HELOS | RODOS & Co. | Laser Diffraction Particle Measurement | Laboratory Size and Distribution | < 0.1 μm to 8,750 μm

Technical Specifications





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



Technical Specifications

Modular Laser Diffraction Sensor for Particle Size Analysis

Sensor				
Label	HELOS/B	r HELO	S/KR ¹	HELOS/KR-Vario ²
Overall measuring range	0.1 - 875	μm 0.1 – 8	3,750 μm	0.1 – 8,750 μm
Measuring range modules	5	8		8
Measuring principle	_			
Laser diffraction	Forward s	cattering in p	barallel bear	m
	- classic o	ptical Fourie	r set up (ISC	J 13320)
	– open m	easuring zone	e offering u	nique
	working	distance		
Light source				
Helium-neon laser	λ =632.8 r	nm (red). Pout=	=5 mW	
Protection class	3R with o	pen dispersio	n units	
	1 with clo	sed dispersio	n units	
Beam diameter	Automatio	adjustment	to measuri	ng range
	R1 / R2		2.2 mm	
	R3 / R4(T)	/ R5(T)	13.0 mm	
	R6T / R7T		26.0 mm	
	R6T / R7T	/ R8T	35.0 mm	
Measuring ranges and opti	cs			
Discrete measuring ranges	with highe	st precision a	and resoluti	ion ³ .
	D1	Focal length	X _{min} , CLmin Cl	Lmax [*] - X _{max}
HELUS/DK	КI Ро	(I=20 mm)	0.10 0	0.18 - 35.0 μm
	R2	$(f_{-100 mm})$	0.23 0	1.45 - 87.5 μm
	R4T	(f=200 mm)	0.50 0	80 = 350.0 μm
	R5T	(f=500 mm)	0.50 4	50 - 875 0 µm
		(1 000 1111)	0.001	
HELOS/KR	R1	(f=20 mm)	0.10 0).18 - 35.0 μm
HELOS/KR-Vario	R2	(f=50 mm)	0.25 0	.45 - 87.5 μm
	R3	(f=100 mm)	0.50 0	.90 - 175.0 μm
	R4	(f=200 mm)	0.50 1	.80 - 350.0 μm
	R5	(f=500 mm)	0.50 4	.50 - 875.0 μm
	R6T (f	=1,000 mm)	0.50 9	.00 - 1,750.0 μm
	R7T (f=	=2,000 mm)	0.50 18	.00 - 3,500.0 μm
	R8T (f=	=5,000 mm)	0.50 45	.00 - 8,750.0 μm
	* Values ir	idicate lower	upper lim	its of first class.
Typical measuring				
range combinations				
Iriple lens holding disc	R2 R4	R6T	0.25 9.0	00 - 1,750.0 μm
Quad lens holding disc	R1 R3	35 R7T	0.10 18	.00 - 3,500.0 μm

Detector and data acquisition				
Multi-element detector	31 semi-circular segments (180°) for orientation-			
	independent characterisation of even irregular			
	shaped particles			
	3 centre elements for precise autofocus prior to			
	every measurement and for continuous monitoring			
	of optical	concentration of	during measu	rement
Acquisition rate	2,000 diff	raction patterns	s per second	
Raw data recording	in up to 24	48 intensities		
Typical measuring times	Distribution wid	dth Measuring time ⁴	Sample amount ⁴	Standard deviation ⁵
minimum	narrow ⁶	< 10-100 ms	< 10-100 mg	< 1.0-1.5 %
	normal ⁷	< 0.1-1 s	< 0.1-< 1 g	< 1.5 %
	wide ⁸	< 1-10 s	< 1-10 g	< 2.0-2.5 %
recommended	narrow ⁶	1-3 s	< 0.1-2 g	< 1.0-1.5 %
	normal ⁷	2-10 s	< 1-10 g	< 1.0-1.5 %
	wide ⁸	5-30 s	< 10-100 g	< 1.5-2.0 %
	If continuous sample feeding is granted, sample			
	amount as well as measuring time is virtually			
	unlimited. In doing so, maximum standard			
	deviation of three consecutive measurements			
	always remains below 2.5 %.			

