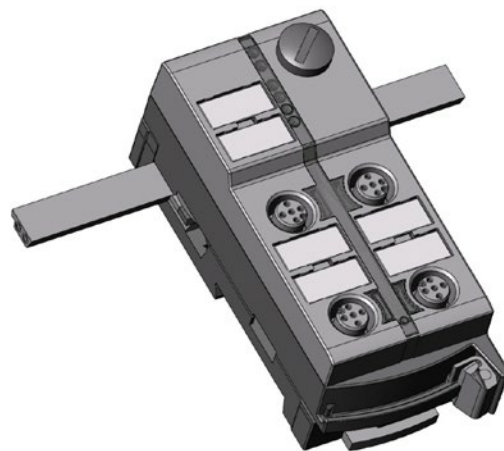


Original operating instructions  
Safe AS-i module

UK

**AC506S**  
**AC509S**

80256452/00 01/2017



# Contents

1	Preliminary note.....	3
1.1	Explanation of symbols.....	3
2	Safety instructions .....	4
2.1	Safety-related requirements regarding the application.....	5
3	Items supplied.....	5
4	Functions and features .....	5
5	Function and electrical connection .....	6
6	Installation.....	7
7	Operating and display elements .....	13
8	Electrical connection.....	14
8.1	Wiring diagram.....	14
8.2	Mechanical contacts (AC506S) .....	15
8.3	Electronic contacts .....	15
9	Addressing.....	16
10	Operation.....	16
10.1	Data bits .....	17
10.2	Parameters .....	18
10.3	Response times.....	19
11	Scale drawing .....	20
12	Technical data.....	20
12.1	Safety classification .....	22
13	Troubleshooting .....	22
14	Terms and abbreviations.....	22
15	Maintenance, repair and disposal.....	23
16	Approvals / certificates.....	23

# 1 Preliminary note

The instructions are part of the unit. They are intended for authorised persons according to the EMC, Low Voltage and Machinery Directive and safety regulations.

The instructions contain information about the correct handling of the product. Read the instructions before use to familiarise yourself with operating conditions, installation and operation.

Follow the safety instructions.

## 1.1 Explanation of symbols

- ▶ Request for action
- LED on
- LED off
- ☒ LED flashes
- ☀ LED flashes quickly

 Important note

 **WARNING**

Warning of dangers which may lead to death or serious irreversible injuries.

## 2 Safety instructions

- Follow the operating instructions.
- In case of non-observance of notes or standards, especially when tampering with and/or modifying the unit, any liability and warranty is excluded.
- The unit must be installed, connected and put into operation by a qualified electrician trained in safety technology.
- The applicable technical standards for the corresponding application must be complied with.
- For installation the requirements according to EN 60204 must be observed.
- In case of malfunction of the unit please contact the manufacturer. Tampering with the unit is not allowed.
- Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.
- After installation of the system perform a complete function check.
- Only use the unit under the specified operating conditions (→ chapter 12 Technical data). In case of special operating conditions please contact the manufacturer.
- In case of any questions please contact the safety authorities in your own country.

### **WARNING**

In case of improper handling of the product, the safety and physical integrity of persons and machinery cannot be guaranteed.

Death or serious irreversible injuries may result.

- ▶ Note all remarks on installation and handling given in these instructions.
- ▶ The unit must only be used under the specified operating conditions and in accordance with use as prescribed.

## 2.1 Safety-related requirements regarding the application

It must be ensured that the safety requirements of the respective application correspond to the requirements stated in these instructions.

Observe the following requirements:

- ▶ Adhere to ISO 14119 for interlocking devices associated with guards.
- ▶ Adhere to the specified operating conditions (→ chapter 12 Technical data). Use of the unit in the vicinity of chemical and biological media as well as ionising radiation is not permitted.
- ▶ In case of faults within the unit which result in the defined safe state: Take measures to maintain the safe state when the complete control system continues to be operated.
- ▶ Replace damaged units.

UK

## 3 Items supplied

1 safe AS-i module AC506S and 1 original operating instructions AC506S

or

1 safe AS-i module AC509S and 1 original operating instructions AC509S.

If one of the above-mentioned components is missing or damaged, please contact one of the ifm branch offices.

## 4 Functions and features

The safe AC506S AS-i module detects safety-related switching states of 1-channel mechanical and electronic contacts, e.g. e-stops, position switches, door contacts, etc.


The safe AC509S AS-i module detects safety-related switching states of 2 electronic contacts with two self-testing semiconductor outputs (OSSD), e.g. fail-safe inductive sensors, safe light grids (active/passive system), safe light curtains (active/passive system), etc.

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).

The following applies to both units:

The safety function of the unit is achieved by the normally closed operation (input disconnected = safe state).

The unit can be used in applications up to Performance Level d, category 3 to EN ISO 13849-1 and SIL 2<sub>CL</sub> to EN 62061.


 Depending on the safety components used the complete safety system can also be classified for a lower Performance Level PL or Safety Integrity Level SIL<sub>CL</sub>!

## 5 Function and electrical connection

Please also refer to all information in the description of the configuration software (e.g. E7040S, E7050S) and the operating instructions of the safety monitor.

The above documents provide all required instructions concerning installation, configuration, operation and maintenance of the AS-i Safety at Work system.

Information on the parameterizable safety functions of the safe AS-i module can be found in the chapter "Monitoring devices" of the configuration software manual.

 The products described here are designed to be components of a safety-oriented machine or control system. A complete safety-related system normally includes sensors, evaluation units, signalling components and concepts for safe switch-off. It is the responsibility of each manufacturer of a machine or installation to ensure a correct functioning of the whole system. The manufacturer of the safe AS-i module, his subsidiaries and affiliates are not in a position to evaluate all of the characteristics of a given machine or product not designed by him.

