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plyon®

Technical datasheet
for the current generation of plyon® flex sensors

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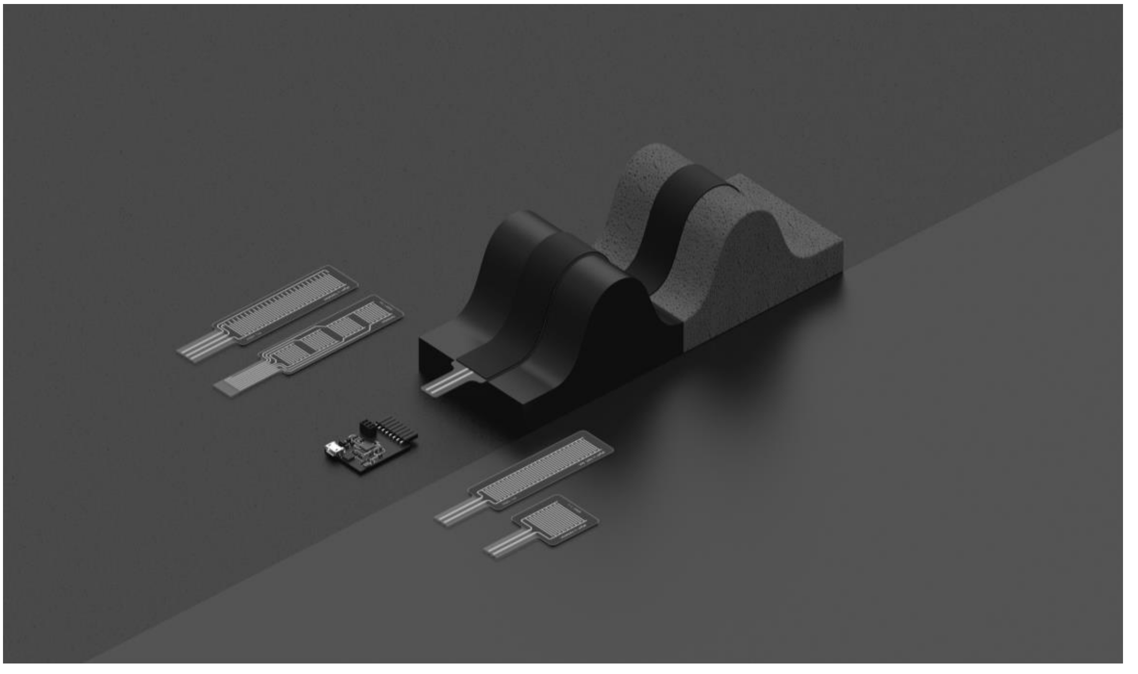
Sensor Characteristics



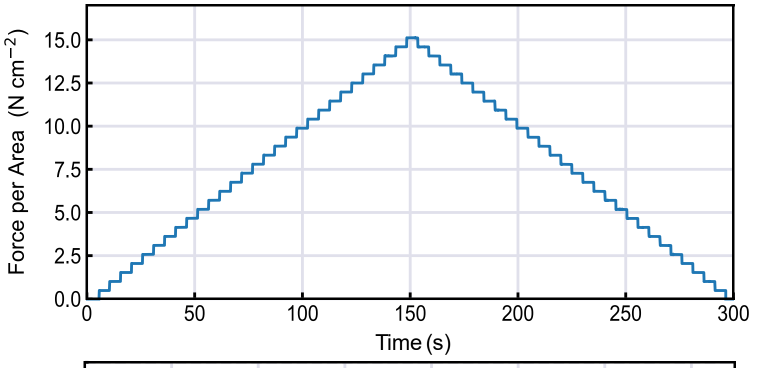
Property	Value	Unit
Product line:	plyon® flex	
Sensor generation:	Zebra	
Size of tactile elements[1]:	Min 3 x 3 | 0.12 x 0.12 Max 100 x 100 | 3.94 x 3.94	mm | in
Sensor thickness:	≥ 0.7 | 0.0276	mm | in
Minimal detectable force[2]:	0.4	N cm^{-2}
Measurement range[2]:	0.5 – 15	N cm^{-2}
Operating voltage:	≤ 3.3	V
Rise time	≤ 60	ms
Surface materials:	Silicone Elastomer / PET	
Measurement principles:	Resistive (force) Capacitive[3] (proximity,touch)	
Electrical termination:	Exposed flex tail – 0.5 mm pitch FFC Connector – 2.54 mm pitch	
Material compatibility:	Typical material compatibility of PET films and silicones needs to be considered.	

