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Global Joint Torque Sensors Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Joint Torque Sensors market size is expected to reach $ 1302 million by 2032, rising at a market growth of 10.4% CAGR during the forecast period (2026-2032).

Joint torque sensors are single-axis torque transducers integrated into or immediately adjacent to robotic joints to directly measure the output torque of the motor and gearbox and provide real-time feedback to motion-control and safety systems. The market primarily covers compact reaction-torque sensors designed for joint integration, with strain-gauge technology as the mainstream architecture and magnetostrictive and optical approaches serving selected applications. Key purchasing specifications include rated torque, accuracy, stiffness, overload capacity, bandwidth, thickness and diameter, temperature stability, cross-load rejection, environmental protection, and analog or digital interfaces such as SPI, CAN, EtherCAT, RS485, BiSS C, and I2C. These sensors are used in collaborative, humanoid, medical and rehabilitation, traditional industrial, and wearable or exoskeleton robots to support compliant control, collision detection, force limitation, gravity and friction compensation, and hand-guided operation. Products range from standard single-channel devices to digital and safety-redundant designs for functional-safety applications. The estimated blended gross margin is approximately 45%.

Market Trends

The market is moving from basic analog bridge sensors toward thinner, higher-stiffness devices with integrated signal conditioning, temperature compensation, digital communication and safety diagnostics. Joint designs are increasingly optimized around strain-wave gear geometry, hollow cable routing and compact actuator packaging. CAN,

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EtherCAT, SPI, BiSS C and other real-time interfaces are becoming more common, while redundant sensing channels and fault detection are gaining importance in human-robot collaboration. The rise of humanoid platforms is also shifting product development toward smaller diameter, lower mass, broader torque coverage and lower unit cost because a single robot may require many sensing joints.

Drivers

Growth is driven by wider adoption of torque-controlled cobots, medical and rehabilitation robots, and emerging humanoid platforms. Direct joint torque measurement improves compliant motion, collision response and force limiting compared with torque estimation based only on motor current, supporting higher safety and interaction performance.

Restraints

Precision elastic-body machining, strain-gauge bonding, calibration and temperature compensation keep manufacturing costs above those of current-based torque estimation. Sensor compliance and added packaging space can also affect joint stiffness, inertia and actuator layout, which limits adoption in highly cost-sensitive or compact platforms.

Opportunities

The strongest opportunities are in high-volume compact actuator platforms that require standardized thin sensors, embedded electronics and digital interfaces. Humanoid and wearable robots create additional demand for multiple torque ranges within one platform, while safety-certified cobot and medical applications support premium products with redundant channels and diagnostics.

Challenges

Key challenges include cross-load rejection, thermal drift, overload durability, calibration consistency and long-term zero stability under repeated joint cycling. Suppliers must also adapt mechanical interfaces to different reducers and actuator architectures while meeting increasingly stringent functional-safety requirements without materially

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increasing size or cost.

Industry Chain Analysis

Upstream inputs include strain gauges or alternative sensing elements, aluminum and stainless-steel elastic bodies, adhesives, flexible circuits, analog front ends, ADCs, microcontrollers, connectors and communication chips. Midstream value creation centers on elastic-structure design, precision machining, gauge bonding, compensation, calibration, embedded electronics, sealing and safety validation. Downstream customers are robot OEMs and integrated joint or actuator suppliers serving collaborative, humanoid, medical, industrial and wearable robotics. Cost is concentrated in precision processing, sensing-element assembly, calibration and electronics, while higher value comes from accuracy, stiffness, cross-load suppression, temperature stability, compactness and integration support.

Segment Insights

Strain-gauge products account for the broadest commercial coverage because they offer a mature balance of accuracy, stiffness, cost and manufacturability. Low- and medium-torque ranges up to roughly 150 Nm cover a large share of compact cobot, humanoid and rehabilitation joints, while higher torque ranges serve shoulder, hip, base and heavier industrial joints. Digital-only and hybrid-output sensors are gaining share as robot makers seek simplified wiring, faster commissioning and direct integration with real-time control networks.

