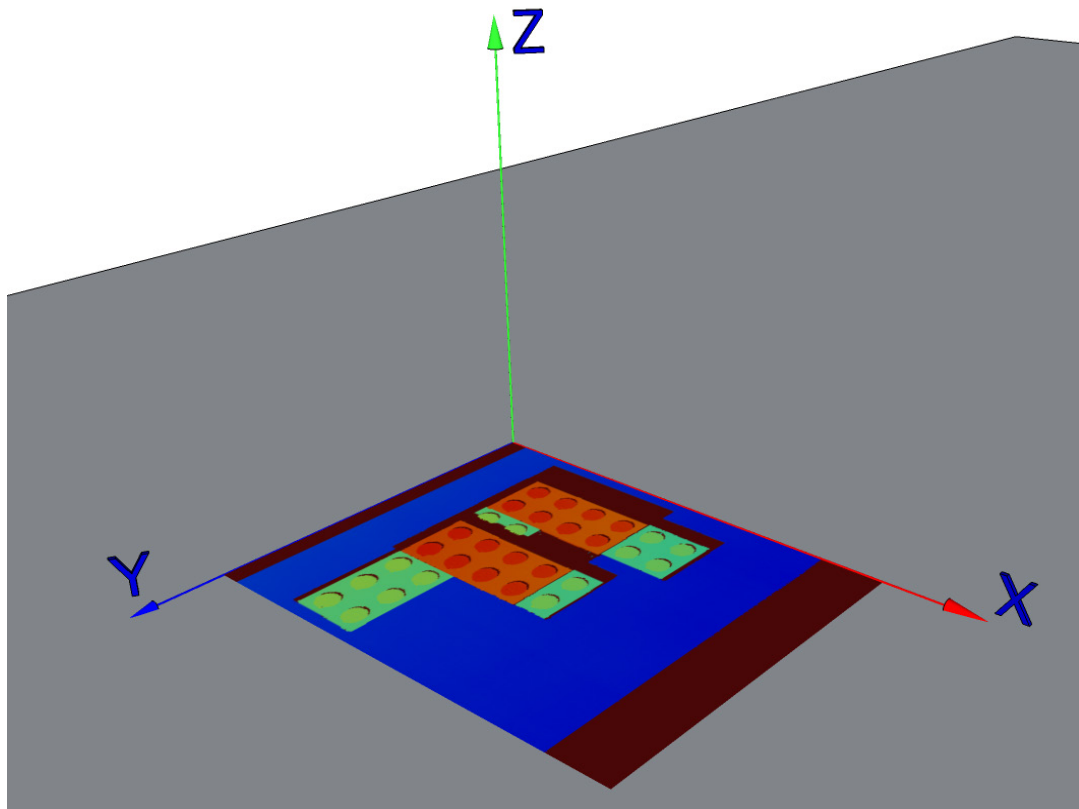
# How the DS 1000 Series Sensor Works

## Image 3D Space

Information appearing in range images is expressed in the Image 3D Space.

The Working Section of the sensor is defined as the cross-section of the laser plane and what the sensor can see. Although different sensors may be oriented slightly differently, the range images are explicitly limited to a *canonical working section* so that all sensors induce exactly the same range image extents.

