



HYDROGEN

Industrial control solutions



setsmart
KEP TECHNOLOGIES

HYDROGEN MARKET

Hydrogen is part of a comprehensive energy portfolio that can provide energy stability, economic value and environmental benefits for a variety of applications. It can be derived from a variety of primary sources, particularly renewables or nuclear energy.

Combined with fuel cells or combustion-based technologies, it can provide zero emissions in transportation or power generation applications.

It can be used to store large amounts of energy or as a feedstock in industries such as steel, cement, ammonia and other chemical manufacturing.

The development of this highly coveted sector has become a real strategic challenge based on four main aspects:

- hydrogen production,
- storage,
- distribution
- and conversion into energy.

This market is growing fast and actors across the entire hydrogen fuel value chain are emerging.

Today you need expert suppliers who have the flexibility to meet a wide variety of designs and applications, from electrolyzers to fuel cells. In this evolving landscape, enhanced technology, deeper expertise and a stronger commitment to value-creating solutions guarantee a market advantage.

Our Setsmart solutions are designed to address the quality needs required by companies within the growing hydrogen fuel market.

With our know-how you can expect innovative, extremely precise and reliable equipment to meet your goals in terms of productivity, savings and safety.



INDUSTRIAL CONTROL

KEP Technologies is a full solution provider. With **SETSMART** we offer a range of advanced standard and customized industrial control solutions with end-to-end project management, as required.

We are confident that with KEP Technologies you will find a dedicated industrial control solution with the performance needed to accurately control your parts and assemblies production.

This being the case no matter which of the hydrogen cycle's step you may work in.

THE KEP TECHNOLOGIES ADVANTAGE

Each Setsmart solution incorporates three essential elements to ensure the best Industrial Control for Smart Industry - Smart Control, Measurement Versatility and Quality Results. We know that solutions providing these benefits will deliver the highest value to our customers

SMART CONTROL With various options for automation, statistical data analysis, feedback loops for manufacturing machines.

MEASUREMENT VERSATILITY With one solution : multiple specifications controlled on one part and multiple types of parts can be controlled.

QUALITY RESULTS High accuracy and high precision transducers to meet and surpass your control requirements.



In addition to our core product offer, we are able to provide customized solutions by harnessing the engineering and project management expertise of our highly skilled organization.

OUR TECHNOLOGIES

VISION

We apply machine vision technologies to the production control of your parts. They integrate a selection of cameras, lighting systems, and image processing software for a fast, reliable and traceable control.

These technologies are versatile because they allow for checking dimensions, proper assembly and inspecting the external appearance of parts. They are applicable to various parts, even with complex shapes or made of flexible or even fragile materials.
See *INSPEX OUT*.

TACTILE

Tactile sensors have excellent performance with accuracies down to sub-micron levels. They are easy to combine to measure multiple dimensions and check geometries. They are also ideally suited for integration into automated machines.

We work with you to select the sensors that meet your cost and performance criteria. The selection is mainly based on the tolerance on the measured dimension, the mechanical resistance of the part's material, and the accessibility of the control point on the part.
See *METRIX OD*, and *GEO*.

SOFTWARE & AI

Our software collects large amounts of data, analyzes results, automates measurements and controls, and generates reliable and sophisticated reports.

They can integrate image analysis for object recognition, mathematical models to simplify the development of reliable supervision protocols, and alert systems when a part is out of specification. They can launch automatic corrective actions for the manufacturing of subsequent parts.
See all solutions except *METRIX ONE*.



PNEUMATIC

Pneumatic measurement uses a proven technology to control various dimensions on mechanical parts. It can be used to measure outside diameters (using an air ring) or inside diameters (using an air plug).

But by using various other sensors, it can also be used to control geometric parameters: straightness, coaxiality, flatness, etc.
See *METRIX ONE, ID, OD, GEO and FILM*.



X-RAYS

Industrial X-ray inspection methods allow the inspection of the internal structure of an assembled object. An X-ray source coupled with a detector and a camera provide an internal view of the part to be inspected.

Then the image processing software checks the conformity of various control points: dimensions, assembly, absence of foreign bodies, cracks, pores, etc. A radiological protection system of the users is also always integrated.
See *INSPEX IN*.



