

*Bosch Rexroth's ActiveMover, one of the newest generation of conveyors and transport systems, incorporates features that can enable new levels of automation for medical device manufacturing.*



# Conveying & Transport in Medical Device Manufacturing

## Five factors for selecting Automated Transport Systems in Medical Device Manufacturing

Today's medical device manufacturing industry is highly competitive. Producing sophisticated, high-value equipment, ranging from pacemakers and hearing aids to respirators, portable oxygen delivery systems and mobile x-ray machines, medical device manufacturers are constantly seeking new technology, processes, and systems to help meet key operational and business goals. These include boosting productivity and throughput, reducing waste and sustaining the highest level of product quality and reliability.

Recently, new automated conveyor and transport systems have been introduced to manufacturing and assembly industries that can help meet these goals. The latest generation of conveyance systems features new capabilities that can facilitate higher levels of automation for medical device manufacturing. This article will explore some of these capabilities and provide some considerations when evaluating and selecting a new "smart conveyor."

## BALANCING QUALITY AND EFFICIENCY IN MEDICAL DEVICE MANUFACTURING

Medical device manufacturers often face some of the most challenging operating requirements anywhere, including: short product runs and shrinking product life cycles; complex products that require multistep, precision assembly; small, sensitive components that must be handled delicately; and strict cleanliness and environmental controls. In addition, manufacturing processes for these products are often highly regulated, requiring detailed documentation of assembly procedures as well as rigorous quality control of operations.

Like other leading industries, one of the ways medical device manufacturers overcome these challenges is by implementing effective lean manufacturing techniques to identify and remove waste in their processes. Manual production and assembly processes are sometimes the best fit for manufacturing certain kinds of medical devices, with little or no automated material transfer or conveying systems needed. These are products with low or uncertain production quantities, or where demand for different products is uncertain, so that the production mix has low predictability.

As the product mix becomes more predictable, with longer product runs to satisfy increased demand, automated production becomes a more viable option if it helps manufacturers increase process reliability and cut costs to recoup the investment in automated transport. In the past, the idea of using conveyor systems in lean production environments was often rejected; it was thought that they were too inflexible and could potentially lock inefficient production processes in place, preventing effective lean efforts to eliminate waste.

Today's flexible conveyor systems go far beyond that and are instrumental in minimizing waste in low-mix, medium-to-high-volume production, commonly found in many medical device production applications. By combining speed with integrated parts tracking, precision workpiece holding, and ergonomically correct work positioning, well-implemented conveyor systems are a key piece in the lean factory.

### OVERVIEW OF CONVEYOR TYPES

Depending on the type of medical device being produced, there is a range of conveyor systems used in these operations. In fact, Bosch Rexroth offers a broad family of conveyor and transport systems, with an array of conveying media and drive options, including:

- The broad TS family of modular pallet-based conveyors
- The VarioFlow plus plastic chain conveyors
- The new ActiveMover linear transfer system



*The variable and flexible positioning of each workpiece pallet means device manufacturers can custom-configure the motion of each pallet to suit product-specific assembly requirements.*

For medical device manufacturers, two of the most common systems used are twin-strand conveyors and plastic chain conveyors. These systems can transport loads of 10 kilograms or more, which satisfies the requirements for a broad scope of medical device and medical kit production operations. Typical transport speeds are 10 to 12 meters per minute and use diverters to offload products or components at workstations or assembly systems.

Conveyors like the Rexroth TS family and VarioFlow plus are powered by AC motors turning at a constant speed, moving products in one direction. Products are transported in totes or on pallets and are delivered to set points along the length of the conveyor through mechanical or pneumatic stops or diverters.

Tracking products on the system often involve attaching RFID tags, either directly to the product being transported or to a tote, which may contain multiple items and add complexity to tracking. This is a crucial concern for medical device manufacturers that must meet regulatory requirements for tracking and documenting how every component in every device was handled, integrated, and tested throughout the production process.

These standard conveyors tend to “lock in” the speed and flow of manufacturing, with throughput determined by the upper limit of the conveyor. That is why these types of conveyors are most valuable for device manufacturing operations with longer, more predictable product or model runs and relatively high rates of throughput.

