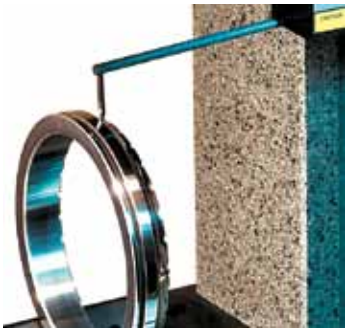
TAYLOR HOBSON®

Form Talysurf PGI Bearings Systems

Universal measurement system for high precision bearing applications



AMETEK®
ULTRA PRECISION TECHNOLOGIES

Improve your bottom line

You invest in measuring equipment to monitor production quality, optimize manufacturing processes and protect against liability. Our instruments improve every aspect of productivity to assure a favorable return on investment.

When the level of precision in your manufacturing is what sets you apart from ordinary suppliers, you need a Form Talysurf PGI to help you prove how good your components really are.

Table of contents

Time
- save more of it

Quality inspection is meticulous and time consuming. We provide multi-tasking instruments that save time, minimize errors and simplify the inspection process.

Form Talysurf PGI systems measure roughness, waviness and contour all at once on curved, flat or angled surfaces.

Money
- spend it more wisely

Value is when you get the benefits you need without paying for features you don't want.

Our patented, industry leading technology comes in several configurations to suit your exact requirements for component size, specification and accuracy.

System	Traverse	Range	Resolution
PGI 420	120mm	4mm	3.2nm
PGI 820	200mm	8mm	3.2nm
PGI 830	200mm	8mm	0.8nm
PGI 1220	200mm	12.5mm	3.2nm
PGI 1230	200mm	12.5mm	0.8nm

Performance
- we deliver dependability

You can scrutinize our industry leading specifications or simply relax and capitalize on the benefit; consistent, repeatable results day after day, year after year.

Not only have we pushed the very limits of precision, we have packaged it in robust, dependable platforms for use by casual operators in virtually any environment.

Reputation
- we are acknowledged to be the best

Our business is structured to serve manufacturers operating at the highest levels of quality and precision.

We have been the definitive name in surface metrology for more than fifty years. You will never have to justify why you purchased from Taylor Hobson.

Metrology contributes to success

As manufacturers invest in processes that better control the combined effects of geometrical shape and surface topography, the ability to measure form and surface texture simultaneously becomes increasingly important.

Form Talysurf leads the way

In 1984 we developed the first instrument ever to measure form, texture and dimension on curved surfaces. Our newest instruments continue that tradition but also address the much more difficult specialized requirements on many types of high precision bearings.

Roller bearings - barrel profile

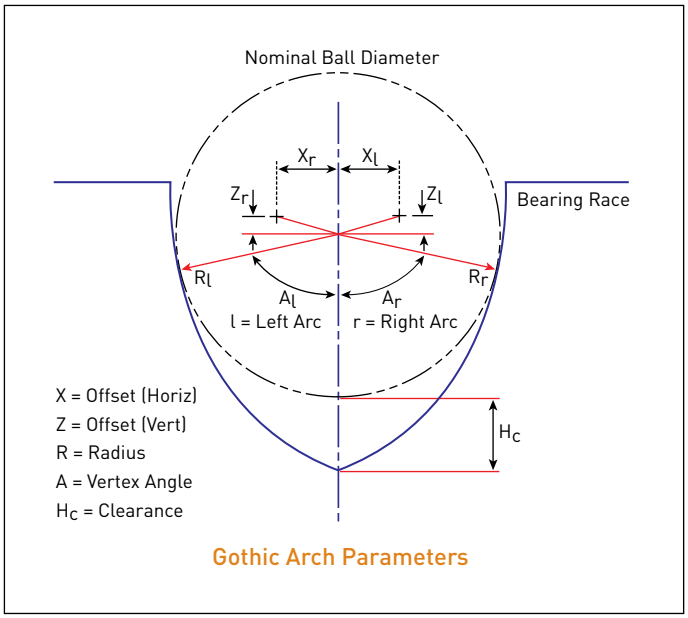
Noise and load characteristics are affected by surface finish and form. Also critical to function is the barrel shape of the tracks and rollers. We offer powerful software to calculate "barrel drop" and other important geometrical/dimensional characteristics.

Hard disc drive bearings - groove dynamics

Of particular interest on fluid dynamic bearings are grooves machined in the shaft and rotor to assist in the build up of a stable lubrication layer. Taylor Hobson has developed a unique software analysis tool to determine the shape, size and spacing of these critical features.

Ball bearings - gothic arch

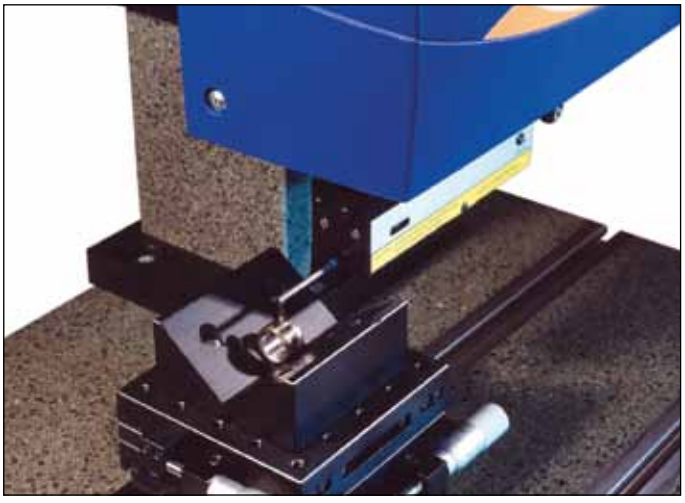
Geometrical form of the tracks and rolling elements influences the contact between them which in turn affects their load and running performance. Along with checking radius and surface finish, Form Talysurf instruments can analyze this complex design element.



gothic arch software

contacting stylus inspection methods are preferred for measuring high precision bearings

Form Talysurf PGI is available in many configurations to accomodate bearings of any size or specification



Form Talysurf PGI 420 with 4mm gauging range is ideal for small and miniature bearings

Achieving accurate bearing measurement

The three elements of a surface - dimension, form and texture - are inseparable in the function of a component. This is especially true with bearing components because complex engineered shapes are critical to performance and function.

Measure all three at once

Form Talysurf PGI instruments simultaneously measure form, dimension, and texture. This ensures that each element is evaluated as it should be, in relation to the other elements and how they work together.

Measuring technique

A contact stylus is traversed across the component. Slight undulations in the surface and the overall shape are traced by the stylus and digitized using modern electronics to provide a replica of the surface.

What is dimension?

Dimensions (radius, distance and angle) are used to define the functional shape of a surface.

