

# Programmable modular safety controller

## PROTECT PSC1



# Introduction



Philip Schmersal, managing director of the Schmersal Group and  
Michael Mandel, managing director of K.A. Schmersal GmbH & Co. KG

With its comprehensive range of about 25,000 products, Schmersal is one of the world's biggest suppliers of safety technology.

Schmersal is not only a manufacturer of safety components, but are also a **system supplier**. In developing the new PROTECT PSC1, we have taken a big step forward in the field of control technology. The multifunctional PROTECT PSC1 system consists of a reliable, programmable compact safety controller and dependable extension modules and can be adapted perfectly to specific applications in various branches of industry. With its combination of certain properties, the new safety controller from Schmersal is unparalleled, as the PROTECT PSC1 has unique features that clearly set this control system apart from other solutions on the market.

The new generation of programmable modular safety controllers from Schmersal is embedded in a comprehensive offering of safety services. Many of our customers want planning and advice from the outset, e. g. in the design of complex automation systems. This also includes the development of custom applications and their integration in higher-order control systems.

A central element here is application consulting. Certified Functional Safety Engineers advise our customers on suitable protection equipment, with the CE conformity assessment as well as the risk analysis and also carry out the technical safety analysis on existing machines, and all this worldwide.

With another service, that of application engineering, Schmersal targets users of safety controllers in automation technology. For them, we develop customised software modules that enable safety functions to be tailored perfectly to the machine's or system's specific application.

Above this, we regularly report to our customers and experts in the field on new developments in machine safety. In short, we offer our customers an all-embracing package of integrated systems solutions in the safety technology sector.

# Content

Introduction	Page	2
Content	Page	3
PROTECT PSC1	Page	4
<b>User software</b>		
Programming software SafePLC2	Page	5
Compact safety controller PSC1-C-100	Page	6
Compact safety controller PSC1-C-10	Page	7
<b>Safe I/O expansion modules for the compact safety controllers PSC1-C-10 and PSC1-C-100</b>		
1) Central I/O expansion modules	Page	8
2) Decentral I/O expansion module – safe remote I/O communication Ethernet SDDC (Safety Device to Device Communication)	Page	9
<b>Safe Drive Monitoring (SDM) – Safe drive monitoring for up to 12 axes</b>	Page	10
a) Safe drive monitoring of the compact safety controller PSC1-C-10	Page	11
b) Safe drive monitoring of the compact safety controller PSC1-C-100	Page	11
<b>International ordering code for the safety controller PROTECT PSC1</b>	Page	12
<b>Topologies</b>		
Safe cross-communication – Ethernet SMMC	Page	13
Safe remote I/O communication – Ethernet SDDC	Page	13
Modular compact safety controller PSC1-C-10	Page	14
Modular compact safety controller PSC1-C-100	Page	14
Universal communication interface – universal fieldbus connection	Page	15
Universal communication interface – integrated SD-Bus-Gateway	Page	15

# PROTECT PSC1

## Programmable modular safety controller



The safety control system PSC1 consists of freely programmable compact safety controllers with I/O extension modules for signal processing of emergency stop switches, guard door switches, light grids and additional mechanical and electronic safety switchgear. Additionally there is the possibility via numerous functions to monitor axes. Using the universal communications interface a connection can be established to all the standard field bus systems.

- Safe logic control according to Annex IV of the Machinery Directive 2006/42/EC
- Connection for all standard safety relays up to PL e and SIL 3
- Modular expansion with up to 272 inputs / outputs
- Secure 2 A p-switching semiconductor outputs, can be switched to secure p/n-switching semiconductor outputs
- Freely programmable inputs / outputs, 2 A p-switching
- Safe drive monitoring according to EN 61800-5-2 (SDM – Safe Drive Monitoring) for up to 12 axes
- Universal communication interface:
  - Supports all standard fieldbus systems
  - Setting and resetting of fieldbus protocols by software
  - Safe remote I/Os via Ethernet Safety Device to Device Communication (SDDC)
  - Safe cross-communication via Ethernet Safety Master to Master Communication (SMMC)
- Integrated Schmersal SD Bus connection to the standard field bus systems
- Safety functionalities up to SIL 3 according to IEC 61508 / IEC 62061, PL e and Cat. 4 according to EN ISO 13849-1

