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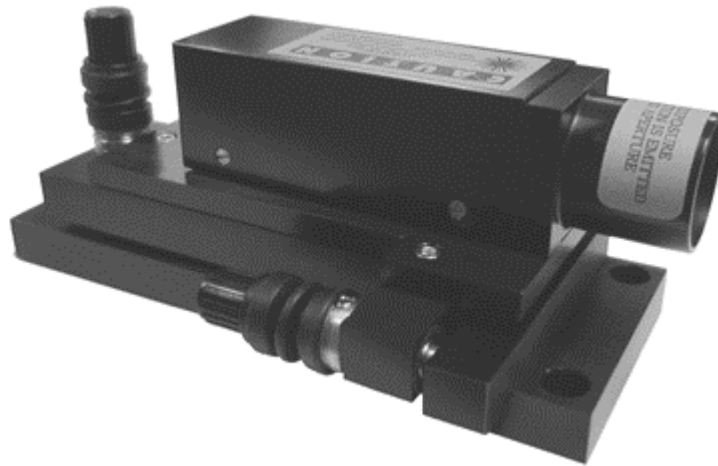
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## **SMALL TARGET LASER AUTOCOLLIMATOR**

### **Model TL40**

The Model TL40 is our small target laser-based autocollimator used for measuring parts to 1mm in diameter. It can measure the position of miniature mirrors, angle of silicon wafers and chips, or the position of poorly reflective surfaces.



## Company Overview

For the past 29 years, Micro-Radian Instruments has met the exacting standards of military, aerospace, metrology, and industry for precision angle measurement. From the first MRA-150 autocollimator to the new ThetaScan Laser-based systems, we have always engaged the latest, most advanced technology available. This continuous improvement has culminated most recently in the revolutionary ThetaScan TL40 laser autocollimator, capable of precision angle measurement and alignment of surfaces down to 1mm square. Our specialized facility in San Marcos, California was designed specifically for the manufacture and testing of angle measurement instruments. Our manufacturing, laboratory, and testing equipment have been selected for their quality and accuracy. Combine these with our experienced technical staff and you have a company with the knowledge and flexibility to meet your specific application requirements. When you deal with a company as experienced and specialized as Micro-Radian, you can be confident that the quality of our instruments will always measure up to your standards. Because they first had to measure up to ours.

### What is an autocollimator?

An autocollimator is an optical instrument that is used to measure small angles with very high sensitivity. As such, the autocollimator has a wide variety of applications including precision alignment, detection of angular movement, verification of angle standards, and angular monitoring over long periods.

### Principles of operation

The autocollimator projects a beam of collimated light. An external reflector reflects all or part of the beam back into the instrument where the beam is focused and detected by a photodetector. The autocollimator measures the deviation between the emitted beam and the reflected beam. Because the autocollimator uses light to measure angles, it never comes into contact with the test surface.

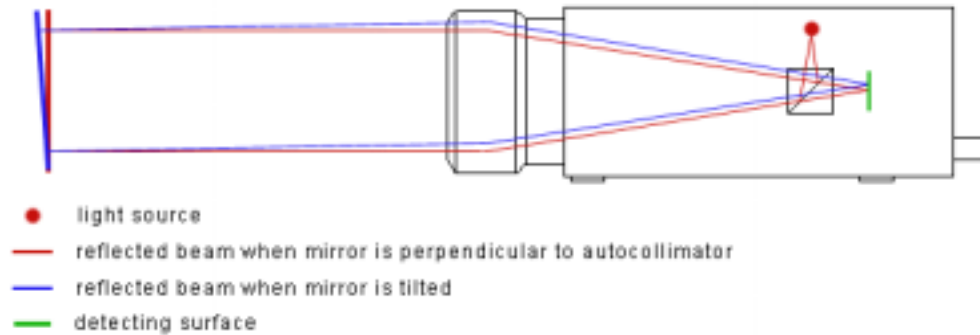
### Digital vs. Visual Autocollimators

#### Digital Autocollimators

Digital autocollimators use an electronic photodetector to detect the reflected beam. Micro-Radian autocollimators take advantage of the latest detector technology including advanced silicon-based photodetectors and germanium-based detectors. The detector sends a signal to the Micro-Radian E2 digital controller, which digitizes and processes the signal using proprietary DSP-based electronics. The processing creates a calibrated angular output, which is traceable to the U.S. National Institute of Standards and Technology. The angular data is retrieved using the digital LCD display, the RS-232 interface, or the analog outputs, which are all, built into the E2 controller. Digital autocollimators are suitable for applications

including calibrating rotary tables, checking angle standards, remote or long term angular monitoring, measurements of flatness or straightness, and to provide angular feedback in servo-controlled systems.

