ifm electronic

Basic device manual

AS-i controllere

ecomat300

1 AS-i master	2 AS-i masters
AC1029	**AC1030**
AC1318	**AC1324**
AC1327	**AC1337**
AC1331	**AC1332**
AC1333	**AC1334**
AC1355	**AC1356**
AC1357	**AC1358**
AC1365	**AC1366**
AC1391	**AC1392**

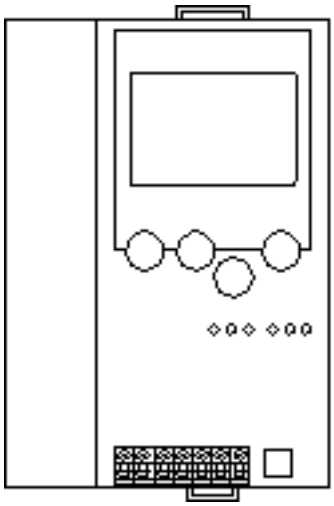
Master profile: M4

Firmware: from version RTS 3.0

Target: from V.15

for CoDeSys® from version 2.3

English



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As in: 2015-10-30

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1 On this manual

In this chapter you will find an overview of the following points:

- What do the symbols and formats stand for?
- What devices are described in this manual?
- How is this manual structured?

1.1 What do the symbols and formats stand for?

The following symbols or pictograms depict our notes in this manual:

⚠ DANGER

Death or serious irreversible injuries are *to be expected*.

⚠ WARNING

Death or serious irreversible injuries *may result*.

⚠ CAUTION

Slight reversible *injuries* may *result*.

NOTICE

Property damage is to be expected or possible.

NOTE

The "i" in the square gives *important* information to help you handle the product or this manual correctly.

► …	Request for action
> …	Reaction of device or software
→ …	Stands for "see"
abc	Cross-reference (link)
[…]	[Designation]] of key, signalling lamp, button, menu item .... For several menu items to be selected consecutively we write: [1st step] > [2nd step] > [3rd step]
ABC	DESIGNATION of **parameters** (inputs, outputs, flags, function blocks)
Abc	Names of **files** are written in Monospace font.

1.2 What devices are described in this manual?

This manual describes the AS-i controllere family of **ifm electronic gmbh**

- with master profile M4
- with AS-i version 3.0 masters
- with a firmware from version RTS 2.2
- with the target from V.15.

In the "programming manual CoDeSys® 2.3" more information about the use of the programming system "CoDeSys for Automation Alliance" is given. This manual can be downloaded free of charge from **ifm's** website at:
→ www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]

Description of the corresponding fieldbus or Ethernet programming interface
→ separate supplementary manual for this device manual.

1.3 How is this manual structured?

This manual is a combination of different instruction types. It is for beginners and also a reference for advanced users.

How to use this manual:

- To find a certain subject straight away, please use the **table of contents** at the beginning of this manual.
- With the **index** at the end of the manual you can quickly find the term you are looking for.
- At the beginning of a chapter we will give you a brief overview of its contents.
- In the **header** of each page you can find the title of the current chapter in bold. Below is the current title of the second order.
- In the **footer** of each page you can find the chapter-related number of the page.

Abbreviations and technical terms
→ chapter Terms and abbreviations, page 272.

We reserve the right to make alterations which can result in a change of contents of the manual. You can find the current version on **ifm's** website at:
→ www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]

Nobody is perfect. Send us your suggestions for improvements to this manual and you will receive a little gift from us to thank you.

1.4 Overview: where is what?

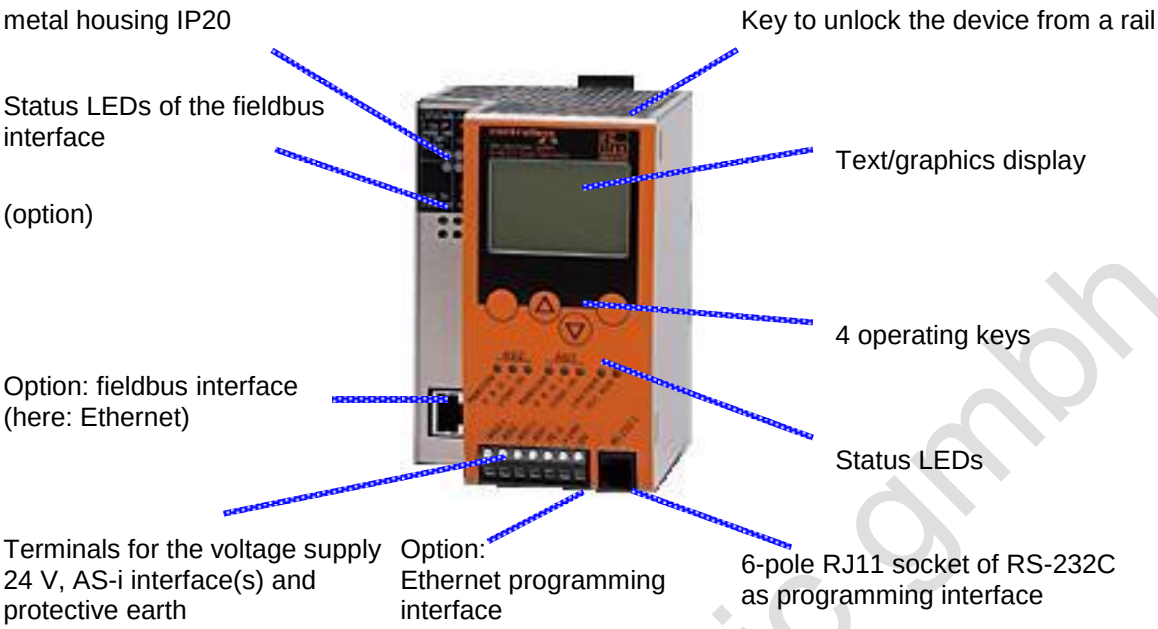


Figure: overview controllere

2 Safety instructions

In this chapter you will find general safety instructions such as:

- General rules
- Safety instructions for mounting and installation
- When are you allowed to use this device and when not?

2.1 General

No characteristics are warranted with the information, notes and examples provided in this manual. The drawings, representations and examples imply no responsibility for the system and no application-specific particularities.

The manufacturer of the machine/equipment is responsible for ensuring the safety of the machine/equipment.

⚠ WARNING

Property damage or bodily injury possible when the notes in this manual are not adhered to!
ifm electronic assumes no liability for this.

► The acting person must have read and understood the safety instructions and the corresponding chapters of this manual before performing any work on or with this device.

► The acting person must be authorised to work on the machine/equipment.

2.2 What previous knowledge is required?

This manual is intended for persons with knowledge of control technology and PLC programming with IEC 61131-3 as well as the CoDeSys® software.

The manual is intended for persons authorised to install, connect and set up the controllere according to the EMC and low voltage directives. The controllers must be installed and put into operation by a qualified electrician.

In case of malfunctions or uncertainties please contact the manufacturer: → back of the manual

2.3 Warnings mounting

NOTICE

Danger by moisture, dust, shocks, overheating.
Damage or failure of the device possible!

- Moisture can destroy the electronics.
- ► Use the device in a condensation-free environment.

- Dust deposits prevent the necessary air circulation for heat dissipation.
- ► If possible, do not expose the device to a dusty environment. If this cannot be avoided, you must clean the device frequently.
  → page 271, chapter Maintenance, repair and disposal.

- Shocks and vibrations can damage the unit.
- ► Adhere to the technical specifications.
- ► The air circulation through the vents must not be hampered. Allow about 30 mm of clear space above and below the device when installing it.

According to the technical specifications (→ "Technical data") you can operate the device in a wide operating temperature range. Because of the additional internal heating the housing walls can have higher perceptible temperatures when touched in hot environments. This is normal and no cause for a complaint.

2.4 Warnings installation

NOTICE

Short circuit, incorrect wiring possible.
Consequence: Malfunction of the machine/plant in which the device is installed!

- ► The unit must be installed and connected by a qualified electrician.
- ► Disconnect power before connecting the controllerето avoid short circuits during installation.
- ► Connect the terminals according to the terminal marking.
- ► The supply voltage (SELV) must not be connected to protective earth. Therefore never connect the minus terminal to the FE terminal or to another terminal of the device.

It must be ensured that the external voltage is generated and supplied according to the criteria for safety extra-low voltage (SELV), since this voltage is provided without further measures to supply the connected controller, the sensors and the actuators.

The wiring of all signals in connection with the SELV circuit of the device must also comply with the SELV criteria (safety extra-low voltage, safe electrical separation from other electric circuits).

If the supplied SELV voltage is externally grounded (SELV becomes PELV), the responsibility lies with the user and the respective national installation regulations must be complied with. All statements in these operating instructions refer to the device the SELV voltage of which is not grounded.

The connection terminals may only be supplied with the signals indicated in the technical data or on the device label or only the approved accessories of **ifm electronic** may be connected.

3 System requirements

3.1 Information concerning the device

This manual describes the AS-i controllere family of ifm electronic gmbh

- with master profile M4
- with AS-i version 3.0 masters
- with a firmware from version RTS 2.2
- with the target from V.15.

3.2 Information concerning the software

The controllere operates with CoDeSys® as from version 2.3. The minimum system requirements of this software are as follows:

- CPU Pentium II, 500 MHz
- working memory (RAM) 128 MB, recommended: 256 MB
- free hard disc memory (HD) 100 MB
- operating systems Windows® 98 / NT4.0 / 2000 / XP
  ➔ Windows® Vista is not yet supported!
- CD-ROM drive

In the "programming manual CoDeSys® 2.3" more information about the use of the programming system "CoDeSys for Automation Alliance" is given. This manual can be downloaded free of charge from ifm's website at:
→ www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]

3.3 Required accessories

In addition to a controllere you need the following accessories (not supplied) to run the system:

- 24 V power supply (e.g. order no. DN2011) and
- one AS-i power supply per AS-i master (e.g. article no. AC1216)
- as well as AS-i slaves.

Description of the corresponding fieldbus or the Ethernet programming interface
→ separate supplementary manual for this device manual

If you want to use the PC for configuration and programming you also need:

- the software "CoDeSys for Automation Alliance" version 2.3 or higher
- a programming cable (e.g. article no. E70320)
- as well as a PC with serial interface.

4 Intended use

NOTICE

Danger when device is overloaded or incorrectly used.

The device and / or the related machine/equipment can be damaged or destroyed or function incorrectly when the limit values of the technical data for this device are exceeded or the device is not used as intended.

► Use the device only within the specified technical data
→ page 236, chapter Technical data.

► Use the device only as intended.

4.1 Allowed use

You may use the device for the following purposes (= intended use):

- as fieldbus gateway between the actuator/sensor interface network and a higher level controller (fieldbus master = host, e.g. PLC) via a fieldbus connection (optional)
- as an independent controller for devices via the actuator/sensor interface with/without data exchange to a PC for visualisation of the plant states

4.2 Prohibited use

The controllere must NOT be used for the following applications:

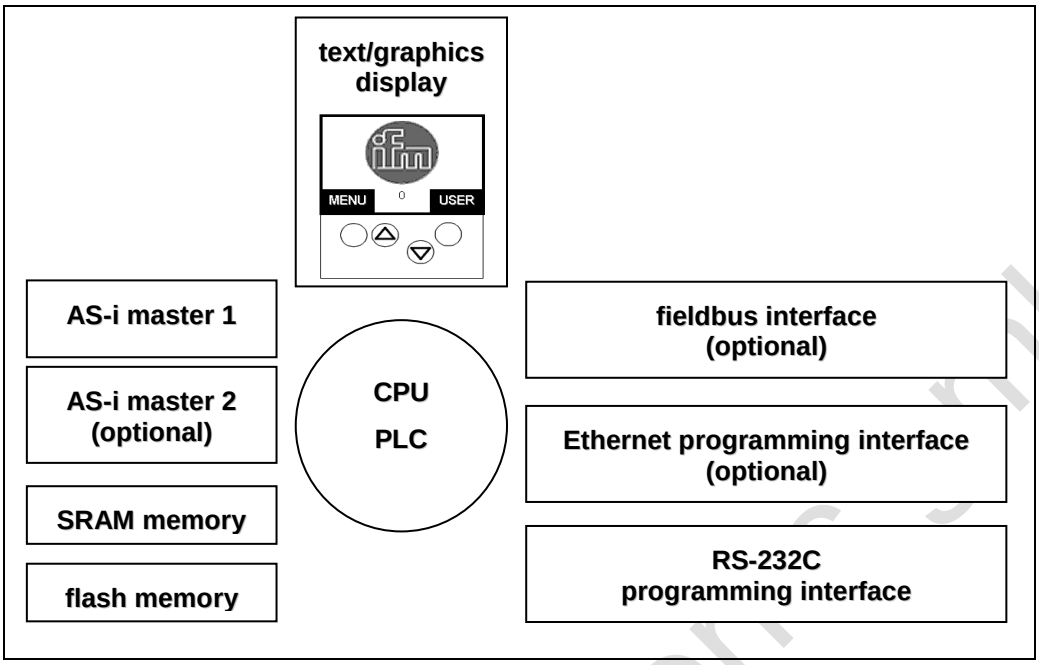
- outdoors
- in wet environments
- outside the specified technical data
→ page 236, chapter Technical data

Tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to an exclusion of liability and warranty.

