

# Newsletter

Issue 4

## Encoder Production

Find out how precision Encoders are made at Precizika metrology

## Laserscale

Magnescale in the pursuit of Picometers ( $10^{-12}$  meters)

## Compass

An ancient geometric instrument by Bocchi control

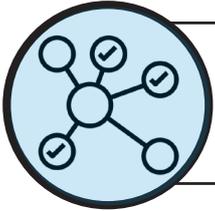


Precision Through Innovation

INNOVATIVE  
MEASUREMENT  
TECHNOLOGY LTD.

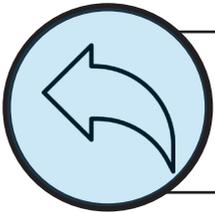


# About us



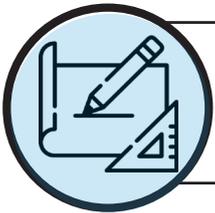
## Extensive product range

Full range of precision metrology instruments from Sony Magnescale, Metro, Precizika Metrology, IBR & Bower Group



## Product repairs / refurbishments

Ability to repair products including older discontinued units via our partners



## Customised measurement solutions

Complete custom measurement solutions including retrofits and access to other fields of engineering

## Suppliers for some the most well known companies in the industry

Innovative Measurement Technology Ltd is a family run business with collectively over 65 years' experience in this industry.

We are well known as one of the leading distributors of high end metrology products for a broad range of applications.

Established as a limited company in 2008, IMT started off by producing gauging transducers with accompanying electronics, gaining a reputation for our reliability and great customer service. Since then we have

# About us



expanded our lineup to include precision workshop tools with custom options, digital displays from Metro, high resolution Encoders from Precizika Metrology as well as the full lineup of IBR products.

Further strengthening our product line, in 2020 Innovative Measurement Technology took over the distributorship for Magnescale Co Ltd in the UK. The range of products from Magnescale (formally Sony Magnescale) enables us to offer customers a complete metrology system.

In 2021 Innovative Measurement Technology teamed up with Bowers Group which gives our customers access to Bowers own products and other well known brands such as Sylvac, Baty, Moore & Wright, Trimos and more.

We are also proud to be part of the GTMA, a UK based trade association which represents the majority of engineering sectors and seen as great resource for companies searching for quality suppliers.

As a company we strive for excellence, Innovative Measurement Technology Ltd wants to be a one stop metrology shop for all your instruments.

# Encoder

# Encoder Production

by Precizika Metrology



## **In the pursuit of environmental resistance and high precision, magnetism was the answer.**

The history of Magnescale began with the invention of a magnetic head with magnetic flux response in 1965 by Mr. Mitsuyoshi Uemura of Sony and others. More than 50 years have passed since then, and today they have magnetoresistive (MR) heads, and the magnetic materials have changed, but the essence is the same: a position detection system that is resistant to adverse environments due to its magnetic detection method. They are not affected by condensation or oil, which are common to machine tools, and they continue to have high vibration resistance and shock resistance characteristics.

It also follows the thermal expansion and contraction of the machine tool table.

The evolutionary form of Magnescale is SmartSCALE, which was released in 2015. This system uses a tunnel magneto-resistive (TMR) device as the magnetic sensor and completely separates the scale from the head by developing new magnetic materials, signal processing circuits, and interpolation algorithms. This is the first system in the industry to achieve both IP67 environmental resistance and high resolution of 5 nm for NC machine tools.

**SmartSCALE achieves high resolution with the interpolation processing technology developed by Magnescale.**

Interpolation processing technology is a technology that accurately divides the signal waveform detected from a magnetic scale to the required pitch (fineness). For example, in the case of a SmartSCALE, two sine waves with a phase shift of 90 degrees are detected from a magnetic scale engraved with a pitch of 400 $\mu$ m.

If the signal contains distortion, accurate position information (true value) cannot be obtained. The DC component is removed from the signal detected from the scale, level and phase adjustments are made in real time. The position information with a resolution of 5nm is obtained by dividing the signal into 80,000 segments through advanced signal processing.



