Surface Roughness Measuring Instruments Surftest Page 503



Contour Measuring Instruments Contracer Page 520



Surface Roughness & Contour Measuring Instruments Formtracer Page 526

> Accessories Surftest, Contracer, Formtracer Page 534

> > Form Measuring Instruments Roundtest Page 545









The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Drive unit	
Measuring range	16 mm 4,8 mm [S-type]
Traverse	17,5 mm 5,6 mm [S-type]
Measuring speed	0,25 mm/s ; 0,5 mm/s; 0,75 mm/s
Detector	
Measuring method	Differential inductance
Range	360 µm
Stylus	Diamond Tip
Skid radius	40 mm
Display unit	
Profiles	Roughness Profile (R), R-Motif, DF-Profile and more
Roughness standards	EN ISO, VDA, JIS, ANSI and customize settings
Digital filter	Gauss, 2CR75, PC75
Cut-off length	λc : 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm λs : 2,5 μm; 8 μm
Tolerance	Coloured upper / lower limit
Interface	USB, Digimatic, RS-232C, Foot switch
Power supply	AC adapter or rechargeable battery



Software USB COMMUNICATION TOOL as a free download on www.mitutoyo.eu (refer to page Optional Software USB Communication Tool)



Refer to Surftest SJ-210 brochure

Surftest SJ-210

Series 178 - Portable Surface Roughness Measuring Instrument

This is a portable measuring instrument that allows you to easily and accurately measure surface roughness.

The Surftest SJ-210 offers you the following benefits:

- It works independently of mains power, allowing you to make on-site measurements.
- The 6 cm [2,4"] colour graphic, back-lit LCD gives you excellent readability.
- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- Different drivers expanding the range of applications.
- Calculation results, assessed profiles, bearing and amplitude curves can be displayed.
- Support of 16 languages.
- Operation by keys on the front and under the sliding cover.



SJ-210

Metric

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]	Description	Price [€]
178-560-01D	0,75	60°	2	SJ-210 model	2215,00
178-562-01D	0,75	60°	2	SJ-210R model	2575,00
178-564-01D	0,75	60°	2	SJ-210S model	4015,00





R-type



S-type

Surftest SJ-210

Series 178 - Portable Surface Roughness Measuring Instrument

The SJ-210R – Retract System is a portable measuring instrument for surface roughness that includes a safety system.

• The detector starts in a safety position, not in contact with the workpiece surface. When measurement starts, the detector is lowered onto the workpiece while the drive unit moves in X measuring direction. During the return movement, the detector lifts up from the workpiece surface before returning to the start position. This is useful for avoiding stylus damage in applications where you cannot easily see the test surface.

SJ-210S (detailed information further on in this chapter)

• The SJ-210S model is a portable measuring instrument for surface roughness that has a transverse drive capability. This allows you to test shrouded surfaces in the transverse direction, such as crankshaft bearing surfaces, flanged features or deep grooves.





Additional Specifications

Other	Other optional and standard
accessories	accessories are listed later in this
	section

Optional accessories

No.	Description	Price €
178-029	Granite stand (12AAA221 is needed for SJ-210/310)	738,00
178-033	Measuring device for cylindrical workpieces	2833,00
178-034	Measuring device as universal fixture	2175,00
178-035	Measuring device for measuring inside diameter	2545,00
12AAA221	Adapter for magnetic stand	45,00
178-230-2	Standard drive unit 17,5 mm	669,00
178-235	R-Type drive unit 17,5 mm	1295,00
178-233-2	S-Type drive unit 5,6 mm	2388,00
936937	Digimatic cable (1 m)	44,00
965014	Digimatic cable (2 m)	58,00
02AZD790D	Connecting cable U-Wave	85,00
06ADV380D	USB Input Tool Direct cable (2 m)	100,00
12BAA303	Connecting cable for extension 1 m	75,00



Keyboard protective cover open



Back view

1

Drive unit	
Measuring range	16 mm 4,8 mm [S-type]
Traverse	17,5 mm 5,6 mm [S-type]
Measuring speed	0,25 mm/s; 0,5 mm/s; 0,75 mm/s
Detector	
Measuring method	Differential inductance
Range	360 µm
Stylus	Diamond Tip
Skid radius	40 mm
Display unit	
Profiles	Roughness Profile (R), R-Motif, DF-Profile and more
Roughness	EN ISO, VDA, JIS, ANSI and
standards	customize settings
Digital filter	Gauss, 2CR75, PC75
Cut-off length	λc : 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm; 8 mm λs : 2,5 μm; 8 μm
Printer	Thermal Printer
Tolerance	Coloured upper / lower limit
Interface	USB, Digimatic, RS-232C, Foot switch
Power supply	AC adapter or rechargeable battery



Software USB COMMUNICATION TOOL as a free download on www.mitutoyo.eu (refer to page Optional Software USB Communication Tool)



Refer to Surftest SJ-310 brochure

Surftest SJ-310

Series 178 - Portable Surface Roughness Measuring Instrument

This is a portable measuring instrument that allows you to easily and accurately measure surface roughness.

The Surftest SJ-310 offers you the following benefits:

- Skid system with touch-screen functionality and built-in printer.
- It works independently of mains power, allowing you to make on-site measurements.
- Easy and intuitive menu navigation.
- The large 14,5cm [5,7"] colour LCD gives you high visibility.
- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- You can store up to 10 different measuring conditions inside the SJ-310, and up to 500 with an
 optional SD card.
- Statistical analysis and coloured tolerance judgement.
- 2 different evaluation conditions within 1 measurement adjustable.
- You can separately password protect many functions.
- It comes with support for 16 languages.



SJ-310

Metric

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]	Description	Price [€]
178-570-01D	0,75	60°	2	SJ-310 model	4450,00
178-572-01D	0,75	60°	2	SJ-310R model	4800,00
178-574-01D	0,75	60°	2	SJ-310S model	6300,00





R-type



S-type

Surftest SJ-210 and SJ-310 - S-Type

Series 178 – Portable Transverse Measurement with S-Type Drive Unit

This is an S-Type drive unit for the Surftest SJ-210 and SJ-310 that provides portable transverse measurement.

It offers you the following benefits:

- It is compatible with the conventional drive units of the Surftest SJ-210 and SJ-310.
- You can simply connected it to the display unit.
- A typical application would be to position the S-Type unit on a crankshaft journal bearing, as shown in the photograph below. Once started the S-Type drive will track the stylus across the surface transversely to its own axis and reliably measure surface roughness in the direction of the crankshaft axis. Transverse tracking simplifies the measurement of surface roughness even in very confined situations, which has long been a problem with conventional instruments which allow only longitudinal measurement.





S - Type Drive Unit Set: [incl. 178-233-2 - 12AAE644 - 12AAE643]

No.	Traverse [mm]	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]	Price [€]
178-234-2	5,6 mm	0,75	60°	2	2494,00



12AAE644

V-type adapter



12AAE643 Point - contact adapter





Specifications

Traverse	5,6 mm
Measuring speed	0,25 mm/s; 0,5 mm/s; 0,75 mm/s

Optional accessories

No.	Description	Price €
178-029	Granite stand (12AAA221 is needed for SJ-210/310)	738,00
12AAA221	Adapter for magnetic stand	45,00
178-230-2	Standard drive unit 17,5 mm	669,00
178-235	R-Type drive unit 17,5 mm	1295,00
178-233-2	S-Type drive unit 5,6 mm	2388,00



Linear movement of S-Type

Accessories for SJ-210 and SJ-310

Series 178 - Standard and Optional Accessories for Surftest SJ-210 / SJ-310

Model			Surfte SJ-210	est)	Surfte SJ-210	est DR	Surfte SJ-210	st S	Surftes SJ-310	t	Surftes SJ-310	st R	Surftes SJ-3109	it S
No.	Price €	Description	Std	Opt	Std	Opt	Std	Opt	Std	Opt	Std	Opt	Std	Opt
12AAA210	220,00	Extension rod length 50 mm												
12AAA216	133,00	Height adjustment feet		0		0			0					
12AAA217	90,00	Nosepiece (flat)		0		0			0		0			
12AAA218	90,00	Nosepiece (cylindrical)		0		0			0		0			
12AAA219	45,00	Adapter for vertical position		0		0				0		0		
12AAA221	45,00	Adapter for magnetic stand		0		0		0		0		0		0
12AAA222	90,00	Height gauge adapter		0		0		0		0		0		0
12AAD510	73,00	USB cable for SJ-310 / SJ-410								0		0		0
12AAE643	217,00	Point - contact adapter					0						0	
12AAE644	235,00	V-type adapter					0						0	
12AAJ088	218,00	Footswitch		0		0		0		0		0		0
12AAL066	20,50	Protective sheets for display (5 sheets)		0		0		0						
12AAL067	81,00	RS-232C cable for printer		0		0		0						
12AAL068D	14,00	USB cable for SJ-210		0		0		0						
12AAL069	35.00	Memory card								0		0		0
12AAN040	260,00	Protective film								0		0		0
12AAN046	175.00	Battery							0		0		0	
12BAA303	75.00	Connecting cable for extension 1 m	0		0		0		_	0	-	0	_	0
12BAG834	3.00	Touch pen	-		-		-		0	-	0	-	0	
12BAK700	4 00	Calibration table	0		0		0						<u> </u>	
12BAK728	62 00	AC adapter 9V							•		-		-	
12BAI 402	23 50	Touch Panel Protection					•						<u> </u>	
357651	78.00	AC Adapter 12V							_				<u> </u>	
178-029	738.00	Granite stand							•		•		•	
178-230-2	669.00	Standard Drive unit 17.5 mm		-						-				
178-233-2	2388.00	S-Type drive unit 5.6 mm	-					-	-					-
178-235-2	1295.00	B-Type drive unit 17.5 mm				-						-	-	
178-296	594.00	Standard detector 2 um: 0.75 mN		-				-		-				-
178-290	721.00	Detector for small holes	-		-				-		-			
170-303	721,00	Ø4,5 mm; 2 µm; 0,75 mN								-		•		
178-384	721,00	Detector for small holes Ø2,8mm		0		0				0		0		
178-385	721,00	Deep groove detector 2 µm; 0,75 mN		0		0				0		0		
178-386	573,00	Detector for S-drive 5 µm; 4 mN		0		0	0			0		0	0	
178-387	637,00	Detector for S-drive 2 µm; 0,75 mN		0		0	0			0		0	0	
178-388	1220,00	Detector for gear tooth surface 2 $\mu\text{m};$ 0,75 mN		0		0				0		0		
178-390	478,00	Detector 5 µm; 4 mN		0		0				0		0		
178-391	478,00	Detector for soft materials 10 μ m; 4 mN		0		0				0		0		
178-392	637,00	Detector for small holes Ø4,5 mm; 5 $\mu\text{m};$ 4 mN		0		0				0		0		
178-393	637,00	Detector for small holes Ø2,8 mm; 5 $\mu\text{m};$ 4 mN		0		0				0		0		
178-394	637,00	Deep groove detector 5 µm; 4 mN		0		0				0		0		
178-398	1145,00	Detector for gear tooth surface 5 $\mu\text{m};$ 4 mN; 90°		0		0				0		0		
178-421DDS	615,00	Printer set for SJ-210		0		0		0						
178-601	303,00	Roughness specimen Ra 3 µm	0		0			0	0		0		0	
178-604	334,00	Roughness specimen Ra 0,4 µm /3 µm		0		0		0		0		0		0
178-605	800,00	Roughness specimen Ra 1 µm		0		۲	0			0		۲	0	
270732	29,00	Printer papers (5 rolls)		0		0		0	0		0		0	

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.



Accessories for SJ-210 and SJ-310

Series 178



Optional accessories

No.	Description	Price €
178-033	Measuring device for cylindrical workpieces	2833,00
178-034	Measuring device as universal fixture	2175,00
178-035	Measuring device for measuring inside diameter	2545,00



178-029 (displayed with 12AAA221 + SJ-210)



178-033



178-034



178-035



Drive unit	
Traverse	SJ-411: 25 mm SJ-412: 50 mm
Measuring speed	0,05 mm/s; 0,1 mm/s; 0,2 mm/s; 0,5 mm/s; 1 mm/s
Detector	
Measuring method	Skidless - Differential inductance
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Positioning	±1,5° (tilting), 10 mm (up/down)
Display unit	
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize settings
Analysis graphs	BAC, ADC
Digital filter	Gauss, 2CR75, PC75
Cut-off length	λc : 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm; 8 mm λs : 2,5 μm; 8 μm; 25 μm
Printer	Thermal Printer
Tolerance	Coloured upper / lower limit
Interface	USB, Digimatic, RS-232C, Foot switch
Power supply	AC adapter or rechargeable battery



Software USB COMMUNICATION TOOL as a free download on www.mitutoyo.eu (refer to page Optional Software USB Communication Tool)



Refer to Surftest SJ-410 brochure

Surftest SJ-410

Series 178 - Portable Surface Roughness Measuring Instrument

This is a portable measuring instrument that allows you to easily and accurately measure surface roughness.

The Surftest SJ-410 offers you the following benefits:

- Skidless system with touch-screen functionality and built-in printer.
- It works independently of mains power, allowing you to make on-site measurements.
- Easy and intuitive menu navigation.
- The large 14,5cm [5,7"] colour LCD gives you high visibility.
- The skidless detector allows you to measure the primary profile (P), roughness profile (R), waviness profile (W) and more.
- Surface compensation of curved, radial and tilted surfaces.
- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- You can store up to 10 different measuring conditions inside the SJ-410, and up to 500 with an
 optional SD card.
- It allows two different evaluation conditions within one measurement adjustable.
- You can separately password protect many functions.
- It comes with support for 16 languages.
- Available options include an auto-set unit, X-axis fine adjustment and digital levelling unit.



SJ-410

Surftest SJ-411

Traverse : 25 mm

Traverse straightness : 0,3 µm / 25 mm

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]	Price [€]
178-580-01D	0,75	60°	2	8430,00
178-580-02D	4	90°	5	8430,00

Surftest SJ-412

Traverse : 50 mm

Traverse straightness : 0,5 µm / 50 mm

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]	Price [€]
178-582-01D	0,75	60°	2	9900,00
178-582-02D	4	90°	5	9900,00





Surftest SJ-410

Series 178 - Portable Surface Roughness Measuring Instrument



Deep groove measurement



R-surface measurement





SJ-411: 207,5 mm / SJ-412: 234 mm Drive unit





- Autoset unit 178-010
- X-axis adjustment 178-020
- Tilting adjustment unit 178-030





178-039 (displayed with SJ-411)

Additional Specifications

Optional Other optional and standard accessories are listed later in different sections for accessories and styli.

