Focusing on Core Technologies, Responding to Market Needs and Enhancing Our Ability to Discover New Markets

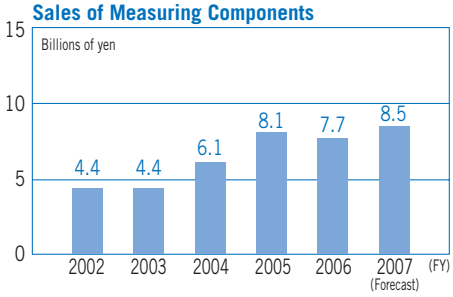
“We have grown our measuring components business by focusing on core strain gage technologies and responding effectively to the diverse needs of different markets.”

Motoyuki Niijima
Executive Officer and Head of the Measuring Components Business Unit

Minebea’s measuring components business centers on strain gages and products that have been developed by applying our strain gage technologies. This is a business that demands highly sophisticated technologies, but individual markets tend to be small and products are highly specialized with little scope for broad application.

For these reasons, it is important to focus on core technologies and respond effectively to the diverse needs of different markets. Enhancing one’s ability to discover new markets also influences business growth.

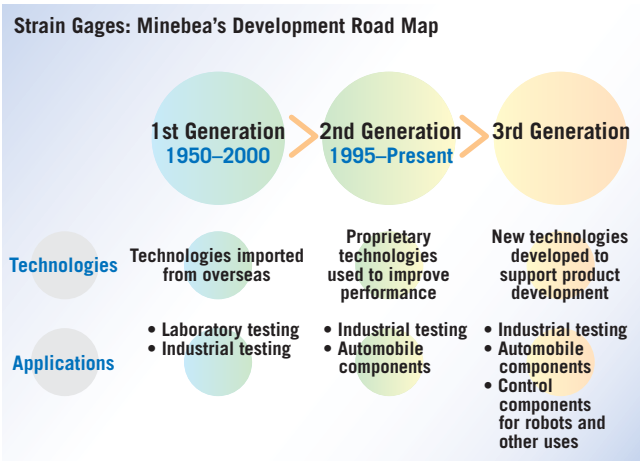
Sales of Measuring Components



Core Strain Gage Technologies

Strain gages consist of a very fine metallic foil etched in a grid pattern, which is bonded to a device and used to measure the strain, or amount of deformation of the device when weight or force is applied. The resulting electrical output is proportional to the strain. Minebea manufactures strain gages engineered and developed in-house at its plants in Thailand and China for shipment to customers worldwide and is the world leader in terms of production volume.

Strain Gages: Minebea’s Development Road Map



Minebea’s first generation of strain gages offered outstanding accuracy, but researchers still faced the challenge of significant zero drift, a time-dependent shifting of the zero calibration point—essential to measurement—from its original zero value. With its second generation of strain gages, Minebea sought to address this by, among others, using different materials and in 2000 succeeded in commercializing a strain gage that essentially eliminated zero drift. Boasting outstanding fatigue resistance, this unit can withstand more than 10 million uses, a key feature that has prompted its adoption by leading automakers for use in weight sensors mounted in passenger seat subframes.

Developing New Technologies

With the aim of expanding this business and ensuring a high level of profitability, we are striving to improve the precision of Minebea strain gages by introducing optical technologies and reinforcing our software development capabilities. At the same time, as a business unit we are promoting the expansion of this business by capitalizing on our sales, development and manufacturing capabilities.

Load cell assembly line

Optical six-axial force sensors

Used in the wrists and ankles of humanoid robots

Placement of SOS structure in diffusion furnace

Measuring Components

Strain Gages

Load Cells and Transducers

Digital Indicators

Tensile and Compression Testing Machines

Chip mounting line

Gage application process

Tensile and compression testing machine

Used to measure the amount of stretch and contraction of metal, plastic and other materials

Optical Six-Axial Force Sensor

Six-axial force sensors measure the force on all three axes (longitudinal, vertical and lateral) as well as torque. Typically, they are used in humanoid and industrial robots. Accordingly, key challenges include reducing size and minimizing price.

Minebea has used its proprietary optical sensing technology to develop an optical six-axial force sensor that achieves an outstanding balance between cost and performance. This groundbreaking new sensor also capitalizes on Minebea's advanced circuit technology—amassed over many years through the development and manufacture of measuring components—which has facilitated the incorporation of a high-speed arithmetic circuit, thereby facilitating a highly compact design.

Optical Transmission Torque Transducer

Like conventional torque transducers, this unit uses a strain gage to detect torque. With conventional torque meters, torque signals (analog) are transmitted via a coil from a rotating shaft to a stationary unit. In contrast, with Minebea's optical transmission torque transducer these analog signals are converted into digital signals and transmitted optically using an LED without the unit ever coming into contact with the shaft. The use of optical fibers as the receiving medium means this innovative unit is compact and lightweight, delivers high-speed revolution and is resistant to noise interference.

Advanced Applications

SOS transducers manufactured by Minebea's Measuring Components Business Unit are used in the Japan Aerospace Exploration Agency's H-IIA rockets. A total of 56 transducers in each H-IIA rocket control the pressure of combusted gas and monitor other types of pressure.

As the name indicates, SOS transducers employ silicon on sapphire (SOS), a process for integrated circuit manufacturing that consists of a thin layer of silicon and a strain gage epitaxially deposited on a sapphire wafer.

H-IIA rocket
(Photo courtesy of Mitsubishi Heavy Industries, Ltd.)

Advantages of Six-Axial Force Sensors

	Strain gage sensor	Optical sensor
Features	• High precision • Complicated sensing element • Complicated wiring • Expensive	• Simple sensing element • Simple wiring • Easy to build in an amp and digitize • Inexpensive

Torque Transducers: Development Road Map

	1st Generation Slip ring-type	2nd Generation Rotary transformer-type	3rd Generation Optical-type
Features	• Low-speed rotation • Continuous rotation not possible	• Medium-speed rotation • Better resistance to noise interference	• High-speed rotation • High resistance to noise interference
Maximum rotation	8,000 rpm	10,000 rpm	15,000 rpm