⑤ SCHMERSAL

EN Operating instructions . . . . .pages 1 to 24
Original

Content

1.1 Function
This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety-monitoring module. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.
This document constitutes operating instructions within the meaning of the Machine Directive 2006/42/EC Annex I, Article 1.7.4.

1.2 Target group: authorised qualified personnel
All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.
Only install and commission the device once you have read and understood these instructions and are acquainted with the applicable regulations on machine safety and accident prevention. The selection and installation of the devices and the technical incorporation into the control system require qualified knowledge of the pertinent laws and requirements set out in standards.

1.3 Explanation of the symbols used

ℹ️	**Information, hint, note:** This symbol indicates useful additional information.

⚠️	**Caution:** Failure to comply with this warning notice could lead to failures or malfunctions. **Warning:** Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use
The Schmersal range of products is not intended for private consumers.

The product described here has been developed to assume safety-oriented functions as part of an overall system or machine.
The safe state corresponds to the de-energised state.
It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant. The safety-monitoring module must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter 2.

1.5 General safety instructions
The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.

ℹ️	Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: products.schmersal.com.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.
All information without guarantee. Subject to change.

1.6 Warning about misuse

⚠️	If used incorrectly or not for the intended purpose or in the case of tampering, danger to persons or damage to machine and system parts from using the safety module cannot be ruled out.

⚠ 1. Range of application (compendium)
This part of EN ISO 13856-1 is applicable to pressure-sensitive mats and pressure-sensitive floors, regardless of the type of energy used (e.g. electrical, hydraulic, pneumatic or mechanical), designed to detect
• persons weighing more than 35 kg, and
• persons (e.g. children) weighing more than 20 kg.
It is not applicable to detect persons weighing less than 20 kg.

⚠ The entire concept of the control system, in which the safety component is integrated, must be validated to the relevant standards.

⚠ If the monitoring of an Emergency-Stop command device is not implemented using the safety module PROTECT SELECT the monitoring must take place using another suitable manner.

1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with the operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden, the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

2. Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

PROTECT-SELECT-CC-910001239-240501
PROTECT-SELECT-SK-910001239-240501

Checksums for
- Progs (P) 974206A1
- Texts (T) 9093B7F8
See printing security seal side.

2.2 Special versions

For special versions, which are not listed in the ordering code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.
For special versions, the supplementary operating instructions are to be observed.

2.3 Purpose

The safety module for integration in safety circuits is designed to fit in control cabinets.

The safety module is for the safe evaluation of floating and OSSD-type safety switchgear and secure analogue signals as well as switch mats in accordance with EN ISO 13856-1.

The logical switching of the inputs to the outputs is determined by a pre-programmed application program. To be able to adapt to each of the application uses the application program has adjustable parameters. Setting the parameters is done using the safety module with a rocker switch in conjunction with a colour display.

The safety function is the safe shutdown of the safety outputs (Q0 to Q3 and QR1 to QR2) upon request via the safety inputs (I0 to I17 and AI0 to AI1) and in the event of a fault. In the switched off state the outputs have no power this means that relay output contacts are open and semiconductor outputs are non-conducting.
To determine the Performance Level (PL) of the entire safety function (e.g. sensor, logic, actuator) to EN ISO 13849-1, an analysis of all relevant components is required.

The safety-related current paths with the outputs Q0 to Q3 and (taking into account a $B10_D$ value consideration) QR1 and QR2 meet the following requirements:
– Category 4 – PL e to EN ISO 13849-1
– corresponds to SIL 3 to IEC 61508

2.4 Technical data

General data

Standards:	EN 60204-1, EN 60947-5-1, EN ISO 13849-1, IEC 61508
Mounting:	snaps onto standard rail to EN 60715
Dimensions (W/H/D):	52.5 x 100 x 118 mm
Weight:	300 g
Readiness after switching on:	approx. 6 s

Mechanical data

Connection type:	cage clamps
Cable type:	rigid single-wire, rigid multi-wire or flexible
Cable section:	0.25 … 2.5 mm² (incl. conductor ferrules)
Mechanical life:	10^7 operations
Electrical life:	Derating curve available on request
Resistance to shock:	to EN 60068-2-27
Resistance to vibrations:	to EN 60068-2-6

Ambient conditions

Ambient temperature:	−25 °C … +55 °C, no condensation, with vertical installed position
Storage and transport temperature:	−25 °C … +75 °C, no condensation
Climatic conditions:	Humidity 15 % … 90 %, no condensation
Degree of protection:	IP20
Installation compartment:	earthed, lockable switch cabinet with degree of protection IP54
Air clearances and creepage distances:	EN 50178 (double insulation)
EMC rating:	EN 61000-6-2, EN 61496-1, IEC 61326-3-1
EMC interference radiation:	EN 61000-6-4
Overvoltage category:	III
Degree of pollution:	2

Electrical Data

Rated operating voltage:	24 VDC +/− 10%
Fuse rating:	3 A slow blow external
Power consumption at 24 VDC:	max. 500 mA, internally fused plus load current

Safety digital inputs

Number:	18 single channel / up to 9 dual channel inputs
Voltage / current:	24 V; 6 mA
Level (nominal):	
- Low:	−3 V … 2.0 V
- High:	18 V … 28.8 V
Category / PL / SIL	:
- Single channel, with minimum Request interval = 30 h:	Cat. 2 / PL d / SIL 2
- Dual channel:	Cat. 4 / PL e / SIL 3

Safe analogue inputs

Number:	2
Measuring range voltage:	0 … 10 V
Voltage change:	Sinusoidal: max. 2.8 Hz, max. 25 V/s
Measuring range current:	
- with external shunt resistor:	0 … 20 mA
- 500 Ω / 0.5W / < 1%:	4 … 20 mA
Current change:	Sinusoidal: max. 2.8 Hz; max. 50 mA/s
Input resistance:	10 kΩ
Category / PL / SIL:	
- Single channel (If a cable break dominates):	Cat. 3 / PL d / SIL 2
- Dual channel:	Cat. 4 / PL e / SIL 3
Accuracy:	3%
Resolution:	12 Bit

SCHMERSAL

Safe semi-conductor outputs

Number (p-/n-switching):	2
- Note:	with OEM -version an activation of the second p+n-switching output Q1/Q1N is possible. In this case a derating must be observed.
Number (p switching):	2
Max. current at 24V:	0.7 A / output, resistive load, short-circuit proof
Output teat pulse:	type 0.5 ms; max. 2 ms, with a capacitive load
Category / PL / SIL:	
- Single channel, with minimum Request interval = 47min:	Cat. 2 / PL d / SIL 2
- Dual channel:	Cat. 4 / PL e / SIL 3
Reaction times:	
- Digital inputs:	Switching off: < 30 ms
	Switching on: < 45 ms
- Analogue inputs:	Switching off: < 100 ms
	Switching on: < 120 ms
- Note:	The stable time must be added to the specified ON times.
Voltage drop:	
- Residual current:	< 1 V, < 2 mA
- Leakage current in the case of error:	< 1 mA
Minimum operating current:	> 5 mA
Required short-circuit current:	9 A

Safe relay outputs

Number:	2 (common access)
Contact load capacity (B_{10D} values see below):	
- AC-1:	240 V / 4 A
- AC-15:	240 V / 3 A
- DC-1:	24 V / 4 A
- DC-13:	24 V / 4 A / 0.1 Hz
Category / PL / SIL:	
- Single channel:	Cat. 1 / PL c / SIL 1
- Dual channel:	Cat. 4 / PL e / SIL 3
Residual current at 24V:	4 A
Fuse rating:	4A gL/gG (for residual current)
Reaction times:	
- Digital inputs:	Switching off: < 50 ms
	Switching on: < 65 ms
- Analogue inputs:	Switching off: < 120 ms
	Switching on: < 140 ms
- Note:	The stable time must be added to the specified ON times.
Required short-circuit current:	1000 A to EN 60947-5-1
Rated isolated voltage:	to EN 50178, double insulation

Signalling outputs

Number, optional:	4
Max. current at24V:	0.1 A, resistive load, conditionally short-circuit proof

Test pulse outputs

Number:	3
Max. current at24V:	0.1 A, resistive load, conditionally short-circuit proof
Switch-off test pulse:	<1.5 ms

cULus — **LISTED 382E**

Main supply:	24 V, Class 2
Consumption:	2.6 A
Ambient temperature:	+ 55°C
Semiconductor output current:	sum 2.1 A
Relay output:	C300, R300

2.5 Safety classification

Standards:	EN ISO 13849-1, IEC 61508
PL:	up to e
Category:	up to 4
DC:	high
CCF:	> 65 points
SIL:	up to 3
SFF:	> 90 %
PFH_d to IEC 61508 Parts 1-7:	1.78×10^{-8} 1/h
- Note:	Valid for dual channel and 60% relay load.
Mission time:	20 years
Hardware fault tolerance:	1
Mode of operation:	High demand / continuous
$MTTF_D$ (inputs+logic):	>100 years
$MTTF_D$ (semi-conductor outputs):	>100 years
B_{10D} value (for one channel of the relay output):	Low load range 20%: 10,000,000
	40%: 7,500,000
	60%: 2,500,000
	80%: 1,000,000
	Maximum load 100%: 400,000

$$MTTF_D = \frac{B_{10D}}{0.1 \times n_{op}} \qquad n_{op} = \frac{d_{op} \times h_{op} \times 3600 \text{ s/h}}{t_{cycle}}$$

For an average annual demand rate of n_{op} = 126,720 cycles per year, Performance Level PL e can be obtained at maximum load.

n_{op} = average number of activations per year
d_{op} = average number of operating days per year
h_{op} = average number of operating hours per day
t_{cycle} = typical demand of the safety function in s
(e.g. 4 × per hour = 1 × per 15 min. = 900 s)

(Determined values can vary depending on the application-specific parameters h_{op}, d_{op} and t_{cycle} as well as the load.)

