Mitutoyo

CNC FORM MEASURING INSTRUMENT SERIES

THE WORLD'S LEADING RANGE OF CNC FORM MEASURING
MACHINES USHERS IN A NEW AGE OF AUTOMATED MEASUREMENT.

Mitutoyo

Towards improved measurement efficiency

CNC Surface Roughness Measuring Instrument Surftest Extreme

CNC Surface Texture Measuring Instrument Formtracer Extreme

CNC Contour Measuring Instrument Contracer Extreme

Mitutoyo provides powerful solutions for improving measurement efficiency.

Existing measurement process

- Workpiece loading / unloading
- Workpiece leveling, etc.
- Positioning the measurement start point
- Measurement
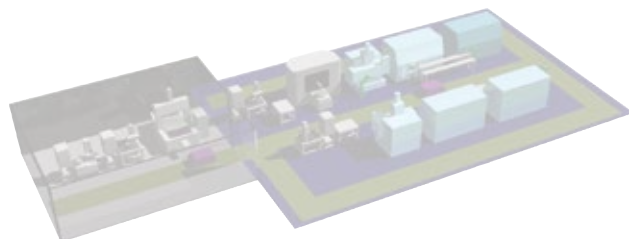- Analysis of recorded geometrical data
- Print

To be repeated for all workpieces.

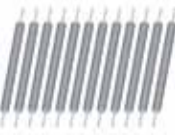**Ties up the operator for an extended period of time.**

CNC Measurement

- As soon as a workpiece pallet is loaded, measurement can be started.

**A CNC measuring machine runs unmanned.
Now the operator can commit to other tasks.**

Applicable workpiece	Measurement conditions	Time for measurement
Crankshaft	Number of measurement points: Approx. 40 points Measuring position: Pin/Journal/Thrust surface. Measuring direction: Along the axis of each cylindrical unit/On the surface of each thrust bearing. Preliminary arrangements: Shifting workpiece/Changing workpiece position/Alignment Analysis items: Surface roughness/Straightness *Alignment in the direction of measurement or mounting the shaft takes time, and can require two people!	**Manual : 90 minutes** ↓ **CNC : 20 minutes**
Cylinder head	Number of measurement points: Approx. 60 points Measuring position: Six surfaces and the inside diameter of each bore. Measuring direction: Multiple directions including the top, bottom, and side surfaces; and in the inclined holes. Preliminary arrangements: Shifting workpiece/Changing workpiece position/Alignment, etc. Analysis items: Surface roughness/Contour and profile *Since more than ten position changes are required to set the workpiece at the measuring point, the measurement efficiency is badly affected!	**Manual : 90 minutes** ↓ **CNC : 30 minutes**
Transmission gear	Number of measurement points: Approx. 4 points Measuring position: Near tip of tooth. Measuring direction: Tangent line Preliminary arrangements: Workpiece rotation/Workpiece positioning Analysis item: Contour and profile *Although the rotary positioning at every 90 degrees requires simple repetitive operations, a significant difference will result in the amount of time required and the accuracy depending on the operator's skill.	**Manual : 20 minutes** ↓ **CNC : 5 minutes** (Each estimated time covers measurement of four teeth.)
Valve body	Number of measurement points: Approx. 20 points Measuring position: Seating surface and holes Measurement direction: Top surface and the hole inside diameter in any of the three directions. Preliminary arrangements: Shifting workpiece/Changing workpiece position/Alignment, etc. Analysis items: Surface roughness *The seating surface can be measured easily after shifting the workpiece appropriately. However, it is not so easy to measure the inside surface roughness of a hole, since the measuring position may be difficult to see by the operator during positioning!	**Manual : 40 minutes** ↓ **CNC : 15 minutes**
Printer roll	Number of measurement points: Approx. 3 points/workpiece Measuring position: On the cylinder's generatrix. Measurement direction: Along the generatrix axis Preliminary arrangements: Workpiece change/Alignment Analysis items: Surface roughness/Straightness *Little time is required to measure only one piece. However, as the number of pieces to be measured within a day becomes large, so does the total time required for alignment, resulting in a time-consuming job!	**Manual : 50 minutes** ↓ **CNC : 15 minutes** (Each estimated time covers measurement of ten rolls.)
Aspheric surface lens	Number of measurement points: Approx. 2 points Measurement position: Along two lines crossing each other on the sectional plane perpendicular to the optical axis Measurement direction: In the direction of stylus retraction Preliminary Arrangements: Workpiece rotation/Workpiece leveling/Optical axis positioning Analysis items: Contour and profile/Tolerance zone measurement data/Surface roughness *It is critical to measure at the sectional profile, which is perpendicular to the optical axis and necessitates a significant amount of time for establishing the complete settings!	**Manual : 40 minutes** ↓ **CNC : 5 minutes**
Rotor/Spindle for motors	Number of measurement points: Approx. 2 points/workpiece Measuring position: On the cylinder's generatrix Measurement direction: Along the generatrix axis Preliminary arrangements: Workpiece change/Alignment Analysis items: Surface roughness/Straightness *It takes little time to measure only one piece. However, since it is often the case that many workpieces are measured during each job, the total setting time required may become too large for piece-by-piece setting!	**Manual : 40 minutes** ↓ **CNC : 20 minutes** (Measurement of 20 work-pieces is estimated within each time period.)

A Range of Functions Enhance Your Measurement Efficiency

Accelerating measurement efficiency through new measuring functions under CNC control

- Tracking measurement function
  The Z_2-axis control makes the target range of form (contour) tracing measurement wider than that covered by only the detector unit.

Z_2
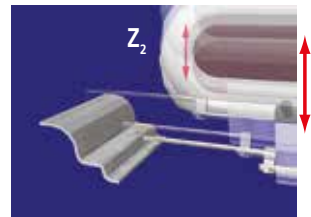
- Inclined plane measurement function (surface roughness)
  Simultaneous control over the X axis and Y axis enables oblique-movement measurement to be performed.
  Even continuous measurement can be achieved without re-setting the workpiece so that the measuring direction can be parallel to the drive unit.

X-axis displacement range
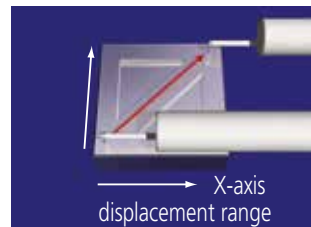
Part program-guided automatic continuous measurement of multiple points/multiple workpieces

The use of the Y-axis table makes it possible to perform automatic continuous measurement of multiple workpieces (measurement points).

Y axis

- Models with the α axis (incorporated with the drive unit tilting function) enable continuous measurement on multiple sections of surfaces including inclined portions without changing the initial set up.
- Installs the Automatic Leveling Function using the α axis or optional Auto Leveling Table.

High-throughput measurement enabled by fast positioning

- Thanks to its high drive speed (a maximum of 200 mm/s*) and multiple-axis simultaneous control, the detector can be positioned practically instantaneously on the target measurement point.

  (* Maximum 40 mm/s for CS-5000 CNC, CS-H4000 CNC, CS-H5000 CNC)

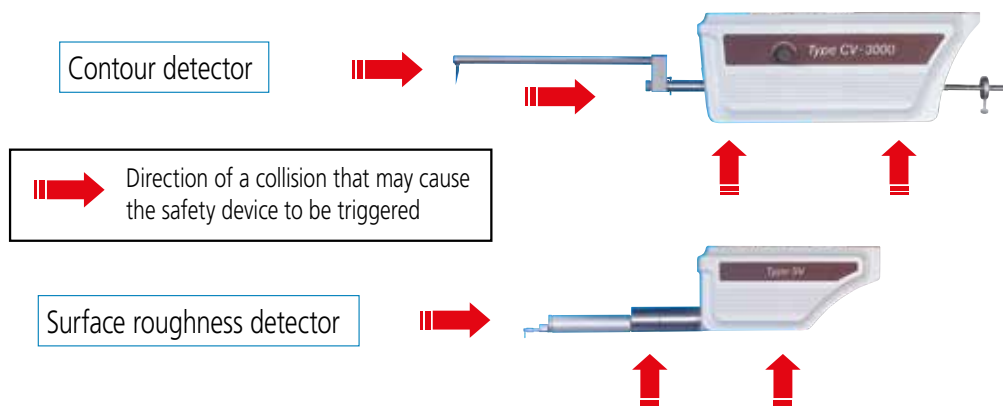## Easy-to-use Remote Box allows the operator to control the measuring unit at hand

- Easy-to-understand operation buttons identified by each icon marked on the top.
- Also provided with the Speed Override Knob, which allows the operator to change the traveling speed even during automatic execution.

Speed Override Knob that allows real-time change of traveling speed

Easy-to-understand operation buttons

An anti-collision safety function is also provided to protect the operator, measuring unit, and/or workpiece from damage.

- This safety device will automatically stop the measuring unit should a collision occur.

Contour detector

Direction of a collision that may cause the safety device to be triggered

Surface roughness detector

FORMTRACEPAK, the surface roughness/form analysis software that strongly supports CNC measurement

- Workpiece identification (coordinate system alignment)
  It is possible to measure the same point even when the current workpiece is positioned in a place offset from that which was set at the time of creating the part program, if the operator establishes the workpiece coordinate system another time.

Identifies the coordinate system through edge measurement.
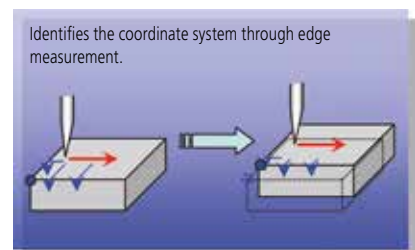
Supports multiple-part measurement.

- By repeatedly running one section of a part program using the loop function, it is possible to batch-measure more than workpiece having an identical form.

Repeated measurement via the loop function

One workpiece
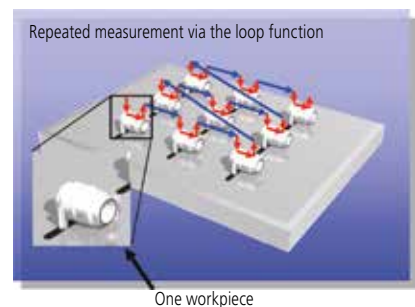
CNC Form Measuring Instrument Line-Up

Contributes greatly to your productivity improvement by increasing measurement throughput. The world's leading range of CNC Form Measuring Machines ushers in a new age of automated measurement.

