

SAFE-DELAY

Functional Safety Module | E-Stop monitoring up to SIL 3 with time-off delayed contacts



SAFE-DELAY is an all-purpose emergency stop device that combines non-time-delayed and time-delayed contacts. This permits dangerous components of a system to be switched off quickly and safely in an emergency situation. At the same time, other circuits can continue to be supplied with voltage for up to 30 seconds to allow a tool to be moved to its idle position or to brake following parts, for example. The safety module provides two safe relay contacts without any delay and two safe relay contacts with a time-off delay up to 30 seconds (can be ordered with fixed or adjustable time). Further applications for the SAFE-DELAY include single or dual channel emergency stop circuits and guard monitoring on machines and plants according to EN ISO 13849-1 and EN 62061.

FEATURES

- 2 non-delayed safety contacts
- 2 time-off delayed contacts (adjustable and fixed)
- Continuously adjustable time delay (1 to 30 s)
- Connection of:
 - Emergency stop buttons
 - Mechanical safety switches
 - Non-contact safety switches
 - Safety components with OSSD outputs
- Control: single or dual channel feedback loop for external contactors or extension modules
- Cyclical monitoring of the output contacts LED indicator for power and status
- Automatic or manual start
- Short-circuit monitoring and ground fault monitoring
- Up to PL e/SILCL 3/category 4 (EN ISO 13849-1/EN 62061)

ORDER DETAILS

Brand	SALZ Automation	
Product Name	SAFE-DELAY SAFE-DELAY-3S, SAFE-DELAY-10S (fixed time-off delay)	
Function	E-stop monitoring module SIL 3 with time-off delay up to 30 sec.	
Product SKU/Order No.	SA-SAFE-DL-01-00	adjustable 0 - 30 sec.
	SA-SAFE3S-DL-01-00	fixed time 3 sec.
	SA-SAFE10S-DL-01-00	fixed time 10 sec.



Product Safety
Functional
Safety
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1 Function

The moving parts of a machine or system can be quickly and safely stopped in case of danger with the non-time-delayed contacts of the SAFE-DELAY safety contacts with time- delay switch-off are also integrated into the SAFE-DELAY. They are used whenever it is safer to keep supplying voltage to parts of a machine after the emergency stop switch is operated.

It is ensured that a single fault or malfunction does not lead to a loss of the safety function and that every fault is detected by cyclical self-monitoring no later than when the system is switched off and switched on again. The time-off delayed contacts are activated at the same time as the non-time-delay contacts; however, when the emergency stop button is pressed, the contacts are only deactivated after the time set on the potentiometer (1 ... 30s). During timeout, no power-loss is accepted.

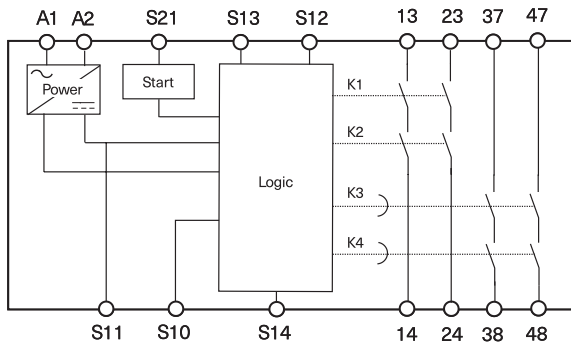


Fig. 1: Block diagram SAFE-DELAY

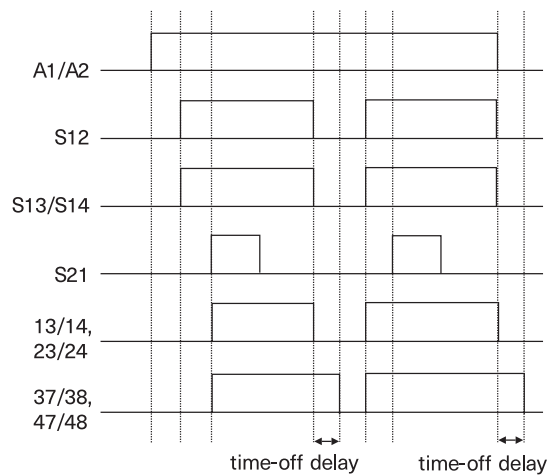


Fig. 2: State diagram SAFE-DELAY with manual start

2 Installation

As per EN 60204-1, the device is intended for installation in control cabinets with a minimum degree of protection of IP54. The following should be noted:

- Mounting on 35 mm rail according to EN 60715.
- Ensure sufficient heat dissipation in the control cabinet.

