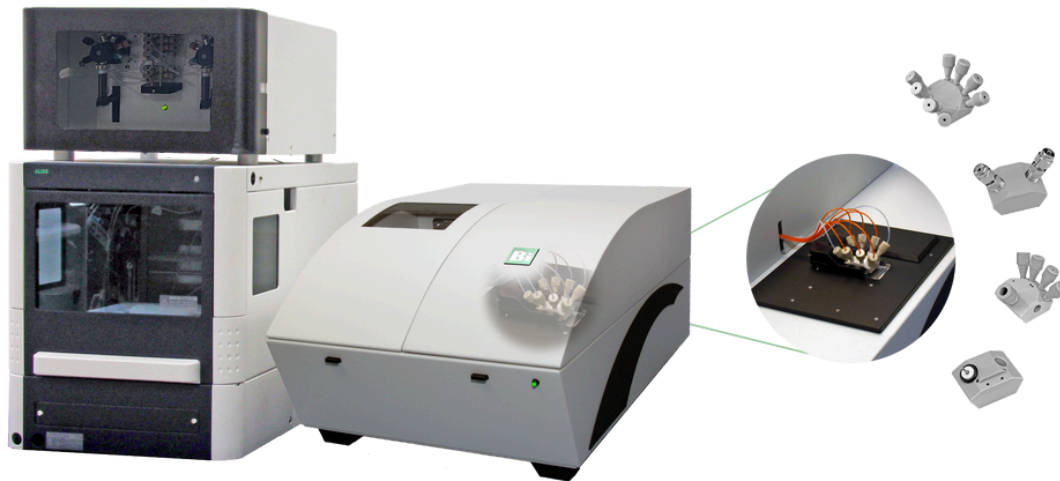


# BI-4500 Series



5 channel SPR with modular design and applications flexibility



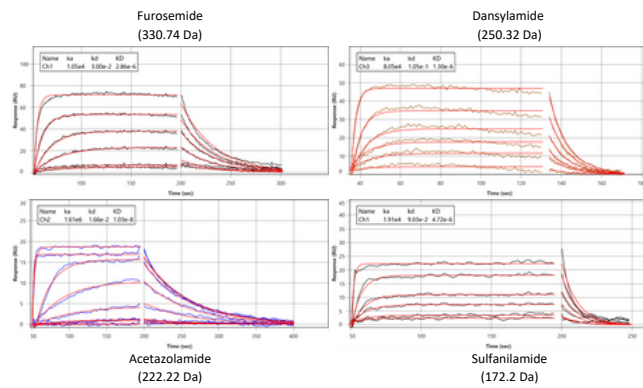
- High throughput with 5 channels and fully automated sample delivery
- Precise sample delivery with BI-DirectFlow™ technology
- High sensitivity to measure small molecules
- Innovative multi-module design for optimal flexibility
- Cost-effective solution

The BI-4500 SPR system provides a 5 channel flow module and delivers high-quality binding response for low immobilization and small molecule detection. The 5 channel system provides higher throughput with more data for binding analysis and greater flexibility and faster assay development. Equipped with BI-DirectFlow™ technology, the BI-4500 system integrates precision sample delivery with near-zero dispersion for fast kinetics and effective removal of various secondary effects.

## Small molecule applications

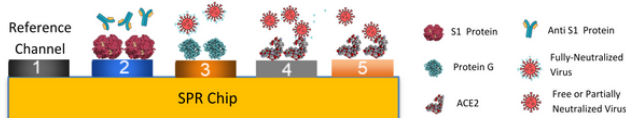
Carbonic anhydrase inhibitors are a class of pharmaceuticals that inhibit the activity of carbonic anhydrases (CA II). Clinically, these inhibitors have been used as antiglaucoma agents to alleviate mountain sickness and to manage neurological disorders. Below are SPR sensorgrams of commonly used small molecule carbonic anhydrase inhibitors: Furosemide, Acetazolamide, Dansylamide, and Sulfanilamide.

