IBS
Precision Engineering

SPINDLE MEASUREMENT TOOLS

ANALYZER SYSTEMS

INTELLIGENT MACHINING

PRODUCTION ENGINEER, MACHINIST OR MAINTENANCE PROFESSIONAL

With our partner Lion Precision, we offer spindle measurement products that will allow you to:

- quickly prove with data the overall condition of a spindle
- determine a machine's best and worst operating speeds
- identify potential root causes of issues

PLANT MANAGER, PRODUCTION SUPERVISOR OR ENGINEERING LEAD

Imagine if you could:

- define the best machine for the job
- minimize unnecessary spindle rebuilds or replacements
- better manage your machine tools

RESEARCHER, PROFESSOR, SCIENTIST OR METROLOGIST

Imagine technology that provides you with data that will help you:

- expand your knowledge of a machine's performance
- allow you to advance a machine to a higher level of precision
- all while speeding up your research process and improving lab capabilities

SOLVE PROBLEMS FOR:

- Production / Machine Shops
- OEM Design Centers
- Maintenance / Calibration
- Universities
- National Labs

HOW IT WORKS

1.

Mount Target in Spindle

2.

Place Electronics

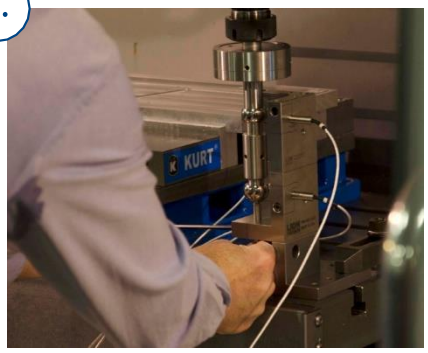
3.

Set Up Probe Nest

4.

Start Up Software

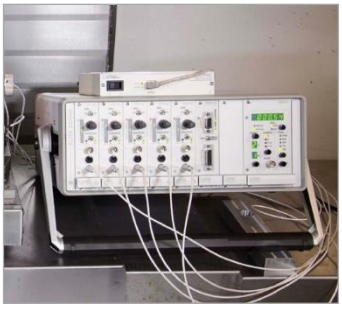
5.



Align and Test

MACHINE MEASUREMENT TOOLS

Spindle Error Analyzer (SEA)



Flexible configuration for sophisticated measurements and highest precision spindles. Best analysis device available.

SpindleCheck Analyzer (SCA)

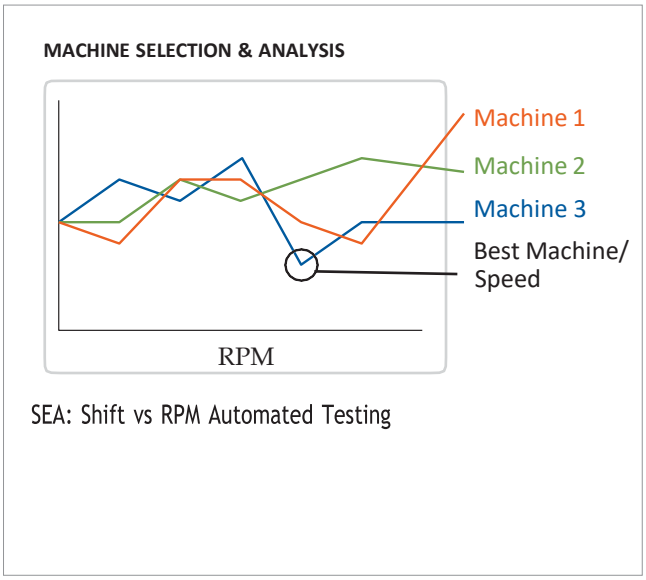
Detailed analysis of machine performance withhigh resolution.

