Malvern Panalytical
a spectris company

WAVEsystem

Creoptix GCI technology

Dive into our world of label-free interaction analysis

The WAVEsystem, a Creoptix GCI technology – innovation at your fingertips

The WAVEsystem, a Creoptix GCI technology, pushes the boundaries of affinity range, sample compatibility and sensitivity to deliver a breakthrough level of kinetics analysis. The system's exceptionally high data quality and automated software facilitate drug discovery, enabling you to make new inroads into R&D.

Four complementary components

High signal-to-noise ratio for high sensitivity

- Work with low immobilization levels
- Compatible with large ligand-to-analyte molecular weight (MW) ratios

Temperature controlled autosampler

- No sample evaporation
- 120 hours of unattended operation
- Sample capacity of 96 or 384 well plates

WAVEdelta system with autosampler and WAVEcontrol software.

Innovative microfluidic cartridge

- No-clogging with crude samples
- Fast transitions enabling widest k_d range
- Compatible with harsh solvents

Automated and intuitive software

- waveRAPID - full kinetics (k_a, k_d, K_D and R_{max}) from a single well
- Direct Kinetics - automated, evidence based data evaluation
- intuitive Wizards for biologics applications - Ligand Screening and CFCA

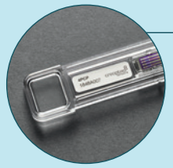
Highlights

- Crude samples, harsh chemicals, and particles up to 1000 nm
- Self-contained, compact, disposable cartridge
- Ultra-fast transition times for weak binding interactions
- Superior signal-to-noise ratios (0.01 pg/mm^2 at 1 Hz)
- Reliable kinetics and binding affinities (K_D) from low pM to low mM with signals below 1 pg/mm^2
- Up to 120 hours of unattended operation

CFCA - calibration-free concentration analysis

WAVEsystem, a Creoptix GCI technology

Next-generation bioanalytical instruments for drug discovery - the wave of the future in kinetics.
Modern label-free technology meets no-clog microfluidics and automated software to provide superior affinity and kinetic data quality and challenging sample compatibility.



WAVEchip

No-clog microfluidic biosensor chips for every need.
Experience a new level of flexibility in assay development.

WAVEcontrol

Software for label-free analysis: fast and automated.
Complete control of your analysis from start to finish.

WAVEcare

Service and maintenance for smooth operations.
Carefree or basic support for high-quality kinetic data and unparalleled performance.

Powered by GCI technology

The WAVEsystem is engineered around the patented GCI technology. GCI is a label-free detection technology based on waveguide interferometry that measures molecular binding affinity and kinetics with superior resolution in both signal and time compared to other forms of label-free detection.

Together with a temperature-controlled autosampler that can handle 2× 48-vial racks, 96- or 384-well plates – or a combination of your choosing – the WAVEsystem is sensitive enough to work with low immobilization levels and large ligand-to-analyte MW ratios.

Learn more about the system's components:

(Creoptix WAVE: Explore the system's components - YouTube)

"We strive to be the technology leader, providing the best solutions for the most challenging projects. The combination of the GCI technology, the unique chip design and the waveRAPID method are the cutting edge solution for kinetics"

Kaspar Cottier
creator of the GCI technology

GCI technology

GCI is a method developed by Creoptix® to monitor and characterize molecular interactions and to determine kinetic rate parameters, affinity constants and concentrations of analyte molecules interacting with an immobilized ligand.

