Optical Sensors

Distance & Thickness measurement

Vision & Inspection

mm

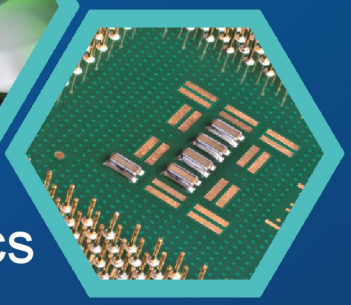
µm

nm

Catalogue 2016

Glass

Medical



Electronics

Semiconductor

Automotive

Aerospace

Watchmaking

STIL

Precision in focus

Selection guides

3D metrology: Products

Vision

General Selection Guide

Application	See
*Measure the Shape of a sample (profilometry, microtopography, tolerance control, vibrometry, warpage) *Measure the Distance of a sample (auto-focusing) *Measure the Thickness of a sample or a coating *Measure the Roughness of a surface	3D Metrology Products Selection guide (on this page)
*Measure or compare the Color of a sample *Measure the Spectrum reflected, transmitted or emitted from a sample or a light source	Non Contact spectrocolorimeter (page 50)
*Microscopy of the sample surface	Vision Systems (page 49)

3D Metrology Products Selection Guide

Product list

Point sensors: controller + optical fiber + interchangeable optical pen

Controller models: CCS Optima+, CCS Prima, STIL-VIZIR, STIL-Duo, CHR-150L
Optical pen series: CL-MG, OP, ENDO, OPILB

Line sensors: controller + optical fiber cable + Optical head (non interchangeable)

Controller models: MPLS180, MPLS-DM, MPLS2000
Optical head models: Nanoview, Microview, Deepview, Wavy

Systems: Micromesure2 3D measuring system
Step comparator

Lines Sensors VS. Point Sensors

	Line Sensor	Point Sensor
Throughput	Up to 324,000 points/s	Up to 10,000 points/s
Scanning	Easy: a single axis is required for scanning a surface Not flexible: line length and pitch are fixed	2 axes required for scanning a surface Flexible: size and pitch may be set for both axes
Measuring Modes	Distance	Distance and Thickness
Advanced Options	"First Peak" mode	"First Peak", "Averaging", "Autoled" "Double frequency" and more
Optics	4 optical heads models available	~ 25 optical pens models available The optical pens are interchangeable on the same controller
Axial Resolution	Standard	Very High (CCS sensors) Extra High (DUO sensor)

Metrological Class

Class	Axial Resolution (1)	Measuring Range	Technology	Products
Sub-nano Metrology	from 0.3 nm	up to 135 µm	**CONFOCAL SPECTRAL INTERFEROMETRY (page 10)**	STIL DUO Controller (2) with OPILB optical pen
Nano Metrology	5.0 nm to 0.3µm (3)	100 µm to 4 mm (3)	**CHROMATIC CONFOCAL IMAGING (page 8)**	All other 3D metrology products
Micro Metrology	from (3) 0.3 µm	4 mm to 42 mm (3)		

(1) Smallest measurable step.
(2) Alone or mounted on a Micromesure 3D measuring system
(3) Depending on the optical pen model

Spectral Range

Requirement	Product
NIR (1)	STIL-VIZIR
VISIBLE	All other 3D metrology products

(1) NIR spectral band allows measuring the thickness of samples made of Silicium, such as wafers.

Measuring Rate

Requirement	Measuring rate (1)	Product
Ultra high rate	Up to 1800 lines/s (324,000 points/s)	MPLS 180, MPLS-DM
Standard rate	Up to 10,000 Hz	CCS Optima+
	Up to 2,000 Hz	CCS Prima, STIL DUO
	Up to 1,000 Hz	CHR-150L, STIL-VIZIR (NIR)

(1) The effective measuring rate depends on the sample characteristics. Low-reflectivity samples cannot be measured at the controller max. rate

Multi-channel operation

Requirement	Product
2 or 4 simultaneous channels (1) (2)	CHR-150L-2, CHR-150L-4
2 or 4 multiplexed channels (1) (3)	CCS Prima2, CCS Prima4
2 multiplexed channels of different types	STIL-DUO: 1 interferometric channel, 1 chromatic confocal channel
Single channel	CCS Optima+, CCS Prima, STIL-VIZIR

(1) The number of channels should be specifed while ordering, no upgrade is possible later.
(2) Simultaneous channels: all the channels measure at the same time.
(3) Mutiplexed channels: all optical pens may be connected to the controller at the same time, but only one of them measures.

Digital outputs

Requirement	RS232 (1)	USB	Ethernet	GigaEthernet
MPLS-DM	-	-	-	1
MPLS180	-	1	-	-
CCS Optima+ CCS Prima STIL-VIZIR	1	1	-	-
STIL-DUO	1	-	1	-
CHR-150L	2	-	-	-

(1) For CCS controllers RS232 may be changed to RS422 by hardware configuration

Other I/O

Requirement	Analog output (1)	Encoder input (2)	Trig-in (3)	Trig-out (3)
MPLS-DM	No	No	Yes	Yes
MPLS180	No	No	Yes	Yes
CCS Optima+ CCS Prima STIL-VIZIR	Yes	Yes	Yes	Yes
STIL-DUO	No	No	Yes	Yes
CHR-150L	Yes	No	Yes	Yes

(1) OV-10V, configurable
(2) Up to 3 digital encoders
(3) TTL 0V-5V

Selecting a Point sensor Controller

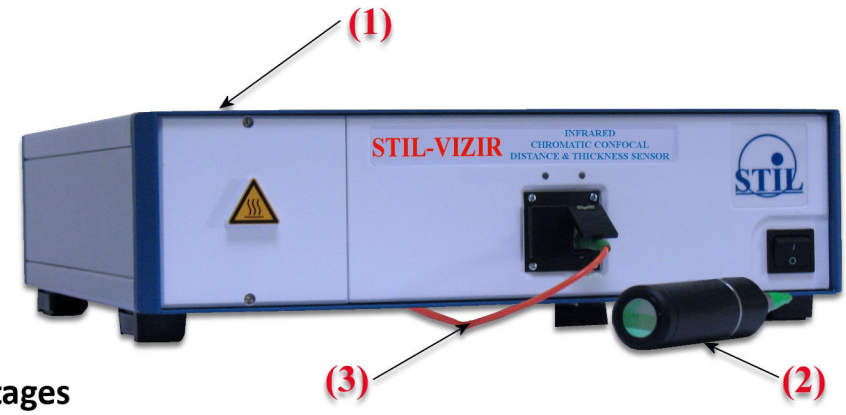
Application / Requirement	Recommended Controller
• General purpose sensor • Industrial applications	CCS Optima+ or CCS Prima
• Measuring distance with sub-nanometric resolution, • Measuring thickness with very high accuracy, • Measuring thin films • Measuring a sample through a thin coating layer	STIL-DUO in interferometric mode
• Multi-layer samples	STIL-DUO in chromatic confocal mode + STIL Multipeak software
• Measuring wafer thickness	CCS VIZIR in NIR mode
• 2 or 4 multiplexed channels required	CCS Prima2 / CCS Prima4
• 2 or 4 simultaneous channels required	CHR-150L-2 / CHR-150-4

Selecting an Optical pen

Application / Requirement	Recommended Optical pen
• General purpose sensor	CL-MG optical pen with adequate measuring range
• Measure inside a cavity (diam. From 7 mm)	ENDO optical pen with adequate measuring range
• Measure in interferometric mode	OPILB optical pen with STIL-DUO
• Measure on rough metallic surface, such as machined parts	Optical pen with a spot size as small as possible Check the measuring rough metal surface specifications
• Roughness (Ra or Sa)	Optical pen with a spot size as small as possible
• Mirror-like samples / low-reflectivity samples	Optical pen whose photometric efficiency is low / high, respectively
• Measure through a window	Optical pen with a removable reference plate
• Thickness of an opaque sample	Two optical pens "looking" at each other, with the sample in-between
• Thickness of a transparent sample or layer (using a single optical pen)	Check the min measurable thickness specification Check the max measurable thickness specification
• Detecting very small or dense features	Check the lateral resolution specification
• Detecting very small Z-steps	Check the axial resolution specifications
• Measure sample global shape or curvature • Measure large Z-steps	Check the accuracy specification
• Measure moving samples whose position during measurement is uncertain	Check that both the measuring range and the working distance are long enough
• The sample may be tilted relative to the sensor axis (example: moving parts) • Sample surface is curved (sphere, cylinder...) • Features with local slopes (scratches, bumps)	Check the max sample slope specification or Adjust the pen orientation in "real time" so that its axis is always normal to the local slope of the sample

Chromatic Confocal "point" sensors

These sensors measure the altitude (z coordinate) of the sample point located on their optical axis.
They can also measure the thickness of transparent samples.
They consist of a controller (1), an "optical pen" (optical probe) (2) and a fiber optic cable (3).
3 controller lines (CCS, STIL-VIZIR and CHR), 3 optical pen lines (CL-MG, OP & ENDO) and different fiber optic cable models are available.
A single controller may be ordered with several interchangeable optical pens.



Advantages

- Configurable: Select the controller, the optical pen and the fiber optics cable best suited for your application.
- Large choice of measuring ranges (100 µm - 20 mm),
- Large choice of optical pens satisfying specific requirements ("endoscopic" / radial pens / large working distance / steep slope / small spot size / through-window measurement...).

Controllers for chromatic confocal "point" sensors

The CCS Controller line

- The leading confocal chromatic sensors worldwide,
- The most sophisticated chromatic confocal sensors on the market,
- Distance and Thickness modes,
- High accuracy, high resolution,
- Compatible with all CL-MG, OP and ENDO optical pens,
- Recommended for OEM users and industrial applications,
- Up to 20 different optical pens interchangeable on the same controller,
- Digital outputs: USB and RS232 / RS422,
- 2 0V-10V Analog outputs,
- Synchronized reading of 3 external digital encoders,
- Improved performances in thickness mode due to a specific thickness calibration,
- Long lifetime light source,
- Advanced features: "Auto-Led", "First peak", "Double frequency", "Hold last value", Temporal Averaging....
- Synchronisation: Master and/or slave

Functions	Application
"Auto-LED": The LED brightness adapts itself automatically	Samples with variations slope e.g lenses Samples with reflectivity variations
"First peak": The sensor locks on the first surface	Topography on transparent objets
"Double Frequency": The sensor selects the optimal measuring rate automatically	Samples with high sharp relectivity variations, e.g. mask for microelectronics
"Hold Last Value": Output data smoothing	Very difficult samples with many non measurable points

The CCS Optima+ Controller

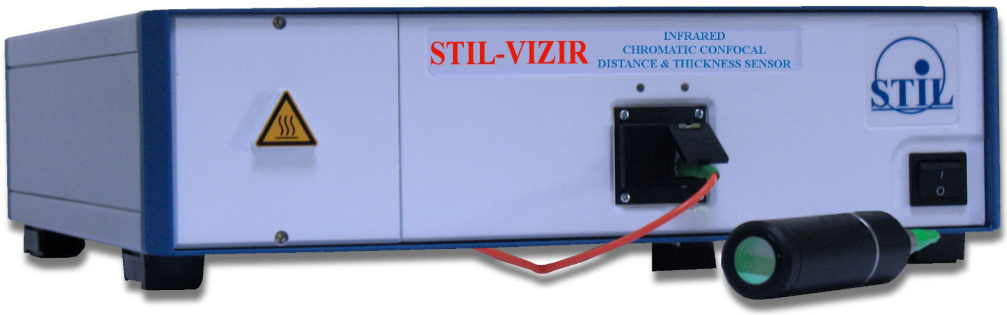
- New 2014 product
- Measuring rate: up to 10 KHz
- Very high sensitivity, allowing an EFFECTIVE high rate on many sample types
- All the advantages of the CCS controller line (see page 7)

The CCS Prima Controller

- The most popular chromatic confocal controller
- Measuring rate: up to 2 KHz
- CCD photodetector with very high Signal to noise ratio
- 2 and 4 multiplexed channels models available (commutation time < 400ms)
- All the advantages of the CCS controller line (see page 7)

The STIL-VIZIR Controller

- New 2014 product
- The optimal solution for high accuracy, non contact Wafer thickness measurement
- Near IR spectral bande
- Up to 1 KHz
- Distance and Thickness modes
- Digital outputs: USB and RS232/RS422
- 2 0V-10V Analog outputs
- Synchronized reading of 3 external digital encoders
- Improved performances in thickness mode due to a specific Thickness calibration
- Long lifetime light source
- Advanced features: "First peak", "double frequency", "Hold last value", Temporal Averaging... (see page 7)



The CHR-150L Controller line

- Measuring rate: up to 1 KHz
- Compatible with all CL-MG, OP and ENDO optical pens
- Digital outputs: 2 RS232 ports (up to 115200 baud)
- 2 Analog outputs
- Long lifetime light source (light level adjustable manually with the aid of a knob)
- 2 or 4 silmultaneous channels

Optical pens for chromatic confocal "point" sensors

- The CL-MG Line consists of modular optical pens, comprising a chromatic lens (CL) and a magnifier lens (MG)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

CL-MG Line Specifications for CCS Optima+ Controller															
Model		CL0[15]		CL1		CL2			CL3		CL4		CL5		CL6
Measuring range[1]	µm	100		150		400			1300		4000		12000		24000
Working distance[2]	mm	2.69		3.35		10.8			12.0		16.2		25.9		21.5
Max. sample slope[3]	deg	±42°		±42.5°		±28°			±25°		±21°		±14°		±8.5°
Reference plate[4]	-	No		No		Yes			Yes		Yes		Yes		No
Axial model[5]	-	Standard													
Radial model[5]	-	Optional													
Magnifier model		MG 210	MG 140	MG 210	MG 140	MG 210	MG 140	MG 70	MG 140	MG 70	MG 35	MG 20	MG 35	MG 20	MG 35	MG 20
NUMERICAL APERTURE																
Beginning of M.R.	-	0.76	0.76	0.72	0.72	0.47	0.47	0.47	0.43	0.43	0.35	0.35	0.25	0.25	0.19	0.19
Mid-range	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.33	0.33	0.21	0.21	0.14	0.14
End of M.R.	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.32	0.32	0.20	0.20	0.12	0.12
LATERAL (XY) PROPERTIES																
Spot size[12]																
Beginning of MR	µm	1.6	2.0	2.4	3.2	3.5	4.6	8.1	6.0	10.8	10.7	17.6	19.6	32.8	18.6	30.5
Center of MR	µm	1.8	2.2	2.7	3.5	4.0	5.2	8.8	6.8	11.9	12.3	19.9	24.3	40.0	26.8	43.0
End of MR	µm	1.9	2.4	3.0	3.8	4.4	5.7	9.3	7.4	12.6	13.4	21.3	27.2	44.2	32.7	51.4
Lateral resolution[6]	µm	1.1	1.0	1.1	1.3	1.7	1.8	3.7	2.6	4.5	4.6	7.0	11	14	11	18
PHOTOMETRIC EFFICIENCY[7]																
Collected energy (relative)		0.5	1.7	3.3	10	2.8	7.9	41	10	57	25	91	33	100	9.8	43
MECHANICAL INTERFACE																
Length[8]	mm	263.6	229	253.1	217.1	243.3	208.9	176.1	205.9	176.1	145.5	131.7	145.5	131.7	167.6	151.8
Diameter	mm	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Weight[8]	g	227	192	268	195	248	190	189	215	214	155	140	175	160	195	180
Performances																
DISTANCE MEASUREMENT																
Static Noise[9]																
With no averaging	nm	5.5	6.5	7.5	8.5	17	20	28	50	60	120	145	400	475	750	850
With averaging 10	nm	1.8	2.2	2.5	2.8	5.7	6.7	9.3	17	20	40	48	133	158	250	283
Accuracy[10]	nm	16	14	25	20	55	45	40	150	130	300	250	750	550	1600	1200
Measuring rough metal surfaces[11]	-	R	R	R	R	R	R	R	R	NR	NR	NR	NR	NR	NR	NR
THICKNESS MEASUREMENT[13]																
Min. measurable thick[14]	µm	≤5	≤5	7.5	9	14	14	22	38	40	110	120	350	550	590	725
Max. measurable thick[14]	µm	≤100	≤100	175	175	510	510	510	2000	2000	5700	5700	16500	16500	34000	34000

For notes see page 15

Optical pens for chromatic confocal "point" sensors (Continued)

- The CL-MG Line consists of modular optical pens, comprising a chromatic lens (CL) and a magnifier lens (MG)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

CL-MG Line Specifications for CCS Prima Controller															
Model		CL0[15]		CL1		CL2			CL3		CL4		CL5		CL6
Measuring range[1]	µm	100		150		400			1400		4000		12000		24000
Working distance[2]	mm	2.69		3.35		10.8			12.0		16.2		25.9		21.5
Max. sample slope[3]	deg	±42°		±42.5°		±28°			±25°		±21°		±14°		±8.5°
Reference plate[4]	-	No		No		Yes			Yes		Yes		Yes		No
Axial model[5]	-	Standard													
Radial model[5]	-	Optional													
Magnifier model		MG 210	MG 140	MG 210	MG 140	MG 210	MG 140	MG 70	MG 140	MG 70	MG 35	MG 20	MG 35	MG 20	MG 35	MG 20
NUMERICAL APERTURE																
Beginning of M.R.	-	0.76	0.76	0.72	0.72	0.47	0.47	0.47	0.43	0.43	0.35	0.35	0.25	0.25	0.19	0.19
Mid-range	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.33	0.33	0.21	0.21	0.14	0.14
End of M.R.	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.32	0.32	0.20	0.20	0.12	0.12
LATERAL (XY) PROPERTIES																
Spot size[12]																
Beginning of MR	µm	1.6	2.0	2.4	3.2	3.5	4.6	8.1	6.0	10.8	10.7	17.6	19.6	32.8	18.6	30.5
Center of MR	µm	1.8	2.2	2.7	3.5	4.0	5.2	8.8	6.8	11.9	12.3	19.9	24.3	40.0	26.8	43.0
End of MR	µm	1.9	2.4	3.0	3.8	4.4	5.7	9.3	7.4	12.6	13.4	21.3	27.2	44.2	32.7	51.4
Lateral resolution[6]	µm	1.1	1.0	1.1	1.3	1.7	1.8	3.7	2.6	4.5	4.6	7.0	11	14	11	18
PHOTOMETRIC EFFICIENCY[7]																
Collected energy (relative)		0.5	1.7	3.3	10	2.8	7.9	41	10	57	25	91	33	100	9.8	43
MECHANICAL INTERFACE																
Length[8]	mm	263.6	229	253.1	217.1	243.3	208.9	176.1	205.9	176.1	145.5	131.7	145.5	131.7	167.6	151.8
Diameter	mm	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Weight[8]	g	227	192	268	195	248	190	189	215	214	155	140	175	160	195	180
Performances																
DISTANCE MEASUREMENT																
Static Noise[9]																
With no averaging	nm	5.0	6.0	7.0	8.0	17	20	25	50	60	110	135	370	425	700	800
With averaging 10	nm	1.7	2.0	2.3	2.8	2.7	6.7	8.3	17	20	37	45	123	142	233	277
Accuracy[10]	nm	16	14	25	20	55	45	40	150	130	300	250	750	550	1600	1200
Measuring rough metal surfaces[11]	-	R	R	R	R	R	R	R	R	NR	NR	NR	NR	NR	NR	NR
THICKNESS MEASUREMENT[13]																
Min. measurable thick[14]	µm	≤5	≤5	7.5	9	14	14	22	38	40	110	120	350	550	590	725
Max. measurable thick[14]	µm	≤100	≤100	175	175	510	510	510	2000	2000	5700	5700	16500	16500	34000	34000

For notes see page 15

Optical pens for chromatic confocal "point" sensors (Continued)

- The CL-MG Line consists of modular optical pens, comprising a chromatic lens (CL) and a magnifier lens (MG)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

CL-MG Line Specifications for STIL-DUO Controller															
Model		CL0[15]		CL1		CL2			CL3		CL4		CL5		CL6
Measuring range[1]	µm	100		130		400			1200		3000		10000		20000
Working distance[2]	mm	2.69		3.35		10.8			12.0		16.2		25.9		21.5
Max. sample slope[3]	deg	±42°		±42.5°		±28°			±25°		±21°		±14°		±8.5°
Reference plate[4]	-	No		No		Yes			Yes		Yes		Yes		No
Axial model[5]	-	Standard													
Radial model[5]	-	Optional													
Magnifier model		MG 210	MG 140	MG 210	MG 140	MG 210	MG 140	MG 70	MG 140	MG 70	MG 35	MG 20	MG 35	MG 20	MG 35	MG 20
NUMERICAL APERTURE																
Beginning of M.R.	-	0.76	0.76	0.72	0.72	0.47	0.47	0.47	0.43	0.43	0.35	0.35	0.25	0.25	0.19	0.19
Mid-range	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.33	0.33	0.21	0.21	0.14	0.14
End of M.R.	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.32	0.32	0.20	0.20	0.12	0.12
LATERAL (XY) PROPERTIES																
Spot size[12]																
Beginning of MR	µm	1.6	2.0	2.4	3.2	3.5	4.6	8.1	6.0	10.8	10.7	17.6	19.6	32.8	18.6	30.5
Center of MR	µm	1.8	2.2	2.7	3.5	4.0	5.2	8.8	6.8	11.9	12.3	19.9	24.3	40.0	26.8	43.0
End of MR	µm	1.9	2.4	3.0	3.8	4.4	5.7	9.3	7.4	12.6	13.4	21.3	27.2	44.2	32.7	51.4
Lateral resolution[6]	µm	1.1	1.0	1.1	1.3	1.7	1.8	3.7	2.6	4.5	4.6	7.0	11	14	11	18
PHOTOMETRIC EFFICIENCY[7]																
Collected energy (relative)		0.5	1.7	3.3	10	2.8	7.9	41	10	57	25	91	33	100	9.8	43
MECHANICAL INTERFACE																
Length[8]	mm	263.6	229	253.1	217.1	243.3	208.9	176.1	205.9	176.1	145.5	131.7	145.5	131.7	167.6	151.8
Diameter	mm	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Weight[8]	g	227	192	268	195	248	190	189	215	214	155	140	175	160	195	180
Performances																
DISTANCE MEASUREMENT																
Static Noise[9]																
With no averaging	nm	6.0	7.5	9.0	12	20	25	35	60	70	110	135	370	425	750	850
With averaging 10	nm	2.0	2.5	3.0	4.0	6.7	8.3	12	20	23	37	45	123	142	250	283
Accuracy[10]	nm	28	35	30	38	70	75	80	200	200	400	350	800	850	2000	1700
Measuring rough metal surfaces[11]	-	R	R	R	R	R	R	R	R	NR	NR	NR	NR	NR	NR	NR
THICKNESS MEASUREMENT[13]																
Min. measurable thick[14]	µm	≤5	≤5	7.5	9	14	14	22	38	40	110	120	350	550	590	725
Max. measurable thick[14]	µm	≤100	≤100	175	175	510	510	510	2000	2000	5700	5700	16500	16500	34000	34000

For notes see page 15

Optical pens for chromatic confocal "point" sensors (Continued)

- The CL-MG Line consists of modular optical pens, comprising a chromatic lens (CL) and a magnifier lens (MG)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

CL-MG Line Specifications for CHR-150L LED Controller															
Model		CL0[15]		CL1		CL2			CL3		CL4		CL5		CL6
Measuring range[1]	µm	70		110		300			1100		2500		10000		20000
Working distance[2]	mm	2.69		3.35		10.8			12.0		16.2		25.9		21.5
Max. sample slope[3]	deg	±42°		±42.5°		±28°			±25°		±21°		±14°		±8.5°
Reference plate[4]	-	No		No		Yes			Yes		Yes		Yes		No
Axial model[5]	-	Standard													
Radial model[5]	-	Optional													
Magnifier model		MG 210	MG 140	MG 210	MG 140	MG 210	MG 140	MG 70	MG 140	MG 70	MG 35	MG 20	MG 35	MG 20	MG 35	MG 20
NUMERICAL APERTURE																
Beginning of M.R.	-	0.76	0.76	0.72	0.72	0.47	0.47	0.47	0.43	0.43	0.35	0.35	0.25	0.25	0.19	0.19
Mid-range	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.33	0.33	0.21	0.21	0.14	0.14
End of M.R.	-	0.75	0.75	0.71	0.71	0.46	0.46	0.46	0.41	0.41	0.32	0.32	0.20	0.20	0.12	0.12
LATERAL (XY) PROPERTIES																
Spot size[12]																
Beginning of MR	µm	1.6	2.0	2.4	3.2	3.5	4.6	8.1	6.0	10.8	10.7	17.6	19.6	32.8	18.6	30.5
Center of MR	µm	1.8	2.2	2.7	3.5	4.0	5.2	8.8	6.8	11.9	12.3	19.9	24.3	40.0	26.8	43.0
End of MR	µm	1.9	2.4	3.0	3.8	4.4	5.7	9.3	7.4	12.6	13.4	21.3	27.2	44.2	32.7	51.4
Lateral resolution[6]	µm	1.1	1.0	1.1	1.3	1.7	1.8	3.7	2.6	4.5	4.6	7.0	11	14	11	18
PHOTOMETRIC EFFICIENCY[7]																
Collected energy (relative)		0.5	1.7	3.3	10	2.8	7.9	41	10	57	25	91	33	100	9.8	43
MECHANICAL INTERFACE																
Length[8]	mm	263.6	229	253.1	217.1	243.3	208.9	176.1	205.9	176.1	145.5	131.7	145.5	131.7	167.6	151.8
Diameter	mm	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Weight[8]	g	227	192	268	195	248	190	189	215	214	155	140	175	160	195	180
Performances																
DISTANCE MEASUREMENT																
Static Noise[9]																
With no averaging	nm	5.0	6.0	7.0	8.0	17	20	25	50	60	110	135	370	425	700	800
With averaging 10	nm	1.7	2.0	2.3	2.7	5.7	6.7	8.3	17	20	37	45	123	142	233	277
Accuracy[10]	nm	16	14	25	20	60	60	60	200	200	400	400	900	900	3000	3000
Measuring rough metal surfaces[11]	-	R	R	R	R	R	R	R	R	NR	NR	NR	NR	NR	NR	NR
THICKNESS MEASUREMENT[13]																
Min. measurable thick[14]	µm	≤5	≤5	7.5	9	14	14	22	38	40	110	120	350	550	590	725
Max. measurable thick[14]	µm	≤70	≤70	110	110	300	300	300	1100	1100	2500	2500	10000	10000	20000	20000

For notes see page 15

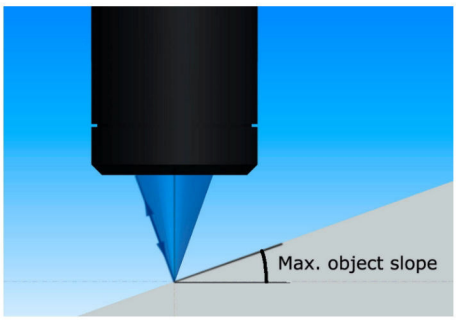
OP Line:

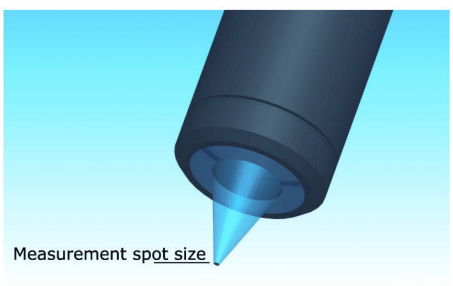
- The OP Line consists of 1-piece optical pen for dedicated applications (e.g. high working distance)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

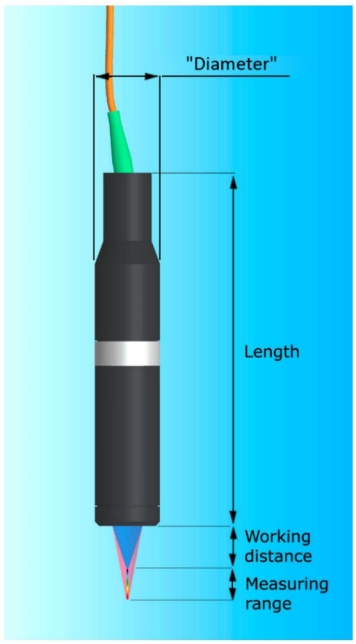
OP Line Specifications for CHR-150N Lamp Controller *							CCS Prima
Model		**OP300VM**	**OP6000**	**OP8000**	**OP10000**	**OP24000**	**OP42000**
Measuring range(1)	[µm]	300	6000	8000	10000	24000	42000
Working distance(2)	[mm]	5	28.8	37.2	66.9	223	518
Max sample slope(3)	[deg]	±25°	± 22°	± 16°	± 12°	± 5°	± 2.5°
Reference plate(4)	-	No	No	Yes	Yes	Yes	No
Axial model(5) Radial model(5)	- -	Standard Optional	Standard No	Standard No	Standard Optional	Standard Optional	Standard No
LATERAL (XY) PROPERTIES Spot size (diameter) Lateral resolution(6)	 [µm] [µm]	 8 4	 12.5 6.25	 34 17	 51 25.5	 100 50	 110 55
MECHANICAL INTERFACE Length(8) Diameter(8) Weight	 [mm] [mm] [g]	 127 15 25	 205.5 60 727	 150 40 400	 189 50 640	 172.5 59 360	 287.2 85 1700
Performances(9)							
DISTANCE MEASUREMENT Static Noise(9) Accuracy(10)	 [nm] [nm]	 10 90	 250 600	 400 800	 450 900	 1500 3000	 4000 40000
THICKNESS MEASUREMENT(13) Min. measurable thickness(14)	[µm]	25	200	300	425	1570	2500

For notes see page 15

*** For the other controllers contact your vendor**







Notes for CL-MG, OP and ENDO Lines

(1) Nominal measuring range (MR) for the controller specified above the table. In certain cases it is possible to calibrate on a larger range with reduced performances (for details contact your vendor).