5 Function

5.1 Data management

The controllere consists of different units:



- The CPU (central processing unit) ensures the data transfer between the subsystems. It manages the remanent flash memory and the volatile RAM memory.
- The flash memory is 1 Mbyte large and stores non volatilely...
  - the system configuration including the AS-i configurations,
  - the **r**un**t**ime **s**ystem (RTS),
  - the PLC program (must be explicitly stored there!),
  - the remanent data.
- The operating system and the PLC programs run in the SRAM memory, now also 1 Mbyte large, after power-on of the device.
- The AS-i masters feature a separate microcontroller and communicate with the connected slave modules on the AS-i bus according to the AS-i specification.
- A text/graphics display in the controllere enables a detailed system diagnosis. Operating the device with the four keys is easy to learn.
  → page 92, chapter Operating and display elements
  - The bilingual structure of the menus and messages simplifies worldwide use of this device family. → page 96, chapter Text/graphics display: language selection
  - An intelligent message management generates priority-controlled diagnostic and error messages and considerably supports the user during set-up and fault-finding. → page 239, chapter Error description
- The PLC is a real-time software core in the central unit. The core cyclically polls the user program. This user program is created using the software CoDeSys® and tested.

- The **serial programming interface** (RS-232C with RJ11 socket) enables easy projection and programming of the AS-i masters and the PLC via a personal computer with a transmission rate of up to 115 kBd.
  → page 121, chapter Set the baud rate of the serial interface
  → page 124, chapter RS-232C
- With the optional **Ethernet programming interface**, (10/100 MBd, twisted pair), the device can, in addition to even faster programming and diagnosis, also be networked to other controllere devices.
  → separate supplementary device manual
- The optional **fieldbus interface** operates independently and exchanges data with the central system via a "dual port RAM" interface or a DMA transfer.
  → separate supplementary device manual

5.2 Introduction AS-i data

The AS-i master and the AS-i slaves make a large amount of data available to the user. The user can request information, such as the status of the master and the configuration data of the slaves. This data is summarised in several data fields and can be accessed via standard IEC addresses.
→ page 152, chapter Overview PLC addresses

The data structures and their contents are described in the following sections.

5.2.1 Table of pointers

The AS-i data of the controllere is summarised in several data fields which are described in the following sections. Each of these fields can be addressed via a 32-bit pointer and can be read or written by the user program. The pointer list has the basic address **FFB00$_h$**.

No.	Address offset	Points to data type	Name	Length in words	Comment
0	0_h	strCmdChannel → page 29	pstM1_CmdResp	18	command channel inputs
1	4_h		pstM1_CmdOut	18	command channel outputs
2	8_h	strMasterFlags → page 22	pstM1_StateFlags	32	master 1 status flags
3	C_h	strSlavePara → page 24	pstM1_SvPRJPara	16	image of the projected slave parameters, copy from _PCO_PRJ_PARA
4…8	10_h … 20_h	reserved	reserved	0	reserved
9	24_h	strSlaveCyc → page 23	pstM1_SvInCyc	32	digital slave inputs
10	28_h	strFbusInCyc → page 24	pstM1_FbInCyc	16	digital fieldbus inputs
11	$2C_h$	strAnalogSlave → page 27	pstM1_AngInPar	155	analogue slave inputs
12	30_h	UINT16_T	pwM1_AngInSer	2	analogue slave inputs, serial access
13	34_h	strSlaveCDI → page 25	pstM1_SvCDI0_31	32	slaves 0…31(A), current CDI data
14	38_h		pstM1_SvCDI1b_31b	32	slaves 1B...31B, current CDI data
15	$3C_h$	strSlavePara → page 24	pstM1_SvParaImage	16	image of slave parameters
16	40_h	strSlaveList → page 26	pstM1_LiLAS	4	slave list LAS
17	44_h		pstM1_LiLDS	4	slave list LDS
18	48_h		pstM1_LiLPF	4	slave list LPF
19	$4C_h$		pstM1_LiLPS	4	slave list LPS
20	50_h	strSlavePrj → page 25	pstM1_SvPRJ0_31	32	slaves 0…31(A), image of projected CDI data
21	54_h		pstM1_SvPRJ1b_31b	32	slaves 1B...31B, image of projected CDI data
22	58_h	strSlavePara → page 24	pstM1_SvRefPara	16	reflected slave parameters
23	$5C_h$	strSlaveErrCtr → page 26	pstM1_SvERRCtr1_62	62	transmission error counter / slave
24	60_h	UINT16_T	pwM1_CFG_ERR_CTR	1	configuration error counter / master
25	64_h		pwM1_ASI_CYL_CTR	1	AS-i cycle counter
26	68_h	strSlaveCyc → page 23	pstM1_SvOutCyc	32	digital slave outputs
27	$6C_h$	strFbusOutCyc → page 24	pstM1_FbOutCyc	16	digital fieldbus outputs
28	70_h	strAnalogSlave → page 27	pstM1_AngOutPar	155	analogue slave outputs
29	74_h	UINT16_T	pwM1_AngOutSer	2	analogue slave outputs, serial access
30	78_h	strSlavePrj → page 25	pstM1_OutSvPRJ0_31	32	slaves 0...31(A), output of projected CDI data
31	$7C_h$		pstM1_OutSvPRJ1b_31b	32	slaves 1B...31B, output of projected CDI data
32	80_h	strSlavePara → page 24	pstM1_OutPrjSvPara	16	output of projected slave parameters

No.	Address offset	Points to data type	Name	Length in words	Comment
33	84_h	strCmdChanne → page l29	pst3S_M1_CmdResp	1	3S command channel inputs
34	88_h		pst3S_M1_CmdOut	1	3S command channel outputs
35 … 39	$8C_h$ … $9C_h$	reserved	reserved	0	reserved
40	$A0_h$	strCmdChannel → page 29	pstM2_CmdResp	18	command channel inputs
41	$A4_h$		pstM2_CmdOut	18	command channel outputs
42	$A8_h$	strMasterFlags → page 22	pstM2_StateFlags	32	master 2 status flags
43	AC_h	strSlavePara → page 24	pstM2_SvPRJPara	16	image of projected slave parameters, copy from _PCO_PRJ_PARA
44 … 48	$B0_h$ … $C0_h$	reserved	reserved	0	reserved
49	$C4_h$	strSlaveCyc → page 23	pstM2_SvInCyc	32	digital slave inputs
50	$C8_h$	strFbusInCyc → page 24	pstM2_FbInCyc	16	digital fieldbus inputs
51	CC_h	strAnalogSlave → page 27	pstM2_AngInPar	155	analogue slave inputs
52	$D0_h$	UINT16_T	pwM2_AngInSer	2	analogue slave inputs, serial access
53	$D4_h$	strSlaveCDI → page 25	pstM2_SvCDI0_31	32	slaves 0...31(A), current CDI data
54	$D8_h$		pstM2_SvCDI1b_31b	32	slaves 1B...31B, current CDI data
55	DC_h	strSlavePara → page 24	pstM2_SvParaImage	16	image of slave parameters
56	$E0_h$	strSlaveList → page 26	pstM2_LiLAS	4	slave list LAS
57	$E4_h$		pstM2_LiLDS	4	slave list LDS
58	$E8_h$		pstM2_LiLPF	4	slave list LPF
59	EC_h		pstM2_LiLPS	4	slave list LPS
60	$F0_h$	strSlavePrj → page 25	pstM2_SvPRJ0_31	32	slaves 0...31(A), image of projected CDI data
61	$F4_h$		pstM2_SvPRJ1b_31b	32	slaves 1B...31B, image of projected CDI data
62	$F8_h$	strSlavePara → page 24	pstM2_SvRefPara	16	reflected slave parameters
63	FC_h	strSlaveErrCtr → page 26	pstM2_SvERRCtr1_62	62	transmission error counter / slave
64	100_h	UINT16_T	pwM2_CFG_ERR_CTR	1	configuration error counter / master
65	104_h		pwM2_ASI_CYL_CTR	1	AS-i cycle counter
66	108_h	strSlaveCyc → page 23	pstM2_SvOutCyc	32	digital slave outputs
67	$10C_h$	strFbusOutCyc → page 24	pstM2_FbOutCyc	16	digital fieldbus outputs
68	110_h	strAnalogSlave → page 27	pstM2_AngOutPar	155	analogue slave outputs
69	114_h	UINT16_T	pwM2_AngOutSer	2	analogue slave outputs, serial access
70	118_h	strSlavePrj → page 25	pstM2_OutSvPRJ0_31	32	slaves 0...31(A), output of projected CDI data
71	$11C_h$		pstM2_OutSvPRJ1b_31b	32	slaves 1B...31B, output of projected CDI data
72	120_h	strSlavePara → page 24	pstM2_OutPrjSvPara	16	output of projected slave parameters
73	124_h	strCmdChannel → page 29	pst3S_M2_CmdResp	1	3S command channel inputs
74	128_h		pst3S_M2_CmdOut	1	3S command channel outputs

No.	Address offset	Points to data type	Name	Length in words	Comment
75 … 79	$12C_h$ … $13C_h$	reserved	reserved	0	reserved
80	140_h	strFBUSProp	pstFbusProp	64	fieldbus properties
81	144_h	strPLCData	pstPlcData;	13	PLC specific data
82	148_h	UINT16_T	pwDPInputBuf	64	output PLC data to DP
83	$14C_h$		pwDPOutputBuf	64	input PLC data from DP
84	150_h	strMUXTIMING	pstMuxTimimg	45	multiplex definitions master1/2
85	154_h	strENET_PROP	pstAbusEnetProp	11	Anybus Ethernet properties
86	158_h		pstIfmEnetProp	11	ifm Ethernet properties
87	$15C_h$	UINT16_T	pawModbusInput	64	output PLC data to Modbus field 1
88	160_h		pawModbusOutput	64	input PLC data from Modbus field 1
89 … 94	164_h … 178_h	reserved	reserved	0	reserved
95	$17C_h$	UINT16_T	pawModbusInput2	64	output PLC data to Modbus field 2
96	180_h		pawModbusInput3	64	output PLC data to Modbus field 3
97	184_h		pawModbusInput4	64	output PLC data to Modbus field 4
98	188_h		pawModbusOutput2	64	input PLC data from Modbus field 2
99	$18C_h$		pawModbusOutput3	64	input PLC data from Modbus field 3
100	190_h		pawModbusOutput4	64	input PLC data from Modbus field 4
101 ... 111	194_h ... $1BC_h$	reserved	reserved	0	reserved

5.2.2 Field definitions for direct data access

strMasterFlags – fields with master status information

Word offset	Bit	Bit = TRUE means:
0	0	"No slave reset" When executing the function "Config all" (via the menu or command channel of the controllere) the slaves are NOT reset, as described in the AS-i specification.
	1...15	reserved
1	0	"Config OK" There is no configuration error. The configuration of all AS-i slaves in the network complies with the projection data.
	1	"LDS.0" One slave with the AS-i address 0 was detected on the master.
	2	reserved
	3	reserved
	4	"Configuration_Active" The controllere is in the configuration mode.
	5	"Normal_Operation_Active" The AS-i master is in normal operation: it communicates with at least one slave.
	6	"AS-i_Power_Fail" The AS-i voltage is too low.
	7	reserved
	8	"Periphery_OK" None of the active AS-i slaves signals a periphery fault.
	9	"Auto_Address_Enable" The mode "automatic addressing of the slaves" is activated on this master.
	10...15	reserved

IEC addresses → page 163

strSlaveCyc – fields with digital I//O data

Word offset	Bits 12...15	Bits 8...11	Bits 4...7	Bits 0...3
0	reserved	slave 2(A)	reserved	slave 1(A)
1	reserved	slave 4(A)	reserved	slave 3(A)
2	reserved	slave 6(A)	reserved	slave 5(A)
3	reserved	slave 8(A)	reserved	slave 7(A)
4	reserved	slave 10(A)	reserved	slave 9(A)
5	reserved	slave 12(A)	reserved	slave 11(A)
6	reserved	slave 14(A)	reserved	slave 13(A)
7	reserved	slave 16(A)	reserved	slave 15(A)
8	reserved	slave 18(A)	reserved	slave 17(A)
9	reserved	slave 20(A)	reserved	slave 19(A)
10	reserved	slave 22(A)	reserved	slave 21(A)
11	reserved	slave 24(A)	reserved	slave 23(A)
12	reserved	slave 26(A)	reserved	slave 25(A)
13	reserved	slave 28(A)	reserved	slave 27(A)
14	reserved	slave 30(A)	reserved	slave 29(A)
15	reserved	reserved	reserved	slave 31(A)
16	reserved	slave 2B	reserved	slave 1B
17	reserved	slave 4B	reserved	slave 3B
18	reserved	slave 6B	reserved	slave 5B
19	reserved	slave 8B	reserved	slave 7B
20	reserved	slave 10B	reserved	slave 9B
21	reserved	slave 12B	reserved	slave 11B
22	reserved	slave 14B	reserved	slave 13B
23	reserved	slave 16B	reserved	slave 15B
24	reserved	slave 18B	reserved	slave 17B
25	reserved	slave 20B	reserved	slave 19B
26	reserved	slave 22B	reserved	slave 21B
27	reserved	slave 24B	reserved	slave 23B
28	reserved	slave 26B	reserved	slave 25B
29	reserved	slave 28B	reserved	slave 27B
30	reserved	slave 30B	reserved	slave 29B
31	reserved	reserved	reserved	slave 31B

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strFbusInCyc / strFbusOutCyc – fields with fieldbus I/O data

