ifm electronic

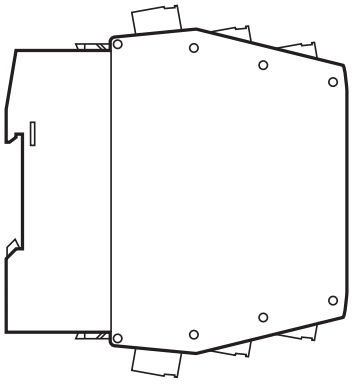
CE

Original operating instructions
Safe AS-i module

AS-interface

AC009S

UK



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Contents

1 Safety instructions

Follow the operating instructions.

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

For installation and prescribed use of the product the notes in the operating instructions must be carefully observed and the applicable technical standards relevant for the application have to be considered.

In case of non-observance of notes or standards, specially when tampering with and/or modifying the product, any liability is excluded.

The unit must be installed, connected and put into operation by a qualified electrician trained in safety technology.

After installation, the system has to be subjected to a complete function check.

Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.

For installation, the requirements according to EN 60204-1 must be observed.

In case of malfunction of the unit please contact the manufacturer. Any tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to an exclusion of liability and warranty.

2 Installation / set-up

2.1 Applications

The safe AS-i module detects safety-related switching states of 1-channel 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, AC041S).

When operated correctly, the system can be used in applications up to performance level e, category 4, according to EN ISO 13849-1 or IEC 61508/SIL3 (see notes in chapter Electrical connection).

⚠ NOTICE

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

2.2 Function and electrical connection

Observe all information in the description of the configuration software (e.g. E7040S, E7050S) and the operating instructions of the AS-i safety monitor. These documents provide all required instructions concerning installation, configuration, operation and maintenance of the AS-i safety 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.

Important note

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!

3 Installation

Mount the safe AS-i module on a 35 mm rail. The protection rating of the unit is IP 20, therefore it should be mounted in a protected location (e.g. control cabinet).

The mounting orientation has no adverse effect on the function Ensure that there is sufficient air circulation in the control cabinet.

4 Electrical connection

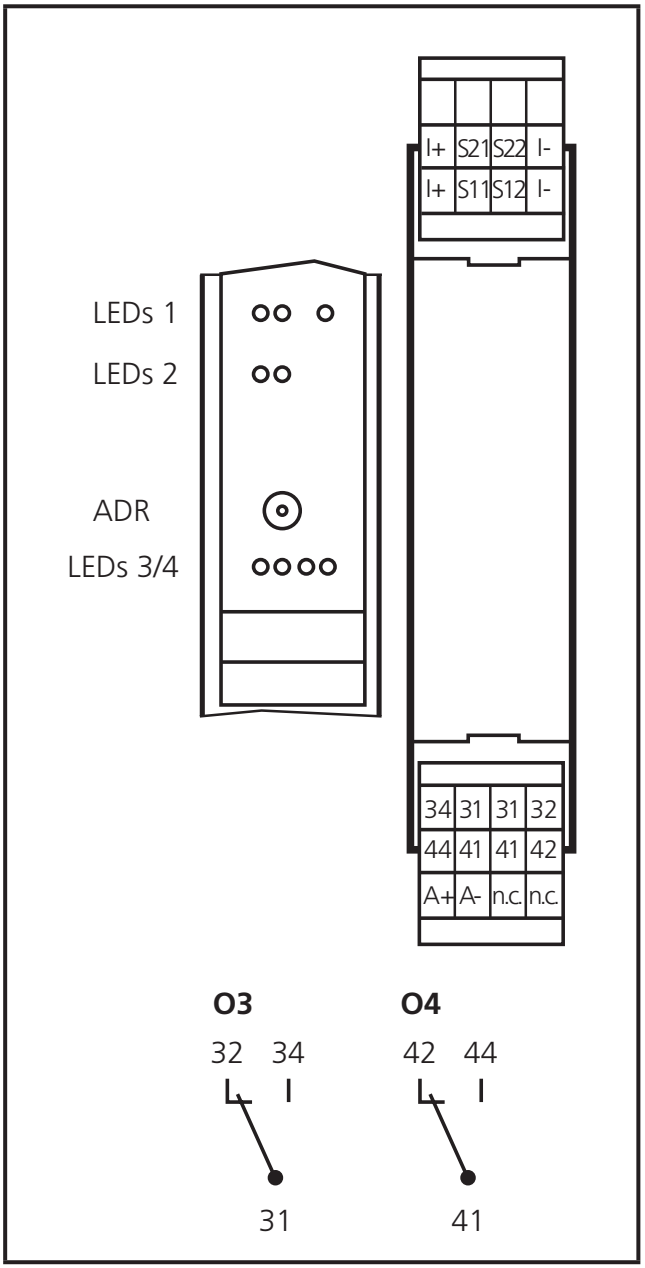
Connect the safe switching contacts to the screw terminals of the Combicon connectors.

