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RAPID KINETICS AND SPECTROSCOPY

SFM-300/ SFM-400



BioLogic
Science Instruments

3 and 4 SYRINGE STOPPED-FLOW
Single, double and triple
mixing applications

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The **SFM-300/400 is the most popular stopped-flow model** for single, double and triple rapid mixing applications in biochemistry and chemistry. Outstanding performance and modularity make the SFM-300/400 the benchmark rapid kinetics mixer for today's laboratory.

The **SFM-300/400 uses independent stepping motor technology**, for full individual control of volume and flow velocity in each syringe. Precise control allows mixing ratios from 1:1 to 1:100 to be achieved. A series of shots at various concentration can be programmed quickly and run in a few minutes without refilling or changing syringes.

Advanced Berger-Ball technology mixers are used to provide the best turbulent mixing over the widest range of flow conditions. Berger-Ball technology offers outstanding consistency and repeatability over classical T-mixers.

Included Bio-Kine software controls the SFM-300/400 from a PC using a USB connected control module. The software provides easy and powerful controls for designing simple or complex mixing experiments "Full automation" is available for concentration dependent studies and double jump experiments. Safeguards in the software alert you to out of range conditions in mixing ratios, calculated flow rates, and number of shots available. Bio-Kine is easy to use and user-friendly for everyone from students to experienced researchers.

The SFM-300/400 are designed to be versatile rapid mixing instruments. **They are adaptable and expandable to a wide variety of rapid mixing techniques and devices**. Many user installable options let you adapt the SFM-300/400 to changing needs in your lab, without buying a complete new system.

The SFM-300 can be upgraded to a SFM-400 by adding a fourth syringe and a third mixer to make it **the only system in the world able to run triple mixing applications**. Either model can be coupled to all Bio-Logic spectrophotometers, external CD spectrometers, fluorometers, synchrotron radiation beam lines, NMR,EPR , freeze quench, and many other systems.

GENERAL SPECIFICATIONS:

- Single and double mixing (SFM-300)
- Single, Double and triple mixing (SFM-400)
- Full control of volume and flow rate
- 0.25 ms dead time
- Mixing ratio 1:1 to 1:100
- Independent stepping motors
- Sample economy
- Full automation
- Compatible with:
  MOS-200
  MOS-250
  MOS-450/AF-CD
  MOS-DA
  MCS-200
  External devices

UNIQUE FEATURES

- Independent stepper motor control for each syringe
- Automatic concentration dependent studies
- Mixing ratio is fully programmable from Bio-Kine
- Ratios can be changed without syringe handling
- µl precision – No pressure artifacts
- SFM-300 can be converted into SFM-400 for triple mixing
- Quench-flow capabilities using optional quench valve

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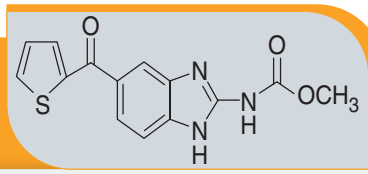
APPLICATIONS

BIOCHEMISTRY
PROTEIN FOLDING/
UNFOLDING/MISFOLDING



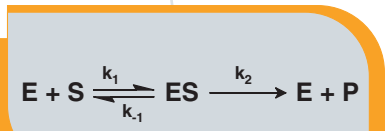
Protein folding is the physical process by which a polypeptide folds into a characteristic three dimensional structure. Formation of the 3D structure is essential for the protein's functions. Understanding these processes is essential for both academic and pharmaceutical research.
Independent syringes and completely variable mixing ratios make the **SFM-300/400** the ideal system for studying protein folding. These studies often involve mixing solutions of different viscosities which is easily done with a micro-volume Berger-ball mixer specially designed for mixing viscous, (up to 2000 cp,) solutions. For reactions longer than 10-15 seconds, a unique high density mixer is available to minimize convection artifacts often observed using pneumatic technology. The flexibility of mixing ratios and differing sample viscosities offered by the **SFM-300/400** give the user unmatched control of experiment design and sample economy.
Detecting protein folding is most often done with fluorescence and circular dichroism techniques. The **SFM-300/400** is easily combined with a Bio-Logic **MOS-200** or **MOS-450** spectrophotometer to bring you the best mixing and analytical performance.
The **SFM-300/400** also has a new mT-jump accessory, which uses temperature change as the trigger for folding or unfolding. The mT-jump accessory is one of the many valuable options available for the **SFM-300/400**.

