

Innovations 2018

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

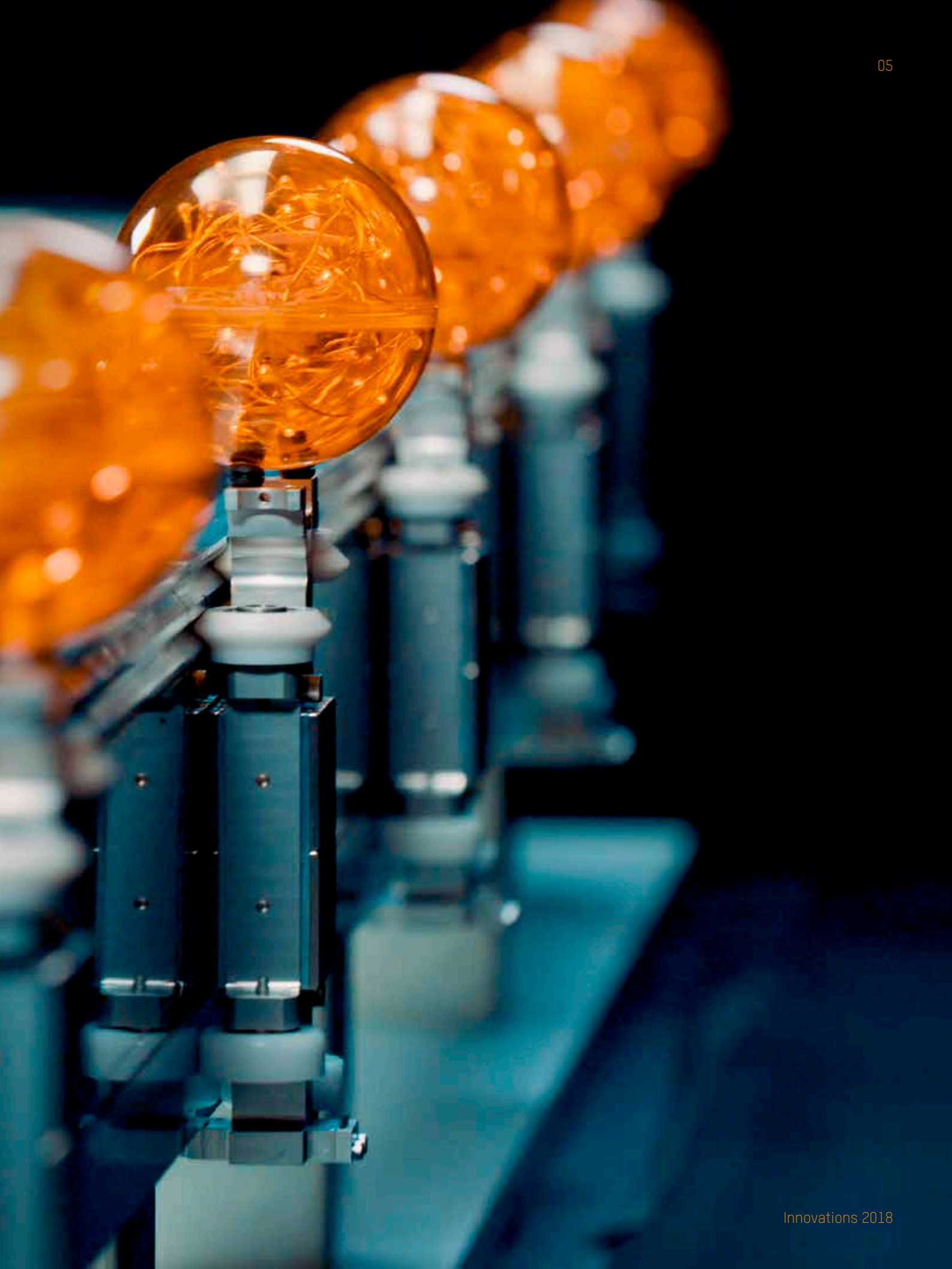


OPC
Unified Architecture
MQTT / AMQP

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ACOP0Strak Ultimate Production Effectiveness



Enabling the adaptive machine

Ultimate production effectiveness

Unbeatable time-to-market

Your ROI accelerator



High
productivity

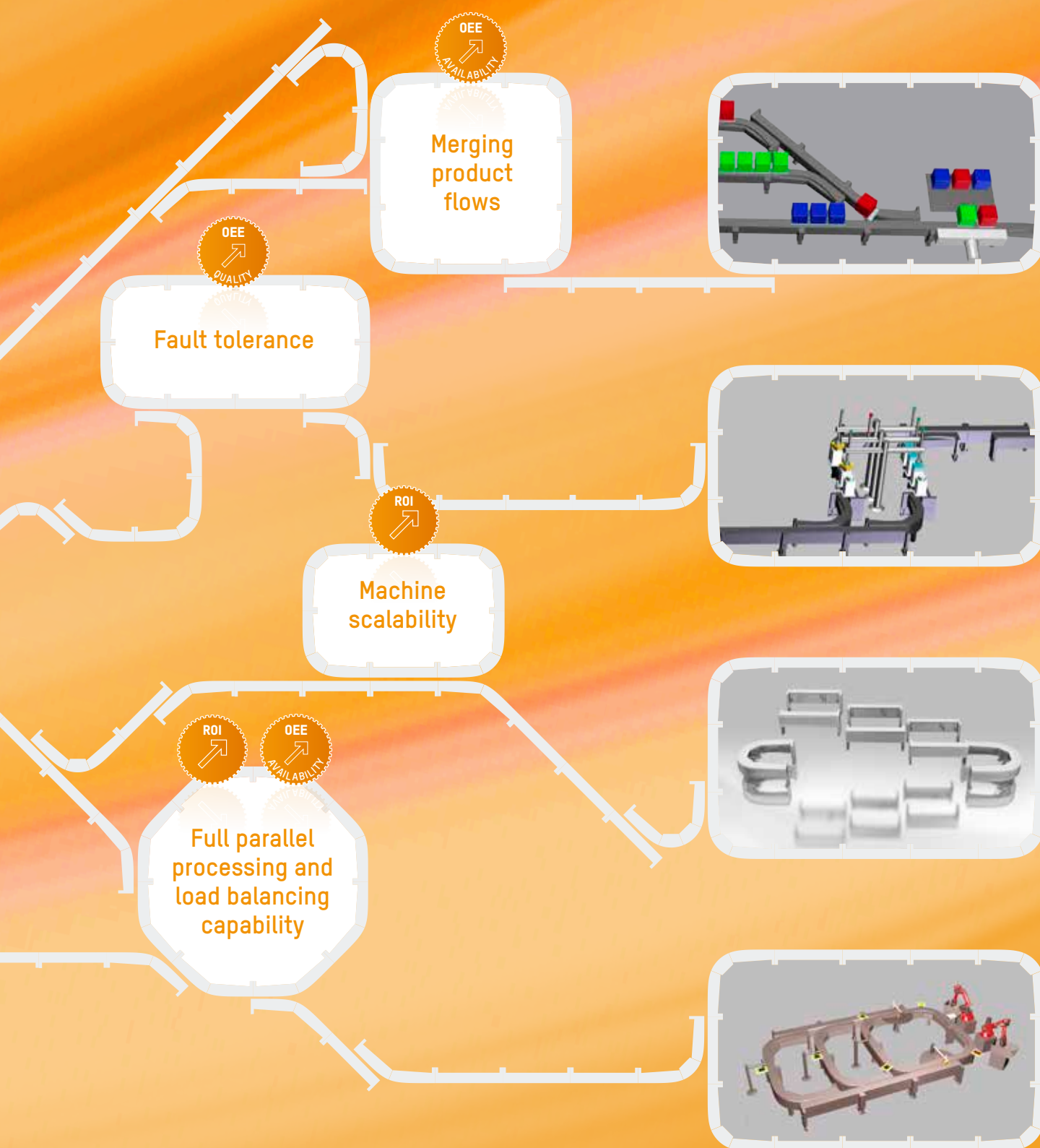


Dividing
product
flows



Reduced
machine footprint

ACOP0Strak redefines production economics and equipment effectiveness. ACOP0Strak's unique design enables you to capture the added-value of small batch flexibility.



Flexible. Fast. Productive.

System components and track design flexibility

135° guide
 1x
 2x
 1x
 1x curved segment (right)
 2x circular arc segment
 1x curved segment (left)

90° guide
 1x
 1x
 1x
 1x curved segment (right)
 1x circular arc segment
 1x curved segment (left)







180° guide
 1x
 3x
 1x
 1x curved segment (right)
 3x circular arc segment
 1x curved segment (left)



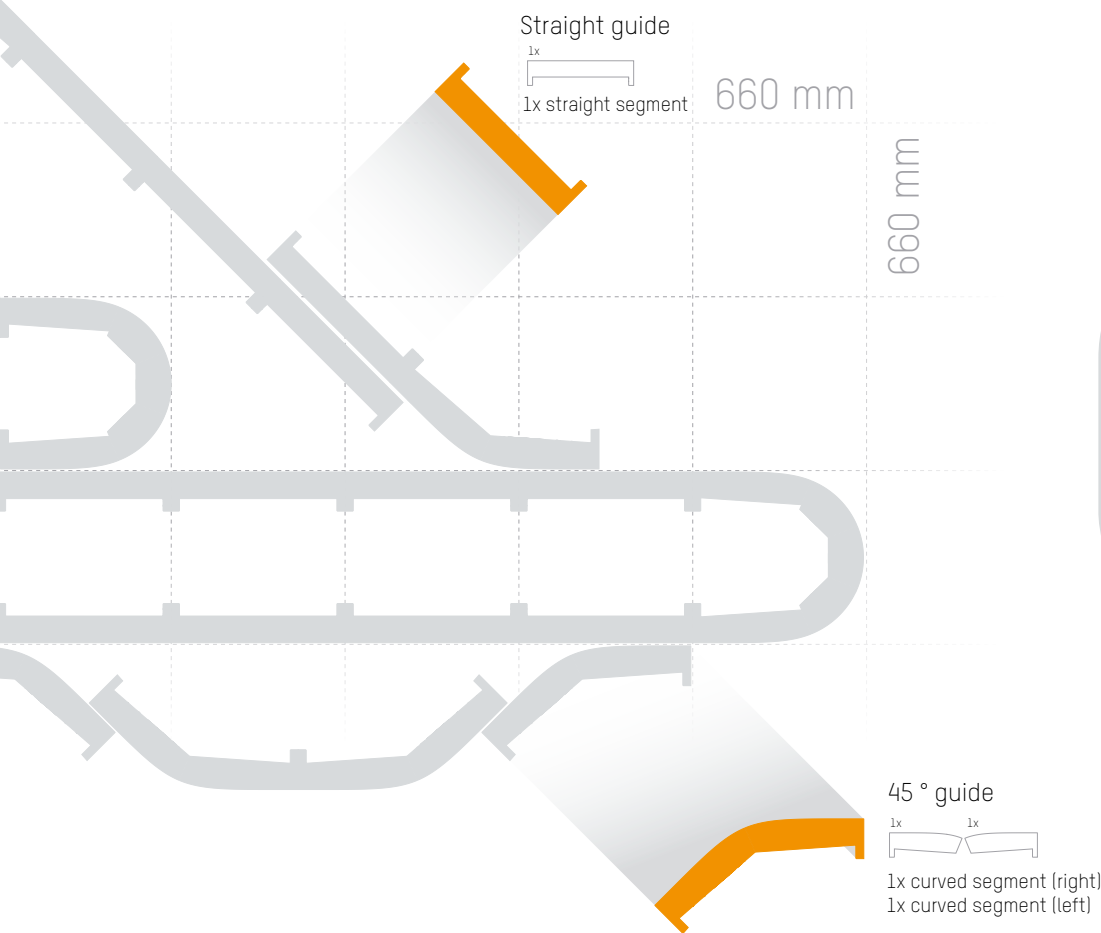
Shuttle



Guide rails

Shuttle	Straight guide	45°	90°	135°	180°
					
Track length	660 mm	900 mm	1340 mm	1580 mm	1620 mm

Morphing into any form



High-speed diverters



- Fully electronic diverter technology
- 100% wear free
- Divide and merge product flows at full speed



Motor/electronics segments



Radius

305.58 mm

Angle

22.5°

45°



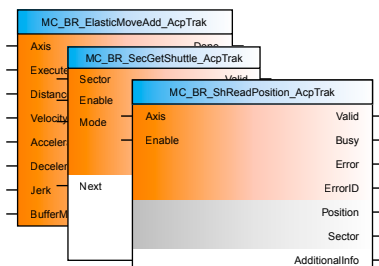
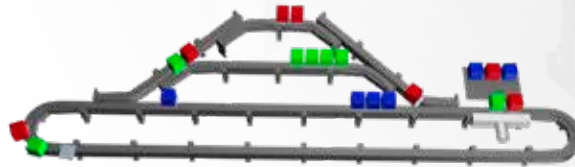
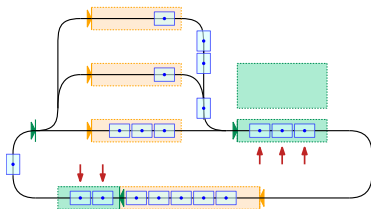
ACOP0Strak →

Technical data and specifications

Maximum track length	> 100 m
Maximum number of shuttles	> 250
Minimum product pitch	50 mm
Speed	> 4 m/s
Acceleration	> 50 m/s ²
DC bus voltage	60 V
Motor dimensions (W x H)	80 mm x 85 mm
Motor housing and seal	Stainless steel (conforms with primary packaging requirements)
Certifications	CE, UL
Installation orientation	Horizontal, vertical, any inclination

Disclaimer: Product is not available in the United States of America until September 2018.

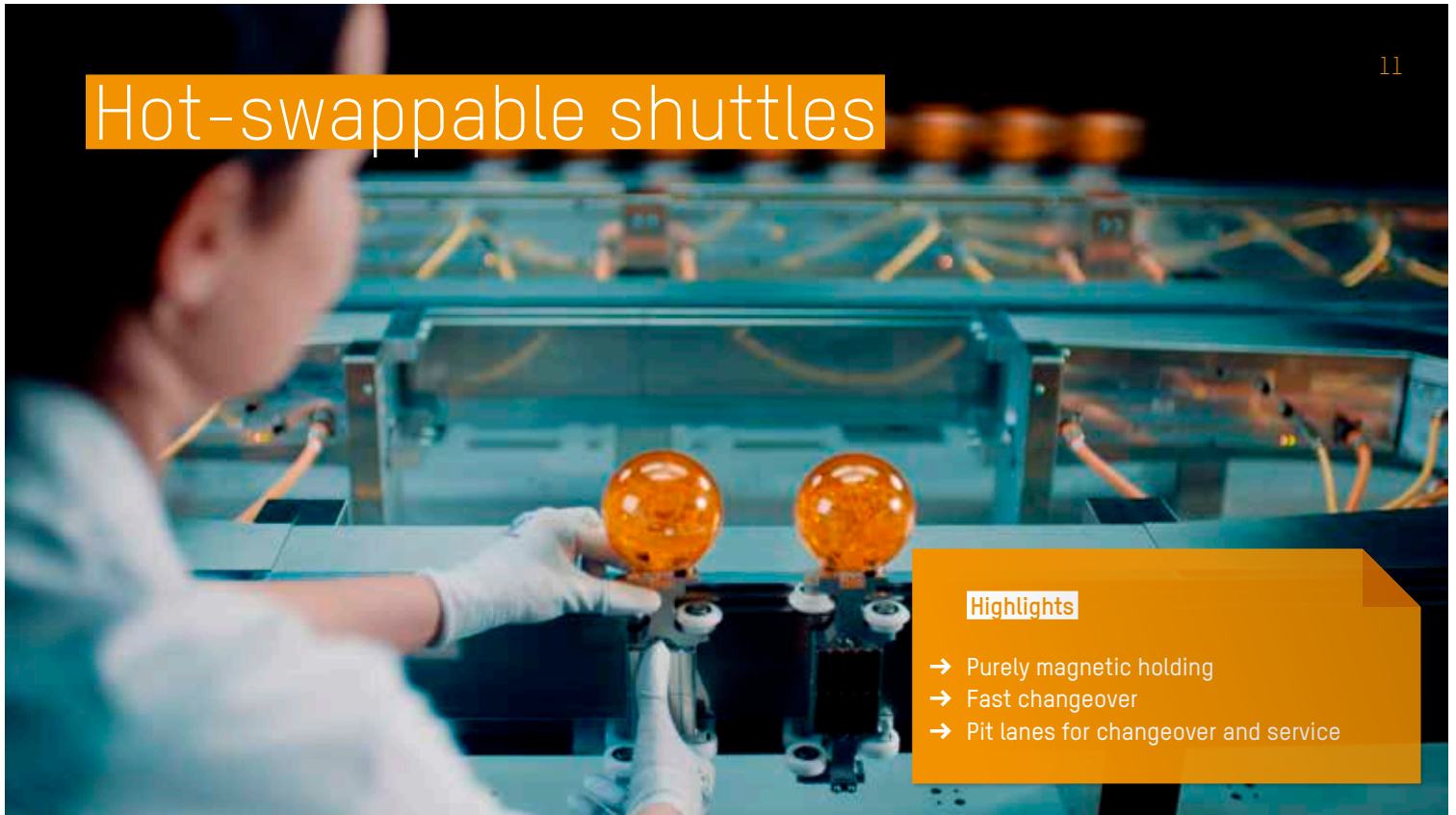
Smart system software



Highlights

- Autonomous traffic control with integrated collision avoidance
- Extensive simulation capabilities for unbeatable time-to-market

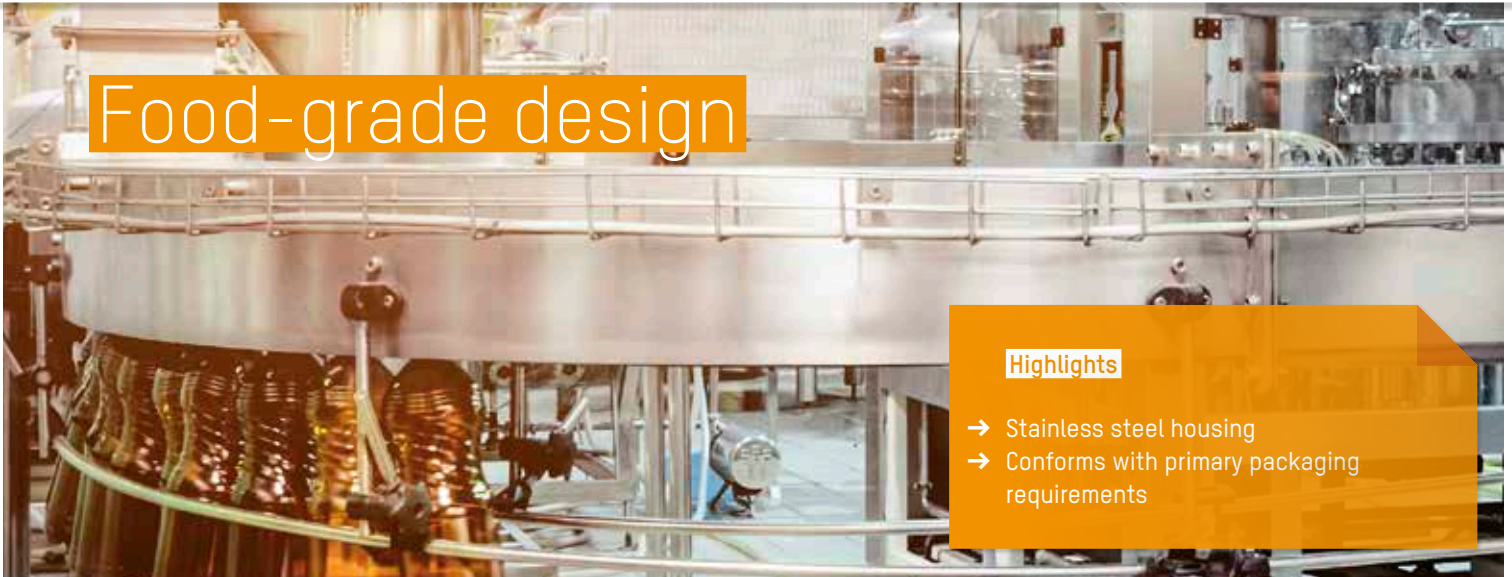
Hot-swappable shuttles



Highlights

- Purely magnetic holding
- Fast changeover
- Pit lanes for changeover and service

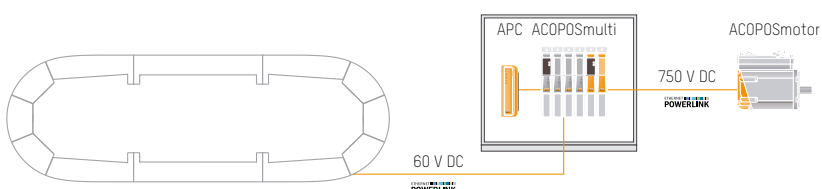
Food-grade design



Highlights

- Stainless steel housing
- Conforms with primary packaging requirements

System topology



Highlights

- Minimized cabinet space
- Integrated motor/electronics units

Performance boost through model-based control

For its ACOPOS P3 servo drives, B&R has added three important new model-based controller functions to Automation Studio. Users can now perform intelligent, model-based feed-forward control for faster positioning. They can also test system performance by suppressing oscillations with the ACOPOS P3 in Advanced or Power mode. With the ability to generate the model-based control loop through autotuning, they can easily obtain optimal parameter settings.

Intelligent, model-based feed-forward control can significantly accelerate positioning processes and dramatically reduce the settling time. It does this by calculating the motor-related setpoints based on a mathematical model and a home position. These setpoints are used as input values for the controller cascade.

Optimum reference position curve

The reference position is the position to be controlled. Particularly in flexible drive systems, this is often different from the encoder

position. Any position that can be derived from the mathematical model can be used as the reference position. The result of intelligent feed-forward control is an optimal encoder position curve that enables the reference position to be followed precisely.

Integrated virtual sensor

Flexible systems have a tendency to develop oscillations in the drive system when acted upon by outside forces. This has a negative impact on motion control performance. A state controller counteracts this by significantly reducing the tendency to oscillate and providing early compensation for external disturbances. There are two ways to obtain the necessary values. They can either be read from physical encoders or calculated using virtual sensors.

The virtual sensor previously available from B&R for reading states on the load side is not an integrated part of the model-based drive controller in Automation Studio. That makes it available on the ACOPOS P3 whether running in

Advanced mode (cycle time of 100 μ s) or Power mode (cycle time of 50 μ s).

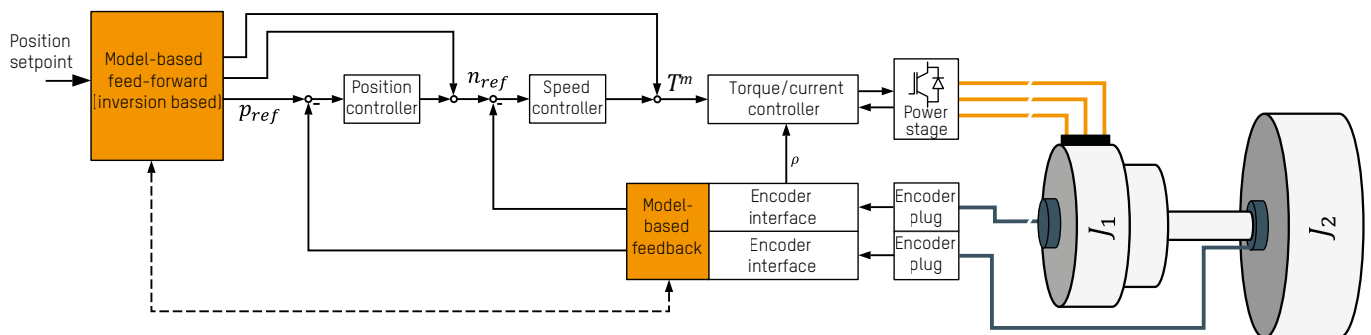
Model-based control at the push of a button

Automation Studio helps users determine the optimum parameters for motion control systems. The ACOPOS P3 servo drive identifies the parameters of the controlled system and uses autotuning to find the parameters of the model-based feed-back controller. The system arrives at the parameter settings by exciting the motion control system and identifying the parameters of the controlled system based on

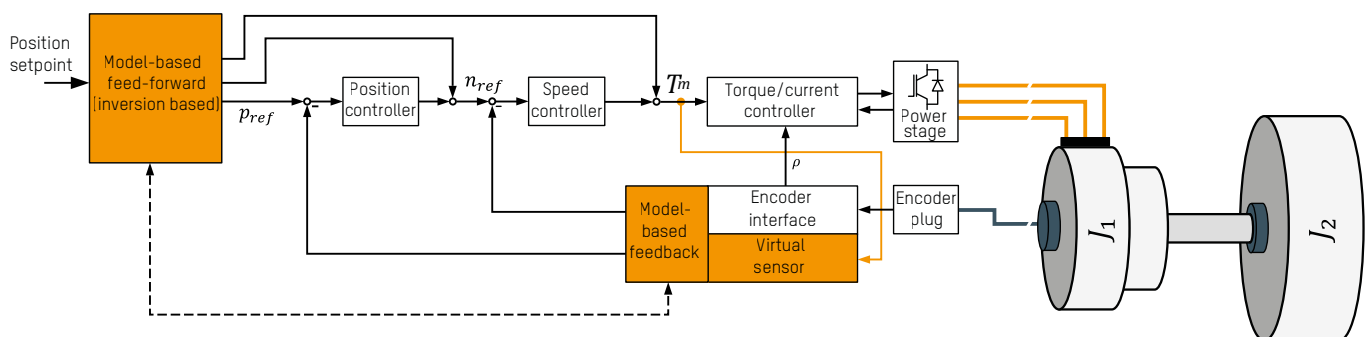
the measured transmission behavior from motor torque to motor speed. There is no longer a need to identify the parameters manually.

Intelligent model-based motion control

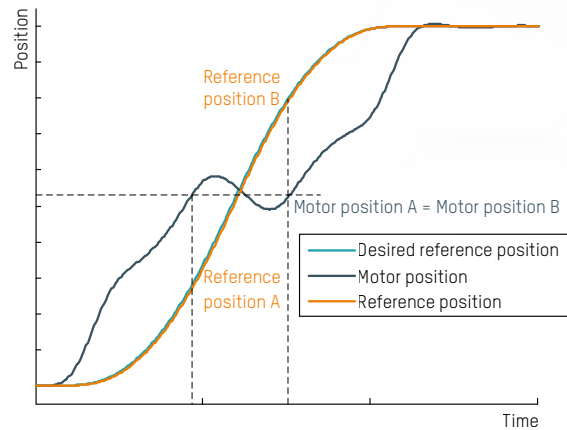
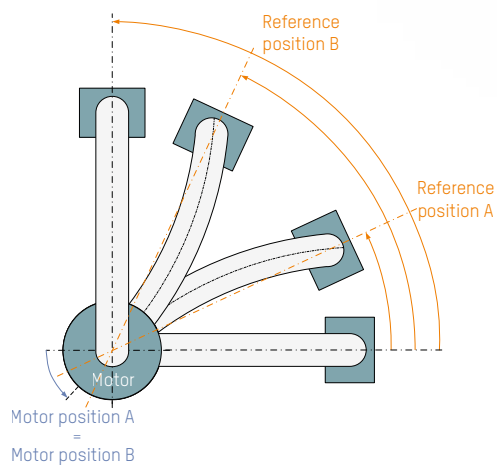
Modern manufacturing machinery must implement increasingly flexible processes with faster and faster cycle times. At the same time, new lightweight designs make the machines less rigid and more prone to oscillations. This presents heightened challenges for motion control technology, which the ACOPOS P3 solves using model-based control.



Model-based control with motor encoder and load encoder. Encoder signals are read from real encoders.



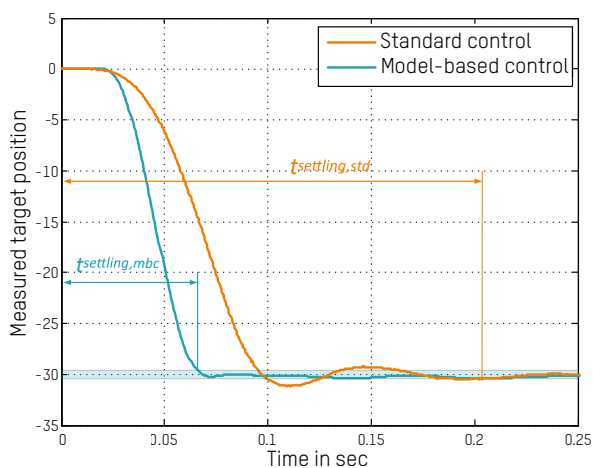
Model-based control with motor encoder and virtual load encoder. The virtual sensor for reading states on the load side is not an integrated part of the model-based controller in Automation Studio.



Model-based feed-forward control is used to calculate motor-related setpoints. These serve as the input values for the controller cascade. The result is an optimized reference position curve.

Model-based control guarantees maximum performance even in flexible systems. Different modes make it possible to perfectly match

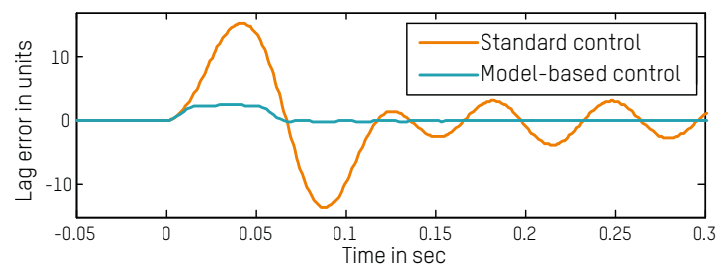
specified trajectories can be configured for each individual application. The drive contributes to easy, intuitive operation with model parameter identification and an autotuning function for the model-based controller.



Using a model-based controller can accelerate positioning and considerably reduce settling time.

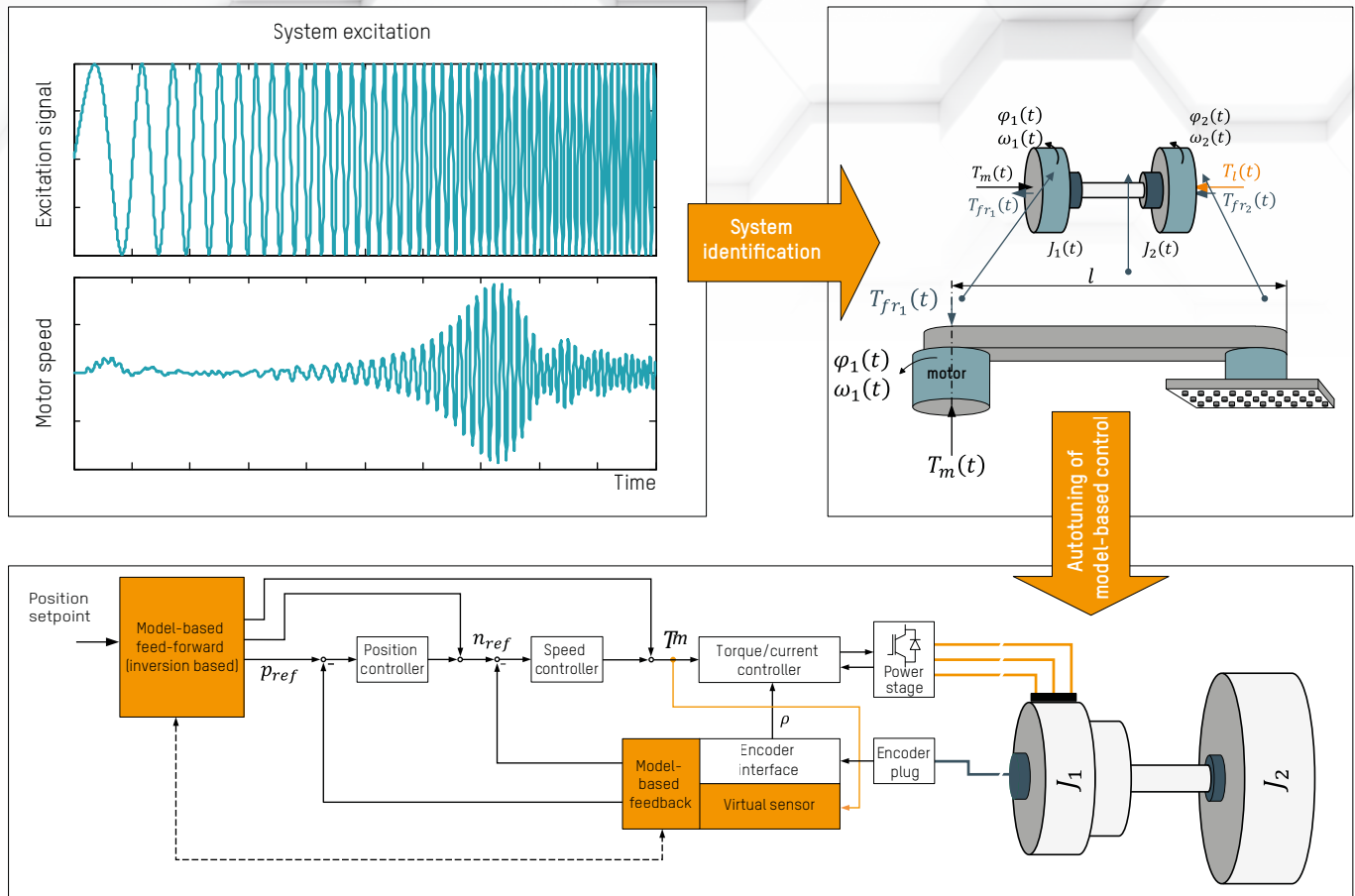
Use dynamic models

The motion control behavior of flexible systems can often be approximated by simplified mathematical models. A palletizer, for example, consists of two masses joined by a massless connection with a defined rigidity and damping.



The negative impact of disturbance forces can be reduced to a minimum using model-based feedback control.

a variety of requirements. Suppression of external disturbances and/or adherence to



The ACOPUS P3 servo drive offers the option of identifying the model parameters of a motion control system and calculating the control parameters of the model-based feedback controller using autotuning. This is done by exciting the motion control system and identifying the parameters of the controlled system based on the measured transmission behavior from motor torque to motor speed. Optimal controller settings can be calculated from the parameters of the controlled system.

The advantage of such an approximation is that it provides interpretable parameters and describes conditions that are physically significant. Based on the model, it is possible to estimate the position and speed of the load, for example. An approximation model also has the advantage, that the model parameters can be found easily and automatically.

Highlights

- High performance with oscillation-prone systems
- Fast positioning with flexible motion systems
- Integrated virtual sensor
- Autotuning for optimized controller parameters
- Automatic identification of model parameters

Virtual sensor reads safe speed

B&R has developed a virtual sensor for its ACO-POS P3 servo drive. Safe Speed Observer determines speed in accordance with SIL 2 / PL d / CAT 3 requirements, allowing it to be used to implement the safety function Safely Limited Speed (SLS). With a safe encoder no longer required, the cost of implementing the safety function is reduced considerably.

The virtual sensor can be used for both linear and rotary synchronous motors. The resolution – the slowest observable safe speed – depends on the electrical and magnetic properties of the motor used. It is typically around 10% of the nominal or maximum speed.

