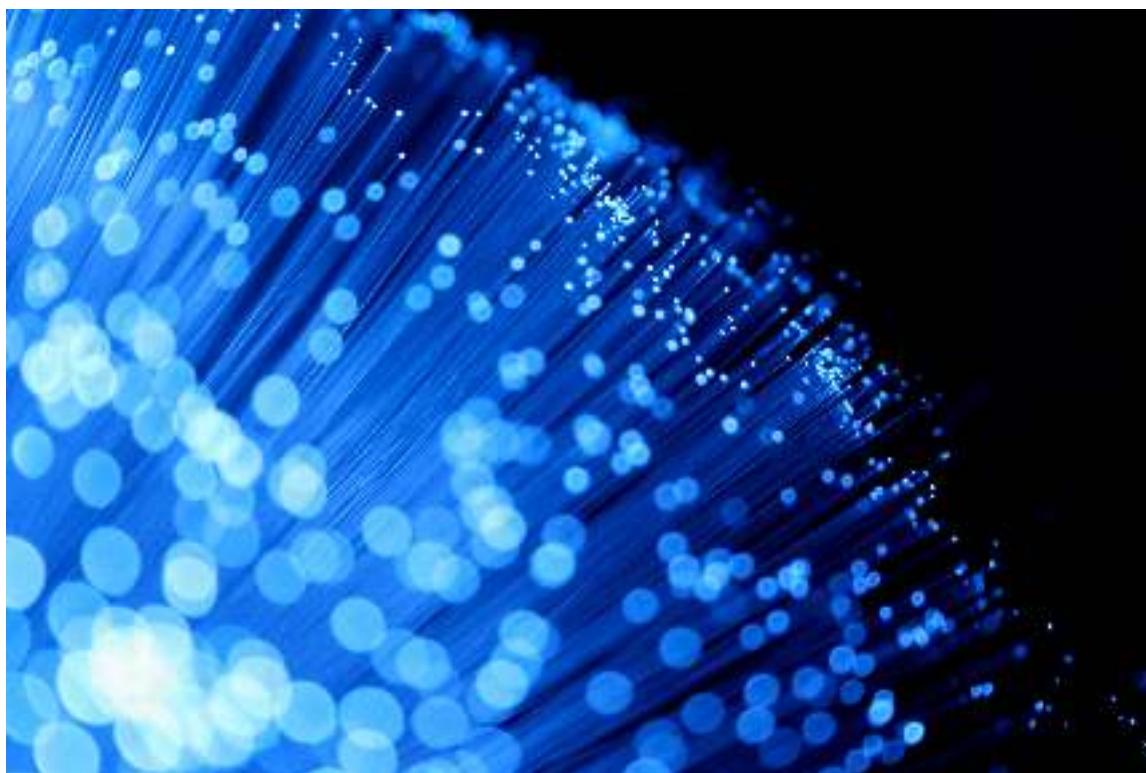


Announcement

Fiber Optic Sensors Global Market Forecast & Analysis

2018-2028



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Fiber Optic Sensors- Global Market Forecast & Analysis

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Report Description

This is the ElectroniCast forecast of global market consumption of Fiber Optic Sensors, segmented into the following geographic regions, plus a Global summary:

- The Americas (North America, Central and South America)
- EMEA (Europe, Middle Eastern countries, plus Africa)
- APAC (Asia Pacific)

The market forecast data is presented and segmented in two main sections:

- Fiber Optic Point (Local) Sensors: Component-Level
- Distributed Fiber Optic Sensor (Continuous and Quasi): System Level

Point Sensor Sensing/Measuring Quantity The Point Sensor Forecast further segmented by the following sensing/measuring types:

- Mechanical Strain
- Temperature
- Pressure
- Chemical, Gas, Liquid
- Vibration, Acoustic, Seismic
- Displacement, Acceleration, Proximity
- Electric, Current and Magnetic Field - Fiber Optic Sensors
- Rotation (such as Fiber Optic Gyroscopes: FOGs)

Fiber Optic Point Sensors - Applications The Point Sensors is segmented by the following end-user applications:

- Manufacturing Process/Factory
- Civil Engineering/Construction (roadways/railways, buildings, bridges, etc)
- Military/Aerospace/Security
- Test & Measurement used in Telecom, CATV, Datacom
- Biomedical/Science
- Petrochemical/Energy/Utilities/Natural Resources
- Automotive/Vehicle

Distributed fiber optic sensors are counted as systems, which include several components (optoelectronic transmitter/receiver, connectors, optical fiber, cable (fiber jacket), other passive components, and enclosures; the quasi-distributed system also includes the FBG sensor elements).

