

# Gated Integrators and Boxcar Averagers

SR200 Series — NIM system modules



## SRS Boxcar Systems

- **SR280 — NIM mainframe**
- **SR250 — 2 ns gated integrator**
- **SR255 — 100 ps fast sampler**
- **SR245 — Computer interface (GPIB and RS-232)**
- **SR240 — 300 MHz preamp (4 ch.)**
- **SR200 — Gate scanner**
- **SR235 — Analog math processor**
- **SR272 — Windows software**

The SR200 Series Boxcar Averager System is a modular instrumentation platform designed to acquire and analyze fast analog signals. The system consists of a NIM compatible mainframe and modules which can be selected to tailor a system to individual requirements. The SR200 series is flexible enough to handle gate widths from 100 ps to 150  $\mu$ s, repetition rates up to 50 kHz, and has both analog and digital outputs. With its low-noise inputs and low-drift outputs, the SR200 series is the standard for gated integrators and boxcar averagers.

### Gated Integration

Gated integrators and boxcar averagers are designed to recover fast, repetitive, analog signals. In a typical application, a time "gate" of predetermined width is precisely positioned relative to an internal or external trigger to coincide with your signal. A gated integrator amplifies and integrates the signal that is present during the time the gate is open, ignoring noise and interference that may be present at other times.

### Boxcar Averaging

Boxcar Averaging refers to the practice of averaging the output of the gated integrator over many shots of the experiment. Since any signal present during the gate will add linearly, while noise will add in a "random walk" fashion as

the square root of the number of shots, averaging N shots will improve the signal-to-noise ratio by a factor of  $\sqrt{N}$ .

### Analog and Digital Measurements

The SR200 series is designed to work without a computer, allowing you to quickly "tune-up" your experiment, or with a computer, automating complex measurement sequences. Modules like the SR235 Analog Processor perform signal processing functions, such as ratioing and background subtraction, without the need for a computer, while the SR245 computer interface gives you complete access to boxcar measurements over GPIB or RS-232.

### SR200 Series NIM Modules

The SR200 series modules are briefly described below. Further details, including specifications and features, can be found in the following pages of this catalog.

#### SR280 NIM Mainframe and Display Module

The SR280 Mainframe and Display module is a rack-mountable NIM bin which can house up to nine, single-width NIM modules. The three rightmost slots in the bin are occupied by a NIM-compatible power supply and display which provides  $\pm 12$  V and  $\pm 24$  V to the other NIM modules. The display module also contains an analog meter, digital meter and bar graph meter useful for monitoring the output of the boxcar system.

#### SR250 Gated Integrator Module

The SR250 Gated Integrator module is the basic building block of the SR200 series. The SR250 is a complete, single-channel gated integrator and boxcar averager with gate widths from 2 ns to 15  $\mu$ s. You can average from 1 to 10,000 samples, and the "last sample" feature lets you bypass averaging and access the gated integrator output directly.

#### SR255 Fast Sampler Module

The SR255 fast sampler allows you to do gated integration with gate widths as short as 100 ps. Four discrete gate widths are provided: 100 ps, 200 ps, 500 ps, and 1000 ps. Output is provided in both analog and digital form.

#### SR245 Computer Interface Module

The SR245 adds both analog and digital data acquisition capabilities to the SR200 series. Eight analog I/O channels can be configured as inputs or outputs, and two front-panel digital I/O ports are provided. The SR245 can communicate with a computer over the RS-232 and GPIB interfaces.

#### SR240 Quad 300 MHz Preamplifier Module

The SR240 contains four DC to 300 MHz amplifier channels, each with a gain of 5. The SR240 is ideal for amplifying low-

level signals from photomultipliers and photodiodes before being measured by the SR250.

#### SR200 Gate Scanner Module

The SR200 Gate Scanner is designed to automate waveform recovery by providing the voltages needed to scan the SR250's gate delay. Scan times from 10 ms to 5 minutes can be selected.

#### SR235 Analog Processor Module

The SR235 Analog Processor performs a variety of functions without the need for a computer. Its two inputs can be combined to form an "argument" of A, B, A-B, AB/10, 10A/B, or  $\sqrt{A^2+B^2}$ . The SR235 then outputs a function F(x) of this argument corresponding to x,  $x^2$ ,  $\ln(x)$ ,  $dx/dt$ , or  $(dx/dt)/100$ .

#### SR275 Display Module

The SR275 display module is provided for users who already own a NIM bin and power supply. It contains the same three meters as the SR280, but has no power supply or NIM bin.

#### SR272 Data Acquisition Software

The SR272 is a Windows compatible software package designed to acquire, display and analyze data taken with the Boxcar system. The program works with the SR245 Computer Interface module over the GPIB or RS-232 interface. Features include on-screen cursors, auto-scaling, smoothing and curve fitting.



*Boxcar rear panel*

### Ordering Information

|       |                              |        |
|-------|------------------------------|--------|
| SR200 | Gate scanner for SR250/SR255 | \$1000 |
| SR235 | Analog math processor        | \$1500 |
| SR240 | 300 MHz preamplifier (4 ch.) | \$1000 |
| SR245 | Computer interface           | \$1500 |
| SR250 | Gated integrator             | \$2990 |
| SR255 | Fast sampler                 | \$2990 |
| SR272 | Data acquisition software    | \$500  |
| SR275 | Display (w/o power supply)   | \$800  |
| SR280 | NIM mainframe and display    | \$1600 |