



Integrated *Robotics* in packaging machines

Unveiled at Interpack, the Packer demonstrates once again that B&R remains at the forefront of innovation when it comes to highly-dynamic motion control applications where individual axes, cam profiles and robotics must be synchronized with the utmost precision. Designed solely for demonstration purposes, the Packer was developed, built and programmed specifically to showcase B&R technology. Integrated into the machine are the absolute latest machine concepts for handling, image processing, safety technology, control and monitoring.

Generic Motion Control: Packaging process and robotics application integrated on one CPU

Three different robots – an articulated arm robot, a tripod robot and a Cartesian coordinate robot – with completely different kinematic characteristics are synchronized along a rotary table to pick up and package golf balls transported along the table's perimeter. The complete system, which includes 15 axes as well as the process control and visualization, is oper-

ated using a single CPU, in this case an industrial PC. The different kinematics exhibited by the three robots are also seamlessly integrated into the controller, with the open interface making it possible to implement any type of customer-specific kinematics. With its flexible interpreter, either standard commands can be used to program different sequences, or user-defined commands can be created that are more relevant to the process at hand. This is one way to drastically reduce the time needed to create the sequence program for the handling system.

Deterministic real-time communication with ultrafast POWERLINK

The various mechatronic modules and stations used on the Packer are connected on a single POWERLINK communication line, which also allows optional machine



A corresponding video can
be found here:

www.automotion.info

modules to be added or removed during operation. When this occurs, the new configuration is automatically detected on the network, with the necessary software enabled or disabled as needed. The axis drives controlling the handling robots are completely integrated into the comprehensive motion concept in use throughout the machine. Process and handling drives can also be operated in a compact, cost-saving module directly next to one another. The set-point for the handling axes is specified in the central machine controller using Generic Motion Control. This is also where both the robot data and the process data are processed using a shared database – completely transparently and fully synchronized. This completely does away with bottlenecks between the machine and the robots that used to exist with bus couplings in traditional solutions. Transparent data storage makes it possible to add new machine functions that were previously impossible to implement due to communication delays caused by the bus transfer cycle. This allows the handling procedures to be optimized to the processing task at hand, thereby further increasing machine throughput and overall availability. Having to pay for a separate robot controller, a separate robot control cabinet and an interface for communication has become a thing of the past.

Generic Motion Control: Synchronous motion control with your choice of drive technologies

Employing stepper motors, variable frequency drives and servo drives, the Packer demonstrates several different types of drive technology in a single network. This makes it possible to use various technologies where they can be the most effective. For example, AC servos and linear or rotary direct drives can be used when dynamic and highly precise movements are needed. Stepper motors – either with or without feedback – are the perfect choice as small direct drives or for adjusting formats. Frequency-controlled asynchronous drives, which are also fully integrated into the programming system, are a low-cost solution when absolute precision or dynamic behavior is not essential.

The dynamics and synchronicity of the drives afforded by General Motion Control not only increases the quality of the product, but also machine throughput as well. Format changes can be easily executed on the fly. All of the different drives in the drive network run on equal footing with the same source code. Because the type of drive to be used can be freely selected right up until commissioning takes place, the machine manufacturer enjoys a maximum degree of flexibility. The seamless integration of all drives using Generic Motion Control allows complete scalability in both technology and performance. In addition, programming times are reduced because all of the drive variables in the programming system are transparent and available immediately. »

The fastest response times and maximum productivity with openSAFETY

Visitors can interact directly with the machine via an entry point equipped with a light curtain. Once an approaching operator is reported to the machine by the light curtain, the machine immediately reverts to an operating mode with a safe speed. Direct, decentralized POWERLINK communication, which connects all of the safety components to the centralized SafeLOGIC controller via the openSAFETY protocol, ensures an immediate response from the machine. Over 20 different safe motion control functions are available that can be used to implement safe drive applications. They are helpful in speeding up the setup process for the safe operation of robots as much as possible. One of these, Safely Limited Speed at the Tool Center Point (SLS@TCP), is demonstrated by the Packer. Here, the positioning data of each robot axis is transferred to the SafeLOGIC controller. The current speed of the robot gripper is calculated in the safety application based on the robot kinematics in use. Unlike safely limiting the speed of each individual robot axis, the constant exploitation of the maximum permissible speed at the tool center point results in a speed advantage that substantially increases productivity during the time-intensive setup process. The fastest safety-oriented res-

ponse speed in the world –provided by the combination of openSAFETY and POWERLINK – reduces the braking distance of an axis up to 100 times when a safety function is violated compared to traditional systems. These faster response times allow the machine manufacturer to considerably reduce the clearance needed for the process in the machine's enclosure, which simplifies operation of the machine by the end user while increasing productivity at the same time.

