

# Talyrond® 465/485H

A revolutionary concept in roundness inspection



# The Talyrond 400H

A new concept in roundness measurement

The Talyrond 400 series is unsurpassed in speed and position control making it the ideal system for high volume precision components







## High precision emulation of your manufacturing process

The all-new Talyrond 400 roundness instruments use rotary, vertical and horizontal measuring datums to duplicate your machine tool's movement and exactly reproduce the workpiece shape. This ultra high precision simulation of the cutting tool path enables precise control of your manufacturing process.

## Reproducible measurement results

Decades of experience, ultra precision machining expertise and FEA optimized design combine to provide low noise and near flawless mechanical execution of the measuring axes. Further enhancement via the use of traceable standards and exclusive algorithms effectively eliminates instrument influence from the measurement results.

## Monitoring manufacturing

 Gauge	 Roundness	 Roughness	 Contour
Gauge Range Up to 4 mm	Radial Accuracy +/- 0.015;	Noise Less than 30 nm Rq all axes	LS Arc measurement 5 µm
Resolution Down to 0.3 nm		Ra values Less than 0.1 µm	Pt 0.5 µm

## Five measurements in one

# 1

## Roughness

High resolution gauge and low axis noise enables linear or circumferential surface roughness measurement.

## Roughness

Modified Profile

Test - P0.807mmLS Line  
c\_fuel injector1 - 10.176mm/Adm/c\_fuel injector1 PRF

microinches

7.00 7.05 7.10 7.15 7.20 7.25 7.30 7.35 7.40 7.45 7.50 7.55 7.60 7.65 7.70 7.75 7.80 7.85 7.90 7.95 8.00 8.05 8.10 8.15 8.20 8.25 8.30 8.35 8.40 8.45 8.50 8.55 8.60 8.65 8.70 8.75 8.80 8.85 8.90 8.95 9.00 9.05

## Roundness


[illegible]

## Contour

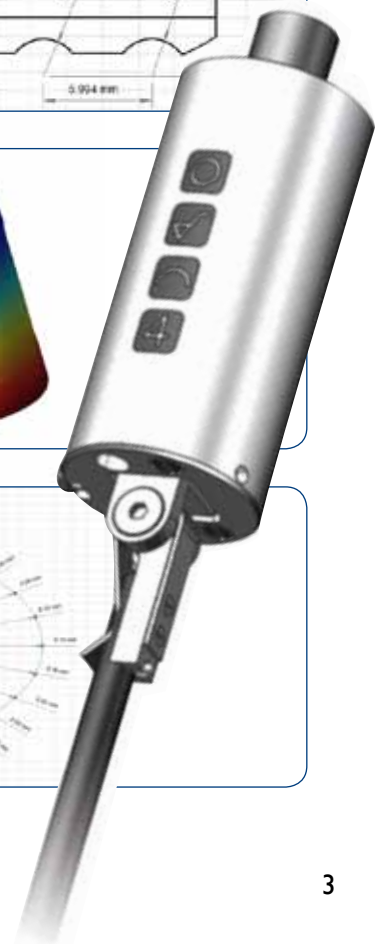
Technical drawing of a mechanical part with the following dimensions:

- Total width: 8.002 mm
- Top flange thickness: 1.643 mm
- Inner diameter:  $\varnothing 2.250 \text{ mm}$
- Outer diameter:  $\varnothing 2.679 \text{ mm}$
- Length: 5.954 mm

## Cylindrical mapping



## Cams and pistons

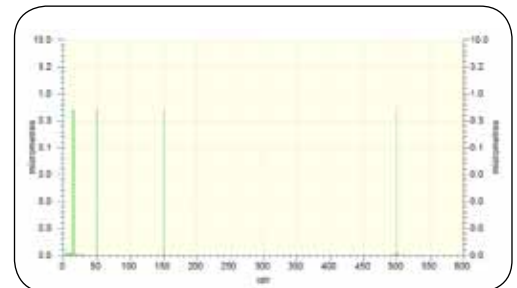
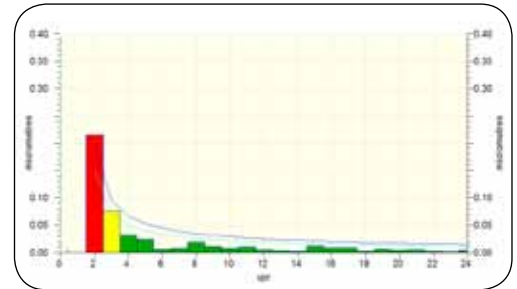
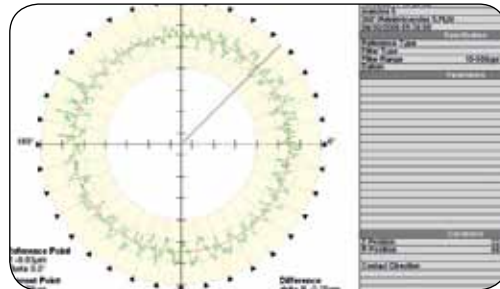


# Powerful software tools help improve your process

## Advanced harmonics – identify the cause of bad parts

Ordinary inspection might detect bad components but Talyrond 400H can help you fix the production issues that are causing them. Deviation in form on a workpiece can be broken down into irregularities that have both frequency and amplitude. Harmonic analysis identifies these imperfections allowing you to pinpoint and correct their cause, reducing the need for ever tighter tolerances on size.

