



Talyrond 440 / 450

Heavy duty roundness



Talyrond 440 and 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.

Large or small parts

Although they are the obvious choice for heavyweight components, both Talyrond 440 and 450 can accommodate small, delicate components as well. Accuracy and repeatability are assured no matter how big or small the parts may be.



Big not clumsy

These instruments can handle the heaviest loads with ease yet they still provide accuracies better than those available on many ordinary measuring systems.

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

Geometric analysis capability for Talyrond 440 and 450

- RONt** Roundness
- STRt** Vertical Straightness
- FLTt** Flatness
- ECC** Eccentricity
- SQR** Squareness
- STRt** Horizontal Straightness*
- 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
- Disk thickness analysis*
- Wall thickness analysis

*Only on TR440



Industry leading mechanical features deliver accuracy and stability

Stable construction

The main base and column of both the Talyrond 440 and 450 are 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 leveling

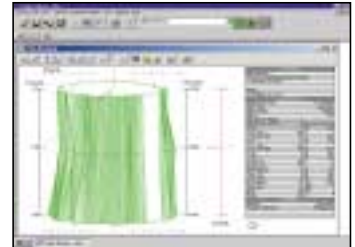
In manufacturing, a surface is always leveled by three points. Taylor Hobson adheres to this fundamental principle by using one fixed and two moving points for leveling of components on both the Talyrond 440 and 450.

Accurate positioning

Axis moves are programmable to maximize correlation of results between operators and minimize 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 for the Talyrond 440 and 450 instruments. It is the ideal tool for any environment where rapid component inspection is desired.



The Talyrond 440 uses a heavy duty, high precision oil hydrostatic spindle to rotate the workpiece during the measurement sequence



Choosing the right product

Talyrond 440 - Rotating worktable instrument

Heavy duty load capacity combines with sophisticated automation to provide excellent throughput for large components. Stable, cast iron construction and oil hydrostatic bearings ensure stiffness and rigidity throughout the measurement loop to provide unsurpassed precision for instruments in this size category.

Form measurement of tall components

The vertical straightness unit utilizes a cast iron column and oil hydrostatic bearings to provide a highly stable and accurate datum for cylindricity and straightness measurements to a height of 1000mm (1500mm optional). Drop arms can be provided for inspection of deep internal bores.

Large diameter roundness measurement

Worktable diameter is 450mm to provide complete support for extra large diameter components, e.g. bearing rings. A stable mounting surface prevents damage to the workpiece, assures operator safety and delivers repeatable measurement results.

Measurement of crankshafts

High eccentric load capacity accommodates even the largest crankshafts. Standard software routines provide analysis of complex geometrical relationships, e.g., pin to bearing axis straightness and run-out. Special axis-offset fixturing is available to allow the measurement of roundness on the pins as well as the bearings.

Automatic centering and leveling

Alignment of the component axis to the instrument axis is critical for correct and repeatable measurements. Automation of the process improves throughput, simplifies operation and eliminates operator influence on the measurement results.



	Height Capacity	Diameter Capacity	Weight Capacity	Table Diameter	Range of Centering	Range of Leveling	Radial Traverse
Talyrond 440							
M137/1975	1000mm	450mm	225kg	450mm	+/- 5mm	+/- 0.5°	300mm
M137/1976	1500mm	450mm	225kg	450mm	+/- 5mm	+/- 0.5°	300mm

Mechanical accuracy and innovation throughout the measuring loop

Precision spindle minimizes coning error for tall parts

Spindle accuracy is crucial to the performance of any roundness instrument. Radial limit of error is a constant value measured at the table top. Coning error, how well the spindle rotates on its axis, increases relative to distance above the table top.

Although radial error can be improved through software correction, coning error can be minimized only through meticulous construction. Taylor Hobson's ultra high precision spindle provides the best combination of precision and "stiffness" in the world. The result is coning error less than $0.0003\mu\text{m}/\text{mm}$ ($0.3\mu\text{"/inch}$).

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 stability throughout the entire 1000mm vertical measurement axis.

