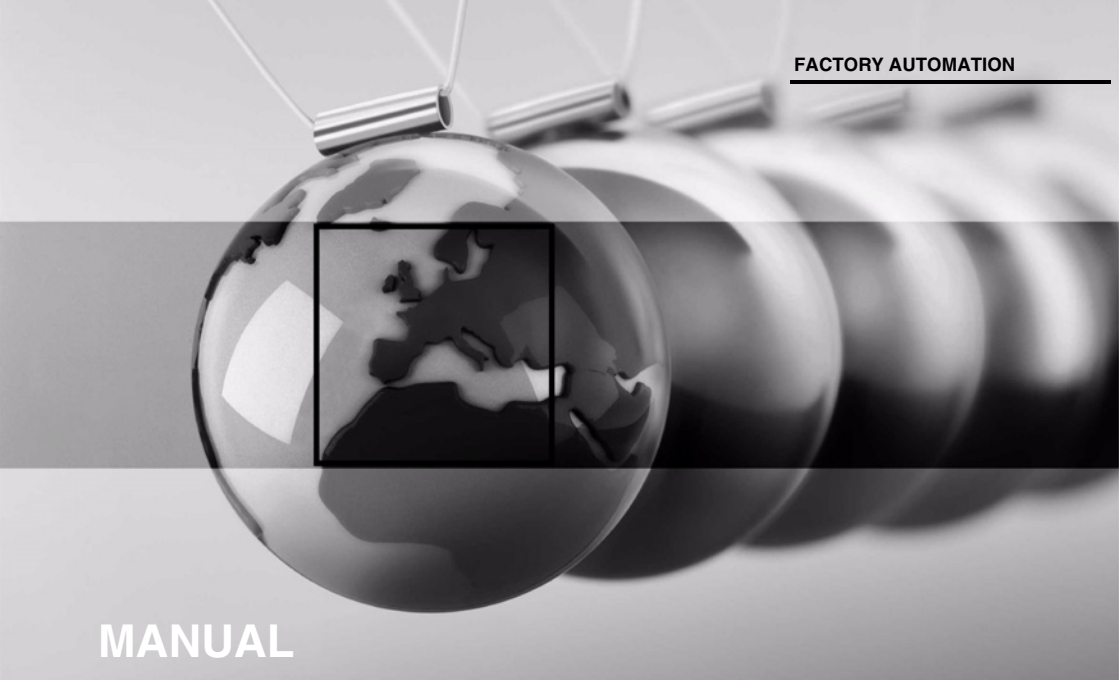

MANUAL

VBG-EN-K30-DMD-S16

EtherNet/IP Gateway with integrated Safety Monitor

Spec. 3.0

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"

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Conformity Statement

The AS-i 3.0 EtherNet/IP Gateways with integrated Safety Monitor have been developed and produced in accordance with the applicable european standards and directives. The conformity statement according to the EC EMC-, low voltage, and -maschinery directive can be sent to by request.

Additional information can be found in the Pepperl+Fuchs GmbH basic catalogue or in the online catalogue in internet.

Subject to technical modifications.

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1. Symbol catalog

Information!

This symbol indicates important information.

Attention!

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

Warning!

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

1.1 Abbreviations

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

Information!

Additional information can be found in section <Glossary>.

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2. General

2.1 Product information

This system manual applies to the following Pepperl+Fuchs GmbH equipment:

AS-i 3.0 EtherNet/IP Gateway, 2 Master with duplicate address' recognition and AS-i inspector, integrated Safety Monitor (16 release circuits)	**VBG-EN-K30-DMD-S16**

Tab. 2-1.

The AS-i/Gateway with integrated Safety Monitor combines two devices in one housing: an AS-i 3.0 EtherNet/IP Gateway and a Safety Monitor for 2 AS-i circuits.

The safety unit provides 4 inputs which can be defined as either EDM or as START inputs.

Functions of the device								
I	**2 master**	**Relais circuits**	**AS-i**	**Master, power supply**	**Diagnostic interface**	**Semiconductor outputs**	**SaW outputs**	**Safety relays**
	VBG-EN-K30-DMD-S16	16	2	2	RS 232	2	16	2

Tab. 2-2.

The EtherNet/IP Gateway serves to connect AS-i systems to the superordinate EtherNet/IP controller.

All possibilities offered by AS-i can be used via EtherNet/IP.

Commissioning, debugging and setting up of the AS-i parameters can be accomplished with the use of push-buttons, the display and the LEDs, but it can also be handled via Ethernet TCP/IP or via the diagnostic interface.

Caption	
2 master:	The device is a double master
Relais circuits:	number of release circuits
	16: safety unit generates 16 independent switching signals
AS-i:	number of AS-i circuits
	2: safety unit functions with two equal AS-i circuits
Master, power supply:	2: The unit contains two AS-i Masters.
Diagnostic interface:	type of the diagnostic port
Semiconductor outputs:	number of semiconductor outputs

Tab. 2-3.

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Caption	
SaW outputs:	number of SaW outputs
Safety relays:	number of safety relays

Tab. 2-3.

2.2 Brief description

The actuator-sensor interface (AS-i) has established itself as a system for networking primarily binary sensors and actuators at the lowest level of the automation hierarchy. The high number of installed systems, the ease of use and the reliable operating behaviour also make the AS-i interesting in the area of machine safety.

The **safety** AS-i system is intended for safety applications up to Category 4/ SIL 3. Mixed operation of standard components and safe components is possible.

The AS-i/Gateways with integrated Safety Monitor monitors within an AS-i system the safe slaves which have been assigned according to the configuration specified by the user with the configuration software. In the event of a stop request or a defect, the AS-i/Gateways with integrated Safety Monitor switches off the system in protective operation mode with a maximum reaction time of 40 ms.

AS-i/Gateway with integrated Safety Monitor

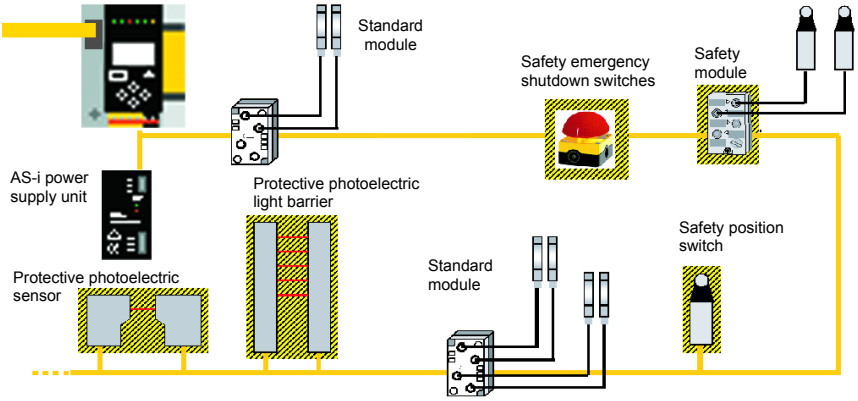

Fig. 2-1. Safe and standard components in an AS-i network

Multiple AS-i Safety Monitors can be used within an AS-i system. In this way, a safe slave can be monitored by multiple AS-i Safety Monitors.

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3. Safety

3.1 Safety standard

The AS-I Safety Monitor has been developed, manufactured, tested and submitted for type testing in accordance with the safety standards prevailing at the time of testing. The safety requirements per Category 4 in accordance with EN 954-1, SIL3 in accordance with EN 61 508 and Performance Level “e” in accordance with EN ISO 13 849-1 are met by all devices.

Information!

A detailed listing of the values for probability of failure (PFD values) can be found in section <Safety-relevant characteristic data>.

Following a risk analysis you can sue the AS-I Safety Monitor in accordance with its safety category as a shut-down protection device for protecting hazardous areas.

3.2 Intended use

3.2.1 Conditions of use

The AS-I Safety Monitor has been developed as a **shut-down protection device** for protecting hazardous areas on powered equipment.

Attention!

Protection of operating personnel and equipment is not provided is the device is not used in accordance with its intended use.

Attention!

Manipulation of and changes to the devices other than expressly described in this Manual are not permitted.

3.2.2 Residual risks (EN 292-1)

The circuits suggested in this Manual have been tested and verified with the greatest care. The prevailing standards and regulations are met when using the components and wiring shown. Residual risks remain if:

- There are any deviations from the suggested wiring concept which may result in the connected safety-relevant assemblies or protective devices not being incorporated or only insufficiently incorporated into the safety circuit.
- The operator does not follow the prevailing safety regulations for operation, setting and maintenance of the machine. Machine inspection and maintenance intervals must be strictly observed.

3.3 Areas of application

The AS-I Safety Monitor, when properly used, enables the operation of sensor-controlled personal protection equipment and additional safety components.

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The device also assumes the mandatory E-STOP function (Stop Category 0 or 1) for all non-manually operated machines, dynamic monitoring of the restart function and the protection monitoring function.

Examples for use of the AS-I Safety Monitor:

The device is used economically in machines and equipment in which the standard AS-I bus is the local bus. Using the Safety Monitor as a bus component allows already existing AS-I bus configurations to be easily expanded, and safety components having the corresponding AS-i Safety at Work interface can be inserted without difficulty. If there is no AS-I Safety at Work interface on the safety component, so-called coupling modules can be used to establish the connection. Existing AS-I masters and AS-I power supplies can be used as well.

There are no industry-specific restrictions. Some of the key applications are listed below:

- Machine tools
- Expanded machining centers with multiple control elements and safety sensors for wood and metal processing
- Printing and paper processing machines, trimming machines
- Packaging machinery, both stand-alone and as systems
- Food and beverage machinery
- Workpiece and bulk material conveying systems
- Rubber and plastics industry processing machinery
- Automatic assembly and handling equipment.

3.4 Organizational requirements

3.4.1 Documentation

All the specifications in this System Manual, in particular the sections “Safety Instructions” and “Commissioning”, must be strictly observed.

All the safety instructions in the manual “**ASIMON 3 G2** Configuration Software” must be strictly observed.

Please note the safety rules when configuring the safety functions, see section <Configuration of the safety functions>. Checking of the release code and testing the system must be documented in writing and is part of the system documentation.

Keep this System Manual in a safe location where it can be readily accessed. It should always be available.

3.4.2 Traceability of the devices

The ordering party is responsible for ensuring traceability of the devices by serial number!

3.4.3 Safety regulations

Observe the locally prevailing legal regulations and requirements of the trade associations.

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3.4.4 Qualified personnel

Installation, commissioning and maintenance of the devices are to be performed only by qualified specialists.

Electrical work is to be performed only by electrical technicians.

Setting and changing the device configuration via PC and **ASIMON 3 G2** configuration software are to be performed only by an authorized safety representative.

The **password** for changing a device configuration must be kept under lock and key by the safety representative.

3.4.5 Repair

Repairs, in particular opening of the housing, are to be performed only by the manufacturer or by an authorized representative of the manufacturer.

3.4.6 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.

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4. Spezifications

4.1 Technical data

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.

4.1.1 Data sheet VBG-EN-K30-DMD-S16

VBG-EN-K30-DMD-S16

Ethernet/IP interface	RJ-45
Baud rates	10/100 MBaud
Serial interface	RS 232
AS-i cycle time	150 µs * (number of slaves + 2)
Safety monitor	
Release circuit	4-channel
Start delay	< 10 s
Respond delay	< 40 ms
Inputs: 4 x EDM/Start	EDM: inputs of external device monitoring circuits start: start inputs switching current statical 4 mA at 24 V, dynamic 30 mA at 24 V (T=100 µs)
Output: 4 x output switching elements	relay outputs (output circuits 1 and 2) max. contact load: 3 A AC-15 at 30 V, 3 A DC-13 at 30 V
	semiconductor outputs (output circuits 3 and 4) max. contact load: 0,5 A DC-13 at 30 V
Card slot	chip card for storage of configuration data
Displays	
LCD	indication of slave addresses and error messages
LED power	power on
LED net	Ethernet/IP master recognized
LED config error	configuration error
LED U AS-i	AS-i voltage OK
LED AS-i active	AS-i normal operation active
LED prg enable	automatic addresses programming enabled
LED prj mode	configuration mode active
LED AUX	auxiliary power

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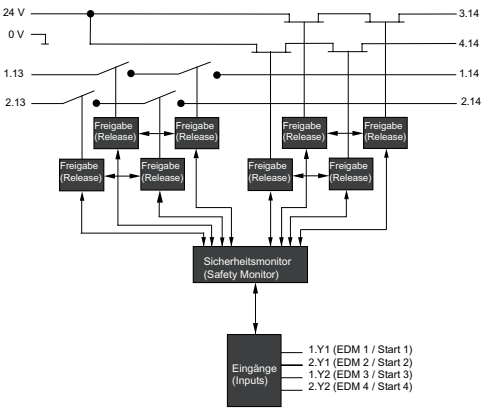
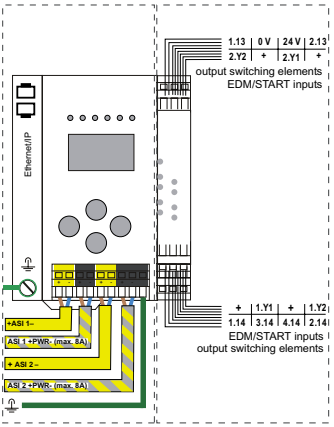
4 x LED EDM/Start	state of input of ext. device monitoring circuit LED off: open LED on: closed
4 x LED output circuit	state of output circuit LED off: open LED on: closed
Electrical data	
Operating current	master power supply, approx. 300 mA out of AS-i network 1, approx. 70 mA out of AS-i network 2
Operating voltage	AS-i voltage 30 V DC
Voltage of insulation	≥ 500 V
Standards	EN 61 000-6-2, EN 61 000-6-4 EN 62 061, SIL3, IEC 61 508, SIL3 EN 13 849, performance level e
Housing	AS-i master housing in stainless steel
Ambient operating temperature	0°C … +55°C
Storage temperature	-25°C … +85°C
Dimensions (L / W / H in mm)	120 / 100 / 96
Protection category IEC 60 529	IP20
Tolerable loading referring to impacts and vibrations	according to EN 61 131-2
Weight	800 g

Safety Monitor block diagram:



Connections: Gateway + Safety Monitor



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4.2 Safety-relevant characteristic data

Characteristic data	Value	Standard
Safety category	4	EN 954-1
Safety category	4	EN 13849-1:2006/PLe Cat 4
Performance Level (PL)	e	
Safety Integrated Level (SIL)	3	IEC 61508
Lifespan (TM) in years	20	EN 13849-1:2006/PLe Cat 4
Maximum switch-on time in months	12	IEC 61508
PFD	$< 9{,}25 \times 10^{-6}$	IEC 61508, EN 62061
PFH_D (probability of a dangerous failure per hour)	$< 5{,}36 \times 10^{-9}$	IEC 61508, EN 62061
Max. system reaction time in milliseconds	40	IEC 61508

Tab. 4-4.

Attention!

In addition to the system reaction time of max. 40 ms, the reaction times of the safe AS-interface sensor slave, of the sensor being used for monitoring, of the safe AS-interface actuator slave and of the actuator used for this purpose must still be added. Please note that additional reaction times may likewise arise through the configuration of the safety monitor.

Notice!

Refer to the technical data for the slaves as well as to that for the sensors and actuators for the reaction times to be added.

Attention!

The system reaction times of the daisy-chained AS-interface components are added up.

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4.3 System reaction times – example calculations

System components:		
ASI1	AS-i network 1	
ASI2	AS-i network 2	
S1-1	Safe sensor slave	(EMERGENCY-OFF switch: $t_{R\ S1-1}$ = 100 ms)
S1-2	Safe sensor slave	(safety light barrier: $t_{R\ S1-2}$ = 18 ms)
S2-1	Safe sensor slave	(EMERGENCY-OFF switch: $t_{R\ S2-1}$ = 100ms)
A2-1	Safe actuator slave	(motor starter: $t_{R\ A2-1}$ = 50ms)
SM1-1	Safety monitor with 16 relais circuits and one safe AS-i output in AS-i network 1	
SM1-2	Safety monitor with 2 relais circuits and one safe AS-i output in AS-i network 1	
SM2-1	Safety monitor with 16 relais circuits and one safe AS-i output in AS-i network 2	

Tab. 4-5.

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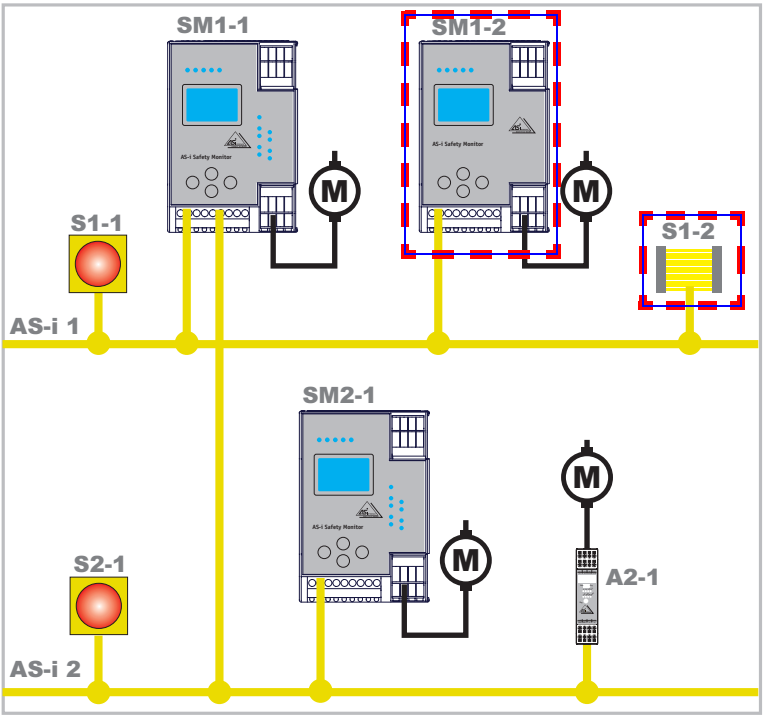
System configuration - example 1: Calculation of the system reaction time



Upon activation of safety light barrier S1-2, the relay safety output of safety monitor SM1-2 is controlled.

Calculation of the AS-i relevant system reaction time:

$$t_{System\ total\ a)} = t_{R\ S1\text{-}2} + t_{R\ System} = 18ms + 40ms = \underline{58ms}$$

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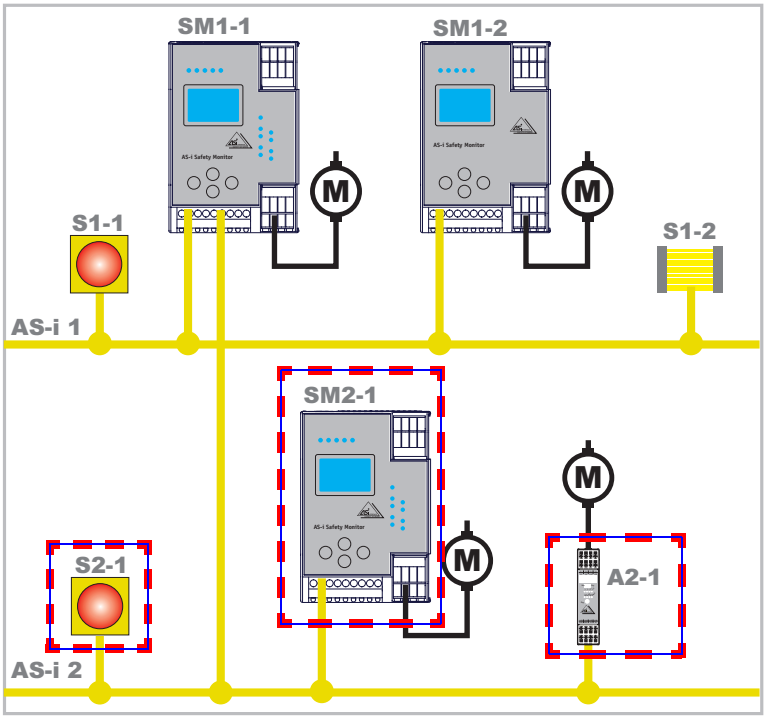
System configuration - example 2: Calculation of the system reaction time



Upon locking of the EMERGENCY-OFF switch S2-1, the motor starter is controlled via the safe AS-interface output of safety monitor SM2-1.

Calculation of the AS-interface-relevant system reaction time:

$$t_{\text{System total b)}} = t_{\text{R S2-1}} + t_{\text{R System}} + t_{\text{R A2-1}} = 100\text{ms} + 40\text{ms} + 50\text{ms} = \underline{190\text{ms}}$$

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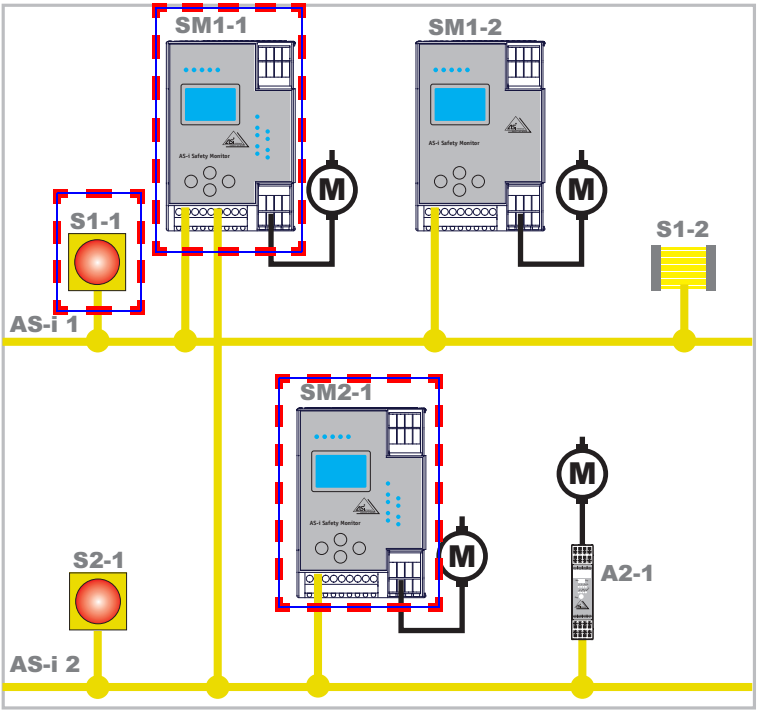
System configuration - example 3: Calculation of the system reaction time



Upon locking of the EMERGENCY-OFF switch S1-1, the relay output of safety monitor SM2-1 is controlled via the coupling of the safe AS-interface output of safety monitor SM1-1.

Calculation of the AS-i relevant system reaction time:

$$t_{\text{System total c)}} = t_{\text{R S1-1}} + t_{\text{R System ASI1}} + t_{\text{R System ASI2}} = 100\text{ms} + 40\text{ms} + 40\text{ms} = \underline{180\text{ms}}$$

4.4 Scope of delivery

The **basic unit** consists of:

AS-i 3.0 EtherNet/IP Gateway with integrated Safety Monitor.

The following **accessories** are available:

Software CD with

- **ASIMON 3 G2** communication software for Microsoft® Windows Me/NT/ 2000/XP/Vista ®
- System manual in PDF format (Adobe® Acrobat Reader® Version 5.x or newer is required for viewing the files)

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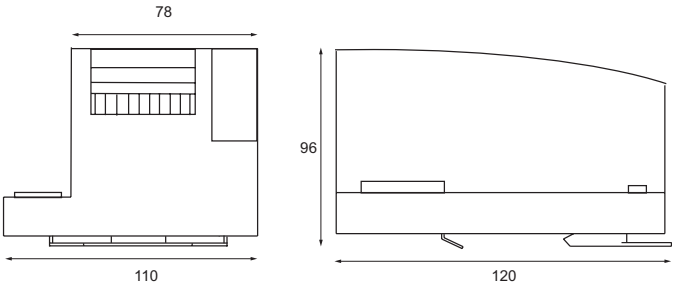
5. Installation

5.1 Dimensions



Warning!

Cover the top of the gateway when doing any drilling work above the unit. No particles, especially metal chips, should be allowed to enter the housing, since this could cause a short circuit.

Information!

Please refer to installation instruction for this device for detailed mounting information.

5.2 Connections

∅ 5 ... 6 mm / PZ2	0,8 Nm 7 LB.IN
10	2 x (0,5 ... 1,5) mm^2
10	2 x (0,5 ... 1,5) mm^2
AWG	2 x 24 ...12

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.

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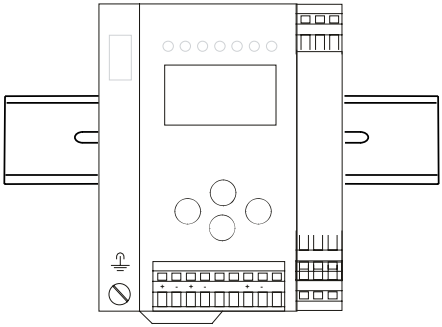
5.3 Installing in the control cabinet

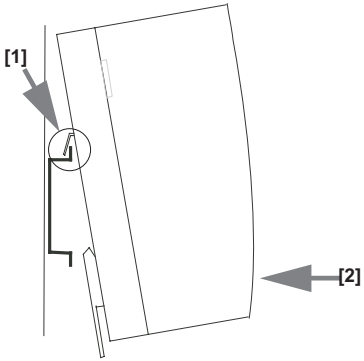
The AS-I/Gateway is installed in the control cabinet on 35mm DIN rails per DIN EN 50 022.

Information!

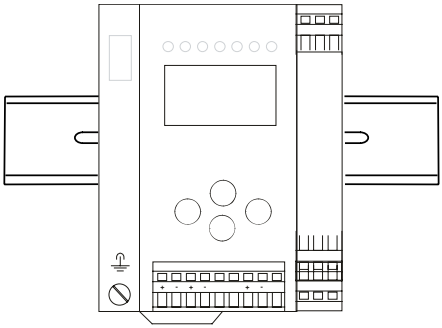
The enclosure of the AS-I/Gateway *is made of stainless steel. The unit is also suitable for exposed wall mounting.*

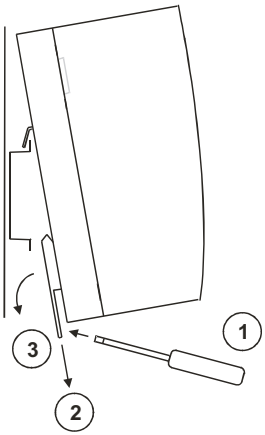
To install, place the unit on the upper edge of the DIN rail and then snap in the lower edge.





5.4 Removing





To remove, press the holding clamps [2] down using a screwdriver [1], press the unit firmly against the upper rail guide and lift out.

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5.5 Electrical Connection

Information!

Electrical connections are described in section <Electrical connection>.

Information!

See also section <Operation in advanced display mode> for further information.

