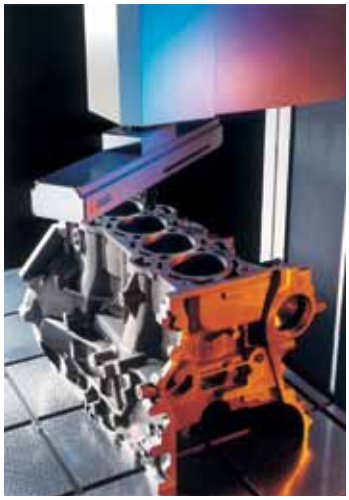
TAYLOR HOBSON®

Talyrond 450

Heavy duty roundness



AMETEK®
ULTRA PRECISION TECHNOLOGIES

Talyrond 450

For high precision inspection of roundness and cylindrical geometry on large, heavy or complex components.

The world's first roundness measuring instrument was produced by Taylor Hobson in 1949. We continue to lead the industry with innovative products developed to suit the most difficult requirements for roundness, form and circular geometry measurement.

Big not clumsy

This instrument can handle the heaviest loads with ease, yet still provide accuracies better than those available on many ordinary measuring systems.

Geometric analysis

RONt	Roundness
STRt	Vertical Straightness
FLTt	Flatness
ECC	Eccentricity
SQR	Squareness
	Parallelism
CONC	Concentricity
COAX	Coaxiality (ISO/DIN)
CYLc	Cylindricity
	Run-out (radial and axial)
	Total run-out (radial and axial)
	Harmonics
	Partial Arc
	Interrupted surfaces
	Slope analysis

Optional software

Piston analysis
Wall thickness analysis

Large or small parts

Although it is the obvious choice for heavyweight components, Talyrond 450 can also accommodate small, delicate components as well. Accuracy and repeatability are assured no matter how big or small the parts may be.

The Talyrond 450 with rotating gauge head is especially well suited for the measurement of non-symmetrical components such as cylinder blocks

Industry leading mechanical features deliver accuracy and stability

Stable construction

The main base and column of the Talyrond 450 is constructed of high grade cast iron for optimal metrology performance. No material, not even machined granite, provides the same level of stability and stiffness when measuring moving loads.

Stress relief

Taylor Hobson uses two stress relieving procedures, one after casting and one prior to finish machining. This ensures that cast iron elements incorporated into the super-structure of the instrument remain stable as to dimension as well as geometry.

Patented three point kinematic levelling

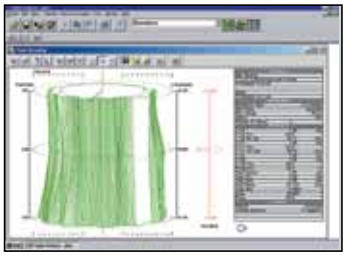
In manufacturing, a surface is always levelled by three points. Taylor Hobson adheres to this fundamental principle by using one fixed and two moving points for levelling of components.

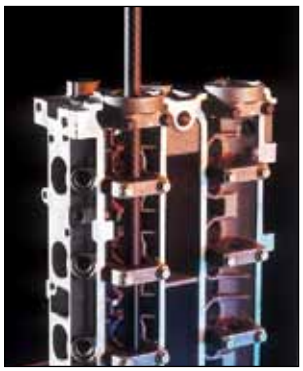
Accurate positioning

Axis moves are programmable to maximise correlation of results between operators and minimise the possibility of operator induced errors. Precision linear scales and reading heads are used to ensure that the exact location of the gauge head is always known.

Powered by µltra roundness software

µltra software provides comprehensive analysis and automated measurement capabilities. It is the ideal tool for any environment where rapid component inspection is desired.





Rotating gauge for greater versatility

Talyrond 450 has significant benefits for manufacturers who demand high precision and versatility in the measurement of circular geometry on large components; especially those with features that are non-symmetrical to a rotational axis. It has particular applications in the machine tool, automotive, aerospace and large bearing industries.

Automatic measurement of cylinder bores

The X - Y travelling worktable allows the system to be programmed to measure the roundness geometry of engine block cylinder bores in turn at any number of pre-selected planes without operator intervention.