## User software

### Programming software SafePLC2



#### Programming software SafePLC2

- Modern, object oriented application development environment
- Preconfigured elements for safe electronic and electromechanical switching devices
- Easy reuse of application code by macros
- Programming assistance by various search functions
- Simple signal tracking by different colour representation and status messages
- Easy to detect safety functions through practice oriented libraries for logic, Safe Drive Monitoring, SD-bus and encoder elements
- Configurable user permissions



## Compact safety controller PSC1-C-100

The PSC1-C-100 is a modular and freely programmable compact safety controller for safe signal processing of safety switchgear with the option of a universal communications interface. The base version of the PSC1-C-100 controller has the following properties:

- 14 safe inputs up to PL e respectively SIL 3
- 20 adjustable safe in-/outputs up to PL e respectively SIL 3, 2 A p-switching
- 4 adjustable safe semiconductor outputs: 2 A p-switching or p-/n-switching
- 2 safe relay outputs for 24 VDC or 230 VAC, 2 A
- 2 signalling outputs, 250 mA
- 2 pulse outputs (clock outputs) for contact sensors
- 1 SDHC card slot for storing application programs (Memory-Card)
- Modular expandable up to 8 I/O modules (central / decentral)
- Modular expandable with up to 6 safe drive monitoring modules (max. 12 axes)
- Universal communication interface (optional)



Basic version with memory card (SDHC)



Universal communication interface incl. memory card (SDHC)



## Compact safety controller PSC1-C-10

The PSC1-C-10 is a modular and freely programmable compact safety controller for safe signal processing of safety switchgear with the options of an integrated drive monitoring and/or a universal communications interface. The base version of the PSC1-C-10 controller has the following properties:

- 14 safe inputs up to PL e respectively SIL 3
- 4 adjustable safe semiconductor outputs: 2 A p-switching or p-/n-switching
- 2 safe relay outputs for 24 VDC or 230 VAC, 2 A
- 2 signalling outputs, 250 mA
- 2 pulse outputs (clock outputs) for contact sensors
- Modular expandable with up to 2 I/O expansion modules (central / decentral)
- Optional expansions: Universal communication interface, memory card (SDHC), safe drive monitoring



Basic unit



with Memory-Card (SDHC)



with communication interface



With integrated Safe Drive Monitoring (SDM) for 1 axis



With integrated Safe Drive Monitoring (SDM) for 2 axes

## Safe I/O expansion modules for the compact safety controllers PSC1-C-10 and PSC1-C-100

The I/O expansion modules can be freely used for the compact safety controllers and differ in their application:

### 1. Central applications

- in the same cabinet, directly aligned to the compact safety controller
- communication via backplane bus

### 2. Decentral applications

- remote control cabinet
- communication to the compact safety controller via Ethernet SDDC

