SIGMATEK

Safety System

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Safety in Machine and Plant Building
Efficiency and Safety

Due to the new ISO 13849-1 machine guidelines, machine and plant manufacturers are required to conduct a comprehensive analysis of potential dangers posed by machines. Corresponding to this risk assessment, technical and organizational measures must be taken to ensure the safe operation of a machine during all possible operating states (continuous operation, setup mode, test, etc.).

Automation Solutions with Integrated Safety

In the past, typical Safety functions such as emergency stop switches, light grids or Safety door guards were separate units, which were designed and built as additional equipment that was independent from the control technology. However today's users demand automation systems, which in addition to conventional tasks of control and drive technology, also include integrated Safety functions; Because only an integrated complete solution provides the user with a real competitive advantage by considerably simplifying the engineering of machines and significantly reducing the time and cost required for certification.

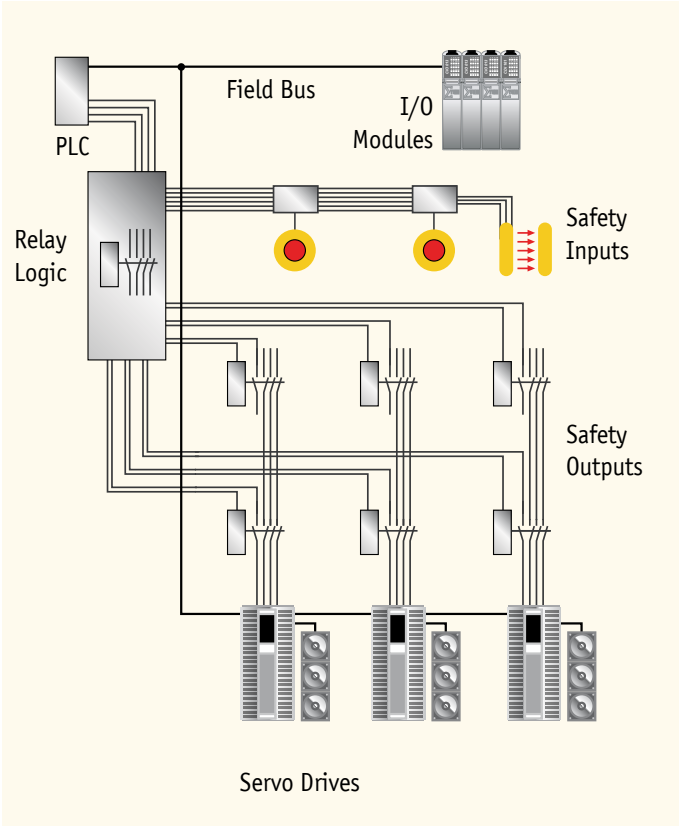
Better Technology for Better Solutions

Because classic Safety systems were inflexible and required a great deal of wiring and programming, the trend moved towards complete integration into the standard control system and enabled cost and space savings, flexibility and efficiency.

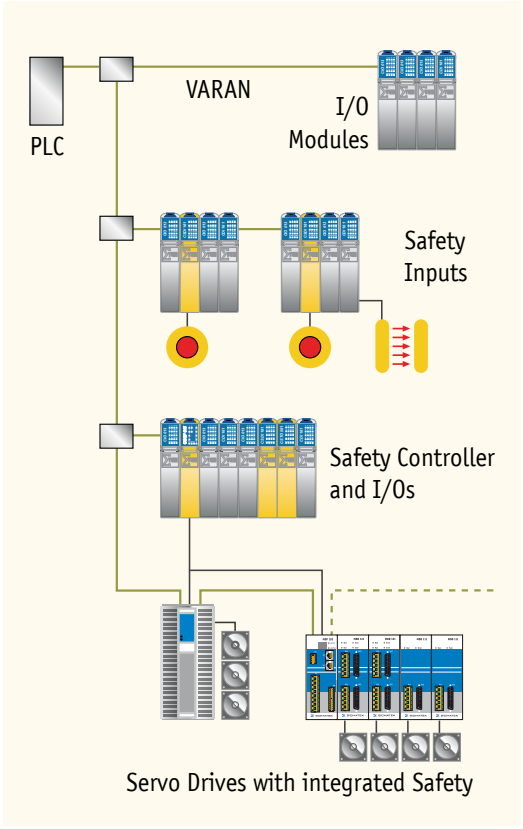
Through an optional decentralized configuration and the modularity of the components, individual requirements can be flexibly realized and existing systems can be easily expanded with Safety functions.

