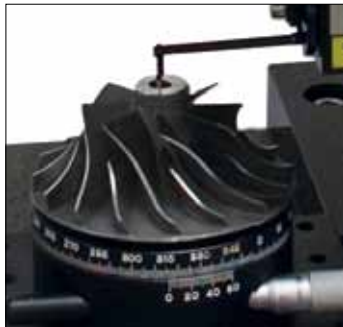


# Form Talysurf PGI 400/800/1200

Ultra precision surface form and finish measurement system



# Form Talysurf PGI 400 / 800 / 1200

## Ultra precision surface and form measuring for high accuracy inspection

Beginning in the 1930s with Talysurf 1, Taylor Hobson has led the industry with innovation and excellence. The Form Talysurf, launched in 1984, was the first instrument ever to measure surface texture, form and contour simultaneously and became the instrument of choice for precision manufacturers. Form Talysurf PGI continues the tradition of providing you with the highest possible measurement accuracy and integrity.

### Outstanding range and resolution

With up to a 12.5mm vertical gauge range (standard 60mm stylus) and 0.8nm resolution the PGI instrument has the wide range necessary to measure form and contour while also providing the resolution required for surface finish

### Unique patented calibration

Calibration is simple, quick and accurate using our patented and fully automated single trace measurement routine. A numeric and visual result gives the user confidence that the calibration and hence any subsequent measurements are correct.

### 200mm Horizontal traverse with 0.125µm straightness

A precision lapped datum bar provides the reference for all profile measurements; high accuracy straightness eliminates instrument error leaving the true form of the component

### 0.125µm High density horizontal data spacing

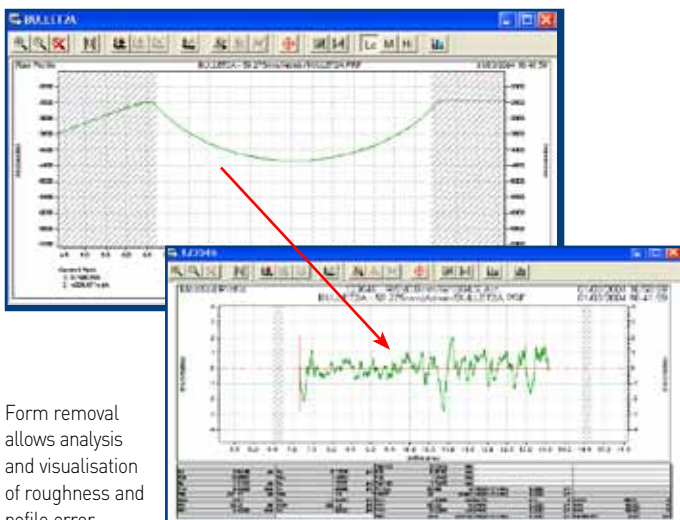
Accurate re-production of the part profile cannot be achieved without high-density data collection. With up to a maximum of 1,600,000 data points and 0.125µm spacing, exceptionally fine detail is assured on small and large components alike.

### Low system noise 2nm

Low noise of the complete system gives roughness measurement capability unsurpassed on this type of instrument.

### 450mm Motorised Column

The motorized column provides high accuracy position control and capacity for even the largest components. It is controlled manually via the joystick or by the computer for full system programmability.



Form Talysurf PGI 1200 with environmental cabinet

### Ultra software for form and surface analysis

Combining versatile operation with ease of use, all Form Talysurf PGI instruments are controlled by Taylor Hobson's Ultra software. All commonly utilized surface form and finish evaluation parameters are included as standard. In addition to enabling full instrument programmability, a dedicated suite of feature analysis and exclusion tools is provided.

- **Form Analysis**  
Measure and analyse Radius, angle and dimension
- **Simplified User Interface\***  
Combines with system programmability to deliver a true shopfloor solution; custom designs available
- **Dual Profile analysis\***  
Allows profile comparison to master components
- **Ultra-contour analysis**  
A powerful software utility providing full dimensional capability, special features such as DXF comparison are also available
- **Talymap 3D Analysis**  
Combined with a Y stage table this separate software utility provides the ability to analyse 3D topography

# Gauge Theory

## 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.

### Gauging Excellence

#### Background

The original Form Talysurf was introduced by Taylor Hobson in 1984. Since then a number of technological advancements have been made, perhaps the most significant being the introduction of the Phase Grating Interferometer gauge, from which the Form Talysurf PGI range of instruments get its name.

