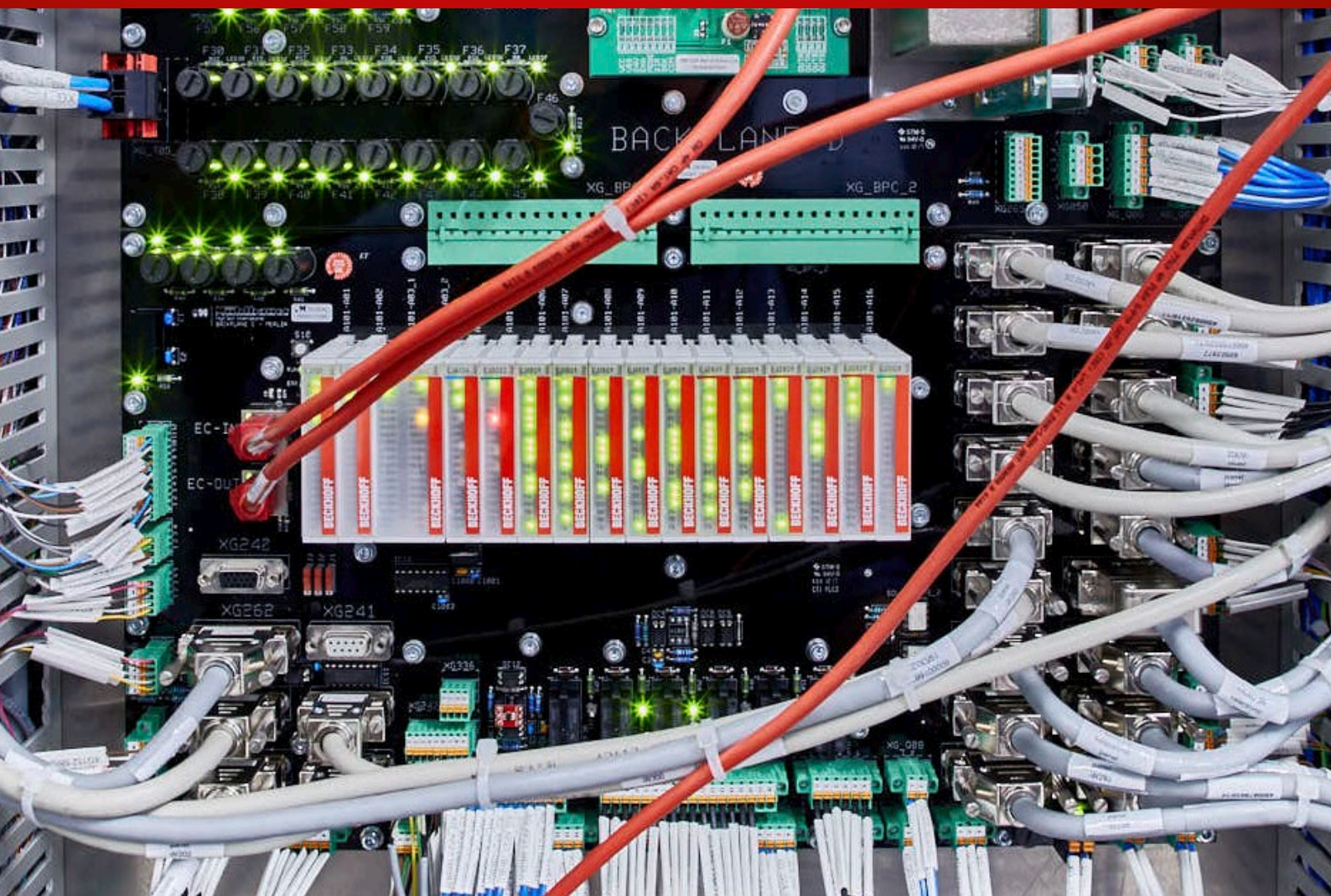
BECKHOFF New Automation Technology

I/O expertise for series production: EtherCAT plug-in modules



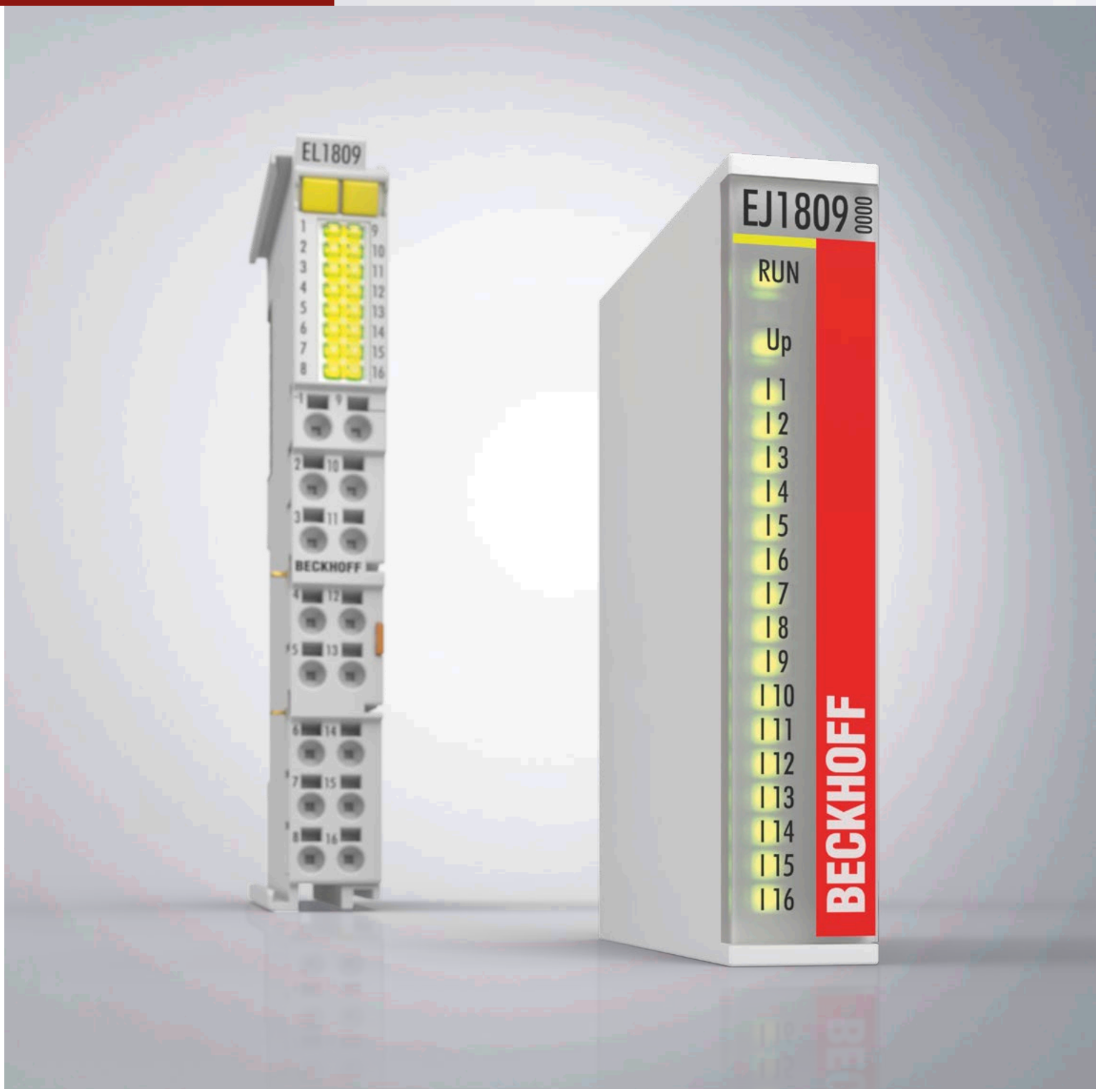
Plug & work: compact I/O solution for high-volume production

The I/O system on a circuit board

The EtherCAT plug-in modules in the EJ series from Beckhoff, the specialist in PC and EtherCAT-based automation solutions, offer significant efficiency gains when it comes to implementing medium to high-volume series production runs. The plug-in modules are based electronically on the established EtherCAT Terminals. Owing to their electromechanical design, these modules can be plugged directly into an application-specific signal distribution board with the wiring level being relocated to the PCB backplane.

With these circuit boards, the EJ system creates a prefabricated and pluggable EtherCAT I/O system. Plug connectors on the rear of the modules and the conductive tracks of the signal distribution board are used for communication, signal distribution, and the supply of power to the modules.

Compared with EtherCAT Terminals, EtherCAT plug-in modules are almost 50% smaller in relation to volume and help optimize the machine footprint. At the same time, the wiring effort is also reduced significantly, since all types of connector interfaces can be placed on the signal distribution board according to customer specification using prefabricated cables and coded plug connectors.



Compared with conventional wiring, the risk of wiring errors is reduced and work processes are simplified: The combination of I/O modules, signal distribution board, and prefabricated cables consistently adopts the plug & work approach.

