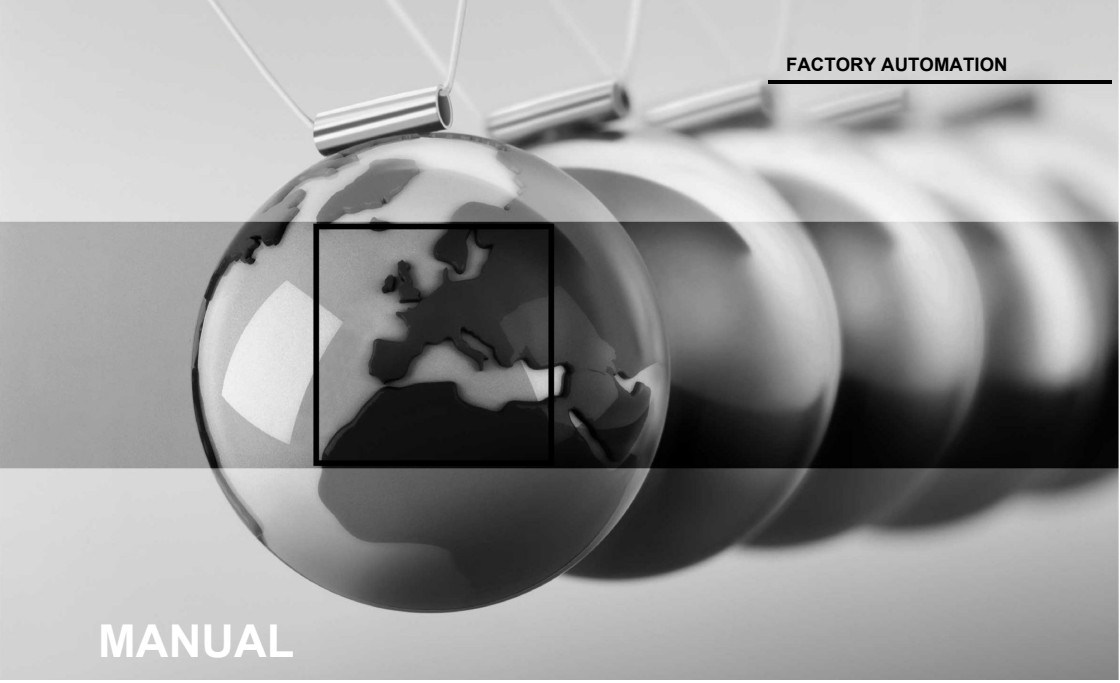


MANUAL

SAFETY BASIC MONITOR

PEPPERL+FUCHS
SENSING YOUR NEEDS

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"

26.6.2015

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 containes 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:

Pepperl+Fuchs GmbH
Lilienthalstraße 200
68307 Mannheim
Telephone: +49 621 776-4411
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.

26.6.2015

3. Safety

This chapter contains user safety information.

Warning!

Please read this chapter carefully before using the Safety Basic Monitor in combination with other machine safeguarding components on protected machinery.

3.1 Experienced staff

The 'Safety Basic Monitor' 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 Checking for safe turn-off

The safety representative is responsible for checking flawless function of the AS-i Safety Monitor within the safety system.

Safe turn-off when an associated safe sensor or switch is triggered must be checked at least once a year.

Attention!

To do this, actuate each safe AS-i slave and observe the switching behavior of the output circuits of the AS-i Safety Monitor.

Attention!

Note the maximum turn-on duration and the overall turn-on operating duration. These values depend on the PFD value selected (see section <Safety-relevant characteristic data>).

When the maximum turn-on duration is reached (three, six or twelve months), check the complete safety system and its proper function.

When the total operating time (20 years) has been reached, the device must be returned to the manufacturer to check for proper function.

3.3 Application area of the device

The device combines a SaW I/O module and a Safety Monitor in one IP20 enclosure.

Special characteristics:

- **Safety Monitor in IP20**
- **up to 8 / 4 local safe inputs**
  optionally the safe inputs will be used as well as standard inputs and signal outputs
- **2 (4) local electronical safe outputs**
- **safe AS-i outputs are supported**
  max. 8 independent AS-i outputs
  multiple safe AS-i outputs possible via a single address
- **chip card for storage of configuration data**

The device is certified according to EN 62 061, SIL 3, and EN 13 849, performance level "e".

3.4 Correct use

The Safety Basic Monitor must only be used as defined in chap. <Application area of the device>. The Safety Basic Monitor 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.

3.5 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.

3.6 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 Safety Monitor.

4.1 Product information

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

4.1.1 Safety Basic Monitor

Safety Basic Monitor successor for Consortium Monitor, compatible replacement	**VAS/M-2A8L-KE4-8SE-C1**
Safety Basic Monitor enhanced	**VAS-2A8L-KE4-8SE**
Safety Basic Monitor Ethernet diagnostics	**VAS/M-2A8L-KE4-6SE-EV**

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 Safety Monitor.

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 Safety Basic Monitors. The manual is also targeted to people integrating Safety Basic Monitors into machinery, performing the initial start-up, or maintaining them.

4.4 AS-i specification 3.0

The AS-i 3.0 devices already fulfil the AS-i specification 3.0.

The previous specifications (2.1 and 2.0) are supported as well.

5. Product Description

This chapter is intended to inform the reader about the special characteristics of the Safety Monitor. 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 Special characteristics of the Safety Basic Monitor

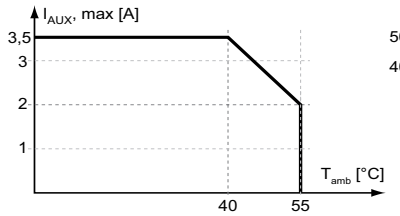
- The module uses only the necessary AS-i addresses.
- Various configuration possibilities for the safe inputs (see chap. <Configuration possibilities for the safe inputs>).
- No limitation of cable length at safe inputs (the maximum loop resistance is 150 Ohm).
- A safe signal exchange of 2 signals between Safety Monitor and AS-i Safety Module as well as between two AS-i Safety Modules are possible.
- LEDs acc. to other Safety Slaves or to the Monitor.
- Simple configuration of the AS-i-Slaves using ASIMON.
- Chipcard for the simple exchange.
- Micro-USB and/or ethernet port for configuring with AS-i-Control-Tools and ASIMON.

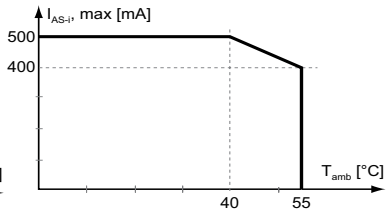
5.2 Technical data

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

5.2.1 Derating

Derating by 24 V auxiliary voltage	Derating by AS-i decoupling out of AUX[1]





1. VAS/M-2A8L-KE4-6SE-EV only !

5.2.2 Standstill-/speed monitor of local inputs

	VAS/M-2A8L-KE4-6SE-EV	VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4')
Number of axis	2 x 2-channel, SIL2, PLd or 4 x 1-channel, SIL1, PLc (speed monitor only)	
Fundamental frequency	max. 4 kHz	max. 400 Hz
Permissible frequency	max. 5 kHz	max. 500 Hz
Accuracy over the total frequency range	± 0,01% x f_{in} + 0,1 Hz	± 5% x f_{in} + 0,1 Hz
Pulse/pause duration	≥ 120µs	

	SIL1	SIL2
Reaction time	1/f + 40 ms	1/f + 60 ms
Error detection time	2,5 s	1/f + 60 ms

5.3 Safety relevant data

Characteristics	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	IEC 61 508, EN 62 061
Service life (TM) [year]	20	EN 13 849-1:2008
Maximal power-on time (month)	12	IEC 61 508
PFD	9,58 x 10^{-7}	EN 62 061
PFH_D [1]	5,08 x 10^{-9}	IEC 61 508, EN 62 061
Max. reaction time [ms]		IEC 61 508
AS-i input slave → local output	40	
local input → local output	20	
local input → AS-i code sequence	26	
AS-i input slave → AS-i code sequence	45	

Tab. 5-1.