#### 1) Central I/O expansion modules



#### Technical specification: PSC1-E-31-12DI-10DIO PSC1-E-131-12DI-10DIO

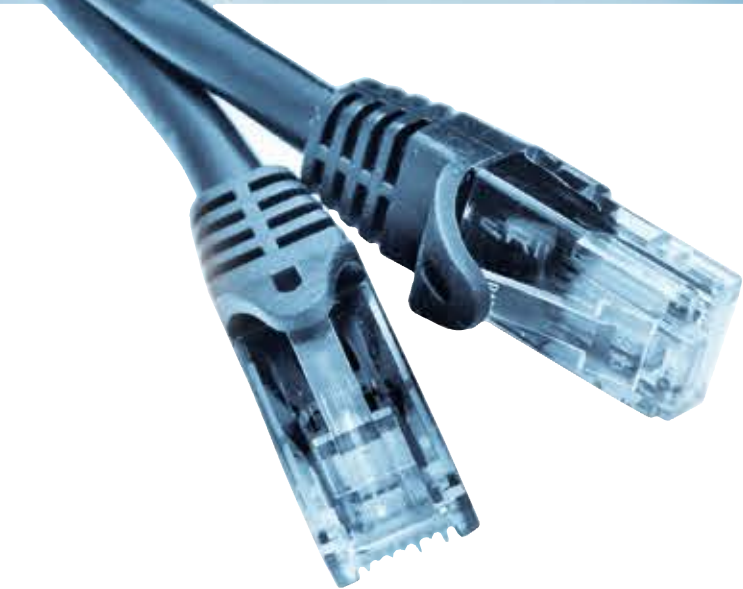
- 12 safe inputs up to PL e respectively SIL 3
- 10 adjustable safe in-/outputs up to PL e respectively SIL 3, 2 A p-switching
- 2 signalling outputs, 250 mA
- 2 pulse outputs (clock outputs) for contact sensors



#### Technical specification: PSC1-E-33-12DI-6DIO-4RO PSC1-E-133-12DI-6DIO-4RO

- 12 safe inputs up to PL e respectively SIL 3
- 6 adjustable safe in-/outputs up to PL e respectively SIL 3, 2 A p-switching
- 4 safe relay outputs for 24 VDC or 230 VAC, 2 A
- 2 signalling outputs, 250 mA
- 2 pulse outputs (clock outputs) for contact sensors





**Technical specification:  
PSC1-E-37-14DI-4DO-2RO-RIO**

- 14 safe inputs up to PL e respectively SIL 3
- 4 adjustable safe semiconductor outputs:
  - 2 A p-switching or p-/n-switching
- 2 safe relay outputs for 24 VDC or 230 VAC, 2 A
- 2 signalling outputs, 250 mA
- 2 pulse outputs (clock outputs) for contact sensors

**2) Decentral I/O expansion module – safe remote I/O communication  
Ethernet SDDC (Safety Device to Device Communication)**

In applications with separated collecting points for safety switching devices, a decentral I/O expansion module is available. The safety logic for the entire system is stored only in the compact safety controller. The safe remote I/O modules transmit and receive their status via the safe local communication protocol Ethernet SDDC.

A mixture of centralised and decentralised applications are possible for both compact safety controller systems PSC1-C-10 and PSC1-C-100.



## Safe Drive Monitoring (SDM)

Safe drive monitoring for up to 12 axes

For safe drive monitoring many safety features are supported:

- **Safe shut-down:** Safe Torque OFF (STO), Safe Break Control (SBC)
- **Safe stopping:** Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS)
- **Safe movement:** Safely-Limited Speed (SLS), Safe Speed Range (SSR), Safe Direction (SDI), Safely-Limited Acceleration (SLA), Safe Acceleration Range (SAR)
- **Safe monitoring:** Safe Speed Monitor (SSM), Safe Cam (SCA)
- **Safe Positioning:** Safely-Limited Position (SLP), Safely-Limited Increment (SLI), Safely Emergency Limit (SEL)

The drive monitoring is carried out depending on the application requirements, with one or two encoder systems. The following encoder signals are supported:

- **1 Encoder system:** TTL, SIN/COS, SSI (Gray code / binary code)
- **2 Encoder systems:** TTL, SIN/COS, SSI (Gray code / binary code), Resolver, HTL





**a) Safe drive monitoring of the compact safety controller PSC1-C-10**

The safe drive monitoring with the compact safety controller PSC1-C-10 is realised by an integrated solution. Depending on the order option, the compact safety controller can safely monitor 1 or 2 axes with one encoder system.