- Full histogram view with tolerance bands
- Pass/Fail and warning messages
- Ranking system according to wave depth or harmonic amplitude
- Comparison to CSV or GKD files
- Up to 5000 upr
- Wave depth or harmonic amplitude format



## Precision harmonic standard

A precision machined standard with the following undulations in 360 degrees:

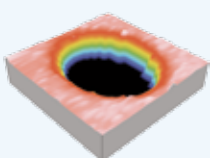
15	upr
50	upr
150	upr
500	upr
1500	upr



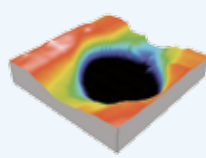
“Giving confidence in your instrument.”

## 3D cylindrical mapping

For production issues beyond the scope of traditional 2D inspection techniques



Crankshaft oil hole without washout



Crankshaft oil hole with washout

With high accuracy and high resolution in all axes, Talyrond 400H allows you to measure in 3 dimensions for more thorough examination of flaws, defects and cutting tool geometry effects that influence performance or lead to component malfunction.

- Twist or lead detection
- Machining defects
- Wear scar analysis
- Leak detection and more

# Q-Link Production Interface

A simplified interface designed specifically for production environments

- Q-DAS accredited
- Compatible with all instruments
- Simple operation
- User levels
- Traceable fields
- Simple tolerancing
- Automatic summary reports
- Automatic statistical studies



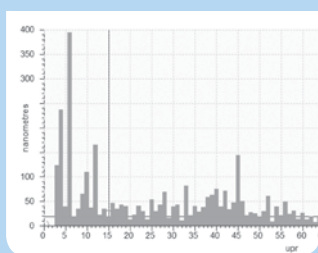


# Applications

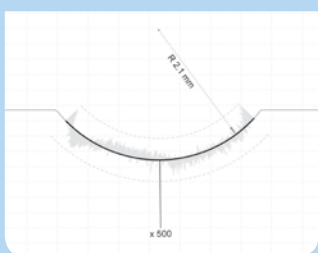
## Inner bearing races



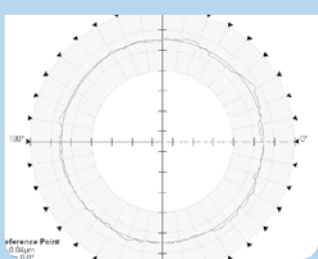
### Harmonic analysis



### Form & radius analysis



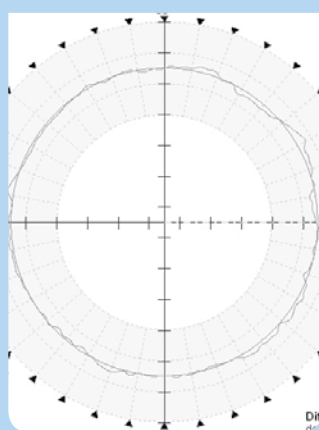
### Roundness



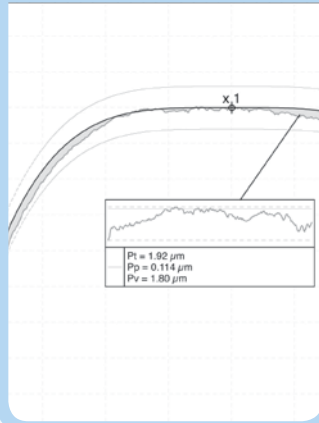
## Roller bearings



### Roundness



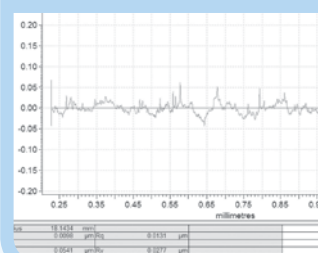
### Tilt and form error to axis of rotation



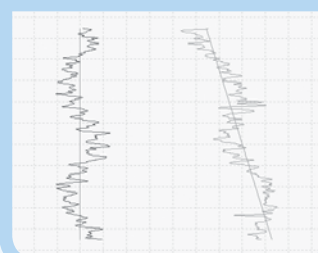
## Turbo chargers



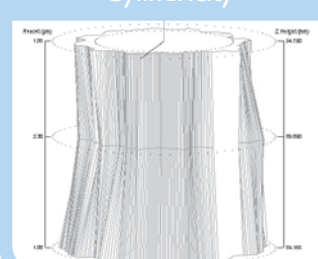
### Surface finish



### Parallelism

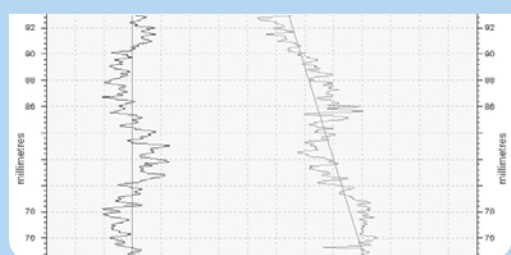


### Cylindricity

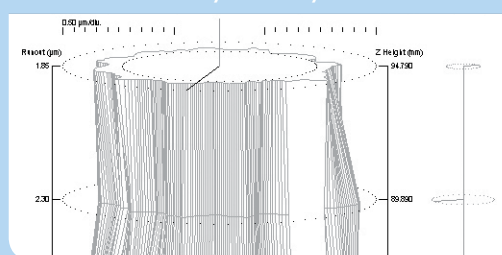


## Crankshafts

### Parallelism



### Cylindricity



# Testimonial

Ultra precision bearings are produced to the highest standards available. They are used in industries with a necessity for critical tolerances, high speeds and reliable performance under demanding operating conditions. Ultra precision bearings are also used in safety-critical and harsh environment applications.