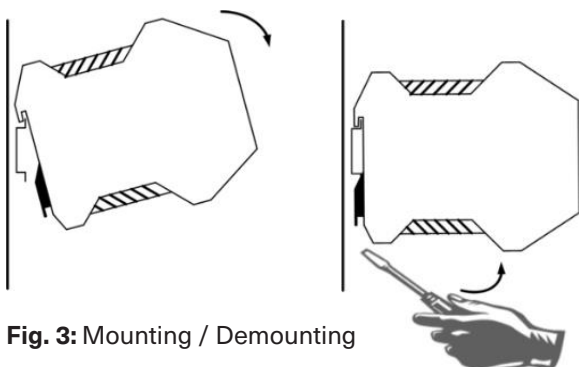


Fig. 3: Mounting / Demounting

3 Safety Precautions

- Installation and commissioning of the device must be performed only by authorized personnel and who has read and understood this operating instructions.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.
- The wiring of the device must comply with the instructions in this operating instructions, otherwise there is a risk that the safety function will be lost.
- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- The contact protection and the insulation of the supply cables must be designed for the highest voltage to the device.
- All relevant safety regulations and standards are to be observed.
- The overall concept of the control system in which the device is incorporated must be validated by the user.
- Failure to observe the safety regulations can result in death, serious injury and serious damage.
- Note down the version of the product (see label "Rev.") and check it prior to every commissioning of a new device. If the version has changed, the overall concept of the control system in which the device is incorporated must be validated again by the user.

4 Electrical Connection

- A safety transformer according to EN 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected.
- Observe the instructions in the section Technical Data.
- If the device does not function after commissioning, it must be returned to the manufacturer unopened. Opening the device will void the warranty.
- External fusing of the safety contacts must be provided
- Use adequate protective circuit for inductive loads (e.g. free-wheeling diode)

A1:	24V DC Power Supply
A2:	0V Power Supply
S10:	Control Voltage
S11:	DC24V Control Voltage
S12:	Control Line
S13:	Control Line
S14:	Control Line
S21:	Start Input
13/14:	Safety Relay Contact
23/24:	Safety Relay Contact
37/38:	Delayed Safety Contacts
47/48:	Delayed Safety Contacts

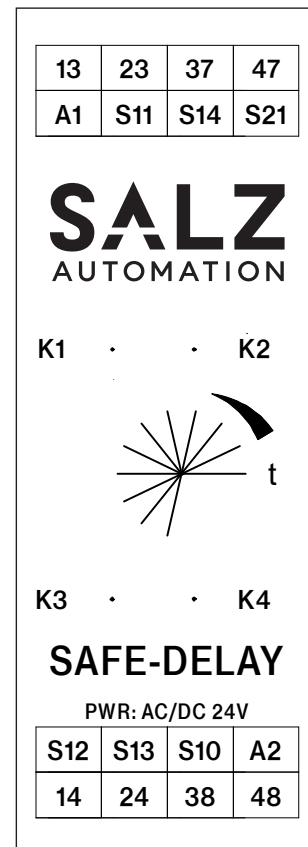


Fig. 4: Terminals

5 Operation Instructions

5.1 Applications

Depending on the application or the result of the risk assessment according to EN ISO 13849-1, the device must be wired as shown in Fig. 5 to Fig. 15. Non delayed contacts 13/14, 23/24 can be used up to PL e, category 4, time-off delayed safety contacts 37/38, 47/48 up to PL e, category 3.

⚠ WARNING:

In order to activate earth fault monitoring, the PE must be connected only to the power supply unit in accordance with EN 60204-1.

⚠ For proper operation, all safety contacts must have returned to their initial state before the device is restarted.