CNC operation ensures that every user performs measurements under the same conditions, even if there are differences in skills and expertise. Your measuring **efficiency** can be enhanced due to the **comprehensive measuring functions** (e.g. tracking measurement/inclined plane measurement) under CNC control. Even **multiple parts** mounted on a palette as well as single parts with **multiple measurement** can be inspected easiliy and efficiently. Mitutoyo has achieved the **maximum drive speed of up to 200mm/s** together with a **multiple axis simultaneous control**, resulting in **ultrafast movement** towards the target measurement point. The drive speed has been increased to 40 times of a conventional instrument (5mm/s → 200mm/s).

An **easy-to-use Remote Box** allows the operator to control the measuring process by hand.

Provided with an **anti-collison safety function** the instrument safeguards operator, measuring unit and/or workpiece against damage.

FORMTRACEPAK, the analysis software for **contour and roughness measurement**, strongly supports CNC measurement. FORMTRACEPAK – developed for the wide-ranging product line. It includes not only **single-purpose** surface roughness or contour measuring instruments, but also **dual-purpose surface/contour measuring** instruments and numerous additional peripheral options. This enables the user to choose the **best instrumen**t for the measurement tasks in hand.
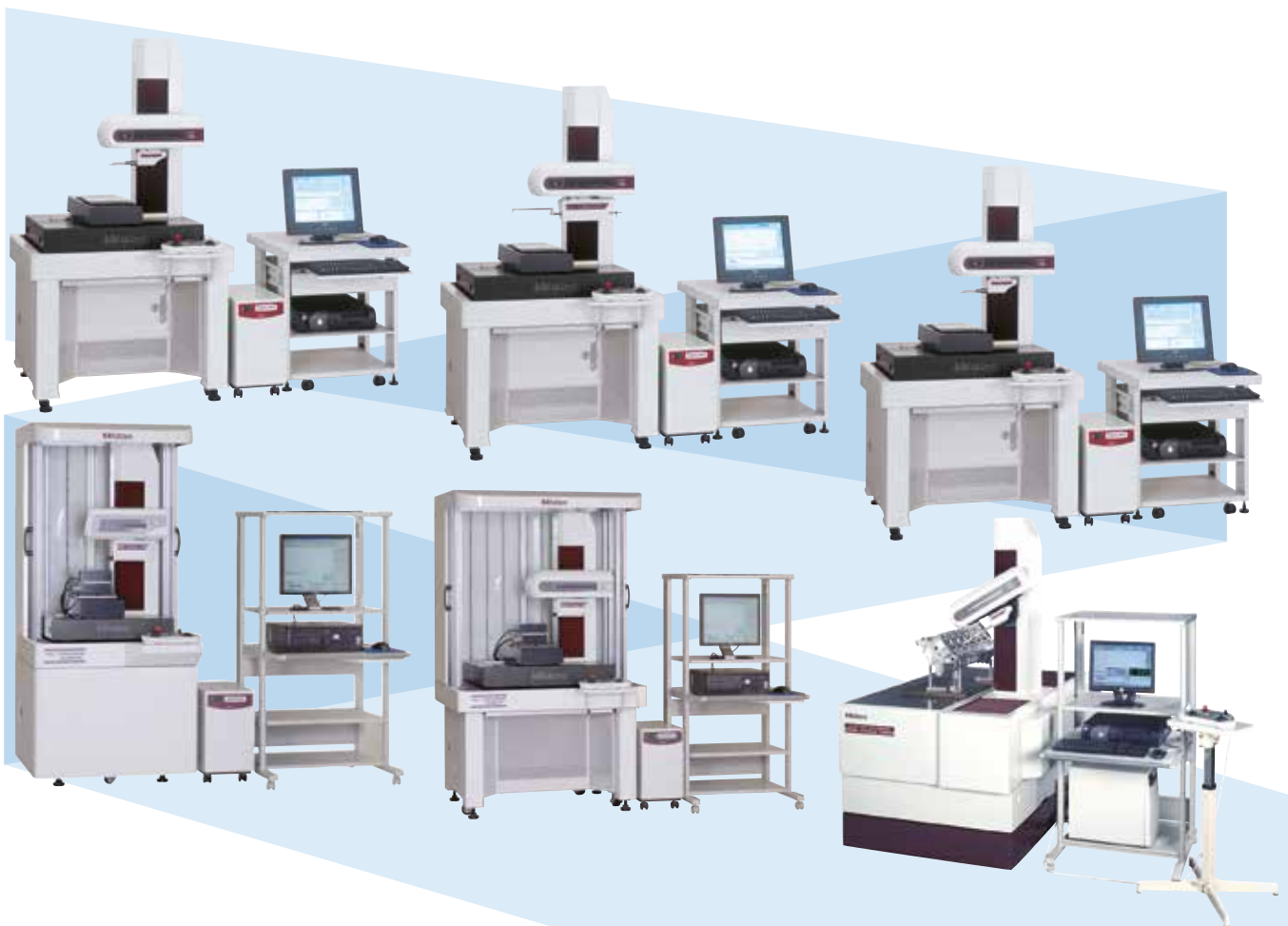
CNC Surface Roughness Measuring Instrument
Surftest Extreme SV-3000CNC

Features
- **High-accuracy** stylus type **CNC Surface Roughness Measuring Instrument.**
- X_1, (Y), and Z_2 axes have a **maximum drive speed of 200 mm/s**, which permits **high-speed positioning** that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- Enables inclined plane measurements through **2-axis simultaneous control** in X- and Y-axis directions.
- For models with the a axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by **power-tilting the X_1 axis**.
- For models with a Y-axis table, it is possible to expand the measuring range for **multiple workpieces**, etc., through positioning in the Y-axis direction.
- For the Z_1-axis detector, one of two types with a **measuring force of 4 mN or 0.75 mN** can be selected.
- All connecting cables are neatly housed in the measuring unit, which ensures **measurement without any interference from the cables**.
- Since the Z_1-axis detector incorporates an **anti-collision safety device**, the detector unit will automatically stop even if its main body collides with a workpiece or jig.
- Supplied with an **easy-to-operate Remote Box**, on which the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing/Analysis section is via **USB**.

CNC Contour Measuring Instrument
Contracer Extreme CV-3000CNC / CV-4000CNC

Features
- **High-accuracy stylus** type CNC contour measuring instrument.
- X_1, (Y), and Z_2 axes have a **maximum drive speed of 200 mm/s**, which permits **high-speed positioning** that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models with the a axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by **power-tilting the X_1 axis**.
- For models with the Y-axis table, it is possible to expand the measuring range for **multiple workpieces**, etc., through positioning in the Y-axis direction.
- The Z_1 axis is provided with a **digital detector** (CV-4000CNC: incorporating the **Mitutoyo Laser Holoscale**) that covers a wide measurement range and can be used for **high-accuracy measurement**.
- Enables inclined plane measurements through **2-axis simultaneous control** in the X- and Y-axis directions.
- Since the Z_1-axis detector incorporates an **anti-collision safety device**, the detector unit will automatically stop even if its main body collides with a workpiece or jig.
- Supplied with an **easy-to-operate Remote Box**, on which the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing/Analysis section is via **USB**.

CNC Surface Roughness/Contour Measuring Instrument Formtracer Extreme SV-C3000CNC / SV-C4000CNC

Features

- **High-accuracy** stylus type **CNC Surface Roughness/Contour Measuring Instrument** that allows both measurement of surface roughness and form/contour with one unit.
- X_1, (Y), and Z_2 axes have the **maximum drive speed of 200 mm/s**, which permits **high-speed positioning** that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models with the α axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by **power-tilting the X_1 axis**.
- For models with the Y-axis table, it is possible to expand the measuring range for **multiple workpieces**, etc., through positioning in the Y-axis direction.
- The CV-type Z_1-axis is provided with a **digital detector** (SV-C4000CNC : incorporating the **Mitutoyo Laser Holoscale**) that covers a wide measurement range and can be used for high-accuracy measurement.
- Enables inclined plane measurements through **2-axis simultaneous control** in the X- and Y-axis directions.
- When the detector for **contour measurement** is replaced with that for **surface roughness measurement**, or vice versa, it is a simple, one-touch replacement without re-routing of the connecting cables.
- Since the Z_1-axis detector incorporates an **anti-collision safety device**, the detector unit will automatically stop even if its main body collides with a workpiece or jig.
- Supplied with an **easy-to-operate Remote Box**, on which the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing/Analysis section is via **USB**.

Mitutoyo

CNC Surface Texture Measuring Instrument Formtracer Extreme CS-H4000CNC / CS-5000CNC / CS-H5000CNC

Features

- **High-accuracy** stylus type **CNC Measuring Instrument** that allows **simultaneous measurement of surface roughness and contour**.
- The X_1 axis has a maximum drive speed of 40 mm/s, and (Y) and Z_2 axes have a **maximum drive speed of 200 mm/s**, respectively. This permits **high-speed positioning** that may result in a large increase in the through-put of multiple-profile/multiple-workpiece measurement tasks.
- A **Mitutoyo Laser Holoscale is incorporated in the X_1 axis and Z_1 axis so that high resolution (X_1 axis: 6.25 nm, Z_1 axis: 1nm (4 nm/8 nm: CS-5000CNC, 1 nm/2 nm: CS-H5000CNC)** is achieved and batch measurement of contour and surface roughness can be made.
- The **active control method** is employed for the Z_1-axis detector to implement a **wide-range measurement capability** wherein the variation in **dynamic measuring force** is restricted.
- Since the Z_1-axis detector incorporates an **anti-collision safety device**, the detector unit will automatically stop even if its main body collides with a workpiece or jig.
- For models with the α axis*, it is possible to perform continuous measurement over horizontal and inclined sur-faces by **power-tilting the X_1 axis**.
- For models with the Y-axis table, it is possible to expand the measuring range for **multiple workpieces**, etc., through positioning in the Y-axis direction.
- Supplied with the **easy-to-operate Remote Box**, on which the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Uses **USB** for communicating with the Data Processing/Analysis Unit (optional).

* Not available only for CS-H4000 CNC / CS-H5000 CNC

Y-axis Column Moving Type Surface Roughness Measuring Instrument
Surftest Extreme SV-M3000CNC

Features

- **CNC Surface Roughness Measuring Instrument** that covers measurement of **large/heavy workpieces** such as engine blocks, crankshafts, etc.
- In combination with the **rotation of the detector unit**, it is possible to **measure continuously in the horizontal and vertical planes**.
- Supplied with either the large table for supporting a **load of 100 kg** or a **large θ2 table**, depending on the order.
- Suitable for **automatic surface roughness measurement on large and heavy workpieces**.
- Employs the **column-moving type** configuration that is not restricted by workpiece size.
- This is advantageous for measuring heavy workpieces such as engine blocks, crankshafts, etc.
- Provides **800 mm of Y-axis** stroke. This makes it possible to measure multiple profiles on large workpieces.
- **Load table has a self-contained structure** to ensure that various size workpieces, jigs, auto-feed devices, etc., are easily accommodated and can be specified, if required, by special order.
- **Surface roughness detector rotating unit**, S-3000AR (optional), covers continuous measurement over the bottom and side surfaces of a workpiece.
- Compatible with the **Large-size Rotary Table** (optional).
- Enables continuous **automatic measurement of large-size workpiece**.