Downstream Market Opportunities

Collaborative robots remain the most established commercial destination because joint-level torque feedback directly supports hand guiding, collision detection and safe force limiting. Medical and rehabilitation robots offer higher-value opportunities where precision and repeatability are critical, while humanoid robots are the most important emerging volume opportunity due to their high joint counts. Traditional industrial and wearable robots provide additional demand where compliant control or direct force awareness is required.

Regional Insights

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Asia is the largest volume opportunity because China, Japan and South Korea combine large robot manufacturing bases with rapid localization of sensors and joint modules. Europe remains important in premium cobot, medical and safety-oriented robotics, where functional-safety design and precision integration are key differentiators. North America is supported by robotics startups, medical-robotics development and custom OEM sensing demand. China is likely to gain share in standardized mid-range products as domestic actuator and humanoid supply chains scale, while European, US and Korean suppliers retain advantages in high-end customization and certified safety solutions.

Competitive Landscape Analysis

Competition is fragmented between specialist robot-sensor companies and broader precision-measurement suppliers. Sensodrive has long-standing specialization in joint torque sensing, while TE Connectivity and FUTEK emphasize OEM integration and functional-safety-oriented designs. Bota Systems, AIDIN Robotics and AL.Robot are expanding compact digital sensing for next-generation robot joints, and Chinese suppliers such as SRI, Kunwei and Forsentek compete through broad torque ranges, customization and faster local support. Competitive differentiation increasingly depends on thin mechanical design, calibration stability, real-time interfaces, safety redundancy and the ability to co-design sensors around specific reducers and integrated actuators.

Report Scope

This report studies the global Joint Torque Sensors production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Joint Torque Sensors and provides market size (US$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of Joint Torque Sensors that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Joint Torque Sensors total production and demand, 2021-2032, (K Units)

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Global Joint Torque Sensors total production value, 2021-2032, (USD Million)

Global Joint Torque Sensors production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (K Units), (based on production site)

Global Joint Torque Sensors consumption by region & country, CAGR, 2021-2032 & (K Units)

U.S. VS China: Joint Torque Sensors domestic production, consumption, key domestic manufacturers and share

Global Joint Torque Sensors production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (K Units)

Global Joint Torque Sensors production by Type, production, value, CAGR, 2021-2032, (USD Million) & (K Units)

Global Joint Torque Sensors production by Application, production, value, CAGR, 2021-2032, (USD Million) & (K Units)

This report profiles key players in the global Joint Torque Sensors market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include Sensodrive, FUTEK, TE Connectivity, Bota Systems, AIDIN Robotics, AL.Robot, SRI, Kunwei, Forsentek, Ultraforce, etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Joint Torque Sensors market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US$ Millions), volume (production, consumption) & (K Units) and average price (US$/Unit) by

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manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Joint Torque Sensors Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Market Segmentation

Global Joint Torque Sensors Market, Segmentation by Type:

?20 Nm

>20–50 Nm

>50–150 Nm

>150–300 Nm

>300 Nm

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Global Joint Torque Sensors Market, Segmentation by Sensing Principle:

Strain Gauge

Magnetoelastic / Magnetostrictive

Optical

Other

Global Joint Torque Sensors Market, Segmentation by Output Type:

Analog Output

Digital Output

Analog and Digital Output

Global Joint Torque Sensors Market, Segmentation by Safety Architecture:

Standard Architecture

Safety-Redundant Architecture

Global Joint Torque Sensors Market, Segmentation by Application:

Industrial Manufacturing

Healthcare

Logistics and Warehousing

Commercial and Consumer Services

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Defense and Special Operations

Others

Companies Profiled:

Sensodrive

FUTEK

TE Connectivity

Bota Systems

AIDIN Robotics

AL.Robot

SRI

Kunwei

Forsentek

Ultraforce

NCTE

Interface

HBK

Key Questions Answered

1. How big is the global Joint Torque Sensors market?

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2. What is the demand of the global Joint Torque Sensors market?
3. What is the year over year growth of the global Joint Torque Sensors market?
4. What is the total value of the global Joint Torque Sensors market?
5. Who are the Major Players in the global Joint Torque Sensors market?
6. What are the growth factors driving the market demand?

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