

## High-Accuracy Non-Contact Measuring Sensors LASER SCAN MICROMETER

Combines high-rate scanning with highly accurate measurement

SENSOR SYSTEMS



# Laser Scan Micrometers

High scanning rate (3200 scans/sec) and high accuracy, non-contact measuring systems, the laser scan micrometer (LSM) inspects small, fragile workpieces at a high temperature, even while in motion or vibrating.



## FEATURES

### 0.005mm-diameter ultra-fine wires to 160mm-diameter cylinders can be measured: Seamless measurement range models

A rich assortment of models for diverse measuring applications. The LSM-500S can measure ultra-fine wires as thin as 0.005mm in diameter to a resolution of 0.00001mm, and the LSM-516S can measure cylindrical workpieces with a diameter as large as 160mm. The LSM-9506 benchtop model combines a display section and measurement section in a single unit.

### Ultra-high scanning rate of 3200 scans/sec

The incorporation of a 16-face polygonal mirror and a high-precision motor now makes scanning at 3200 scans per second possible. This formidable capability is ideal, for example, for taking measurements on high-speed production lines or on vibrating workpieces.

### Certified accuracy over entire measurement range

The specified accuracy over the entire measurement range is certified by the "Traceability System to the International Standard" which Mitutoyo, as a leading manufacturer of precision measurement tools and instruments, has established within its business practices.

### Improved resistance to IP64-level environments

The measuring unit has been extensively developed to resist rough measurement environments. As a result, for example, it can operate at an ambient temperature of 45°C. (IP64-level resistance is not guaranteed for the display unit and the LSM-9506.)

### DIN-size compact panel-mounted display unit (LSM-5200)

The LSM-5200 display unit is a compact DIN size, allowing it to be mounted in a panel so as to be suitable for mounting in a rack, etc., for use on production lines.

### Standard I/O output, analog output and RS-232C output interfaces. Wireless capable

The LSM-5200/6200/6900 has a standard I/O and analog output interface to connect it to an operation controller or PLC used on a production line. Also, every model has a standard RS-232C interface for connection to personal computers or printers. Capable of using U-wave wireless system using optional accessories.

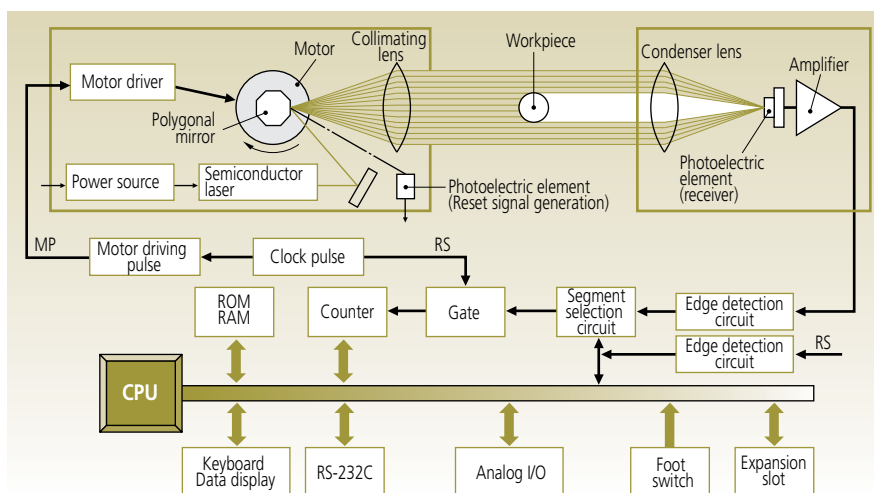
### QUICKTOOL

**Free Quicktool\*** software simplifies the setup and operation of the LSM-6200/9506/6900.

This program can be downloaded from <http://www.mitutoyo.jp>

\*For use with customer-supplied PC and RS-232C cable

## PRINCIPLE



A laser beam is directed at a polygonal mirror rotating at high speed in exact synchronism with highly stable pulses from the system clock. The reflected beam is rotating clockwise as it sweeps across the input surface of a collimating lens but changes direction to be always horizontal after the lens' exit surface as it moves, or scans, downward. This horizontal beam enters the measuring space and, with no workpiece present, reaches a receiver via a condensing lens to produce an output signal. When a simple workpiece (a cylinder, for example) is put into the measuring space the beam will be interrupted for a time during its sweep and this time, as indicated by clock pulses occurring while the receiver signal is absent, is proportional to the workpiece dimension in the downward direction.

Each transition between the receiver detecting the beam and then not detecting the beam, or vice versa, is called an edge and marks the start and/or end of measuring sections called segments, so that the differences in position of these edges define the length of each segment. The edges and segments generated by a workpiece are numbered sequentially by the instrument and are used when writing programs to extract the required dimensional data.

