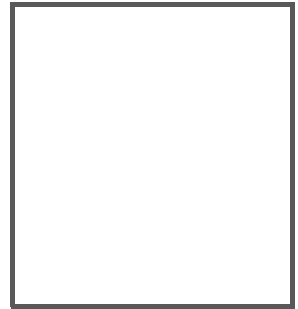


MANUAL

**AS-I SAFETY INPUT
MODULE**



With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1. Introduction

Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Before installing this equipment and put into operation, read this manual carefully. This manual contains instructions and notes to help you through the installation and commissioning step by step. This makes sure bring such a trouble-free use of this product. This is for your benefit, since this:

- ensures the safe operation of the device
- helps you to exploit the full functionality of the device
- avoids errors and related malfunctions
- avoids costs by disruptions and any repairs
- increases the effectiveness and efficiency of your plant

Keep this manual at hand for subsequent operations on the device.

After opening the packaging please check the integrity of the device and the number of pieces of supplied.

Symbols used

The following symbols are used in this manual:



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.

Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

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68307 Mannheim
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Fax: +49 621 776-274411
E-Mail: fa-info@pepperl-fuchs.com

2. Declaration of conformity

2.1 Declaration of conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.



Information!

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

3. Safety

This chapter contains user safety information.



Warning!

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

3.1 Experienced staff

The "AS-i Safety Input Module" 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 „AS-i Safety Input Module" is a decentralized input module for the integration of safety components into the AS-i Safety at Work (SaW) safety bus system.

The module provides a safety SaW code sequence if the input signal is within the adjustable safety range.

The Speed Monitor is approved for safety applications up to Category 4 / PL e / SIL 3.

The Speed Monitor may only be operated within the limits of its technical specifications. It may only be operated with the specified current and voltage values.

The module VAA-2E2A-KE1-SE is used for connecting a self tested optoelectronic protective device. Moreover, it has got two non-safety related outputs.



Attention!

Don't use the outputs for safety related functions.



ESD protection

The module is an ESD unsecured building group. When assembling the relevant ESD preventive measures are to be kept!

3.3 Correct use

The "AS-i Safety Input Module" must only be used as defined in chap. <Application area of the device>. The "AS-i Safety Input Module" 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 Pepperl+Fuchs GmbH 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. General Remarks

Please read this chapter carefully before working with the documentation and the "AS-i Safety Input Module".

4.1 Product information

This user manual is valid for the following Pepperl+Fuchs GmbH devices:

AS-i Safety Input Module	VAA-2E2A-KE1-SE
---------------------------------	------------------------

4.2 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 module.

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 module can be found in data sheet VAA-2E2A-KE1-SE that can be located at www.pepperl-fuchs.com

4.3 Target group

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

4.4 AS-i 3.0 specification

The "AS-i Safety Input Module" is designed according to the AS-i 3.0 specification.

5. Product Description

This chapter is intended to inform the reader about the special characteristics of the AS-i Safety Input Module. 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.

5.1 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.

5.1.1 Special characteristics of the "AS-i Safety Input Module"

The module VAA-2E2A-KE1-SE is a 1I/2O safety input slave.

Further characteristics:

- 2/1 safety inputs with 2 channels for floating contacts
- 2 standard semiconductor outputs
- the two input channels are monitored concerning cross-connection against each other
- supports AS-i Safety applications up to category 4/SIL3
- optical indication of inputs/outputs via LEDs
- outputs are short-circuit, overload and pole protected
- the outputs and the sensors are powered galvanically isolated out of separate 24 V
- integrated watchdog function for non-safe outputs (depending on parameter)
- connection for an address programming device (handheld).

5.2 Technical data

The technical data are placed in the data sheet. Please view the current version on the web page: www.pepperl-fuchs.com.

5.3 Safety relevant data

Identification data	Value	Standard
Safety category	4	EN 954-1
Safety category	4	EN ISO EN 13 849-2: 2008
Performance level (PL)	e	EN ISO EN 13 849-1: 2008
Safety Integrity Level (SIL)	3	EN 62061
Usage time (TM) in years	20	EN ISO EN 13 849-2: 2008 EN ISO EN 13 849-1: 2008
Maximum operating time in months	12	EN 62061
PFD	8,00E ⁻⁰⁷	EN 61508
PFH _D (Probability of a dangerous failure per hour)	1,48E ⁻⁰⁹	EN 61508
	2,83E ⁻⁰⁹	EN 62061
Max. system reaction time	10 ms	EN 62061

To determine the safety characteristics (PFD and PFH), the values of all components using this function are to be considered. The VAA-2E2A-KE1-SE module provides no significant contribution to the PFD or PFH values of the complete system. For the values of other components, please refer to relevant documentation.