(2) The Working Distance (WD) is the distance from the optical pen to the beginning of the measuring range, The values in this table were measured for CCS Prima. Variation: for CL0, CL2, CL3, CL4: ± 3%, for CL1, CL5, CL6: ± 6%

(3) The Max Sample Slope (MSS) is the max angle between the optical axis and the normal to the sample surface for which measurement is still possible. The MSS refers to the real local slope at the measured point, not to the slope of a theoretical "average surface". This feature is significant for specular (mirror-like) surfaces only, for scattering surfaces the maximal slope angle is higher (up to 87° for perfect diffusers). However the intensity of the collected signal decreases with increasing slope angle for all types of samples.

The MSS values given in this table are measured on a mirror at the lowest measuring rate of the sensor, with no averaging.

(4) The reference plate is a glass window that can be either located inside the optical pen, or fixed on the sample surface, or removed when measuring through an equivalent external window (for details contact your vendor).

(5) For "Axial" optical pens the measuring range is parallel to the mechanical axis of the pen.
For "Radial" optical pens the measuring range is normal to the mechanical axis, allowing measuring inside holes.

(6) Lateral Resolution (LR) is the 10% - 90% transition distance observed when measuring an abrupt photometrie change. The values in this table are measured at the center of the measuring range.

(7) The photometric efficiency (PHE) is the amount of energy collected by different optical pens when measuring the same sample, in relative units. The values given in this table are typical, and are only given as a guide for selecting the optimal optical pen: For measuring a highly reflective sample select a model with low PHE, in order to avoid saturation; for measuring a diffusive or low-reflecting sample samples select a model with high PHE, in order to avoid a poor signal-to-noise ratio.

(8) Length and weight excluding the fiber optics cable. The values given in this table are for the "axial" pen model.

(9) The Static Noise (SN) is the RMS of noise level measured on a perfectly static sample located at the center of the measuring range. Two SN values are given in this table: one with no temporal averaging, the other with temporal averaging 10. These are max accepted values. The SN is measured for each individual sensor immediately after calibration and is specified in the calibration certificate. This parameter determines the axial resolution of the sensor.

(10) The accuracy is the max error observed when comparing the distance measured by the sensor with sample position determined by an encoder of 1 nm accuracy class. This parameter is measured immediately after calibration, at the following conditions: optimized rate, slope angle=0°, temporal averaging = measuring rate/10, number of steps at least 100. For sensors with "auto-adaptive Led" mode, this mode is enabled.

The accuracy is a good indicator for short-term repeatability of the sensor and of the calibration bench. The values in the table are max accepted values: the accuracy of each individual sensor is measured immediately after calibration and specified in the calibration certificate.

(11) For measuring rough metallic surfaces, the smaller the spot size, the better. As a thumb rule, optical pens marked with R (Recommended) may measure such samples with full performances; optical pens marked NR (Not Recommended) measure such samples with reduced performances.

(12) Theoretrical spot size, computed for the focalized wavelength (indicative value)

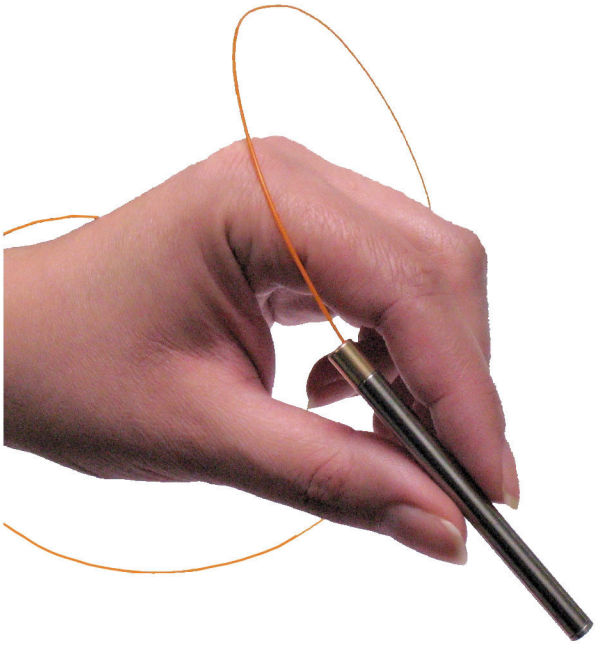
(13) Performances in thickness measuring mode depend on the characteristics of the sample. For CCS Prima and Optima, best accuracy may be achieved by performing a "thickness calibration" on a suitable standard, and loading the resulting refractive-index file into the sensor. This procedure is described in the sensor user manual. For STIL-Duo sensor thickness calibration may be applied by post-processing; for more information contact the vendor.

Axial resolution in thickness measuring mode may be improved by placing the sample inside the MR so that the intensities of the signal from the two faces are as close as possible.

(14) The values in this table are typical values measured at the following conditions: optimal rate, no averaging, min thickness measured at the center of the MR, sample refractive index =1.5 (for measuring air gaps, these values should be divided by 1.5).

(15) Preliminary specifications

Miniature Optical pens: ENDO Line



STIL introduce ENDO, a new line of confocal chromatic pens providing an amazing tiny size

The ENDO optical pens are ideal for non-contact measurements application in reduced space environnements.

These miniature pens are very useful fot the measurement of holes or cavities with small diameter.

Thanks to their small size (6 mm diameter), their integration in inspection machines in the production line is easier.

Working with any STIL optoelectronic controller, the ENDO series allow performing a precise measurement with submicron resolution.

Axial measuring direction configuration

ENDO Line

- The ENDO Line consists of small-diameter optical pens for measuring inside cavities.
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

ENDO Line - Specifications for CCS Prima*											
MODEL		ENDO 0.1/D6	ENDO 0.3/D6	ENDO 0.3/D6 90	ENDO 1.2/D6	ENDO 1.2/D6 90	ENDO 1.5/D6	ENDO 1.5/D6 90	ENDO 2.0/D4	ENDO 10/D8	ENDO 10/D8 90
OPTICAL CHARACTERISTICS											
Measuring range (1)	µm	100	300	300	1200	1200	1500	1500	2000	10000	10000
Working distance (2)	mm	1.1	1.1	0.8	2.3	0.4	2.1	0.76	5.4	10.0	3.3
Measuring direction	-	axial	axial	radial	axial	radial	axial	radial	axial	axial	radial
Min measurable radius (16)	mm	-	-	3.8	-	3.4	-	3.5	-	-	14
Measuring mode	-	Distance only									
Max. sample slope (3)	deg	±24°	±11°	±11°	±13°	±11°	±14°	±10°	±5°	±7.2°	±5.8°
Spot size (12)	µm	6.2	6.0	6.0	15	15	7.1	20	30	41.6	41.6
MECHANICAL CHARACTERISTICS											
Diameter	mm	6.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	8.0	8.0
Length (8)	mm	58.9	71.2	69.9	75.2	82.0	100.6	90.0	54.0	43.0	-
Weight (8)	g	10	10	10	10	10	12	12	20	10	10
METROLOGICAL PERFORMANCES											
Static noise (9)	µm										
With no averaging With averaging 10	µm µm	0.025 0.008	0.050 0.017	0.050 0.017	0.160 0.053	0.160 0.053	0.220 0.073	0.220 0.073		0.9 -	0.9 -
Accuracy (10)	µm	0.045	0.085	0.100	0.200	0.250	0.300	0.300		1.2	1.2

(16) The minimum radius measurable is the distance from the axial axis to the beginning of the measuring range for radial configuration

For notes see pages 15

*** For other controllers contact your vendor**

Optical pens for chromatic confocal "point" sensors

- The CLIR-MGIR Line consists of modular optical pens, comprising a chromatic lens (CLIR) and a magnifier lens (MGIR)
- Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

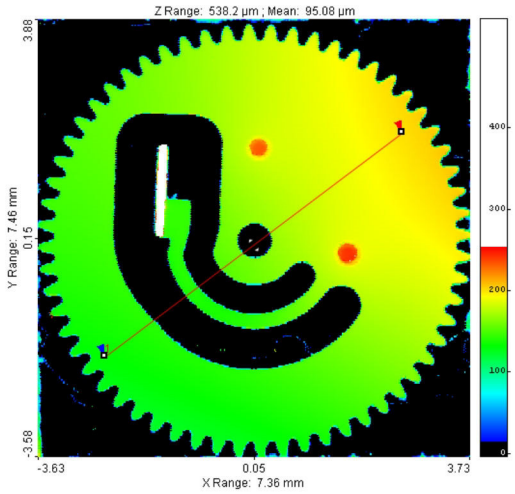
CLIR-MGIR Optical pen Line:

CLIR-MGIR Line Specifications for STIL-VIZIR Controller															
Model		**CLIR0** (15)		**CLIR1**		**CLIR2**			**CLIR3**		**CLIR4**		**CLIR5**		**CLIR6**	
		MGIR 210	**MGIR 140**	**MGIR 210**	**MGIR 140**	**MGIR 210**	**MGIR 140**	**MGIR 70**	**MGIR 140**	**MGIR 70**	**MGIR 35**	**MGIR 20**	**MGIR 35**	**MGIR 20**	**MGIR 35**	**MGIR 20**
Measuring range (1)	µm	132	132	118	119	364	366	375	427	444	791	800	2004	2046	5352	5431
Working distance (2)	mm	2.8	2.8	3.6	3.6	12.8	12.8	12.8	14.0	14.0	28.0	28.0	48.3	48.4	60.5	60.7
Max. sample slope (3)	deg	47.7	47.7	44.5	44.5	30.4	30.4	30.4	23.2	23.2	17.7	17.7	10.4	10.4	5.8	5.8
Axial model (5)	-	Standard														
Radial model (5)	-	Optional														
Magnifier model																
LATERAL (XY) PROPERTIES																
Spot size (12)																
Beginning of MR	µm	2.65	3.08	3.62	4.47	5.10	6.34	10.04	8.68	13.99	15.35	23.54	31.57	49.82	41.90	63.56
Center of MR	µm	3.00	3.42	3.98	4.84	5.62	6.86	10.58	9.35	14.70	16.31	24.58	33.46	52.02	45.74	68.14
End of MR	µm	3.60	4.03	4.62	5.48	6.53	7.79	11.53	10.53	15.92	17.93	26.29	36.36	55.18	51.28	74.25
THICKNESS MEASUREMENT (13)																
Min. measurable thick (14)	µm	5.2	5.6	6.8	8.3	18.6	22.9	37.1	31.7	54.6	72.0	117.0	241.2	397.1	446.0	719.2

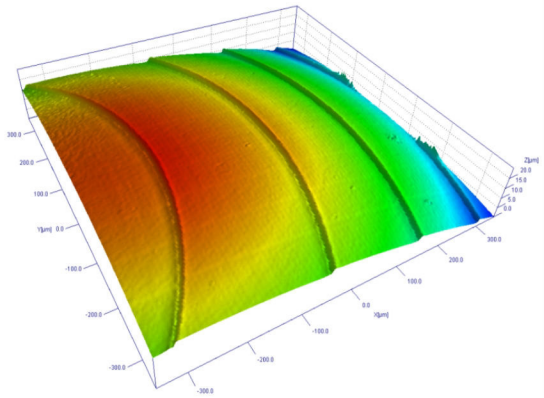
For notes see page 15

Measurement Examples

Chromatic confocal imaging: Distance mode

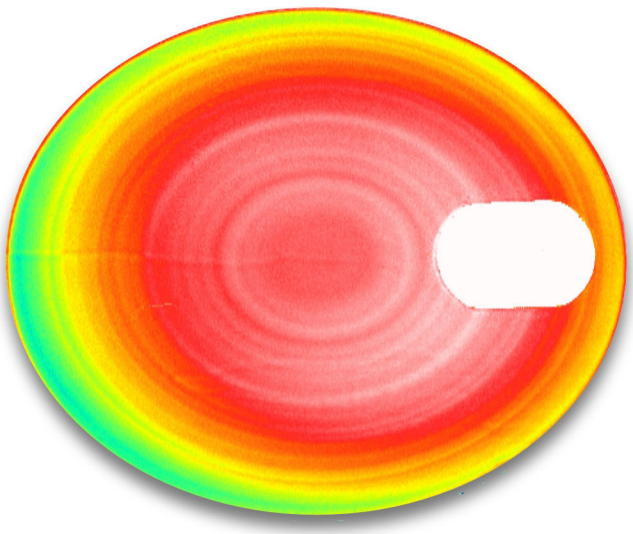


Horlogy item (Z range = 540 µm)



Medical application: ocular implant (Z range = 25 µm)

Chromatic confocal imaging: Thickness mode



Thickness of watch glass cover

Double Technology "point" sensors

The sensor STIL-Duo is the first system in the world that offers two simultaneous measurement technologies: the Confocal Chromatic and the white Light Spectral Interferometry with an original confocal setup.

By associating these two technologies (two STIL processes) the sensor STIL-Duo creates a new standard in the world of dimensional measurement because it allows the user to get the very best out of these two operating principles:

- STIL's Confocal Chromatic principle makes it possible to work with a large measurement scale going from 130µm to 42 mm. This characteristic is perfect for roughness and surface topography measurements, which give very high precision results on any type of material, be it reflective or diffusing. The measurement is in compliance with the new ISO 25178 standard.

- STIL's Confocal Spectral Interferometry process gives access to sub-nanometric resolution (<1nm) for thickness and topography measurements that can be performed within a measurement scale larger than 100 µm. Moreover, the minimum measurable thickness of the samples is 0.4 µm.

The new sensor STIL-Duo is perfectly fitted to the industrial environnement and its interfacing is very easy, thanks to the many inputs and outputs and the software development kits.

Advantages

Of Interferometric mode

- Vibration insensitive (OPILB-RP optical pen),
- High signal to noise ratio (OPILB-RP optical pen),
- No vertical scanning required,
- Minimum measurable thickness 0.4 µm,
- Subnanometric resolution inherent to the optical principle,
- No cross talk between neighbouring points, thanks to confocality,
- Exceptionnal performances in thickness measurement (0.3 nm resolution, 10 nm accuracy)

Of Chromatic Confocal mode

- Multi layer sample measurement using Multipeak Software (see page 32)

Configurations

The sensor consists of:

- A STIL-Duo controller,
- One or more interference optical pen(s),
- One or more chromatic confocal optical pen(s) (optional),
- a fiber optic cable for each optical pen.

Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

STIL-Duo controller: technical specifications

	DUO
Measuring frequency	up to 2000 Hz
Wavelength range	400-900 nm
Spectral resolution	0.63 nm / pixel
Light Source	Tungsten halogen lamp and White LED
Digital outputs	Ethernet / RS232
Synchronization I/O	1 input (TTL) / 1 output (TTL)
Optical fiber connectors	E2000
Humidity limits	5% - 80% HR without condensation
Temperature in use	5 - 50° C
Dimensions	376 mm x 363 mm x 114 mm
Weigth	6 Kg
Measuring mode: Distance / Thickness	1 - Confocal Chromatic 2 - Confocal spectral Interferometry

Interferometric optical pens (OPILB Line)

Performance specifications supply for optical pens calibrated on STIL certified bench for a particular controller

		OPILB Line							
Model		**OPILB-RP**		**OPILB-LWD-D**		**OPILB-LWD-T**			**OPILB**
Measuring mode	-	Distance		Distance		Thickness			Thickness
Measuring range	[µm]	135		135		-			-
Working distance	[mm]	9.7		4.6		9.2			42
Max. object slope	[deg]	± 17°		± 17°		± 17°			± 5.4°
Reference plate[1]	-	Yes		No		No			No
Magnifier model		**MG210**	**MG140**	**MG210**	**MG140**	**MG70**	**MG35**	**MG20**	**-**
LATERAL (XY) PROPERTIES									
Spot size (diameter)[3]	[µm]	3.8	5.7	3.8	5.7	11.4	22.9	40.2	32
Lateral resolution[2]	[µm]	1.9	2.8	1.9	2.8	5.7	11.4	20	20
MECHANICAL INTERFACE									
Length[4]	[mm]	200	164	200	164	131	100	84	145.5
Diameter[4]	[mm]	27	27	27	27	27	27	27	27
Weight	[g]	200	127	200	127	126	67	52	155
Performances									
DISTANCE MEASUREMENT									
Static noise [5]	[nm]	0.5		2		-			-
Accuracy[6]	[nm]	10		10					
Measuring rough metal surface[7]	-	NR		NR					
THICKNESS MEASUREMENT									
Min.measurable thickness [8]	[µm]	-	-	-	-	0.4	0.4	0.4	0.4
Max. measurable thickness [8]	[µm]	-	-	-	-	90	90	90	90
Static noise[5]	[nm]	-	-	-	-	0.3	0.3	0.3	0.3
Accuracy [6]	[nm]	-	-	-	-	10	10	10	10

(1) The reference plate is placed directly on the sample. The reference plate of the OPILB-RP acts as an absolute reference. It compensates for the mechanical imperfections of the scanning system.

(2) The lateral resolution is defined as half the spot diameter.

(3) Geometrical spot size computed at the center of the measuring range, without diffraction (indicative value).

(4) Length and weight excluding the fiber optics cable.

(5) RMS noise level measured on a static sample. Measurement is performed at optimal rate on a sample located at the optimal position.

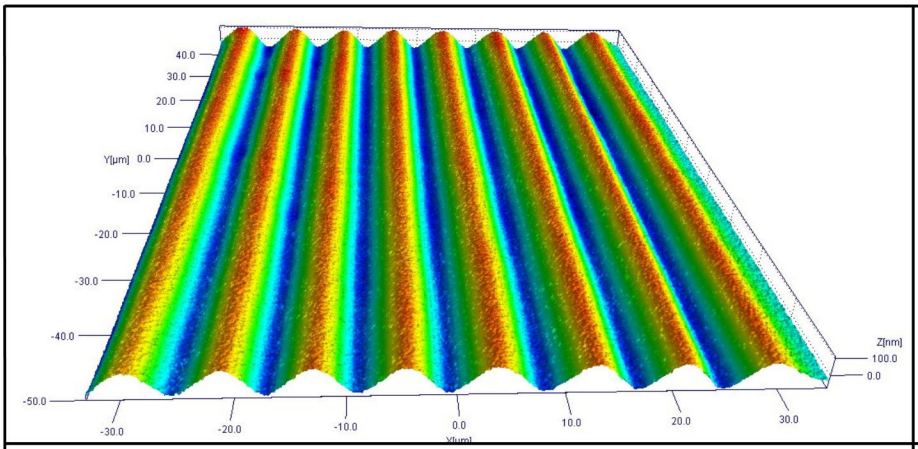
(6) The accuracy is the max error observed in the entire measuring range when comparing the distance measured by the sensor with sample position determined by a 1-nm accurate encoder.

(7) R= Recommended for measuring metallic sample (these samples can be measured with full performances)
NR= Not recommended for measuring metallic samples (these samples may be measured, but with reduced performances)

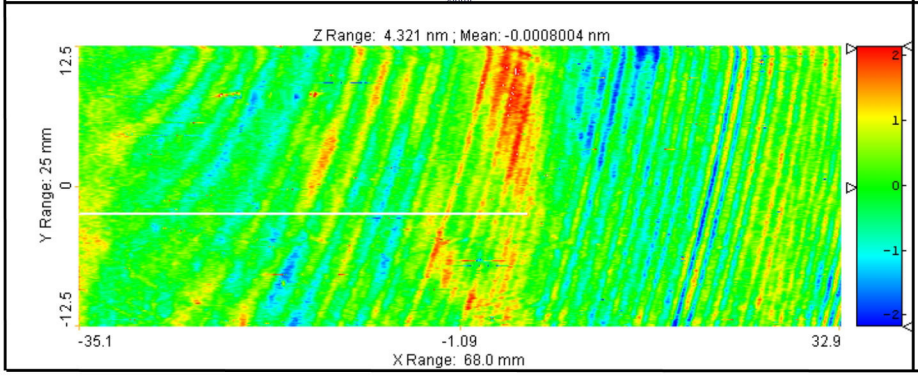
(8) These values are for a sample with a refractive index = 1.5 (when measuring the thickness of an air-gap they should be multiplied by 1.5)

Measurement examples

Confocal spectral interferometry: distance mode

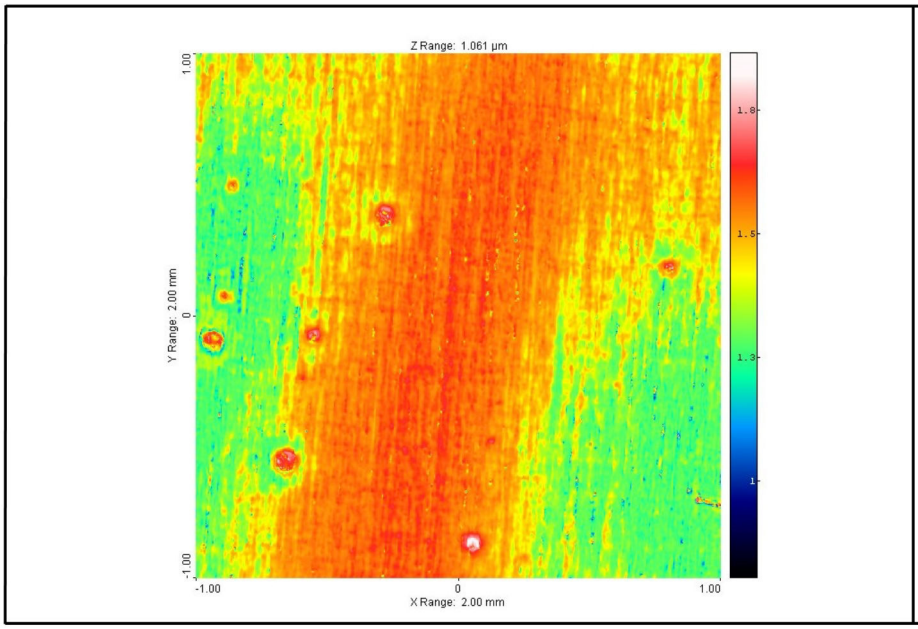


Diffraction grating on a chrome-glass mask (Z range = 100nm)



Superpolished glass nanoroughness (Z range = 4.3 nm)

Confocal spectral interferometry: Thickness mode



Thin film thickness (thickness = 1.4 µm ± 0.2 µm)

Fiber optic cables

E2000 "push / pull" connector

Model	Length	Ø Max	Sheath	Connector type
E50-3	3 m	2.8 mm	Standard	E2000
E50-5	5 m	2.8 mm	Standard	E2000
E50-10	10 m	2.8 mm	Standard	E2000
E50-3-M	3 m	5 mm	Metal armored	E2000
E50-5-M	5 m	5 mm	Metal armored	E2000
E50-10-M	10 m	5 mm	Metal armored	E2000
E50-20-M	20 m	5 mm	Metal armored	E2000

Standard E2000 connector optical fiber
min. bending radius = 20 mm

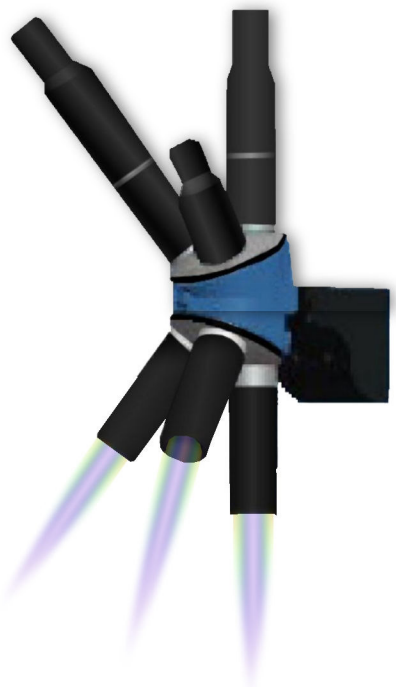
Metallic armored E2000 connector optical fiber
min. bending radius = 33 mm

Accessories

Turrets for CL-MG optical pens

Based on a microscope turret, the MULTIPEN ST consists of the combination of one chromatic magnifier with three different chromatic lenses, thus offering three different depths of field in a single mechanical assembly.

The MULTIPEN DT (for double turret) comprises a second turret equipped with three different magnifiers, thus offering three different spot sizes for each of the three chromatic objectives. This corresponds to nine different Modular Optical Pens in a single mechanical assembly.



Optical pen holder

Model	Description
OPH-27	Ø 27 MM Holder for a CL-MG optical pen

Power supplies and cables

Model	Description
PS-CCS	Power supply for CCS controllers (1.8 m + 1.75 m cables)
RC-CCS-2	RS232 cable for CCS controllers (2 m)
UC-CCS-3	USB 2.0 cable for CCS controllers (3 m)
EC-DUO-2	Ethernet cable for STIL-DUO (2 m)
RC-DUO-2	RS232 cable for STIL-DUO (2 m)
UC-VIS-3	USB 2.0 cable for STIL-VIZIR controllers (3 m)
RC-VIS-2	RS232 cable for STIL-VIZIR (2 m)

Exhange bulbs

Model	Description
HL100 W	Pack of 5 exhange lamps for STIL-DUO
HV100 W	Pack of 5 exhange lamps for STIL-VIZIR

Metrological standards

Model	Description
VS10	**10µm depth step** (non calibred, optional calibration certificate)
RS08	**Roughness standard,** Ra~0.8 µm (Optimal DKD calibration certificate)
FS150	**150mm diameter optical flat** (ZERODUR uncoated)

Software

A CD comprising the CCS Manager software, the STIL Sensors DLL SDK, the required drivers and User Manual is provided with any CCS, STIL-DUO or STIL-VIZIR sensors.
For software destined to CHR-150L sensors, please contact your vendor.

CCS Manager

The CCS Manager software is a powerful executable which allows stating measurement with your new CCS, STIL-DUO or STIL-VIZIR sensor in a very short time.

Thanks to its very user-frendly interface, the CCS Manager software is the simplest way to get accurate measurements from the sensor and to have a full control over all the settings of your CCS sensor.

Moreover, CCS Manager provides advanced maintenance functions:

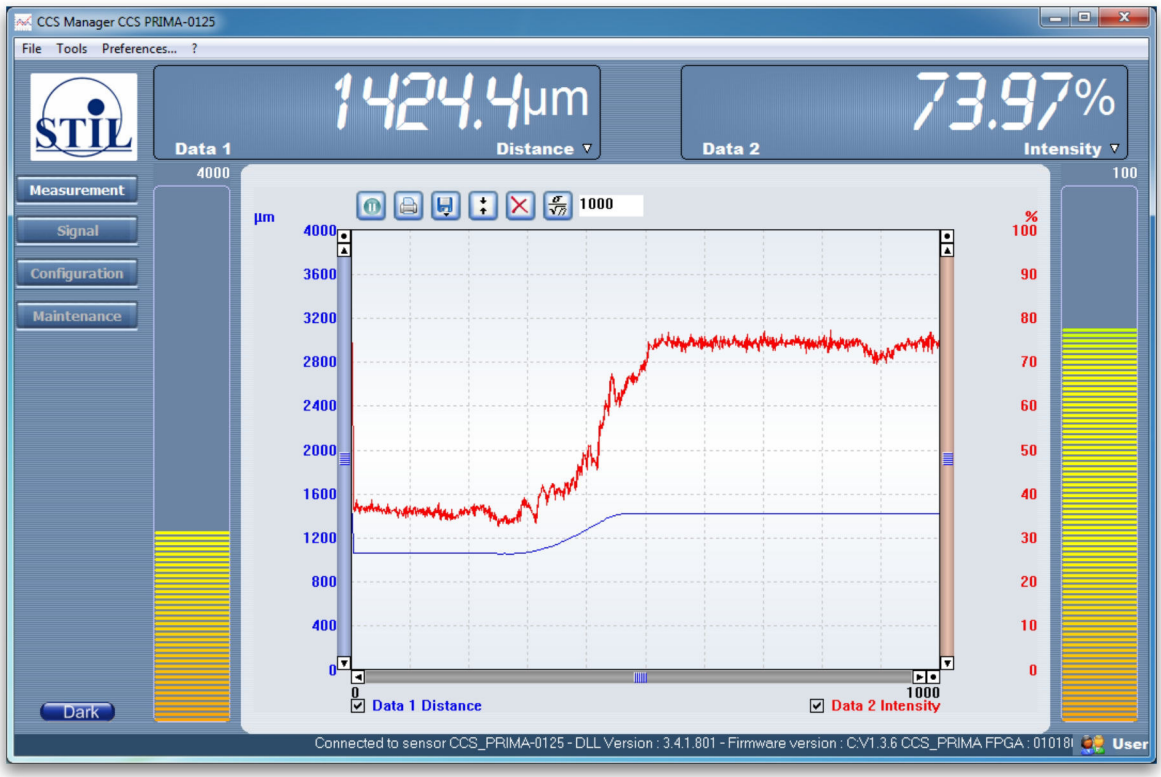
- Update of the sensor's firmware to take advantage of the latest enhancements and the new functions developped by STIL's engineers.

- In situ calibration of your controller.

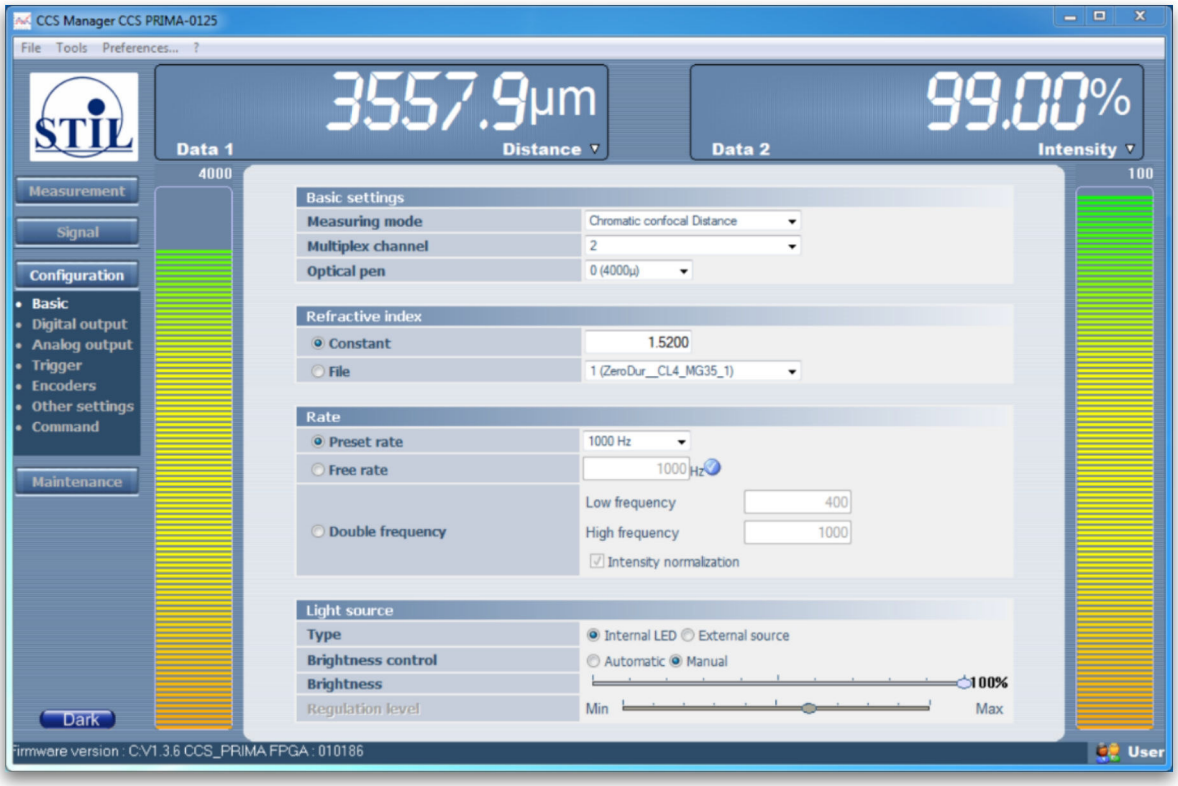
- Download to the sensor's memory of additional calibration tables allowing to use more optical pens with your CCS controller.

