

iMAP System

INTEGRATED MEASUREMENT AND ASSEMBLY PLATFORMS

Circular geometry inspection and assembly system for mechanical assemblies such as aircraft engines, industrial gas and steam turbines

www.rpiuk.com

iMAP's capabilities delivers new levels of accuracy, flexibility and performance over a wide range of inspection and assembly applications.

IntelliProbe Corrects For Extreme Setup Errors

Software algorithms address profile distortion due to part misalignment, "intelligent probing" corrects for part off-centering errors of up to 2% of the part radius with negligible error.

Distribute Results Easily

Inspection Templates and Inspection Data Files are easily distributed via email for analysis using the free downloadable viewer or via PDF generated reports and CSV files as standard.

Reduces Inspection Time by up to 90%

AccuScan's ability to measure 3,600 data points on up to 8 surfaces simultaneously per revolution will significantly reduce your process times compared with other available methods.

Unlimited Number of Surfaces

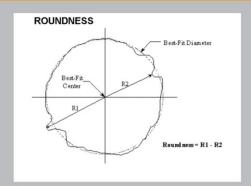
Up to 8 surfaces can be measured simultaneously with the total number of surfaces that can be measured unlimited.

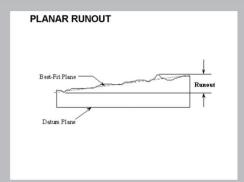
Used To Measure Circular Geometry

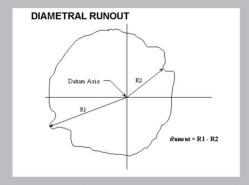
Designed for the collection and analysis of circular geometry inspection data including Roundness, Eccentricity, Diametral Runout, Planar Runout, Circular Flatness and Parallelism.

Probe Types

AccuScan[™] can be supplied with probes to best suit your application and can include LVDT, Half Bridge, Laser, Wireless Laser, Eddy Current and Capacitance.







Advanced Stacking Software For Predictive Modelling

IntelliStack™ is software designed to solve the mathematical problem of how to best assemble a multistage rotor assembly. The Rotor Stacking Program can be used for the assembly of Industrial Gas Turbines, Steam Turbines, and Aircraft Engine Rotors.

Sub-Micron Performance

iMAP offers extremely high levels of accuracy boasting sub-micron measurements and repeatability.

High Loading Capacity

iMAP's cleverly designed bearing options not only guarantee the highest precision available but a very high load carry capability.

Shop Floor Compatible

iMAP has been specifically designed for shop floor use and employs B89.3.1 Standard - Profile Filtering to remove all background interference.



Process Reference Standard

The sub-micron circular geometry reduces process measurement uncertainty to a level where iMAP can be considered your measurement reference standard.

Why RPI

Over 75 years of engineering heritage underpins our rotary innovation and reputation as a leading supplier of measurement systems for Gas Turbine measurement and assembly, Calibration Laboratories, Coordinate Measurement and for wider inspection and measurement applications where high precision angular accuracy and axis geometry is demanded.







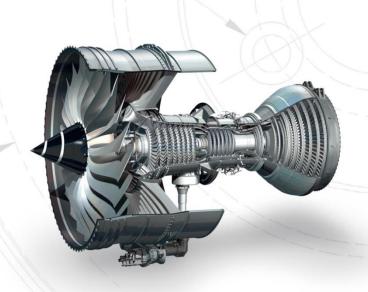








ESTABLISHED IN THE 1940's, RPI is based in the city of Bath, South West England, an area with a very strong Engineering pedigree.





Experts in the supply of challenging and niche measuring solutions.

Extensive global experience.

Market Forces

Aerospace Trends and Challenges

Big changes underway

- Strong world emerging market growth
- Re-fleeting for North America
- New technology engines increasing share of fleet Fuel efficiency dominates operating economics
- Operators expect maintenance costs to be flat relative to current models Operators more sophisticated and demanding
- More consideration of maintenance at the time of equipment purchase/lease



Source: CAVOK

Engine New Build

The global air transport jet and turboprop engine fleet will grow by more than 20,000 net new engines by 2025

- 2015 engine levels 50,478, 2025 engine levels 70,563
- Global engine fleet will grow by 3.4% per annum
- Next generation engines will comprise 30% of the fleet by 2025
- Combined Engine revenues forecast to reach \$1th over the next 20 years
- Boeing and Airbus combined deliveries 2015 was 1300, their backlog 10,000

Engine Overhaul MRO

Engine overhaul is defined as off-wing repair and replacement of parts to restore the engine to designed operational condition. The engine is disassembled and inspected with parts repaired or replaced as necessary.

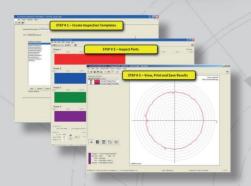
- Engine Overhaul Frequency 3,500 hrs to 7,000 hrs
- Typical Overhaul Cost \$200,000 to \$800,000
- Market value \$27.9bn in 2015
- Annual growth at 5.3% reaching \$46.8bn by 2025



iMAP Concept



The definitive system for productivity improvement in Turbine Rotor assembly, **iMAP** is designed to enable our customers to meet the ever changing needs of a fast paced industry.



