User Manual ----
--i-Motion film Sensor

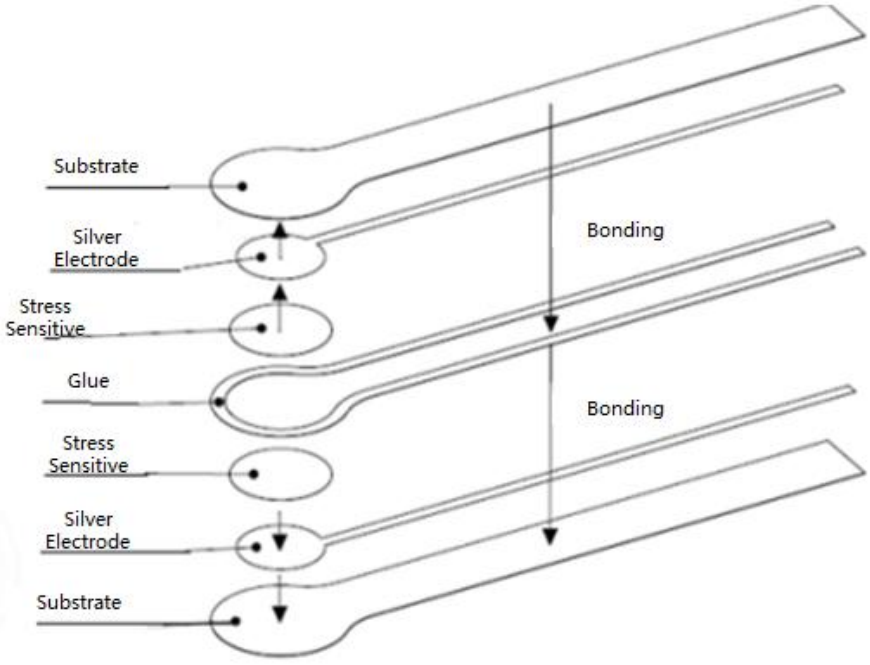
Introduction:

In this manual, we describe how to use film sensors with one unit only. i-Motion sensor is the resistive film pressure sensor that allows the forces of the static force and dynamic forces between two surfaces. The paper height of the thin sensor (100 microns thickness) is used conveniently for the application.

The film resistance sensor is fabricated with the double-sided polyester substrate respectively by the layers including the printed silver electrode one, the stress sensitive one, the insulation one(option), the glue one. Then on the layer of the substrate package, there were two terminal electrodes punched with the male connector or the female connectors based on the requirement from the customers. This kind of the sensor is used to test the vertical force to the sensing plane.

By two wire of from the sensor, it is works as one resistor. Under the static status without the applied force and the flexible bending, the resistance of the sensor is the huge resistance value (>1MOhm). Applying the force on the effective area of the sensor will lead to a decrease in the resistance between two leads of the sensor, and the greater the applied force, the smaller the resistance.

IMS film resistance pressure sensor is neither dynamometer nor strain gauge. Although there are the very similar properties, IMS sensor is not suitable for the accurate measurement.



The Structure of IMS Sensor

Disclaimer:

The information in this manual only is provided only the general information and guidance applications of the product, and it is not to be used as a supplemental agreement for the signing of the sales contract.

I-Motion Sensor company reserves the right to amend the contents of this manual without the notice.

Since i-Motion Sensor company does not control the final use of the IMS sensors in customer products, please confirm the suitability of your product before any potential customer acknowledges the use of the IMS sensor for its commercial application.

Contacting Windows：

If any requirement, please contact with us by email: 13601207437@163.com .

1 The recommendations of the sensor application

The sensor is a passive component made of multi-layer printed circuit. As a variable resistor, it can be applied in circuit by many methods. In order to use IMS sensor more conveniently, there are several important items to be introduced.

1.1. Right expectations (learn the film resistance pressure sensor)

I-Motion sensor is a thin film sensor, not the strain gauge dynamometer. In the measurement, the sensor usually can lead to qualitative results. The range of the measuring accuracy of the force probably is around + 5% to + 25% depending on the consistency of the measurement and application of force system and the correction method.

Please note the difference between the accuracy and the resolution, and the force resolution of the IMS sensor is less than 1%.

1.2. The active area of the sensor

The effective testing area of the IMS standard sensor is the range of the sensor round covered by the silver round surface. In order to achieve the test results of the accurate and repeated, the measured force must be evenly distributed over the active region of the sensor. In the active region of the sensor, the changed position of the measured force will be got by the resistance changing.

If the effective area of the contacted area is greater than the area of the measured force, then we recommended adding one rubber mat with the area slightly smaller than the active area of the sensor. The force should be applied fully within the active area of the sensor.

