ifm electronic

CE

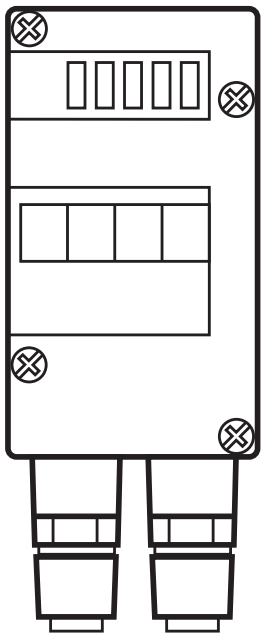
Operating instructions

ENGLISH

AS-interface

AC007S

Safe AS-i module



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Contents

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 handling can affect the safety of people 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 device 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. Tampering with the unit can seriously affect the safety of operators and machinery. This is not permitted and leads to an exclusion of liability and warranty.

Installation / set-up

Applications

The safe AS-i module is used to detect safety-related switching states, e.g. electro-sensitive protective equipment (ESPE) type 4 to EN 61496-1. Electro-sensitive protective equipment are, for example, safety light barriers, safety light curtains, laser scanners or fail-safe inductive sensors without specific counterpart. 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).
When operated correctly, the system can be used in applications up to the control category 4 according to EN 954-1 or IEC 61508/SIL3 (see notes electrical connection).

Note!

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

Function and electrical connection:

Observe all information in the description of the configuration software (e.g. E7030S) 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 herein are designed to be components of a safety-oriented machine or control system. A complete safety-related system normally includes sensors, evaluation units, actuators and signalling components. 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.

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!

Installation

Install the safe AS-i module onto an FC lower part, e.g. AC5003, and fix it onto a 35 mm rail or fasten it onto a mounting device.
The mounting position can be vertical or horizontal.
Then carefully lay the yellow flat cable (e.g. AC4000) and the black flat cable (e.g. AC4002) into the lower part using the supplied seals.
To guarantee the specified protection rating, the 4 screws of the upper part must be tightened evenly crosswise with 0.8 Nm. When installing the module ensure that the seal is carefully inserted.

Electrical connection

To achieve type 4 to EN 61496-1 for the ESPE a two-channel switch-off signal is necessary. This must be supplied by a device which itself detects short circuits between the individual channels and short circuits between every channel and the supply cable.
In this configuration SIL 3 to EN 61508 or category 4 to EN 954-1 can be achieved for the system.

Do not connect the inputs to an external potential.
Connect the safe OSSD outputs to the M12 sockets.
The switching inputs are limited in current and their behaviour meets EN / IEC 61496-1 and EN 61131-2.
In addition the connected devices may generate test pulses on the input cables.

Cover the unused sockets with protective caps to guarantee the indicated protection rating.

