

VisionPro[®] **Trevista CI Dome** **Line Scan Getting Started**

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Precautions


To reduce the risk of injury or equipment damage, observe the following precautions when you install the Cognex product:


- Trevista Controller requires power supply connection from a supply network that meets the following requirements:
100-240 V AC +/- 1-%, 50-60 Hz, 550 VA
- This product is intended for industrial use in automated manufacturing or similar applications.
- The safety of any system incorporating this product is the responsibility of the assembler of the system.
- Do not install Cognex products where they are exposed to environmental hazards such as excessive heat, dust, moisture, humidity, impact, vibration, corrosive substances, flammable substances, or static electricity.
- Route cables and wires away from high-current wiring or high-voltage power sources to reduce the risk of damage or malfunction from the following causes: over-voltage, line noise, electrostatic discharge (ESD), power surges, or other irregularities in the power supply.
- Do not expose the image sensor to laser light. Image sensors can be damaged by direct, or reflected, laser light. If your application requires laser light that might strike the image sensor, use a lens filter at the corresponding laser wavelength. For suggestions, contact your local integrator or application engineer.
- This product does not contain user-serviceable parts. Do not make electrical or mechanical modifications to product components. Unauthorized modifications can void your warranty.
- Changes or modifications not expressly approved by the party responsible for regulatory compliance could void the user's authority to operate the equipment.
- Include service loops with cable connections.
- Ensure that the cable bend radius begins at least six inches from the connector. Cable shielding can be degraded or cables can be damaged or wear out faster if a service loop or bend radius is tighter than 10X the cable diameter.
- This device should be used in accordance with the instructions in this manual.
- All specifications are for reference purposes only and can change without notice.


Symbols

The following symbols indicate safety precautions and supplemental information:

 **WARNING:** This symbol indicates a hazard that could cause death, serious personal injury or electrical shock.

 **CAUTION:** This symbol indicates a hazard that could result in property damage.

 **Note:** This symbol indicates additional information about a subject.

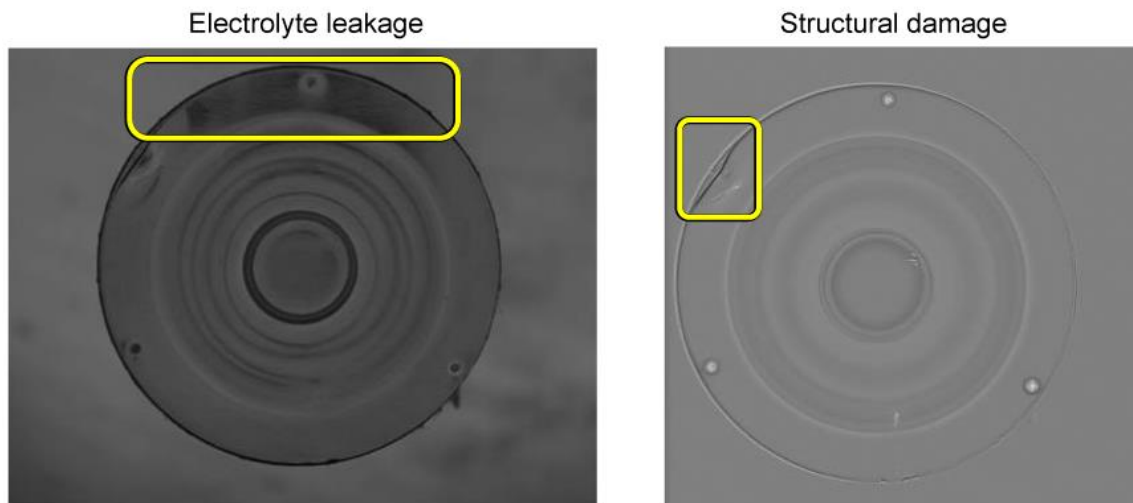
 **Tip:** This symbol indicates suggestions and shortcuts that might not otherwise be apparent.

Introduction

Cognex "shape from shading" technology determines topographical surface information of materials that range from a matte appearance to shining reflectance.

A VisionPro application using a Trevista Computational Imaging (CI) Dome captures multiple images of a stationary object as it passes under patented dome illumination. Your vision application accepts the output images and allows you to choose one or more for additional analysis by other vision tools in your application.

For example, the following figure shows different output images generated by the same object and highlights how they enhance different defect information:



This document describes the use of a Trevista CI Dome with a line-scan camera and supported VisionPro software to capture an image and make output images available for additional analysis.

i Note: Refer to the Trevista CI Dome Line Scan Getting Started for an introduction to using the Trevista Dome Light with a line-scan camera.

Module Components

A Trevista CI Dome consists of the following hardware components:

Trevista Dome

The Trevista Dome provides structured and diffuse illumination across the field of view:

	Small	Medium	Large
			
Diameter of measuring field/scan width *	Up to 30 mm (1.18") * (application-specific)	Up to 75 mm (2.95") * (application-specific)	Up to 300 mm (11.81") * (application-specific)
Working distance between lens and inspection plane	Typ. 72 mm (2.83")	Typ. 158 mm (6.22")	Typ. 300 mm (11.81")
Working distance between bottom edge and inspection plane	Typ. 2 mm (0.08")	Typ. 10 mm (0.39")	Typ. 47 mm (1.85")
Dimensions (W x D x H)	246 x 160 x typ. 259 mm (9.69" x 6.30" x typ. 10.20")	388 x 330 x typ. 348 mm (15.28" x 12.99" x typ. 13.70")	669 x 610 x typ. 453 mm (26.34" x 24.02" x typ. 17.83")
Weight (Without cable)	4.1 kg (9.04 lb)	6.9 kg (15.21 lb)	16.2 kg (35.71 lb)
Material	Aluminum	Aluminum/Plastic	Aluminum/Plastic
* Depending on the camera, optics, and surface properties of the test part			

Note: Trevista Dome hardware shown with cameras and additional camera-mounting hardware.

Controller

The Trevista Controller acts as the interface between the Trevista Dome and the PC running the VisionPro application:

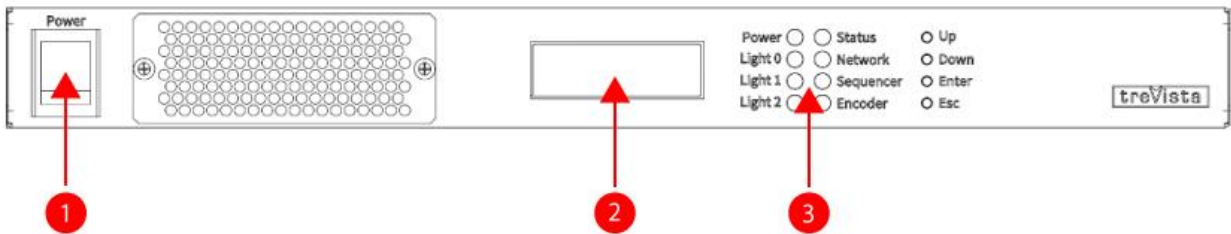


Dimensions (W x D x H)	484 x 370 x 44 mm (19.06" x 14.57" x 1.73")
Weight	6.4 kg (14.11 lbs.)
Material	Aluminum-zinc
Electrical Power Supply	100-240 V AC +/-10%, 50-60 Hz, 550 VA

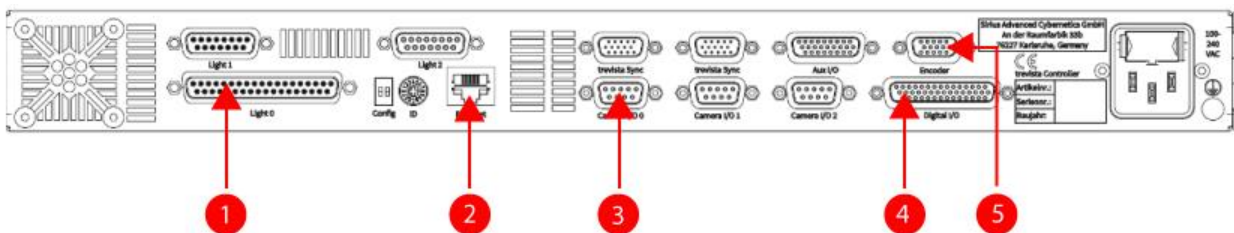
As your VisionPro application executes, the Trevista Controller:

- Accepts the signal from a hardware trigger used to cue the start of an image acquisition
- Triggers the connected camera for image acquisition
- Manages the lighting sequence of the Trevista Dome
- Interprets an incoming encoder signal (for line-scan configurations only)
- Receives the A/B signals of an encoder and provides them as encoder pulses to other logical functional units

In addition to all hardware connections, the controller supports an LCD display for visual feedback on all channels to check electrical signal status.



Feature	Description
1	Power switch
2	LCD Display
3	Status Indicators



Feature	Description
1	Connection to Trevista Dome
2	Ethernet port
3	Camera I/O
4	Digital I/O
5	Encoder

Encoder

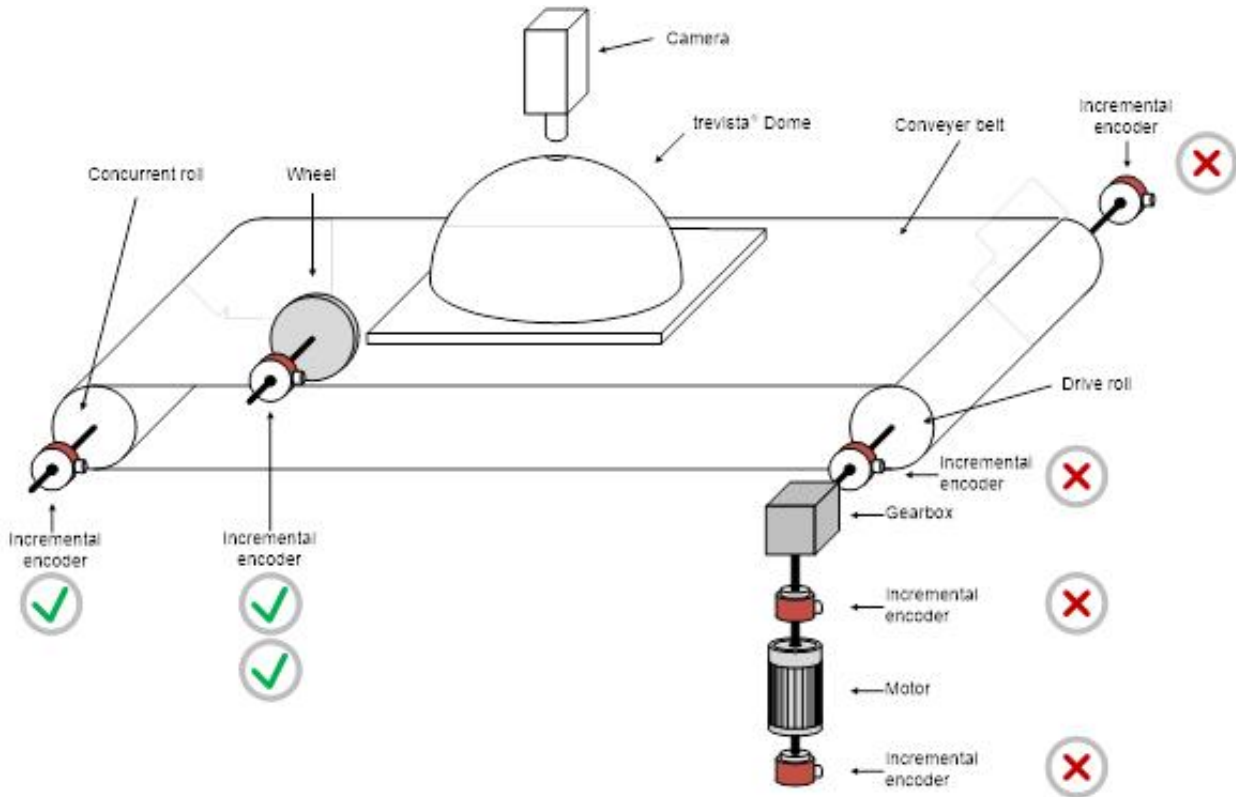
An encoder is a sensor with a rotary axis that provides digital output signals for acquisition. The programmable encoder enables you to set the number of increments per rotation integrally to between 2 and 36,000 impulses. In quarter-step operation, 8 to 144,000 impulses per rotation are possible.