This gauging technology, developed and patented by Taylor Hobson, brings new levels of measurement capability to the stylus profilometer.

#### Technology

The heart of the PGI gauge is a cylindrical grating. It is this grating that is primarily responsible for the measuring capability of the gauge. The grating rotates about a precision pivot, and is illuminated using a collimated laser beam derived from a low power laser diode. Specially designed optics analyse the diffraction patterns from the grating to provide the movement information.

All of this is packaged in a compact unit mounted underneath the traverse unit. As a result the gauge can be supplied with either 120mm or 200mm traverse units as appropriate to the measurement application.

#### The key benefits of the PGI gauge are:

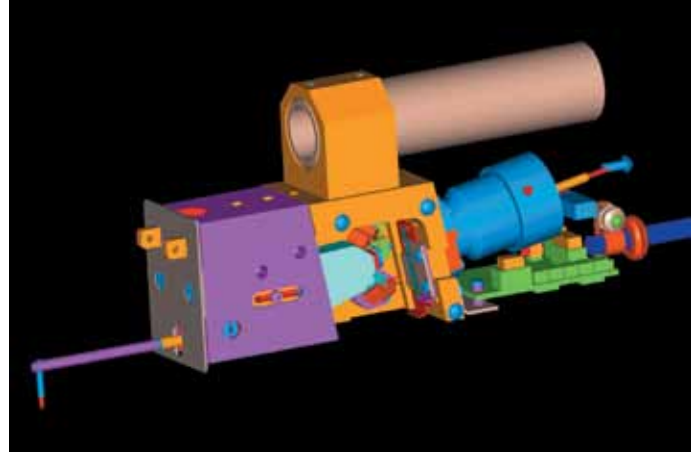
- Completely independent of atmospheric conditions, unlike a Michelson interferometer.
- Available with a variety of gauge ranges and resolutions to closely match the requirements of the application in both performance and price.
- Compact measuring unit with low-voltage supplies for added safety.

#### Gauge Calibration

**A key requirement for optics measurement is the calibration of dimensional measurement capability and gauge linearity.**

The Form Talysurf PGI systems use a patented ball calibration routine to ensure that both of these requirements are dealt with in a single, automated operation. This is accomplished through the measurement of high-precision spherical calibration artefacts that have been produced to exacting standards and then calibrated for radius, form and surface finish in our own UKAS approved laboratory.

In operation the user simply completes a dialog confirming parameters such as the percentage of gauge range to be used and the traverse speed. Working from knowledge of the stylus geometry and the dimensions of the calibration standard, the software automatically calculates the measurement properties and drives the traverse unit and column appropriately, completing the calibration with the minimum of operator intervention.



CAD rendering of PGI gauge mechanism



PGI gauge in robust, protective housing



Ball calibration standard (22mm radius)  
One of the various calibration standards available

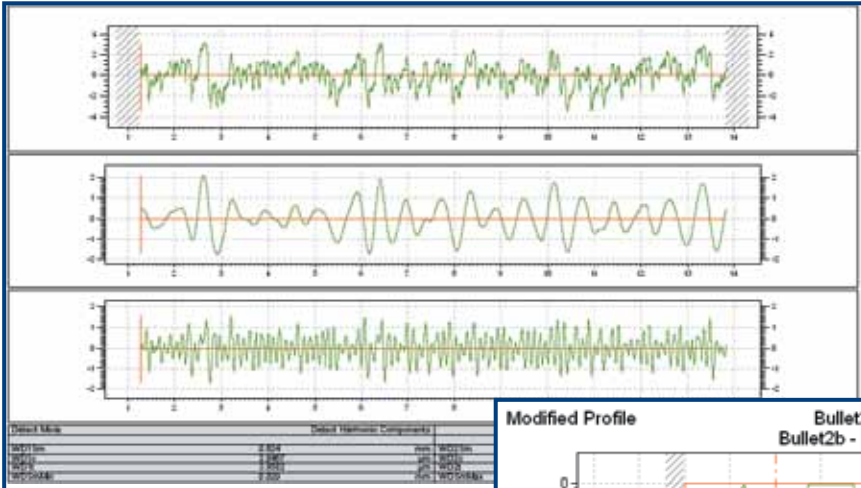
# Ultra Surface Finish Software

## User programmability

A major benefit of Ultra is user programmability. This enables users to write their own measurement sequences for repetitive measurement tasks. In production environments this can be invaluable for automating measurement procedures, reducing cycle time and minimizing operator variability. Programming modes include learn mode, program editing, single step and user breakpoints.