- Unique "Diagnostics" function, allowing to record the current status of the sensor into a file, which can be directly sent by email to STIL's Application and Sopport department. Thanks to these detailed information, our engineers are able to give help and device in minutes, even if the product is used thousands of kilometers away from our premises.

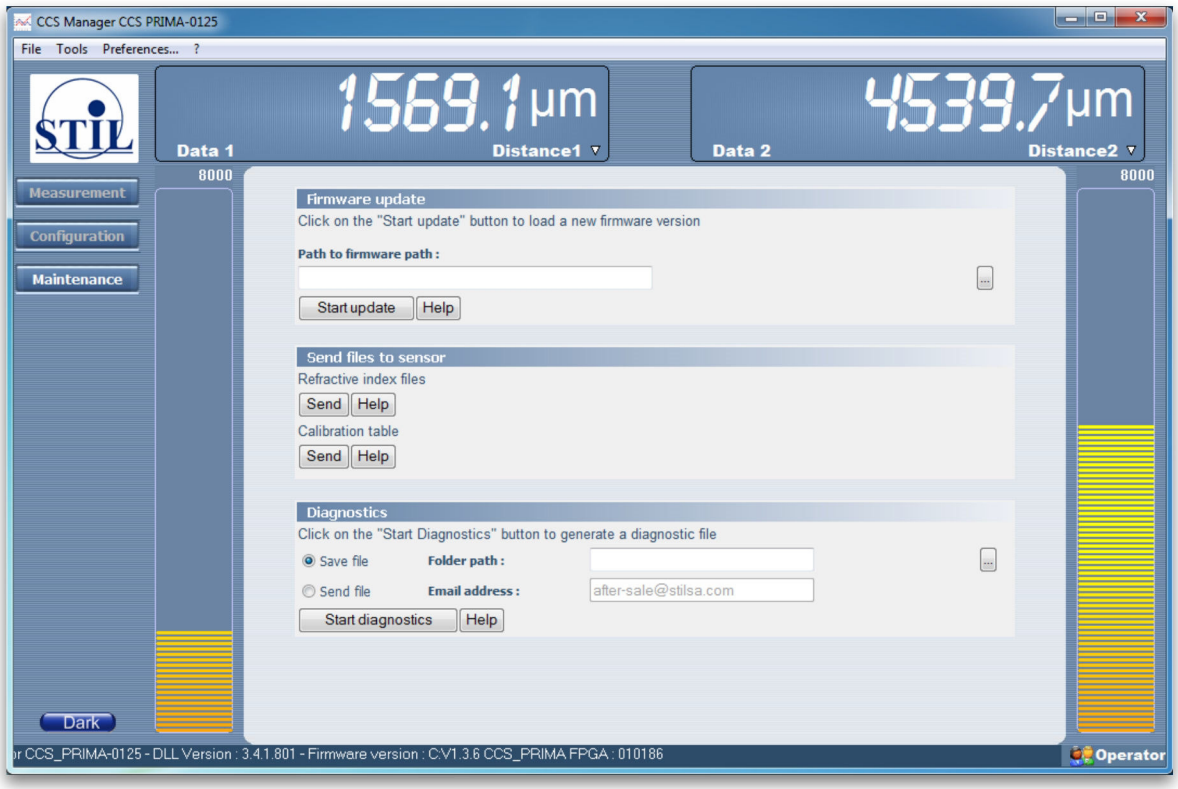
CCS Manager: viewing and saving time-profiles of measured data



CCS Manager: Setting sensor parameters



CCS Manager: Tools for updating the firmware and for generating diagnostic files



STIL Sensor DLL

The "STIL Sensors DLL" provides a powerful high-level software development toolkit enabling an easy interfacing of STIL's sensors to custom applications.

It may be used with all STIL point sensors

DLL Compatibility
- ANSI-C programs - Microsoft Visual C++™ (versions6, 2005, 2010, 2013) - .NET (framework 3.5) languages

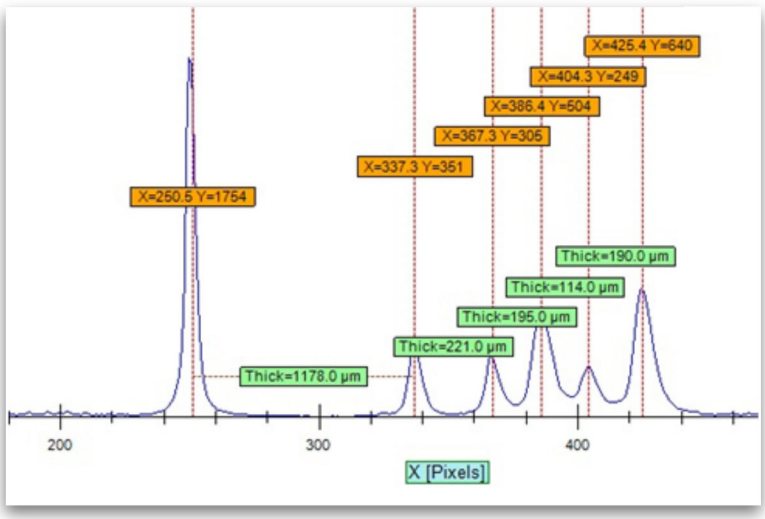
The main features of the DLL are:

- Initialize and connect to sensor through RS232, Ethernet or USB2;
- Get / Set the sensor settings, e.g. :
    - Sampling rate,
    - Measuring mode (Distance / Thickness),
    - Optical pen selection,
    - Digital output settings (data selection, ascii / binary mode, baud rate...),
    - Analog output settings (data selection, scaling of the data on the 0-5V range),
- Measure the sensor "Dark" signal,
- Enable disable hardware trigger mode,
- Launch measurement from other processes,
- Synchronize the measurement with other processes,
- Get the sensor status and the "last error" parameter.

The "STIL Sensors DLL" is delivered with a detailed User Manual and a large number of code samples.

Multipeak

Multipeak software with STIL-DUO sensor allow measuring the thickness of multilayer transparent samples (up to 10 layers).



Multipeak –Graphic window (zoom)

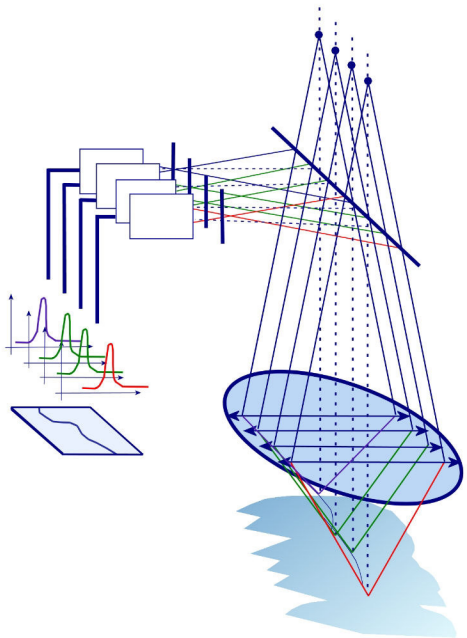
MPLS180

The MPLS180 is the first "line" chromatic confocal sensor on the market.

It projects on the sample surface a "line" constituted of 180 discrete points, each corresponding to an independent measuring channel.

The max line rate of the sensor is 1800 lines/s (324 000 mesured points/s). Thanks to this very high throughput the MPLS180 is the ideal tool for online inspection.

Optical principle



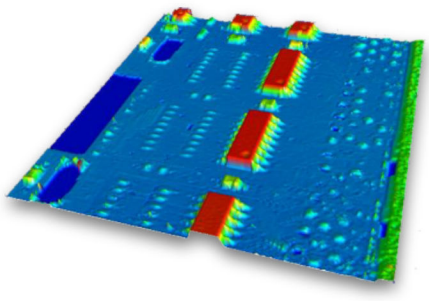
The chromatic confocal layout and its advantages are presented in the "Technology" section at the beginning of this catalogue. The MPLS180 consists of 180 independent chromatic confocal channels. Each channel measures a single point on the surface of the sample, and comprises its own point source, pinhole and spectrometer. The chromatic lens is common to all the channels.

In the MPLS180 the controller and the optical head are connected by two fiber optics bundles. The first bundle connects the internal light source inside the controller to the entrance plane of the lens; the tips of the 180 fiber optic cables in the bundle materialize the point sources of the 180 channels. The second bundle connects the output plane of the spectro-meters; the tips of the 180 fiber optics cables materialize the pinholes of the 180 channels.

The fact that each point is measured by a separate channel is essential for preventing "cross talk"; otherwise stated, highly-reflecting sample points do not disturb the measurement of near-lying points with lower reflectivity.

Advantages

- Very high throughput
- High resolution, high accuracy
- Can measure on any material
- Insensitive to ambient light



MPLS180 Controller

Model	MPLS180
Number of points per line	180
Max measuring rate	1800 lines / s (324 000 points / s)
Data transmission	USB 2.0
Measuring modes	Distance
Advanced features	"First peak", dedicated mode for highly scattering samples
Synchronization	Master and / or Slave par TTL signals
Power supply	100 - 240 Vac, consumption 100 W
Mechanical interface	Table-top controller
Software package	SDK comprising a dedicated .Net compatible DLL (Windows 7) and "Line Sensor Example" program
Compatible optical heads	Several models are available. The optical head is not interchangeable

MPLS-DM (new product 2014)

The MPL-DM is the new generation of chromatic confocal "line" sensors.
The difference between the MPLS-DM and the MPLS180 resides mainly in the design of the 180 spectrometers and in the signal processing. The measuring rate is slightly higher and data transmission is performed by GigaEthernet while the MPLS180 uses an USB 2.0 link

Characteristics

- Measuring rate: up to 2000 lines / s
- 180 points per line
- Compatible with all optical heads
- Synchronization: Master and / or Slave

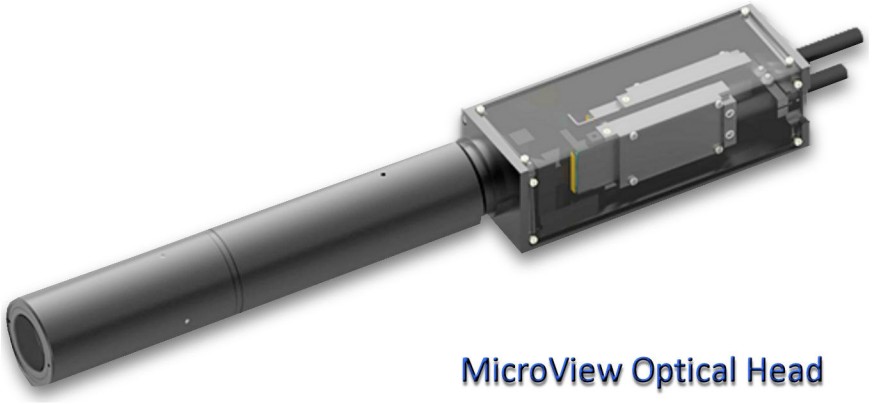
Advantages

- Very high throughput (360 000 points / s)
- Data transmission by GigaEthernet
- High resolution, high accuracy
- Can measure on any material
- Insensitive to ambient light

Optical heads for MPLS180 and MPLS-DM

Model	Unit	NanoView	MicroView	DeepView	Wavy	Cobra
Line Length (X axis)	mm	1.34	1.87	4.1	45.6	14
Depth of field	mm	0.11	0.5	2.6	1.3	15
Number of points along the line	-	180	180	180	180	180
Spot size diameter (for each point)	µm	3.75	5.2	11.5	42.4	38
Pitch (distance between 2 points)	µm	7.4	10	22.5	250	78
Maximum slope angle	deg	40°	30°	20°	11°	6.5°
Working distance	mm	4.6	10	47.8	40	7
Axial resolution	µm	0.040	0.125	0.800	0.500	2.5
Accuracy	µm	0.12	0.50	5.00	2.50	8

Ethernet interface 1Gbit available



MicroView Optical Head

Notes (Continued):

(8) Measuring range (MR): The value in the table is nominal value for an MPLS180.

(9) The working distance is the distance from the optical pen to the beginning of the MR
The values in the table are typical.

(10) Static noise is the variation (also called standard deviation, or RMS) of values measured over time by the same channel on a static sample. The values in the table are average static noise of the 180 channels. For measuring this feature the light level should be high, but not saturated.

(11) The accuracy is the max error observed when comparing a distance-step measured by the sensor with the step measured by a 1-nm accurate encoder. The step may be anywhere inside the MR.
This feature is measured immeditely after factory calibration, in the following conditions:
- The measurement of each channel is averaged to eliminate static noise
- Signal level is high, but not saturated

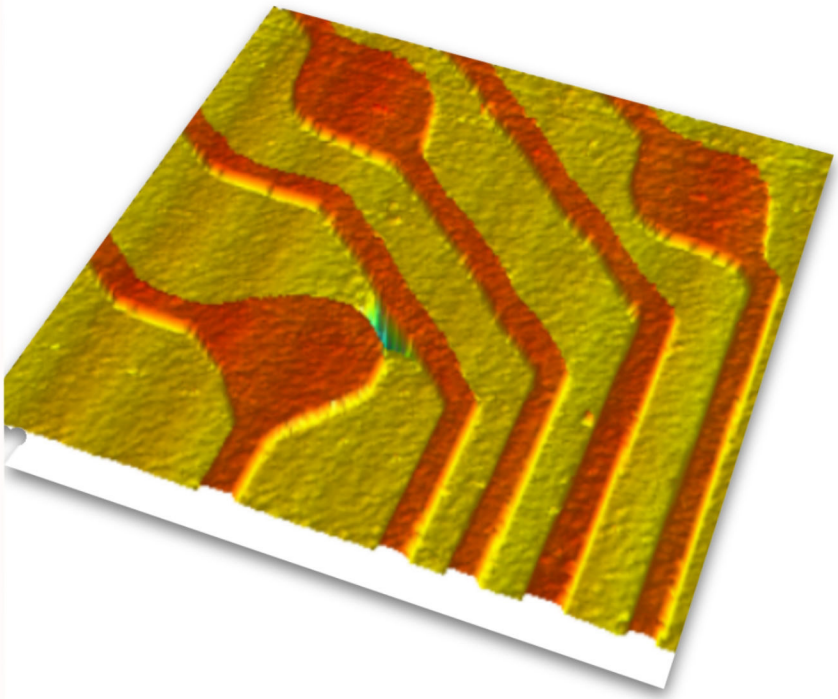
(12) Max angle between the optical axis and the local surface slope. The max measurable slope angle applies to specular (mirror-like) surfaces. For scattering surfaces, the angle may be higher. However the intensity of the collected signal decreases when slope angle increases. The values in this table were measured on a mirror.

(13) Preliminary specifications.

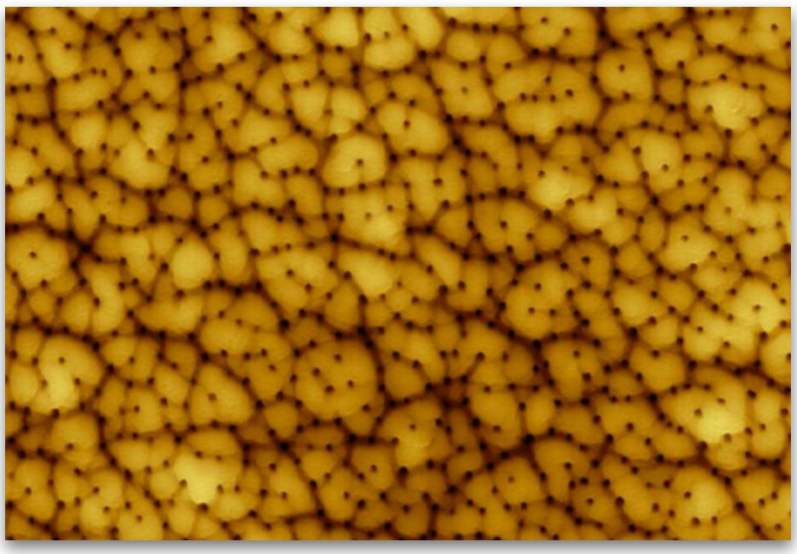
Measurement examples

Medical applications: Stents (MicroView optical head)

PCB defects measurement (MicroView optical head)



Leather surface for car industry (DeepView optical head)



Software

The line sensor requires a host computer running under Window 7, 32 bits or 64 bits, comprising a free USB 2.0 port.
The SDK-CD provided with the sensor includes:

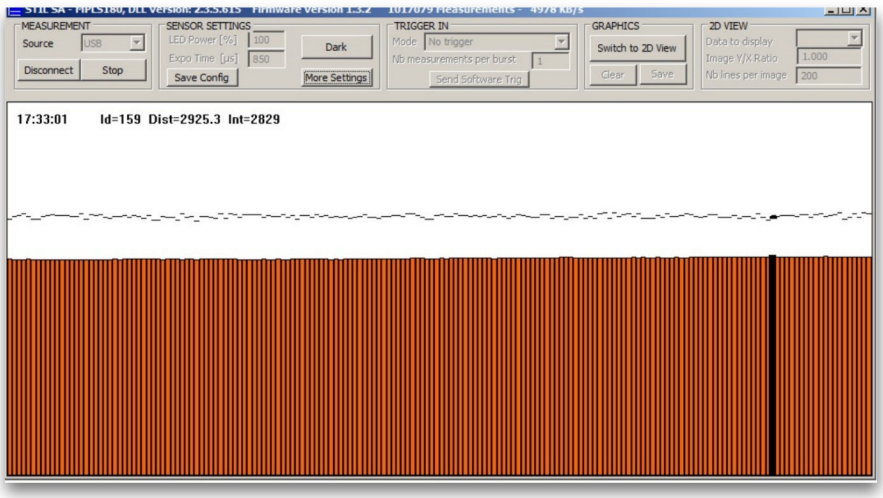
- A native DLL for C++
- A .NET DLL
- The "Line Sensor Example" program
- A USB driver
- The Sensor User Manual and the software user Manual.

Using a DLL, it is possible to connect to the sensor, configure it and acquire the data from a user program written in C++ or any .NET programming language.

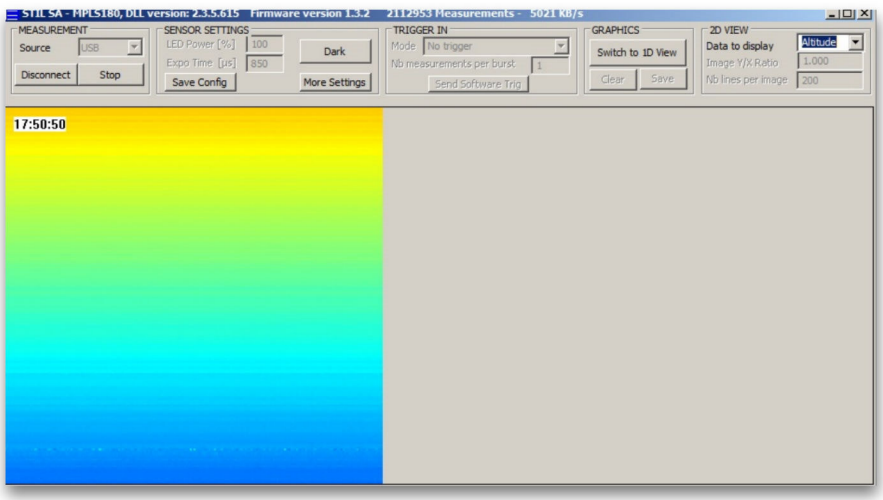
Using the "Line Sensor Example", the user can accomplish immediately tasks:

- Connect to the sensor
- Save and load configuration files
- Modify the sensor settings (LED intensity, measuring rate, trigger options...)
- Launch measurements, view and save the data,
- Launch user calibrations.

The program has display modes: "line by line", and "image". In the latter mode, each block of N lines is displayed as an image of size N x 180.



"Line view" in "Line Sensor Example" program. The 180 orange bars indicate the measures distances, and the 180 black strokes indicate the measured intensity



"Image view" in "Line Sensor Example" program. The distance is indicated by the color of each pixel

Chromatic Confocal microscopy

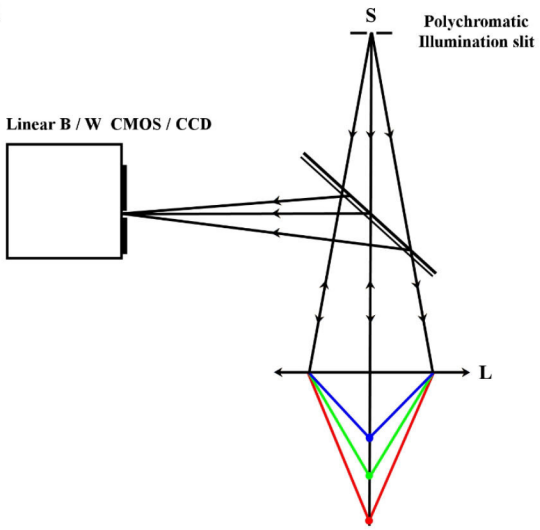
Introduction

Vision systems have a double role:

- Provide a good-quality image of the sample surface with the desired magnification
- Process the image in order to detect and analyze some predefined features or textures.

While the processing units get more and more powerful and sophisticated, the basic limitation of current Vision systems resides in their very small depth or focus (a few dozens of µm or less, depending on the numerical aperture). Due to this limitation, expensive and complicated Z scanning systems and / or autofocus mechanism are required for viewing samples with larger Z extension and moving samples.

Chromatic confocal microscopy (STIL SA patent) is a technology allowing the design of optical systems with a very large depth of focus (up to several mm). For samples located anywhere within the extended depth of view these system provide a sharp, high quality and perfectly focused image. This technology combines the merits of color coding and of traditional confocal microscopes. Confocal chromatic microscopes consist of a slit illuminated by a polychromatic light source, a high quality chromatic lens, a beam separator and a linear B & W photodetector

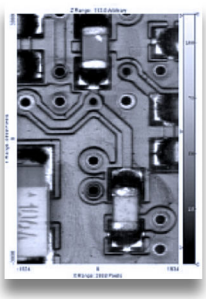
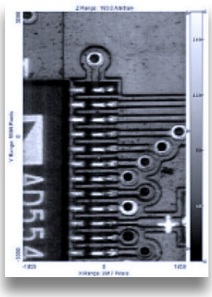
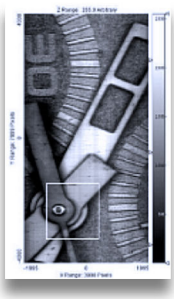
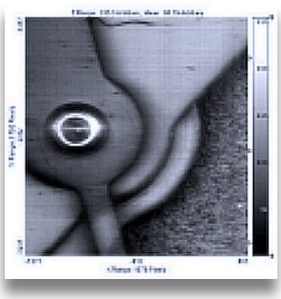


Advantages

- Extended depth of focus
- High resolution
- Large numerical aperture allowing high quality imaging even on local slopes
- No need for Z scanning or autofocus
- The optical head is totally passive
- TTL (Through-The-Lens) illumination

The MC2 Microscope

- New products 2014
- All the advantages of chromatic confocal microscopes
- 5 optical heads models available:
  DeepView, MicroView, NanoView, Wavy and ExtraView

Confocal Chromatic microscope MC2 Vision system

Confocal Chromatic microscope MC2 vision system comprising:
- One MC2 / Optical head described below
- One CCS line camera (2K, 4K, 8K)
- High luminosity multi-led light source box for MC2
- Optical fiber cable between the light source box and the optical head: length 5 meters

		NanoView		MicroView		DeepView		Wavy
Model		**2K**	**4K**	**2K**	**4K**	**2K**	**4K**	**8K**
Characteristics								
Nominal line length (1)	mm	1.35		1.88		4.10		37.5
Depth of field	mm	0.11		0.5		2.6		1.3
Working distance (2)	mm	4.6		10		47.8		40
Pixel size on the sample	μm^2	0.8 x 0.8	0.4 x 0.4	1.1 x 1.1	0.6 x 0.6	2.5 x 2.5	1.2 x 1.2	4.6 x 4.6

(1) Theoretical values. Line length varies linearly inside the measuring range.

(2) The working distance is the distance from the optical pen to the beginning of the MR.
The values in the table are typical.

3D Measuring systems

Micomesure2 equipped with a "point"sensor

The MICROMESURE 2 system, equipped with CCS-Prima, STIL-DUO or CHR150 sensors is the ideal tool for non contact surface measurement, including 3D roughness, shape metrology and 3D microtopography.

The MICROMESURE 2 system fully exploits the extraordinary performances of STIL's non contact sensors in various applications and fields.

Delivered with the necessary control & acquisition hardware and software, the MICROMESURE 2 system is a "turn key" device that is immediately operational after its installation.

