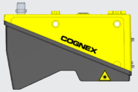
COGNEX®

DS1000 Series Displacement Sensors

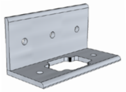
Quick Reference Guide

DS1100 Models

		Class 2M Laser	Class 3R Laser (high-powered for more challenging applications)
DS1100 P100-220-000-xx 821-0088-1R		✓	
DS1100R P100-320-000-xx 821-0088-3R			✓

DS1000 Series Sensor Accessories

Power + I/O + Encoder cable
(CKR-4G-CBL-001)



Top Mounting Bracket
(DS-BKT-000)

IP67-rated RJ45 Ethernet Cable

(PPLUS-CBL-ENET)

Precision Adapter Plate

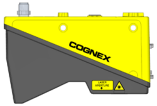
Laser Safety Warnings

DS1100

(821-0088-1R)

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

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY



DS1100R

(821-0088-3R)

LASER LIGHT, DO NOT LOOK INTO BEAM:
CLASS 3R LASER PRODUCT

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY

Warnings and Notices

- 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 it 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 (821-0088-1R)

In accordance to the standards, the following labels are placed on their respective places on every sensor manufactured by Cognex Corporation:

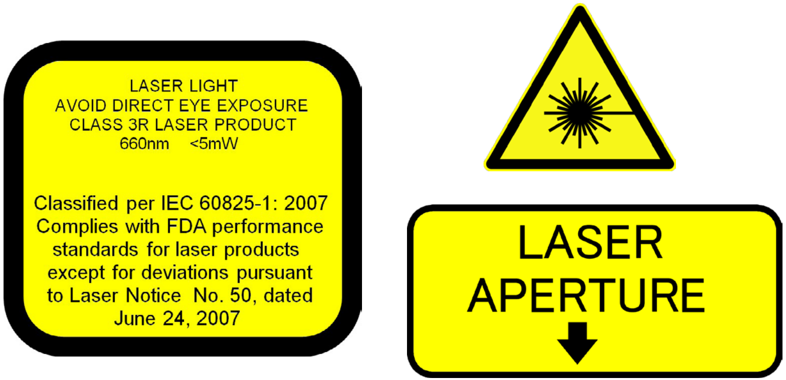
FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY

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.

Labels (821-0088-3R)

In accordance to the standards, the following labels are placed on their respective places on every sensor manufactured by Cognex Corporation:

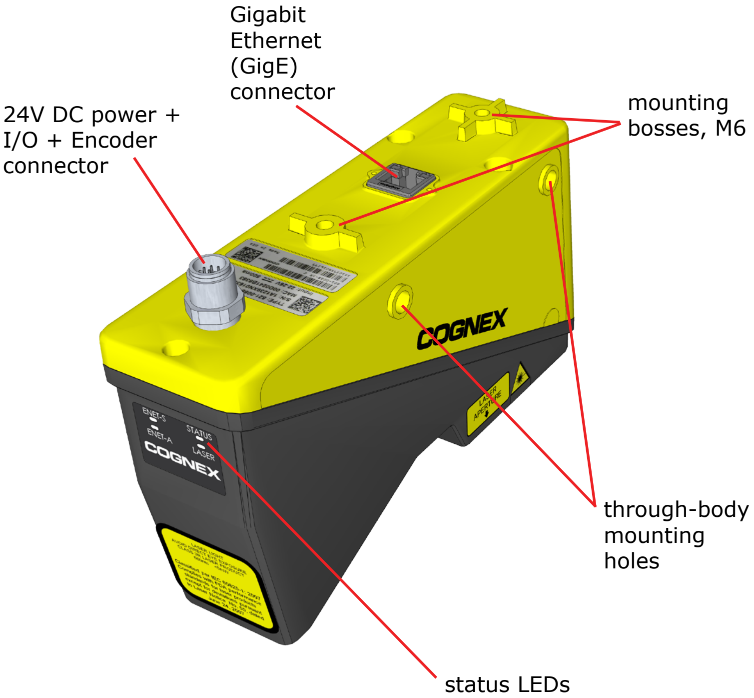


FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS INJURY

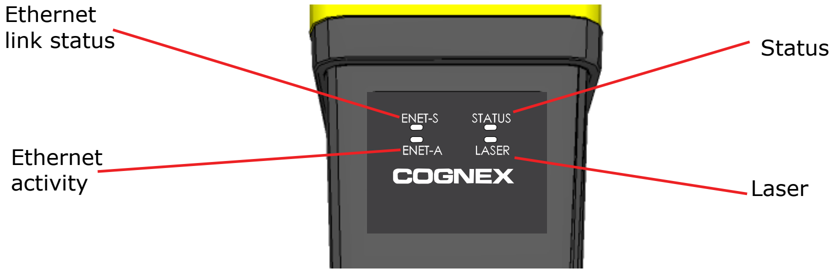
If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

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

System Layout



System Layout



Ethernet link status

This LED indicates what type of link the device has achieved with the host. If the LED is off, no link has been achieved. If you see blinking in groups of 3 (blink-blink-blink-pause-blink-blink-blink-pause, and so on), a 1000 Mb connection is established.

Ethernet activity

This LED is on when a link has been achieved and blinks when there is Ethernet activity on that link. When there is no link, the LED is off.

Status

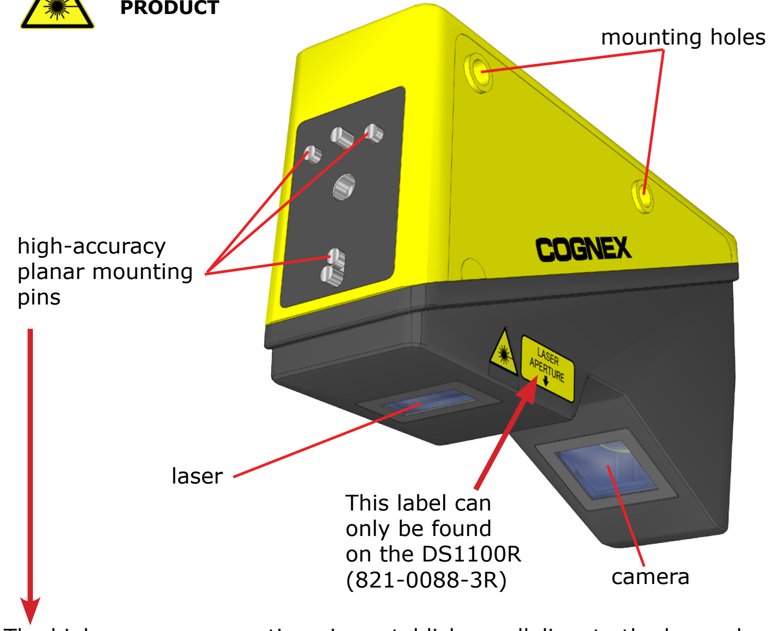
This LED is on when the sensor is booted and running normally, with a short blink of approximately every 5 seconds.