Optional accessories

No.	Description	Price €
178-396-2	Detector 0,75 mN	933,00
178-397-2	Detector 4 mN	933,00
178-047	Three-axis adjustment table	4456,00
178-048	Leveling table D.A.T.	2260,00
178-042-1	Digimatic XY leveling table 25 mm x 25 mm	3236,00
178-043-1	XY leveling table 25 mm x 25 mm	2568,00
178-605	Roughness specimen Ra = 1 µm	800,00
178-610	Step gauge (1, 2, 5, 10) µm	626,00
178-611	Reference step specimen (2, 10) μm	467,00
178-019	Precision vise	610,00
12AAB358	Cylinder attachment ø15 - 60 mm	239,00
936937	Digimatic cable (1 m)	44,00
965014	Digimatic cable (2 m)	58,00
02AZD790D	Connecting cable U-Wave	85,00
12AAD510	USB cable for SJ-310 / SJ-410	73,00
12AAL069	Memory card	35,00
12AAG202	Extension rod 50 mm	394,00
12AAG203	Extension rod 100 mm	454,00
Stands		
178-039	Granite stand	732,00

Consumable spares

No.	Description	Price €
12AAB355	Nosepiece	119,00
12BAG834	Touch pen	3,00
12BAL402	Touch Panel Protection	23,50
12AAN046	Battery	175,00
270732	Printer paper (5 rolls)	29,00



178-048 Leveling table D.A.T.



12AAB358 Cylinder attachment

Drive unit	
Traverse	50 mm
Measuring speed	0,02 - 5 mm/s
Drive speed	0 - 20 mm/s or joystick operation
Traverse straightness	0,2 μm / 50 mm
Detector	
Measuring method	Skidless - Differential inductance
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Positioning	±1,5° (tilting) 30 mm (up/down)
Display unit	
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize setting
Analysis graphs	BAC, ADC
Digital filter	Gauss, 2CR75, PC75, RobustSpline
Cut-off length	λc : 0,025 mm; 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm; 8 mm; 25 mm λs : 0,25 μm; 0,8 μm; 2,5 μm; 8 μm; 25 μm; 80μm; 250μm; None λf : 0,08mm; 0,25mm; 0,8mm; 2,5mm; 8mm; 25mm; None
Printer	Thermal printer

Optional accessories

No.	Description	Price €
178-396-2	Detector 0,75 mN	933,00
178-397-2	Detector 4 mN	933,00
178-085	Granite stand 600x450x710 mm	3915,00
178-089	Granite stand 400x250x578 mm	1730,00
178-047	Three-axis adjustment table	4456,00
178-048	Leveling table D.A.T.	2260,00
178-042-1	Digimatic XY leveling table 25 mm x 25 mm	3236,00
178-043-1	XY leveling table 25 mm x 25 mm	2568,00
12AAG202	Extension rod 50 mm	394,00
12AAG203	Extension rod 100 mm	454,00



Software **USB COMMUNICATION TOOL** as a free download on www.mitutoyo.eu (refer to page **Optional Software USB Communication Tool)**

Refer to SURFACE MEASUREMENT brochure

Surftest SJ-500

Series 178 - Surface Roughness Measuring Instrument

This is a portable measuring instrument that allows you to easily and accurately measure surface roughness.

The Surftest SJ-500 offers you the following benefits:

- The skidless detector allows you to measure the primary profile (P), roughness profile (R), waviness profile (W) and more.
- User friendly control unit for high precision surface roughness measurement.
- The large 19cm [7,5"] colour TFT LCD with touch-screen functionality gives you high visibility and ease of use.
- The display menu is easy to read and simple to operate.
- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- The built-in joystick on the control unit enables quick and easy positioning. The manual adjustment knob allows you to finely position a small stylus to measure the inside surface of small holes.
- The detector unit allows a 90° displacement of the stylus, which is ideal for crankshaft and narrow space measurement.
- You can use the instrument stand-alone or mounted on a stand.



No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-532-01D	0,75	60°	2
178-532-02D	4	90°	5



-	-	141	1.00	34			
	-	-		1.14	-	-	
	WW	WW	inthis	WW	141	white:	
	01.1	sh it	linar	1	rab.	1.11	1
Ra L	114 4	3.35 μ	Inat	1	1.11		x
Ra Ra		3. 36 µm 21. 55 µm	11.4	1			DK
Ra Rz Rt		3, 36 µm 21, 55 µm 24, 18 µm	11.4	1			DK DK MG

Preview

SJ-500 with optional manual column stand





400x250x578 mm

511



The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is no included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Surftest SV-2100

Series 178 - Surface Roughness Measuring Instrument

This is a stationary measuring instrument that allows you to easily and accurately measure surface roughness.

The Surftest SV-2100 offers you the following benefits:

- It is mounted on a granite base with a manual or power column.
- The large 19cm [7,5"] colour TFT LCD gives you high visibility and touch-screen functionality.
- It has a user friendly display unit for high precision surface roughness measurement.
- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- Designed for usage in workshop areas.





SV-2100S4

SV-2100M4

SV-2100H4 model

Vertical travel : 550 mm power column Granite base size (WxD) : 600 x 450 mm

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]			
178-682-01D	0,75	60°	2			
178-682-02D	4	90°	5			

SV-2100M4 model

Vertical travel : 350 mm manual column Granite base size (WxD) : 600 x 450 mm

erannee babe			
No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-636-01D	0,75	60°	2
178-636-02D	4	90°	5

SV-2100S4 model

Vertical travel : 350 mm power column

Granite base size (WxD) : 600 x 450 mm

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-680-01D	0,75	60°	2
178-680-02D	4	90°	5

SV-2100W4 model

Vertical travel : 550 mm power column

Granite base size (WxD) : 1000 x 450 mm

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-684-01D	0,75	60°	2
178-684-02D	4	90°	5

Specifications

Drive unit	
Traverse	100 mm
Measuring speed	0,02 - 5 mm/s
Drive speed	X = 0-40 mm/s Z2 = 0-20 mm/s or joystick operation
Traverse straightness	0,15 μm / 100 mm
Detector	
Measuring method	Skidless - Differential inductance
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Display unit	
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (P, R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize settings
Analysis graphs	BAC, ADC
Digital filter	Gauss, 2CR75, PC75, RobustSpline
Cut-off length	λc : 0,025 mm; 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm; 8 mm; 25 mm; 80 mm λs : 0,25 μm; 0,8 μm; 2,5 μm; 8 μm; 25 μm; 80 μm; 250 μm; none λf : 0,08 mm; 0,25 mm; 0,8 mm; 2,5 mm; 8 mm; 25 mm; 80 mm; none
	T I I I I I

Optional accessories

No.	Description	Price €
12AAG202	Extension rod 50 mm	394,00
12AAG203	Extension rod 100 mm	454,00
218-001	Cross-travel table	2545,00
	XY range : 100x50 mm	
218-003	Rotary vice (heavy-duty type)	1445,00



Software

USB COMMUNICATION TOOL as a free download on www.mitutoyo.eu (refer to page Optional Software USB Communication Tool)



Refer to SURFACE MEASUREMENT brochure



The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Drive unit	
Traverse	50 mm
Measuring speed	0,02 - 5 mm/s
Drive speed	0-20 mm/s
Traverse straightness	0,2 μm / 50 mm
Detector	
Measuring method	Skidless - Differential inductance
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Positioning	±1,5° (tilting) 30 mm (up/down)
Software	FORMTRACEPAK

Name <th



Formtracepak layout

Surftest SJ-500P - SV-2100P

Series 178 - Surface Roughness Measuring Instruments with Software FORMTRACEPAK

These are surface roughness measuring instruments with software FORMTRACEPAK. Software FORMTRACEPAK offers you the following benefits:

- It supports all standard conform analyses including EN ISO, VDA, ANSI, JIS as well as customised settings.
- It can be used for contour calculation within the measuring range.
- It offers total support for measurement system control, analysis and inspection report.
- All advantages of the SJ-500 and SV-2100 also apply to the P Type.



33-300F

No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-530-01D	0,75	60°	2
178-530-02D	4	90°	5

Surftest SV-2100M4P



Drive unit	
Traverse	100 mm
Measuring speed	0,02 - 5 mm/s
Drive speed	X = 0-40 mm/s Z2 = 0-20 mm/s
Traverse straightness	0,15 μm / 100 mm
Detector	
Measuring method	Skidless - Differential inductance
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Software	FORMTRACEPAK



Refer to SURFACE MEASUREMENT brochure



No.	Detector measuring force [mN]	Stylus Tip angle	Stylus Tip radius [µm]
178-634-01D	0,75	60°	2
178-634-02D	4	90°	5



Surftest SV-3100

Series 178 - Surface Roughness Measuring Instrument

This is a stationary surface roughness measuring instrument with software FORMTRACEPAK that allows you to take highly accurate measurements.

The Surftest SV-3100 offers you the following benefits:

- It complies with many standards including EN ISO, VDA, ANSI, JIS as well as customised settings.
- It also supports contour calculation within the measuring range of the styli software.
- Part programing as well as motorised axes give you many features of a CNC instrument.
- The X-axis uses a superbly anti-abrasive ceramic drive unit guideway, so you don't need any lubrication.
- You can choose from a huge number of styli that are easy to replace.
- It has an easy-to-operate remote box with many functionalities.



SV-3100

X-axis measuring range : 100 mm

X-axis Traverse straightness : (0,05+1L/100) µm, L = Measurement length (mm)

		1 1	5 (,		
Model	SV-310054	SV-3100S4.	SV-3100H4	SV-3100H4.	SV-3100W4	SV-3100W4.
No.	178-471D-1	178-471D-2	178-472D-1	178-472D-2	178-473D-1	178-473D-2
Detector measuring force [mN]	0,75	4	0,75	4	0,75	4
Stylus Tip angle	60°	90°	60°	90°	60°	90°
Stylus Tip radius [µm]	2	5	2	5	2	5
Vertical travel [mm]	300	300	500	500	500	500
Granite base size (WxD) [mm]	600x450	600x450	600x450	600x450	1000x450	1000x450

X-axis measuring range : 200 mm X-axis Traverse straightness : 0,5 µm/200 mm

A data haveise statightless . 0,5 µm/200 mm						
Model	SV-310058	SV-3100S8.	SV-3100H8	SV-3100H8.	SV-3100W8	SV-3100W8.
No.	178-476D-1	178-476D-2	178-477D-1	178-477D-2	178-478D-1	178-478D-2
Detector measuring force [mN]	0,75	4	0,75	4	0,75	4
Stylus Tip angle	60°	90°	60°	90°	60°	90°
Stylus Tip radius [µm]	2	5	2	5	2	5
Vertical travel [mm]	300	300	500	500	500	500
Granite base size (WxD) [mm]	600 x 450	600 x 450	600 x 450	600 x 450	1000 x 450	1000 x 450

Specifications

Traverse	100 mm / 200 mm
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Drive speed	X = 0 - 80 mm/s Z2 = 0 - 20 mm/s
Measuring speed	0,02 - 5 mm/s
Inclining range	±45°
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (P, R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize setting
Software	 FORMTRACEPAK Enables control of all axes and rotary table for realizing efficient measurement automation. Perform contour evaluation that allows free analysis of level differences, angles, pitch, area and other characteristics as well as surface roughness evaluation. Able to create an original inspection certificate by setting the print format to suit particular requirements.

Surftest SV-3100

20

Dimensions and Optional accessories

Additional Specifications

Optional	Other optional and standard
accessories	accessories are listed later in different
	sections for accessories and styli.

Optional accessories

•					
No.	Description	Price €			
178-097	Y-axis table				
12AAD975	θ1-axis table				
178-078	θ 2-axis table				
178-023	Manual vibration isolator	3660,00			
178-024	Stand for vibration isolator				
178-025	Dynamic vibration isolator				
218-001	Cross-travel table	2545,00			
	XY range : 100x50 mm				
218-003	Rotary vice (heavy-duty type)	1445,00			
12AAG202	Extension rod 50 mm	394,00			
12AAG203	Extension rod 100 mm	454,00			
178-611	Reference step specimen	467,00			
	(2, 10) µm				
178-087	Automatic leveling table				
	SV-, CV-series, CS-3200				





240 (240) [640] 100 98 966 (1166) [1176] 300 (500) [500] ſ

The is off

Series 178 - Surface Roughness Measuring Instrument



SV-3100S8 - SV-3100H8 - SV-3100W8

515

Surftest Extreme SV-3000CNC

Series 178 – CNC Surface Roughness Measuring Instrument

These is a fully CNC surface roughness measuring instrument with powerful software FORMTRACEPAK.

The Surftest Extreme SV-3000CNC offers you the following benefits:

- It is perfectly made for increased throughput of multiple profile and workpiece measurement tasks.
- Each axis has a drive speed of up to 200 mm/s.
- You can take continuous measurement over horizontal and inclined surfaces by power-tilting the drive unit.
- Within the measuring range of the styli software FORMTRACEPAK supports contour calculation
- 3D topography measurement as option available
- Inclined plane measurement is possible through 2-axis simultaneous control in the X and Y directions.
- The detector unit incorporates an anti-collision safety device, causing it to automatically stop if its main body collides with a workpiece or jig.



SV-3000CNC

Model	SV-3000CNC-S	SV-3000CNC-H	SV-3000CNC-S.	SV-3000CNC-H.
No.	178-522-2	178-542-2	178-524-2	178-544-2
Z2-axis vertical travel [mm]	300	500	300	500
Y-axis table unit	-	-	Installed	Installed
lpha-axis unit	Installed	Installed	Installed	Installed



Automatic measurement

Specifications

Traverse	X = 200 mm Y = 200mm
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Measuring speed	0,02 - 2 mm/s
Drive speed	CNC mode: max. 200 mm/s Joystick mode: 0 - 60 mm/s
Traverse straightness	0,5 μm / 200 mm
Inclining range	+45° (CCW) to -10° (CW)
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (P, R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize setting
Software	 FORMTRACEPAK Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement. Surface roughness analysis and contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard. An inspection certificate can be created by setting the print format as required.

Additional Specifications

Optional	Other optional and standard
accessories	accessories are listed later in different
	sections for accessories and styli.

