Integrated safety technology
Smart Safe Reaction

PERFECTION IN AUTOMATION
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Smart Safe Reaction: Who knew safety could be so productive?

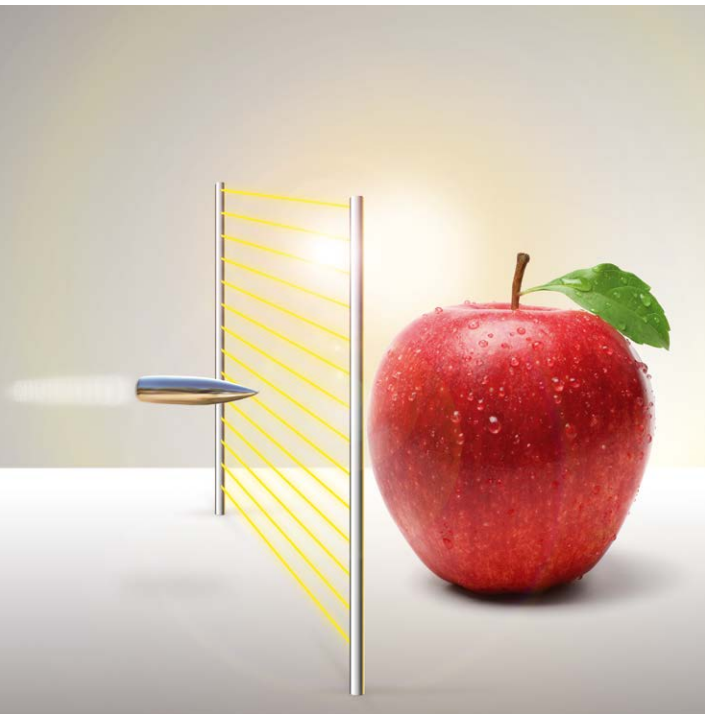
Contents

Smart

Greater flexibility and lower costs
through virtual wiring

Safe

For manufacturing and process control
applications up to SIL 3 / PL e / Cat 4

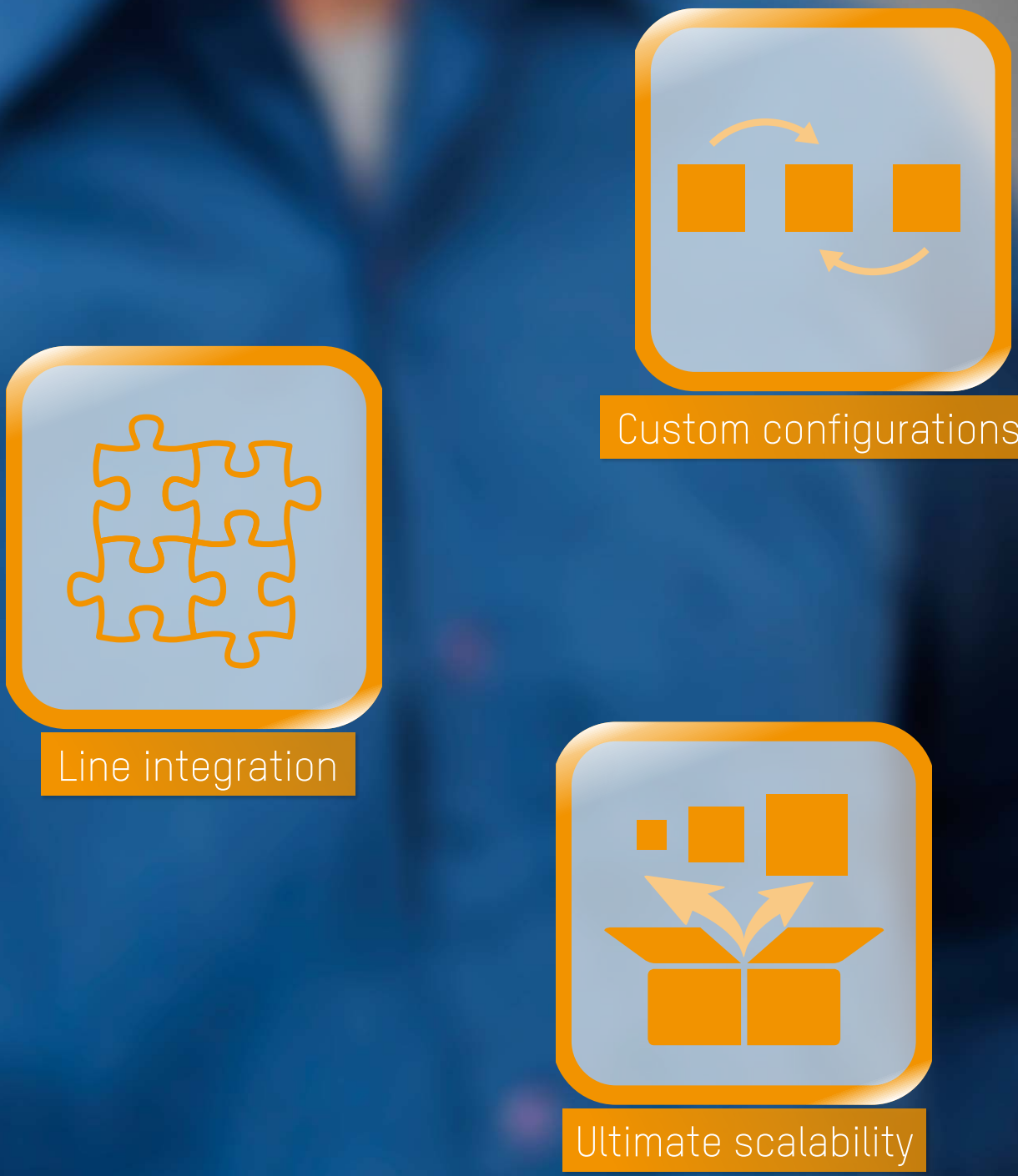


Reaction

Fastest response times
for maximum safety


10:47
open SAFETY
ACOPOS P3
R/E
ENTER
MXCHG
FW-ACKN
FAILSAFE
SKEY
FW-ACKN
SK-XCHG
SK-COPY
SCAN
TEST
ENTER
STATUS
L/A IF1
L/A IF2
X20 SL 8100

5 good reasons to choose integrated safety from B&R



Today's safety technology actively supports a machine's functionality while simultaneously safeguarding it against hazards. It adapts to changing configurations and works reliably anywhere in the world. No longer limited to a single machine, today's safety solutions span entire lines.

Maximum productivity

To avoid the painfully high cost of stopping production, machinery needs to have availability designed in from the start. Intelligent safety technology plays a critical role in preventing downtime and production outages.

Traditional hardwired safety technology responds to safety events by abruptly shutting down the machine – often making work more difficult for service personnel. B&R safety technology, on the other hand, allows production to continue at a safely reduced speed even when a safety door is open or an operator reaches into a protected area. In most cases, a full production stop can be avoided.

Stress-free maintenance

B&R safety technology even makes things easier for service personnel in cases where a component needs to be replaced. Configurations and parameters are stored centrally on the SafeLOGIC controller and distributed via the bus system using certified mechanisms. The functionality of the safety application remains intact at all times.

The ability to remove and reconnect fully-wired cable terminals eliminates the error-prone task of rewiring sensors and actuators. B&R safety technology ensures that – even after many years and countless maintenance calls – a machine offers the same level of safety that it did when it was first delivered.

Every millisecond counts

Today's drives pack enough torque to accelerate an axis to top speed in a matter of milliseconds. These highly dynamic systems are responsible for some of the most impressive feats in industrial production – such as printing presses where the web zips along at 100 kilometers per hour, or where 400 individual drives operate in unison with microsecond precision to stretch plastic film. Hardwired safety technology wasn't able to keep pace with these rapid developments in servo technology.

A machine's moving parts are only dangerous if they come into contact with a human with a certain amount of speed or force. What can be particularly hazardous are maximum accelerations caused by encoder slippage, motor commutation errors or faulty control parameter settings. For a safe motion control function, a millisecond can make all the difference in nipping a faulty acceleration or uncontrolled spin in the bud. Smart Safe Reaction from B&R enables safety response times in the sub-millisecond range so that machine builders can safely enjoy the benefits of highly dynamic drives.

The faster the process, the faster the safety technology needs to react to faults

Fast, compact, safe, innovative

A faster response time has a dramatic effect on the force of impact and the distance required to stop. As a result, machines can be more compact and can run safely at higher speeds than the limits permitted by traditional speed monitors. Often, users find themselves able to implement entirely new processes or machine designs that give them an edge on the market.

Your advantage

- → Maximum safety
- → Faster response times
- → Smaller machine footprint
- → New safety concepts

Custom configurations

Reconfigure a line via the operator panel without affecting the safety application

The general approach taken with series-produced machinery is to equip it with a suite of customization options. This approach places special demands on the safety technology that can't be met by traditional safety solutions. Smart Safe Reaction from B&R makes machine options manageable without compromising the safety level.

The traditional series-produced machine no longer exists. When you consider all the options they offer, each machine is one of a kind. The same applies to the safety technology: one version has a safety door, another doesn't. With a conventional hardwired solution, each machine variant might as well be a one-off specialty product. Wiring, testing, certifying and maintaining each one individually is costly and time-consuming.

One machine with many options

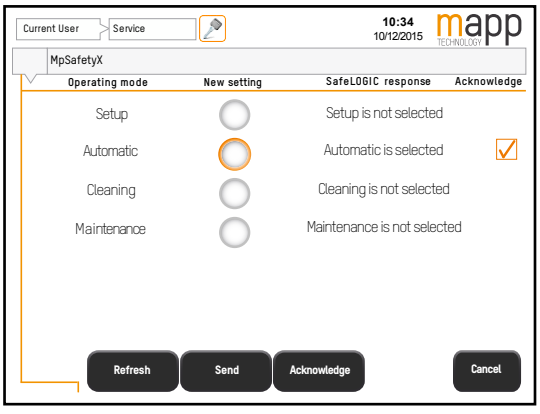
There is an easier way: SafeOPTION from B&R. Early in the planning stage of the safety solution, designers consider the most extensively equipped variant of the machine. This maximum configuration is laid out in Automation Studio's SafeDESIGNER editor, and the machine functions and safety elements are each assigned to a machine option.

This ensures that the safety solution covers every machine that could possibly be built from the available options. Yet there is only a single safety application to be tested, validated and maintained. The options required for any given machine can simply be enabled via the machine's user interface during commissioning. Neither SafeDESIGNER nor Automation Studio is needed to configure the machine.

In other cases, the machine configuration can be generated automatically from an order system, and all that's left to do for the technician during commissioning is to check and confirm it.

Safe mode selection without the switch

Another use of the SafeOPTION functions is to allow the operating mode to be set safely via the machine's user interface. There's no longer any need for a key-operated mode selector switch. It is also possible to define safety parameters via the HMI application. This is made possible by components and visualization objects certified for safety applications.



Any B&R panel can serve as the HMI without requiring any extra safety certification. Changes to the operating mode are archived in a log file and can be retraced at any time. The same applies to modified safety parameters such as limit values for pressure and temperature.

