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Global Joint Torque Sensors Market Growth 2026-2032

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Abstracts

The global Joint Torque Sensors market size is predicted to grow from US$ 615 million in 2025 to US$ 1282 million in 2032; it is expected to grow at a CAGR of 11.1% from 2026 to 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 increasing size or cost.

Industry Chain Analysis

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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

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

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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

LP Information, Inc. (LPI) ' newest research report, the “Joint Torque Sensors Industry Forecast” looks at past sales and reviews total world Joint Torque Sensors sales in 2025, providing a comprehensive analysis by region and market sector of projected Joint Torque Sensors sales for 2026 through 2032. With Joint Torque Sensors sales broken down by region, market sector and sub-sector, this report provides a detailed analysis in US$ millions of the world Joint Torque Sensors industry.

This Insight Report provides a comprehensive analysis of the global Joint Torque Sensors landscape and highlights key trends related to product segmentation, company formation, revenue, and market share, latest development, and M&A activity. This report also analyzes the strategies of leading global companies with a focus on Joint Torque Sensors portfolios and capabilities, market entry strategies, market positions, and geographic footprints, to better understand these firms’ unique position in an accelerating global Joint Torque Sensors market.

This Insight Report evaluates the key market trends, drivers, and affecting factors shaping the global outlook for Joint Torque Sensors and breaks down the forecast by Type, by Application, geography, and market size to highlight emerging pockets of opportunity. With a transparent methodology based on hundreds of bottom-up qualitative and quantitative market inputs, this study forecast offers a highly nuanced

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view of the current state and future trajectory in the global Joint Torque Sensors.

This report presents a comprehensive overview, market shares, and growth opportunities of Joint Torque Sensors market by product type, application, key manufacturers and key regions and countries.

Market Segmentation

Segmentation by Type:

?20 Nm

>20–50 Nm

>50–150 Nm

>150–300 Nm

>300 Nm

Segmentation by Sensing Principle:

Strain Gauge

Magnetoelastic / Magnetostrictive

Optical

Other

Segmentation by Output Type:

Analog Output

Digital Output

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Analog and Digital Output

Segmentation by Safety Architecture:

Standard Architecture

Safety-Redundant Architecture

Segmentation by Application:

Industrial Manufacturing

Healthcare

Logistics and Warehousing

Commercial and Consumer Services

Defense and Special Operations

Others

This report also splits the market by region:

Americas

United States

Canada

Mexico

Brazil

APAC

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China

Japan

Korea

Southeast Asia

India

Australia

Europe

Germany

France

UK

Italy

Russia

Middle East & Africa

Egypt

South Africa

Israel

Turkey

GCC Countries

The below companies that are profiled have been selected based on inputs gathered

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from primary experts and analysing the company's coverage, product portfolio, its market penetration.

Sensodrive

FUTEK

TE Connectivity

Bota Systems

AIDIN Robotics

AL.Robot

SRI

Kunwei

Forsentek

Ultraforce

NCTE

Interface

HBK

Key Questions Addressed in this Report

What is the 10-year outlook for the global Joint Torque Sensors market?

What factors are driving Joint Torque Sensors market growth, globally and by region?

Which technologies are poised for the fastest growth by market and region?

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How do Joint Torque Sensors market opportunities vary by end market size?

How does Joint Torque Sensors break out by Type, by Application?

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Contents

1 SCOPE OF THE REPORT

1.1 Market Introduction
1.2 Years Considered
1.3 Research Objectives
1.4 Market Research Methodology
1.5 Research Process and Data Source
1.6 Economic Indicators
1.7 Currency Considered
1.8 Market Estimation Caveats

2 EXECUTIVE SUMMARY

2.1 World Market Overview
  2.1.1 Global Joint Torque Sensors Annual Sales 2021-2032
  2.1.2 World Current & Future Analysis for Joint Torque Sensors by Geographic Region, 2021, 2025 & 2032
  2.1.3 World Current & Future Analysis for Joint Torque Sensors by Country/Region, 2021, 2025 & 2032
2.2 Joint Torque Sensors Segment by Type
  2.2.1 ?20 Nm
  2.2.2 >20–50 Nm
  2.2.3 >50–150 Nm
  2.2.4 >150–300 Nm
  2.2.5 >300 Nm
  2.2.6 Joint Torque Sensors Sales by Type
    2.2.6.1 Global Joint Torque Sensors Sales Market Share by Type (2021-2026)
    2.2.6.2 Global Joint Torque Sensors Revenue and Market Share by Type (2021-2026)
    2.2.6.3 Global Joint Torque Sensors Sale Price by Type (2021-2026)
2.3 Joint Torque Sensors Segment by Sensing Principle
  2.3.1 Strain Gauge
  2.3.2 Magnetoelastic / Magnetostrictive
  2.3.3 Optical
  2.3.4 Other
  2.3.5 Joint Torque Sensors Sales by Sensing Principle
    2.3.5.1 Global Joint Torque Sensors Sales Market Share by Sensing Principle