SETUP & OPERATION

Configuration
Each measurement device comes with a configuration interface which includes the choice of multiple languages, targets, diagnostic and analytic settings that can be adjusted to any application.
SEA / SCA

Oscilloscope
The Oscilloscope is a utility display that emulates a basic oscilloscope, allowing a time-based view of the data acquired on any probe channels.
SEA / SCA

Probe Meter
Probe Meter is an analog meter indicating the current probe/target gap of the selected probe. It is often used as a tool for setup and troubleshooting.
SEA / SCA



SEA: Shift vs RPM Automated Testing

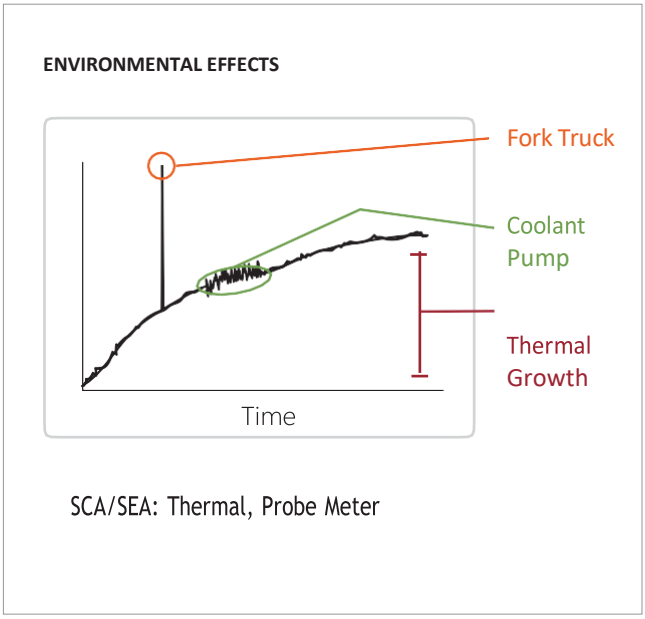
THERMAL MEASUREMENT

Thermal
Thermal testing allows for rotating or non-rotating spindle measurement to analyze the effect temperature changes have on the machine tool. It is often used in troubleshooting environmental conditions or determining thermal stability.
SEA / SCA

Warm Up
When a cold spindle begins to rotate, friction heating of the bearings causes the spindle to expand (primarily in the Z axis). Knowing the time until a machine stabilizes allows for more precise scheduling/planning, less scrap, and may expose machine frame distortions.
SEA / SCA

Temp & Encoder Input Module
Uses sensors for monitoring temperature change. Also includes an encoder and index input for triggering the measurement.

SEA



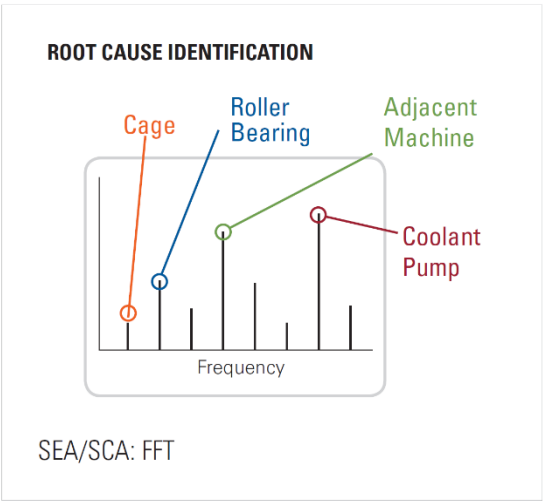
SCA/SEA: Thermal, Probe Meter

POSITION MEASUREMENT

FFT

The FFT analysis test acquires data from a single probe and displays the relative amplitude of its frequency components. A graph of amplitude vs. frequency is produced. FFT data is used in identifying bearing frequencies, resonant frequencies, harmonics, RPM and structural vibration.

SEA / SCA



SEA/SCA: FFT

Position Shift

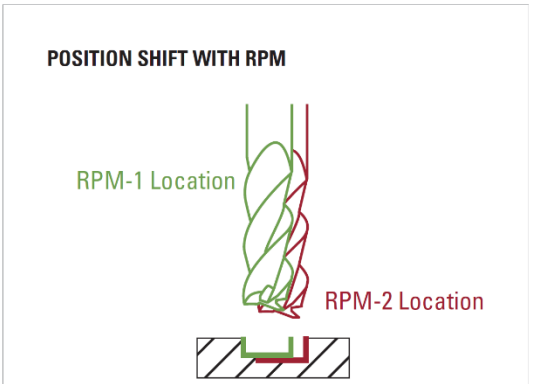
The axis of rotation of the spindle may shift location with changes in RPM. Charting any changes in position of the axis of rotation of the spindle against RPM allows the operator the ability to adjust RPM or offsets to correct any errors.

