

Competitive through the latest automation



→ Until 10 years ago, most mains connection cables were manufactured manually. Since then, the majority of manufacturing has been shifted to low-wage countries, where wage costs are more than 17 times lower than those in Europe. Leoni CWA Cable in Hasselt, Belgium, represents an exception. Their production capacity for mains connection cables is still relatively large. This plant can hold its place against the competition because of advanced automation and rising productivity.

A mains connection cable consists of a plug, a cable and an appropriate socket for connection to a specific device. The plugs may be standardized for particular countries, or even for groups of countries, but electrical devices – whether toasters, razors, televisions, PCs or washing machines – have connections that are specific to the make, or even to the particular model, which means that there is a very large number of different mains connection cables. Automation of the manufacturing process for this essentially simple product calls for a large number of relatively complex handling operations: The cable must be cut to the correct length, outer cladding removed and insulation stripped from the conducting wires, the loose pins, or a bridge with pins, must be fixed to the conducting wires by soldering or clamping, and the housing must be molded around it in two further working steps. This is followed by a number of tests and checks, because an extension cable must be safe, and may well have to accord with the safety regulations applicable in particular countries.

Higher quality in spite of falling prices

The drop in prices in the cable manufacture sector of the market has been extreme: Whereas a cable cost 0.50 EUR about 20 years ago (which corresponds to about 1.50 EUR when converted to today's prices) the same cable is now sold for less than 0.30 EUR, although the requirements for quality have risen sharply. Thanks to ever-increasing automation that is able to hold the price at the same level while ensuring uniform quality of the highest class, production at Leoni CWA Cable is still competitive. In co-operation with Multiprox, Beckhoff's partner in Belgium, Leoni's technical management decided in favor of an automation concept based on the software PLC/NC TwinCAT, and for automation components from Beckhoff. The first production equipment was converted to use Beckhoff components in March 2000, and the third machine is already being fitted in the same way at the moment.





The production at Cable and Wire Assemblies in Hasselt can remain competitive thanks to more and more powerful automation. The factory in Belgium is the largest producer of electric razor cables in the world.

Continuous optimization of the machines

The production site in Hasselt can look back over many years of tradition in automation. Until 1990, the factory maintained a large internal development department for the construction of the machines. Nowadays development is carried out in co-operation with suppliers, while the construction has entirely been handed over to other companies. The automation concept is developed, and certain particular adaptations are carried out, by the company's own engineers. The factory in Hasselt has 10 production units, which start with the manufacture of a cable and take it up to the fully processed mains connection cable. Part of the manufacturing work must still be carried out manually for a few types of cable. It is planned that the machines will systematically be automated further, so that a dark room production unit will be achieved.

The oldest machines reached the limits of their development capacity two years ago: The capacity of the PLCs was too small, and not enough I/Os were available. The expansion that was then on the agenda called for comprehensive modernization, one reason for which was the fact that the electrical cabling was becoming more and more entangled and difficult to comprehend. At the same time the number of suppliers for machine parts was reduced.

Less for more

The decision in favor of TwinCAT as a replacement for the proprietary controllers was reached on the basis of a comparison of the price/performance ratios. An Industrial PC with a software PLC is cheaper than a conventional PLC offering the same facilities. Further advantages include the rapid, reliable transfer of data through optical fiber over the Lightbus system, and the flexibility of the Beckhoff Bus Terminals. TwinCAT, furthermore, itself offers short cycle times for the transfer of data over the fieldbus, so that a pulse generator on the machine (100 pulses in 1.5 s) can be directly read via one input without the need for special count-





Some examples of mains connection cables.



LEONI Cable Assemblies (Belgium) NV

Leoni CWA Cable was founded in 1964 as a division of Philips for the manual production of mains connection cables. In 1990 this division was turned into an independent company, Cable and Wire Assemblies, and was taken over in 1998 by Leoni, a German group specialized in the production of cables and wires, and which can look back over 400 years of company tradition. Leoni operates six factories in the mains connection cable sector, which is a sub-division of cable production: Two are in China, and there is one each in Brazil, Morocco (a subsidiary of CWA), the Czech Republic and Belgium. The largest production capacity however is still located in Hasselt, Belgium.

Since the beginning of the 1980s, production in Hasselt has been automated, and has specialized in the manufacture of larger series (piece counts of between 5000 and 10000) of cables with "category 2" connecting plugs. Hasselt is the largest producer in the world of spiral cables for electric razors. The production of "power plugs", in which a 220 V to 12 V conversion facility is integrated into the plug, will begin soon. A total of about 1.5 million cables of all types are produced each week. With 200 employees, the annual turnover is 37.5 million EUR.

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er cards. The PC controller is programmed in accordance with the IEC 61131-3 standard. Every machine fitted with TwinCAT has a Beckhoff Control Panel. Operation is easy to understand, so that fault finding on the machine has become much easier and faster. Downtime is thus reduced to a minimum. The extensive and flexible possibilities for further expansion are yet another advantage. Expansion of the system with additional fieldbus devices can be done quickly with an additional PC card.

Integration of axis control

A robot developed by Leoni themselves is planned for the new project. It has two degrees of freedom – longitudinal and vertical movement. Its purpose is to accept the mains connection cables that have been prepared in the previous stages and to apply the pins to a positioning plate. This plate is then pushed into the injection nozzle by means of a conveying system. This allows the molding of the plug to be integrated into the automatic production process. Because it is necessary for the robot's movement to be controllable both in height and velocity (fast movement followed by slow positioning at the precise position), it is not possible to use linear pneumatic elements here, but only axis controllers with servomotors. The AX2000 servoamplifier and servomotors from the AM2000 series offering 8 Nm, 3,000 rpm, and having permanent magnet rotors and built-in resolvers are used.

Leoni have preferred the Beckhoff solution also for the motors, drives and the NC software necessary on the PCs for control of the robot movement. The TwinCAT NC PTP software can run on the same Industrial PC (Celeron 700 MHz, 64 MB SDRAM) as the TwinCAT software PLC, resulting in a machine controller that is both economical and yet very powerful. The decision was taken to use the Lightbus again for communication between the PC and the drives, as well as for the I/Os.

Theoretically, the Beckhoff NC controller can control up to 255 axes with an Industrial PC. If the NC communication is given precedence, above, for example, the PLC tasks, then the fastest task can be executed within a cycle time of 50 μ s. The IPC used only requires 13 μ s to process each axis.

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