Redundancy for maximum safety

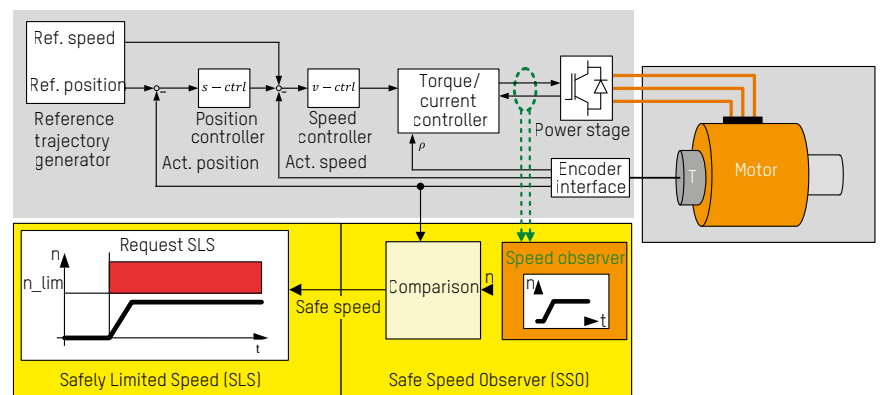
The Safe Speed Observer is based on a model of the machine created through safe evaluation of the electrical manipulated variables of a permanently excited synchronous motor. The high safety level can be achieved because the ACO-POS P3 servo drive allows redundant modeling based on the motor's electrical manipulated variables. Additionally, the speed read by the virtual sensor is compared against the reading of a standard encoder.

There is no need to use a safe encoder when using the virtual sensor. It must only meet the requirements for functional control, rather than

the costly additional requirements otherwise placed on the properties and mechanical construction of the encoder.

Easy configuration

In the Automation Studio editor for safety applications, the Safe Speed Observer can easily be configured via the respective encoder interface. The only additional information to be entered are the electrical properties of the motor. Then the user can implement the safety functions available for the safe axis from the respective library as usual. This new solution is made possible by the drive-integrated safety technology of SafeMOTION.



As a virtual sensor, Safe Speed Observer makes it possible to implement safely limited speed (SLS) without the added cost of a safe encoder.

Highlights

- Easy configuration
- Using a standard encoder
- Reduced costs
- Suitable for both linear and rotary synchronous motors
- Safety level SIL 2 / PL d / CAT 3

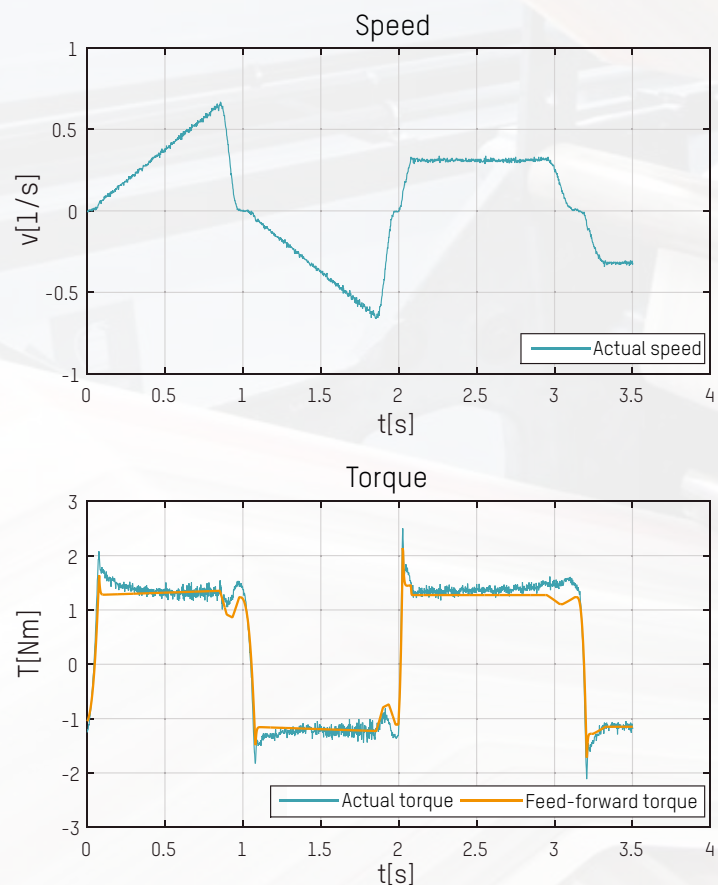


Precise control for maximum product quality

B&R presents new software functions for friction compensation that optimize control performance for improved product quality. The new friction compensation functions minimize lag error while at the same time reducing oscillations at the start of a movement. The necessary parameter settings can be generated automatically with autotuning. For applications with setpoint noise, B&R now offers solutions to compensate for undesirable effects such as jitter.

B&R's friction models accurately represent the hysteresis behavior typical of systems with pronounced friction – particularly static friction. Static friction has a detrimental effect on motion control performance in many applications. That's why it is especially important to model and compensate for the highly non-linear behavior.

B&R's friction models accurately compensate for the negative effects of friction. The solution also compensates for stick-slip effects and friction amplitudes that change with variations in speed and acceleration.



Reduced lag error

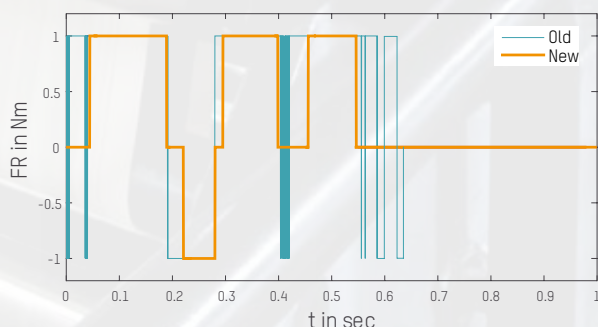
B&R's new friction compensation helps machine manufacturers accurately model friction and compensate for it in the motion control application. In many applications, this results in a decisive reduction in lag error, which in turn increases positioning precision in the machine and improves the quality of the finished product.

Suppress vibrations

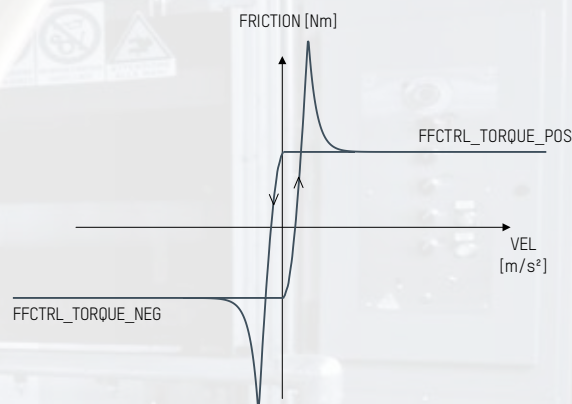
Compensating for the complex effects of static friction has an especially positive effect on control quality in high-precision machine tools. Not only does the compensation reduce lag error, it also significantly reduces vibration at the start of a movement.

Tune parameters automatically

The model parameters needed for friction compensation can be generated conveniently using autotuning. This greatly simplifies and accelerates commissioning of complex models.



With noise-laden master axis couplings, unwanted edge changes (jitter) can occur between the positive and negative friction torque. B&R friction compensation suppresses this effect.



Static friction has a detrimental effect on motion control performance in many applications. B&R's friction models accurately compensate for these negative effects.

Suppress setpoint noise

B&R's friction compensation solution is also helpful in suppressing setpoint noise. This occurs, for example, when setpoints are derived from a real motion control axis.

In particular with noise-laden master axis couplings, unwanted edge changes (jitter) can occur between the positive and negative friction torque. B&R friction compensation suppresses this effect without allowing a significant amount of lag error to develop.

Highlights

- Improve product quality
- Reduce lag error
- Suppress vibrations
- Suppress setpoint noise
- Tune parameters automatically



Tool-supported parameter optimization

B&R continues to expand the range of software functions available for its ACOPOS P3 servo drives. Servo Loop Optimizer (SLO) is now also available for model-based controllers. Easily find the the perfect parameter settings to maximize your machine's dynamic performance.

The effects of specific parameter changes on the overall control loop can be analyzed visually in the graphics provided. B&R developers have also updated the viewing functions in the Automation Studio engineering environment.

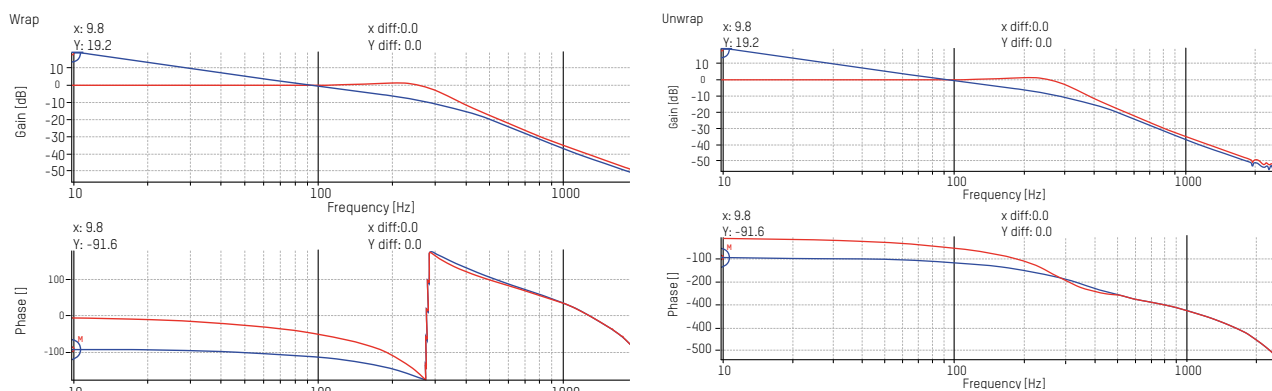
Easy phase curve smoothing

To better identify changes in the frequency response, users can define the viewing range in the Bode plot. The wrap/unwrap functions can be used to correct the phase angle when the jumps between successive data points are too large. The result is a smoother phase curve.

Easy control parameter verification

It is now easy to verify whether the parameter settings meet the requirements for robustness. After first identifying the optimal parameter





The wrap/unwrap functions can be used to correct the phase angle when the jumps between successive data points are too large. The result is a smoother phase curve.

settings for one operating point, they can then be applied to other operating points to test whether they result in a consistently stable performance. The verified settings can then quickly and easily be applied on the drive.

Digital model of the machine

All of the data for the controlled system are saved in a way that allows a model of the machine to be generated. This function can be used to create a model for simulating the machine or to perform offline commissioning.

Proven approach

Servo Loop Optimizer (SLO) is a familiar tool for optimizing drive parameters. The intuitive SLO interface for analyzing the frequency response,

for example, makes it easy to find the ideal parameters in only a few steps. This provides welcome assistance to users faced with increasingly complex control tasks, such as model-based control.

Many different motion control systems

The model-based controller for the ACOPUS P3 covers a wide range of different motion control systems. This is made possible by the simplified mathematical model on which it is based. Users can identify the model parameters and use the tool to verify them. With very little effort, the quality of the model can be evaluated the parameters released for use by the model-based controller.

Generate performance advantages

The ACOPUS P3 rises to meet increasing performance requirements with operating modes Advanced and Power. The entire controller cascade is calculated with a cycle time of 100 μ s in Advanced mode; or even 50 μ s in Power mode. Both modes are ideal for getting maximum performance out of rigid drive systems. They enable the machine to achieve faster processing cycles without having to modify the mechanical system. With SLO, it is easy to find the optimal settings for each mode.

Highlights

- Support for model-based control
- Stable machine behavior at multiple operating points
- User-friendly interface
- Simulation data generated automatically
- Faster machine cycle times



Economic motion control technology for industrial machinery

The highest level of efficiency, improved competitiveness, reduced energy consumption and lower maintenance costs. With its new ACOPOSinverter P66, P76 and P86, B&R offers machine builders a

broad palette of new frequency inverters that perfectly fulfill the full range of application requirements – from low-cost to high-end.



Highlights

- Powerful dynamic behavior and high efficiency
- Ultimate scalability
- A wide range of products for a wide range of applications
- Total machine costs reduced



Increased performance for industrial machines

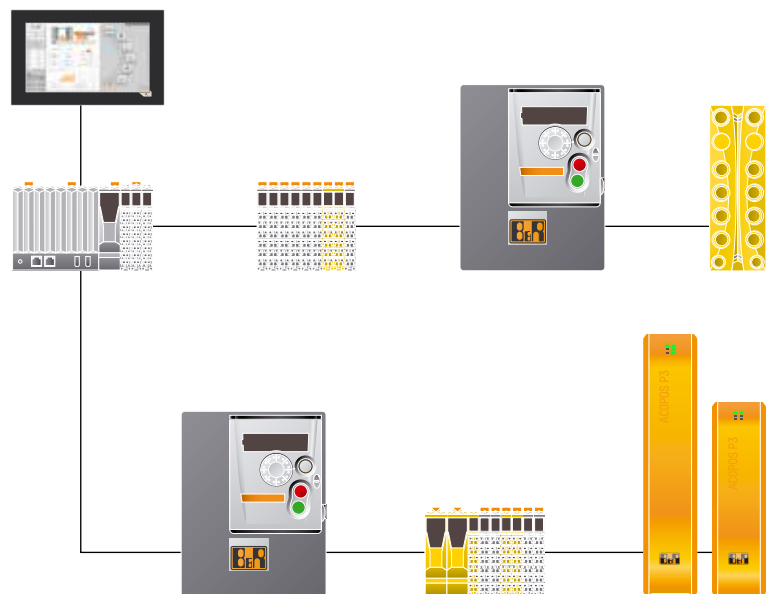
New generation frequency inverters – the ACOPOSinverter P66 and P76 – are being added to B&R's product portfolio. The ACOPOSinverter P66 and P76 are speed controllers that meet requirements for simple and advanced applications using single-phase and three-phase synchronous and induction motors ranging from 0.18 to 15 kW. They were designed to improve the efficiency and effectiveness of machines and at the same time to optimize the design and engineering costs for OEMs.

The ACOPOSinverter P66 and P76 are robust and easy to use. With two different design concepts (book format and compact format), they can be easily integrated in various machine layouts and control cabinets. Machine performance and availability are increased and, at the same time, total machine cost is reduced.

The new frequency inverters from B&R offer enhanced automation possibilities for industrial machines:

- Easy motor control for synchronous and induction motors, also at low speed, and dynamic accuracy for start/stop applications
- Full POWERLINK support for the P76 ensures complete integration in B&R's system architecture

- CANopen, X2X Link or POWERLINK as optional interfaces for the P66
- Compact or book format for integration in different types of control cabinets
- Integrated safety function for compliance with functional safety standards
- Increased resistance to contaminated atmospheres



Possible network topology with ACOPOSinverter P66 or P76.



Total machine costs reduced

Reduced installation costs: The availability of two form factors – book format and compact format – makes it possible to optimally adapt the machine design. The machine footprint can therefore be considerably reduced. Options for installation on the machine frame or in the control cabinet reduce costs and save space. With full POWERLINK integration, it is very easy to add a frequency in-



verter to an application with nearly no additional engineering work.

Integrated safety and control functions

The ACOPOSinverter P66 and P76 offer integrated safety technology out of the box. The safety functions provided include Safe Torque Off (STO) to meet simple requirements as well as advanced monitoring functions such as Safely Limited Speed (SLS) and Safe Stop 1 (SS1).

P66 highlights

- Compact format
- Optional interfaces: CAN, POWERLINK and X2X Link
- Integrated safety functions (STO, SLS, SS1)
- Power range
 - Single-phase: 0.18-2.2 kW
 - Three-phase: 0.37-15 kW
 - Three-phase (600 V): 0.75-15 kW

P76 highlights

- Book format
- POWERLINK interface
- Integrated safety functions (STO, SLS, SS1)
- Power range
 - Single-phase: 0.18-2.2 kW
 - Three-phase: 0.37-15 kW

Frequency inverters for a wide range of services in machine manufacturing



The ACOPOSinverter P86 is a high-performance frequency inverter for synchronous and induction motors. It covers a very wide range of applications for three-phase motors with or without sensors ranging from 0.75 to 75 kW and is particularly well-suited for packaging, conveyor system or material processing applications.

- Dynamic and powerful motor control for synchronous and induction motors
- Complete integration in POWERLINK system architecture
- Safe Torque Off (STO) with two inputs in accordance with SIL3/PL e to meet the requirements of safety standards for machines

Powerful dynamics and scalability

The ACOPOSinverter P86 is a powerful frequency inverter specifically aligned for maximum torque of the motor on your machine. With an optimized speed range up to 400 Hz, the ACOPOSinverter P86 is designed for dynamic applications that require faster acceleration or settling times.

- Robust overload capability: Depending on the application, the ACOPOSinverter P86 can handle up to 220% of the rated torque for 2 seconds
- Compatible with a wide range of motors
- Maximized machine throughput: The ACOPOSinverter P86 with a minimum response time (1 ms task cycle) combined with full POWERLINK integration

Sustainable productivity

The ACOP0SInverter P86 was designed to meet the demands of applications in harsh environmental conditions including vibrations, shock, dust and high temperatures up to 60°C.

Highlights

- Powerful dynamics and scalability
- Wide range of applications
- Comprehensive functional safety
- Extremely robust in harsh environments



ACOP0SInverter →

Interfaces

Power supply

Power rating

Integrated safety technology

Areas of use

ACOP0SInverter P66			ACOP0SInverter P76		ACOP0SInverter P86
CAN, X2X POWERLINK			POWERLINK		POWERLINK
Single phase 200-240 VAC	Three phase 380-500 VAC	Three phase 500-600 VAC	Single phase 200-240 VAC	Three phase 380-500 VAC	Tree phase 380-500 VAC
0.18-2.2 kW	0.37-4 kW	0.75-15 kW	0.18-2.2 kW	0.37-15 kW	0.75-75 kW
STO, SLS, SS1					
Conveyors, palletizers, packaging machines, pumps, fans, textile machines, kneading machines, milling machines, strapping machines, mixers					



Dynamic powerhouse added to servo motor lineup

B&R has taken the next step in development of its 8LS servo motors. Size 5 motors with 142 mm flange will now be available in new lengths that fit seamlessly into the line of dynamic motors. With a maximum torque of 177 Nm, these motors deliver excellent dynamics and energy efficiency in very compact dimensions.

The three newly designed motors fill out the mid-range of the 8LS product line. They offer comparable performance to their predecessors in more compact dimensions and with improved thermal design.

Dynamic performance

Like all 8LS servo motors, the new size 5 motors are highly dynamic and offer a high torque-over-

load ratio. They are therefore perfectly suited for applications such as plastics processing, printing presses and servo pumps.

Strong performance

With a flange size of 142 mm, the new motors deliver excellent torque density. Customers will benefit from real powerhouse performance with sleeker dimensions.

8LS servo motors come in a smooth housing with optional fan mounting to support even higher power ratings. The highly reliable motors are long lived and exceptionally resistant to failure. They can be combined with any of B&R's many gearbox options and shipped as pre-assembled motor-gearbox combinations.



New lengths available for size 5 motors round off the 8LS line of servo motors with powerful, dynamic performance.

Safety included

All motors from the 8LS series are offered with an optional digital encoder and optional safety functions. For the majority of speed variants, motors up to size 7 are also available with a single-cable solution that combines the cables for the motor and encoder. This minimizes cabling and substantially reduces installation costs.

Highlights

- Dynamic performance
- Compact dimensions
- Maximum torque density
- Optional safety functions
- Robust single-cable solution



More functions for better HMI applications

B&R continues to add new functions and editors that make it easier than ever to create HMI applications using its web-based mapp View HMI system. New features include improved support for Asian languages and simplified integration of external data sources.

mapp View currently supports 23 languages and 20 different keyboard layouts. Not only have new keyboard layouts for entering Chinese and other characters been added to mapp View, users now also have the ability to incorporate their own languages and keyboard layouts.



更多的功能支持更美的呈现

借助新功能和编辑器，贝加莱可以更容易地使用mapp View来创建网络呈现。

新的功能改进了亚洲语言支持，并促进了外部数据源的连接。

目前，mapp View支持23种语言，以及20种不同的键盘布局。其中包括用于输入汉字的键盘设置。用户现在可以在mapp View中添加和使用自己的语言和键盘设置。



It is now even easier to design entire HMI pages with mapp View.

Interfacing with OPC UA

External data sources can be integrated directly into mapp View HMI applications via OPC UA. To simplify this, it will soon be possible to import device description files from OPC UA servers into Automation Studio. mapp View can then access these files to learn which data the server will be providing. This data can be used in mapp View without having to manually enter the names or addresses of the data points.

WYSIWYG editing for entire pages

It will now be even easier to edit entire pages in mapp View. While mapp View has already provided a visual editor for positioning and designing wid-

gets, this convenience will now be available for entire pages as well. This is particularly beneficial when designing HMI applications for a variety of output media. Making settings in XML files is no longer necessary.

B&R also offers predesigned HMI templates for typical applications. HMI developers can simply open these templates in the new visual editor and quickly adapt them to their needs.

Intelligent Toolbox

The mapp View Toolbox is becoming smarter as well. It can automatically detect the widget selected by the user so that only the functions



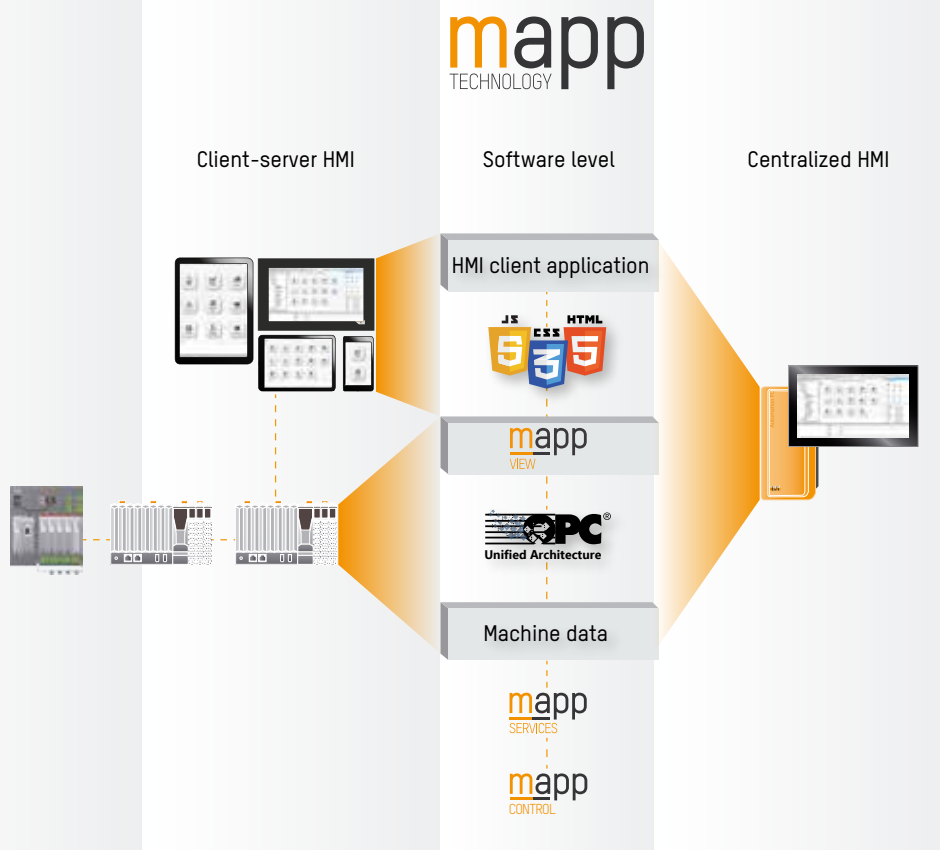
available for that widget are offered. This makes the configuration of charts much more intuitive, for example.

It is also easier to define events bindings in mapp View. Instead of having to manually enter and modify a bunch of data in an XML file, bindings can be created directly in the widget. mapp View automatically generates a suitable XML frame-

work where only the desired actions need to be entered. The upshot is less time and effort spent on HMI application development.

Autocomplete

Autocomplete and IntelliSense are now also supported in the mapp View XML editor, speeding up data entry and eliminating typos at the same time. Other improvements have been made to the



property editors. Whether it's quickly setting up complex data types like those for color gradients or selecting text, units and color values – it's now much easier and more intuitive in the new editors.

ample two input fields and a button for username, password and confirmation. This way, frequently used interface elements can be designed once and reused again and again with minimal effort.

User-defined widgets

mapp View comes with a large set of standard widgets, as well as themes and styles that allow developers to adapt their appearance to the system design. Now, it is also possible for users to



create and save their own widgets. The developer can modify the height, width and style of an existing widget and then save it as a new widget. OEMs can create libraries of their own widgets to be reused for each new machine.

In addition to individual widgets, mapp View users can also save multiple widgets as a group, for ex-



In the future, users will be able to save their defined events, actions and data links along with their widget groups to create small predefined functional units that can be reused at any time.

Highlights

- Easy development of HMI applications
- More functions
- More customization

New widgets for streamlined HMI design

B&R is constantly adding new elements to the mapp View web-based HMI solution to make development as easy as possible. Called widgets, these elements are conveniently dragged and

dropped into place and then configured. There are about 80 widgets currently available. By the end of 2018, 50 more will be added. Some of the newest widgets:

"Paper" widget

B&R makes it easy to create highly dynamic HMI applications. By linking SVG elements to real-time data, visual effects such as rotations, transitions and movements are possible at runtime. All of this is possible using just a single SVG image, which saves both time and money, especially when compared to all the work required to put together multiple images into image sequences. Vector-based SVG graphics also have the advantage of maintaining the quality of an image when zooming.

Highlights

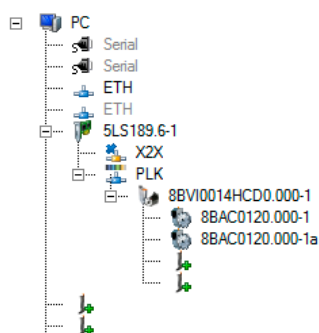
- Easily create animated graphics
- Integrate VNC-based HMI applications
- Easily move multiple axes





"VNC viewer" widget

It is now possible to easily integrate VNC-based HMI applications into a mapp View HMI application. The "VNC viewer" widget allows existing equipment and machines with VNC servers to be integrated into the mapp View HMI application for a primary machine or line – completely without programming.



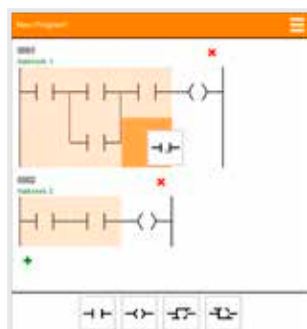
"Tree view" widget

This widget brings the well-known tree structure to your HMI application. Easy access to recipe values, directory trees or anything else with a linear design is now possible using structures similar to those in file explorers used by established operating systems.



"MultiAxis slider" widget

The "MultiAxis slider" widget turns your HMI application into a touchpad. Using only a finger, it is possible to move along axes in two dimensions at the same time, making the manual positioning of robot and CNC axes more efficient without needing special hardware.



"CodeBox" widget

B&R has upgraded the functions of this widget considerably. The design of the "CodeBox" can be modified as needed to harmonize its appearance with the rest of the application. "CodeBox" is used to modify or upgrade machine code at runtime, making it easy to program and configure things like machine options directly at the machine.

Interfacing with OPC UA servers

B&R is constantly expanding the range of OPC UA functions in the Automation Studio development environment. With the introduction of new drivers, it has become easier than ever before for B&R controllers to interface with OPC UA servers.

All B&R controllers can be operated as an OPC UA server and OPC UA client. It used to be necessary to program the connection between a B&R controller and another OPC UA server using PLCopen

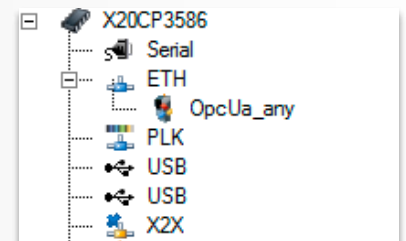
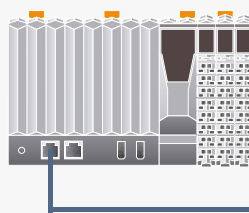
client function blocks. All that programming work is now a thing of the past.

Highlights

- Less programming
- Vendor-independent communication
- Integration of devices from 3rd-party manufacturers

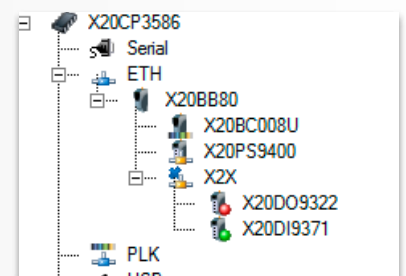
New I/O driver

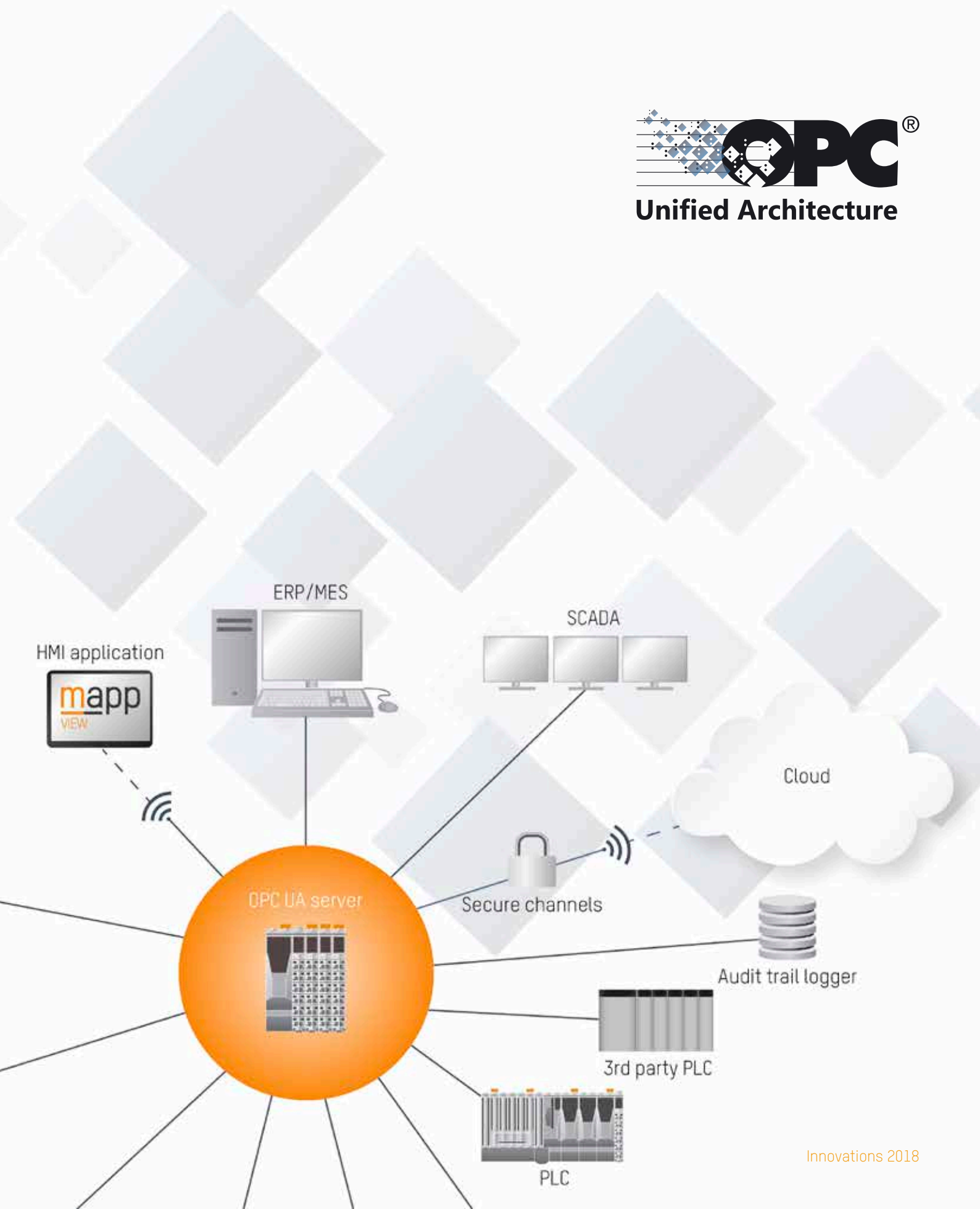
B&R has implemented an I/O driver in the real-time Automation Runtime operating system that makes it possible to integrate any OPC UA server into the controller configuration. The application developer simply adds "OPC UA Any Device" to the Ethernet interface in either the Physical View or System Designer component of Automation Studio. Process variables are then assigned to the nodes in the I/O mapping, configuring the driver and ensuring the transfer of data via OPC UA.



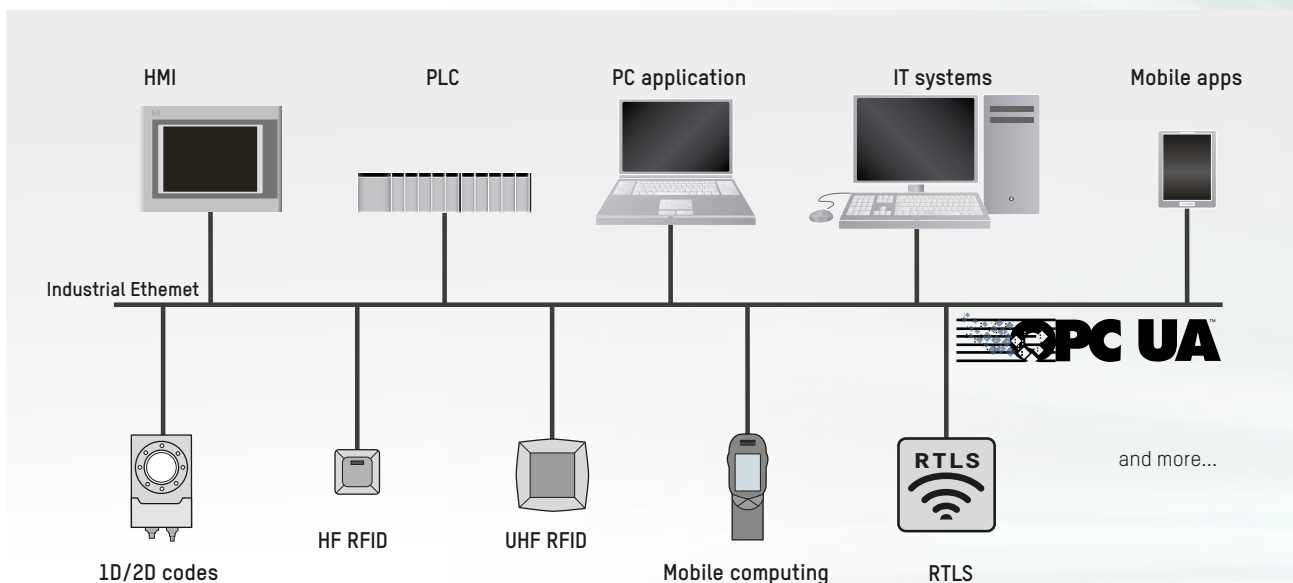
Simple communication

The I/O driver uses the write, subscription and monitored item services employed by OPC UA. This covers the majority of OPC UA communication tasks with other devices. Only more in-depth functions such as calling methods have to be programmed. The OPC UA bus controller from B&R can also be easily interfaced with B&R controllers using the new I/O driver.





Seamless integration of AIDC devices



B&R and OPC UA make it easy to communicate with AIDC devices.

