How to connect a pump to the internet?

Authors:
Dipl.-Ing. (FH)Lars Meisenbach; BestSens AG
Dipl.-Ing Harald Tobies; METAX Kupplungs-und Dichtungstechnik GmbH

This white paper addresses the most relevant questions that a machine builder must answer on the way to IIoT-enabled machines and shows possible solutions. IIoT stands for Industrial Internet of Things and is part of Industry 4.0. IIoT-enabled machines can communicate with other machines and higher-level systems via interfaces.

Why should I connect a pump to the internet?

Whether it is the desire to offer a closer and better service for the customer/pump operator, the desire to counteract the shortage of skilled workers in maintenance with smart condition monitoring solutions, or simply the fear of being left behind by competitors in the future market of "pump 4.0". The reasons for machine builders are numerous.

As an example. Imagine you are working in the production plant of your favorite ice cream manufacturer and you are responsible for the pumps in maintenance.

It's Saturday afternoon, you were just about to enjoy the weekly free ice cream at home with your children. Suddenly your cell phone rings, your colleagues from production are calling. Only warm cream is dripping into the cone instead of cool ice cream.
When arriving at the company, you can see that the entire production line has stopped.

It turns out that the seal and the bearing of the cooling circuit pumps are no longer working and are broken. Several thousand liters of ice cream are unsalvageable and have to be disposed. You spend two and a half hours repairing the pump. A special cleaning cycle follows before commissioning.
The next Monday, of course, you call the manufacturer of the pump, which was still under warranty. Could you have taken countermeasures if you had noticed earlier that something was wrong with the pump?

If an e-mail with a warning had arrived a few days earlier, maintenance could have been performed. This would have been scheduled between production cycles and thus the downtime and failure of the plant in connection with the high costs (e.g. also warranty costs) could have been avoided.

This is only one example, but it raises many questions.

Contact us

BestSens AG
www.bestsens.de
info@BestSens.de

METAX
www.metax-gmbh.de
info@metax-gmbh.de

What challenges need to be overcome?

The maintenance engineer has to keep his machine running - he will hardly find the time to implement digitization himself. The next time he replaces the hardware, he will buy pumps from manufacturers who already offer him condition monitoring and digitization options. What does the machine manufacturer have to do now?
First of all, they have to be clear about what they want to achieve and what functionalities they want to offer the user.
After the mission is clear, machine builders often realize that in addition to the existing mechanical engineering competencies in the company, other competencies in the areas of sensors, electronics, informatics, data analysis, etc. are needed to achieve the goals.

Questions arise such as:

- Which data and therefore which sensors are needed to generate the desired information to achieve the goals?
- What mechanical interfaces do I need to provide on my machines?
- How are sensor cables safely routed out of the pump and protected with long-term stability?
- How is the sensor data processed and interpreted?
- What actions are derived from the sensor data?
- How is the information passed on to higher-level systems?
- Which structures in the service department do I have to adapt in order to benefit from the information?

The basic prerequisite for a successful IIoT solution is that the machine builder is open to change.

This is how implementation works: As a team!

Your excellence lies in your machines - we keep them running smoothly and support them with the combined know-how of BestSens and METAX

When it comes to increasing the productivity of systems and minimizing machine downtimes through data-based, demand-driven maintenance, it makes sense to keep an eye on the main wear components of the machine. In the case of pumps, these are the mechanical seal and the bearings. To monitor the bearings, threaded holes for mounting a vibration sensor are often sufficient, or if the axial thrust is also to be determined via the fixed bearing, two holes in the bearing pedestal for the BeMoS sensors from BestSens. With the mechanical seal, things get a bit trickier, since a classic vibration analysis is not expedient here. A smart mechanical seal from METAX with an integrated ultrasonic sensor from BestSens can provide a remedy here.
METAX's more than 30 years of expertise in the field of sealing technology and BestSens' more than 10 years of experience in the fields of sensor technology, electronics, computer science and data analysis result in a highly competent task force for your needs.
Step by step, the answers to the questions relating to the customer's machines are provided and solutions are developed that can be integrated into the machine manufacturer's product portfolio in the long term as an IIoT toolkit.

Contact us

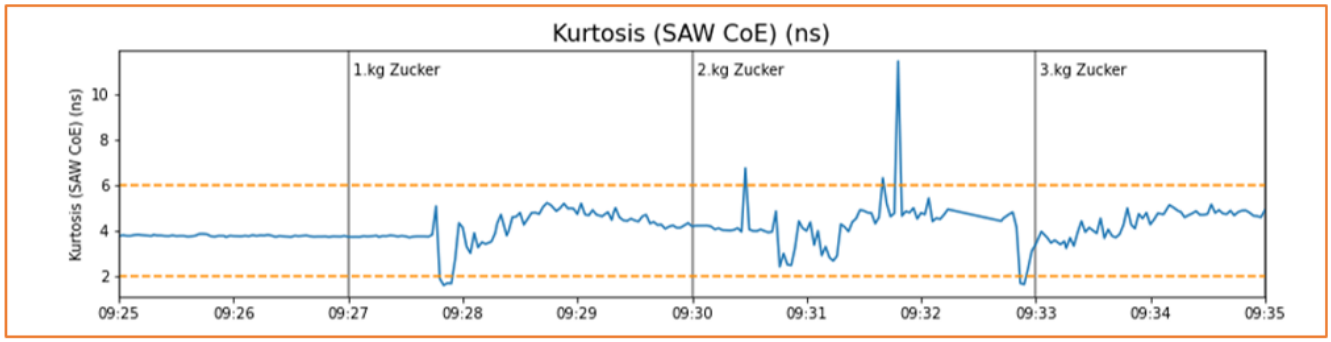
BestSens AG
www.bestsens.de
info@BestSens.de

