Inspector

In-process inspection: "Inspector" – technology and concept

Need to inspect a part during production or the final result? The "Inspector" system provides a quick and efficient method to interface a computer controlled moving platform("Machine") with the most accurate laser probe. Real time data acquisition is fast and simple. With the "Inspector" system, users can connect a milling machine or an assembly line robot to the Optimet laser probe and quickly provide high precision inspection and measurement.

Control of parts produced on a production line, has always, and will be the principal quality factor of a product. Until today quality control was made mainly after finishing the production. In the past, dedicated machines, sample measurements and statistics methods were used to determine if the product was accepted or not. This is slow, expensive and as it does not detect problems during the production – inefficient. With the help of new technology we propose to change the conventional way. No mater how big or small the part to measure, if simple or complex, during the production or at the final step. "Inspector" provides a new way to ensure high quality parts every time, all the time.

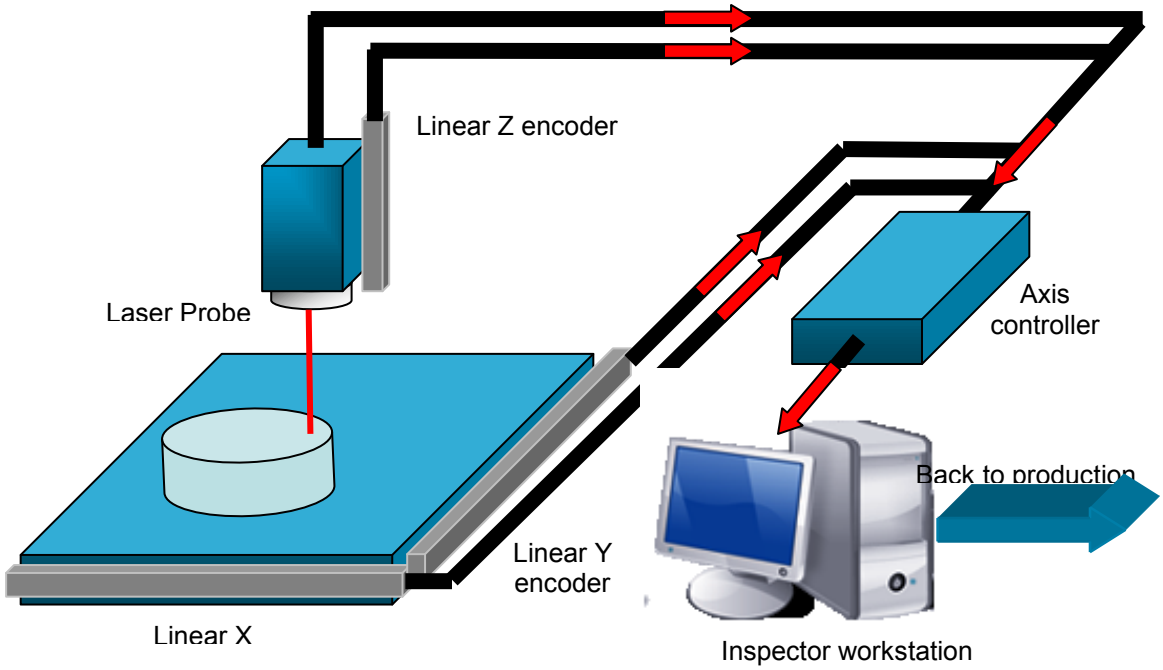
In-process inspection enables fast and accurate inspection of parts during the various production steps. The "Inspector" system takes advantage of the production equipment, enabling the same machine that has just completed a production step, also to verify its results. "Inspector" relays on its own tools to guarantee accuracy and is not dependant on the production machine accuracy.

"Inspector" provides a platform to quickly and easily generate an inspection program, convert it to the machine language and track the execution.

“Inspector” uses real time hardware to monitor both the machine axis motion and the flow of data from the laser probe. The data is then analyzed and compared with the desired result. “Inspector” provides an open architecture enabling customization of the solution to multiple applications, using a library of software tools and standard industry formats. “Inspector” is the ideal system to create a customized solution for inspecting any product with a minimum investment in time or money.

Inspector data flow and schematic

“Inspector” enables connecting up to 5 external encoders onto any motion platform. The system then tracks the motion of the machine as it executes an inspection program, generated by the system. The probe and encoder data is collected, filtered and analyzed to provide high quality measurement data. The system enables full surface scans, 3D sections, Edge detection, Hole evaluation and calibration. Customizing of the system for dedicated products, provides a highly efficient method to automate measurement strategies.



