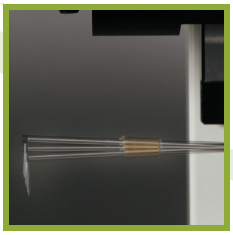
# SURFCOM CONTOURECORD

## *Linear DX3/SD3 Series*



TOKYO SEIMITSU

# SURFCOM CONTURECORD

# Works for you

We have prepared a lineup that answers to you needs in terms of surface texture and contour measuring instruments
Choose one that best fits to your purpose.

It's a measuring machine that finds out correlation with the material, process, function, and performance as well as optimum management by precisely capturing the minutely changing surface profile (the range between several nanometer and several tenth micrometer) in 2-D and 3-D image data and through quantitative measurement.

## New concept software ACCTee

### World first

Adopting a linear motor driving unit in the surface roughness measurement machine and the contour profile measurement machine

### Hybrid

Equipped with a wide-range roughness contour integrated detector (S2000DX3/SD3)

### Eco-product

Adoption of new design for space-saving feature

### Highly accurate roughness analysis

The high performance roughness detector provides the maximum 500,000 magnification (S1500DX3/SD3 S1900DX3/SD3 S2000DX3/SD3)

### Highly accurate contour analysis

The contour detector (analog) surpasses digital devices in terms of accuracy (C1700DX3/SD3 S1900DX3/SD3)

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## Surface roughness measurement

- The feel of the surface of physical objects is often expressed as “smooth” or “rough” however, there are minute convexes and concaves on the surface. The surface roughness means the parameter expressing the degree of such minute convexes and concaves.

- The purpose of the surface roughness measurement is to help the improvement of product quality control and cost management. Following are the typical items that affect the function and performance of machines.

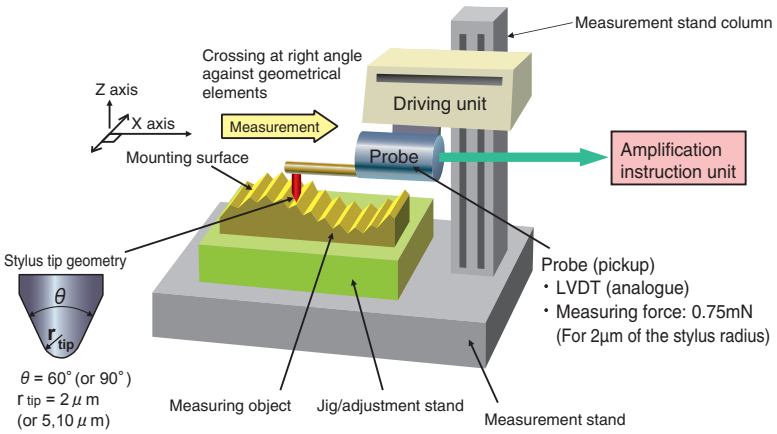
| Required function | Pertinent work | Example of evaluation parameter |
|---|---|---|
| Air resistance | Valve cock | Ra, Rq, Sm, Rpk |
| Wear-out | Cam and bearing | Rp and Tp load curve |
| Lubricity | Honing surface | Rv and Tp load curve |
| Noise and vibration | Gear and ball screw | Rz, Pt, and power graph |
| Sharpness | Cold rolled steel sheet and plate | Ra, Wca, Pc |
| Adhesiveness | Painting groundwork | Rzjis, Rz |
| Appearance and luster | Plating surface and pattern surface | Ra, Rq, Wca, Wcm |
| Optical performance | Lens and prism | Ra, Rq |
| Strength against fatigue failure | Crank shaft | Pt, Rv, Rvk |
| Touch | Knurl and pear skin surface | Rz, Pc, and power graph |
| Electric resistance | Relay and connector | Ra, Hsc, Tp, Mr1 |

### Difference of surface

Example of “smooth” surface

Example of “rough” surface

### Basic structure of the surface roughness measurement machine

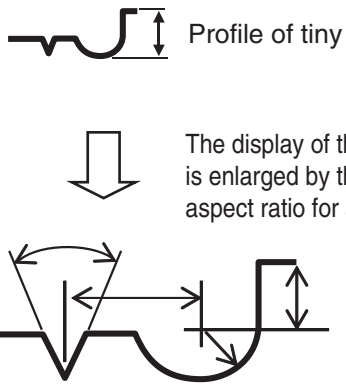



## Contour profile measurement

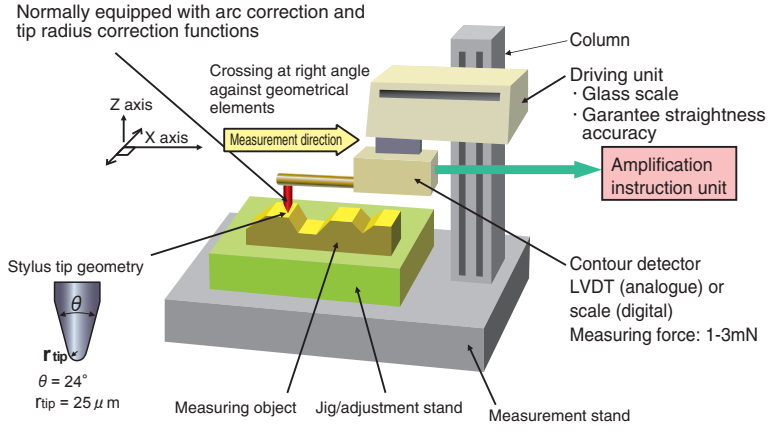
The contour profile means the profile (sectional contour) traced along the ridge line of the appearance and figure of an entire physical object.

The contour profile measurement machine is used for making a dimension measurement evaluation by tracing a surface (marked by stylus) and enlarging the profile.
The machine is useful for measuring such objects as: the convexes and concaves which are difficult to be measured or inspected by projector; inner profile of a hole; and tiny objects which is difficult to apply a stylus by 3-D coordinate measuring machine.

### Measurement analysis of contour profile




### Basic structure of the contour profile measurement machine



# Line up of Surfcom and Contourecord series

| Classification | Linear Series Measuring instrument Models | Measuring Function | | Sensing Types of Detector | | | | Style | | Main Specifications | | | | Export license |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Roughness | Contour | Analog Roughness | Analog Contour | Digital Contour | Integrated Analog | All-in-One | Separate | Detector Stroke (Z) | Indication Accuracy of Contour (Z) | Resolution of Detector (Z) | Tracing driver (X) | |
| Roughness |  SURFCOM1500DX3 | ● | | ● | | | | ● | | 1000μm | — | 0.1~10nm | 0.05+1L/1000μm | Not reqiured |
| |  SURFCOM1500SD3 | ● | | ● | | | | | ● | | | | | Not reqiured |
| Contour |  CONTOURECORD1700DX3 | | ● | | ● | | | ● | | 50mm | ±(1.8+I2HI/100)μm | 0.1~1μm | 1μm/100mm (2μm/200mm) | Required |
| |  CONTOURECORD1700SD3 | | ● | | ● | | | | ● | | | | | Required |
| |  CONTOURECORD2700DX3 | | ● | | | ● | | ● | | | ±(0.8+I2HI/100)μm | 0.025μm | | Not reqiured |
| |  CONTOURECORD2700SD3 | | ● | | | ● | | | ● | | | | | Not reqiured |
| Roughness/ Contour (Hybrid Detector) |  SURFCOM1900DX3 (S1500+C1700) | ● | ● | ● | ● | | | ● | | Roughness: 1000μm Contour : 50mm | ±(1.8+I2HI/100)μm | Roughness : 0.1~10nm Contour: 0.1~1μm | Roughness : 0.05+1L/1000μm Contour: 1μm/100mm (2μm/200mm) | Required |
| |  SURFCOM1900SD3 (S1500+C1700) | ● | ● | ● | ● | | | | ● | | | | | Required |
| |  SURFCOM2900DX3 (S1500+C2700) | ● | ● | ● | | ● | | ● | | | ±(0.8+I2HI/100)μm | Roughness : 0.1~10nm Contour: 0.025μm | | Not reqiured |
| |  SURFCOM2900SD3 (S1500+C2700) | ● | ● | ● | | ● | | | ● | | | | | Not reqiured |
| Roughness/ Contour (Integrated Detector) |  SURFCOM2000DX3 | ● | ● | | | | ● | ● | | 5mm | ±(2.5+I2HI/100)μm | 0.8~80nm | 0.05+1L/1000μm | Required |
| |  SURFCOM2000SD3 | ● | ● | | | | ● | | ● | | | | | Required |

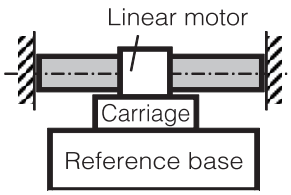
★ In case of export, please contact us.

# Product feature (surface roughness and contour profile measurement machine)

## Thoroughly pursuing low vibration, durability, and operability – The linear drive unit of the new generation

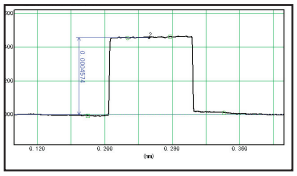
### Structure

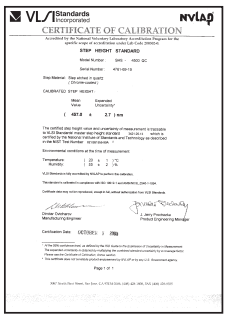
The simple structure of the linear motor unit with a non-contact driving unit and without feed screws or gearboxes, the linear motor ensures a long-term stable operation with less vibration.
Due to the adoption of the linear motor, the vibration is reduced to less than one-fifth (Ra=1nm) of the conventional machines and it is understood that the vibration is relatively small even changing the speed.
Because of the structure of the machine, the factor for backlash is also reduced which improved the response.




### Low vibration and high accuracy

First-ever of the world, Tokyo Seimitsu has introduced a high accurate linear motor in the driving unit (patent applied for). We have cleared the "limit of high accuracy" of the fundamental structure.
The linear motor is also suitable for reciprocation movement and provides accurate locating and high-speed measurement.
Because of the simple structure of the linear driving unit composing only the linear motor and the scale, the machine provides high response and high accurate locating operation.

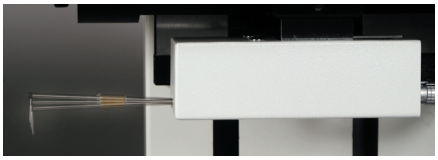





## The detector lineup for high accurate measurement

### Surfcom 2000 series

Wide-range pickup (hybrid detector)

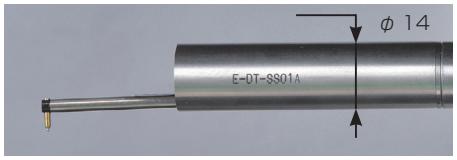


The high-range detector performs evaluation, analysis, and printing automatically by once measuring the surface roughness or contour profile.
Since the another detector can be added, the measurement range of one measurement machine can be expanded.
Example 1: S1900 + Hybrid
Example 2: S2000 + roughness + contour

| | |
|---|---|
| Measuring force | : 0.75mN |
| Measurement range | : 5mm |
| Instruction accuracy | :±(2.5+\|2H\|/100)μm |
| Minimum resolution | : 0.0008μm |

### Surfcom 1500 series

Roughness pickup for large magnification

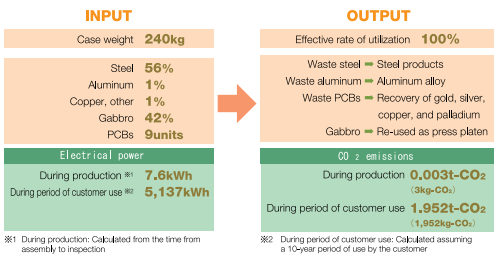



Achieving the measurement range of 1000μm for roughness measurement, minute contour and rough alignment measurement can be provided.
In order to support large magnification measurement for high precision processed part, the machine provides maximum 500,000 magnification.

| | |
|---|---|
| Measuring force | : 0.75mN |
| Measurement range | : 1000μm |
| Measurement magnification | : 0.0001μm |
| Measurement magnification | : x 500,000 |
| Outer diameter | : ϕ 14mm |

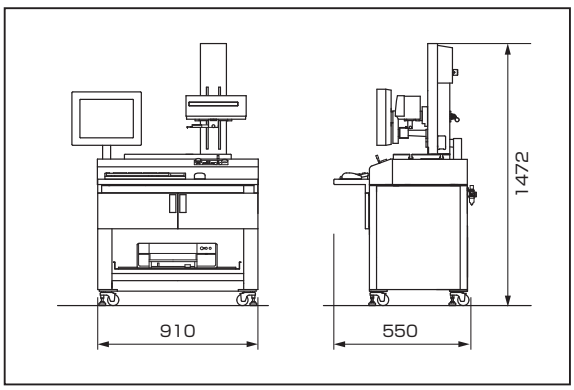
## Eco-product

For making products, we have to think about various impacts on the environment. Tokyo Seimitsu group place an obligation for environmental compliance of a certain degree or more on our newly developed products, and set a goal of producing environmental-friendly products including semi-conductors, measurement devices, parts, and other elements.
The CO2 exhaust is calculated for each product, trying to abate the environmental burden ranging from the material procurement to the abandonment.



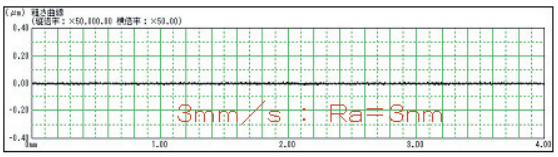

### Space-saving DX design

- Space-saving feature for linear DX design
- For the space-saving feature, the installation site can be utilized effectively.
- The installation size for linear DX design: 910x550=0.5㎡



## Maintenance-free

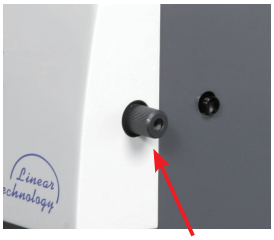
The slide between the core and shaft is a no contact drive type, as the linear motor is not attached with ball screws and gear boxes. The maintenance-free feature is provided by means of no wear-out and no vibration (sound) mechanism.
The user's maintenance free is also achieved by improving the material and working accuracy of the sliding surfaces, low friction property, and wear and abrasion resistance.
The minute surfacing objects generated by oil slick can be eliminated for avoiding the impact on the straightness measurement and evaluation.




## Operation

### Improved operability with multi operation

The joystick lever and the JOG dial of the operation panel, and the manual feed switch at the driving unit side can be concurrently used. These three modes can be switched freely depending on the profile to be measured and for the relocation to the measurement position.