Wide choice of optional accessories expands the application range - 1

Examples of optimal combinations of accessories

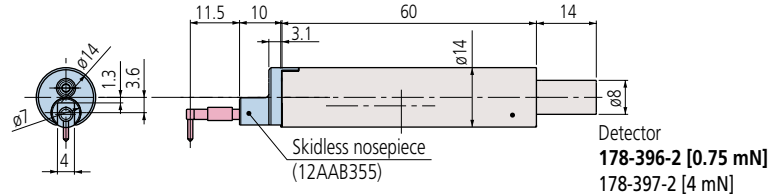| Optional accessory Function	Y-axis Table	θ₁ Table	θ₂ Table	Drive unit tilting function	Large θ Table	Rotary-type detector holder
Automatic leveling	—	—	—	○	—	—
Automatic alignment (Patent registered: Japan)	○	○	—	△	—	—
Multiple workpiece batch measurement	△	—	—	—	—	—
Measurement in the Y-axis direction	○	—	—	—	—	—
Oblique measurement of XY plane *2	○	—	—	—	—	—
Outside 3D surface roughness measurement/ evaluation *2	○	—	—	△	—	—
Multiple-piece measurement in the Y-axis direction (Positioning in the Y-axis direction)	○	—	—	—	—	—
Multiple-piece measurement in the radius direction (Positioning in the rotating direction of XY plane)	△	○	—	—	—	—

*1: Applicable only to contour measurement
*2: Applicable only to surface roughness measurement
*3: Applicable only for SV-M3000CNC

○ : Essential   △ : Better to provide with   — : Not necessary

Optional accessory Function	Y-axis Table	θ_1 Table	θ_2 Table	Drive unit tilting function	Large θ Table	Rotary-type detector holder
Tracking measurement in the Z-axis direction *1	—	—	—	—	—	—
Inclined surface measurement in the X-axis direction	△	—	—	○	—	—
Inclined hole inside measurement in the X-axis direction	△	—	—	○	—	—
Multiple cylinder generatrices measurement	△	—	○	—	—	—
Measurement of both top and bottom surfaces	△	—	○	—	—	—
Rotary positioning of large workpiece *3	—	—	—	—	○	—
Upward/downward and frontward/backward measurement of large workpiece *3	—	—	—	—	—	○

○ : Essential   △ : Better to provide with   — : Not necessary

Wide choice of optional accessories expands the application range - 2

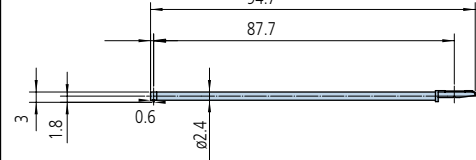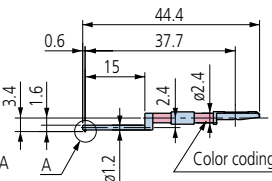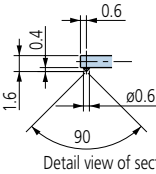## Stylus nosepiece (SV-3000CNC / SV-C3000CNC / SV-C4000CNC / SV-M3000CNC)

Skidless nosepiece
(12AAB355)
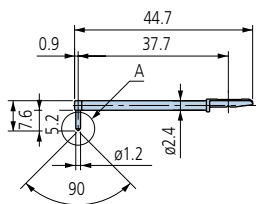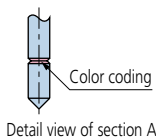
Detector
178-396-2 [0.75 mN]
178-397-2 [4 mN]

Styli

Standard stylus

12AAE882 (1 µm)*
12AAE924 (1 µm)
12AAC731 (2 µm)*
12AAB403 (5 µm)
12AAB415 (10 µm)
12AAE883 (250 µm)*
( ): Tip radius

Color coding

Detail view of section A

Double-length for deep hole

12AAE898 (2 µm)*
12AAE914 (5 µm)
( ): Tip radius

For small hole

12AAC732 (2 µm)*
12AAB404 (5 µm)
12AAB416 (10 µm)
( ): Tip radius

Detail view of section A
Color coding

For small hole/Double-length for deep hole

12AAE892 (2 µm)*
12AAE908 (5 µm)
( ): Tip radius

Detail view of section A
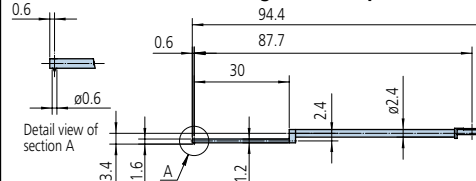
For extra small hole

12AAC733 (2 µm)*
12AAB405 (5 µm)
12AAB417 (10 µm)
( ): Tip radius

Detail view of section A
Color coding

For small hole

12AAE884
(ø1.6 mm)

ø1.6 carbide ball
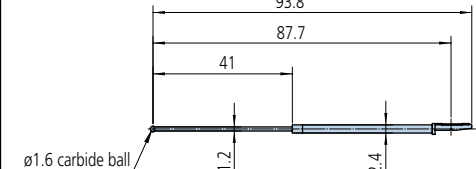
For extra minute hole

12AAC734 (2 µm)*
12AAB406 (5 µm)
12AAB418 (10 µm)
( ): Tip radius

Detail view of section A
Color coding
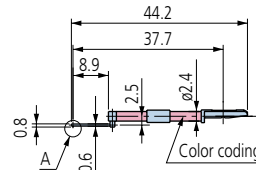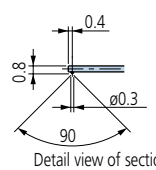
For ultra small hole

12AAE885
(ø0.5 mm)

ø0.5 carbide ball

Detail view of section A

For deep hole

Color coding
Detail view of section A

Color coding
Detail view of section A
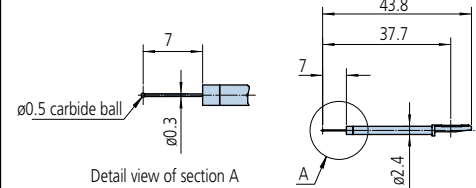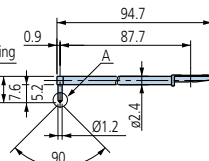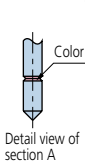
Double length
12AAC740 (2 µm)*
12AAB413 (5 µm)
12AAB425 (10 µm)
( ): Tip radius
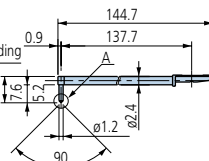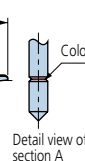
Triple length
12AAC741 (2 µm)*
12AAB414 (5 µm)
12AAB426 (10 µm)
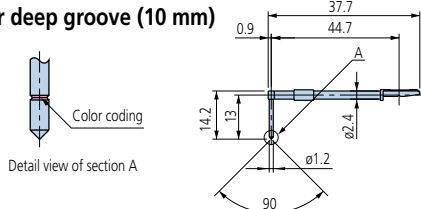( ): Tip radius

For small slotted hole

12AAE938 (2 µm)*
12AAE940 (5 µm)

Detail view of section A
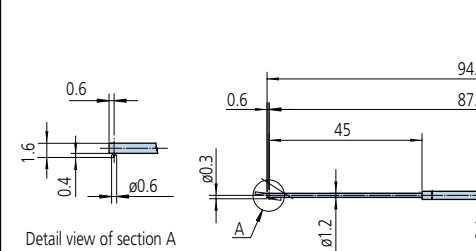
* Tip angle: 60°

Styli

For deep groove (10 mm)

Color coding
Detail view of section A

37.7
44.7
0.9
14.2
13
A
ø2.4
ø1.2
90

12AAC735 (2 μm)*
12AAB409 (5 μm)
12AAB421 (10 μm)
( ): Tip radius

For deep groove (20 mm)
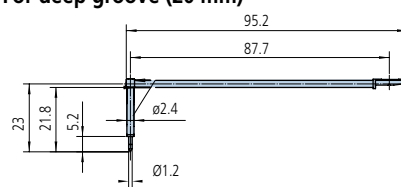
95.2
87.7
23
21.8
5.2
ø2.4
Ø1.2

12AAC736 (2 μm)*
12AAB408 (5 μm)
12AAB420 (10 μm)
( ): Tip radius

For deep groove (20 mm)

Color coding
Detail view of section A

0.9
24.2
23
37.7
44.7
ø2.4
A
ø1.2
90

12AAC736 (2 μm)*
12AAB408 (5 μm)
12AAB420 (10 μm)
( ): Tip radius

For deep groove (40 mm)

45.2
37.7
43.8
42.6
ø2.4
5.2
ø2.4
Ø1.2
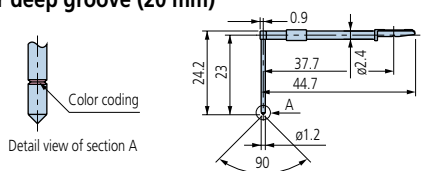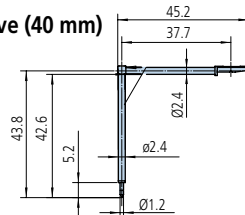
12AAE895 (2 μm)*
12AAE911 (5 μm)
( ): Tip radius

For deep groove (30 mm)

Color coding
Detail view of section A

ø2.4
Ø2.4
37.7
45.2
33
31.8
5.2
A
ø1.2
90
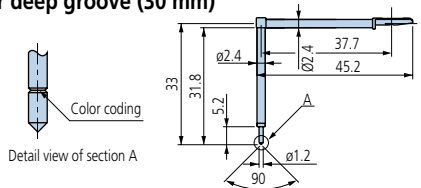
12AAC737 (2 μm)*
12AAB407 (5 μm)
12AAB419 (10 μm)
( ): Tip radius

For deep groove (30 mm)/ Double-length for deep hole

93.8
87.7
Ø3
36.5
35
5.2
Ø1.2
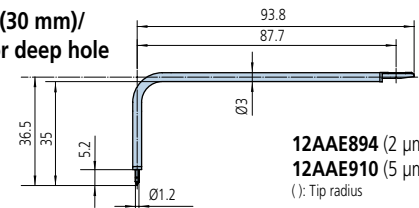
12AAE894 (2 μm)*
12AAE910 (5 μm)
( ): Tip radius