The manufacturer accepts no liability for any recommendation that may be implied or stated herein.

The warranty contained in the contract of sale is the sole warranty. Any statements contained herein do not create new warranties or modify existing ones.

The complete description of the configuration software, the operating instructions of the AS-i safety monitor and the operating instructions of the safe AS-i module must be taken into account.



- ▶ Observe the maintenance requirement → chapter 15 Maintenance, repair and disposal

## 6 Installation

- ▶ Carefully place the yellow flat cable (e.g. E74000) in the lower part.

To maintain the indicated protection rating IP 67

AC506S

- ▶ Seal the unused sockets using a bridging plug (E7005S)\*, tightening torque 0.6...0.8 Nm.

AC509S

- ▶ Seal the unused sockets using a bridging plug (E7008S for SI-1 or SI-2)\* or with a protective cap (E73004 for O-3 or O-4)\*, tightening torque 0.6...0.8 Nm.

The following applies to both units:

- ▶ Tighten all connected M12 connectors and protective caps, tightening torque 0.6...0.8 Nm.
- ▶ Close the addressing interface using the supplied protective cap, tightening torque 0.6...0.8 Nm.
- ▶ Attach the flat cable seal (E70413)\* if the module is at the end of the cable line.

\*to be ordered separately

UK

**⚠ WARNING**

Non-observance of the installation instructions (e.g. non-observance of the tightening torque) can lead to a loss of the protection rating and consequently to the loss of the safety function.

Death or serious irreversible injuries may result.

- ▶ Note all remarks on installation and handling given in these instructions.
- ▶ The unit must only be used under the specified operating conditions and in accordance with use as prescribed.

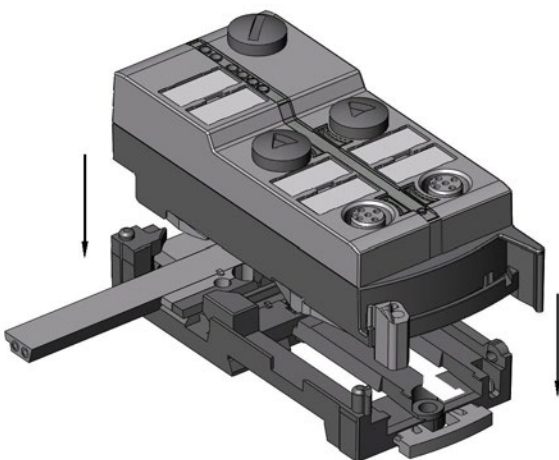
1



**Alignment of the flat cable on delivery**

Carefully place the yellow AS-i flat cable into the profile slot.

2



Mount the upper part.

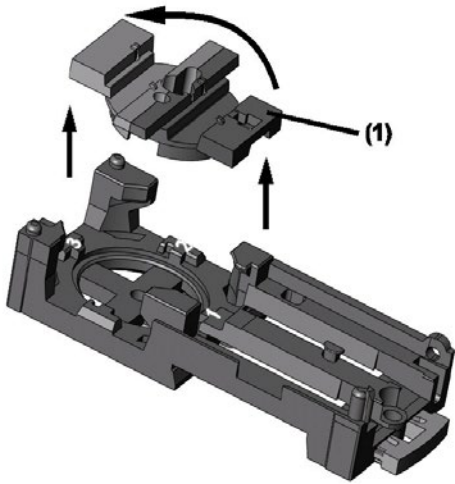


3



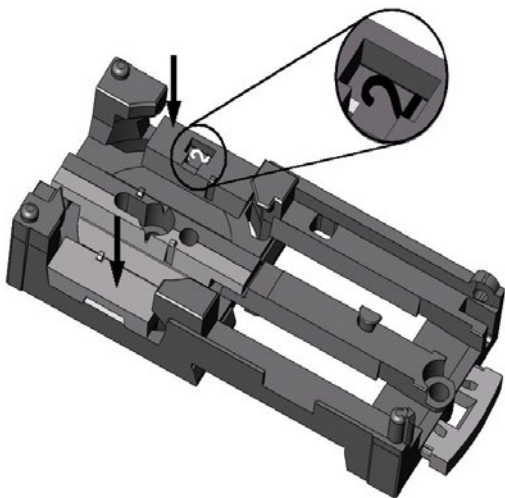
Lock the unit.

