SOLUTIONS FOR THE MEASUREMENT OF MATCHING COMPONENTS

MARPOSS

INTERNAL DIAMETER AND OUTER DIAMETER CONTROLS FOR DIFFERENT PARTS OF AN ASSEMBLY COMPONENT

M39S is Marposs gauging solution to guarantee the highest level of repeatability and accuracy required for the measurement of very precise mechanical components like injectors, pumps, and hydraulic valves. The gauge is extremely compact in overall size, since all components are fixed to one common aluminium profile. M39S checks, at the same time, the external diameter of the pin component and the internal diameter of the valve body. The leak test is connected to the matching diameter clearance of these two components. Marposs M39S measuring station is ideal for integration in automatic machines, even when there is very little space available. Its robust design, together with the use of standardized and easily interchangeable pneumatic measuring components, makes M39S highly proficient. These features guarantee excellent metrological performance in typical production environments, such as automatic post-process applications. As automotive manufacturers are not conditioned to maintain the process accurate enough to meet the specific and stringent industry requirements, Marposs enters to provide functional control of diesel sealing test and gasoline components of pump body and fuel dosing.

APPLICATIONS

Scanning technology is an essential tool to perform dimensional and form checks on corresponding mechanical parts with very tight clearance tolerance. The richness of metrological data and the immediacy of the graphical representation of the surface profiles enable the worker to fully control the critical production processes of these components.
Thanks to the ease with which they can be integrated with workpiece handling equipment, the M39S can be used both in manual and fully automatic systems.

The range of possible applications includes:

- Quality control stations beside the production line
- Pre-process measurement (e.g. to determine the ideal diameter to machine a male part to match with finished female part or vice versa)
- Post-process measurement (e.g. to provide an immediate check of the results of a critical machining operation, with the possibility to provide tool compensation feedback to the machine tool)
- Stations for grading parts
- Measurement stations in assembly lines (e.g. to determine the grade of parts required to obtain the required clearance)

The standard model includes:

- Air gauging plug for checking internal diameters
- Air gauging ring for checking external diameters

Also, a New HSD-AECONV had been integrated.

This A/E converter is the result of a sophisticated engineering study in order to offer a completely digitalized device, which major advantages are:

1. A complete working field with a total absence of linearity error; consistent benefit in terms of gauge capability, perfectly in line with sub-micron resolution, nowadays essential for working parts having smallest tolerance.
2. Quicker reaction times which let to meet further solution, especially if the technical surfaces to be explored are short.
3. Consistent reduction of air consumption thanks to the simplification of the inner circuit principle.
4. Achieving waterproof levels ideal for working in wet environments, typically due to the presence of coolant which is essential for grinding processes, giving excellent metrological results in a wide range of applications. The standardised design of the gauging plugs and rings ensures the interchangeability required for rapid retooling without the need to re-adjust the converter. Gauge plugs and rings with two or more jets are available to suit different measurement requirements.

MEASUREMENT PRINCIPLE

A gauging plug is moved at a constant speed inside the bore to be gauged and the diameter reading is continuously stored. For gauging external diameters, generally, the part itself is moved within the fixed ring gauge.

Drive System

A brushless motor with encoder guarantees very high precision of position and perfect control of the speed of movement. Positions and speeds of the measuring system are programmed in the E9066TM gauge computer, which controls the complete system.

Versions Available

- Single station M39S for individual ID or OD checks
- Twin station M39S for simultaneous or alternate checking of ID and OD with the facility to calculate the clearance
- M39S with rotary table or a horizontal shuttle for automatic part loading and unloading
- M39S gauge for horizontal scanning of a bore
- Dedicated solutions using “single lip” air to electronic technology, can be also proposed to scan a surface really close to the edges or to measure extremely small bores (ID starting from 0.6 mm) with sub-micron performances
- Specific Version for Aerospace components

SPECIAL VERSION FOR AEROSPACE COMPONENTS

The required M39S have been profoundly modified, with new mechanical implementations to meet and exceed the good performances achieved in the previous version.
The new recirculating ball screw and the updated mechanical structure are part of the innovations that we are doing at the moment.
The gauge will have a modified basic structure to have a more robust solution: it will be provided with a central steel column instead of an aluminium profile. In addition, there will be a second rail with four carriages and a double rail to support the measuring slide. The stability of the gauge is one of the main improvements that we have decided to consider for this robust application.
Here, the process control of injection systems and valves is crucial since the dimensional features that need to be measured are strictly related to some fluyd dynamic consideration about the actual amount of diesel or gasoline.
The measuring unit will also be equipped with the new dedicated AMA parallelogram that will guarantee a better performance of the contact measuring cycle.

