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Global Joint Torque Sensors Market 2026 by Manufacturers, Regions, Type and Application, Forecast to 2032

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Abstracts

According to our (Global Info Research) latest study, the global Joint Torque Sensors market size was valued at US$ 647 million in 2025 and is forecast to a readjusted size of US$ 1302 million by 2032 with a CAGR of 10.4% during review period.

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

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communication and safety diagnostics. Joint designs are increasingly optimized around strain-wave gear geometry, hollow cable routing and compact actuator packaging. CAN, 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

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also adapt mechanical interfaces to different reducers and actuator architectures while meeting increasingly stringent functional-safety requirements without materially 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.

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Regional Insights

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 is a detailed and comprehensive analysis for global Joint Torque Sensors market. Both quantitative and qualitative analyses are presented by manufacturers, by region & country, by Type and by Application. As the market is constantly changing, this report explores the competition, supply and demand trends, as well as key factors that contribute to its changing demands across many markets. Company profiles and product examples of selected competitors, along with market share estimates of some of the selected leaders for the year 2025, are provided.

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Key Features:

Global Joint Torque Sensors market size and forecasts, in consumption value ($ Million), sales quantity (K Units), and average selling prices (US$/Unit), 2021-2032

Global Joint Torque Sensors market size and forecasts by region and country, in consumption value ($ Million), sales quantity (K Units), and average selling prices (US$/Unit), 2021-2032

Global Joint Torque Sensors market size and forecasts, by Type and by Application, in consumption value ($ Million), sales quantity (K Units), and average selling prices (US$/Unit), 2021-2032

Global Joint Torque Sensors market shares of main players, shipments in revenue ($ Million), sales quantity (K Units), and ASP (US$/Unit), 2021-2026

The Primary Objectives in This Report Are:

To determine the size of the total market opportunity of global and key countries

To assess the growth potential for Joint Torque Sensors

To forecast future growth in each product and end-use market

To assess competitive factors affecting the marketplace

This report profiles key players in the global Joint Torque Sensors market based on the following parameters - company overview, sales quantity, revenue, 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.

Joint Torque Sensors market is split by Type and by Application. For the period

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2021-2032, the growth among segments provides accurate calculations and forecasts for consumption value by Type, and by Application in terms of volume and value. This analysis can help you expand your business by targeting qualified niche markets.

Market Segmentation

Market segment by Type

?20 Nm

>20–50 Nm

>50–150 Nm

>150–300 Nm

>300 Nm

Market segment by Sensing Principle

Strain Gauge

Magnetoelastic / Magnetostrictive

Optical

Other

Market segment by Output Type

Analog Output

Digital Output

Analog and Digital Output

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Market segment by Safety Architecture

Standard Architecture

Safety-Redundant Architecture

Market segment by Application

Industrial Manufacturing

Healthcare

Logistics and Warehousing

Commercial and Consumer Services

Defense and Special Operations

Others

Major players covered

Sensodrive

FUTEK

TE Connectivity

Bota Systems

AIDIN Robotics

AL.Robot

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SRI

Kunwei

Forsentek

Ultraforce

NCTE

Interface

HBK

Market segment by region, regional analysis covers

North America (United States, Canada, and Mexico)

Europe (Germany, France, United Kingdom, Russia, Italy, and Rest of Europe)

Asia-Pacific (China, Japan, Korea, India, Southeast Asia, and Australia)

South America (Brazil, Argentina, Colombia, and Rest of South America)

Middle East & Africa (Saudi Arabia, UAE, Egypt, South Africa, and Rest of Middle East & Africa)

Chapter Outline

Chapter 1, to describe Joint Torque Sensors product scope, market overview, market estimation caveats and base year.

Chapter 2, to profile the top manufacturers of Joint Torque Sensors, with price, sales quantity, revenue, and global market share of Joint Torque Sensors from 2021 to 2026.

Chapter 3, the Joint Torque Sensors competitive situation, sales quantity, revenue, and

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global market share of top manufacturers are analyzed emphatically by landscape contrast.

Chapter 4, the Joint Torque Sensors breakdown data are shown at the regional level, to show the sales quantity, consumption value, and growth by regions, from 2021 to 2032.

Chapter 5 and 6, to segment the sales by Type and by Application, with sales market share and growth rate by Type, by Application, from 2021 to 2032.