Continuous Distributed sensing (system) provides continuous, real-time measurements along the entire length of a fiber optic cable; continuous distributed sensing does not rely upon manufactured sensors but utilizes the optical fiber.

Quasi-Distributed sensing (system) utilizes Fiber Bragg gratings (FBGs), which have been employed as sensing elements where dense (closely-spaced) sensing points are required, and the FBGs are multiplexed with various methods. The use of these FBGs are not “doubled-counted” in the Point Sensor market forecast data.

Distributed Sensors Market Forecast Application and Technology Categories:

- Manufacturing Process/Factory
 - Continuous – Interferometric
 - Continuous – Raman scattering (Raman effect)
 - Continuous – Brillouin Scattering
 - Quasi-Distributed (Grating-Based)
- Civil Engineering/Construction (buildings, bridges, tunnels, etc)
 - Continuous – Interferometric
 - Continuous – Raman scattering (Raman effect)
 - Continuous – Brillouin Scattering
 - Quasi-Distributed (Grating-Based)
- Military/Aerospace/Security
 - Continuous – Interferometric
 - Continuous – Raman scattering (Raman effect)
 - Continuous – Brillouin Scattering
 - Quasi-Distributed (Grating-Based)
- Petrochemical/Energy/Utilities/Natural Resources
 - Continuous – Interferometric
 - Continuous – Raman scattering (Raman effect)
 - Continuous – Brillouin Scattering
 - Quasi-Distributed (Grating-Based)
- Biomedical/Science
 - Continuous – Interferometric
 - Continuous – Raman scattering (Raman effect)
 - Continuous – Brillouin Scattering
 - Quasi-Distributed (Grating-Based)

Technology Review This study report provides a review of applicable technologies, including:

- Interferometry
- Intensity
- Polarization
- Fiber Bragg Grating (FBG)
- Raman back-scattering
- Fluorescence
- Brillouin waves
- Doppler Anemometry
- Spectroscopy
- Waveguides/ Specialty Optical Fiber
- Optrode

Competition Also included in this market forecast and analysis report from ElectroniCast Consultants is an extensive list of nearly 160-fiber optic sensor manufacturers and related companies, along with a matrix table classifying the types of sensors technologies. Market share estimates (2018) for the selected leading competitors are also provided.

Market Forecast Data Base – Microsoft Excel Spreadsheets:

The market forecast data are presented for fiber optic sensors, segmented by the following functions:

- Consumption Value (US\$, million)
- Quantity (number/units in Thousands)
- Average Selling Prices (ASP \$, each)

Excel File Contents:

- Fiber Optic Sensor Company / Product Matrix
- Market Forecast Data Table
- Distribution Fiber Optic Sensor Market Forecast
 - Global
 - America
 - Europe, Middle East, Africa (EMEA)
 - Asia Pacific (APAC)
- Point Fiber Optic Sensor Market Forecast
 - Global
 - Point Fiber Optic Sensors – America
 - Point Fiber Optic Sensors – EMEA
 - Point Fiber Optic Sensors – APAC

Market Research Methodology Information Base

This study is based on analysis of information obtained continually over 30 years, but updated through the end of May 2019. Continuously, ElectroniCast analysts performed interviews with authoritative and representative individuals in the fiber optics industry plus automotive, petrochemical/energy/ utilities, civil engineering/construction, telecommunications, data communication, military/aerospace/security and other (multiple) industries, instrumentation/laboratory – R&D and factory/manufacturing, from the standpoint of both suppliers and users of fiber optic sensors. The interviews were conducted principally with:

- Engineers, marketing personnel and management at manufacturers of fiber optic sensors, test equipment, biophotonics and medical devices, mechanical splice, connectors, transceivers and receivers, as well as LEDs, laser diodes and photodiodes, and other components used in the fabrication of optoelectronic transceivers, specialty optical fiber, optical fiber/cable and installation apparatus
- Design group leaders, engineers, marketing personnel and market planners at major users and potential users of fiber optic sensor system manufacturers, defense (primary) contractors, weapon system, aircraft and spacecraft electronic equipment producers, optical instrumentation system producers, optic fiber/cable, telecommunication transmission, commercial/industrial, manufacturing switching and distribution equipment producers, data communications equipment producers (switches, hubs, routers), computer and workstation producers, and others. Other industry experts, including those focused on standards activities, trade associations, and investments.

