

“Interlink Electronics has been reliably providing Computer Motion FSR technology for their robotic controlled surgical systems since 1994. Computer Motion's robots use optical encoding to ensure accurate positioning of its components during surgery. They also use Interlink's technology as a redundancy system. The force sensing data is constantly cross-checked during a robotic surgical procedure.... There is no room for errors in robotically controlled surgery. Interlink's FSR technology plays a key role in the surgical system's reliability.”

COMPUTER MOTION, INC.

“Interlink Electronics provides Varian with Touch Detector Assemblies using Interlink's Force Sensing Resistor (FSR) technology for use in Varian's radio-therapy equipment for oncology treatment. Interlink's FSR technology has been a significant improvement over prior solutions that used microswitch, cable, and pulley arrangements. Interlink has provided Varian with quality products and support for over 10 years. We are pleased to have this long-standing relationship.”

VARIAN MEDICAL  
SYSTEMS, INC.

“Baxter's Infusion Systems division develops, markets, and manufactures a broad portfolio of electronic infusion pumps to healthcare markets around the globe. Interlink's FSR technology adds value to Baxter's FLO-GARD Infusion Pump as described in Baxter's European Patent Specification # 0 551 088 B1. The FSR from Interlink Electronics is a critical component of the sensing system in Baxter's pump. Interlink has been providing this custom FSR solution to for Baxter's FLO-GARD pumps for more than 10 years.”

BAXTER HEALTHCARE CORP.

# FSR<sup>®</sup>

## Force Sensing Resistors<sup>®</sup>



Since 1985, Interlink Electronics has pioneered the design and manufacture of patented Force Sensing Resistors for mission-critical applications in industries such as medical, automotive, and the military. Unparalleled reliability and quality control standards have made Interlink the leader in qualitative force sensing technology. Numerous customers have integrated Interlink's Force Sensing Resistors and referenced Interlink in their respective patents.

- Qualitative passive sensing device
- Force sensing optimized for use in human touch control applications
- Wide use in medical, automotive and diagnostic instrumentation
- Available in standard and custom configurations



# FSR<sup>®</sup>

## Force Sensing Resistors<sup>®</sup>

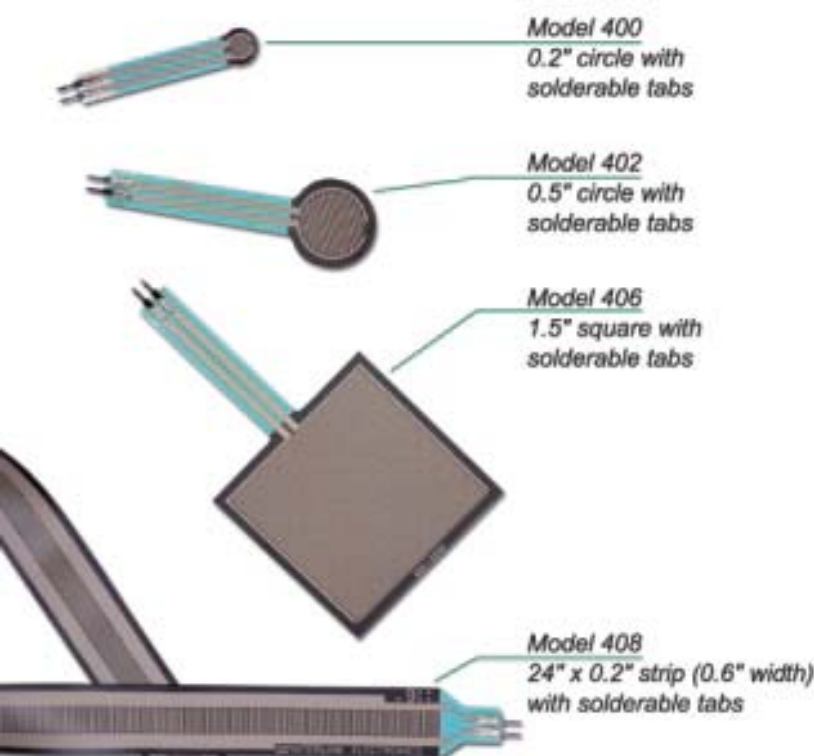
### What are FSRs?