Laser

This LED is on when the laser is on.

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

LASER LIGHT, DO NOT LOOK INTO BEAM: CLASS 3R LASER PRODUCT



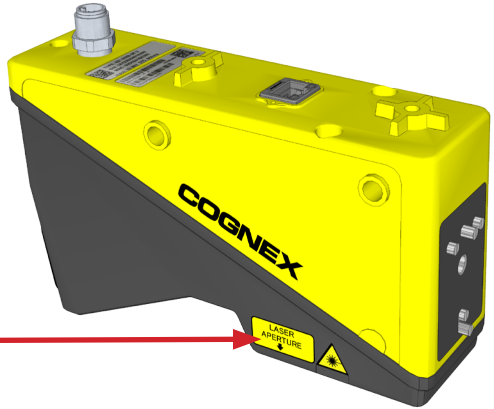
The high-accuracy mounting pins establish parallelism to the laser plane.

Label Locations

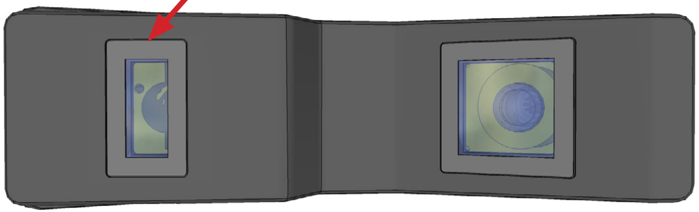
DS1100 (821-0088-1R)

DS1100R (821-0088-3R)

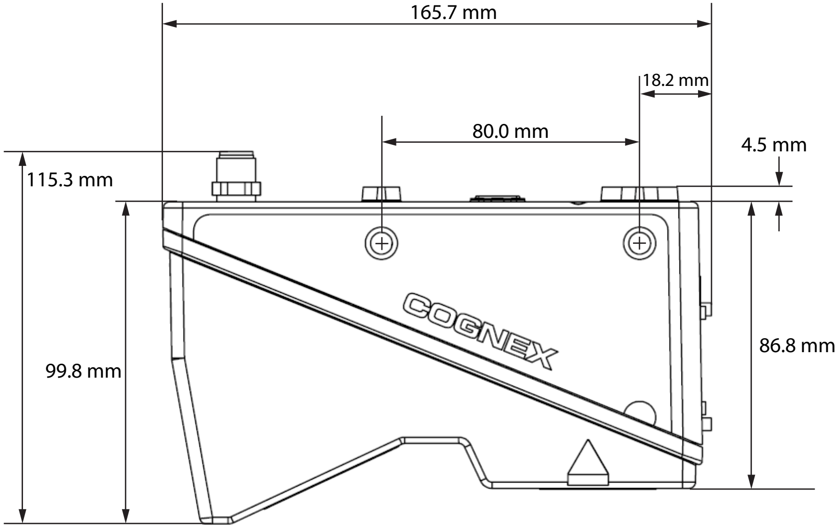
This label can only be found on the DS1100R (821-0088-3R)

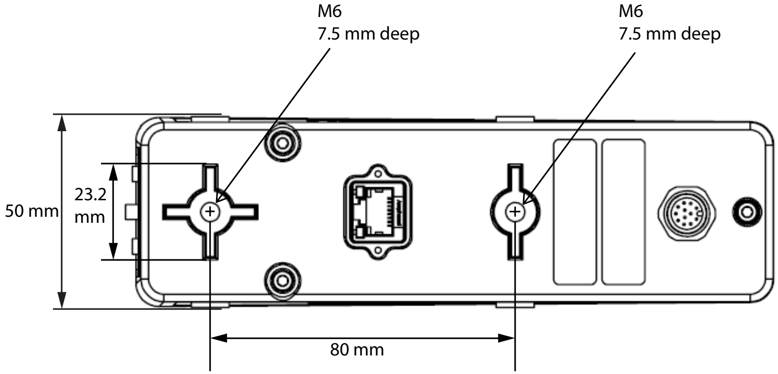


AVOID EXPOSURE - LASER RADIATION IS EMITTED FROM THIS APERTURE



Dimensions


165.7 mm
18.2 mm
80.0 mm
4.5 mm
115.3 mm
99.8 mm
86.8 mm
COGNEX


M6
7.5 mm deep
M6
7.5 mm deep
50 mm
23.2
mm
80 mm

About The DS1000 Series Sensors

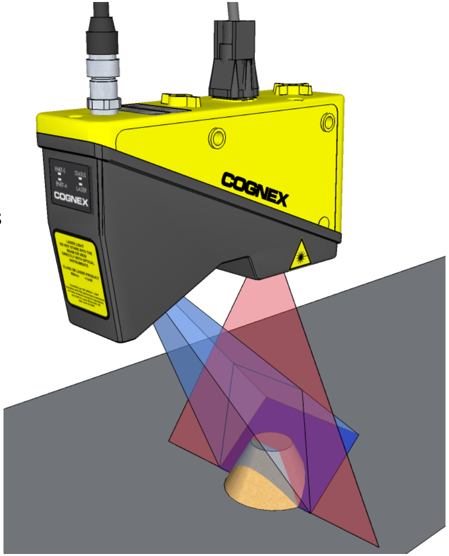
The *Cognex DS1000 Series Sensors* (from now on: sensors) have an integrated digital camera and laser stripe illuminator, mounted in a single mechanically robust package. The sensor uses two-dimensional surface profiling to create range images which provide three dimensional data.

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 DS1000 Series Sensor

- Your sensor is a sensitive, precision instrument. Subjecting the unit to shock, vibration, or rough handling in excess of the specified limits (see page 18) 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 on page 18.

- Follow the instructions in the section “Sensor Maintenance” on page 25 to clean your sensor.

- Refer to the section “Warnings and Notices” on page 6 for laser safety information.

- Refer to the section “Powering The DS1000 Series Sensor” on page 26 for electrical safety information.

DS1100 Sensor Specifications

Weight	700 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 = ½ (A+/B+)	
"Field of View and Working Section" on page 16	working distance	140-315 mm
Ethernet	• Gigabit Ethernet interface • Integrated link and traffic LEDs • Standard RJ-45 connector	
Shock	• 10 gs for 5ms (any axis)	
Vibration	• 8 gs (any axis, any frequency)	
Certification	Compatible with Windows 7, FCC, CSA, CE, RoHS	

Laser Specifications (821-0088-1R)

This Laser Product is designated as **Class 2M** during all procedures of operation.

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
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.	

Laser Specifications (821-0088-3R)

This Laser Product is designated as **Class 3R** during all procedures of operation.

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
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.	