## Industries and applications:

- Automotive
- Aerospace
- Bearings
- Hydraulics
- Optics
- Dental and medical
- Industrial plants

*“Having the responsibility to ensure 1.5 million bearings each year are manufactured to the highest quality, means controlling our components at all stages of manufacturing. We have 15 Taylor Hobson roundness measuring instruments that help us maintain high throughput and the accuracies we require to ensure every one of our bearings is of the highest quality.”*

**Measurement Q/A Coordinator – Leading global bearings manufacturer**



# Designed for metrology without compromise

The construction of the 400H series range is key to measurement integrity

## Reproducing the part

Taylor Hobson's core competencies are in cylindrical grinding, surface grinding and diamond turning. All of these disciplines coupled with knowledge in drive mechanisms go towards constructing an instrument with low noise and high geometric accuracy, ensuring reproducibility of the component.

## Frictionless air bearing spindle

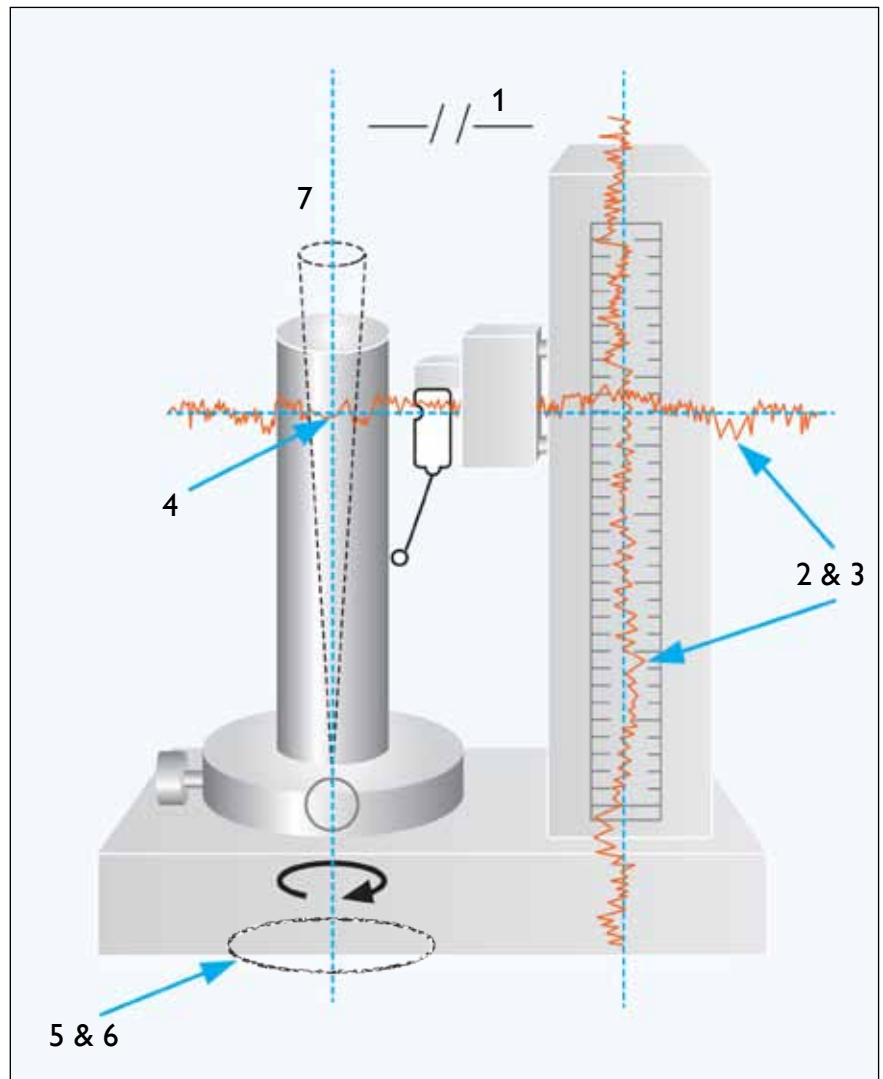
The instrument's spindle axis, like any spindle based machine tool, is paramount in ensuring integrity of measurement. Utilising Taylor Hobson's own diamond turning lathe we are able to create a reference datum unsurpassed in accuracy and reliability.

## Instrument base

Using finite element analysis software, the cast iron base provides a solid foundation for both the high precision air bearing spindle and vertical straightness datum, ensuring movement and weight do not effect results. A choice of passive or active isolation mounts are available, which have been designed for either inspection laboratories or production environments.