5.4 Requirements for the voltage supply +24 V_{EXT} (AUX)



Information!

The externally connectable circuits are to be separated from the net absolutely reliable!

The power supply +24 V_{EXT} may only occur via SELV or PELV networks.

5.5 Response time

The response time corresponds to the load-time in the AS-i slave. It is the maximal (i.e. also in the case of an error) required time between the opening of the switching contacts and the operational availability in the AS-i chip of the slave.

For the computation of the safety distance of a protective device you must consider (among others) following things:

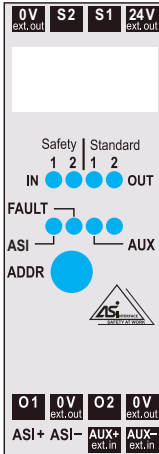
- the response time of the AS-i slave
- the response time of the AS-i Safety Monitor
- the follow-up time of the machine or production line.



Information!

Please view the appropriate manual to find information about response time of the particular devices.

5.6 Front view and connections



In 1/2

State inputs OSSD 1/2

Out 1/2

State outputs Out 1/2 // état sorties Out 1/2 // stato uscite Out 1/2

ASI (PWR)

AS-i supply power

FAULT

AS-i communication error

AUX

auxiliary voltage

S1, S2

safe input terminal

O1, O2

connection to output O1/O2

0V_{ext.out}

reference potential for the outputs and protectiv devices

24V_{ext.out}

supply voltage for electronic protectiv devices

ASI+/-

AS-i connection








AUX+/-_{ext.in}

Supply voltage for the conventional outputs and voltage supply input for the electrical protective devices

ADDR


addressing jack

5.7 LED status display


LED	Description
ASI	 (1) AS-i supply power OK
FAULT	 (2)  Tab. "Peripheriefehler // Peripheral fault // ..."
	1Hz  (2) AS-i communication error, slave does not participate in the normal exchange of data, e.g. slave address '0'
AUX	 (1) 24V _{DC} AUX on
Out 1, Out 2	 (3) status of outputs
In 1, In 2	 (3) status of inputs

Tab. 5-1. LEDs

Peripheral fault

 (2) AUX voltage is missing, overload output

Tab. 5-2. Peripheriefehler // Peripheral fault // ...

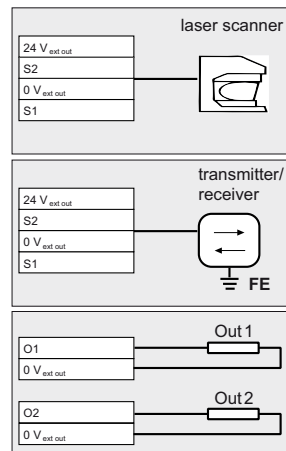
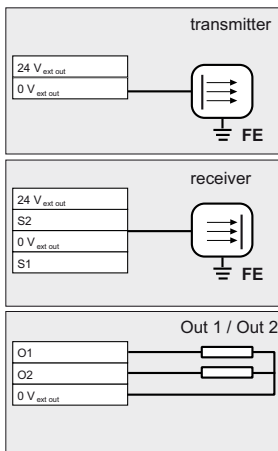
(1)  LED green

(2)  LED red

(3)  LED yellow

 LED on  LED flashing  off

5.8 connection examples

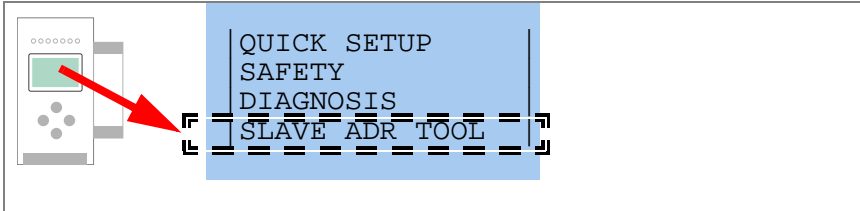


17.2.2016



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

5.9 Addressing with AS-i Master



For further information, please refer to the documentation of the gateway.