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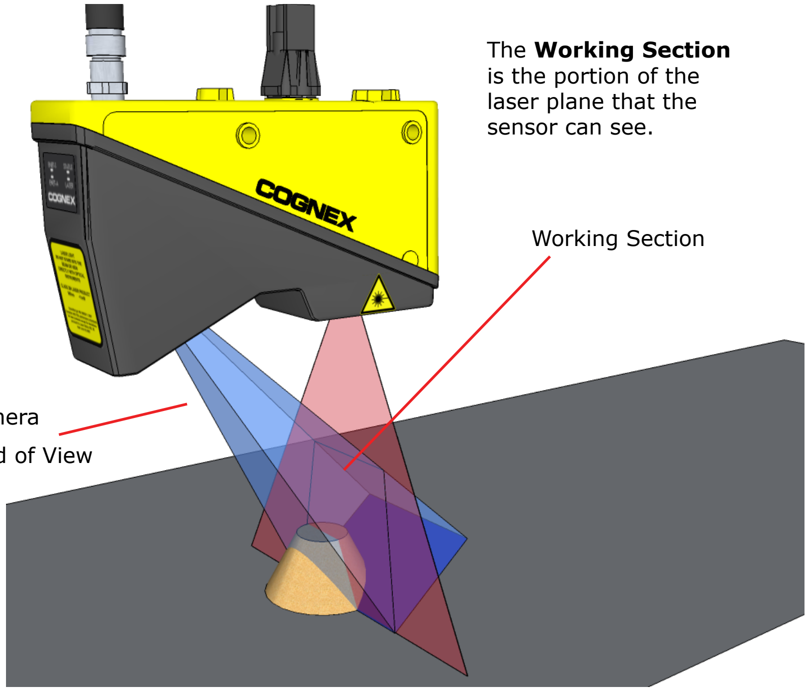
Field of View and Working Section

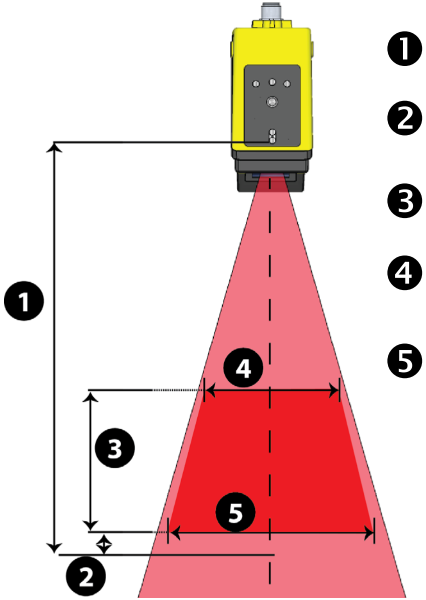


The **Working Section** is the portion of the laser plane that the sensor can see.

Working Section

Camera Field of View

The working section is a subset of the overall laser plane.



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)

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.
- In case of any necessary service or repairing processes, return the unit to the factory.
- Service is only to be handled by authorized factory trained technicians. The sensor does not contain parts that are user-serviceable.
- For best results, Cognex recommends using the PPLUS-CBL-ENET Ethernet cable. If the PPLUS-CBL-ENET cable is not used, a shielded, Cat 5e or Cat 6 cable is required.

Sensor Maintenance

The DS1000 Series Sensor windows should be kept clean, so avoid touching the windows and, if possible, keep your 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.

Powering The DS1000 Series Sensor

When wiring your 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.

For More Information...

This document provides basic information about how you can set up your DS1000 Series 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:

CHM

VisionPro Documentation Set

Cognex->VisionPro->Documentation

PDF

DS1000 Series Displacement Sensors Technical Reference

(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**.

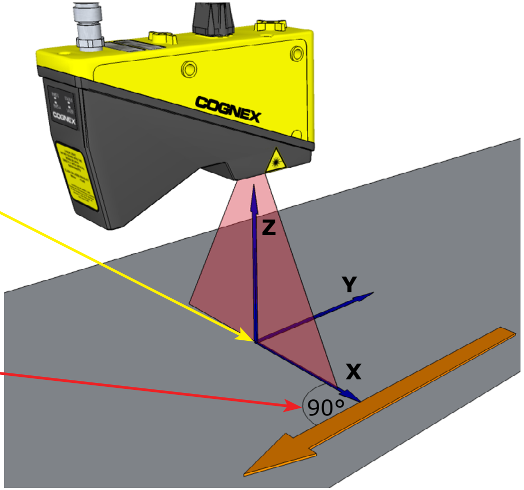
Mounting The DS1000 Series Sensor

For accurate operation, the sensor must be mounted firmly – acquired range images will be unrepeatable (and, consequently, inaccurate) if the device moves during acquisition. Furthermore, the device must be mounted perpendicular to the motion of travel; the more accurately you mount your device, the more accurate your acquired range images will be.

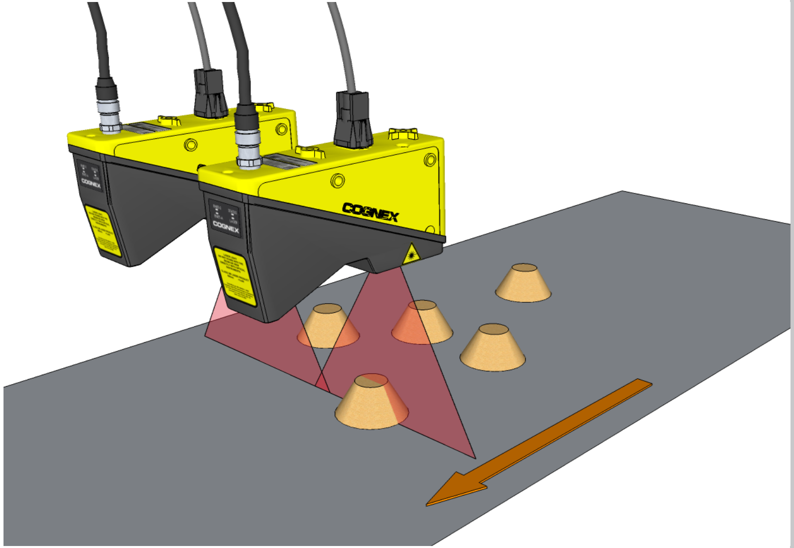
The sensor must be precisely aligned with the direction of movement taking into consideration the following guidelines:

The origin of the X axis is the optical centerline of the sensor projected onto the Working Section.

Movement should be perpendicular to the laser plane.



If multiple sensors are used, the laser planes should be coplanar with each other. The devices must be spaced so that there is sufficient overlap between the working sections of the sensors to cover the range of distances required by your application.

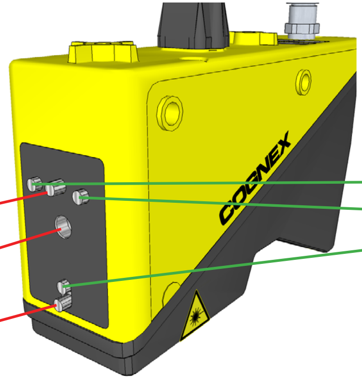


Mounting The DS1000 Series Sensor

You can mount your sensor in 3 different ways:

1. Attaching the device to a pre-drilled stainless steel plate. The high-accuracy mounting pins on the back of the device help to adjust the sensor (recommended).
2. With the mounting bosses on the top of the device.
3. With the mounting through-body holes on the side of the device.