The $MTTF_D$ value results as follows
Semi-conductor output: $1/MTTF_{D \text{ (inputs+logic)}} + 1/MTTF_{D \text{ (semi-conductor outputs)}}$
Relay output: $1/MTTF_{D \text{ (inputs+logic)}} + 1/MTTF_{D \text{ (relay)}}$

3. Mounting

⚠ The safety module should only be installed and removed when without power.

3.1 General mounting instructions
Snap the bottom of the enclosure slightly tilted backwards in the standard rail and push down until it latches in position.

ℹ Depending on requirements, the connector plugs can be coded individually using the supplied coded pins. Electrical power cables must be routed separately from communication lines.

3.2 Disassembly
Unlock the bottom of the enclosure by means of a slotted screwdriver, push up and hang out slightly tilted forwards.

3.3 Disposal
After the maximum service life of 20 years, the security module should be disposed of properly in accordance with national laws and regulations.

4. Electrical connection

4.1 General information for electrical connection

⚠️ The electrical connection may only be carried out by authorised personnel in a de-energised condition!
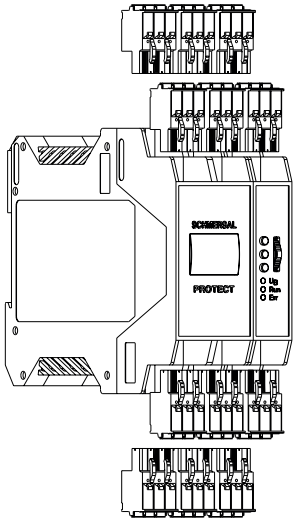
Settle length x of the cable at terminals of type s, f or r: 10 mm

4.2 Terminal coding

The connector parts can be coded by inserting coding profiles into the grooves provided. The coding tabs are inserted into the corresponding recesses on the basic enclosure.

4.3 Power supply

A1: 24 VDC ± 10% (via external safety fuse 3 A slow blow)
A2: GND, this must be connected to the protective earth (PE).
FE: Functional earth (short line where possible min. 1.5 mm²)

⚠️ Requirements placed on the power supply unit
- Safety mains transformer in accordance with EN 61558 / VDE 0570 Part 2-6
- Switching power supply unit in accordance with EN 60950-1 and EN 50178. The power supply unit must be suitable to supply SELV current circuits in accordance with EN 60950-1.

⚠️ The FE connection (functional ground) must be connected to PE.

⚠️ If A2 and PE do not have a connection, FE must be connected to A2.

4.4 Start level

Number and terminal will depend on the application program (see chapter 8.1).

4.5 Sensor level

Number and terminal will depend on the application program (see chapter 8.1). All inputs are plus-switching.
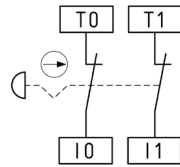
ℹ️ Input circuits which have been deactivated via the parameter assignment may not be connected.
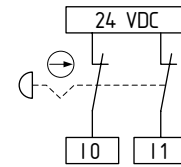
Wiring examples Sensors

ℹ️ The actual pin assignment can be found in the description of the respective application program (see section 8.1).
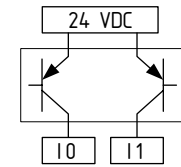
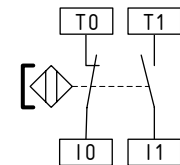2-channel potential-free with cross-wire monitoring

2-channel potential-free without cross-wire monitoring

2-channel electronic output (cross-wire monitoring via sensor)

2-channel potential-free with NO and NC contacts

Switch mat (Schmersal type SMS 4)
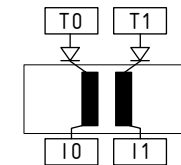
1-channel potential-free connection first contact
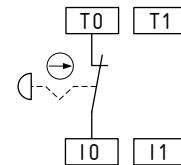
ℹ️ Safety mat to EN ISO 13856-1
• In combination with SMS safety mat (from Schmersal)
• With reset function
• The connection of the inputs is realised through the safety mat here.
• When the safety mat is actuated, the potentials of both inputs are connected, so that a cross-wire short is created and the device is safely shut down.
• Category 3 – PL d to EN ISO 13849-1 possible

⚠️ Proximity switches with Reed contacts (e.g. safety switches such as the Schmersal BNS type series) may not be connected to inputs (I0, I4, I12, I14) due to the alternative function as signalling output. They must satisfy the following technical requirements
– switching capacity: min. 240 mW
– switching voltage: min. 24 VDC
– switching current: min. 10 mA

⚠️ When a safety mat is connected make sure that the clock outputs are decoupled, for example via diodes.

⚠️ When installing the cables the safe analogue inputs AI0 / AI1 high frequency signal decoupling must be avoided.

ℹ️ Recommended cable type for the safe analogue inputs AI0 / AI1: LAPP KABEL unitronic® FD CP (TP) plus 1 x 2 x 0.75

ℹ️ For further information regarding possible applications using the analogue inputs, please contact our technical sales department.

ℹ️ For inputs that are configured for antivalent (1NO/1NC) evaluation, the NO contact must always be connected to the input with the odd number.

ℹ️ With single-channel use the input with the odd number is not used.

ℹ️ When connecting safety door interlocks the door position should be connected to the even input and magnet position connected to the odd input.

EN

Schmersal

4.6 Actuator level

2 x safe p-/n-switching semiconductor outputs (Q0/Q0N, Q1/Q1N) with 24 VDC

2 x safe p-switching semiconductor outputs (Q2, Q3) with 24 VDC

2 x safe relay outputs (QR1, QR2) with common supply (QR0) up to 250 VAC or 24 VDC

4 x operational optional message outputs (Y0 … Y 3) with 24 VDC

Relay outputs

Semi-conductor outputs

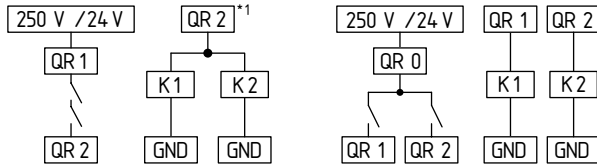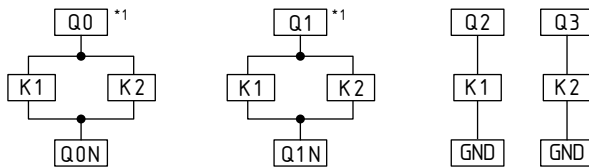*1 Measures for short circuit shutout against the supply are necessary

Test pulses

The correct function of the semi-conductor outputs is secured by a cyclical test, i.e. all switched outputs are deactivated for approx. 0.5 ms (in the event of capacitive loads the deactivation is for a maximum of 2 ms).

⚠️ If contactors and coils are connected suitable protective measures (free-wheeling diode, varistor or similar) must be taken to protect the internal output switching.

ℹ️ If after a shutdown of max. 2 ms no HIGH signal is detected on the semiconductor output (e.g. due to a capacitive load), a system failure is the result.

ℹ️ If a subsequent assembly is disturbed by the test pulse it can be eliminated by including a D/C filter in the circuit:
Typical values: 3…10 kΩ, 1000 nF
10…30 kΩ, 330 nF
The resulting signal delay is to be considered.

Signalling outputs

The terminals I0/Y0, I4/Y1, I12/Y2 and I14/Y3 may be used both as safe input and as signalling output.
Which function is used will depend on the application program (see chapter 8.1).

ℹ️ The signalling outputs Y0…Y3 are not safety-related.

5. Operating principle and settings

5.1 Connection / operating elements
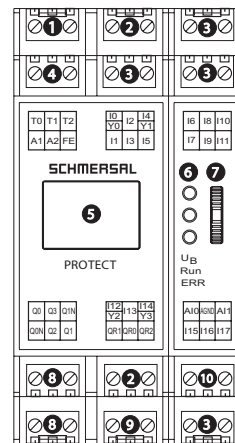
1	Cycle outputs T0...T2
2	Safe inputs / optional signalling outputs
3	Safe inputs
4	Supply voltage
5	Graphic colour display
6	Status LEDs
7	Rocker switch
8	Safe semi-conductor outputs
9	Safe relay outputs
10	Safe analog inputs

Operating the rocker switch

Up/down: **Navigation through the menu and the input masks.**
Press: Acceptance of the entry or confirmation of an action.

LED indications

U_B	lights up	Operating voltage applied
Run	lights up	Operating mode
	blinking	Configuration mode or module has the factory defaults (see initial parameterization)
ERR	illuminates	A fault is present (safe condition)
	blinking	There is a caution or warning (Operation with possible limitations)

Fault / Warnings / Messages appear on the display in plain text.

Menu structure

The complete structure may be derived from Chapter 7.

5.2 Description of the terminals

Voltage	A1	+24 VDC
	A2	0 VDC
	FE	Functional earth connection
Inputs	I0...I17	Safety digital inputs
	AI0	Safe analogue input
	AI1	Safe analogue input
	AGND	Analogue ground
Outputs	Q0, Q0N	Safe semi-conductor output p-/n-switching
	Q1, Q1N	Safe semiconductor output p-/n-switching (only available OEM-products)
	Q2	Safe semi-conductor output p-switching
	Q3	Safe semi-conductor output p-switching
	QR0	Supply of safe relay output
	QR1	Safe relay outputs
	QR2	Safe relay outputs
	Y0...Y3	Operational outputs (signalling output)
	T0...T2	Clock outputs for the supply of safe digital inputs for short-circuit recognition

5.3 Start level

Alternatively:	Auto-start or manual start (falling edge)
Optional:	Feedback circuit (EDM), start-up testing

Start-up test
After switching on the supply voltage again the protective device must first be opened and closed again before the enable can be activated with the start/RESET button.

