EUCHNER

AS-i Safety Relay Output Module with Diagnostic Slave

User Manual

...supports the requirements for AS-i Safety up to SIL3

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AS-i Safety Relay Output Module with Diagnostic Slave

1. Symbol Catalog

Information!

This symbol indicates important information.

Attention!

This symbol warns of a potential failure. Non-compliance may lead to interruptions of the device, the connected peripheral systems, or plant, potentially leading to total malfunctioning.

Warning!

This symbol warns of an imminent danger. Non-compliance may lead to personal injuries that could be fatal or result in material damages and destruction.

1.1 Abbreviations

AS-i	AS-interface (actuator sensor interface)
AOPD	Active opto-electronic protective device
CRC	Cyclic redundancy check
I/O	Input/output
EDM	External device monitoring
EMC	Electromagnetic compliance
ESD	Electrostatic discharge
PELV	Protective extra-low voltage
PFD	Probability of failure on demand
PLC	Programmable logic control
SaW	Safety at Work, safety technic

2. General Remarks

Please read this chapter carefully before working with the documentation and the "AS-i Safety Relay Output Module with Diagnostic Slave".

2.1 Product information

This user manual is valid for the following EUCHNER GmbH + Co. KG devices:

AS-i Safety Relay Output Module with Diagnostic Slave and 1 EDM input	**SOM-4E-0A-C1**

2.2 Function of this manual

This manual instructs for the safe assembly, electrical installation, addressing, start-up as well as for the operation and for the maintenance of the AS-i Safety Output Relay.

This manual does ***not*** provide instructions for operating machines, on which this module is built in. Please view the appropriate machine manual for corresponding information.

Information!

Additional information concerning the technical data as well as the parameterization of the AS-i Safety Output Relay can be found at http://www.euchner.de

2.3 Target group

This manual is intended for designers, developers and operators of systems that will be safeguarded by one or more AS-i Safety Output Relays. The manual is also targeted to people integrating AS-i Safety Output Relays into machinery, performing the initial start-up, or maintaining them.

2.4 AS-i specifikation 3.0

The "AS-i Safety Relay Output Module with Diagnostic Slave" is designed according to the AS-i specification 3.0.

Earlier specifications (2.1 and 2.0) continue to be fully supported.

3. Safety

This chapter contains user safety information.

Warning!

Please read this chapter carefully before using the AS-i Safety Output Relay in combination with other machine safeguarding components on protected machinery.

3.1 Experienced staff

The AS-i Safety Relay Output Module with Diagnostic Slave must only be installed, operated, and maintained by qualified staff.

Qualified is a person who

- has a suitable technical education
- has been instructed in operating the machinery and has been informed about the valid safety guidelines by the machinery operator
- has access to the user manual.

3.2 Application area of the device

The SOM-4E-0A-C1 is a decentralized output-module that safely controls actuators on the AS-i Safety at Work (SaW) safety bus system.

In this set-up, a Safety Monitor or a Gateway with integrated Safety Monitor, respectively, controls the SOM-4E-0A-C1.

A special characteristic of this module is its two different kinds of AS-i addresses:

- Safe AS-i address
  SOM-4E-0A-C1 listens to the communication on the safe address and switches based on these data.
- Non-safety relevant AS-i address
  The non-safety relevant AS-i address is used for diagnostic purposes and for switching under PLC control.

All SaW output modules with the same safe AS-I address switch at the same time.

The SOM-4E-0A-C1 is certified according to EN 62 061, SIL 3, and EN 13 849, performance level e.

3.3 Correct use

The AS-i Safety Relay Output Module with Diagnostic Slave must only be used as defined in chap. Application area of the device. The AS-i Safety Relay Output Module with Diagnostic Slave must only be used on the system, at which it was installed in accordance with this manual by adept personnel.

Information!

If used in a way differing from this description or if the device has been changed in any way – even during installation – any warranty claims with respect to EUCHNER GmbH + Co. KG are invalid.

3.4 Disposal

Information!

Electronic waste is hazardous waste. Please comply with all local ordinances when disposing this product!

The device does not contain batteries that need to be removed before disposing it.

4. Product Description

This chapter is intended to inform the reader about the special characteristics of the AS-i Safety Relay Output Module with Diagnostic Slave. It describes the design and the functionality of the devices.