# Compass

## An ancient geometric instrument

by Bocchi Control

A square and compass has been used since ancient times. A square in order to create straight lines and cuts, and the compass being used to create the curved lines required in carpentry and other applications.

The initial design for a compass comprised of two rods of equal length, at the ends of which there are respectively a fixing system (needle) and a writing system (nib or chalk), thus allowing the user to create the curved lines desired.

The main two types of compasses are markers and gauges. Markers are used in the preliminary stages of the production to sketch the desired contours onto the given piece of material either by scoring the material or using a writing system like that mentioned previously in the form of chalk. The second form of compass (gauges) is then

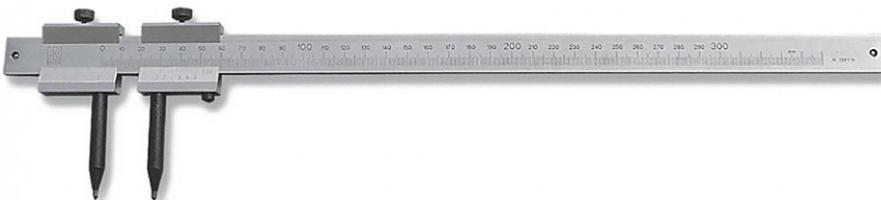
used to measure the thickness or distance between two points along a contour, in similar context to callipers.

There are numerous variations of compass, with precision ranging from one tenth to one hundredth of a millimetre. The compasses precision is provided to the client with a millimetre scale, micrometre screw and two slides with tips made of suitable material to the surface to be tracked. Like all precision metrology the measuring instruments must undergo regular and stringent testing in order to conform to relevant calibration requirements. This regular calibration checking ensures the quality of the product remains precise throughout the manufacturing process and there are no variation in products.

Different tip size and hardness depends on the application of the device, whether they

be for electrical componentry or a material with a high hardness.

Bocchi offers a vast variety in both compass markers and gauges depending on client requirements and can be contacted for bespoke specifications.



**“Proud to contribute to the development of “MADE IN ITALY” in a sector of advanced technological level.”**



Find out more from Bocchi Control on our website or directly from Bocchi

[www.bocchicontrol.it](http://www.bocchicontrol.it)