Hardware: standard configuration for M39S

Applications can be provided using Marposs PC based E9066™ systems with GagePod™

Software: standard configuration for M39S

- Windows® operating system
- Quick SPC™ software for process and quality control
- Scanning software for the graphical display of the surface profiles and for the measurement calculations

Gauge Explorer

- Fast programming interface for movements and measuring cycles
- A complete library of possible measurement calculations
- Programmable filtering parameters to allow measurement of interrupted surfaces

On-Line

- Graphical display of the surface profile
- Double profile display for the clearance check in the M39S Twin Station version
- Zoom functions available in the axial and radial directions, for a more detailed display
- Manual exploration of the total profile
- Facility to display the measuring point diagram beside the profile display
- Facility to store and export files containing the measured profile data
- EasyScan page with the on-line acquisition of the profile for a new part type for self-taught programming of the scanning sequence and the measurement elaborations

MEASUREMENT CALCULATIONS

From the samples acquired during the scanning cycle, various measurements can be calculated:

- Maximum, minimum and median diameters calculated over the total length or over sections of the scanned profile
- Diameters in programmed positions along the length of the part
- Maximum variation of diameter calculated over the total length or over sections of the scanned profile
- Evaluation of the taper or barrel-shape error in accordance with various criteria

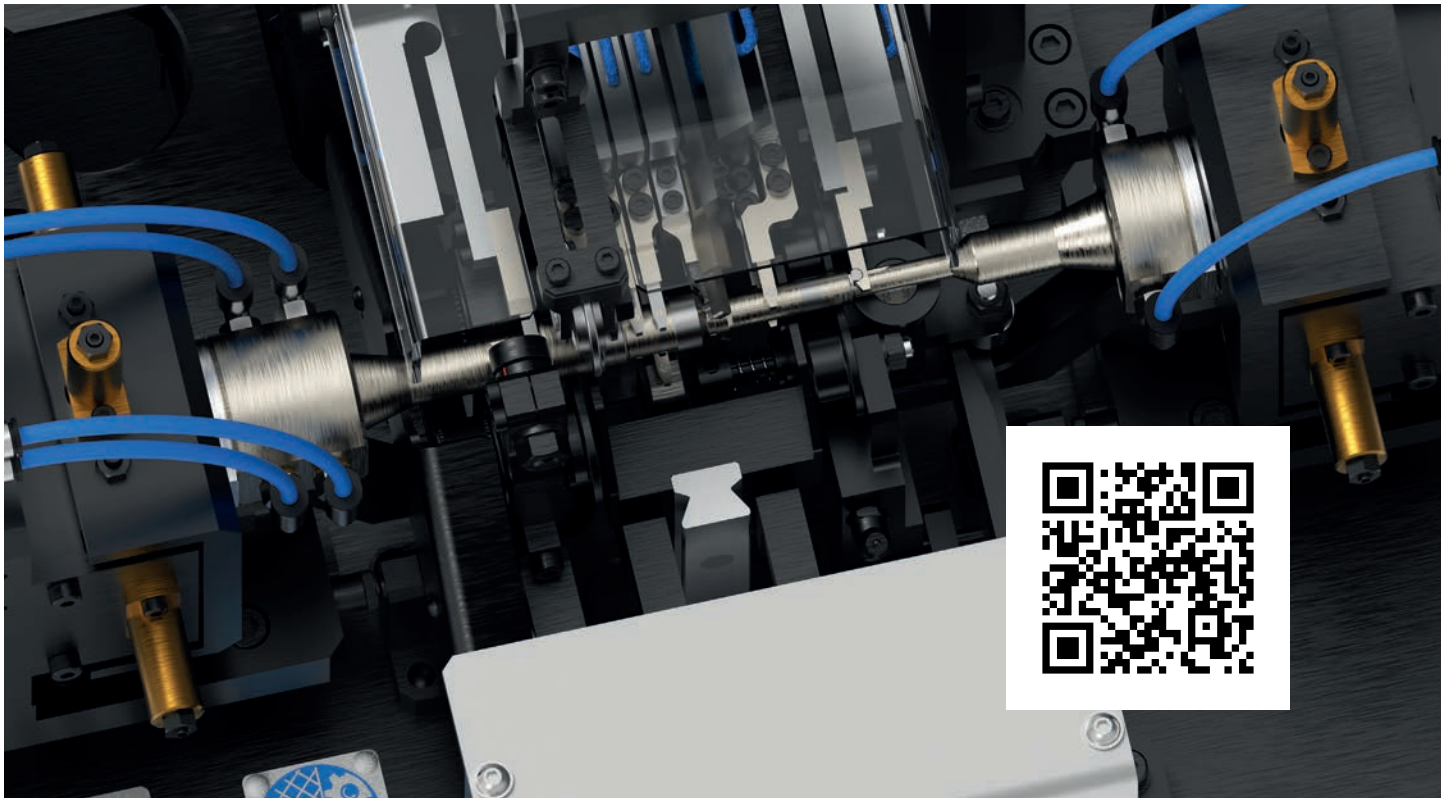
Evaluation of the matching clearance in accordance with various criteria (e.g. maximum, median, minimum clearance, or clearance in specified positions)