Warning!

This chapter must be read before installation and operation of the device in conjunction with other safety components on protected machinery.

4.1 AS-i Safety at Work

AS-i Safety at Work combines safe and non-safe data on a bus system. The classification AS-i Safety at Work identifies the safe data transfer that enables the integration of safety procedures in an AS-i network.

The components of AS-i Safety at Work conform to EN 50295 and are compatible with all other AS-i components. Therefore, existing AS-i applications can easily be extended with safety-relevant functions.

AS-i Safety at Work always requires a Safety Monitor (as a stand-alone device or integrated into a Gateway), that evaluates the safe signals on the bus, and a safe AS-Interface bus connection, that enables the transfer of safe signals from safety-relevant components (AS-i SaW input).

Additionally, decentralized safe AS-I SaW outputs can be added. Controlled by the Safety Monitor these outputs can be used to safely switch off safe actuators.

Several Safety Monitors and safe input and output slaves can be used on an AS-i system. At the same time, the Safety Monitors can be parameterized and, thus, be checked through AS-i and the configuration software.

Information!

By utilizing AS-i Safety at Work safety requirements according to SIL3, EN 61 508 and EN 62 061 and as well Cat. 4 and Performance-Level "e" according to EN ISO 13 849 can be satisfied.

In order to satisfy the requirements of these safety categories, all peripheral components, for instance the Safety Monitors, all safe bus connections, and all connected sensors must satisfy these standards.

4.1.1 Special characteristics of the AS-i Safety Output Relay

- Two redundant, force-guided relays
- Two parallel, galvanically isolated contact sets
- 4 standard inputs
- External sensors supplied from AS-i
- Programming jack
- Operating mode selector switch

4.2 Technical Data

Connection	
Connection	4 x COMBICON
Length of connecting cable	I/O: max. 15 m (1)
AS-i	
Profile	S.7.A.E ID1 = 5_{hex} (default), value adjustable
Address	1 Single Slave + 1 AB Slave
Required master profile	≥ M3
As of AS-i specification	2.1
Operating voltage	30 V DC
Max. current consumption	< 200 mA
Inputs	
Number	1 diagnostic + 1 EDM
Switching current	15 mA (T = 100 µs), continuously 4 mA at 24 V
Power supply	out of AS-i
Power supply of attached sensors	90 mA
External device monitoring (EDM)	supplied out of AS-i, approx. 24 V, approx. 10 mA
Number	1 relay output max. contact load: 3 A DC-13 at 24 V or 3 A AC-15 at 230 V protection via external fuse, max. 4 A semi time-lag type E
Max. output current	max. 3 A
Max. inrush current	20 A for 20 ms
Number of switching operations	
Usage category (EN 60347-4-1 / EN 60947-5-1)	AC1: 230 V/3 A (ca. 150 x 10^3 cycles) AC 15: 230 V/3 A (ca. 80 x 10^3 cycles) DC 1: 24 V/3 A (ca. 500 x 10^3 cycles) DC 13: 24 V/3 A/0,1 Hz (ca. 50 x 10^3 cycles)
Display	
LED I1 ... In (yellow)	state of inputs I1 ... I3
LED 1.Y1 (yellow)	state of EDM input 1.Y1
LED ASI (green)	AS-i voltage ON
LED FAULT (red)	AS-i fault
LED OUT (yellow)	for definition see table "Diagnostic (device color)"
LED ALARM (red)	PLC indicates alarm
Environment	
Applied standards	IEC 61508 SIL 3 EN ISO 13849-1 PLe cat 4 EN 62061 SIL 3 EN 60529
Operating height max.	2000 m
Ambient temperature	-30 °C ... +55 °C (2), no condensation permitted
Storage temperature	-25 °C ... +85 °C
Relative humidity max.	90% (40 °C), no condensation permitted
Protection category	IP20
Housing	plastic, Din-rail mounting
Voltage of insulation	≥6 kV
Weight	149 g
Dimensions (L / W / H in mm)	22,5 / 99 / 114

(1) Loop resistance ≤150 Ω

(2) temperature range up to -30°C from Ident.No. ≥16366

Protection category according to DIN 60 529: Housing IP20 (only for the use in an electrical enclosure/ cabinet with minimum protection category IP54).