1. Probability of a dangerous loss per hour.

To determine the safety characteristics (PFD and PFH), the values of all components using this function are to be considered. The 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.

26.6.2015

Attention!

If the option „augmented reliability“ is selected the response time can extend.

Attention!

Error states of the remote outputs used in the safe configuration can be eliminated by starting and stopping the monitor.

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!

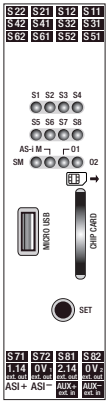
The power supply +24 V_{EXT} may only occur via SELV or PELV networks.

Attention!

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 output voltage of the power supply must also be less than 42 V in case of a fault.

5.5 Front view and connections

5.5.1 VAS-2A8L-KE4-8SE, VAS/M-2A8L-KE4-8SE-C1



Micro USB
Micro USB interface

SET
Service button

Chip Card
Chip card

$1.14_{ext.out}$
Semiconductor output 1

$2.14_{ext.out}$
Semiconductor output 2

$0V_{1ext.out}$, $0V_{2ext.out}$
Ground for semiconductor outputs

ASI+, ASI–
Connection to the AS-i Bus

$AUX+_{ext.in}$, $AUX-_{ext.in}$
Connection for external 24 V_{DC} PELV power supply

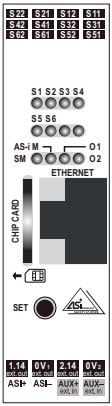
S22, S21, S12, S11
Terminal safety 2-channels input 1

S42, S41, S32, S31
Terminal safety 2-channels input 2

S62, S61, S52, S51
Terminal safety 2-channels input 3

S71, S72, S81, S82
Terminal safety 2-channels input 4

5.5.2 VAS/M-2A8L-KE4-6SE-EV



Ethernet
Diagnostic interface

SET
Service button

Chip Card
Chip card

$1.14_{ext.out}$
Semiconductor output 1

$2.14_{ext.out}$
Semiconductor output 2

$0V_{1ext.out}$, $0V_{2ext.out}$
Ground for semiconductor outputs

ASI+, ASI–
Connection to the AS-i Bus

$AUX+_{ext.in}$, $AUX-_{ext.in}$
Connection for external 24 V_{DC} PELV power supply

S22, S21, S12, S11
Terminal safety 2-channels input 1

S42, S41, S32, S31
Terminal safety 2-channels input 2

S62, S61, S52, S51
Terminal safety 2-channels input 3

5.5.3 Assignments of the inputs

Dual-channel, 'potential-free input'

Terminal		Dual-channel, 'potential-free' (normally closed/normally open)	Local I/O settings in ASIMON
S1,2	S11	Input 1 channel 1 test output	safety input / safety antivalent input
	S12	Input 1 channel 1 (N/C contact)	
	S21	Input 1 channel 2 (N/C / N/O contact)	
	S22	Input 1 channel 2 test output	
S3,4	S31	Input 2 channel 1 test output	safety input / safety antivalent input
	S32	Input 2 channel 1 (N/C contact)	
	S41	Input 2 channel 2 (N/C / N/O contact)	
	S42	Input 2 channel 2 test output	
S5,6	S51	Input 3 channel 1 test output	safety input / safety antivalent input
	S52	Input 3 channel 1 (N/C contact)	
	S61	Input 3 channel 2 (N/C / N/O contact)	
	S62	Input 3 channel 2 test output	
S7,8	S71	Input 4 channel 1 test output	safety input / safety antivalent input
	S72	Input 2 channel 1 (N/C contact)	
	S81	Input 2 channel 2 (N/C / N/O contact)	
	S82	Input 4 channel 2 test output	

Dual-channel, 'electronic input'

Terminal		Dual-channel, 'electronic input'	Local I/O settings in ASIMON
S5,6	S51	24V max. 10mA	safety electronic input
	S52	OSSD input 3 channel 1	
	S61	OSSD input 3 channel 2	
	S62	—	
S7,8	S71	24V Power-Supply-Pin max. 1,4A	safety electronic input
	S72	OSSD input 4 channel 1	
	S81	OSSD input 4 channel 2	
	S82	—	

Dual-channel, 'clocked input'

Only

VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

Terminal		Dual-channel, 'clocked input'	Local I/O settings in ASIMON
S5,6	S51	clocked output 3	Safety electronic input - *Configuration input* (see chap. <Configuration of the safe inputs>)
	S52	clocked input 3	
	S61	clocked input 3	
	S62	—	
S7,8	S71	clocked output 4	Safety electronic input - *Configuration input* (see chap. <Configuration of the safe inputs>)
	S72	clocked input 4	
	S81	clocked input 4	
	S82	—	

Speed monitor 1-channel

Only

VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

Terminal		Speed monitor 1-channel	Local I/O settings in ASIMON
S5,6	S51	Signal output 5	Standard input/signal output
	S52	frequency input 1	
	S61	frequency input 2	
	S62	Signal output 6	
S7,8	S71	Signal output 7	Standard input/signal output
	S72	frequency input 3	
	S81	frequency input 4	
	S82	Signal output 8	

Speed monitor 2-channel

Only

VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

Terminal		Speed monitor 2-channel	Local I/O settings in ASIMON
S5,6	S51	Signal output 5	Standard input/signal output
	S52	Frequenz-Eingang 1 channel 1	
	S61	Frequenz-Eingang 1 channel 2	
	S62	Signal output 6	
S7,8	S71	Signal output 7	Standard input/signal output
	S72	Frequenz-Eingang 2 channel 1	
	S81	Frequenz-Eingang 2 channel 2	
	S82	Signal output 8	

Standstill monitor

Only

VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

Terminal		Standstill monitor	Local I/O settings in ASIMON
S1,2	S11	Signal output 1	Standard input/signal output
	S12	Frequenz-Eingang 1 channel 1	
	S21	Frequenz-Eingang 1 channel 2	
	S22	Signal output 2	
S3,4	S31	Signal output 3	Standard input/signal output
	S32	Frequenz-Eingang 2 channel 1	
	S41	Frequenz-Eingang 2 channel 2	
	S42	Signal output 4	
S5,6	S51	Signal output 5	Standard input/signal output
	S52	Frequenz-Eingang 3 channel 1	
	S61	Frequenz-Eingang 3 channel 2	
	S62	Signal output 6	
S7,8	S71	Signal output 7	Standard input/signal output
	S72	Frequenz-Eingang 4 channel 1	
	S81	Frequenz-Eingang 4 channel 2	
	S82	Signal output 8	

Standard inputs/outputs

Terminal		Standard inputs/outputs	Local I/O settings in ASIMON
S1,2	S11	Signal output 1	Standard input/signal output
	S12	input 1	
	S21	input 2	
	S22	Signal output 2	

S3,4	S31	Signal output 3	Standard input/signal output
	S32	input 3	
	S41	input 4	
	S42	Signal output 4	
S5,6	S51	Signal output 5	Standard input/signal output
	S52	input 5	
	S61	input 6	
	S62	Signal output 6	
S7,8	S71	Signal output 7	Standard input/signal output
	S72	input 7	
	S81	input 8	
	S82	Signal output 8	

5.6 Inputs

The inputs are powered by the 24 V auxiliary power supply. Each input consists of two terminals: a passive input pin and an active test pulse output. A switch connects the two pins together.