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(2021-2026)
2.3.5.2 Global Joint Torque Sensors Revenue and Market Share by Sensing Principle (2021-2026)
2.3.5.3 Global Joint Torque Sensors Sale Price by Sensing Principle (2021-2026)
2.4 Joint Torque Sensors Segment by Output Type
2.4.1 Analog Output
2.4.2 Digital Output
2.4.3 Analog and Digital Output
2.4.4 Joint Torque Sensors Sales by Output Type
2.4.4.1 Global Joint Torque Sensors Sales Market Share by Output Type (2021-2026)
2.4.4.2 Global Joint Torque Sensors Revenue and Market Share by Output Type (2021-2026)
2.4.4.3 Global Joint Torque Sensors Sale Price by Output Type (2021-2026)
2.5 Joint Torque Sensors Segment by Safety Architecture
2.5.1 Standard Architecture
2.5.2 Safety-Redundant Architecture
2.5.3 Joint Torque Sensors Sales by Safety Architecture
2.5.3.1 Global Joint Torque Sensors Sales Market Share by Safety Architecture (2021-2026)
2.5.3.2 Global Joint Torque Sensors Revenue and Market Share by Safety Architecture (2021-2026)
2.5.3.3 Global Joint Torque Sensors Sale Price by Safety Architecture (2021-2026)
2.6 Joint Torque Sensors Segment by Application
2.6.1 Industrial Manufacturing
2.6.2 Healthcare
2.6.3 Logistics and Warehousing
2.6.4 Commercial and Consumer Services
2.6.5 Defense and Special Operations
2.6.6 Others
2.6.7 Joint Torque Sensors Sales by Application
2.6.7.1 Global Joint Torque Sensors Sale Market Share by Application (2021-2026)
2.6.7.2 Global Joint Torque Sensors Revenue and Market Share by Application (2021-2026)
2.6.7.3 Global Joint Torque Sensors Sale Price by Application (2021-2026)

3 GLOBAL BY COMPANY

3.1 Global Joint Torque Sensors Breakdown Data by Company

+357 96 030922
info@marketpublishers.com

3.1.1 Global Joint Torque Sensors Annual Sales by Company (2021-2026)
3.1.2 Global Joint Torque Sensors Sales Market Share by Company (2021-2026)
3.2 Global Joint Torque Sensors Annual Revenue by Company (2021-2026)
3.2.1 Global Joint Torque Sensors Revenue by Company (2021-2026)
3.2.2 Global Joint Torque Sensors Revenue Market Share by Company (2021-2026)
3.3 Global Joint Torque Sensors Sale Price by Company
3.4 Key Manufacturers Joint Torque Sensors Producing Area Distribution, Sales Area, Product Type
3.4.1 Key Manufacturers Joint Torque Sensors Product Location Distribution
3.4.2 Players Joint Torque Sensors Products Offered
3.5 Market Concentration Rate Analysis
3.5.1 Competition Landscape Analysis
3.5.2 Concentration Ratio (CR3, CR5 and CR10) & (2024-2026)
3.6 New Products and Potential Entrants
3.7 Market M&A Activity & Strategy

4 WORLD HISTORIC REVIEW FOR JOINT TORQUE SENSORS BY GEOGRAPHIC REGION

4.1 World Historic Joint Torque Sensors Market Size by Geographic Region (2021-2026)
4.1.1 Global Joint Torque Sensors Annual Sales by Geographic Region (2021-2026)
4.1.2 Global Joint Torque Sensors Annual Revenue by Geographic Region (2021-2026)
4.2 World Historic Joint Torque Sensors Market Size by Country/Region (2021-2026)
4.2.1 Global Joint Torque Sensors Annual Sales by Country/Region (2021-2026)
4.2.2 Global Joint Torque Sensors Annual Revenue by Country/Region (2021-2026)
4.3 Americas Joint Torque Sensors Sales Growth
4.4 APAC Joint Torque Sensors Sales Growth
4.5 Europe Joint Torque Sensors Sales Growth
4.6 Middle East & Africa Joint Torque Sensors Sales Growth