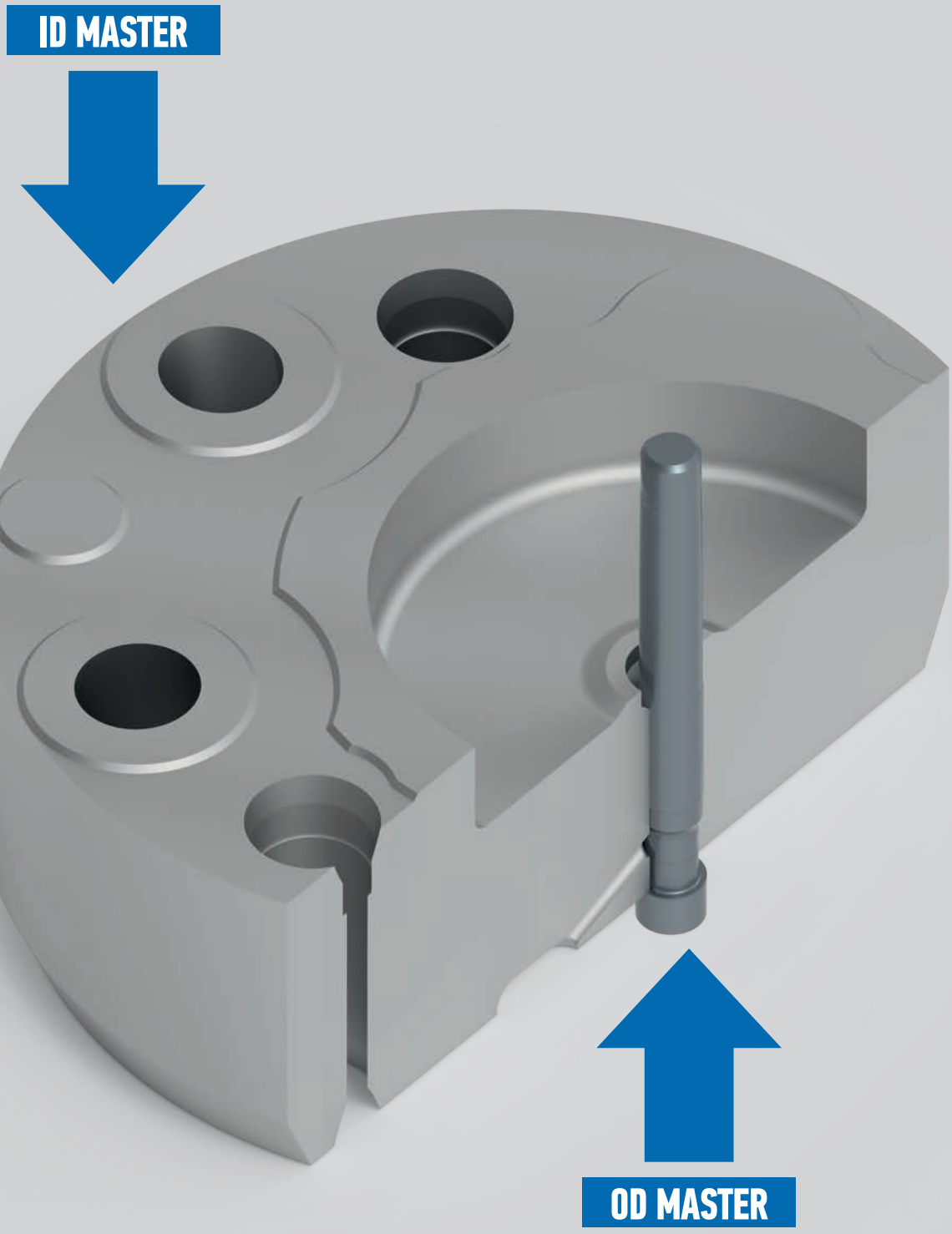
Accuracy of Measurement

The system has been designed to guarantee excellent metrological performance in the gauging of very precise parts, with extremely tight tolerance and matching conditions. Within a measuring range of +/-20 μm (depending on the condition of the part), it is possible to guarantee a resolution of 0.01μm, with a Repeatability< 0.05 μm and a Linearity error <0.02 μm.

INTERNAL DIAMETER AND OUTER DIAMETER CONTROLS AT THE SAME TIME IN THE SAME PART OF THE COMPONENT (NEW RELEASE)

Marposs is able to control simultaneously both the internal and the external diameter in the same assembly component through a Hybrid pneumatic and contact gauge.
Marposs provides a special hybrid tire and contact gauge with two pneumatic nozzles plug and contact cell for OD for all the dedicated requirements that are required. This gauge, designed to meet the specific inspections of different characteristics in the same components through the experience of calculation of the combination of the M39S Twin configuration. The result is that in about 20 seconds the total control of all the features of the parts is achieved.
The resolution of all measurements is in line with the ones typically used for sub microns measurements: the electronic units the hundredth of micron for all the measurements.
Moreover, thanks to the robust and accurate engineering of the mechanical concept, Marposs solution is able to keep good performances in the workshop environment, for a long time. The repeatability for OD and ID measurements achieved together with composed measurements such as taper, concentricity, distances are high level of precision.
The electronic unit used for the special gauge is an E9066T with a Gage Pod configuration.