METAX
www.metax-gmbh.de
info@metax-gmbh.de

Two examples of seal monitoring

1. Sugar crystals inside the seal

Below you can see a diagram, a food pump that initially only pumps water. Crystalline sugar was then added to the tank. This dissolves only partially and individual crystals enter the lubrication gap of the seal.



First you see that the characteristic values are at a kurtosis value of 4 until the sugar is added. From the addition of the sugar onwards, significant fluctuations occur in the characteristic value of the seal. From 9.30 on, the characteristic values set for this pump are exceeded.
You will receive such characteristic value exceedances directly as an alarm via the web app. You can also receive daily and weekly reports from the system that also reflect whether characteristic value exceedances or problems have already occurred in the past. If you see that these incidents are accumulating, this is a clear indication to take a closer look at the pump and, if necessary, perform maintenance before major damage occurs that could trigger a breakdown. This is made possible by the sensors collecting information directly on the smart mechanical seal and then evaluating this information via the BeMoS controller.

Condition monitoring via Web-App

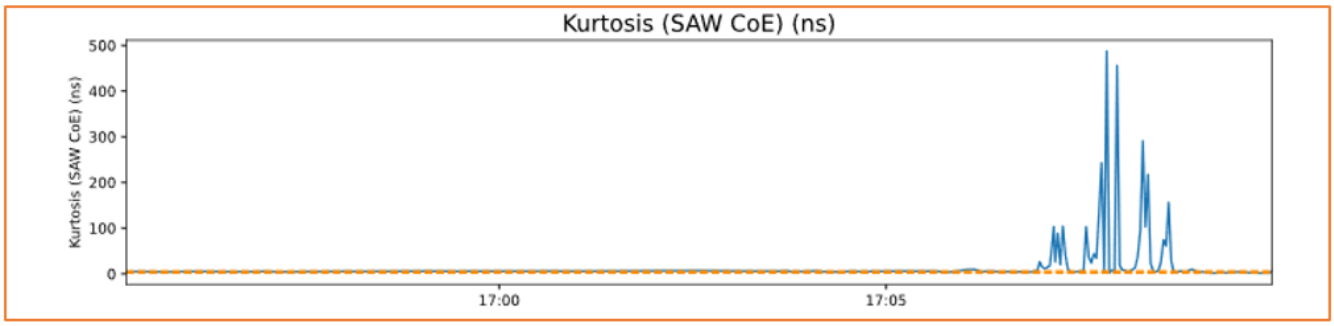
Contact us

BestSens AG
www.bestsens.de
info@BestSens.de

METAX
www.metax-gmbh.de
info@metax-gmbh.de

2. Dry run oft he seal

In this test setup, the medium was gradually withdrawn from the pump.
The tank emptied steadily and the pump ran in the worst possible condition, dry. Within a few minutes, the seal can suffer massive damage or break.



The diagram shows, as long as the seal is still supplied with a lubricating film by the pumping medium, the characteristic value is also in a low range as in the example before. As soon as dry running occurs (start after 17.05), the characteristic values abruptly shoot up.
As soon as you receive a dry-running warning, you can adjust the operating mode of the pump (e.g. through other start-up processes) and thus avoid permanent damage in the future. Before the seal breaks, an emergency shutdown can also be performed, thus saving particularly expensive and specialized equipment. The contamination of sensitive products by a broken seal is thus avoided and also the batches of the conveyed product remain safe.

Summary

The products and solutions offered by BestSens in cooperation with METAX are well thought-out, field-tested and, as smart components, can be quickly implemented as IIoT solutions with little effort on the part of the pump manufacturer and user.

BestSens

For ten years, the name BestSens has stood for cutting-edge sensor technology and the ambition to give our customers the competitive advantage through the digitalization of their products, thus ensuring sustainable market success. We are your experienced full-stack IIoT partner for rotating machinery and can effectively reduce the risks of failures and increased repair costs with our technology. In this way, you achieve your digital competitive advantage with us step by step in a guided process.

METAX
DIE DICHTUNG.

For more than 30 years METAX Kupplungs- und Dichtungstechnik GmbH is a successful sealing partner for any number of industrial sectors. Our wide range of seals includes simple sealing elements as well as complex sealing systems for sophisticated applications. Our core competence is the configuration, selection and design of rotating sealing arrangements (mechanical seals, rotary joints or radial lip seal systems) adapted to the specific customer requirement as a single piece or for a series production.

Contact us

BestSens AG
www.bestsens.de
info@BestSens.de

METAX
www.metax-gmbh.de
info@metax-gmbh.de