The principle of the plug-in module

- EJ series plug-in modules in combination with customer-specific circuit boards
- the plug-in module is based on the EtherCAT Terminals
- reduces the footprint by 50%
- plugs in simply and locks securely in place with fixing holes
- reduces the wiring effort considerably
- minimizes wiring errors owing to mechanical coding

- machine-specific connector level with prefabricated cable harnesses
- absolute flexibility regarding the form factor of the signal distribution board
- simplifies and accelerates series production of machines
- quick implementation and commissioning
- reduced time-to-market

Scenario 1

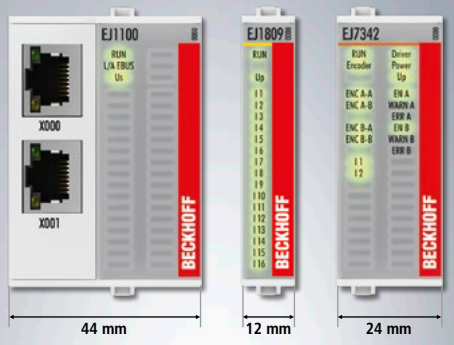
The EJ system: simple integration with in-house electronics

Individual development by the customer
The EtherCAT plug-in modules allow on the one hand simple integration with the electronic assemblies of existing machines, on the other hand they offer a good alternative to the conventional point-to-point wiring for new projects. The signal distribution board can then be custom-designed independently by the user and integrated with their own electronics. Beckhoff supplies the modules for this purpose and provides all necessary information to support the customer-specific development process, for example in the form of the user-friendly and well-documented Design Guide.

The advantage: Customers are assured of retaining their specialist technical knowledge and in-house development expertise.

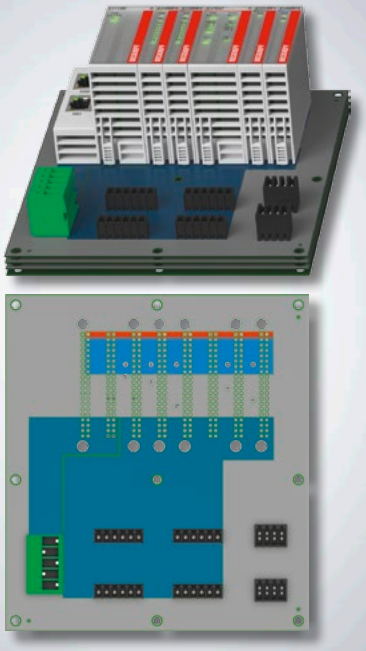
Technical drawing

- planning the installation space in the control cabinet and enclosure (2D and 3D data)



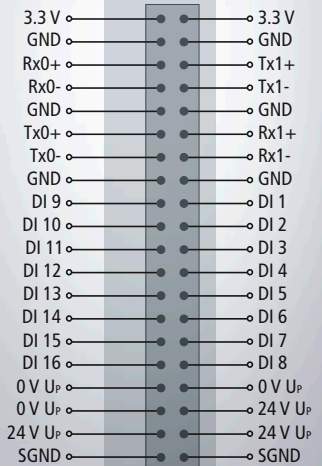
Design Guide

- basis for in-house development of signal distribution boards
- use of internal development resources
- safeguarding of company's internal expertise and protection of intellectual property