### Digital Autocollimator Diagram



### Visual Autocollimators

Visual autocollimators rely on the operator's eye to act as the photodetector. Micro-Radian visual autocollimators project a pinhole image. The operator views the reflected pinhole images through an eyepiece. Because the human eye acts as the photodetector, resolution will vary among operators. Typically, people can resolve from 3 to 5 arc-seconds. Because the human eye is able to discern multiple images simultaneously, visual autocollimators are suitable for measuring multiple surfaces simultaneously. This makes them ideal alignment instruments in applications like aligning laser rod ends or checking parallelism among optics. Visual autocollimators can also be equipped with an eyepiece reticle for aid in lining up test optics to a master reference. All Micro-Radian visual autocollimators are focused on infinity for suitable use at any working distance.

### Specialized Autocollimators

#### Laser Autocollimators

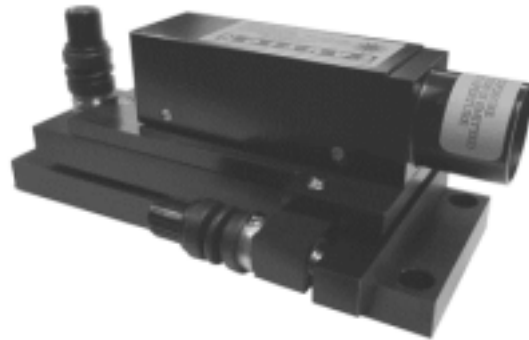
Micro-Radian is the only company that manufactures autocollimators with laser light sources. Micro-Radian laser autocollimators have emitted beams as small as 1.0 mm in diameter. These specialized instruments are designed for measuring small test parts including silicon components, miniature mirrors and lenses, and fiber optic components. Micro-Radian laser autocollimators are also available with IR sources and detectors for use in the near-IR.

#### Beam Steering

The Micro-Radian TL40 laser autocollimator is available in a version suitable for measuring the position of an external laser beam. Please [contact](#) Micro-Radian for more information and to discuss your application.

#### Servo-controlled Systems

Micro-Radian digital autocollimators are available in a version suitable for providing angular monitoring in OEM servo-feedback and servo-feed forward systems.



## Micro-Radian TL40

The Micro-Radian TL40 is the only autocollimator in the world capable of measuring parts to 1.0 mm.

### **The Micro-Beam approach.**

In response to the need for aligning miniature mirrors and silicon read heads, Micro-Radian developed the Micro-Beam approach. The Micro-Beam system enables the TL40 autocollimator to emit a 1.0 mm diameter beam, thus ending the long-standing requirement that beam size and aperture size be the same. This exclusive feature gives the TL40 the ability to measure and align surfaces that were previously too small for autocollimators.

The compact, lightweight TL40 is simple to operate and is ideal for use on assembly lines or in remote monitoring applications. It will operate successfully in any mounting orientation and initial alignment is simple since the beam is easily visible to the naked eye.

For those working at the Telecom wavelengths or in other near-IR applications, the TL40 are available with an optional infrared diode laser and a Germanium detector. The TL40 can also be adapted for beam steering in applications involving external laser alignment.

