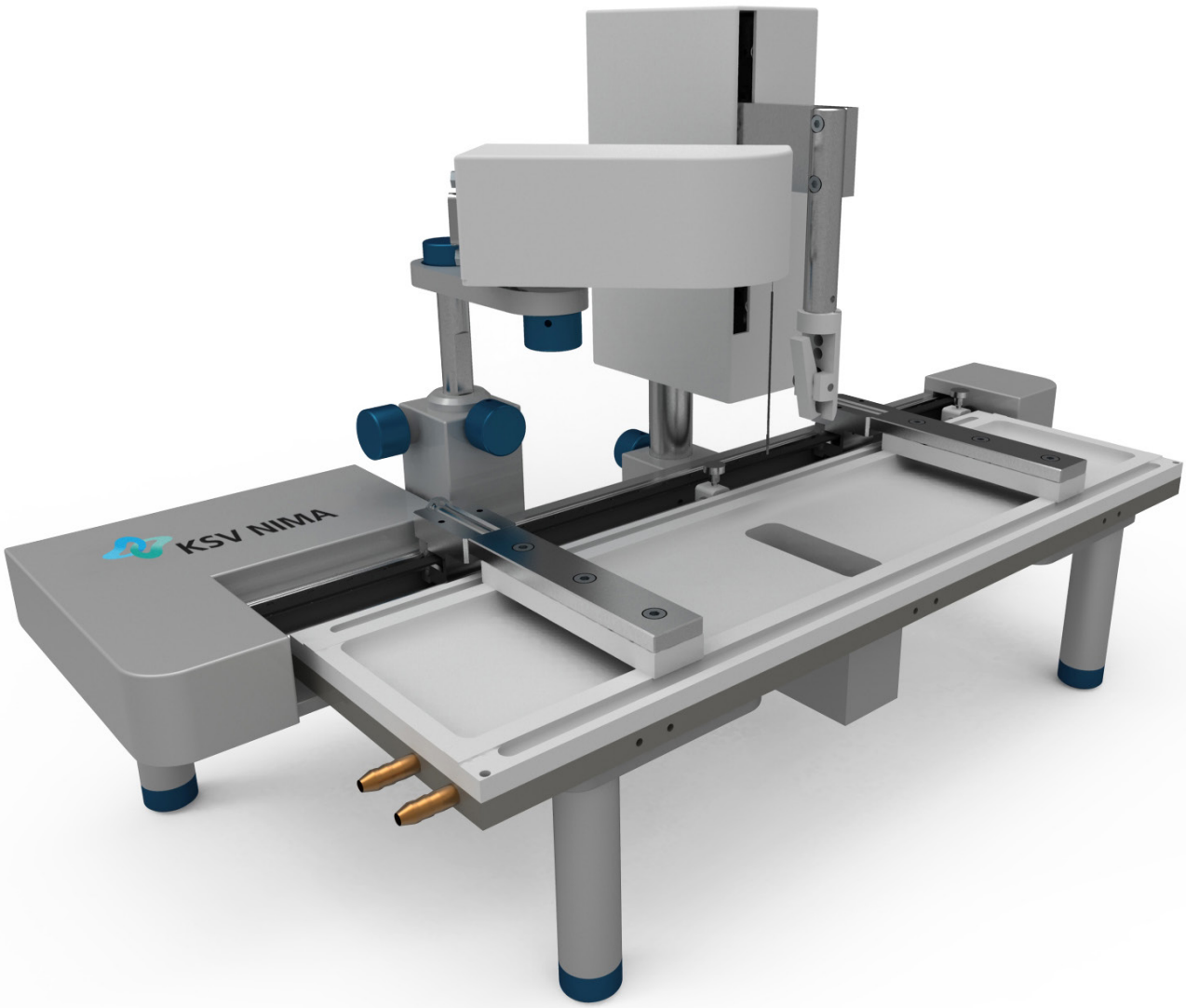
Biolin Scientific
[Progress Together]

KSV NIMA

Langmuir and Langmuir-Blodgett Deposition Troughs

Create and define thin films

- Molecular layers with precise control of thickness, molecular orientation and packing density
- Controlled nanoparticle and graphene deposition
- Verified modelling of biological membranes
- The widest selection of Langmuir, Langmuir-Blodgett Troughs and characterization tools
- Fully modular system with optimized performance based on over 30 years of experience