A fresh take on waveguide interferometry

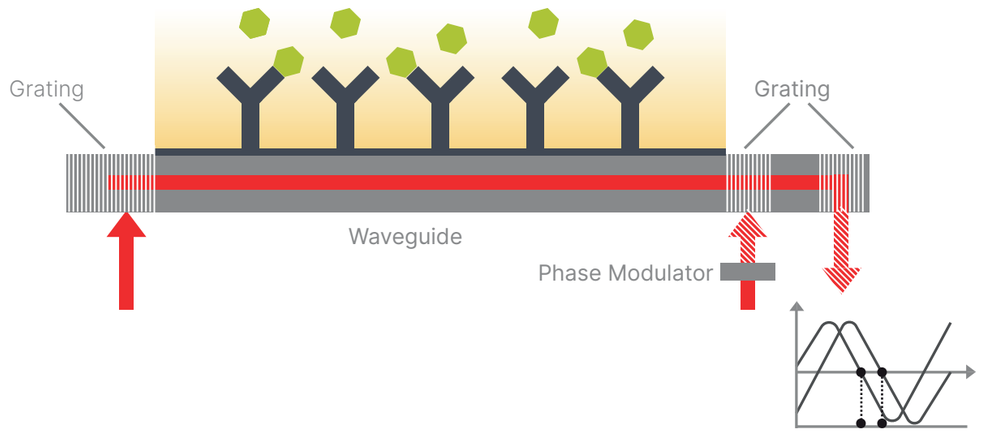
Based on waveguide interferometry, GCI – like other optical label-free methods – measures changes in refractive index within an evanescent field near a sensor surface, which are caused by the displacement of buffer by analyte molecules binding to the ligand immobilized on the sensor surface.

The refractive index changes occurring within the evanescent field of a waveguide result in a change of the light phase, which is read out interferometrically.

Evanescent field

An electromagnetic field, in particular near an optical or waveguide interface, which decays exponentially as the distance to the sensor surface increases.

Unlike other optical label-free techniques, the light travels throughout the waveguide, creating an evanescent wave that spans the entire length of the sensor surface. This allows more binding events to contribute to the overall signal, giving waveguide interferometry an intrinsically higher primary sensitivity for label-free interaction analysis.



The GCI advantage

With classical waveguide interferometry, the perfect alignment of measurement and reference beam is challenging – and sensitive to environmental effects such as temperature shifts or mechanical distortions or vibrations.

Creoptix® GCI technology eliminates these typical alignment issues, enabling robust implementation of waveguide interferometry.

The GCI readout scheme sees the interferogram created in the time domain and directly within the waveguide, instead of being projected onto a camera. This provides a more robust and more sensitive readout compared to classical waveguide interferometry.

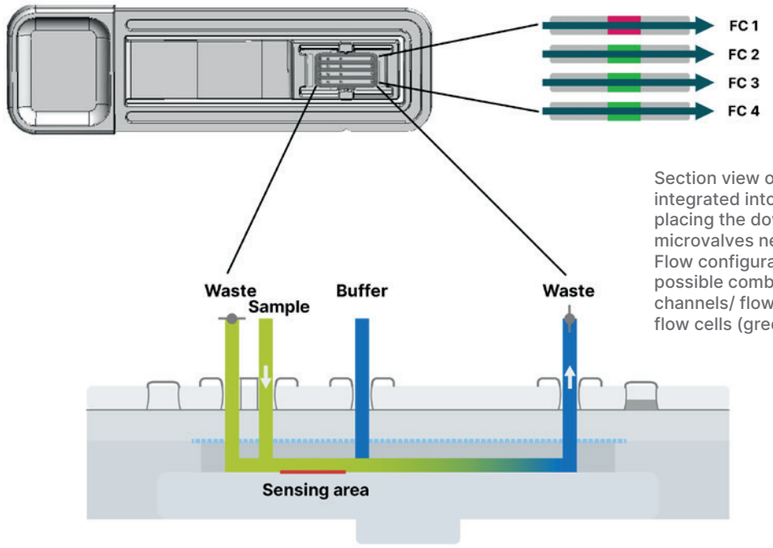
WAVEchip – the no-clog microfluidic sensor chip

The innovative design of our patented microfluidic cartridge supports crude samples, pathogenic samples, harsh solvents, and large particles up to 1000 nm normally only achieved with plate-based assays. The WAVEchips are uniquely designed for the WAVEsystem.

