Taylor Hobson
PRECISION

AUTOCOLLIMATORS AND ACCESSORIES RANGE

MEASURING ANGLE, STRAIGHTNESS, FLATNESS, SQUARENESS , PARALLELISM

AMETEK®
ULTRA PRECISION TECHNOLOGIES

THE AUTOCOLLIMATOR RANGE

FOR MEASURING ANGLE, STRAIGHTNESS, FLATNESS, SQUARENESS, PARALLELISM

Used extensively in workshop, tool rooms, inspection departments and quality control laboratories throughout the world, Taylor Hobson Autocollimators - developments of the renowned Hilger and Watts products - are sensitive optical instruments designed for the accurate measurement of small angular displacements. There are five models in this comprehensive range, from the simple Minidekkor to the ultra precision DA20, each produced as a result of the company's commitment to quality optics and backed by a dedicated staff with considerable experience.

THE PRINCIPLES OF AUTOCOLLIMATION

Figures A and B illustrate the basic principles of Autocollimation.

Light from an origin point O is collimated (made parallel) by a high quality objective lens. If the collimated beam falls perpendicularly onto a plane reflecting surface, the light is reflected back along its original path and is brought to a focus at a point coincident with the origin point (as Figure A). If the reflector is tilted through an angle θ, the reflected beam is deflected through an angle 2θ, and the image I is displaced laterally from the origin 0.

The amount of displacement is given by $d=2\theta f$ where f is the focal length of the lens, and θ is in radians.

Given that f is a known constant for the Autocollimator, measurement of the displacement d enables the tilt θ to be ascertained.

A practical Autocollimator is illustrated in Figure C.

Light from an illuminated target graticule at the focus of an objective lens is directed towards the lens by a beam splitter. After reflection by a mirror on the workpiece, the light returns through the Autocollimator and passes through the beam splitter, forming an image of the target graticule in the plane of an eyepiece graticule.

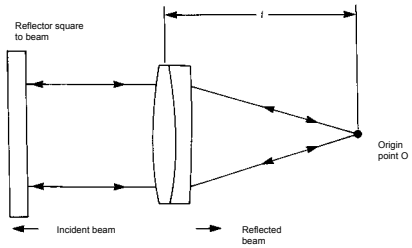


Figure A

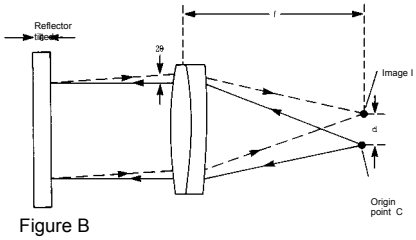


Figure B

The eyepiece graticule and the reflected image of the target graticule are viewed simultaneously through the eyepiece.

The image of the target graticule is always seen in focus and at constant magnification in the eyepiece, regardless of the distance between the Autocollimator and the reflecting surface.

However, at long working distances only a portion of the reflected target graticule may appear in the eyepiece, owing to the failure of obliquely returning rays to enter the Autocollimator. This will result in a restricted measuring range.

Displacement of the image is measured by various means, as detailed in the descriptions of individual autocollimators within this brochure.

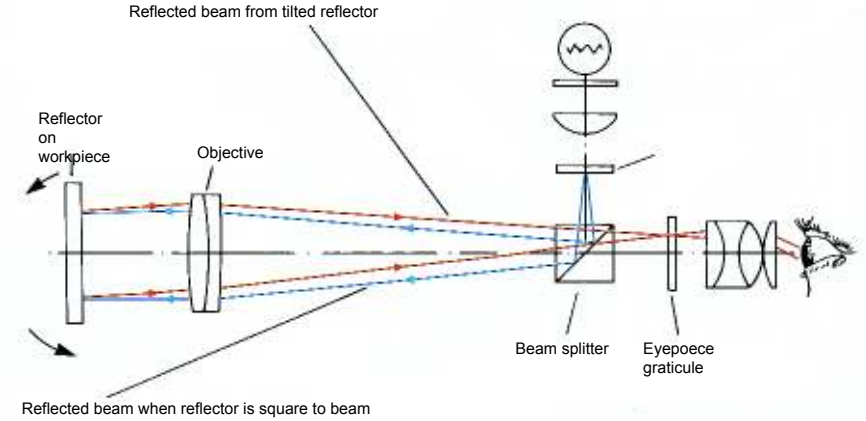


Figure C

AUTOCOLLIMATION IN PRACTICE
CHECKING, MEASURING, INDEXING & MONITORING

Taylor Hobson Autocollimators are used in conjunction with reflecting mirrors or surfaces for the accurate measurement of small angular deviations from a datum angle.