Existing access protection mechanisms such as passwords, RFID tags and other technologies can also be used to make sure that the operating mode is selected safely. Existing approaches to user authorization can simply be integrated as-is.

Your advantage

- → Manage machine options with ease
- → Configure without development software
- → Select mode safely via user interface

open SAFETY

Safe line integration

In a production line, machines from various vendors must interact. With integrated, network-based safety technology from B&R, the entire line is able to react to safety events in a coordinated way. Safe communication is provided by the bus-independent safety standard openSAFETY.

On the factory floor, machines from different vendors labor autonomously at their respective tasks. Conventionally, safety events have only been handled locally on the machine that is directly affected. The rest of the machines on the line either continue with production or are halted. This utter lack of cross-machine communication has thus far prevented the various elements of a production network from orchestrating collective reactions to safety events. In the worst case, a single defective safety door could cripple an entire assembly line.

If sufficiently detailed information about the event is shared safely across the line, then the various machines can coordinate very robust reactions. B&R safety solutions execute orchestrated safety reactions, such as reducing production speed to avoid halting the entire line.

Common communication basis

Coordinated interaction between machines from different manufacturers using different fieldbus systems requires a common communication basis. As a bus-independent protocol, openSAFETY is the only safety standard on the market that is up to the task.

openSAFETY communication services are certified for applications up to SIL 3 in accordance with the international IEC 61508 / IEC 61784-3 standards. Integrated in the safety layer, automated parameterization and configuration services ensure short commissioning and changeover times without sacrificing SIL 3 certification.

OPC UA for plantwide communication

Safety-relevant data is encapsulated in an "openSAFETY Container" and distributed throughout the production network. openSAFETY's unique design allows the use of different fieldbus or industrial Ethernet protocols. With full support for the vendor-independent OPC UA standard, openSAFETY ensures that safety solutions implemented plantwide enjoy all the advantages of integrated safety technology from B&R.

Profile specification for safe data exchange

Ensuring safe data exchange is only half the battle. A machine also needs to be able to interpret data from other manufacturers. The data specification is defined in the openSAFETY line profile.

Your advantage

- Safely network production lines
- Less downtime – more productivity
- Vendor-independent communication with OPC UA

Complex assembly lines rely on secure data exchange

Global installations

Network-based safety solutions from B&R are designed to be used anywhere in the world. Integrated diagnostic functions turn any smartphone into a highly effective troubleshooting instrument able to perform rapid and precisely targeted remote service. Across global markets, international certifications guarantee smooth implementation.

System Diagnostics Manager (SDM) is B&R's web-based diagnostics platform. It provides a clear overview of the status and error data for an entire machine. An integral component of every B&R automation system, SDM provides information about safety components as well.

Simple and efficient maintenance

From anywhere in the world, service technicians can retrieve data from the controller at the click of a mouse. They have ready access to all types of information – from the status of drives to current speed or position values, the states of controllers and much more. With B&R remote maintenance products, this is all possible while also adhering to the most stringent IT security guidelines.

Dual-channel evaluation and line diagnostics provide detailed information that helps troubleshoot the safety technology and identify issues such as short circuits in the valve control signal or problems caused by safety door contact bounce. As an integral element of every B&R automation system, SDM provides all of this functionality without having to plan explicitly for every possible service case in the machine application.

Closed-cabinet diagnostics

The advantages of SDM really come to bear in situations where – for reasons of security or to safeguard against electrical or explosion hazards – access to the control cabinet is severely restricted.

International certification

Certification by internationally recognized bodies such as TÜV Süd, Underwriter Laboratories (UL) and Gemanischer Lloyd (GL) ensures acceptance and market approval for B&R safety products all around the world.

Your advantage

- ➜ Integrated web-based diagnostics
- ➜ Ready for use worldwide
- ➜ Certification from TÜV Süd, Underwriter Laboratories (UL) and Gemanischer Lloyd (GL)

Highly efficient out-of-the-box diagnostic tools streamline service calls

Ultimate scalability

SafeLOGIC and SafeLOGIC-X controllers give B&R safety technology the scalability it takes to create a cost-optimized solution for any application. Hardware components and software functions remain fully compatible, regardless of which safety controller is selected.

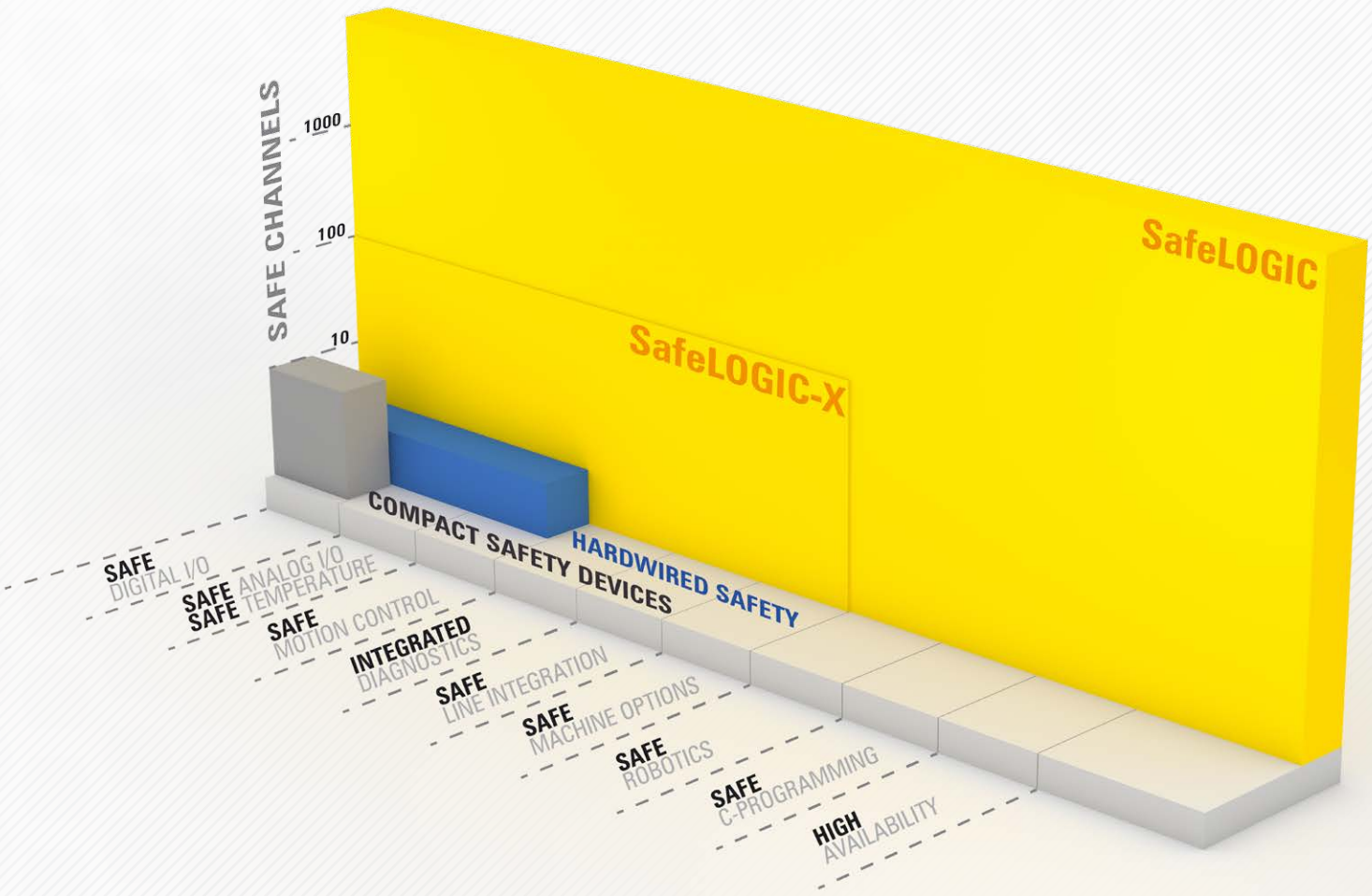
SafeLOGIC-X is a comprehensive, integrated solution for implementing programmable safety on smaller machines. The safety application is executed on a special safe digital I/O module, reducing not only costs, but also space, power, waste heat and cabling in the control cabinet.

Easily expandable

Should your safety requirements change over time, you can easily upgrade your safety solution with a safety controller from the next performance class. There's no need to adjust the safety application or module parameters – and that includes safe motion control technology as well. The functionality of safe machine options and the overall handling of the system also remain unchanged. The know-how invested in the SafeLOGIC-X solution continues to generate returns even after switching to a SafeLOGIC controller. That is the decisive advantage of B&R's Scalability+ solution program.

Scale without sacrificing continuity

With Scalability+, it's just as easy to downscale a safety application. High-performance machinery is often so complex that the necessary safety functions can only be handled by a powerful safety controller. At the same time, a simplified version of the same machine with fewer safe sensors and actuators might allow the use of a SafeLOGIC-X solution. Once again, the overall design of the machine's safety solution remains fully intact, and the applicable portions of the safety application are implemented in the SafeLOGIC-X without any changes.



B&R's Scalability+ ensures system continuity even when switching platforms

Your advantage

- → Perfect hardware for every application
- → Reduced costs
- → Scale up or down without affecting system continuity
- → Full range of functionality for smaller applications

The perfect hardware for every safety application

open SAFETY

ETHERNET POWERLINK

Innovative software functions paired with robust hardware designed according to proven principles of safety – that is the backbone of B&R safety technology.

The safety controller SafeLOGIC

As the brains behind B&R's integrated safety technology, the SafeLOGIC safety controller is responsible for handling all core safety-related tasks. In addition to running the safety application, the SafeLOGIC controller is also responsible for managing configurations and parameters.

High-performance and deterministic

With cycle times as low as 800 µs, the SafeLOGIC series of controllers delivers the fastest safety solutions on the market. Even highly complex applications with 100 safety modules and hundreds of signals can be implemented with cycle times under 10 ms. The real-time POWERLINK network enables jitter-free data exchange.