The cartridges contain four flow cells in parallel. Typically, one flow cell is used as a reference to account for bulk effects. You can configure the reference channel freely on the four-channel WAVEdelta system. While the two-channel WAVE only allows the usage of two FC per experiment (FC1 and FC4; FC2 and FC3), the choice for the reference channel is still free.

Compatibility

- 100% serum, plasma and cell supernatant
- Organic solvents, including high percentages of acetonitrile and DMSO
- Viscous detergents and additives to solubilize membrane proteins
- Cell membrane preps, partially solubilized, unpurified material
- VLPs, liposomes, or nanodisks used as solubilization structures
- Large binding partners: nanoparticles and crude membrane preps



Section view of WAVEchip, showing microfluidics integrated into the disposable cartridge by placing the downstream valves instead of microvalves near the chip.
Flow configuration of the WAVEchips, with one possible combination among many of reference channels/ flow cells (red) and sensing channels/ flow cells (green).

WAVEchips – your choice, your benefits

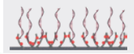
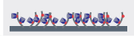
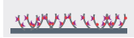
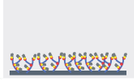
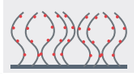
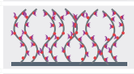
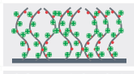
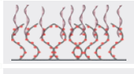
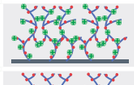
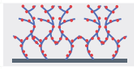
Besides offering unparalleled compatibility, the WAVEchips improve the performance, flexibility and effectiveness of your work.

Performance	Flexibility	Effectiveness
• Parallel flow channels • Rapid, synchronized sample transitions	• All-in-one solution for any biomolecular interaction • Broad range of sensor chip surfaces	• Rapid exchange for fresh, clean microfluidics within minutes • No clogging, no downtime

Choosing your WAVEchip

Our WAVEchips are designed with your applications in mind. Choose from our range of products for small molecules, serology, membrane proteins and biologics.

DMSO - dimethyl sulfoxide; FC - flow cell; VLP - virus-like particle

WAVEchip sensor Quick guide		Description of chip	Immobilisation modality	Suggested applications
PCP		**Quasi-planar** PC hydrogel	Amine coupling	Large ligands and/or analytes such as proteo/liposomes
PCP-STA		Pre-immobilized streptavidin, **quasi-planar** PC hydrogel	Biotin	Large biotinylated ligands, analytes such as liposomes, viruses, VLPs
PCP-RST		Regenerable streptavidin surface **Quasi-planar** PC hydrogel	Biotin	Large biotinylated ligands, ligand screening
PCP-PAG		Pre-immobilized fusion protein A/G, **quasi-planar** PC hydrogel	IgG	For capturing the broadest range of IgG and FC-tagged proteins
PCP-NTA		Pre-immobilized NTA, **quasi-planar** PC hydrogel	His-Tag	Large His-tagged ligands, analytes such as liposomes, viruses, VLPs
PCP-LIP		Pre-immobilized lipophilic groups, **quasi-planar** PC hydrogel	Lipid	Hydrophobic (large) ligands such as liposomes, membrane vesicles
PCZ		Functionalized with a zwitterionic polymer bearing carboxylic acids and tertiary amines in similar densities, **quasi-planar** PC hydrogel	Amine coupling	Low fouling, ideal for coupling proteins with low isoelectric points or polyanionic ligands
PCL		Low capacity, **thick** PC hydrogel with a lower amount of negative charges (approx. 25%)	Amine coupling	Complex matrices such as serum, culture supernatant. Requires sulfo-NHS for activation
PCH		**Thick** PC hydrogel	Amine coupling	Large ligand-to-analyte molecular weight ratio. General purpose
PCH-NTA		Pre-immobilized NTA, **thick** PC hydrogel	His-Tag	His-tagged ligands. General purpose
PCH-STA		Pre-immobilized streptavidin, **thick** PC hydrogel	Biotin	Biotinylated ligands. General purpose
PCH-RST		Regenerable streptavidin surface **thick** hydrogel	Biotin	Biotinylated ligands. ligand screening
DXP		**Quasi-planar** *DX hydrogel*	*Amine coupling*	*Large ligands and/or analytes such as proteo/liposomes, viruses, VLPS*
DXP-STA		*Pre-immobilized streptavidin,* ***thick*** *DX hydrogel*	*Biotin*	*Biotinylated ligands. General purpose*
DXH		***Thick*** *DX hydrogel*	*Amine coupling*	*Large ligand-to-analyte molecular weight ratio. General purpose*

