Taylor Hobson PRECISION

Surtronic Duo

Roughness checker

a division of AMETEK

Surtronic Duo

A portable tool for checking surface roughness.

What it does

Surtronic Duo measures Ra at the touch of a button and shows the result on a large LCD window. Cycle time is about 5 seconds and the result is saved until another measurement is taken.

Additional parameters Rz, Rp, Rv and Rt can be displayed and units of measure switched between inch and metric without re-measuring the part.

There is no setting up or programming of the device, it is ready to use out of the box. Operator training is not required. Battery life is 5,000 measurements minimum.

How it does it

A diamond stylus is drawn across the part. The motorized traverse mechanism is cam driven to ensure that the correct horizontal distance is traveled.

Vertical movement of the stylus as it travels across peaks and valleys is detected by a piezo-electric pick up which converts mechanical movement into an electrical signal.

The electrical signal is digitized and sent to a microprocessor where the parameters are instantly calculated using standardized algorithms.

Keeping it simple

Surtronic Duo keeps the process simple. It is the perfect tool for any inspector to check roughness anywhere.

- Auditing batch production before shipment
- Process control on the production line
- Quality control as an entry level instrument
- Checking large components or structures

Splits into two pieces

The bottom half contains the traverse mechanism and stylus pick up assembly. This is placed on the surface to be measured. It has a wide base to ensure stability.

The upper half includes the large LCD display, start button, mode and parameter buttons. This is held comfortably in the hand for easy operation and clear viewing of the results.

Surtronic Duo uses an infra-red (IrDA) link between the upper and lower units to provide remote, cable free operation up to a distance of one meter (40 inches).

Error proof calibration

Even calibration of the Surtronic Duo is easy and foolproof. First, the operator pushes a button to select calibration mode.

Then, using the roughness standard supplied with the instrument, the operator simply measures as usual.

Storage of the result and subsequent measurement compensation based on the calibration constant are completely automatic.

Energy efficient by design

Automatic shut-off after 5 minutes of inactivity and a low power consumption LCD help to preserve battery life.

The rapid mechanical traverse and 5 second cycle time conserve enough energy to provide a minimum of 5,000 measurements on a single set of batteries.

Standard off-the-shelf calculator type batteries are used and replacement is easy using a wide blade screwdriver or large coin.

Surface mount digital technology

Surtronic Duo uses modern electronic circuitry and components to optimize performance and extend useful operating life. Outstanding reliability and 5% of reading accuracy are just two of the features rarely found in instruments at this price level.

Pre set to industry standards

Surtronic Duo is configured to measure using the most common industrial settings:

- 5mm (0.2in) traverse length
- 0.8mm (0.03in) cut off
- 2CR filter
- 5µm (200µin) radius diamond stylus

Pre-setting these critical functions eliminates errors and ensures correlation between multiple operators.

Available in two versions:

Surtronic Duo - 2 parameters
Reference code 112/2916-03

For basic roughness checking of parameters Ra and Rz

Surtronic Duo - 5 parameters
Reference code 112/3115-01

Includes basic roughness parameters Ra and Rz plus advanced parameters Rp, Rv and Rt

Both versions include:

- Surtronic Duo
- Calibration standard
- Batteries
- Carrying case
- Operation guide

Technical specifications

Gauge range	200µm (0.008in)
Accuracy	5% of reading + 0.1µm (4µin)
Pick up type	Piezoelectric
Gauge force	200mg
Stylus	Diamond, Radius 5µm (200µin)

Cut off value	0.8mm ± 15% (0.03in ± 15%)
Filter	2CR
Traverse length	5mm (0.2in)
Traverse speed	2mm/sec (0.08in/sec)
Display units	µm / µin
Battery life	5,000 operations minimum

Parameter results

Code 112/2916-03	Ra, Rz	
Code 112/3115-01	Ra, Rz, Rv, Rp, Rt	
Parameters	**Range**	**Resolution**
Ra:	40µm (1600µin)	0.01µm (0.4µin)
Rz, Rv, Rp, Rt:	199µm (7800µin)	0.1µm (4µin)

Dimensions

Overall dimensions	125x80x38mm (4.92x3.15x1.5 in)
Weight	200gm (7oz)

Component dimensions and condition

Min bore	65mm (2.6in)
Min diameter	25mm (1.0in)
Max temperature	35°C (95°F)

Nominal operating conditions

Temperature	20°C (68°F)
Humidity	0 to 80% non condensing

Storage conditions

Temperature	0 to 50°C (32°F to 122°F)
Humidity	0 to 80% non condensing

Taylor Hobson pursues a policy of continual improvements due to technical development in all their instruments. We therefore reserve the right to depart from catalogue specifications.