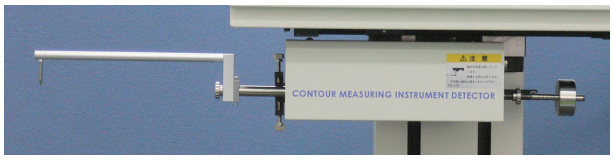


Manual feed switch

Joystick JOG dial

## Contourecord 1700 series

High accuracy contour detector (analog)




### Uniting of analogue and digital

The contour detector, Contourecord 1700, is an analog detector of the differential motion inductance method. In our effort of trying to develop high accuracy products focusing on this analog high resolution characteristic, we have succeeded in produce high accuracy analog contour detector which is unique in the world by introducing software correction technique in addition to the improvement of the inner structure.

| | |
|---|---|
| Standard measuring force adjustable range | : 10 ～ 30mN |
| Low measuring force adjustable range | : 2-10mN (option) |
| Measurement range | : 50mm |
| Instruction accuracy | : ±(1.8+\|2H\|/100)µm |
| Minimum resolution | : 0.1µm |

## Contourecord 2700 series

High accuracy contour detector (digital)

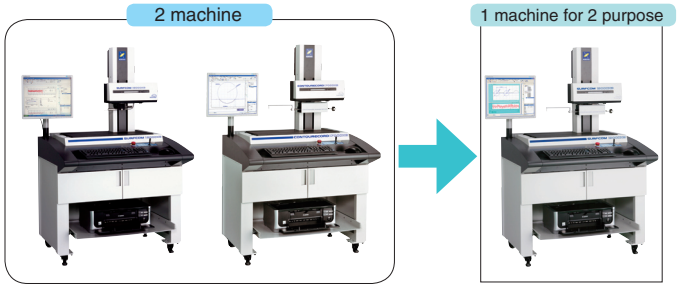

### High accuracy

The contour detector, Contourecord 2700, is a detector of high accuracy equipped with a laser beam analysis scale.
Achieving 0.025µm for minimum resolution, the machine provides the high accuracy measurement covering the entire detection range of 50mm in the Z direction.

| | |
|---|---|
| Measuring force adjustable range | : 10 ～ 30mN |
| Measurement range | : 50mm |
| Instruction accuracy | : ±(0.8+\|2H\|/100)µm |
| Minimum resolution | : 0.025µm |

## Compound machine

- Space-saving feature for compound and integrated machine




Surface roughness measurement machine (S1500DX3)
Contour profile measurement machine (C1700DX3)
Surface roughness + contour profile measurement machine (S1900DX3)

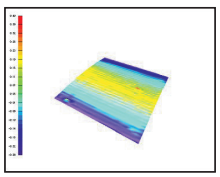
A compound machine or an integrated machine can provide the features of two machines with less installation space and with less cost.

## Linear fast relocation

### High speed measurement for the significant improvement of productivity.

- Achieving incomparable high speed (roughness measurement: max. 3mm/s, waviness profile curve measurement: max.20mm/s, and wave speed measurement: 60mm/s) , the machine provides automatic operation including the measurement, analysis, and result print, which may improve the efficiency of the measurement 5 to 10 times. (compared with another product of ours)

- The 3-D roughness measurement can make an evaluation based on the surface by repeating the scanning motion of the detector. For the measurement of maximum 2000 lines, the measurement time can be reduced up to 30 to 50 percent comparing with the conventional method. High speed measurement for the significant improvement of productivity.



Glass Flatness Measurement

| | |
|---|---|
| Measuring Range | 20 mm x 20 mm<br>1000 Lines (Y-direction) |
| Conventional Instrument | 165 minutes |
| S1500DX-3DF | 22 minutes |

# SURFCOM 2000DX3/SD3

As the standard equipment, the machine is equipped with the detectors for measuring the surface roughness and contour profile, which enables the evaluation, analysis, and printing for the roughness measurement and contour profile measurement with one unit, leading to the improvement of the workability.
For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.

## SURFCOM 2000DX3

## SURFCOM 2000SD3

*Printer is optional.

### ■High-accuracy, Wide-range Detector Built-in

Measuring range　Z-axis direction: 5mm range (Resolution: 80nm) to 0.05mm range (Resolution: 0.8nm)
Indication Accuracy　Z-axis direction: ±2.5 + 2 |H| / 100μm　H = detector measuring range: ±2.5mm

### ■New Linear Motor Drive (Patent pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement. A simple configuration and non-contact driver also maintains stability over long term operation.

### ■High-speed measurement for Dramatically Improved Productivity

Roughness Measurement: 3mm/s max.; Contour Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

**Specifications**

| Model | | | SURFCOM 2000DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | Z-axis (vertical) | | 5mm/Standard arm; 10mm/2 X arm | | | | | | | |
| | X-axis (horizontal) | | 100mm | | | | 200mm | | | |
| Accuracy | Detectors | Z-axis indication accuracy (vertical) | ±(2.5+｜2H｜/100)μm (H: Measuring Height mm) | | | | | | | |
| | | Resolution | 0.8nm/0.05mm range, 3.2nm/0.2mm range, 8nm/0.5mm range, 16nm/1mm range, 32nm/2mm range, 80nm/5mm range | | | | | | | |
| | X-axis | Indication accuracy (horizontal) / Min Pitch | ±(1.0+1L/100)μm (L: Measuring length mm) / Min 0.1μm | | | | | | | |
| | Tracing driver | Scale Resolution | 0.016μm | | | | | | | |
| Straightness accuracy | | | (0.05+1.0L/1000)μm (L: Measuring length mm) | | | | | | | |
| Sensing method | | | Z-axis (vertical direction): differential transducer; X-axis (horizontal direction): linear scale | | | | | | | |
| Speed | Column up/down speed (Z-axis) | | 3~10mm/s | | | | | | | |
| | Speed (X-axis) | | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | Stylus, Measuring Force | | Changeable, Retract function | | | | | | | |
| | Stylus radius (Stylus material) | | 2μmR(60°conical diamond)0.75mN, 25μm(24°conical super-solder)5mN, one equipped as standard for each | | | | | | | |
| Moving range | Pickup movement drive distance | | 100mm | | | | 200mm | | | |
| | Column up/down stroke | | 250mm | 450mm | | 650mm | 250mm | 450mm | | 650mm |
| Stone table dimensions and weight | Dimensions | | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | Max. load★ | | 37kg | 28kg | 93kg | 84kg | 31kg | 22kg | 87kg | 78kg |
| Dimensions and weight※★ | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | Height | 1480mm | 1680mm | | 1880mm | 1480mm | 1680mm | | 1880mm |
| | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

★ Dimensions and weight are for the DX type.

# SURFCOM 1500DX3/SD3

Introducing the high accuracy linear motor for the surface roughness measurement machine first-ever of the world.
Achieving the world class low vibration, which allows high accuracy and large magnification measurement.
For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.

## SURFCOM 1500DX3

## SURFCOM 1500SD3

*Printer is optional.

### ■High-Performance Compact Pickup

A new compact built-in pickup allows high-magnification, wide area measuring.
The measuring range is 1000µm with an outside diameter of 14 mm, and a measuring magnification of 500,000 times.

### ■New Linear Motor Drive (Patent Pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement.
A simple configuration (no feed screw or gear box) and non-contact driver also maintains stability over long term operation.

### ■High-speed Measurement for Dramatically Improved Productivity

Roughness Measurement: 3mm/s max.; Waviness Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

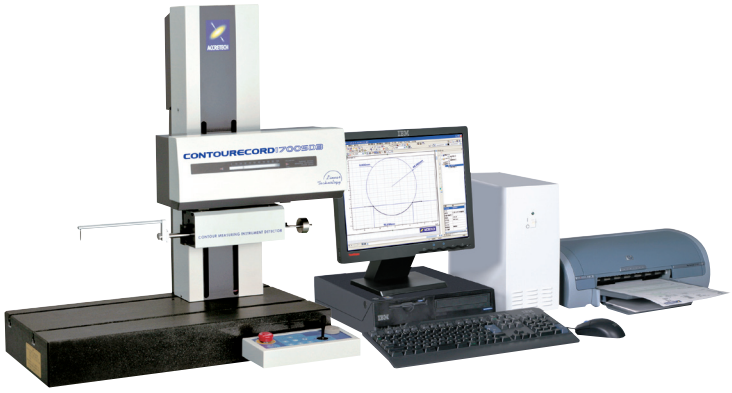
**Specifications**

| Model | | | SURFCOM 1500DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | Z-axis (vertical) | | 1000µm | | | | | | | |
| | X-axis (horizontal) | | 100mm | | | | 200mm | | | |
| Accuracy | Detectors | Measuring Resolution | 0.01µm/1000µm range ~0.0001µm/6.4µm range | | | | | | | |
| | X-axis | Resolution | 0.04µm or 32,000 points (300,000 data uptake points) | | | | | | | |
| | Tracing driver | Scale Resolution | 0.016µm | | | | | | | |
| Straightness accuracy | | | (0.05+1.0L/1000)µm (L: Measuring length mm) | | | | | | | |
| Sensing method | | | Z-axis (vertical direction): differential transducer; X-axis (horizontal direction): linear scale | | | | | | | |
| Speed | Column up/down speed (Z-axis) | | 3~10mm/s | | | | | | | |
| | Speed (X-axis) | | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | Stylus, Measuring Force | | Changeable, 0.75mN | | | | | | | |
| | Stylus radius (Stylus material) | | 2µmR(60°conical diamond), one equipped as standard | | | | | | | |
| Moving range | Pickup movement drive distance | | 100mm | | | | 200mm | | | |
| | Column up/down stroke | | 250mm | 450mm | | 650mm | 250mm | 450mm | | 650mm |
| Stone table dimensions and weight | Dimensions | | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | Max. load★ | | 38kg | 29kg | 94kg | 85kg | 32kg | 23kg | 88kg | 79kg |
| Dimensions and weight※★ | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | Height | 1480mm | 1680mm | | 1880mm | 1480mm | 1680mm | | 1880mm |
| | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

★ Dimensions and weight are for the DX type.

# CONTOURECORD 1700DX3/SD3


Achieving the high accuracy contour detector.
Surpassing the digital counterpart, the analog detector achieves the accuracy of higher level.
For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.




## CONTOURECORD 1700DX3

## CONTOURECORD 1700SD3

*Printer is optional.

### ■Easy Evaluation of General-Purpose Part Contours

Contours of parts that normally have been evaluated on a projector of tool microscope now can be obtained quickly and easily. Measured results can be incorporated into inspection reports.

### ■New Linear Motor Drive (Patent Pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement. A simple configuration (no feed screw or gear box) and non-contact driver also maintains stability over long term operation.

### ■High-speed Measurement for Dramatically Improved Productivity

Contour Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

**Specifications**

| Model | | | CONTOURECORD 1700DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | | Z-axis (vertical) | 50mm | | | | | | | |
| | | X-axis (horizontal) | 100mm | | | | 200mm | | | |
| Accuracy | Detectors | Z-axis indication accuracy (vertical) | ±(1.8+ \| 2H \| /100)μm (H: Measuring Height mm) | | | | | | | |
| | | Resolution | 0.1μm/5mm range, 0.4μm/20mm range, 1μm/50mm range | | | | | | | |
| | X-axis | Indication accuracy (horizontal) / Min Pitch | ±(1.0+1L/100)μm (L: Measuring length mm) / Min 0.1μm | | | | | | | |
| | Tracing driver | Scale Resolution | 0.016μm | | | | | | | |
| Straightness accuracy | | | 1μm/100mm | | | | 2μm/200mm | | | |
| Sensing method | | X-axis (horizontal) | Linear scale | | | | | | | |
| | | Z-axis (vertical) | Differential transducer (trans) | | | | | | | |
| Speed | | Column up/down speed (Z-axis) | 3~10mm/s | | | | | | | |
| | | Speed (X-axis) | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | | Stylus, Measuring Force | Changeable, 30mN, Retract function | | | | | | | |
| | | Stylus radius (Stylus material) | 25μm(24°conical super-solder), two equipped as standard | | | | | | | |
| | | Measuring Direction, Orientation | Pull/push and Up/down directions, Maximum following angle:77° | | | | | | | |
| Moving range | | Pickup movement drive distance | 100mm | | | | 200mm | | | |
| | | Column up/down stroke | 244mm | 444mm | | 644mm | 244mm | 444mm | | 644mm |
| Stone table dimensions and weight | | Dimensions | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | | Max. load★ | 37kg | 28kg | 93kg | 84kg | 31kg | 22kg | 87kg | 78kg |
| Dimensions and weight※★ | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | Height | 1480mm | 1680mm | | 1880mm | 1480mm | 1680mm | | 1880mm |
| | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

★ Dimensions and weight are for the DX type.

# SURFCOM 1900DX3/SD3

As the standard equipment, the machine is equipped with the detectors for measuring the surface roughness and contour profile, which enables the evaluation, analysis, and printing for the roughness measurement and contour profile measurement with one unit, leading to the improvement of the workability. For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.

## SURFCOM 1900DX3

## SURFCOM 1900SD3

*Printer is optional.

### ■Higher Precision ··· Allows measuring of workpiece contours that are impossible for other instruments

Measuring accuracy of 1.8µm provides plenty of accuracy for molds and other precision components. A level of measuring accuracy that is normally associated with high-end machines greatly broadens the range of possible appplications.

### ■New Linear Motor Drive (Patent Pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement.
A simple configuration (no feed screw or gear box) and non-contact driver also maintains stability over long term operation.

### ■High-speed Measurement for Dramatically Improved Productivity

Roughness Measurement: 3mm/s max.; Contour Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

**Specifications**

| Model | | | | SURFCOM 1900DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | | Z-axis (vertical) | | 50mm | | | | | | | |
| | | X-axis (horizontal) | | 100mm | | | | 200mm | | | |
| Accuracy | Roughness | Detectors | Measuring Resolution | 0.01µm/1000µm range ~0.0001µm/6.4µm range | | | | | | | |
| | | Tracing driver | X-axis Resolution | 0.04µm or 32,000 points (300,000 data uptake points) | | | | | | | |
| | Contour | Detectors | Z-axis indication accuracy (vertical) | ±(1.8+\|2H\|/100)µm (H: Measuring Height mm) | | | | | | | |
| | | | Resolution | 0.1µm/5mm range, 0.4µm/20mm range, 1µm/50mm range | | | | | | | |
| | | X-axis | Indication accuracy (horizontal) / Min Pitch | ±(1.0+1L/100)µm (L: Measuring length mm) / Min 0.1µm | | | | | | | |
| | Tracing driver | | Scale Resolution | 0.016µm | | | | | | | |
| Straightness accuracy | | | | Roughness System: (0.05+1.0L/1000)µm (L: Measuring length mm), Contour System: 1µm/100mm , 2µm/200mm | | | | | | | |
| Sensing method | | X-axis (horizontal) | | Linear scale | | | | | | | |
| | | Z-axis (vertical) | Roughness Detector | Differential transducer (trans) | | | | | | | |
| | | | Contour Detector | Differential transducer (trans) | | | | | | | |
| Speed | | Column up/down speed (Z-axis) | | 3~10mm/s | | | | | | | |
| | | Speed (X-axis) | | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | Roughness | Stylus, Measuring Force | | Changeable, 0.75mN | | | | | | | |
| | | Stylus radius (Stylus material) | | 2µmR(60°conical diamond), one equipped as standard | | | | | | | |
| | Contour | Stylus, Measuring Force | | Changeable, 30mN, Retract function | | | | | | | |
| | | Stylus radius (Stylus material) | | 25µm(24°conical super-solder), two equipped as standard | | | | | | | |
| | | Measuring Direction, Orientation | | Pull/push and Up/down directions, Maximum following angle :77° | | | | | | | |
| Moving range | | Pickup movement drive distance | | 100mm | | | | 200mm | | | |
| | | Column up/down stroke | | 244mm | 444mm | | 644mm | 244mm | 444mm | | 644mm |
| Stone table dimensions and weight | | Dimensions | | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | | Max. load★ | | 37kg | 28kg | 93kg | 84kg | 31kg | 22kg | 87kg | 78kg |
| Dimensions and weight※★ | | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | | Height | 1480mm | 1680mm | | 1880kg | 1480mm | 1680mm | | 1880kg |
| | | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

★ Dimensions and weight are for the DX type.