Addressing

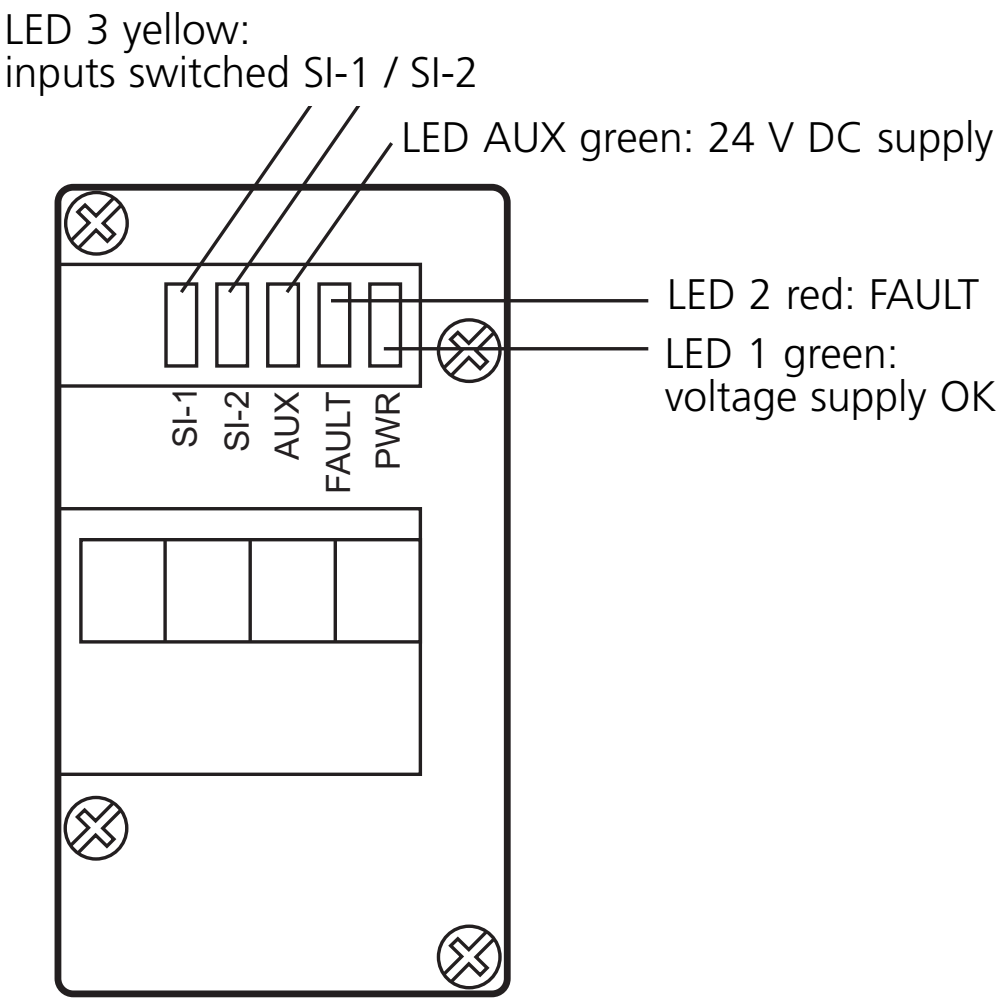
The safe AS-i module can be addressed via the addressing unit AC1144. Assign a free address between 1 and 31. At the factory the address is set to 0.
If it is used with the FC lower part, e.g. AC5003 (without addressing socket), the module must first be addressed via the addressing unit AC1144 and then mounted onto the lower part.

Operation

Check whether the unit operates correctly. Display by LEDs:

- LED 1 green: AS-i voltage supply ok
- LED 2 red lights: AS-i communication error, slave does not participate in the "normal" exchange of data, e.g. slave address 0
- LED AUX green: 24 V DC supply
- LEDs yellow: inputs switched SI-1 / SI-2

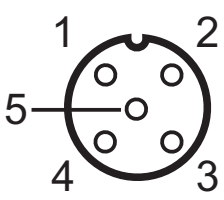
Operating elements and indicators



Socket 3 (receiver)

M12 socket	Pin
supply +24 V	1
OSSD2	2
supply +0 V	3
OSSD1	4
FE	5

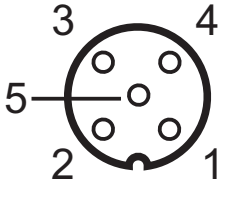
socket 3



Socket 4 (transmitter)

