ISSN 1726-5749

SENSORS & TRANSDUCERS

vol. 86
12/07

Sensor Market Trends

International Frequency Sensor Association Publishing

IFSA

Sensors & Transducers

Volume 86
Issue 12
December 2007

www.sensorsportal.com

ISSN 1726-5479

Editor-in-Chief: professor Sergey Y. Yurish, phone: +34 696067716, fax: +34 93 4011989,
e-mail: editor@sensorsportal.com

Sensors & Transducers Journal (ISSN 1726-5479) is a peer review international journal published monthly online by International Frequency Sensor Association (IFSA). Available in electronic and CD-ROM.

Sensors & Transducers Journal

Contents

Volume 86
Issue 12
December 2007

www.sensorsportal.com

ISSN 1726-5479

Research Articles

Authors are encouraged to submit article in MS Word (doc) and Acrobat (pdf) formats by e-mail: editor@sensorsportal.com
Please visit journal's webpage with preparation instructions: http://www.sensorsportal.com/HTML/DIGEST/Submition.htm

Sensors & Transducers Journal, Vol.86, Issue 12, December 2007, pp. 1794-1801

www.sensorsportal.com

Sensors & Transducers

ISSN 1726-5479

http://www.sensorsportal.com

Global Pressure Switch Market

James K. Taylor
Venture Development Corporation
One Apple Hill Drive, Box 8190, Ste. 206, Natick, MA 01760-9904

Tel.: 508-653-9000, ext. 132, fax: 508-653-9836
E-mail: jimt@vdc-corp.com, info@vdc-corp.com

Received: 22 February 2007 /Accepted: 20 December 2007 /Published: 26 December 2007

Abstract: The VDC has released a study on worldwide markets for electromechanical and electronic/solid-state pressure switches. This paper describes some of the significant research findings.

Keywords: Electromechanical pressure switches; Electronic pressure switches; Solid-state pressure switches; Pressure switch market

1. Overview

In 2006, worldwide shipments of pressure switches totaled $US 965.6 million, and are forecast to increase at a compound annual growth rate (CAGR) of 3.0% to $US 1,121.8 million in 2011. This revenue growth will be primarily due to inflationary price increases of commodity materials, as unit shipments are expected to remain stagnant. Other major factors expected to drive the market include:

Favorable:

- Forecast high shipment growth rate to Asia-Pacific markets, primarily to those in China and other emerging economies of the region.
- Displacement of electromechanical types in applications by higher priced solid-state pressure switches, and growth beyond this for these solid-state products.

Unfavorable:

- Worldwide displacement of pressure switches, principally electromechanical types, in the market by electronic/solid-state transducers and transmitters.

2. Geographic Markets

Worldwide 2006 pressure switch shipment shares to market in the major geographic regions of the world were:

Americas*	45.8%	**-Central, North and South America*
EMEA**	35.0%	***-Europe, the Middle East and Africa*
Asia-Pacific	19.2%	
	100.0%	

Within each geographic region, the pressure switch market is very fragmented, given the multitude of applications and industries where pressure switches are used. Individual vendors typically only serve a handful of these.

Pressure switch markets of developed economies in area such as the US, Western Europe, and Japan differ from those of emergent economies such as China. The markets in the developed economies tend to be led by domestic firms, or at least ones headquartered in the region. For emerging economies, vendors from across the world are attempting to gain a foothold, and also are competing against domestic start-ups there, which are sometimes government-backed.

The pressure switch market is expected to shift more to the Asia-Pacific region, principally in China, and other emerging Asia-Pacific economies. The overall growth rate in shipments to this regional market is forecast to be significantly higher than for the Americas and the EMEA regions through 2011.

3. Sensing Technologies

Worldwide 2006 pressure switch monetary shipment shares by sensing technologies were:

Diaphragm	68.8%
Bellows	10.8%
Piston	10.1%
Bourdon tube	1.9%
Solid state	8.4%
	100.0%

VDC forecasts declining worldwide unit shipments of electromechanical pressure switches through 2011, with the sharpest decline rates being for bourdon tube and bellows products. Unit shipments of diaphragm types are expected to hold up the best with only a small decline.