The shape of surface features as well as linear relationships between the features can be assessed and compared using powerful analysis tools:

- Least squares arc (radius)
- LS or MZ line (angle)
- True X and Z co-ordinates

What is form?

Form is deviation away from the intended nominal shape of the surface; variations due to roughness and waviness are ignored. Deviations from intended shape will affect the performance and useful life of a component.

What is waviness?

Waviness, an unintended and undesired machine tool effect, is almost always present in manufactured surfaces.

Usually periodic in appearance, waviness is distinguished from roughness by exhibiting larger horizontal wavelength.

What is roughness?

Roughness is produced by the action of the cutting tool or machining process, usually resulting in process marks.

An engineered, controllable element of component design, roughness directly influences performance and useful life.

Minimizing system noise

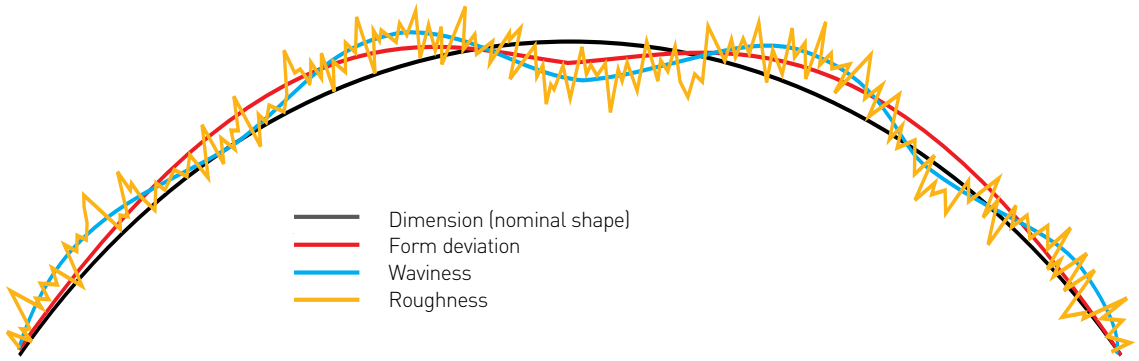
To optimize the benefit of their superior gauge resolution, all PGI systems feature innovative mechanical design and advanced positional control electronics to effectively eliminate all system noise. (Rq less than 2nm in the PGI 830 and PGI 1230 systems.)

Calibration over a sphere

The contacting stylus moves in an arcuate manner over curved surfaces. A method to linearize data collected in this way was pioneered by Taylor Hobson.

With this method a polynomial is applied to the readings from the gauge. The coefficients of the polynomial are determined by means of calibration over a ball or spherical artifact.

Patented by Taylor Hobson, this method of calibration checks all critical elements of the system including, linearity, stylus tip geometry, traverse datum and data logging, gauge stiffness, and processor functions.



The elements of a surface are inseparable in the function of a component (not drawn to scale)

Gauge linearity

Gauge linearity concerns the relationship between stylus tip movement (input) and response in the gauge head electronics (output), throughout the total measuring range. Factors that affect gauge linearity include electronic gain and arcuate motion of the gauge arm.

With all Form Talysurf systems, the entire gauge range is tested as the stylus is traversed over a precision spherical artifact.

Linearity of data collected during the measurement process is assured, regardless of where the measurement is taken within the gauge range or the amplitude of the surface under test.

Stylus tip geometry

With many surface measuring systems, the condition, size, and shape of the stylus tip are assumed to be constant in terms of data processing.

In actual practice the stylus tip may vary due to manufacturing tolerance, physical damage or routine wear.

With Form Talysurf the stylus is traversed over the spherical artifact, making contact at all points along the radius of the tip, to detect effects caused by wear, damage or deviations of size and shape.

Traverse datum unit

Imperative to the measurement of form is the integrity of the reference datum to which the measured surface is compared.

Either of two units, 120mm or 200mm traverse length, can be provided depending on the PGI system that you purchase.

A non-influencing belt drive is used to minimize cyclic errors and exceptionally low system noise maximizes the benefit of PGI's gauge resolution.

Horizontal data logging

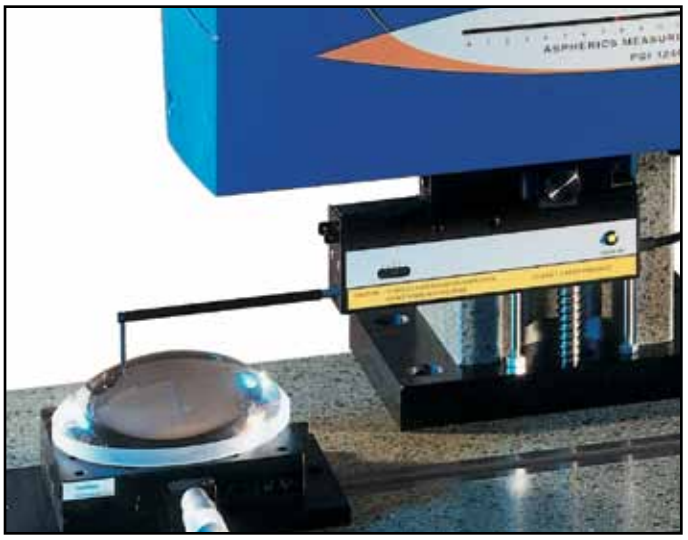
All PGI units feature horizontal data logging via linear scale and reading head. Data spacing is 0.125µm over the entire traverse length (1,600,000 points over 200mm) which assures high resolution and repeatability.

Precision datum bar

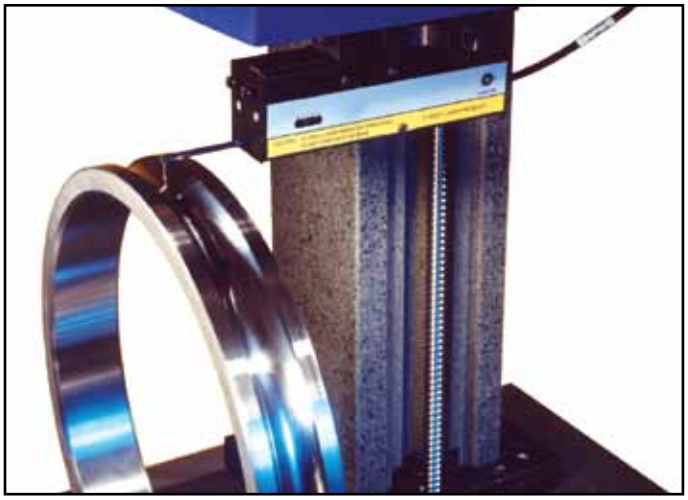
The datum bar is made of tool steel that has been subjected to a proprietary heat treatment to ensure optimum stability. Both the carriage and datum bar use low friction bearings machined in place for optimum flatness and squareness.

