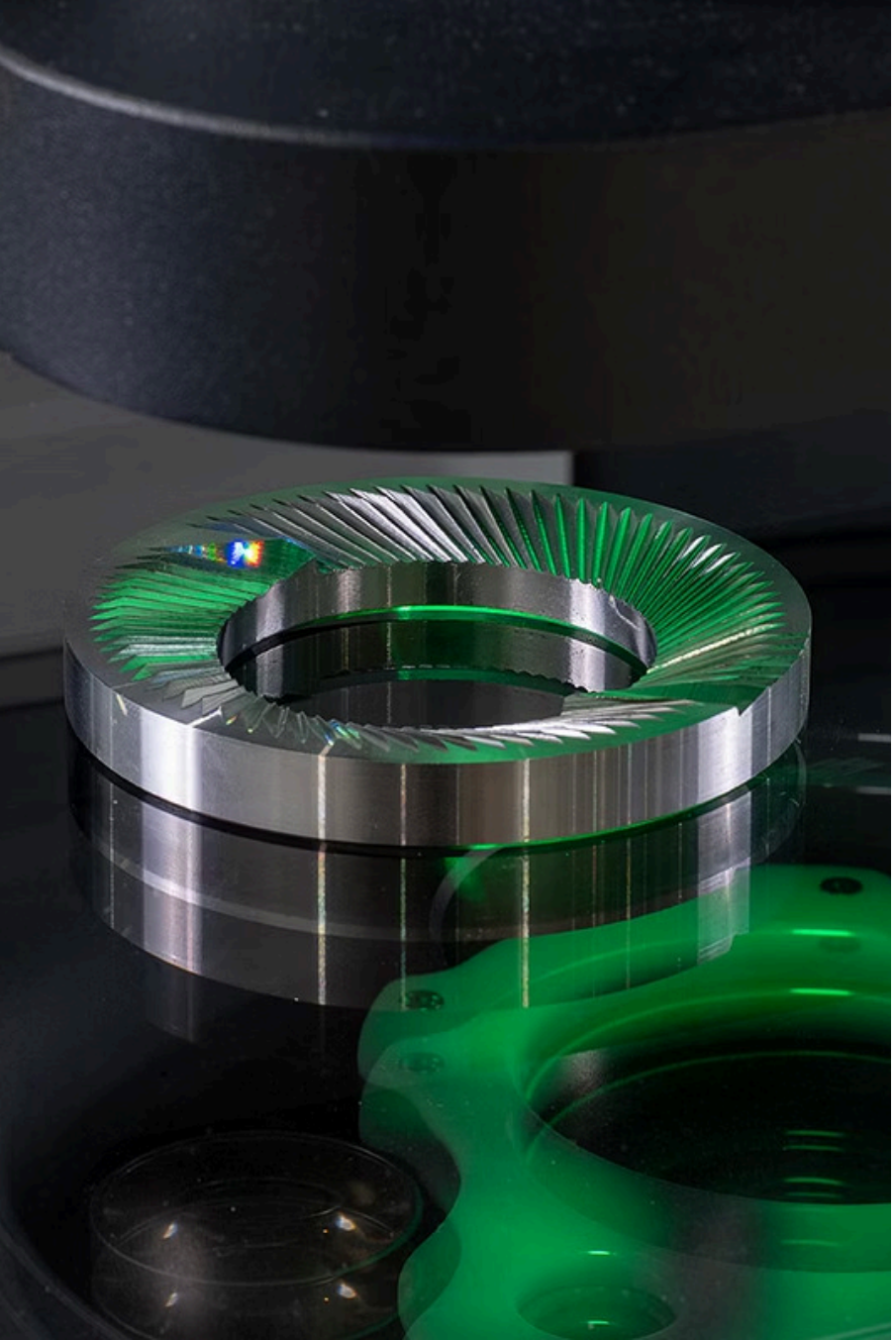

Confocal sensor on Metrios 332 and 532

How the confocal sensor transforms optical measurement machines into complete 3D systems, enabling applications that cannot be handled with 2D vision alone.

MEASUREMENT TECHNOLOGY

METRIOS 332 & 532

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What is the confocal sensor?

The **confocal sensor** is a non-contact optical measurement system.

