

FEATURES

The RQF-3 chemical quench-flow the mixes and then quenches reactants after times as short as 2 msec, using reaction volumes as small as 15 microliters per sample. The sample handling valves provide efficient sample injection and recovery so that 20 different time points can be obtained from 300 microliters of each reactant. No other instrument can match these specifications. The computer-controlled servo-motor affords precise and reproducible reaction times and ease of use.

FUNCTION

The rapid chemical-quench flow allows the measurement of the rates of chemical reactions over the time range of milliseconds to seconds. It is especially useful for examining rates of single turnovers of enzyme-catalyzed reactions which typically occur on this time scale. Most importantly, rates of chemical reaction can be measured directly at the active site of an enzyme without the need for an optical signal. In many instances, data obtained using the quench-flow complement or supercede results obtained by stopped-flow where optical methods are required.

PROVEN PERFORMANCE

Rapid-quench kinetic analysis has become the method of choice for examination of enzyme reaction pathways. The KinTek quench-flow enables the most definitive experiments to be performed most efficiently, preserving precious biological samples and providing accurate, reliable data. The KinTek RQF-3 quench-flow has become the international standard for analysis of enzyme reaction mechanisms. The unique features of the RQF-3 enable unprecedented studies on DNA polymerase mechanisms and other enzymes where the need for performing single turnover experiments is especially significant and minimal volumes are needed to conserve the expensive synthetic substrates. The KinTek motor drive system and syringe chamber are easily adaptable to new experimental setups. Call us if you have an idea for an experiment you would like to perform. We will be happy to work with you to design and build an instrument to suit your needs.

New improved performance!



NEW IN 2003

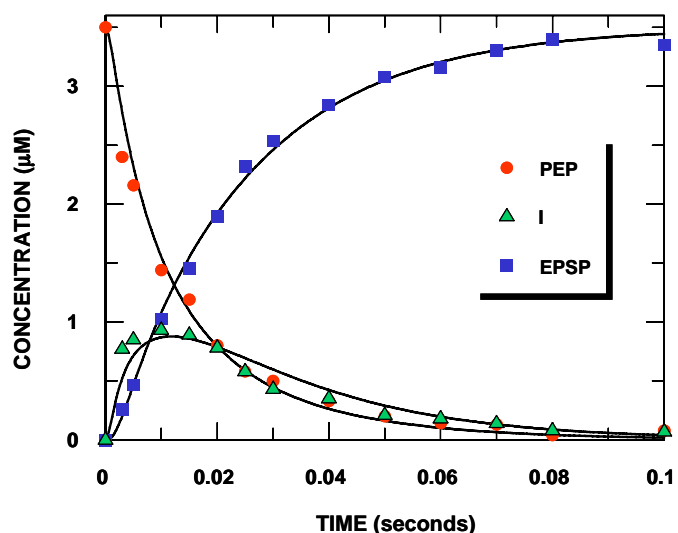
We have made the legendary Kintek RQF-3 even better by redesign of the motor drive system utilizing advances in servo-motor technology to provide an even better drive system, capable of smoother and faster starts and stops to precisely control the mixing and quenching of samples. In addition, we have further improved in the valve system and syringe/valve chamber to increase reliability and ease of use. This instrument makes chemical-quench experiments easy to perform so you can do the right experiment the first time and obtain data that is directly interpretable. At KinTek we believe in supporting the best science, and in making it easy to do the most direct experiments.

EXAMPLE: EPSP SYNTHASE

The chemical quench-flow provides unique information to define the reaction sequence and identify enzyme intermediates. The data on the right shows the time course of a single enzyme turnover obtained using a KinTek RQF-3 for the reaction catalyzed by the enzyme EPSP synthase:



The reaction proceeds by an addition-elimination mechanism through a transiently formed tetrahedral intermediate (I). The intermediate is formed in the first 10 milliseconds and decays with the formation of the product, EPSP over the next 80 msec.