Optional accessories

No.	Description
12AAD975	θ1-axis table
178-078	θ2-axis table
178-037	Automatic leveling table CNC
178-077	3D leveling table
12AAE032	Vibration isolator stand
12AAE449	Cabin for H-type



Refer to SURFACE MEASUREMENT brochure

Traverse	X = 200 mm Y = 800 mm Z2 = 500 mm
Range	800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Measuring speed	0,02 - 2 mm/s
Drive speed	CNC mode: max. 200 mm/s Joystick mode: 0 - 50 mm/s
Traverse straightness	X = 0,5 μ m / 200 mm (standard) X = 0,7 μ m / 200 mm (long-type detector) X = 0,5 μ m / 200 mm (rotary-type detector) Y = 0,5 μ m / 50 mm; 2 μ m / 800 mm (standard) Y = 0,7 μ m / 50 mm; 3 μ m / 800 mm (long-type detector) Y = 0,7 μ m / 50 mm; 3 μ m / 800 mm (rotary-type detector)
Inclining range	-45° (CCW) to +10° (CW)
Profiles	Primary Profile (P), Roughness Profile (R), Waviness (W), MOTIF (P, R, W) and more
Standards	EN ISO, VDA, JIS, ANSI and customize setting
Loading weight	300 kg
Software	 FORMTRACEPAK Enables control of all axes for realizing efficient measurement automation. Perform contour evaluation that allows free analysis of level differences, angles, pitch, area and other characteristics as well as surface roughness evaluation. Able to create an original inspection certificate by setting the

Additional Specifications

Optional accessories



Refer to SURFACE MEASUREMENT brochure

print format to suit particular

Other optional and standard accessories are listed later in different

requirements.

Surftest Extreme SV-M3000CNC

Series 178 - CNC Surface Roughness Measuring Instrument

This is a top performance CNC surface roughness measuring instrument with powerful software FORMTRACEPAK.

The Surftest Extreme SV-M3000CNC offers you the following benefits:

- You can measure large and heavy workpieces such as engine blocks and crankshafts.
- It has an 800mm moving column configuration to largely eliminate workpiece size restrictions.
- Each axis has a drive speed of up to 200 mm/s.
- When combined with the optional detector swivelling unit, continuous measurement over the bottom, top and side surface of a workpiece is possible.
- The huge load table has a self-contained structure ensuring that you can easily accommodate various size workpieces, standard and custom jigs, and auto-feed devices.



No.	Detector hold type (Essential option)	Model	
	Standard	178-071	
178-549-2	Long type	178-072	
	Rotary type	178-073	



Typical measurement task





Quick Guide to Precision Measuring Instruments



Surftest (Surface Roughness Testers)

Profiles and filters

(DIN EN ISO 4287:1998 and DIN EN ISO 11562:1998)

The **actual surface profile** is the result of the actual surface of the workpiece intersecting with a plane that is perpendicular to this surface. The plane should run approximately vertical to the tool marks.

The **measured surface profile** is the profile after tracing the actual surface profile using a probe. The measured values are filtered due to the effect of the stylus tip radius **r** and, if applicable, due to the skid of the probe system. Surface imperfections, such as cracks, scratches and dents, are not considered roughness and should not be measured. If necessary, specify the tolerances in accordance with DIN EN ISO 8785.

The **primary profiles** the profile after low-pass filtering of the measurement values with the cutoff wavelength λs . For this, the short-wave profile segments are segregated. The parameters are identified by P and are evaluated within the individual sampling length. In this case, this is equal to the evaluation length or the length of the measured surface profile.



Fig. 1: Primary profile and mean line for the λs profile filter

The **roughness profile** is the result of high-pass filtering of the primary profile with the cutoff wavelength λc . For this, the long-wave profile segments are segregated. The parameters are identified by **R** and are analyzed across the evaluation length **In**, which usually consists of five individual sampling lengths Ir. The sampling length is equal to the cutoff wavelength λc of the profile filter.



Fig. 2: Roughness profile with mean line (high-pass filtering of the primary profile using the λc -profile filter) The **waviness profile** is the result of low-pass filtering of the primary profile with the cutoff wavelength λc and high-pass filtering with the cutoff wavelength f. The parameters are identified by **W** and are evaluated over the evaluation length **In**, which consists of several sampling lengths **Iw**. The sampling length Iw corresponds to the cutoff wavelength λf of the high-pass filter. However, the number of sampling lengths is not standardized and must therefore always be specified on the drawing. It should be between five and ten.



Fig. 3: Mean line from the primary profile and mean line for the λf profile filter after high-pass filtering



Fig. 4: Waviness profile with mean line after low-pass filtering using the λc profile filter



Fig. 5: Transmission characteristics of the filters for the different profiles, Gaussian filter as per DIN EN ISO 11562:1998

Roughness parameters (DIN EN ISO 4287:1998)

Ra – Arithmetic average roughness value: arithmetic mean of the sums of all profile values

Rmr(c) – **Material portion of profile:** quotient from the sum of the material lengths of the profile elements at the specified section height c (in µm) and of the evaluation length **In** (specified as a percentage)

RSm – Mean groove width: mean value of the width of the profile elements **Xsi** (previously Sm); horizontal and vertical counting thresholds have been defined for the evaluation

Rt – Total height of the roughness profile: Sum from the height **Zp** of the highest profile peak and the depth **Zv** of the lowest profile valley within the evaluation length **In**

Rz_i – **Maximum height of the roughness profile:** Sum from the height of the highest profile peak and the depth of the lowest profile valley within a sampling length **Ir**_i

Rz1max – Maximum roughness depth: Largest of the five Rzi values from the five sampling lengths Iri within the evaluation length **In**

Rz – Mean roughness depth: mean value of the five **Rz**_i values from the five sampling lengths **Ir**_i within the evaluation lengthln



Fig. 6: Arithmetic average roughness value Ra



Fig. 7: Total height of the roughness profile Rt, mean roughness depth Rz and maximum roughness depth Rz1max



Fig. 8: The mean groove width RSm is the mean value of the width Xs of the profile elements



Fig. 9: The material ratio curve of the profile represents the material portion Rm(c) of the profile as a function of the section height c (Abbott-Firestone curve)

Preferred parameters

Maximum roughness depth Rz1max for surfaces where individual deviations strongly affect the function of the surface, e.g. sealing surfaces. Material portion of the profile Rmr(c) for guide surfaces and opposing sealing surfaces

Mean roughness depth Rz usually applies to all other surfaces. The arithmetic mean roughness value **Ra** hardly reacts to individual peaks or valleys due to the mean value formed from all profile values; its significance is therefore rather low.

Mitutoyo

518

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Roughness measuring conditions (DIN EN ISO 4288:1998)

Non-periodic profiles		Periodic profiles	Measuring conditions as per DIN EN ISO 4288 and DIN EN ISO 3274			
Grinding, honing, lapping, eroding ↓ or ↓		Turning, milling, planing ↓	rtip f Ir S In E It f	Maximum Sampling Evaluation Fraversing evaluation pre-travel engths)	stylus tij length length length n length and post	plus t-travel
Rt, Rz μm	Ra μm	RSm mm	r tip μm	λc =lr mm	In mm	lt mm
> 0,0250,1	> 0,0060,02	> 0,0130,04	2	0,08	0,4	0,48
> 0,10,5	> 0,020,1	> 0,040,13	2	0,25	1,25	1,5
> 0,510	> 0,12	> 0,130,4	2*)	0,8	4	4,8
> 1050	> 210	> 0,41,3	5	2,5	12,5	15
> 50200	> 1080	> 1,34	10	8	40	48

*) For $Rz > 3 \ \mu m$ or $Ra > 0.5 \ \mu m$, the stylus tip radius $r_{tip} = 5 \ \mu m$ may be used.

In addition, the measuring point distance Δx and the cutoff wavelength λs of the low-pass filter are standardized. However, these values have already been set in the roughness measuring devices.

Practical tip 1: If there is insufficient space on the workpiece surface for the required traversing length **It**, the number of evaluation lengths must be reduced and indicated in the drawing.

Practical tip 2: If there is still insufficient space, the total height of the primary profile **Pt** is measured over the available length instead of **Rt** or **Rz**. **Pt** is still equal to **Rt**, but defined at the primary profile, and the measurement value is always larger.

■ Evaluation of roughness measurements (DIN EN ISO 4288:1998)

Roughness measurement values, particularly the vertical parameters **Rt**, **Rz**, **Rz1max** and **Ra**, have a spread of somewhere between -20 % and +30 %. A single measurement value can therefore not provide a complete statement with regard to compliance with the permissible parameter tolerances. The following procedure is specified in the DIN EN ISO 4288 Appendix A:

Max rule

All roughness parameters with the addition of **"max"** as the maximum of the mean value from the five sampling lengths: Measure at least three points on the surface where the highest values are expected; the stated limit must not be exceeded at any point.

16% rule

All roughness parameters without the addition of **"max"** as the mean value from the five sampling lengths:

16% of the measured values may exceed the stated limit; the step-by-step procedure is as follows:

1. If the first measured value is less than 70% of the stated limit, this is considered compliant.

2. If the result is otherwise, two additional measurements are taken at other locations on the surface; if all three measured values are less than the stated limit, this considered compliant.

3. If the result is otherwise, nine additional measurements are taken at other locations on the surface; if no more than two of the measured values exceed the stated limit, this is considered compliant.



Drawing symbols (DIN EN ISO 1302:2002)



 $^{\star)}\!...$ to projection plane of view in which the symbol is entered

Examples	Explanation
$\sqrt{Rz 5}$	No material removal allowed, default transmission band, R profile, 16% rule, mean roughness depth 5 µm (upper limit)
0,2 <i>Rzmax</i> 3	Material removal allowed, default transmission band, R profile, max rule, maximum roughness depth 3 µm (upper limit); machining allowance 0.2 mm
$\sqrt{\frac{Rz3}{C}}$	Material removal permitted, default transmission band, R profile, evaluation length of 3 sampling lengths, 16% rule, mean roughness depth 4 μ m (upper limit); concentric surface grooves
$\sqrt{\frac{Rz}{Ra}}$	Material removal allowed, default transmission band, R profile, 16% rule, mean roughness depth 5 µm; arithmetic average roughness value 1 µm (upper limit)
$\sqrt{\frac{U Rz 3}{L Rz 1}}$	Material removal allowed, default transmission band, ${\bf R}$ profile, 16% rule, mean roughness depth between 1 μm (lower limit) and 3 μm (upper limit)
√ Pt 25	Material removal allowed, default transmission band for λs , no λc filter, P profile, evaluation length equals workpiece length, 16% rule, total height of primary profile 25 μ m (upper limit)
0,8 - 25 / Wt 5 10	Material removal allowed, default transmission band 0.8 (= λ c) 25 (= λ f= Iw) mm, W profile, evaluation length of 5 sampling lengths In =5* Iw = 125 mm), 16% rule, total height of profile 10 µm (upper limit)
<i>Rt</i> 1 <i>Rmr</i> (c=0,3) 90%	Material removal allowed, default transmission band, R profile, 16% rule, total height of roughness profile 1 μ m (upper limit); material portion of profile is 90% in cutting height c =0.3 μ m (lower limit)
U RSm 0,3 L RSm 0,1	Material removal allowed, default transmission band, R profile, mean groove width between 0.1 mm (lower limit) and 0.3 mm (upper limit)
$\frac{y}{z} = \frac{y}{\sqrt{Rz \ 10}}$	Explanation of the meaning (right) of simplified benchmarking (left), if space is limited.

Contracer CV-2100

Series 218 - Contour Measuring Instruments

This contour measuring instrument is designed to support "easy to use" and "speedy" measurements.

The Contracer CV-2100N4 and CV-2100M4 offer you the following benefits:

- Extensive contour measurement quick and easy.
- Quick movement in Z2 because of an easy to use quick grip. [M4 type]
- Auto execution and multi point measurement with the new stylus up-and down function.
- X-axis drive up to 20mm/s by jog shuttle.
- Easy part programming as well as single measurement with software FORMTRACEPAK.
- Automatic evaluation, best fit of contours, CAD comparison and many more features as standard.
- CV-2100 M4 mounted with quick grip stand on a granite base.
- CV-2100 N4 can be mounted on an optional granite base with a manual column.
- Centralized front control panel



CV-2100M4



CV-2100N4



Measuring range	Z1 = 50mm X = 100mm
Measuring speed	0,02 - 5 mm/s
Drive speed	X = 0 - 20 mm/s
Accuracy	X = $(2,5 + 0,02L) \mu m$ [L: drive length (mm)] Z1 = $(2,5 + 10,1HI) \mu m$ [H: Measurement height from the horizontal position (mm)]
Traverse straightness	2,5 μm / 100 mm
Column type	M4: 350 mm
Software	 FORMTRACEPAK Allows control of measuring conditions for efficient automated

- measurement.
 Contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard.
 An inspection certificate can be
- created by setting the print format as required.





Refer to CV-2100 brochure



Contracer CV-2100

Specifications and accessories

Series 218 - Contour Measuring Instruments

Additional Specifications

Other optional	Other optional and standard	
accessories	accessories are listed later in	
	different sections for accessories	
	and styli.	

Optional accessories

No.	Description	Price €
218-001	Cross-travel table XY range : 100x50 mm	2545,00
218-003	Rotary vice (heavy-duty type)	1445,00
178-023	Manual vibration isolator	3660,00
178-024	Stand for vibration isolator	
218-042	Column stand for CV-2100N4	

IVIODEI	CV-2100N4 CV-2100N4	
No.	218-613D	218-633D
Z2-axis vertical travel [mm]	-	350
Z1-axis measuring range [mm]	50	50
Z2-axis column type	Optional: Manual	Manual: Quick up-and-down motion, fine feed
X1-axis measuring range [mm]	100	100



CV-2100 Stylus up-and-down function



CV-2100M4 with column and quick grip



Easy and quick movement in Z2



Optional column stand 218-042





Contracer CV-3200 and CV-4500

Series 218 - Contour Measuring Instruments

These are high accuracy semi-automatic contour measuring instruments equipped with powerful software FORMTRACEPAK.

The Contracer CV-3200 offers you the following benefits:

- Huge measuring range of Z=60 mm comes as standard.
- Easy exchange of magnetic stylus arm gives you excellent flexibility.
- The CV-3200 provides excellent accuracy and resolution in Z1-axis measurement.
- Its high positioning speed reduces the total measurement time.
- It has a fully automatic calibration routine.

