Safety Basic Monitor

User Manual

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

Revision date: 2013-01-23

Subject to modifications without notice.

Generally, this manual refers to products without mentioning existing patents, utility models, or trademarks.

The absence of any such references does not indicate that a product is patent-free.

Table of Contents

Safety Basic Monitor

Issue date: 23.1.2013

Issue date: 23.1.2013

Issue date: 23.1.2013

EC Declarion of Conformity

EC Declaration of conformity

Translation of the original declaration of conformity

K.A. Schmersal GmbH & Co. KG
Möddinghofe 30, 42279 Wuppertal
Germany
Internet: www.schmersal.com

We hereby certify that the hereafter described safety components both in its basic design and construction conform to the applicable European Directives.

Name of the safety component:	**Master monitor combination**
Type:	ASMM-1M-IO-SS
Description of the safety component:	AS-i Master with integrated safety monitor
Relevant EC-Directives:	2006/42/EC EC-Machinery Directive 2004/108/EC EMC-Directive
Person authorized for the compilation of the technical documentation:	Oliver Wacker Möddinghofe 30 42279 Wuppertal
Notified body for the prototype test:	TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen, Germany ID n°: 0044
EC-prototype test certificate:	44 205 12 410213 006
Place and date of issue:	Wuppertal, September 03, 2012

Authorised signature
Philip Schmersal
(Managing Director)

ASMM-1M-IO-SS-EN-A

Issue date: 23.1.2013

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)
I/O	Input/output
EMC	Electromagnetic compliance
PELV	Protective extra-low voltage
PFD	Probability of failure on demand
SaW	Safety at Work, safety technic
OSSD	Output Signal Switching Device, release circuit

Issue date: 23.1.2013

2. General Remarks

Please read this chapter carefully before working with the documentation and the Safety Monitor.

2.1 Product information

This user manual is valid for the following Schmersal devices:

2.1.1 Safety Basic Monitor

Safety Basic Monitor	ASMM-1M-IO-SS
enhanced	

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 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.

Information!

Additional information concerning the technical data as well as the parameterization of the Safety Monitor can be found in data sheet ASMM-1M-IO-SS that can be located at http://www.schmersal.net.

2.3 Target group

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

2.4 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.

Issue date: 23.1.2013

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 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".

3.3 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 Schmersal are invalid.

Issue date: 23.1.2013

3.4 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 up to category 4 according to EN 954-1 and additionally performance level "e" according to EN 13 849 as well as SIL 3 according to EN 62 061 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.

3.5 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.

Issue date: 23.1.2013

4. 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.

4.1 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 port for configuring with AS-i-Control-Tools and ASIMON.

Issue date: 23.1.2013

4.2 Technical data

Article no.	ASMM-1M-IO-SS
Connection	
Connection	COMBICON clamp
Safety Monitor	
Respond delay	< 40ms
AS-i Master	
AS-i Master	integrated
Interface	
Interface	USB, chip card slot
AS-i	
AS-i voltage	18 ... 31,6V
Max. AS-i current consumption	200 mA
AUX	
AUX voltage	20 ... 30V (PELV)
Max. AUX current consumption	4A max.
Input	
Supply voltage inputs	of AUX (24V auxiliary power)
Network connection between the safe input terminals	max. resistance 150Ω
Output	
8 / 4 safe inputs cat. 4 or 8 standard in -and outputs	switching current statical 4mA at 24V, dynamic 30mA at 24V (T=100µs)
2 (4) output switching elements	semiconductor outputs (output circuits 1 and 2) max. contact load: 700mA DC-13 at 24V
Supply voltage outputs	of AUX (24V auxiliary power)
Max. output current signal outputs	10mA each output
Max. output current for OSSD supply	1,4A (S71)
Test pulse	when output is switched on minimal distance between 2 test pulses: 250ms, pulse length to 1ms
Display	
4x LEDs S1, S2, S3, S4 (yellow)	state of input S1, S2, S3 and S4
4x LEDs S5, S6, S7, S8 (yellow)	state of input S5, S6, S7 and S8
LED SM (green/yellow/red)	state of Safety Monitor
LED AS-i M (green/yellow/red)	state of AS-i Master
LED O1 (green/yellow/red)	output 1 has switched
LED O2 (green/yellow/red)	output 2 has switched