Simple and intuitive data acquisition software



Advanced Stacking software significantly improves rotor assembly rotor quality



Inspection templates and results can be easily written and displayed on any PC anywhere in the world

Connectivity and Compatibility



- Generate and export Polar Plots, Calculated Results, N Point and Strip Chart PDF inspection reports
- Easily share inspection data worldwide via our free downloadable software AccuScan Viewer
- Integrate iMAP with your internal quality system
- Ethernet or Wi-Fi connectivity
- Export CSV files for external analysis
- Shop floor compatible
- Export inspection data directly into stacking software
- Oracle data base
- Networkable

iMAP System Configuration



iMAP System Configurations

The definitive system for productivity improvement in Turbine Rotor assembly, iMAP is designed to enable our customers to meet the ever changing needs of a fast paced industry

- High Precision Air Bearing Rotary Spindle
- Motor driven rotary axis
- Load carrying capacities of up to 14,000kgs
- Multiple gauge setup with 2, 4 or 8 Channel Measurement Software
- IntelliStack predictive rotor stacking software
- Centring and levelling platens
- Fully retractable measuring arms for safe component loading
- Parameters include, Roundness, Runout, Flatness, Parallelism and Concentricity

Significant Operational Improvements

	% Study Variation			
	Concentricity (Manual Data Collection)	Concentricity (iMAP Data Collection)	Swash (Manual Data Collection)	Swash (iMAP Data Collection)
	26.69	7.57	36.38	3.56
Repeatability	14.86	4.02	32.83	2.63
Reproducibility	22.17	6.42	15.68	2.40
Operator	4.85	3.32	5.66	0.00
Operator*Part	21.63	5.49	14.62	2.40
Part-to-Part	96.37	99.71	93.15	99.94
Total Variation	100.00	100.00	100.00	100.00
	Reproducibility Operator Operator*Part Part-to-Part	(Manual Data Collection) 26.69 Repeatability 14.86 Reproducibility 22.17 Operator 4.85 Operator*Part 21.63 Part-to-Part 96.37	Concentricity (Manual Data Collection) Concentricity (iMAP Data Collection) 26.69 7.57 Repeatability 14.86 4.02 Reproducibility 22.17 6.42 Operator 4.85 3.32 Operator*Part 21.63 5.49 Part-to-Part 96.37 99.71	Concentricity (Manual Data Collection) Concentricity (iMAP Data Collection) Swash (Manual Data Collection) 26.69 7.57 36.38 Repeatability 14.86 4.02 32.83 Reproducibility 22.17 6.42 15.68 Operator 4.85 3.32 5.66 Operator*Part 21.63 5.49 14.62 Part-to-Part 96.37 99.71 93.15

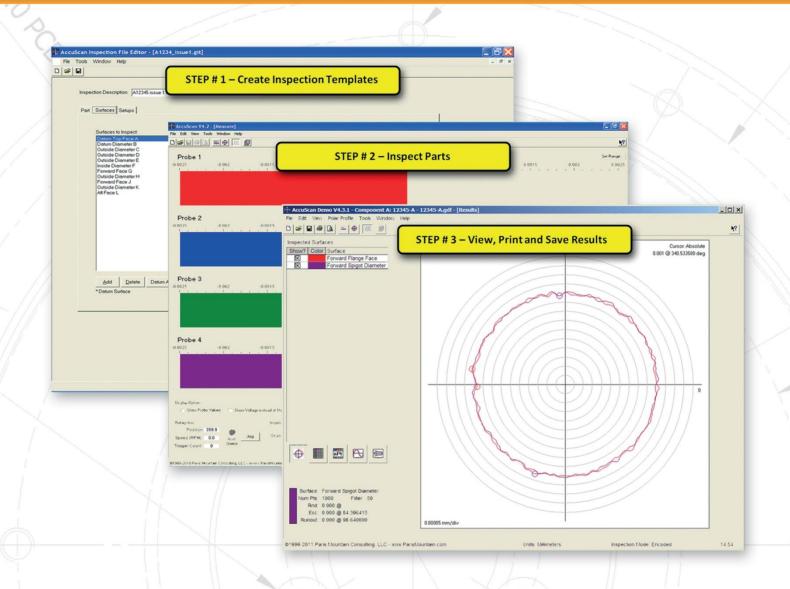
iMAP Gauge R&R (Concentricity and Swash)

Manual data collection compared to iMAP data collection

Gage R&R, which stands for gage repeatability and reproducibility, is a statistical tool that measures the amount of variation in the measurement system arising from the measurement device and the people taking the measurement.

- 10 times improvement in Repeatability and Reproducibility in Runout measurements over manual systems
- 3.5 times improvement in Repeatability and Reproducibility in Concentricity measurements over manual systems
- 90% faster than conventional methods

AccuScan Inspection Procedure



Complete Your Inspection Process In 3 Easy Steps

Step 1

Select an Inspection Template and Assign color-coded probes to surfaces.

