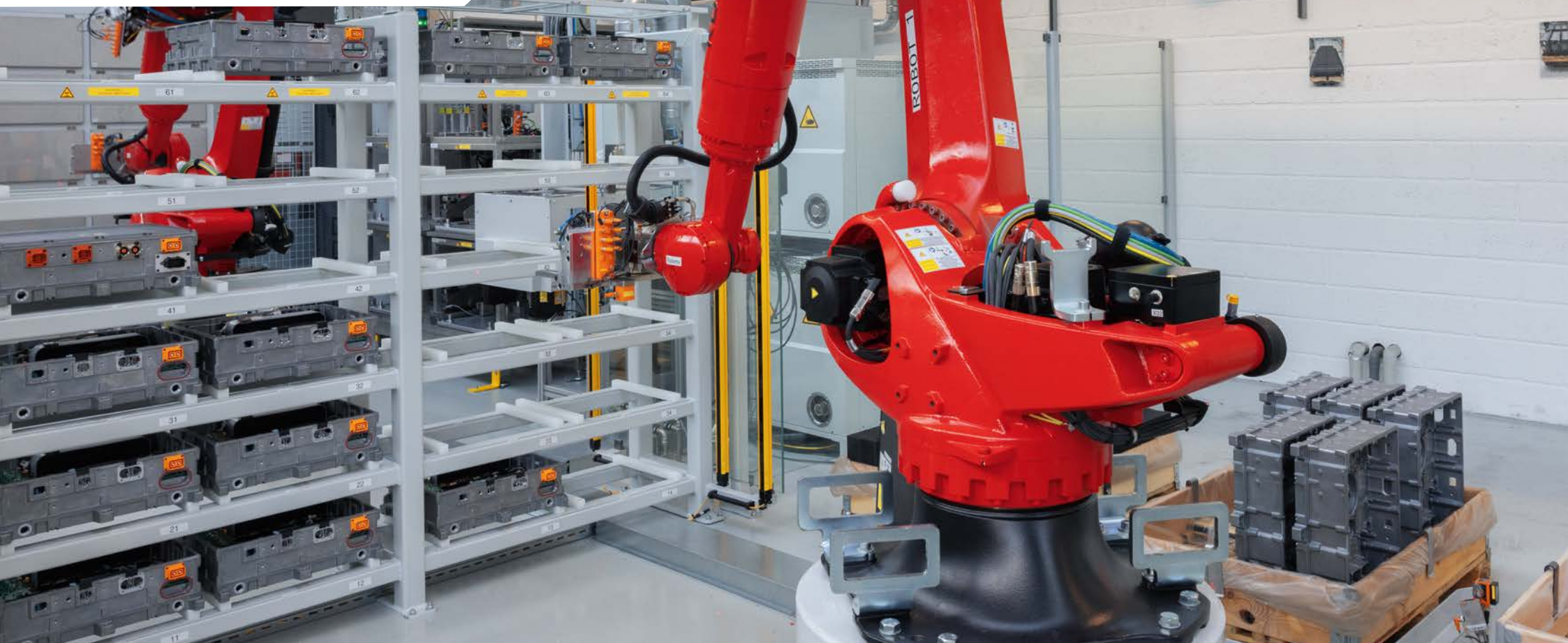# Danfoss
Digitalised production line

Flexibility right from the start

IO-Link for an adjustable production

Danfoss and ifm electronic are successfully working together to advance innovative automation solutions. One example of this partnership is their successful digitalisation of a new production line for robot-assisted assembly of onboard chargers for electric vehicles.

Danfoss is a Danish family-owned company founded in 1933 that today has production sites in more than 100 different countries worldwide. At its Norborg site, Danfoss manufactures products including powerful onboard chargers for electric trucks and construction machinery.

Mia Parsberg Brumvig, Head of Operations at Editron Danfoss, explains: *"Here in Nordborg we produce the ED3, an onboard charger for off-highway and on-highway applications. It's a three-in-one solution, with the distinctive feature that it delivers up to 44 kilowatts, twice the power of the market standard 22-kilowatt onboard charger. Compared to other*

> *The IO-Link system considerably accelerates assembly on the line because everything is connected by cables and plugs, making manual wiring unnecessary.*

onboard chargers, our 44-kilowatt AC charger reduces charging time by half. Our ED3 also features a 44-kW DC/DC and DC/AC converter that can power ancillary tools on the beds of lorries or construction machines, for example."