PC- = polycarboxylate
DX- = Carboxymethyldextran
DX coated sensors available upon request

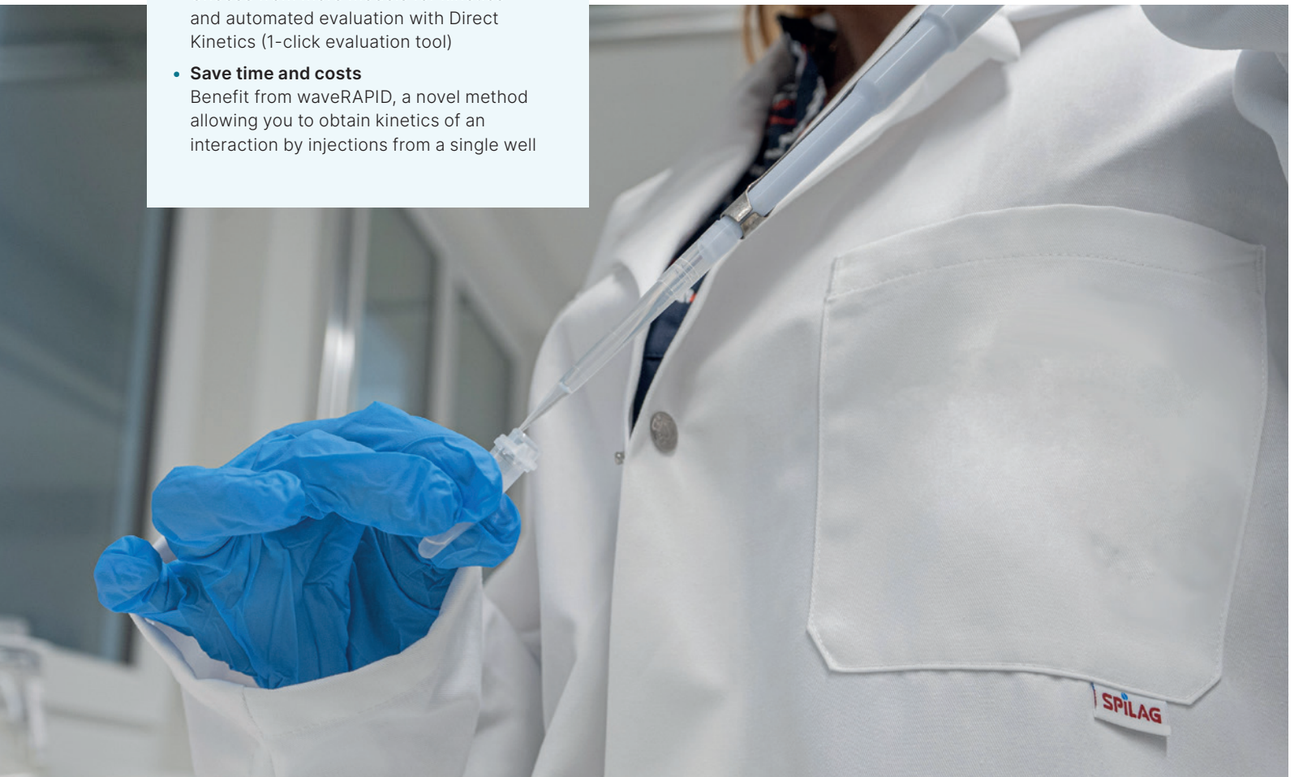
WAVEcontrol – for flexibility and functionality

Move seamlessly from sample to data in a simple stepwise process, generating outputs at the touch of a button. Every step – from assay setup and data evaluation to report writing – is simplified with an intuitive design that mirrors the way you work.