Extraordinary straightness

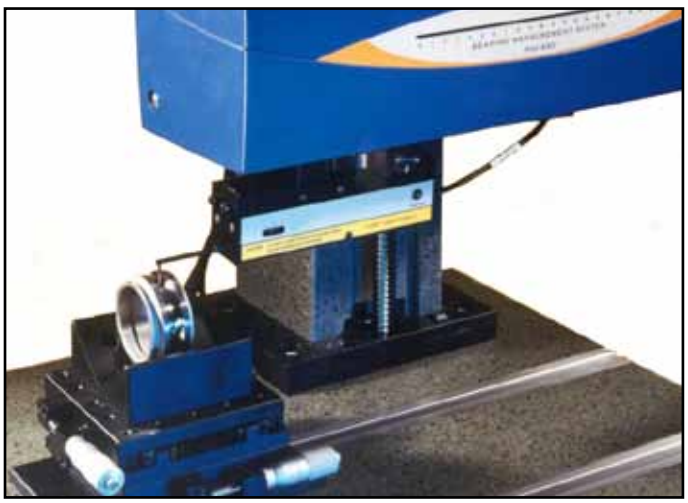
The end result is extraordinary straightness deviation of just 0.125µm over the entire 200mm traverse in the Form Talysurf PGI 1230 system.



calibration over a spherical artifact checks gauge linearity, stylus condition and processor functions



measure dimension, form and texture at once with a single traverse over curved surfaces



measureable form features may be aspherical, spherical, concave, convex, internal or external

Choosing the right system

The new Form Talysurf PGI Bearing Measurement systems are offered in a variety of configurations to suit your particular requirements for performance, workpiece capacity and price.

Form Talysurf PGI 420 - medium capacity

With 4mm of gauge range and 120mm traverse unit, this system is ideal for miniature to medium sized bearing components. System performance is compatible with standard duty and precision duty bearings.

Form Talysurf PGI 820 and 830 - large capacity

Both sytems offer 8mm gauging range, 450mm column and 200mm traverse unit which makes either a good choice for medium to large sized components. PGI 820 is a cost effective system for standard duty or precision duty bearings.

PGI 830, with 0.8nm gauge resolution, improved straightness accuracy and reduced system noise, is the correct choice if your product specification ranges from precision to high precision bearings. It includes an isolation cabinet to minimize the effects of environmental influences.

Form Talysurf PGI 1220 - extra large capacity

With 12.5mm of gauge range and 700mm column, this system is ideal for large to extra large bearing components. It is also extremely cost effective for manufacturers of standard duty, heavy duty and precision duty bearings.

Form Talysurf PGI 1230 shown with environmental enclosure and surround desk

Form Talysurf PGI 1230
- specially configured for Super Precision bearings of all sizes

Intended for the most demanding applications, this high performance system has 200mm traverse with just 0.125µm straightness uncertainty, 450mm column and 12.5mm gauge range with 0.8nm resolution. It includes an environmental isolation chamber to minimize the affects of temperature, air movement and contamination.

Form Talysurf PGI - Selection Table

Product code	Gauge range	Gauge resolution	Horizontal traverse	Horizontal straightness	Vertical traverse	System noise	Isolation cabinet
PGI 420	4mm	3.2nm	120mm	0.35µm over 120mm	450mm	5nm	Optional
PGI 820	8mm	3.2nm	200mm	0.35µm over 200mm	450mm	3nm	Optional
PGI 830	8mm	0.8nm	200mm	0.35µm over 200mm	450mm	2nm	Standard
PGI 1220	12.5mm	3.2nm	200mm	0.35µm over 200mm	700mm	3nm	Optional
PGI 1230	12.5mm	0.8nm	200mm	0.125µm over 200mm	450mm	2nm	Standard

Standard system configurations. All systems include industrial PC, color printer and Form Talysurf computer desk.

Measuring stations for all systems

Composite granite construction

Both the column and the base are made of this unique material to provide high vibration dampening, thermal inertia and stiffness throughout the measuring loop.

Large base

This massive base isolates the instrument from vibration and offers plenty of room for staging large components. Two tee slots, parallel to each other within 0.3mm (0.01in), are provided for precise mounting of accessories.

Motorized, programmable column

The column has fully motorized vertical and tilting movements for programmability and total automation.

- Absolute positional control - servo controlled motor drive and encoder for up/down movements is programmable for batch inspection. Maximum positioning speed is 10mm/second (0.4in/second)
- Tilt control (+/- 9° range) - allows the traverse unit to be automatically adjusted parallel to inclined surfaces
- "Stop on contact" - automatically advances the stylus to the workpiece and stops on contact centered in the middle of the gauge range

Steel support frame

Welded steel frame for rigid support of granite instrument base and motorized column; includes heavy duty leveling mechanism on all four legs.

Anti-Vibration system

Set of (4) pneumatic isolation pads for use with the steel support frame to reduce measurement noise in shop environments.

Environmental enclosure
Code 112/3325

Clear polycarbonate panels set in a rigid aluminium frame completely surround the measuring station to suppress contamination, air currents and temperature fluctuations.

Sliding panels in the front and rear of the enclosure provide access for loading components.
(standard with PGI 830 and PGI 1230 systems)

motorized column and base shown with steel support frame
(traverse unit is shown inclined via motorized tilting function)

Benchmark for the industry

Since the first Talysurf was introduced in 1941, a Taylor Hobson instrument has always been the benchmark for the surface finish industry. The tradition continues with Form Talysurf PGI Bearing Measurement Systems.

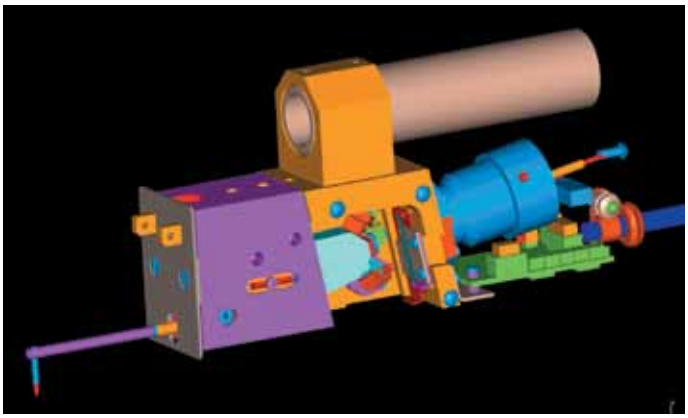
Phase Grating Interferometer (PGI)

Phase Grating Interferometry via a cylindrical grating is superior in every way to linear displacement gauges, making possible the accurate measurement of surface finish, form, radius and contour in a single traverse.