Device Colors

Value	Color	Description	State change	LED "Out"
0	green	Output on		on
1	green flashing	–		–
2	yellow	Error lock	Auxiliary signal 2	1 Hz
3	yellow flashing	–		–
4	red	Output off		off
5	red flashing	Waiting for error unlock signal	Auxiliary signal 1	8 Hz
6	gray	Internal error, for instance "fatal error"	Only through turning power "on" on the device	all LEDs are flashing
7	green/yellow	Output released but not turned on	Switched "on" by setting O1	off

Tab. 4-1.

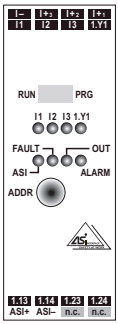
4.3 Safety relevant data

Identification data	Value	Standard
Safety category	4	EN 954-1
		EN 13 849-1:2008
Performance level (PL)	e	EN 13 849-1:2008
Safety Integrity Level (SIL)	3	EN 61 508 / EN 62 061
Usage time (TM) [year]	20	EN 13 849-1:2008
Maximum operating time [month]	12	EN 61 508
PFD[1]	$9{,}25 * 10^{-06}$	EN 61 508
PFH_D[1] (Probability of a dangerous failure per hour)	$3{,}30 * 10^{-09}$	EN 61 508
	$5{,}54 * 10^{-09}$	EN 62 061
Max. system response time [ms]	50	EN 61 508

Tab. 4-2.

1.) The specified PFD and PFHD values refer to the maximum power-on time of 12 months and a maximum service life of 20 years, according to EN 13 849-1. The failure rates are based on a switching frequency of 1/h and on an average operating temperature of 50 °C.
The maximum cycle time of the module (also under the assumption of errors) is 50 ms from the concern of the zero sequence to the shutdown of the relay.
In addition to the reaction time of the monitor and of the inputs must also be considered.

4.4 Front view and connections



PRG
Programming of safety relevant AS-i address enabled. Protective mode disabled

RUN
Protective mode enabled. Programming of non-safety relevant AS-i address enabled

ADDR
addressing jack

I1, I2, I3
Inputs I1, I2 and I3

1.13, 1.14
Output contact set 1

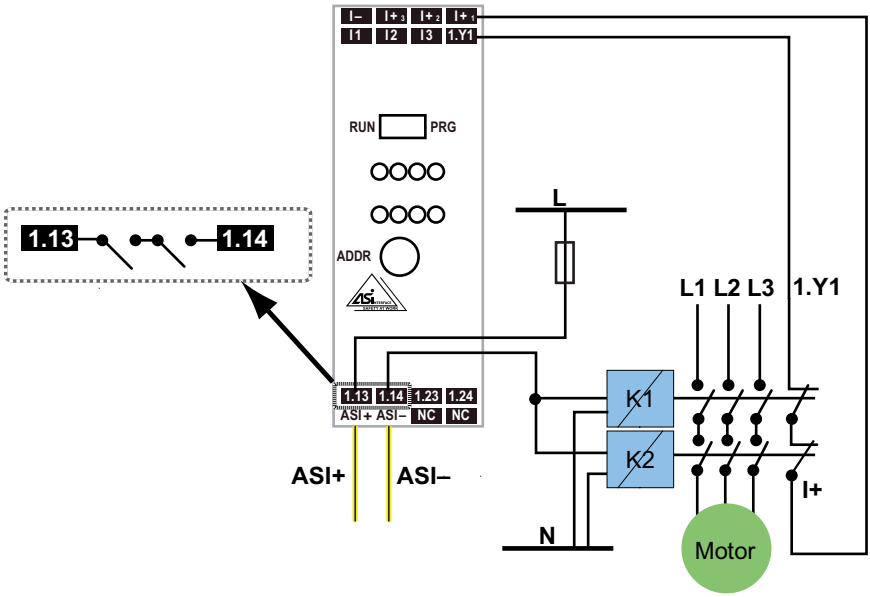
1.23, 1.24
Output contact set 2

I-, I+
voltage supply for inputs

1.Y1
EDM (input of external device monitoring circuit)

