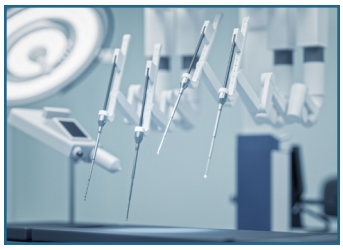
FORCE MEASUREMENT SOLUTIONS

CASE STUDY

# Sensor Technologies Advance Function in Varied Robot Types

## About

The indispensable role of precise force and torque measurement drives the evolution of robotics, enhancing capabilities across all major types—from collaborative industrial robots and autonomous mobile platforms to surgical assistants, defense systems, humanoid dexterity, and extraterrestrial exploration. With global robot installations projected to exceed 500,000 units annually this year, the demand for highly refined control is rising. Interface provides sensor solutions that empower these robotic systems to attain unprecedented accuracy, control, and adaptability in managing complex tasks. Interface's precision sensor technologies guarantee the reliability and safety of high-performance robotic operations.

## Challenge

As robots take on increasingly complex tasks from delicate surgical incisions to autonomous navigation in unpredictable environments, real-time, multi-dimensional force measurement is essential. The failure costs vary significantly by application, ranging from significant financial losses in industrial settings to severe safety risks in medical or defense operations. Manufacturers require reliable sensor technologies to measure torque, monitor load, provide force feedback, and ensure operational safety in various conditions. Advanced robotics necessitates multi-axis force measurement to improve control algorithms and confirm system reliability.

## Solutions

Interface provides robotics developers and manufacturers with load cells, torque transducers, multi-axis sensors, wireless products, and instrumentation. These solutions support various robotic types' design, testing, and performance monitoring stages. We also offer customized sensors for OEM solutions, enabling advanced controls and enhanced safety. Interface sensors deliver the accuracy, quality, and flexibility essential for breakthrough robotic applications.

1200 Standard Precision LowProfile® Load Cell

SMTM Micro S-Type Load Cell

6A40 Series 6-Axis Standard Capacity Load Cell

BX8-HD44 Data Acquisition System

**Interface Solutions for Robotic Systems and Platforms**

Our sensors are used in the design and testing of robots across various industries, including: Industrial Robots such as Articulated, SCARA, Delta, Cartesian, and Collaborative Robots; Service Robots, including Medical, Logistics, Agriculture, Construction, Inspection, Security, Space, and Underwater; Consumer Robots like Household, Companion, and Educational; Humanoid Robots designed to resemble the human body; Bio-inspired Robots that mimic animals; Mobile Robots, including Autonomous Vehicles, Wheeled, Legged, Flying, and Underwater; and Fixed-Base Robots, which operate from a static position, such as robotic arms used in production, lifting, machinery, and testing

## Industrial Robots

Industrial robots leverage Interface's load cells, multi-axis sensors and torque transducers for precise joint and gripper control in sectors like automotive and aerospace. These solutions enable exact force and torque management during robotic welding, fastening, and material handling operations. For example, a 1200 Universal LowProfile Load Cell can monitor payload distribution in an automated assembly arm, ensuring consistent output over thousands of cycles.

## Surgical Robots

Interface's Mini load cells in medical robotics provide real-time force feedback for surgical and diagnostic robots. These systems demand sub-gram precision and rapid response to force changes. Interface sensors integrate into robotic instruments, helping surgeons detect subtle resistance to improve accuracy and protect patient tissues. Our sensors also enhance safety in rehabilitation robots.

## Entertainment Robots

Entertainment robots, including theme park animatronics and interactive exhibits, require precise, lifelike motion and responsiveness. Interface sensors measure and fine-tune these robots' mechanical movements, enabling creators to program realistic gestures and facial expressions. With capabilities like multi-axis force detection, Interface solutions deliver a new level of immersion and realism to robotic characters and attractions.

## Autonomous Mobile Robots

Mobile robots, including autonomous vehicles and exploration rovers, depend on interface sensors for crucial navigation and environmental interaction. Load cells and multi-axis sensors monitor ground contact forcesL, oad Cell weight distribution, and collision impacts, which are essential for stable locomotion across varied terrains and safe operation around obstacles. These sensors provide precise data for path planning, obstacle avoidance, and maintaining balance, enabling reliable performance in dynamic and unpredictable environments.

## Results

Interface offers force, torque, and weight measurement solutions to use across the robotic continuum. Across diverse robotic applications, Interface sensors have enabled robots to achieve greater reliability in real-world conditions, enhancing their ability to detect overloads, maintain balance, and respond dynamically to environmental changes. By leveraging Interface's advanced force measurement, manufacturers have significantly improved machine accuracy, safety, and performance. Force and torque data empower engineers to fine-tune robotic control systems. Ultimately, Interface's contributions help to deliver smarter, safer, and more capable robots to market.