



Batch size 1 – setup time 0

In almost all conversations with production managers and those responsible for production, this question inevitably crops up: “So when will I be able put Industry 4.0 to use?” The answer to this always depends on what the production specialists want to achieve. Many ideas can already be implemented today with intelligent automation solutions: automatically documenting quality in large-scale production, reducing manufacturing costs by means of shorter transportation times and simplified workstations or a varied assembly without setup times. Solutions from Bosch Rexroth with the intelligent [transport system FTS](#) satisfy precisely these kinds of requirements.

Analog transport digitalized

The principle is simple: in a conventional assembly line, a conveyor belt carries all workpieces at a consistent speed through the process. At each station, the workpiece pallet is removed from the belt, processed and then placed back onto the conveyor belt. The logical consequence: the speed of the belt depends on the process step that takes the longest. If the belt moves faster, this results in backlogs. Not to mention the many purely mechanical factors, such as the exact positioning of the workpiece pallets. For this, the workpiece pallet must be stopped and indexed by another mechanical lifting device. This approach wastes valuable time without minimizing the complexity of the processes e.g. [three-axis handling](#).



FTS, a modular transport system with its own intelligence, is completely different. It works according to the linear motor principle. The linear motors are integrated in the transport route, on which as many workpiece pallets as required move contactlessly with magnetic discs affixed underneath. Each workpiece pallet can be controlled individually, moved in both directions and positioned with an accuracy of up to 20 μm . And all that with maximized dynamics and without wear. FTS shortens cycle times by shortening the unproductive transport and positioning times. The proven process steps remain unchanged.



Above all, FTS shifts the entire mechanical optimization into the software. The system controls the acceleration and speed at which each workpiece pallet moves between two stations individually. The work preparation can optimize these movements completely offline with simulation programs and copy the result simply through network connection to the FTS controls. An analog conveyor belt is replaced with a fully digital transport system which reduces the manufacturing costs by means of interconnectivity.

Significantly higher output in practice

The Bosch plant in Ansbach has for instance introduced FTS for the assembly of ABS and ESP systems. As a result, the plant was able to significantly increase its output without changing any process steps. This has several reasons. On the one hand, the most time-intensive process no longer determines a consistent transport speed. After each station, the workpiece pallet travels with maximum acceleration to the next station. At the same time, lifting off the belt is eliminated at most stations. FTS positions the workpiece pallets directly with a repeat accuracy of 20 micrometers – a human hair is three

times a thick. This means most stations only need two axes instead of three, which saves investment costs. An intelligent layout with several parallel stations for the longest processing step reduces bottlenecks at this position and decouples this processing time from the throughput time at the other stations – a practical use of interconnected production.

Documented quality

Because each position is known precisely at all times during the process, this data can flow into the quality documentation. Open standards such as OPC UA ensure seamless machine-to-machine communication. Users do not have to program any interfaces in a PLC in order to access the data. FTS can also be integrated into external controllers as a slave via Sercos, EtherNet/IP, EtherCAT, PROFIBUS and PROFINET.



Varied assembly

In many sectors and applications, companies increasingly want to produce tailored products in small batch sizes. FTS facilitates this as well thanks to decentralized intelligence. When feeding into the process, an [RFID chip](#) on the workpiece pallet identifies the product to be produced with all production steps. The MES system, for instance OPCON from Bosch, links this information with the configuration saved in the order. The FTS uses this data to position each individual workpiece in accordance with the specific requirements. Result: Zero setup time even with batch size 1.



Simple application

This is extremely interesting for production specialists, particularly when they see how easily it can be implemented in practice. Technicians simply have to parameterize pre-

programmed software components and that's it. Even in terms of hardware, FTS is extremely scalable: From solar cells weighing just a few grams or electronic circuits, right up to refrigerators or automotive parts weighing over a tonne – the FTS is always as big as the application requires.

Economical brownfield approach

The experiences from over one hundred [Industry 4.0](#) projects in the Bosch Group show that the brownfield approach is particularly economical. Here, the available machines and equipment are integrated into interconnected concepts. This also works with the modular FTS. Users can first modify transport routes individually in order to gain experience. Once this step has been taken, it never really takes long until the entire line has been converted to FTS, because this enables plant managers to quickly and intelligently reduce assembly costs and increase output.