The high-accuracy mounting pins on the back of your sensor are mechanically linked to the laser inside the camera, eliminating this assembly as a potential source of error.



❶ Location Pin

❸ M6 screw thread

❷ Master Pin

These three Plane Pins ensure that the camera (inside the sensor) is parrallel to the laser plane.

High-Accuracy Mounting

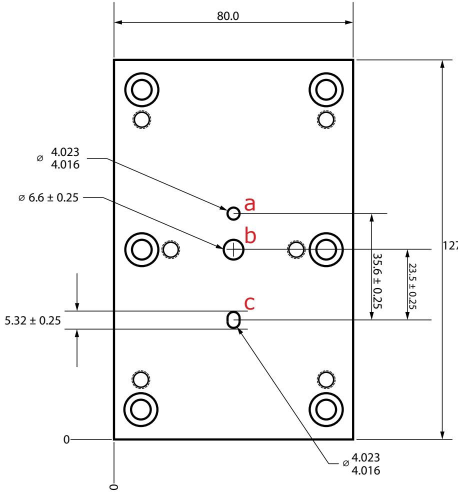
To mount your device using the high-accuracy mounting pins, you will need the Precision Adapter Plate accessory:

This Plate has 3 holes that are described below:

a) A hole for the **Location Pin** is circular to match the pin. For the orientation shown in the figure below, this hole constrains the height and lateral position.

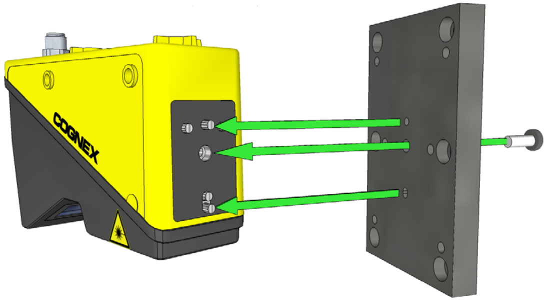
b) One through hole for an M6 screw.

c) An elongated slot for the **Master Pin**. The purpose of this slot is to constrain the rotation of the device around the Master Pin.



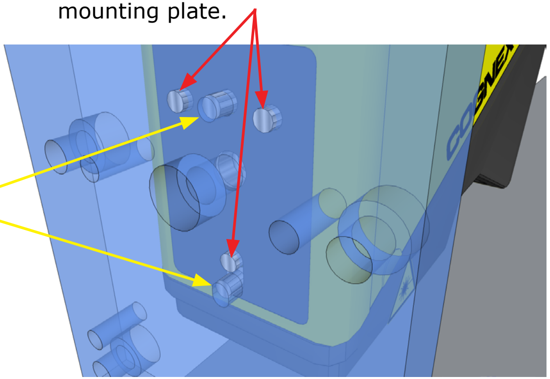
High-Accuracy Mounting (Continued)

❷ Align the Master Pin and the Location Pin with your holes and mount the device.

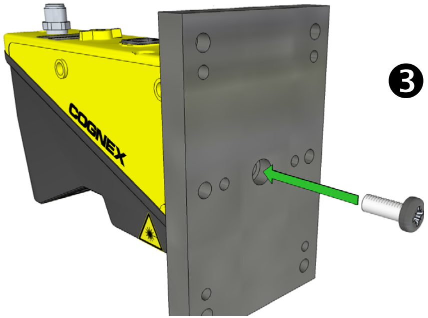


The three high-accuracy planar pins will ensure that the laser plane is parallel to the mounting plate.

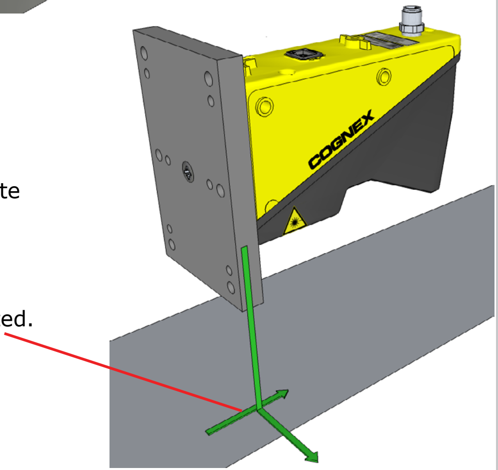
The Master Pin and the Location Pin fits in their respective holes.



❸ Insert and tighten the M6 screw. Torque limit: 2.2 Nm (19 Lb-In)



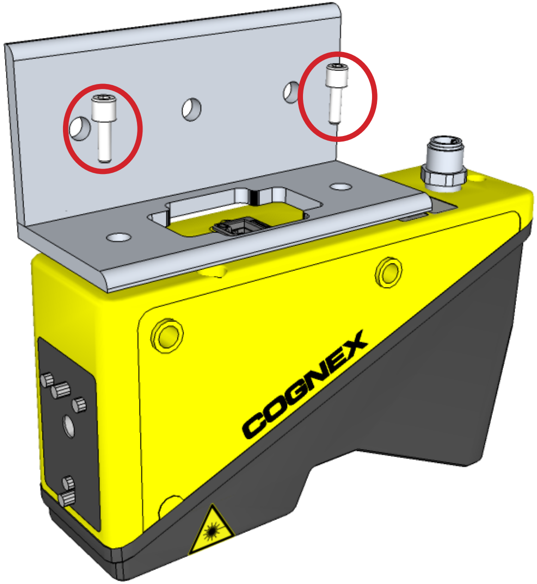
The mounting plate must be oriented perpendicular to the direction of movement of the part to be inspected.



Top Mounting

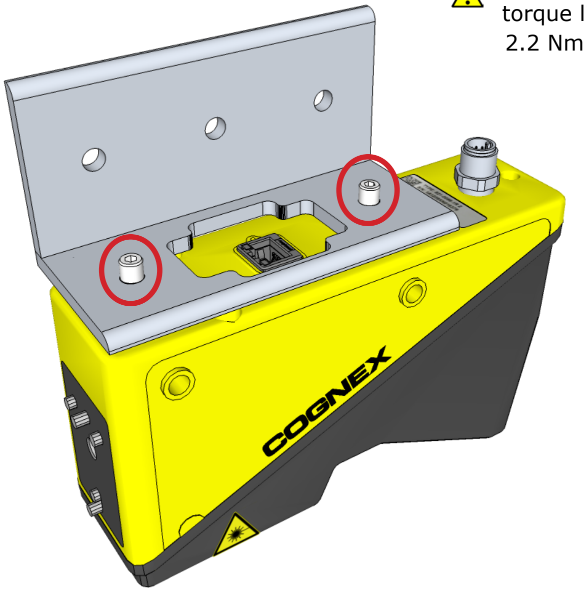
Perform the following steps to mount your device using the mounting bosses on top of the device.