Use switching contacts with:

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

4.1 Wiring

LEDs 1	Status indication inputs/Hardware/ERROR
LEDs 2	AS-i, FAULT
LEDs 3/4	Switching status indication LED alarm outputs / actuator outputs
ADR	Addressing interface
A+	AS-i +
A-	AS-i -
I+	Sensor supply from AS-i (+24 V output)
I-	Sensor supply via AS-i (0 V)
S11-S12/ S21-S22	Switching input Mechanical contact SI1/SI2



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 terminals S11 - S12 and S21 - S22 via a 4-wire cable.

The connection of two **independent** switching contacts is made to the terminals S11 - S12 or to the terminals S21 - S22 in separately laid cables.

5 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 outputs	Bit sequence D3-D0
O-1	XXX1
O-2	XX1X

Activated relay outputs	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").

Notice: non-safe relay outputs.

The non-safe relay outputs must **not** be used for safety-related functions.

If only **one** single-channel switch is to be connected to the module, it is to be connected to the input S11-S12. The second input S21-S22 must be bridged. This can be done by means of a wire link between the terminals S21 - S22.

Notice: 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 performance level (EN ISO 13849-1 or IEC 61508). The performance level is either determined by means of a risk analysis (e.g. to EN ISO 14121) or taken from a C standard. The performance level or SIL of the AS-i safety monitor must at least correspond to the performance level or SIL required by the application.

6 Addressing

When mounted and wired, the module can be addressed with the addressing cable (E70213) via the addressing unit AC1154.

Assign a free address between 1 and 31. At the factory the address is set to 0.

7 Operation

Check whether the unit operates correctly. Display by LEDs:

LEDs 1 yellow	Inputs switched
LED red ERROR	Hardware fault / cross fault / short circuit
LED 2 green	Supply voltage OK
LED 2 red lit	AS-i communication error, slave does not participate in the "normal" exchange of data, e.g. slave address 0
LED 2 red flashing	Peripheral fault, e.g. overload or short circuit of the sensor supply
LED 3 red	Alarm outputs O-1/O-2 (non-safe) (through the host system the alarm output LED can be set as a static or dynamic output)
LED 4 yellow	Relay outputs O-3/O4 (non-safe)

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.

8 Safety characteristics

Characteristics	Value
Safety integrity level	SIL 3
Performance level	PL e
Category	Cat. 4
$MTTF_d$	8513 years
Life time T	20 years
PFH	$4 \cdot 10^{-9}$/h
DC / CCF / Cat.	99 % / 65 % / 4

- These calculations were made on the basis of an ambient temperature of 40 °C. They are only valid for two-channel applications.
- The device 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 MTTFd values of the other components, especially of the AS-i safety monitor, can be found in the corresponding documentation.

