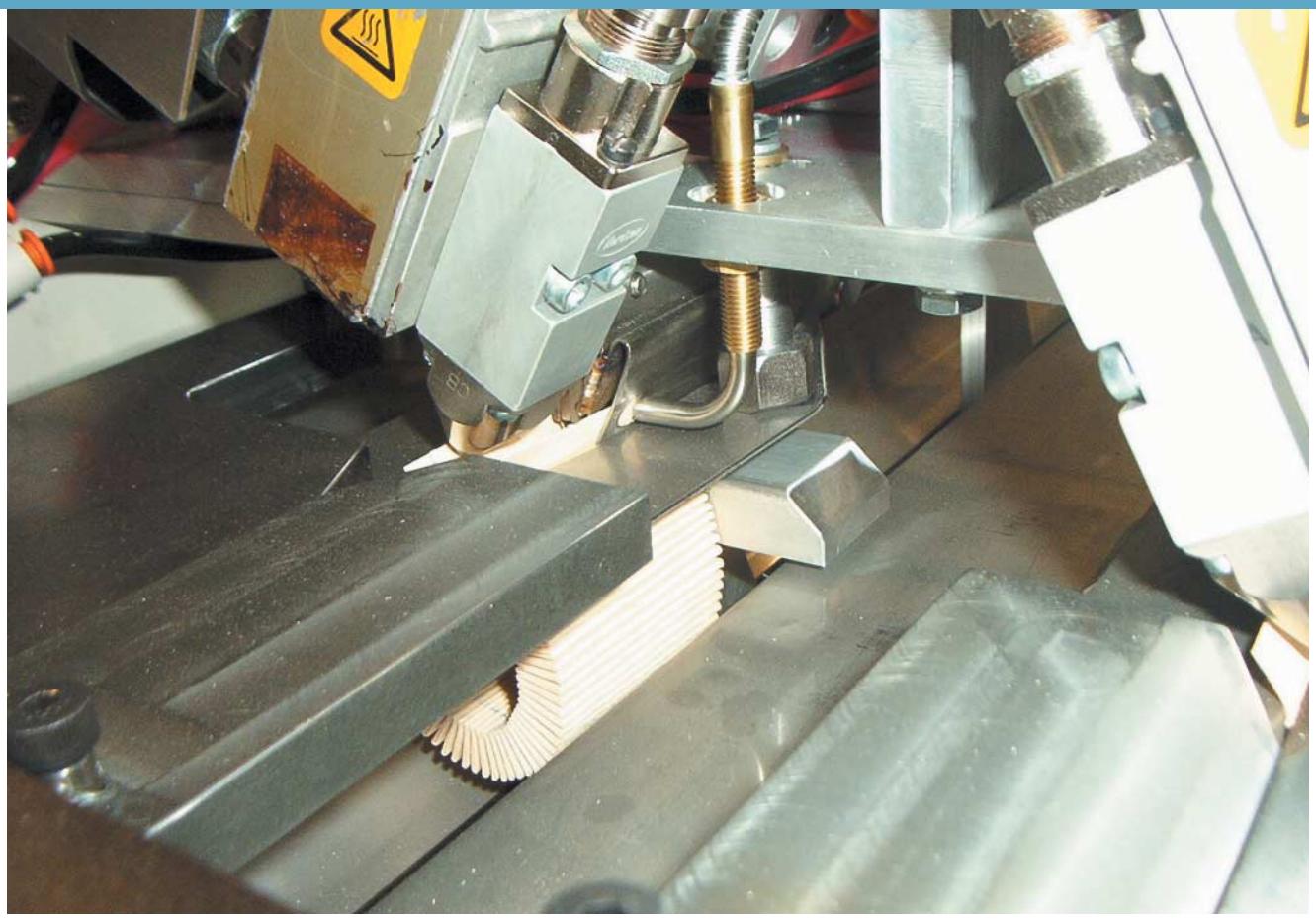
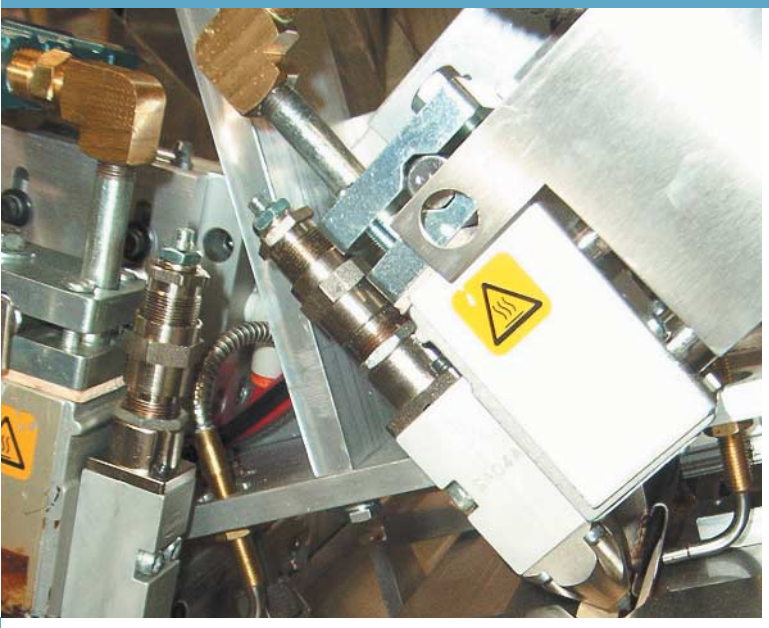
Advanced I/O technology helps get the metal out of environmentally-unfriendly oil filters

A clean solution

Spent oil filters have been a concern of environmentalists and a source of headaches for filter manufacturers. Thanks to industry-wide efforts, those problems may soon be history. In just one example, used oil is now being squeezed out of filters and recycled. Following the accomplishments of their progressive European counterparts, many North American automotive oil filter manufacturers are redesigning components and remodeling production lines to produce environmentally safer oil filters.