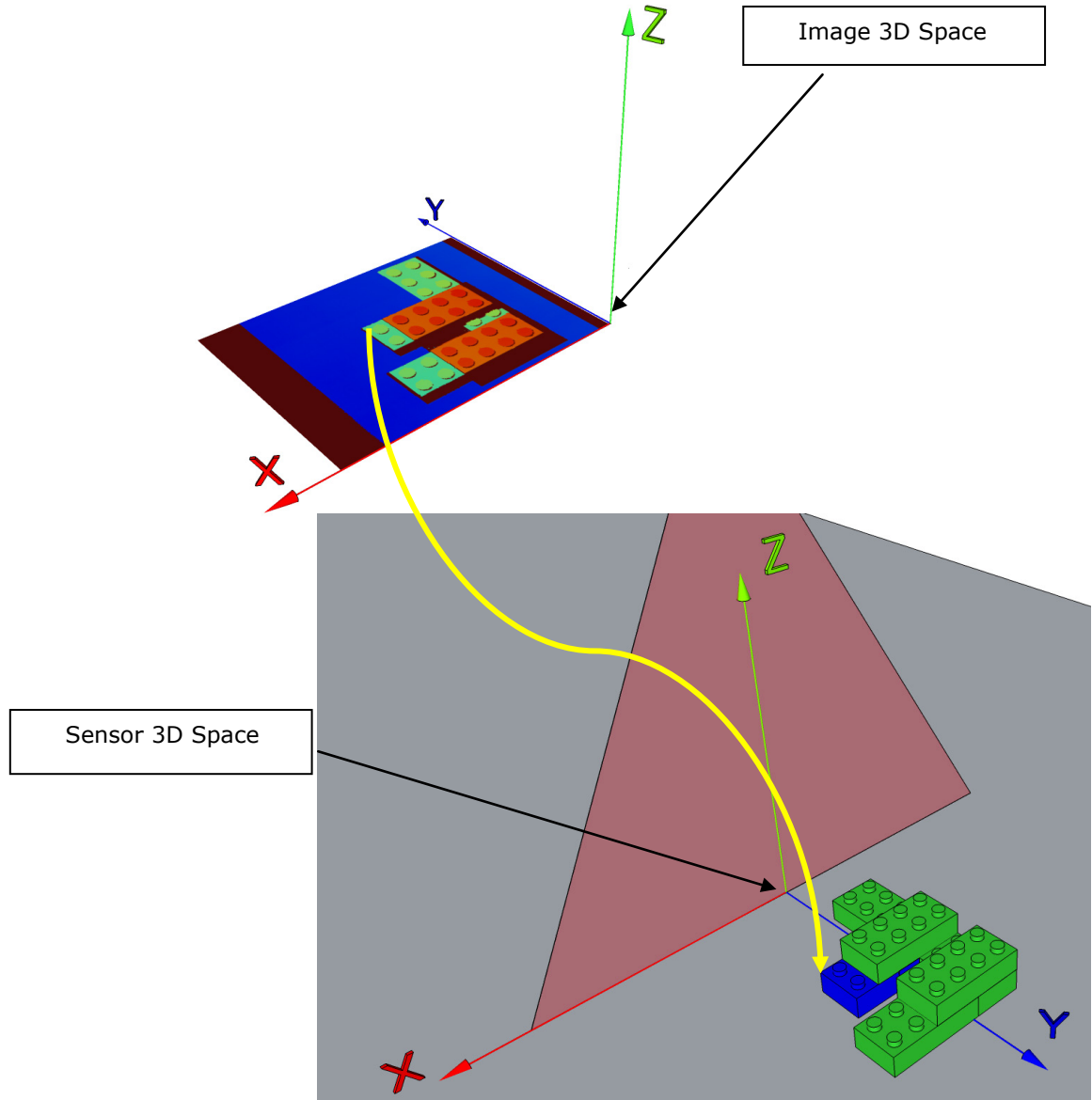
The units in this coordinate system are defined in pixel values (X,Y). Z contains the height information.



