CBI Product Factsheet:

Sensors in Germany

Introduction

Germany is Europe's powerhouse for the manufacturing of electrical and electronic components. It holds by far the largest market for suppliers, and the economic slowdown in other EU countries has increased its market share in Europe. With its broad and innovative industrial base, Germany offers suppliers from developing countries a wide range of opportunities for selling sensors.

Product Definition

In the broadest definition, a sensor is an object whose purpose is to detect events or changes in its environment, and then provide a corresponding output. A sensor is a type of transducer. Although sensors may provide various types of output, they typically use electrical or optical signals. Sensors should ideally be designed to have little or no effect on what is being measured. Improvements in this regard are often achieved by making the sensor smaller. Technological progress is increasingly allowing sensors to be manufactured on a microscopic scale.

The following types of sensors are commonly sold in Europe:

- Pressure sensors
- Ultrasonic sensors
- Humidity sensors
- Gas sensors
- PIR (passive infrared) motion sensors
- Acceleration sensors
- Displacement sensors

Note that there are no HS codes for sensors.

Sensors are used in everyday objects, including touch-sensitive elevator buttons (tactile sensors) and lamps that dim or brighten by touching the base, in addition to innumerable applications of which most people are never aware. With advances in micro-machinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the more traditional fields of temperature, pressure or flow measurement, as exemplified by MARG (magnetic, angular rate, and gravity) sensors. Analogue sensors (e.g. potentiometers and force-sensing resistors) also continue to be widely used. Applications include manufacturing and machinery, aircraft and aerospace applications, cars, medicine and robotics. Sensors are also used in our day-to-day lives.

There is a broad range of sensor manufacturers. The most important factors for customers have to do with the quality and design of the end product. Nevertheless, established brands in electronic components are known for their superior quality and design. For this reason, industrial users may prefer established brands. The following are amongst the leading suppliers of sensors: Omron Automation and Safety, Schneider Electric, Telemecanique (all for industry automation), Eurotech, and Phoenix Contact.

Product Specifications

Quality: Customers look for sensors that meet their current requirements. Typical requirements include the following:
- Sensors have a wide range of specifications, and they can be classified according to the construction, permissible power, type of integration and shape.
- Current market requirements for sensors include:
    o increased efficiency;
    o memory capacity;
    o computing power;
    o more compact size;
    o compatibility with peripheral systems;
    o competitive pricing.
- To assure quality and safety, products must comply with the relevant EU regulations and standards. The materials used, and especially any hazardous substances, must comply with RoHS, and they must fulfil the REACH requirements (see the heading 'Legislative requirements' in this document).

Labelling:
- Sensors are typically labelled with the description of content, including the following types of information:
    o type of product;

- o model type;
- o supplier/manufacturer name;
- o supplier/manufacturer location;
- o serial number.

Packaging:
- Sensors are typically packaged in plastic bags and cardboard boxes.

Legislative Requirements

To assure the durability and safety, products must comply with the relevant EU regulations and standards. Compliance with European legislative and non-legislative requirements is a basic necessity for all exporters in the electronics and electrical engineering sector. The most important requirements that apply to your products are discussed below. Be sure that you are familiar with the applicable legal requirements with regard to labelling, hazardous substances, product safety and liability. Your products must comply with all EU directives.

Liability for defective products.The liability applies to all products manufactured or imported into the European market. Although the company that brings the product onto the European market is usually responsible, claims can be passed along to producers or exporters.

> **Tip:**
> - Be familiar with standards that apply specifically to your products. To ensure that your products are of high quality, review your quality assurance and testing procedure (e.g. by implementing an accredited quality management system; ISO 9001). Formulate labels, instructions for use and disclaimers carefully. Finally, be sure that your insurance covers product liability. Additional information is available in the document on EU legislation: Liability for defective products. Another resource is the ITC standards map.

CE marking. As components, sensors are typically sold to equipment manufacturers. With a few exceptions, sensors must be marked with the CE mark. Sensors that are sold within assemblies, sub-assemblies or finished goods are not legally required to bear a CE mark. Driven by market requirements, however, nearly all customers continue to demand the CE mark for most components, particularly those that are critical to the application. The following directives may be relevant for sensors:
- Electromagnetic compatibility (EMC Directive 2004/108/EC),
- Low-voltage equipment (LVD 2006/95/EC),
- Eco-design for Energy-related products (Directive 2009/125/EC),
- Equipment for use in a potentially explosive atmosphere (ATEX Directive 94/9/EC),

Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive 2002/95/EC). Additional details are available in the section on RoHS below.

