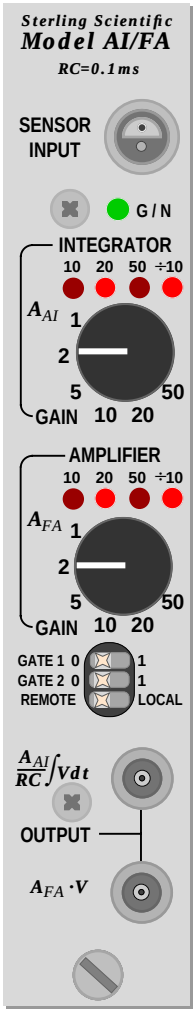
DUAL FUNCTION LONG PULSE ANALOG INTEGRATOR AND FILTERING AMPLIFIER

APPLICATIONS:

- Magnetic fluxmeter for time varying magnetic fields or inhomogeneous DC (permanent) magnetic fields (with user supplied loop coil sensors)
- Electrically isolated current measurements (with Rogowski loop sensors)
- Electronic mathematical integration of any voltage source, such as accelerometer measurements of velocity and position
- Convienient modular design for applications requiring many simultaneous measurements, such as magnetic field spatial structures

FEATURES:

- A precision analog integrator and a separate lowpass filtering amplfier combined in one convienient "extended front panel" module
- Extremely low drift using gated feedback control
- Fifth-order low pulse distortion lowpass filter ideal for anti-aliased digital sampling (amplifier only)
- Optional remote controlled gain selection and gate functions



Actual size front panel Lemo-style connectors (BNC style optional)

Our *Model AI/FA* long pulse analog integrator developed from research in magnetic fusion research laboratories where many simultaneous measurements of magnetic field are required. The simplest and most robust measurement of magnetic flux is a coiled loop of wire, across which a signal voltage appears when inserted into a time varying magnetic field, or by moving the loop coil in an inhomogeneous DC magnetic field. Using an endless variety of loop coil arrangements, virtually any magnetic field (and electric current) can be measured with fine spatial resolution, including permanent magnets. The key to such measurements is a high gain, long pulse integrator. Since the signal voltage is equal to the rate of change of the magnetic flux in the loop ($Vinput = -d\Phi/dt$), it must be integrated to mathematically transform it into one directly proportional to the magnetic flux itself ($\Phi = -\int Vinput\, dt$). Analog integration—as opposed to digital integration—allows the loop's huge dynamic range to be accurately measured (typically spanning four orders of magnitude or more). The main challenge in any integration scheme is avoiding the slow "drift" of the zero-flux reference resulting from steady accumulation of the unavoidable residual in zeroing the input signal. The *Model AI/FA* uses an auto-zeroing feedback scheme to minimize the input offset voltage of the integrating operational amplifier, resulting in less than 1 μWeber/second drift in the zero-flux reference. To achieve accurate near-dc response, the auto-zeroing feedback must be gated off while a measurement is performed. The gate triggering and timing control is provided by Sterling Scientific's *Model AI/FA-C* or *Model AI/FA-CP* gate control modules.

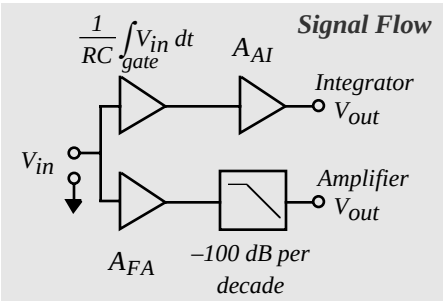
Since it is often desirable to simultaneously measure both the sensor voltage and its time integral, *Model AI/FA* also provides independent variable gain amplification of the input voltage including a low pulse-distortion, fifth-order lowpass filter optimized for anti-aliased digital sampling. So for example, used with loop coils, both the flux and amplified rate-of-change of flux are independently measured. Used with accelerometers, two *Model AI/FA* modules can simultaneously measure acceleration, velocity, and position.