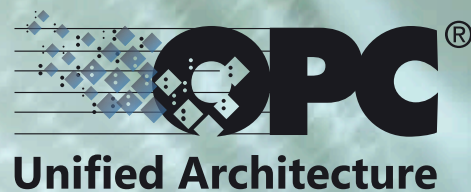
B&R and OPC UA make it easy to communicate with AIDC devices such as barcode readers, RFID readers and RTLS systems. The "AutoID companion specification" for OPC UA makes this possible.

This specification has provided a way for the Association for Automatic Data Capture, Identification and Mobility in Germany (AIM Germany) to standardize the writing of data from AIDC devices. B&R will be supporting this specification into the future. The most frequent applications of this technology include the Scan() method for reading data from

RFID devices and the WriteTag() method for writing to data storage devices.

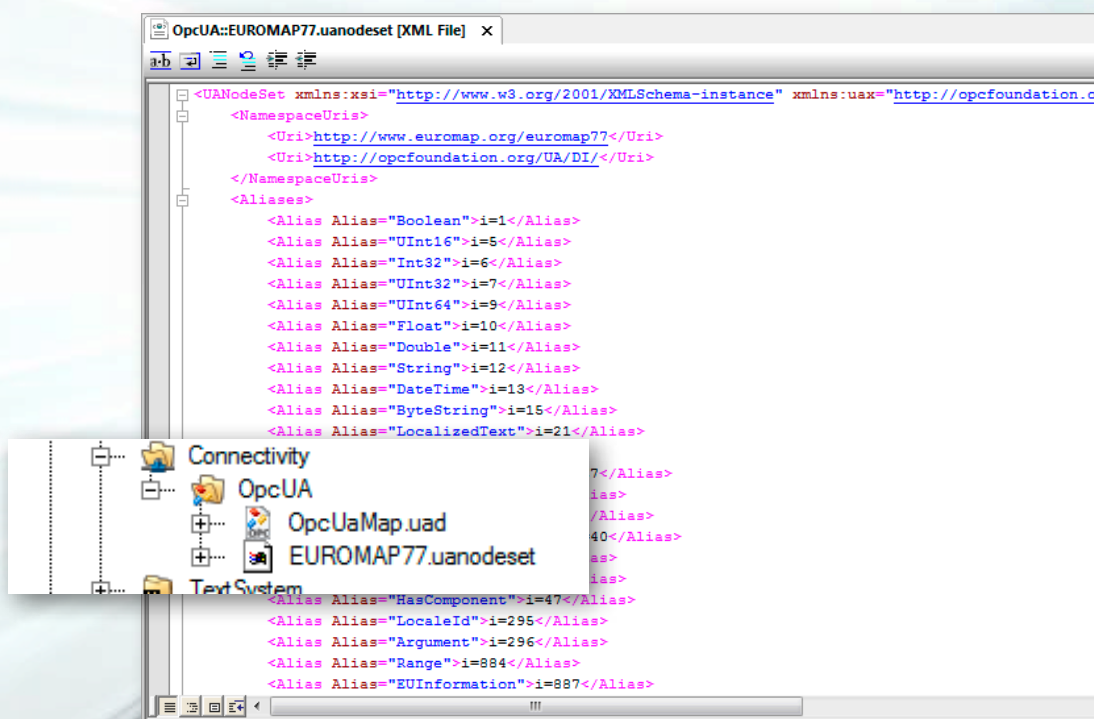
Integrating 3rd-party information models

It also becomes very easy to integrate OPC UA information models from 3rd-party manufacturers into the B&R Automation Studio development environment. It's simply a matter of importing the open source nodeset2.xml files. This eliminates the need for cumbersome typing and also prevents typos. Automation Studio then generates the necessary data types for the application from the files.

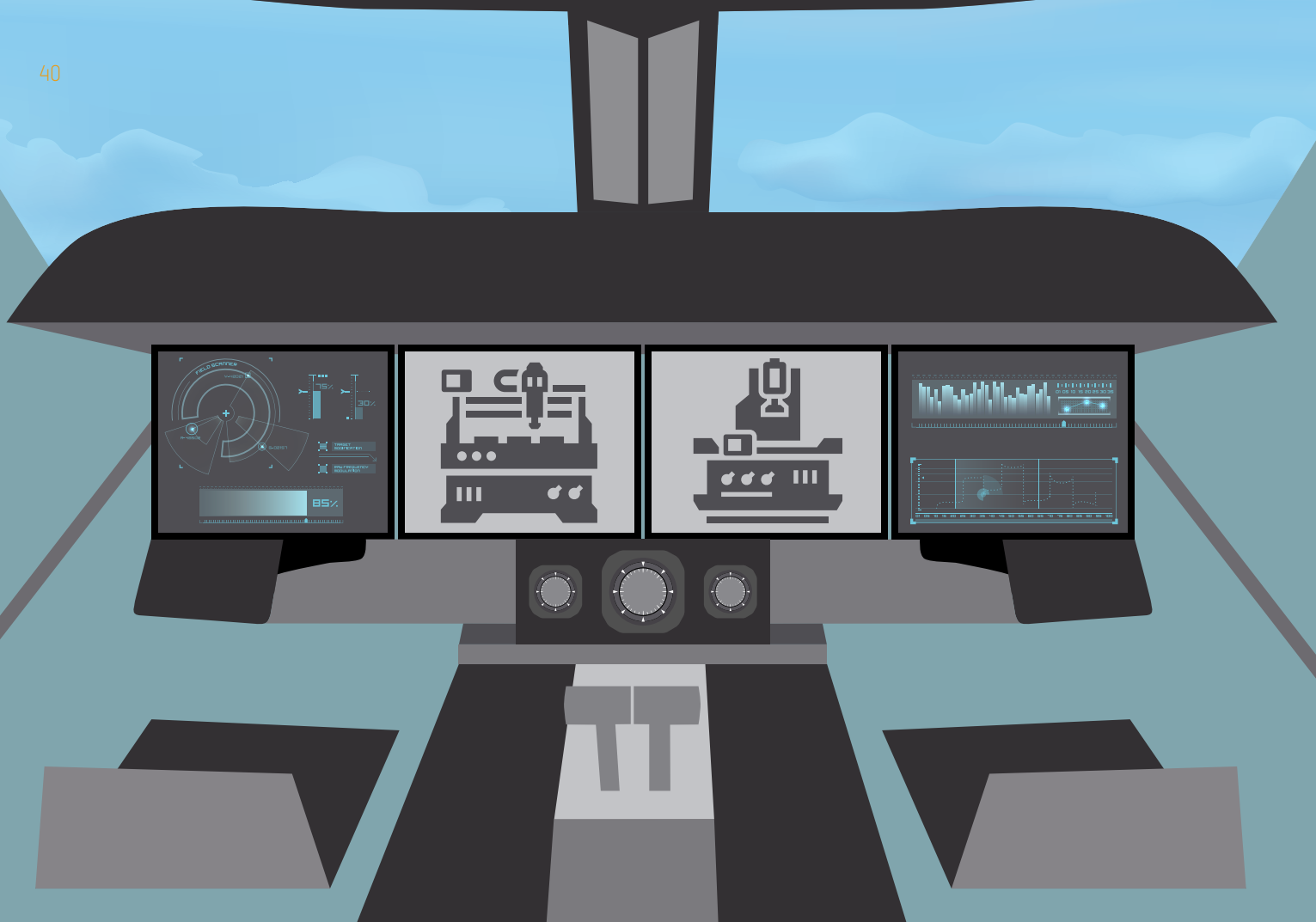


Highlights

- Easy integration of ID devices
- Possible to import information models
- Less programming



It is now easy to integrate OPC UA information models from 3rd-party manufacturers into B&R Automation Studio.



Cockpit for commissioning and diagnostics

mapp Cockpit from B&R is an advanced yet easy-to-use tool for commissioning and troubleshooting mapp components. Forming the technological foundation for mapp Cockpit are the web-based mapp View HMI system and an OPC UA information model.

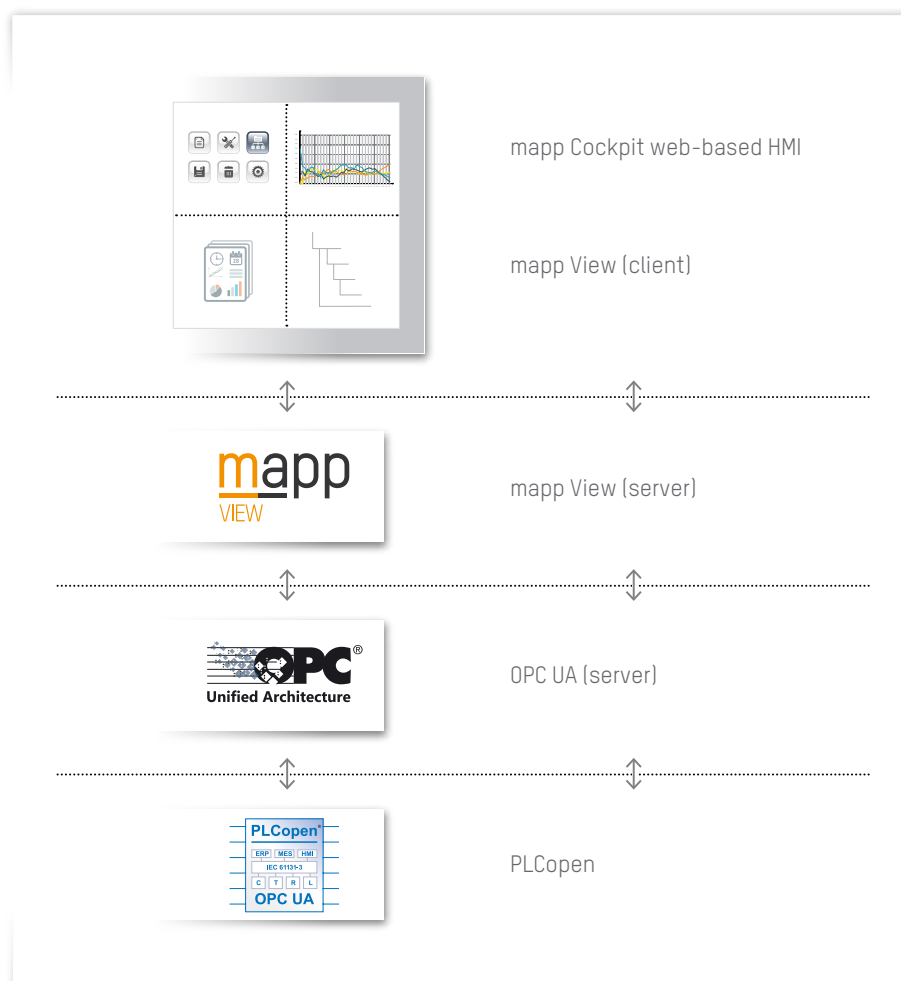
Axes and axis groups, for example, can be controlled directly in the clean interface of mapp Cockpit. Commands from components – otherwise carried out as function blocks – are easily executed at the push of a button. How the components react can then be observed in real-time in the Watch window, where all relevant values are displayed in graphic form.

Universal Trace function

A systemwide Trace function makes it possible to analyze the characteristics of a machine with a high degree of precision. Variables on the controller and drive can be recorded and evaluated simultaneously down to the very cycle. Cycle times down to 50 μ s are possible depending on the device without loading down the fieldbus. This way, it is possible to record the synchronized data of axis movements from a robot, the tool center point and the tool being used and visualize it in a diagram.

OPC UA communication

Information is exchanged between mapp Cockpit and the automation project via OPC UA. B&R makes



Since it is based on standard technologies, mapp Cockpit is easy to integrate into any application.

use of the modeling rules set forth in OPC UA companion specification "OPC Unified Architecture for Devices". As a result, performing diagnostics with mapp Cockpit and a B&R automation system is not just extremely flexible, but also compliant with an established standard. Data from the automation system can be used by other OPC UA supported HMI applications in the future as well.

Since mapp Cockpit is based on mapp View, machine manufacturers and plant engineers will be able to integrate individual mapp Cockpit functions into their own mapp View HMI applications.

This will make possible individual, flexible and easy-to-create commissioning pages tailored to the machine/operator target group in the respective corporate design.

Highlights

- Easy systemwide diagnostics
- High-precision analysis
- Clear visual representation
- Communication with OPC UA



Perfect temperature control

It's never been as easy to control temperature processes as it is with mapp Temperature. This new software component combines maximum usability with proven powerful and robust control algorithms. The integrated simulation possibilities are setting new standards, making virtual commissioning possible in just a few minutes.

The technical challenges of industrial applications can be easily mastered thanks to the optimized usability and model-based approach. mapp Temperature is a mapp component that makes it possible to define zones and groups so that the user has the necessary flexibility and scalability to meet any requirement involving temperature control.

Uniform zone control

Units consisting of an actuator (heating or cooling element), temperature process (extrusion, annealing, blow molding, etc.) and a sensor for mea-

suring the temperature are referred to as zones. Multiple zones can be put together to into logical physical groups that can be controlled and optimized as one.

The innovative autotuning function in mapp Temperature is able to calculate all of the parameters necessary for further operation as quickly as possible and without overshoot. The resulting optimized closed-loop control ensures high control quality in both heating and cooling processes. These processes can be further boosted using the internal Kalman filter. Intelligent pulse width modulation establishes the connection to the temperature process while efficiently managing the digital pulses within a group to minimize power peaks.

Multistage autotuning

A single tuning is usually not sufficient to optimize parameters when an application must cover



a large temperature range. The behavior of temperature processes can vary strongly from operating point to operating point. For this reason, mapp Temperature makes it possible to define multiple operating points that can then be optimized individually.

If only a certain electrical heat output is available for a group, for example, it must never be exceeded. To ensure this, the heat output of each zone as well as the maximum output of the group can be stored in mapp Temperature. The PWM function ensures that the maximum output of the group is not exceeded; if necessary, it reduces the output from the zones in equal measure.

Integrated simulation

mapp Temperature simplifies virtual commissioning, with each piece of hardware replaced by its corresponding simulation counterpart. For this user, this opens up new possibilities for quickly learning new functions or preparing the application without risk of harm. Virtual commissioning is a powerful way to considerably reduce the amount of time needed by the actual commissioning. It allows the application's logic, HMI and error handling to be tested without the need for the physical plant.

Highlights

- Simple approach to closed-loop control
- Highly advanced control algorithms
- Virtual commissioning
- Integrated simulation
- Multistage autotuning

Multizone tension control with just a few clicks

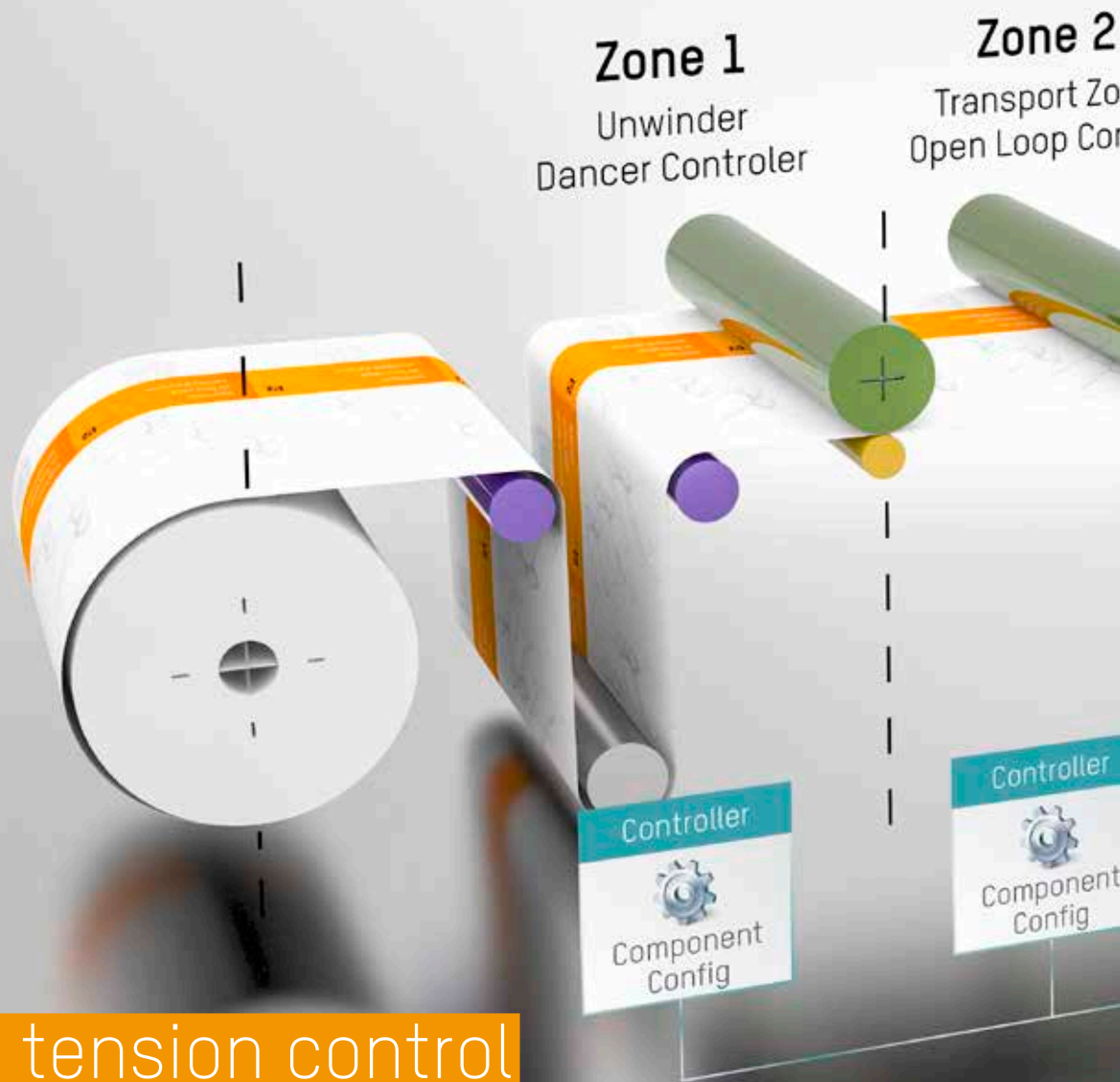
With mapp Web Handling, B&R provides an easy way to access advanced algorithms for closed-loop tension and winder control. Packed in simple-to-configure software components, these technologies can be built into an application with no programming whatsoever.

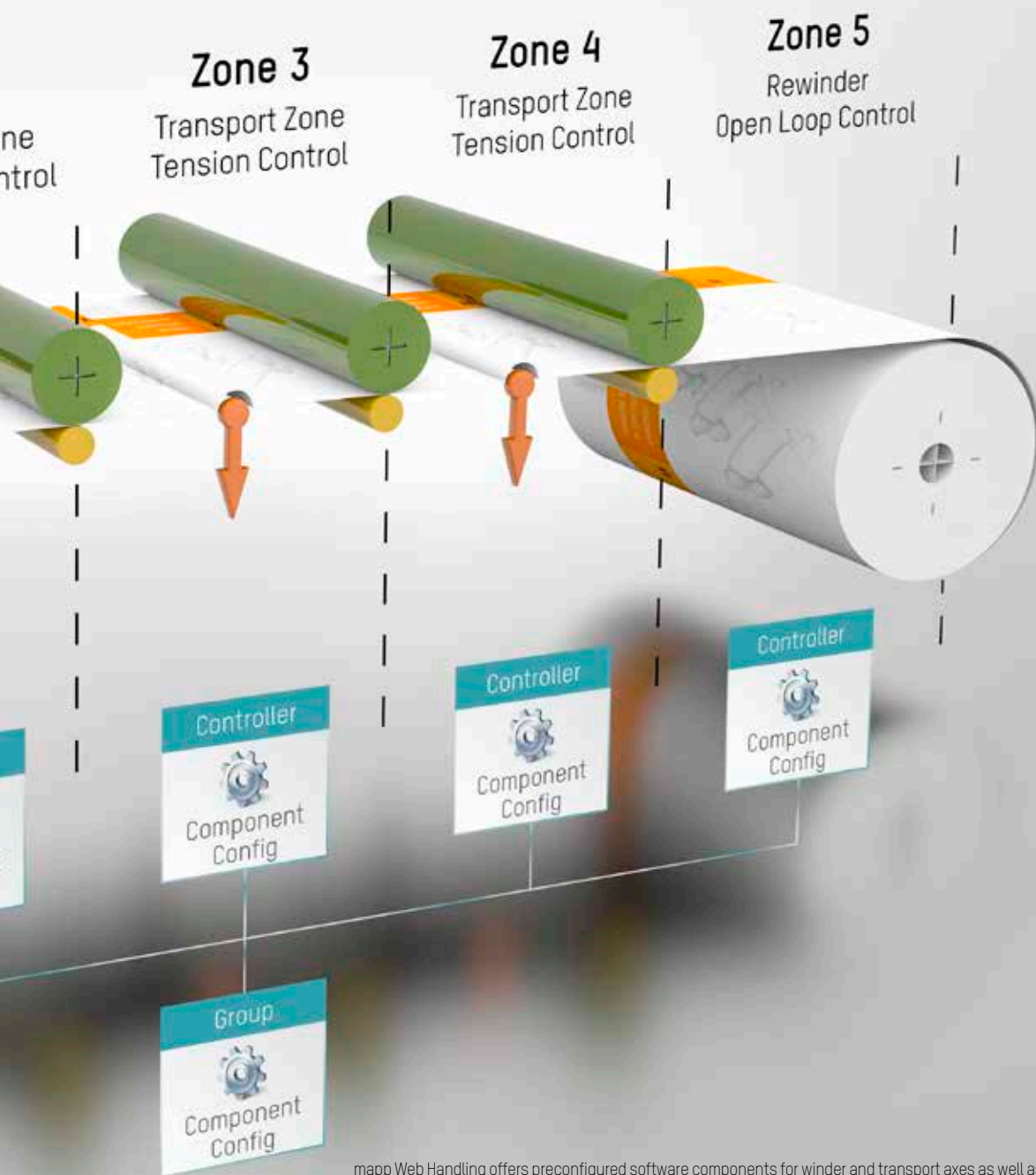
Web handling comprises technologies for transporting webs through a machine or manufacturing system. Intense focus is placed on maximizing productivity while minimizing waste. Typical areas

of use include packaging, printing and textile lines.

Automatic communication between components

mapp Web Handling offers preconfigured software components for winder and transport axes as well as closed-loop dancer and tension control. To further simplify operation, individual controllers can be grouped together. This allows functions and commands that require interaction between individual controllers to be executed di-





mapp Web Handling offers preconfigured software components for winder and transport axes as well as closed-loop dancer and tension control.

rectly using a group component. All steps involving communication between controllers are handled in the background without having to be programmed by the operator.

Integrated simulation

Individual zones as well as the combination of all zones can be switched over to simulation at the press of a button. This not only allows virtual commissioning, but also the replacement of a real zone with a simulated zone in the event of defective hardware, for example. The application soft-

ware can then be further developed without losing any time.

Highlights

- Less programming
- Integrated simulation
- Advanced closed-loop control algorithms
- Shortened commissioning times

Get servo pumps up and running faster



ACOPDS P3

Motor

Pump

Pump component config.



Axis configuration file



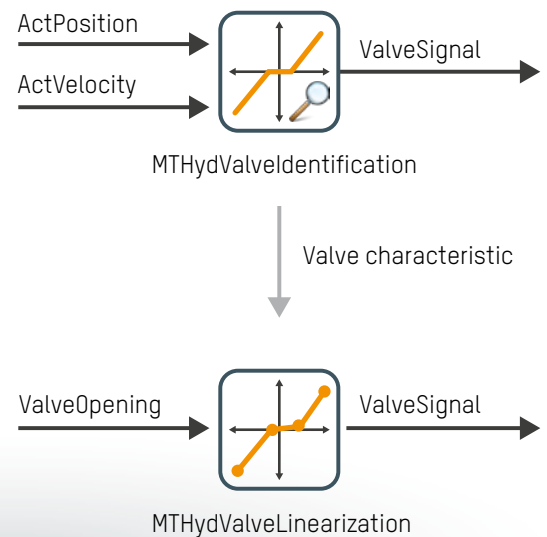
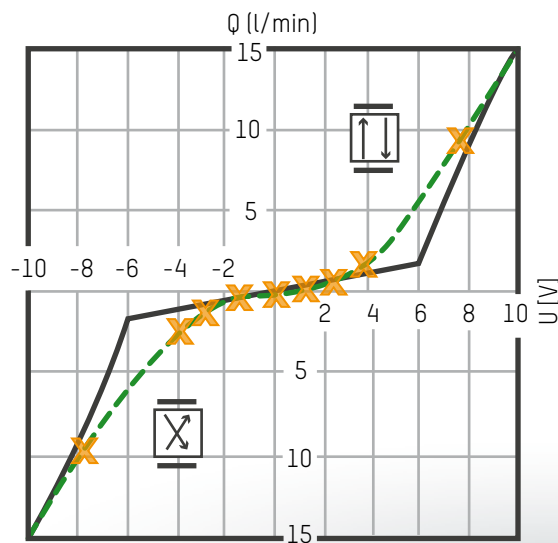
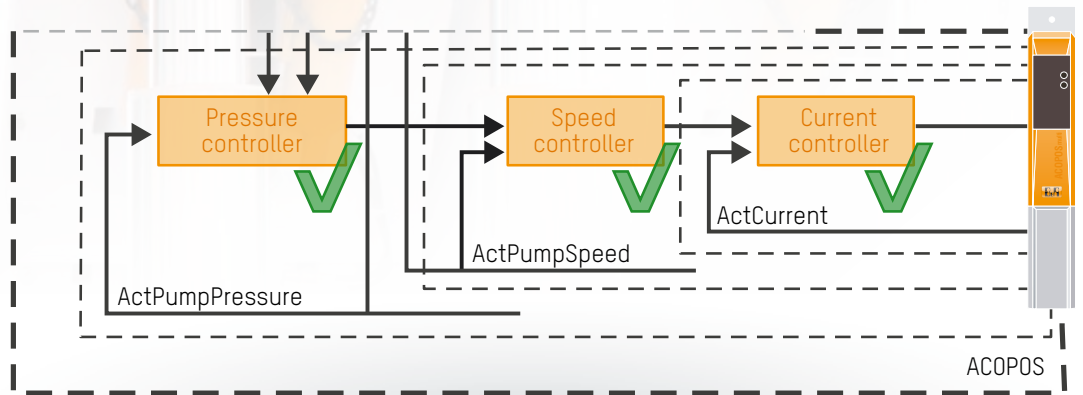
mapp Hydraulics makes it simple to configure a servo pump and optimize controller settings automatically through identification.

mapp Hydraulics simplifies both the engineering and commissioning of servo pumps. By monitoring measured values, it is possible to detect early signs of wear on control valves.

This new mapp component makes it simple to configure a servo pump and optimize controller settings automatically through identification.

A uniform, easy-to-operate interface provides access to proven B&R functions such as alternating pressure/speed control and pump, motor and ACOPDS overload protection.

mapp Hydraulics allows the characteristics of control valves to be identified automatically at any time. Creeping signs of wear can be detect-



ed early in this way. Or valves can be exchanged before they break. Either way, the predictive maintenance strategies required for Industry 4.0 can easily be implemented. What's more, performing automatic identification at regular intervals makes it possible to optimize the characteristic curve to always achieve maximum control quality.

Highlights

- Predictive maintenance
- Maximum control quality
- Faster and easier commissioning

Precise simulation for faster development

Another way B&R is simplifying simulation-based development is through the introduction of a new wizard. This new feature allows seamless switching between simulation and the real application. In addition, the existing simulation and virtualization options in Automation Studio have been upgraded and improved.

Software is taking on a more important role in the development of new machines. Using simulation tools, software development can be considerably accelerated in all phases – from design and implementation to testing and deployment. Simulation makes the development package easier to plan and much more efficient.

Open simulation environment

In addition to all of the simulation possibilities available for B&R hardware, the open interfaces and Functional Mock-up Interface (FMI) in Automation Studio provide efficient, industrially tested interfaces to a wide range of tools, including:

- MATLAB/Simulink (MathWorks)
- MapleSim (Maplesoft)
- industrialPhysics (machineering)
- Virtuos (ISG Stuttgart)
- Dymola (Dassault Systems)

Improved virtualization

Virtual commissioning can be divided up into modeling, software-in-the-loop and hardware-in-the-loop. For each of these areas, B&R Automation Studio makes it possible to switch from the virtual machine – in simulation – to the actual hardware. In addition, a wizard automatically creates a simulation configuration based on the machine's configuration.





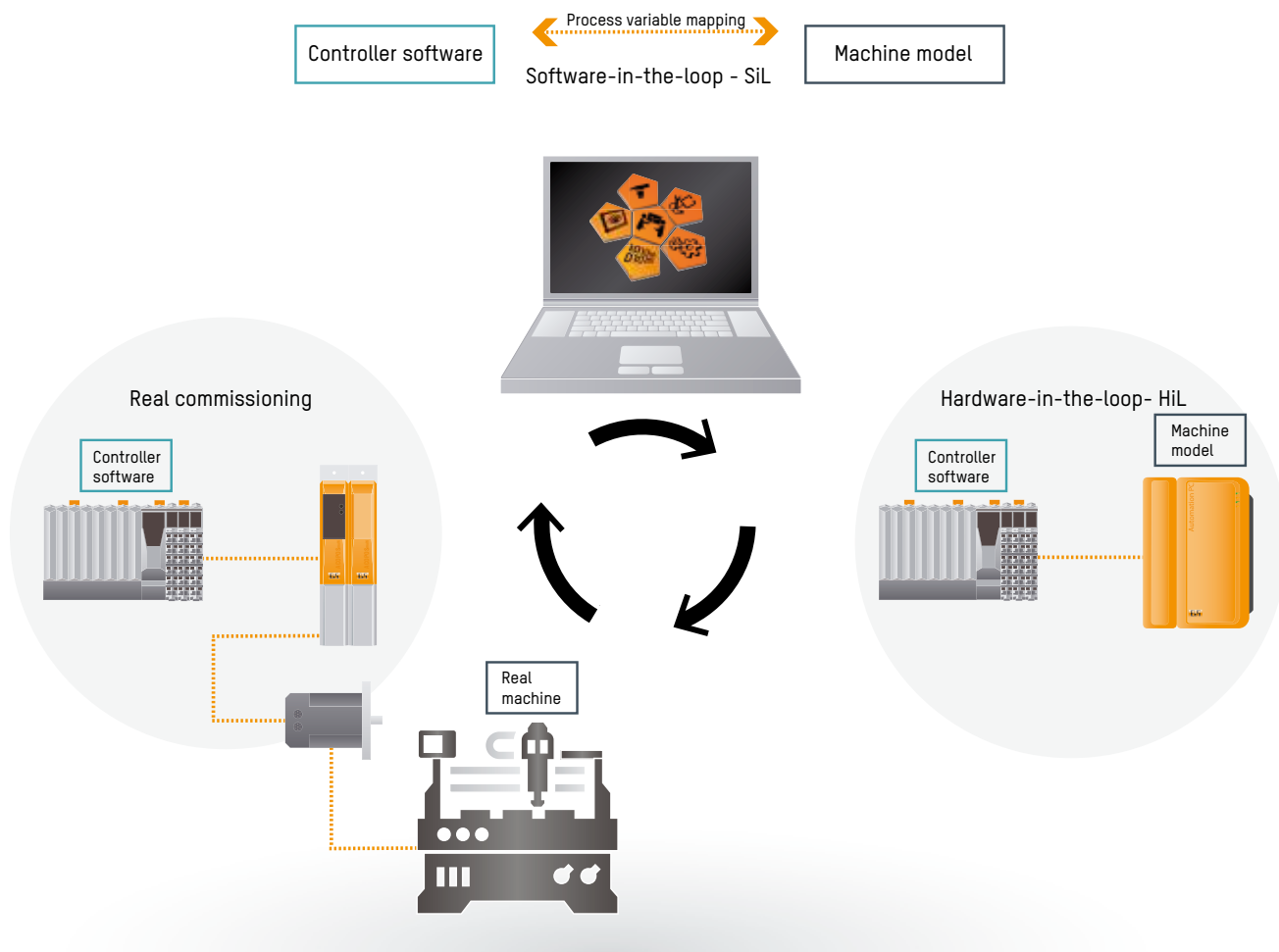
Modeling and simulation

Models are usually created in a tool specifically designed for modeling and development. Automation Studio supports a wide range of methods for integrating these models seamlessly into the industrial real-time environment (Automation Runtime). Some tools that can be integrated:

- FMI-compatible tools: The Functional Mock-Up Interface makes it possible to export models from a modeling tool and import them in Automation Studio. The model is available as a function block that can be tested and used either in the ARsim simulation environment or directly on the real-time system. The interface with the MapleSim tool is particularly easy and efficient.
- MATLAB/Simulink: Automation Studio Target for Simulink makes it possible to import any Simulink model as an executable functional unit in Automation Studio. This model can be used as a virtual testing unit for software.
- industrialPhysics: The BSR controller can connect to a simulation model in industrialPhysics over standard interfaces such as TCP/IP and POWERLINK. The 3D visualization is made possible by a high-performance driver in the industrialPhysics Windows application.
- ISG-Virtuos: A real-time capable model is created on a BSR target system from ISG-Virtuos using standard BSR mechanisms. The user sets up the model in Virtuos, views it there and also modify the model's properties on the fly.



Integrated simulation accelerates commissioning.



Software-in-the-loop

Software-in-the-loop simulation is an effective way to develop, verify and test application software. The machine model (digital "twin") is linked with the application software in Automation Studio over software interfaces. Software-in-the-loop now makes it possible to simulate drive components, including internal control loops (position, speed, current controllers), as well as the temperature characteristics of the drive and BSR servo drives with even more precision.

Hardware-in-the-loop

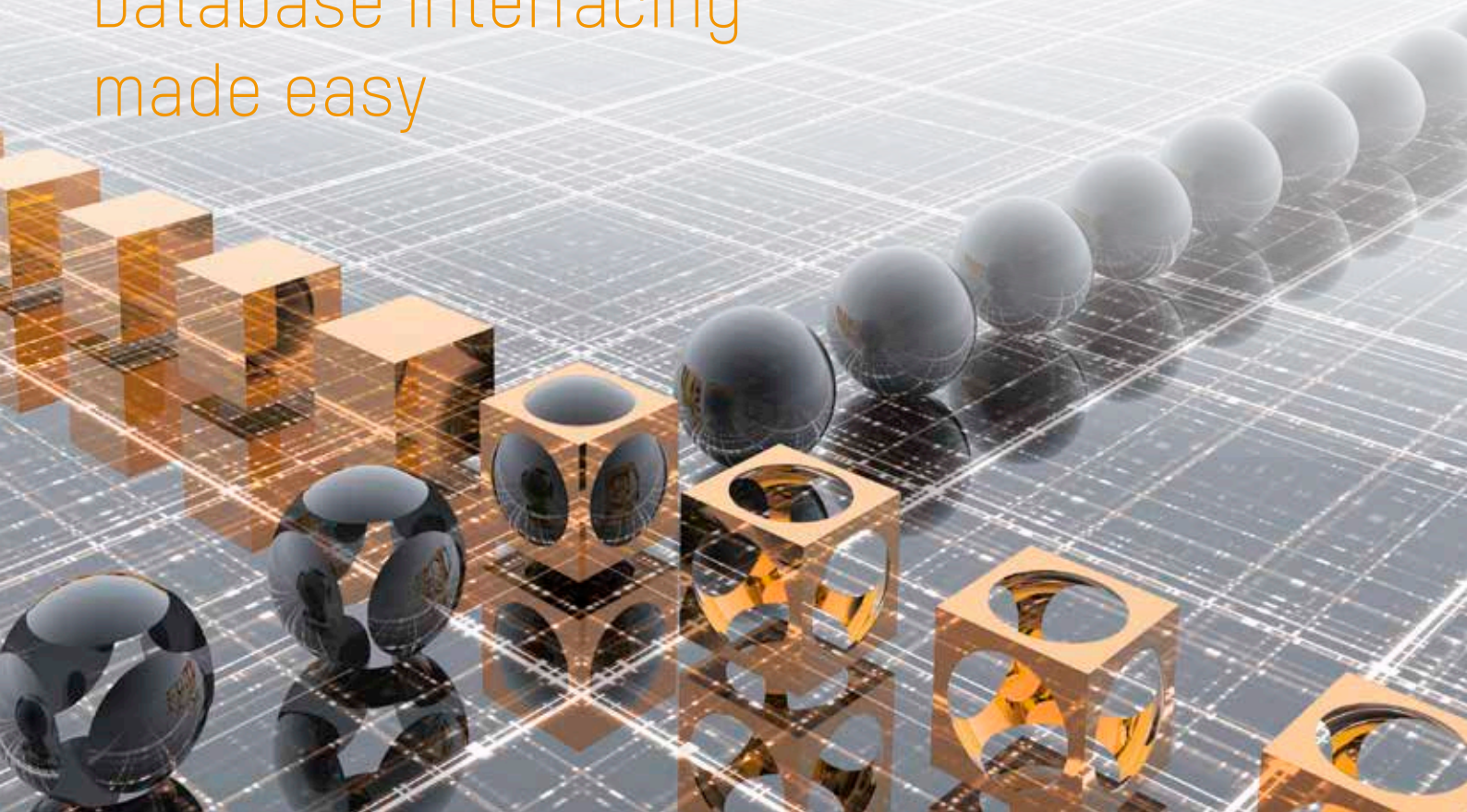
Hardware-in-the-loop simulation is generally used to test the performance requirements on the controller. The simulated machine communicates with the controller in real time, making it possible to carry out a battery of tests.