Issue date: 23.1.2013

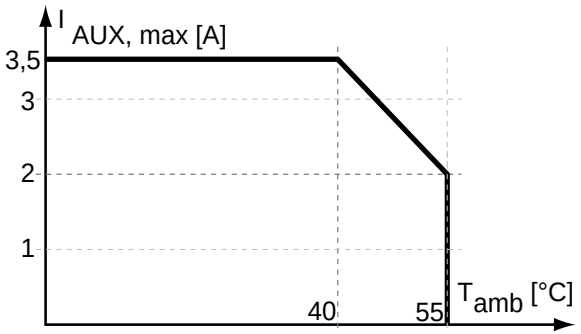
Article no.	ASMM-1M-IO-SS
1 button	service
Environment	
Applied standards	EN 954-1 Kat 4 EN 61 508:2001 EN 62 061:2005 EN ISO 13 849-1:2008
Housing	DIN-rail mounting
Operating temperature	0°C … +55°C
Storage temperature	-25°C … +85°C
Protection class DIN 60 529	IP20
Voltage of insulation AS-i/AUX	500V
Dimensions (W / H / D in mm)	22,5 / 99 / 114

Article no.	ASMM-1M-IO-SS
AS-i Safety Monitor	
Safety Monitor	Safety Basic Monitor, enhanced
Optimized to AS-i Monitor operations	no
Release circuits	8, additional 8 release circuits (9 - 16) for actuating standard AS-i outputs
Antivalent switches for local inputs	yes
Standstill monitors of local inputs	yes
Electrical data	
Power supply decoupling unit	integrated

ASMM-1M-IO-SS

Clamps	Description
S22, S21, S12, S11	safety input terminal input 1
S42, S41, S32, S31	safety input terminal input 2
S62, S61, S52, S51	safety input terminal input 3
S71, S72, S81, S82	safety input terminal input 4
$1.14_{ext.out}$	semiconductor output 1
$2.14_{ext.out}$	semiconductor output 2
$0\ V_{ext.out}$	mass connection for semiconductor output
AS-i+, AS-i-	connection to the AS-i Bus
	Micro USB
$AUX+_{ext.in}$, $AUX-_{ext.in}$	power supply input

4.2.1 Derating by 24 V auxiliary power



Issue date: 23.1.2013

4.3 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	$9{,}58 \times 10^{-7}$	EN 62 061
PFH_D [1]	$5{,}08 \times 10^{-9}$	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. 4-1.

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.

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.

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

Information!

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

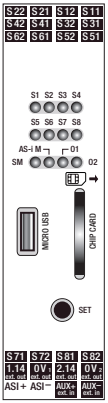
The power supply +24 V_{EXT} may only occur via SELV or PELV networks.

Issue date: 23.1.2013

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.

4.5 Front view and connections



Micro USB
Micro USB interface

SET
service button

Chip Card
chip card

$1.14_{ext.out}$
Safe semiconductor output 1

$2.14_{ext.out}$
Safe semiconductor output 2

$0V_{ext.out}$
ground connection for semiconductor output

ASI+, ASI–
AS-i connection

AUX+, AUX–
connection to ext. 24 V_{DC}

4.5.1 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 (normally closed)	
	S21	Input 1 channel 2 (normally closed/normally open)	
	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 (normally closed)	
	S41	Input 2 channel 2 (normally closed/normally open)	
	S42	Input 2 channel 2 test output	

Issue date: 23.1.2013

S5,6	S51	Input 3 channel 1 test output	safety input / safety antivalent input
	S52	Input 3 channel 1 (normally closed)	
	S61	Input 3 channel 2 (normally closed/normally open)	
	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 (normally closed)	
	S81	Input 2 channel 2 (normally closed/normally open)	
	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'

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

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

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	

Issue date: 23.1.2013

Standstill monitor

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	

4.6 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>.