5.4 Sensor level

18 safety digital inputs

Selectable:	1-channel of 2-channel, equivalent, antivalent or deactivated.
Optional condition:	Short circuit recognition, discrepancy monitoring

2 safe analogue inputs
2 analogue safe 1-channel inputs each with 4 adjustable limit values or 1 analogue safe 2-channel input with 4 adjustable limit values and adjustable monitoring of the percentage (of maximum value = 4095) channel deviation.

Discrepancy monitoring
After a request for a 2-channel protection device that is carried out by only one of the input channels, both input channels must be opened and closed again before the release with the START / RESET button can be activated.

Short-circuit recognition
Measure for detecting short circuits between the input channels for 2-channel operation. The cross-circuit detection is achieved here by the use of clock outputs T0 ... T2 using floating safety sensors. The assignment of the clock outputs to the inputs is fixed. The setting takes place in the inputs menu.

> ℹ️ To reach cat. 4 / PL e / SIL 3, cross-circuit detection must be enabled in floating safety sensors.

Test pulse outputs	Digital inputs I0 … I17 (optional signalling outputs Y0 … Y3)					
T0 closed	I0 (Y0)	I3	I6	I9	I12 (Y2)	I15
T1 closed	I1	I4 (Y1)	I7	I10	I13	I16
T2 closed	I2	I5	I8	I11	I14 (Y3)	I17

Analogue limit values
The limit values are set with a number of between 0 to 4095.
The following conversion applies:

Limit value = Voltage [V] x 337

5.5 Actuator level
The actuator level consists of:
2x p-/n-switching safe outputs
2x p-switching safe outputs
2x safe relay outputs
4x optional signalling outputs
Each safe output can be switched off either without delay (Stop 0) or delayed (Stop 1) via safe timer.

5.6 Project planning
The planner selects the suitable application program and stipulates the necessary parameter assignment data. All information must be entered by setting instructions for the person charged with commissioning. The person charged with commissioning transfers this data to the safety module and verifies the correct parameter assignment and wiring. The following sequence must be observed for planning:

1. Definition of the safety function and determination of the requisite PL / Cat. / SIL.
2. Selection of the suitable application program.
3. Assignment of the periphery to the terminals.
4. Stipulation of the necessary additional functions.
5. Stipulation of which inputs require cross-wire detection.
6. Analogue inputs: stipulation of the type and limit values.
   If not used, lay AI0+AI1 to AGND and values to 4095.
7. Setting wiring plan.
8. Determination of the MSP code (see chapter 5.7).
9. Entry of the MSP code and additional functions in the setting instructions.
10. Entry of the cross short settings in the setting instructions.
11. Entry of the requisite timer values.
12. Entry of the analogue settings.
13. Enter the desired PIN.
    The following PINs are not allowed:
    - 0000, 0001, 0815, 4711
    - 1111, 2222, 3333, 4444, 5555, 6666, 7777, 8888, 9999
    - 0123, 1234, 2345, 3456, 4567, 5678, 6789
    - 9876, 8765, 7654, 6543, 5432, 4321, 3210
14. Sign setting instructions.

5.7 Configuration

Multifunctional sensor processor (MSP)
An input circle is analysed using a multifunctional sensor processor (MSP) which is parameter-assigned by a three-digit hexadecimal number. The 1st position describes the sensor, the 2nd position describes the additional function and the 3rd position describes the contact properties.

EN

**SCHMERSAL**

The entry of the MSP code is from right to left.

MSP code	Sensor type (Position 1)	Feature
0	Sensor evaluation deactivated	- There is no evaluation of a connected sensor! - Upon detection of a signal, an error message is generated on the screen! - Upon detection of a signal, all safety outputs are disabled!
1	Emergency stop control unit	Evaluation of the internal clock signals of the clock outputs T0 to T2 Setting = Cross-wire short
2	Safety switch (contact) e.g. AZ16	Evaluation of the internal clock signals of the clock outputs T0 to T2 Setting = Cross-wire short
3	Interlock (electro-mechanical, magnetic and actuator switch) e.g. AZM150, AZM161, AZM170	- Direct activation of the interlock (power supply for the magnet) over the semiconductor outputs Q0 / Q0N - Evaluation of the internal clock signals of the clock outputs T0 to T2 - Setting = Cross-wire short - No simultaneous evaluation of the solenoid and actuator contacts - The monitoring time is automatically set to infinity
4	Electronic solenoid interlock e.g. AZM40, AZM201, AZM300, AZM400, MZM100	- Direct activation of the interlock (power supply for the magnet) over the semiconductor outputs Q0 / Q0N - Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Setting = Standard - Simultaneous evaluation of the solenoid and actuator contacts
5	Non contact safety switch e.g. BNS 260	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Setting = Cross-wire short
6	Safety mat SMS4 / SMS5 to EN ISO 13856-1 (4-wire)	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Setting = Safety mat
7	AOPD e.g. SLC/SLG440 Electronic safety sensors e.g. RSS36/CSS sensors	- Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Setting = Standard - Test pulses by the sensor can be tolerated

Additional functions (Position 2)

MSP code	Discrepancy error monitoring	Start-up test	Feedback circuit	Autostart
0				
1				•
2			•	
3			•	•
4		•		
5		•		•
6		•	•	
7		•	•	•
8	•			
9	•			•
A	•		•	
B	•		•	•
C	•	•		
D	•	•		•
E	•	•	•	
F	•	•	•	•

Contact properties (Position 3)

0	Equivalent	(e.g. 2 NC contacts)	Standard setting
1	Antivalent	(e.g. 1 NC contact, 1 NO contact)	
2	Single channel	(e.g. 1 NC contact)	

Example, MSP code:
Emergency stop command device with active discrepancy monitoring, feedback loop and 2 NC contacts.

MSP	0	A	1	= E-stop command device
	Position 3	Position 2	Position 1	Input sequence from right to left
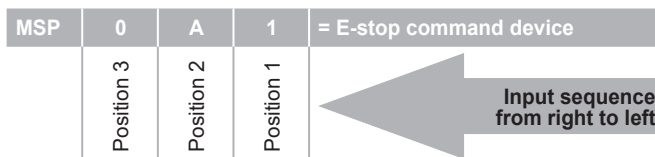
⚠ If the additional function "Discrepancy monitoring" is not used in a two-channel sensor, this should be especially justified in the risk analysis.

⚠ Door interlocking mechanisms have an infinite discrepancy, this allows the additional function to be used for error detection. With an activated discrepancy monitoring the interlock has to be opened after an unlocking request.

⚠ **Contact property (3rd position)** = single-channel: The input with the even number is always evaluated (e.g. sensor on I2 and I3 the input I2 single-channel is evaluated). The odd input must remain open.

ℹ **Sensor type 0 (deactivate):** With a HIGH signal to the sensor inputs of a disabled sensor all safety clearances are deactivated.

ℹ On deactivation of auto-start the function of monitored start is selected.

Further Parameter

Interlock type	
Power to unlock	For spring-locked guard interlocks.
Power to lock	For solenoid-locked guard interlocks.

ℹ The interlock type always applies to all connected guard interlocks.

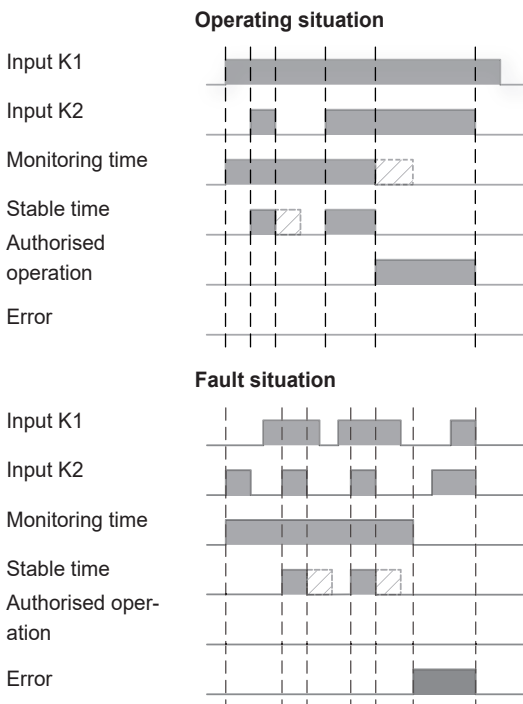| Inputs		
Standard	(S)	No cross-wire detection for input active.
Cross-wire short	(C)	Cross-circuit detection for this input is active.
Safety mat	(M)	Connecting a 4-wire safety mat. Cross-circuit detection for this input is active.

Times

Each MSP has a safety switch device input filter for bounce on protective equipment, or detection of failures.

Monitoring time / discrepancy time

Maximum tolerated delay between the channels of a 2-channel input. If exceeded a warning on the screen is displayed and the indicator light ERR flashes. Both channels must be opened to clear before the input can be activated again. Unless otherwise specified, this time is set to 10s (guard interlocks set to infinity).

Stable time

During the stable time (default value = 0.1 s) there is a debounce time, which causes a turn-on delay. The release of the safety function only takes place when both input contacts are switched stable for the duration of the stabilizing time.