## Custom layouts

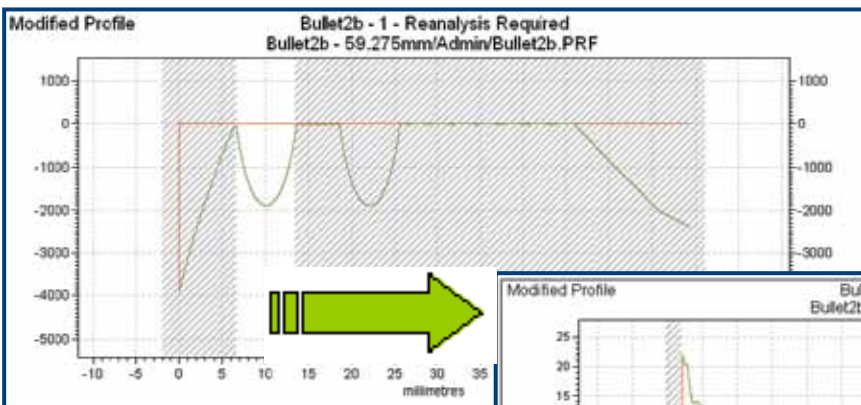
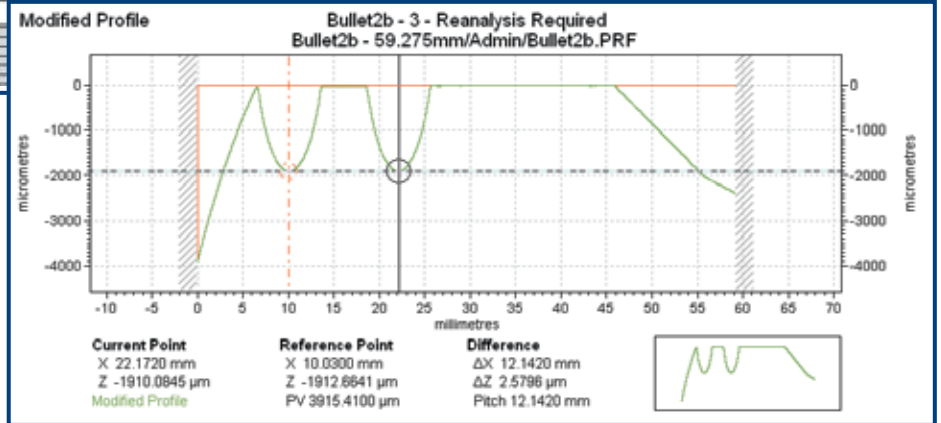
Ultra software is supplied with a comprehensive set of pre-defined result layouts, enabling the user to produce high-quality printouts with the minimum of effort. The software also gives the user great flexibility in creating "custom" layouts, enabling them to tailor the layouts to meet their individual needs. Once a custom layout has been created it can be selected as the default layout for additional measurements of that type.



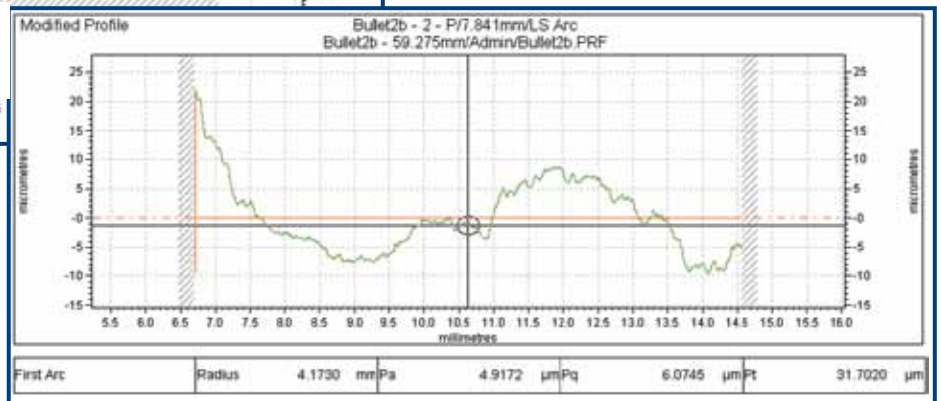
### Dominant Wavelength Analysis (VDA 2007)

