

# Retrofitting plastic blow molding machines: From extruder to wall thickness control

W. Müller GmbH specializes in extrusion heads and extruders, mainly for retrofitting blow molding machines in conjunction with associated control technology. The company's retrofit solutions enable faster and more cost-effective adaptation to new products and higher productivity than replacing the machines with new ones. PC-based control from Beckhoff is used as a control platform which, through its openness and integration, supports innovative extrusion head functionality and facilitates interfacing with the blow molding machinery.

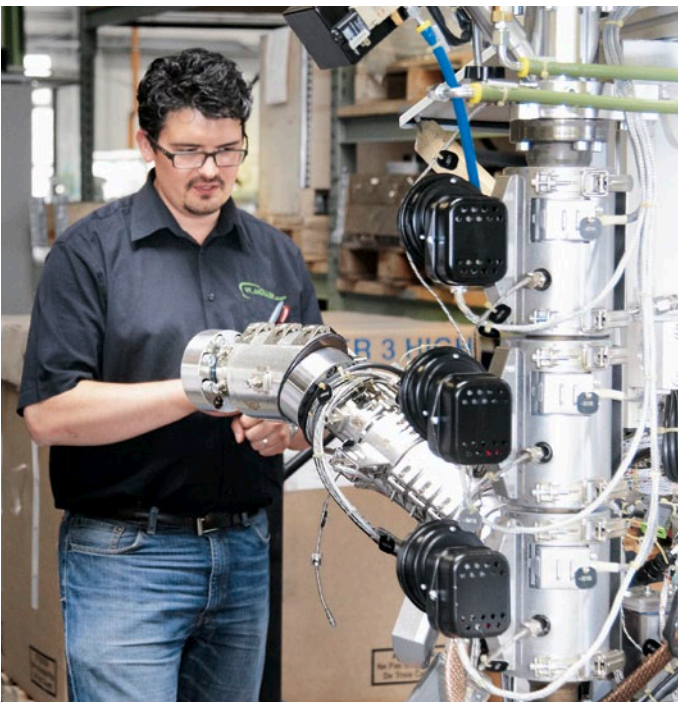


W. Müller GmbH, based in Troisdorf, Germany, has been delivering extrusion heads, extruders and associated services across the world since 1976. One of the main markets is the retrofitting of blow molding machines for which the comprehensive Müller Extrusion Retrofit Control solution complements the available machine functionality and therefore must be open and customizable for interfacing. PC-based control from Beckhoff offers the ideal platform for the retrofit solution of W. Müller, as James Birt from the control technology division explains: "The openness and flexibility of this control technology is a big advantage for us. It enables us to integrate the existing machine signals and the drive technology or temperature control from third-party suppliers without great expense and helps us meet customer requirements in terms of various bus systems, for example. The fast EtherCAT system was one of the main reasons why we switched to Beckhoff technology in 2010. EtherCAT has become the market standard and is supported by all our suppliers. Further key advantages are the wide range of over 300 EtherCAT Terminals and their high installation density."

The shape, color and design of the blow molded end products are as varied as the extrusion heads required to produce them.



The compact C6920 control cabinet IPC with dual-core processor is able to control the heating zones and wall thickness at the same time.



James Birt, W. Müller control technology division, in front of the CoEx-6 single-strand extrusion head, disassembled for transport.

### The extrusion head, the key component for any blow molding machine

The process complexity that must be mastered is illustrated by a current project, for which W. Müller supplies the complex extrusion platform, including extruders, extrusion heads and the corresponding control system - in this case for a new blow molding machine. A CoEx-6 extrusion head is used in conjunction with six extruders, which produces a six-layer plastic strand. The term "co-extrusion" is used in cases where non-related materials with different characteristics, which normally cannot be combined due to their consistency, are combined in a single hose. This is achieved through interlayers with special coupling agents, resulting in glossy outside and barrier layers against oxygen or UV radiation, for example.