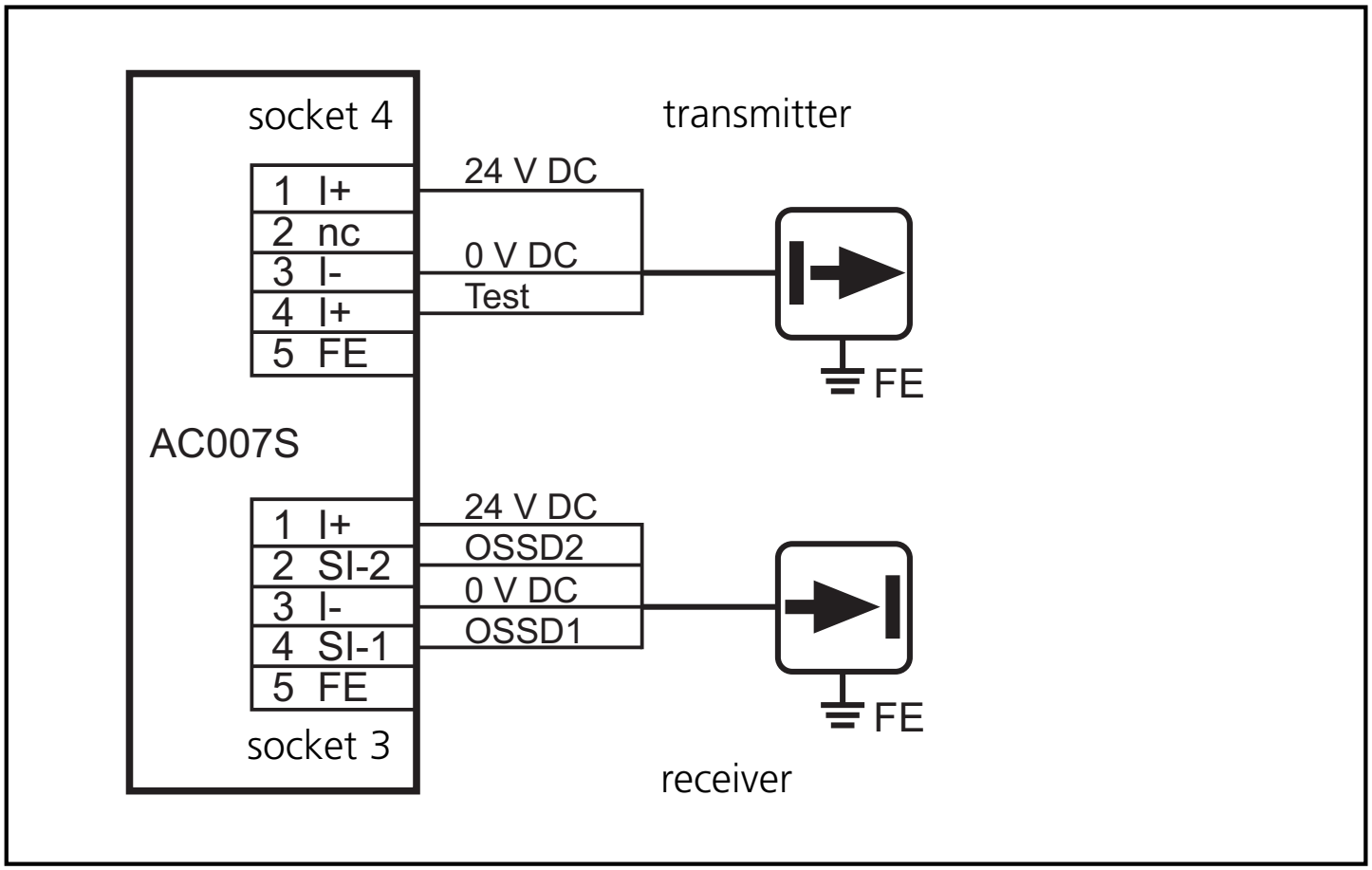
M12 socket	Pin
supply +24 V	1
not connected	2
supply +0 V	3
supply +24 V test	4
FE	5