SEA / SCA

Meter Module

Provides a digital display of the displacement.

SEA



SEA/SCA: Shift with RPM

DYNAMIC MEASUREMENT

Total Error

While the individual components of the "Total Rotation Error" provide insight into specific part errors; the Total Rotation Error (total error motion) gives a general condition of a spindle and a quick comparison of the condition of spindles on multiple machines.

SEA / SCA

Runout/TIR

Often used in manufacturing, Runout will affect the diameter of holes and straightness of cuts. It should not change dramatically with changes in speed. Changes in Runout are a potential sign of significant wear causing the system to shift or bend as the spindle turns faster.

SEA / SCA

Synchronous Error/ Roundness Capability

The portion of the total error motion that repeats every revolution and relates to the ability of the machine to produce round features when drilling or boring in a milling operation or when doing longitudinal turning on a lathe.

SEA / SCA

Asynchronous Error/ Surface Roughness

The portion of the total error motion that does not repeat from revolution to revolution. These are caused by machine vibrations and in ideal cutting conditions with a single point tool would be a reasonable indicator of the surface roughness (Ra) of the finished part.

SEA / SCA

Radial Fixed Sensitive/Turning

Radial Fixed Sensitive acquires displacement in one axis relative to spindle angular location and displays the data in a polar plot. Most often used in lathe applications.

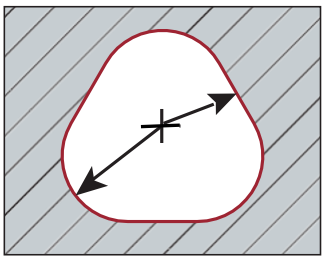
SEA / SCA

Radial Rotating Sensitive/Milling

Radial Rotating Sensitive acquires displacement data from two probes positioned 90° apart. The probes measure the X and Y displacement of the axis of rotation to generate a polar plot. Most often used when measuring mills.

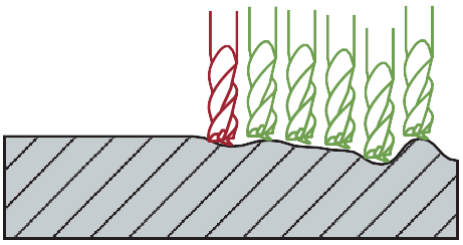
SEA / SCA

ROUNDNESS CAPABILITY



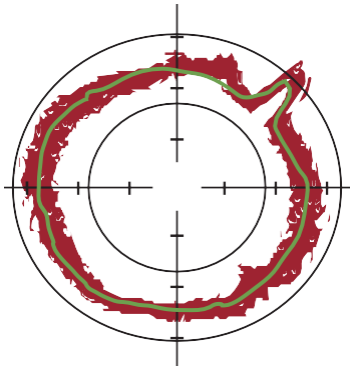
SCA/SEA: Radial Synchronous Error Motion

