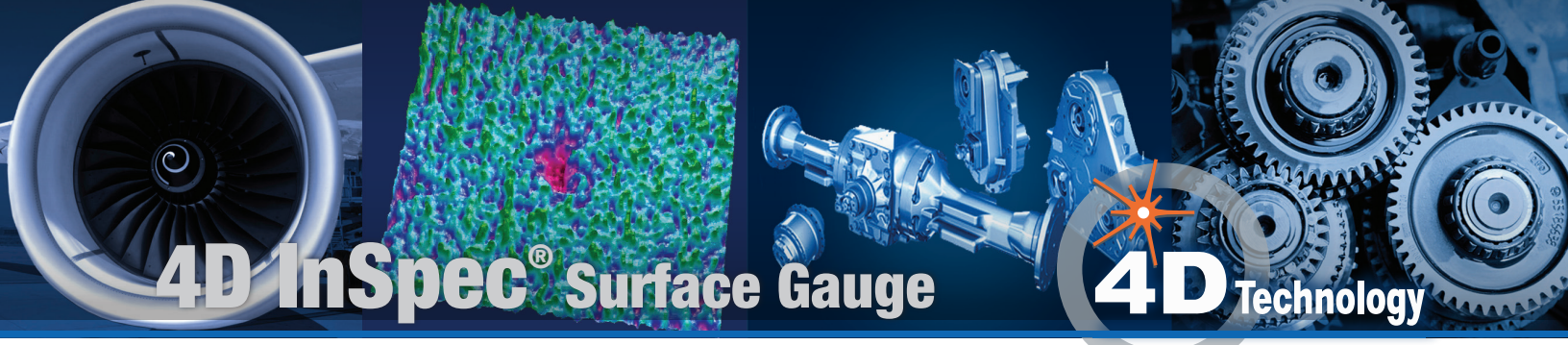
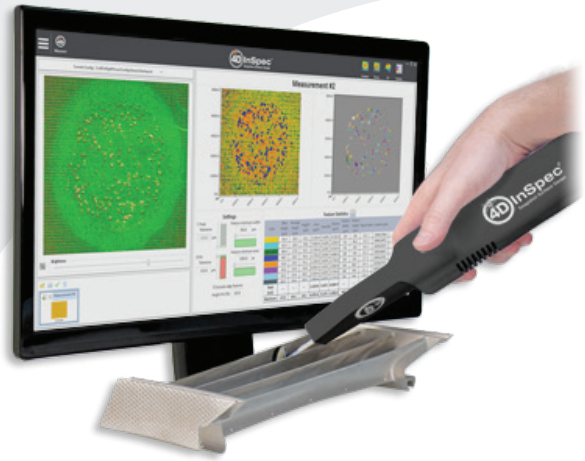


4D InSpec® Surface Gauge

4D Technology

- Instant 3D Surface Measurement
- Measure Defects and Features from 4 µm–2.5 mm Deep
- Measure Large Components Directly—No Replication Needed
- Easy Measurement of Complex Geometries
- Handheld, Workstation or Robotic Operation

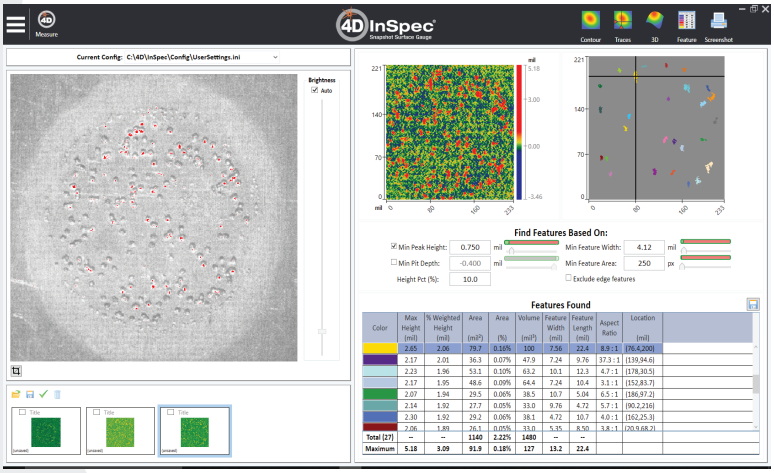
The 4D InSpec Surface Gauge is the first handheld, precision instrument for non-contact measurement of surface features and defects. With micrometer-level resolution, portability, affordability and ease-of-use, 4D InSpec puts high resolution measurement on the factory floor, in machine shops and deployed environments.