Explanation of the abbreviations:

SIL	Safety Integrity Level 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 under predictable conditions to fulfil the expected risk reduction.
PFD	Probability of a dangerous failure
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

9 Response times

The response time of the safe AS-i module for a safety demand 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 Technical data

Electrical design	2 safe inputs / 2 non-safe LED outputs 2 non-safe relay outputs
Operating voltage	26.5...31.6 V DC
Current consumption	≤ 250 mA
Inputs	
Wiring	DC PNP
Power supply	via AS-i
Short-circuit detection	yes
Input current	typ. 10 mA
Cross-fault monitoring	yes
LED output	
Supply via AS-i	yes
Integrated watchdog	yes
Relay outputs	
Electrically isolated	yes reinforced insulation to EN 50178, overvoltage category II, degree of soiling 2 up to 240 V AC nominal voltage
Short-circuit proof	no
Integrated watchdog	yes
Current rating per output	6 A resistive
External supply	yes

Voltage range	10...240 V AC / 24 V DC all outputs (relays) must be supplied with the same voltage (e.g. 2x 240 V AC, same phase conductor or 2x 24 V DC)
Current rating per module	6 A
Additional sensor supply via AS-i	24 V DC / 100 mA
Function display	
Operation LED	green
Fault LED	red
Function LED	yellow
Ambient temperature	-25...50 °C
Storage temperature	-25...80 °C
Maximum relative air humidity	< 80%, no condensation permitted
Protection rating	IP 20
AS-Interface / extended addressing mode possible	Version 2.11 / 3.0 / no
AS-i profile	S-7.B.E
I/O configuration [Hex] / ID code [Hex]	7 / B.E
AS-i certificate	62001
Maximum number of safe modules per master	31
EMC	EN 50295
Housing materials	PA
Dimensions (HxWxD) [mm]	114 x 25 x 105 mm (HxWxD)
Cable length between module and mechanical contacts	≤ 10 m

11 Standards

The following standards and directives have been applied:

- MLR 2006/42/EC
- EMC Directive 2004/108/EC
- EN ISO13849-1:2008
- IEC 61508 parts 1-7:2000
- EN 62061:2005
- EN50295:1999
- UL 508

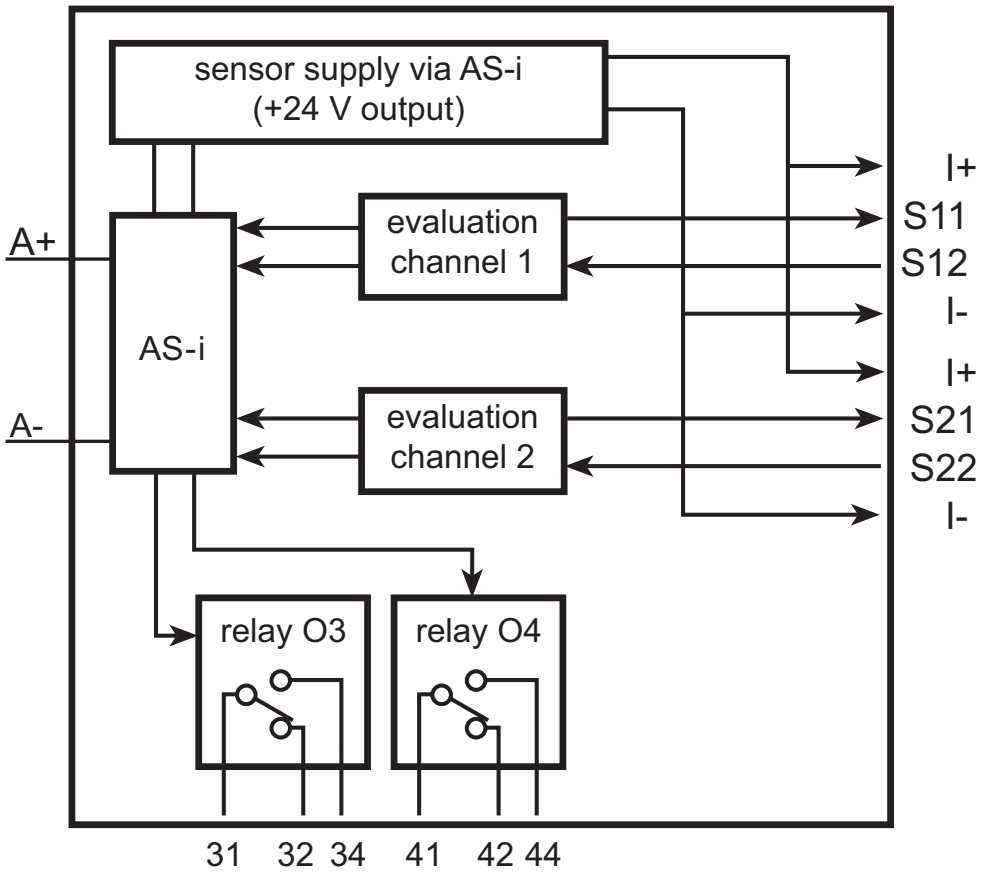
The device shall be supplied from an isolating transformer having a secondary UL Listed fuse rated as noted in the following table.