Radial straightness arm

The radial arm provides a stable unit for the accurate measurement of horizontal straightness and multi-plane flatness. Travel beyond the center of the table is 75mm to accommodate components with eccentric features.

"Auto follow" fast centering

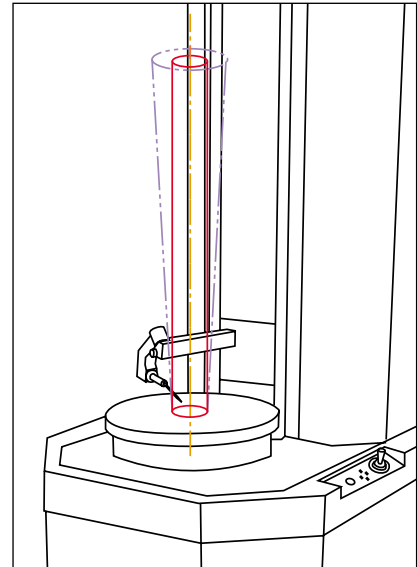
This unique feature allows the radial arm position to be varied continuously in response to the gauge signal. By keeping the gauge in range and in contact with the workpiece, centering is fast and effective for large or eccentric components.

Direct drive spindle

Positional accuracy is assured by the use of a direct drive to move the spindle, ruling out inherent errors typically found in gear driven systems.

Motorized gauge head

The fully automated gauge arm enables inspection of internal, external, vertical and horizontal features without any operator intervention to minimize errors and improve repeatability.



measure tall components with confidence and accuracy; coning error is less than $0.3\text{nm}/\text{mm}$



the massive worktable is powered by dual, high torque, direct drive motors for accurate positioning of centric loads to 225Kg (495lbs)

Spindle Radial Limit of Error	Measurement Uncertainty - Arm	Measurement Uncertainty - Column	Instrument Weight	Instrument Dimensions (LxWxH)
+/- $(0.05\mu\text{m} + 0.0003\mu\text{m}/\text{mm})$	+/- $1\mu\text{m}$	+/- $5\mu\text{m}$	3500Kg	920 x 1400 x 2310mm
+/- $(0.05\mu\text{m} + 0.0003\mu\text{m}/\text{mm})$	+/- $1\mu\text{m}$	+/- $5\mu\text{m}$	3600Kg	920 x 1400 x 2810mm

Choosing the right product

Talyrond 450 - Rotating gauge instrument

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 traveling 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

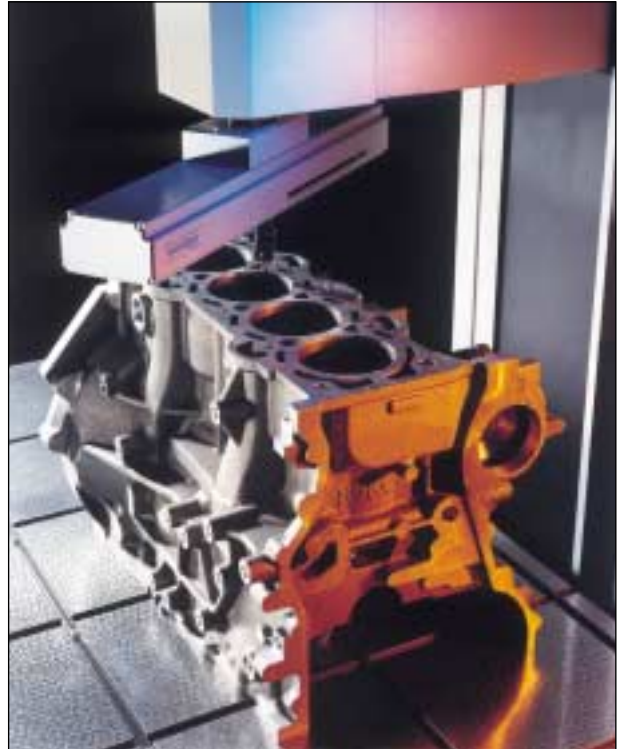
Gauge extension arms up to 750mm length permit vertical straightness and multi-plane geometrical measurements on extra long components.

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. Un-attended 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 stability throughout the entire 1000mm vertical measurement axis.

