

MOTION

Intelligent transport for production lines

To square the circle of reconciling mass production with batch-of-one production, enterprises need highly flexible manufacturing systems that are also efficient and profitable. B&R's ACOPOStrak intelligent transport system →1 promises to deliver just that. B&R became part of the ABB group in 2017.

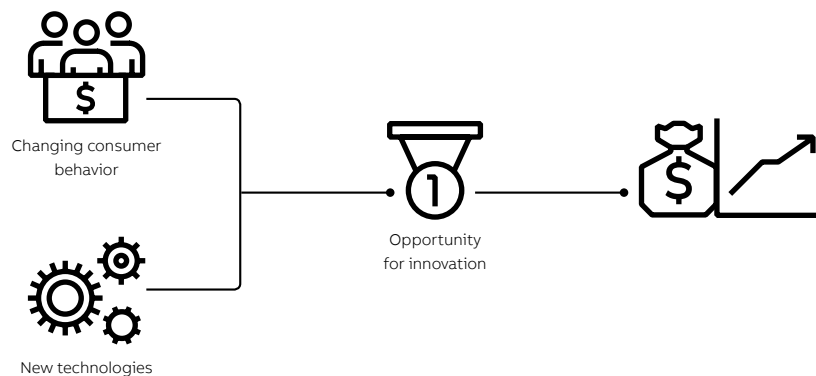


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For today's generation of digital natives, the ability to personalize the products they buy is increasingly a given. To keep pace with this rapidly changing situation, the makers of these products need highly flexible manufacturing systems that are, at the same time, efficient and profitable. This introduces a whole new set of demands on plant infrastructure.

Batch-of-one production is nothing new – in fact, it is standard practice in many craft businesses. What is new, however, is the idea of making customized products under mass-production conditions. So far, this has proven difficult to implement in a way that is economically viable. That is because any increase in system flexibility is usually accompanied by a reduction in overall equipment effectiveness (OEE). In short, individualization becomes unprofitable.





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01 The ACOPOStrak intelligent transport system will fundamentally change the way production lines are designed and operate.

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02 The convergence of new technologies and growing demand for personalized consumer goods creates new opportunities for adding value.

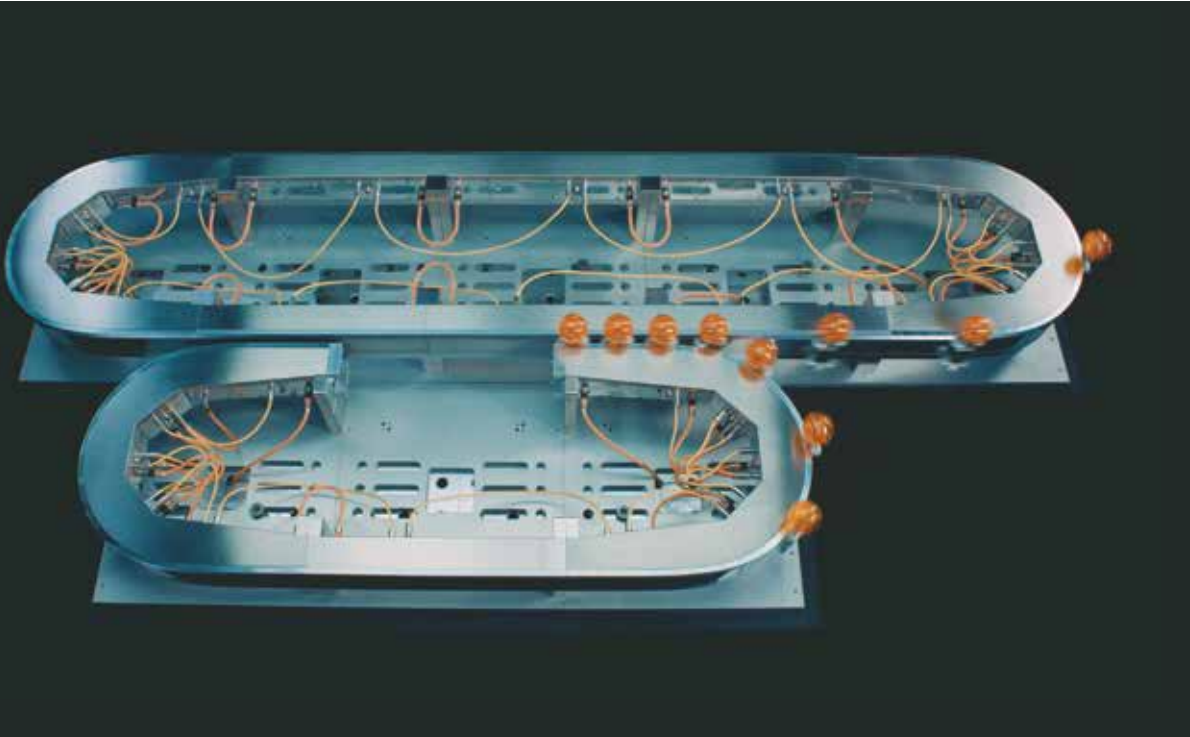
The goal of mass customization is, therefore, to keep the three factors of OEE – availability, performance and quality – at a level consistent with what can be achieved in mass production. In addition, manufacturers seek to maximize their return on investment (ROI) and to minimize their time to market for new and improved products. This is the only way to make mass customization viable from an economic perspective →2.