For gear tooth

Color coding
Detail view of section A

43.8
37.7
60
6.4
7.6
A
60
ø1.2
ø2.4
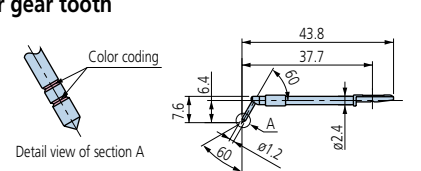
12AAB339 (2 μm)*
12AAB410 (5 μm)
12AAB422 (10 μm)
( ): Tip radius

For gear tooth/ Double-length for deep hole

93.8
87.7
Ø3
Ø3
36.5
35
6.77
ø1.2
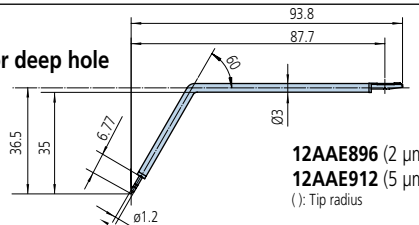
12AAE896 (2 μm)*
12AAE912 (5 μm)*
( ): Tip radius

For rolling circle waviness surface

44.7
0.9
37.7
7.6
5.2
Ball ø1.588
ø2.4
ø1.2
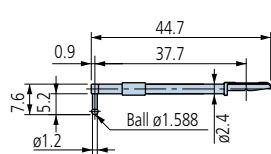
12AAB338
(0.8 mm)

For rolling circle waviness/ Double-length for deep hole

94.7
0.9
87.7
7.6
6.4
5.2
ø1.2
ø2.4
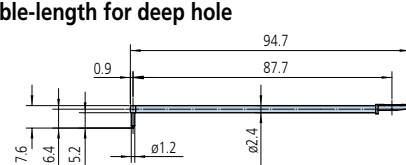
12AAE886 (250 μm)

For knife-edge detector

Color coding
Detail view of section A

44.7
37.7
0.9
7.6
A
ø1.2
ø2.4
90
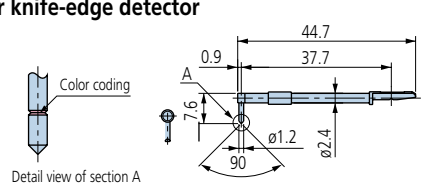
12AAC738 (2 μm)*
12AAB411 (5 μm)
12AAB423 (10 μm)
( ): Tip radius

For corner hole/Double-length for deep hole

93.8
87.7
35
60
5.8
5
Ø0.8
ø1.6
ø2.4
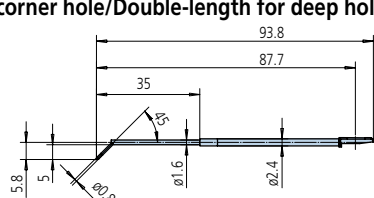
12AAE897 (2 μm)*
12AAE913 (5 μm)
( ): Tip radius

For eccentric arm

Color coding
Detail view of section A

10
ø2.4
0.9
45.2
37.7
7.6
A
ø1.2
ø2.4
90
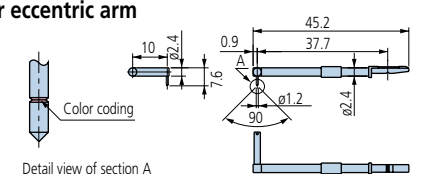
12AAC739 (2 μm)*
12AAB412 (5 μm)
12AAB424 (10 μm)
( ): Tip radius

For bottom surface of hole

37.5
31.4
7.6
60
ø3
25
ø1.2
50
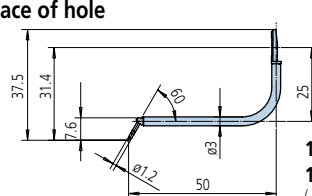
12AAE899 (2 m)*
12AAE915 (5 m)
( ): Tip radius

12AAE939 (2 μm)*
12AAE941 (5 μm)
( ): Tip radius

* Tip angle: 60°

Wide choice of optional accessories expands the application range - 3

Arms and for CV-3000CNC, CV-4000CNC, SV-C3000CNC, SV-C4000CNC

Straight arm

ø8
H
185 15

Eccentric arm

ø8
H
185 15
40

Arm for small hole

ø3
ø8
15 130 15

One-sided cut stylus

ø3
H
Tip angle: 12°
Tip radius: 25 µm
Material: Carbide

Conical stylus

ø3
H
Tip angle: 20°
Tip radius: 25 µm
Material: Carbide

Intersecting cut stylus

ø3
H
Tip angle: 20°
Tip radius: 25 µm
Material: Carbide

Conical stylus

ø3
H
Tip angle: 30°
Tip radius: 25 µm
Material: Sapphire or carbide

Knife-edge stylus

ø3
H
Tip angle: 20°
Tip width: 3 mm
Tip radius: 25 µm
Material: Carbide

Ball stylus

ø3
H
Tip ball diameter: 1 mm
Tip material: Carbide

Small hole stylus SPH-11/21/31

ø1.6 ø4
0.4
13 55

Small hole stylus SPH-12/22/32

ø3 ø5
20 55

Small hole stylus SPH-13/23/33

ø4
2.5
55

Arm Applicability Table

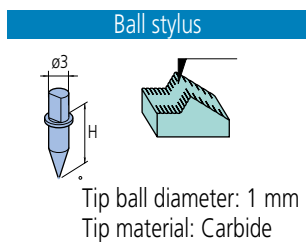| Arm	Model	Part No.	Applicable Stylus No.	H (mm)
Straight	ABH-53	12AAE294	SPH-51, 52, 53, 54, 55, 56, 57	6
	ABH-63	12AAE295	SPH-61, 62, 63, 64, 65, 66, 67	12
	ABH-71*	996506	SPH-71, 72, 73, 74, 75, 76, 77, 79	20
	ABH-81	996507	SPH-81, 82, 83, 84, 85, 86, 87	30
	ABH-91	996508	SPH-91, 92, 93, 94, 95, 96, 97	42
Eccentric	ABH-52	996509	SPH-51, 52, 53, 54, 55, 56, 57	6
	ABH-62	996510	SPH-61, 62, 63, 64, 65, 66, 67	12
	ABH-72	996511	SPH-71, 72, 73, 74, 75, 76, 77, 79	20
	ABH-82	996512	SPH-81, 82, 83, 84, 85, 86, 87	30
	ABH-92	996513	SPH-91, 92, 93, 94, 95, 96, 97	42
Arm for small hole	ABH-21	12AAE296	SPH-21, 22, 23	—

*Standard accessories (CV-3000/4000 series, SV-C3000/4000)

Stylus Applicability Table

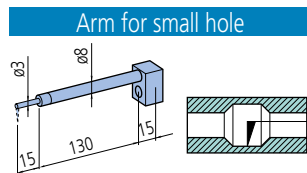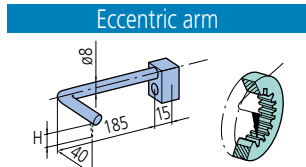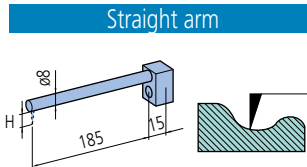| Arm	Model	Part No.	Applicable Stylus No.	H (mm)
One-sided cut stylus	SPH-51	354882	ABH-53 · 52	6
	SPH-61	354883	ABH-63 · 62	12
	SPH-71	354884	ABH-71 · 72	20
	SPH-81	354885	ABH-81 · 82	30
	SPH-91	354886	ABH-91 · 92	42
Intersecting cut stylus	SPH-52	354887	ABH-53 · 52	6
	SPH-62	354888	ABH-63 · 62	12
	SPH-72	354889	ABH-71 · 72	20
	SPH-82	354890	ABH-81 · 82	30
	SPH-92	354891	ABH-91 · 92	42
Conical stylus Tip angle: 20° (Carbide)	SPH-57	12AAE865	ABH-53 · 52	6
	SPH-67	12AAE866	ABH-63 · 62	12
	SPH-77	12AAE867	ABH-71 · 72	20
	SPH-87	12AAE868	ABH-81 · 82	30
	SPH-97	12AAE869	ABH-91 · 92	42
Conical stylus Tip angle: 30° (Sapphire)	SPH-53	354892	ABH-53 · 52	6
	SPH-63	354893	ABH-63 · 62	12
	SPH-73	354894	ABH-71 · 72	20
	SPH-79	355129	ABH-71 · 72	20
	SPH-83	354895	ABH-81 · 82	30
	SPH-93	354896	ABH-91 · 92	42
Conical stylus Tip angle: 30° (Carbide)	SPH-56	12AAA566	ABH-53 · 52	6
	SPH-66	12AAA567	ABH-63 · 62	12
	SPH-76*	12AAA568	ABH-71 · 72	20
	SPH-86	12AAA569	ABH-81 · 82	30
	SPH-96	12AAA570	ABH-91 · 92	42
Knife-edge stylus	SPH-54	354897	ABH-53 · 52	6
	SPH-64	354898	ABH-63 · 62	12
	SPH-74	354899	ABH-71 · 72	20
	SPH-84	354900	ABH-81 · 82	30
	SPH-94	354901	ABH-91 · 92	42
Ball stylus	SPH-55	354902	ABH-53 · 52	6
	SPH-65	354903	ABH-53 · 52	12
	SPH-75	354904	ABH-53 · 52	20
	SPH-85	354905	ABH-53 · 52	30
	SPH-95	354906	ABH-53 · 52	42
Small hole stylus (One-sided cut)	SPH-21	12AAE297	ABH-21	0.4
	SPH-22	12AAE298	ABH-21	1.0
	SPH-23	12AAE299	ABH-21	2.5

* Standard accessories (CV-3000/4000 series, SV-C3000/4000)

Possible styli with the FORMTRACER models CS-5000 CNC and CS-H5000 CNC

Styli for CS-H4000CNC, CS-5000CNC and CS-H5000CNC

Type	Dimensions	Styli		additional CS-H5000CNC	
Standard		Standard 12AAD543	Ball tip 12AAD544	12AAJ037	
Double length		Standard 12AAD545	Ball tip 12AAD546	12AAJ039	12AAJ041
For bores		12AAD651	12AAD652		
Eccentric		12AAD653			