Each safe input can also be configured as two standard inputs. The test pulse outputs can also be switched as diagnostics outputs (non safety).

For additional information see chap. <Additional connection examples>.

5.7 Outputs

The outputs must be powered by a PELV power supply.

The maximum output current is 700 mA per output, and the outputs are suitable for DC13 loads.

The plus side of the output load is at **1.14** or **2.14**. The minus side of the output load must be connected to the 0Vext out.

The lines between the module and the load must be routed so that no extraneous voltages caused by damaged insulation can inadvertently switch the load.

5.7.1 Push button

The Teach/Service button (SET) has the following functions:

- Error acknowledgment
- PC-less substitution of Safety Slaves

Keystroke	Description
< 1s	**Error acknowledgement**
> 1s	**Changing to service mode** The Safety Monitor goes into service mode and is ready to learn a code sequence (analogous to learning using the Set key on standard monitors).
< 1s	**Service mode** is exited without changes.
> 1s	**Saving the actual configuration in the Safety Monitor** Teaching the individual code sequence of a newly safety-configured slave when exactly one safety-configured slave is replaced.

For additional information see Tab. <LEDs>.

5.8 LED status display

LED		Description
S1 … Sn		Contact (S1 … Sn) open
		Cross circuit
		Contact (S1 … Sn) closed

Tab. 5-2. LEDs

LED		Description
SM[1]		AS-i supply power not OK
	 (1) 1 Hz	'Protective mode' and ASIMON active
		'Protective mode' active
		'Configuration mode' active
	 (2) 1 Hz	'Configuration mode' and ASIMON active
	 (2,3) 2 Hz	At least 1 device in state 'red flashing' or 'yellow flashing'
	 (3) 1 Hz	Service button, state: 'teach-error'
	 (3)	Service button, state: 'ready'
AS-i M[2]		Off-line, monitor mode
	 (2) 1 Hz	'Peripheral fault' without 'config error'
	 (2)	'Config error', auto addressing *not* possible
	 (1,2) 2 Hz	'Config error', auto addressing possible
	 (1)	Master: 'protective mode', no error
	 (1) 1 Hz	Master: 'configuration mode', no error
O1, O2[3]		Output (O1, O2) off
	 (3) 1 Hz	Restart inhibit
	 (3) 8 Hz	Rectifiable fault condition
		Output (O1, O2) on
		No auxiliary voltage
SM, AS-i M, O1, O2	 1 Hz (2)	Competing master active

Tab. 5-2. LEDs

1. 'Yellow' has higher priority than 'red' and 'green' and will displayed preferentially.
2. If 'config-error' and 'peripheral fault' occur simultaneously, only 'config-error' is displayed.
3. 'Red' has higher priority than 'yellow'

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

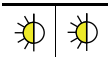
LED on LED flashing off

5.8.1 LED flashing sample

LEDs	State					Process
S1-S4					2 x 1 Hz	Chip card will be written
S5-S6					2 x 1 Hz	Chip card will be written
SM, AS-i M, O1, O2					table 5-2	Chip card will be written
S1-S4					—	Internal error
S5-S6					—	Internal error
SM, AS-i M, O1, O2					8 Hz	Internal error
S1-S4					table 5-2	Competing master active
S5-S6					table 5-2	Competing master active
SM, AS-i M, O1, O2					1 Hz	Competing master active
S1-S4					1 Hz	Data on the chip card + device different
S5-S6					1 Hz	Data on the chip card + device different
SM, AS-i M, O1, O2					table 5-2	Data on the chip card + device different
S1-S4					1 Hz	Chip card defect
S5-S6					1 Hz	Chip card defect
SM, AS-i M, O1, O2					table 5-2	Chip card defect

Tab. 5-3.

Legend

	**Flashing in common mode**
	**Flashing in push-pull mode**
	**off**
	**on**
	**Chaser lights**
	**Standard view acc. to table 5-2**

Tab. 5-4.

5.9 Chip card

The chip card stores the addresses of the slaves. All programming operations are stored both in the module and on the chip card.

- The device can operate both with and without a chip card.
- If a blank chip card is plugged into a programmed module, the configuration of the module is stored on the chip card.
- If a non-blank chip card is plugged into an non-programmed module, the configuration of the chip card is transmitted to the module. The changes do not become effective until the module is restarted.
- If a non-blank chip card is plugged into a different programmed module, the configurations do not agree and an error message is displayed.

5.10 AS-i Power24

- internal decoupling network / AS-i voltage is generated out of 24 V_{ext} directly
- no external AS-i power supply, no external decoupling unit required!
- maximum 0,5 A for AS-i available using internal decoupling network
- switching between internal and external decoupling.

Only
VAS/M-2A8L-KE4-8SE-C1, VAS/M-2A8L-KE4-6SE-EV !

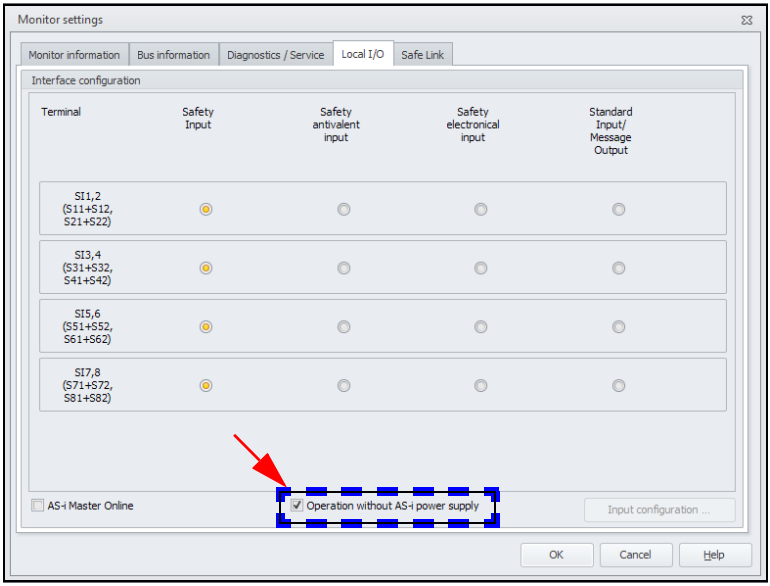
5.10.1 Decoupling function

Bei activating the option "Operation without AS-i power supply" you can use the AS-i Power24V data decoupling network instead of an external AS-i power supply.

Information!
The internal decoupling unit can supply a maximum current of 500 mA.

Simply open the ‘Monitor settings’ window in ASIMON, select the tab ’Local I/O’ and activate the check box "Operation without AS-i power supply".

ASIMON Software



Information!