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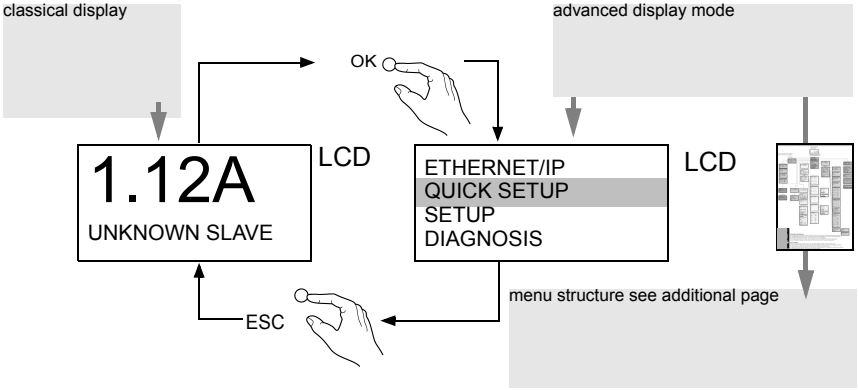
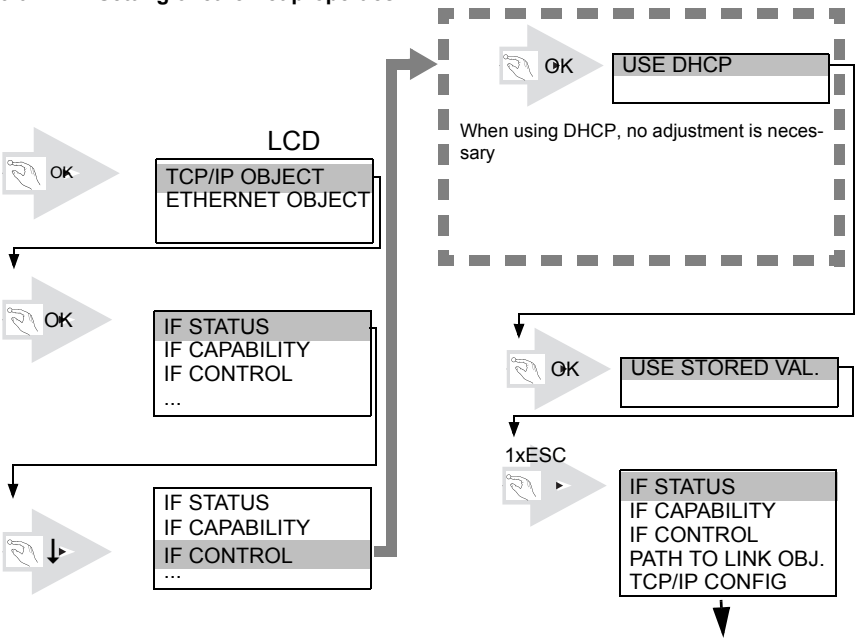
5.6 Commissioning

5.6.1 Switching to advanced display mode



5.6.2 Setting of ethernet properties



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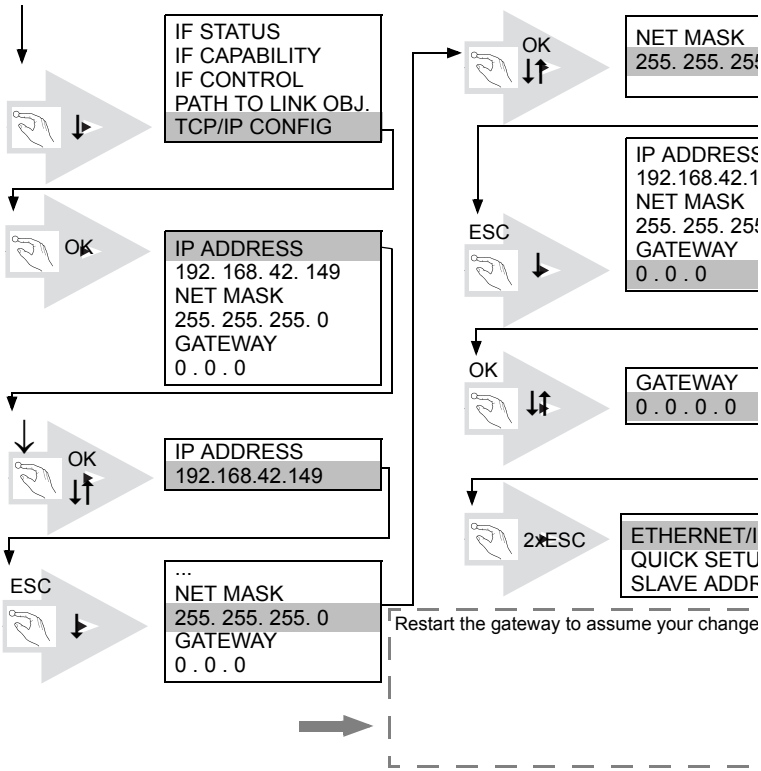
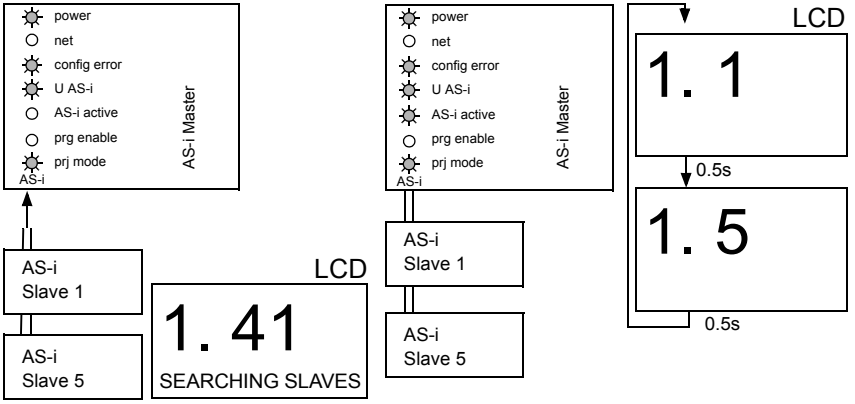


5.6.3 Connecting AS-i Slaves



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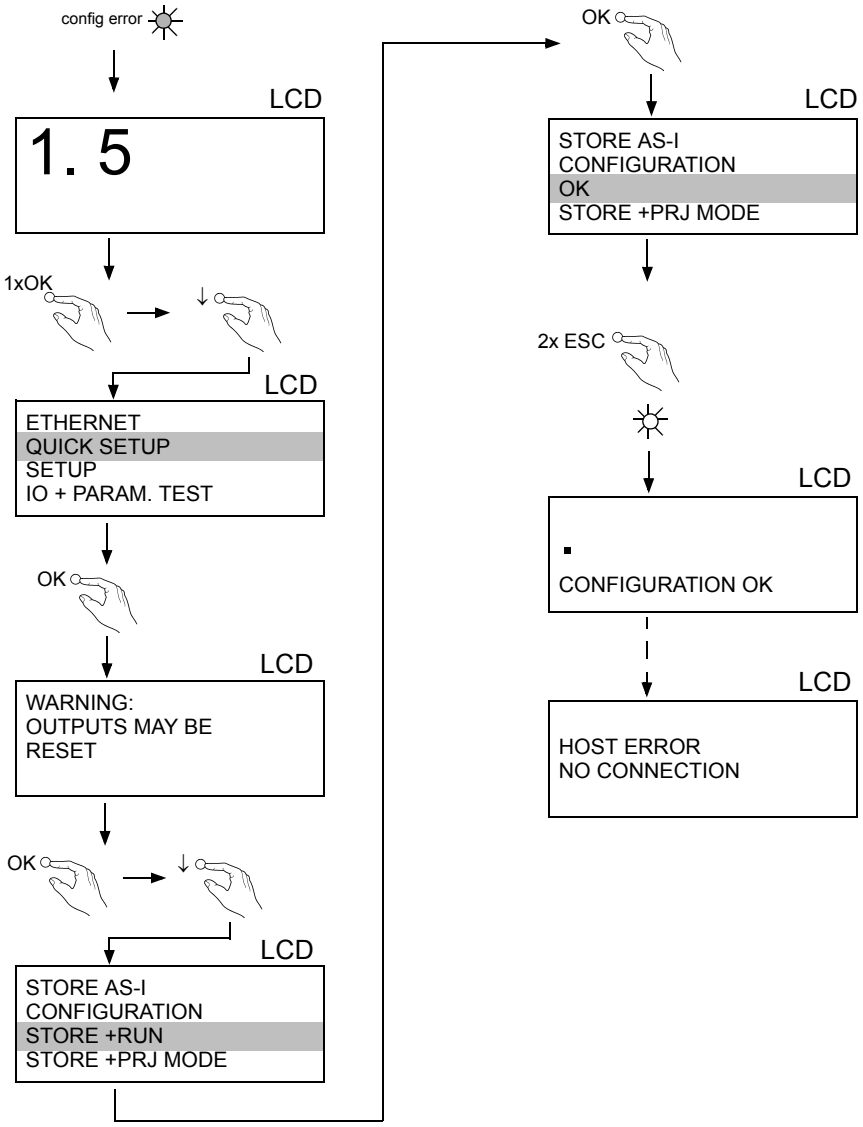
5.7 Quick setup



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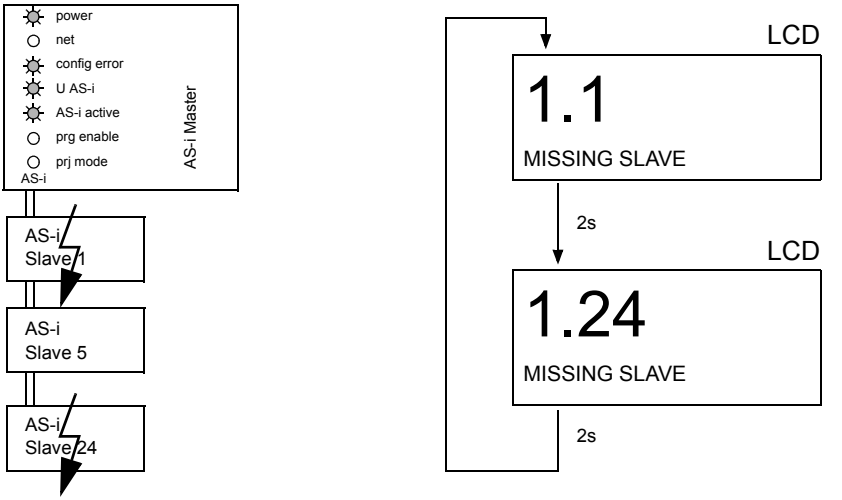
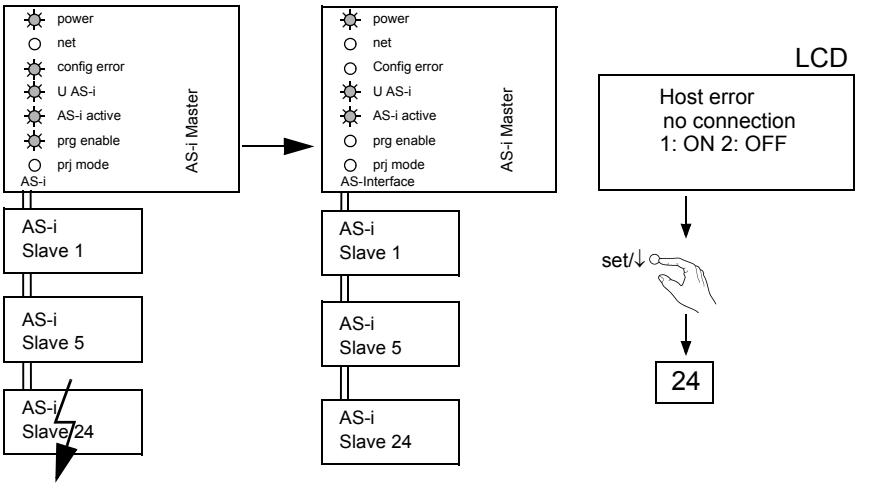
5.8 Error tracing

5.8.1 Faulty slaves



5.8.2 Error display (last error)



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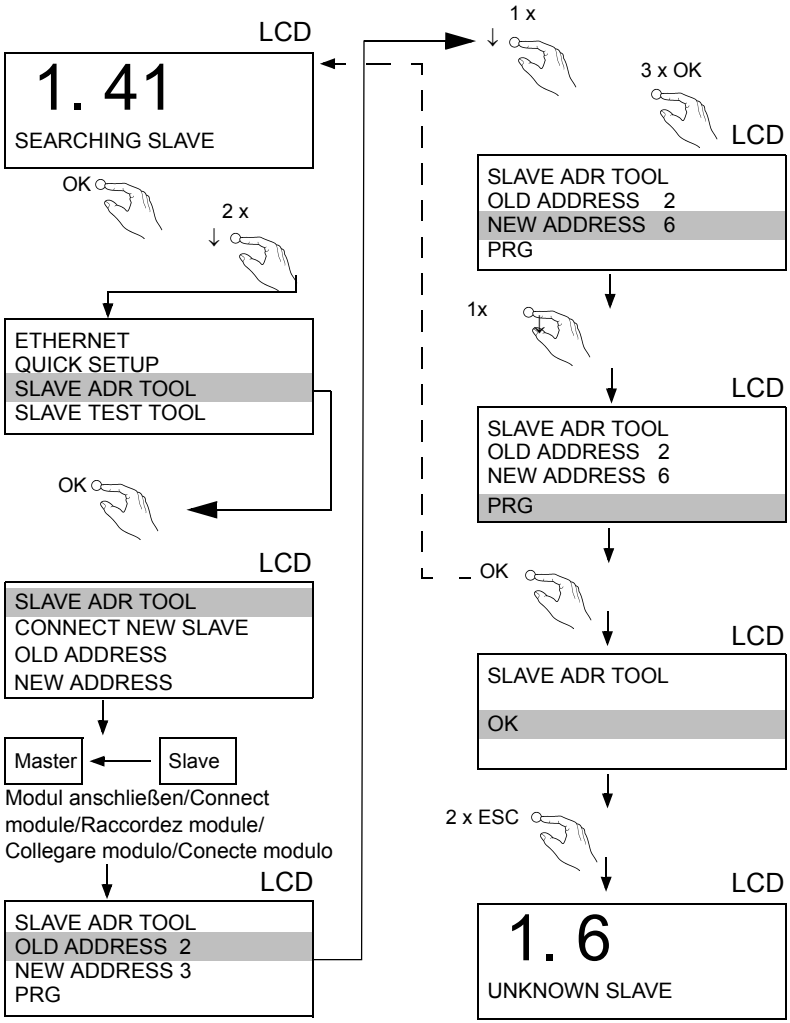
5.8.3 Addressing

5.8.3.1 Assigning address 6 to slave currently at address 2



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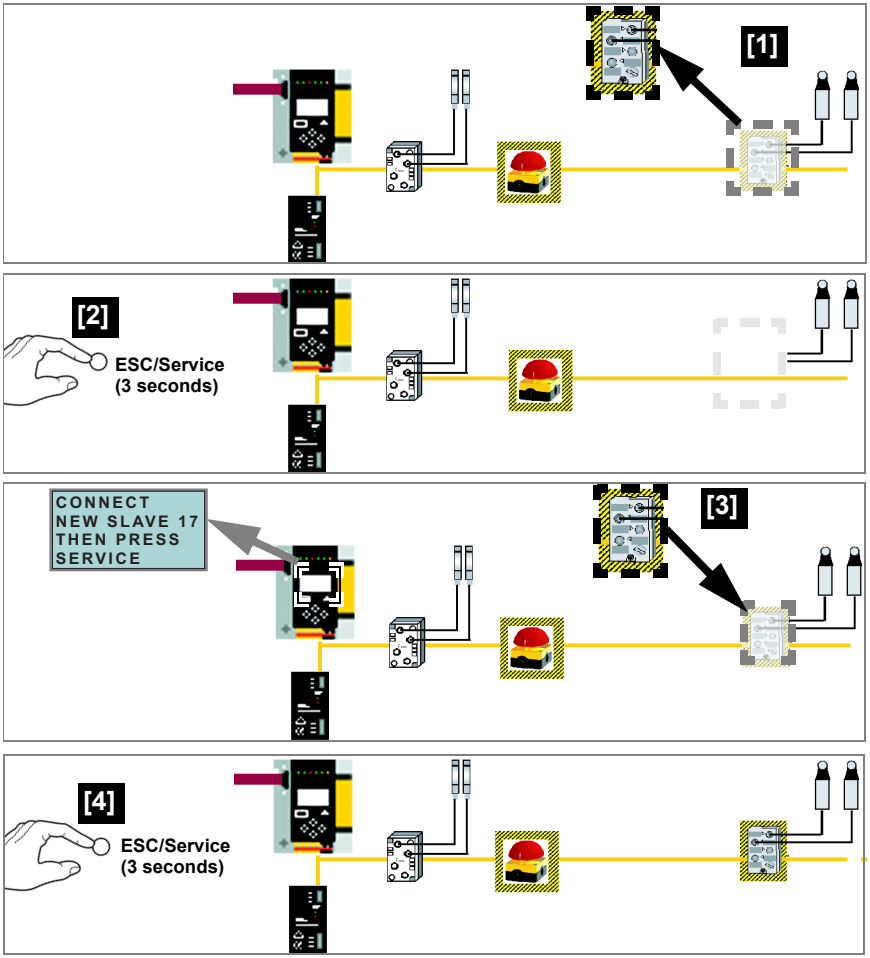
For additional information see manual, section <Operation in advanced display mode>.

5.8.4 Replacing a defective AS-i Safety Slave

The new slave must be able to send teaching codes and must have the same address as the old one. Only one missing slave is allowed!



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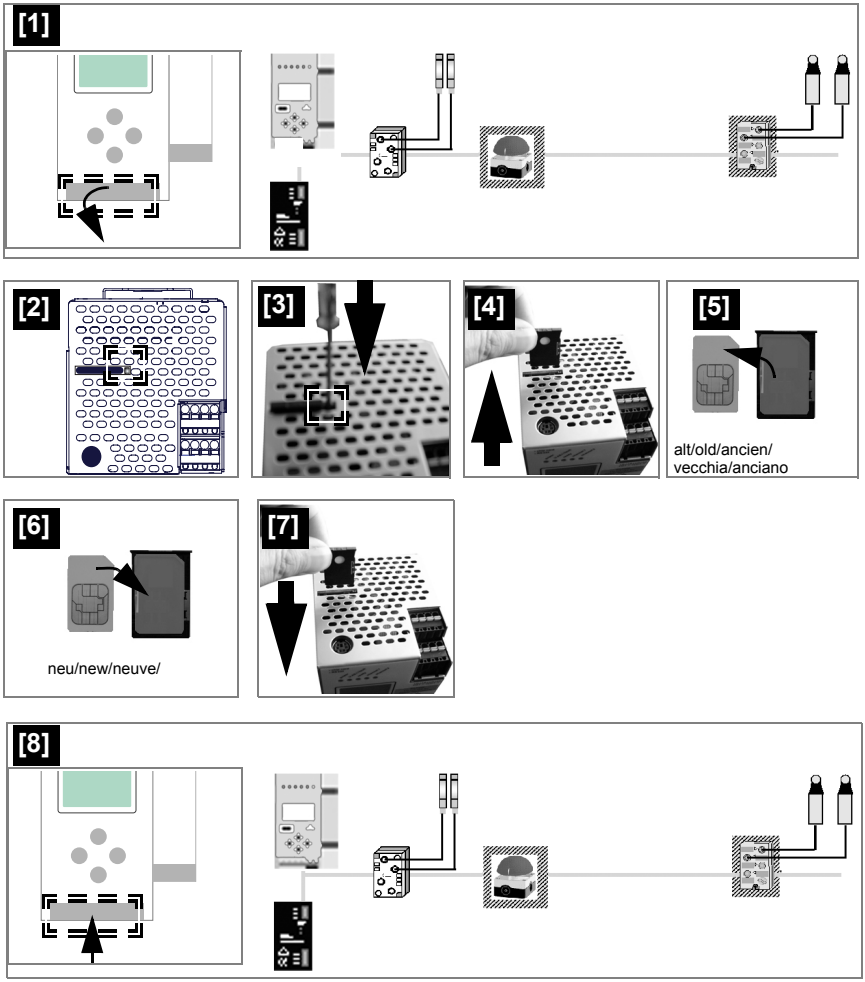
5.8.5 Replacing the chip card

Always turn off power before inserting or removing the card!



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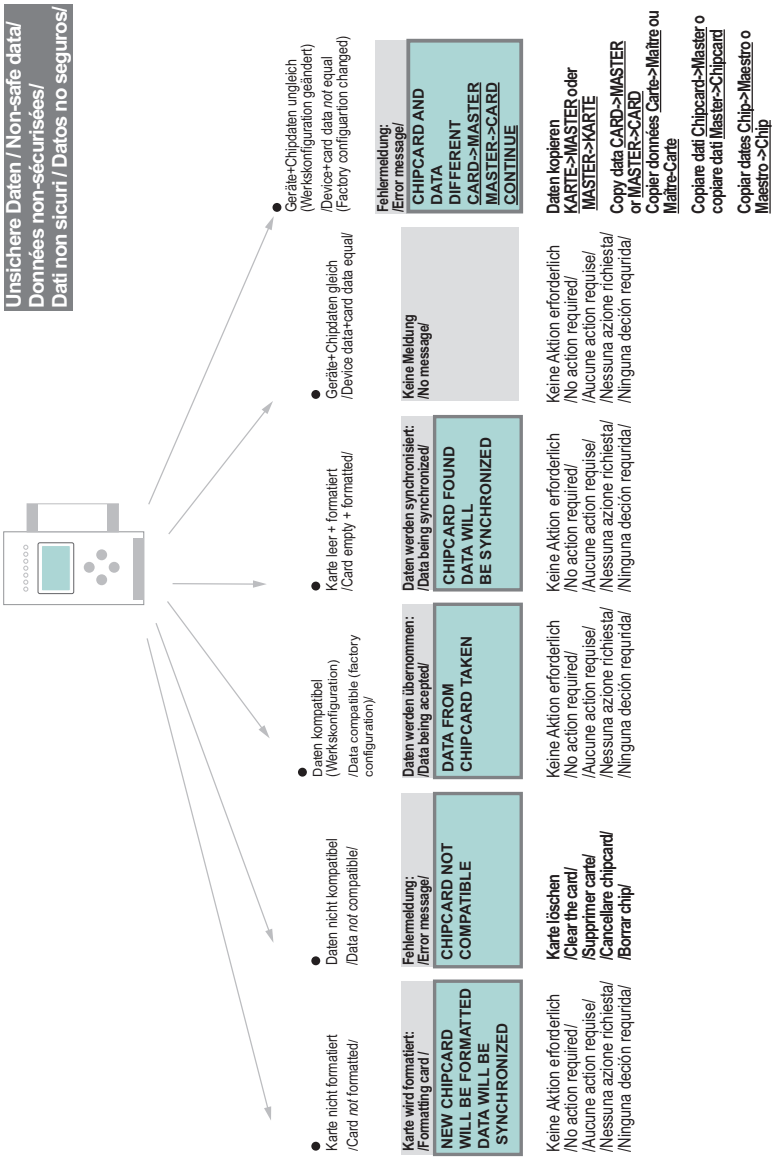
5.8.6 Local parameter setting of safe AS-i/Gateways and Monitors



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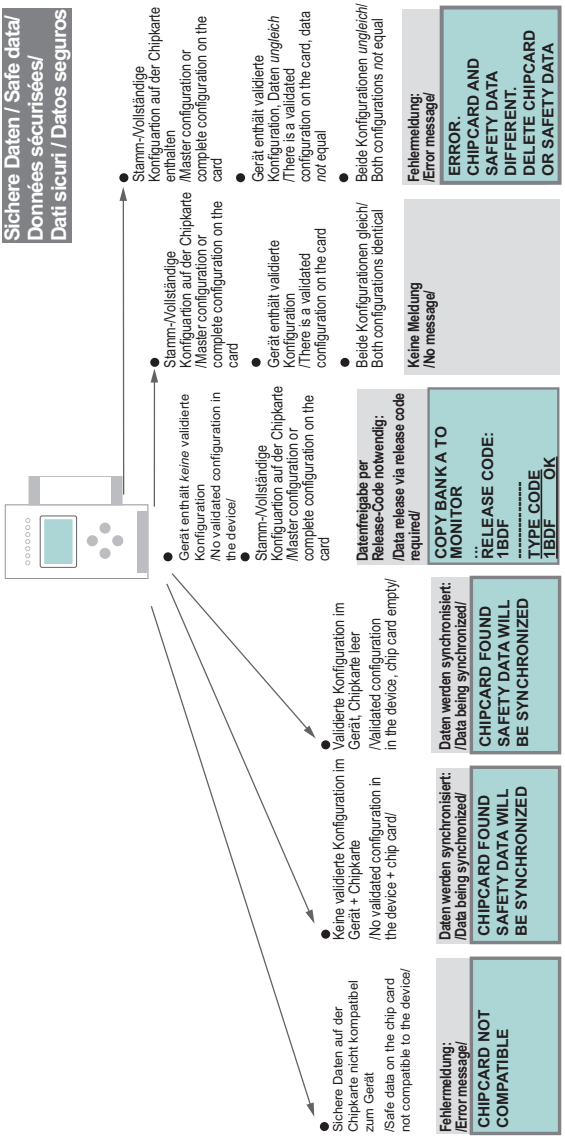
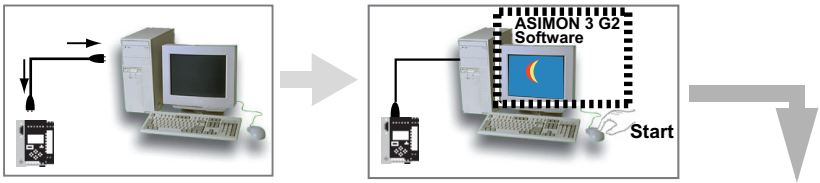


For further information see manual, section <Chip card>

Issue date: 17.4.2009

5.9 Safe configuration using ASIMON 3 G2



Before commissioning the safety unit, put the gateway into operation!

ASIMON 3 G2 Software

Change the preset password 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

You can acknowledge the request TEACH CODE SEQUENCES? selecting "Yes", or you can do it later via display selecting "No".

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.

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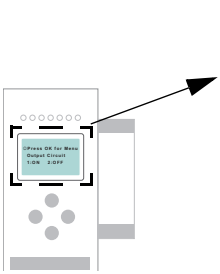
ASIMON 3 G2 Software



The device is in the protected mode now.

If you have assigned the safety monitor its own address in the software ASIMON 3 G2, adjust the configuration in the AS-i master (Quick Setup)! This is also valid when using simulated slaves.

Please consider notes on safety in the software manual ASIMON 3 G2!

Issue date: 17.4.2009

6. Maintenance

6.1 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.