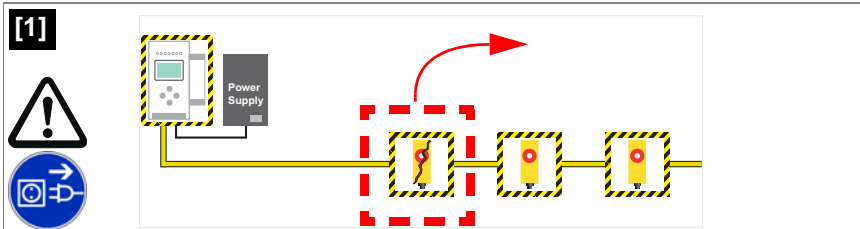


Addressing is possible also with hand addressing devices.



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

5.10 Teaching code sequences by replacing a slave

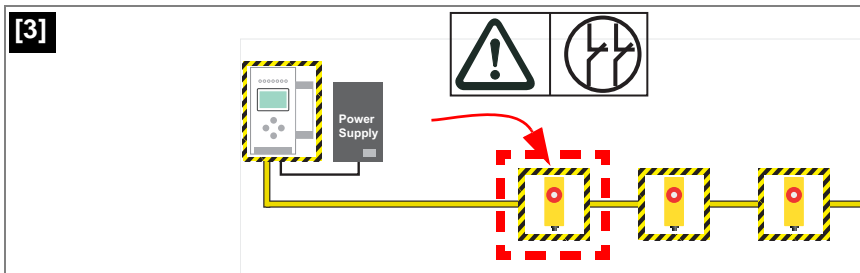


[2]

1.1
missing slave

Slave 1 to
be connected
then press
service long

ESC
5 sec.



[4]

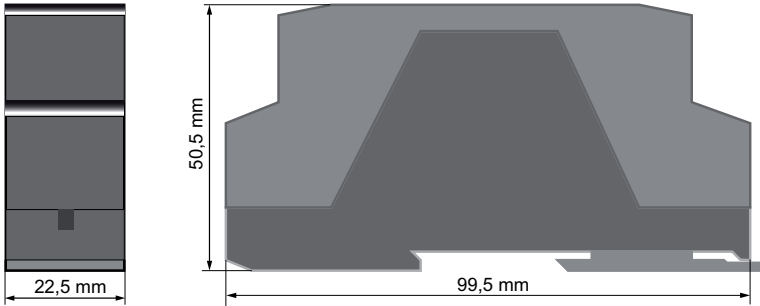
ESC
5 sec.

Teaching Codes
Slave Addr. 1
Codes learned
Help:

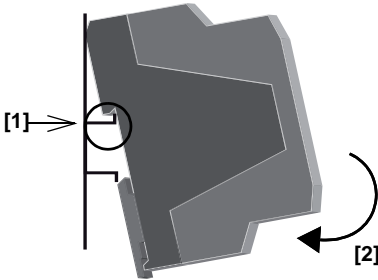
1.
Configuration OK

6. Installation

6.1 Dimensions






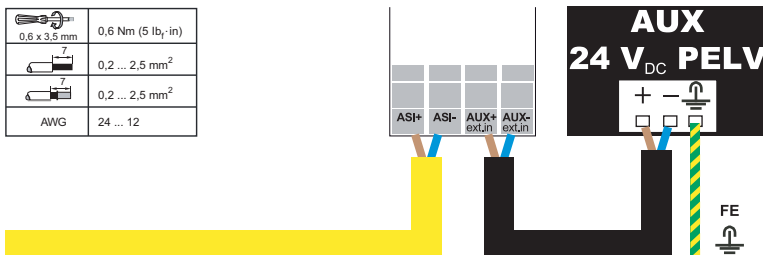
6.2 Installation



On mounting plate with 35 mm top-hat rail
Vertical mounting position!

6.3 Electrical Installation

 0.6 x 3.5 mm	0.6 Nm (5 lb _f -in)
 7	0.2 ... 2.5 mm ²
 7	0.2 ... 2.5 mm ²
AWG	24 ... 12





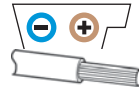
Ambient air temperature

*Temperature rating for
cable*

Use copper conductors only

max. +55 °C (UL)

60/75 °C



Caution

The AS-i power supply for the AS-i components must have isolation per IEC 60742 and be able to handle momentary power interruptions of up to 20 ms. The power supply for the 24 V supply must also have isolation per IEC 60742 and be able to handle momentary power interruptions of up to 20 ms.

