

4 Ways to Use FlexiForce™ Touch Sensors in an Embedded Application

Discover How You Can Successfully Create Smart Force-Sensitive Devices with FlexiForce Sensors

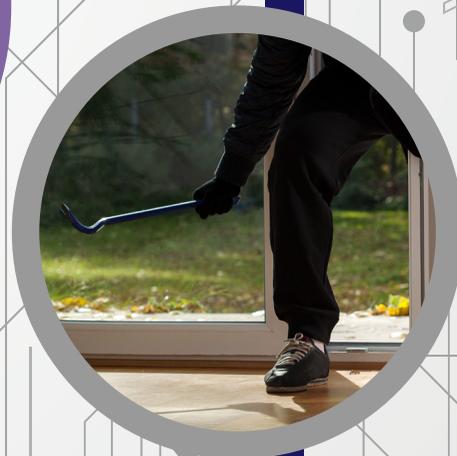
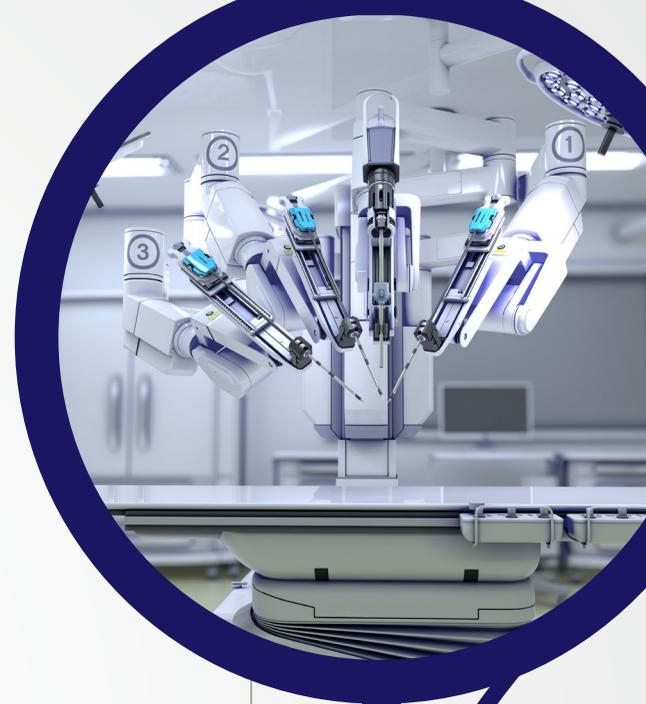


Table of Contents

3 Integrate Ingenuity with Ultra-Thin Force-Sensing Technology

4 4 Ways to Use FlexiForce Sensors

5 What are FlexiForce Sensors?

6 FlexiForce at Work

7 Detect and Measure Relative Change in Force or Applied Load

8 Detect and Measure Rate of Change in Force or Applied Load

9 Detect Contact and/or Touch

10 Identify Force Thresholds to Trigger an Action

11 Now, Let's Put FlexiForce Touch Sensors to Work

Integrate Ingenuity with Ultra-Thin Force-Sensing Technology

Given the fact you are reading this eBook, you more than likely have an appreciation for the numerous roles that force and pressure exchanges play in our daily lives. They are demonstrated in the real world in a variety of ways: a physician performing a manual evaluation on a patient, a robotic manufacturing system placing delicate components in an assembly, or a vehicle security system activating when an intruder is detected, to name a few.