4.7 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.

Issue date: 23.1.2013

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.

4.7.1 Push button

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

- Error acknowledgement
- 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>.

4.8 LEDs

LEDs	Status	Signal // Description
S1, S2, S3, S4, S5, S6, S7, S8 (yellow)		contact (S1 … S8) open
	1 Hz	cross circuit //
		contact (S1 … S8) closed
SM[1]		AS-i supply power not OK
(green)	1 Hz	'protective mode' and ASIMON active
(red)		'configuration mode' active
	1 Hz	'configuration mode' and ASIMON active //
	1 Hz	at least 1 device in state 'red flashing' or 'yellow flashing'
(yellow)	1 Hz	service button, state: 'teach-error'
		service button, state: 'ready'
AS-i M[2]		off-line, monitor mode

Tab. 4-2. LEDs

Issue date: 23.1.2013

LEDs	Status	Signal // Description
(red)	1 Hz	'peripheral fault' without 'config error'
		'config error', auto addressing *not* possible
(green)	1 Hz	'config error', auto addressing possible
		master: 'protective mode', no error //
	1 Hz	master: 'configuration mode', no error //
O1, O2[3] (yellow)		output (O1, O2) off
	1 Hz	restart inhibit
	8 Hz	rectifiable fault condition
(red)		output (O1, O2) on
		no auxiliary voltage
SM, AS-i M, O1, O2	1 Hz	competing master active

Tab. 4-2. LEDs

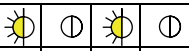
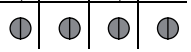
1. 'yellow' has higher priority than 'red' and 'green' and will displayed preferentially.
2. If 'config-error' and 'peripheral fault' occur simultaneously, only 'config-error' is displayed.
3. 'red' has higher priority than 'yellow'

4.8.1 LED flashing sample

operation	LEDs	frequency	Status
chip card will be written (yellow)	**S1-S4**	**2 x 1 Hz**	
	S5-S8		
	SM, AS-i M, O1, O2	**table 4-2**	
internal error (red)	**S1-S4**	—	
	S5-S8	—	
	SM, AS-i M, O1, O2	**8 Hz**	
data on the chip card + device different (yellow)	**S1-S4**	**1 Hz**	
	S5-S8		
	SM, AS-i M, O1, O2	**table 4-2**	

Tab. 4-3.

Issue date: 23.1.2013

operation	LEDs	frequency	Status
chip card defect (yellow)	**S1-S4**	**1 Hz**	
	S5-S8		
	SM, AS-i M, O1, O2	**table 4-2**	

Tab. 4-3.

legend

	flashing in common mode
	flashing in push-pull mode
	off
	on
	standard view acc. to table 4-2

Tab. 4-4.

4.9 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.

4.10 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.

Issue date: 23.1.2013

4.11 Decoupling function

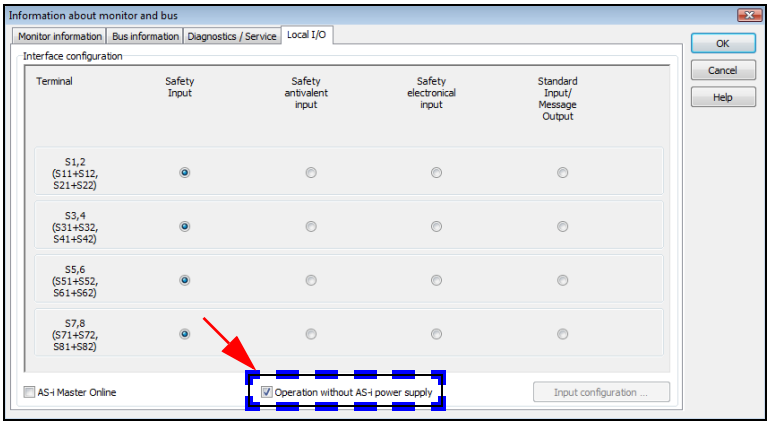
Bei activating the option "Operation without AS-i power supply" you can use the AS-i Power24V data decoupling network instead of an external AS-i power supply.