> **Tip:**
> - Apply for CE marking, which is required by many customers, even if your product is a sub-system or part of a finished good and is thus not legally required to bear a CE mark. If you are a manufacturer, you should be familiar with the process of affixing the CE marking to sensors. The European Commission's insightful website 'Export Helpdesk' illustrates the key steps to take from the beginning to the trading of the product. The following documents provide additional information on EU legislation:
>   - o CE marking for Electromagnetic compatibility
>   - o CE marking for Low-Voltage Devices
>   - o CE marking for Eco-design of energy-related products
>   - o Directive 94/9/EC (ATEX)

Waste of Electrical and Electronic Equipment (WEEE). If you are considering exporting electronic or electrical products to the EU, you be aware that EU buyers have obligations regarding the waste of these products. Producers in the EU are obliged to participate in product take-back schemes. Although this does not directly affect exporters from developing countries, such requirements may have an impact when EU buyers ask their suppliers to meet specific design requirements or provide certain information.

Tip:

- Ensure that your product design complies with WEEE and enables product recycling, recovery or dismantling (note that these requirements may differ from one EU Member State to another). Formulate labels carefully, and mark products in accordance with WEEE (e.g. the symbol of the crossed-out wheeled bin). Obtain additional information on the EU legislation concerning Waste Electrical and Electronic Equipment (WEEE).

Labelling of energy-related products. Producers and exporters in the EU are obliged to indicate energy consumption by household appliances and other energy-related products (the list is being extended to include products used for industrial purposes. Be sure to check this when importing your products, and discuss it with your European customers).

Tip:

- Indicate all product details (e.g. energy class, performance, capacity) required by the EU. Consult the EU legislation on energy labelling for energy-using and energy-related products on the EU website.

The **REACH regulations** are intended to manage risks relating to chemicals and to provide safety information on such substances. This legislation restricts the use of certain hazardous chemicals. It also established requirements regarding information on chemicals that have been used. Manufacturers are required to provide buyers with information on the properties of any chemical substances used.

Tip:

- Ask your buyer about their requirements regarding REACH. List all chemicals, including raw materials and additional materials, used in your production process. The EU legislation REACH on chemicals is available on the EU website.

Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS). The directive bans the placing on the EU market of electrical and electronic equipment containing more than the agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl and polybrominateddiphenyl ether flame retardants.

Tip:

- Be sure that none of the hazardous substances referred to in the RoHS Directive is used in your production process. Exporters of electronic components are required to meet the standards specified under both the RoHS and the REACH directives, as they are complementary. The EU legislation on the Restriction of Hazardous Substances (RoHS) is available on the EU website.

Non-Legislative Requirements

It is important not to under-estimate the importance of non-legislative requirements. They are very important, as they reflect standards that have been established by industry players themselves. In many cases, they pose a significant barrier to entering a market.

Quality management systems (QMS) – ISO 9001. If you plan to export to Europe, all products must meet the quality demands of the buyer. The ISO 9001 system was designed to ensure that products manufactured in and/or exported to Europe meet the needs of customers.

> **Tips:**
> - Apply for ISO 9001 as quickly as possible. Understand the requirements of your target customers and, if you plan to target the automotive industry, obtain ISO/TS 16949.
> - Consult the document ISO Quality management systems.

For automotive applications, components within assemblies, sub-assemblies and finished goods must meet the quality demands outlined in ISO/TS 16949 QMS.

> **Tip:**
> - Requirements relating to automotive applications with regard to quality-management systems are also available on the ISO website

Functional Safety in accordance with ISO 26262. The ISO 26262 requirements focus on the functional safety of electrical and electronic systems in vehicles.

> **Tip:**
> - Apply for ISO 26262. Even though these requirements are not mandatory, they are sure to provide you with an advantage over other exporters from developing countries serving the vehicle industry. Consult the ISO website for additional information on the guidelines ISO 26262.

Occupational health and safety in the electronic-components sector. Occupational health and safety (OHS) issues include all aspects relating to labour conditions, and they are very often part of the social requirements that EU buyers impose on their suppliers.

> **Tip:**
> - Consider implementing a management system on OHS (e.g. OHSAS 18000). European buyers are becoming increasingly sensitive and are demanding transparency in the supply chain and with regard to labour conditions at all levels. Even though these requirements are not mandatory, compliance is sure to provide you with an advantage over other exporters from developing countries. Additional information on occupational health and safety in the electronic components sector is available on the ISO website.

Electronic Industry Citizenship Coalition (EICC) Initiative. The most important sustainability initiative in the Electronics Sector, in Europe and internationally, focuses on social, ethical, health and safety, and environmental issues. Members are required to comply with the requirements of the Code. Some industry buyers can require their suppliers to follow the EICC code of conduct. This is especially relevant for first-tier suppliers.

