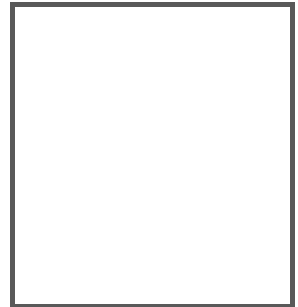


MANUAL

**AS-I SAFETY OUTPUT  
MODULE WITH DIAGNOSTIC  
SLAVE**



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"

<b>1</b>	<b>Introduction.....</b>	<b>4</b>
<b>2</b>	<b>Declaration of conformity .....</b>	<b>5</b>
2.1	Declaration of conformity.....	5
<b>3</b>	<b>Safety .....</b>	<b>6</b>
3.1	Experienced staff .....	6
3.2	Application area of the device .....	6
3.3	Correct use .....	7
3.4	Disposal .....	7
<b>4</b>	<b>General Remarks .....</b>	<b>8</b>
4.1	Product information.....	8
4.2	Function of this manual.....	8
4.3	Target group.....	8
4.4	AS-i spezifikation 3.0.....	8
<b>5</b>	<b>Product Description .....</b>	<b>9</b>
5.1	AS-i Safety at Work.....	9
5.1.1	Special characteristics of the AS-i Safety Output Module.....	9
5.2	Technical data .....	10
5.3	Safety relevant data .....	11
5.4	Electrical connection .....	12
5.5	Operating interface .....	13
5.5.1	LEDs.....	14
<b>6</b>	<b>Maintenance .....</b>	<b>15</b>
6.1	Controlling safe shutdowns.....	15
<b>7</b>	<b>Address Assignment.....</b>	<b>16</b>
7.1	Programming the AS-i address of the safety output.....	16
7.2	Programming the AS-i address of the 4I input slave (AB address) .....	17
7.3	Programming of the AS-i address of the diagnostics slave (AB Address).....	17
<b>8</b>	<b>Safety Requirements .....</b>	<b>18</b>

## 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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## 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 #variable<produkt\_name\_kurz># in combination with other machine safeguarding components on protected machinery.*

#### 3.1 Experienced staff

The 'AS-i Safety 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 VBA-4E2A1A-KE3-ZEL/E2L/SEL module 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 VBA-4E2A1A-KE3-ZEL/E2L/SEL .

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

- safety output  
VBA-4E2A1A-KE3-ZEL/E2L/SEL listens to the communication on the safe address and switches based on these data.
- 4I input slave  
One standard AS-i slave (AB slave) for polling inputs I1, I2, I3 and 1.Y1
- diagnostic slave  
The standard AS-i slave (AB slave) is used for diagnostic purposes and for switching under normal operating conditions.



#### **Attention!**

*For protective operation of the module the switches must be in the ON/RUN position.*

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

The VBA-4E2A1A-KE3-ZEL/E2L/SEL module is certified according to EN 62 061, SIL3, and EN 13 849, performance level "e".

### 3.3 Correct use

The AS-i Safety Output Module with Diagnostic Slave must only be used as defined in chap. Application area of the device. The AS-i Safety 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 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 Output Module with Diagnostic Slave".

##### 4.1 Product information

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

<b>AS-i Safety Output Module with Diagnostic Slave 1 EDM input, 3I and 2O</b>	<b>VBA-4E2A1A-KE3-ZEL/E2L/SEL</b>
---	-----------------------------------

##### 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 AS-i Safety Output 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.

##### 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 Output Modules. The manual is also targeted to people integrating AS-i Safety Output Modules into machinery, performing the initial start-up, or maintaining them.

##### 4.4 AS-i specification 3.0

The "AS-i Safety 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.