Range: 400 & 700mm

Resolution: 0.001 $\mu$ m

Data Output: USB / RS232

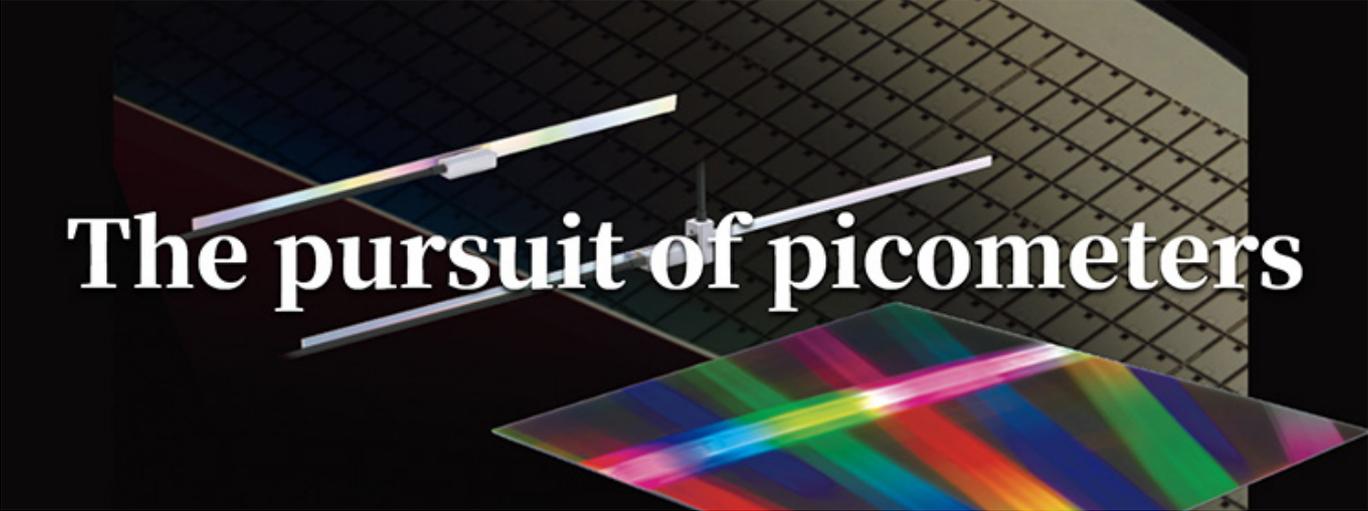
Robust Design

# TRIMOS

## V3

### Height Gauge





# The pursuit of picometers

# Laserscale

by Magnescale

## Laserscale resolution finally reaches the realm of picometer

Laserscale resolution is poised to surpass not only the nano level, but also the realm of picometers.

Development aimed at resolutions that anticipate customer needs has indeed progressed at the pace of Moore's Law.\*

The high resolution and stability of Laserscales supports advanced measurement and positioning control. Laserscales are essential in fields requiring superior precision and resolution, such as next-gen semiconductor manufacturing and camera lens mould fabrication.

Meanwhile, we have continued to anticipate customer needs by expanding the scope of measurement from one dimension to two, and with Z sensors, to three, and by developing one of the world's most precise encoders for angular measurement.

### \*Moore's Law

: Posits that semiconductor integration doubles about every two years. Drawn from the experience of Intel co-founder Gordon Moore in 1965.

## Grating interferometer scale technology

It uses a lattice interferometer developed by Magnescale for the detection principle,

which enables measurement and control unaffected by temperature, air pressure, and air turbulence.

## Holographically generated scale.

Because the scale is holographic, it provides an output signal with excellent linearity.

## Excellent interpolation processing technology

Our proprietary interpolation circuit and signal compensation technology can provide excellent interpolation accuracy.

## Products

\*other series also available



### BS Series

ultra-high resolution Laserscale

Transmissive type ultra high resolution Laserscale BS78, BS65. Ideal for precision stages, semiconductor inspection/ manufacturing systems and ultra precision processing machines.

**Max resolution:**

2.1 pm

**Signal Pitch:**

138 nm

**Measuring length:**

- BS78: 10mm- 420 mm
- BS65: 160mm- 960 mm

**Maximum response speed:**

400 mm/s

**Scale Material:**

- Low expansion glass (BS78)
- Soda lime glass (BS65)

**Thermal expansion coefficient:**

- Low expansion glass  $-0.7 \times 10^{-6}/^{\circ}\text{C}$
- Soda lime glass  $8 \times 10^{-6}/^{\circ}\text{C}$

### BL Series

high response speed Laserscale

Reflective type high response speed Laserscale. Ideal for precision stages, semiconductor inspection systems, precision processing machines and liquid crystal manufacturing equipment.

**Max resolution:**

6.1 pm

**Signal Pitch:**

400 nm

**Measuring length:**

- BL57: 30mm- 1060 mm

**Maximum response speed:**

- When BD700 is connected 3,000 mm/s
- Analog Output 5,000 mm/s

**Scale Material:**

- ZERO glass
- Alkali-free glass

**Thermal expansion coefficient:**

- ZERO glass  $0.1 \times 10^{-6}/^{\circ}\text{C}$
- Alkali-free glass  $3.7 \times 10^{-6}/^{\circ}\text{C}$

### BH Series

ultra-high resolution Laserscale

Reflective type high resolution speed Laserscale. Ideal for high resolution angle measuring in HDD manufacturing equipment, precision measuring instruments and aspheric surface processing machines.

