Integrated Safety Technology
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**Smart Safe Reaction - It doesn't always have to be downtime**

Conventional safety technology has meant stopping the entire machine group when even the smallest disturbance occurs. B&R’s Smart Safe Reaction uses a completely new approach. Flexible safety functions such as Safe Direction or Safely Limited Increment are integral parts of the drive system and allow service work to be performed during operation. This minimizes the time and effort required for service and installation work and also eliminates the motivation to manipulate the system.

**Virtual wiring - Safety at the click of a mouse**

Safety shutdowns were handled using fixed wiring in the past, but they are now implemented using virtual wiring in Automation Studio. Pre-certified blocks are placed and connected in the graphic editor for this purpose. Even extremely complex relationships can be handled clearly and easily in this way. Unlike with real wiring, an identical copy of the safety application is processed in the safe controller. This completely eliminates wiring errors during series production. Commissioning times are significantly reduced. The safe PLC provides options that were never possible with real wiring.

**Safe wiring made easy**

Intelligent tests integrated in the modules continuously check cable quality, thereby eliminating safety risks for every meter of cable. The use of shielded cables or expensive protected lines is outdated. The testing patterns generated for the tests identify each channel individually. All diagnosed wiring errors can be called up via the network and also referenced during remote diagnostics.

**Integrated yet separate**

A clear separation of components and applications is incredibly important in spite of, or in reality because of, the full integration of safety technology and standard automation components. Anyone using the products must always be 100% certain of whether they are currently working in the safety-related or standard environment. This is why B&R clearly separates safety technology from standard technology:

- Separate safe CPU
- Different housing coding for SafeIO
- Separate password management in Automation Studio
- Isolated engineering interface in Automation Studio

This physical separation also makes it possible to select a cost-optimized standard CPU independent of the safe CPU.

**Avoid service stress concerning safety**

What are the consequences if a single DIP switch on the safe rotation speed monitor has the wrong setting? What happens if a 6 A switching device is replaced by one with 4 A? Your service technician is not likely to find this error and the safety of the machine is no longer ensured. At B&R, the system takes over responsibility for a
A fast response is a good response
Until now, guaranteed, safety-related response times of less than 6 ms have been limited to a few compact controllers on the market - without integration or fieldbus capability. B&R is the only supplier to offer this performance with distributed SafeIO or SafeMC via the machine bus and with all the advantages of integrated safety.

When safe data starts traveling
Safety technology requires a large amount of data and parameters. Why is this data allowed to be transported by a non-certified machine bus? The answer is openSAFETY, the only real-time capable and open safety bus system currently on the market. Data is stored and duplicated in a sophisticated safety container that provides protection against tampering, accidental replacement and delay. As a result, all of the network stations such as controllers, drives, visualization units, remote diagnostics applications and safety technology use the same data on the bus.

Prevent a false diagnosis
Diagnostics are necessary to ensure the right actions are taken when errors occur. Integrated safety technology at B&R allows complete diagnosis of the safety technology and the standard automation components being used. This also includes special information pertaining to the safety environment such as two-channel evaluation or an extensive logbook containing safety-related events. Access is also possible using remote diagnostics.
At first glance, the emphasis of "Integrated Safety Technology" seems to be placed on the products. Indeed, the X20 SafeIO modules, the integral SafeMC (Safe Motion Control) capabilities of ACOPOS and ACOPOS multi-platforms, the SafeLOGIC controller and the SafeDESIGNER toolset in Automation Studio are truly eye-catching. However, Integrated Safety Technology means much more than this: It's a synonym for the way in which safety-related components work with one another and with the standard automation technology being used.

**SafeLOGIC**

Safety-oriented controllers at B&R are purposefully designed as standalone devices. Only in this way can all applications be implemented in a safe manner, regardless of the standard controller that has been selected. However, SafeLOGIC is seamlessly integrated into the entire system according to the principle "integrated yet separate".

**SafeIO**

Safe digital and analog I/O modules are available with IP20 or IP67 protection. In addition to their normal I/O tasks, they also monitor the signal line as well as the connected sensors and actuators. Because they are integrated within the entire system, they initially function in the standard application as normal modules. They deliver input signals and process output commands. Only when used together with SafeLOGIC, do their safety-related characteristics become evident.

**SafeMC**

Direct integration of the safety functions in the drive system greatly reduces response times and opens up new possibilities for decreasing danger. Especially during service work, i.e. situations in which service technicians have to work on running processes, the advantages of Smart Safe Reaction open new perspectives.

