

Surtronic Duo

A portable measurement instrument
for checking surface roughness



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.

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

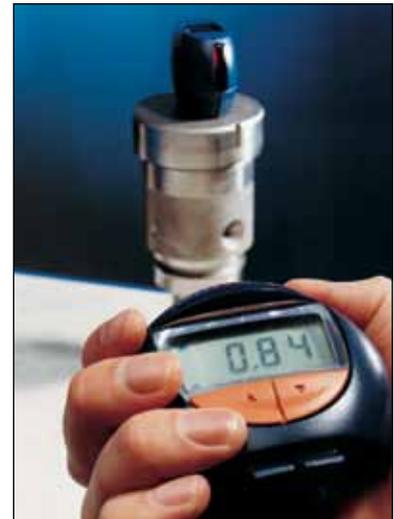
Surtronic Duo keeps the process simple. It is the perfect tool for any inspector to check roughness anywhere.

- 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.

5 parameters as standard:

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

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

Standard delivery scope:

- 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 112/3115-01 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 $5\mu\text{m}$ ($200\mu\text{in}$) 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 $2\mu\text{m}$ ($80\mu\text{in}$). 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.

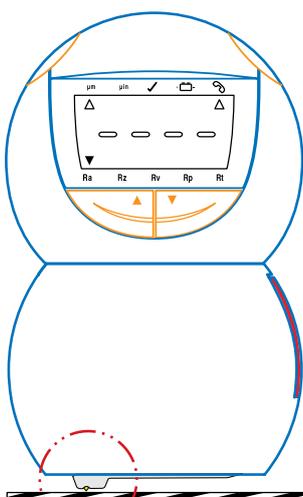
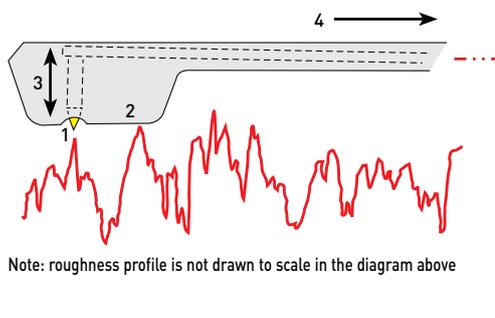


Figure 1

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



Other Taylor Hobson Products

Surtronic® S100-series offers high speed roughness with a large display and simple menu structure. Battery powered and offering total portability with a built-in memory for up to 100 readings.

- Unique stylus lift for total flexibility
- Long traverse length & extended pick-up reach
- Powerful PC software included

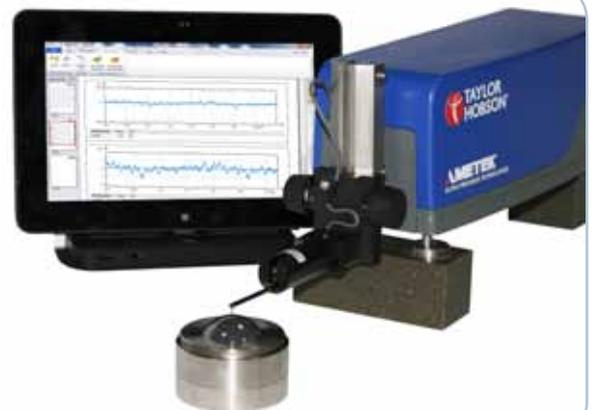
Features	
Gauge range / resolution	400 µm (0.012 in) / 0.01 µm (0.4 µin)
Accuracy (5 µm diamond tip)	1% of reading + LSD µm



IntraTouch measures roughness, waviness and contour. A low cost, portable system for high level surface texture analysis on the shop floor.