Configuration and parameter management

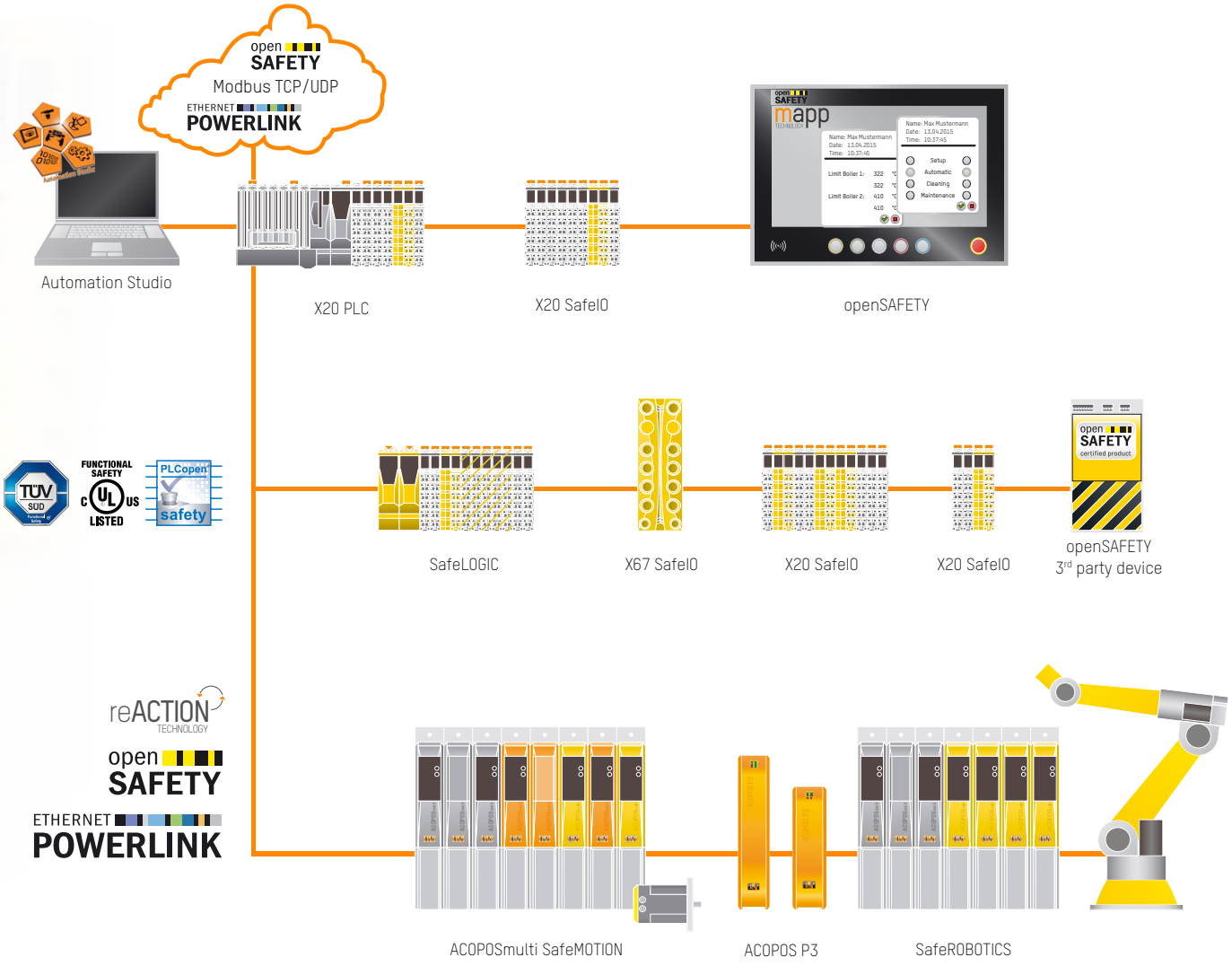
The SafeLOGIC controller stores all safety-related data on a removable storage device – the SafeKEY. The SafeKEY holds the safety application and its remanent data, the safety-related machine bus configuration and the parameters of all the safety modules. This applies not only to B&R products, but to all openSAFETY-enabled 3rd-party devices as well. If necessary, the SafeKEY can simply be moved to a replacement controller and the safety application will continue to operate as designed.

Integrated bus controller

The X20SL8101 SafeLOGIC controller features a POWERLINK interface, integrated I/O interface and dedicated power supply. This ensures that I/O modules from the X20 family – safety or standard – can all be used side-by-side.

Your advantage

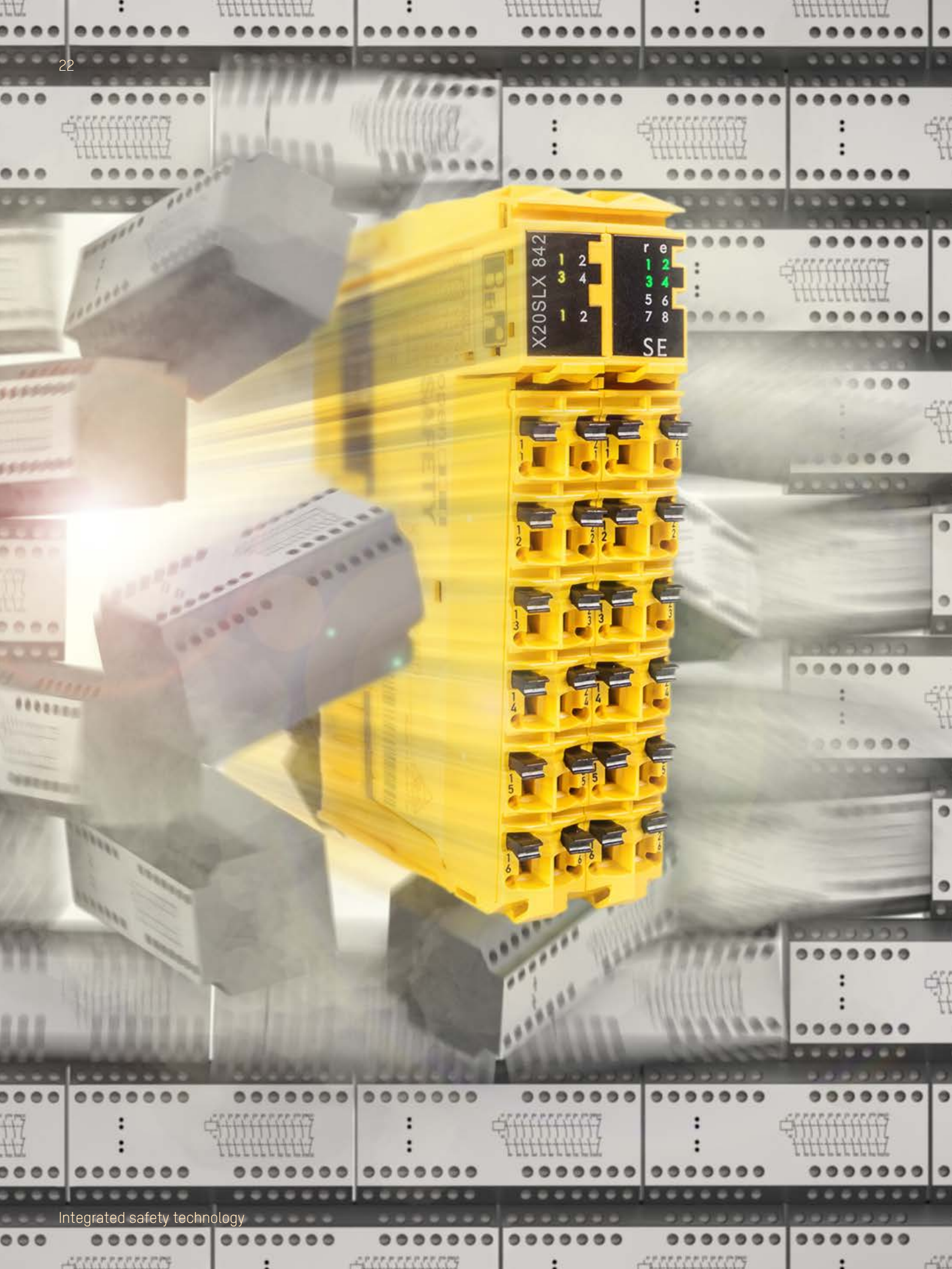
- → Replace hardware without losing data
- → Cycle times < 1 ms
- → Safety following network failure



Topology of a Smart Safe Reaction network

Full safety following network failure

B&R has set yet another benchmark in integrated safety technology with its new blackout mode. This feature allows safety applications to continue to run after a failure of the network or main controller. It no longer takes an expensive redundancy solution to ensure maximum availability of the safety application. In addition to safe reactions such as STO (Safe Torque Off), it is also possible to program complex sequences to be executed in the event of a network or controller failure.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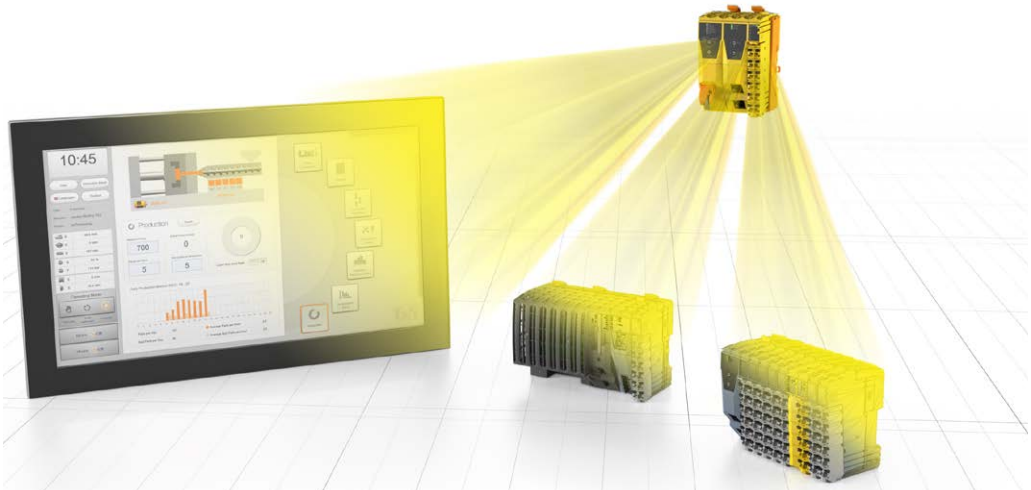
open SAFETY

ETHERNET POWERLINK

Break free from hardwired safety
SafeLOGIC-X



SafeLOGIC-X distributes tasks normally performed by a SafeLOGIC controller across existing components

Users with smaller machines are just as eager as anyone to enjoy the benefits of integrated safety technology. That's why B&R has developed the ultra compact SafeLOGIC-X safety controller.

For applications with few safe I/O points, a full-scale safety controller is overkill and frequently cost-prohibitive. The SafeLOGIC-X is no larger than a safe I/O module, yet offers all the functionality of a full-fledged SafeLOGIC controller. This is made possible by distributing control functions across automation components already used in the system.

Up to SIL 3 / PL e / Cat. 4

The safety application itself runs on the SafeLOGIC-X, while parameter handling and configuration management are outsourced to the standard controller. In SafeLOGIC-X applications, these system functions, which are certified for SIL 3 / PL e / Category 4, are implemented as two inversely coded tasks that monitor each other. Ready-to-use service screens in the HMI application provide an interface for operating and servicing the virtual controller.