[1] *For custom size and shape please contact us*
[2] *Dependent on several factors such as actuator geometry and readout electronics.*
[3] *Capacitive characteristics not shown in this datasheet*

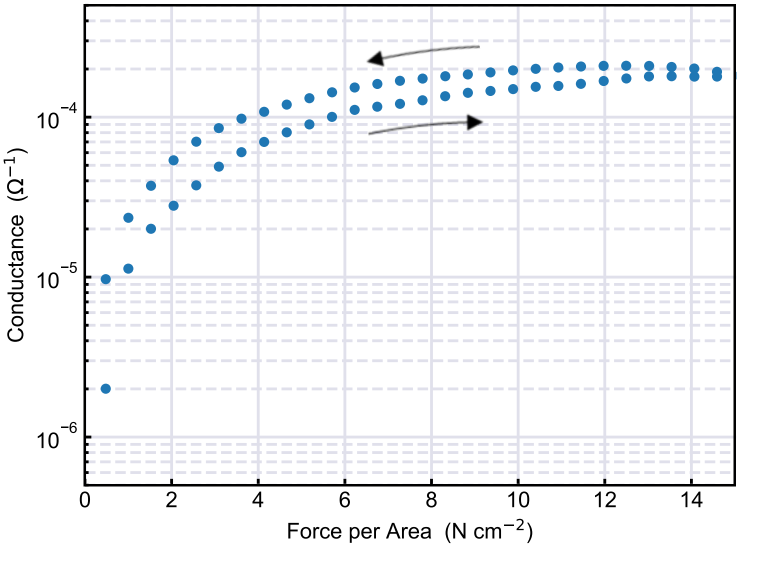
Sensor Characteristics

Unless otherwise stated, tests are conducted using a cylindrical Nylon (MC901) contact part of 8 mm diameter, resulting in an actuation area of 0.5 cm².

Conductance - Force



In the following, the sensor resistance is determined for gradually increasing force levels ranging from 0 N to 7.5 N according to the depicted actuation profile.

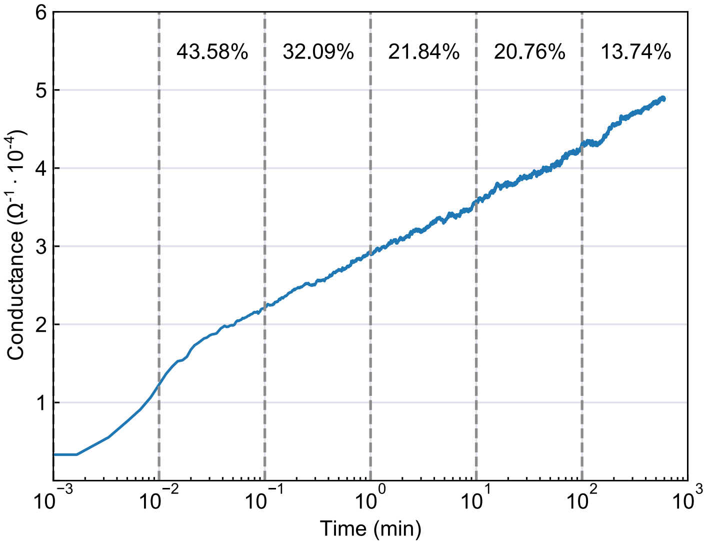


The sensor response is measured through a transimpedance amplifier with a 5 kΩ feedback resistor.

The conductance of the sensor is calculated from the recorded voltage signal and plotted against the force per square centimeter.

Sensor Characteristics

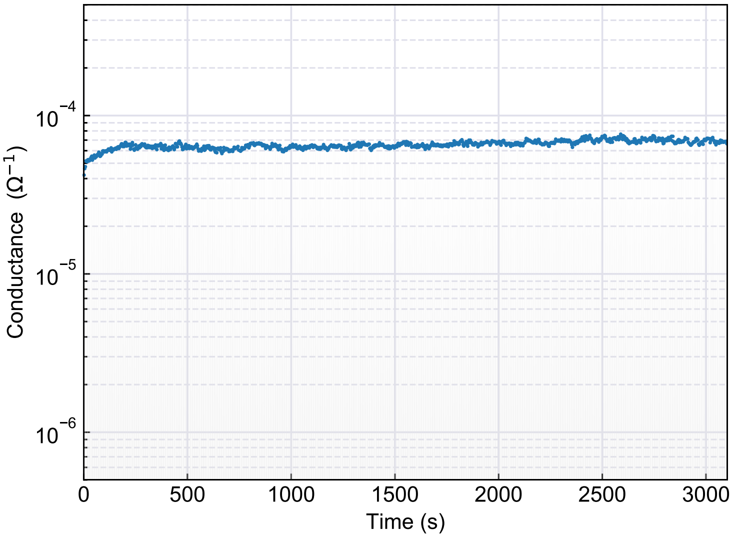
Drift



The deviation in sensor response resulting from the exhertion of a static force (4 N) is characterized and determined for each order of magnitude of time. In this graph the base unit of time is chosen to be in minutes.