Provides important information for sealing applications. Primary profile is shown together with dominant wavelength profiles and results. (Optional)

**Dimensional measurement**  
Interactive results views allow simple dimensions to be measured by means of cursors.



**Profile zoom and extraction function**  
Elements of a profile can be selected and analysed for form and surface finish in a single operation.



Specifications are subject to change without notice. Availability of some features is dependent on instrument type or optical licence.

# Powerful software for the analysis of surface finish and form

## Operation and control

- Full instrument control
- Ease of use through extensive use of icons
- Built-in tolerance checking giving simple pass/fail indication
- User programmability – allowing repetitive tasks to be automated
- Simplified User Interface capability to allow programs to be executed from a simple push-button interface.

## Powerful analysis

- Primary (unfiltered) parameters
- Roughness parameters
- Waviness parameters
- R & W parameters
- Rk parameters
- Bearing Ratio and Amplitude Distribution
- Pitch and Intercept
- Interactive results displays

## Form removal options

- Datum
- LS Line
- MZ Line
- LS Arc
- LS Arc absolute
- LS ellipse / hyperbola

## Filtering

- 2CR or Gaussian
- Support for the latest ISO standards
- Support for VDA 2006 (no Ls filter for Primary, Roughness and Rk)

## Presentation of results

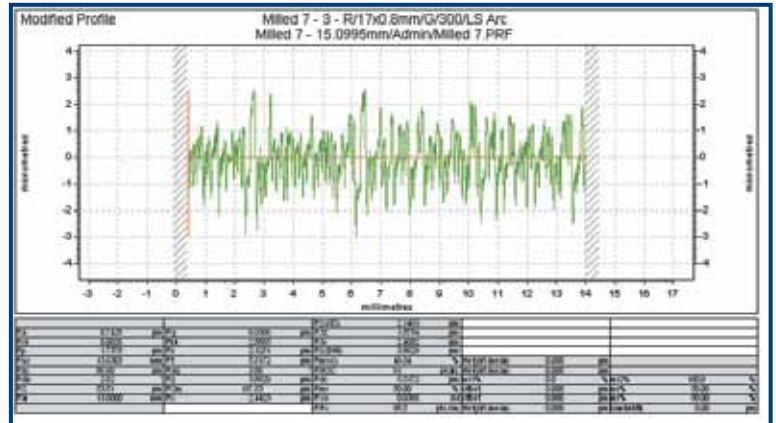
- Comprehensive single page layouts
- Custom layout capability
- Built-in tolerance checking gives simple pass/fail indication
- Export to SPC

## Optional analyses

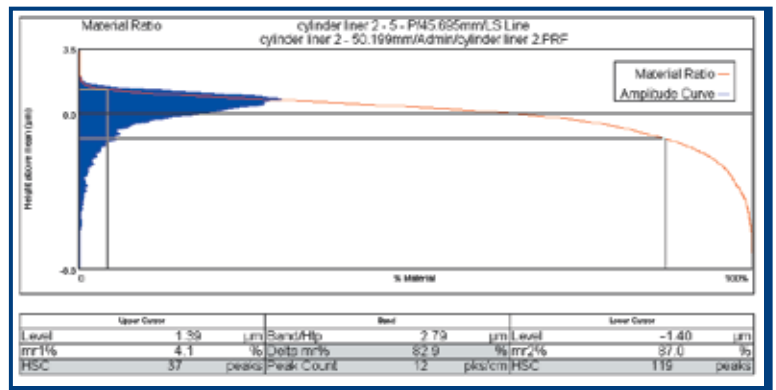
- Dual Profile (for comparing two measured profiles)
- Dominant Wavelength (VDA 2007) identifies most significant wavelengths in a surface. Useful for sealing applications

