

Drive & Control profile

Ophthonix Sees Value with Rexroth Conveyors for Automated Production Line



Rexroth uses patented curve technology to reduce friction in curves, allowing trays to accumulate in the curve while using fewer drives to save on system costs.

Bosch Rexroth's VarioFlow flexible conveyor and aluminum structural framing help accelerate production time and improve quality, while employing less space, for Ophthonix, a producer of the iZon[®] high resolution lens—the first eyeglass lens custom-made according to a unique optical fingerprint called an iPrint[™].

The 21st century, with its bright lights, all-day computing, 24-hour shopping and high-definition TV, places more stress on people's eyesight than perhaps any other time in history. That's why [Ophthonix Inc.](http://www.izonlens.com) (www.izonlens.com), a high-

precision eyeglass manufacturer based in Vista, CA, embarked on a new technological process to create lenses offering more accurate vision correction.

With the appeal of better vision forming a solid foundation for

Challenge

Integrate a lean-based fully automated continuous-flow pull system that links all facets of Ophthonix's production facility

Rexroth Solution

- VarioFlow 100 Conveyor with patented UltraCurve[™] horizontal curve technology
- Aluminum structural framing

Results

- Ophthonix enjoys a 90 percent yield range.
- Variable speed drive module provides lens with ample cooling while still maintaining quicker pace throughout remainder of the production line.
- Ultracurve technology reduces number of required drives, thereby reducing up-front costs and overall power consumption.
- Lens cooling process is assisted by a vertical buffer, comprised of Rexroth's aluminum structural framing.



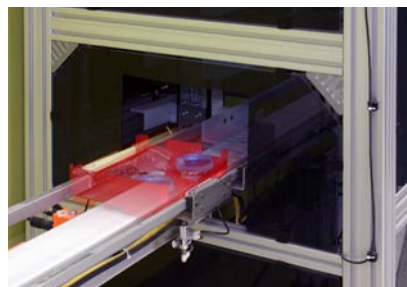
Ophthonix sends lenses to workstations using modular conveyors from Rexroth.

continued growth, Ophthonix had definitive goals to ramp up its production capacity in planned phases. As a result, the company needed a facility that could be adapted easily to match their growing production volume.

With design, layout and integration help from [Eagle Technologies](http://www.eagletechnologies.com) (Bridgman, MI www.eagletechnologies.com) Ophthonix utilized a [VarioFlow conveyor system](#) and [aluminum structural framing](#) from [Bosch Rexroth Corporation](http://www.boschrexroth-us.com) (Hoffman Estates, IL www.boschrexroth-us.com). The goal was to implement a lean-based fully automated continuous-flow pull system that linked all facets of their production equipment. As a result, the Ophthonix lab is now equipped to move lenses to various workstations via a modular conveyor, without the need for constant employee input and monitoring, saving valuable time, resources and money.

High Quality Lenses

Ophthonix produces [iZon lenses](#), which are the first eyeglass lenses custom-made from an individual's own iPrint, or unique optical fingerprint. The company's iZon lenses essentially provide your eyes with a view comparable to watching high-definition television. They address the vision problems associated with microscopic irregularities, also referred to as higher order aberrations. These aberrations impact how light passes through the eyes, and therefore, how well individuals are able to see.



The Ophthonix lab uses Rexroth's VarioFlow conveyors and aluminum structural framing to automate its manufacturing process.

For example, a person who has perfect 20/20 vision with conventional lenses may still experience blurriness around images, shadows, unclear vision at night, or glare and halos around lights as a result of these aberrations. By incorporating the iPrint into the iZon production process, the Ophthonix iZon lenses are able to address the symptoms associated with these distortions.

High Quality Manufacturing

The iZon lens consists of three layers. The back layer is developed according to the patient's iPrint and focuses on cylindrical correction. Ophthonix applies a unique algorithm to the iPrint to help determine this fit. The middle layer features a patented photo-refractive polymer, designed by Ophthonix. The front layer of the lens then completes the structure. The entire three-layer design contributes to the superior vision performance of the iZon lens.

Because the iZon lens is formed from a unique three-layer structure, it requires a special process to create it. When Ophthonix decided to create the lens, they discovered no other lab in the U.S. could handle the unique high-tolerance process. Therefore, they established a completely new lab, allowing them to oversee the entire production process. Rather than using conventional equipment, Ophthonix opted to use free-forming production machinery capable of cutting progressive lenses into complicated shapes and providing unmatched micron-level accuracy.

Ophthonix considered not only its current production needs, but also what it would need in the future. With a production curve planned to meet future volume requirements, Ophthonix chose a modular conveyor system that could be phased in and adapted to meet anticipated production increases without disrupting their entire operation.

The company partnered with Eagle Technologies and Bosch Rexroth to help design and integrate a fully automated lab. Because lab space is so expensive, Eagle recommended using the three-dimensional area in the 10,000 square-foot finishing lab, like a cube, to take advantage of vertical space. In addition to mapping out the layout, Eagle specified and built the conveyors, vertical buffer system, and a tray-up de-stacker to optimize the production process. They worked with Rexroth's [Linear Motion and Assembly Technologies](#) group to source the modular VarioFlow conveyor system and the necessary aluminum structural framing.

Implementing a new conveyor system was particularly challenging because not only did Eagle have to install a conveyor that would fit into their lab space, but they also had to integrate it with various pieces of pre-existing equipment. This included an autotaper, autoblocker, two lens generators, and two lens polishers, each made by [Satisloh](#), as well as two automated edgers from [MEI System](#). Overall, the entire system was designed to accommodate up to two autotapers, six autoblockers,

six generators, 12 polishers and four robotic edgers as future production requires.