Footprint

- convenient circuit board layout using existing module footprints

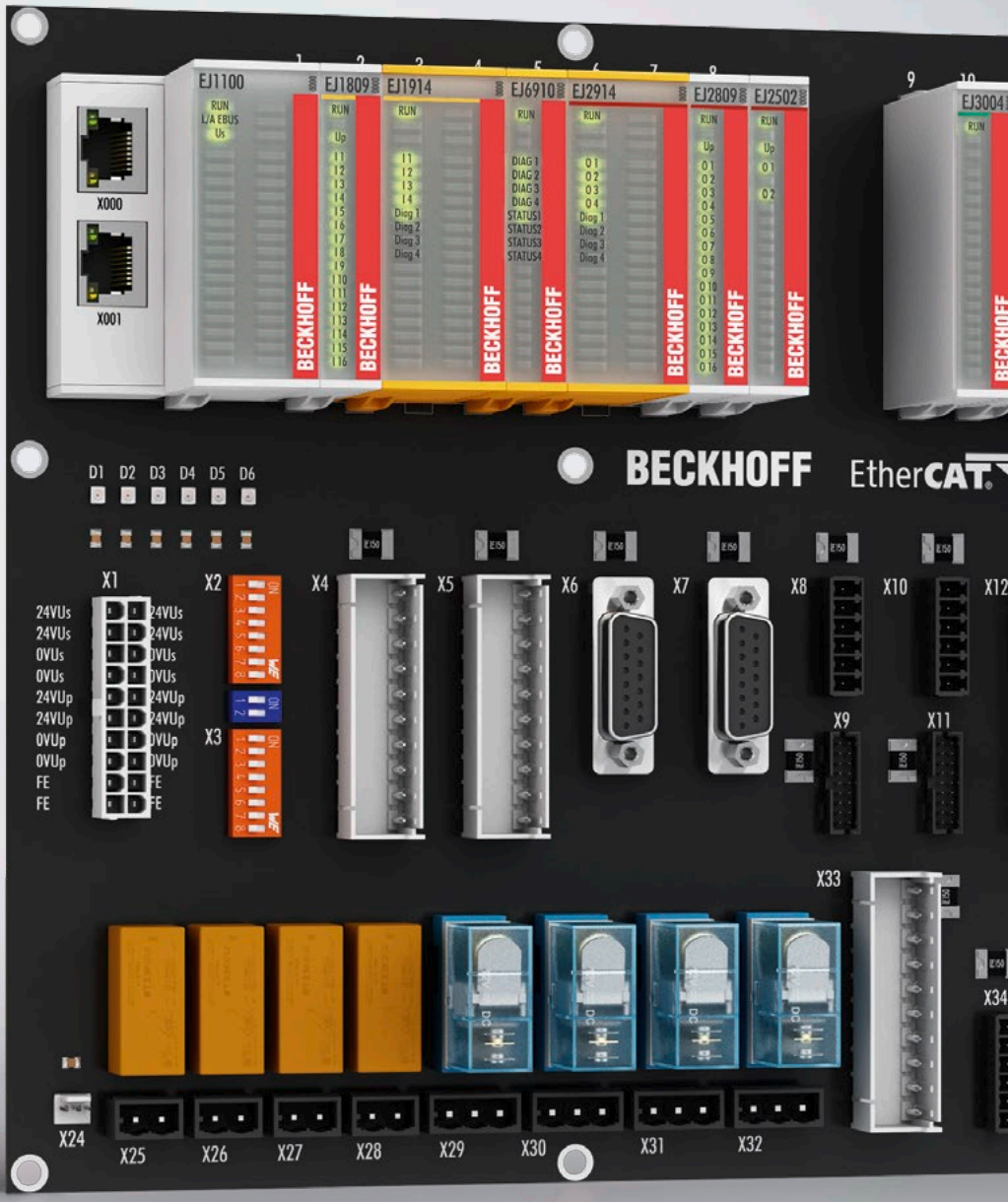


Scenario 2

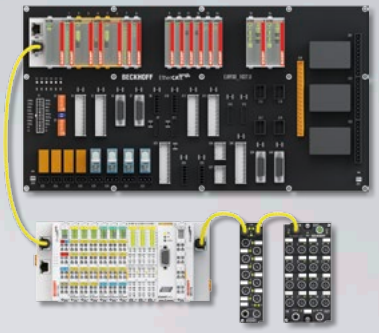
On request: custom-designed complete solution

Individual development by Beckhoff
25 years of I/O experience: If desired, customers can also use the extensive Beckhoff expertise for demand-driven development in the form of a service. If the required know-how and resources are not available internally to develop the signal distribution board, Beckhoff supports customers with an individually tailored complete solution. This includes the development and production of the individual signal distribution board in close consultation with the customer, with flexible addition of other products such as EtherCAT Terminals or IP67 EtherCAT Box modules and also, if desired, an integrated Industrial PC in various configurations.