Note that the drift between 10^{-2} and 10^{-1} is calculated from 1 second onward.

Repeatability

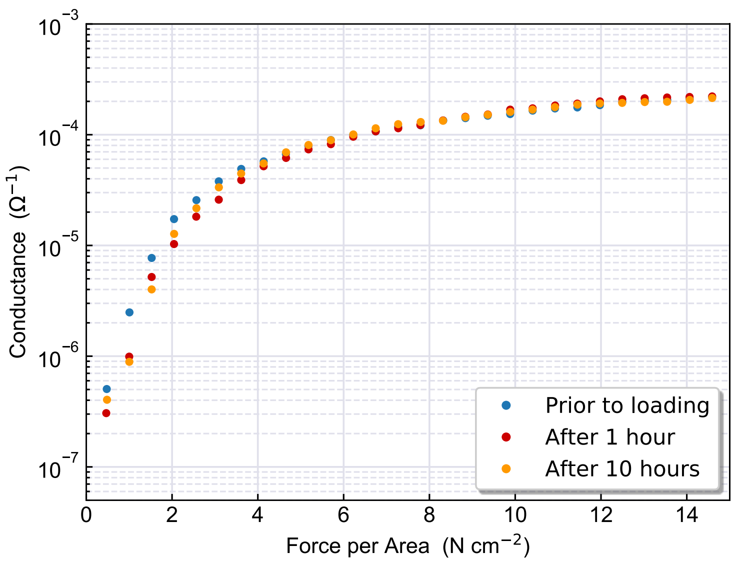


The response to a repetitive actuation profile of 1000 pulses at 4 N is plotted in grey. Blue dots indicate the maximum value for each pulse, highlighting the envelope of the sensor signal and demonstrating increased repeatability after a few hundred actuation cycles.

Sensor Characteristics

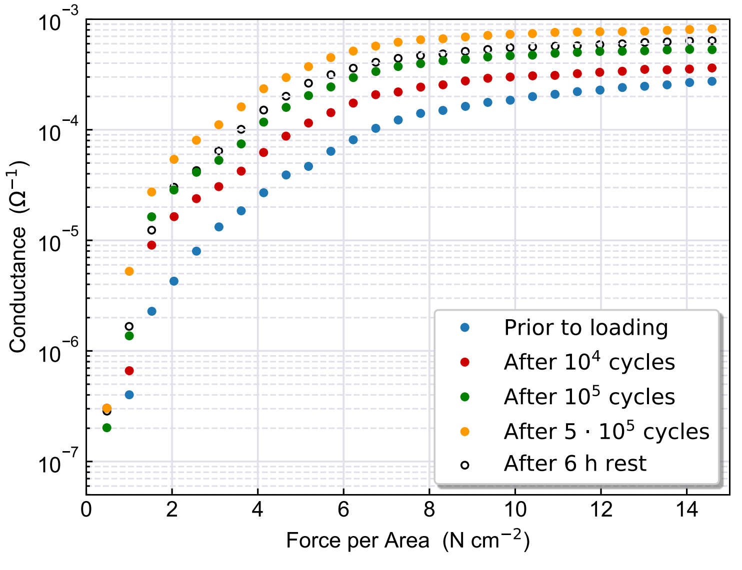
For static and cyclic loading tests, the sensor response before and after any loading cycle was recorded according to the actuation profile described in section 2.a. In the following, only the forward sweep of the Conductance-Force characteristics is plotted.

Static Loading



The Conductance-Force characteristics are recorded after 1 and 10 hours of static loading at 4N and plotted alongside the characteristics of the sensor prior to loading. The results indicates that the sensor performance is only marginally affected by long-term static loading.