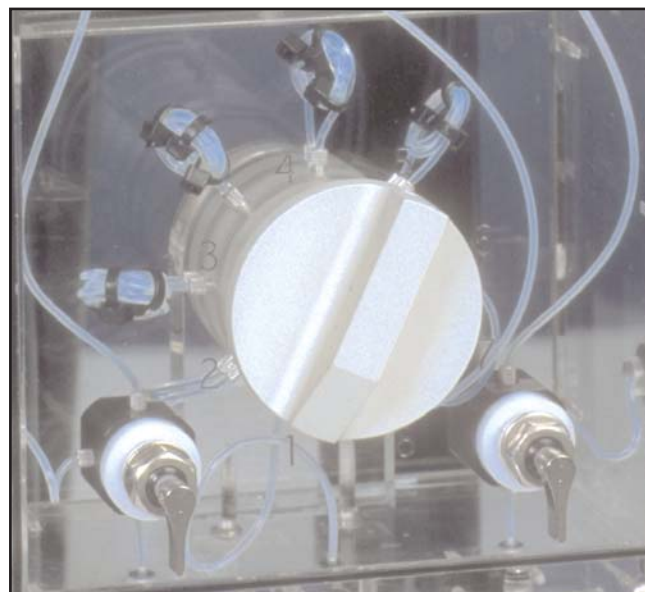
This study which led to the identification and isolation of this intermediate serves as an example for the detection of enzyme intermediates [Anderson, K. S., Sikorski, J. A. and Johnson, K. A. (1988) A Tetrahedral Intermediate in the EPSP Synthase Reaction Observed by Rapid Quench Kinetics. *Biochemistry* 27, 7395-7406.] For more information on how to design and interpret single turnover experiments see: Johnson, K. A. (1992) Transient State Kinetic Analysis of Enzyme Reaction Pathways. *The Enzymes* XX, 1-61.

SAMPLE LOAD VALVES

Samples are loaded through special 3-way valves to provide efficient utilization of reactants. This valve allows repetitive cycles of loading and flushing without wasting any sample.

8-WAY REACTION VALVE

In order to obtain different reaction times in a range of 3-100 msec, it is necessary to use delay lines of different lengths. In other quench-flow instruments, this is a tedious task with interchangeable reaction loops. In the KinTek RQF-3 quench-flow, a novel 8-way valve is used to select one of 8 different reaction delay lines. The two reactants are first mixed in the valve to start the reaction, flow through the selected delay line and are then mixed with the quench solution to stop the reaction. The desired reaction time is selected by turning the valve to the appropriate delay line. No messy interchangeable reaction loops are needed. The computer-controlled motor drive is then set for the precise drive speed to achieve the desired reaction time.