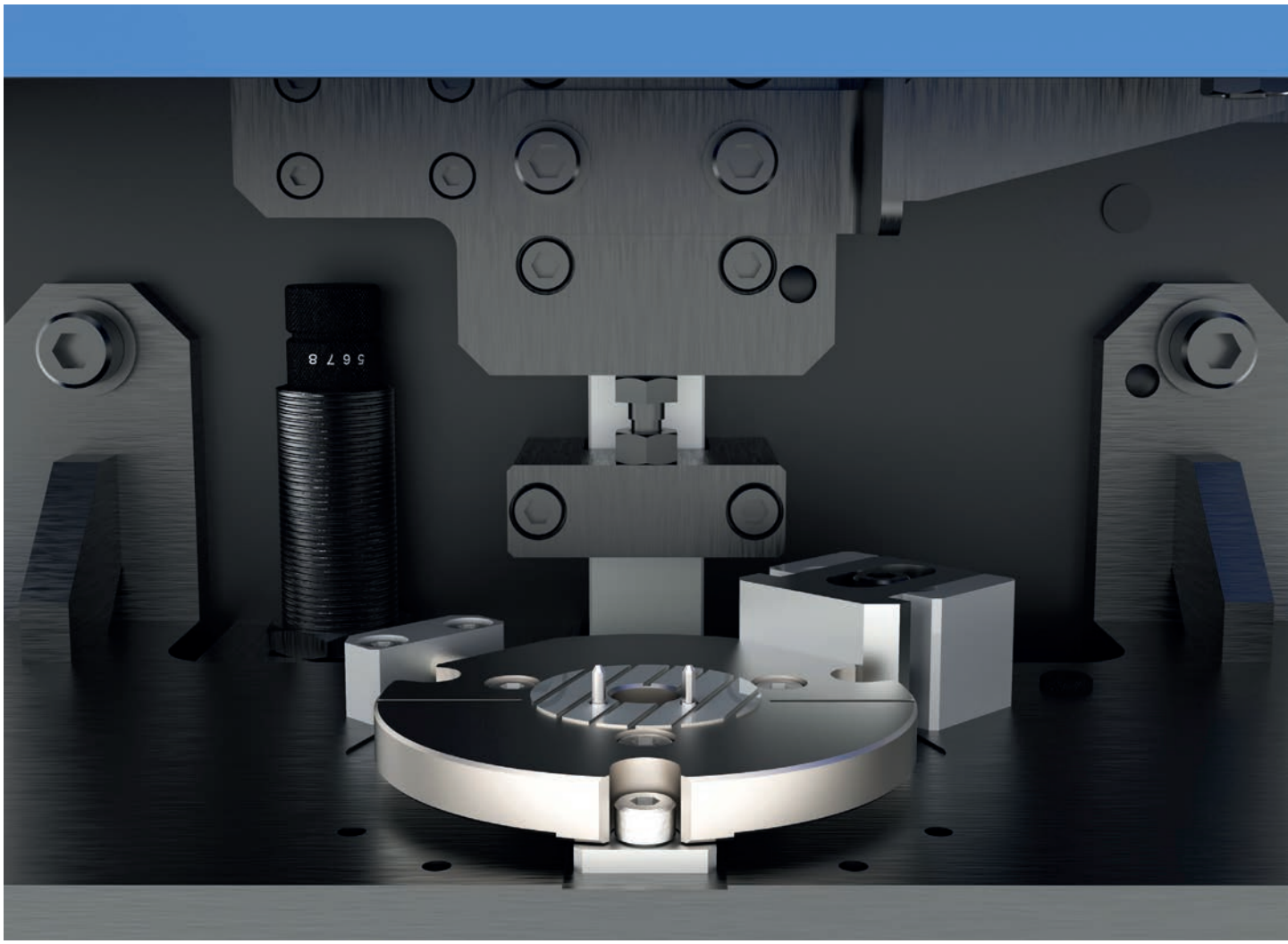


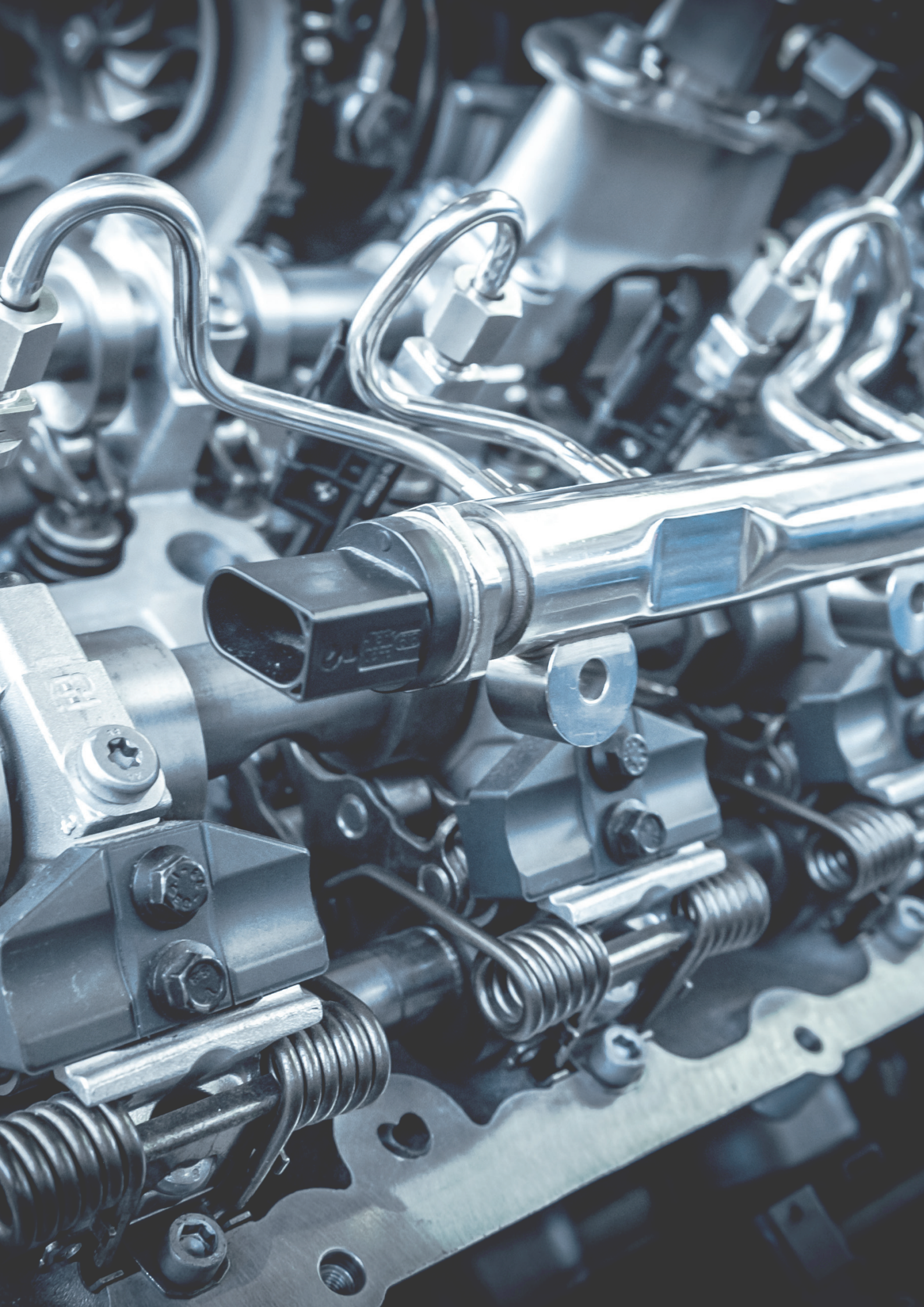


The zeroing master manufactured
for the control of 1 mm

SINGLE DIAMETER CONTROLS WITHIN 1 MM (BRAND NEW 2020)

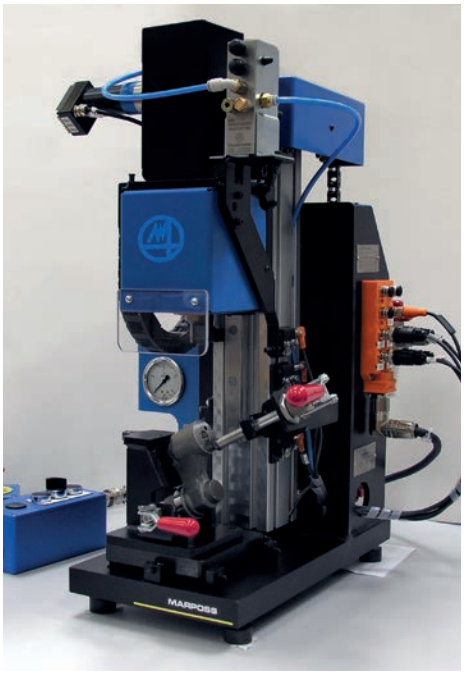
The main measuring unit is composed of a pneumatic plug with a 0.9 mm diameter sphere and a dedicated mechanical reference for the adaptation of the part type for the reference to the alignment to be implemented. The special pneumatic gauge required has been deeply modified with new mechanical and pneumatic implementations in the measurement group using Single Lip plug technologies.
The great and already achieved challenge was to inspect the total tolerance of 3 microns in an internal diameter of 1mm with an incredible result for a GR&R within 10%.