Advantages

Due to Confocal Chromatic sensors

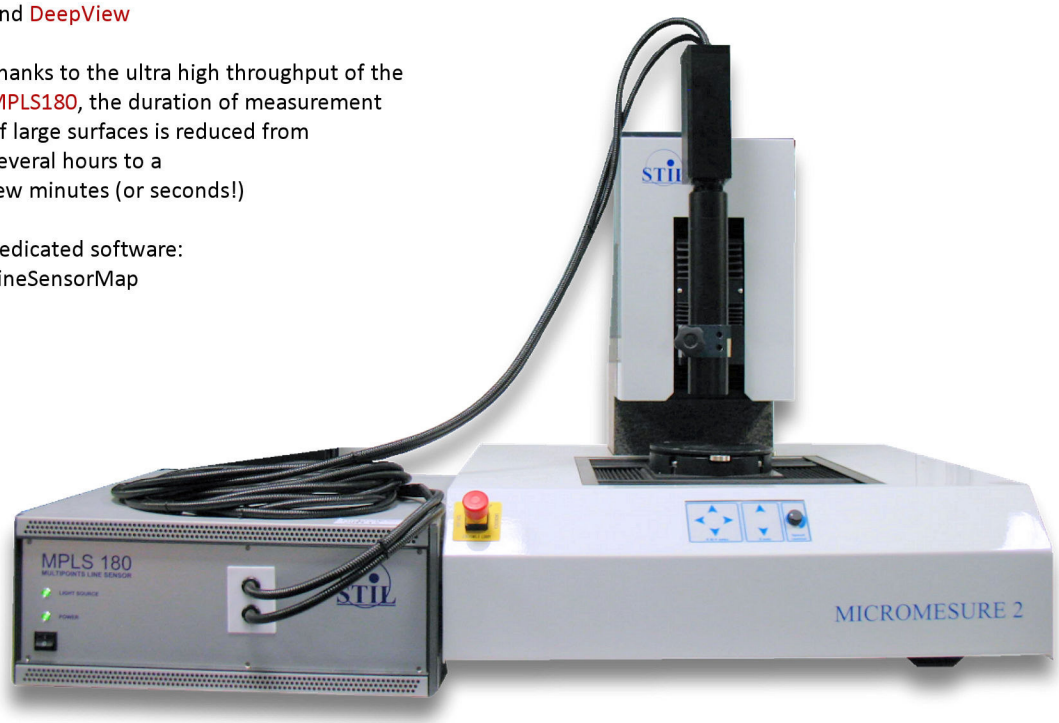
- Non contact dimensional measurement
- Nanometric and Micrometric resolutions
- White light sensor (no speckle, wide measuring range)
- Coaxial measurement (no shadowing)
- High local slopes on specular (reflective) surfaces
- Insensitive to ambient light
- Can measure on metal, glass, semi-conductor, ceramics and more
- Thickness & form Measurement of transparent objects
- Wide measuring ranges capabilities (from 20 µm to 24 mm)

Due to high quality scanning system

- 0.1 µm encoder on Z axis (series product)
- 0.1 µm encoders on X & Y axes (optional)
- Low vibrations
- Orthgonality and flatness corrections
- Transparent housing for avoiding air-turbulences

Micromesure2 equipped with a "line"sensor

- **New product 2014:**
  MICROMESURE 2 with a MPLS180 Line sensor
- 3 optical heads available: NanoView, MicroView, and DeepView
- Thanks to the ultra high throughput of the MPLS180, the duration of measurement of large surfaces is reduced from several hours to a few minutes (or seconds!)
- Dedicated software: LineSensorMap



Specifications

Scanning system specifications for series MICROMESURE 2

	X & Y axes		Z axis
Configuration (1)	**3M - 1R**	**3M - 3R**	**Both**
Travel	100 mm	100 mm	50 mm
Encoder	No	Yes	Yes
Position accuracy	10 µm / 100 mm	1 µm / 100 mm	1 µm / 100 mm
Position resolution	0.1 µm	0.1 µm	0.1 µm
Flatness	1 µm / 100 mm	1 µm / 100 mm	1 µm / 100 mm
Max. speed	20 mm / s	20 mm / s	5 mm / s

(1) For other configurations contact us

Sensor specifications

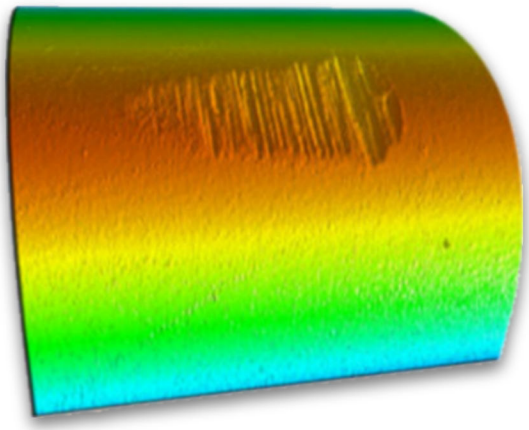
For detailed specifications refer to the following pages

"Point" sensor controllers:

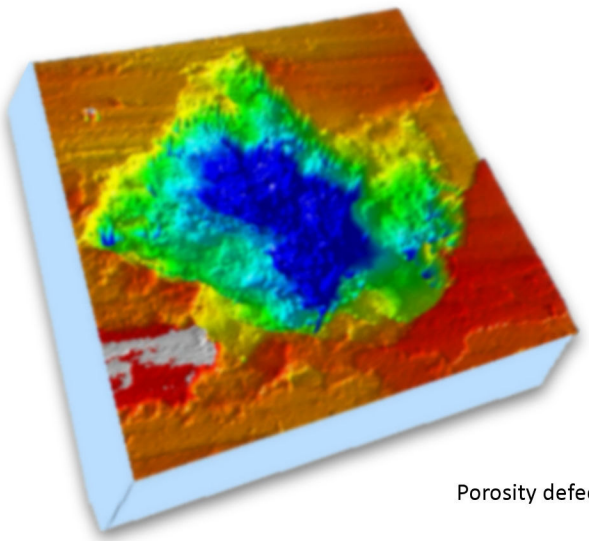
"Point" sensor optical pens:

"Line" sensor controllers:

"Line" sensor optical heads:

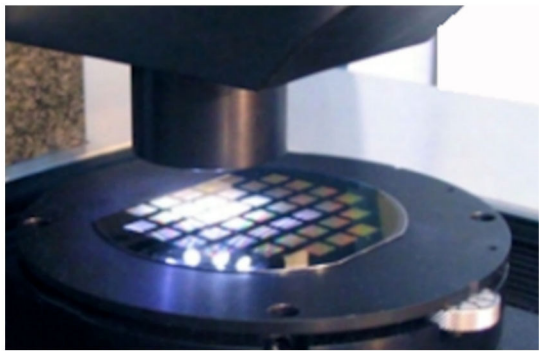


Wearing on metallic tube



Porosity defects

Application types



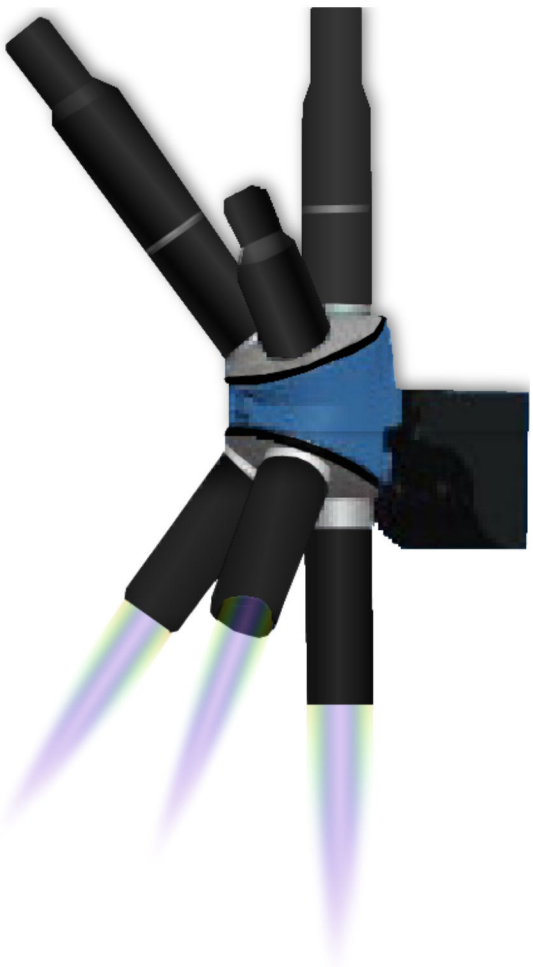
- Shape and texture analysis
- Fine mechanics inspection
- Surface characterization
- 3D altitude and thickness topography / profilometry
- Roughness measurement
- Dimensional metrology

Application fields

- Mechanics (roughness, tribology, 3D metrology, corrosion analysis...)
- Glass industry (float glass on line thickness control, 3D metrology...)
- Microelectronics (roughness, 3D metrology, defects analysis...)
- Optics (roughness, 3D metrology...)
- Horlogy (flatness, roughness, thickness...)
- Nuclear fuel industry (roughness, tribology, 3D metrology, corrosion analysis...)
- Aeronautics (roughness, turbine shape)

Options and accessories

Options:



- Post-processing software: SPIP from Image Technology
- Linear encoders on X & Y axes for real 3D metrology (position accuracy = 1 µm / 100 mm)
- Video Camera
- Simple turret or double turret for changing the optical pens
- Vibration-damping stand
- 1-axis and 2-axes configurations (1)
- X & Y travel up to 300 mm (2)
- Z travel up to 100 mm (2)

(1) For details contact us
(2) Transparent housing not available

Metrology artifacts:

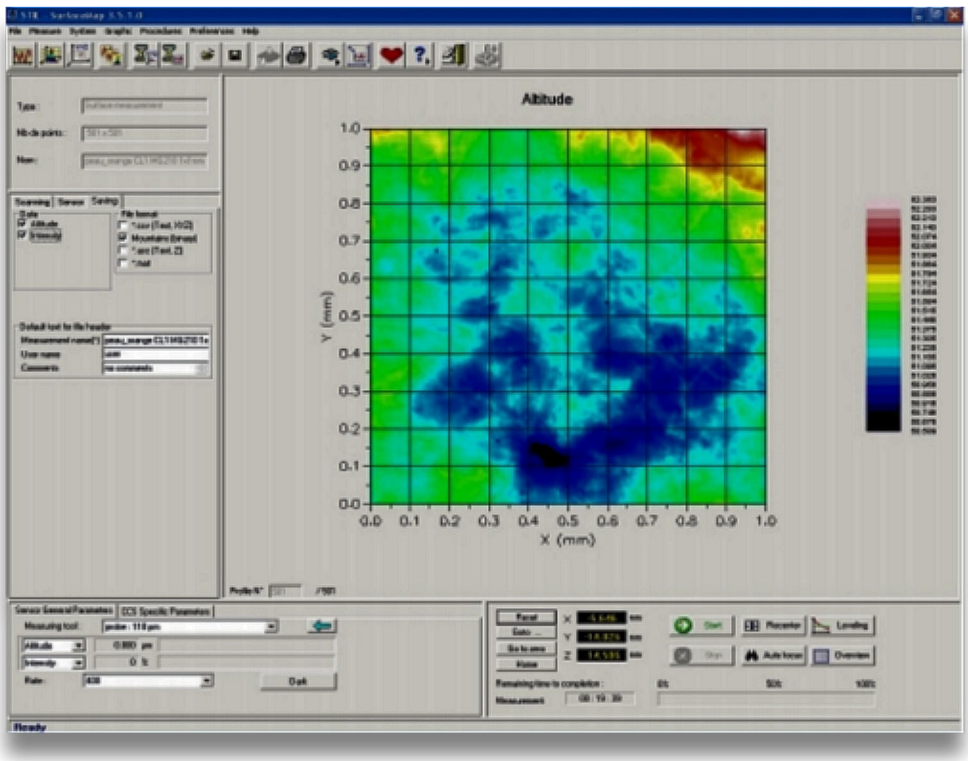
- Calibrated groove (depth = 10 µm)
- Roughness standard (Ra = 0.8 µm)
- Optical flat (diameter = 140 mm)
- Offset reticle (for setting video camera offset)

Software for Micromesure2

Control and acquisition Software Surface Map by STIL SA

Surface Map Control & Acquisition Software	
Main Functions	
Type of acquisition	Profile Scanning (X, Y, Oblique)
	Surface Scanning
	Point series acquisition
	Repetitive Measurements
	Multi acquisition sequence
	Video image (if camera option)
Scanning parameters setting	Dimensions
	Step along each axis
Sensor parameters setting	Altitude Mode
	Thickness Mode
	Optical pen choice
	Averaging
	Double frequency (if available)
Scanning type	Constant speed (with backlash compensation)
	Constant speed 'back & forth)
	Step by step
	Z following
Data saving	Folder selection
	Format selection (binary, csv)
User's Supervision	Measurement Progress
	X, Y, & Z Coordinates
	Sensor Status
Automatic Procedures	Hardware homing
	Leveling
	Autofocus
	Recentering
	Preview


Surface Map
Motion Control & acquisition Software
for Micromesure systems
STIL

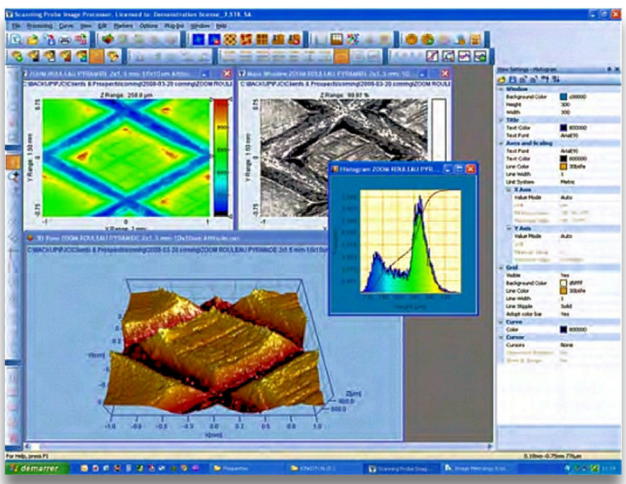

Altitude
Y (mm)
X (mm)

Post Processing Software SPIP by Image Technology

SPIP Post processing Main Functions		4 modules Version	8 modules Version
Basic Module	Plane correction / Flattening	Yes	Yes
	Cross section & Profiling	Yes	Yes
	Altitude Histogram	Yes	Yes
	Fourier Transform	Yes	Yes
	Correlation functions	Yes	Yes
	Image Substration & Addition	Yes	Yes
	Color coding	Yes	Yes
	Zoom	Yes	Yes
	Transformation: Mirrors, rotations	Yes	Yes
	Plug-in interface	Yes	Yes
	Copy, print & save functions	Yes	Yes
Roughness Analysis (ISO 25178 + ANSI B46.1)		Yes	Yes
3D Visualization Studio		Yes	Yes
Filter Module		Yes	Yes
Extended Fourier Analysis			Yes
Grain Analysis			Yes
Batch processing			Yes
ImageMet Explorer			Yes

Scanning Probe Image Processor SPIP™

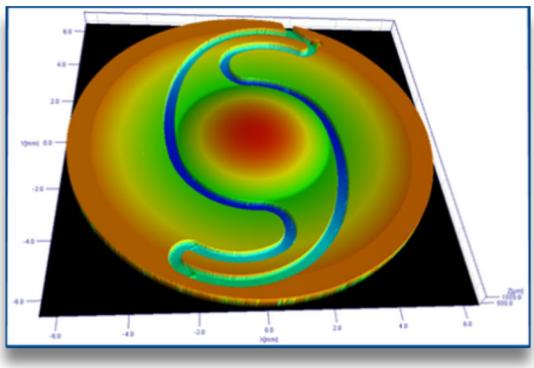
Image Metrology was founded as a world-wide leading supplier of software for nano and microscale image processing. Over the years, the Scanning Probe Image Processor, SPIP™, has become the de-facto standard for image processing at nanoscale.



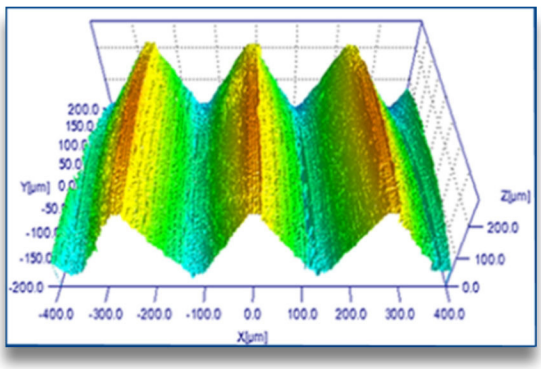
SPIP provides customers with state-of-the-art image processing software for microscopy, including:

- Correction tools for creating the most accurate presentation of the "true" surface,
- Automated analysis techniques ensuring high accuracy, quality and cost efficiency,
- Visualization and reporting tools enabling convincing and impressive communication of results.

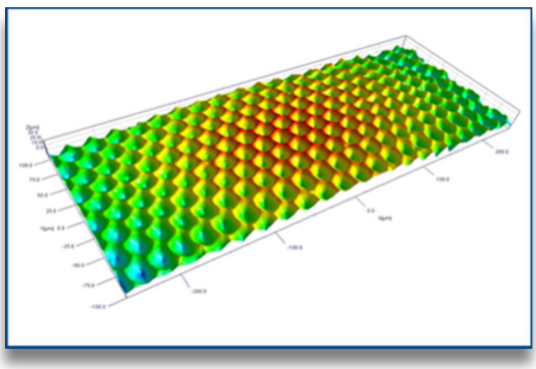
Measuring examples



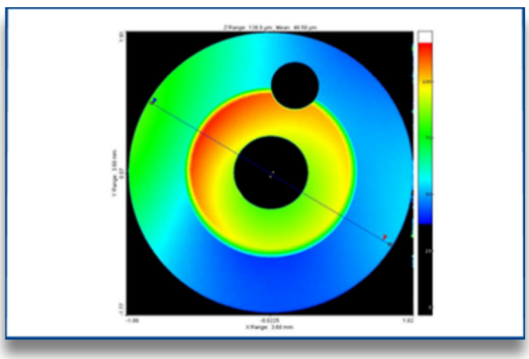
Ophtalmic Implant



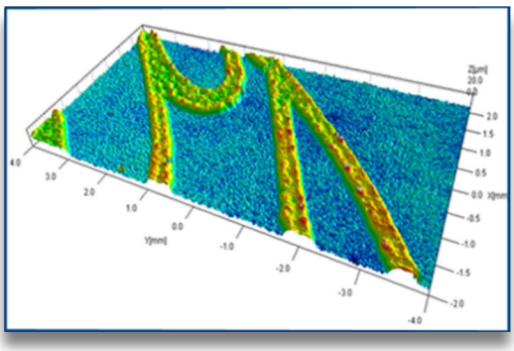
Thread



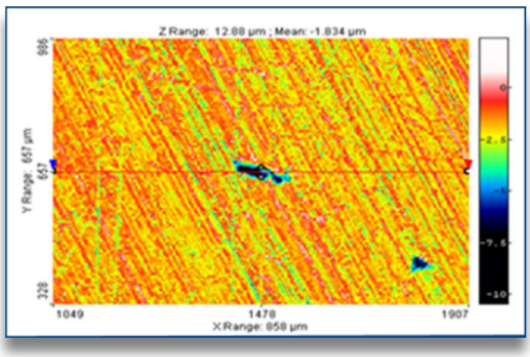
Texture - Wasp' eye



Flatness Watch Industry



Coating Thickness



Roughness

STIL-STEP Comparator

New product 2014

Applications

Measuring thickness, step height, hole depth, liquid level

Sensor

- Chromatic confocal "point" sensor: CCS Optima+ or CCS Prima,
- Large choice of optical pens (chromatic lenses) with different measuring ranges and different spots-sizes to suit all applications,
- Turret for holding 3 optical pens (option)
- Digital outputs (RS232 / RS422 / USB)
- Analog outputs (V-10V)
- Trigger modes (hardware or software)

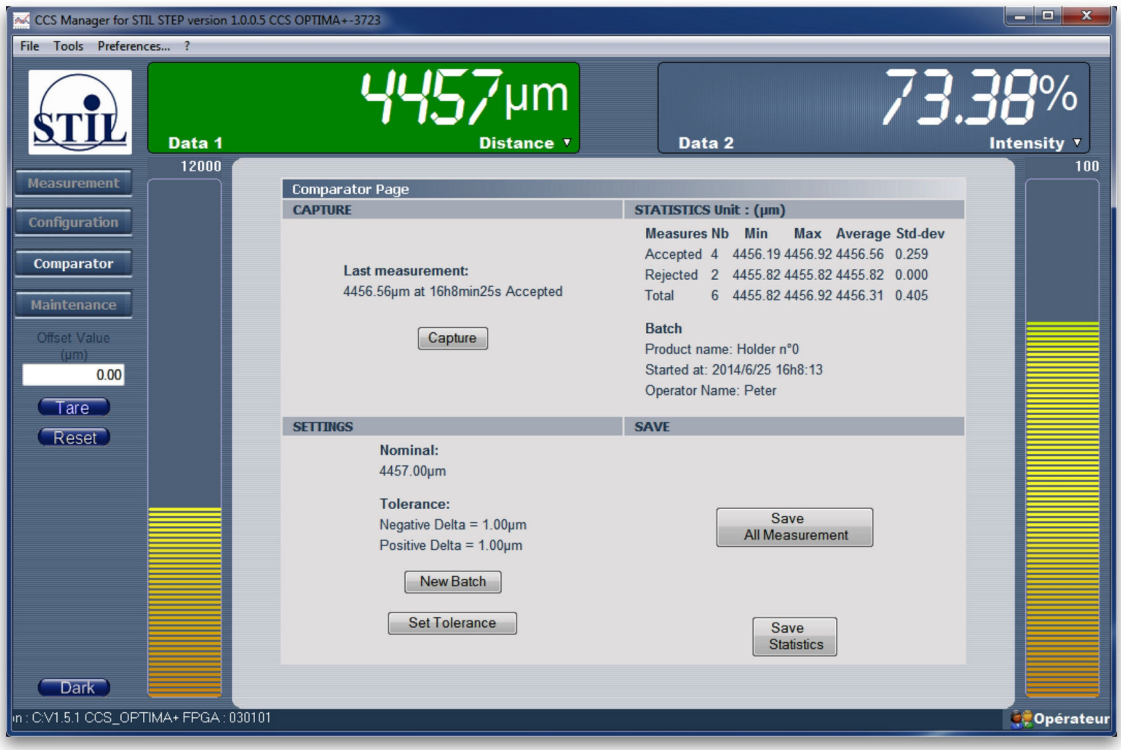
Advantages

- No risk of damaging the sample
- Static sensor, no direct contact with operator hand for better thermal stability
- High measuring rate (up to 10 Khz)
- Any material: metal, glass, plastics, ceramics, rubber....
- Any sample type: glossy or diffusive, rough or polished, soft or sticky, deformable, transparent, liquid...
- Compact and light weight

Software

- User friendly "STIL-Step Manager" program
- Tolerance control (3 tolerance levels)
- Batch statistics

STIL-STEP Manager: tolerance control



STIL-STEP Manager: batch statistics

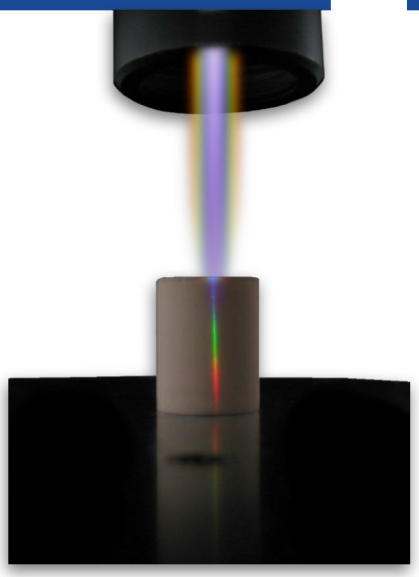
Chromatic Confocal Imaging

Introduction

STIL chromatic confocal sensors, fruit of more than fifteen years of research and development, are non-contact optical sensors for high resolution 3D measurement with a wide range of applications.

Their basic characteristics are:

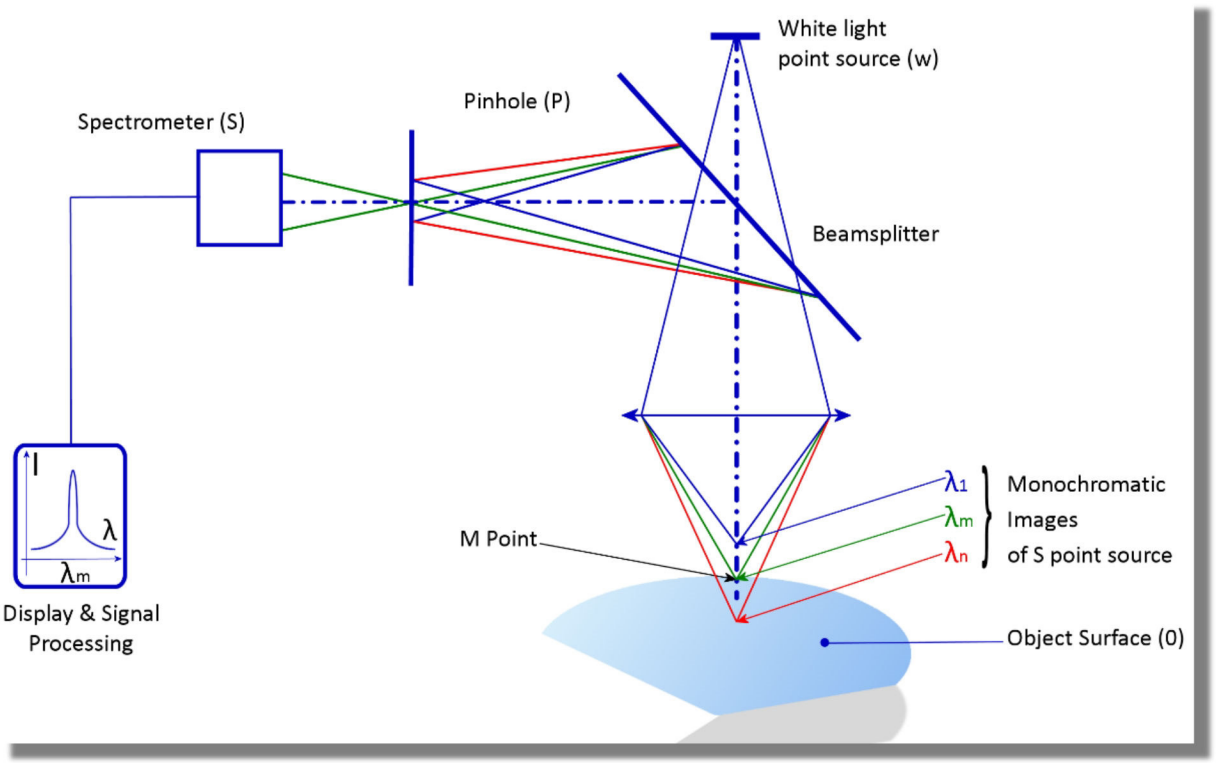
- Chromatic coding of the optical axis (each wavelength is focused at a different point)
- Confocal setup (spatial filtering using a "pinhole")
- Coaxial setup (the same axis for illumination and collection)
- Use of optical fiber
- 2 measuring modes: Distance and Thickness



Chromatic coding

Optical principle

The optical principle of chromatic confocal imaging (STIL SA patent) is shown in the following setup:



An incident white light pinhole is imaged through a chromatic objective into a continuum of monochromatic images along the Z-Axis, thus providing a "color coding" along the optical axis.

When an object is present in this "colored" field, a unique wavelength is perfectly focused at its surface and then reflected into the optical system.

This backscattered beam passes through a filtering pinhole into a spectrograph, which determines the wavelength has been perfectly focused on the object, and then accurately determine its position in the measuring field.

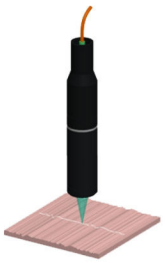
The Confocal Chromatic Imaging gives access to reliable, accurate and reproducible dimentional measurements with extremely high resolution.

Applications

Roughness measurement

Our sensors are fully compliant with the new ISO25178 regulation and are able to measure roughness values down to a few nanometers.

They allow to acquire roughness profiles much faster than a classical tactile probe, and without any risk of marking the surface.



Profilometry & Microtopography

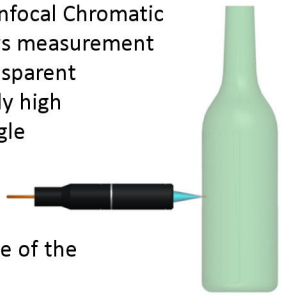
Interfaced with 3D scanning devices, STIL's sensors give access to full 2D and 3D measurements of complex objects or assemblies with submicronic accuracy.

Autofocus

Thank to their extended measuring range, STIL's sensors are the perfect solution for an accurate autofocus in vision systems.

Thickness measurement

The very innovative Confocal Chromatic Imaging principle allows measurement of the thickness of transparent material, with extremely high accuracy, using one single sensor.
The thickness is directly measured from one side of the sample.

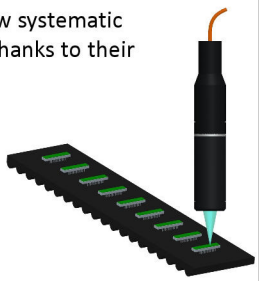


Level control

Thank to their non-contact technology, our sensors allow detection and measurement of fluid's level.

Online inspection

STIL SA's optical sensors allow systematic control on production lines thanks to their very high measuring rates and advanced interfacing capabilities with the manufacturing chain or the custom inspection machine.



Vibrometry

Thanks to very high measuring frequencies and nanometric resolution, our sensors allow the measurement of vibrations in objects under test. Their non-contact design avoids disturbance of the system under test, and allows analysis and measurement of difficult to access areas.

Characteristics

High resolution non contact optical sensors for 3D measurement with a wide range of applications.

Characteristics	Benefits
Confocal setup	- Exceptional signal-to-noise ratio (SNR) - High resolution
Coaxial setup	- No shadowing effects - Capability of measuring highly polished surfaces
Chromatic coding / decoding	- No Z scanning required - High precision
Optical fiber system	- Small, light weight, passive optical probe ("optical pen") connected to the controller by a fiber optics cable
Measuring modes	- "Distance" (Z-coordinate) - "Thickness" measurement of transparent materials

Advantages

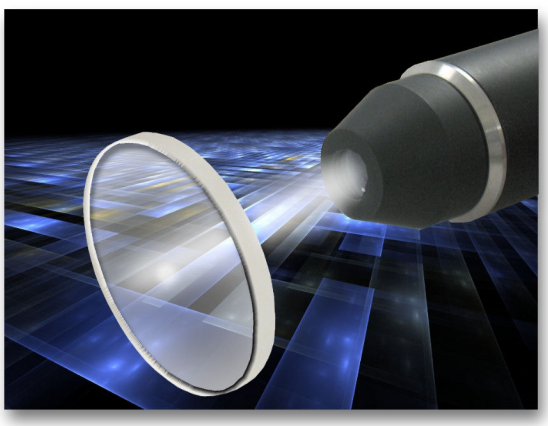
- Measure on any type of material (metal, glass, ceramics, semiconductors, paper),
- Measure on polished surfaces (mirrors, wafers) and on rough ones,
- Insensitive to ambient lighting,
- Compatible with harsh environments (high temperature / high pressure / irradiation),
- ISO 25178 standard compliant,
- Large choice of measuring ranges (100 µm to 42 mm ranges),
- Large choice of optical pens for specific requirements ("endoscopic" pens / radial pens / large working distance / steep slope / small spot size / through-window measurement...),
- Free software toolkit for an easy interfacing ("CCS Manger" utility, c++ and .net DLL SDK).

Confocal Spectral Interferometry

Introduction

The measurement accuracy in non contact profilometric techniques is generally limited by mechanical vibrations and by positional inaccuracies of the micro-scanning table. In order to free the measurement from these environnemental perturbations, STIL has developed a new vibration insensitive interferometric method. With this new type of interferometric system, the potential subnanometric accuracy of interferometric microscopy is effective.

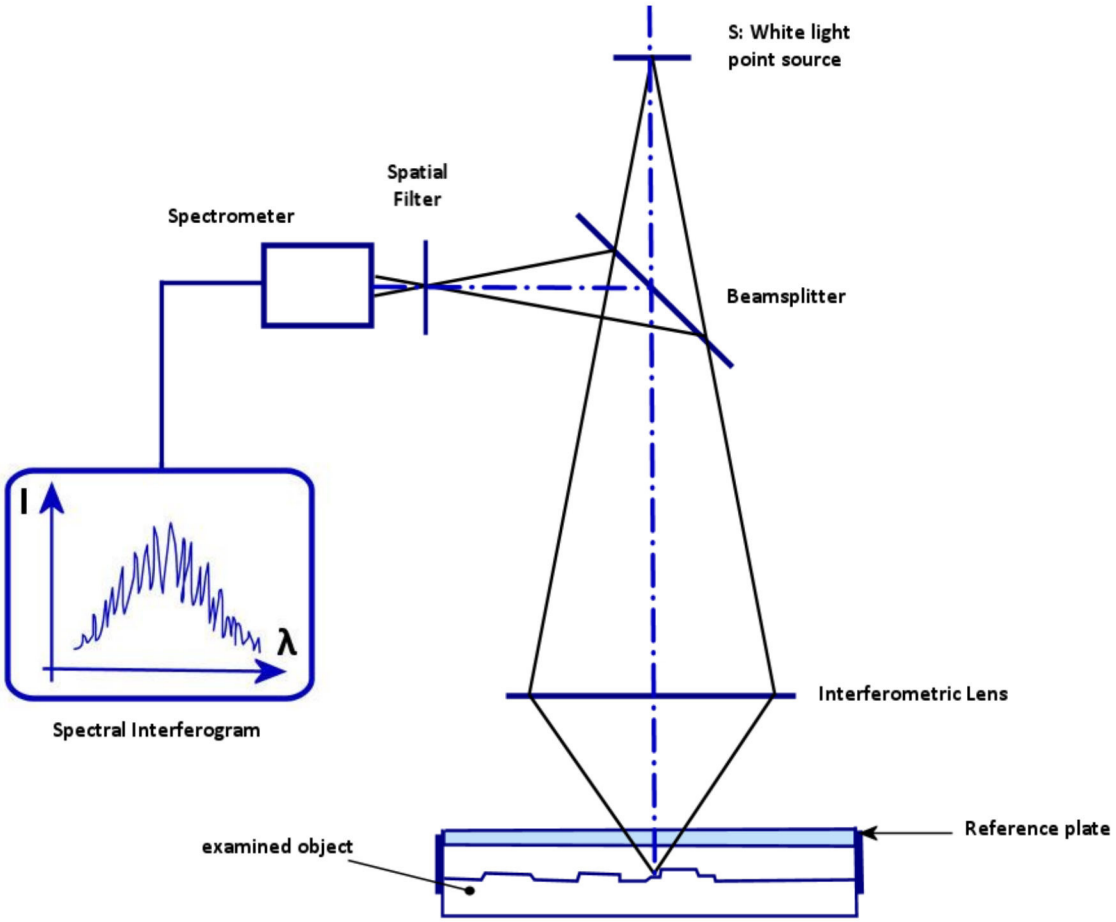
Moreover this new sensor can be used for measuring transparent films that are too thin to allow the "Chromatic Confocal" technique to be used. The minimum measurable thickness is 0.4 µm.