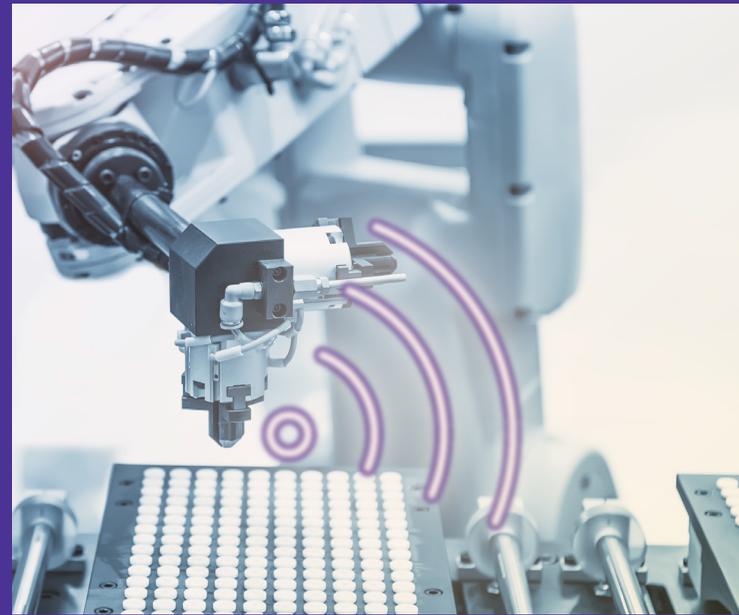
Every touch, movement, push, pull, expansion, contraction, or impact that a device or system experiences over use are dynamic, quantifiable actions. Tactile sensing technologies provide the ability to capture and monitor changes in force to ensure consistency of a process and/or automatically prompt an action in response to a change.

Today's design engineers find themselves in a constant struggle to develop differentiated devices and systems with embedded applications that improve usability and efficiency. In general, many of today's noteworthy

design innovations feature compact devices with smart applications that are easy to use and power-efficient. To address these growing demands, the embedded sensor components design engineers use to enable new and exciting features should also have these same small, simple, and smart qualities.

As a result, FlexiForce™ touch sensors offer the best opportunity as an embedded force sensor for design engineers to conquer these challenges and develop innovative force-sensitive devices. The flexible properties of the technology, combined with their performance success in a variety of industries and operating environments, make FlexiForce a truly design-friendly force sensor.

While new applications for FlexiForce sensors are being discovered every day, this eBook will explain four unique ways FlexiForce sensors are used as an embedded component, supporting these uses with real-world successes. These applications will cover a range of industries, including medical robotics, manufacturing process & quality control, athletics, and more.



A SMART, SIMPLE AND SUCCESSFUL SENSOR

There are three common force sensor types used in embedded devices and systems today: load cells, strain gauges, MEMS devices, and ultra-thin force-sensitive resistors, including FlexiForce touch sensors.

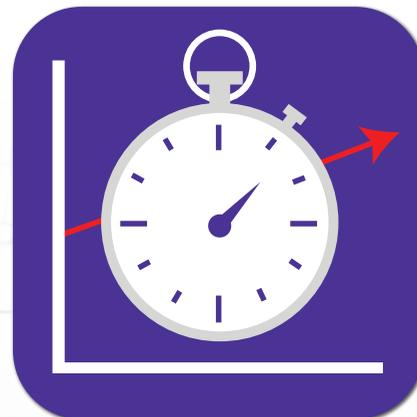
Load cells, strain gauges, and MEMS devices technologies are ideal for applications requiring highly-precise force measurements, but present challenges from an integration perspective, and can be quite expensive for mass production.

In addition to being a thin, flexible, and more cost-effective embedded sensor alternative, FlexiForce sensors have multiple applications to help create smart, force-sensitive devices.