**Max resolution:**

1.5 nrad

**Signal Pitch:**

250 nm

**Measuring length:**

Radius 12.03- 41.72 mm

**Maximum response speed:**

555 min<sup>-1</sup>

**Scale Material:**

Crown glass

# Laserscale

# Principle

The semiconductor laser beam is split by a polarized light beam splitter into S and P polarized light beams, then diffracted through a volume holographic grating with very high diffraction efficiency.

The two diffracted beams pass through separate 1/4-wavelength plates to a mirror, which reflects the beams back through the plates.

This process converts the S polarized beam to P polarized light and the P polarized beam to S polarized light.

The two beams are diffracted again through the volume holographic grating, then super-positioned by the polarized light beam splitter to create interference.

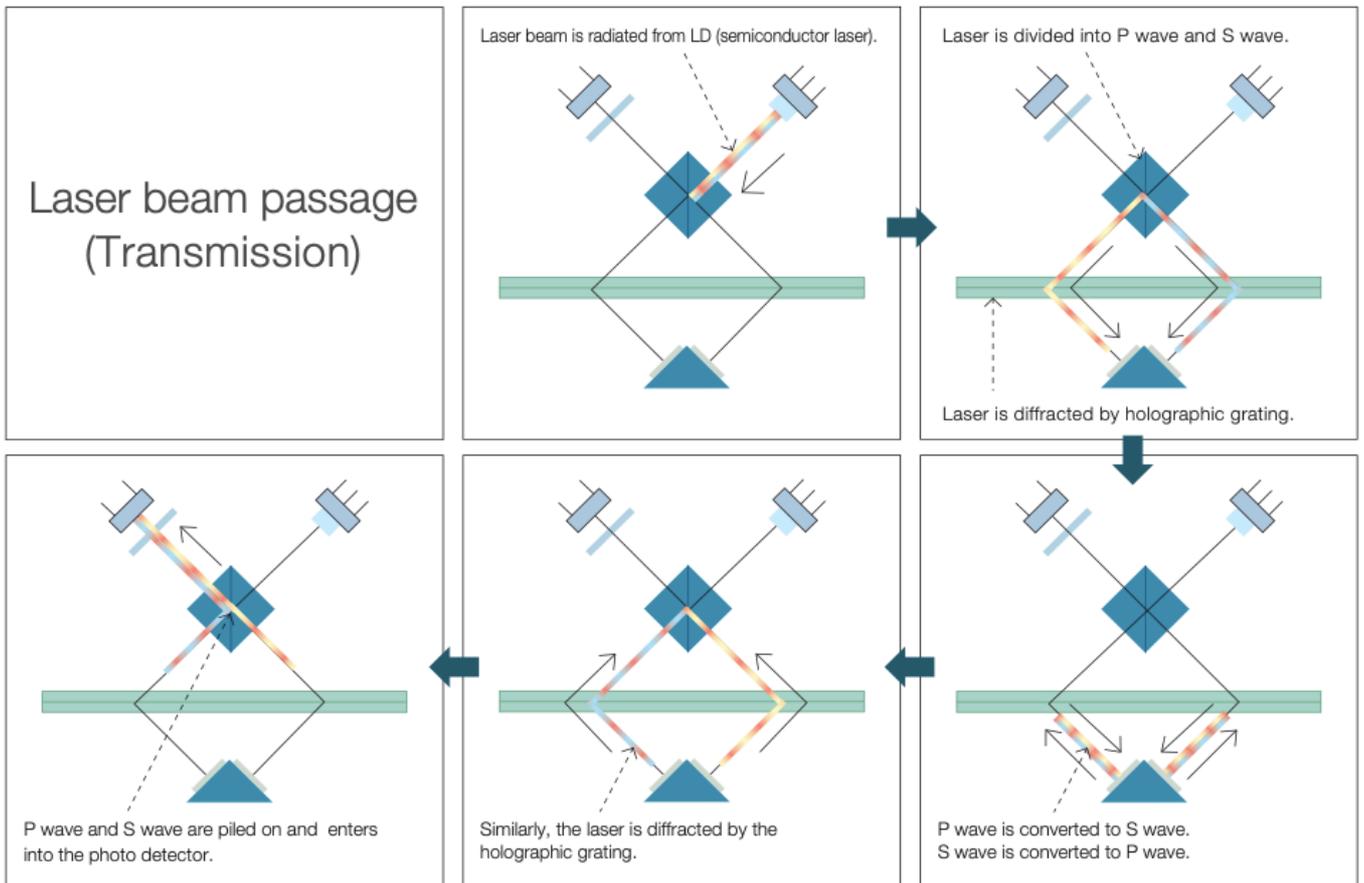
All interference travels to the photo-detector side due to conversion of the polarization direction.