Information!

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

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

ASIMON 3 G2 Software

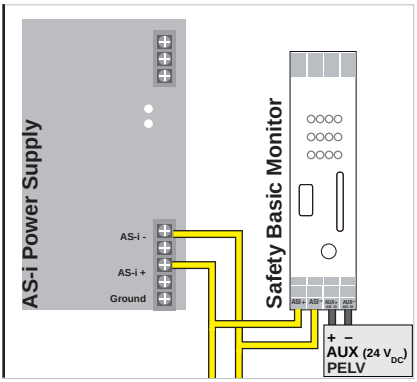


Information!

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

Issue date: 23.1.2013

4.12 AS-i supply



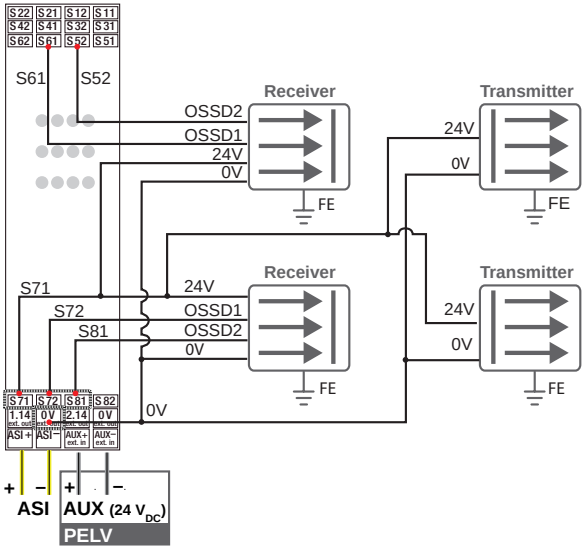
Tab. 4-5.

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

Issue date: 23.1.2013

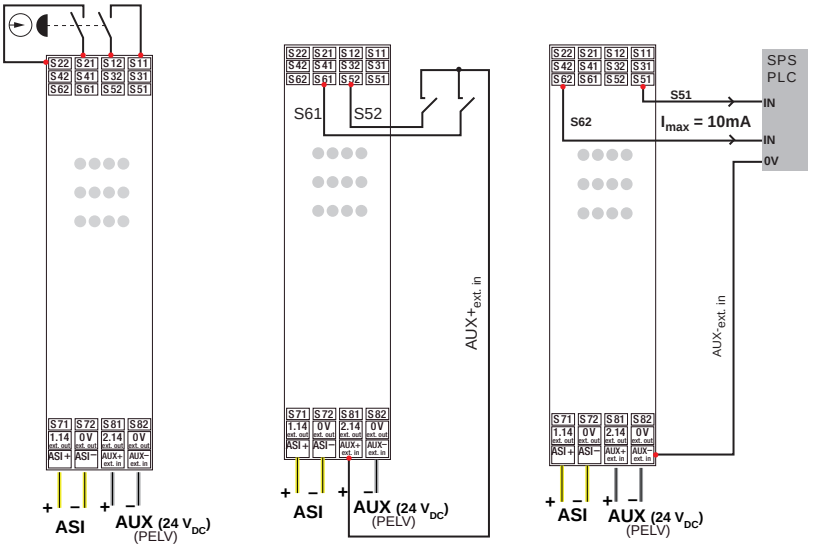
4.13 Connecting of an OSSD (S71,S72,S81), supplying of several OSSDs out of the same connection (S71)