The unit shipment declines are forecast to be offset by rising prices, such that worldwide monetary shipments for the four electromechanical product classes studied are expected to increase at slow growth rates. In contrast, high single-digit growth rates are forecast for worldwide electronic/solid-state pressure switch shipments.

Reasons for robust growth expectations for solid-state pressure switches include:

- Ability to implement multiple programmable set-points in one unit (solid state can be less expensive in these applications).
- Ability to incorporate self diagnostics
- Better long-term stability
- Built-in temperature compensation
- Can handle a wide range of pressures, thus suitable for a broad range of applications
- Faster, with broader frequency range
- Much higher reliability and life cycle
- Programmable set points and dead bands
- Stand up better to shock and vibration

In addition, the price premiums for the solid-state products over electromechanical pressure switches are narrowing, making these more attractive.

4. Consuming Applications / Industries

Worldwide 2006 monetary shipment rankings for the top five consuming applications/industries are as follows, separately for electromechanical and electronic/solid-state pressure switches.

4.1. Electromechanical Pressure Switches

1. HVAC/Refrigeration
2. Military/Aerospace Equipment
3. Appliances
4. Pneumatic Equipment
5. Automotive Vehicles

Together these five accounted for over half the total market for these products.

Solid-state pressure switches, transducers and transmitters continue to replace electromechanical pressure switches in applications. This transition is occurring at different rates for the various applications. For example, worldwide shipments for automotive vehicles applications are expected to decline, and those for military/aerospace equipment should have slow growth. In automotive subsystems such as air conditioning equipment, a high rate of displacement by pressure transducers is occurring.

4.2. Electronic/Solid-State Pressure Switches

1. Pneumatic Equipment
2. Off-Road Vehicles
3. Chemical Industry
4. Food/Beverage Industries
5. Pulp/Paper Industry

Together these five accounted for over 60% of the total market for these products. High single-digit growth rates are forecast for all these market segments from 2006-2011.

5. Vendor Analysis

5.1. Overall Market

The 6 leading worldwide suppliers of pressure switches in 2006 were:
1. Sensata Technologies
2. Honeywell (includes shipments of 4 separate Honeywell operations)
3. Danfoss
4. SMC
5. Tied: ITT Aerospace Controls/Neo-Dyne, Schneider Electric

The worldwide pressure switch market is very fragmented, with the 2006 market leader Sensata Technologies having less that a 10% market share, and the top 6 accounting for under 30 % of the market.

5.2. Geographic Regions

Americas – Most of the major suppliers to the Americas are U.S. firms, including Sensate Technologies and Honeywell. The only foreign company in the 2006 top ten was Schneider Electric, which is based in France.

Europe, the Middle East and Africa – Except for ITT Aerospace Controls/NEO-Dyne, all the top ten suppliers to this regional market in 2006 were European-based firms. This includes Danfoss, Bitron Industrie, Suco Robert Scheuffele, Schneider Electric, and Bosch Rexroth.

Asia-Pacific – Japanese-based SMC Corporation, Nagano Keiki, and Saginomyia Seishakusho, as well as South Korean-based Useong Electro Mechanic were the largest Asian-based suppliers to this geographic market in 2006. Additionally, Sensata Technologies, and Danfoss were among the top suppliers to this region.

5.3. Type of Sensing Technology

Bellows – Danfoss was the leading worldwide supplier of these pressure switches in 2006 with a commanding market share lead.

Bourdons Tube – Nagano Keiki/Ashcroft and Bosh Rexroth had large 2006 market shares.

Diaphragm – This product market is fragmented, and Sensata, the leading worldwide supplier, had less than a 10 % share in 2006.

Piston – Bosch Rexroth had over a 15 % worldwide market share in 2006. No other vendor had as much as a 10 % share.

Electronic/Solid-State – Hydac International was the leading supplier worldwide of these products in 2006. The top 4 suppliers all had over 10 % worldwide market shares in 2006, and the top 5 accounted for over half of the market.

