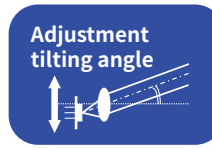
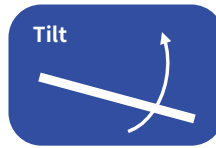


Select from Optical Sensor Model

Angle and Tilt Laser Autocollimator: Smart LAC



Non-contact angle and tilt measurement by using laser.

- Easy setup and measurement by Non-contact and Wide working distance.
- Various application as Optical alignment, Audio & Visual equipment alignment, Machine alignment and material check.
- Image Processing Unit can analyze various condition and process various output.

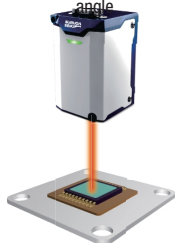
Select from Applications

Smart LAC

Lens tilting Angle



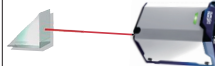
CMOS device tilting angle



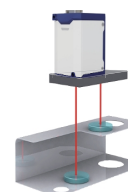
VCM actuator drift



Prism Angle

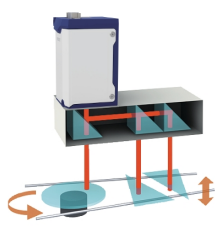


Mechanical parts Parallelism by High precision press



Smart LAC

Parallelism for Motor and shaft



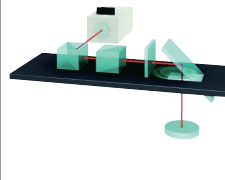
External Laser tilting angle



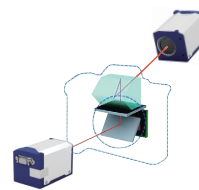
Lens tilting angle



Optical Device tilt angle



Digital Camera Mirror angle

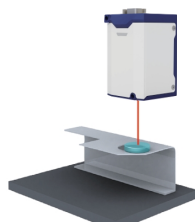


Smart LAC

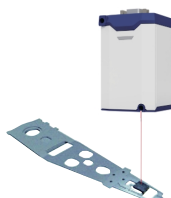
Actuator Skew measurement



Press angle measurement



Gimbal angle measurement



Embedded system

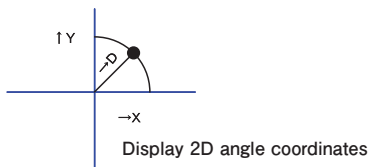


Laser Autocollimator Technical Guide

What is a Laser autocollimator?

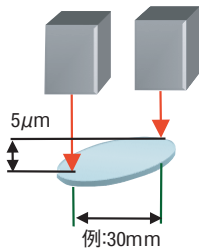
Laser autocollimator

- Measure instantaneously the angle in a single location.
- $\theta \times \theta$ 2 dimension coordinates display
- Long width
- High resolution 1 sec.



Length measurement system

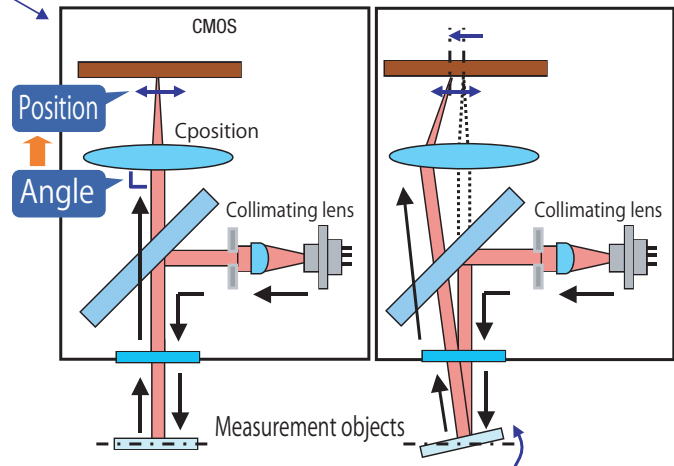
Calculates the differences in height between any 2 points with a length measurement sensor.



5Resolution is $= \text{Atan}(0.005/30) = 34\text{sec}$
in $5\mu\text{m}$ change. $\theta = \text{Atan}(0.005/30) = 34\text{second}$

Angle measurement principle

When the parallel light incidents to the collecting lens, it will be converted to the position information on the focal plane depending on the incidence angle. Irradiation of parallel laser beam to the measurement object using this principle, the tilt value of the object will be measured by collecting reflection light on the CMOS.