## 5. Product Description

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

### 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 Output Module

- Two series connected, self-testing semiconductor switches for safe release
- Two separately drivable standard semiconductor outputs, controlled from the safe release.
- Four standard inputs
- Supply for in- and outputs from 24 V auxiliary voltage.
- Programming jack
- 2 operating mode selector switches

## 5.2 Technical data

Article no.	VBA-4E2A1A-KE3-ZEL/E2L/SEL
Inputs	3 standard, diagnostic + 1 EDM  switching current static 4mA at 24V, dynamic 15mA at 24V (T = 100µs)
Outputs	2 x output switching elements max. contact load: 0,5A DC-13 at 24V
Test pulse	if output is switched on: 1 pulse per second, pulse length 1ms
External device monitoring (EDM)	supplied out of 24V, approx. 10mA
Indicators	
3 x LED yellow (I1, I2, I3)	state of inputs I1, I2 and I3
1 x LEDs yellow (1.Y1)	state of EDM input 1.Y1
LED green (PWR)	AS-i voltage ON
LED red (FAULT)	AS-i Fault
LED yellow (O1)	output 1 closed
LED yellow (O2)	output 2 closed
Operating current	< 200mA
Current supply of sensors	100mA
Operating voltage	AS-i (30V <sub>DC</sub> )
Voltage of insulation	≥ 500V
External supply	24V ±20%
Applied standards	IEC 61508 SIL 3 EN 62061 SIL 3 EN ISO 13849-1 PLe Cat 4
Housing	Din-rail mounting
Ambient operating temperature	0°C ... +55 °C
Storage temperature	-25°C ... +85 °C
Dimensions (L / W / H in mm)	114 / 25 / 105
Protection class (EN 60529)	housing IP20
Weight	150 g
Tolerable loading referring to impacts and vibrations	according to EN 61131-2

### Diagnostic (device colors)

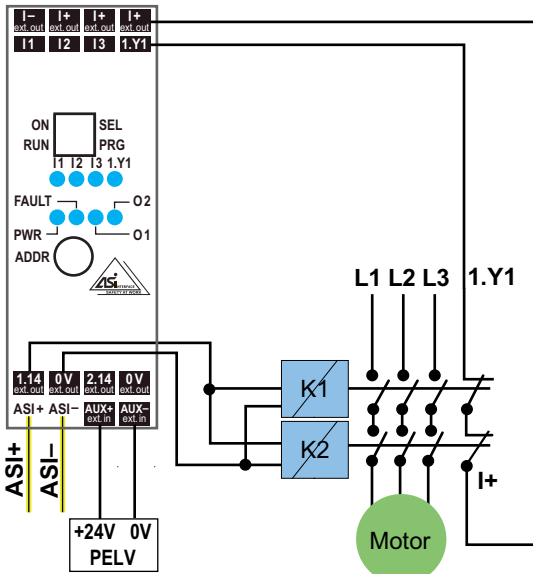
Value	color	description	state change	LED "Out"
0	green	output on		on
1	green flashing	–		–
2	yellow	restart inhibit	auxillary signal 2	1 Hz
3	yellow flashing	–		–
4	red	output off		off
5	red flashing	waiting for "reset of error condition"	auxillary signal 1	8 Hz
6	grey	internal error, such as "fatal error"	only via "Power On" on device	all LEDs flashing
7	green/yellow	output released, but not switched on	switching-on by setting of A1	off

### 5.3 Safety relevant data

Identification data	Value	Standard
Safety category	4	EN 13 849-1:2006/PLe
Performance level (PL)	e	
Safety Integrity Level (SIL)	3	IEC 61508
Usage time (TM) in years	20	EN 13 849-1:2006/PLe
Maximum operating time in months	12	IEC 61508
PFD	$5,94 \cdot 10^{-7}$	IEC 61508 EN 62061
PFH <sub>D</sub> (Probability of a dangerous failure per hour)	$1,91 \cdot 10^{-9}$	IEC 61508 EN 62061
Max. system reaction time in milliseconds	50	IEC 61508

### 5.4 Electrical connection

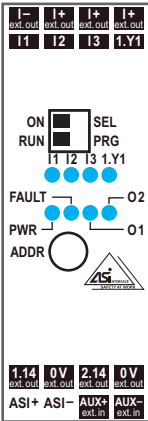
Clamps	description
I1, I2, I3	standard inputs I1, I2 and I3
1.14	semiconductor output 1
1.24	semiconductor output 2
I-, I+	supply voltage for inputs
1.Y1	EDM 1/ input for electronic device monitoring
AS-i+, AS-i-	AS-i network connection
AUX+ <sub>ext.in</sub> , AUX- <sub>ext.in</sub>	voltage supply input



#### Attention!

The AS-I power supply for the AS-I components must have isolation per IEC 60 742 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 60 742 and be able to handle momentary power interruptions of up to 20 ms. The maximum out-put voltage of the power supply must also be less than 42 V in case of a fault.