100% upward compatible

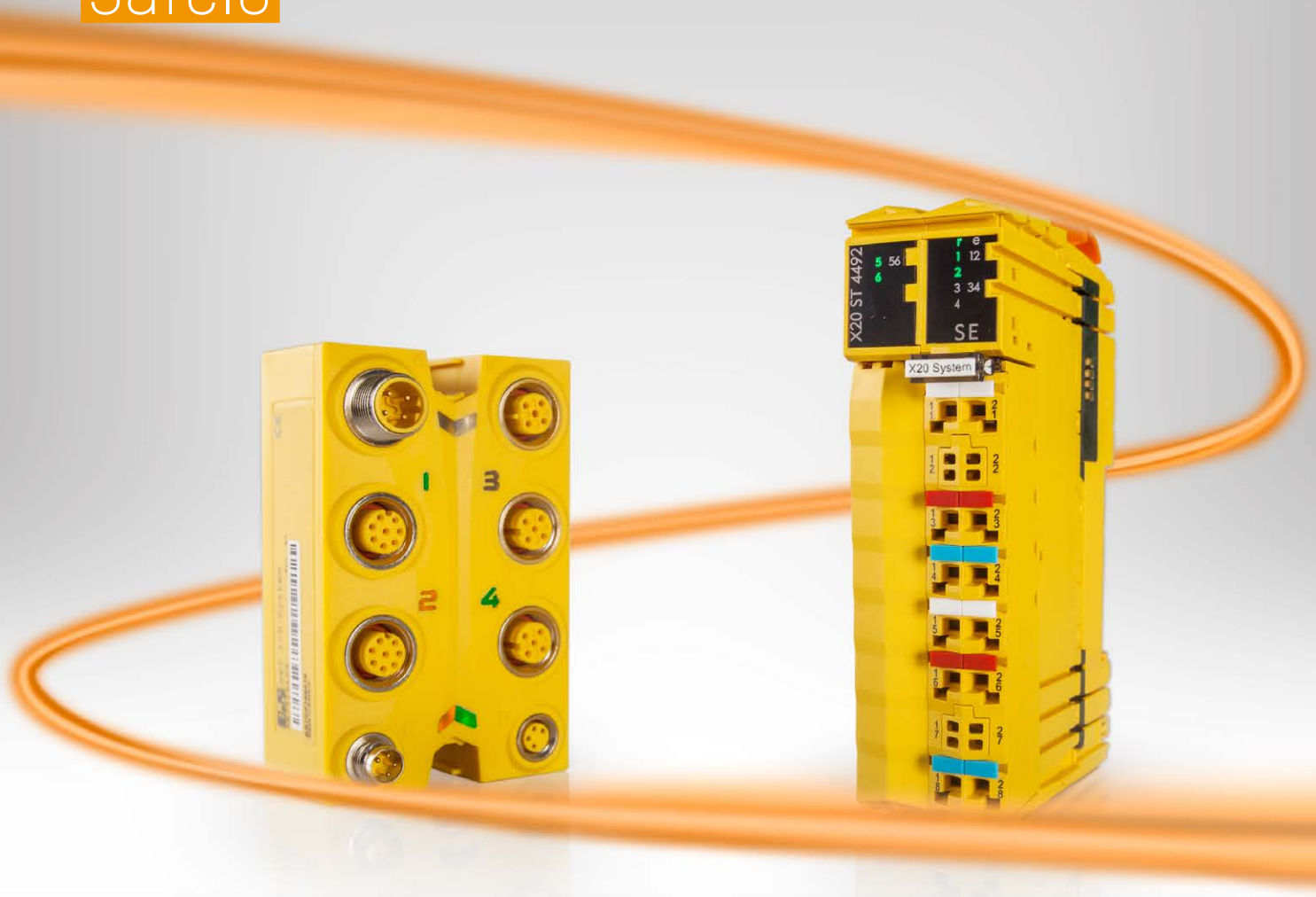
SafeLOGIC-X and SafeLOGIC controllers are completely interoperable. Should you ever need to expand your safety application, the existing software can be carried over as-is to the new hardware.

Your advantage

- → Minimized hardware
- → Space savings
- → Lower costs
- → Full functionality

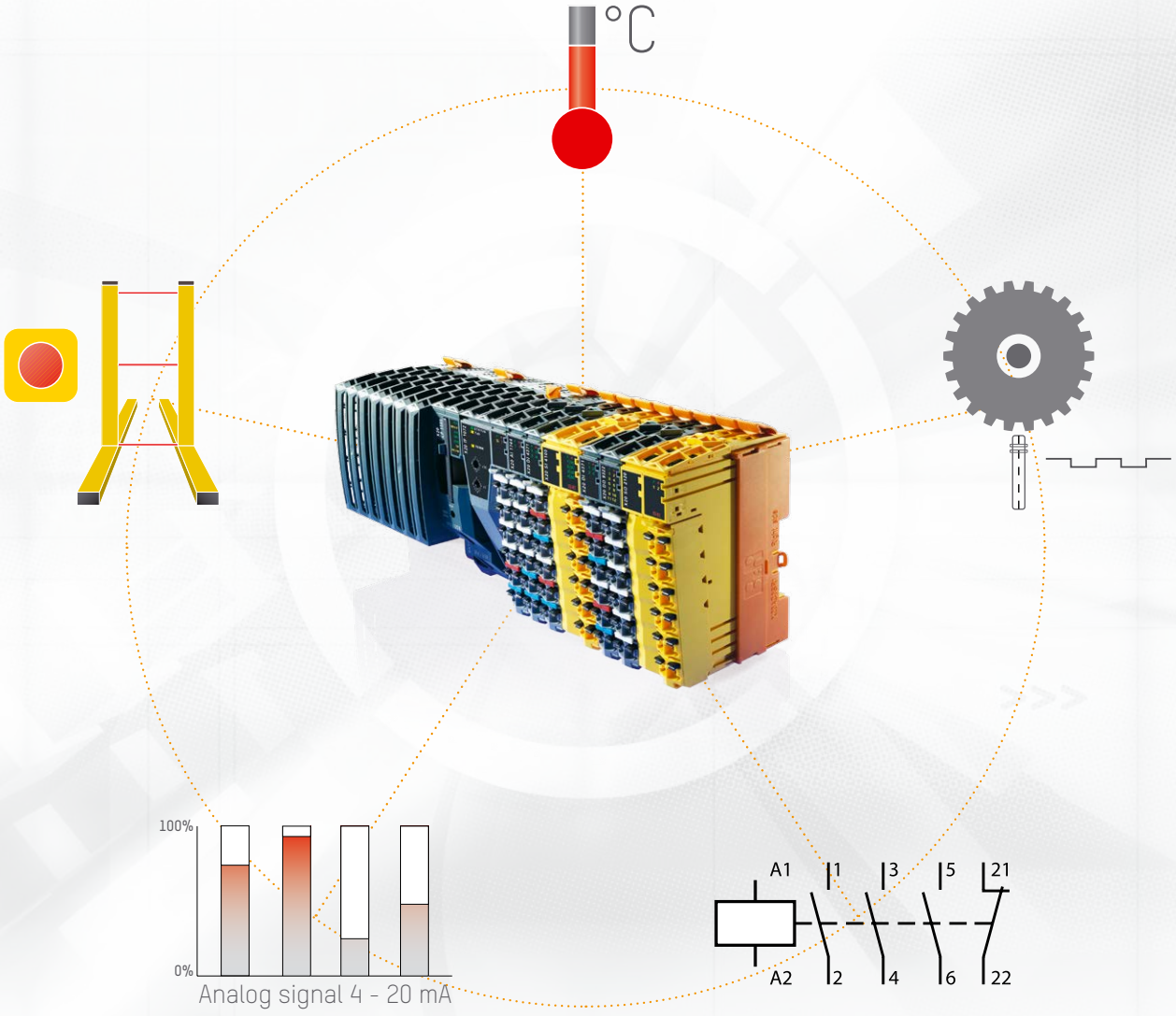
Safety-rated I/O for any application

SafeIO



Every safety application poses its unique challenges. That's why it's important that I/O modules offer a variety of channels, both in number and function. B&R's diverse portfolio of safety-rated I/O has the right module for any application.

Safety-rated digital and analog I/O modules are a key feature of every automation system. In addition to delivering input signals and processing output commands, they also monitor connected sensors and actuators.



B&R offers safety-rated I/O for every application

Always the optimum solution

With its rich selection of safety-rated I/O modules, B&R offers the perfect arrangement of channels for any safety application. Developers can choose between safe digital input modules with 2, 4, 8 or 20 channels. Safe digital output modules are available with 500 mA, 2 A or even 10 A. Other modules offer safety relays, analog inputs and safe collection of temperature and speed data.

IP67 for harsh environments

In addition to the X20 SafeIO modules with IP20 protection for cabinet installation, B&R also offers IP67-rated digital input and mixed modules for harsh environments. These modules are ideal for implementing decentralized architectures and saving space in the control cabinet. Functionally, the X67 SafeIO modules are fully compatible with their X20 counterparts.

Your advantage

- → The perfect module for any task
- → IP20 or IP67
- → Outputs with 500 mA to 10 A
- → Temperature, speed and much more

Only one cable openSAFETY operator panel

openSAFETY operator panels from B&R allow safe data exchange over the bus system. With the integrated openSAFETY interface, there is no need to wire the E-stop, mode selectors and start buttons separately. The only connections needed are for the bus and power.

Simple cabling of swing arm systems

Setting up operator panels with numerous hardwired switches and buttons used to mean tediously threading cable after cable through the swing arm system. With an openSAFETY operator panel, you can position the HMI exactly where it is needed without having to deal with unwieldy cable harnesses. Commissioning and service are also simplified, saving additional money in these areas as well. The E-stop button is just as reliable as its hardwired counterpart.

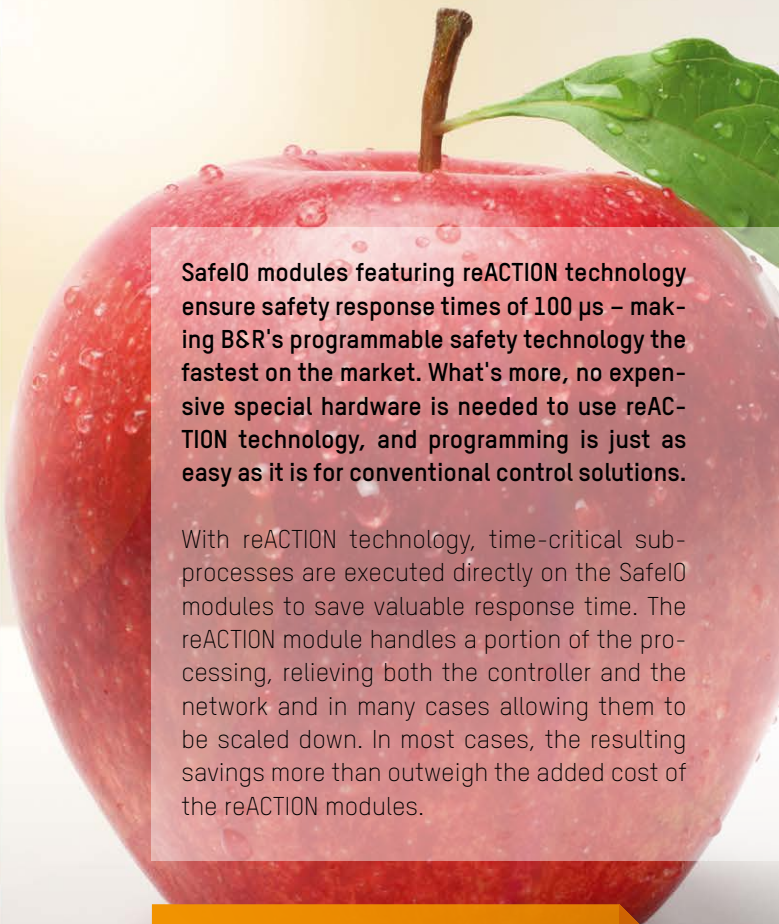
Arrange buttons and switches as needed

These operator panels are available in a wide range of configurations, allowing them to be tailored perfectly to any application. In addition to different display sizes and ratios, it is also possible to choose between various touch technologies. Just as configurable are the number and arrangement of buttons, switches and the E-stop button. The operator panels are also available in housings rated up to IP65. To round it off, B&R also offers custom HMI devices tailored to the needs of specific industries and customers.