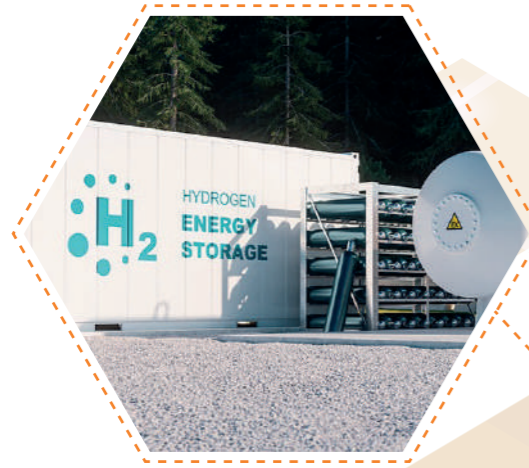
AUTOMATION

Manual measuring systems are very easy to use and generate measurements independent of the operator. But we also offer automated systems integrated to your production line.

Depending on the required control cycle and on the parts to be controlled, we can integrate various automatisms (linear movement, rotation, elevators, etc.), robots (cartesian, 6 axis, with various types of grippers), or cobots.
See all solutions except *METRIX ONE*.



HYDROGEN CHALLENGES & SOLUTIONS



STORAGE

We provide solutions for the control and inspection of hydrogen tanks, whether they are metallic or reinforced with composite materials.



PRODUCTION

Our solutions support the scale-up of your electrolyser production by automating and controlling the production of parts and sub-assemblies.



CONVERSION

We offer solutions for the control and automation of the mass production of fuel cell components and subsystems: electrodes, stacks, etc.



HYDROGEN

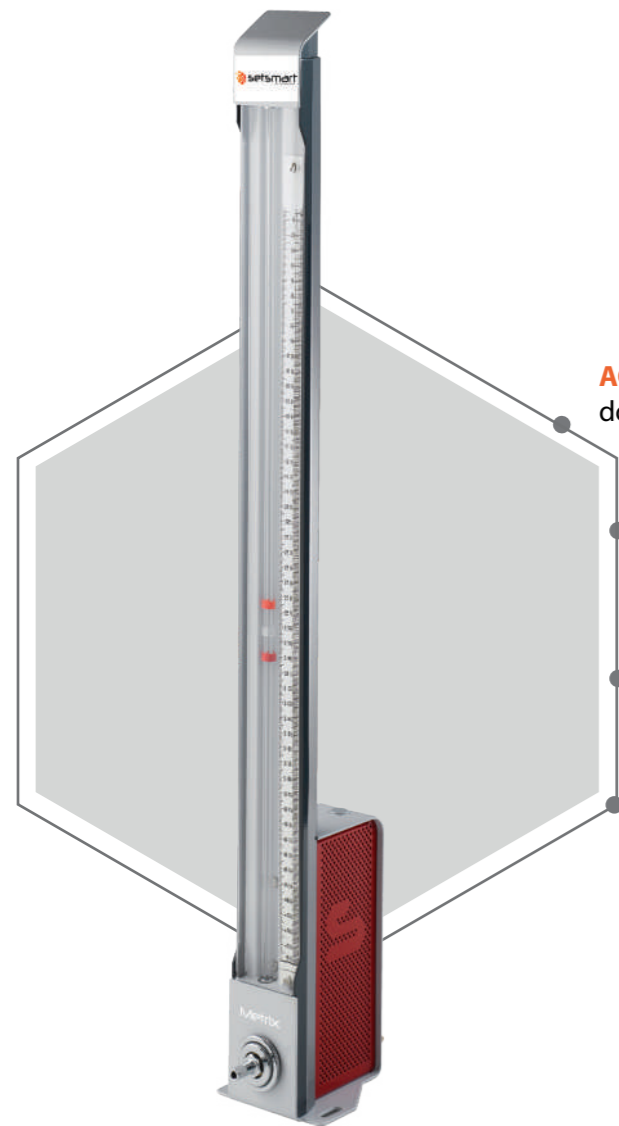


DISTRIBUTION

We improve the reliability of your fueling components and systems with our inspection and dimensional control solutions. They can be applied to valves, nozzles, compressors or their sub-assemblies.

