

For logistics systems,
the company RESA GmbH
relies on small controllers
from Beckhoff



→ The system provider RESA GmbH handles intelligent control tasks for automotive production using Ethernet and decentralized small controllers from Beckhoff. For the production of the new Ford Fiesta in Cologne and the Ford Focus in Saarlouis, RESA supplied a "Plant Floor Process Control System" for quality monitoring of all critical screw joints and for controlling the screw controllers.

Decentralized automation solutions with Ethernet network

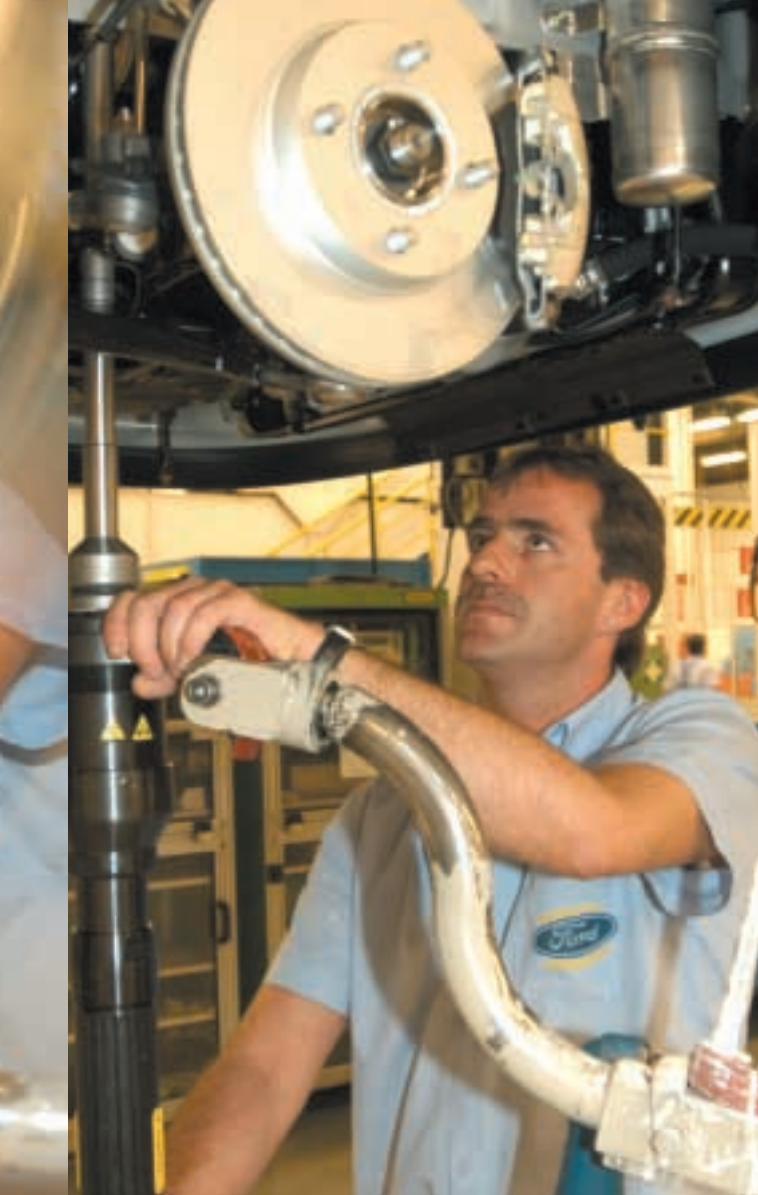
RESA GmbH with head office in Saarwellingen (Germany) was established in 1982 and now has more than 400 staff. The company's main customers are car manufacturers and their suppliers. Dr. Udo Kiefer, manager for logistics systems at RESA, said: "Our competencies clearly lie in automation technology with focus on the electrical engineering side, and in project management. This comprises all aspects of project-related application software development, including assembly, commissioning and complete documentation of the implemented projects."

Prior to the Cologne Ford project, the company had already gathered experience with the automation system from Beckhoff, which is used in a variety of applications in the automotive sector. At the Jaguar factory based at the English town of Halewood, for example, a variant-dependent "pick control" system based on the

TwinCAT software PLC and BC9000 small controllers was realized for the company Visteon. Another example is LMK, a Ferrostaal Group company producing engines and gearboxes for Fiesta cars, where screw data and gearbox oil levels are recorded and monitored at 50 workstations, each using a BC9000 small controller.

Intelligent assembly stations ensure high quality standards

In the assembly systems for the Fiesta and Focus that were implemented in the Ford plants at Cologne and Saarlouis, the tasks included checking the assembly of safety-relevant components and demonstrating that, within a continuous process, all screw joints required for a particular vehicle were executed correctly



Dr. Udo Kiefer is manager for logistics systems at RESA GmbH.