**Order option: integrated safe drive monitoring up to 2 axes**



1 axis

2 axes

**b) Safe drive monitoring of the compact safety controller PSC1-C-100**

**Monitoring up to 12 axes with up to 6 expansion modules**

A safe drive monitoring is realised with the compact safety controller PSC1-C-100 via extension modules. In this case, each axis can be safely monitored by one or two encoders. The drive monitoring modules are available for one or two encoders.



**Safe drive monitoring with one encoder each**

- For 1 axis: ■ PSC1-E-21-SDM1
- For 2 axes: ■ PSC1-E-23-SDM2

**Safe drive monitoring with two encoders each**

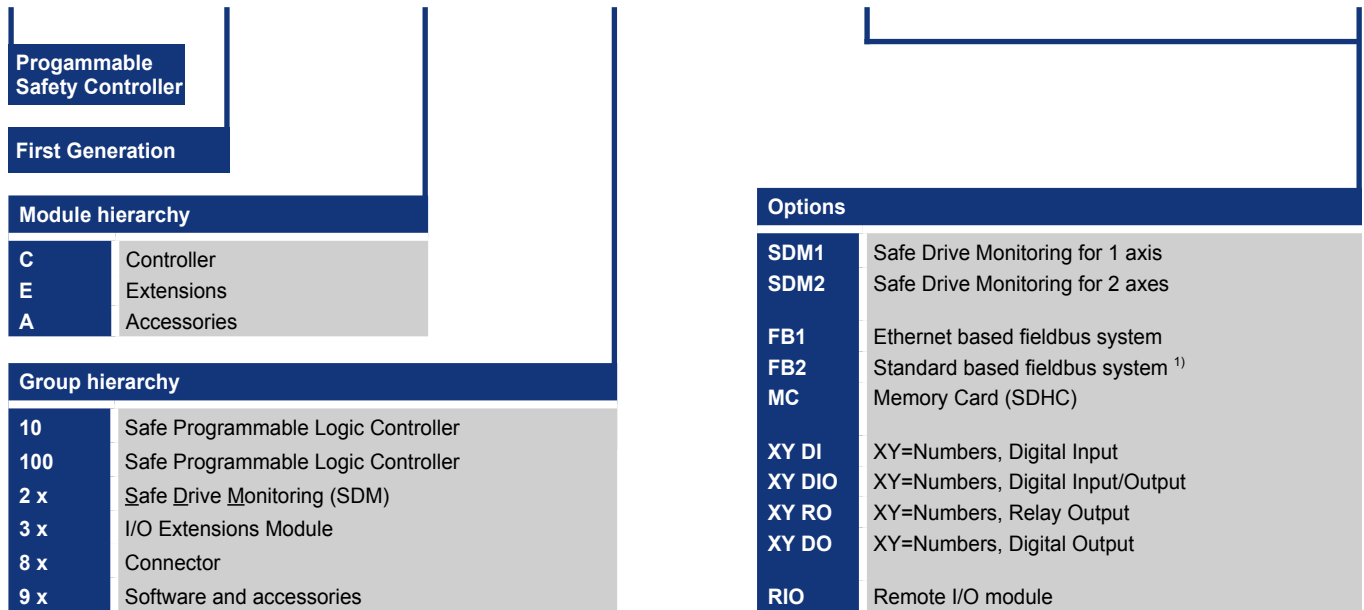
- For 1 axis: ■ PSC1-E-22-SDM1-2
- For 2 axes: ■ PSC1-E-24-SDM2-2



