b'champ glass processing machine by Bystronic.

Bystronik – Crystal-Clear Calculation.

The automotive industry is the pioneer in the use of new production methods and technologies. Demands, which were unthinkable not too long ago, are also being placed on glass materials. The company Bystronic Maschinen AG from Bützberg, Switzerland is the leading supplier of industrial systems for commercial glass processing in the building and automotive field. 80% of their revenues are generated in the automotive sector. There is hardly any automobile manufacturer or supplier, who does not count on Bystronic Know-how to cut, grind and drill glass for windshields, rear or side windows. 90% of European cars use windows cut with a Bystronic machine, which is also known as the "Mercedes" of the industry.

"Broken glass brings good luck" is a saying which does not apply to glass processing. Glass is expensive. Although glass technically is a liquid, it is extremely fragile and can be easily broken. This processing requires particular manipulation precision to prevent the workpiece from being shattered. Glass cutting cannot be compared with conventional cutting processes on other materials. Glass is first scored and then broken. In order to achieve a clean cut, the glass must be scored at the highest possible speed. The quicker the scoring, the cleaner the break. Hard-metal cutting wheels are still used for scoring the glass.

b'champ is the new generation of compact, fully automatic automotive glass processing machines by Bystronic. The ability to fully process glass in extremely tight corners is a major feature. Cutting, grinding and drilling car windows is done on a very small cutting area. This is quite valuable in production halls. On the production lines, the highest demands are put on three-shift production which is very common in this branch: High availability and the fastest possible changeover time play a large roll in achieving high performance. A Bystronic b'champ glass cutting machine can be individually adjusted according to customer requirements. Bystronic machines are often in use for 30 years.

Precision requirements when cutting glass for buildings fall within the range of one to three tenths of a millimeter. Automotive glass requires precision of five to fifteen hundredths of a millimeter. This degree of precision and the previously mentioned need for high scoring speeds of 80 to 150 m/min place the highest demands on the drive systems and their coordination in the b'champ. Furthermore, the hard-metal cutting wheel must always be aligned tangential to the path when scoring.

Twenty years ago, a speed of 80 m/min and the synchronization requirements mentioned above were unimaginable for a glass cutting machine. Back then, Bystronic met this challenge with their own high-speed NC controllers and drive systems, which were also used in laser cutting. After the processor used in these controllers was cancelled, Bystronic was faced with the decision to change over to a new generation of controllers that also accounted for future requirements.

"Our primary area of expertise is processing glass", says Davor Deprato, main developing engineer of the b'champ controller at Bystronic. "A redesign of our controller would have been an enormous effort. We assumed that meanwhile there were many controllers on the market which matched our ideas. The only question was 'how precise and how dynamic'."

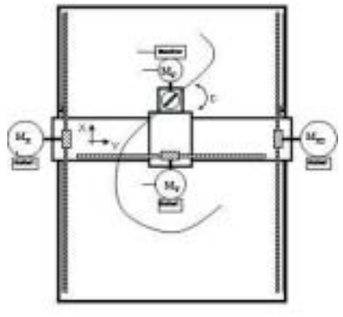
Davor Deprato, Bystronic.

A disadvantage of the in-house system was that the focus was on CNC functions and communication to the environment required a lot of additional effort. The number of inputs and outputs was also greatly limited. Each machine consists of a cutting, grinding and drilling cell, which were each automated via individual NC controllers in separate cabinets. A higher level production line controller coordinated the procedure. This lead to the combination of various standard controllers, frequency inverters and I/O systems with the in-house CNC and drive components. It is no wonder that this resulted in respectively high effort in development, construction and wiring, as well as maintenance.

"We knew exactly what we wanted", explained Deprato. "Not just a controller for the individual machines, but a complete platform, which automated our systems. This includes drives, NC, visualization and the respective networking."

With the well-founded experience based in the development of their own controllers and drive systems, as well as the highly dynamic requirements, Bystronic of course had high expectations. They decided to use a multistage selection process.

After making thorough inquiries, several suppliers were contacted. Following these initial contacts, a selection list came out of this group. Four manufacturers were invited to automate a specific machine. Technically, it was to be a machine component with functions common to the glass industry and with high demands on the dynamic properties. Just two manufacturers succeeded at the task. In the end, the solution from B&R prevailed with ETHERNET Powerlink. A decisive factor was that a universally integrated system for control, drive and visualization also allows short-term changes to be made quickly. ETHERNET Powerlink provided the assurance needed for present and future communication demands.



Synchronized axes in glass cutting table.

The ability to network all automation components in the machine is an interesting factor. ETHERNET Powerlink is applied universally in the b'champ even though CAN bus performance would have still been sufficient in some areas. More and more axes and spindles can be linked in the machines. Glass drilling machines contain up to 11 drives, with up to 15 in vertical glass processing.

"With figures like these, ETHERNET Powerlink sells itself", says. Deprato. "CAN is indeed clever and convenient, however you can only achieve the required dynamic properties with ETHERNET Powerlink. With that in mind, why would we use two bus systems?"

In the smart'cut, a newly developed glass cutting machine for the building glass sector (b'smart is the name of the building glas product range) two drives are used to move the bar in the X direction when cutting glass. This tandem or gantry axis is coupled electronically via ETHERNET Powerlink. This also applies to linking the cutting device drive on the Y axis and the cutting wheel drive, which must also be aligned tangential to the cutting path. In the first step, the glass is scored on this system. In the second step, a roller runs on the same platform along the outside of the scored contour and breaks off the excess glass.

The data is exchanged via ETHERNET Powerlink at 100 MBit/s and with 800 µs cycle time, to meet the precision and speed requirements. The smart'cut is easily connected to a higher level Intranet using the Ethernet interface on the CP360 CPU from the B&R 2005 series.

"With other manufacturers, we would have needed to buy an additional interface board" admitted Deprato. For further standardization and for logistical reasons, Bystronic uses the CP360 universally, even though some machines do not require this level of performance.

Less than one year after the decision for the B&R system with ETHERNET Powerlink, the first machines were delivered. The systems were programmed at Bystronic with strong support from the application experts at B&R and external companies.

During the process, Deprato began wishing that everything could be connected to ETHERNET Powerlink, even basic sensors and actuators such as pneumatic valves:

"We do not want an intermediate layer using another bus anymore. ETHERNET Powerlink should become the fieldbus of the future. You hear about all the problems with the fieldbus systems on the market. Therefore it is important for ETHERNET Powerlink to be developed into a standard."