1. Align the top-mounting bracket and the M6 screws with the mounting bosses.



3. Attach the device to the bracket and tighten the M6 screws.

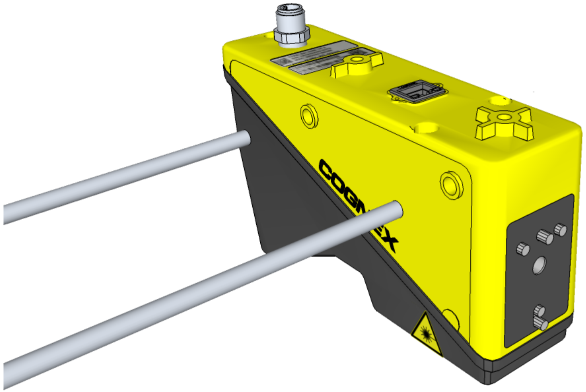
⚠ Observe torque limit: 2.2 Nm (19 Lb-In)



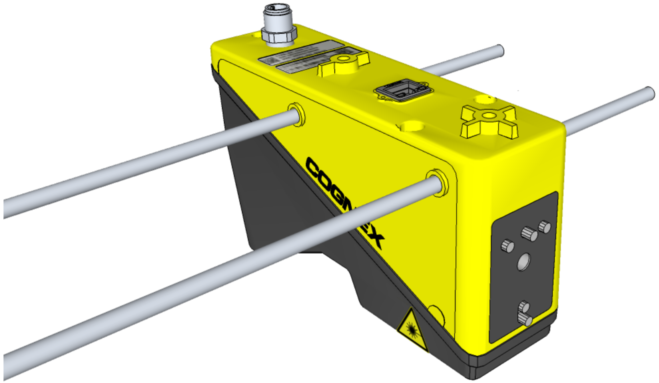
Through-Body Mounting

To mount your sensor using the through-body mounting holes, perform the following steps:

1. Align two rods (or long bolts) with the mounting through-body holes.



2. Insert them into the holes and use a clamping device (or nuts) to prevent the sensor from moving. Torque limit: 1.7 Nm (15 Lb-In).



NOTE: If you are mounting multiple sensors, use the high-accuracy mounting method.

Theory of Operation

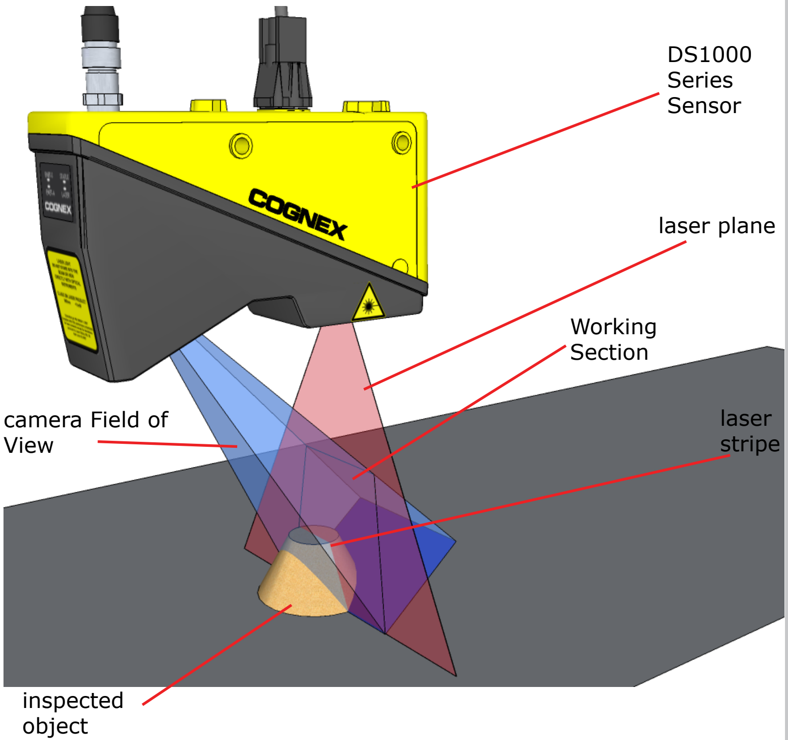
A DS1000 Series Sensor can return information about the 3D shape or size of objects that are difficult to visualize using regular 2D cameras.

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 device. 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**).
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.

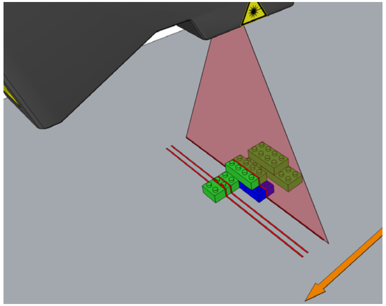
There are certain image distortions that derive from the fact that the camera has a fixed-point aspect, it has a lens, and that the object is moving under the sensor. However, Cognex's VisionPro software makes various adjustments (calibration) and, as a result, the range image does not show these unwanted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

Theory of Operation (Continued)



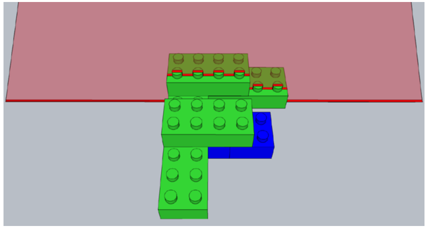
Theory of Operation - Intensity Image

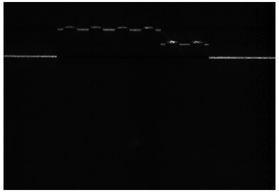
The sensor projects a triangular laser plane onto the object under inspection, illuminating its surface. The illumination of the laser plane results in a laser stripe, the shape of which is determined by the surface of the object.



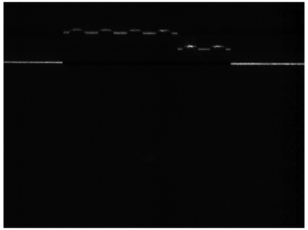
The shape of the laser stripe provides exact height profile information of the object. Taller objects appear closer to the top of the intensity images.

The following figure illustrates the laser stripe as seen from the position of the camera (on the left), and the **Intensity Image** (on the right), which is the image that the camera sees:

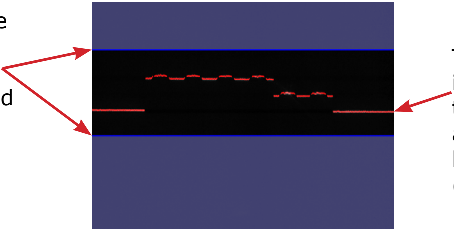




The sensor then applies a bright stripe curve algorithm to find the brightest pixels and to extract the (uncalibrated) peak data.