Form measurement of tall components

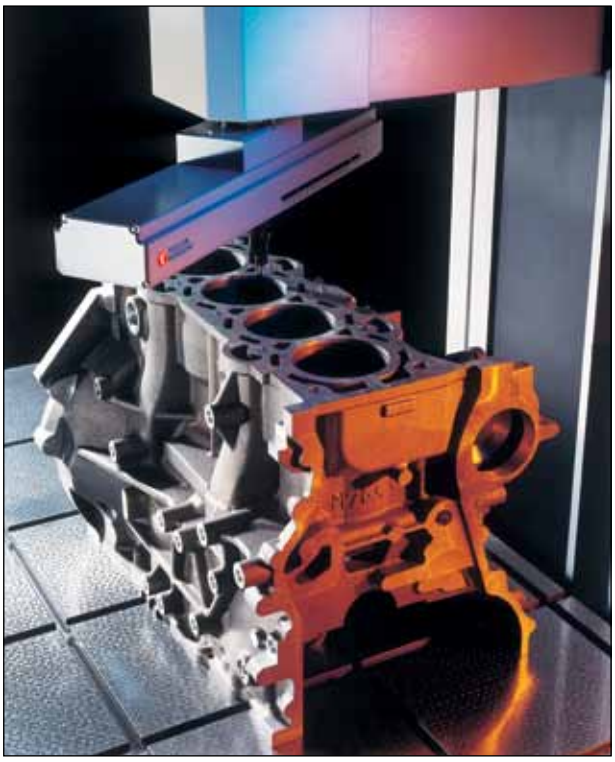
Gauge extension arms up to 750mm length permit vertical straightness and multi-plane geometrical measurements on extra long components.

Automated batch inspection of small components

With fixturing designed to accept a number of small components, the system can be programmed for automatic, continuous multi-component inspection. Unattended operation allows operators to perform other tasks which can result in much higher levels of inspection room productivity.

Don't touch for best results

Automation saves time and frees an operator to perform other tasks. However, the real benefit of eliminating operator intervention is the elimination of operator error. The Talyrond 450, with completely automatic measuring runs, assures that any deviation of measured values is due to variations in the manufacturing process, not operator influence.



	Height capacity	Throat depth	Weight capacity	Table area	X Axis traverse	Y Axis traverse	Radial traverse
Talyrond 450							
M155/P33359	1000mm	400mm	1000kg	1200 x 630mm	+/- 500mm	+/- 50mm	150mm
M155/P33799	1500mm	400mm	1000kg	1200 x 630mm	+/- 500mm	+/- 50mm	150mm

Precise, programmed movement in 5 axes for the ultimate in measurement versatility

Large X - Y worktable

At 1,200 x 630mm with load capacity of 1,000Kg (2,200lb), the worktable accommodates virtually any sized component. The surface is hand scraped to the flatness of a granite plate; most large components can be staged without fixturing.

Stepping motors control X - Y positioning to a resolution of 5µm so movement between features on a workpiece is safe, reliable and repeatable.

High accuracy vertical column

Measurements of cylindricity and straightness depend on optimum mechanical integrity of the measuring axis. Taylor Hobson uses a dual guidance system in the vertical column to isolate torsional load effects from the straightness datum. The result is absolute stablilty thoughout the entire 1000mm vertical measurement axis.

Motorised radial arm

The radial arm positions the gauge head to suit different diameters on the workpiece. It also handles feedback from the gauge head for 'stop on contact' commands during programmed measurements.

Rotating gauge spindle

The hydro-dynamic oil bearing spindle delivers precision and stiffness for accurate rotation of the gauge head. A rotary encoder with 0.1° resolution controls the spindle position for measurements such as parallelism or straightness or for avoiding interruptions on the workpiece during automatic routines.

'Four point' fast centering

Non-symmetrical components are difficult to manually align within the gauge range. Fast centering uses movement of the X - Y table to touch four points spaced 90° apart to determine the exact centre of the feature being measured.

Target eccentricity

Automatic centre and levelling continues until the workpiece is mechanically aligned to the target value set by the operator.

Full collision protection

Talyrond 450 has full gauge protection in case of operator error. In the event of a gauge over-range condition all axes are automatically shut down to prevent stylus damage.

