

TESTING TELESCOPES

INTRODUCTION

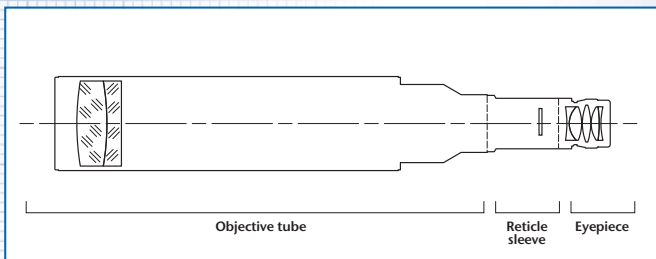
Layout and principle of operation

A testing telescope provides a magnified real image of a distant object. Usually the object is at infinity at a wavelength of 546 nm. The main components of a testing telescope are:

- objective tube with objective
- reticle sleeve with reticle
- eyepiece

The following figure shows the principle set-up of a testing telescope with straight viewing adjusted to infinity. The reticle is positioned at the rear focal plane of the objective. Due to this configuration all objects at infinity are imaged into the reticle plane. The reticle plane is viewed through the eyepiece. Due to this set-up the image in the eyepiece is rotated by 180°.

Mechanical and optical axes of testing telescopes with focal length $f \leq 300$ mm are adjusted with an accuracy of $\pm 30 \mu\text{m}/f$.



Testing telescopes form with collimators a measuring system for direction and angle testing of optical elements or optical systems in transmission.

Calculation of the angles

The angles (α_x and α_y) can be calculated from the distances Δx or Δy of the image of the collimator reticle to zero position of the eyepiece reticle as follows:

$$\alpha_x = \arctan\left(\frac{\Delta x}{f}\right) \approx \frac{\Delta x}{f}$$

$$\alpha_y = \arctan\left(\frac{\Delta y}{f}\right) \approx \frac{\Delta y}{f}$$

f : focal length of the telescope objective

Numerical example:

A displacement of 3 mm measured with a testing telescope with 300 mm focal length corresponds to an angle of:

$$\alpha \approx 3/300 \text{ rad} = 10 \cdot 10^{-3} \text{ rad} = 0,5730^\circ = 34'23''$$

A point at a distance of 10 μm to the centre of the eyepiece reticle corresponds to an angle of the parallel beam to the optical axis of the telescope as follows:

Focal length	Angle
50 mm	41''
90 mm	23''
140 mm	15''
200 mm	10''
300 mm	6,9''
500 mm	4,1''
600 mm	3,4''
1100 mm	1,9''