METRIX ONE

YOUR ACCESSIBLE SOLUTION FOR PNEUMATIC DIMENSION CONTROL



ACCURATE AND PRECISE DIAMETER MEASUREMENTS

down to micrometers or better, and low R&R

FAST AND EASY CONTROL

- quick testing (within seconds), independent of the operator's skills

MATERIAL-FRIENDLY CONTROL

- with contactless pneumatic sensors that preserve the material's integrity

MADE-TO-MEASURE ANYWHERE

Installation possible in any work environment

METRIX ONE FOR SMALL APERTURES

Measurable diameter	0.2 to 3 mm (others on request)
Measurement uncertainty	+/-10 to +/-150 µm*

METRIX ONE FOR LARGER DIMENSIONS

Measurable dimension	2 to 300 mm
Measurement uncertainty	+/-0.1 to +/-3 µm**
Controllable tolerance interval	15 to 200 µm

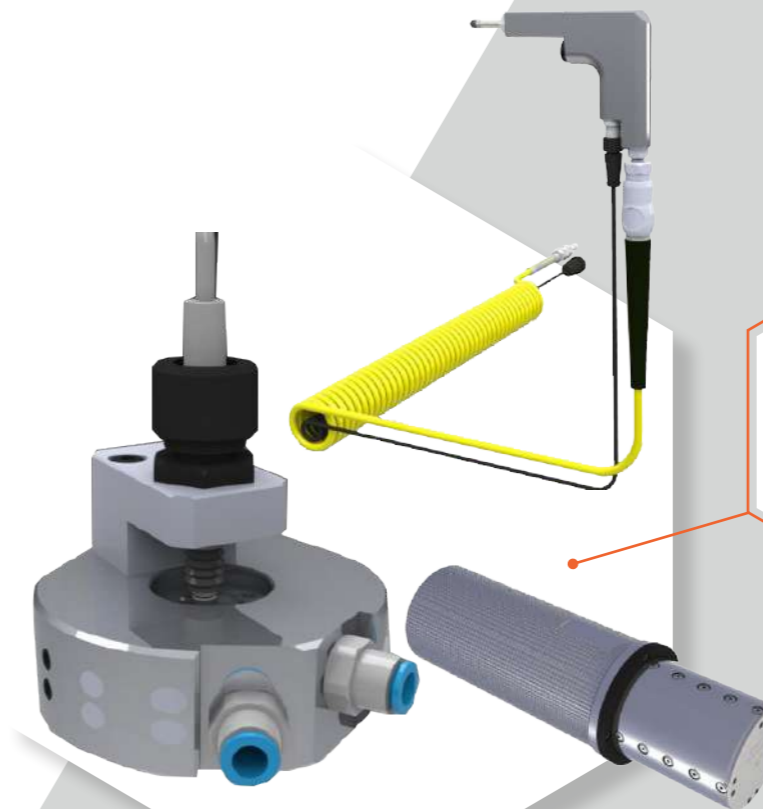
GENERAL

Dimensions of the base column (H / D / L)	730 / 112 / 96 mm
---	-------------------

* Depends on the measured diameter and on the calibrant's dimension uncertainty

** Depends on the tolerance interval to be controlled, and on the calibrant's dimension uncertainty

DIMENSIONAL CONTROL



A **specific measuring tool** is applied to the part to be checked (ring, gun, plug).

The controlled dimension is represented by a height of liquid, read on a graduated ruler.

This height is compared to the height read for a part of ideal size (standard), and the part is accepted if the height difference is within the defined tolerance interval.



METRIX OD

FOR PRECISE OUTER DIAMETER CONTROL

OUTER DIAMETER CONTROL



ACCURATE AND PRECISE DIAMETER MEASUREMENTS
down to micrometers or better, and low R&R

FAST AND EASY CONTROL
quick testing (within seconds), independent of the operator's skills

ULTRA HIGH PRECISION
with contact (tactile) transducers, also allowing for more measurement points over a smaller area

PRESERVATION OF THE CONTROLLED PART'S INTEGRITY
with contactless pneumatic sensors, that can also be used for online continuous control

UNATTENDED OPERATION
with automation, allowing operators to focus on value-added work

Various contact or contactless measurement transducers are used to fit your control requirements in terms of accuracy, density of measurement points, or parts robustness. Contactless transducers allow for online control, on continuously moving parts.

Positioning the controlled part is achieved by automated systems, making the use and measurements of METRIX OD user-independent.



Software provides information for quick decisions (good / bad / unclear) and more detailed analysis (e.g. parts profiles, statistics).

CONTACTLESS	
Technology	Pneumatic
Measurement uncertainty – moving part	+/- 5 µm or better
Measurement uncertainty – static part	+/-0.1 to +/-3 µm*
CONTACT	
Technology	LVDT
Tactile transducers resolution	0.1 µm
Measurement uncertainty – static part	+/- 5 µm or better
GENERAL	
Type of control	Diameter, Concentricity and more on request
Measurement cycle time	Within seconds

* Depends on the tolerance interval to be controlled, and on the standard part's dimension uncertainty

METRIX ID

FOR THE MOST DEMANDING INNER DIAMETER CONTROL



ACCURATE AND PRECISE DIAMETER MEASUREMENTS

Down to micrometers or better, and low R&R

VERSATILE MEASUREMENT

Adaptable to parts of varying diameters, shapes, and control depths. One base unit can be connected to various sensors for multiple measurements.