# How the DS 1000 Series Sensor Works

## Transformation from Image 3D to Sensor 3D Space

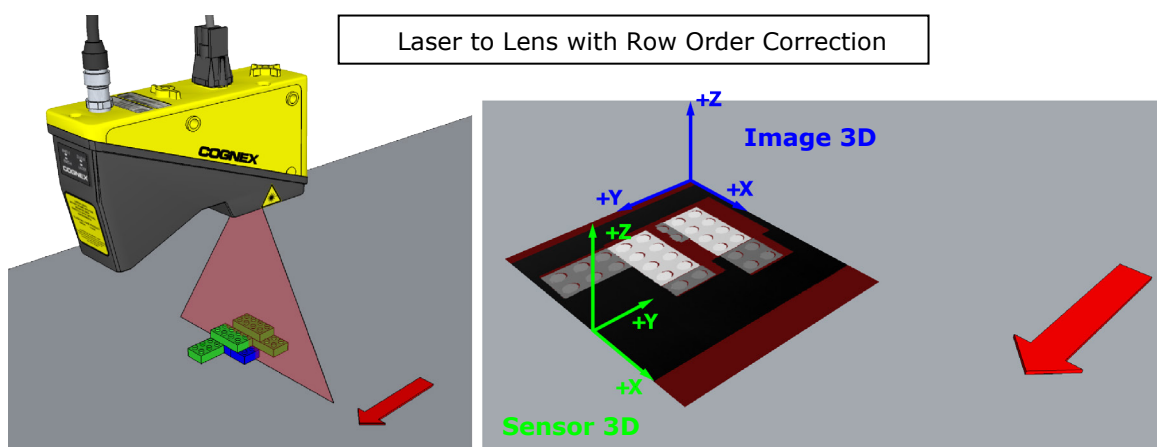
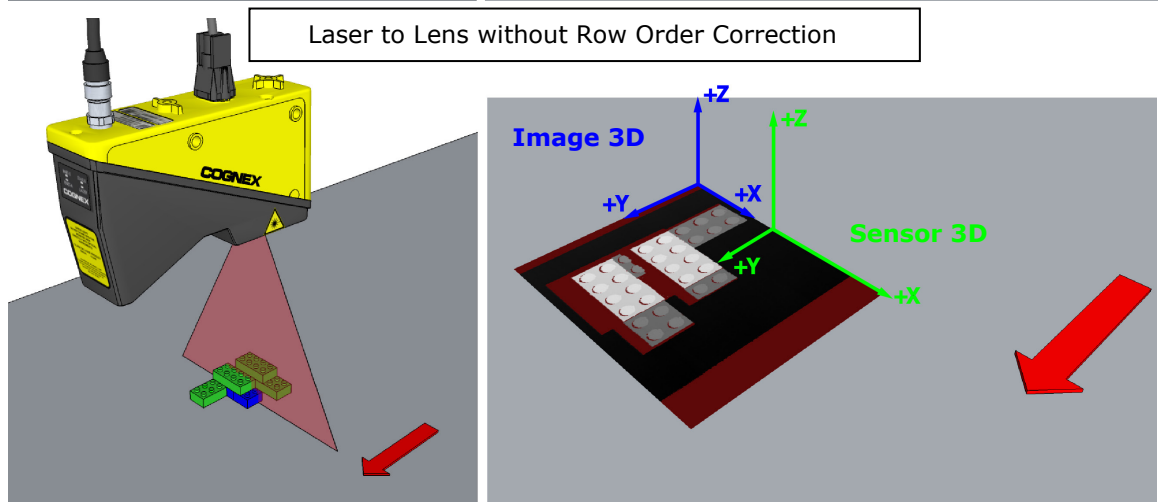
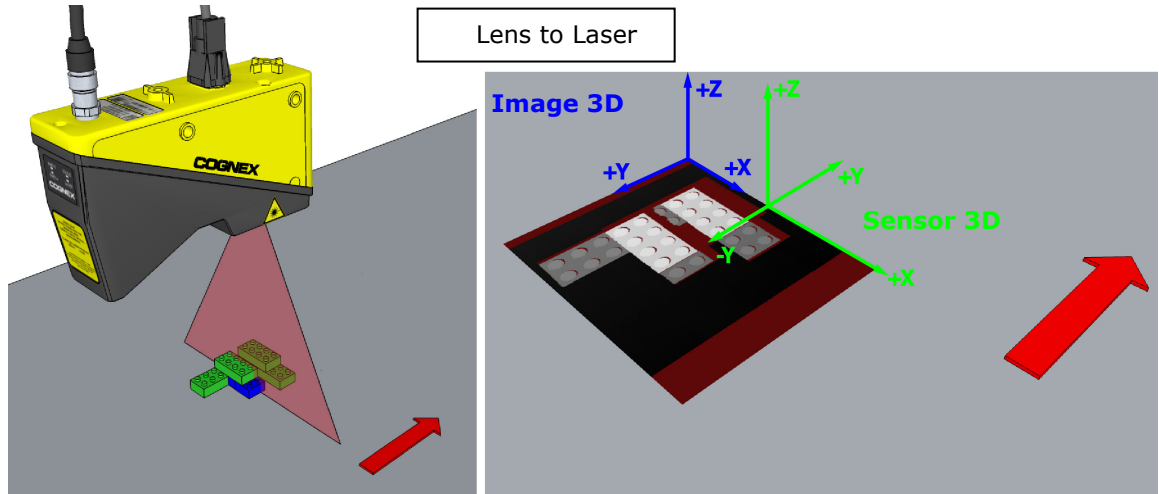
A pixel location  $(X,Y)$  and the belonging height value  $(Z)$  in the Image 3D Space of the range image corresponds to a real physical point in the Sensor 3D Space. See the illustration below:



# How the DS 1000 Series Sensor Works

## Motion Direction

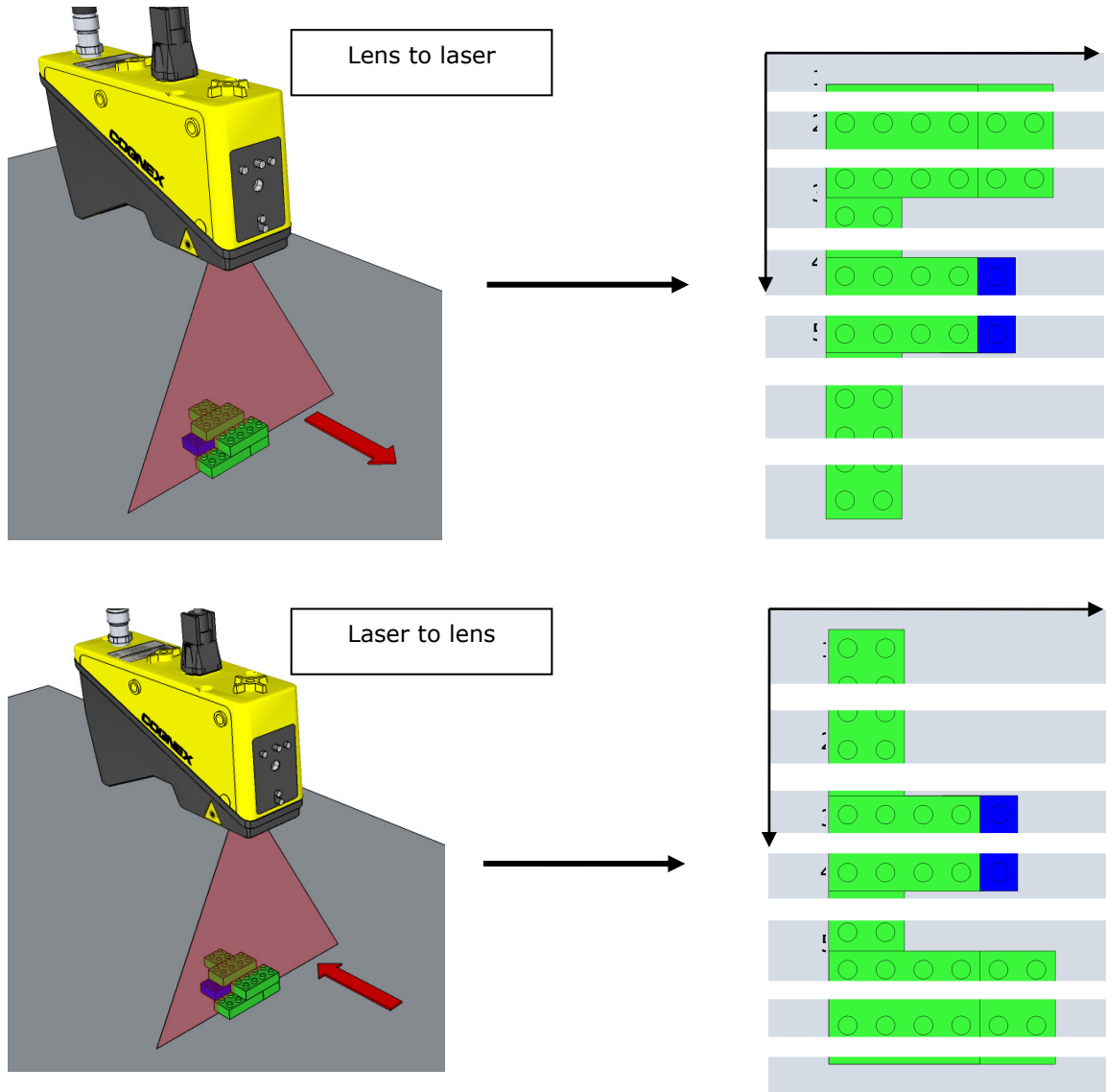
As the illustration shows below, the motion direction changes the appearance of the pixels (unless row order correction is applied) and also the location of the origin of Sensor3D space in the image.



# How the DS 1000 Series Sensor Works

## Why Does Changing Motion Mirror the Pixels?

As the same object arrives from opposite directions, the first acquired pixels are made from the other end of the object (assuming that the object is not rotated). As the software stitches them together in the order of arrival and builds up the image, the result is that the object from one of the two directions looks mirrored.