Engine blocks can be mounted vertically for the measurement of crankshaft and camshaft bores using a suitable gauge extension arm

Complex crankshaft measurements can be performed automatically with the crankshaft accessory arm and powerful analysis software

Spindle radial limit of error	Measurment uncertainty - column	Instrument weight	Instrument dimensions (LxWxH)
+/- 0.1µm	+/- 5µm	6000Kg	2200 x 1600 x 2400mm
+/- 0.1µm	+/- 5µm	6200Kg	2200 x 1600 x 2900mm

µltra roundness software

Although written with familiar Windows conventions, µltra has the look and feel of a machine tool interface. Driven through an industrial strength interface, commands are direct, purposeful and guided by intuitive logic. Perhaps for the first time in metrology, the computer serves as a bridge instead of a barrier between operator and instrument.

Total system control

µltra software takes charge of all functions to eliminate hardware / software conflicts. Performance is optimised by proprietary software routines and full cycle programmability.

- Mechanical functions – positioning and speed of all axis movements
- Administrative functions – user preferences, data storage and retrieval
- Analysis functions – application of filters and constants, calculation of results
- Display functions – customised templates, screen graphics, print commands

Compatibility

µltra software was designed to be fully compatible with older Taylor Hobson data file formats to enable re-analysis and comparison of old data. It also has a programmable facility for the simple export of results to standard packages such as SPC and Excel™.

Compliance with standards

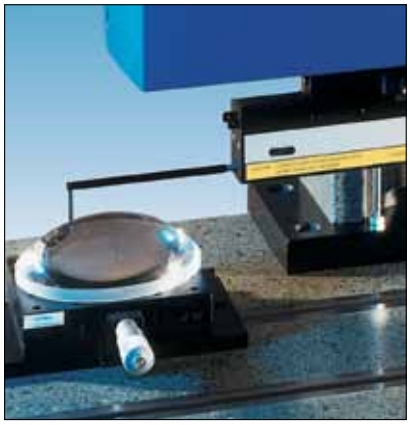
µltra follows global industrial metrology disciplines as well as international standards for inspection and calibration.

- Calibration routines can be easily integrated into most corporate ISO 9001 programs
- Calibration artifacts can be identified and referenced to certification date
- Calibration history regarding operator, artifact and date is automatically stored
- Separate calibrations for different probe arms can be saved and easily restored

Designed for all instruments

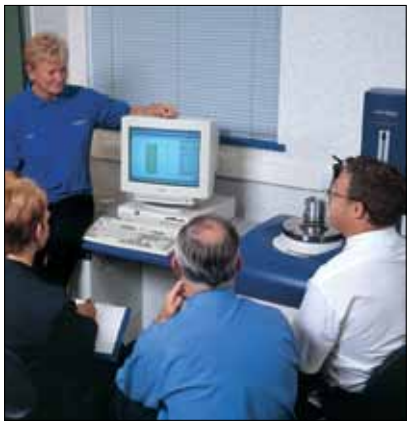
µltra drives all Taylor Hobson measuring systems including Form Talysurf instruments and Talyrond roundness systems.

- Operators familiar with µltra can easily operate multiple inspection instruments
- Productivity is not limited by single instrument operators
- The transfer of knowledge is simplified when operators are promoted or transferred



µltra powers Form Talysurf surface roughness, form and contour measuring instruments

µltra powers Talyrond roundness, cylindricity and circular geometry measuring systems



µltra simplifies training and eliminates the need for dedicated, single system operators

Roundness / cylindricity / coaxiality / concentricity

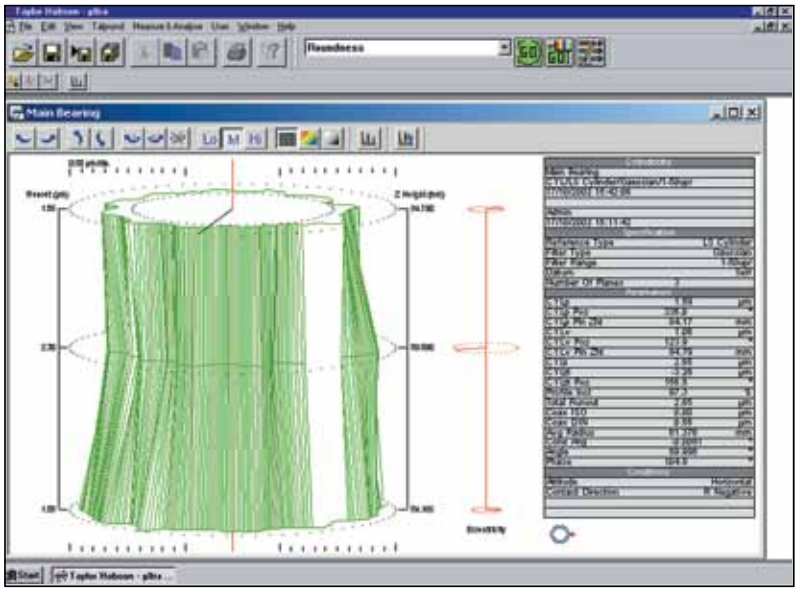
The first step in any measurement is automatic centering and levelling to mechanically align the axis of the component with the axis of the spindle. This minimises the effect of setting up errors on subsequent analysis.