FAST AND EASY CONTROL

Quick testing (within seconds), independent of the operator's skills

MADE-TO-MEASURE ANYWHERE

Installation possible in any work environment

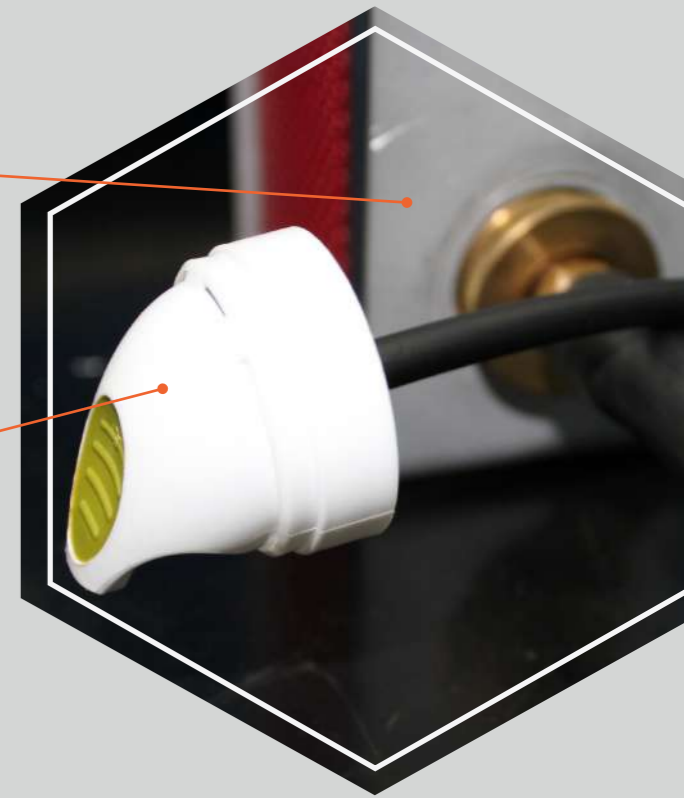
INNER DIAMETER CONTROL

The base unit provides compressed air to the sensor and **compares the measurement** with the calibrated value.

Sensors for small apertures (like spray nozzles) are directly connected on the part to be controlled.

Sensors for larger bores or tubes are inserted in the controlled part, at a set depth. Their diameters and lengths depend on the controlled part. They bear two or more control points to **check more than one diameter and detect defects like conicity or ovalization.**

Software provides simple information (good / bad / unclear) and statistical analysis.