# CONTOURECORD 2700DX3/SD3

Equipped with high accuracy contour detector.
Introducing the laser beam diffraction scale that achieves the resolution of 0.025µm.
For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.

## CONTOURECORD 2700DX3

## CONTOURECORD 2700SD3

*Printer is optional.

### ■High-accuracy Contour Detector Using Laser Optical Diffraction Scale

Indication accuracy of detectors : ±(0.8+|2H|/100)µm, Resolution : 0.025µm (the entire range). The system can measured and evaluated the contour of a precision manufacturing component at high accuracy.

### ■New Linear Motor Drive (Patent Pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement.
A simple configuration (no feed screw or gear box) and non-contact driver also maintains stability over long term operation.

### ■High-speed Measurement for Dramatically Improved Productivity

Contour Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

**Specifications**

| Model | | | CONTOURECORD 2700DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | | Z-axis (vertical) | 50mm | | | | | | | |
| | | X-axis (horizontal) | 100mm | | | | 200mm | | | |
| Accuracy | Detectors | Z-axis indication accuracy (vertical) | ±(0.8+\|2H\|/100)µm (H: Measuring Height mm) | | | | | | | |
| | | Resolution | 0.025µm/Full range | | | | | | | |
| | X-axis | Indication accuracy (horizontal) / Min Pitch | ±(1.0+1L/100)µm (L: Measuring length mm) / Min 0.1µm | | | | | | | |
| | Tracing driver | Scale Resolution | 0.016µm | | | | | | | |
| Straightness accuracy | | | 1µm/100mm | | | | 2µm/200mm | | | |
| Sensing method | | X-axis (horizontal) | Linear scale | | | | | | | |
| | | Z-axis (vertical) | Laser optical diffraction scale | | | | | | | |
| Speed | | Column up/down speed (Z-axis) | 3~10mm/s | | | | | | | |
| | | Speed (X-axis) | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | | Stylus, Measuring Force | Changeable, 30mN, Retract function | | | | | | | |
| | | Stylus radius (Stylus material) | 25µm(24°conical super-solder), two equipped as standard | | | | | | | |
| | | Measuring Direction, Orientation | Pull/push and Up/down directions, Maximum following angle : 77° | | | | | | | |
| Moving range | | Pickup movement drive distance | 100mm | | | | 200mm | | | |
| | | Column up/down stroke | 226mm | 426mm | | 626mm | 226mm | 426mm | | 626mm |
| Stone table dimensions and weight | | Dimensions | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | | Max. load★ | 37kg | 28kg | 93kg | 84kg | 31kg | 22kg | 87kg | 78kg |
| Dimensions and weight※★ | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | Height | 1480mm | 1680mm | | 1880mm | 1480mm | 1680mm | | 1880mm |
| | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

★ Dimensions and weight are for the DX type.

# SURFCOM 2900DX3/SD3

The detector is equipped with the device for measuring the surface roughness and high accuracy contour profile.
Two tasks including the measurement of surface roughness and contour profile is achieved in one unit that provides high efficiency and high accurate evaluation.
For the space-saving design of the DX3 model, the measurement room can be utilized efficiently.

## SURFCOM 2900DX3

## SURFCOM 2900SD3

*Printer is optional.

### ■2-in-1 High-accuracy Measuring Instrument

Indication accuracy of contour detectors : ±(0.8+|2H|/100)μm, Resolution : 0.025μm (the entire range). Measuring magnification of roughness pickup : 50,000 times Max. The system can measured and evaluated the roughness and contour of a precision manufacturing component at high accuracy.

### ■New Linear Motor Drive (Patent Pending)

The new linear motor enables the fastest measurement speeds in the world and low vibration for stable, high-magnification measurement.
A simple configuration (no feed screw or gear box) and non-contact driver also maintains stability over long term operation.

### ■High-speed Measurement for Dramatically Improved Productivity

Roughness Measurement: 3mm/s max.; Contour Measurement: 20mm/s max.; Moving Speed: 60mm/s max.
Measurement Efficiency: 10 times better (compared with previous models)

**Specifications**

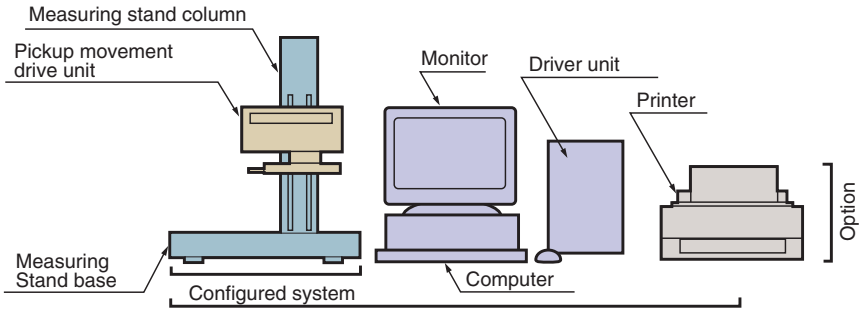
| Model | | | | SURFCOM 2900DX3/SD3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -12 | -13 | -14 | -15 | -22 | -23 | -24 | -25 |
| Measuring Range | | Z-axis (vertical) | | 50mm | | | | | | | |
| | | X-axis (horizontal) | | 100mm | | | | 200mm | | | |
| Accuracy | Roughness | Detectors | Measuring Resolution | 0.01μm/1000μm range ~0.0001μm/6.4μm range | | | | | | | |
| | | Tracing driver | X-axis Resolution | 0.04μm or 32,000 points (300,000 data uptake points) | | | | | | | |
| | Contour | Detectors | Z-axis indication accuracy (vertical) | ±(0.8+\|2H\|/100)μm (H: Measuring Height mm) | | | | | | | |
| | | | Resolution | 0.025μm/Full range | | | | | | | |
| | | X-axis | Indication accuracy (horizontal) / Min Pitch | ±(1.0+1L/100)μm (L: Measuring length mm) / Min 0.1μm | | | | | | | |
| | Tracing driver | | Scale Resolution | 0.016μm | | | | | | | |
| Straightness accuracy | | | | Roughness System: (0.05+1.0L/1000)μm (L: Measuring length mm), Contour System: 1μm/100mm , 2μm/200mm | | | | | | | |
| Sensing method | | X-axis (horizontal) | | Linear scale | | | | | | | |
| | | Z-axis (vertical) | Roughness Detector | Differential transducer (trans) | | | | | | | |
| | | | Contour Detector | Laser optical diffraction scale | | | | | | | |
| Speed | | Column up/down speed (Z-axis) | | 3~10mm/s | | | | | | | |
| | | Speed (X-axis) | | Measuring: 0.03~20mm/s, Movement: 60mm/s max. | | | | | | | |
| Detectors | Roughness | Stylus, Measuring Force | | Changeable, 0.75mN | | | | | | | |
| | | Stylus radius (Stylus material) | | 2μmR(60°conical diamond), one equipped as standard | | | | | | | |
| | Contour | Stylus, Measuring Force | | Changeable, 30mN, Retract function | | | | | | | |
| | | Stylus radius (Stylus material) | | 25μm(24°conical super-solder), two equipped as standard | | | | | | | |
| | | Measuring Direction, Orientation | | Pull/push and Up/down directions, Maximum following angle : 77° | | | | | | | |
| Moving range | | Pickup movement drive distance | | 100mm | | | | 200mm | | | |
| | | Column up/down stroke | | 226mm | 426mm | | 626mm | 226mm | 426mm | | 626mm |
| Stone table dimensions and weight | | Dimensions | | 600x320mm | | 1000x450mm | | 600x320mm | | 1000x450mm | |
| | | Max. load★ | | 37kg | 28kg | 93kg | 84kg | 31kg | 22kg | 87kg | 78kg |
| Dimensions and weight※★ | | Installation dimensions | Width | 1250mm | | 1650mm | | 1250mm | | 1650mm | |
| | | | Depth | 800mm | | 900mm | | 800mm | | 900mm | |
| | | | Height | 1480mm | 1680mm | | 1880mm | 1480mm | 1680mm | | 1880mm |
| | | Weight | | 225kg | 235kg | 420kg | 430kg | 230kg | 240kg | 425kg | 435kg |
| | | Power source/power consumption | | Single phase AC100~240V ±10% grounding required., 50/60Hz/670VA | | | | | | | |

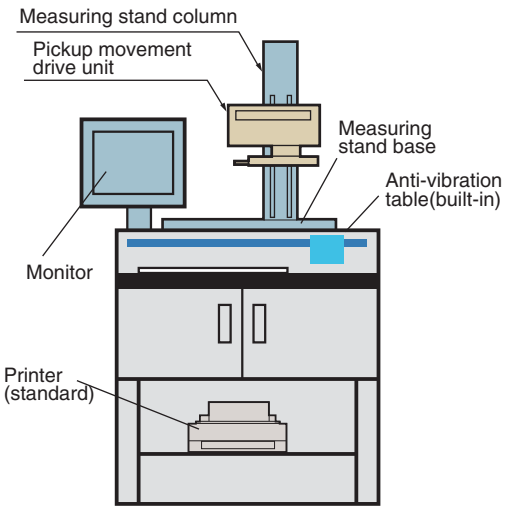
★ Dimensions and weight are for the DX type.

# System Configuration

SURFCOM ○○○○△△-□□
Drive unit
Measuring stand
Type(DX3/SD3)

S1500, C1700, C2700, S1900, S2900, S2000 Series




* The optional printer can be an A3/A4 printer, laser printer or color printer

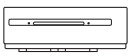
**SD3Model** **DX3Model**

## Drive

- 1□ Pickup movement E-RM-S177

Max. movement Distance 100mm

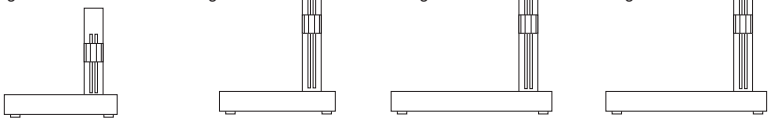
- 2□ E-RM-S183D



Max. movement Distance 200mm

## Measurement stand

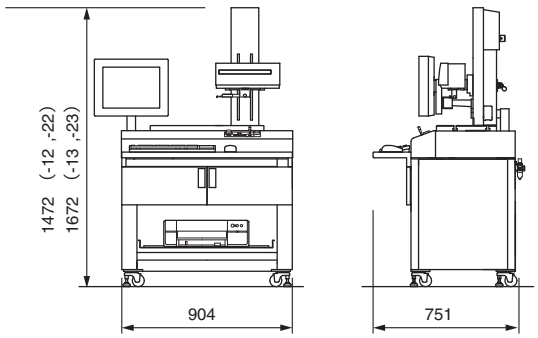
| | - □2 | - □3 | - □4 | - □5 |
|---|---|---|---|---|
| Column | Motorized | Motorized | Motorized | Motorized |
| Base Dimensions | 600×320mm | 600×320mm | 1000×450mm | 1000×450mm |
| Measuring height | 250mm | 450mm | 450mm | 650mm |
| *Allowable Load | 40kg | 30kg | 100kg | 90kg |



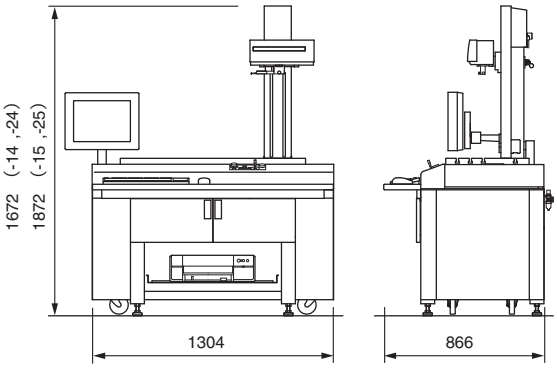
Allowable load change depends on the max. load of the anti vibration table in case of combination with it.

## External View

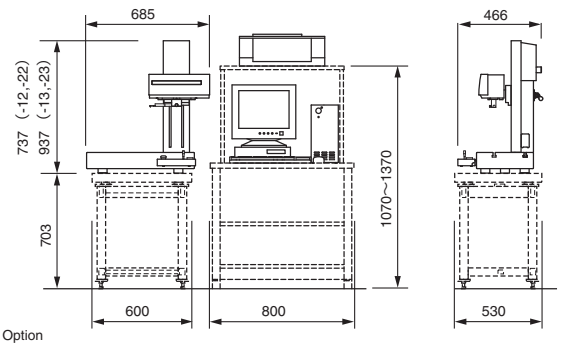
SURFCOM ○○○○ DX3-12, -13, -22, -23




SURFCOM ○○○○ DX3-14, -15-, -24, -25

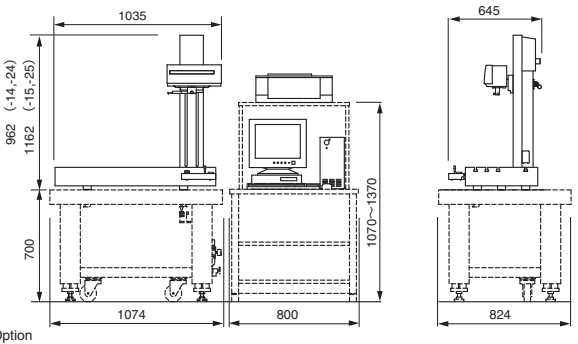



SURFCOM ○○○○ SD3-12, -13, -22, -23



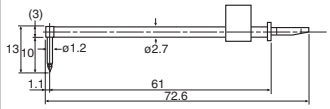
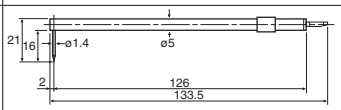
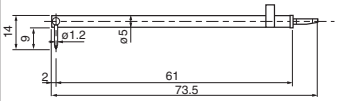
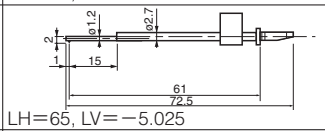
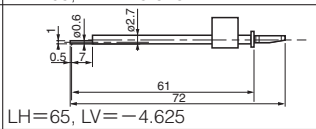
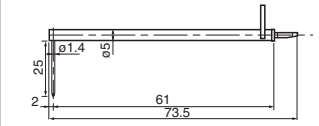
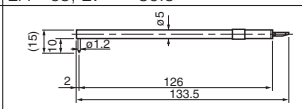
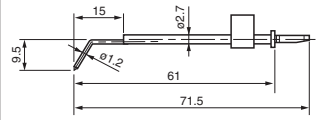