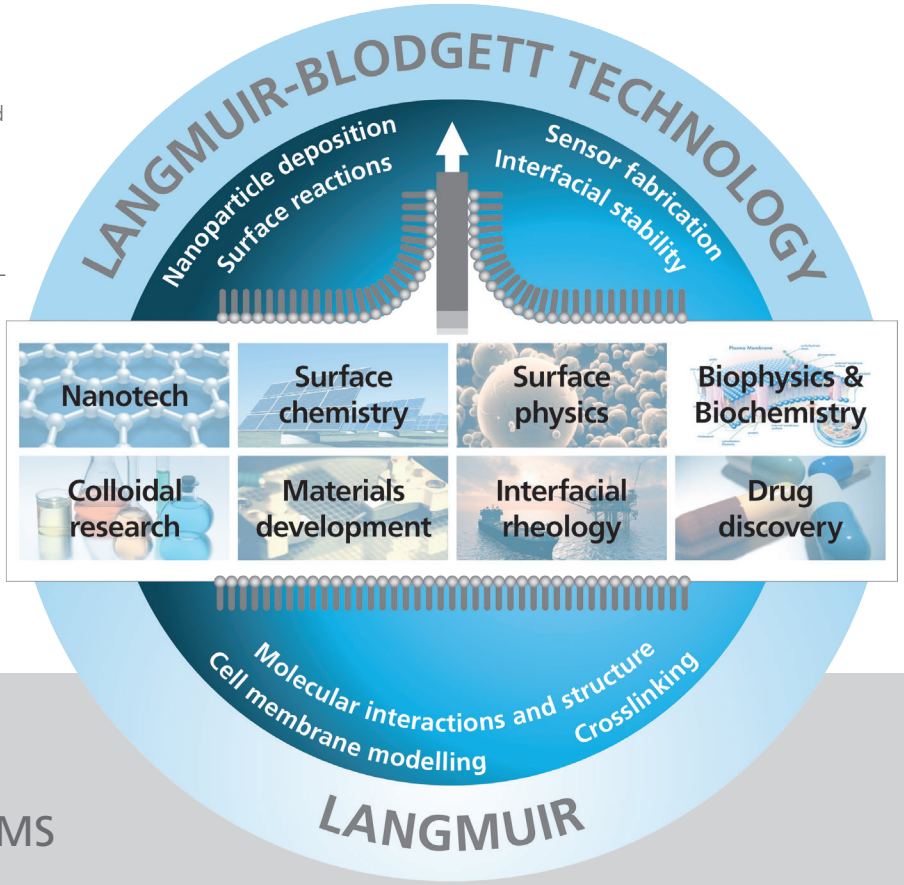


The widest range of Langmuir and Langmuir-Blodgett Deposition Troughs

KSV NIMA has applied over 30 years of expertize to make our Langmuir (L) and Langmuir-Blodgett (LB) deposition troughs the leading instruments for fabrication of organized monolayers and multilayer molecular structures at interfaces with precise control of thickness, molecular orientation and packing density.

We offer the widest range of L&LB troughs on the market and also offer characterization tools including KSV NIMA ISR, PM-IRRAS, BAM, MicroBAM and SPOT to measure the viscoelastic properties, molecular orientation, chemical composition and visualization of thin films.

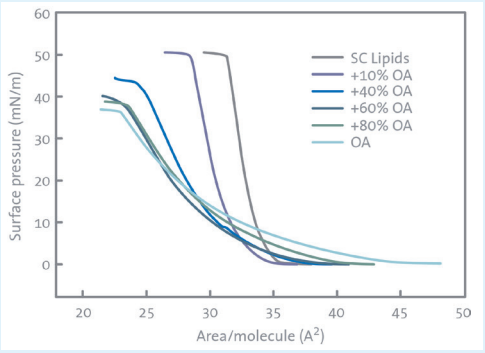
KSV NIMA Trough design is based on our long experience optimizing the experimental performance and usability. KSV NIMA L&LB Troughs work with intuitive and easy to use KSV NIMA LB software, and combining this with our knowledge and application support team let you to get the best out of your instrument.