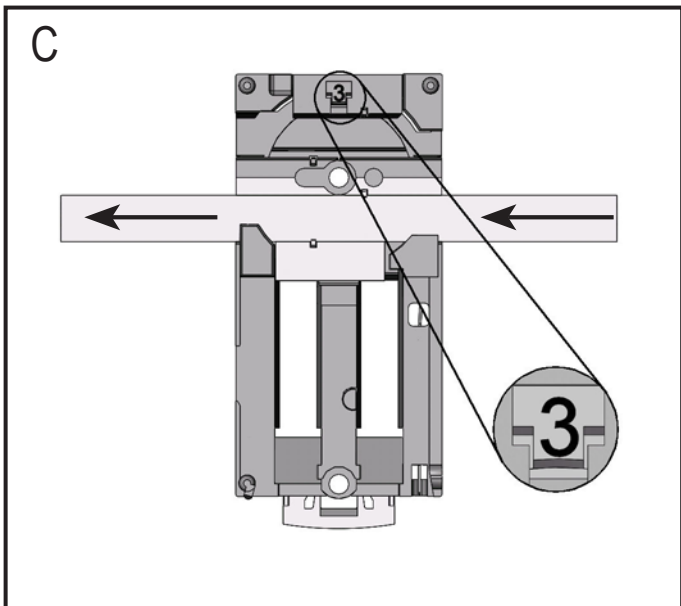
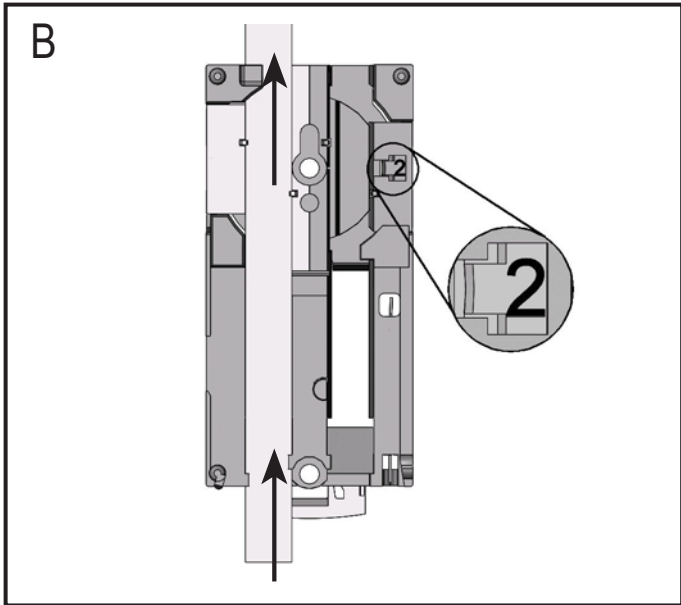
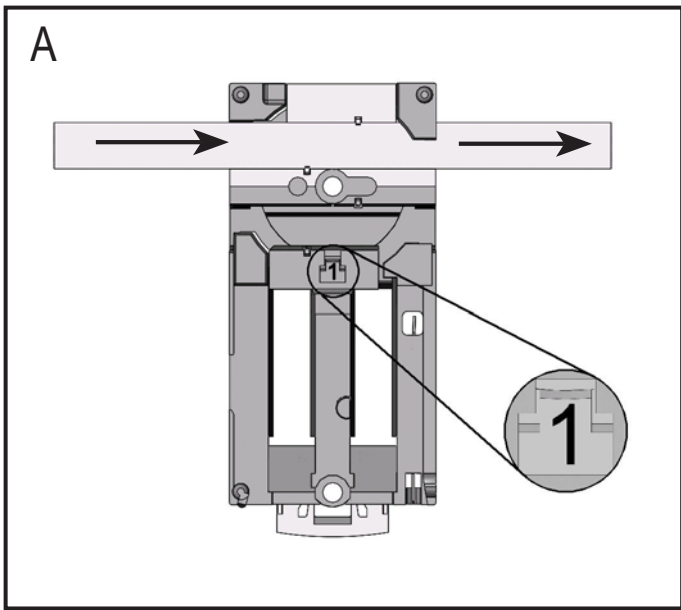
UK



With the supplied lower part the flat cable can be aligned in three directions.

For the requested direction place the flat cable guide (1) accordingly.

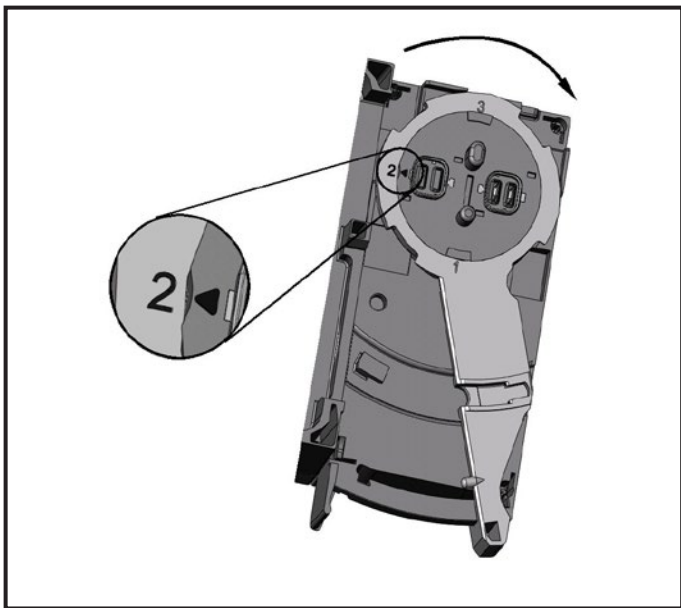




## Settings at the lower part

Select position 1, 2 or 3 depending on the required flat cable alignment (→).