## Languages

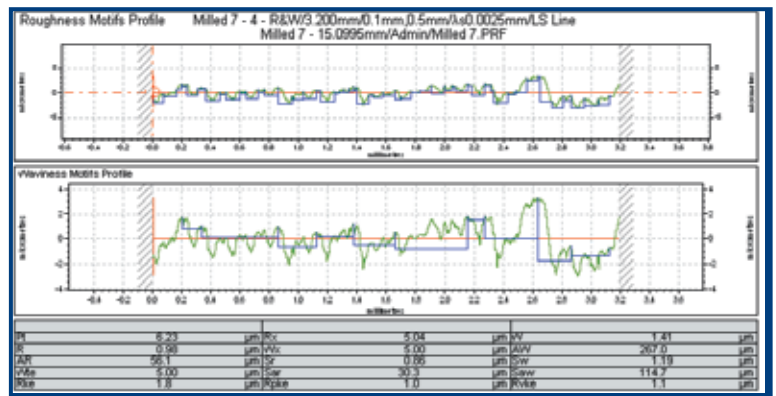
Brazilian Portuguese, Chinese, Czech, English, French, German, Italian, Japanese, Polish and Spanish.



High-quality results presentations are incorporated as standard, enabling the user to produce professional outputs with the minimum of effort. Extensive form analysis options allow most surfaces to be measured for form and surface finish in a single measurement.

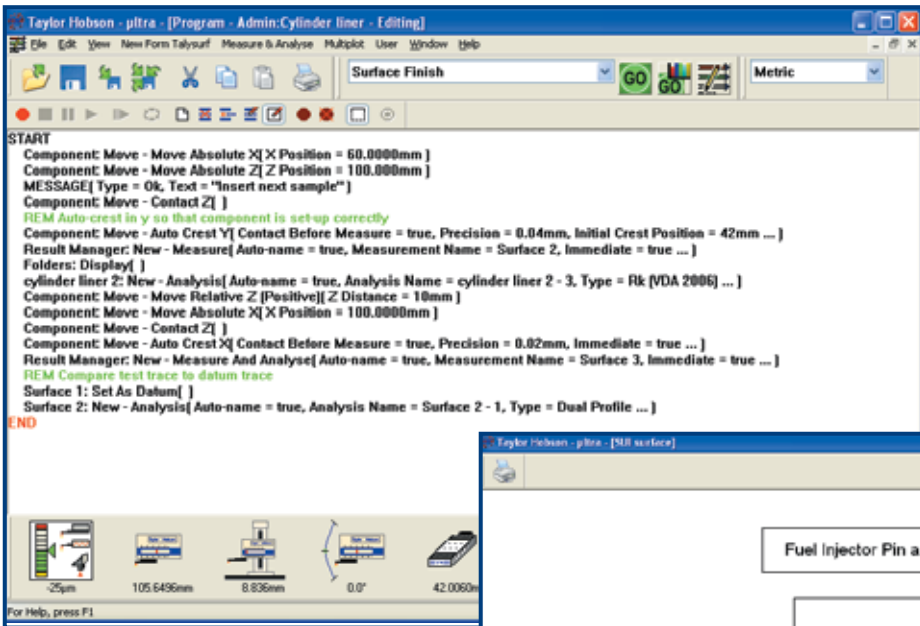


Interactive material ratio and amplitude distribution curves.



R&W analysis (ISO 12085) showing roughness motif and waviness motif profiles.

