The craftsmanship predicament

Along with an entirely new magnetic encoder product line, a sensor manufacturer relaunches its company's internal business structure from the ground up.

by Michelle EauClaire-Kopier

Meeting the high performance of an optical encoder, but in a smaller size, FRABA POSITAL IXARC ULTRA magnetic encoders can replace most optical encoders in almost all applications, even in dynamic situations like motor feedback applications.
FRABA

We always hear of how technologies advance, but rarely do we hear of an internal company structure advancing along with them. The **FRABA Group**, Heerlen, The Netherlands, made a daring decision back in 2004 to completely deconstruct its business model based on craftsmanship design and rebuild it in an industrialized fashion.

A craftsman process begins when an order is placed. A customer's specific requests are created, manufactured and the unique product is added to the existing product line. In terms of risk, a craftsmanship company model is a zero; it's a flexible system, but can also be inefficient. "A company should want to design an entire product portfolio strategically for a market, but with the craftsmanship model, a portfolio never develops because each project is taken on individually," says Christian Leeser, CEO of FRABA.

Another issue with the craftsmanship model is production. The craftsman is the intelligence behind the optimal production process. "We used to be a craftsman-centric company," says Leeser. "If we didn't have a specific part, our manufacturing team could find something similar in our inventory and modify it for the project. But, all of the unique production steps weren't documented for public use for future projects that may be able to benefit from the solution. The knowledge is in the craftsman's head and not known throughout the company, essentially lost to others that could leverage it working on similar projects."

With an industrial approach, a company must think in terms of strategic segments of its product offerings and what a particular market needs. "It's a much more complex process to end up with the types of products you want to design, and there is more risk involved. There are no orders to support your product line development, and the off-road industry is inherently low-volume. That's why many companies work in the craftsmanship model on an order-by-order customized design process. But, if you get it right, industrialized plants can be much more efficient," says Leeser.

Industrialized model in practice

With tens of thousands of encoder configurations available, the company knew it had to move away from the widely used model- or family-grouping structure of product lines. FRABA decided to move to a system that takes full advantage of computer technology. The company's product finder technology, an **online searchable product database**, helps to communicate all of its product configuration options. "Our product lines were designed from about 600 modules—parameters such as communication interface, shaft diameter, level of accuracy and level of resolution. We ensure the computer only shows the combined modules that make sense through a matrix that matches functional modules. By using the matrix, we end up with well over 50,000 encoder options along with all of the product information, spec sheets, pricing and manufacturing instructions for those configurations," says Leeser.

The same system that organizes the product finder also allows orders to be

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MAGNETIC ENCODERS

placed and has product assembly instructions tied directly to each configuration. "That means we can literally set up shop anywhere in the world that has manufacturing space and product inventory," Leeser says.

"We are capable of lower cost production because we have unskilled labor, can produce anywhere and scale production easily because all we need to do to increase production volume is have the work stations and inventory.

The basic concept of FRABA's products is to use components that are designed for other high volume industries. For example, most of the company's Hall sensors are designed for the automotive industry. Accuracy and resolution requirements for automotive are lower than what FRABA needs, so they are tuned up in house, taking the standard 10-bits of accuracy and combining it with algorithms and processing power to 12 to 13-bits of accuracy.

From optical to magnetic

FRABA also recently launched its new line of magnetic encoders under its POSITAL brand, the **IXARC encoders** (**Click here** *to read more product information*), to eventually replace the company's optical encoder product line. Depending on the model, IXARC encoders have resolutions of up to 16 bits per revolution and accuracy of 12 bits. They are equipped with a wide range of communication interfaces so they can be a cost-efficient alternative to existing optical systems.

With the exception of integrated servo motor feedback systems and a few other applications, there are no longer many compelling arguments to use shaft mounted optical encoders since their magnetic models offer the same functionality with advantages such as improved durability and a smaller footprint.

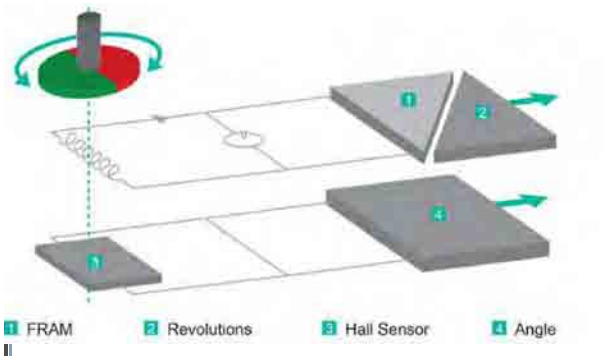
Magnetic technology can be much more tolerant of moisture, dust, grease and oil. "It has opened up some potential opportunities where optics don't work, such as machines that operate in hot and cold alternating climates," says Leeser. "With the mobile machine industry, you never know in which environment the machine will operate because it is always changing." The wider temperature range allows OEMs to potentially standardize the sensor on equipment instead of using regionally dependent sensor technology for extreme cold or hot areas.

"We will continue to support the optic product line because we cannot make that decision for our customers. The magnetic sensors are drop-in replacements for the optic sensors, but often customers want tested and validated parts."

Inside the magnetic encoder

For linear actuators driven by electric motors, it typically takes multiple turns of the motor to span the full linear range. This means that you need to know both the position of the shaft of the motor within one turn and the number of complete turns. In terms of absolute systems, the number of turns must include those that happen when there is no power to the machine. "You need to have power to run the electronics that store the information of the counter, or you need extra mechanical parts," says Leeser, "so where does that power come from?"

If something has movement, there is power, and the energy of the movement can be induced. The energy harvesting technology within FRABA's magnetic encoder products consists of a wire with a special alloy treatment so all of the magnetic fields are pointed in one direction. As it crosses a threshold, the magnet flips over, and for that short period of time enough energy is generated to wake up the electronics and store the information. "The magnetic sensor detects the angular position of the shaft by measuring the direction of the magnetic field. The number of revolutions is recorded with a counter circuit powered by [an] energy harvesting system based on the Wiegand effect," says Leeser. "This absolute system records the position with one revolution, as well as the number of revolutions, even when external power has been interrupted." Signal processing is carried out by a 32 bit microcontroller.



A schematic of the IXARC magnetic encoder.
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"We were the first licensee of the multi-turn magnetics technology, and we were the first company with a product out harnessing it," says Leeser. FRABA isn't the only company that will be using the technology, but the company believes that its investment in its business structure will allow it to readily address market needs and meet customer demand better than its competitors.