Roundness is determined from a single plane. Cylindricity is a much more powerful tool that combines data from multiple roundness profiles into a single geometric figure.

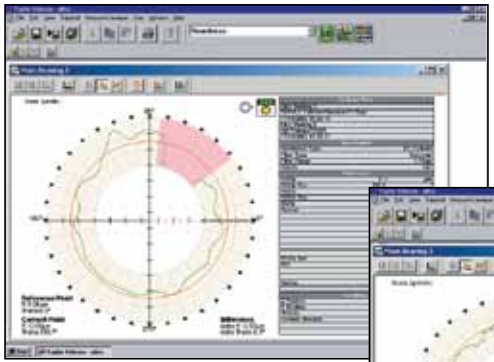
In addition, the axis calculated from the cylinder analysis can be used as a reference datum and compared with another axis for assessment of coaxiality, concentricity, run-out and total run-out.

µltra provides full and accurate assessment of roundness and cylindricity with respect to the four internationally recognised reference circles or cylinders:

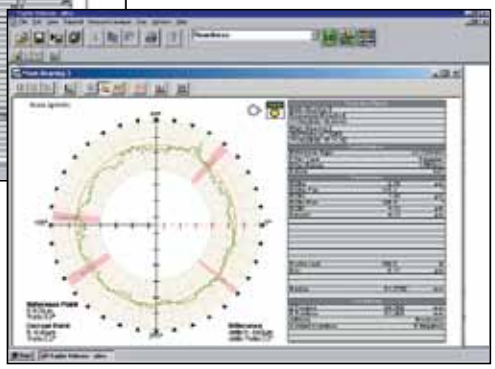
- Least Squares (LSC)
- Minimum Zone (MZC)
- Minimum Circumscribed (MCC)
- Maximum Inscribed (MIC)



In this example of cylindricity three profiles have been measured on a crankshaft main bearing; note that the oil hole has been automatically excluded from analysis.



Interruption removed from analysis



Asperities removed from analysis

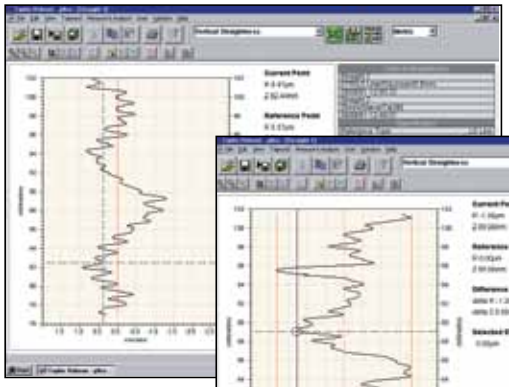
Measurements on interrupted surfaces

Interruptions and asperities will have a detrimental influence on measurement results if they are not excluded from the analysis. µltra software can automatically or manually exclude data caused by interruptions (hole and edge removal) or dirt (asperity removal).

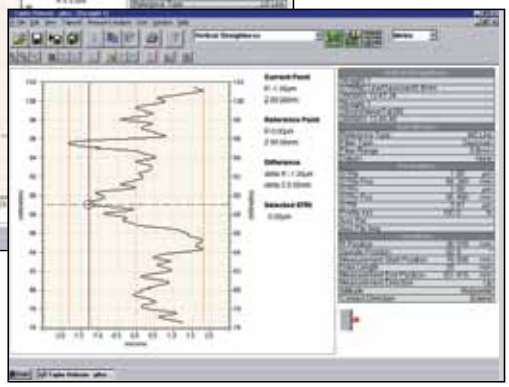
In the examples to the left, the pink shaded areas indicate data automatically excluded from the measurement results.