The main advantages of Taylor Hobson Autocollimators are:

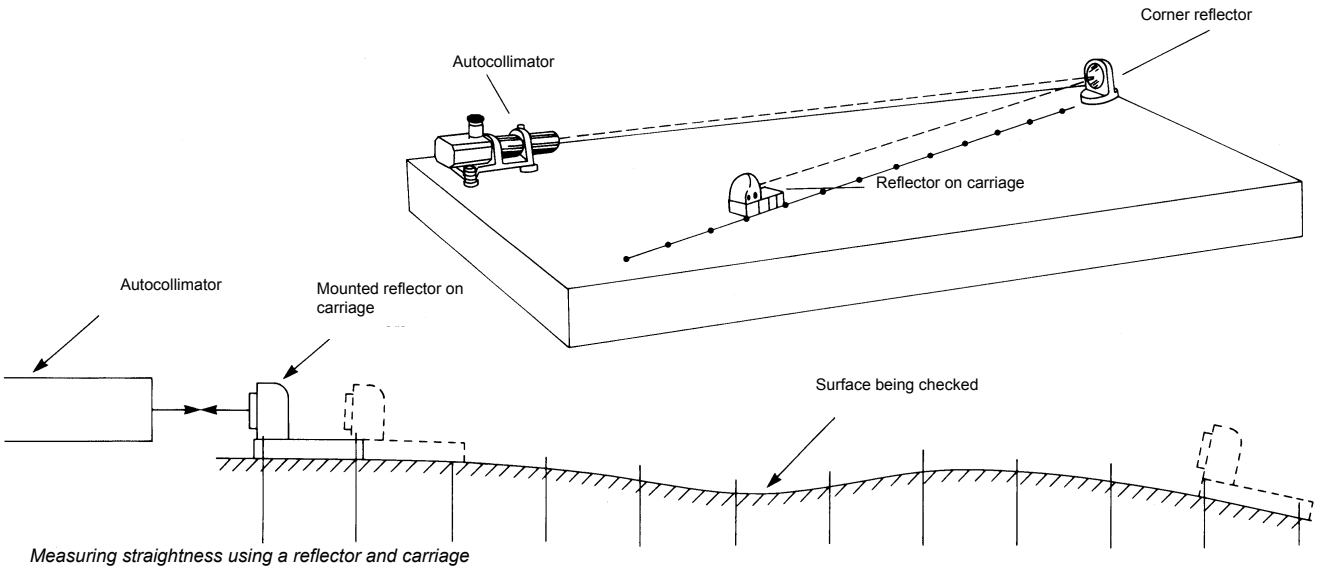
- High accuracy angle measurement
- Easy to set up and operate
- Non contact measurement
- Calibration traceable to international standards
- High performance and repeatable measurement
- Choice of visual or photo electronic systems

DA20 Autocollimator with reference index table used to calibrate a polygon

Precision Machine Tool alignment using DA20 Autocollimator

Their main applications include:

- Checking straightness of machine tool slideways
- Setting the angle of machine tool heads
- Checking dividing heads for their angular displacements
- Measuring very small angles
- Indexing small angles precisely
- Measuring small linear displacements
- Checking flatness of bed plates and surface tables

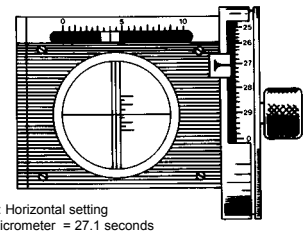


Measuring straightness using a reflector and carriage

VISUAL AUTOCOLLIMATORS. EASY TO USE AND READ

The visual Autocollimators are extremely accurate instruments with a wide variety of applications, particularly for checking straightness and flatness and for angular indexing.

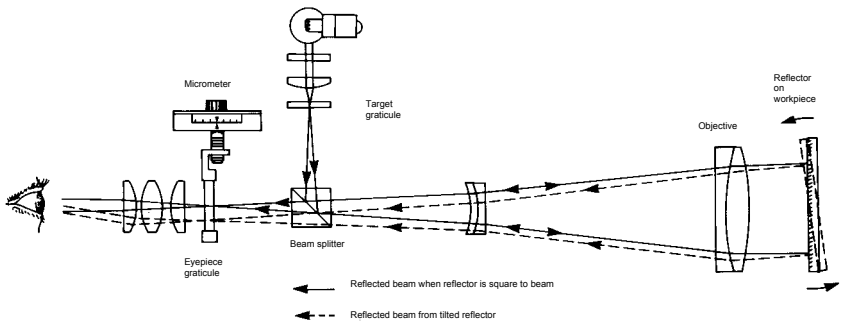
They are normally supplied with the eyepiece positioned for straight through viewing, although the TA51 is available with the eyepiece positioned for right angle viewing if required. All models have a long eyepoint - convenient for spectacle wearers. Measurements are made using a graticule in the eyepiece viewing system with or without micrometers.