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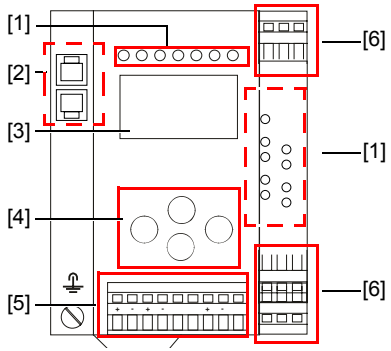
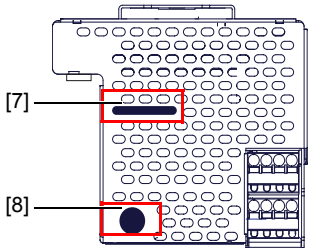
7. Electrical connection

7.1 Overview of terminals, indicators and operating elements

7.1.1 VBG-EN-K30-DMD-S16





∅ 5 ... 6 mm / PZ2	0,8 Nm 7 LB.IN
10	2 x (0,5 ... 1,5) mm²
10	2 x (0,5 ... 1,5) mm²
AWG	2 x 24 ...12

Legend:

[1] LEDs
[2] EtherNet/IP interface
[3] LC display
[4] Buttons
[5] Terminals: Supply voltage and AS-i circuit
[6] Terminals: Safety monitor
[7] Chip card slot
[8] RS 232 diagnostics port[1]

1. Only together with ASIMON 3 G2 Software or AS-i Control Tools

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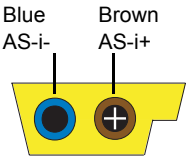
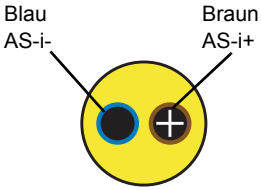
7.2 AS-i bus connection



Yellow ASi ribbon cable



2-conductor AS-i round cable
(Recommended: flexible power cable
H05VV-F2x1,5 per DIN VDE 0281)

Information!

Electrical work is to be performed only by electrical technicians.

7.3 Information about the device types

Information!

A listing of the individual devices and their features can be found in section <Product information>.

7.4 AS-i and power supply terminal assignments

Information!

The cable indicated by hatching must not have slaves or repeaters connected to it.

The yellow cable must not have AS-i power suppliers or additional masters connected to it.

Information!

The function ground can be connected either to the grounding screw or to the terminal.

The function ground should be made with as short a cable as possible to ensure good EMC characteristics.

Therefore function grounding using the grounding screw is preferred.

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.

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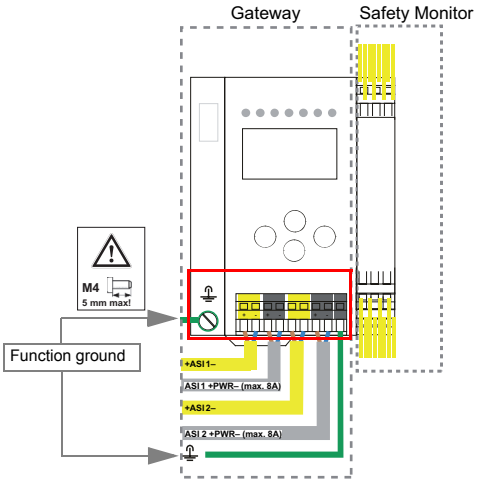
7.4.1 Electrical connection VBG-EN-K30-DMD-S16



Terminal	Signal / Description
+ASI 1–	Connection to AS-i Circuit 1
+ASI 2–	Connection to AS-i Circuit 2
ASI 1 +PWR–	Supply voltage for AS-i Circuit 1 (max. 8 A)
ASI 2 +PWR–	Supply voltage for AS-i Circuit 2 (max. 8 A)
FG	Function ground

Information!

AS-i Circuits 1 and 2 are powered by separate power supplies.

Information!

For additional information, please refer to the section <AS-i and power supply terminal assignments>.

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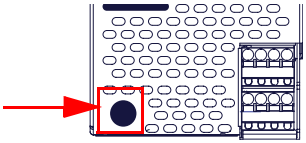
7.5 Diagnostics interface

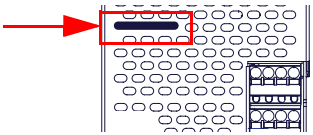
The service and diagnostics interface (in conjunction with **AS-i Control Tools** or **ASIMON 3 G2** software) is used for communication between the PC and the unit.

7.5.1 Diagnostics port RS 232

The service and diagnostics interface is configured as a mini DIN-6 female and it is placed on the front plate, on the left hand side.



7.6 Chip card

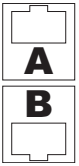


The configuration is stored in a fixed installed EEPROM and can be overwritten by the chip card. The chip card does not have to be inserted in operation.

Warning!

Power must always be turned off when removing or inserting the chip card!

7.7 EtherNet/IP interface



The EtherNet/IP interface consists of two RJ-45 sockets. It is placed on the left housing side (see section <Overview of terminals, indicators and operating elements>). The RJ-45 socket is based on the MDI (none auto-crossover) and supports 10 Base T or 100 Base TX networks according to the IEEE 802.3

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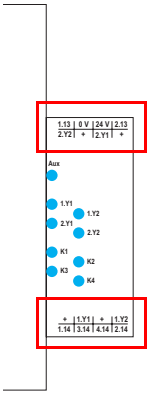
7.8 Release circuits

7.8.1 Wiring overview of Safety Monitor



1.Y1 (EDM 1/Start 1), 2.Y1 (EDM 2/Start 2), 1.Y2 (EDM 3/Start 3), 2.Y2 (EDM 4/Start 4)

The safety unit provides 4 inputs. The EDM & START inputs can be defined freely. The inputs may not be connected to other potentials, but rather only directly or through potential-free switches to + (for EDM/START).
Switching current static 4 mA at 24 V, dynamic 30 mA at 24 V (T=100 µs).

3.14, 4.14

Semiconductor outputs. Max. contact load: 0.5 A DC-13 at 30 V.

1.14, 2.14; 1.13, 2.13

Potential-free relay contacts. Safety relay with one contact set for read-back. Max. contact load: 3 A AC-15 at 30 V, 3 A DC-13 at 30 V.

0 V, 24 V

Semiconductor outputs are powered by separate 24 V DC.

+ (for EDM/Start)

Output supply, powered by AS-i. May not be connected to other potentials, but rather only directly or through potential-free switches to one of the EDM or START inputs. Voltage 30 ... 15 V_{DC}.

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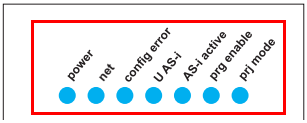
7.9 Indicators and operating elements

7.9.1 LED indicators – master



The LED's on the front panel of the device indicate:

Power

The master is receiving sufficient power.

net (the bi-color LED indicates the state of the ethernet port)

LED red: no valid ENIP- or CIP connection.
LED green: at least one ENIP- or CIP connection present

config error

Configuration error.
At least one configured slave is missing, or at least one detected slave is not configured, or for at least one configured and detected slave the actual configuration data does not match the nominal configuration data, or the master is in the startup process.
This LED flashes if a peripheral fault has been detected for at least one AS-i slave on the AS-i network. If there are configuration errors as well as periphery faults, only the configuration error is displayed.

U AS-i

The AS-i network is sufficiently powered.

AS-i active

Normal operation is active

prg enable

Automatic single node replacement is enabled.
Exactly one slave is missing in the protected operating mode. The slave can be replaced by another slave of the same type with address zero. The master automatically addresses the new slave to the faulty address and thus corrects the configuration error

prj mode

The AS-i master is in configuration mode.

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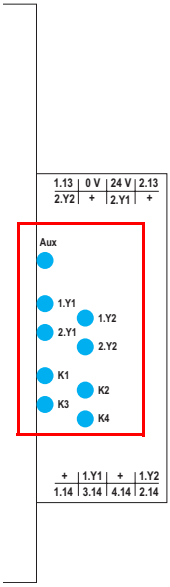
7.9.2 LED indicators - monitor



The LED's on the safety unit indicate:

Aux

24 V supply for the semiconductor outputs is present.

1Y.1, 1Y2, 2Y.1, 2Y.2

Input 1.Y1 (EDM 1/Start 1), 2.Y1 (EDM 2/Start 2), 1.Y2 (EDM 3/Start 3), 2.Y2 (EDM 4/Start 4) is turned on.

K1, K2

Contact sets 1.13, 1.14 (K1) resp. 2.13, 2.14 (K2) closed.

K3, K4

Auxiliary voltage is present on the semiconductor output 3.14 (K3) resp.4.14 (K4).

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7.9.3 Buttons

The buttons are used for the following:

Mode/⇑	Switching between configuration mode and protected operating mode, and saving the current AS-i configuration as the nominal configuration.
Set/⇓	Selecting the address of and assigning an address to a slave.
OK	Change to extended mode.
ESC/Service	For teaching the code table for a new safe slave, when exactly one safe slave is being replaced, and for unlocking the Safety Monitor. This button is also used to exit extended mode.

For additional information see:

- <Section <Function of the ESC/Service key>
- <Section <Replacing a defective safety-configured AS-i slave>
- <Section <Operation in advanced display mode>.

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8. Function and startup of the Safety Monitor

Configuration and startup of the AS-i Safety Monitor is accomplished using a PC/ Notebook and the **ASIMON 3 G2** configuration software.

The operating language of the device can be set for the respective country (see section <Language (menu language)>).

Information!

*The description of the **ASIMON 3 G2** software and startup of the AS-i Safety Monitor can be found in the manual "**ASIMON 3 G2** AS-i Safety Monitor Configuration Software for Microsoft®-Windows®".*

*The software manual is an important component of the operating manual for the AS-i Safety Monitor. It is not possible to configure and start up the AS-i Safety Monitor without the **ASIMON 3 G2** software.*

Configuration may be performed only by a safety authorized person. All safety-related commands are password protected.

8.1 Powering up the device

As soon as supply voltage is present on the device an internal system test is started. This operating state is indicated by lighting of the upper LED row.

8.2 Configuration of the safety functions

The device can be configured in several ways:

1. Using **ASIMON 3 G2** software
   The **ASIMON 3 G2** software represents the most universal method of configuring the Safety Monitor. Here the behavior of the Safety Monitor can be determined by linking various monitoring modules. After being sent to the Safety Monitor, this configuration is verified and can then be validated.
   For additional information, refer to the separate manual for the **ASIMON 3 G2** configuration software.
2. Using a chip card with the master configuration
   Configurations stored on the chip card, which are validated but which do not contain any code sequences, can be sent to the device. The code sequences must then be taught to the corresponding safety AS-i slaves. This procedure is useful when you want to use a safety program in several safety monitors without any changes.

Information!

For additional information refer to section <Description of configuration using chip card with master configuration>.

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3. Using a chip card with complete configuration
   In contrast to the master configuration, the complete configuration also contains the code sequences for all included slaves. Sending the complete configuration from the chip card to the Safety Monitor can make replacement of the device enormously simpler and faster.

Information!

For additional information refer to <Configuration using a chip card with complete configuration>.

8.2.1 Description of configuration using ASIMON 3 G2 software

The following description represents a short guide to configuring the AS-i Safety Monitor. For a detailed description of the **ASIMON 3 G2** software, refer to the corresponding manual for the **ASIMON 3 G2** configuration software.

The **ASIMON 3 G2** software is responsible for the following:

- Configuring the AS-i Safety Monitor
- Documenting the device configuration
- Starting up the AS-i Safety Monitor
- Diagnosing the AS-i Safety Monitor

Information!

*The description of the **ASIMON 3 G2** program can be found in the separate software manual.*

Proceed as follows:

- Install the program on your PC.
- Apply power to the AS-i Safety Monitor

Information!

To prevent ESD damage, we recommend grounding at an appropriate location before plugging in the interface cable to the Safety Monitor.

- Connection of monitors with a RS 232 diagnostics interface
  - To connect, plug the diagnostic cable end with the PS2 connector into the socket of the diagnostic interface (RS 232) of the monitor and the other end with the 9-pin Sub-D socket connector to a free COM port (serial RS232 interface) on your PC (see section 2.1.2 “Connection between the AS-i Safety Monitor and the PC" in the software manual).
- Configure the AS-i Safety Monitor and start it up as described in the software manual.

Attention!

Before starting up the device you must adapt the device configuration to your application. This means configuring the AS-i Safety Monitor according to the software manual so that the location to be protected is in fact protected by the device.

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8.2.2 Description of configuration using chip card with master configuration

Generating a master configuration:

- Generate a configuration using the **ASIMON 3 G2** software
- Load the configuration into the device
- Release (validate) the configuration, but do not teach the code sequences
- The code sequences will be taught on the physical AS-i circuit

Attention!

Safety advisory:

Ensure that the chip card contains the configuration intended for and released for the application!

This can be done by comparing the release codes on the display (section <MONITOR CONFIG (configuration of the int. monitor)>):

- The safety representative who generated and validated the release code stores the release code for the master configuration and approves use of the configuration for specific equipment.
- The person performing the startup reads out the release code on the display before teaching the code and compares it with the release code stored and approved for the equipment.

After the chip card has been used to load the configuration into the device, the safety functions of the device must be checked in the equipment.

Checking of the release code and testing the system must be documented in writing and is part of the system documentation.

8.2.3 Configuration using a chip card with complete configuration

The chip card contains the complete configuration if:

- An empty chip cared is plugged into an AS-i Safety Monitor which already contains a complete configuration, or
- The chip card is already inserted while the configuration is being written into the device using **ASIMON 3 G2** software and before validating the code sequences.

If the AS-i Safety Monitor needs to be replaced, the stored configuration can be transferred by simply plugging the chip card from the old device into the new one.

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Attention!

Safety advisory:

Power must always be turned off when removing or inserting the chip card!

Ensure that the chip card contains the configuration intended for and released for the application!

This can be done by comparing the release codes on the display (section<MONITOR CONFIG>):

- The safety representative who generated and validated the release code stores the release code for the master configuration and approves use of the configuration for specific equipment.
- The person performing the startup reads out the release code on the display before starting the equipment and compares it with the release code stored and approved for the equipment.

After the chip card has been used to load the configuration into the device, the safety functions of the device must be checked in the equipment.

Checking of the release code and testing the system must be documented in writing and is part of the system documentation.

8.3 Safety-relevant documentation of the application

Information!

The detailed description of the safety-relevant documentation of the configuration for your application can be found in the separate software manual.

Proceed as follows:

- Create the configuration of the AS-i Safety Monitor for your application.
- Validate the configuration (done by the safety supervisor).
- Print out the final configuration protocol and optionally the configuration overview (see Section 5.8 "Configuration documentation" in the software manual).
- Sign the final configuration protocol (done by the safety supervisor).
- Take the protocol for the safety-relevant documentation for your application (machine documentation) and keep it in a safe place.

8.4 Diagnostic data

Information!

A detailed description of the setting for diagnostics mode is described in the section “Setting diagnostics type” in the separate manual "AS-i 3.0 Command Inteface".

Diagnostics data can be obtained in any of 4 ways:

- Display
- Ethernet
- **ASIMON 3 G2** software via diagnostic interface

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- AS-i Control Tools via diagnostic interface or Ethernet

The following diagnostics can be displayed (see section <INT MON (internal monitor)>):

- Display of the switching state of the outputs
- State (“color”) of the devices and sub-devices[1]; distinction when turning off only half (“Category 2“)
- Error history for finding the cause of sporadic errors

8.4.1 Switch-off history

The switch-off history, accessible from the menu DIAGNOSTICS->INT MONITOR->LAST DIAGNOSTIC, is intended to make reconstruction of the reason for switch-off easier for the user. The states of all safety-relevant AS-i slaves and all devices at the time the state change on the output device (change from green to another color) are stored.

8.5 Password protection

All safety-related commands are password protected. These include:

- Loading configurations into the Monitor
- Stopping
- Learning code sequences
- Releasing
- Changing the password

Information!

No new release is necessary if when using safety-configured AS-i slaves code sequences have been newly learned using the ESC/Service key.

8.5.1 Procedure for configuring and teaching code sequences

The configuration is created using **ASIMON 3 G2** software, loaded into the safety unit and released. The name of the person releasing and the date are stored at this moment. If code sequences controlled through the display are newly taught, this is secured by a PIN to prevent unintended/unauthorized changing of the code sequences.

Information!

For additional information see section<Replacing a defective safety-configured AS-i slave>.

- A PIN is a 4-digit number and can only be changed from the display, not via the **ASIMON 3 G2** software.

1. For the sake of better diagnostics thet procedure is being expanded using a Device/Device Color for adding diagnostics based on AS-i addresses (sub-devices) and their states.

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- After entering the PIN, the display can be used to start a teaching procedure for the code sequences. The monitor stops immediately after entering the PIN. After teaching, the monitor starts after a prompt and acknowledgement on the display.

Action	ASIMON Software	On AS-i Safety Monitor
Configure and load into Safety Monitor	✓	✓ *(only from chip card)*
Stopping	✓	✓
Releasing	✓	–
Starting	✓	✓
Teaching code sequences	✓	✓
Changing the password	✓	✓ *(only from chip card)*
Changing the PIN	–	✓

Legend: "✓" = possible; "–" = not possible

Code sequences for releasing a configuration do not necessarily have to have been successfully learned. It is also possible to release without code sequences, which must then be learned at a later time. An AS-i Safety Monitor does not go into the protecting operating mode without learned code sequences.

Teaching the code sequences is simple to perform:

- Using the ESC/Service key (See section <Replacing a defective safety-configured AS-i slave>)

or

- Using the display (See section <TEACH CODES>).

8.5.2 Function of the ESC/Service key

In traditional (classical) display mode, the ESC/Service key takes on two kinds of functions:

- Briefly pressing the ESC/Service key unlocks the Safety Monitor when red is flashing
- A longer press (3s) starts the teach procedure for a slave.

Information!

For additional information see section <Replacing a defective safety-configured AS-i slave>.

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8.6 Safe coupling slaves on the AS-i circuits

The two AS-i circuits are capable of emulating a total of up to sixteen safe coupling slaves.

The assignment of the coupling slaves addresses to the release circuits is made using the ASIMON software.

8.7 Chip card

The chip card is divided into two areas. One area is reserved for unsafe data and administration, the other for safe data.

Warning!

Always turn off power before inserting or removing the card.

8.7.1 Unsafe data

This section describes the system behavior of the unsafe system section when using the chip card.

8.7.1.1 Card unformatted

If an unformatted card is found when the device is started, the following is displayed:

```
NEW CHIPCARD
WILL BE FORMATED
AS-I DATA WILL
BE SYNCHRONIZED
```

The chip card is formatted and then the data copied to the chip card.

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8.7.1.2 Data not compatible

If a card is found whose data are incompatible with the device, the following error message is displayed:

```
CHIPCARD NOT
COMPATIBLE
```

8.7.1.3 Card empty

The following message is displayed for an empty card:

```
CHIPCARD FOUND
AS-I DATA WILL
BE SYNCHRONIZED
```

From this time on all changes are made both in the device and on the chip card.

8.7.1.4 Data compatible

If when starting with an empty device (e.g. after a factory reset) a non-empty card is found whose data are compatible with the device, the following message is displayed:

```
AS-I DATA FROM
CHIPCARD TAKEN
```

The card configuration is written to the device. From this time on all changes are made both in the device and on the chip card.

8.7.1.5 Data in the device and on the chip card identical

If the card and device are not empty at start and the data are identical, no message is displayed.

8.7.1.6 Data in the device and on the chip card not identical

If the card and device are not empty at start and the data are not identical, an error message is displayed and the card is not synchronized with the device. The following menu is then automatically opened:

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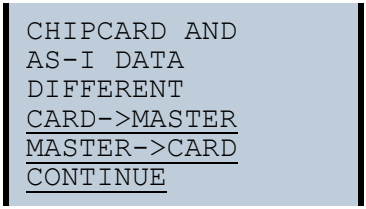


Command	Description
CHIP CARD>MASTER	Chip card data are copied to the master
MASTER->CHIPCARD	Master data are copied to the chip card
NEXT	No change to the data

The menu can be exited by pressing the ESC/Service key without changing the data.

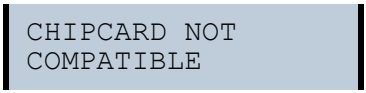
8.7.2 Safe data

This section describes the system behavior of the safe unit when using the chip card.

In general the safe part of the chip card has 4 memory banks (A…D). A bank is referred to as an active bank. Unless otherwise stated, the operations described in the following are always performed on the active bank.

8.7.2.1 Data incompatible

If a card with incompatible data is found, the following error message is output:



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8.7.2.2 Data compatible

If a card with an empty active memory bank is found, the safety configuration including code sequences is written to the card and in future all changes are made in the card and in the device at the same time. The following message is displayed on the device:

```
CHIPCARD FOUND.
SAFETY DATA WILL
BE SYNCHRONIZED
```

8.7.2.3 Complete configuration

If when starting with an empty device a card with a released safety configuration including code sequences is found (Complete safety configuration) in the active memory bank, this configuration is written to the device, then the menu for releasing using Release Code is opened:

```
COPY BANK A
TO MONITOR
RELEASE DATE:
2006/06/17 18:43
BY: ROLF BECKER
CONFIG NAME:
L3040 MIT LADEVO
RRICHTUNG LINKU
ND PALETTENWECHS
LER V1.23
RELEASE CODE: 1BDF
 - - - - - - - - -
- - - - - -
TYPE CODE
0000
OK
```

If the active bank contains a Complete Configuration and if the data in the active bank on the memory card and the data in the device are identical (e.g. both empty), in future all changes are made in the card and in the device at the same time.

8.7.2.4 Data on the chip card and in the device are identical

If the card and device are not empty at start and the data are identical, no message is displayed.

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8.7.2.5 Data not identical

If the active bank on the memory card and in the device are not empty at start and the data are not identical, the following message is displayed:

```
ERROR.
CHIPCARD AND
SAFETY DATA
DIFFERENT.
DELETE CHIPCARD
OR SAFETY DATA
```

The safety unit will not operate in this case. You must either clear the device or the active bank via menu.

8.7.2.6 Operating the chip card from the menu

The data on the chip card can, as described in section <SAFE CHIPCARD>, be exchanged between the Monitor and the chip card. Note however the following:

In order to store a configuration on the chip card as a master configuration (i.e. without code sequences), proceed as follows:

- Write the released configuration into the Monitor without code sequences.
- Copy the configuration into a memory bank using the menu.

For additional information, see section <CARD –>MONITOR (copy card data to the Monitor)>.

To convert a master configuration on the memory card to a Complete Configuration, this configuration must be overwritten by a Complete Configuration.

This is done as follows:

- Copy the card data to the Monitor.
- Teach the code sequences
- Write the data from the Monitor to the card.

8.7.3 Working with multiple memory banks

The chip card has four memory banks, each of which may contain a configuration (Complete or Master configuration). One of the banks is the active bank.

The AS-i 3.0 EtherNet/IP Gateway with integrated Safety Monitor always independently utilizes the active bank. Menu commands can however be used to copy the other memory banks to the AS-i Safety Monitor.

The corresponding memory bank thereby becomes the active bank.

If configurations from another memory bank are copied, a few safety rules need to be followed:

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Attention!

Safety advisory:

Ensure that the configuration intended for and released for the application is used!

This can be done by comparing the release codes on the display (See section <MONITOR CONFIG>):

- The safety representative who generated and validated the configuration stores the release code for the configuration (Complete or Master) stores the release code for the configuration and approves use of the configuration for specific equipment.
- The person performing the startup reads out the release code on the display before starting the equipment or before teaching the code sequences in the case of master configurations and compares it with the release code released for the equipment.

After the chip card has been used to load the configuration into the device, the safety functions of the device must be checked in the equipment.

Checking of the release code and testing the system must be documented in writing and is part of the system documentation.

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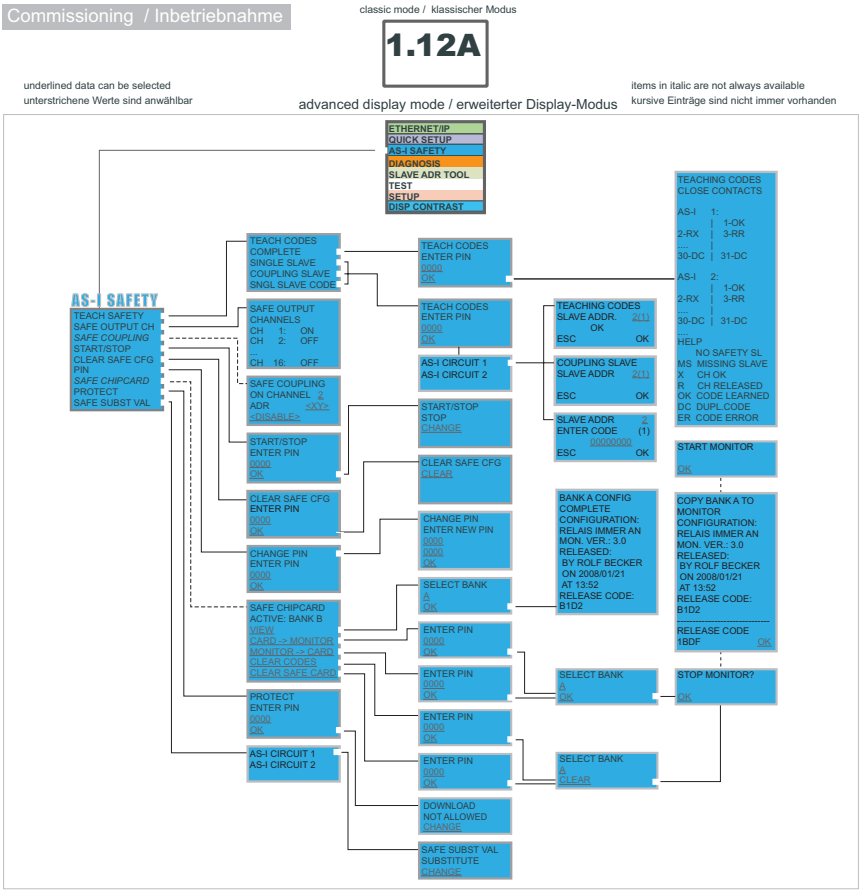
9. Operation in advanced display mode

Information!

From SETUP/LANGUAGE you can set the desired menu language (German, English, French, Italian or Spanish), see <Language (menu language)>.

9.1 Overview



Basic Operation
The device starts in the traditional mode. You can switch between the two modes with ESC or OK. In the advanced mode the cursor is moved by the arrow buttons. Pushing OK puts you to the superior menu (in the drawing one step to the right side). ESC puts you back to the previous menu. To edit data move with arrow buttons the marking to desired line first and then select the item with OK, change the data by using the arrow buttons and finally press OK button to accept the input. Pushing ESC cancels the editing.