Correlation with other instruments

What is a skid? (Figure 1)

Surtronic Duo is a skidded device. A skid guides the pick-up along the workpiece, with the workpiece itself forming the datum for measurement. This method usually eases set-up by reducing the need for leveling. It also reduces the effects of vibration due to a much smaller measuring loop.

The skid is an integral part of the gauge and has a radius large enough to prevent movement in and out the roughness characteristics of the surface. The stylus and the skid are independent in their height (Z) movement but move together in the measurement direction. Surface deviations are recorded as the difference between the stylus and the skid movement in the Z direction.

What effect will a skid have?

The skid will act as a mechanical filter, taking out much of the general form of the component. Also, wavelengths greater than the diameter of the skid will not register.

How much difference does the stylus tip size make?

Surtronic Duo uses a 5µm (200µin) stylus tip radius. This suits the Duo's purpose as a portable tool for checking roughness in three ways:

- A large stylus tip acts as a mechanical filter to ignore high frequency surface defects that are more reliably measured in a clean room.
- Dirt and oil collect on the tip during shop floor use. A large stylus lends itself to periodic cleaning.
- The larger tip is less sensitive to mishandling and other hazards often found in production areas.

Other Taylor Hobson instruments use a stylus with a tip radius of 2µm (80µin). This smaller radius coupled with an inductive gauge head having low contact force allows for analysis of even the smallest surface imperfections.

Stylus tip radius is one factor that can contribute to non-correlation between different instruments measuring the same surface.

What is the difference between roughness, waviness and form?

Surtronic Duo is intended for the analysis of roughness. The other elements of surface texture are waviness and form.

Roughness - produced by the action of the cutting tool or machining process usually in the form of process marks.

Waviness - usually produced by instabilities in the machining process, such as an imbalance in a grinding wheel. Waviness has a longer wavelength than roughness.

Form - the general shape of the surface, ignoring variations due to roughness and waviness. Deviations from the desired form can be caused by many factors such as inaccuracies of the machine tool guideways.

How do we measure waviness and form?

A typical instrument will consist of a stylus, gauge, traverse datum and processor. For correct data collection, the gauge must pass over the component in a straight line with only the stylus tip contacting the surface under test.

Vertical movement of the stylus is relative to the traverse datum, typically a reference bar that has been lapped or precision ground to a high straightness tolerance.

The gauge detects vertical movement of the stylus, converts it to a signal and passes it to the processor for calculation of parameter results and display of a profile graph.

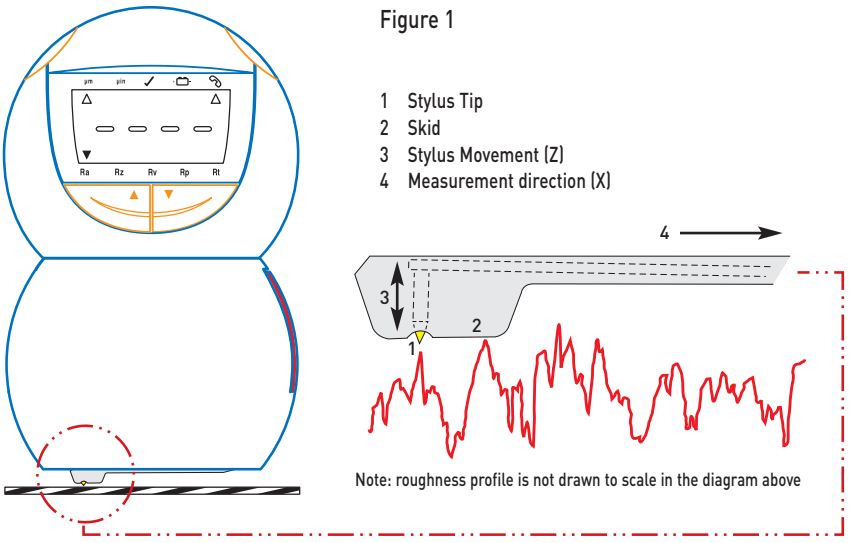


Figure 1

1 Stylus Tip
2 Skid
3 Stylus Movement (Z)
4 Measurement direction (X)

Note: roughness profile is not drawn to scale in the diagram above

Other Taylor Hobson products

Surtronic 25
Roughness only
High performance workshop instrument with selectable cut-off lengths and built in memory for data storage

