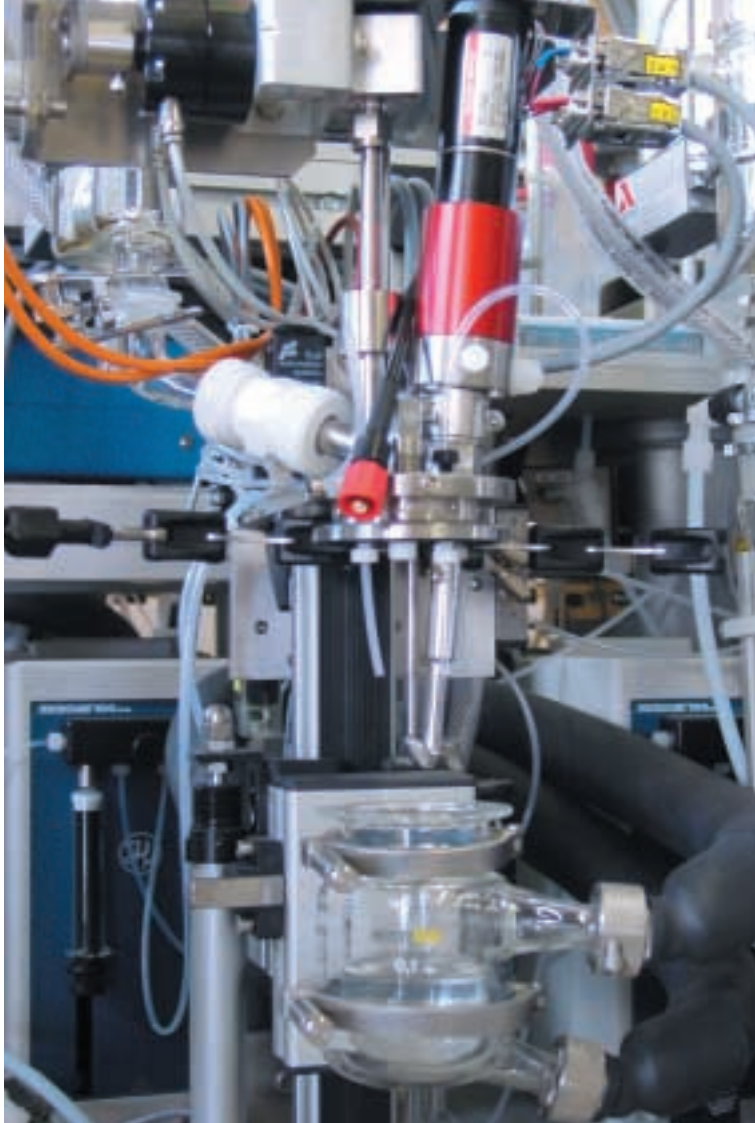


In the highly productive automation solutions from accelab GmbH, Beckhoff Industrial PCs and fieldbus products are part of the central nervous system

Biotechnology and modern laboratory automation



Automation system for fully automatic process optimization for chemical reactions.

→ The company accelab GmbH based in Kusterdingen, Germany, deals with solutions for accelerating laboratory processes. The motto of the specialists for innovative laboratory automation is the guiding principle "creativity for people – routine for machines". As a pragmatic implementation of this motto, the scientists, engineers and computer scientists from accelab create customer-specific partial and complete solutions for high sample throughput in the laboratory.

Dr. Martin Winter, managing partner of accelab GmbH, describes the activities of the company as follows: "Laboratory automation places particular demands on the classic automation technology that are characterized by the large number and uniqueness of the processes and products. These individual process components are usually essential, i.e. they cannot simply be removed from the process, and have a high value. For example, tasks in the pharmaceutical, chemical or biotechnological industry often deal with small product quantities that may nevertheless represent the world reserves of a substance. Any samples removed from this quantity can therefore not simply be blown out of the process."

From engineering concept to laboratory facility

The activities of the customers require highly flexible plants, combined with high productivity, as far as the plant supplier accelab is concerned. This is the particular difficulty. On the one hand, it means very high demands on the hardware, which has to be very reliable. "For example, in our automation solutions we have to integrate a lot of functionality in very little space", said Dipl.-Ing. Frank Greiner, authorized signatory responsible for system and equipment technology at accelab. Frank Greiner continued: "On the other hand, sophisticated software is required. This also results in a special requirements profile for the control

technology. We need high signal throughput, in order to integrate and use the sensors and actuators appropriately."

Customers from the pharmaceutical, chemistry and biotechnological industries use the systems designed and created by accelab for advancing their research into active substances. This means that a large number of chemical compounds have to be produced, processed and characterized. The substances are initially synthesized with different, parallelized techniques. Subsequently, analysis techniques are used to check the chemical identity of the substances. After synthesis and purification, the samples need to be prepared, so that the subsequent tests can be carried out with high throughput. This "High Throughput Screening" ensures, for example in pharmaceutical research, that several hundred thousand individual chemical substances can be checked for their efficiency in a defined test procedure. It is thus possible to determine relatively quickly which chemical substances are potentially interesting and may be suitable as active ingredients for new drugs. Once an active substance has been developed, the synthesis conditions have to be optimized in order to minimize the creation of waste products during large-scale production and to ensure that the product is as clean as possible. For this task, accelab offers sophisticated parallelized synthesis robots.