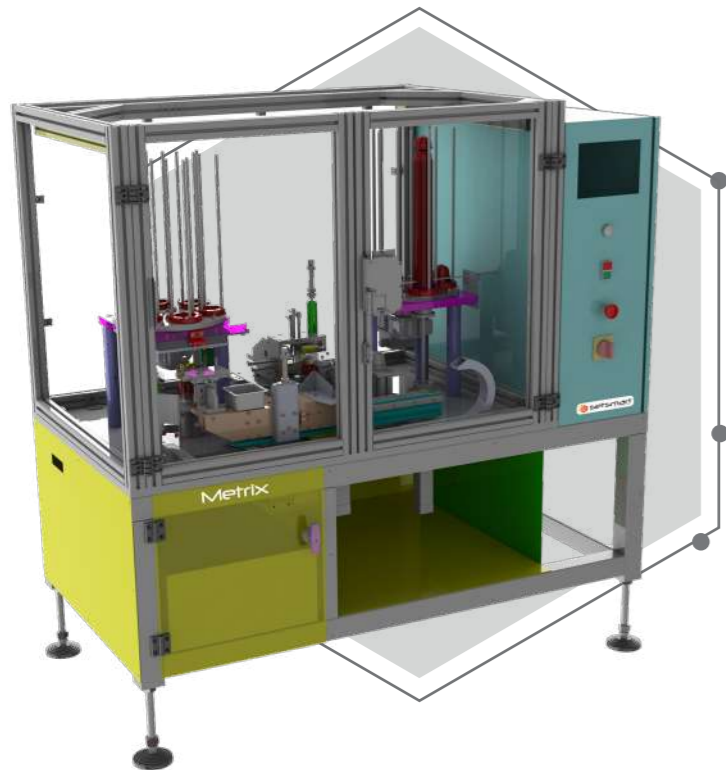


METRIX ID FOR SMALL APERTURES	
Measurable diameter	0.2 to 3 mm (others on request)
Measurement uncertainty	+/-10 to +/-150 µm*
METRIX ID FOR LARGER BORES OR TUBES	
Measurable diameter	2 to 300 mm
Measurement uncertainty	+/-0.1 to +/-3 µm**
Controllable tolerance interval	15 to 200 µm
GENERAL	
Type of control	Diameter, Conicity, Ovalization
Measurement cycle time	Within seconds
Dimensions of the base unit (H / D / L)	330 / 185 / 95 mm

* Depends on the measured diameter and on the calibrant's dimension uncertainty
 ** Depends on the tolerance interval to be controlled, and the standard part's dimension uncertainty

METRIX GEO

YOUR VERSATILE SHAPE CONTROL SOLUTION



VERSATILE SHAPE AND GEOMETRY MEASUREMENTS

- Of straightness, perpendicularity, parallelism, roundness, coaxiality, concentricity, depths of grooves, etc
- Of various types of objects : the number and positions of sensors are tailored to the part's design

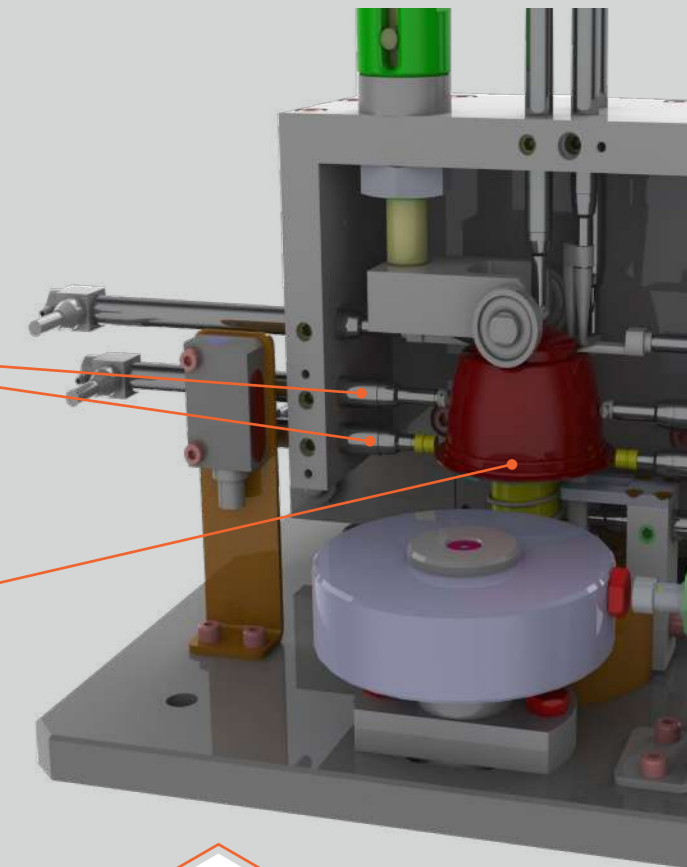
ACCURATE AND PRECISE CONTROL

Based on contact (tactile) transducers, contactless pneumatic transducers or a combination of both

OPTION FOR UNATTENDED OPERATION

With automation, allowing operators to focus on value-added work

SHAPE DEFECT CONTROL



Contact transducers provide ultra high precision measurements. They allow for many measuring points within a small area.

Unlike optical methods, they can **measure parts regardless of their color or surface condition.**

The controlled part is placed on a rotating stand. If sensors detect a fluctuation of its diameter, the part is deformed.

The loading, measurement, unloading, marking and sorting **of the part can be automated.**

Contactless pneumatic transducers can be used to **control outside shapes (with air rings) or inside shapes (with air plugs).**

The air plug shown here controls the coaxiality of two bores.