The interviews covered issues of technology, R&D support, pricing, contract size, reliability, documentation, installation/maintenance crafts, standards, supplier competition and other topics. Customers also were interviewed, to obtain their estimates of quantities received and average prices paid, as a crosscheck of vendor estimates. Customer estimates of historical and expected near term future growth of their application are obtained. Their views of use of new technology products were obtained.

The analyst then considered customer expectations of near-term growth in their application, plus forecasted economic payback of investment, technology trends and changes in government regulations in each geographical region, to derive estimated growth rates of quantity and price of each product subset in each

application. These forecasted growth rates are combined with the estimated baseline data to obtain the long-range forecasts at the lowest detailed level of each product and application.

A full review of published information was also performed to supplement information obtained through interviews. The following sources were reviewed:

- Professional technical journals and papers; Trade press articles
- Technical conference proceedings; Product literature
- Company profile and financial information
- Additional information based on previous ElectroniCast market studies
- Personal knowledge of the research team

In analyzing and forecasting the complexities of the total available market for optical interconnect products, it is essential that the market research team have a good and a deep understanding of the technology and of the industry. ElectroniCast members who participated in this report were qualified.

Bottom-up Methodology ElectroniCast forecasts are developed initially at the lowest detail level, and then summed to successively higher levels. The background market research focuses on the amount of each type of product used in each application in the base year (last year), and the prices paid at the first transaction from the manufacturer. This forms the base year data. ElectroniCast analysts then forecast the growth rates in component quantity use in each application, along with price trends, based on competitive, economic and technology forecast trends, and apply these to derive long term forecasts at the lowest application levels. The usage growth rate forecasts depend heavily on analysis of overall end user trends toward digital broadband communication equipment usage and economic payback.

Cross-Correlation Increases Accuracy The quantities of fiber optic sensors, transmitters/receivers, test equipment, biophotonic devices, couplers, filters, attenuators, specialty and single-mode/multimode glass fiber and plastic optical fiber and other optical communication components used in a particular application are interrelated. Since ElectroniCast conducts annual analysis and forecast in each component field, accurate current quantity estimates are part of the corporate internal database. These quantities are cross-correlated as a "sanity check".

ElectroniCast, each year since 1985, has conducted extensive research and updated their forecasts of each fiber optic component category. As technology and applications have advanced, the number of component subsets covered by the forecasts has expanded impressively.

About ElectroniCast

ElectroniCast, founded in 1981, specializes in forecasting technology and global market trends in fiber optics communication components and devices, as well providing market data on light emitting diodes used in lighting.

As an independent consultancy we offer multi-client and custom market research studies to the world's leading companies based on comprehensive, in- depth analysis of quantitative and qualitative factors. This includes technology forecasting, markets and applications forecasting, strategic planning, competitive analysis, customer-satisfaction surveys and marketing/sales consultation. ElectroniCast, founded as a technology-based independent consulting firm, meets the information needs of the investment community, industry planners and related suppliers.

Proprietary Statement

All data and other information contained in this data base are proprietary to ElectroniCast and may not be distributed or provided in either original or reproduced form to anyone outside the client's internal employee organization, without prior written permission of ElectroniCast.

ElectroniCast, in addition to multiple-client programs, conducts proprietary custom studies for single clients in all areas of management planning and interest. Other independent consultants, therefore, are considered directly competitive. ElectroniCast proprietary information may not be provided to such consultants without written permission from ElectroniCast Consultants.