Straightness

µltra software is able to measure and analyse both vertical and horizontal straightness on both continuous and interrupted surfaces. Crankshaft and camshaft bores, for example, can be checked for collective straightness over their entire length via Least Squares Line or Minimum Zone references.



Least squares line (LSS) straightness (reference only)

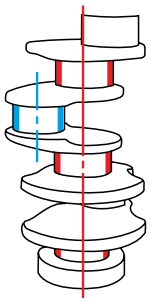


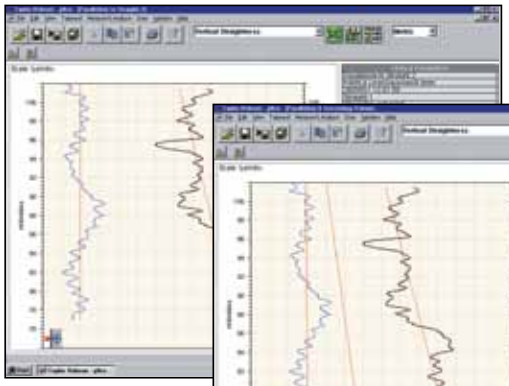
Minimum zone (MZL) straightness (reference only)

Parallelism

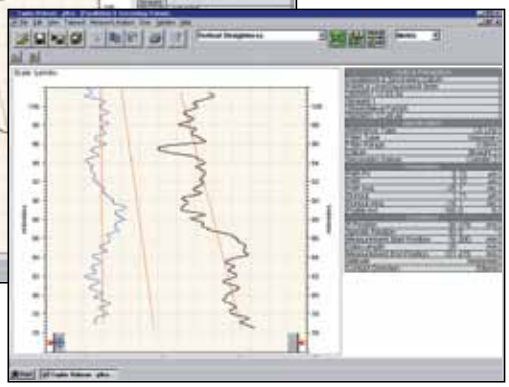
Two straightness measurements taken 180° apart are necessary for an assessment of parallelism. Either of the measurements can be set as a datum and compared to the other for the assessment.

In addition, the parallelism bisector can be compared to a secondary datum for an assessment of run-out. A typical application is shown here. In this example the secondary datum is the cylinder axis of the component features indicated in red.





Parallelism (reference only)



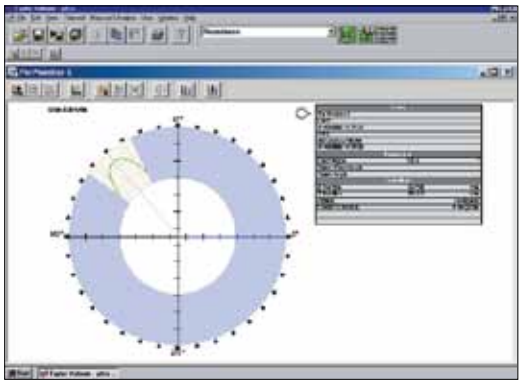
Parallelism to a secondary datum (reference only)

Special roundness features

Talyrond 450 has the ability to analyse partial arc roundness. This enables facilities such as 'Radial auto-crest' to function. The software calculates the position of the highest point of the roundness result and automatically re-positions the spindle to that point.

For example, the pins on a crankshaft are eccentric to the main bearing axis. It is possible to measure roundness of the pins and automatically rotate the instrument spindle to the highest point of the measurement.

With the pin positioned at its point of maximum throw, straightness and parallelism measurements can now be performed correctly.



Example of partial arc analysis

Specification

Measuring capacity

Maximum component diameter	N/A
Maximum component height	1000mm (39.4in) or 1500mm (59.0in)
Maximum throat depth	400mm (15.7in) (column to spindle axis)
Maximum measuring diameter	300mm (11.8in)
Maximum component weight	1000kg (2200lb)
Maximum worktable moment loading	N/A

Instrument dimensions

Instrument width	1766mm (69.5in)
Instrument length	1766mm (69.5in)
Instrument height	3500mm (138in)
Height of worktable	890mm (35in)
Instrument workstation (L x W x H)	1260mm x 850mm x 750mm (49.6in x 33.in x 31in)
Recommended installation floor area	2000mm x 2000mm + Workstation (79in x 79in + Workstation)
Instrument weight (1000mm column)	6000kg (13200lb)
Floor loading (1000mm column)	65000kg/m^2 (92lb/in^2)