4 WAYS TO USE FLEXIFORCE SENSORS



Detect and Measure Relative Change in Force or Applied Load



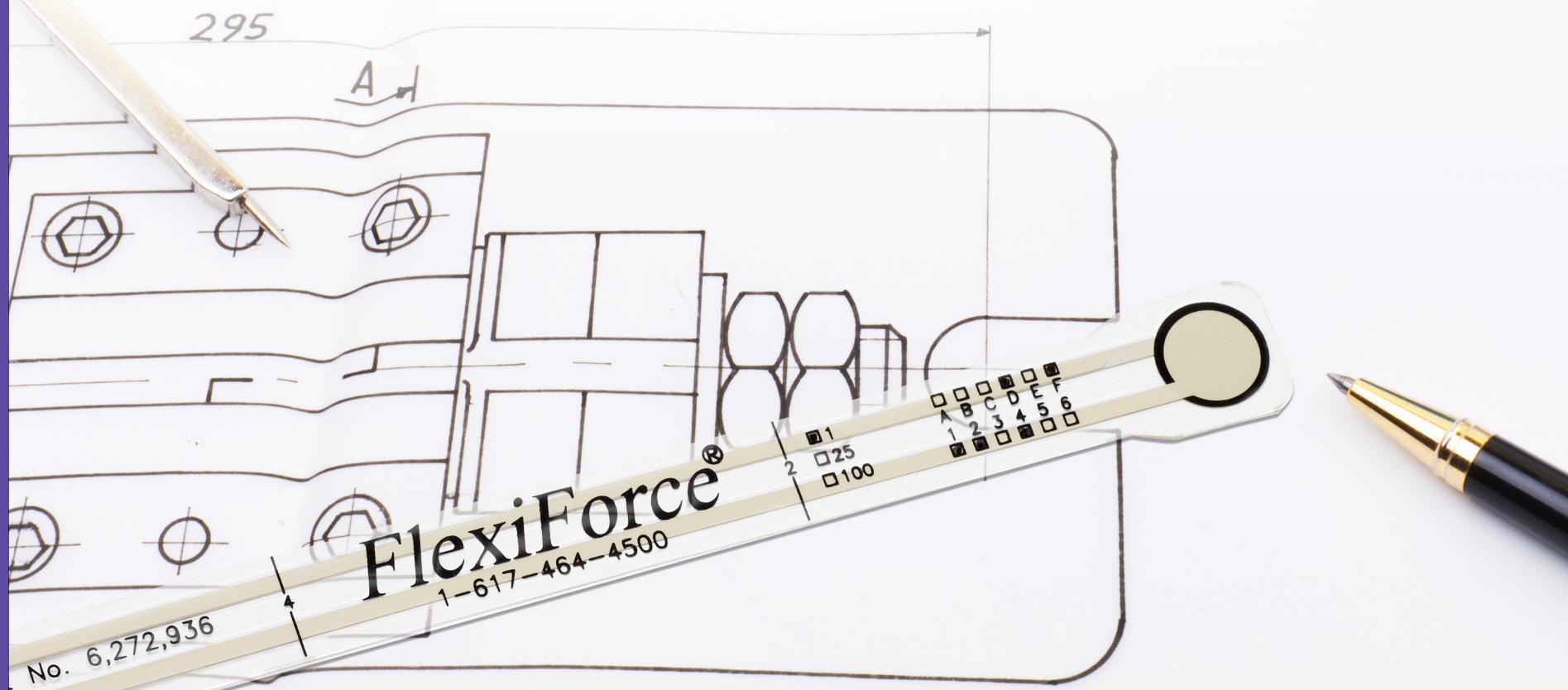
Detect and Measure Rate of Change in Force or Applied Load



Detect Contact and/or Touch

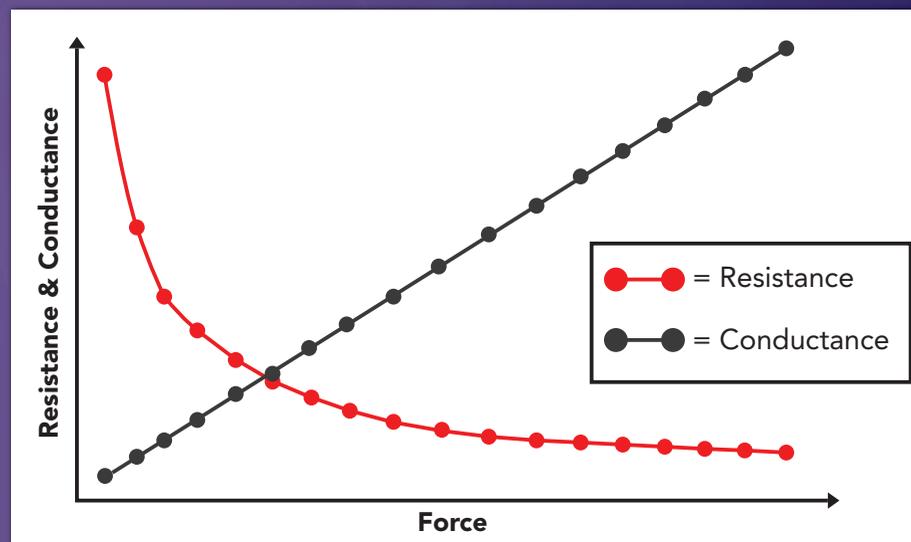


Identify Force Thresholds to Trigger an Action



BENEFITS OF A FLEXIFORCE SENSOR

FlexiForce sensors act as a force sensing resistor in an electrical circuit. When the force sensor is unloaded, its resistance is very high. When force is applied to the sensor, this resistance decreases. This resistance change can be customized, depending on the needs of the application.