Challenges when setting up the production line
When planning the new production line for onboard chargers, Danfoss faced several challenges to find a future-proof solution.

"The initial planning of the production plant was rather tricky because the product hadn't yet been fully developed", explains **Karsten Fibiger**, Production Engineer at Danfoss. *"That meant having to think outside the box, because planning is particularly challenging when the precise size of the part to be produced is not known."*

These unknowns made it necessary to design a production line that could be flexibly adapted to meet new requirements. Danfoss opted for an Industry 4.0 approach with intelligent sensors to collect data for predictive maintenance and reduce the number of different sensor types.
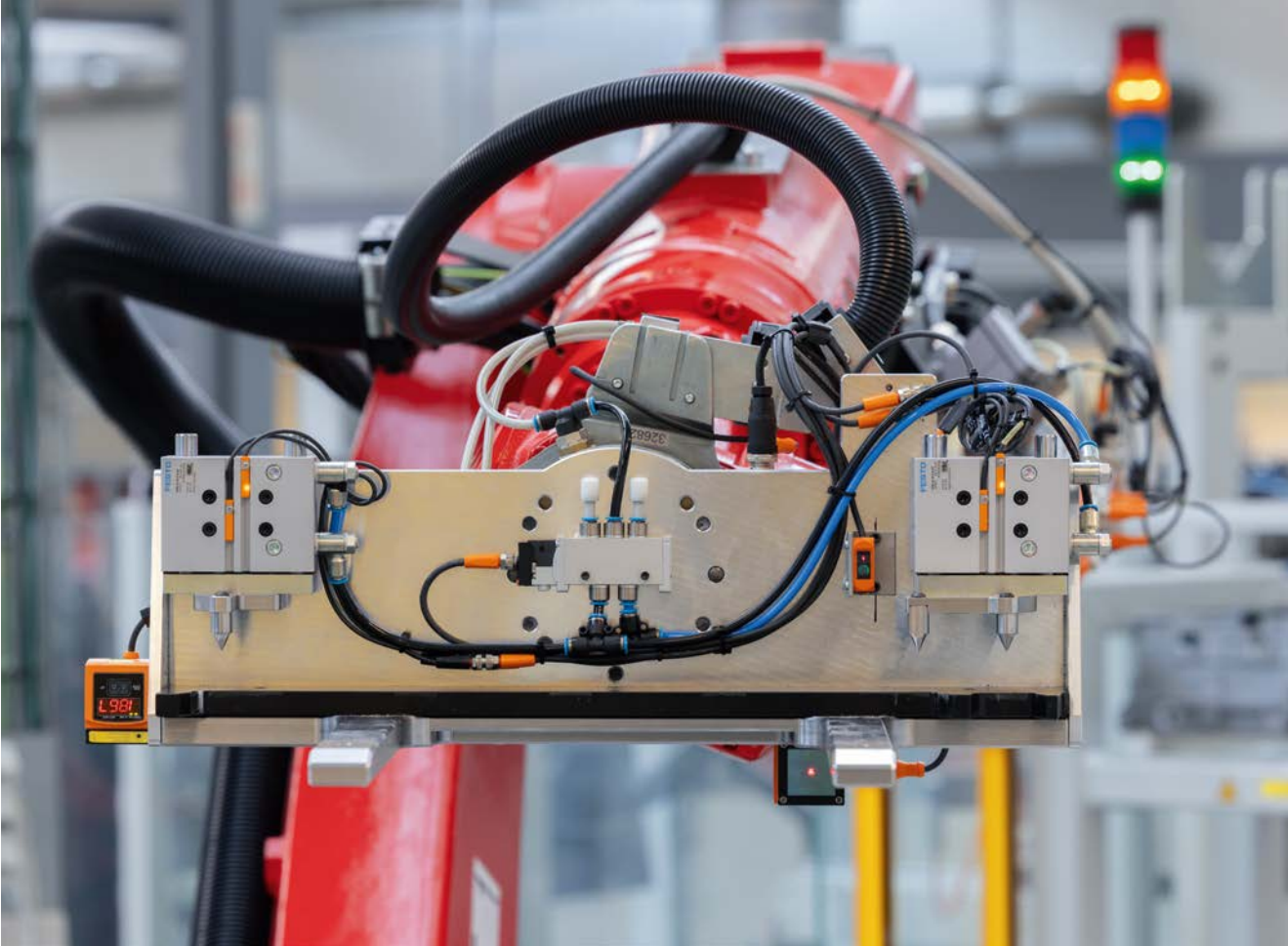
*Robots assemble the components
of the Danfoss ED3 onboard charger.*

The IO-Link module on the lifting tool connects all the sensors and actuators. Connection to the controller is by means of Profinet.