socket 4

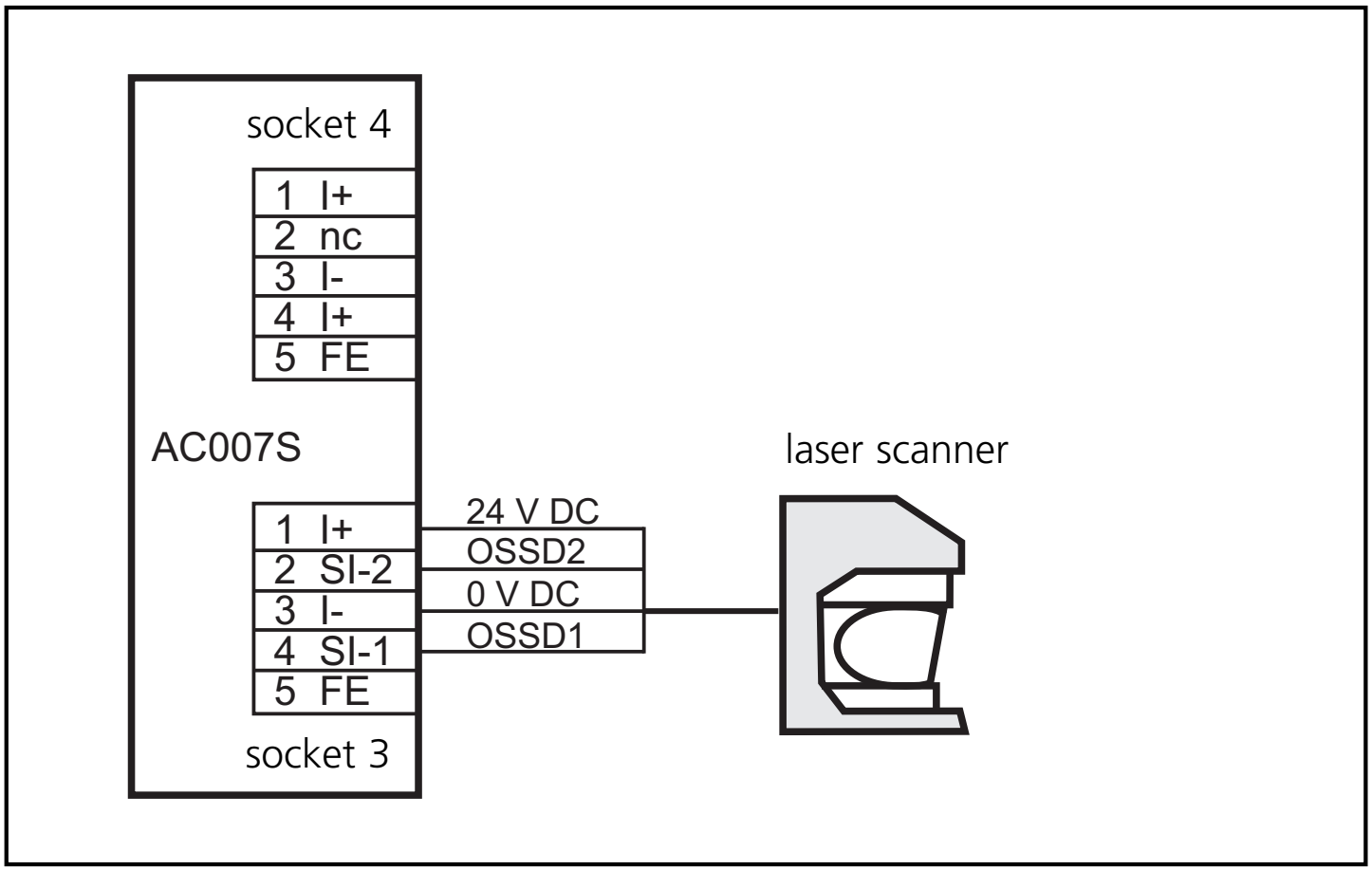


Wiring examples

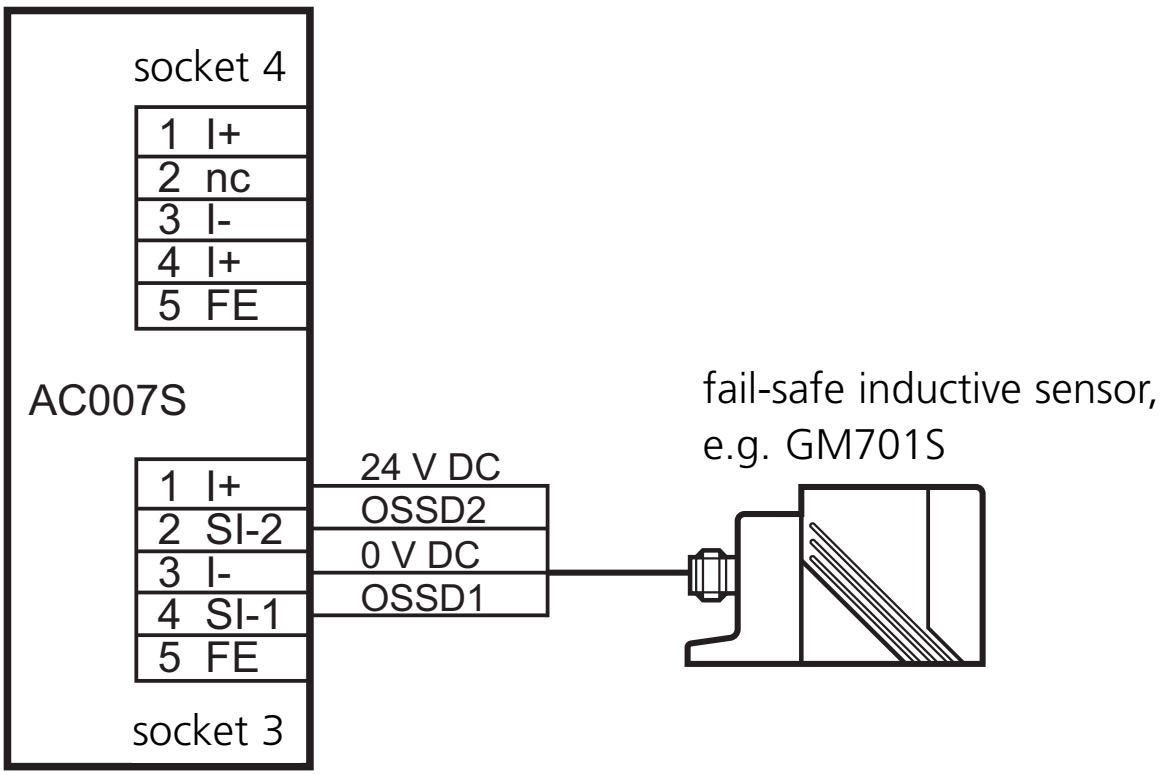
Connection of light barriers and light curtains to AC007S