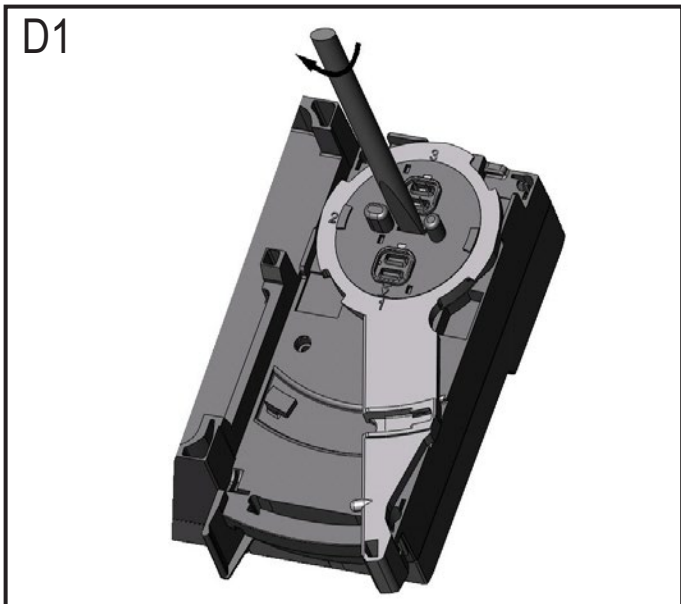
A = factory setting



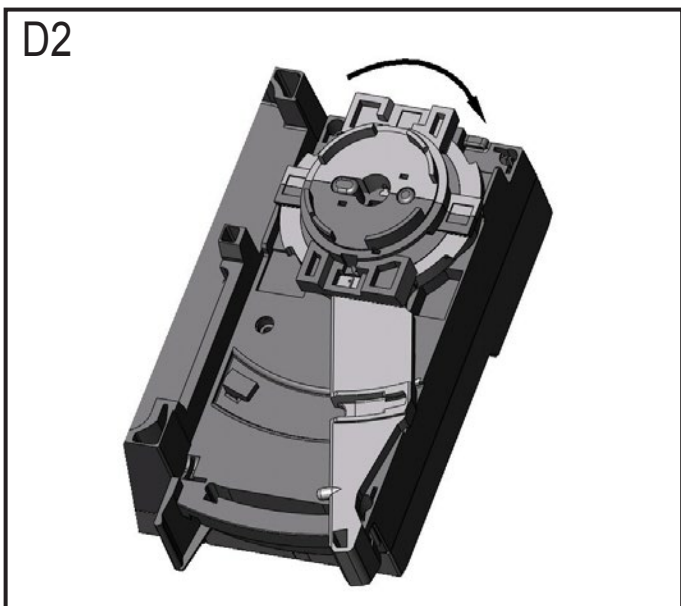
## Settings at the upper part

Then set the selected position at the upper part. To do so, turn the triangle to the corresponding number (figures D1 and D2).

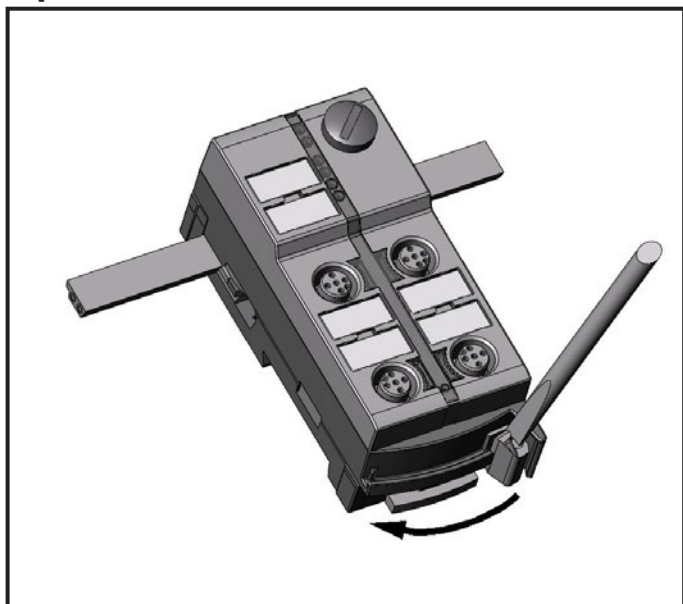
UK



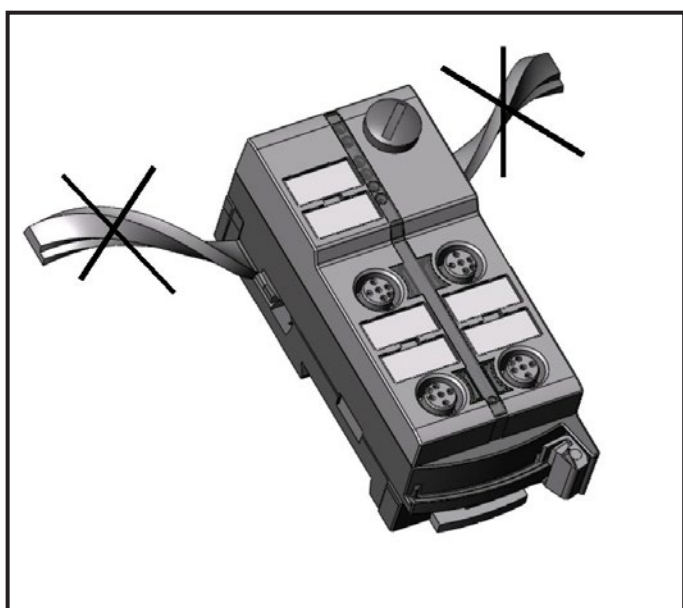
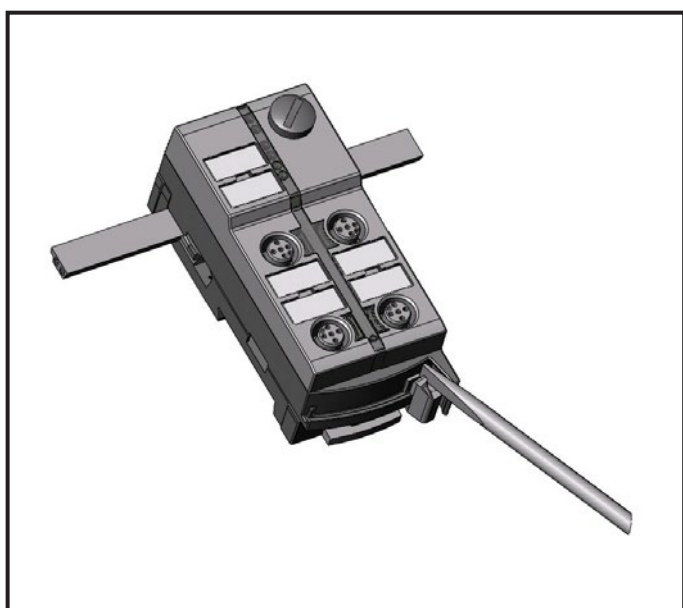
Use a tool, e.g. a screwdriver (figure D1) or the yellow / black flat cable guide (figure D2).



