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Small linear optics kit

Introduction

The small linear optics kit allows the Renishaw laser measurement system to be used in applications where a small and light measurement optic is desirable, minimising its effect on a machine's dynamic performance and providing greater flexibility in mounting options.

The kit includes a small lightweight retroreflector with a magnet on its back face to allow easy fixturing onto metal ferrous surfaces. To allow the small retroreflector to be used with the standard laser optics a beam reduced optic is provided to reduce the diameter of the separation between the outward and return beams.

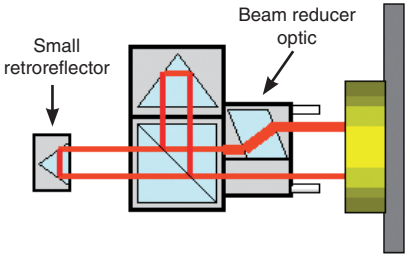


Figure 1 - schematic of optics operation

Kit includes:

(a) Beam reducer optic
(b) Retroreflector optic - magnetic mount
(c) Mounting adapter for (b) - provides magnetic and screw mount options
(d) User guide

Optical set-up

A) Retroreflector

The retroreflector, shown in photograph 1, is held to the mounting adapter, or directly to a surface, by way of a 3-point mounting and recessed magnet as shown in photograph 2.

Photograph 1 - retroreflector

Photograph 2 - magnetic mounting

The mounting adapter enables flexibility of alignment of the retroreflector by attaching the optic in different orientations relative to the adapter as shown in photographs 3 and 4. The mounting as photograph 3 enables greater alignment flexibility through easier access to the retroreflector for adjustment, and the largest mounting face.

Alternatively, mounting the retroreflector as in photograph 4 results in a more compact arrangement for applications with size limitations and to potentially maximise the length of the measurement path.

Photograph 3 - mounting for alignment flexibility

Photograph 4 - mounting for compactness

Note that the mounting adapter is drilled and counter bored to accept an M4 cap screw for attachment to non-ferrous surfaces.

B) Main optics

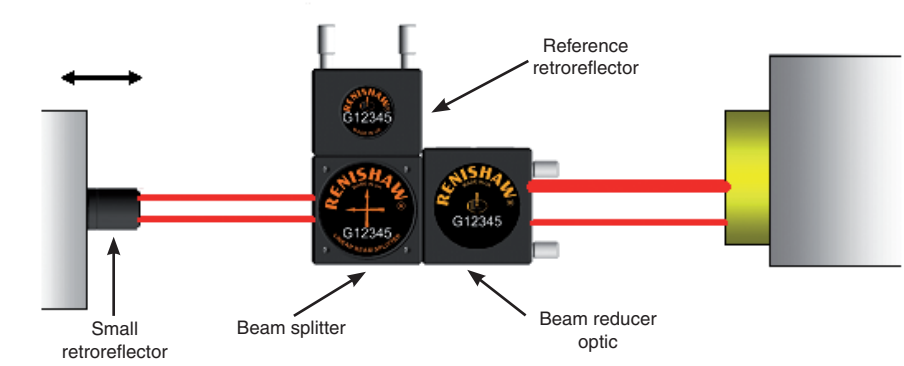


Figure 2 - side view of main optics set-up

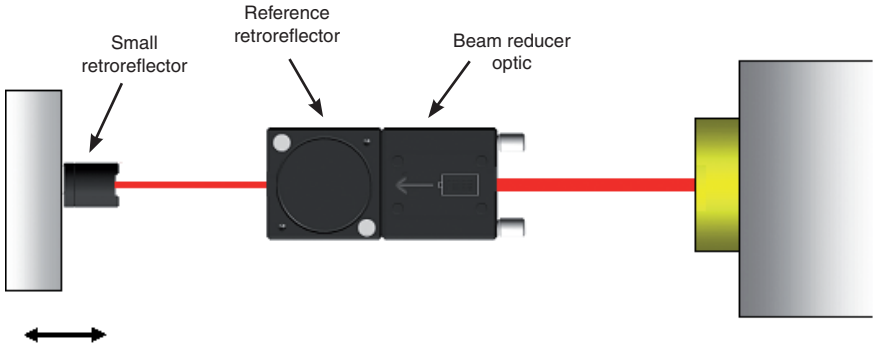
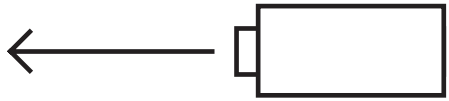


Figure 3 - top view of main optics set-up

1. Set-up the optics and laser as shown above, mounting the beam reducer optic on the input face of the linear beam splitter using the clamp screws provided.