Cognex recommends the following when you position an encoder:

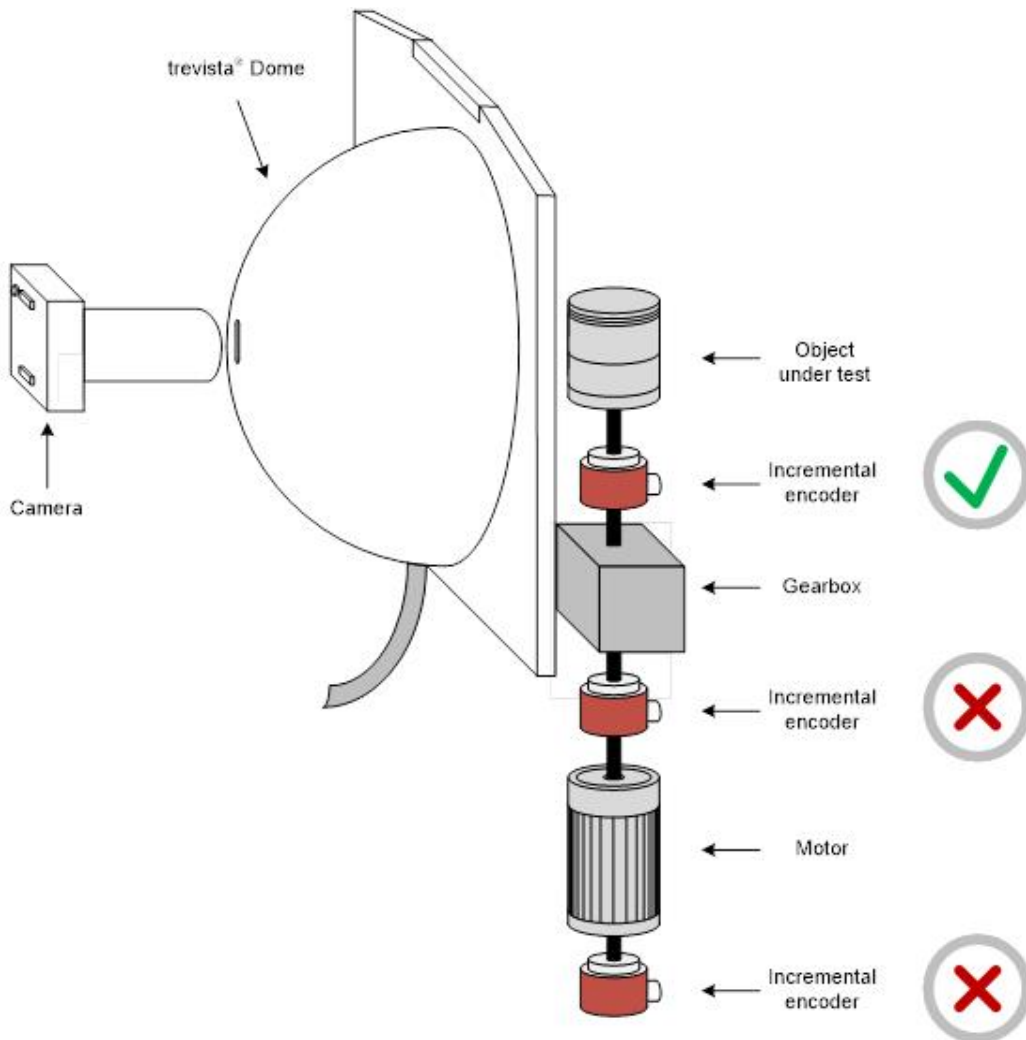
- Mount the encoder as closely to the inspection object as possible within the drive train.
- Do not mount the encoder directly to the motor shaft, especially with a downstream gearbox.

- The connection of the encoder with the inspection object should be as tight as possible. A springy or slipafflicted connection of encoder and inspection object should be avoided.
- Conveyor belts often exhibit slip between the drive roll and the belt. Mount the encoder to the concurrent, non-driven roll. Better still, connect the encoder to the belt via a wheel near the inspection position.

The following figures show suitable and unsuitable encoder positions for linear motion:



The following figures show suitable and unsuitable encoder positions for rotary motion:



Industrial PC

Refer to the following table for minimum and recommended specifications for a PC that meets the prerequisites for using a Trevista CI Dome and VisionPro software.

Spec	Minimum	Recommended
Operating System	Windows 10 (64 bit)	Windows 10 (64 bit)
CPU	64-bit processor with SSE3 technology	Intel Core i7 (13. Gen)
RAM	4 GB	8 GB (Area scan) / 16 GB (Line scan)
Hard drive	200 MB free space	SSD drive with 2 GB free space
Controller Adapter	1x 100-Mbit/s-Ethernet	1x Gigabit-Ethernet
NVIDIA GPU	Turing (NVIDIA T1000 with 4GB memory)	RTX-3080 and A4000 with 12GB memory

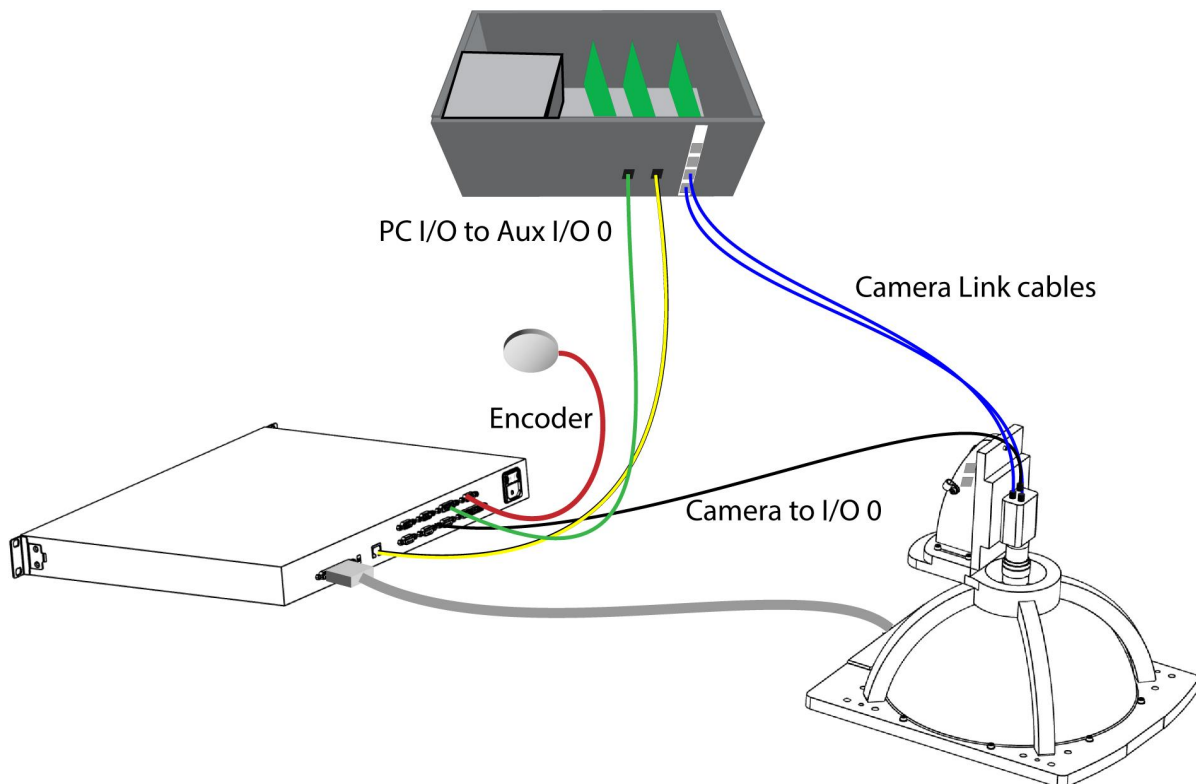
Hardware Connections

In many cases your Trevista Dome Light arrives with the GigE Vision camera already mounted. Perform the following steps to connect the Dome Light to the Trevista controller and your PC:

- Connect the Trevista Dome Light to the **Light0** connection on the Trevista controller.
The Trevista Dome Light supports a permanent cable connection.
- Connect the Trevista controller to an Ethernet adapter on the PC.
- Connect your Camera Link camera to your Camera Link frame grabber.
Refer to your camera documentation for more information.
- Connect your Camera Link power connection to the **Camera I/O** port on the Trevista controller.
- Connect your encoder to the **Encoder** port on the Trevista controller.
- Connect the I/O panel in your PC to the **Aux I/O 0** port on the Trevista controller.
- Connect your PC and the Trevista controller to respective power supplies.

The following figure represents the connections between PC, GigE Vision camera and Trevista controller:

Note: The following figure represents the connections using a Medium Trevista Dome Light.



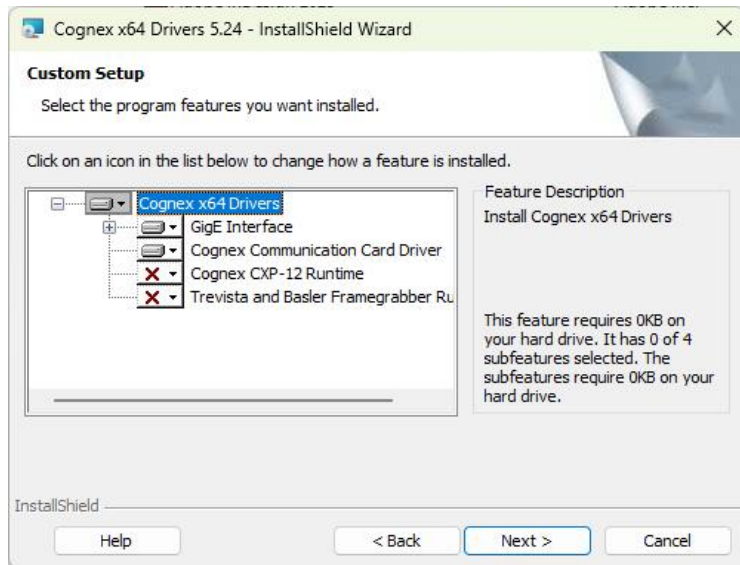
Software Installation

With your Trevista CI Dome hardware connected, install and configure your VisionPro software.