Connection of a laser scanner to AC007S



Connection of a fail-safe inductive sensor to AC007S



Data bits

Data bit	D3	D2	D1	D0
In	SI-2	SI-2	SI-1	SI-1

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

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").

The safety monitor must monitor the inputs SI-1 and SI-2 for synchronous switch-off. This can be achieved by using function blocks for two-channel positively-driven or two-channel dependent components.
An input signal which is interrupted temporarily at short intervals (signal bouncing, passing of very small objects through the light barrier) can be interpreted as an error by the safety monitor. Programming a debouncing time for this safe AS-i module in the safety monitor is helpful.

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

Attention: 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 954-1/ISO 13849-1 or EN/IEC 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.

Response time

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 (safety light barriers, data transmission, safety monitor and external relays or contactors possibly connected to the monitor output).

Consideration of the residual error probability to IEC 61508

To calculate the PFD/PFH value of a safety-related function the PFD/PFH values of all components used in this function must be taken into account.

The probability of a dangerous failure (PFD) is
2.5×10^{-5}.
The probability of a dangerous failure per hour (PFH) is
$1{,}54 \times 10^{-9}$/h.

These calculations were made on the basis of an operating temperature of 40 °C.

The maximum service life (T) is 10 years. The unit can be used in applications up to SIL 3.

Explanation of the abbreviations:
PFD = probability of a dangerous failure
PFH = probability of a dangerous failure per hour
SIL = safety integrity level
T = life time (= service life)
The PFD/PFH values of the other components, especially of the AS-i safety monitor, can be found in the corresponding documentation.

Technical data

Electrical design	2 safe inputs (OSSD)
Operating voltage	26.5...31.6 V DC
Current consumption	≤ 35 mA
Inputs	
Wiring	DC PNP
Sensor supply	ext. 24 V DC PELV
Voltage range [V]	± 15%
Current rating	≤ 2 A
Short-circuit/overload protection	yes / yes
Switching level high/low signal 1 (IEC 61131-2 type 2)	> 11 V / < 5 V
Input current high/low (IEC 61131-2 type 2)	> 6 / < 2 mA
Function display	
Operation LED	green
Fault LED	red
Function LEDs	yellow
Operating temperature [°C]	-25...55
Protection rating	IP 67
AS-interface / extended addressing mode possible	version 2.11 and 3.0 / no
AS-i profile	S-0.B.E
I/O configuration [hex]	0
ID code [hex]	B.E
AS-i certificate	80002
Maximum number of safe modules per master	31
EMC	IEC 62026-2; EN 50295
Housing materials	PA 6
Dimensions (HxWxD) [mm]	110 x 45 x 51
Cable length between module and electro-sensitive protective equipment	≤ 10 m

Electrical data	
Electrical separation AS-interface - inputs (U_{AUX})	safe separation to IEC 61203: 40 V DC
Electrical separation AS-interface - functional earth	basic insulation to IEC 61203: 40 V DC
Electrical separation inputs (U_{AUX}) - functional earth	basic insulation to IEC 61203: 35 V DC
Rated insulation voltage [V]	40
Pulse withstand voltage [kV]	0.5
Short-circuit current U_{AUX} [A]	max. 8
Maximum switch-off voltage [V]	24 DC PELV
Maximum input capacitance [nF]	< 10
Max. air humidity [%]	95
Storage temperature [°C]	-25...85
Protection class	III
Overvoltage category	II
Standards functional safety	EN954-1, IEC 61496-1, IEC 61508, IEC 62061

Scale drawing