Option
Desktop anti-vibration table: E-VS-S57B; Ordinary stand for desktop anti-vibration table: E-VS-S13A
System Rack: E-DK-S24A

SURFCOM ○○○○ SD3-14, -15-, -24, -25

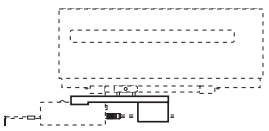
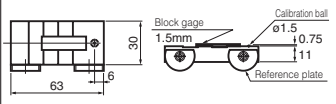



Option
Anti-vibration table: E-VS-S21A
System Rack: E-DK-S24A

# Replaceable Stylus for S2000DX/SD

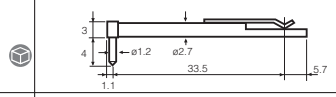
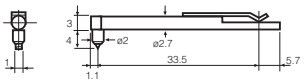
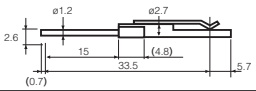
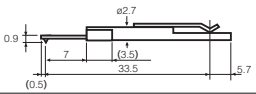
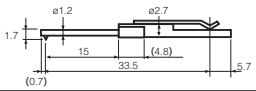
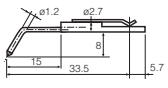
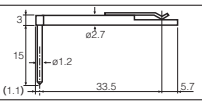
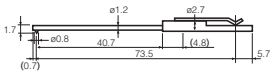
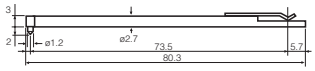
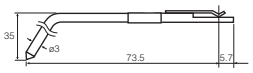
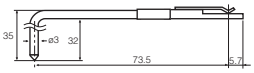
| Measuring Application | Model | Outer Appearance | Specifications | Remarks |
|---|---|---|---|---|
| General Purpose | DM47501 |  LH=65, LV=−14.35 | 2µmR, 60°conical diamond, 0.75mN | · Standard accessory · Stroke : 5mm<br>· For roughness and contour measurement |
| | DM47508 | | 5µmR, 30°conical diamond, 0.75mN | · Stroke : 5mm · Stylus height:13mm<br>· For roughness and contour measurement |
| | DM47548 | | 5µmR, 40°conical diamond, 4mN | · Stroke : 5mm<br>· For roughness and contour measurement |
| Contour stylus 2X arm | DM47513 |  LH=130, LV=−21.5 | 25µmR, 24°conical diamond, 5mN | · Standard accessory<br>· Stroke : 10mm<br>· For contour only |
| Right angle stylus | DM47504 |  LH=65, LV=−14.5 | 2µmR, 60°conical diamond, 0.75mN | · Stroke : 5mm<br>· Offset: 13.5mm<br>· Stylus height:13mm<br>· For roughness and contour measurement |
| Fine hole stylus | DM47505 |  LH=65, LV=−5.025 | 2µmR, 60°conical diamond, 0.75mN | · Stroke : 5mm<br>· Stylus height:2mm<br>· For roughness only |
| Extra fine hole stylus | DM47506 |  LH=65, LV=−4.625 | 2µmR, 60°conical diamond, 0.75mN | · Stroke : 5mm<br>· Stylus height:1mm<br>· For roughness only |
| Deep hole stylus | DM47507 |  LH=65, LV=−30.5 | 2µmR, 60°conical diamond, 0.75mN | · Stroke : 5mm<br>· Stylus height:25mm<br>· For roughness and contour measurement |
| | DM47549 | | 5µmR, 90°conical diamond, 4mN | · Stroke : 5mm<br>· Stylus height:25mm<br>· For roughness and contour measurement |
| General Purpose stylus 2x arm | DM47547 |  LH=130, LV=−15.5 | 2µmR, 60°conical diamond, 4mN | · Stroke : 10mm<br>· Stylus height:10mm<br>· For roughness and contour measurement |
| Corner/tooth surface stylus | DM47523 |  | 2µmR, 55°conical diamond, 0.75mN<br>LH=65, LV=−12.525 | · Stroke : 5mm<br>· Stylus height:8.3mm<br>· For roughness only |

# Peripherals for S2000DX/SD

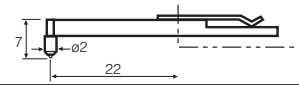
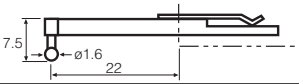
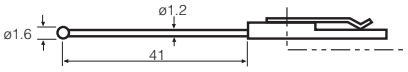
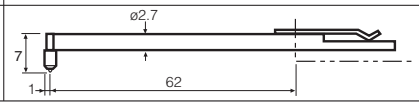
| Measuring Application | Model | Outer Appearance | Specifications | Remarks |
|---|---|---|---|---|
| Wide-range hybrid detector holder | E-DH-S182A |  | · Magnification: x5000 or less<br>· Straightness: 0.5µm/100mm | · Max. protrusion amount: 90mm from left edge of drive unit<br>· Column height: 10mm from normal height |
| Small hole stylus Master ball calibration unit | E-MC-S59A |  | · Block gage: 1.5mm<br>· Calibration ball: | · For measurements with prove pointing downwards, for small hole stylus<br>· C1700DX/SD<br>· C2700DX/SD |

S2000DX/SD series represent S2000DX/DX2/DX3 and S2000SD/SD2/SD3 model.

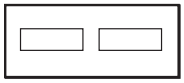
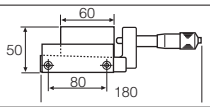
## S1500DX/SD Stylus for Roughness measurement

| Measuring Application | Model | Outer Appearance | Specifications | Remarks |
|---|---|---|---|---|
| General purpose | DM43801 |  | 2μmR, 60°conical diamond, 0.75mN | · Standard accessory<br>· All orientations<br>· Horizontal tracing possible |
| Fine wires, knife edges | DM43802 |  | 2μmR, 60°ax-shaped diamond, 0.75mN | · Downward measurements |
| Medium fine holes | DM43809 |  | 2μmR, 60°conical diamond, 0.75mN | · All orientations<br>· Horizontal tracing possible |
| Extra fine holes, gear flank | DM43811 |  | 2μmR, 60°conical diamond, 0.75mN | · All orientations<br>· Horizontal tracing possible |
| Fine holes /thin grooves | DM43812 |  | 2μmR, 60°conical diamond, 0.75mN | · All orientations<br>· Horizontal tracing possible |
| Corners /tooth surfaces | DM43814 |  | 2μmR, 60°conical diamond, 0.75mN | · All orientations<br>· Horizontal tracing possible |
| Deep holes, round grooves | DM43815 |  | 2μmR, 60°conical diamond, 0.8mN | · Downward measurements |
| Fine long holes | DM43821 |  | 2μmR, 60°conical diamond, 3mN | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x10,000 |
| Low magnification, long holes | DM43822 |  | 2μmR, 60°conical diamond, 3mN | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x20,000 |
| Deep grove corners | DM43827 |  | 2μmR, 60°conical diamond, 4mN | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x10,000 |
| Extra deep grooves | DM43826 |  | 2μmR, 60°conical diamond, 4mN | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x10,000<br>· Large waveform distortion |

## S1500DX/SD Stylus for waviness measurement

| Measuring Application | Model | Outer Appearance | Specifications | Remarks |
|---|---|---|---|---|
| Steps | 010 2504 |  | 250μmR, 60°conical sapphire | · All orientations |
| Waviness | 010 2505 |  | 800μmR, ruby | · All orientations |
| Fine long hole waviness | 010 2520 |  | 800μmR,ruby | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x10,000 |
| Large steps | 010 2523 |  | 250μmR, sapphire | · Downward measurements<br>· Sensitivity: 1/2 Max.<br>· Magnification: x25,000 |

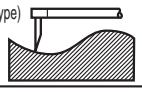
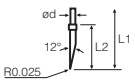
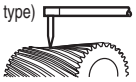
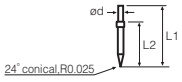
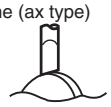
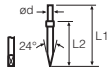
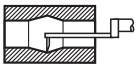
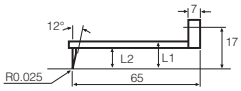
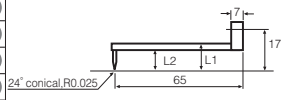
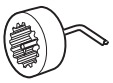
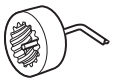
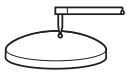
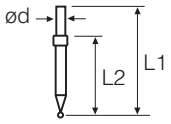
## Peripherals

| Measuring Application | Model | Outer Appearance | Specifications | Remarks |
|---|---|---|---|---|
| Standard piece | E-MC-S24B |  | · Calibration surface: About 3.1μmRa<br>· Checking surface of stylus pointing: About 0.4μmRa<br>· Actual measured value denoted. | · For magnification calibration and for checking stylus |
| Magnification calibrator | E-MC-50B |  | · Narrow range accuracy: 0~10μm±0.1μm<br>· Wide range accuracy: 0~400μm±0.1μm | · For magnification calibration |

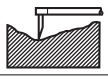
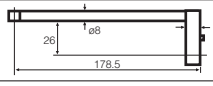
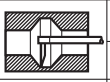
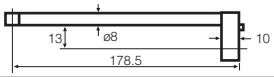
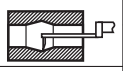
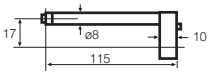
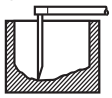
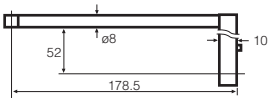
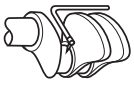
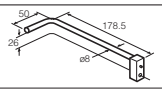
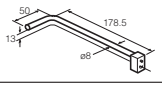
S1500DX/SD series represent S1500DX/DX2/DX3 and S1500SD/SD2/SD3 model.

Standard Inventory Parts

# C1700DX/SD, C2700DX/SD Contour Stylus

| Measuring Application | Model | Outer Appearance | d | L1 | L2 | Application Arm C1700/S1900 | Application Arm C2700/S2900 | Remarks |
|---|---|---|---|---|---|---|---|---|
| General purpose (wedge type)  | DM45501 |  | 3 | 60 | 52 | 010 2804 | DM45531 | |
| | DM45502 | | 3 | 34 | 26 | 010 2800 | DM45528 | |
| | DM45503 | | 2 | 21 | 13 | 010 2801 | DM45529 | |
| General purpose (conical type)  | DM45504 |  | 3 | 60 | 52 | 010 2804 | DM45531 | |
| | DM45505 | | 3 | 34 | 26 | 010 2800 | DM45528 | · Standard accessory |
| | DM45506 | | 2 | 21 | 13 | 010 2801 | DM45529 | |
| Edge line (ax type)  | DM45507 |  | 3 | 60 | 52 | 010 2804 | DM45531 | |
| | DM45508 | | 3 | 34 | 26 | 010 2800 | DM45528 | |
| | DM45509 | | 2 | 21 | 13 | 010 2801 | DM45529 | |
| Small holes  | DM45081 |  | — | 12 | 9 | 010 2802 | — | |
| | DM45082 | | — | 7 | 5 | | | |
| | DM45083 | | — | 3.5 | 1.5 | | | |
| | DM45510 | | — | 12 | 9 | — | DM45530 | · Measuring force: 10mN or less<br>· Deflection: Approx. 1.5µm for 10mN |
| | DM45511 | | — | 8 | 5 | | | |
| | DM45512 | | — | 4.5 | 1.5 | | | |
| Small hole twist  | DM45084 |  | — | 12 | 9 | 010 2802 | — | |
| | DM45085 | | — | 7 | 5 | | | |
| | DM45086 | | — | 3.5 | 1.5 | | | |
| | DM45513 | | — | 12 | 9 | — | DM45530 | · Measuring force: 10mN or less<br>· Deflection: Approx. 1.5µm for 10mN |
| | DM45514 | | — | 8 | 5 | | | |
| | DM45515 | | — | 4.5 | 1.5 | | | |
| Ordinary offset  | DM45087 |  | — | 12 | 9 | 010 2802 | — | · Offset: 25mm |
| | DM45088 | | — | 7 | 5 | | | |
| | DM45089 | | — | 3.5 | 1.5 | | | |
| | DM45516 | | — | 12 | 9 | — | DM45530 | · Offset: 25mm<br>· Measuring force: 10mN or less<br>· Deflection: Approx. 3µm for 10mN |
| | DM45517 | | — | 8 | 5 | | | |
| | DM45518 | | — | 4.5 | 1.5 | | | |
| Helix surface offset  | DM45090 |  | — | 12 | 9 | 010 2802 | — | · Offset: 25mm |
| | DM45091 | | — | 7 | 5 | | | |
| | DM45092 | | — | 3.5 | 1.5 | | | |
| | DM45519 | | — | 12 | 9 | — | DM45530 | · Offset: 25mm<br>· Measuring force: 10mN or less<br>· Deflection: Approx. 3µm for 10mN |
| | DM45520 | | — | 8 | 5 | | | |
| | DM45521 | | — | 4.5 | 1.5 | | | |
| High Precision  | DM45522 |  | 3 | 60 | 52 | 010 2804 | DM45531 | ·Φ0.7ruby ball |
| | DM45523 | | 3 | 34 | 26 | 010 2800 | DM45528 | |
| | DM45524 | | 2 | 21 | 13 | 010 2801 | DM45529 | |
| | DM45525 | | 3 | 60 | 52 | 010 2804 | DM45531 | ·Φ1ruby ball |
| | DM45526 | | 3 | 34 | 26 | 010 2800 | DM45528 | |
| | DM45527 | | 2 | 21 | 13 | 010 2801 | DM45529 | |

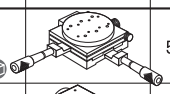
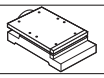
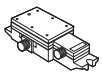
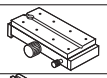
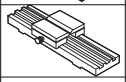
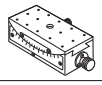
# C1700DX/SD, C2700DX/SD Arms for Contour

| Measuring Application | Model | Outer Appearance | Application Stylus | | Remarks |
|---|---|---|---|---|---|
| General purpose  | 010 2800 |  | DM45502 DM45505 DM45508<br>DM45523 DM45526 | C1700/S1900 | · Standard configuration<br>· Deflection: Approx. 1.2µm for 10mN<br>Approx. 3.7µm for 30mN |
| | DM45528 | | | C2700/S2900 | |
| Inner surface  | 010 2801 |  | DM45503 DM45506 DM45509<br>DM45524 DM45527 | C1700/S1900 | · Deflection: Approx. 1.2µm for 10mN<br>Approx. 3.7µm for 30mN |
| | DM45529 | | | C2700/S2900 | |
| Small holes  | 010 2802 |  | DM45081～DM45092 | C1700/S1900 | · Stylus combination arm for measuring small holes (Provided with auxiliary weight) |
| | DM45530 | | DM45510～DM45521 | C2700/S2900 | |
| Deep grooves  | 010 2804 |  | DM45501 DM45504 DM45507<br>DM45522 DM45525 | C1700/S1900 | · Measuring Range : ±10mm<br>010 2744 pickup holder coupling required.<br>· Measuring force: 10mN or less<br>(Provided with auxiliary weight)<br>· Deflection: Approx. 1.2µm for 10mN<br>Approx. 3.7µm for 30mN |
| | DM45531 | | | C2700/S2900 | |
| Offset measurement  | 010 2805 |  | DM45502 DM45505 DM45508<br>DM45523 DM45526 | C1700/S1900 | · Measuring Range : ±2.5mm<br>· Offset : 50mm<br>· Measuring force: 10mN or less<br>(Provided with auxiliary weight)<br>· Deflection: Approx. 2.6µm for 10mN<br>Approx. 7.8µm for 30mN |
| | DM45532 | | | C2700/S2900 | |
| | 010 2807 |  | DM45503 DM45506 DM45509<br>DM45524 DM45527 | C1700/S1900 | |
| | DM45533 | | | C2700/S2900 | |

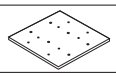
C1700DX/SD series represent C1700DX/DX2/DX3 and C1700SD/SD2/SD3 model.
C2700DX/SD series represent C2700DX/DX2/DX3 and C2700SD/SD2/SD3 model.