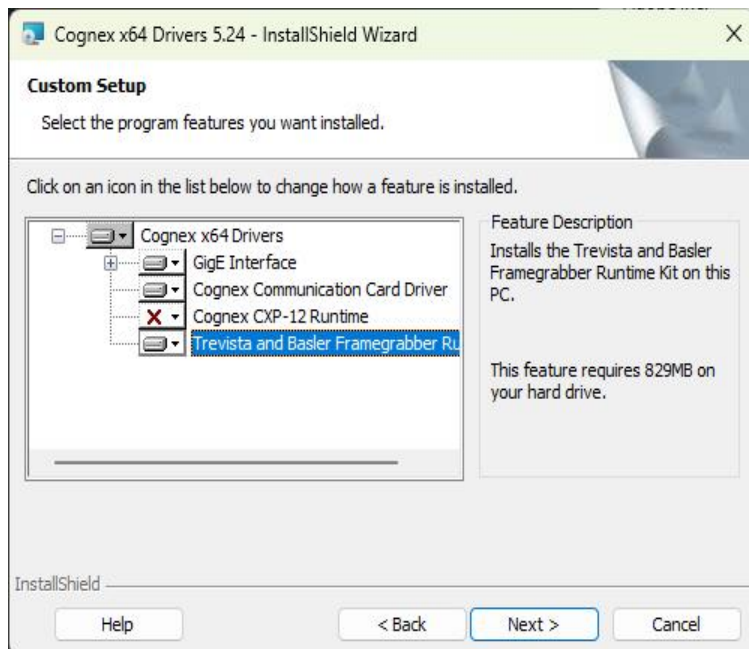
Install VisionPro

Turn on your PC and install the latest VisionPro software release. Visit the [VisionPro Support site](#) to find VisionPro downloads.

Follow the on-screen prompts. Be aware that the driver installer disables the installation of the **Trevista Hardware Driver** by default:



Enable the **Trevista Hardware Driver** before you click **Next**:



Complete the software installation and attach your VisionPro security key to a USB port on your PC.

Set IP Address for Controller Adapter

The topic [Hardware Connections on page 12](#) describes the physical connections between components of your Trevista CI Dome setup.

You must allow communications between your Trevista controller and your PC using an Ethernet cable connection, and configure the connected PC Ethernet adapter to use the same IP subnet as the controller.

Your Trevista controller arrives with an IP address of "10.1.1.1". Use the Windows **Network & Internet** settings to assign your PC Ethernet adapter with a compatible address, such as "10.1.1.5", and with a subnet mask of "255.255.0.0".

Launch QuickBuild

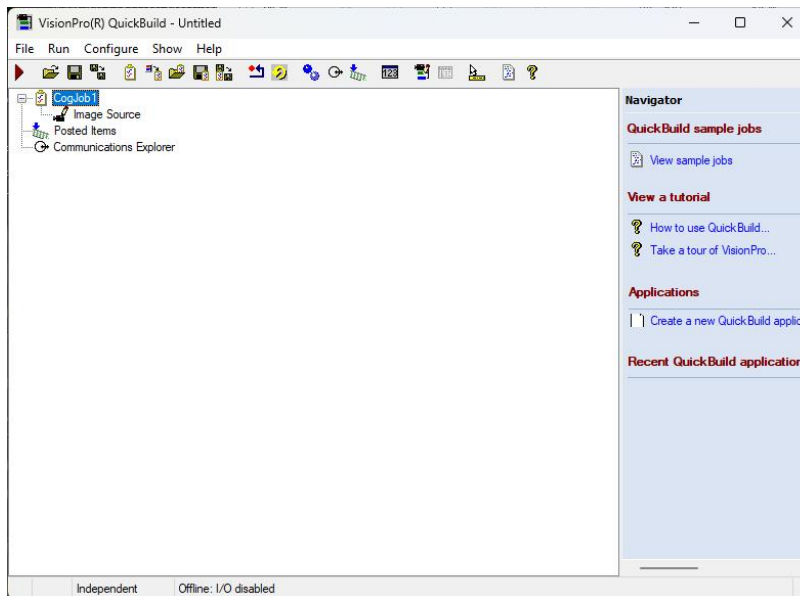
With the physical connections between Trevista CI Dome components described in the topic [Hardware Connections on page 12](#) completed, and your VisionPro software installed as described in the topic [Software Installation on page 13](#), perform the steps outlined in this topic to become familiar with the Trevista Acquisition Wizard and the Trevista tool.

VisionPro includes the QuickBuild utility for prototyping vision applications using a graphical user interface. QuickBuild supports image acquisition from cameras or image databases, adding and configuring all the vision tools VisionPro supports, and configuring attached I/O devices to allow communication with external hardware.

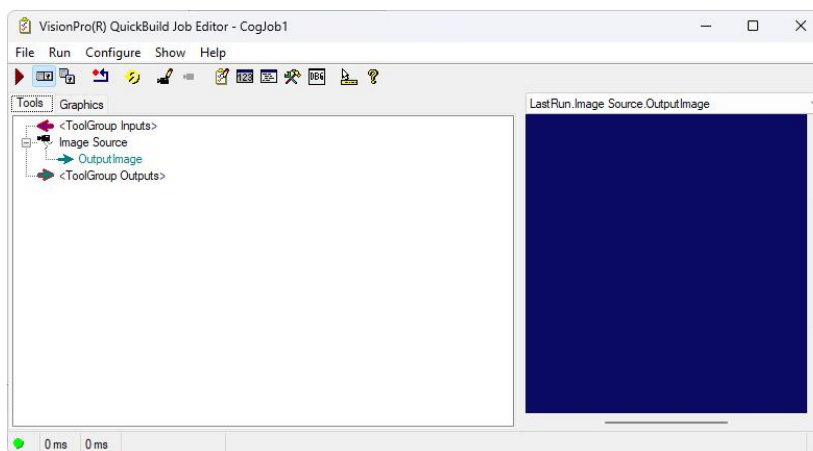
Perform the following steps to launch QuickBuild and acquire an image with your Trevista CI Dome:

1. Launch VisionPro QuickBuild from the Windows Start menu or the icon installed on your desktop.

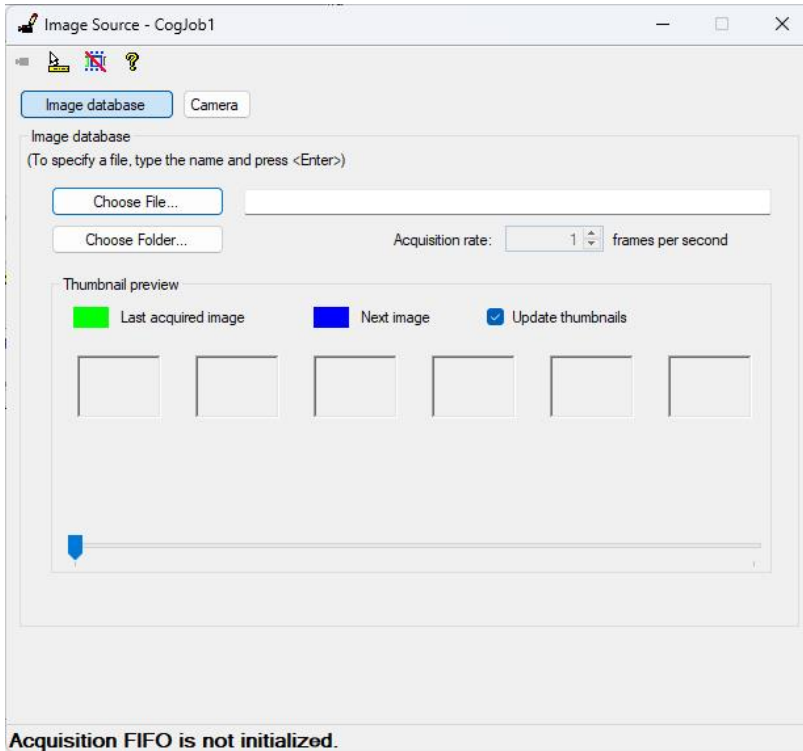
QuickBuild appears as shown:



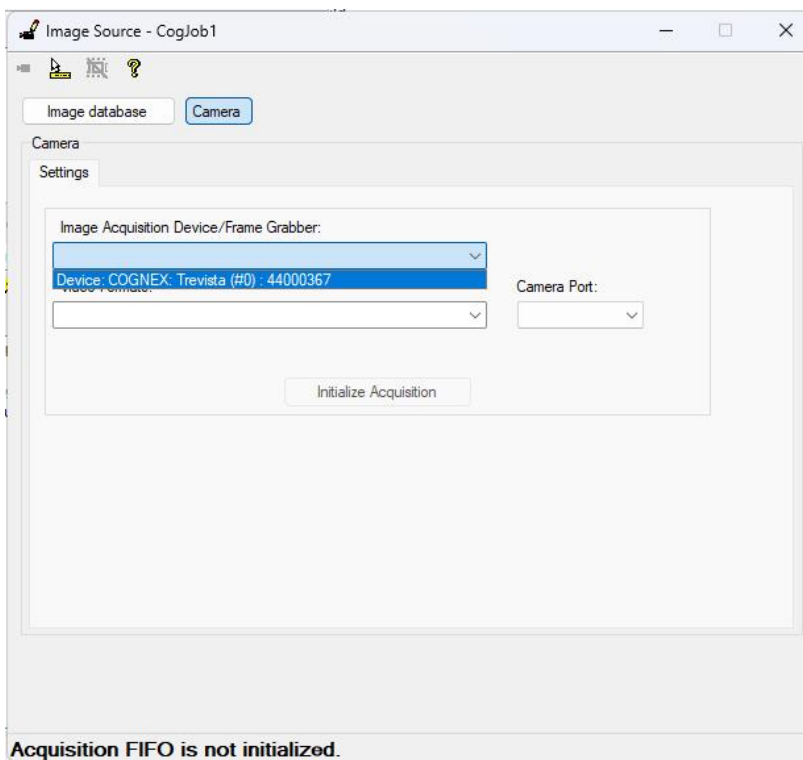
2. Double-click on **CogJob1** to access its image source:



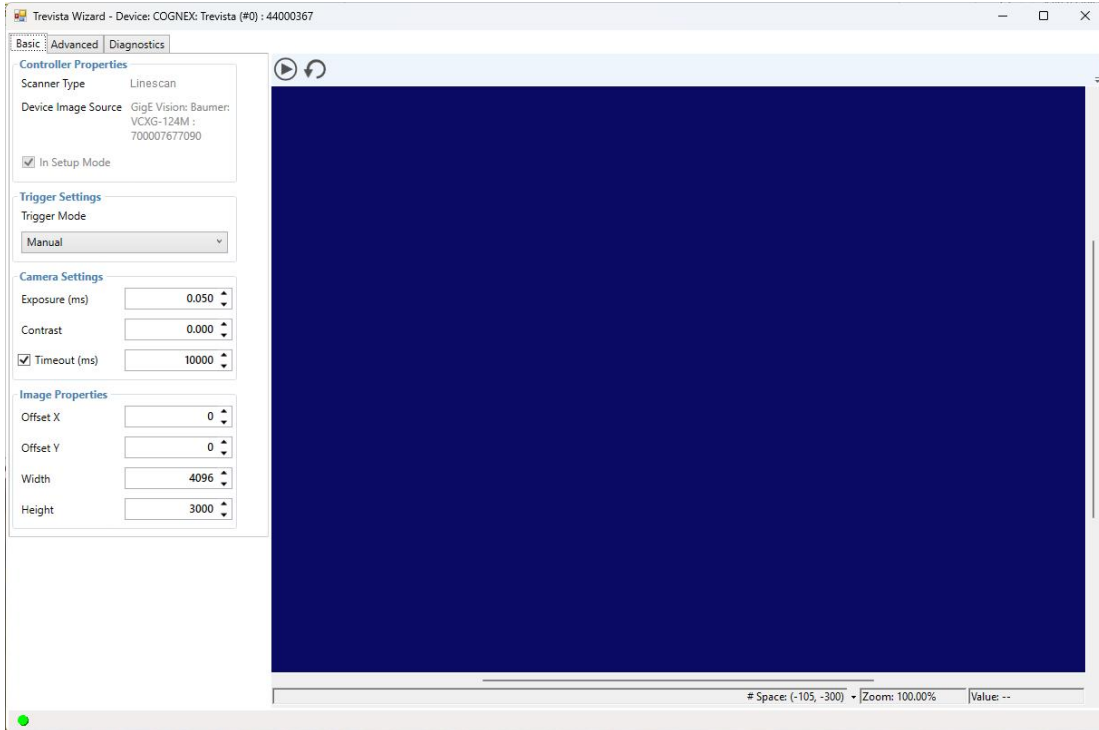
3. Double-click on **Image Source**:



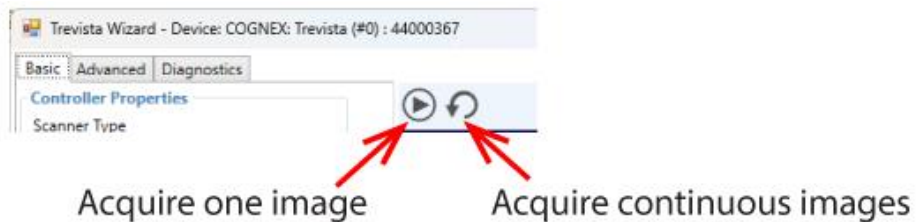
4. Choose **Camera** and select the Trevista CI Dome from the **Image Acquisition** source:



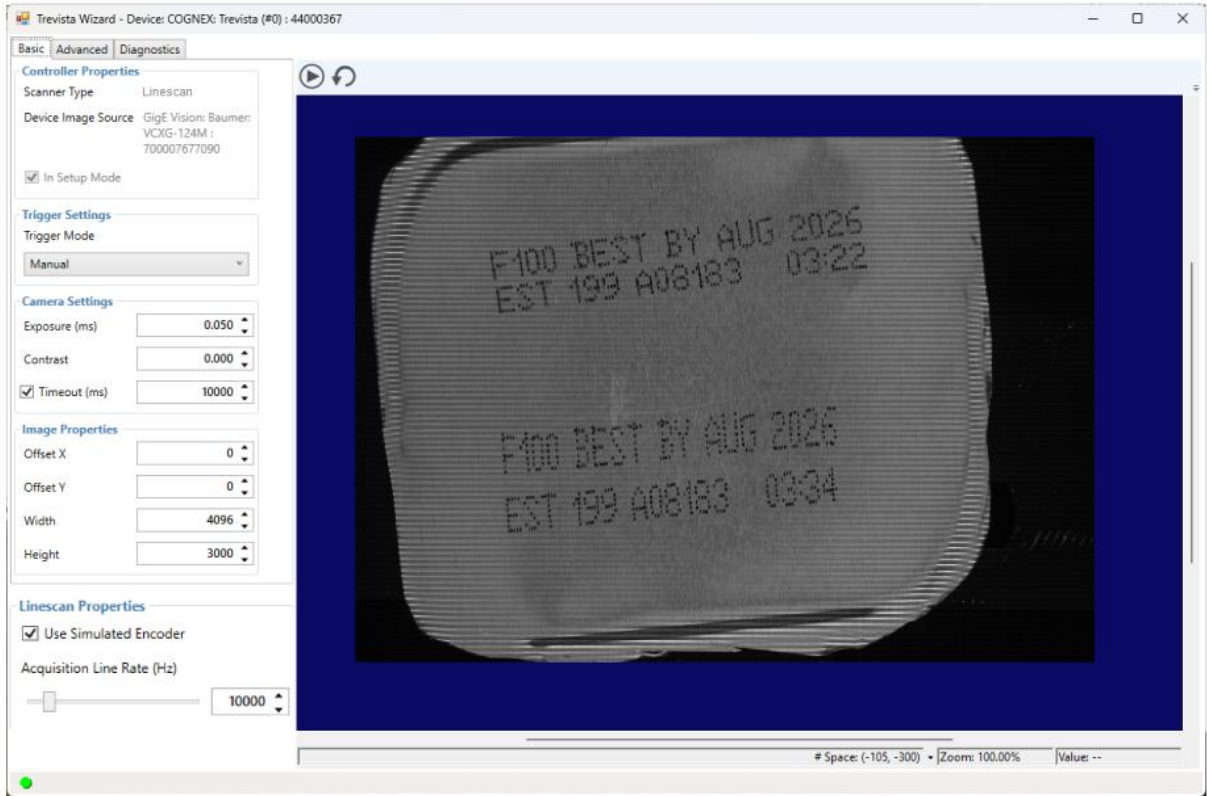
5. Click **Initialize Acquisition** and then click **Trevista Wizard** to launch the wizard, which appears as shown:



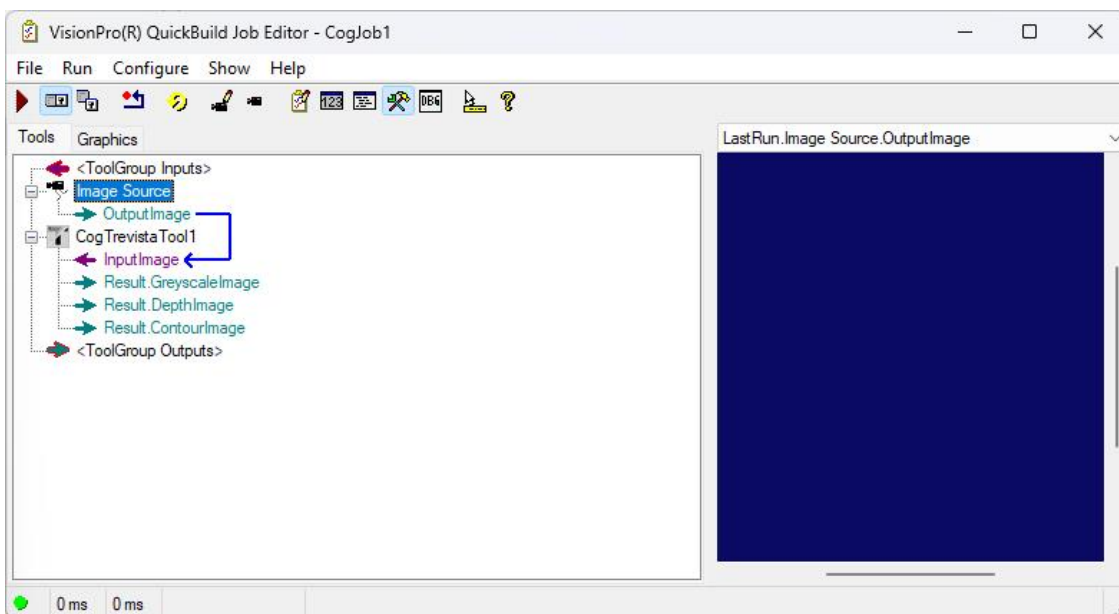
Your VisionPro installation includes documentation on using the wizard. Open the VisionPro Documentation from the Start menu and search for "Trevista Acquisition Wizard" for more information. For this first usage, Cognex recommends you use a **Trigger Mode of Manual**. You can acquire an image by clicking either of these buttons:



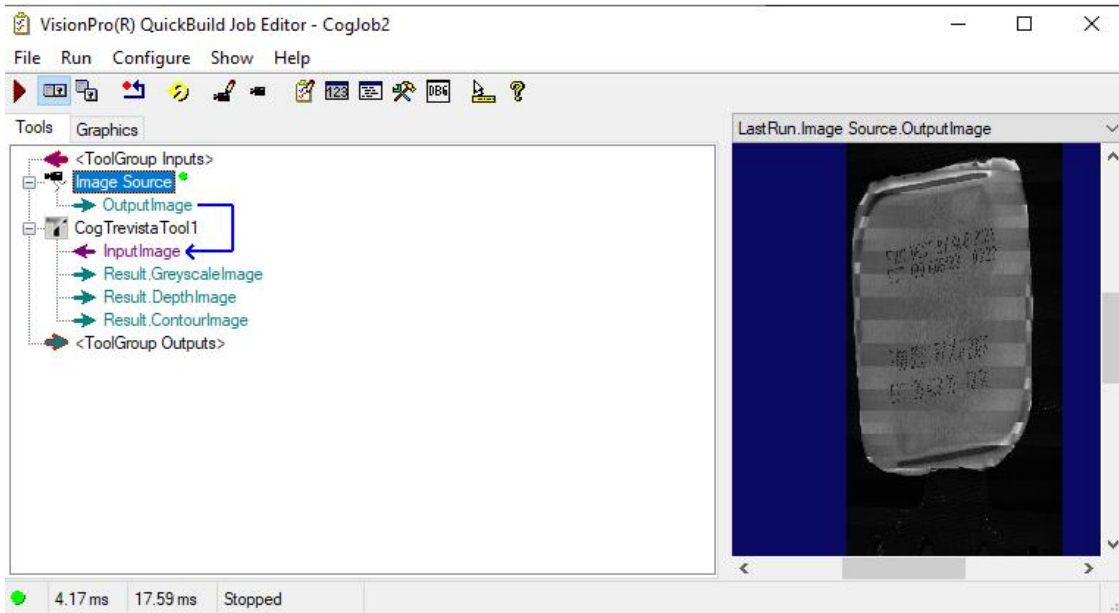
- Place an object in view of the Trevista Dome and click the button for one image. Engage whatever mechanism you use to move the object within the field of view of the camera to trigger an image acquisition. Repeat this process and adjust the camera settings and the height of the object relative to the dome until you get a clear image:



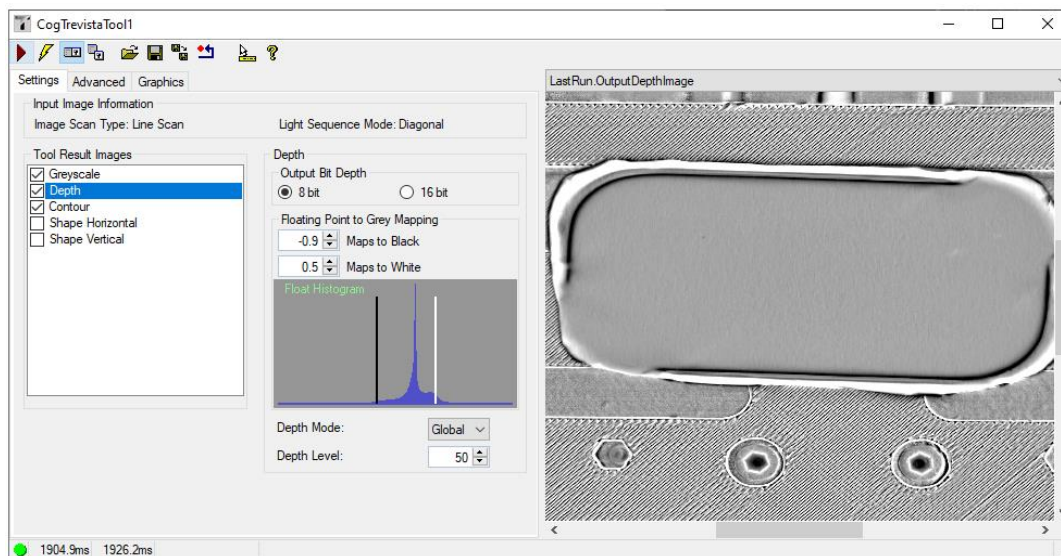
- Close the acquisition wizard and add a Trevista tool to your QuickBuild application. Connect the Image Source to the CogTrevistaTool as shown:



- Run the Job once. QuickBuild will show the images captured by the Trevista Dome Light:



- Open the Trevista tool edit control. The following figure shows the edit control viewing the depth image the tool generates:



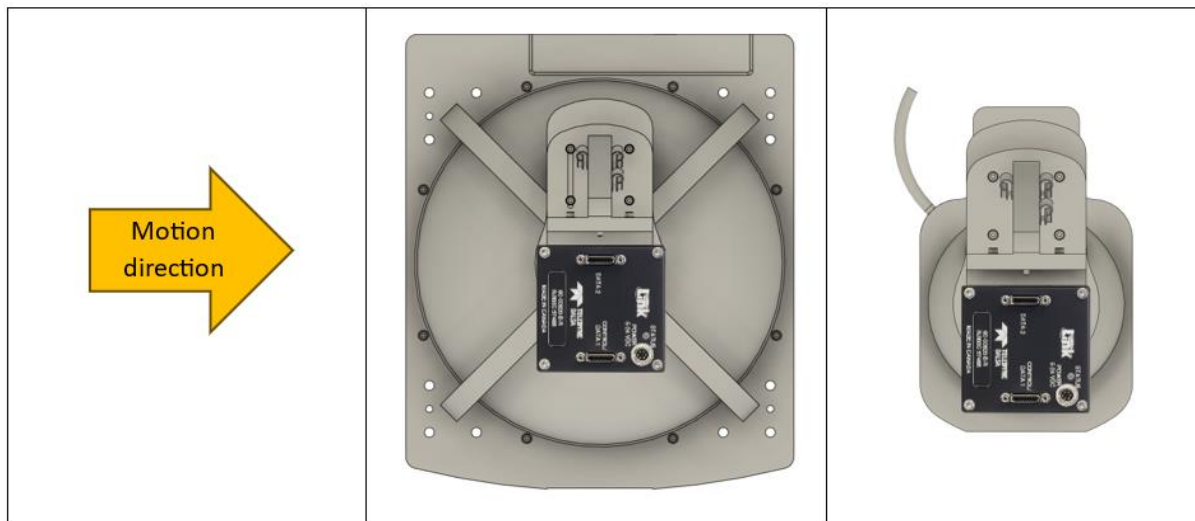
The Trevista tool edit control offers more documentation by choosing the "?" button in the row of buttons across the top.

Integration Notes

Cognex offers the following guidance on integrating your Trevista CI Dome installation with your production environment and generating reliable calibration data.

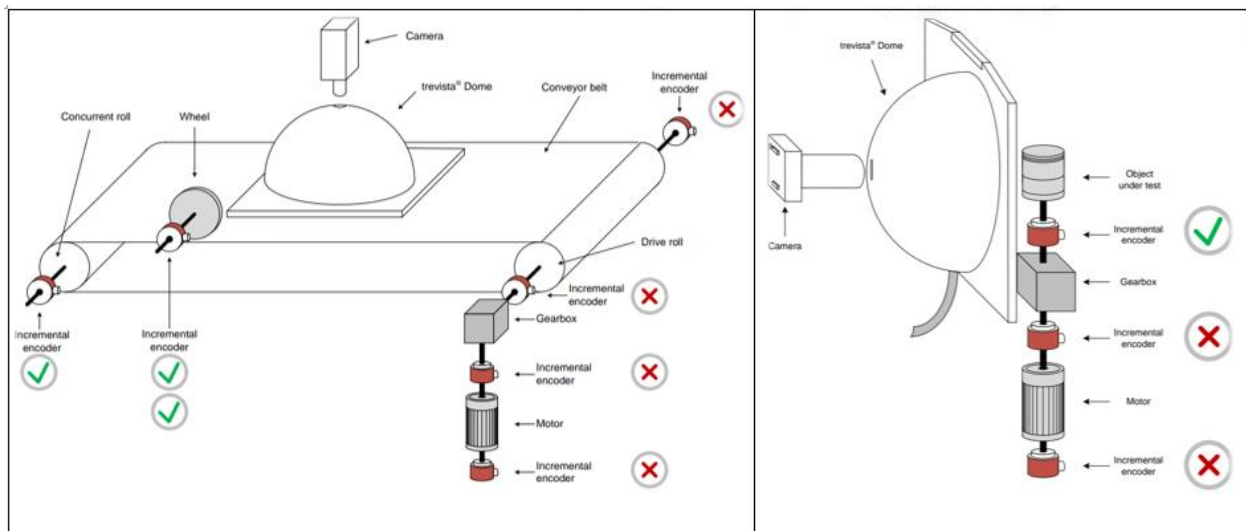
Prerequisites

This section assumes that the Trevista Dome mechanical installation and wiring have been performed correctly, following the guidance earlier in this document and other Trevista CI Dome hardware documentation. It is also assumed that the camera has been installed in its default orientation as presented below. Otherwise, adjusting the advanced parameter “Lightning Orientation” in the Trevista Wizard may be necessary. This guide will assume default orientation.



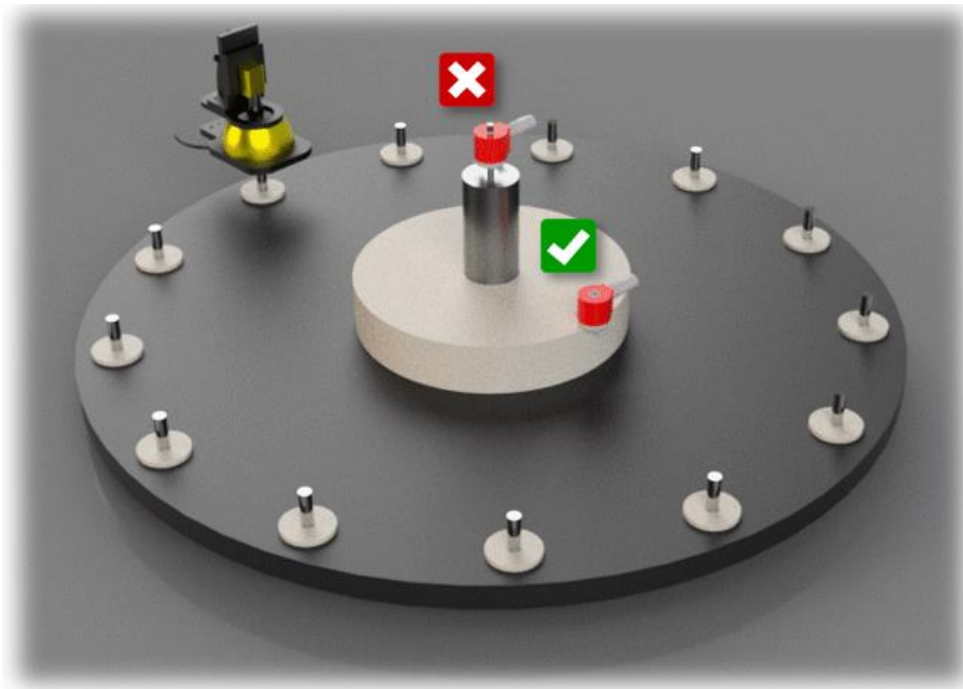
Encoder Installation

For accurate motion tracking of the inspection object, the position of the encoder is vital. Mount the encoder as closely as feasible to the part within the drive train system to generate precise signals.



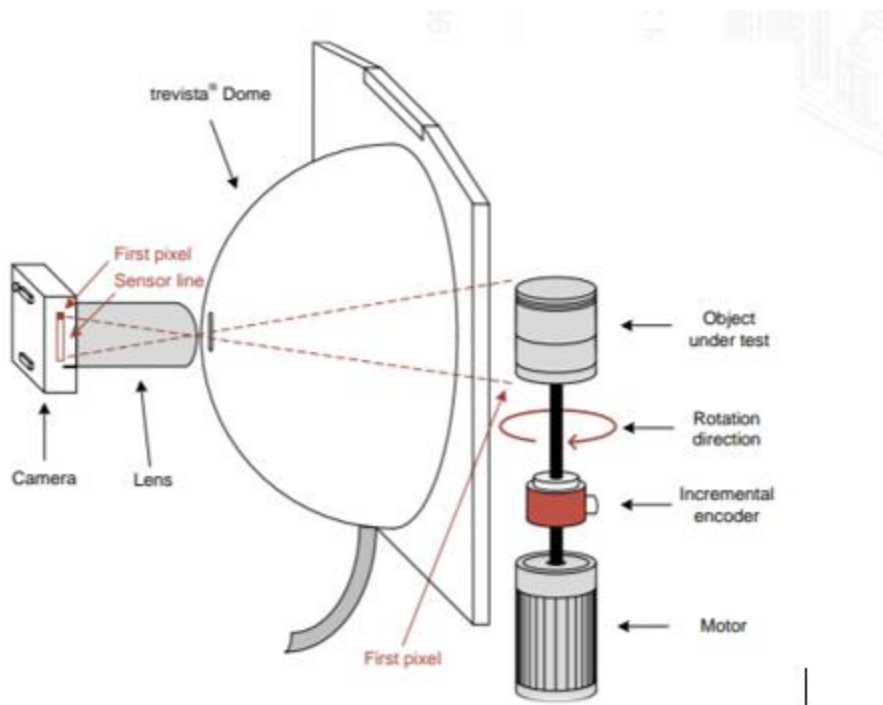
If the encoder is tracking the motion of a large object, consider whether the smallest displacement it can track matches the spatial resolution (the physical space each image pixel represents). There can be situations where this number might not be enough. In such cases, it's advisable to think about moving the encoder to a different location.

The Trevista programmable encoder enables you to set values up to 144,000 increments per revolution.

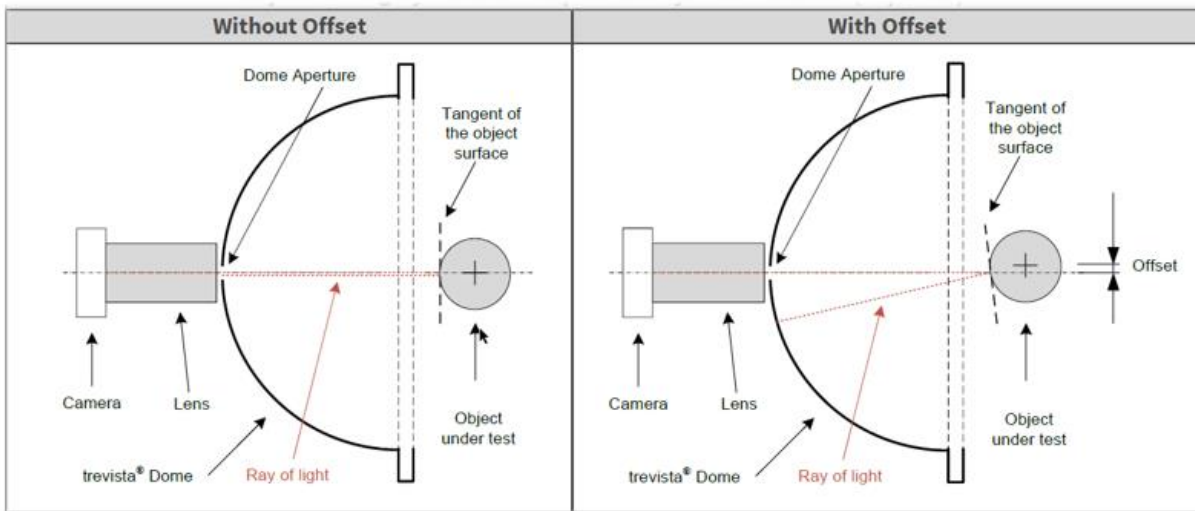


Mounting and Mechanical Configuration

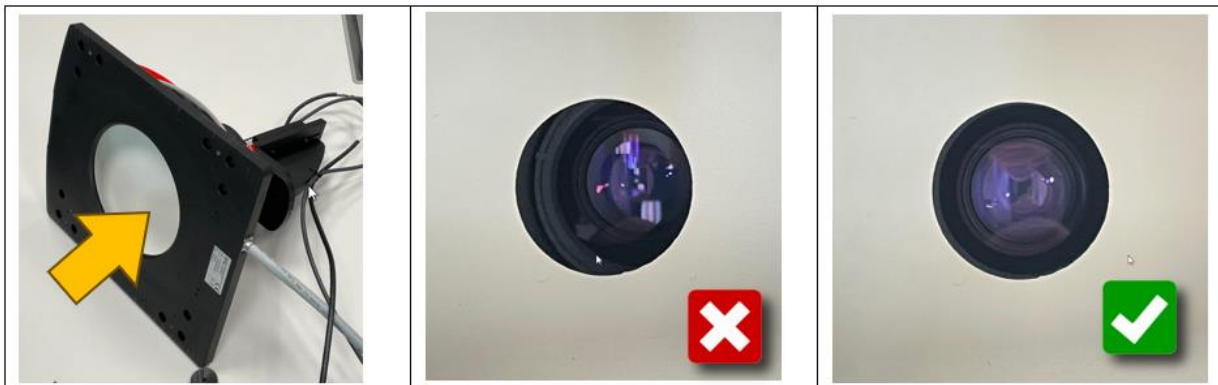
The camera, dome aperture, and inspected object should be aligned in a straight line.