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ACOPOStrak is an intelligent transport system whose revolutionary design enables adaptive manufacturing systems and promises a new era in flexible and efficient production.

Up to now, developing flexible manufacturing systems has been a tedious process. In many cases, problems are not seen until the system is up and running. At that point, fundamental changes to the machine design can extend the time to market by months, which is a costly affair.

ACOPOStrak intelligent transport system

If flexible manufacturing is to match the increasing demand for true mass customization and batch-of-one production, then new approaches to mechanical design and motion control hardware must be conceived. Breakthrough innovations in these two areas are at the heart of ACOPOStrak – an intelligent transport system whose revolutionary design enables adaptive manufacturing systems and promises a new era in flexible and efficient production. ACOPOStrak was developed by B&R Industrial Automation GmbH, an Austrian company recently acquired by ABB.



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Diverter maximizes OEE

So, what is it that makes the intelligent transport system so uniquely suited for automating adaptive processes? The answer lies with the diverter. The diverter is – quite literally – a pivotal component of the system. It is 100 percent electromagnetic, so does not require any additional components, as a diverter-less transport system does, and is, therefore, entirely free from wear. Like a highway junction, the ACOPOStrak diverter lets product flows diverge and converge and allows the shuttles that carry the product components to switch tracks at full speed with no compromise in productivity →3.

The ACOPOStrak diverter allows mass-produced items such as bottled beverages, for example, to be grouped on-the-fly into custom six-packs – three of one flavor, two of another and one of a third – without any changes to the hardware →4. To sustain high quality, lines must be able to react to faults and defects in real time – without compromising the production process. Defective products need to be rejected on the spot, while maintaining full production speed. If a defective item is not sorted out immediately following quality inspection and is instead permitted to continue down the line, it may eventually become necessary to scrap an entire job lot of products. The ACOPOStrak diverter allows defective products to be sorted out as soon as they are identified.



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— 03 ACOPOStrak's purely electromagnetic diverters divide and merge product flows at full production speed.

— 04 Mass-produced items such as bottled beverages can be grouped into custom six-packs on-the-fly.

— 05 To switch products, the operator simply places the wheels of a new shuttle on the guides of the pit lane, while production continues at full speed.

Parallel processing

ACOPOStrak and its diverters also add a new dimension of flexibility for implementing parallel processing. A product flow can be divided, pass through multiple processing stations and then converge further down the line. This way, production speed is no longer throttled by the station with the slowest processing time – the end customer can increase productivity without a corresponding increase in machine footprint. In other words, ACOPOStrak boosts the output per square meter, which, ultimately, means a higher ROI.

— ACOPOStrak and its diverters also add a new dimension of flexibility for implementing parallel processing.

A machine or line built using ACOPOStrak gives the modularity and flexibility needed to add individual track segments and processing stations in response to changes in demand; the truly adaptive, scalable machines envisioned for the industrial Internet of things (IIoT) has become reality.

