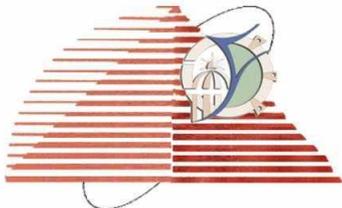


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

*Measurements  
and  
Metrology*



**Fayoum University**



**Faculty of Engineering  
Industrial Engineering Dept.**

*Lecture (8)*

*on*

*Measurement Based on  
LASER*

*By*

*Dr. Emad M. Saad*

*Industrial Engineering Dept.*

*Faculty of Engineering*

*Fayoum University*

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# LASER Metrology

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- **Laser stands for Light Amplification by Stimulated Emission of Radiation.**
- **Laser instrument is a device to produce powerful, monochromatic, collimated beam of light in which the waves are coherent.**
- **Metrology lasers are low power instruments. Most are helium-neon type. Wave output laser that emit visible or infrared light. He-Ne lasers produce**
- **Laser systems have wide dynamic range, low optical cross talk and high contrast. Laser find application in dimensional measurements and surface inspection because of the properties of laser light. These are useful where precision, accuracy, rapid non-contact gauging of soft, delicate or hot moving points.**





# LASER Use

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## Laser Telemetric system

- Laser telemetric system is a non-contact gauge that measures with a collimated laser beam.
- It measures at the rate of 150 scans per second.

## Application Fields

- The high speed of scanning permits on line gauging and thus it is possible to detect changes in dimensions when components are moving on a continuous product such as in rolling process moving at very high speed.
- This system can also be applied on production machines and control them with closed feedback loops.

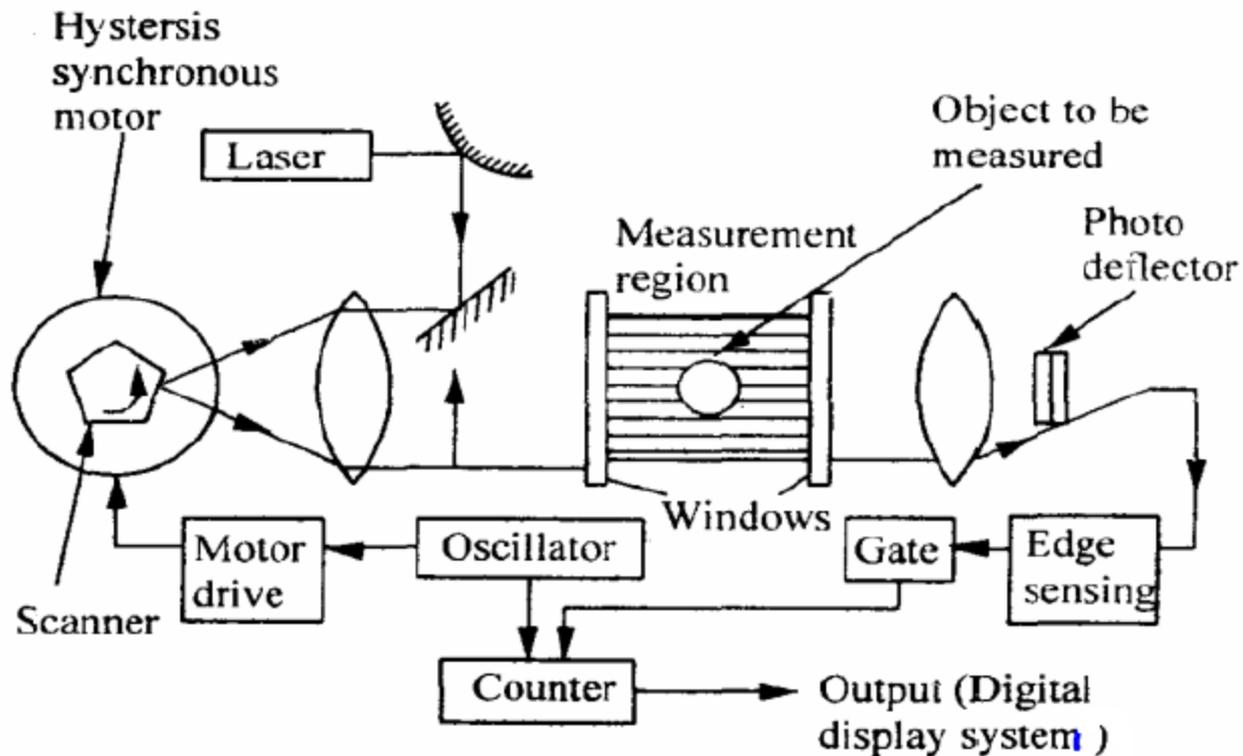




# LASER Use

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## Laser Telemetric system





# LASER Use

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## Laser Telemetric system

It basically **consists of three components, a transmitter, a receiver and processor electronics**. The transmitter module produces a collimated parallel scanning laser beam moving at a high constant, linear speed. The scanning beam appears a red line. The receiver module collects and photoelectrically senses the laser light transmitted past the object being measured. The processor electronics takes the received signals to convert them to a convenient form and **displays the dimension being gauged**. The transmitter contains a low power helium-neon gas laser and its power supply, a specially designed collimating lens, a synchronous motor, a multi faceted reflector prism, a synchronous pulse photo detector and a protective replaceable window. Since the output of this system is available in digital form, it can run a process controller limit alarms can be provided and output can be taken on digital printer.