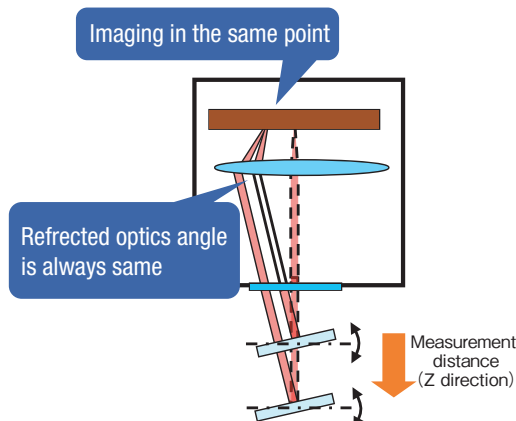
Left drawing: If the object is perpendicular to the irradiation beam, the reflection light returns to vertical, and light will be collected in the center.

Right drawing: In case of the object is tilted, the reflection light will tilt to the left, and also collecting area will move to the left.

Can be known the tilt by measuring the different between the reflection light and collecting area.

Unchanged the measurement result, even the measurement distance is changed.

The measurement result that is gotten by using an autocollimator as an angle is measured directly even if the distance between the object is changed. Available for pitching and yawing measurement of the up and down.

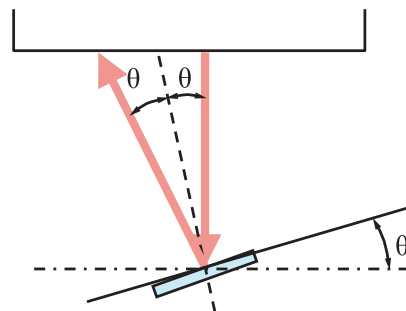


Specialized usage: External light source incidence measurement

Normal (The reflection measurement)

Normally an autocollimator is used in the reflection measurement. (Left drawing) When the object tilt is θ degree, the reflection light returns 2θ degree angle. Autocollimator shows tilt angle θ degree of the object.

(e.g.) When the object tilts 0.1-degree, 0.2-degree tilted reflection light returns to an autocollimator, but measurement value is displayed 0.1-degree.



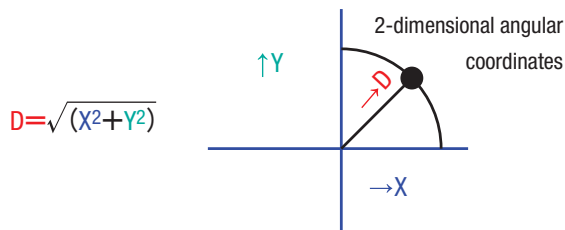
Measure the external light source

Can be measured laser beam tilt that is emitted from the object light source by turning off the semiconductor laser (LD) in the autocollimator.

Angle value

The spot position on the sensor is displayed as 2-dimensional angular coordinates.

As shown in the figure below, the X-direction angle component, Y-direction angle component, and spot-direction angle are displayed. The unit of angle can be selected from deg, rad, sec.



Field of view angle

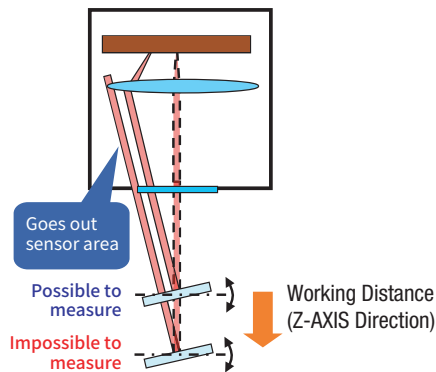
The measurement range (field of view) of the laser autocollimator is determined by the design value of the optical system of the sensor head.

Basically, the measurable range is limited by WD (working distance). Generally, the shorter the distance can measure the wide angle, and the longer the distance can only measure the smaller angle. For details, refer to the specifications of each model.

Laser Autocollimator Technical Guide [Notice]

Working Distance

If the distance between Laser Autocollimator to the Object is longer than a specification, the reflected beam may go out from sensor area, then a specification angular range may not cover. Please use within a specification W.D.