## Open the unit



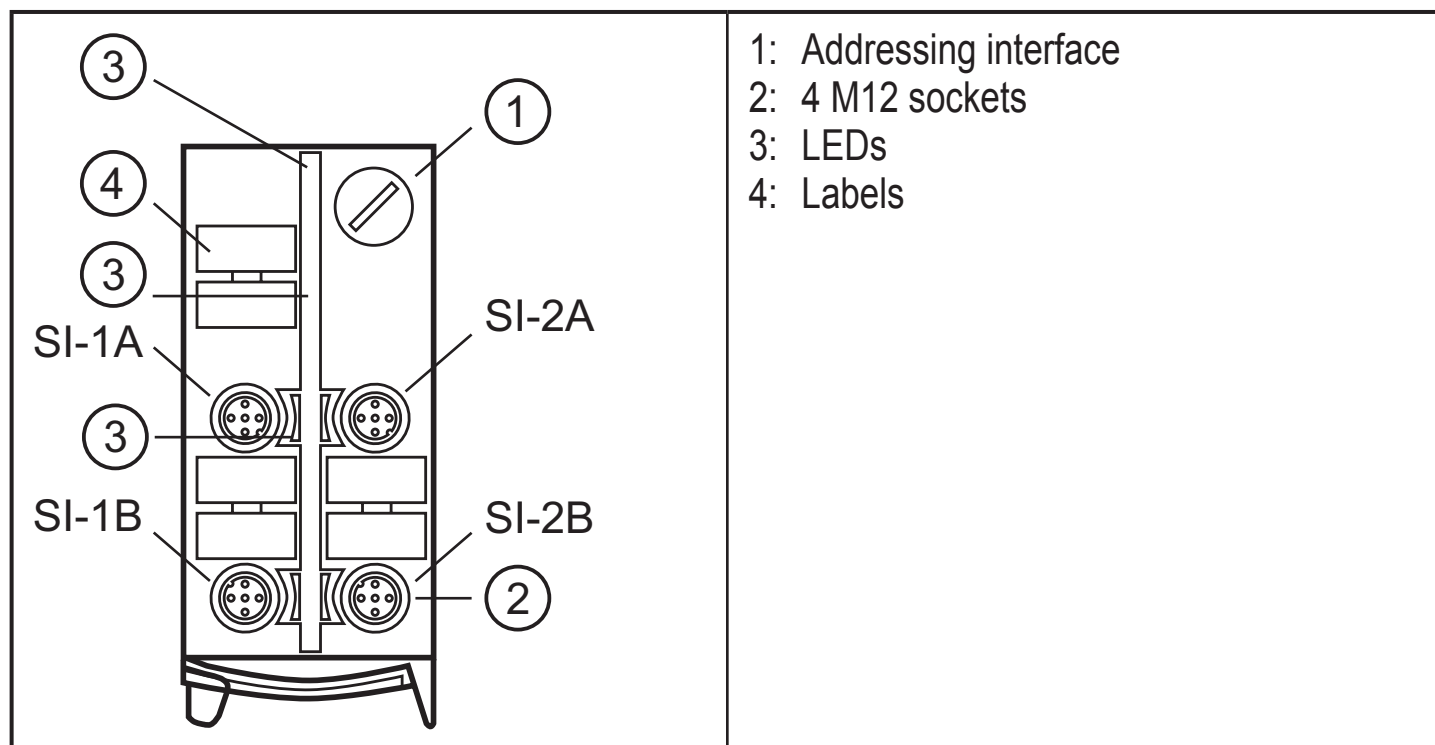
Open the unit using a tool as shown (e.g. screwdriver).



Take care in laying the AS-i flat cable, the flat cable should be laid straight for about 15 cm.