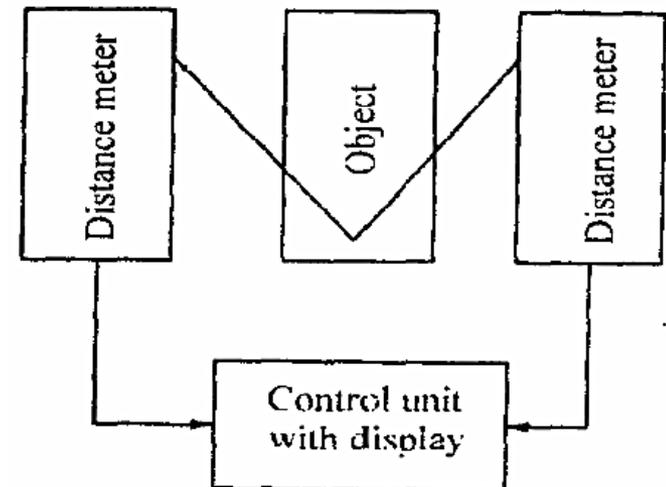
# LASER Use

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## Laser and LED based distance measuring instruments

These can measure distances from 1 to 2 inch with accuracy of the order of 0.1 to 1% of the measuring range. When the light emitted by laser or LED hits an object, scatter and some of this scattered light is seen by a position sensitive detector or diode array. If the distance between the measuring head and the object changes,

The angle at which the light enters the detector will also change. The angle of deviation is calibrated in terms of distance and output is provided as 0-20mA. Such instruments are very reliable because there are no moving parts their response time is milliseconds. The measuring system uses two distance meters placed at equal distance on either side of the object and a control unit to measure the thickness of an object. The distance meter is focused at the centre of the object.





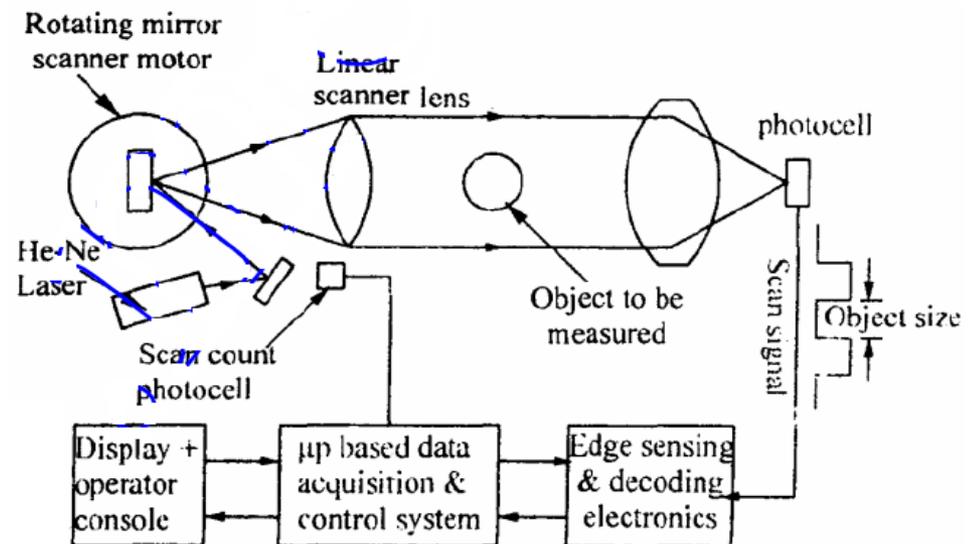
# LASER Use

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## Scanning Laser gauge

The scanning laser gauge consists of transmitter, receiver and processor electronics. A thin band of scanning laser light is made to pass through a linear scanner lens to render it parallel beam. The object placed in a parallel beam, casts a time dependent shadow.

Signal from the light entering the photocell (receiver) is processed by a microprocessor to provide display of the dimension represented by the time difference between the shadow edges. It can provide results to an accuracy of 0.25 for 10 to 50mm diameter objects. It can be used for objects 0.05mm to 450mm diameter; and offers repeatability of 0.1 $\mu$ m.



Thank  
You