The Contracer CV-4500 offers you the following benefits:

- It has a dual stylus system for upward/downward measurement at double sided contours.
- Variable measuring force is controlled by software FORMTRACEPAK.
- Easy exchange of magnetic stylus arm gives you excellent flexibility.
- The CV-4500 provides the highest accuracy and resolution possible.
- The motorised axes have a high positioning speed.
- The dual stylus system has a fully automatic calibration routine.



Contracer CV-3200 (CV-4500 equipped with dual stylus system)



Drive unit CV-4500

Specifications

Traverse Measuring range	Z2 = 300 mm / 500 mm Z1 = 60 mm X = 100 mm / 200 mm
speed	0,02 - 5 mm/s
Drive speed	X = 0 - 80 mm/s Z2 = 0 - 30 mm/s
Accuracy	$\begin{split} X &= (0,8+0,01L) \ \mu m \ (S4, \ H4, \ W4 \ model) \\ X &= (0,8+0,02L) \ \mu m \ (S8, \ H8, \ W8 \ model) \\ [L : Drive length (mm)] \\ \hline CV-3200 : \\ Z1 &= (1,6+12HI/100) \ \mu m \\ \hline CV-4500 : \\ Z1 &= (0,8+12HI/100) \ \mu m \\ [H : Measurement height from the horizontal position (mm)] \end{split}$
Inclining range	±45°
Measuring force	CV-3200 : 30 mN CV-4500 : 10, 20, 30, 40, 50 mN (software controlled)
Software	FORMTRACEPAK

Additional Specifications

Optional	Other optional and standard
accessories	accessories are listed later in different
	sections for accessories and styli.



Optional Y-axis - 178-097



Optional Rotary Table θ 1 - 12AAD975



Optional Rotary Table 02 - 178-078



Refer to CONTOUR MEASUREMENT brochure

Software FORMTRACEPAK

- Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement.
- Contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard.
- An inspection certificate can be created by setting the print format as required.







Contour analysis screen



Contour comparison

FORMTRACEPAK

Contracer CV-3200 and CV-4500

Series 218 - Contour Measuring Instruments

Dimensions and specifications





S8, (H8), [W8] - mm

CV-3200

Model	CV-320054	CV-3200H4	CV-3200W4	CV-320058	CV-3200H8	CV-3200W8	
No.	218-481D	218-482D	218-483D	218-486D	218-487D	218-488D	
Dimensions main unit (WxDxH) [mm]	756x482x966	756x482x1166	1156x482x1176	766x482x966	768x482x1166	1166x482x1176	
X1-axis measuring range [mm]	100	100	100	200	200	200	
Vertical travel [mm]	300	500	500	300	500	500	
Granite base size (WxD) [mm]	600x450	600x450	1000x450	600x450	600x450	1000x450	

CV-4500

CV-4300						
Model	CV-4500S4	CV-4500H4	CV-4500W4	CV-450058	CV-4500H8	CV-4500W8
No.	218-441D	218-442D	218-443D	218-446D	218-447D	218-448D
Dimensions main unit (WxDxH) [mm]	756x482x966	756x482x1166	1156x482x1176	766x482x966	768x482x1166	1166x482x1176
X1-axis measuring range [mm]	100	100	100	200	200	200
Vertical travel [mm]	300	500	500	300	500	500
Granite base size (WxD) [mm]	600x450	600x450	1000x450	600x450	600x450	1000x450





Quick Guide to Precision Measuring Instruments



Traceable Angle



The maximum angle at which a stylus can trace upwards or downwards along the contour of a workpiece, in the stylus travel direction, is referred to as the traceable angle. A one-sided sharp stylus with a tip angle of 12° (as in the above figure) can trace a maximum 77° of up slope and a maximum 87° of down slope. For a conical stylus (30° cone), the traceable angle is smaller. An up slope with an angle of 77° or less overall may actually include an angle of more than 77° due to the effect of surface roughness. Surface roughness also affects the measuring force.

For model CV-3200/4500, the same type of stylus (SPH-71: one-sided sharp stylus with a tip angle of 12°) can trace a maximum 77° of up slope and a maximum 83° of down slope.

Compensating for Stylus Tip Radius

A recorded profile represents the locus of the center of the ball tip rolling on a workpiece surface. (A typical radius is 0.025mm.) Obviously this is not the same as the true surface profile so, in order to obtain an accurate profile record, it is necessary to compensate for the effect of the tip radius through data processing.



Compensating for Arm Rotation

The stylus is carried on a pivoted arm so it rotates as the surface is traced and the contact tip does not track purely in the Z direction. Therefore it is necessary to apply compensation in the X direction to ensure accuracy. There are three methods of compensating for arm rotation.

- 1: Mechanical compensation
- 2: Electrical compensation



3: Software processing. To measure a workpiece contour that involves a large displacement in the vertical direction with high accuracy, one of these compensation methods needs to be implemented.

Contracer (Contour Measuring Instruments)

Overload Safety Cutout

If an excessive force (overload) is exerted on the stylus tip due, perhaps, to the tip encountering a too-steep slope on a workpiece feature, or a burr, etc., a safety device automatically stops operation and sounds an alarm buzzer. This type of instrument is commonly equipped with separate safety devices for the tracing direction (X axis) load and vertical direction (Y axis) load.

For model CV-3200/4500, a safety device functions if the arm comes off the detector mount.

Simple or Complex Arm Guidance

In the case of a simple pivoted arm, the locus that the stylus tip traces during vertical movement (Z direction) is a circular arc that results in an unwanted offset in X, for which compensation has to be made. The larger the arc movement, the larger is the unwanted X displacement (δ) that has to be compensated. (See figure, lower left.) The alternative is to use a complex mechanical linkage arrangement to obtain a linear translation locus in Z, and therefore avoid the need to compensate in X.

Z axis Measurement Methods

Though the X axis measurement method commonly adopted is by means of a digital scale, the Z axis measurement divides into analog methods (using a differential transformer, etc.) and digital scale methods.

Analog methods vary in Z axis resolution depending on the measurement magnification and measuring range. Digital scale methods have fixed resolution.

Contour analysis methods

You can analyze the contour with one of the following two methods after completing the measurement operation.

Data processing section and analysis program

The measured contour is input into the data processing section in real time and a dedicated program performs the analysis using the mouse and/or keyboard. The angle, radius, step, pitch and other data are directly displayed as numerical values. Analysis combining coordinate systems can be easily performed. The graph that goes through stylus radius correction is output to the printer as the recorded profile.

Tolerancing with Design Data

Measured workpiece contour data can be compared with design data in terms of actual and designed shapes rather than just analysis of individual dimensions. In this technique each deviation of the measured contour from the intended contour is displayed and recorded. Also, data from one workpiece example can be processed so as to become the master design data to which other workpieces are compared. This function is particularly useful when the shape of a section greatly affects product performance, or when its shape has an influence on the relationship between mating or assembled parts.

Best-fitting

If there is a standard for surface profile data, tolerancing with design data is performed according to the standard. If there is no standard, or if tolerancing only with shape is desired, best-fitting between design data and measurement data can be performed.



The best-fit processing algorithm searches for deviations between both sets of data and derives a coordinate system in which the sum of squares of the deviations is a minimum when the measured data is overlaid on the design data.

Data Combination

Conventionally, if tracing a complete contour is prevented by stylus traceable-angle restrictions then it has to be divided into several sections that are then measured and evaluated separately. This function avoids this undesirable situation by combining the separate sections into one contour by overlaying common elements (lines, points) onto each other. With this function the complete contour can be displayed and various analyses performed in the usual way.



Measurement Examples





Dual stylus for upward and downward measurement





Male thread form



Female thread form



Gage contour

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is no included Product illustr tions are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.





Formtracer SV-C3200 and SV-C4500

Series 525 - Surface and Contour Measuring System

These are high accuracy semi-automatic contour and roughness measuring instruments equipped with powerful software FORMTRACEPAK.

The Formtracer SV-C3200 offers you the following benefits:

- It is as powerful as two separate, specialised instruments.
- It economically combines roughness & contour measurement into a single device.
- You have access to a huge contour measuring range of Z=60mm as standard, and a roughness measurement range of 800µm as standard.
- Easy exchange of the magnetic contour stylus arm gives you excellent flexibility.
- The SV-C3200 provides you with excellent accuracy and resolution in Z1-axis measurement.

The Formtracer SV-C4500 offers you the following benefits:

- It economically combines roughness & dual stylus upward/downward contour measurement into a single device.
- You have access to a huge contour measuring range of Z=60mm as standard, and a roughness measurement range of 800µm as standard.
- Its variable measuring force is controlled by software FORMTRACEPAK.
- Easy exchange of the magnetic contour stylus arm gives you excellent flexibility.
- The SV-C4500 provides you with high accuracy and resolution.



Formtracer SV-C3200



Surface Roughness drive unit

[Surface Roughness Measurement : Complies with EN ISO, VDA, JIS, ANSI and other international surface roughness standards.]



Contour drive unit SV-C3200



Contour drive unit SV-C4500



Specifications

Traverse	Z2 = 300 mm / 500 mm
Measuring range	X = 100 mm / 200 mm Contour: Z1 = 60 mm Roughness: Z1 = 800 μm; 80 μm; 8 μm (up to 2,4 mm with an optional stylus)
Measuring speed	0,02 - 5 mm/s
Drive speed	X = 0 - 80 mm/s Z2 = 0 - 30 mm/s
Accuracy	$\begin{split} X &= (0,8+0,01L) \ \mu m \ (S4, \ H4, \ W4 \ model) \\ X &= (0,8+0,02L) \ \mu m \ (S8, \ H8, \ W8 \ model) \\ [L : Drive length (mm)] \\ \textbf{SV-C3200 :} \\ Z1 &= (1,6+12HI/100) \ \mu m \\ \textbf{SV-C4500 :} \\ Z1 &= (0,8+12HI/100) \ \mu m \\ [H : Measurement height from the horizontal position (mm)] \end{split}$
Inclining range	±45°
Measuring force	SV-C3200 Contour : 30 mN SV-C4500 Contour : 10, 20, 30, 40, 50 mN software controlled Roughness : 0,75 mN / 4mN
Software	FORMTRACEPAK

Additional Specifications

Optional Other optic accessories accessories

Other optional and standard accessories are listed later in different sections for accessories and styli.



Refer to Formtracer SV-C3200 / 4500 brochure

Formtracer SV-C3200 and SV-C4500

Series 525 - Surface and Contour Measuring System

Specifications

- Software FORMTRACEPAK
 - Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement.
 - Surface roughness analyisis and contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard.
 - An inspection certificate can be created by setting the print format as required.



Measurement control screen



Contour analysis screen



Contour comparison



Roughness analysis

Metric	SV-C32	00					
No.	Model	Detector 0,75 mN	Detector 4 mN	Z2-axis 300 mm	Z2-axis 500 mm	X-axis 100 mm	X-axis 200 mm
525-481D-1	SV-C3200S4	0		0		0	
525-481D-2			0	0		0	
525-482D-1	SV-C3200H4	0			0	0	
525-482D-2	"		0		0	0	
525-483D-1	SV-C3200W4	0			0	0	
525-483D-2			0		0	0	
525-486D-1	SV-C320058	0		0			0
525-486D-2			0	0			0
525-487D-1	SV-C3200H8	0			0		0
525-487D-2			0		0		0
525-488D-1	SV-C3200W8	0			0		0
525-488D-2	"		0		0		0

Metric SV-C4500							
No.	Model	Detector 0,75 mN	Detector 4 mN	Z2-axis 300 mm	Z2-axis 500 mm	X-axis 100 mm	X-axis 200 mm
525-441D-1	SV-C4500S4	0		0		0	
525-441D-2	"		0	0		0	
525-442D-1	SV-C4500H4	0			0	0	
525-442D-2	"		0		0	0	
525-443D-1	SV-C4500W4	0			0	0	
525-443D-2	"		0		0	0	
525-446D-1	SV-C4500S8	0		0			0
525-446D-2	"		0	0			0
525-447D-1	SV-C4500H8	0			0		0
525-447D-2	"		0		0		0
525-448D-1	SV-C4500W8	0			0		0
525-448D-2	I		0		0		0



Using Y-axis table



Using rotary table θ 1



Using rotary Table $\theta 2$





Formtracer CS-3200

Series 525 - Surface and Contour Measuring System

This provides all-in-one surface roughness and contour measurement within one drive unit. The Formtracer CS-3200 offers you the following benefits:

- You can carry out simultaneous analysis of roughness and contour with one measurement.
- It complies with many standards including EN ISO, VDA, ANSI and JIS as well as customised settings.
- It gives you the best measuring condition with a vibration stand as standard.
- The high drive speed reduces the total measurement time.
- The detector unit can be extended to avoid interference between the drive unit and workpiece.



CS-3200S4 (with optional Y-axis 178-097)



- 1: Outside diameter
- 2: Outside diameter
- 3: Inside diameter
- 4: Measurement element
- 5: Positioning element

Continuous measurement example:

The drive unit (X-axis) and column (Z2-axis) are equipped with high-accuracy linear scales (ABS type) enabling fully automatic measurement combining vertical and horizontal movement. This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurements of parts which are difficult to position



528

Specifications

rai

Traverse	Z2 = 300 mm
Measuring range	X = 100 mm Z1 = 5 mm (up to 10 mm with an optional stylus)
Measuring speed	Roughness measurement: 0,02 / 0,05 / 0,1 / 0,2 mm/s Contour measurement: 0,02 / 0,05 / 0,1 / 0,2 / 0,5 / 1 / 2 mm/s
Drive speed	X = 0 - 80 mm/s Z2 = 0 - 20 mm/s
Accuracy	X = (0,8+0,01L) μm [L : Drive length (mm)] Z1 = (1,5+12Hl/100) μm H : Measurement height from the horizontal position (mm)
Inclining range	±45°
Traverse straightness	X = 0,2 μm / 100 mm
Software	 FORMTRACEPAK Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement. Surface roughness analysis and contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard. An inspection certificate can be

created by setting the print format as required.



Refer to Formtracer CS-3200 brochure

Additional Specifications

Optional accessories

Other optional and standard accessories are listed later in different sections for accessories and styli.