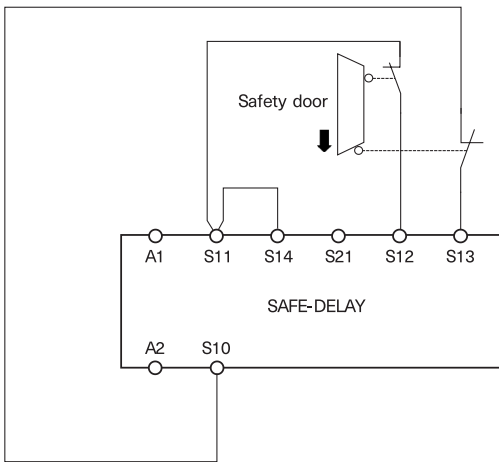


Fig. 5: Dual channel emergency stop with short circuit and ground fault monitoring (up to PL e/SIL 3, category 4)

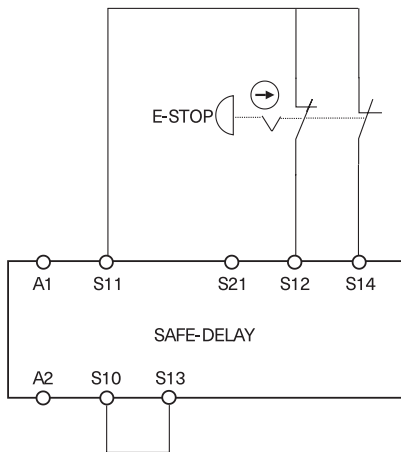


Fig. 6: Dual channel emergency stop with ground fault monitoring (up to PL d/SIL 2, category 3)

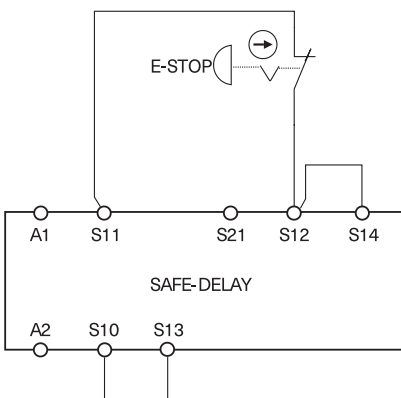


Fig. 7: Single channel emergency stop with ground fault monitoring (up to PL c/SIL 1, category 1)

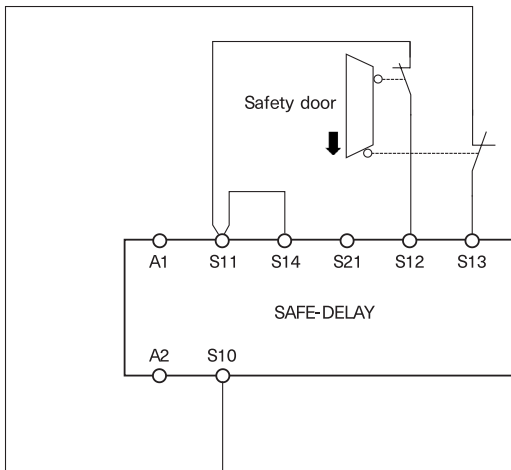


Fig. 8: Dual channel safety guard monitoring with short circuit and ground fault monitoring (up to PL e/SIL 3, category 4)

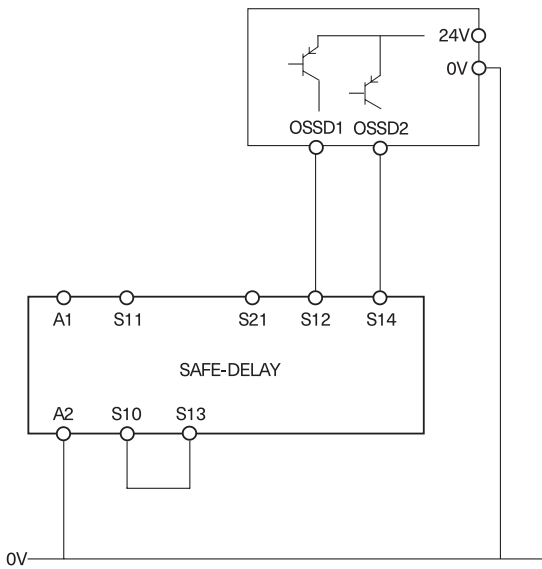


Fig. 9: Two channel emergency stop with PNP outputs/OSSD outputs with its own short circuit monitoring (up to PL e/SIL 3, category 4)

⚠ WARNING: Loss of functional safety!

