# Model 4121B

## Gated Integrator


SIGNAL RECOVERY

## FEATURES

- **1 ns minimum gate width**
- **80 kHz max trigger rate**
- **Linear or Exponential averaging**
- **Input offset control**
- **Normal and Baseline sampling modes**
- **Built-in trigger generator**

## APPLICATIONS

- **Pulsed laser experiments**
- **Phosphorescence decay time studies**
- **Precision signal sampling**

## DESCRIPTION

This module is an ideal component for building boxcar averager systems. It includes a wide bandwidth variable gain AC/DC coupled input amplifier with offset adjustment and a high speed sampling gate with variable width and delay controls. It operates in normal or baseline sampling mode and features a switch-selected choice of how many samples are included in the averaging process. Separate outputs for the average and last sample taken are also provided. A gate monitor supplies a synchronized gate output pulse for application to an oscilloscope trigger or for referencing associated processing electronics. Trigger input is ECL or TTL or can be derived from the module's own adjustable trigger generator.

The module is packaged in a 2-unit wide NIM format and as such requires a suitable NIM rack and power supply to operate. The simplest single-channel system can therefore be produced with one model 4121B module and a suitable NIM rack and power supply (such as the ***SIGNAL RECOVERY*** model 4006 or 4001A/4002D. The addition of a second model 4121B and a model 4161A Display/ADC and control module provides a dual channel system with the added capability of allowing the transfer of output data to a computer for external analysis. Further modules can be added to increase the overall number of channels.

The unit can also be used with other ***SIGNAL RECOVERY*** instruments, such as our lock-in amplifiers, to build systems capable of swept-gate waveform recovery experiments, all controlled via the Acquire data acquisition software.

## Specifications

**General**

Single-channel gated integrator module mounted in NIM enclosure with adjustable sensitivity, offset, gatewidth and output averager. Manual controls.

Analog gate delay generator with manual or DC voltage control.

**Measurement Modes**

On receipt of an external trigger, the instrument waits for the preset gate delay and then integrates the voltage present at its input for the preset gate width. On completion a DC voltage representing this integral is provided at the Last Sample Output connector and in addition fed forward into an analog integrator stage.

**Signal Channel**

| | |
|---|---|
| Mode | Normal or Baseline Sampling |
| Sensitivity | ±20 mV to ±2 V in 1-2-5 sequence |
| Coupling | AC/DC |
| Impedance | |
| DC only | 50 Ω // 10 pF |
| DC or AC | 1 MΩ // 30 pF |
| Maximum Safe Input | |
| 50 Ω Input | ±5 V |
| 1 MΩ Input | ±100 V |
| Offset | ±10 × FS; non-removable |
| Overload Indicator | LED |
| Overload Level | Input (signal plus noise) > 1.1 × FS |
| Overload Recovery | Recovers after 1 sample for ×10 overload |
| Gain Drift | 0.5% /°C, gate width > 30 ns; 1.0% /°C, gate width < 10 ns |

DC Drift (referred to input)
0.2%/°C, gate width > 20 ns;
1.0%/°C, gate width < 20 ns

Bandwidth
- 50 Ω input: DC to 450 MHz
- 1 MΩ DC input: DC to 100 MHz
- 1 MΩ AC input: 1.5 Hz to 100 MHz

Signal Risetime
- 50 Ω input: 2 ns; 20% to 80%
- 1 MΩ input: 10 ns; 20% to 80% from 50 Ω source.

**Sampler and Timing**

Gate Width
1 ns to 30 µs in 1-3-10 sequence, switch selectable with a continuously variable ×1 to ×5 multiplier

Sample Correlation: Less than 0.5% of the sample output due to trigger *t* remains at trigger *t* + 1

Gate Delay
- Input: 0 to 10 V DC varies delay by 0.5% to 100% of range setting
- Max delay: 3 ns to 300 ns in a 1-3-10 sequence plus user options, which give 10 µs (default), and 1 µs, 100 µs, 1 ms or 3 ms by capacitor change.

Trigger Source
- Internal: 0.5 Hz to 40 kHz selectable with range switches 0.5, 5, 50, 500, 5000, off. Vernier is 10× range.
- External
  - ECL: Positive edge, 5 ns min pulse width with termination of 50 Ω to -2 V; -5 V to +10 V pk-pk safe input.
  - TTL: Negative edge, 20 ns min pulse width; -5 V to +10 V safe input.
- Max. Trigger Rate: 80 kHz

Trigger Indicator: LED lights when unit is triggered

Trigger Generator
- Output: BNC TTL out on rear panel active in all trigger modes. Polarity set by jumper.
- Frequency ranges: 0.5, 5, 50, 500 Hz, 5 kHz and off with vernier to overlap ranges.

Baseline Input: TTL line to indicate whether sample is signal or baseline value.

**Analog Output Averager**
- Mode: Linear or Exponential
- Samples Averaged: 1, 3, 10, 30, 100, 300, 1k, 10k
- LSO Droop Rate: < 0.2% FS/s
- Averager Droop Rate: When there are no triggers the droop rate is < 0.001% per minute for 10k samples

**Outputs**
- Average Out: ±10 V FS with 50 Ω output impedance and capable of driving 2 kΩ load
- Last Sample Out: ±10 V FS
- Gate Monitor: 0.3 V into 50 Ω to ground. Marker pulse-width equals gate width. Position is within 5 ns from actual gate
- Trigger: TTL
- Baseline Output: TTL output line that toggles with each trigger to indicate whether next sample is signal or baseline value.

**General**

Power Requirements
+24 V at 200 mA; -24 V at 150 mA
+12 V at 300 mA; -12 V at 590 mA
+6 V at 160 mA; -6 V at 630 mA

Dimensions
- Height: 8¾" (222 mm)
- Width: 2¾" (70 mm)
- Depth: 9¾" (248 mm)

Weight: 3 lb (1.4 kg)

## Why should you choose *SIGNAL RECOVERY* products?

### Model 4121B Gated Integrator

| *SIGNAL RECOVERY* Product Features | Benefit to you |
|---|---|
| ◆ Higher maximum sensitivity | Sensitivity settings on 4121B are for a full 10 V output, not the 1 V of competing units, allowing you to measure smaller signals |
| ◆ High input bandwidth | Signals are less distorted before being sampled |
| ◆ 1 ns minimum gate width | Isolate narrower features more easily. In scanned gate work obtain finer resolution of peaks |
| ◆ Built-in trigger generator | Use to trigger your experiment |
| ◆ Linear or exponential averaging | Linear averaging means that every sample contributes equally to the output |
| ◆ Baseline Out output | Will directly drive one of our light choppers for automatic baseline subtraction |
| ◆ Faster Triggering | 80 kHz max trigger rate allows acquisition up to 4 times faster than competing instruments |
| ◆ Excellent reset of integrator between triggers | Ensures that each sample is essentially independent of previous samples |