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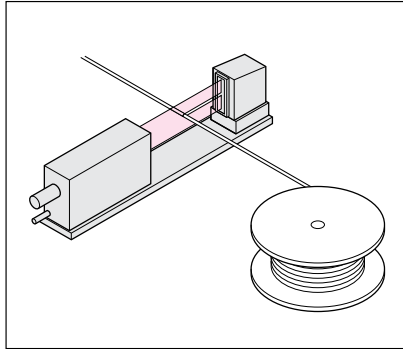
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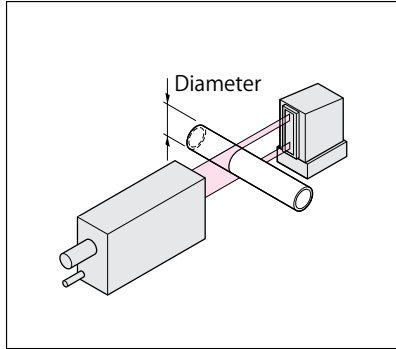
# Applications

## Measurement Examples

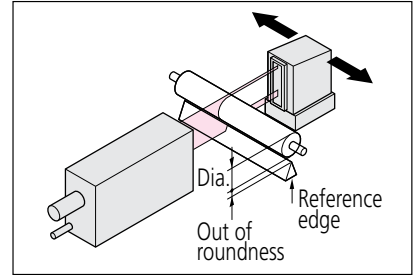
In-line glass fiber or fine wire diameter



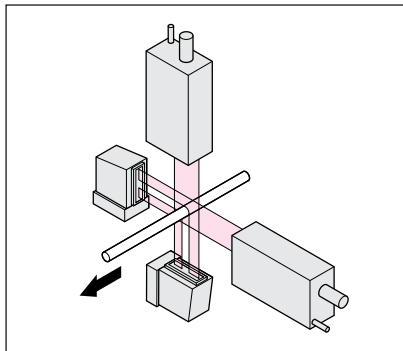
Outer diameter of opaque or transparent cylinders



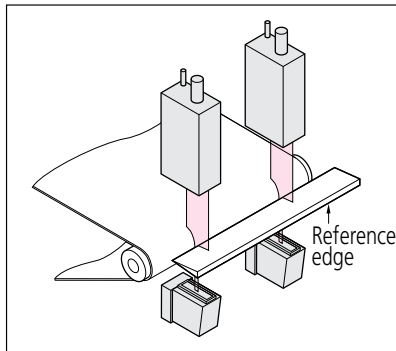
Outer diameter and roundness of cylinder



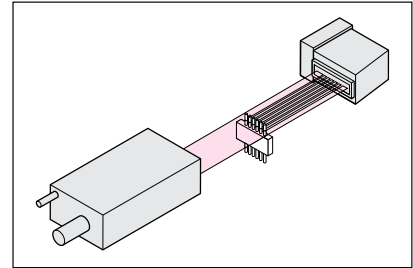
X- and Y-axis electric cables and fibers