Overcurrent protection		
Wire cross section control circuit		Maximum nominal current of the protective equipment ampere
AWG	(mm^2)	
26	(0.13)	1
24	(0.20)	2
22	(0.32)	3
20	(0.52)	5
18	(0.82)	7
16	(1.3)	10

12 Approvals/Certificates

- EC declaration of conformity
- AS-Interface
- TÜV NORD
- UL (cRUus) see www.ifm.com

13 Block diagram



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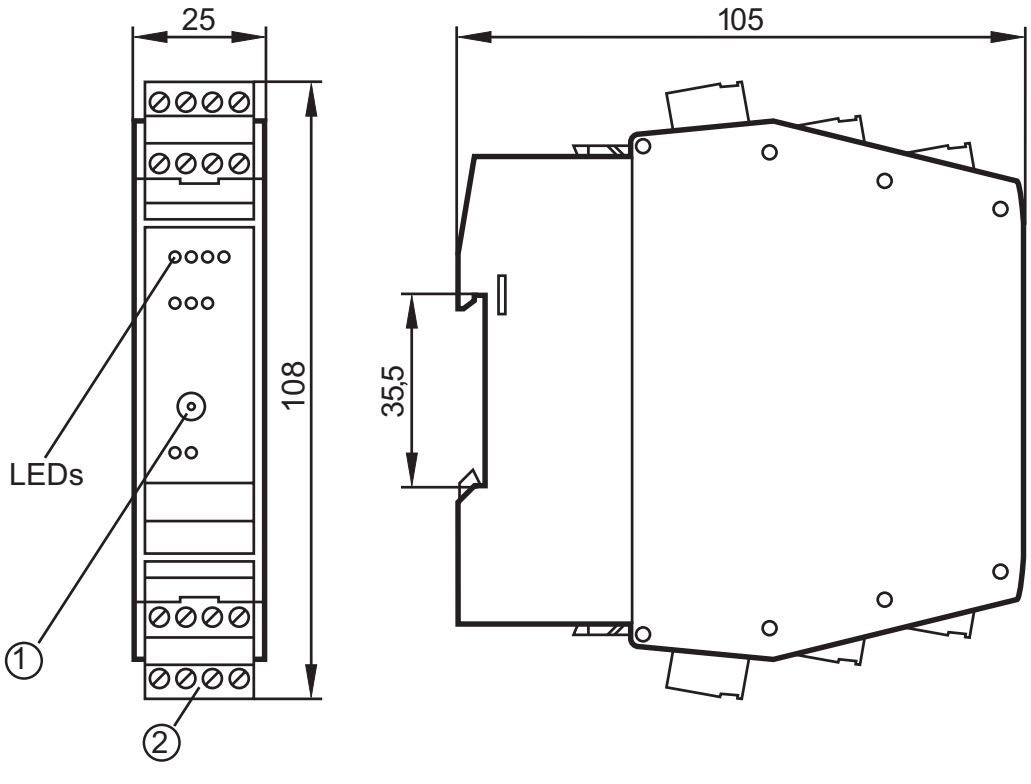
14 Scale drawing



1: Addressing plug
2: Combicon connector with screw terminals (option)