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Addendum

Market Forecast Data Base – Excel Spreadsheets:

Market Forecast Data Table
Point Fiber Optic Sensors – Global
Point Fiber Optic Sensors – America
Point Fiber Optic Sensors – EMEA
Point Fiber Optic Sensors – APAC
Distribution Fiber Optic Sensor Market Forecast
Global
America
Europe, Middle East, Africa (EMEA)
Asia Pacific (APAC)
Fiber Optic Sensor Company / Product Matrix

Partial list of the companies/organizations mentioned in the market study report:

ABB Power, Sweden (Asea Brown Boveri)
Acreo, Sweden (RISE - Research Inst. of Sweden)
Adamant Kogyo Company, Ltd.
Advanced Chemical Systems (ACS)
ADVEC Power Systems, Inc. (APS)
AFL - Fujikura Ltd Japan (Verrillon ®)
AFL Telecommunications
Agilent Technologies / AP Sensing
AI Cielo Inertial Solutions (ACIS)
Alcatel-Lucent (now – Nokia)
Alstom
Alxenses Company Limited
American Institute of Physics
American Medical Systems (GreenLight™)
Anritsu
Apogee Technology, Inc.
Applied Analytics, Inc
Applied Optoelectronics, Inc
Applied Physics Letters
AP Sensing GmbH (see Agilent)
Argonne National Laboratory
Asahi Kasei Microdevices
Autonics Corporation
Avantes B.V.
Babcock & Wilcox
Baker Hughes Incorporated
Baluff Incorporated
Bandweaver
Banner Engineering Corporation
Baumer Electric AG
BEI Electronics LLC
Biolitec group
Brugg Kabel AG
Biometrics Ltd
Boeing
Cardiogenesis (CryoLife)
Caterham
CGGVeritas
Chico State (California State University-Chico)
China University of Petroleum (Beijing)
Chiral Photonics
CiDRA
Coherent-Rofin / Nufem
Conax Technologies
Colibrys Ltd. (Safran Colibrys SA)
Corning Inc. / 3M
CVI Laser, LLC.
Davidson Instruments
Delaware Department of Transportation (DelDOT)
Department of Applied Physics, Zhejiang University of Technology, People's Republic of China.
Department of Energy-Golden Field Office
Department of Mechanical Engineering, Yuan Ze University, Taiwan
Department of Physics, Government Arts College, Salem, India
Department of Physics, National Institute of Technology, Tiruchirappalli, India
Department of Urban and Civil Engineering, Ibaraki University, Hitachi, Japan
Division of Bioengineering, Chemical and Biomedical Engineering, Nanyang Technological Univ., Singapore
Draper Laboratories

Edinburgh University
Emcore Corporation
Engineering and Physical Sciences Research Council (EPSRC)
Evanescent Optics Inc.
EXFO Inc.
Expro International Group Ltd.
FBG Korea
FBGS
FCI Environmental Inc.
FFPI Industries, Inc.
Fibercore
Fiberguide Industries
Fiber SenSys
Fiberware GmbH
Fizoptika
Fluke Process Instruments (Iacon, Raytek)
FOSTA Pte Ltd
Fraunhofer Heinrich Hertz Institute
Fuji Electric
Furukawa Electric/OFS Fitel
Future Fibre Technologies Pty Ltd
GE Global Research (GRC)
Goddard Space Flight Center (NASA)
Gooch & Housego
Gould Fiber Optics
Graduate School of Medicine and Engineering, University of Yamanashi, Japan
Gregg Drilling & Testing, Inc.
Halliburton / SensorTran
Hamamatsu Corporation
Hecho Technology (Nanjing Hecho Technology)
Heriot-Watt University (Edinburgh, Scotland)
Hitachi Metals, Ltd.
Honeywell
Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong
Hoya Corporation
IDEC
IFM Efector
Infrared Fiber Sensors
Input/Output inc
IRadimed Corporation
Institute of Communications Engineering, PLA Univ. of Sci. & Tech, Nanjing, China
Integrated Photonics Technology, Inc. (IPITEK)
Intelligent Fiber Optic Systems (IFOS)
Intelligent Optical Systems, Inc. (IOS)
International Institute for Urban Systems Engineering Southeast University, Nanjing
Inversion Sensor Co. Ltd.
ITF Technologies (O-Net)
iX Blue
Jet Propulsion Laboratory – NASA
Johns Hopkins School of Medicine in Baltimore, Md.
Johns Hopkins University Whiting School of Engineering
Johnson Controls International plc (Tyco)
Journal of Instrumentation
Keyence
Keystone Automation Incorporated
KVH Industries
LEONI
Lake Shore Cryotronics, Inc.
Lepton Technologies
Leuze Electronic
LIOS Technology GmbH
Lockheed Martin Corporation