Danfoss deliberately opted for ifm as a one-stop supplier of sensors and automation components.

Karsten Fibiger: *"I deliberately aimed for a single supplier for the entire system because it is simpler to have just a few components from one manufacturer in stock, rather than having to stock numerous variants from different brands. And I knew that ifm had the IO-Link sensors I needed for this system. Therefore, I chose ifm as the supplier for the entire production line."*

Karsten Fibiger: *"One of our aims was to collect data from all the sensors in order to be able to take predictive maintenance measures before a malfunction could occur. Furthermore, using intelligent sensors meant that fewer different sensor types were necessary because the measuring range and the switch points, for example, can be adjusted in the sensor."*

A further challenge was to transmit the numerous signals from the sensors and actuators mounted on the tool change heads via contact surfaces to the robot arm, and from there to the controller. This complex task required an innovative solution that is both efficient and reliable.

Intelligent automation solution through IO-Link

Working closely with ifm electronic, Danfoss developed an intelligent automation solution based on IO-Link.
"We carried out numerous tests together with ifm to determine which IO-Link modules could be positioned together to enable us to change the heads at the end of the robot arm using only three cables", explains Fibiger. *"And it worked: it posed no problems, and the test was successful."*

This solution simplified the processes considerably and helped increase the production line's efficiency. The successful implementation of IO-Link demonstrates the importance of close cooperation between partners when it comes to developing innovative solutions.

Using IO-Link considerably accelerated installation on the line. Cable connectors can now be plugged in instead of manually screwed in, which also simplifies system extension. This simplification of the processes led to considerable time-saving and higher production flexibility.

Karsten Fibiger: *"The IO-Link system considerably accelerates assembly on the line because everything is connected by cables and plugs, making manual wiring unnecessary. And extending the system was also very easy because we could simply install another IO-Link module and then add up to eight more sensors to the line. In view of the fact that we didn't know exactly what the production line should look like, IO-Link offered us maximum flexibility."*

The finally assembled ED3 onboard charger.

In this kind of electric truck, the Danfoss onboard charger charges the drive batteries and supplies their AC and DC devices with power.

> *The use of optical time-of-flight sensors instead of standard sensors in the oven meant we could solve that problem and save ourselves future maintenance work.*

Clever use of sensors

In some places, special ifm sensors were used to solve challenges elegantly. For example, time-of-flight distance sensors on the robot head enable non-contact checking of whether there are parts in the hot oven without exposing the sensors to the heat.

"We concluded that it is better not to have sensors in the oven because it is quite difficult to find sensors that can constantly withstand the high temperatures", explains **Fibiger**. *"The use of optical time-of-flight sensors instead of standard sensors in the oven meant we could solve that problem and save ourselves future maintenance work."*

This solution demonstrates how intelligent sensors can be used to prolong component service life and reduce maintenance requirements.

Another example is the use of moisture sensors when drying components after water tests. Instead of estimating the drying time and wasting compressed air, Danfoss can now measure the actual residual moisture. This enables more efficient use of resources and higher production accuracy.

By using an ifm distance sensor to carry out level measurement in a chemical bath, it was possible to replace unreliable float switches. This solution helped increase process reliability and reduce production costs.

Reliable partnership with a future

The collaboration between Danfoss and ifm electronic demonstrates how even complex automation tasks can be solved efficiently by means of innovative sensors and intelligent networking. The reliability and flexibility of ifm products allowed Danfoss to develop a future-proof production line that meets the needs of modern industry.