The basis of SIGMATEK Safety solutions is hardware components that regularly monitor themselves to detect possible errors and put the machine in a safe status if necessary. Protection for the operator is therefore ensured without affecting the performance of the machine.

The modern Safety system from SIGMATEK allows easy implementation of the requirements according to ISO 13849-1. Simple installation and comfortable programming contribute to a significant increase in the efficiency of your machine.



Conventional Safety technology



Modern automation concept
with integrated Safety

Consistency for Your Machine:

C-DIAS System with Integrated Safety

The Safety system is completely integrated into the world of SIGMATEK controls. All Safety components can be combined as desired with any module of the C-DIAS series. Safety functions are already integrated into the drives as well. This consistency generates a real added value: In addition to control technology, visualization and motion control, Safety also comes from one source. The entire system meets the **IEC 61508 / SIL 3 / PL e** standard.

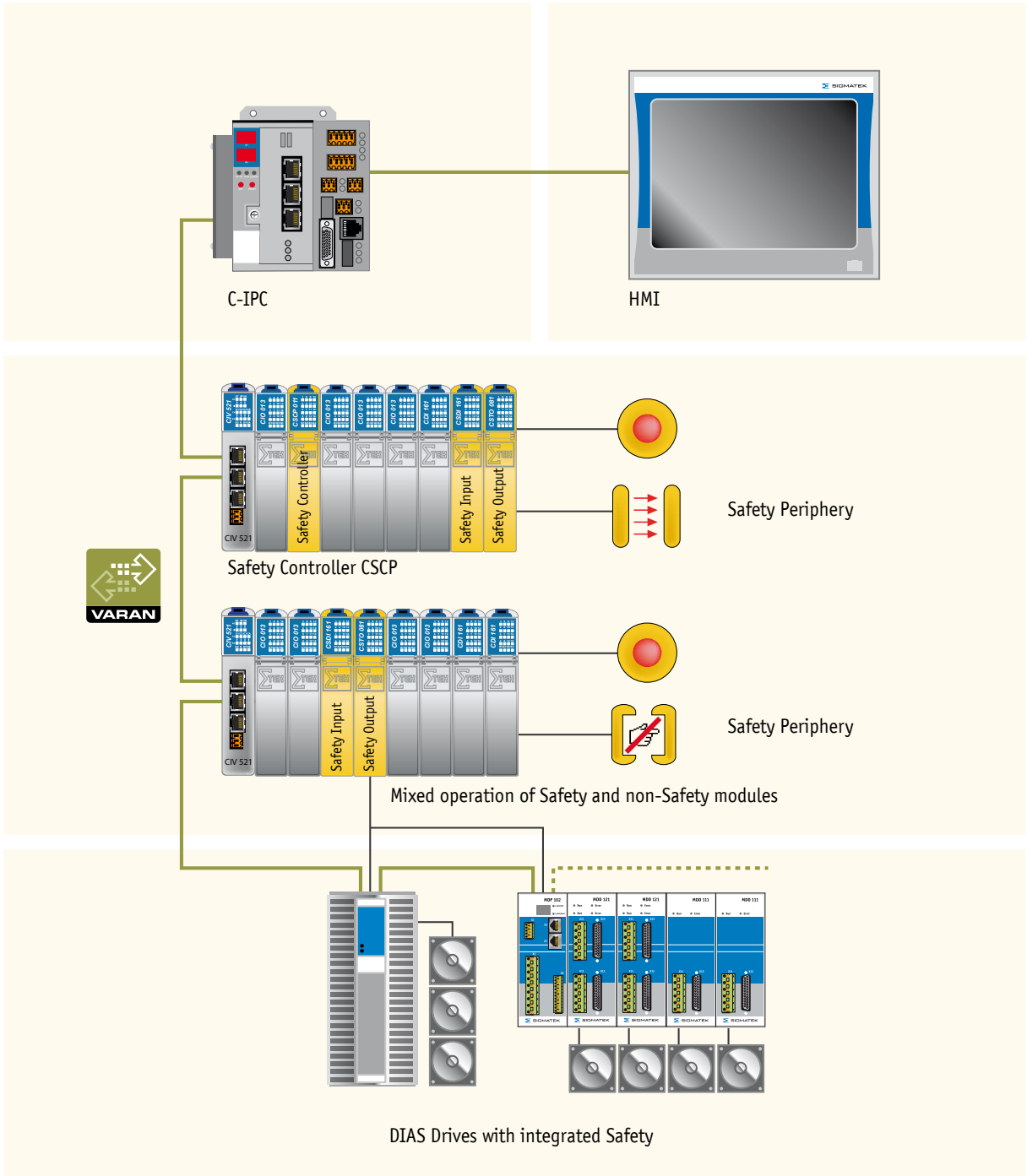
Flexibility and Safety

As usual with SIGMATEK, any topology and configuration is possible in the Safety system as well. The modularity ensures individual customization for any requirement. The system is therefore flexible and suited for application in various branches. The proven compact design, simple module exchange through uncomplicated wiring and hard real-time capability were transferred from the control to the Safety system as well.

Efficient Communication

