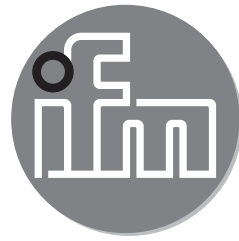


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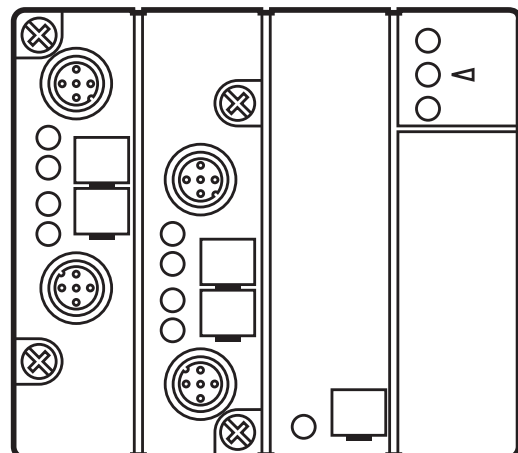
Original operating instructions
Safe AS-i module

AS interface

AC006S

UK

7390919 / 00 11 / 2011



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1 Preliminary note

The instructions are part of the unit. They are intended for authorised persons according to the EMC and Low Voltage 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.

Adhere to the safety instructions.

1.1 Symbols used

- ▶ Instruction
- > Reaction, result
- Cross-reference
- LED on
- LED out
- ☒ LED flashes
- ☀ LED flashes quickly
-  Important note
Non-compliance can result in malfunction or interference.
-  Information
Supplementary note.

WARNING

Warning of serious personal injury.
Death or serious irreversible injuries may result.

2 Safety instructions

- Follow the operating instructions.
- In case of non-observance of notes or standards, specially 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.
- Use the unit only in specified environmental conditions (→ chapter 11 Technical data). In case of special operating conditions please contact the manufacturer.
- In case of any questions - if required - contact the safety expert in charge of your country.

WARNING

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

Death or serious irreversible injuries may result.

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

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 EN 1088 for interlocking devices associated with guards.
- ▶ Adhere to the specified operating conditions (→ chapter 11 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.

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3 Items supplied

1 safe AS-i module AC006S, 1 operating instructions AC006S ident number 7390919.

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 AS-i module detects safety-related switching states of 1- or 2-channel e-stops, position switches, door contacts, etc. For this purpose, a code table is transferred via the AS-i system with 8 x 4 bits which is evaluated by the AS-i safety monitor (e.g. AC001S ... AC004S, AC031S, AC032S).

When operated correctly, the system can be used in applications up to performance level e according to ISO 13849-1 or IEC 61508/SIL3 (→ chapter 7 Electrical connection).



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

5 Function and electrical connection

Please also refer to all information in the description of the configuration software (e.g. E7040S) 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!



Maintenance requirement

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

6 Installation

- ▶ Install the safe AS-i module onto an FC lower part (e.g. AC5003) and then fix it onto a 35 mm raised rail.
- ▶ Alternatively, fasten it onto a mounting device.

Mounting position: vertical or horizontal.

- ▶ Carefully place the yellow flat cable (e.g. AC4000) and the black flat cable (e.g. AC4002) in the lower part; use the enclosed seals.

To achieve the indicated protection class IP 67

- ▶ insert the seal carefully.

- ▶ Tighten the 4 screws of the upper part evenly crosswise with 0.6...0.8 Nm.
- ▶ Cover the unused socket with the enclosed protective cap.
- ▶ Tighten all connected M12 connectors and protective caps, tightening torque 0.6...0.8 Nm.

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 device must only be used under the specified operating conditions and in accordance with use as prescribed below.

7 Electrical connection

- ▶ Disconnect power. Also disconnect any independently supplied relay load circuits.

The connected switching contacts must be configured as normally closed. The connection of two **positively driven** or two **dependent** switching contacts must be made to the socket SI-1/2.