CREATE AND DEFINE THIN FILMS

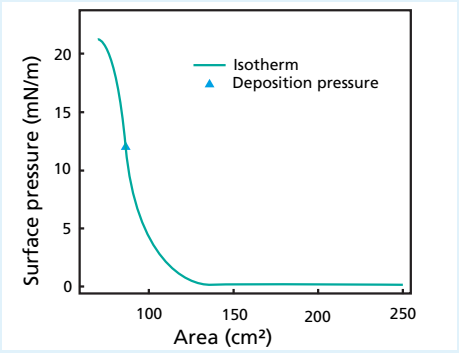
[APPLICATION EXAMPLES]

Unique tool for biomembrane modelling



THE ISOTHERMS OF MODEL SKIN LIPIDS WITH INCREASING LEVELS OF OLEIC ACID. With permission from Langmuir 2013, 29 (15), pp 4857–4865. Copyright 2013 American Chemical Society.

Controlled graphene & nanoparticle deposition



CdSe-NANOCRYSTALS WERE COMPRESSED TO A SURFACE PRESSURE OF 12 mN/m FOR DEPOSITION. The figure above displays the surface pressure - area isotherm obtained during compression. Adapted with permission from Langmuir 2010, 26 (11), pp 7732-7736. Copyright 2010 American Chemical Society.

Optimized experimental performance and usability based on over 30 years of experience

KSV NIMA Langmuir and KSV NIMA Langmuir Blodgett trough tops are made from single pieces of pure PTFE for optimized cleanliness and reliability. This unique design prevents any leakage in any part of the trough top including the dipping well. It avoids the use of potentially contaminating glues or other seals.

Standardized method to measure surface pressure with Wilhelmy platinum plates. Platinum rod and paper plates also available to meet all needs.

The widest range of specialized characterization tools for thin films to measure viscoelastic properties, molecular orientation, chemical composition and visualization.

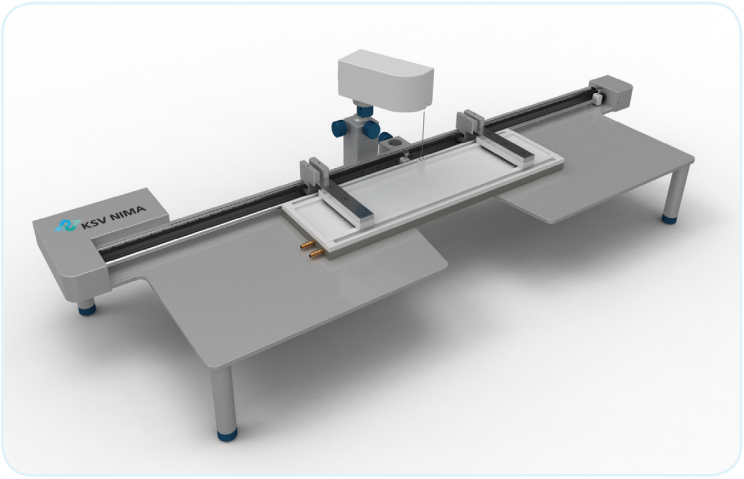
Powerful and intuitive software satisfying novice and experienced user's needs. See details below.

Ultra-sensitive surface pressure sensor for extremely precise measurements.

Open design and modularity enables easy placement of trough tops into the frame allowing easy exchange with another trough top within seconds, combining it with other characterization systems and easy cleaning of the trough top surface.

Integrated sub-phase temperature control facilitated by aluminum heat/cool base plate operated by external circulating water bath (the water bath is sold separately).

Optimized usability with many detailed design solutions such as adjustable legs for fast and easy levelling, locating pins of trough top, barrier limit switches and overflow channels.



KSV NIMA LB Software

The KSV NIMA LB software allows the user to perform a variety of pre-programmed methods which cover the best known L and LB film experiments. These pre-programs can be modified further for particular needs. The recordable parameters are: data point number, time, barrier position, barrier speed, trough top area, molecular area, dipper position, dipper speed, layer number, transfer ratio, cumulative transfer, temperature, pH and surface potential.

Standard programs include:

• Compression/relaxation isotherms: measuring surface pressure as a function of mean molecular area, remaining area, time or any other measured parameter.

• Analysis of monolayer kinetics (enzyme kinetics, monolayer hydrolysis, polymerisation, or any other zeroth-order reactions).

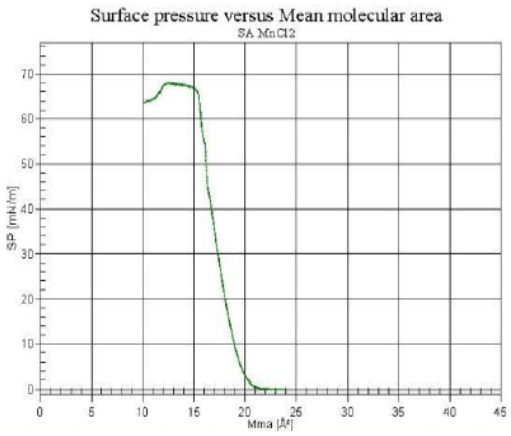
• Analysis of monolayer penetration, solubility and binding of biomolecules (enzymes, proteins, peptides etc.).