Vertical straightness module

Construction	hydrostatic bearing
Measurement length	1000mm (39.4in) (1500mm optional)
Straightness over column length	3µm/1000mm (120µin/39.4in)
Straightness over any 100mm	0.5µm/100mm (20µin/3.94in)
Positional control uncertainty	+/- 20µm (800µin) for a single move
Vertical axis to spindle axis parallelism	N/A
Speed range (stepped)	0.5 - 15mm/s (0.02 - 0.6in/s)
Measurement uncertainty	+/- 5µm (200µin)
Measurement resolution	1µm (40µin)

Spindle

Spindle construction	Hydrodynamic bearing
Speed range	1, 2 and 6 rpm
Positional control uncertainty	+/- 0.5° for a single move
Radial limit of error (concentric load)	+/- 0.1µm (4µin)
Radial limit of error (eccentric load) 225kg (495lb) offset by 100mm (3.9in)	N/A N/A
Measurement uncertainty	N/A
Measurement resolution	N/A
Axial limit of error (MZ)	N/A

Center and levelling

Worktable dimensions	See worktable opposite
Center and leveling table control	
Centering range	
Leveling range	
Accuracy of auto centering	
Accuracy of auto levelling	

The above technical data is for measurements taken in a metrology laboratory controlled environment: 20°C ± 1°C (68°F ± 1.8°F), draft free, and isolated from low frequency floor borne vibration.

Uncertainties and maximum permissable errors (MPE) are at 95% confidence in accordance with recommendations in the ISO Guide to the expression of uncertainty in measurement (GUM: 1993).

Note: Taylor Hobson pursues a policy of continual improvement due to technical developments.

We therefore reserve the right to deviate from catalog specifications.

1. All roundness results are quoted as the departure from the least squares circle at 6rpm with 1-50upr gaussian filter, concentric minimum load and software correction applied.
2. All errors are quoted as Maximum Permissible Errors (MPE).
3. All straightness / parallelism results are quoted with an 8mm (0.3in) cut off low pass filter, 5mm/s, minimum zone and software correction.

Worktable The worktable is comprised of three movements: X axis, Y axis and levelling

Table area	1200 x 630mm (47.2 x 24.8 in)
X axis movement	+/- 500mm (19.6in)
X axis speeds	1mm/sec and 10mm/sec (0.039in/sec and 0.39in/sec)
X Δ Z straightness	6µm / 1000mm traverse (240µin / 39.4in)
Y axis movement	+/- 50mm (1.96in)
Y axis speed	1mm/sec (0.039in/sec
Y Δ Z straightness	6µm / 100mm traverse (240µin / 3.9in)
Levelling range	+/- 30 arc minutes
Positional resolution	5µm (200µin) X and Y axes

Motorised radial gauge arm

Radial travel	150mm (5.9in)
Traverse speeds	2.5 - 25mm/sec (0.1 - 0.95in/sec)
Positional control uncertainty	+/- 100µm (0.004in)
Positional resolution	50µm (0.002in)

Gauge

Standard stylus arm length	100mm (3.9in)
Gauge type	Single bias, inductive
Normal range	+/- 1mm (0.039in)
Normal resolution	0.06µm (2.5µin)
High range	+/- 200µm (0.008in)
High resolution	0.012µm (0.5µin)
Stylus force	0 to 15g adjustable
Crutch	Adjustable

Analysis capability

Roundness	Radius	Edge detection
Parallelism	Cylindricity	Run-out
Eccentricity	Total run-out	Harmonics (1-500upr)
Slope analysis	DFTC / DFTP	Partial arc
Asperity removal	Squareness	Coaxiality
Vertical straightness		

Filters

Phase corrected 2CR and Gaussian
Filtering is selectable from: 1-15upr, 1-50upr, 1-150upr, 1-500upr and user designated

Environment

Operating temperature	10°C to 35°C (50°F to 95°F)
Storage temperature	-10°C to 50°C (14°F to 122°F)
Temperature gradient	< 2°C / hour (< 3.6°F / hour)
Operating humidity	30% to 80% relative humidity non condensing
Storage humidity	10% to 90% relative humidity non condensing
Maximum RMS vertical floor vibration	0.05mm/s (0.002in/s) at < 50Hz 0.10mm/s (0.004in/s) at > 50Hz
Free air flow rate (steady)	1.0m/sec (39.4in/sec) maximum

Electrical (alternating supply, single phase with earth, 3-wire)

Instrument and computer voltage	90V-130V or 200V-260V (switch selectable)
Frequency	47Hz to 63Hz
Supply voltage transients – amplitude	Maximum five times RMS operating voltage
Supply voltage transients – width	Not less than 2µs and not greater than 20µs
Power consumption	2500VA maximum
Safety	EN 61010-1: 2001
EMC	EN 61000-6-1: 2001, EN 61000-6-4: 2001

Accessories

All the accessories you need to begin using Talyrond 450 are supplied as standard. However, for more demanding measuring requirements, we have a range of accessories that may be ordered separately.