Grundlegende Bedienungshinweise
Das Gerät startet im klassischen Modus. Mit ***ESC*** oder ***OK*** kann zwischen dem klassischen und dem erweiterten Modus gewechselt werden. Im erweiterten Modus wird der Cursor mit den Pfeil-Tasten bewegt. ***OK*** wechselt ins nächsthöhere Menü. ***ESC*** wechselt zurück ins vorherige Menü. Die zu editierenden Werte zunächst mit dem Cursor markieren, dann mit

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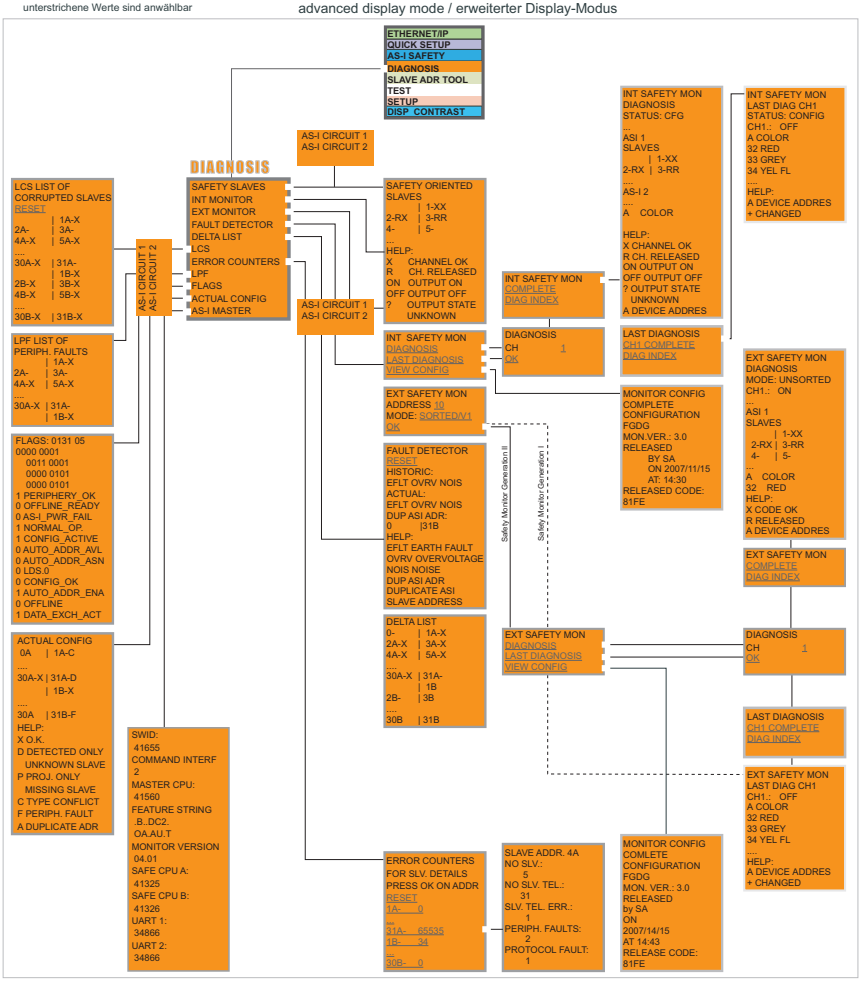
Commissioning / Inbetriebnahme

classic mode / klassischer Modus

1.12A

underlined data can be selected
unterstrichene Werte sind anwählbar

advanced display mode / erweiterter Display-Modus



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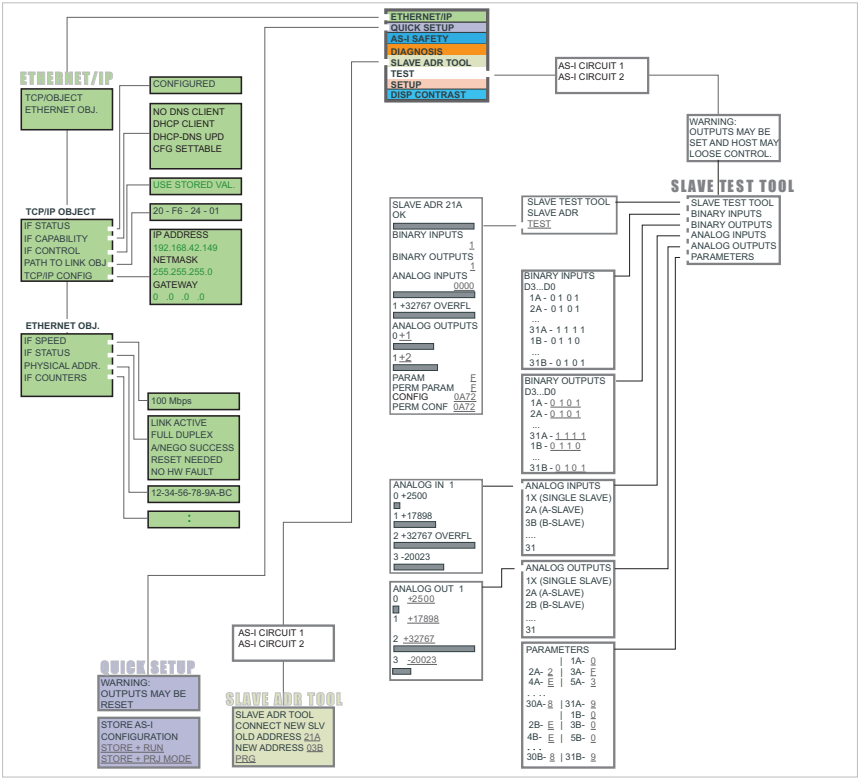
Commissioning / Inbetriebnahme

classic mode / klassischer Modus

1.12A

underlined data can be selected
unterstrichene Werte sind anwählbar

advanced display mode / erweiterter Display-Modus



Basic Operation
The device starts in the traditional mode. You can switch between the two modes with ESC or OK. In the advanced mode the cursor is moved by the arrow buttons. Pushing OK puts you to the superior menu (in the drawing one step to the right side). ESC puts you back to the previous menu. To edit data move with arrow buttons the marking to desired line first and then select the item with OK, change the data by using the arrow buttons and finally press OK button to accept the input. Pushing ESC cancels the editing.

Grundlegende Bedienungshinweise
Das Gerät startet im klassischen Modus. Mit ***ESC*** oder ***OK*** kann zwischen dem klassischen und dem erweiterten Modus gewechselt werden. Im erweiterten Modus wird der Cursor mit den Pfeil-Tasten bewegt. ***OK*** wechselt ins nächsthöhere Menü. ***ESC*** wechselt zurück ins vorherige Menü. Die zu editierenden Werte zunächst mit dem Cursor markieren, dann mit ***OK***

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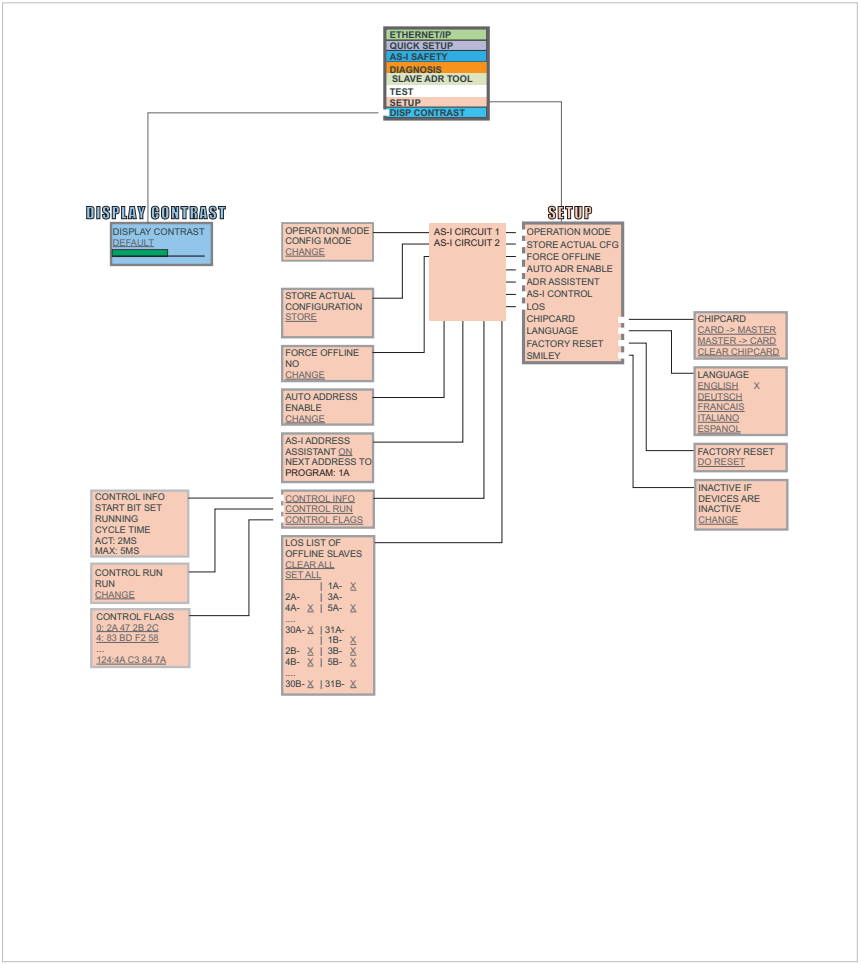
Commissioning / Inbetriebnahme

classic mode / klassischer Modus

1.12A

black/white marked data can be selected
schwarz/weiß markierte Werte sind anwählbar

advanced display mode / erweiterter Display-Modus



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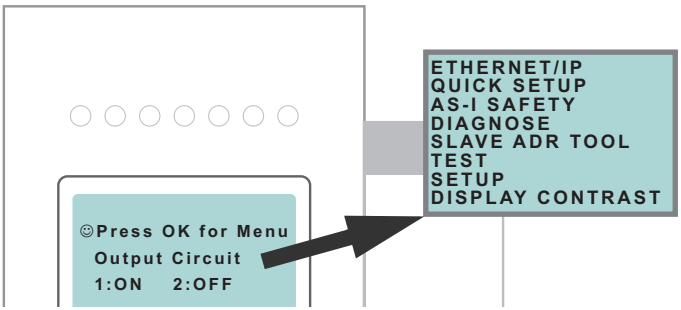
Warning!

Classical (Traditional) mode does not guarantee any protection of the settings of the device!

In the classical mode, it is possible to change settings while the device is in operation. This can lead to failures of the installation/process (for example changing the address of an AS-i slave).

9.2 Navigating through the advanced display mode



Information!

Some of the settings in the advanced mode are protected as long as the upstream fieldbus running. That means that some status information can be displayed only.

To protect the installation/process, many options such as "change address", "write parameter", "set outputs", etc. cannot be performed with an active connection to the control system (active fieldbus connection) . In order to execute these commands via the display, the connection to the control system must be deactivated first (no fieldbus connection).

The device starts up in the classical mode. Pressing the OK button switches to the advanced mode. To return to the classical mode, the ESC/service button must be pressed several times.

In the advanced mode, the selection menu can be moved up and down by using the two arrow buttons. Pressing OK switches to the selected function or to the displayed menu, respectively. Pressing ESC/service returns to the previous menu.

To edit a value it must be highlighted by using the selection bar and then pressing OK. The data can be changed by using the arrow-buttons. Changes are confirmed with OK. The ESC/service button cancels the editing process.

All possible slave addresses are displayed in sequence from 1 A to 31 A and from 1 B to 31 B. Data for single slaves are displayed along with the addresses 1 A to 31 A.

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9.3 ETHERNET/IP (main menu)

Main menu || **ETHERNET/IP** ||

```
TCP/IP OBJECT
ETHERNET OBJECT
```

This menu enables the following functions:

TCP/IP OBJECT:	TCP/IP object
ETHERNET OBJECT:	Ethernet object

9.3.1 TCP/IP Object

Main menu || ETHERNET/IP || **TCP/IP OBJECT** ||

```
IF STATUS
IF CAPABILITY
IF CONTROL
PATH TO LINK OBJ
TCP/IP CONFIG
```

This menu is equivalent to the Ethernet/IP TCP / IP Interface Object (Class code F5) and allows you to verify or change the configuration of the TCP / IP stack:

IF Status:	Attribut 1: Interface status
IF Capability:	Attribut 2: Interface capability flags
IF Control:	Attribut 3: Interface control flags
Path to Link Obj:	Attribut 4: Path to physical link object
TCP/IP Configuration:	Attribut 5: TCP/IP network interface configuration.

9.3.1.1 IF STATUS

Main menu || ETHERNET/IP || TCP/IP OBJECT || **IF STATUS** ||

```
IF STATUS
IF CAPABILITY
IF CONTROL
PATH TO LINK OBJ
TCP/IP CONFIG
```



```
CONFIGURED
```

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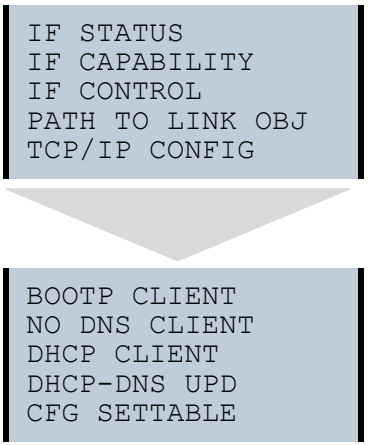
This submenu shows the configuration status.

9.3.1.2 IF CAPABILITY

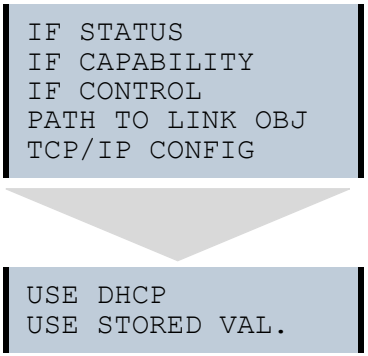
Main menu || ETHERNET/IP || TCP/IP OBJECT || **IF CAPABILITY** ||



This submenu shows which optional configuration of the TCP/IP stack in the controls are implemented.

9.3.1.3 IF CONTROL

Main menu || ETHERNET/IP || TCP/IP OBJECT || **IF CONTROL** ||



This submenu is used to control configuration options.

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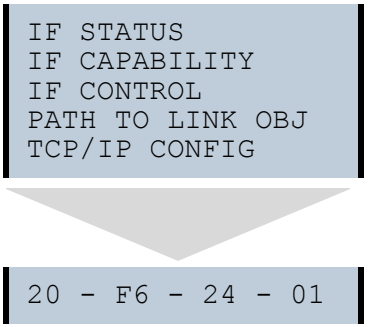
9.3.1.4 PATH TO LINK OBJECT

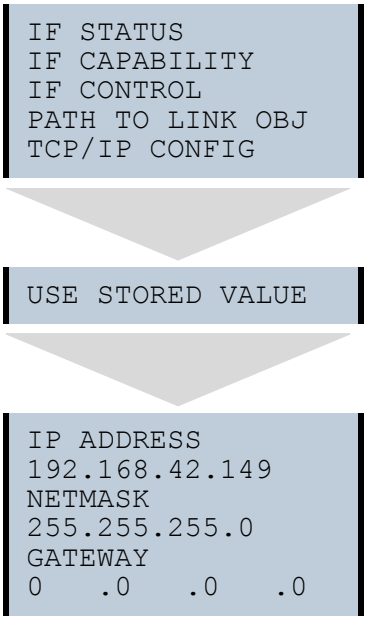
Main menu || ETHERNET/IP || TCP/IP OBJECT || **PATH TO LINK OBJ.** ||



This submenu shows connection path to ethernet object.

9.3.1.5 TCP/IP CONFIG

main menu || ETHERNET/IP || TCP/IP OBJECT || **TCP/IP CONFIG.** ||



This menu allows you to enter values for the TCP/IP configuration (IP address, net mask and gateway).

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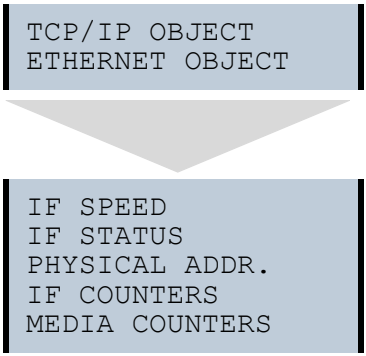
Information!

Restat the gateway to assume your changes.

9.3.2 ETHERNET OBJECT

Main menu || ETHERNET/IP || **ETHERNET OBJECT** ||



This menu corresponds to the EtherNet/IP Ethernet Link Object (Object code F6) and provides information on the following ethernet properties:

IF SPEED:	Attribute 1: Interface speed (displays the instantaneous data transmission speed)
IF STATUS:	Attribute 2: Interface flags (displays the connection status of the ethernet interface)
PHYSICAL ADDR.:	Attribute 3: physical address (displays the ethernet address)
IF COUNTERS:	Attribute 4: Interface counters (displays the ethernet packet counters)
MEDIA COUNTERS:	Attribute 5: Media-Specific counters (displays the status of ethernet specific counters)

Information!

Not all RFC1213 counters are implemented.

Information!

Not all RFC1642 counters are implemented.

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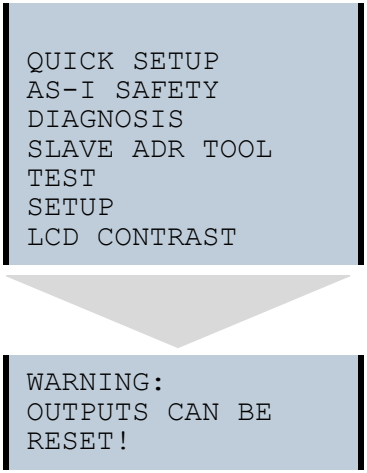
9.4 QUICK SETUP

Main menu || **QUICK SETUP** ||

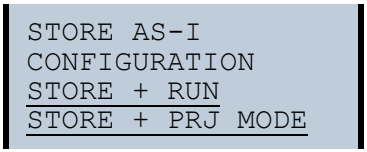
This menu enables a quick configuration of the AS-i network.



Warning!

Outputs can be reset!

Pressing "OK" switches the user to the sub menu "Store AS-i Configuration".



Store+Run

Pressing "OK" stores the detected configuration and the detected slaves on the AS-i network as the active configuration. The gateway then switches to the protected operating mode.

Store + Prj Mode

Pressing "OK" stores the detected configuration and the detected slaves on the AS-i network as the active configuration. The gateway remains in configuration mode.

Pressing "ESC" leaves this menu and switches back to the main menu.

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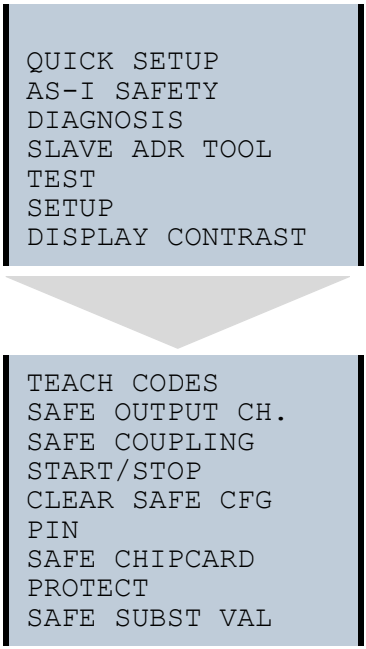
9.5 AS-I SAFETY

Main menu || AS-I SAFETY || **CODEFOLGEN** ||



This menu enables the following functions:

TEACH CODES:	Teaching the code sequences using the display
SAFE OUTPUT CH:	Display function for the status of the individual channels
SAFE COUPLING:	Generating safe coupling slaves on the second AS-i circuit (Optional Menu)[1]
START/STOP	Changing mode Safe operating mode / configuration mode
CLEAR SAFE CFG:	Deleting the safe configuration
PIN:	Changing the PIN number
SAFE CHIPCARD:	Chip card configuration
PROTECT:	Protecting the configuration on the chip card
SAFE SUBST VAL:	Activation/deactivation of the code substitute function for safe slaves

1. This function is only displayed if no coupling slaves were entered in the configuration.

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9.5.1 TEACH CODES

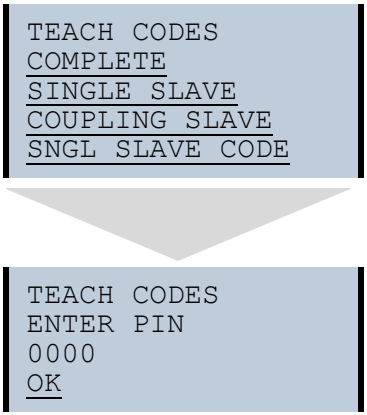
The TEACH CODES menu enables teaching of code sequences using the display.

9.5.1.1 TEACH CODES – COMPLETE

Main Menu || AS-I SAFETY || TEACH CODES || **TEACH CODES COMPLETE** ||

In the sub-menu TEACH CODES COMPLETE you teach the code tables for all included safety AS-i slaves.

First enter the PIN and confirm with OK.



If the PIN was correctly entered, the Monitor is stopped and the following information appears:

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```
TEACHING CODES
CLOSE CONTACTS

AS-I  1:
      |1-OK
2-RX  | 3-RR
....  |
30-DC |31-DC

AS-I  2:
      | 1-OK
2-RX  | 3-RR
....  |
30-DC |31-DC
....
HELP
   NO SAFETY SL
MS MISSING SLAVE
X  CH OK
R  CH RELEASED
OK CODE LEARNED
ER CODE ERROR
DC DUPL.CODE
```

Information!

If all safety AS-i slaves have been successfully taught, the first line in the display changes from TEACHING CODES to CODES LEARNED.

All safety contacts (also in sequence) must be closed for the safety unit to learn the code sequences. Incomplete code tables are not learned.

Press on ESC/Service to quit learning. It is then possible to restart the Monitor:

```
START MONITOR?


OK
```

Information!

See also <Procedure for configuring and teaching code sequences>.

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9.5.1.2 SINGLE SLAVE

Main Menü || AS-I SAFETY || TEACH CODES || **SINGLE SLAVE** ||

This menu point allows you to teach the code table for a safe slave. Proceed as follows:

- Use the arrow keys to navigate to the third line (0000) on the display
- Enter the PIN there
- Use the arrow keys to navigate to the fourth line (OK) on the display
- Confirm your entries with OK

```
TEACH CODES
ENTER PIN
0000
OK
```

In the following menu:

- Use the arrow keys to select the AS-i circuit (1/2)
- Confirm with OK

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

After selecting the AS-i circuit the safe unit switches to configuration mode.

In the following menu:

- Use the arrow keys to navigate to the second line (– –1) on the display

```
TEACH CODES
SLAVE ADDR.    --1
ESC           OK
...
HELP           ⇓
```

- Confirm with OK (display flashes)
- Use the arrow keys to enter the desired address
- Confirm with OK (display stops flashing)
- Use one of the two arrow keys to exit the input screen
- Save with OK, or cancel the process by pressing ESC.

Information!

Be sure that all slave contacts on the corresponding slave are closed.

The teaching procedure was successful if an OK appears in the third line.

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The grafical symbols indicate the state of the contacts:

Message	Description
RR	Both contacts open
RX	Left contact open, right contact closed.
XR	Right contact open, left contact closed.

Press the OK key to save the learned code table or press ESC to discard it.

9.5.1.3 COUPLING SLAVE

Main Menu || AS-I SAFETY || TEACH CODES || **COUPLING SLAVE** ||

This menu point allows you to teach the code table for a coupling slave. To continue, enter the PIN and confirm with OK.

```
TEACH CODES
ENTER PIN
0000
OK
```

In the following menu you select the AS-i circuit.

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

After selecting the AS-i circuit the safe unit switches to configuration mode.

Then enter the slave address.

```
COUPLING SLAVE
SLAVE ADDR.    --1

ESC
```

The teach procedure was successful if after approx. 2 s an OK appears in the display.

```
COUPLING SLAVE
SLAVE ADDR.    --1

ESC        [OK]
```

Save with OK, or cancel the process by pressing ESC.

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9.5.1.4 INPUT CODE SEQ.

Main Menu || AS-I SAFETY || TEACH CODES|| **INPUT CODE SEQ.** ||

This menu point allows you to directly enter the code sequence for a particular AS-i safety slave. If the slave address is already indicated, you can directly enter the sequence using the keys and then save or discard it.

To continue, enter the PIN and confirm with OK.

```
TEACH CODES
ENTER PIN
0000
OK
```

In the following menu you select the AS-i circuit.

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

After selecting the AS-i circuit the safe unit switches to configuration mode.

Then enter the code sequence.