Optical principle

The STIL interferometric method is based on Spectroscopic Analysis of White Light Interferograms (SAWLI). It consists in analysing the interference signal observed on a spectrometer in order to measure the air gap thickness between the reference plate and the sample. The originality of the developed system lies in the fixation of the reference plate on the inspected object. As reference plate and sample are fixed together, the machanical vibrations do not affect the measurements.

The interferometric signal is a channelled spectrum. From this signal, the spectral phase is calculated using a numerical seven points phase shifting algorithm allowing the measurement of the local height of the analyzed surface with a subnanometric resolution.

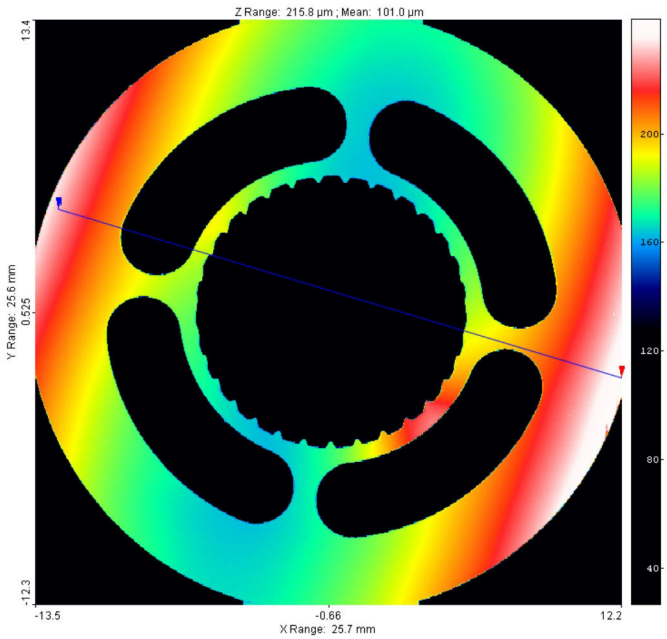


Advantages

- Vibration insensitive (OPILB-RP optical pen),
- High signal to noise ratio (OPILB-RP optical pen),
- No vertical scanning required,
- Minimum measurable thickness 0.4 µm,
- Subnanometric resolution inherent to the optical principle,
- No cross talk between neighbouring points, thanks to confocality,
- Exceptionnal performances in thickness measurement (0.3 nm resolution, 10 nm accuracy)

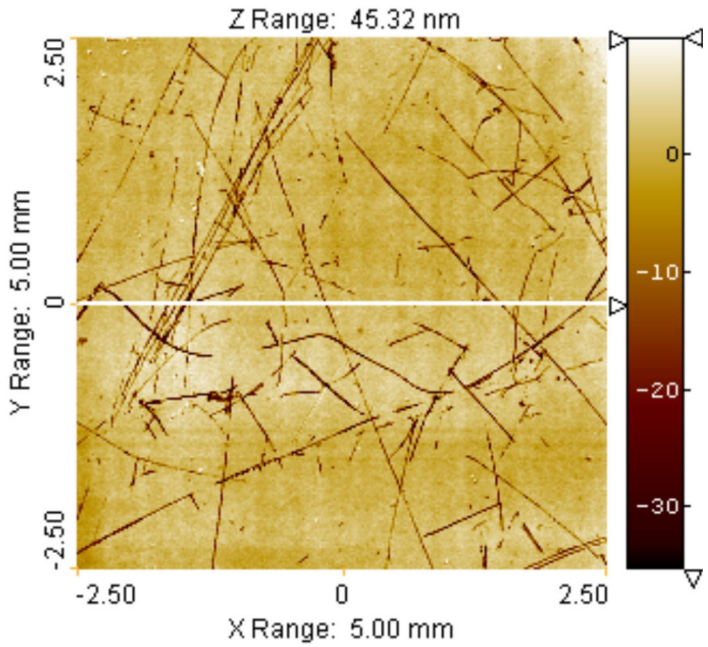
Measurement examples

Chromatic confocal imaging



Horlogy item (X range = Y range = 25.7 mm, Z range = 216 µm)

Confocal spectral interferometry



Nano-scratches on glass plate (X range = Y range = 5.0 mm, Z range = 45.3 nm)

Introducing Colorimetry

Color only exists through the combination of three elements: a light source, an object and an observer. Color becomes a subjective sensation,which can be described with a color name. The International Commision on Illumination defined some standards allowing us to quantify colors. In consequence, colorimetric spaces are defined for different pairs of illuminant / observer and the color is identified by three coordinates, for example CIELAB, CIELUV...

Two categories of instrument are used for characterizing the color of an object: the colorimeters and the spectro-colorimeters. A colorimeter is a very simple system proposing a series of colored filters in order to simulate the normalized curves of a standard observer. The measurement is not very accurate and it does not allow users to detect differences that invisible for some illuminants and visible for others (metameric colors). In contrast, a spectrocolorimeter includes a dispersive component (grating, prism) allowing the measurement of the light reflected by the object in a much more precise manner, for the whole range of visible wavelengths.

Applications

Spectroscopic and colorimetric measurement are used for analyzing: Reflectance of diffusing materials and samples, Intensity and color of light sources and displays, transmittance of filters and liquids.

Plastic

Paper

Cosmetics

Paints

Inks

Drugs

Food

Ceramics

Fabrics

Wood

RUBY spectrocolorimeter

RUBY is a perfect solution for real time measurement of color drifts and servo-controlling production tools possibilities allow a cost reduction for a low level of investment.

- High acquisition speed,
- Non contact measurement,
- Synchronization with custom machines,
- Stand-alone use.

In addition to color monitoring, different kinds of application are available: Whiteness measurement, formulation, counter-typing, characterization of the effects of materials and light stability measurement (artificial or natural ageing).

Adavantages

- Real time measurements for spectroscopy,
- Internal light source,
- Selectable spot size on the sample,
- Long working distance,
- Ergonomic and removable grip,
- Color and irradiance measurement,
- Metameric sample detection,
- Automatic color sorting,
- Integrated software solution,
- Portable system allowing in situ measurements.

Controller

RUBY CONTROLLER	
Power Supply	85 to 240 V (50 / 60 Hz)
Consumption	200 Watts
Light Source	Tungsten halogen lamp
Measuring Rate	up to 2000 Hz
Analog outputs	2 outputs 0 - 10V
Digital outputs	Ethernet / RS232
Synchronization I/0	1 input (TTL) / 1 output (TTL)
Wavelength range	400 - 800 nm (other ranges on request)
Spectral resolution	0.63 nm / pixel
Humidity limits	5% - 80% HR without condensation
Temperature in use	5 - 50° C
Dimensions	376 mm x 363 mm x 114 mm
Weight	6 Kg

Optical head

RUBY OPTICAL HEAD	
Spot size	1 / 2 / 4 / 7 mm
Working distance	80 mm
Depth of field	10 mm
Fastening thread	1/4"
Accessories thread	30.5 mm
Accessories	Contact tip, pods
Dimensions	60 mm diam. / 178 mm length
Weight	0.5 Kg

Software

DLL for RUBY controllers

The "RUBYDLL" provides a powerful high-level interface enabling user's-programs written in C/C++ language to communicate with RUBY controllers. This DLL is bared on the DLL for point sensors (DLL - CHR)

DLL compatibility
ANSI-C programs Microsoft Visual C++ 6. Microsoft VS 2005, 2010, 2012, 2013 . NET languages (C#, Visual Basic)

The main features of the DLL are:

- Initialize and connect to the controller through RS232 or Ethernet;
- Get / Set the sensor settings, e.g:
  - Color coordinates,
  - Color difference,
  - Spectral difference,
  - Colorimetry settings (observers, illuminants),
  - Spectral sampling,
  - Analog output settings,
  - Digital output settings,
- Calibrate black,
- Calibrate White,
- Acquire a target to compare with the current measurement,
- Enable / Disable hardware trigger mode,
- Launch the measurement with other processes,
- Synchronize the measurement,
- Get the controller status and the "last error" parameter.

RUBY MANAGER Software

Data processing is performed inside the RUBY controller.
A desktop or notebook PC and the RUBY Manager software could complete the system in order to perform sophisticated measurements and analysis.

RUBY Manager is a powerful software which allows you to start measuring color with your new RUBY controller in minutes.

Thanks to its user-friendly interface, RUBY Manager software is the simplest way to gain complete control over all the settings of your RUBY controller.

The interface offers two different display modes:

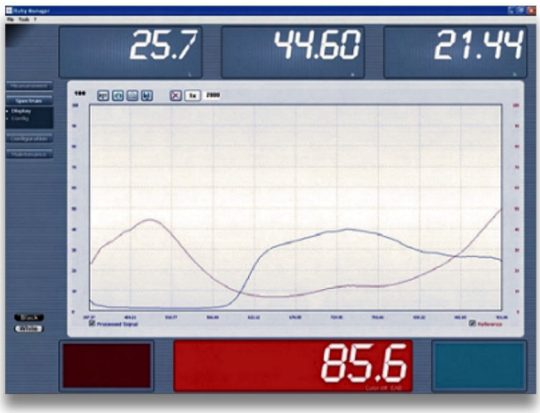
The measurement mode dedicated to color conformity control, and the spectrum mode, dedicated to curve display and comparison.

All the data is displayed in real time and allows the visualization of the historic of production process or chemical kinetic experiment monitoring.

Morever, RUBY Manager provides advanced maintenance functions:

- Update of the controller's firmware to take advantage of the latest enhancements and the new function developed by STIL's engineers.

- Unique "Diagnostics" function, allowing to record the current status of the controller into a file, wich can be directly sent by email to STIL's application and support department.



The last version of RUBY Manager includes two new functions:

- Management of a database of reference colors
- Monitoring of the quality of a production

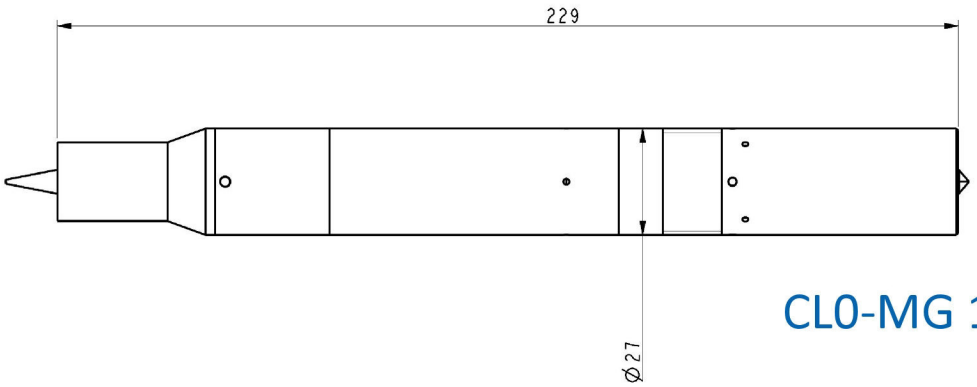
The first function allows the user to create a reference colors library that can be used for the online control of a varied production. In spectroscopy applications, the comparison with reference spectra enables the possible recognition of characteristic signatures.

The second function (Save in Regular Intervals) allows the user to save these data at a determined interval. This function is important for controling the quality of a production over a long period.

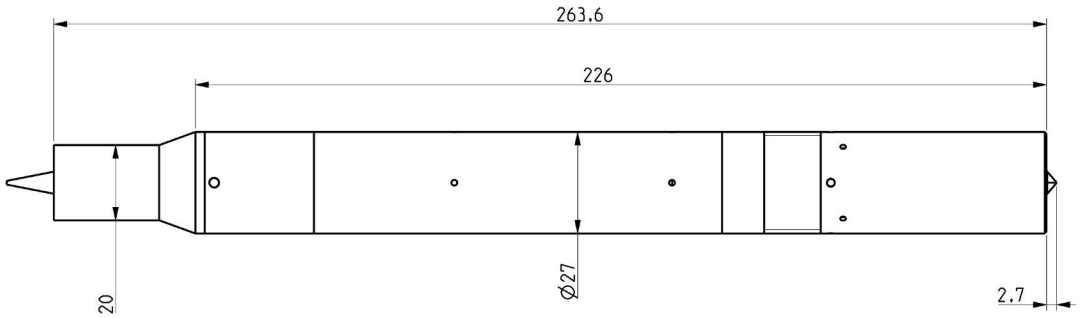
Minimal computer configuration
Seven 32 bit / 64 bit 4 Go RAM, 3GHz RS232 (exported data: color coordinates) or Ethernet (exported data: all)

Optical pens

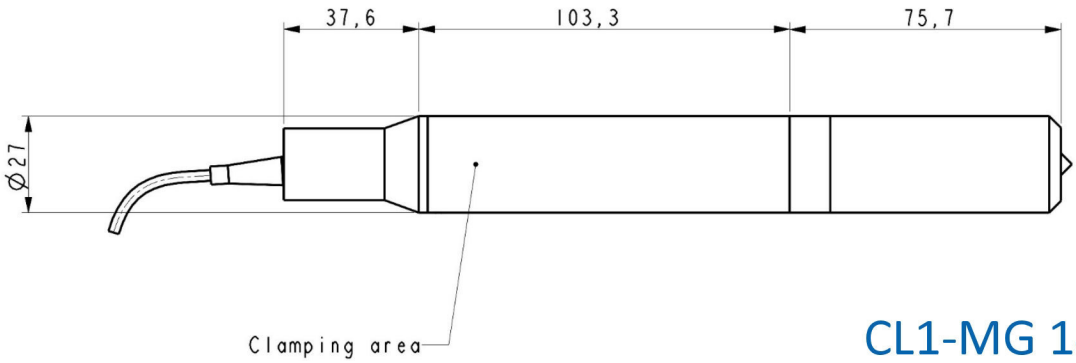
CL-MG Line: chromatic optical pens



CL0-MG 140



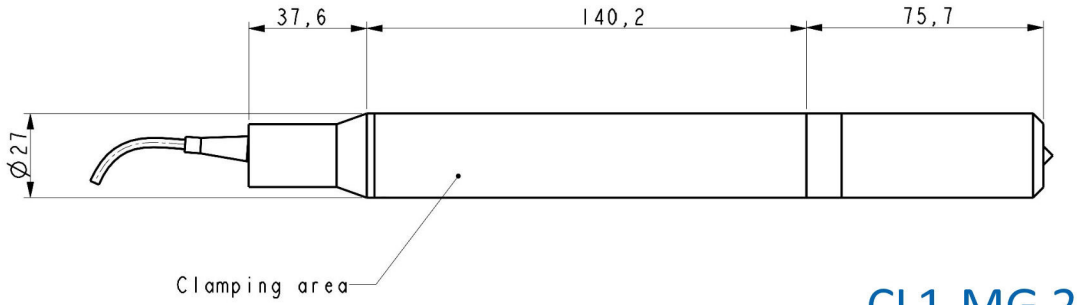
CL0-MG 210



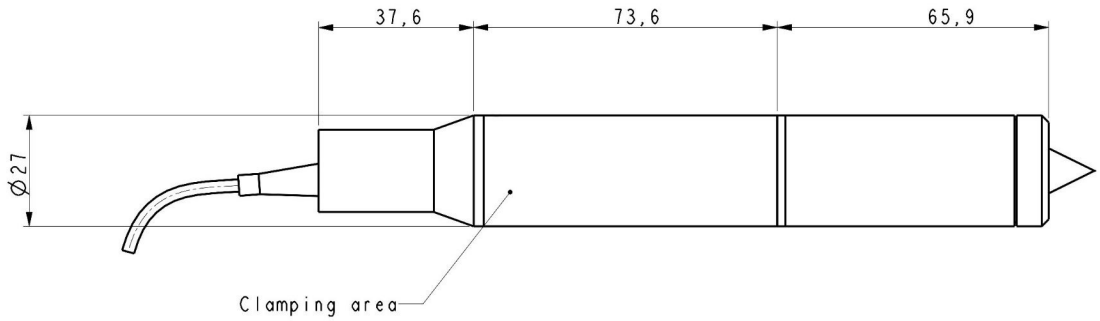
CL1-MG 140

Dimensions are indicated in millimeters

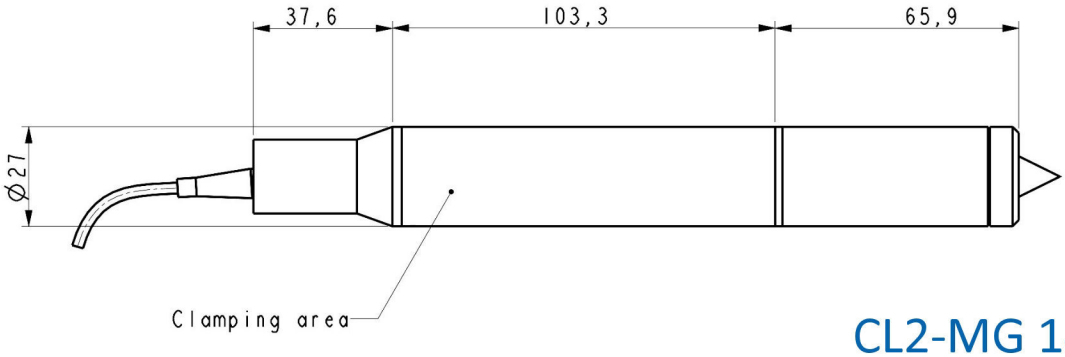
CL-MG Line: chromatic optical pens (Continued)



CL1-MG 210



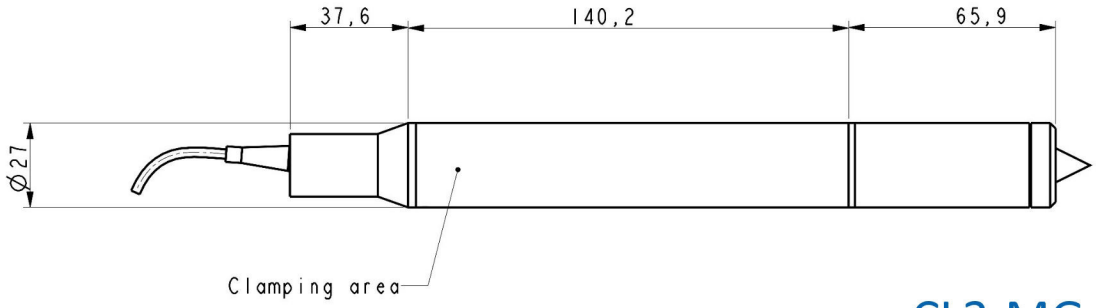
CL2-MG 70



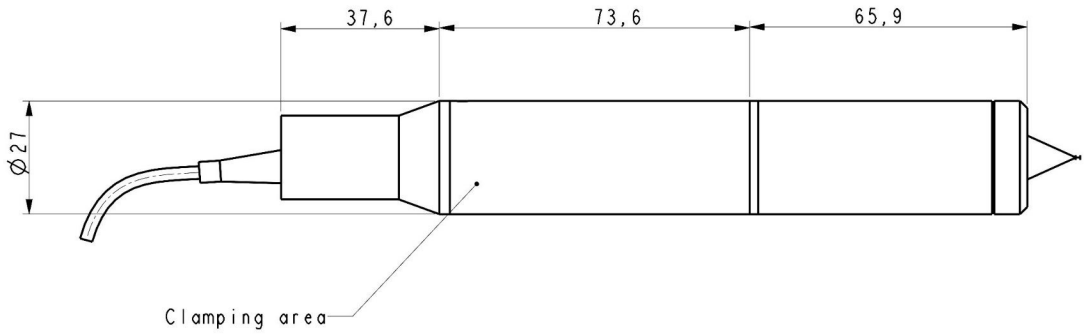
CL2-MG 140

Dimensions are indicated in millimeters

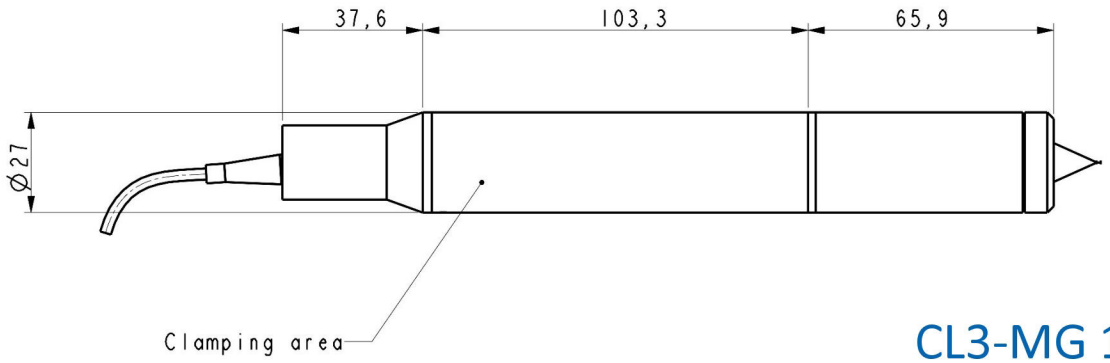
CL-MG Line: chromatic optical pens (Continued)



CL2-MG 210



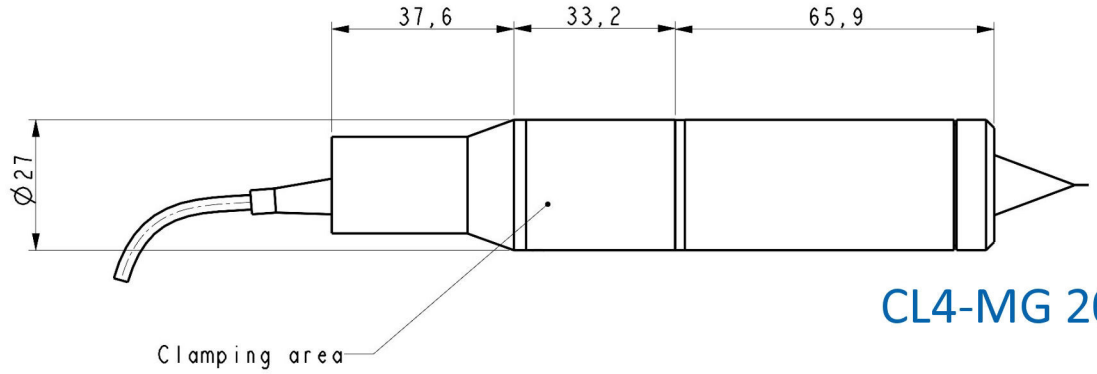
CL3-MG 70



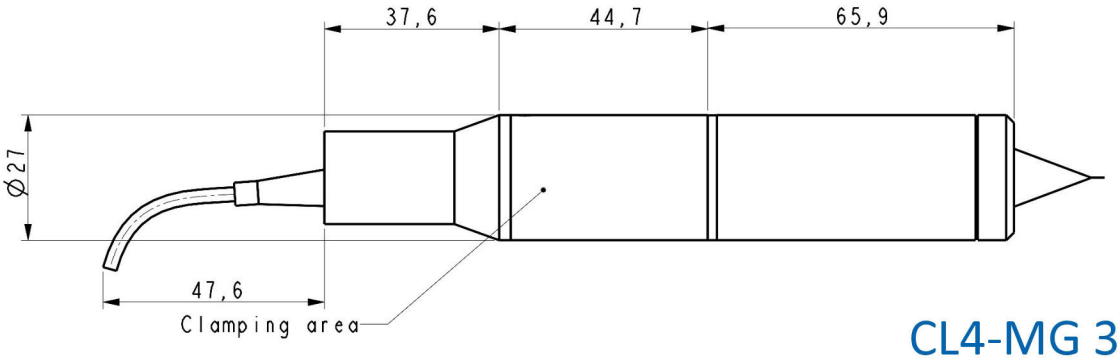
CL3-MG 140

Dimensions are indicated in millimeters

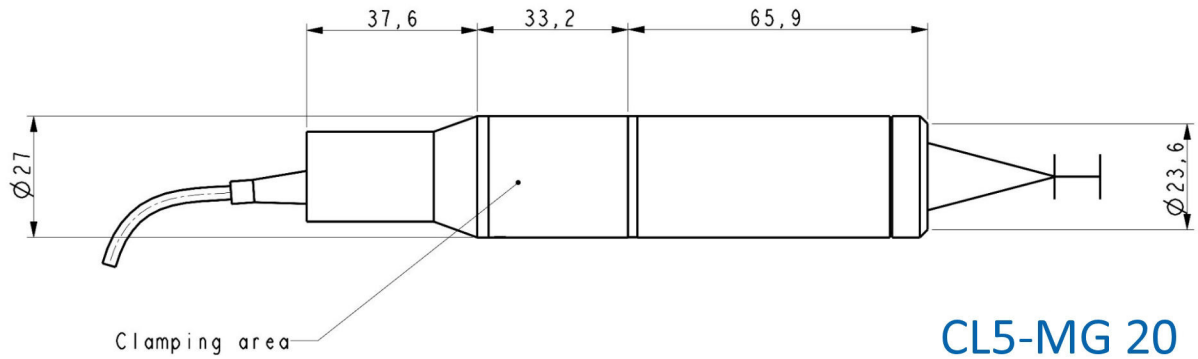
CL-MG Line: chromatic optical pens (Continued)



CL4-MG 20



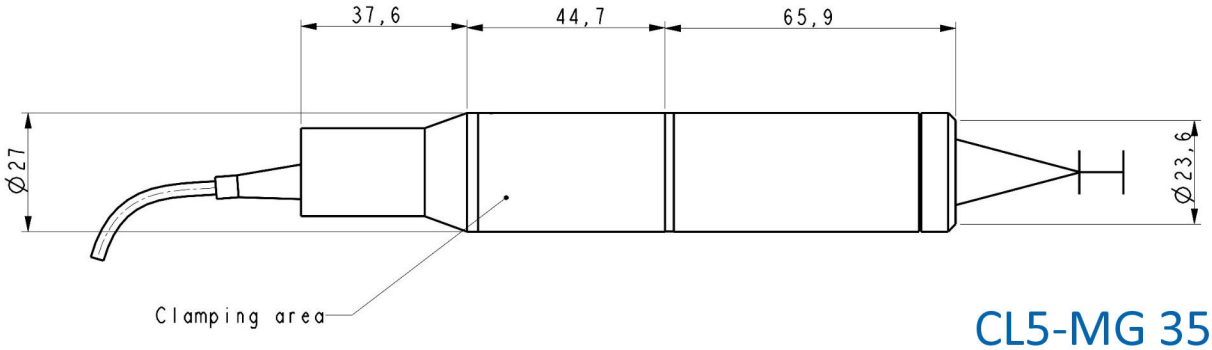
CL4-MG 35



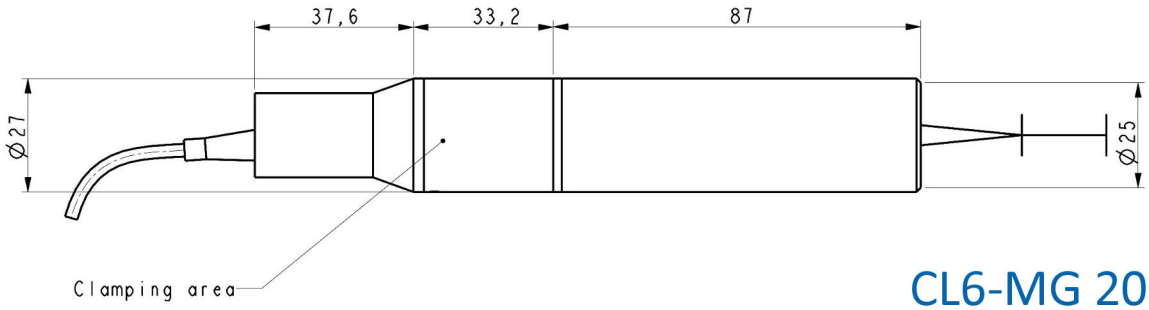
CL5-MG 20

Dimensions are indicated in millimeters

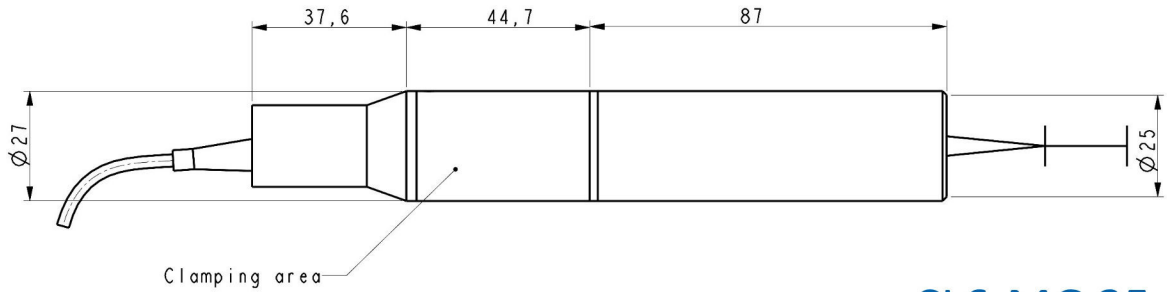
CL-MG Line: chromatic optical pens (Continued)