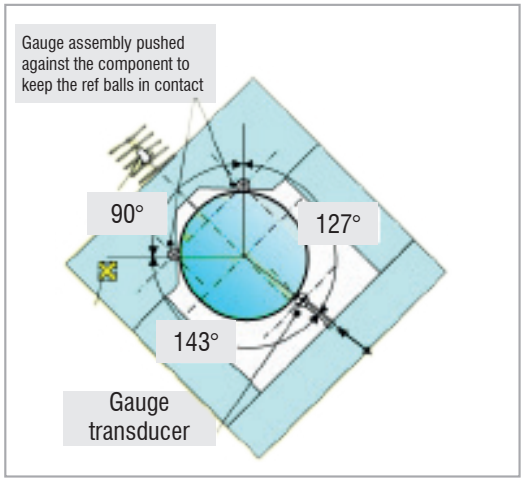
ROUNDNESS AND CONCENTRICITY CHECKS

M39S for Roundness ID and OD is a noteworthy solution as it offers the combination of axial scan control associated with roundness error in different positions, all programmable.



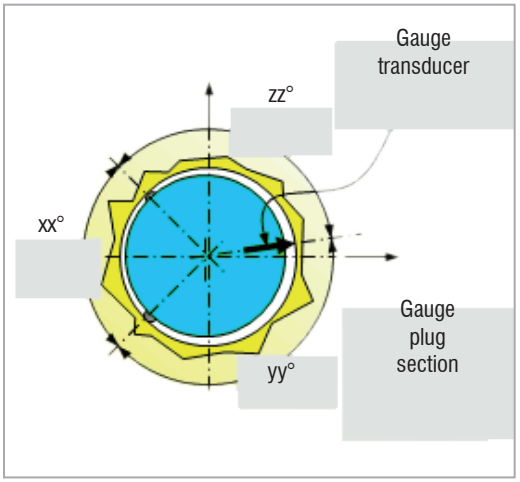
M39s for Roundness OD

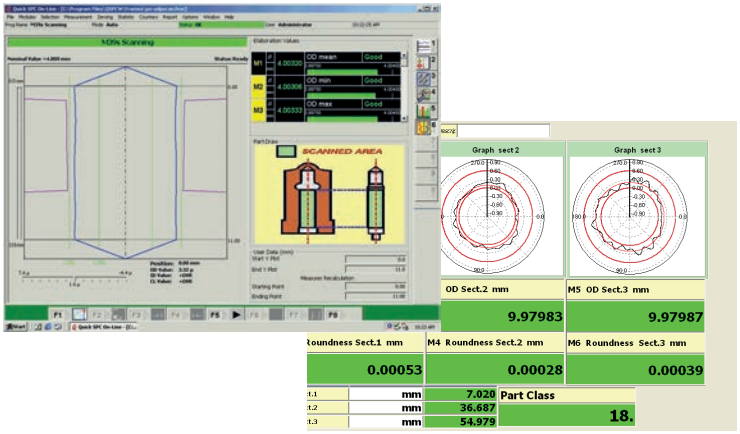
The gauge is good to be used in a workshop environment as it can be put aside from the grinding machine to provide immediate information about the process, without waiting for the Metrology Lab inspection. The gauge can provide dimensional data on the absolute value of diameter and shape information on the part measured at the same time. The inspection can be carried out in short cycle times (15 - 45 sec, depending on the size of the workpiece and the programmed cycle), without the need for particular attention to the setting of the workpiece on the gauge.



Measuring principle

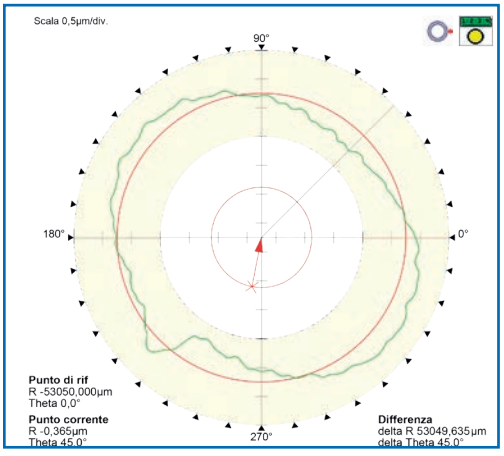
A roundness check is achieved by using two fixed contacts plus a measuring contact, positioned at specific angles. The transducer signal is acquired during the rotation of the parts; then it will perform the Fourier analysis of the sample vector and will find the component of “sin” and “cos” of the harmonic curves from 2nd to 50th order. Thanks to the use of different coefficients of sensitivity (depending on the angles mentioned above)….. Combined scan inspection: it’s possible to program different measurement sequences, with the combination of scan diameter inspection along the axis and roundness in different sections.





Roundness and Concentricity

The gauge architecture is similar to the above-described gauges. A precise rotating table equipped with a measuring air plug and a reference clamping device offers the necessary revolution to perform these types of measurements. From the outside, an optical scale cell, positioned by a floating device, detects the position of the surface to be inspected. Roundness and concentricity can be detected on various programmable sections.



