Analyte 2000™

Fiber Optic Fluorometer

INTRODUCTION

There is currently a need for new technologies that are designed specifically for the high-sensitivity field monitoring of toxins, explosives, and chemical contaminants. Some of the most promising strategies for performing such assays are based on harnessing the highly specific immune and protective responses of animals and humans. Research International has developed a patented 4-channel, solid-state fluorometer system based on a careful integration of optics, electronics, and software that can monitor the progress of these immunological reactions on exposed optical waveguide surfaces using fluorescent-tagged reagents. Using this system, toxins such as *Y. pestis* have been detected at levels below one part per billion from samples of a few hundred microliters.

FEATURES

Up to four sensor waveguides can be simultaneously interrogated with 635 nm light and monitored for fluorescence levels. Manipulation of incoming data is performed on a host PC that is connected to the fluorometer via an RS-232 link. A Windows-based software package is included that provides the user with a high degree of control over the data collection process. Return signal levels are displayed both numerically as well as in strip chart form, and the user may initiate or terminate storage of incoming data at any time. Data logging also incorporates an event feature that allows the user to insert markers into the data file at random points. To minimize deterioration of light-sensitive fluorophores, the operating system allows the lasers to be operated in a pulsed mode at a repetition rate set by the user. The system also features RS-232 output, allowing the transmission of data from a remote location via telephone lines or an RF telecommunications link.

Calibration software is provided that permits the user to create calibration files based on responses obtained with samples of known concentration. Five different curve-fitting options are available for fitting highly nonlinear calibration responses. Due to the variety of strategies possible for generating standard response curves, Research International invites queries regarding custom software implementations.

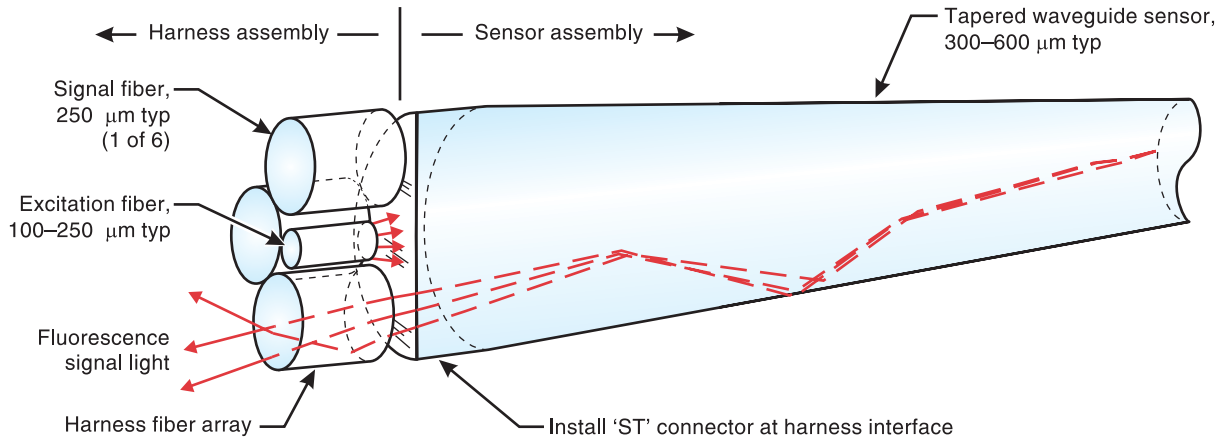
DESIGN

Internally, the fluorometer uses a mother/daughter printed wiring card strategy wherein a microprocessor-based mother card accepts up to four plug-in sensor interrogation cards. Fluorescence excitation sources on the daughter cards incorporate 635 nm laser diode assemblies that are electronically chopped at a frequency of 135 Hz to provide AC optical signals analogous to those produced by a mechanical chopper.

Each channel is connected to its sensor waveguide via a custom multifiber harness of approximately 1 m length. The harness incorporates a custom ‘ST’ female connector at the distal end. This connector contains a single on-axis quartz fiber for waveguide excitation and a symmetric surrounding array of plastic fibers for fluorescence signal recovery. Sensor waveguides for use with

RESEARCH INTERNATIONAL

Sensor Interconnect Strategy for Tapered Multimode Waveguide



the system are equipped with low-cost male 'ST' connectors and during testing, are inserted into the harness's female connector.

A quartz fiber is used to transfer excitation light because of its low internal fluorescence, while the signal fibers are constructed of a high-numerical aperture plastic to maximize light capture. Since light levels in the return fiber array are low, there is no concern regarding the excitation of fluorescence.

This combination of optics, electronics, and software results in an exceptionally small multichannel fluorometer module that is portable, user-friendly, and adaptable to a wide variety of sensor types.

FOR MORE INFORMATION

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

RESEARCH INTERNATIONAL

17161 Beaton Road, Monroe, WA 98272
Tel: 360-805-4930; fax: 360-863-0439-
E-mail: info@resrchintl.com
www.resrchintl.com

SPECIFICATIONS

Characteristic	Description
Excitation Source	635 nm, 5 mW laser diode operated at a derated 1.5 mW level.
Receiver Design	Dichroic long-pass filter to reject excitation light. Synchronous detector with auto gain-ranging.
Photocurrent Resolution	0.019 pA; 12-bit A/D.
Dynamic Range	22, 522 pA
Maximum Number of Channels	Four
Measurement Rate	One sample per second
Data Display	Real-time CRT and numeric windows
Data Output	CRT, diskette, printer, or RS-232.
Sensor Interface	Duplex fiber optic cable (1 m is typical) with female 'ST'-type bulkhead connector at the distal end
Sensor Waveguide Requirements	Optimum fiber size at connector interface is 400–800 μm o.d.; 'ST' termination required.
Software Package	Windows-based software is provided
Operating Voltage	5.3–12 V lump-in-cord AC adapter or 10-hr battery pack available
Warm-Up Time	15 min
Physical Size	20.0 cm L x 8.5 cm H x 11.2 cm W
Weight	1.6 kg
Host Hardware Requirements	IBM 486, 100 MHz or compatible; 8 MB RAM running Windows® 95.

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

U.S. Patent No. 5,606,170
Analyte specs (091503).p65