• Isochores and Isobars: increase or decrease of surface pressure/temperature, surface pressure/time, or surface pressure/any desired measurable parameter can be plotted.

• Dilational rheology: oscillating barriers for monitoring viscoelastic properties at desired surface pressure.

• Dipping: both Langmuir-Blodgett and Langmuir-Schaefer modes allow the control and monitoring of surface pressure, dipping speed, stroke length, deposition profiles and transfer ratio.

After an experiment has been performed the user can return to the data for further analysis in the data reduction and analysis section. Different experimental data can be displayed on the same graph for comparison. Calculation of additional results and export of data can be done. There is an option of viewing and editing the experimental setup which can be very helpful if the data produced should be recalculated based on new information about the materials.



Screen shoot KSV NIMA LB software; Surface pressure against mean molecular area for steric acid in water - $MnCl_2$

Create, characterize and deposit Langmuir films

Langmuir films

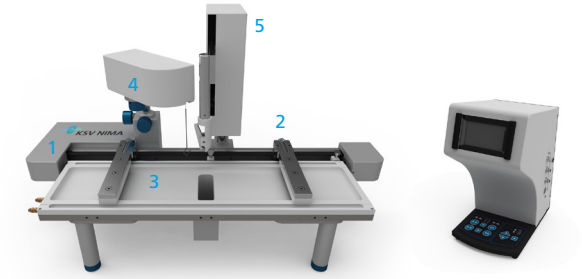
KSV NIMA Langmuir Troughs are used to create, modify and study Langmuir films. A Langmuir film can be defined as an insoluble monolayer of functional molecules, nanoparticles, nanowires or microparticles that reside at the gas-liquid or liquid-liquid interface. The fact that these molecules can move freely at the interface provide great flexibility for controlling the packing density and studying monolayer behaviour.

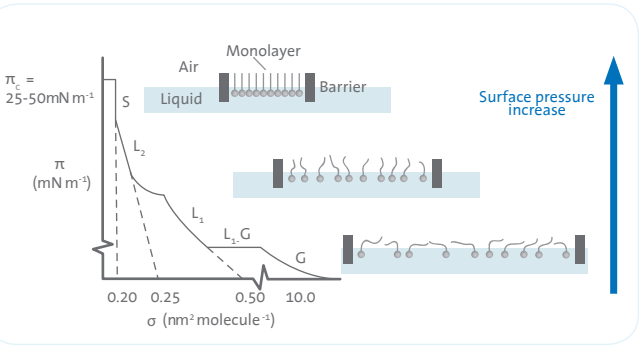
A Langmuir film is created by depositing material on an aqueous subphase confined in a shallow chamber called trough top (3). The monolayer can then be compressed with the help of a set of barriers (2). The surface pressure thus the packing density is controlled via the pressure sensor (4) of the Langmuir Trough.

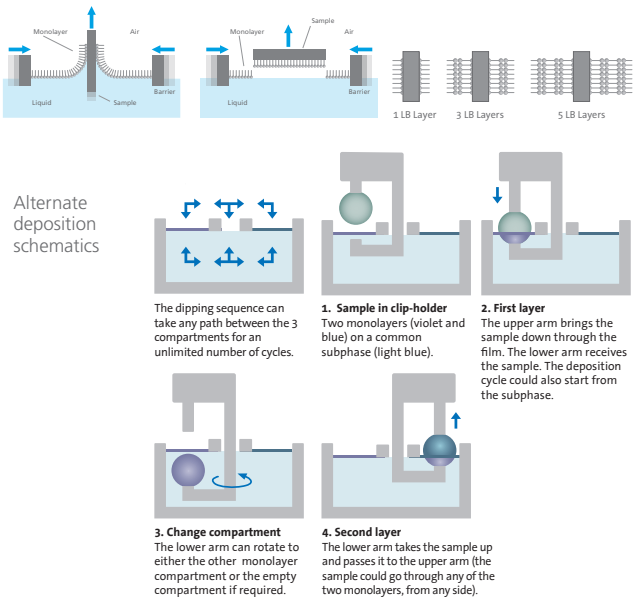
The Langmuir Trough allows you to infer how particular molecules pack together while confined in two dimensions. The surface pressure-area isotherm can also provide a measure of the average area per molecule and the compressibility of the monolayer.