Chapter 7, 8, 9, 10 and 11, to break the sales data at the country level, with sales quantity, consumption value, and market share for key countries in the world, from 2021 to 2026.and Joint Torque Sensors market forecast, by regions, by Type, and by Application, with sales and revenue, from 2027 to 2032.

Chapter 12, market dynamics, drivers, restraints, trends, and Porters Five Forces analysis.

Chapter 13, the key raw materials and key suppliers, and industry chain of Joint Torque Sensors.

Chapter 14 and 15, to describe Joint Torque Sensors sales channel, distributors, customers, research findings and conclusion.

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Contents

1 MARKET OVERVIEW

1.1 Product Overview and Scope
1.2 Market Estimation Caveats and Base Year
1.3 Market Analysis by Type
  1.3.1 Overview: Global Joint Torque Sensors Consumption Value by Type: 2021 Versus 2025 Versus 2032
  1.3.2 ?20 Nm
  1.3.3 >20–50 Nm
  1.3.4 >50–150 Nm
  1.3.5 >150–300 Nm
  1.3.6 >300 Nm
1.4 Market Analysis by Sensing Principle
  1.4.1 Overview: Global Joint Torque Sensors Consumption Value by Sensing Principle: 2021 Versus 2025 Versus 2032
  1.4.2 Strain Gauge
  1.4.3 Magnetoelastic / Magnetostrictive
  1.4.4 Optical
  1.4.5 Other
1.5 Market Analysis by Output Type
  1.5.1 Overview: Global Joint Torque Sensors Consumption Value by Output Type: 2021 Versus 2025 Versus 2032
  1.5.2 Analog Output
  1.5.3 Digital Output
  1.5.4 Analog and Digital Output
1.6 Market Analysis by Safety Architecture
  1.6.1 Overview: Global Joint Torque Sensors Consumption Value by Safety Architecture: 2021 Versus 2025 Versus 2032
  1.6.2 Standard Architecture
  1.6.3 Safety-Redundant Architecture
1.7 Market Analysis by Application
  1.7.1 Overview: Global Joint Torque Sensors Consumption Value by Application: 2021 Versus 2025 Versus 2032
  1.7.2 Industrial Manufacturing
  1.7.3 Healthcare
  1.7.4 Logistics and Warehousing
  1.7.5 Commercial and Consumer Services

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1.7.6 Defense and Special Operations
1.7.7 Others
1.8 Global Joint Torque Sensors Market Size & Forecast
1.8.1 Global Joint Torque Sensors Consumption Value (2021 & 2025 & 2032)
1.8.2 Global Joint Torque Sensors Sales Quantity (2021-2032)
1.8.3 Global Joint Torque Sensors Average Price (2021-2032)

2 MANUFACTURERS PROFILES

2.1 Sensodrive
2.1.1 Sensodrive Details
2.1.2 Sensodrive Major Business
2.1.3 Sensodrive Joint Torque Sensors Product and Services
2.1.4 Sensodrive Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.1.5 Sensodrive Recent Developments/Updates
2.2 FUTEK
2.2.1 FUTEK Details
2.2.2 FUTEK Major Business
2.2.3 FUTEK Joint Torque Sensors Product and Services
2.2.4 FUTEK Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.2.5 FUTEK Recent Developments/Updates
2.3 TE Connectivity
2.3.1 TE Connectivity Details
2.3.2 TE Connectivity Major Business
2.3.3 TE Connectivity Joint Torque Sensors Product and Services
2.3.4 TE Connectivity Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.3.5 TE Connectivity Recent Developments/Updates
2.4 Bota Systems
2.4.1 Bota Systems Details
2.4.2 Bota Systems Major Business
2.4.3 Bota Systems Joint Torque Sensors Product and Services
2.4.4 Bota Systems Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.4.5 Bota Systems Recent Developments/Updates
2.5 AIDIN Robotics
2.5.1 AIDIN Robotics Details