Note: The beam reducer optic should be orientated so that its position relative to the laser is as indicated by the laser diagram on the top of the optic.

Figure 4



2. Using the tripod and laser head adjusters, align the laser beam by eye to be parallel to the axis of the machine. Ensure the beam splitter/beam reducer optical assembly is square to the axis.

3. Rotate the laser shutter until the full beam diameter is output and a target covers the input port.

Figure 5

4. Using the tripod height adjuster and horizontal adjust on the laser stage, adjust the laser beam so that it strikes the input aperture of the beam reducer optic. The beam should be evenly distributed around the input aperture as shown below.

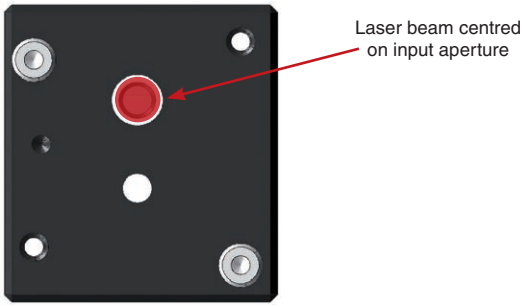


Figure 6

5. Check the return beam from the reference retroreflector hits the centre of the target on the laser shutter.

Note: A small rotation of the beam splitter assembly may be required.

6. Position the small retroreflector close to the beam splitter and move the reflector up/down and left/right until the return beam passes back through the beam reducer optic and hits the laser shutter's target, overlapping the return beam from the reference retroreflector.
7. Drive the machine axis and the small retroreflector away from the beam splitter.
8. Rotate and translate the laser head, **ensuring the laser beam is always striking the beam reducer's input aperture**, until the measurement beam is returned onto the centre of the shutter's target and on top of the reference beam.
9. It may be necessary to repeat steps 6 to 8 to complete the alignment.
10. Rotate the laser shutter into its measurement position and check the signal strength over the axis length. The beam signal strength, as indicated in the laser software, will show a lower than normal reading, even when aligned correctly. This is normal and due to the reduction in beam size. However, as long as the signal is above the 'low' level, then it is adequate for successful measurement.

Other optical configurations

Small optics kit and laser steerer

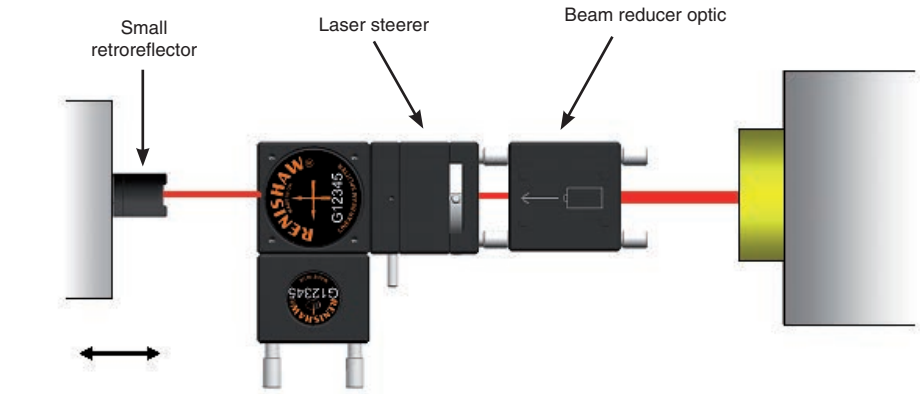


Figure 7

High signal strength configuration

If more signal strength is required, the following set-up can be used.

