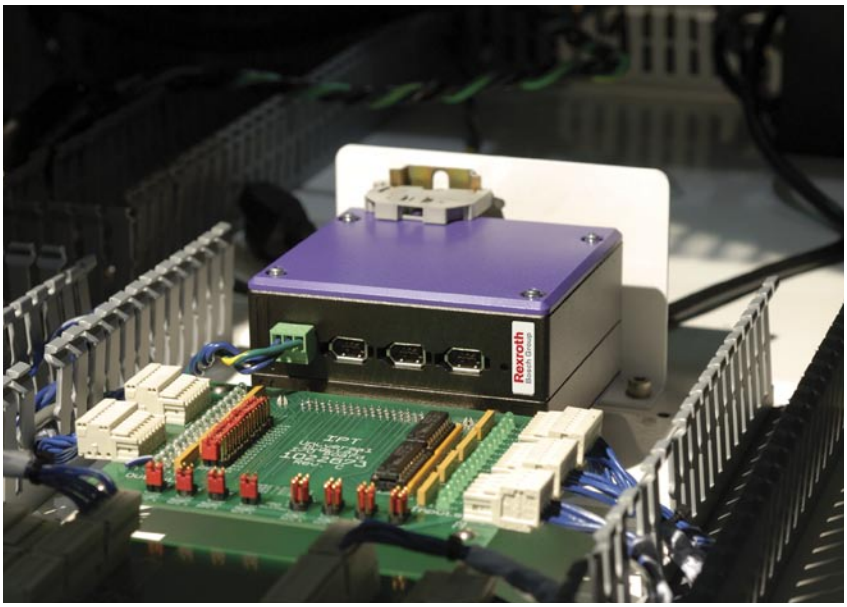
Drive & Control profile

Shattering Semiconductor Production Speed Records



The motion control from Bosch Rexroth uses a distributed, scalable architecture built around the high-speed FireWire backbone to support up to 20 axes of control per machine.

High-Performance Motion Control Helps Boost Back-End Inspection and Packaging Throughput

The semiconductor industry has an urgent need for speed. Driven by intense cost and competitive pressures, semiconductor producers are trying to maximize production lines across the globe while improving outgoing quality.

A critical point is the final step: inspection and packaging. The faster the finished integrated circuits are inspected and moved out the door, the faster the plant achieves optimum return on investment.

Systemation of New Berlin, WI (www.systemation.us) is one of the top manufacturers of inspection

Challenge

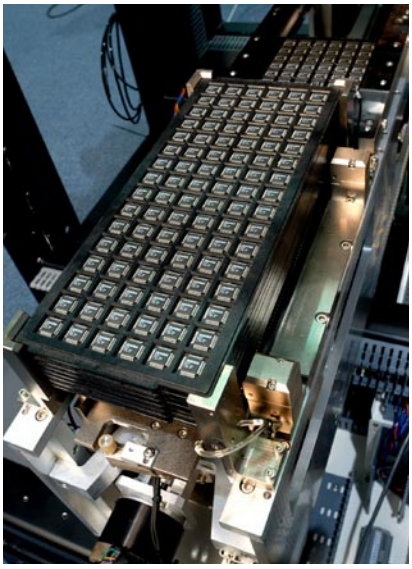
Double the productivity of semiconductor back-end inspection and packaging equipment

Rexroth Solution

Bosch Rexroth FirePoint™ motion control—part of the company's NYCe family of motion controllers

Results

- New packaging machine can handle up to 15,000 units per hour (4 per second)
- Visual inspection integrated into platform; supports real-time results
- High-speed motion control enables virtual pipeline providing nearly coincident overlap of inspection duty cycle with eight autonomous axes of movement
- Modular machine supports both JEDEC tray and tape-and-reel processing
- Motion control platform supports high-speed processing without sacrificing inspection quality
- Less programming need for faster machine commissioning
- Modular control system reduces machine footprint



The Rexroth control provides extremely fast response times with very little overhead allowing the ST-868 to meet its high production goals for integrated circuits.

and packaging equipment for the semiconductor and electronics industries. Recently, the company launched a high-performance integrated circuit (IC) inspection and packaging machine under its Systemation® brand with throughput speeds that leave previous production records in the dust.

To help set this production record, the new machine relies on a high-performance, robust motion control solution from Bosch Rexroth (Hoffman Estates, IL www.boschrexroth-us.com).