- ▶ Connect the first switching contact SI-1 to pin 1 and pin 2.
- ▶ Connect the second switching contact SI-2 to pin 3 and pin 4.

The connection of two **independent** switching contacts is made to the socket SI-1/2 (pin 1 and pin 2) and to the socket SI-2 (pin 1 and pin 2).

It is not allowed to connect switching contact SI-2 to the sockets SI-1/2 and SI-2 at the same time.



Do **not** connect the inputs to an external potential. Connect the safe switching contacts to the M12 sockets.

Use switching contacts with:

- a current rating ≥ 1 A.
- electrically isolated contact elements.
- contacts which open when there is a demand on the safety function.

Inputs

<p>SI-1/2 SI-2</p> <p>3 S-21 4 S-22 3 4</p> <p>2 S-12 1 S-11 2 1</p>	M12 socket	Socket SI-1/2	Socket SI-2
		Pin	Pin
	S-11	1	-
	S-12	2	-
	S-21	3	1
	S-22	4	2
not used	5	3,4,5	

Outputs

<p>3 4</p> <p>2 1</p> <p>5</p>	M12 socket	Socket O-3	Socket O-4
		Pin	Pin
	supply +24 V	1	1
	not used	2	2
	supply 0 V	3	3
	output (p)	4	4
not used	5	5	

Note:

If only one single-channel switch is to be connected to the module, it is to be connected to the input SI-1. The second input SI-2 must be bridged.

This can be done by means of a wire bridge between pin 3 and pin 4 on socket SI-1/2 or by means of a wire bridge between pin 1 and pin 2 on socket SI-2.

Optionally connect the bridging plug E7005S to the socket SI-2. The bridging plug is to be ordered separately.

► Tighten the bridging plug with a tightening torque of 0.6...0.8 Nm.

This is the only way to ensure the maximum protection of IP 67.

Note: 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 (EN/ISO 13849-1 or EN 61508). The control category is either determined by means of a risk analysis (e.g. to EN 1050) 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.

8 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.

In connection with the FC lower part (e.g. AC5003 without addressing socket):

- ▶ First address the module via the addressing unit AC1154, then install it.

