Heinz Nixdorf Vocational College

Retrofit as a study project

Retrofit meets Industry 4.0

How a vocational college and ifm are preparing old machines for the digital future

Heinz Nixdorf Vocational College (Heinz-Nixdorf-Berufskolleg) in Essen is one of the leading educational centres for electrical engineering and information technology, with a strong emphasis on practice-oriented knowledge transfer. In close cooperation with industrial companies, the college implements learning projects that reflect current technological developments.
The aim is to is to provide future technicians and engineers not only with theoretical knowledge, but also with practical skills in handling modern automation and digitalisation solutions. A particular challenge was the digitalisation and modernisation of an ageing machine tool – a project implemented in cooperation with automation specialist ifm.

Parts of this 1970s lathe were digitalised for demonstration purposes to show how older machines can be modernised with sensor technology.

At the heart of the project was the task of upgrading an older machine tool to the latest state of the art through a targeted retrofit. The assignment was clearly defined: to set up a condition monitoring system for predictive maintenance without major structural interventions in the machine.
"Our goal was a minimally invasive retrofit – we wanted to integrate sensors in such a way that they are barely visible while maintaining compatibility with a wide range of systems," explains **Patrick Bonneval**, state-certified technician at Heinz Nixdorf Vocational College.

The challenge lay not only in the technical implementation, but also in developing a platform that could function both as a proof of concept for Industry-4.0-compatible upgrades and as a versatile training tool. In particular, the integration of the new sensors into existing structures and the digitalisation of machine data required innovative solutions.

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Using time-of-flight measurement, an OGD distance sensor determines the slide position with millimetre accuracy and transmits the distance value via IO-Link.

An inductive sensor detects the grooves on the shaft to measure the rotational speed.

Smart sensor technology, IO-Link and Edge connectivity from ifm

The technical solution was implemented using a wide range of ifm components. Central to the setup was the use of IO-Link sensors such as the OGD photoelectric distance sensor and the LT level and temperature sensor. Together with an IO-Link master and an EdgeGateway (AE2100), these formed the basis for data acquisition and processing.

The system was supplemented by a VSA005 vibration sensor and a VSE150 evaluation unit, specifically configured for vibration diagnostics on rolling element bearings.

"With the IO-Link sensors, we not only capture the slide position but also key parameters of the coolant. The core element, however, is high-resolution vibration diagnostics, which allow us to monitor the condition of bearings in detail," **Patrick Bonneval** continues.

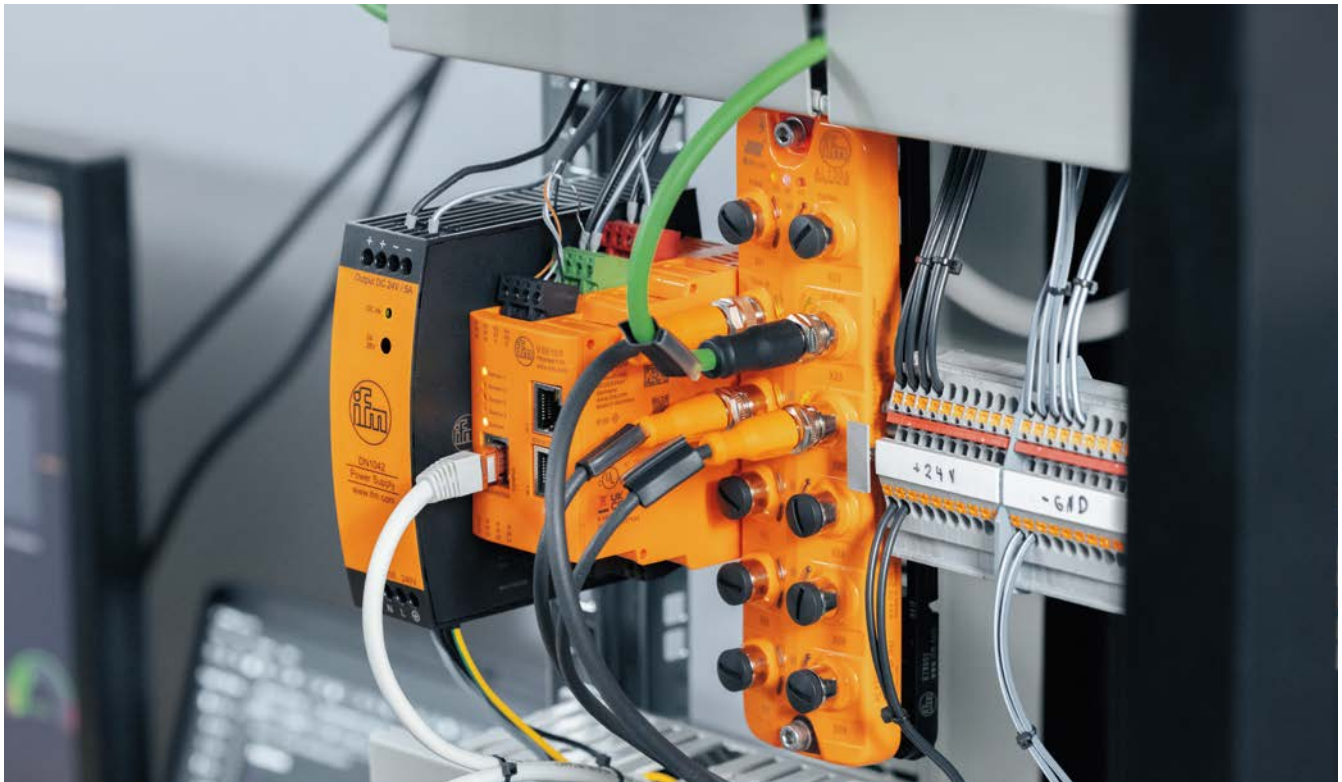
The 'ear' of the machine: the VSA005 vibration sensor captures the vibration spectra of all rolling element bearings in the machine drive.

