

## BI-TELECENTRIC OPTICS



**Opto Engineering bi-telecentric optics** are specifically designed for accurate measurement and inspection of parts in a wide variety of industries spanning from Automotive to Electronics, Pharmaceutical and Beverage.

**Opto Engineering bi-telecentric lenses** are compatible with a wide variety of industrial cameras, ranging from affordable VGA 1/3" detectors to ultra-high resolution 29 Mpix CCD cameras.

**Bi-telecentric lenses** offer significant advantages when compared to standard lenses due to their unique optical properties. In addition Opto Engineering offers specific telecentric backlight illuminators capable of producing perfectly sharp edges and well-contrasted images in order to further enhance the benefits of bi-telecentric technology.

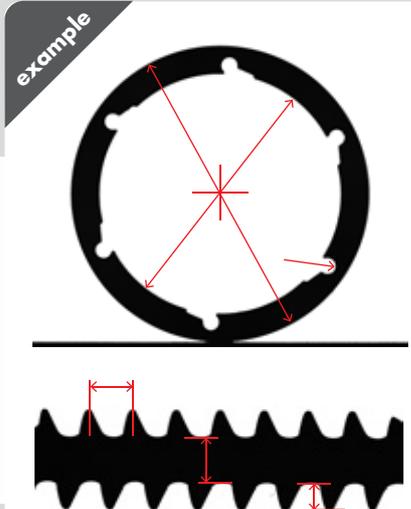
**NEW**

Opto Engineering is the leading manufacturer of bi-telecentric lenses in a wide variety of industries spanning from Automotive to Electronics, Pharmaceutical and Beverage.

**This paper has the objective to explain the advantages of bi-telecentric technology compared to traditional optics.**

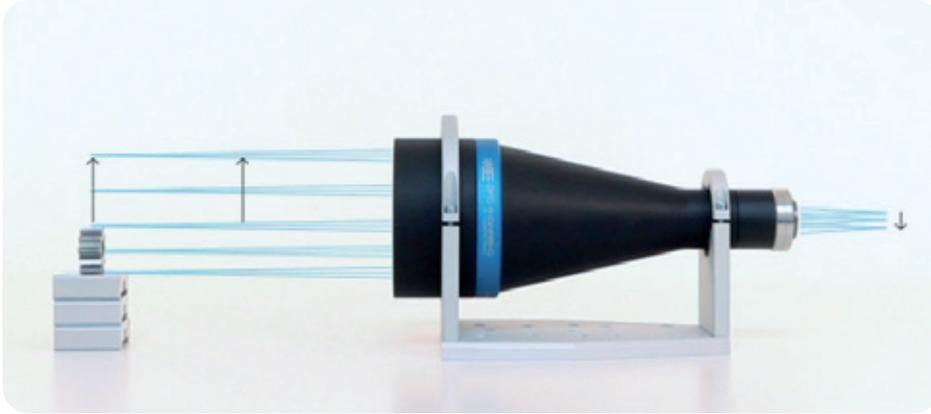
Please feel free to contact us and book a free test session in one of our labs around the world.

## TC BENCH CONFIGURATION



Bi-telecentric lenses are able to deliver incredibly accurate measurement on many different precision parts.

# MAIN FEATURES & BENEFITS OF BI-TELECENTRIC LENSES



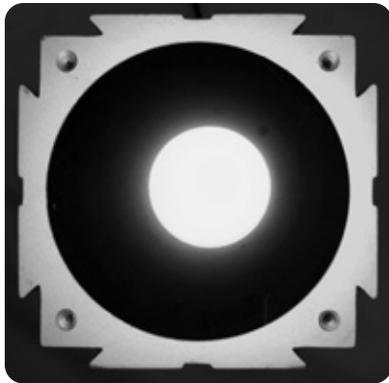
## NO CHANGE IN MAGNIFICATION WHEN THE OBJECT IS DISPLACED

With standard lenses an object appears to be smaller or bigger when it is closer or farther away from the lens.