Operating situation

Input K1	
Input K2	
Monitoring time	
Stable time	
Authorised operation	
Error	

Fault situation

Input K1	
Input K2	
Monitoring time	
Stable time	
Authorised operation	
Error	

⚠ The setting for the monitoring time / discrepancy time and stable time must be greater than zero.

6. Set-up and maintenance

The person putting into operation for the first time makes the necessary settings on the safety module using the setting instructions and then verifies these. The following sequence is to be observed.
1. Make settings in accordance with the setting instructions.
2. Compare the read-back displays with the setting instructions.
3. Enter the parameter program CRC in the setting instructions.
4. Perform acceptance check (checking of function, correct wiring, polarity of the actors, ….).
5. Sign setting instructions and minutes of the acceptance check.
6. Add setting instructions and minutes of the acceptance check to the machine documentation.

6.1 Operating the safety module

The safety module is operated using the rocker switch. If an entry us emphasised by a coloured bar (cursor), the menu can be navigated by moving the switch up and down. The current entry is selected by pressing on it. If this is a parameter, the value can now be set ("up/down"). The value is similarly accepted by pressing the rocker switch. If you actuate "up" the first time you enter a menu, you will reach the higher ranking menu. If the screen saver appears (a moving circle), this is similarly left by pressing the rocker switch. The term ENTER used in the further description for pressing the rocker switch.

6.2 Putting into operation for the first time

1. After switching on the start screen appears.

   SCHMERSAL
   PROTECT SELECT

2. The request is then made to select the menu language (default: English).

   Language
   English

3. The necessity for a configuration / parameter setting is displayed after ENTER.
4. Confirm by ENTER.

   CAUTION!
   Module needs to be configured first!

5. To conduct the configuration a PIN must be entered (factory default: 0000). The entry is made number by number using the rocker switch (up/down). The next number is reached by ENTER.

   Enter PIN
   0000

6. After correct entry the "Safety module configuration" screen appears.

   Configuration
   Safety module

7. Enter the menu by ENTER. Now select the desired program and confirm with ENTER.

   Program select
   Prog 01
   Prog 02
   Prog 03
   Prog 04

8. The list of the MSP codes now appears for the input circuits. Set the corresponding code for every MSP in accordance with the list. After entry a plain text display of the selected settings appears. ENTER moves back to the code list display. If you navigate "up" with the last MSP code, the next menu appears.

   Input circuit code
   MSP 01: 1 A 5
   MSP 02: 3 6 8
   MSP 03: 1 E 7

   MSP 03: (1 E 7)
   E-Stop 2K
   NC/NC start
   Feedback circuit
   Start-up + Cycl. Test

9. If a guard lock is used the selection of the type will appear (Power to unlock: Yes/no).

   Solenoid interlock
   Power to unlock

10. Now set the requisite values for the analogue inputs and times.

    Parameter
    Analog inputs
    Inputs
    Times

11. Once all settings have been made, leave the menu by moving "Up" until the query "Save Yes/No" appears. Confirm with "Yes". All parameters are then shown on several screen pages (red background). All parameters are marked with "M" (modified). Check all values once more and scroll further with "ENTER".

12. After display of "Readback completed" you will reach the PIN entry.

13. First enter the factory set PIN 0000.
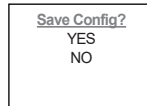
14. Then you must enter and repeat the new PIN from the settings instructions.
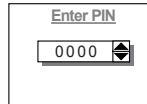
15. The CRC which is now shown must be entered in the settings instructions.

```
Save Config?
     YES
     NO
```

```
Enter PIN

  0000   ⬍
```

```
Enter new PIN

  3107   ⬍
```

```
New CRC
Par-CRC: A5778EDB

Write down CRC!
Press button to
restart...
```

6.3 Configuration
The setting is made essentially as described in chapter 5.7.

Alternatively:
If the logo appears after switching on, the display of the set program is first reached by pressing the rocker switch and then the main menu. If no logo appears, but an SPS message, move "Up" until you reach the main menu. Select "Configuration" here. The PIN to be entered is now the one on the settings instructions. The sequence corresponds to "Putting into operation for the first time". For the final parameter display with red background only altered values marked with a blue "M" are shown and must be checked specially.

> ℹ️ **LED RUN**
> lights up: operating mode
> blinking: Configuration mode or
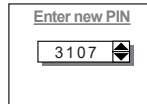> module has the factory defaults
> (see initial parameterization)

6.4 Behaviour in the case of faults
In the event of a fault the following procedure is recommended
1. UB LED dark: Check voltage supply
2. ERR LED lights up/flashes: Analyse error message on the display and arrange for appropriate actions.
3. ERR LED dark: Fault cannot be diagnosed by PROTECT SELECT. Action: Check the external cabling

> ℹ️ **LED ERR**
> illuminated: There is a fault (safe condition)
> blinking: There is a caution or warning
> (Operation with possible limitations)
> Fault / Warnings / Messages appear on the display in plain text.

6.5 Maintenance
A regular visual inspection and functional test, including the following steps, is recommended:
1. Check the correct fixing of the safety module
2. Check the cable and device for damage/manipulation indications
3. Check electrical function
   If relay outputs are used:
   • For PLd (Cat. 3) / SIL 2 (with HFT 1) at least every 12 months
   or
   • for PLe (Cat. 3 or 4) / SIL 3 (with HFT 1) at least once a month.
   Otherwise: at least once every 12 months.

> ⚠️ Damaged or defective components must be replaced.

7. Menu structure

7.1 Menu structure - Safety module

Status
  ↳ **Safety module**
    ↳↳ **Inputs**
      Display of status of the inputs.
    ↳↳ **Outputs**
      Display of status oft he outputs.
    ↳↳ **Analogue AI0**
      Display of the current analogue values and status of the set limit values.
    ↳↳ **Analogue AI1**
      Display of the current analogue values and status of the set limit values.
  ↳ **System**
    ↳↳ **Operating duration**
      Display of the time at which the system was activated.
    Warnings

> ℹ️ If the ERR display flashes the warnings can be shown here.

    ↳↳ **History**
      Display of the last changes of the inputs/outputs.

Error message

> ℹ️ If the rocker switch is pressed in this menu, a new start is possible.

  ↳ **Error code**
    Internal error code
  ↳ **Error message**
    Plain text message of the error code
  ↳ **Troubleshooting**
    Description of possible error cause and rectification measures
  ↳ **Restart**
    Trigger of a new start once the error has been eliminated.

Configuration

ℹ️ **Enter PIN**
Entry of the PIN codes so as be able to perform the configuration.

👌 **Safety module**

👌👌 **Program select**

Selection of one of the application programs. With the SELECT version there is a description of the programs in chapter 8. In the OEM version the customer-specific documentation must be consulted.

👌👌👌 **Input circuits**

Parameter assignment of the MSP in accordance with chapter 5.7.

👌👌👌 **Solenoid interlocks**

Selection of the guard interlock type (see chapter 5.7):
power to lock or power to unlock principle

⚠️ If the configuration is left without saving the old state remains valid.

👌👌👌 **Parameter**

👌👌👌👌 **Analog inputs**

👌👌👌👌👌 **Input type**

Single sensor:	Single channel
Dual sensor:	Dual channel with specification of the tolerance of the channels.

👌👌👌👌 **Limit values**

Limit values of the analogue inputs.

👌👌👌 **Inputs**

Standard (S)	24 VDC for ON
Cross-wire short (C)	Cycle signal for ON. (see chapter 5.4)
Safety mat (M)	For safety mats in short circuit mode.

👌👌👌 **Times**

Setting of the timer.

👌👌 **Default settings**

Resets the device to the delivery status

Adjustment

👌 **Contrast**
Stipulation of the contrast.

👌 **Screen saver**
Waiting time until the screen saver becomes active.

👌 **Language**
Setting of the language.

Info

👌 **Firmware version**
Specification of the firmware version used.

👌 **Hardware info**
Identification of the hardware.

👌 **Program version**
Specification of the program including the hash totals (CRC) for program and parameter assignment.

👌 **Configuration**
Display of the current configuration.

---

8. Appendix

8.1 Program 1 – C-Module (Prog.-CRC: 96AE)
Par.-CRC: A5AA7419
Collector Module for six configurable safety devices, with superordinate E-Stop functionality.

8.1.1 Description
This program covers to safety functions.

The first safety function is implemented by 6 safety sensors, which can be configured to match a specific type of safety switch or safety sensor, by setting the corresponding MSP codes for MSP1 to MSP 6 (see section 2.1.3). The combined output state of all these sensors affects the outputs Q0/Q0n, Q1/Q1n, Q2 and Q3. Switch-on and switch-off delay for these outputs can be configured by setting the timer values of T20 (TON) and T21 (TOF), the default value being 0 seconds.
The start/reset behavior of this safety function is always automatic start.

⚠️ Automatic Start is not permitted without additional measures against bypassing safety equipment by stepping behind!

⚠️ According to IEC/EN 60204-1 paragraph 9.2.5.4.2 the operating mode "automatic start" is only restrictedly admissible.
In particular, any inadvertent restart of the machine must be prevented by other suitable measures.

The second safety function (E-Stop) is implemented by one sensor input element (MSP7), which affects the relay contacts QR1 and QR2 and can be delayed by T22 (switch-on delay) and T23 (switch-off delay), default delay being 0 s. The delayed sensor signal also affects the outputs Q0/Q0N, Q1/Q1N, Q2 and Q3. The start/reset behavior of the E-Stop function can be configured using the second digit of MSP7 (see section 2.1.3).
Based on the general operating instructions, a performance level up to PL e can be achieved with this program for individual safety outputs and with standard-compliant wiring.
- Two channel (even and odd terminal designation of the input circuit)
  Cat. 4 / PL e / SIL 3 (PFH_D = 1.78 * 10^{-8} / h)
- Single-channel or dual-channel (only even or odd terminal designation of the input circuit), with a minimum request interval of >=30 hours.
  Cat. 2 / PL d / SIL 2 (PFH_D = 5.70 * 10^{-8} / h).
  If this minimum requirement interval is undershot, the achievable Cat. / PL / SIL is reduced by one step in each case.