## Straightness datums

The vertical column is machined for straightness, waviness and roughness to an exacting standard, using traceable standards and techniques developed by Taylor Hobson. The straightness datums are further enhanced to ensure reproducibility of the part with little or no instrument influence.

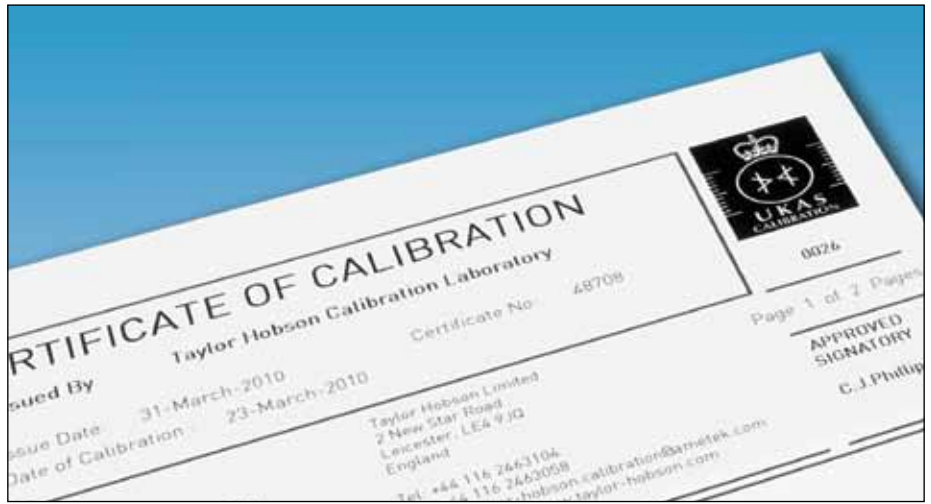


## Important features of a roundness system

- |   |                                       |
|---|---------------------------------------|
| 1 | Parallelism of column to spindle axis |
| 2 | Column and arm straightness           |
| 3 | Low vertical and radial arm noise     |
| 4 | Squareness of arm to spindle axis     |
| 5 | Radial run-out of spindle             |
| 6 | Low spindle noise                     |
| 7 | Minimized coning error of spindle     |
| 8 | Accurate glass scales in all axes     |

“World-beating noise floor”





## Traceability

Full traceability to international standards

### Traceability

All calibration standards can be provided with traceability to international standards using Taylor Hobson's own UKAS laboratory.

### Roundness

Using a precision polished glass hemisphere calibrated to an uncertainty of less than 5nm Taylor Hobson can guarantee your spindle is within specification and maintain quality of results.

### Straightness, squareness and parallelism

To ensure the column and radial straightness unit conform to specification we can provide standards that are either cylindrical or flat. These standards provide certainty of the measurement axes. These artefacts are combined with special software routines to enhance all axes for correct geometrical form.

### Surface finish

A unique standard is available that provides measurement traceability for roughness in both a vertical and circumferential direction.

### Arcuate correction (contour option)

Taylor Hobson's patented calibration routine and calibration ball corrects for the arcuate motion of the stylus allowing dimensional measurement. This routine is critical to measurement of radius and angled parts when normal calibration routines will not suffice.

### Gain correction

The TR400 series has a unique automated gain calibration for the instrument's gauge; the routine is automated and takes a matter of seconds to set. Alternatively a set of calibrated slip blocks traceable to primary standards are also supplied.

### Axis calibration

Automated or manual routines can be supplied allowing the user to set coordinates to the part or instrument axes. The optional fully automated routine calibrates the arm, column and spindle.

## Industry specific software

*Velocity analysis allows bearing manufacturers to evaluate harmonics with respect to amplitude and predict function with respect to speed.*



# Accessories

All the accessories you need to begin using Taylor Hobson roundness measuring systems are supplied as standard. However, for more demanding requirements or improved measurement throughput, we have a range of accessories which may be ordered separately.

## Active AV mounts with environmental cabinet

Provides isolation from airflow, dust and external vibration.

**code 112/4278**

## ① Talyrond ball calibration standard

Required for use with contour or form software, this calibration standard corrects for gain, tip and arcuate motion of the stylus

Talyrond ball standard rad 7.5mm  
(Not recommended for 4 mm range)

**code 112-4305UC**

Talyrond ball standard rad 12.5mm  
(Not recommended for 4 mm range)

**code 112-4319UC**

Talyrond ball standard rad 22.5mm

**code 112-4092UC**

**② Calibration standard** for vertical and circumferential roughness  
**code 112/4341 UCR**

**③ Precision collet chuck** - removable three ball type location (for use with manual or automated tables)  
Note: Collet required – see list below.  
**code 112/3662**

code 112/3554-1.0 1 mm Collet  
code 112/3554-1.5 1.5 mm Collet  
code 112/3554-2.0 2 mm Collet  
code 112/3554-2.5 2.5 mm Collet  
code 112/3554-3.0 3 mm Collet  
code 112/3554-3.5 3.5 mm Collet  
code 112/3554-4.0 4 mm Collet  
code 112/3554-4.5 4.5 mm Collet  
code 112/3554-5.0 5 mm Collet  
code 112/3554-5.5 5.5 mm Collet  
code 112/3554-6.0 6 mm Collet  
code 112/3554-6.5 6.5 mm Collet  
code 112/3554-7.0 7 mm Collet  
code 112/3554-7.5 7.5 mm Collet  
code 112/3554-8.0 8 mm Collet

## ④ Six jaw component chuck

A 6 jaw precision scroll chuck.  
Capacity - Inside diameter  
20 mm - 95 mm (0.78 in - 3.74 in).

