

SPIRIT - Portable SPR Instrument Specifications

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Overall Instrument Performance

The instrument is a rugged, portable, high-performance, multi-analyte, instrument suitable for field use, based on surface plasmon resonance (SPR) biosensors. Demonstrated ability to detect pathogens and toxins from complex sample sources. See peer-reviewed publications on seattlesensors.com.
(http://hwww.seattlesensors.com/Scientific_Background.html)

Multi Analyte Detection and Timing

- Able to simultaneously assay 4 different analytes, in triplicate, from a single sample
- A total of 12 channel measurements reported every second
- Fast assay time, 5 minute direct detection

Portability

- Small size and weight, (approximately 2 lbs), Dimensions (4"x6"x4")
- Pre-programmable for standalone operation for customizing the sampling sequence and timing
- Low power (~0.4 amp) so that it can be operated with a rechargeable battery pack supply for 10 or more hours of operation between charges

Automation of Fluidics System for easy development and operation of complex assays

- Valves and pumps are automated to implement an injection loop flow system that allows sensors to be exposed to sample, rinsed, and treated with additional reagents (such as secondary antibodies) under computer control
- Injected samples flow over the surfaces of four or eight sensor chips fastened into a temperature-controlled flowcell
- Fluidic are pressurized to about 10 psi, eliminating bubbles in the sample
- Manual injection of sample
 - Ultra low flow cell volume (1 ul per flow chamber)
 - Total sample volume of 100ul
- The system incorporates fluidics fabricated to give the following benefits:
 - The flowcell design allows easy removal and replacement of individual sensor elements
 - Fluidics system that is integrated into a single manifold
 - System seal well with pressure

SPR 2000 (Spreeta) Sensing Chip

The measurement system makes use of pre-designed, or customized, assays that are compatible with the SPR 2000 (Spreeta) SPR sensor component, the benefits of which are:

- Miniaturized, robust, high performance devices have fixed optical and detector components critical for portable sensing
- Excellent manufacturing capabilities and quality control
- Unique in that the all of the optoelectronic components needed to perform an SPR measurement are incorporated into a rugged molded plastic chip about 1.5 x 1.5 x 0.5 inches in size.

- Exhibit very low noise when used in conjunction with its optimized readout hardware, signal processing, and data analysis techniques

Temperature Control

- A thermoelectric heater/cooler (peltier) stabilizes the specimen and sensor block to within 0.01°C
- This is one of the technical breakthroughs that gives this instrument its small size, robust operation in non-lab environments, and ensures its accuracy and repeatability

Control and Data Acquisition

- The unit contains control components necessary to perform refractive index measurements with the SPR 2000 (Spreeta) chips, control the sensor fluidics, and drive the sensor's user interface.
- A 1MHz analog-to-digital converter and a digital signal processing (DSP) microcomputer is used to digitize the SPR2000 outputs, process sensor data, and control the instrument
- Custom electronics boards drive the Spreeta LEDs, provide control of fluidics pumps and valves, and control the temperature of the sensor elements by driving the thermoelectric elements mated to the flowcell.
- System electronics are powered by switching power supplies for efficient generation of instrument voltages and drive of thermoelectric elements,
- The instrument measures and reports refractive index values at a programmable rate per channel
- Instrument reports temperatures, current consumption, and fluidic state

Graphic Display and User Interface

- The detection system is controlled by a combination of embedded software and a serial link communication interface to your portable computer (laptop, smartphone, or tablet)
- The interactive display shows numerical values of baseline refractive index for all 12-sensor channels, with values updated once per second
- It supports user interactions such as switching between the value for a particular channel, and the current SPR curve for that channel
- The system allows the user to record background and reference data, establish a baseline for the displayed refractive index values, and store and recall reference data from flash memory
- A scrolling "strip chart" display is included to allow monitoring of sensor temperature, temperature set point, and instrument current consumption
- There is a fluidics control programming screen that allows the user to enter and store up to four programmed sequences of fluidic operations to be automatically performed by the sensor. Each sequence is able to contain up to 15 steps to support a wide variety of assays