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Benefits

- High accuracy laser measurements: 2-50 micron
- Fast data acquisition: 3000 measurements per second
- Up to 5 axis control
- Cost effective
- Open architecture – easy customization,
- Support of Industry standards for both test planning and reporting
- In-Process inspection - Usage of production equipment
- Easy interface to any system – CNC machines, Assembly lines
- Easy to customize for a specific application
- No size limitation
- Ideal for mass production of precision parts

Markets

The main benefits of “Inspector” are:

- In-Process inspection
- High accuracy
- Speed
- Low cost

These benefits translate into efficiency and reliability in the mass production of high accuracy parts such as in the following industries:

- Military
- Automotive
- Aerospace
- Plastic
- Medical
- Packaging
- Electronics

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Inspector Components

Optimet Laser ConoProbe technology

The ConoProbe emits a laser beam that is reflected by a beam splitter and hits the object being measured. Scattered light returns from the object through the beam splitter and birefringent crystal and is then detected by the sensor's CCD camera (refer to Figure A1).

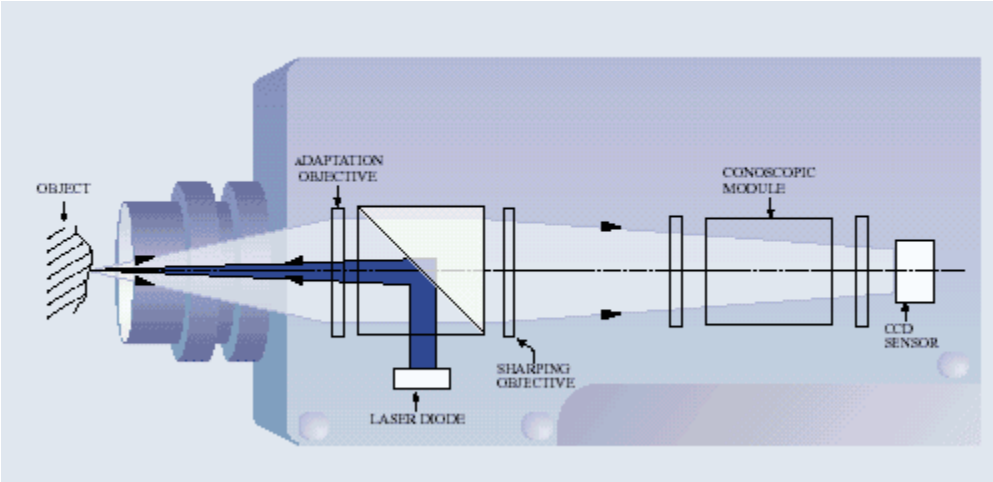

Figure A1

The birefringent crystal modifies the speed of each light ray differently in accordance with its angle. This creates a high contrast fringe pattern on the CCD camera. The angle of the light ray is a function of the distance between the reference plane and the laser spot projected on the object. The distance therefore can be determined by analyzing the characteristics of the created pattern.

ConoProbe description

ConoProbe – 850Hz

Smart – 3000Hz

The Smart and ConoProbe are the new generation of single point non-contact optical sensors developed and manufactured by Optimet. Optimet produce state of the art sensors, which are the result of over 5 years of field experience and over 100 different OEM applications around the world. In accordance with Optimet's line of non-contact sensors, these probes are based on our unique and patented Conoscopic Holography technology. Like the ConoProbe sensor, the Smart has been designed for integration in a large variety of industrial applications such as: Quality Control, In-process inspection and Reverse Engineering

The exceptional features of the Smart include:

- Optimum measurements at 3000 Hz (Smart) 850 Hz (ConoProbe).
- Low weight of 350 grams (Smart) 700 gram (ConoProbe).
- Compact.
- Modular setup with interchangeable objective lenses enabling various standoffs and working ranges in the same sensor.
- Sub-micron precision with short focal length objectives.
- Simultaneous measurement on highly reflective and diffusive surfaces.
- Extensive angular coverage of over 170° width.
- Measurement of hard to measure geometries, steep grooves and angles.
- Integration capability with relay optics.