Capacity - Outside diameter  
2 mm - 32 mm (0.08 in - 1.26 in).  
**code 112/1859** optional

**code 112/3555** Adjustable End Stop  
Recommended for use with 112/3549 or 112/3662; may require modification to suit the component under test.

## ⑤ Standard stylus arms

Ruby ball x 100 mm (3.9 in)  
1 mm (0.039 in), **code 112/3245**  
2 mm (0.078 in), **code 112/3244**  
4 mm (0.157 in), **code 112/3243**

## Bar stylus

A 100mm (3.9in) stylus for measuring small diameter components.  
**code 112/3489** optional

## Diamond styli

Conisphere stylus with 90° included angle; required for cylindrical mapping or surface finish applications.  
**code 112/3806** optional 5 µm Rad  
**code 112/3807** optional 10 µm Rad

## Kinematic dowel support set

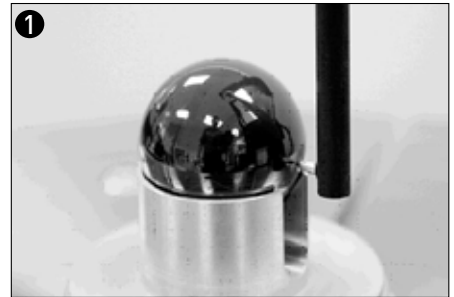
For stable workpiece mounting.  
**code 112/1861** standard

## Reservoir assembly kit

If the air supply is unreliable or of poor quality then the reservoir assembly is recommended to provide an even flow of air to the spindle.  
**code 112/2869** optional

## Force setting gauge

Recommended with diamond styli and where specific stylus forces are required.  
**code 112/3808** optional



### 6 High precision glass hemisphere

For checking total system performance;  
UKAS calibration certificate is optional.  
Roundness < 0.02 µm (0.8 µ")

**code 112/2324** optional

### Glass hemisphere

For checking total system performance;  
UKAS calibration certificate is optional.  
Roundness < 0.05 µm (2 µ")

**code 112/436** optional

### 7 High precision test cylinder

For verification of the instrument's  
vertical straightness accuracy and  
parallelism of the vertical axis to the  
spindle axis. UKAS calibration certificate  
is optional.

**code 112/3670-01** optional

### 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.

300 mm (11.8") cylinder  
Roundness < 0.25 µm (10 µ")  
Straightness < 0.5 µm (20 µ")\*  
**code 112/1888** optional

500 mm (19.7") cylinder  
Roundness < 0.25 µm (10 µ")  
Straightness < 0.5 µm (20 µ")\*  
**code 112/1997** optional

\* Straightness over central 90%  
of test cylinder length

### 8 Cresting standard

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

**code 112/1876** optional

### 9 Flick standard

For rapid calibration of the gauge head;  
alternative to the standard gauge  
calibration set.

20 µm (788 µ") range

**code 112/2308** Optional

300 µm (0.012") range

**code 112/2233** optional

### 10 Calibration set

For calibrating the gauge head. The  
set comprises a circular glass flat and  
four gauge blocks. UKAS calibration  
certificate is optional.

**code 112/2889** standard

Glass flat 250 mm (10") diameter  
For checking the straightness and  
alignment of the horizontal arm with  
respect to the spindle axis.

**code 112/1998** optional

### Instrument cover

To protect the instrument when not in use.

**code 112/1393** optional

### ECU Fuse kit

**code 112/4234** optional

### Pre-filter element

**code 112/3351** optional

### Accessory case

A useful case for carrying standard  
and optional accessories.

**code 48/453** optional

### Set of hexagonal wrench keys

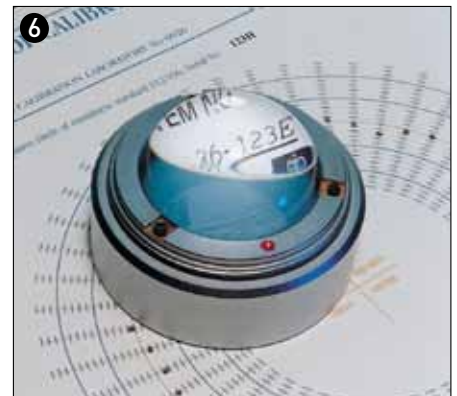
To assist with minor adjustments  
on the instrument.

**code 630/412** optional

### Coalescing filter element

Secondary filter to be changed every  
3 months to maintain a clear air supply,  
(1 included with the instrument).

**code 112/3378** optional



## Customised solutions for special applications

Our strategy for success is simple,  
instead of just selling products, we  
provide solutions. If our standard  
instruments and accessories do not  
satisfy your needs, we can customise  
a solution to exactly match your  
application. This may include such  
things as work holding devices or  
special styli for applications such as  
small bores, shoulders or undercuts.