Faster ROI in semiconductor back-end processing

The cost for a next-generation semiconductor assembly and test facility is staggering. Maximizing throughput measured in units per hour (UPH) and doing it in the smallest area possible helps speed return on investment in an extremely competitive environment.

Systemation has responded to these needs. For over 25 years, the Systemation name has been respected in the semiconductor manufacturing and services industry as an innovator of high-quality process equipment for the production of electronic components.

Their newest machine is the ST-868 Handling System featuring AVS *DefectZero*™ Inspection Technology. It sets a new throughput standard for integrated inspection/packaging machines: up to 15,000 units per hour (UPH). That's up to four chips *per second*. The previous industry benchmark was 10,000 UPH.

The ST-868 can handle inspection and packaging of different electronic component device form factors such as ball grid arrays (BGA), quad flat leaded packages (QFP), and emerging outlines like quad flat non-leaded and micro-BGA (QFN, µBGA). After the devices have been fully assembled and electrically tested, they are visually inspected to ensure mechanical compliance to specification at accuracy levels measured in microns. With semiconductor manufacturers facing customer quality demand of zero defects, inspection accuracy and stability cannot be traded for speed.

Extremely simple and modular in design, the ST-868 provides fast, accurate and reliable handling of devices without the need for risky "gang" handling. Each individual chip is handled only once as it is transported from input to output and is optically aligned prior to insertion at the output destination.

According to Mark Jaeger, president, the ST-868 dramatically changes the productivity equation for back-end inspection and packaging. Modularity of the motion control system is a critical element, enabling distributed self-contained intelligence for every sub-system. The result is a 50-percent increase in the raw sprint speed of the handling system.

"Basically, one ST-868 machine can deliver the same production as two previous-generation machines," Jaeger said. "By leveraging the motion control advantage plus maximizing packaging process efficiency, Systemation is able to provide a 100-percent increase of UPH per square foot of plant floor space."

For JEDEC tray processing, the ST-868 platform pushes device scanning and taping productivity to higher performance levels. It is the industry's only tray-based scanner that does not compromise throughput when combined with optional tape-and-reel packaging.

The system also includes an advanced optional visual inspection feature called AVS *DefectZero*™ Inspection Technology, developed by Systemation. It provides thorough end-of-line quality assurance with

redundant device inspection at tray and tape outputs.

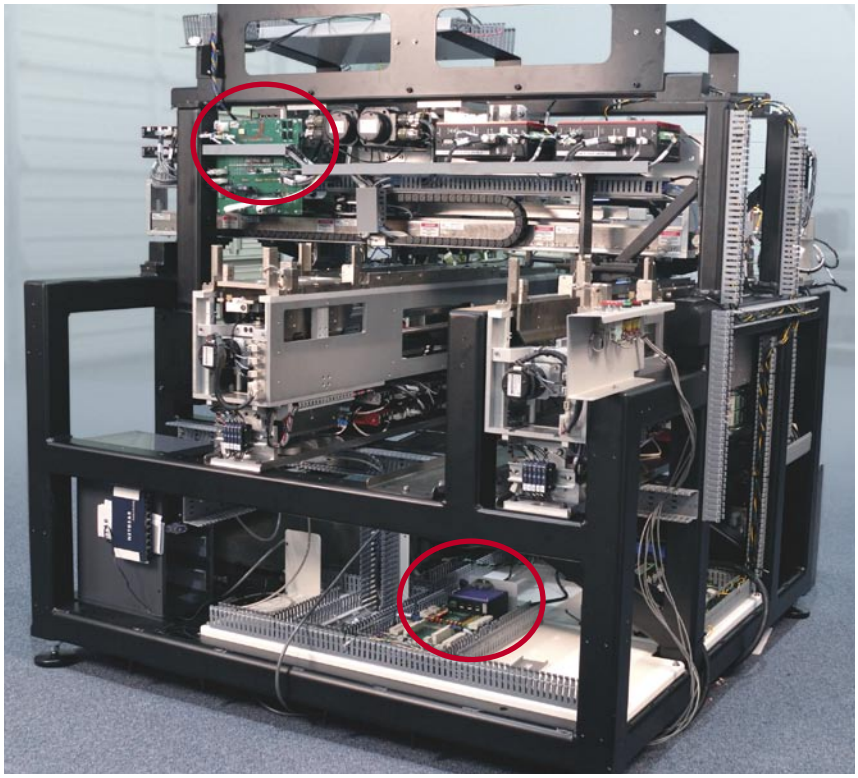
Optional inspection sites are selectable and may be configured to provide comprehensive defect detection on all six surfaces of all package types, with real-time remote access to inspection results. This remote access feature means results from every Systemation inspection machine on the test floor can be viewed from a central workstation, or even from another location—across the country, or around the world.