Your advantage

- → Reduced cabling
- → Easier swing arm mounting
- → Faster installation

Ultrafast safety technology with reACTION for safety



SafeIO modules featuring reACTION technology ensure safety response times of 100 µs – making B&R's programmable safety technology the fastest on the market. What's more, no expensive special hardware is needed to use reACTION technology, and programming is just as easy as it is for conventional control solutions.

With reACTION technology, time-critical subprocesses are executed directly on the SafeIO modules to save valuable response time. The reACTION module handles a portion of the processing, relieving both the controller and the network and in many cases allowing them to be scaled down. In most cases, the resulting savings more than outweigh the added cost of the reACTION modules.

Your advantage

- → Response time: 100 µs
- → Relieves the controller
- → Relieves the network

reACTION TECHNOLOGY

ETHERNET POWERLINK

open SAFETY

Safe drive technology SafeMOTION

At B&R, safe motion control functions are integrated directly in the drive system. This cuts down on cabling and reduces response times. Integration in the real-time POWERLINK network allows for perfect coordination between all safety components.

B&R drives featuring SafeMOTION offer a complete set of safety functions – in accordance with the IEC 61800-5 safety standard – giving you the tools to solve even the most demanding motion control challenges. SafeMOTION functions make it extremely easy to implement the special operating modes explicitly required by various safety standards, including maintenance, setup and process observation.

Fastest reaction times
Reactions to workspace intrusions are triggered directly in the SafeMOTION module. A safe stop, for example, is initiated within 7 ms. Response times 10 times faster than with previous solutions mean residual distance and force of impact are reduced by a factor of 100. This makes it possible to create more compact machine designs.

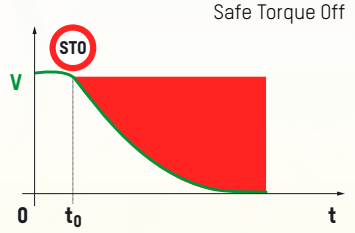
Open to 3rd-party components
Safe sin/cos interfaces support integration of 3rd-party motors. Even in cases of atypical motor dimensions or installation in problematic locations, this openness ensures that a suitable safety solution can always be found.

Broad spectrum of servo controllers
Every performance class of B&R's ACOPOSmulti, ACOPOSmotor and ACOPOS P3 servo drives supports SafeMOTION. So whether you have a motor-mounted servo drive, an individual axis or even an application with over 100 axes – you stand to benefit cost-effectively from SafeMOTION.

