



Original operating instructions
AS-i Safety PCB
AC015S

GB



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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

- ✓ Requirement
- ▶ Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Disconnect the unit externally before handling it. Also, disconnect any independently supplied relay load circuits.

3 Intended use

The AS-i Safety PCB is used for the detection of safety-related switching states of 1-channel or 2-channel mechanical NC contacts.

For this purpose, a code table is transferred via the AS-i system with 8 x 4 bits which is evaluated by the safety monitor (e.g. AC001S...AC004S; AC032S; AC041S).

When operated correctly, the system can be used in applications up to the control category 4, PL e according to DIN EN ISO 13849-1 or IEC 61508 / SIL3.

Installation must be in accordance with EN 60204 and EN 62026-2.

If an AS-i network is controlling a machine with potentially dangerous movements and EN 60204-1 applies, a special insulation monitoring device must also be installed.



The wiring influences the achievable control category.

The requirements for external wiring and the selection of the connected switching contacts refer to the functionality to be accomplished and to the required control category (DIN EN ISO 13849-1 or IEC 61508).

The control category is either determined by means of a risk analysis (e.g. to DIN EN ISO 12100) or taken from a C standard.

The control category or SIL level of the AS-i safety monitor must at least correspond to the control category or SIL level necessary for the application.



Depending on the safety components used the complete safety system can also be classified for a lower control category.

▶ Characteristic safety values of other components, especially of the AS-i safety monitor, can be found in the corresponding documentation.



▶ Observe the configuration software manual, the operating instructions of the AS-i safety monitor and the operating instructions of the AS-i Safety PCB.

▶ Configurable safety functions for the AS-i Safety PCB can be found in the configuration software manual (e.g. E7050S).

4 Installation



Use of the unit in the vicinity of chemical and biological media as well as ionising radiation is not permitted.

- ▶ Install the AS-i Safety PCB in a protected location (e.g. control cabinet, housing).
- ▶ The housing must have a protection rating of at least IP54.
- ▶ Protect from humidity and condensation.
- ▶ Insulate unused open wires.
- ▶ Carry out a set-up test after installation of the AS-i Safety PCB.
- ▶ Connect the AS-i Safety PCB to two mechanical (positively guided) NC contacts. In doing so, the two outer mechanical pins are connected to one side of the NC contacts. The other side of the NC contacts is connected with the two black cables.



When the AS-i Safety PCB is mounted, cross faults between the connections of the mechanical contacts must be prevented. The connection wires of the AS-i Safety PCB must not be extended.

- ▶ For installation in a housing, rotate the AS-i Safety PCB by 180°.

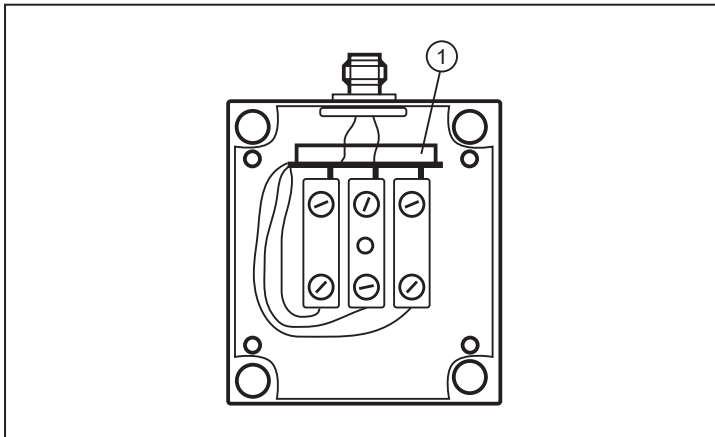


Fig. 1: Installation

1: AS-i Safety PCB installed rotated by 180°

5 Electrical connection



The device must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

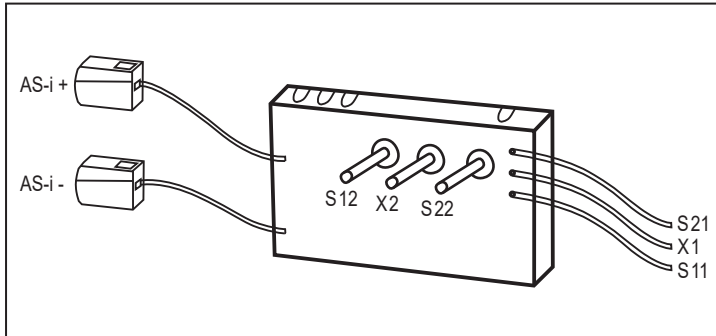


Fig. 2: Electrical connection



▶ When installing the AS-i Safety PCB, cross faults between the connections of the mechanical contacts must be avoided.