For communication, no additional wiring is needed. In addition to standard data, safety-relevant data can also be exchanged over the Ethernet-based, hard real-time capable VARAN bus. For communication between the Safety components, the „Black-Channel“ principle is used, in which the bus does not assume any safety-relevant tasks but serves as a single-channel data exchange medium only and does not have to be included in Safety considerations. The Safety telegram is embedded in the standard VARAN frame: The data and addresses are coded twice and saved through a check sum (CRC), which includes a timestamp. Thereby faulty data during communication is clearly detected.

C-DIAS with Integrated Safety



The Safety components can be configured decentrally and combined as desired with any module of the C-DIAS series.

C-DIAS Safety

All hardware components of the Safety system have a safe core provided by their two-channel construction. They can be mounted on any module carrier of the C-DIAS series. The modules can be exchanged quickly and easily.

Modular Constructed Safety Solution

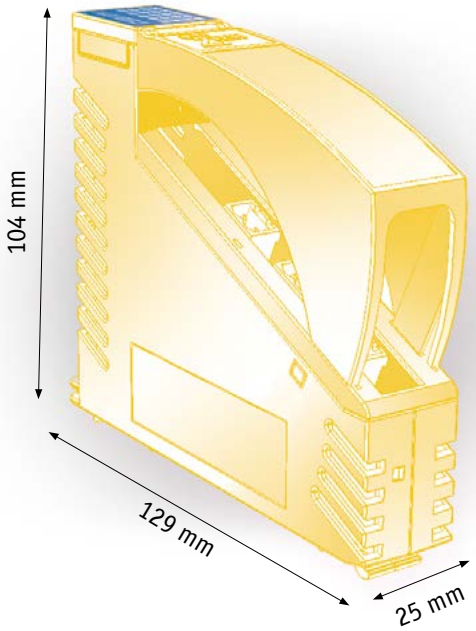
The modular construction of the C-DIAS series allows safe and non-safe components to be combined as required. Flexibility and expandability are important arguments for the SIGMATEK C-DIAS Safety system.

The heart of the system is the **CSCP 011 Safety controller**, which has 4 safe inputs and 2 safe outputs. Therefore additional Safety modules are not required for simple applications. The module stores the application and monitors and/or controls the Safety I/Os.

For expansion, the **CSDI 161 Safety module** with 16 safe inputs and 2 short-circuit proof signal outputs is available, as well as the **CSTO 081 Safety module** with 8 safe short circuit protected outputs.

The C-DIAS Safety System was **certified by TÜV Rheinland** according to IEC 61508 / SIL 3 / PL e.

