

## Features and Benefits

- Actuation Force as low as 0.1N and sensitivity range to 10N.
- Easily customizable to a wide range of sizes
- Highly Repeatable Force Reading; As low as 2% of initial reading with repeatable actuation system
- Cost effective
- Ultra thin; 0.45mm
- Robust; up to 10M actuations
- Simple and easy to integrate

## Description

Interlink Electronics FSR™ 400 series is part of the single zone Force Sensing Resistor™ family. Force Sensing Resistors, or FSRs, are robust polymer thick film (PTF) devices that exhibit a decrease in resistance with increase in force applied to the surface of the sensor. This force sensitivity is optimized for use in human touch control of electronic devices such as automotive electronics, medical systems, and in industrial and robotics applications.

The standard 402 sensor is a round sensor 18.28 mm in diameter. Custom sensors can be manufactured in sizes ranging from 5mm to over 600mm. Female connector and short tail versions can also be ordered.



## Industry Segments

- Game controllers
- Musical instruments
- Medical device controls
- Remote controls
- Navigation Electronics
- Industrial HMI
- Automotive Panels
- Consumer Electronics

Figure 1 - Force Curve

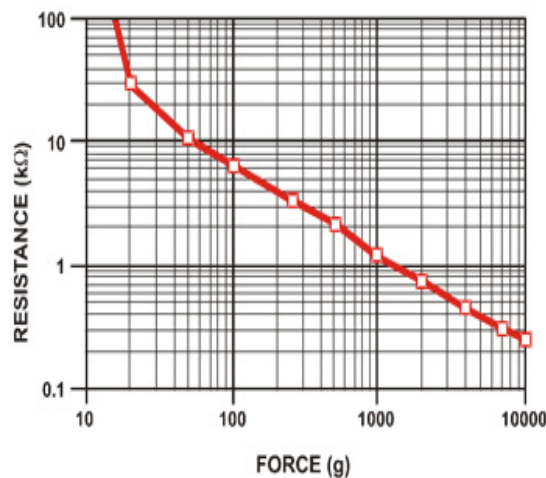
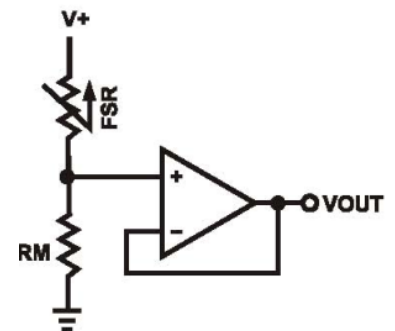


Figure 2 - Schematic



## Applications

### Detect & qualify press

Sense whether a touch is accidental or intended by reading force

### Use force for UI feedback

Detect more or less user force to make a more intuitive interface

### Enhance tool safety

Differentiate a grip from a touch as a safety lock

### Find centroid of force

Use multiple sensors to determine centroid of force

### Detect presence, position, or motion

Of a person or patient in a bed, chair, or medical device

### Detect liquid blockage

Detect tube or pump occlusion or blockage by measuring back pressure

### Detect proper tube positioning

### Many other force measurement applications

## Device Characteristics

Feature	Condition	Value*	Notes
<b>Actuation Force</b>		0.1 Newtons	
<b>Force Sensitivity Range</b>		0.1 - 10.0 <sup>2</sup> Newtons	
<b>Force Repeatability<sup>3</sup></b>	(Single part)	± 2%	
<b>Force Resolution<sup>3</sup></b>		continuous	
<b>Force Repeatability<sup>3</sup></b>	(Part to Part)	±6%	
<b>Non-Actuated Resistance</b>		10M W	
<b>Size</b>		18.28mm diameter	
<b>Thickness Range</b>		0.2 - 1.25 mm	
<b>Stand-Off Resistance</b>		>10M ohms	Unloaded, unbent
<b>Switch Travel</b>	(Typical)	0.05 mm	Depends on design
<b>Hysteresis<sup>3</sup></b>		+10%	$(R_{F+} - R_{F-})/R_{F+}$
<b>Device Rise Time</b>		<3 microseconds	measured w/steel ball
<b>Long Term Drift</b>		<5% per log <sub>10</sub> (time)	35 days test, 1kg load
<b>Temp Operating Range</b>	(Recommended)	-30 - +70 °C	
<b>Number of Actuations</b>	(Life time)	10 Million tested	Without failure

\* Specifications are derived from measurements taken at 1000 grams, and are given as one standard deviation / mean, unless otherwise noted.

1. Max Actuation force can be modified in custom sensors.
2. Force Range can be increased in custom sensors. Interlink Electronics have designed and manufactured sensors with operating force larger than 50Kg.
3. Force sensitivity dependent on mechanics, and resolution depends on measurement electronics.

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## Application Information

FSRs are two-wire devices with a resistance that depends on applied force.

For specific application needs please contact Interlink Electronics support team. An integration guide is also available.

For a simple force-to-voltage conversion, the FSR device is tied to a measuring resistor in a voltage divider configuration (see Figure 3). The output is described by the equation:

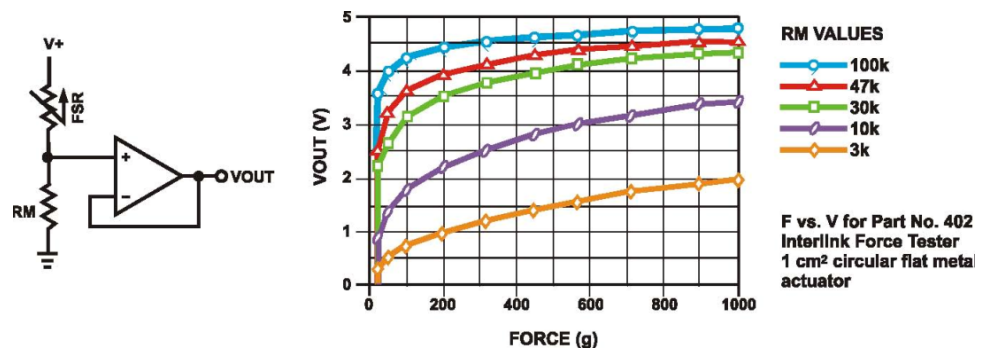
$$V_{OUT} = \frac{R_M V_+}{(R_M + R_{FSR})}$$

In the shown configuration, the output voltage increases with increasing force. If  $R_{FSR}$  and  $R_M$  are swapped, the output swing will decrease with increasing force.

The measuring resistor,  $R_M$ , is chosen to maximize the desired force sensitivity range and to limit current. Depending on the impedance requirements of the measuring circuit, the voltage divider could be followed by an op-amp.

A family of force vs.  $V_{OUT}$  curves is shown on the graph below for a standard FSR in a voltage divider configuration with various  $R_M$  resistors. A ( $V_+$ ) of +5V was used for these examples.

Figure 3



## Part No. 402

- Active Area: 12.7mm
- Nominal thickness: 0.55 mm

## Mechanical Data