- Paper-thin construction
- Unobtrusive; sensors can be embedded in small spaces



- Works in most operating environments
- High temperature options available (up to 204°C)



- More energy efficient than other alternatives
- Only simple electronics needed



- Various standard sensor sizes available
- Customizable solutions

WHAT ARE FLEXIFORCE SENSORS?

FlexiForce tactile force sensors are ultra-thin and flexible printed circuits, which can be easily integrated into force measurement applications. They are used to measure force between almost any two surfaces.

FlexiForce sensors are ideal for OEM products, due to Tekscan's ability to customize for an application's specific needs:

- **Geometry:** FlexiForce sensors can be designed in a variety of shapes and sizes, to meet specific application and product needs.
- **Ink technology:** Tekscan offers three pressure-sensitive ink variations: standard, enhanced, and high temperature.
- **Integration support:** Tekscan's team of mechanical, electrical, and application engineers have extensive experience assisting design engineers to achieve successful product integration.

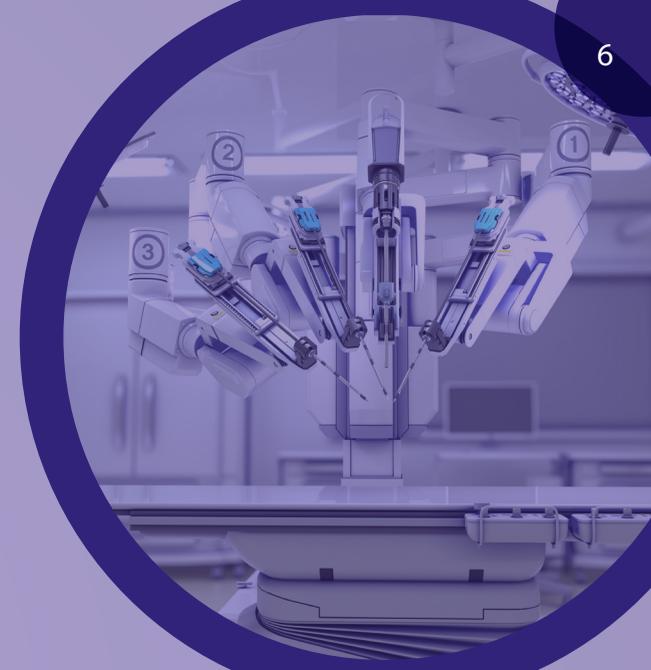


CLICK HERE!