- Skidded pick-up with 5µm (200µin) stylus tip
- Selectable cut-offs, 0.25mm, 0.8mm, 2.5mm (0.01in, 0.03in, 0.10in)
- Self-contained, battery operation for shop floor use
- Customize to your application with exchangeable pick-ups, measuring stands and other accessories

Form Talysurf PGI Series
Roughness, waviness and contour
Phase grating interferometer gauge head delivers wide range and exceptional resolution for surface finish and contour

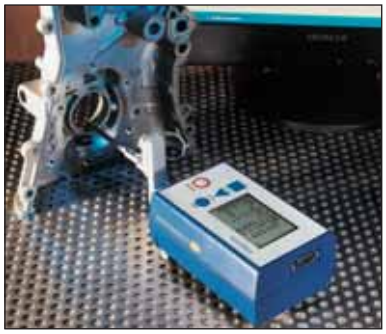
- Available with 4mm, 8mm or 12.5mm vertical measuring range which can be increased to 8mm, 16mm or 25mm with double length stylus arm
- 15,625,000:1 range to resolution ratio for 0.8nm maximum gauge resolution
- 120mm (4.72") or 200mm (7.9in) traverse with straightness datum
- 0.125µm (5µin) horizontal data spacing for exceptional profile resolution on both large and small components

Form Talysurf Intra
Roughness, waviness and form
Low cost, portable system for high level surface finish analysis in the manufacturing shop

- Skidless pick-up with 2µm (80µin) stylus tip
- 50mm (1.97in) traverse with straightness datum
- Color VGA touch screen control panel for simple operation and high visibility display
- Automatic calibration over a sphere ensures that radius and form measurements are correct

Form Talysurf Inductive Series
Roughness, waviness and form
Modular product line for high level surface finish analysis to suit a wide range of applications and budgets

- 120mm (4.72in) 200mm (7.9in) traverse with straightness datum
- Inductive gauge with 1mm (0.040in) range and interchangeable stylus arms for small bores, grooves and other difficult features
- Ultra software takes charge of all hardware/software/analysis functions for seamless operation
- Programmable for automatic inspection and analysis routines


Surtronic 25


Form Talysurf PGI with 12.5mm range


Form Talysurf Intra

Talyrond 365
for Roughness, Roundness and Cylindricity
With the dual capability Talymin 5 gauge and seamlessly integrated Ultra roughness and roundness analysis software, this is the first instrument ever to efficiently measure surface finish and circular geometry on a single platform with a single gauge head.

Automatic center and leveling assures correct alignment of the workpiece and full automatic operation virtually eliminates operator errors and other measurement inconsistencies. Talyrond 365 is the way to increased productivity and reduced costs.


Talyrond 365

Surface finish fundamentals

The surface of every component has some form of texture which varies according to its structure and the way it has been manufactured. These surfaces can be broken down into three main categories: Roughness, Waviness and Form. In order to control the manufacturing process or predict a component's behaviour during use, it is necessary to quantify surface characteristics by using surface texture parameters.

Surface texture parameters can be separated into three basic types:

Amplitude Parameters -
Measurement of the vertical characteristics of the surface deviations

Spacing Parameters -
Measurement of the horizontal characteristics of the surface deviations

Hybrid Parameters -
Combinations of spacing and amplitude parameters

Sample Length - The profile is divided into sample lengths l, which are long enough to include a statistically reliable amount of data. For roughness and waviness analysis, the sample length is equal to the selected cut-off.

Cut-off (Lc) - A cut-off is a filter that uses either electronic or mathematical means to remove or reduce unwanted data in order to look at wavelengths in the region of interest. The sample length is also known as the cut-off length.

Evaluation Length - The length in the direction of the X axis used for assessing the profile under evaluation. The evaluation length may contain one or more sample lengths. For the primary profiles the evaluation length is equal to the sample length.