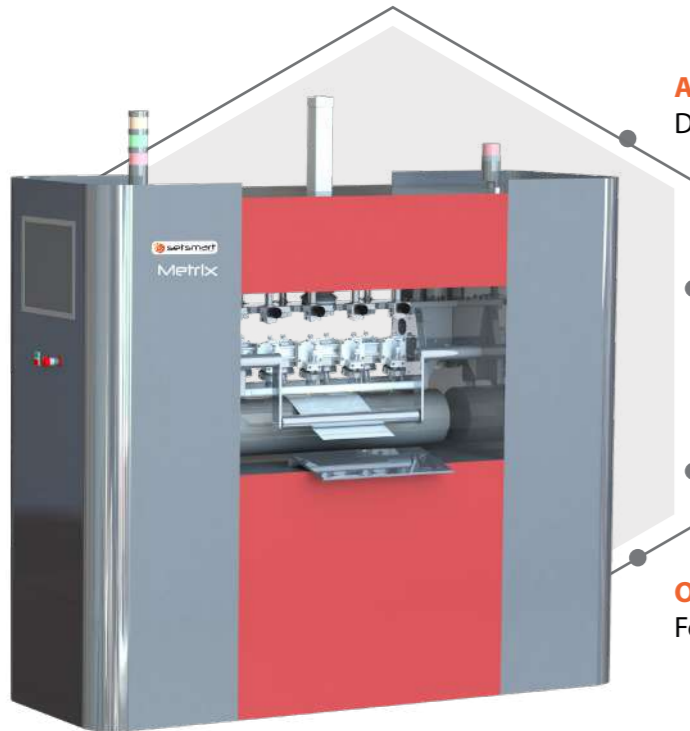
CONTACTLESS	
Technology	Pneumatic
Measurement uncertainty	+/- 5 µm or better*
CONTACT	
Technology	LVDT
Tactile transducers resolution	0.1 µm
Measurement uncertainty	+/- 5 µm or better*
GENERAL	
Type of control	Straightness, perpendicularity, parallelism, roundness, coaxiality, concentricity, depths of grooves, etc
Measurement cycle time	Within seconds

* Depends on the part controlled, and on the calibrant's dimension uncertainty

METRIX FILM

FOR CONTACTLESS THICKNESS CONTROL

THICKNESS CONTROL



ACCURATE AND PRECISE THICKNESS MEASUREMENTS

Down to micrometers or better, and low R&R

VERSATILE MEASUREMENT

Applicable to various shapes (e.g. plates, films, pads, tablets, pellets) and independent of the material's color or brightness

MATERIAL-FRIENDLY CONTROL

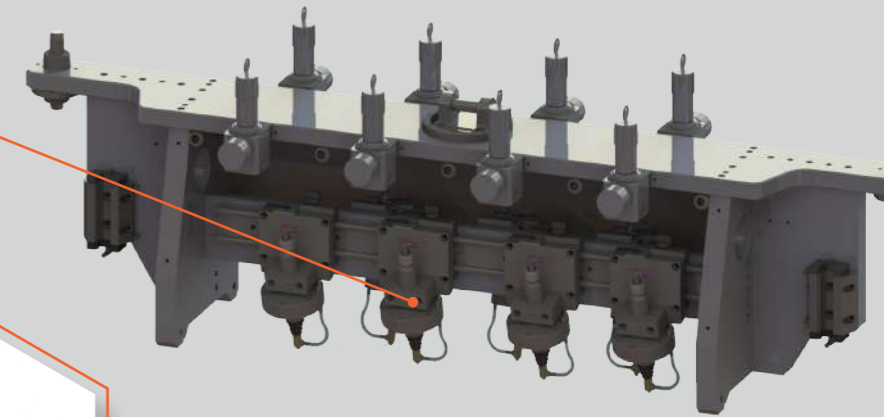
With contactless pneumatic sensors that preserve the material's integrity

ONLINE MEASUREMENT OPTION

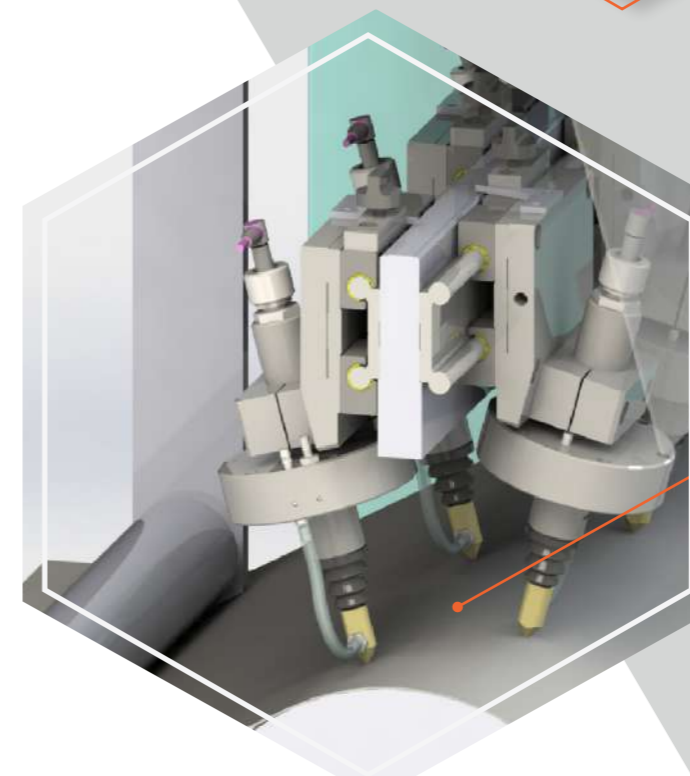
For automated measurement of moving parts or films