Design your experiment	Set up your experiment	Evaluate your data	Report your data
Use our built-in optimizer to simulate data and get the design right before you begin.	Let our wizards accelerate your preparation – or edit manually for full flexibility and control.	Apply our predefined models to evaluate the results of your experiments. Adjustments can be fully fine-tuned.	Get access to raw data and export your results in a customizable PDF or Word format.

Four key benefits

- **Helpful wizards**
  Use pH scouting, support for new WAVEchip® types, Ligand Screening, calibration-free concentration analysis and our new wizards to improve time-to-result
- **Smoother setup**
  Copy/paste and import from Excel files for large screens, drag and drop for full flexibility
- **Improved evaluation**
  Choose from more models for kinetics and automated evaluation with Direct Kinetics (1-click evaluation tool)
- **Save time and costs**
  Benefit from waveRAPID, a novel method allowing you to obtain kinetics of an interaction by injections from a single well



Innovative software solutions

Our robust and sensitive hardware is complemented by sophisticated software solutions to help you get the most from your analysis.

waveRAPID™ – a new way of measuring kinetics

Instead of relying on a titration series, waveRAPID (Repeated Analyte Pulses of Increasing Duration) injects a single concentration, pulsing the sample over the sensing surface at increasing durations, meaning kinetics can be derived from a single well.

waveRAPID also addresses a fundamental challenge of refractive index-based sensors: liquid refractive index disturbances that need correction. This is especially useful when dealing with molecules that significantly alter the refractive index of the buffers used, such as DMSO. It means there's no need for DMSO buffer correction, making it even easier to prepare your assay.

Direct kinetics – automated, objective data evaluation

Global fitting is the most commonly used data evaluation function in real-time biomolecular interaction analysis. Based on non-linear least-squares fitting, this method finds rates and affinity constants to fit curves as close as possible to the actual data.

Global fitting needs human intervention for obtaining best results and is driven by "what looks good". A well-trained scientist would need 3-5 minutes to analyze one interaction. With Direct Kinetics, instead of optimizing the visuals, the error on the determined parameters is minimized. Dozens of interactions are automatically analyzed in 3-5 minutes.

Benefits for you waveRAPID:

- Run more samples: up to 500 in 24 hours
- Faster assay development: no DMSO correction
- Cost and time savings: full kinetics from one single well (up to 7x less plates)

Benefits for you Direct kinetics:

- Quick decision making: rapid computation of confidence intervals
- Fewer errors: automated, evidence-based estimation
- Reproducible data: mitigate the risk of over-fitting artifacts

Ligand Screening	CFCA
A faster, flexible way to screen and characterize antibodies	**A calibration-free approach to quantification**
Multiple analyte injection is the preferred method to screen for binding partners. But it's not suitable for all biological systems. In kinetic analysis, for example, it's important to maintain the same immobilization levels for all antibodies to ensure correct interpretation of the results. The Ligand Screening Wizard: • Allows easy and intuitive assay setup by creating a "ligand block", where ligand samples are cycled through the biosensor surface in sequential capture/regeneration steps • Works in perfect harmony with the "target level" function • Ensures that ligands are always captured at the same density level for correct data interpretation	CFCA stands for "calibration-free concentration analysis". It's a label-free approach using the relationship between the diffusion properties of the analyte and the absolute analyte concentration. It's useful when: • You want to determine only the "active" fraction of a sample • No satisfactory calibrant is available for the analyte under study • There's a mismatch between buffers or matrices • Fast quantification is required without sample purification (e.g. antibodies in serum)

Learn how Ligand Screening provides a faster, flexible way to screen and characterize antibodies:
https://www.youtube.com/watch?v=Kn8tvSYcJeA

have a look at our one pager explaining waveRAPID
https://view.highspot.com/viewer/65dd969ae4d7b78546991e47

Small molecules and biologics

Research involving small molecules and biologics comes with specific challenges. The WAVEsystem is designed to meet these – and deliver high-quality results whatever your objectives.