Working principle

Each wavelength is focused at a different distance along the optical axis. The system detects the wavelength exactly in focus on the surface of the part and determines the distance with high precision.

Key characteristics

- High-resolution point measurement along the Z axis
- High precision even on low-reflectivity surfaces or surfaces with variable optical properties
- No contact with the part

Role on Metrios

The confocal sensor “adds” to optical measuring machines information that 2D image measurement alone cannot provide directly and robustly: the height dimension (Z), therefore depth and steps, with non-contact and high repeatability measurement.

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Problems solved by confocal

Problem	Limitation of traditional technologies	Confocal solution
Reflective surfaces	Instability in optical measurement	Stable and repeatable measurement
Transparent materials	Difficulty focusing	Precise surface detection
Deep geometries	2D vision limitation	Direct Z-axis measurement
Delicate components	Risk of deformation with probe	Non-contact measurement

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Ideal applications and use cases

Cavities and steps

Measurement of depths of cavities, grooves and steps on turned or milled components.

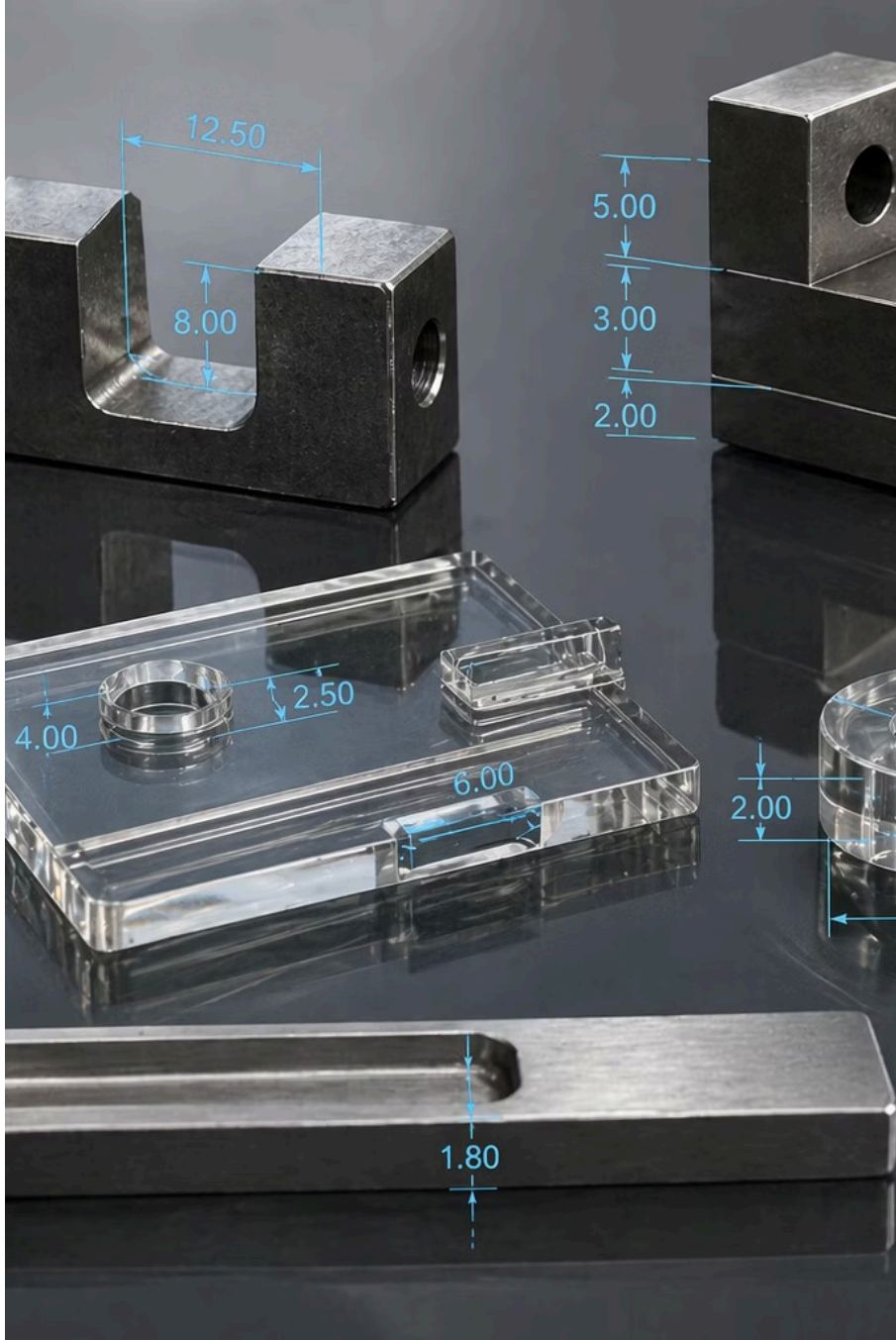
Thicknesses

Inspection of thicknesses even on transparent or semi-transparent materials such as glass and film.

Critical surfaces