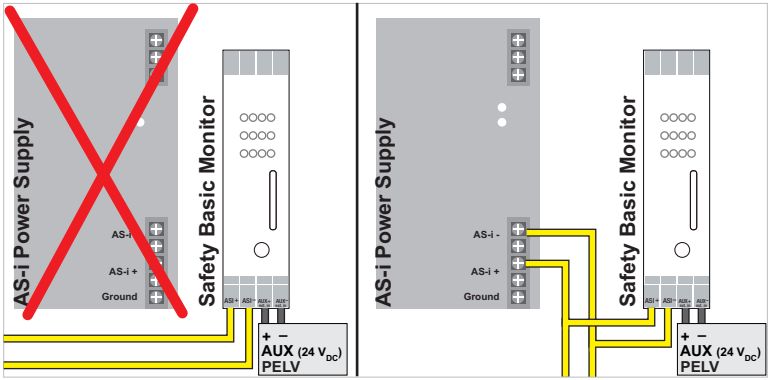
Please note additional information in the manual for the ASIMON software.

Only

VAS/M-2A8L-KE4-8SE-C1, VAS/M-2A8L-KE4-6SE-EV !

5.11 AS-i supply options

VAS/M-2A8L-KE4-8SE-C1, VAS/M-2A8L-KE4-6SE-EV	VAS-2A8L-KE4-8SE, VAS/M-2A8L-KE4-8SE-C1, VAS/M-2A8L-KE4-6SE-EV
internal decoupling	external decoupling



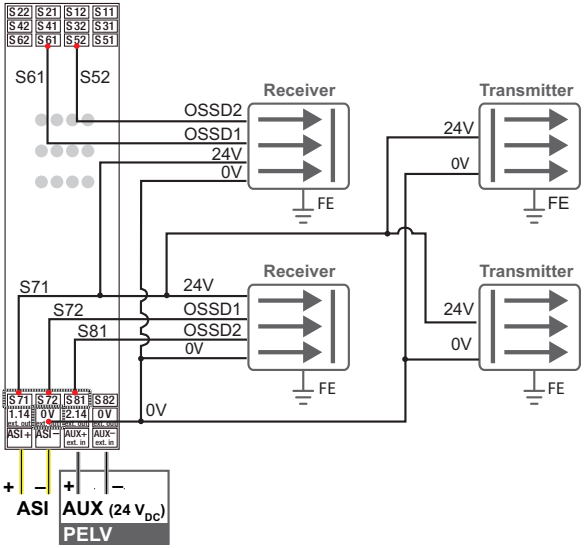
Tab. 5-5.

Caution

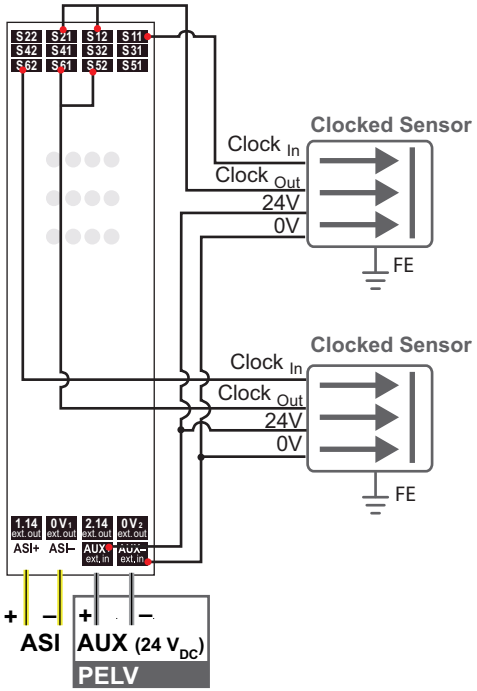
The AS-i power supply for the AS-i components must have isolation per IEC 60742 and be able to handle momentary power interruptions of up to 20 ms. The power supply for the 24 V supply must also have isolation per IEC 60742 and be able to handle momentary power interruptions of up to 20 ms. The maximum output voltage of the power supply must also be less than 42 V in case of a fault.

5.12 Connection examples

5.12.1 Connecting of an OSSD (S71,S72,S81), supplying of several OSSDs out of the same connection (S71)



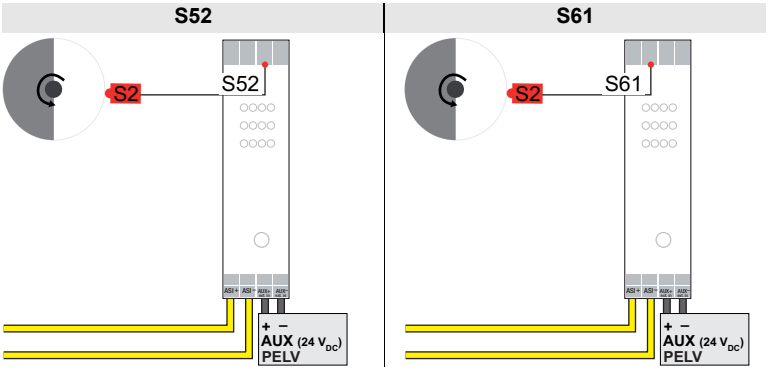
5.12.2 Connecting of a clocked sensor



Only

VAS/M-2A8L-KE4-6SE-EV, VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

5.12.3 Speed monitoring (1-channel) on local inputs S52/S61



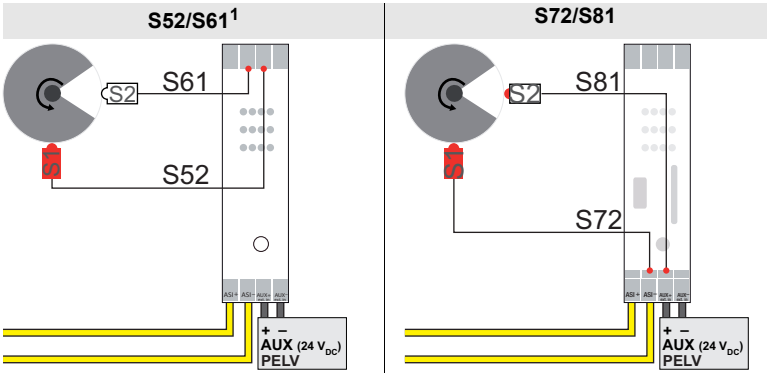
Tab. 5-6.

When operating in 1-channel mode the SIL 1 is achieved

Only

VAS/M-2A8L-KE4-6SE-EV, VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

5.12.4 Speed Monitor (2-channel) on local inputs



Tab. 5-7.

1. Only VAS/M-2A8L-KE4-6SE-EV

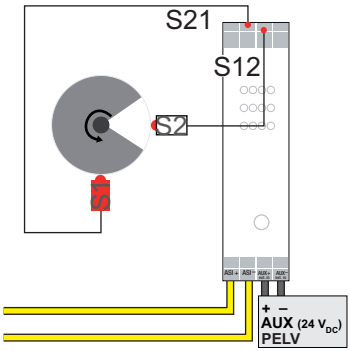
Warning!

