NANOPHOX | PCCS Particle Measurement | Laboratory Size and Stability | 0.5 nm to 10,000 nm



107

### **Technical Specifications**



Sympatec develops, manufactures, sells, services and supports a range of best instruments for particle size and shape analysis for laboratory and process applications to customers worldwide. With continuous innovations Sympatec makes a prominent contribution to D laser diffraction, D image analysis, D ultrasonic extinction and D photon cross-correlation spectroscopy.



# Photon Cross-Correlation Spectroscopy

#### **Technical Specifications**

Sensor

## Photon Cross-Correlation Sensor for Particle Size and Stability Analysis

Measuring Principle | Optics | Data Acquisition | Evaluation

Label	NANOPHOX		
Overall measuring range	<sup>1</sup> 0.5 nm - 10,000 nm		
Measuring principle			
Dynamic light scattering	Acquisition of scattered light intensiti	es of particles	
(DLS)	in suspension under thermal motion (	BROWN'ian	
	Motion) at 90°		
Photon	3D cross-correlation		
cross-correlation	Illumination of the same measuring	volume by	
spectroscopy (PCCS)	two separate laser beams		
	Intensity fluctuations recorded by ty	wo independent	
	detectors deploying identical scatte	ring vectors	
	Cross-correlation of the two separa	tely acquired	
	intensity patterns in order to deterr	nine particle	
	size		
	Elimination of multiple scattering e	ffects	
	In accordance with ISO 22412		
Photon correlation spect	croscopy (PCS) included		
12.1.4			
Light source			
Semiconductor laser	A=658 nm (red), Pout=0 30 mW;		
	Software-controlled intensity,		
Drotostion aloss	e.g., to defined scattering intensity		
Frotection class			
Ontical setup			
Two optical paths via her	am splitter alignment_free		
	an spitter, algument-rice.		
Measuring zone			
Refractive index-matchi	ng bath, temperature-controlled, free of	condensation.	
Temperature range	0 to 90°C		
Temperature stability <sup>2</sup>	± 0.1°C*		
Temperature accuracy <sup>3</sup>	± 0.1°C*	* at 20°C	
,			
	Cuvettes	Sample volume	
Cuvettes	Disposable cuvette (acrylic glass)	up to 4 ml	
	Glass cuvette (crown glass)	up to 4 ml	
	Disposable micro cuvette	50 µl to 2 ml	
	(Eppendorf UVETTE®)		
Positioning	X/Y-table, positionable relative to lase	X/Y-table, positionable relative to laser beam	
	(precisely software-controlled)		
Scattering volume	Approx. 5.5 x 10 <sup>-4</sup> µl		
Sample concentration <sup>1</sup>	< 1.0/2 up to approx 20.0/2 by volume		

Sample-dependent 2) Stability: < ±0.3 % with respect to the determination of particle size (for aqueous latex suspension)</li>
Accuracy deviation: < 0.3 % concerning determination of particle size (for aqueous latex suspension)</li>
Depending on particle size, concentration, viscosity 5) Reduced measuring time due to dual-correlation function

Photo detectors	Avalanche photo diodes with subsequent	
Scattering angle	90°	
Measuring time	1 5 min typical <sup>4,5</sup>	
incusting time		
Evaluation modes		
Auto NNLS <sup>a,b</sup>	Inversion procedure based on non-negative least	
	square (NNLS) algorithm with system-defined	
	input values	
	Yields complete particle size distribution	
	with no user input required	
	Automated fit range determination	
	Very high reproducibility	
	Validation possible	
NNLS <sup>a,b</sup>	Inversion procedure based on non-negative least	
	square (NNLS) algorithm	
	Yields complete particle size distribution	
	Individual parameter selection and	
	variation of fit range	
	> Recommendation of optimum fit range (small-	
	est residual) to support user input decision	
2nd Cumulant <sup>b</sup>	Second cumulant approximation	
	Determines median diameter of particles	
	Indicates width of particle size distribution	
<sup>a</sup> Direct volume- and ir	itensity-based evaluation;	
• Optional outlier filter	for robust results	
Stability analysis <sup>6</sup>	Evaluation of the time-based sequence of the	
	cross_correlation function amplitude indicates	
	sample stability concerning particle size	
	distribution	



Detector and data acquisition



Cuvette holde

method 6) Evaluation is done by charting amplitude and count rate as a time series. 7) Applies for certified reference material (e.g., Polystyrene latex nanosphere 100 nm). 8) System-to-system reproducibility 9) No clean room conditions required. Avoid vibrations, draught, and direct exposure to sun light. 10) Microsoft® Windows 8 Pro supported.