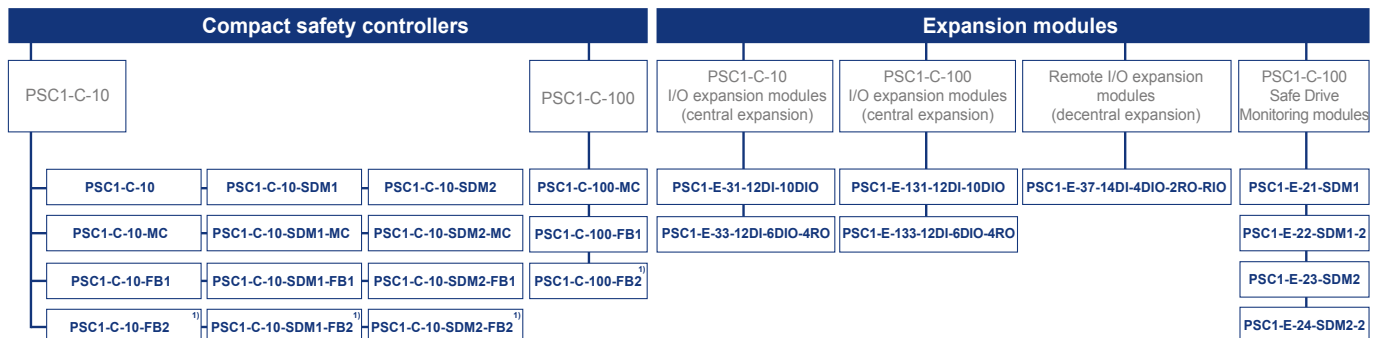
## International ordering code

### Controller system PROTECT PSC1

**PSC1 – C – 100 – SDM1 – FB1**

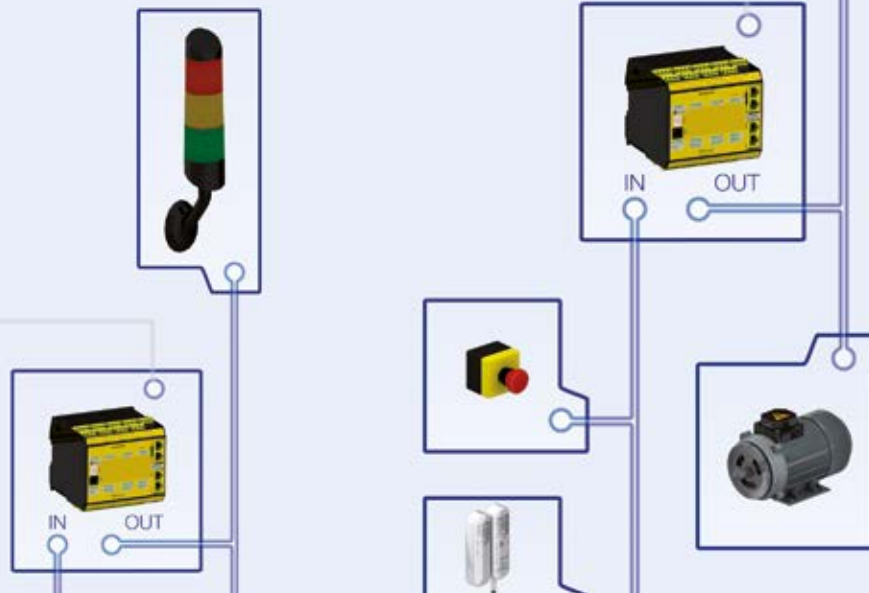


### PROTECT PSC1 - Programmable modular safety controller



<sup>1)</sup> under preparation

## Topologies



## Safe cross-communication – Ethernet SMMC (Safety Master to Master Communication)

The safe cross-communication is used as a composite of safety controllers to safely exchange data via the local Ethernet SMMC communication.

In a complete system (consisting of individual system components) with concatenated EMERGENCY STOP signals or concatenated signals from solenoid interlocks, this requirement can be solved by using the safe cross-communication. The simultaneous operation of safe cross-communication and safe remote I/O communication and a field-bus communication for a superordinate control is possible.