When operating in 2-channel mode the SIL 2 is achieved

Only

VAS/M-2A8L-KE4-6SE-EV, VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

5.12.5 Standstillmonitor (2-channel) on local inputs



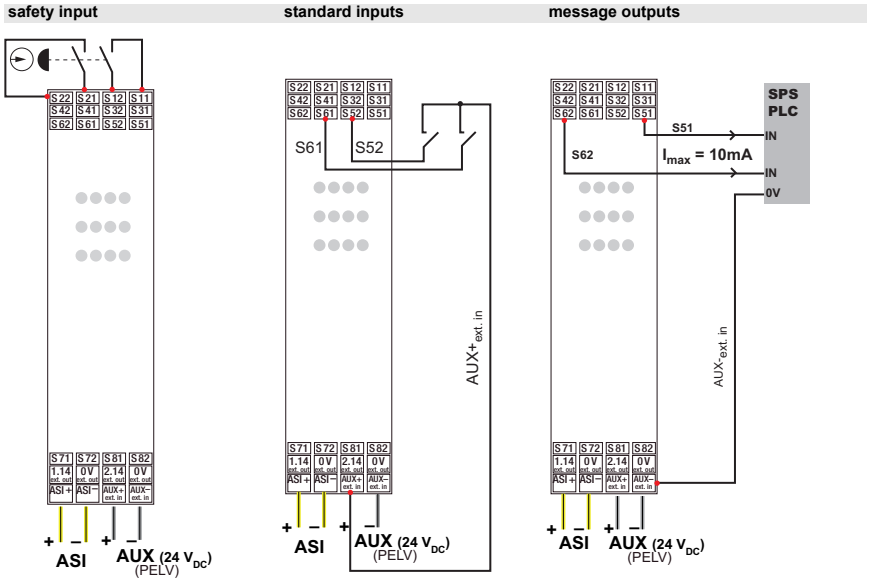
Warning!

When operating in 2-channel mode the SIL 2 is achieved

Only

VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4') !

5.12.6 Additional connection examples



Tab. 5-8. Additional connection examples

6. Maintenance

6.1 Controlling safe shutdowns

The plant safety engineer is responsible for verifying that the Safety Basic Monitor 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.

7. AS-i Diagnostics

7.1 Introduction

The device provides two different diagnostics modes:

- Consortium monitor, for replacement (see chap. 6.2)
- Compatibility mode with additional diagnostics data (see chap. 6.3)
- AS-i 3.0 (**S-7.5.5**), recommended (see chap. 6.4)

The respective diagnostics mode is selected using the ASIMON software.

- ☐ Simply open the 'Monitor/-Bus Information' window in ASIMON
- ☐ Select the 'Diagnostics/Service' tab
- ☐ There select the required diagnostics mode.

7.1.1 Data of the different diagnostics modes

	AS-i 3.0 (S-7.5.5), recommended (see chap. 7.4)	Consortium monitor, for replacement (see chap. 7.2)	Compatibility mode with additional diagnostics data (see chap. 7.3)
base address	**S-7.5** communication (see chap. 7.4.1 … 7.4.4)	consortium diagnostics (chap. 7.3.2 … 7.3.6 software manual)	consortium diagnostics (chap. 7.3.2 … 7.3.6 software manual)
simulate slave 1 base address+1	state OSSD1+OSSD2	state OSSD1+OSSD2	state OSSD1+OSSD2
simulate slave 2 base address+2	**S-7.F** slave, input data = 0	**S-7.F** slave, input data = 0	**S-7.3.0.C** slave (see chap. 7.3)
simulate slave 3 base address+3	**S-7.F** slave, input data = 0	**S-7.F** slave, input data = 0	**S-7.3.1.C** slave (see chap. 7.3)

Tab. 7-9.

7.2 Diagnostics mode "Consortium monitor, for replacement"

Information!

Diagnostics type: compatibility mode for Safety Basic Monitors starting with the Safety-Version 'SV4.3'.

Consortium diagnostics, with S-7-3 diagnostics added.

Address	Meaning
basic address	Consortium diagnostics, limited to 48 devices
simulated slave 1	status OSSD 1 and OSSD 2
simulated slave 2	S-7.F slave, input data = 0
simulated slave 3	

Tab. 7-10.

Simulated slave 1: status OSSD 1 and OSSD 2 (binary data)

Data bit	content
D0	status relay output 1
D1	status message output 1
D2	status relay output 2
D3	status message output 2

Tab. 7-11.

7.3 Diagnostics mode "Compatibility mode with additional diagnostics data"

Information!

Diagnostics type: compatibility mode for Safety Basic Monitors starting with the Safety-Version 'SV4.3'.

Address	Meaning
basic address	Consortium diagnostics, limited to 48 devices
simulated slave 1	status OSSD 1 and OSSD 2
simulated slave 2	S-7.3 OSSD diagnostics, 4 channel transparent input, Profil S-7.3.0.C
simulated slave 3	S-7.3 SaW slave diagnostics, 4 channel transparent input, profile 7.3.1.C

Tab. 7-12.

Simulated slave 1: status OSSD 1 and OSSD 2 (binary data)

Data bit	content
D0	status relay output 1
D1	status message output 1
D2	status relay output 2
D3	status message output 2

Tab. 7-13.

Simulated slave 2 (7.3.0.C): OSSD diagnostics

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH1	Safety status OSSD 2								Safety status OSSD 1							
CH2	Safety status OSSD 4								Safety status OSSD 3							
CH3	Safety status OSSD 6								Safety status OSSD 5							
CH4	S8	S7	S6	S5	S4	S3	S2	S1	Safety status OSSD 7							

Tab. 7-14.

When switch **S1** … **S8** is closed a '1' is entered in the corresponding position.

The Safety Status is defined as follows:

Bit	7	6	5	4	3	2	1	0
	1: not less than one device red flashing	1: not less than one device yellow flash-ing	n/a	n/a	OSSD color (siehe Tab. Status codes for the release circuits (OSSD))			

Tab. 7-15.

Simulated slave 3 (S-7.3.1.C): SaW slave diagnostics

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH1	Slv 7		Slv 6		Slv 5		Slv 4		Slv 3		Slv 2		Slv 1			
CH2	Slv 15		Slv 14		Slv 13		Slv 12		Slv 11		Slv 10		Slv 9		Slv 8	
CH3	Slv 23		Slv 22		Slv 21		Slv 20		Slv 19		Slv 18		Slv 17		Slv 16	
CH4	Slv 31		Slv 30		Slv 29		Slv 28		Slv 27		Slv 26		Slv 25		Slv 24	

Tab. 7-16.

For each safe slave (ID=B) the status of the code sequence is entered as seen by the Master. Code sequence errors are not detected here. For non-safe slaves ‘00’ is entered.

Bit-combination	meaning
00	Not a safe slave or save slave with zero sequence, both switches open
01	Safe slave, switch for upper bits open
10	Safe slave, switch for lower bits open
11	Safe slave, both switches closed

Tab. 7-17.

7.3.1 Status codes for the release circuits (OSSD)

Code bit [3..0]	Status / color	Description
0	green permanent lighting	Output on
1	green flashing	delay time is running at stop category 1
2	continuous yellow	start-up/restart-disable active
3	yellow flashing	External test required / acknowledgement / Turn-on delay active
4	red permanent lighting	Output off
5	red flashing	Error
6	grey or off	output not projected
7 ... F	reserved	

Tab. 7-18.

Information!
Monitors which support less than 8 release circuits do not set all release circuits present to “grey".

7.4 Diagnostics mode "AS-i 3.0 (S-7.5.5), recommended"

7.4.1 Binary data

	D3	D2	D1	D0
input data	Serial communication	Serial communication	1: Output 2 either turned off or flashing green	1: Output 1 either turned off or flashing green
output data	–	–	Serial communication	Serial communication

Tab. 7-19.

7.4.2 Transparent input data

Using profile 7.5.5 it is possible to poll the status of the release circuits (OSSD Safety Control Status) of the Safety Monitor cyclically (see table below). To do this you must assign an AS-i address (basic address) to the Safety Monitor and assign an 8-byte analog input slave to the basic address of the Safety Monitor. These 8 bytes contain the diagnostics data (transparent input data) as shown in the following table:

channel	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
CH0	AU	MO			S8	S7	S6	S5	S4	S3	S2	S1	UA1	UA		
CH1	Safety status OSSD 4				Safety status OSSD 3				Safety status OSSD 2				Safety status OSSD 1			
CH2	Safety status OSSD 8				Safety status OSSD 7				Safety status OSSD 6				Safety status OSSD 5			
CH3	OSSD 8		OSSD 7		OSSD 6		OSSD 5		OSSD 4		OSSD 3		OSSD 2		OSSD 1	
	RF	YF	RF	YF	RF	YF	RF	YF	RF	YF	RF	YF	RF	YF	RF	YF

Tab. 7-20.

