

Engine production without turbulences

GKN Aerospace is one of the world's largest suppliers for the aerospace industry.

Sensors monitor the production process and make maintenance calculable

The Swedish company GKN Aerospace from Trollhättan produces high-precision parts for aircraft engines and for aerospace industries. The machine tools have sensors that ensure maximum transparency and the highest product quality.

GKN Aerospace is the worldwide leading cross-technological supplier of aerospace technology. With 50 production sites in 15 countries, the company supplies over 90 % of the aircraft and engine manufacturers in the world. They develop and manufacture innovative intelligent systems and technologies for aerospace, that are used for example in cargo planes and in the world's largest passenger aircraft. The company also works on space technology. For instance they produced the rocket nozzle of the well known Ariane 5.

Mikael Alm, Industrial IoT Engineer at GKN: *"We produce components for aircraft engines. In my department ND Digital we work on precise machine tools. We monitor our machines with the help of sensors, so that everything works perfectly and nothing unexpected happens. We use different sensors to ensure a flawless production process. For about 3 years we have been using vibration sensors from ifm. They monitor the spindles in our machine tools."*

Machine tool for high-precision metalworking.





There are various operations in metalworking that are fully automated carried out by computers. Milling heads work their way through the metal with high rotational speeds. Cutting tools create shafts to the micromillimetre and drills place exact drilling holes. This is how high-precision components for aircraft turbines, among others, are manufactured in the shortest amount of time.

Ensuring fault and trouble-free machining of the workpiece is of the utmost priority. This is the only way to continuously guarantee high product quality. Due to the high machining speed and process forces, quickly reacting diagnostic systems are required, that immediately detect damage occurring on the tool or collisions during machining and that stop the process immediately thus preventing damage to the machine and the workpiece. Permanent vibration diagnosis has proven to be the optimum procedure.

■ Minimum unbalances reveal problems

The centrepiece of this system is a highly sensitive and extremely reliable vibration sensor from the sensor specialist ifm electronic, that is mounted directly onto the spindle housing. The vibration sensor of type VSA is a small micromechanical acceleration sensor that continuously detects vibration on non-rotating machine surfaces.

The VSA is so sensitive that it detects even the slightest damage on a milling head that itself only has the size of a millimetre due to occurring unbalance. Changes in the cutting forces that may, for example, be caused by a blunt drill or too much swarf are detected and reported to a diagnostic unit on account of the changed vibration characteristics. At GKN, the evaluation unit VSE100 is from ifm. It processes signals from up to four vibration sensors and can trigger a warning or machine stop in case of a fault. The data is transmitted to the higher-level controller via Ethernet.

Limit values for vibration and collision detection can be stored in the machine controller for each tool and for every step in the process. To determine them in advance, a program cycle is carried out in the teach mode. Individual vibration data and adjustable tolerance values are stored in the controller for each tool. If those values are exceeded during machining, this is interpreted as an error and provides a warning message or stops the machining depending on the amplitude of the vibration.

Another protective function is spindle condition monitoring. Wear on the bearings of the complex spindle mechanics is detected and signalled on the basis of unusual vibration characteristics. This provides the user with additional safety.



For transparency and optimisation: The Smartobserver software collects, visualises and analyses all sensor data.



Pressure sensors monitor the pressure in the cooling circuit.

*Constantly listening:
Vibration sensor VSA004 from ifm placed right on the spindle.*



■ Further sensors

The evaluation system has two analogue inputs, where additional sensors for monitoring measuring parameters can be integrated. GKN uses countless PN7 pressure sensors to constantly control the pressure in the cooling pipe. A pressure drop could stop the cooling process and damage the tool and workpiece. This is why sensors signal if the operating pressure is too low in a case of fault.

Mikael Alm: *"I work with sensors from ifm since I started working at GKN Aerospace. ifm has a good and broad selection of sensors, so that there is always a solution that suits our requirements."*

GKN connected all sensors to the central controller via the AS-i bus system. A two-wire flat cable transmits signals from up to 127 sensors with the help of AS-i IO-modules to the AS-i master. Bus wiring significantly reduces the cabling costs and provides a higher flexibility of installation.

■ Evaluation

GKN uses Smartobserver to monitor and analyse the machine condition. This software was especially developed by ifm for condition monitoring of installations.



” *The combined solution of ifm’s sensors and software will help us understand and improve our equipment in future as it does now.*



The VSE100 evaluation unit detects the smallest deviations and gives a signal in case of exceeded limit values.

All measured values of the sensors meet here. Next to illustrating all process values and their limits, the software creates for example trend analyses, helping to optimize the production process.

Mikael Alm explains, “It is very important for us to understand what happens during the production process. Our products are very expensive and we have to be able to make improvements when the processes are not entirely true. We can use the collected data from Smartobserver in our own analysis tool, thus making precise assessments and acting accordingly.”

The extensive alarm management of the ifm software allows condition-based maintenance of the machines.

Mikael Alm’s conclusion is, “For many years I worked with this type of maintenance and it works the way it is supposed to. The combined solution of ifm’s sensors and software will help us understand and improve our equipment in future as it does now. ifm provides excellent customer support which has always helped us finding a solution to our problems.”

The close cooperation with the customer is also reflected in the ifm slogan, “ifm – close to you”.

■ Conclusion

With the help of sensors and Smartobserver, machine tools can be monitored automatically and reliably. Faults are detected in time and the maintenance operation is calculable and condition-based. This does not only save costs, but it also ensures maximum availability and the highest product quality.



Reduces wiring: AS-i modules collect sensor data and transfer it to the controller via the 2-wired bus cable.