

## Omron brings full automation to duct forming

Ducting for heating, ventilation and air conditioning (HVAC) is a hugely important global engineering industry. UK producer of duct manufacturing equipment Firmac has, thanks to a 17-year relationship with automation specialist Omron, engineered a fully-automated line rated by the supplier as one of the most sophisticated applications of its NJ controller in Europe.

In late 2011, Firmac and Swiss-based ducting producer Dresohn first developed the concept for what is now the Pro-Duct Evolution machine. In the words of Firmac Controls Manager Gregg Firth: "With the support of Dresohn, we set out to make the most advanced, intelligent and automated duct-forming machine in the marketplace."

Firmac explains that labour costs are high in Switzerland, and its customer was keen to minimise operator requirements. "Compared to our standard Pro-Duct machine, average production times and machine setup procedures have been greatly improved. This combined with the additional automation features means that one operator can man the whole machine," says Gregg.

In fact, because of reductions in setup times and overall downtime with the Pro-Duct Evolution, Dresohn's output has increased, Firmac reports, and it has reduced costs by moving from a three to two-shift production.

Omron's role was central to the success of the project, working on ways of replacing pneumatic and hydraulic actuators with alternatives controlled and positioned by servo drives. According to Gregg, Omron engineers helped to select the hardware solutions and integrate the entire control system.

"The Omron NJ machine controller was the obvious choice for this application. The complex motion requirements across 31 axes, integrated inverter control, along with the wide spread IO network meant the built-in EtherCAT was ideal network to accommodate all these requirements. Less time-critical devices, such as the machine HMI's, were connected on the integrated Ethernet/IP network. The traditional solution would have meant the use of a PLC with a separate motion controller," reports Ian Knight, Omron Applications Engineer.

"Most of our existing lines use an Omron CP1L or CJ2 PLC controller, with sheet positioning being controlled by open or closed-loop inverter drives," Gregg explains. "So to go fully servo, especially on 31 axes - with a further five on a robotic arm - was always going to be a challenge from a programming point of view. But with the expertise and support of Omron, our ambitions were met."



Omron's Sysmac Studio programming platform provided the ideal tool to combine together all aspects of the machines software development across the 60m2 line, Gregg adds.

The principle servo drive used is the Omron G5 range. As well as the NJ controller, MX2 inverter drives and the NS human-machine interface (HMI) are also sourced from Omron.

Once galvanised or stainless steel coils have been manually loaded onto the machine's coil holders, the automated process can begin. One of the main design goals was to produce a duct without any manual intervention, says Gregg. Entire processes, from machine setup to forming, folding and seam closing, have never before been automated to this degree.

The machine controller receives job data from an external networked computer system, after which the required coil is automatically selected and fed into the machine. Servo-driven side-guides measure the coil width (which can vary by +/- 5mm) and communicates those settings to all the other machine operations: levelling, pleating, notching, roll-tooling and folding.

A notched sheet with a formed male and female seam allowance passes through a series of roll-tooling stations to create a newly designed flange (known as CGF3) on either end of the duct. With the help of the robotic arm, the duct is folded before the seam is closed. The finished duct is then conveyed away from the machine.

"Machine setup times are reduced further by the ability to set sections of the machine independently," says Gregg. "For example, while the roll tooling and folding section is busy, the infeed can be changing its setup and also the coil selection to suit the requirements for the next job, all without interrupting production."

This ability to run multiple operations at once is a direct result of using Omron's single machine controller.

Other firsts attributable to the use of NJ machine control include the integration of a plasma cutter and a five-axis robot arm into the machine. Use of the cutter to create holes and access panels avoids the need for an additional, time-consuming manual process. "The robotic arm supports the ducts whilst they are being folded, duct sizes can vary from anything between 150x150mm up to 2000x2000mm. It also aides the mating of the male and female

joints for seam-closing, before removing the finished duct from the machine," Gregg explains.

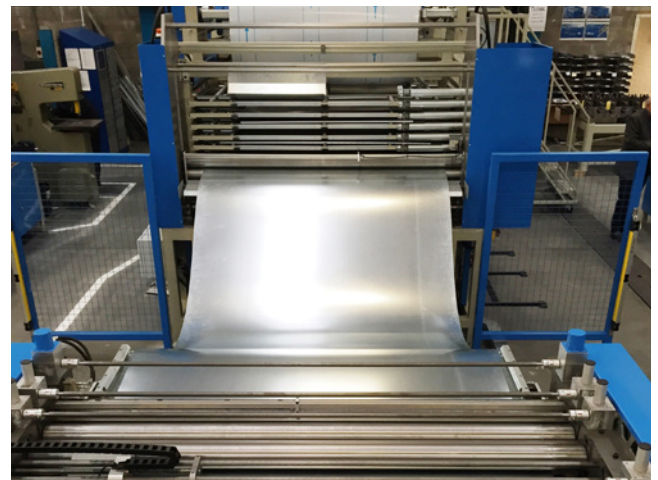
"Omron recommended the NJ as a 'solution from a single controller,'" he adds. "We took their word for it and they delivered. We didn't look elsewhere because we knew Omron would support us throughout the project."

Gregg says: "As a company, I know we've learnt many things during this machine build." For example, some of the technologies applied to the Pro-Duct Evolution are now being transferred to less highly-specified machines in the company's range.

He explains: "One of the new ideas applied to the Pro-Duct Evolution machine was the use of two servos to close the seam on the duct. This concept will now be used on the standard Pro-Duct DRS machine, controlled by a CJ2M PLC."

The partnership between the two companies goes back to 1998, when Firmac's then supplier of bespoke machine control systems unexpectedly pulled out of the market. Omron stepped in to offer help and support, later that year the first Firmac Mini-Line machine using an Omron PLC, HMI and inverter drive was sold into Ireland.

"Omron helped immensely in the development and testing of the machine through to its completion," Gregg recalls. "From an OEM's perspective, you couldn't have asked for more. And now, some 17 years on, the service is at the same high level!"



## About Omron

Omron Electronics Ltd is the UK subsidiary of Omron Corporation, a global leader in the field of automation. Established in 1933, Omron has more than 35,000 employees in over 35 countries working to provide products and services to customers in a variety of fields including industrial automation, electronic components industries, and healthcare. Omron Electronics Ltd provides a comprehensive sales and support service for Omron's vast range of industrial automation products including industrial components, sensing and safety, automation systems and drives.