Motorized 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 center of the feature being measured.

Target eccentricity

Automatic center and leveling 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**

+/- 0.1µm
+/- 0.1µm

**Measurement
Uncertainty - Column**

+/- 5µm
+/- 5µm

**Instrument
Weight**

6000Kg
6200Kg

**Instrument
Dimensions (LxWxH)**

2200 x 1600 x 2400mm
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 optimized 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 - customized 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.

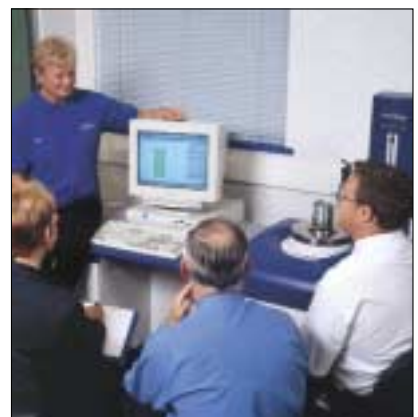
- Operators familiar with µltra can easily operate multiple inspection instruments
- Productivity is not limited by single instrument operators
- The transfer of knowledge is simplified when operators are promoted or transferred



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



µltra powers Talyrond roundness, cylindricity and circular geometry measuring systems



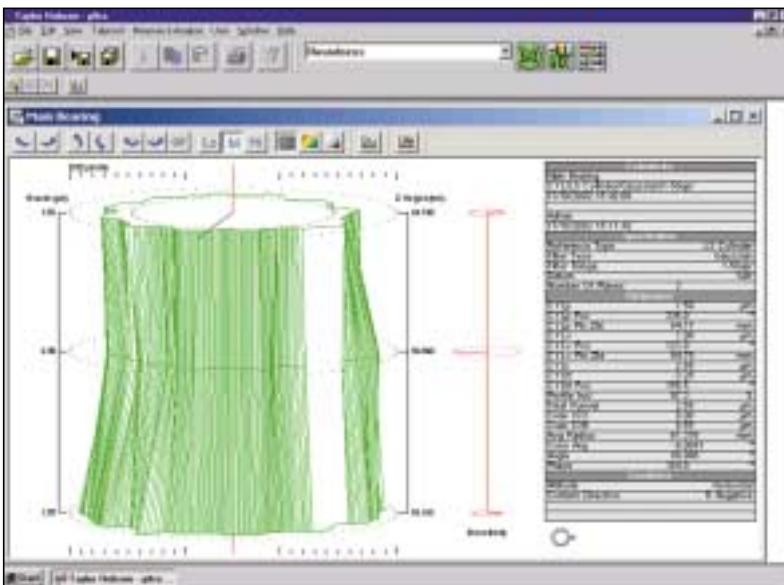
µltra simplifies training and eliminates the need for dedicated, single system operators

Roundness / Cylindricity / Coaxiality / Concentricity

The first step in any measurement is automatic centering and leveling to mechanically align the axis of the component with the axis of the spindle. This minimizes 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.

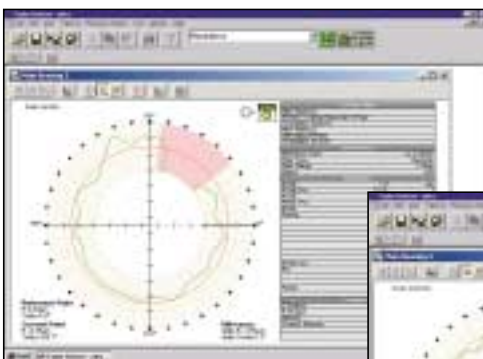
In addition, the axis calculated from the cylinder analysis can be used as a reference datum and compared with another axis for assessment of coaxiality, concentricity, run-out and total run-out.



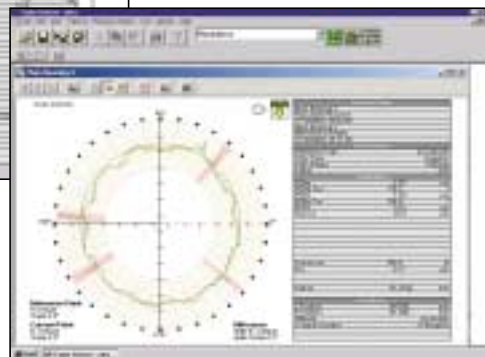
in this example of cylindricity three profiles have been measured on a crankshaft main bearing; note that the oil hole has been automatically excluded from analysis.

