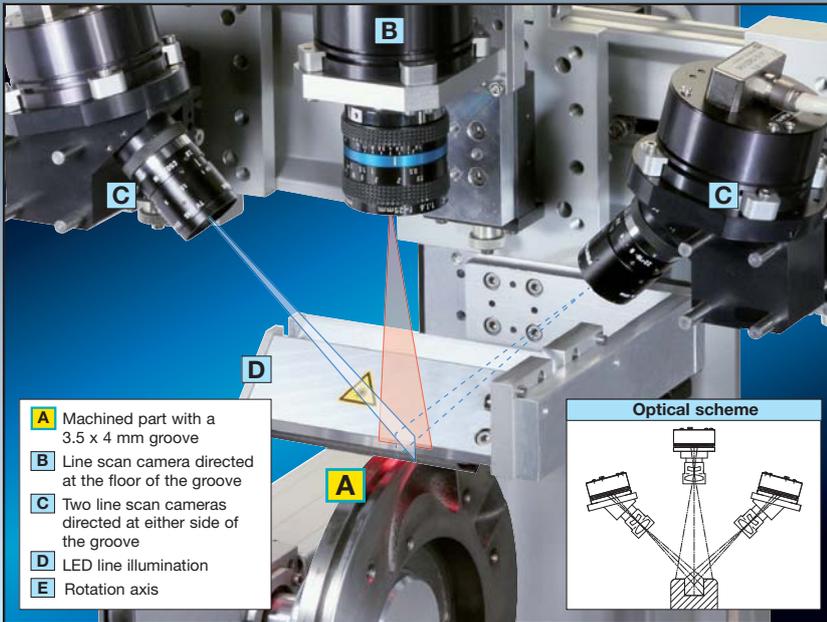
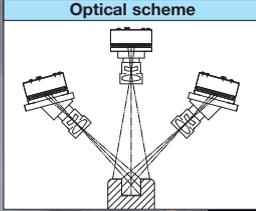


O-Ring Groove: Inspection of Seal Contact Areas

Inspection system with three line scan cameras - endocentric and Scheimpflug optical configuration



- A** Machined part with a 3.5 x 4 mm groove
- B** Line scan camera directed at the floor of the groove
- C** Two line scan cameras directed at either side of the groove
- D** LED line illumination
- E** Rotation axis



Three line scan cameras are used to inspect a 3.5 mm x 4 mm O-ring groove in a metal casting. The center camera is directed at the floor and the flanking cameras at either side of the groove. The signals, from the three line cameras with LVDS interfaces, are concatenated into

a single data string within the connected Merger Box.

The optical axes of the two flanking cameras meet their respective object planes at an angle. The *Scheimpflug Principle*, presented in more detail on the right, explains how to set up the object, lens and sensor for optimum oblique imaging acquisition.

Application: Inspection of Metal Casting with an O-ring Groove

In standard optical imaging, the object, lens, and image (sensor) planes are all orientated in parallel and the optical axis of the lens is perpendicular to these planes. In some applications, including the imaging of the sides of a small groove, this configuration is not possible.

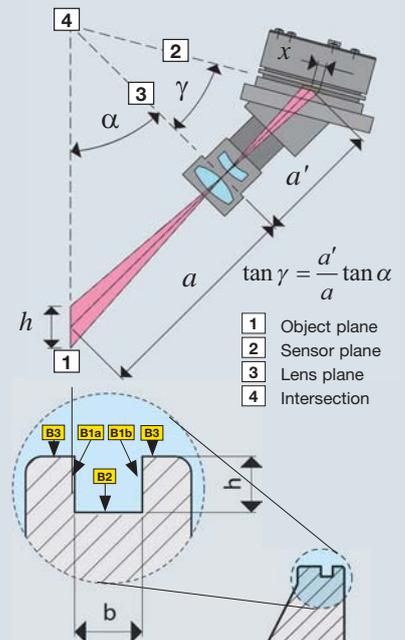


In 1904, Theodor Scheimpflug, an Austrian captain, found a geometric rule for sharply focussed oblique imaging acquisition.

Theodor Scheimpflug 1865–1911

With a standard camera, it is then necessary to reduce the camera aperture until enough depth of focus is achieved to acquire an focussed image across the complete object width. This results in increased exposure times and, because of optical diffraction at the smaller aperture, also reduces the resolution of the image acquisition.

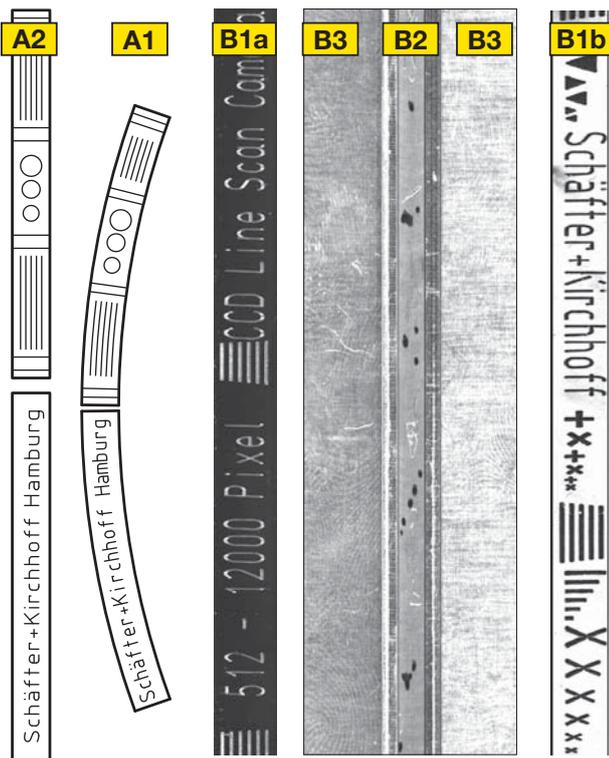
Scheimpflug Configuration



Top: Scheimpflug Configuration
An oblique object is imaged sharply on the image plane when the object, image and lens planes all meet at the same intersection.

Right: Drawing of the machined part under test.

Results



- A1** Test label (original shape)
- A2** Test label as imaged by a scanning camera
- B1** Groove sides
- B2** Groove floor
- B3** Exterior surfaces either side of the groove

Left: For the demonstration, test labels written using a laser were attached to the sides of the groove.