Fieldbus and Movicon on board machines

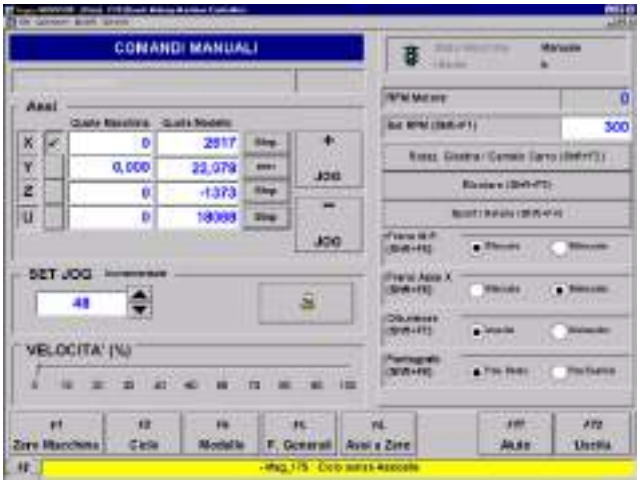
The most modern technology is now used on mass-produced automatic machines. Borghi Spa has entrusted its machine monitoring needs to Movicon.

By Giuseppe Bettini

Borghi Spa is worldwide leader when it comes to automatic machines that produce brushes and brooms. With its headquarters in S. Cesario sul Panaro (Modena), Borghi Spa is a company with ISO9001 certification and exports amounting to 80% of its turnover. Its core-business is the high-performance multi-station BR machine with automatic control which features boring and tufting stations that operate at a rate of 500 strokes per minute.

The brush and broom machine sector has unexpectedly proved to be a highly technological one. And this is particularly true of a company like Borghi Spa, which has always used avant-garde, innovative technologies for both the electronic and mechanics of the machines it produces even when compared to apparently more technological sectors like the vehicle or

robotics industries. True to this company philosophy, Borghi Spa has recently terminated the prototype phase for a new machine model that revolutionizes plant monitoring applied to already highly efficient mechanics.
The new model, called BR32, is based on a totally PC-integrated architecture where an industrial PC with Windows NT hosts the Scada Movicon system and the monitoring board that governs the I/O on an Interbus network.
Choice of Interbus field bus-bars conforming to the EN50254 standard has allowed the manufacturer to make drastic reductions in wiring costs, to reduce the size of the electric cubicle and to improve the performances in applications where speed is a critical factor.
Axis management is distributed amongst bus-bars thanks to “intelligent” drives equipped with microprocessors able to regulate the axis on their own and to position it at the destination target transmitted by the monitoring system as required.
Thanks to its speed and the performances of the bus-bars, the system can reliably handle the axes positioning times, which must not be more than 80 milliseconds from step to step.
The machine can have up to 5 controlled axes and around 200 digital inputs and outputs distributed between two machining units, plus a loading/unloading station with a Touch Screen PC featuring industrial architecture positioned nearby on a mobile console for the operator.
The operator positions the blank workpiece, called “tablet”, in the loading/unloading station. This is then conveyed by a turntable with controlled axis to the next station where it is bored. The housing head on the turntable contains the heart of the machine. The controlled axes on the turntable move the workpiece along three linear axes (XYZ) and one tilting axis (U).
The machining units are driven by a single main motor that determines the production