The seamless integration of simulation concepts allows the user to easily apply any combination of software-in-the-loop, hardware-in-the-loop and the control of actual machine components. You can't ask for much more when it comes to support for simulation-based methods when developing software and machine commissioning.

Highlights

- Faster software development
- Seamless transition from simulation to real-time operation
- Simple virtual commissioning
- Support for numerous simulation tools

Database interfacing made easy



The preconfigured software components in mapp Services simplify and speed up the development of machine applications. The already broad selection of existing mapps is now being reinforced by numerous new ones. For example, it is now possible to generate automatic PDF reports or set up an automated database connection for mapp functions.



mapp Report makes it possible to generate PDF reports from any application data. For example, the user can select whether diagnostic data or production statistics from the last batch should be saved as a PDF. The format and design of the document

can also be customized. mapp Report also has the ability of encrypting reports to ensure they are only opened by authorized users.

mapp Report can be connected to other mapp components via its mapp Link. This allows all data from other mapps to be included in the report, for example OEE data, energy consumption values, alarms and user actions. Together with mapp Tweet, a report can also be sent automatically as an email attachment. This procedure only needs to be configured once; it is then carried out automatically at a defined point in time or when a defined event takes place. It is also possible to transmit the PDF automatically to a network printer.



mapp Database allows data from mapps as well as user data to be easily managed in an SQL database.

SQL

mapp Database optimizes how applications manage data. Instead of countless files in a complex folder structure, mapp Database makes it possible to manage data in one or more SQL databases. mapp Database can be connected to any mapp component that saves or reads data. Instead of generating individual files for alarm lists, process values and audit events, all data is stored automatically in a database where it can be easily managed. Since these are standard SQL data-

bases, the data is available not just to other mapp components, but higher-level systems as well, such as B&R's APROL process control system.

Highlights

- Individual PDF reports
- Connectivity with all mapps
- Optimized data management



48 %

+ 26° C



Easily monitor control cabinets

With three new I/O modules in its X20 series, B&R makes control cabinet monitoring easier than ever. Without any additional sensors, these modules measure the environmental conditions – and optionally vibrations – in the control cabinet. Some variants allow user data to be stored on the module, and the module can be used in place of a licensing dongle.

All three versions are used to measure the temperature and humidity in the control cabinet and store the amount of time the values are within the defined ranges. The data can be read by the application at any time. This allows critical environmental conditions to be evaluated later on. The modules also log operating hours and power cycles internally. In addition, the X20CMR111 module features an integrated accelerometer that can be used to record vibration data.

Save recipes permanently

The X20CMR010 and X20CMR111 modules are equipped with 512 kB of non-volatile user memory. The memory functions without a battery and is therefore maintenance free. It can be used to store recipe information or other data. The data remains available even if the controller is replaced.

Integrated Technology Guarding

Two of the new I/O modules provide Technology Guarding functionality and can be used to manage software licenses. They replace the USB dongle otherwise used to manage runtime licenses for B&R software. This is especially helpful if there is no USB port available for dongles or if the port can't be used due to security concerns. The I/O modules can also be used on a remote backplane, which makes it easier to handle machine options.


I/O for additional functionality

In addition to the integrated functionality, the X20CMR111 module also provides the possibility to connect external sensors and actuators. The

two digital inputs can be used, for example, to connect door switches in order to determine if the control cabinet door is open. Two PT1000 inputs are available for external temperature sensors. A digital output is also available that can be used, for example, to switch on a warning light.

Highlights

- Keep track of vibrations and environmental conditions
- Licensing without a USB interface
- Integrated user memory

				
X20CMR module	→	X20 CMR 010	X20 CMR 100	X20 CMR 111
Temperature measurement		✓	✓	✓
Humidity measurement		✓	✓	✓
Operating information		✓	✓	✓
Vibration measurement				✓
User data storage		✓		✓
Technology Guarding			✓	✓
External I/Os				✓



Protecting software and storing data



The licensing dongles from B&R are now also available in a version with 16 GB of built-in flash memory.

Technology Guards from B&R are now also available in a version with built-in USB flash memory. The memory and licensing dongle therefore only require one USB interface.

Technology Guards allow simple and straightforward runtime license activation for B&R software. A USB dongle with the license information is simply connected to the controller or the industrial PC and the software is activated.

In addition, machine manufacturers and plant builders can also protect their software knowledge using a Technology Guard. They can offer the same machine with different functions, which are enabled by licenses on the USB dongle. This prevents unauthorized copies of the software from being made or software features that are not licensed being used.

The USB dongle has an integrated operating hours counter. This allows new business models to be implemented, such as usage-based billing for machine operation (pay-per-use).

16 GB memory

The new version of the USB dongle has 16 GB of built-in flash memory. This memory can be used, for example, to store machine data during operation. In combination with software component mapp Backup, it is also possible to create a backup or to download an update to the controller. The use of USB memory is especially interesting for machines or systems that are not integrated in a company network and therefore cannot create backups on a central server. With the new dongle, an additional USB flash drive is no longer necessary.

Highlights

- Memory and licensing dongle in one
- Only one USB interface required
- Easy updates and backups

mapp
VIEW



New T50 web terminal sizes

B&R is expanding the range of Power Panel T50 units to include two additional sizes: 12.1" and 15.6". There are now five different sizes to choose from with the smallest variant being 5" and the largest 15.6". Users can therefore find the operator terminal that best meets the requirements for their machine. All T50 models have a glass touch screen and are capable of handling multi-touch gestures.

These HMI devices are compact, easy to configure and ideally suited for premium machine designs. They have a projected capacitive touch screen with sensitive and precise response. This allows modern and user-friendly HMI applications to be implemented. Gestures such as zoom or swipe provide an intuitive user experience.

Powerful hardware

These features are made possible by using powerful hardware that meets the comparatively high demands of web-based HMI. With the Power Panel T50, both web-based and VNC-based applications can be implemented.

Easy configuration

The T-Series Power Panels are delivered with an integrated service page. This service page opens without having to be installed and offers custom configurations for settings such as IP address, DHCP server or screen saver. Other Power Panel T50 options include definition of a custom start screen that displays the user's company logo, for example. This configuration can easily be saved to a USB flash drive and copied to other Power Panel T50 devices.

Fast cabling

The Power Panel T50 is equipped with a Gigabit Ethernet interface. Power Panel T50 units are available with an optional integrated switch that allows simple daisy-chain cabling.

Highlights

- Widescreen variants from 5" to 15.6"
- Modern user experience
- Integrated service page for custom settings
- Customized start page

Power Panel T50 →

	6PPT50.0502-1xx	6PPT50.0702-1xx	6PPT50.101E-1xx	6PPT50.121E-1xx	6PPT50.156B-1xx
Display size	5.0" wide	7.0" wide	10.1" wide	12.1" wide	15.6" wide
Type	Terminal				
Display	Color TFT				
Resolution	800 x 480 pixels (WVGA)	800 x 480 pixels (WVGA)	1280 x 800 pixels (WXGA)	1280 x 800 pixels (WXGA)	1366x 768 pixels (HD)
Front	Aluminum frame with edge protection				
Glass	Clear glass or non-reflective glass, chemically hardened, black framed				
Touch screen	Projected capacitive multi-touch, electromagnetic compatibility				
CPU	ARM Cortex-A9, 800 MHz dual core				
DRAM	1 GB				
Flash (User)	512 MB				
Ethernet 10/100/1000 Base-T	1x or 2x (integrated switch)				
USB 2.0	2x				
Voltage range	24 VDC (-15%/+20%)				
Maintenance-free	No fans, no batteries				
Temperature range	-20°C to +60°C				
Protection in accordance with IEC 60529	Front: IP65 / Back: IP20				
Orientation	Landscape/Portrait (can be set using SW)				
Operating modes	VNC / Web mode				



Smart Safe Reaction meets mapp Technology



B&R is incorporating integrated safety technology into its mapp Technology software framework. The safety functions are now also available via the uniform and easy-to-use mapp user interface. New functions also make creating safety applications much faster and easier.

One of mapp's biggest advantages is automatically linking all software components. mapp Safety functions do not only exchange data with each other, they also automatically communicate with all other mapp components such as mapp User or mapp View web-based HMI.

mapp Safety consists of several elements, which can be combined as needed depending on the requirements:

Highlights

- Faster safety programming
- Easier creation of safety applications
- Automatic data exchange



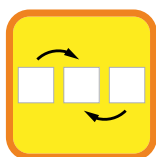
SafeDOMAIN

A safety controller is configured and managed in a safeDOMAIN. In the sense of Scalability+, users can select a powerful safety controller from the SafeLOGIC family or a more cost-effective SafeLOGIC-X controller. Very large safety tasks can consist of several SafeDOMAINs that communicate with each other via SafeDOMAIN gateways.



SafeDESIGNER

The safety application for a SafeDOMAIN is created in SafeDESIGNER. Certified functions used in combination with the visual editor allow virtual wiring. In addition, all device parameters for the SafeDOMAINs are managed here. This accelerates the development and commissioning process and prevents errors.



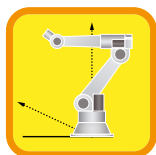
SafeOPTION

With SafeOPTION, B&R offers a predefined set of certified functions that can be used to map different machine variants in a safety application. This makes it possible to create robust, adaptive safety solutions, which simplifies managing different sets of machine options. SafeOPTION also allows safety settings be changed during operation. For example, limits values can be adjusted or another mode of operation can be selected.



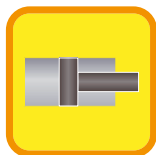
SafeMOTION

B&R offers a full range of safety functions for drives. Your application and configuration are seamlessly integrated into the overall system.



SafeROBOTICS

If robots are to work hand-in-hand with humans, their movements must be safety-monitored. With SafeROBOTICS functions, B&R makes this possible.



SafeHYDRAULICS

Hydraulic drives have unique requirements in terms of safety technology. B&R has further developed the SafeMOTION portfolio so that hydraulic movements can be made safe just as easily and efficiently as electric axes.



Commissioning: Quick and out of the box



B&R has simplified commissioning of safety applications with new widgets for mapp View web-based HMI. These ready-made HMI components can be used individually or multiple components can be placed via drag and drop to create a custom commissioning page.

The Connection widget provides an overview of all available SafeDOMAINs and makes it possible to establish a connection with a SafeDOMAIN. The Status widget displays all basic information related to a SafeDOMAIN. The Transfer widget is available for downloading data. It transfers the safety applications and all safe commissioning options to the SafeLOGIC controller. The latter are specified using an XML-based configuration file. This configuration file can also be generated by a customized order system.

The Completion widget is used to complete commissioning. It lists all relevant information and provides the user with an overview of the SafeDOMAIN configuration. It is easy to check the status of the machine or plant from a safety perspective. Once the configuration has been confirmed, commissioning is completed and a full report is generated.

The Exchange widget provides support to the machine operator when exchanging a module. It shows the necessary information so the maintenance engineer can complete the maintenance task easily and safely.



Automatic communication

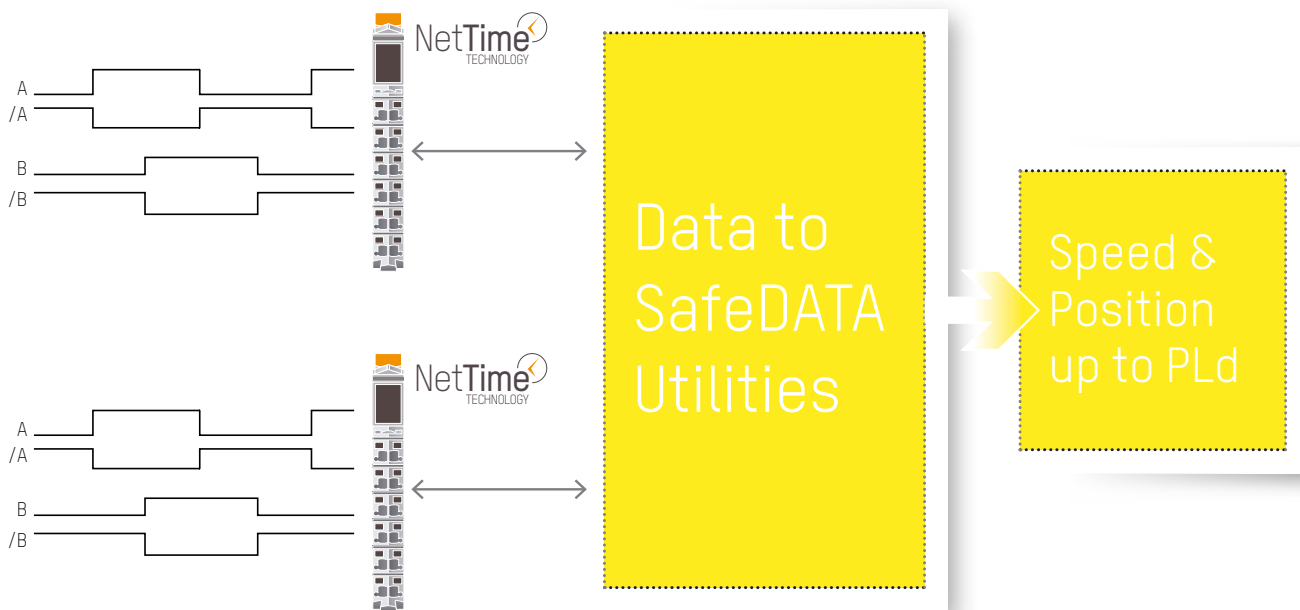
The widgets are automatically linked with other mapp components on the machine. mapp User can be used to manage access rights. In addition, mapp Audit also automatically saves all changes with a timestamp and username in order to prevent unwanted manipulation. Other functions make it possible to backup and restore safety applications or format SafeKEYs.

Highlights

- HMI components for commissioning
- No programming required
- Automatic communication with all mapp components
- Configure machine options via XML file



New functions in SafeDESIGNER

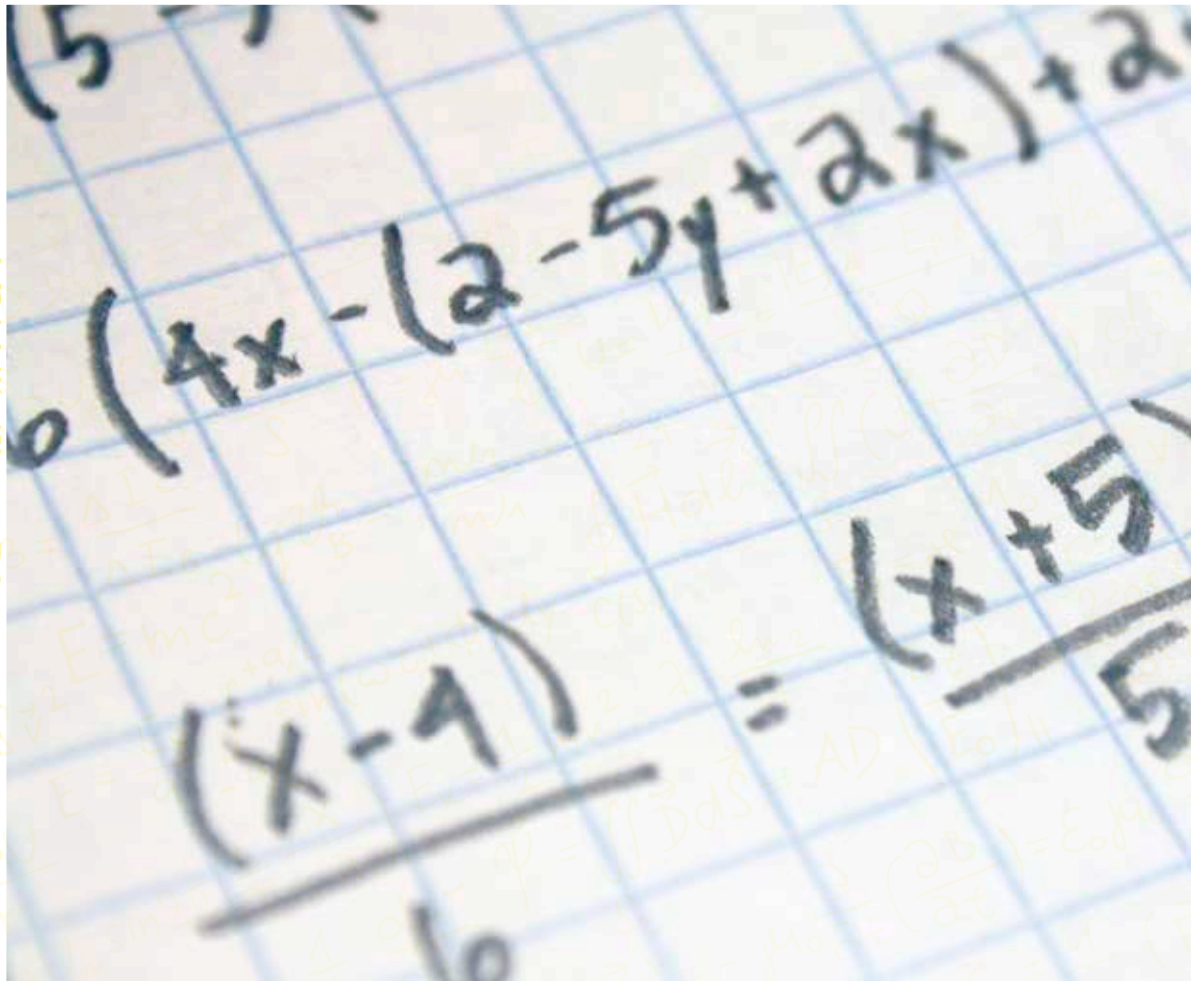


B&R makes it easier to create safety applications with a series of new mapp functions in SafeDESIGNER. It is also possible to use a combination of data from the standard application to generate safety-relevant data.

B&R is expanding the existing table functions for safety technology by two: A lookup table allows easy conversions and a two-dimensional table can be used to implement array functions when programming.

Data to SafeDATA

The Data-to-SafeDATA function determines a safe speed and a safe position using data from the standard application. This is done by comparing speed and position data from two standard (non-safety) X20DC1196 I/O modules with each other. With the help of the functions provided, the data can be used as the safe speed for applications up to PL d and the safe position for applications up to PL c .



Another use case is safe evaluation of signals from strain gauges. If two X67AI2744 modules with one strain gauge sensor each are used, safe strain information can be created for applications up to PL d.

Advanced mathematics

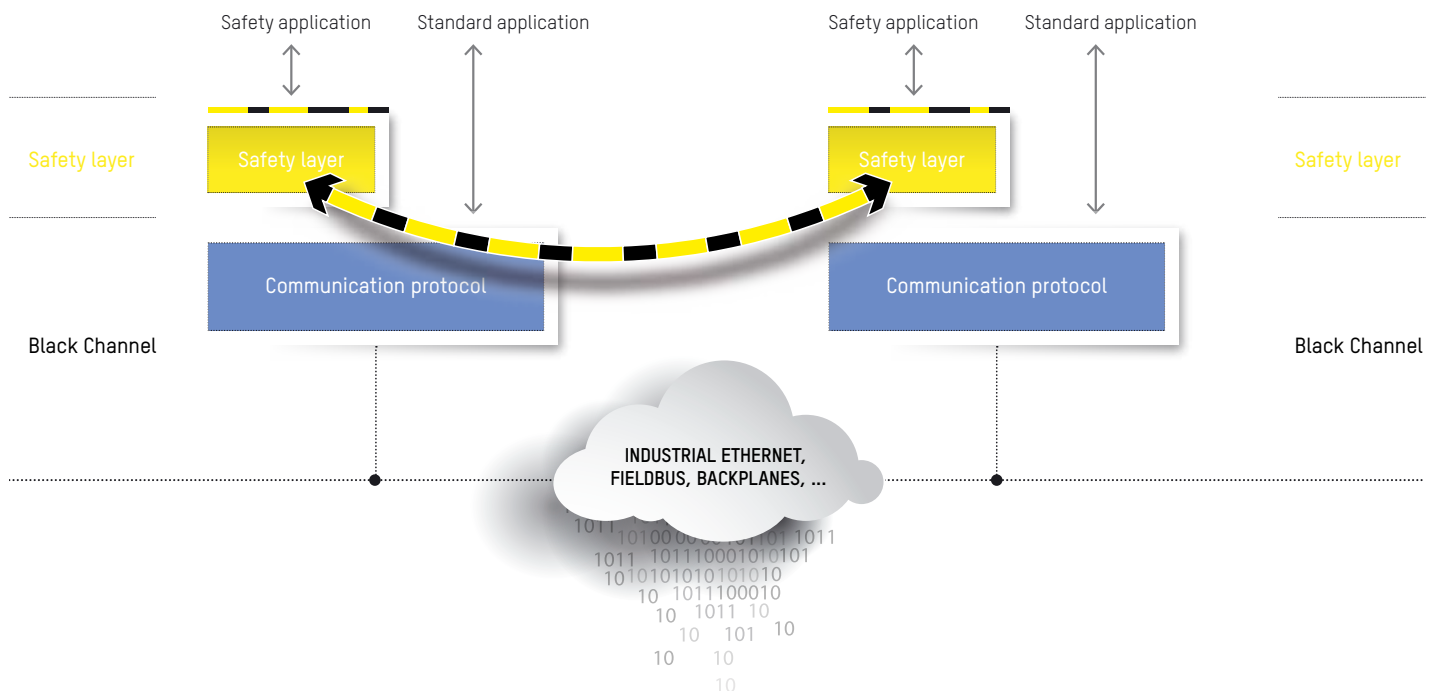
With advanced mathematics functions, B&R makes it easier to make complex calculations in an application. All data is calculated as fixed point numbers. The user does not need to use the in-

ternal floating-point calculations and does not have to worry about rounding, resolution or buffer overflow errors.

Highlights

- Safe data from functional signals up to PL d
- Easily solve complex calculations
- LookUp tables and array functions

openSAFETY can be used universally



Connected manufacturing requires safe data exchange not only within a machine but also between machines in a line. B&R has therefore expanded the possibilities for openSAFETY to transfer data via various transport media used in industrial automation.

openSAFETY@POWERLINK

This black channel has already been in use successfully for many years. Via POWERLINK, openSAFETY achieves up to 100 communication relationships and provides by far the fastest solution

with safe response times below 20 ms. Networks with POWERLINK and openSAFETY are extremely stable and independent of the overall load on the network.

openSAFETY@UDP

UDP is ideal for real-time communication via standard Ethernet, so it is therefore often used for industrial communication. openSAFETY can now transfer data using the black channel principle via UDP, which allows safe controller-to-controller communication for machines with UDP communi-

cation. Safe response times starting at 50 ms can be achieved. openSAFETY@UDP also supports up to 100 communication relationships. With UDP, the stability and response times depend on the overall load on the network. Despite these limitations to stability and response times, the number of applications with UDP is increasing because it is well-suited for WLAN or Bluetooth transmission.

openSAFETY@OPC UA

OPC UA is considered the standard for controller-to-controller communication and is therefore also an ideal black channel for openSAFETY. OPC UA can provide performance comparable with UDP. Through the use of time-sensitive networking (TSN), response times will be reduced in the future and performance will no longer depend on the overall network load.

Safe production line automation with OPC UA

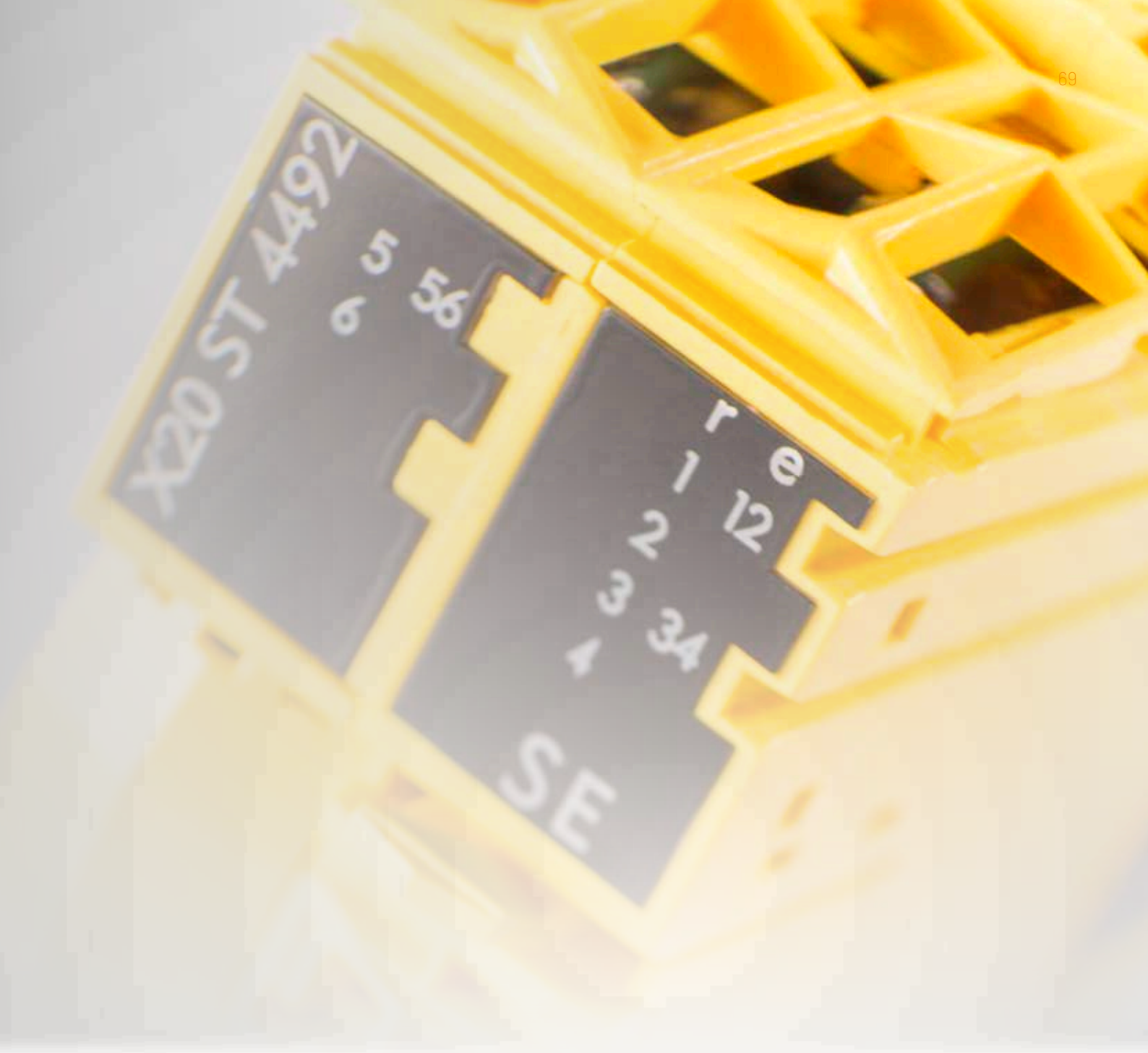
The combination of OPC UA and openSAFETY enables preconfigured communication and, for the first time, also supports fully automatic safe line communication for modular systems. Self-organizing safety networks make it possible to add or remove entire machines or individual components on the machine network without having to reprogram the safety application.

Highlights

- Transfer protocol can be freely selected
- Support for modular machine lines
- Wireless transmission
- Self-organizing safety networks

New SafeI/O functions for the X20 system family





X20S06530 – 6 safety relays on a 25 mm module

The X20S06530 offers 6 safety relays on a module with the standard X20 SafeIO form factor (25 mm width). B&R thus offers a cost-effective solution for applications where numerous floating signals are needed. Evaluation of positively driven feedback contacts, which is necessary from a safety perspective, is handled internally in the module. This allows the 6 safe relay output channels to be used in the application just as easily as conventional semiconductor-based output channels.

X20S06530 - Technical data

- 6 safety relays, each with 1 N.O. contact
- Cat 1 for each channel / CAT 4 for each channel pair
- Max. switching capacity
 - AC 230 VAC / 6 A
 - DC 24 VDC / 6 A
- Internal evaluation of positively driven contacts



Safe monitoring of wind turbine battery charge

X20SA4130 – Safely measuring voltages

The X20SA4130 safe analog input module is suitable for safely measuring voltage signals for safety-related applications up to PL e or SIL 3. This makes it possible to safely monitor the voltage of batteries, for example.

In the event of a fault, the wind turbine rotor blades must be turned away from the wind. A battery is used here to provide power to the drives. To ensure this is done properly, the charge level of the battery must be monitored constantly.

X20SA4130 – Technical data

- 2 safe analog input pairs for voltage measurement
- +/-10 volts (for the voltage level)
- Channels individually electrically isolated
- Configurable input filter and switching threshold



10 V supply voltage for strain gauge load cells

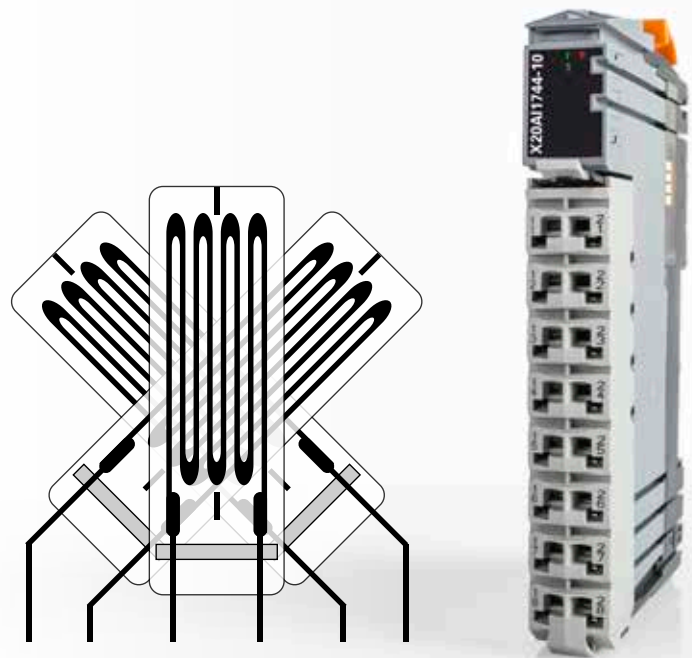
B&R is expanding its line of measurement modules for strain gauge sensors to include another analog input module. The X20AI1744-10 is a variant of the standard X20AI1744 module that provides a 10.5 V strain gauge supply voltage. This is necessary for many melt pressure sensors that are based on the principle of a strain gauge. With the new X20 module, these sensors are provided the correct supply voltage and can therefore be easily connected to the X20 system.

This new module works with both 4-wire and 6-wire strain gauge load cells. The concept applied by the module requires compensation in the measurement system. This compensation helps eliminate the absolute uncertainty in the measurement circuit, such as component tolerances, effective bridge voltage or zero offset.

Two filters are available for the analog input. They can be individually enabled and configured at runtime. In order for the filter behavior to be adapted to the measuring situation or machine cycle, the filter characteristics of both the IIR low-pass filter and the FIR filter can be changed together at any time. The data output rate of the new measurement module is configurable between 2.5 Hz and 7.5 kHz via software.

Highlights

- Data output rate configurable from 2.5 Hz to 7.5 kHz
- Special operating modes (synchronous mode and multisampling)
- Configurable filter level



X20AI1744-10 →

X20 I/O module
Bridge supply voltage
Connection
Digital converter resolution
Data output rate
Cutoff frequency
Order
Slope

Technical data	
X20 single-channel full-bridge strain gauge input	
10.5 V	
4-wire or 6-wire connections	
24-bit	
2.5 - 7500 samples per second, can be configured with software	
5 kHz	
3	
60 dB	

Improved performance for stepper motors

With the X20SM1436-1, B&R is expanding its product range to include another X20 module for direct control of stepper motors. This module allows operation of stepper motors with operating voltages from 18 to 60 VDC and rated currents up to 5 A.

Through use of the integrated current reduction function, B&R has significantly increased the power of the module. Double the rated current, which is 10 A, can be handled for a short period of time. The current reduction function can be defined as sensor-free, load-dependent current control. The module controls the current by reducing it depending on the operating situation and load. This results in energy savings up to 75%.

Less consumption, more performance

In addition to energy savings, power loss and therefore the heat generated in the module are also significantly reduced. At the same time, current control also results in the stepper motor running more smoothly. To prevent damage to the module, it is equipped with inrush current limitation and a motor output with short circuit and overload protection.

In addition to the connections for the stepper motor, there are also four 24 VDC digital inputs available. Three of them can be configured as ABR en-

Highlights

- Sensor-free, load-independent current control
- Inrush current limitation
- Motor output with short circuit and overload protection
- Open circuit monitoring
- Stall detection
- Highly accurate timestamp

coder inputs with a counter frequency of 1 MHz for 4x evaluation. All digital inputs have open circuit monitoring to help ensure safe, reliable operation.

The X20SM1436-1 is equipped with stall detection in order to determine if slip is occurring. The module is fully integrated in Automation Studio and can therefore be easily used with B&R's CNC function. In addition, the stepper motor module has NetTime capabilities. In ABR mode, precise timestamps can be assigned to the positions and they can then be further processed by the controller. The timestamps are based on distributed network clocks that automatically deliver highly accurate and perfectly synchronous values.



NetTime
TECHNOLOGY

X20SM1436-1 →

X20 I/O module	Technical data
Stepper motor outputs	X20 single-channel stepper motor module 5 A, 18-60 VDC, 4 inputs, current reduction function, NetTime function, X20 double-width module
Nominal current	1x stepper motor (full-bridge)
Nominal voltage	5 A
Digital inputs	24 - 48 VDC +/- 25%
Evaluation	4x 24 VDC
Counter frequency	4x
Counter size	1 MHz
	16-bit



Ultrafast automation with floating point calculation

The reACTION product portfolio will be expanded to include the X20RT8381 module. With this module, it is possible to process and calculate numbers with data type Single Precision REAL.