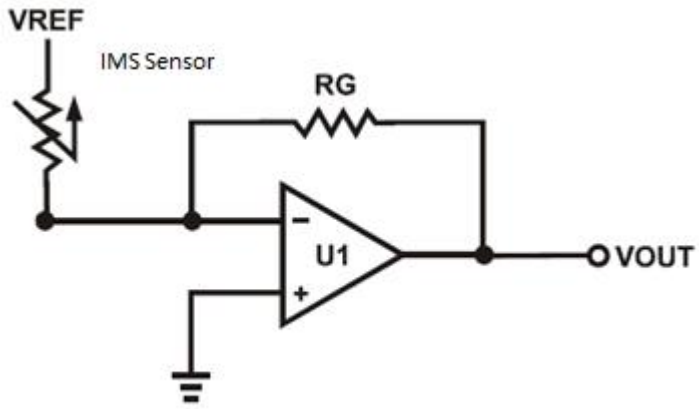
1.3. Set up one repeatable mechanical force system for the calibration

For the IMS sensor application in the customer electronic system, it is necessary to need to be calibrated by applying the standard force in order to get the value of the applied force (N, KG). So we need a stable repeated standard force system as one benchmark.

Since the IMS series sensor is sensitive to the distribution of the force applied on the effective area, so the application of the uniform stability is very important. Adding a thin elastic mat between the applied force and the IMS sensor can effectively reduce the value deviation of the force caused by the distribution the introduction of force.

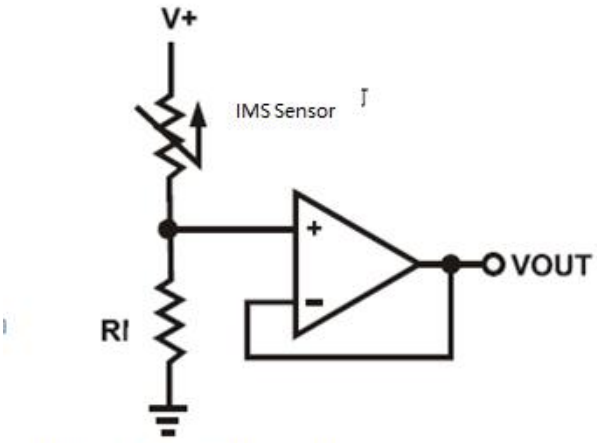
2 Recommended circuits:

The IMS sensor is used as a variable resistor simply by using a resistor divider. Then through accumulating the value of the resistance by the tested voltage or the operation amplifier, the real-time resistance of the IMS sensor can be gotten.



Method : R-IMS= (VREF/VOUT)*RG,

Circuit No.1



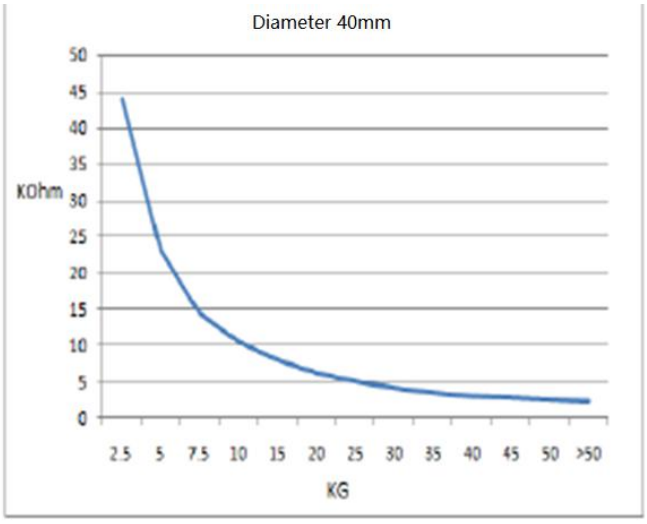
Method : R-IMS=((V+)/VOUT-1)*R1

Circuit No.2

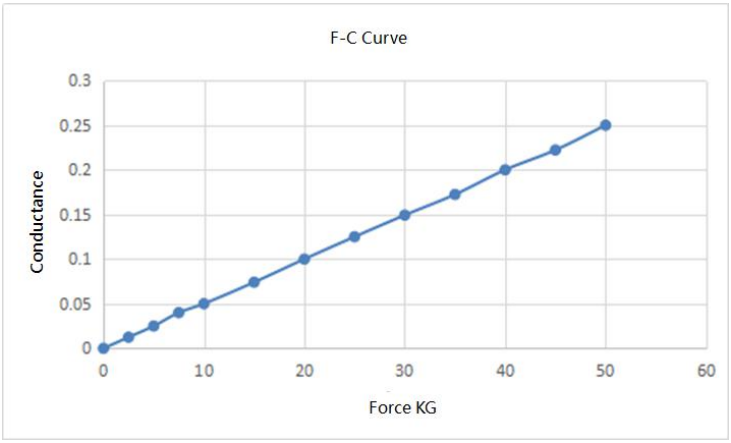
3 Calibrate the sensor

3.1 Force VS. Resistance&conductance

The following figure is the typical force vs. the resistance curve. The force and resistance characteristics of IMS sensor can be adjusted for the pressure range of the application according to the customer's requirements.



The following diagram is the curve by the X and Y scatter of force and conductance. From the diagram, its F-C curve of the film pressure sensor is the linear.