+357 96 030922
info@marketpublishers.com

2.5.2 AIDIN Robotics Major Business
2.5.3 AIDIN Robotics Joint Torque Sensors Product and Services
2.5.4 AIDIN Robotics Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.5.5 AIDIN Robotics Recent Developments/Updates
2.6 AL.Robot
2.6.1 AL.Robot Details
2.6.2 AL.Robot Major Business
2.6.3 AL.Robot Joint Torque Sensors Product and Services
2.6.4 AL.Robot Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.6.5 AL.Robot Recent Developments/Updates
2.7 SRI
2.7.1 SRI Details
2.7.2 SRI Major Business
2.7.3 SRI Joint Torque Sensors Product and Services
2.7.4 SRI Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.7.5 SRI Recent Developments/Updates
2.8 Kunwei
2.8.1 Kunwei Details
2.8.2 Kunwei Major Business
2.8.3 Kunwei Joint Torque Sensors Product and Services
2.8.4 Kunwei Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.8.5 Kunwei Recent Developments/Updates
2.9 Forsentek
2.9.1 Forsentek Details
2.9.2 Forsentek Major Business
2.9.3 Forsentek Joint Torque Sensors Product and Services
2.9.4 Forsentek Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.9.5 Forsentek Recent Developments/Updates
2.10 Ultraforce
2.10.1 Ultraforce Details
2.10.2 Ultraforce Major Business
2.10.3 Ultraforce Joint Torque Sensors Product and Services
2.10.4 Ultraforce Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)

+357 96 030922
info@marketpublishers.com

2.10.5 Ultraforce Recent Developments/Updates
2.11 NCTE
2.11.1 NCTE Details
2.11.2 NCTE Major Business
2.11.3 NCTE Joint Torque Sensors Product and Services
2.11.4 NCTE Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.11.5 NCTE Recent Developments/Updates
2.12 Interface
2.12.1 Interface Details
2.12.2 Interface Major Business
2.12.3 Interface Joint Torque Sensors Product and Services
2.12.4 Interface Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.12.5 Interface Recent Developments/Updates
2.13 HBK
2.13.1 HBK Details
2.13.2 HBK Major Business
2.13.3 HBK Joint Torque Sensors Product and Services
2.13.4 HBK Joint Torque Sensors Sales Quantity, Average Price, Revenue, Gross Margin and Market Share (2021-2026)
2.13.5 HBK Recent Developments/Updates

3 COMPETITIVE ENVIRONMENT: JOINT TORQUE SENSORS BY MANUFACTURER

3.1 Global Joint Torque Sensors Sales Quantity by Manufacturer (2021-2026)
3.2 Global Joint Torque Sensors Revenue by Manufacturer (2021-2026)
3.3 Global Joint Torque Sensors Average Price by Manufacturer (2021-2026)
3.4 Market Share Analysis (2025)
3.4.1 Producer Shipments of Joint Torque Sensors by Manufacturer Revenue ($MM) and Market Share (%): 2025
3.4.2 Top 3 Joint Torque Sensors Manufacturer Market Share in 2025
3.4.3 Top 6 Joint Torque Sensors Manufacturer Market Share in 2025
3.5 Joint Torque Sensors Market: Overall Company Footprint Analysis
3.5.1 Joint Torque Sensors Market: Region Footprint
3.5.2 Joint Torque Sensors Market: Company Product Type Footprint
3.5.3 Joint Torque Sensors Market: Company Product Application Footprint
3.6 New Market Entrants and Barriers to Market Entry

+357 96 030922
info@marketpublishers.com

3.7 Mergers, Acquisition, Agreements, and Collaborations

4 CONSUMPTION ANALYSIS BY REGION

4.1 Global Joint Torque Sensors Market Size by Region
  4.1.1 Global Joint Torque Sensors Sales Quantity by Region (2021-2032)
  4.1.2 Global Joint Torque Sensors Consumption Value by Region (2021-2032)
  4.1.3 Global Joint Torque Sensors Average Price by Region (2021-2032)
4.2 North America Joint Torque Sensors Consumption Value (2021-2032)
4.3 Europe Joint Torque Sensors Consumption Value (2021-2032)
4.4 Asia-Pacific Joint Torque Sensors Consumption Value (2021-2032)
4.5 South America Joint Torque Sensors Consumption Value (2021-2032)
4.6 Middle East & Africa Joint Torque Sensors Consumption Value (2021-2032)

5 MARKET SEGMENT BY TYPE

5.1 Global Joint Torque Sensors Sales Quantity by Type (2021-2032)
5.2 Global Joint Torque Sensors Consumption Value by Type (2021-2032)
5.3 Global Joint Torque Sensors Average Price by Type (2021-2032)

6 MARKET SEGMENT BY APPLICATION

6.1 Global Joint Torque Sensors Sales Quantity by Application (2021-2032)
6.2 Global Joint Torque Sensors Consumption Value by Application (2021-2032)
6.3 Global Joint Torque Sensors Average Price by Application (2021-2032)