ORGANIC & INORGANIC CHEMISTRY
STRUCTURAL CHANGES



Understanding reaction mechanisms and characterizing the structure of reaction intermediates are common goals in organic and inorganic chemistry. These reactions often occur in organic solvents. This requires instruments that can maintain design function and performance in an aggressive environment. The **SFM-300/400** mixer components and optional Isolast O-ring set easily withstand exposure to solvents such as THF and toluene.
For studies where a reactant is oxygen sensitive, the **SFM-300/400** anaerobic option provides a simple and reliable way to perform an experiment in an oxygen limited environment.
Some intermediates have very short life times, and can only be observed through cryogenic methods. The **SFM-300/400** cryo option captures intermediates down to -90°C. This opens up a complete new range of studies that are difficult or impossible with conventional mixing systems.
Absorbance measurements are the most popular detection method, and the **SFM-300/400** can be combined with the **MOS-200** or **MOS-450** for single wavelength measurements. For fast multi-wavelength measurements, it can also be coupled with our extra-fast diode array detectors. The included Bio-Kine software controls both mixer and detection system, and can analyze 2D and 3D data, (SVD analysis), to extract intermediate information from the kinetics data.

ENZYME KINETICS
LIGAND BINDING
CONFORMATIONAL CHANGES



Stopped-flow has long been a key technique for understanding enzyme kinetics. Single and multi-substrate reactions can be followed with stopped flow techniques to study the catalytic mechanism of an enzyme, and to learn about its role in the cell. Mechanisms can be investigated by changing of reactant concentrations, and by adding fluorescent dyes to the protein to enable observation of movements during reactions. The **SFM-300/400** can be used for all optical techniques to detect conformational changes. With independent stepping motors, users can change mixing ratio after each shot without refilling the system, so a series of concentration studies can be done rapidly. Bio-Kine's analytical tools provide immediate information about the reaction mechanism.

WATER AND IONS TRANSPORT IN VESICLES



A common stopped-flow application is fast tracking of transient kinetics of water or solute transport across the membranes of small, (10-500 nm scale), vesicles. The reactions can be generated by mixing purified membrane vesicles with a hyper-osmotic solution. The concentration gradient induces a fast flow of water out of the vesicles, reducing the volume of vesicles in a kinetic reaction. With the **SFM-300/400**, membrane permeability can be evaluated from the measured rate constants.
Vesicles are very sensitive to change of pressure. With the **SFM-300/400's** precise control of total flow rate, and a synchronized electro-valve to stop sample flow, sheer forces are and over pressure artifacts are minimized. The combination minimizes changes in vesicle integrity.
The **SFM-300/400** coupled to one of our spectrometers is an ideal system for 90° light scattering and fluorescence, often used to following such reactions in blood cells, aquaporins, liposomes, and for water purification applications.

Other applications : Micelles, Second messenger, drug design, polymerization...

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BIO-KINE is the reference software for stopped-flow measurements. This software is intuitive and thus very easy-to-use. Bio-Kine controls the stopped-flow, the detection device, follows the acquisition, and analyzes data.

SINGLE MIXING APPLICATIONS



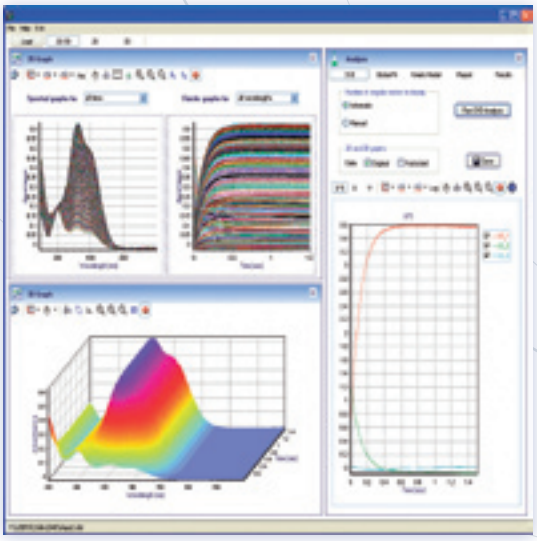
Two levels of operation are provided for mixer control. The first level is designed for rapid and easy experiment design.
The user sets the mixing ratio, the size of the cuvette and the volume of samples. Color coded windows display calculated values and alert the user to out of range conditions. The estimated dead time is automatically displayed, and a pre-trigger is also available to be sure stationary state is well reached.
This interface is ideal for routine mixing designs, occasional users, or students.

DOUBLE MIXING APPLICATIONS



The classic interface allows sophisticated andunrestrictedinstrumentprogramming. This is ideal for multi-step sequences such as double jump experiments. It can also be used to include pre-washing phase and for coupling with external devices, (synchrotron lines for example).
In double mixing application samples 1 and 2 are mixed in phase 1 before incubation in phase 2. Then it is mixed with a third reactant in phase 3, and the second kinetics is followed optically.
Estimated dead time and ageing time are automatically calculated by the software. This mode is also suitable for chemical quench, freeze quench and optical quench modes. In these applications ageing time is also automatically calculated according to user's parameters.