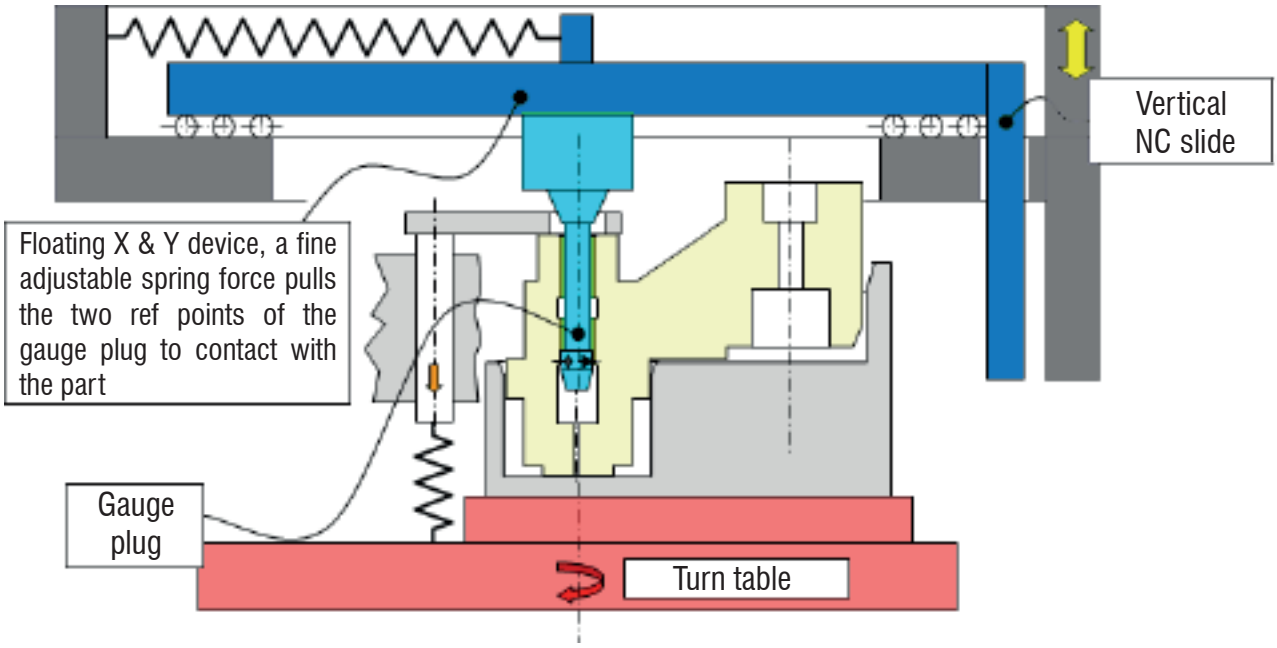
The resolution of the measurements given by the gauges meets sub-micron requirements, as well as performance, which are in coordination with all customer requests. The following table shows them:

Repeatability range:

- Diameter ≤ 0,1 µm
- Roundness ≤ 0,05 µm
- Concentricity on master ≤ 0,1 µm - 0,2 µm
- Concentricity on parts ≤ 0,1 µm - 0,2 µm

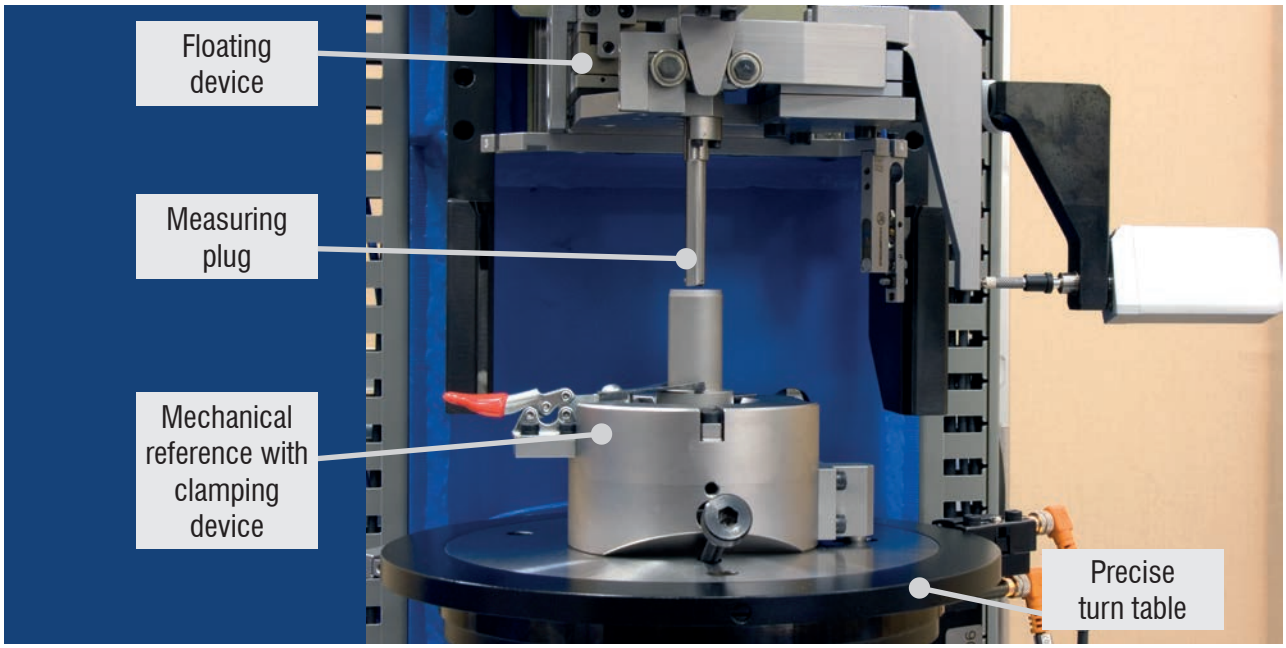
M39s for Roundness ID

As well as the gauge for ODM, this gauge is also for ID, and is designed to be used in the workshop environment and all of the rest of technical prerogatives, like to provide immediate information about the process, without waiting for Metrology Lab inspection.