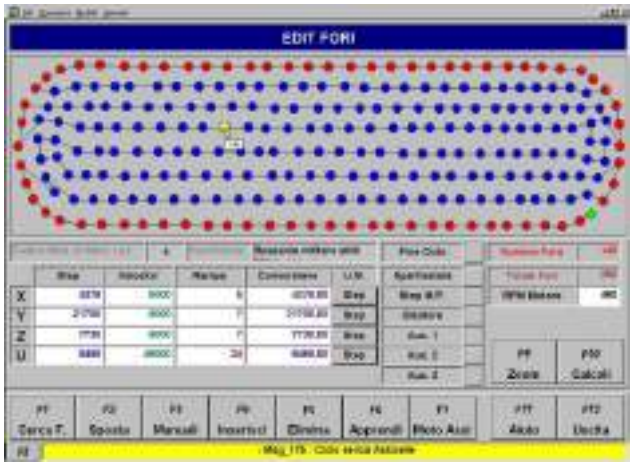


One of Movicon’s graphic masks used to control the machine in the manual mode

speed of the entire system. The machining heads on the units are thus synchronized with each other, while the speed of the main motor allows the heads to work at over 500 strokes per minute.
The work stations are equipped with a boring unit and a punching unit to house the tufts of plastic material (synthetic or natural fiber) that form the brushes or brooms. Positioned in the automatic clamping system on the turntable, the workpiece moves on the linear and tilting axes along a programmed trajectory, while the units carry out their respective operations at high speed. Just consider that an axis, working at 500 strokes per minute, has up to 80 milliseconds in which to move to the next target. If this fails to occur, the anti-collision systems are activated to protect the machine and stop it in safety conditions.
Choice of the architecture for the system thus depended on the performances required from the machine as a whole. Reliable, safe and fast systems were

therefore required. But it was also essential to provide the user with expandable and standard architecture plus all the relative backup. After a series of analyses and evaluations, Borghi decided to use Movicon as Scada system to handle the entire system. Scada is the heart of the monitoring system. The Movicon application is particularly complex. It does not merely provide the man-machine interface and diagnosis functions, but controls the true machine with functions similar to those of a simple Numeric Control. The Movicon application deals with tasks like monitoring the machining program, calculating the targets, speeds and accelerations. The system actually guides the operator to all effects, autolearns the programs and files the data depending on the type of product being made. The performances of the machining program can be re-processed and optimized so that it can be adapted to the required product model. This function allows production to be optimized without stressing the mechanics to an excessive extent while improving the quality. Movicon then transmits the optimized machining program to the control system. This type of architecture guarantees the deterministic performances that the high machine speed requires.
To do this, the monitoring board has two microprocessors which govern the I/O and bus-bars in an independent way from Windows NT (a non-deterministic operating system).
Thus the monitoring board handles the logic sequences, the safety devices and axes according to the parameters processed by the Movicon application.
The operator therefore uses an extremely simple system that is intuitive to work with in order to control the machine, program and autolearn the cycles. Graphic display of the work cycles showing the hole layout is of great interest.

Thanks to Movicon's graphic potential, the path and boring layout are represented according to the program in question while during the cycle, the holes change colour as they are made, in synchrony with the effective activity of the machine. Thanks to its speed, the Movicon system can colour the holes even when the machine operates at its maximum production rate.
Besides editing and programming, processing and optimizing, the supervising station provides the operator with all the manual controls he needs to handle the machine. This has allowed the manufacturer to rationalize the layout of the controls, cutting down the size of the push button panel and taking advantage of the intuitive way in which the touch screen is used.
Besides the graphic operator interface functions, the Movicon application also deals with production data filing tasks. In view of the large number of brushes and brooms produced on a batch order basis, it is of fundamental importance for user companies to have a production data archive and to be



The operator can use interesting functions provided by the Movicon supervising and monitoring application, such as program editing and graphic display of the boring path.

able to make statistical analyses and print reports. Thanks to use of a standard platform, the data are filed in standard database format with SQL backup. The

production analyses therefore arrange the data according to the batch, the product, shift, period, etc.
Preventive Maintenance is also handled while all the technical documentation concerning the machine is to be shortly linked to the Movicon application in electronic format. This will create a user-friendly guide for the maintenance engineer with direct links between alarms and technical descriptions about repairs, diagrams and spare parts codes.
Architecture of this type obviously requires high processing speeds and a high degree of reliability in all circumstances. This is why the choice was Movicon, the fast, expandable and standard system produced by Progea which, along with the potential required, provides customers with a consultation and engineering service, working alongside the planners in the manufacturing company. All this adds up to something which, during the prototype developing phase, is of fundamental importance for the success of the project as a whole.
This particular prototype has recently passed all the strict tests and trials conducted to verify its performances and reliability. Scrupulously complying with the company's quality philosophy, Borghi's test engineers made sure that the system was reliable by running the machine for months in conditions of the utmost stress and at top speeds. Now that the setting up phase has terminated, and the planners and test engineers have been trained, the prototype phase can be considered to be concluded. Mass production is shortly to begin.

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