METRIX FILM's sensors are a unique combination of LVDT and pneumatic transducers. They allow for contactless measurements with **great accuracy and precision, over a large range.** Two sensors can be placed near the top and bottom of the controlled part, manually or automatically.

Options of:
Feedback loop to set the manufacturing parameters and correct thickness deviations.
Vision control to detect stains or color defects.



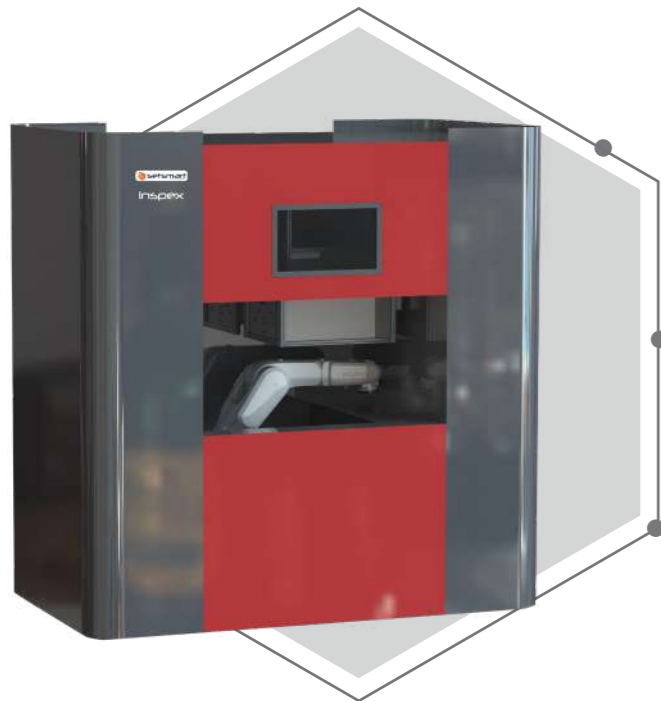
PERFORMANCE	
Measurement uncertainty	+/- 5µm
Thickness variation range	Up to 100 µm
GENERAL	
Data acquisition rate	50 milliseconds (e.g. a measurement every 2 mm at a scrolling speed of 2.5 m/min)



Continuous control of soft materials is achieved by placing sensors near the film that is stretched between rollers. The **high data acquisition rate leads to many measurement points.** Data treatment allows the reconstitution of the film's thickness profile.

INSPEX OUT

VERSATILE INSPECTION SOLUTION BY INDUSTRIAL VISION



VERSATILE CONTROL

- Surface defects (cracks, scratches, deformation, etc), incorrect assemblies (absence or wrong positioning of screws, connectors, etc), finish (color, burr, etc), dimensions, foreign objects
- On mono or multi-material parts and systems of various sizes and shapes