ROUGHNESS CAPABILITY



SCA/SEA: Radial and Axial Asynchronous Error Motion

POLAR PLOTS

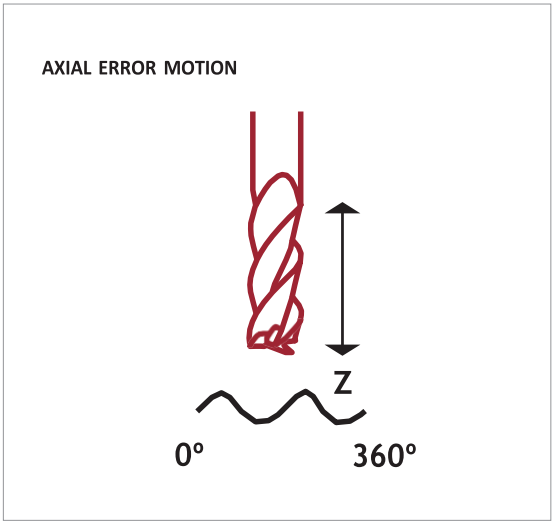


SEA/SCA: Asynchronous & Synchronous Error

Axial

Axial Error Motion utilizes displacement data from one probe in the Z axis. The probe measures the axial displacement of the spindle. In addition to a polar plot, axial error motion can also be displayed in a linear, oscilloscope type display.

SEA / SCA



Tilt Thermal

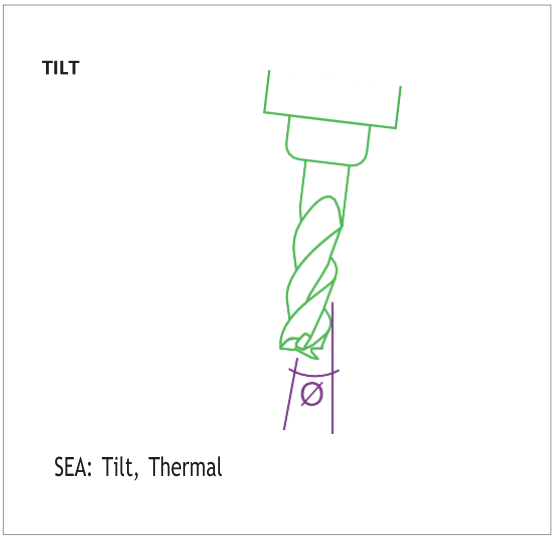
Using two probes in either the X or Y direction, thermal tilt can determine if there is a distortion of the machine frame which will cause a much larger error than simple thermal expansion.

SEA

Tilt Dynamic

Using two probes in either the X or Y direction, dynamic tilt is measured to determine how much worse the synchronous error (related to roundness) and asynchronous error (related to surface roughness) are as the distance from the spindle nose increases. Results are displayed as polar plots or 3D plots.

SEA



Donaldson Reversal

Donaldson Reversal displays data from two Radial – Fixed Sensitive tests combined in such a way that form errors in the target (out of roundness) are separated from the synchronous error motion of the spindle.

SEA

HARDWARE

Travel Case

SEA / SCA

SELECT A PRODUCT FAMILY

To find the right product, determine the following criteria:

1. ### *Spindle Speed (RPM)*
Determine which product you need based on the maximum and minimum RPMs needed for your application.

2. ### *Distance to the End of Tool*
If you have a long distance from spindle nose to tool end, you may want to measure tilt. The longer this distance, the more error that occurs at the point of machining as the machine distorts with temperature changes and the spindle tilts at different points of rotation at different speeds.

3. ### *Hardware*
Select the hardware components you need for your system. Your decision may be based on where the product will be used: such as a production environment, where items will move around the shop, versus a lab environment where items will often be setup and left in a location.

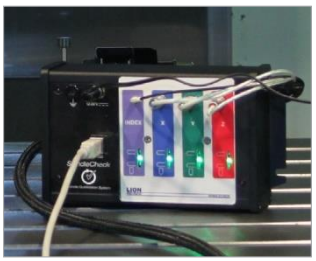
4. ### *Features*
Products were designed with specific types of users in mind. SEA was built for high end machine testing and R&D centers, where SCA was developed for the quick check of machines in a production environment.

5. ### *Tilt*
Tilt measurements require five probes.

6. ### *Select Product*
The final outcome of these selections should give you the product that is right for you:
The Spindle Check Analyzer or the Spindle Error Analyzer.