7 NORTH AMERICA

7.1 North America Joint Torque Sensors Sales Quantity by Type (2021-2032)
7.2 North America Joint Torque Sensors Sales Quantity by Application (2021-2032)
7.3 North America Joint Torque Sensors Market Size by Country
  7.3.1 North America Joint Torque Sensors Sales Quantity by Country (2021-2032)
  7.3.2 North America Joint Torque Sensors Consumption Value by Country (2021-2032)
  7.3.3 United States Market Size and Forecast (2021-2032)
  7.3.4 Canada Market Size and Forecast (2021-2032)
  7.3.5 Mexico Market Size and Forecast (2021-2032)

8 EUROPE

+357 96 030922
info@marketpublishers.com

8.1 Europe Joint Torque Sensors Sales Quantity by Type (2021-2032)
8.2 Europe Joint Torque Sensors Sales Quantity by Application (2021-2032)
8.3 Europe Joint Torque Sensors Market Size by Country
8.3.1 Europe Joint Torque Sensors Sales Quantity by Country (2021-2032)
8.3.2 Europe Joint Torque Sensors Consumption Value by Country (2021-2032)
8.3.3 Germany Market Size and Forecast (2021-2032)
8.3.4 France Market Size and Forecast (2021-2032)
8.3.5 United Kingdom Market Size and Forecast (2021-2032)
8.3.6 Russia Market Size and Forecast (2021-2032)
8.3.7 Italy Market Size and Forecast (2021-2032)

9 ASIA-PACIFIC

9.1 Asia-Pacific Joint Torque Sensors Sales Quantity by Type (2021-2032)
9.2 Asia-Pacific Joint Torque Sensors Sales Quantity by Application (2021-2032)
9.3 Asia-Pacific Joint Torque Sensors Market Size by Region
9.3.1 Asia-Pacific Joint Torque Sensors Sales Quantity by Region (2021-2032)
9.3.2 Asia-Pacific Joint Torque Sensors Consumption Value by Region (2021-2032)
9.3.3 China Market Size and Forecast (2021-2032)
9.3.4 Japan Market Size and Forecast (2021-2032)
9.3.5 South Korea Market Size and Forecast (2021-2032)
9.3.6 India Market Size and Forecast (2021-2032)
9.3.7 Southeast Asia Market Size and Forecast (2021-2032)
9.3.8 Australia Market Size and Forecast (2021-2032)

10 SOUTH AMERICA

10.1 South America Joint Torque Sensors Sales Quantity by Type (2021-2032)
10.2 South America Joint Torque Sensors Sales Quantity by Application (2021-2032)
10.3 South America Joint Torque Sensors Market Size by Country
10.3.1 South America Joint Torque Sensors Sales Quantity by Country (2021-2032)
10.3.2 South America Joint Torque Sensors Consumption Value by Country (2021-2032)
10.3.3 Brazil Market Size and Forecast (2021-2032)
10.3.4 Argentina Market Size and Forecast (2021-2032)

11 MIDDLE EAST & AFRICA

+357 96 030922
info@marketpublishers.com

11.1 Middle East & Africa Joint Torque Sensors Sales Quantity by Type (2021-2032)
11.2 Middle East & Africa Joint Torque Sensors Sales Quantity by Application (2021-2032)
11.3 Middle East & Africa Joint Torque Sensors Market Size by Country
  11.3.1 Middle East & Africa Joint Torque Sensors Sales Quantity by Country (2021-2032)
  11.3.2 Middle East & Africa Joint Torque Sensors Consumption Value by Country (2021-2032)
  11.3.3 Turkey Market Size and Forecast (2021-2032)
  11.3.4 Egypt Market Size and Forecast (2021-2032)
  11.3.5 Saudi Arabia Market Size and Forecast (2021-2032)
  11.3.6 South Africa Market Size and Forecast (2021-2032)

12 MARKET DYNAMICS

12.1 Joint Torque Sensors Market Drivers
12.2 Joint Torque Sensors Market Restraints
12.3 Joint Torque Sensors Trends Analysis
12.4 Porters Five Forces Analysis
  12.4.1 Threat of New Entrants
  12.4.2 Bargaining Power of Suppliers
  12.4.3 Bargaining Power of Buyers
  12.4.4 Threat of Substitutes
  12.4.5 Competitive Rivalry