Measuring instrument control



Contour analysis screen



Contour analysis screen



Contour and roughness layout



Series 525 - Surface and Contour Measuring System

Specifications and Styli







12AAD560 Deep groove stylus Radius of tip curvature = 2 μm Tip Material: Diamond





Formtracer Extreme SV-C4500CNC

Series 525 - Surface and Contour Measuring Instrument

High accurate fully CNC surface and contour measuring instrument. The Formtracer Extreme SV-C4500CNC offers you the following benefits:

- Powerful as two separate, fully CNC instruments.
- Measurement of long distances in Z2-axis for models without α axis.
- Each axis has a drive speed up to 200mm/s.
- Dual stylus system for upward and downward contour measurement at doubled sided contours.
- It's variable contour measuring force is controlled by software FORMTRACEPAK.
- The contour drive unit is equipped with an arc encoder detector giving excellent accuracy and resolution in Z1-axis.
- Perfectly made for increased throughput of multiple profile and workpiece measurement tasks.
- The detector unit incorporates an anti-collision safety device, causing it to stop automatically if
- its main body collides with a workpiece or jig.



SV-C4500CNC equipped with two powerful exchangeable drive units



Surface Roughness drive unit



Contour drive unit

Specifications

	•	
	Traverse	Z2= 300 mm / 500 mm
	Measuring	X= 200 mm
	range	Y= 200 mm
		Contour:
		Z1= 60 mm
		Z2= 300 mm / 500 mm
		Roughness:
		Z1= 800 μm; 80 μm; 8 μm
		(up to 2,4 mm with an optional stylus)
	Measuring speed	0,02 - 2 mm/s
	Drive speed	CNC mode: max. 200 mm/s
		Joystick mode: 0-50 mm/s
	Accuracy	X= (0,8 +4L/200) μm
		[L: Drive length (mm)]
		Z1= (0,8 + I2HI/100) μm
		H: Measurement height from the
		horizontal position (mm)]
		Model without α -axis:
	1	$22=(1,5+10H11000) \mu m$
	inclining	-45° (CCVV) to +10° (CVV)
	range	
	Measuring	0,/5 mN
	torce	
	C = {}	
	Sottware	FURINI KACEPAK

- Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement.
- Contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard.
- An inspection certificate can be created by setting the print format as required.



Refer to CONTOUR AND SURFACE MEASUREMENT brochure



Optional	Other optional and standard
accessories	accessories are listed later in different
	sections for accessories and styli.

Optional accessories

No.	Description	Price €
178-397-2	Detector 4 mN	933,00
12AAD975	θ1-axis table	
178-078	θ2-axis table	
178-037	Automatic leveling table CNC	
178-077	3D leveling table	
12AAE449	Cabin for H-type	
12AAE287	Cabin for S-type	

Formtracer Extreme SV-C4500CNC

Series 525 - Surface and Contour Measuring Instrument

SV-C4500CNC-.S

No.	Z2-axis vertical travel [mm]	Y-axis table unit	lpha-axis unit
525-661-1D	300	-	-
525-662-1D	300	-	Installed
552-663-1D	300	Installed	-
552-664-1D	300	Installed	Installed

SV-C4500CNC-H

No.	Z2-axis vertical travel [mm]	Y-axis table unit	lpha-axis unit
525-681-1D	500	-	-
525-682-1D	500	-	Installed
525-683-1D	500	Installed	-
525-684-1D	500	Installed	Installed





Multiple measurements



Through 2-axis simultaneous control in the X and Y directions



Y-axis



α-axis

Formtracer Extreme CS-5000CNC and CS-H5000CNC

Series 525 - CNC Surface and Contour Measuring Instruments

This is the highest-accuracy stylus type CNC surface roughness and contour measuring instrument. The Formtracer Extreme CS-5000CNC / CS-H5000CNC offers you the following benefits:

- It meets the highest demands of accuracy and repeatability.
- You can carry out simultaneous analysis of roughness and contour within one measurement.
- It includes a cabin and a vibration stand as standard to avoid external influences.
- A Mitutoyo Laser Holoscale is incorporated in the X1- and Z1-axes so you can achieve high resolution of X1-axis : 6,25 nm and Z1-axis : 4nm/8nm.
- The X1 and Z2-axis have maximum drive speeds of 40mm/s and 200mm/s respectively.



CS-H5000CNC





Specifications

Traverse	Z2 = 300 mm / 500 mm
Measuring	X = 200mm
range	Z1 = 12 mm [standard lenght stylus]
-	Z1 = 24 mm [double lenght stylus]
Measuring	Roughness measurement:
speed	0.02 - 0.2 mm/s
.1	Contour measurement:
	0.02 - 2 mm/s
Drive speed	CNC mode: max 200 mm/s
Brive speed	lovstick mode 0 - 50 mm/s
Δοιιτοον	CS-5000CNC:
Accuracy	$X = (0.3 \pm 0.0021) \text{ µm}$
	$\Lambda = (0, 3+0, 002L) \mu \Pi$
	$X = (0.16 \pm 0.0011)$ um
	$\Lambda = (0, 10+0, 00 \text{ L}) \mu \text{III}$
	$21 = (0,07+10,02 \Pi) \mu \Pi$
	[L: Drive length (mm)]
	[H : Measurement neight from the
-	norizontal position (mm) j
Iraverse	CS-5000CNC:
straightness	$X = (0, 1+0, 0015L) \mu m [$ standard
	stylus]
	$X = (0,2+0,0015L) \mu m [$ double length
	stylus]
	CS-H5000CNC:
	$X = (0,05+0,0003L) \mu m [standard$
	stylus]
	$X = (0, 1+0, 0015L) \mu m [double length]$
	stylus]
Measuring	4 mN (with standard stylus)
Force	0,75 mN (with 2X-long stylus)
Resolution	X = 0,00625 μm
[µm]	CS-5000CNC:
	Z1 = 0,004 µm [standard stylus]
	Z1 = 0,008 µm [double length stylus]
	CS-H5000CNC:
	Z1 = 0,001 µm [standard stylus]
	Z1 = 0,002 µm [double length stylus]

Software

FORMTRACEPAK



Refer to CONTOUR AND SURFACE MEASUREMENT brochure

Software FORMTRACEPAK

- Allows control of all axis, optional motor-driven Y-axis table and rotary table for efficient automated measurement.
- Surface roughness analysis and contour evaluation can be performed using analysis of level differences, angle, pitch, area and contour tolerancing as standard.
- An inspection certificate can be created by setting the print format as required.



Contour and roughness analysis



Optional: Aspherical lens analysis program ASLPAK

Formtracer Extreme CS-5000CNC and CS-H5000CNC

Series 525 - CNC Surface and Contour Measuring Instruments

Specifications and Styli

CS-5000CNC				
Model	CS-5000CNC-1S	CS-5000CNC-2S	CS-5000CNC-3S	CS-5000CNC-4S
No.	525-721-2	525-722-2	525-723-2	525-724-2
Z2-axis vertical travel [mm]	300	300	300	300
Y-axis table unit	-	-	Installed	Installed
α -axis unit	-	Installed	-	Installed
Model	CS-5000CNC-1H	CS-5000CNC-2H	CS-5000CNC-3H	CS-5000CNC-4H
No.	525-741-2	525-742-2	525-743-2	525-744-2

No.	525-741-2	525-742-2	525-743-2	525-744-2
Z2-axis vertical travel [mm]	500	500	500	500
Y-axis table unit	-	-	Installed	Installed
α-axis unit	-	Installed	-	Installed

CS-H5000CNC

Model	CS-H5000CNC-1S	CS-H5000CNC-2S
No.	525-761-2	525-763-2
Z2-axis vertical travel [mm]	300	300
Y-axis table unit	-	Installed
α -axis unit	-	-



(31.5)

(31.5)

8

8

154.5

1

8

Double length

(19) 115.95



Ø0.5 mm



12AAD651 Ø1.2 4 40°

/40%

12AAD653

8

533



35.95 For small holes

15 10

9.1



65.95

145.95

106.6 / 106.4 74.5

8

(1.1)



1 = additional for CS-H5000CNC



Optional Software USB Communication Tool

Series 178 - Control Software for SJ series, SV-2100

This is a control software for Surftest SJ-210 / SJ-310 / SJ-410 / SJ-500 and SV-2100 which offers you the following benefits:

- It is available as a free download on www.mitutoyo.eu.
- Output software is based on Microsoft® Excel® for controlling the devices, reproducing and storing measurement data.
- Measurement device control.
- It provides definition of measurement variables.
- Graphic representation of the profile.
- Storage of measurement records.
- Documentation of measurements result.
- A USB connecting cable is necessary.



Input mask for Surftest SJ series



Output record from Microsoft® Excel® in 18 languages as standard.

Optional accessories

No.	Description	Price €
12AAL068D	USB cable for SJ-210	14,00
12AAD510	USB cable for SJ-310 / SJ-410	73,00
12AAH490	USB cable for SJ-500 /	54,80
	SV-2100	



Output record from Microsoft® Excel®

Detectors





12AAG203 Extension rod 100mm



Order No	Measuring force		Inclusive stylus
178-396-2	0,75mN	R2µm, 60°	12AAC731
178-397-2	4mN	R5µm, 90°	12AAB403

No.	Radius	Angle [°]	Price [€]
12AAE882	1 µm	60°	1290,00
12AAE924	1 µm	90°	1539,00
12AAC731	2 µm	60°	264,00
12AAB403	5 µm	90°	255,00
12AAB415	10 µm	90°	274,00
12AAE883	250 µm	60°	959,00



Standard

No.	Radius	Angle [°]	Price [€]
12AAC732	2 µm	60°	327,00
12AAB404	5 µm	90°	314,00
12AAB416	10 µm	90°	344,00





No.	Radius	Angle [°]	Price [€]
12AAC733	2 µm	60°	456,00
12AAB405	5 µm	90°	314,00
12AAB417	10 µm	90°	344,00



For extra-small hole

No.	Radius	Angle [°]	Price [€]
12AAJ662	250 µm	-	640,00



mm



For ultra-small hole

§ 0.3



mm



No.	Radius	Angle [°]	Price [€]
12AAC734	2 µm	60°	422,00
12AAB406	5 µm	90°	401,00
12AAB418	10 µm	90°	445,00

For ultra-small hole



mm	No.	Radius	Angle [°]	Price [€]
	12AAC740	2 µm	60°	483,00
	12AAB413	5 µm	90°	460,00
	12AAB425	10 µm	90°	519,00

For deep hole [double-length]



No.	Radius	Angle [°]	Price [€]
12AAE886	250 µm	60°	1330,00

For rolling circle waviness [double-length]



١	No.	Radius	Angle [°]	Price [€]
	12AAE892	2 µm	60°	630,00
	12AAE908	5 µm	90°	582,00





No.	Radius	Angle [°]	Price [€]
12AAE898	2 µm	60°	837,00
12AAE914	5 µm	90°	722,00

For deep hole [double-length]



^m No.	Radius	Angle [°]	Price [€]
12AAE938	β 2 μm	60°	934,00
12AAE940) 5 µm	90°	825,00

For small slotted hole [double-length]

Radius	Angle [°]	Price [€]
2 µm	60°	479,00
5 µm	90°	478,00
10 µm	90°	563,00
	Radius 2 μm 5 μm 10 μm	Radius Angle [°] 2 μm 60° 5 μm 90° 10 μm 90°



mm

mm

Mitutoyo

For deep hole [triple-length]

No.	Radius	Angle [°]	Price [€]
12AAC735	2 µm	60°	286,00
12AAB409	5 µm	90°	277,00
12AAB421	10 µm	90°	296,00

Angle

[°]

60°

90°

90°

Radius

2 µm

No.

No.

12AAC737

12AAB407

12AAB419 10 µm

12AAC736

12AAB408 5 µm

12AAB420 10 µm

Price

[€]

286,00

277,00

292,00



For deep groove 10 mm



For deep groove 20 mm



Price

[€]

543,00

532,00

600,00

Angle

[°]

60°

90°

90°

Radius

2 µm

5 µm



For deep groove 20 mm [double-length]



For deep groove 30 mm

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.



No.	Radius	Angle [°]	Price [€]
12AAE894	2 µm	60°	251,00
12AAE910	5 µm	90°	255,00

For deep groove 30 mm [double-length]



nm	No.	Radius	Angle [°]	Price [€]
	12AAE895	2 µm	60°	251,00
	12AAE911	5 µm	90°	255,00

Price

[€]

Radius

12AAB338 0,8 mm 276,00

For deep groove 40 mm



For rolling circle waviness surface roughness (Roughness specimen 178-611 required)



For rolling circle waviness surface roughness [double-length] (178-611 required)



nm	No.	Radius	Price [€]
	12AAE884	0,8 mm	452,00

No.

n	No.	Radius	Angle [°]	Price [€]
	12AAE899	2 µm	60°	1489,00
	12AAE915	5 um	90°	1611.00

For hole bottom

Mitutoyo

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.