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

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



interruption removed from analysis



asperities removed from analysis

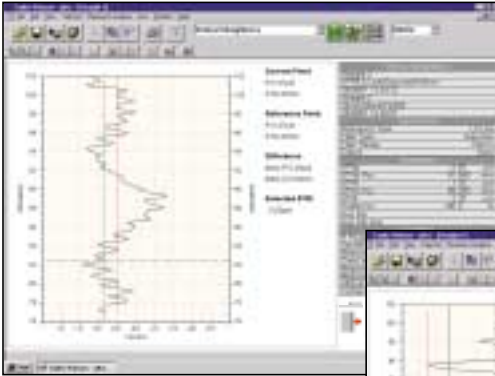
Measurements on interrupted surfaces

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

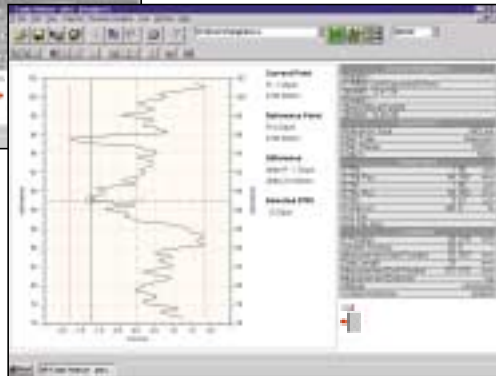
In the examples to the left, the pink shaded areas indicate data automatically excluded from the measurement results.

Straightness / Parallelism

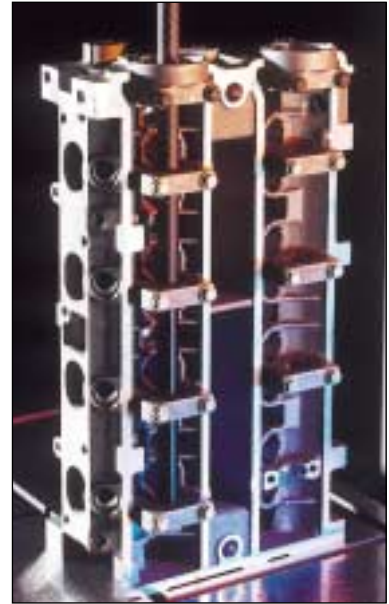
ultra software is able to measure and analyze both vertical and horizontal straightness on both continuous and interrupted surfaces. Crankshaft and camshaft bores, for example, can be checked for collective straightness over their entire length via Least Squares Line or Minimum Zone references.



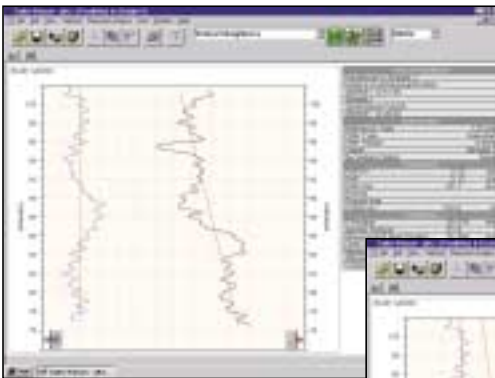
least squares line (LSS) straightness (reference only)



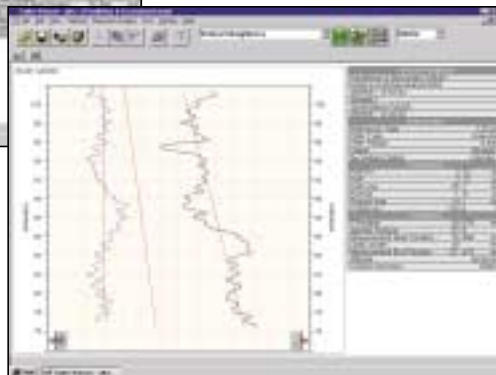
minimum zone (MZL) straightness (reference only)