13 RAW MATERIAL AND INDUSTRY CHAIN

13.1 Raw Material of Joint Torque Sensors and Key Manufacturers
13.2 Manufacturing Costs Percentage of Joint Torque Sensors
13.3 Joint Torque Sensors Production Process
13.4 Industry Value Chain Analysis

14 SHIPMENTS BY DISTRIBUTION CHANNEL

14.1 Sales Channel
  14.1.1 Direct to End-User
  14.1.2 Distributors
14.2 Joint Torque Sensors Typical Distributors
14.3 Joint Torque Sensors Typical Customers

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info@marketpublishers.com

15 RESEARCH FINDINGS AND CONCLUSION

16 APPENDIX

16.1 Methodology
16.2 Research Process and Data Source
16.3 Disclaimer

+357 96 030922
info@marketpublishers.com

List Of Tables

LIST OF TABLES

Table 1. Global Joint Torque Sensors Consumption Value by Type, (USD Million), 2021 & 2025 & 2032
Table 2. Global Joint Torque Sensors Consumption Value by Sensing Principle, (USD Million), 2021 & 2025 & 2032
Table 3. Global Joint Torque Sensors Consumption Value by Output Type, (USD Million), 2021 & 2025 & 2032
Table 4. Global Joint Torque Sensors Consumption Value by Safety Architecture, (USD Million), 2021 & 2025 & 2032
Table 5. Global Joint Torque Sensors Consumption Value by Application, (USD Million), 2021 & 2025 & 2032
Table 6. Sensodrive Basic Information, Manufacturing Base and Competitors
Table 7. Sensodrive Major Business
Table 8. Sensodrive Joint Torque Sensors Product and Services
Table 9. Sensodrive Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 10. Sensodrive Recent Developments/Updates
Table 11. FUTEK Basic Information, Manufacturing Base and Competitors
Table 12. FUTEK Major Business
Table 13. FUTEK Joint Torque Sensors Product and Services
Table 14. FUTEK Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 15. FUTEK Recent Developments/Updates
Table 16. TE Connectivity Basic Information, Manufacturing Base and Competitors
Table 17. TE Connectivity Major Business
Table 18. TE Connectivity Joint Torque Sensors Product and Services
Table 19. TE Connectivity Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 20. TE Connectivity Recent Developments/Updates
Table 21. Bota Systems Basic Information, Manufacturing Base and Competitors
Table 22. Bota Systems Major Business
Table 23. Bota Systems Joint Torque Sensors Product and Services
Table 24. Bota Systems Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 25. Bota Systems Recent Developments/Updates
Table 26. AIDIN Robotics Basic Information, Manufacturing Base and Competitors

+357 96 030922
info@marketpublishers.com

Table 27. AIDIN Robotics Major Business
Table 28. AIDIN Robotics Joint Torque Sensors Product and Services
Table 29. AIDIN Robotics Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 30. AIDIN Robotics Recent Developments/Updates
Table 31. AL.Robot Basic Information, Manufacturing Base and Competitors
Table 32. AL.Robot Major Business
Table 33. AL.Robot Joint Torque Sensors Product and Services
Table 34. AL.Robot Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 35. AL.Robot Recent Developments/Updates
Table 36. SRI Basic Information, Manufacturing Base and Competitors
Table 37. SRI Major Business
Table 38. SRI Joint Torque Sensors Product and Services
Table 39. SRI Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 40. SRI Recent Developments/Updates
Table 41. Kunwei Basic Information, Manufacturing Base and Competitors
Table 42. Kunwei Major Business
Table 43. Kunwei Joint Torque Sensors Product and Services
Table 44. Kunwei Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 45. Kunwei Recent Developments/Updates
Table 46. Forsentek Basic Information, Manufacturing Base and Competitors
Table 47. Forsentek Major Business
Table 48. Forsentek Joint Torque Sensors Product and Services
Table 49. Forsentek Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 50. Forsentek Recent Developments/Updates
Table 51. Ultraforce Basic Information, Manufacturing Base and Competitors
Table 52. Ultraforce Major Business
Table 53. Ultraforce Joint Torque Sensors Product and Services
Table 54. Ultraforce Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 55. Ultraforce Recent Developments/Updates
Table 56. NCTE Basic Information, Manufacturing Base and Competitors
Table 57. NCTE Major Business
Table 58. NCTE Joint Torque Sensors Product and Services
Table 59. NCTE Joint Torque Sensors Sales Quantity (K Units), Average Price