Small molecules – no more hiding

Weak binders, such as those found in fragment-based screening libraries, are typically ranked by affinity rather than kinetics. This is because standard instrumentation lacks the capacity to measure fast off-rates. However, measuring affinity rather than off-rates can generate large numbers of false positive hits, extending workflows and incurring unnecessary costs.

With the industry's fastest kinetics and utmost sensitivity, the WAVEsystem offers a whole new level of previously unattainable interaction data. The WAVEsystem is compatible with the high ligand-to-analyte molecular weight ratios, providing outstanding resolution and reliable kinetics at low immobilization levels for target-to-analyte molecular weight ratios of up to >1000:1. The outcome is increased sensitivity to accurately measure low-potency small molecules or fragments, or targets with low activity.

"Employing a proprietary GCI technology, the Creoptix WAVE provides resolution of fast off-rates up to 10 sec^{-1}. This enables accurate, early stage selection of true hits to greatly increase efficiencies."

Biologics – characterization and quality control

Biologics – such as antibodies, nanobodies, and other large molecules manufactured in living systems – are highly complex. Characterizing them is an important task in drug development and quality control, but it can be a challenge.

With the WAVEsystem, you measure more than just affinity, even in the low pM range, while confirming and enriching ELISA data. Use it to:

- Run slow off-rate analysis of high-affinity binders
- Detect anti-drug antibodies (ADA) in the low ng/ml range
- Identify the most effective antibody pairs in diagnostic development

Learn how to determine affinity and binding kinetics of crude samples like cell extracts, serum, plasma, virus-like particles, (in)organic nanoparticles, liposomes and nanodisks directly, reliably and easily:
https://www.youtube.com/watch?v=4Ayml3×5fcM

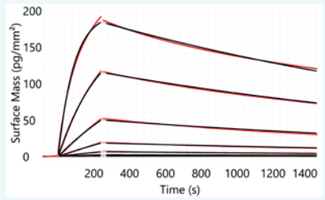
ADA - anti-drug antibodies

Full kinetic characterization in complex matrix samples

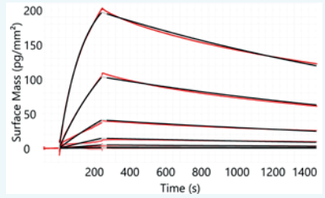
Kinetic characterization of interactions with the respective crude matrix.
Profile biologic reagents in great detail in pure serum (or even plasma).

Ligand 1: Antibody 1

Buffer

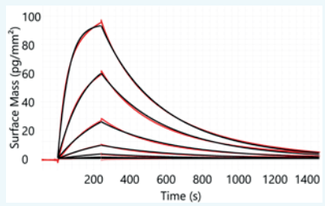


Serum (90%)

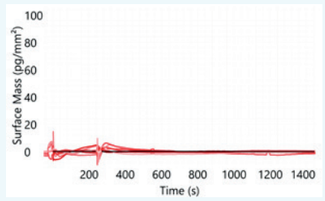


Ligand 2: Antibody 2

Buffer



Serum (90%)



- Surface: 4PCP WAVEchip (quasi planar)
- Immobilization: amine-coupling
- Ligand: two different IgG antibodies
- Analyte: Protein antigen
- Running buffer:
  - PBS-P+
  - 90% Bovine Serum
- Double referencing
- Globally fit with 1:1 binding model

Not all antibodies work in a serum or plasma!

No binding detected from mAb 2 when run in serum, demonstrating the importance of antibody profiling in the respective matrix.