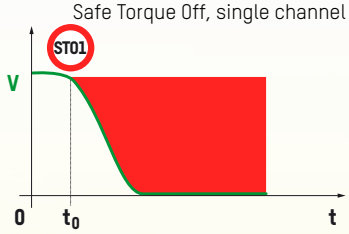
Your advantage

- → Drive-integrated safety technology
- → Easy setup
- → Fast reactions

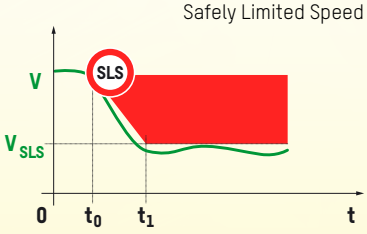
Safe Torque Off



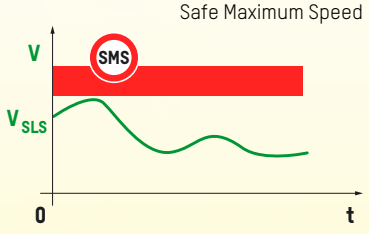
Safe Torque Off, single channel



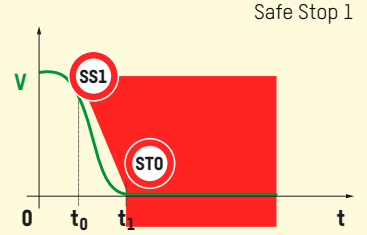
Safely Limited Speed



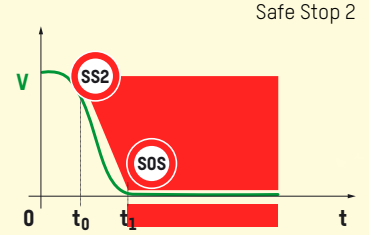
Safe Maximum Speed



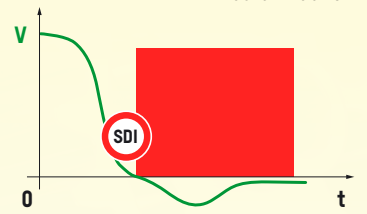
Safe Stop 1



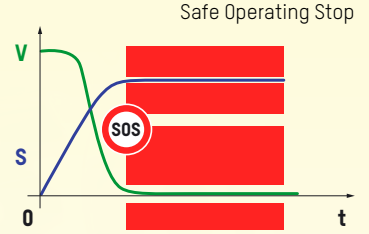
Safe Stop 2



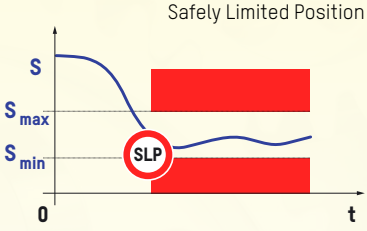
Safe Direction



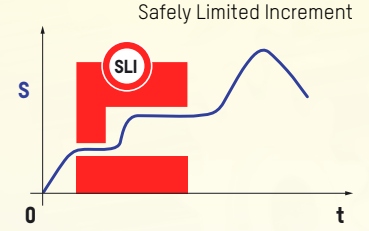
Safe Operating Stop



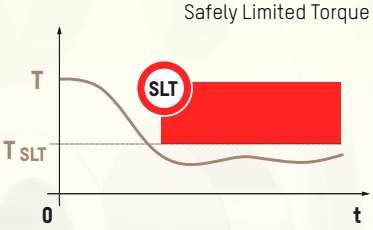
Safely Limited Position



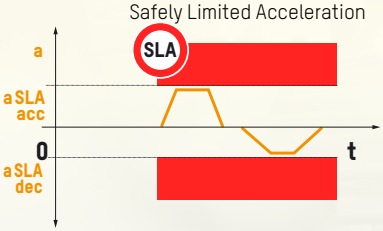
Safely Limited Increment

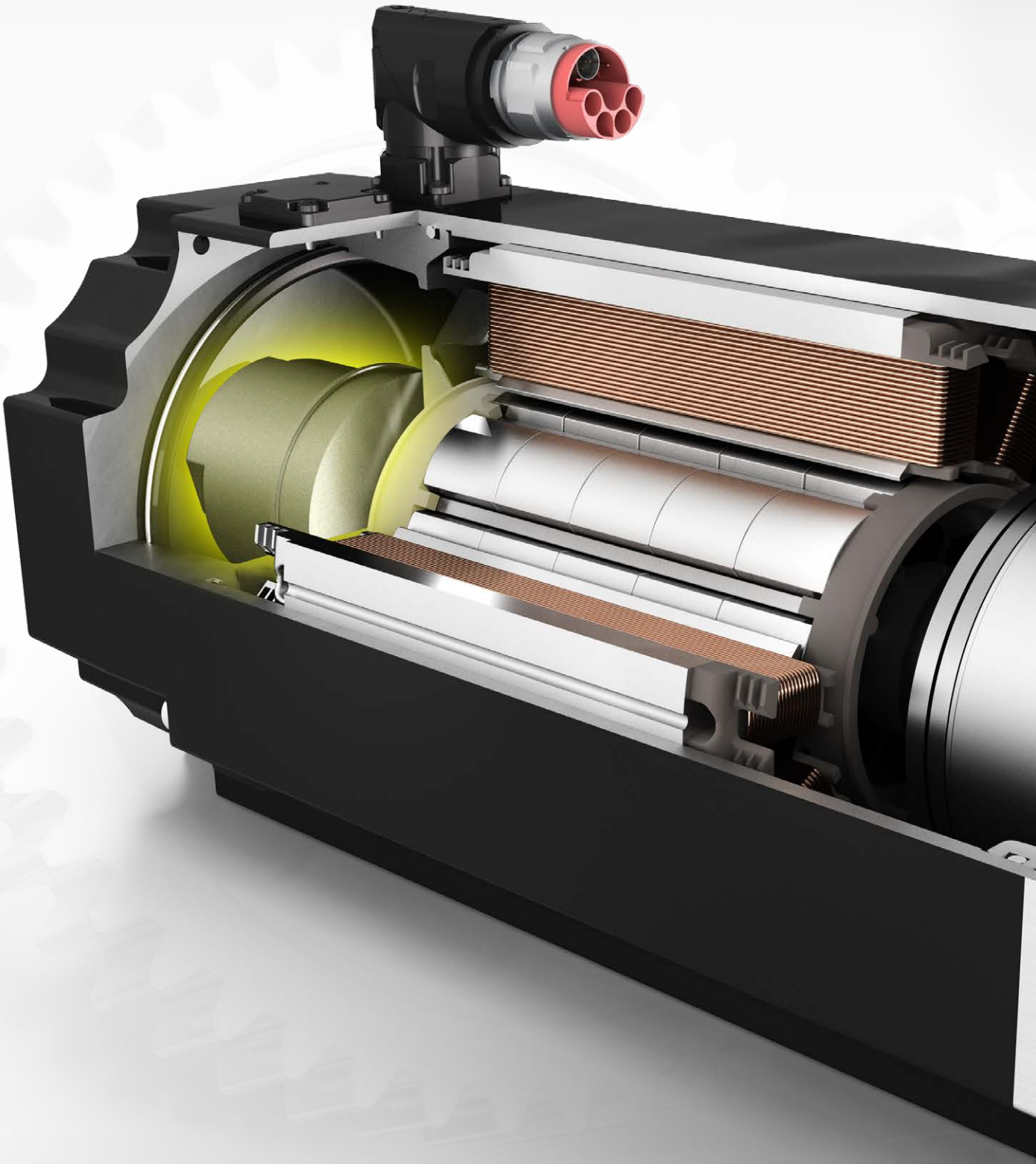


Safely Limited Torque

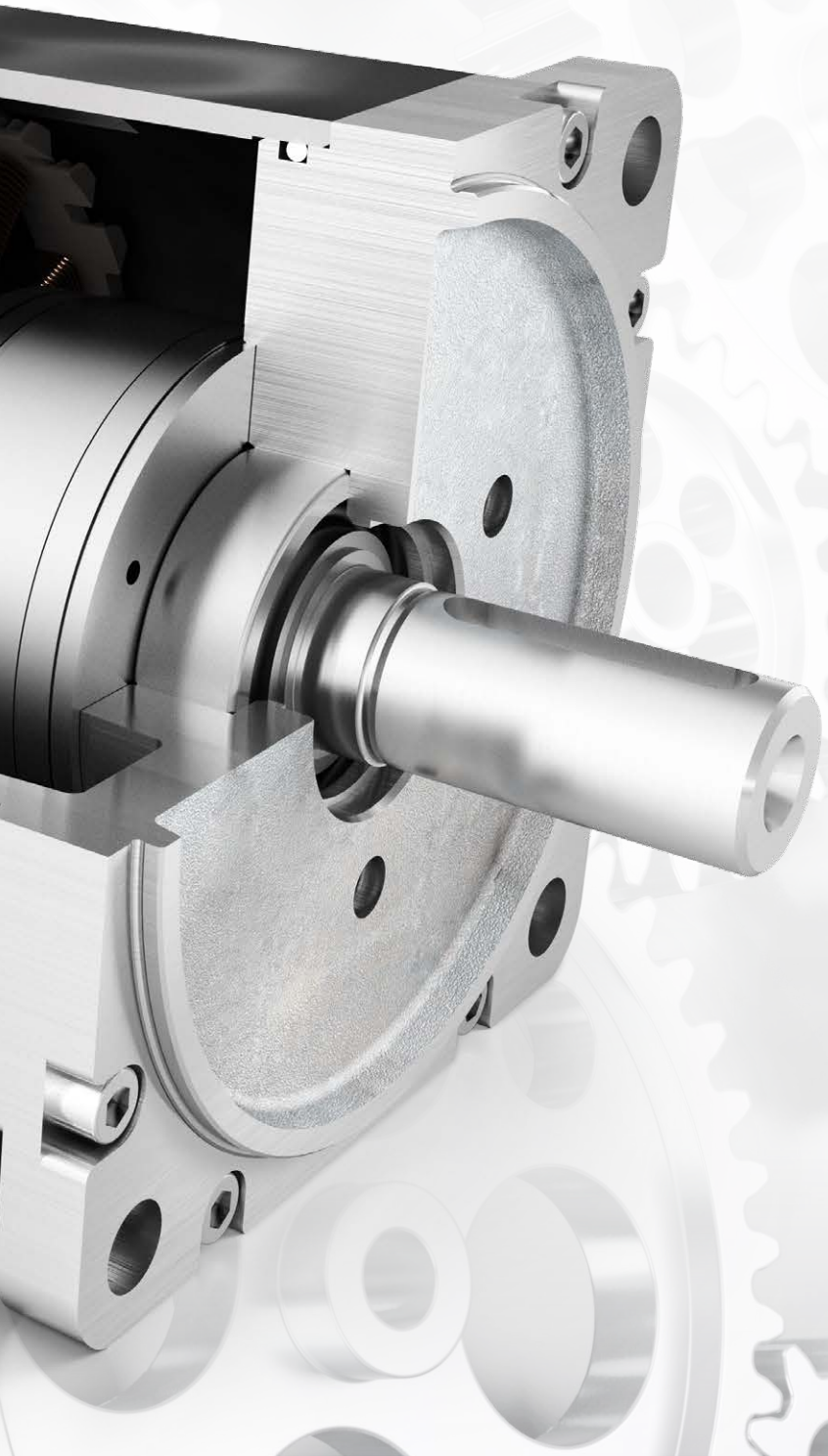


Safely Limited Acceleration





100% safe power transmission system SafeENCODER



You can't provide a safety function for a drive unless you have reliable information about its speed and position. Traditionally, this has meant using a securely mounted encoder. With SafeENCODER, however, B&R has opened up some exciting alternatives.

SafeENCODER without slip-proof mounting
In many applications, encoder slippage can be detected by test routines on the drive system. Available with certified EnDat 2.2 encoders, all of B&R's standard servo motors support this function as long as active position control is used.

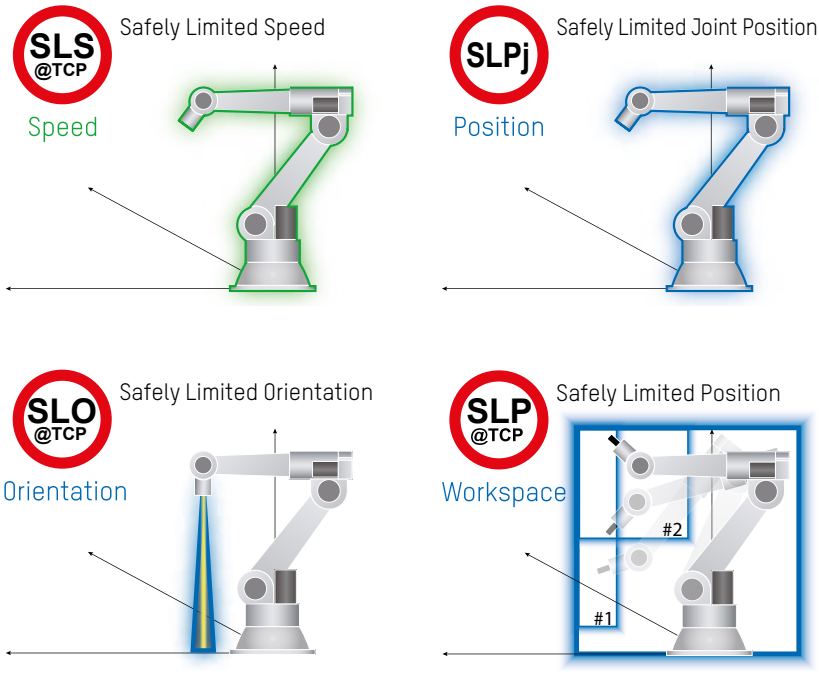
SafeENCODER with slip-proof mounting
For applications involving induction motors or without position control, B&R offers motors with slip-proof encoder mounting to rule out potential errors. All together, Smart Safe Reaction from B&R establishes a seamlessly certified chain of products – from the safety controller to the output shaft.

One cable is enough
A motor traditionally requires two cables – one for the motor and one for the encoder. Eliminating one of these cables not only results in reduced cable costs, but also less time and effort when it comes to commissioning and maintenance. As the name suggests, a hybrid motor cable solution allows the power supply, encoder data and digital safety information to be transferred between the servo drive and motor using just a single cable. This reduces both component and commissioning costs, while also eliminating potential sources of error.

Kinematics under control SafeROBOTICS

The robot safety cage is out of place in the modern production hall. If robots are to work harmlessly hand-in-hand with humans, their movements must be safety-monitored. That is precisely what's possible with B&R's SafeROBOTICS library.

To safeguard humans from hazardous situations, the kinematic chain moving the robot arm must be safety-monitored. It's not enough to simply monitor individual axes. The only way to do it is with the combination of safe position and speed data for all axes in the kinematic chain.



Fully integrated
The SafeROBOTICS library is integrated in the B&R Automation Studio engineering environment, where its functions are configured using the SafeDESIGNER editor. SafeROBOTICS is based on a generic model, so it's also possible to monitor axes that deviate from the classic robot kinematic structures, such as robots mounted on a moving platform. Another possible use is for safe monitoring of the tool mounting point on a CNC machine.

Array of functions
Paired with the impressive processing power of the SafeLOGIC controller, this comprehensive drive-integrated safety functionality makes it possible to craft sophisticated and highly effective safety solutions. Wherever robots and operators work hand-in-hand, for instance, it is possible to limit the speed at the tool center point, robot joints and at the tool endpoints. The safety function responsible for this is called Safely Limited Speed at the Tool Center Point, or simply SLS@TCP.

Wherever laser or water jet cutters are involved, controlling their aim is a primary safety concern. A function that safely limits the orientation of the tool center point can effectively safeguard against the dangers of an errant jet or beam. It is also possible to define safe workspaces into which the robot is not permitted to intrude.

Simple and safe programming SafeDESIGNER

The process of programming a safety application needs to be both easy and reliable. That's why, in Automation Studio's SafeDESIGNER editor, there's not much programming to do at all. With certified function blocks and a visual editor, developers do more virtual wiring than code writing, while at the same time enjoying a much broader range of functions than would ever be possible with a hardwired solution.

The Automation Studio development platform provides tools for every aspect of industrial automation – from controllers and drives to communication and HMI. SafeDESIGNER is a license-free feature of Automation Studio that perfectly rounds off its spectrum of advanced safety technology.

Virtual wiring replaces written code
Users create safety applications by simply dragging and dropping certified function blocks from the PLCopen library into the visual editor and wiring them virtually with a few clicks of the mouse. The signal lines are color-coded, with orange indicating safety-related signals and black representing all other types.

SafeDESIGNER differentiates between the following data types: BOOL, INT, DINT, WORD, DWORD and TIME, as well as SafeBOOL, SafeINT, SafeDINT, SafeWORD, SafeDWORD and SafeTIME. This prevents unintentional use of variables with conflicting data types.

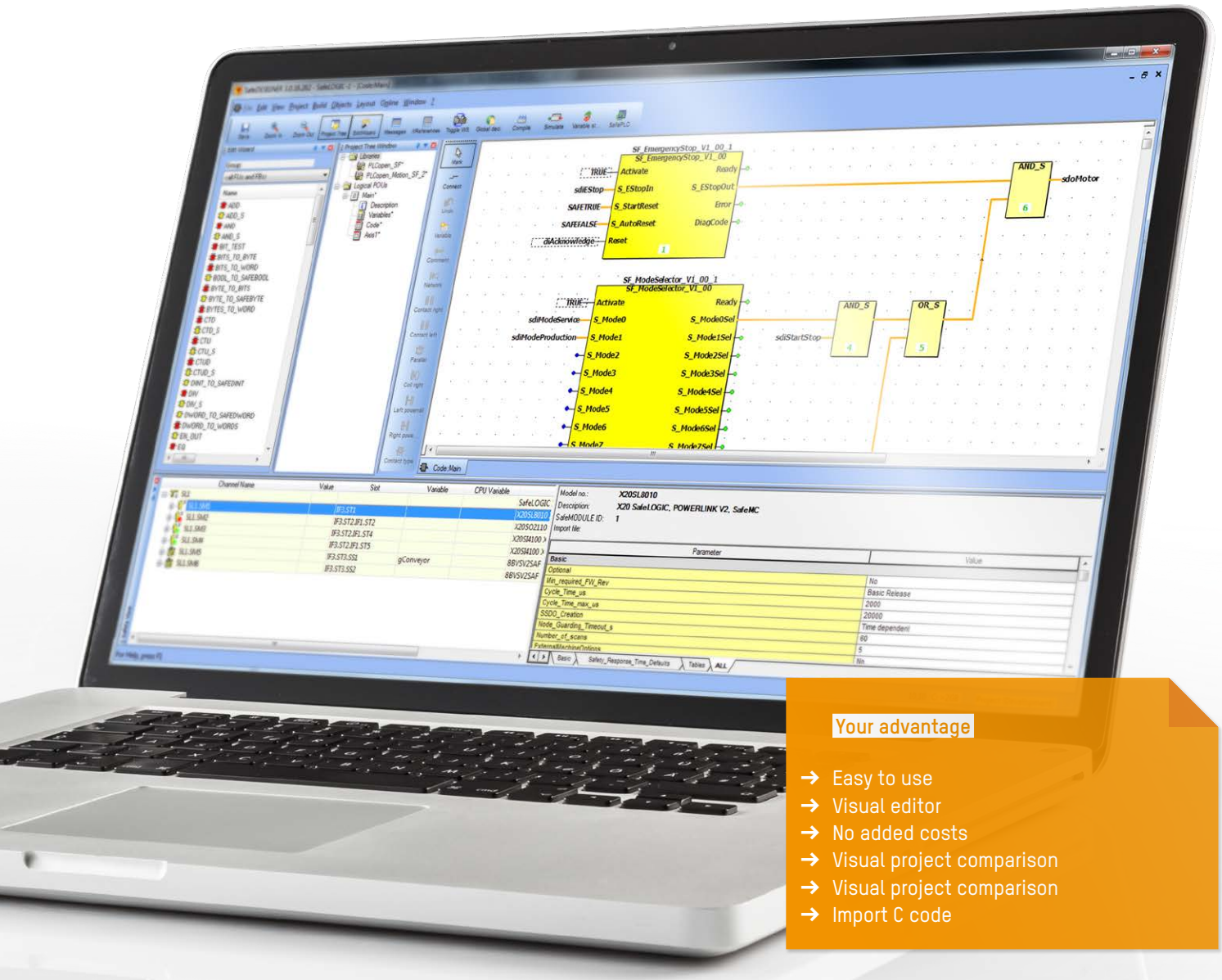
Visual project comparison
A key feature of SafeDESIGNER is the ability to compare projects visually. This helps developers quickly identify changes that have been

