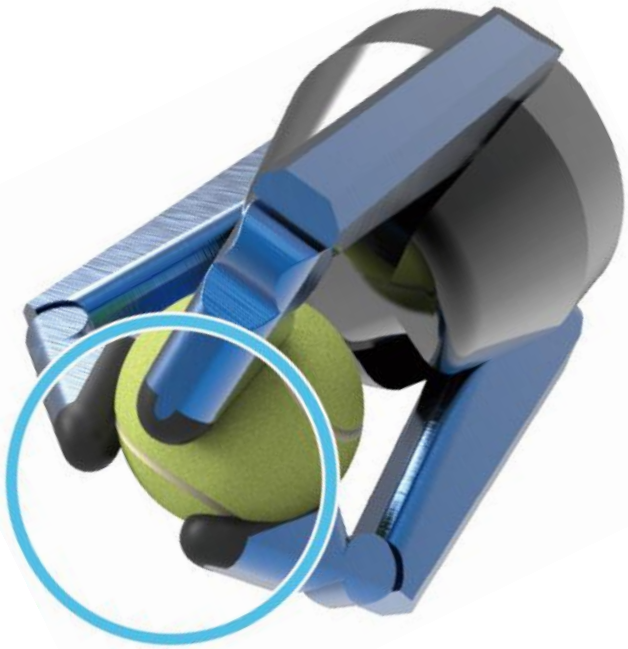
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Perfecting the Art of Electronics

Alps Alpine

Force Sensor







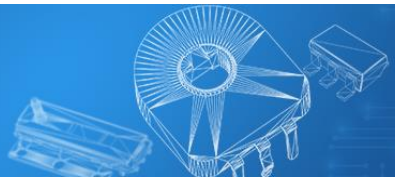


Alps Alpine's force sensor employs a piezoresistive method using Si semiconductor elements.
Here we introduce features of our force sensors.

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Force Sensor



Alps Alpine's force sensor employs a piezoresistive method using Si semiconductor elements. They detect loads with a piezoresistive element manufactured using MEMS processes. The new HSFPAR007A is the smallest in the industry (according to Alps Alpine research as of June 2020) and can be used for a wide range of applications such as stylus pens, other input devices, and pressure application adjustment for gripping by robot arms.

Principles of Humidity Sensors

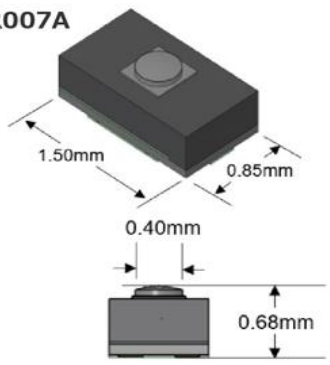


Feaures of Force Sensors

Industry-Smallest (Alps Alpine research, December 2019)

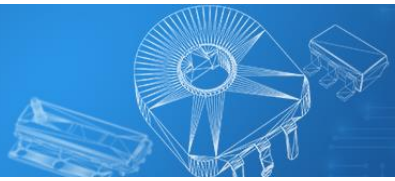
Alps Alpine has realized the smallest force sensors in the industry (according to Alps Alpine research as of June 2020) with dimensions compact enough to fit in the tip of a small, fine-diameter stylus pen.