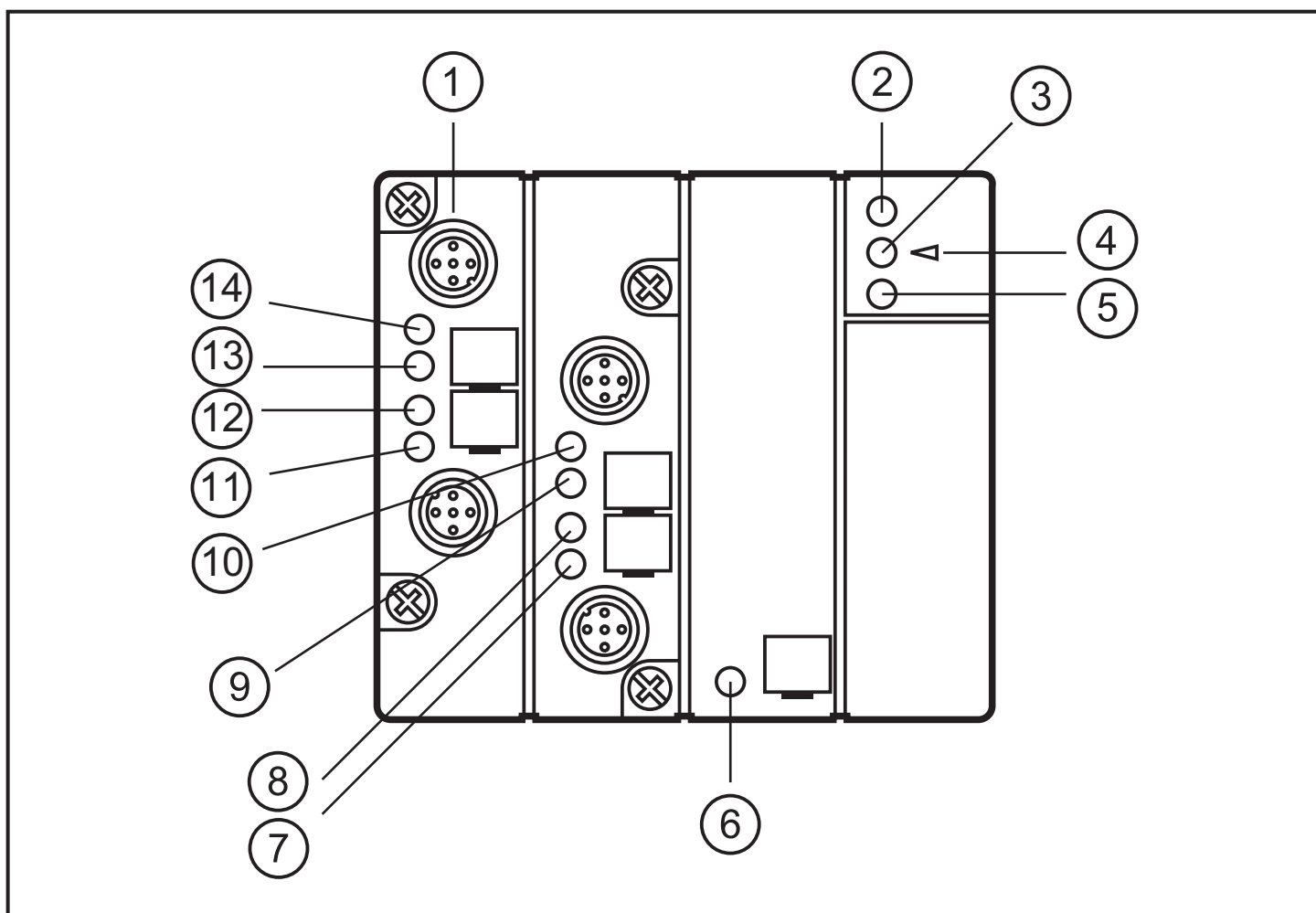
8.1 Infrared addressing

The safe AS-i module also offers the option of infrared addressing with the addressing unit AC1154. The AS-i communication (yellow cable) must be switched off during the infrared addressing.

- ▶ Disconnect the master.
- ▶ Supply the slaves with voltage via the AS-i power supply.

Addressing is carried out via the IR addressing cable E70211. When the ifm AS-i power supplies type SL are used, the communication can be deactivated via a jumper on the power supply.

9 Operation



- 1: 4 M12 sockets
- 2: LED red FAULT
- 3: LED infrared receiver
- 4: Fixture for infrared adapter
- 5: LED green PWR
- 6: LED AUX
- 7: LED 6 yellow O-4
- 8: LED 5 red O-2
- 9: LED red Error
- 10: LED 4 yellow I-2
- 11: LED 6 yellow O-3
- 12: LED 5 red O-1
- 13: LED 4 yellow I-2
- 14: LED 4 yellow I-1

LED Designation	LED state / Colour	Operating status
LED infrared	Infrared	infrared receiver
LED FAULT	⊗ red	peripheral fault, e.g. overload or short circuit of the sensor supply
LED FAULT	● red	AS-i communication error, slave does not participate in the "normal" exchange of data, e.g. slave address 0
LED PWR	○ green ● green	no AS-i voltage AS-i voltage supply ok
LED AUX	● green	auxiliary voltage supply ok
LEDs 5 Alarm	● red	alarm output O-1 / O-2 (unsafe) through the host system the alarm output LED can be set as a static or dynamic output
Error	● red	hardware fault / cross fault / short circuit
LEDs 4 Switching status	○ yellow ● yellow	inputs not switched inputs I-1 / I-2 switched
LEDs 6 Output status	○ yellow ● yellow	no voltage voltage supply ok for 24 V DC supply of the transistor outputs O-3 / O-4

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9.1 Data bits

Data bit	D3	D2	D1	D0
In/Out	SI-2/O-4	SI-2/O-3	SI-1/O-2	SI-1/O-1

Activated input channel	Bit sequence D3-D0
SI-1	XX00
SI-2	00XX
SI-1 and SI-2	0000
none	XXXX

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

Activated output	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. 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").