Word offset	Bits 12...15	Bits 8...11	Bits 4...7	Bits 0...3
0	slave 2(A)	slave 3(A)	status DP	slave 1(A)
1	slave 6(A)	slave 7(A)	slave 4(A)	slave 5(A)
2	slave 10(A)	slave 11(A)	slave 8(A)	slave 9(A)
3	slave 14(A)	slave 15(A)	slave 12(A)	slave 13(A)
4	slave 18(A)	slave 19(A)	slave 16(A)	slave 17(A)
5	slave 22(A)	slave 23(A)	slave 20(A)	slave 21(A)
6	slave 26(A)	slave 27(A)	slave 24(A)	slave 25(A)
7	slave 30(A)	slave 31(A)	slave 28(A)	slave 29(A)
8	slave 2B	slave 3B	reserved	slave 1B
9	slave 6B	slave 7B	slave 4B	slave 5B
10	slave 10B	slave 11B	slave 8B	slave 9B
11	slave 14B	slave 15B	slave 12B	slave 13B
12	slave 18B	slave 19B	slave 16B	slave 17B
13	slave 22B	slave 23B	slave 20B	slave 21B
14	slave 26B	slave 27B	slave 24B	slave 25B
15	slave 30B	slave 31B	slave 28B	slave 29B

strSlavePara – fields with current / projected / reflected parameter data

Word offset	Bits 12...15	Bits 8...11	Bits 4...7	Bits 0...3
0	slave 4(A)	slave 3(A)	slave 2(A)	slave 1(A)
1	slave 8(A)	slave 7(A)	slave 6(A)	slave 5(A)
2	slave 12(A)	slave 11(A)	slave 10(A)	slave 9(A)
3	slave 16(A)	slave 15(A)	slave 14(A)	slave 13(A)
4	slave 20(A)	slave 19(A)	slave 18(A)	slave 17(A)
5	slave 24(A)	slave 23(A)	slave 22(A)	slave 21(A)
6	slave 28(A)	slave 27(A)	slave 26(A)	slave 25(A)
7	slave 1B	slave 31(A)	slave 30(A)	slave 29(A)
8	slave 5B	slave 4B	slave 3B	slave 2B
9	slave 9B	slave 8B	slave 7B	slave 6B
10	slave 13B	slave 12B	slave 11B	slave 10B
11	slave 17B	slave 16B	slave 15B	slave 14B
12	slave 21B	slave 20B	slave 19B	slave 18B
13	slave 25B	slave 24B	slave 23B	slave 22B
14	slave 29B	slave 28B	slave 27B	slave 26B
15	reserved	reserved	slave 31B	slave 30B

IEC addresses → page 158

strSlaveCDI / strSlavePrj – fields with current and projected configuration data (CDI)

Word offset	Bits 12...15 XID2-Code	Bits 8...11 XID1-Code	Bits 4...7 ID code	Bits 0...3 IO code
0	slave 0 *)	slave 0 *)	slave 0 *)	slave 0 *)
1	slave 1	slave 1	slave 1	slave 1
2	slave 2	slave 2	slave 2	slave 2
3	slave 3	slave 3	slave 3	slave 3
4	slave 4	slave 4	slave 4	slave 4
5	slave 5	slave 5	slave 5	slave 5
6	slave 6	slave 6	slave 6	slave 6
7	slave 7	slave 7	slave 7	slave 7
8	slave 8	slave 8	slave 8	slave 8
9	slave 9	slave 9	slave 9	slave 9
10	slave 10	slave 10	slave 10	slave 10
11	slave 11	slave 11	slave 11	slave 11
12	slave 12	slave 12	slave 12	slave 12
13	slave 13	slave 13	slave 13	slave 13
14	slave 14	slave 14	slave 14	slave 14
15	slave 15	slave 15	slave 15	slave 15
16	slave 16	slave 16	slave 16	slave 16
17	slave 17	slave 17	slave 17	slave 17
18	slave 18	slave 18	slave 18	slave 18
19	slave 19	slave 19	slave 19	slave 19
20	slave 20	slave 20	slave 20	slave 20
21	slave 21	slave 21	slave 21	slave 21
22	slave 22	slave 22	slave 22	slave 22
23	slave 23	slave 23	slave 23	slave 23
24	slave 24	slave 24	slave 24	slave 24
25	slave 25	slave 25	slave 25	slave 25
26	slave 26	slave 26	slave 26	slave 26
27	slave 27	slave 27	slave 27	slave 27
28	slave 28	slave 28	slave 28	slave 28
29	slave 29	slave 29	slave 29	slave 29
30	slave 30	slave 30	slave 30	slave 30
31	slave 31	slave 31	slave 31	slave 31

*) For the slave address 0B (not allowed) the default setting for these values is "0".

Notes:

Single, A and B slaves use the same structure for profiles: S-[IO-Code].[ID-Code].[XID2-Code]	
IO code	I/O configuration, first digit in the slave profile
ID code	ID code, second digit in the slave profile
XID1-Code	Extended ID code 1, can be changed by the user, no part of the slave profile (for AS-i slave version ≤ 2.0 = F_h)
XID2 code	Extended ID code 2, third digit in the slave profile (for AS-i slave version 2.0 = F_h)

Details → page 36, chapter Configuration data (CDI) of the slaves (slave profiles)

strSlaveList– fields with slave lists

Word offset	Slave address															
0	15(A)	14(A)	13(A)	12(A)	11(A)	10(A)	9(A)	8(A)	7(A)	6(A)	5(A)	4(A)	3(A)	2(A)	1(A)	0 *)
1	31(A)	30(A)	29(A)	28(A)	27(A)	26(A)	25(A)	24(A)	23(A)	22(A)	21(A)	20(A)	19(A)	18(A)	17(A)	16(A)
2	15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res.
3	31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B

*) There is no slave 0 in the LAS and LPS lists, therefore the master sets the field to "0"!

IEC addresses → page 159

strSlaveErrCtr – fields with slave telegram error counters

Word offset	Telegram error counter of ...
0	slave 1(A)
1	slave 2(A)
2	slave 3(A)
3	slave 4(A)
4	slave 5(A)
5	slave 6(A)
...	...
28	slave 29(A)
29	slave 30(A)
30	slave 31(A)
31	slave 1B
32	slave 2B
33	slave 3B
34	slave 4B
...	...
57	slave 27B
58	slave 28B
59	slave 29B
60	slave 30B
61	slave 31B

IEC addresses → page 161

strAnalogSlave – fields with analoge I/O data

Word offset	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	analogue data channel 0 from/to slave or: analogue data channel 0 from/to slave 1A															
1	analogue data channel 1 from/to slave 1 or: analogue data channel 1 from/to slave 1A															
2	analogue data channel 2 from/to slave 1 or: analogue data channel 0 from/to slave 1B															
3	analogue data channel 3 from/to slave 1 or: analogue data channel 1 from/to slave 1B															
4	TIB	TOB	TIA	TOA	TVB	OVB	TVA	OVA	O3	V3	O2	V2	O1	V1	O0	V0
5	analogue data channel 0 from/to slave 2 or: analogue data channel 0 from/to slave 2A															
6	analogue data channel 1 from/to slave 2 or: analogue data channel 1 from/to slave 2A															
7	analogue data channel 2 from/to slave 2 or: analogue data channel 0 from/to slave 2B															
8	analogue data channel 3 from/to slave 2 or: analogue data channel 1 from/to slave 2B															
9	TIB	TOB	TIA	TOA	TVB	OVB	TVA	OVA	O3	V3	O2	V2	O1	V1	O0	V0
…	…															
150	analogue data channel 0 from/to slave 31 or: analogue data channel 0 from/to slave 31A															
151	analogue data channel 1 from/to slave 31 or: analogue data channel 1 from/to slave 31A															
152	analogue data channel 2 from/to slave 31 or: analogue data channel 0 from/to slave 31B															
153	analogue data channel 3 from/to slave 31 or: analogue data channel 1 from/to slave 31B															
154	TIB	TOB	TIA	TOA	TVB	OVB	TVA	OVA	O3	V3	O2	V2	O1	V1	O0	V0

Legend:

Vn	Validity bit "valid" for channel number n = 0...3 NOTE: set Vn = "1" for analogue output slaves!
On	Bit "overflow" for channel number n = 0…3
OVA	Channel-independent bit "output data valid" of the A slave CTT1: 0 = more than 3.5 s have elapsed since the last update of the output values 1 = slave requests new output data within the next 3 s CTT2…CTT5: 0 = slave receives no new output data 1 = slave receives new output data
TVA	Channel-independent bit "transmission valid" from A slave/single slave: 0 = error during transmission or: timeout 1 = transmission of analogue input/output data OK
OVB	Channel-independent bit "output data valid" from B slave: CTT1: 0 = more than 3.5 s have elapsed since the last update of the output values 1 = slave requests new output data within the next 3 s CTT2…CTT5: 0 = slave receives no new output data 1 = slave receives new output data NOTE: only valid for analogue output slaves. Set OVB = 0 for input slaves!
TVB	Channel-independent bit "transmission valid" from B slave: 0 = error during transmission or: timeout 1 = transmission of analogue input/output data OK

TIA	Slave transmits analogue input data...
TIB	0 = in the analogue mode (15 bits, with sign) 1 = in the transparent mode (16 bits, without sign)
TOA	Slave receives analogue output data...
TOB	0 = in the analogue mode (15 bits, with sign) 1 = in the transparent mode (16 bits, without sign)

IEC addresses → page 153

Command channel: description

General structure:

Channel CmdOut (requests from the user program to the operating system)

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte request *)								request output *) / status input *)							
1	command code															
2…16	data															
17	reserved															
18	reserved															

Channel CmdResp (responses of the operating system for the user program)

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte response *)								status input *)							
1	command code															
2…16	data / error code															
17	reserved															
18	reserved															

The field "request output / status input" in the channel "CmdOut" synchronises the process.

*) After the user program has entered a request in the command channel the operating system responds with "_PC_CMD_ACKN" in the output and input buffer. The command is now processed. As soon as the response is available the operating system enters a value greater than "_PC_CMD_ACKN" (= signal "command processing finished"). In this case the "echo byte request" is also copied to the "echo byte response". So the user program can detect a response even if the command code has not changed since the last command.

Valid values of "request output / status input"

Value	Symbolic name	Description
65_h	_PC_CMD_REQ	Command request by the user program
66_h	_PC_CMD_DETECT	Command request detected by the operating system
$6A_h$	_PC_CMD_ACKN	Command read and started by the operating system
$6B_h$	_PC_CMD_ERROR	Result of the command incorrect, error code command-specific
$6C_h$	_PC_CMD_TIMEOUT	timeout during the command processing
$6D_h$	_PC_CMD_IDLE	Reserved for test purposes
$6E_h$	_PC_CMD_INVALID	Unknown command, execution stopped
$6F_h$	_PC_CMD_READY	Command executed, data in the response buffer valid

Process for a command call

User program		Operating system
Status input equal to *_PC_CMD_READY* ?		—
NO	Wait	—
YES	Enter command data in the field "CmdOut" and set request output to _ PC_CMD_REQ Then → operating system:	- sets status input to *_PC_CMD_ACKN*, - starts command - copies command data to "CmdResp" - copies command code to "CmdResp" After finished processing: - entry of *_PC_CMD_READY* in status input
status input greater *_PC_CMD_ACKN* ?		—
NO	Wait	—
YES	Process result	—

Contents of "CmdResp" in case of _PC_CMD_ERROR

Word no.	15	14	13	12	11	10	9	8	Bits 0…7
0	echo byte								_PC_CMD_ERROR
1	command code								
2	not defined								command-specific error code
3…18	not defined								

Command channel: basic commands

Overview of the commands in the command channel

Command number		Description	→Page
Decimal	Hexadecimal		
1	01_h	Write parameters to a connected AS-i slave	31
4	04_h	Change the list of projected AS-i slaves (LPS)	32
5	05_h	Set the operating mode of the AS-i master	32
6	06_h	Readdress connected AS-i slave	33
9	09_h	Change the extended ID code 1 in the connected AS-i slave	34
28	$1C_h$	Deactivation of the slave reset when passing to the protected mode	35

Further commands depend on the version of the controller
→ separate supplementary manual for this device manaul.

Command 1 (01_h): write parameters

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request output							
1	00_h								01_h							
2	ignored										Sel	A4	A3	A2	A1	A0
3	ignored												P3	P2	P1	P0
4…18	ignored															

Legend:

SEL	0 = A slave 1 = B slave
A4…A0	slave address 0...31
P3…P0	parameter value to be written

Command response in case of _PC_CMD_READY:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								_PC_CMD_READY							
1	0								01_h							
2	ignored												P3	P2	P1	P0
3…16	ignored															
17…18	reserved															

Legend:

P3…P0	parameter value read back (= reflected parameter)

Possible error codes in case of _PC_CMD_ERROR:

Status	Error	Description
01_h	NOK	No slave response or: master is in offline mode
$0A_h$	NA	Slave not activated (= not in LAS)
$0B_h$	ID	Parameters not valid (>7_h for ID = A_h) or: Address invlaid
14_h	IC	Master not in normal operation (LED [COM] out)

Command 4 (04_h): write LPS

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request output							
1	0								04_h							
2	15(A)	14(A)	13(A)	12(A)	11(A)	10(A)	9(A)	8(A)	7(A)	6(A)	5(A)	4(A)	3(A)	2(A)	1(A)	0 *
3	31(A)	30(A)	29(A)	28(A)	27(A)	26(A)	25(A)	24(A)	23(A)	22(A)	21(A)	20(A)	19(A)	18(A)	17(A)	16(A)
4	15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
5	31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B
6…16	ignored															
17…18	reserved															

Possible error codes in case of _PC_CMD_ERROR:

Status	Error	Description
14_h	IC	Master not in the configuration mode

Command 5 (05_h): change operating mode

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request output							
1	0								05_h							
2	ignored															M
3…16	ignored															
17…18	ignored															

Legend:

M	0 = activate protected mode 1 = activate configuration mode

When changing to the protected mode the master normally passes the "offline phase" where all connected slaves (and so all outputs) are reset for some seconds.

If the master flag "no offline phase" is set, the "offline phase" and the reset are not executed.

The status of this flag can be changed by the command $1C_h$ (→ page 35) or via the menu items [Master Setup] > [AS-i Master x] > [Slave Reset] of the controllere.

Possible error codes in case of _PC_CMD_ERROR:

Status	Error	Description
03_h	SD0	Slave with address 0 connected

Command 6 (06_h): change slave address

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request output							
1	0								06_h							
2	ignored										Sel	old slave address				
3	ignored										Sel	new slave address				
4…16	ignored															
17…18	reserved															

Legend:

Sel	If slave ID = A, then: 0 = A slave or single slave 1 = B slave If slave ID ≠ A, Sel must be 0!