Specifications WAVE

General	
Noise (RMS)	<0.01 pg/mm^2 @ 1 Hz
Drift	<0.3 pg/mm^2/min
Readout Frequency	1 Hz, 10 Hz or 40 Hz
Association Const. Range	k_a = 10^2 – 5×10^7 M^{-1} sec^{-1} (small molecules) k_a = 10^2 – 3×10^9 M^{-1} sec^{-1} (large molecules)
Dissociation Const. Range	k_d = 10^{-6} – 10 sec^{-1}
Analysis temperature range	15°C – 40°C
Molecular Weight Limit	No lower limit
Fluidics	
Flow Channels / Path	2, parallel
Channel Referencing	1–4 and 4–1 or 2–3 and 3–2
Flow Cells	Sealed, disposable, integrated into disposable WAVEchip
Flow Rate	1 – 400 µl/min
Crude Sample Robustness	Yes
Sample handling	
Sample Capacity	2x microtiter plates (96 or 384 well, standard or deep well) or vial racks (48 positions of 1.5 ml)
Buffer	1 buffer
Degasser	Built-in
Injection Volume	< 450 µl, 100 µl typical
Sample Volume Required	Injection volume plus 15-50 µl (application dependent)
Sample Storage Temperature	Ambient or 4°C – 20°C regulated
Sample Recovery	Yes
Automation	120 hours of unattended operation
Data treatment	
Information Provided	Kinetic affinity (k_a, k_d, K_D)
Graphs	Real-time curves, multiple curve overlays, fit, report point plots
Data Extraction	Curves, k_a, k_d, K_D tables, graphs, reports
Data Analysis	Fully automated data evaluation
Kinetic Models	Predefined models including 1:1 interaction, mass transport, heterogenous ligand, conformational change and bivalent
Direct Kinetic	Yes
waveRAPID Functionality	No

Specifications WAVEdelta

General	
Noise (RMS)	<0.01 pg/mm^2 @ 1 Hz
Drift	<0.3 pg/mm^2/min
Readout Frequency	1 Hz, 10 Hz or 40 Hz
Association Const. Range	k_a = 10^2 – 5×10^7 M^{-1} sec^{-1} (small molecules) k_a = 10^2 – 3×10^9 M^{-1} sec^{-1} (large molecules)
Dissociation Const. Range	k_d = 10^{-6} – 10 sec^{-1}
Analysis temperature range	4°C – 45°C (max 15°C below ambient)
Molecular Weight Limit	No lower limit
Fluidics	
Flow Channels / Path	4, parallel
Channel Referencing	Any combination of the 4 channels
Flow Cells	Sealed, disposable, integrated into disposable WAVEchip
Flow Rate	1 – 400 µl/min
Crude Sample Robustness	Yes
Sample handling	
Sample Capacity	2x microtiter plates (96 or 384 well, standard or deep well) or vial racks (48 positions of 1.5 ml)
Buffer	Automatic switching between 4 buffers
Degasser	Built-in
Injection Volume	< 450 µl, 100 µl typical
Sample Volume Required	Injection volume plus 15-50 µl (application dependent)
Sample Storage Temperature	Ambient or 4°C – 20°C regulated
Sample Recovery	Yes
Automation	120 hours of unattended operation
Data treatment	
Information Provided	Kinetic affinity (k_a, k_d, K_D)
Graphs	Real-time curves, multiple curve overlays, fit, report point plots
Data Extraction	Curves, k_a, k_d, K_D tables, graphs, reports
Data Analysis	Fully automated data evaluation
Kinetic Models	Predefined models including 1:1 interaction, mass transport, heterogenous ligand, conformational change and bivalent
Direct Kinetics	Yes
CFCA and Ligand Screening	Yes
waveRAPID Functionality	Yes