### ACTIVEMOVER SYSTEM OFFERS NEW BENEFITS

New material transport systems are now available that are redefining the capabilities and potential of conveyors. One of the most important advantages they offer is that

they are engineered for greater flexibility, precision, speed, and process control. These systems fit many newly emerging needs incurred by some of today’s medical device manufacturers. They may need to move products through different assembly steps much faster, or they may need to vary the speed, and in some cases the direction of movement, to serve unique production requirements.



*Stop positions can be configured in software anywhere around the system, even in curves. ActiveMover features integrated measuring systems that enable for precise indexing of the pallets, eliminating the need for additional lift-and-locate units.*

One of the most innovative examples of these types of new conveyor system is the Rexroth ActiveMover transfer system. It is a linear motor transfer system that offers a unique combination of speed, precision, and load capacity that can increase manufacturing process quality, productivity, and profitability with every single workpiece.

### KEY FACTORS FOR EVALUATION

Systems like ActiveMover support much faster throughput and more efficient use of costly manufacturing floor space and can more easily track material transport activities and communicate that data to plant management systems for documentation and analysis purposes. With these new conveyance capabilities, it’s important for medical device manufacturers to consider five key factors as they select the best solution for their needs.

**Innovation:** The ActiveMover system replaces the typical belt or chain associated with standard conveyors with a revolving linear motor with a vertically mounted workpiece pallet. The motion of each workpiece pallet – how fast it goes, where it stops – can be individually defined, and the system even supports reverse movement of the pallet, when needed. This kind of flexible motion ensures that manufacturers gain the

major benefits of automated transport without being locked into some of its drawbacks.

**Precision:** Systems such as ActiveMover also offer a new level of endpoint precision with highly repeatable, individual stopping points of  $\pm 0.01$  millimeters. Stop positions can be configured in software anywhere around the system, even in curves. It’s important to choose a system featuring integrated measuring systems that enable precise indexing of the pallets, eliminating the need for additional lift-and-locate units.

This variable and flexible positioning of each workpiece pallet means device manufacturers can custom-configure the motion of each pallet to suit product-specific assembly requirements. The precise control provided by the linear motor also means there is virtually no loss of time for positioning the pallet in front of each workstation.



*With Bosch Rexroth’s ActiveMover AMpro Software, customers can design and build their systems virtually prior to receiving their hardware, thus eliminating start-up time. The virtual ActiveMover can interface with nearly every PLC and will respond the same as the physical system.*

**Speed:** Linear motor-driven systems like ActiveMover combine versatile motion with transport speeds up to 4 meters per second, significantly faster than many standard conveyors. In addition, workpiece pallet changeover time is under one second. And since each pallet is independently programmable, its position can be tracked and documented with 100% accuracy. Faster throughput and tight, pallet-level tracking can increase productivity, thereby helping reduce cycle time and manufacturing costs.

**Robust design:** These types of systems also pack a lot of functionality into tight footprints: some installations have replaced multiple conveyors with a single linear transport system and saved nearly 40% of the plant’s floor space. They feature a powerful drive with up to 160 N per pallet and incorporate both 180-degree and 90-degree curve modules to enable increased variation in transport system layouts.

Also, the transport system should support interfaces for many high-speed automation busses, such as ProfiNet and Ethernet IP, and EtherCAT. These interfaces allow easier integration with a device manufacturer's existing machine communications backbone, as well as connecting to edge-computing devices.

**Technical support:** One of the critical capabilities to assess when selecting conveyor transport systems is the technical support and simulation capabilities available for designing the system and programming its operations – even before the hardware comes into play. Rexroth's ActiveMover AMpro system is a good example. This simulator allows users to create a "digital twin" of their machine that can: calculate power consumption; determine cycle time and the number of pallets and power units their system will need; and fully program the system, defining motion sequences, stop positions, move configurations and many other system functions.

These end user simulation and configuration tools can make it much easier for medical device manufacturers to implement the latest technologies without going through steep learning curves.

## SMART USE OF AUTOMATION

Medical device manufacturers are making smarter use of automation to improve manufacturing productivity and flexibility. This latest generation of material transport system offers a valuable tool that is relatively easy to implement and provides an easily reconfigurable transport system that lets manufacturers adjust their production processes built around the system with minimal cost and time required.

Manufacturers who have installed this type of transport system have been able to dramatically improve productivity and reduce cycle time. The ability to independently program each pallet, varying its speed and direction, gives assemblers and manufacturers a powerful new tool to keep their production fast and lean as they respond to the needs of their markets and customers.

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