# Talyrond 400H specification

## Analysis capability

Standard software		Optional software	Filters
Roundness	Parallellism	Piston measurement	<b>Roundness</b> <ul style="list-style-type: none"> <li>• Gaussian</li> <li>• 2 CR Phase corrected</li> </ul>
Squareness	Vertical straightness	Commutator analysis	
Concentricity	Partial arc flatness	Disk thickness variation	
Coaxiality	Partial arc roundness	Velocity analysis	
Slope	Cylindrical mapping	Wall thickness	
Cylindricity	Departure from True Plane (DFTP)	Advanced harmonics	<b>Surface</b> <ul style="list-style-type: none"> <li>• Gaussian</li> <li>• Robust Gaussian</li> <li>• 2 CR Phase corrected</li> <li>• 2 CR</li> </ul>
Total run-out	Departure from True Circle (DFTC)	Groove analysis	
Flatness	Radial straightness (RSU)	Harmonics	
Eccentricity	Multiplane flatness (RSU)	TalyMap Contour software	
Run-out	Multiplane roundness	TalyMap 3D analysis software	
		Circumferential surface finish analysis	
		Surface finish analysis	
		Twist analysis	

## Measurement capability

Column axis	300 mm column	500 mm column
Straightness over column length	0.3 µm / 300 mm (11.8 µin / 11.8 in) and 0.3 µm / 500 mm (11.8 µin / 19.7 in)	
Straightness over any 100mm (3.94in)	0.15 µm / 100 mm (5.9 µin / 3.94 in)	
Vertical axis to spindle axis parallelism	0.5 µm / 300 mm (20 µin / 11.8 in)	0.75 µm / 500 mm (29.5 µin / 19.7 in)
Column noise †	<30 nm	

Horizontal arm axis	Radial straightness unit	Motorized radial arm
Straightness over full length of travel	0.25 µm / 200 mm (10 µin / 7.9 in)	N/A
Straightness over any 50 mm	0.125 µm + 0.000625 µm/mm (5 µin + 0.025 µin/in)	N/A
Squareness to spindle axis	1 µm / 200 mm (39.4 µin / 7.9 in)	N/A
Radius measurement *	(0.1 µm/mm + 1.5 µm)	
Arm noise †	<30 nm Rq	N/A

Spindle axis	
Radial limit of error (height above table)	± 0.015 µm (1-50 upr)
Axial limit of error (radius from center)	± 0.015 µm (1-50 upr)
Coning Error (height above table)	± 0.0003 µm/mm
Coning Error (radius from centre)	± 0.0003 µm/mm

Gauge	Range/resolution
High range	± 2 mm , 0.016 µm resolution (0.078 in range, 0.6 µin resolution)
Normal range	± 1 mm range, 0.008 µm resolution (0.039 in range, 0.3 µin resolution)
Mid range	± 0.2 mm range, 0.0016 µm resolution (0.0078 in range, 0.06 µin resolution)
Low range	± 0.04 mm range, 0.0003 µm resolution (0.003 in range, 0.012 µin resolution)

## Component capacity

Measuring capacity	300 mm column	500 mm column
Maximum component height	300 mm (11.8 in)	500 mm (19.7 in)
Maximum component diameter	Ø 400 mm (15.7 in) [extendable to 485 mm (19.1 in)]	
Maximum bore measuring depth (with standard length stylus)	TR465H 160 mm (6.3 in) or TR485H 155 mm (6.1 in)	
Maximum measuring diameter	Ø 350 mm (13.8 in) [extendable to 450 mm (17.7 in)]	
Maximum worktable loading	20kg (44lb)	
Maximum worktable moment loading	Manual C&L: 120kg/mm (10.4lb/in) up to 25mm (0.98in) along load line	

† Vertical traverse measured with a 10 Kg load at 200 mm height; horizontal traverse measured with a 20 Kg load at 400 mm height. All measurements based on a nominally leveled glass flat using the specified stylus; analyzed using a Gaussian filter; 0.8 mm cut off, 300:1 bandwidth and parameter Rq.

\* Based on measurements made within 2 mm radius of a calibrated ring or plug gauge

# Technical

Column axis	300 mm column	500 mm column
Column construction	Precision machined cast iron	
Movement range	300 mm (11.8 in)	500 mm (19.7 in)
Speed of traverse - moving	0.25 - 105 mm/s (0.01 - 4.33in/s) stepped	
- measuring	0.25 - 20 mm/s (0.01 - 0.8in/s) stepped	
- contacting	0.5 - 5 mm/s (0.02 - 0.2in/s) stepped	
Positional control	+/- 5 µm (200 µin)	
Length measurement	(0.03 µm/mm + 1.5 µm)	
Minimum movement	0.005 mm	
Resolution	0.25 µm (0.98 µin)	
Data points	200,000	

Horizontal arm axis	Radial straightness unit	Motorized radial arm
Arm construction	Lapped ceramic datum	Extruded aluminum datum
Movement range	200 mm (7.9 in)	200 mm (7.9 in)
Speed of traverse - moving	0.25 - 15 mm/s (0.01 - 0.6 in/s) stepped	
- measuring	0.25 - 15 mm/s (0.01 - 0.6 in/s) stepped	N/A
- contacting	0.5 - 5 mm/s (0.02 - 0.2 in/s) stepped	
Positional control	5 µm (200 µin)	
Over-center travel	25 mm (0.98 in) in standard column position	
Resolution	0.25 µm (0.98 µin)	
Minimum movement	0.05 mm (0.002 in)	
Data points	200,000	