Stable and repeatable measurements on glossy, reflective or transparent surfaces.

Typical sectors: **Medical, technical plastics, electronics, precision automotive.**



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Use case: O-ring seats and grooves

The problem with traditional measurement

Rapid inspection of the **width and especially the depth** of O-ring seats or grooves on turned or milled components (in steel/aluminium, with machined or ground finish) is crucial.

With 2D optical vision alone, the contour is measured well, but the **depth is not directly "visible"** and requires the use of additional instruments, introducing complexity and possible errors.

The confocal sensor solution

The confocal sensor enables depth and step measurement in a non-contact, highly repeatable way. It transforms the Metrios 332 and 532 into a system capable of:

- Acquiring depth information
- Measuring level differences and steps
- Ensuring precision and reliability without physical contact

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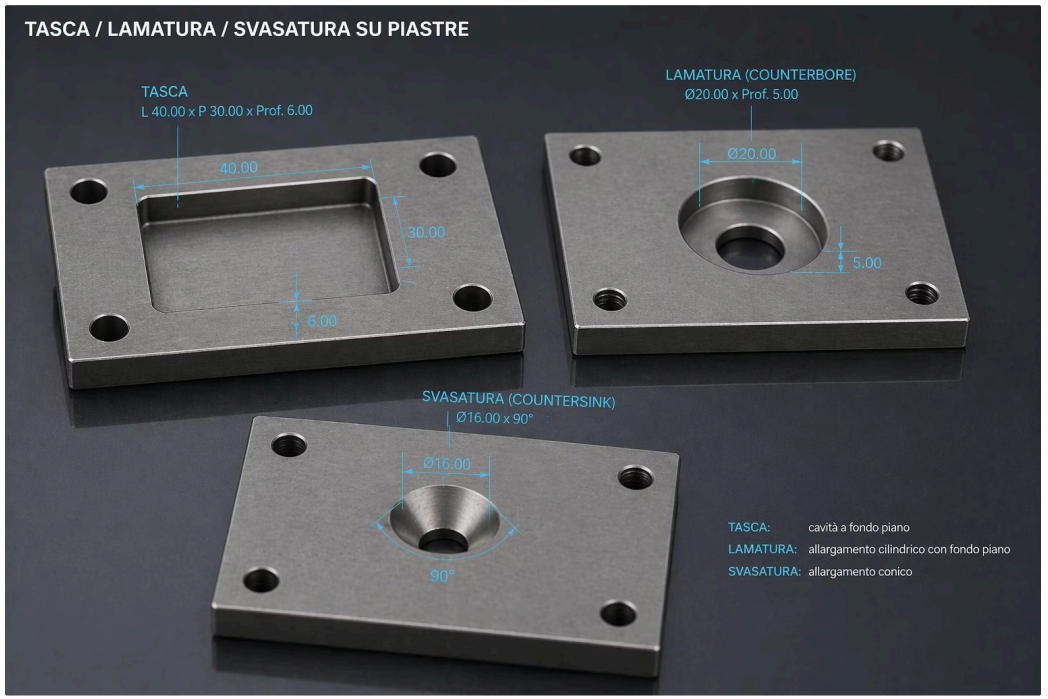
Use case: pocket/counterbore/countersink on plates



The Problem

Checking Z dimensions (depth or step height) on pockets, sheet metal or countersinks is often critical. On materials such as aluminium or steel, even polished, operators frequently rely on manual tools such as gauges or height gauges. This approach introduces **significant variability** in measurements and slows down the quality control process.