4D InSpec brings 3D measurement to the factory floor, to quantify pits, scratches, nicks, dents, bumps, porosity and other features from 0.0002" to 0.1" (5 µm–2.5 mm) deep or tall. 4D InSpec is far more repeatable and accurate than visual comparison techniques typically used for surface defect measurements. Unlike high-end metrology systems it is rugged, flexible and affordable, to measure a wide range of part geometries in the most challenging environments.

The 4D InSpec can be handheld to access tight corners or to sample large surfaces. An optional fold mirror accessory lets the system function like a borescope to access blind holes and inner diameters. One-button operation and immunity to sensor movement make it easy to align and measure, while a rugged aluminum housing and single cable tether withstand the rigors of daily use.

In a workstation configuration 4D InSpec makes it fast and easy to obtain repeatable quality control data. An intuitive, touchscreen interface handles setup, operation, analysis and report generation. The 4D InSpec can also be mounted on a robotic manipulator for fully automated measurements of complex components.

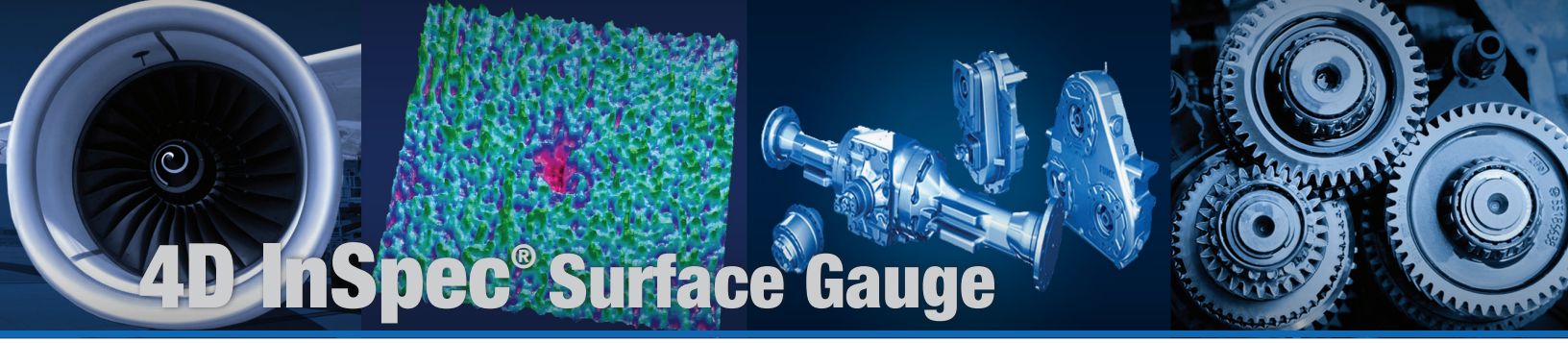


The included software automatically locates defects and calculates their height, volume, area, slopes and location. The operator can choose from 2D traces or 3D plots to view defects in great detail. The system also supports easy data transfer to quality control systems for rapid pass-fail analysis.

A complete 4D InSpec system includes the instrument, computer with HD 1080p touch-screen interface, single Ethernet cable tether and software. A portable workstation and Li-ion rechargeable battery with up to 8 hours of operational time are also available.

The 4D InSpec quantifies damage, wear and corrosion directly on parts with complex geometries, such as this turbine blade section. Automatic feature finding, 2D traces and 3D plots make it easy to analyze surface features and defects.