5.4. Types of Pressure Measurement

Absolute – Worldwide MKS Instruments was the leading supplier in 2006, followed by ITT Aerospace Controls/Neo-Dyne. Combined they accounted for over 30% of the market.

Differential – Honeywell's Environmental and Combustion Controls Business Unit, which supplies pressure switches for HVAC applications, had by far the largest share of this market.

Gauge – This large market segment is very fragmented, and no vendor had even a 10% shares. The largest supplier was Sensata Technologies, followed by Danfoss.

Vacuum – This again is a fragmented market with no vendor having even a 10% share. The largest supplier in 2006 was Schneider Electric, followed by SMC.

6. Product Segmentations and Trends

6.1. By Type of Pressure Measurement

Worldwide shipments for all four types of measurement (absolute, differential, gauge, and vacuum) are expected to increase at rates relatively close to the 3.0% CAGR industry average.

6.2. By Pressure Ratings

- The bulk of the 2006 worldwide market was for pressure switches with ratings of 1000 PSI or less. Pressure switches with pressure ratings above 1000 PSI often involve specialized applications found in the military/aerospace segment, in some chemical & petrochemical applications, and in hydraulic control systems.
- The expected market trend is for above-average growth in product shipments with 50 PSI and less ratings.

6.3. Adjustability

- Pressure switches with field-adjustable set points accounted for the majority of global shipments in 2006. The field-adjustable share is forecast to increase.
- Vendors noted the advantage of having field-adjustable products in serving a broader range of customer applications. Vendors offering fixed set-point products mentioned that customers for these know their settings, and furthermore do not want changes to occur accidentally in the field, especially for hazardous applications.

6.4. Standard, Modified Standard, and Custom Devices

Standard pressure switches are, and should remain, the most demanded type of device during the forecast period. However, an increase is expected in the worldwide shipment share of custom-designed products. There is a trend toward more OEMs requiring pressure switches with special characteristics such as unique physical dimensions, pressure sensing elements, housings, switch mechanisms, and switch contact elements. The military/aerospace market segment often demands customized products due to severe performance and reliability specifications.

6.5. By Type of Enclosure

Open-frame pressure switches that have no housing accounted for only a small share of worldwide shipments in 2006, and the share is not expected to grow. These are sold mainly to OEMs who design their own specialized housings or mount the pressure switches inside enclosed cabinets or other equipment.

6.6. Environmental Protection Ratings

The majority of 2006 pressure switch shipments consisted of products with environmental protection ratings, and the share for these is expected to increase. Applications determine the extent to which a pressure switch will need environmental protection (if at all). Ratings tend to not be required in appliance, automotive vehicle, HVAC, and medical device applications. Ratings are much more likely to be required for difficult environments such as for military/aerospace equipment and use in process industries such as chemical, and oil & gas.

The most popular environmental protection ratings are IP 54, IP 65, IP 66, NEMA 1, and NEMA 4.

Little change is expected in the environmental protection ratings required for given applications. Thus, shifts in shipments by specific specifications will be more a function of the relative growth in the applications.

6.7. Hazardous Environment Ratings

Worldwide, only small shipment shares of pressure switches are of explosion proof and intrinsically safe products. The shipment share of intrinsically safe products is expected to increase somewhat through 2011, while that for explosion-proof products is expected to decline. Factors expected to lead to these trends are displacement of explosion-proof products by intrinsically safe products, more attractive price trends for intrinsically safe products, and an overall trend to displacement of pressure switches by electronic/solid-state pressure transmitters and transducers in hazardous applications. Furthermore, the explosion proof and intrinsically safe products tend to be used in rather slow-growing process industry applications.

7. User Requirements

As part of this market study, VDC surveyed users (end users, OEMs, systems integrators, etc.) who purchase and specify pressure switches about their requirements. The following summarize some of the findings.

7.1. Product Selection Criteria

VDC asked users to identify the most important features and specifications in their selection of pressure switches. Most identified by a majority of the respondents in ranked order were: (1) Accuracy, (2) Repeatability, (3) Durability/Ruggedness, and (4) Size.