The Confocal Solution

By integrating the confocal sensor into the measurement cycle on Metrios 332 and 532, it is possible to acquire Z points with **high precision and repeatability**. This makes it possible to complete dimensional inspection (2D + depth) in a single cycle, eliminating the need for additional tools and drastically reducing operator-induced variability.

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Use case: components with variable surfaces and colours

The Problem

On complex components with mixed surfaces — such as moulded plastics, painted metals, electronic boards with solder joints — traditional 2D optical measurement encounters difficulties. Variability in lighting, contrast and surface reflectivity can compromise accuracy and repeatability. In addition, when precise Z-axis measurement is required, the robustness of the system becomes critical.

The Confocal Solution

The Metrios confocal sensor excels precisely in these contexts. It enables extremely accurate acquisition of the Z-axis dimension (depth or height) regardless of the surface characteristics of the part, overcoming the challenges posed by different colours, variable textures or degrees of reflectivity. Integrating the confocal sensor means obtaining complete and reliable 2D+Z dimensional inspection in a single cycle, eliminating the need for additional instruments and guaranteeing robust, repeatable results even on the most challenging materials.

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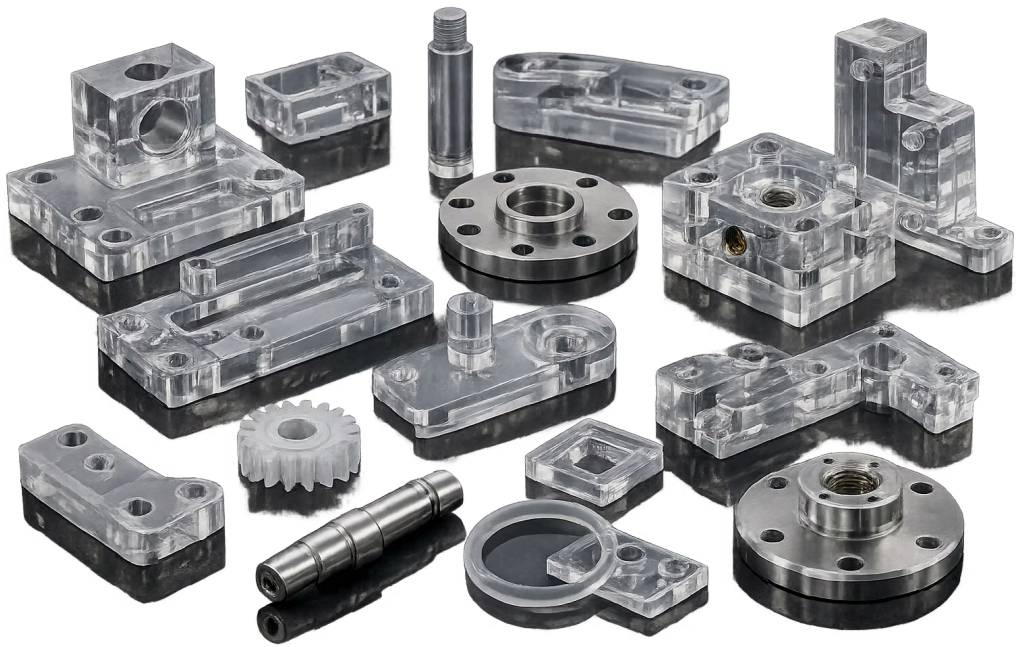
Use case: thickness measurement on transparent or semi-transparent materials (glass, film, thin sheets)



The Problem

Measuring thickness on transparent or semi-transparent materials (glass, film, thin sheets) is complex. It requires precisely distinguishing two interfaces (front/back), a task where traditional triangulation and 2D technologies are not ideal without specific set-ups.

The Confocal Solution

The confocal sensor solves this problem, enabling thickness measurement and compatibility with transparent surfaces. It is able to detect surfaces with high precision, even on materials such as glass.