Step 2

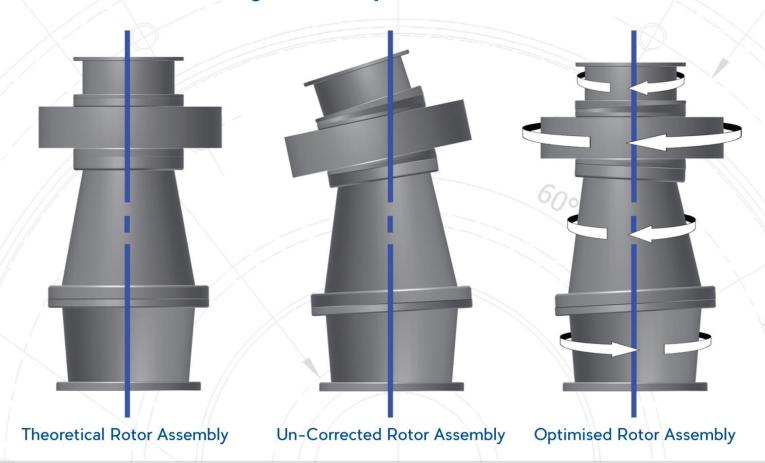
Start inspection

Step 3

View results, Print Report or Save As PDF file, Save results in Geometry Data File

IntelliStackTM

Advanced stacking software for predictive modelling of multi-part rotor assemblies



IntelliStack™ - software designed to solve the mathematical problem of how to best assemble a multi-stage rotor assembly.

IntelliStack™ can be used for the assembly of Industrial Gas Turbines, Steam Turbines, and Aircraft Engine Rotors and is fully compatible with all AccuScan™ inspection systems and will significantly improve rotor assemblies by iteratively calculating each part's optimal position with respect to its neighbours and its effect on overall rotor quality.

Stacking parameters, including number of parts per assembly, number of allowable positions for each part both with no theoretical maximum, stacking methodology (e.g. runout-driven or balance-driven) and more, can all be configured by the user.

Stacking parameters for each part can be pre-programmed at the same time as inspection parameters using **AccuScan IFETM**, inspection results will then be "stack-ready" when generated by $AccuScan^{TM}$.

Re-usable Stacking Templates can be created and used for repetitive assembly scenarios. By preprogramming stacking parameters and using Stacking Templates, just a list of part IDs are needed to run a stack.

Sub-assembly stacking, partial stacking, known or locked-position stacking, and part-replacement stacking are all scenarios that can be accomplished using IntelliStack™. Benefits include reduced assembly time, avoidance of costly rotor teardowns, lower runout and unbalance, and a better understanding of machining process capabilities and their effects on rotor assembly.

iMAP's features have been designed to help you get the job done.

Fast and Simple

The simple and intuitive full-featured Windows software enables any operator to quickly and easily inspect the type of complicated parts normally associated with gas turbines.

Programming Can Be Done Off-Line, On The Fly, Or Both

Inspection templates can be generated at the machine using AccuScan™, independently on any PC anywhere in the world using AccuScan IFE™ or a combination of both.

Integrated Help

Clicking the Help button located in the top right hand corner of any screen gives the operator instant access to the comprehensive users instruction.

Internal Probe Calibration

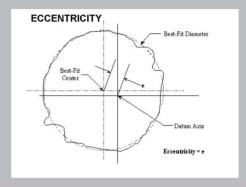
Probe calibration is accomplished using the Probe Calibration Wizard, which is accessed via the Tools menu. The calibration is a multistep process, and instructions are displayed at each step.

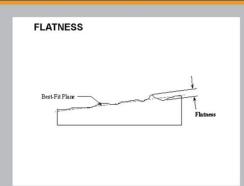
Anti-Vibration Base

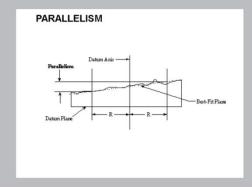
The anti-vibration granite base assembly helps to guarantee accuracy by isolating the measurement process from shop floor interference.

Measurement Probe Alignment

Lasers aid alignment of the measuring probe with each other and component / process datum's. The lasers project a green line down the length of the component under test.







Results Are Recalculated Dynamically

Raw inspection data is collected and stored so datum's, surface definitions and measurement units can be changed at any time with results being recalculated dynamically.

Out-Of-Tolerance Flagging

Out-Of-Tolerance Flagging quickly identifies to the operator non-conforming parts.

Centering And Levelling Platens

Centering and levelling platens allow the operator to easily position the part with radial adjustments of +/-12mm and tilting of +/- 1 degree.

Rigid Column Units

Column Units provide a rigid platform on which to mount the measuring probes and can be manoeuvred by counter-balance arms and locked at any position via a mechanical clamping system.



High Precision Air Bearings

iMAP utilises very high accuracy air lubricated hydrostatic bearings which guarantee exceptionally good motion geometry.

"You can know a company by the companies it keeps"

















Interested to know more about the ground-breaking iMAP range of inspection systems?

Call: +44 (0)1225 426206 **Email:** sales@rpiuk.com

Visit: www.rpiuk.com

Measurement systems designed, developed and manufactured by

Rotary Precision Instruments UK Ltd

For further information please visit: www.rpiuk.com



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