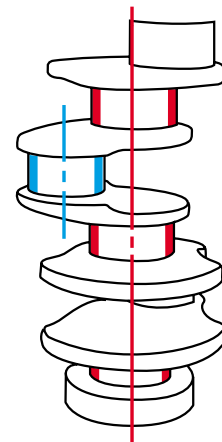
Two straightness measurements taken 180° apart are necessary for an assessment of parallelism. Either of the measurements can be set as a datum and compared to the other for the assessment.



parallelism (reference only)



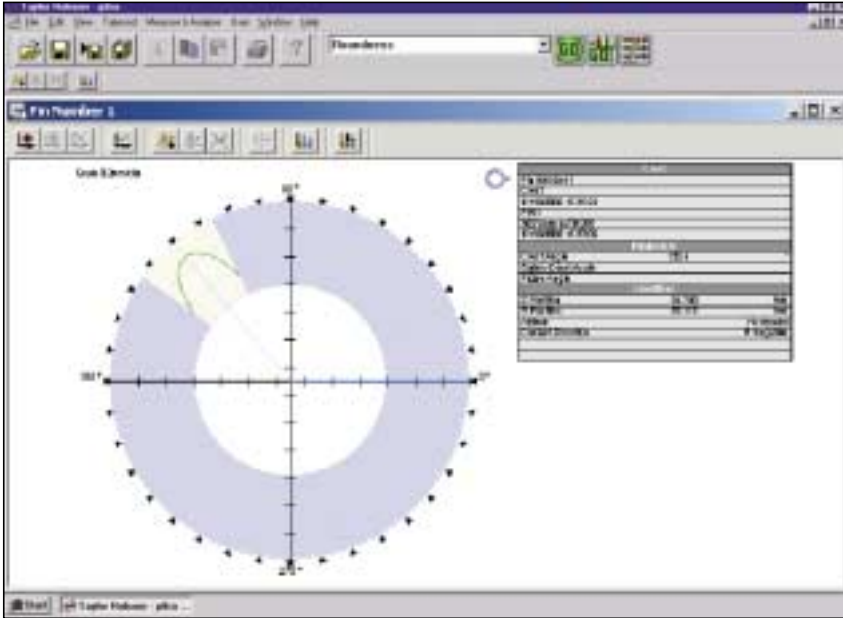
parallelism to a secondary datum (reference only)



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

Special Roundness Features

Both the Talyrond 440 and 450 have the ability to analyze 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.



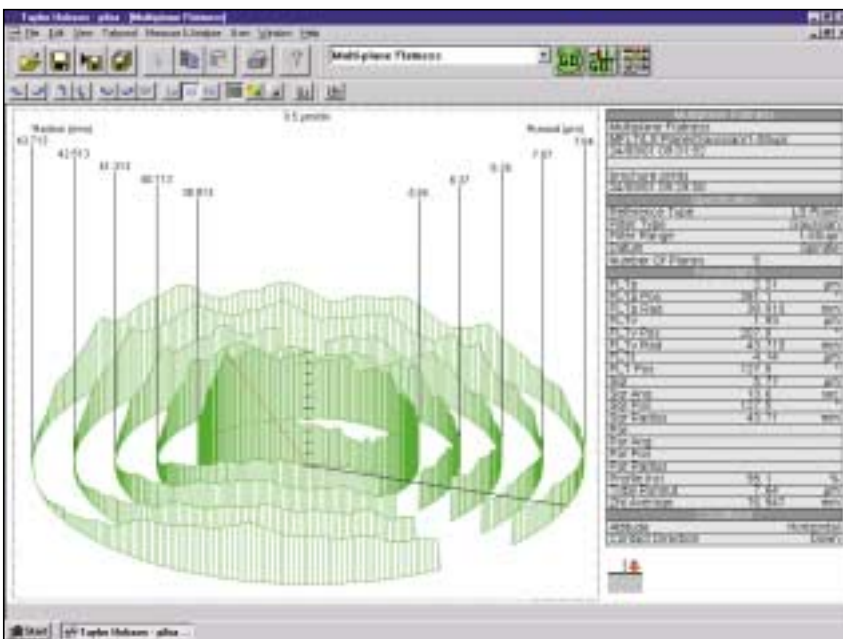
example of partial arc analysis

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.