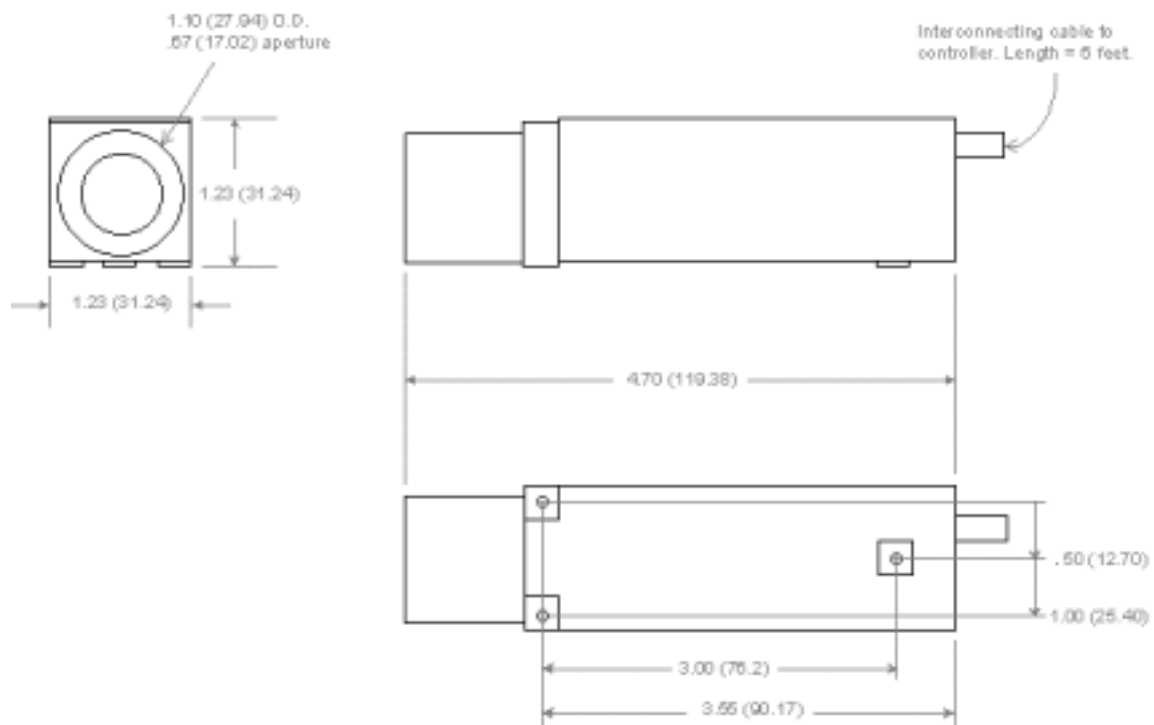
### Specifications

- Minimum target size of 1.0 mm diameter.
- Maximum measuring range of 3600 arc-seconds in each axis.
- Maximum working distance of 1 meter.
- Maximum resolution of 0.1 arc-second.
- Measurement linearity of 99.5%.
- Simultaneous two-axis measurement.
- Maximum measurement bandwidth of 1000 Hz (variable bandwidth optional).
- Diode laser light source, 670 nm, Class II (IR source optional).
- Designed for use with the E2 digital controller.

## E2 Digital Controller

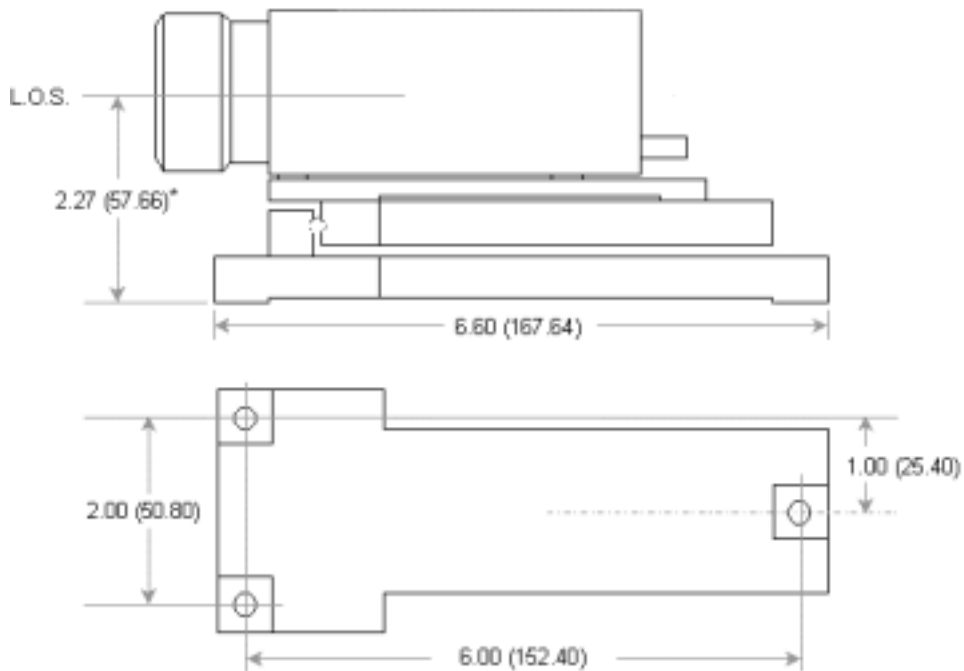
- Digital processing via DSP.
- Dynamic bandwidth LCD display.
- Line-of-sight, low signal indication.
- RS-232 interface.
- Analog output for each axis.
- Selectable zero mode.
- Switching power supply for use with 100V, 115V and 220V input.
- For use with all Micro-Radian autocollimators.
- Optional variable bandwidth switch (10,100,1000 Hz).
- Optional rack mounts hardware.
- Optional storage case.

### Outline and mounting drawing



## Drawing of stand

### S-5 stand outline and mounting (shown here with T100 optical head)



**\*Height of line of sight for stand used with  
the following optical heads:**

**T160 = 2.27 (57.66)**

**T40 = 1.96 (49.78)**

**TL160 = 2.27 (57.66)**

**TL40 = 2.00 (50.80)**



## Customers

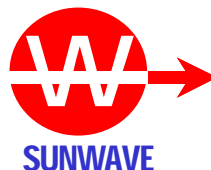
Many companies for measuring small targets use the TL40. These include

- Lucent Technologies,
- Raytheon,
- Eastman Kodak.

## Applications

Typical applications include measuring position of miniature mirrors, angle of silicon wafers and chips, or measuring the position of poorly reflective surfaces.

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