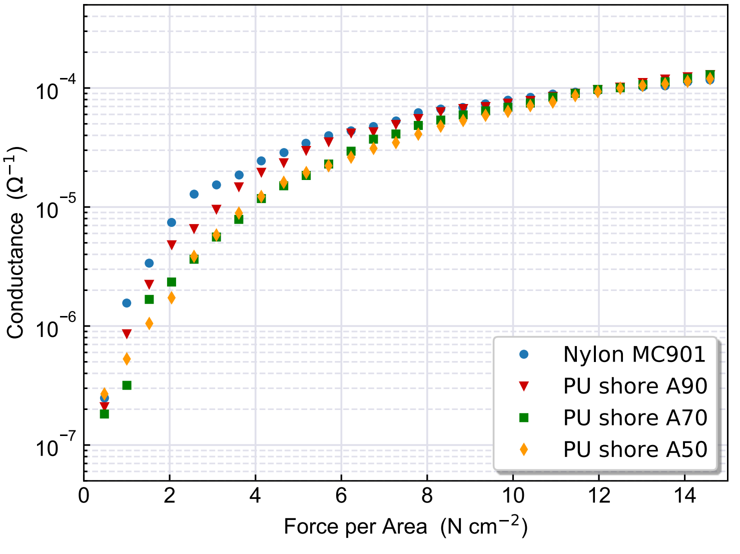
Cyclic Loading



The Conductance-Force characteristics are recorded after 10^4, 10^5 and $5 \cdot 10^5$ loading cycles (1Hz) at 4 N and plotted alongside the characteristics of the sensor prior to loading. The open circles represent the conductance of the sensor after a resting time of 6 hours following $5 \cdot 10^5$ indentations. The results indicate a partial recovery of the sensor after prolonged cyclic loading.

Sensor Characteristics

Actuators with different hardness

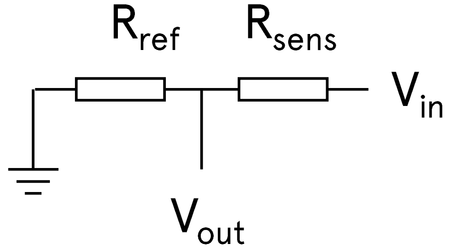


Actuators of different hardness were used to record the Conductance-Force characteristics of the sensor.
The response resulting from an actuation with our reference contact part (Nylon MC901) is plotted as blue circles.
For softer materials with a shore hardness between A90 and A50 a shift in the response is observed, particularly at lower actuation forces.

Readout Circuits

In the following two possible sensor readout circuits are suggested .
Note that all measurements presented in this datasheet were recorded using a transimpedeance amplifier with a feedback resistor R_F = 5 kΩ.

Circuit 1: Voltage Divider

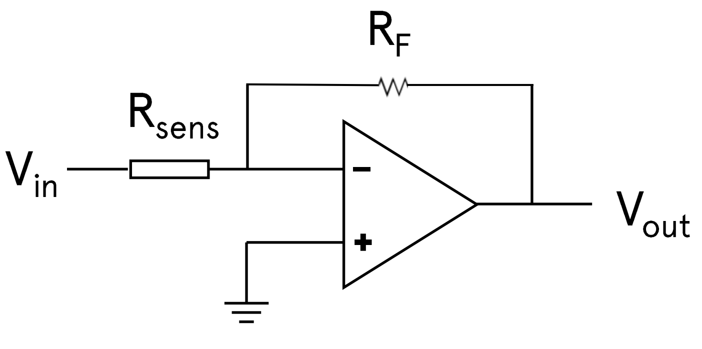


A voltage divider configuration is the simplest readout circuit to determine sensor resistance.
Given that R_{ref} and V_{in} are known, the sensor resistance R_{sens} can be calculated by measuring the voltage drop V_{out} across the reference resistor R_{ref}.

The output voltage can be expressed as:

$$V_{out} = \frac{V_{in} \cdot R_{ref}}{R_{ref} + R_{sens}}$$

Circuit 2: I-V Converter (Transimpedeance Amplifier)



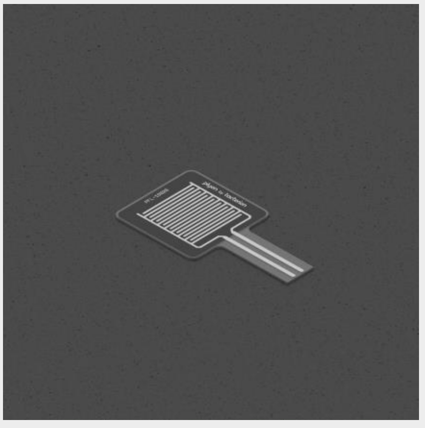
A transimpedeance amplifier (TIA) converts the current flowing through the sensor (V_{in} /R_{sens}) to a voltage signal (V_{out}), providing a more ideal transfer function than a voltage divider.