- Safe cross-communication with up to 4 compact safety controllers PSC1
- Free mixing of compact safety controllers PSC1-C-10 and PSC1-C-100

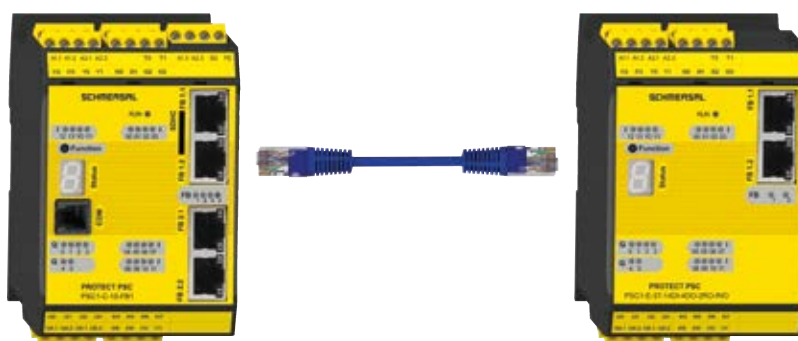


## Safe remote I/O communication – Ethernet SDDC (Safety Device to Device Communication)

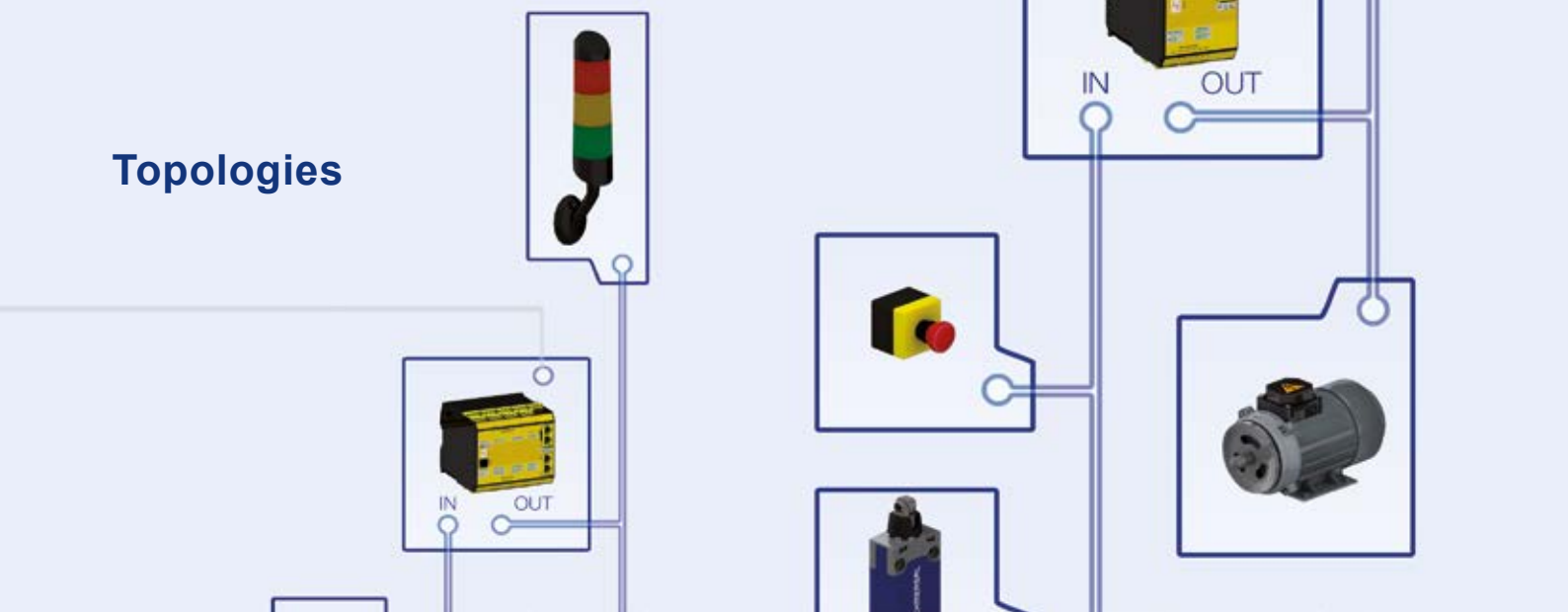
For the decentral application structure the remote I/O expansion module PSC1-E-37-14DI-4DO-2RO-RIO is available.

