

Drive & Control profile

Bosch Security Systems Improves Production Using Modular Lean Assembly Workcell Components from Rexroth



After initially going with the U-shaped configuration, Bosch Security Systems decided an L-shaped lean cell would better suit their needs.

Lean workcell uses components from Rexroth's Manual Production System, including aluminum structural framing, flow racks, and other elements to help Bosch Security Systems reduce waiting time, improve efficiency and quality, increase storage capacity and eliminate waste from their camera assembly operation.

Most people are used to see security cameras dotting the interiors of casinos and banks, where money routinely changes hands. However, other locations such as government buildings, schools and even city street intersections are now utilizing high-scale security equipment to protect both people and property.

Challenge

Implement a modular lean manufacturing workcell for more efficient assembly, testing and packaging while keeping the ability to easily adapt the manufacturing line for future needs.

Bosch Rexroth Solution

- Aluminum structural framing
- Flow racks
- Ergonomic workstations with Bosch tools and lighting
- Rexroth CAD software

Benefits

- Pull system allows workcell to take a purely make-to-order approach on camera assembly.
- Camera orders are now completed in one-day cycle.
- Workcell permits production of over 2,000 top level products.
- T-slotted aluminum structural framing allows workstations to support one-piece flow within the workcell and it can accommodate complete schedule flexibility with no downtime.

The Lancaster, PA, facility of [Bosch Security Systems](http://www.boschsecurity.us) (www.boschsecurity.us) manufactures, supplies and distributes closed-circuit television (CCTV) cameras and monitors, digital recording and switching systems, and IP network video products for many of these applications.

When Bosch Security Systems decided to replace their flagship AutoDome camera with new and improved modular units, they opted to implement a lean workcell that would offer more flexibility and avoid waste to help them meet production needs for the new modular AutoDome. A Bosch corporate lean manufacturing initiative called *Bosch Production Systems* (BPS) was the starting point. BPS focuses on eight key principles: *Process Orientation, Pull System, Perfect Quality, Flexibility, Standardization, Transparent Process, Waste Elimination, and Associate Involvement*.

“We wanted to focus on specific lean principles surrounding our camera line,” explained Mark Ellis, manager of product assembly. “Our primary objectives included: perfect quality, implementing a pull system, maintaining flexibility and avoidance of waste since we were designing a new workcell. After years of continuous improvement with AutoDome we wanted the supply chain performance for the new modular version to continue that upward trend. A pull system was crucial because our late-configuration workcell would run purely in a make-to-order approach,” he



Bulk materials are stored around the perimeter of the workstations. Milkrunners maintain stock levels at each workstation.

said. “To avoid waste, no finished goods would be produced ahead of customer orders. Inventory is not created until the order is in hand and ready to be assembled and shipped immediately. This eliminates carrying costs and any potential issues with aging inventory that could require software or hardware upgrades. With the modular design, our inventory investment can be minimized and kept at the module level, still flexible within the supply chain,” said Ellis.

The Bosch camera surveillance system is based on a modular design consisting of: CPU module, camera/lens combination, housing, AutoDome window, communication module, power supply and various mounting options. Customers can select exactly the type of AutoDome configuration that meets their needs. The result is over

2,000 possible configurations of finished product.

The challenge for Bosch Security Systems’ global supply chain network was to offer customers the full advantage of the modular design and complete their orders in a one-day cycle. The printed circuit board assemblies in the core modules and their variants are supplied to the Bosch Security Systems late-configuration facilities in Lancaster and in the Netherlands, where they are assembled to meet various customer requests close to the regional demand point.

After using the BPS model to guide their deployment of lean manufacturing principles, Bosch Security Systems needed a supplier who could equip them with the necessary [manual production system \(MPS\)](#) components to set up a new lean workcell. They

called on the Bosch Rexroth Corporation's [Linear Motion](#) and [Assembly Technologies](#) group (Buchanan, MI www.boschrexroth-us.com/brl) to provide the necessary items for their new workcell. With Rexroth's local full-service assembly and automation distributor, [Airline Hydraulics](#) (www.airlinehyd.com) in close proximity, managing the ordering process was simple. Airline provided Bosch Security Systems with Rexroth's [aluminum structural framing](#), [flow racks](#), workstation lighting, electrostatic discharge (ESD) surfaces, and other MPS products.