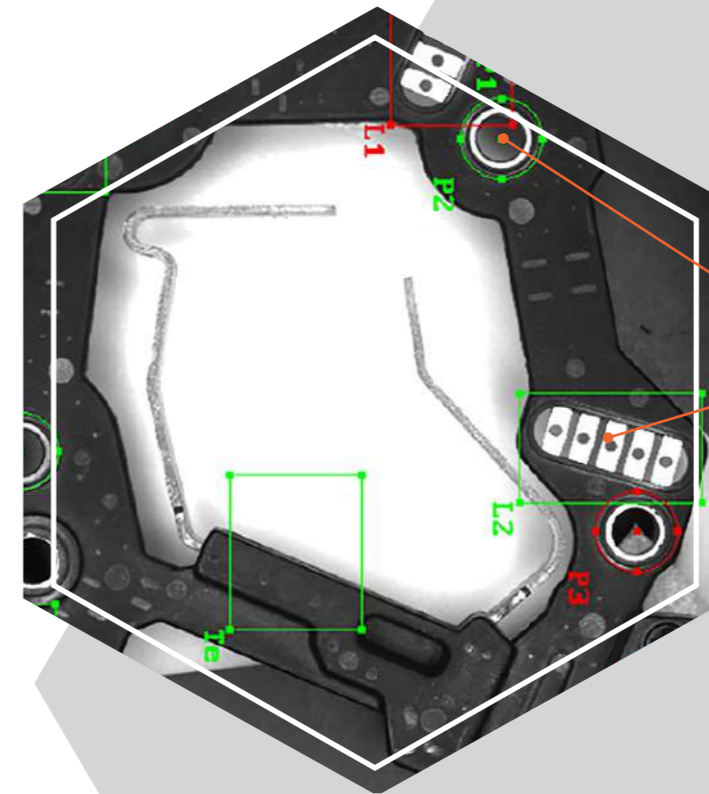
FAST AND EASY INSPECTION

- Achieved in a few seconds, user independent
- Non-destructive, non-intrusive, adapted to online control

AUTOMATION OPTIONS

Loading and unloading of parts, camera angles, sorting and marking, etc

INSPECTION BY VISION



Several inspection points (regions of interest) **are automatically treated** for measurements or detection. They are identified by comparing the part's picture with a compliant parts' photo library.

Parts handling is automated using robots, conveyors, etc. They can be automatically sorted based on the inspection results.

Vision technologies (cameras, lighting) are selected and combined **to obtain the best picture for the part's control.** Several pictures can be shot by several cameras, or by placing the part at different angles in front of one camera.

One machine's software and robot can handle several parts, with a possibility of automated identification of the part.



PERFORMANCE		
	Frame 1*	Frame 2*
Imaging system*	CMOS 3000x2208 pixel monochromatic camera	CMOS 640x480 pixel monochromatic camera
	Up to 5 frames per second	Up to 60 frames per second
	Focal length 25mm	Focal length 12mm
	Aperture F/1.4 to F/22	Aperture F/1.4 to F/16
Measurement uncertainty - dimensions**	0.25 mm	
Measurement uncertainty - area**	0.9 mm ²	
Cycle time	Within seconds	
GENERAL		
Dimensions in mm* (H / D / L)	1940 / 1150 / 1884	

*Typical values, can be tailored to your control requirements

**Guideline values, depend on the controlled part

INSPEX IN

INDUSTRIAL X-RAY INSPECTION SOLUTION



NON-DESTRUCTIVE AND VERSATILE INSPECTION

- Incorrect assembly (absence or wrong position of screws, connectors, etc), material failure (cracks, etc), dimensions, foreign bodies
- On pre-assembled and complex systems

SAFE CONTROL

With protection devices to ensure containment of radiation during the control cycle

AUTOMATED OPTIONS

Loading and unloading of parts, camera angles, sorting and marking, etc

PERFORMANCE

Imaging system*	1000x1000 pixels CCD camera
	Up to 30 frames per second
	Focal length 30 mm +/- 1%
	Aperture F/2 to F/12
Measurement uncertainty – dimension*	Up to 0.2mm
Cycle time*	Less than 15 seconds

GENERAL

Dimensions in mm* (H / D / L)	3110 / 2220 (closed) to 2830 (open) / 3300
--	--

*Typical values, can be tailored to your control requirements

X-RAY INSPECTION

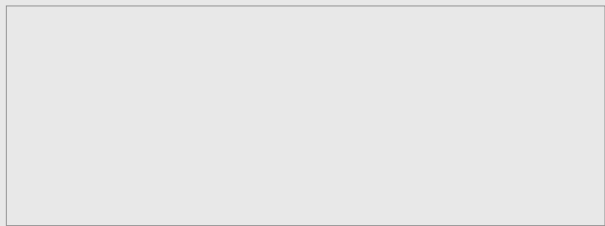
The controlled part is placed between the X-ray source and a detector for taking the picture. Radioprotection is possible thanks to a lead body and trapdoor.

Several inspection points (regions of interest) are automatically treated for dimensions measurement or defects detection. They are identified by comparing the part's picture with a compliant parts' photo library.



Parts handling is automated thanks to robots, conveyors, etc. They can be sorted automatically, based on the inspection results.

One machine's software and robot can handle several parts, with a possibility of automated identification of the parts.



Switzerland - France - China - United States - India - Hong Kong
Contact us : www.setsmartsolutions.com ou setsmart@kep-technologies.com

Setsmart is a registered trademark of KEP Technologies Group

EC • The specifications are given for information only and are not contractual - 04/22