Precision measurement for improving design, throughput and performance
Established in 1886, Taylor Hobson is the world leader in surface and form metrology and developed the first roundness and surface finish measuring instruments.

Taylor Hobson is part of the Ultra Precision Technologies Division of AMETEK, Inc. which is a leading global manufacturer of electronic instruments and electromechanical devices with 2014 sales of $4 billion. AMETEK has over 15,000 colleagues at more than 120 manufacturing locations around the world. Supporting those operations are more than 100 sales and service locations across the United States and in 30 other countries around the world.

We provide contact and non-contact measurement solutions for the most demanding applications on a global basis, with a worldwide infrastructure to support our clients; we are a truly global ultra precision metrology company.

We are pioneers, continually developing our products to meet the ever-increasing demands of next generation technologies, particularly in bearings, automotive, aerospace, optics, medical and renewable energy technologies.

This forward thinking philosophy is captured perfectly in our diverse range of product solutions. Recent developments include new bearing measurement systems and a full suite of dedicated software analysis packages.

Taylor Hobson – the experts in bearing, automotive and optics metrology
Bearings require exceptional levels of quality, durability, precision and reliability in order to meet the demanding requirements of modern applications. Recent developments by Taylor Hobson deliver an in depth understanding of bearing characteristics such as surface finish, contour, form, radius, roundness and harmonic analysis, providing vital feedback for improvements in design and production.

### Critical measurements: complete trust

#### Applications
- Miniature bearings
- Large bearings
- Ball bearings
- Roller bearings
- Four point bearings
- Fluid dynamic bearings
- Ballscrews
- Leadscrews
- Angular contact ball bearings
- Deep groove ball bearings

#### Critical analysis types
- Roundness, flatness, straightness…
- Advanced harmonics
- Velocity
- Wall thickness variation
- Disc thickness variation
- FDB Grooves
- DFTC / DFTP
- Slope
- Multi-plane roundness
- Multi-plane flatness…
- 3D - multi-plane roundness
- 3D - cylinder map…
- Form error and radius
- Roughness and waviness
- DFTF/LSLP
- Contour
- Gothic arch
- Roller profile and drops
- Dual profile
- Angle…
- Morphological filters
- Lead angle
- Twist
- Structured surfaces
- Dimple
- Dominant wavelength…
Taylor Hobson provides non-contact and contact measurement solutions for improving the design and functionality of roller bearings and ensuring that they are manufactured precisely in accordance with their design criteria...

**Rapid non-contact and contact solutions**

![3D Roller bearing form with respect to the axis](image1)

![Non-contact Roundness](image2)

**Compare measured profiles to design data**

Taylor Hobson’s ‘DXF Creator’ coverts design formulae into profiles for comparison to measurements, providing analysis of:

**FORM ERROR** - View the difference between the desired and measured shape, then check and dress the shape of the grinding wheel.

**X OFFSET** - The shape of the measured profile and its X position with respect to the end datum of the bearing can be measured using fixtures. The machine axis can then be adjusted as required.

**PROFILE TILT** - unique to Taylor Hobson Talyrond systems, any tilt of the profile with respect to the roller bearing axis can be calculated. This allows adjustment of the grinding wheel angle.
Taylor Hobson’s Talyrond systems have the unique ability to analyse the form of a roller bearing in relation to its axis...

Use Taylor Hobson’s Advanced Harmonics and Velocity Analysis

- Improve bearing design
- Understand dynamic bearing performance
- Predict functional behaviour by simulation of rotational speed
- Establish how waviness affects resonance generation
- Reduce component scrap
- Identify problem areas in production

Product solutions

- Talyrond
- Form Talysurf
- CCI

Analysis solutions

- Advanced Contour
- Cylinder Map
- Advanced Harmonics
- Velocity Analysis
- Advanced Dual Profile
- DXF Creator
- Roughness
Taylor Hobson has an in depth understanding of the wide range of applications for ball screw and lead screw actuator functionality; from aircraft control surfaces and landing gear, to precision movement of machine tools.