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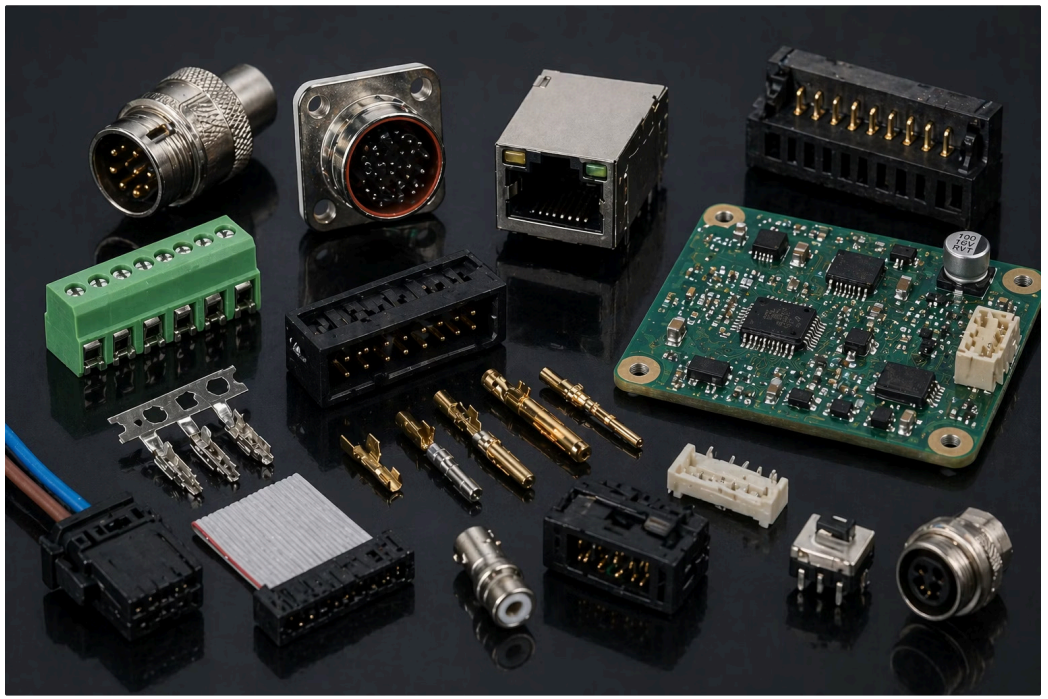
Use case: Electronics and mechatronics (connectors, pins, components on PCB; mixed surfaces, glossy/matt)



The Problem

On complex electronic components (connectors, pins, PCBs), height measurements (e.g. pin coplanarity, solder height, standoff) often require dedicated benches, adding complexity and time to the production process.

The Confocal Solution

The confocal sensor of Metrios 332 and 532 measures the Z height precisely on mixed surfaces, integrating inspection directly into the cycle. This removes the need for additional instruments and simplifies the steps, optimising time and ensuring reliability.

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TECHNOLOGY COMPARISON

Confocal vs Probe

> The confocal sensor stands out significantly from traditional contact probes, such as stylus probes, offering crucial advantages in terms of part integrity, speed and automation potential.

	Probe	Confocal
Contact	Yes	**No**
Speed	Low	**High**
Effect on the part	Possible (e.g. deformation, scratches)	**None**
Automation	Limited	**High**

This comparison highlights how confocal technology overcomes the limitations of contact systems, ensuring faster and safer measurements, ideal for modern production.

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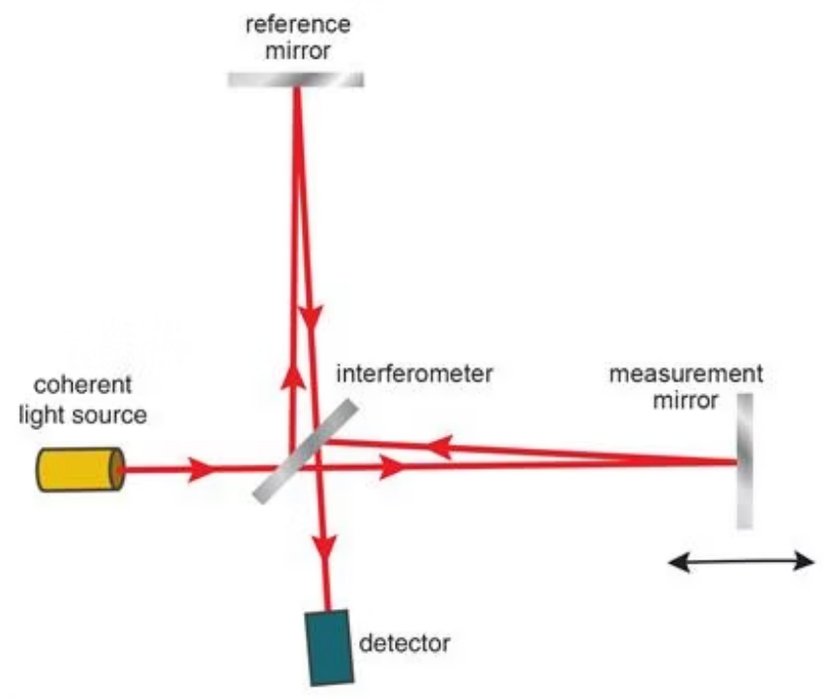
TECHNOLOGICAL COMPARISON