Process analog values faster

The new reACTION module is especially well-suited for high-speed analog value processing because they are calculated directly on the module. The function blocks provided can be used, for example, to create n^{th} order digital filters or controllers that are fully integrated in the automation system. This integration and the increased number range for data processing are the main features of the new module.

The Automation Studio engineering environment provides the necessary arithmetic functions as well as other functions for dealing with Real numbers. This allows simple and fast programming.

Decentralized time-critical subprocesses

With reACTION technology, time-critical subprocesses are executed directly on the I/O module. This greatly speeds up response times compared to conventional control solutions, which transfer the signal from the I/O module via the network to the central controller and back again. The program is executed on decentralized devices, but

the software itself remains centralized. Programming reACTION technology is as easy as with conventional control solutions.

The appropriate programs are created in the Automation Studio function block editor and then executed directly on the I/O modules. Response times down to 1 μs can be implemented easily and cost-effectively using standard hardware and software.

The following functions can be implemented with data type Real using the new module:

- Addition, Subtraction, Multiplication, Division
- Inversion, Square Root
- Double Integer to Real, Real to Double Integer
- Comparator
- Various known functions with Real support (Latch, Mux, Delay, Par, Res, etc.)

Highlights

- Response times down to 1 μs
- Processing Real numbers
- Simple programming



X20RT8381 →

X20 I/O module

Digital inputs

Digital inputs/outputs

Analog inputs

Analog outputs

Technology

Technical data

X20 reACTION module, Real arithmetic function, digital/analog module, double width

4x 24 VDC, <2 µs

4x 24 VDC, 0.1 A, <2 µs

2x +/- 10 V, 12-bit, 5 µs, configurable software filter

1x +/- 10 V, 12-bit, 2.5 µs

Mobile automation



Agriculture and forestry



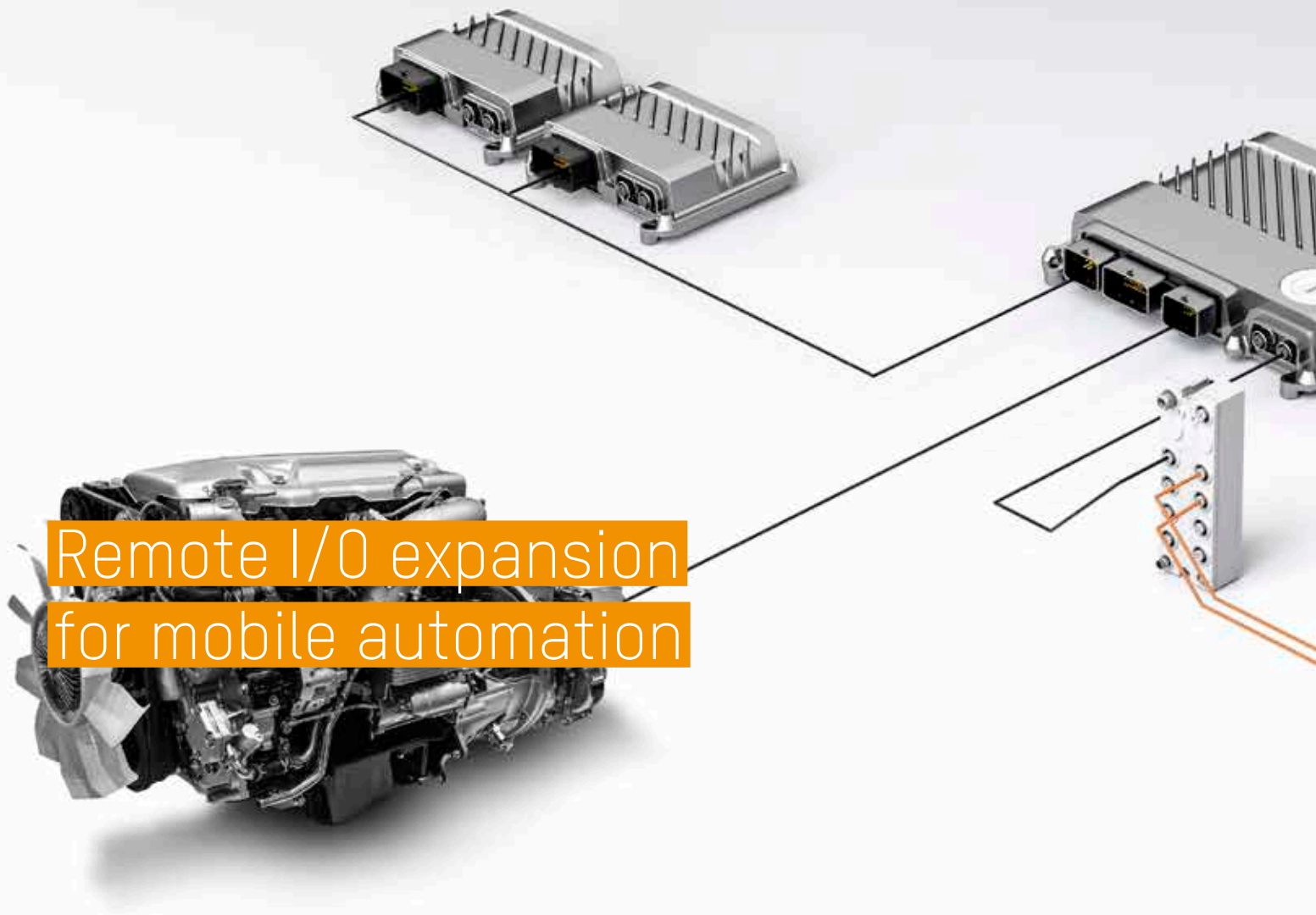
Construction



Municipal vehicles

The modular X90 control and I/O system brings all the functionality of a B&R automation solution to mobile machinery. Customers benefit from an easy-to-use development environment, high-performance real-time operating system and ready-made software components. It has never been easier to implement automation solutions for vehicles and heavy equipment used in construction, agriculture, forestry and municipal applications.





Remote I/O expansion for mobile automation

B&R is expanding its X90 control and I/O system to include an I/O module for connecting distributed sensors and actuators on mobile equipment. The X90BC124.32 is connected to the X90 controller via CANopen and has 32 multifunction inputs and outputs.

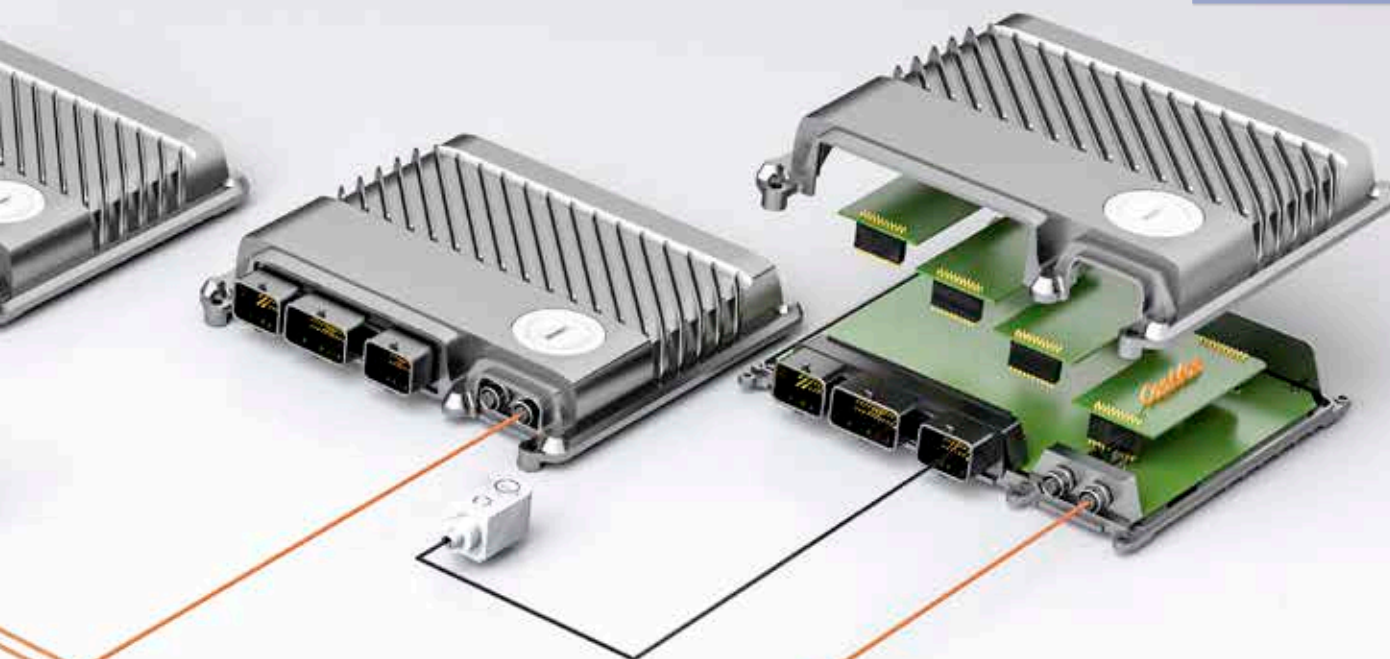
For use in harsh environments

- IP69K
- -40 to 85°C
- 50 g shock

The new module with a new compact housing is used in combination with an X90 controller for remote I/O expansion. The multifunction inputs and outputs make the X90BC124.32 very versatile. Functions such as digital I/O or PWM outputs are configured in the control application using the B&R Automation Studio development environment.

Highlights

- CANopen interface
- 32 multifunction I/O channels
- Compact housing



X90 controller →

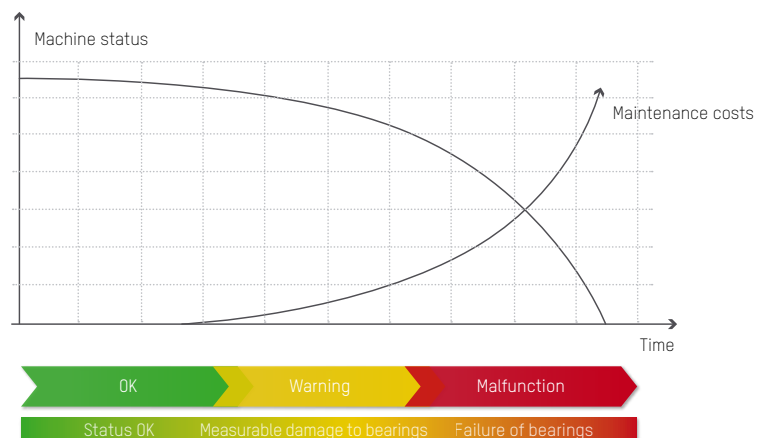
	Function	X90BC124.32-0000
Interface	CANopen	1x
Total I/O	Mainboard	32x
Multifunction digital inputs	Sink counter, 50 kHz (1 AB encoder)	4x
Multifunction analog inputs	0-5 V, 0-10 V, 0-32 V, 0-25 mA Can be used as digital input	10x
Multifunction temperature inputs	0-2000 Ω, 0-5 V, 0-10 V, 0-32 V, 0-25 mA Can be used as digital input	2x
Multifunction digital outputs	Up to 3 A, plus-switching Up to 3 A, minus-switching Can be used as 0-32 V analog input	2x 2x
Multifunction PVG outputs	PVG valve control Can be used as 0-32 V analog input	4x
Multifunction PWM outputs	Up to 3 A, plus-switching, 15 Hz to 1 kHz, current measurement, can be used as 0-32 V analog input	8x
Sensor power supply	5 V, 10 V	1x
Dimensions	Width, depth, height	153 x 137 x 43,5

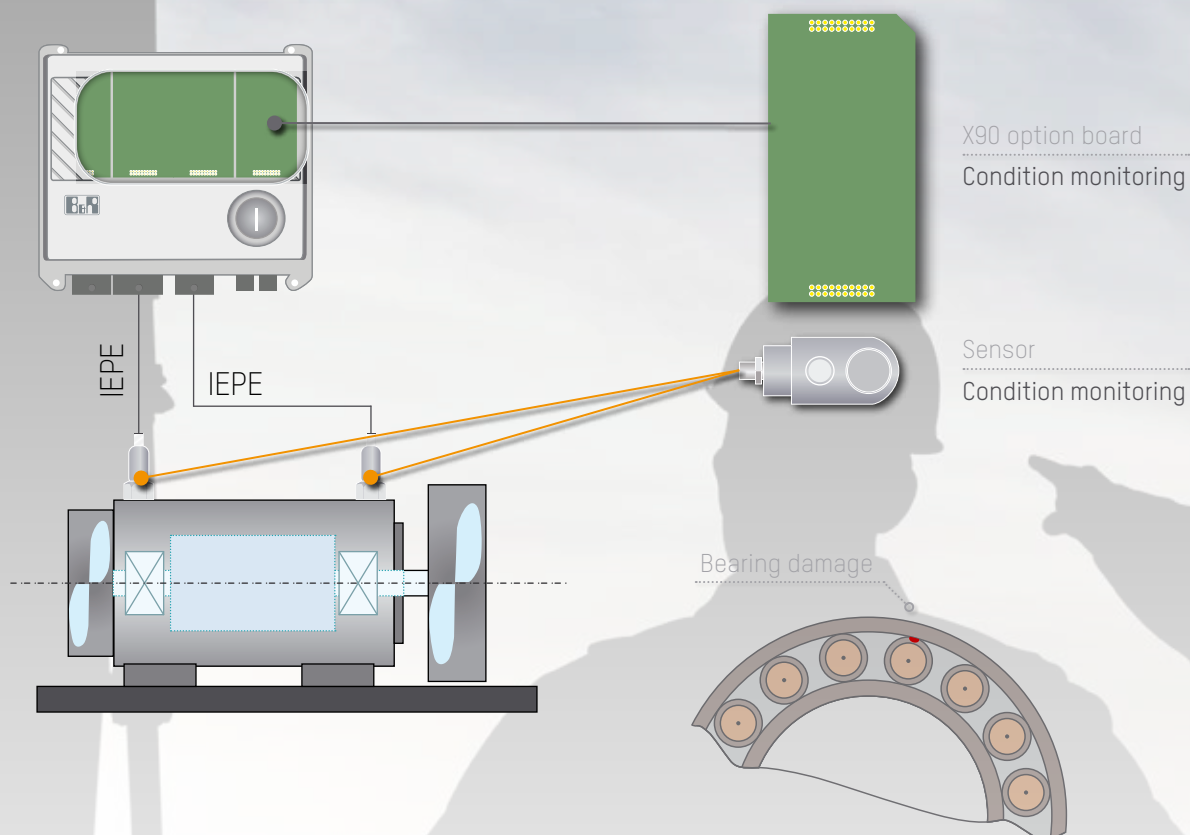
High machine availability, reduced downtime

The modular X90 control and I/O system can now also be equipped with condition monitoring functions. Problems can be detected in their early stages and corrected before they result in unplanned downtime. Condition monitoring can increase machine availability and reduce the considerable cost of outages and unplanned service calls.

Mobile equipment is subject to high levels of stress and strain. Regular service intervals are therefore a necessity for operators of agricultural and construction machinery. Regular service does not, however, provide 100% protection against unexpected failures. Faults don't only cause downtime on the affected machine, they can often span an entire machine network. The cost for repairs can be immense. One cause for this can be the fact that the affected machines are locat-

ed in hard-to-reach places, for example when used for mining. To achieve a high level of machine availability, it is therefore necessary to be able to detect impending failures at an early stage. Repairs can instead be timed to coincide with regularly scheduled service.





The optional condition monitoring circuit board provides early warning of impending failures on mobile equipment.

Predictive maintenance

The X90 controller with integrated condition monitoring allows operators of heavy machinery to continuously monitor the health of their equipment. The results help determine exactly which components require maintenance and when. Typical applications include continuous monitoring of rotating machine components such as hydraulic assemblies, belts, gears and motors. The processed sensor data is also available for further use in the application.

In addition to typical characteristics of a condition monitoring system such as temperatures or current profiles, error detection using vibration

measurement is indispensable. With rotating machine parts in particular, impending failures cause specific vibration patterns. The X90 controller with condition monitoring function records the data, evaluates it and makes it available to the application.

Highlights

- High machine availability
- Lower maintenance costs
- Condition monitoring integrated in the control system



Optimized mid-range performance

The 3100-series combines the advantages of a compact system with the performance of the latest Core i-series processors. To top it off, they also offer added flexibility. Up to two interface cards can be added for additional options. They are available as either a box PC (Automation PC 3100) or as a panel PC (Panel PC 3100).

The Automation PC 3100 and Panel PC 3100 offer a variety of modular interface options. The two slots can accommodate cards for serial interfaces, Ethernet, CAN and POWERLINK. The slots can also be used for a UPS solution or audio interfaces. The PCs also offer standard slots for two CFast-format storage devices. With up to 256 GB each, the CFast cards can be used to boost performance, as backup protection against failure or as a RAID set.

Broad performance spectrum

The processors are based on Intel's latest Core-i generation. Scalable over a wide range – from Celeron to Core i7, they allow the performance to be tailored exactly to the needs of the application.

All variants are fanless, so the Automation PC 3100 and Panel PC 3100 feature no rotating parts. This makes maintenance tasks like replacing air filters a thing of the past. The scalable memory options range from 4 to 32 GB.

Scalable Panel PCs

Whereas the Automation PC 3100 is designed to control remote panels, the Panel PC 3100 combines the PC unit and display into a single system. The PC unit can be combined with any cabinet-mounted Automation Panel with a diagonal of 10.1" or larger. The options range from 4:3 VGA displays to Full HD widescreen panels, either single- or multi-touch.

Future-proof

B&R PC systems offer long-term availability with reliable updates well into the future. It is not necessary to make continuous adjustments to the PC hardware over time.

Highlights

- Intel Core i processors
- Compact dimensions
- Numerous interfaces
- Modular interface options
- SDL/DVI/SDL4 (Automation PC 3100)
- Fanless





Maximum reliability

Automation PCs are designed and built for continuous operation in harsh industrial environments over a period of many years. They are encased in a robust welded housing that shields the electronics from the external environment.

A heavy-duty industrial coating protects the housing against aggressive conditions and keeps the Automation PC looking new, even after years of use. Circuit boards are connected using screw-in connectors, with extra resistance to vibration and shock provided by the elimination of all internal cable connections.

The Automation PC was developed with a special focus on providing fanless operation over a broad range of performance levels. Even when equipped with Core i7 processors, the Automa-

tion PC 3100 and Panel PC 3100 require no active cooling. Replacing hard disks with SSDs results in a PC with no rotating parts at all. Maintenance tasks such as regularly changing out fan filters have been completely eliminated. In fact, all components have been selected with maximum reliability in mind. These components have been designed specifically for use in industrial environments, can withstand high ambient temperatures and enjoy long-term availability.

With their high performance and compact dimensions, the 3100-series fits in perfectly between the ultra-compact 2100-series and the high-end 900-series. Machinery and equipment builders will now have an even easier time tailoring their industrial PC technology to specific requirements.



Industrial PC production

Efficiency down to batch size 1

B&R's industrial PCs come from a completely connected factory, where a batch of one is just as efficient to produce as a batch of a thousand.

Each PC is configured according to the requirements of its intended application. After verifying the feasibility of the configuration, the ERP system automatically generates a bill of materials with a unique serial number. All-in-all, there are more than 250 billion different possible hardware configurations that could potentially be built. Nevertheless, the lead time from order placement to delivery is only six days.

Smart factory

The ERP system plans an optimized order processing schedule and ensures that the logistics run smoothly. Parts that come from the warehouse are delivered just in time. This is where one of the advantages of B&R's smart factory comes into play: it is completely networked, both vertically and horizontally. The homogeneous network incorporates every machine and every building automation component as well as the ERP system. That's what gives the ERP system the ability to control the automated storage and retrieval vehicles in the high bay warehouse. The ERP system sorts the items in the high bay warehouse according to current and forecasted production

volumes and triggers reorders when inventory is running low.

Extensive testing

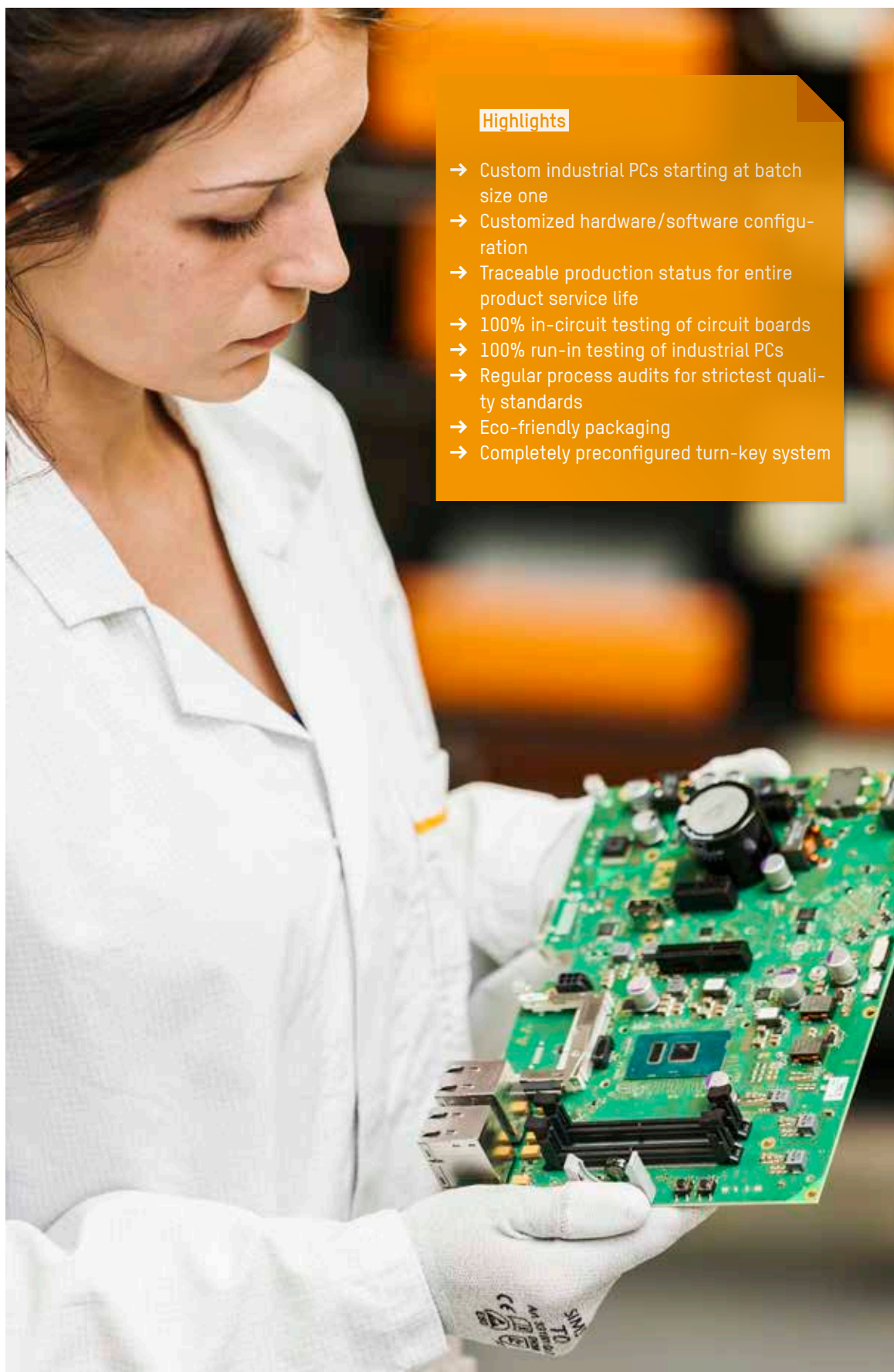
By the time a PC order arrives at a worker's assembly station, all the necessary components are within reach. The worker is guided through the assembly of each PC by on-screen instructions and "pick-by-light" signals.

Each and every PC is tested repeatedly during and after assembly. They are checked for correct assembly and the CPU and RAM are subjected to functional and stress testing. Only when all tests have been completed successfully does the ERP system release the PC for shipping.

Every production step, test and key raw materials can be retraced even years later, because the data is linked to the device's serial number.

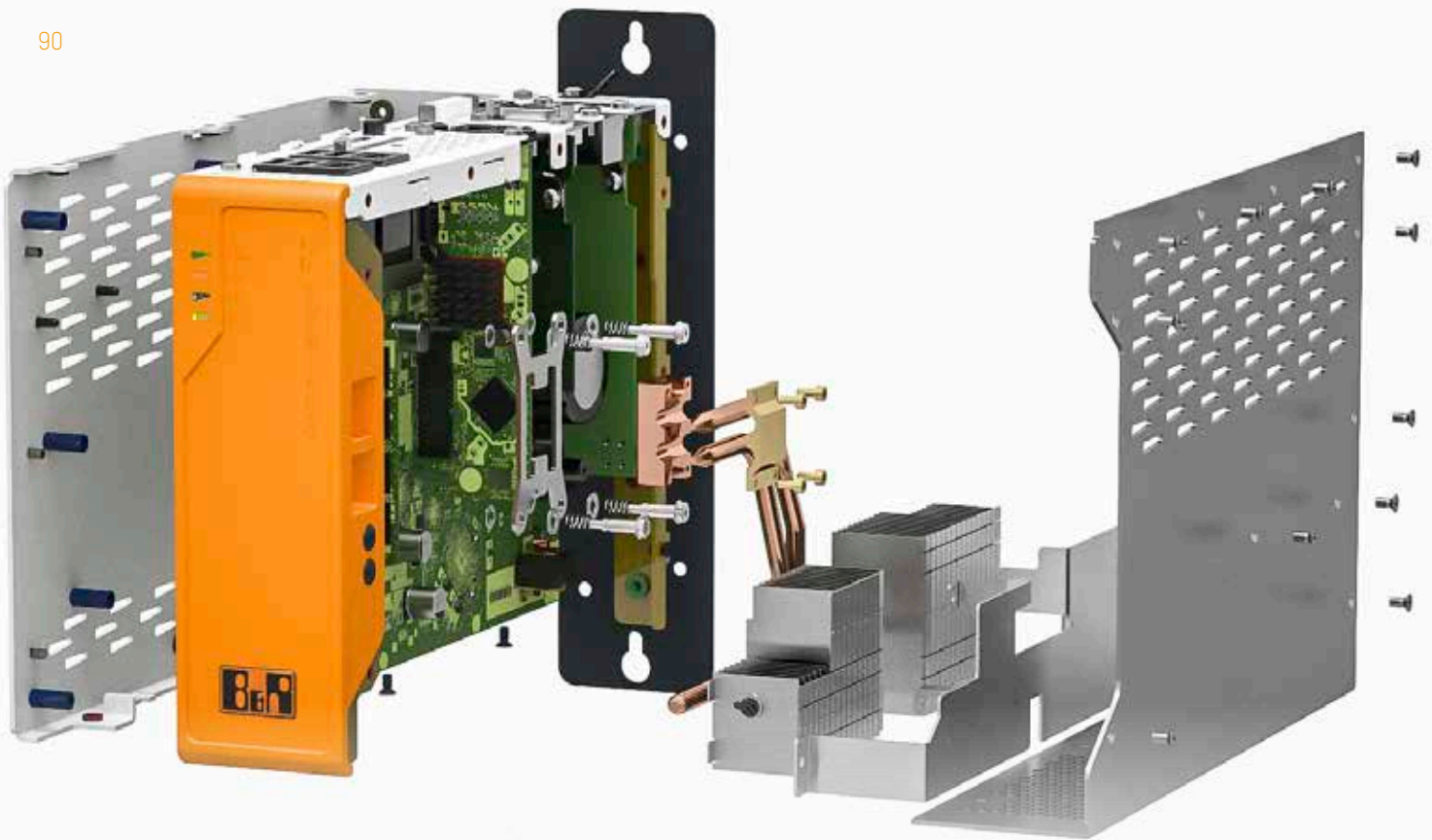
Access to all data

That gives customers an added layer of certainty. On its website, B&R provides a service portal where its customers can look up technical data and order-related information by simply entering their product's serial number. This includes version information, delivery date, warranty status and much more.



Highlights

- Custom industrial PCs starting at batch size one
- Customized hardware/software configuration
- Traceable production status for entire product service life
- 100% in-circuit testing of circuit boards
- 100% run-in testing of industrial PCs
- Regular process audits for strictest quality standards
- Eco-friendly packaging
- Completely preconfigured turn-key system



Cool design for maximum performance

Fanless operation that meets the highest demands

All 3100-series Automation PCs and Panel PCs allow fanless operation. In combination with CFast cards, these PC systems are completely free of rotating parts – a huge advantage when it comes to maintenance-free operation.

The cooling system ensures optimal heat transfer out of the housing. To maximize convection for fanless operation, the heat sink design was optimized through an extensive evaluation process using simulated models.

As processors shrink in size, heat is generated on a smaller and smaller surface area. To deal with this, heat pipes are the best way to provide optimal heat dissipation.

Optimized air circulation

The honeycomb openings on the housing panels provide the perfect combination of air circulation and structural rigidity. Celeron and Core i-series processors are able to operate without fans. Yet even without fans, Automation PCs are able to achieve performance results that previous PC generations required fans to achieve.

Comprehensive diagnostics with HMI Service Center

Industrial PCs from B&R have always offered extensive system diagnostics that go above and beyond those of a standard PC. Not only is it possible to read information like serial numbers and part numbers, but also statistical data like pow-

er-on cycles and temperature sensor values. This data is managed by the specially developed Maintenance Controller. Users benefit from maximum system transparency.

	Function
Battery	Feedback regarding battery status
COM	Test the serial interfaces on the PC and interface options
Fan	Speed Status Log entries for all available fans Fan test
Firmware	Firmware versions of the PC and connected Automation Panel
Network	Configure and test the Ethernet interfaces
RAM	Read the size and factory settings Test memory with test patterns
Statistics	Power-on cycles Hours of operation
Temperature	Status and log entries for all temperature sensors Alarm for limit value violation including time period of occurrence
Touch screen	Test connected touch screen
UPS	Read voltage statistics UPS status UPS tests
USB	Test the USB interfaces on the PC and connected panels

Automation PC 3100

Modular interface

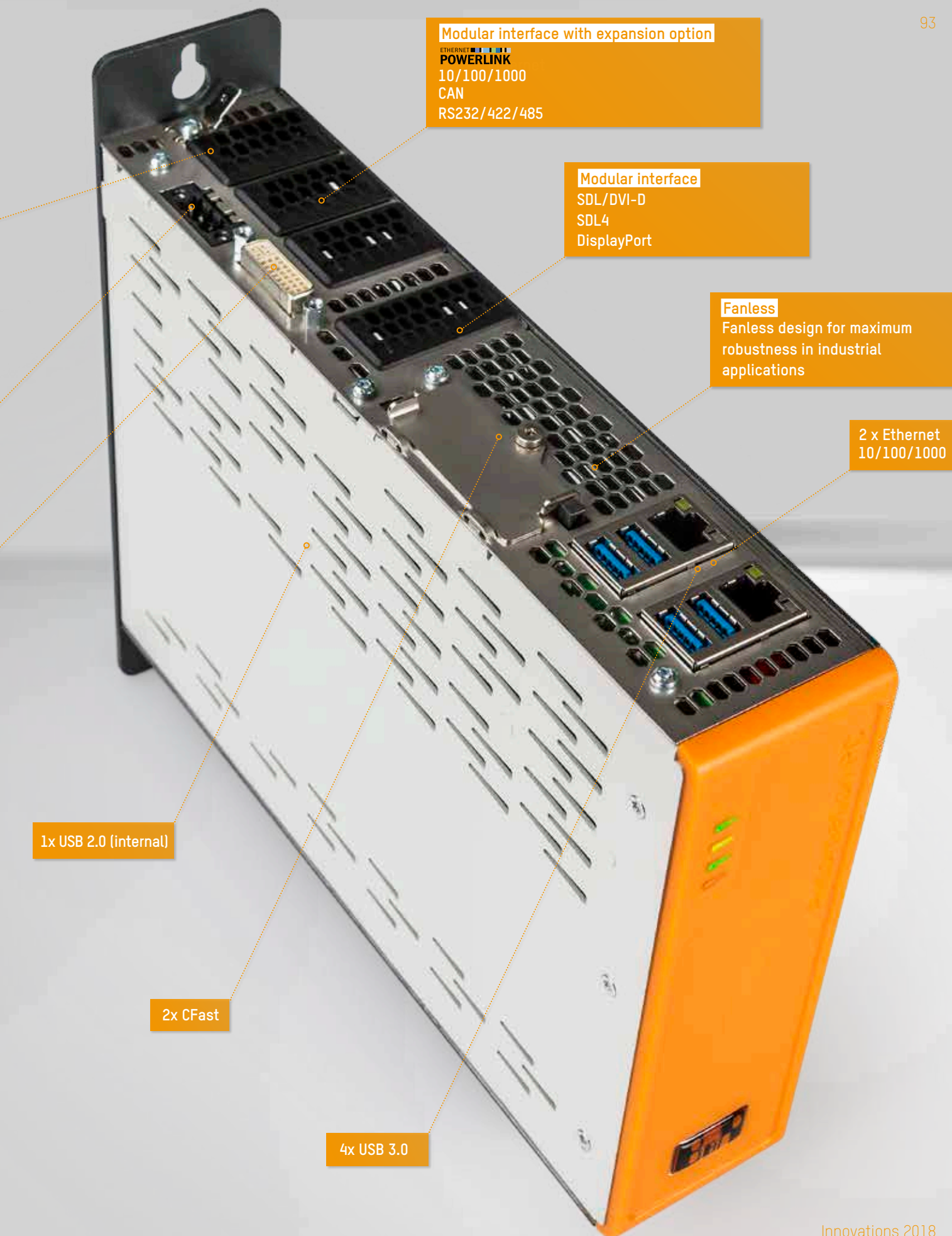
CAN
RS232/422/485
Audio
UPS

24 VDC

SDL/DVI-D

Operating systems

- Windows 10 IoT Enterprise 64-bit
- Linux
- Automation Runtime Embedded
- Automation Runtime Windows



Panel PC 3100

1x USB 2.0 (internal)