Standards - Where appropriate Taylor Hobson equipment follows procedures as determined in ISO 3274-1996, ISO 4287-1997, ISO 4288-1996, ISO 11 562 and other international standards.

All parameters using either Roughness, Waviness or Primary Profiles conform to the following assumptions:

T = Type of profile, either R (Roughness) or W (Waviness) or P (Primary)

n = Parameter suffix, e.g. q, t, p, v, etc.

N = Number of measured sampling lengths

When a parameter is displayed as Tn (e.g. Rp), then it is assumed that the value has been measured over 5 sampling lengths. If the number of measured sampling lengths is other than 5 sampling lengths, then the parameter shall display this number thus TnN, e.g. Rp2.

Max Rule - If a parameter also displays max (e.g. Rz1max) then the measured value shall not be greater than the specified tolerance value. If max is not displayed (e.g. Rp) then 16% of the measured values are allowed to be greater than the specified tolerance value.

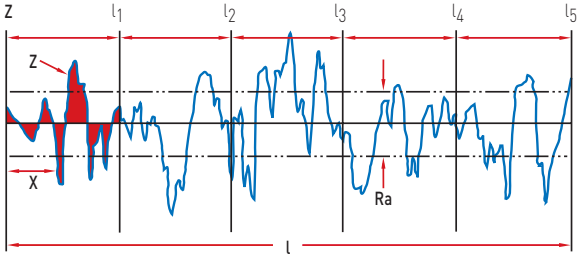
See ISO 4288-1996 for more details of the Max and 16% rules.

RECOMMENDED CUT-OFF ISO 4288-1996

PERIODIC PROFILES	NON-PERIODIC PROFILES		CUT-OFFS	SAMPLING LENGTH/ EVALUATION LENGTH
Spacing Distance Sm (mm)	R_z (µm)	R_a (µm)	lc (mm)	lc/L (mm)
>0.013 to 0.04	(0.025) to 0.1	(0.006) to 0.02	0.08	0.08/0.4
>0.04 to 0.13	>0.1 to 0.5	>0.02 to 0.1	0.25	0.25/1.25
>0.13 to 0.4	>0.5 to 10	>0.1 to 2	0.8	0.8/4
>0.4 to 1.3	>10 to 50	>2 to 10	2.5	2.5/12.5
>1.3 to 4	>50 to 200	>10 to 80	8	8/40

If not otherwise indicated on a drawing, the above table should be used to determine the proper cut-off (lc).

Amplitude Parameters



R_a, R_q, W_a, W_q, P_a, P_q

l_1 - l_5 are consecutive and equal sampling lengths (l the sampling length corresponds to filter cut-off length λ_C).

The assessment length l is defined as the length of profile used for the measurement of surface roughness parameters (usually containing several sampling lengths; five consecutive sampling lengths are taken as standard).

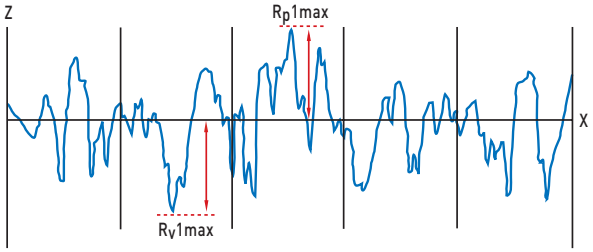
R_a is the universally recognised, and most used, international parameter of roughness. It is the arithmetic mean of the absolute departures of the roughness profile from the mean line.

$$Ra = \frac{1}{l}\int_0^l \left| z(x) \right| dx$$

R_q is the rms parameter corresponding to R_a

$$Rq = \sqrt{\frac{1}{l}\int_0^l z^2(x)\, dx}$$

W_a, W_q, P_a and **P_q** are the corresponding parameters from the waviness and primary profiles, respectively.



R_v, R_p, R_t, W_v, W_p, W_t, P_v, P_p, P_t

***R_v** is the maximum depth of the profile below the mean line within the sampling length.

***R_p** is the maximum height of the profile above the mean line within the sampling length.

***$R_z = R_p + R_v$** and is the maximum peak to valley height of the profile within a sampling length.

R_t is the maximum peak to valley height of the profile in the assessment length.

R_p1max is the largest of the individual peak to mean from each sample length.