Spindle axis	
Spindle construction	Precision air bearing
Speed of rotation	0.3 - 10 rpm
Resolution	0.02° (optional ± 0.005°)
Positional control	± 0.2°
Number of data points (selectable)	3600 and 18,000 (optional 72,000)

Electrical (alternating supply, single phase with earth, 3-wire)	
Instrument & computer voltage	90V - 130V or 200V - 260V (switch selectable)
Frequency	47 Hz to 63 Hz
Power consumption	500 VA maximum
Safety	BS EN 61010-1
EMC	BS EN 61000-6-1 BS EN 61000-6-3

Centering and leveling table	
Construction	Patented 3 point kinematic support
Center and leveling table control	Manual
Centering range	± 5 mm (0.2 in)
Leveling range	± 0.5 °
Worktable diameter	190 mm (7.5 in)

Air supply	
Air pressure	550 to 1030 kPa (5.5 to 8 bar) (80 to 116 psi)
Regulator (pre-set)	350 kPa (3.5 bar) (50 psi)
Max. particle size	5 micron (0.0002 in)
Moisture content – dew point	-20 °C (-4 °F)
Flow rate at operating pressure	150 litres/minute (minimum) 5.3 ft³ /minute
Max oil content	25 mg/m³ (0.01 grains/ft³)
Solid particle content	5 mg/m³ (0.002 grains/ft³)

Gauge	
Gauge type	Talymir 6 single bias inductive transducer
Stylus tip force	0 to 4 g adjustable
Crutch angle	Adjustable (optional fixed)
Cresting (TR485)	Dual cresting facility (horizontal & vertical)

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)
Storage humidity	30 % to 80 % relative humidity non condensing
Operating humidity	10 % to 90 % relative humidity non condensing
Maximum RMS vertical	0.05 mm/s (0.002 in/s) at < 50 Hz
Floor vibration	0.10 mm/s (0.004 in/s) at > 50 Hz

Gauge attitude/ orientation	465H	485H
Control	Manual	Automatic
Attitude	Horizontal and Vertical	
Attitude Vertical	Internal/External	
Attitude Horizontal	Up/Down Extend/Retract	
Orientation	Rotation in steps of 30 °	Rotation in steps of 1 °

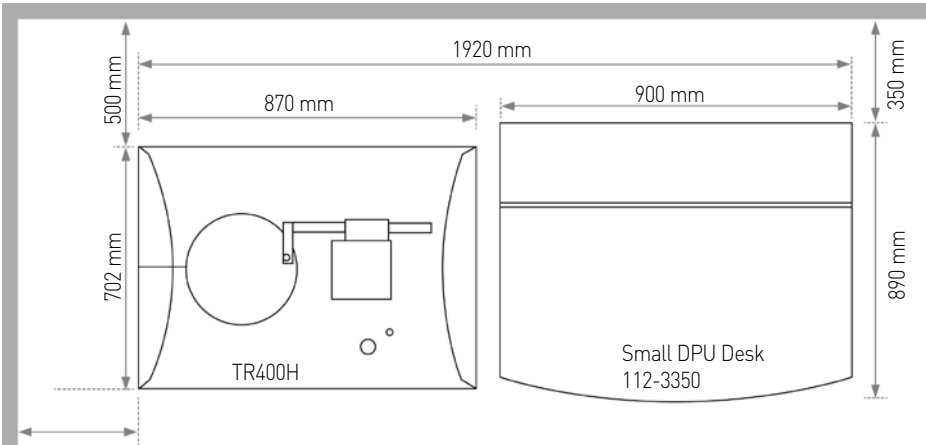
All accuracies are quoted at 20° C ± 1° C (68° F ± 1.8° F). All roundness and flatness results are quoted as the departure from the Least Squares Circle (LSC) at 1 - 50 UPR, Gaussian filter; 6 RPM, clockwise rotation (unless otherwise specified). All errors are quoted as maximum permissible errors (MPE). All straightness / parallelism results are quoted with an 8 mm cut-off, low pass filter; 5mm/s measuring speed, Minimum Zone (MZ) reference. Quoted uncertainties are at 95% confidence in accordance with recommendations in the ISO Guide to the Expression of Uncertainty in Measurement (GUM: 1993).

All measurements are taken using a standard 100 mm-length stylus with 2 mm-diameter ball tip. All measurements of roundness and flatness are quoted using the gauge horizontal orientation. All measurements of roundness are relative to the calibrated form of a glass hemisphere. Calibration error of glass hemisphere is ± 5nm.