"The integration of ifm into our MES system also works very well. It's simply plug and play", says **Anders Abildtrup Jørgensen**, Manufacturing IT Engineer at Danfoss, summing up. *"If we have a problem that an additional ifm sensor can rectify, it can be simply plugged into the IO-Link module and will then usually function after only minimal configuration adjustments."*
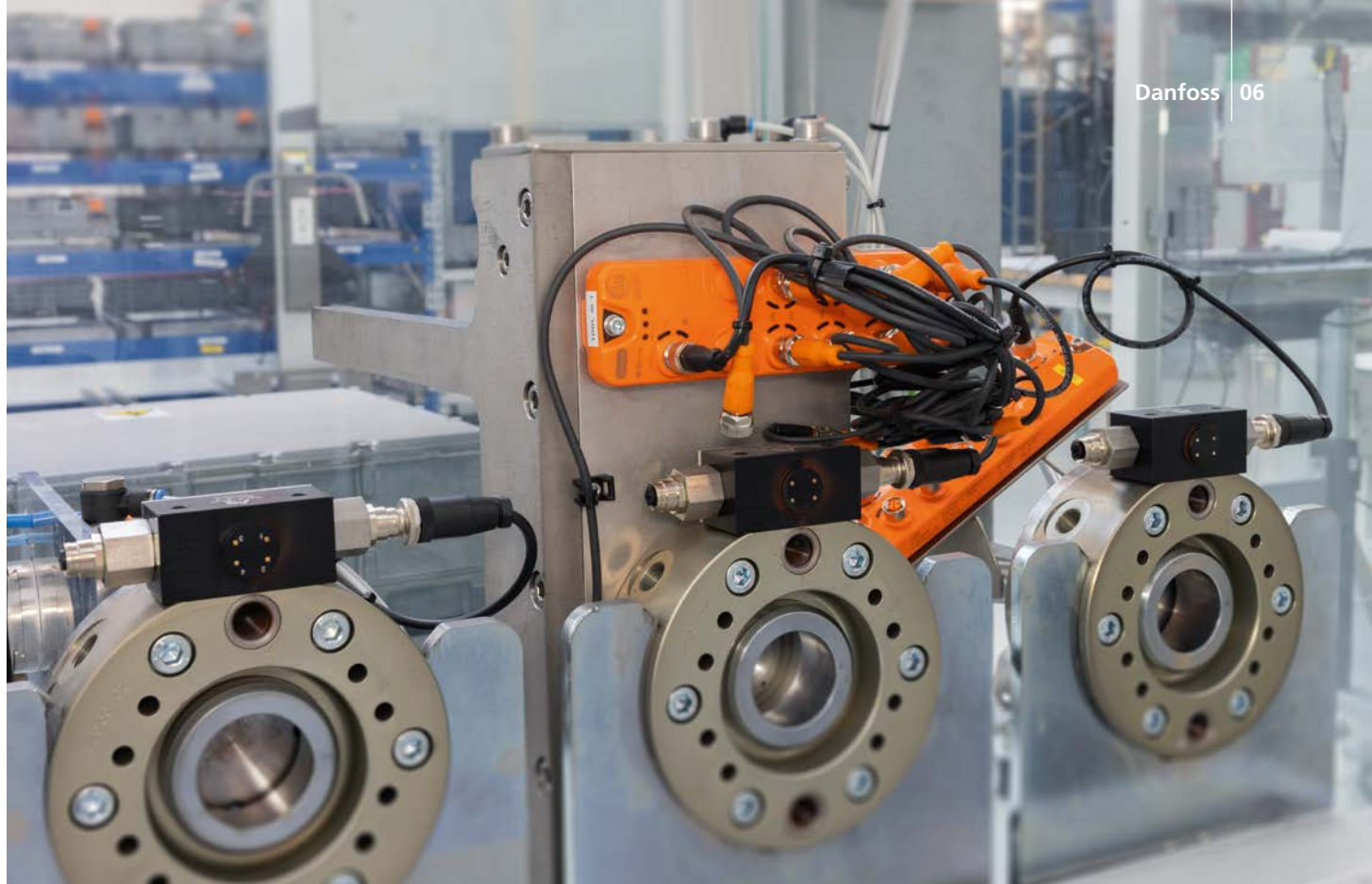
The robot independently changes the different heads during assembly. IO-Link ensures that all the signals are bundled and transmitted by Profinet via four contacts.

This simplicity and the high level of product reliability are decisive factors when it comes to efficient plant operation. And ifm's service and support was also impressive in every respect. If there were any problems, ifm always provided Danfoss with quick, professional support and detailed suggested solutions. This quick, competent support helped to smooth the production processes and keep potential downtimes to a minimum. The company now plans to continue the successful partnership with ifm in installing further production lines. This long-term collaboration demonstrates the importance of strong partnerships to achieve success in modern industry.

Conclusion

The combination of innovative technology, reliable products and close cooperation enabled Danfoss to create a production line that not only meets today's demands, but is also equipped to meet future challenges. The partnership with ifm exemplifies how, through joint effort and the use of modern technologies, sustainable solutions can be developed that offer real added value.