Note: unsafe transistor outputs

► The unsafe transistor outputs must **not** be used for safety-related functions.



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

9.2 Response times

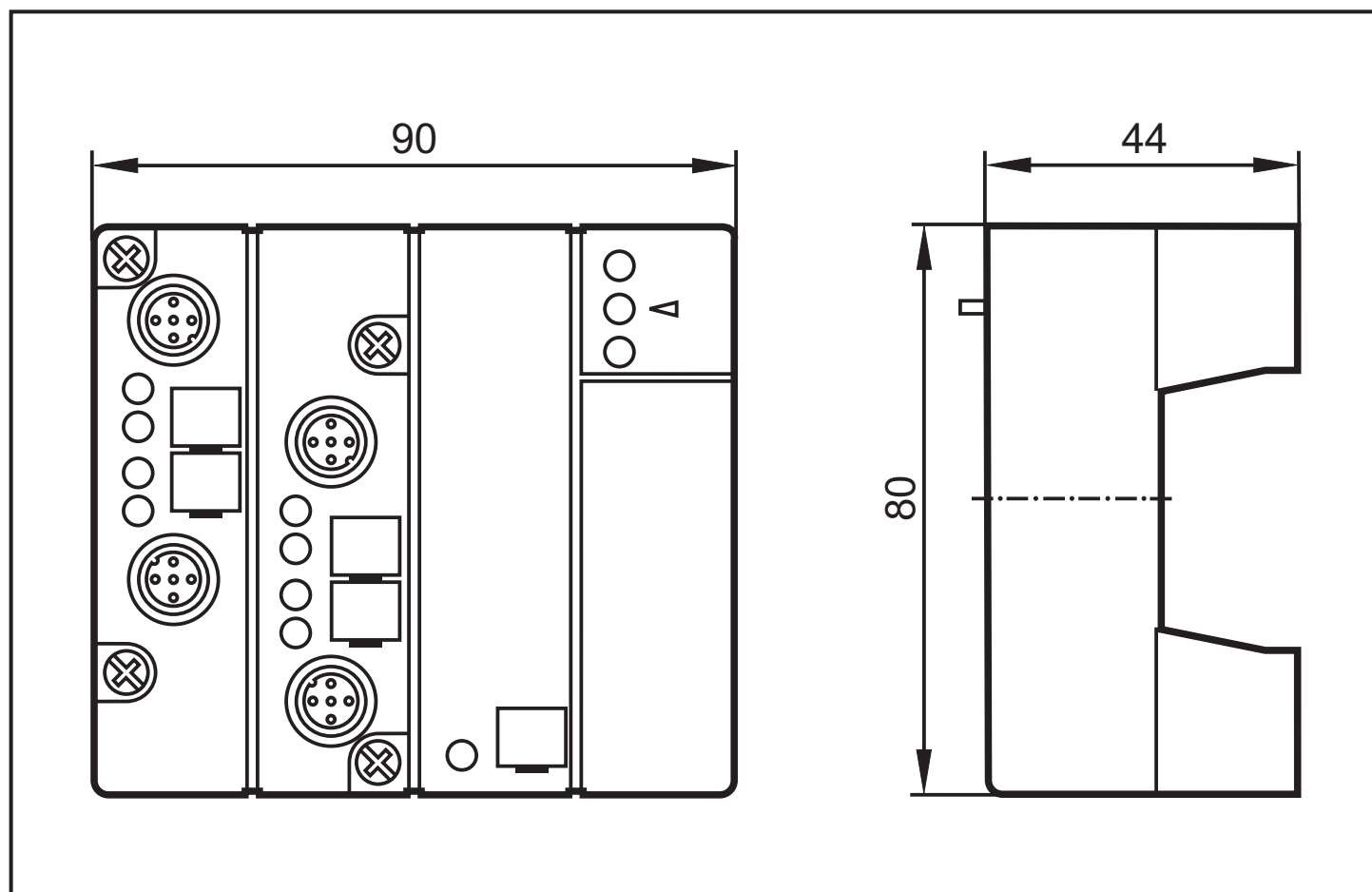
The response time of the safe AS-i module for a safety request is max. 10 ms.