5 AMERICAS

5.1 Americas Joint Torque Sensors Sales by Country
5.1.1 Americas Joint Torque Sensors Sales by Country (2021-2026)
5.1.2 Americas Joint Torque Sensors Revenue by Country (2021-2026)
5.2 Americas Joint Torque Sensors Sales by Type (2021-2026)
5.3 Americas Joint Torque Sensors Sales by Application (2021-2026)

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5.4 United States
5.5 Canada
5.6 Mexico
5.7 Brazil

6 APAC

6.1 APAC Joint Torque Sensors Sales by Region
  6.1.1 APAC Joint Torque Sensors Sales by Region (2021-2026)
  6.1.2 APAC Joint Torque Sensors Revenue by Region (2021-2026)
6.2 APAC Joint Torque Sensors Sales by Type (2021-2026)
6.3 APAC Joint Torque Sensors Sales by Application (2021-2026)
6.4 China
6.5 Japan
6.6 South Korea
6.7 Southeast Asia
6.8 India
6.9 Australia
6.10 China Taiwan

7 EUROPE

7.1 Europe Joint Torque Sensors by Country
  7.1.1 Europe Joint Torque Sensors Sales by Country (2021-2026)
  7.1.2 Europe Joint Torque Sensors Revenue by Country (2021-2026)
7.2 Europe Joint Torque Sensors Sales by Type (2021-2026)
7.3 Europe Joint Torque Sensors Sales by Application (2021-2026)
7.4 Germany
7.5 France
7.6 UK
7.7 Italy
7.8 Russia

8 MIDDLE EAST & AFRICA

8.1 Middle East & Africa Joint Torque Sensors by Country
  8.1.1 Middle East & Africa Joint Torque Sensors Sales by Country (2021-2026)
  8.1.2 Middle East & Africa Joint Torque Sensors Revenue by Country (2021-2026)
8.2 Middle East & Africa Joint Torque Sensors Sales by Type (2021-2026)

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8.3 Middle East & Africa Joint Torque Sensors Sales by Application (2021-2026)
8.4 Egypt
8.5 South Africa
8.6 Israel
8.7 Turkey
8.8 GCC Countries

9 MARKET DRIVERS, CHALLENGES AND TRENDS

9.1 Market Drivers & Growth Opportunities
9.2 Market Challenges & Risks
9.3 Industry Trends

10 MANUFACTURING COST STRUCTURE ANALYSIS

10.1 Raw Material and Suppliers
10.2 Manufacturing Cost Structure Analysis of Joint Torque Sensors
10.3 Manufacturing Process Analysis of Joint Torque Sensors
10.4 Industry Chain Structure of Joint Torque Sensors

11 MARKETING, DISTRIBUTORS AND CUSTOMER

11.1 Sales Channel
  11.1.1 Direct Channels
  11.1.2 Indirect Channels
11.2 Joint Torque Sensors Distributors
11.3 Joint Torque Sensors Customer

12 WORLD FORECAST REVIEW FOR JOINT TORQUE SENSORS BY GEOGRAPHIC REGION

12.1 Global Joint Torque Sensors Market Size Forecast by Region
  12.1.1 Global Joint Torque Sensors Forecast by Region (2027-2032)
  12.1.2 Global Joint Torque Sensors Annual Revenue Forecast by Region (2027-2032)
12.2 Americas Forecast by Country (2027-2032)
12.3 APAC Forecast by Region (2027-2032)
12.4 Europe Forecast by Country (2027-2032)
12.5 Middle East & Africa Forecast by Country (2027-2032)
12.6 Global Joint Torque Sensors Forecast by Type (2027-2032)

+357 96 030922
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12.7 Global Joint Torque Sensors Forecast by Application (2027-2032)

13 KEY PLAYERS ANALYSIS

13.1 Sensodrive
13.1.1 Sensodrive Company Information
13.1.2 Sensodrive Joint Torque Sensors Product Portfolios and Specifications
13.1.3 Sensodrive Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.1.4 Sensodrive Main Business Overview
13.1.5 Sensodrive Latest Developments
13.2 FUTEK
13.2.1 FUTEK Company Information
13.2.2 FUTEK Joint Torque Sensors Product Portfolios and Specifications
13.2.3 FUTEK Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.2.4 FUTEK Main Business Overview
13.2.5 FUTEK Latest Developments
13.3 TE Connectivity
13.3.1 TE Connectivity Company Information
13.3.2 TE Connectivity Joint Torque Sensors Product Portfolios and Specifications
13.3.3 TE Connectivity Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.3.4 TE Connectivity Main Business Overview
13.3.5 TE Connectivity Latest Developments
13.4 Bota Systems
13.4.1 Bota Systems Company Information
13.4.2 Bota Systems Joint Torque Sensors Product Portfolios and Specifications
13.4.3 Bota Systems Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.4.4 Bota Systems Main Business Overview
13.4.5 Bota Systems Latest Developments
13.5 AIDIN Robotics
13.5.1 AIDIN Robotics Company Information
13.5.2 AIDIN Robotics Joint Torque Sensors Product Portfolios and Specifications
13.5.3 AIDIN Robotics Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.5.4 AIDIN Robotics Main Business Overview
13.5.5 AIDIN Robotics Latest Developments