Mechanical Dimensions:



Controller

C-DIAS Safety CSCP 011

Output specifications

Number of outputs	2 outputs	
Rated output voltage	+24 V DC	
Max. output current	2 A	
Turn on delay	< 200 µs	
Turn off delay	< 1 ms	
Miscellaneous	short circuit protected	

Input specifications

Number of inputs	4 or 2 two-channel inputs	
Input voltage	+24 V DC	
Signal strength	low: ≤+5 V	high: ≥+15 V
Switch threshold	typically +11 V	
Input current	5 mA at +24 V	
Input delay	max. 2.5 ms	

Specifications for cross-circuit detecting output signal

Number	2 signal outputs
Rated output voltage	+24 V DC
Output current	100 mA at +24 V
Miscellaneous	short circuit protected

I/O Module

C-DIAS Safety CSDI 161

Input specifications

Number of inputs	16 or 8 two-channel inputs	
Input voltage	+24 V DC	
Signal strength	low: ≤+5 V	high: ≥+15 V
Switch threshold	typically +11 V	
Input current	5 mA at +24 V	
Input delay	max. 2.5 ms	

Specifications for cross-circuit detecting output signal

Number	2 signal outputs
Output voltage	+24 V DC
Output current	100 mA at +24 V
Miscellaneous	short circuit protected

I/O Module

C-DIAS Safety CSTO 081

Output specifications

Number of outputs	8 outputs
Rated output voltage	+24 V DC
Max. output current	2 A
Turn on delay	< 200 µs
Turn off delay	< 1 ms
Miscellaneous	short circuit protected

Safe Drive Technology

Highly dynamic motion control applications require fast reaction times and real-time capable communication from the Safety technology to prevent uncontrolled movements if an error occurs. In the SIGMATEK DIAS Drives, essential Safety functions are already integrated.

Consistency in the Entire Line

With its Motion Control System, SIGMATEK offers reliable drive technology. The optimal interaction between the control, drives and software allow dynamic and exact motion sequences.

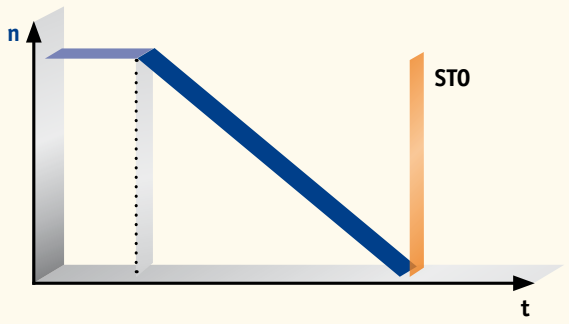
The motion control tasks are processed by the control CPU; no expensive intelligence in the drive is needed. This consistency extends into the area of Safety. In the various DIAS Drives series, essential Safety functions such as **Safe Stop 1 (SS1)** or **Safe Torque Off (STO)** are already **integrated**.

Additional functions such as Safe Operating Stop (SOS), Safety Limited Speed (SLS) or Safe Direction (SDI) are in development.

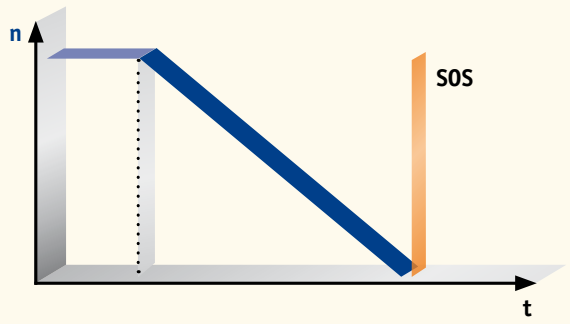
STO	**Safe Torque Off**
SS1	**Safe Stop 1**
SS2	**Safe Stop 2**
SOS	**Safe Operating Stop**
SLS	**Safety Limited Speed**
SDI	**Safe Direction**
SLT	**Safety Limited Torque**