**SafeROBOTICS**

Safety-related functions can be used for kinematic objects based on the SafeMC functions and the programming options available using SafeLOGIC. This enables functions such as safe reduced speed on the tool center point of the robot, thereby introducing a new era of safety technology in the area of robotics and CNC.

**SafeDESIGNER**

Programming safety functions on B&R systems is based on SafeDESIGNER’s ability to perform virtual wiring and simple mapping of even the most complex functions. Integration in Automation Studio allows information to flow freely between the standard application and the safety-related program without losing an overview of the two platforms and without responsibilities becoming muddled.

**openSAFETY & POWERLINK**

openSAFETY represents the backbone of a system. The SIL 3 certified container for the openSAFETY protocol transports all safety-related data between components. The true real-time properties paired with POWERLINK's excellent performance characteristics result in an optimal communication platform for machines and systems.

Based on the "black channel" principle, openSAFETY is independent of the underlying transport protocol. This freedom makes it possible to exchange safety-related data via TCP/IP or MODBUS/TCP. As a result, topologies that include wireless components are also possible in addition to standard wired Ethernet networks.

**openSAFETY / AS-i gateway**

As a simple and inexpensive installation system for the lowest field level, AS-i is both accepted and popular. With the openSAFETY / AS-i gateway, AS-i components can be elegantly and easily integrated into B&R systems. More than one hundred companies are offering over a thousand different products for AS-i.
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SafeIO - More than just yellow terminals

What makes SafeIO safe? The internal dual-channel 1oo2 (one out of two) architecture is actually a secondary consideration here. For the user, it is the technological advantages that distinguish the products when they are used in safety-related applications.

**Safe digital inputs**
- Module-internal evaluation of 2-channel sensors
- Separately configurable filters for rising and falling signal edges
- Unique modulation patterns (serial number encoding) on the clock outputs
- Simultaneously suitable for switching devices with contacts and electronic sensors

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<thead>
<tr>
<th>Digital input modules</th>
<th>Analog input modules</th>
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<tbody>
<tr>
<td>X20SI2100</td>
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<td>Current</td>
<td>0.5 A</td>
</tr>
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</table>
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**Safe analog inputs**
- For current, PT100, PT1000 and thermocouple sensors
- Monitor function for minimum programming effort
- Sensor function for maximum usability
- Standard and safe analog measurement in one device
- Certified functions for further signal processing in SafeDESIGNER

**Safe digital outputs**
- Semiconductor or relay technology
- "Plus/Minus" switching outputs for the highest levels of safety
- "Plus switching only" outputs for actuators with GND supply
- Additional current ranges: 0.1 A, 0.5 A, 2 A, 10 A
- Test impulses that can be switched off
- Open-circuit detection (muting lamp monitoring)

Output modules

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<tr>
<th>0</th>
<th>X20SO4110</th>
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<table>
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**Digital**

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**Plus/Minus switching**

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<td>500 μs</td>
<td>500 μs</td>
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</tr>
<tr>
<td>0.5 A</td>
<td>2 A</td>
<td>2 A</td>
<td>100 mA</td>
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<table>
<thead>
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<th>6 A / 48 V</th>
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<tr>
<td>2 A</td>
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**Plus switching only**

<table>
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<tr>
<td>500 μs</td>
<td>600 μs</td>
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Today’s safety technology is rigid and detached from the flexibility of modern machine controllers. Next to slimmed down automation that is based on well-established fieldbus systems, the implementation of safety technology seems archaic by comparison. This missing flexibility often demands safety fences and enclosures, which results in time-intensive and complicated work sequences that further reduce a system’s productivity.

**openSAFETY sets technical standards**

There are a number of new approaches to safe fieldbus systems that are heavily influenced by proprietary standards and slow response times. The ACOPOSmulti drive system is different. Here the approach is systematically based on openSAFETY and POWERLINK. Combining the open and SIL 3 certified services of openSAFETY with the strict yet high-performance real-time behavior of POWERLINK forms the ideal basis for SafeMC.

Functions such as Safely Limited Speed are enabled directly over the network. Wiring these safety-related signals to the drive is now a thing of the past. The information is collected right from its source via safe digital inputs. The information is then distributed to the respective actuators - the drive in this case - via a safe central unit, the SafeLOGIC controller. Thanks to openSAFETY, all information is available directly in the standard CPU; the standard application is then synchronized automatically with the safety application.
openSAFETY also provides for safe parameter assignment. During booting, the parameters on the module are checked against the data on the SafeLOGIC device. If they don’t match, the data is transferred to the module securely via the openSAFETY service. This relieves technicians from the responsibility of always having to configure parameters when performing maintenance.