Optional Styli and Arms for Contracer and Formtracer SV-C Series





Arm Eccentric type CV-2100

Applicable arms for CV-2100

Arm for small-hole stylus CV-2100

No.	Arm	Arm No.	Compatible stylus height (H) [mm]	Price [€]
935110	Small hole	AB-11	0,4/1/2,5	86,00
935111	Straight type	AB-51	6	98,00
935112	Straight type	AB-61	12	98,00
935113	Straight type	AB-71	20	100,00
935114	Straight type	AB-81	30	103,00
935115	Straight type	AB-91	42	115,00
935116	Eccentric type	AB-52	6	121,00
935117	Eccentric type	AB-62	12	121,00
935118	Eccentric type	AB-72	20	123,00
935119	Eccentric type	AB-82	30	113,00
935120	Eccentric type	AB-92	42	118,00

Applicable Arms for CV-3200 / CV-4500 / SV-C3200 / SV-C4500 / SV-C4500CNC

No.	Arm	Arm No.	Compatible stylus height (H) [mm]	Price [€]
12AAM101	Straight type	AB-31	all	283,00
12AAM102	Eccentric type	AB-32	all	350,00
12AAM103	Small hole	AB-33	SPH-41, SPH-42, SPH-43	330,00

Applicable Styli for CV-2100

No.	Stylus	Stylus No.	Stylus height (H) [mm]	Price [€]
932693	Small hole, carbide-tipped one-sided cut	SP-11	0,4	122,00
932694	Small hole, carbide-tipped one-sided cut	SP-12	1	128,00
932695	Small hole, carbide-tipped one-sided cut	SP-13	2,5	134,00
12AAE873	Small hole, carbide-tipped cone	SP-31	0,4	235,00
12AAE874	Small hole, carbide-tipped cone	SP-32	1	235,00
12AAE875	Small hole, carbide-tipped cone	SP-33	2,5	235,00

Applicable Styli for CV-3200 / CV-4500 / SV-C3200 / SV-C4500 / SV-C4500CNC

No.	Stylus	Stylus No.	Stylus height (H) [mm]	Price [€]
12AAM104	Small hole, carbide tipped one sided cut	SPH-41	2	247,00
12AAM105	Small hole, carbide tipped one sided cut	SPH-42	4	247,00
12AAM106	Small hole, carbide tipped one sided cut	SPH-43	6,5	247,00



Arm straight type CV-3200/CV-4500 SV-C3200/SV-C4500 SV-C4500CNC



Arm eccentric type CV-3200/CV-4500 SV-C3200/SV-C4500 SV-C4500CNC



Arm for small-hole stylus CV-3200/CV4500 SV-C3200/SV-C4500 SV-C4500CNC



Small hole: 932693 / 12AAE873 Tip shape: Single bevel / Cone Tip angle: 20° / 30° Tip radius: 25 µm / 25 µm Tip material: Carbide / Carbide



Small hole: 932694 / 12AAE874 Tip shape: Single bevel / Cone Tip angle: 20° / 30° Tip radius: 25 µm / 25 µm Tip material: Carbide / Carbide



Small hole: 932695 / 12AAE875 Tip shape: Single bevel / Cone Tip angle: 20° / 30° Tip radius: 25 µm / 25 µm Tip material: Carbide / Carbide



Small hole: 12AAM104 Tip shape: One-sided cut Tip angle: 20° Tip radius: 25 µm Tip material: Carbide



Small hole: 12AAM105 Tip shape: One-sided cut Tip angle: 20° Tip radius: 25 µm Tip material: Carbide

Small hole: 12AAM106 Tip shape: One-sided cut Tip angle: 20° Tip radius: 25 µm Tip material: Carbide

Mitutoyo

The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Optional Styli and Arms for Contracer and Formtracer SV-C Series



Single bevel Tip angle: 12° Tip radius: 25 µm Tip material: Carbide



Cross ground Tip angle: 20° Tip radius: 25 μm Tip material: Carbide



Tip angle: 30°/50° Tip radius: 25 µm Tip material: Carbide/Sapphire/Diamond (355129: 50°, Diamond)



Cone Tip angle: 20° Tip radius: 25 μm Tip material: Carbide



Knife edge Tip angle: 20° Edge width: 3 mm Tip radius: 25 µm Tip material: Carbide



Ball: ø1 mm Tip material: Carbide



Both sides conical stylus Tip angle: 30° Tip radius: 25 µm Tip material: Carbide

Applicable Styli for

CV-2100 / CV-3200/ CV-4500 / SV-C3200 / SV-C4500 / SV-C4500CNC

CV-2100/	CV-3200/ CV-4300 / 3V-C3200 / 31	-C430073	V-C4300CIVC	
No.	Stylus	Stylus No.	Stylus height (H) [mm]	Price [€]
354882	Single bevel, carbide tipped	SPH-51	6	126,00
354883	Single bevel, carbide tipped	SPH-61	12	126,00
354884	Single bevel, carbide tipped	SPH-71	20	152,00
354885	Single bevel, carbide tipped	SPH-81	30	177,00
354886	Single bevel, carbide tipped	SPH-91	42	180,00
354887	Cross ground, carbide tipped	SPH-52	6	143,00
354888	Cross ground, carbide tipped	SPH-62	12	143,00
354889	Cross ground, carbide tipped	SPH-72	20	168,00
354890	Cross ground, carbide tipped	SPH-82	30	177,00
354891	Cross ground, carbide tipped	SPH-92	42	180,00
12AAE865	Cone, carbide-tipped angle 20°	SPH-57	6	173,00
12AAE866	Cone, carbide-tipped angle 20°	SPH-67	12	168,00
12AAE867	Cone, carbide-tipped angle 20°	SPH-77	20	168,00
12AAE868	Cone, carbide-tipped angle 20°	SPH-87	30	218,00
12AAE869	Cone, carbide-tipped angle 20°	SPH-97	42	218,00
354892	Cone, sapphire-tipped angle 30°	SPH-53	6	83,00
354893	Cone, sapphire-tipped angle 30°	SPH-63	12	83,00
354894	Cone, sapphire-tipped angle 30°	SPH-73	20	83,00
355129	Cone, diamond-tipped angle 50°	SPH-79	20	336,00
354895	Cone, sapphire-tipped angle 30°	SPH-83	30	83,00
354896	Cone, sapphire-tipped angle 30°	SPH-93	42	85,00
12AAA566	Cone, carbide-tipped angle 30°	SPH-56	6	122,00
12AAA567	Cone, carbide-tipped angle 30°	SPH-66	12	122,00
12AAA568	Cone, carbide-tipped angle 30°	SPH-76	20	122,00
12AAA569	Cone, carbide-tipped angle 30°	SPH-86	30	175,00
12AAA570	Cone, carbide-tipped angle 30°	SPH-96	42	175,00
354897	Knife edge, carbide tipped	SPH-54	6	165,00
354898	Knife edge, carbide tipped	SPH-64	12	165,00
354899	Knife edge, carbide tipped	SPH-74	20	165,00
354900	Knife edge, carbide tipped	SPH-84	30	167,00
354901	Knite edge, carbide tipped	SPH-94	42	167,00
354902	Ball, carbide tipped	SPH-55	6	74,00
354903	Ball, carbide tipped	SPH-65	12	74,00
354904	Ball, carbide tipped	SPH-75	20	74,00
354905	Ball, carbide tipped	SPH-85	30	74,00
354906	Ball, carbide tipped	SPH-95	42	76,00

Applicable Styli for only CV-4500 /SV-C4500 / SV-C4500CNC

No.	Stylus	Stylus No.	Stylus height (H) [mm]	Price [€]
12AAM095	Both sides conical stylus	SPHW-56	20	352,00
12AAM096	Both sides conical stylus	SPHW-66	32	336,00
12AAM097	Both sides conical stylus	SPHW-76	48	336,00
12AAM108	Both sides small hole arm stylus	SPHW-31	2,4	598,00
12AAM109	Both sides small hole arm stylus	SPHW-32	5	584,00
12AAM110	Both sides small hole arm stylus	SPHW-33	9	549,00







The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.



Optional Accessories for Surftest, Contracer and Formtracer

For SV series, SV-C series, CV series, CS series and CNC Models

Automatic-leveling table : 178-087 (for SV, CV, SV-C, CS)

Automatic-leveling table : 178-037 (for CNC Models)

This is a stage that performs fully automatic leveling as measurement starts, freeing the user from this troublesome operation. Fully automatic leveling can be done quickly by anyone. In addition, the operation is easy and reliable.

No.	Inclination adjustment angle	Maximum load [kg]	[mm]
178-087	± 2°	7	130 x 112
178-037	± 2°	7	130 x 112

Micro-chuck

This chuck is suitable for clamping extra-small diameter workpieces (ø1,5 mm or less), which cannot be retained with the centering chuck.

No.	Dimensions	Retention range	Price
	[mm]	[mm]	[€]
211-031	ø118 x 48,5	OD : ø0 - ø1,5	1380,00

Quick chuck

This Chuck is useful when measuring small workpieces. You can easily clamp them with its knurled ring.

No.	Dimensions [mm]	Retention range [mm]	Price [€]	
211-032	ø118 x 41	Inner latch : OD Ø1 - Ø36 Inner latch : ID Ø16 - Ø69 outer latch : OD Ø25 - Ø79	1977,00	

Y-axis table

for SV-3100, SV-C, CS and CV models (not CNC models)

Enables efficient, automatic measurement of multiple aligned workpieces and multiple points on a single measurement surface. It allows semi-automatic measurement with a semi-automatic with non CNC models by using these items.

No.	Resolution [µm]	Travel range [mm]	Positioning accuracy [µm]	Maximum load [kg]	Drive speed
178-097	0,05	200	±3	50	Max. 80 mm/s

θ1-axis:*1

For efficient measurement in the axial / transverse directions. When measuring a cylindrical workpiece, automatic alignment can be performed in combination with the Y-axis table.

*1 = **12AAE630** mounting plate is required when directly installing on the base of the machine.

No.	Resolution	Rotational speed	Displacement	Maximum load [kg]
12AAD975	0,004°	Max. 10°/s	360°	12

θ2-axis:*1

For efficent measurment of multiple points on a cylindrical workpiece and automate front/rear-side measurement.

- *1 = 12AAE718 mounting plate is required when directly installing on the base of the machine.
- *1 = 12AAE705 attachment plate is required when installing on θ 1-axis table.
- *1 = 12AAE707 mounting plate is required when directly installing on Y-axis table with automatic leveling table.

No.	Resolution	Rotational speed	Displacement	Maximum load [kg]
178-078	0,0072°	Max. 18°/s	360°	4



178-097 using Y-axis



12AAD975 using θ1-axis



178-078 using θ2-axis





211-032



178-097



12AAD975



178-078



Optional Accessories for Surftest, Contracer and Formtracer



3 - Axis Adjustment Table



No.

Description [€] This table helps to make the alignment adjustments required when measuring cylindrical surfaces. The corrections for the pitch angle and the swivel angle are determined from a preliminary measure-4456,00 178-047 ment and the Digimatic micrometers are adjusted accordingly. A flat-surfaced workpiece can also be leveled with this table.

Price

[€]

3236,00

Price

[€]

2568,00

806,00



Calibration Stand

Digital Leveling Table

No.	Description	Price [€]
12AAG175	For mounting a roughness specimen or step gauge during calibration	358,00

Leveling range

±1,5°

Leveling range

±1,5°

±1,5°

12AAG175





Cross-travel Table					
No	Table top	XY travel	Price		
NO.	[mm]	[mm]	[€]		
218-001	280 x 180	100 x 50	2545,00		
218-041	280 x 152	50 x 25	2460.00		

Table top XY travel

[mm]

±12,5

XY trave

[mm]

±12,5

40

[mm]

Table top

[mm]

130 x 100







No. 178-042-1 130 x 100



178-043-1



178-016

No.

Precision Vise

Leveling Table

178-043-1 130 x 100

No.	Description	Price [€]
178-019	Max. workpiece size : 36 mm Can be mounted on a leveling table	610,00





Rotary \	lise	
No.	Description	Price [€]
218-003	Two-slide jaw type Max. workpiece size : ø60 mm Minimum reading : 1°	1445,00

218-003

V-Block

No.	Description	Price [€]
998291	Workpiece diameter : 1 mm to 160 mm Can be mounted on a leveling table	679,00



The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.



Price

eco-fix Fixtures Form

eco-fix Kit Form S

Adapter plate Ø150mm usable with:

- Roundtest RA-10
- Roundtest RA-120
- Roundtest RA-120P
- Roundtest RA-1600
- THETA 1 for CV, SV, SV-C and CS types





eco-fix Kit Form L

Adapter plate Ø200mm usable with:

- Roundtest RA-2200
- Roundtest RA-H5200
- Roundtest RA-2200CNC
- Roundtest RA-H5200CNC
- THETA 1 for CV, SV, SV-C and CS types





Turntable	
Rotational accuracy	Radial: (0,04+0,0006H)µm H: Measuring height from turntable surface (mm) Axial: (0,04+0,0006X)µm X: Radial distance from center (mm)
Max. probing Ø	100 mm
Max. workpiece Ø	320 mm
Max. turntable loading	10 kg
Vertical column	
Vertical travel	117 mm
Max. probing height	152 mm
Display unit	
Data analysis items	Roundness, Coaxiality, Concentricity, Flatness,

Printer

Concentricity, Flatness, Runout radial Built-in thermal line printer



USB Communication Program as a free download on www.mitutoyo.eu



Refer to FORM MEASUREMENT brochure

Roundtest RA-10

Series 211 - Form Measuring Instrument

This is a compact and affordable form measuring instrument. The Roundtest RA-10 offers you the following benefits:

- It combines outstanding cost and performance with full measurement capabilities.
- The machine has a compact body with integrated electronics and printer, making it ideal for installation in space-restricted locations.
- You can easily view measurement results and recorded profiles on the large coloured LCD panel display.
- Despite being a low-priced model, the turntable with air bearings gives you rotational accuracy as high as (0,04+0,0006H)µm, assuring a precision that compares well with that of higher priced models.
- The control panel has large keys and an intuitive layout for easy operation.
- One-key calling function.
- One-key zero-set function.
- Support of 16 languages.
- It complies with EN ISO standard like 12181-1, 12181-2, 12781-1 and 12781-2.
- USB Communication Program Microsoft® Excel ® based to import results and create, save and print out inspection certificates on PC.