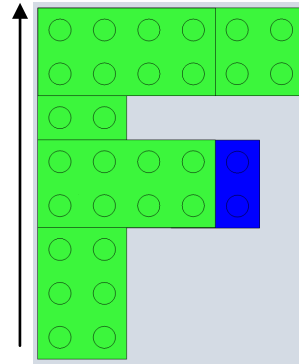


# How the DS 1000 Series Sensor Works

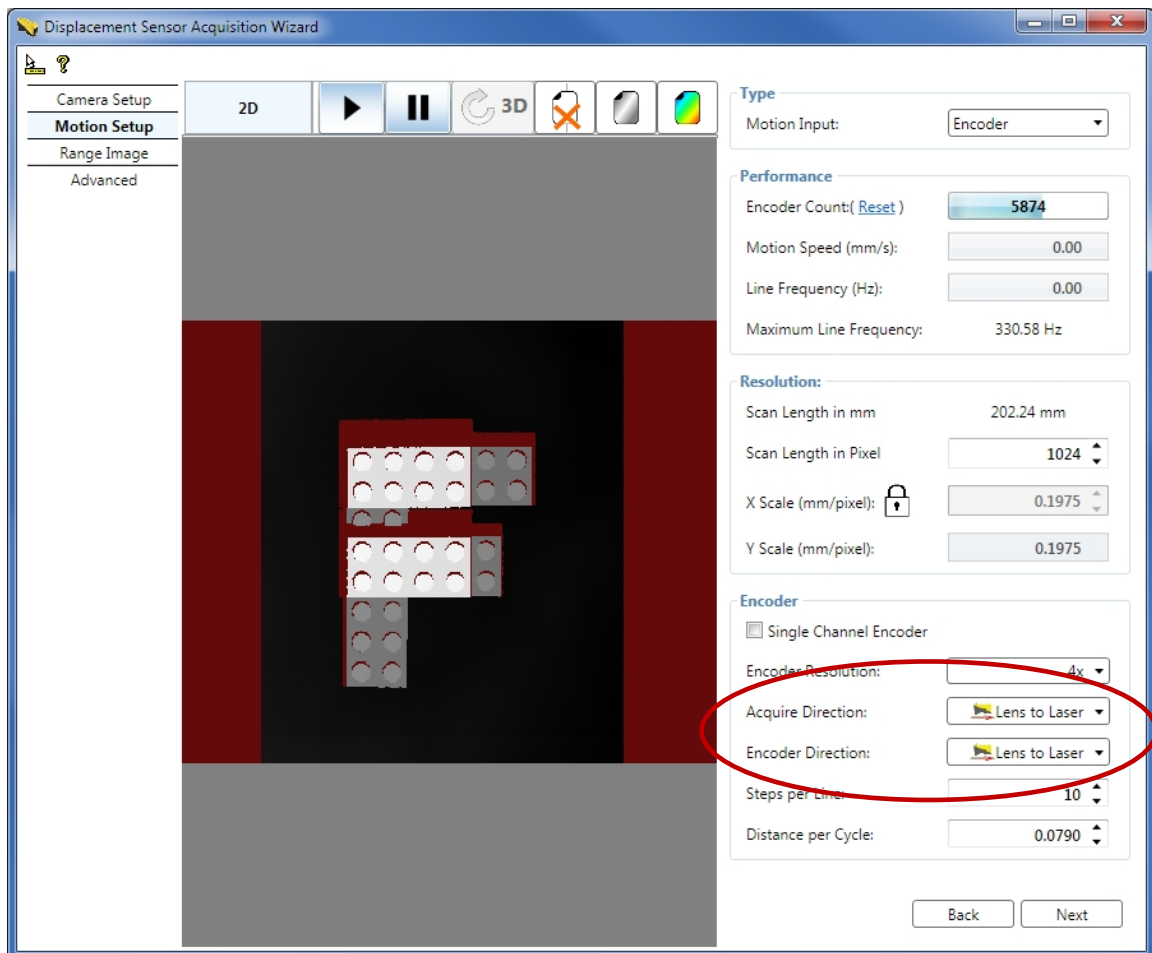
To avoid confusion, the following sections act as a short guide about the motion directions and range images of the same object.

Here is our familiar Lego® block.

As this is an asymmetric 'F' letter, let us say that it has a default orientation which is how we see it in print in general.



In VisionPro, you can simulate either changing the *motion direction of the conveyor belt* or the *orientation of the device*. These settings are on the Motion Setup tab of the Displacement Sensor Acquisition Wizard available through the Image Source window.



# How the DS 1000 Series Sensor Works

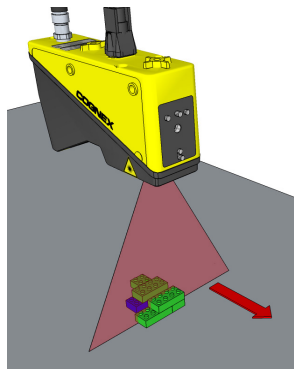
## Positive Encoder Direction settings

VisionPro provides the Positive Encoder Direction setting, which basically means the **moving direction** of the conveyor belt **below** the sensor. These settings are provided to help prevent physical reorientation of the conveyor belt.