In a typical isotherm measurement a monolayer is organized under compression, starting from a two dimensional gas phase (G) moving through a liquid phase (L) to a fully organised solid phase (S). In the gas phase the molecules are not strongly interacting with each other. When the surface area is decreased the molecules become more closely packed and start to interact with each other. At the solid phase the molecules are completely organized and the surface pressure increases dramatically. At the maximum surface pressure the collapse point is reached after which the monolayer packing is no longer controlled.

Creating of Langmuir films enables characterization of molecular adsorption kinetics, phase transitions and molecular structural properties. Additional chemicals can be injected with a special port design to understand further molecular interactions and surface reactions. Our software also includes a program for dilation rheology to evaluate interfacial viscoelasticity and stability. Please ask further information for enzyme kinetics and later conductivity studies that demand special Trough design.







Langmuir-Blodgett deposition

KSV NIMA Langmuir-Blodgett Deposition Trough (LB Trough) is very similar to a KSV NIMA Langmuir Trough as it also enables Langmuir film fabrication and study. In addition, a LB Trough is equipped with a dipping well and a dipping mechanism (5). The well makes room for the solid sample below the Langmuir film. The dipping mechanism is used to transfer the Langmuir film onto a solid substrate at the desired packing density. Typical deposited films include lipids, polymers, nano- and microparticles and various functional organics.

In the case of Langmuir-Blodgett (LB) deposition the sample is moved vertically through the monolayer while in the case of the Langmuir-Schaefer (LS) method the sample is brought to the interface horizontally (i.e. no need for a trough top with a well).

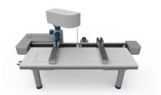
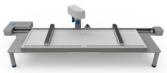
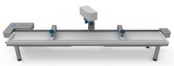
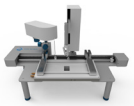
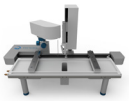
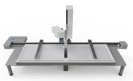
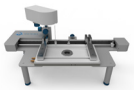
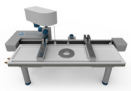
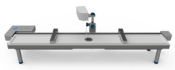
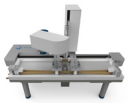
Nanoscale films of custom thickness can be built up by repeating the deposition techniques. When using the LB and LS techniques, both hydrophilic and hydrophobic samples can be coated with a monolayer from either the liquid phase or the gas phase. Density, thickness and homogeneity properties are preserved when transferring the Langmuir film onto the sample, giving the possibility to make organized multilayer structures with varying layer composition.

Compared to other organic thin film deposition techniques, LB is much less limited by the molecular structure of the functional molecule. This means that it is often the only technique that can be used for bottom-up assembly. Deposited films can be further analyzed, for example by using KSV NIMA infrared reflection absorbance spectroscopy (PM-IRRAS).

Fully modular system - various functionalities

Langmuir films

KSV NIMA offers L&LB Troughs with various sizes and functionalities. Our system is fully modular, and one frame can be used for different sizes and types of trough tops. Please see our standard offering below, and if you don't find suitable one for your studies, please feel free to contact us for custom dimensions. Detailed specifications are available in the specification chart (last page).

Extra small	Small	Medium	Large	Liquid-Liquid	High Compression (ISR)	Alternate
Langmuir Troughs						
 KN 1001	 KN 1002	 KN 1003	 KN 1006	 KN 1004	 KN 1005	
Langmuir-Blodgett Deposition Troughs (A = Alternate)						
	 KN 2001	 KN 2002	 KN 2003			 A = KN 2006
Microscopy Troughs (U = upright, I = inverted)						
	 U = KN 3001 (no inverted)	 U = KN 3005 I = KN 3003			 U = KN 3002 I = KN 3004	
Ribbon Barrier Troughs (L = Langmuir, LB = Langmuir-Blodgett)						
		 L = KN 1007 LB = KN 2005				
STANDARD FRAME			LARGE FRAME	HIGH COMPRESSION FRAME		ALTERNATE FRAME

[SPECIAL TROUGH TYPES]

Liquid-Liquid Trough
A Liquid-Liquid Trough enables monolayer studies at the oil-water interface. When combined with an ISR, a Liquid-Liquid Trough enables the study of viscoelasticity at the oil-water interface.