For the application according to Fig. 5 the following is to be noted:

- Make sure that the ground potential of the signal generator and the SAFE-DELAY is the same.
- It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated.

5.2 Start Behavior

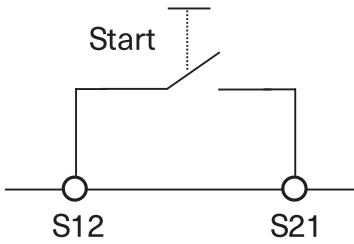


Fig. 10: Manual start

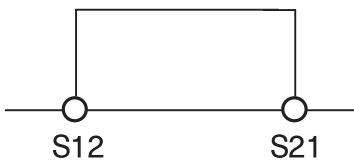


Fig. 11: Automatic start. Maximum allowable delay when closing the safety switches at S12 and S13:

S12 before S13: 300 ms
S13 before S12: no limit

⚠ WARNING: Safety contacts will be activated immediately at power ON

⚠ For proper operation, all safety contacts must have returned to their initial state before the device is restarted.

5.3 Feedback Loop

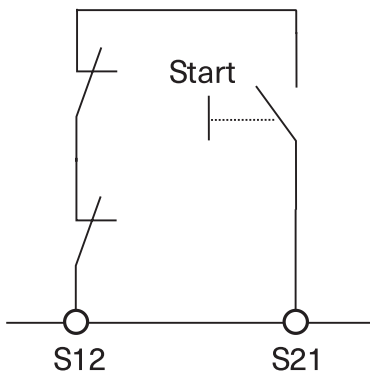


Fig. 12: Feedback loop for manual start. The feedback loop monitors contactors or the expansion modules

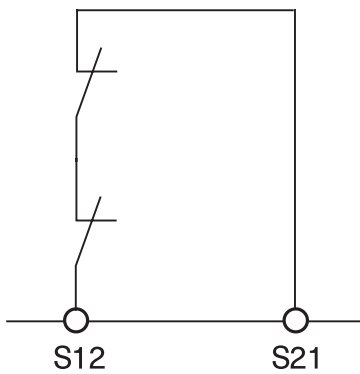


Fig. 13: Feedback loop for automatic start. The feedback loop monitors contactors or the expansion modules

5.4 Power Supply and Safety Contacts

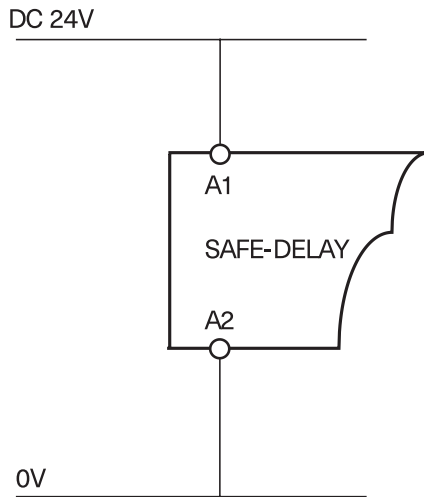


Fig. 14: Power supply A1 and A2

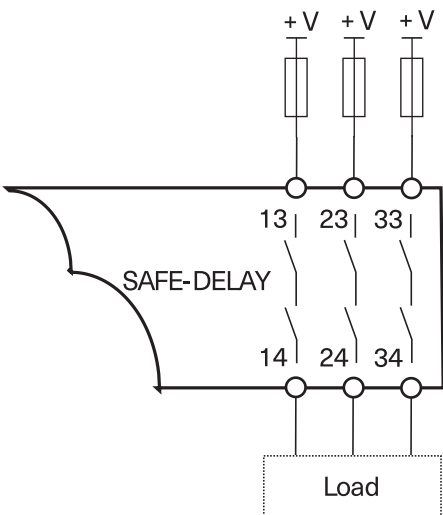


Fig. 15: Connecting load to safety contacts. Voltage (+V) according to Technical Data.

⚠ ATTENTION: Inductive loads should have adequate protection circuit such as a free-wheeling diode.