+357 96 030922
info@marketpublishers.com

13.6 AL.Robot
13.6.1 AL.Robot Company Information
13.6.2 AL.Robot Joint Torque Sensors Product Portfolios and Specifications
13.6.3 AL.Robot Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.6.4 AL.Robot Main Business Overview
13.6.5 AL.Robot Latest Developments
13.7 SRI
13.7.1 SRI Company Information
13.7.2 SRI Joint Torque Sensors Product Portfolios and Specifications
13.7.3 SRI Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.7.4 SRI Main Business Overview
13.7.5 SRI Latest Developments
13.8 Kunwei
13.8.1 Kunwei Company Information
13.8.2 Kunwei Joint Torque Sensors Product Portfolios and Specifications
13.8.3 Kunwei Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.8.4 Kunwei Main Business Overview
13.8.5 Kunwei Latest Developments
13.9 Forsentek
13.9.1 Forsentek Company Information
13.9.2 Forsentek Joint Torque Sensors Product Portfolios and Specifications
13.9.3 Forsentek Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.9.4 Forsentek Main Business Overview
13.9.5 Forsentek Latest Developments
13.10 Ultraforce
13.10.1 Ultraforce Company Information
13.10.2 Ultraforce Joint Torque Sensors Product Portfolios and Specifications
13.10.3 Ultraforce Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.10.4 Ultraforce Main Business Overview
13.10.5 Ultraforce Latest Developments
13.11 NCTE
13.11.1 NCTE Company Information
13.11.2 NCTE Joint Torque Sensors Product Portfolios and Specifications
13.11.3 NCTE Joint Torque Sensors Sales, Revenue, Price and Gross Margin

+357 96 030922
info@marketpublishers.com

(2021-2026)
13.11.4 NCTE Main Business Overview
13.11.5 NCTE Latest Developments
13.12 Interface
13.12.1 Interface Company Information
13.12.2 Interface Joint Torque Sensors Product Portfolios and Specifications
13.12.3 Interface Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.12.4 Interface Main Business Overview
13.12.5 Interface Latest Developments
13.13 HBK
13.13.1 HBK Company Information
13.13.2 HBK Joint Torque Sensors Product Portfolios and Specifications
13.13.3 HBK Joint Torque Sensors Sales, Revenue, Price and Gross Margin (2021-2026)
13.13.4 HBK Main Business Overview
13.13.5 HBK Latest Developments

14 RESEARCH FINDINGS AND CONCLUSION

+357 96 030922
info@marketpublishers.com

List Of Tables

LIST OF TABLES

Table 1. Joint Torque Sensors Annual Sales CAGR by Geographic Region (2021, 2025 & 2032) & ($ millions)
Table 2. Joint Torque Sensors Annual Sales CAGR by Country/Region (2021, 2025 & 2032) & ($ millions)
Table 3. Major Players of ?20 Nm
Table 4. Major Players of >20–50 Nm
Table 5. Major Players of >50–150 Nm
Table 6. Major Players of >150–300 Nm
Table 7. Major Players of >300 Nm
Table 8. Global Joint Torque Sensors Sales by Type (2021-2026) & (K Units)
Table 9. Global Joint Torque Sensors Sales Market Share by Type (2021-2026)
Table 10. Global Joint Torque Sensors Revenue by Type (2021-2026) & ($ million)
Table 11. Global Joint Torque Sensors Revenue Market Share by Type (2021-2026)
Table 12. Global Joint Torque Sensors Sale Price by Type (2021-2026) & (US$/Unit)
Table 13. Major Players of Strain Gauge
Table 14. Major Players of Magnetoelastic / Magnetostrictive
Table 15. Major Players of Optical
Table 16. Major Players of Other
Table 17. Global Joint Torque Sensors Sales by Sensing Principle (2021-2026) & (K Units)
Table 18. Global Joint Torque Sensors Sales Market Share by Sensing Principle (2021-2026)
Table 19. Global Joint Torque Sensors Revenue by Sensing Principle (2021-2026) & ($ million)
Table 20. Global Joint Torque Sensors Revenue Market Share by Sensing Principle (2021-2026)
Table 21. Global Joint Torque Sensors Sale Price by Sensing Principle (2021-2026) & (US$/Unit)
Table 22. Major Players of Analog Output
Table 23. Major Players of Digital Output
Table 24. Major Players of Analog and Digital Output
Table 25. Global Joint Torque Sensors Sales by Output Type (2021-2026) & (K Units)
Table 26. Global Joint Torque Sensors Sales Market Share by Output Type (2021-2026)
Table 27. Global Joint Torque Sensors Revenue by Output Type (2021-2026) & ($