The blue lines characterize a subregion of the Working Section where the sensor is looking for peaks (defined by the user).

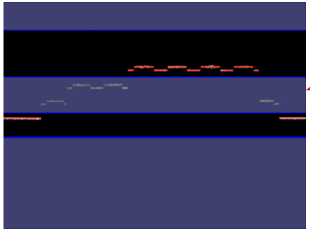


The red stripe is made by the software and marks the brightest pixels (raw peak data).

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

Recommended default acquisition setting: Contrast = 0

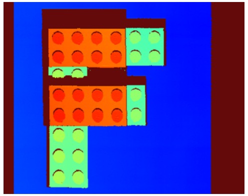
Theory of Operation - Intensity and Range Image

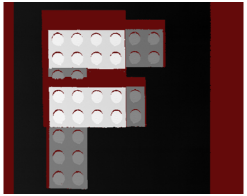


If you are interested in two separate height ranges and not in the gap separating them, you may increase the acquisition speed of your sensor by specifying a gap in which bright stripe curve finding should not be performed.

A range image is a 16-bit greyscale image containing height profile information in real world coordinates. This is an actual range image:

There are different color maps that can be applied on a range image:





Theory of Operation - Range Image

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 (illustration):

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	0

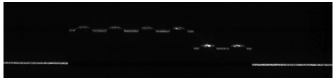
These values are then turned into one row of the greyscale range image:

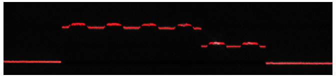
These images are then assembled and the whole picture of the object passing under the laser is created. This is called a range image.

The diagram on the next page depicts the process of range image generation:

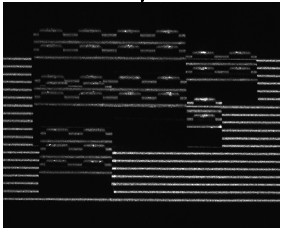
The **intensity images** are acquired as the object passes under the sensor.

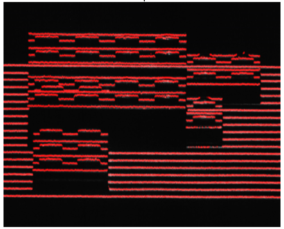
The bright stripe curve algorithm finds the brightest pixels (**intensity with graphics**).





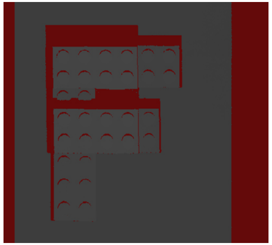
These rows together build up the shape of the object.





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.



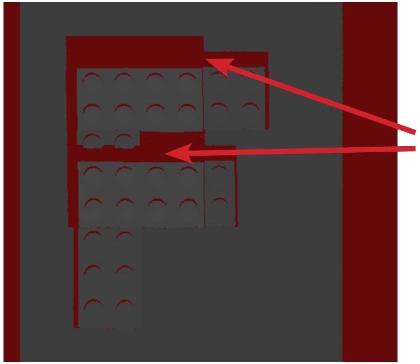
Theory of Operation - Range Image

A range image contains a 16-bit greyscale image with pixel-based height profile information. This information can be transformed into real-world coordinates by factory calibration.

Factory calibration transforms the raw peak data into real world coordinates as well as removes distortions such as camera lens distortion and perspective distortion. This creates an image which closely represents the physical contours of the object.

Invisible Pixels

Because the camera views the scene at an angle from the laser plane, certain areas of the object under inspection may be hidden from a single sensor. The shape of the object itself blocks the laser from hitting some parts. By default, the missing values are substituted with zero by the acquisition system.

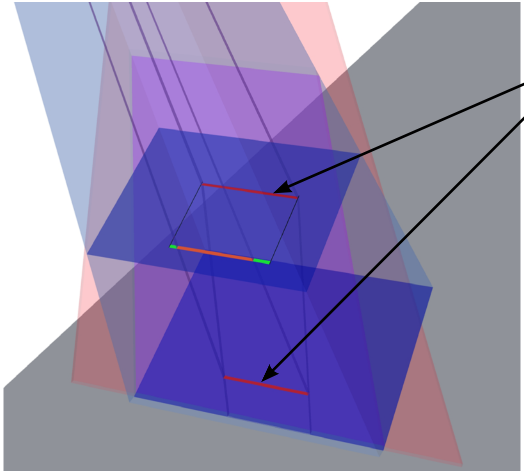


These red areas are invisible because they are hidden from the camera *by the inspected object itself*.

Compensation of Perspective

A laser stripe that is closer to the camera does not only appear closer in the intensity image but also wider because it is closer to the camera. This introduces *perspective*, that is, view in depth in the raw peak data.

The following figure illustrates the effect of perspective distortion with two laser stripes of the same width.



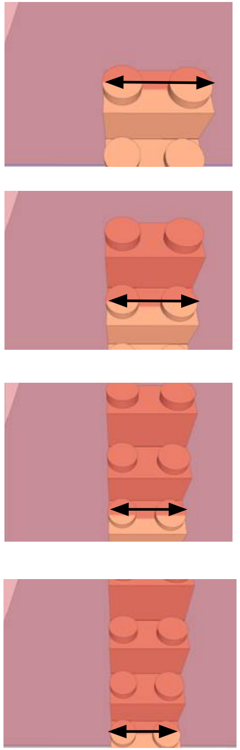
Although these two red stripes have the same width, the lower one seems narower.

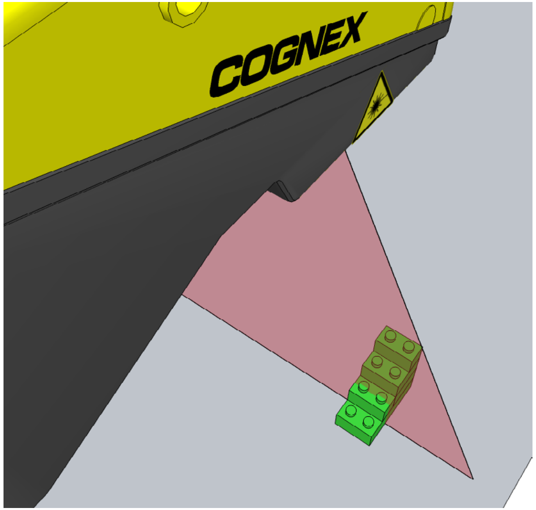
The orange stripe shows the width of the lower red stripe seen by the camera (relative to the upper red stripe).

The green portions show the difference between the two widths.