+357 96 030922
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(US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 60. NCTE Recent Developments/Updates
Table 61. Interface Basic Information, Manufacturing Base and Competitors
Table 62. Interface Major Business
Table 63. Interface Joint Torque Sensors Product and Services
Table 64. Interface Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 65. Interface Recent Developments/Updates
Table 66. HBK Basic Information, Manufacturing Base and Competitors
Table 67. HBK Major Business
Table 68. HBK Joint Torque Sensors Product and Services
Table 69. HBK Joint Torque Sensors Sales Quantity (K Units), Average Price (US$/Unit), Revenue (USD Million), Gross Margin and Market Share (2021-2026)
Table 70. HBK Recent Developments/Updates
Table 71. Global Joint Torque Sensors Sales Quantity by Manufacturer (2021-2026) & (K Units)
Table 72. Global Joint Torque Sensors Revenue by Manufacturer (2021-2026) & (USD Million)
Table 73. Global Joint Torque Sensors Average Price by Manufacturer (2021-2026) & (US$/Unit)
Table 74. Market Position of Manufacturers in Joint Torque Sensors, (Tier 1, Tier 2, and Tier 3), Based on Revenue in 2025
Table 75. Head Office and Joint Torque Sensors Production Site of Key Manufacturer
Table 76. Joint Torque Sensors Market: Company Product Type Footprint
Table 77. Joint Torque Sensors Market: Company Product Application Footprint
Table 78. Joint Torque Sensors New Market Entrants and Barriers to Market Entry
Table 79. Joint Torque Sensors Mergers, Acquisition, Agreements, and Collaborations
Table 80. Global Joint Torque Sensors Consumption Value by Region (2021-2025-2032) & (USD Million) & CAGR
Table 81. Global Joint Torque Sensors Sales Quantity by Region (2021-2026) & (K Units)
Table 82. Global Joint Torque Sensors Sales Quantity by Region (2027-2032) & (K Units)
Table 83. Global Joint Torque Sensors Consumption Value by Region (2021-2026) & (USD Million)
Table 84. Global Joint Torque Sensors Consumption Value by Region (2027-2032) & (USD Million)
Table 85. Global Joint Torque Sensors Average Price by Region (2021-2026) & (US$/Unit)

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Table 86. Global Joint Torque Sensors Average Price by Region (2027-2032) & (US$/Unit)
Table 87. Global Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 88. Global Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 89. Global Joint Torque Sensors Consumption Value by Type (2021-2026) & (USD Million)
Table 90. Global Joint Torque Sensors Consumption Value by Type (2027-2032) & (USD Million)
Table 91. Global Joint Torque Sensors Average Price by Type (2021-2026) & (US$/Unit)
Table 92. Global Joint Torque Sensors Average Price by Type (2027-2032) & (US$/Unit)
Table 93. Global Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)
Table 94. Global Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 95. Global Joint Torque Sensors Consumption Value by Application (2021-2026) & (USD Million)
Table 96. Global Joint Torque Sensors Consumption Value by Application (2027-2032) & (USD Million)
Table 97. Global Joint Torque Sensors Average Price by Application (2021-2026) & (US$/Unit)
Table 98. Global Joint Torque Sensors Average Price by Application (2027-2032) & (US$/Unit)
Table 99. North America Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 100. North America Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 101. North America Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)
Table 102. North America Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 103. North America Joint Torque Sensors Sales Quantity by Country (2021-2026) & (K Units)
Table 104. North America Joint Torque Sensors Sales Quantity by Country (2027-2032) & (K Units)
Table 105. North America Joint Torque Sensors Consumption Value by Country (2021-2026) & (USD Million)
Table 106. North America Joint Torque Sensors Consumption Value by Country