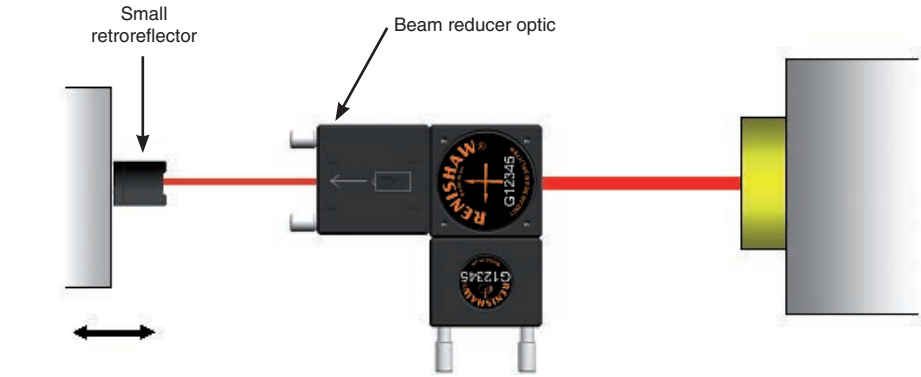


Figure 8

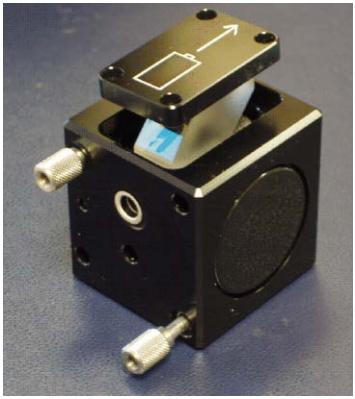
The beam reducer optic is mounted on the output face of the beam splitter. It should be orientated so that its position relative to the laser is as indicated by the laser diagram on top of the beam reducer optic. This requires the thumbscrews to be removed and reinserted on the other face of the beam reducer in the other pair of thumbscrew holes.

Warning: As the beam reducer optic is positioned in the measurement path, more measurement drift may result if the set-up is subjected to a significant temperature change during a measurement.

Care of optics

It is essential for the performance of the system that the optics are kept clean. Dirty optical surfaces are likely to result in a loss of signal strength, making alignment and measurement more difficult. Care should be taken to avoid contaminated atmospheres.

If contamination of the beam reducer's optical surfaces is suspected, they have to be removed from the housing for cleaning. This is achieved by undoing the four screws retaining the optics cartridge within the housing and then carefully inverting the unit to separate it from the housing.



Photograph 5 - removal of the optics cartridge

The optics can then be cleaned using good quality lens tissues together with a proprietary, residue-free, glass-fluid in accordance with the manufacturer's instructions. When reassembling, ensure that the optics carrier is 'butted up' against one of the long edges of the housing before fully tightening the cap screw. This will ensure proper alignment of the optics within the housing.

Note that cleaning should not need to be carried out frequently; the emphasis should be on storage, handling and use of the optics so that they don't become dirty.

Cosine error

The small linear optics kit will often be used over short axis lengths. Following general good practice, to minimise cosine error, the measurement laser beam must be aligned so that it is parallel to the axis of travel. With shorter axes, this becomes increasingly difficult to achieve. Care should be taken to optimise alignment and minimise cosine error using the techniques detailed in the Laser System Measurement Manual.

Specifications

A-8003-3244: small linear optics kit

Maximum measurement range = 4 m

Small retroreflector

Size = 15 mm diameter x 19 mm (standard retroreflector = 38 mm x 37 mm x 30 mm)

Weight = <10 g (standard retroreflector = 100 g)

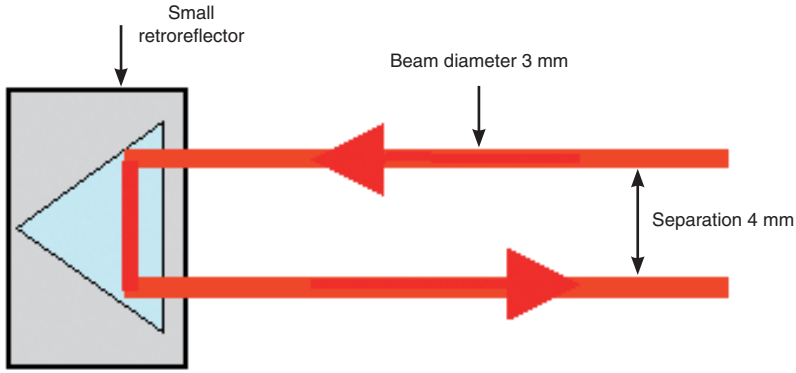


Figure 9 - beam diameter and separation using the small optics kit

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