# 7 Operating and display elements

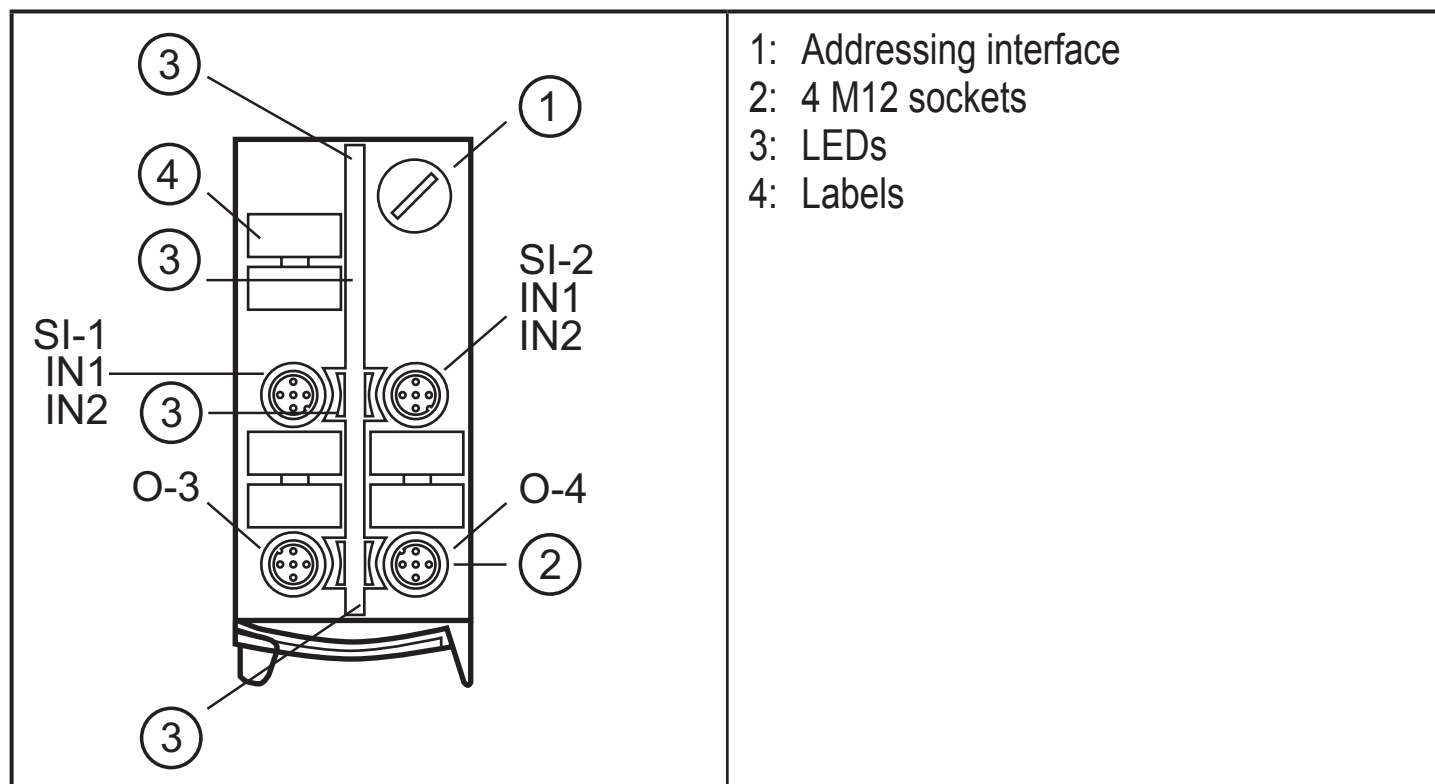
AC506S



- 1: Addressing interface
- 2: 4 M12 sockets
- 3: LEDs
- 4: Labels

UK

AC509S



- 1: Addressing interface
- 2: 4 M12 sockets
- 3: LEDs
- 4: Labels

## 8 Electrical connection

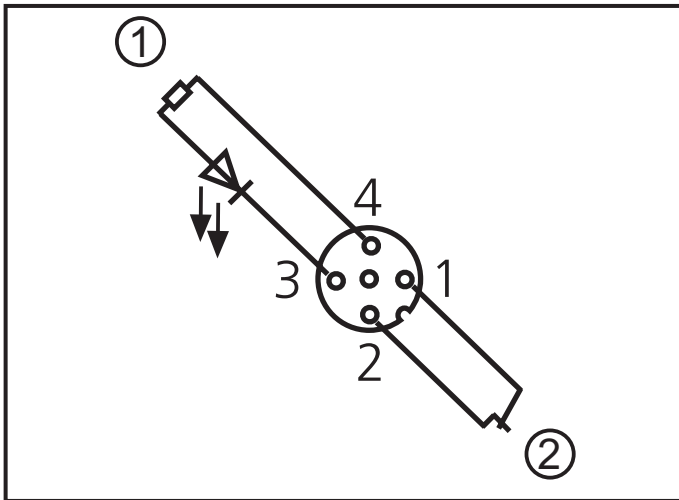
► Disconnect power. Also disconnect any independently supplied relay load circuits.

**i** Do **not** connect inputs and outputs to an external potential.

Use switching contacts with

- a current rating of  $\geq 1$  A.
- a minimum load current  $< 7$  mA.
- electrically isolated contact elements.
- contacts which open when there is a demand on the safety function.
- a safety function by positive opening to IEC / EN 60947-5-1 annex K.

### 8.1 Wiring diagram



- 1: Signal  
2: Safety contact (NC)

Pin connection AC506S				
Connector	Pin 1	Pin 2	Pin 3	Pin 4
1 A	S-11A	S-12A	0 V	Output O3 (pnp)
1 B	S-11B	S-12B	0 V	Output O3 (pnp)
2 A	S-21A	S-22A	0 V	Output O4 (pnp)
2 B	S-21B	S-22B	0 V	Output O4 (pnp)

<b>Pin connection AC509S</b>				
Connector	Pin 1	Pin 2	Pin 3	Pin 4
SI-1	I+	IN1	I-	IN2
SI-2	I+	IN1	I-	IN2
O-3	not used	not used	0 V	Output O3 (pnp)
O-4	not used	not used	0 V	Output O4 (pnp)

## 8.2 Mechanical contacts (AC506S)

The connected switching contacts must be configured as normally closed in accordance with IEC / EN 60947-5-1 annex K.

The connection of **two positively driven** or **two dependent** switching contacts is not permitted!

## 8.3 Electronic contacts

The safe inputs correspond to type 2 digital inputs of EN 61131-2.

The connection of independent switching contacts is made to the sockets SI-1A, SI-1B, SI-2A and SI-2B for AC506S and SI-1 and SI-2 for AC509S.

The unit supports the connection of safe electronic sensors in 3-wire operation (AC506S) or 4-wire operation (AC509S). The duration of the switch-off test pulses of electronic sensors must not be longer than 1 ms.



A safe separation must be ensured between the external LED and the normally closed contact.

Do not connect any of the pins to an external potential since they are electrically connected to the AS-i cable.

Note: The wiring influences the achievable Performance Level PL or the Safety Integrity Level SIL<sub>CL</sub>.

The requirements for Performance Level c according to EN ISO 13849-1 are met. Performance Level d to EN ISO 13849-1 can be achieved by wiring the contacts to be monitored to the module so that cross faults between the wires can be excluded (incl. switching elements). This can for example be achieved if the contacts to be monitored are protected against external damage.