Nosepiece   Detector
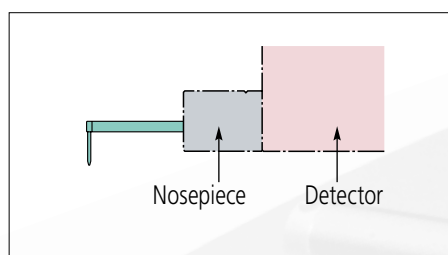
Software FORMTRACEPAK
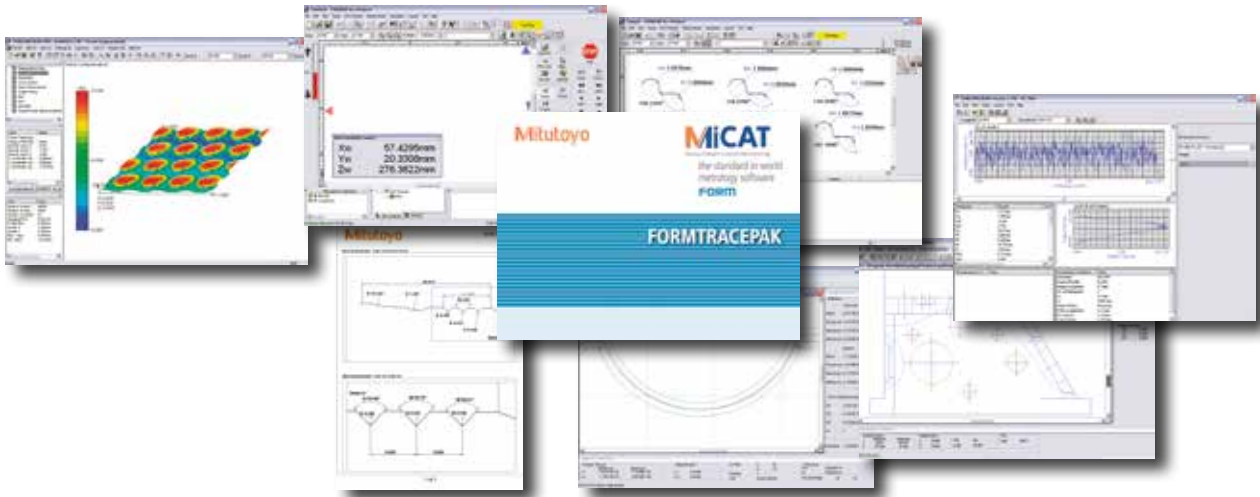
Measurement Control

- The Measurement Control screen has various command buttons appropriately arranged. They are required for creating and executing measurement procedures (part programs). Since the buttons and display areas not frequently used can be optionally set for display or no-display, the operator is permitted to arbitrarily customize the screen layout as easily as possible for operation.

- Any operation procedure can be accessed through a simple selection from the pull-down menu so as to be quickly ready for measurement.

- To aid effective measurement procedure (part program) creation, the arrangement of the control buttons is consistent with those on the Remote Box.

- The "Workpiece Identification Function", for example, that detects the amount of offset brought up during datum setting and mechanically fine-adjusts each axis to the optimum setting position for the measurement, as well as the "Coordinate System Alignment" commands that generate the optimum coordinate system for each measurement part allow fully automatic running.

- With the multi-axis translation command that simultaneously controls the movement along a maximum of six axes it is now possible to reduce the operation time required by the measuring instrument to a minimum and to further reduce the tracing time.

- For measuring multiple parts arranged on the palette, the use of the multiple-part loop function that repeats a set of movement, measurement, and analysis commands can reduce the time required to create the specific measurement steps.

MiCAT
Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software
FORM
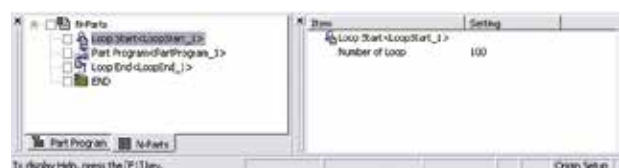
Profile Analysis Function

• Various commands including the point command (10 kinds), line command (6 kinds), and circle command (6 kinds) are provided to cover the basic elements of analysis. Standard calculation commands that combine these elements for angle, pitch, and distance calculations are also provided.
The display method used by additional commands that are not regularly used can be optionally tailored by the customization function, e.g. "Hide", can be applied to the calculation command button to suit the application environment.

• The Outlier Removal Function is very useful, for example, to automatically remove irregular flaws from the data and set the calculation range for a section in which the boundary between a circle and a line can not be easily identified.

• Calculation results will be output as text (in the csv or txt format). The geometrical measurement data can be either output as a text file of point-series data or a CAD file (in the DXF or IGES format) or copied onto the clipboard. It is also possible to use some commercial documentation software and statistical processing software to share the data on a PC that is not equipped with Mitutoyo-original analysis software or if reverse engineering is intended with CAD.
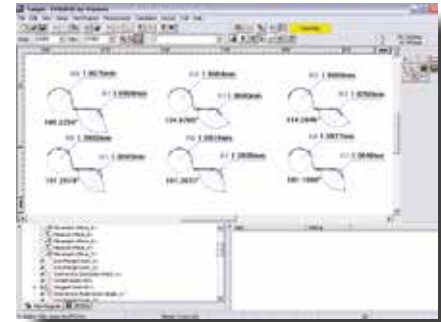
Surface Roughness Analysis Function

• Using the surface roughness measurement data it is possible to conduct analysis that conforms to global standards including DIN EN ISO, VDA, JIS, ANSI, MOTIF, etc.

• This software has integrated not only parameter calculating functions but also comprehensive graphical analysis functions, which can be widely used in daily quality control and R&D operations.

• Also enhanced with the data correction function (applicable to inclination and a curved surface) and data elimination function, etc.
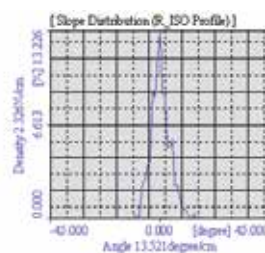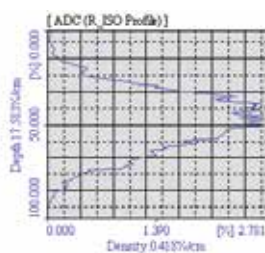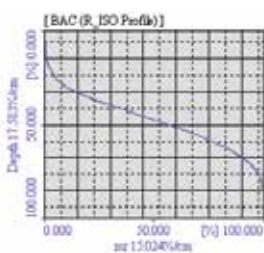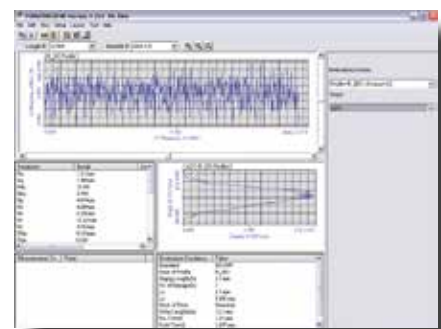
Software FORMTRACEPAK

Design Data Generation Function

Design data can be created from a CAD file (DXF- or IGES-formatted).
Measurement data from the measuring instrument can also be converted into design data.
In addition, lens design data, critical in the rating of aspheric lenses, can be created not only from the input (maximum 20 degrees) of a generic formula for the aspheric surfaces of revolution but also from the CSV-formatted text file.

Design data generation
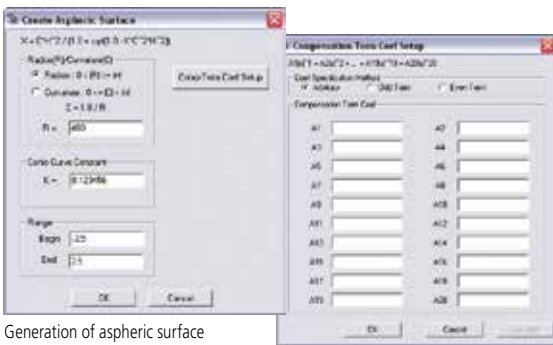
Generation of aspheric surface design values
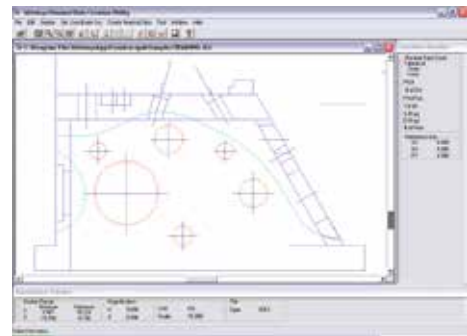
Profile Tolerance Zone Measurement Function

This application serves to collate the measurement data with the design data created in the process of design data generation. The Best-Fit Function that allows both the design data and measurement data to be translated to their optimal coordinates is provided as standard.
From this profile tolerance zone measurement result, it is not only possible to present a visual form of geometrical data and the amount of error at each coordinate but also to output in text-file format, which can be applied for feedback to a machine tool, etc.
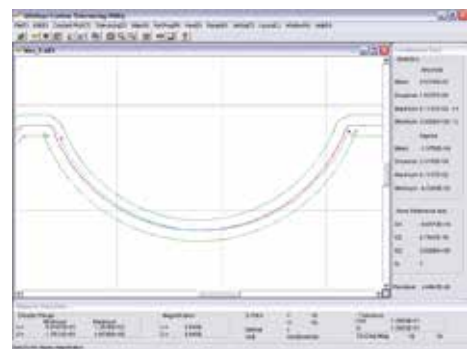
Profile Tolerance Zone Measurement Result

Profile tolerance zone measurement results
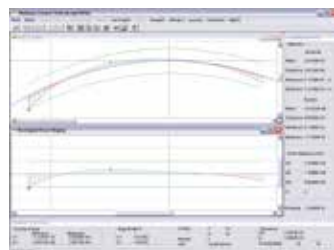
Output example of profile tolerance zone measurement result values

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world
metrology software
FORM

3D Data Analysis Program, FORMTRACEPAK-Pro (optional)