```
SLAVE ADDR      --
ENTER CODE       1
   00000000
ESC             OK
```

If no error message is displayed, the teach procedure was successfully completed.

Use OK to save the entries and return to the previous menu. Use ESC to cancel the procedure.

9.5.2 SAFE OUTPUT CH (channels for the release circuits)

Main Menu || AS-I SAFETY || **SAFE OUTPUT CH** ||

```
SAFE OUTPUT
CHANNELS
CH 1:  ON
CH 2:  OFF
...
CH 16:  OFF
```

In this menu you can read off the status of the 16 release circuits.

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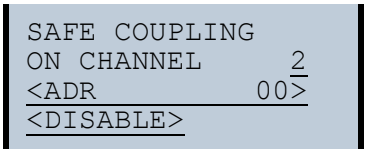
9.5.3 SAFE COUPLING (optional menu)

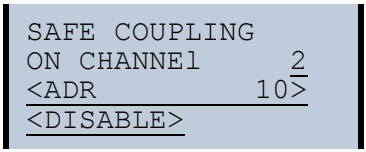
Main menu || AS-I SAFETY || **SAFE COUPLING** ||



Information!

This menu is only displayed if there are no coupling slaves in the configuration.

On the 2nd AS-i circuit up to two safe AS-i slaves (coupling slaves) can be created which represent the states of the first two release circuits.

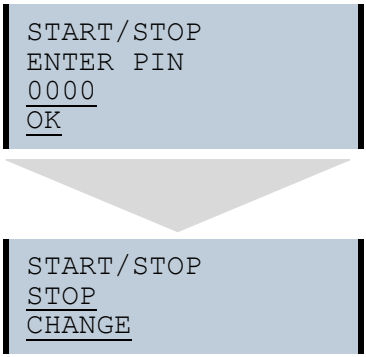


After entering the address (using the arrow keys) and confirming (with OK), the display changes from ENABLE to DISABLE. Selecting DISABLE sets the address to “00”.

For additional information refer to <Safe coupling slaves on the AS-i circuits>.

9.5.4 START/STOP (changing the Monitor mode)

Main Menu || AS-I SAFETY || **START/STOP** ||



In this menu you change the mode of the Monitor.

START:	Sets the Monitor to protecting operating mode
STOP:	Sets the Monitor to configuration mode

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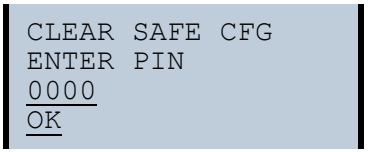
9.5.5 CLEAR SAFE CFG (delete safe configuration)

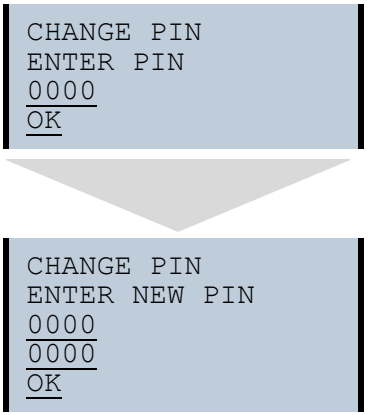
Main Menu|| AS-I SAFETY || **CLEAR SAFE CFG** ||



In the CLEAR SAFE CFG menu the stored safe information is deleted. This procedure is PIN protected.

9.5.6 PIN (changing the PIN)

Main Menu || AS-I SAFETY || PIN || CHANGE **PIN** ||



In this menu you change the PIN. This procedure is protected by entering the previous PIN.

Information!

The default setting for the PIN is “0000” and must not be changed.

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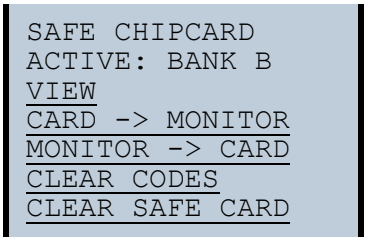
9.5.7 SAFE CHIPCARD

Main Menu || AS-I SAFETY || **SAFE CHIPCARD** ||



In this menu you can manage the safe area of the chip card.

ACTIVE: BANK X	Displays the active bank on the chip card.
VIEW:	Reads out the safety configuration of a chip card bank.
CARD->MONITOR:	Copies the configuration of a chip card bank to the Monitor.
MONITOR->CARD:	Copies the Monitor configuration to a chip card bank.
CLEAR CODES:	Deletes the safety configuration on the Monitor.
CLEAR SAFE CARD:	Deletes a safe memory bank on the chip card.

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9.5.7.1 VIEW BANK X CONFIG (view active bank)

Main Menu || AS-I SAFETY || SAFE CHIPCARD || VIEW || SELECT BANK || **BANK X CONFIG** ||

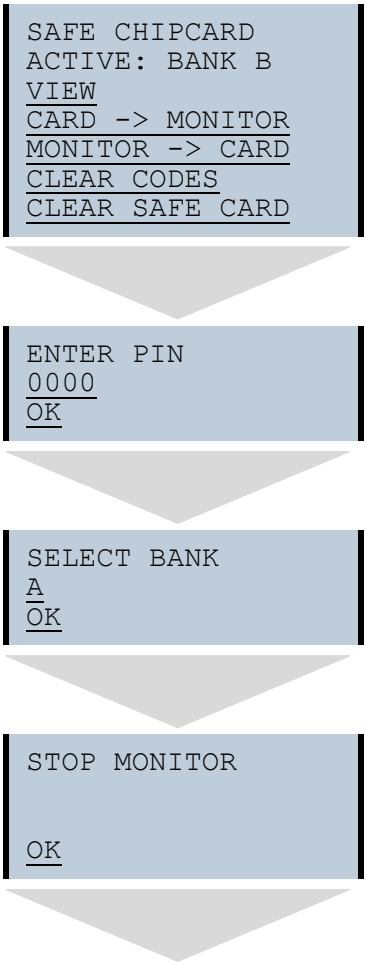
After selecting the desired memory bank and confirming with OK, the configuration is displayed.

For additional information refer to <Chip card>.

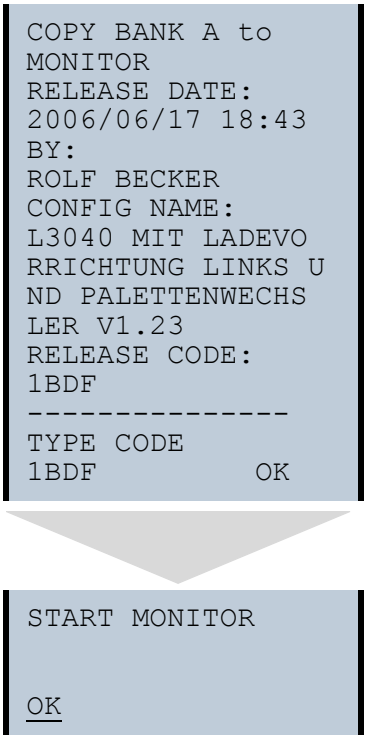
Issue date: 17.4.2009

9.5.7.2 CARD –>MONITOR (copy card data to the Monitor)

Main Menu || AS-I SAFETY || SAFE CHIP CARD || CARD -> MONITOR ||
ENTER PIN || SELECT BANK || **COPY BANK X -> MONITOR** ||



Issue date: 17.4.2009

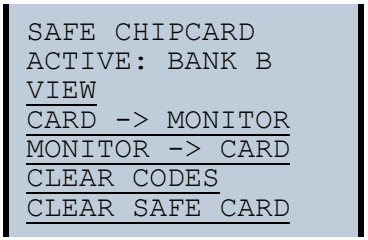


In this menu you send the safe configuration stored on the memory card to the EEPROM on the Monitor. Use the keys to set the release code and confirm with OK.

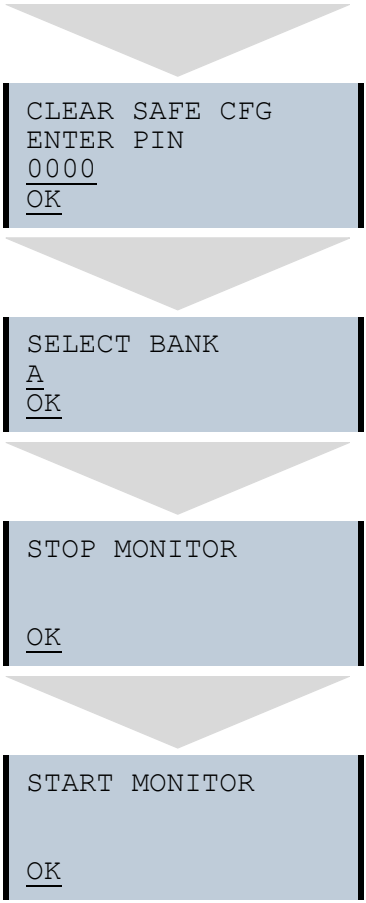
After a bank on the chip card has been written to, this bank is the active bank. To activate the new configuration, the Safety Monitor must be started.

9.5.7.3 MONITOR –>CARD (copy Monitor data to the chip card)

Main Menu || AS-I SAFETY || SAFE CHIPCARD || MONITOR -> CARD ||
ENTER PIN || SELECT BANK || **COPY X -> CARD** ||



Issue date: 17.4.2009

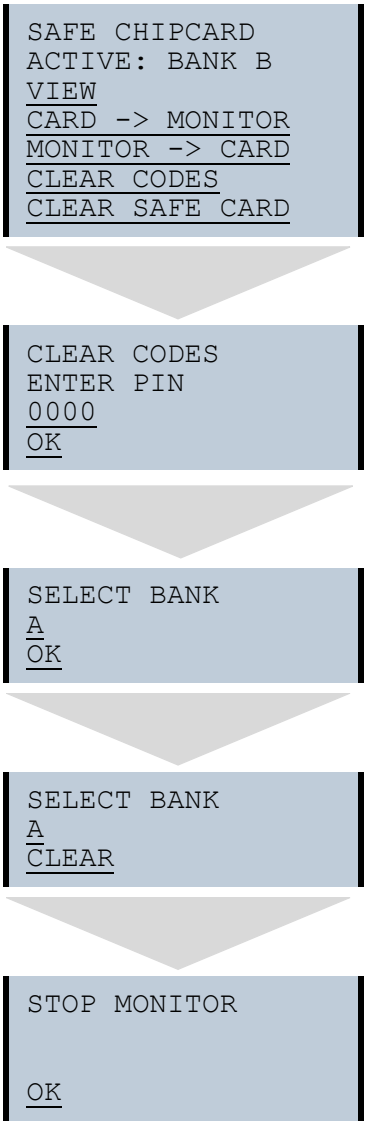


In this menu you sent the safe configuration from the EEPROM on the Monitor to the memory card. This procedure is PIN protected.

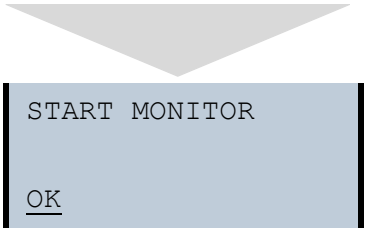
Issue date: 17.4.2009

9.5.7.4 CLEAR CODES (delete code sequences)

Main Menu || AS-I SAFETY || SAFE CHIPCARD || CLEAR CODES ||
ENTER PIN || SELECT BANK || **DELETE** ||



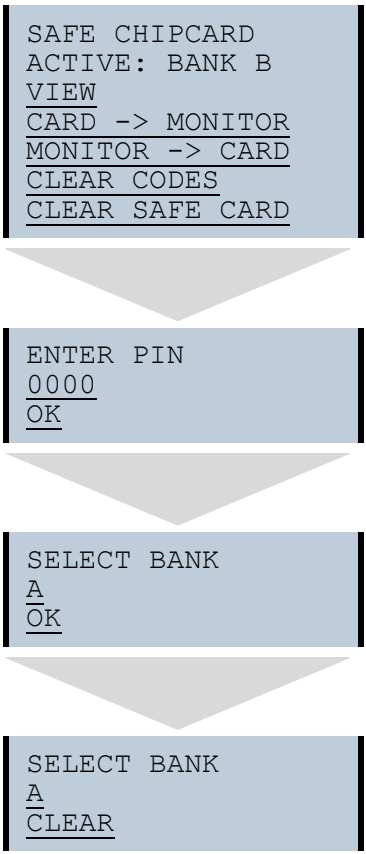
Issue date: 17.4.2009



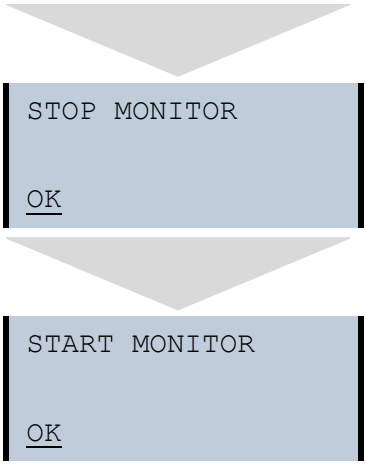
In this menu you delete the code sequences from the selected bank. This procedure is PIN protected.

9.5.7.5 CLEAR SAFE CARD

Main Menu || AS-I SAFETY || SAFE CHIPCARD || CLEAR SAFE CARD || ENTER PIN || SELECT BANK || **CLEAR** ||



Issue date: 17.4.2009



Using this menu you can delete the safe configuration from a chip card bank. This procedure is PIN protected.

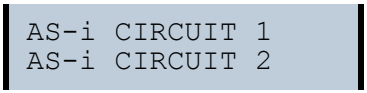
9.5.8 PROTECT (protect safe configuration)

Main Menu|| AS-I SAFETY || **PROTECT** ||

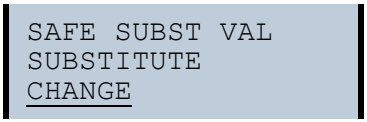
This function allows you to protect the safe configuration before downloading over the serial interface.

9.5.9 SAFETY SUBST VAL (Substitute values for input data from safe slaves)

Main menu || AS-I SAFETY || SAFETY SUBST VAL ||



When working with a double master (AS-i master and two AS-i circuits) the AS-i circuit must be selected first by using the arrow and the OK buttons.



Issue date: 17.4.2009

This function enables activation/deactivation of the code substitute function for safe slaves.

SUBSTITUTE (values)

The safety code sequences are replaced by the following values:

Both channels are in the safe state: 0000_{bin}

Channel 1 is in the safe state: 0011_{bin}

Channel 2 is in the safe state: 1100_{bin}

No channel is in the safe state: 1111_{bin}

NO SUBSTITUTE

The safety code sequences are transmitted via the input data.

9.6 DIAGNOSTICS

Main menu || **DIAGNOSIS** ||

```
SAFETY SLAVES
INT MONITOR
EXT MONITOR
FAULT DETECTOR
DELTA LIST
LCS
ERROR COUNTERS
LPF
FLAGS
ACTUAL CONFIG
AS-I MASTER
```

This menu contains the following sub-menus:

SAFETY SLAVES:	Safety input slaves
INT MONITOR:	Display the diagnosis data for the integrated Safety Monitor
EXT MONITOR:	Display the diagnosis data for the external Safety Monitors
FAULT DETECTOR:	Informations about the AS-i Fault Detector
DELTA LIST:	List of AS-i slaves with configuration error
LCS:	List of slaves having caused a configuration error
ERROR COUNTERS:	Fault counter for each single AS-i slave
LPF:	List of Peripheral Faults
FLAGS:	Display of the EC-Flags
ACTUAL CONFIG:	Display of the current configuration
AS-I MASTER:	Display of the software states

For additional information refer to chap. <Advanced Diagnostics for AS-i Masters>.

Issue date: 17.4.2009

9.6.1 AS-I CIRCUIT (Selecting the AS-i circuit)

Main Menu || DIAGNOSIS || SAFETY SLAVES || **AS-I CIRCUIT** ||

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

Please select the required AS-i circuit using the arrow buttons and the OK button. Than you get the diagnostic menu.

9.6.2 SAFETY SLAVES (safety oriented slaves)

Main Menu|| DIAGNOSIS || SAFETY SLAVES || **SAFETY ORIENTED SLAVES** ||

```
SAFETY ORIENTED
SLAVES
          | 1-XX
   2-XR   | 3-RR
   4-     | 5-
```

The list of “Safety Input Slaves” (“AS-i Safety at Work”) shows the slaves for which the safety function has been released.

The grafical symbols indicate the state of the contacts:

X: The channel is closed
R: The channel is open

The first place corresponds to Channel 2, the second place to Channel 1. Thus RX means that Channel 2 released and Channel 1 is OK.

The channels can not be evaluated individually, if the substitution of safety slaves input data was disabled in menu:

• command interface/ function profile

or

• slave value substitute (SAFETY SUBST VALUE).

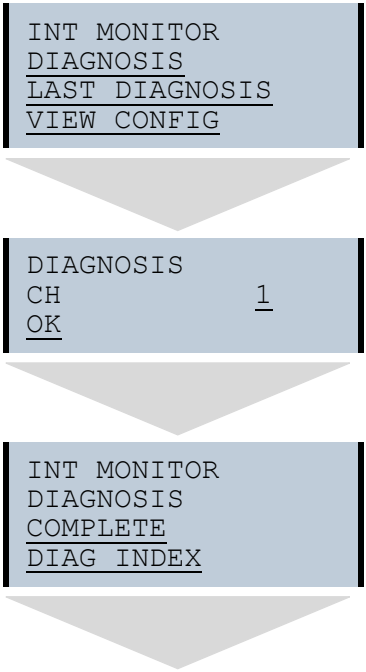
In this case both channels must have the same state, otherwise the indication will not be proper.

Issue date: 17.4.2009

9.6.3 INT MON (internal monitor)

9.6.3.1 DIAGNOSTICS (Diagnostics for the internal monitor)

Main menu || DIAGNOSIS || INT MONITOR || **DIAGNOSOSIS** ||



Issue date: 17.4.2009

```
INT SAFETY MON
DIAGNOSIS
CH 1.:    ON
...
ASI 1
SLAVES
      |  1-XX
2-RX  |  3-RR
4-    |  5-

....
A     COLOR
32    RED
....
HELP:
X CHANNEL OK
R CH. RELEASED
A DEVICE ADR.
```

This menu shows the status of the safety AS-i safe slaves and the diagnostics for the integrated Safety Monitor for each release circuit separately.

COMPLETE:	The complete diagnostic is read out.
DIAG INDEX:	The diagnostic is shown as it was configured under the "device_Index_Assignment" in ASIMON.

Information!

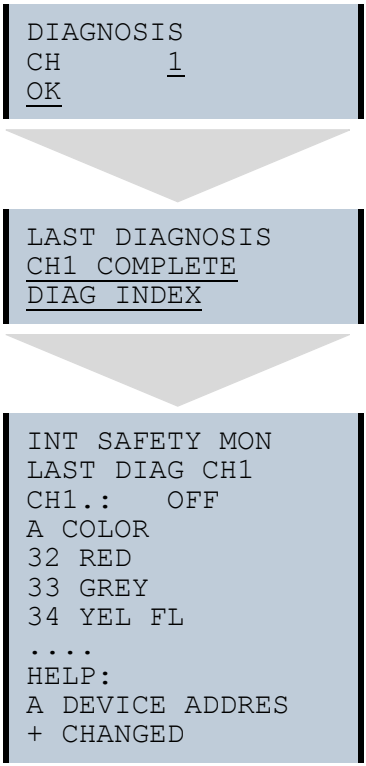
If the diagnosis is read using DIAG INDEX, the device count begins at 0, otherwise at 32!

9.6.3.2 LAST DIAGNOSIS (Last diagnostics for the int. monitor)

Main menu || DIAGNOSIS || INT MONITOR || **LAST DIAGNOSIS** ||

```
INT MONITOR
DIAGNOSIS
LAST DIAGNOSIS
VIEW CONFIG
```

Issue date: 17.4.2009



This menu displays the diagnosis at the time the Safety Monitor was deactivated.

Complete:	The complete diagnostic is read out.
DIAG INDEX:	The diagnostic is shown as it was configured under the "device_index_assignment" in ASIMON

For additional information, please refer to the <ASIMON> documentation.

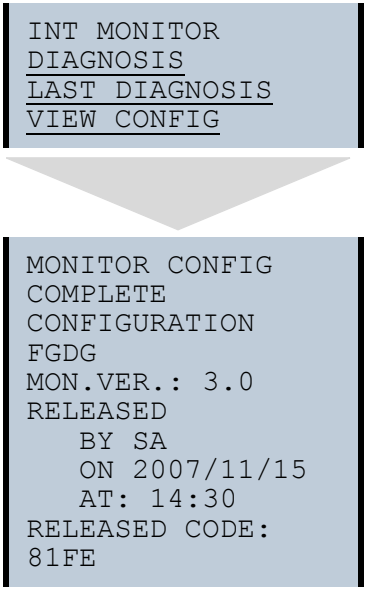
Information!

If the diagnosis is read using DIAG INDEX, the device count begins at 0, otherwise at 32!

Issue date: 17.4.2009

9.6.3.3 MONITOR CONFIG (configuration of the int. monitor)

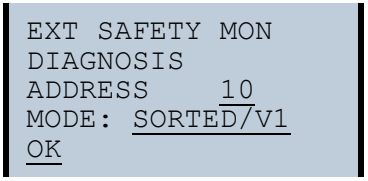
Main menu || DIAGNOSIS || INT MONITOR || VIEW CONFIG || **MONITOR CONFIG** ||



This menu indicates which configuration is loaded in the integrated Safety Monitor.

9.6.4 EXT SAFETY MON (external monitor)

Main menu || DIAGNOSIS || EXT MONITOR || **EXT SAFETY MON** ||



The AS-i Safety Monitor diagnostics reads the diagnostics data from the AS-i Safety Monitor and shows this diagnostics data in the display.

The menu item ADDRESS can be used to select the desired external monitor.

For additional information, please refer to the <ASIMON> documentation.

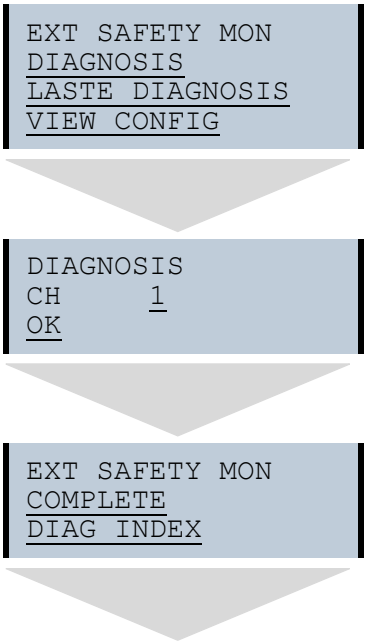
Generation 2 external monitors always have unsorted diagnostics.

Issue date: 17.4.2009

9.6.4.1 DIAGNOSE (Diagnosis for the external monitor)

Main menu || DIAGNOSIS || EXT MONITOR || EXT SAFETY MON || **DIAGNOSIS** ||

If the external Safety Monitor is a second generation version, this menu opens up.



Issue date: 17.4.2009

```
EXT SAFETY MON
DIAGNOSIS
MODE: UNSORTED
CH1.:   ON
...
ASI 1
SLAVES
         |  1-XX
   2-RX  |  3-RR
  4-     |  5-
...
A       COLOR
32      RED
HELP:
X CODE OK
R RELEASED
A DEVICE ADDRES
```

Just as with the internal Safety Monitor, here the current diagnostics and shut-down history can be read, see <INT MON (internal monitor)>.

9.6.4.2 LAST DIAGNOSIS (Last diagnostics for the external monitor)

Main menu || DIAGNOSIS || EXT MONITOR || **LAST DIAGNOSIS** ||

```
EXT SAFETY MON
DIAGNOSIS
LAST DIAGNOSIS
VIEW CONFIG
```

```
EXT SAFETY MON
CH1 COMPLETE
CH1 DIAG INDEX
CH2 COMPLETE
CH2 DIAG INDEX
```

Issue date: 17.4.2009

```
EXT SAFETY MON
LAST DIAG CH1
STATUS: OK
CH1.:   OFF
CH2.:   ON
A COLOR P
32 RED 01
33 GREY 01
34 YEL FL 01
....
HELP:
A DEVICE ADDR.
P DEVICE FROM
00 PREPROCES.
01 CIRCUIT1
10 CIRCUIT2
11 BOTH CIR.
+ CHANGED
```

This menu displays the diagnosis at the time the Safety Monitor was deactivated.

For additional information, please refer to the <ASIMON> documentation.

Information!

If the diagnosis is read using DIAG INDEX, the device count begins at 0, otherwise at 32!

Complete:	The complete diagnostic is read out.
DIAG INDEX:	The diagnostic is shown as it was configured under the "device_index_assignment" in ASIMON

9.6.4.3 ACTUAL CONFIG (Configuration for the external monitor)

Main menu || DIAGNOSIS || EXT MONITOR || VIEW CONFIG || **MONITOR CONFIG** ||

```
EXT MONITOR
LAST DIAGNOSIS
VIEW CONFIG
```

Issue date: 17.4.2009

```
MONITOR CONFIG
ASI ADDR: 10
SIM. SLAVES: 3
MON. VER.: 1.0
RELEASE DATE:
2006/06/17 18:43
BY:
ROLF BECKER
CONFIG NAME:
L3040 MIT LADEVO
RRICHTUNG LINK U
ND PALETTENWECHS
LER V1.23
RELEASE CODE:
1BDF
```

This menu indicates which configuration is loaded in the external Safety Monitor.

9.6.5 FAULT DETECTOR

Main menu || DIAGNOSIS || FAULT DETECTOR ||

```
FAULT DETECTOR
RESET
HISTORIC:
EFLT OVRV NOIS
ACTUAL:
EFLT OVRV NOIS
DUP ASI ADR:
  0       | 31B
HELP:
EFLT EARTH FAULT
OVRV OVERVOLTAGE
NOIS NOISE
DUP ASI ADDR
   DUPLICATE ASI
   SLAVE ADDRESS
```

The menu FAULT DETECTOR displays information about the AS-i fault detector and permits deleting the AS-i fault detector´s history. Furthermore, a list of abbreviations in clear text is displayed in the HELP section.

By selecting RESET the history of the AS-i fault detector can be deleted.

The section HISTORIC lists the error messages generated by the AS-i fault detector since the last RESET.

Issue date: 17.4.2009

The section ACTUAL lists the currently present error messages of the AS-i fault detector.

The following error messages are displayed:

- Duplicate address (displaying of 2 lowest slave addresses with duplicate addresses)
- Earth faults
- Noise
- Over-voltage

Optionally, the absence of the redundant 24 V for some single masters may be displayed.

9.6.6 DELTA LIST

Main menu || DIAGNOSIS || **DELTA LIST** ||

```
DELTA LIST
0-      |  1A-X
2A-X    |  3A-X
4A-X    |  5A-X
....
30A-X   | 31A-
        |  1B
2B-     | 3B
....
30B     | 31B
```

The Delta List is a list of AS-i slaves with configuration error.

9.6.7 LCS (History of the slaves which have triggered a configuration error)

Main menu || DIAGNOSIS || **LCS** ||

```
LCS LIST OF
CORRUPTED SLAVES
RESET
        |  1A-X
2A-     |  3A-
4A-X    |  5A-X
....
30A-X   | 31A-
        |  1B-X
2B-X    |  3B-X
4B-X    |  5B-X
....
30B-X   | 31B-X
```

Issue date: 17.4.2009

This list contains entries for all AS-i slaves that were responsible for at least one intermittent configuration error since the list was last read or since the AS-i master was turned on.

empty field:	no error
X:	AS-i Slave triggered a configuration error.

9.6.8 ERROR COUNTERS

Main Menu|| DIAGNOSIS || **ERROR COUNTERS** ||

```
ERROR COUNTERS
RESET
1A - 0
...
31A - 65535
 1B - 34
...
30B - 0
```

This list displays the fault counter for each single AS-i slave.

In addition, the number of voltage dropouts/undervoltage on AS-i (APF) is displayed.

Selecting RESET resets the fault counter to 0.

Selecting OK on a slave address displays a list with additional information:

```
SLAVE ADDR. 4A
NO SLV.:
       5
NO SLV. TEL.:
      31
SLV. TEL. ERR.:
       1
PERIPH. FAULTS:
       2
PROTOCOL FAULT:
       1
```

Information	error discription
NO SLV	frequency of slave failure
NO SLV. TEL	number of missing slave telegrams
SLV. TEL. ERR	number of slave telegram errors
PERIPH. FAULTS	number of peripheral faults
PROTOCOL FAULT	number of superior protocol faults (i.e. CTT2)

Issue date: 17.4.2009

9.6.9 LPF (List of Peripheral Faults)

Main menu|| DIAGNOSIS || **LPF LIST OF PERIPH. FAULTS** ||

```
LPF LIST OF
PERIPH. FAULTS
      |  1A-X
2A-   |  3A-
4A-X  |  5A-X
....
30A-X | 31A-
      |  1B-X
```

This list shows the list of slaves which have triggered peripheral faults (LPF).

Empty field:	Peripheral O.K.
X:	Peripheral fault

9.6.10 FLAGS

Main menu || DIAGNOSIS || **FLAGS** ||

```
FLAGS: 0131 05
       0000 0001
       0011 0001
       0000 0101
1   PERIPHERY_OK
0   OFFLINE_READY
0   AS-I_PWR_FAIL
1   NORMAL_OP.
1   CONFIG_ACTIVE
0   AUTO_ADDR_AVL
0   AUTO_ADDR_ASN
0   LDS.0
1   CONFIG_OK

1   AUTO_ADDR_ENA
0   OFFLINE
1   DATA_EXCH_ACT
```

This function displays the EC-flags in hexadecimal or binary format as well as single bits beginning with the least significant bit.

Arrangement of the bits within the byte:

Issue date: 17.4.2009

Byte								
Byte value:	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Bit:	7	6	5	4	3	2	1	0

Byte 1

Bit 0: Periphery_OK
This flag is set if none of the AS-i slave signals a peripheral fault.

Byte 2

Bit 7: Offline_Ready
The flag is set if the AS-i master is offline.

Bit 6: AS-i Pwr Fail
The flag is set if the AS-i circuit is not sufficiently powered.

Bit 5: Normal_Op.
The flag is set if the AS-i master is in normal operation.

Bit 4: Config_Active
The flag is set in configuration mode and is reset in protected mode.

Bit 3: Auto_Addr_Avl
The flag is set if the automatic addressing is possible. This means that exactly one slave has failed.

Bit 2: Auto_Addr_Asn
The flag is set if automatic addressing is possible (AUTO_ADDR_ENABLE = 1; no "incorrect" AS-i slave is connected to AS-i).

Bit 1: LDS.0
The flag is set,if an AS-i slave with address 0 has been detected.

Bit 0: Config_OK
The flag is set if the projected configuration is equal to the actual configuration.

Byte 3

Bit 0: Data_Exch_Act
If the flag "Data Exchange Active" is set, the data exchange with AS-i slaves is possible during the data exchange phase. If the bit is not set, the data exchange with AS-i slaves is inhibited. Instead of data telegrams READ_ID telegrams will be sent.
The bit is set by the AS-i master at the beginning of the offline phase.

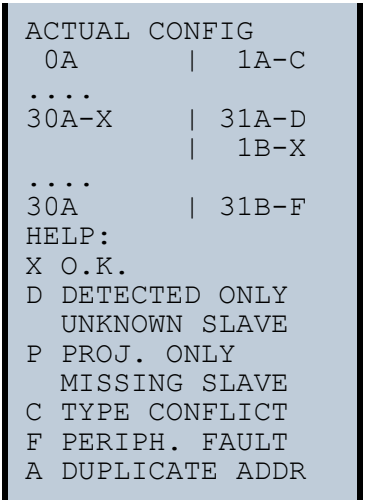
Bit 1: Offline
This bit is set if the operating mode is supposed to be changing to offline or is already offline.

Bit 2: Auto_Addr_Ena
This flag indicates if automatic addressing has been disabled (bit = 0) or enabled (bit = 1) by the user.

Issue date: 17.4.2009

9.6.11 ACTUAL CONFIG (actual slave configuration)

Main menu || DIAGNOSIS || **ACTUAL CONFIG** ||



This function displays the status of the actual configuration of the individual AS-i slaves.

A help appears at the end of the list explaining the abbreviations:

X (O.K.):	The configuration data for the detected AS-i slave agree with the designed in configuration data.
D (Detected Only):	An AS-i slave is detected at this address, but it was not designed in.
P (Projected Only):	An AS-i slave was designed in at this address, but it was not detected.
C (Type Conflict):	The configuration data for the detected AS-i slave do not agree with the designed in configuration data. The actual existing configuration of the connected AS-i slave is displayed.
F (Periph. Fault):	The AS-i slave has a peripheral error.
A (Duplicate Adr.):	Two AS-i slaves at the indicated address.

After selecting the desired AS-i slave address, the values for the current configuration data are displayed after the respective address in the following order:

- IO (I/O-Configuration)
- ID (ID-Configuration)
- xID1 (extended ID1)
- xID2 (extended ID2).

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```
0A - .... -

1A - 7A28 -C
WRONG TYPE
```

In addition, the status of the configuration is shown in plain text.