# User friendly software for controlling surface finish measuring instruments

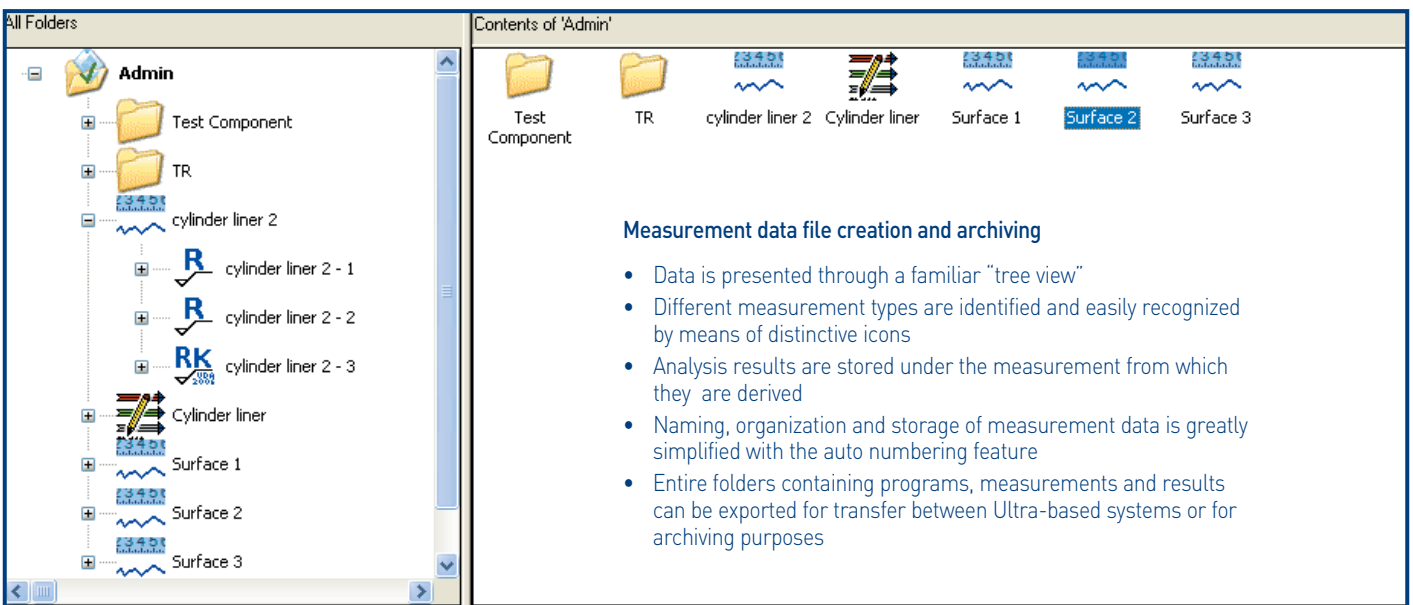
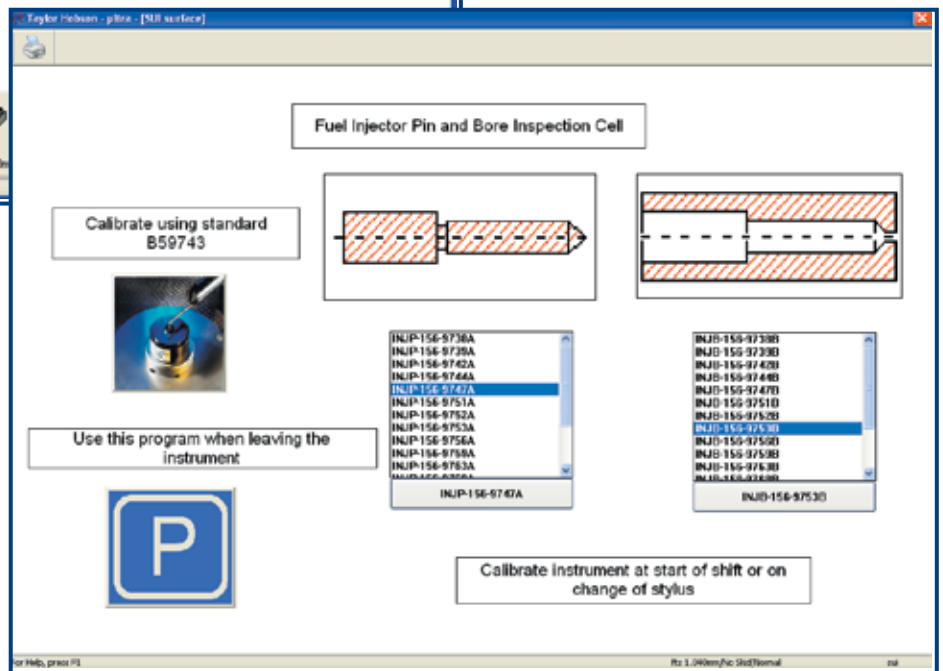