+357 96 030922
info@marketpublishers.com

million)
Table 28. Global Joint Torque Sensors Revenue Market Share by Output Type (2021-2026)
Table 29. Global Joint Torque Sensors Sale Price by Output Type (2021-2026) & (US$/Unit)
Table 30. Major Players of Standard Architecture
Table 31. Major Players of Safety-Redundant Architecture
Table 32. Global Joint Torque Sensors Sales by Safety Architecture (2021-2026) & (K Units)
Table 33. Global Joint Torque Sensors Sales Market Share by Safety Architecture (2021-2026)
Table 34. Global Joint Torque Sensors Revenue by Safety Architecture (2021-2026) & ($ million)
Table 35. Global Joint Torque Sensors Revenue Market Share by Safety Architecture (2021-2026)
Table 36. Global Joint Torque Sensors Sale Price by Safety Architecture (2021-2026) & (US$/Unit)
Table 37. Global Joint Torque Sensors Sale by Application (2021-2026) & (K Units)
Table 38. Global Joint Torque Sensors Sale Market Share by Application (2021-2026)
Table 39. Global Joint Torque Sensors Revenue by Application (2021-2026) & ($ million)
Table 40. Global Joint Torque Sensors Revenue Market Share by Application (2021-2026)
Table 41. Global Joint Torque Sensors Sale Price by Application (2021-2026) & (US$/Unit)
Table 42. Global Joint Torque Sensors Sales by Company (2021-2026) & (K Units)
Table 43. Global Joint Torque Sensors Sales Market Share by Company (2021-2026)
Table 44. Global Joint Torque Sensors Revenue by Company (2021-2026) & ($ millions)
Table 45. Global Joint Torque Sensors Revenue Market Share by Company (2021-2026)
Table 46. Global Joint Torque Sensors Sale Price by Company (2021-2026) & (US$/Unit)
Table 47. Key Manufacturers Joint Torque Sensors Producing Area Distribution and Sales Area
Table 48. Players Joint Torque Sensors Products Offered
Table 49. Joint Torque Sensors Concentration Ratio (CR3, CR5 and CR10) & (2024-2026)
Table 50. New Products and Potential Entrants

+357 96 030922
info@marketpublishers.com

Table 51. Market M&A Activity & Strategy
Table 52. Global Joint Torque Sensors Sales by Geographic Region (2021-2026) & (K Units)
Table 53. Global Joint Torque Sensors Sales Market Share Geographic Region (2021-2026)
Table 54. Global Joint Torque Sensors Revenue by Geographic Region (2021-2026) & ($ millions)
Table 55. Global Joint Torque Sensors Revenue Market Share by Geographic Region (2021-2026)
Table 56. Global Joint Torque Sensors Sales by Country/Region (2021-2026) & (K Units)
Table 57. Global Joint Torque Sensors Sales Market Share by Country/Region (2021-2026)
Table 58. Global Joint Torque Sensors Revenue by Country/Region (2021-2026) & ($ millions)
Table 59. Global Joint Torque Sensors Revenue Market Share by Country/Region (2021-2026)
Table 60. Americas Joint Torque Sensors Sales by Country (2021-2026) & (K Units)
Table 61. Americas Joint Torque Sensors Sales Market Share by Country (2021-2026)
Table 62. Americas Joint Torque Sensors Revenue by Country (2021-2026) & ($ millions)
Table 63. Americas Joint Torque Sensors Sales by Type (2021-2026) & (K Units)
Table 64. Americas Joint Torque Sensors Sales by Application (2021-2026) & (K Units)
Table 65. APAC Joint Torque Sensors Sales by Region (2021-2026) & (K Units)
Table 66. APAC Joint Torque Sensors Sales Market Share by Region (2021-2026)
Table 67. APAC Joint Torque Sensors Revenue by Region (2021-2026) & ($ millions)
Table 68. APAC Joint Torque Sensors Sales by Type (2021-2026) & (K Units)
Table 69. APAC Joint Torque Sensors Sales by Application (2021-2026) & (K Units)
Table 70. Europe Joint Torque Sensors Sales by Country (2021-2026) & (K Units)
Table 71. Europe Joint Torque Sensors Revenue by Country (2021-2026) & ($ millions)
Table 72. Europe Joint Torque Sensors Sales by Type (2021-2026) & (K Units)
Table 73. Europe Joint Torque Sensors Sales by Application (2021-2026) & (K Units)
Table 74. Middle East & Africa Joint Torque Sensors Sales by Country (2021-2026) & (K Units)
Table 75. Middle East & Africa Joint Torque Sensors Revenue Market Share by Country (2021-2026)
Table 76. Middle East & Africa Joint Torque Sensors Sales by Type (2021-2026) & (K Units)
Table 77. Middle East & Africa Joint Torque Sensors Sales by Application (2021-2026)