Multiplane Flatness (Talyrond 440 only)

ultra includes a very powerful tool for defining the flatness of a plane surface.



multiplane flatness display

Multiple profiles can be taken on a flat component (e.g. brake disc) and combined into a composite assessment of surface flatness. The number of measurements to be taken as well as the spacing between profiles are assigned by the user to suit the application.

Whenever necessary, the data exclusion tool can be used for removal of individual asperities or to exclude entire profiles from the composite flatness calculation.

Accessories

All the accessories you need to begin using Talyrond 440 and 450 are supplied as standard. However, for more demanding measuring requirements, we have a range of accessories which may be ordered separately.

❶ 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

❷ 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

❸ 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

❹ 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

❺ 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

❻ 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

❼ Cresting standard

For checking the vertical and horizontal alignment of the gauge head.

code 112/1876 Optional

❽ 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



9 Glass hemisphere

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

Roundness $< 0.05\mu\text{m}$ ($2\mu\text{m}$)
code 112/436 Standard

10 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

11 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 $< 0.75\mu\text{m}$ ($30\mu\text{m}$)
Straightness $< 3\mu\text{m}$ ($120\mu\text{m}$)*
code 112/2333 Optional

*Straightness over central 90% of cylinder length

12 Glass flat

For checking the straightness and alignment of the horizontal arm with respect to the spindle axis. (Talyrond 440 only)

Diameter 350mm (13.8")
Flatness $< 0.25\mu\text{m}$ ($4\mu\text{m}$)
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 (TR450)

For bores down to 22mm diameter

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

Crankshaft drop arms (TR450)

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

Crankshaft arm (TR440)

This accessory is essential for the analysis of crankshaft main and pin bearings. See photo on page 4.

Code 137/2091-01 Optional

13 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.



Specification

Measuring capacity Maximum component diameter Maximum component height Maximum throat depth Maximum measuring diameter Maximum component weight Maximum worktable moment loading	Talyrond 440 450mm (17.7in) [extendable to 600mm (23.6in)] 1000mm (39.4in) or 1500mm (59.0in) N/A 450mm (17.7in) 225kg (495lb) 2250g.m (1953lb.in) within a central 275mm (10.8in) equilateral triangle	Talyrond 450 N/A 1000mm (39.4in) or 1500mm (59.0in) 400mm (15.7in) (column to spindle axis) 300mm (11.8in) 1000kg (2200lb) N/A
Instrument dimensions Instrument width Instrument length Instrument height Height of worktable Instrument workstation (L x W x H) Recommended installation floor area Instrument weight (1000mm column) Floor loading (1000mm column)	1400mm (55.1in) 920mm (36.2in) 2310mm (90.9in) 890mm (35in) 1260mm x 850mm x 750mm (49.6in x 33.1in x 31in) 1500mm x 1100mm + workstation (59in x 43in + workstation) 3500kg (7700lb) 49508kg/m ² (70lb/in ²)	1766mm (69.5in) 1766mm (69.5in) 3500mm (138in) 890mm (35in) 1260mm x 850mm x 750mm (49.6in x 33.1in x 31in) 2000mm x 2000mm + Workstation (79in x 79in + Workstation) 6000kg (13200lb) 65000kg/m ² (92lb/in ²)
Vertical straightness module Construction Measurement length Straightness over column length Straightness over any 100mm Positional control uncertainty Vertical axis to spindle axis parallelism Speed range (stepped) Measurement uncertainty Measurement resolution	hydrostatic bearing 1000mm (39.4in) [1500mm optional] 1µm/1000mm (40µin/39.4in) 0.25µm/100mm (10µin/3.94in) +/- 20µm (800µin) for a single move 2µm/1000mm (400µin/39.4in) 0.5 - 20mm/s (0.02 - 0.8in/s) +/- 5µm (200µin) 1µm (40µin)	hydrostatic bearing 1000mm (39.4in) [1500mm optional] 3µm/1000mm (120µin/39.4in) 0.5µm/100mm (20µin/3.94in) +/- 20µm (800µin) for a single move N/A 0.5 - 15mm/s (0.02 - 0.6in/s) +/- 5µm (200µin) 1µm (40µin)
Spindle Spindle construction Speed range Positional control uncertainty Radial limit of error (concentric load) Radial limit of error (eccentric load) 225kg (495lb) offset by 100mm (3.9in) Measurement uncertainty Measurement resolution Axial limit of error (MZ)	Hydrostatic bearing 0.6, 1, 2 and 6 rpm +/- 0.5° for a single move +/- [(0.05µm + 0.0003µm/mm) +/- [(0.8µin + 0.3µin/in)] +/- [(0.05µm + 0.0005µm/mm) +/- [(2.0µin + 0.5µin/in) +/- 10 arc mins +/- 1.5 arc sec 0.06µm (2.36µin)	Hydrodynamic bearing 1, 2 and 6 rpm +/- 0.5° for a single move +/- 0.1µm (4µin) N/A N/A N/A N/A N/A
Center and leveling Worktable dimensions Center and leveling table control Centering range Leveling range Accuracy of auto centering Accuracy of auto leveling	450mm (17.7in) diameter Computer +/- 5mm (0.2in) +/- 0.5° < 1µm (39µin) < 0.8 arc secs	See worktable on opposite page