GLOBAL FITTING/SVD ANALYSIS



Bio-Logic now provides SVD (Single Value Decomposition) analysis tools with all new mixers. This feature is ideal to analyze data generated by diode array detectors, and multi-wavelength data generated by **MOS-200/M**, **MOS-250** and **MOS-450**.

It includes:

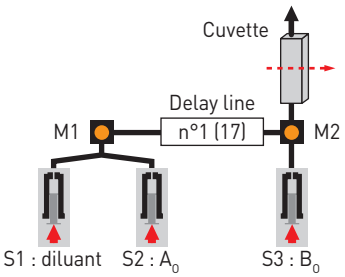
- automatic estimation of number of vectors
- fast SVD analysis
- global fitting with residual analysis (2D and 3D)
- levenberg-Marquardt and Simplex fit algorithms
- large selection of kinetics models
- import of data from clipboard or text files

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SAVE SAMPLE, TIME and MONEY.
Independent stepping motors offer unique automation possibilities.

AUTOMATIC CONCENTRATION DEPENDENCE STUDIES

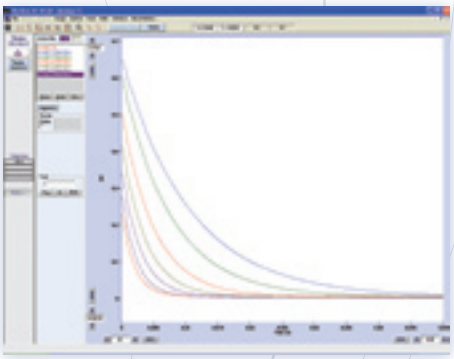
The aim of this protocol is to study the reaction A+B by varying the concentration of A at each shot while keeping B constant. The first mixer is used to set concentration of A by mixing A with buffer. Then A is mixed with B in the second mixer and the reaction is followed optically. The dead time is identical for all concentration steps.





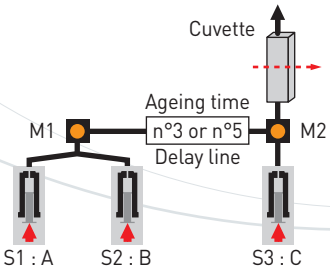
The user enters the mixing ratio between A and B at each mixing step, and the final concentration of A he wants to reach. Bio-Kine automatically calculates the optimum volume to push from each syringe. Mixing ratios can be varied from 1:1 to 1:20 using the same configuration.

Each concentration step can be repeated for averaging, concentrations at each step are automatically saved with data to facilitate data analysis. This mode is also available when using an external detector. The method is ideal for rapidly collecting data for a Chevron plots.



AUTOMATIC VARIATION OF AGEING TIME (double mixing applications)

This protocol was designed for automation of double jump experiments such as folding/unfolding experiments. Samples A and B are mixed and then aged for a user-defined time. After incubation the aged solution is mixed with sample C so the second kinetics can be observed optically.





The user defines the mixing ratios for the 3 reactants, then edits the ageing times he wants to reach.

Bio-Kine automatically calculates the optimum sequence according to the users parameters, (cuvette, mixer, flow rate), and displays the corresponding dead time. Each ageing step can be repeated for averaging. This mode is also available for external detectors.



OPTICAL COUPLING



MOS-200/M

Absorbance, fluorescence, chemiluminescence and 90° light scattering

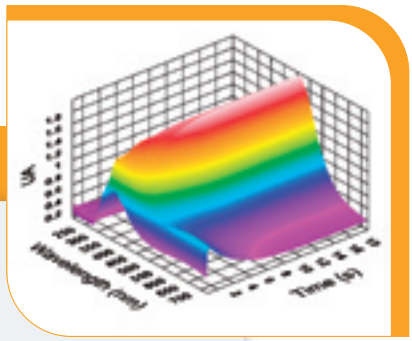
The perfect system for all basic rapid kinetics studies. It includes manual or motorized monochromator, dual light source, and high sensitivity photomultiplier. Triple detection available. Full automation for multi-wavelength experiments with automatic spectral reconstruction. 10 µs time resolution.
Circular Dichroism and T-format anisotropy techniques with special accessories.



MOS-450/AF-CD

Absorbance, fluorescence, Circular Dichroism, LD, fluorescence anisotropy and 90° light scattering

The most advanced kinetics and steady state spectrometer on the market with a double excitation monochromator and double light source. No purging needed in kinetics mode, and no need to handle lamps for operation. Time resolution to 10 µs. Bio-Kine control software allows full automation and multi-wavelength experiments with automatic spectral reconstruction.



MOS-DA

Diode array spectrometer

The fastest Diode array spectrometers on the market for UV, visible and near IR, with speed down to 0.8ms/spectra.
High quality 3D software interface. SVD analysis through Bio-Kine software.