Possible error codes in case of _PC_CMD_ERROR:

Status	Error	Description
01_h	NOK	Master in offline mode during execution of the command
02_h	SND	No slave with old address found
03_h	SD0	Slave with address 0 found
04_h	SD2	Slave with new address already available
05_h	DE	Error when deleting the old address
06_h	RE	Error when reading the extended ID code 1
07_h	SE	Error when writing the new address or extended ID-code 1
08_h	AT	New address only stored temporarily
09_h	ET	Extended ID code 1 only stored temporarily
$0B_h$	ID	Invalid address or: slave with address 0 requested
14_h	IC	Master is not in normal operation

Command 9 (09_h): write extended ID code 1

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request ouput							
1	0								09_h							
2	ignored										Sel	A4	A3	A2	A1	A0
3	ignored												D3	D2	D1	D0
4…18	ignored															

Legend:

Sel	0 = A slave or single slave 1 = B slave
A4…A0	slave address 0…31
D3…D0	extended ID code 1

Possible error codes in case of _PC_CMD_ERROR:

Status	Error	Description
01_h	NOK	Master is in offline mode during execution of the command
02_h	SND	No slave with old address found
03_h	SD0	Slave with address 0 found
07_h	SE	error when writing the new address or extended ID code 1
09_h	ET	extended ID code 1 only stored temporarily
14_h	ID	Invalid address or: slave with address 0 requested

Command 28 ($1C_h$): change flag "no offline phase"

Command request:

Word no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	echo byte								request output							
1	0								$1C_h$							
2	ignored															M
3…18	ignored															

Legend:

M	0 = reset of the flag "no offline phase" (default setting!) 1 = setting of the flag "no offline phase"

When changing to the protected mode the master normally passes the "offline phase" where all connected slaves (and so all outputs) are reset for some seconds.

If the master flag "no offline phase" is set, the "offline phase" and the reset are not executed.

5.2.3 Configuration data (CDI) of the slaves (slave profiles)

The configuration data CDI (= **C**onfiguration **D**ata **I**mage) for standard, A and B slaves is stored in a data word. The structure is indicated as follows and the same for all slaves.

Structure of the slave profile: S-[IO-Code].[ID-Code].[ext.ID-Code2]

Bits 15...12	Bits 11...8	Bits 7...4	Bits 3...0
XID2 Extended ID code 2 3rd digit in the slave profile (AS-i slave v2.0 = F_h *)	XID1 Extended ID code 1 can be changed by the user; no part of the slave profile (AS-i slave v2.0 = F_h *)	ID code ID code 2nd digit in the slave profile	IO code I/O configuration 1st digit in the slave profile
Example: AC2255 4 digital inputs, 2 digital outputs AS-i profile = S-7.A.E This results in the following configuration data of the slave:			
$1110_2 = E_h$	(e.g.) $0111_2 = 7_h$	$1010_2 = A_h$	$0111_2 = 7_h$
The corresponding CDI data word is: $1110011110100111_2 = E7A7_h$			

*) AS-i slaves according to the AS-i specification 2.0 and older do not support the extended ID codes 1 and 2. In the master "F_h" is stored for this configuration data.

Current and projected configuration data are distinguished. The addresses for these data are listed from page 86.

Meaning of the IO code for digital slaves

Structure slave profile = S-[IO-Code].x.x

IO code (hex)	IO code (bits 3…0)	Function of the periphery bits			
		D3	D2	D1	D0
0	0000	input	input	input	input
1	0001	output	input	input	input
2	0010	input/output	input	input	input
3	0011	output	output	input	input
4	0100	input/output	input/output	input	input
5	0101	output	output	output	input
6	0110	input/output	input/output	input/output	input
7	0111	input/output	input/output	input/output	input/output
8	1000	output	output	output	output
9	1001	input	output	output	output
A	1010	input/output	output	output	output
B	1011	input	input	output	output
C	1100	input/output	input/output	output	output
D	1101	input	input	input	output
E	1110	input/output	input/output	input/output	output
F	1111	not allowed			

Meaning of the ID code (selection)

Structure slave profile = S-x.[ID-Code].x

ID code (hex)	ID code (bits 3…0)	Description
0	0000	4 I/O connections for binary sensors and/or actuators with 1 signal each
1	0001	2 dual-signal I/O connections for binary sensors and/or actuators with 2 signals each
A	1010	Slave operates in the "extended addressing mode" (B slave or A/B slave)
B	1011	Slave corresponds to "Safety at Work"
F	1111	Manufacturer-specific device (cannot replaced by products from other manufacturers)

Description of the extended ID code 1

Can be changed by the user, but is not part of the slave profile.

Default setting:
F_h for standard slaves
7_h for A/B slaves

The value is evaluated and checked by the master. The user can make an additional distinction between slaves which do not differ in the AS-i system, e.g. slaves with different ranges for current, voltage or frequency. This prevents damage when replacing slaves with a wrong range.

Description of the extended ID code 2

Extended ID code 2 for analogue slaves with profile 7.3.x

The extended ID code 2 is used to specify complex slaves.

Structure slave profile = S-7.3.[ext.ID code2]

Bit 3 (8_h)	Bit 2 (4_h)	Bit 1 (2_h)	Bit 0 (1_h)	Description
		0	0	1-channel slave
		0	1	2-channel slave
		1	0	4-channel slave
		1	1	4-channel slave (if slave has no extended ID code)
	0			transparent exchange of data = binary bits
	1			transmission of analogue values
0				output slave
1				input slave

The ID code 2 results from a combination of the options stated above.

Extended ID code 2 for analogue slaves with profile 7.4.x

The extended ID code 2 is used to specify complex slaves.

Structure slave profile = S-7.3.[ext.ID code2]

Bit 3 (8_h)	Bit 2 (4_h)	Bit 1 (2_h)	Bit 0 (1_h)	Description
		0	0	1-channel slave
		0	1	2-channel slave
		1	0	4-channel slave
		1	1	4-channel slave (if slave has no extended ID code)
0	0	0	0	4 binary inputs + 4 binary outputs
0				Output slave
1				Input slave

The ID code 2 results from a combination of the options stated above.

Valid combinations IO code / ID code / extended ID code 2

Structure slave profile = S-[IO code].[ID code].[ext.ID code2] x = any value (0…F)

IO code (hex)	ID code (hex)	Ext. ID code 2 (hex)	Description
0…E not: 9, B, D	0	x	Binary I/O connections for sensors and actuators
0, 3, 8	1	x	1 or 2 binary sensors or actuators with 2 signals each (dual-signal devices)
0	1	x	4 binary inputs for 2 dual-signal sensors
0…E not: 2, A	A	x	Slave operates in the "extended addressing mode" (B slave or A/B slave)
0	A	E	Slave with extended address function: 4 binary inputs for 2 dual-signal sensors (e.g. I/O module AC2250)
0	B	x	Slave corresponds to "Safety at Work"
0…E	F	x	Manufacturer-specific device (cannot be replaced by other products)
1	1	x	Single sensor with remote setting: 3 binary inputs + 1 binary output (e.g. sensor OC5226)
3	1	x	2 binary inputs for 1 dual-signal sensor AND 2 binary outputs for 1 dual-signal actuator
3	A	x	Slave with extended address function
3	A	1	Slave with extended address function: 2 binary inputs + 1 binary output
3	A	2	Slave with extended address function: 4 binary inputs
6	0	x	Quick combined transmission type 5 of 8, 12 or 16 data bits by using 2, 3 or 4 slave addresses in a slave
7	0	F	Motor starter 2I + 2O (e.g. ZB0032)
7	0	E	4 binary inputs + 4 binary outputs (e.g. I/O module AC2251)
7	1	x	Interface for the transmission of 6...18-bit signals; analogue profile for combined transmission type 1; was replaced by S-7.3
7	2	x	Extended slave profile for the transmission of 6...18-bit signals; extended analogue profile for combined transmission type 1; was replaced by S-7.4
7	3	x	Slave profile for 16-bit transmission with integrated support in the master; integrated analogue profile for combined transmission type 1 (Extended ID code 2 for analogue slaves with profile 7.3.x → page 37)
7	3	5	2 analogue outputs of 16 bits each (e.g. I/O module AC2618)
7	3	6	4 analogue outputs of 16 bits each (e.g. I/O module AC2518)
7	3	C	1 analogue input of 16 bits (e.g. sensor PPA020)
7	3	D	2 analogue inputs of 16 bits each (e.g. I/O module AC2616)
7	3	E	4 analogue inputs of 16 bits each (e.g. I/O modulel AC2516)

Valid combinations IO code / ID code / extended ID code 2

Structure slave profile = S-[IO code].[ID code].[ext.ID code2] x = any value (0…F)

IO code (hex)	ID code (hex)	Ext. ID code 2 (hex)	Description
7	4	x	Extended slave profile for 16-bit transmission with integrated support in the master; integrated extended analogue profile for combined transmission type 1 (Extended ID code 2 for analogue slaves with profile 7.4.x → page 38)
7	4	C	RFID identification system for writing and reading RFID tags 15-bit data + 1-bit messages (e.g. DTA100)
7	5	5	Combi Field Slaves – outputting and/or processing serial data as well as digital data
7	A	x	Slave operates in the "extended addressing mode" (B slave or A/B slave)
7	A	5	Slave operates in the "extended addressing mode" (B slave or A/B slave) combined slave; supports combined transmission type 2
7	A	7	Slave operates in the "extended addressing mode" (B slave or A/B slave) 4 binary inputs + 4 binary outputs
7	A	8	Slave operates in the "extended addressing mode" (B slave or A/B slave) 1 channel for combined transmission type 4
7	A	9	Slave operates in the "extended addressing mode" (B slave or A/B slave) dual channel for combined transmission type 4
7	A	A	Slave operates in the "extended addressing mode" (B slave or A/B slave) 8 binary inputs + 8 binary outputs
7	A	E	Slave operates in the "extended addressing mode" (B slave or A/B slave); dual sensor with actuator interface (e.g. sensor AC2317); 2 binary inputs + 2 binary outputs
7	B	x	Safety slave with non-safe outputs
7	B	0	Safety slave with non-safe outputs; 2 safe binary inputs (e.g. I/O module AC005S)
7	B	E	Safety sensor with non-safe outputs; 3 safe binary inputs AND 2 safe binary outputs AND 2 non-safe (relay) outputs (e.g. I/O module AC009S)
7	D	x	Device for motor control (electromechanical)
7	D	0	Electromechanical motor control with open sub-profile
7	D	1	Electromechanical direct starter
7	D	2	Electromechanical reverser
7	D	3	Electromechanical direct starter with brake
7	D	4	Electromechanical reverser with brake
7	D	5	Electromechanical direct starter with accessories
7	D	6	Electromechanical reverser with accessories
7	E	x	Device for motor control (electronic)
7	E	0	Electronic motor control with open sub-profile
7	E	1	Electronic direct starter
7	E	2	Electronic reverser
7	E	3	Electronic direct starter with brake
7	E	4	Electronic reverser with brake
7	E	5	Electronic direct starter with accessories
7	E	6	Electronic reverser with accessories
8	1	x	4 binary outputs for 2 dual-signal actuators
B	1	x	Dual-signal actuator with feedback: 2 binary outputs + 2 binary inputs
B	A	5	Slave operates in the "extended addressing mode" (B slave or A/B slave); supports combined transmission type 2
B	A	E	Slave operates in the "extended addressing mode" (B slave or A/B slave); 2 binary outputs + 2 binary inputs (e.g. AC2086 module)
D	1	x	Single actuator with monitoring: 1 binary output + 3 binary inputs

Controller$_E$ devices with master profile M4 enable connection of slaves with more than 4 digital inputs/outputs. The transmission is combined: part of the data transmission is carried out via the digital bits D0...D3, another part via the "analogue" channels.

NOTE

The more data is transmitted, the longer it takes until all data of a slave has been transmitted.

Cycle time standard single slave = 5 ms
Cycle time standard A/B slave (if address is only assigned to A or B slave) = 5 ms
Cycle time standard A/B slave (if address is assigned to A and B slave) = 10 ms
The cycle time for CTT transmission (= combined transmission) is a multiple of these values for individual data.

CTT = Combined Transaction Type

Slave profile for slaves with combined transmission

Structure slave profile = S-[IO code].[ID code].[ext.ID code2]

Slave profile	Master profile	Use of analogue channels in the controller		Binary bits D0…D3	Additional acyclic string data transmission	Combined transmission CTT
		Number of channels	Use analogue / binary			
S-6.0	M4	1 I **and** 1 O	2/3/4 x 4 binary inputs **and** 2/3/4 x 4 binary outputs	—	no	type 5
S-7.3	M3	1/2/4 I **or** 1/2/4 O	1/2/4 analogue inputs **or** 1/2/4 analogue outputs	—	no	type 1
S-7.4	M3	1/2/4 I **or** 1/2/4 O	1/2/4 analogue inputs **or** 1/2/4 analogue outputs	**or** 4 inputs 4 outputs	yes	type 1
S-7.5.5	M4	0…4 I **and** 0…4 O	0…4 analogue inputs or ≤ 64 binary inputs **and** 0…4 analogue outputs or ≤ 64 binary outputs	**and** 2 inputs 2 outputs	yes	type 2
S-7.A.5	M4	0…2 I **and** 0…2O	0…2 analogue inputs or ≤ 32 binary inputs **and** 0…2 analogue outputs or ≤ 32 binary outputs	**and** 2 inputs 1 output	yes	type 2
S-7.A.7	M4	—	—	4 inputs 4 outupts	no	type 3
S-7.A.8	M4	1 I	1 analogue input **or** ≤ 16 binary inputs	**and** 1 output	no	type 4
S-7.A.9	M4	2 I	2 analogue inputs **or** ≤32 binary inputs	—	no	type 4
S-7.A.A	M4	1 I **and** 1 O	8 binary inputs **and** 8 binary outputs	—	no	type 3
S-B.A.5	M4	0…2 I **and** 0…2 O	0…2 analogue inputs or ≤ 32 binary inputs **and** 0…2 analogue outputs or ≤ 32 binary outputs	—	yes	type 2

NOTE

Further slave profiles are continuously developed and approved by the technical commission of "AS-International Association". The AS-i controller can only communicate with slaves whose profiles are defined in the controller operating system.