Safety Functions

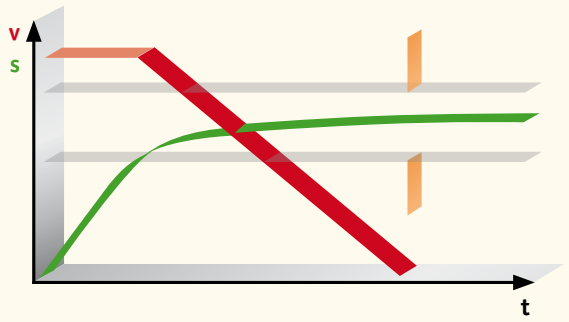
Safe stop 1, SS1



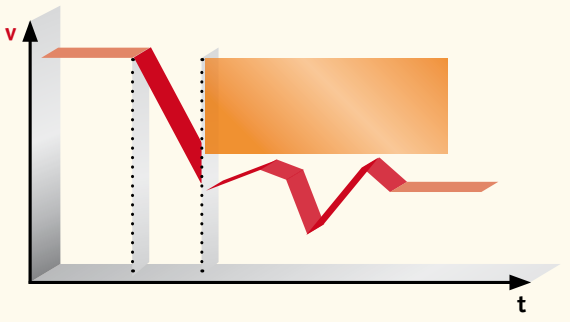
Safe stop 2, SS2



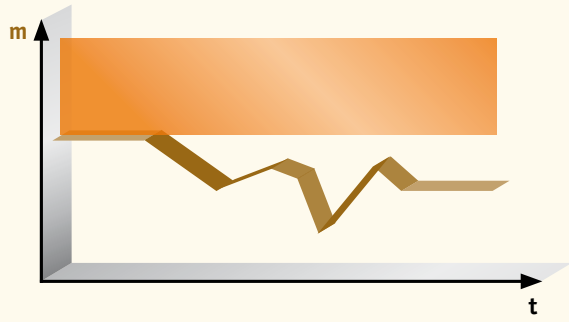
Safe operating stop, SOS



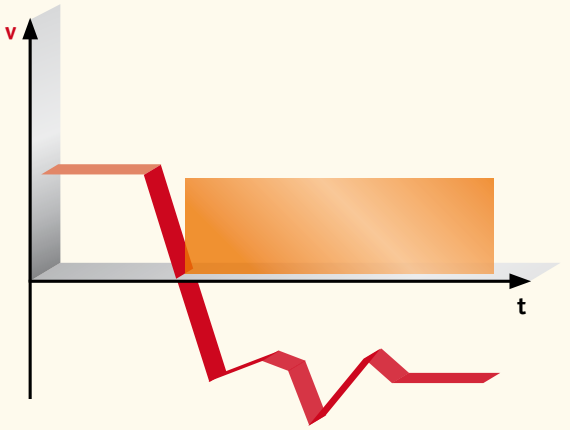
Safety limited speed, SLS



Safety limited torque, SLT



Safe direction, SDI



Safety Seamlessly Integrated with the LASAL SAFETY Designer

The full integration of the SAFETY Designer into the LASAL Engineering Toolkit simplifies the programming and configuration of the Safety Controller. Logic operations and I/O configurations can be created comfortably.

Easily integrate Safety

With the functions library, which in addition to **standard function blocks**, provides **Safety function blocks** based on the PLCopen standard such as Emergency Stop, Two Hand Control or Guard Locking, the user can easily create the logic operations for the safety-relevant tasks.