In addition, the Rexroth conveyor had to handle another special transport requirement; the lens trays traveling on the conveyor feature a special ribbed design standardized for the Ophthonix production process.

Automated Delivery

Producing a top quality lens is an elaborate procedure. The primary goal of the conveyor system is to deliver the trays that house the lenses through various processing operations within the optical lab. The fully automated tray delivery system also had to supply easy access to various machines throughout the footprint, despite varying heights of the conveyor entry and exit locations for a given station.



With the Rexroth conveyors, standard robotic processing trays can accumulate in curves as they are routed to various stages of production.

As Ophthonix prepares to run the lens production process, the patient's data is gathered and entered into their computer system in a "tray-up" area. A corresponding barcode is then connected to each prescription and attached to a lab tray for identification purposes. Next, operators load prepared trays into



With over 1,000 feet of conveyors, lens polishing equipment can easily connect into the main line as future production needs increase.

a de-stacker that can hold up to 10 trays. The trays are then released automatically one at a time onto the production line.

During the production process, the lenses go to an autotaper machine, where protective tape is positioned. The conveyor then takes the lenses to an autoblocker which positions the raw lens relative to the tooling block, according to the individual prescription, and then affixes them together with a metallic alloy.

At this point, Ophthonix had a special conveyor requirement fulfilled by the VarioFlow system. To prevent the lens from distorting during the generating process, it must go through a 25 to 45 minute cooling period. This process is accomplished with the variable speed conveyor running slowly around 3 feet-per-minute (fpm) above the work area (to save space) while the rest of the line is running at approximately 45 fpm. The conveyor system must maintain adequate speed throughout a majority of the production process, but then decelerate during the cooling process. “Rexroth’s variable speed drive module is an



The system uses standard robotic trays barcoded with the patient’s prescription and frame style for automation processing.



VarioFlow vertical and horizontal curves integrate easily with existing process equipment.

extremely beneficial component of the overall system,” remarked John Lemperle, Ophthonix vice president of operations.

With the limited overall room available for the layout, Ophthonix was also looking to maximize its use of space. To help satisfy floor space requirements, the cooling process is assisted by a vertical buffer, designed by Eagle and made with Rexroth’s aluminum structural framing. The buffer lifts the lens trays off the floor to a raised area, eliminating the need for an expensive tray stacking and de-stacking area. This is also more efficient, as the blocked lenses cool faster when they are not in a dense stack.

After cooling, the tray goes through the generating process to impart the basic prescription curve to the lens, then to the polishing stage where the final curve finish is provided. Then, after de-blocking and cleaning, the lens is conveyed to a clean room where the Ophthonix proprietary protective layers are processed. The lenses

come back for finishing, which involves applying a finish block and then processing by the MEI System machines for edge cutting, polishing and drilling. The trays are then delivered to the assembly, inspection and packing personnel.

“Eagle did a tremendous job implementing this system using the Rexroth components,” said Lemperle. “It’s nice because Eagle is large enough to be competent, but still offered a small-company approach with regards to attentiveness, detail and response time. Plus, they were able to install the system in less than three weeks, which is a quick turnaround for a conveyor system of this magnitude.”

Handling the Curves

In selecting the VarioFlow, Ophthonix received a single-



Using Rexroth aluminum structural framing, Eagle Technologies saved Ophthonix valuable floor space with this custom FIFO vertical buffer to transport trays to an overhead cooling line.



Continuous workflow reduces the need for carts, material shuttles and other WIP equipment.

strand conveyor designed to meet the unique needs of the packaging, material handling, and assembly industries.

Rexroth's VarioFlow conveyors are available in various sizes, ranging in width from 65 to 320 mm. Within that range, Bosch Rexroth offers two solutions appropriate for optical lens tray transfers: the VarioFlow 90 and VarioFlow S 100. Eagle Technologies recommended VarioFlow S 100 for its wider width and patented UltraCurve™ design.

The features of the curves in the conveying system were particularly important for the Ophthonix layout, which has 40 horizontal curves in the production line,

comprising 45, 90, and 180 degrees. With traditional conveyors, a complex layout like this would be extremely difficult to implement. Even with more traditional styles of modular chain conveyors like VarioFlow 90, a complex layout can be more challenging because each tray has to wait until the previous tray clears the curve before it can enter the curve itself.

Rexroth's UltraCurve horizontal curve technology produces minimal friction and maximum production output, and also allows trays to accumulate in curves. With a layout of this type, the curves reduce the number of drives required, thereby reducing up-front costs and overall power consumption.

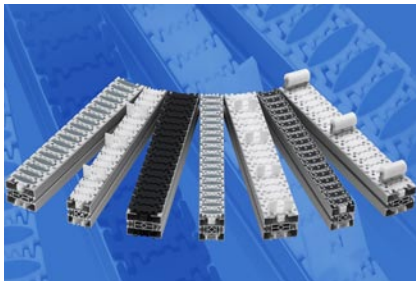
Quality Up, Costs Down

Because the entire production process is now automated, including the insertion and retrieval of the lenses within each machine, costs affiliated with staffing have been reduced. "Most labs are loaded with carts and people and the entire process works in batches," remarked Lemperle. "With the Rexroth VarioFlow conveyor system and automated equipment, there is now a constant and continuous flow. We've noticed our product cycle time is now approaching the process time of the equipment. Quality is improving daily, currently putting us at a 90 percent yield range, even though production of our lenses is more intensive. If this process was done manually, we would need more people and a facility twice as large," said Lemperle.

As a result of Eagle Technologies' integration and VarioFlow's adaptive modularity, Ophthonix can now add equipment to expand or modify the current footprint without disrupting the automated flow. This piece of mind, provided by Bosch Rexroth, allows Ophthonix to view the future with even greater clarity.

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Rexroth
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