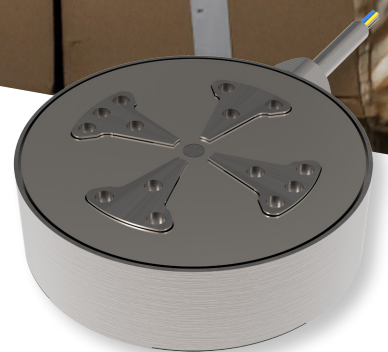




E-commerce growth drives logistics complexity. HBK's 6DoF sensors enable safer, smarter, and more adaptive automation with unmatched precision for handling diverse and fragile products.

APPLICATION NOTE

NextGen logistics automation with HBK's custom 6DoF sensors – touch precision for industrial performance



CONTEXT: LOGISTICS AT A TECHNOLOGICAL TURNING POINT

The logistics sector is undergoing rapid transformation. The growth of e-commerce and increasing order volumes are driving warehouse operators - and supply chain providers - to push automation further than ever. Traditional systems, based solely on vision and suction grippers, struggle to cope with today's reality: millions of products of different shapes, sizes, and fragilities moving through distribution centers on a daily basis.

This is where multi-axis tactile perception and touch precision really makes the difference. By giving robots the ability to feel and adapt their handling in real time, logistics automation gains the flexibility and reliability needed to manage highly diverse product flows.

THE CHALLENGE: MANAGING DIVERSITY IN THE WAREHOUSE

Automated logistics systems must overcome several obstacles:

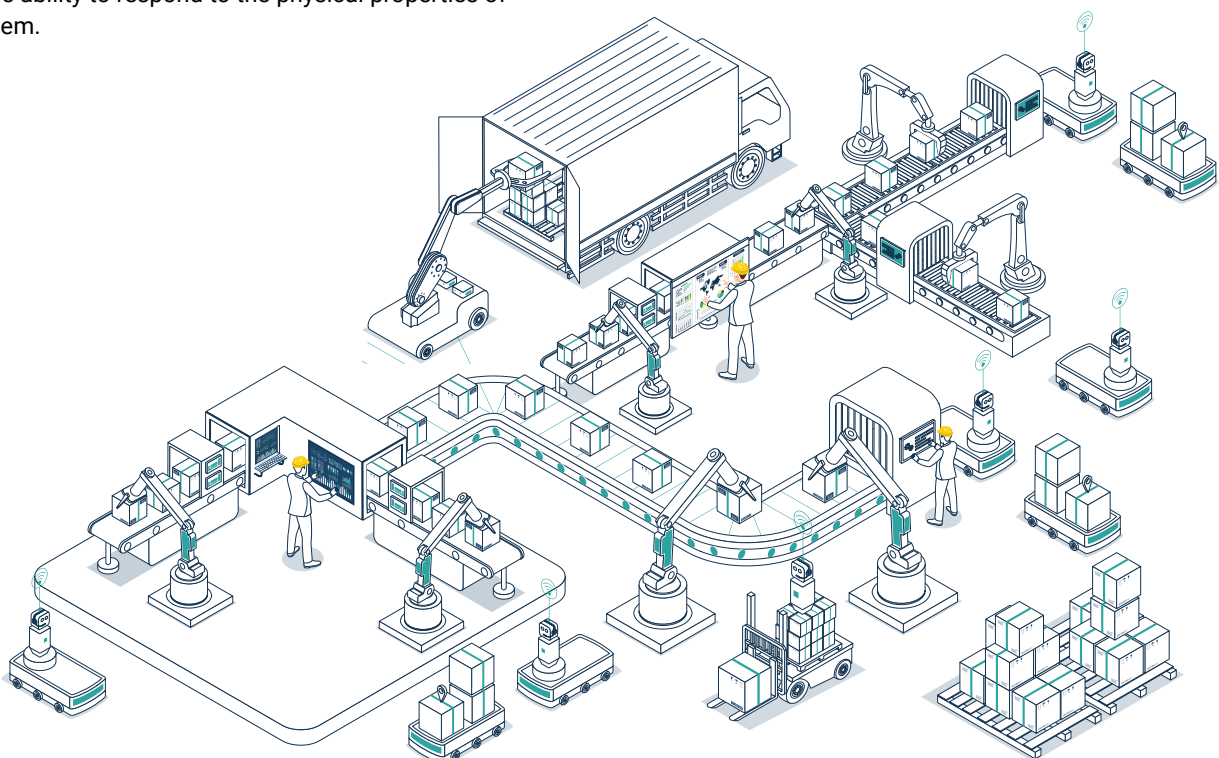
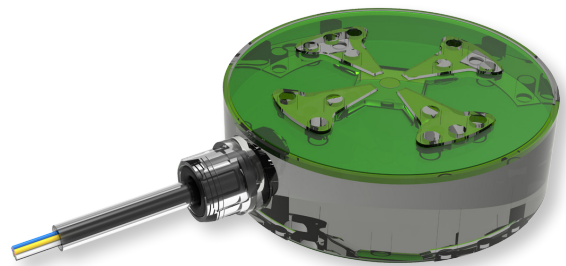
- Safely handling fragile, soft, or irregularly shaped parcels and items
- Reducing pick-and-place errors caused by the absence of tactile feedback
- Limiting physical strain and repetitive tasks for warehouse operators