Key measurements for design and production

Taylor Hobson works with leading manufacturers of actuator screw shafts to develop unique measurement techniques for the industry.

This enables us to provide capability for the reliable inspection of production parts as well as providing detailed information needed to improve the designs and production processes.

For further information, please contact Taylor Hobson and request Application note A149: Inspection of ball and lead screw actuator components.

Ball and lead screw inspection capabilities

**Key specifications:**

- Lead accuracy
- Thread shape / form
- Alignment mount accuracy
- Surface finish and waviness
- Harmonics
- Pitch circle diameter (PCD)
- Gothic arch parameters

Opposing axial traces are taken with the part axis aligned to the instrument axis.

Unique Pitch Circle Diameter (PCD) analysis. Measurements are related to the part datum axis.
“In depth analysis to reduce vibration and noise, improving performance and positional accuracy”

**Helix angle correction and thread analysis**

Helix angle correction takes an axial measurement along a thread profile and transforms it so that it represents a measurement taken perpendicular to the thread. This allows for tolerancing of the profile as it is usually defined in the design drawings.

**Helical measurements for analysis of harmonics and surface finish**

**Product solutions**
- Talyrond
- Form Talysurf

**Analysis solutions**
- Bearing surface roundness
- Bearing surface straightness
- Bearing surface finish
- Bearing wear
- Thread gothic arch / form
- Thread axial surface finish
- Thread helical harmonics
- Thread helical surface finish
- Thread PCD variation
- Axial alignments
Taylor Hobson is the only supplier that provides complete solutions for Fluid dynamic bearings, including non-destructive internal 3D measurements.

**Fluid dynamic bearing - analysis**

Multiple step height analysis

3D high data density measurement

Groove analysis

Fully automated groove analysis with no operator influence

Groove analysis software was written specifically for Fluid Dynamic Bearings. This software removes all subjectivity from results and provides the operator with the ability to trap errors and control the process.

**Groove Parameters include**

- Depth Max, Min, Ave
- Width Max, Min, Ave
- Pitch Ratio Max, Min, Ave
- Arc length Max, Min, Ave

**Product solutions**

- Talyrond
- Form Talysurf
- CCI

**Analysis solutions**

- 3D High data density
- Groove analysis
- Step height analysis
- Surface finish
- Roundness...
Taylor Hobson’s **Advanced Harmonic Software** enables bearings manufacturers to extract harmonic information from any rotational measurement. Results can be viewed as a full harmonic histogram view with tolerance bands and pass/fail warning messages. The software allows analysis up to 5000 upr and provides a ranking system according to wave depth or harmonic amplitude. Results can be compared to CSV or GKD files.

“Taylor Hobson is the only company that can prove measurement capability up to 1500 upr”

---

**Advanced Harmonic Standard – for traceable results**

**New Harmonic Standard**
- Provides confidence in your results
- Traceable to international standards
- The only standard to provide 1500 upr
- A precision machined standard with the following undulations in 360 degrees
  - 15 upr
  - 50 upr
  - 150 upr
  - 500 upr
  - 1500 upr
Ball bearings

Ball bearings have long been a fundamental component in numerous devices and appliances. Taylor Hobson’s latest systems and analysis software helps ball bearing manufacturers improve quality and precision to meet the increasing demands of modern applications.

Ball roundness - Talyrond contact and non-contact measurements

Excellent repeatability and contact / non-contact correlation (example R = 22 mm ball)

Non-contact roundness – ideal for miniature ball bearings

Taylor Hobson has developed non-contact capabilities on its Talyrond systems offering the following advantages:

- Zero holding force required!
- Easy sample setup
- Rapid measurements

“Talyrond systems now offer both contact and non-contact solutions on a single platform!”
Comprehensive measurement - Ball form, radius and surface finish

Control form, radius and surface finish

- Reduce wear
- Reduce noise and vibration
- Improve ball matching
- Increase lifespan

Unique circumferential roughness measurement
Form Talysurf Ball Unit

Offers the unique ability to measure roughness around the full circumference of a ball. This method provides the most precise and low-noise roughness assessment. It takes advantage of the Form Talysurf’s highest gauge resolution setting and exceptional linearity.