> **Tip:**
> - Identify which of your potential clients or which industries are likely to require the EICC code of conduct. Try to implement this policy. It could provide you with an advantage over other exporters. Explain the steps that you have taken in this regard on your website and in your company's other literature. Consult the EICC website for additional information on the sustainability initiative.

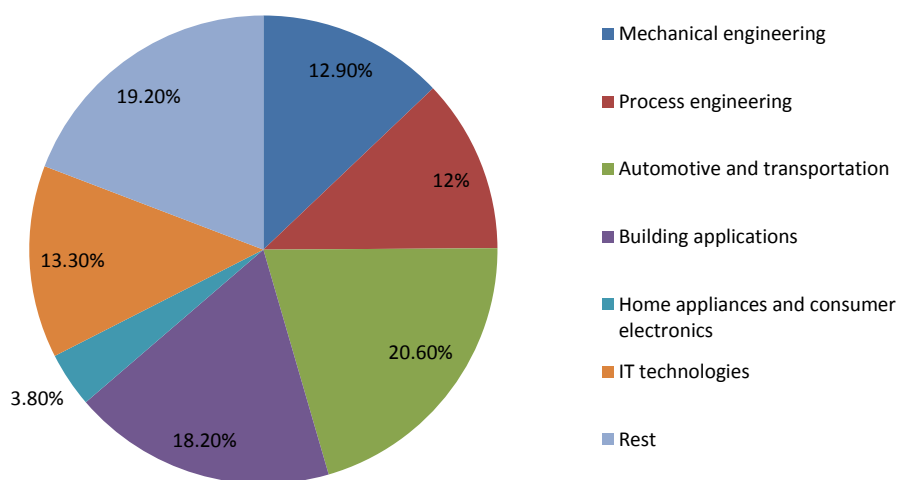## Trade Statistics

Consumption

The market for sensors has more than doubled in the last decade. Sensors are increasingly being used in established application industries, as well as beyond. They are essential to the operation of production-based processes, modern cars, innovative medical technologies and intelligent energy grids. In addition to these areas, demand is also developing in the environmental and infrastructure (incl. oil and gas pipelines) sectors.

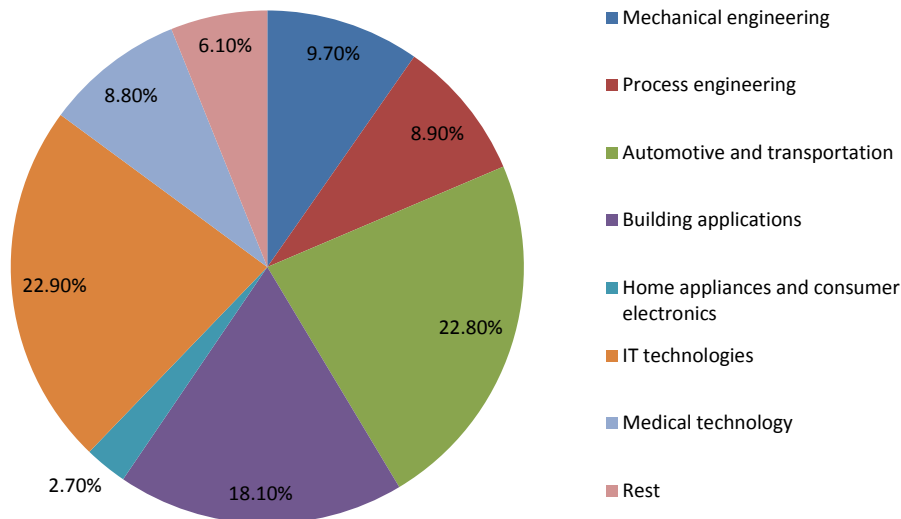**Figure 1: Worldwide consumption of sensors, value in € billion**
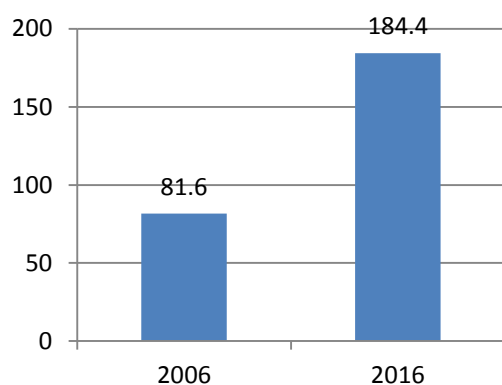
Source: INTECHNO Consulting (2014)