Depending on the application, CoEx blow molding configurations with 3 to 7 layers are used in practice. Typical examples include food packaging such as ketchup bottles with barrier layers for extended shelf-life, cosmetics bottles with high gloss and scratch-proof outside layers as glass substitutes, and mineral tanks, e.g. for lawnmowers, with barrier layers for environmental protection. James Birt explained: "With multilayer technology the best result is achieved through application of individual extruders per layer, because in this case the thickness of each individual layer and therefore the plastic strand can be optimally adjusted to the respective end product. The wall thickness control, which operates with forces between 0.6 t and up to, in extreme cases, 100 t, depending on the application, must be precise and offer high enough performance to meet this requirement."

### Integrated and customizable control solution for extrusion heads and extruders

The 'Müller Extrusion Retrofit Control' solution, with a special user interface created in Visual Studio®, is based entirely on Beckhoff control technology and is available in three versions, as James Birt explains: "One version for smaller roll cabinets uses a 5.7" Panel PC with Intel® Atom™ processor for controlling a small number of heating zones and an extruder, for example. The same Panel PC is used in a special retrofit solution for wall thickness control. At the other end of the spectrum, our large control version for extrusion platforms with up to 10 extruders operates with a 15" touch screen panel from Beckhoff, combined with a dual-core control cabinet IPC. A Panel PC may be used, depending on the application and customer requirements."

The extrusion head, fed by six extruders, produces a plastic strand consisting of six layers.



Via the sub-distributions of the EtherCAT Terminal system the signals provided by the blow molding machine are logged as well as axis and heating zone information. Generally one servo axis has to be used per extrusion machine, and a further axis is used for wall thickness control. According to James Birt, most I/O data comes from the thermocouples: "Our concept uses a large number of individual heaters, since this is the best way to control the flow of material. A maximum of 220 heating zones are available in the control system, although 50 heating zones are usually sufficient, even for larger systems. In addition there are numerous temperature-controlled zones, e.g. for water-cooled feed zones or valve control."

#### **Control technology opens up development potential**

According to James Birt, the trend in blow molding is a move towards all-electric machines, because they are more energy-efficient and enable outstanding energy recovery. Therefore, W. Müller uses servo axes as a matter of principle, which in conjunction with software solutions developed in-house reduce the energy consumption during the extruder heating phase, for example. Further energy savings are achieved by logging currents and voltages via the EL34xx power measurement terminal from Beckhoff. Control expert James Birt said: "Today we already use the data recorded by the power measurement terminal to determine the energy consumption for each product. In the future we intend to expand this system and implement full energy management via TwinCAT software. Customers increasingly expect energy-optimized systems, for which PC-based control in conjunction with servo technology offers the ideal platform."

The operating system changeover from Windows CE to the more powerful Windows 7 Embedded, in conjunction with the migration to the new TwinCAT 3 software generation, offers further development potential. James Birt illustrates

the advantages of the latest version of TwinCAT: "We expect significant efficiency benefits from TwinCAT 3 thanks to the wide selection of integrated tools. We also intend to integrate safety technology into the central software platform, which in the past has been wired individually on the machine." Further benefits are provided by active multi-core and 64 bit operating system support, which enables control technology and visualization to be allocated to two different processor cores in order to maximize CPU performance, for example, explains the control system expert of W. Müller GmbH.

A further recent innovation could be achieved thanks to a special EtherCAT characteristic: for the first time, the distributed clocks function enabled us to synchronize two axes with high precision for wall thickness control via Ethernet. James Birt explained: "This prototype extrusion head features two electrical control cylinders at the corresponding steel plate for wall thickness control, instead of the usual one. It goes without saying that the cylinders have to move exactly in parallel, in order to avoid tilting of the plate, which would result in imprecise wall thickness. No doubt this technology, which was successfully implemented thanks to EtherCAT, will be used more regularly in the future."

Further information:

[www.extrusionhead.com](http://www.extrusionhead.com)

[www.beckhoff.com/plastic](http://www.beckhoff.com/plastic)