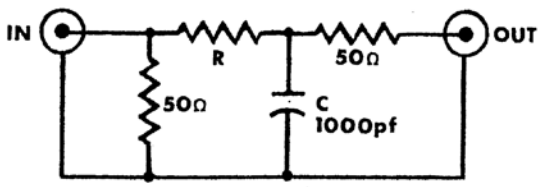
# Passive Integrators


The PI-1, 5, 10 and 100 series integrators are passive resistor-capacitor integrators with standard RC time constants of 1, 5, 10 and 100us. They are available with a variety of standard connector types such as N-type.

## IDEALIZED CIRCUIT




*Idealised circuit based on the AFWL RCI-1B integrator.*

## TRANSFER FUNCTION

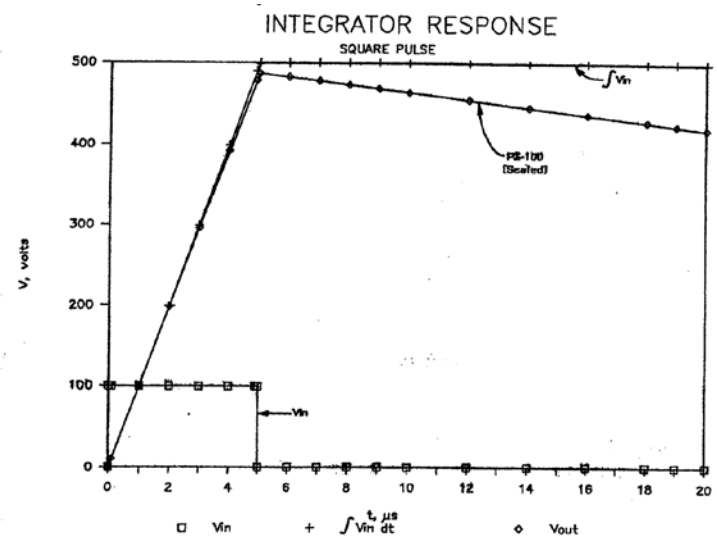
$$R\frac{dq}{dt} + \frac{q}{C} = V_{in}(t)$$

*…where q = charge on capacitor.*

The integrator is designed to drive a 1MΩ / 10pF load impedance. The voltage out is essentially the voltage across the capacitor q/C which is calculated by solving (integrating) the differential equation for q(t). This is most conveniently done by Laplace transforms which ield the transfer function in the frequency domain.

$$\frac{V_{out}(s)}{V_{in}(s)} = \frac{1}{(sRC + 1)}$$

where s = jw = Laplace operator. The transfer function is an integrator for sinusoidal inputs with frequencies large compared to $1/(2\pi RC)$; or for transient inputs for times small compared to RC. Typical performance of the PI-100 integrating a 5μs square pulse is shown in the plot below. This pulse is integrated with an error of 2.5% over the 5μs duration.




| | PI-1 | PI-5 | PI-10 | PI-100 |
|---|---|---|---|---|
| RC (Time Constant) | 1µs | 5µs | 10µs | 100µs |
| CW Accuracy (5%) | 100 MHz | 75 MHz | 63 MHz | 20 MHz |
| CW Accuracy (3db) | 200 MHz | 150 MHz | 126 MHz | 40 MHz |
| Input Impedance | 50Ω | | | |
| Max Vin | *Depends on connector type* | | | |
| Load Impedance | >1MΩ, <10pF | | | |
| Maximum CW Pin | 1W | | | |
| Connector types | SMA, TNC, BNC, N, GR + others on special request | | | |
| Size | 2.5 x 2.5 x 5.0cm (body length only) | | | |
| Mass | 100g | | | |