

FAST 2000™

Flow Assay Sensing and Testing



INTRODUCTION

The Flow Assay Sensing and Testing system (FAST 2000) is a rapid and convenient system for performing displacement assays with a resolution to 1 ppb. Research International has developed the FAST 2000 under contract to the United States Naval Research Laboratory for performing flow immunoassays specifically targeted for small molecules. The optically-based signal gathering capabilities of the FAST 2000 are combined with precise fluidics control to yield a highly versatile assay system. The unit can be easily carried into the field and plugged directly into a portable PC via a PCMCIA port for on-site data acquisition and analysis.

DESCRIPTION

With this detection approach, a fluorophore-labeled, low-molecular weight analyte is bound to analyte-specific antibody immobilized on a permeable filter membrane. When untagged analyte passes through the charged filter, an exchange reaction occurs wherein some or all of the incoming analyte displaces tagged material. A sensitive downstream fluorometer detects the fluorophore using a 635 nm laser diode as an excitation source. This produces a signal whose integrated fluorescence is proportional to analyte concentration.

The FAST 2000 is designed to plug into a National Instruments data acquisition card (DAQCard -

1200) located in the PCMCIA slot of an IBM-compatible computer. An advanced Windows-based software program has been developed to record and display the fluorescent signal from the FAST 2000 system in real time. The software provides a simple, menu-driven user interface to lead users through the steps required to successfully determine if a trace amount of analyte is present in a given sample and to quantify the concentration level. The software also provides more advanced users complete control of the operational parameters for running nonstandard protocols. Recipes for running customized assays can easily be developed and saved for use at a later time.

The hardware provides all necessary fluid storage and flow control needs. An outboard box provides convenient storage of the various fluids required in performing the assay. The software provides a straightforward calibration protocol that can be performed at any time. The software then automatically analyzes subsequent assays based on the most recent calibration assay so that accurate concentrations are obtained even if tagged analyte levels in the membrane are depleted. From 10 to 50 assays can typically be performed before the membrane's loading is depleted and must be recharged. In a laboratory setting, the quantification of dissolved TNT and RDX levels down to 1 to 10 ppb have been demonstrated using the FAST

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2000 system. The system is capable of detecting 0.001 ppb of fluorescent tag in a 100 μ l sample (about 100 femtomoles), and is ideal for the development of trace analyte assays. The permeable filter membrane that contains the tagged analyte and several of the system fluidic valves are housed in a disposable injection molded plastic coupon (patent pending). This creates a turnkey system, allowing assays to be run in the field with no preparation time required between each assay. If a membrane becomes depleted of tagged analyte, the user can simply insert a new coupon into the system and immediately continue to run assays.

The FAST 2000 was designed to be a field-portable instrument. It is extremely small—measuring only 6 cm x 15.5 cm x 16 cm, with a total weight of 1.25 kg (2.75 lbs.). It draws all of its power from the PCMCIA port, requiring no batteries or external power connections.

FOR MORE INFORMATION

System specifications of a general nature are indicated here. For further details concerning specific system or assay characteristics, please contact Research International directly.

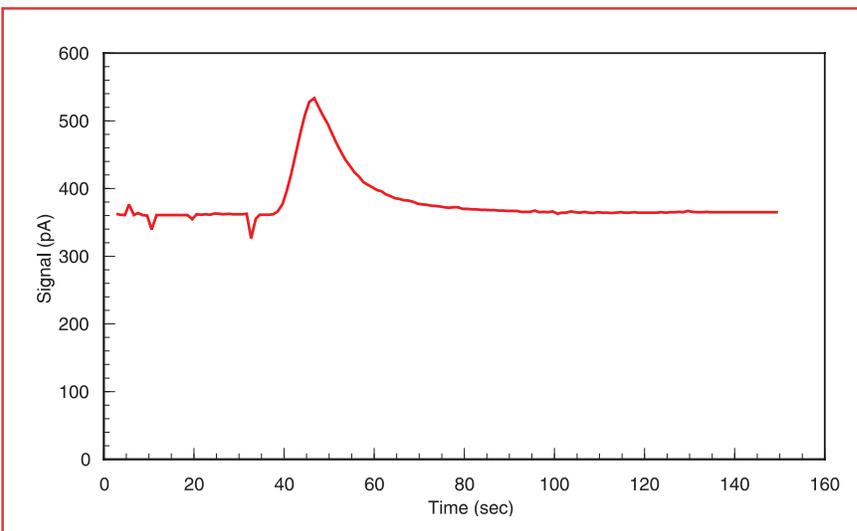


Figure 1: Signal measured on the FAST 2000 from 10 pg/ml of Cy5.

SPECIFICATIONS

<u>Characteristic</u>	<u>Description</u>
Sensing media	Affinity polymer membrane.
Assay vessel	Disposable coupon.
Resolution	5 ppb.
Minimum assay time	120 seconds.
Buffer solution volume	200 ml stored in double-bladder PVC bag.
Reference standard volume	3 ml stored in double-bladder bag.
Buffer operational flow rate	1 ml/min, variable during assay protocol.
Optical source	5 mW solid-state laser, 635 nm, operated at derated 1.5 mW.
Optical detection	Displacement fluorescence assay.
Photocurrent resolution	0.0122 pA.
Maximum photocurrent	2.5 nA.
Measurement rate	One reading/second or slower, controlled by user.
Warm-up time	15 minutes.
Number of channels	One channel.
Host requirements	Win95 system: 486/80 MHz with 12 MB RAM. Win3.1 system: 486/33 MHz with 12 MB RAM. Mouse required.
Hardware requirement	PCMCIA slot.
Data acquisition	National Instruments DAQCard - 1200.
DAQCard - 1200 driver	NIDAQ for Windows version 4.9.0 or newer.
Power requirements	300 mA at 5 volts, supplied by PCMCIA port. No external power connections required.
Size	6 cm x 15.5 cm x 16 cm.
Weight	1.25 kg (2.75 lbs.).

Research International reserves the right to change specifications without prior notice on any devices in this data sheet.



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