Then the information is listed individually:

MO	Operating mode	1: Safety Monitor in protected operating mode 0: Safety Monitor in configuration operation
UA	UAS-i	AS-i voltage greater than 18 V 1: voltage is sufficient 0: voltage is *not* sufficient
AU	AUX 24V	The 24 V for supplying the safe outputs is present 1: 24 V for supplying the safe outputs is present 0: 24 V for supplying the safe outputs is *not* present
UA1	Warning	AS-i voltage OK, but less than 22.5 V 1: AS-i voltage greater than 22.5 V 0: AS-i voltage less than 22,5 V
S1-S8	Switch	S1-S8: for a closed switch **S1 … S8** '1' is entered at the corresponding position.

Channel ‘0’ of the transparent input data describes the status of the AS-i segment and the local inputs S1-S8.

Channels 1 and 2 describe the states of the respective release circuits (OSSD’s) of the Safety Monitor. For status codes and colors see section Status codes for the release circuits (OSSD).

Channel 3 contains information as to whether there are warnings or faults in a release circuit for one or more devices assigned to this release circuit. The meanings are as follows:

YF	Yellow flashing	At least one of the devices associated with this release circuit is in the yellow flashing state
RF	Red flashing	At least one of the devices associated with this release circuit is in the red flashing state

Tab. 7-21.

7.4.2.1 Status codes for the release circuits (OSSD)

Code bit [3..0]	status / color	Description
0	green permanent lighting	output on
1	green flashing	delay time is running at stop category 1
2	yellow permanent lighting	start-up/restart-disable active
3	yellow flashing	external test necessary / acknowledgement / start delay active
4	red permanent lighting	output off
5	red flashing	error
6	grey or off	output not projected
7 ... F	reserved	

Tab. 7-22.

7.4.3 Transparent output data

The transparent output data are available there to the safe unit as non-safe additional bits, for example for Start buttons. They are linked with the input bits of the input configured as non-safe terminals.

Ch	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
0	reserved								S81	S61	S41	S21	S72	S52	S32	S12

Tab. 7-23.

7.4.4 Acyclical data

7.4.4.1 Vendor Specific Object 7 - device colors OSSD 1

Read only

This object contains the colors and additional information for all release circuits for all devices assigned to Release Circuit 1.

Information!
If not all 128 devices are assigned, the Monitor can shorten the S-7.5.5 telegram in order to save transmission time.

Coding for the states and colors

Byte	Meaning
1	bit 0 0=configuration mode, 1=protecting mode bit 3 … 1 reserved, 0 bit 4 status S12 bit 5 status S21 bit 6 status S32 bit 7 status S41
2	relay status, output 1+2 bit 3 … 0 status output 1 bit 7 … 4 status output 2
3 … 8	...
9	relay status output 15+16 bit 3 … 0 status output 15 bit 7 … 4 status output 16
10	bit field for devices which are present. Device 7 … 0
11 ... 40	...
41	bit field for devices which are present. Device 248 … 255
42	color device 1+2 bit 3 … 0 color device 1 bit 7 … 4 color device 2

Tab. 7-24.

Coding for the states and colors

Byte	Meaning
43 ... 168	...
105	device 127+128 bit 3 … 0 color device 127 bit 7 … 4 color device 128

Tab. 7-24.

Bit field coding for devices which are present:

The numbers indicate the position of the bit for the corresponding device.

0: Device is not present

1: Device is present

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-25.

Coding of states and colors

Code Bit [2 … 0]	State or color
0	green permanent lighting
1	green flashing
2	yellow permanent lighting
3	yellow flashing
4	red permanent lighting
5	red flashing
6	grey or off
7	non existent
Bit 3	0: Device is *not* present in this OSSD 1: Device is present in this OSSD

Tab. 7-26.

7.4.4.2 Vendor Specific Object 8 - device colors OSSD with device index assignment

Read only.

This object contains, for all devices assigned to Release Circuit 1, the colors and additional information for all release circuits with the module index assignment from the configuration.

Coding of the states and colors

Byte	Meaning
1	bit 0 0=configuration operation, 1=protective operation bit 3 … 1 reserved, 0 bit 4 status S12 bit 5 status S21 bit 6 status S32 bit 7 status S41
2	relay status output 1+2 bit 3 … 0 status output 1 bit 7 … 4 status output 2
3 … 8	...
9	relay status output 15+16 bit 3 … 0 status output 15 bit 7 … 4 status output 16
10	bit field for devices which are present. Device 7 … 0
11 ... 40	...
41	bit field for devices which are present. Device 248 … 255
42	color device 1+2 bit 3 … 0 color device 1 bit 7 … 4 color device 2
43 ... 168	...
105	device 127+128 bit 3 … 0 color device 127 bit 7 … 4 color device 128

Tab. 7-27.

Bit field coding for devices which are present:

The numbers indicate the position of the bit for the corresponding device.

0: Device is *not* present

1: Device is present

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-28.

Coding of states and colors

Code Bit [2 … 0]	State or color
0	green permanent lighting
1	green flashing
2	yellow permanent lighting
3	yellow flashing
4	red permanent lighting
5	red flashing
6	grey or off
7	non existent
Bit 3	0: Device is *not* present in this OSSD 1: Device is present in this OSSD

Tab. 7-29.

7.4.4.3 Vendor Specific Object 9 - device colors at switch off OSSD 1

Read only.

This object contains colors and additional information about all release circuits at the time of the most recent switch-off of release circuit 1. Additionally, information identifying all devices assigned to release circuit 1 is transferred.

Coding for the states and colors

Byte	Meaning
1	bit 0 0=Configuration mode, 1=protecting mode bit 3 … 1 reserved, 0 bit 4 status S12 bit 5 status S21 bit 6 status S32 bit 7 status S41
2	relay status output 1+2 bit 3 … 0 status output 1 bit 7 … 4 status output 2
3 ... 8	...
9	relay status output 15+16 bit 3..0 status output 15 bit 7..4 status output 16
10	bit field for devices which are present. Device 7 ... 0
11 ... 40	...
41	bit field for devices which are present. Device 248 ... 255
42	bit field for devices which changed in the last step. Device 7 ... 0
43 ... 72	...
73	bit field for devices which changed in the last step. Device 248..255
74	color device 1+2 bit 3 … 0 color device 1 bit 7 … 4 color device 2
75 ... 200	...
137	device 127+128 bit 3..0 color device 127 bit 7..4 color device 128

Tab. 7-30.

Bit-field for devices that changed during the last step.

These numbers indicate the position of the bits that correspond to a certain device.

0: device not changed during the last step

1: device changed during the last step

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-31.

Bit field coding for devices which are present:

The numbers indicate the position of the bit for the corresponding device.

0: Device is not present

1: Device is present

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-32.

Coding of states and colors

Code Bit [2 … 0]	status bzw. color
0	green permanent lighting
1	green flashing
2	yellow permanent lighting
3	yellow flashing
4	red permanent lighting
5	red flashing
6	grey or off
7	non existent
Bit 3	0: Device is *not* present in this OSSD 1: Device is present in this OSSD

Tab. 7-33.