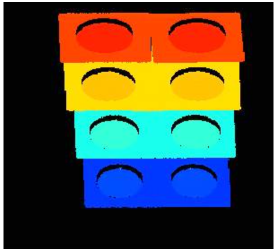
Theory of Operation (Continued)

Consider a Lego® block scanned by the sensor. As it passes in front of the camera, the laser line will appear for each step. Note that the closer the block is to the sensor, the wider it will appear to the camera:

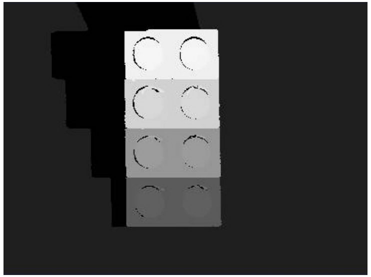




If the sensor were to produce an uncalibrated image, it would look like this (theoretical image, colorized):



Factory calibration converts the distorted image into the calibrated image. The calibrated image, then, allows the calculation of parameters like the exact volume of the object.



Based on real-world height information and perspective compensation, the sensor is able to calibrate the image, allowing you to calculate, for example, the exact volume of the object that passes under the sensor.

DS1000 Series Sensors Accuracy

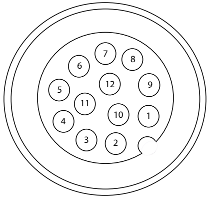
- Measurement accuracy varies depending on how accurately the unit is mounted and on the surface characteristics of the object being measured; it is not possible to specify a guaranteed accuracy value.

- In general, sensor accuracy is improved when:
  - Relative measurements are made within a single scene (what is the difference between surface A and surface B) are more accurate than absolute measurements (how far is surface B from the sensor).
  - The unit is rigidly mounted using the high-accuracy mounting pins.
  - The unit is precisely perpendicular to the surface being measured.

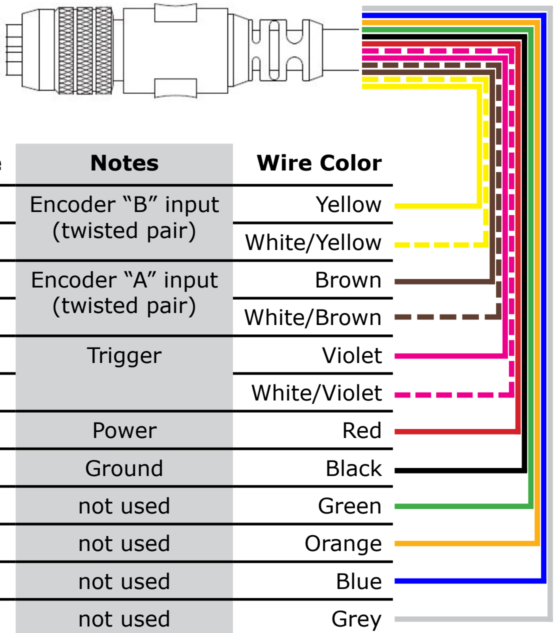
- In general, sensor accuracy is the best at the optical axis.

- In general, sensor range measurements are extremely repeatable. In most cases, repeated measurements of the same surface will be within 5 μm (micrometres). The accuracy is also dependent on how well the exposure is set. For more information on this, see the acquisition exposure parameter on page 41.

I/O Cable



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-	not used	Orange
11	Ctrl+	not used	Blue
12	Ctrl-	not used	Grey

Note: For best results, Cognex recommends using the PPLUS-CBL-ENET Ethernet cable. If the PPLUS-CBL-ENET cable is not used, a shielded, Cat 5e or Cat 6 cable is required.

When wiring the sensor, observe the following precautions:

- 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.
- Pins 1, 2, 3, and 4 may be used for an encoder connection. The configuration that you set for your sensor using the VisionPro software determines how those lines are used.
- To reduce the risk of damage or malfunction, route all cables and wires away from high-voltage power sources.

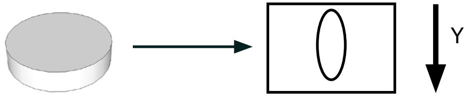
Encoder

You must use an encoder to generate pulses as the parts move under the sensor.

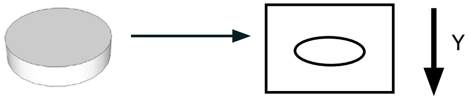
The way in which you set up your encoder affects the results from the sensor. Observe the following guidelines when installing your encoder:

- The rate at which encoder pulses are generated, relative to the speed of movement of the surface, will determine how many slices of height data are acquired per millimeter.

If too many slices are acquired, the image will be stretched in the Y-direction.



If too few slices are acquired, the image will be squashed in the Y-direction.



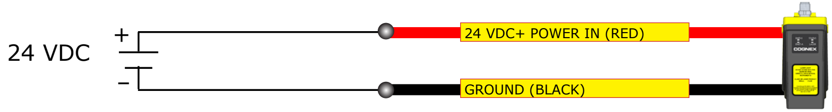
(**Y-direction**: The axis on which the conveyor belt and the object itself is moving.)

- For each set of encoder steps per line, the sensor acquires an **intensity image**, locates the laser line, and generates a row of peak data, which is the basis of a row in the **range image**. The time that it takes for the sensor to do this is the time that it takes for the encoder to count the number of steps specified in software as **StepsPerLine**. The duration of this encoder time must always be longer than the time it takes for the sensor to expose and process one row of data from an intensity image. The time needed to acquire an intensity image and process it is referred to as the **DS1000 Series Line Time**.

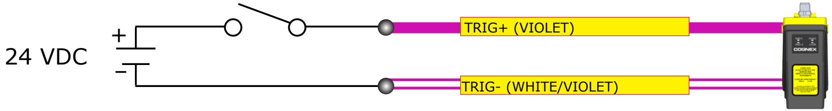
NOTE: The sensor has its own **software encoder**. You can use it for initial range image acquisition setup; also, it is a good troubleshooting tool that you can use to verify the operation of the sensor and diagnose any encoder wiring issues.

Power, Trigger and Output Wiring

Power



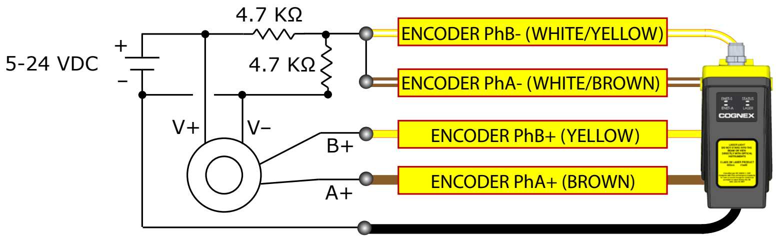
Trigger (sensor sinks current)



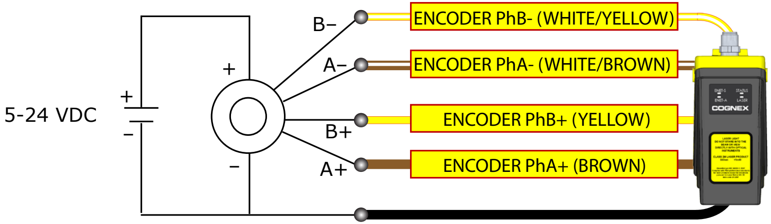
Wiring the Encoder

If your sensor is configured for encoder input, you can connect both differential and single-ended encoders. Using an encoder allows you to specify input and output delay values in pulse counts instead of real time units.