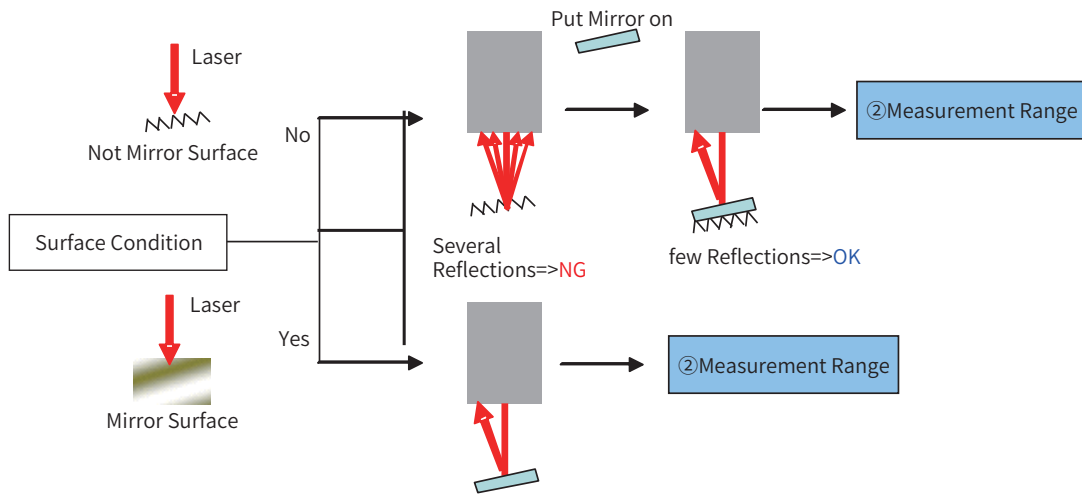
Laser Class

Class 1	A laser that is safe under reasonably foreseeable driving conditions.
Class 1M	Lasers with a wavelength range of 02.5 to 4000 nm that are safe under reasonably foreseeable operating conditions. However, it is considered dangerous when observing using optical equipment.
Class 2	A laser with a wavelength range of 400 to 700 nm (visible light) whose eyes are protected by avoidance behavior including blinking.
Class 2M	A laser with a wavelength range of 400 to 700 nm (visible light) whose eyes are protected by avoidance behavior including blinking. However, it is considered dangerous when observing using optical equipment.
Class 3R	Lasers with a wavelength range of 302.5 nm to 106 nm where direct beam observation is potentially dangerous. Within 5 times that of Class 2 in visible light (400 to 700 nm). Wavelengths other than visible are within 5 times that of class 1.
Class 3B	Lasers that are dangerous to observe the beam directly. However, diffuse reflected light is usually considered safe.
Class 4	A laser that can cause dangerous diffuse reflection. Not only do they cause skin damage, but they can also pose a risk of fire.

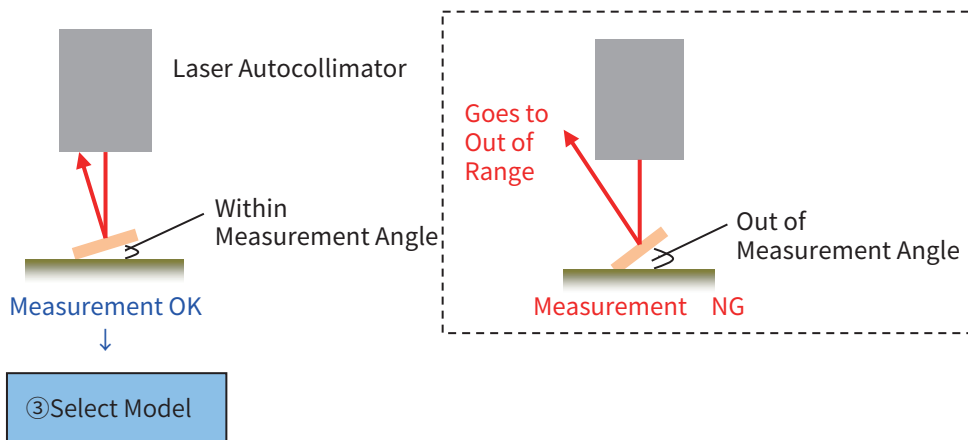
Source: JIS C 6802 excerpt
 Publisher: Japanese Standards Association