Dipl.-Ing. Arno Fries is head of department for logistics computer systems.

Gearbox bearing screw joint in the Ford Focus.

Overview of the Ford project

For the production of the new Ford Fiesta in Cologne and the Ford Focus in Saarlouis, RESA supplied a "Plant Floor Process Control System" that deals with the following tasks: monitoring of the quality of all critical screw joints, control of the screw controllers independent of type, and station-specific machine operator guidance.

The following components were used for the implementation:

- | Line server with PPCS system software,
- | 60/130 station controllers (Universal Control Box, based on Beckhoff BC9000 small controllers) with identification units,
- | Sensors and coupling with 2 screw controllers in each case,
- | Mixed optical fibre/TP network for the communication between the station controllers with the line servers, and between the line servers with the Ford control and quality systems via Ethernet.

and within the tolerance range. To this end, in Cologne 60 assembly stations with a total of 100 screwdrivers and in Saarlouis 130 assembly stations with 170 screwdrivers have to be controlled and monitored within a closed-loop system. The customer-specific vehicles are identified via a scanner and integration into the Ford production management system. Feeding of the individual parts for each vehicle order and the activation of the respective assembly orders are synchronized. To this end, the assembly stations transfer enable signals to the screw controllers from Atlas Copco or Stanley. The screw process is monitored with regard to quantity and quality, i. e. torque and angle of rotation are controlled. After the screw processes are completed, the data that were determined are registered and archived in the PPCS server. Screw joints that were not executed correctly are



Final assembly of the Ford Focus at the Saarlouis plant.



Bus Terminal Controller BC9000 with Ethernet interface.

checked and corrected. Once acknowledged, the result is transferred to the Ford quality management system.

For realizing this task, every one of the 190 assembly stations was equipped with a Universal Control Box (UCB), each featuring a BC9000 type Beckhoff Bus Terminal Controller with various I/O terminals. Up to two independent screw controllers from Atlas Copco are controlled on a lower level basis. The small controllers are networked via Ethernet and communicate the process data and the Ident scanner data to the TwinCAT OPC Server, which in turn is linked to the production management computer. "The network serves the respective hierarchically positioned stations," explained Dr. Kiefer. The communication path thus comprises the BC9000 Ethernet controller, hubs, switches, the TwinCAT software PLC with OPC Server and the PPCS line server.

Scalable control platform

The crucial factors for the decision to use BC9000 small controllers in this and in other projects were the Ethernet interfaces and the availability of local, decentralized intelligence. "When programming the respective individual tasks," said Dr. Kiefer, "one often wants to quickly include this or that additional programming detail, frequently reaching the available storage capacity limits in series BC controllers." The new BX series Bus Terminal Controllers were optimized for this type of application. Ralf Vienken, product manager with responsibility for small



Universal Control Box with screw controller with integrated Beckhoff controller.



Ralf Vienken, at Beckhoff responsible for small controllers: "The BX series expands our successful BC series Bus Terminal Controllers for use in more complex applications requiring larger program and data memory."

controllers at Beckhoff, said: "The areas of application of this series are similar to that of the BC series, but due to its larger memory, the BX can process significantly more complex and larger programs and can manage more data locally, for example history and trend data recording. When Bus Terminal controllers reach their limits with regard to performance and capacity, alternatives are available in the form of the CX1000 Embedded PC or the Industrial PCs as high-end controllers."

RESA too, appreciates the scalable control system: "Irrespective of the Beckhoff controllers used, they can all be programmed consistently with TwinCAT based on the IEC 61131-3 standard," said Dr. Kiefer.

Changing requirements

The RESA experts feel that, in future, solutions with Ethernet-capable hardware will dominate when it comes to automation tasks. Inevitably, this means that traditional control platforms will be replaced by Ethernet-capable control concepts, and standardized concepts will gain in significance. Particularly in applications for large customers, plant engineers such as RESA are still regularly being confronted with a relic from "the old days" in the form of equipment regulations. "These can have different effects depending on the individual case," explained Arno Fries, manager of the engineering/computer systems/logistics department within the business area of logistics systems at RESA. "For each case, it will depend on whether the client orders a complete black box-type solution or requires special products with individual description of the system components," said Fries. "Ultimately, it is also a question of costs," added Dr. Kiefer, noting that particular consideration should be given to the change from decentralized periphery to decentralized intelligence: "With a decentralized periphery at fieldbus level, changes in the I/O setup usually have extensive consequences and therefore require high service effort, whereas with decentralized intelligence based on Ethernet, the system remains autonomous even if changes are made, which means that the whole setup is more robust. These so-called 'soft' factors will gain in significance."

Flexibility of the hardware platform and powerful Ethernet communication are no contradiction. Decentralized intelligent control architecture, as required in the type of the applications that RESA GmbH deals with, is scalable and can be realized without loss of functionality using the Beckhoff control construction kit.