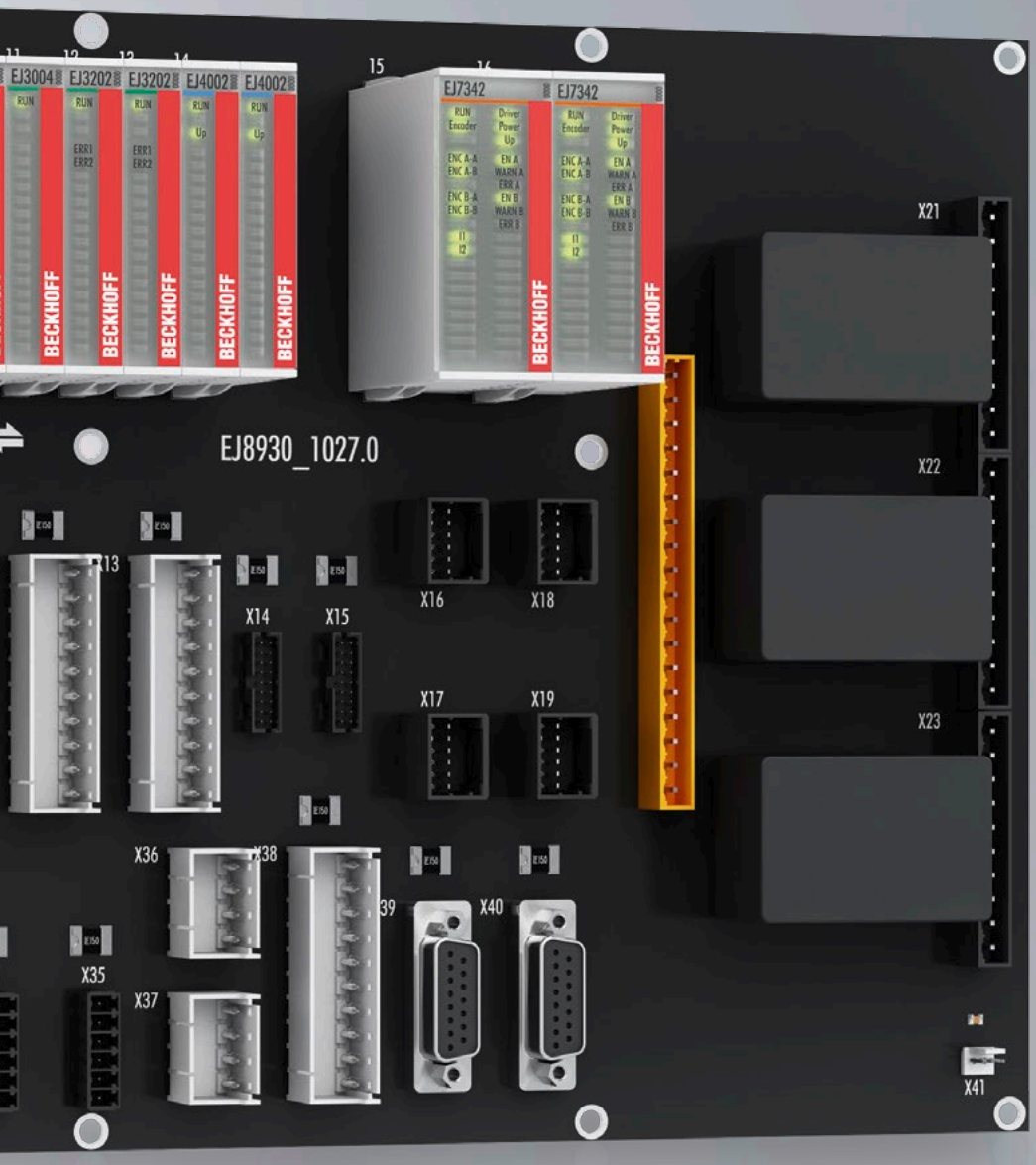
The advantage: Beckhoff undertakes the development work for the customer, allowing the customer to focus on their own core competencies.



Various Industrial and Embedded PCs can also be integrated directly into the signal distribution board.



The I/O system can be expanded to suit requirements by adding IP20 EtherCAT Terminals and IP67 EtherCAT Box modules.



Scenario 3

Ready for operation: plug & work with complete I/O box

For the next level of series production
Ready for use in the field: As a more extensive complete solution, Beckhoff offers the possibility to install custom-designed and fully prefabricated I/O boxes directly in the machine. The pretested I/O boxes are ready to operate, with no need to assemble or install the electronic components. The connector interface to the field level can be designed individually to suit the machine. All components required to support I/O signals and the end-to-end EtherCAT communication can then be connected simply from the outside.

The advantage: With its consistent plug & work approach, the turnkey I/O box offers even greater time savings for the series production of machines.