Standard Inventory Parts

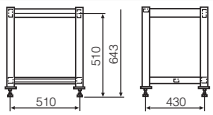
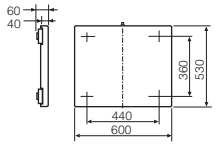
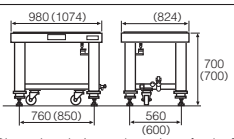
## Adjustment Devices

| Name | Model | Outer Appearance | Orthogonal Axis Adjustment (mm) | | | Swivel Adjustment | | Tilt Adjustment | | Table Size (mm) | Allowable Load (kg) (net wt.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | X | Y | Z | | | | | | | |
| Adjustment stand | E-AT-S01C |  | 50 | 50 | | 8° | 360° | | | φ150 | 20 (7) | Min. reading increment: 10μm |
| Leveling adjustment stand | E-AT-S02A |  | | | | | | ±1.5° | | 80×110 | 15 (3) | |
| Adjustment stand | E-AT-S03A |  | | ±2.5 | | ±2° | | | | 80×58 | 3 (0.9) | For E-RM-S75A |
| Adjustment stand | E-AT-S04A |  | | ±8 | | ±3° | | | | 80×125 | 15 (8) | |
| Adjustment stand | E-AT-S05A |  | | ±3 | | ±1° | | | | 120×58 | 3 (1.4) | For E-RM-S76A |
| Adjustment stand | E-AT-S36A |  | | ±3 | | ±1° | | | | 200×120 | 5 (4.5) | For E-RM-S77A |
| X-direction movement adjustment stand | E-AT-S08A |  | 400 | | | | | | | 150×150 | 20 (25) | |
| Tilting stand | E-AT-S64B |  | | | | | | ±20° | | 60×120 | 10 (1) | Min. reading value: 5' |
| Universal stand | E-WJ-S03A |  | | | | | 360° | | ±90° | φ110 | 3 (2.5) | X/Y-direction adjustment |

## Holders

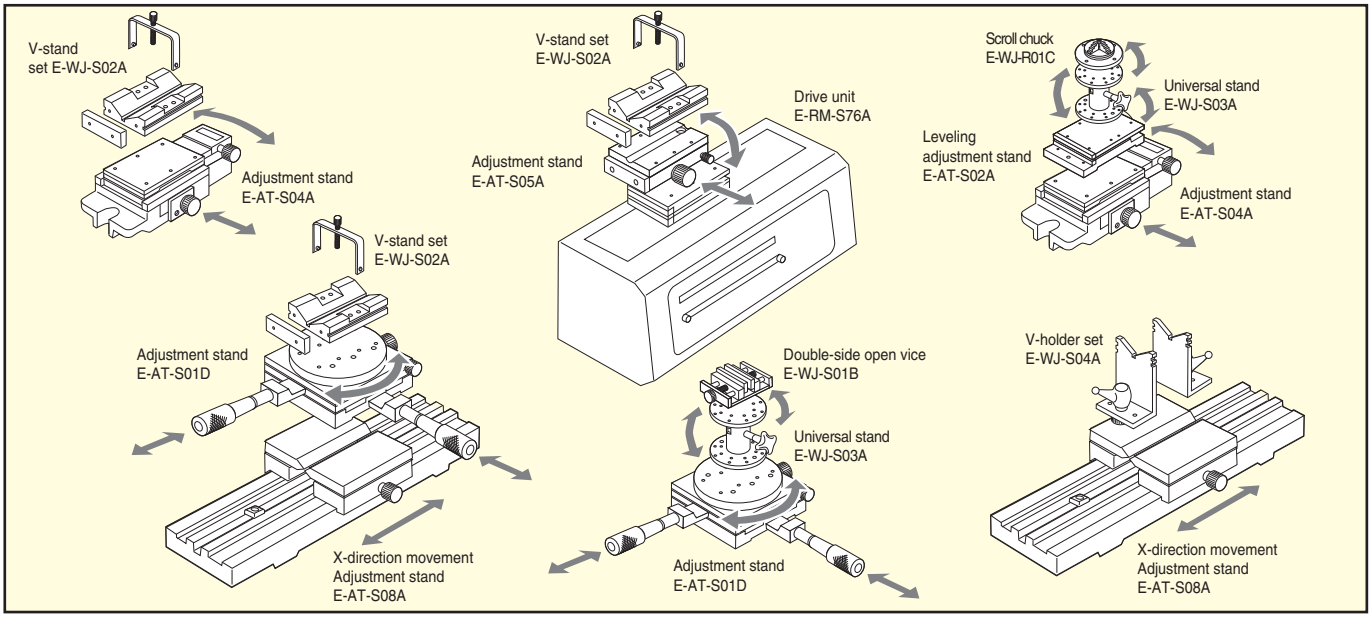
| Name | Model | Outer Appearance | Holder (mm) | Chucking (mm) | Vice (mm) | Clamp (mm) | Flat Surface (mm) | Allowable Load (kg) (net wt.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Double-side open vice | E-WJ-S01B |  | | | ID:59<br>OD:38~105 | | | 5 (0.8) | Consult us when combining with the tilt stand. |
| V-stand set | E-WJ-S02A |  | φ1~150 | | | | | (1.5) | Provided with workpiece clamper |
| V-stand holder set | E-WJ-S04A |  | φ12~150 | | | | | (3) | Two pieces used just for T-groove clamp. |
| Compact stand | E-WJ-S05A |  | φ4~10 | | | | | (0.4) | |
| Load plate | E-WJ-S06A |  | | | | | 150X150 angle plate | (1) | |
| Static electricity holding plate | E-WJ-S11A |  | | | | | 80X130 angle plate | (1.3) | Holding strength: 0.2kg<br>Ideal for paper, aluminum, and film |
| Scroll chuck | E-WJ-R01C |  | | OD:Ø2~75<br>ID:Ø56~91 | | | | (1) | |

## Peripherals

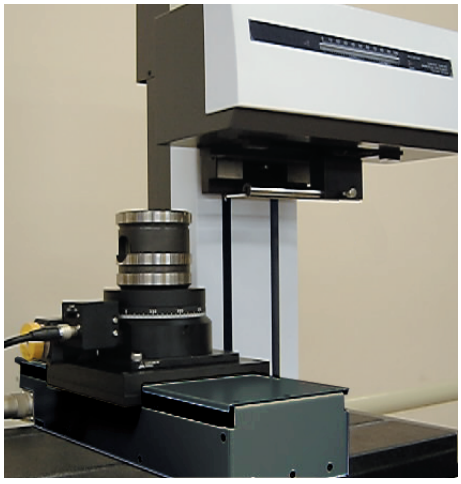
| | | | | |
|---|---|---|---|---|
| Ordinary stand for desktop anti-vibration table | E-VS-S13A |  | | · Dimensions: 510$^{W}$ x 430$^{D}$ x 643$^{H}$ mm<br>· Weight: 22kg<br>· E-VS-S57A/B, E-VS-S58A |
| Desktop anti-vibration table | E-VS-S57B |  | Anti-vibration: Pneumatic diaphragm spring<br>Natural frequency: 2.5 to 3.5Hz<br>Load weight:130kg | · Dimensions: 600$^{W}$ x 530$^{D}$ x 60$^{H}$ mm<br>· Air source: 350 to 700kPa<br>· Weight: 25kg<br>Requires nylon tube with Ø6 mm outer and Ø4mm inner diameter for quick joint connecting aperture. |
| | E-VS-S58A | | Anti-vibration: Pneumatic diaphragm spring<br>Natural frequency: 2.5 to 3.5Hz<br>Load weight:130kg | · Dimensions: 600$^{W}$ x 530$^{D}$ x 60$^{H}$ mm<br>· Air source: Pump<br>· Weight: 25kg |
| Anti-vibration table | E-VS-R16B |  Dimensions in (parentheses) are for the E-VS-S21A. | Anti-vibration: Pneumatic diaphragm spring<br>Natural frequency: V: 2Hz; H:2.2Hz<br>Load weight:250kg | · Dimensions: 980$^{W}$ x 780$^{D}$ x 700$^{H}$ mm<br>· Air source: 350 to 700kPa<br>· Weight: 170kg |
| | E-VS-S21A | | Anti-vibration: Pneumatic diaphragm spring<br>Natural frequency: V: 1.6Hz; H:2Hz<br>Load weight:550kg | · Dimensions: 1100$^{W}$ x 850$^{D}$ x 700$^{H}$ mm<br>· Air source: 350 to 700kPa<br>· Weight: 340kg |

Standard Inventory Parts

# Sample Adjustment Stand/Holder Configurations




# Expended System by adding CNC table unit



Example of axis CNC table (100mm)
and θ-axis CNC table (horizontal) combination

● CNC Table

1.The standard measuring system can be automated by adding a CNC table unit.

2.CNC table control, and simplified teaching and playback can be performed from the『**ACCTee**』integrated measuring software.

3.The Y-axis table and rotary table can be rearranged as needed in order to configure the system to suit the workpiece.

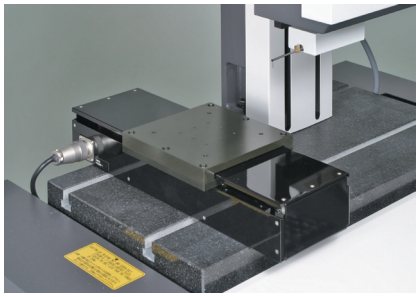
**Specifications**

| 〈Y-axis CNC table (100mm)〉 E-AT-S105A | |
|---|---|
| Travel | 100mm |
| Max. travel speed | 50mm/s |
| Positioning precision | 20μm |
| Max. load | 30kg |
| Weight | Approx. 22kg |

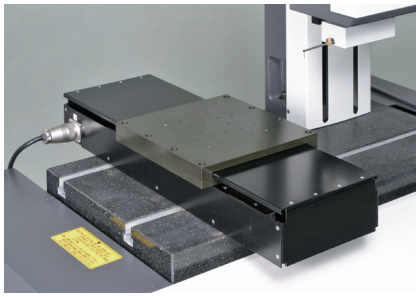
| 〈θ-axis CNC table (horizontal)〉 E-AT-S107A | |
|---|---|
| Travel | 360° |
| travel speed | 20° /sec |
| Positioning precision | 0.03° |
| Max. load | 15Kg |
| Weight | Approx. 2.5kg |

| 〈Y-axis CNC table (200mm)〉 E-AT-S106A | |
|---|---|
| Travel | 200mm |
| travel speed | 50mm/s |
| Positioning precision | 20μm |
| Max. load | 30kg |
| Weight | Approx. 19kg |

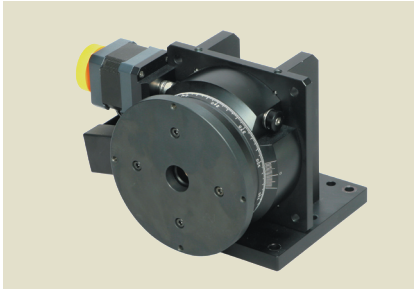
| 〈θ-axis CNC table (vertical)〉 E-AT-S108A | |
|---|---|
| Travel | 360° |
| travel speed | 20°/sec |
| Positioning precision | 0.03° |
| Max. load | 5kg |
| Weight | Approx. 3.2kg |



Y-axis CNC table (100mm)



Y-axis CNC table (200mm)



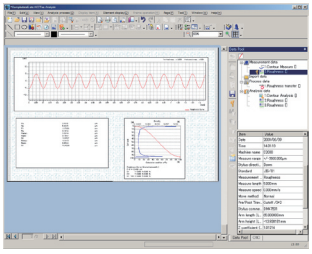
θ-axis CNC table (vertical)

## Measurement and analysis software for surface roughness measurement machine

# Roughness

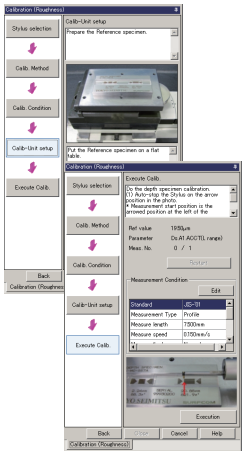
## ACCTee roughness measurement analysis system

**ACCTee** has changed the roughness measurement style with its new concept the measurement can be executed on a document basis, providing preeminent workability and comfortable work environment. As the setting can be proceeded under the guidance of various setting wizards, anyone can perform the measurement tasks easily and efficiently.



## Various setting wizards

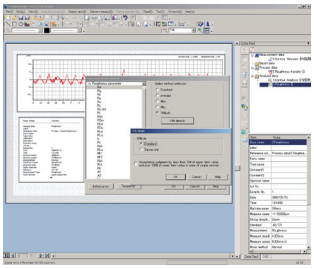
- **Measurement AI**
  The parameters and analysis condition appropriate for the roughness standard and evaluation purpose can be specified.
- **Detector Calibration**
  The sensitivity calibration is executed by selecting any of the following three options: depth specimen; magnification calibration unit; and reference specimen. The time for calibration can be notified in a message according to the time for replacing the probe, measurement frequencies, and lapsed days.
- **Checking tip of stylus**
  The tip of the stylus gets wears and chips more and more as it is used for measurement continuously. A regular check is necessary to maintain accurate measurement.



Detector calibration wizard

## Automatic judgment under 16% rule (JIS2001 standard)

The 16% rule and the max rule are standardized for the tolerance criteria of the roughness evaluation parameters. The criteria for the 16% rule and the max rule are as follows: 16% rule - if the number of sections that exceed the tolerance is below 16% of the measurement values of multiple standard length (sections), it is assumed to meet the criteria; max rule - if all the measurement values of multiple standard length (all sections) do not exceed the tolerance, it is assumed to meet the criteria.