Sample preparation

① Check Object Status



② Check Measurement Range



③ Select Model

	Smart LAC H410
Measurement Range	$\pm 1.75^\circ$
Working Distance	0~300mm
Sampling Speed	40Hz

Angle
measurement

Laser
autocollimator

High speed・
High resolution

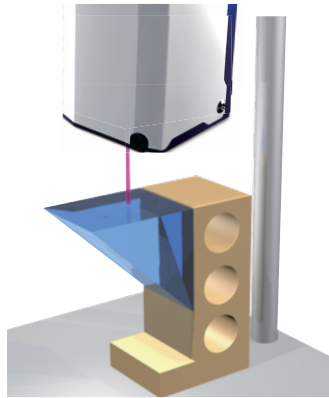
Standard

Accessories

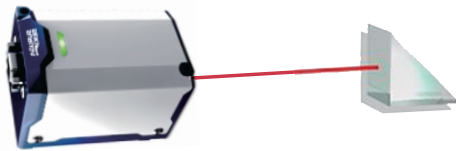
Laser Autocollimator Technical Guide(Measurement Technique)

Right angle Prism measurement

Right angle(90deg) is measured by using jig to hold the prism as blow image.



By Laser Autocollimator setting as horizontal way, Vertical Prism plane can be measured.

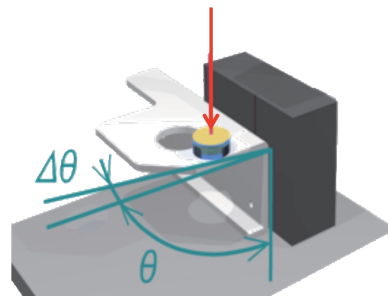


Scattered reflection Measurement (Resin/Metal)

Laser Autocollimator can not handle scattered light, divergent light and condensed light.



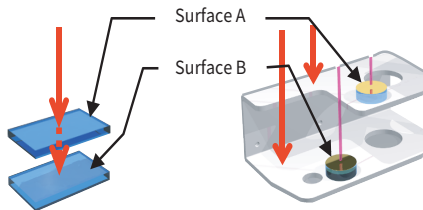
By putting parallel mirror on to the object, Laser Autocollimator can measure object tilting angle.



Simultaneous measurement for two surface parallelism

Laser Autocollimator can measure two different height or two different position tilt angle simultaneously.

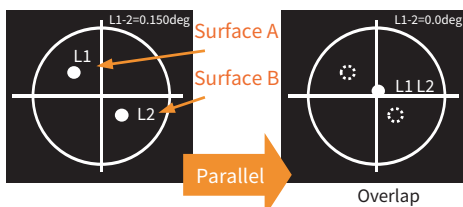
【Two Parallel planes on the same axis】 【Parallelism of two different planes】



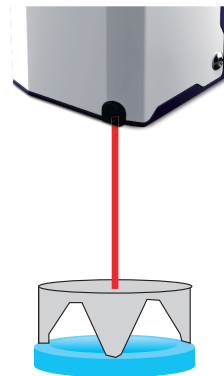
<Left figure> One laser beam is transmitted and the parallelism coaxial surface is measured.

<Right figure> Using 2-Beam adaptor(Optional), different height and position planes parallelism can be measured simultaneously.

At these case, when two plans become parallel, observed spot overlap at one point.



Lens tilt angle measurement



The lens tilt angle is measured by pointing the laser on the Lens Flange(Flat surface point).

<Problem>

Rough surface of Lens Flange.

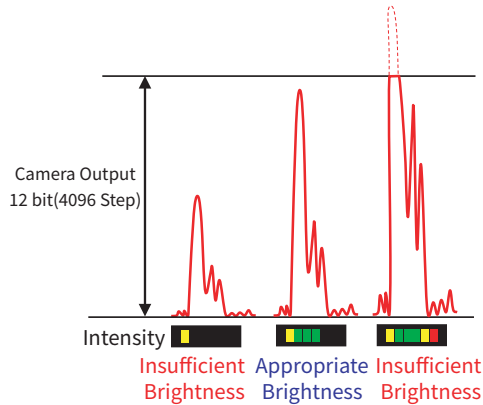
<Solutions>

Use mirror surface jig which is mounted on to Lens flange.