If the parts are highly reflective, the dome aperture may be visible in the image causing a dark spot in the image. Tilting the dome slightly (or the part) can prevent this. For cylindrical parts, a potential solution could be to shift the part by a small offset.

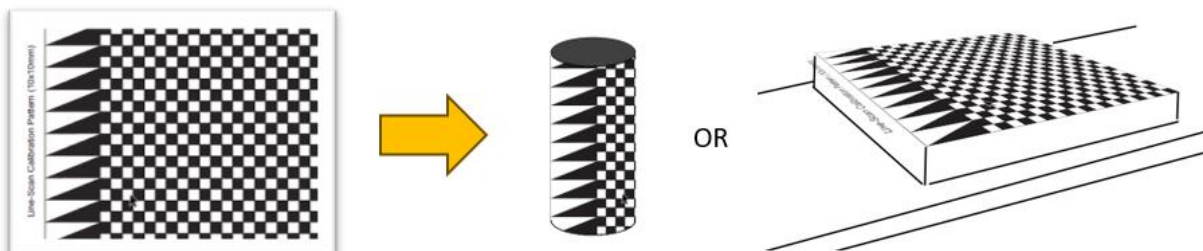


Ensure proper camera alignment with the dome aperture (concentricity). This is best done from inside the dome. Examine the lens to check if it is concentric with the dome aperture.



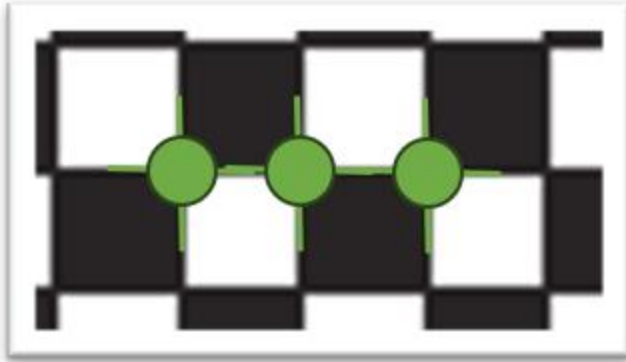
Preparing Part for Calibration

In theory, the grid on the calibration sticker need to be aligned perfectly with the part's motion; otherwise, artificial distortion (skew) will be applied to the output images. However, in practice, achieving this can be challenging. Our recommendation is to apply the calibration sticker to the part in a way that aligns its edge with the part's edge. Make sure to avoid any wrinkles, stretching, or surface slopes. Following these steps should be sufficient to achieve satisfactory results.



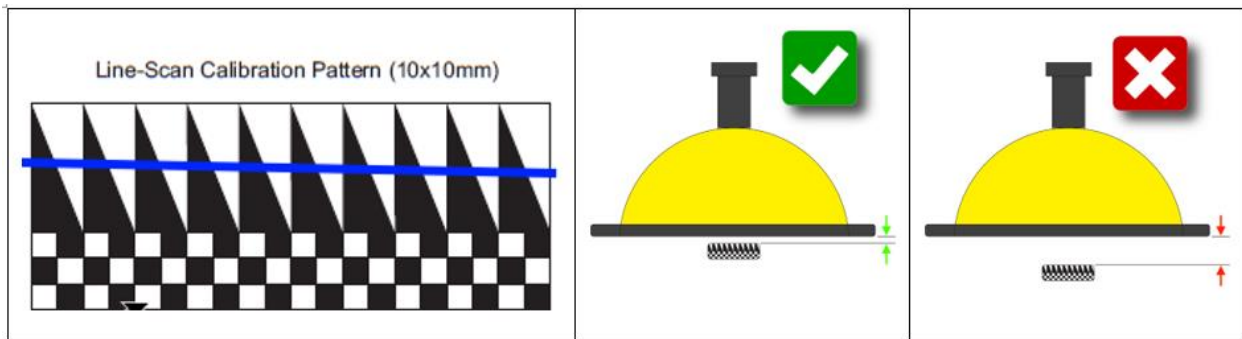
Cognex offers two sticker sizes: 5 and 10 mm. The explanation below will help you decide which one to choose.

Moving further into the process, we will utilize a CalibrationGrid tool designed to detect multiple points. These points will later be used to correct any non-linear distortions, often caused by lens imperfections. The tool will identify numerous corners of the squares on the calibration grid. For optimal calibration results, it is advised to have a minimum of 50 points evenly distributed across the entire region of interest (ROI). It's generally better to avoid calibrating the corners of the image because these areas tend to have the most distortion.



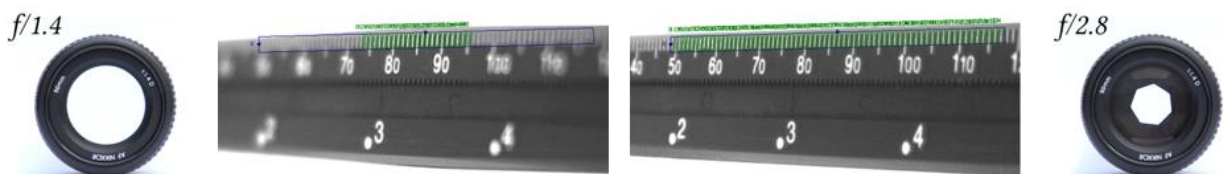
Getting Good Initial Image

Place the part under the dome in such a way that the camera captures the area with the triangle pattern. No motion is necessary at this point. The motor may be disabled, allowing you to move the part freely. To ensure optimal image quality, it's important to follow the recommendations regarding the working distance listed previously in this guide.



In the next steps, we will adjust the image brightness and focus. Following the procedure below may help you achieve good results.

Open the lens aperture to create a very shallow depth of field. This helps in precise focus adjustment since you can clearly observe the area with the sharpest plane in the image. With the lens aperture fully opened, you will need to set a short exposure time before proceeding. Greyish images work well for this task, so avoid oversaturation or very dark images.



Open the Image Source and select the Trevista controller.

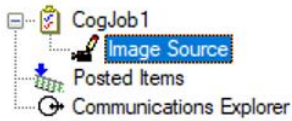


Image Acquisition Device/Frame Grabber:

Device: COGNEX: Trevista (#0) : 44000411

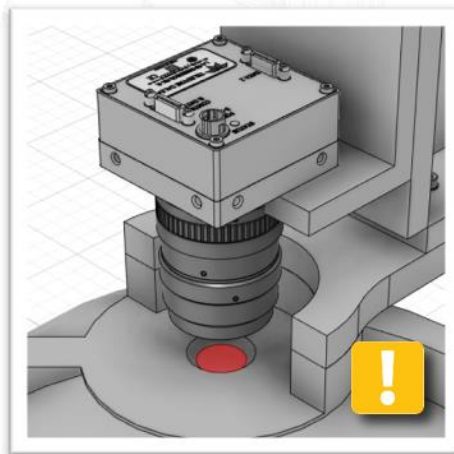
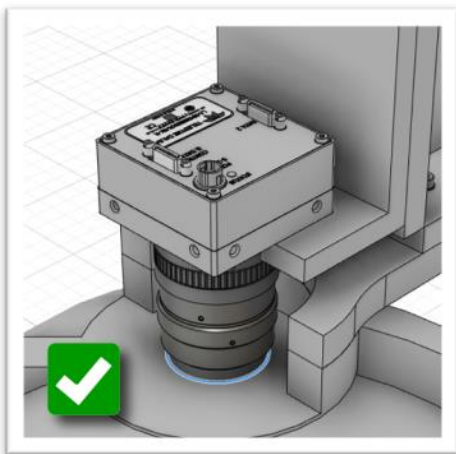
Proceed to Trevista Wizard and adjust the exposure time as instructed above.

Camera Settings

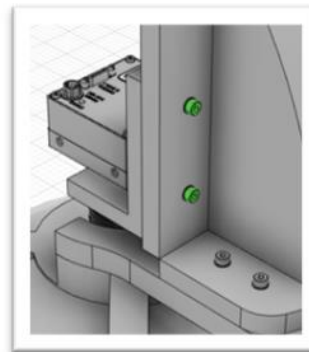
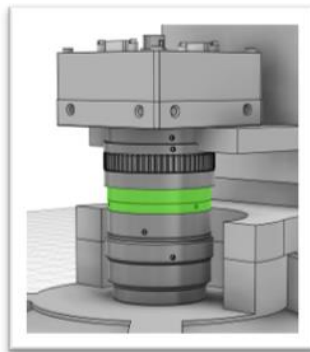
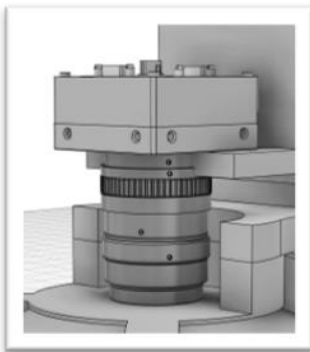
Exposure (ms)	0.100
Contrast	0.000
<input checked="" type="checkbox"/> Timeout (ms)	10000

In the next steps we'll adjust the lens focus.

It is advised to keep the lens touching the dome to prevent the edges of the dome aperture from obstructing the optical path.



Some of the lenses will change their length while focusing. Please make sure the camera plate is unscrewed and it's free to move.



Adjust the lens focus to achieve the best possible image sharpness. Your image should look like the one below:

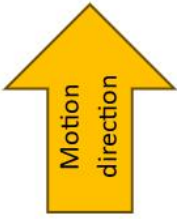
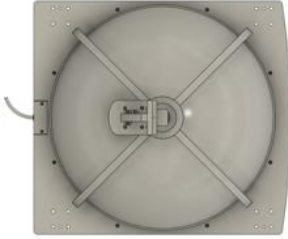
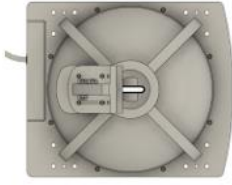



Once you have completed the adjustments, securely close the thumb screws on the lens and screws on camera plate to avoid any misadjustments during production. We'll close lens aperture after focusing on the actual part later on (without the sticker).