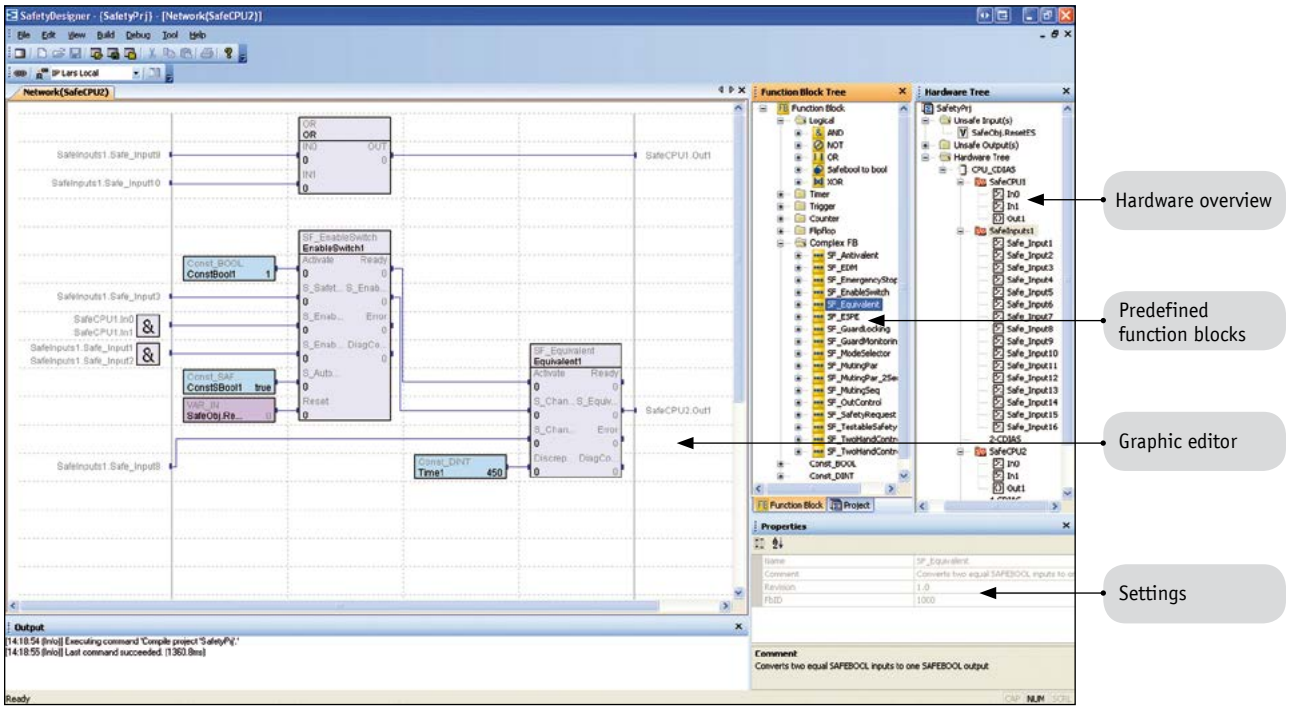
In the **integrated graphic editor**, function blocks and I/Os can be easily placed through Drag & Drop and connected to the non-safe variables of the PLC. Downloading, online monitoring and debugging are done over LASAL's online interface.

Several Safety controllers can be used per project, whereby the program in each Safety controller can be distributed over any number of networks.

The **simple operation** and **clearly organized representation** reduce time and effort for programming, maintenance, diagnosis and especially for the validation.

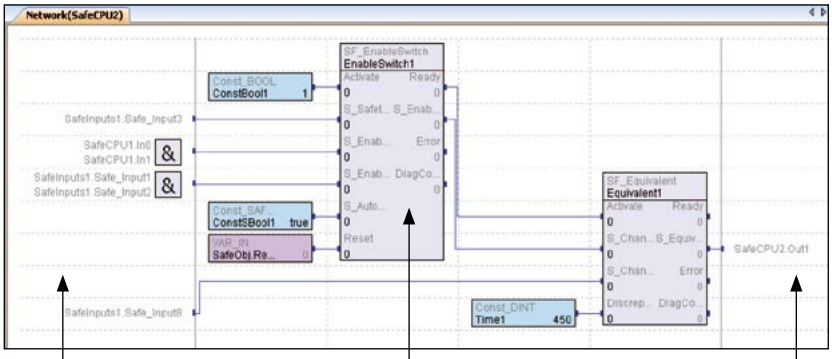
The LASAL SAFETY Designer User Interface

The LASAL SAFETY Designer offers the same operating comfort as LASAL, into which it is seamlessly integrated. Predefined function blocks simplify programming and maintenance.



Graphic Editor

In the integrated graphic editor, the function blocks and I/Os can be easily allocated from the project tree. Logic AND operations can be created in the input module directly.