STANDARDS & REFERENCES

- ISO230: Test Code for Machine Tools, Part 3: Determination of Thermal Effects (SEA/SCA) Part 7: Geometric Accuracy of Axes of Rotation(SEA/SCA) Part 2: Determination of Accuracy and Repeatability of Positioning Numerically Controlled Axes (SCA).
- ANSI/ASME Standard B5.54-2005, Methods for Performance Evaluation of CNC Machining Centers (SEA/SCA)
- ANSI/ASME B5.57-2012, Methods for Performance Evaluation of CNC Turning Centers (SEA/SCA)
- ANSI/ASME B89.3.4-2010, Axes of Rotation, Methods for Specifying and Testing (SEA/SCA)
- JIS B 6190-7, Test Code for Machine Tools Part 7, Geometric Accuracy of Axes of Rotation (SEA/SCA)



		SEA Spindle Error Analyzer	SCA Spindle Check Analyzer
PERFORMANCE	Max RPM	No Limit*	120000
	Min RPM	< 1	12
	Using Long Tool (>300mm)	✓	
	Using Short Tool (<300mm)	✓	✓
	Channels/Package	1-5	3
HARDWARE	Meter Module	✓	
	Encoder Input	✓	
	Temperature Module (7 sensors)	✓	
	Lathe/Swiss Adapters	✓	✓
	Carrying Case	✓	✓
OPERATION	Probe Meter	✓	✓
	Oscilloscope	✓	✓
	Automated Testing	✓	
	Analysis Configuration	✓	
DYNAMIC / ROTATING	Total Error	✓	✓
	Fixed Sensitive Radial	✓	✓
	Axial	✓	✓
	Runout/TIR	✓	✓
	Rotating Sensitive Radial	✓	✓
	Roughness/Asynchronous	✓	✓
	Roundness/Synchronous	✓	✓
	Donaldson Reversal	✓	
	Tilt Dynamic	✓	
POSITION	Position Shift (Shift vs. RPM)	✓	✓
	Vibration	✓	✓
	FFT	✓	✓
THERMAL	Thermal Drift (Non-Rotating)	✓	✓
	Warm-Up (Rotating)	✓	✓
	Tilt Thermal	✓	
	Brochure Page »	10	12

** Limited by DAQ speed and number of channels.*

Export License - Because of high resolutions, export of some systems to some countries requires an export license.

Spindle Error Analyzer

Expand your capabilities with the ultimate in precision and analysis.

SELECTION STEPS:

1. ## *Spindle Application*

Spindle based on air bearing Nanometer precision, often with two measurementranges (10 & 50 micrometers).

Spindle based on oil bearing Applications with precision requirementsin the tens of nanometers that need a larger range of 50 micrometers plus thermal growth ranges of 250 micrometer.

Spindle based on rolling element bearings (hybrid) Sub-micrometer precision hybrid spindles with higher speed and accuracy needing a 50 micrometer range for dynamic measurements and up to 250 micrometer ranges for the thermal measurements.

Spindle based on rolling Element Bearings (Conventional) High quality production spindles with micrometer precision requirements wanting to test dynamic performance plus thermal growth measurements of 50 and 250 micrometer range.

2. ## *Number of Probes Required*

The number of probes required will be based on the measurement requirements you have. The numbers of probes was determined on the product selection table on page 9.

3. ## *Accessories*

Temp Encoder Module Select this accessory if you want to use sensors for monitoring temperature change. Also includes an encoder input for triggering the measurement (TMP190).

Meter Module Provides a digital display of the displacement in metric or inch units (MM190).

4. ## *Enclosures Slots*

Selected based on the number of channels required (# of probes + accessories + any future expansion)

5. ## *Probe & Calibration Range*

While there are standard calibrations, Lion Precision can customize calibration ranges to fit your specific needs.