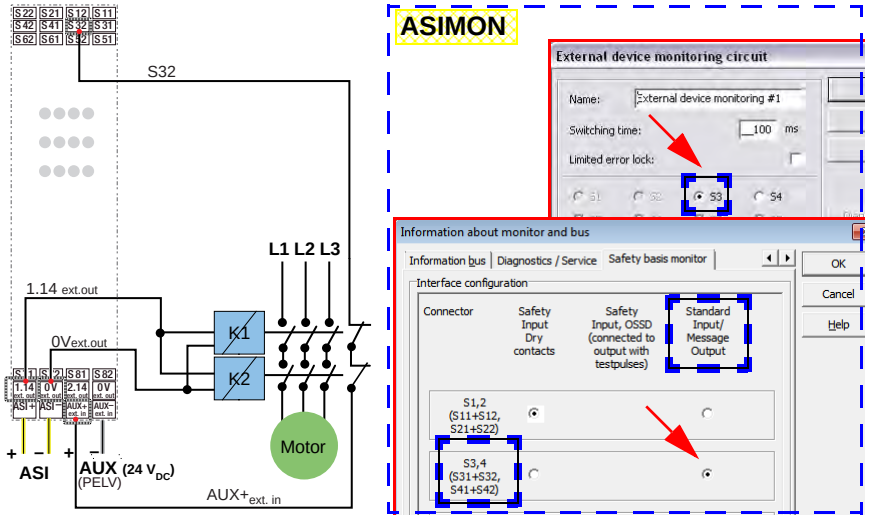
Issue date: 23.1.2013

4.13.1 Additional connection examples

safety input | **standard inputs** | **message outputs**



contactor



Tab. 4-6. Additional connection examples

Issue date: 23.1.2013

5. Maintenance

5.1 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.

Issue date: 23.1.2013

6. AS-i Diagnostics

6.1 Introduction

The device provides two different diagnostics modes:

- Consortial 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.

6.1.1 Data of the different diagnostics modes

	AS-i 3.0 (S-7.5.5), recommended (see chap. 6.4)	Consortial monitor, for replacement (see chap. 6.2)	Compatibility mode with additional diagnostics data (see chap. 6.3)
base address	**S-7.5** communication (see chap. 6.4.1 … 6.4.4)	consortial diagnostics (chap. 7.3.2 … 7.3.6 software manual)	consortial 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. 6.3)
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. 6.3)

Tab. 6-7.

Issue date: 23.1.2013

6.2 Diagnostics mode "Consortial monitor, for replacement"

Information!

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

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

Address	Meaning
basic address	Consortial 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. 6-8.

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. 6-9.

Issue date: 23.1.2013

6.3 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	Consortial 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. 6-10.

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. 6-11.

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. 6-12.

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 flashing	n/a	n/a	OSSD color (siehe Tab. Status codes for the release circuits (OSSD))			

Tab. 6-13.

Issue date: 23.1.2013

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. 6-14.

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. 6-15.

6.3.1 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. 6-16.

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

Issue date: 23.1.2013

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

6.4.1 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. 6-17.

6.4.2 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. 6-18.

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.

Issue date: 23.1.2013

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. 6-19.

6.4.2.1 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. 6-20.

Issue date: 23.1.2013

6.4.3 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								S8	S7	S6	S5	S4	S3	S2	S1

Tab. 6-21.

6.4.4 Acyclical data

6.4.4.1 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. 6-22.

Issue date: 23.1.2013

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. 6-22.

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. 6-23.

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. 6-24.

Issue date: 23.1.2013

6.4.4.2 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. 6-25.

Issue date: 23.1.2013

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. 6-26.

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. 6-27.

Issue date: 23.1.2013

6.4.4.3 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. 6-28.

Issue date: 23.1.2013

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. 6-29.

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. 6-30.

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. 6-31.

Issue date: 23.1.2013

6.4.4.4 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. 6-32.

Issue date: 23.1.2013

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. 6-33.

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. 6-34.

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. 6-35.

Issue date: 23.1.2013

6.4.4.5 Vendor specific object 11 … 38

Objects 11 … 38 correspond 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. 6-36.

Issue date: 23.1.2013

6.4.4.6 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. 6-37.

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. 6-38.

Information!