Semiconductor wafer processing

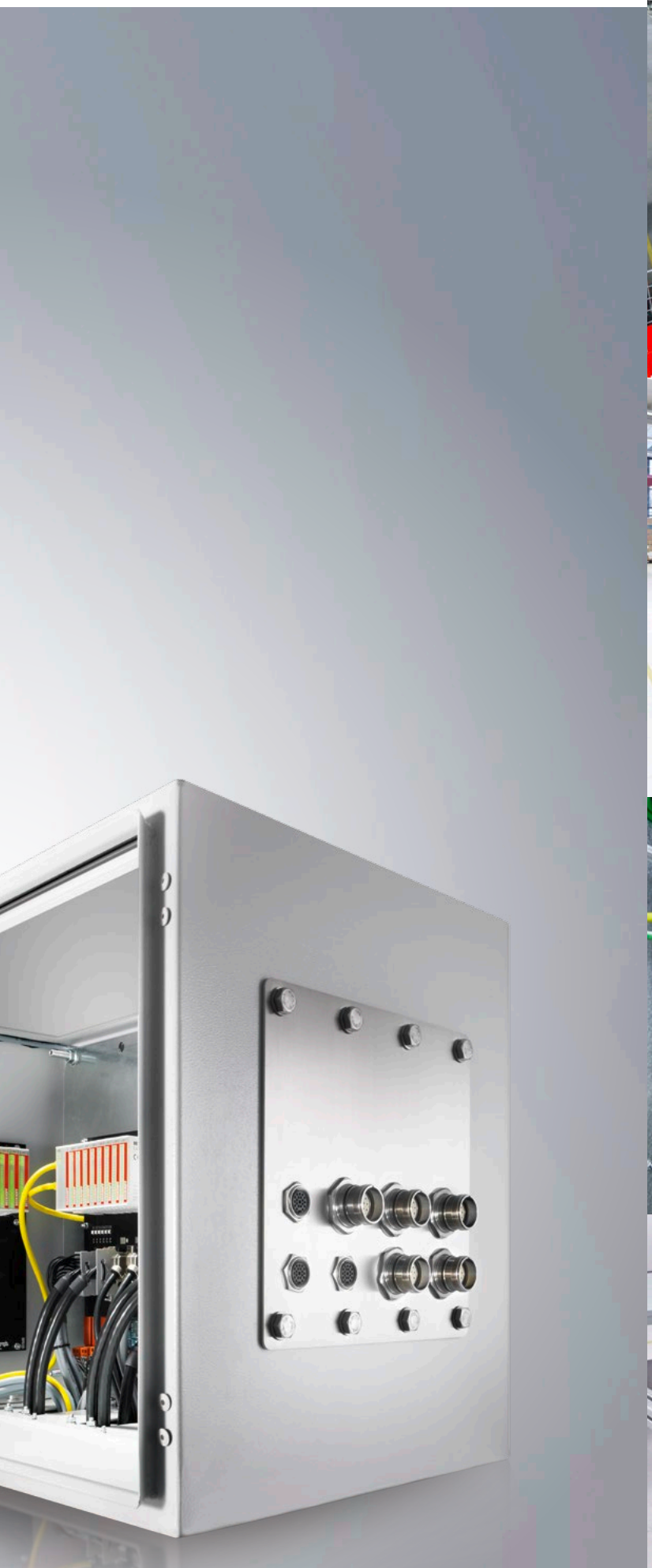
Semiconductor industry

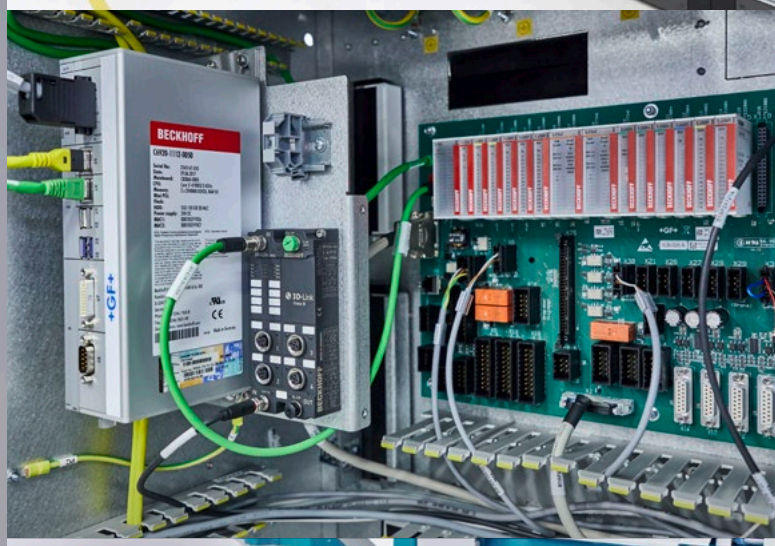
Scenario 4

Full service: plug & work with complete control cabinet

Turnkey delivery by the specialist
Beckhoff applies the I/O expertise it has established over decades to also develop highly individual full-service solutions, thus again allowing customers to considerably simplify their implementation. By means of its in-house system engineering department, Beckhoff offers the development of custom control cabinets. The control cabinet specialists at Beckhoff support the project throughout – from initial consultation to delivery of the finished control cabinet fitted with EtherCAT plug-in modules. During the course of designing and manufacturing the control cabinet, Beckhoff draws on its broad product portfolio from Industrial PCs to I/Os through to drive technology, ensures the optimum configuration of all components, and can therefore adapt the control cabinets precisely to meet all customer requirements.