CL5-MG 35



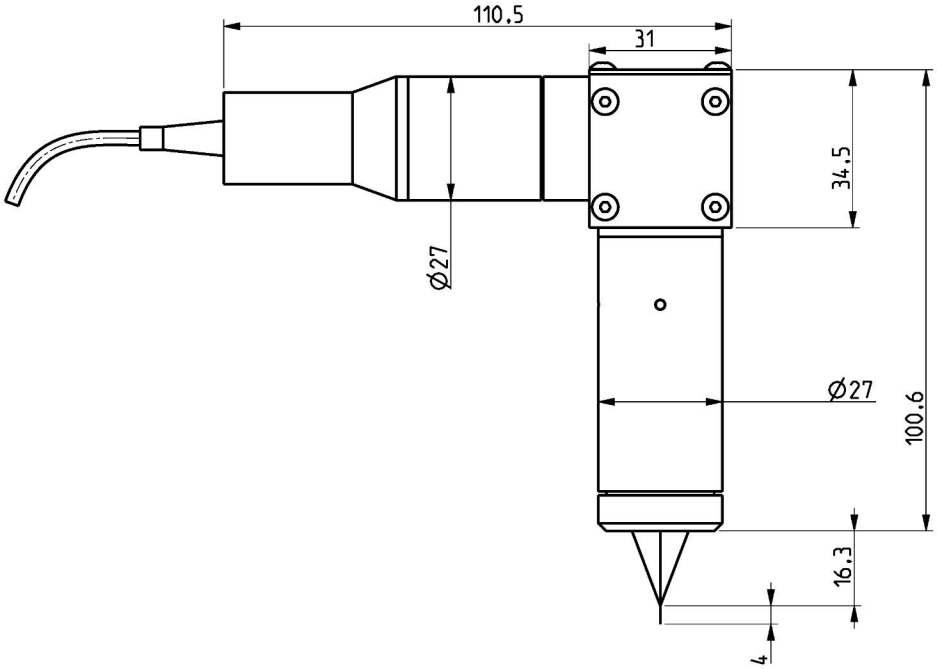
CL6-MG 20



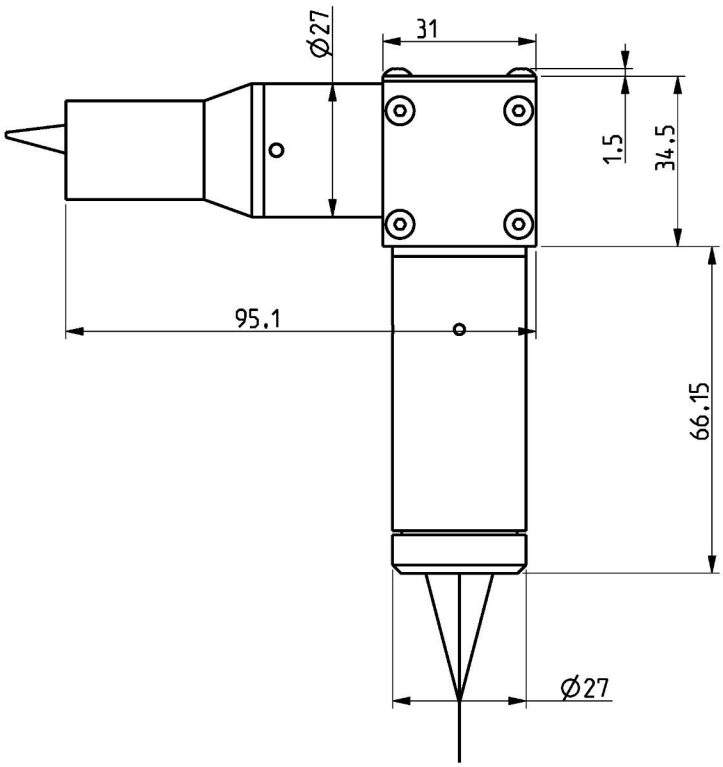
CL6-MG 35

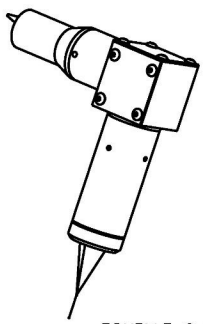
Dimensions are indicated in millimeters

CL-MG Line: chromatic optical pens (Continued)



CL4-MG 35/90°

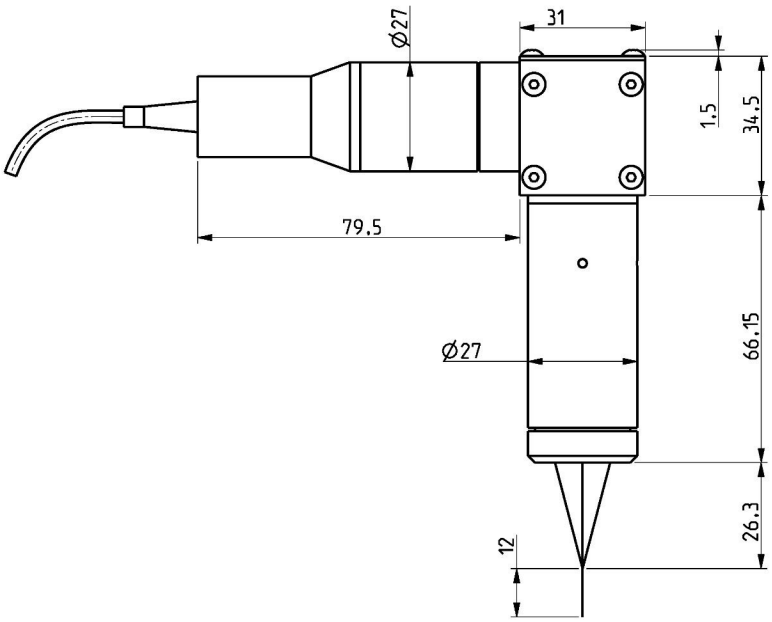


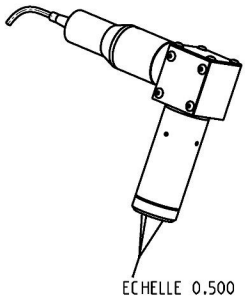


CL5-MG 20/90°

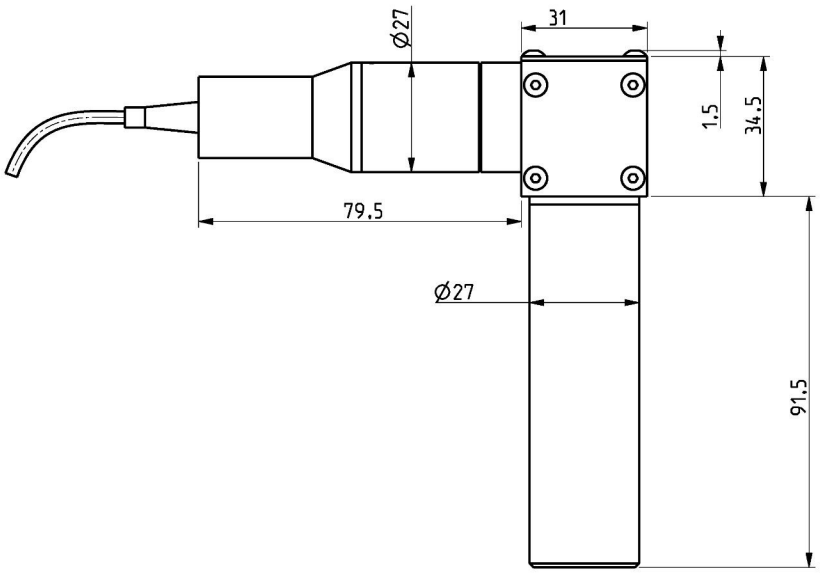
Dimensions are indicated in millimeters

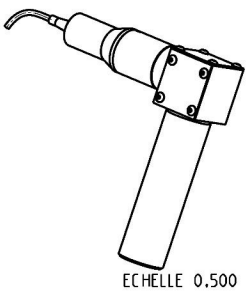
CL-MG Line: chromatic optical pens (Continued)





CL5-MG 35/90°

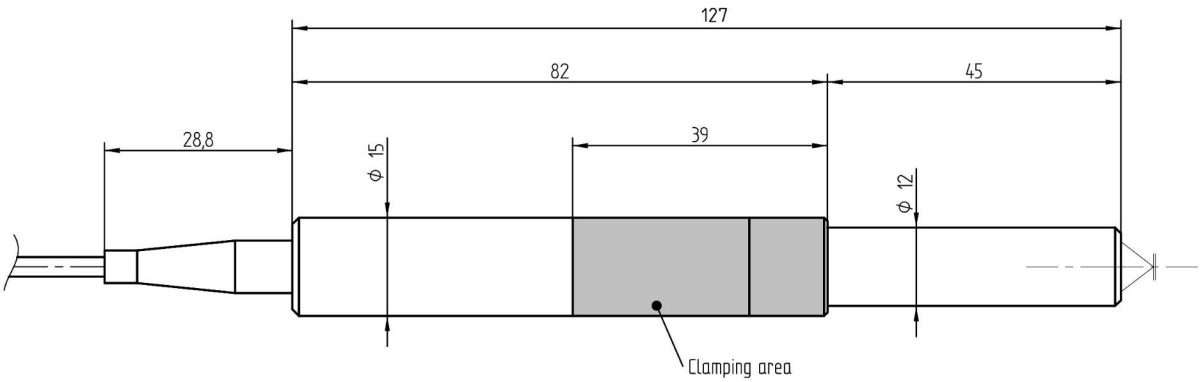




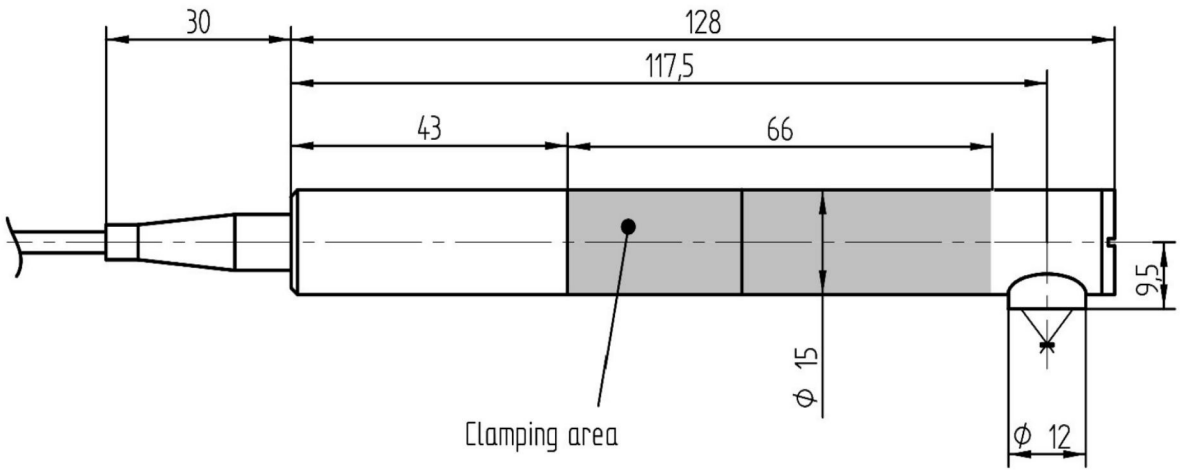
CL6-MG 35/90°

Dimensions are indicated in millimeters

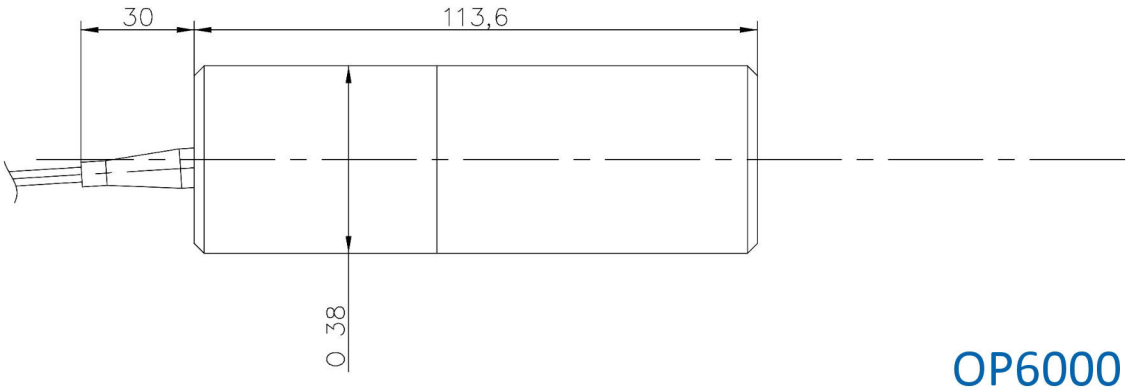
OP Line: chromatic optical pens



OP300-VM



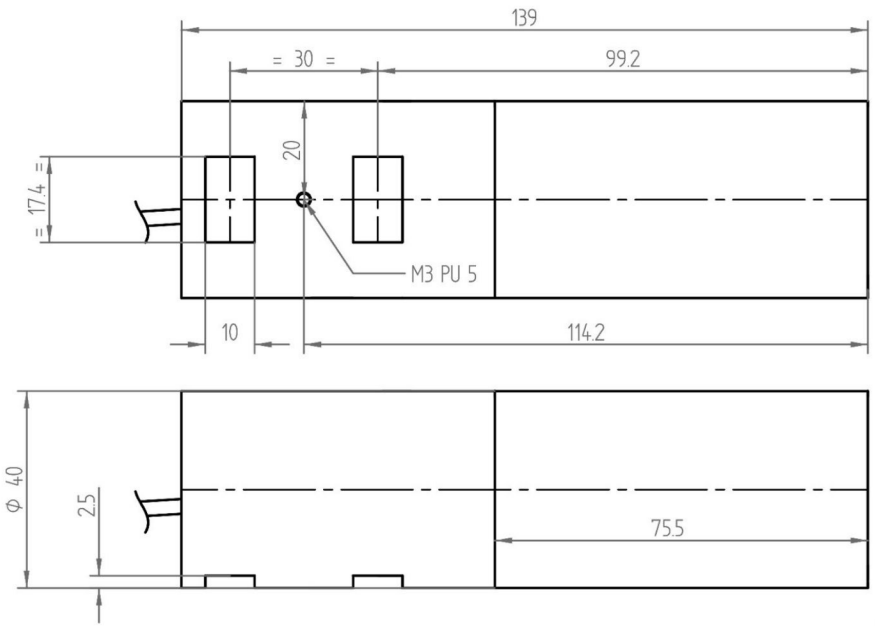
OP300-VM/90°



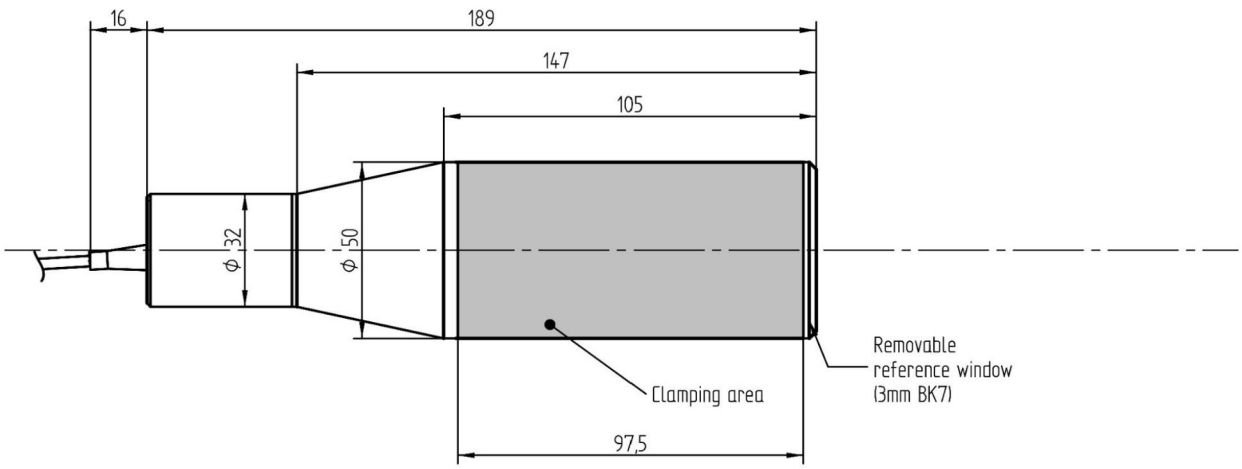
OP6000

Dimensions are indicated in millimeters

OP Line: chromatic optical pens (Continued)



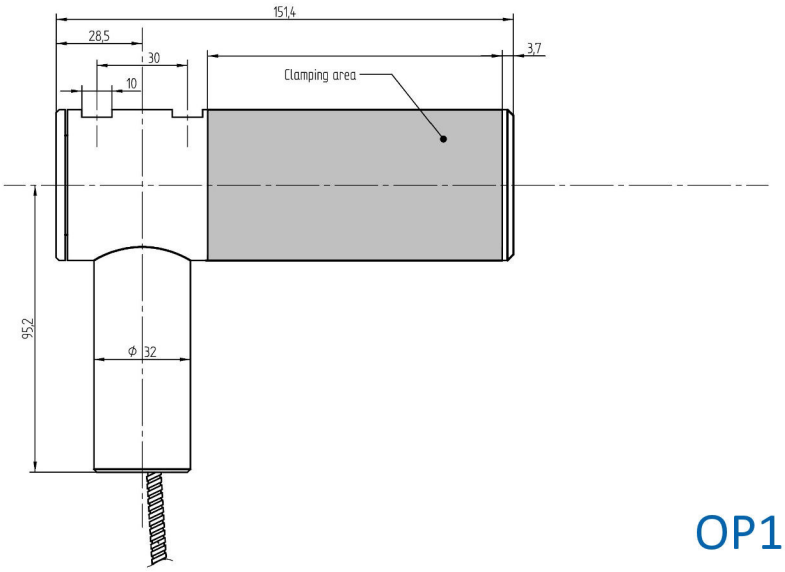
OP8000



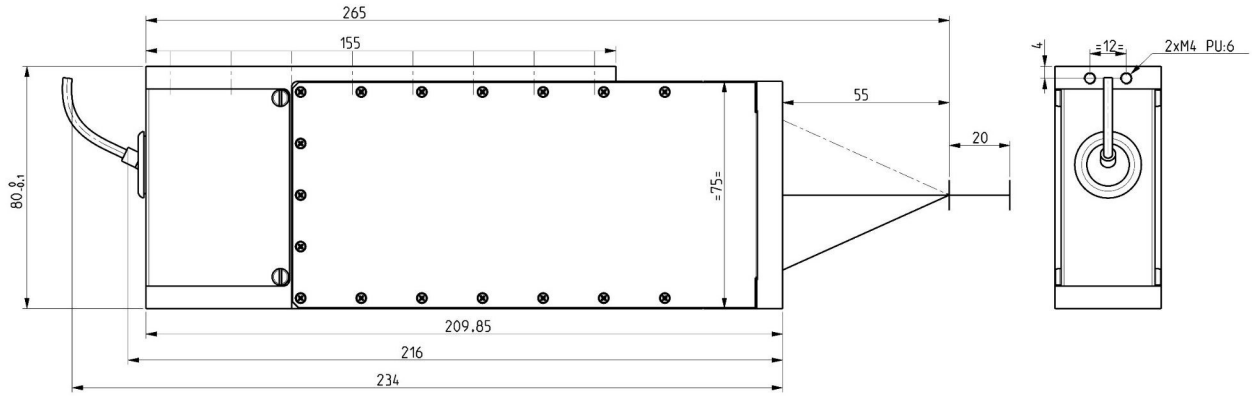
OP10000

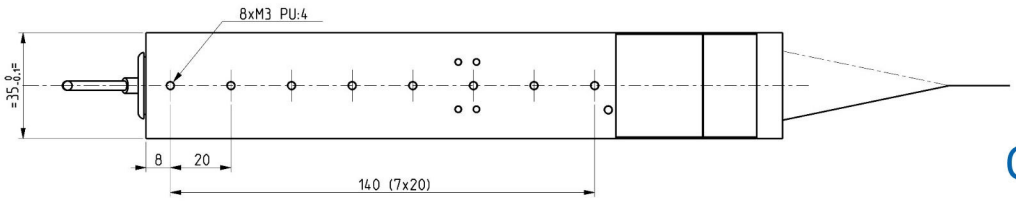
Dimensions are indicated in millimeters

OP Line: chromatic optical pens (Continued)

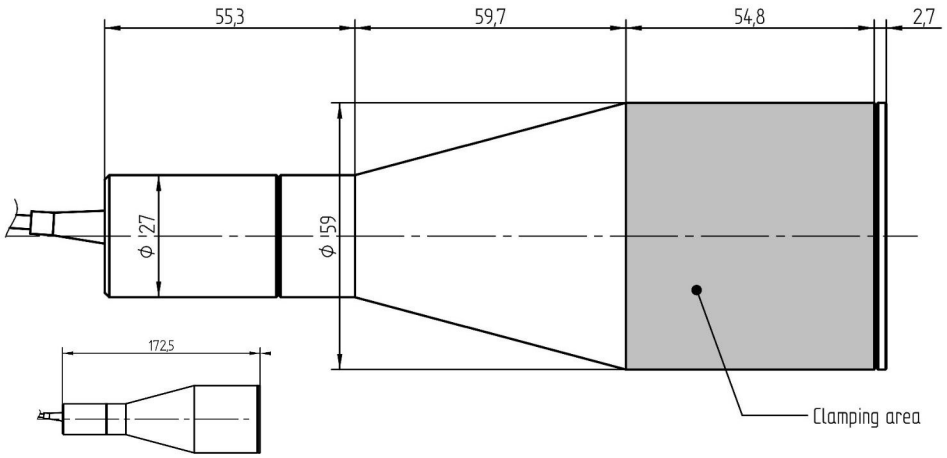


OP10000/90°





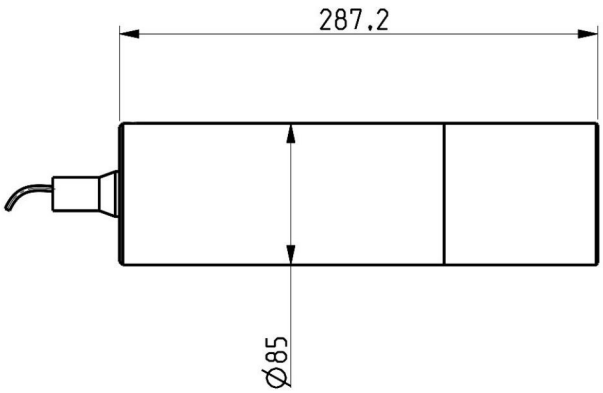
OP20000



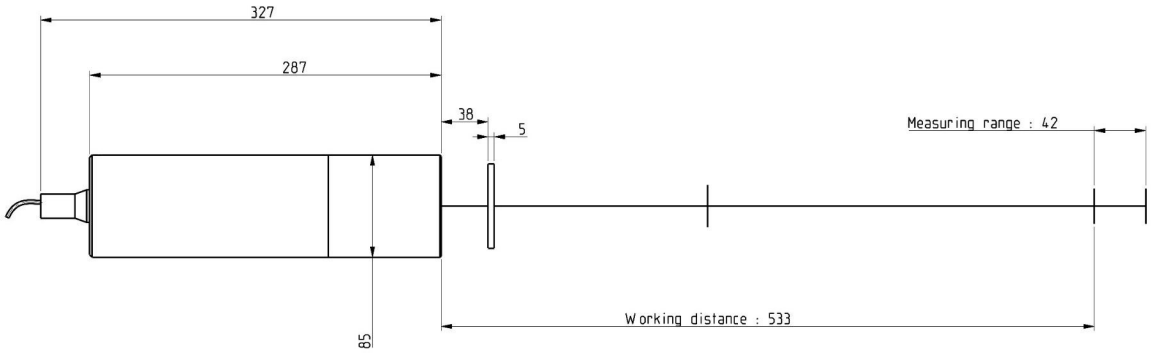
OP24000

Dimensions are indicated in millimeters

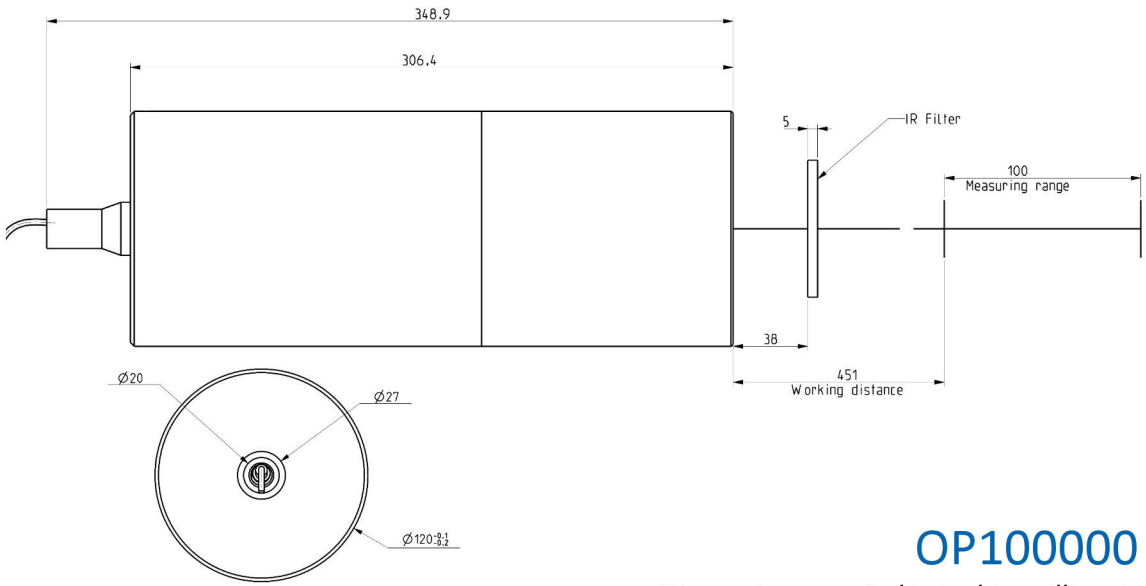
OP Line: chromatic optical pens (Continued)



OP42000



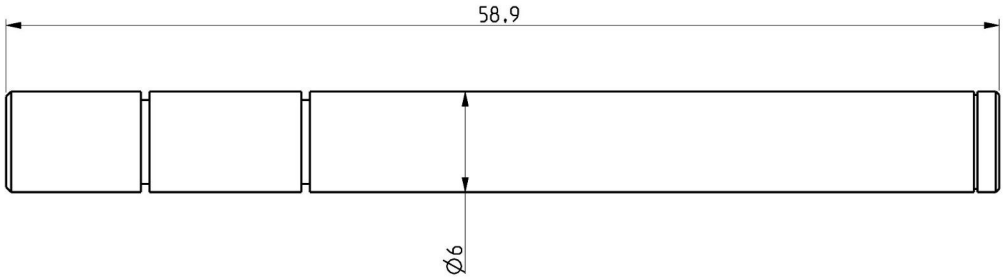
OP42000



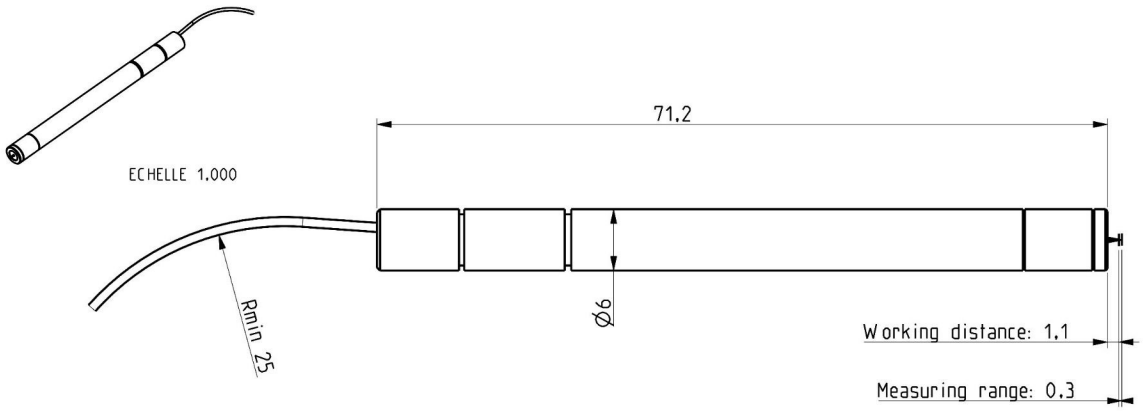
OP100000

Dimensions are indicated in millimeters

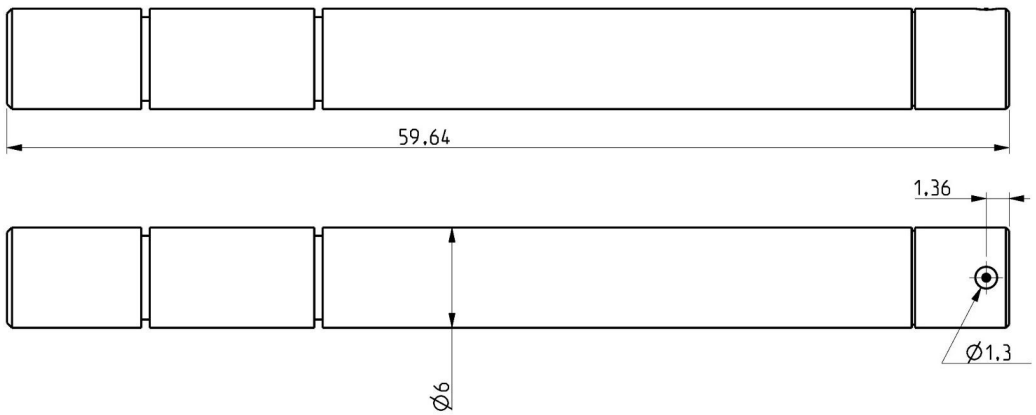
ENDO Line: chromatic optical pens



ENDO 0.1



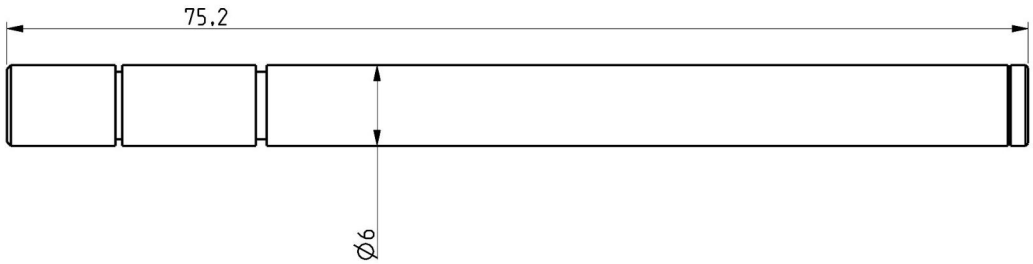
ENDO 0.3



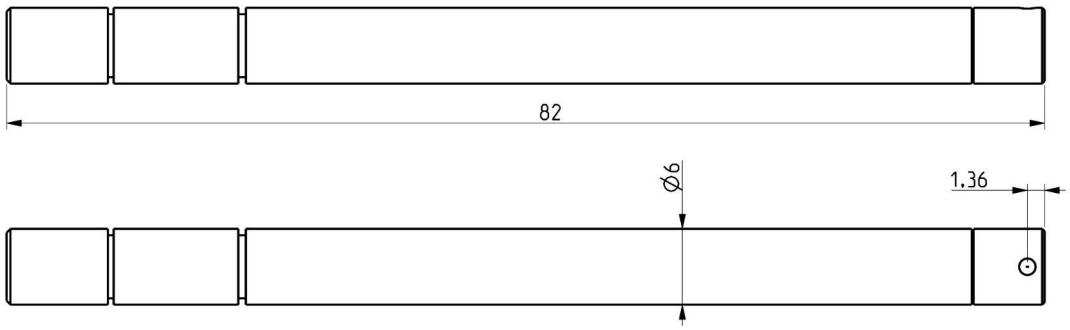
ENDO 0.3/90°

Dimensions are indicated in millimeters

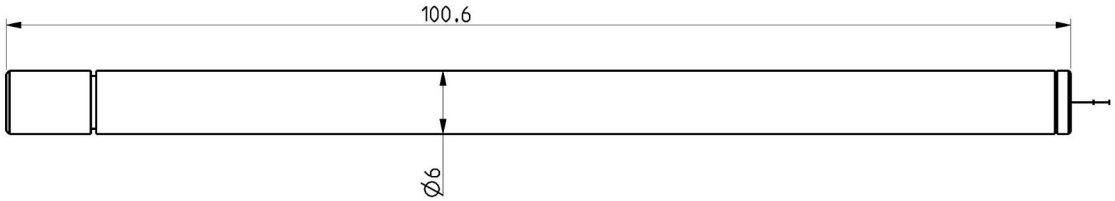
ENDO Line: chromatic optical pens (Continued)