Force Sensing Resistors (FSRs) are a polymer thick film (PTF) device which exhibits a decrease in resistance with an increase in the force applied to the active surface.

### Why FSRs?

FSRs have similar properties to load cell or strain gauge devices, and can provide a cost effective alternative. While FSRs can be used for dynamic measurement, only qualitative results are generally obtainable. Force accuracy ranges from approximately  $\pm 5\%$  to  $\pm 25\%$  depending on the consistency of the measurement and actuation system, the repeatability tolerance held in manufacturing, and the use of part calibration. Typically, the part-to-part repeatability tolerance held during manufacturing ranges from  $\pm 15\%$  to  $\pm 25\%$  of an established nominal resistance. The force resolution of FSR devices is better than  $\pm 0.5\%$  of full use force.

### Standard FSRs from Interlink Electronics



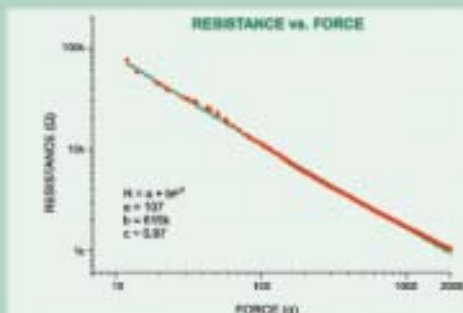
Custom sensors also available for high-volume applications

Also available:  
The FSR 400 Series  
Design Kit (not shown)

### General FSR Characteristics

#### Simple FSR Devices and Arrays

| PARAMETER                        | VALUE                                                                        | NOTES                                |
|----------------------------------|------------------------------------------------------------------------------|--------------------------------------|
| Size Range                       | Max = 20" x 24"<br>(51 x 61 cm)<br>Min = 0.2" x 0.2"<br>(0.5 x 0.5 cm)       | Any shape                            |
| Device thickness                 | 0.008" to 0.060"<br>(0.20 to 1.25 mm)                                        | Dependent on materials               |
| Force Sensitivity Range          | <1 N to >100 N                                                               | Dependent on mechanics               |
| Pressure Sensitivity Range       | <1.5 psi to >150 psi<br>(<0.1 kg/cm <sup>2</sup> to >10 kg/cm <sup>2</sup> ) | Dependent on mechanics               |
| Part-to-Part Force Repeatability | $\pm 15\%$ to $\pm 25\%$ of established nominal resistance                   | With a repeatable actuation system   |
| Single Part Force Repeatability  | $\pm 2\%$ to $\pm 5\%$ of established nominal resistance                     | With a repeatable actuation system   |
| Force Resolution                 | Better than 0.5% full scale                                                  |                                      |
| Break Force (Turn-on Force)      | 20 g to 100 g<br>(0.7 oz to 3.5 oz)                                          | Dependent on mechanics and FSR build |
| Stand-Off Resistance             | >1M                                                                          | Unloaded, unbent                     |
| Switch Characteristic            | Essentially zero travel                                                      |                                      |
| Device Rise Time                 | Resistance instantaneously tracks force                                      |                                      |
| Lifetime                         | >10 million actuations                                                       |                                      |
| Temperature Range                | -30°C to +70°C<br>(-22°F to +158°F)                                          | Dependent on materials               |
| Maximum Current                  | 1 mA/cm <sup>2</sup> of applied force                                        |                                      |
| Sensitivity to Noise/Vibration   | Not significantly affected                                                   |                                      |
| EMI / ESD                        | Passive device                                                               |                                      |
| Lead Attachment                  | Standard flex circuit techniques                                             |                                      |



The force vs. resistance characteristic shown in this figure provides an overview of FSR typical response behavior.

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