



Silk-screen printing machines for the glass goods decoration networked by Beckhoff bus terminals

What links noble perfumes with field buses

The Balsfulland-Maschinenfabrik GmbH at Schloß Holte-Stukenbrock in Westphalia, Germany uses the electronic bus terminals of Beckhoff in its most recent generation of fully automatic multi-color silk-screen printing units for the decoration of small beauty bottles. The variable bus terminals remove the inflexible connection of CNC and field bus and thus enable the problem-free adaption to different field bus systems.

The printing spectrum that the Westphalian silk-screen printing equipment builder offers their customers experiences scarcely limitations with respect to the article forms and the position of the print images. "Again and again, the market demands other print images on other forms and materials", David Blankenauffland responsible for control technology within Balsfulland Maschinenfabrik GmbH located at Schloß Holte-Stukenbrock reports. Whether round, oval, angular or other forms, glass, plastic, metal or other materials, the customer only demands high quality, the shortest conversion times, and

different color combinations in order to profitably produce also at small lot sizes.

The Westphalian machine builder use an intelligent control concept as an answer to these requirements. For a few years, they have converted their silk-screen printing machines to CNC controlled systems and optimized drive technology. By this means, the machines become more flexible and efficient. With the most recent machine generation, the CNC 500, a Type 3 Bosch controller with open architecture provides, e. g. a quick 4-axis interpolation using Sercos interfaces connected to Indramat drives.

In their most recent generation of fully automatic multi-color silk-screen printing units, the Balsfulland machine factory uses the electronic Beckhoff bus terminals.



Field bus change without installation cost

In this context, a special feature represents the combination of the open controller concept including the electronic bus terminals of Beckhoff. Extensive CNC functionalities should be decoupled from the peripheral controller technology to reduce the CNC development investments. For this reason, the machine developers used six stations with Beckhoff bus terminals as remote input/output stations and connected them to the PLC integrated in the CNC.

In the past, the entire wiring had always to be changed for test runs with different CNC controllers and drives; this process was quite time-consuming and expensive. Using the electronic block terminals, it was possible to exchange the CNC controller in a plug & play type manner without large investments after installing the bus terminals. The peripheral components connected to the PLC via a field bus and an optical fiber ring remained untouched by the change.

Due to its field bus independence, the bus terminal system also meets the special demands for flexibility. The Interbus/Profibus conversion of the field bus system was performed without problems. Due to

Silk-screen printing technology:

Most refined method for decorating glass goods

The fully automatic one or two color silk-screen printing machines from the Balsfulland machine factory have been designed for a multitude of forms of small beauty bottles, beverage bottles, jugs, mugs, or technical glass articles. Current CNC technology is used for every article movement and printing mode. A specialty of the Balsfulland machines is that there are no limitations with respect to article forms and printing positions.

A superior characteristic is also that various printing forms and color combinations can be printed in one run. The simultaneous use of two color wiper heads and silk-screens makes this possible. Monitor-based operator guidance based on stored work data offers a simple handling of this two-color machine. The necessary information, e.g. diameter of the article, printing form length, register desired yes/no, number of colors etc. are inquired by the computer and answered by the machine operator. Then, the new program is automatically generated.

The articles are supplied and transported away standing on a conveyor. A handling system places the articles into a fixture (bottom neck centering equipment) and removes them after printing. For monotone print procedures, the position of the handling robot can be easily changed manually. Advantage: reduced production cycle time = increased performance.

The secret of the Balsfulland CNC 500 concept is a perfect combination of a solid mechanical engineering construction and high-tech electronics with the objective of high flexibility, possible shortest set-up times of 15 to 30 min for an article change and low tool costs.

In the silk-screen printing machine application, the bus-variable field bus terminals made by Beckhoff remove the inflexible link of CNC and field bus and enable thus the problem-free conversion to different systems.



the fast change of the field stations, the equipment was again operational after a few minutes. In the result the same but considerably more extensive and expensive, the exchange of I/O modules would have required a rewiring.

Flexible control constellations are getting increasingly more important. Altogether, the simplicity is convincing. Balsfulland that enables any system to be realized just by exchanging the individual bus coupler. Also, that this company philosophy fits the aimed independence from a single source supplier made

the concept even more convincing. David Blankenauffland: "Without problems, we can flexibly integrate the efficient CNC controllers, field buses, and digital drives into a functioning complete system. That not only shows in the optimized automation of silk-screen printing machines but also enables price negotiations when purchasing automation components."

EMI security included
Since the K-Bus was optimized for the use in industrial environment in extensive tests and the contacts and lines run densely next to the

mounting rail and directly over the mounting plate, the bus is extensively protected against inducted noise. David Blankenauffland: "EMI problems never occurred yet to us since we use fiber optics as bus ring line in addition." However, should radiations affect once, the radiated disturbances remain without effect due to the complete galvanic separation of the K-Bus from external potentials. The complete galvanic separation to the field and to the power supply provides for a maximum operating reliability. Since the interface module features "its own intelligence" and deter-

The electronic block terminals – the rugged system

In addition to the two-channel digital input/output terminals that can be loaded with a current of 2 A for 24 V DC outputs, there are analog versions for currents and voltages in standardized signal levels and for PT100 and thermo-couplers. Using a terminal with serial interface, RS 232 C or 20 mA current loop conforming intelligent devices can be interfaced and parameterized. Featuring a width of 12 mm, all electronic block terminals have twice the width of a mechanical grid of 6 mm.



The advantages of the Beckhoff system become obvious if individual options such as additional potential separation, ease of maintenance, economical stock-keeping, expandability and flexibility are in demand as in the configuration of six I/O points in case of the silk-screen printing machines of Balsfulland.



mines noise on a stand-alone basis, noise is signaled to the controller via the bus system. A positive image is drawn also in case of faults. Here, 35 German Marks for exchanging a block terminal are in contrast to 1000 German Marks of cost when changing a faulty I/O module.

Tested for the practice, proven in practice

David Blankenauffulland makes no secret of the fact that he considers the competitors modules with 4, 8, and 16 I/O points too inflexible compared to the individual terminal of Beckhoff. "In addition, often another more unfavorable design format would apply to our applications and higher costs would result at the end due to using fixed numbers of inputs and outputs", the control expert reports. In fact, there is nearly none or only a slight costs advantage of the most reasonably priced competitor for, e. g. exactly 8 inputs or outputs compared to the individual bus terminal and that for only one field bus. However, practice shows that exactly 8-bit large groups of only inputs or only outputs are relatively rare. That also applies to combinations of eight. The advantages of the Beckhoff system become obvious if individual options such as addition-

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The configuration of the bus terminal is also most easy. At purely digital or analog applications, no special configuration of the preset standard terminal is required but it is rather lined up as a block terminal. Also, a special set-up does not become a problem. The KS2000 configuration software is used here. This configuration software enables a clear simplification of the bus interfacing. The software module supports the set-up of the terminal block up to the output of corresponding address and reference lists.

The Balsfulland machine factory made intensive use of the possibilities offered by the Beckhoff bus terminals and equipped their most recent generation of silk-screen printing machines with this terminal type at comparatively low time and cost investments. Thus, the machine builders from Schloß Holt-Stukenbrock implemented an open systems structure in their equipment. Up-to-date PC-based controller systems, operating and

visualizing systems are used as standard components. In summary, the optimal equipment selection and adaptation was considerably eased for the Balsfulland machine factory in spite of a obviously more complex functionality of the new silk-screen printing unit generation.