MOS-250

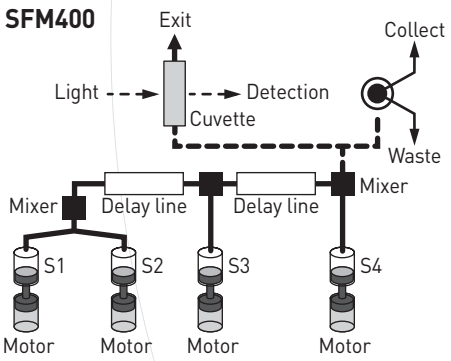
Absorbance, fluorescence and 90° light scattering in standard

Fully automated with a built-in emission monochromator. The MOS-250 can be used for kinetics and steady state absorbance/fluorescence (excitation/emission). Flexible connection options using fiber optic links.

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QUENCH-FLOW MODULARITY

SFM-300 and SFM-400 systems can be converted quickly to top performance quench-flow operation by replacing the stopped-flow observation head with a quench-flow collecting valve.
The user varies ageing times by selecting delay lines. Mixing is made in continuous flow mode, interrupted flow mode, or in Bio-Logic's unique pulse mode, (single mixing applications only).



No one could imagine doing quench-flow seriously without controlling exactly the flow rate of solutions through the delay line nor doing long calibration procedure to estimate flow rate. **Thanks to our stepping motor technology, the SFM-300 and SFM-400 flow rate is controlled precisely from Biokine software**.
The **independent stepping motors remove all limitations of a single drive mechanism**, so mixing ratios can also be changed freely.

The SFM-400/Q is the only system in the world having 4 independent syringes and 3 mixers. It is a unique system for triple mixing applications, such as De/H exchange experiments or radioactive labeling. The user controls two ageing times from the software and series of experiments can be done rapidly
A long list of papers using our instruments in this application field is available.



CUSTOMIZATION

The SFM-300/400 observation head was designed to allow easy coupling to external devices. Optional heads and adaptors have been designed for titration, neutron scattering, EPR, large and small angle X-ray, FT-IR, and conductimetry.

EASY INTERFACING:

- Fiber optic accessory
- Single and double light links
- Umbilical connection



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SPECIFICATIONS

Drive mechanism: independent stepping motors

Number of syringes:	3 (SFM-300) or 4 (SFM-400)
Number of stepping motors:	1 per syringe
Precision of stepping motors:	10.4 nl per microstep.
Number of mixers:	2 (SFM-300) or 3 (SFM-400)
Mixer type:	Berger-Ball mixer
Stop mechanism:	electrovalve

Syringes

Syringe material:	PEEK
Syringe size:	10 ml (6.8 ml, 3.6 ml and 1.9 ml are optional)
Anaerobicity:	Anaerobic operation standard

Sample consumption

Priming volume:	150 µl per syringe
Flow rate range:	0.003 to 9 ml/s (per syringe)
Mixing ratio:	fully variable from 1:1 to 1:100
Minimum injection volume:	10-30 µl depending on syringe size in stopped-flow mode
Minimum injection volume in titration mode:	2 µl

Observation head

Number of detection windows:	3
Cuvette:	quartz; choice of 8 models with light path from 0.8 mm to 1 cm
Optional:	capillary for X-ray measurements
Minimal dead time:	0.25 ms using microcuvette (0.8 mm light path), < 0.8 ms using FC-08
Material:	PEEK, Viton Full solvent compatibility using Isolast o'rings (option)

Specifications subject to change without prior notice

Note: Bio-Kine software and a USB connected hardware interface is included with the **SFM-300/400**. A PC is required in addition for controlling the **SFM-300/400** system, with a Pentium IV, and Windows 2000, XP, Vista.

Temperature control

Temperature range:	-10°C to +80°C (standard) down to -90°C using cryo-option up to 200°C using high temperature umbilical and mixing head
Temperature control:	water bath circulation
Temperature probe:	optional PT100 allows direct reading of temperature in Bio-Kine

Synchronization with detection

Trigger:	fully programmable ; 5V TTL trigger in/out available
Optical coupling:	fiber optics or direct attachment

Compatible detection devices

MOS-200:	absorbance, fluorescence, 90° Light scattering, Circular dichroism, T-format anisotropy
MOS-250:	absorbance, fluorescence, 90° Light scattering
MOS-DA:	diode array, absorbance
MOS-450/AF-CD:	absorbance, fluorescence, 90° Light scattering, Circular dichroism, anisotropy (EMFA)
MCS-200:	conductivity

General

Dimensions:	200 x 197 x 522 mm
Weight:	13 kg (SFM-300), 14 kg (SFM-400)
Communication:	USB
Power:	110V-220V

Upgrades

Chemical quench-flow
Freeze quench (EPR, Mossbauer, NMR, XAFS)
EPR stopped-flow
Upgrade from SFM-300 to SFM-400
XAFS head - neutron scattering head
Titration - Optical quench

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