▶ Do not extend the connection wires of the AS-i Safety PCB.



The connected mechanical switching contacts must be configured as normally closed.

5.1 Connection of a switching contact

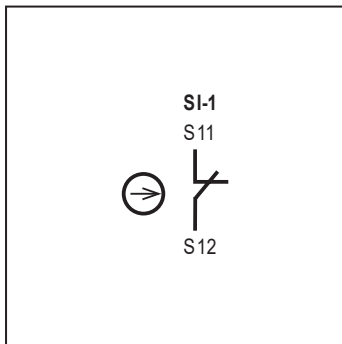


Fig. 3: Connection of a switching contact

▶ Connect the switching contact to input S-I1 of the AS-i Safety PCB: connection to strand S11 and pin S12.

▶ Bridge input S-I2:

- wire bridge between pin 3 and pin 4 on socket S-I1 and S-I2

or

- link between pin 1 and pin 2 on socket S-I2.



If only one switching contact is connected, the classification to DIN EN ISO 13849-1 category 4 or EN 61508 SIL3 is not met.

5.2 Connection of two switching contacts

- ▶ Connect the first switching contact to input S-I1 of the AS-i Safety PCB: connection to strand S11 and pin S12.
- ▶ Connect the second switching contact to input S-I2 of the AS-i Safety PCB: connection to strand S21 and pin S22.
- ▶ The two switching contacts must either be connected positively driven or dependent or independent:

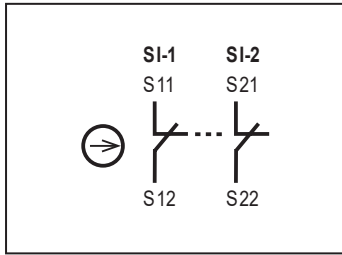


Fig. 4: Positively driven or dependent connection

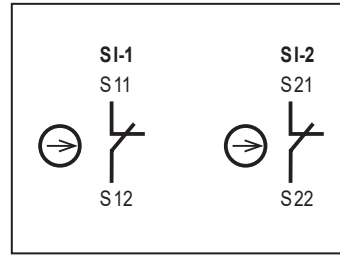


Fig. 5: Independent connection

! For a classification to DIN EN ISO 13849-1 category 4 or EN 61508 SIL3, positively guided mechanical contacts to EN IEC 60947-5-1, rated for a voltage > 120 V and a current > 0.8 A, must be connected (→ Fig. 4).

5.3 Connection of an external alarm LED

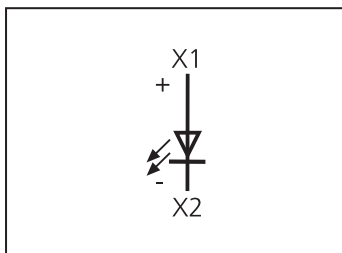


Fig. 6: Connection of external alarm LED

► Connect the LED to output O-1 of the AS-i Safety PCB: connection to strand X1 and pin X2.

Through the host system the alarm output LED can be set as a static or dynamic output.

! The alarm output has no safety-related function.

5.4 Data bits

The code words 0000, XX00 and 00XX cause the AS-i safety monitor to bring the installation into the safe state.

► For more details on the effect of the data bits on the transmission sequence refer to the configuration software manual (→ chapter “Monitoring devices”).

Activated input	Bit sequence D3-D0	Data bit
S-11	XX00	D0, D1
S-12	00XX	D2, D3
S-11 and S-12	0000	D0, D1, D2, D3
None	XXXX	

Activated output	Bit sequence D3-D0	Data bit
O-1	XXX1	D0

X = random

6 Operating and display elements

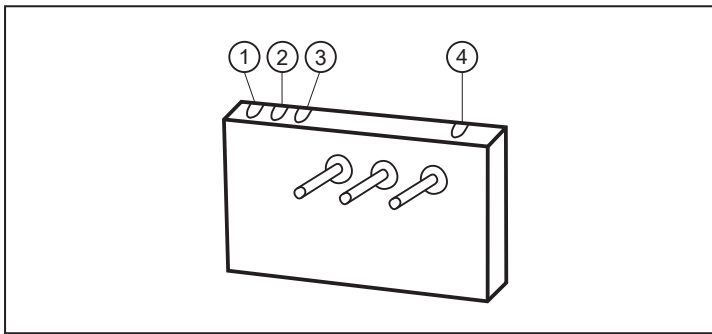


Fig. 7: Light indicators

LED	Colour	Display
1 (PWR)	Green	AS-i voltage supply OK
2 (FAULT)	Red	AS-i communication error, slave does not participate in the "normal" exchange of data, e.g. slave address 0
3 (S-I1)	Yellow	Input S-I1 switched
4 (S-I2)	Yellow	Input S-I2 switched

7 Parameter setting

7.1 Addressing

When mounted and wired the AS-i Safety PCB can be addressed via the addressing unit AC1154 using an addressing cable.