+357 96 030922
info@marketpublishers.com

& (K Units)
Table 78. Key Market Drivers & Growth Opportunities of Joint Torque Sensors
Table 79. Key Market Challenges & Risks of Joint Torque Sensors
Table 80. Key Industry Trends of Joint Torque Sensors
Table 81. Joint Torque Sensors Raw Material
Table 82. Key Suppliers of Raw Materials
Table 83. Joint Torque Sensors Distributors List
Table 84. Joint Torque Sensors Customer List
Table 85. Global Joint Torque Sensors Sales Forecast by Region (2027-2032) & (K Units)
Table 86. Global Joint Torque Sensors Revenue Forecast by Region (2027-2032) & ($ millions)
Table 87. Americas Joint Torque Sensors Sales Forecast by Country (2027-2032) & (K Units)
Table 88. Americas Joint Torque Sensors Annual Revenue Forecast by Country (2027-2032) & ($ millions)
Table 89. APAC Joint Torque Sensors Sales Forecast by Region (2027-2032) & (K Units)
Table 90. APAC Joint Torque Sensors Annual Revenue Forecast by Region (2027-2032) & ($ millions)
Table 91. Europe Joint Torque Sensors Sales Forecast by Country (2027-2032) & (K Units)
Table 92. Europe Joint Torque Sensors Revenue Forecast by Country (2027-2032) & ($ millions)
Table 93. Middle East & Africa Joint Torque Sensors Sales Forecast by Country (2027-2032) & (K Units)
Table 94. Middle East & Africa Joint Torque Sensors Revenue Forecast by Country (2027-2032) & ($ millions)
Table 95. Global Joint Torque Sensors Sales Forecast by Type (2027-2032) & (K Units)
Table 96. Global Joint Torque Sensors Revenue Forecast by Type (2027-2032) & ($ millions)
Table 97. Global Joint Torque Sensors Sales Forecast by Application (2027-2032) & (K Units)
Table 98. Global Joint Torque Sensors Revenue Forecast by Application (2027-2032) & ($ millions)
Table 99. Sensodrive Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 100. Sensodrive Joint Torque Sensors Product Portfolios and Specifications
Table 101. Sensodrive Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price

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(US$/Unit) and Gross Margin (2021-2026)
Table 102. Sensodrive Main Business
Table 103. Sensodrive Latest Developments
Table 104. FUTEK Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 105. FUTEK Joint Torque Sensors Product Portfolios and Specifications
Table 106. FUTEK Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 107. FUTEK Main Business
Table 108. FUTEK Latest Developments
Table 109. TE Connectivity Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 110. TE Connectivity Joint Torque Sensors Product Portfolios and Specifications
Table 111. TE Connectivity Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 112. TE Connectivity Main Business
Table 113. TE Connectivity Latest Developments
Table 114. Bota Systems Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 115. Bota Systems Joint Torque Sensors Product Portfolios and Specifications
Table 116. Bota Systems Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 117. Bota Systems Main Business
Table 118. Bota Systems Latest Developments
Table 119. AIDIN Robotics Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 120. AIDIN Robotics Joint Torque Sensors Product Portfolios and Specifications
Table 121. AIDIN Robotics Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 122. AIDIN Robotics Main Business
Table 123. AIDIN Robotics Latest Developments
Table 124. AL.Robot Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 125. AL.Robot Joint Torque Sensors Product Portfolios and Specifications
Table 126. AL.Robot Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 127. AL.Robot Main Business
Table 128. AL.Robot Latest Developments
Table 129. SRI Basic Information, Joint Torque Sensors Manufacturing Base, Sales