7.2. Accuracy Requirements

Accuracy requirements were found to be quite diverse, and the majority of these users do not expect any change in accuracy requirements. However, some indicated an expected shift to a need for better accuracy. The median response on current requirements was found to be in the (+,-) 1.1-2.0% of full-scale PSI accuracy range. The median expectation for 2011 is in the (+,-) 0.76 % -1.0% range.

7.3. Non-Product Vendor Selection Criteria

Users were asked to identify the most important non-product or "commercial" considerations in their selection of pressure switch vendors. Most identified in ranked order of responses were: (1) Price, (2) Availability/Delivery, (3) Application Support, (4) Experience With Supplier, and (5) Technical Support.

7.4. Information Sources on Products and Vendors

Purchasers/specifiers were asked how they obtain information about pressure switches and the vendors. The Internet was cited as the most utilized source, by the vast majority. The majority also cited trade periodical ads and product literature/catalogs of the vendors. The most cited trade publication was *Sensors Magazine*, followed by *Machine Design*, *InTech*, and *Control Magazine*. Many of the respondents identified periodicals specific to their industry or application.

Although identified by fewer of the respondents as primary data sources, trade shows are still an important source of information for many. Most identified was the national ISA show, followed by Sensors Expo, and Hannover Messe. Many respondents identified trade shows specific to their industry/application and/or held locally in their area.

8. Channels of Distribution

8.1. Sales Organizations

The majority of worldwide pressure switch sales are by field and inside sales personnel of the vendors, with a smaller but still-substantial portion by manufacturers' representatives and agents, and with a fractional share sold over the Internet.

8.2. Customer Classes

The majority of 2006 worldwide pressure switch sales were to OEMs, with a large share also through distributors. Much of the direct OEM sales are to high-volume accounts such as found in the appliance, automotive vehicle, and HVAC/ refrigeration market segments.

9. About the Study

The detailed findings of this study are contained in the VDC report **Pressure Switches: Global Demand Analysis.** The report contains:

- Insights, trends, and data on global markets through 2011. Forecasts are given in dollar volumes, units, and average selling prices for electromechanical pressure switches (bellows, bourdon tube, diaphragm, and piston) and electronic/solid state pressure switches.
- Global 2006 and 2011 forecasts on pressure switch shipments by types of pressure measurements (absolute, differential, gauge, vacuum)
- Global 2006 and 2011 forecasts on pressure switch shipment shares by pressure ranges
- 2006 and forecast 2011 electromechanical and electronic/solid-state pressure switch shipments to the major consuming regions of the world: Americas (Central, North and South America), Asia-Pacific, and EMEA (Europe, the Middle East and Africa).
- Global and regional 2006 and forecast 2011 electromechanical and electronic/solid-state pressure switch shipments by consuming industries and applications:
- Global 2006 and forecast 2011 pressure switch shipment shares: Between field adjustable and fixed set point; Between custom designed, modified standard, and standard products; Between enclosed and open frame products; Between products with and without environmental protection ratings; Between types of environmental protection ratings; Products that are explosion proof and intrinsically safe; and Electronic types with AC and DC power inputs.
- Global and major region 2006 pressure switch sales shares by types of organizations.
- Global and major region 2006 pressure switch sales shares by customer classes.
- Analysis of user requirements overall, and in selected industries/applications: Pressure switch product selection criteria; Trend in accuracy requirements; and Trend in high operating temperature requirements.
- User non-product “commercial” vendor selection criteria.
- User information sources about pressure switches and vendors of these products.
- Vendor 2006 pressure switch shipments and shipment shares to global and regional markets by types.
- Vendor-identified key success factors for ongoing success in pressure switch markets.
- Profiles of 34 major vendors of pressure switches worldwide. The profiles include: Corporate overview, Pressure Switch Shipments for 2006, Geographic Shipment Distribution, Applications/Industries Served, Channels of Distribution, New Product Developments, and Strategic Direction and Outlook.
- VDC provides recommendations on how pressure switch vendors can enhance their competitive advantage. Covered are: Product Characteristics and Customer Needs, Technology Research and Development, Product Diversification, Applications to Target, Global Markets, Distribution Channels, and Promotion.