**Extensive safety functions**
A complete set of safety functions that conform to the IEC 61800-5 safety standard have been implemented in the SafeMC module. They allow even the difficult demands of drive applications to be represented. Even the special operating modes explicitly required in the standards such as maintenance, setup and process observation are easy to implement as a result.

**Fastest response times**
With SafeMC, responses to violations in safety-related areas are triggered directly in the SafeMC module itself. Within just a few milliseconds, a safe stop procedure is initiated. Compared to previously technologies, the response time here reduces the response time by a factor of 10 and the subsequent remaining distance and impact energy by a factor of 100.
One long-term objective for safe robotics is the development of an industrial robot that is safe enough to work hand in hand with its human colleagues without requiring any sort of separator to provide protection. After the integration of safety-oriented controller and drive technology using openSAFETY, the next step towards this goal is the safe monitoring of the entire kinematic chain. As with anything else, the respective machine guidelines form the basis specifications for robots. First and foremost, this has to do with the movements of the robots themselves. In addition, application-specific features such as lasers or water jets in cutting applications need to be taken into consideration.

**Requirement 1: openSAFETY, SafeLOGIC, SafeIO and SafeDESIGNER**

Using the open protocol openSAFETY allows signals to be safely and securely transported via any fieldbus system. Proven SafeLOGIC controller technology and compact SafeIO modules make it possible to integrate a complete range of peripheral safety devices - from pressure-sensitive safety mats to wireless image processing devices - directly into the controller on the robot itself. A safety application for robot systems is developed using function blocks that conform to PLCopen and are certified by TÜV; they are wired virtually in SafeDESIGNER, a platform whose programming capabilities go far beyond simple conventional configuration.
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Requirement 2: SafeMC
Monitoring axis and arm movements as well as mastering braking and stopping distances are just as important as actual sequential control when it comes to the safety of robotic systems. Integrating safety technology directly into servo drives and motors resulted in a reduction of the time it takes to detect and respond to errors from the typical 80 ms (using safety circuits with cut-off relays) down to 7 ms, reducing stopping distances by a factor of 100. This means a reduction in the safety clearance when traveling the same speed, which in turn also reduces the total dimensions of the robot cell itself. A clear advantage of (Safe Brake Control) and SLS (Safely Limited Speed) offers countless alternatives to just shutting off all the machines. This more gentle mechanism not only protects personnel, it also prevents robots from being damaged as a result of safety shutdowns.

Logical consequence: The kinematic chain
The next step to increasing robotic safety currently under development has to do with applying Smart Safe Reaction technology not just at the level of single axes, but to the resulting movement at the tool center point (TCP). In order to do this, the logic of the safe response within the entire kinematic chain must take into consideration all the different possible movements and eventualities that can occur. The SLS@TCP function (Safely Limited Speed at the Tool Center Point) will be available as the first function for this.

ISO 10218-1
The ISO 10218-1 standard specifies the special demands placed on safety technology for robots. For operation at reduced speeds, the standard requires that the speed of the tool center point (TCP) and the flange for the tool fitter is monitored against a maximum value of 250 mm/s. The SLS@TCP function as well as the associated function block in SafeDESIGNER are certified to meet the requirements of ISO 10218-1.
SafeLOGIC - Simply safe

All central tasks are handled using SafeLOGIC. These can be generally subdivided into the following areas: configuration management, parameter management and the safety-oriented application program. When combined with SafeO, SafeMC and/or SafeROBOTICS components, these functions make it possible to implement both extremely simple as well as more complex demands on a uniform, safety-oriented platform.

**Configuration management**
- Ensures a consistent, safety-related machine configuration
- Checks the module type as well as hardware and firmware versions against application specifications
- Checks the configuration at startup and periodically during operation
- Mechanisms specified in openSAFETY and usable across manufacturer lines

**Parameter management**
- Ensures consistent parameters on the devices
- Checks parameters against the application’s specifications and performs complete parameter downloads independently
- Mechanisms specified in openSAFETY and usable across manufacturer lines

**Safety-oriented application program**
- Diverse execution of the code generated in SafeDESIGNER
- Highest process performance for application cycle times of 1 ms and higher
- Implicit signal transfer and synchronization of diagnostic states with the standard CPU

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**Scalable safety technology:**
- **SafeLOGIC Standard**
  For simple applications up to a maximum of 20 nodes
- **SafeLOGIC Extended**
  For complex applications
- **SafeLOGIC Motion**
  For safe motion applications
SafeKEY
- Memory for the application program, the configuration and the device parameters
- The SafeKEY has been designed to be removable so that data can be transferred easily to an initialized SafeLOGIC device during maintenance

Machine options
Managing machine options and machine types is definitely the pinnacle of series machine manufacturing. It is a fact that one machine is rarely exactly the same as another. A slew of options determines the actual machine characteristics and often also determines the functionality of the safety technology. With integrated safety technology from B&R, this challenge can be mastered in a simple and elegant way.