3.2 Calibration

A linear relationship between the conductance and the force is recommended in the calibration. The single point calibration, two-point calibration, or multi-point calibration can be used.

#1: single-point calibration: the MAX working force selected, and the output resistance of the sensor tested, then the conductance calculated, and a straight line drawn from the origin of the coordinate to the calibrated point.

#2: two-point calibration: two point of applied force selected, and two output resistance of the sensor tester, then a straight line drawn from the 1st point to 2nd point of coordinates

Multi-point calibration is the similar method such as #2.More points of the calibrated force, higher accuracy of the calibration.

4.Sensor parameters

Feature	Value	Notes
Actuation force *1	0.5 Newtons	
Force sensitivity range *1	0.5- 10 Newtons	
Force resolution	Continuous	Analog output
Force repeatability	10%	Part to part
Non- actuated resistance	>2 Mega Ohms	
Thickness	0.25 mm	
Stand-off resistance	>2 Mega ohms	Unloaded,unbent
Device rise time	<5 Microseconds	
Hysteresis	+10%	
Long term drift	<5% per Log10(time)	
Number of actuation(life time)	1 Million tested	Without failure
Operating temperature	-20℃~55℃	
Relative humidity	5%~90%	
Parasitic Capacitance	50~500 PF	The bigger single zone area,The bigger parasitic capacitance.
Substrate	Polyester	

*1: Actuation force and force range can be modified according to the requirement of client. The minimum actuation force can be 0.1 Newtons with thin substrate. The maximum pressure of our sensor can be up to 500 Newtons/cm^2.

4.1 The drift of the sensor resistance value

The drift of the sensor resistance value is that the sensor resistance will continuously decreased when the continuous application of a fixed force on the sensor. So, during the sensor calibration in the application of the sensor, the drift of the sensor need to be taken into account to reduce effect of the drift to results. The best way of the applied force is that the time of the calibration and the application time is basically the same.

4.2 The saturation of the sensor resistance

The saturation of the sensor resistance is that the resistance of sensor is not almost reduced when the applied forced is increased after the fixed pressure is applied on the active area of the sensor. From the example curves of the sensor force vs. resistance, the resistance changes gradually to saturation after 50 kilograms applied.

Note: In the practical application, the saturated of the system has to be told the difference with the one of the sensor. The sensor saturation is the intrinsic characteristic of the sensor. Due to the inappropriate of the circuit parameters such as the driving voltage, the operation set of amplification circuit, the circuit system would lead to the saturation of the working voltage. In order to avoid the saturation of the system, before the setting of the parameters,

we recommend to measure the changing range of the resistor when the force applied, and to calculate the appropriate parameters of circuit. When the standard circuit provided by I-Motion occurs probably the saturation of the system, the reduction the driving voltage or the lower magnification can alleviate the system saturation.

4.3 The sensitivity of sensor (including the break, the force, turn-on, the force)

The sensitivity of the sensor is that the resistance is relatively stable at the same time after the sensor is applied by the fixed force. Smaller the force, higher the sensitivity. There is the relationship between the sensitivity of the sensor, the sensor substrate and the saturated force. Usually using thinner substrate (such as 38 micron substrate), then the saturation pressure is lower and the sensitivity higher. And the highest sensitivity of IMS sensor can be achieved around 50 grams.

4.4 The hysteresis of the sensor

The hysteresis of the sensor is that the difference of the resistance with the same force during the trend of the increasing force or the reducing force. For the static force or the increasing force only on the sensor surface, it is not effect for the hysteresis. Otherwise the hysteresis will lead into variation.

4.5 The rise time of the sensor

The rise time of the sensor is that is the MAX lagging time of the resistance changes when the sensor pressure increases. The typical value of the time is 1~2 milliseconds.

4.6 The response of the temperature for the sensor

The storage temperature of IMS sensor is from -20 degrees to +60 degrees Celsius. The sensors should be stored side by side.

Generally, the output resistance of the sensor in an application environment more than a certain temperature (45 degrees Celsius) is different from one at the normal temperature

Used under the huge loading and the high temperature, the sensor may fail to work.

4.7 The repeatability of the sensor

The repeatability of the sensor is that the resistance difference of the same sensor applied by the same force every time. Combined with the resistance drift of the sensor, the value of the resistance difference is less than 5% at the same time after applied by the same force.

4.8 The life cycle of the sensor

IMS sensor can be used repeatedly many times. The life cycle of the IMS sensor depends on the using method. As long as the sensor is not destructive, such as the cutting of a sharp edge, the maximum pressure exceeded by the shear force, the huge load under the high temperature, IMS sensor can be used more than 500 thousand times.

4.9 The Electromagnetic compatibility and electrostatic protection (EMI/ESD)

The sensor is the passive component without the electromagnetic radiation. Electrostatic protection is not required for the special consideration

4.10 The MAX operating current of sensor

The wires and the resistors of the sensor are the substrates made by the screen printing, and the MAX operating current is 10mA.