Evaluation modes	
FREE	Fraunhofer Enhanced Evaluation
	(Fraunhofer diffraction, parameter free)
MIEE ¹⁸	Mie Extended Evaluation
	(Mie Scattering, deploying the complex
	refractive index)
Combination of	Automatic combination of up to 4 high-resolution
measuring ranges ¹⁸	measuring ranges capturing wide distributions
	$(ratio x_{90}/x_{10} > 1,000)^9$
	Calculation of an aggregated particle size distribu-
	tion with up to 57 size classes out of a maximum of
	124 independent observations.

Quality of measuring results				
Accuracy	σ±1%	mean relative standard deviation		
		to absolute value (x ₁₀ x ₉₀)		
Repeatability ¹⁰	$\sigma < 0.04$ %	typical, wet measurement ¹¹		
	$\sigma < 0.3$ %	typical, dry measurement ¹²		
Comparability ¹³	σ < 1 %	mean relative standard deviation		
		of median (x ₅₀)		
	 Δx ₅₀ < 2.5 %	maximum relative deviation		

Adaptable Dispersion Units

for Powders, Granules, Aerosols, Sprays, Inhalants, Suspensions, Emulsions, Bubbles, Gels, ...

Dispersing Units and Feeder ¹⁴			Wet ¹⁷		
				Dispersing range	Analysis volume
Dry ¹⁵			SUCELL		
	Dispersing range	Sample amount per analysis	Closed loop flow-through cell for	0.1 - 875 μm	400 ml
RODOS	< 0.1 - 3,500 µm	< 1 mg - 1,000 g	suspensions and emulsions;		
Injection disperser for finest,			built-in sonication (0-72 W);		
even cohesive powders			small volume adapter (SVA) ¹⁸		50 ml
GRADIS	0.5 - 8,750 μm	10 - 1,000 g	QUIXEL	0.1 - 3,500 μm	250 - 1,000 ml
Gravity disperser for coarser,			Closed loop flow-through cell for		
even fragile particulate systems			suspensions and emulsions, even with		
			coarser, high density particles;		
VIBRI ¹⁶	< 0.1 - 10,000 µm	1 mg - 1,000 g	built-in sonication (0-72 W);		
vibratory feeder for precise dosing			heatable ¹⁸		
and feeding of dry particulate					
systems			CUVETTE		
			Stationary cuvette for precious suspen-	0.25 - 3,500 μm	50 ml
ASPIROS ¹⁶	0.1 - 875 μm	< 1 mg - 1 g	sions and emulsions of small volume;		
micro dosing system for feeding			external sonication (0-60 W) and		
small amounts of precious or toxic			magnetic stirrer;		
dry substances in encapsulated			for smallest quantities with	0.1 - 87.5 μm	6 ml
sample vials			manual stirrer		
Dry and wet			Sprays and Inhalants		

OASIS		
Combines RODOS	< 0.1 - 3,500 µm	0.5 mg - 1,000 g
and SUCELL;	0.1 - 875 μm	400 ml

VIBRI or ASPIROS

for feeding of dry samples¹⁶



1) For special applications also available with open measuring zone of doubled width (HELOS/KR+) for inclusion of up to two dispersing units. 2) Open and variable measuring zone. R8 with gravity disperser GRADIS only. 3) User defined configuration of up to four precision lens modules per lens holding disk. 4) By tendency, lower values apply to finer, upper values to coarser particulate systems, respectively. Stated amounts valid for densities up to 2 g/cm³. 5) Maximum standard deviation in any size class of three consecutive measurements (repeatability). Sample splitting error < 0,5 %. 6) x_{min} ... x_{max}: 1 decade (e.g., 1 ... 10 μm). 7) x_{min} ... x_{max}: 2 decades (e.g., 1 ... 100 μm). 8) x_{min} ... x_{max}: more than two decades (e.g., 1 ... 1,000 μm). 9) Using a single lens holding disc. By using another lens holding disc further measuring ranges may be added.

10) The given values are valid for measurements with reference material SiC P600 related to the x_{g_0} -value. 11) Repeated wet measurement of the same sample in closed-loop SUCELL 12) Repeated dry measurement of riffled sample with RODOS. 13) System-to-system reproducibility. 14) Stated size ranges are application dependent.