If no AS-i slave is present at an address and none is designed in, four decimal points are displayed instead of the configuration data.

9.6.12 AS-I MASTER (Info)

Main menu || DIAGNOSIS || **AS-I MASTER** ||

```
SWID:
 41655
COMMAND INTERF
 2
MASTER CPU:
 41560
FEATURE STRING
 .B..DC2.
 OA.AU.T
MONITOR VERSION
 04.01
SAFE CPU A:
 41325
SAFE CPU B:
 41326
UART 1:
 34866
UART 2:
 34866
```

This function shows information about the version and features of the AS-i master:

Information	Meaning
SWID	Software ID for the host prozessors
COMMAND INTERFACE	Revision of the command interface
MASTER CPU	Software ID of the master prozessor
FEATURE STRING	Feature string for the AS-i master
MONITOR VERSION	Monitor version
SAFE CPU A	Software ID for the Safe CPU A
SAFE CPU B	Software ID for the Safe CPU B

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Information	Meaning
UART 1	Software ID for the Safety UARTS 1
UART 2	Software ID for the Safety UARTS 2

9.7 SLAVE ADR TOOL

Main menu || **SLAVE ADR TOOL** ||

This function enables setting and changing the addresses of both new and already configured AS-i slaves. This function replaces the handheld AS-i address programming device.

Pressing the OK button continues with the actual test, ESC/SERVICE cancels the process.

```
SLAVE ADR TOOL
CONNECT NEW SLV
OLD ADDRESS
NEW ADDRESS
```

Now the new slave can be connected to the AS-i network. After connecting, the current address of the slave is displayed as OLD ADDRESS and the message CONNECT NEW SLV disappears.

To assign a new address to the slave the menu entry NEW ADDRESS must be selected. Afterwards the new address can be selected by using the arrow buttons. The selected address is assigned by selecting PRG on the menu and pressing the OK button.

```
SLAVE ADR TOOL
CONNECT
OLD ADDRESS  21A
NEW ADDRESS  03B
PRG
```

If an error occurs while addressing a slave, one of the following error messages is displayed for about 2 seconds:

Failed: SND:	Slave with old address has not been detected.
Failed: SD0:	Slave with address 0 already exists.
Failed: SD2:	Chosen slave address already exists.
Failed: DE:	AS-i slave address cannot be deleted.
Failed: SE:	Error setting new address for AS-i slave.
Failed: AT:	New address for AS-i slave could be stored temporarily only.
Failed: RE:	Error reading extended ID1-code.

Issue date: 17.4.2009

Information!

When working with a double master (AS-i master and two AS-i networks) the AS-i network must be selected first by using the arrow and the OK buttons.

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

9.8 TEST (Test tools for slaves)

Main menu || **TEST** ||

After selecting the menu TEST a warning message is displayed, pointing out, that it is possible during this test that outputs are set and that the host may loose control over the network.

```
WARNING:
OUTPUTS MAY BE
SET AND HOST MAY
LOOSE CONTROL.
```

Pressing the OK button continues with the actual test, ESC/SERVICE cancels the process.

```
SLAVE TEST TOOL
BINARY INPUTS
BINARY OUTPUTS
ANALOG INPUTS
ANALOG OUTPUTS
PARAMETERS
```

The menu TEST contains the following sub-menus:

SLAVE TEST TOOL:	Testing the selected slave
BINARY INPUTS:	State of the binary inputs
BINARY OUTPUTS:	State of the binary outputs
ANALOG INPUTS	State of the analog inputs
ANALOG OUTPUTS:	State of the analog outputs
PARAMETERS:	Value of the current AS-i parameter

9.8.1 AS-I CIRCUIT (Selecting the AS-i circuit)

Main Menu || **TEST** ||

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

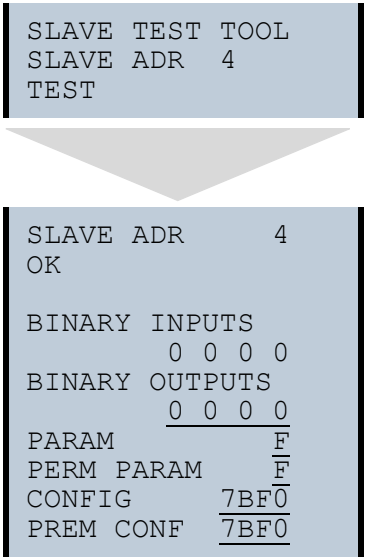
Issue date: 17.4.2009

Please select the required AS-i circuit using the arrow buttons and the OK button. Than you get the TEST menu.

The function is only available for AS-i masters with two AS-i circuits.

9.8.2 SLAVE TEST TOOL

Main menu || TEST || **SLAVE TEST TOOL** ||



This function is used to test an individual slave.

First, select the slave in the menu by entering the slave address. Confirm your choice pressing the menu item TEST and as a result perform testing the selected slave.

Having finisched the test, all relevant information about the slave are displayed. An "OK" below der slave address is displayed, if the test has been successful.

Following information are displayed (if the selected slave does not support a particular funtion, the corresponding fileds in the display will be missing):

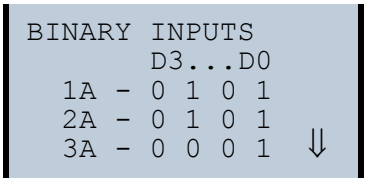
Address of the tested slave
Displaying of configuration errors (if existing)

BINARY IN:	digital inputs
BINARY OUT:	digital outputs
ANALOG IN:	analog inputs
ANALOG OUT:	analog outputs
PARAM:	current parameter
PROJ PARAM:	projected parameter
CONFIG:	current configuration
PRJ CONF:	projected configuration

Issue date: 17.4.2009

9.8.3 BINARY INPUTS

Main menu || TEST || **BINARY INPUTS** ||

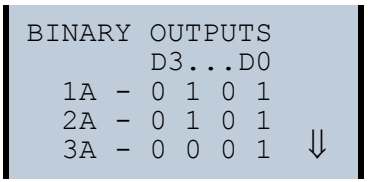


This function displays the state of the binary inputs for all AS-i slaves.

0: Input cleared
1: Input set

9.8.4 BINARY OUTPUTS

Main menu || TEST || **BINARY OUTPUTS** ||



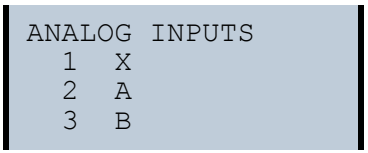
This function displays the state of the binary outputs for all AS-i slaves.

0: Output cleared
1: Output set

The binary outputs can be modified after selecting an AS-i slave.

9.8.5 ANALOG INPUTS

Main menu || TEST || ANALOG INPUTS ||



The slave types are characterized as follows:

X: Single Slave
A: A-Slave
B: B-Slave

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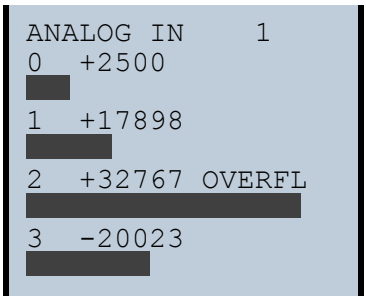
AB: A+B Slave
...

The data of the B slaves starts at channel 2!

The order in which information is displayed is as follows:

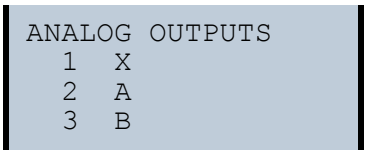
- AS-i slave address
- decimal 16-bit value
- bar graph

If the selected slave is a transparent slave, the value is always displayed without sign. If the selected slave is a transparent slave, the value is always displayed without sign. In this case, when the value is changed only positive values can be entered. Additionally, a value overflow is indicated by "Overfl".



9.8.6 ANALOG OUTPUTS

Main menu || TEST || ANALOG OUTPUTS ||



This function displays the values of the analog outputs for all AS-i slaves.

The order in which information is displayed is as follows:

- AS-i slave address
- decimal 16-bit value
- bar graph.

If the selected slave is a transparent slave, the value is always displayed without sign. If the selected slave is a transparent slave, the value is always displayed without sign. In this case, when the value is changed only positive values can be entered. Additionally, a value overflow is indicated by "Overfl".

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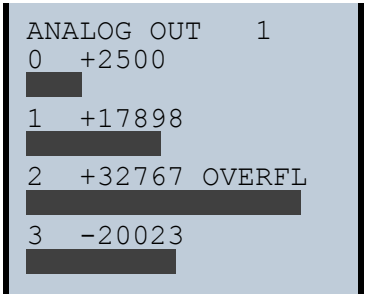
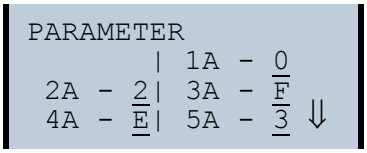


The analog outputs can be changed after selecting an AS-i slave.

9.8.7 PARAMETER

Main menu || **TEST** || PARAMETER ||

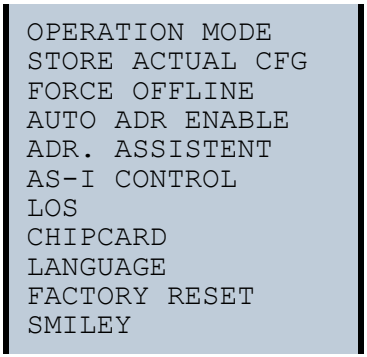


This function displays the hexadecimal value of the current AS-i parameters for all AS-i slaves.

The current AS-i parameters can be changed after selecting a slave address.

9.9 SETUP (configuration of the AS-i network)

Main menu || **SETUP** ||



In the "Setup menu", the following sub menus are available:

Issue date: 17.4.2009

OPERATION MODE:	operation mode of the AS-i master
STORE ACTUAL CFG:	store current configuration
FORCE OFFLINE:	switch AS-i Master to offline operation
AUTO ADR ENABLE:	enable automatic address
ADR. ASSISTENT:	AS-i address assistant
AS-I CONTROL:	status of the control program
LOS:	list of offline slaves
CHIPCARD:	chipcard
LANGUAGE:	select menu language
FACTORY RESET:	reset to factory settings

9.9.1 AS-I CIRCUIT

Main menu || **SETUP** ||

```
AS-i CIRCUIT 1
AS-i CIRCUIT 2
```

To start this setup menu, an AS-i circuit must first be selected using the arrow and the OK buttons.

The function is only available for AS-i masters with two AS-i circuits.

9.9.2 OPERATION MODE

Main menu || SETUP || OPERATION MODE ||

```
OPERATION MODE
CONFIG MODE
CHANGE
```

This function shows the current operation mode of the AS-i master:

PROTECTED MODE:	protected operating mode
CONFIG MODE:	configuration mode

The operation mode can be changed with "Change".

Parameters and configuration data can be modified in configuration mode, only.

9.9.3 STORE ACTUAL (store currently detected configuration)

Main menu || SETUP || STORE ACTUAL||

```
STORE ACTUAL
CONFIGURATION
STORE
```

This function can only be executed in configuration mode.

This function enables currently detected slaves on the selected AS-i network to be stored in the configuration of the AS-i Master.

Issue date: 17.4.2009

If "Store" was successful, the LED "Config error" is turned off. The configuration is stored and the configuration error has been eliminated.

However, if one of the connected slaves exhibits a peripheral fault, the LED "Config error" will flash.

If the AS-i master is in protected mode, the error message "Failed No Config Mode" will appear:

Address 0 is not a permitted operation address for a slave. If an AS-i slave with this address exists, storing the configuration will still be confirmed with "OK". However, the configuration error remains.

9.9.4 FORCE OFFLINE (Switch AS-i Master to offline operation)

Main menu || SETUP || **FORCE OFFLINE** ||

This function is used to change the address of a slave.

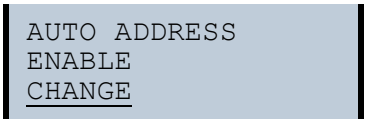
YES:	AS-i Master is offline.
NO:	AS-i Master is online.

With "Change", this status can be changed.

Switching the AS-i master to offline operation puts the AS-i network into the safe state. The AS-i master must be offline if an AS-i slave needs to be readdressed via the IR-interface.

9.9.5 AUTO ADDR ENABLE (enable automatic address)

Main menu || SETUP || **AUTO ADDRESS** ||



This function is used to enable or disable automatic single node address assignment. This mode can be:

Enable:	Automatic address assignment is released
Disable:	Automatic address assignment is locked

With "Change" the operation can be changed.

Issue date: 17.4.2009

9.9.6 AS-I ADDRESS (AS-i address assistant)

Main menu || SETUP || **AS-I ADDRESS** ||

```
AS-I ADDRESS
ASSISTANT    ON
NEXT ADDRESS TO
PROGRAM 1A
```

The AS-i address assistant assists the user to quickly set up an AS-i network. Once the AS-i configuration has been stored, a new AS-i slave with address 0 can be used to assign the correct address.

Selecting "Assistant on" or "Assistant off" switches the AS-i address assistant on or off. The current state of the AS-i address assistant is displayed:

ASSISTANT ON:	AS-i address assistant is switched on.
ASSISTANT OFF:	AS-i address assistant is switched off.

Procedure:

1. Store AS-i configuration in the device. This can easily be done by using the Windows software AS-i Control Tools (Master | Store configuration for the AS-i Master ...), or directly in the advanced display mode.
2. All AS-i slaves have to be addressed to 0 or to the desired address. The slaves must be disconnected from the AS-i network.
3. Start the AS-i address assistant.
4. Now the AS-i slaves are connected to the AS-i network one at the time in the order specified by the AS-i address assistant. The last line displayed for the AS-i address assistant shows which AS-i slave will be connected next.

9.9.7 AS-I CONTROL (Optional)

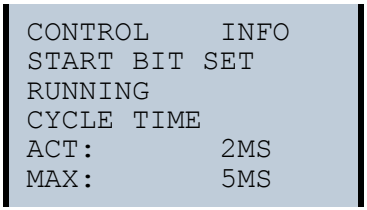
Main menu || SETUP || **AS-I CONTROL** ||

```
CONTROL   INFO
CONTROL   RUN
CONTROL   FLAGS
```

Issue date: 17.4.2009

9.9.7.1 CONTROL INFO (Status of the control program)

Main menu || SETUP || AS-I CONTROL || **CONTROL INFO** ||

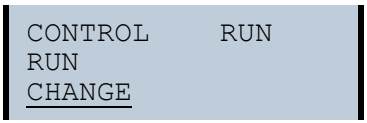


This function displays the current status of the AS-i control (control program).

START BIT SET:	The control program has been started.
START BIT RESET:	The control program has been stopped.
RUNNING:	The control program is running.
STOPPED:	The control program has stopped. If, for instances, a configuration error occurs or if the master is in the configuration mode, the control program can be stopped even if the start bit is set.
CYCLE TIME ACT:	Current cycle time of the control program.
CYCLE TIME MAX:	Maximum cycle time of the control program since its last start.

9.9.7.2 CONTROL RUN (start or stop the control program)

Main menu || SETUP || AS-I CONTROL || **CONTROL RUN** ||



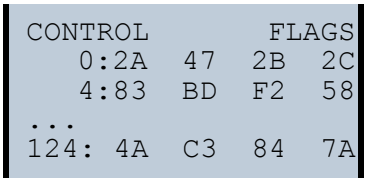
This function is used to start or stop the control program. It modifies the START BIT in the Control Info menu.

RUN:	The control program has been started. The control program can be stopped even if the start bit is set, for example if a configuration error occurred or if the master is in configuration mode.
STOP:	The control program has been stopped.
CHANGE:	Change the state between RUN and and STOP.

Issue date: 17.4.2009

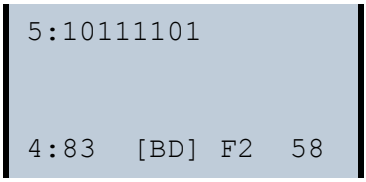
9.9.7.3 CONTROL FLAGS (control program flag memory)

Main menu || SETUP || AS-I CONTROL || **CONTROL FLAGS** ||



This function is used to read and modify the control program's flag memory.

- First, a row needs to be selected using the soft keys.
- Pressing OK displays the selected row.

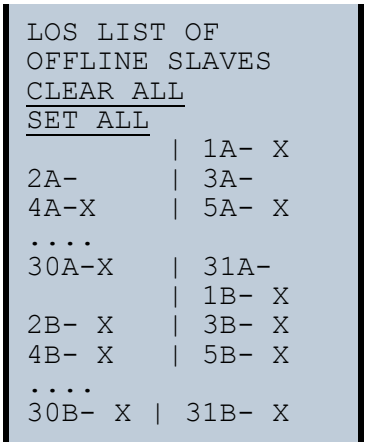


After pressing OK, the display mode changes and it is now possible to select individual flags using the soft keys. The selected flag is then displayed in binary format at the top row.

- Pressing OK again enables editing the selected binary value.

9.9.8 LOS (list of offline slaves)

Main menu || SETUP || LOS LIST OF OFFLINE SLAVES ||



Issue date: 17.4.2009

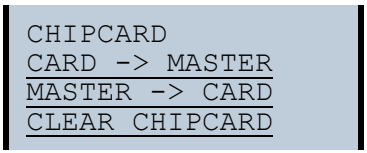
See also <Advanced Diagnostics for AS-i Masters>.

By using "Clear all" and "Set all" all bits in this list can be delete or set, respectively, at the same time. Below this is a list of all slaves that can be selected individually in order to set or delete the LOS bit.

Empty field:	LOS bit deleted
X:	LOS bit set

9.9.9 CHIPCARD

Main menu || SETUP || **CHIPCARD** ||



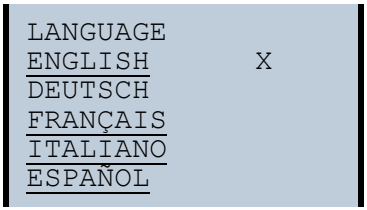
This function is used to send unsafe AS-i data between the master and chip card. In addition, the unsafe section of the chip card can be deleted.

CHIPCARD->MASTER:	Chip card data are copied to the Monitor
MASTER->CHIPCARD:	Monitor data are copied to the chip card
CLEAR CHIPCARD:	Chip card data are cleared

For additional information refer to chap. <Chip card>.

9.9.10 Language (menu language)

Main Menu || SETUP || **LANGUAGE** ||



From this menu you can select the menu language. „X“ marks the currently selected language.

9.9.11 FACTORY RESET (factory default settings)

Main Menu || SETUP || FACTORY RESET ||

Issue date: 17.4.2009

This function can be used to reset the master to the factory default settings. The “Reset” is done by selecting menu point DO RESET.

Warning!

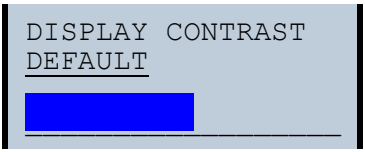
This function should be used only in emergencies, since all previously set attributes are set back to the factory setting and ,thus, secure communication and operation of the masters with the AS-i network is no longer guaranteed.

Master and AS-i network have to be reconfigured after a successful "Reset".

For double masters the "Reset" acts on both AS-i masters!

9.10 DISPLAY CONTRAST (set display contrast)

Main Menu || **DISPLAY CONTRAST** ||



This function allows you to set the display contrast.

- Use the arrow keys to select the line with the bar
- Confirm your selection with OK (bar flashes)
- Use the arrow keys to set the display contrast
- Use OK to apply the setting

The factory settings are invoked from the DEFAULT field.

If the contrast is set so that the display can no longer be read, it can be reset to the factory default setting as follows:

- Shut the unit off
- Press the MODE and SET keys and hold them down.
- Shut the unit on.

Issue date: 17.4.2009

10. Advanced Diagnostics for AS-i Masters

The advanced AS-i diagnostics is intended to localize occasionally occurring configuration errors and to determine the quality of data transmission on AS-i without using additional diagnostics tools.

AS-i Control Tools, a MS-Windows software designed to simplify AS-i installation and used to program AS-i Control, enables operation of the advanced diagnostics functions (LCS, error counters, and LOS).

10.1 List of corrupted AS-i Slaves (LCS)

The LCS contains the information from the Delta list. In addition to the list of configured slaves (LPS), the list of detected slaves (LDS), and the list of activated slaves (LAS), the AS-i master creates a fourth list, the list of corrupted slaves (LCS) containing advanced diagnostics data used to diagnose the causes for intermittently occurring configuration errors on AS-i. This list contains entries for all AS-i slaves that were responsible for at least one intermittent configuration error since the list was last read or since the AS-i master was turned on. Furthermore, intermittent AS-i power failures are listed in the LCS at the position of AS-i slave with address 0.

Information!

Whenever the LCS is read it is deleted from memory.

Information!

The last intermittent configuration error can also be displayed on the AS-i master:

Pressing the "Set" button on the AS-i master initiates the display of the AS-i slave responsible for the last intermittent configuration error. If a intermittent AS-i power failure occurred, the display shows 39 after pressing the "Set" button.

This function is only available if the device is in normal operating mode of the protected mode (display empty) or in the off-line phase (Display: "40").

10.2 Protocol analysis: Counters for corrupted data telegrams

The AS-i master with advanced diagnostics provides a counter for telegram repetitions for each AS-i slave. The counter counts up every time a corrupted data telegram has been found, making it possible to determine the quality of the transmission if only a few telegrams are corrupt and the AS-i slave never caused a configuration error.

Information!

The counter values are read via the host interface and will be deleted after they were read.

The highest possible counter value is 254. 255 indicates a counter overflow.

Displaying the protocol analysis is possible through the AS-i Control Tools software by using the command "Master | AS-i Diagnostics".

Issue date: 17.4.2009

10.3 Offline Phase for Configuration Errors

The AS-i masters with advanced diagnostics offer the possibility to set themselves into the offline phase when a configuration error occurs and thus are able to transition the AS-i network into a safe operational state. This ensures a quick reaction to a configuration error and the host can be relieved from this task. If any problems occur on the AS-i network, the AS-i masters can independently switch the AS-interface into a safe state.

There are two different ways to parameterize the AS-i master for this feature:

- Any configuration error occurring on AS-i switches the master from regular operation in protected mode into the offline phase.
- o . A list with the addresses of slaves that can potential initiate the off-line phase is defined (list of offline slaves LOS).

The user can decide how the system should react to a configuration error on AS-i. Thus, the AS-i master can be set to the offline phase for critical AS-i slaves, whereas for less critical slaves only the error message is sent to the host, but AS-i is still running.

Like the advanced diagnostics, the parameterization "offline phase on configuration error" is also supported by "AS-i-Control-Tools"
(Command | Characteristics | Offline because of configuration error).

There are two options to reset the error message "OFFLINE BY LOS:

1. Deleting the complete LOS list on the affected AS-i network ("CLEAR ALL").
2. Power reset on the affected AS-i network.

Attention!

If a power reset occurs on the AS-i network 1 the complete double gateway will be shut down.

10.4 Functions of the AS-i Fault Detector

10.4.1 Duplicate address detection

If two slaves on an AS-i network have the same address, a duplicate address exists. Since the master cannot communicate individually with these slaves any longer, this is considered an error. Because the two slave replies interfere, it is impossible for the master to recognize the slave responses. This results in extremely unstable network behavior.

The duplicate address detection function is used to safely recognize a duplicate address and to display it on the screen and in AS-i Control Tools.

A duplicate address causes a configuration error and is displayed on the screen.

Information!

Duplicate addresses can be recognized only on an AS-i segment directly connected to the master.

Issue date: 17.4.2009

10.4.2 Earth/Ground Fault Detector

An Earth/Ground Fault exists when the voltage $\mathbf{U_{GND}}$ (Nominal value of U_{GND}=0,5 $U_{AS\text{-}i}$.) is outside of the following range:

$$\mathbf{10\%\ U_{AS\text{-}i} \leq U_{GND} \leq 90\%\ U_{AS\text{-}i}}$$

This error substantially limits the noise immunity of the AS-i communication.

Ground faults are indicated on the master´s display as well as in AS-i Control Tools.

Information!

A ground fault in one of the two networks of a double master in a version 1 power supply for two AS-i networks causes a ground fault in the other network as well because of the the existing galvanic connection.