The parameters listed below are default values for program 1.

8.1.2 Terminal assignment program 1

Terminal	Function	Comment
I0/Y0	MSP1	Sensor 1
I1		default value 097
I2	MSP2	Sensor 2
I3		default value 097
I4/Y1	MSP3	Sensor 3
I5		default value 097
I6	MSP4	Sensor 4
I7		default value 092
I8	MSP5	Sensor 5
I9		default value 092
I10	MSP6	Sensor 6
I11		default value 092
I12/Y2	n.c.	
I13	Reset	E-Stop Circuit
I14/Y3	EDM	Sensor Circuit
I15	EDM	E-Stop Circuit
I16	MSP7	Emergency Stop
I17		default value 0A1
AI0	n.c.	

Terminal	Function	Comment
AI1	n.c.	
AGND	n.c.	
Q0	High-Side-Switch	Sensor Circuit
Q0N	Low-Side-Switch	Sensor Circuit
Q1	High-Side-Switch	Sensor Circuit
Q1N	Low-Side-Switch	Sensor Circuit
Q2	High-Side-Switch	Sensor Circuit
Q3	High-Side-Switch	Sensor Circuit
QR1	Relay Contact	E-Stop Circuit
QR2	Relay Contact	E-Stop Circuit

8.1.3 Valid MSP codes

The MSPs of this program can be set to following values.

In case a sensor evaluation needs to be deactivated, the respective MSP code must be set to 000. Upon detection of a signal, an error message is generated on the screen and all safety outputs are disabled.

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
1	Emergency stop control unit	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
2	Safety switch (contact) e.g. AZ16	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
5	Non contact safety switch e.g. BNS 260	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
6	Safety mat SMS4 / SMS5 to EN ISO 13856-1 (4-wire)	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
7	OSSD e.g. SLC/ SLG440, RSS36/CSS sensors	- Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Test pulses of the sensor will be tolerated

Additional Functions – 2. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0*			EDM must always be wired	
1				x
5		x		x
9	x			x
D	x	x		x

Contact Configuration – 3. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0**	Equivalent		NC/NC	Default
1	Antivalent		NC/NO	
2***	Single-channel		NC	

*)   only valid for MSP7
**) MSP7 – E-Stop must always be configured equivalent contact configuration
***) in case of detected dual channel actuation, release is blocked until power cycle

8.1.4 Used Timer

Function	Timer	Time [s]
Monitoring time MSP1	T00	10.0
Stable time MSP1	T01	0.1
Monitoring time MSP2	T02	10.0
Stable time MSP2	T03	0.1
Monitoring time MSP3	T04	10.0
Stable time MSP3	T05	0.1
Monitoring time MSP4	T06	10.0
Stable time MSP4	T07	0.1
Monitoring time MSP5	T08	10.0
Stable time MSP5	T09	0.1
Monitoring time MSP6	T10	10.0
Stable time MSP6	T11	0.1
Monitoring time MSP7	T13	10.0
Stable time MSP7	T14	0.1
Switch-on delay Q0…Q3	T20	0.0
Switch-off delay Q0…Q3	T21	0.0
Switch-on delay QR1/QR2	T22	0.0
Switch-off delay QR1/QR2	T23	0.0

8.1.5 Messages

Message Text	Description
Single-channel switching detected sensor 1	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 2	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 3	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 4	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 5	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 6	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Antivalence fault sensor 1	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 2	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 3	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 4	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 5	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 6	Sensor action NC/NO instead of NC/NC
Emergency Stop actuated	E-Stop not released
Safety sensor 1 actuated	Sensor 1 not released
Safety sensor 2 actuated	Sensor 2 not released
Safety sensor 3 actuated	Sensor 3 not released
Safety sensor 4 actuated	Sensor 4 not released
Safety sensor 5 actuated	Sensor 5 not released
Safety sensor 6 actuated	Sensor 6 not released
EDM Safety area 1 required	Feedback Loop open
EDM Safety area 2 required	Feedback Loop open
RESET required	Falling edge needs to be detected for starting/resetting Safety Function

8.1.6 Connection example and illustration of the logic combination of the inputs to the outputs

I0 / I1	Sensor 1	MSP1		
I2 / I3	Sensor 2	MSP2		
I4 / I5	Sensor 3	MSP3		
T0 T1 / I6 I7	Sensor 4	MSP4		
T2 T0 / I8 I9	Sensor 5	MSP5	AND	
T1 T2 / I10 I11	Sensor 6	MSP6		
I13	Start/Reset			
I14	EDM Sensors Q0...Q3			
I15	EDM E-Stop QR			
T1 T2 / I16 I17	E-Stop	MSP7		

TON T20 — TOF T21

TON T22 — TOF T23

Output Q0 / Q0N
Output Q1 / Q1N
Output Q2
Output Q3

Output QR1
Output QR2

SCHMERSAL
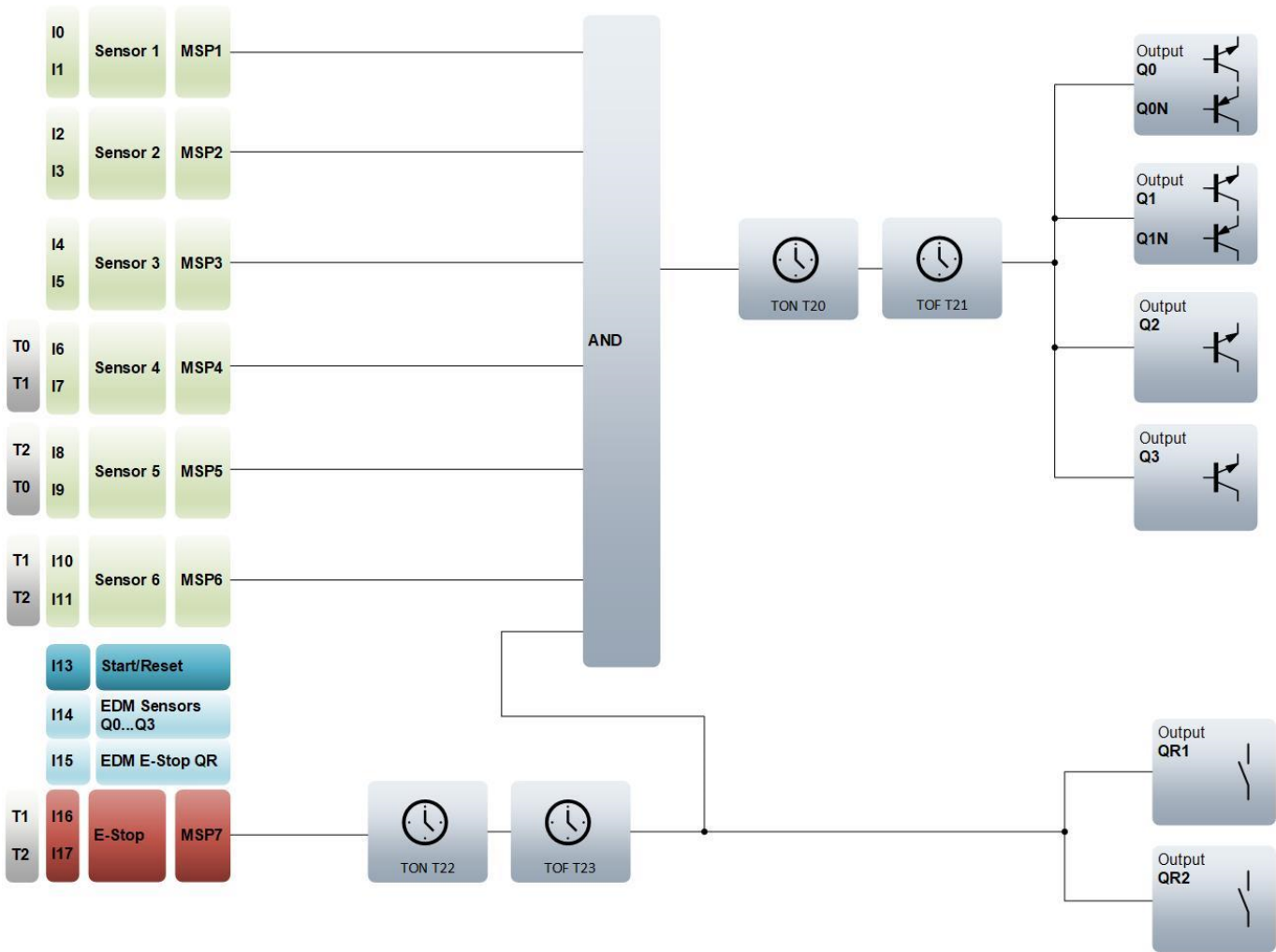
8.2 Program 2 – 2-Hand-Ctrl (Prog.-CRC: 3CC0)
Par.-CRC: 9E96EB98
Control of a Two-Hand control panel with E-Stop button, along with three configurable sensor input elements.

⚠️ Cross-circuit detection for two-hand-control input elements must be activated manually via "Inputs" sub menu of PRO-TECT-SELECT's configuration menu.