7.4.4.4 Vendor Specific Object 10 - device colors at switch off OSSD 1 with device index-assignment

Read only.

This object contains colors and additional information about all release circuits at the time of the most recent switch-off of release circuit 1, sorted by the diagnostics index. Additionally, information identifying all devices assigned to release circuit 1 is transferred.

Coding of states and colors

Byte	Meaning
1	bit 0 0=configuration mode, 1=protective operation bit 3 … 1 reserved, 0 bit 4 status S12 bit 5 status S21 bit 6 status S32 bit 7 status S41
2	relay status output 1+2 bit 3 … 0 status output 1 bit 7 … 4 status output 2
3 ... 8	...
9	relay status output 15+16 bit 3..0 status output 15 bit 7..4 status output 16
10	bit field for devices which are present. Device 7 ... 0
11 ... 40	...
41	bit field for devices which are present. Device 248 ... 255
42	bit field for devices which changed in the last step. Device 7 ... 0
43 ... 72	...
73	bit field for devices which changed in the last step. Device 248 … 255
74	color device 1+2 bit 3 … 0 color device 1 bit 7 … 4 color device 2
75 ... 200	...
137	device 127+128 bit 3..0 color device 127 bit 7..4 color device 128

Tab. 7-34.

Bit field coding for devices which changed in the last step:

The numbers indicate the position of the bit for the corresponding device.

0: Device did not change in the last step

1: Device changed in the last step

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-35.

Bit field coding for devices which are present:

The numbers indicate the position of the bit for the corresponding device.

0: Device is not present

1: Device is present

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	7	6	5	4	3	2	1	0
2	15	14	13	12	11	10	9	8
…	…							
32	255	254	253	252	251	250	249	248

Tab. 7-36.

Coding of states and colors

Code Bit [2 … 0]	State or color
0	green permanent lighting
1	green flashing
2	yellow permanent lighting
3	yellow flashing
4	red permanent lighting
5	red flashing
6	grey or off
7	non existent
Bit 3	0: Device is *not* present in this OSSD 1: Device is present in this OSSD

Tab. 7-37.

7.4.4.5 Vendor specific object 11 … 70

Objects 11 … 70correspond to Objects 7 … 10, but do not refer to the following release circuits. The table shows the relationship:

OSSD	device colors	device colors with device index	device colors at switch off	device colors at switch off mit device index
Vorverarb.	object 3	object 4	-	-
1	object 7	object 8	object 9	object 10
2	object 11	object 12	object 13	object 14
3	object 15	object 16	object 17	object 18
4	object 19	object 20	object 21	object 22
5	object 23	object 24	object 25	object 26
6	object 27	object 28	object 29	object 30
7	object 31	object 32	object 33	object 34
8	object 35	object 36	object 37	object 38
9	object 39	object 40	object 41	object 42
10	object 43	object 44	object 45	object 46
11	object 47	object 48	object 49	object 50
12	object 51	object 52	object 53	object 54
13	object 55	object 56	object 57	object 58
14	object 59	object 60	object 61	object 62
15	object 63	object 64	object 65	object 66
16	object 67	object 68	object 69	object 70

Tab. 7-38.

7.4.4.6 Vendor- specific object 110

Vendor specific object 110 describes the SaW slave diagnostics.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH1	Slv 7		Slv 6		Slv 5		Slv 4		Slv 3		Slv 2		Slv 1			
CH2	Slv 15		Slv 14		Slv 13		Slv 12		Slv 11		Slv 10		Slv 9		Slv 8	
CH3	Slv 23		Slv 22		Slv 21		Slv 20		Slv 19		Slv 18		Slv 17		Slv 16	
CH4	Slv 31		Slv 30		Slv 29		Slv 28		Slv 27		Slv 26		Slv 25		Slv 24	

Tab. 7-39.

For each safe slave (ID=B) the status of the code sequence is entered as seen by the Master. Code sequence errors are not detected here. For non-safe slaves ‘00’ is entered.

Bit-combination	meaning
00	Not a safe slave or save slave with zero sequence, both switches open
01	Safe slave, switch for upper bits open
10	Safe slave, switch for lower bits open
11	Safe slave, both switches closed

Tab. 7-40.

Information!

Please note additional information in the manual for the ASIMON software.

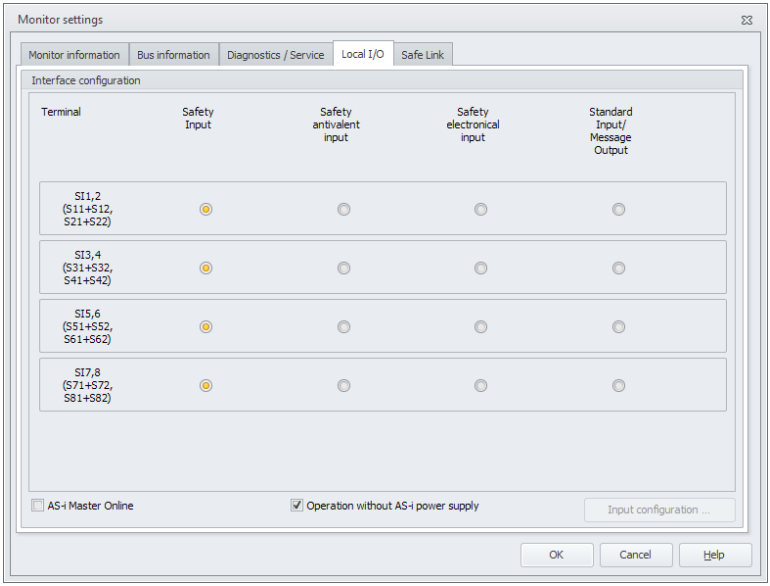
8. Configuration of the safe inputs

The unit is configured and diagnosed using the ASIMON software.

Communication takes place over the USB interface.

8.1 Configuration possibilities for the safe inputs

Configuration is done in ASIMON, in the **Information about monitor and bus** window, using the **Local I/O** tab:



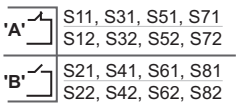
For each connection, the following options are available:

- **Safe input** for potential-free contacts (normally closed / normally closed), used in monitoring devices.
- **Safety antivalent input** for potential-free contacts (normally closed / normally open), used in monitoring devices (beginning with Safety Version 'SV4.3').

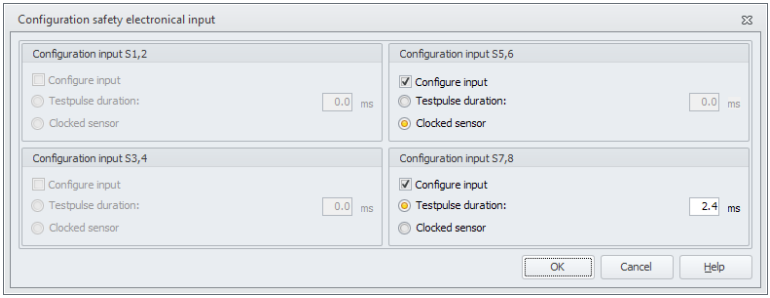
Information!

To meet the safety requirements, it is recommended that an antivalent switch be used only in combination with the "forced" or "dependent" input devices in order to monitor switching between the two contacts over time.