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(2027-2032) & (USD Million)
Table 107. Europe Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 108. Europe Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 109. Europe Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)
Table 110. Europe Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 111. Europe Joint Torque Sensors Sales Quantity by Country (2021-2026) & (K Units)
Table 112. Europe Joint Torque Sensors Sales Quantity by Country (2027-2032) & (K Units)
Table 113. Europe Joint Torque Sensors Consumption Value by Country (2021-2026) & (USD Million)
Table 114. Europe Joint Torque Sensors Consumption Value by Country (2027-2032) & (USD Million)
Table 115. Asia-Pacific Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 116. Asia-Pacific Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 117. Asia-Pacific Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)
Table 118. Asia-Pacific Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 119. Asia-Pacific Joint Torque Sensors Sales Quantity by Region (2021-2026) & (K Units)
Table 120. Asia-Pacific Joint Torque Sensors Sales Quantity by Region (2027-2032) & (K Units)
Table 121. Asia-Pacific Joint Torque Sensors Consumption Value by Region (2021-2026) & (USD Million)
Table 122. Asia-Pacific Joint Torque Sensors Consumption Value by Region (2027-2032) & (USD Million)
Table 123. South America Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 124. South America Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 125. South America Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)

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Table 126. South America Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 127. South America Joint Torque Sensors Sales Quantity by Country (2021-2026) & (K Units)
Table 128. South America Joint Torque Sensors Sales Quantity by Country (2027-2032) & (K Units)
Table 129. South America Joint Torque Sensors Consumption Value by Country (2021-2026) & (USD Million)
Table 130. South America Joint Torque Sensors Consumption Value by Country (2027-2032) & (USD Million)
Table 131. Middle East & Africa Joint Torque Sensors Sales Quantity by Type (2021-2026) & (K Units)
Table 132. Middle East & Africa Joint Torque Sensors Sales Quantity by Type (2027-2032) & (K Units)
Table 133. Middle East & Africa Joint Torque Sensors Sales Quantity by Application (2021-2026) & (K Units)
Table 134. Middle East & Africa Joint Torque Sensors Sales Quantity by Application (2027-2032) & (K Units)
Table 135. Middle East & Africa Joint Torque Sensors Sales Quantity by Country (2021-2026) & (K Units)
Table 136. Middle East & Africa Joint Torque Sensors Sales Quantity by Country (2027-2032) & (K Units)
Table 137. Middle East & Africa Joint Torque Sensors Consumption Value by Country (2021-2026) & (USD Million)
Table 138. Middle East & Africa Joint Torque Sensors Consumption Value by Country (2027-2032) & (USD Million)
Table 139. Joint Torque Sensors Raw Material
Table 140. Key Manufacturers of Joint Torque Sensors Raw Materials
Table 141. Joint Torque Sensors Typical Distributors
Table 142. Joint Torque Sensors Typical Customers

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List Of Figures

LIST OF FIGURES

Figure 1. Joint Torque Sensors Picture
Figure 2. Global Joint Torque Sensors Revenue by Type, (USD Million), 2021 & 2025 & 2032
Figure 3. Global Joint Torque Sensors Revenue Market Share by Type in 2025
Figure 4. ?20 Nm Examples
Figure 5. >20–50 Nm Examples
Figure 6. >50–150 Nm Examples
Figure 7. >150–300 Nm Examples
Figure 8. >300 Nm Examples
Figure 9. Global Joint Torque Sensors Revenue by Sensing Principle, (USD Million), 2021 & 2025 & 2032
Figure 10. Global Joint Torque Sensors Revenue Market Share by Sensing Principle in 2025
Figure 11. Strain Gauge Examples
Figure 12. Magnetoelastic / Magnetostrictive Examples
Figure 13. Optical Examples
Figure 14. Other Examples
Figure 15. Global Joint Torque Sensors Revenue by Output Type, (USD Million), 2021 & 2025 & 2032
Figure 16. Global Joint Torque Sensors Revenue Market Share by Output Type in 2025
Figure 17. Analog Output Examples
Figure 18. Digital Output Examples
Figure 19. Analog and Digital Output Examples
Figure 20. Global Joint Torque Sensors Revenue by Safety Architecture, (USD Million), 2021 & 2025 & 2032
Figure 21. Global Joint Torque Sensors Revenue Market Share by Safety Architecture in 2025
Figure 22. Standard Architecture Examples
Figure 23. Safety-Redundant Architecture Examples
Figure 24. Global Joint Torque Sensors Consumption Value by Application, (USD Million), 2021 & 2025 & 2032
Figure 25. Global Joint Torque Sensors Revenue Market Share by Application in 2025
Figure 26. Industrial Manufacturing Examples
Figure 27. Healthcare Examples
Figure 28. Logistics and Warehousing Examples