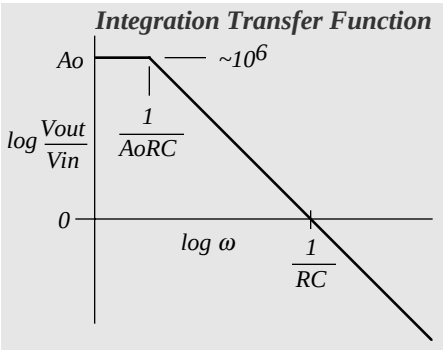
The front panel switches on the *Model AI/FA* control the integrator/amplifier gains and gate function. The module is constructed in a cost-efficient 1 inch wide "extended front panel" (EFP) format which mounts in Sterling Scientific's *AI/FA-CAGE*, a 5.25 inch standard height rack mount card cage with backplane (19 inch wide). The cage holds up to 16 modules.

Gate timing is communicated on the backplane by the *Model AI/FA-C* gate control module. Only one control module is required per cage. Also, the backplane is easily extendable to other cages, allowing one control module to operate the entire extended backplane cage system. Optional remote control of the gain and gate functions (both read and set) is provided through the *Model AI/FA-CP* gate controller. In remote control mode, the front panel switches select the default power on gain settings and gate function.

GATED INTEGRATOR SPECIFICATIONS:

FIXED *RC*, ms	0.1 or 1 (0.2, 0.5, 2, 5, 10 optional)
SECONDARY GAIN, A_{AI}	1, 2, 5, 10, 20, 50 (all ±0.5%)
FREQ. BANDWIDTH	~0.002 Hz to 250 KHz
OUTPUT OFFSET DRIFT	±5 mV/sec typical ($\times A_{AI}$, $\div 10RC$) (±0.5 μWeber/sec flux equivalent independent of A_{AI} and RC)
INPUT IMPEDANCE	9.74 KΩ (unbalanced)
OUTPUT IMPEDANCE	51 Ω "back" terminated
OUPUT DRIVE	±10 V, 50 mA maximum
GATE CONTROL	Sterling Scientific controller required





FILTERING AMPLIFIER SPECIFICATIONS:

VARIABLE GAIN, A_{FA}	1, 2, 5, 10, 20, 50 (all ±0.5%)
INPUT IMPEDANCE	common to integrator (9.74 KΩ)
OUTPUT IMPEDANCE	51 Ω "back" terminated
OUTPUT DRIVE	±10 V, 50 mA maximum
LOWPASS –3 dB FREQ.	150 KHz, 5th order

Standard filter is "0.05° equiripple": –36 dB at 500 KHz and at least –66 dB at 1 MHz. Equiripple has ±0.05° phase variation over –3 dB passband, 90% linear to 270 KHz for very low pulse distortion. Other filter designs available by special request.

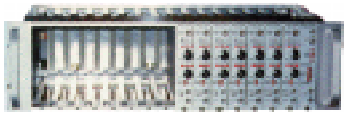
FRONT PANEL CONNECTORS:

INPUT	LEMO ERA.0S.302.CLL or equivalent (shielded twinaxial)
OUTPUT	LEMO ERA.00.250.CTL or equivalent (coaxial)

BNC connectors (coaxial and twinaxial) are optional by special request. ***Shielded twisted pair input cabling with suitable shield extending around sensor strongly recommended.***

FRONT PANEL CONTROLS AND INDICATORS:

GAIN SELECTION	separate rotary switches for integrator and amplifier
GATE SELECTION	1-of-4 encoding with 2-bit DIP switches
LOCAL/REMOTE CONTROL	1-bit DIP switch
GAIN INDICATORS	**10**, **20**, **50**, and ÷**10** red LEDs
GATE/ADDRESS INDICATOR	**G / N** 2-color LED : gate (**G**) green, module addressed (**N**) red



AI/FA-CAGE with installed Model AI/FA and AI/FA-C modules

REQUIRED PERIPHERAL EQUIPMENT:

GATE CONTROLLER	Sterling Scientific's *Model AI/FA-C* or *Model AI/FA-CP**
EFP MODULE CAGE	Sterling Scientific's *AI/FA-CAGE* (includes backplane)
POWER SUPPLY	user supplied ±20-24 VDC, 80 mA per module (quiescent)

**Model AI/FA-CP* in development. Control via RS232 and/or GPIB planned.

For purposes of continued product improvement, Sterling Scientific reserves the right to change these specifications without notice.