Since double diffraction adds +2 Kx and -2 Kx phases to each beam, the interference is subject to four light-dark inversion cycles for each grating scale of movement. Thus a grat-

ing pitch of  $0.55 \mu\text{m}$  produces a signal pitch of  $0.55/4 = \text{approx. } 0.138 \mu\text{m}$ .

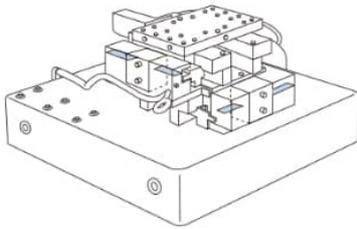
This detecting optics is free from fluctuations and change in air pressure, since the light path of both left and right changes identically even with the change in wavelength of the optical source.

Repeatability and returning errors do not occur in principle.

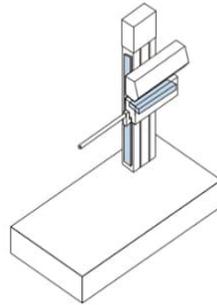


# Applications

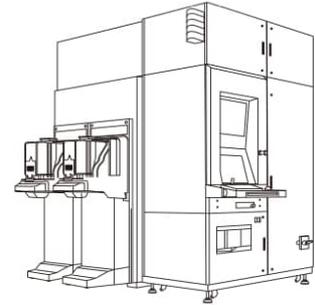
Where absolute precision is required



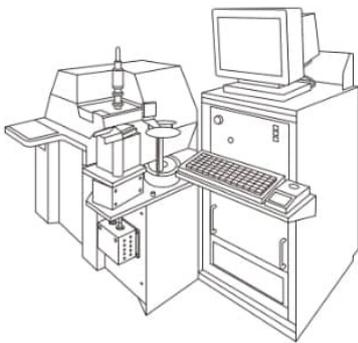
Ultra high precision air stages  
(vacuum resistant)



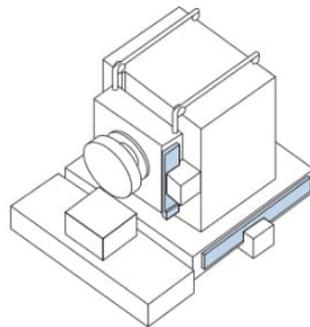
Surface roughness / contour  
measuring machines



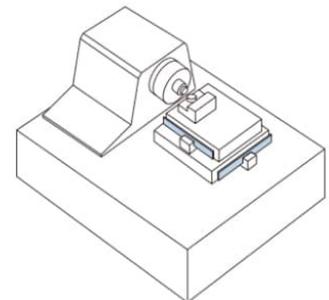
DUV-based automatic wafer  
defect classification systems