See the table on page 11 for an overview of these selection options

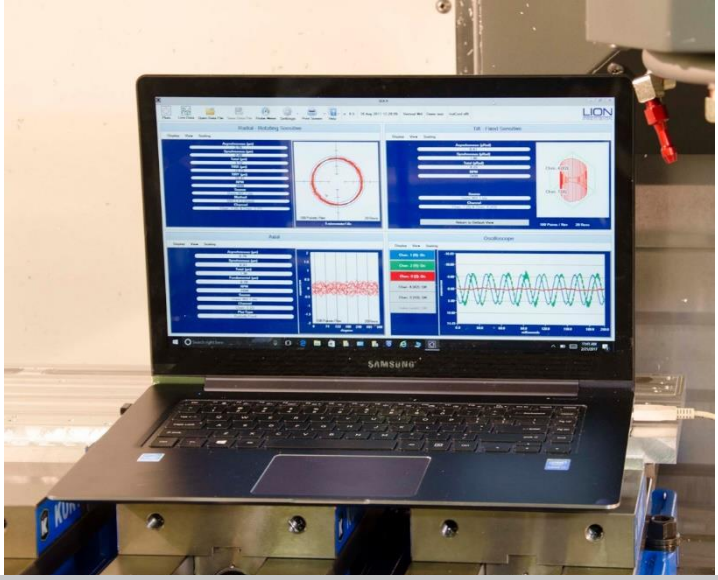
CHOOSE YOUR SEA KIT

MFG3-1905
MASTERBALL 1" SINGLE or DOUBLE.
FIXED ECCENTRICITY. 20MM SHANK

4900-0001 & 4900-0002
3 PROBE NEST.
OPTIONAL 5 PROBE ADAPTOR

P017-6207
PROBES

P017-8900
USB WITH
SEA SOFTWARE



		Accessories		Enclosure Slots			Range	
Spindle & Application	Number of Probes	TMP190	MM190	3	6	8	50 µm	250 µm
Air Bearing (Thermal) Oil-Bearing Rolling Element (Hybrid)	3			MSSF-2343	MSSF-2346	MSSF-2348	√	√
		√			MSSF-2356	MSSF-2358	√	√
			√		MSSF-2366	MSSF-2368	√	√
		√	√		MSSF-2376	MSSF-2378	√	√
	5				MSSF-2546	MSSF-2548	√	√
		√			MSSF-2556	MSSF-2558	√	√
			√			MSSF-2568	√	√
		√	√			MSSF-2578	√	√
Rolling Element (Conventional)	3			MSSS-1343	MSSS-1346	MSSS-1348		√
		√			MSSS-1356	MSSS-1358		√
			√		MSSS-1366	MSSS-1368		√
		√	√		MSSS-1376	MSSS-1378		√
	5				MSSS-1546	MSSS-1548		√
		√			MSSS-1556	MSSS-1558		√
			√			MSSS-1568		√
		√	√			MSSS-1578		√

Velocity Shipping Product

FEATURES:

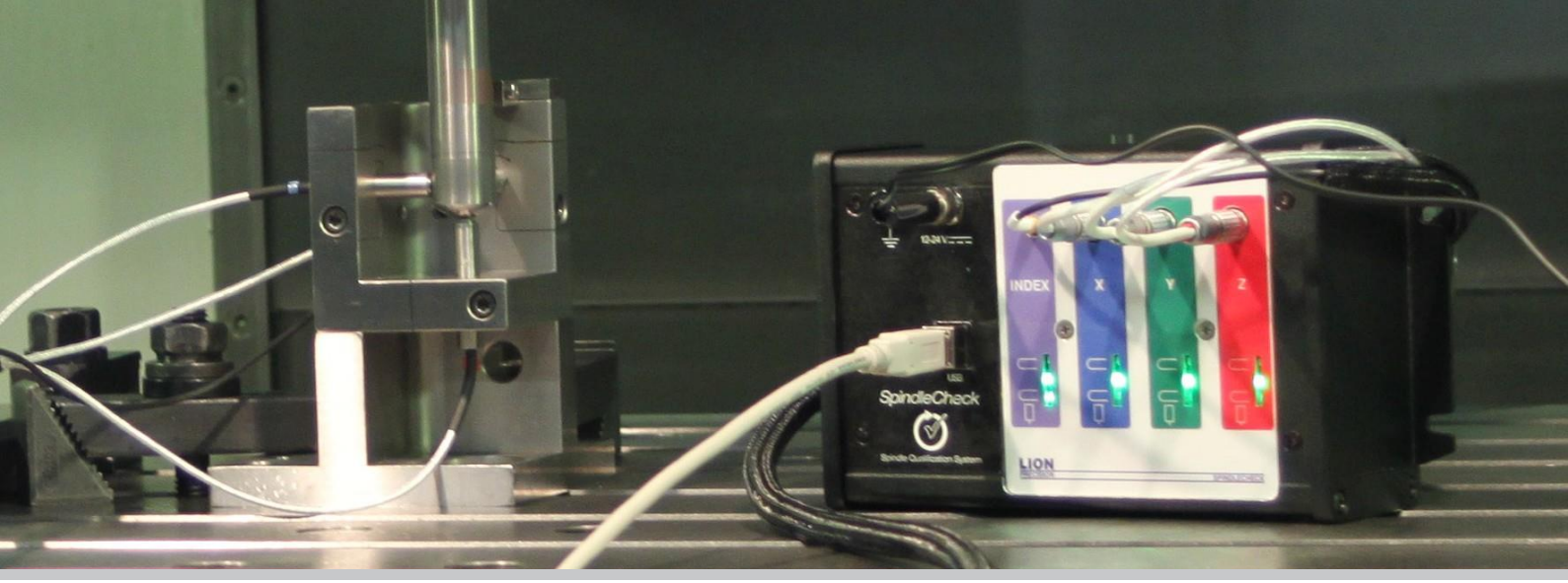
FURTHER SEA OPTIONS

P014-2292
CALIBATION CHECK FIXTURE

4900-0108
HEX KEY

P014-2451
PROBE CAP

P017-0100
TRAVEL CASE

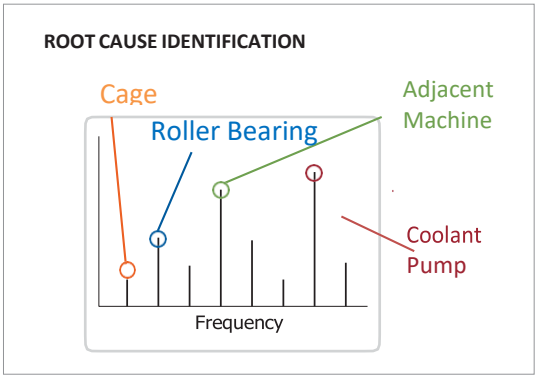


SPINDLE CHECK ANALYZER

Analyze machine performance for detailed analysis and troubleshooting

Benefits include:

- Portable hardware & easy set-up
- Important data clearly displayed – including Polar Plots, Oscilloscope & FFT graphs
- Ideal for the technical user that wants to link error motions to possible root causes



SELECTION STEPS:

1. Target Pin Size

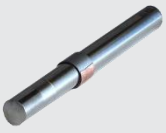
Region	Precision	Target Pin Size	Part #
WORLD	Standard	8mm	MFG5-0235
		20mm	MFG5-0233

Velocity Shipping Product

*Electronics also included.