## 9 Addressing

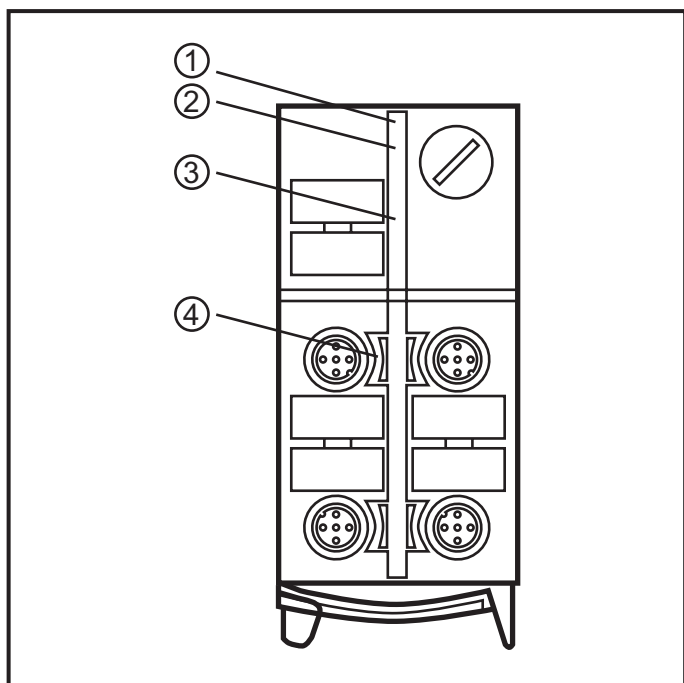
The module can be addressed via the addressing unit AC1154.

► Assign a free address between 1 and 31, on delivery the address is 0.

When mounted and wired the module can be addressed with the addressing cable (E70213) via the integrated addressing interface.

## 10 Operation

Avoid build-up of dirt and dust on the upper and lower parts so that the locking mechanism is not affected.



- 1: LED green PWR
- 2: LED red FAULT
- 3: Output LEDs O1...O4  
LED red O1, O2 alarm LEDs  
LED yellow O3, O4 signal output
- 4: LEDs yellow, inputs

LED designation	LED status / colour	Operating status
FAULT	⊗ red	peripheral fault, e.g. overload or short circuit of the sensor supply
	● red	AS-i communication error, slave does not participate in the "normal" exchange of data, e.g. slave address 0



LED designation	LED status / colour	Operating status
PWR	○ green ●	no voltage voltage supply OK
Alarm O1, O2	● red	alarm output logic state of the alarm LED outputs O1 and O2
Signal output O3, O4	● yellow	signal output logic state of the signal outputs O3 and O4
Input	○ yellow ●	safety contact opened safety contact closed

UK

**i** LED indications are no safe information.

Overload and short circuit of the input supply are signalled to the AS-i master (version 2.1) via the "peripheral fault" flag in the status register.

## 10.1 Data bits

Data bit AC506S	D3	D2	D1	D0
Input	I-2	I-2	I-1	I-1
Socket	SI-2A, SI-2B	SI-2A, SI-2B	SI-1A, SI-1B	SI-1A, SI-1B
Output	Output O-4	Output O-3	LED alarm O-2	LED alarm O-1
Socket	SI-2A, SI-2B	SI-1A, SI-1B	-	-

Data bit AC509S	D3	D2	D1	D0
Input	IN1, IN2	IN1, IN2	IN1, IN2	IN1, IN2
Socket	SI-2	SI-2	SI-1	SI-1
Output	Output O-4	Output O-3	LED alarm O-2	LED alarm O-1
Socket	O-4	O-3	-	-

The output bits D0...D3 are intended for signalling. Bits D0 and D1 have effect on the red alarm LEDs on the front panel (O-1, O-2) and can be used for signalling directly on the module.

Bits D2 and D3 have effect on the switching outputs O-3 and O-4 and can be used for external alarm LEDs, e.g. in button housings.

**! WARNING**

Safe separation between the safety-related NC contact circuit and the connections of the external alarm LED must be guaranteed!

Death or serious irreversible injuries may result.

- ▶ Note all remarks on installation and handling given in these instructions.
- ▶ The unit must only be used under the specified operating conditions and in accordance with use as prescribed.

Activated alarm output	Bit sequence D3-D0
O-1	XXX1
O-2	XX1X

Activated output channel	Bit sequence D3-D0
O-3	X1XX
O-4	1XXX

X = random

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

In the configuration software for the safety monitor the **dual-channel independent** module must be used for the AS-i modules.

For more details on the effect of the data bits on the transmission sequence refer to the configuration software manual (see the chapter "Monitoring devices").

## 10.2 Parameters

This module allows to read the current module parameters and informs which of the 4 connected switching contacts was opened during the demand on the safety function.

**i** However, this parameter information is not part of the safe AS-i transmission, the parameter information is thus to be treated as non-safe and must in no case be linked with any safety functions nor evaluated!