Non-contact measuring  
machines

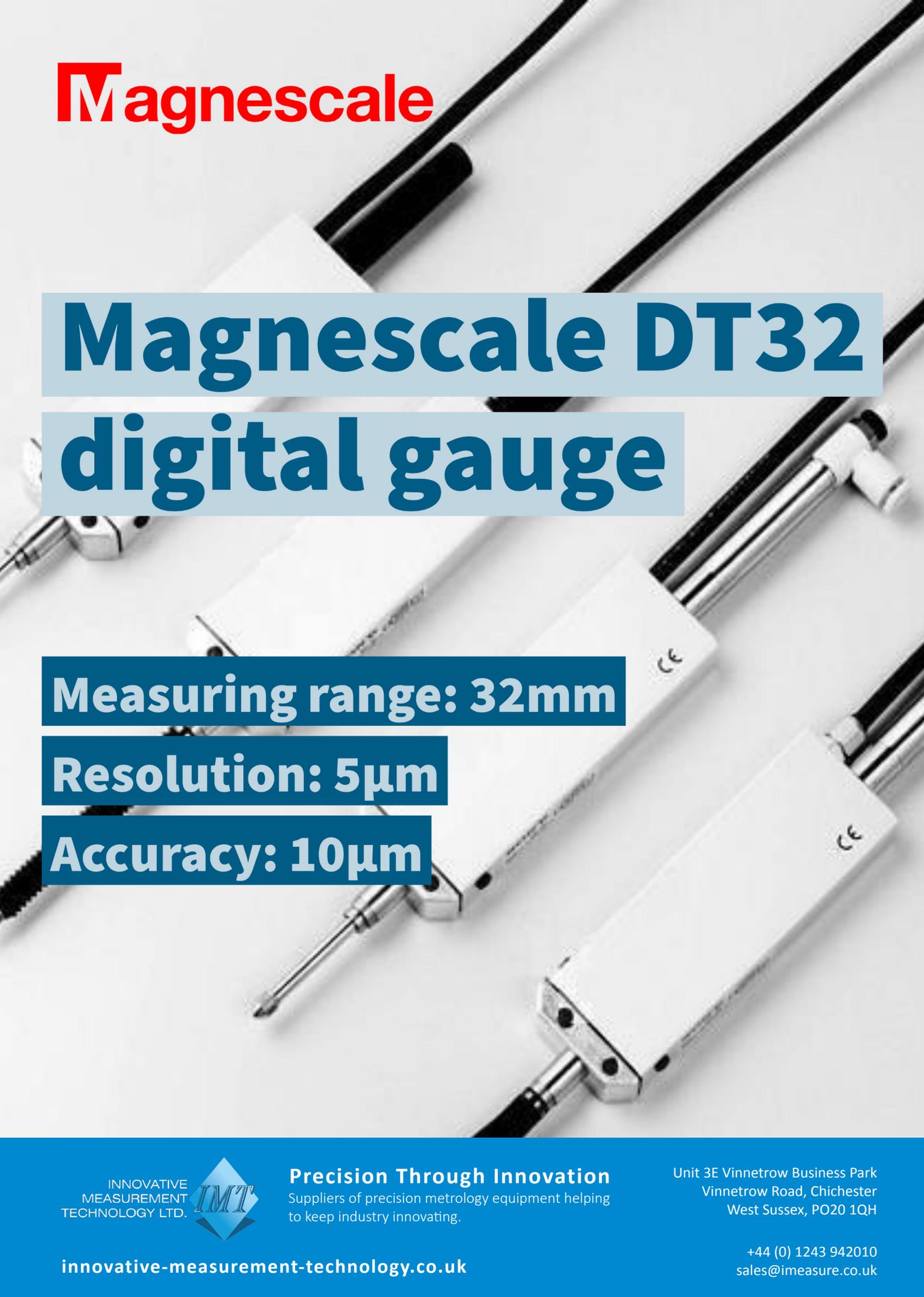


Micro grinders



Aspherical surface  
machining

# Laserscale

The background of the entire page is a close-up photograph of a Magnescale DT32 digital gauge. The gauge is white with a black cable and a stainless steel probe. It is positioned diagonally across the frame. The text is overlaid on this image.

**Magnescale**

# Magnescale DT32

## digital gauge

**Measuring range: 32mm**

**Resolution: 5 $\mu$ m**

**Accuracy: 10 $\mu$ m**

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**Precision Through Innovation**

Suppliers of precision metrology equipment helping to keep industry innovating.

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