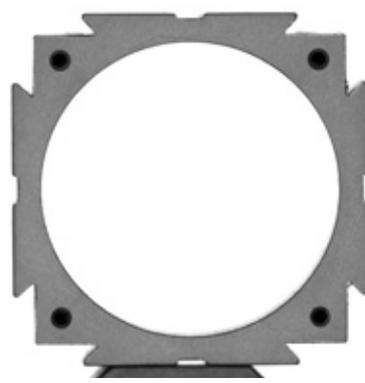
Unlike common optics, TELECENTRIC LENSES only accept incoming ray bundles that are **parallel** to the optical axis; therefore the object size remains unchanged. This is essential when you must measure objects that cannot be precisely positioned (e.g. on a conveyor belt).



Images of two identical screws. Screw "1" is 10 mm closer to the lens. As you can see with telecentric lenses object size remains the same.



Common optics showing significant image perspective error.



A telecentric lens is able to cancel any perspective effect.

## NO PERSPECTIVE ERROR

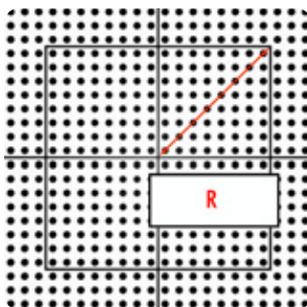
Telecentric lenses eliminate any perspective error and are therefore perfect when thick objects must be measured.

## NEARLY ZERO IMAGE DISTORTION

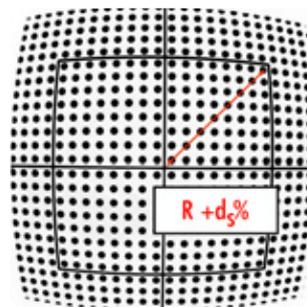
An image is distorted when straight lines in the object space appear as curved lines in the image space.

Distortion is measured as a percent deviation. OE TELECENTRIC LENSES feature incredibly low distortion, typically under 0.05 % and deliver extremely accurate geometrical information.

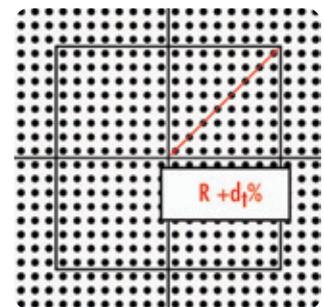
### PATTERN



### STANDARD LENSES



### TELECENTRIC LENSES

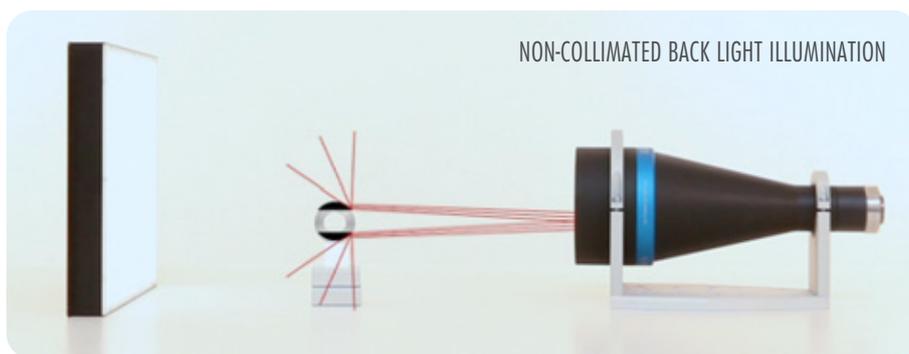
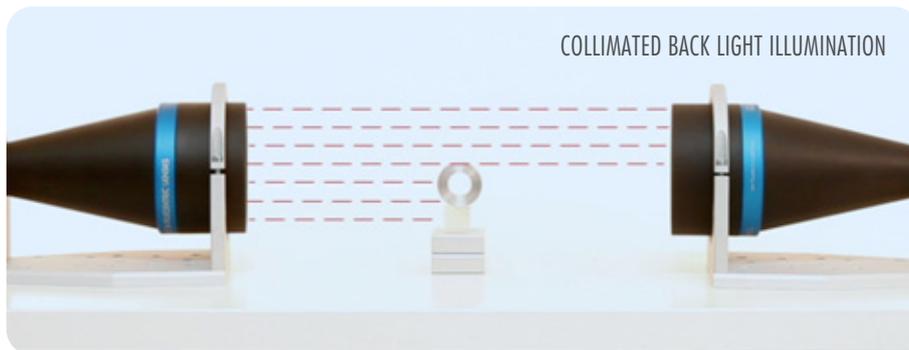


Left image shows the object to be displayed. Middle image is taken with standard lenses with distortion  $d_s = 1-3\%$ . Right image is taken with a telecentric lens and shows almost zero distortion  $d_t < 0,05\%$

## BETTER ACCURACY WITH COLLIMATED ILLUMINATION

Using OE Collimated backlight illuminators with bi-telecentric lenses ensures incredibly sharp profiles and well contrasted images unlike common backlights.