Checking Trevista Dome Mounting Orientation

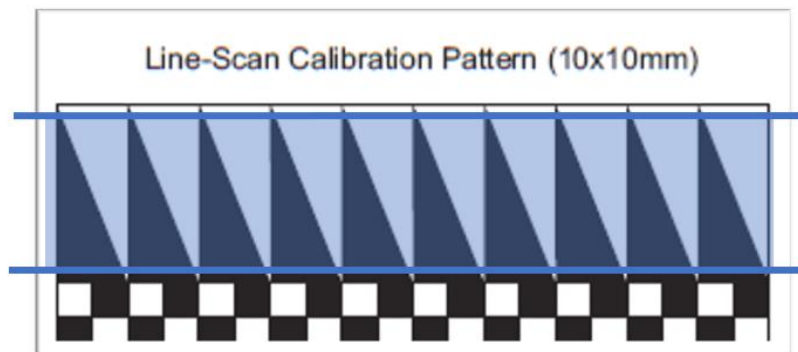
In this section, we will verify whether the dome and camera are mounted in the correct orientation relative to the motion direction.

To make the visualization clearer, we will use the motion direction presented below.

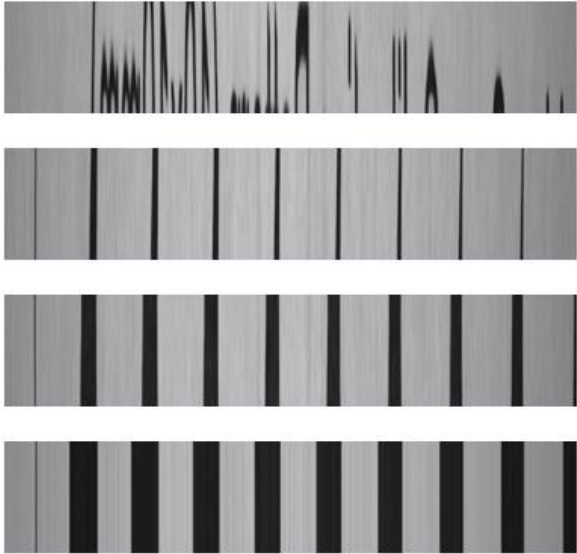
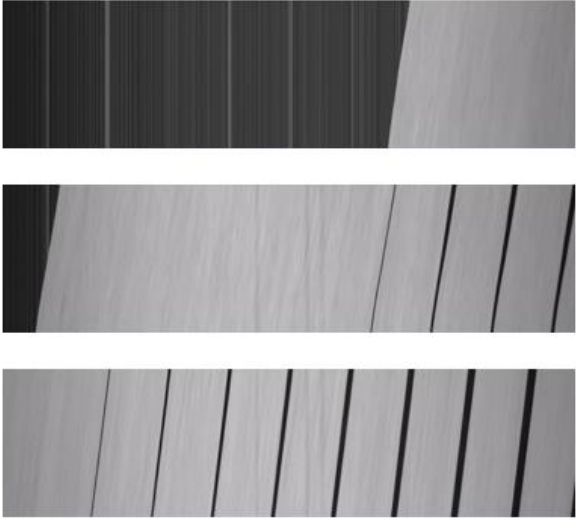
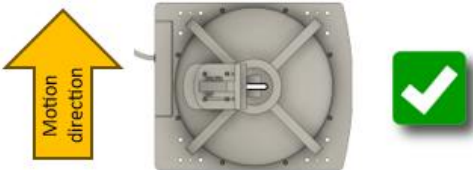
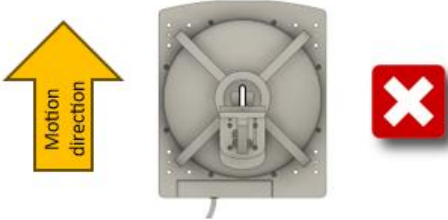
Motion direction	Trevista L	Trevista M	Trevista S
			

To complete this step, part movement will be necessary. We recommend moving slowly at this stage. We'll check the setup at full speed later.

We only need a limited area, specifically the part with the triangle pattern as shown below. Having slightly more or slightly less coverage will not affect the result. Our objective is to ensure that the majority of the triangle pattern is covered by the motion.

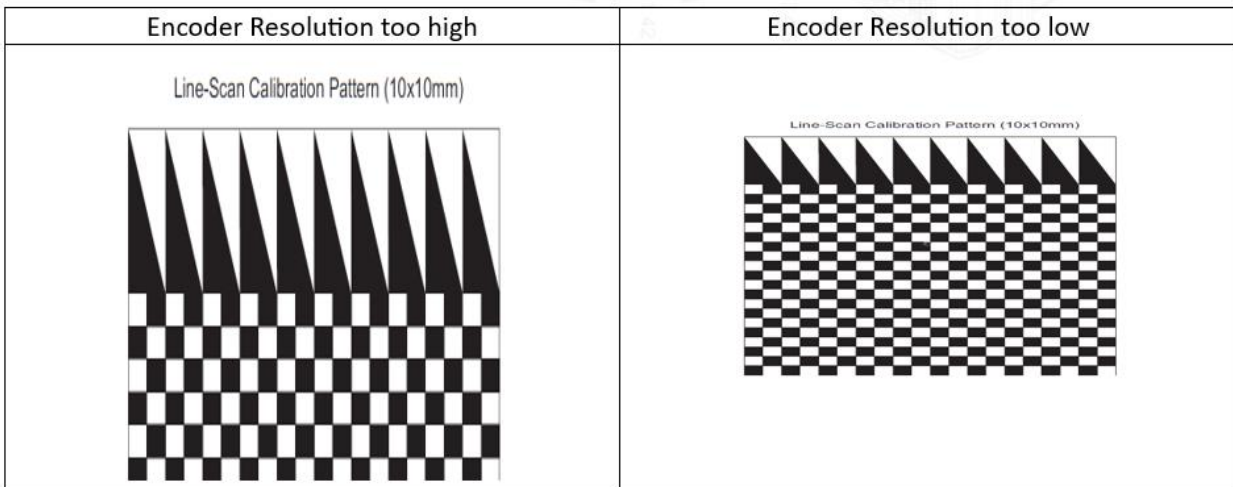


While the motion is cycling back and forth within the above range, access the wizard and observe the view. There are two possible cases described below:

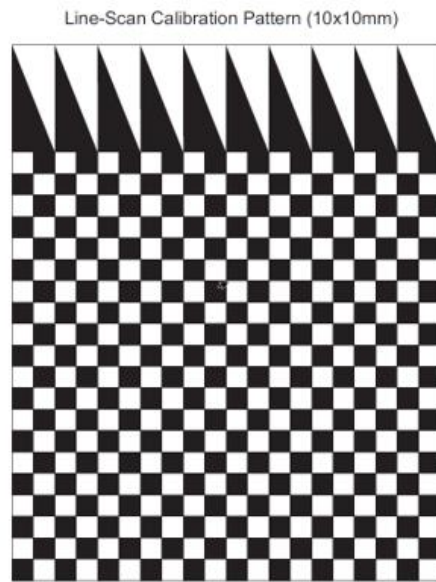
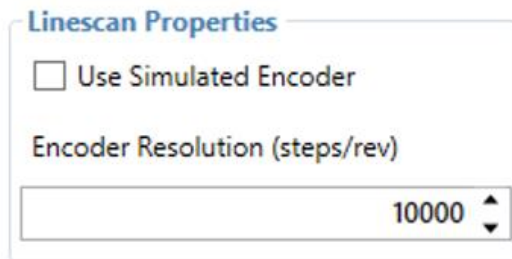
CORRECT	INCORRECT
<p>You should see <u>image</u> moving up and down. Vertical stripes are getting thicker while part is entering FOV.</p> 	<p>If you see part entering FOV from a side with visible tilt, then the dome is not at correct orientation, and it's mounted parallel to the motion.</p> 
<p>Motion direction and dome orientation</p> 	<p>Motion direction and dome orientation</p> 

Encoder Settings

Set the motion range to cover the full calibration pattern, and then acquire an image. It is likely that your image will be distorted similar as presented below:



Fine-tune the Encoder Resolution value until the image appears without any noticeable distortion and the pixels appear square.



Having square pixels ensures that objects and defects are imaged in the same way regardless of their orientation.

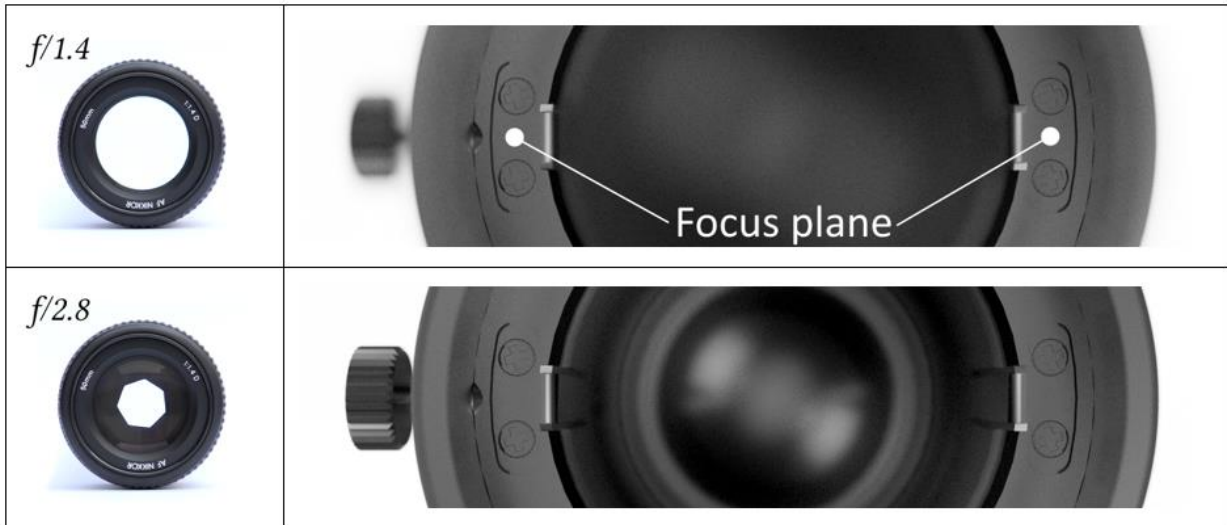
Adjusting Final Image

Place the actual part to be inspected (without calibration pattern).

Follow a similar focusing procedure as before. Begin by fully opening the lens aperture and adjusting the exposure time to achieve a greyish image, just as done previously. Next, adjust the lens focus.

If you plan to inspect multiple planes at different heights, aim to position the best focus plane in the middle of those heights. This will help ensure that the entire range of planes receives reasonable focus.

Once the focus plane is set in the middle, you can then proceed to close the aperture. Doing so will increase the depth of field, allowing more planes to be in focus.



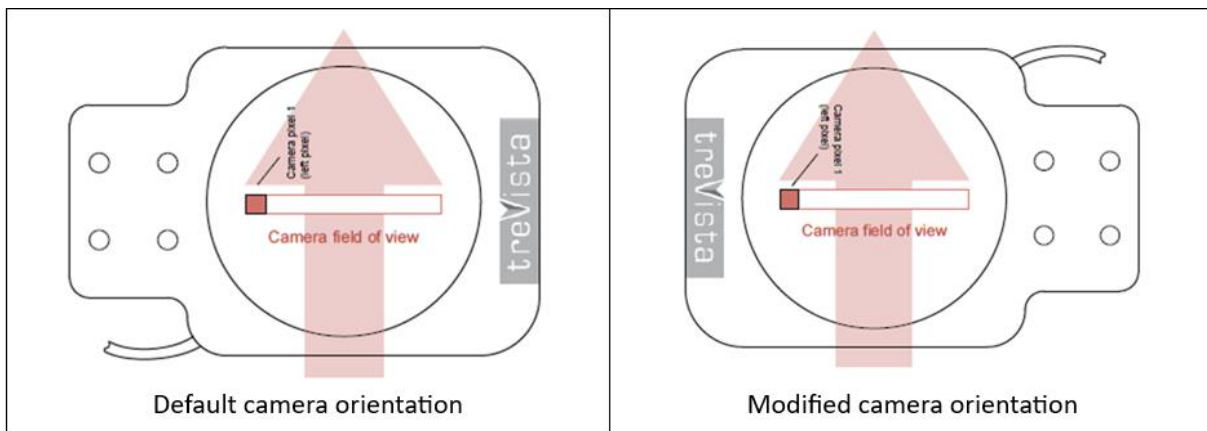
After configuring the focus, proceed to acquire the image with the motion set to your desired speed. Adjust the exposure time to achieve a satisfying image brightness but avoid oversaturating the images. In case the image appears too dark, you can adjust the Gain (if increasing exposure is not an option, for instance due to motion blur).