Non-contact surface finish

The example below illustrates the use of a CCI instrument and associated TalyMap analysis software to assess the fluid retention characteristics of an engineered surface. The number and shape of pits are determined in order to optimize performance.

Product solutions

- Talyrond
- Form Talysurf
- CCI
- LuphoSmart

Analysis solutions

- Form
- Radius
- Roughness
- Circumferential surface finish
On thrust bearing applications, axial movements affect function and may be caused by the variation in bearing thickness. Taylor Hobson’s disc thickness variation software provides the ability to analyse the relationship between bearing’s raceway and back face. This enables manufacturers to predict function prior to assembly and prevent failure.

**Comprehensive analysis**

Taylor Hobson offers a full range of bearing analysis capabilities for improvements to thrust bearing components:

- Raceways
- Ball bearings
- Retainer rings

**Product solutions**

- Talyrond
- Talysurf
- CCI

**Analysis solutions**

- Disc thickness variation
- Harmonics
- Flatness, squareness, DFTP
- Form, waviness and roughness
- Roundness, runout, DFTC…

**Disk thickness variation software – an essential tool for bearings manufacturers**

*Talyrond Disc thickness variation analysis of 3 sets of flatness measurements. The difference profiles are shown in red.*

**Thrust bearings**

Improve performance and accuracy by monitoring raceway to backface thickness variation.

Compare flatness profiles to generate difference profiles – these may then be analysed for:

- Flatness
- Harmonics
- Squareness
Engineered surfaces are surfaces that have been manufactured in such a way that the surface structure has been optimised to improve the part's intended function. We provide a range of 3D measurements solutions to help quantify and predict the surface function.

**Twist analysis software - predict sealing capability prior to assembly**

**Prevent oil leakage**

Sealing of rotating shafts is often accomplished by use of a two lip polymer seal in contact with a ground cylindrical surface.

Roughness measurement alone is not enough. Leakage is more influenced by **spiralling marks along the rotating shaft**.

These marks can cause a pumping action and depending on depth and wavelength, they may bridge the seal allowing ingress of water or loss of oil.

**Twist measurement on Talyrond:**

A series of traces is taken in the axial direction. The part is rotated by a given amount after each trace.

A 3D surface map is created, from which spiralling effects can be detected on the surface.

**Improving Engineered surfaces**

We provide contact and non-contact measurement techniques which are critical to the design and manufacture of structured surfaces...

- Improve aero-dynamics
- Reduce or increase friction
- Optimise optical surface qualities
- Increase fluid retention

**Product solutions**

- Talyrond
- Talysurf
- CCI
- LuphoScan

**Analysis solutions**

- TalyMap - Dimple
- TalyMap - Twist
- ULTRA - Cylinder map

CCI: Example of 3D surface dimple structure for improving oil retention
Taylor Hobson provides high technology solutions for measuring raceways and analysing critical characteristics such as roundness, radius, form, roughness and harmonics. This data is essential for reducing wear and noise and for improving functionality and quality.

### Powerful software for critical measurement and analysis

#### Roundness analysis suite
DFTC* example: for identifying localised roundness errors

#### Surface analysis suite
Form, radius, roughness and waviness analysis from one measurement

---

### Form, radius and roughness from one measurement

Most bearings standards ask for two measurements: one of radius and form using a ball stylus and another of surface finish using a diamond stylus.

**Morphological filtering**

A 'morphological filter' allows the user to measure using a diamond stylus and then simulate measurement using a ball stylus. It can also be used with non-contact systems to simulate measurement with a stylus:

- Measure roughness then simulate form and radius measurement!
- Improve roundness and form repeatability
- Standard on Talyrond, Talysurf and non-contact systems
- Internal and external measurements

---

**Product solutions**

- Talyrond
- Surtronic Roundness
- Form Talysurf
- LuphoScan
- CCI

**Analysis solutions**

- Roughness and waviness
- Morphological filtering
- Radius and form error
- Roundness, flatness …
- DFTC, DFTP, Slope …
- …DFTF, LSLP …
- Circumferential surface finish
- Harmonics and velocity analysis
Introduction
Taylor Hobson works with leading manufacturers of actuator components to develop unique measurement techniques for the industry. This enables us to provide capability for the reliable inspection of production parts as well as providing detailed information needed to improve the design and production process.