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SPRAYER	0.25 - 1,750 μm	1 dose
Actuator (force or trajectory) for spray		
cone analysis of MDIs and various sprays		
INHALER	0.25 - 1,750 μm	1 dose
INHALER Vacuum controlled adapter for aerosol	0.25 - 1,750 μm	1 dose
INHALER Vacuum controlled adapter for aerosol analysis of DPIs, MDIs, nebulizers and	0.25 - 1,750 μm	1 dose
INHALER Vacuum controlled adapter for aerosol analysis of DPIs, MDIs, nebulizers and various sprays;	0.25 - 1,750 μm	1 dose

collectors¹⁸, pre-seperator¹⁸



15) Recommended optical concentration for particle size analysis with dry dispersing units: c_{opt} =5-15 %, ideally c_{opt} =8-12 %. 16) RODOS and GRADIS typically with dry feeding unit VIBRI. Feeding of RODOS with ASPIROS, alternatively. 17) Recommended optical concentration for particle size analysis with wet dispersing units: c_{opt} =15-25 %. 18) optional.

HELOS | R-Series | Laser Diffraction

The Modular Classic



Systems for Particle Size Analysis Sensors | Dispersers | Evaluation | Quality

Quality assurance system		Compliance				
Certification	Standardised test procedure	ISO 13320	The ISO standard requirements concerning		ncerning	
Reference material	erence material SiC-F1,200 $(x_{50} \approx 4.5 \ \mu m)$		"Particle size and	alysis – Laser diffr	action methods"	
	SiC-P600 (x ₅₀ ≈ 27 μm)		are met and in parts outperformed.		d.	
	SiC-P80 ($x_{50} \approx 260 \ \mu m$)	FDA 21 CFR Part 11	The compliance	to FDA rule stand	ards concerning	
	SiC-P50 (x ₅₀ ≈ 430 µm)		electronic records and electronic signatures is		signatures is	
Validation	according to FDA regulations		provided.			
Software		System specifications				
PAQXOS	PC or remote control of application in terms of		HELOS/BR	HELOS/KR	HELOS/KR-Vario	
Control and evaluation	sensor, dispersing units and sample feeding	Dimensions (L/W/H) mm	705/279/322	1,102/279/322	2,020/279/501	
software for particle	Evaluation	Measuring zone mm	123	123	123 to 1,400	
size analysis	- Fraunhofer Enhanced Evaluation (FREE)				variable	
	– Mie Extended Evaluation (MIEE) ¹⁸	Weight kg	30	35	70	
	- mean values and standard deviations	Supply voltage	90 - 250 V AC @ 50-60 Hz			
	- combination of measuring ranges ¹⁸	Power consumption	Standby	0.1 W		
	Presentation of results based on user defined		Laser on	31 W		
	reports and templates		Ready	43 W		
	- diagrams (distribution curves, trend graphs)	Compressed air ¹⁹	Supply	max. 6 bar ISO	8573-1 Class 3	
	– tables		Consumption	typical 200 l/mir	n max. 300 I/min	
	– characteristic values	Extraction ²⁰	Application depe	endent industrial e	extraction unit	
	Step-by-step wizard for quick and successful	Computer specifications				
	measurements	Operating system ²¹	Microsoft® Wind	lows® 10 Professio	onal (64 Bit)	
	Intuitive SOP management	Hardware specification ²²	Up-to-date desktop PC, e.g., Intel® Core™ i7-7700, min. 3.6 GHz, 8 GB RAM, 8 MB Cache, SSD PCIe 512 GB, Intel® HD Graphics			
	User-friendly, individual user interface				6 GHz, 8 GB RAM,	
					el® HD Graphics	
			630 (integrated)	, DVD±RW		
		Display	27" Full HD (2.56	60 x 1.440 px)		
Interfaces Ethernet LAN connection (nnection (100 ME	00 MBit/s)			



19) Required in conjunction with injection disperser RODOS (resp. OASIS). 20) Required in conjunction with dry dispersers RODOS (resp. OASIS) and GRADIS. 21) Microsoft® Windows® 7 Professional (64 Bit) supported.
22) Sympatec reserves the right to supply equivalent or better specified personal computers.
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