Modular interface

CAN
RS232/422/485
Audio
UPS

24 VDC

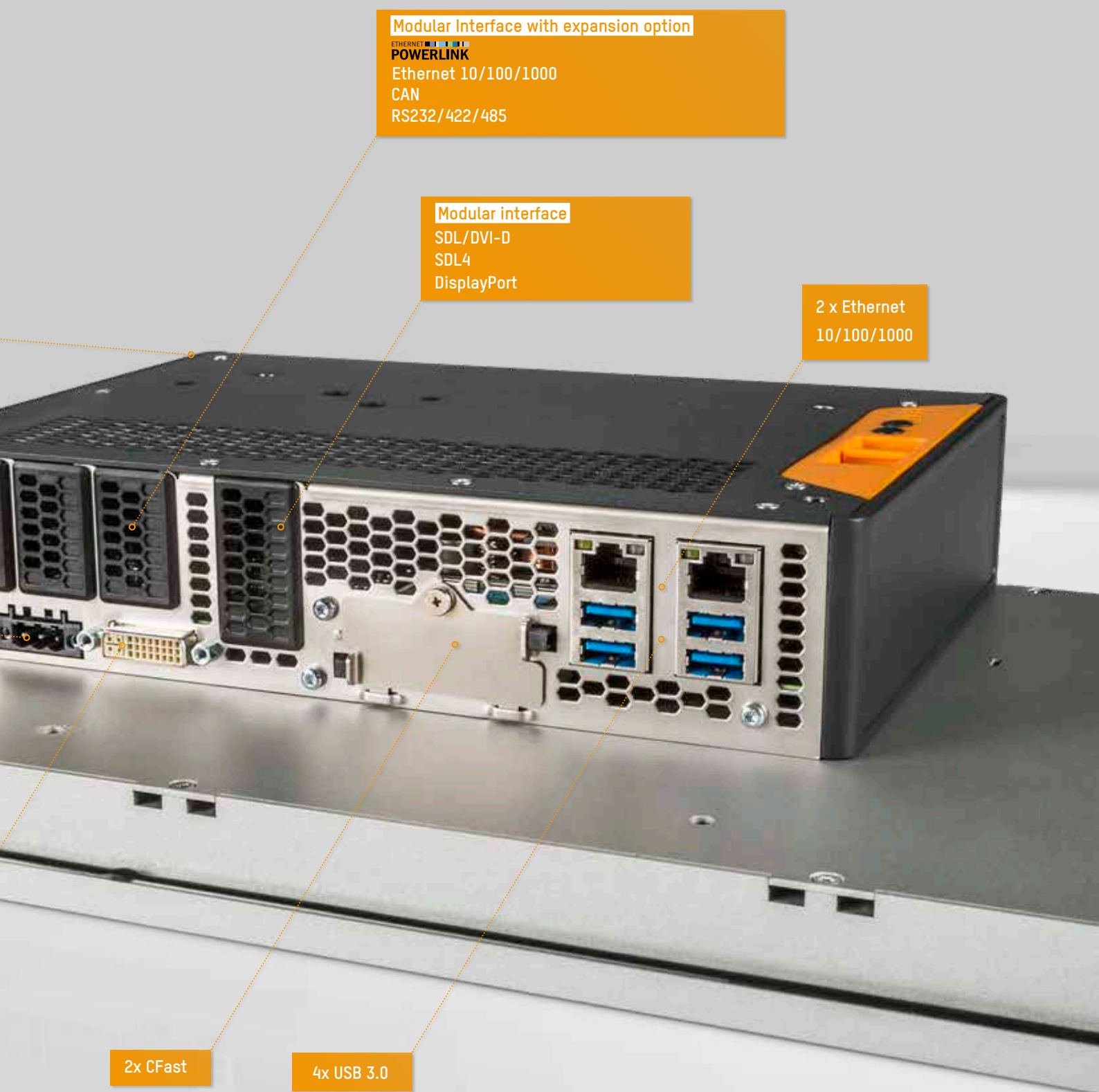
Fanless

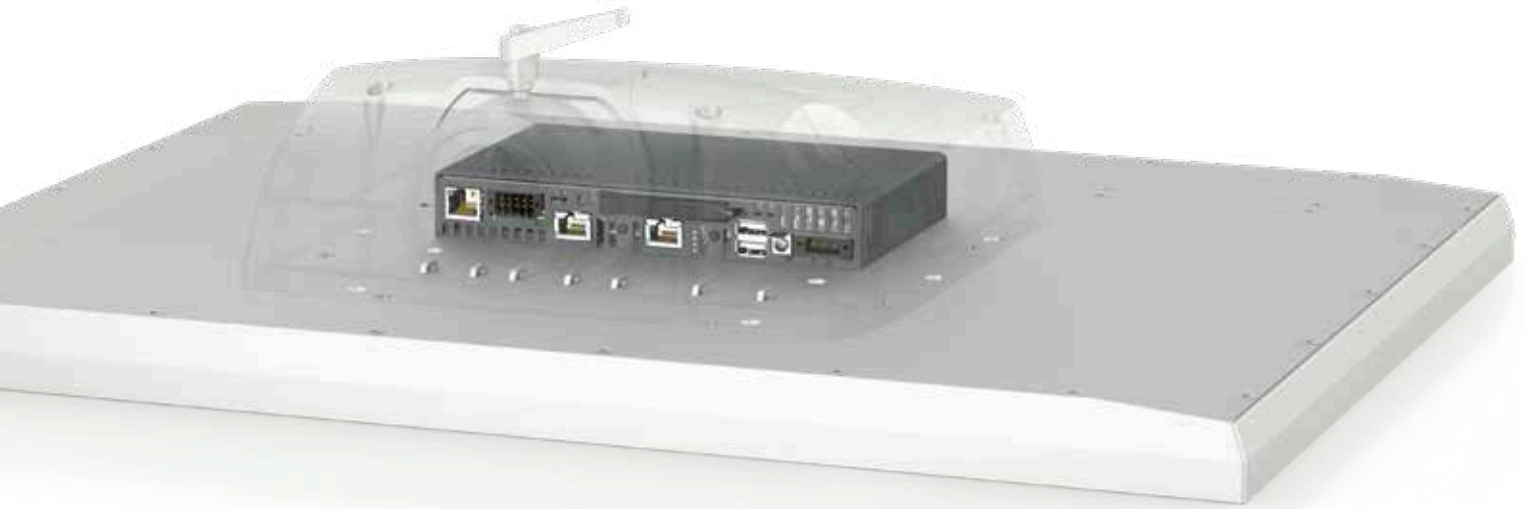
Fanless design for maximum robustness in industrial applications

Operating systems

- Windows 10 IoT Enterprise 64-bit
- Linux
- Automation Runtime Embedded
- Automation Runtime Windows

SDL/DVI-D





Modular swing arm systems

Fully enclosed panels with IP65 protection offer decisive advantages when it comes to positioning operator terminals at the most convenient locations on the machine.

The continuing reduction of control cabinets in particular is increasing the need for input stations that can be installed flexibly. For this reason, completely enclosed Automation Panel and Panel PC variants are available for mounting on swing arm systems.

Simple cabling

Cables are installed through the swing arm system and connected to an easily accessible area with IP65 protection, which makes it possible to use inexpensive standard cables.

To facilitate extremely simple handling, an installed panel can be wired directly on the swing arm. Setting up the device is done in the same modular way as mounted devices. Customers who opt for Smart Display Link 3 or 4, B&R's display transmission technology, benefit from slim, cabling-friendly RJ45 connectors. They are the perfect choice when it comes to feeding through cables in extremely tight spaces, including the limited openings on swing arms.

Easy operation

Swing arm devices are available in two variants: with touch screen or with touch screen and additional control elements. Multi-touch technology opens up whole new dimensions for designing innovative interactions for clean, intuitively structured user guidance. Implementation of two-hand gestures is an effective way to prevent operator errors. Buttons, selector switches, key switches and an integrated emergency stop button provide exceptional user comfort.

As an alternative to the swing arm system, the Automation Panel can also be installed on a VESA monitor mount. The optional swivel-tilt flange allows the panel to be adjusted to an ergonomic viewing angle for comfortable use without fatigue.

Easy customization

To adapt optimally to the needs of each machine, keys and switches can be individually customized. Custom HMI devices are delivered fully assembled. This minimizes the time needed for configuration of series-produced machines.



IP65 or IP69K protection

No dirt-collecting edges

Easy to clean

High-quality, scratch-resistant housing



Smart Display Link / DVI,
Smart Display Link 3/4

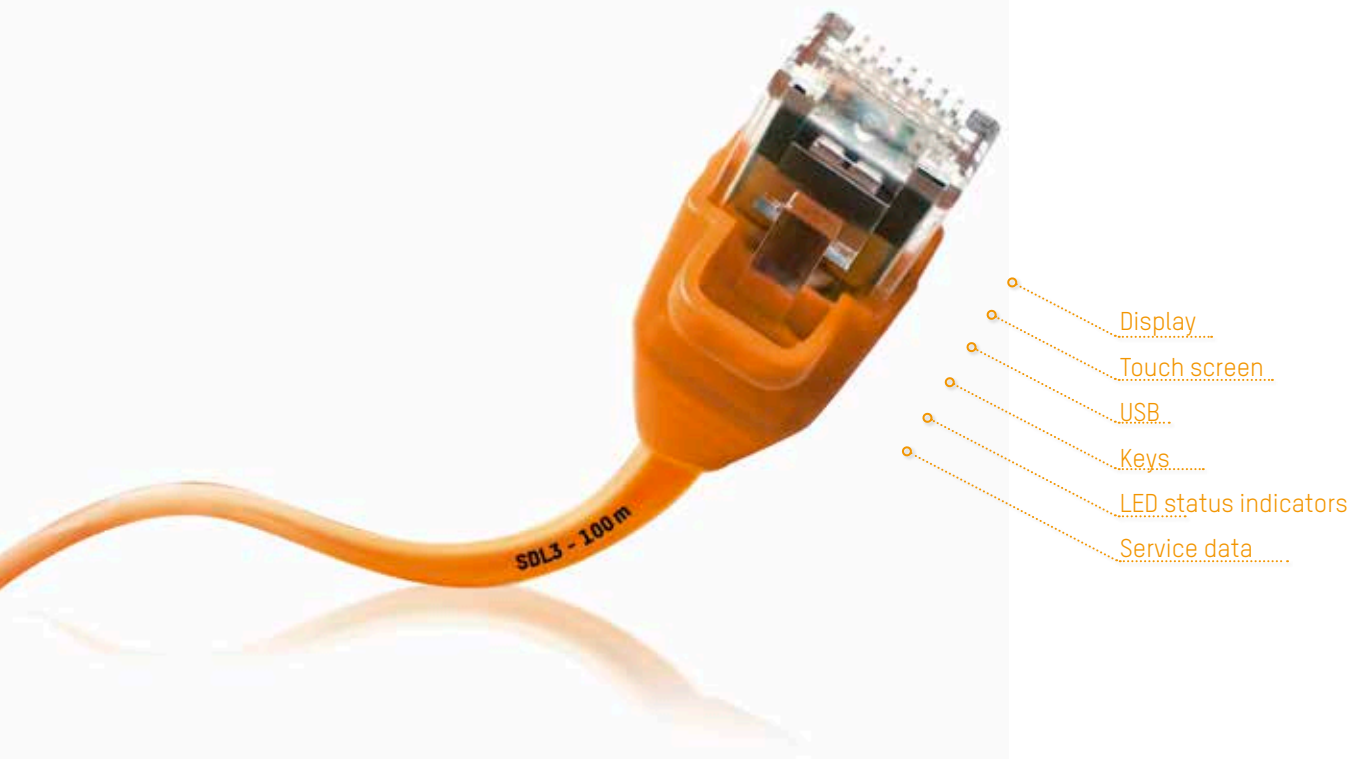
Display sizes 15" to 24" widescreen
or 4:3 landscape or portrait



Optional handles

Smart Display Link 3/4,
Panel PC 2100

Flexible installation on top or bottom



Revolutionary cabling - Smart Display Link 4

Smart Display Link 4 digital transmission technology offers clear advantages for constructing modular machines and systems.

The fourth generation of this digital display transmission technology represents a new chapter in the success story that is Smart Display Link. Smart Display Link's unsurpassed convenience is owed to two key advantages: complete independence from the operating system and the ability to connect the PC to the operator panel using only a single cable.

Up to 100 m

Smart Display Link 4 (SDL4) makes it possible to transmit display content and other data over much greater distances. It's possible to span up

to 100 meters between PC and display. This allows for optimal placement of Automation PCs and operator panels even on more expansive systems.

A second highlight of SDL4 is its use of standard Ethernet cables, which drastically reduces cable costs over longer distances. The thin cable and slim RJ45 connector are a perfect fit in tight situations such as feed-through openings and swing arm systems.

Simple cabling

Similar solutions used to require a thin client with a complete PC design. This not only took up more space, but was also dependent on the software and operating system being used. On top of that were the added costs of the PC architecture. The



modular design of B&R's PC and panel systems allows any Automation Panel to be equipped with an SDL4 interface.

Continuity over many years

This modularity, which can be traced back to the very first Automation Panels introduced to the market ten years ago, even makes it easy to upgrade existing machines and systems to SDL4, for example during retrofitting. PCs without an SDL4 interface of their own can be upgraded from SDL to SDL4 with a converter.

An optional SDL4 converter is also available on the PC side so that the SDL interface on the Automation PC 810 or Panel PC can be upgraded to SDL4.

SDL4 technology

- SDL4 transmits all communication channels between PC and panel via a standard Ethernet cable.
- Up to 100 m
- Independent of operating system and software
- Simplified cabling
- Small connector – also suitable for tight feed-throughs
- No need for a CPU in the panel
- No load on the PC system
- Maximum graphics performance
- Long-term availability



100 m



Multiple panels on one PC – Smart Display Link 4



Smart Display Link 4 (SDL4) continues the advances made with SDL3. SDL4 is compatible with standard HDBaseT 2.0 and makes it possible to connect multiple panels to a single industrial PC.

The other specifications correspond with SDL3: CAT 6/7 cables are used, and the maximum distance between PC and panel is 100 meters. Of course, in addition to screen content, SDL4 also transmits data for touch screen operation, keys, LEDs and USB devices.

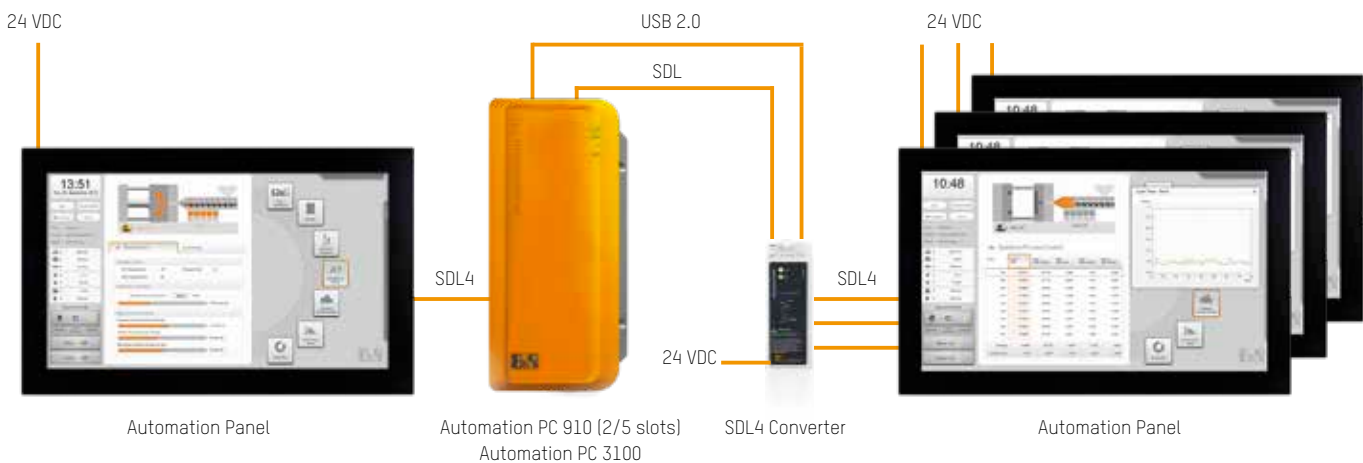
New standard for operator panel communication

With HDBaseT 2.0, SDL4 transmits all the signals needed to operate the Automation Panel uncompressed over large distances. The modular de-

sign of B&R's industrial PCs and operator panels make it easy to upgrade existing installations with SDL4.

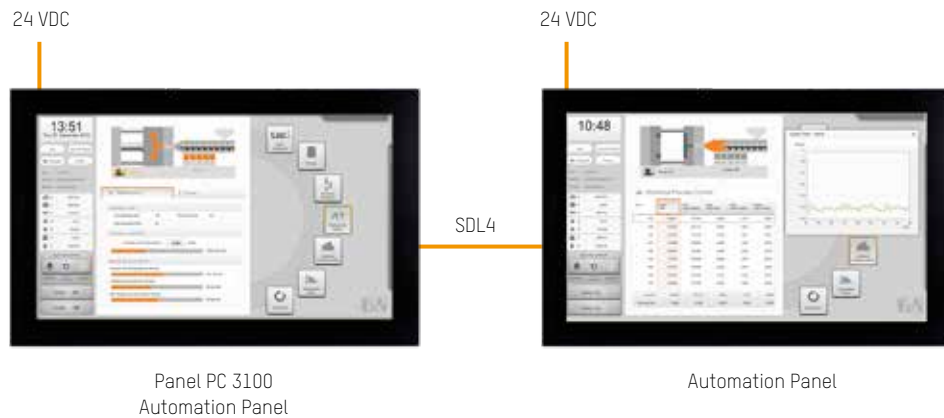
Multi-panel operation

A significant difference compared to SDL3 is the ability to operate up to three Automation Panels on an Automation PC or Panel PC via an SDL/SDL4 Splitter. If the PC system has an additional display interface (e.g. Automation PC 910 + Panel PC 3100), then it is also possible to operate an additional panel either with the same or different content.



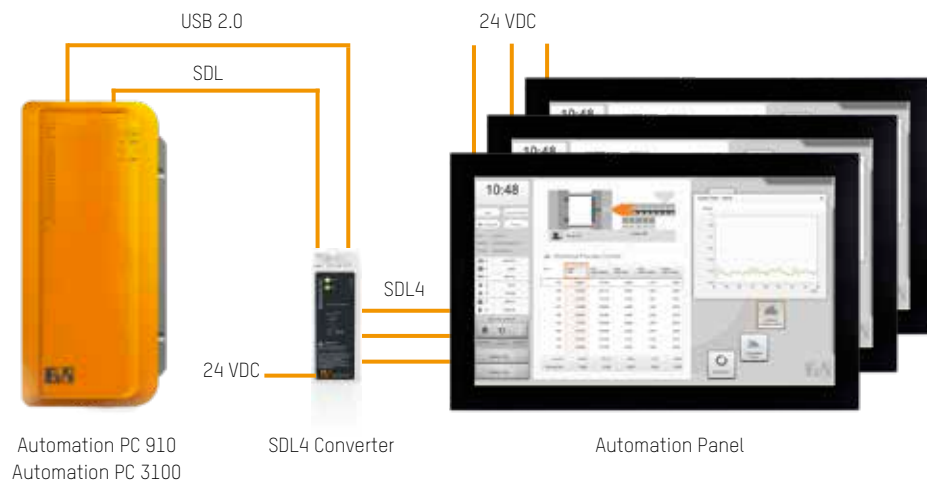
Automation PC 910 with external SDL4 Converter

→ Connected via SDL4 to up to three Automation Panels showing same content



Automation PC 910 with integrated SDL4 interface and external SDL4 Converter

- Connected via SDL4 to up to three Automation Panels showing the same content and an additional Automation Panel, optionally with different content (dual independent display)



Panel PC 3100 with integrated SDL4 interface

- Connected via SDL4 to one Automation Panel, optionally with different content (dual independent display)

Open technology development platform

To establish the seamless connectivity required for digitalization, the Industrial IoT needs standardized, open technologies. When it comes to open communication standards, B&R is a pioneer. Its field devices rely on the real-time POWERLINK protocol for machine and process control and on openSAFETY for integrated functional safety.

The independent user organization EPSG provides POWERLINK and openSAFETY free of charge – the fully documented open-source stacks can be found on the SourceForge developer platform. POWERLINK is standardized in accordance with IEC 61784-2 and is the only Industrial Ethernet protocol to be adopted under IEEE 61158. The latter is particularly advantageous in the context of the Industrial IoT, since the IEEE is responsible for standardizing all Ethernet technologies for the IT sector. openSAFETY is compliant with the IEC 61508 functional safety standard. The POWERLINK OPC UA companion specification and openSAFETY Safe Line Integration via OPC UA ensure interoperability with new communication architectures in the Industrial IoT. With the BSD license, the open and standardized communication technologies offer maximum investment protection for machine builders and plant operators.

Fully documented reference designs and open-source implementations

OEMs can easily add POWERLINK and openSAFETY to their own electronics components. B&R offers

development kits based on the respective open-source stacks. The POWERLINK Slave Development Kit and the openSAFETY Development Kit provide a package of FPGA-based development hardware, training and support services for rapid product development based on the reference designs.

The openSAFETY Demo is a fully functional, documented example implementation that can be downloaded free from SourceForge. Detailed guides for integrating other POWERLINK master or slave systems for various hardware platforms can be found under "Tutorials" on the EPSG website.

Fast time-to-market through broad support among chip manufacturers and technology integrators

As well-established communication technologies, POWERLINK and openSAFETY offer broad support among chip manufacturers and technology integrators for slave, master and safety node interfaces. An overview of technology integrators can be found under "Technology Providers" on the EPSG website. The technology partner portfolio scales to match the requirements: from FPGA-based solutions with development services to ASICs for multi-protocol interfaces and out-of-the-box solutions. This guarantees that integration into existing automation components is fast and straightforward. ESPG certification ensures perfect interoperability between devices in the field.

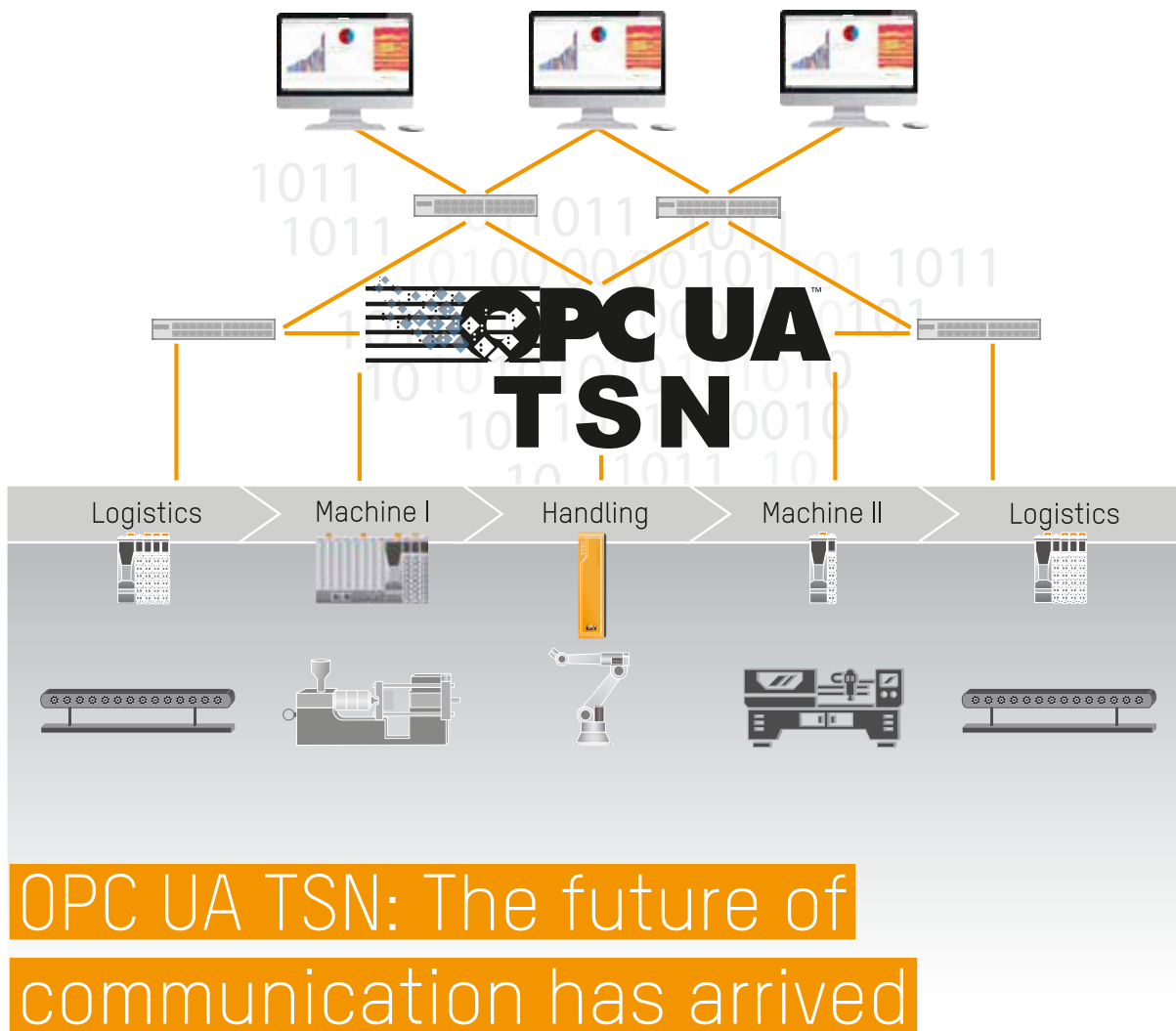


Highlights

- Full compatibility with OPC UA
- POWERLINK is IEEE 61158
- Fast time-to-market
- openSAFETY Demo on SourceForge
- B&R technology development kits with training & support
- Technology integrators for slave, master and safety devices

ETHERNET 
POWERLINK
 certified product

open 
SAFETY
 certified product



OPC UA TSN: The future of communication has arrived

Integration of all communication from the ERP level to the field level is an essential requirement for today's most advanced production systems. To bridge the divide between IT and automation, plant operators are increasingly turning to the open OPC UA standard. When it comes to complex processes with real-time requirements, however, OPC UA has had its limitations. That is now changing thanks to Time Sensitive Networking (TSN).

100% interoperability and synchronization

The fourth industrial revolution has taken great strides under the leadership of global initiatives aimed at making manufacturing more efficient and effective. A central role in the transition is played by intersystem connectivity, which relies on precisely timed exchange of information between components, and between components

and the cloud. So far, the necessary timing precision has been achieved using a variety of proprietary protocols, forcing users to compensate for the lack of interoperability with enormous amounts of extra work.

Through intense collaboration, a group of automation suppliers has succeeded in achieving 100% interoperability with precise timing between their respective systems. OPC UA TSN makes it possible to create uniform solutions for all applications to achieve seamless connectivity.

Automated communication reduces engineering during commissioning

OPC UA TSN combines IT mechanisms with OT requirements to allow network nodes to communicate and exchange information automatically. As

Having played an instrumental role in the development of OPC UA TSN, B&R quickly applied the valuable experience to the development of its own OPC UA TSN enabled products.



networks become self-configurable, all that remains to do during commissioning is make adjustments based on the requirements of the application. With the focus on the application itself, rather than configuring the network, commissioning times are reduced drastically.

Easily model large volumes of data

As network architectures grow, so does the volume of data being transmitted. The information models offered by OPC UA make it possible to represent this data in a structured and consistent way throughout the system. The information models make it easy to model the properties of objects – which can be things like devices, lines or plants. Standardized models have been defined to make data modeling as efficient as possible. They can be used and expanded as necessary. The models range from individual drives to entire machines. Harmonization at this level allows communication to be automated and prevents complications when replacing faulty components.

B&R products based on OPC UA TSN

B&R has played a significant role in the development of this technology since early in the speci-

cation process. The experience gained along the way has helped the company quickly integrate OPC UA TSN into its own portfolio.

The first product to arrive on the scene is an OPC UA TSN bus controller designed for integration as a data source in OPC UA TSN networks. Signals from processes are read via the respective I/O connections and made available to higher-level systems via OPC UA TSN. Any OPC UA client is able to access the bus controller deterministically. B&R's bus controller is the first device on the market to allow OPC UA TSN connections.

Highlights

- Uniform communication solution for every application
- Based 100% on open standards
- Integrated safety

Advanced analytics for brownfield assets

B&R's Orange Box lets users access previously unreadable energy and process data from digitally isolated machinery. The Orange Box is able to read data from the machine without any changes to existing hardware or software. Clearly visualized performance metrics make it easy to identify opportunities for targeted improvement so machinery can be operated more efficiently.

The Orange Box has already been able to acquire and evaluate OEE data, but users now benefit from an even broader range of possibilities. With the new Energy, PackML and Tweet functions, they can monitor energy consumption and process execution, as well as send automated text message notifications.



The Orange Box energy function lets you gather, view and analyze energy consumption data.

Optimize energy consumption

Equipped with the Energy function, the Orange Box can evaluate energy data collected from the machine. Energy consumption is measured directly on the machine and viewed on an industrial HMI screen. The software breaks down energy consumption by device and displays it in a clear graphical overview. At a glance, operators can see which equipment is responsible for which portion of overall power consumption.



Monitor process execution

For the first time, the Orange Box makes it possible to collect, display and analyze process data from previously isolated machines. A PackML state diagram on the HMI screen highlights the current status. Thanks to this standardized view, the operator sees immediately where the machine is at in its process. A detailed statistical overview makes it possible to monitor the time spent in each state. Any deviations or inefficiencies become clearly evident, and corrective measures can be implemented right away.

The Pack ML function provides a statistical overview showing the percentage of time spent in each machine process.



Notification via smartphone

When certain status changes occur, the new Tweet function automatically informs one or more defined recipients, who can then either go directly to the machine or check it remotely. This is made possible by the HTML5-based HMI application, which can be viewed on mobile devices and operated via touch screen.

Highlights

- Read data from digitally isolated machinery
- Optimize processing efficiency and energy consumption
- Monitor equipment status from anywhere

Orange Box

As an Industrial IoT solution package, the Orange Box brings smart-factory intelligence to brownfield installations. It is now possible to read and analyze data from previously isolated machinery and equipment. A controller col-

lects runtime data via I/O or fieldbus and processes it using intelligent software components. The greatest advantage is that there's no need for any changes to existing hardware and software.

Digitized: B&R's Industrial IoT solutions

An growing variety of products produced in ever smaller batches makes it increasingly challenging for SMEs to operate production cells economically. The advancements in digitalization, virtualization and connectivity that will enable them to succeed are major focal points for B&R in the development of new technologies. The advantages of this are enormous.

Edge architecture

The Industrial IoT presents new challenges for existing network architectures. The need to pre-process data acquired from machinery makes edge architectures the solution of choice. A holistic approach must also satisfy the demand for real-time communication and provide the necessary data processing functionality.

Connectivity

The functionality of the entire concept depends on the degree to which the connected machines and devices are able to provide information about their own availability and utilization. In order for the machines to be capable of this, it is necessary that the components which are used in the machines can record and communicate the status data.

Digital twins

Virtualization allows descriptive models to be constructed in order to simulate the behavior of

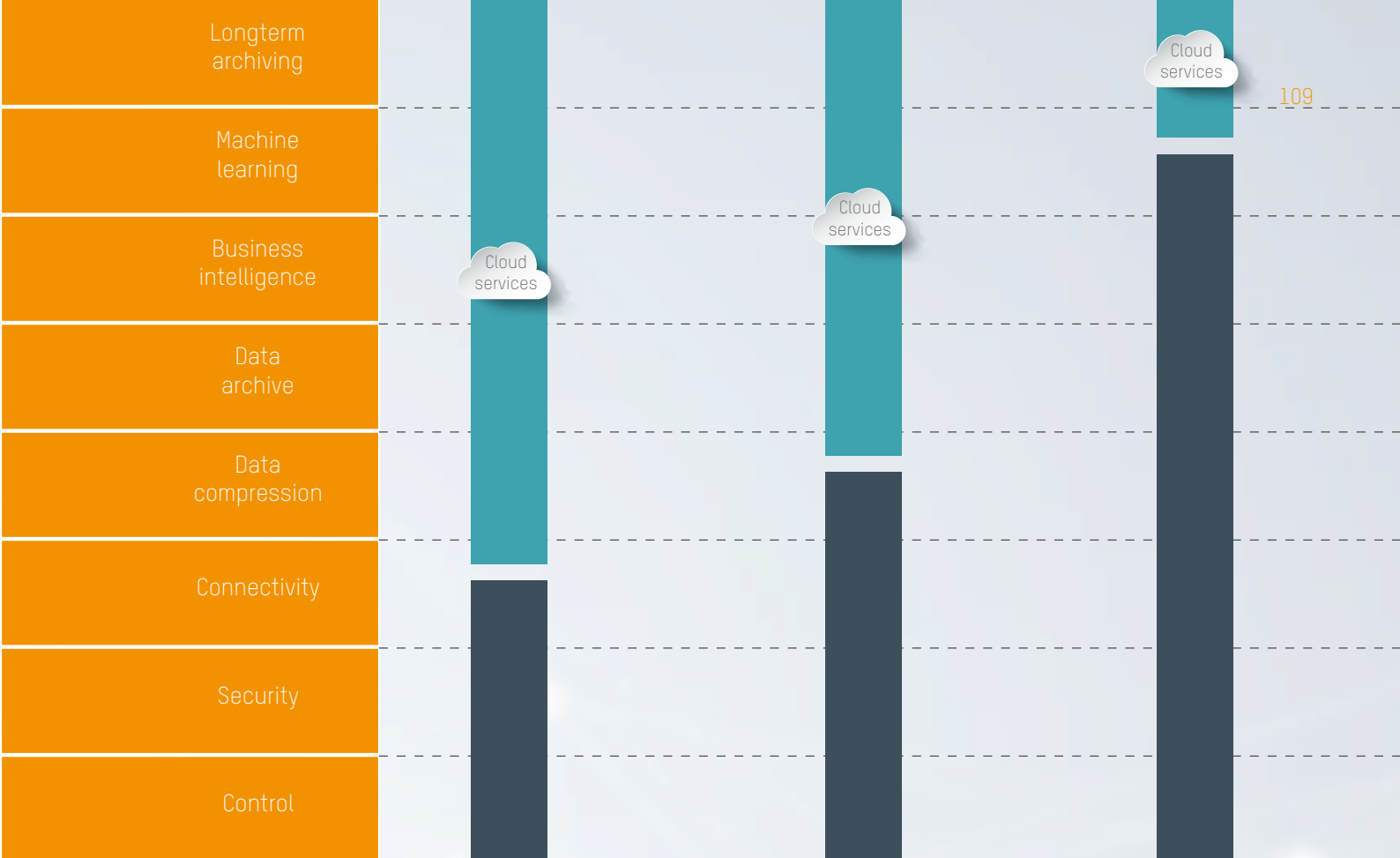
the motion control system or control loops. This allows future challenges to be identified early. For optimum networking, machines must be equipped with semantic interfaces. These allow them to provide process data in high resolution for advanced analytics or to be integrated into functionally interlinked systems.

Model-based development

The merging of automation disciplines – sensing, computing, communication and control – places heightened demands on processing power. Increasingly complex software now accounts for the lion's share of engineering work in any given project. A simple way to create smart software solutions, rather than writing all the code manually, is to assemble a model out of function blocks. In doing so, all of the mechatronic demands can be taken into account from the very beginning.

Highlights

- End-to-end solutions with high market potential
- Fully scalable hardware solutions
- Extensive data processing on the edge
- Connectivity from the sensor to the cloud



Edge
Connect



Edge
Embedded



Edge
Controller

B&R's edge architectures are implemented using one of three types of edge device.

Object-oriented software development

A library of over 500 function blocks and growing helps drastically reduce the time and cost of implementing machine processes in the control software. Special components developed for the Industrial IoT can be integrated seamlessly into existing automation solutions. With a few quick settings, for example, they can be used to visualize OEE parameters on the machine.

Predictive maintenance

Predictive maintenance allows users to constantly monitor a machine's health and use the collected condition data to calculate upcoming service intervals. This approach prevents unplanned downtime and substantially increases availability.

B&R's particular expertise lies in the collection of high-quality data and in the technology needed to share it with other participants in the process.

Energy monitoring

By acquiring data for all media – from electrical energy to natural gas and heating oil and even compressed air – it is possible to automatically and comprehensively record all energy consumption. The ability to calculate and view consumption and costs makes it considerably easier to implement energy management systems as defined in ISO 50001. Evaluation and visualization of historical data allows energy consumption to be analyzed at various levels of detail in order to accurately identify cause-and-effect relationships.

Edge Connect: Simple communication via OPC UA bus controller

B&R is expanding its X20 system to include support for the manufacturer-independent communication protocol OPC UA. The new X20 I/O system bus controller makes it possible to implement OPC UA communication directly from the sensor layer to the ERP layer without any interfaces whatsoever.