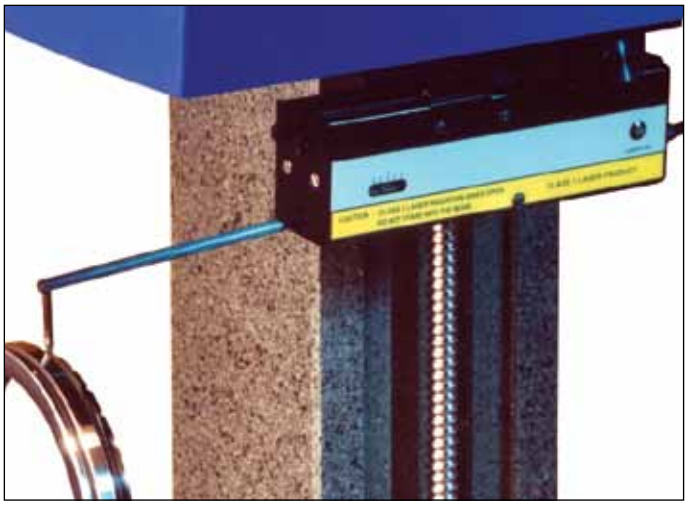
This edition of the PGI gauge is completely new with state-of-the-art optical and mechanical components that deliver both high performance and robust operation.

And now, for the first time, PGI technology is available with different gauge ranges and resolutions to serve an entire industry with systems configured to suit every application and every budget.

- Output is proportional only to rotation angle of arm - independent of laser frequency
- Stylus force change is less than 5%
- Gauge range is easily increased with double length stylus arms (note, resolution will also be doubled)
- Improved stylus arm mounting design offers easy interchangeability along with absolute rigidity



CAD rendering of PGI gauge mechanism

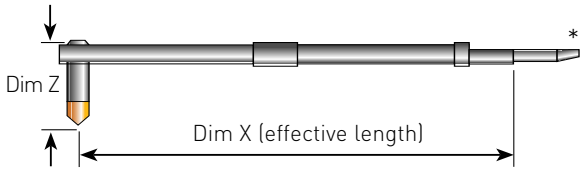


PGI gauge in robust, protective housing

Stylus arms available for PGI Bearing systems

ID No.	Description	Dim X	Dim Z	Tip angle	Tip radius
112/3221	Standard 60	8.3	90°	2µm	
112/3227	Standard fine	60	8.3	60°	2µm
112/3412	Standard very fine	60	8.3	40°	2µm
112/3454	Standard ultra fine	60	8.3	40°	1µm
112/3229	Standard coarse	60	8.3	90°	5µm
112/3222	Small bore60	1.9	90°	2µm	
112/3223	Miniature bore	60	1.2	90°	2µm
112/3224	Recess / groove	60	14.7	90°	5µm
112/3225	Right angle front facing	60	10	90°	5µm
112/3226	Right angle rear facing	60	10	90°	5µm
112/3228	Ball contact (sapphire)	60	16.5	n/a	0.5mm
112/3161	Ball contact (sapphire)	120	27.8	n/a	1mm
112/3162	Ball contact (sapphire)	150	32.5	n/a	1mm
112/3230	Extension tube				
112/3218	Stylus stop attachment				

Typical stylus configuration



* Improved spigot design provides easy interchangeability along with rigid mounting for overall stiffness and measurement repeatability

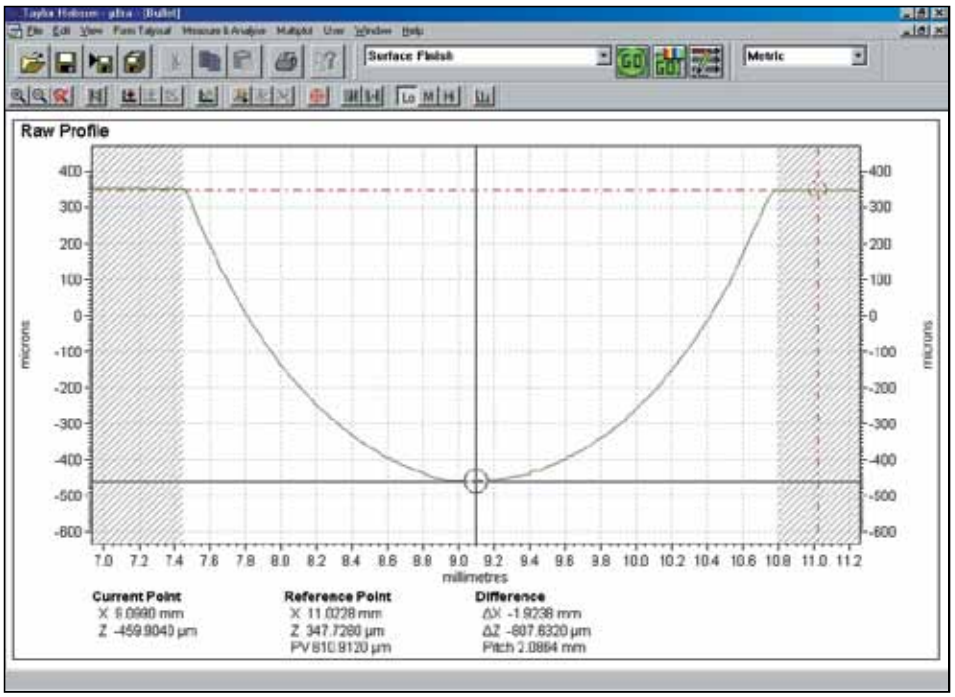
Note:
All stylus arms have conisphere diamond tip unless otherwise stated. The stylus arms shown on these pages represent just some of the standard configurations available. In addition, Taylor Hobson can provide customized stylus arms for specific applications.

µltra software

µltra software with Form Analysis was expressly developed for the bearing industry and is recommended whenever a component has features that are curved, inclined or otherwise deviating from a straight line.

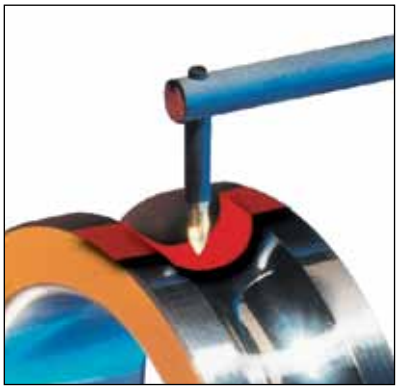
This industry leading software takes control of all mechanical, administrative, analysis and display functions and is network ready for central data storage and output to network printers.