<h3>Radial Straightness Unit (Talyrond 440 only)</h3> <table> <tr><td>Arm construction</td><td>Ceramic</td></tr> <tr><td>Measurement range</td><td>300mm (11.8in)</td></tr> <tr><td>Over-center travel</td><td>75mm (2.95in)</td></tr> <tr><td>Straightness over 300mm</td><td>1.25µm/300mm (50µin/11.8in)</td></tr> <tr><td>Straightness over any 50mm</td><td>0.25µm/50mm (9.85µin/1.97in)</td></tr> <tr><td>Positional control uncertainty</td><td>+/- 50µm (1970µin)</td></tr> <tr><td>Squareness to spindle axis</td><td>2µm/300mm (79µin/11.8in)</td></tr> <tr><td>Speed range (stepped)</td><td>0.5mm/s - 10mm/s (0.02 - 0.39in/s)</td></tr> </table>			Arm construction	Ceramic	Measurement range	300mm (11.8in)	Over-center travel	75mm (2.95in)	Straightness over 300mm	1.25µm/300mm (50µin/11.8in)	Straightness over any 50mm	0.25µm/50mm (9.85µin/1.97in)	Positional control uncertainty	+/- 50µm (1970µin)	Squareness to spindle axis	2µm/300mm (79µin/11.8in)	Speed range (stepped)	0.5mm/s - 10mm/s (0.02 - 0.39in/s)	<h3>Worktable (Talyrond 450 only)</h3> <p>The worktable is comprised of three movements: X axis, Y axis and leveling</p> <table> <tr><td>Table area</td><td>1200 x 630mm (47.2 x 24.8 in)</td></tr> <tr><td>X axis movement</td><td>+/- 500mm (19.6in)</td></tr> <tr><td>X axis speeds</td><td>1mm/sec and 10mm/sec (0.039in/sec and 0.39in/sec)</td></tr> <tr><td>X Δ Z straightness</td><td>6µm / 1000mm traverse (240µin / 39.4in)</td></tr> <tr><td>Y axis movement</td><td>+/- 50mm (1.96in)</td></tr> <tr><td>Y axis speed</td><td>1mm/sec (0.039in/sec)</td></tr> <tr><td>Y Δ Z straightness</td><td>6µm / 100mm traverse (240µin / 3.9in)</td></tr> <tr><td>Leveling range</td><td>+/- 30 arc minutes</td></tr> <tr><td>Positional resolution</td><td>5µm (200µin) X and Y axes</td></tr> </table>		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)	Leveling range	+/- 30 arc minutes	Positional resolution	5µm (200µin) X and Y axes
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