Chromatic confocal technology for optical measurement of distance and thickness has been used in industry and research for a long time. It is now a mature technology.

Polytec offers a huge variety of sensors for the measurement of any kind of material with exceptional accuracy. These sensors have applications in practically all sectors of industry, whether as high-precision instruments in metrology or research labs, or for quality control on production lines. Designed for use in industrial environments, the TopSens sensors interface quickly and easily with your common equipment.

Highlights

- Measurement on any type of material (metal, glass, ceramic, semiconductors, paper)
- Measurement of polished surfaces (mirrors, wafers) and rough ones
- Instant measurement with no moving parts in the sensor
- Resistant to harsh environments (temperature, pressure, radiation)
- Insensitive to ambient lighting
- ISO 25178 compliant
- Easy to integrate into production lines

TopSens Series
Configurable Chromatic Confocal Point Sensors
Datasheet

TopCSS PRIMA

- A single controller for distance and thickness measurement
- High axial and lateral resolution
- Depth of field of perfect focus
- Compact and light weight
- Easy plugging with optical fibre cable

TopCCS Functions	Application
Auto-LED: LED brightness adapts itself automatically	Samples with variable slope, e.g. lenses
First Peak: the sensor locks on the first surface	Topography on transparent objects or coated samples
Double Frequency: the sensor selects the optimal measurement rate automatically	Samples with high, sharp reflectivity variations, e.g. masks for microelectronics
Hold Last Value: output data smoothing	Difficult samples with many non-measurable points

Measurement frequency	From 100 to 2,000 points/sec; user defined
Multichannel version [1]	Available (2 & 4 channels)
Light source	White LED
Light source brightness setting	Programmable
First Peak Hold Last Value Thickness Calibration Auto-LED [2] Autodark [3] Double Frequency	Yes Yes Yes Yes Yes Up to 1,850 Hz
Measurement modes	Distance Thickness
Calibration tables (max.)	20
Encoder input [4]	Yes (up to 3 axes) – TTL signal input – 30-bit counters (>1 billion step count)
Digital output	30 bit resolution
Analog output	2 configurable outputs [0 ... 10 V] – 16 bit resolution
Digital I/O	USB 2.0 and RS-232/RS-422 (up to 46,800 baud)
Synchronization I/O	1 Synchro input (TTL) / 1 Synchro output (TTL)
Fiber optic connector	E2000 type (push-pull) with Autoprotect system
Compatible optical pens	All chromatic confocal pen types
Power supply/consumption	24 V DC/20 W
Temperature in use	5 °C ... 40 °C
Storage temperature	-30 °C ... 70 °C
Relative humidity in use	5% ... 80% HR without condensation
Protection type	IP 40
EMC	EN 61000-6-3 and EN 61000-6-2 compliant
Weight	1.4 kg
Dimensions [W x H x D]	168 x 138 x 120 mm
Mechanical interface	Integrated DIN rail-mount interface

[1] TopCCS PRIMA 4 multiplexed channels: 1 (out of 4) optical pen can measure at a time; the sensor can switch to another optical pen in about 400 ms.
[2] The Auto-LED function allows the TopCCS PRIMA to dynamically adjust the LED power in order to adapt it to the reflectivity of the measured object.
[3] The Autodark function allows a constant and automatic regulation of the dark signal level of the TopCCS controller.
[4] The incremental encoder input port allows the acquisition of the instant position of the measuring system motion axes (3 axes maximum). These measurements are synchronized with the measurement frequency of the sensor.

Optical Pens

CL-MG Series

Model		CL0		CL1		CL2			CL3		CL4		CL5		CL6	
Measuring range [1]	[µm]	100		150		400			1,400		4,000		12,000		24,000	
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	
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**
Lateral (XY) Properties																
Spot size diameter [5]	[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
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
Mechanical Interface																
Length [7]	[mm]	236.6	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 [7]	[g]	227	192	268	195	248	190	189	215	214	155	140	175	160	195	180
Performances																
Distance Measurement Static Noise [8]																
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 [9]	[nm]	16	14	25	20	55	45	40	150	130	300	250	750	550	1.600	1.200
Measuring rough metal surface [10]	–	R		R		R			R	NR	NR		NR		NR	
Thickness Measurement [11]																
Min. measurable thickness [12]	[µm]	≤5		7.5	9	14	14	22	38	40	110	120	350	550	590	725
Max. measurable thickness [12]	[µm]	≤100		175		510			2,000		5,700		16,500		34,000	
Axial model [13]	–								Standard							
Radial model [13]	–								Optional							

[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 us).