ACOPOStrak-based manufacturing systems are also exceptionally fault-tolerant. If there is a problem with one valve in a bottling line, the bottles are simply no longer sent to that valve. The defective valve does not result in waste, which makes a big difference in the OEE quality factor.

Zero-downtime changeover

The hot-swappable shuttles can be replaced tool-free and on-the-fly for unprecedented availability. When switching products, all the operator has to do is place the wheels of the new shuttle on the guides. The shuttles are held on the track purely by permanent magnets. Changeover and service can be made even more efficient by including a pit lane in the track layout: The new shuttles are mounted in the pit lane and then channeled to the track's production lines via a diverter →5. In the same way, any shuttles that are no longer needed can simply be rerouted to the pit lane. All of this takes place at full production speed.



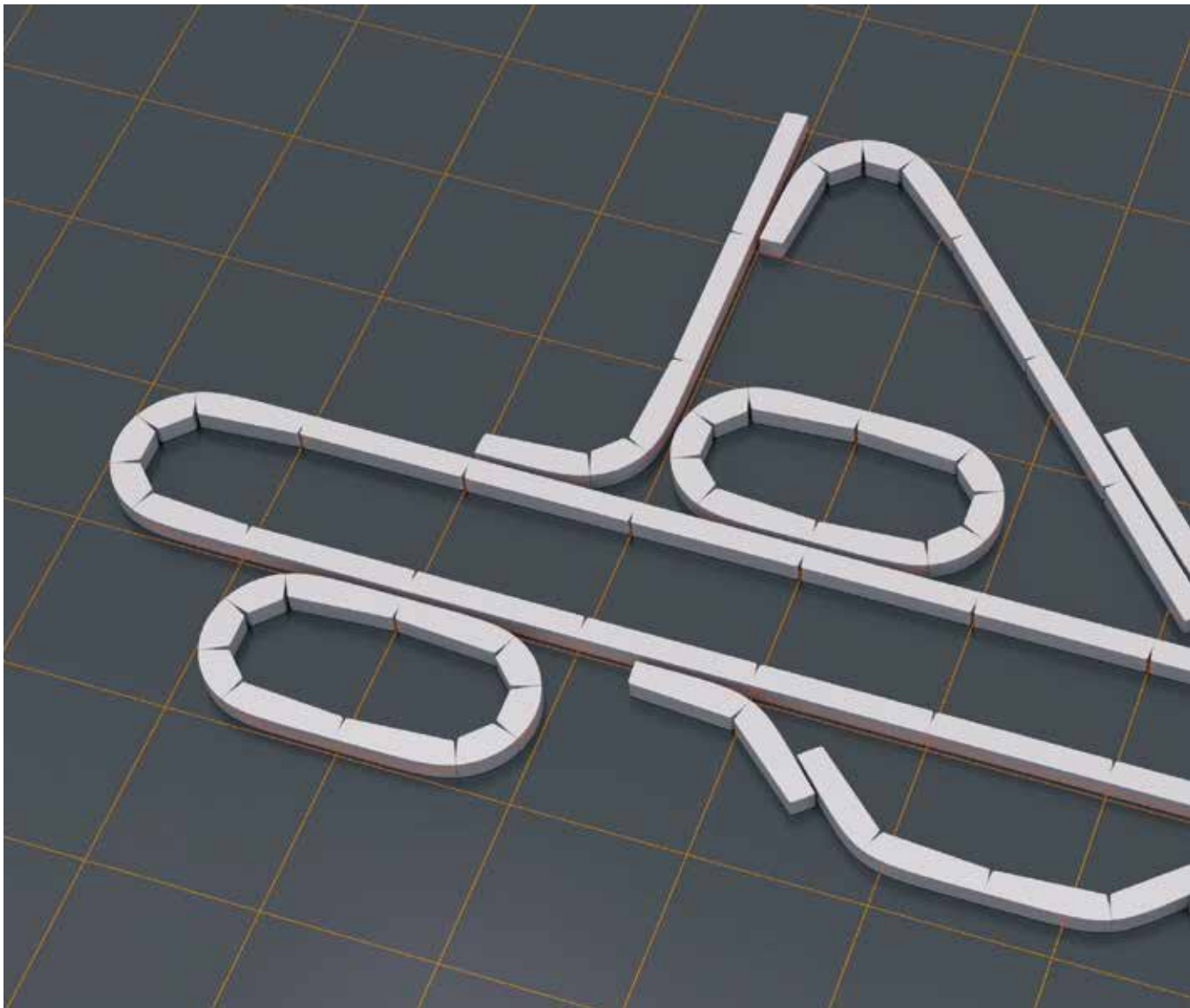
ACOPOStrak's absolute design flexibility allows it to morph into all types of open and closed layouts by arranging the segments in different combinations on a grid →6. The core of the track system is a linear motor assembled from four types of modular segments: a straight segment, a 45° segment and two 22.5° segments – one curved to the right, the other to the left.