To Learn About our Full Line of Standard FlexiForce Sensors

FlexiForce at Work

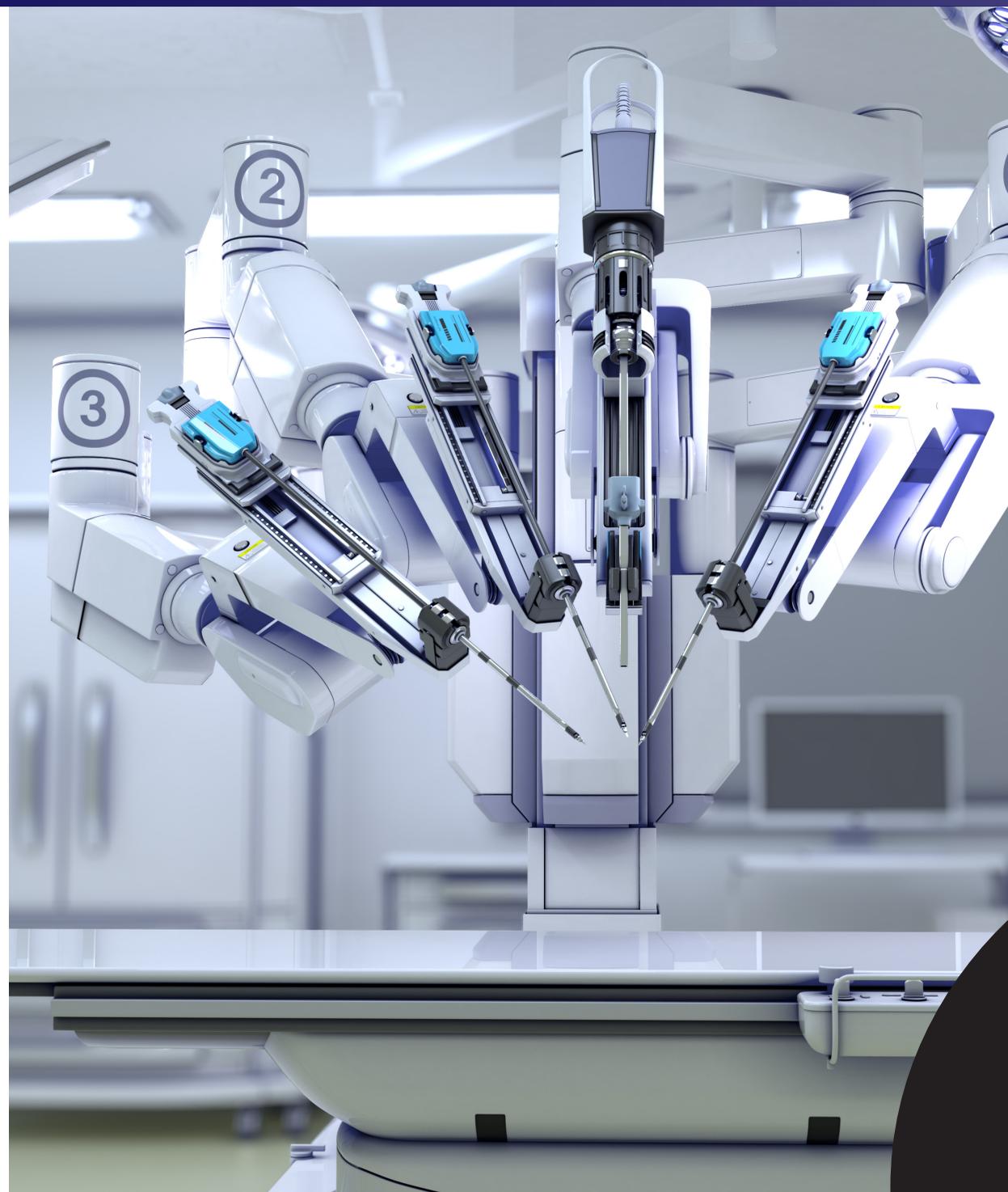
The following pages demonstrate the 4 defined uses for FlexiForce sensors in real-world applications.





DETECT AND MEASURE RELATIVE CHANGE IN FORCE OR APPLIED LOAD

For force-sensitive applications that monitor real-time changes in force – such as a shift in weight, position, or expansion of two contact surfaces – FlexiForce touch sensors may be your solution. They are especially useful for applications with extremely tight or sensitive space constraints, such as the example shared on the right.



CASE EXAMPLE: ENSURING SAFETY OF ROBOTIC SURGICAL SYSTEMS

While electronic medical devices, like robotic surgical systems, were once viewed with skepticism a few decades ago, surgeons and patients now understand that these innovations can improve the efficacy of a treatment process.

Recently, a robotic surgical system manufacturer was exploring a force-sensing application for a suture administration robot. They embedded a FlexiForce sensor into the clamping mechanism to monitor the amount of force applied while administering sutures. The robot could be programmed to automatically adjust its force output as it proceeded from one end of the incision to the other, which is extremely important when applying sutures in areas that have sensitive tissue nearby.

This man-machine haptic-feedback application presents an effective way to command a safe and consistent procedure.

OTHER SIMILAR APPLICATIONS:

- Robotic Manufacturing Systems
- Joystick/Controller Applications
- Physical Therapy Grip
- Machine Alignment and Setup (e.g. Nip Roll)



DETECT AND MEASURE RATE OF CHANGE IN FORCE OR APPLIED LOAD

Pairing your FlexiForce sensor with a timing method can create applications that allow the operator or subject to monitor force changes over a time period. This data can be used to gauge performance, consistency, or expose potential flaws before they happen.



CASE EXAMPLE: A SMART METHOD TO CALCULATE PEDALING POWER

Whether it's beating a personal best, or striving to overcome a world record, statistics will forever be ingrained in athletic activities. Force-sensing technology can enable an application to capture critical information on an athlete's performance.