► Contact your AS-i specialist.

Combined transmission:
Use of analogue channels in the controllere depending on the slave profile

Transmission	Slave profile	Slave type	Number channels	Analogue input channels					Analogue output channels				
				CH3	CH2	CH1	CH0	Trans.	CH3	CH2	CH1	CH0	Trans.
CTT5	6.0.x	S	1	–	–	–	b	–	–	–	–	b	–
CTT1	7.3.C	S	1	–	–	–	a	–	–	–	–	–	–
	7.3.D	S	2	–	–	a	a	–	–	–	–	–	–
	7.3.E	S	4	a	a	a	a	–	–	–	–	–	–
	7.3.4	S	1	–	–	–	–	–	–	–	–	a	–
	7.3.5	S	2	–	–	–	–	–	–	–	a	a	–
	7.3.6	S	4	–	–	–	–	–	a	a	a	a	–
	7.3.C	S	1	–	–	–	a	–	–	–	–	–	–
	7.3.D	S	2	–	–	a	a	–	–	–	–	–	–
	7.3.E	S	4	a	a	a	a	–	–	–	–	–	–
	7.3.4	S	1	–	–	–	–	–	–	–	–	a	–
	7.3.5	S	2	–	–	–	–	–	–	–	a	a	–
	7.3.6	S	4	–	–	–	–	–	a	a	a	a	–
CTT1	7.4.4	S	1	–	–	–	–	–	–	–	–	a	X
	7.4.5	S	2	–	–	–	–	–	–	–	a	a	X
	7.4.6	S	4	–	–	–	–	–	a	a	a	a	X
	7.4.C	S	1	–	–	–	a	X	–	–	–	–	–
	7.4.D	S	2	–	–	a	a	X	–	–	–	–	–
	7.4.E	S	4	a	a	a	a	X	–	–	–	–	–
CTT2	7.5.5	S	0…4	a b	a b	a b	a b	X	a b	a b	a b	a b	X
CTT2	7.A.5	A	0…2	–	–	a b	a b	X	–	–	a b	a b	X
	7.A.5	B	0…2	a b	a b	–	–	X	a b	a b	–	–	X
CTT3	7.A.7	A	–	only binary				–	only binary				–
		B	–					–					–
CTT4	7.A.8	A	1	–	–	–	a b	–	–	–	–	–	–
		B	1	–	a b	–	–	–	–	–	–	–	–
CTT4	7.A.9	A	2	–	–	a b	a b	–	–	–	–	–	–
		B	2	a b	a b	–	–	–	–	–	–	–	–
CTT3	7.A.A	A	1	–	–	–	b	–	–	–	–	b	–
		B	1	–	b	–	–	–	–	b	–	–	–
CTT2	B.A.5	A	0…2	–	–	a b	a b	X	–	–	a b	a b	X
	B.A.5	B	0…2	a b	a b	–	–	X	a b	a b	–	–	X

S = single slave
A = A slave
B = B slave

a = analogue inputs/outputs (word)
b = binary inputs/outputs (bits)
– = not used

X = additional acyclic transmission of strings for device, parameters, diagnosis

5.2.4 Data distribution of slaves in the M4 controllere (depending on the profile)

Data distribution of the single slave with profile S-0.1 in the M4 controllere

Slave:

- 4 binary inputs for 2 dual-signal sensors

Controllere:

- 4 binary inputs

M4 controllere Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	%IX1.3.0
A binary IN D1	%IX1.3.1
A binary IN D2	%IX1.3.2
A binary IN D3	%IX1.3.3
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave Profile S-0.1 Example slave adr. 3
binary IN D0
binary IN D1
binary IN D2
binary IN D3

Data distribution of the A slave with profile S-0.A.E in the M4 controller$_e$

Slave:

- 4 binary inputs for 2 dual-single sensors

Controller$_e$:

- 4 binary inputs

M4 controller$_e$ Example for master 1			**A slave profile** **S-0.A.E** Example slave adr. 3A
analogue IN 1			
analogue IN 2			
analogue IN 3			
analogue IN 4			
analogue OUT 1			
analogue OUT 2			
analogue OUT 3			
analogue OUT 4			
A binary IN D0	%IX1.3.0	←	binary IN D0
A binary IN D1	%IX1.3.1	←	binary IN D1
A binary IN D2	%IX1.3.2	←	binary IN D2
A binary IN D3	%IX1.3.3	←	binary IN D3
A binary OUT D0			
A binary OUT D1			
A binary OUT D2			
A binary OUT D3			
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the B slave with profile S-0.A.E in the M4 controller$_e$

Slave:

- 4 binary inputs for 2 dual-single sensors

Controller$_e$:

- 4 binary inputs

M4 controller$_e$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	%IX11.3.0
B binary IN D1	%IX11.3.1
B binary IN D2	%IX11.3.2
B binary IN D3	%IX11.3.3
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

B slave profile **S-0.A.E** Example slave adr. 3B
binary IN D0
binary IN D1
binary IN D2
binary IN D3

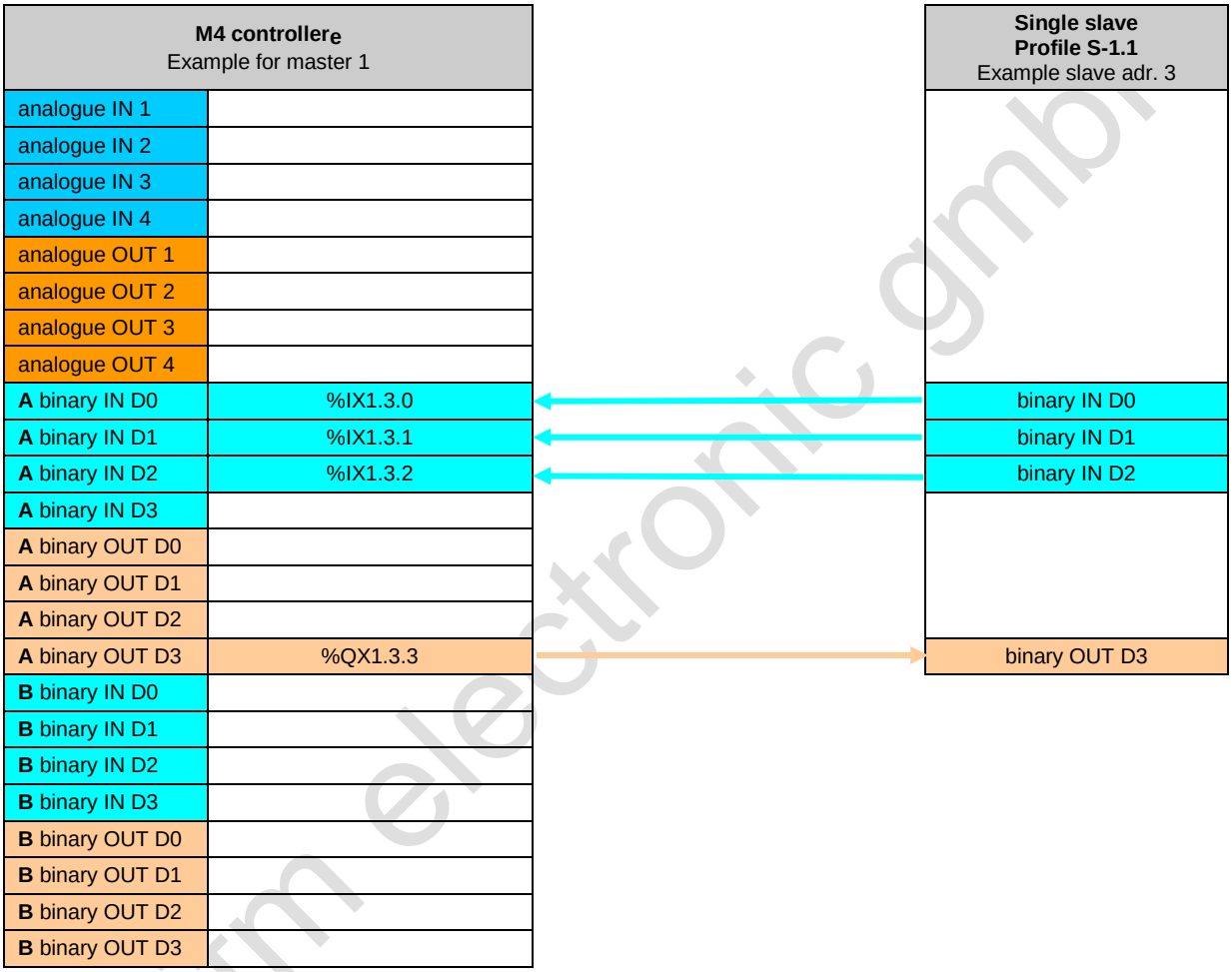
Data distribution of the single slave with profile S-1.1 in the M4 controllere

Slave:

- 3 binary inputs
- 1 binary output

Controllere:

- 3 binary inputs
- 1 binary output



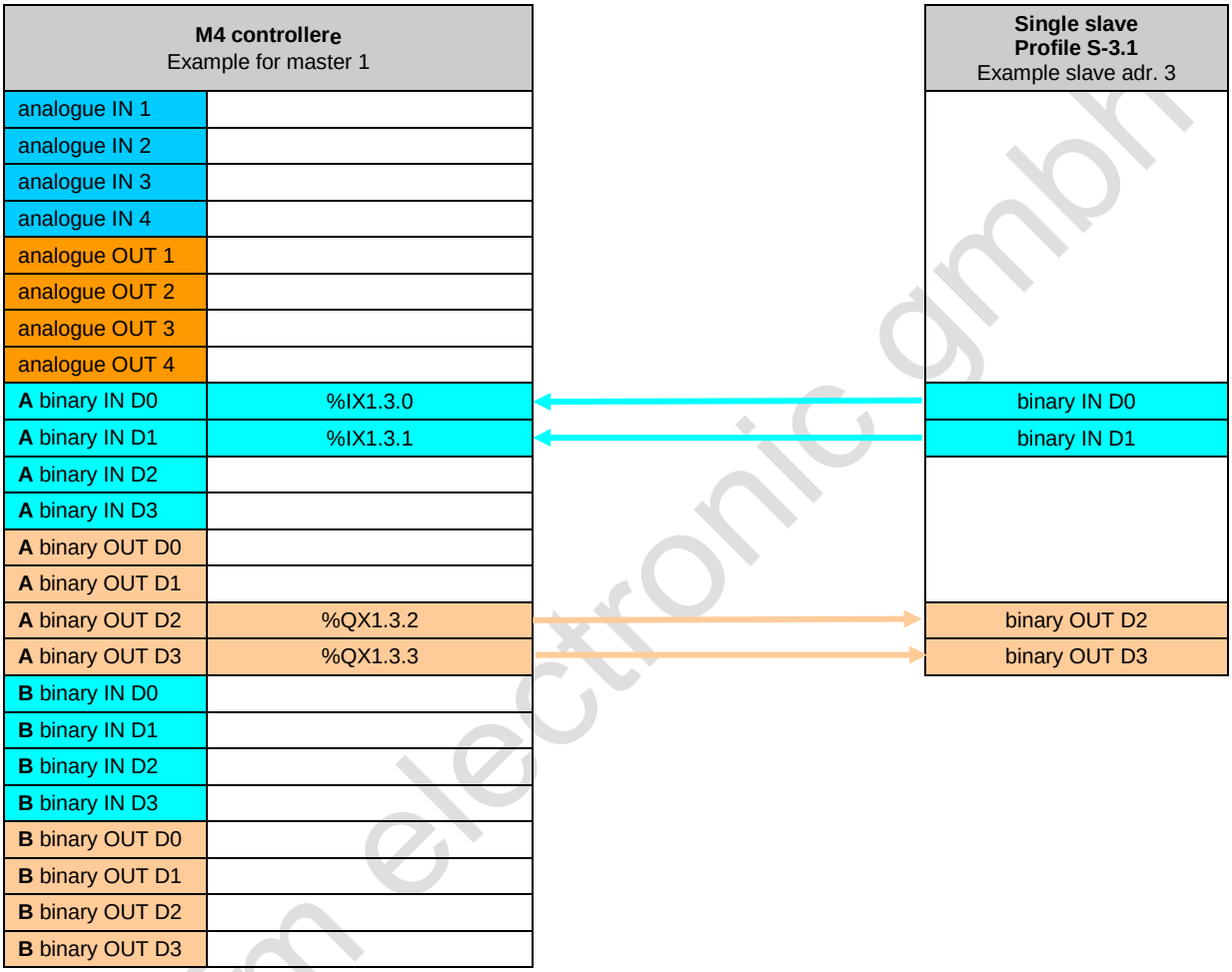
Data distribution of the single slave with profile S-3.1 in the M4 controllere

Slave:

- 2 binary inputs for 1 dual-signal sensor
- 2 binary outputs for 1 dual-signal actuator

Controllere:

- 2 binary inputs + 2 binary outputs



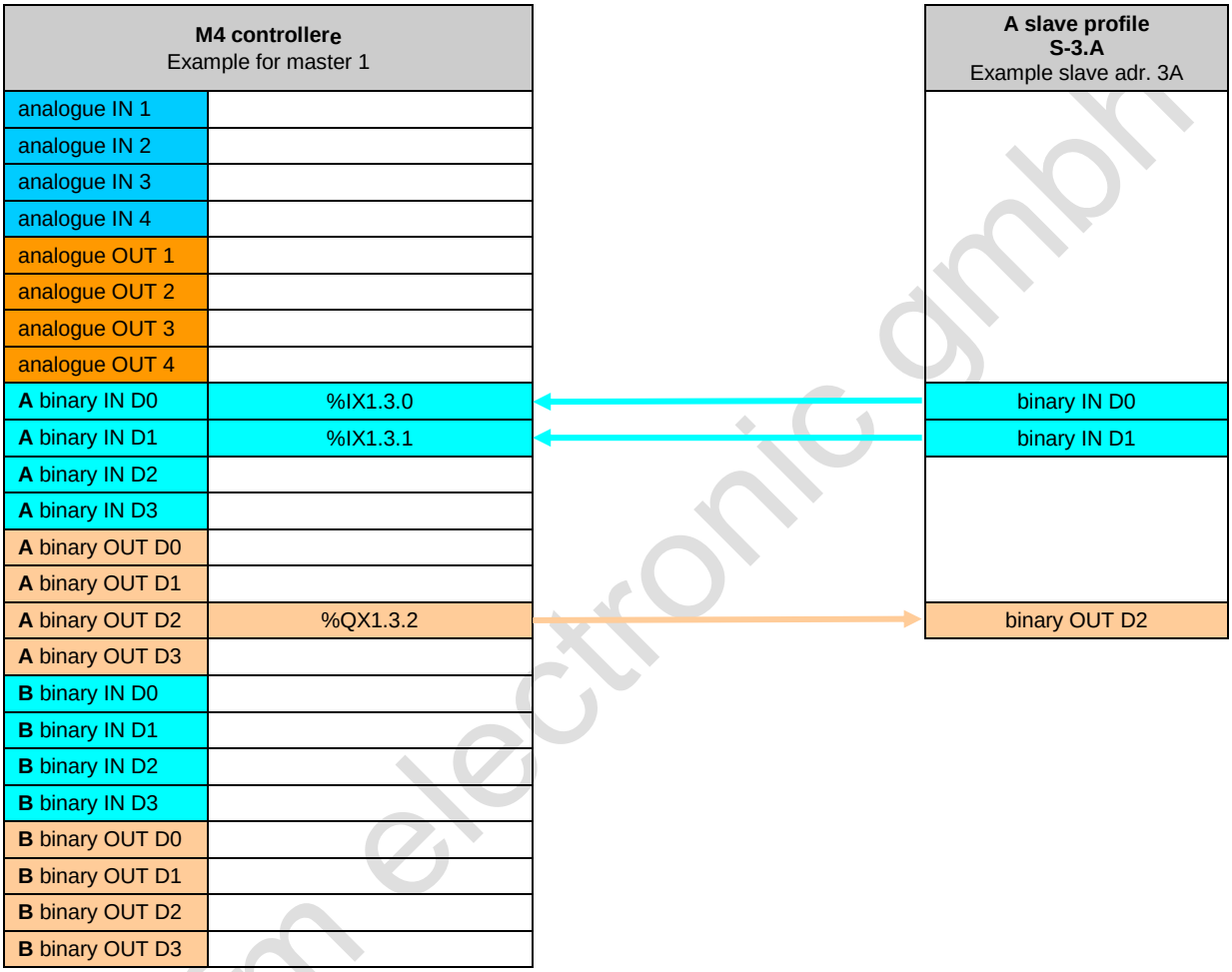
Data distribution of the A slave with profile S-3.A in the M4 controllere

Slave:

- 2 binary inputs
- 1 binary output

Controllere:

- 2 binary inputs + 1 binary output



For slaves with extended addressing mode (ID code = A) the master uses the binary output bit D3 to distinguish between A and B slaves. D3 cannot be used.

Data distribution of the B slave with profile S-3.A in the M4 controllere

Slave:

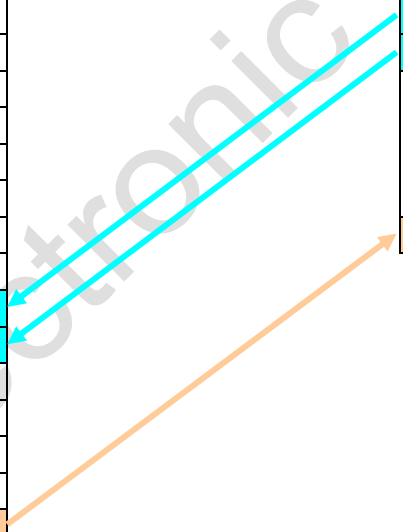
- 2 binary inputs
- 1 binary output

Controllere:

- 2 binary inputs + 1 binary output

M4 controllere Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	%IX11.3.0
B binary IN D1	%IX11.3.1
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	%QX11.3.2
B binary OUT D3	

B slave profile **S-3.A** Example slave adr. 3B
binary IN D0
binary IN D1
binary OUT D2



For slaves with extended addressing mode (ID code = A) the master uses the binary output bit D3 to distinguish between A and B slaves. D3 cannot be used.

Data distribution of the single slave with profile S-6.0.x in the M4 controllere (transpar. mode)

The slave module contains 2...4 successive slave addresses with digital data.

Slave:

Number slave addresses	Data length bit stream	Slave profile for ...			
		1st slave	2nd slave	3rd slave	4th slave
2	8 bits	S-6.0.2	S-6.0.5	—	—
3	12 bits	S-6.0.3	S-6.0.6	S-6.0.5	—
4	16 bits	S-6.0.4	S-6.0.7	S-6.0.6	S-6.0.5

Controllere:

- 1 input channel + 1 output channel (if less than 4 slave addresses only partly used and always filled from left (D15) to right (D0))

Example: first slave address = 3 and data length = 16 bits

M4 controllere						Single slave profile S-6.0.x
analogue IN 1	15…12	11…8	7…4	3…0	%IW21.3.0	**Slave profile S-6.0.4 (adr.= 3)**
analogue IN 2						binary IN D0
analogue IN 3						binary IN D1
analogue IN 4						binary IN D2
analogue OUT 1	15…12	11…8	7…4	3…0	%QW21.3.0	binary IN D3
analogue OUT 2						binary OUT D0
analogue OUT 3						binary OUT D1
analogue OUT 4						binary OUT D2
A binary IN D0						binary OUT D3
A binary IN D1						**Slave profile S-6.0.7 (adr.= 4)**
A binary IN D2						binary IN D0
A binary IN D3						binary IN D1
A binary OUT D0						binary IN D2
A binary OUT D1						binary IN D3
A binary OUT D2						binary OUT D0
A binary OUT D3						binary OUT D1
B binary IN D0						binary OUT D2
B binary IN D1						binary OUT D3
B binary IN D2						**Slave profile S-6.0.6 (adr.= 5)**
B binary IN D3						binary IN D0
B binary OUT D0						binary IN D1
B binary OUT D1						binary IN D2
B binary OUT D2						binary IN D3
B binary OUT D3						binary OUT D0
						binary OUT D1
						binary OUT D2
						binary OUT D3
						Slave profile S-6.0.5 (adr.= 6)
						binary IN D0
						binary IN D1
						binary IN D2
						binary IN D3
						binary OUT D0
						binary OUT D1
						binary OUT D2
						binary OUT D3

Data distribution of the single slave with profile S-6.0.x in the M4 controllerE (analogue mode)

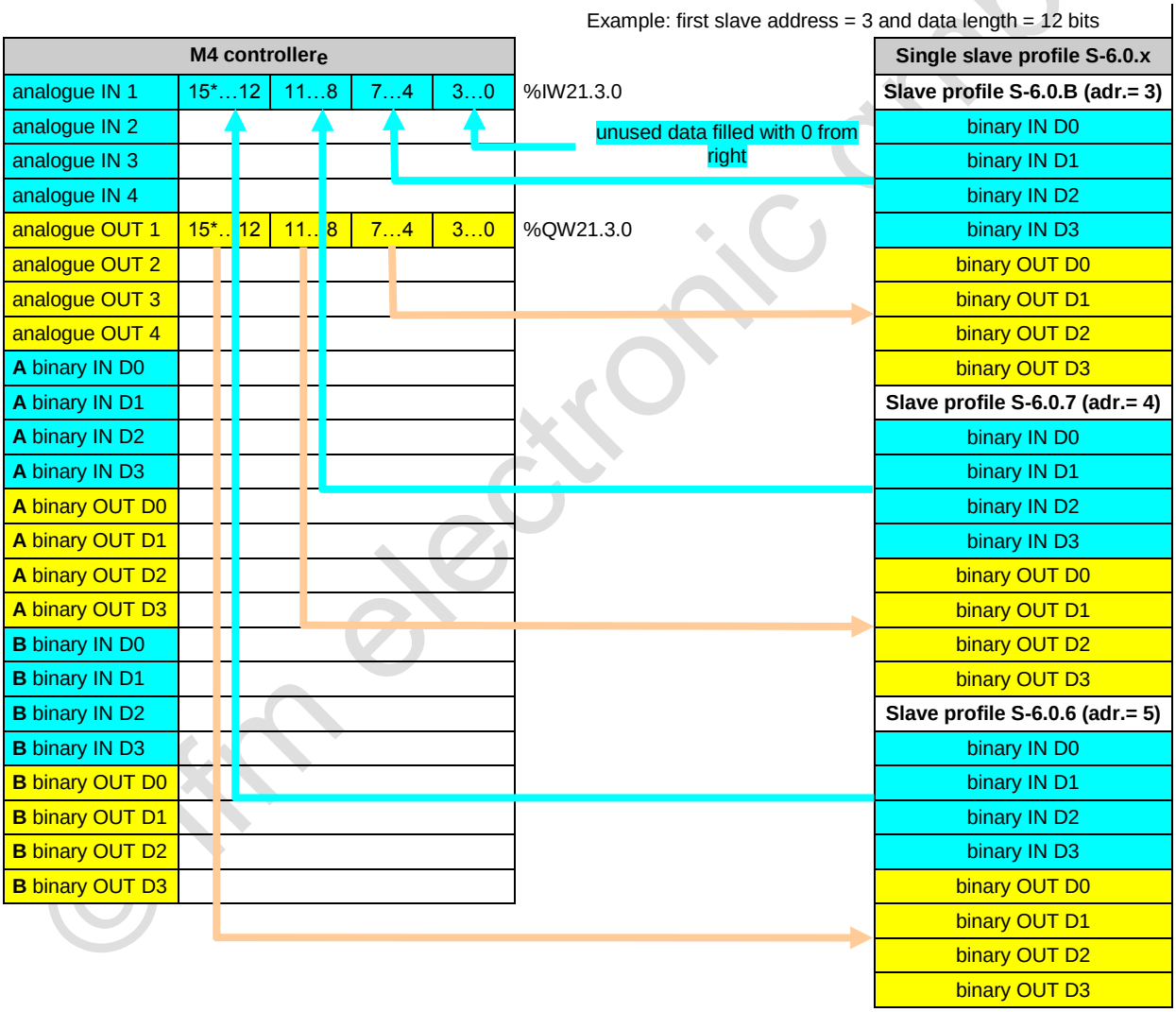
The slave modue contains 2...4 successive slave addresses with binary data which together represent an analogue value.

Slave:

Number slave addresses	Data length bit stream	Slave profile for …			
		1st slave	2nd slave	3rd slave	4th slave
2	8 bits	S-6.0.A	S-6.0.5	—	—
3	12 bits	S-6.0.B	S-6.0.6	S-6.0.5	—
4	16 bits	S-6.0.C	S-6.0.7	S-6.0.6	S-6.0.5

ControllerE:

- 1 input channel + 1 output channel (if less than 4 slave addresses only partly used and always filled from left (D15) to right (D0))



* Data bit D15 = bit with sign ➔ therefore the highest slave number always provides the sign of the analogue value and the 3 most significant bits of the analogue value.

Data distribution of the single slave with profile S-7.3.4 in the M4 controller$_e$

Slave:

- 1-channel analogue output

Controller$_e$:

- 1 output channel

M4 controller$_e$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.3.4** Example slave adr. 3
analogue OUT 1

Data distribution of the single slave with profile S-7.3.5 in the M4 controller$_e$

Slave:

- 2-channel analogue outputs

Controller$_e$:

- 2 output channels

M4 controller$_e$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	%QW21.3.1
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.3.5** Example slave adr. 3
analogue OUT 1
analogue OUT 2

Data distribution of the single slave with profile S-7.3.6 in the M4 controller$_e$

Slave:

- 4 channels analogue outputs

Controller$_e$:

- 4 output channels

M4 controller$_e$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	%QW21.3.1
analogue OUT 3	%QW21.3.2
analogue OUT 4	%QW21.3.3
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.3.6** Example slave adr. 3
analogue OUT 1
analogue OUT 2
analogue OUT 3
analogue OUT 4

Data distribution of the single slave with profile S-7.3.C in the M4 controller$_e$

Slave:

- 1-channel analogue input

Controller$_e$:

- 1 input channel

M4 controller$_e$ Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.3.C** Example slave adr. 3
analogue IN 1

Data distribution of the single slave with profile S-7.3.D in the M4 controller$_e$

Slave:

- 2-channel analogue inputs

Controller$_e$:

- 2 input channels

M4 controller$_e$ Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	%IW21.3.1
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.3.D** Example slave adr. 3
analogue IN 1
analogue IN 2

Data distribution of the single slave with profile S-7.3.E in the M4 controller$_e$

Slave:

- 2-channel analogue inputs

Controller$_e$:

- 2 input channels

M4 controller$_e$ Example for master 1			**Single slave Profile S-7.3.E** Example slave adr. 3
analogue IN 1	%IW21.3.0	←	analogue IN 1
analogue IN 2	%IW21.3.1	←	analogue IN 2
analogue IN 3	%IW21.3.2	←	analogue IN 3
analogue IN 4	%IW21.3.3	←	analogue IN 4
analogue OUT 1			
analogue OUT 2			
analogue OUT 3			
analogue OUT 4			
A binary IN D0			
A binary IN D1			
A binary IN D2			
A binary IN D3			
A binary OUT D0			
A binary OUT D1			
A binary OUT D2			
A binary OUT D3			
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the single slave with profile S-7.4.0 in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 4 binary inputs + 4 binary outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 4 binary inputs + 4 binary outputs