SCA KIT*

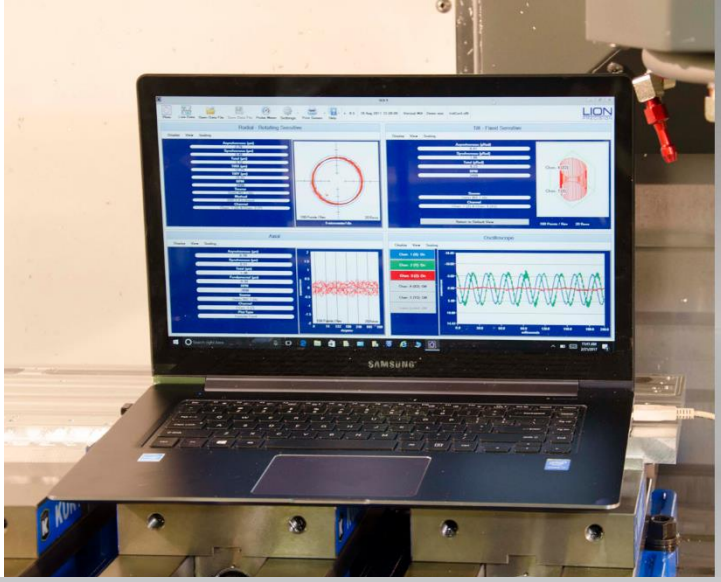
P017-6207
MAGNETIC BASE WITH PROBE NEST

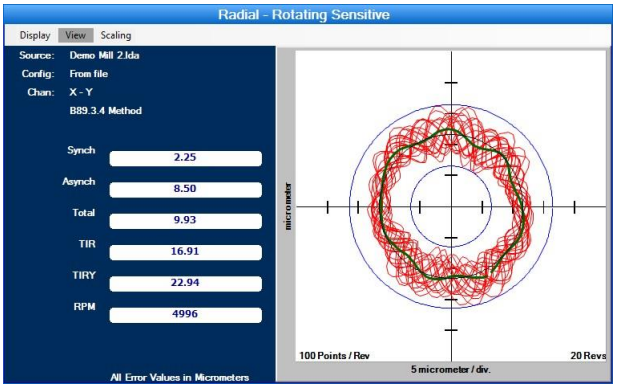


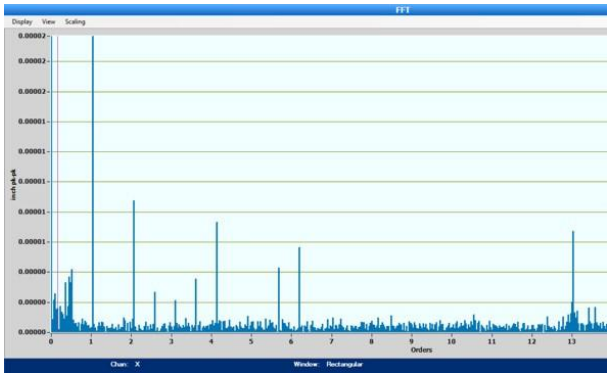
MFG5-1240
PRECISION TARGET PIN

P017-7485
PROBE SET

P017-8766
USB WITH SCA SOFTWARE







FEATURES:

*Electronics also included.

SCA KIT*

4490-0515
FIVE METER USB CABLE

A017-7560
INDEX PROBE
SPACER

P014-8250
GROUNDING KIT

P017-7490
TRAVEL CASE

ACCESSORIES

SCA

MFG5-1240
8 MM TARGET PIN

MFG5-1241
20 MM TARGET PIN

SEA

4900-0026
MASTERBALL 1”
DOUBLE ADJUSTABLE
ECCENTRICITY 20MM
SHANK

SCA/SEA

8017-3911	ADAPTOR 1.00” DIAMETER WITH FLATS
8017-3901	ADAPTOR 1.00” DIAMETER WITHOUT FLATS
8017-3912	ADAPTOR 1.25” DIAMETER WITH FLATS
8017-3902	ADAPTOR 1.25” DIAMETER WITH FLATS
8017-3905	20 MM DIAMETER WITHOUT FLATS
8017-3906	25 MM DIAMETER WITHOUT FLATS
8017-3910	3/4” DIAMETER WITH FLATS
8017-3900	3/4” DIAMETER WITHOUT FLATS

These lathe adaptors insert into the tool holder and may be used to mount a probe holder.

IBS Precision Engineering BV (Head Office)

Esp 201
5633 AD Eindhoven, The Netherlands
Tel: +31 40 290 1270
E-mail: info@ibspe.com
www.ibspe.com

IBS Precision Engineering Deutschland GmbH

Leitzstraße 45
70469 Stuttgart, Germany
Tel: +49 711 490 66 230
E-mail: info@ibspe.de
www.ibspe.de

IBS Precision Engineering France sarl

10 rue Michel Servet
59000 LILLE Cedex, France
Tel: +33 3 66 21 25 24
E-mail: info@ibspe.fr
www.ibspe.fr

IBS Precision Engineering Ltd

Blythe Gate, Blythe Valley Park,
Solihull B90 8AH, United Kingdom
Tel: +44 7464210568
E-mail: info@ibspe.com
www.ibspe.com