The local communication is realised via the Ethernet SDDC protocol.

This ensures that the simultaneous operating of the safe cross-communication and the safe remote I/O communication can take place over the universal communication interface.



# Topologies



## Modular compact safety controller PSC1-C-10

2 expansion modules / up to 64 I/Os

**Central structure:**  
I/O expansion modules

- PSC1-E-31-12DI-10DIO
- PSC1-E-33-12DI-6DIO-4RO



**Decentral structure:**  
Expandable with the remote I/O module

- PSC1-E-37-14DI-4DO-2RO-RIO



The compact safety controller PSC1-C-10 can be expanded with up to 2 I/O expansion modules. A mixture of centralised and decentralised structures can be used.

## Modular compact safety controller PSC1-C-100

8 expansion modules / up to 272 I/Os

**Central structure:**  
I/O expansion modules

- PSC1-E-131-12DI-10DIO
- PSC1-E-133-12DI-6DIO-4RO



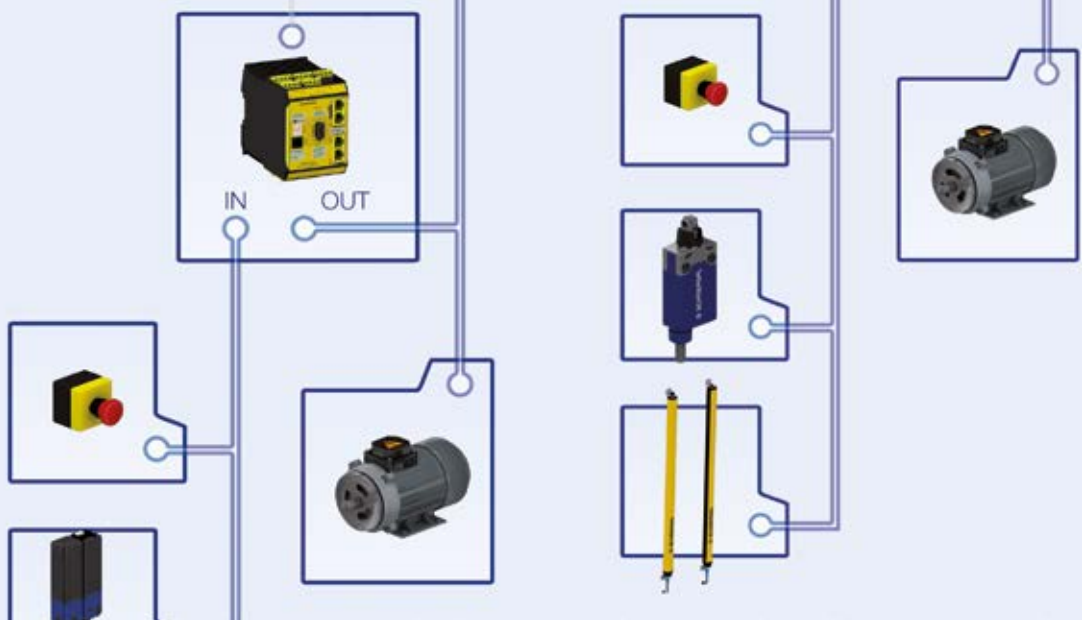
**Decentral structure:**  
Expandable with the remote I/O module

- PSC1-E-37-14DI-4DO-2RO-RIO

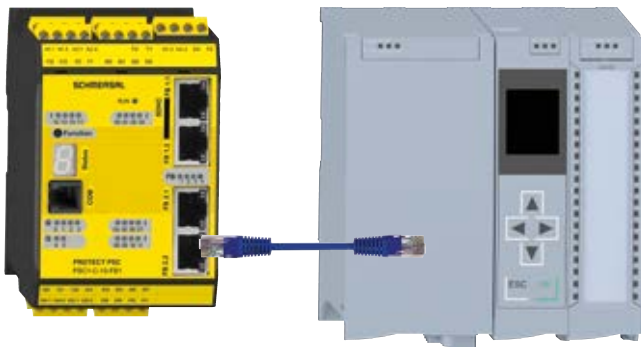


The compact safety controller PSC1-C-100 can be expanded with up to 8 I/O expansion modules. A mixture of centralised and decentralised structures can be used.