Power supply, vibration diagnostic evaluation unit and IO-Link master in the machine's control cabinet.

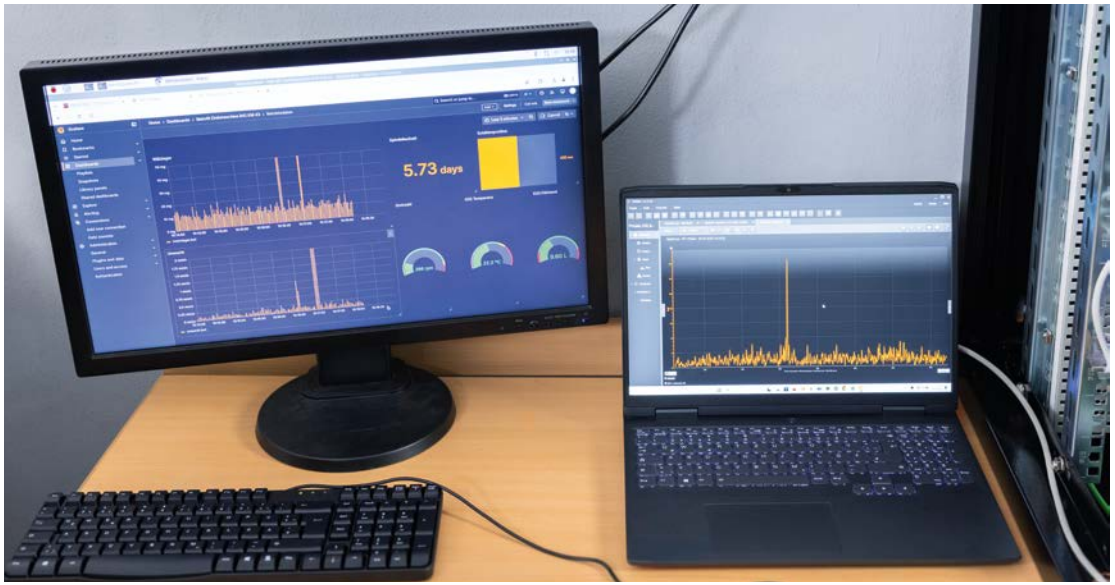
The integration of sensors into the existing machine was particularly efficient thanks to IO-Link. *"IO-Link saved us a great deal of work, since it is very straightforward to implement and allows uncomplicated system expansion,"* confirms **Pascal Heider**, state-certified technician at Heinz Nixdorf Vocational College.

The IO-Link master collects the data from the connected sensors and transmits it in bundled form to the EdgeGateway. The gateway also ensures secure separation of operational technology (OT) and information technology (IT).

"The EdgeGateway is the central data hub for our sensors," explains **Pascal Heider**. *"All data is collected here, pre-processed, and transferred to our server solution, a Raspberry Pi."* For example, the EdgeGateway converts the sensor's level values from centimetres to litres. On the Raspberry Pi, various software instances capture, process, and ultimately visualise the data.



In the EdgeGateway (right), all sensor data are consolidated, pre-processed and then transmitted to the server.



Operating and vibration data can be clearly visualised. If limit values are exceeded, an alarm message is generated.

The team: Tobias Kunze (ifm) and Dr Markus Steffens, Pascal Heider, Patrick Bonneval and Philip Bourgon (Heinz Nixdorf Vocational College).

Transparency, maintenance optimisation and future viability

Modernisation with ifm technology has delivered several key benefits. The machine is now capable of providing real-time data for condition monitoring and predictive maintenance. *"With continuous vibration monitoring, we can not only determine the precise condition of individual bearing components, but also effectively prevent unplanned downtime,"* explains Patrick Bonneval. The ability to detect bearing fault patterns early increases machine availability and significantly reduces the risk of production losses.

Students gain valuable practical experience

For the students, the project offered a unique opportunity to familiarise themselves with cutting-edge Industry 4.0 technologies and to gain valuable hands-on experience. *"Our aim with the retrofit was to show that even long-serving machines can be elevated to modern standards,"* summarises **Philip Bourgon**, state-certified technician at Heinz Nixdorf Vocational College.

The collected data now serve as a basis for students in automation engineering to perform spectral analyses and develop skills in condition monitoring in an industrial context.

The school also benefited from the cooperation: *"The idea for this project stems from our new technical college for automation engineering and digital production technology,"* explains Dr **Markus Steffens**, head of the technical college at Heinz Nixdorf Vocational College. *"Our goal was to create a learning platform where students can work with state-of-the-art sensor technology, data transmission, and data evaluation in a retrofit scenario. Thanks to the cooperation with ifm, this has been highly successful."*

Tobias Kunze, Director Regional Sales at ifm, emphasises the importance of close cooperation: *"We support our educational partners not only with hardware but also with technical support. This way, young talents can work directly with future-oriented technologies and gain practical experience."*

The seamless integration of the ifm solutions and the support in configuring the vibration diagnostics made a significant contribution to the project's success.

Conclusion

The retrofit project at Heinz Nixdorf Vocational College demonstrates clearly how intelligent sensors and modern data connectivity from ifm can sustainably bring existing machines up to Industry 4.0 standards. The collaboration not only promotes digital transformation in industry, but also delivers practice-oriented training concepts that equip future professionals for the demands of tomorrow.