Product overview / Order info

Name	Description	Product code
Devices		
WAVE	Includes WAVEcore **(2-channel device)**, WAVEsampler (autosampler), WAVEcontrol (2 perpetual software licenses) and warranty coverage for the first 12 months * *Warranty extension to be purchased with device*	9005002
WAVEdelta	Includes WAVEcore **(4-channel device)**, WAVEsampler (autosampler), WAVEcontrol (2 perpetual software licenses with waveRAPID functionality, ligand screening and CFCA wizards) and warranty coverage for the first 12 months * *Warranty extension to be purchased with device*	9005004
Sensor surfaces		
PCP	**Quasi-planar** PC hydrogel	9060001
PCP-STA	Pre-immobilized streptavidin, **quasi-planar** PC hydrogel	9060002
PCP-RST	Regenerable streptavidin surface, quasi-planar PC hydrogel. 50 cycles (includes sensorchip, RST capture solution and regeneration solution)	9060019
PCH-RST	Regenerable streptavidin surface, thick hydrogel. 50 cycles (includes sensorchip, RST capture solution and regeneration solution	9060020
PCP-PAG	Pre-immobilized fusion protein A/G, **quasi-planar** PC hydrogel	9060003
PCP-NTA	Pre-immobilized NTA, **quasi-planar** PC hydrogel	9060004
PCP-LIP	Pre-immobilized lipophilic groups, **quasi-planar** PC hydrogel	9060005
PCZ	Functionalized with a zwitterionic polymer bearing carboxylic acids and tertiary amines in similar densities, **quasi-planar** PC hydrogel	9060006
PCL	Low capacity, **thick** PC hydrogel with a lower amount of negative charges (approx. 25%)	9060007
PCH	**Thick** PC hydrogel	9060008
PCH-NTA	Pre-immobilized NTA, **thick** PC hydrogel	9060009
PCH-STA	Pre-immobilized streptavidin, **thick** PC hydrogel	9060010
DXP	***Quasi-planar*** *DX hydrogel. Available upon request*	*9060012*
DXP-STA	*Pre-immobilized streptavidin,* ***thick*** *DX hydrogel. Available upon request*	*9060013*
DXH	***Thick*** *DX hydrogel. Available upon request*	*9060014*
Software		
WAVEcontrol 1 Year License	• Enjoy all options for a full year. • Includes software updates with bug fixes, stability and usability improvements. • Exclude software version upgrades. * *In addition to licenses included with system*	9270014
WAVEcontrol Perpetual license	• Pay once, use as long as you want. • Includes software updates with bug fixes, stability and usability improvements. • Excludes software version upgrades. * *In addition to licenses included with system*	9270013
Services		
Creoptix offers a wide range of service agreements, trainings and maintenance. Please reach out to your contact to decide which solution suits you best.		

Discover more

This brochure is designed to offer you an overview of our products and solutions. To learn more, scan the QR codes on the relevant pages or visit our website for the latest updates: About Creoptix | Malvern Panalytical

We've also put together a list of further resources that may be of interest to you:

Our Kinetics Guide
Kinetics Guide - Binding Kinetics with the WAVEsystem | Malvern Panalytical

How the Creoptix WAVEsystem drove real-time kinetic and affinity analysis for faster and better characterization of candidates – from fragments to biologics:
https://www.malvernpanalytical.com/en/learn/knowledge-center/customer-stories/CS220810-Creoptix-drug-discovery-WAVE

Antibody characterization from COVID-19 patient plasma binding to SARS-COV-2 antigens:
https://www.malvernpanalytical.com/en/learn/knowledge-center/technical-notes/TN201124-Creoptix-antibody-characterization-plasma-binding

Malvern Panalytical
a spectris company

About Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

Malvern Panalytical. We're BIG on small™

Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy

Malvern Panalytical

Grovewood Road, Malvern,
Worcestershire, WR14 1XZ,
United Kingdom

Tel. +44 1684 892456
Fax. +44 1684 892789

Lelyweg 1,
7602 EA Almelo,
The Netherlands

Tel. +31 546 534 444
Fax. +31 546 534 598

www.malvernpanalytical.com