Information!

To recognize ground faults the master must be grounded with its machine ground connection.

10.4.3 Noise Detector

The noise detector detects AC voltages on AS-i, that are not initiated by an AS-i master or AS-i slaves. These interference voltages can cause telegram disturbances.

A frequent cause are insufficiently shielded frequency inverters or improperly routed cables.

Noises is indicated on the master´s display as well as in AS-i Control Tools.

10.4.4 Over-voltage Detector

Over-voltages are present if the conductors of an AS-i network that normally are routed electrically symmetrical with respect to machine ground, are strongly electrically raised. A cause can for example be startup procedures of large consumers.

However, over-voltages do generally not interfere with the AS-i communication, but can under certain circumstances cause incorrect sensor signals.

Over-voltages are indicated on the master´s display as well as in the AS-i Control Tools.

Issue date: 17.4.2009

11. EtherNet/IP interface

11.1 Objekt modelling

The attributes of bus participants are mapped into objects in the CIP family (DeviceNet, ControlNet and EtherNet/IP) bus systems.

In addition to for all EtherNet/IP devices common objects, there are six objects in the AS-i gateways to access the data of the AS-i network:

- Identity
- Assembly
- AS-i master
- AS-i slave
- I/O data
- Advanced diagnostics

Class code	Object name	Number of instances
0x01	Identity	1
0x02	Message router	1
0x04	Assembly	72 (double master) 24 (single master)
0x06	Connection manager	1
0x64	AS-i master	1 for each AS-i circuit
0x65	AS-i slave	64 for each AS-i circuit
0x66	E/A data	1 for each AS-i circuit
0x67	Advanced diagnosics	1 for each AS-i circuit
0x68	Short command interface	1
0x69	Long command interface	1
0x6A	Safety Control Status internal Monitor	1
0x6B	Safety Control Status external Monitor	1 for each AS-i circuit

Tab. 11-6.

Issue date: 17.4.2009

11.1.1 Identity object

Class code: 1 (0x01)
number of instanzes: 1
instance attributes

Attribute ID	Access Rule	Name	Value
1	get	vendor	645
2	get	device type	12
3	get	product code	2267 (single master) 2273 (double master)
4	get	revision	1.1
5	get	status	see overwiev listed below
6	get	serial number	unique number, 32-bit
7	get	product name	AS-i EnIP GW+Safety Monitor 3.0

Tab. 11-7.

Common services

Service Code	Class	Instance	Service name
0x05	no	yes	code 1 (class + instance)
0x10	yes	yes	get attributes all
0x0E	yes	yes	get attributes all

Tab. 11-8.

Issue date: 17.4.2009

11.1.2 Assembly Object

Class code 4 (0x04)
number of instances: 72

The Assembly Object bandles data from the application objects.

The Assembly Object Instances consist of (in case of a double master):

- A-slaves and/or single slaves from circuit 1
- single, A- and B-slaves (all slaves) from circuit 1
- A-slaves and/or single slaves from both circuits
- single, A- and B-slaves (all slaves) from both circuits
- No 16-bit data
- 16-bit data from slaves 29…31 from circuit 1
- 16-bit data from slaves 29…31 from both circuits
- No command interface
- Short command interface
- Long command interface

Attribute ID	Access Rule	Name	Data value
3		Data item(s)	

Instances 100 (0x64)…135 (0x87) can only be read, while instances 136 (0x88)…171 (0xAB) can be read and written.

Warning!

Don't use "Change of State" for Assembly, if you have slaves with fast input change!

Information!

The are only instances 100 (0x64)…105 (0x69) and 109 (0x6D)…114 (0x72) in case of a single master.

Assembly instance			Data item		
Input	Output	Size (byte)	Digital	Analog	Command interface
100 (0x64)	136 (0x88)	16	AS-i circuit 1, single- and A-Slaves		
101 (0x65)	137 (0x89)	28	AS-i circuit 1, single- and A-Slaves		short
102 (0x66)	138 (0x8A)	54	AS-i circuit 1, single- and A-Slaves		long
103 (0x67)	139 (0x8B)	40	AS-i circuit 1, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	
104 (0x68)	140 (0x8C)	52	AS-i circuit 1, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	short

Tab. 11-9.

Issue date: 17.4.2009

Assembly instance			Data item		
Input	**Output**	**Size (byte)**	**Digital**	**Analog**	**Command inter-face**
105 (0x69)	141 (0x8D)	78	AS-i circuit 1, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	long
106 (0x6A)	142 (0x8E)	64	AS-i circuit 1, single- and A-Slaves	AS-i circuits 1+2, analog slaves 29 .. 31	
107 (0x6B)	143 (0x8F)	76	AS-i circuit 1, single- and A-Slaves	AS-i circuitsAS-i circuits 1+2, analog slaves 29 .. 31	short
108 (0x6C)	144 (0x90)	102	AS-i circuit 1, single- and A-Slaves	AS-i circuits 1+2, analog slaves 29 .. 31	long
109 (0x6D)	145 (0x91)	32	AS-i circuit 1, all slaves		
110 (0x6E)	146 (0x92)	44	AS-i circuit 1, all slaves		short
111 (0x6F)	147 (0x93)	70	AS-i circuit 1, all slaves		long
112 (0x70)	148 (0x94)	56	AS-i circuit 1, all slaves	AS-i circuit 1, analog slaves 29 .. 31	
113 (0x71)	149 (0x95)	68	AS-i circuit 1, all slaves	AS-i circuit 1, analog slaves 29 .. 31	short
114 (0x72)	150 (0x96)	94	AS-i circuit 1, all slaves	AS-i circuit 1, analog slaves 29 .. 31	long
115 (0x73)	151 (0x97)	80	AS-i circuit 1, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	
116 (0x74)	152 (0x98)	92	AS-i circuit 1, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	short
117 (0x75)	153 (0x99)	118	AS-i circuit 1, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	long
118 (0x76)	154 (0x9A)	32	AS-i circuits 1+2, single- and A-Slaves		
119 (0x77)	155 (0x9B)	44	AS-i circuits 1+2, single- and A-Slaves		short
120 (0x78)	156 (0x9C)	70	AS-i circuits 1+2, single- and A-Slaves		long
121 (0x79)	157 (0x9D)	56	AS-i circuits 1+2, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	
122 (0x7A)	158 (0x9E)	68	AS-i circuits 1+2, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	short
123 (0x7B)	159 (0x9F)	94	AS-i circuits 1+2, single- and A-Slaves	AS-i circuit 1, analog slaves 29 .. 31	long
124 (0x7C)	160 (0xA0)	80	AS-i circuits 1+2, single- and A-Slaves	AS-i circuits 1+2, analog slaves 29 .. 31	
125 (0x7D)	161 (0xA1)	92	AS-i circuits 1+2, single- and A-Slaves	AS-i circuits 1+2, analog slaves 29 .. 31	short
126 (0x7E)	162 (0xA2)	118	AS-i circuits 1+2, single- and A-Slaves	AS-i circuits 1+2, analog slaves 29 .. 31	long
127 (0x7F)	163 (0xA3)	64	AS-i circuits 1+2, all slaves		
128 (0x80)	164 (0xA4)	76	AS-i circuits 1+2, all slaves		short

Tab. 11-9.

Issue date: 17.4.2009

Assembly instance			Data item		
Input	**Output**	**Size (byte)**	**Digital**	**Analog**	**Command interface**
129 (0x81)	165 (0xA5)	102	AS-i circuits 1+2, all slaves		long
130 (0x82)	166 (0xA6)	88	AS-i circuits 1+2, all slaves	AS-i circuit 1, analog slaves 29 .. 31	
131 (0x83)	167 (0xA7)	100	AS-i circuits 1+2, all slaves	AS-i circuit 1, analog slaves 29 .. 31	short
132 (0x84)	168 (0xA8)	126	AS-i circuits 1+2, all slaves	AS-i circuit 1, analog slaves 29 .. 31	long
133 (0x85)	169 (0xA9)	112	AS-i circuits 1+2, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	
134 (0x86)	170 (0xAA)	124	AS-i circuits 1+2, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	short
135 (0x87)	171 (0xAB)	150	AS-i circuits 1+2, all slaves	AS-i circuits 1+2, analog slaves 29 .. 31	long

Tab. 11-9.

Issue date: 17.4.2009

11.1.3 AS-i Master Object

Class code: 100 (0x64)
1 instance for each AS-i circuit

Attribute ID	Access rule	Name	DeviceNet data type	Default data value
100 (0x64)	get	ec-flags	UINT (16-bit)	
101 (0x65)	get/set	hi-flags	USINT	
102 (0x66)	get/set	operational mode	BOOL	
103 (0x67)	get	LDS	ULINT	
104 (0x68)	get/set	LPS	ULINT	
105 (0x69)	get	LAS	ULINT	
106 (0x6A)	get	LPF	ULINT	
107 (0x6B)	get/set	Store_Actual_Configuration	BOOL	
108 (0x6C)	get/set	Store_Actual_Parameters	BOOL	
109 (0x6D)	get/set	Change_Slave_Adress	UINT	
110 (0x6E)	get/set	Lock push-buttons	BOOL	

Tab. 11-10.

EC-flags (16-bit)

EC-flags (16-bit)															
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}
DA	NSE	OV	EF	–	–	–	Pok	OR	APF	NA	CA	AAv	AAs	S0	Cok

Tab. 11-11.

Pok:	Periphery_Ok
S0:	LDS.0
AAs:	Auto_Address_Assign
AAv:	Auto_Address_Available
CA:	Configuration_Active
NA:	Normal_Operation_Active
APF:	APF
OR:	Offline_Ready
Cok:	Config_Ok
EF:	Earth falut
OV:	Overvoltage
NSE	Noise
DA:	Double address

Issue date: 17.4.2009

Hi-flags (8-bit)

Hi-flags (8-bit)		
2^2	2^1	2^0
AAe	OL	DX

Tab. 11-12.

AAe: Auto_Address_Enable
OL: Off-line
DX: Data_Exchange_Active

Operational mode (8-bit):

1: configuration mode
0: protected mode

LDS, LAS, LPS, LPF (64-bit)

LDS, LAS, LPS, LPF (64-bit)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
7	31B	30B	29B	28B	27B	26B	25B	24B

Tab. 11-13.

Store actual parameter/store actual configuration/lock push-buttons

True: proceed the action

Change slave address (16-bit)								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	–		B	source address				
1	–		B	target address				

Tab. 11-14.

Meaning of the bit B

B = 0: Single AS-i slave or A-slave
B = 1: B-slave

Issue date: 17.4.2009

11.1.4 AS-i slave Object

Class Code: 101 (0x65)
64 instances for each AS-i circuit, 1 for each AS-i slave

Instance ID	AS-i slave
1	slave 0, circuit 1
2	slave 1A, circuit 1
…	…
32	slave 31A circuit 1
33	empty, circuit 1
34	slave 1B, circuit
…	…
64	slave 31B, circuit 1
65	slave 0, circuit 2
…	…
96	slave 31A, circuit 2
97	empty, circuit 2
…	…
98	slave 1B, circuit 2
…	…
128	slave 31B, circuit 2

Tab. 11-15.

Attribute ID	Access Rule	Name	DeviceNet Data Type	Remark
100	get	actual configuration	UINT	
101	get/set	permanent configuration	UINT	slave 0, 32: not read-/ writeable
102	get/set	actual parameters	USINT	
103	get/set	permanent parameters	USINT	
104	get/set	xID1	USINT	slave 0: writeable only, slave 0 - 32: readable

Tab. 11-16.

Issue date: 17.4.2009

Actual configuration/permanent configuration (16-bit):

Actual configuration/permanent configuration															
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}
ID				IO				xID2				XID1			

Tab. 11-17.

Parameter xID1 (8-bit)							
2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
–				data			

Tab. 11-18.

11.1.5 I/O Data Object

Class code: 102 (0x66)
Input and output data
1 instance for each AS-i circuit

Attribute ID	**Access rule**	**Name**	**DeviceNet data type**	**Default data value**
100	get	input data image, single and A-slaves	ARRAY[16] of USINT	
101	get	input data image, B-slaves	ARRAY[16] of USINT	
102	get/set	output data image single and A-slaves	ARRAY[16] of USINT	
103	get/set	output data image, B-slaves	ARRAY[16] of USINT	
104	get	16-bit input data slave 1	ARRAY[4] of INT	
…	…	…	…	o
134	get	16-bit input data slave 31	ARRAY[4] of INT	
135	get/set	16-bit output data slave 1	ARRAY[4] of INT	
…	…	…	…	o
165	get/set	16-bit output data slave 31	ARRAY[4] of INT	

Tab. 11-19.

Issue date: 17.4.2009

Input and Output Data Image:

Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	flags				slave 1/1A			
	F3	F2	F1	F0	D3	D2	D1	D0
1	slave 2/2A				slave 3/3A			
2	slave 4/4A				slave 5/5A			
3	slave 6/6A				slave 7/7A			
4	slave 8/8A				slave 9/9A			
5	slave 10/10A				slave 11/11A			
6	slave 12/12A				slave 13/13A			
7	slave 14/14A				slave 15/15A			
8	slave 16/16A				slave 17/17A			
9	slave 18/18A				slave 19/19A			
10	slave 20/20A				slave 21/21A			
11	slave 22/22A				slave 23/23A			
12	slave 24/24A				slave 25/25A			
13	slave 26/26A				slave 27/27A			
14	slave 28/28A				slave 29/29A			
15	slave 30/30A				slave 31/31A			
16	reserved				slave 1B			
17	slave 2B				slave 3B			
18	slave 4B				slave 5B			
19	slave 6B				slave 7B			
20	slave 8B				slave 9B			
21	slave 10B				slave 11B			
22	slave 12B				slave 13B			
23	slave 14B				slave 15B			
24	slave 16B				slave 17B			
25	slave 18B				slave 19B			
26	slave 20B				slave 21B			
27	slave 22B				slave 23B			
28	slave 24B				slave 25B			
29	slave 26B				slave 27B			
30	slave 28B				slave 29B			
31	slave 30B				slave 31B			

Flags		
	Input data	**Output data**
F0	ConfigError	Off-line
F1	APF	LOS-master-bit

Tab. 11-20.

Issue date: 17.4.2009

Flags		
F2	PeripheryFault	→ ConfigurationMode
F3	ConfigurationActive	→ ProtectedMode

Tab. 11-20.

ConfigError:	0=ConfigOK	1=ConfigError
APF:	0=AS-i-Power OK	1=AS-i-Power Fail
PeripheryFault:	0=PeripheryOK	1=PeripheryFault
ConfigurationActive:	0=ConfigurationActive	1=ConfigurationInactive
Off-Line:	0=On-Line	1=Off-Line
LOS-master-bit	0=Off-Line by ConfigError deactivated	1=Off-Line by ConfigError activated.

16-bit value

16-bit value															
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}
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

16-bit data

Information!

A-slaves map the data on channels 1 and 2.

B-slaves map the data on channels 3 and 4.

In addition to the access via the command interfaces, the 16-bit data for or by the slaves with 16-bit value can by exchanged cyclically (profile 7.3., S-7.4, S-6.0, S-7.5, S-7.A.8, S-7.A.9, S-7.A.A). Competing writing access attemps on 16-bit output data will not be blocked by every other. If 16-bit output data for a particular slave are being transmitted both cyclically and acyclically with the command interface, the acyclically transmitted values will be overwritten by the cyclically transmitted values.

AS-i 16-bit data can be transmitted in a reserved data area. Therefore accessing 16-bit data is as easy as accessing digital data.

16-bit data								
Byte	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
1	slave 31 channel 1, low byte							
2	slave 31, channel 1, high byte							
3	slave 31, channel 2, low byte							
4	slave 31, channel 2, high byte							
5	slave 31 channel 3/slave 31B, channel 1, low byte							
6	slave 31 channel 3/slave 31B, channel 1, high byte							

Tab. 11-21.

Issue date: 17.4.2009

16-bit data								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
7	slave 31 channel 3/slave 31B, channel 2, low byte							
8	slave 31 channel 3/slave 31B, channel 2, high byte							
…	…							
n-7	slave 31-n/8, channel 1, low byte							
n-6	slave 31-n/8, channel 1, high byte							
n-5	slave 31-n/8, channel 2, low byte							
n-4	slave 31-n/8, channel 2, high byte							
n-3	slave 31-n/8, channel 3/slave 31-n/8 B, channel 1, low byte							
n-2	slave 31-n/8, channel 3/slave 31-n/8 B, channel 1, high byte							
n-1	slave 31-n/8, channel 4/slave 31-n/8 B, channel 2, low byte							
n	slave 31-n/8, channel 4/slave 31-n/8 B, channel 2, high byte							

Tab. 11-21.

Issue date: 17.4.2009

11.1.6 Advanced Diagnostics Object

Class Code: 103 (0x67)
1 instance for each AS-i circuit

Attribute ID	Access rule	Name	DeviceNet data type	Default data value
100 (0x64)	Get/Set	LOS (List of offline slaves)	ULINT	
101 (0x65)	Get	error counter A	ARRAY[32] of USINT	
102 (0x66)	Get	error counter B	ARRAY[32] of USINT	

Tab. 11-22.

Error counter:

Single- and A slaves	
Index	error counter
1	slave 1/1A
2	slave 2/2A
3	slave 3/3A
…	…
31	slave 31/31A

Tab. 11-23.

B slaves	
Index	error counter
1	slave 1B
2	slave 2B
3	slave 3B
…	…
31	slave 31B

Tab. 11-24.

Issue date: 17.4.2009

11.1.7 Short Command Interface Object

Class Code: 104 (0x68)
1 instance

Attribute ID	Access Rule	Name	DeviceNet data type	Default data value
100 (0x64)	get/set	content command toggle-bit and as-i circuit data	ARRAY[12] of USINT [0] [1] [2 … 11]	

Tab. 11-25.

11.1.8 Long Command Interface Object

Class Code: 105 (0x69)
1 instance

Attribute ID	Access rule	Name	DeviceNet data type	Default data value
100 (0x64)	get/set	content command toggle-bit and as-i circuit data	ARRAY[38] of USINT [0] [1] [2 … 37]	

Tab. 11-26.

For special details acc. the command interface commands see the separat manual.

11.1.9 Safety Control Status Internal Monitor

Class Code: 106 (0x6A)
1 instance

Attribute ID	Access rule	Name	DeviceNet data type	Default data value
100 (0x64)	get	safety status relais circuit 1 safety status relais circuit 2 … safety status relais circuit 16	ARRAY[16] of USINT [0] [1] [2 … 14 [15]	
101 (0x65)	get/set	safety control	USINT	

Tab. 11-27.

Issue date: 17.4.2009

Coding of status bytes

Bit [0 ... 3]	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	reserved
Bit [6]	status or color
0	no device flashing yellow
1	at least one device flashing yellow
Bit [7]	status or color
0	no device flashing red
1	at least one device flashing red

Tab. 11-28.

Safety control

Byte	description
1	byte from the EtherNet/IP
	bit 0: 1.Y1
	bit 1: 1.Y2
	bit 2: 2.Y1
	bit 3: 2.Y2
	bit 4 ... 7: reserved

Tab. 11-29.

Issue date: 17.4.2009

11.1.10 Safety Control Status External Monitor

Class Code: 107 (0x6B)
1 instance per AS-i circuit

Attribute ID	Access rule	Name	DeviceNet data type	Default data value
100 (0x64)	get	slave 1: safety status relais circuit 1 safety status relais circuit 2 … safety status relais circuit 8	ARRAY[8] of USINT [0] [1] [2 … 6] [7]	
…	…	…	…	…
130 (0x82)	get	slave 31: safety status relais circuit 1 safety status relais circuit 2 … safety status relais circuit 8	ARRAY[8] of USINT [0] [1] [2 … 6] [7]	
131 (0x83)	get/set	safety control slave 1	USINT	
…	…	…	…	…
161 (0xA1)	get/set	safety control slave 31	USINT	

Tab. 11-30.

Coding of status bytes

Bit [0 ... 3]	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	reserved
Bit [6]	status or color
0	no device flashing yellow
1	at least one device flashing yellow

Tab. 11-31.

Issue date: 17.4.2009

Coding of status bytes

Bit [7]	status or color
0	no device flashing red
1	at least one device flashing red

Tab. 11-31.

Safety control

Byte	description
1	byte from the EtherNet/IP
	bit 0: 1.Y1
	bit 1: 1.Y2
	bit 2: 2.Y1
	bit 3: 2.Y2
	bit 4 ... 7: reserved

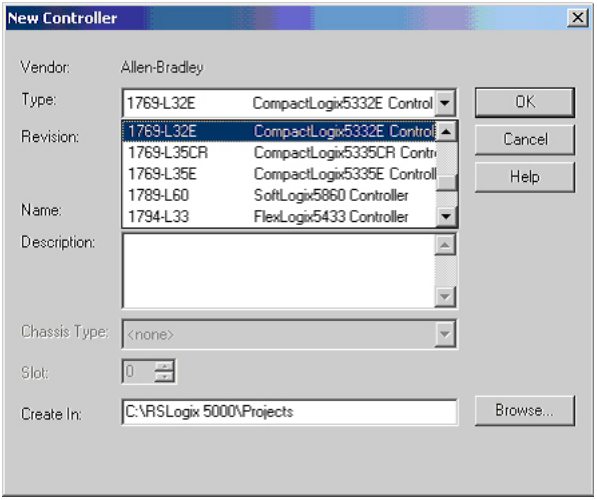
Tab. 11-32.

Issue date: 17.4.2009

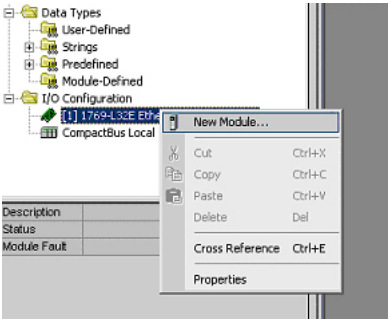
12. Appendix: the first commissioning with CompactLogix

This chapter shows exemplarily the start-up of the AS i 3.0 EtherNet/IP Gateways with the software RSLogix 5000 CompactLogix, version 13.00.

- ☐ Start the software RSLogix 5000.
- ☐ Select *New* from the menu *File*.
- ☐ Now select your controller, register its name and confirm with *OK*.



- ☐ Click in the tree view control window with the right mouse button on your controller
- ☐ Click in the PopUp window with the left mouse button on *New Module*.



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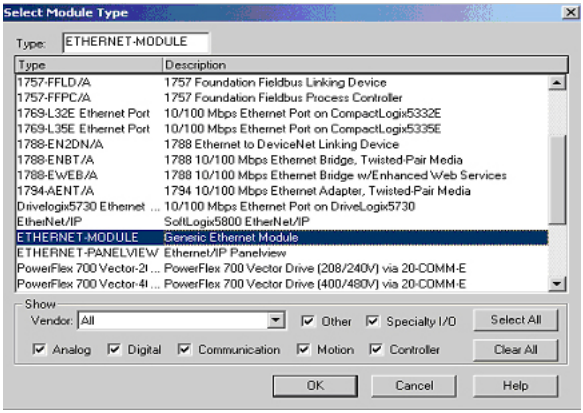
☐ Select the entry *Generic Ethernet Module* and confirm with *OK*.



☐ Now register all necessary characteristics of the module:

- Controller name
- Comm. format
- IP-Address
- Connection parameters
- Assembly Instance - Input/Output
- Assembly Instance - Configuration
  (Register here a number between 1…255)
- Assembly Instance - Size

Assembly Instances

A so-called Assembly Object specifies the structure of objects for the data communication. The data (e.g.: I/O data) can be combined into blocks with the Assembly Object Data and sent over only one communication link.

Thus less access to the network are necessary.

It is differentiated between Input Assemblies and Output Assemblies:

-Input Assembly reads application data over the net and/or produces data on the network.

-Output Assembly writes data on the application and/or prozesses data of the network.

In this example the *Input Instance* **114** and the *Output Instance* **150** is used (92 bytes for in and output data).

Issue date: 17.4.2009

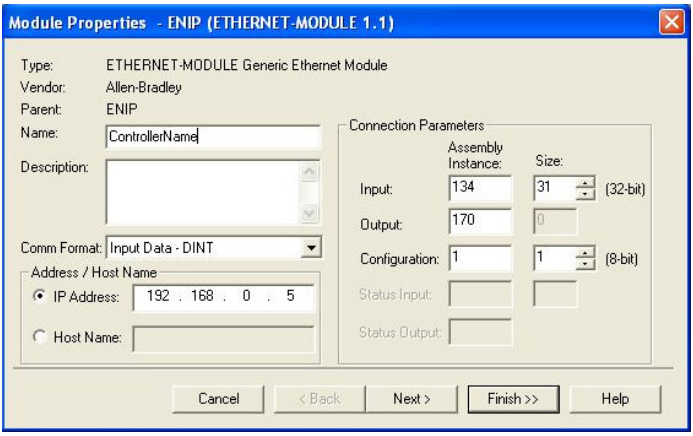
Allocation of the data

32 bytes for digital data (A/B slaves)

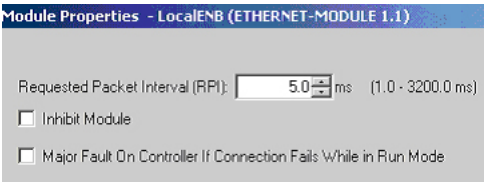
24 bytes for analog data (slave address 29 .. 31)

36 bytes für command interface

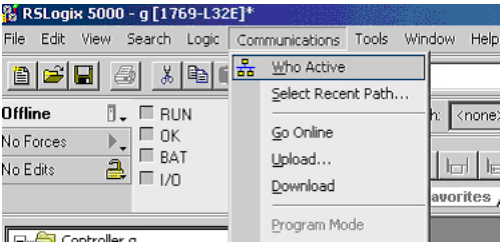
- Register here minimum "1"!



- Click the button *Next*
- Please enter in the data field *Request Packet Interval* (RPI) a time (≥ 5 ms).
- Please click on the *Finish* button.



- Now you can begin programming.
- For the first downloading of the software the transmission path must be indicated. Select for this purpose from the menu *Communications* the entry: *Who Active*.



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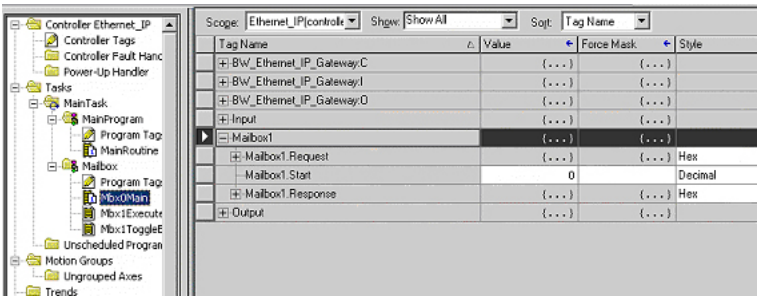
- With a double click on the pictogram *Processor* you can begin with the download.