## Measurement program creation

- User programs can be written quickly and easily using the learn mode facility
- Simple or detailed listings can be shown.
- User breakpoints can be used to help in the debugging of complex measurement programs

## Program selection and activation

- Programs can be accessed through a "Simplified User Interface".
- Programs can be linked to simple buttons or to list boxes.
- Buttons can be identified by means of text or a bitmap such as a picture.
- Program "chooser" allows programs to be selected from a list



## Measurement data file creation and archiving

- Data is presented through a familiar "tree view"
- Different measurement types are identified and easily recognized by means of distinctive icons
- Analysis results are stored under the measurement from which they are derived
- Naming, organization and storage of measurement data is greatly simplified with the auto numbering feature
- Entire folders containing programs, measurements and results can be exported for transfer between Ultra-based systems or for archiving purposes

**Languages:** Brazilian Portuguese, Chinese, Czech, English, French, German, Italian, Japanese, Polish and Spanish.

Specifications are subject to change without notice. Availability of some features is dependent on instrument type.

# Specification PGI 400 / 800 / 1200

Horizontal Performance	400	800	1200	<b>Environment</b>  <b>Storage temperature</b> 5°C to 40°C (41°F to 104°F)  <b>Storage humidity</b> 10% to 80% Relative, non condensing  <b>Operating temperature</b> 18°C to 22°C (64°F to 72°F)  <b>Temperature gradient</b> < 2°C (< 3.6°F) per hour  <b>Operating humidity</b> 45% to 75% Relative, non condensing  <b>Maximum RMS floor vibration</b> 2.5µm/s (100µin/s) at < 50Hz 5.0µm/s (200µin/s) at > 50Hz  <b>Electrical supply</b>  <b>Supply type</b> Alternating supply, singlephase with earth (3-wire system)  <b>Instrument and computer voltage</b> 90V - 130V or 200V-260V (switch selectable)  <b>Frequency</b> 47Hz to 63Hz  <b>Supply voltage transients - width</b> EN 61000 - 4 - 4 : 1995  <b>Power consumption</b> 500VA  <b>Safety</b> EN 61010 - 1 : 2001  <b>EMC</b> EN 61000 - 6 - 4 : 2001 EN 61000 - 6 - 1 : 2001  <b>Laser classification</b> Class 1 product to EN 60825-1 (2001)  Continuous wavelength (CW) output < 1mW Max power for the laser < 50µW Max power for the product  The above technical data is for measurements taken in a metrology laboratory controlled environment: 20°C ± 1°C (68°F ± 1.8°F), draft free, and isolated from low frequency floor borne vibration.  Uncertainties and maximum 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.
Traverse length - X Max / Min	120mm/0.1mm (4.7in/0.04)	200mm / 0.1mm (7.9in / 0.004in)		
Measuring speeds <sup>1</sup>	0.1mm/s, 0.25mm/s, 0.5mm/s & 1mm/s (0.004in/s, 0.01in/s, 0.02in/s & 0.04in/s)			
Traverse speeds	0.1-10mm/s (0.004-0.39in/s)			
Data sampling interval in X	0.125µm over 120mm (5µin over 4.7in)	0.125µm over 200mm (5µin over 7.9in)		
Maximum number of data points	960,000	1,600,000		
Straightness error [Pt] (X = length) <sup>2</sup>	0.35µm/120mm (14µin/4.7in)	0.35µm/200mm (14µin/7.9in)	125nm/200mm (10µin/7.9in)	
Datum correction	Optional	Optional	Standard	
Vertical Performance	400	800	1200	
Nominal measuring range [Z]	4mm (60mm stylus arm) (0.16in [2.36in])	8mm (60mm stylus arm) (0.32in [2.36in])	12.5mm (60mm stylus arm) (0.98in [2.36in])	
Resolution [Z] <sup>3</sup>	12.8nm @ 4mm range (0.5µin @ 0.49in) range	3.2nm @ 8mm range (0.12µin @ 0.32in) range	0.8nm @ 12.5mm range (0.03µin @ 0.49in) range	
Range to resolution ratio <sup>3</sup>	312,500 : 1	2,500,000 : 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 nonlinearity (Z=gauge displacement)	(0.07 + 0.03 Z [mm]) µm (3 + 30 Z [inches]) µin - after calibration <sup>4</sup>			
Repeatability of Z axis indication (flat surface - diamond stylus)	0.1µm (4µin) <sup>5</sup>		0.15µm (6.1µin) <sup>5</sup>	
Repeatability of Z axis indication (curved surface - diamond stylus)	0.8µm (3.2µin) <sup>6</sup>		0.16µm (6.3µin) <sup>6</sup>	
Repeatability of Z axis indication (curved surface - ball stylus)	0.12µm (4.5µin) <sup>6</sup>			
System Performance <sup>3</sup>	400	800	1200	
Calibration Pt <sup>7</sup>	0.15µm (6µin)		0.2µm (8µin)	
Spherical calibration artifact [accuracy]	80mm (3.15in) nominal radius glass standard [5µm (197µin)]			
System noise - Rq <sup>8</sup>	Typically 5nm (0.02µin)	Typically 3nm (0.12µin)	Typically 2nm (0.08µin)	
Radius measurement uncertainty <sup>9</sup>	0.1 - 80mm (0.004 - 3.15in) = 1 to 0.005% of nominal 80 - 1000mm (3.15 - 39.4in) = 0.005 to 0.1% of nominal 1000 - 2000mm (39.4 - 78.7in) = 0.1% of nominal			
Inclination measurement uncertainty	0.5 arc minute uncertainty (+ / - 35° maximum range)			
Dimensions L x D x H (Instrument & surround)	900 x 880 x 1750mm (35.4 x 34.6 x 68.9in)			
Dimensions L x D x H (computer desk)	900 x 880 x 760mm (35.4 x 34.6 x 30in)			
Motorized column	450mm (17.7in) vertical traverse			

