Form Talysurf PGI
Bearings Systems

Universal measurement system for high precision bearing applications
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.

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 Specifications

<table>
<thead>
<tr>
<th>System</th>
<th>Traverse</th>
<th>Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGI 420</td>
<td>120mm</td>
<td>4mm</td>
<td>3.2nm</td>
</tr>
<tr>
<td>PGI 820</td>
<td>200mm</td>
<td>8mm</td>
<td>3.2nm</td>
</tr>
<tr>
<td>PGI 830</td>
<td>200mm</td>
<td>8mm</td>
<td>0.8nm</td>
</tr>
<tr>
<td>PGI 1220</td>
<td>200mm</td>
<td>12.5mm</td>
<td>3.2nm</td>
</tr>
<tr>
<td>PGI 1230</td>
<td>200mm</td>
<td>12.5mm</td>
<td>0.8nm</td>
</tr>
</tbody>
</table>

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.
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.
**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.
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 systems 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 - 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 effects of temperature, air movement and contamination.

Form Talysurf PGI - Selection Table

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

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)
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

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

CAD rendering of PGI gauge mechanism

PGI gauge in robust, protective housing

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.
**ultra software**

ultra 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.

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.

In figure 2 the roughness along the radius is displayed at high vertical magnification. Typical roughness parameters have been calculated using conventional filters.
**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, PPe*, Pq, PS, Psk, Psm, Pt, Pv, Pvo*, Pz, Pz[JIS]

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


**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

Ultra 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.
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 stylus 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.
6 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.

7 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.

8 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.

8 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)

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

10 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.

11 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**

<table>
<thead>
<tr>
<th></th>
<th>PGI 420</th>
<th>PGI 820</th>
<th>PGI 830 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traverse length - X Max / Min</td>
<td>120mm / 0.1mm (4.7in / 0.004in)</td>
<td>200mm / 0.1mm (7.9in / 0.004in)</td>
<td></td>
</tr>
<tr>
<td>Traverse speeds — Measuring speeds nominal 1</td>
<td>10mm/s max – 0.1mm/s, 0.25mm/s &amp; 1mm/s (0.39in/s max – 0.004in/s, 0.01in/s &amp; 0.04in/s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data sampling interval in X</td>
<td>0.125µm (5µin)</td>
<td>0.125µm (5µin)</td>
<td>0.125µm (5µin)</td>
</tr>
<tr>
<td>Maximum number of data points</td>
<td>760,000</td>
<td>1,600,000</td>
<td></td>
</tr>
<tr>
<td>Straightness uncertainty (Pt)2</td>
<td>0.35µm over 120mm (14µm over 4.7in)</td>
<td>0.35µm over 200mm (14µm over 7.9in)</td>
<td></td>
</tr>
<tr>
<td>Datum correction</td>
<td>Optional</td>
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</tbody>
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**Vertical Performance**

<table>
<thead>
<tr>
<th></th>
<th>PGI 420</th>
<th>PGI 820</th>
<th>PGI 830</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal measuring range (Z)</td>
<td>4mm [60mm stylus arm] (0.16in [2.36in])</td>
<td>8mm [60mm stylus arm] (0.32in [2.36in])</td>
<td>8mm [60mm stylus arm] (0.32in [2.36in])</td>
</tr>
<tr>
<td>Resolution [Z]3</td>
<td>3.2µm @ 4mm range (0.12µin @ 0.16in)</td>
<td>3.2µm @ 8mm range (0.12µin @ 0.32in)</td>
<td>0.8mm @ 8mm range (0.32µin @ 0.32in)</td>
</tr>
<tr>
<td>Range to resolution ratio</td>
<td>1,250,000 : 1</td>
<td>2,500,000 : 1</td>
<td>10,000,000 : 1</td>
</tr>
<tr>
<td>Stylus arm length, tip size, force</td>
<td>60mm arm, 2µm radius conisphere diamond stylus, 1mN force 120mm arm, 0.5mm radius ball, 20mN force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z axis non-linearity, (Z = gauge displacement)</td>
<td>(0.07 + 0.03 Z [mm]) µm (3 + 30 Z [inches])</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability of Z axis indication3</td>
<td>(Surface may be curved or flat)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Performance</td>
<td>PGI 420</td>
<td>PGI 820</td>
<td>PGI 830</td>
</tr>
<tr>
<td>Standard spherical calibration artifact, [calibrated radius uncertainty]</td>
<td>22mm (0.87in) nominal radius (0.4µm [15.7µin])</td>
<td>80mm (3.15in) nominal radius glass standard 5µm (197µin)</td>
<td></td>
</tr>
<tr>
<td>Calibration Pt7</td>
<td>0.15µm [60mm stylus arm] (6µin [2.36in])</td>
<td>0.3µm [120mm stylus arm] (12µin [4.72in])</td>
<td></td>
</tr>
<tr>
<td>System noise – Rq8</td>
<td>5nm (0.2µin)</td>
<td>3nm (0.12µin)</td>
<td>2nm (0.08µin)</td>
</tr>
<tr>
<td>Radius measurement uncertainty9</td>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclination measurement uncertainty</td>
<td>0.5 arc minute uncertainty ( +/- 35º maximum range)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorized vertical column</td>
<td>450mm (17.7in) vertical traverse length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorized tilting of traverse unit</td>
<td>+/- 9º from horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions L x D x H (granite base)</td>
<td>410 x 130 x 225mm (16 x 5.2 x 8.9in)</td>
<td>470 x 130 x 225mm (18.5 x 5.2 x 8.9in)</td>
<td></td>
</tr>
<tr>
<td>Dimensions L x D x H (traverse unit)</td>
<td>760 x 500 x 120mm (30 x 20 x 4.7in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (traverse unit)</td>
<td>13.5Kg (30lbs)</td>
<td>15Kg (33lbs)</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental Conditions**