Compounds	$k_a$ ( $M^{-1} s^{-1}$ )	$k_d$ ( $s^{-1}$ )	KD
Furosemide	$1.05 e^4$	$3.00 e^{-2}$	2.86 nM
Acetazolamide	$1.61 e^6$	$1.66 e^{-2}$	13 nM
Dansylamide	$8.04 e^4$	$1.05 e^{-1}$	1.30 $\mu$ M
Sulfanilamide	$1.91 e^4$	$9.03 e^{-2}$	4.72 $\mu$ M



## Detecting viral particles in serum samples using SPR

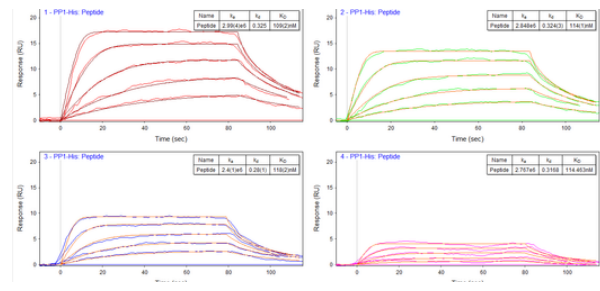
SARS-CoV-2 spike (S1) protein and angiotensin-converting enzyme 2 (ACE2) were immobilized into separate channels to simultaneously study their interaction with anti-S1 antibody and viral particles in serum samples.



Dong et al. ACS Sens. 2022, 7, 3560-3570

## Protein Phosphatase 1 interactions with glycogen synthase protein

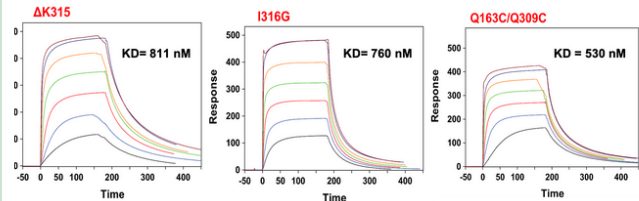
Protein phosphatase 1 (PP1) regulates muscle contraction and other cellular processes. Different amounts of His<sub>6</sub>-tagged PP1 were immobilized on a Ni-NTA chip using different loading times (20, 40, 60, 80 s) in different SPR channels. SPR binding plots show different responses as a function of varying concentrations of glycogen-targeting subunit in muscle, GM 64-105 (0, 31.25, 62.5, 125, 250, 500 nM). KD= 114 +/- 4 nM.



Kumar et al. Sci. Adv. 2018, 4:eaau6044

## Binding studies of integrin proteins

Integrin  $\alpha$ 5 $\beta$ 2 is a protein receptor that helps cell adhesion and to migrate through tissues. SPR sensorgrams shown below for the binding of integrin domain variants,  $\Delta$ K315, I316G, and Q163C/Q309C, with C3d protein. Integrin concentrations at 0.19, 0.39, 0.78, 1.56, 3.13, 6.25, and 12.5  $\mu$ M flown over the CM-dextran sensor with C3d protein immobilized on it.



Nguyen et al. Plos one 18.1 2023, e0280778

## Benefits of a 5 channel SPR

The BI-4500 provides greater flexibility and faster assay development, doubling the throughput over 3 channel SPR systems.



Improves data fidelity by obtaining more data in one injection



High productivity with different ligands in each channel



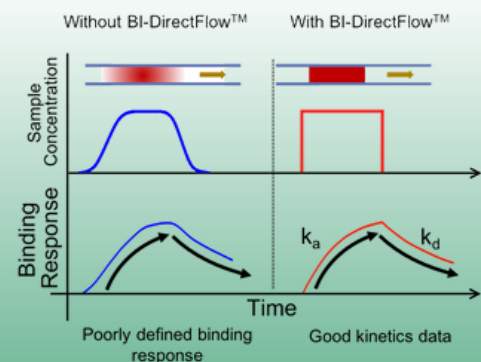
Cost effective by quickly optimizing immobilization and regeneration conditions