Deterministic integration of image processing for maximum precision

When visitors add "bogus balls" to the Packer, their different color is detected by the integrated image processing system, and they are subsequently rejected. The communication between the image processing system and the CPU is also handled over the POWERLINK system bus. High-speed cycle times in the microsecond range as well as precision determinism well below 1 μ s allow the image processing results to be reliably assigned to the respective product. In addition, the synchronous connection between the image analysis and the process significantly increases productivity, especially in high-performance machines. The image processing system demonstrated here is fully integrated into the Automation Studio development

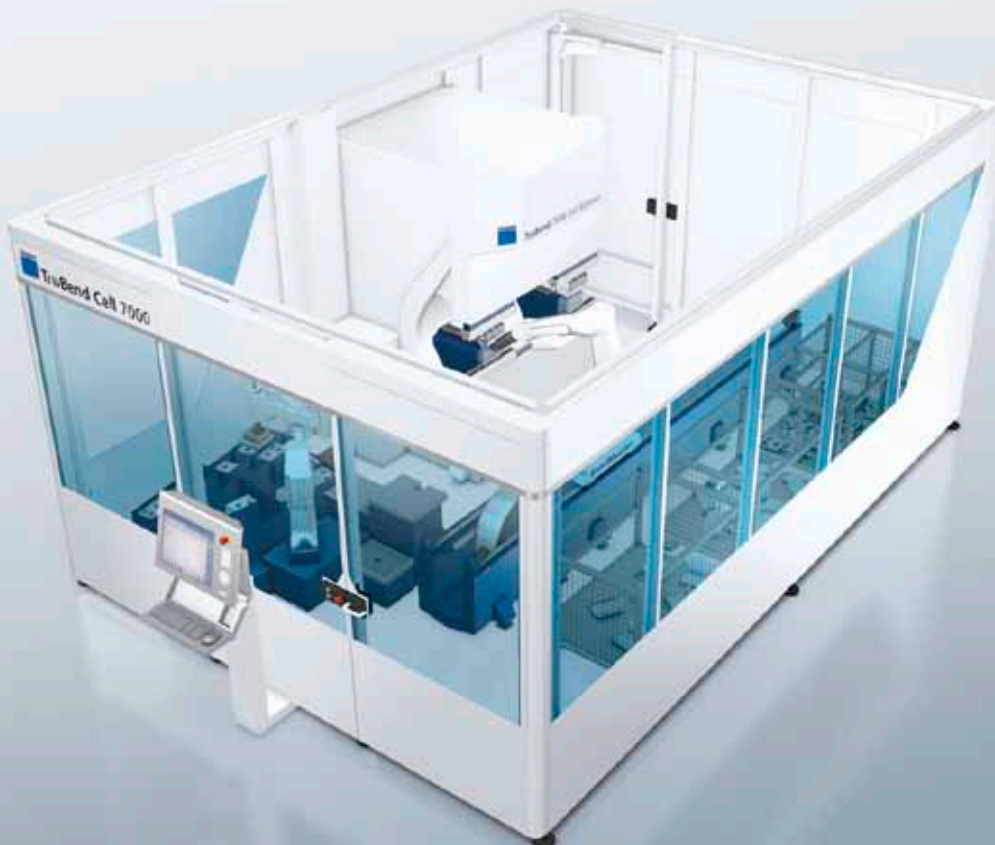


Image 1

environment, so all variables shared by the controller and the image processing system are already available. This eliminates costly and time-consuming programming and parameter configuration.

Simple machines linking and operating data collection with PackML

The machine also implements PackML technology, which allows identical machine operation using standardized operating modes and uniform communication with an MES (management execution system) or ERP (enterprise resource planning system), regardless of the controller platforms being used by the different machine manufacturers.

Remote access with the integrated System Diagnostics Manager

Visitors can also access both the machine visualization system and the integrated System Diagnostics Manager (SDM) over a wireless network using an iPad. Using the System Diagnostics Manager tool, maintenance personnel can perform local or remote diagnostics and are easily able to verify the function of all machine components using the diagnostic pages implemented in the firmware. A single interface is used to access the entire machine. The robots, the process, the safety technology and the visualization application can therefore be efficiently diagnosed from anywhere on the planet. Diagnostic functions that used to be so difficult to program are available in the System Diagnostics Manager from the very start, simplifying the overall diagnostic process and shortening the amount of time needed to get a project up and running.

Image 1: Trumpf bending cell: A B&R CPU controls the entire bending cell, which consists of an electric bending machine and two robots.

Image 2: The Packer integrates the absolute latest machine concepts for handling, image processing, safety technology, control and monitoring.

Image 3: The ultrafast response time of the openSAFETY-POWERLINK combination is demonstrated by the immediate activation of the safely limited speed safety function when an operator interacts with the machine.

Image 4: The System Diagnostics Manager uses a single interface to access diagnostic data from the entire machine from anywhere on the planet.



Image 2

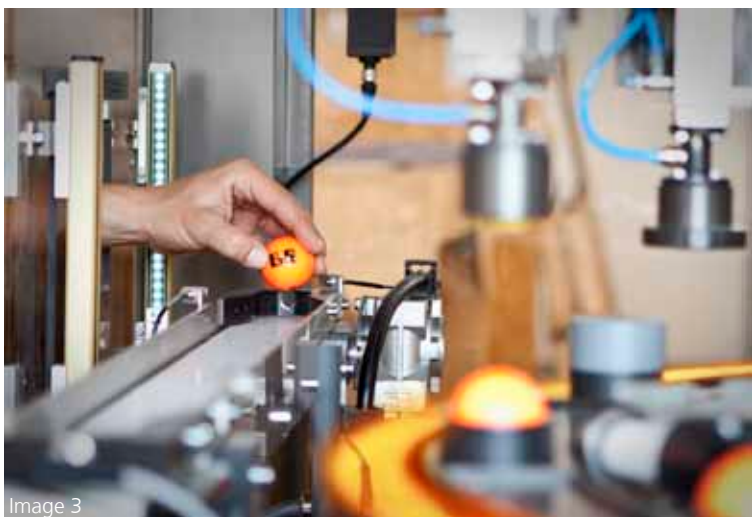


Image 3



Image 4