

Designed for medical research, this sensor can measure forces in living tissues. Micro-machined, heat treated stainless steel is used to create the tiny elliptical spring structure, which deforms elastically under load.

A thermally matched strain gauge bonded to the steel probe provides a sensitive, linear output proportional to applied force. The elliptical cross section and ultra-flexible, flat tape cable keep the device anchored and oriented within fibrous materials.

Specialized instruments have been developed to bury the transducer within tissue substance. A suture eyelet in the wall of the probe facilitates removal. The device is fully encapsulated with vacuum deposited, biocompatible parylene for protection against saline.

Applications include orthopaedic research, tactile sensing, and feedback for electrical muscle stimulation.



Approximately the size of a No. 2 pencil point, the patented AIFP is designed for placement in very tight areas.

ELECTRICAL SPECIFICATIONS

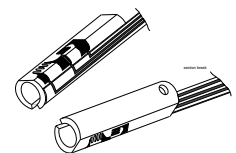
▲ Excitation	<i>14 milliamps D.C.</i>
▲ Sensitivity	<i>30 mV/ma/N</i>
▲ Non-Linearity	<i>+/- 1.5% over 1/2 FS +/- 2.5% over FS</i>
▲ Hysteresis	<i>0.3% FS</i>
▲ Repeatability	<i>0.3% FS</i>
▲ Temp. Coeff. - Offset	<i>+/- .013% FS/C deg.</i>
- Span	<i>+ .0125%/N/C deg.</i>

* Full scale range may be tailored for specific applications.

U.S. Patent Nos. 4,993,428 & 5,083,573 and Patents Pending

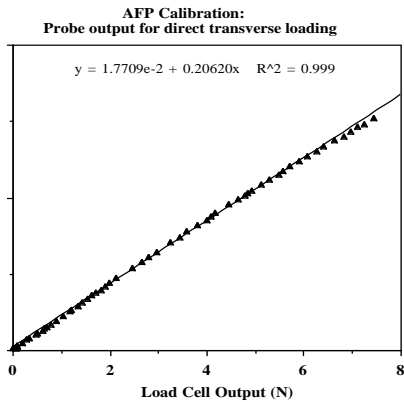
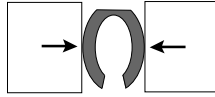
MECHANICAL SPECIFICATIONS

▲ Full scale (FS)	<i>16 N *</i>
▲ Length	<i>5 mm</i>
▲ Cross section	<i>elliptical 1.4 mm by 1.8 mm</i>
▲ Leads	<i>Polyimide and copper tape cable, 20 cm long</i>
▲ Transverse stiffness	<i>Approx. 1.5 N/micron</i>
▲ Fatigue life	<i>Approx. 1 million cycles at 1/2 FS</i>



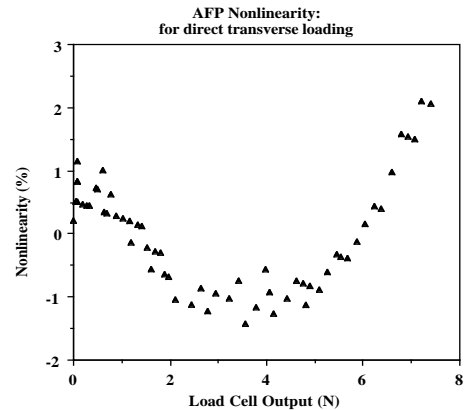
Calibration

AIFP's are factory calibrated by applying transverse forces. A calibrated load cell (accuracy +/- 0.12 N) is used as a reference.



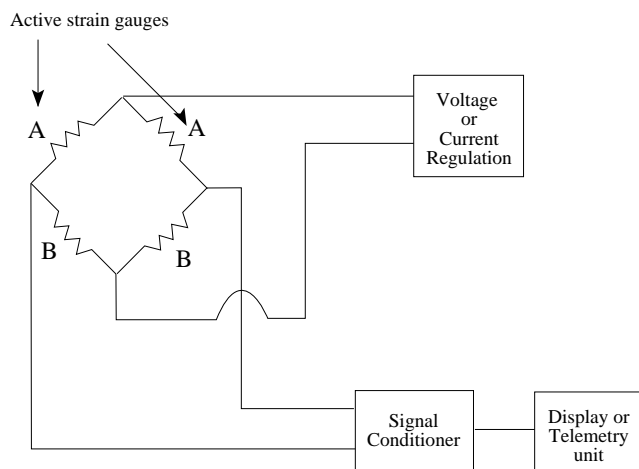
Non-Linearity

Non-linearity is defined as the % deviation from a best fit straight line, as determined by linear regression, over the calibrated range.



Signal conditioning

Excitation and measurement is accomplished by classic Wheatstone bridge circuits and instrumentation amplifiers. Using MicroStrain's DataGauge software, or StrainLink telemetry systems, multiple probe outputs may be read, displayed, and saved for data analysis.



Measuring soft tissue forces

As tissue fiber bundles come under uniaxial tension, the walls of the probe are subjected to transverse forces. This creates elastic bending of the probe, which, in turn, varies the bonded strain gauge(s) resistance. Amplified signals from the probe's circuitry may be related to uniaxial tension by using calibration techniques.

The device is constructed of biocompatible materials, however, the instrument is not FDA approved for implant in live humans.