Inputs

- Allocation using drag & drop from the hardware tree
- Logic AND operation of two-channel inputs

Function blocks

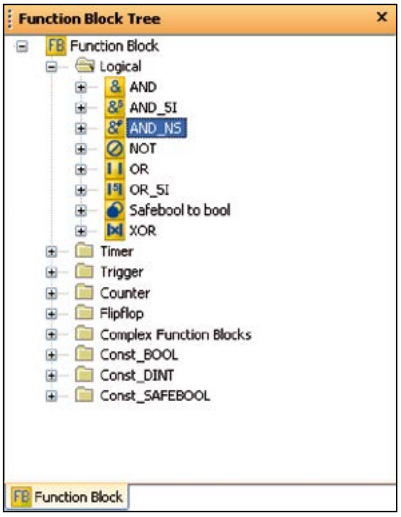
- Allocation using drag & drop from the function block tree
- Wiring of predefined function blocks with I/Os, variables, constants and help variables

Outputs

- Allocation using drag & drop from the hardware tree

Safety Function Blocks

The LASAL SAFETY Designer functions library contains, in addition to predefined, certified standard function blocks (logic blocks, timers, counters, etc.), function blocks based on the PLCopen standard:



- **Equivalent** - AND connection between 2 normally open inputs with time verification of the transition state
- **Antivalent** - AND connection of a safe normally open and normally closed input with time verification of the transition state
- **ModeSelector** - Selection of the system operation mode (e.g. manual, automatic, semi-automatic,...)
- **EmergencyStop** - Monitoring of an emergency stop switch and restart mechanism
- **GuardMonitoring** - Monitoring of protective equipment with 2 switches and a restart mechanism
- **TwoHandControl TypeII** - Implementation of a two-hand control
- **TwoHandControl TypeIII** - Implementation of a two-hand control with a predefined time difference of 500 ms
- **GuardLocking** - Controlling access to a dangerous area through a lockable protective device
- **TestableSafety Sensor** - Periodic testing of Safety sensors to avoid a dangerous failure
- **MutingSeq** - Suppression of the Safety functions, if the component moves into the danger zone, with 4 sequentially allocated sensors
- **MutingPar** - Suppression of the Safety functions, if the component moves into the danger zone, with 2 parallel allocated sensors
- **MutingPar_2Sensor** - Suppression of the Safety functions, if the component moves into the danger zone, with 2 parallel allocated sensors
- **EnableSwitch** - Evaluate the status of a release switch with 2 channels
- **SafetyRequest** - Request for the security function of an output and safe status monitoring
- **OutControl** - Combination of the control application with the Safety control to activate a safe output
- **EDM** - Activation of a safe output with monitoring of the output status using two feedback signals