12.1 Working with sample files

-
- Please start the software RSLogix 5000.
- Please open the file "F01_Module.ACD". This sample file contains a program that shows you, how to use the command interface (mailbox).
- If it is needed, please adjust your controller and the ip of your gateway.
- Please look at the description of the controller tags, where you can find the tag *Mailbox1*.



Here you can edit the command interface instructions. You can find an appropriate description in the *Mbx0Main* routine in the *Mailbox*.

Further sample files:

F02_RD_RW.ACD, F03_Get_LAS.ACD, F04_READ_IDI.ACD,
F05_GET_DELTA.ACD, F06_GET_TECA.ACD,
F07_SET_LOS.ACD, F08_GET_LOS.ACD,
F09_GET_LCS.ACD, F10_GET_LPF.ACD,
F11_SafeDiagSort.ACD, F12_ACYCLIC_TRANS.

The task *MainProgram* of these examples shows, how to use some instructions of the *Command Interface* with help of the task *Mbx0Main*.

DataExchange.ACD

This sample file contains a very simple program that shows you how to read and write digital AS-interface inputs and outputs.

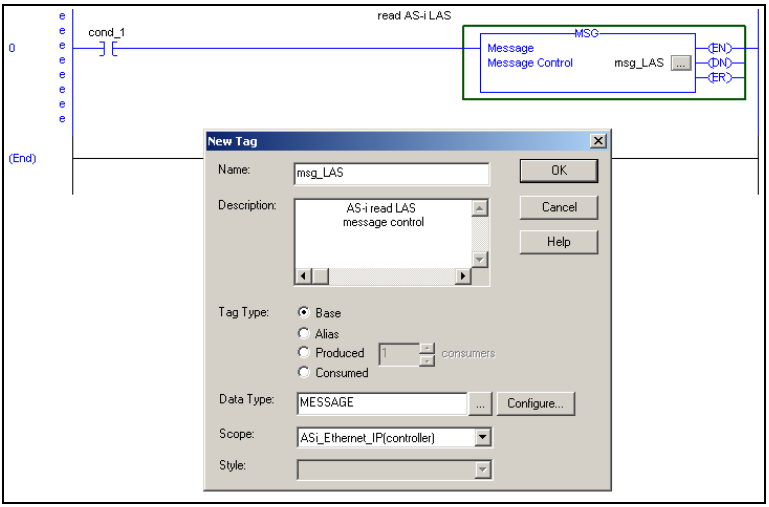
Issue date: 17.4.2009

13. Data Transfer using CIP Messages in RSLogix5000

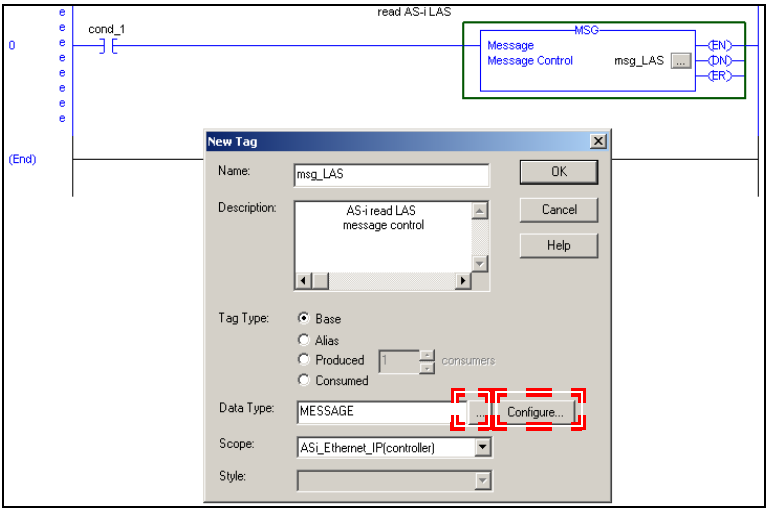
This chapter explains the data transfer of AS-i 3.0 EtherNet/IP Gateways using CIP Messages in RSLogix5000.

13.1 MSG instruction and Message Type Tag

- ☐ Include a MSG instruction.
- ☐ Create a new MESSAGE-type tag as control tag for the instruction.



- ☐ Select "Configure" on the "New Tag" window or "..." next to the tag name to open the "Message Configuration" window.



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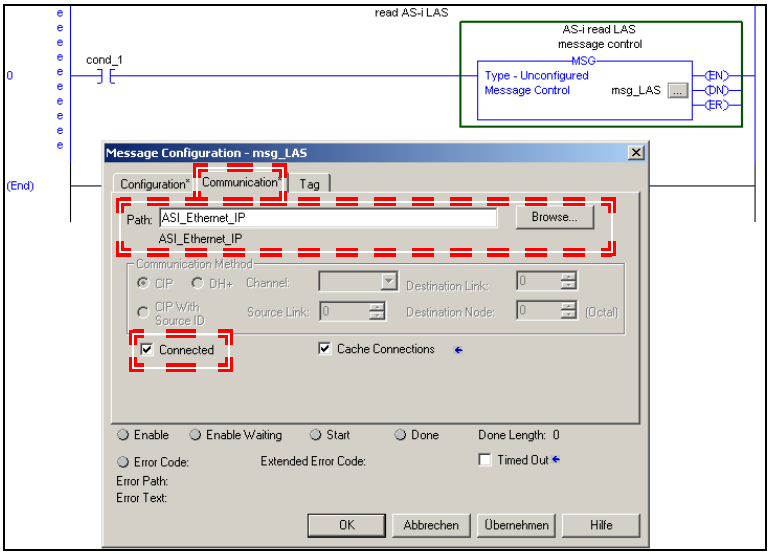
- ☐ Select the "Communication" tab.
- ☐ Browse to the "AS-i Ethernet IP" module
- ☐ Check the "Connected" check box.



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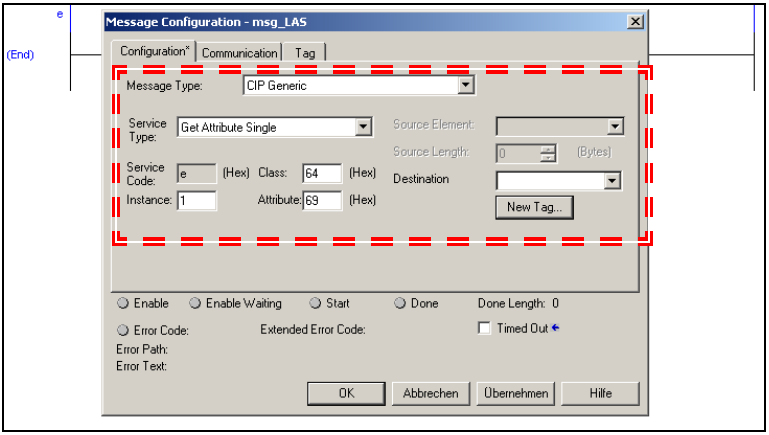
13.2 Example 1: read LAS

- Select the "Configuration" tab in the "Message Configuration" window
- Select:
  - Message Type: CIP generic
  - Service Type: Get attribute single
- Map:
  - For "Class": "64"
  - For "Instance": "1" (for AS-i circuit 1)
  - For "Attribute": "69"
- As "Destination", create a new tag or select an existing tag to hold the incoming data.



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13.3 Example 2: read/write 16-bit (analog) data

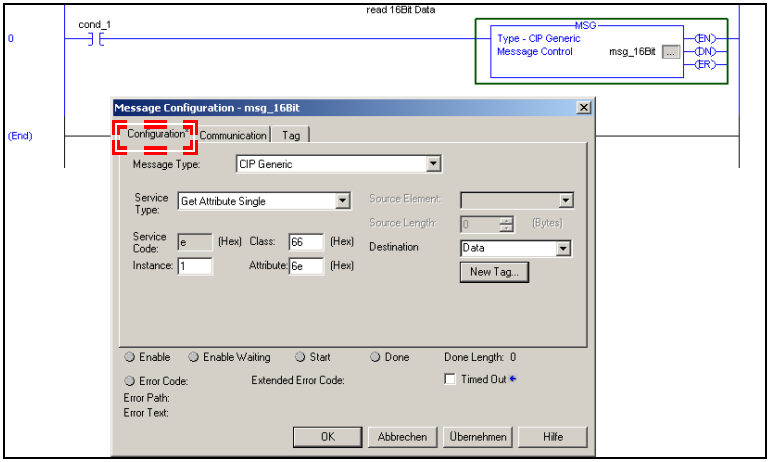
- Select the "Configuration" tab in the "Message Configuration" window
- Select:
  - Message type: CIP generic

Read 16-bit data from slave address 7

- Select:
  - Service type: Get attribute single
- Map:
  - For "Class": "66"
  - For "Instance": "1" (for AS-i circuit 1)
  - For "Attribute": "6E" (16-bit input data slave 7)
- As "Destination", create a new tag or select an existing tag to hold the incoming data.

Write 16-bit data to slave address 7

- Select:
  - Service type: Set attribute single
- Map:
  - For "Class": "66"
  - For "Instance": "1" (for AS-i circuit 1)
  - For "Attribute": "8D" (16-bit output data slave 7)
- As "Source element", create a new tag or select an existing tag to hold the outgoing data
- As "Source length": "4" (16-bit data = 8 bytes)



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14. System startup using AS-i Control Tools

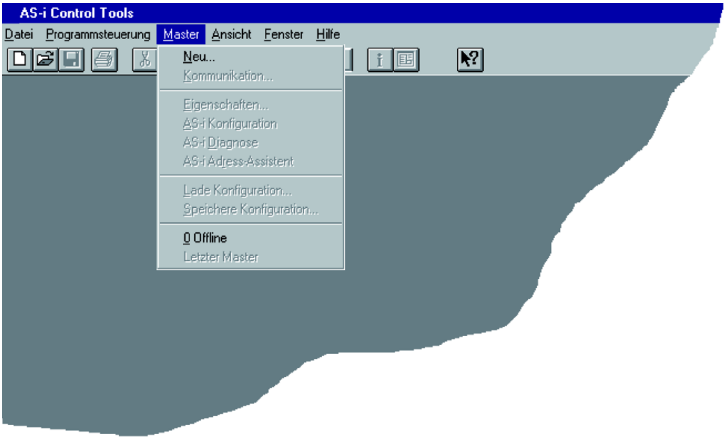
The Windows based software AS-i Control Tools enables an easy and clear configuration of the AS-i network.

Information!

AS-i Control Tools must be installed first!

This way, the device driver is copied into the previous designed folder in AS-i Control Tools and should be recognized automatically.

1. Connect the device to the PC via its serial interface and the diagnostic interface.
2. Start AS-i Control Tools.
3. Select Master | New.



4. Choose RS232 diagnostic interface as the protocol.

5. Select the appropriate settings (for example serial interface COM 2, station address <auto>).
6. Select Master | AS-i configuration.
7. The AS-i configuration editor will be started. All detected and configured AS-i slaves are displayed in this window.

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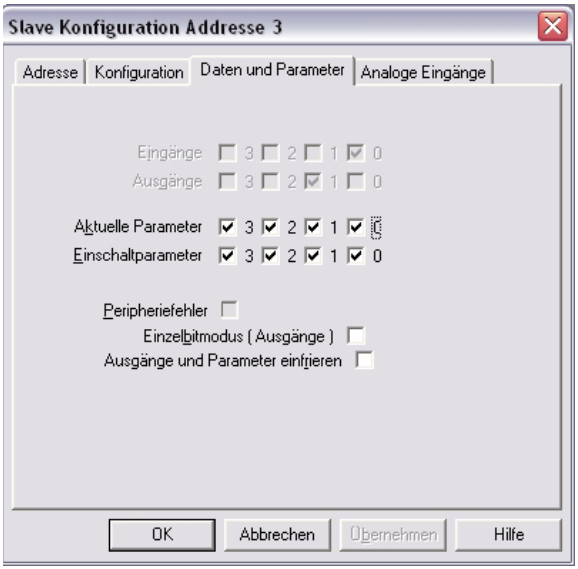
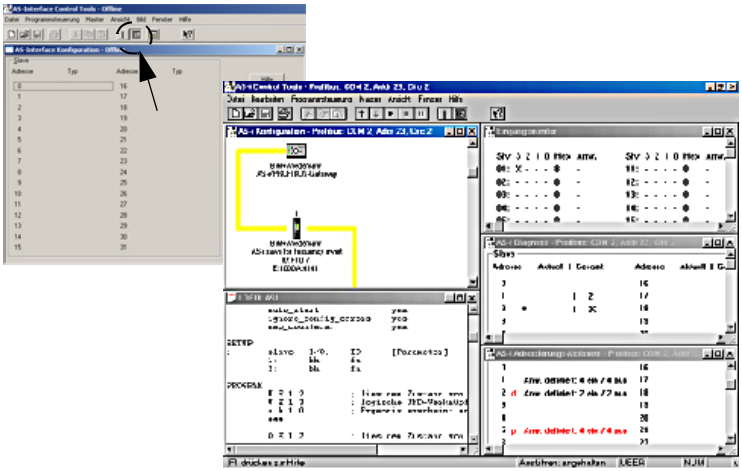
8. Click on a slave to open the dialog window 'slave configuration'.



This window enables the user to edit a slave address and to set AS-i parameters or AS-i configuration data. Additionally, inputs and outputs can be tested.

9. Click the second button on the right side of the tool bar to get a graphical display of "AS-i Control Tools".



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Configuring the AS-i network is easily accomplished by first connecting each AS-i slave separately to the AS-i line and setting its address, followed by pressing the button “Store configuration” to store the existing AS-i network in the AS-i master as configuration data.

Furthermore, an **AS-i Address Assistant** is available, allowing to perform an address change of a new AS-i slave to the desired address as soon as it is connected to the AS-i network. The desired AS-i configuration can be created offline ahead of time and can be stored to a file. When setting up the system the AS-i slaves are then simply connected, one at a time, to the AS-i network. Further descriptions to all additional features of this software can be obtained from the integrated help file.

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15. Configuration with Windows Software ASIMON 3 G2

Information!

*Please note further information in the configuration software **ASIMON 3 G2** for Windows.*

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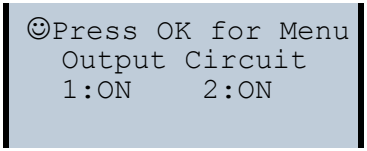
16. Status indication, faults and fault elimination

16.1 Spontaneous display of faults from the safety unit

Spontaneous messages are displayed on Pepperl+Fuchs GmbH AS-i monitors as follows:

- When both networks are operating without error, a smiley is displayed.
- When field bus communication fails, this is indicated by a text message.
- When there is a fault on an AS-i slave, this is displayed until the fault is no longer present.
- When there are no faults present, the states of the safety unit are displayed in text beneath the smiley.
- When four local release circuits are present, a line is displayed with their status.



Coding:

Display in protecting mode:

1, **2** for the release circuits

display	status of the safety unit	meaning
ON	green	relais circuit turned on
OFF	red	relais circuit turned off
WAIT	flashing green	wait time Stop 1 running
START	yellow	waiting for Start signal

Display in error status:

SAFETY FAULT: flashing red
TEST: flashing yellow

Red and *flashing yellow* are fault messages and are treated separately.

If the safety unit is in configuration mode, this is indicated by the CONFIG-OPERATION display.

Yellow flashing and *red flashing* means the AS-i slave address of the faulted device is displayed. If there are other faults present at the same time, all faults are displayed alternatingly.

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If the safety unit is in the *red flashing* state and no menu is open, the safety unit can be unlocked by pressing the ESC/Service key (Section <Function of the ESC/Service key>).

- If the message “Fatal Error” is reported from the safety unit, only this error message will be displayed in normal mode (not the menu). The non-safe unit continues to operate normally in this case and the menus can also be opened.

```
FATAL ERROR
000 255 222 111
```

- All other messages are not shown spontaneously.

If the safety unit is in the *yellow flashing* state, depending on the status of the configuration an external test may be required, an acknowledgement of the status may need to be made, or the turn-on delay active.

16.2 Replacing a defective safety-configured AS-i slave

If a safety-configured AS-i slave is defective, it can be replaced even without a PC or reconfiguration of the AS-i Safety Monitor by pressing the ESC/Service key on the AS-i Safety Monitor.

Information!

Pressing the ESC/Service key changes the safety monitor from protecting mode to configuration mode. The output circuits are therefore not turned off.

Code tables for replaced AS-i slaves can be taught without the PIN.

Proceed as follows:

1. Disconnect the AS-i slave from the AS-i cable.
2. Press the ESC/Service key on the AS-i Safety Monitor and on all other safety monitors for approx. 3 seconds.

```
CONNECT NEW
SLAVE 17
THEN PRESS
SERVICE
```

3. Connect the new safety-configured AS-i slave, which has already been programmed to the corresponding address, to the AS-i cable.
4. Press the ESC/Service key again on the AS-i Safety Monitor and on all other Safety Monitors which use the replacement safe AS-i slave for approx. 3 seconds. The code table for the new slave is taught and checked for correctness.
   If this is OK, the AS-i Safety Monitor changes to protecting mode. Otherwise you are prompted again to teach.

Information!

Inputs on the new slave must be turned on.

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Attention!

After replacing a defective safe AS-i slave, always check the correct function of the new slave.

16.3 Replacing a defective AS-i Safety Monitor

If an AS-i Safety Monitor is defective and needs to be replaced, the replacement unit does not necessarily have to be newly configured using the **ASIMON 3 G2** software, rather it is possible to copy the configuration of the defective device using a chip card.

Requirement:

The replacement unit has an empty configuration in its configuration memory.

Information!

After replacing a defective safe AS-i Safety Monitor, always check the correct function of the new AS-i Safety Monitor.

16.4 Forget the password? What do I do now?

Attention!

Only the responsible safety representative is permitted to retrieve a lost password as follows!

If the password is lost for your configuration, proceed as follows:

1. Find the valid configuration protocol for the AS-i Safety Monitor whose password you have lost (printout or file). In the configuration protocol in line 10 (Monitor Section, Validated) you will find a 4-digit code.

- If you do not have the configuration protocol and do not want to place the AS-i safety monitor in configuration mode, connect the AS-i safety monitor whose password you have lost to the PC and start the **ASIMON 3 G2** software.
- Select a neutral configuration and start the diagnostics function in **ASIMON 3 G2** using MONITOR -> DIAGNOSTICS. Wait until the current configuration appears on the screen. This may take up to 1 minute.
- Open the window MONITOR/BUS INFORMATION (EDIT MENU -> MONITOR/BUS INFORMATION…). On the Title tab you will also find the 4-digit code in the Download time window area.

2. Contact technical support at your supplier and enter the 4-digit code.
3. From this code a master password can be generated which can be used to access the stored configuration.
4. Use this master password to stop the AS-i Safety Monitor and enter a new user password. In the Monitor menu of the **ASIMON 3 G2** configuration software select the menu item Password changing.

Attention!

*Please note that accessing the configuration stored in the AS-i Safety Monitor can affect the safe function of the system. Changes to released configurations are to be made only by authorized personnel. Any change must be made according to the instructions in the User's Manual for the **ASIMON 3 G2** configuration software.*

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Information!

The default password (factory setting) of the AS-i safety monitor is "SIMON". If you would like to reconfigure the AS-i safety monitor, you must first change this default password to a new one known only to you as safety officer.

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17. Glossary

A/B slave

An AS-i slave with extended addressing. The address range of an A/B slave extends from 1A to 31A and 1B to 31B.

AS-i Power Fail

Voltage below the threshold on the AS-i cable.

Complete configuration

Counterpart to ⇒ *master configuration*. Release configuration including code sequences. The device is always usable.

EDM (External Device Monitoring, feedback circuit)

Used for monitoring the switching function of the contactors connected to the Safety Monitor, whereby the normally closed contacts (forced-opening when possible) are fed back to the start circuit of the Safety Monitor. A restart is then only possible if the normally closed contacts are closed (in the quiescent state).

ID code

The ID code is set by the slave manufacturer and cannot be changed. The AS-i Association determines the ID codes which are assigned for a particular class of slaves. For example, all ⇒ *A/B slaves* have ID code “A“.

ID1 Code, extended ID1 code

The ID1 code is set by the slave manufacturer. In contrast to the other codes, which determine the profile, it can be changed from the master or using an addressing device. The user should however only use this feature in exceptional circumstances, since otherwise *configuration errors* may occur.

In the case of A/B slaves, the MSB of the ID1 code is used for distinguishing between the A and the B address. Therefore, only the lowest 3 bits are relevant for these slaves.

Since this code was not introduced until AS-i Specification 2.1, it is also referred to as extended ID1 code.

ID2 Code, extended ID2 code

The ID2 code is set by the slave manufacturer and cannot be changed. The AS-i Association determines the ID2 codes, which are assigned for a particular class of slaves. For example, all 2-channel 16 bit input slaves having an S-16 bit code use ID2 code “D”. Since this code was not introduced until AS-i Specification 2.1, it is also referred to as extended ID2 code.

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Inclusion phase

The AS-i master sends a command to an available slave address to detect new slaves. If no reply is received, it immediately begins with the next data exchange phase.

I/O code

The first digit of the slave profile, which indicates how many in- and outputs the slave has. A 4I/4O slave has for example a “7”, and a slave with 4 digital inputs a "0".

LPF - List of Peripheral Faults

The list of peripheral faults was introduced with specification 2.1. This list includes an entry for each slave that signals a ⇒ peripheral fault.

Master configuration

Released configuration, without code sequences. The safety unit cannot turn on the outputs, but as soon as the code sequences are learned, the device is usable.

Such a master configuration can for example be used in serial production machine building for loading the safety program, whereby the configuration is created in the design and the code sequences taught on the physical machine.

Offline phase

In offline phase there is no communication on AS-i.

Password

Security code for a (security) configuration, is required for releasing a configuration or activating a changed configuration. The password is a string of 4 … 8 alphanumeric characters. It is stored in the configuration.

Peripheral fault

Depending on the slave, an overflow, an overload on the sensor supply, or some other fault affecting the slave peripheral can be displayed.

PIN

A security code is required for teaching code sequences. The PIN is a 4-digit decimal number.

The PIN does not authorize for activating a safety configuration.

The PIN is stored in the EEPROM of the unprotected device section as well as in the unprotected area of the chip card, and is therefore sent to a new device when the chip card is replaced. When resetting to factory defaults, the PIN is set to 0000.

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Release Code

Security code for a safety configuration on the chip card. A 4-character hex number generated by the **ASIMON 3 G 2** software. The release code is displayed before copying a configuration from the memory card to the Monitor and must be repeated by the operator.

This provides a technical safeguard against errors in the unprotected display and keyboard software.

Single Slave

A single slave can in contrast to a ⇒ *A/B slave* only be addressed from range 1 to 31; the fourth output data bit can be used. All slaves as defined by the older AS-i Specification 2.0 are single slaves.

There are however also single slaves as defined by Specification 2.1, for example the new 16 bit slaves.

Slave profile

Configuration data for a slave, consisting of:

⇒ *I/O configuration* and ⇒ *ID-Code*, as well as ⇒ *extended ID1-Code* and ⇒ *extended ID2-Code*.

The slave profile is used to distinguish between various slave classes. It is specified by the AS-i Association and set by the slave manufacturer.

AS-i 2.0 slaves do not have extended ID1 and ID2 codes. A 2.1 or 3.0 AS-interface master enters in this case an “F” for each of the extended ID1 and ID2 codes.

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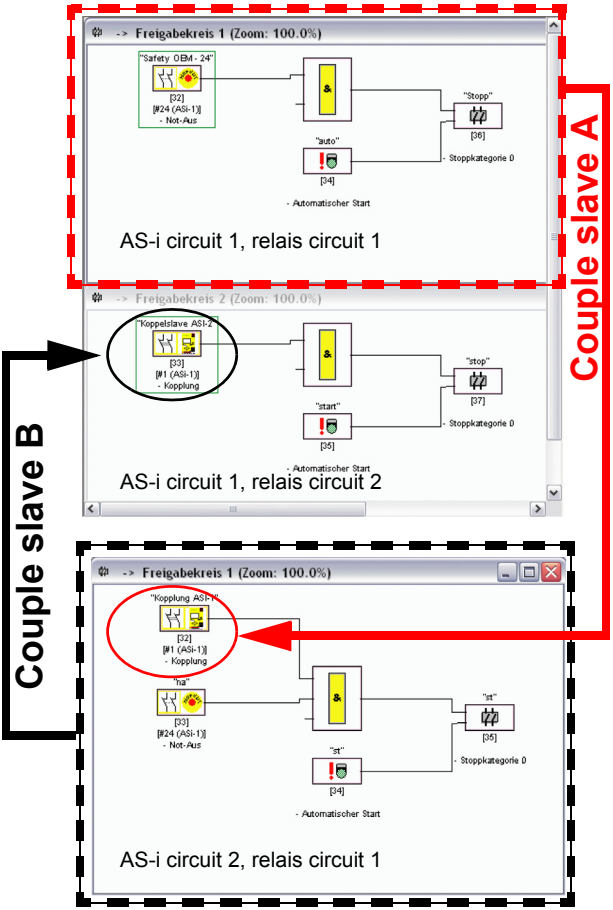
18. Appendix: example of a bidirectional safety coupling

The following example describes a biderectional safety coupling between 2 AS-i circuits.



AS-i circuit 1:

relais circuit 1: All EMERGENCY STOPs in circuit 1.

relais circuit 2: Alle other safety objects + couple slave B.

AS-i circuit 2:

relais circuit 1: All EMERGENCY STOPs in circuit 2 + couple slave A

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Couple slaves:

A = Couple slave circuit 1, relais circuit 1, Address 1

B = Couple slave circuit 2, relais circuit 1, Address 1 (contains all EMERGENCY STOPs)

Configuration:

1. The couple slaves on the monitor are to be configurated first! (AS-i Safety>Safety Coupling).
2. Deactivate the "Coupling AS-i 1" first
3. Configure the monitor from the circuit 2
4. Configure the monitor from the circuit 1
5. Activate the "Coupling AS-i 1" on the monitor from the circuit 2.

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19. Reference List

19.1 Manual: "ASIMON 3 G2 Configuration Software"

This Manual contains a detailed description of the configuration software for the AS-i Safety Monitor. The manual is an important component of the documentation for the AS-i Safety Monitor. It is not possible to configure and start up the AS-i Safety Monitor without the **ASIMON 3 G2** software.

19.2 Sources

1. Kriesel, Werner R.; Madelung, Otto W. (editors): AS-interface. Das Aktuator-Sensor-Interface für die Automation. Auflage, Carl Hanser Verlag; München, Wien, 1999, ISBN 3-446-21064-4
2. Spezifikation des AS-interface, ComSpec V3.0 AS-international Association (available from AS-international Association, http://www.as-interface.net).
3. Vorschlag eines Grundsatzes für die Prüfung und Zertifizierung von „Bussystemen für die Übertragung sicherheitsrelevanter Nachrichten", Stand 29.2.2000.
4. AS-interface - Die Lösung in der Automation, Ein Kompendium über Technik, Funktion, Applikation (erhältlich, auch in englischer Sprache, bei AS-international Association, http://www.as-interface.net).

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