<table>
<thead>
<tr>
<th></th>
<th>PGI 420</th>
<th>PGI 820</th>
<th>PGI 830</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td>5ºC to 40ºC (41ºF to 104ºF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage humidity</td>
<td>10% to 80% Relative, non condensing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>18ºC to 22ºC (64ºF to 72ºF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating humidity:</td>
<td>45% to 75% Relative, non condensing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature gradient</td>
<td>&lt;2ºC (&lt;3.6ºF) per hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum RMS floor vibration</td>
<td>3µm/s [120µin/s] at ≤50Hz 6µm/s [240µin/s] at &gt;50Hz</td>
<td>Supply voltage transients - width</td>
<td>Not less than 2µs and not greater than 20µs</td>
</tr>
</tbody>
</table>

**Electrical Supply**

<table>
<thead>
<tr>
<th></th>
<th>PGI 420</th>
<th>PGI 820</th>
<th>PGI 830</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply type</td>
<td>Alternating supply, singlephase with earth (3-wire system)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument and computer voltage</td>
<td>90V - 130V or 200V-260V (switch selectable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>47Hz to 63Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>500VA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Horizontal Performance</strong></th>
<th>PGI 1220</th>
<th>PGI 1230 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traverse length - X Max / Min</td>
<td>200mm / 0.1mm (7.9in / 0.004in)</td>
<td></td>
</tr>
<tr>
<td>Traverse speeds – Measuring speeds nominal 1</td>
<td>10mm/s max – 0.1mm/s, 0.25mm/s, 0.5mm/s &amp; 1mm/s [0.39in/s max – 0.004in/s, 0.01in/s, 0.02in/s &amp; 0.04in/s]</td>
<td></td>
</tr>
<tr>
<td>Data sampling interval in X</td>
<td>0.125µm (5µin)</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Maximum number of data points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straightness uncertainty (Pt) 2</td>
<td>0.35µm over 200mm (14µin over 7.9in)</td>
<td>0.125µm over 200mm (5µin over 7.9in)</td>
</tr>
<tr>
<td>Datum correction</td>
<td>Optional</td>
<td>Standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Vertical Performance</strong></th>
<th>PGI 1220</th>
<th>PGI 1230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal measuring range (Z)</td>
<td>12.5mm [60mm stylus arm] (0.49in [2.36in])</td>
<td></td>
</tr>
<tr>
<td>Resolution (Z) 3</td>
<td>3.2nm @ 12.5mm range (0.12µin @ 0.49in)</td>
<td>0.8nm @ 12.5mm range (0.03µin @ 0.49in)</td>
</tr>
<tr>
<td>Range to resolution ratio</td>
<td>3,908,250 : 1</td>
<td>15,625,000 : 1</td>
</tr>
<tr>
<td>Stylus arm length, tip size, force</td>
<td>60mm arm, 2µm radius conisphere diamond stylus, 1mN force 120mm arm, 0.5mm radius ball, 20mN force</td>
<td></td>
</tr>
<tr>
<td>Z axis non-linearity, (Z = \text{gauge displacement})</td>
<td>([0.07 + 0.03Z\ \text{[mm]}) (m) (\text{um}) over (3 + 30Z\ \text{[inches]}) (m) (\text{um}) - after calibration 6</td>
<td></td>
</tr>
<tr>
<td>Repeatability of Z axis indication (\text{[Surface may be curved or flat]})</td>
<td>Dependent upon user environment - contact sales agent for additional details</td>
<td>Flat - 0.03µm (1.2µin) 5 Curve - 0.08µm (3µin) 6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>System Performance</strong></th>
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<th>PGI 1230</th>
</tr>
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<tbody>
<tr>
<td>Standard spherical calibration artifact, (\text{[calibrated radius uncertainty]})</td>
<td>80mm (3.15in) nominal radius glass standard 5µm (197µin)</td>
<td></td>
</tr>
<tr>
<td>Calibration Pt 7</td>
<td>0.2µm [60mm stylus arm] (8µin [2.36in]) 0.4µm [120mm stylus arm] (16µin [4.72in])</td>
<td></td>
</tr>
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<td>System noise - Rq 8</td>
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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 permissible 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 \(\lambda_s = 2.5mm\).
3 Using a 60mm arm with a diamond stylus.
4 Measurements up and down a 39º angled slope over 80% of the gauge range, using a 60mm arm with a diamond stylus.
5 Repeated measurements on a glass flat that is nominally parallel to the datum, 10mm traverse length, analysis using a Primary filter of \(\lambda_s = 0.025mm\).
6 Repeated measurements over an 80mm radius glass standard, analysis using a Primary filter \(\lambda_s = 0.25mm\).
7 Analysis using a primary filter \(\lambda_s = 0.25mm\).
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 environmental chamber; refer to pages 6 and 7 for additional information.
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