Proven components and in-house developments

Some of the units and peripheral devices used in the accelab automation solutions are in-house developments or joint developments with co-operation partners, or devices from qualified partner companies. accelab's know-how is in system development and system integration, including engineering. One of the requirements of the accelab plant technology is the capability to handle toxic or aggressive materials. "Via a central robot control, we are able to operate flexible structures", said Frank Greiner. Robot technology is thus a very important system component in automation solutions. In this respect, the company remains flexible. Frank Greiner explains: "We don't use a specific robot. We use the most appropriate type of robot for each task."

Flexible control technology for flexible automation solutions

Bus Terminals and Industrial PCs from Beckhoff are used in the automation solutions from accelab. The Bus Terminals are available as both digital and analog terminals to cater for all types of systems. "Since each new accelab automation system is different from the previous one, the technical system variety and the so-called fine granularity of the Bus Terminals is very welcome", said Dipl.-Ing. Frank Würthner from the Beckhoff branch at Balingen. Even for the first projects, the flexibility of the Bus Terminals in particular proved to be very useful. In addition, the Bus Terminal Controllers can be used as mini-PLCs and can be operated decentralized as local control units. "In terms of communication,

we recommend either Profibus or Ethernet, depending on the application," said Frank Würthner, pointing out that this recommendation was partly determined by the time requirements and the amount of data to be transferred. Data throughput will no doubt continue to play an important role in future projects, i.e. when Control Panels are used in addition to Bus Terminals. "The mail function used in conjunction with visualization causes the amount of data to be transferred to be larger," said Frank Würthner.

The C6110 Industrial PCs from Beckhoff that are used are slot versions with passive backplane, which is very compact and is therefore ideally suited for this plant concept, which is also very compact. Apart from TwinCAT, part of the "Workflow Manager" laboratory control software developed by accelab also runs on the Industrial PC. According to the accelab description, the Workflow Manager is an IT solution for integrating stand-alone laboratory apparatus, robot stations and analyzers in a unified, programmable laboratory control system.

The high function density and resulting extremely compact configuration of biotechnological systems means that another feature of the Beckhoff Industrial PC is particularly advantageous. "All Beckhoff products are specified for temperatures between 0 to 55° C, which means that no additional air-conditioning devices are required," said Frank Würthner. While the ambient temperature is not the critical factor during the operation of the accelab systems, the permanently



↑
Dr. Martin Winter,
managing partner

Dipl.-Ing. (FH) Frank Greiner,
authorized signatory and respon-
sible for system and equipment
technology (automation) at accelab
↓





↑ Biotechnological automation solution from accelab with turboscara platform

→ www.accelab.de

↓ Laboratory facility for carrying out feasibility studies that feed into the estimated price offers



high performance requirements for the process computer and the resulting warming of the individual devices have to be considered over-proportionally, so that the temperature specifications of the Beckhoff devices ensure trouble-free operation.

Variable connection and installation

In each system, between 100 and 160 solenoid valves have to be controlled, some of them pneumatic or hydraulic valves. In each system, 200 to 250 digital input signals and up to 20 analog sensor signals (4 to 20 mA, 0 to 20 mA or 0 to 10 V DC) have to be logged and processed on the input side. To deal with this, on average up to 5 Bus Terminal Controllers are used in each automation system. "The BC9000 Bus Terminal Controllers enable us to also utilize PLC func-

tionality locally", said Frank Greiner, noting that to this end the Bus Terminal Controllers are addressed via Ethernet (TCP/IP) and thus control complicated sensor systems such as detectors for phase separation or the superposition of the axis data in the robot motion control, which represent special measures within the system control and require local intelligence. The flexibility mentioned also applies for cases, in which accelab customers require the Profibus to be used as the system fieldbus. For this too, Beckhoff offers the appropriate intelligent controllers and Bus Couplers.

The system includes gripper changing stations for the handling of the different vessels and devices by the robot. These grippers can deal with a variety of handling tasks and have various mechanical and technological interfaces at the change-over flange, for example for compressed air or inert gas. The specific sensors and actuators in the respective robot gripper are linked via special plug connectors.

For accelab, flexibility is a very important prerequisite, due to the changing and varying nature of tasks. According to Frank Greiner, PC control technology and decentralized control technology are particularly suitable for this purpose. "Software is also a very important factor for us, which we address through high reusability of the software components," said Frank Greiner. In his opinion, this strategy works very well with Beckhoff products, since this combination makes it possible to tackle a wide variety of tasks from a common platform.