Under the assumption of an ideal op-amp, the output voltage is calculated as:

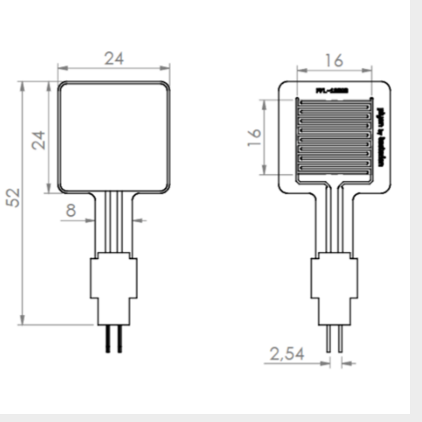
$$V_{out} = - V_{in} \cdot R_{sens} / R_F$$

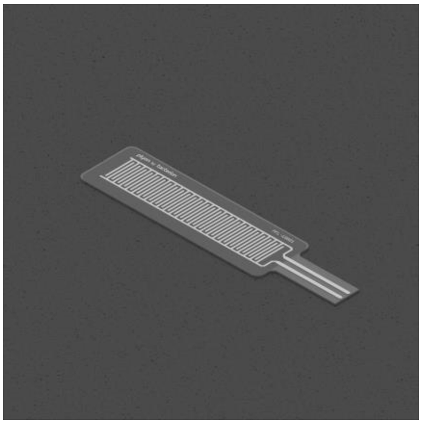
Family of plyon® flex standard sensors

Type	Mechanical data

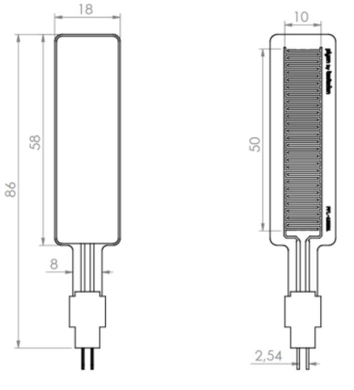


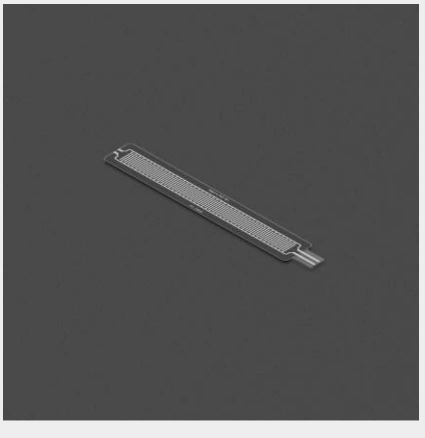
plyon® Square



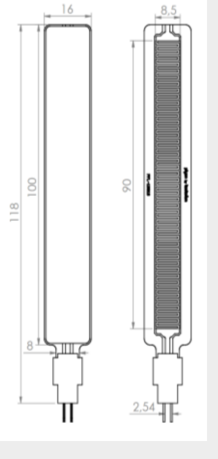


plyon® Medium

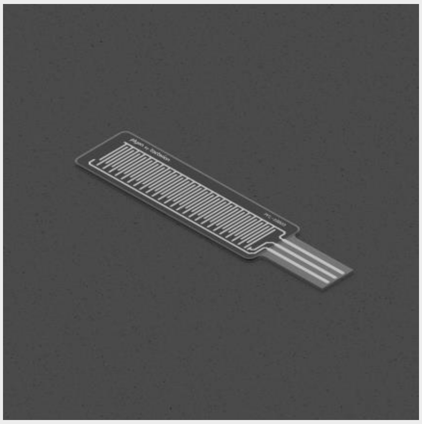
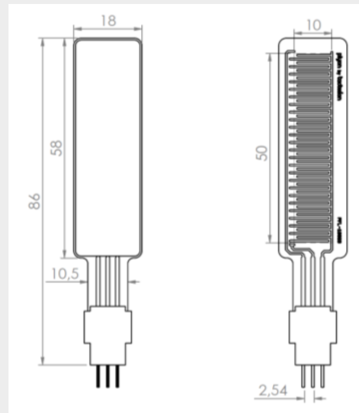
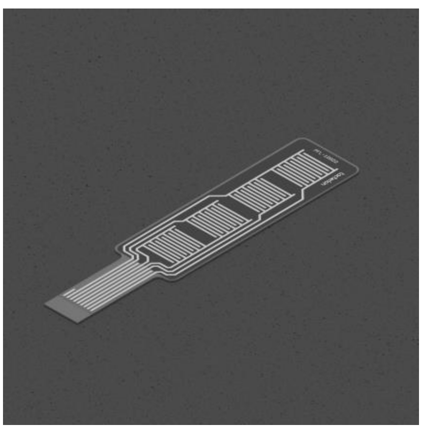




plyon® Stripe



Family of plyon® flex standard sensors

Type	Mechanical data
 plyon® Slider	
 plyon® Array