Troubleshooting

Refer to the following sections to resolve potential issue.

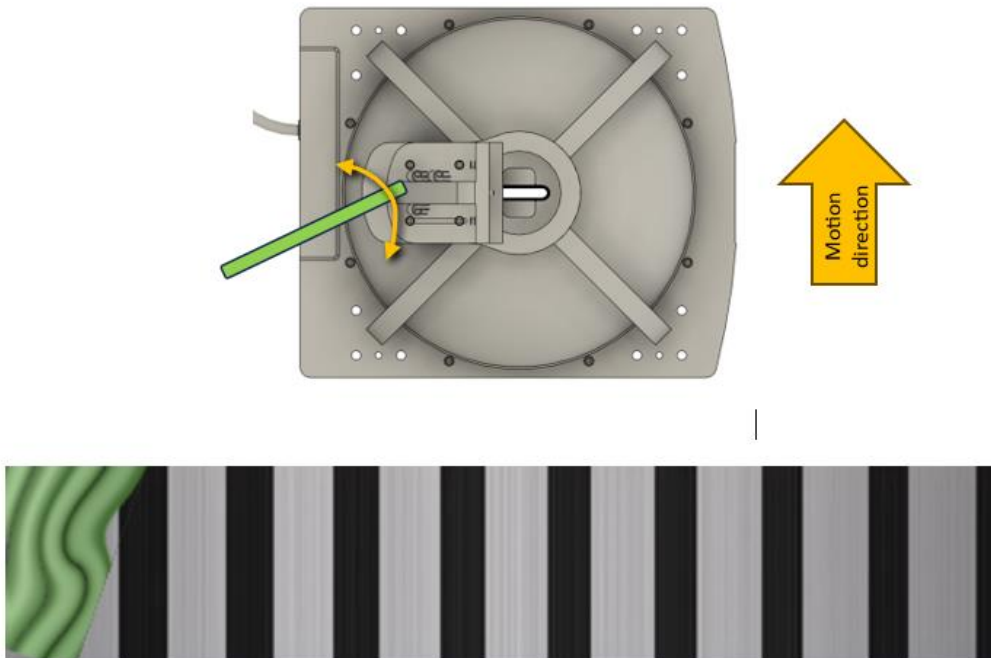
Checking First Pixel Orientation

It is important to mount the camera in the correct orientation so that the first pixel matches the motion direction.



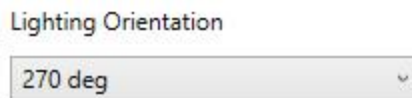
The first pixel of the camera is always on the left in the image.

In the Trevista wizard, enter Live mode. Generate movement on the left side of your part (left side, observing along the motion direction). Check if you can see this motion on the left side of the image, indicated by the green color in the image below.

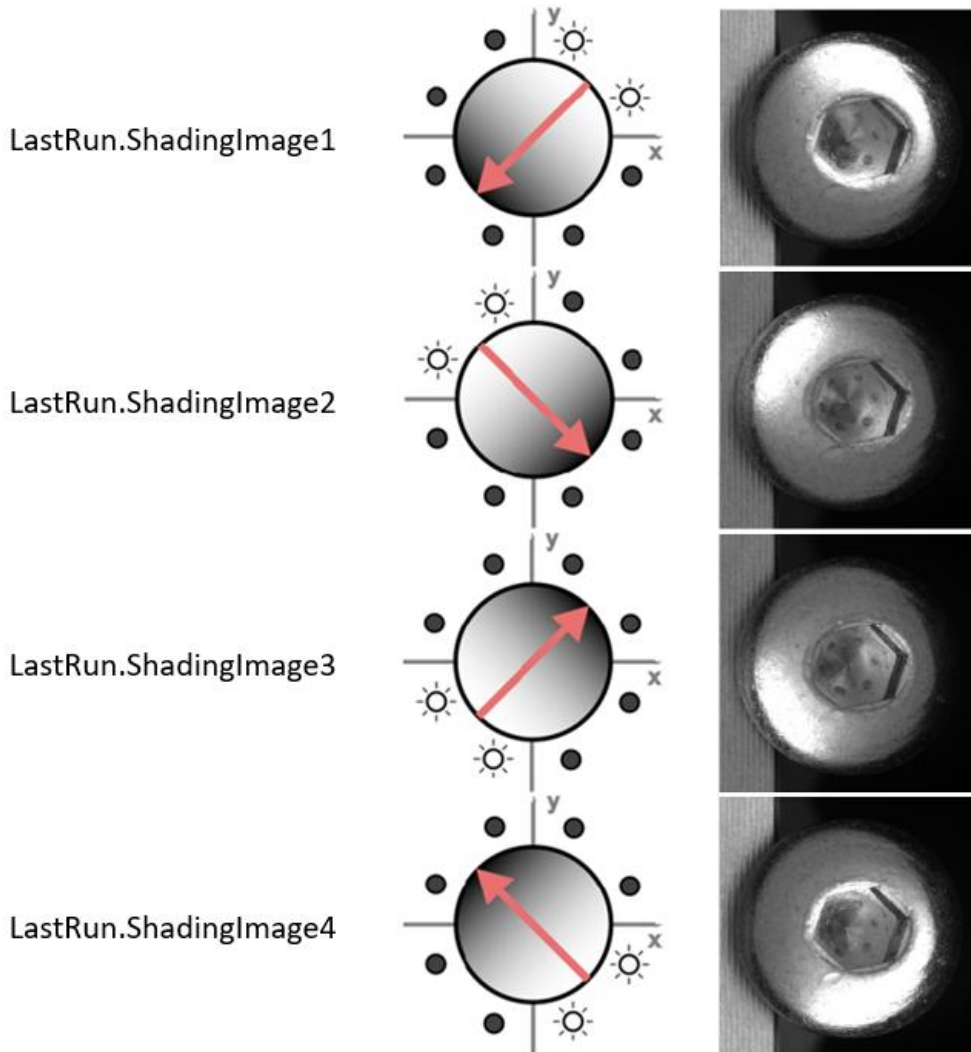


Lightning Orientation Check

The Lightning Orientation parameter must be adjusted whenever the camera has been installed in a different orientation than the default. Each of the Shading Images is expected to be illuminated from a predefined direction. Default lightning orientation for line-scan camera is 270 degrees.



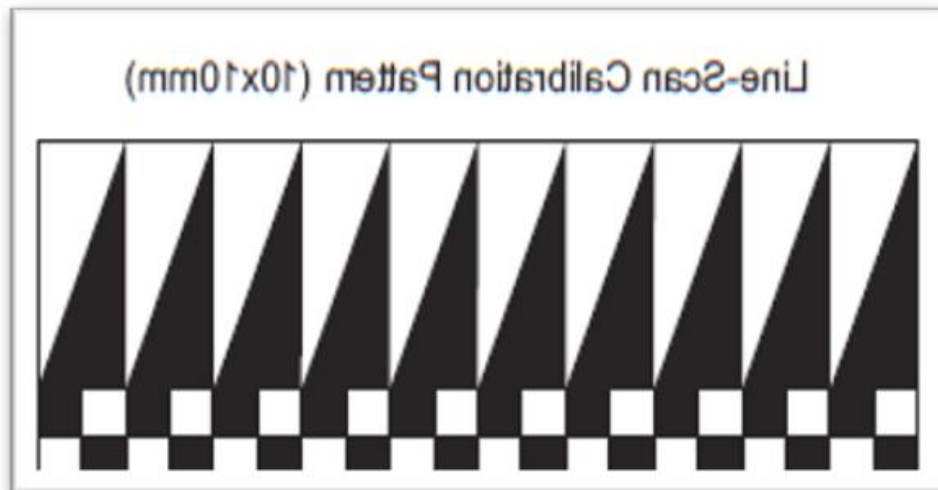
To clearly see the light direction, please attach a reflective hemisphere object to the part. Use the Trevista tool to examine the shading images. The following table provides the correct lighting directions for each of the shading images in the diagonal sequence type.



Mirrored image

Since the Trevista tool expects lines to be captured with the light direction arranged in a specific order, it is not feasible to operate with a mirrored image.

In such instances, please reverse the motion direction or rotate the dome by 180°. Advanced users may also choose to rotate just the camera and adjust the Lightning Orientation accordingly.



High-Frequency Encoder Signals

The frequency of encoder impulses can approach, but not fully reach, the camera's theoretical maximum. Within that range, small speed variations can cause over-triggering, leading to image acquisition issues.




It is recommended to leave a safety margin.

With frequencies higher than 50Hz, jitter on encoder signals could start to impact line triggering. In situations like these, it might be better to use the free run mode.

Regulations and Conformity

Note: For the most current CE and UKCA declaration and regulatory conformity information, see the Cognex support site: cognex.com/support.

The Trevista Controller has a Regulatory Model number 50240 and meets or exceeds the requirements of all applicable standards organizations for safe operation. As with any electrical equipment, however, 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.

Safety and Regulatory	
Manufacturer	Cognex Corporation One Vision Drive Natick, MA 01760 USA
	Trevista Controller: Regulatory Model 50240 This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take immediate measures. This equipment complies with the essential requirements of the EU Directive 2014/30/EU. Declarations are available from your local representative.
EU RoHS	Compliant to the most recent applicable directive.
FCC	FCC Part 15, Class A 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 instruction manual, 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 his own expense.
Korea 	Trevista Controller, KC ID : R-R-CGX-TREVISTA2004 This device is certified for office use only and if used at home, there can be frequency interference problems.
TÜV	Trevista Controller: Regulatory Model 50240 NRTL: TÜV SÜD SCC/NRTL OSHA Scheme for UL/CAN 61010-1. CB report available upon request. TÜV SÜD, IEC/EN 61010-1.
	Trevista Controller: Regulatory Model 50240 This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take immediate measures. This equipment complies with the essential requirements of the Electromagnetic Compatibility Regulations 2016. Declarations are available from your local representative.

中国大陆RoHS (Information for China RoHS Compliance)

根据中国大陆《电子信息产品污染控制管理办法》(也称为中国大陆RoHS), 以下部份列出了本产品中可能包含的有毒有害物质或元素的名称和含量。



Hazardous Substances 有害物质						
Part Name 部件名称	Lead (Pb) 铅	Mercury (Hg) 汞	Cadmium (Cd) 镉	Hexavalent Chromium (Cr (VI)) 六价铬	Polybrominated biphenyls (PBB) 多溴联苯	Polybrominated diphenyl ethers (PBDE) 多溴二苯醚
Regulatory Model 50240	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.
这个标签是根据SJ/T 11364 的规定准备的。

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB / T26572 - 2011.
表示本部件所有均质材料中含有的有害物质低于GB / T26572 - 2011 的限量要求。

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB / T26572 - 2011.
表示用于本部件的至少一种均质材料中所含的危害物质超过GB / T26572 - 2011 的限制要求。

For European Community Users

Cognex complies with Directive 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 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.