Rexroth Aluminum Structural Framing for Ultimate Workcell Flexibility

A major consideration for Bosch Security Systems' lean workcell was the ability to adapt to changing needs. Using the standard camera modules (roughly 60 part numbers) in combination, Bosch



Rexroth aluminum structural framing and lean cell design keep security camera housings within reach.

Security Systems is able to produce over 2,000 top level products. The workcell design keeps all of the standard modules within reach of the line associates so schedule changes can be made with no changeover. This is critical because all work is make-to-order and the

next production job can be for any of the units offered for sale. In previous versions of the AutoDome camera, this level of complexity could not be supported even with other kitting operations performed in regional distribution centers.

The company knew that the commercial diversity of the product line would continue to grow as more modules were developed to add functionality and features to the surveillance system. Therefore, Bosch Security Systems needed a workcell that would be able to keep pace with changes to their product line.

Using Rexroth T-slotted [aluminum structural framing](#) as the foundation of the lean cell, all the work components are mounted in easily accessible locations. Because each T-slotted surface is a potential mounting surface, [ergonomic workstations](#) Rexroth's ergonomic workstations allow parts bins, tools, shelves, and fixtures to be positioned in optimum locations for efficient work. The workstations support one-piece flow within the workcell as well as the requirement to accommodate complete schedule flexibility with no downtime for line changeovers. This results in a production flow without stoppages or delay.

Another major design consideration surrounding lean implementation was the flow of material into the workstation. Using the pull system principle from its BPS initiative, which requires line-side inventory replenishment, warehouse



Lean manufacturing principles are now executed with superior efficiency.



Rexroth's aluminum structural framing allowed Bosch Security Systems to add a packaging station after the initial configuration was put in place. A workstation houses brochures while a stand for bubble wrap was added to the end of the assembly line.

personnel deliver cartons of raw material, staging them around the perimeter of the workcell at fixed locations. A “milkrunner” employee maintains the stock levels at each workstation and replenishes the flow rack chutes built into each workstation with enough material to last for two hours. Every associate in the workcell is cross-trained on all positions including milkrunner. Job rotation occurs on that same two-hour cycle to increase workforce flexibility and also as an ergonomic precaution.

Lean Production Provides Global Reach

Overall, Bosch Security Systems' AutoDome modular design includes: 16 different camera/lens combinations, three types of housings, three communication modules dependent upon the protocol of the system the camera is connected to (including Ethernet support), four CPU modules,

and numerous power supply, window and mounting options. The various CPU modules are programmed at the production source. Occasionally, new versions of the firmware become available which makes existing stock of CPU modules obsolete unless they are upgraded to the new version. In the past, this meant a production stop followed by batch rework of raw material inventory and finished goods.

Now, a unique characteristic of the AutoDome Modular workcell involves an on-line programming station. Each CPU module, before being built into the product, is loaded onto a firmware programming station. The station compares the CPU version against the current version maintained by design engineering. If the files are outdated, current files are downloaded. By building this programming station into the

workcell design and accepting a short duration handling step on each CPU, all product shipped has the current version and no downtime is ever necessary to rework stock for version upgrades.

After the CPU firmware is verified, it is assembled into the camera and proceeds to a final test station, made of Rexroth aluminum framing, where they are powered up and tested to ensure everything is functioning correctly. The modular aluminum framing allows custom add-ons such as instruction manuals or tool-holders to be added as needed for each workstation. Finally, the tested camera is disassembled into two parts (housing and camera head) for packaging.