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Figure 29. Commercial and Consumer Services Examples
Figure 30. Defense and Special Operations Examples
Figure 31. Others Examples
Figure 32. Global Joint Torque Sensors Consumption Value, (USD Million): 2021 & 2025 & 2032
Figure 33. Global Joint Torque Sensors Consumption Value and Forecast (2021-2032) & (USD Million)
Figure 34. Global Joint Torque Sensors Sales Quantity (2021-2032) & (K Units)
Figure 35. Global Joint Torque Sensors Price (2021-2032) & (US$/Unit)
Figure 36. Global Joint Torque Sensors Sales Quantity Market Share by Manufacturer in 2025
Figure 37. Global Joint Torque Sensors Revenue Market Share by Manufacturer in 2025
Figure 38. Producer Shipments of Joint Torque Sensors by Manufacturer Sales ($MM) and Market Share (%): 2025
Figure 39. Top 3 Joint Torque Sensors Manufacturer (Revenue) Market Share in 2025
Figure 40. Top 6 Joint Torque Sensors Manufacturer (Revenue) Market Share in 2025
Figure 41. Global Joint Torque Sensors Sales Quantity Market Share by Region (2021-2032)
Figure 42. Global Joint Torque Sensors Consumption Value Market Share by Region (2021-2032)
Figure 43. North America Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 44. Europe Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 45. Asia-Pacific Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 46. South America Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 47. Middle East & Africa Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 48. Global Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 49. Global Joint Torque Sensors Consumption Value Market Share by Type (2021-2032)
Figure 50. Global Joint Torque Sensors Average Price by Type (2021-2032) & (US$/Unit)
Figure 51. Global Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)

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Figure 52. Global Joint Torque Sensors Revenue Market Share by Application (2021-2032)
Figure 53. Global Joint Torque Sensors Average Price by Application (2021-2032) & (US$/Unit)
Figure 54. North America Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 55. North America Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)
Figure 56. North America Joint Torque Sensors Sales Quantity Market Share by Country (2021-2032)
Figure 57. North America Joint Torque Sensors Consumption Value Market Share by Country (2021-2032)
Figure 58. United States Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 59. Canada Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 60. Mexico Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 61. Europe Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 62. Europe Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)
Figure 63. Europe Joint Torque Sensors Sales Quantity Market Share by Country (2021-2032)
Figure 64. Europe Joint Torque Sensors Consumption Value Market Share by Country (2021-2032)
Figure 65. Germany Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 66. France Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 67. United Kingdom Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 68. Russia Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 69. Italy Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 70. Asia-Pacific Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 71. Asia-Pacific Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)

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Figure 72. Asia-Pacific Joint Torque Sensors Sales Quantity Market Share by Region (2021-2032)
Figure 73. Asia-Pacific Joint Torque Sensors Consumption Value Market Share by Region (2021-2032)
Figure 74. China Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 75. Japan Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 76. South Korea Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 77. India Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 78. Southeast Asia Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 79. Australia Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 80. South America Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 81. South America Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)
Figure 82. South America Joint Torque Sensors Sales Quantity Market Share by Country (2021-2032)
Figure 83. South America Joint Torque Sensors Consumption Value Market Share by Country (2021-2032)
Figure 84. Brazil Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 85. Argentina Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 86. Middle East & Africa Joint Torque Sensors Sales Quantity Market Share by Type (2021-2032)
Figure 87. Middle East & Africa Joint Torque Sensors Sales Quantity Market Share by Application (2021-2032)
Figure 88. Middle East & Africa Joint Torque Sensors Sales Quantity Market Share by Country (2021-2032)
Figure 89. Middle East & Africa Joint Torque Sensors Consumption Value Market Share by Country (2021-2032)
Figure 90. Turkey Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 91. Egypt Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 92. Saudi Arabia Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)

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Figure 93. South Africa Joint Torque Sensors Consumption Value (2021-2032) & (USD Million)
Figure 94. Joint Torque Sensors Market Drivers
Figure 95. Joint Torque Sensors Market Restraints
Figure 96. Joint Torque Sensors Market Trends
Figure 97. Porters Five Forces Analysis
Figure 98. Manufacturing Cost Structure Analysis of Joint Torque Sensors in 2025
Figure 99. Manufacturing Process Analysis of Joint Torque Sensors
Figure 100. Joint Torque Sensors Industrial Chain
Figure 101. Sales Channel: Direct to End-User vs Distributors
Figure 102. Direct Channel Pros & Cons
Figure 103. Indirect Channel Pros & Cons
Figure 104. Methodology
Figure 105. Research Process and Data Source

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