■ Tips for center of gravity evaluation

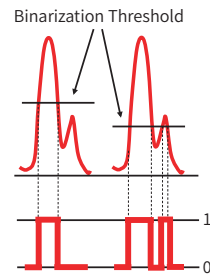
When measuring the tilt of a surface with low flatness such as the edge surface of a lens, Luminance center of gravity mode is suitable.

Luminance center of Gravity mode has better Linearity and repeatability than Area Center of Gravity mode.



When using the Brightness Center of Gravity Mode, in order to improve the measurement accuracy, Check the Intensity and use it within an Appropriate Brightness range.

■ Glossary: Binarization Threshold

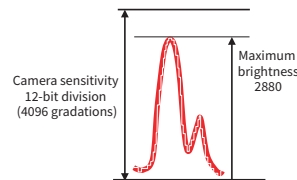


The Binarization threshold is the criterion for converting Gray image to Binary image.

Binarization processing is an image processing method that sets to One which is excess than criteria and other set to Zero.

Remarks: This criteria is set in the Area Center of Gravity Mode.

■ Glossary: 4096 Gradations



An intensity of Laser Autocollimator is 12bit (4096 Steps)

At the Brightness Center of gravity case, 12bit data is used to get Brightness Center of Gravity,

At the Area Center of Gravity, Binary data is used to get Area Center of Gravity.

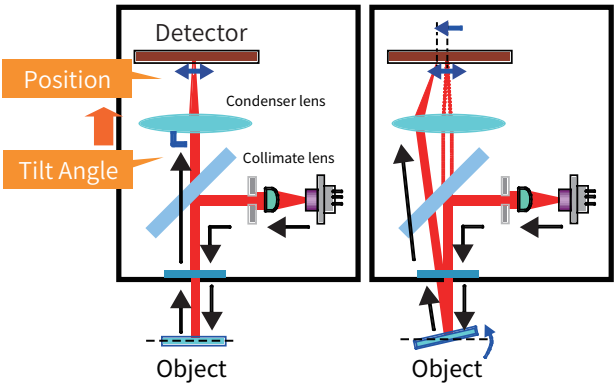
Then the Brightness Center of Gravity value is accurate the Area Center of Gravity value.

Remarks: Noise reduction criteria must be set for the Brightness Center of Gravity mode.

Smart LAC

Angle measurement

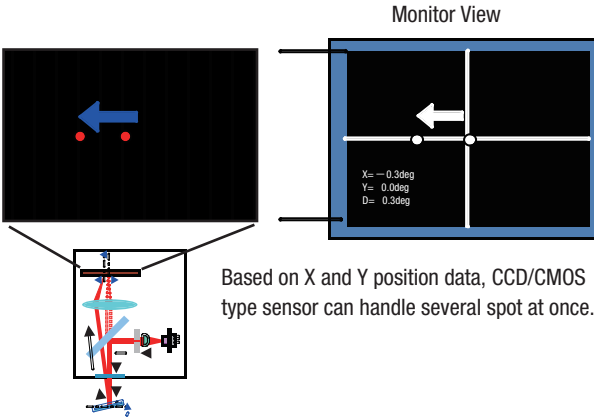
Laser autocollimator



Detector	
Detector	Model
CMOS	Smart LAC H410

CMOS Complementary Metal Oxide Semiconductor

2D position sensor



High speed•
High resolution

Standard

Accessories

Requests/Inquiries

For requests and inquiries regarding our products and support, please contact us.

- Need a drawing of an optical sensor product
- Need a price of the product
- Need an instruction manual for optical sensor products
- Need a sample program of IPU

e-ost@suruga-g.co.jp

Please Contact.

- Demo request

- ① Company Name
- ② Contact Person
- ③ Model name
- ④ Desirable Date
- ⑤ Use case

Please note ① to ⑤, then please contact us.

e-ost@suruga-g.co.jp

Please Contact.

Standard Demo period is two weeks.

- Products Calibration Service
- Issue Inspection Certification

Please contact with a request for [Inspection Certification]

e-ost@suruga-g.co.jp

Please Contact.

- ※ Calibration fee is required separately.
- ※ If you need to ship the inspection certificate and the product together, Please contact us before ordering.