# ACCTee

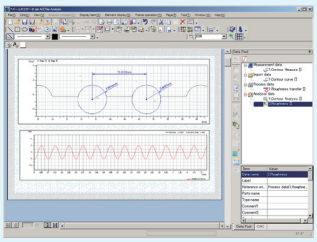
## *All in the Document !*

### Distinguished operation by document screen


ACC Tee is equipped with a Windows style user interface to which anyone can access easily. High operability is achieved with the friendly and intuitive icons that assist a series operation from the measurement to the printing of analysis result.

### Document basis data batch processing

As an integrated measurement system, ACCTee can comprehensively manage the roughness and contour data in inspection result sheet or file.



### International Support

ACCTee can be used overseas and supports several languages including Japanese, English, German, French, Italian, Spanish, Chinese, and Korean. (consult us before taking out to overseas countries)


Support multiple languages

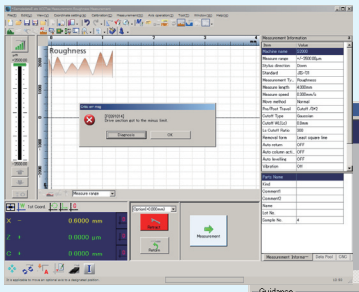
| Specification | ACCTee roughness measurement and analysis program |
|---|---|
| Support roughness standard | Conforming to JIS2001, and JIS1994, JIS1982, ISO1997, ISO1984, DIN1990, ASME2002/1995 – CNOMO |
| Parameter | Ra, Rq, Ry, Rp, Rv, Rc, Rz, Rmax, Rt, Rz.J, R3z, Sm, S, RΔa, RΔq, Rλa, Rλq<br>TILT A, Ir, Pc, Rsk, Rku, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, VO, K, tp, Rmr, Rmr2, Rσc, AVH, Hmax, Hmin,<br>AREA, NCRX, R, Rx, AR, NR, CPM, SR, SAR, etc |
| Parameter judgment | The judgment result can be displayed by standard, average value, the maximum value, minimum value, and 16% rule |
| Evaluation curve | Profile Curve, Roughness Curve, Filtered Waiveness Curve, Roll. Circ. Waiveness, Rolling Circle Waiveness Curve<br>ISO13565-1(DIN4776) Roughness Curve, Roughness Motif Curve, Waiveness Motif Curve, and Upper Envelope Curve |
| Surface characteristic display | Bearing area curve, power graph, ADC graph, ISO13565-2 Bearing area curve, peak height distribution graph/list, auto correlation graph<br>wear-out amount analysis (two arbitrary curves), and overlapping analyses (ten curves or less) |
| Form remove<br>(tilt correction) | Least square straight line correction, n-dimension polynomial (n=2-9) correction, both ends correction, least square circle correction,<br>least square oval correction, spline correction, robust (spline) correction (arbitrary or beginning or latter half of the setting range can be specified for all the options) |
| Filter type | Gaushian phase compensating filter, phase uncompensation type 2RC filters, phase compensation type 2RC filters,<br>spline filter, and robustness (spline) |
| Filter | Cut-off wavelength (λc) : 0.008、0.025、0.08、0.25、0.8、2.5、8、25、50mm (9 levels)、arbitrary (from 0.001mm)<br>Cutoff ratio (λs) : 1/30、1/100、1/300、1/1000、arbitrary (from 1/10)<br>Cut-off wavelength (λs) : 0.08、0.25、0.8、2.5、8、25、80μm (7 levels)、arbitrary (from 0.05) |
| Stylus calibration | Can be selected from depth specimen (JIS standard), magnification calibration unit, and reference specimen.<br>Maximum 20 units of stylus calibration information can be registered (dead line for the calibration time can be specified) |
| Number of data points | Maximum 300,000 points |
| Magnification display: Lengthwise | Arbitrary value (unit:0.01), automatic and 50 - 10,000k times |
| Magnification display: Sidewise | Arbitrary value (unit:0.01), automatic and 1 - 1,000k times |

**Establish new measurment style by new concept**

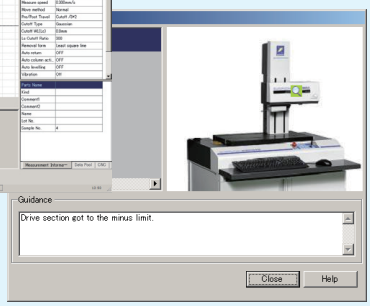
**All meaurement and analysis can be done on the document**

## Self diagnostic susyem

In preparation for emergency, the self-diagnosis function is always working. As the support function for handling errors, the message indicating the troubled locations such as failures and errors of the measurement machine is displayed, so that the operator smoothly can take appropriate actions in order to settle down the problem as soon as possible.



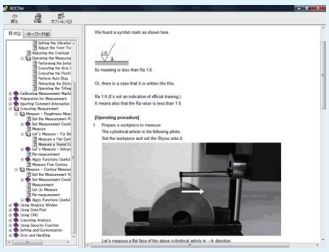
Error message display




The troubled location is indicated by a picture

## International Support

ACCTee always can call up the Help whenever the ACCTee is on. ACCTee introduces on-line manual system so that an appropriate help message can be displayed by clicking the soft key of the help. The help message also can be retrieved by the index or by keywords.

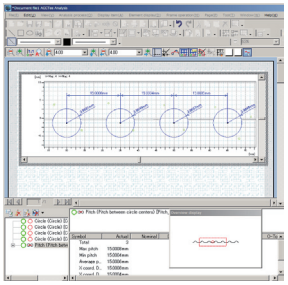


Help display

# Contour

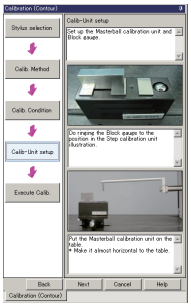
## ACCTee contour profile measurement analysis system

ACCTee has changed the contour profile measurement style with its new concept - the measurement can be executed on a document basis, providing preeminent workability and comfortable work environment. As the setting of each function from measurement to analysis can be proceeded with the operability easy for operators, anyone can perform the measurement tasks easily and efficiently.

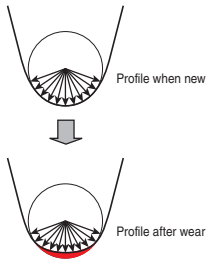


## Batch stylus calibration wizard

The calibration for the R tip correction (acquiring radius values of each 10 degrees) and the circular arc error correction (misalignment of X value) can be executed automatically at a time by the masterball measurement and the step height measurement of the masterball calibration unit. The procedure of the calibration is proceeded under the guidance of the wizard. *Patent



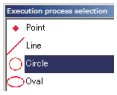
Calibration wizard

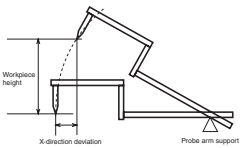



Tip R correction

## AI function (automatic element judgment)

The points, straight lines, and circles of the basic elements are automatically distinguished just by selecting the specified area of the measurement data.

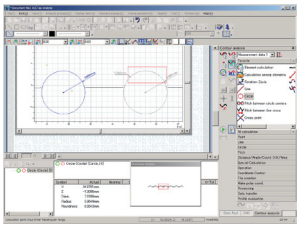



Circle Correction Calculation

## Calculation result preview function (patent pending)

When the area for the calculation is entered, the preview of the calculation result and the dimension lines are displayed immediately which can be used for the confirmation before finalizing the result.



Calculation result preview state

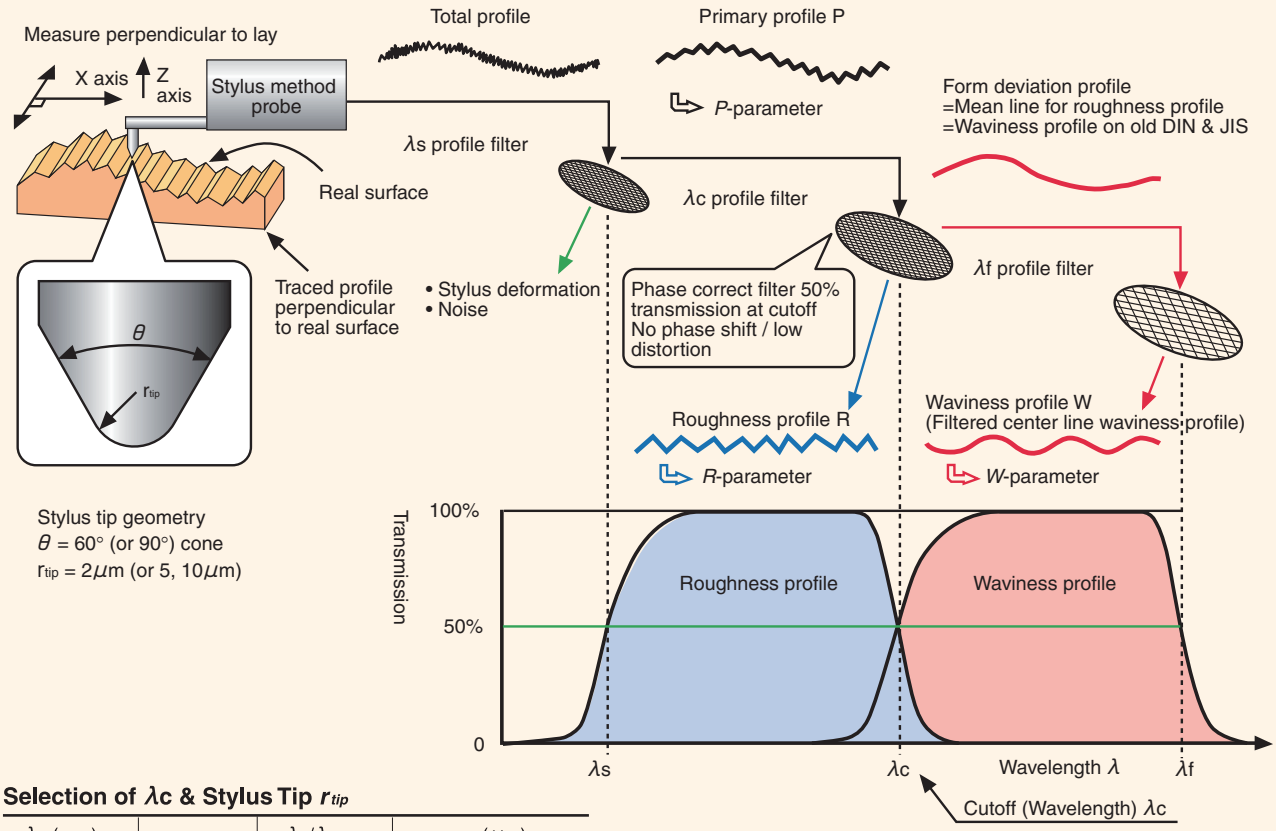
| Specification | ACCTee contour profile measurement machine and analysis program |
|---|---|
| AI function | Automatic distinction of elements including points, straight lines,<br>and circles Automatically distinguish the combination executable of calculation between two elements<br>(point - point, point - straight line, point - circle, point - oval, straight line - straight line, circle - straight line, circle - circle, straight line - oval, circle - oval, oval - oval) |
| Arithmetic processing | Point (cross point, mid-point, contact point, peak, valley), Line (perpendicular, median, contact line, parallel line, bisector, virtual line),<br>Circle (partial circle, oval, contact circle, virtual circle), Pitch (pitch between line cross, pitch between circle centers),<br>Distance, Curve length, Angle, Inter angle(cmplm. angle, suppl. angle), Coord. Diff (X coord. difference, Z coord. difference, dliff. angle, radius difference), Polar coord difference,<br>Step difference (average step, max. step, min. step),<br>Area calculation (addition, subtraction, multiplication, division, power operation, surplus, absolute value, square root), Statistics (average, max., min., std. dev., total sum),<br>Over-pin calculation, Dimension line display function, Calculation result design value collation, mirror inverse, smoothing, form combining (whole composition, partial composition),<br>Calculation point repeat function, Work trace function, Peak/valley function, CNC function,<br>Nominal collation, Best fit (parallel move, rotary move), Nominal value preparation function |
| Data file I/O | Input of point sequence, text, CSV, IGES, DXF data and ASCII data of Calypso Curve |
| Coordinate control | Origin, setting each axis, parallel move, and rotary move |
| Calculation support function | Infinite cursor, cursor form vertical/horizontal switch, one point micro motion, setting or error band |
| Stylus calibration | Batch automatic calibration and manual calibration by the masterball calibration unit<br>Maximum 20 units of stylus calibration information can be registered (the deadline of the calibration time can be specified) |
| Measure pitch | 0.01~1000 µm |
| Number of data points | Maximum 300,000 points |
| Magnification display: Lengthwise | Arbitrary value (unit:0.01), automatic and 0.01 - 10,000,000 times |
| Magnification display: Sidewise | Arbitrary value (unit:0.01), automatic and 0.01 - 10,000,000 times |

# Description of data analysis/parameter standard

## Definition of Surface texture and Stylus instrument

### Profile by Stylus and phase correct filter

ISO4287: '97 and ISO3274: '96




**Selection of λc & Stylus Tip $r_{tip}$**

| λc (mm) | | λc/λs | $r_{tip}$ (μm) |
|---|---|---|---|
| 0.08 | 2.5 | 30 | 2 |
| 0.25 | | 100 | |
| 0.8 | | 300 | 2 (5 at $RZ > 3\mu m$) |
| 2.5 | 8 | | 5 or 2 |
| 8 | 25 | | 10, 5 or 2 |

## Acceptance decision rule

ISO4288 : '96

**Upper limit - the 16% rule (shown with U, Default) in EU**
Measure the most critical surface.
The surface is acceptable if not more than 16% of all values averaged through evaluation length are exceed the limit

**Lower limit - the 16% rule (shown with L) in EU**
Measure the surface that can be expected the lowest roughness.
The surface is acceptable if not more than 16% of all values averaged through evaluation length are less than the limit.

**Max value - the max rule (shown with "max" suffix) in EU**
The surface is acceptable when none of values averaged through evaluation length in entire surface are over the limit.

JIS B0633 : '01

**Upper limit - the 16% rule (shown with U, Default) in JISB0633**
Measure the most critical surface. If not more than 16% of all values based on sampling length are exceed the limit, surface is acceptable

**Lower limit - the 16% rule (shown with L) in JISB0633**
Measure the surface that can be expected the lowest roughness.
The surface is acceptable if not more than 16% of all sampling lengths are less than the limit

**Max value - the max rule (shown with "max" suffix) in JISB0633**
The surface is acceptable when none of values based on each sampling length in entire surface are over the limit.