With SafeDESIGNER, most of the available machine options are implemented with virtual wiring. Optional safety-related functions are grouped into machine options in the next step. A safe activation signal then determines if machine options exist or not and subsequently determines if the safety function will be executed or bypassed. A safe input channel, virtual signals in SafeDESIGNER or a configuration file from the standard application can be used as the signal source, depending on the specific requirements of the machine manufacturer.

A single safety application for different levels of machine expansion - all configurable from the operator panel.
SafeDESIGNER - Virtual wiring

Clear and easy to use development tools are highly important when programming safety-related applications. In this regard, the concept of virtual wiring has been consistently implemented in SafeDESIGNER. The most important characteristics are:

- Graphic linking of predefined function blocks
- Parameter-defined signal processing
- Identifiable safety application
- Graphical commissioning and validation of the complete project documentation

**Graphic linking of predefined function blocks**
SafeDESIGNER function blocks are certified by TÜV Rheinland. They have therefore been shown to function properly by an independent testing institute. Engineers handling safety-related applications can concentrate on connecting these function blocks in the graphics editor. Even challenging safety applications can be implemented in an easy, fast and intuitive manner.

**Parameter-defined signal processing**
The functionality of the safety-related application depends greatly on the quality and preprocessing of the signals used. With B&R products, the functions required for this purpose are represented in the device as parameter-defined properties. The safety-related program is therefore not loaded down with unnecessary programming code for signal processing.

Examples of this:
- Signal filter
- 2-channel analysis
- Safe Motion Control functions
- Limit value monitors
- Safety measures for the response time

Default values for parameters are always tuned to typical applications. Making specific parameter settings is usually not necessary. The application engineer doesn’t have to spend time setting parameters for unnecessary functions.

When downloading a project, all parameters are stored together with the safety-related application on the SafeKEY for the SafeLOGIC. When booting, they are sent by the SafeLOGIC to peripheral safety modules. The user doesn't have to worry about the consistency and distribution of the data.

**Identifiable safety application**
Hard wiring means that each machine produced in a series is wired individually. This method is extremely susceptible to errors, so each machine has to be thoroughly and extensively tested. If safety components are exchanged during service work, then the wiring must also be remapped and completely retested. All measures must be documented in a manner that ensures traceability and are only permitted to be implemented by trained personnel.

The integration of SafeDESIGNER reduces costs in all phases of a machine’s life cycle.
When SafeDESIGNER compiles applications with virtual wiring, the user name, date/time and CRC are also saved as identifying properties. After the program has been checked once, the same identifying properties always result in the same machine characteristics. The properties can be read from the SafeLOGIC by service personnel without the SafeDESIGNER. During commissioning or service work, it's only necessary to carry out simple wiring tests for actuators and sensors and to make sure that the identifying properties match the machine documentation.

Graphic commissioning and validation
SafeDESIGNER also provides graphic support for commissioning. Functions such as variable watch, forcing safety-related signals, listing cross references and much more reduce the workload here. Integration in the graphics editor ensures simple and intuitive operation.

Complete project documentation
This documentation must be complete, concise and easy to understand. This is required by the relevant standards. Documentation is therefore a central feature in SafeDESIGNER, not just an afterthought. The program code and all data and parameters in the safety-related application are summarized in clearly organized project documentation. This includes application-specific test instructions, documentation of the test results, the names of the engineers responsible for the project and much more.

Integrated yet separate
Errors and problems always occur at the interfaces separating different systems. The complete integration of SafeDESIGNER in Automation Studio eliminates this error source, however. In addition, the user profits from uniform tooling, comprehensive debugging and system-wide data exchange between the standard application and the safety-oriented project. The separated design of the editor allows the application engineer to always know whether he is working in a safety-related or standard context.
Simplifying the development of safety-oriented applications - that's the goal of the PLCopen Safety workgroup. The PLCopen guideline package includes safe data types, a complete diagnostics concept and standardized function blocks. In addition to B&R, other well-known automation manufacturers as well as TÜV Rheinland and the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) have also worked on the specification. These guidelines are widely accepted in the industry for this reason and many others.