One bicycle manufacturer embedded a FlexiForce sensor within their bike pedal design with the goal of calculating power (force * velocity) exerted by the individual. This system was able to record the rider's performance over the duration of the race, which could be used in further endurance training.

Track designers can also use this information to assess the difficulty of their course, adding to the entertainment value of the event.

OTHER SIMILAR APPLICATIONS:

- Velocity Control Tools
- CPR/Manual Therapy Administration
- Quantity Detection (Containers, Inventory Management, etc.)
- Monitoring Medication Levels (Autoinjector Applications)



DETECT CONTACT AND/OR TOUCH

From damaging impacts, to soft bumps or glances, every touch or contact tells a story. FlexiForce sensors can be your method to capture these moments to better understand and control your device's operating environment.



CONTROLLING FILL LINE IMPACTS

Minimizing damage and loss during high-throughput fill line operations is a major challenge for production managers and engineers. With Tekscan's advanced technology, you can now develop solutions that measure how much force a product endures throughout the fill line process.



With the help of our thin and flexible sensors, our customers have been able to reduce costs, waste and increase revenue through their production lines. Tekscan's force sensing solutions effectively capture forces applied to bottles and cans by rail lines, robotic grippers, and adjacent product units, during production. As shown above, custom FlexiForce sensors were embedded into a model of a product that could be sent through the manufacturing process to monitor and relay force output. This information helps manufacturers significantly minimize losses and improve efficiency.

OTHER SIMILAR APPLICATIONS:

- Neuromuscular Rehabilitation
- HMI Touch Switch
- Window or Door Seal
- Vehicle Presence (Capacity)



IDENTIFY FORCE THRESHOLDS TO TRIGGER AN ACTION

FlexiForce sensors can function as a highly-sensitive smart switch to collect data for a communication system. This helps reduce the need for human interaction in a given process, a concept commonly known as the “Internet of Things,” or IoT.



CASE EXAMPLE: FORCE-SENSITIVE SECURITY SYSTEMS

Whether it's an intruder entering a facility after hours, or items in storage mysteriously disappearing over time, these measurable force exchanges can be an indication of foul play.

A security system developer designed a force-sensitive security pad that would be placed on the floor surrounding a display case of valuable items. An ultra-thin FlexiForce sensor matrix was embedded into a pad design resembling the surrounding floor boards. The pad would trigger a silent alarm after a certain weight threshold was detected, but not when a lighter weight (e.g. the sweep from a broom) came in contact.

A similar application could be developed for shelving units, where a force-sensitive system could monitor any unusual changes in force – potentially signaling theft.

OTHER SIMILAR APPLICATIONS:

- Security/Theft Management
- Vehicle Presence (Occupancy)
- Package Delivery Theft
- On-the-Go Rehabilitation Equipment (Crutches, Wheelchairs, etc.)

CONCLUSION

Now, Let's Put FlexiForce Touch Sensors To Work

Now is the time to consider how embedding force sensing technology into your products will provide a competitive edge. Here are four questions to ask yourself as you begin to define your process:

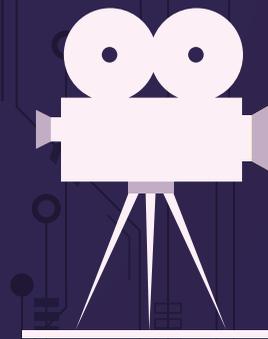
1. What force sensing technology can effectively and economically be integrated into my product design?
2. What mechanical or electrical requirements or obstacles may impact my choice of force sensing technology?
3. Does my product require capturing force within a specific sensitivity range?
4. Is my choice of force sensor backed with a support group of expert engineers experienced in embedding force sensing technology?



Seeking Force-Sensing Technology for your Application? Let's start a conversation.

We at Tekscan understand the challenges design engineers face, and the risks they take when embedding new technology. Whether it's a standard FlexiForce sensor or a custom design, Tekscan has a proven track record for helping design engineers achieve high-value products with force sensing technology. Your return on investment comes in the form of confidence in your product design, a shortened development process time, and an improved end-user experience.

Visit www.tekscan.com/es or call 1.800.248.3669 / +1.617.464.4283 for more information.



Visit the FlexiForce
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