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

Issue date: 23.1.2013

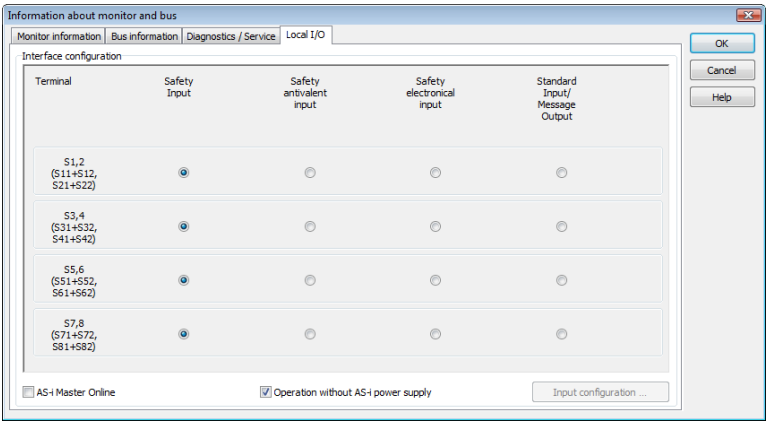
7. Configuration of the safe inputs

The unit is configured and diagnosed using the ASIMON software.

Communication takes place over the USB interface.

7.1 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!

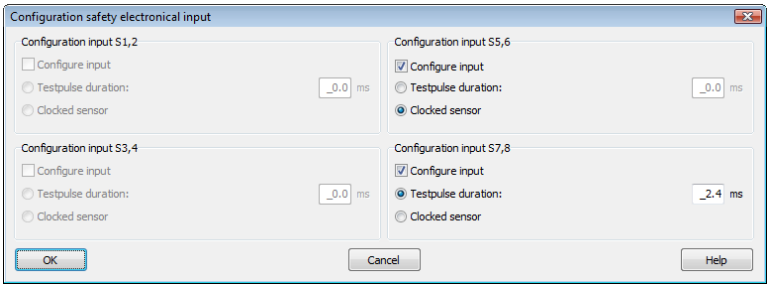
To meet the safety requirements, it is recommended that an antivalent switch be used only in combination with the "forced" or "dependent" input devices in order to monitor switching between the two contacts over time.

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

'A'	S11, S31, S51, S71 S12, S32, S52, S72
'B'	S21, S41, S61, S81 S22, S42, S62, S82

- **Safe electronic input** connected to an OSSD output with test pulses, used in monitoring devices.
- If this option 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.

Issue date: 23.1.2013



- **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.

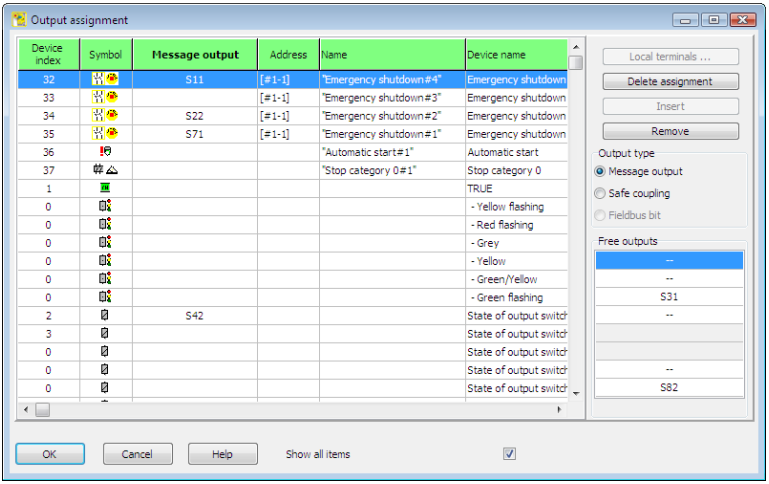
Information!

The ASIMON Control logic prevents invalid combinations.

Issue date: 23.1.2013

7.2 Assigning the diagnostics outputs

Diagnostics outputs represent the status of the selected safety devices. Outputs are assigned using the ‘Message Output’ column in the ‘Module Index Assignment’ field.