The company Midmac Systems Inc. specializes in the development and construction of customer-specific machines for filtration, packaging and medical systems and for production automation.



These driving forces have called for the elimination of automotive oil filter components that cannot be recycled or incinerated. One such part, a metal clip used to secure the pleated paper tube, is being replaced with a hot-melt glue seam. Midmac Systems, Inc. developed a patented process and machine that effectively allowed for the elimination of the metal clips in the filters. Midmac, located in St. Paul, Minnesota, USA, designs and builds custom machines for filtration, packaging, medical, and general factory automation. One of Midmac's specialties is developing automated equipment to assemble oil filters. Responding to customer demand, Midmac developed their ACAM-H-series (Automated Cartridge Assembly Machine) as part of a total assembly line that pleats the filter paper, forms it into a roll and then applies a glue bead, finishing the product.

The search for reliable, high speed control

Midmac had determined that in order for their ACAM-H machine to be successful, extremely tight control of the glue gun at high speeds was essential. This presented a major challenge in designing the new system because a faulty pattern could result in leaky filters.

Midmac's initial version of the gluing system had local I/O in the PLC chassis. "Everything was hardwired back to a main enclosure which was costly in material and labor," explained Eric Bauer, electrical project manager for Midmac. "We had already designed a project using the Beckhoff distributed I/O products and were very happy with the results. The Beckhoff Bus Controller product provided local intelligence, more I/O choices, and cost savings over comparable products due to hardware and standardization reductions."

Employing Beckhoff distributed I/O, Midmac was able to design a gluing system with one electronic photo eye instead of two. "In the previous version, we had to use one photo eye to start the bead and another to stop it. The eye that picked up and fired a valve would work in one situation, but not in another—for example, if the machine sped up or slowed down," Bauer said. The programmable Bus Terminal Controller BC3100 is now used to run the gluing function block and pass variables in and out. "We can also count on an extremely fast and accurate response because all the intelligence is in the I/O modules," said Bauer.

The system's sequence of operation is as follows: A single photo eye detects the filters as they go by. The photo input then indicates that a glue pattern should be applied to the filter at the next stage. As the filter passes under the glue gun, the glue pattern is applied. The application is made at high speeds and based on a specified and configurable number of encoder counts, according to the machine's line speed. The photo eye and encoder counts are fed into a Beckhoff KL5121 high speed PLS counter module, which triggers the glue gun output based on the specified number of encoder counts after the photo eye detects the filter.

With this programmable variable, the pattern can be adjusted closer or further away from each end of the filter through local intelligence in the KL5121 Bus Terminal. The entire gluing sequence is controlled using a BC3100 intelligent Bus Coupler, various digital I/Os, and the intelligent KL5121 PLS module with programmable outputs. This allows the device to be nested below any higher-level PLC which is often specified by Midmac's customer. This reduces costs since Midmac can provide one glue controller standard for any customers-specified PLC.

Bauer explained that because of fixed delays in the system, a high-speed controller was needed to change the glue bead position to match the line speed. Beckhoff provided Midmac with sample code that Bauer used as a template to write a custom function block to direct the glue controller the way he wanted.

Flexible installation reduces material and labor costs

Bauer gives Beckhoff high marks for its extensive product line and flexible approach. "The Beckhoff selection of modules is a big thing. We deal with a lot of different signal types and networks and Beckhoff offers a wide range of modules that can be easily added to these networks. With other brands, we would have to order special modules and develop custom interfaces in order to get them to do what we want. Now, we just add a module to the network, map the I/O and we're done," he said. "It's very flexible as well as cost-effective."

Whenever practical, Midmac uses Beckhoff products on other machine systems they build. "Their Bus Terminals and Fieldbus Boxes are designed so that the I/O can be spread out. We don't have to hardwire a lot of sensors back to a main enclosure. In some instances, the distributed I/O is used just to reduce the wiring," said Bauer.

Additionally, TwinCAT IEC 61131-3 PC-based computer software and Bus Terminal I/Os are used on robotic palletizer systems the company builds.

Because many of the same components are employed across the board, Bauer has developed standardized CAD drawings and templates for PLC mapping to reduce engineering development time on new projects.

Bauer estimates savings in materials and labor by using Beckhoff hardware at 30 to 40 percent over alternative systems. He also pointed out that because the ACAM-H filter assembly machine has its own distributed controller, it can be easily integrated into customers' existing plant architectures.

As Midmac ships ACAM-H filter assembly machines with the new glue pattern controller, more filter manufacturers are able to meet their customers' needs and be ahead of the curve in the global movement to produce oil filters that are less harmful to the environment.

→ Midmac Systems, Inc. www.midmac.com

→ Beckhoff North America www.beckhoffautomation.com