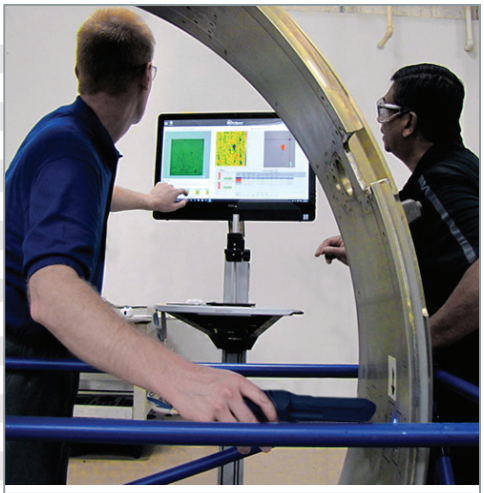
3280 E Hemisphere Loop, Ste 146, Tucson, AZ 85706 • Tel: +1 (520) 294-5600 • Fax: +1 (520) 294-5601 • www.4DInSpec.com

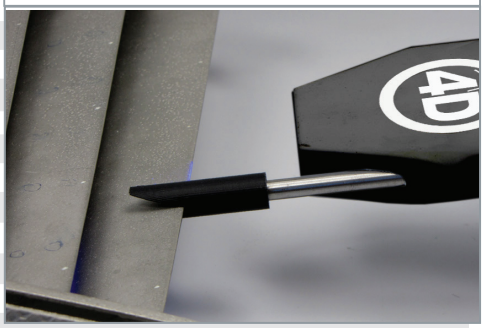


4D InSpec® Surface Gauge

Specifications

Description	4D InSpec Surface Gauge
Basic Specifications	
Acquisition	Instantaneous, non-contact 3D surface measurement
Measurable Range	Defects and features 0.0002–0.1 in (5 µm–2.5 mm) deep/tall
Field of View (module)	0.3 x 0.3 in (7.7 x 7.7 mm)
Lateral Sampling	Lateral Sampling 0.00016 in (4.0 µm)
Vertical Resolution	0.00016 in (4.0 µm)
Mounting	Handheld, microscope stand, or robotic mounting possible
Standoff Distance	1.4 in (35 mm)
Software	
Analysis	4D InSpec control and analysis software
Measurement Modes	Single snapshot; enhanced resolution multi-snapshot mode
Defect Detection	Identify features based on height, area, and width thresholds
Defect Calculations	Max height, volume, area, max slope, density, aspect ratio, XY location
Data Displays	Contour, 3D, XY slice with arbitrary cursors, radius of curvature
Data Output	Tabular feature analysis statistics with 3D surface maps
Data Masking	Masking based on signal to noise ratio; rectangular ROI masks for analysis
Export	XYZ point cloud, CSV file, or 2D Trace
Computer	Multiple options including all-in-one touchscreen, laptop, or customer-supplied
Electrical/Mechanical	
Dimensions	11 x 2 x 2.8 inches (280 mm x 50 mm x 70 mm)
Light Source	450 nm LED with 100,000 hour MTBF
Sensor	1900x1900 pixels, 12-bit scientific CMOS camera
Power Consumption	< 10 W 4D InSpec unit; < 250 W with computer system @ 120 VAC
Weight	< 2 lbs (0.8 kg) instrument only
Cable Length	10 ft (3 m); longer length optional
Operating Temperature	50–86° F (10–30° C)
Operating Humidity	< 98% non-condensing
Shock resistance	150G ($1*10^{-8}$/kg/s^2)
Performance	
Noise Floor	< 0.00016 inches (4.0 µm) [1]
Vertical Repeatability	< 0.00001 inches (0.15 µm) [2]
Step Height Accuracy	< 1% [3]
Depth of Focus	> 0.10 inches (2.5 mm)
Minimum Part Roughness	2.5 µin (60 nm) Ra
Warranty	One Year, limited





1 Average Ra of difference between two measurements on 4D calibration sample.

2 1σRa for 30 measurements on 4D calibration sample.

3 Difference vs. PTB-certified values sample for features from 0.00039-0.035 in (100-900 µm) tall.

4 1σstandard deviation on 30 measurements of 50 µm tall feature.

Patents US 7777895, 7489408 and US 7230717. Others pending.

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