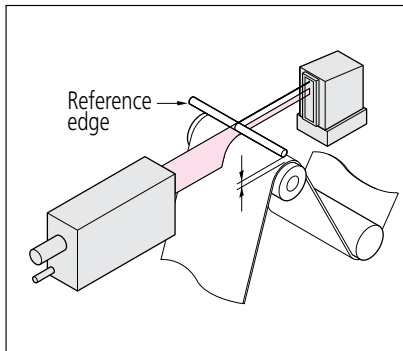
Thickness of film and sheet



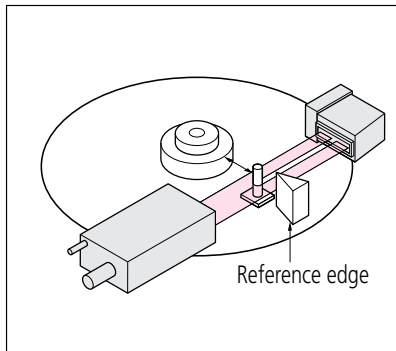
Spacing of IC chip leads



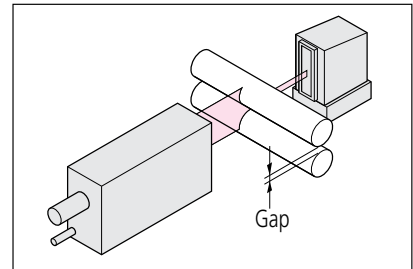
Film sheet thickness



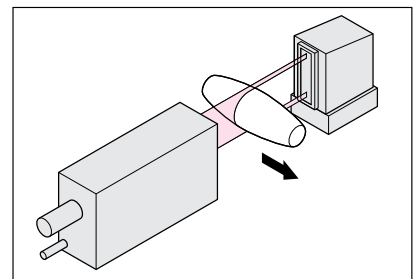
Disk head movement



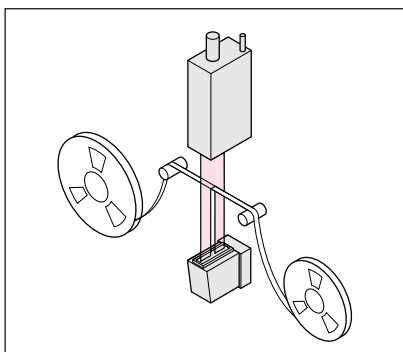
Gap between rollers



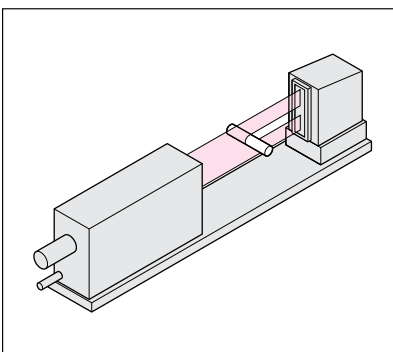
Taper and form



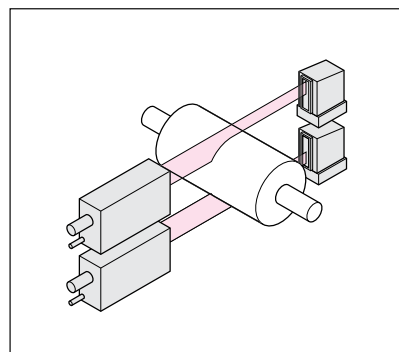
Tape width



Outer diameter of optical connector and ferrule



Dual system for measuring a large outside diameter



## Optimal for Inspecting the Outside Diameter of Pin Gages or Plug Gages

The use of world-class laser scan micrometer LSM-902/6900, along with an adjustable workstage, allows high-accuracy measurement inspection of the outside diameter of pin gages or plug gages. This LSM is also capable of data output to an external device such as a personal computer from the display unit.

(Measurement data can be stored easily in EXCEL by using a Mitutoyo input tool.)

### Major Specifications

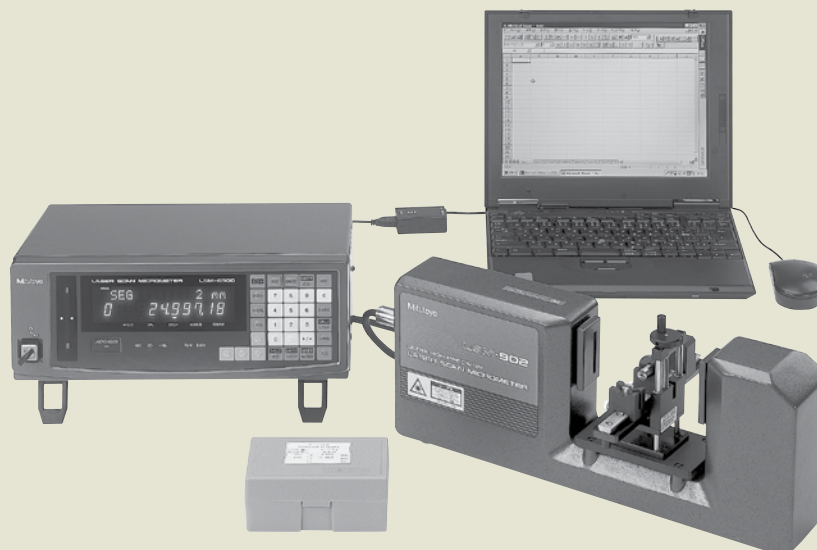
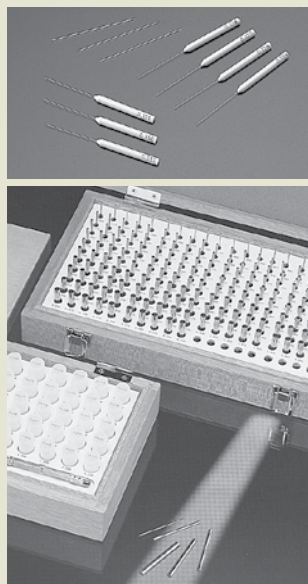
**Measuring range:** 0.1mm to 25.0mm in diameter

**Resolution:** 0.01 $\mu$ m

**Linearity:** from  $\pm 0.3\mu$ m to  $\pm 0.5\mu$ m\*

**Repeatability:**  $\pm 0.05\mu$ m

\* depending on  $\Delta$  from calibration size





# MODELS OF LASER SCAN MICROMETERS

## MEASURING UNITS

Measuring range	Model	Page
0.005 - 2mm (.0002" - .08")	<b>LSM-500S</b> 	10
0.05 - 10mm (.002" - .4") FDA Class II	<b>LSM-501S</b> 	12
0.3 - 30mm (.012" - 1.18")	<b>LSM-503S</b> 	14
1 - 60mm (.04" - 2.36")	<b>LSM-506S</b> 	16
1 - 120mm (.04" - 4.72")	<b>LSM-512S</b> 	18
1 - 160mm (.04" - 6.30")	<b>LSM-516S</b> 	20