8.2.1 Description
This program has two separate safety functions plus a superordinate E-Stop.

The first safety function is the monitoring of a Two-Hand-control-panel (two-hand control acc. to ISO 13851 type IIIC)l. The panel affects the outputs Q2, Q3, QR1 and QR2 and is delayed by timer T12 (QR1, QR2, switch-off delay, default 0 s) and T13 (Q2, Q3, switch-off delay, default 0 s). This safety function always has automatic start behavior.

⚠️ The two-hand control only offers protection for the person using it.

The second safety function is implemented by three configurable sensor elements, which affect the outputs Q0/Q0N and Q1/Q1N. These inputs are delayed by timer T10 (Q0/Q0N, switch-off delay, default 0 s) and T11 (Q1/Q1N, switch-off delay, default 0 s)

The E-Stop shuts down both safety functions. E-Stop is reset via I11 (monitored start).

Based on the general operating instructions, a performance level up to PL e can be achieved with this program for individual safety outputs and with standard-compliant wiring.
- Two-channel (even and odd terminal designation of the input circuit)
  Cat. 4 / PL e / SIL 3 (PFH$_D$ = 1.78 * 10^{-8} / h)
- Single-channel or dual-channel (only even or odd terminal designation of the input circuit), with a minimum request interval of >= 30 hours.
  Cat. 2 / PL d / SIL 2 (PFH$_D$ = 5.70 * 10^{-8} / h).
  If this minimum requirement interval is undershot, the achievable Cat./PL/SIL is reduced by one step in each case.

The parameters listed below are default values for program 2.

Attention: Do not set MSP-codes to use monitored start/reset in this program! Start/Reset is handled separately from MSP settings in this instance.

⚠️ Automatic Start is not permitted without additional measures against bypassing safety equipment by stepping behind!

⚠️ According to IEC/EN 60204-1 paragraph 9.2.5.4.2 the operating mode "automatic start" is only restrictedly admissible. In particular, any inadvertent restart of the machine must be prevented by other suitable measures.

8.2.2 Terminal assignment program 2

Terminal	Function	Comment
I0/Y0 I1	MSP1	Emergency-Stop default value 0B1
I2 I3	MSP2	Sensor 1 default value 0B2
I4/Y1	Status SF1	Status 2-Hand-Ctrl Circuit
I5 I6	2-Hand Button #1*	NC NO
I7	MSP3	Sensor 2, channel 1 default value 0B2
I8 I9	2-Hand Button #2*	NO NC
I10	MSP4	Sensor 2, channel 2 default value 0B2
I11	Start/Reset	All safety functions

Terminal	Function	Comment
I12/Y2	Status SF2	Status Sensor Circuit
I13	EDM	Safety Function 1 (2-Hand)
I14/Y3	Fault EDM	Fault EDM Safety Function SF1 and SF2
I15	EDM	Safety Function 2 (Sensors)
I16 I17	MSP4	Sensor 3 default value 0B2
AI0	n.c.	
AI1	n.c.	
AGND	n.c.	
Q0	High-Side-Switch	Safety Function 2 (Sensors)
Q0N	Low-Side-Switch	Safety Function 2 (Sensors)
Q1	High-Side-Switch	Safety Function 2 (Sensors)
Q1N	Low-Side-Switch	Safety Function 2 (Sensors)
Q2	High-Side-Switch	Safety Function 1 (2-Hand)
Q3	High-Side-Switch	Safety Function 1 (2-Hand)
QR1	Relay Contact	Safety Function 1 (2-Hand)
QR2	Relay Contact	Safety Function 1 (2-Hand)

* cross-short detection must be activated manually, via "Inputs" sub menu in "Configuration" section

8.2.3 Valid MSP codes
The MSPs of this program can be set to following values.

In case a sensor evaluation needs to be deactivated, the respective MSP code must be set to 000. Upon detection of a signal, an error message is generated on the screen and all safety outputs are disabled.

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
1	Emergency stop control unit	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
2	Safety switch (contact) e.g. AZ16	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
5	Non contact safety switch e.g. BNS 260	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
6	Safety mat SMS4 / SMS5 to EN ISO 13856-1 (4-wire)	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
7	OSSD e.g. SLC/SLG440, RSS36/CSS sensors	- Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Test pulses of the sensor will be tolerated

Additional Functions – 2. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0*			EDM must always be wired	
3				x
7		x		x
B	x			x
F	x	x		x

Contact Configuration – 3. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0	Equivalent		NC/NC	Default
1	Antivalent		NC/NO	
2**	Single-channel		NC	

*)   only MSP2…MSP4
**)   in case of detected dual channel actuation, release is blocked until power cycle

8.2.4 Used Timer

Function	Timer	Time [s]
Monitoring time MSP1	T00	10.0
Stable time MSP1	T01	0.1
Monitoring time MSP2	T02	10.0
Stable time MSP2	T03	0.1
Monitoring time MSP3	T04	10.0
Stable time MSP3	T05	0.1
Monitoring time MSP4	T06	10.0
Stable time MSP4	T07	0.1
Reset Error	T08	5.0
Switch-off delay Q0/Q0N	T10	0.0
Switch-off delay Q1/Q1N	T11	0.0
Switch-off delay QR1/QR2	T12	0.0
Switch-off delay Q2, Q3	T13	0.0

8.2.5 Messages

Message Text	Description
Single-channel switching detected sensor 1	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 2	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 3	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Singel-channel switching detected E-Stop	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Antivalence fault sensor 1	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 2	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 3	Sensor action NC/NO instead of NC/NC
Antivalence fault E-Stop	Sensor action NC/NO instead of NC/NC
Emergency Stop actuated	E-Stop not released
Safety sensor 1 actuated	Sensor 1 not released
Safety sensor 2 actuated	Sensor 2 not released
Safety sensor 3 actuated	Sensor 3 not released
EDM Safety area 1 required	Feedback Loop open
RESET required	Falling edge needs to be detected for starting/resetting Safety Function
Two-Hand-function faulty	Two-hand operation constraints violated

SCHMERSAL

8.2.6 Connection example and illustration of the logic combination of the inputs to the outputs

Input		Function
T0 / T1	I0 / I1	E-Stop MSP1
T2 / T0 / T2 / T0	I5 / I6 / I8 / I9	2-Hand
T2 / T0	I2 / I3	Sensor 1 MSP2
T1 / T1	I7 / I10	Sensor 2 MSP3
T1 / T2	I16 / I17	Sensor 3 MSP4
I11		Start/Reset
I13		EDM 2-Hand & E-Stop
I15		EDM Sensors

Y3 Fault EDM SF1 and SF2

AND → TOF T13 → Output Q2 / Output Q3

OR → Y1 Status 2-Hand

TOF T12 → Output QR1/QR2

AND → TOF T10 → Output Q0 / Q0N

OR → Y2 Status Sensors

TOF T11 → Output Q1 / Q1N

OFF: SF switched OFF — Y1 Status 2-Hand
Blinking: Reset required — Y2 Status Sensors
ON: SF switched ON

8.3 Program 3 – 2 Areas lock (Prog-CRC: 6475)
Par.-CRC: CA406B8E
Monitoring of two separate safety areas with one configurable interlock each and two configurable sensor elements. The sensors can be assigned both of the safety areas.

8.3.1 Description
This program monitors two separate safety areas.

Safety area 1 is defined as a safety function switching off output Q0/Q0N.Q0/Q0N can be delayed, using T20 (switch-on delay, default 0 s) and T21 (switch-off delay, default 0 s).
Safety area 1 is safeguarded by a solenoid interlock, which can be controlled via output Q2. Q2 can be delayed, using T26 (switch-on delay, default 0 s) and T27 (switch-off delay, default 0 s). When unlocking is requested via I3, output Q0/Q0N is switched off after the delay is elapsed and solenoid is unlocked via Q2.
Safety area 2 is defined as a safety function switching off output Q1/Q1N. Q1/Q1N can be delayed, using T22 (switch-on delay, default 0 s) and T23 (switch-off delay, default 0 s).

Safety area 2 is safeguarded by a solenoid interlock, which can be controlled via output Q3. Q3 Q0/Q0N can be delayed, using T28 (switch-on delay, default 0 s) and T29 (switch-off delay, default 0 s). The activation mode of the interlock is "power-to-unlock". When unlocking is requested via I7, output Q1/Q1N is switched off after the delay is elapsed and solenoid is unlocked via Q3.

Furthermore, there is a superordinate E-Stop, which affects relay contacts QR1 and QR2. QR1 and QR2 can be delayed, using T24 (switch-on delay, default 0 s) and T25 (switch-off delay, default 0 s).

Additionally, switches off Q0/Q0N as well as Q1/Q1N with the respective delays (T20, T21, T22, T23, T26, T27, T28, T29)

The additional sensors can be assigned to both safety functions by setting the corresponding MSP codes. By setting MSP3, additional sensor 1 is assigned to affect Q0/Q0N, by setting MSP5 it affects Q1/Q1N. By setting MSP4, additional sensor 2 is assigned to affect Q0/Q0N, by setting MSP6 it affects Q1/Q1N. If the respective MSP is deactivated, it doesn't affect the corresponding safety function.

Based on the general operating instructions, a performance level up to PL e can be achieved with this program for individual safety outputs and with standard-compliant wiring.
- Two-channel (even and odd terminal designation of the input circuit)
  Cat. 4 / PL e / SIL 3 (PFH$_D$ = 1.78 * 10^{-8} / h)
- Single-channel or dual-channel (only even or odd terminal designation of the input circuit), with a minimum request interval of >= 30 hours.
  Cat. 2 / PL d / SIL 2 (PFH$_D$ = 5.70 * 10^{-8} / h).
  If this minimum requirement interval is undershot,
  the achievable Cat. / PL / SIL is reduced by one step in each case.