The requirements for PLCopen have been consistently implemented in SafeDESIGNER. This can be recognized, for example, through the use of safety-related data types such SAFEBOOL, SAFEWORD, SAFETIME, SAFEINT, etc. as well as the strict separation of safe and non-safe data types. Function blocks specified by PLCopen are included in SafeDESIGNER free of charge as the PLCopen and PLCopen Motion libraries. An interesting aspect results from the diagnostics concept integrated in the PLCopen function blocks. The function blocks signal their internal states and errors using a standardized data interface. Data content is interpreted in the same way for all function blocks. This allows diagnostics to be handled independently of how the function blocks are connected. Diagnostics are usually implemented in the standard application, so this information is also available in the standard CPU.

**Sensor connection**

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<th>Function block</th>
<th>Function</th>
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<tr>
<td>EQUIVALENT</td>
<td>1 of 2 evaluation of two equivalent contacts (N.C. / N.O. or N.O. / N.C.) with discrepancy time monitoring</td>
</tr>
<tr>
<td>ANTIVALENT</td>
<td>1 of 2 evaluation of two antivalent contacts (N.C. / N.O.) with discrepancy time monitoring</td>
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<tr>
<td>MODE SELECTOR</td>
<td>Operating mode switch (1 of max. 8 evaluation) with discrepancy time monitoring</td>
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<tr>
<td>EMERGENCY STOP</td>
<td>E-stop evaluation with restart inhibit</td>
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<tr>
<td>ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT (ESPE)</td>
<td>Evaluation of an ESPE signal with restart inhibit</td>
</tr>
<tr>
<td>TWO-HAND CONTROL TYPE II</td>
<td>Evaluation for a two-handed operator console without monitoring of the simultaneous operation</td>
</tr>
<tr>
<td>TWO-HAND CONTROL TYPE III</td>
<td>Evaluation for a two-handed operator console with monitoring of the simultaneous operation</td>
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<td>SAFETY GUARD MONITORING</td>
<td>Safety door monitoring with discrepancy time monitoring and restart inhibit</td>
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<tr>
<td>TESTABLE SAFETY SENSORS</td>
<td>Testing of an ESPE device with restart inhibit</td>
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<tr>
<td>ENABLE SWITCH</td>
<td>Evaluation of an enable switch with restart inhibit</td>
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**Actuator connection**

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<td>OUTCONTROL</td>
<td>Control of an actuator with restart inhibit</td>
</tr>
<tr>
<td>EXTERNAL DEVICE MONITORING</td>
<td>Control of an actuator with evaluation of the feedback signals and restart inhibit</td>
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<tr>
<td>SAFETY REQUEST</td>
<td>General safety request with status monitoring</td>
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<tr>
<td>SAFETY GUARD INTERLOCKING WITH LOCKING</td>
<td>Control of a safety door with bolt</td>
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Muting

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<thead>
<tr>
<th>Function block</th>
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<tbody>
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<td>SEQUENTIAL MUTING</td>
<td>Muting with standard sensors arranged sequentially</td>
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<tr>
<td>PARALLEL MUTING</td>
<td>Muting with standard sensors arranged in parallel</td>
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<td>PARALLEL MUTING WITH 2 SENSORS</td>
<td>Muting with safety sensors arranged in parallel</td>
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Motion/Robotics

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<td>SAFEMC</td>
<td>Request and status monitoring of SafeMC functions:</td>
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<td></td>
<td>STO  Safe Torque Off</td>
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<td></td>
<td>STO1 Safe Torque Off, single channel</td>
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<td>SOS  Safe Operating Stop</td>
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<td>SS1  Safe Stop 1</td>
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<tr>
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<td>SS2  Safe Stop 2</td>
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<td>SLS  Safely Limited Speed</td>
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<td>SMS  Safe Maximum Speed</td>
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<td>SDI  Safe Direction</td>
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<td>SLI  Safely Limited Increment</td>
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<tr>
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<td>SLP  Safely Limited Position</td>
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<td>SMP  Safe Maximum Position</td>
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<td>SBC  Safe Break Control</td>
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<tr>
<td>SAFERC</td>
<td>Request and status monitoring of SafeMC functions:</td>
</tr>
<tr>
<td></td>
<td>SLS@TCP Safely Limited Speed at Tool Center Point</td>
</tr>
</tbody>
</table>
IEC approves openSAFETY as a worldwide standard

The fieldbus-independent openSAFETY protocol has been tested according to IEC 61784-3 FSCP 13 and approved by national IEC committees representing 27 countries including China, the USA and Germany, therefore undergoing rigorous examination before being approved for international standardization. Since openSAFETY remains independent of any particular bus, it can be used with all fieldbus or industrial Ethernet systems. End customers have been requesting a uniform and manufacturer-independent standard for years, and openSAFETY is the answer to those requests. This system makes possible productivity increases that cannot currently be matched by other safety protocols.