Advanced Environmental Monitoring Research Center (ADEMRC)

Call for Papers
The First Announcement

Gwangju Institute of Science and Technology

The 7th International Symposium on Advanced Environmental Monitoring

February 25-28, 2008
East-West Center
Honolulu, HI, USA

Organized by GIST/ADEMRC

Abstract Submission	**The deadline for abstract submission is September 15, 2007** **The abstract should be written in MS Word format.**

Abstract Submission

You are invited to submit short abstracts for the "**7th International Symposium on Advanced Environmental Monitoring**". To have your abstract considered for oral or poster presentation at the symposium, submit the abstract and author information form through symposium web-site; http://ademrc.gist.ac.kr/7th_sym.

Technical Program

The 2008 ADEMRC symposium technical program will be developed from both submitted and solicited papers. Presentation format will include oral and poster technical sessions.

Venue

The symposium will take place at the **Hawaii Imin International Conference Center** on the **East-West Center** campus. The East-West center is located in Honolulu, three miles from Waikiki and adjacent to the University of Hawaii.

Symposium Topics

- Atmospheric Environment Monitoring
  - Optical atmospheric environment monitoring
  - Remote sensing of atmospheric environment
  - Monitoring and modeling of trace air pollutants
- Contaminants Control Process Monitoring
  - Biological wastewater process monitoring
  - NOM & DBPs monitoring
  - Soil environment & remediation monitoring
- Environmental Toxicity Monitoring and Assessments
  - Toxicity monitoring & bio-sensors
  - Biological and chemical monitoring of environmental toxicity

Technical Tour

- NOAA Mauna Loa Observatory
- National Renewable Energy Laboratory (NREL)

Science & Program Committee

Prof. Young J. Kim, GIST, Korea, Symposium Chair
Prof. Ulrich Platt, Univ. of Heidelberg, Germany
Prof. Man Bock Gu, Korea University, Korea
Prof. Peter D. Hansen, Technical Univ. of Berlin, Germany
Prof. In Soo Kim, GIST, Korea
Dr. Russ Schnell, NOAA, USA
Prof. Shimshon Belkin, Hebrew Univ. of Jerusalem, Israel
Dr. Histosh Iwahashi, AIST, Japan

Registration Information

- Pre-registration available at web-site
- On-line abstract submission

Advanced Environmental Monitoring Research Center (ADEMRC)
Gwangju Institute of Science & Technology (GIST), Gwangju, Korea

E-mail: sympo@gist.ac.kr | PHONE: +82-62-970-3402~3 | Fax: +82-62-970-3404

Sensors & Transducers Journal

Guide for Contributors

Aims and Scope

Sensors & Transducers Journal (ISSN 1726- 5479) provides an advanced forum for the science and technology of physical, chemical sensors and biosensors. It publishes state-of-the-art reviews, regular research and application specific papers, short notes, letters to Editor and sensors related books reviews as well as academic, practical and commercial information of interest to its readership. Because it is an open access, peer review international journal, papers rapidly published in *Sensors & Transducers Journal* will receive a very high publicity. The journal is published monthly as twelve issues per annual by International Frequency Association (IFSA). In additional, some special sponsored and conference issues published annually.

Topics Covered

Contributions are invited on all aspects of research, development and application of the science and technology of sensors, transducers and sensor instrumentations. Topics include, but are not restricted to:

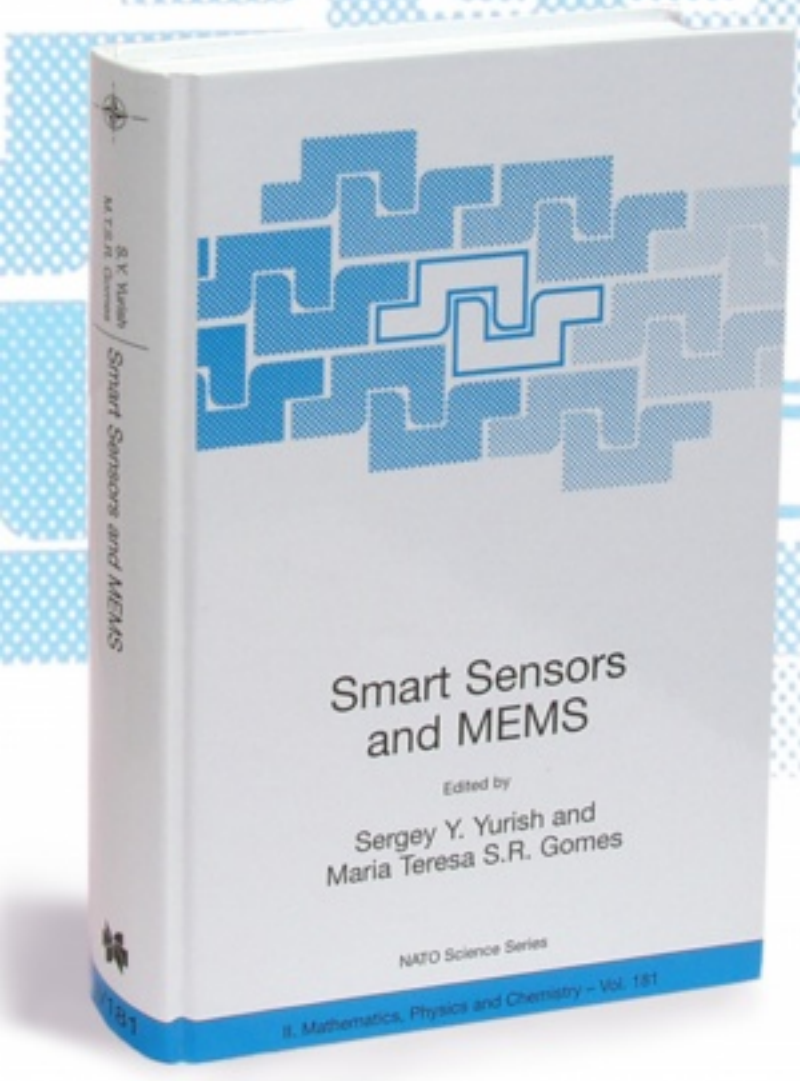
- Physical, chemical and biosensors;
- Digital, frequency, period, duty-cycle, time interval, PWM, pulse number output sensors and transducers;
- Theory, principles, effects, design, standardization and modeling;
- Smart sensors and systems;
- Sensor instrumentation;
- Virtual instruments;
- Sensors interfaces, buses and networks;
- Signal processing;
- Frequency (period, duty-cycle)-to-digital converters, ADC;
- Technologies and materials;
- Nanosensors;
- Microsystems;
- Applications.

Submission of papers

Articles should be written in English. Authors are invited to submit by e-mail editor@sensorsportal.com 6-14 pages article (including abstract, illustrations (color or grayscale), photos and references) in both: MS Word (doc) and Acrobat (pdf) formats. Detailed preparation instructions, paper example and template of manuscript are available from the journal's webpage: http://www.sensorsportal.com/HTML/DIGEST/Submition.htm Authors must follow the instructions strictly when submitting their manuscripts.

Advertising Information

Advertising orders and enquires may be sent to sales@sensorsportal.com Please download also our media kit: http://www.sensorsportal.com/DOWNLOADS/Media_Kit_2007.PDF



Smart Sensors and MEMS

Edited by

Sergey Y. Yurish and
Maria Teresa S.R. Gomes

The book provides an unique collection of contributions on latest achievements in sensors area and technologies that have made by eleven internationally recognized leading experts ...and gives an excellent opportunity to provide a systematic, in-depth treatment of the new and rapidly developing field of smart sensors and MEMS.

The volume is an excellent guide for practicing engineers, researchers and students interested in this crucial aspect of actual smart sensor design.

Kluwer Academic Publishers