[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 us).

[5] Theoretical spot size, computed for the focalized wavelength (indicative value).

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

[7] Length and weight excluding the fiber optics cable. The values given in this table are for the axial pen model.

[8] 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.

[9] 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.

[10] 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.

[11] Performances in thickness measuring mode depend on the characteristics of the sample. For CCS PRIMA, 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. Thickness calibration may be applied by post-processing. For more information contact your sales engineer.

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.

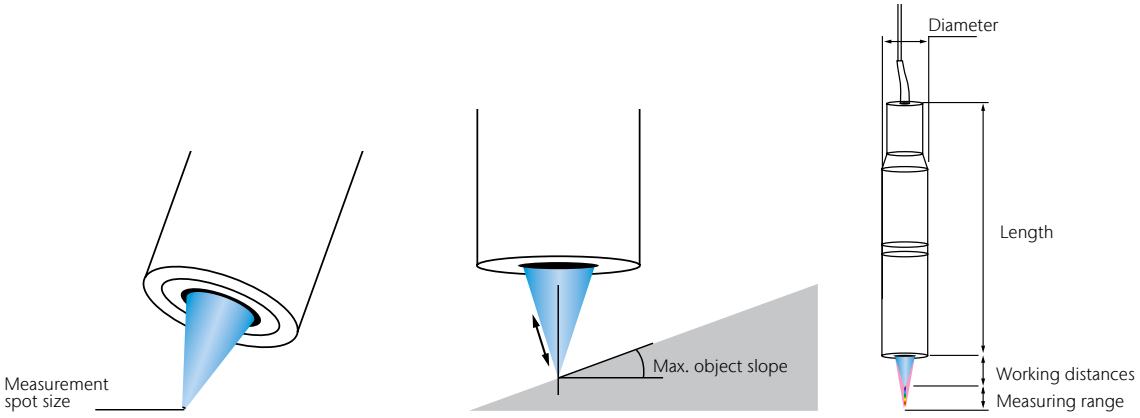
[12] The values in this table are typical values measured at the following conditions: optimal rate, no averaging, min thickness measured at the center of the MR, sample refractive index =1.5 (for measuring air gaps, these values should be divided by 1.5).

[13] 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.

Fiber Optics Cables

E2000 Push-Pull Connector

Model	Length	Core Ø	Max Ø	Sheath
E50-5	5 m	50/125 µm	2.8 mm	Standard
E50-10	10 m	50/125 µm	2.8 mm	Standard
E50-3-M	3 m	50/125 µm	5 mm	armored
E50-5-M	5 m	50/125 µm	5 mm	armored
E50-10-M	10 m	50/125 µm	5 mm	armored
E50-20-M	20 m	50/125 µm	5 mm	armored



Polytec GmbH (Germany)
Polytec-Platz 1-7
76337 Waldbronn
Tel. +49 7243 604-0
info@polytec.de

Polytec GmbH (Germany) Vertriebs- und Beratungsbüro
Schwarzschildstraße 1
12489 Berlin
Tel. +49 30 6392-5140

Polytec, Inc. (USA)
North American Headquarters
16400 Bake Parkway
Suites 150 & 200
Irvine, CA 92618
Tel. +1 949 943-3033
info@polytec.com

Central Office
1046 Baker Road
Dexter, MI 48130
Tel. +1 734 253-9428

East Coast Office
25 South Street, Suite A
Hopkinton, MA 01748
Tel. +1 508 417-1040

Polytec Ltd. (Great Britain)
Lambda House
Batford Mill
Harpenden, Herts AL5 5BZ
Tel. +44 1582 711670
info@polytec-ltd.co.uk

Polytec France S.A.S.
Technosud II
Bâtiment A
99, Rue Pierre Semard
92320 Châtillon
Tel. +33 1 496569-00
info@polytec.fr

Polytec Japan
Arena Tower, 13th floor
3-1-9, Shinyokohama
Kohoku-ku, Yokohama-shi
Kanagawa 222-0033
Tel. +81 45 478-6980
info@polytec.co.jp

Polytec South-East Asia Pte Ltd
Blk 4010 Ang Mo Kio Ave 10
#06-06 TechPlace 1
Singapore 569626
Tel. +65 64510886
info@polytec-sea.com

Polytec China Ltd.
Room 1026, Hanwei Plaza
No. 7 Guanghua Road
Chaoyang District
100004 Beijing
Tel. +86 10 65682591
info-cn@polytec.com

www.polytec.com