This software will analyze the three-dimensional surface roughness data collected from coordinate measurement with the Y-axis table.
It can offer various visual representation methods, such as shading display, mesh display, and contour-line display.
Thus, the user can analyze the target surface texture from various angles by making use of not only the 3D Roughness Parameter Calculation, Profile Analysis (area, volume), but also Bearing Area Curve (BAC), Amplitude Distribution Curve and Power Spectrum Analysis, etc.
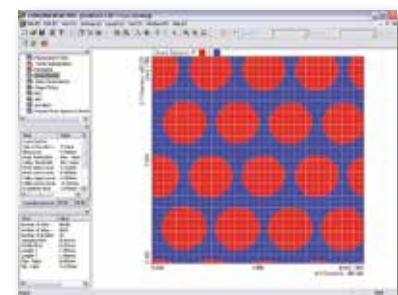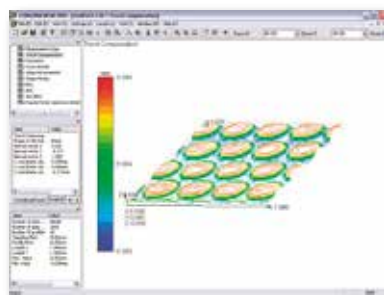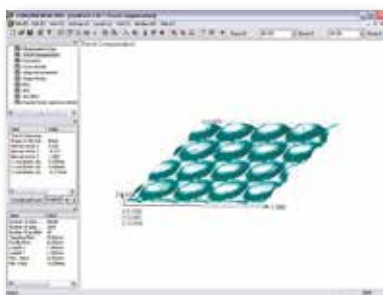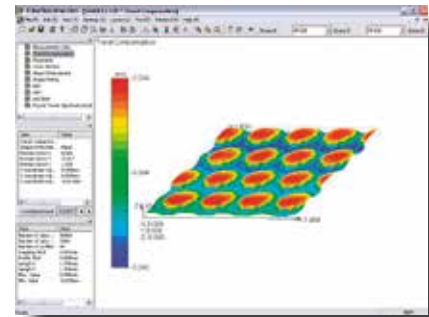
External Communication Program, FORMEio (optional)

This is optional software for installing the external control function in the CNC form measuring instrument.
With this function it is possible to monitor and control the measuring instrument conditions via RS-232C communication from PLC.

CNC Form Measuring Instrument Data Processing Unit PC		
Analysis Software FORMTRACEPAK	External Communication Software FORMEio	

RS-232C → PLC*

Workpiece Feed Unit
Operation Console
Signal Tower
Available signals:
Approach SW, Limit SW

* Programmable Logic Controller
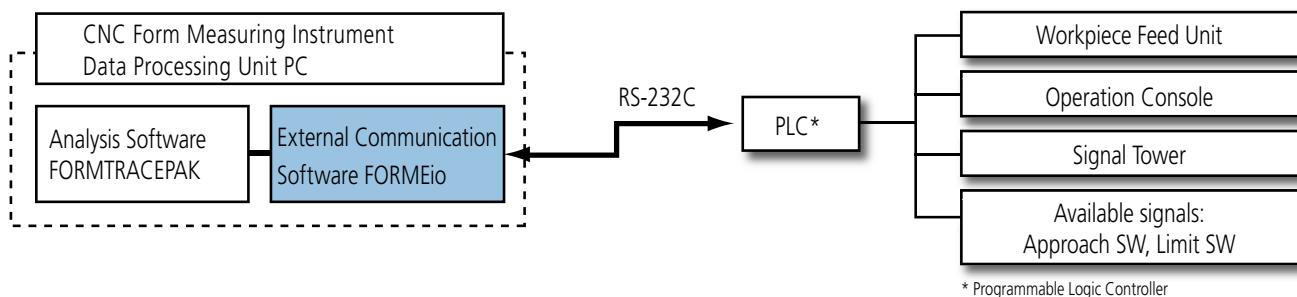
Specifications

SV-3000CNC

Main unit

X_1 axis	Measuring range	200 mm
	Resolution	0.05 μm
	Scale unit	Reflective-type Linear Encoder
	Drive speed — CNC mode	Max. 200 mm/s
	Drive speed — Joystick control mode	0-60 mm/s
	Measuring speed	0.02-2 mm/s
	Measuring direction	Retracting direction
	Traverse linearity	0.5 μm/200 mm
Z_2 axis (column)	Travel range — Standard column type	300 mm
	Travel range — High column type	500 mm
	Resolution	0.05 μm
	Scale unit	Reflective-type Linear Encoder
	Drive speed — CNC mode	Max. 200 mm/s
	Drive speed — Joystick control mode	0-60 mm/s
	Base size (W x D)	750 x 600 mm
	Base material	Granite
External dimensions (W x D x H)	Standard column type	800 x 620 x 1000 mm
	High column type	800 x 620 x 1200 mm
Mass	Standard column type	240 kg (not including the Y-axis Table unit and Vibration Insulating Stand)
	High column type	250 kg (not including the Y-axis Table unit and Vibration Insulating Stand)
Operating temperature and humidity ranges		15-25°C, 20-80% RH (without condensation)
Storage temperature and humidity ranges		-10-50°C, 5-90% RH (without condensation)

Controller (common to all models)

External dimensions (width x depth x height)	250 x 427 x 517 mm
Mass	28 kg
Communication interface	USB
Power supply specifications	100-120V, 200-240V ±10%, AC50/60Hz
Power consumption	500W

Remote Box (common to all models)

External dimensions (W x D x H)	300 x 143 x 71mm
Mass	1.5 kg

Vibration Insulating Stand (optional)

Vibration insulating mechanism	Diaphragm air spring
Natural frequency	2.5-3.5Hz
Damping mechanism	Orifice
Leveling mechanism	Automatic control with mechanical valves
Air supply pressure	390 kpa
Allowable loading capacity	350 kg
External dimensions (W x D x H)	1000 x 895 x 715 mm
Mass	280 kg

Cabin (optional)

External dimensions (W x D x H)	Standard column type	1000 x 750 x 1100 mm
	High column type	1000 x 750 x 1300 mm
Mass	Standard column type	46 kg
	High column type	53 kg

α-axis unit (common to only the installed models)

Inclination angle	+45° (counterclockwise), -10° (clockwise)
Rotating speed under inclined condition	1 rpm
Resolution of inclination angle	0.000225°
Mass	9 kg

Y-axis table unit (common to only the installed models)

Measuring range		200 mm
Minimum reading		0.05 μm
Scale unit		Reflective-type Linear Encoder
Drive speed	CNC mode	Max. 200 mm/s
	Joystick control mode	0-60 mm/s
Maximum loading capacity		20 kg (the center of gravity should be placed within 50 mm from the table center)
Traverse linearity	Surface roughness mode	0.5 μm/200 mm
	Contour mode	2 μm/200 mm
Linear displacement accuracy (at 20°C, contour mode)		± (2+2L/100) μm L : Dimension between two measured points (mm)
Table size		200 x 200 mm
External dimensions (W x D x H)		320 x 646 x 105 mm
Mass		35 kg

Specifications

CV-3000CNC/CV-4000CNC
Main unit

Model			CV-3000CNC	CV-4000CNC
X$_1$ axis	Measuring range		200 mm	
	Resolution		0.05 µm	
	Scale unit		Reflective-type Linear Encoder	
	Drive speed	CNC mode	Max. 200 mm/s	
		Joystick control mode	0-60 mm/s	
	Measuring speed		0.02-2 mm/s	
	Measuring direction		Forward/backward direction	
	Traverse linearity		2 µm/200 mm	
	Linear displacement accuracy (at 20°C)		± (1+4L/200) µm L : Measuring length (mm)	
Z$_1$ axis (detector unit)	Measuring range		50 mm (±25 mm from the horizontal plane)	
	Resolution		0.2 µm	0.05 µm
	Stylus up/down operation		Arc movement	
	Scale unit		Reflective-type Linear Encoder	Laser Holoscale
	Linear displacement accuracy (at 20°C)		± (3+2H/25) µm	± (0.8+I0.5HI/25) µm
	Measuring force		30 mN	
	Traceable angle		70° for ascent, 70° for descent (depending on the surface texture)	
	Stylus tip		Refer to page 15.	
	Face of stylus		Downward	
Z$_2$ axis (column)	Travel range	Standard column type	300 mm	
		High column type	500 mm	
	Resolution		0.05 µm	
	Scale unit		Reflective-type Linear Encoder	
	Drive speed	CNC mode	Max. 200 mm/s	
		Joystick control mode	0-60 mm/s	
	Base size (W x D)		750 x 600 mm	
	Base material		Granite	
External dimensions (W x D x H)		Standard column type	800 x 620 x 1000 mm	
		High column type	800 x 620 x 1200 mm	
Mass (not including the Y-axis Table unit and Vibration isolating		Standard column type	240 kg	
		High column type	250 kg	
Operating temperature and humidity ranges			15-25°C, 20-80% RH (without condensation)	
Storage temperature and humidity ranges			-10-50°C, 5-90% RH (without condensation)	

Controller	Common to all models, refer to page 21.
Remote Box	Common to all models, refer to page 21.
α-axis	Common to only the installed models, refer to page 22.
Y-axis table unit	Common to only the installed models, refer to page 22.
Main unit dimensions	Refer to page 27.
Vibration Isolating Stand	Standard accessory, refer to page 22.
Cabin	Standard accessory, refer to page 22.

SV-C3000CNC/SV-C4000CNC
Main unit

☐ Surface roughness mode (when the surface roughness detector holder is used)
☐ Contour mode (when the CV-3000/CV-4000 detector is used)

Model			SV-C3000CNC	SV-C4000CNC
X_1 axis	Measuring range		200mm	
	Resolution		0.05µm	
	Scale unit		Reflective-type Linear Encoder	
	Drive speed	CNC mode	Max. 200 mm/s	
		Joystick control mode	0-60 mm/s	
	Measuring speed		0.02-2 mm/s	
	Measuring direction		Forward/backward direction	
	Traverse linearity		2 µm/200 mm	
	Linear displacement accuracy (at 20°C)		± (1+4L/200) µm L : Measuring length (mm)	
	Measuring direction		Retracting direction	
	Traverse linearity		0.5 µm/200 mm	
Z_1 axis (detector unit)	Measuring range		50 mm (±25 mm from the horizontal plane)	
	Resolution		0.2 µm	0.05 µm
	Stylus up/down operation		Arc movement	
	Scale unit		Reflective-type Linear Encoder	Laser Holoscale
	Linear displacement accuracy (at 20°C)		± (3+2H/100) µm	± (0.8+l0.5Hl/25) µm
	Measuring force		30 mN	
	Traceable angle		70° for ascent, 70° for descent (depending on the surface texture)	
	Stylus tip		30° cone, tungsten carbide	
	Face of stylus		Downward	
Z_2 axis (column)	Travel range	Standard column type	300 mm	
		High column type	500 mm	
	Resolution		0.05 µm	
	Scale unit		Reflective-type Linear Encoder	
	Drive speed	CNC mode	Max. 200 mm/s	
		Joystick control mode	0-60 mm/s	
	Base size (W x D)		750 x 600 mm	
	Base material		Granite	
External dimensions (W x D x H)		Standard column type	800 x 620 x 1000 mm	
		High column type	800 x 620 x 1200 mm	
Mass (not including the Y-axis Table unit and Vibration isolating Stand)		Standard column type	240 kg	
		High column type	250 kg	
Operating temperature and humidity ranges			15-25°C, 20-80% RH (without condensation)	
Storage temperature and humidity ranges			-10-50°C, 5-90% RH (without condensation)	

Controller	Common to all models, refer to page 21.
Remote Box	Common to all models, refer to page 21.
α-axis	Common to only the installed models, refer to page 22.
Y-axis table unit	Common to only the installed models, refer to page 22.
Main unit dimensions	Refer to page 27.
Vibration Isolating Stand	Standard accessory, refer to page 22.
Cabin	Standard accessory, refer to page 22.