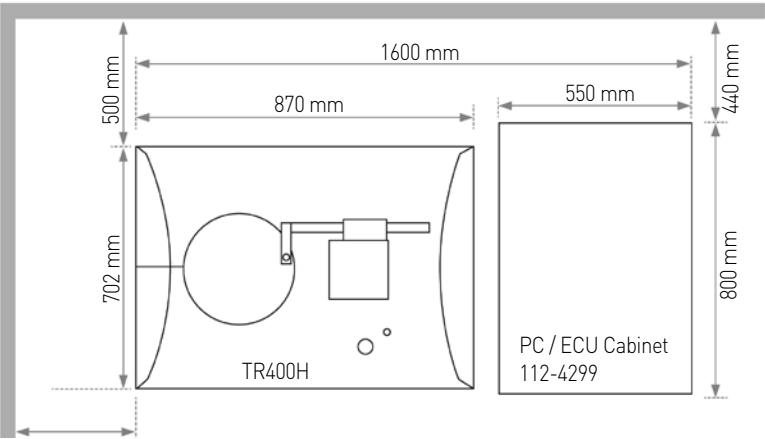
The above quoted technical data is for measurements taken with good metrology practice in a draft free, controlled environment isolated from low frequency floor borne vibration (i.e., metrology laboratory or Taylor Hobson supplied environmental enclosure).



# Talyrond 400H floor plan

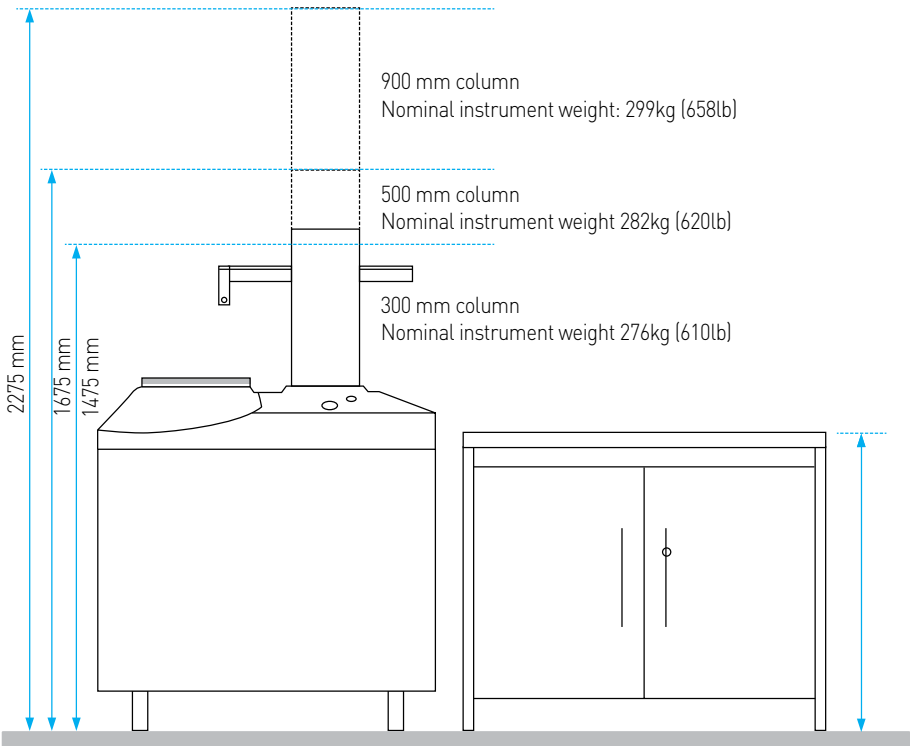


Talyrond 400H  
with desk

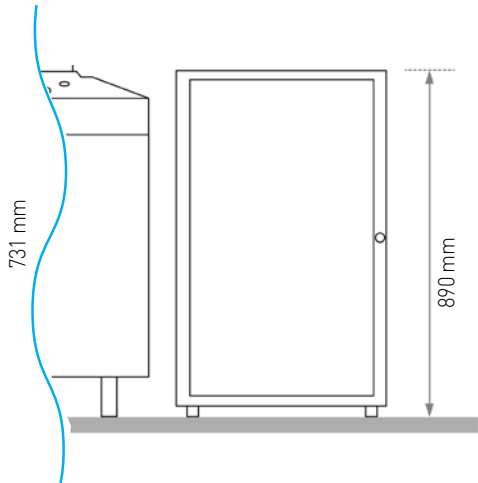


Talyrond 400H  
with cabinet

## Talyrond 400H with desk



Optional cabinet



# Parameters

Type of analysis	Measurement mode	Evaluation diagram	Talyrond 400H	Type of analysis	Measurement mode	Evaluation diagram	Talyrond 400H
Roundness			✓	Radial Runout	Axial		✓
Parallelism			✓		Radial		✓
Cylindricity			✓	Squareness		✓	
Straightness			✓	Parallelism		✓	
Flatness		✓	Measure Interrupted Surface		✓		
Coaxiality		✓	Harmonic Analysis		•		
Concentricity		✓	Thickness Variation	Radial		•	
Eccentricity		✓		Axial		•	

✓ = Included – • = Optional ✕ = Not available  
(Customer specific analysis available on request)

## 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.

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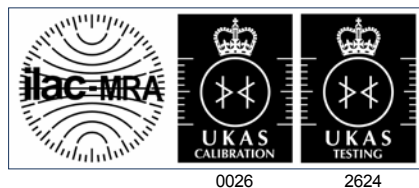
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on-site instruction will lead to greater proficiency and higher productivity
- **UKAS calibration and testing**  
certification for artifacts or instruments in our laboratory or at customer's site



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