7. Maintenance

7.1 Controlling safe shutdowns

The plant safety engineer is responsible for verifying that the "AS-i Safety Input Module" 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 switches:



Attention!

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



Attention!

After reaching the projected maximum operating time (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.

8. Safety Requirements

8.1 Requirements acc. to SIL3 and/or PLe

- To achieve SIL3 and PLe respectively an appropriate switch has to be connected.
- The module transmits the two channels` switching status only. The interpretation regarding synchronous run and chronological synchronism of the two channels happens inside the AS-i Safety Monitor. For this an appropriate monitoring function block must be selected. This function block must be parameterized according to the system to be monitored.

8.2 Requirements for use in a Safety Category 4 environment

Safe E-Stop must be checked at regular intervals (a recommended value is 3 months).

8.3 Recommendation for improved availability of the function

The switching contacts should be turned off for at least 41 ms, since the safety monitor (depending on the set monitoring component) must recognize the INPUT OFF for a minimum number of AS-i telegrams. IF the minimum off time of 41 ms (depending on the number of slaves on the AS-i bus and the set monitoring component) is maintained, correct recognition of the input state is assured. Non-observance of this time may limit the availability of the AS-i Safety Monitor as follows:

- A setting of TWO-CHANNEL POSITIVE OPENING can cause the Safety Monitor to go into the error state.
- A setting of TWO-CHANNEL DEPENDENT means the Safety Monitor allows release only after a sufficient off-time; the release can be achieved if the switching contacts are turned off for at least 41 ms .

9. SIL3 for single-channel sensor connecting

1. Overview

Intelligent, self-monitoring safety sensors can not only output their signal on two channels, but also over a single cable if certain errors are excluded.

This signal can fully meet **SIL3** requirements and should also be processed using this safety integrity level.

Here we will describe how this is accomplished and under what conditions.

2. Error Exclusion

To connect signals to **SIL3** the following errors must be excluded from the customer side:

- The switching signal is reliably generated (switching signal corresponds to **SIL3**), e.g. by means of two positive-opening relays wired in series.
- The signal line is configured such that an error exclusion can be accomplished for the cable with respect to contact with external potentials.

3. Wiring Diagram

As shown in <Wiring diagram> the output is routed to two different inputs. The clock outputs on the safety input module are not used.

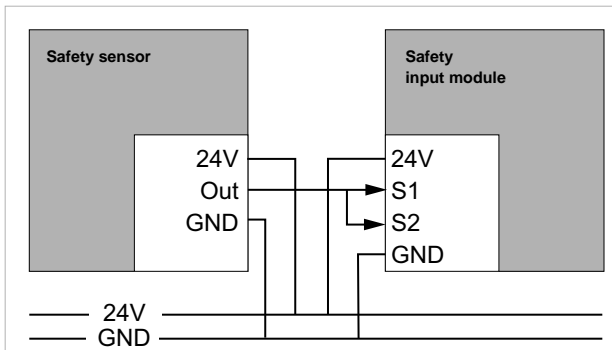


Fig. 9-1. Wiring diagram

4. AS-i Safety Monitor

In the AS-i Safety Monitor a module connected in this way must be monitored using the "2-channel positive-opening" monitoring module.

Now discrepancy times of more than 100 ms will result in an error lock.

5. Summary

When connecting according to <Wiring diagram>, for the Pepperl+Fuchs device VAA-2E2A-KE1-SE.

Noting the following requirements

- The switching signal is reliably generated (switching signal corresponds to SIL3), e.g. by means of two positive-opening relays wired in series.
- The signal line is configured such that an error exclusion can be accomplished for the cable with respect to contact with external potentials.
- "2-channel positive-opening" monitoring module is used.
- Shut-off testing every 12 months

SIL3 also ensured with just a single connection cable.



Information!

*If the switching signal meets only **SIL2**, then when connecting as described in this document an overall level of **SIL2** is achieved.*

FACTORY AUTOMATION – SENSING YOUR NEEDS



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