1 Large Computer Desk
1260mm wide x 850mm deep x 750mm high (49.6"x 33.5"x 29.5"). Locking cabinet can be assembled to left or right of the desk.
code 112-2998 Optional

2 Storage Unit
820mm wide x 625mm deep x 640mm high (32.3"x 24.6"x 25.2"). Features lockable doors and is mounted on castors for easy installation; designed to fit under the small computer desk.
code 112-3142 Optional

3 Small Computer Desk
900mm wide x 850mm deep x 750mm high (35.5"x 33.5"x 29.5"). A small drawer is provided for tools, styli, accessories, etc.
code 112-3144 Optional

Monitor Support
Monitor support with vertical and swivel adjustment.
code 112-3182 Optional

4 Six jaw component chuck
A 6 jaw precision scroll chuck. Capacity - Inside diameter 20mm - 95mm (0.78in - 3.74in). Capacity - Outside diameter 2mm - 32mm (0.08in - 1.26in).
code 112/1859 Optional

5 Standard Stylus Arms
Ruby ball x 100mm (3.94")
1mm (0.039in), **code 112/2253**
2mm (0.078in), **code 112/2254**
4mm (0.157in), **code 112/2255**

Bar stylus
A 100mm (3.9in) stylus for measuring small diameter components
code 112/2256 optional

6 Stylus Kit - For assembling stylus arms for use with work pieces where the standard styli are unsuitable.
code 112/2235 Optional

Special Styli
Taylor Hobson can also provide customized stylus arms to suit specific requirements such as undercuts, recesses, shoulders or small inside diameters.
Code T.B.D. Optional

Measuring Gauge
Talymin single bias inductive gauge with 2mm (0.078") range.
code 112/1855 Standard

Stylus stop attachment
For limiting movement of the stylus when measuring interrupted surfaces.
code K501/1547 Optional

7 Cresting standard
For checking the vertical and horizontal alignment of the gauge head.
code 112/1876 Optional

8 Flick standard
for rapid calibration of gauge head sensitivity; alternative to the gauge calibration set.

20µm (788µ") range
code 112/2308 Optional

300µm (0.012") range
code 112/2233 Optional

❾ Glass hemisphere
For checking overall system performance. UKAS certificate of calibration is included.

Roundness < 0.05µm (2µ")
code 112/436 Standard

❿ Calibration set
For calibrating the gauge head. Comprises a circular glass flat (50mm diameter) and three gauge blocks (2.5mm, 2.8mm and 3mm). UKAS certificate of calibration is included.
code 112/1874 Standard

⓫ Precision test cylinder
For checking the instrument's vertical straightness accuracy and parallelism of the vertical axis to the spindle axis. UKAS calibration certificate is optional.

Height 1000mm (39.4")
Roundness < 0.75µm (30µ")
Straightness < 3µm (120µ")*
code 112/2333 Optional

*Straightness over central 90% of cylinder length

⓬ Glass flat
For checking the straightness and alignment of the horizontal arm with respect to the spindle axis.

Diameter 350mm (13.8")
Flatness < 0.25µm (4µ")
code 112/2334 Optional

Kinematic Dowel Support Set
For stable workpiece mounting.
code 112/1861 Standard

Gauge extension arms
These optional extension arms extend the reach of the Talymin gauge for measurement of tall components and for specific applications such as camshaft, crankshaft and cylinder bore measurement. Custom arms are available on special order. See photo on page 7.