In short: enabling physical intelligence and touch precision in automated handling, so that robots complement vision with the ability to respond to the physical properties of each item.

THE SOLUTION: A CUSTOM-ENGINEERED 6-DOF TORQUE/FORCE SENSOR

To meet the specific requirements of this application, HBK's specialised custom-sensor engineering team recently designed a fully tailored, six-degree-of-freedom force/torque sensor. The development was guided by demanding constraints: limited space within the gripper, the need for real-time force feedback, and robust operation in challenging warehouse environments.

The result is an ultra-compact sensor with an integrated digital amplifier, capable of delivering simultaneous force and torque data (F_x , F_y , F_z , M_x , M_y , M_z) with multi-axis precision and millisecond-level latency. Its rugged design (IP65, $-20\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$) and wide supply range (5–30 VDC) ensures seamless integration and long-term performance in harsh environments.



TANGIBLE BENEFITS IN LOGISTICS AUTOMATION

Integrators and OEMs using these customised sensors, with touch precision, report significant benefits:

Product diversity management: from rigid cartons to flexible packaging, each item is handled with the right force

- Reduced error rates: fewer damaged goods, fewer failed picks, and less manual rework
- Safer workplaces: automation takes over repetitive and demanding tasks, reducing operator strain
- Operational robustness: consistent accuracy even in high-throughput warehouses running up to 20 hours a day

STRATEGIC IMPACT FOR LOGISTICS PROVIDERS

- Higher productivity: increased throughput to keep pace with growing order volumes
- Greater flexibility: ability to adapt to constantly changing product assortments in modern warehouses
- Sustainable competitiveness: introducing automation with a true sense of touch provides lasting differentiation in the logistics market

TOWARD LOGISTICS AUTOMATION WITH PHYSICAL INTELLIGENCE

Warehouse automation is entering a new era: robots are no longer limited to “seeing” - they can now “feel.” With HBK’s custom-engineered 6DoF sensor, touch precision becomes a cornerstone of next-generation logistics, enabling safer, more adaptive, and more efficient distribution centers.

HBK’S ENGINEER-TO-ENGINEER APPROACH

Beyond technology, HBK differentiates itself through its collaborative model, working engineer-to-engineer with OEMs and automation innovators. Each project results in a tailored design, addressing the specific integration, durability, and performance challenges of warehouse environments.

This approach delivers more than measurement - it delivers confidence. Confidence that HBK can design, prototype, and industrialise the right sensing solution for the unique requirements of logistics leaders.

USE CASE EXAMPLE: LOGISTICS AUTOMATION IN PRACTICE

In a large-scale warehouse environment, robots equipped with HBK’s custom 6DoF sensors demonstrated the ability to handle a wide range of SKUs - from fragile glassware to irregularly shaped parcels - with unprecedented accuracy. By combining vision systems with touch precision feedback, the automation system achieved significantly higher pick success rates, while reducing product damage and minimising manual intervention.

This example illustrates how HBK’s custom sensor technology directly addresses the challenges of modern logistics, delivering both operational and strategic benefits.