Calculation of the total response time

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).

10 Scale drawing

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11 Technical data

AC006S	
Safe AS-i module 2 safe inputs / 2 unsafe LED outputs / 2 unsafe transistor outputs	
Operating voltage	26.5 ... 31.6 V DC
Current consumption	≤ 250 mA
Inputs	
Wiring	DC PNP
Voltage supply	via AS-i
Short circuit detection	yes
Input current	typ. 10 mA
Cross fault monitoring	yes
LED output	
Power via AS-i	yes
Integrated watchdog	yes
Transistor outputs	
Electrically isolated	yes
Short-circuit proof	yes
Integrated watchdog	yes
Current rating per output	1 A
External supply	yes
Voltage range	18...30 V DC
Current rating per module	2 A
Additional sensor supply	24 V DC / 100 mA
LED function display	
Operation / fault / function	green / red / yellow
Ambient temperature	-25 ... +55 °C
Protection rating	IP 67 in connection with FC lower part and AS-i flat cable
AS-Interface / extended addressing mode possible	version 2.1 / no
AS-i profile	S-7.B.E

I/O configuration / ID code	7 [Hex] / B.E [Hex]
AS-i certificate	75501
Maximum number of safe modules per master	31
EMC	EN 50081-1; EN 50295
Housing materials	PBTP (Pocan)
Housing dimensions	80 x 90 x 44 mm (H x W x D)
Cable length between module and mechanical contacts	≤ 10 m

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11.1 Safety characteristics

Characteristics	Value
Safety integrity level	SIL 3
Performance level	PL e
Category	Cat. 4
MTTF _d	8513 years
Service life T	10 years
PFH	2.2 x 10 ⁻⁹
DC / CCF / Cat.	98 % / 65 % / 4

These calculations were made on the basis of an ambient temperature of 40 °C. The unit meets the requirements of EN ISO 13849-1: 2008 category 4 PL e, SIL 3 (IEC 61508) and can be used in applications up to SIL 3 / PL e.

The PFD / PFH values and MTTF_d values of the other components, especially of the AS-i safety monitor, can be found in the corresponding documentation.

12 Terms and abbreviations

SIL	Safety Integrity Level	SIL 1-4 to IEC 61508. The higher the SIL the lower the probability that a safety function will fail.
PL	Performance level	Capability of safety-related parts to perform a safety function at predictable conditions to fulfil the expected risk reduction.
PFD	Probability of Failure on Demand	
PFH	Probability of Dangerous Failure per Hour	
Cat.	Category	Classification of the safety-related parts of a controller as regards their resistance to failures.
CCF	Common Cause Failure	
DC	Diagnostic Coverage	
T	Life time	(= max. service life)
MTTF _d	Mean Time To Dangerous Failure	

13 Troubleshooting

The LEDs of the safe AS-i module indicate faulty operating states → chapter 9 Operation).

14 Maintenance, repair and disposal

If used correctly, no maintenance and repair measures are necessary.

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.

15 Standards

The following standards and directives have been applied:

- Machinery Directive 2006/42/EC
- EMC Directive 2004/108/EC
- EN ISO 13849-1: 2008
- IEC 61508 parts 1-7: 2000
- EN 62061:2005
- EN 50295:1999
- UL 508

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The unit shall be supplied from an isolated source and protected by an overcurrent device such that the limited voltage/current requirements in accordance with UL 508 are met.

15.1 Approvals / certificates

- EC declaration of conformity
- AS-Interface
- TÜV Nord
- UL (cULus)