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Area and Its Competitors
Table 130. SRI Joint Torque Sensors Product Portfolios and Specifications
Table 131. SRI Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 132. SRI Main Business
Table 133. SRI Latest Developments
Table 134. Kunwei Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 135. Kunwei Joint Torque Sensors Product Portfolios and Specifications
Table 136. Kunwei Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 137. Kunwei Main Business
Table 138. Kunwei Latest Developments
Table 139. Forsentek Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 140. Forsentek Joint Torque Sensors Product Portfolios and Specifications
Table 141. Forsentek Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 142. Forsentek Main Business
Table 143. Forsentek Latest Developments
Table 144. Ultraforce Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 145. Ultraforce Joint Torque Sensors Product Portfolios and Specifications
Table 146. Ultraforce Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 147. Ultraforce Main Business
Table 148. Ultraforce Latest Developments
Table 149. NCTE Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 150. NCTE Joint Torque Sensors Product Portfolios and Specifications
Table 151. NCTE Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 152. NCTE Main Business
Table 153. NCTE Latest Developments
Table 154. Interface Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 155. Interface Joint Torque Sensors Product Portfolios and Specifications
Table 156. Interface Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)

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Table 157. Interface Main Business
Table 158. Interface Latest Developments
Table 159. HBK Basic Information, Joint Torque Sensors Manufacturing Base, Sales Area and Its Competitors
Table 160. HBK Joint Torque Sensors Product Portfolios and Specifications
Table 161. HBK Joint Torque Sensors Sales (K Units), Revenue ($ Million), Price (US$/Unit) and Gross Margin (2021-2026)
Table 162. HBK Main Business
Table 163. HBK Latest Developments

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List Of Figures

LIST OF FIGURES

Figure 1. Picture of Joint Torque Sensors
Figure 2. Joint Torque Sensors Report Years Considered
Figure 3. Research Objectives
Figure 4. Research Methodology
Figure 5. Research Process and Data Source
Figure 6. Global Joint Torque Sensors Sales Growth Rate 2021-2032 (K Units)
Figure 7. Global Joint Torque Sensors Revenue Growth Rate 2021-2032 ($ millions)
Figure 8. Joint Torque Sensors Sales by Geographic Region (2021, 2025 & 2032) & ($ millions)
Figure 9. Joint Torque Sensors Sales Market Share by Country/Region (2025)
Figure 10. Joint Torque Sensors Sales Market Share by Country/Region (2021, 2025 & 2032)
Figure 11. Product Picture of ?20 Nm
Figure 12. Product Picture of >20–50 Nm
Figure 13. Product Picture of >50–150 Nm
Figure 14. Product Picture of >150–300 Nm
Figure 15. Product Picture of >300 Nm
Figure 16. Global Joint Torque Sensors Sales Market Share by Type in 2026
Figure 17. Global Joint Torque Sensors Revenue Market Share by Type (2021-2026)
Figure 18. Product Picture of Strain Gauge
Figure 19. Product Picture of Magnetoelastic / Magnetostrictive
Figure 20. Product Picture of Optical
Figure 21. Product Picture of Other
Figure 22. Global Joint Torque Sensors Sales Market Share by Sensing Principle in 2026
Figure 23. Global Joint Torque Sensors Revenue Market Share by Sensing Principle (2021-2026)
Figure 24. Product Picture of Analog Output
Figure 25. Product Picture of Digital Output
Figure 26. Product Picture of Analog and Digital Output
Figure 27. Global Joint Torque Sensors Sales Market Share by Output Type in 2026
Figure 28. Global Joint Torque Sensors Revenue Market Share by Output Type (2021-2026)
Figure 29. Product Picture of Standard Architecture
Figure 30. Product Picture of Safety-Redundant Architecture