In this example, the exclusion tool is used to isolate the critical area of a bearing race. Next, the radius and, significantly, deviation from true radius will be analyzed via removal of the LS Arc. After removal of the LS Arc, conventional filters can be applied to determine roughness, waviness, material ratio and more than 95 different surface finish parameters.



zoom section of radius

detail of radius shown in zoom section



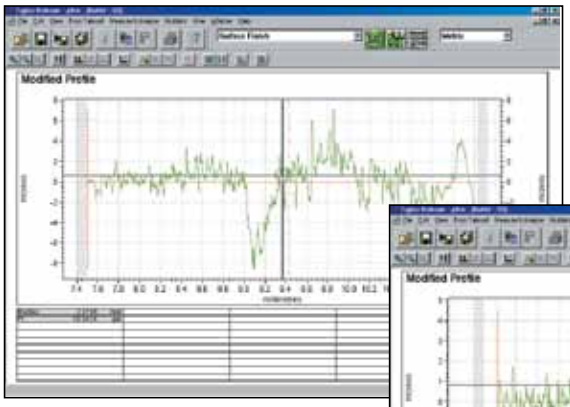


Figure 1

In figure 1 errors of form along the radius are shown clearly. A perfect sphere would appear as a straight line and the total profile height (Pt value) would approach zero.

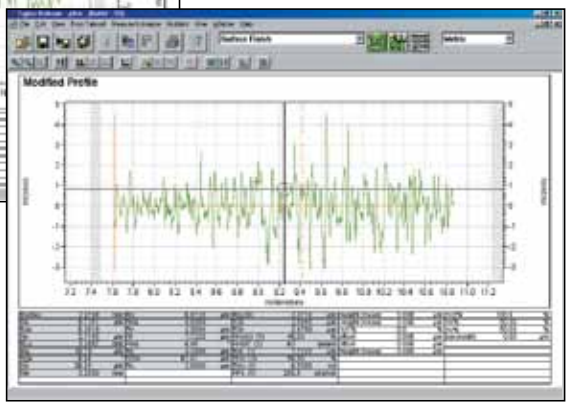


Figure 2

In figure 2 the roughness along the radius is displayed at high vertical magnification. Typical roughness parameters have been calculated using conventional filters.

Form Talysurf PGI standard software

Form error: deviation from the nominal is calculated with reference to a best fit concave or convex circular arc or straight line; surface roughness detail is included. An alternative is with reference to a minimum zone (the minimum separation between two parallel lines containing the data set).

Radius: using a least squares best fit, the radius of concave or convex circular arcs can be automatically calculated from selected data. The option to exclude any unwanted surface features such as edges is also available. Alternatively, the absolute radius can be set to analyse the actual deviation from a design master. Other calculated parameters include the center coordinate and pitch.

Angle (slope): using a straight line or minimum zone algorithm, surface tilt can be determined and removed prior to parameter analysis. Other calculated values include intercept and pitch.

Dimension: X and Z coordinate positions can be calculated and linear relationships of surface features can be assessed and compared.

Datum slope
Delta slope
Intercept X / Intercept Z
Slope

Filters: Gauss, ISO 2CR

Cut-offs: 0.08, 0.25, 0.8, 2.5 and 8mm as well as user designated cut-offs

Bandwidth: 300:1, 100:1 and user defined

Pass / Fail tolerances: All parameters can be assigned nominal, minimum and maximum values.

*** Qualifiers:** All parameters marked with an asterisk are suitable for user assigned single or multiple qualifiers. For example, material ratio (mr) may be assessed at one or more slice levels within a single measurement.

Note: Where applicable, the above parameters conform to and are named as per ISO standards, 4287-1997, 13565-1-2 and 12085.

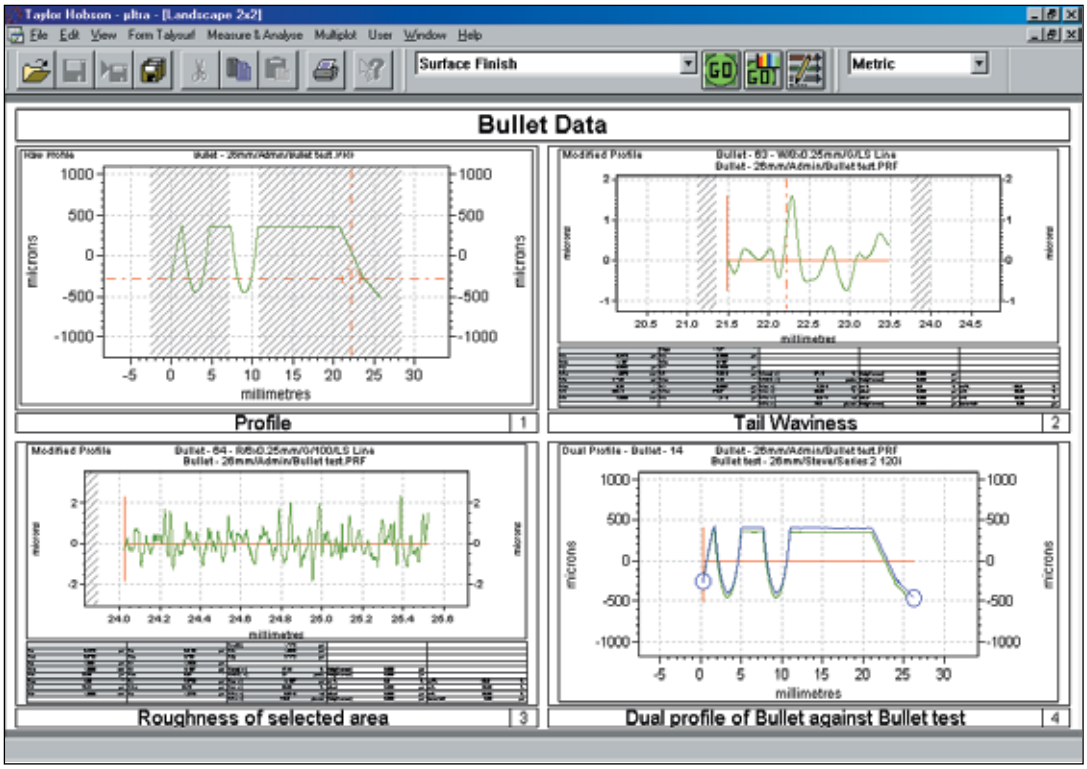
Primary parameters: Pa, Pc, Pda, Pdc*, Pdq, PHSC*, Pku, Pln, Plo, Plq, Pmr(c)*, Pmr*, Pp, PPc*, Pq, PS, Psk, Psm, Pt, Pv, Pvo*, Pz, Pz(JIS)