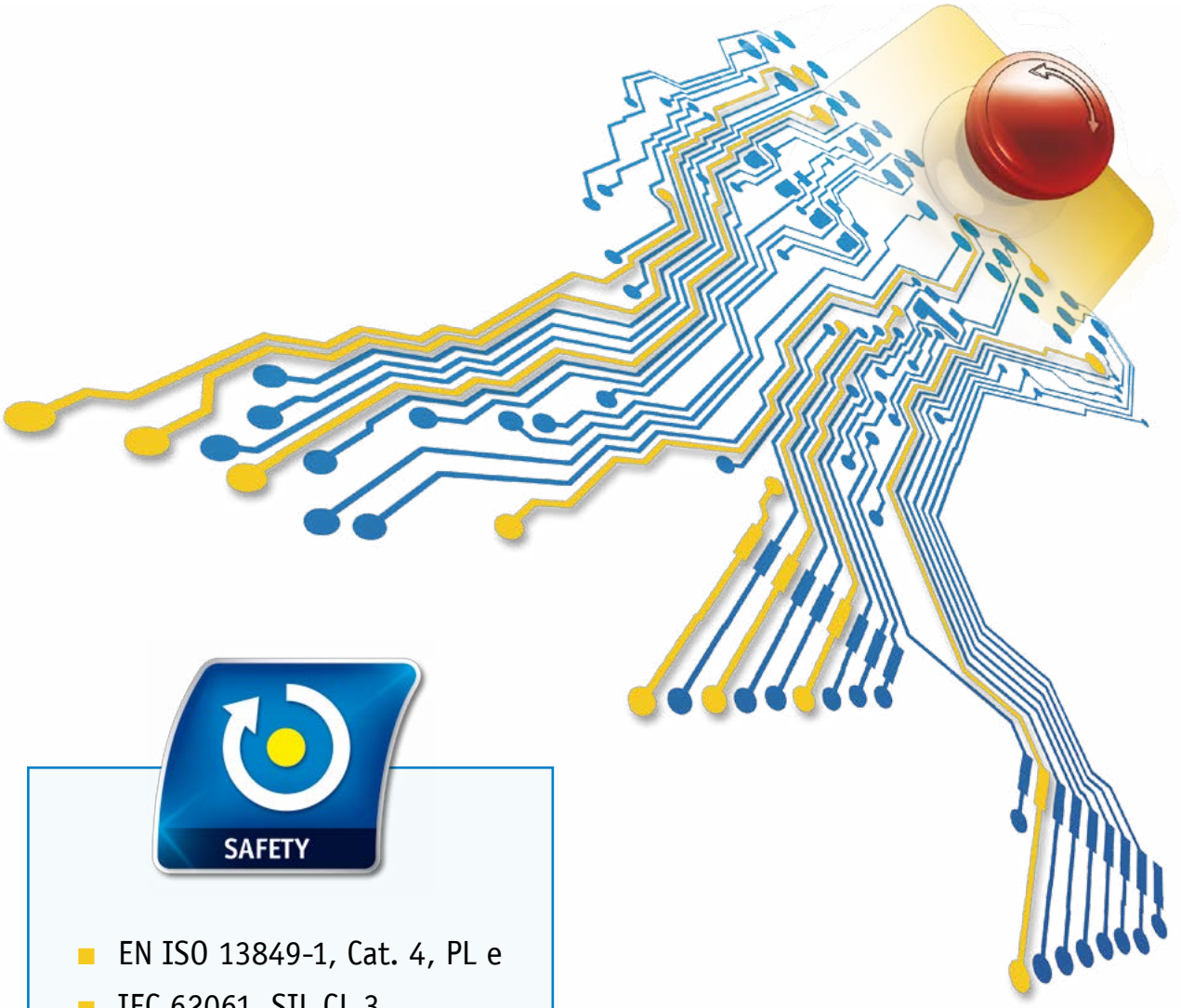
Guidelines and Norms

Machine and plant manufacturers must meet numerous norms, laws and guidelines for equipping machines with safety technology.

The new machine guideline requires a significantly broader analysis of the potential dangers posed by a machine. In ISO 13849-1, the simple evaluation according to safety categories has been replaced by a classification according to so-called performance levels (PL).

Corresponding to these PL values, technical and organizational measures must be taken to ensure the safe operation of a machine during all possible operation modes.

With the SIGMATEK Safety solution, your automation system meets the latest safety norms: SIL CL 3 according to IEC 61508 / IEC 62061 or Performance Level PL e according to ISO 13849-1 respectively.



SAFETY

- EN ISO 13849-1, Cat. 4, PL e
- IEC 62061, SIL CL 3
- IEC 61508, SIL CL 3
- TÜV Rheinland Certification

Your Advantages at a Glance

The integration of Safety into the SIGMATEK automation system offers a range of advantages:

Integrated automation solution

The innovative automation systems from SIGAMTEK integrate PLC, motion control, visualization and Safety in an universal system architecture. From the compact machine to complex and modular systems, any machine concept can be easily realized.

Uniform communication

The real-time Ethernet bus system VARAN enables integrated communication. That means, Safety-critical and standard data are exchanged in the same bus system. Labor and cost intensive wiring of Safety components is eliminated.

All-in-one Engineering Tool LASAL

With LASAL an integrated engineering environment for any automation function is provided: PLC programming, visualization, motion control, Safety and diagnosis. The engineering of the entire system is simplified considerably, engineering times and costs are significantly reduced.

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