LumaSense Technologies (Luxtron)
Lumentum Operations LLC (JDSU)
Luna Innovations / Micron Optics
Max Planck Institute for the Science of Light in Erlangen
M.D. Micro Detectors SpA
Measurand, Inc., Canada
Mechanical Engineering Department of the University of Maryland
MellanoX Technologies (Kotura)
Memsic Corporation
Micronor Inc. Automation Components
MicroStrain
Microwave and Optical Technology Letters
Mitsubishi Precision Co., Ltd. (MPC)
MOCKWELL (Dongguan MOCKWELL)
MTI Instruments, Inc.
National Institute of Standards and Technology (NIST)
National Instruments Corporation (NI)
National Science Foundation (US)
Nature Nanotechnology
Nedaero
Neoptix, Incorporated
Newport / New Focus
NGK Insulator
NKT Photonics A/S
National Oceanic & Atmospheric Administration (NOAA)-Pacific Marine Environmental Laboratory (PMEL)
Northrup Grumman
Nova Metrix (FISO/Roctest/Smartec/Others)
Ocean Optics, Incorporated
O/E Land Incorporated
Omega Engineering (Spectris plc)
OmniSens S.A.
Omron
Opsens
Optek Technology (TT Electronics)
Optellios, Inc
Optical Society of America/ Optics Letters
Optocon AG
OptoElectronic Science and Technology for Medicine Ministry of Education, Fujian Normal University, China
Optolink Scientific LTD.
Optosci Ltd
Optrand Inc.
Oxsensis Ltd.
OZ Optics
Palo Alto Research Center (PARC)/Xerox
Panasonic / Ramco (Sunx)
Paroscientific, Inc.
Pepperl+Fuchs
Philtec
Photonics Laboratories, Incorporated
Photonics Society of Poland
Physics Club of Los Angeles Harbor College
Physik Instrumente
Predynamics
PreSens Precision Sensing (Germany)
Prime Photonics, LC
Prisma Photonics, Ltd.
Profotech
Promore (Core Laboratories)
Provincial Key Laboratory of Photonic Technology, Fujian Normal University, China
Proximion AB
QinetiQ Group PLC
QOREX (Petrospec Engineering Ltd.)

Reflectronics, Inc.
Rockwell Automation (Allen-Bradley)
Rolls Royce
Saab AB, EDS, Avionics Division/Defense/Security
Sabeus Incorporated
Samba Sensors
Sandia National Labs
Scantron Industrial Products Ltd.
Schlumberger Limited
SCHOTT Glass/Fiber Optics
Science & Sensors Technologies (S&ST)
Scripps Institution of Oceanography at UC San Diego (US)
SDI Science & Technology Co., Ltd (Beijing)
Sensor Line (Germany)
Sensornet Ltd.
Sensor Technologies/Mooncor (previously FOX-TEK)
SensorTran / Halliburton
Sensuron
Shell Oil Company
Sichuan Huiyuan Plastic Optical Fiber Co., Ltd.
Siemens AG
Smart Fibres Ltd. (U.K.)
Smartec SA
Society of Petroleum Engineers
Soka University, Japan
Spectranetics Corporation
Stanford University
Sumita Optical Glass
Sumitomo Electric
Takenaka Sensor Group (TAKEX / PULNiX)
Tektronix
Telemecanique Sensors (OsiSense XU)
TeraXion
TGS-NOPEC Geophysical Company ASA (TGS)
Thorlabs, Inc.
Trimeddyne, Incorporated
Tri-Tronics Co., Inc.
UC San Diego
United States Environmental Protection Agency (EPA)
University of Bath
University of Calgary
University of Glasgow
University of Pune
University of Wisconsin-Milwaukee (UWM)
Virginia Polytechnic Institute and State University, Blacksburg, Virginia (USA)
U.S. Federal Highway Administration (FHWA)
U.S. National Bureau of Standards
U.S. Navy
U.S. Patent and Trademark Office
Weatherford International Ltd.
Westinghouse
Williamson Corporation
Xiamen Xi-BTR Electronic Technology Co., Ltd.
Xi'an Jiaotong University (Xi'an, China)
Yokogawa Electric Corporation
Ziebel AS