One uniform safety standard for entire machine lines

openSAFETY is a uniform safety standard for a complete machine product line, independent of the controller manufacturer and fieldbus standard being used. This enables the bus-independent standard openSAFETY to reduce costs and start-up times for entire production plants.

Highlights:
- A uniform standard for all leading fieldbus systems
- Highest level of productivity through direct communication
- Reduced service and commissioning times
- Automatic safe parameter configuration
- Ideal for safe modular machine concepts
- The only 100% open safety solution
- The fastest IEC 61508 SIL3 communication solution
- No investment risk: TÜV certified conformity test
Integrated Safety Technology

Advantages for the plant operator
- One comprehensive safety standard for the entire plant
- For all controller manufacturers
- Ideal for safe modular system concepts
- Minimal commissioning and retooling times
- Investment security - legal and technical independence

Advantages for the machine manufacturer
- Free selection of safety sensor technology
- Faster response times
- Reduced safety clearances
- Increased productivity
- Simplified implementation of machine guidelines
- Series availability of Safe Motion

Advantages for the sensor manufacturer
- Development only necessary once
- No investment risk
- Minimal time-to-market
- Low costs due to open source
- Guaranteed interoperability
- No risk for redesigns
AS-i and AS-i Safety at Work

As a simple and inexpensive installation system for the lowest field level, AS-i is both accepted and popular. With AS-i Safety at Work, these advantages are also being offered for safety-oriented sensors and actuators as well. This is why K.A. SCHMERSAL GmbH and more than a hundred other companies are now offering various products for use with this system.

Intelligent sensor technology from the safety experts at K.A. SCHMERSAL GmbH. Thanks to the AS-i / openSAFETY gateway, seamless integration into B6R systems is not only possible, it is also extremely easy.
A secure gateway between AS-i Safety at Work and openSAFETY

The AS-i technology leader Bihl + Wiedemann is producing a secure AS-i / openSAFETY gateway. On the AS-i side, this gateway provides an AS-i master with an integrated safety monitor. For openSAFETY, the gateway is seen as a safe I/O node with a flexible number of secure input and output signals; the exact number is taken from the AS-i configuration.

With this gateway, safety-oriented and standard data as well as diagnostic information can now be exchanged between the openSAFETY network and the AS-i installation in both directions.
Adherence to legal requirements and guidelines is essential for companies who want to keep their liability claims to an absolute minimum. The resulting measures are generally implemented according to the state of technology, which is established by norms and standards.

In the area of safety-oriented technology, the IEC 61508 standard defines this state in a very general way. The certification of products according to IEC 61508 requirements allows products to be used in general safety-oriented applications such as cable propelled transport (ski lifts and gondolas) or those related to medicine.

For process-related applications, however, the IEC 61511 standard must be applied. Based on IEC 61508, it details the safety-related requirements specifically for process industries.

In the area of machine manufacturing, requirements are governed by machine directives in Europe (DIRECTIVE 2006/42/EC) as well as the ISO 13849 and IEC 62061 standards internationally.

All products enhanced by B&R’s Integrated Safety Technology are internationally recognized and have been certified by the respective governing bodies. This guarantees that products can be accepted even in the international arena. All safety-related data is listed in the respective documentation.
**SISTEMA library**

In order to mathematically analyze achieved performance levels according to ISO 13849, the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) has developed a PC-based tool. This tool, known as “SISTEMA”, can be downloaded at no cost from the IFA homepage. It is available in both German and English.

Like many well-known manufacturers of sensors and actuators, B&R also offers a library where safety-related data values do not need to be entered manually, making the tool considerably easier to use. This library can be downloaded free of charge from the B&R homepage.

**Links:**

- **SISTEMA download - German**
  www.dguv.de/ifa/de/pra/softwa/sistema
- **SISTEMA download - English**
  www.dguv.de/ifa/en/pra/softwa/sistema
- **B&R SISTEMA library**
  www.br-automation.com/sistema