# BI-4500 Specifications

Base Station	Light source	Two low coherent light sources (670 nm)
	Detection speed	4 ms
	Incident angles	40-47 Deg (gas) 67-81 Deg (liquid)
	Refractive index ranges	1.00 - 1.40
	Baseline noise	< 0.06 RU RMS (0.01 mDeg RMS)
	Baseline drift	0.30 RU/hr (0.05 mDeg/hr) (when ambient drifts < 1°C/hr)
	Measurement ranges	Association rate constant $k_a$ : up to $10^8 \text{ M}^{-1} \text{ s}^{-1}$ Dissociation rate constant $k_d$ : $10^{-6}$ to $1 \text{ s}^{-1}$ KD: pM to mM
	Molecular weight cutoff	100 Da
	Temperature Control	Range: 50°C to 10°C below ambient temperature max down to 6°C Control accuracy: 0.01 °C
	PC interface	USB 3.0
	Data IO port	IO ports for sending and receiving raw signals with other equipment
	Outer dimension	355(w) x 250 (h) x 515 (d) mm
	Weight	11.5 kg
Power supply	110-230 V 50/60 Hz	
Fluid Handling	Sample channels	5 channels
	Flow cell material	PEEK (biologically compatible)
	Flow rate	1.0 to 150 $\mu\text{L}/\text{min}$ (application dependent)
	Buffer handling	Dual syringes driven by programmable infusion pump (BI-4500/4500A) Automatic Buffer Exchange Pump and Degasser (BI-4500AP)
	Sample injection volume	10 to 500 $\mu\text{L}$ (application dependent)
	Sample injection methods	Semi automated (BI-4500) Fully automated (BI-4500A/4500AP)
	Channel volume	< 32 nL
	Injection rise time	< 0.2 s
	Analysis module (standard)	5 channel BI-DirectFlow™ Module
	Optional modules	EC SPR module for SPR measurement with electrochemistry EC-DualFlow™ for two channel flowthrough EC SPR measurement Gas SPR module for chemical vapor SPR measurement
Control System	Computer Software	Windows OS SPR Control software for real-time instrument control with programmable interaction assays for various application protocols. Data Analysis software for affinity, kinetics analysis, and concentration determination (calibrated or calibration-free).
Autosampler (option)	Sample capacity	2 x SBS standards (384 / 96), 2 x 48 Vials (1.5mL), 2 x 12 Vials (10mL)
	Sample cooling	Minimum: 4°C +/- 2°C
	Outer dimension	300 (w) x 575 (h) x 360 (d) mm
	Weight	21 kg
Automatic Buffer Exchange Pump and Degasser (option)	Buffer exchange	Automatic buffer exchange up to six sources
	Buffer degasser	In-line
	Buffer delivery	Continuous
	Outer dimension	305 (w) x 191 (h) x 330 (d) mm
Weight	6.8 kg	
Compliance		CE, 21 CFR part 11 IQOQ certification

## BI-DirectFlow™ Technology

BI-DirectFlow™ technology delivers sample to the sensor surface with near-zero dispersion, enabling ultra-fast kinetics and high resolution binding analysis. This unique technology enables finer observation and removal of secondary effects such as bulk refractive index shift, mass limited transport, and non-specific binding. As a result, high quality data that is more representative of true molecular binding behavior can be obtained.



## 4500 analysis modules



Included

### BI-DirectFlow™

Provides precise flow control that delivers sample to sensor surface with near-zero dispersion



Optional

### EC-DualFlow™

EC combined SPR measurements under the influence of applied electrochemical potentials at different flow rates



Optional

### EC SPR

Facilitates simultaneous electrochemical and SPR measurements on the same sensor surface



Optional

### Gas SPR

Enables the high sensitivity of SPR analysis to be performed in the gas phase

## Sensor chips

### Gold Sensor Chip

Highly uniform gold film for reproducible SPR research.

### Divided Gold Sensor Chip

Pre-patterned gold surface for SPR with EC-DualFlow™ applications.

### Dextran Sensor Chip

Sensor carboxymethylated dextran hydrogel covalently attached via carboxyl groups to a self-assembled monolayer on gold surface. Ideal for high capacity amine coupling with low non-specific absorption.

### Streptavidin (SA) Sensor Chip

Streptavidin covalently attached to a carboxymethyl dextran matrix for immobilization of biotinylated analytes such as proteins, peptides, nucleic acids or carbohydrates.

### Ni-NTA Sensor Chip

Carboxymethylated dextran hydrogel with Ni<sup>2+</sup>/NTA chelation. NTA surface can be regenerated by injecting EDTA or imidazole.

### Protein A Sensor Chip

Sensor with protein A immobilized on carboxymethylated dextran substrate pre-functionalized for affinity capture of a broad range immunoglobulins like total IgG, IgG1, IgG2 and IgG4 from Human, Horse, Rabbit, Goat, Sheep and Mouse.

### L1 Sensor Chip

Carboxymethylated dextran hydrogel, partially alkyl derivatized. For immobilization of liposomes and vesicles.