Roughness parameters: R3y, R3z, Ra, Rc, Rda, Rdc*, Rdq, RHSC*, Rku, Rln, Rlo, Rlq, Rmr(c)*, Rmr*, Rp, Rp1max, Rpc*, Rq, RS, Rsk, RSm, Rt, Rv, Rvo*, Rv1max, Rz, Rz(DIN), Rz(JIS), Rz1max

Waviness parameters: Wa, Wc, Wda, Wdc*, Wdq, WHSC*, Wku, Wln, Wlo, Wlq, Wmr(c)*, Wmr*, Wp, WPc*, Wq, WS, Wsk, Wsm, Wt, Wv, Wvo*, Wz

Rk Parameters: A1, A2, Mr1, Mr2, Rk, Rpk, Rvk

R + W Parameters: AR, AW, Pt, R, Rke, Rpke, Rvke, Rx, Sar, Saw, Sr, Sw, W, Wte, Wx



µltra software is comprehensive and flexible (user customized layout shown)

Software options

Contour Analysis code 112/3170

Provides dimensional analysis of geometric features such as radii, angles, length and height. Includes user programmed measurement macros, individual feature tolerancing, comparison of DXF files to contour and fitting of geometric elements to unknown contour.

Dual Profile code 112/2846

Enables two sets of measurement data to be displayed at once with one set being used as the datum against which the other set is tested. Comparison can be of one measured profile to another or to a master profile which has been saved as a template. A "difference" profile can be displayed at the touch of a button and used for further analysis.

Gothic Arch Analysis code 112/3121

Of particular benefit to bearing producers, the Gothic Arch tool electronically fits the nominal bearing diameter into the raceway profile and the parameters (radius, radius offset, vertex angle and ball clearance) are automatically calculated for on-screen display or color printout.

3D Topography Measurement

Additional hardware and software make the third dimension of surface metrology easily accessible for Form Talysurf systems.

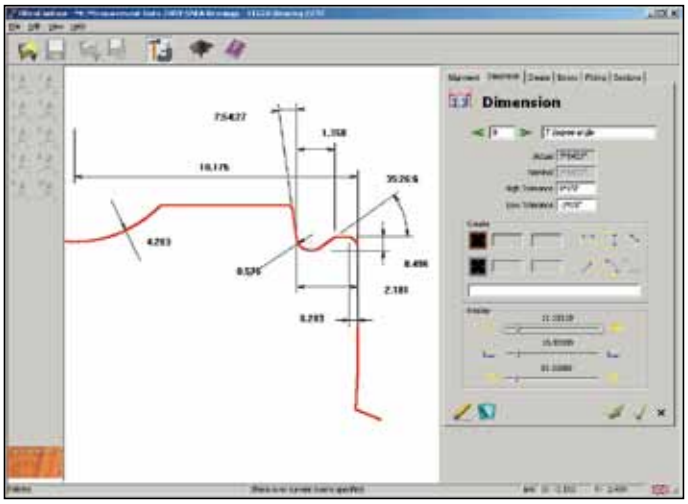
Data for 3D analysis is collected by data logging a number of parallel profiles at pre-determined spacing using the Y-Axis translation stage.

Talymap 3D Topography Software

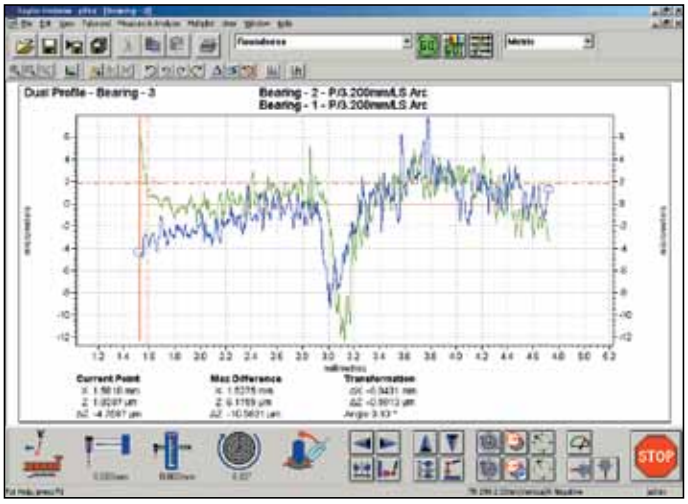
Expert code B112/2819
Universal code B112/2820.

Y-Axis Translation Stage code 112/3178

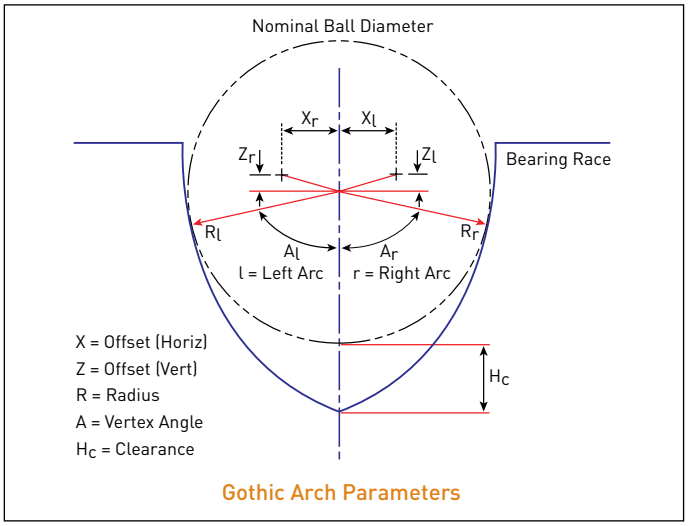
The motor driven Y-axis stage ensures accurate and repeatable spacing for data logging parallel profiles of a component. Total travel is 100mm (3.94in) with 1µm (40µin) step resolution. Mounting of the stage is via tee slots in the Form Talysurf granite base.



contour analysis software (detail of bearing seal profile)



dual profile software (detail of track profile at two locations)



gothic arch software

Accessories

All the accessories you need to begin using Form Talysurf Series 2 are supplied as standard. However, for more demanding measuring requirements, we have a range of accessories which may be ordered separately.

1 Universal Worktable - code 112/3064
Complete stage assembly to provide X, Y, Z, rotary and tilting positioning moves. Includes vee block and location plate for mounting to the tee slot in the granite base.

Stage & Vee Plate Assembly - code 112/3067
Simple stage assembly with Y axis positioning, vee block and location plate for mounting in the granite base.

Stage Assembly - code 112/3163 **standard**
For Y axis positioning, includes mounting plate for fixing to the granite base.
(photo on page 5)

2 Ball Joint Vise - code 112/2685
Provides universal positioning via 360º rotation and 180º tilt; especially for lightweight or small components.