made to the safety application. They can analyze differences between machine generations or check which device parameters and time values have been modified.

This function allows the user to compare the project currently open in Automation Studio with another version of the same project. It is also frequently used to check the current project against the version on the machine's safety controller.

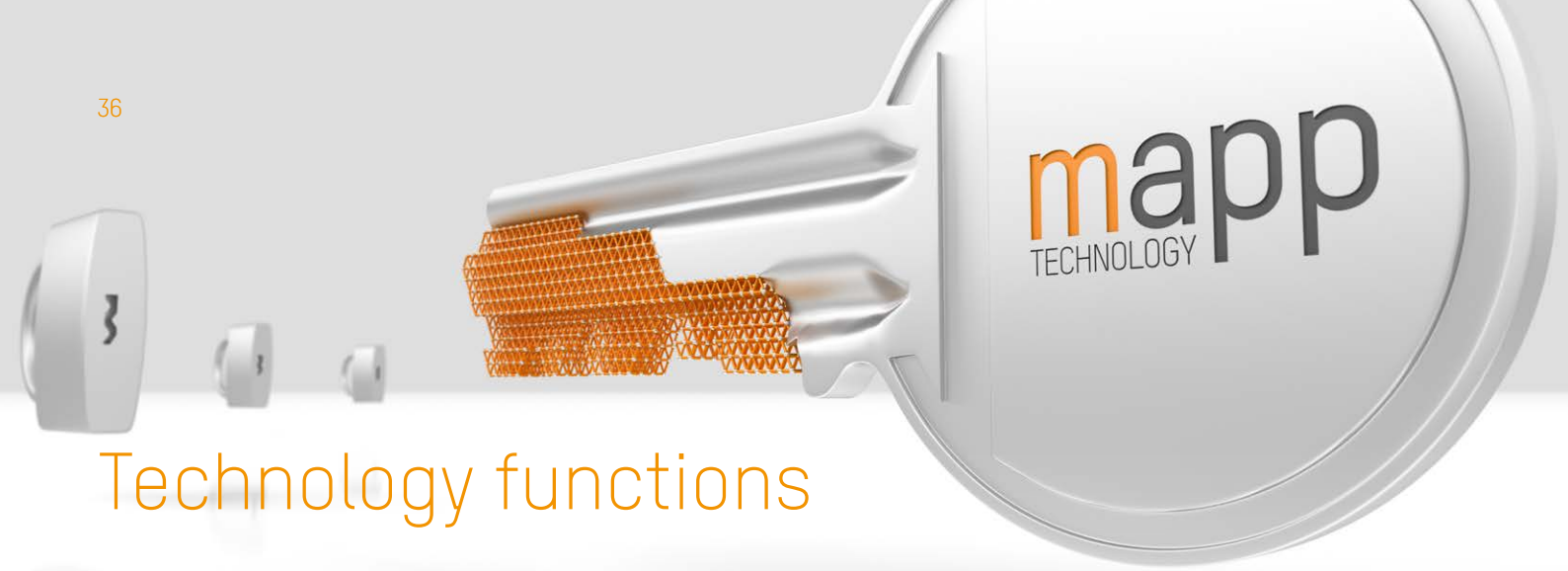
Importing C code

For more complex solutions, there is the C programming extension, which encapsulates C code into a function block that can be imported into SafeDESIGNER. This feature is helpful in situations where you want to execute existing C code on a B&R safety controller or when you have mathematical algorithms with floating point calculations (Float, Double data types).



Your advantage

- Easy to use
- Visual editor
- No added costs
- Visual project comparison
- Visual project comparison
- Import C code



Technology functions

For countless applications, B&R offers ready-to-use function packages and libraries that help users create their safety application more quickly and easily.

Safe PLCopen function blocks

The certified function blocks in B&R's PLCopen library provide a solid functional foundation for any safety application. Tasks such as two-hand controls, E-stop buttons with restart inhibit, mode selectors, dead man's switches and various types of muting can all be solved using these 18 certified, standardized function blocks.

Supplemental libraries offer functions for safe motion control, safe robotics, safe remanent data, safe data type conversion and much more. Together, the certified blocks and vast array of functions make Automation Studio the ideal tool for any safety application – whether it's a simple safeguard for a small machine or an elaborate solution for an entire steel mill.

Safe storage of remanent data

B&R allows you to store user data securely on a removable storage device – the SafeKEY. After startup, the safety controller checks that the data from the SafeKEY is correct before once again making it available in the application. Application-specific calibration and limit values can be stored here securely.

Select the same operating mode via the HMI application

The certified components provided by mapp SafeOPTION make it possible to implement safe operating mode selection and safe parameter input screens in the machine's HMI application. There is no longer any need for a key-operated mode selector switch. Any B&R panel can serve as the HMI without requiring any extra safety certification.

Function blocks for press applications

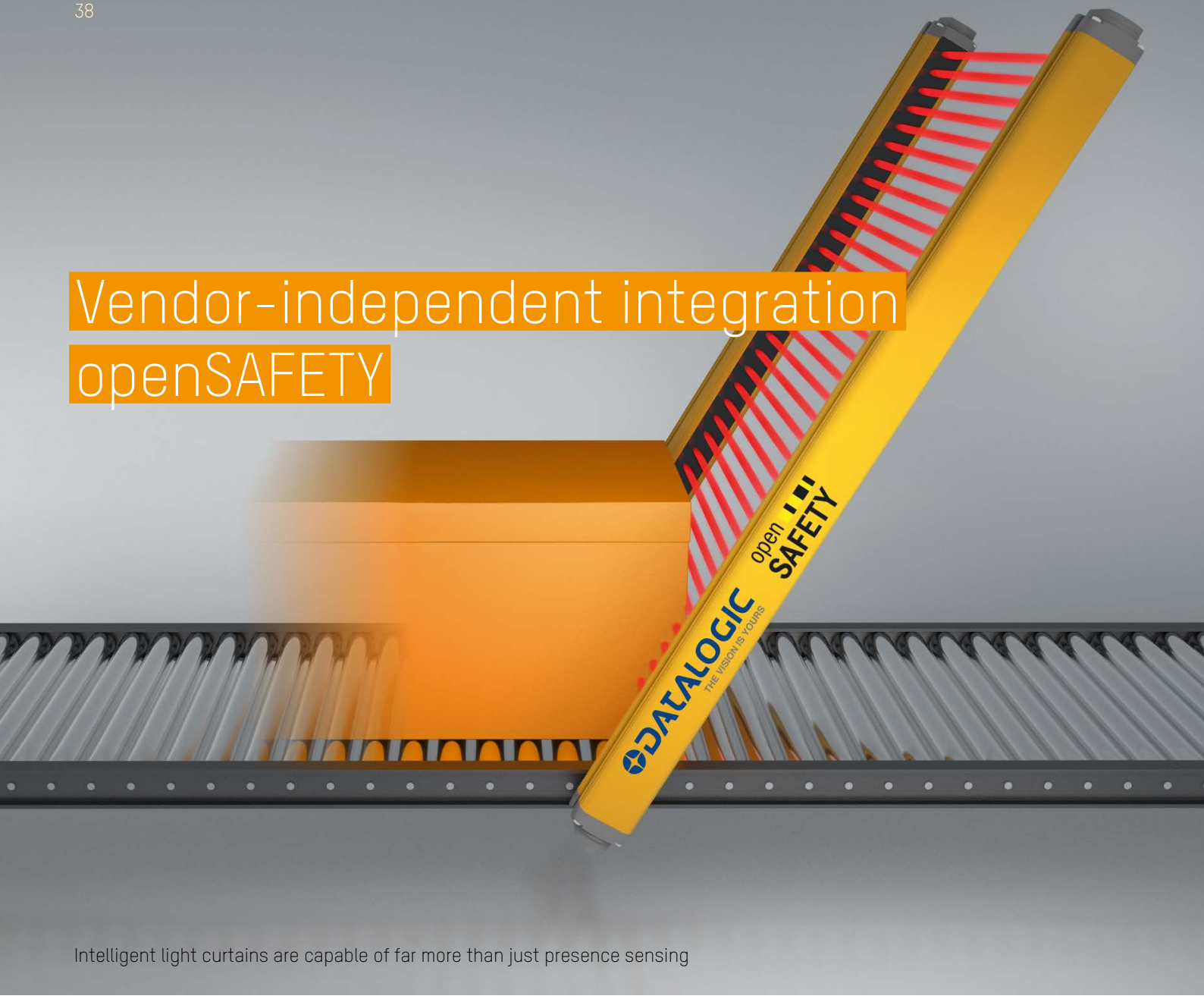
With its library for press applications, B&R is one of the first manufacturers to offer a complete set of the function blocks specified in PLCopen Part 4. As a result, users working with safety-critical press applications will have a much easier time setting up the necessary safety functions. Tasks like controlling hydraulic valves or monitoring different press cycle modes are conveniently encapsulated in these ready-to-use function blocks.

Your advantage

- → Fast and easy application development
- → No key switches
- → Safe storage of user data

Whether new machine or retrofit – the press functions in SafeDESIGNER meet the latest safety standards

Vendor-independent integration openSAFETY



Intelligent light curtains are capable of far more than just presence sensing

The open source safety protocol openSAFETY enables optimal integration of 3rd-party products. With openSAFETY profiles, they can be incorporated into an automation solution just as easily as a B&R product.

B&R offers considerable savings in safety applications through network-integrated light curtains. Light curtains equipped with an openSAFETY interface eliminate the hardwiring required for conventional solutions. The first to bring a network-integrated light curtain to market was Datalogic.