### Assignment of the parameter bits

Parameter bit AC506S	P0	P1	P2	P3
Switching contact socket	S-1A	S-1B	S-2A	S-2B

Parameter bit AC509S	P0	P1	P2	P3
Switching contact socket	SI-1 / IN1	SI-1 / IN2	SI-2 / IN1	SI-1 / IN2

### Meaning of the logic states P0...P3

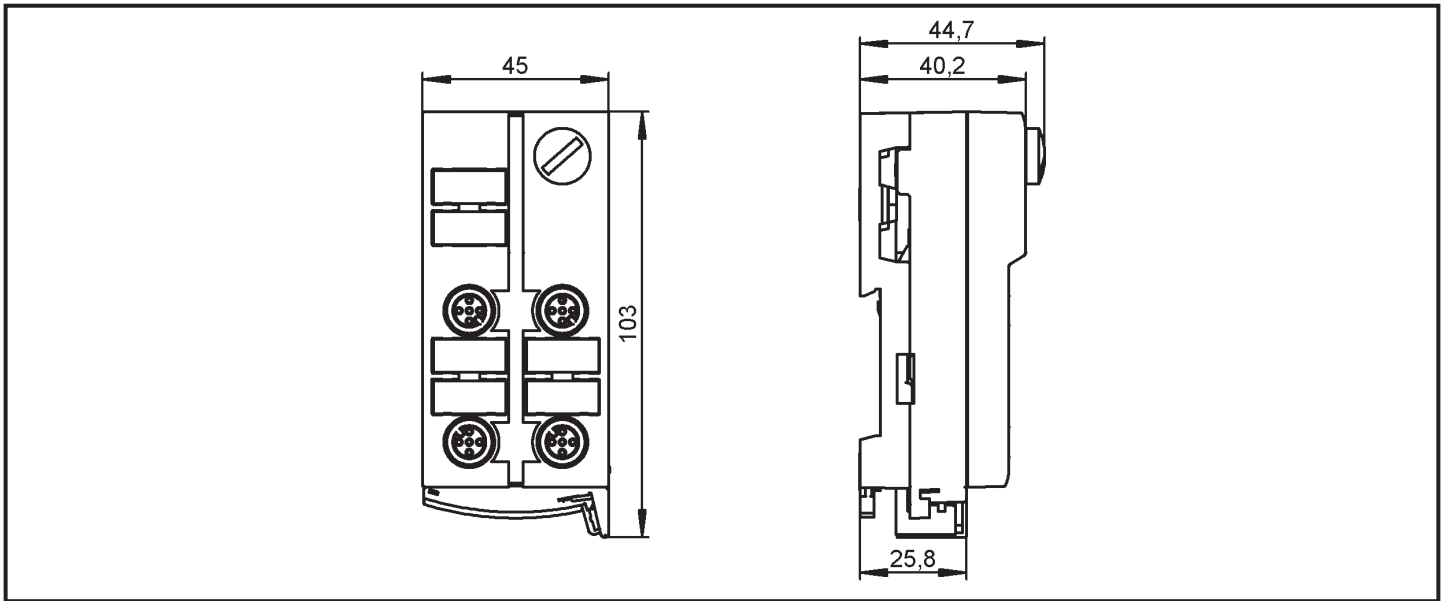
1: Contact closed

0: Contact open

## 10.3 Response times

The response time of the safe AS-i module for a safety request is max. 10 ms. For the calculation of the response time of the complete system the response times of the other components also have to be added (mechanical contacts, safety monitor and external relays or contactors possibly connected to the safety monitor output).

## 11 Scale drawing



## 12 Technical data

### AC506S

4 x 1 safe inputs / 2 non-safe LED outputs / 2 non-safe outputs

### AC509S

2 x 2 safe inputs / 2 non-safe LED outputs / 2 non-safe outputs

Operating voltage	26.5 ... 31.6 V DC
Current consumption	≤ 280 mA
<b>Inputs</b>	
Circuits	DC PNP
Voltage supply	via AS-i
Short-circuit detection	yes
Input current	typ. 8 mA
Cross fault monitoring	no
<b>LED outputs</b>	
Supply via AS-i	yes
Integrated watchdog	yes
<b>Signal outputs</b>	
Electrically isolated	no
Short-circuit protection	yes
Integrated watchdog	yes

Current rating per output	50 mA
Voltage supply	via AS-i
Voltage range	24 V DC (18...30 V DC)
Current rating per module	200 mA
Utilisation category	DC-12
Ambient temperature (without switched outputs)	-25 ... +55 °C
Ambient temperature (with switched outputs)	-25 ... +40 °C
Humidity	90 % non-condensing
Max. operating altitude	2000 m
<b>LED function display</b>	
Operation / fault / function	green / red / yellow
Protection	IP 67
AS-Interface / extended addressing 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]
Maximum number of safety modules per master	31
Housing materials	PA
Housing dimensions	103 x 45 x 44.7 mm (H x W x D)
Cable length between module and mechanical / electronic contacts or at the switching outputs	≤ 10 m

## 12.1 Safety classification

Characteristics	Value
Mission time T	20 years
Performance Level PL	PL d *)
SIL <sub>cl</sub>	SIL <sub>cl</sub> 2 *)
*) PL d, SIL <sub>cl</sub> 2 only if the fault exclusions described in the manual are used (→ chapter 8 Electrical connection).	
PFH (PFHD)	2.4 E-11 (1/h)

- These calculations were made on the basis of an ambient temperature of 40 °C.
- The PFH and MTTFd values of the other components, especially of the AS-i safety monitor, can be found in the corresponding documentation.

## 13 Troubleshooting

The LEDs of the safe AS-i module indicate faulty operating states (→ chapter 10 Operation).

## 14 Terms and abbreviations

PL	Performance level	Capability of safety-related parts to perform a safety function under predictable conditions to fulfil the expected risk reduction.
PFH (PFH <sub>D</sub> )	Probability of (dangerous) Failure per Hour	
SIL <sub>cl</sub>	Safety Integrity Level claim limit	(according to IEC 62061)

## 15 Maintenance, repair and disposal



### Maintenance requirement

A minimum of one testing per year is compulsory by a demand on the safety function.

AC506S

- ▶ Check all connected individual switches.

AC509S

- ▶ Test both inputs individually.

UK

Only the manufacturer is allowed to repair the unit.

After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

## 16 Approvals / certificates

- EC Declaration of Conformity
- TÜV Rheinland
- AS-Interface approval number 97201 (AC506S)
- UL (cULus) (AC506S)

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