ENDO 1.2



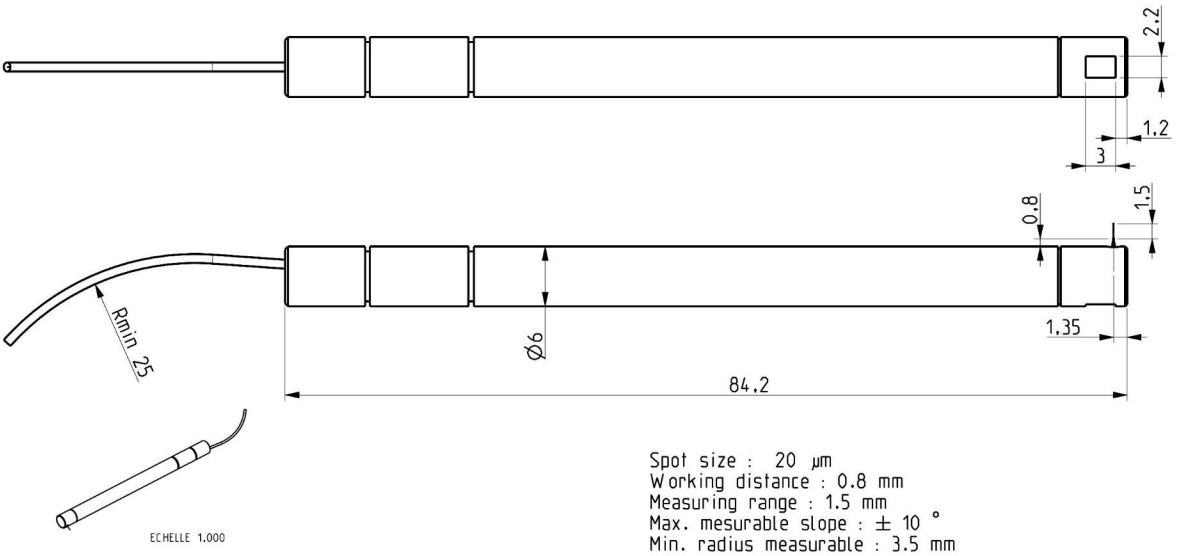
ENDO 1.2/90°



ENDO 1.5

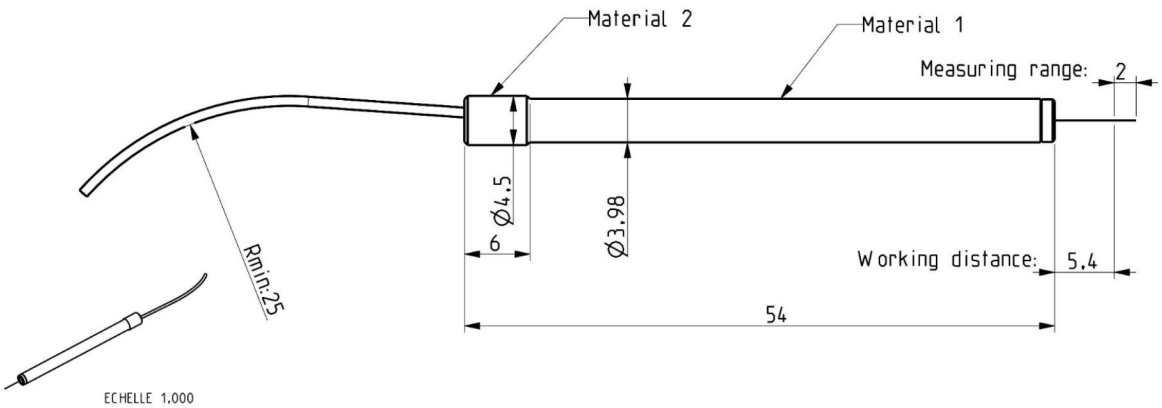
Dimensions are indicated in millimeters

CL-MG Line: chromatic optical pens (Continued)



Spot size : 20 µm
Working distance : 0.8 mm
Measuring range : 1.5 mm
Max. mesurable slope : ± 10 °
Min. radius measurable : 3.5 mm
Fiber lenght : 3 m

ENDO-1.5/90°

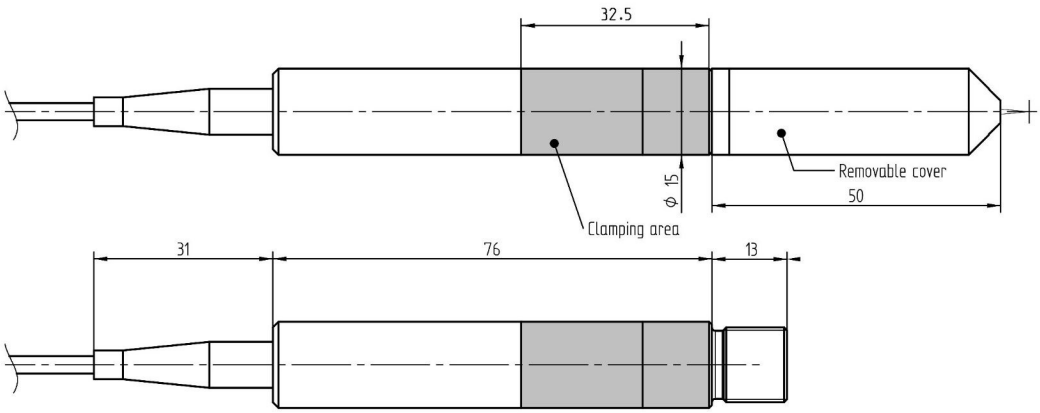


Spot size : 30 µm
Measuring range : 2 mm
Max. mesurable slope : ±5°
Fiber length : 3 m

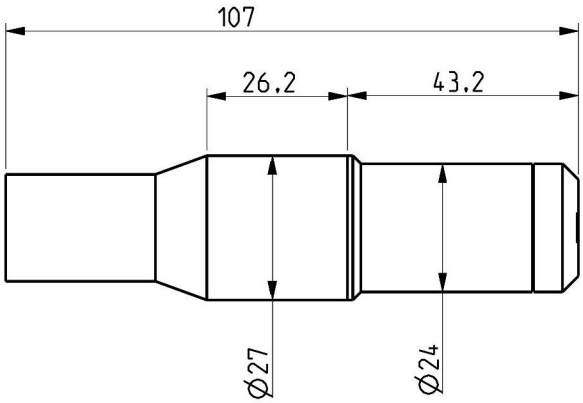
ENDO-2.0

Dimensions are indicated in millimeters

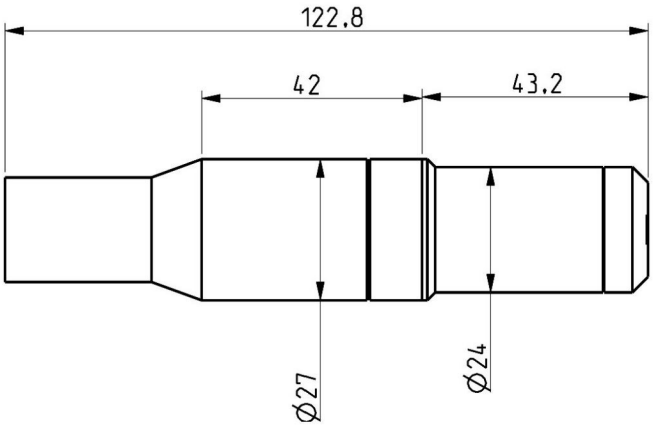
OPILB Line: interferometric optical pens



OPILB



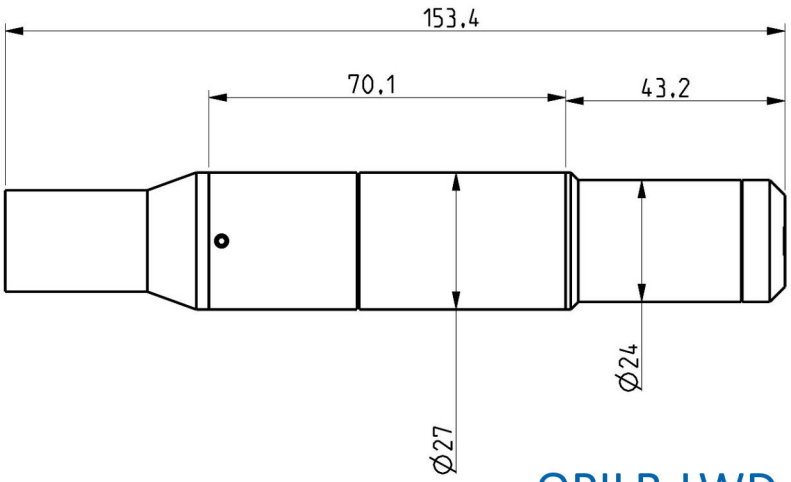
OPILB-LWD-T MG20



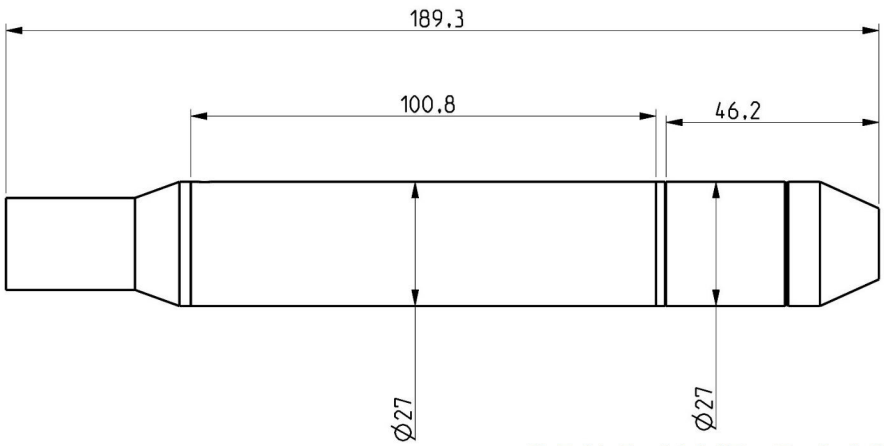
OPILB-LWD-T MG35

Dimensions are indicated in millimeters

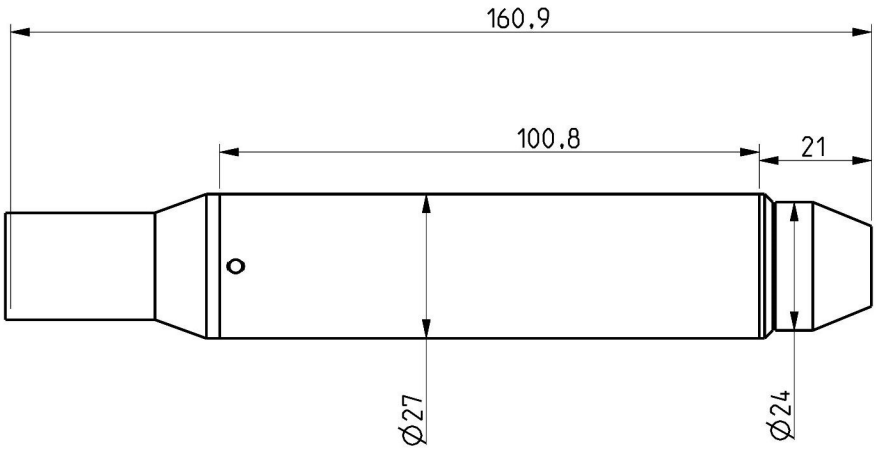
OPILB Line: interferometric optical pens (Continued)



OPILB-LWD-T MG 70



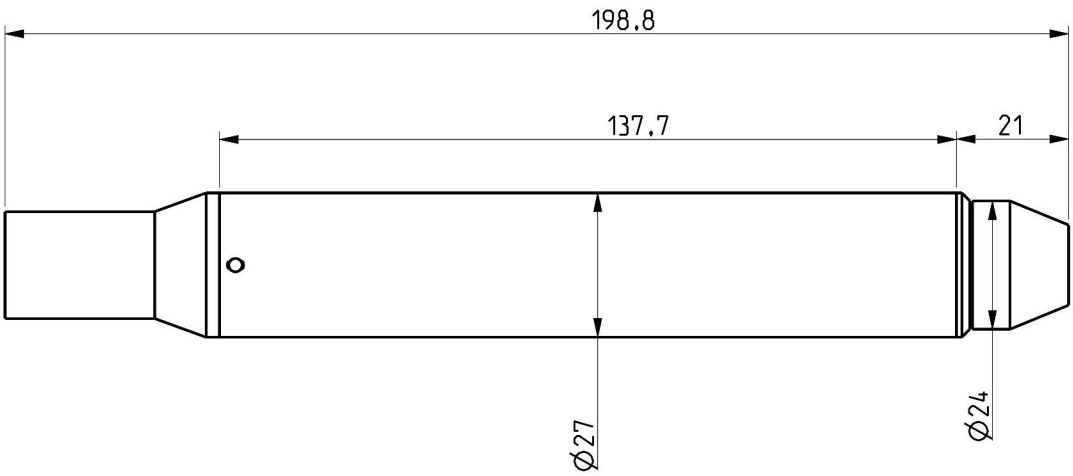
OPILB-LWD-D MG140



OPILB-RP- MG 140

Dimensions are indicated in millimeters

OPILB Line: interferometric optical pens (Continued)

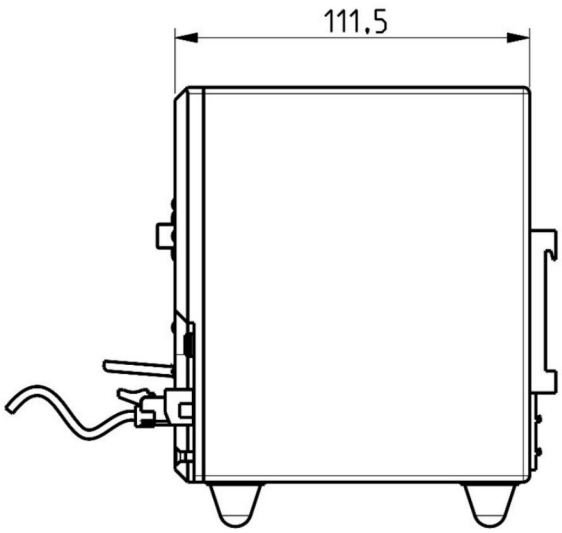


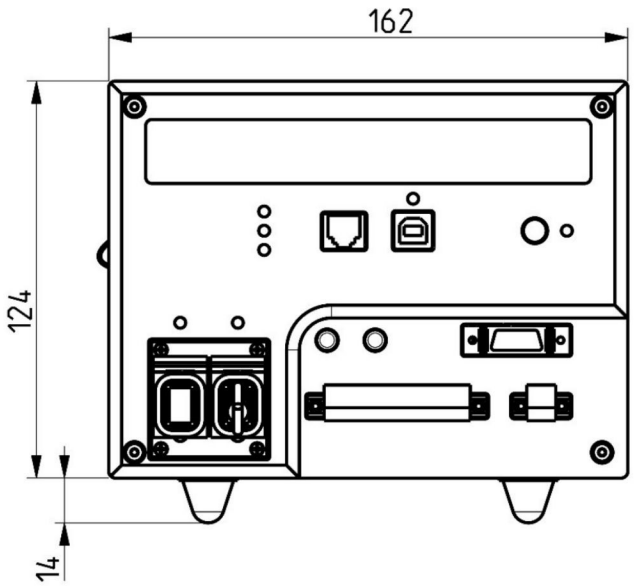
OPILB-RP- MG 210

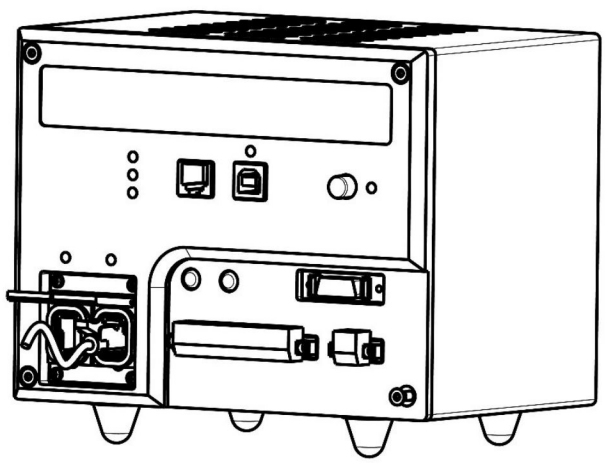
Dimensions are indicated in millimeters

Controllers

Point-sensor controllers





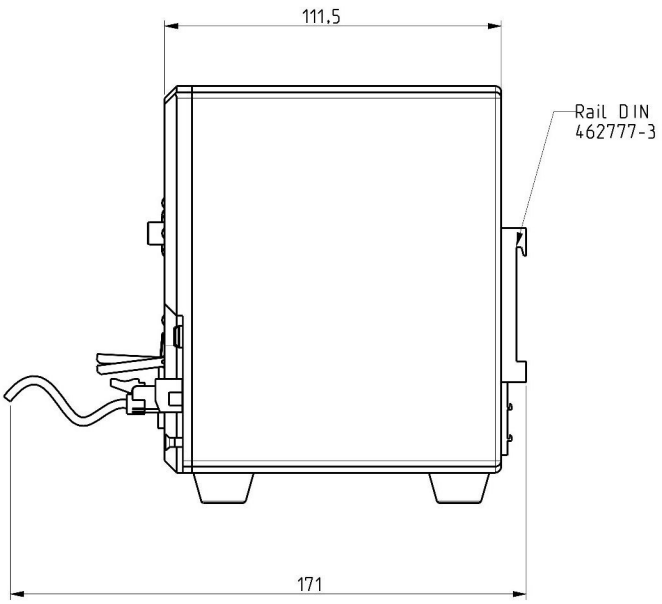


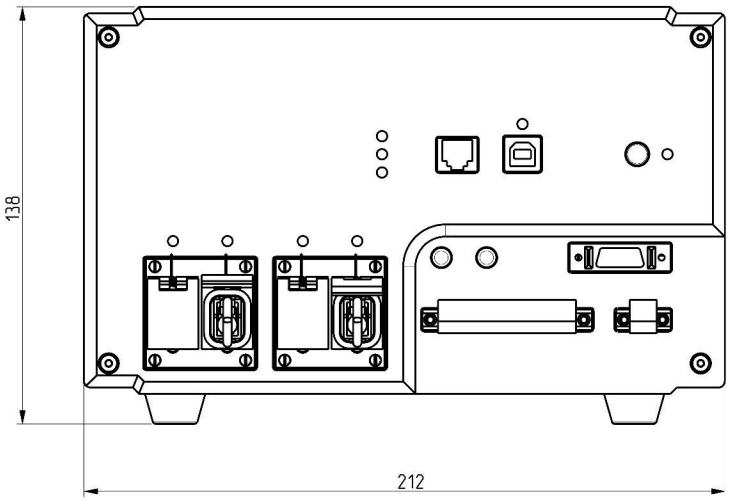
ECHELLE 0.500

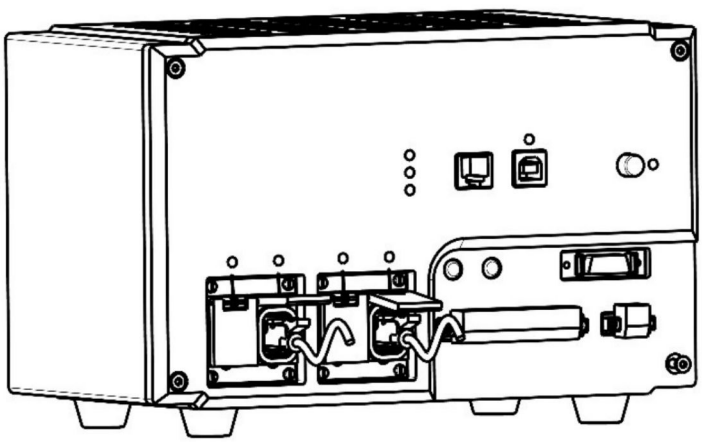
CCS PRIMA 1&2

Dimensions are indicated in millimeters

Point-sensor controllers (Continued)



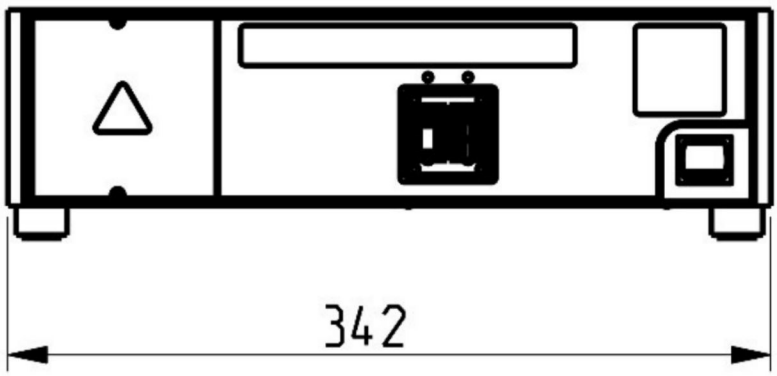


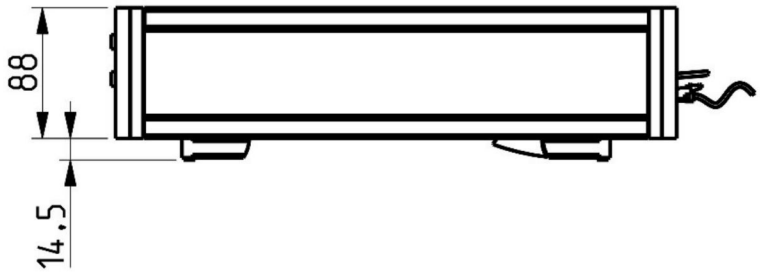


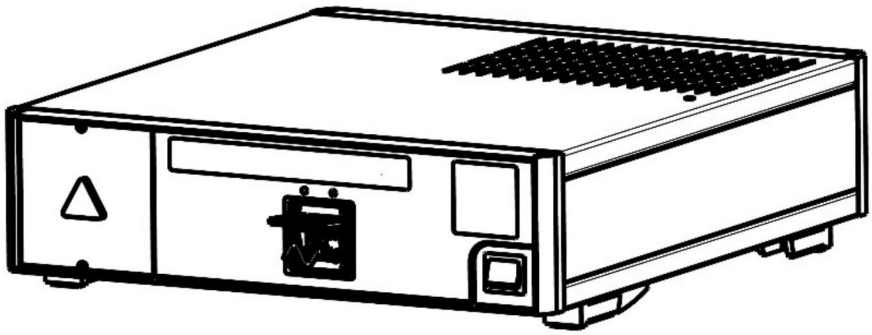
PRIMA 4

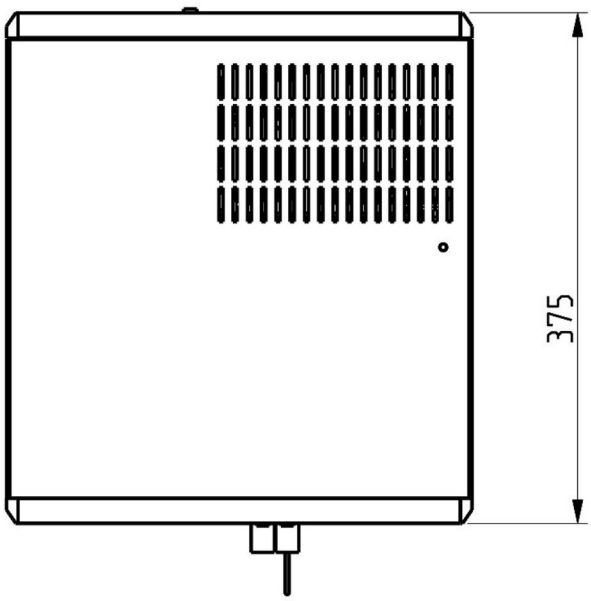
Dimensions are indicated in millimeters

Point-sensor controllers (Continued)





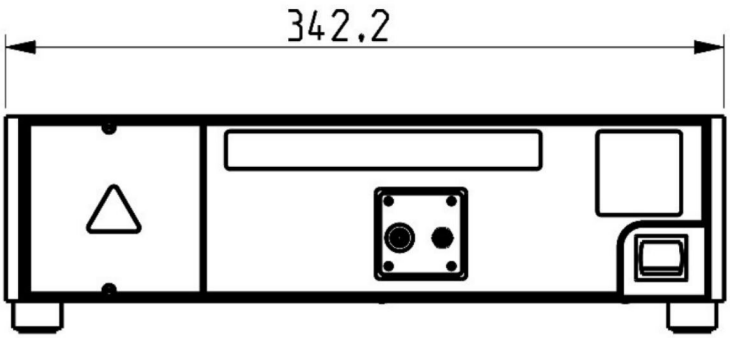


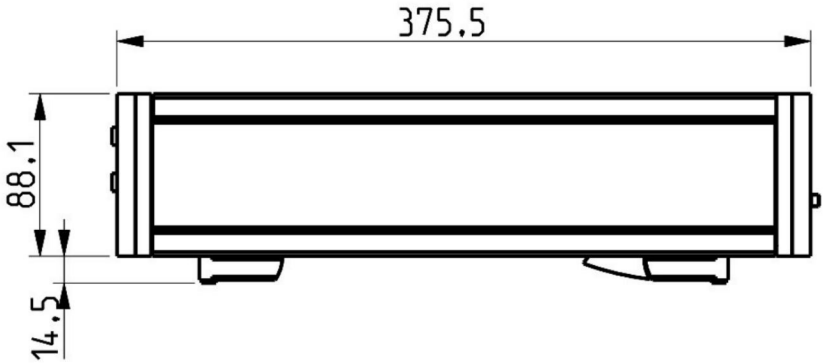


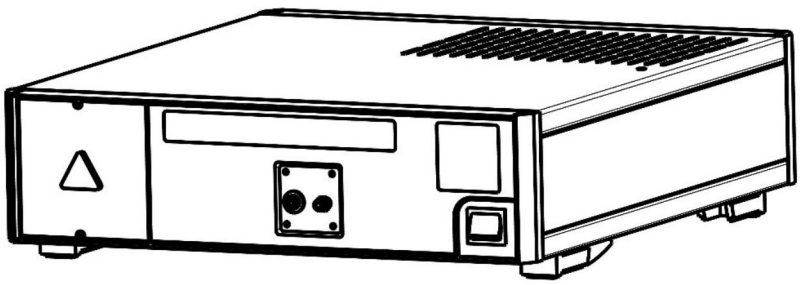
STIL DUO

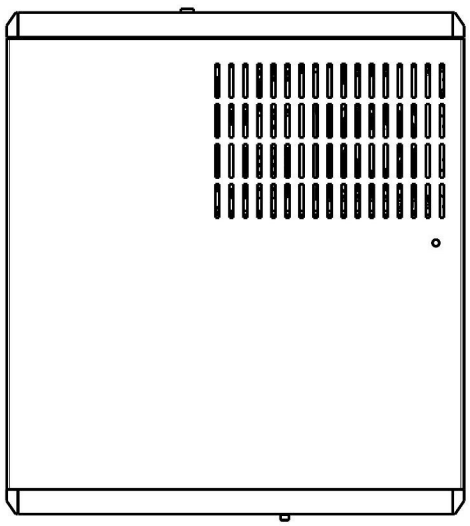
Dimensions are indicated in millimeters

Point-sensor controllers (Continued)