Example : Horizontal setting
Micrometer = 27.1 seconds
Turn counter = 4 minutes 30 seconds
Reading = 4 minutes 57.1 seconds
Each graduation equals 0.5 minute (Scale)
Each graduation = 0.2 second (Micrometer)
Double setting lines straddle reflected image

Field of view through eyepiece

Checking a TB100 Clinometer with the TA51 Autocollimator



The Taylor Hobson VA900 and TA51 Autocollimators incorporate a micrometer in the eyepiece viewing system for the precise measurements of angular displacement. The TA51 has two micrometers, one in each axis of measurement.

On single axis types, the instrument is rotated through 90 degrees to measure in a second plane perpendicular to the first.

The micrometer is used to move the eyepiece graticule across the field of view until it coincides with the reflected target graticule image. The angular displacement of the reflector can then be read directly from the micrometer scale.

The field of view as observed though the Autocollimator eyepiece is shown above.

For measuring horizontal displacement in a single axis instrument, the micrometer drum is rotated to move the twin setting lines across the field of view until they straddle the vertical line of the reflected image.

The instrument reading is then the sum of the indicated positions of micrometer and turn counter scale.

The TA51 Autocollimator is normally supplied with a light field graticule. Only one setting line is used in instruments fitted with dark field graticules.

GRATICULES TO SUIT YOUR REQUIREMENTS

The VA900 and Minidekkor Autocollimators are normally fitted with dark field graticules as standard for a better visual contrast from low reflectivity surfaces or a small cross section reflector. However, light field graticule variants can be supplied on request.

TA60 DUAL AXIS MINIDEKKOR Code 142/10

- Lightweight and portable
- Wide range of measurement
- Can measure X and Y Axes at the same time
- Can measure components of low reflectivity or with small surface area

The TA60 Minidekkor is an inexpensive visual Autocollimator using a two axes graticule for general measuring duties in workshop and tool room.

Only 152mm (6in) long for straight through viewing or 203mm (8in) long for right angle viewing, it is an ideal instrument for inclusion in a fitters tool kit for use outside the factory.

The standard Minidekkor is provided with a dark field graticule, forming an illuminated cross line image on a dark background. This offers the advantage of clear images being obtained from low reflectivity surfaces such as unsilvered glass, and from surfaces as small as 3mm (0.125in) in diameter.

With the addition of a microscope objective and linear measuring device, the Minidekkor can be used for measuring radius of curvature of a lens or mirror and, for example, the spacing of electrodes enclosed in a glass envelope.

This Autocollimator is supplied as standard without mounting fixtures. Therefore, when ordering it is important to consider the applications and select the appropriate mounting accessories.

TA51 MICROPTIC DUAL AXIS AUTOCOLLIMATOR
Code 142/13

- Ideal for checking machine slides for straightness and squareness
- Checking flatness of surface tables
- Checking angular indexing tables and polygons
- Low reflectivity surfaces

TA51 Autocollimator

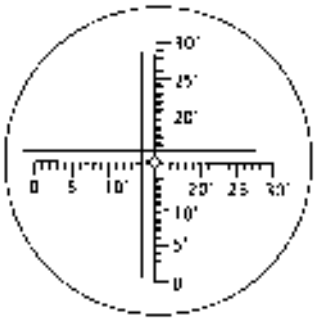
The TA60 Minidekkor

VA900 MICROPTIC DUAL AXIS AUTOCOLLIMATOR
Code 112/2208

- Lightweight high accuracy instrument
- Ideal for precise measurement of angle of components such as prisms and for checking straightness, flatness and angular indexing
- Wide range using combination of graticule and micrometer

The VA900 Microptic Autocollimator is a dual axis, lightweight, highly accurate instrument. It is ideally suited for the precise measurement of angles or components such as prisms, for checking straightness, flatness or angular indexing. Measurement of the two axes is made using a combination of the instrument's two axes graticule and single micrometer.

This Autocollimator is supplied as standard without mounting fixtures. Therefore, when ordering, it is important to consider the application and select the appropriate mounting accessories.