Specifications

CS-H4000CNC / CS-5000CNC / CS-H5000CNC

Main unit

Model			CS-H4000CNC	CS-H5000CNC / CS-5000CNC
X_1 axis	Measuring range		100 mm	200 mm
	Resolution		0.00625 μm	
	Scale unit		Laser Holoscale	
	Drive speed	CNC mode	Max. 40 mm/s	
		Joystick control mode	0-40 mm/s	
	Measuring speed		For surface roughness: 0.02-0.2mm/s, for contour: 0.02-2mm/s	
	Measuring direction		Forward/backward direction	
L: Measurement length (mm)	Traverse linearity	Using standard-length stylus	(0.05+0.0003L) μm	(0.05+0.0003L) μm/(0.1+0.0015L) μm
		Using double-length stylus	–	(0.1+0.0015L) μm/(0.2+0.0015L) μm
	Linear displacement accuracy (at 20°C)		± (0.16+0.001L) μm	± (0.16+0.001L) μm/± (0.3+0.002L) μm
Z_1 axis (detector unit)	Measuring range	Using standard-length stylus	12 mm	
		Using double-length stylus	–	24 mm
	Resolution	Using standard-length stylus	1 nm	1 nm/4 nm
		Using double-length stylus	–	2 nm/8 nm
	Stylus up/down operation		Arc movement	
	Scale unit		Laser Holoscale	
	Linear displacement accuracy (at 20°C)		± (0.7+0.02H) μm	± (0.7+0.02H) μm/± (0.3+0.02H) μm
H: Measurement length (mm)	Measuring force	Using standard-length stylus	4 mN constant	
		Using double-length stylus	–	0.75 mN constant
	Traceable angle		60° for ascent, 60° for descent (depending on the surface texture)	
	Stylus tip		Refer to page 16.	
	Face of stylus		Downward	
Z_2 axis (column)	Measuring range	Standard column type	300 mm	
		High column type	–	500 mm (only for CS-5000CNC)
	Resolution		0.05 μm	
	Scale unit		Reflective-type Linear Encoder	
	Drive speed	CNC mode	Max. 200 mm/s	
		Joystick control mode	0-50 mm/s	
	Base size (W x D)		600 x 550 mm	750 x 600 mm
	Base material		Granite	
External dimensions (W x D x H)	Standard column type		600 x 570 x 992 mm	800 x 620 x 1000 mm
	High column type		–	800 x 620 x 1200 mm (only for CS-5000CNC)
Mass (not including the Y-axis Table unit and Vibration Isolating Stand	Standard column type		190 kg	240 kg
	High column type		–	250 kg (only for CS-5000CNC)
Operating/storage temperature and humidity ranges			15-25°C/-10-50°C, 20-80% RH/5-90% RH (without condensation)	

Controller	Common to all models, refer to page 21.
Remote Box	Common to all models, refer to page 21.
α-axis	Common to only the installed models, refer to page 22.
Y-axis table unit	Common to only the installed models, refer to page 22.
Vibration Isolating Stand	Standard accessory, refer to page 22.
Cabin	Standard accessory, refer to page 22.

SV-M3000CNC

Main unit

X_1 axis	Measuring range			200 mm
	Resolution			0.05 μm
	Scale unit			Reflective-type Linear Encoder
	Drive speed	CNC mode		Max. 200 mm/s
		Joystick control mode		0-50 mm/s
	Measuring speed			0.02-2 mm/s
	Traverse linearity	Using standard-type detector		0.5 μm/200 mm
		Using long-type detector		0.7 μm/200 mm
		Using rotary-type detector	Up/down direction	0.5 μm/200 mm
			Forward/backward direction	0.7 μm/200 mm
Z_2 axis (column)	Measuring range			500 mm
	Resolution			0.05 μm
	Scale unit			Reflective-type Linear Encoder
	Measuring force	CNC mode		Max. 200 mm/s
		Joystick control mode		0-50 mm/s
Y-axis	Measuring range			800 mm
	Resolution			0.05 μm
	Scale unit			Reflective-type Linear Encoder
	Drive speed	CNC mode		Max. 200 mm/s
		Joystick control mode		0-50 mm/s
	Measuring speed			0.02-2 mm/s
	Traverse linearity	Using standard-type detector		Narrow range: 0.5 μm/50 mm, Wide range: 2 μm/800 mm
		Using long-type detector		Narrow range: 0.7 μm/50 mm, Wide range: 3 μm/800 mm
		Using rotary-type detector		Narrow range: 0.7 μm/50 mm, Wide range: 3 μm/800 mm
Base unit	Base size (W x D)			600 x 1500 mm
	Base material			Steel
	Allowable loading capacity			300 kg
Vibration isolating unit	Air supply pressure			0.4 MPa
	Vibration insulating mechanism			Diaphragm air spring
	Natural frequency			4.0-5.0Hz
	Damping mechanism			Orifice & Oil damper
	Leveling mechanism			Automatic control with mechanical valves
External dimensions (W x D x H)				1085 x 1695 x 1922
Mass (including the vibration isolating unit)				1600 kg
Operating temperature and humidity ranges				15-25°C, 20-80% RH (without condensation)
Storage temperature and humidity ranges				-10-50°C, 5-90% RH (without condensation)

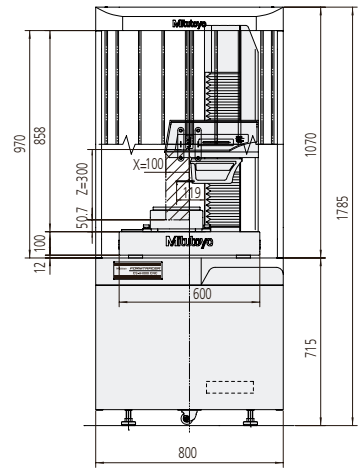| Controller	Common to all models, refer to page 21.
Remote Box	Common to all models, refer to page 21.
α-axis	Common to only the installed models, refer to page 22.
Y-axis table unit	Common to only the installed models, refer to page 22.

External dimensions of main unit

Common to SV-3000CNC / CV-3000CNC /
CV-4000CNC / SV-C3000CNC / SV-C4000CNC

CS-H4000CNC

Unit : mm
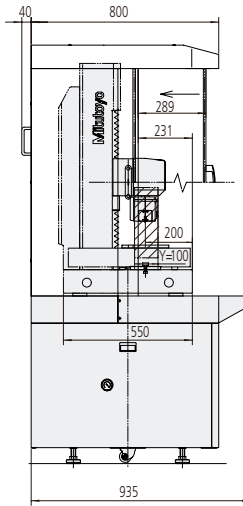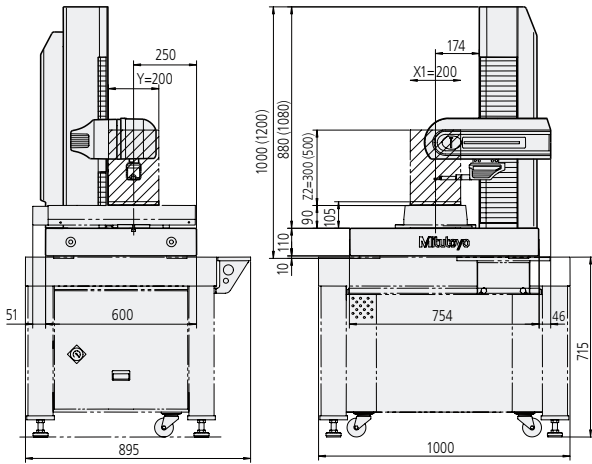
CS-5000CNC

CS-H5000CNC

SV-M3000CNC

Unit : mm

A

(478) 200 200 200 200 122

90
200
580
200
(90)

1400

15 X M8 Depth 10

(478) 800 122
(Y-axis stroke)

A

580

1080

(1922)

842

500
(Z2-axis stroke)

200
(X1-axis stroke)

90

155 28 1460 52

(1695)