3 Adjustable Worktable - code 112/1644
Provides fine adjustment for rotational [+/- 3º] and lateral [+/-10mm (0.4in)] positioning of the workpiece. Work surface with T-slot = 120mm x 120mm (4.7in x 4.7in).

Stylus Stop Attachment - code 112/3218
For use with PGI systems when measuring components with holes or grooves. This restricts gauge range movement and prevents styli damage.

4 Adjustable Vee Block - code 112/1326
Lateral adjustment of 40mm (1.5in) assists in bringing the crest of a cylindrical workpiece directly under the stylus. Length = 90mm (3.5in)

Vee Blocks (Pair) - code 112/1645
For the positioning and support of large, cylindrical components.

Leveling Stage - code 112/3159
Provides 3º tilting adjustment to bring workpiece parallel with the traverse unit. Work surface 150mm length x 75mm width (5.9in x 2.95in).

Y Axis Table - code 112/3163
Precision Y axis stage with 25mm (1.0") travel and a load capacity of 30kg (66lbs). The platform area is 120 x 120mm (4.7 x 4.7") with mounting holes for component fixturing.

5 Y-Axis Translation Stage - code 112/3178
Motorized Y stage with 100mm (3.9") travel and weight capacity of 20Kgs (44lbs). Minimum data spacing is 1µm (40µ") with slide straightness of 0.75µm (30µ") over 100mm (3.9").

Motorized Rotary Stage - code 112/3483
Motorized rotary stage for the rotation of components through 360º. Weight capacity is 10kgs (22lbs) with rotational speed of 80 rpm.

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

❼ **Storage Unit - code** 112/3142
820 wide x 625 deep x 640mm high (32.3 x 24.6 x 25.2"). With lockable doors, designed to fit under the small computer desk. Mounted on castors for easy installation.

❽ **Small Computer Desk - code** 112/3350
900 wide x 850 deep x 750mm high (35.5 x 33.5 x 29.5"). A small drawer is provided for secure storage of tools, styli, etc.

❽ **Swivel Arm Platform - code** 112/3182
For mounting and positioning the monitor and keyboard.

Steel Support Frame - code 112/3101
750 wide x 500 deep x 800mm high (29.5 x 19.7 x 31.5"). Welded steel frame for rigid support of the granite base and motorized column. (Photo on page 7)

Surround Desk - code 112/3323
900 wide x 850 deep x 750mm high (35.4 x 33.5 x 29.5"). Used with the steel support frame to provide additional work area isolated from the granite base. (Photo on page 6)

Anti-Vibration System - code 112/3110
Pneumatic isolation pads (set of 4) used with the steel support frame to reduce measurement noise in shop environments.
(Photo on page 7)

❾ **Video Magnifier - code** 112/3167
Color vision system with up to 75X magnification; integrates fully with µltra software to aid in the inspection of small features or components. Includes optics, CCD camera, magnetic base, transformer, and software.

❿ **Ra and 3 Line Standard - code** 112/557
An Ra verification patch with step height standard can be supplied with a Form Talysurf for supplemental verification of surface roughness parameters.

⓫ **Radius Calibration Standard**
For systems using form software, spherical calibration artifacts are a requirement.

80mm (3.15in) Radius - code 112/2028
A glass spherical artifact for 200mm systems.

22mm (0.86in) Radius - code 112/1844 **standard**
A mounted precision ball for 120mm systems (pictured)

Zerodur Optical Flat - code 112/3220
A precision optical glass flat 220 long x 50 wide x 75mm thick (8.7 x 2 x 3"). It offers a flatness of λ / 10 and is ideal for straightness and system noise verification.

Specification

Horizontal Performance	PGI 420	PGI 820	PGI 830 *
Traverse length - X Max / Min	120mm / 0.1mm (4.7in / 0.004in)	200mm / 0.1mm (7.9in / 0.004in)	
Traverse speeds – Measuring speeds nominal [1]	10mm/s max – 0.1mm/s, 0.25mm/s, 0.5mm/s & 1mm/s (0.39in/s max – 0.004in/s, 0.01in/s, 0.02in/s & 0.04in/s)		
Data sampling interval in X **Maximum number of data points**	0.125µm (5µin) 960,000	0.125µm (5µin) 1,600,000	
Straightness uncertainty (Pt) [2]	0.35µm over 120mm (14µin over 4.7in)	0.35µm over 200mm (14µin over 7.9in)	
Datum correction	Optional		
Vertical Performance	**PGI 420**	**PGI 820**	**PGI 830**
Nominal measuring range (Z)	4mm [60mm stylus arm] (0.16in [2.36in])	8mm [60mm stylus arm] (0.32in [2.36in])	8mm [60mm stylus arm] (0.32in [2.36in])
Resolution (Z) [3]	3.2nm @ 4mm range (0.12µin @ 0.16in)	3.2nm @ 8mm range (0.12µin @ 0.32in)	0.8nm@ 8mm range (0.03µin @ 0.32in)
Range to resolution ratio	1,250,000 : 1	2,500,000 : 1	10,000,000 : 1
Stylus arm length, tip size, force	60mm arm, 2µm radius conisphere diamond stylus, 1mN force 120mm arm, 0.5mm radius ball, 20mN force		
Z axis non-linearity, (Z = gauge displacement)	(0.07 + 0.03 Z [mm]) µm (3 + 30 Z [inches]) µin - after calibration [4]		
Repeatability of Z axis indication [3] (Surface may be curved or flat)	Dependent upon user environment - contact sales agent for additional details		Flat - 0.03µm (1.2µin) [5] Curved - 0.08µm (3µin) [6]
System Performance	**PGI 420**	**PGI 820**	**PGI 830**
Standard spherical calibration artifact, [calibrated radius uncertainty]	22mm (0.87in) nominal radius [0.4µm (15.7µin)]	80mm (3.15in) nominal radius glass standard 5µm (197µin)	
Calibration Pt [7]	0.15µm [60mm stylus arm] (6µin [2.36in]) 0.3µm [120mm stylus arm] (12µin [4.72in])		
System noise - Rq [8]	5nm (0.2µin)	3nm (0.12µin)	2nm (0.08µin)
Radius measurement uncertainty [9]	0.1mm - 80mm (0.004in - 3.15in) = 1% - 0.005% of nominal 80mm - 1000mm (3.15in - 39.4in) = 0.005 - 0.1% of nominal 1000mm - 2000mm (39.4in - 78.7in) = 0.1% of nominal		
Inclination measurement uncertainty	0.5 arc minute uncertainty (+/- 35º maximum range)		
Motorized vertical column	450mm (17.7in) vertical traverse length		
Motorized tilting of traverse unit	+/- 9º from horizontal		
Dimensions L x D x H (granite base)	760 x 500 x 120mm (30 x 20 x 4.7in)		
Dimensions L x D x H (traverse unit)	410 x 130 x 225mm (16 x 5.2 x 8.9in)	470 x 130 x 225mm (18.5 x 5.2 x 8.9n)	
Weight (traverse unit)	13.5Kg (30lbs)	15Kg (33lbs)	