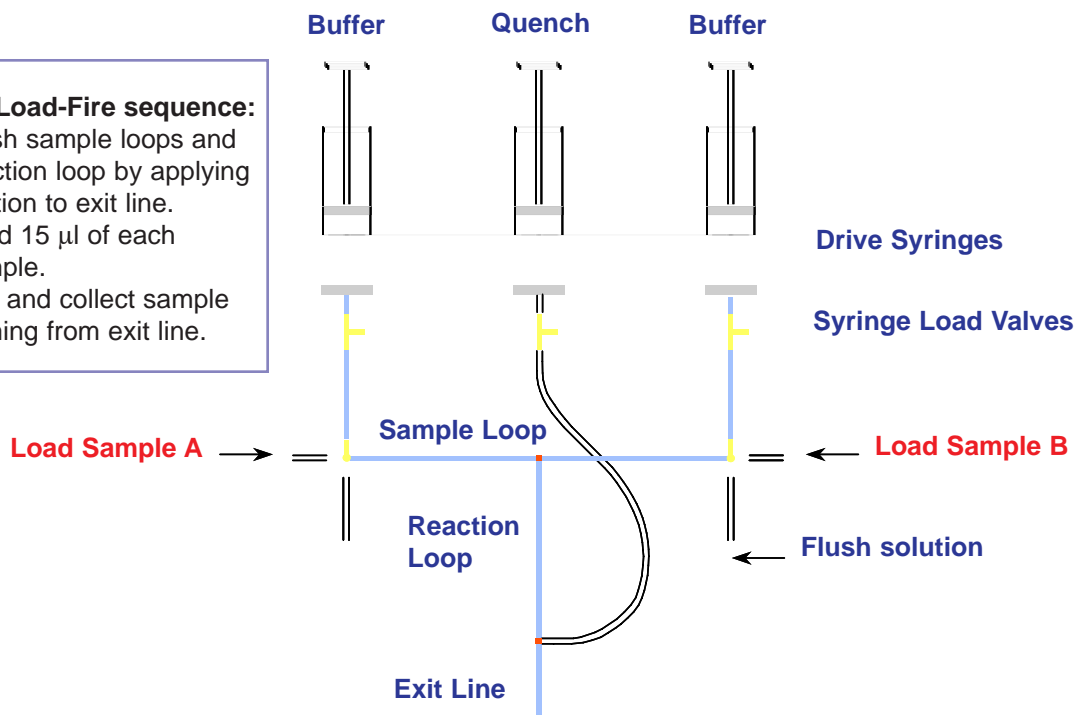
STEPPER MOTOR DRIVE

The KinTek quench-flow uses a computer-controlled stepper motor, which allows 5,000 steps per revolution of the motor. The high torque and the high performance, bipolar 6 amp, 65 volt power supply provide for fast acceleration and deceleration allowing for essentially instantaneous starts and stops of the motor. No other quench-flow provides such performance. Coupled to a unique, precision valve system, the RQF-3 provides unparalleled ease of use and reliability. Even "four syringe" type experiments involving three mixing events and two programmed reaction times can be achieved using the computer-controlled motor drive - without the complications of four drive syringes!

KINTEK QUENCH-FLOW SCHEMATIC DIAGRAM

Flush-Load-Fire sequence:

1. Flush sample loops and reaction loop by applying suction to exit line.
2. Load 15 μ l of each sample.
3. Fire and collect sample coming from exit line.



RQF-3 VALVE SYSTEM

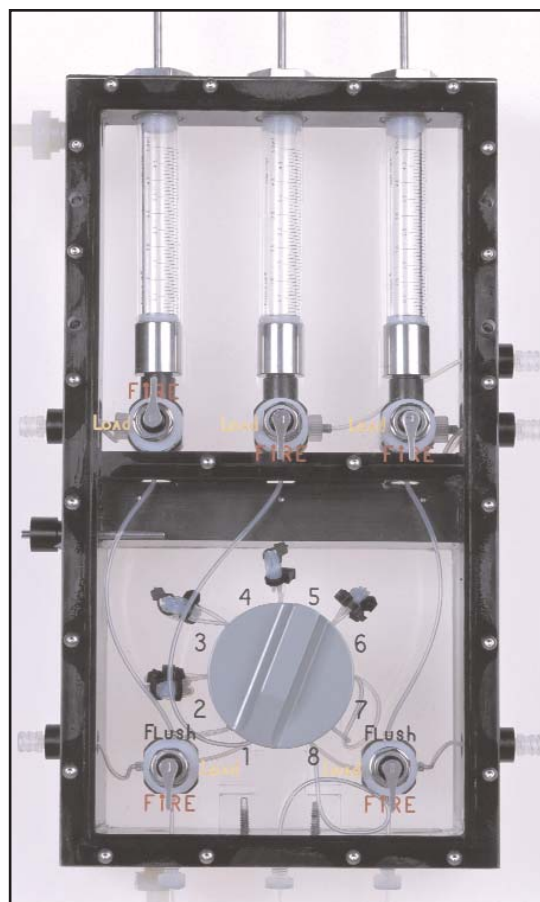
The unique valve arrangement of the KinTek RQF-3 allows samples to be loaded into the 15 microliter sample loops via a three-way valve. The reactants are then forced together through the delay line by buffer from the drive syringes. This valve system allows efficient sample loading so that 20 data points can be collected from less than 300 microliters of each reactant, with no waste! Larger sample loops can be used or samples can be loaded into the drive syringes to get up to 5 ml in a single shot.

SYRINGE/VALVE CHAMBER

The drive syringes, sample loading valves and reaction loops are all contained within a thermostatted sample chamber. The syringe/valve chamber can be detached from the motor drive allowing easy interchange between different experimental setups or maintenance. KinTek offers a complete factory maintenance with rapid turnaround to keep your experiments working. Simply detach and return the syringe/valve chamber to the factory for maintenance.

SAMPLE LOAD LOOPS

The 3-way valve is used to connect the sample loops either to the flush line, the sample load syringe or the drive syringe containing buffer. This method enables efficient sample loading and flushing with no waste of sample between runs. The Flush-Load-Collect cycle can be completed in less than two minutes so that an entire course time consisting of 20 data points can be collected from approximately 300 microliters of each reactant. And the entire experiment can be completed in less than 45 minutes.



COMPUTER CONTROL

The KinTek quench-flow is entirely under computer control, making the operation of the instrument easy and convenient and allowing the operator to concentrate on the sample collection and analysis. The user interface is simple and intuitive. Simply input the desired reaction time, and the computer sets up the stepper motor and tells the operator which reaction loop to use.

KEYBOARD COMPUTER TERMINAL

Because quench-flow experiments involve the use of concentrated acids or bases and radioactive materials, the KinTek quench-flow uses a sealed keyboard terminal with a two-line LCD display. Thus, the computer interface is protected from the harsh environments necessary for performing the experiment. The keyboard can be washed with mild soap and water at the end of the experiment to eliminate contamination.



