

A Laser head with 3/4" (20 mm) diameter beam for the applications with Long range, large air turbulence and flying chips

I. What is the problem

The Laser Doppler Scale (LDS) has been installed in many machines for high accuracy positioning servo control feed back. The resolution and accuracy is high, the range is long, and it is not affected by thermal expansion. For most applications, the laser beam is well protected from air current and flying chips. However, many times, there is a sudden rush of air current or turbulence, or a flying chip passing through the laser beam, or a structure distortion causes misalignment of the laser beam. All these will cause a beam break, which means the machine lost track of its position and have to be re-home. Usually this may cause either damaging to the tool and the part, or lose of valuable machining times. All these are costly.

II. How to solve this problem

Conventional laser interferometer uses two apertures, one for the output laser beam and the other for the return laser beam as shown in the top of Fig. 1. To increase the laser beam diameter requires very large optics and very expensive. The LDS uses a single aperture laser head as shown in the bottom of Fig. 1. It is relatively easy to increase the laser beam diameter to 3/4" (20 mm) without using excessive large optics.

With such a large diameter laser beam, the diffraction loss is less, the tolerance to air turbulence and flying chips is very large.

III. How it works

The Laser Doppler Displacement Meter (LDDM) is based on Dopplermetry. It is possible to make a single aperture optical arrangement without any laser stability problem caused by scattered laser light entering the resonator. A beam expander is used to expand the laser beam to 20 mm diameter. A highly sensitive photo detector is used with very high signal to noise ratio. Hence only a small fraction of the return laser beam is needed.

The retroreflector is 1" (25.4 mm) diameter. Under normal operation condition, only 10% of the return laser light is needed. Hence, it can tolerate a large lateral displacement of the retroreflector, up to +/- 0.2" (+/- 5 mm). Furthermore, a 0.2" (5 mm) diameter steel ball can pass through the laser beam without cause a beam break.

Other features are high resolution (0.4 μin or 10 nm), high accuracy (1ppm), high speed (160 in/sec or 4 m/sec), and long range (330 ft or 100 m). It is very compact (2" x 2" x 8.5" or 50.8 mm x 50.8 mm x 216 mm) and can stand 10 g of acceleration. The automatic air pressure and temperature compensation, the material thermal expansion compensation and variable increment are all available.

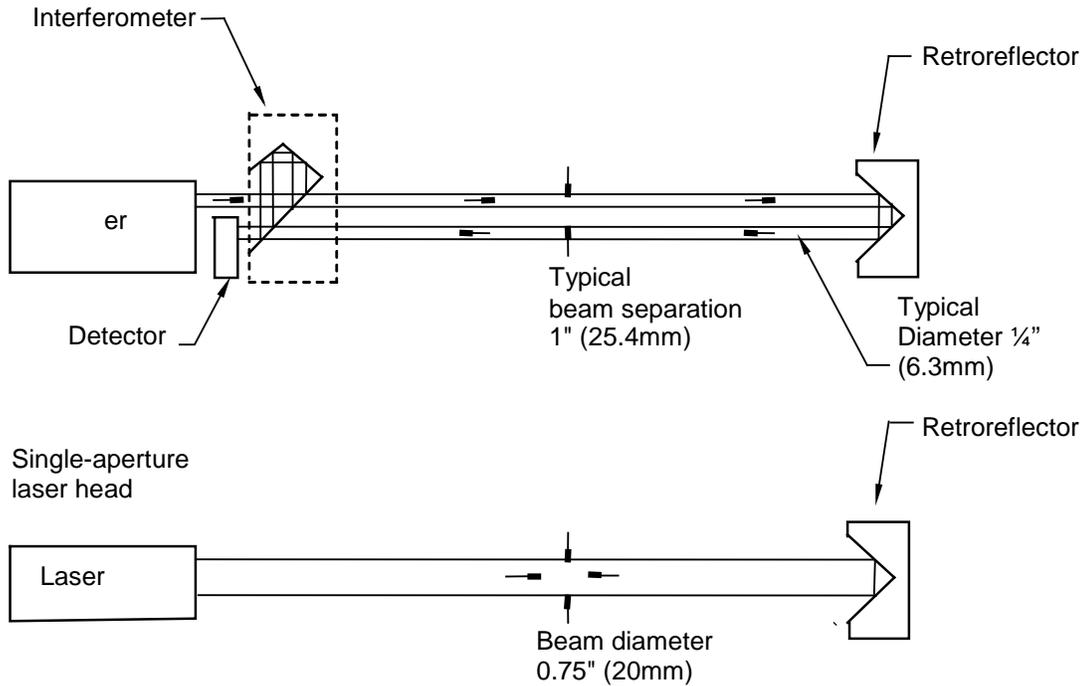


Fig. 1 A comparison of a laser interferometer and a single-aperture Laser system with 20mm diameter beam

VI. Need more information

Call Optodyne at 310-635-7481 or your local representative.