Single-beam evaluation
An additional advantage of openSAFETY light curtains is the ability to evaluate each beam individually. This makes it possible to implement intelligent muting, for example, doing away with the sensors that were necessary for previous muting solutions.

Easy configuration and diagnostics
With a B&R solution using openSAFETY light curtains, safety functions such as muting and blanking are easily programmed in the Automation Studio development environment. The amount of

Safe absolute position and safe speed in one compact device

work needed for commissioning is reduced considerably – especially for series-produced equipment. Diagnostics have also been simplified, with information available in plain text instead of having to be decrypted from blinking LEDs.

Lower costs for safe drives

The CD75M safety rotary encoder from TR-Electronic is a perfect example of how safe drives can respond to external movements at very high speed more easily and cost-efficiently than ever before. This encoder delivers safe position and speed values in openSAFETY format and can be directly connected to POWERLINK networks. It is available with SIL 3 / PL e certification and doesn't require external safety modules or any of their associated programming. The result? Safe monitoring of movement axes without time-consuming hardware setup.

Safety through cross-checking

The CD75M is able to determine safe values for position and speed by cross-checking redundant pairs of scanning sensors and processors. These values are then output via the openSAFETY protocol. During configuration, parameters such as the differential and standstill windows, direction of rotation or integration time are set up directly over the safe configuration channels of openSAFETY.

Safety-related data in the form of openSAFETY packages can be transferred via the same medium as the process data using the "black channel" principle. The openSAFETY rotary encoder from TR-Electronic reduces overall complexity as well as hardware and wiring costs. In addition, innovative features such as automatic configuration of the direction of rotation or differential and standstill windows can be loaded over the network. The rotary encoder from TR-Electronic also provides preset electronic adjustment, which allows the current position value to be applied as the new actual value.

Innovative safety concept

The use of a single communication medium means that it couldn't be easier for the user to access and implement every bit of safe and non-safe data in the application. This not only greatly simplifies and maximizes diagnostics with the CD75M, it also allows the use of innovative functions without requiring extra work. The rotary encoder from TR-Electronic featuring openSAFETY integration truly opens up entirely new safety concepts.

Your advantage

- → Less hardware
- → Shorter commissioning times
- → Easy maintenance
- → No wiring errors

Standards and directives

International regulations provide a foundation for uniform product standards and are essential to the widespread acceptance of safety-related components.

Within the European market, cross-border commerce is facilitated by EU directives and harmonized standards. Of these, the definitive regulatory framework for machine manufacturers is Machinery Directive 2006/42/EC. The most significant harmonized standards for compliance with the machinery directive are ISO 13849-1 and IEC 62061.

Compliance with these standards and the machinery directive supports machine manufacturers when issuing declarations of conformity. The procedure for evaluating conformity requires an analysis of potential dangers followed by a risk assessment. The safety level required for the safety function can be determined using the risk graphs provided in the various standards.

As internationally recognized standards, ISO 13849-1 and IEC 62061 provide the basis for worldwide use of safety systems and components designed in accordance with their requirements. Supplemental national regulations may apply, and these must be evaluated and applied on a case-by-case basis. Fundamentally, however, the two safety standards provide an internationally uniform framework for the requirements to be met by safety technology in machine manufacturing.

All safety technology products from B&R meet the requirements of both ISO 13849-1 and IEC 62061. The products' conformity with applicable standards is always certified by the following independent testing organizations:

- TÜV Süd
- UL (Underwriter Laboratories)

Performance level per ISO 13849-1 (PL)	Probability of a dangerous failure per hour (1/h)	Safety integrity level per IEC 62061 (SIL)
a	$\geq 10^{-5}$ to $< 10^{-4}$	-
b	$\geq 3x10^{-6}$ to $< 10^{-5}$	SIL 1
c	$\geq 10^{-6}$ to $< 3x10^{-6}$	SIL 1
d	$\geq 10^{-7}$ to $< 10^{-6}$	SIL 2
e	$\geq 10^{-8}$ to $< 10^{-7}$	SIL 3

Safety definitions

CCF **Common cause failure**	Failures of different items resulting from a single event, where these failures are not consequences of each other
DC **Diagnostic coverage**	Measure for the effectiveness of diagnostics, which can be determined as a ratio between the failure rate of the observed dangerous failures and the failure rate of total dangerous failures
FVL **Full variability language**	Type of programming language that provides the capability of implementing a wide variety of functions
LVL **Limited variability language**	Type of programming language that provides the capability of combining predefined, application-specific library functions to implement the specified safety requirements
Category	Classification of the safety-related parts of a control system according to their resistance against malfunction and their subsequent behavior in the event of a malfunction
$MTTF_d$ **Mean time to dangerous failure**	Expected average time before a dangerous failure occurs
PFH_D **Probability of dangerous failure per hour**	Average probability of a dangerous failure per hour
PL **Performance level**	Discrete level that specifies the ability of safety-related parts of a control system to perform a safety function under foreseeable conditions
PL_r **Required performance level**	Performance level (PL) applied in order to achieve the required risk reduction for each safety function
SIL **Safety integrity level**	One of four discrete levels used to specify the safety integrity of the safety functions assigned to the E/E/PE safety-related system, whereby 4 is the highest level and 1 the lowest

3 steps to your safe machine

Risk analysis

IEC 62061

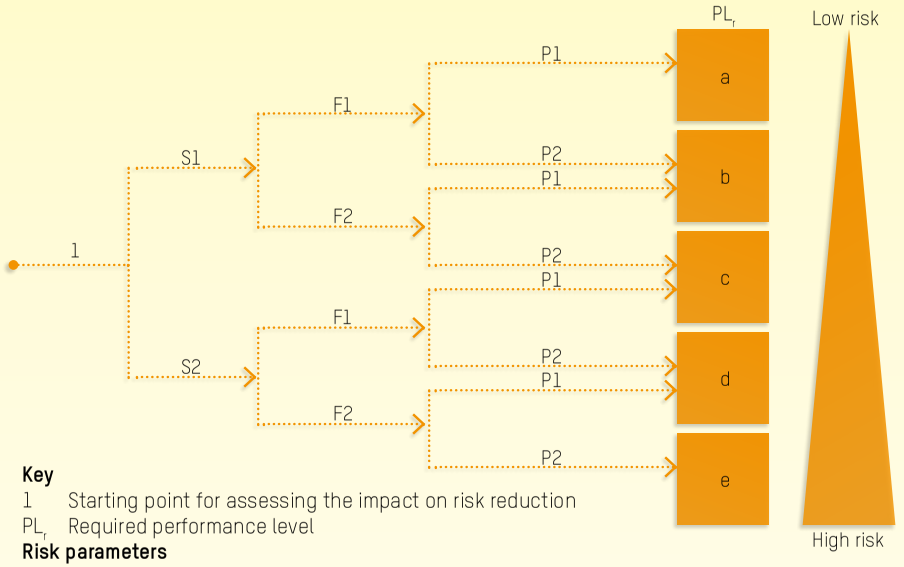
Frequency and duration of exposure (F)		Probability of occurrence (P)		Possibility to circumvent or limit the damage	
> 1 year	2	Negligible	1	Probable	1
> 2 weeks to ≤ 1 year	3	Rare	2	Rare	3
> 1 day to ≤ 2 weeks	4	Possible	3	Impossible	5
> 1 hour to ≤ 1 day	5	Probable	4		
≤ 1 hour	5	Very high	5		

Effects	Severity (S)	Class (C)				
		3-4	5-7	8-10	11-13	14-15
Reversible: First aid required	1				(o.m.) [1]	SIL 1
Reversible: Professional medical treatment required	2			(o.m.) [1]	SIL 1	SIL 2
Irreversible: Broken limb, loss of one or more fingers	3		(o.m.)[1]	SIL 1	SIL 2	SIL 3
Irreversible: Death, loss of an eye or limb	4	SIL 2	SIL 2	SIL 2	SIL 3	SIL 3

1) Other measures

Source: ÖVE/ÖNORM EN 62061:2005

ISO 13849-1



Key
1 Starting point for assessing the impact on risk reduction
PL_r Required performance level

Risk parameters
Sx Severity of injury
Fx Frequency and/or duration of the exposure to the hazard
Px Possibility to circumvent the danger or limit the damage

Source: DIN EN ISO 13849-1:2007

Easy to implement with B&R safety technology

SafeLOGIC

SafeDESIGNER

openSAFETY

X67 and X20 Safe I/O

SafeMOTION

SafeENCODER

Calculating the PL / SIL achieved

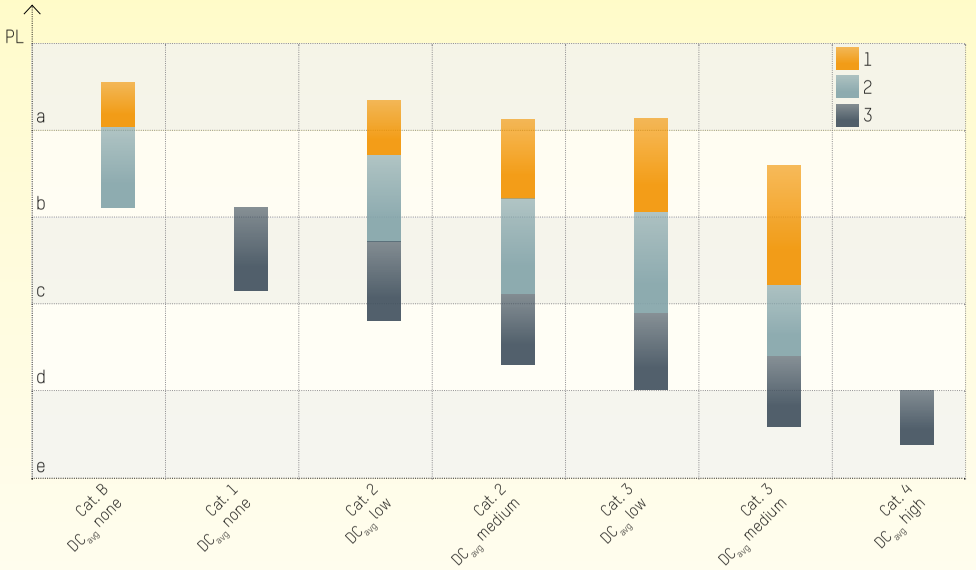
IEC 62061

Safety integrity level	Probability of dangerous failure per hour (PFH_D)
1	$\geq 10^{-6}$ to $< 10^{-5}$
2	$\geq 10^{-7}$ to $< 10^{-6}$
3	$\geq 10^{-8}$ to $< 10^{-7}$

Share of safety-related outages	Hardware fault tolerance		
	0	1	2
≥99%	SIL 3	SIL 3	SIL 3
90% to < 99%	SIL 2	SIL 3	SIL 3
60% to < 90%	SIL 1	SIL 2	SIL 3
< 60%	Not permitted	SIL 1	SIL 2

Source: ÖVE/ÖNORM EN 62061:2005

ISO 13849-1



Source: DIN EN ISO 13849-1:2007

Integrated automation
Global presence
Solid partnership

ETHERNET POWERLINK

open SAFETY

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