In the previous AutoDome operation, cameras had been delivered to distribution centers where other mounting hardware and power supplies were added as secondary kitting operations. This added at least three handling steps to every order cycle. In some cases not only the various camera configurations were held in finished goods inventory but additional kitted configurations were made to forecast, and held in finished goods inventory. With all of those finished goods in stock, implementing a software change that involved pulling finished goods for rework sometimes cost a week of downtime.

With AutoDome Modular there are no secondary kitting operations and no finished goods to generate carrying cost, space

requirements or obsolescence costs. Space savings in the Lancaster distribution center alone amounts to nearly 1,500 square feet and 100 pallet locations.

Assembling the Workcell

To help implement the workcell, Bosch Security Systems relied on Airline Hydraulics. Bosch Security Systems' senior manufacturing engineer, Dennis Weaver, had developed a solid model at his CAD station depicting how the cell would look. Thanks to the flexibility of Rexroth's [FMSsoft layout planning and design software](#), Airline Hydraulics was able to work with the design and turn the vision into reality.

"Rexroth components are easy to assemble and adjust," remarked Dave Smith, applications engineer at Airline Hydraulics. "Bosch Security Systems had a good idea of what they wanted, including grab boxes and adjustable shelves, but [FMSsoft](#) allowed them to gain a full visual of the overall lean design. The software program and the modularity of the structural framing saved valuable planning time and allowed Bosch to tweak the design and get exactly what they wanted."

Initial Workcell - Reconfigured

After the workcell was initially implemented, several enhancements were made, ranging from adjusting lights around the cell, to major rearrangements of complete workstations designed to accommodate different types of product flow.



With Rexroth aluminum structural framing, Bosch Security Systems was able to use a variety of parts bins, tools, shelves, fixtures and other components as needed.

"While the CAD software provided us with a solid visual of what the workcell would look like, I was concerned about keeping sufficient stock readily available," remarked Weaver. "We have some very large components that we must stage around the perimeter of the workcell and the milkrunner needs enough working space to pull these materials and feed them into the flowrack chutes."

One significant change involved the overall shape of the workcell. "We installed the workcell originally as a U-shaped design," commented Weaver. "But after a short time, we concluded that our employees would work more efficiently in an L-shaped configuration that could accommodate storage for the bulky materials. Fortunately the cell uses Rexroth aluminum

framing instead of welded steel so we could handle the necessary fabrication in-house to reconfigure the workstations. We didn't have to out-source a supplier to cut it apart and reconfigure it. We could simply unbolt the connectors to make the necessary structural adjustments ourselves," said Weaver.

Ellis added that later, with the proven incoming quality of the camera module, they decided to eliminate an entire inspection station on their assembly line. "We recorded such good quality that we felt we could eliminate the inspection station and use its components more effectively somewhere else in the cell," he said. "Even without that inspection step we're currently enjoying final test yields that meet our high quality standards," commented Ellis.

Utilizing the [aluminum structural framing](#) that was initially intended for the inspection station, Bosch Security Systems was then able to add an ergonomically designed packaging workstation to the end of the assembly line. The packaging station features easy-to-identify color-coded trays for different camera brochures, as well as a custom space-saving bubble-wrap stand.

While these changes have made the entire operation leaner, the alterations may continue. There appears to be no end to how creative one can get with the workcell design. "I like to say, if you can dream it, Rexroth allows you to configure it," remarked Weaver.

The lean cell designed at the Lancaster facility has achieved Bosch Security Systems' design target production rate and workcell reconfiguration has kept pace with their team-based continuous improvement suggestions. In fact, the design was replicated at the Bosch facility in the Netherlands. While enjoying the increased productivity that comes with [lean manufacturing implementation](#), Ellis said they also have the peace of mind knowing that if any additional changes need to be applied, Bosch Rexroth provides the capability to make it happen.

"We've achieved the initial objectives and we're very pleased with our experience using Rexroth and Airline Hydraulics, but we can't afford to be satisfied. Continuous improvement means we're always looking for that next great idea," said Ellis.

Rexroth
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