- 50mm (1.97in) traverse with straightness datum
- Automatic calibration over a sphere ensures that radius and form measurements are correct

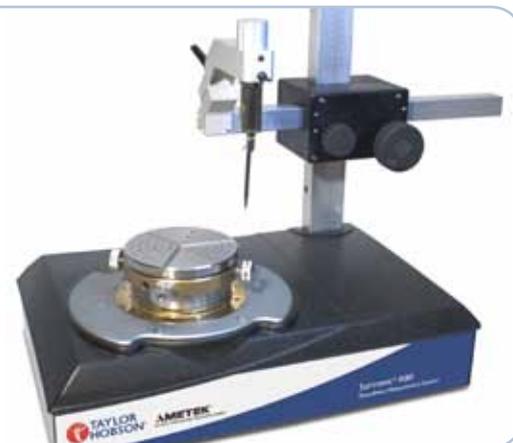
Features	
Gauge range / resolution	16 nm @ 1mm range (0.63 µin @ 0.04 in) / 3 nm @ 0.2 mm range (0.12 µin @ 0.008 in)
Straightness accuracy	0.2 µm over any 20 mm (8 µin over any 0.78 in)



The Surtronic® R-50/R-80 is robust enough for the shop floor but accurate for any inspection area, giving a flexible solution for all roundness and form measurements.

- Patented gauge orientation
- Robust enough for 24/7 operation
- Easy-to-use touchscreen software

Features	
Gauge resolution	30 nm (1.18 µin)
Spindle accuracy	±25 nm (0.98 µin)



Surtronic® R-100 Series builds on the robustness and ease-of-use of the R-50/R-80, offering a higher throughput and improved feature set that includes advanced harmonic analyses and a higher gauge resolution.

- Robust, fast and easy-to-use
- Includes Rapid Centre™ *
- Throughput 3 parts/minute including set-up

Features	
Gauge resolution	6 nm (0.24 µin)
Spindle accuracy	±25 nm (0.98 µin)



* Centering attachment is supplied as standard with R-120/R-125 models, or available to purchase as an accessory on other models.

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 T_n (e.g. R_p), 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 T_nN , e.g. R_{p2} .

Max Rule - If a parameter also displays max (e.g. R_{z1max}) then the measured value shall not be greater than the specified tolerance value. If max is not displayed (e.g. R_p) then 16% of the measured values are allowed to be greater than the specified tolerance value.

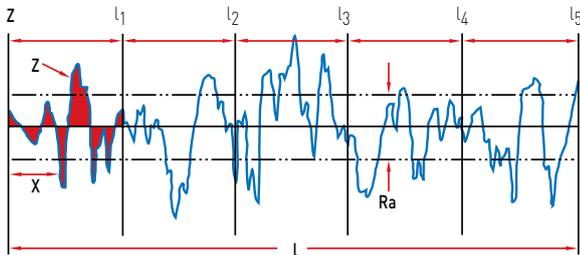
See ISO 4288-1996 for more details of the Max and 16% rules.

RECOMMENDED CUT-OFF ISO 4288-1996

PERIODIC PROFILES	NON-PERIODIC PROFILES		CUT-OFFS	SAMPLING LENGTH/ EVALUATION LENGTH
Spacing Distance S_m (mm)	R_z (μm)	R_a (μm)	l_c (mm)	l_c/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 (l_c).

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).

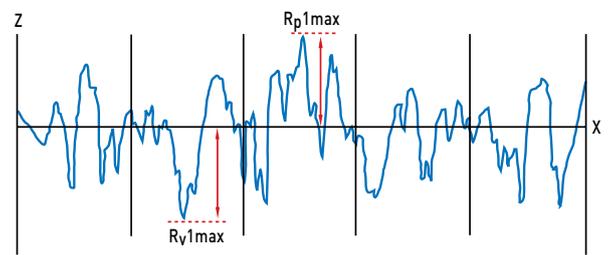
R_a is the universally recognised, and most used, international parameter of roughness. It is the arithmetic mean of the absolute departures of the roughness profile from the mean line.

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

R_q is the rms parameter corresponding to **R_a**

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

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

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.

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



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