VA900 Graticule

The VA900 Microptic Dual Axis Autocollimator

PHOTOELECTRONIC AUTOCOLLIMATORS

DUAL AXIS MEASUREMENT WITH DIGITAL DISPLAY

The DA instruments are highly versatile Autocollimators which use the latest light source and detector technology to provide dual axis operation with digital display.

Whereas the wide range DA400 is used for a variety of applications, typically in the machine tool industry, the ultra high precision DA20 is used primarily under strict environmental conditions in laboratories.

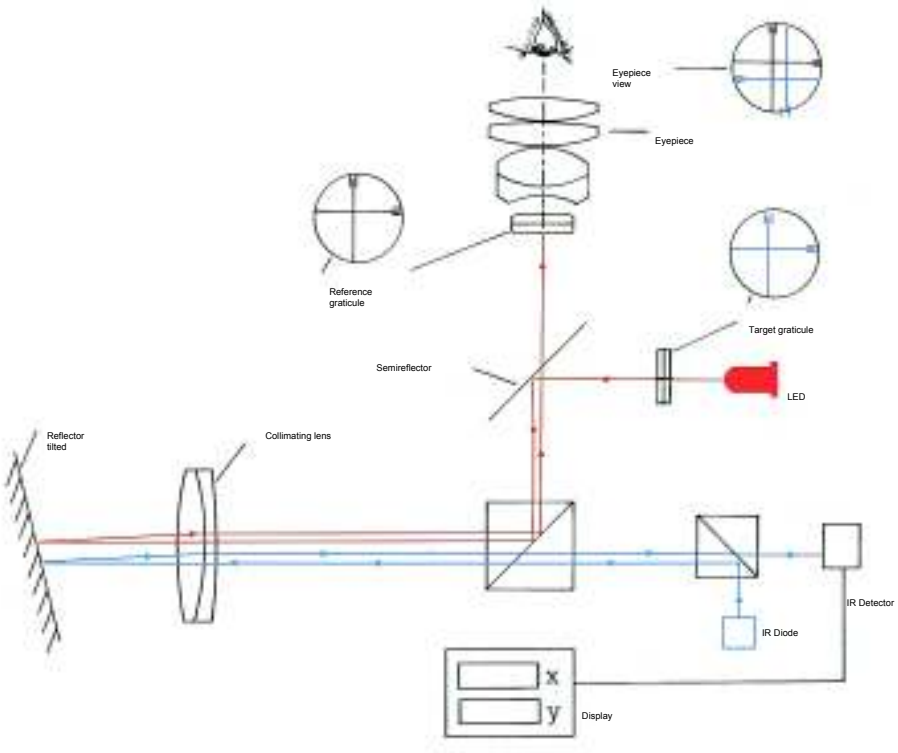
Each Autocollimator has an eyepiece with an independent visual channel to assist initial setting up procedures.

The electronic unit display is readable from several metres. Also incorporated is a signal strength display to ensure correct set up and results.

Measured values of angular displacement are displayed in digital form.

An RS232 interface is provided for connection to various types of accessory computer. Among other applications, this allows computer processing of straightness, flatness, angle and polygon (rotary devices) measurement. A remote control switch is available, enabling the Autocollimator and Electronic Unit to be positioned remotely from the operator.

The DA20 and DA400 dual axis Autocollimators can be provided software which includes a straightness (squareness and twist) program, a flatness (Union Jack or Moody) program and a polygon or rotary analysis package.



DA20 DIGITAL DUAL AXIS AUTOCOLLIMATOR
Code 137/1939

- High accuracy dual axis operation with digital display
- Independent visual channel to assist in setting up
- Direct analogue display, readable from several metres
- RS232 interface provided
- Software programs for flatness, straightness and rotary analysis
- Ideal for ultra-precision measurement and indexing of small angles
- Suitable for calibration of polygons, rotary tables and encoders

DA20 Photoelectronic Autocollimator

Serving a global market

Taylor Hobson is world renowned as a manufacturer of precision measuring instruments used for inspection in research and production facilities. Our equipment performs at nanometric levels of resolution and accuracy.

To complement our precision manufacturing capability we also offer a host of metrology support services to provide our customers with complete solutions to their measuring needs and total confidence in their results.

Contracted Services from Taylor Hobson

- **Inspection services**
  measurement of your production parts by skilled technicians using industry leading instruments in accord with ISO standards
- **Metrology training**
  practical, hands-on training courses for roundness and surface finish conducted by experienced metrologists
- **Operator training**
  on-site instruction will lead to greater proficiency and higher productivity
- **UKAS Calibration and Testing**
  certification for artifacts or instruments in our laboratory or at customer's site

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