The advantage: When it comes to series production of machines with larger production runs, customers can rely fully on the expertise of Beckhoff to deliver their orders on schedule.

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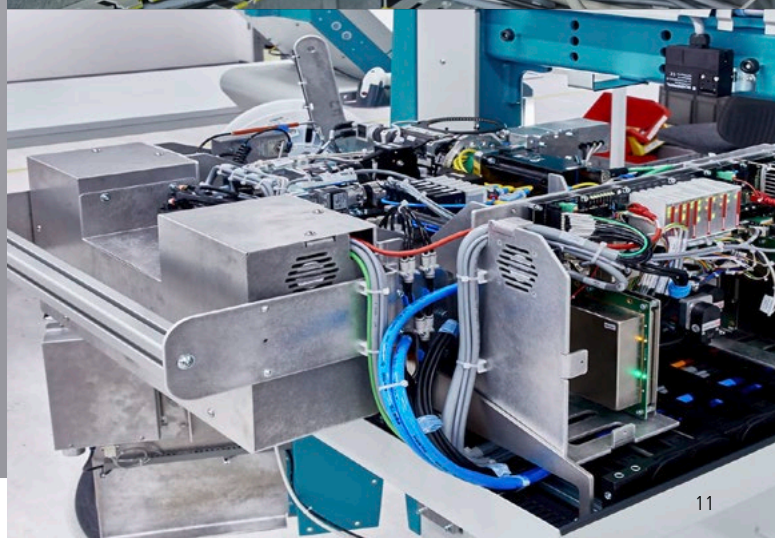


The EJ system: Pretested in three stages

Quality assurance by the manufacturer
Through extensive individual and complete tests, Beckhoff ensures optimum reliability and availability in all of the scenarios outlined above – from custom-development of the signal distribution board through to full-service production of control cabinets. The function tests are carried out in three stages: The EtherCAT plug-in modules and the signal distribution boards are first tested as individual components of the EJ system in relation to their functionality prior to being assembled. The overall construction of the plug-in modules is then tested following installation. This three-stage pretesting approach reduces the failure rate and increases availability in the field. Pretested complete systems can then be stored at the customer's premises and installed in plug & work mode during machine production.

Test 1

EtherCAT plug-in modules
100% function test of the EJ modules in production using end test systems developed in-house

Test 2

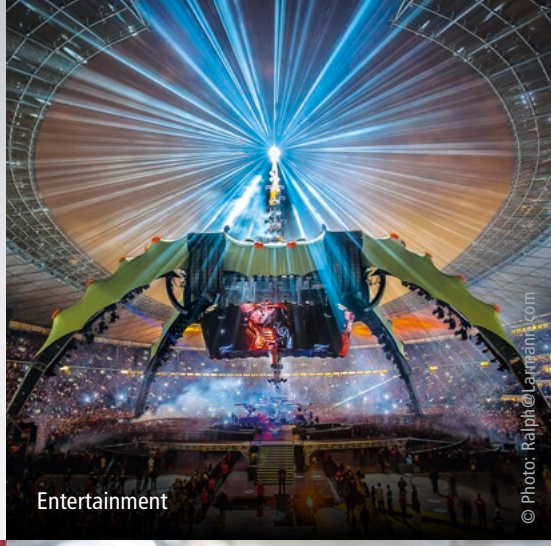
Signal distribution board
100% function test of the customer-specific signal distribution boards using ICT test systems