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

2 Measured over a glass flat nominally parallel to the traverse datum using a 60mm arm with a diamond stylus (speed = 1mm/s, LS Line analysis, primary filter λs = 2.5mm).

3 Using a 60mm arm with a diamond stylus.

4 Measurements up and down a 35° 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, primary filter λs = 0.025mm).  
- results valid when measured in environmental enclosure (optional)

6 Repeated measurements over an 80mm radius glass standard [primary filter λs = 0.25mm].  
- results valid when measured in environmental enclosure (optional)

7 From a repeat measurement on the calibration artifact over 75% of the gauge range (LS Arc analysis, primary filter λs = 0.25mm).

8 Measured over a glass flat nominally parallel to the traverse datum using a 60mm arm with a diamond stylus (speed = 0.1mm/s, Gaussian roughness filter, 0.08mm cut-off, 30:1 bandwidth).

9 Assumes a calibration artifact of perfect radius.

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

## Serving a global market

Taylor Hobson is world renowned as a manufacturer of precision measuring instruments used for inspection in research and production facilities. Our equipment performs at nanometric levels of resolution and accuracy.

To complement our precision manufacturing capability we also offer a host of metrology support services to provide our customers with complete solutions to their measuring needs and total confidence in their results.

## Contracted services from Taylor Hobson

### Sales department

Email: [taylor-hobson.sales@ametek.com](mailto:taylor-hobson.sales@ametek.com)

Tel: **+44 (0)116 246 2034**

- **Design engineering**  
special purpose, dedicated metrology systems for demanding applications
- **Precision manufacturing**  
contract machining services for high precision applications and industries

### Service department

Email: [taylor-hobson.service@ametek.com](mailto:taylor-hobson.service@ametek.com)

Tel: **+44 (0)116 246 2900**

- **Preventative maintenance**  
protect your metrology investment with an Amecare support agreement

### Centre of Excellence department

Email: [taylor-hobson.cofe@ametek.com](mailto:taylor-hobson.cofe@ametek.com)

Tel: **+44 (0)116 276 3779**

- **Inspection services**  
measurement of your production parts by skilled technicians using industry leading instruments in accord with ISO standards
- **Metrology training**  
practical, hands-on training courses for roundness and surface finish conducted by experienced metrologists
- **Operator training**  
on-site instruction will lead to greater proficiency and higher productivity
- **UKAS calibration and testing**  
certification for artifacts or instruments in our laboratory or at customer's site



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