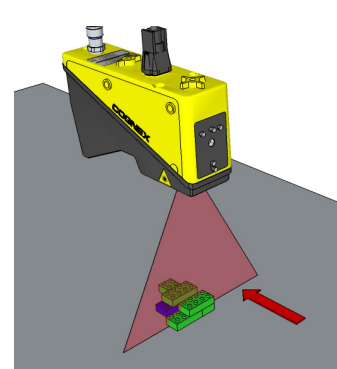
## Positive Encoder Direction settings

We can scan this F letter with the sensor in two ways. (For the sake of simplicity, let us say that we are interested in only those two ways in which the axis of the object movement is parallel with its default direction.) Namely, *Lens-to-laser*, and *Laser-to-lens*.

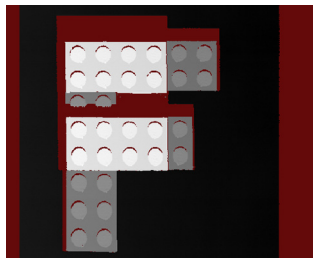
Lens to laser



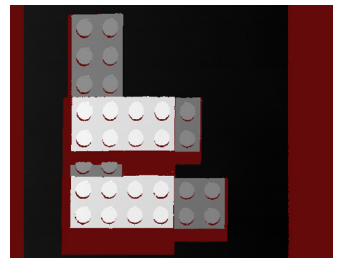
Laser to lens



Lens to laser – Range Image 1



Laser to lens – Range Image 2



These are the results of the two scans, respectively, with some colormap applied to illustrate height differences. Let us call them *Range Image 1* and *Range Image 2*.

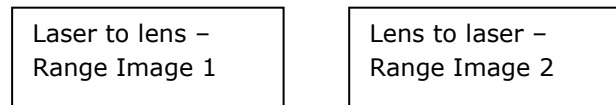
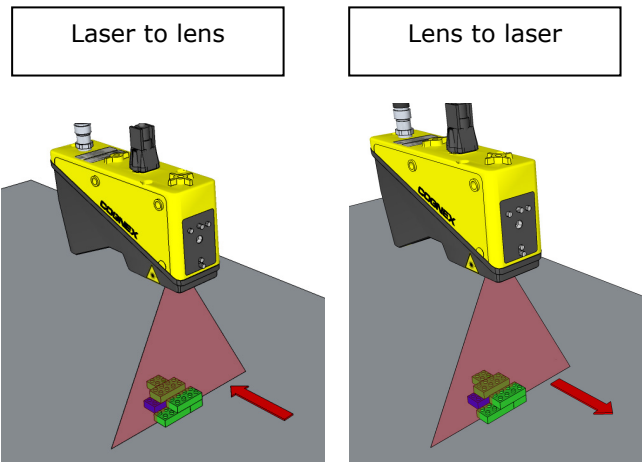
# How the DS 1000 Series Sensor Works

## Acquire Direction Settings

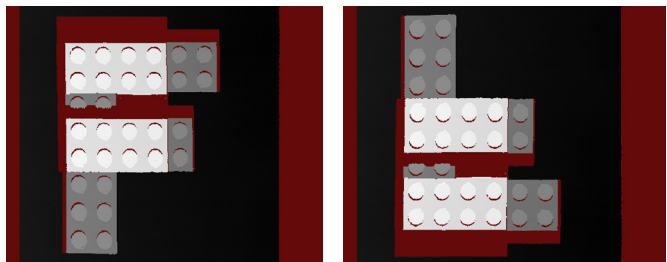
VisionPro provides the Acquire Direction setting, which means the **orientation** of the sensor **above** the conveyor belt. These settings are provided to help prevent physical reorientation of the device.

### Acquire Direction settings

We can scan this F letter with the sensor in two ways. (For the sake of simplicity, let us say that we are interested in only those two ways in which the axis of the object movement is parallel with its default direction.) Namely, *Lens-to-laser*, and *Laser-to-lens*.



These are the results of the two scans, respectively, with some colormap applied to illustrate height differences. *Range Image 1* and *Range Image 2*.



## Conclusion

Although the variety of settings provides four possible ways altogether to scan an object, the result will be two range images that are the mirrored varieties of each other. Furthermore, the two range images contain the same physical information about the object.