THE RPL-3 RAPID PHOTOLYSIS CHAMBER

The RPL-3 Rapid Optical Photolysis Chamber replaces the 8-way valve with a optical flow cell. In this arrangement the samples are mixed into the flow cell where the reaction is paused for the desired time. After this time the computer triggers an external light source to irradiate the mixed sample in the flow cell. This source can be almost anything. We have built photolysis chambers utilizing many light sources, including flash lamps, lasers and even synchrotron radiation! Our RPL-3 Rapid Optical Photolysis Chamber is based on our world leading quench-flow and mounts to the same drive system. This allows the customer to have both a RQF-3 Rapid Quench Flow and a RPL-3 Rapid Photolysis Chamber at a very affordable price.

FREEZE-QUENCH ACCESSORY

An optional freeze-quench nozzle can be added to any chemical quench-flow. The nozzle provides a fine aerosol to allow rapid freezing of samples after defined reaction times. Simply attach the nozzle to the end of the exit loop and direct the spray to liquid nitrogen-cooled propane or other suitable coolant. The frozen powder can then be collected for analysis.

ABOUT KINETEK CORPORATION

KinTek was founded by Kenneth A. Johnson, Ph.D. in 1987. Dr. Johnson needed to design and build new instruments for his own research. The company was founded in response to the large demand by his colleagues instruments to do similar experiments. Dr. Johnson's major motivation in starting the company was to encourage others to do the right experiments to directly measure reactions occurring at the active sites of enzymes. The company has continued that tradition, putting the needs of the scientific community first and encouraging innovation.



SPECIFICATIONS

The KinTek RQF-3 quench-flow instrument allows the rapid mixing and quenching of samples to provide reaction times as short as 2-3 milliseconds and with volumes as small as 15-20 μ l per shot. A unique valve system affords easy loading and collection of samples with no waste. The entire system is chemically inert and can be thermostatted. The KinTek computer-controlled stepper motor drive systems allows for precision and ease of use that is unparalleled in the industry.

Reaction Times: The minimum reaction time is 2 milliseconds. Reaction times up to 10000 seconds can be programmed.

Sample Volumes: The minimum reaction volume is 15-20 μ l per shot. The load-fire-flush cycle is completed with no waste between runs so that 20 time points can be obtained with 300-400 μ l of solution. Up to 5 ml can be collected in a single shot for bulk sample collection.

Motor Drive: A computer-controlled servo-motor drive provides precise and reproducible setting of the reaction times. The motor is digitally-controlled by a built in computer that is part of the power supply. A high torque, high performance motor provides smooth, essentially instantaneous starts and stops of the drive syringes.

8-Way Reaction Loop Valve: A single valve allows selection of one of eight reaction loops to obtain reaction times of 2 msec to 100 msec in 8 time zones. The reaction loop volume and solution flow rate are varied to the desired reaction time.

Computer Control: The volumes of reaction loops are stored in the computer in non-volatile memory, integral to the power motor supply. During an experiment, the operator simply enters the reaction time of interest and the computer sets up the drive motor to control the drive pulse sequence.

Sealed Keyboard: A sealed keyboard with a two-line display provides a convenient user interface for entering reaction parameters. The hermetically sealed keyboard can be easily washed to eliminate contamination by acids or radioactivity.

Vertically Mounted Sample Chamber: A single chamber contains the drive syringes and valve systems. It can be adapted for various experimental setups or for different users.

Syringe volume and range: 5 ml standard. Syringes of 0.25, 0.5, 1.0, 2.0 and 10.0 ml are also available for variable ratio mixing.

Temperature range: A range of 0-70°C is maintained by circulating water bath (not provided).

Dimensions (width x depth x height) & weight:

Quench-flow stand: 20 x 48 x 91 cm 17.9 kg.

Motor controller: 30 x 28 x 15 cm 8.2 kg.

Keyboard: 29 x 18 x 4.4 cm 0.9 kg.

WARRANTY

The KinTek RQF-3 is covered by a 2-year limited warranty covering factory repair or replacement of the motor, drive system, keyboard or computer/power supply. The valves, syringes and tubing system are covered by a 90 day warranty.

SERVICE

At KinTek we know the difficulties of planning and executing quench-flow experiments. So we work hard to keep your instruments in optimal condition. If you have a problem and need fast service, we usually can repair a quench-flow system in 24 hours, so you can get back to doing that important experiment.

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