We understand ball screws, lead screws and bearings the factors affecting their performance, many of which documented in ISO, DIN, ANSI and JIS standards. Inspection of these factors is fundamental to ensure product specifications are achieved.

Ball and lead screw applications
Ball and lead screws are used to convert rotational and linear motion in a variety of applications, the most common being linear actuators such as the ones used for aircraft control surfaces.

Ball screw applications include:
- Aircraft control surfaces
- Precision movement of machine tools
- Various automotive applications
- Automatic gates
- Various automation applications
- Steering wheel columns

Learning Zone

First time visitor? sign up here to access all downloads

Please login below

Email Address: 
Password: 
Sign in  Forgotten your Password?
The metrology experts

Taylor Hobson is world renowned as a manufacturer of precision measuring instruments used for inspection in research and production facilities. Our equipment performs at nanometric levels of resolution and accuracy.

To complement our precision manufacturing capability we also offer a host of metrology support services to provide our customers with complete solutions to their measuring needs and total confidence in their results.

www.taylor-hobson.com

Serving a global market

Taylor Hobson UK
(Global Headquarters)
PO Box 36, 2 New Star Road
Leicester, LE4 9JD, England
Tel: +44 (0)116 276 3771
Taylor Hobson sales@ametek.com

Taylor Hobson China
Shanghai Office
Tel: +86 21 58685111-110
Beijing Office
Tel: +86 10 8526 2111
Chengdu Office
Tel: +86 28 86758111
Guangzhou Office
Tel: +86 20 83634768
Taylor Hobson china.sales@ametek.com.cn

Taylor Hobson France
Tel: +33 130 68 89 30
taylor-hobson.france@ametek.com

Taylor Hobson Germany
Tel: +49 611 973040
taylor-hobson.germany@ametek.com

Taylor Hobson India
Tel: +91 80 67823200
taylor-hobson.india@ametek.com

Taylor Hobson Italy
Tel: +39 02 946 93401
taylor-hobson.italy@ametek.com

Taylor Hobson Japan
Tel: +81 36809 2406
taylor-hobson.japan@ametek.com

Taylor Hobson Korea
Tel: +82 31 888 5255
taylor-hobson.korea@ametek.com

Taylor Hobson Mexico
Tel: +52 442 426 4480
taylor-hobson.mexico@ametek.com

Taylor Hobson Singapore
Tel: +65 6484 2388 Ext 120
taylor-hobson.singapore@ametek.com

Taylor Hobson Taiwan
Tel: +886 3 575 0099
taylor-hobson.taiwan@ametek.com

Taylor Hobson USA
Tel: +1 630 621 3099
taylor-hobson.usa@ametek.com

Sales department
Email: taylor-hobson.sales@ametek.com
Tel: +44 (0)116 246 2034
- Design engineering – special purpose, dedicated metrology systems for demanding applications
- Precision manufacturing – contract machining services for high precision applications and industries

Service department
Email: taylor-hobson.service@ametek.com
Tel: +44 (0)116 246 2900
- Preventative maintenance – protect your metrology investment with an Amecare support agreement

Centre of Excellence department
Email: taylor-hobson.cofe@ametek.com
Tel: +44 (0)116 246 3779
- Inspection services – measurement of your production parts by skilled technicians using industry leading instruments in accord with ISO standards
- Metrology training – practical, hands-on training courses for roundness and surface finish conducted by experienced metrologists
- Operator training – on-site instruction will lead to greater proficiency and higher productivity
- UKAS calibration and testing – certification for artifacts or instruments in our laboratory or at customer’s site

© DiskArt™ 1988