240mm (9.5"), **code 155/P29510**
350mm (13.8"), **code 155/P29427**
500mm (19.7"), **code 155/P29428**
750mm (29.5"), **code 155/P29429**

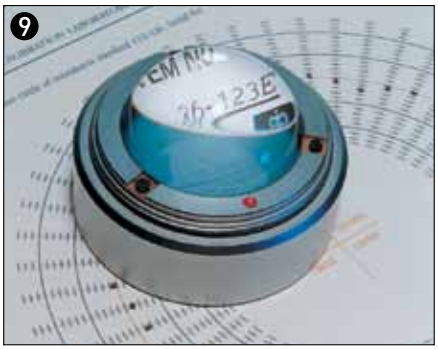
Special narrow drop arms
For bores down to 22mm diameter

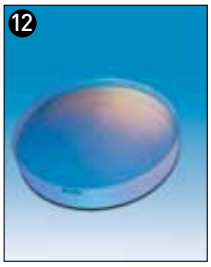
490mm (19.3"), **code 155/P52393**
750mm (29.5"), **code 155/P51992**

Crankshaft drop arms
These optional arms allow measurement access to pins and main bearings. See photo on page 7.

500mm (19.7"), **code 155/P36970**
1000mm (39.4"), **code 155/P37055**

⓭ Workholding devices
Specially designed to suit specific requirements of component size or shape to provide fast, positive set-up for components such as crankshafts (shown); fixtures can be dedicated or universal.





TAYLOR HOBSON®

Serving a global market

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.

Contracted services from Taylor Hobson

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**

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Centre of Excellence department

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- **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

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Taylor Hobson UK
(Global Headquarters)
PO Box 36, 2 New Star Road
Leicester, LE4 9JQ, England
Tel: +44 (0)116 276 3771 Fax: +44 (0)116 246 0579
email: taylor-hobson.uk@ametek.com

Taylor Hobson France
Rond Point de l'Epine Champs
Batiment D, 78990 Elancourt, France
Tel: +33 130 68 89 30 Fax: +33 130 68 89 39
taylor-hobson.france@ametek.com

Taylor Hobson Germany
Postfach 4827, Kreuzberger Ring 6
65205 Wiesbaden, Germany
Tel: +49 611 973040 Fax: +49 611 97304600
taylor-hobson.germany@ametek.com

Taylor Hobson India
1st Floor, Prestige Featherlite Tech Park
148, EPIP II Phase, Whitefield, Bangalore – 560 006
Tel: +91 1860 2662 468 Fax: +91 80 6782 3232
taylor-hobson.india@ametek.com

Taylor Hobson Italy
Via De Barzi
20087 Robecco sul Naviglio, Milan, Italy
Tel: +39 02 946 93401 Fax: +39 02 946 93450
taylor-hobson.italy@ametek.com

Taylor Hobson Japan
3F Shiba NBF Tower, 1-1-30, Shiba Daimon Minato-ku
Tokyo 105-0012, Japan
Tel: +81 (0) 3 6809-2406 Fax: +81 (0) 3 6809-2410
taylor-hobson.japan@ametek.com

Taylor Hobson Korea
#310, Gyeonggi R&DB Center, 906-5, Iui-dong
Yeongtong-gu, Suwon, Gyeonggi, 443-766, Korea
Tel: +82 31 888 5255 Fax: +82 31 888 5256
taylor-hobson.korea@ametek.com

Taylor Hobson China Beijing Office
Western Section, 2nd Floor, Jing Dong Fang Building (B10)
No.10, Jiu Xian Qiao Road, Chaoyang District, Beijing, 100015, China
Tel: +86 10 8526 2111 Fax: +86 10 8526 2141
taylor-hobson-china.sales@ametek.com.cn

Taylor Hobson China Shanghai Office
Part A1, A4. 2nd Floor, Building No. 1, No. 526 Fute 3rd Road East,
Pilot Free Trade Zone, Shanghai, China 200131
Tel: +86 21 5868 5111-110 Fax: +86 21 5866 0969-110
taylor-hobson-china.sales@ametek.com.cn

Taylor Hobson Singapore
AMETEK Singapore, 10 Ang Mo Kio Street 65
No. 05-12 Techpoint, Singapore 569059
Tel: +65 6484 2388 Ext 120 Fax: +65 6484 2388 Ext 120
taylor-hobson.singapore@ametek.com

Taylor Hobson USA
1725 Western Drive
West Chicago, Illinois 60185, USA
Tel: +1 630 621 3099 Fax: +1 630 231 1739
taylor-hobson.usa@ametek.com

www.taylor-hobson.com

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