Telecentric Lenses - RJ Wilson | Imaging Components for Industry & Science

Telecentric lenses are ideal for metrology, enabling the inspection of 3D surfaces that include holes and raised surfaces by virtually eliminating perspective distortion. All objects within the depth-of-focus range of the lens will have the same magnification factor, enabling improved metrology despite camera-distance variations.

Two key points to note about the benefits of telecentric lenses are:

1. There is no “angle-of-view” or perspective error. Using telecentric lenses is like looking straight up and down across the entire scene. For example, with a telecentric lens, 3 adjacent round holes all look round and you can see straight down the holes’ side-walls anywhere across the field-of-view.With a standard lens, the center hole will look pretty much round, but the bottom of the hole looks smaller than the top of the hole and you can see the side walls of the hole. In addition, the holes toward the outside of the image will look like ovals. You’re looking down the far side-wall of each outside hole and can’t see the bottom of the outside holes.
2. Because there is no perspective distortion, the objects that are in-focus within the image (within the depth-of-field) will have the same calibration factor when these features are measured, even though these features may physically be at different distances from the camera.

In the first set of images, a standard lens is used. The object on the left has some thickness and a large hole runs though the center of the part. The bottom of the hole has a smaller measurable diameter than the top of the hole and you can see the side-walls of the hole because of perspective error or the angle-of-view from a standard lens.

In the image on the right, the bolts are at different distances to the camera. Although these bolts are the same, the closer bolt looks and will measure larger in both diameter and height than the bolt that is farther away from the camera.

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In the second set of images, a telecentric lens is used. Note that there is no perspective error; the view is straight through the part with the top and bottom of the hole being the same diameter, with no visible side wall inside the hole.

In the image of the bolts on the right, although the bolts are physically staggered, both will have the same measured diameter because both are within

the depth-of-focus of the lens. Any metrology done on the bolts will yield the same results provided they are within the depth-of-focus. By the way, the depth-of-focus of the larger field-of-view telecentric lenses can be 300mm (12-inches) and more.

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Message

R.J. Wilson, Inc.

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