Measuring principle

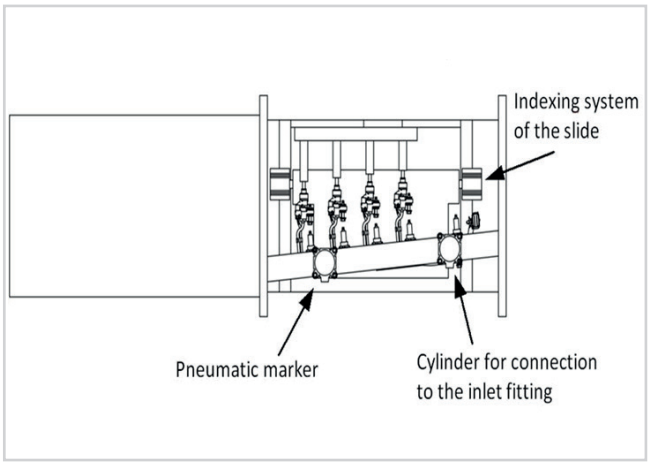
The measuring concept is the same described for OD inspection.
In case of small diameters, it is also possible to propose an A/E (Air to Electronic) technical solution, where the measuring plug has two diamond contacts and one measuring air jet. The angular positions of the two pads and the air jet are the same requested for the correct roundness inspection.
The use of air jet for the roundness inspection produces a sensitivity reduction in the evaluation of the different harmonics; this reduction can be theoretically predicted and consequently compensated. The use of A/E solution is recommended only for parts having a good surface finishing.



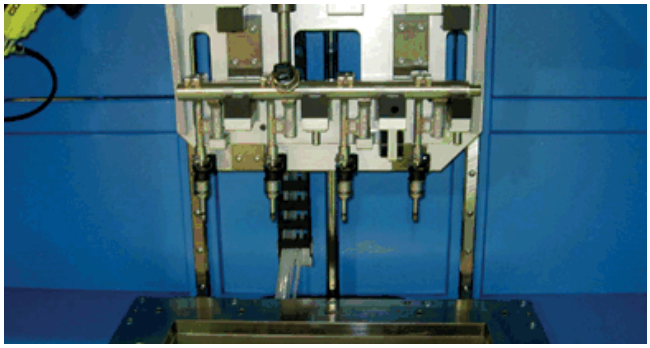
OTHERS

LEAK TEST

Marposs has solutions for the single components of the gasoline fuel system test and for the final test in the assembly line.
The main problem for Gasoline engines is the fuel Pressure up to 300 Bars: even if each component has already been tested with helium separately, there may be problems when they are assembled together as the fitting between the components may leak.
Leak Test with Helium Test in “vacuum chamber” technology.



Robot “sniffing” application to detect a maximum leakage of 0,03 cc/min (with mass spectrometer).



OTHERS

MEDICAL INDUSTRY

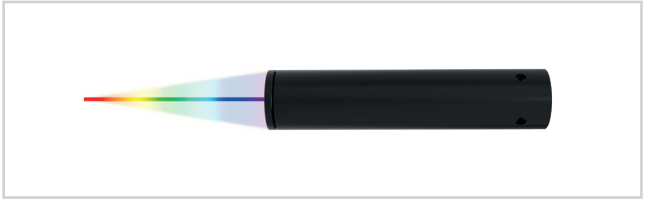
Other mechanical components produced with a tight matching tolerance:

- Hydraulic Steering System
- HDD Air Bearings for electronic industry
- Component for medical Industry
  (See the following picture)

Internal diameter as indicated in the drawing had been checked for a bore of 2.7 mm with a pneumatic measuring plug.
The used nozzles possess a bore of 0.4 mm.
The whole duration regarding the acquisition of the measure and the related measuring performance is within 4 seconds for similar components
Repeatability under ≤ 0.3 μm.

CONFOCAL MICROSCOPE

Chromapoint shows the original STIL technology and is positioned as the best-selling sensor of the outfit. Easy to use and integrable, it provides high performance on all types of materials. Chromaline is a natural evolution from STIL Chromapoint and is available in two models: Chromaline Sensor with 180 discrete measuring points placed on a single line.



For a full list of address locations, please consult the Marposs official website

Marposs has an integrated system to manage the Company quality, the environment and safety, attested by ISO 9001, ISO 14001 and OHSAS 18001 certifications.