Example: HSFPAR007A



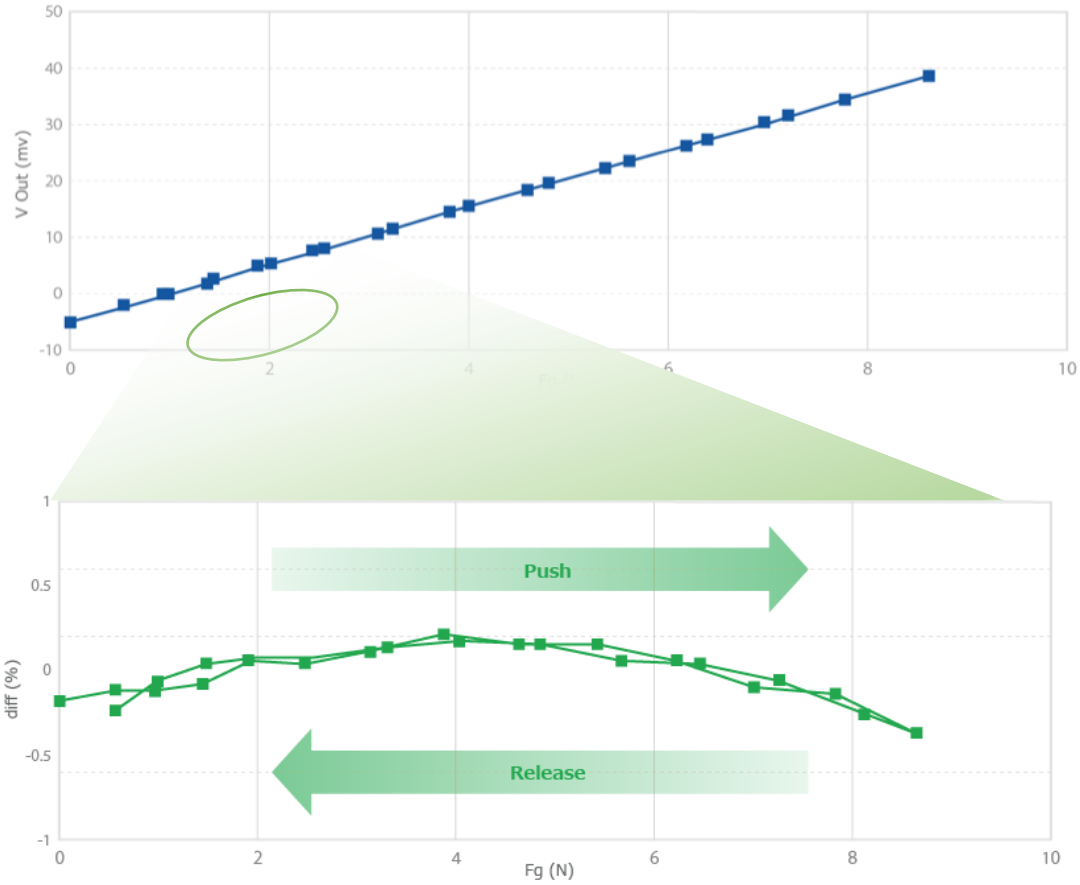


Force Sensor



High Linearity

Piezoresistive force sensors achieve higher linearity than other force sensors, but Alps Alpine force sensors enjoy even higher linearity than piezoresistive products of other companies.

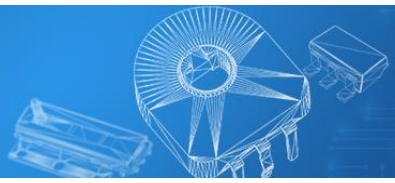


Alps Alpine's HSFPAR004A / HSFPAR007A achieving less than 2% FS*.
FS = Full span (output variation between 0 and 8N)

We can also see that the sensor has excellent hysteresis characteristics.

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Force Sensor



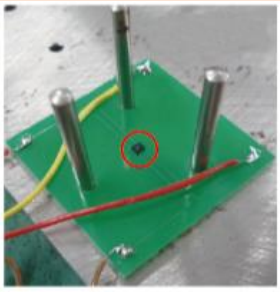
High Sensitivity

Alps Alpine's force sensors can detect stress as light as 1 gram (approx. 0.01N).

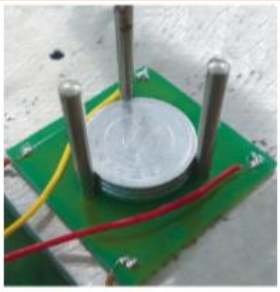
Test Example

We conducted a test that involved stacking 1-yen coins (1 gram each) on top of the force sensor. As the graph shows, the sensor managed to detect each coin correctly*. And because Alps Alpine's force sensors enjoy high linearity, as explained above, they can perform to the same level across the entire load range.

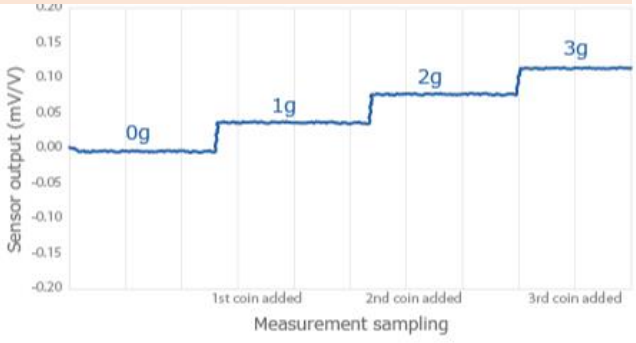
* Detection of very small amounts of stress requires that the signal is amplified, such as with an operational amplifier, and stabilized, for example by averaging.



Force Sensor



One-yen coins are added one at a time

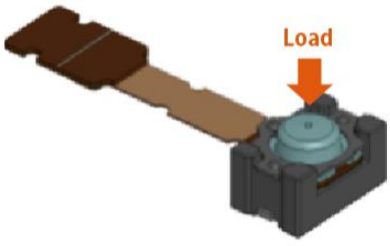


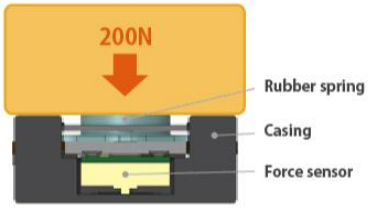
These characteristics make it possible to detect the pressure applied to a stylus pen tip, enabling very pleasant writing expression, for example in terms of fluency of pen use and repeatability.

High Sensitivity

Alps Alpine's force sensors have a guaranteed operating life of one million cycles when used with loads within the operating range (up to 8N). HSFPAR004A / HSFPAR007A withstands loads up to 55N, a 30-40% higher maximum load rating than earlier models.

Alps Alpine also supplies the HSFPAR303A, a module (for installation by FPC) that withstands up to 200N.



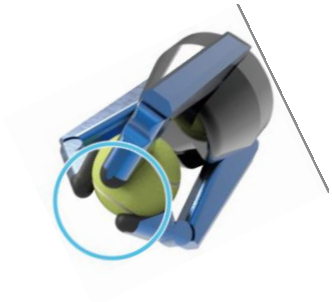


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Force Sensor

Applications

The grip parts of robot arms for precision grip force adjustments





Load balance on force detection for hobby robots

Stylus pens and various other input devices



Part Number	Photo	Size	Force range	Supply voltage	Max load rating
HSFPAR003A		2.0×1.6×0.66mm	0 to 8N	1.5 to 3.6V	40N
HSFPAR004A		2.0×1.6×0.66mm	0 to 8N	1.5 to 3.6V	55N
NEW HSFPAR007A		1.5×0.85×0.68mm	0 to 8N	1.5 to 3.6V	55N
HSFPAR303A		4.0×2.7×2.06mm	0 to 7N	1.5 to 3.6V	200N