## Topologies



## Universal communication interface – Universal field-bus connection



Using the universal communication interface the required field-bus protocol can be manually selected via software.

Parallel to the active field-bus protocol the local communication within the PSC1 control system can be realised via the Ethernet SDDC and SMMC.

Available



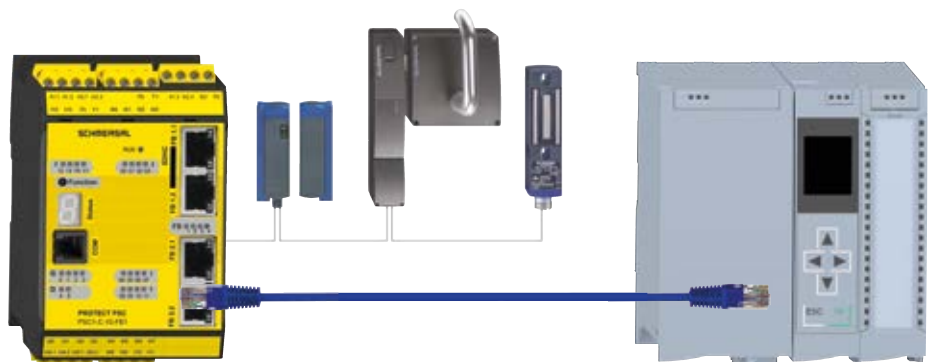
Under preparation



## Universal communication interface – Integrated SD Bus gateway

Up to 31 Schmersal SD bus sensors can be connected and evaluated with their extended diagnostic data directly onto the compact safety controller PSC1.

In doing so, the universal communication interface takes on the task of a gateway to the respective field-bus protocols, set via software (communication to machine controller).





# The Schmersal Group

In the demanding field of machine safety, the owner-managed Schmersal Group is one of the international market leaders. The company, which was founded in 1945, has a workforce of about 2000 people and seven manufacturing sites on three continents along with its own companies and sales partners in more than 60 nations.

Customers of the Schmersal Group include global players from the area of mechanical engineering and plant manufacturing as well as operators of machinery. They profit from the company's extensive expertise as a provider of systems and solutions for machine safety. Furthermore, Schmersal specialises in various areas including foodstuff production, the packaging industry, machine tool industry, lift switchgear, heavy industry and the automotive industry.

A major contribution to the systems and solutions offered by the Schmersal Group is made by tec.nicum with its comprehensive range of services: certified Functional Safety Engineers advise machinery manufacturers and machinery operators in all aspects relating to machinery and occupational safety – and do so with product and manufacturer neutrality. Furthermore, they plan and realise complex solutions for safety around the world in close collaboration with the clients.

## Safety Products



- Safety switches and sensors, solenoid interlocks
- Safety controllers and safety relay modules, safety bus systems
- Optoelectronic and tactile safety devices
- Automation technology: position switches, proximity switches

## Safety Systems



- Complete solutions for safeguarding hazard areas
- Individual parametrisation and programming of safety controllers
- Tailor-made safety technology – be it for individual machines or a complex production line
- Industry-specific safety solutions

## Safety Services



- tec.nicum academy – Seminars and training
- tec.nicum consulting – Consultancy services
- tec.nicum engineering – Design and technical planning
- tec.nicum integration – Execution and installation

The details and data referred to have been carefully checked.  
Subject to technical amendments and errors.

[www.schmersal.com](http://www.schmersal.com)



x.000 / L+W / 01.2018 / Teile-Nr. 103009155 / EN / Ausgabe 05

 **SCHMERSAL**  
Safe solutions for your industry