Motion control fires machine performance

Systemation achieved this throughput in part by using a powerful and highly efficient motion control solution from Bosch Rexroth - the FirePoint IEEE 1394 system, which is part of the company's NYCe family of motion controllers. This platform uses a distributed, scalable architecture built around the high-speed FireWire backbone to support up to 20 axes of control per machine. These motion axes include the lift, rotation, inspection and packaging functions of the ST-868.

The FirePoint system is a complete, high-performance motion and logic system that uses a distributed architecture and modular components to give machine builders an "out-of-the-box" solution.

It provides fully configurable I/O and functional nodes networked via high-speed FireWire backbone to an industrial PC.



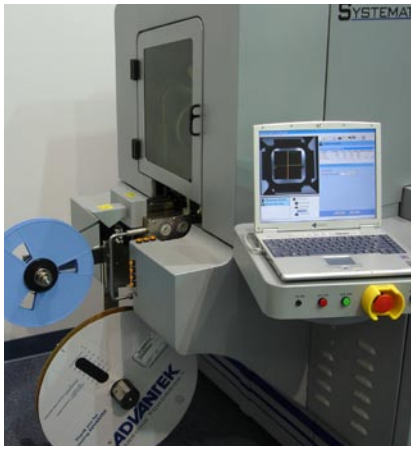
The modularity of the Rexroth control system (shown here) helped Systemation design the ST-868 with a compact footprint for a truly competitive solution.

Each node's functionality is user-programmable, and is capable of controlling digital and analog I/Os, servo motors and stepper motors. In addition, other FireWire devices like intelligent cameras can be integrated into the control architecture.

The distributed architecture and high-power FireWire backbone make the FirePoint platform extremely flexible and scalable: from one up to 62 intelligent control nodes can all be connected and controlled in a network, so machine builders can design complex systems around a proven control solution.

The FirePoint platform was specifically developed to support high-speed motion and vision control systems that also use the IEEE 1394 network. It offers several advantages to tool designers. It is an open architecture, which means any systems that are IEEE 1394 compliant—motion systems, visual systems, etc.—can co-exist on the same network with ease, and without additional programming steps to make them compatible.

FireWire is suited to very fast, multi-axis applications. It has a high-performance serial bus supporting throughputs of up to 400 megabits per second, and a real-time deterministic architecture that increases the accuracy and ensures the latency necessary for the



One ST-868 machine can deliver the same production as two previous generation machines.

controls demand in a machine that inspects and packages four components per second.

According to Jaeger, the speed and reliability offered by the FirePoint platform were crucial to engineering the lightning-fast production of the ST-868.

"The ST-868 hosts dozens of motors and several hundred digital I/O points," Jaeger said. "FirePoint provides extremely fast response times with very little overhead, which allows us to perform the complex real-time control operations required to meet our goals."

Modularity speeds development

Choosing the FirePoint platform for the ST-868 packaging and inspection application also provided other benefits: faster machine development, flexible end-user options, and an overall reduction of the footprint on a factory floor by achieving high output with one machine instead of two.

The platform comes with an extensive library of motion control tools and commands, to enable faster commissioning and testing of machines. These C and C++ libraries eliminate much of the motion control programming burden that previous generations of motion control platforms required. This lets tool builders like Systemation spend less time on programming motion control so they can focus more time on the specific machine functionalities that provide their strategic advantage.

The FirePoint platform's physical design is also optimized for flexibility. The node units are modular and compact, engineered to conserve space. Standard units are DIN-rail mountable; however, rackline mountable or bare-board versions are also available, depending on an end-user's requirements.

This modularity helped Systemation design the ST-868 to be very compact, a key design goal; coupled with its throughput, this tight footprint is what enables the ST-868 to deliver a truly competitive solution.

"To leapfrog the competition in terms of throughput, our ST-868 required a control system that was both fast and scalable," Jaeger said. "Bosch Rexroth provided Systemation with a cutting-edge solution that satisfied our requirements for centralized control and decentralized I/O and motion. After evaluating virtually every alternative, FirePoint stood alone as the ultimate control solution for the ST-868."

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