Single-ended Encoder



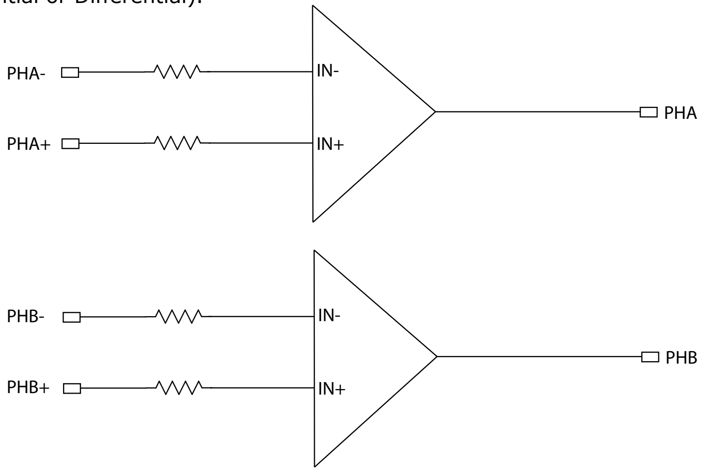
Differential Encoder



Wiring the Encoder (Continued)

For a single-ended encoder, connect PHA+ and PHB+ to the encoder outputs. Derive PHA- and PHB- from the encoder voltage source and make them equal to 50% of the encoder reference voltage. (For example, if the encoder is connected to 24V, set PHA- and PHB- to 12V.)

The following image shows the Encoder **Phase A** and **B** Inputs (5V - 24V, Non-Differential or Differential).



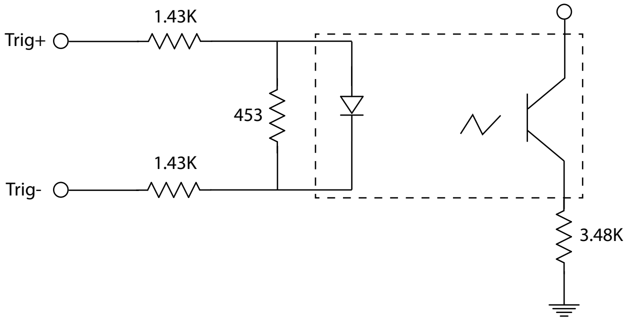
NOTE: If you are using a Single-Channel Encoder, always connect to the 'A' input.

NOTE: The frequency of pulses must not exceed 50 kHz.

Acquisition Trigger Input

The acquisition trigger input to the sensor is opto-isolated. The sensor will respond to a trigger event when the voltage difference between the Trig+ and Trig- inputs exceed 10 volts. To configure the acquisition trigger as a sourcing input, connect the Trig+ terminal to the high voltage reference (for example, +24V) and the Trig- terminal to the output of the photo-electric sensor. When the sensor turns on, the Trig- terminal will be pulled to a low voltage level (for example, ground) resulting in current flow through the opto-isolator's LED emitter, turning the opto-coupler output on.

To configure the acquisition trigger as a sinking input, connect the Trig- terminal to the low voltage reference (ground) and the Trig+ terminal to the output of the photo-detector or PLC. When the detector or PLC turns on, the Trig+ terminal will be pulled to a positive voltage level resulting in current flow through the opto-isolator's LED emitter, turning the opto-coupler output on.



24V Max. across the input pins – Transition approx. 10V (Min.)

Acquiring Long Objects

If the trigger type is set to “Edge and Level”, as long as the Trigger Input signal is high, the sensor will be in acquiring mode. The ability to acquire a series of images continuously without any gaps between those images is a very handy feature.

For inspecting long parts which exceed the length of a single image from the sensor, this can be used as follows (for this example, assume the part is 48,000 lines long):

- Set up a trigger signal to go active when the front of the part is under the sensor, and inactive when the back of the part has passed. For example, have the part pass in front of an optical sensor, so the trigger signal is the length of the part.
    - Configure acquisition using auto trigger model, and 10,000 lines per image (this can be adjusted as needed, as long as it is within the capabilities of the sensor).
    - When triggered, a 10,000 line image will be acquired. Since the trigger is still active at the end of the acquire, another 10,000 line image will be acquired with no gap from the preceding image. This will occur for a series of 5 images (50,000 lines total).
    - The application will need to complete the 5 acquires and stitch the images together into a single, full-size image. *This is not recommended on a 32-bit OS.*
- When acquiring very short images, make sure that the trigger signal is not active at the end of the image, or they will get an unexpected, extra acquire.

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Compliance Statements

DS1000 series sensors meet or exceed the requirements of all applicable standards organizations for safe operation. However, as with any electrical equipment, the best way to ensure safe operation is to operate them according to the agency guidelines that follow. Please read these guidelines carefully before using your device.

Regulator	Specification
USA	CFR 47 FCC Part 15 (b) Class A FDA/CDRH Laser Notice No. 50
Canada	ICES-003 Issue 4 Class A
European Community	EN 55022:2006/A1:2007 Class A EN 61000-6-2:2005
Australia	C-TICK, AS/NZS CISPR 22 / EN 55022 for Class A Equipment
Japan	J55022, Class A

FCC Class A Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

European Compliance

The CE mark on the product indicates that the system has been tested to and conforms to the provisions noted within the 2004/108/EEC Electromagnetic Compatibility Directive and the 2006/95/EEC Low Voltage Directive.

For further information please contact:

Cognex Corporation
One Vision Drive
Natick, MA 01760
USA

Cognex Corporation shall not be liable for use of our product with equipment (i.e., power supplies, personal computers, etc.) that is not CE marked and does not comply with the Low Voltage Directive.

Laser Safety Statement - DS1100

Compliance with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

This device has been tested in accordance with IEC60825-1 2nd ed., and has been certified to be under the limits of a Class 2M Laser device.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

CAN/CSA-C22.2 No. 61010-1-04 Part 1, UL STD. No. 61010-1, 2nd Edition.

Laser Safety Statement - DS1100R

Compliance with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

This device has been tested in accordance with IEC60825-1 2nd ed., and has been certified to be under the limits of a Class 3R Laser device.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

CAN/CSA-C22.2 No. 61010-1-04 Part 1, UL STD. No. 61010-1, 2nd Edition.

Compliance Statements (continued)

For European Community Users
Cognex complies with Directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on waste electrical and electronic equipment (WEEE).

This product has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment, if not properly disposed.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems for product disposal. Those systems will reuse or recycle most of the materials of the product you are disposing in a sound way.

The crossed out wheeled bin symbol informs you that the product should not be disposed of along with municipal waste and invites you to use the appropriate separate take-back systems for product disposal.

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.

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