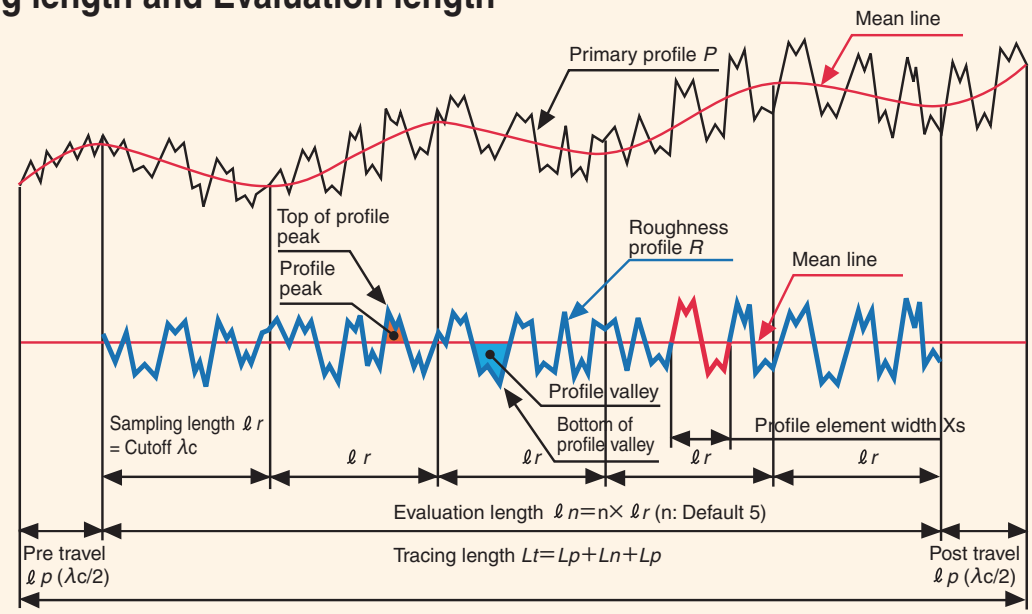
## Sampling length setting procedure

JIS B0633 : '01/ ISO 4288 : '96

1. View the surface and decide whether profile is periodic or non-periodic.
2. Estimate roughness and measure it in corresponding condition in the table.
3. Change condition according with above result and measure it again.
4. Repeat "3." if the result does not reached the condition.
5. When the result reaches the condition, it will be the final value.
   Check it in shorter sampling length at non periodic and change it if it meets.
6. Judge if the value clear the tolerance by the rule shown at the left column.

## Sampling length and Evaluation length

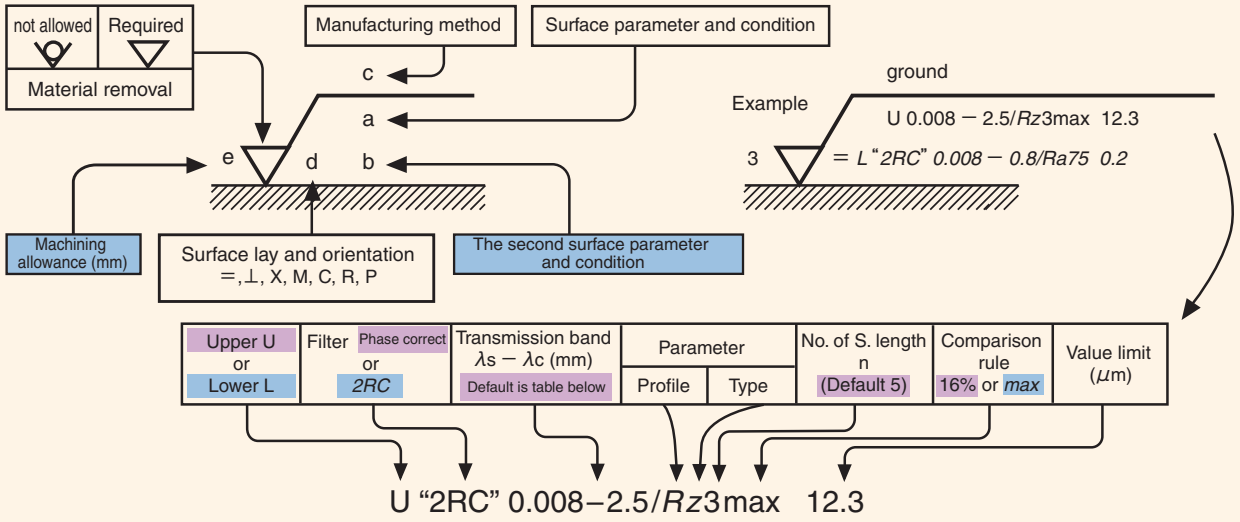
ISO4287: '97




## Indication of surface texture

ISO 1302: '02

Note.:
Default item (red) is not indicated.
Additional item (blue) is indicated if necessary.




### Measuring condition: *R*-parameter

JIS B0633 : '01/ ISO4288 : '96

| Non-periodic profile | | | | Periodic profile or *RSm* | | Measuring Condition | |
|---|---|---|---|---|---|---|---|
| *Ra*,*Rq*,*Rsk*,*Rku* or *RΔq* | | *Rz*,*Rv*,*Rp*,*Rc*, or *Rt* | | | | Sampling length: ℓr = CutOff λc (mm) | Evaluation length ℓn (mm) = 5 × ℓr |
| *Ra* (μm) | | *Rz* (μm) | | *RSm* (mm) | | | |
| Over> | Less≤ | Over> | Less≤ | Over> | Less≤ | | |
| 0.006 | 0.02 | 0.025 | 0.1 | 0.013 | 0.04 | 0.08 | 0.4 |
| 0.02 | 0.1 | 0.1 | 0.5 | 0.04 | 0.13 | 0.25 | 1.25 |
| 0.1 | 2 | 0.5 | 10 | 0.13 | 0.4 | 0.8 | 4 |
| 2 | 10 | 10 | 50 | 0.4 | 1.3 | 2.5 | 12.5 |
| 10 | 80 | 50 | 200 | 1.3 | 4 | 8 | 40 |

### Measuring condition : *P*-parameter

JIS B0633 : '01/ ISO4288 : '96

| Stylus radius | λs | λc | No. of ℓp = n | S. length ℓp | E. length ℓn |
|---|---|---|---|---|---|
| 2μm | 2.5μm | – | 1 | Length of feature (Plane, Line) | Length of feature |
| 5μm | 8μm | | | | |
| 10μm | 25μm | | | | |

### Measuring condition: *W*-parameter

ISO1302: '02

| λc | λf | No. of ℓw = m | S. length ℓw | E. length ℓn |
|---|---|---|---|---|
| λc (for roughness) | nλc (n: specified) | m: specified | λf | mλf |

# Description of data analysis/parameter standard

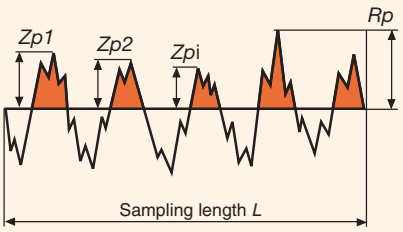
## Basic surface texture parameters and curves

### Amplitude parameters (peak and valley)

**Rp**
**Pp**
**Wp** — Maximum profile peak height

The largest profile peak height *Zp* within a sampling length.

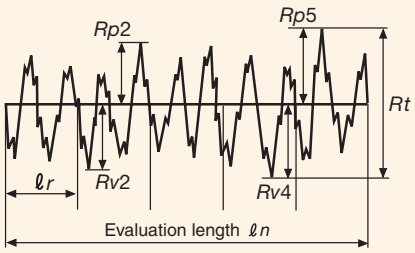
$$Rp,\ Pp,\ Wp = \max\ (Z(x))$$




**Rt**
**Pt**
**Wt** — Total height of profile
(*Pt* = Rmax at JIS'82)

Sum of height of the largest profile peak height *Rp* and the largest profile valley *Rv* within an evaluation length.

$$Rt,\ Pt,\ Wt = \max\ (Rpi) + \max\ (Rvi)$$

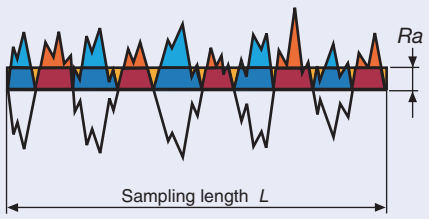



### Amplitude average parameters

**Ra**
**Pa**
**Wa** — Arithmetical mean deviation

Arithmetic mean of the absolute ordinate values *Z*(x) within a sampling length.

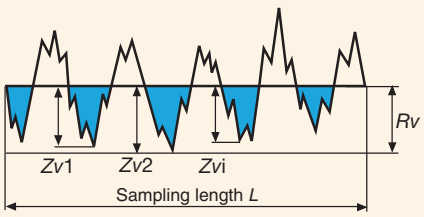
$$Ra,\ Pa,\ Wa = \frac{1}{L}\int_0^L |\ Z\ (x)\ |\ dx$$




**Rv**
**Pv**
**Wv** — Maximum profile valley depth

The largest profile valley depth *Z*p within a sampling length.

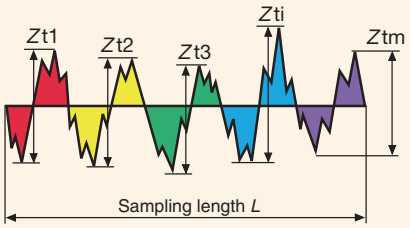
$$Rv,\ Pv,\ Wv = \min\ (Z(x))$$




**Rc**
**Pc**
**Wc** — Mean height of profile elements

Mean value of the profile element heights *Zt* within a sampling length.

$$Rc,\ Pc,\ Wc = \frac{1}{m}\sum_{i=1}^{m} Zti$$

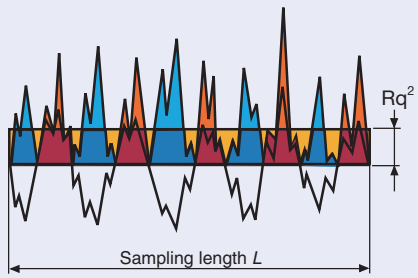



Profile element:
Profile peak & the adjacent valley

**Rq**
**Pq**
**Wq** — Root mean square deviation

Root mean square value of the ordinate values *Z*(x) within a sampling length.

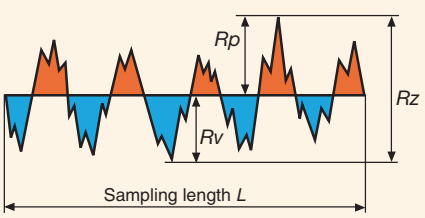
$$Rq,\ Pq,\ Wq = \sqrt{\frac{1}{L}\int_0^L Z^2\ (x)\ dx}$$




**Rz**
**Pz**
**Wz** — Maximum height of profile
(*Rz* = *Ry* at ISO4287 '84)

Sum of height of the largest profile peak height *Rp* and the largest profile valley *Rv* within a sampling length.

$$Rz = Rp + Rv$$

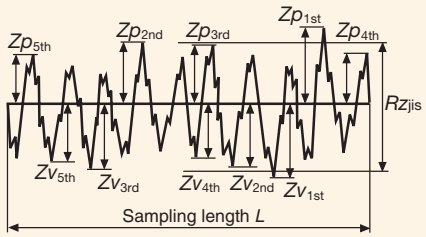



Different from *Rz* at old ISO, ANSI & JIS

**Rzjis** Ten point height of roughness profile
(*Rz* at JIS'94)

Sum of mean value of largest peak to the fifth largest peak and mean value of largest valley to the fifth largest valley within a sampling length.

$$Rz_{jis} = \frac{1}{5}\sum_{j=1}^{5} (Zpj + Zvj)$$

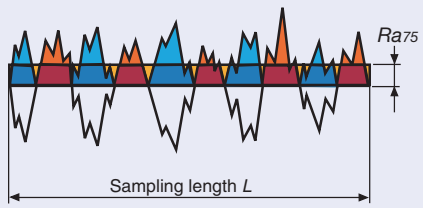



Annex of JIS only and confirm to JIS'94
Different from *Rz* at JIS'82

**Ra75** Center line average
(Old *Ra*, AA, *CLA*)

Arithmetic mean of the absolute ordinate value *Z*(x) in a sampling length of roughness profile with 2RC filter of 75% transmission.

$$Ra_{75} = \frac{1}{L}\int_0^{\ell n} |\ Z\ (x)\ |\ dx$$



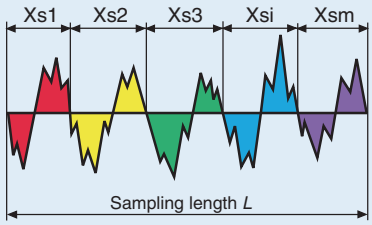

Annex of JIS only
Same as *Ra* at old ISO, ANSI & DIN

## Spacing parameters

**RSm**
**PSm**
**WSm**
Mean width of the profile elements
(*RSm* = *Sm* at ISO4287 '84)

Mean value of the profile element width Xs within a sampling length.

$$RSm,\ PSm,\ WSm = \frac{1}{m}\sum_{i=1}^{m} Xsi$$

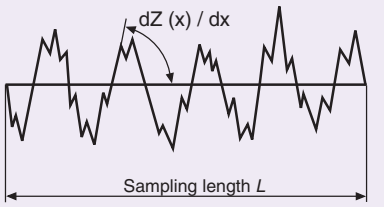



## Hybrid parameters

**RΔq**
**PΔq**
**WΔq**
Root mean square slope

Root mean square value of the ordinate slopes dZ/dX within a sampling length.

$$\left.\begin{matrix} R\Delta q \\ P\Delta q \\ W\Delta q \end{matrix}\right\} = \sqrt{\frac{1}{L}\int_0^L \left[\frac{d}{dx} Z(x)\right]^2 dx}$$

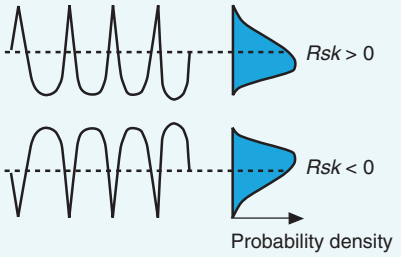



## Height characteristic average parameters

**Rsk**
**Psk**
**Wsk**
Skewness

Quotient of mean cube value of the ordinate values *Z*(x) and cube Pq, Rq, Wq respectively, within a sampling length.

$$Rsk = \frac{1}{Rq^3}\left[\frac{1}{\ell r}\int_0^{\ell r} Z^3(x)\,dx\right]$$



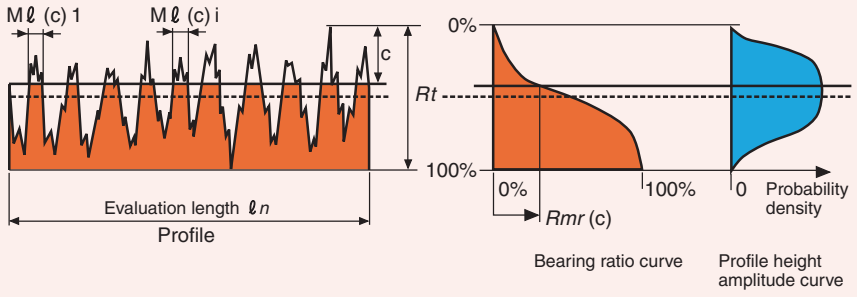

## Parameter from bearing ratio curve and profile height amplitude curve

Material ratio curve of the profile
(Abbott Firestone curve)

Curve representing the material ratio of the profile as a functional of level c.