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Figure 31. Global Joint Torque Sensors Sales Market Share by Safety Architecture in 2026
Figure 32. Global Joint Torque Sensors Revenue Market Share by Safety Architecture (2021-2026)
Figure 33. Joint Torque Sensors Consumed in Industrial Manufacturing
Figure 34. Global Joint Torque Sensors Market: Industrial Manufacturing (2021-2026) & (K Units)
Figure 35. Joint Torque Sensors Consumed in Healthcare
Figure 36. Global Joint Torque Sensors Market: Healthcare (2021-2026) & (K Units)
Figure 37. Joint Torque Sensors Consumed in Logistics and Warehousing
Figure 38. Global Joint Torque Sensors Market: Logistics and Warehousing (2021-2026) & (K Units)
Figure 39. Joint Torque Sensors Consumed in Commercial and Consumer Services
Figure 40. Global Joint Torque Sensors Market: Commercial and Consumer Services (2021-2026) & (K Units)
Figure 41. Joint Torque Sensors Consumed in Defense and Special Operations
Figure 42. Global Joint Torque Sensors Market: Defense and Special Operations (2021-2026) & (K Units)
Figure 43. Joint Torque Sensors Consumed in Others
Figure 44. Global Joint Torque Sensors Market: Others (2021-2026) & (K Units)
Figure 45. Global Joint Torque Sensors Sale Market Share by Application (2025)
Figure 46. Global Joint Torque Sensors Revenue Market Share by Application in 2025
Figure 47. Joint Torque Sensors Sales by Company in 2025 (K Units)
Figure 48. Global Joint Torque Sensors Sales Market Share by Company in 2025
Figure 49. Joint Torque Sensors Revenue by Company in 2025 ($ millions)
Figure 50. Global Joint Torque Sensors Revenue Market Share by Company in 2025
Figure 51. Global Joint Torque Sensors Sales Market Share by Geographic Region (2021-2026)
Figure 52. Global Joint Torque Sensors Revenue Market Share by Geographic Region in 2025
Figure 53. Americas Joint Torque Sensors Sales 2021-2026 (K Units)
Figure 54. Americas Joint Torque Sensors Revenue 2021-2026 ($ millions)
Figure 55. APAC Joint Torque Sensors Sales 2021-2026 (K Units)
Figure 56. APAC Joint Torque Sensors Revenue 2021-2026 ($ millions)
Figure 57. Europe Joint Torque Sensors Sales 2021-2026 (K Units)
Figure 58. Europe Joint Torque Sensors Revenue 2021-2026 ($ millions)
Figure 59. Middle East & Africa Joint Torque Sensors Sales 2021-2026 (K Units)
Figure 60. Middle East & Africa Joint Torque Sensors Revenue 2021-2026 ($ millions)
Figure 61. Americas Joint Torque Sensors Sales Market Share by Country in 2025

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Figure 62. Americas Joint Torque Sensors Revenue Market Share by Country (2021-2026)
Figure 63. Americas Joint Torque Sensors Sales Market Share by Type (2021-2026)
Figure 64. Americas Joint Torque Sensors Sales Market Share by Application (2021-2026)
Figure 65. United States Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 66. Canada Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 67. Mexico Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 68. Brazil Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 69. APAC Joint Torque Sensors Sales Market Share by Region in 2025
Figure 70. APAC Joint Torque Sensors Revenue Market Share by Region (2021-2026)
Figure 71. APAC Joint Torque Sensors Sales Market Share by Type (2021-2026)
Figure 72. APAC Joint Torque Sensors Sales Market Share by Application (2021-2026)
Figure 73. China Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 74. Japan Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 75. South Korea Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 76. Southeast Asia Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 77. India Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 78. Australia Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 79. China Taiwan Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 80. Europe Joint Torque Sensors Sales Market Share by Country in 2025
Figure 81. Europe Joint Torque Sensors Revenue Market Share by Country (2021-2026)
Figure 82. Europe Joint Torque Sensors Sales Market Share by Type (2021-2026)
Figure 83. Europe Joint Torque Sensors Sales Market Share by Application (2021-2026)
Figure 84. Germany Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 85. France Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 86. UK Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 87. Italy Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 88. Russia Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 89. Middle East & Africa Joint Torque Sensors Sales Market Share by Country (2021-2026)
Figure 90. Middle East & Africa Joint Torque Sensors Sales Market Share by Type (2021-2026)
Figure 91. Middle East & Africa Joint Torque Sensors Sales Market Share by Application (2021-2026)
Figure 92. Egypt Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)

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Figure 93. South Africa Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 94. Israel Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 95. Turkey Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 96. GCC Countries Joint Torque Sensors Revenue Growth 2021-2026 ($ millions)
Figure 97. Manufacturing Cost Structure Analysis of Joint Torque Sensors in 2026
Figure 98. Manufacturing Process Analysis of Joint Torque Sensors
Figure 99. Industry Chain Structure of Joint Torque Sensors
Figure 100. Channels of Distribution
Figure 101. Global Joint Torque Sensors Sales Market Forecast by Region (2027-2032)
Figure 102. Global Joint Torque Sensors Revenue Market Share Forecast by Region (2027-2032)
Figure 103. Global Joint Torque Sensors Sales Market Share Forecast by Type (2027-2032)
Figure 104. Global Joint Torque Sensors Revenue Market Share Forecast by Type (2027-2032)
Figure 105. Global Joint Torque Sensors Sales Market Share Forecast by Application (2027-2032)
Figure 106. Global Joint Torque Sensors Revenue Market Share Forecast by Application (2027-2032)

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