The parameters listed below are default values for program 3.

⚠ Automatic Start is not permitted without additional measures against bypassing safety equipment by stepping behind!

⚠ According to IEC/EN 60204-1 paragraph 9.2.5.4.2 the operating mode "automatic start" is only restrictedly admissible. In particular, any inadvertent restart of the machine must be prevented by other suitable measures.

8.3.2 Terminal assignment program 3

Terminal	Function	Comment
I0/Y0	Signaling Output	State MSP1
I1 I2	MSP1	Solenoid Interlock Safety Area 1/Sensor 1 default value 097
I3	Latch Magnet #1	Request unlock Interlock Safety Area 1
I4/Y1	Signaling Output	State MSP2
I5 I6	MSP2	Solenoid Interlock Safety Area 2, Sensor 2 default value 097
I7	Latch Magnet #2	Request unlock Interlock Safety Area 2
I8 I9	MSP3 MSP5	Sensor 3 default value 097
I10 I11	MSP4 MSP6	Sensor 4 default value 097
I12	EDM	E-Stop Circuit QR1/QR2
I13	Start/Reset	E-Stop Circuit
I14	EDM	Safety Area 1 / Q0/Q0N
I15	EDM	Safety Area 2 / Q1/Q1N
I16 I17	MSP7	Emergency Stop, default value 0A1
AI0	n.c.	
AI1	n.c.	
AGND	n.c.	
Q0	High-Side-Switch	Output Safety Area 1
Q0N	Low-Side-Switch	Output Safety Area 1
Q1	High-Side-Switch	Output Safety Area 2
Q1N	Low-Side-Switch	Output Safety Area 2
Q2	Solenoid Control	Safety Area 1 -> MSP1
Q3	Solenoid Control	Safety Area 2 -> MSP2
QR1	Relay contact	E-Stop
QR2	Relay contact	E-Stop

8.3.3 Valid MSP codes
The MSPs of this program can be set to following values.

In case a sensor evaluation needs to be deactivated, the respective MSP code must be set to 000. Upon detection of a signal, an error message is generated on the screen and all safety outputs are disabled.

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
1	Emergency stop control unit	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
2	Safety switch (contact) e.g. AZ16	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
5	Non contact safety switch e.g. BNS 260	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active

SCHMERSAL

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
6	Safety mat SMS4 / SMS5 to EN ISO 13856-1 (4-wire)	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
7	OSSD e.g. SLC/SLG440, RSS36/CSS sensors	- Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Test pulses of the sensor will be tolerated

Additional Functions – 2. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0			EDM must always be wired	
1				x
5		x		x
9	x			x
D	x	x		x

Contact Configuration – 3. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0	Equivalent		NC/NC	Default
1	Antivalent		NC/NO	
2*	Single-channel		NC	

*) in case of detected dual channel actuation, release is blocked until power cycle

8.3.4 Used Timer

Function	Timer	Time [s]
Monitoring time MSP1	T00	10.0
Stable time MSP1	T01	0.1
Monitoring time MSP2	T02	10.0
Stable time MSP2	T03	0.1
Monitoring time MSP3	T04	10.0
Stable time MSP3	T05	0.1
Monitoring time MSP4	T06	10.0
Stable time MSP4	T07	0.1
Monitoring time MSP5	T08	10.0
Stable time MSP5	T09	0.1
Monitoring time MSP6	T10	10.0
Stable time MSP6	T11	0.1
Monitoring time MSP7	T13	10.0
Stable time MSP7	T14	0.1
Switch-on delay Q0/Q0N	T20	0.0
Switch-off delay Q0/Q0N	T21	0.0
Switch-on delay Q1/Q1N	T22	0.0
Switch-off delay Q1/Q1N	T23	0.0
Switch-on delay QR1/QR2	T24	0.0
Switch-off delay QR1/QR2	T25	0.0
Switch-on delay Q2	T26	0.0
Switch-off delay Q2	T27	0.0
Switch-on delay Q3	T28	0.0
Switch-off delay Q3	T29	0.0

8.3.5 Messages

Message Text	Description
Single-channel switching detected sensor 1	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 2	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 3	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 4	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 5	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 6	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Singel-channel switching detected E-Stop	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Antivalence fault sensor 1	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 2	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 3	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 4	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 5	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 6	Sensor action NC/NO instead of NC/NC
Antivalence fault E-Stop	Sensor action NC/NO instead of NC/NC
Emergency Stop actuated	E-Stop not released
Safety sensor 1 actuated	Sensor 1 not released
Safety sensor 2 actuated	Sensor 2 not released
Safety sensor 3 actuated	Sensor 3 not released
Safety sensor 4 actuated	Sensor 4 not released
Safety sensor 5 actuated	Sensor 5 not released
Safety sensor 6 actuated	Sensor 6 not released
EDM Safety area 1 required	Feedback Loop open Q0
EDM Safety area 2 required	Feedback Loop open Q1
EDM E-Stop required	Feedback Loop open QR1/QR2
RESET required	Falling edge needs to be detected for starting/resetting Safety Function
Guard Locking 1 not locked	
Guard Locking 2 not locked	

8.3.6 Connection example and illustration of the logic combination of the inputs to the outputs

Release E-Stop requires valid EDM on I12 (E-Stop/QR), I14 (Safety Area 1/Q0) and I15 (Safety Area 2/Q1)

EN
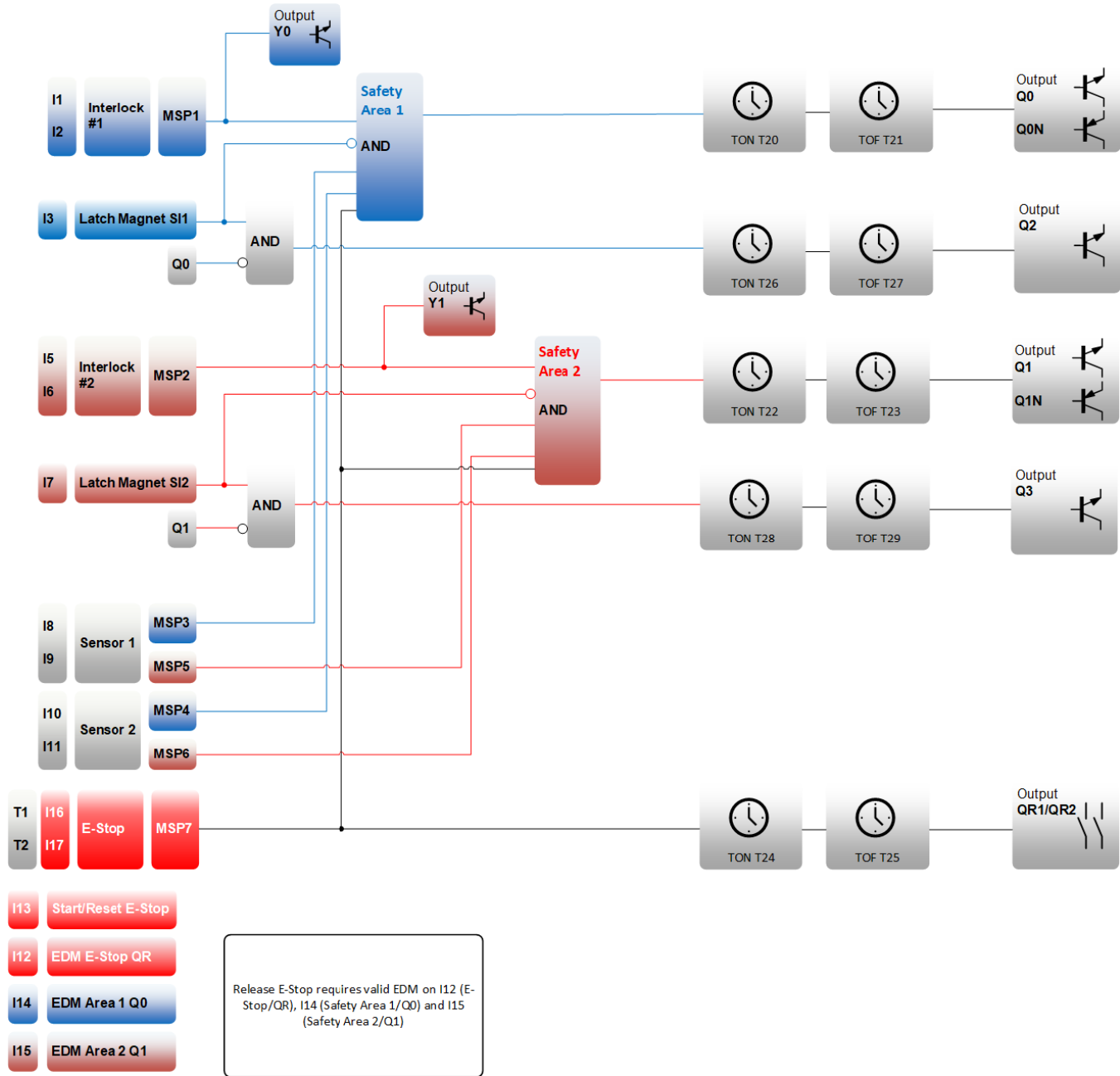
8.4 Program 4 – Flexible 6 (Prog.-CRC: B692)
Par.-CRC: 740564BE
Six configurable sensor elements which can be assigned to three separate safety functions.

8.4.1 Description
This program implements three separate safety functions. There are 6 sensor input elements, which can be assigned individually to the safety functions, via the corresponding MSPs.