High Compression Trough (ISR Trough)
A longer but narrower trough, the High Compression Trough provides a higher compression ratio. Specifically designed for use with the Interfacial Shear Rheometer (ISR), but the High Compression Trough can be used to increase performance with other characterization instruments.

Microscopy Troughs
A Microscopy Trough has the same dimensions as a standard trough while featuring a sapphire window in the base of the trough top allowing high optical transmission down to a wavelength of 200 nm (suitable for visible light or UV microscopy). Inverted microscopy featuring a glass window is also possible with some trough sizes.

Ribbon Barrier Trough
A Ribbon Barrier Trough can be used either in Langmuir or Langmuir-Blodgett deposition configurations. Specially designed for lung surfactant studies, the PTFE coated glass fiber ribbon enables higher packing densities (e.g. >70 mN/m for DPPC) than the standard barriers used in standard systems.

Alternate-Layer Deposition Trough
An Alternate trough used to deposit alternating layers of two materials, with a two compartment trough, two surface pressure sensors and two pairs of barriers. The substrate can be moved through any of the two monolayers or water in the desired order.

Accessories
KSV NIMA offers also the widest range of accessories including pH and temperature monitoring, magnetic stirrer, injection port, various sizes of standardized Wilhelmy plates, rod and paper plates. Please see more details from our accessory list. Surface potential sensor (KSV NIMA SPOT) and miniature Brewster Angle Microscopes (KSV NIMA MicroBAM) are also commonly utilized as standard characterization tools together with L&LB system to provide basic complementary data about molecular orientation and packing, and visualization.

[SPECIFICATIONS AND COMPATIBILITY CHART]

	Extra Small	Small	Medium	Large	Liquid-Liquid	(ISR) High Compression	Alternate
Surface area (cm^2)	150	98	273	841	580 (423*)	587	586 (x2**)
Trough top inner dimensions (L x W x H mm)	300 x 50 x 1.2	195 x 50 x 4	364 x 75 x 4	580 x 145 x 4	784 x 74 x 7 (784 x 54 x 5*)	782 x 75 x 5	782 x 75 x 5 (x2**)
Maximum compression ratio	8.7	5.2	10.8	18	24.7	24.7	3,9
Barrier speed (mm/min)	0.1...270	0.1...270	0.1...270	0.1...270	0.1...270	0.1...270	0.1...270
Balance measuring range (mN/m)	0...300	0...300	0...300	0...300	0...300	0...300	0...300
Maximum balance load (g)	1	1	1	1	1	1	1
Balance resolution (µN/m)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Langmuir trough top	•	•	•	•	•	•	-
Total subphase volume (mL)	18	39	109	336	406 (212*)	293	-
Langmuir-Blodgett trough top	-	•	•	•	-	-	•
Total subphase volume (mL)	-	57	176	578	-	-	1400
Dipping well dimensions (L x W x H mm)	-	20 x 30 x 30	20 x 56 x 60	20 x 110 x 110	-	-	Half a circle, radius 75; depth 74
Maximum sample size (T x W x H mm)	-	3 x 26 x 26 (1 inch)	3 x52 x56 (2 inches)	3 x 106 x 106 (4 inches)	-	-	3 x 30 x 50
Dipping speed (mm/min)	-	0.1…108	0.1…108	0.1…108	-	-	0.1…108
Upright microscopy trough top	-	•	•	-	-	•	•
Inverted microscopy trough top	-	-	•	-	-	•	•
Ribbon barrier trough top	-	-	•	-	-	-	•
Compatible with							
KSV NIMA PM-IRRAS	-	•	•	•	-	•	-
KSV NIMA ISR	-	-	-	-	•	•	-
KSV NIMA MicroBAM	-	-	•	•	-	•	•
KSV NIMA BAM	-	-	-	•	-	-	-
KSV NIMA SPOT***	-	•	•	•	-	•	-

* The Liquid-Liquid Trough is deeper than a standard trough as this allows for the two liquid phases. The value in the brackets corresponds to confinement of the lower phase (other value for the upper phase).
** The Alternate-Layer Deposition Trough is made of two separated compartments for creation of two monolayers simultaneously.
*** Need extension part for the serial port connections.

• : available
– : not available/not applicable

Each of these four colours used in the table correspond to one frame.
All trough tops labelled with the same colour can be placed on the same frame, for modularity.

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About Us

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