Test 3

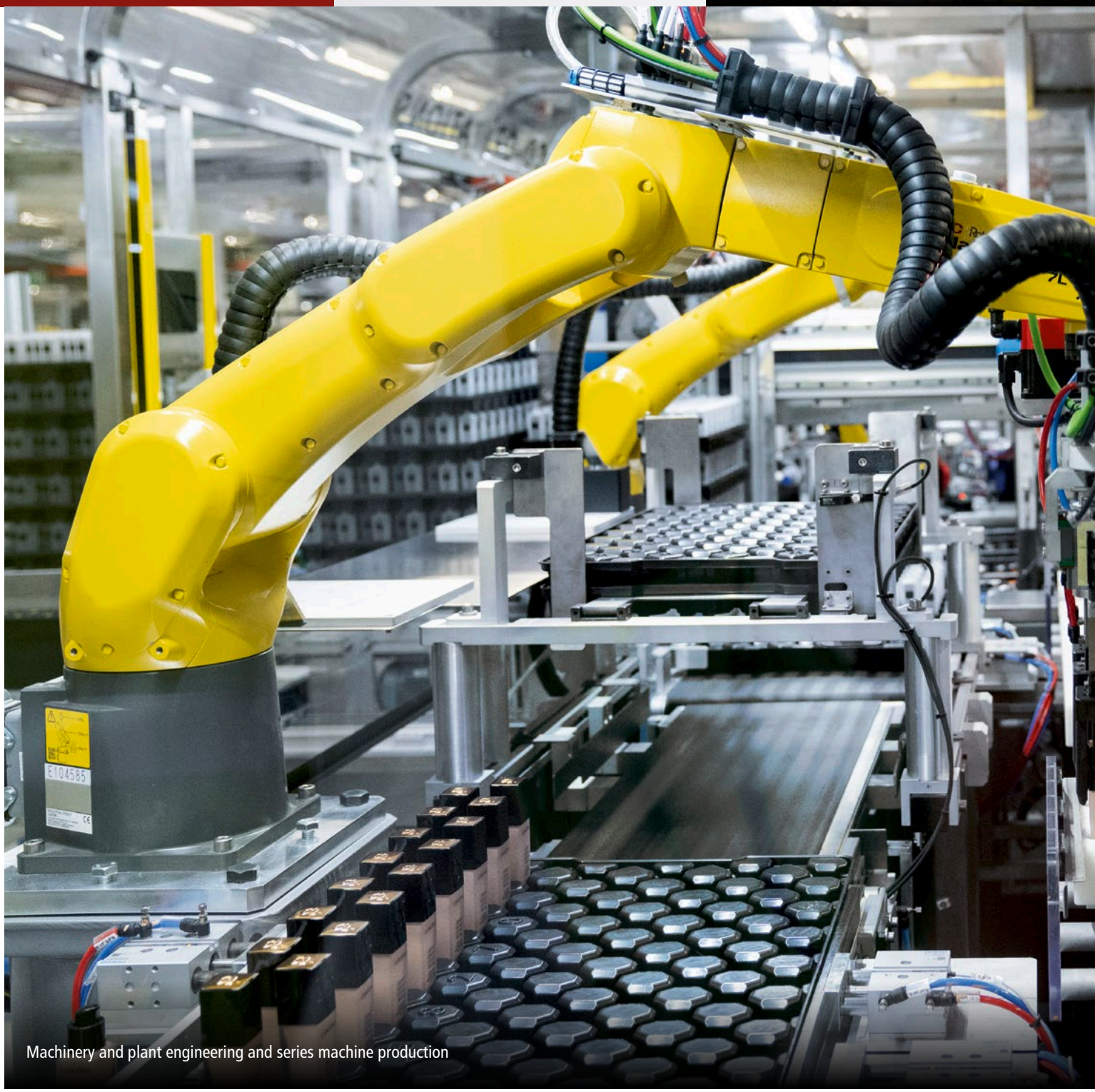
Complete solution
100% function test of the complete solution in production using end test systems developed in-house

The EJ system from Beckhoff in worldwide use

References and examples of applications
No matter where the EJ system from Beckhoff is used, users stand to benefit. Installation costs are reduced through a minimized wiring effort. Coded modules and prefabricated cable harnesses limit wiring errors and reduce follow-up costs for corrections. Tested components improve the quality of the machine due to enhanced availability. Prefabricated components shorten machine delivery times. Individual compact solutions can be used even where space is limited.



Entertainment

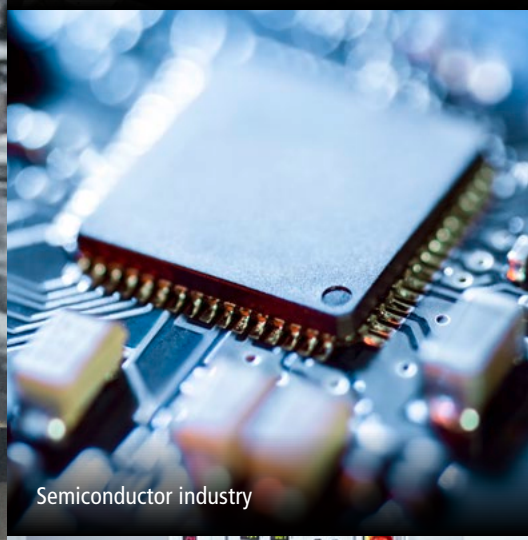

Machinery and plant engineering and series machine production

Robotics

Dental technology

Plastics industries

Warehouse and distribution logistics



Semiconductor industry

Test-bench engineering

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How can we optimize your series production?
Talk with us.

▸ **www.beckhoff.com/ethercat-plug-in-modules**

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