### 5.5 Operating interface



#### Switches to select the operational mode:

- ON  SEL Normal operation state  
RUN  PRG

---

- ON  SEL addressing: safety slave (single address)  
RUN  PRG

---















- ON  SEL addressing: 4I input slave (AB address)  
RUN  PRG

---

- ON  SEL addressing: diagnostic slave (AB address)  
RUN  PRG

#### Addressing jack (ADDR)

### 5.5.1 LEDs

LEDs	Status	Signal // Description	
PWR	green	 No supply power	
		 1 Hz	Supply power is on, safety-relevant address and/or AS-i AB address is "0" or no 24 V ext. in (auxiliary power)
			Supply power on
FAULT	red	 AS-i communication OK	
			no data exchange with at least one AB slave
			no 24 V ext. in (auxiliary power)
O 1, O 2	yellow	 semiconductor output switched off	
		 1 Hz	Error lock state, waiting for start signal, after transmission of start signal semiconductor output switches on
		 8 Hz	The device is in an un-lockable error state. The devices resumes regular operation after the Monitor sent the signal "error unlock".
			semiconductor output switched on
I1, I2, I3, 1.Y1	yellow	 Corresponding input not switched on	
		 <u>running light</u> Switch is set to ON/PRG	
			Corresponding input switched
FAULT, O1/O2		 <u>alternating</u> Periphery fault	



LED on



LED flashing



LED off

## 6. Maintenance

### 6.1 Controlling safe shutdowns

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



**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.*

## 7. Address Assignment

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

### Safety output

VBA-4E2A1A-KE3-ZEL/E2L/SEL monitors communication on the safety address and switches based on the monitored data.


 This address can only be programmed if the switches are set to ON / PRG.




### Information!

The address must be tested as described in Section <Programming the AS-i address of the safety output>.


### 4I input slave

One standard AS-i slave (AB slave) for polling inputs I1, I2, I3 and 1.Y1



 This address can only be programmed if the switches are set to SEL / PRG.

### Diagnostic slave


One standard-AS-i-Slave (AB-Slave) for diagnostics and switching under normal operating conditions.


 This address can only be programmed if the switches are set to SEL / RUN.

### 7.1 Programming the AS-i address of the safety output


 Basic position

Programming and monitoring of the address of the safety output is done as described here:


 1. Set the switches of the device to ON/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".



**Warning!**

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

## 7.2 Programming the AS-i address of the 4I input slave (AB address)

Programming of the AB Address (4I input slave):

ON  SEL 1. Set the swiches of the device to SEL / PRG.  
RUN  PRG

2. The desired AB address can be programmed by using the hand-held addressing device or AS-i Master.

## 7.3 Programming of the AS-i address of the diagnostics slave (AB Address)

Programming of the AS-i address of the diagnostics slave (AB address):

ON  SEL 1. Set the swiches of the device to SEL / RUN.  
RUN  PRG

2. The desired AB address can be programmed by using the hand-held addressing device or AS-i Master.

## 8. Safety Requirements

- Two semiconductor switches in series are used which issue the safety release.
- These switches are tested in the unit so that any error which prevents one of the two semiconductor switches from turning off is detected.
- The two outputs **1.14 ext.out** and **2.14 ext.out** are fed by the same release signal. They are not safely isolated from each other.
- If there is no release, both outputs are safety turned off.
- If there is a release, both outputs can be controlled by non-safety signals.
- The return line from the consumers must be connected to the **0 V ext.out** terminal on the module and may not be taken directly to the **0 V ext.out** of the power supply.
- There is no cross-connection monitoring between **1.14 ext.out** and **2.14 ext.out**.
- If two independent, series wired contactors need to be controlled by the device, you must ensure that the line between the contactors and the device cannot make a connection to a different potential, so as to prevent undesired turning on of the contactors.
- Input 1.Y1, just like inputs I1... I3, is a standard AS-i input.
- The external 24 V supply must be provided by a PELV power supply.

# FACTORY AUTOMATION – SENSING YOUR NEEDS



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