- ▶ Assign a free address between 1 and 31.

Address set at factory: 0.

8 Scale drawing

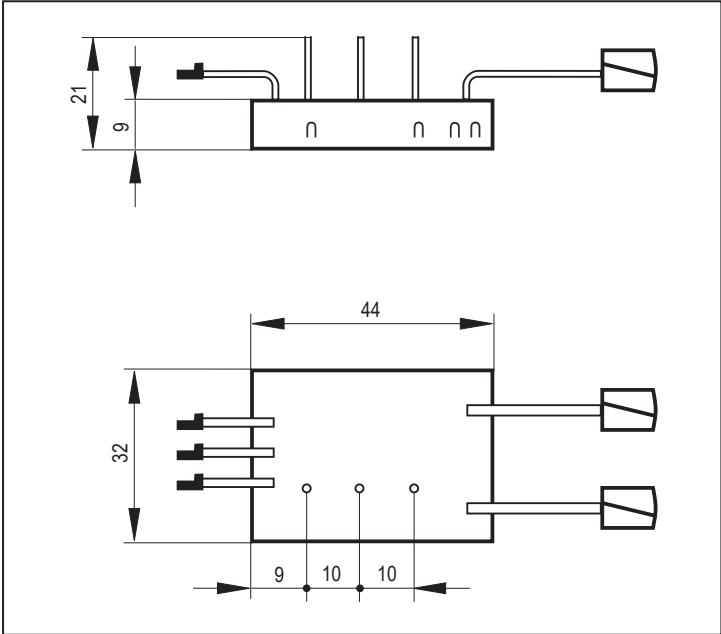


Fig. 8: Scale drawing AC015S

9 Technical data

Electrical data	
Electrical design	2 safe inputs / 1 non-safe LED output
Operating voltage	26.5 ... 31.6 V DC
Current consumption [mA]	≤ 50 mA
Inputs	
Circuits	DC PNP
Voltage supply	via AS-i
Input current	typ. 5 mA
Short-circuit detection	no
Cross fault monitoring	no
LED output	
Supply via AS-i	yes
Integrated watchdog	yes
Short-circuit protection	no
Current rating LED output	10 mA
Response times	
Response time on safety request	≤ 10 ms
Safety classification	
Maximum mission time TM	10 years at -25 ... 60 °C 20 years at 10 ... 40 °C
Performance Level PL	PL e
SIL	SIL 3
Probability of a dangerous failure per hour (PFH _D)	1.8 x 10 ⁻¹⁰ / h
Environmental conditions	
Ambient temperature	-25 ... 60 °C for 10 years of use 10 ... 40 °C for 20 years of use
Protection rating	IP 20
Rate of temperature change	0.5 K/min
Height above sea level	≤ 2000 m
Approvals / tests	
EMC	EN 62026-2
AS-i classification	
AS-Interface / extended address mode possible	version 2.11 and 3.0 / no
AS-i profile	S-7.B.E
I/O configuration / ID code	7 [hex] / B.E [hex]
AS-i certificate	74601
Maximum number of safety modules per master	31
Mechanical data	
Housing dimensions	32 x 44 x 9 mm
AS-Interface / extended address mode possible	version 2.11 and 3.0 / no

9.1 Response times

For the calculation of the response time of the total system the response times of the other components have to be added to the response time of the AS-i Safety PCB (mechanical switching contacts, data transmission, safety monitor and external relays or contactors possibly connected to the monitor output).

AS-i Safety PCB	≤ 10 ms
Safety monitor (including data transmission)	≤ 40 ms
Total response time (before application of the signal to AC015S until the safe outputs of the safety monitor switch)	≤ 50 ms

Tab. 1: Calculation example

Here, the switching times of the mechanical contacts (e-stops) and external relays or contactors possibly connected to the relay output of the safety monitor have not been taken into account.

9.2 Residual error probability according to IEC 61508

To calculate the PFH_D (probability of a dangerous failure per hour) of a safety-related function the PFH_D values of all components used in this function must be taken into account.

10 Maintenance, repair and disposal

- ▶ A minimum of one test per year must be carried out by requesting the safety function.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

11 Approvals / standards

- EC Declaration of Conformity
- TÜV Rheinland
- AS-Interface approval number 74601
- UL (cULus)

The unit shall be supplied via an appropriate class 2 source such that the supply class requirements in accordance with UL 508 are met.