Figure 2: Areas of application of sensors (2006), in %

Source: INTECHNO Consulting (2014)

Figure 3: Areas of application of sensors (2016), in %

Legend:
- Mechanical engineering
- Process engineering
- Automotive and transportation
- Building applications
- Home appliances and consumer electronics
- IT technologies
- Medical technology
- Rest

Pie chart values: 9.70%, 8.90%, 22.80%, 18.10%, 2.70%, 22.90%, 8.80%, 6.10%

Source: INTECHNO Consulting (2014)

Most important developments

The market for sensors is expected to grow in Germany. Industry investments grew by 5% in 2014, and an increase of around 24% was predicted for 2015.

Between 2011 and 2016, the compound annual growth rate (CAGR) of the German sensor market was around 9%. On average, this level of growth exceeds that of other electronic components.

> **Tip:**
> - Consider supplying Germany with low-cost sensors, to benefit from the increasing demand and to supply the application industries with attractive products. Be aware of market requirements, including those relating to the quality and design of products, short production times and favourable delivery terms.

Large market segments exist within the following industries: automotive and transportation (incl. aircraft, trains and ships), construction and IT. Other areas of strong growth include medical technology, IT and automotive/transportation.

> **Tip:**
> - Depending upon your production capacity and expertise, consider supplying sensors to the growth areas within the market.

For additional information on trade statistics, consult CBI Trade Statistics for Electronics and Electrical Engineering.

Exports

In July 2015, Germany reported a new record in the export of electronics. Exports increased by 8.1% between January and August, reaching a value of €101.7 billion. Exports to partner countries in the eurozone increased by 9.5%, with exports to third countries increasing by 7%.

Figure 4: National consumption and export of sensors from Germany
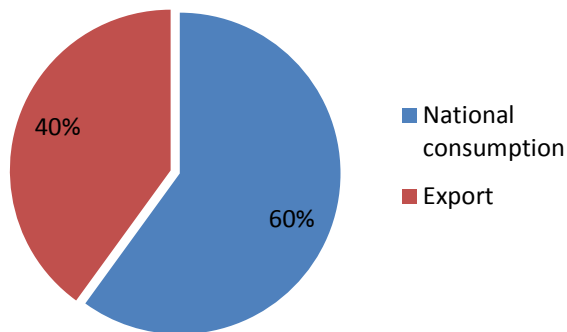
Source: AMA Sensorik (2015)

Most important developments

Around 40% of all sensors produced in Germany were exported in 2014. This figure remained stable relative to 2013.

Of all exports, 25% went to other European countries, translating into an increase of around 3%. At the same time, exports to countries outside Europe shrank by 2% to 17% overall.

Tip:
- Enter the German market with a value-for-money proposition for sensors. Start actively looking for partners in various industries, including in the automotive and other industrial sectors (e.g. automation or building applications).

Market Trends

Most important developments

Technological development: Various industries (e.g. mechanical and electrical engineering, medical technology) are constantly working to add intelligence to their production machinery and processes. Sensors are a key component in this context.

Tip:
- Be sure to anticipate technological developments. This will increase your market opportunities significantly. Focus on your strengths.

Product innovation: In addition to conventional sensors for measuring temperature, pressure, flow rate or filling level, new sensors are being introduced. These new sensors include 'pointing sensors' (e.g. for touch screens, touch pads or RFID readers).

Tip:
- If your products do not meet the market requirements, you should invest in innovation and demonstrate openness to cooperation with existing or potential customers.

The R&D departments of large corporations are focusing on the development of sensors for mobile phones for such applications as face recognition or the measurement of the freshness of food. Nevertheless, such developments are unlikely to emerge in the near future.

Sensors with digital signals are increasingly displacing sensors with analogue outlets. Sensors with buses and wireless communication are also becoming more important, especially in housing and private-home applications. They are also

being used in the manufacturing context for such purposes as the condition-based monitoring of dispersed operating machinery.
Most of these types of sensors need batteries. In the future, however, these types of sensors will be replaced by energy-harvesting concepts (e.g. light, vibration or thermal converters).

Increased R&D spending: The industry, which is driven predominantly by small and medium-sized companies, invests strongly in R&D. Companies are currently investing around 10% of their revenue into R&D. In 2013, the industry increased its R&D budget by 3%, with investments in innovation increasing by 8% in 2014.

Product design and quality: Sensors have become more sophisticated, more specific, more robust and more intelligent, in addition to being more communicative. At the same time, the learning curve of the industry could also lower prices.