5.5 Commissioning Procedure


 **ADVICE:** Follow the guidelines in “Electrical Connection” during the start-up.

1. Input circuit

Depending on the risk evaluation choose one of the wiring diagrams in „Applications“ (Fig. 5 to Fig. 9).

2. Choose start mode

Connect the start button with S12 and S21 for monitored manual start or connect S21 with S12 directly for automatic start (Fig. 10 or Fig. 11).


 **WARNING:** If “Automatic start” is set, bear in mind that the safety contacts will switch immediately after the power supply is connected. If “Monitored manual start” is set, the start button must be opened after wiring.

3. Feedback loop

If external contactors or extension modules are used, connect them according to Fig. 12 or Fig. 13.

4. Power supply

Connect the power supply to A1 and A2 (Fig. 14).

 **CAUTION:** Power must not yet be activated.


5. Set delay time

Set the desired delay time with the rotary switch.

 **WARNING:** Scale marks are only to be understood as a setting aid. It is essential to measure the delay time.

6. Starting the device

Switch on the operating voltage.

 **WARNING:** If the “Automatic start” starting behavior is set, the safety contacts will close immediately. If the “Manual start” starting behavior is set, close the start button to close the safety contacts. No monitoring of a connected start button. LEDs K1, K2, K3 and K4 are lit.

7. Triggering safety function

Open the emergency stop circuit by actuating the connected safety switch. The safety contacts open immediately.

8. Reactivation

Close the emergency stop circuit. If “Automatic start” is selected, the safety contacts will close immediately. If the “Monitored manual start” starting behavior is set, close the start button to close the safety contacts.

5.6 Check and Maintenance

No maintenance is required for the device itself. But the following checks are regularly required to ensure proper and continuous functioning:

- Check the switch function.
- Check for signs of manipulation and safety function bypassing.
- Check if the device is mounted and connected securely
- Check for soiling, check if the safety device is working properly, in particular:
 - Every time after initial commissioning
 - Every time after replacing a component
 - After every fault in the safety circuit

According to European Machinery Directive 2006/42/EC + Amendment No. CNB / M / 11.050, a request for the safety function is recommended at the following intervals:

- Once a month for applications up to PL e with Cat. 3 or Cat. 4 or SIL CL3, SIL 3 with HFT = 1
- Once a year for applications up to PL d with Cat. 3 or SIL CL 2, SIL 2 with HFT = 1

5.7 What to do in Case of a Fault?

Device does not switch on:

- Check the wiring by comparing it to the wiring diagrams.
- Check the safety switch for correct function and adjustment.
- Check whether the emergency stop circuit is closed.
- Check whether the start button (manual start) is closed.
- Check the operating voltage at A1 and A2.
- Is the feedback loop closed?

Device cannot be switched on after an emergency stop:

- Emergency stop circuit was closed again.
- Was the start button opened before closing of the emergency stop circuit (manual start)?
- Is the feedback loop closed?

If the fault still exists, perform the steps listed under "Commissioning Procedure".
If these steps do not remedy the fault either, return the device to the manufacturer.

 **Opening the device is impermissible and will void the warranty.**

5.8 Safety Characteristics according to EN ISO 13849-1

Load per contact	≤ 0,1A	≤ 1A	≤ 2A
Use duration T_{10d} [years]	20	20	20
Category			
Time-off delay	3	3	3
Non time delay	4	4	4
Performance Level PL	e	e	e
PFH _d [1/h] a			
Time-off delay	8.84×10^{-8}	8.84×10^{-8}	8.84×10^{-8}
Non time delay	4.22×10^{-8}	4.22×10^{-8}	4.22×10^{-8}
nop [Cycles per year] DC 13 / 24V	≤ 500,000	≤ 350,000	≤ 100,000