## **In Opaque Suspensions and Emulsions** Quality | Periphery | Software | Compliance

Accuracy	σ < 2 %
Repeatability	σ < 1.5 %
Comparability <sup>8</sup>	$\sigma$ < 2 % typical
Quality assurance system	
Certification	Standardised test procedure
Reference material	Polystyrene latex nanosphere 20   100   500 nm
(NIST traceable)	
Operational conditions <sup>9</sup>	
Temperature range	5 to 35°C (41° 95°F), stable within ± 5°C (± 9°F)
Humidity	max. 80 % RH, non-condensing
System specifications	
Dimensions (L/W/H)	445 / 359 / 188 mm
Weight	20 kg
	20 Kg
Supply voltage	90 - 250 V AC, 50 - 60 Hz
Supply voltage Power consumption	90 - 250 V AC, 50 - 60 Hz Standby 31 W
Supply voltage Power consumption	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W
Supply voltage Power consumption	20 kg     90 - 250 V AC, 50 - 60 Hz     Standby   31 W     Laser on   48 W     All on   58 W after 2 min., 110 W peak
Supply voltage Power consumption	20 kg     90 - 250 V AC, 50 - 60 Hz     Standby   31 W     Laser on   48 W     All on   58 W after 2 min., 110 W peak
Supply voltage Power consumption	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup>	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit)
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC,
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware specifications <sup>11</sup>	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC, e.g., Intel® Core i5, 4 GB RAM, HDD 1 TB SATA,
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware specifications <sup>11</sup>	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC, e.g., Intel® Core i5, 4 GB RAM, HDD 1 TB SATA, nVidia® Quadro NVS 300 512 MB, CD-RW/DVD
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware specifications <sup>11</sup>	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC, e.g., Intel® Core i5, 4 GB RAM, HDD 1 TB SATA, nVidia® Quadro NVS 300 512 MB, CD-RW/DVD
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware specifications <sup>11</sup> Interfaces	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC, e.g., Intel® Core i5, 4 GB RAM, HDD 1 TB SATA, nVidia® Quadro NVS 300 512 MB, CD-RW/DVD Ethernet LAN connection (100 MBit/s)
Supply voltage Power consumption Computer specifications Operating system <sup>10</sup> Hardware specifications <sup>11</sup> Interfaces	90 - 250 V AC, 50 - 60 Hz Standby 31 W Laser on 48 W All on 58 W after 2 min., 110 W peak Microsoft® Windows 7 Professional (32 and 64 Bit) Up-to-date desktop PC, e.g., Intel® Core i5, 4 GB RAM, HDD 1 TB SATA, nVidia® Quadro NVS 300 512 MB, CD-RW/DVD Ethernet LAN connection (100 MBit/s)



PC or remote control of sensor application
Evaluation <sup>13</sup>
Particle size and size distribution generated
by various evaluation modes
Mean values and standard deviations
Presentation of results based on user-defined
reports and templates <sup>13</sup>
Diagrams (distribution curves, trend graphs)
Tables and characteristic values
Management of measuring data base
(Firebird®-DB, client/server architecture)
The ISO standard requirements concerning
"Particle size analysis – Dynamic Light Scatter-
ing (DLS)" are met.
The compliance to FDA rule standards
concerning electronic records and electronic
signatures is provided.

TOPE



Dimensions

11) Sympatec reserves the right to supply equivalent or better specified personal computers. 12) Version 5.8.3 or higher required. 13) The recording of measurement results as raw data allows for ex-post recalculation and modification of evaluation and presentation.



# Particle Measurement and Know-how from Pulverhaus

Several Thousand Installations At Particle Professionals Worldwide



TOTAL

### Sales | Service and Partner Organisations



#### **)** Sympatec

Headquarter Pulverhaus Clausthal Germany Centre & North +49 5323 717 0

Germany South & Alps Southeastern Europe Augsburg +49 8231 605 7991

Germany East | Eastern Europe Leipzig +49 341 942 3510

Germany West Pulverhaus | Krefeld +49 2151 978 100 | 101

Nordic Vimmerby SE +46 4964 0220

Switzerland Basel +41 61 303 1040

BeNeLux Etten-Leur NL +31 76 503 1634

12 2014 © Copyright. All rights reserved. All information without guarantee and subject to change without notice. Commonwealth of Independent States (CIS) Ekatarinburg RU +7 343 311 6147

United Kingdom & Ireland Bury GB +44 161 763 5757

France Orsay +33 1 6918 1955

Korea Seongnam +82 31 706 4783

China Head Office Suzhou +86 512 6660 7566

China Beijing Region Beijing +86 10 6831 5728

Sympatec GmbH - System | Partikel | Technik Am Pulverhaus 1, 38678 Clausthal-Zellerfeld Germany Head Office North America USA Northeast & Canada Pennington NJ +1 609 303 0066

USA Middle Atlantic Columbia MD +1 410 299 1746

USA Southeast Charlotte NC +1 704 519 5379

USA Midwest Patricksburg IN +1 812 859 3699

USA West Fort Collins CO +1 970 232 9686

India Mumbai +91 961 925 0418

Contact +49 5323 717 0 sales@sympatec.com

#### ) Partner

Your personal contact

ners

www.sympatec.com