How "smart plastics" reduce maintenance costs and prevent production losses

Predictive maintenance is part of Industry 4.0 and the factory of tomorrow. To achieve this, igus has developed a family of products under the name 'isense', where various sensors and monitoring modules make plastic energy chains, cables and plain bearing products intelligent.

The smart plastics help to avoid unplanned plant downtimes and expensive production losses. "Thanks to the digital networking of machines and products, it is possible to continuously record the condition of the components and to inform as soon as a repair or replacement is required," explains Michael Blaß, authorised officer e-chain systems at igus. In energy chain systems this is called the isense EC.M sensor, and is mounted on the moving end of the chain where it automatically records acceleration, speed, temperature and the number of cycles completed. The distance travelled and the remaining service life of the system can then be derived from this information. With the optimised isense EC.W sensor, the wear on the e-chain is determined to the nearest percent in gliding e-chain applications such as those found on cranes, linear robots or travel axes.

Immediate stop after incidents

The company igus has developed the isense EC.B module for unpredictable incidents. It determines if there is a breakage in a chain link due to accidental or deliberate damage. The module consists of a polymer wire in special separators and a sensor unit. The information from the sensor unit can either be read by the evaluation unit isense EC.B, either as part of the IoT network or connected directly to the customer's system. Among other things, this system is used by an Austrian automotive supplier on their indoor linear robot which handles engine blocks. Here a failure occurred even after visual monitoring of the energy chain systems. This could have been prevented by the break monitoring system. Since 2010, the so-called PPDS (Push/Pull Force Detection System) has been used worldwide on hundreds of crane systems to detect unusual operating conditions. A force sensor attached to the moving end of the e-chain continuously measures the resulting tensile and shear forces during operation

and compares them with expected data. In the event of a fault, an immediate shutdown of the system takes place, depending on the settings made by the customer, before further major damage to the e-chain system occurs. The proven PPDS concept has now been integrated into the isense concept under the name isense EC.P. In addition, the modules can be integrated wirelessly via WLAN or wired (CAN bus) and thus also help to improve the preventive maintenance recommendations. For energy chains and in particular in guide troughs on long travels, isense EC.RC (e-chain run control) provides reliable protection against the chain rising up in the event of a blockage. Sensors measure and check the position of the energy chain. In this way, the machine is prevented from continuing to operate or the chain from rising up when mechanical faults occur; preventing total loss of the chain or an electrical shutdown (for example, due to cable damage).

With the new isense CF.Q top-hat rail module even chainflex cables, which were developed by igus specifically for the moving application in energy chains, become "intelligent". Based on the experience of thousands of tests in the world's largest laboratory for dynamic cables with an area of 2,750 m², they advise the customer before the changes in the electrical properties lead to a plant shutdown. With continuous measurement of the electrical properties, ambient temperature and the number of cycles, a possible failure of the cable is predicted in good time. Continuous testing in the test laboratory and in customer applications help to make analysis of the measured values increasingly precise.

Intelligent plain bearing technology

There are members of the isense family also in the plain bearing technology division, the second largest business area of igus. With the isense PRT.W module and the isense DL.W module, the abrasion and remaining service life can be measured on iglidur PRT polymer slewing ring bearings or drylin linear guides. The status data is passed on via wireless to the user, who is able to intervene at the right time from anywhere. As lightweight and robust plastic elements, these modules are also suitable for easy retrofitting and a variety of applications. For example in packaging technology, assembly automation, automobile factories or in the manufacture of electronic components.

Collecting and evaluating machine data

In Industry 4.0 networks, isense products can send all collected data anonymously to a central igus data store via an icom data module. The advanced icom module now communicates extensively without wiring. It is even easier to integrate into existing production, one of the reasons being that only a single icom module is needed for several sensor systems. In addition, customers can optionally connect status-monitoring, data-generating units of other manufacturers to the icom module. From these data, the igus Machine Learning models calculate a wear prediction that takes into account the actual usage patterns. The precision of the maintenance recommendations presented via a web interface is therefore continuously improving. The plant operator can then make use of planned production stoppages to implement precise preventive maintenance recommendations and therefore optimise their business processes. In this way, the maintenance and service costs can be further reduced and the quality of the production enhanced. The collection and analysis of machine data is in the process an important cornerstone for a higher planning reliability and efficient maintenance in the factory of the future. Comparable to a global test laboratory, the analysis and evaluation of concrete data from a wide range of applications allows the identification of numerous statistical values which, on the one hand, make more precise predictions possible and on the other, could also be integrated into the research and development of new products.