## MEASURING UNIT (Factory-set package)

Measuring range	Model	Page
0.1 - 25mm (.004" - 1.0")	<b>LSM-902/6900</b> 	8

## MEASURING UNIT WITH INTEGRATED DISPLAY

Measuring range	Model	Page
0.5 - 60mm (.02" - 2.36")	<b>LSM-9506</b>  <p>Measuring unit / integrated-display model for benchtop use only</p>	22

## DISPLAY UNITS

Type	Model	Page
Multi-function (Power Supply 100V - 240V AC)	<b>LSM-6200</b>  	29
Compact (Power Supply +24V DC)	<b>LSM-5200</b>  	28

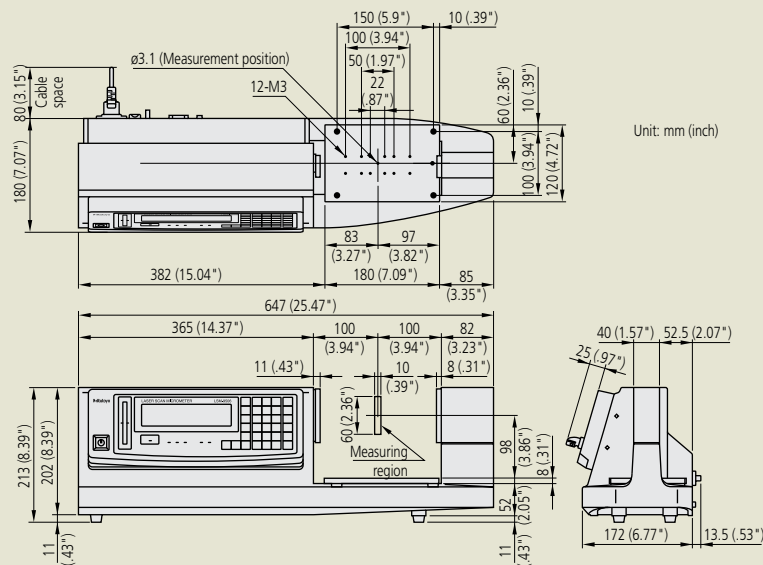
# LSM-9506

## Benchtop with Display Unit

- With a design that integrates the display section and measuring section into one unit, this instrument is best suited for making benchtop measurements in an inspection room.
- A statistical calculation function is provided.
- Standard RS-232C and SPC output interfaces are provided as standard.



### Dimensions



### SPECIFICATIONS

Model	LSM-9506
Order No. (Order no. suffix denotes the AC power cord type equipped.)	544-116-1A
120V AC	
Type	inch/mm
Measuring range	.02" - 2.36"/0.5 - 60mm
Resolution (selectable)	.000002" - .005"/0.00005 - 0.1mm
Repeatability*1	±0.6µm (±24µinch)
Linearity at 20°C*2	±2.5µm (±100µinch)
Positional error*3	In the optical axis direction: ±2.5µm (±100µinch) In the scanning direction: ±(2.0+L/10µm) (±(.00008+L/10000)")
Measuring region*4	10 x 60mm (.4" x 2.36")
Scanning rate	1600 scans/s
Laser wavelength	650nm, Visible*5
Laser scanning speed	226m/s (8900"/s)
Power supply	120V AC ±10%, 60Hz, 40VA
Data output	Via RS-232C interface, SPC (Digimatic) output port
Functions	(See page 30.)
Operating temperature	0°C - 45°C
Operating humidity	35 - 85% RH (with no condensation)
Mass	13kg (28.6lbs.)

### OPTIONAL ACCESSORIES

**02AGD170**  
Calibration gage set (ø1.0mm, ø60mm)



- 02AGD680** Adjustable workstage
- 02AGD580** Center support\*
- 02AGD590** Adjustable V-block\*
- 936937** SPC output cable (1m)
- 937179T** Footswitch

\*Use with an adjustable workstage.

- \*1: Determined by the value for  $\pm 2\sigma$  at the measurement interval of 0.32 sec.
- \*2: At the center of the measuring region.
- \*3: An error due to workpiece shift either in the optical axis direction or in the scanning direction. L= Distance between the center of workpiece and the center of optical axis (in mm or inches).
- \*4: The area given by "measuring range on the optical axis" x "measuring range in the scanning direction."
- \*5: FDA Class II (**544-116-1A**) semiconductor laser for scanning (Maximum power: 1.0mW)