RA-10 with optional collet



Z-axis scale unit



X-axis stop

Roundtest RA-10

Series 211 - Form Measuring Instrument

Dimensions and accessories





211-051

211-054







211-032



211-052



211-055



211-053

12AAH425

No.	Model	Max. workpiece ø [mm]	Max. probing Ø [mm]	Max. turntable loading [kg]
211-541D	RA-10	320	100	10

Optional accessories

No.	Description	Price €
12AAH402	Collet (ø0,5-1,0 mm)	185,00
12AAH403	Collet (ø1,0-1,5 mm)	185,00
12AAH404	Collet (ø1,5-2,0 mm)	155,00
12AAH405	Collet (ø2,0-2,5 mm)	155,00
12AAH406	Collet (ø2,5-3,0 mm)	129,00
12AAH407	Collet (ø3,0-3,5 mm)	129,00
12AAH408	Collet (ø3,5-4,0 mm)	129,00
12AAH409	Collet (ø4,0-5,0 mm)	129,00
12AAH410	Collet (ø5,0-6,0 mm)	129,00
12AAH411	Collet (ø6,0-7,0 mm)	129,00
12AAH412	Collet (ø7,0-8,0 mm)	129,00
12AAH413	Collet (ø8,0-9,0 mm)	129,00
12AAH414	Collet (ø9,0-10,0 mm)	129,00
211-013	Vibration damping stand	4090,00
211-016	Reference hemisphere	977,00
211-031	Micro-chuck OD: 1-1,5 mm	1380,00
211-032	Quick chuck OD: 1-79, ID: 16-79 mm	1977,00
211-045	Magnification checking gauge	2990,00
211-051	Collet chuck (OD : 0,5- 10 mm)	1170,00
211-052	Quick chuck	1635,00
211-053	V-block jig A (for ø50 mm)	1025,00
211-054	V-block jig B (for ø50 mm)	1230,00
12AAH420	Spacer for reference hemisphere	78,00
12AAH425	Alignment table with D.A.T. (mm)	2740,00
12AAH427	Alignment table with mechanical heads	
12AAH318	Z-axis scale unit	319,00
12AAH320	X-axis stop	106,00
356038	Auxiliary stage for a low- height workpiece	470,00
997090	Gauge block set for calibration	307,00

Consumable spares

No.	Description	Price €
12AAH181	Printer paper (10 rolls)	88,00



211-013

Turntable	
Rotational accuracy	Radial: (0,04+0,0006H)µm H: Measuring height from turntable surface (mm) Axial: (0,04+0,0006X)µm X: Radial distance from center (mm)
Max. probing Ø	280 mm 380 mm in reverse position
Max. workpiece Ø	440 mm
Max. turntable loading	25 kg
Centering range	±3 mm
Leveling range	±1°
Vertical column	
Vertical travel	280 mm
Max. probing height	280 mm above turntable surface 480 mm in reverse position
Max. probing depth	100 mm (minimum ID: 30 mm)
Display unit	Only RA-120 (RA-120P with PC)
Data analysis items	Roundness, Coaxiality, Flatness, Runout (radial), Runout (axial), Thickness deviation, Parallelism, Perpendicularity
Printer	Built-in thermal line printer (RA-120)
Software	ROUNDPAK (only RA-120P)



USB Communication Program as a free download on www.mitutoyo.eu



Refer to ROUNDTEST RA-120 brochure

Roundtest RA-120 and RA-120P

Series 211 - Form Measuring Instrument

These are compact, affordable and simple-to-use instruments for measuring roundform geometry. The Roundtest RA-120 and RA-120P offer you the following benefits:

• The turntable accuracy of (0,04+0,0006H)µm provides high level form analysis.

RA-120

- The RA-120 has a compact body with integrated electronics and printer, making it ideal for installation in space-restricted locations.
- You can easily view measurement results and recorded profiles on the large coloured LCD panel display.
- One-key operations.
- Support of 16 languages.
- It complies with EN ISO standard like 12181-1, 12181-2, 12781-1 and 12781-2
- USB Communication Program Microsoft® Excel ® based to import results and create, save and print out inspection certificates on PC.

RA-120P

- The RA-120P is a PC based model with all operations controlled via powerful ROUNDPAK software.
- Software ROUNDPAK gives you excellent possibilities for single measurement and part programming.



RA-120



RA-120P





Roundtest RA-120 and RA-120P

Series 211 - Form Measuring Instrument

The is a compact roundness tester with D.A.T. (Digital Adjustment Table) function. The Roundtest RA-120 and RA-120P give you the following benefits:

- The turntable displays centering and leveling adjustments digitally, making this challenging task easy enough for even an untrained operator to perform, through these four simple steps:
- 1. Preliminary measurement of two cross sections on the workpiece.
- 2. The centering and leveling adjustment values are displayed.
- 3. The digital micrometer heads on the rotary table are adjusted to match the values displayed.
- 4. Centering and leveling is complete. [Centering range : ±3 mm Leveling range : ±1°]







No.	Model	Max. workpiece ø [mm]	Max. probing Ø [mm]	Max. turntable loading [kg]
211-542D	RA-120 with D.A.T. function	440	280	25
211-544D	RA-120 with mechanical turntable	440	280	25
211-545D	RA-120P with D.A.T. function	440	280	25
211-547D	RA-120P with mechanical turntable	440	280	25

Additional Specifications

Optional	Other optional and standard
accessories	accessories are listed later in this
	section for accessories and styli.

Optional accessories

•		
No.	Description	Price €
211-013	Vibration damping stand	4090,00
211-014	Three jaw chuck OD: 2-78, ID: 25-68 mm	1045,00
211-016	Reference hemisphere	977,00
211-031	Micro-chuck OD: 1-1,5 mm	1380,00
211-032	Quick chuck OD: 1-79, ID: 16-79 mm	1977,00
211-045	Magnification checking gauge	2990,00
211-061	Collet chuck OD: 0,5-10 mm	730,00
12AAH320	X-axis stop	106,00
356038	Auxiliary stage for a low- height workpiece	470,00
997090	Gauge block set for calibration	307,00

Consumable spares

No.	Description	Price €
12AAH181	Printer paper (10 rolls)	88,00



211-016



211-013





Z-axis scale unit (optional)

Turntable	
Rotational accuracy	Radial: (0,02+0,0006H)µm H: Measuring height from turntable surface (mm) Axial: (0,02+0,0006X)µm X: Radial distance from center (mm)
Rotational speed	4, 6, 10 rpm
Max. probing Ø	280 mm
Max. workpiece Ø	560 mm
Max. turntable loading	25 kg
Centering range	±3 mm
Leveling range	±1°
Vertical column	
Max. probing height	300 mm above turntable surface
Max. probing depth	91 mm (minimum ID : ø32 mm) 50 mm (minimum ID : ø7 mm)
Straightness	0,2 μm / 100 mm 0,3 μm / 300 mm
Parallelism with turntable axis	1,5 μm / 300 mm

Software

ROUNDPAK



Measuring screen



Result screen

ROUNDPAK Simple to operate even with a full set of parameters and analysis functions.

Roundtest RA-1600

Series 211 - Form Measuring System

This is a PC-compliant form measuring system which allows you to measure roundform geometry like cylindricity.

The Roundtest RA-1600 offers the following benefits:

- It is equipped with a high accurate turntable accuracy of (0,02+0,0006H)µm.
- You can carry out simple & accurate centering and leveling of the workpiece with D.A.T. (Digital Adjustment Table).
- The user friendly software, ROUNDPAK, gives you easy drag and drop usage.
- ROUNDPAK also has easy-to-use part programming and single measurement functions.
- A remote control box is including allowing you easy operation.
- There is also an auto follow function for easy and quick pre-centering of the workpiece.



RA-1600



Spiral Measurement/Analysis (RA-1600)

Provided with a spiral measurement function that combines turntable rotation and rectilinear motion allowing cylindricity, coaxiality and other form characteristics to be measured in continuous data stream mode.



Measurement through X - axis tracking

Measurement while tracing is possible through a built-in linear scale in the X - axis.



Roundtest RA-1600

Series 211 - Roundness Measuring System





390 02



Dimensions

No.	Description	Max. workpiece ø [mm]	Max. probing Ø [mm]	Max. turntable loading [kg]
211-723D	RA-1600	560	280	25





Additional Specifications

Optional	Other optional and standard
accessories	accessories are listed later in this
	section for accessories and styli.

Optional accessories

•		
No.	Description	Price €
211-014	Three jaw chuck OD: 2-78, ID: 25-68 mm	1045,00
211-031	Micro-chuck OD: 1-1,5 mm	1380,00
211-032	Quick chuck OD: 1-79, ID: 16-79 mm	1977,00
211-045	Magnification checking gauge	2990,00
211-061	Collet chuck OD: 0,5-10 mm	730,00
12AAL019	Side table	
12AAL090	Sliding detector holder	1510,00
12AAF203	Double length detector holder	1910,00
12AAF204	Large diameter detector holder	1695,00
12AAK110	Vibration isolator	
12AAK120	Monitor arm	
356038	Auxiliary stage for a low- height workpiece	470,00
997090	Gauge block set for calibration	307,00



Refer to ROUNDTEST RA-1600 brochure

Turntable	
Rotational accuracy	Radial: (0,02+0,00035H)µm H: Measuring height from turntable surface (mm) Axial: (0,02+0,00035X)µm X: Radial distance from center (mm)
Rotational speed	2, 4, 6, 10 rpm
Max. probing Ø	300 mm
Max. workpiece Ø	580 mm
Max. turntable loading	30 kg
Centering range	DS / DH: ±5 mm AS / AH: ±3 mm
Leveling range	±1°
Vertical column	
Max. probing height	AS / DS : 300 mm AH / DH: 500 mm above turntable surface
Max. probing depth	85 mm (minimum ID : ø32 mm) 50 mm (minimum ID : ø7 mm)
Straightness	AS / DS : 0,1 μm / 100 mm AS / DS : 0,15μm / 300 mm AH / DH: 0,25 μm / 500 mm
Parallelism with rotation center	AS / DS : 0,7 μm / 300 mm AH / DH: 1,2μm / 500 mm
Horizontal axis	
Straightness	0,7 μm / 300 mm
Perpendicularity to rotation center	1 μm / 150mm
Software	ROUNDPAK
	FORMTRACEPAK-RA

(optional for roughness detection unit)





ROUNDPAK Simple to operate even with a full set of parameters and analysis functions.

Roundtest RA-2200

Series 211 - Form Measuring Instrument

This is a highly accurate form measuring system which allows you to measure roundform geometry like cylindricity.

The Roundtest RA-2200 offers the following benefits:

- It has fully motorised axes movement.
- Its extremely high turntable accuracy of (0,02+0,00035H)µm gives you excellent form analysis.
- The user friendly software, ROUNDPAK, gives you easy drag and drop usage and a wide range of parameters.
- ROUNDPAK also has easy-to-use part programming and single measurement functions.
- A huge number of styli provides you with maximum flexibility.
- There is an auto follow function for easy and quick pre-centering of the workpiece.

There is a wide variety of models available to suit any application.

RA-2200DS/DH: These models have a navigation function supplied as standard, to quickly and simply guides you through the centering and leveling task. The models are equipped with the D.A.T. (Digital Adjustment Table).

RA-2200AS/AH: The models have an automatic centering and leveling turntable supplied as standard, freeing you from the centering and leveling task. The models are equipped with the A.A.T. (Automatic Adjustment Table).



Automatic measurement



Roundtest RA-2200

Series 211 - Roundness/Cylindricity Measuring System

Accessories and dimensions



No.	Model	Centering/leveling adjustment 1*	Vertical travel [mm]	Max. workpiece ø [mm]	Max. probing Ø [mm]	Max. turntable loading [kg]
211-511D	RA-2200AS	AAT	300	580	300	30
211-512D	RA-2200AH	AAT	500	580	300	30
211-513D	RA-2200DS	DAT	300	580	300	30
211-515D	RA-2200DH	DAT	500	580	300	30

1* AAT : Automatic Adjustment Table

DAT : Digital Adjustment Table

Additional Specifications

Optional	Other optional and standard
ccessories	accessories are listed later in this
	section for accessories and styli.

Optional accessories

(

a

•		
No.	Description	Price €
211-014	Three jaw chuck OD: 2-78, ID: 25-68 mm	1045,00
211-031	Micro-chuck OD: 1-1,5 mm	1380,00
211-032	Quick chuck OD: 1-79, ID: 16-79 mm	1977,00
211-045	Magnification checking gauge	2990,00
12AAL019	Side table	
12AAF203	Double length detector holder	1910,00
12AAF204	Large diameter detector holder	1695,00
12AAK110	Vibration isolator	
12AAK120	Monitor arm	
356038	Auxiliary stage for a low- height workpiece	470,00
12AAF353	Roughness detection unit	
178-396-2	Detector 0,75 mN	933,00



Refer to ROUNDTEST RA-2200 brochure

Radial: (0,02+0,00035H)µm H: Measuring height from turntable surface (mm) Axial: (0,02+0,00035X)µm X: Radial distance from center (mm)
2, 4, 6, 10 rpm
400 mm
680 mm
65 kg
80 kg without auto centering
±5 mm
±1°
AS : 350 mm AH: 550 mm above turntable surface
85 mm (minimum ID : ø32 mm) 50 mm (minimum ID : ø7 mm)
AS / AH : 0,05 μm / 100 mm AS : 0,14μm / 350 mm AH : 0,2 μm / 550 mm
AS : 0,2 µm / 350 mm
AH : 0,32µm / 550 mm
0,4 µm / 200 mm
0,5 μm / 200 mm
(ontional for roughness



detection unit)



Simple to operate even with a full set of parameters and analysis functions.

Roundtest RA-H5200

Series 211 - High-precision Form Measuring Instrument

This is a highly accurate, precision form measuring system developed to give you the highest accuracy as well as high flexibility and analytical capability.

The Roundtest RA-H5200 offers the following benefits:

- Its integrated vibration isolator helps you to measure within the best conditions.
- It has a high measuring range and loading mass.
- The user friendly software, ROUNDPAK, gives you easy drag and drop usage and a wide range of parameters.
- ROUNDPAK also has easy-to-use part programming and single measurement functions.
- A.A.T. (Automatic Adjustment Table) gives you fully automatic centering and leveling.
- There is an auto follow function for easy and quick pre-centering of the workpiece.





Highly accurate, automatic centering/leveling turntable

The performance of this turntable has been achieved through exceptional manufacturing accuracy of the critical components, in addition to a high-accuracy air-bearing that provides superior rigidity. The resulting rotational accuracy, the heart of a Roundtest measuring system, is world-class at 0.02+0.00035H µm.



<u>Sliding detector-unit holder provided as a standard feature</u> The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm. Sliding distance : 112 mm.



Roundtest RA-H5200

Series 211

Dimensions and accessories



Dimensions

No.	Model	Centering/leveling adjustment 1*	Vertical travel [mm]	Max. workpiece ø [mm]	Max. probing Ø [mm]	Max. turntable loading [kg]
211-531D	RA-H5200AS	AAT	350	680	400	65
211-532D	RA-H5200AH	AAT	550	680	400	65

1* AAT : Automatic Adjustment Table





mm

Additional Specifications

Optional	Other optional and standard
ccessories	accessories are listed later in this
	section for accessories and styli.