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ABOUT IGUS:

igus GmbH is a globally leading manufacturer of energy chain systems and polymer plain bearings. The Cologne-based family business has offices in 35 countries and employs 3.180 people around the world. In 2016, igus generated a turnover of 592 million euros with motion plastics, plastic components for moving applications. igus operates the largest test laboratories and factories in its sector to offer customers quick turnaround times on innovative products and solutions tailored to their needs.
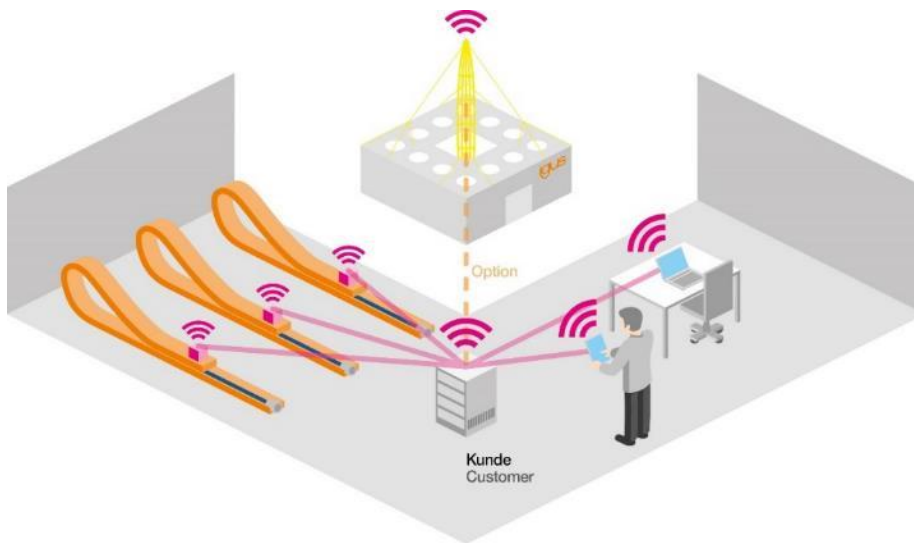
Image captions:

Image FAT2317-1

Through isense the smart e-chain, cable and linear guide communicate with the customer and inform them about their condition and potential maintenance dates. Optionally isense can be connected to the igus data centre to automate and optimise maintenance processes. (Source: igus GmbH)
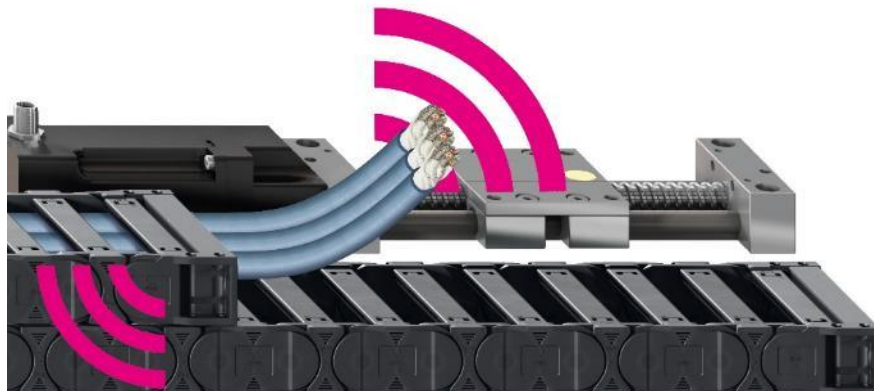

Image FAT2317-2

igus smart plastics eliminate unplanned system downtime. The intelligent drylin linear guide, the intelligent energy chain and the intelligent cable permanently monitor themselves, enabling predictive planning of maintenance and replacement. (Source: igus GmbH)
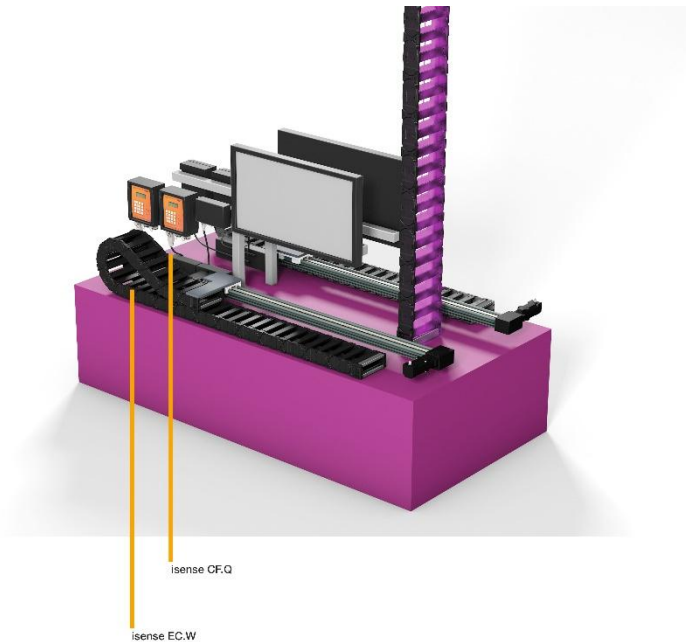
Image FAT2317-3

The isense CF.Q determines the data of the chainflex cables while the isense EC.W measures the abrasion of the e-chain. (Source: igus GmbH)

Image FAT2317-4

The isense EC.RC uses different sensors to carry out measurements and check that the energy chain is functioning correctly. A single communication module can monitor many e-chains and cables simultaneously. (Source: igus GmbH)

Image FAT2317-5

Continuous testing in the in-house test laboratory and in customer applications help to make analysis of the measured values increasingly precise. (Source: igus GmbH)