Profile height amplitude curve

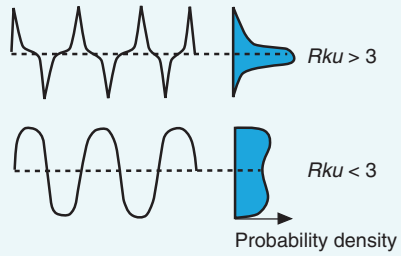
Sample probability density function of ordinate *Z*(x) within an evaluation length.




**Rku**
**Pku**
**Wku**
Kurtosis of profile

Quotient of mean quartic of the ordinate values *Z*(x) and 4th power of *Pq*, *Rq*, *Wq* respectively, within a sampling length.

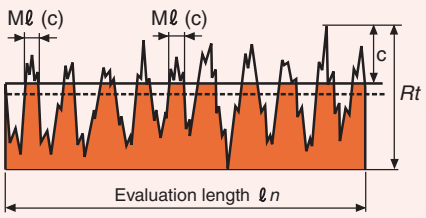
$$Rku = \frac{1}{Rq^4}\left[\frac{1}{\ell r}\int_0^{\ell r} Z^4(x)\,dx\right]$$




**Rmr(c)**
**Pmr(c)**
**Wmr(c)**
Material ratio of profile
(*Rmr*(c) = ex- tp)

Ratio of the material length of the profile elements *Ml*(c) at a given level c to the evaluation length.

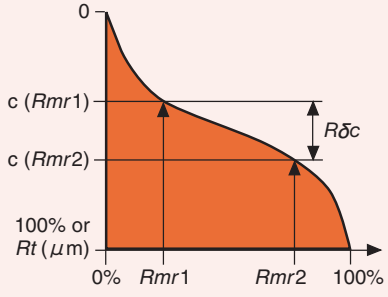
$$Rmr\,(c) = \frac{100}{\ell n}\sum_{i=1}^{m} M\ell\,(c)_i\,(\%)$$




**Rδc**
**Pδc**
**Wδc**
Profile section height difference

Vertical distance between two section levels of given material ratio.

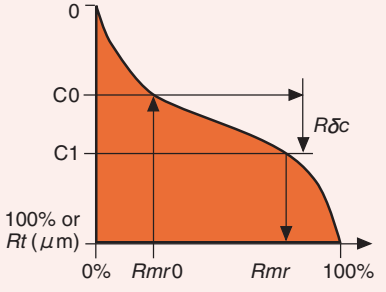
$$R\delta c = c(Rmr1) - c(Rmr2) : Rmr1 < Rmr2$$




**Rmr**
**Pmr**
**Wmr**
Relative material ratio

Material ratio determined at a profile section level *Rδc*, related to a reference c0.

$$Rmr = Rmr\,(c_1)$$
$$C_1 = C_0 - R\delta c,\ C_0 = C\,(Rmr0)$$



# Description of data analysis/parameter standard

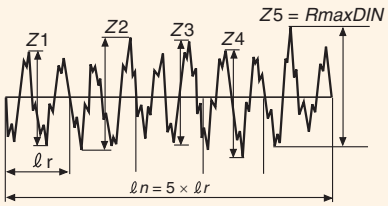
## Expanded surface texture parameters and curves

### Traditional local parameters

***RmaxDIN*** Maximum peak to valley height
***RzDIN*** Average peak to valley height

Zi is the maximum Peak to valley height of a sampling length *ℓr*.
*RmaxDIN* is the maximum Zi of 5 adjoining sampling length *ℓr* in an evaluation length *ℓn*.
*RzDIN* is arithmetic mean of 5 Zi.

$$RzDIN = \frac{1}{n}\sum_{i=1}^{n} Zi$$



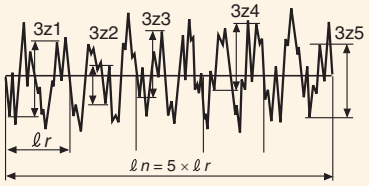

German old standard DIN4768/1: '90

***R3z*** Base roughness depth

3Zi is the height of the 3rd height peak from the 3rd depth valley in a sampling length *ℓr*.

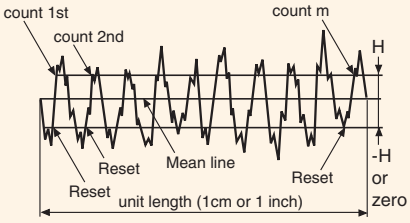
*R3z* is arithmetic mean of 3Zi's of 5 sampling lengths in an evaluation length *ℓn*.

$$R3z = \frac{1}{n}\sum_{i=1}^{n} 3zi$$




***Pc*** Peak density /cm: ASME B46.1: '95
***PPI*** Peaks per inch: SAEJ911
***HSC*** High spot count

*Pc* is the number of peaks counted when a profile intersects a lower boundary line –H and an upper line +H per unit length 1 cm.
*PPI* shows *Pc* in 1 inch (25.4mm) unit length.
*HSC* shows the number of peaks when the lower boundary level is equal to zero.

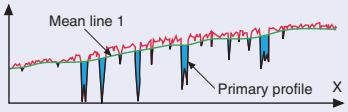



Confirm to ISO4287: '96, ISO12085: '96
& ISO13565-1: '96 / -2: '96 / -3: '98

### Parameters of surfaces having stratified functional properties ISO13565's

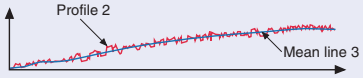
**Filtering process of ISO13565-1:'96**

Calculate mean line 1 from a primary profile with phase correct filter.

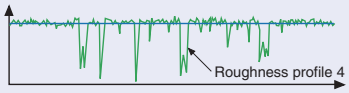



Calculate profile 2 with cutting valley lower than mean line 1.


Calculate mean line 3 from profile 2 with phase correct filter.



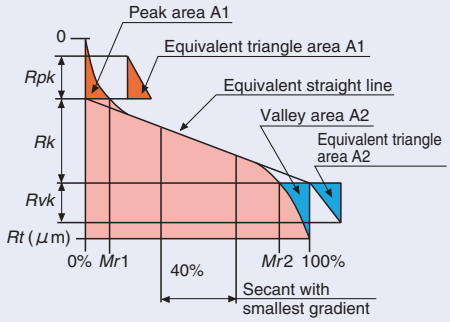

Calculate roughness profile 4 by taking mean line 3 off from a primary profile.




**Measuring conditions of ISO13565-1**

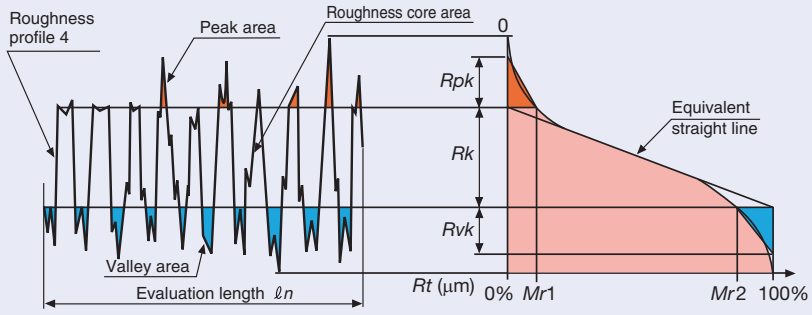
| Cutoff value λc | Evaluation length ℓn |
|---|---|
| 0.8 mm | 4 mm |
| 2.5 mm | 12.5 mm |

40% length secant of smallest gradient separate the material ratio curve into core area & projected areas.
Calculate Rpk & Rvk with equivalent triangles of projected areas.




**Height characterization using the linear material ratio curve ISO13565-2:'96**

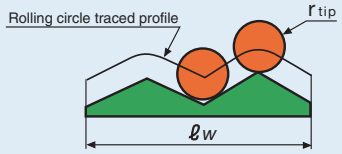
***Rk*** core roughness depth : Depth of the roughness core profile
***Rpk*** reduced peak height : Average height of protruding peaks above roughness core profile.
***Rvk*** reduced valley depths : Average depth of valleys projecting through roughness core profile.
***Mr1*** material portion 1 : Level in %, determined for the intersection line which separates the protruding peaks from the roughness core profile.
***Mr2*** material portion 2 : Level in %, determined for the intersection line which separates the deep valleys from the roughness core profile.




### Rolling circle waviness parameter JIS B0610 : '01

**Measuring condition**

Radius of rolling circle $r_{tip}$ : 0.08, 0.25, 0.8, 2.5, 8, 25mm
*ℓw* Sampling length : 0.25, 0.8, 2.5, 8, 25, 80mm




**Tilt correction**

Rolling circle waviness total profile

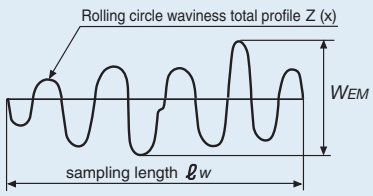
**Delete longer component than waviness by λf filter**

λf cutoff value : 0.8, 2.5, 8, 25mm
Default value : 8 mm

Z (x) Filtered rolling circle waviness profile

***WEM*** **WEM Maximum height of rolling circle waviness profile**
Defined only JIS standard

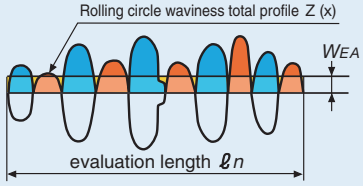
Vertical spacing between 2 line parallel to mean line within sampling length *ℓw* of Filtered rolling circle waviness profile.



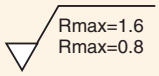
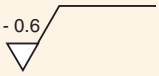
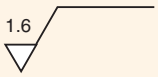
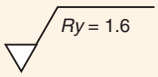
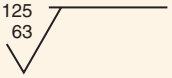

***WEA*** **Arithmetical mean deviation of filtered rolling circle waviness profile.**
Defined only JIS standard

Arithmetical mean of absolute ordinate value Z(X) within evaluation length *ℓn* of Filtered rolling circle waviness profile.

$$WEA = \frac{1}{\ell n}\int_{0}^{\ell n} |Z(x)|\,dx$$



# Comparison of national standards of surface texture measurement

| Specification \ ID. of national standard / country | | JIS B0601-'82<br>JIS B0031-'82<br>former Japan | ANSI B46.1-'85<br>former U.S.A. | NF E05-015('84)<br>NF E05-016('78)<br>NF E05-017('72)<br>former France | ISO468-'82<br>ISO4287/1-'84<br>ISO4288-'85<br>ISO1302-'78<br>former ISO |
|---|---|---|---|---|---|
| Primary profile *P* | Profile format | Analog signal without filtering | Analog signal with low pass filtering | Analog signal without filtering | Analog signal without filtering |
| | Evaluation length | 1 sampling length<br>0.25, 0.8, 2.5, 8, & 25 | ——— | not defined | ——— |
| *P* profile parameter | Maximum height | Rmax (**S** indication) | ——— | Pt | ——— |
| | Ten point height | Rz (**Z** indication) | ——— | ——— | ——— |
| | Other P parameters | ——— | ——— | Pp, Pa, (Tp)c, | ——— |
| | Motif parameters | ——— | ——— | R, AR, Kr, W,<br>W'max, W't, AW, Kw | ——— |
| | Indication of maximum height < 1.5$\mu$m |  | ——— | Pt 0.8 - 0.6  | ——— |
| Roughness profile *R* | Unit of height | $\mu$m | $\mu$m or $\mu$in. | $\mu$m | $\mu$m |
| | Unit of length | mm | mm or in. | mm | mm |
| | Filter | 2RC | 2RC | 2RC | 2RC |
| | Long cutoff | $\lambda$c | $\lambda_B$ | $\lambda$c | $\lambda$c |
| | Short cutoff | ——— | cutoff value 2.5$\mu$m | ——— | ——— |
| | Sampling length | L=3 × $\lambda$c or over | L:1.3-5mm@$\lambda$B 0.25<br>L:2.4-8mm@$\lambda$B 0.8<br>L:5-15mm @$\lambda$B 2.5 | $\ell$ | $\ell$ |
| | Evaluation length | TL=L=3 × $\lambda$c or over | | L = n × $\ell$ | $\ell n$ = n × $\ell$ |
| *R* profile Height parameter | Maximum height | ——— | Peak-to-Valley Height (*Rmax*, *Ry*) | Ry | *Ry* |
| | Maximum peak to valley height | ——— | ——— | Rmax | *Ry*max |
| | Ten point height | ——— | (*Rz*) | Rz | *Rz* |
| | Average peak to valley height | ——— | ——— | ——— | *Ry*5 |
| | Other peak height parameters | ——— | (*Rp*) | Rp | *Rp*, *Rp*max, *Rp*5, *Rm*, *Rc* |
| $\ell r$ & $\lambda$c for peak height parameter | 0.25mm | $R_{max}$, Rz ≤ 0.8$\mu$m | ——— | not defined | 0,1 < *Rz*, *Ry* ≤ 0,5$\mu$m |
| | 0.8mm | 0.8 < $R_{max}$, Rz ≤ 6.3$\mu$m | ——— | not defined | 0,5 < *Rz*, *Ry* ≤ 10$\mu$m |
| | 2.5mm | 6.3 < $R_{max}$, Rz ≤ 25$\mu$m | ——— | not defined | 10 < *Rz*, *Ry* ≤ 50$\mu$m |
| Indication of Maximum height in case of *Rz* < 1.5$\mu$m | | ——— | ——— | Rmac 1.6  |  |
| *R* profile averaging parameter | Arithmetic average | Ra (**a** indication) | *Ra* | Ra | *Ra* |
| | root mean square | ——— | (*Rq*) | Rq | *Rq* |
| | Skewness, kurtosis | ——— | (Skewness, Kurtosis) | Sk, Ek | *Sk* |
| $\ell r$ & $\lambda$c for *Ra* on non-periodic profile | 0.25mm | optional | 0.0063 < *Sm* ≤ 0.05$\mu$m | not defined | 0,02 < *Ra* ≤ 0,1$\mu$m |
| | 0.8mm | Ra ≤ 12.5$\mu$m | 0.02 < *Sm* ≤ 0.16$\mu$m | not defined | 0,1 < *Ra* ≤ 2$\mu$m |
| | 2.5mm | 12.5 < Ra ≤ 100$\mu$m | 0.063 < *Sm* ≤ 0.5$\mu$m | not defined | 2 < *Ra* ≤ 10$\mu$m |
| Indication of *Ra* in case of 1.5 < *Ra* < 3.1$\mu$m | |  |  | Ra 1.6 - 3.2  |  |
| *R* profile other parameter | Mean spacing | ——— | Roughness spacing | Sm | *Sm* |
| | RMS slope | ——— | ——— | Δq | Δ*q* |
| | material ratio | ——— | (*tp*) | ——— | *tp* |
| | Other parameters | ——— | (Peak count *Pc*) | S, Δa, $\lambda$a, $\lambda$q | *S*, Δ*a*, $\lambda$*a*, $\lambda$*q*, *Lo*, *D* |
| Comparison rule of measured value with tolerance limits | Average | average value of all sampling lengths | average value of all sampling lengths | not defined | ——— |
| | 16% rule | ——— | ——— | not defined | 16% rule default |
| | Maximum rule | ——— | ——— | not defined | Max rule for parameter with suffix "*max*" |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