The X20BC008U bus controller functions as an OPC UA server and provides all information about connected I/O modules to OPC UA clients from any manufacturer. This includes, for example, controllers, SCADA systems, ERP systems or cloud applications.

Interfaces and gateways are no longer needed

Interfaces, gateways and the associated loss of information are a thing of the past. All production process data is transferred using a single protocol. The X20BC008U bus controller can be used

with all controllers and I/O modules from the X20 and X67 product lines.

A standard Ethernet network infrastructure is sufficient for this communication, which is based on TCP/IP. An integrated Ethernet switch also enables daisy-chain cabling with other network components. The built-in NTP client ensures precise time synchronization so the standardized OPC UA timestamp can provide valuable additional information.

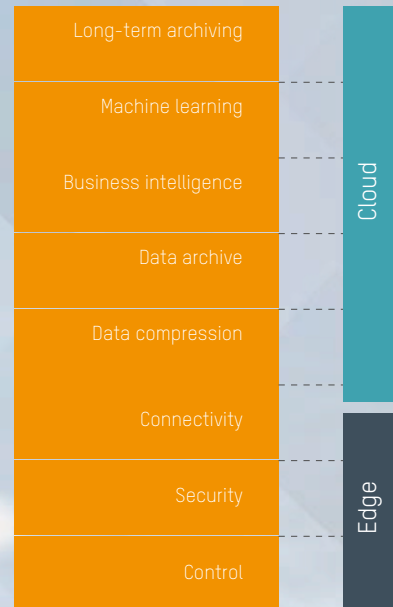
Easy configuration and diagnostics

Except for an OPC UA client, no additional tools are required. In addition to reading and writing process data, the OPC UA information model enables configuration and diagnostics of bus controller and I/O modules via OPC UA. The browse feature included in OPC UA makes it possible to quickly view an overview of existing data and parameters.



OPC[®]

Unified Architecture



This new B&R bus controller can be used in machine networks, but is also perfectly suited for use in higher-level networks at the plant or factory level.

The new bus controller can also be added to a B&R system using the Automation Studio development environment, as with other modules. In addition, a library provides the application program access to all OPC UA services offered by the bus controller at runtime.

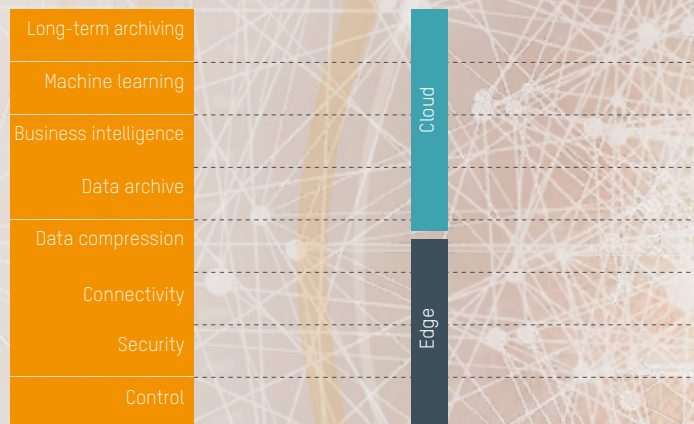
Highlights

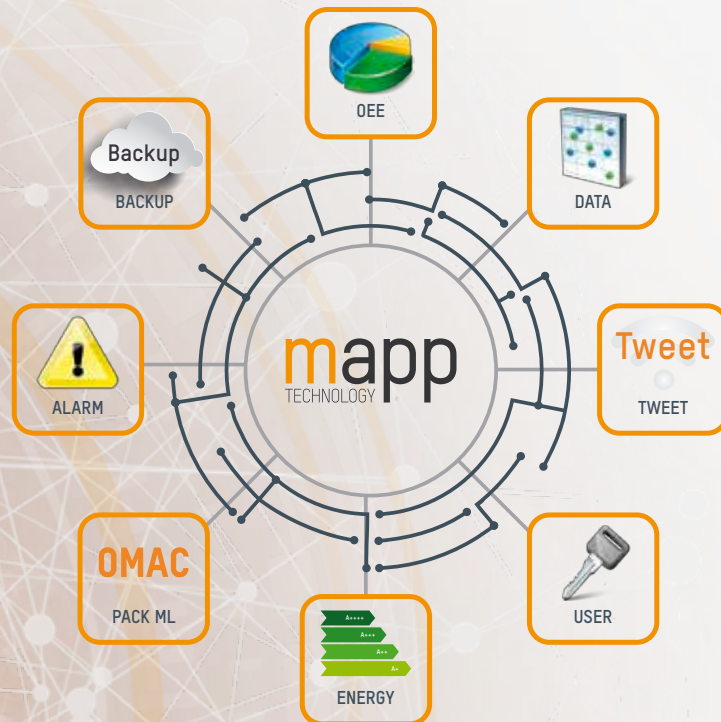
- From the I/O layer directly to the cloud
- Interface-free, vendor-independent communication
- No additional tools required

Edge Embedded: Software makes all the difference

Modern Industrial IoT solutions rely on decentralized data processing close to the process. B&R's Edge Embedded is a flexible solution that can be easily adapted to any application.

Edge Embedded is perfectly suited for situations where larger volumes of data need to be sent to the cloud. Aggregating the data on the edge reduces bandwidth requirements and lowers the cost of cloud solutions. With sufficient memory for buffering, a lost connection doesn't mean lost data. The solution uses a standard B&R controller, which also executes the machine logic in real time in addition to providing edge functionality.





Flexible hardware

Edge Embedded hardware can be selected freely from B&R's extensive portfolio. Since the software is independent of which hardware is selected, the controller can be replaced at any time to adapt to new memory or processing requirements. Secure data transfer is ensured by the security mechanisms of OPC UA.

Edge Embedded software is based on the mapp software framework. The connection to higher-level IT systems is configured using ready-made software components. mapp Data, for example, allows the controller to send and retrieve data directly to and from databases. There are also functions for data aggregation. The component mapp OEE, for example, calculates overall

equipment effectiveness automatically from a multitude of individual data points.

mapp components can be combined as needed with software developed in-house to expand or adapt solutions efficiently. Customers benefit from scalable, flexible solutions that allow new installations to be seamlessly and effortlessly integrated into Industrial IoT architectures.

Highlights

- Easy data pre-processing
- Direct access to databases
- Embedded security with OPC UA

Edge Controller: Platform for digital transformation

The much-anticipated digital industrial transformation promises unprecedented levels efficiency and productivity that benefit from the absolute latest technological innovations. This will be achieved by leveraging previously untapped potential that will bring sustainable improvements to productivity and competitiveness.

Cloud computing and edge computing

A key enabler of the digital industrial transformation is cloud computing. This relies on the Industrial Internet of Things (Industrial IoT) and makes edge computing an indispensable part of the overall concept.

Intelligence and processing power at the source

Edge computing is not an entirely new concept. It is an established method used to acquire, compress and aggregate large volumes of data as close as possible to its source using distributed devices – and then transform that data into actionable intelligence.

High risk: bandwidth, latency and availability

Locally installed edge controllers provide levels of

availability, bandwidth and response times that cannot be achieved in the cloud without enormous costs.

Local intelligence is indispensable

Monitoring methods such as vibration measurement generate large volumes of data, which must be prepared and analyzed close to the process – either directly in the sensor or on the edge controller.

Continuous real-time analysis

The ability to acquire and store process data strengthens the bonds between machines and their operators. Locally generated intelligence enables direct implementation of targeted corrective measures.

Assignment of the Responsibility - IT versus OT

Industrial IoT requires a communication between company level (enterprise) and production level (MES/MCS). While the IT is normally responsible for the business data, customer data, and intellectual property, the OT is responsible for the entire production procedure.

Long-term archiving
Machine learning
Business intelligence
Data archive
Data compression
Connectivity
Security
Control

Cloud
Edge

Enterprise zone

Level 5: Enterprise

Level 4: Site business planning and logistics

Manufacturing zone

Level 3: Site manufacturing operations & control

Cell/area zone

Level 2: Area supervisory control

Level 1: Basic control

Level 0: Process

Safety

IT

OT

The convergence of Information Technology (IT) and Operational Technology (OT) is accelerated by the digital industrial transformation.



Industrial IT / OT platform

Decentralized data processing on the edge

Edge computing requires the use of very high-quality resources able to withstand what tend to be very harsh environmental conditions.

Long product lifecycle

In manufacturing and processing plants, lifecycles are measured in decades, so edge computing hardware must ensure long-term availability.

Industrial edge controllers – Robust and high-performance

The B&R Edge Controller for monitoring, optimizing and analyzing processes is based on the robust, high-performance Automation PC 910. This allows it to be installed close to the machine and process data in real time.

Automation Runtime Embedded – Real-time operating system

In addition to the general purpose operating system normally used to connect to the enterprise LAN, it is also possible to run a real-time Automa-

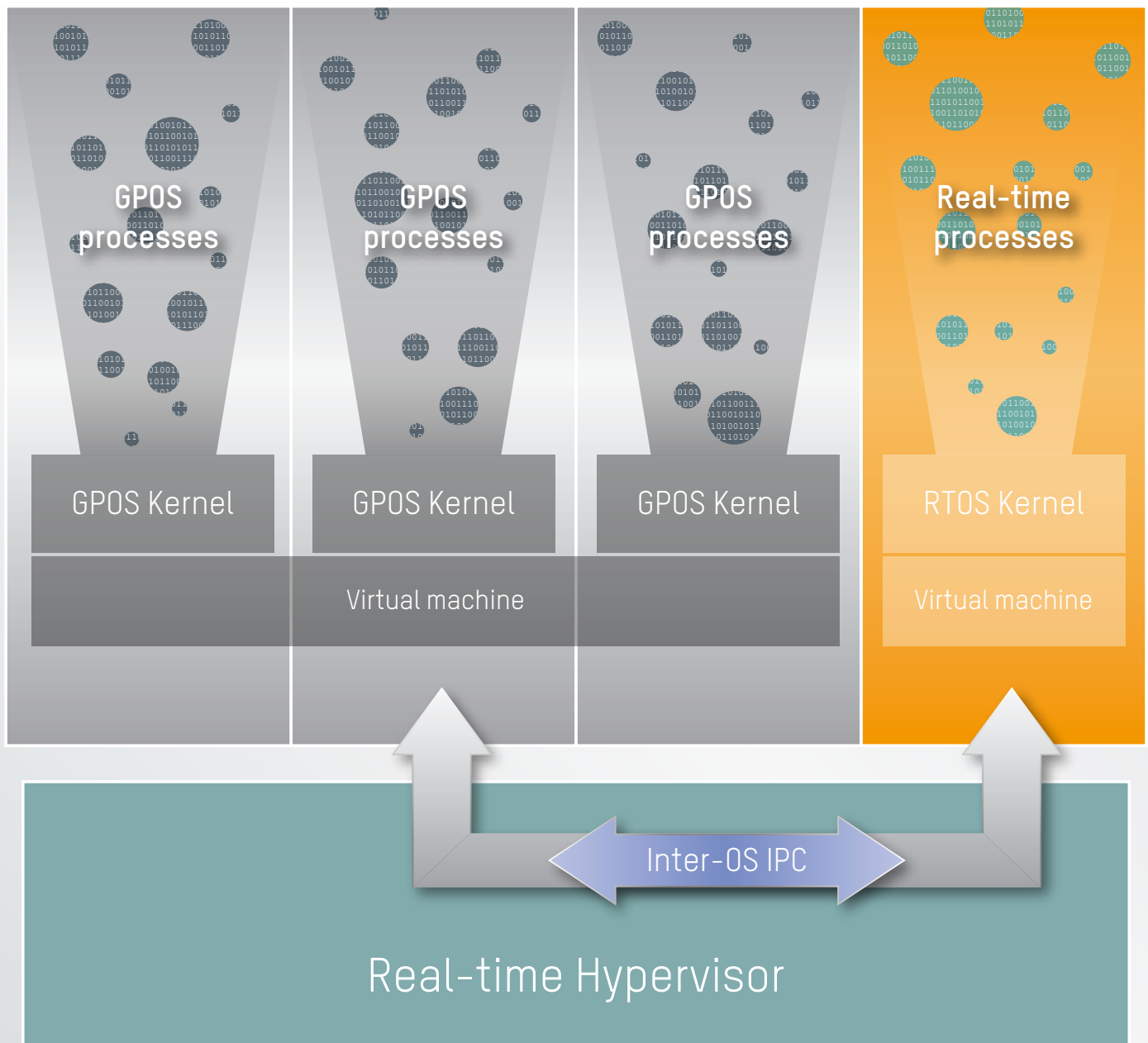


Robustness, performance and an extremely long lifecycle are fundamental requirements.

tion Runtime Embedded operating system along with a real-time hypervisor. The hypervisor allows multiple operating systems to run safely on the same hardware under real-time conditions. This decoupling of data acquisition and processing tasks from the process control system helps ensure the necessary levels of safety and reliable operation and allows data transfer to be orchestrated with cycle times in the millisecond range.

Automation Runtime embedded also supports remote I/O

I/O modules are connected via Ethernet POWER-LINK or another proven fieldbus system. The integrated "Remote Firmware Upgrade (AR/FW)" feature makes it easy to install updates remotely for Automation Runtime Embedded (ARemb) and connected I/O modules.



Long-term data archive (data historian)

Data acquisition and processing

The potential of IoT technology is restricted by limited bandwidth and storage space available on site. Continuous pre-processing of collected data is therefore indispensable.

Archiving data in the integrated SQL/NoSQL databases

The Edge Controller is equipped with a NoSQL database (APROL ChronoLog) to record continuous signals and events. The user also has an SQL database at their disposal (MariaDB) for use with the application.



Acquisition



Analysis



Reporting



Visualization



A high level of tamper resistance is achieved by separating the historical data of the system from that of the application.

Data buffering is essential for gapless records

Local buffering is essential to avoid data loss when there are disturbances in the infrastructure.

Process Data Acquisition (PDA) approximates the digital twin

If they hope to gain the full benefit of digitalization, manufacturers of devices, machinery and equipment need to take the concept of digital

twins out of the drawer and dust it off. Digital twins provide the basis for viewing and analyzing the data of the physical product.

SQL interface for data access

An SQL server interface grants client applications read access to all the data in the historical archive.

Analytics on the edge

Modern analytical tools allow data to be analyzed and viewed on the fly.

Control Performance Monitoring (CPM) for PID control loops

The CPM control module delivers a variety of parameters that can be used to evaluate the performance of control loops.

Asset Performance Monitoring (APM) for pumps and heat exchangers

APM control modules can be used to implement continuous asset monitoring. This makes it possible to determine the pollution degree of a heat exchanger, estimate the hydraulic loss of transport pipes and identify the cavitation-critical operating point of a centrifugal pump. Maintenance costs and downtime are greatly reduced and the availability and utilization of machinery and equipment is optimized.

Condition monitoring for predictive maintenance

Most companies currently still rely on run-to-failure or preventive maintenance strategies. Condition-based predictive maintenance can be implemented quickly and easily using APROL ConMon.

Energy monitoring – The basis for energy management

Energy management systems measure, log and evaluate all relevant energy consumption data. The Load Shedding control module can be used to forecast the average power requirement for a given billing period and avoid expensive peak loads.

Trend system with maintenance-free database

The integrated trend system records process data in a high-performance, maintenance-free database.

Alarm system generates and manages alarms

The alarm system is based in a multilevel alarm concept (message, alarms not requiring acknowledgment, alarms requiring acknowledgment, alarms requiring text acknowledgment and acquires all of the significant information for each alarm.

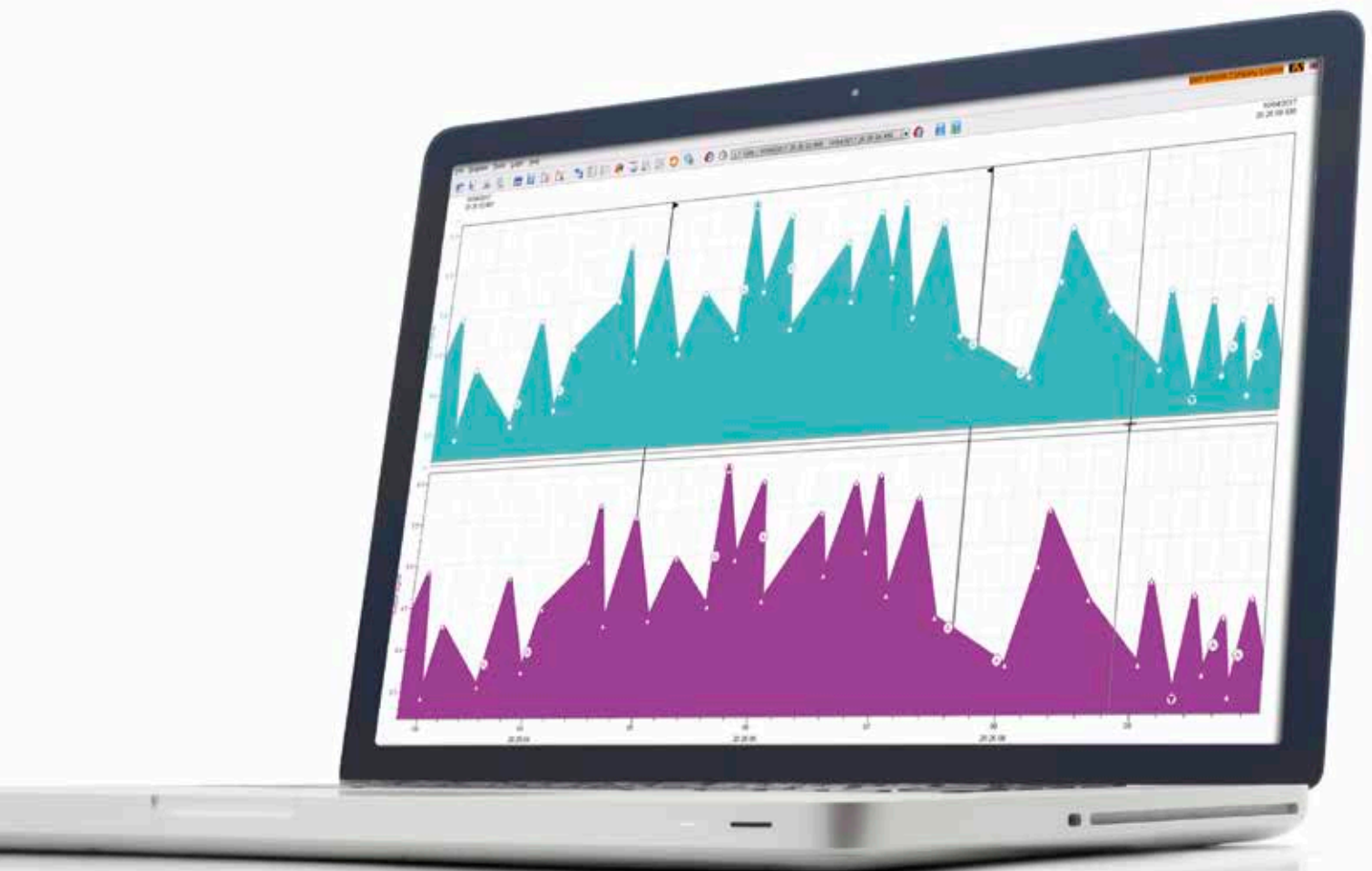
offers dashboards and ad hoc reports. Web-based tools allow users to create customized reports and display interactive dashboards without any previous technical expertise. Mobile Reporting supports interactive reports and dashboards in a native app for Android or iOS devices.

Edge analytics (embedded business intelligence)

An integrated Business Intelligence Suite encompasses a BI server for web-based reporting and

RESTful API for report server queries

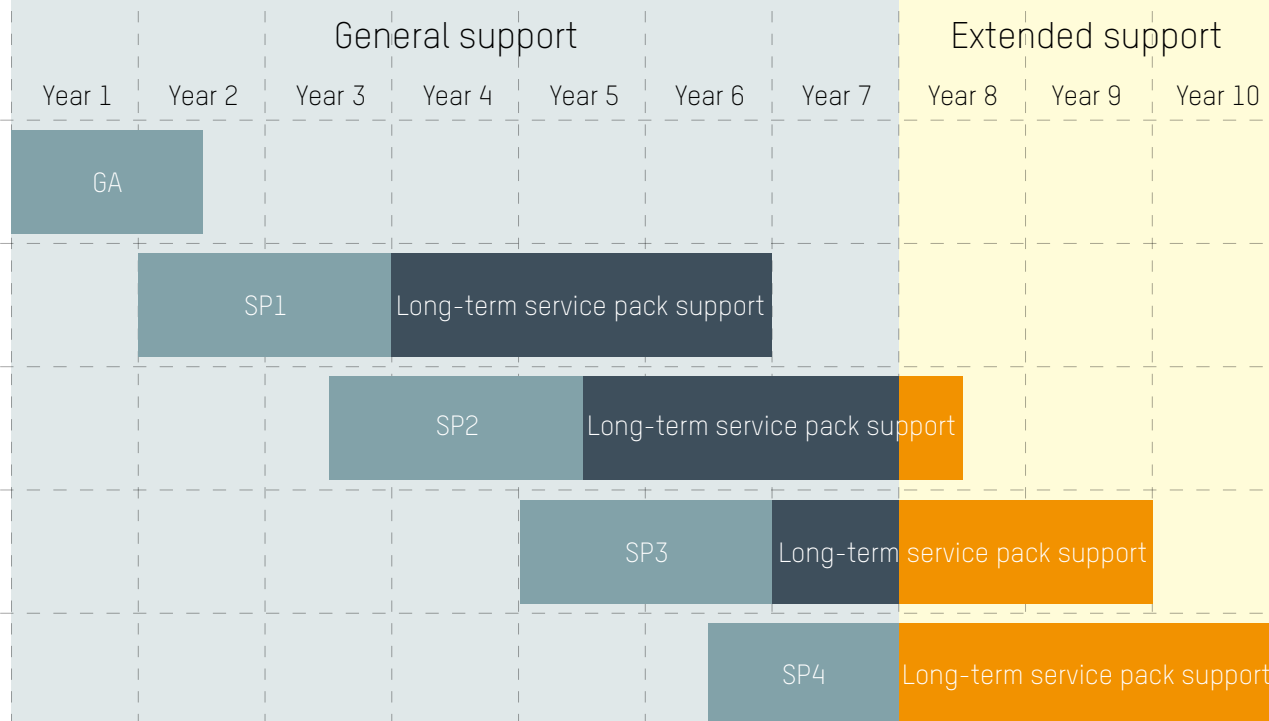
The web services of the report server make it easy for client applications to interact with the server.



Continuous data (trend curves) and event-based data (messages, alarms, etc.) can be analyzed in any desired combination.

IT security

SUSE® Linux Enterprise Standard Lifecycle & SLES12



Product Lifecycle GPoS

General purpose operating system (GPoS) with embedded cybersecurity

Each Edge Controller has a general purpose operating system (SUSE Linux Enterprise Server 12) for which B&R supplies regular updates in the Downloads section of its website. The SUSE Linux Enterprise Server operating system has many standard security certifications and features that guarantee that sound security practices are used for the Edge Controller. Embedded cybersecurity is provided through a variety of measures, such as secure boot (UEFI), automatically configured firewall, hardened system, LDAP, TLS and more.

Integrated (embedded) cybersecurity

The Edge Controller is composed of robust, industrial hardware, the Linux SLES 12 operating system and the B&R APROL system software and offers a variety of enhanced security features, including a secure remote access solution (VPN via SiteManager Embedded).

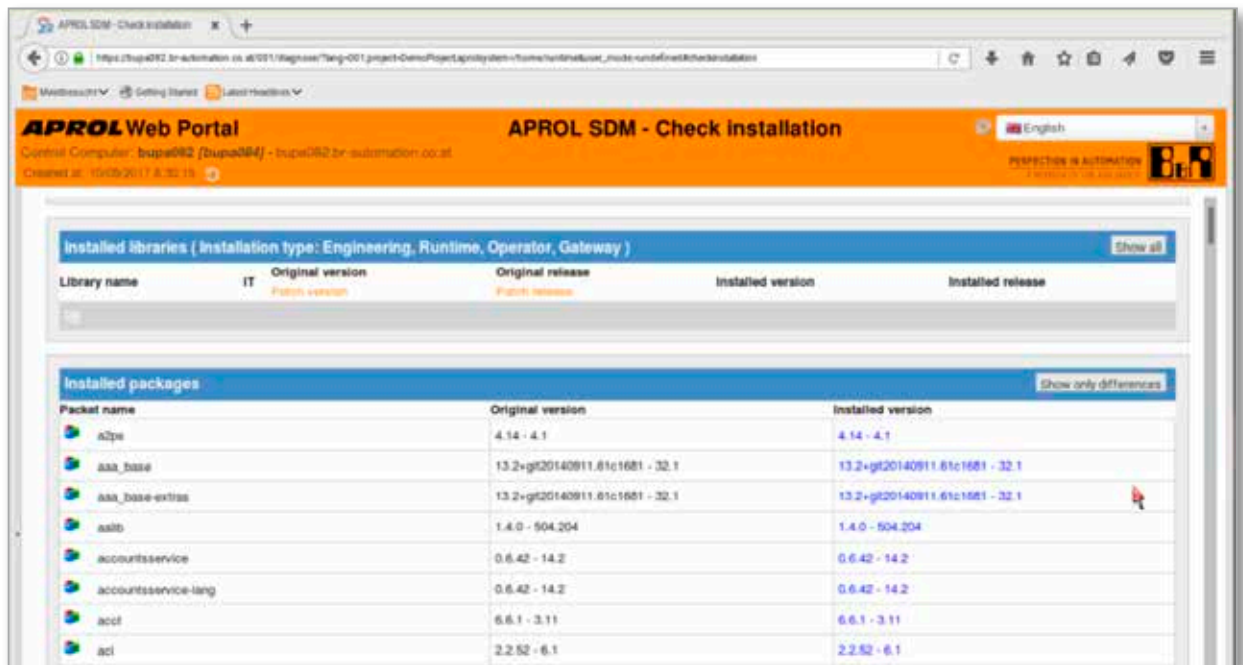
System management/maintenance with Long-term service pack support (LTSS)

The SUSE Linux Enterprise Server 12 general-purpose operating system is subject to continuous development, so security patches and technical

support are crucial to achieving the long product lifecycle required for industrial applications. Before releasing an operating system update for the Edge Controller, B&R performs comprehensive testing of all system functionality.

Diagnostics even after installation

Following a new installation or patch update, the CheckInstallation report allows you to verify that all applications, libraries and packages have been installed correctly on the device.



Installed libraries (Installation type: Engineering, Runtime, Operator, Gateway)					
Library name	IT	Original version	Original release	Installed version	Installed release
[Empty row]					

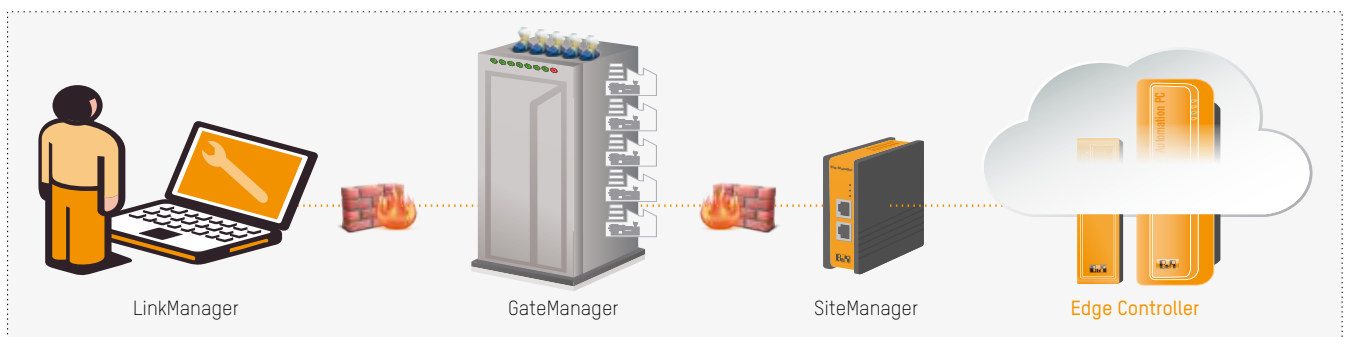
Installed packages		
Packat name	Original version	Installed version
atpe	4.14 - 4.1	4.14 - 4.1
aaa_base	13.2+git20140911.61c1681 - 32.1	13.2+git20140911.61c1681 - 32.1
aaa_base-extras	13.2+git20140911.61c1681 - 32.1	13.2+git20140911.61c1681 - 32.1
asdb	1.4.0 - 504.204	1.4.0 - 504.204
accounts-service	0.6.42 - 14.2	0.6.42 - 14.2
accounts-service-lang	0.6.42 - 14.2	0.6.42 - 14.2
acct	6.6.1 - 3.11	6.6.1 - 3.11
act	2.2.52 - 6.1	2.2.52 - 6.1

System management/maintenance – Remote diagnostics

The Edge Controller offers convenient, comprehensive diagnostics with the integrated, web-based System Diagnostics Manager. The configuration overview showing open and required ports is especially helpful during integration into the company network.

System management/maintenance – Remote access

B&R's secure remote maintenance solution makes it simple to diagnose and maintain the Edge Controller.





Plant orchestration with Edge Controller

Machine controller

The goal of an edge computing architecture is to ensure that data from a machine is processed securely and reliably. Real-time performance is crucial. The algorithms evaluate data with cycle times in the microsecond range – regardless of the infrastructure.



Line control and line management

Line control orchestrates machines in real time with cycle times in the millisecond range. A line management system serves the following purposes:

- Improved effectiveness (OEE) of production and packaging lines
- Management reporting
- Product and batch traceability
- Line visualization and condition monitoring
- Acquisition of machine and process data from package units

Easy simulation of process models

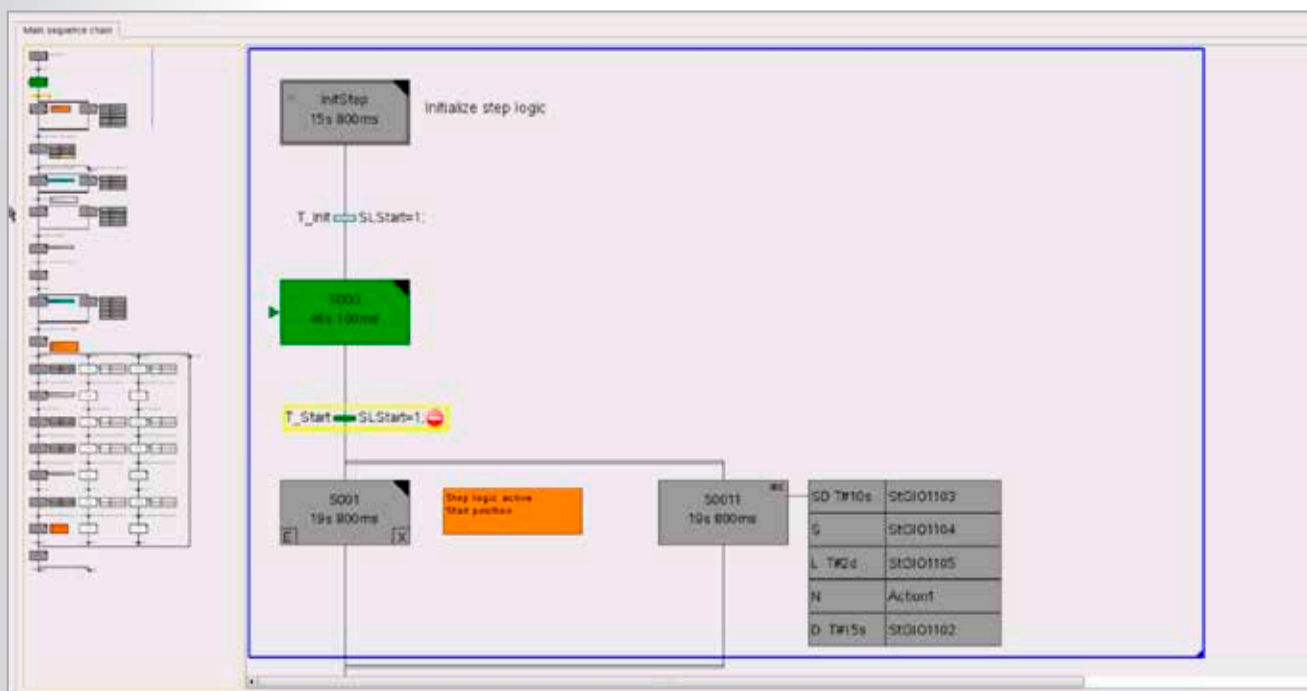
A variety of predefined models are available on the Edge Controller for representing dynamic systems. Complex models can be developed using MATLAB and Automation Studio Target for Simulink®.

Advanced process control

The model based predictive control (MPC) is based on an optimization method which cyclically minimizes the predicted control errors. The prediction of the control error is done with the help of a model.

Rule-based control

Rules can be created in the Edge Controller using IEC 61131-3 languages and can be as complex as necessary.



Shop floor communication

Classic fieldbus protocols – ANSL, PROFIBUS DP, PROFINET and Modbus TCP – are used for the shop floor communication.

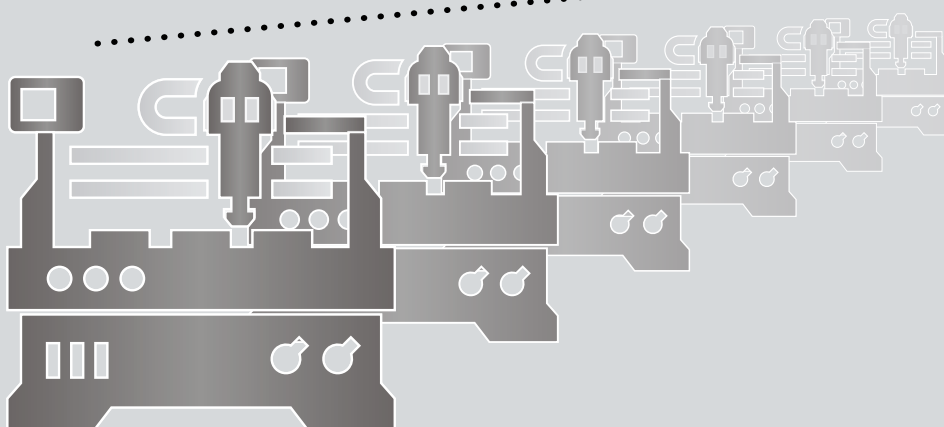
The popular cloud protocols such as MQTT client, OPC UA server and OPC UA client are available on the Edge Controller for cloud communication.

Advantages of edge computing

- Higher speeds
- More flexibility
- Better quality
- Increased efficiency
- Improved security



MQTT



HMI on the edge



Web-based HMI – mapp View server

As an integrated, web-based, real-time HMI solution, mapp View makes it easy to design sophisticated, high-quality graphical interfaces. Based on web standards HTML5, CSS3 and JavaScript, mapp View applications are platform-independent, future-proof and guaranteed to display optimally on all clients that access the mapp View server.



APROL

Flexible. Scalable. Modular.

APROL system software and X20 automation components are continuously confronted with new challenges in manufacturing, process and factory automation applications all around the world.

Full scalability

APROL perfectly adjusts to meet demands with complete scalability from a single node with 50 I/O channels to a large plant with 500,000.