	'A' open	**'A' closed**
'B' open	Transition state	On
'B' closed	Off	Transition state



- **Safe electronic input** connected to an OSSD output with test pulses, used in monitoring devices.
- If this option (VAS/M-2A8L-KE4-8SE-C1 (> 'SV4.4')) is selected, the **Input Configuration** button can be used to make settings for the safe electronic inputs. An additional window opens in which – for the respective input – cyclic sensors or the maximum test pulse width (0.2 ... 51.0 ms) can be defined for the OSSDs.

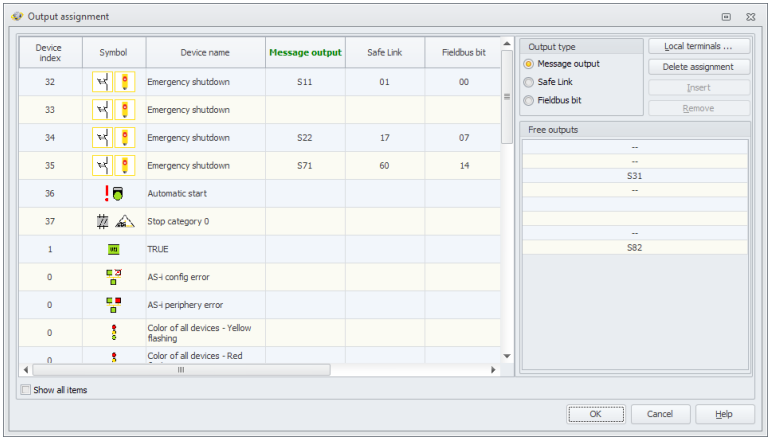


- **Standard input** and/or **message output** (can be used in monitor inputs and message output assignment, see chapter 6.4 "Output assignment").
- **AS-i Master Online**: With this option the internal AS-i master of the Safety Basic Monitor can be activated.
  In this case it's not allowed to connect an external AS-i Master to the AS-i line!
- **Operation without AS-i power supply**: Activate this option, if the AS-i Power24V data decoupling network shall be used in the Safety Basic Monitor instead of an external AS-i power supply.
  The internal decoupling network can supply a maximum current of 500mA.

Information!

The ASIMON Control logic prevents invalid combinations.

8.2 Output assignment



Outputs are assigned using multiple columns in the **Device Index Assignment** field:

- **Message outputs** indicate the state of selected devices. The allocation is carried out in the column **Message output** by drawing the clamp (eg S31) into the row of the terminal it needs to be linked with.
- **Fieldbus bits** can be assigned to any device, similar to message outputs. The bit is transmitted to the analog word of the fieldbus bit slave which can be activated in the monitor and in the bus information.
- **Diagnostics output** switches an AS-i output bit. The configuration is carried out within the output device of the OSSD and it is displayed in this window.

8.3 Safe configuration using ASIMON

ASIMON Software
Change the preset password "SIMON" during the first use of the device (Monitor/change password)!

ASIMON Software

Create the desired configuration.

ASIMON Software

Download the configuration with MONITOR / PC -> MONITOR into the device. Enter the password for this purpose.

ASIMON Software

Acknowledge the request TEACH CODE SEQUENCES? selecting "Yes".

ASIMON Software

Check the configuration log (respect instructions in <chap. 5.8> of the ASIMON manual!).

ASIMON Software

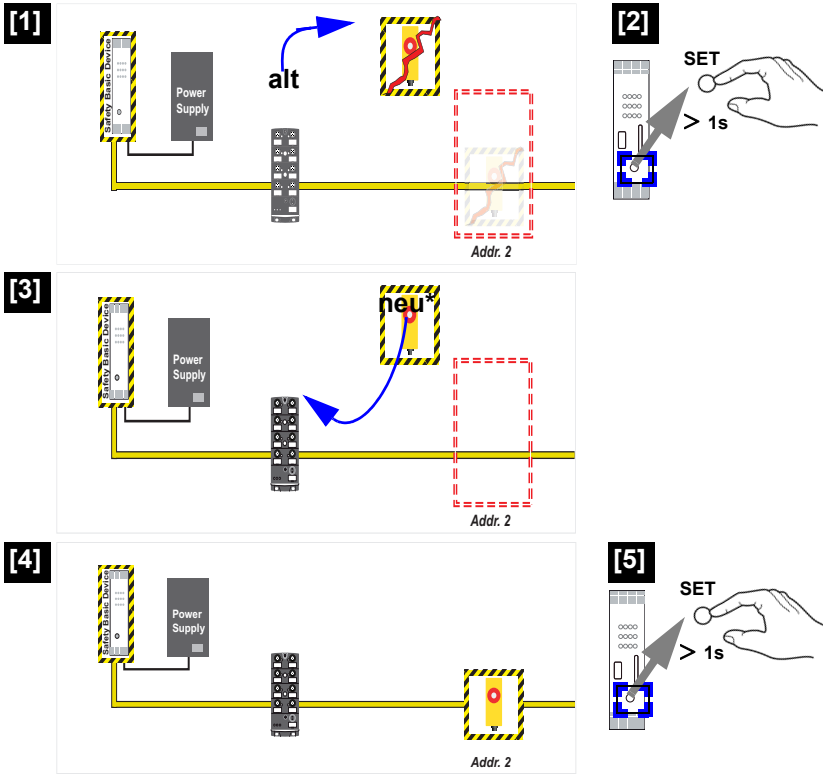
Validate the configuration with MONITOR –> VALIDATION.

ASIMON Software

Start the monitor with MONITOR –> START.

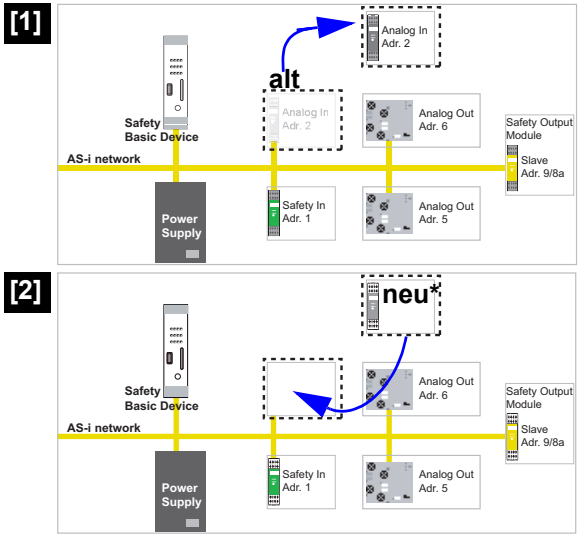
The correct safety function of the device must be verified once installed within the protected machinery!

8.4 Replacing a defective AS-i Safety Slave



* 'new' (address '0' or '2')

8.5 Replacing a defective AS-i standard slave



* 'new' (address '0' or '2')

9. Safety Requirements

9.1 Safety consideration for selecting OSSD/potential-free contacts

Potential-free contacts are cross-circuit monitored by the module. OSSD outputs test themselves and only require that the module tolerate the test pulses.

If the module is incorrectly configured so that OSSDs are connected but potential-free contacts are configured, a cross-circuit is detected, since the test pulses which the module sends out on S82 and S62 do not correlate with the test pulses on S81 and S61. The error is thus detected.

If the module is incorrect configured so that potential-free contacts are connected by OSSDs are configured, Contact S81 / S82 is never seen as turned on, since S82 is not turned on as a supply pin for the OSSD module. The error is thus detected. The same applies by analogy to Contact S61 / S62.

9.2 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; to eliminate the error state, the supply voltage for the Safety Monitor must be disconnected.
- 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 .

FACTORY AUTOMATION – SENSING YOUR NEEDS

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