W_v, W_p, W_z, W_t, P_v, P_p, P_z and **P_t** are the corresponding parameters from the waviness and primary profiles, respectively.

*Note, almost all parameters are defined over one sample length, however in practice more than one sample length is assessed (usually five) and the mean calculated. This provides a better statistical estimate of the parameter's measured value.

Reference

The information on pages 6 and 7 is taken from Taylor Hobson's **"A Guide to Surface Texture Parameters"**.

To request a free copy of this informative 16 page booklet, please visit our website at **www.taylor-hobson.com**

At Taylor Hobson we don't sell products - we provide solutions. Whatever our customers' measuring needs, we will find a solution to meet them.

Our reputation for excellence is based on more than 100 years of metrology design and manufacturing experience. Add to this our worldwide coverage, our after sales support and our commitment to customer care and you have a company which provides its customers with total peace of mind.

The Taylor Hobson service:

Special applications
We have a team of engineers who provide a design service for dedicated metrology solutions. This can involve customising standard Taylor Hobson instruments to meet specific requirements or designing unique products.

For details of your local support center phone
+44 116 246 3034 or e-mail sales@taylor-hobson.com

After sales support
To ensure that all our products are maintained to the standards you require, we offer a range of after sales service packages. They include an on-site calibration service, field service and a refit and upgrade service.

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For details of your local support center phone
+44 116 246 3135 or email service@taylor-hobson.com

Spectrum Metrology
Customers with measurement needs often require not only equipment but also advice on solving a specific manufacturing or measurement problem. Spectrum Metrology provides rapid technical and application support via phone, fax & e-mail. A full demonstration facility is available at Spectrum Metrology's demonstration room.

Spectrum Metrology can be contacted on
Tel: +44 0116 276 6262
Fax: +44 0116 276 6868
E-mail: sales@spectrum-metrology.co.uk
Internet: www.spectrum-metrology.co.uk
Unit 8 Ireton Avenue, Leicester, LE4 9EU, England

UKAS CALIBRATION
No. 0026

UL REGISTERED FIRM
UKAS QUALITY MANAGEMENT
062
TAYLOR HOBSON
A8248 ISO9001

Taylor Hobson France
Rond Point de l'Epine des Champs
Bâtiment D, 78990 ELANCOURT, France
Tel: +33 130 68 89 30 Fax: +33 130 68 89 39
e-mail: contact@taylor-hobson.fr

Taylor Hobson Germany
Postfach 4827, Kreuzberger Ring 6
65205 Wiesbaden, Germany
Tel: +49 611 973040 Fax: +49 611 97304600
e-mail: info@taylor-hobson.de

Taylor Hobson Italy
Via De Barzi
20087 Robecco sul Naviglio, Milan, Italy
Tel: +39 02 94693401 Fax: +39 02 94693450
e-mail: mail@taylor-hobson.it

Taylor Hobson Japan
Sankyo Meguro Building 5-37, 4-Chome
Kamiosaki, Shinagawa-Ku, Tokyo 141-0021, Japan
Tel: +81 33494 5110 Fax: +81 33490 5119
e-mail: mail-box@taylor-hobson.co.jp

Taylor Hobson Korea
Hungkuk Life Building. 5th Floor 6-7, Soonae Dong
Pundang-Ku, Seongnam, Kyungki-Do, 463-020, Korea
Tel: +82 31 713 1371 Fax: +82 31 713 1372
e-mail: thkorea@kornet.net

Taylor Hobson China Beijing Office
Room 2305, CITIC Building 19
Jianguomenwai Dajie, Beijing, 100004, China
Tel: +00 86 10 8526 2111 Fax: +00 86 10 8526 2141
e-mail: sales.bj@taylor-hobson.com

Taylor Hobson China Shanghai Office
Room 408, Metro Tower, No 13 Tian
Yao Qiao Road, Shanghai, 200030, China
Tel: +00 86 21 6426 7049 Fax: +00 86 21 6426 7054
e-mail: sales.sh@taylor-hobson.com

Taylor Hobson USA
1725 Western Drive
West Chicago, Illinois 60185, USA
Tel: +1 630 621 3099 Fax: +1 630 231 1739
e-mail: sales@taylorhobson.us

Taylor Hobson PRECISION

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
e-mail: sales@taylor-hobson.com
www.taylor-hobson.com

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