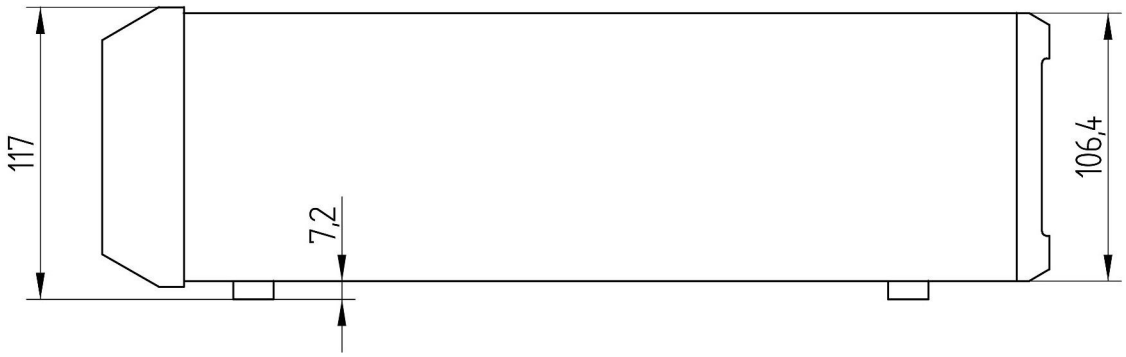


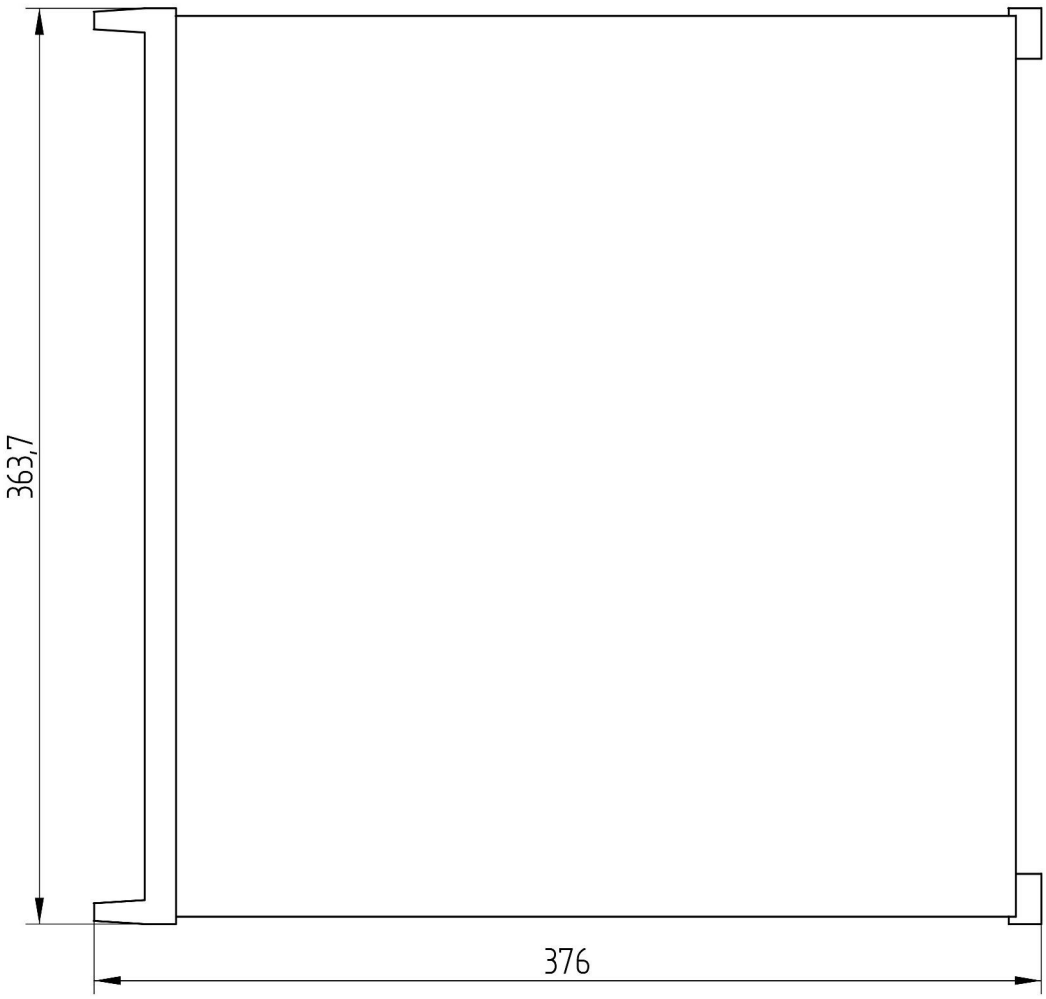


STIL RUBY

Dimensions are indicated in millimeters

Point-sensor controllers (Continued)

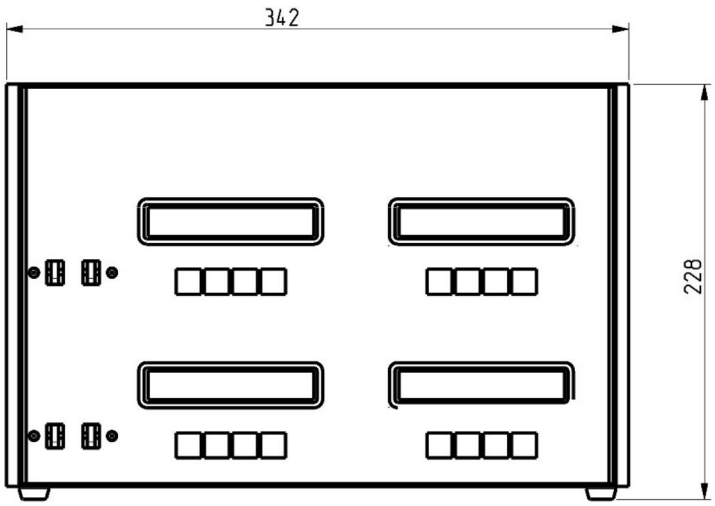


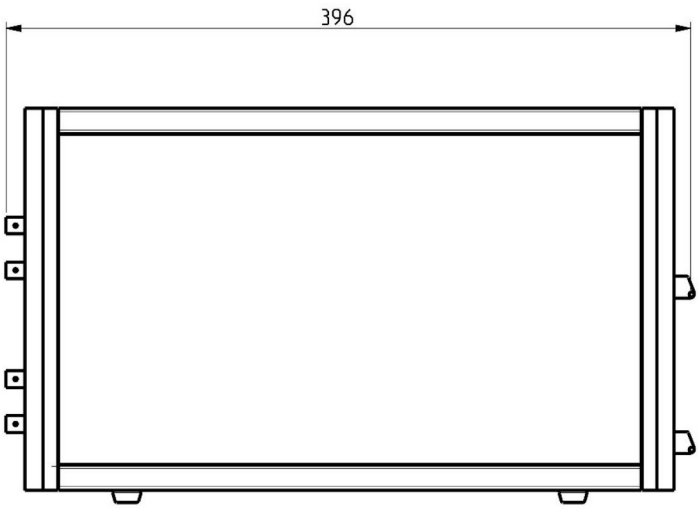


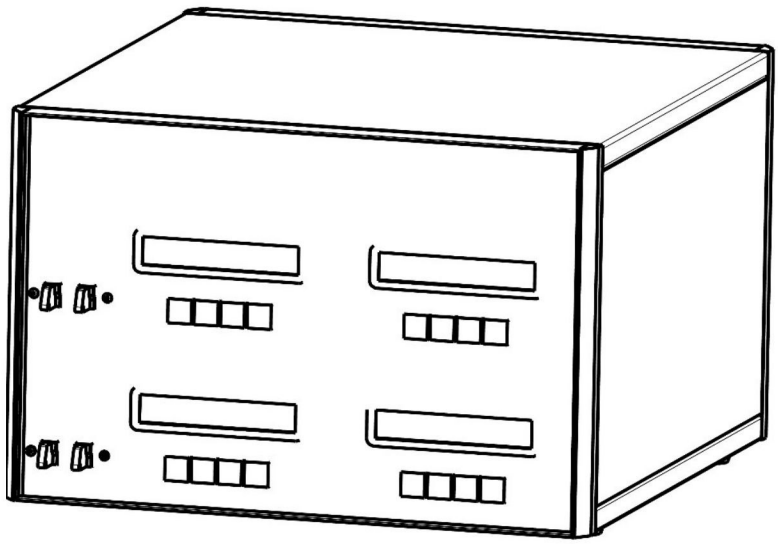
CHR-150L- 2V

Dimensions are indicated in millimeters

Point-sensor controllers (Continued)



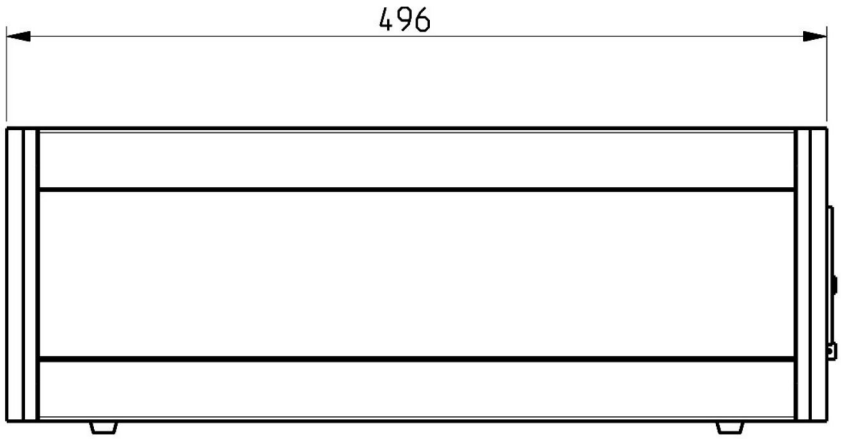


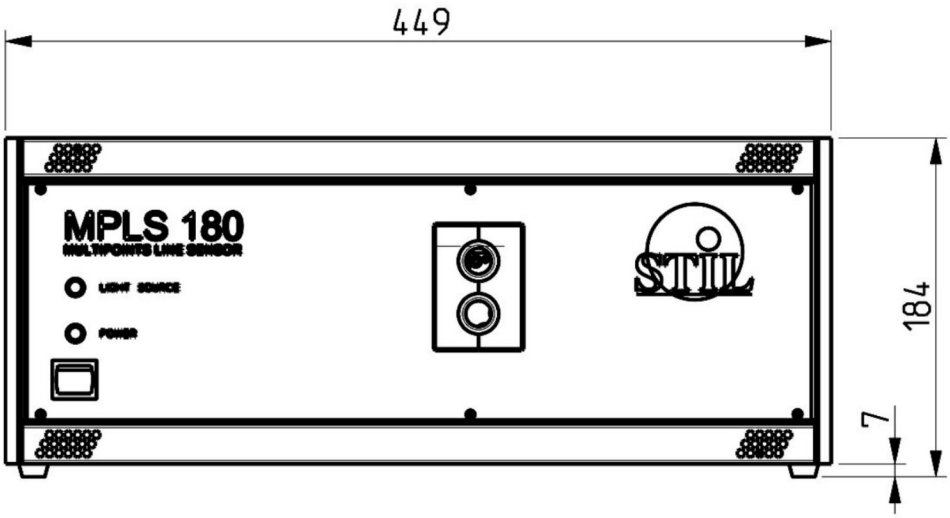


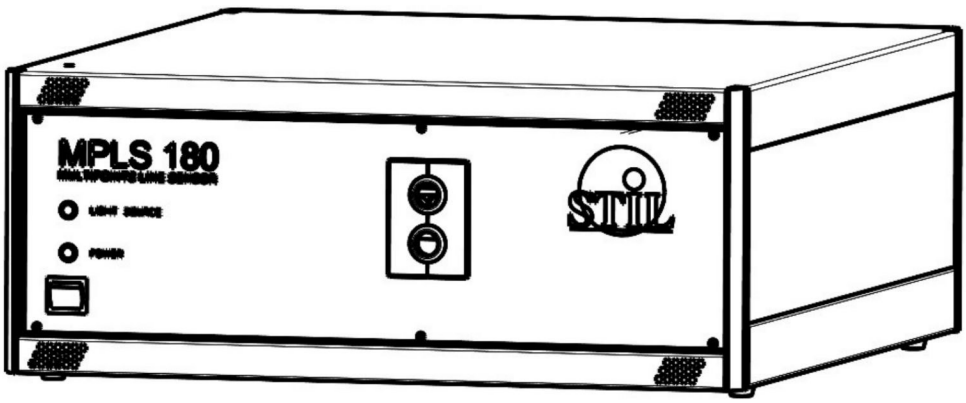
CHR-150L-4V

Dimensions are indicated in millimeters

Line-sensor controllers





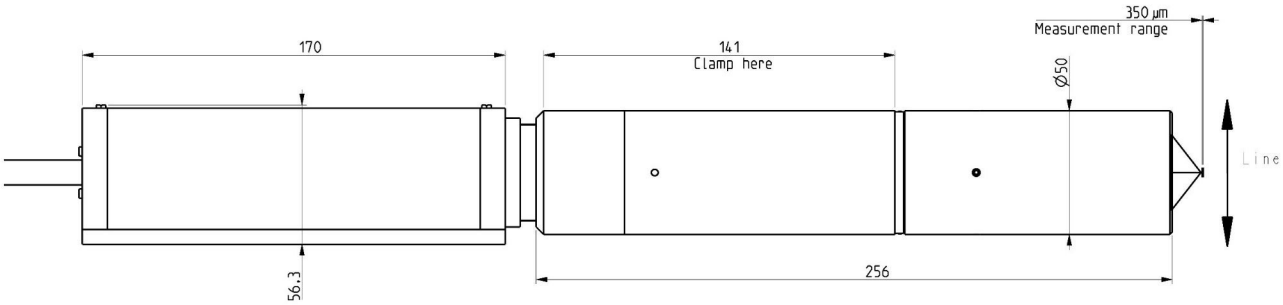


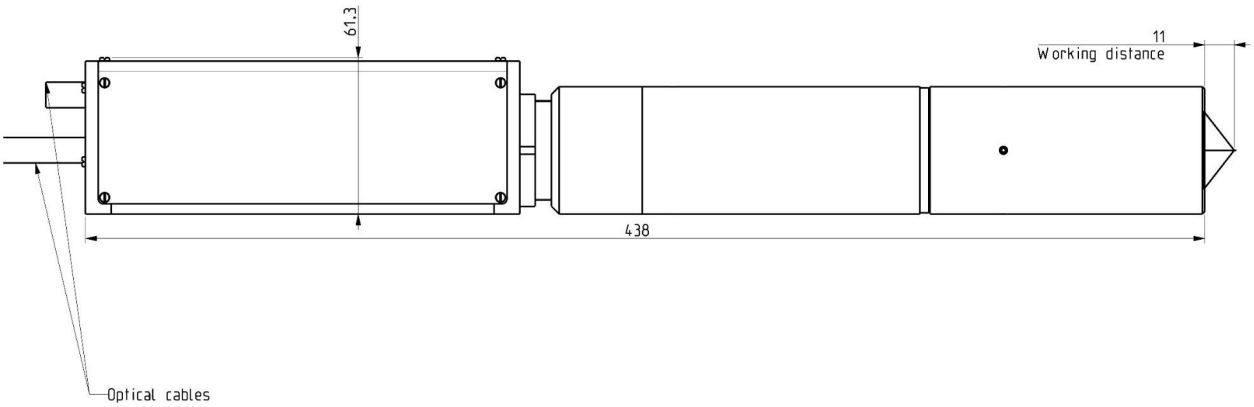
MPLS 180

Dimensions are indicated in millimeters

Optical heads

Optical heads for MPLS-180 and MPLS-DM

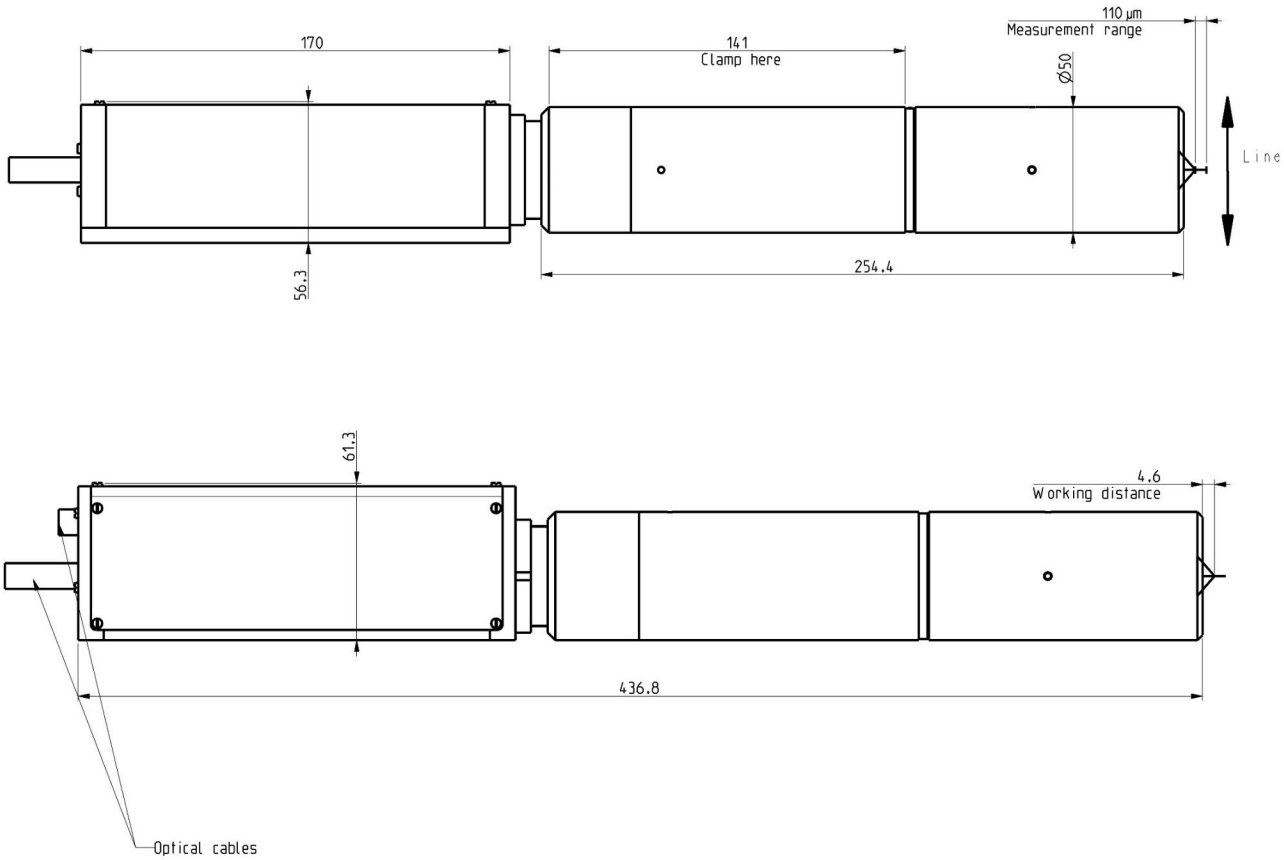




MICROVIEW

Dimensions are indicated in millimeters

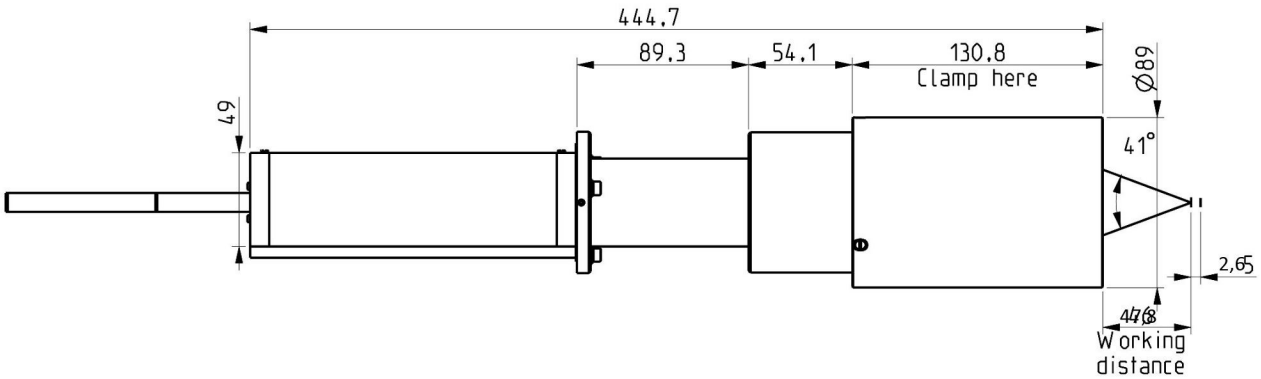
Optical heads for MPLS-180 and MPLS-DM (Continued)

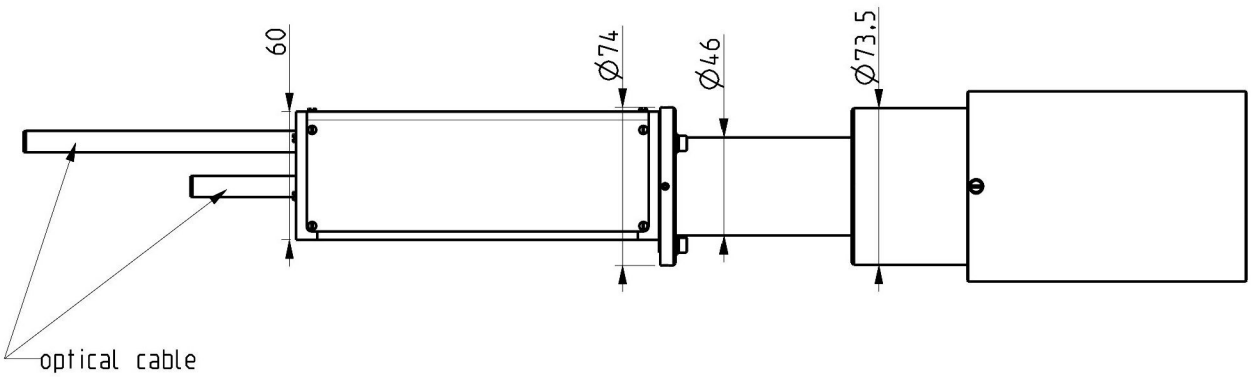


NANOVIEW

Dimensions are indicated in millimeters

Optical heads for MPLS-180 and MPLS-DM (Continued)

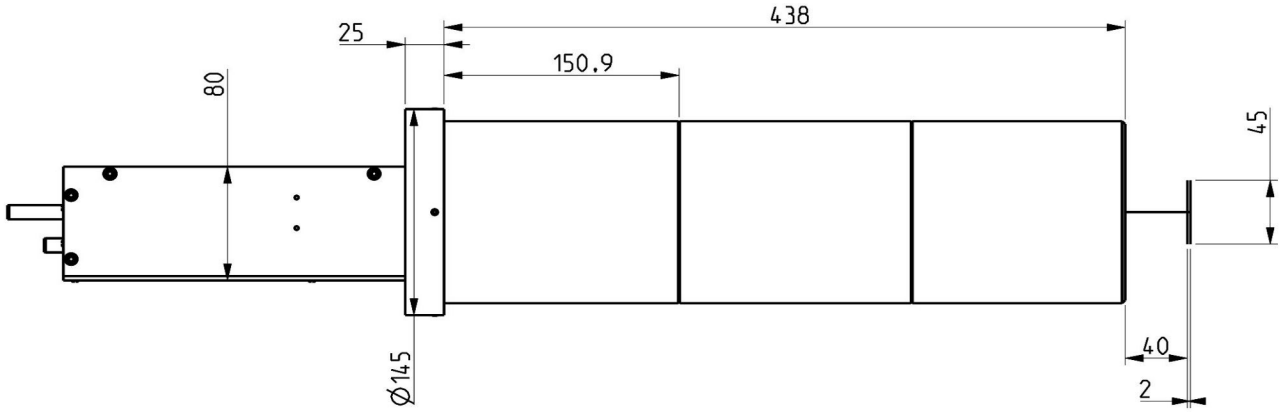


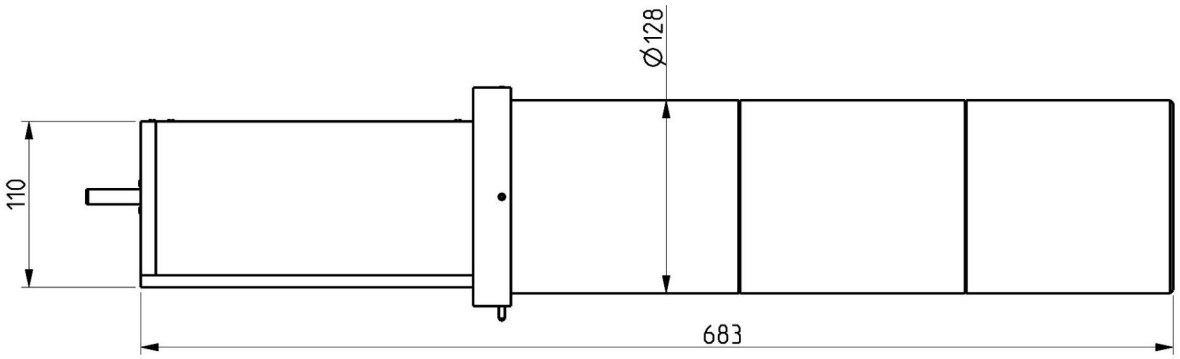


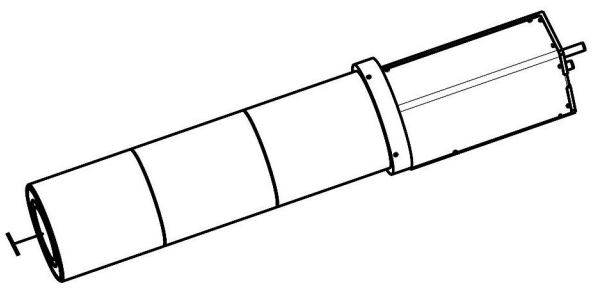
DEEPVIEW

Dimensions are indicated in millimeters

Optical heads for MPLS-180 and MPLS-DM (Continued)





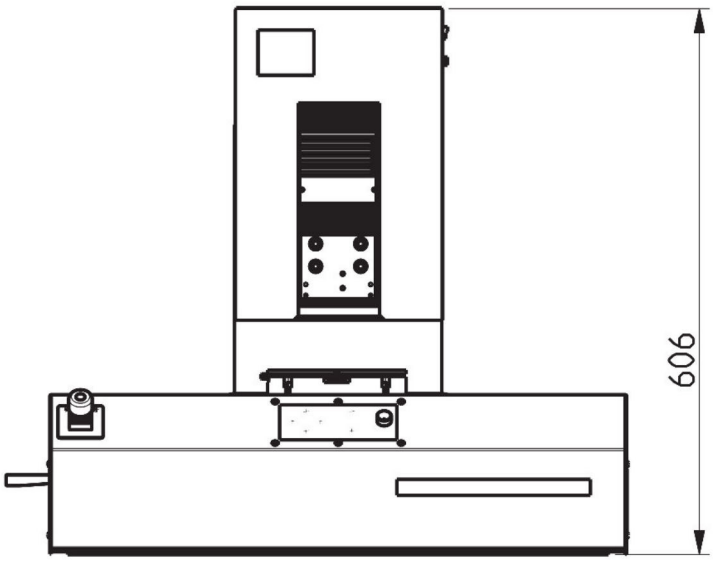


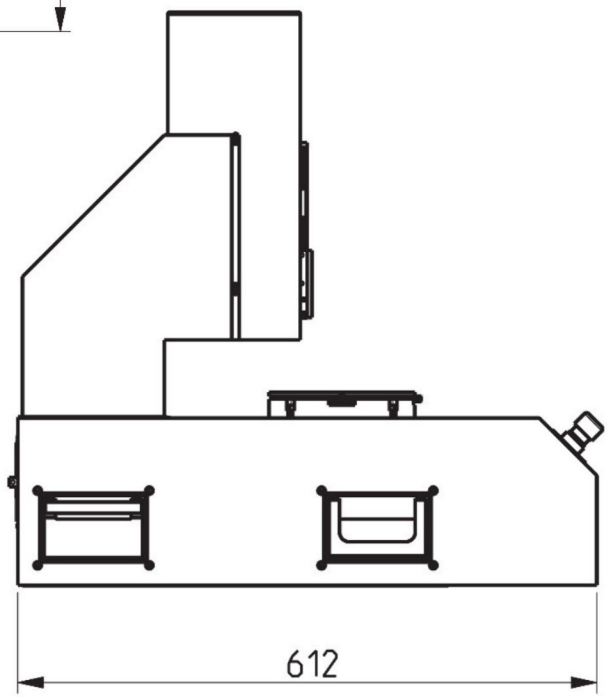
ECHELLE 0.150

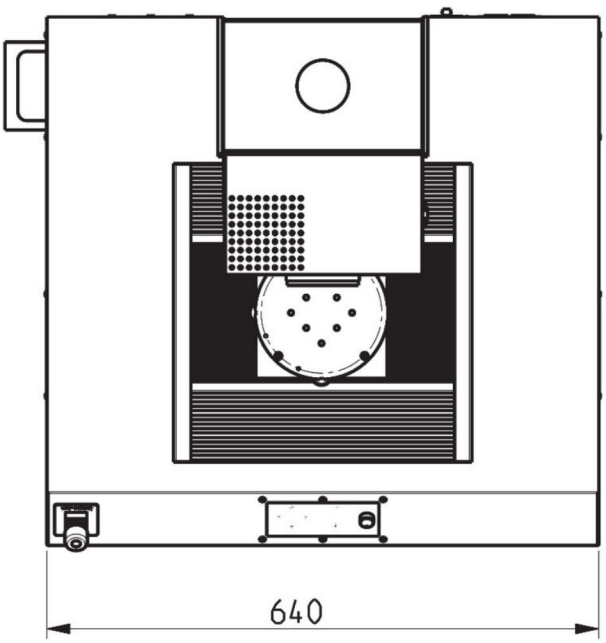
WAVY

Dimensions are indicated in millimeters

Micromesure2 system







MICROMESURE2

Dimensions are indicated in millimeters

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