Environment		Electrical supply	
Storage temperature Storage humidity	5ºC to 40ºC (41ºF to 104ºF) 10% to 80% Relative, non condensing.	Supply type	Alternating supply, singlephase with earth (3-wire system)
Operating temperature: Operating humidity:	18ºC to 22ºC (64ºF to 72ºF) 45% to 75% Relative, non condensing.	Instrument and computer voltage	90V - 130V or 200V-260V (switch selectable)
Temperature gradient	<2ºC (<3.60F) per hour	Frequency	47Hz to 63Hz
Maximum RMS floor vibration	3um/s (120uin/s) at <50Hz 6um/s (240uin/s) at >50Hz	Supply voltage transients - width	Not less than 2µs and not greater than 20µs
Safety EMC	EN 61010 - 1 : 2001 EN 61000 - 6 - 4 : 2001, EN 61000 - 6 - 1 : 2001	Power consumption	500VA

Horizontal Performance	PGI 1220	PGI 1230 *
Traverse length - X Max / Min	200mm / 0.1mm (7.9in / 0.004in)	
Traverse speeds – Measuring speeds nominal [1]	10mm/s max – 0.1mm/s, 0.25mm/s, 0.5mm/s & 1mm/s (0.39in/s max – 0.004in/s, 0.01in/s, 0.02in/s & 0.04in/s)	
Data sampling interval in X **Maximum number of data points**	0.125µm (5µin) 1,600,000	
Straightness uncertainty (Pt) [2]	0.35µm over 200mm (14µin over 7.9in)	0.125µm over 200mm (5µin over 7.9in)
Datum correction	Optional	Standard
Vertical Performance	**PGI 1220**	**PGI 1230**
Nominal measuring range (Z)	12.5mm [60mm stylus arm] (0.49in [2.36in])	
Resolution (Z) [3]	3.2nm @ 12.5mm range (0.12µin @ 0.49in)	0.8nm @ 12.5mm range (0.03µin @ 0.49in)
Range to resolution ratio	3,906,250 : 1	15,625,000 : 1
Stylus arm length, tip size, force	60mm arm, 2µm radius conisphere diamond stylus, 1mN force 120mm arm, 0.5mm radius ball, 20mN force	
Z axis non-linearity, (Z = gauge displacement)	(0.07 + 0.03 Z [mm]) µm (3 + 30 Z [inches]) µin - after calibration [4]	
Repeatability of Z axis indication (Surface may be curved or flat)	Dependent upon user environment - contact sales agent for additional details	Flat - 0.03um (1.2µin) [5] Curved - 0.08µm (3µin) [6]
System Performance	**PGI 1220**	**PGI 1230**
Standard spherical calibration artifact, [calibrated radius uncertainty]	80mm (3.15in) nominal radius glass standard 5µm (197µin)	
Calibration Pt [7]	0.2µm (60mm stylus arm) (8µin [2.36in]) 0.4µm (120mm stylus arm) (16µin [4.72in])	
System noise - Rq [8]	3nm (0.12µin)	2nm (0.08µin)
Radius measurement uncertainty [9]	0.1mm - 80mm (0.004in - 3.15in) = 1% to 0.005% of nominal 80mm - 1000mm (3.15in - 39.4in) = 0.005 to 0.1% of nominal 1000mm - 2000mm (39.4in - 78.7in) = 0.1% of nominal	
Inclination measurement uncertainty	0.5 arc minute uncertainty (+ / - 35º maximum range)	
Motorized vertical column	700mm (27.6in) vertical traverse length	450mm (17.7in) vertical traverse length
Motorized tilting of traverse unit	+/- 9º from horizontal	
Dimensions L x D x H (granite base)	760 x 500 x 120mm (30 x 20 x 4.7in)	
Dimensions L x D x H (traverse unit)	470 x 130 x 225mm (18.5 x 5.2 x 8.9in)	
Weight (traverse unit)	15Kg (33lbs)	

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

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

Note:
Taylor Hobson pursues a policy of continual improvement due to technical developments. We therefore reserve the right to deviate from catalog specifications.

1 Traverse speeds of 0.5mm/s (0.02in/s) and less are recommended for surface texture measurements.

2 Using a 60mm arm with a diamond stylus measured over a glass flat nominally parallel to the traverse datum and analysis using a primary filter of λs = 2.5mm.

3 Using a 60mm arm with a diamond stylus.

4 Measurements up and down a 35º angled slope over 80% of the gauge range, using a 60mm arm with a diamond stylus.

5 Repeated measurements over a glass flat that is nominally parallel to the datum, 10mm traverse length, analysis using a Primary filter of λs=0.025mm.

6 Repeated measurements over an 80mm radius glass standard, analysis using a Primary filter λs=0.25mm.

7 Analysis using a primary filter λs=0.25mm.

8 Using a 60mm arm with a diamond stylus, measured over a glass flat nominally parallel to the datum and analysis using a Gaussian roughness filter, 0.08mm cut off and 30:1 bandwidth.

9 Assumes a calibration artifact of perfect radius.

*** Form Talysurf PGI 830 and PGI 1230 systems are furnished with an envirnmental chamber; refer to pages 6 and 7 for additional information.**

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

- **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

For the above services, contact our Center of Excellence:
email: taylor-hobson.cofe@ametek.com
or call: +44 116 276 3779

- **Design engineering**
  special purpose, dedicated metrology systems for demanding applications
- **Precision manufacturing**
  contract machining services for high precision applications and industries
- **Preventative maintenance**
  protect your metrology investment with a Talycare service cover plan

For the above services, contact our Sales Department:
email: taylor-hobson.sales@ametek.com
or call: +44 116 246 2034

UKAS CALIBRATION No. 0026

UKAS TESTING 2624

UL REGISTERED FIRM UKAS QUALITY MANAGEMENT 062
TAYLOR HOBSON A8248 ISO9001

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

Taylor Hobson China Shanghai Office
Part A, 1st Floor, No. 460 North Fute Road
Waigaoqiao Free Trade Zone, Shanghai, 200131, China
Tel: +86 21 5868 5111-110 Fax: +86 21 5866 0969-110
taylor-hobson.shanghai@ametek.com

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

AMETEK® ULTRA PRECISION TECHNOLOGIES