There the selected diagnostics outputs can be assigned to the module indices. Each diagnostics output can be assigned to just one safety device.

Issue date: 23.1.2013

7.3 Safe configuration using ASIMON 3 G2

ASIMON 3 G2 Software

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

ASIMON 3 G2 Software

Create the desired configuration.

ASIMON 3 G2 Software

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

ASIMON 3 G2 Software

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

ASIMON 3 G2 Software

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

ASIMON 3 G2 Software

Validate the configuration with MONITOR –> VALIDATION.

ASIMON 3 G2 Software

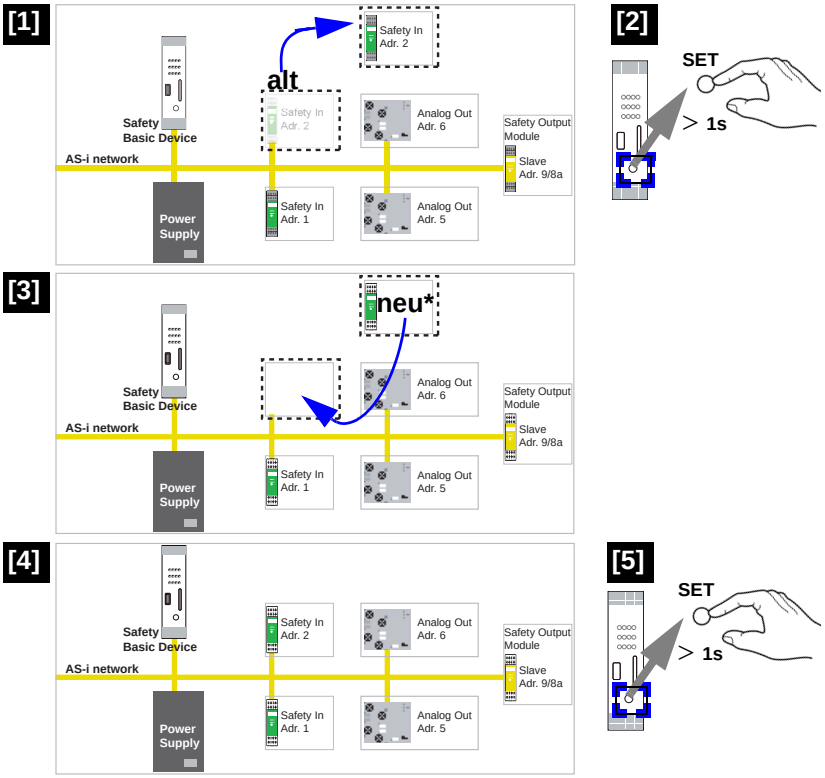
Start the monitor with MONITOR–> START.

STOP

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

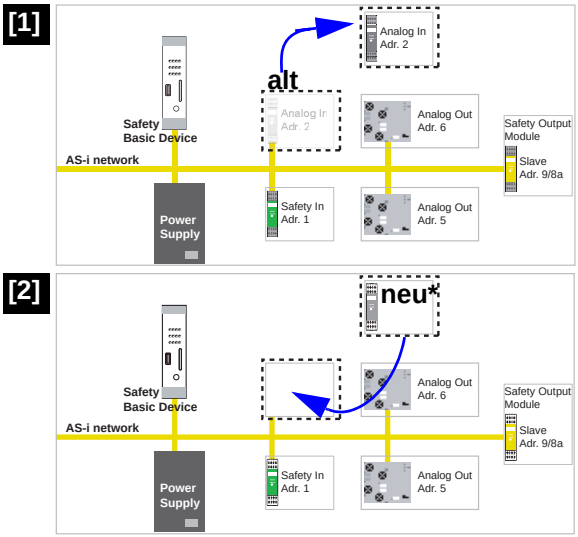
Issue date: 23.1.2013

7.3.1 Replacing a defective AS-i Safety Slave



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

7.3.2 Replacing a defective AS-i standard slave



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

Issue date: 23.1.2013

8. Safety Requirements

8.1 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.

8.2 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 .

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