6 Technical Data

In compliance with	EN 60204-1; EN ISO 13849-1; IEC 62061
Operating voltage	AC/DC 24 V +/- 10 %
Power consumption	AC 5.3 VA/DC 4.7 W
Rated supply frequency	50 to 60 Hz
Control voltage at S11	DC 24 V
Control current	typ. 190 mA
Safety contacts non-delayed	2 NO
Safety contacts delayed	2 NO
Max. switching voltage	AC 250 V
Contact rating of safety contacts 6 switching cycles/min	AC: 250 V, 2,000 VA, 8 A for resistive load 250 V, 3 A for AC-15
	DC: 40 V, 320 W, 8 A for resistive load 24 V, 3 A for DC-13
Max. total current through all contacts	15 A I more than one device is closely spaced under load, the max. total current at the ambient temperature of T = 20 °C: 9 A; at T = 30 °C: 3 A; at T = 40 °C = 1 A. Otherwise a distance of 5 mm between two devices is necessary.
Minimum contact load	5 V, 10 mA
External fuses	10 A gG
Max. switch-on delay	< 30 ms
Switch-off delay (adjustable)	30 ms to 30 s
Recovery time	< 500 ms
Max. length of control line	1,000 m at 0.75 mm ²
Wire width	0.14 to 2.5 mm ²
Tightening moment (min./max.)	0.5 Nm/0.6 Nm
Contact material	AgSnO ₂
Service life	mech. approx. 1 x 10 ⁷
Test voltage	2.5 kV (control voltage/contacts)
Rated impulse withstand voltage, leakage path/air gap	4 kV (DIN VDE 0110-1)
Rated insulation voltage	250 V
Degree of pollution/overvoltage category	2/3 (DIN VDE 0110-0)
Protection	IP20
Temperature range ambient	-15 °C to +40 °C
Temperature range storage	-15 °C to +85 °C
Max. altitude	≤ 2,000 m (above sea level)
Weight approx.	250 g
Mounting DIN rail according to EN 60715	TH35

7 Dimension Drawing

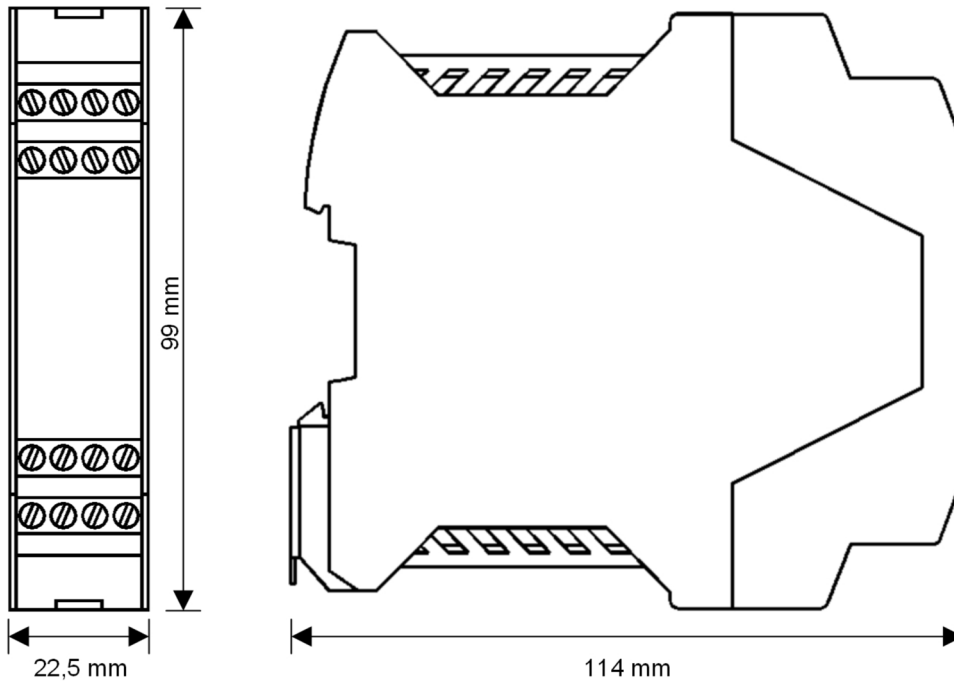


Fig. 16: Housing with Plug-In Terminal Blocks

8 Content of the EU Declaration of Conformity

The above mentioned product conforms with the most important requirements of the following directives and their modification directives:

2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2011/65/EU	RoHS Directive

Originator: Thomas Hüttemeier, Managing Director

Manufacture: SALZ Automation GmbH
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32107 Bad Salzufen
Germany

The complete EU declaration of conformity is available on the Internet at www.salz-automation.com