ASI+, ASI–
AS-i connection

4.5 Connecting a safety contactor



4.6 LED status display

LEDs		Signal // Description
ASI / PWR		No supply power
	(1) **1 Hz**	Supply power is on, safety-relevant address and/or AS-i AB address is “0”
	(1)	Supply power on
FAULT		AS-i communication OK
	(2)	no data exchange with the AB slave and/or safety-relevant address address is “0”
OUT		Output relay switched off
	(3) **1 Hz**	Error lock state, waiting for start signal, after transmission of start signal Output Relay switches on
	(3) **8 Hz**	The device is in an un-lockable error state. The devices resumes regular operation after the Monitor sent the signal “error unlock”.
	(3)	Output Relay switched on
ALARM		AS-i output bit O 0 is not set
	(2)	AS-i output bit O 0 is set
I1, I2, I3, 1.Y1		the corresponding input is not connected (mode standard inputs) or release has not been issued (I3, diagnostic mode)
		(running light) Switch is set to PRG
	(3)	the corresponding input is connected (mode standard inputs) or release has not been issued (I3, diagnostic mode)

Tab. 4-3.

(1) LED green (2) LED red (3) LED yellow

LED on LED flashing off

Attention!

In case all LEDs are blinking simultaneously in fast rythm a fatal error has been detected. This message is reset by a short-run disconnection of the power supply (Power On Reset).

5. Maintenance

5.1 Controlling safe shutdowns

The plant safety engineer is responsible for verifying that the AS-i Safety Relay Output Module with Diagnostic Slave works correctly as part of the safety system.

At least once a year it is necessary to verify the safe shutdown by initiating associated safety-related sensors or switchs:

Attention!

Press each safety-related AS-i slave and watch the reaction of the output circuits of the AS-i Safety Monitor.

Attention!

Check the maximum activated time and the total operating time. These values depend on the PFD value chosen for the total failure probability. Please refer to the information in chap. Safety relevant data.

After reaching the projected maximum operating time (three, six, or twelve months) the entire safety system must be checked for proper operation.

After reaching the projected total usage time (20 years) the device must be checked by the manufacturer concerning its proper operation.

6. Address Assignment

The device offers two different types of AS-i addresses:

The safety relevant (single) AS-i address is the target address for the device through which it receives the signal for the safe release of the output. This address is not used for communication; the device only uses it to listen to ongoing communications.

This address can only be programmed if the switch is set to PRG.

The device uses the non-safety relevant (A/B) AS-i address to communicate with the master in order to exchange diagnostics data (I1 …I3, 1.Y1) and control signals (Alarm LED).

This address can only be programmed if the switch is set to RUN.

6.1 Programming of the safety relevant AS-i address

1. Set device switch to PRG.
2. Set desired address by using the hand-held addressing device or AS-i Master.
3. Check programmed address by using the hand-held addressing device or AS-i Master.
4. Check slave's ID code by using the hand-held addressing device or AS-i Master. The code should be set to "F".
5. Check slave's ID1 code by using the hand-held addressing device or AS-i Master. Code should be the same as the tens-digit of the address.
6. Check slave's ID2 code by using the hand-held addressing device or AS-i Master. The code should be the same as the ones-digit of the address.
7. Check slave's IO code by using the hand-held addressing device or AS-i Master. The code should be "7".
8. If the settings in steps 3 to 7 were correct continue with step 9. Otherwise repeat, starting with step 1.
9. Set the switch on the device to RUN.

Warning!

The correct safety function of the device must be verified once installed within the protected machinery!

6.2 Programming of the non-safety relevant AS-i address

This address can be programmed by using the hand-held addressing device or AS-i Master when the switch is set to RUN.

7. Safety Requirements

- The device uses two redundant, force-guided relays.
- The module recognizes if one of the relays does not switch (for instance if the contacts are welded).
- The contact sets 1.13/1.23 and 1.14/1.24 use the same relay; they do not operate independently.
- The contacts 1.13, 1.23, 1.14, 1.24 are potential-free. A cross-short check is not available.
- If the device is set up to control two independent safety contactors, connected in series, the connection between the safety contactors and the device must never be subjected to another potential as this could result in the inadvertent activation of the safety contactors.
- Input 1.Y1, just like inputs I1... I3, is a standard AS-i input.