Scaling is also simple. In most cases, a conventional manufacturing system does not scale easily: To increase output, it is often necessary to either add a second line or replace the existing line with a larger one. These options require considerable investment and eat up valuable floor space. ACOPOStrak's design flexibility does away with this scalability problem once and for all. If the line also allows one to add and remove stations on site, that opens up yet more possibilities to adjust capacity to changing demand.

Highly dynamic and flexible

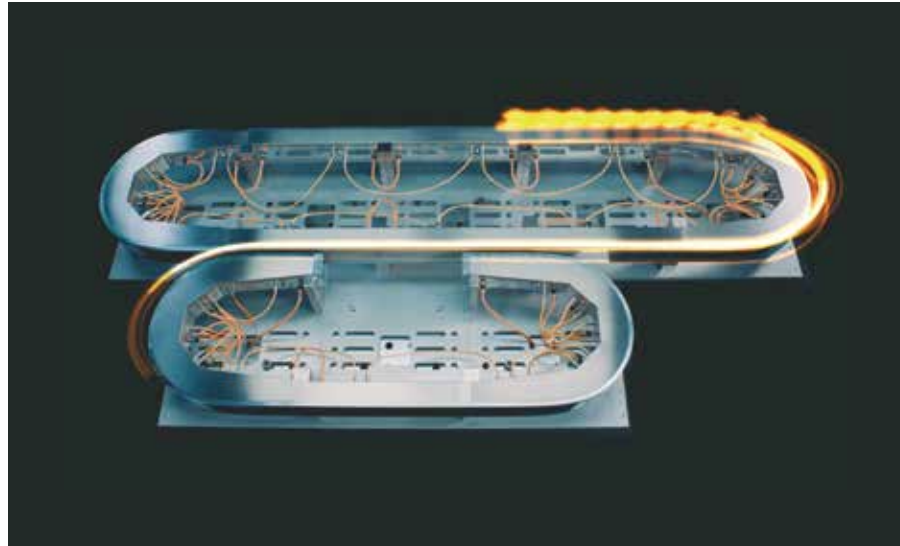
The intelligent transport system offers more than just flexibility - it is also unmatched in performance. ACOPOStrak is capable of over 5 g acceleration and reaches top speeds in excess of 4 m/s with a minimum product pitch of only 50 mm →7.

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Faster time to market

B&R provides an extensive range of software functionality to get ACOPOStrak up and running with minimal time and effort. The same application code can be executed in simulation or on the actual hardware with no limitations.

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Developers benefit from process-oriented programming: They simply describe the rules that define the product flow on the track, rather than having to program a multitude of axes and shuttles individually.

Developers can switch back and forth between simulation and real hardware as often as necessary. This shortens development and commissioning times considerably and thus gives a significant advantage in terms of time to market.

Developers also benefit from process-oriented programming. They simply describe the rules that define the product flow on the track, rather than having to program a multitude of axes and shuttles individually. Autonomous traffic control with integrated collision avoidance takes further work off the hands of developers.

With ACOPOStrak, B&R has designed a solution that makes flexible, modular manufacturing systems highly profitable to operate. ACOPOStrak enables high OEE, attractive ROI and short time to market. And with that, the industry is on the fast track to true mass customization. ●