Confocal vs White-light Interferometry

> White-light interferometry offers extremely high precision, but the confocal sensor stands out for its industrial robustness and lower sensitivity to environmental conditions, making it more suitable for production environments.



	Interferometry	Confocal
Accuracy	Very high	High
Environmental sensitivity	High	Medium
Industrial robustness	Limited	High

While interferometry can offer slightly higher precision in controlled conditions, confocal emerges as the more practical choice for industrial applications, thanks to its reliability in less ideal environments and its inherent stability.

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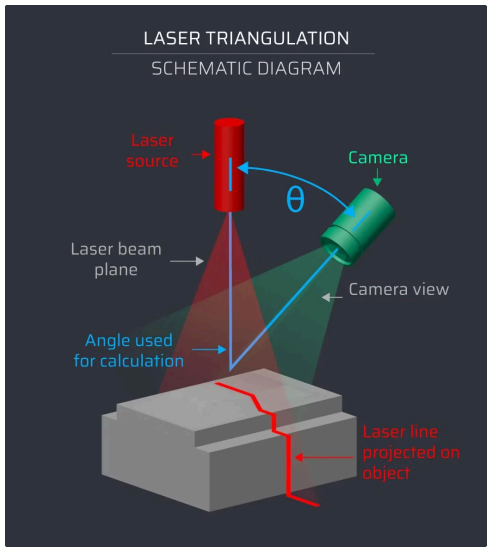
TECHNOLOGY COMPARISON

Confocal vs Laser triangulation

> The confocal sensor stands out from laser triangulation for its superior precision and robustness across a wide range of surfaces, making it ideal for complex applications in industrial environments.



	Laser	Confocal
Accuracy	Average	High
Critical surfaces	Limitations	Excellent performance
Application flexibility	Average	High

This comparison highlights how confocal technology offers a significant advantage in terms of measurement capability, especially in contexts where laser triangulation reaches its limits, ensuring more reliable and versatile results.