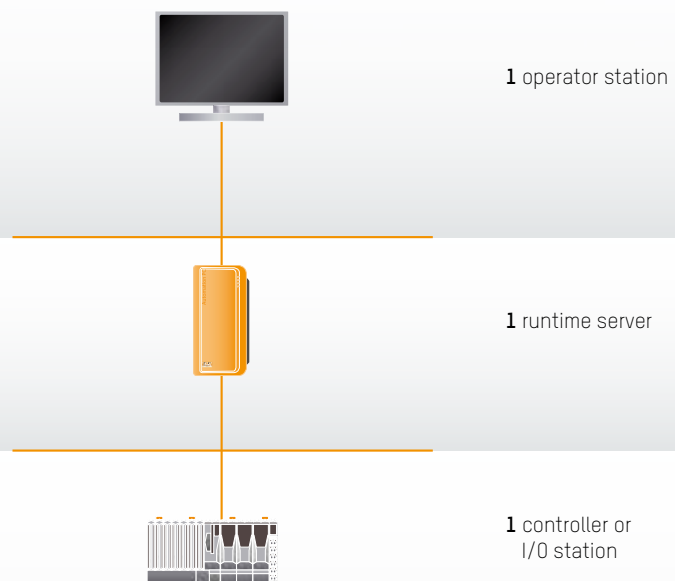
Client/Server architecture

Larger systems can feature up to 63 optionally redundant runtime servers. The operator station obtains its real-time data as a client from the runtime server.

Single node

A single-node system is composed of one Automation PC and one controller. The engineering, runtime and operator systems are installed on the Automation PC in separate Linux systems.

- Installations in different industries
- High performance, system reliability and availability
- Optimized, efficient operation throughout an asset's lifecycle
- Upstream, downstream and auxiliary processes all automated by APROL
- Current process values managed online in a central real-time database
- Updates and new innovations interoperable with installed base
- I/O modules – High-performance, robust design and variety



R4.2

Engineering/Commissioning as a team

The concurrent engineering functionality of the APROL process control system allows up to 25 engineers to work simultaneously on one project.

Redundancy at every level

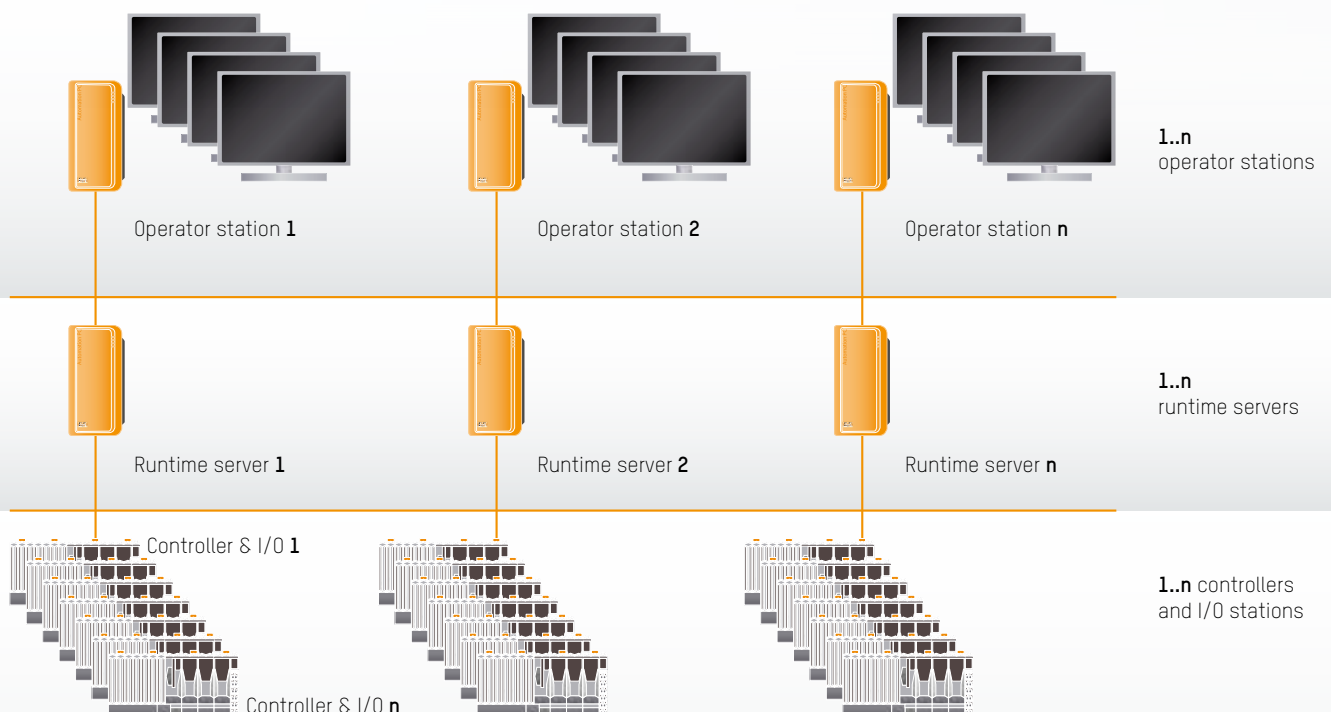
APROL can be implemented with partial or full redundancy at every level. This ensures the necessary level of availability for all bus systems, operator stations, runtime servers and controllers.

Safety fully integrated, but separated

Safety controllers and safe I/O modules are fully integrated in the system. The SafeDESIGNER engineering software, however, is separate from Cae-Manager engineering.

Functionality independent of system size

Regardless of the size of their system, users enjoy access to the full range of unrestricted APROL functions and features and can work in the same familiar engineering environment.





By permanently monitoring manufacturing assets, it is possible to reduce maintenance costs and downtime while optimizing availability and utilization.

Failure of assets located at critical points in the production process could bring down an entire line. Continuous monitoring of operating data using Asset Performance Monitoring gives operating personnel access to important information about their equipment.

Many failures can easily be avoided by checking the pollution degree of a heat exchanger or identifying a cavitation-critical operating point of a centrifugal pump. Combining measurement data with defined quality thresholds allows time for efficiently planned corrective measures before larger problems occur.

Control module for supply lines

This software block continuously calculates pressure loss in a pipe. This makes it possible to estimate the pollution degree and hydraulic loss in transport pipelines.

Control module for heat exchangers

Continuous detection of fouling in the heat exchanger makes it possible to continuously monitor the effectiveness of heat transfer.

Control module for centrifugal pumps

This control module is supplied with the existing measurements and data from the centrifugal pump. Conclusions about the efficiency of the pump can be drawn by comparing the pump data with the actual measurement data. Suction and discharge measurements, together with the flow rate, can be used to detect cavitation-critical operating points.

Condition monitoring using vibration measurement



Damage or contamination in machinery and equipment can be detected by using vibration measurement. The results are visualized in a new interactive 3D graphic to give plant operators and maintenance technicians optimal support.

Disturbance frequencies are identified using the fast Fourier transform (FFT) in the I/O module, and the results are displayed clearly in 3D diagrams. Displaying several measurement series simultaneously makes it easy to identify changes in measurement points at a glance.

Clear overview of fast Fourier transform (FFT)

The tooltip shows detailed X/Y values including timestamp. Clicking and dragging a rectangle zooms into the diagram – the 3D diagram replaces the previous waterfall diagram.

Display of harmonics

The display of harmonics helps to identify which frequency is causing a vibration. The first harmonic (fundamental frequency) is defined manually by selecting a peak; the others are identified and displayed automatically.

Marking and identifying sidebands

Marking sidebands helps to identify errors with specific frequencies. The user defines the baseband and the first sideband manually; the others are detected and displayed automatically. The amplitudes are displayed in a table as an absolute value and as a percentage of the baseband value.

Redundancy at every level

The construction of high-availability systems by using controller redundancy is also very attractive and economical for small applications. APROL supports redundancy on all levels; operator bus and process bus, as well as runtime server and controller can be set up redundantly.

Controller with process control

With controller redundancy, one controller controls the process while another stands by in inactive mode. Continuous monitoring ensures that, if necessary, the inactive controller can take over all of the active controller's functions in a completely bumpless manner.

Redundancy link based on Gigabit Ethernet

The controller without control of the process monitors all data traffic on the POWERLINK fieldbus – including the synchronization signal of the controller with control of the process – in order to be able to react without delay within one network cycle. Data for synchronizing the two controllers is exchanged continuously over a redundancy

link, which is based on Gigabit Ethernet. All of the hardware components come from the standard X20 product portfolio.

Switchover in milliseconds

The CPU redundancy switchover is in the range of only 1 to 2 task cycles on the I/O bus, and is therefore completed within a few milliseconds.

Fully automatic comparison and synchronization

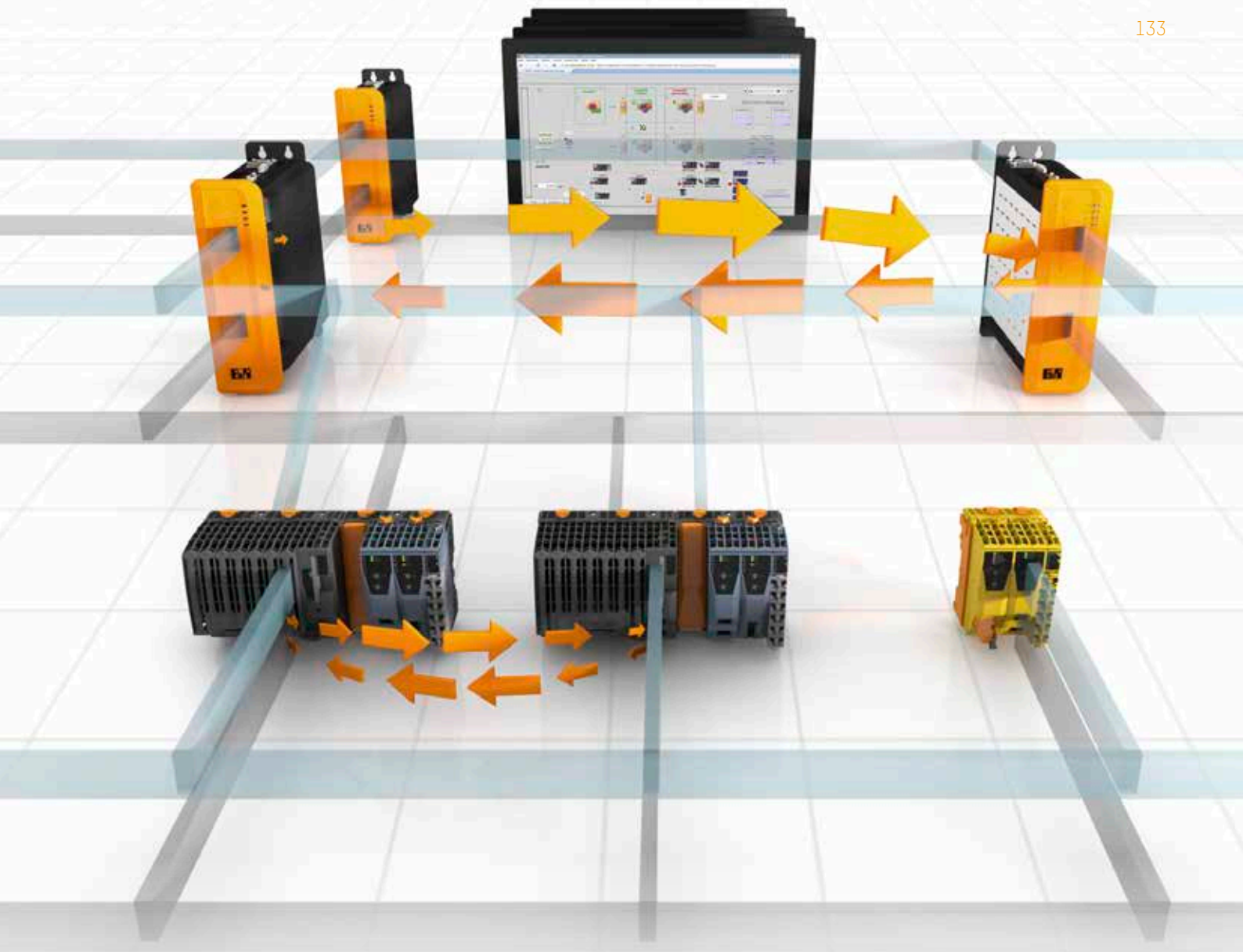
When a controller is exchanged during operation, the controller operating system and control application are updated automatically and then the real-time data is synchronized.

Minimal engineering

To configure a redundant controller, the user simply declares it as such. This can also be done retrospectively.

Redundant runtime server

Apart from the real-time data, the runtime server also contains the trend and alarm systems as well



All bus systems (fieldbus, process bus, control bus), controllers, runtime servers and operator stations can be partially or fully redundant.

as the report server. Redundancy support also includes execution of the control computer tasks. In case the computer with process control fails, there is an automatic take-over of the jobs by the redundancy partner (master/slave). The recording gaps which occur in the historical archive during a failure standstill are automatically compensated for by the system.

Process bus supports bonding

Bonding can be used to increase the availability of the operator bus and process bus. This allows two independent Ethernet interfaces on the nodes to be used without doubling the communication load.

Evaluate control performance efficiently

The Control Performance Monitor (CPM) helps plant operators work more efficiently. Based on standard data found in every control loop, the CPM control module automatically calculates parameters that can be used to evaluate control performance.

These parameters are summarized in an analysis report that is tailored to the respective control loop. The graphics in the report make it easy to quickly identify typical fault scenarios (e.g. valve friction) that have a negative effect on control performance. APROL CPM works in real time and enables highly dynamic analysis.

Control loop, plant and ad hoc reporting

The following functions are available:

- Loop reporting: Detailed report of characteristic control loop parameters
- Plant reporting: Identify control problems at a glance
- Ad hoc reporting: Create your own key performance indicators

Key Performance Indicators (KPI) for control quality comparison

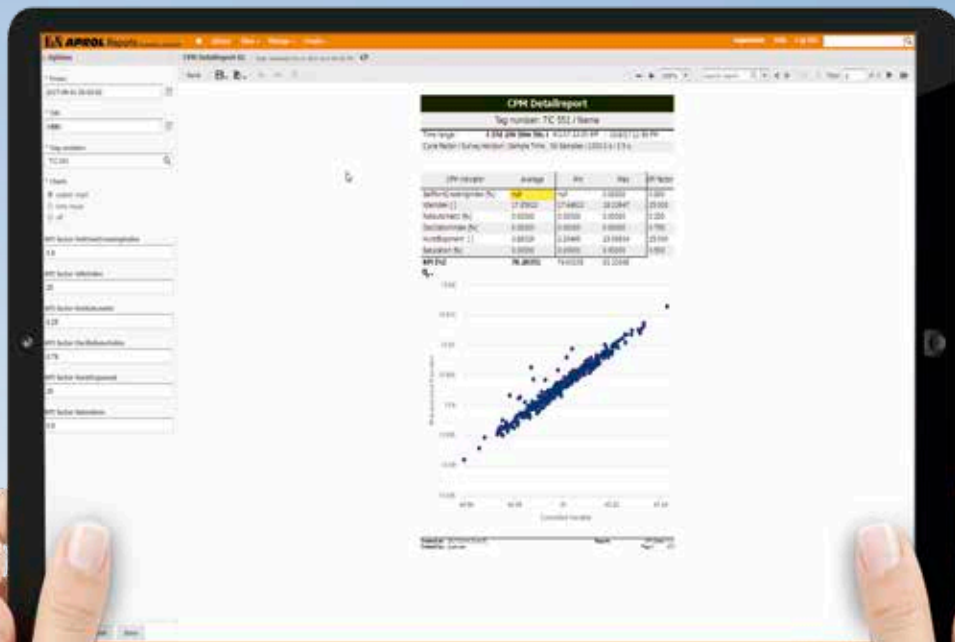
Dimensionless Key Performance Indicators (KPI) make it possible to compare the performance of different control loops. Each KPI is composed of various parameters provided by the CPM control module. They can have values ranging from 0% (poor) to 100% (very good).



Intuitive comparison of all PID controllers in the plant

Highlights

- Informative KPIs
- Control performance clearly visible at all times
- Easily adaptable parameters



The intuitive graphical interface helps maintenance engineers easily identify problems such as malfunctioning control valves.

Report server



Dashboards display all the most important information in aggregated form.

The powerful system component for business intelligence (BI) is a substantial addition to the many existing reporting options, and provides important features for factory automation and Industrial IoT applications. With the corresponding app, dashboards and reports can also be viewed and edited on mobile devices.

Modern production processes require continuous monitoring and evaluation of production data in order to guarantee the highest possible product quality. APROL supports real-time collection of raw production data and seamless archiving of operating and process data. The business intelligence component takes care of the analytical evaluation and presentation.

Web-based design tool

Components can be combined to create custom dashboards using an intuitive, web-based drag-and-drop design tool. The dashboards can also be changed interactively.

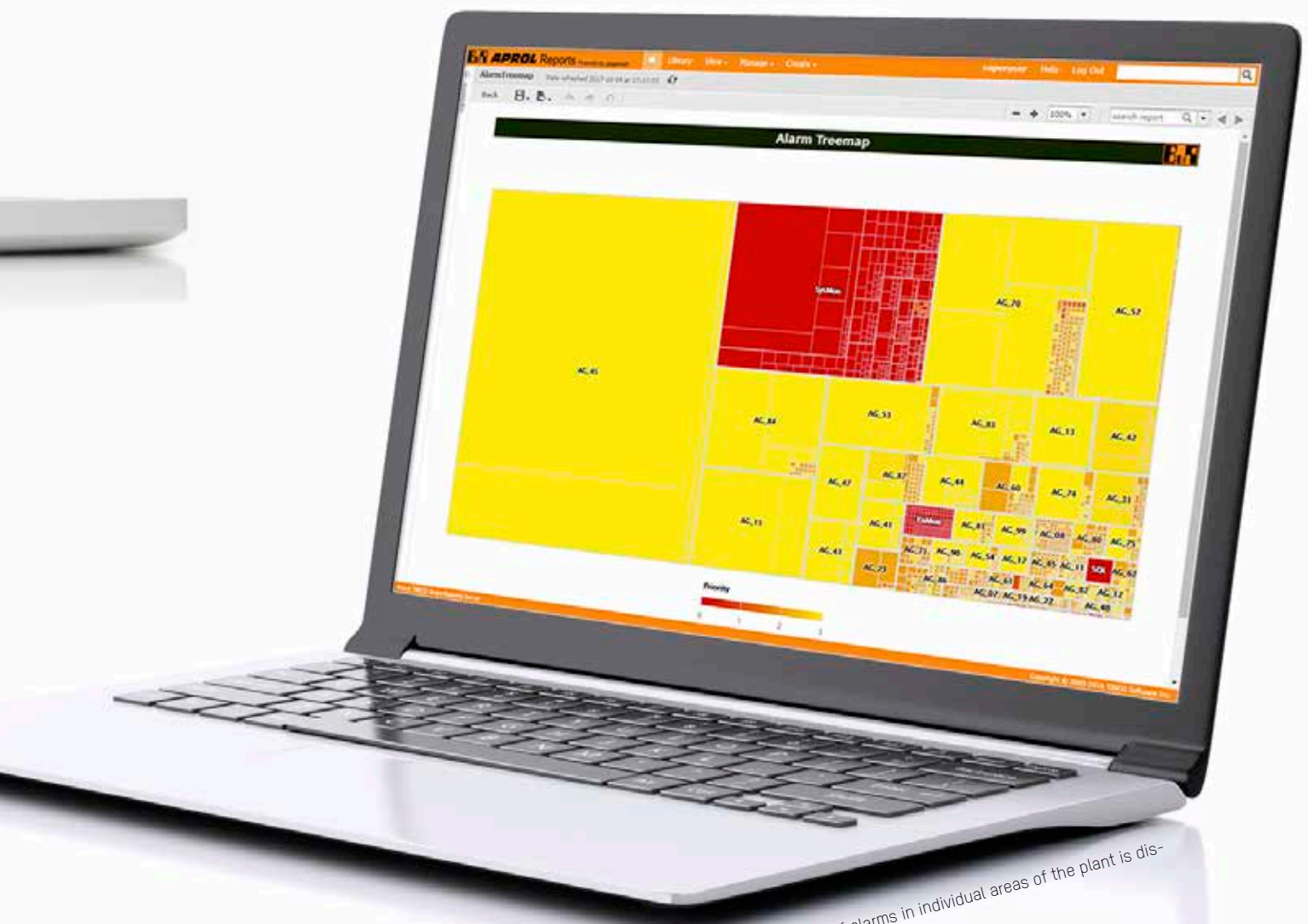
Standard and ad hoc reporting

Users can gain valuable information for the decision-making process with the help of standard reports, personalized interactive reports and ad

hoc reports. Native iOS and Android apps are available for mobile access.

Cockpit

Like a cockpit, the APROL dashboard provides a quick and intuitive overview of key data in speedometers, diagrams, level indicators and more. Multi-report dashboards can be created using both internal and external data.



The frequency of alarms in individual areas of the plant is displayed as a tree map.



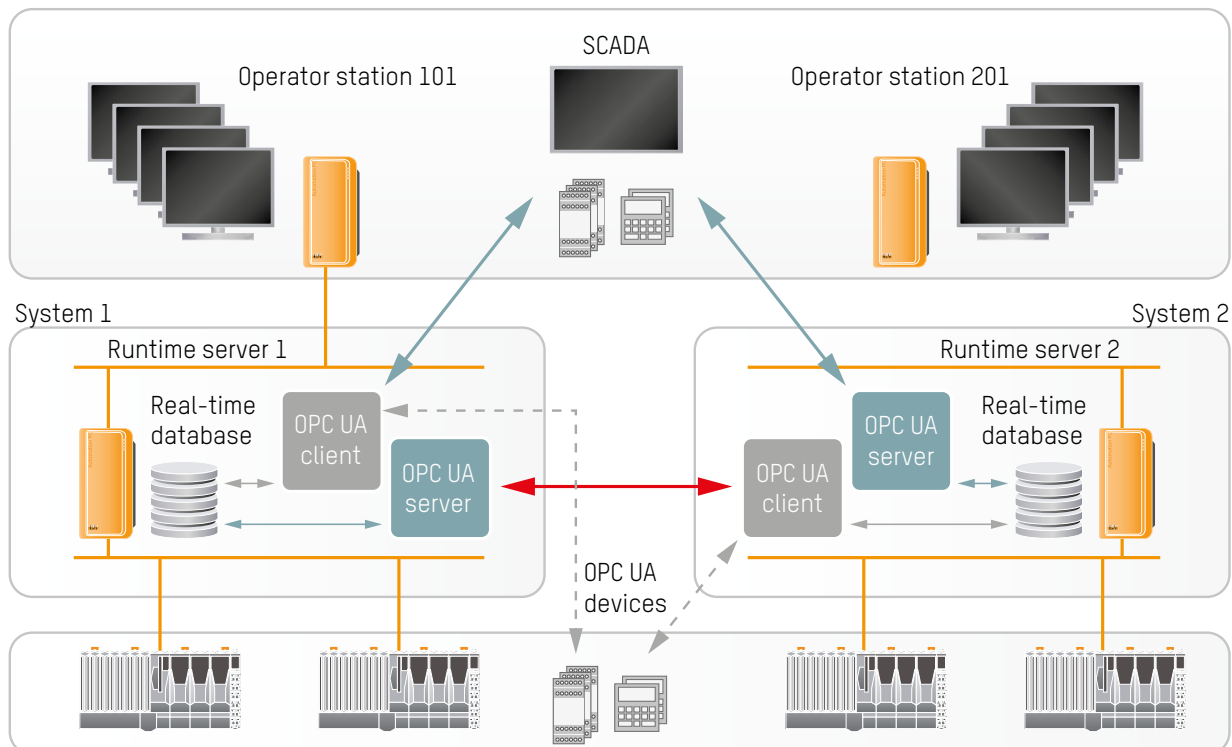
OPC UA clients and servers in all directions

APROL runtime servers provide OPC UA clients and servers for open, vendor-independent communication.

Simply select the APROL variables that the OPC UA server should make available to OPC UA clients via read or write access.

Motor management and control units, compact controllers and other devices can exchange im-

portant operating, service and diagnostics data with OPC UA clients. In addition, an OPC UA server can be used to connect any number of HMI panels or SCADA systems to the APROL process control system. Communication can also be set up between APROL runtime servers. This is also possible between APROL systems with different software versions.



OPC UA client/server functionality makes it possible to connect controllers, field devices or other APROL systems to the runtime server.

Online parameter management

The powerful and convenient online parameter management features in the APROL DisplayCenter are extremely helpful when commissioning measurement and control loops. Online parameters for identical or similar equipment can be adopted easily via drag-and-drop.

Clear display and easy editing

Apart from the faceplate view (measuring points / online parameters), there is also a control module view (online parameter groups) available to clearly display and easily edit online parameters. A list view makes it possible to enter parameters or activate control modules simultaneously.

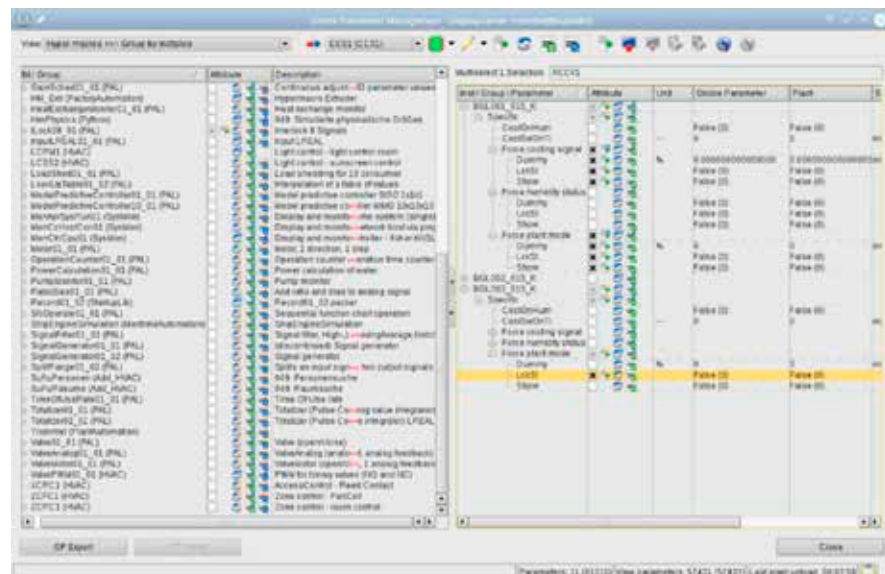
Display and compare parameters simultaneously

New dialog boxes make it possible to view all parameters for a measurement point at the same

Highlights

- Clear overview
- Easy installation
- Transfer parameters via drag-and-drop

time or to compare multiple measurement points. Existing online parameters can also be transferred to other measurement points using these dialog boxes. When importing online parameters into the APROL CaeManager project, a new version is created automatically with the version comment "Online parameters imported".



Online parameter management makes it easy to configure parameters, transfer them to other measurement points or return them back to the project.

Reduce alarm rates efficiently

The integrated report server supports exploratory analysis and is also available for historical alarm data. Reducing the number of unnecessary alarms and notifications enables more sustainable alarm management, relieves plant personnel and improves safety.

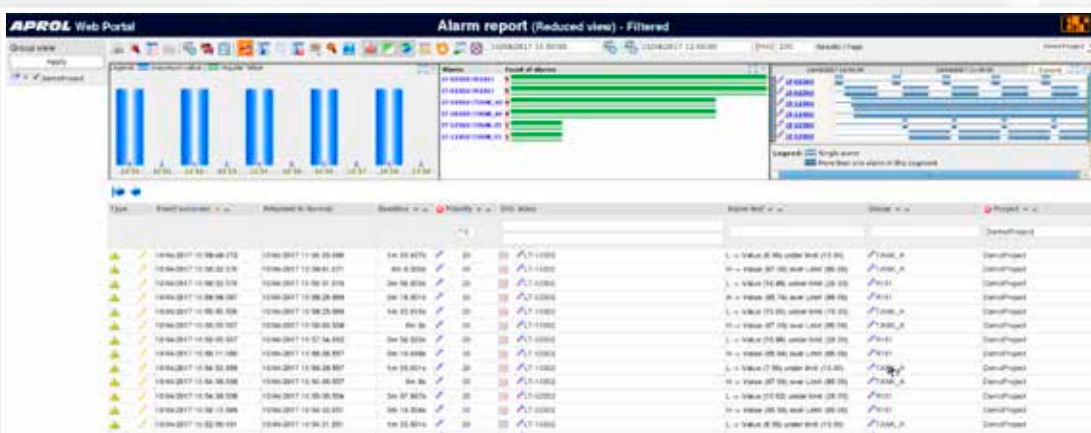
Number and frequency

Error rates increase when operators are overwhelmed by alarms and notifications calling for their attention. It becomes tempting to acknowledge frequently recurring alarms blindly and to disable irritating alarm bells. That is why it is critical

that the number and frequency of alarms is limited to a reasonable level, so that operators can process them efficiently and reliably.

Key Performance Indicators (KPI)

The APROL alarm statistics report gives users a clear, transparent and consistent overview and provides key performance indicators (KPIs) for efficient alarm management according to the requirements of EEMUA 191, ANSI/ISA 18.2 and IEC 62682. KPI reporting helps identify consequential alarms and chattering alarms, and the average alarm rate is displayed per operator and time unit.



Intuitive navigation and clear display help minimize the number of alarms and increase process reliability.

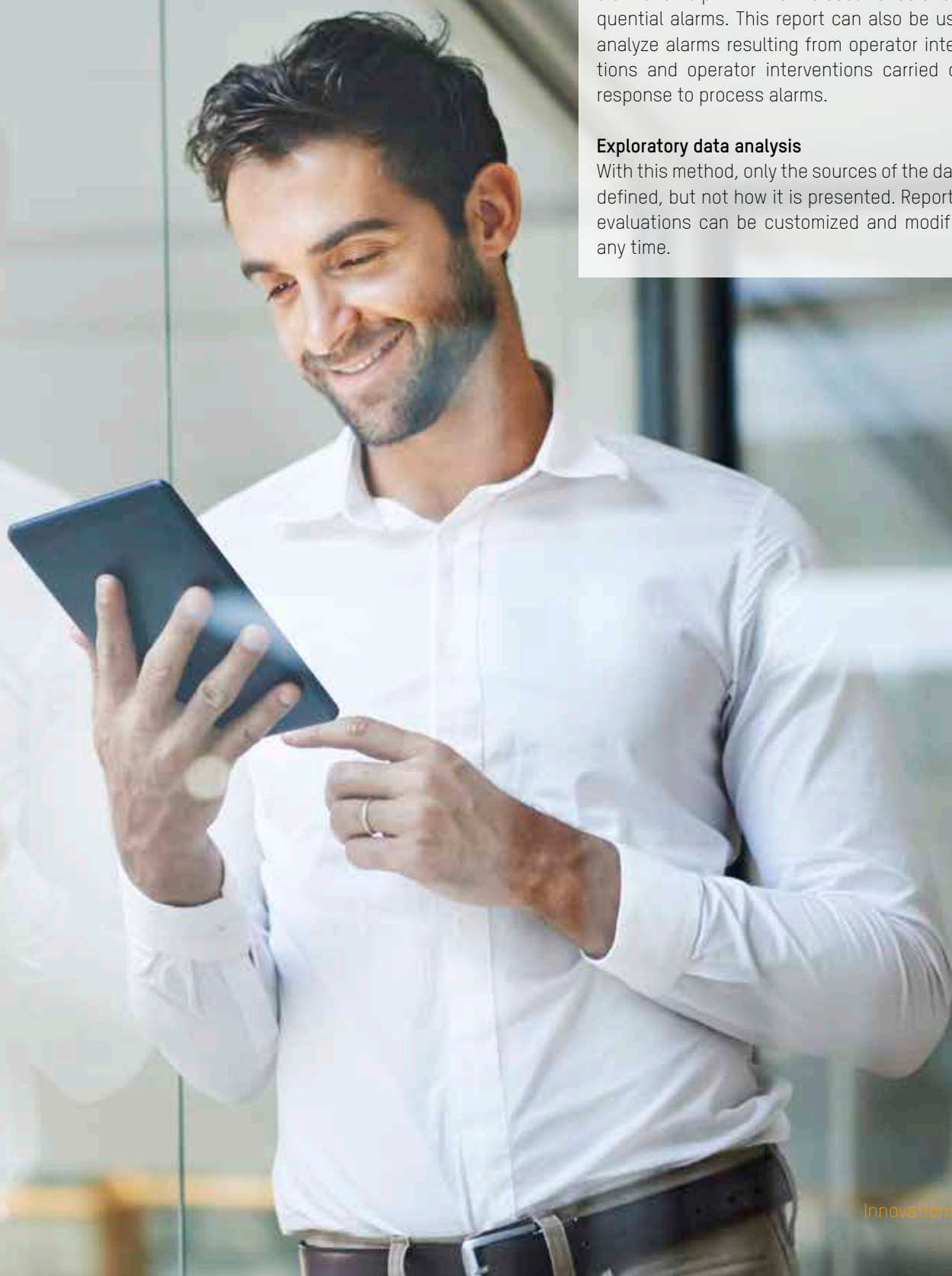
The daily, weekly and monthly hit lists provide a solid foundation for recognizing any existing weak points.

Consequential alarms and operator interventions

The consequential alarm report effectively identifies cause-and-effect relationships between alarms to help minimize the occurrence of consequential alarms. This report can also be used to analyze alarms resulting from operator interventions and operator interventions carried out in response to process alarms.

Exploratory data analysis

With this method, only the sources of the data are defined, but not how it is presented. Reports and evaluations can be customized and modified at any time.





For every industry

Automation Studio 4 is the ultimate integrated automation software for every industry. When it comes to efficient and sustainable software engineering for machines and systems, Automation Studio offers the power and versatility to optimize every horizontal and vertical aspect of your system and the openness to secure its value long into the future.

Manufacturers face unyielding pressure to raise the level of automation in their production lines, with individual machines becoming increasingly automated as well. When it comes to integrating handling equipment, robots and the transport systems that connect them, it makes no difference whether you're running a production hall or processing plant. The logical next step is to merge individual subsystems with automated control of the entire system at a supervisory level to close any gaps between processes.

Methodological differences from industry to industry are fading. Control algorithms and production sequences have many similarities, whether processing metal or wood, whether printing on textiles, plastic or paper or converting them into packag-

ing, or whether producing or packaging pharmaceutical, food and beverage or tobacco products. On the other hand, there are most certainly industry-specific differences, as indicated by different applicable standards.

The Automation Studio 4 development system integrates every aspect of automation, providing uniform solutions for open and closed loop control, motion control and safety technology as well as hardware and software for operating and monitoring entire systems from the highest supervisory level down to individual sensors and actuators. The features it provides and the systems it is used to create are suited for all industries, support compliance with relevant standards and are certified by the respective industrial governing bodies.

A selection of technology packages provides pre-programmed open loop, closed loop and motion control technology as well as visualization solutions for typical industry-specific system components, making it easy for software developers to create solutions optimized for particular industries.

Integrated automation software for every industry:

01 Packaging, **02** Infrastructure, **03** Metal, **04** Handling & Robotics, **05** Print, **06** Wind power, **07** Maritime & Offshore, **08** Tobacco, **09** Commercial vehicles, **10** Environment & Recycling, **11** Chemicals & Pharmaceuticals, **12** Food & Beverages, **13** Semiconductors, **14** Oil & Gas, **15** Measurement and testing technology, **16** Energy, **17** Wood, **18** Medical engineering, **19** Plastics, **20** Textiles, **21** Automotive

Integrated automation
Global presence
Solid partnership



ETHERNET 
POWERLINK

open 
SAFETY