Tip:
- Meet the demands for product design and quality by incorporating a quality-assurance programme into your production process. Work to optimise the production process and reduce delivery time. Increase the efficiency and flexibility of the production process. Minimise the risk of damage during production, and meet customer requirements in terms of delivery time.

Political measures: Various EU Directives have been issued in recent years that are aimed at increasing safety (e.g. EU directive EC – 661\2009, which specifies that tires must be equipped with air pressure sensors) and reducing the environmental impact of industries and human beings, particularly through CO_2 emission.

Tip:
- Stay abreast of legislative requirements, as they may contain signals of impending increases or decreases in the demand for certain sensors.

For additional information on market trends, consult CBI Trends for Electronics and Electrical Engineering.

Market segments

Europe comprises around one third of the worldwide market for sensors. This illustrates the attractiveness of the market to exporters from outside Europe. Germany represents around 40% of the Western European market.

Figure: Share of sensors in regional market segments (2013), in %
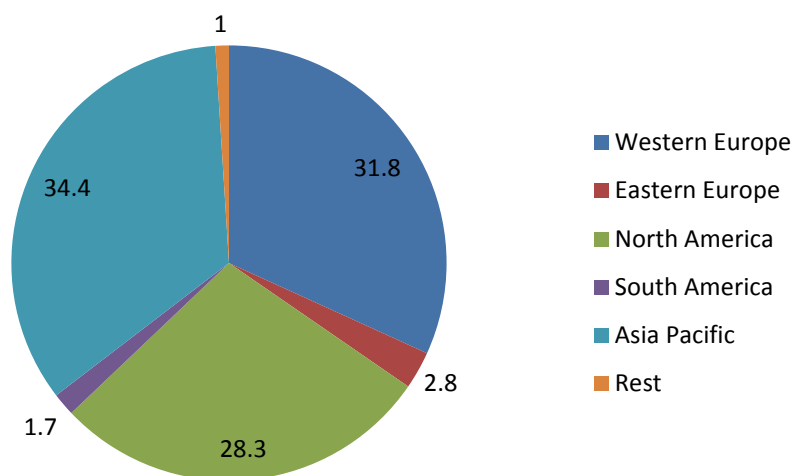
Source: INTECHNO Consulting (2013)

The CBI Market Channels and Segments for Electronics and Electrical Engineering provides a general overview.

Market Competitiveness

The document CBI Competition for Electronics and Electrical Engineering provides a general overview.

What are the end-market prices for (capacitive) sensors?

Price range for sensors

Like many other electronic components, sensors have a broad price range. The following table provides indications of this price range. In Europe, the price for sensors ranges from €0.10 to €5,000, depending upon specifications. Suppliers in several European countries have harmonised their prices; any differences in pricing are due to differences in logistics, taxes and other local costs.

Most important groups of sensors	Price range for distributors, in €
Motion and position	0.15 – 5,000
Pressure	1.30 – 1,500
Proximity	0.40 – 4,000
Temperature	0.25 – 950
Optical	0.15 – 25,000
Magnetic	0.1 – 800
Encoder	0.4 – 2,000

Producers from developing countries should consider different costs and margins along the value chain that could add to the product price. The production and administration costs of the producer usually account for around 50% of the end price. These costs should include all costs for raw materials, development and labour, as well as other fixed and administration costs. Exporters from developing countries should understand their own costs, liabilities and responsibilities, and they would do well to analyse product market price levels. This is necessary to developing a unique selling proposition (USP).

OEM volume price breakdown	Margin
Production and administration costs	50%
Marketing and sales costs in developing countries	3%
Freight to Europe and other related costs	6%
Import and other (e.g. VAT, financing) costs	5%
Marketing costs in Europe	7%
Importer margin	8% – 10%
Distributor margin	20%

Useful resources

Leading trade fairs in Europe

- Electronica, world's leading fair for electronic components, systems and applications
- Embedded World, world's leading fair for embedded technologies
- Hannover Messe, world's leading fair for industrial applications and automation
- PCIM, Europe's largest fair for control electronics, intelligent power trains and energy management
- Sensor+Test, world's leading fair for sensor and measurement technology

Important resources

- AMA
- Elektroniknet
- Elektronikpraxis Vogel
- FBDI
- Mouser
- ZVEI

Additional information

CBI market information:
- Trade Statistics for Electronics and Electrical Engineering;
- Trends for Electronics and Electrical Engineering;
- Market Channels and Segments for Electronics and Electrical Engineering;
- Competition for Electronics and Electrical Engineering;
- 10 Tips for Doing Business in the Electronics and Electrical Engineering sector
- Finding Buyers in the Electronics and Electrical Engineering sector