Safety Function 1 is defined as switching off output QR1/QR2.QR1/QR2 can be delayed, using T20 (switch-on delay, default 0 s) and T21 (switch-off delay, default 0 s). Y2 is used as signaling output for safety function 1.

Safety Function 2 is defined as switching off output Q0/Q0N.Q0/Q0N can be delayed, using T22 (switch-on delay, default 0 s) and T23 (switch-off delay, default 0 s). Output Y3 is used as a signaling output for safety function 2.

Safety Function 3 is defined as switching off output Q1/Q1N.Q1/Q1N can be delayed, using T24 (switch-on delay, default 0 s) and T25 (switch-off delay, default 0 s). Output Q2 is used as a signaling output for safety function 3.

Q3 is used as a combined status signal for safety function 1, 2 and 3.

Based on the general operating instructions, a performance level up to PLe can be achieved with this program for individual safety outputs and with standard-compliant wiring.
- Two-channel (even and odd terminal designation of the input circuit) Cat. 4 / PL e / SIL 3 ($PFH_D = 1.78 * 10^{-8}$ / h)
- Single-channel or dual-channel (only even or odd terminal designation of the input circuit), with a minimum request interval of >= 30 hours. Cat. 2 / PL d / SIL 2 ($PFH_D = 5.70 * 10^{-8}$ / h).
  If this minimum requirement interval is undershot, also for frequency monitoring, the achievable Cat./PL/SIL is reduced by one level in each case.

The parameters listed below are default values for program 4.

⚠️ Automatic Start is not permitted without additional measures against bypassing safety equipment by stepping behind!

⚠️ According to IEC/EN 60204-1 paragraph 9.2.5.4.2 the operating mode "automatic start" is only restrictedly admissible. In particular, any inadvertent restart of the machine must be prevented by other suitable measures.

8.4.2 Terminal assignment program 4

Terminal	Function			Comment
I0/Y0 I1	MSP1 (SF1)	MSP7 (SF2)	MSP12 (SF3)	Sensor 1 default value 0A1
I2 I3	MSP2 (SF1)	MSP8 (SF2)	MSP13 (SF3)	Sensor 2 default value 0A1
I4/Y1 I5	MSP3 (SF1)	MSP9 (SF2)	MSP14 (SF3)	Sensor 3 default value 0A1
I6 I7	MSP4 (SF1)	MSP10 (SF2)		Sensor 4 default value 0A1
I8 I9	MSP5 (SF1)	MSP11 (SF2)		Sensor 5 default value 0A1
I10 I11	MSP6 (SF1)			Sensor 6 default value 0A1
I12/Y2	Signaling Output			Constant: Safety Function 1 ok Pulsing: Safety Function 1 waiting for Reset
I13	Start/Reset			All Safety Functions
I14/Y3	Signaling Output			Constant: Safety Function 2 ok Pulsing: Safety Function 2 waiting for Reset
I15	EDM			Safety Function 1
I16	EDM			Safety Function 2
I17	EDM			Safety Function 3
AI0	n.c.			
AI1	n.c.			
AGND	n.c.			
Q0	High-Side-Switch			Safety Function 2
Q0N	Low-Side-Switch			Safety Function 2
Q1	High-Side-Switch			Safety Function 3
Q1N	Low-Side-Switch			Safety Function 3
Q2	Signaling Output			Constant: Safety Function 3 ok Pulsing: Safety Function 2 waiting for Reset
Q3	Signaling Output			Safety Function 1 and Safety Function 2 and Safety Function 3 are ok
QR1	Relay Contact			Safety Function 1
QR2	Relay Contact			Safety Function 1

8.4.3 Valid MSP codes
The MSPs of this program can be set to following values.

In case a sensor evaluation needs to be deactivated, the respective MSP code must be set to 000. Upon detection of a signal, an error message is generated on the screen and all safety outputs are disabled.

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
1	Emergency stop control unit	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
2	Safety switch (contact) e.g. AZ16	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active

Sensor Types – 1. Digit		
MSP Code	Sensor Type	Feature
5	Non contact safety switch e.g. BNS 260	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
6	Safety mat SMS4 / SMS5 to EN ISO 13856-1 (4-wire)	- Evaluation of the internal clock signals of the clock outputs T0 to T2 - Cross-wire monitoring is active
7	OSSD e.g. SLC/SLG440, RSS36/CSS sensors	- Evaluating signals of the safety sensors - No evaluation of the internal clock signals of the clock outputs T0 to T2 - Test pulses of the sensor will be tolerated

Additional Functions – 2. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
2			EDM must always be wired	
3				x
6		x		
7		x		x
A	x			
B	x			x
E	x	x		
F	x	x		x

Contact Configuration – 3. Digit				
MSP Code	Discrepancy Error	Start-Up test	EDM	Autostart
0	Equivalent		NC/NC	Default
1	Antivalent		NC/NO	
2*	Single-channel		NC	

*) in case of detected dual channel actuation, release is blocked until power cycle

8.4.4 Used Timer

Function	Timer	Time [s]
Stable time MSP1	T01	0.1
Stable time MSP2	T02	0.1
Stable time MSP3	T03	0.1
Stable time MSP4	T04	0.1
Stable time MSP5	T05	0.1
Stable time MSP6	T06	0.1
Stable time MSP7	T07	0.1
Stable time MSP8	T08	0.1
Stable time MSP9	T09	0.1
Stable time MSP10	T10	0.1
Stable time MSP11	T11	0.1
Stable time MSP12	T12	0.1
Stable time MSP13	T13	0.1
Stable time MSP4	T14	0.1
Switch-on delay QR1/QR2	T20	0.0
Switch-off delay QR1/QR2	T21	0.0
Switch-on delay Q0/Q0N	T22	0.0
Switch-off delay Q0/Q0N	T23	0.0
Switch-on delay Q1/Q1N	T24	0.0
Switch-off delay Q1/Q1N	T25	0.0

8.4.5 Messages

Message Text	Description
Single-channel switching detected sensor 1	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 2	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 3	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 4	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 5	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Single-channel switching detected sensor 6	Single-channel action on a dual-channel sensor detected/ Failed Start-Up-Test
Antivalence fault sensor 1	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 2	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 3	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 4	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 5	Sensor action NC/NO instead of NC/NC
Antivalence fault sensor 6	Sensor action NC/NO instead of NC/NC
Safety sensor 1 actuated	Sensor 1 not released
Safety sensor 2 actuated	Sensor 2 not released
Safety sensor 3 actuated	Sensor 3 not released
Safety sensor 4 actuated	Sensor 4 not released
Safety sensor 5 actuated	Sensor 5 not released
Safety sensor 6 actuated	Sensor 6 not released
EDM Safety area 1 required	Feedback Loop SF1 open
EDM Safety area 2 required	Feedback Loop SF2 open
EDM Safety area 3 required	Feedback Loop SF3 open
RESET required	Falling edge needs to be detected for starting/resetting Safety Function

8.4.6 Connection example and illustration of the logic combination of the inputs to the outputs

T0	I0	Sensor 1	MSP1
T1	I1		MSP7
			MSP12
T2	I2	Sensor 2	MSP2
T0	I3		MSP8
			MSP13
T1	I4	Sensor 3	MSP3
T2	I5		MSP9
			MSP14
T0	I6	Sensor 4	MSP4
T1	I7		MSP10
T2	I8	Sensor 5	MSP5
T0	I9		MSP11
T1	I10	Sensor 6	MSP6
T2	I11		

I13	Start/Reset
I15	EDM SF1
I16	EDM SF2
I17	EDM SF3

MSP1, MSP2, MSP3, MSP4, MSP5, MSP6 → AND → TON T20 → TOF T21 → Output QR1/QR2 — Y2: SF1 ok

MSP7, MSP8, MSP9, MSP10, MSP11 → AND → TON T22 → TOF T23 → Output Q0 / Q0N — Y3: SF2 ok

MSP12, MSP13, MSP14 → AND → TON T24 → TOF T25 → Output Q1 / Q1N — Q2: SF3 ok

Y2, Y3, Q2 → AND → Output Q3

OFF: SF switched OFF — Y2 SF1 Status

Blinking: Reset required — Y3 SF2 Status

ON: SF switched ON — Q2 SF3 Status

9. EU Declaration of conformity

EU Declaration of conformity   **SCHMERSAL**

Original

K.A. Schmersal GmbH & Co. KG
Möddinghofe 30
42279 Wuppertal
Germany
Internet: www.schmersal.com

We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.

Name of the component:

PROTECT-SELECT-CC-910001239-240501 [1]
PROTECT-SELECT-SK-910001239-240501 [1]

[1] SYS firmware: 1.1.7 or higher
    Hardware: FOMP or higher

Type:

See ordering code

Description of the component:

User-specific multifunctional safety controller, also for emergency stop circuits and two-hand control monitoring

Relevant Directives:

Machinery Directive	2006/42/EC
EMC-Directive	2014/30/EU
RoHS-Directive	2011/65/EU

Applied standards:

EN ISO 13849-1:2023
IEC 61508 parts 1-7:2010
EN ISO 13850:2015
EN ISO 13851:2019

Notified body, which approved the full quality assurance system, referred to in Appendix X, 2006/42/EC:

TÜV Rheinland Industrie Service GmbH
Am Grauen Stein, 51105 Köln
ID n°: 0035

Person authorised for the compilation of the technical documentation:

Oliver Wacker
Möddinghofe 30
42279 Wuppertal

Place and date of issue:

Wuppertal, November 8, 2024

Authorised signature
Philip Schmersal
Managing Director

PROTECT-SELECT-910001239-240501-B-EN