This configuration leaves no uncertainty in edge position thus providing incredibly accurate measurement results.

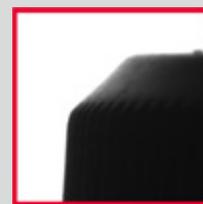


NON-COLLIMATED BACK LIGHT ILLUMINATION

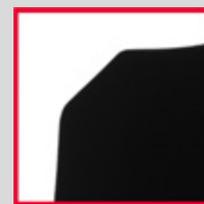


COLLIMATED BACK LIGHT ILLUMINATION

LEFT



RIGHT



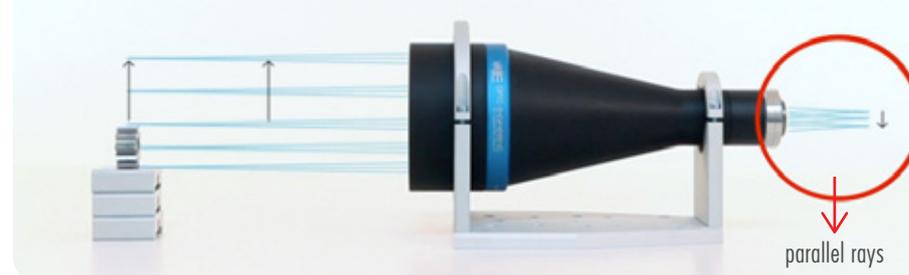
## ADDITIONAL ADVANTAGES OF BI-TELECENTRICITY

BI-TELECENTRIC lenses are also telecentric on the detector side.

**This additionally guarantees:**

- Increased Field Depth
- Even CCD illumination
- Constant magnification even when the CCD is not perfectly positioned

### BI-TELECENTRIC LENS



## VERY ROBUST INDUSTRIAL DESIGN

Opto Engineering Bi-telecentric lenses are specifically designed for real industrial applications.

The lenses have a fixed design with no adjustable focus or aperture mechanisms to withstand vibrations and ensure accurate and consistent performances

### SINGLE SIDE TELECENTRIC LENS



# FITTING INDUSTRIAL APPLICATIONS

## AUTOMOTIVE



Shafts



Rotors



Pipes



Coil Springs

## MECHANICAL



Hairs prings



Watch gears



Screws

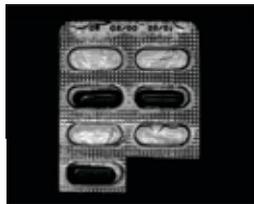


Nuts

## GLASS&PHARMA



Tablet glasses



Blister packs

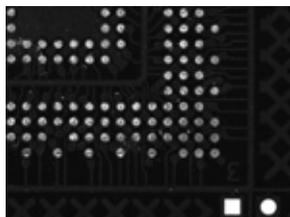


Vials

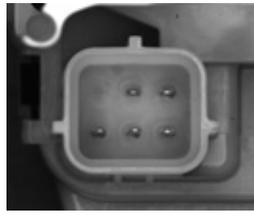


Needles

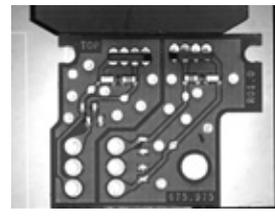
## ELECTRONICS



BGAs



Pins



PCBs



Hard Disk Head arms

## PLASTIC/RUBBER



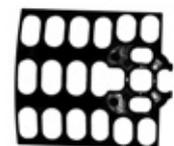
Rubber parts



Bottle-necks



O-rings



Keyboards

Many custom telecentric lenses for special applications can be manufactured upon request. Please contact us to discuss your specific telecentric application with our team at [info@opto-engineering.com](mailto:info@opto-engineering.com)