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ConoProbe Specification

	Lens Assembly Type (By Focal Length in mm)												
ConoProbe Specification	**Standard**									**High Definition**			
	16	25	40	50	75	100	125 ext	150	250	16	25	40	50
Z (Vertical) axis													
Precision (1,4) (µm)	<2	<3	<4	<6	<10	<15	<20	<35	<100	<0.5	<1	<2.0	<2.5
Reproducibility 2σ (µm)	<0.15	<0.4	<0.7	<1	<2	<4	<8	<15	<15	<0.1	<0.2	<0.4	<0.5
Working Range (mm)	0.6	1.8	4	8	18	35	45	70	180	0.2	0.6	1.4	2
Standoff (mm)	12	15	40	42	65	90	240	140	240	11	14	37	40
Lateral Axes													
Laser Spot Size (X) (µm)	11	22	30	45	65	75	100	120	220	3.5	6	10	15
Lateral Resolution (X) (µm)	5	12	14	15	25	35	50	50	100	2	4	7	10
Weight													
Lens (g)	460	40	122	25	25	25	400	25	25	460	40	122	25
Probe (g)	700									700			
Control Box (g)	1200												
Data Handling													
Data Rate	850pps												
Macros	Macro commands are provided to automate similar measurements												
Export Data to:	Excel, ASCII text file, BMP, JPEG, UBM, VRML												
Applications													
Precision for radius measurements	Relative to lens accuracy												
Angle measurement	170°												
Working temperature	18 to 35°C												
Continuous shock resistance	245 m/s2-25g-6ms >6000 shocks 6 directions												
Supply Voltage	82-265 VAC 50-60Hz												

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SmartProbe

Configuration	Standard					High Definition	
Objective Focal Length (mm) (*)	25	50	75	100	200	25	50
Precision (µm)	<1	<3	<6	<12	<60	<1	<2
Reproducibility 2σ (µm)	<0.3	<0.8	<1.5	<3.0	<15	<0.3	<0.5
Measurement Range (mm)	1.8	7.5	17	34	120	0.6	1.8
Standoff (mm)	18.5	40	60	90	175	15	45
Angle coverage	170°						
Dimensions (mm)	62X85X94(Smart)				62X85X94(ConoProbe)		
Weight (g)	380(Smart)				500 (ConoProbe)		
Laser class	FDA Class II - IEC class 2						

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Axis encoder control card

Compatibility	TTL/CMOS
Power-on state	Input (high-Z) with weak pull-downs Pull-down current: 10 mA (min) to 200 mA (max)
Hysteretic	300 mV Schmitt triggers

Digital logic levels

Level	Min	Max
Input low voltage	-0.3 V	0.8 V
Input high voltage	2.0 V	Supply + 0.3 V
Input low current (V_{in} =0 V)	—	10 µA
Input high current (V_{in}=Supply)	—	200 µA
Output low voltage (I_{out}=4 mA)	—	0.4 V
Output high voltage (I_{out}=4 mA)	2.4 V	—

Digital I/O

Number of channels	32
Data transfers	Static

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Handshaking	None

Timing I/O

Number of channels	
4 Channel devices	4 up/down counters
8 Channel devices	8 up/down counters
Resolution	32 bits
Maximum Count	4,294,967,295
Rollover times	
100 kHz timebase	11.93 hours
20 MHz timebase	214.74 s
80 MHz timebase	53.69 s
Pre-scalers	X8 or X2 prescaler for each counter
Base clocks available	
4 Channel devices	100 kHz and 20 MHz
8 Channel devices	100 kHz, 20 MHz, and 80 MHz
Base clock accuracy	50 ppm (± 0.005%) over temperature
Maximum source frequency	
4 Channel devices	
without prescaling	20 MHz
with prescaling	60 MHz
8 Channel devices	
without prescaling	80 MHz
with prescaling	125 MHz
Minimum source pulse duration	
without prescaling	5 ns in edge-detection mode
with prescaling	3.5 ns in edge-detection mode
Minimum gate pulse duration	5 ns in edge-detection mode
Data transfers	
4 Channel devices	DMA (1 channel), interrupts

8 Channel devices	DMA (up to 3 channels) interrupts
DMA modes	Scatter-gather

Bus Interface

All devices	Master, slave

Power

Device requirement	+5 VDC (±5%) 4 Channel devices: 0.4 A to 0.75 A 8 Channel devices: 0.5 A to 1.5 A (with 1 m shielded cable as load) Varies with application, does not Include I/O power supplied through I/O connector
Available at I/O connector	4.65 to 5.25 VDC, 1 A

Environment

Operating temperature	0 to 50 °C
Storage temperature	–20 to 70 °C
Relative humidity	10% to 95% no condensing

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