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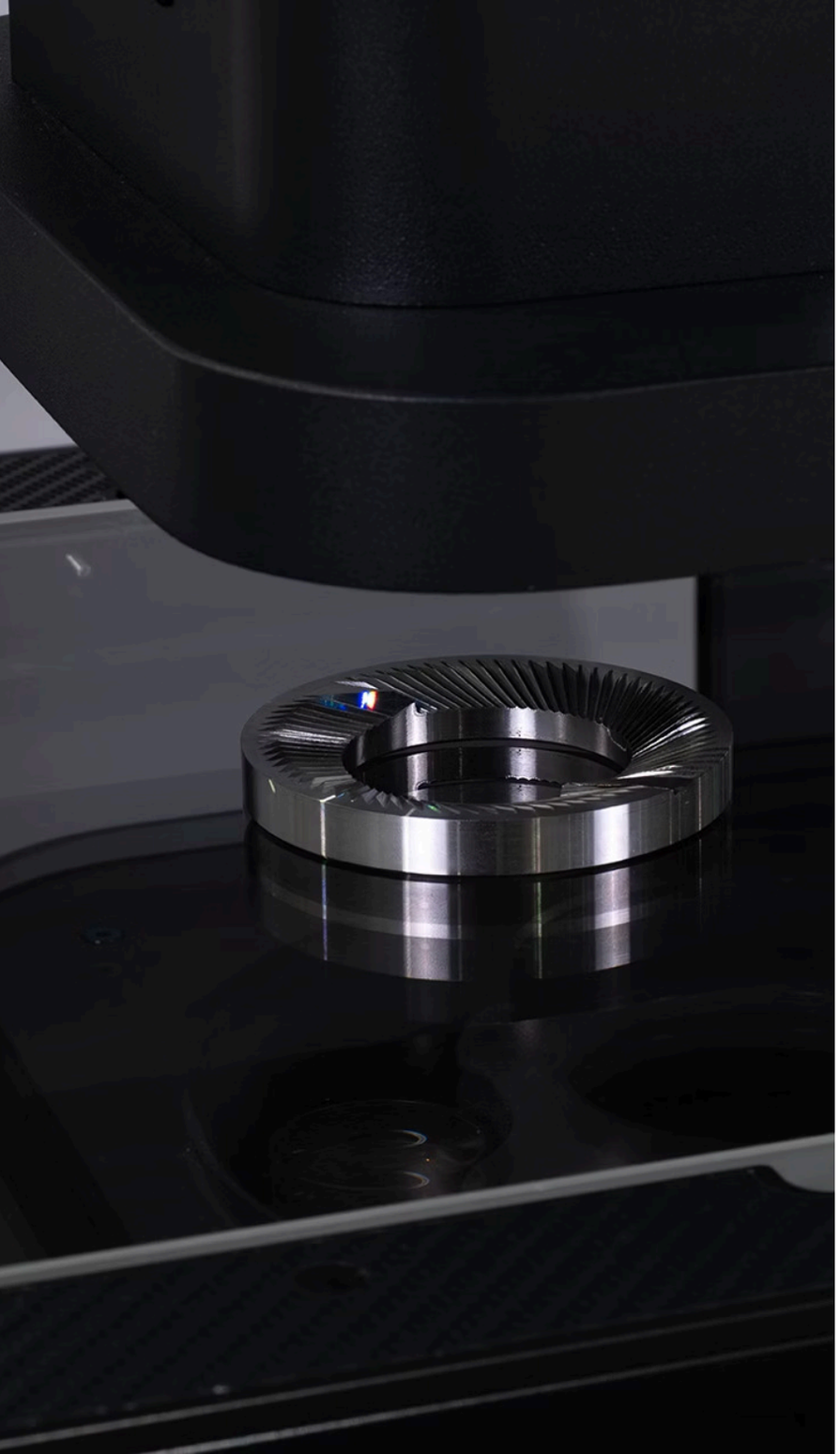

Advantages of the Confocal Sensor

Non-contact

No risk of scratches or deformation on delicate surfaces or soft materials.

High accuracy on the Z axis

High repeatability on the Z axis in a production environment, reducing human error.

Direct Integration

2D+Z acquisition in the same cycle: fewer tools, fewer steps, fewer bottlenecks.

Reduced Waste

Z dimensions that can be measured to guide functional scrap: assembly, sealing, stop.

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ROI: example of a calculation model

Scenario without integrated confocal

The depth/step check requires an additional instrument (height gauge, CMM, profilometer) with repositioning and extra time.

2 min

extra per part

separate Z-axis measurement

5 h

lost per day

on 150 parts/day

3,000€

per month

at £30/h of cost at full production capacity over 20 working days

With integrated confocal

"No extra tools. No wasted time."

Depth and step acquisition within the same 2D+Z cycle. Reduction in tooling + elimination of extra steps = measurable impact on daily productivity.

⚠ This figure is not a "promise", but an example model to highlight the impact of consolidating 2D+Z in a single cycle. The parameters must be replaced with the customer's actual times and costs.

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Sales Messages and Positioning

Key arguments

- Reduction of production instrumentation
- Improved measurement quality on surfaces with low reflectivity, high roughness or variable optical properties
- Increased automation of quality control

Enabling technology

Position the confocal solution for applications not manageable with vision alone: it captures depth and steps that standard optics do not provide.

Robust industrial alternative

More robust than interferometry in a production environment, more precise than laser triangulation on critical surfaces.

Strategic upgrade

It expands the machine's capabilities: less instrumentation in production, more objective quality, greater automation of quality control.

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