Optional accessories

(

a

No.	Description	Price €
211-014	Three jaw chuck OD: 2-78, ID: 25-68 mm	1045,00
211-031	Micro-chuck OD: 1-1,5 mm	1380,00
211-032	Quick chuck OD: 1-79, ID: 16-79 mm	1977,00
211-045	Magnification checking gauge	2990,00
12AAL019	Side table	
12AAF203	Double length detector holder	1910,00
12AAF204	Large diameter detector holder	1695,00
12AAF205	Triple length holder for extra-deep holes	
12AAF353	Roughness detection unit	
178-396-2	Detector 0.75 mN	933.00



/ĭ



211-014



211-031

211-045



Refer to ROUNDTEST RA-H5200 brochure



Rotational accuracy	Radial: (0,02+0,00035H)µm H: Measuring height from turntable surface (mm) Axial: (0,02+0,00035X)µm X: Radial distance from center (mm)
Rotational speed	2, 4, 6, 10 rpm
Max. probing Ø	256 mm
Max. workpiece Ø	580 mm
Max. turntable loading	30 kg
Centering range	±3 mm
Leveling range	±1°
Vertical column	
Max. probing height	AS : 300 mm AH: 500 mm above turntable surface
Max. probing depth	104 mm (minimum ID : ø32 mm) 26 mm (minimum ID : ø12,7 mm)
Straightness	AS / AH : 0,1 μm / 100 mm AS : 0,15 μm / 300 mm AH : 0,25 μm / 500 mm
Parallelism with rotation center	AS : 0,7 μm / 300 mm AH : 1,2 μm / 500 mm
Horizontal axis	
Straightness	0,7 µm / 150 mm
Perpendicularity to rotation center	1 μm / 150 mm
Software	ROUNDPAK
	FORMTRACEPAK-RA (optional for roughness detection unit)

Optional accessories

No.	Description
12AAL019	Side table
12AAK110	Vibration isolator
12AAK120	Monitor arm
12AAG419	Roughness detection unit CNC (0,75mN)



Simple to operate even with a full set of parameters and analysis functions.



Refer to ROUNDTEST RA-2200 brochure

Roundtest Extreme RA-2200CNC

Series 211 - High-precision Form Measuring Instrument

This is a fully automatic CNC form measuring instrument that gives highly accurate results. The Roundtest Extreme RA-2200CNC offers you the following benefits:

- It has a CNC controlled measuring system with orientation steps of 1°.
- The extremely high turntable accuracy of (0,02+0,00035H)µm gives you highly accurate form analysis.
- The user friendly software, ROUNDPAK, gives you easy drag and drop usage and a wide range of parameters.
- ROUNDPAK also has easy-to-use part programming and single measurement functions.
- An automatic centering and leveling turntable A.A.T. (Automatic Adjustment Table) is supplied as standard, freeing you from the centering and leveling task.



RA-2200 CNC + optional vibration isolator [12AAK110] and side table [12AAL019]





No.	Centering/leveling adjustment 1*	Vertical travel [mm]	Max. work- piece ø [mm]	Model	Max. probing Ø [mm]	Max. turntable loading [kg]
211-517D	AAT	300	580	RA-2200CNC AS	256	30
211-518D	AAT	500	580	RA-2200CNC AH	256	30

1* AAT : Automatic Adjustment Table



Roundtest Extreme RA-H5200CNC

Series 211 - High-precision Roundness/Cylindricity Measuring System

This is a CNC form measuring instrument that combines high accuracy with automatic CNC measurements.

The Roundtest Extreme RA-H5200CNC offers you the following benefits:

- An integrated vibration isolator helps you to measure within best conditions.
- It will greatly improve your productivity and efficiency.
- You can take highly accurate, fast and operator-free measurements.
- The user friendly software, ROUNDPAK, gives you easy drag and drop usage and a wide range of parameters.
- ROUNDPAK also has easy-to-use part programming and single measurement functions.
- An automatic centering and leveling turntable A.A.T. (Automatic Adjustment Table) is supplied as standard, freeing you from the centering and leveling task.



RA-H5200CNC + side table [12AAL019]



Max. turntable Max. work-Max. probing Centering/leveling Vertical travel Model No. piece ø Ø loading adjustment 1* [mm] [mm] [kg] [mm] 211-533D RA-H5200CNC AS AAT 350 680 356 65 211-534D RA-H5200CNC AH AAT 550 680 356 65

1* AAT : Automatic Adjustment Table

Mitutoyo



Specifications

Turntable				
Rotational accuracy		Radial: (0,02+0,00035H)µm H: Measuring height from turntable surface (mm) Axial: (0,02+0,00035X)µm X: Radial distance from center (mm)		
Rotational speed	I	2, 4, 6, 10 rpm Auto centering: 20 rpm		
Max. probing Ø		356 mm		
Max. workpiece	Ø	680 mm		
Max. turntable loading		65 kg 80 kg without auto centering		
Centering range		±5 mm		
Leveling range		±1°		
Vertical column				
Max. probing height		AS : 350 mm AH: 550 mm above turntable surface		
Max. probing depth		104 mm (minimum ID : ø32 mm) 26 mm (minimum ID : ø12,7 mm)		
Parallelism with		AS: 0.2 µm / 350 mm		
rotation center		AH : 0,32 μm / 550 mm		
Horizontal axis				
Straightness		0.4 µm / 200 mm		
Perpendicularity	to	0.5 µm / 200 mm		
rotation center	10	0,5 μπ7 200 mm		
Software		ROUNDPAK		
		FORMTRACEPAK-RA (optional for roughness detection unit)		
Additional Spec	ificatio	ns		
Optional	Other	optional and standard		
accessories accessories are listed later in this section for accessories and styli.				
Optional access	ories			

No.	Description
12AAL019	Side table
12AAG419	Roughness detection unit CNC (0,75mN)



ROUNDPAK

Simple to operate even with a full set of parameters

Standard accessories

No. Description

12AAL021 Stylus standard type

Optional accessories

No.	Description	Price (
12AAL022	Stylus for notches	412,00
12AAL023	Stylus for deep grooves	377,00
12AAL024	Stylus for corner	377,00
12AAL025	Stylus for cutter marks	412,00
12AAL026	Stylus ø0,8 mm for small holes	355,00
12AAL027	Stylus ø1 mm for small holes	344,00
12AAL028	Stylus ø1,6 mm for small holes	342,00
12AAL029	Stylus ø0,5 mm for extra small holes	250,00
12AAL030	Stylus ø1,6 mm ball type	342,00
12AAL031	Stylus disc type	560,00
12AAL032	Stylus ø0,5 mm for cranks	298,00
12AAL033	Stylus ø1 mm for cranks	339,00
12AAL034	Stylus for flat surfaces	412,00
12AAL035	Stylus 2x-long standard type	328,00
12AAL036	Stylus 2X-long type for notches *1	528,00
12AAL037	Stylus 2X-long type for deep grooves *1	488,00
12AAL038	Stylus 2X-long type for corners *1	488,00
12AAL039	Stylus 2X-long type for cutter marks *1	528,00
12AAL040	Stylus 2X-long type ø1 mm for small holes *1	447,00
12AAL041	Stylus 3X-long standard type *1 *2	588,00
12AAL042	Stylus 3X-long type for deep grooves *1 *2	590,00
12AAL043	Stylus shank	196,00
12AAL044	Stylus shank for grooves	206,00
12AAL045	Stylus shank 2X-long type for grooves *1	320,00

*1 Not available for RA-10, RA-120, RA-120P

*2 Measuring is only possible in the vertical direction



Cutter marks



Small hole

Flat surface

Optional Styli for Roundtest

Interchangeable styli for RA-10, RA-120, RA-120P, RA-1600, RA-2200, RA-H5200

12AAL021 - Standard ø 1,6 mm tungsten carbide	66 12AAL022 - Notch ø 3 mm tungsten carbide	12AAL023 - Deep groove R 0,25 mm sapphire
12AAL024 - Corner	12AAL025 - Cutter mark	12AAL026 - Small hole
R 0,25 mm sapphire	R 15 mm tungsten carbide	ø 0,8 mm tungsten carbide
12AAL027- Small hole ø 1 mm tungsten carbide	12AAL028 - Small hole ø 1,6 mm tungsten carbide	e0 5 mm 10 12AAL029- Extra small hole ø 0,5 mm tungsten carbide
12AAL030- ø 1,6 mm ball	12AAL031- Disc	12AAL032- Crank
ø 1,6 mm tungsten carbide	ø 12 mm	ø 0,5 mm tungsten carbide
12AAL033- Crank	12AAL034- Flat surface	12AAL035- 2X-long standard
ø 1 mm tungsten carbide	Tungsten carbide	ø 1,6 mm tungsten carbide
12AAL036- 2X-long notch	12AAL037- 2X-long deep groove	Tataloge 2X-long corner
ø 3 mm tungsten carbide	R 0,25 mm sapphire	R 0,25 mm sapphire
12AAL039- 2X-long type cutter mark	12AAL040- 2X-long small hole	12AAL041- 3X-long standard
R 15 mm tungsten carbide	ø 1 mm tungsten carbide	ø 1,6 mm tungsten carbide
12AAL042- 3X-long deep groove	12AAL043- Stylus shank	12AAL044- Stylus shank groove
R 0,25 mm sapphire	for mounting M2 - CMM stylus	for mounting M2 - CMM stylus
		1

12AAL045- Stylus shank 2X groove for mounting M2 - CMM stylus





Optional Styli for Roundtest

Interchangeable styli for RA-2200CNC, RA-H5200CNC



Standard accessories

No.	Description
12AAE301	Stylus standard type for CNC
12AAE302	Stylus for flat surfaces for CNC

Optional accessories

No.	Description	Price €
12AAE303	Stylus ball ø1,6 mm for CNC	430,00
12AAE304	Stylus ball Ø0,8 mm for CNC	430,00
12AAE305	Stylus ball ø0,5 mm for CNC	430,00
12AAE306	Stylus for deep holes for CNC	525,00
12AAE307	Stylus for deep holes for CNC	430,00
12AAE308	Stylus for deep grooves for CNC	430,00
12AAE309	Stylus for notches for CNC	430,00
12AAE310	Stylus for grooves for CNC	430,00

Optional Accessories for Roundtest

Optional accessories for Roundtest and Roundtest Extreme

356038

No.





211-032



211-014













178-025



Description

356038 Used for measuring a workpiece whose diameter is 40 mm or less and whose height is 20 mm or less 470,00

This Chuck is useful when measuring small workpieces. You can easily clamp them with its knurled ring.

No.	Holding capacity [mm]	External dimensions [mm]
211-032.	Internal jaw: ID = ø 16 - 69 External jaw: OD = ø 1 - 79	ø118 x 41
211-031	Internal jaw: ø 0 1 - 1 5	ø 107 x 48 5

Chuck - Three jaw chuck (key operated)

Auxiliary stage for a low-height workpiece

No.	Holding capacity [mm]	External dimensions [mm]	Price [€]
211-014	Internal jaw: ID = ø 25 - 68 Internal jaw: OD = ø 2 - 35 External jaw: OD = ø 35 - 78	ø157 x 70,6	1045,00

Cylindric square

No.	Cylindricity	Roundness	Squareness	Straightness	Price
	[µm]	[µm]	[µm]	[µm]	[€]
350850	2	0,5	3	1	520,00

Gauge block set for calibration

No.	Description	Price [€]
997090	Standard accessory for RA-2200,RA-2200CNC Standard accessory for RA-H5200 and RA-H5200CNC	307,00

Magnification checking gauge

No	Max. calibration range	Graduation	Price	
NO.	[µm]	[µm]	[€]	
211-045	400	0,2	2990,00	

Origin point gauge

No.	Description		
998382	Standard accessory for RA-1600, RA-2200 and RA-H5200	297,00	

Vibrator isolator and accessories

No.	Vibration isolation method	External dimensions [mm]	Description
178-025	Air suspension Diaphragm isolation system	(WxDxH) 750x550x59	For RA-2200 and RA-2200CNC
178-024			Stand for RA-2200 and RA-2200CNC
12AAL019		660 x 670 x 700	Side table
12AAK110		830 x 800 x 700	Vibration isolator
12AAK120			Monitor arm



12AAK110 + 12AAK120



12AAK110 + 12AAL019





Price

[€]

Quick Guide to Precision Measuring Instruments



Roundtest (Form Measuring Instruments)

Defining roundness

Deviation from perfect roundness is defined by the difference in radii of two coplanar and concentric reference circles whose sizes and center position are constructed by one of four methods (described below) after the circumferential line has been extracted. The diagrams show how the deviation value obtained is affected by the method used.





The prices listed are suggested retail prices (valid until 31st May 2015). All products to be sold to commercial customers. Therefore VAT is not included. Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

Filtering

Extracted lines can be low-pass filtered in various ways to reduce or eliminate unwanted detail, with a cut-off value set in terms of undulations per revolution (upr). The effect of different upr settings is shown in the diagrams below, for a phase-corrected 50% Gaussian filter, which illustrate how the measured roundness value decreases as lower upr settings progressively smooth out the extracted line.						
No filter	4.50 µm 0°	150 upr	50 upr 180	90° 173 yrs 0° 200°	15 upr	255 pp
Characteristic Symbol*	Definition			Geometrical Tolerancing*	Test Method	Result
0	Concentricity Concentricity dev extracted circum circular cross sect a value t/2.	viation is the maximum radial distance between ferential line center and the datum element cent cion. A feature is toleranced by limiting the devia	the er in a ation to			
//	Parallelism (Plane Plane-to-Plane Pa between the extr toleranced by lim	to Plane) arallelism deviation is the maximum difference ir acted plane surface and the datum plane. A fea iting the deviation to a value t.	i distance ture is			
L	Perpendicularity (Plane to Axis) Plane-to-Axis Perpendicularity deviation is the maximum difference distance between the extracted plane surface and a plane perpend to the datum axis. A feature is toleranced by limiting the deviation t value t.		ce in ndicular n to a			
L	Perpendicularity (Axis to Plane) Axis-to-Plane Perpendicularity deviation is the maximum difference distance between the extracted axial line and an axis perpendicula datum plane. A feature is toleranced by limiting the deviation to a		ce in lar to the a value t.			
1	Run-out (Radial) Radial Run-out de extracted circumf toleranced by lim	eviation is the maximum difference in radii of ar ferential line centered on the datum axis. A featu iting the deviation to a value t.	ı ure is			
1	Run-out (Axial) Axial Run-out de direction betwee the axis. A featur	viation is the maximum difference in distance in n an extracted circular line and a plane perpend e is toleranced by limiting the deviation to a valu	the axial icular to Je t.			
11	Total Run-out (Ra Radial Total Run- concentric cylinde and enclose the e feature is tolerand	idial) out deviation is the difference in radii between tv ers coaxial with the datum axis constructed to to xtracted cylindrical surface with minimum separa ced by limiting the deviation to a value t.	vo uch ation. A			
11	Total Run-out (A) Total Axial Run-o in the axial direct perpendicular to to a value t.	xial) ut deviation is the maximum difference in distar ion between an extracted flat surface and a pla the axis. A feature is toleranced by limiting the o	nce ne deviation		a a a a a a a a a a a a a a a a a a a	
				* Following ISO 1101:2012; t = tolerance	Reference Element	- Extracted Geometry