984 100

Vibration isolating unit
(4 places)
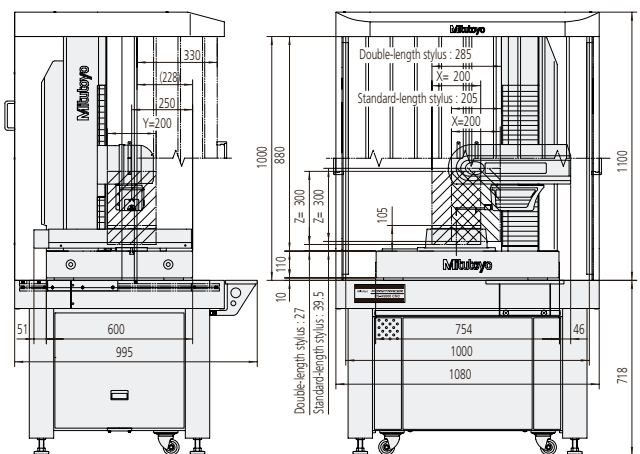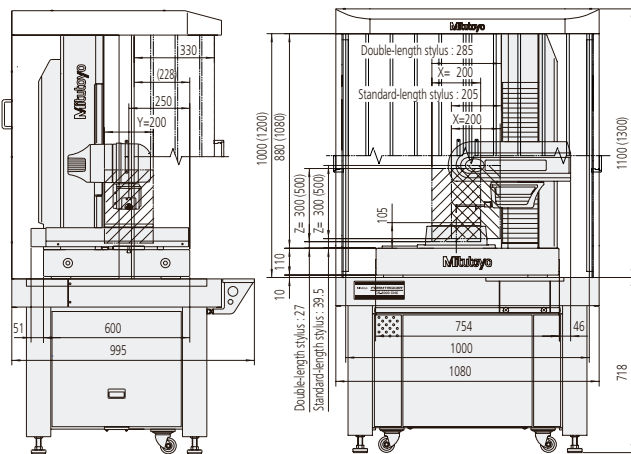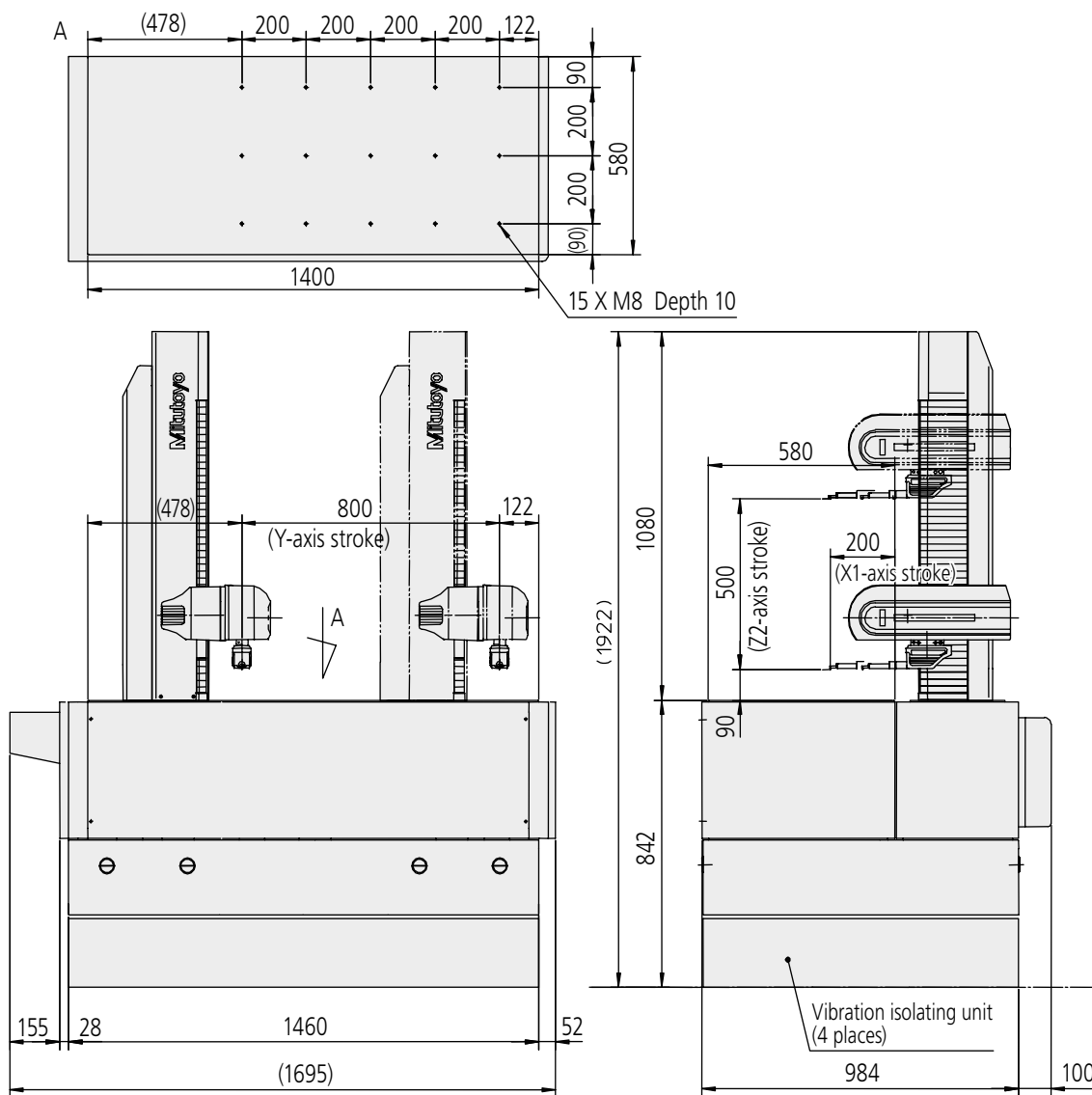
Mitutoyo

CNC Form Measuring Instrument
Roundtest Extreme RA-2200 CNC / RA-H5200 CNC

High-accuracy and easy-to-use oriented turntable

Mitutoyo has achieved high rotational accuracy in the radial direction together with high linear displacement accuracy in the axial direction. Thanks to this precision mechanism not only the roundness/cylindricity but also the flatness and many other parameters of a workpiece can be measured with high accuracy. Moreover, since the standard turntable is a type that enables automatic centering/leveling, the operator is freed from conventional centering and leveling operations on the workpiece, which are time-consuming and tedious.

Detector position change function that enables Automatic Measurement (CNC)

With precision control over the position (vertical/horizontal) of the holder arm unit that supports the detector in addition to the detector tilting mechanism (ranging from 0° to 270°, in 1° increments), continuous automatic measurement on the outside diameter, inside diameter, top surface, and bottom surface is possible.
The enhanced off-line teaching function also makes it easy to create part programs.

Positioning sensor critical to actualize High-Accuracy Automatic Measurement (CNC)

A Mitutoyo linear scale is used as the positioning sensor for the X-axis drive unit. It can directly sense the amount of detector unit displacement and perform high-accuracy positioning essential for automatic measurement.

Mode			RA-2200S CNC	RA-2200H CNC	RA-H5200S CNC	RA-H5200H CNC
Turn Table Unit	Rotational accuracy JISB7451-1997	Radial direction	(0.02 + 3.5H/10000) µm*		(0.02 + 3,8H/10000) µm*	
		Vertical direction	(0.02 + 3.5x/10000) µm**		(0.02 + 3,8x/10000) µm**	
	Rotational speed		2, 4, 6, 10 rpm		2, 4, 6, 10rpm (At automatic centering: Max. 20 rpm)	
	Effective table diameter		ø235 mm		ø300 mm	
	Range of centering/leveling adjustment		±3 mm, ±1°		±5 mm, ±1°	
	Maximum loading capacity		30 kg		80 kg (At automatic centering: 65 kg)	
	Maximum diameter for measurement/loading		ø256 mm, 580 mm		ø356mm, ø680 mm	
Vertical Column Unit	Linearity of vertical movement (λc : 2.5 mm)	Narrow range	0.1 µm/100 mm		0.05 µm/100 mm	
		Wide range	0.15 µm/300 mm	0.25 µm/500 mm	0.14 µm/350 mm	0.2 µm/550 mm
	Parallelism with the rotation axis (On the generatrix basis)		0.7 µm/300 mm	1.2 µm/500 mm	0.2 µm/350 mm	0.32 µm/550 mm
	Travel speed		Max. 50 mm/s		Max. 60 mm/s	
	Maximum measurement height (at I.D. or O.D. measurement)		300 mm	500 mm	350 mm	550 mm
	Maximum measurement depth (When the standard stylus is used)		ø12.7 x depth of 26 mm ø32 x depth of 104 mm			
Radial direction	Straightness (λc : 2.5 mm)		0.7 µm/150 mm		0.4 µm/200 mm	
	Perpendicularity to the rotation axis (On the generatrix basis)		1.0 µm/150 mm		0.5 µm/200 mm	
	Amount, speed of travel		175 mm, Max. 30 mm/s		225 mm, Max. 50 mm/s	
Detector	Measuring force		40 mN			
	Stylus tip shape, material		ø1.6 mm carbide ball		ø1.6 mm carbide ball	
	Detection range (normal/tracing)		±400 µm, ±5 mm		±400 µm, ±5 mm	
Available air pressure			0.39 MPa		0.39 MPa	
Radial direction	Normal state		30 L/min		45 L/min	
Mass (including the main unit and mounting stand)			180 kg	200 kg	650 kg	670 kg

* H = Height above surface of turntable ** x = Distance from turntable axis
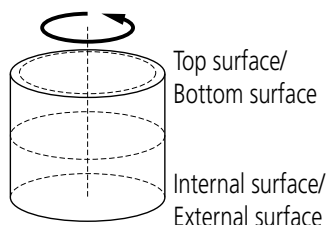
RA-H5200H CNC

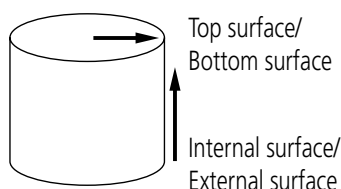RA-2200S CNC

Detector rotating mechanism

Surface roughness measurement function (Roughness measurement unit: optional)

This is a multiple-sensor compatible system that is capable of accepting not only the form measuring system standard probe but also a surface roughness measuring detector. It permits verification of both geometric tolerancing on round-ness or cylindricity and surface roughness to be performed with a single system.

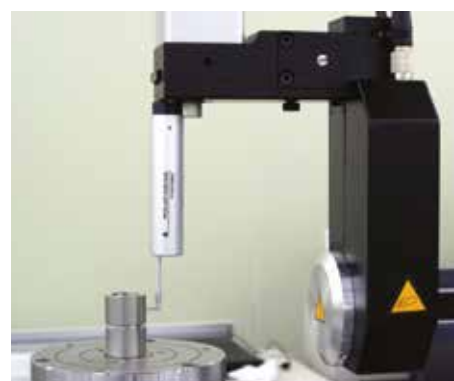**Measuring direction**

Top surface/
Bottom surface

Internal surface/
External surface

**Roughness in
circumferential direction**

Top surface/
Bottom surface

Internal surface/
External surface

**Roughness in horizontal
and vertical directions**

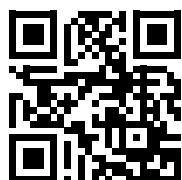| Coordinate Measuring Machines	Vision Measuring Systems	Form Measurement	Optical Measuring
Sensor Systems	Test Equipment and Seismometers	Digital Scale and DRO Systems	Small Tool Instruments and Data Management

**Whatever your challenges are,
Mitutoyo supports you from start to finish.**

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.

**Find additional product literature
and our product catalogue**

www.mitutoyo.eu

Mitutoyo

Mitutoyo Europe GmbH

Borsigstraße 8-10
41469 Neuss

Tel. +49 (0) 2137-102-0
Fax +49 (0) 2137-102-351

info@mitutoyo.eu
www.mitutoyo.eu

Note: All information about our products in this printed material, particularly the illustrations, drawings, measurement and performance specifications, as well as other technical specifications, are to be interpreted as approximate average values. In this respect, changes in construction, technical specification, measures and weights remain reserved. Our specified standards, similar technical regulations as well as the technical specifications, descriptions and illustrations of products are accurate on the date of printing. Furthermore, our general terms of business in the currently applicable revision are binding. Only the offers we make are definitive.