M4 controllere Example for master 1			**Single slave** **Profile S-7.4.0** Example slave adr. 3
analogue IN 1			
analogue IN 2			
analogue IN 3			
analogue IN 4			
analogue OUT 1			
analogue OUT 2			
analogue OUT 3			
analogue OUT 4			
A binary IN D0	%IX1.3.0	←	binary IN D0
A binary IN D1	%IX1.3.1	←	binary IN D1
A binary IN D2	%IX1.3.2	←	binary IN D2
A binary IN D3	%IX1.3.3	←	binary IN D3
A binary OUT D0	%QX1.3.0	→	binary OUT D0
A binary OUT D1	%QX1.31	→	binary OUT D1
A binary OUT D2	%QX1.3.2	→	binary OUT D2
A binary OUT D3	%QX1.3.3	→	binary OUT D3
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the single slave with profile S-7.4.4 in the M4 controllere

Slave:
E type field in the ID string of the slave = 1

- 1-channel analogue output
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 1 output channel

M4 controllere Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.4.4** Example slave adr. 3
analogue OUT 1

Data distribution of the single slave with profile S-7.4.5 in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 2-channel analogue outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 2 output channels

M4 controllere Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	%QW21.3.1
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.4.5** Example slave adr. 3
analogue OUT 1
analogue OUT 2

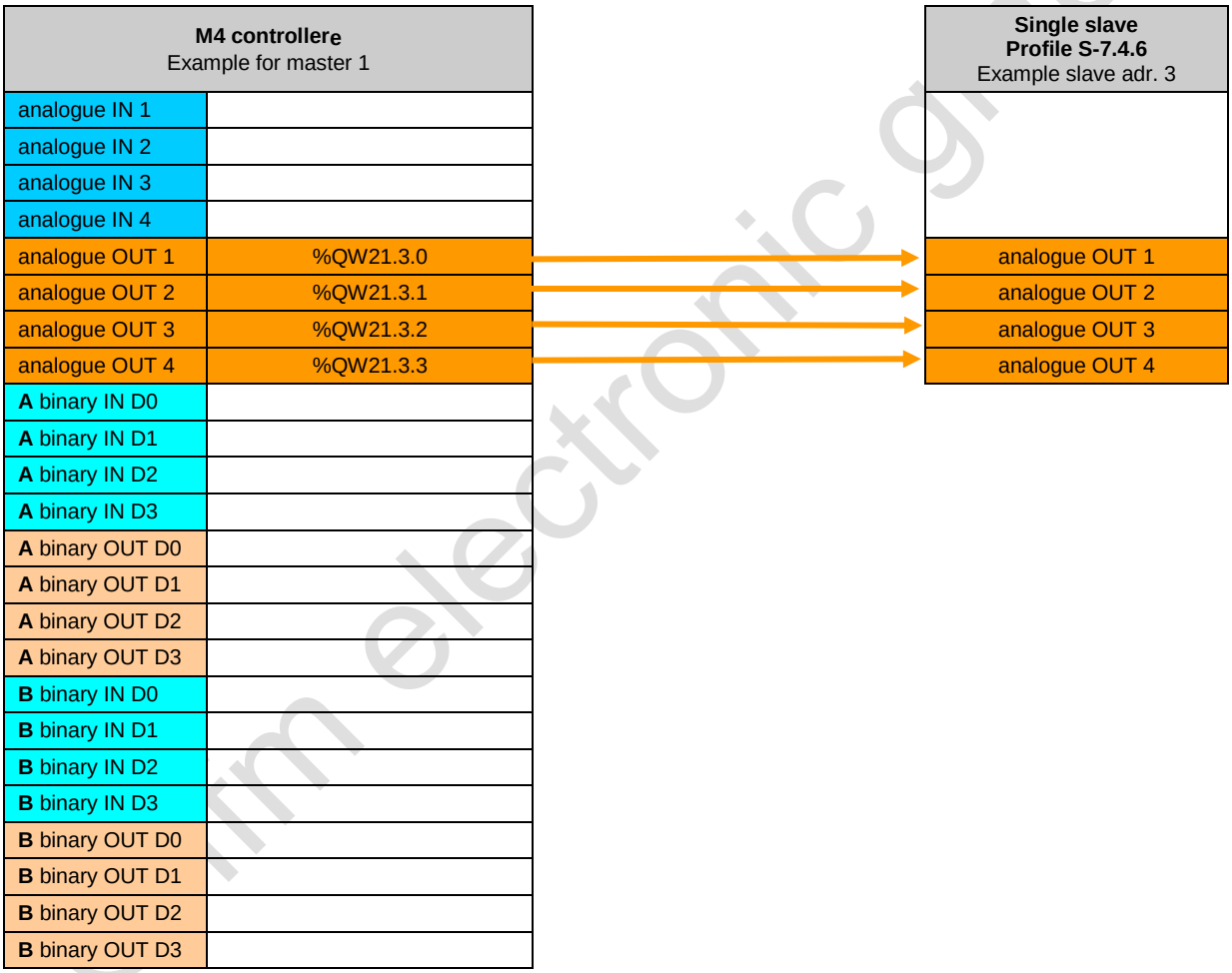
Data distribution of the single slave with profile S-7.4.6 in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 4-channel analogue outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 4 output channels



Data distribution of the single slave with profile S-7.4.C in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 1-channel analogue input
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 1 input channel

M4 controllere Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.4.C** Example slave adr. 3
analogue IN 1

Data distribution of the single slave with profile S-7.4.D in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 2-channel analogue inputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 2 input channels

M4 controllere Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	%IW21.3.1
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.4.D** Example slave adr. 3
analogue IN 1
analogue IN 2

Data distribution of the single slave with profile S-7.4.E in the M4 controllere

Slave:
E type field in the ID string of the slave = 3

- 4-channel analogue inputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 4 input channels

M4 controllere Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	%IW21.3.1
analogue IN 3	%IW21.3.2
analogue IN 4	%IW21.3.3
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

Single slave **Profile S-7.4.E** Example slave adr. 3
analogue IN 1
analogue IN 2
analogue IN 3
analogue IN 4

Data distribution of the single slave with profile S-7.5.5 in the M4 controllere

Slave:

- 0…4-channel analogue inputs OR
  ≤ 64-bit binary inputs
- 0…4-channel analogue outputs OR
  ≤ 64-bit binary outputs
- 2 binary inputs + 2 binary outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

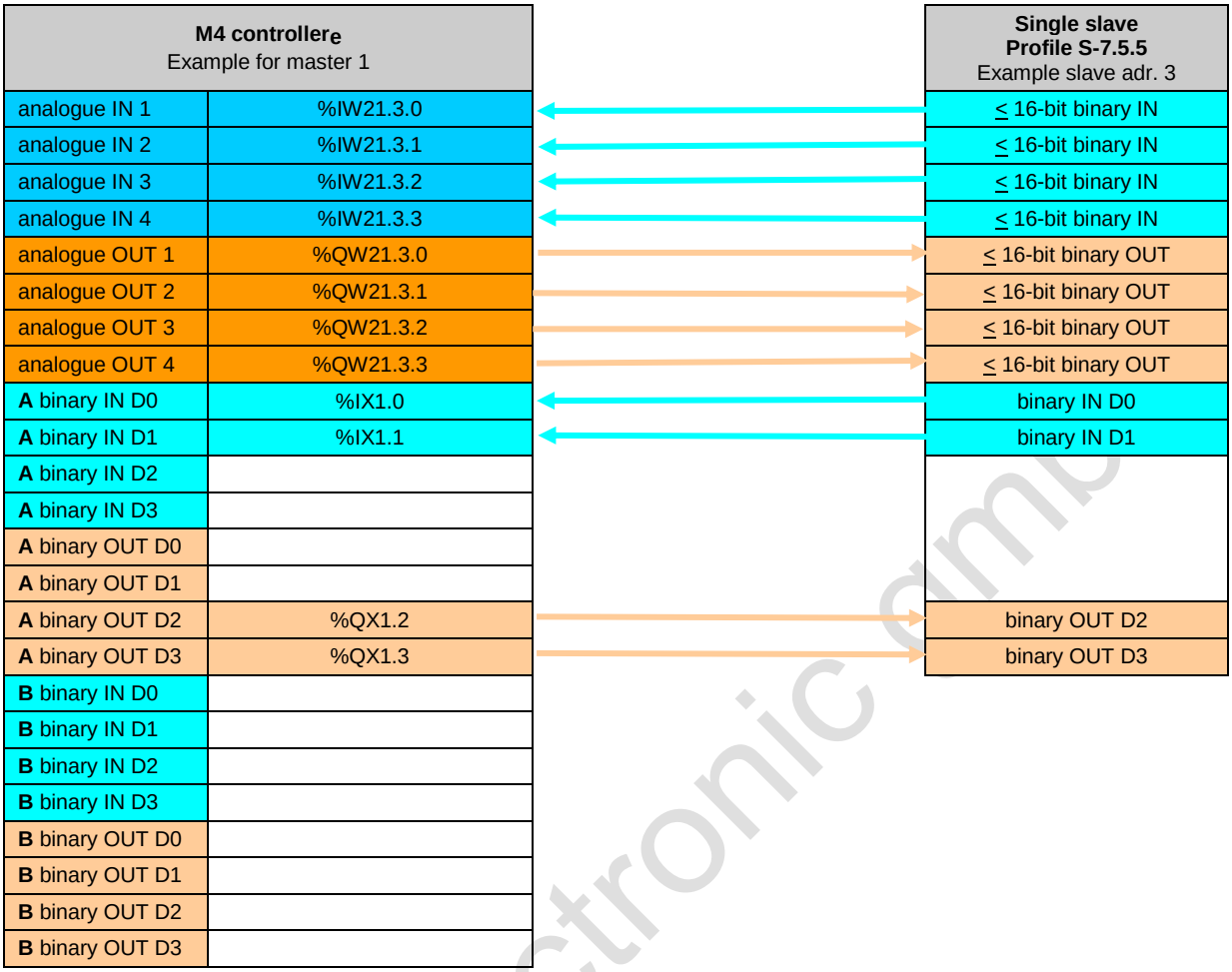
Controllere:

- 0…4 input channels
- 0…4 output channels
- 2 binary inputs + 2 binary outputs

Figure: diagram for analogue signals

M4 controllere Example for master 1			**Single slave** **Profile S-7.5.5** Example slave adr. 3
analogue IN 1	%IW21.3.0	←	analogue IN 1
analogue IN 2	%IW21.3.1	←	analogue IN 2
analogue IN 3	%IW21.3.2	←	analogue IN 3
analogue IN 4	%IW21.3.3	←	analogue IN 4
analogue OUT 1	%QW21.3.0	→	analogue OUT 1
analogue OUT 2	%QW21.3.1	→	analogue OUT 2
analogue OUT 3	%QW21.3.2	→	analogue OUT 3
analogue OUT 4	%QW21.3.3	→	analogue OUT 4
A binary IN D0	%IX1.0	←	binary IN D0
A binary IN D1	%IX1.1	←	binary IN D1
A binary IN D2			
A binary IN D3			
A binary OUT D0			
A binary OUT D1			
A binary OUT D2	%QX1.2	→	binary OUT D2
A binary OUT D3	%QX1.3	→	binary OUT D3
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Figure: diagram for binary signals



M4 controller$_E$ Example for master 1			**Single slave Profile S-7.5.5** Example slave adr. 3
analogue IN 1	%IW21.3.0	←	≤ 16-bit binary IN
analogue IN 2	%IW21.3.1	←	≤ 16-bit binary IN
analogue IN 3	%IW21.3.2	←	≤ 16-bit binary IN
analogue IN 4	%IW21.3.3	←	≤ 16-bit binary IN
analogue OUT 1	%QW21.3.0	→	≤ 16-bit binary OUT
analogue OUT 2	%QW21.3.1	→	≤ 16-bit binary OUT
analogue OUT 3	%QW21.3.2	→	≤ 16-bit binary OUT
analogue OUT 4	%QW21.3.3	→	≤ 16-bit binary OUT
A binary IN D0	%IX1.0	←	binary IN D0
A binary IN D1	%IX1.1	←	binary IN D1
A binary IN D2			
A binary IN D3			
A binary OUT D0			
A binary OUT D1			
A binary OUT D2	%QX1.2	→	binary OUT D2
A binary OUT D3	%QX1.3	→	binary OUT D3
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the A slave with profile S-7.A.5 in the M4 controllere

Slave:

- 0…2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 0…2-channel analogue outputs OR
  ≤ 32-bit binary outputs
- 2 binary inputs + 1 binary output
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 0…2 input channels
- 0…2 output channels
- 2 binary inputs + 1 binary output

Figure: diagram for analogue signals:

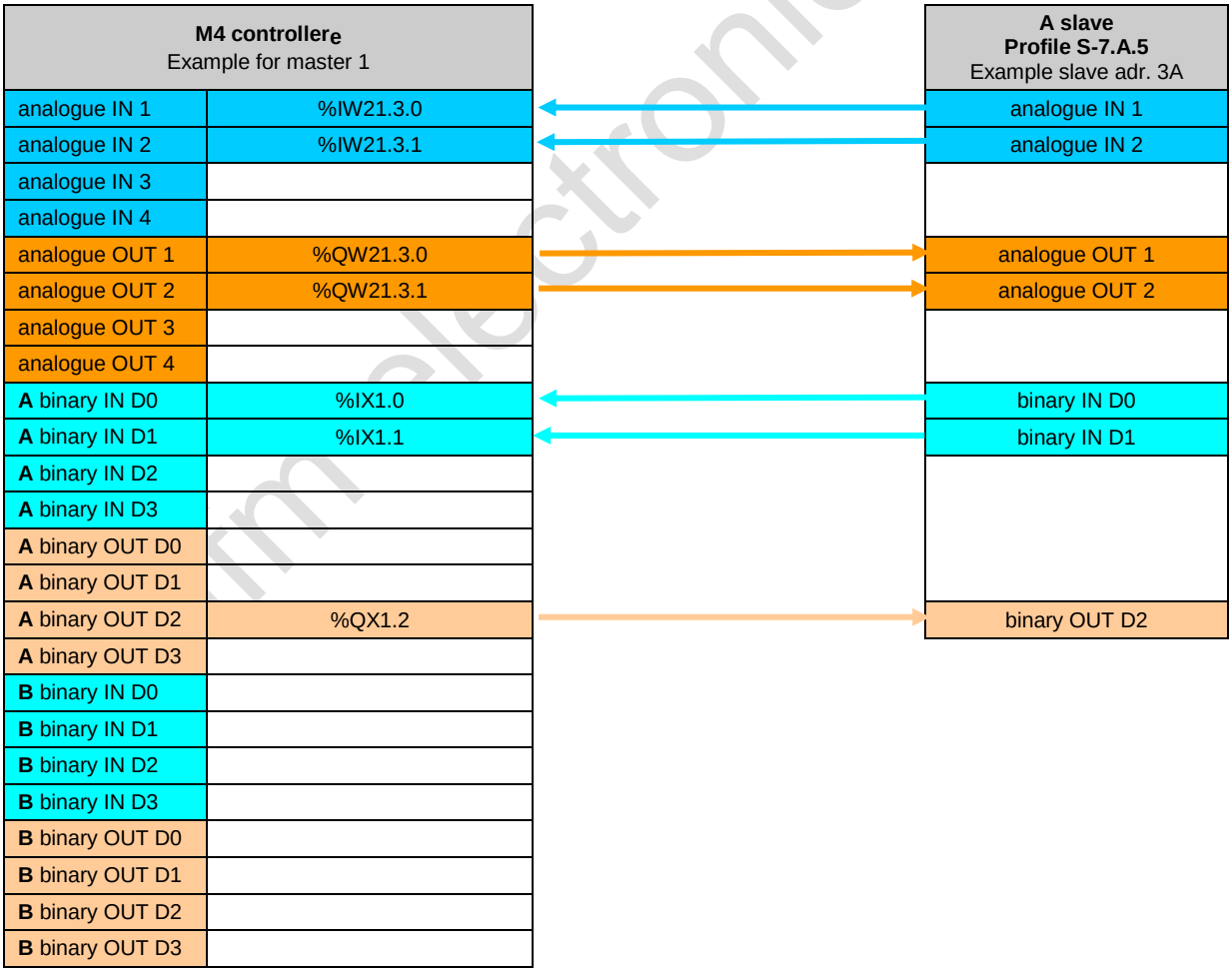


Figure: diagram for binary signals:

M4 controller$_E$ Example for master 1			**A slave** **Profile S-7.A.5** Example slave adr. 3A
analogue IN 1	%IW21.3.0	←	≤ 16-bit binary IN
analogue IN 2	%IW21.3.1	←	≤ 16-bit binary IN
analogue IN 3			
analogue IN 4			
analogue OUT 1	%QW21.3.0	→	≤ 16-bit binary OUT
analogue OUT 2	%QW21.3.1	→	≤ 16-bit binary OUT
analogue OUT 3			
analogue OUT 4			
A binary IN D0	%IX1.0	←	binary IN D0
A binary IN D1	%IX1.1	←	binary IN D1
A binary IN D2			
A binary IN D3			
A binary OUT D0			
A binary OUT D1			
A binary OUT D2	%QX1.2	→	binary OUT D2
A binary OUT D3			
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the B slave with profile S-7.A.5 in the M4 controllere

Slave:

- 0…2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 0…2-channel analogue outputs OR
  ≤ 32-bit binary outputs
- 2 binary inputs + 1 binary output
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controllere:

- 0…2 input channels
- 0…2 output channels
- 2 binary inputs + 1 binary output

Figure: diagram for analogue signals:

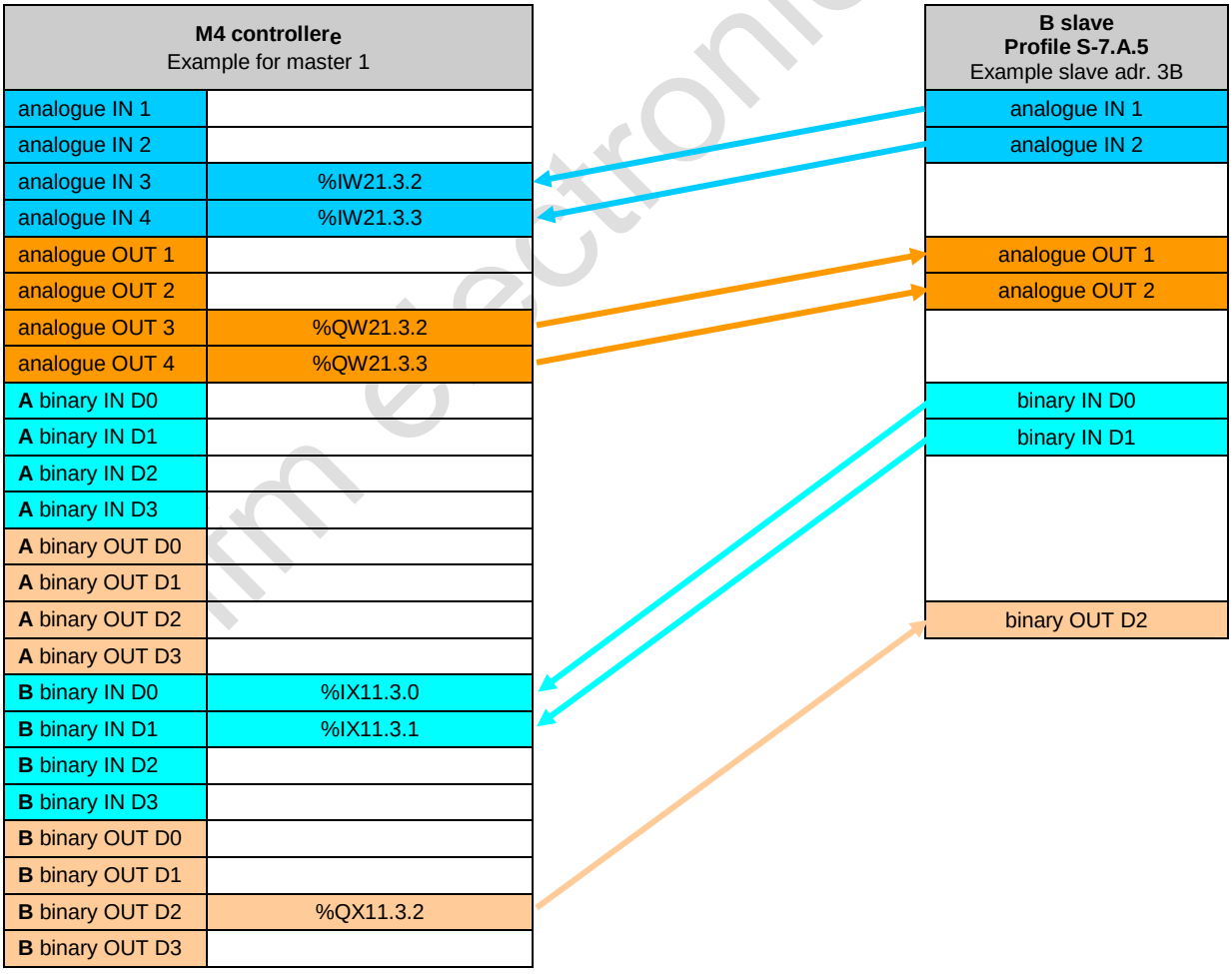
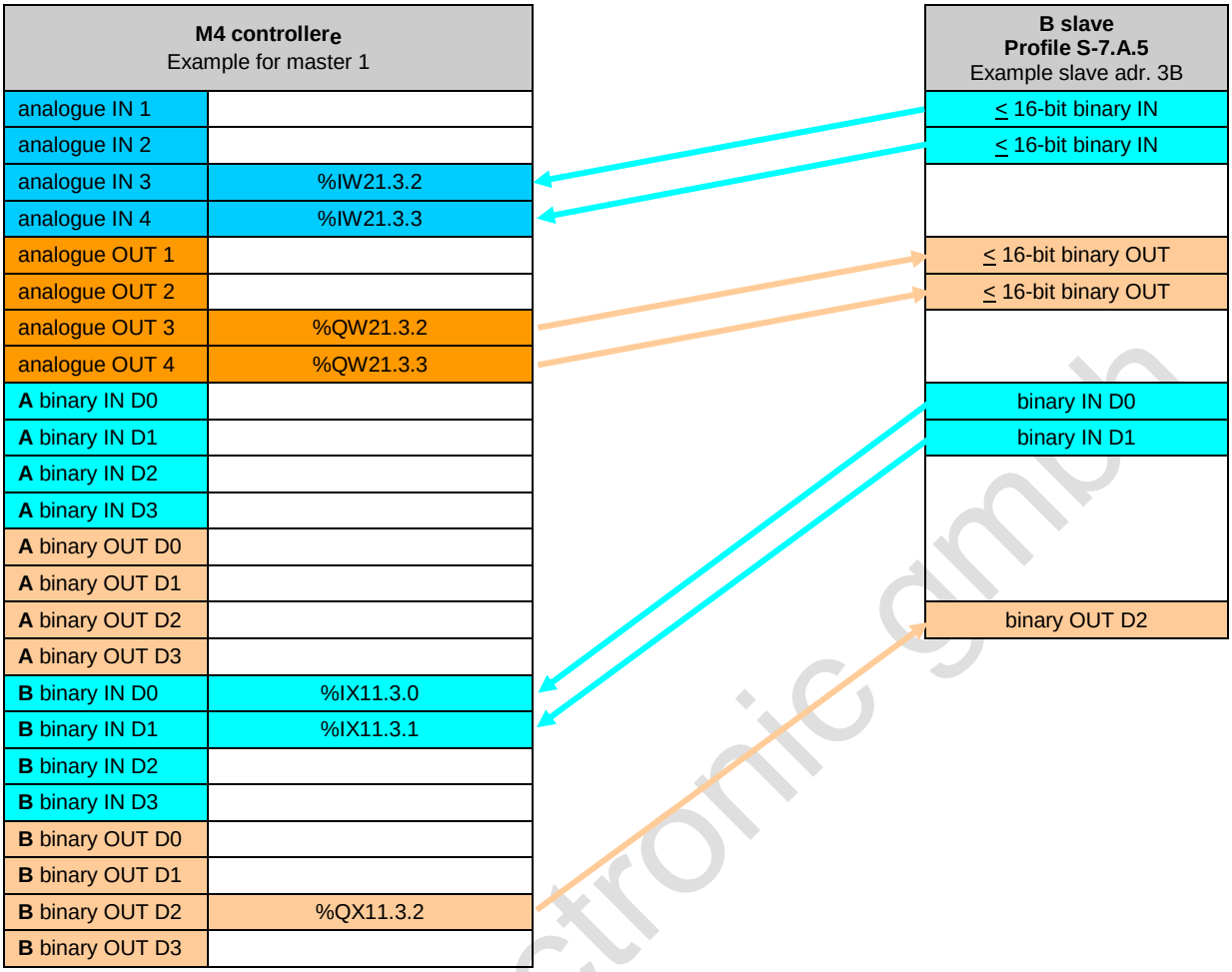


Figure: diagram for binary signals:



Data distribution of the A slave with profile S-7.A.7 in the M4 controllere

Slave:

- 4 binary inputs + 4 binary outputs
- 16-bit integer OR
  bit stream

Controllere:

- 4 binary inputs + 4 binary outputs

M4 controllere Example for master 1			**A slave** **Profile S-7.A.7** Example slave adr. 3A
analogue IN 1			
analogue IN 2			
analogue IN 3			
analogue IN 4			
analogue OUT 1			
analogue OUT 2			
analogue OUT 3			
analogue OUT 4			
A binary IN D0	%IX1.3.0	←	binary IN D0
A binary IN D1	%IX1.3.1	←	binary IN D1
A binary IN D2	%IX1.3.2	←	binary IN D2
A binary IN D3	%IX1.3.3	←	binary IN D3
A binary OUT D0	%QX1.3.0	→	binary OUT D0
A binary OUT D1	%QX1.3.1	→	binary OUT D1
A binary OUT D2	%QX1.3.2	→	binary OUT D2
A binary OUT D3	%QX1.3.3	→	binary OUT D3
B binary IN D0			
B binary IN D1			
B binary IN D2			
B binary IN D3			
B binary OUT D0			
B binary OUT D1			
B binary OUT D2			
B binary OUT D3			

Data distribution of the B slave with profile S-7.A.7 in the M4 controller$_E$

Slave:

- 4 binary inputs + 4 binary outputs
- 16-bit integer OR
  bit stream

Controller$_E$:

- 4 binary inputs + 4 binary outputs

M4 controller$_E$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	%IX11.3.0
B binary IN D1	%IX11.3.1
B binary IN D2	%IX11.3.2
B binary IN D3	%IX11.3.3
B binary OUT D0	%QX11.3.0
B binary OUT D1	%QX11.3.1
B binary OUT D2	%QX11.3.2
B binary OUT D3	%QX11.3.3

B slave **Profile S-7.A.7** Example slave adr. 3B
binary IN D0
binary IN D1
binary IN D2
binary IN D3
binary OUT D0
binary OUT D1
binary OUT D2
binary OUT D3

Data distribution of the A slave with profile S-7.A.8 in the M4 controllere

Slave:

- 1-channel analogue input OR
  ≤ 16-bit binary inputs
- 1 binary output
- 14/16-bit integer OR
  8/12/16-bit bit stream

Controllere:

- 1 input channel
- 1 binary output

Figure: diagram for analogue signals:

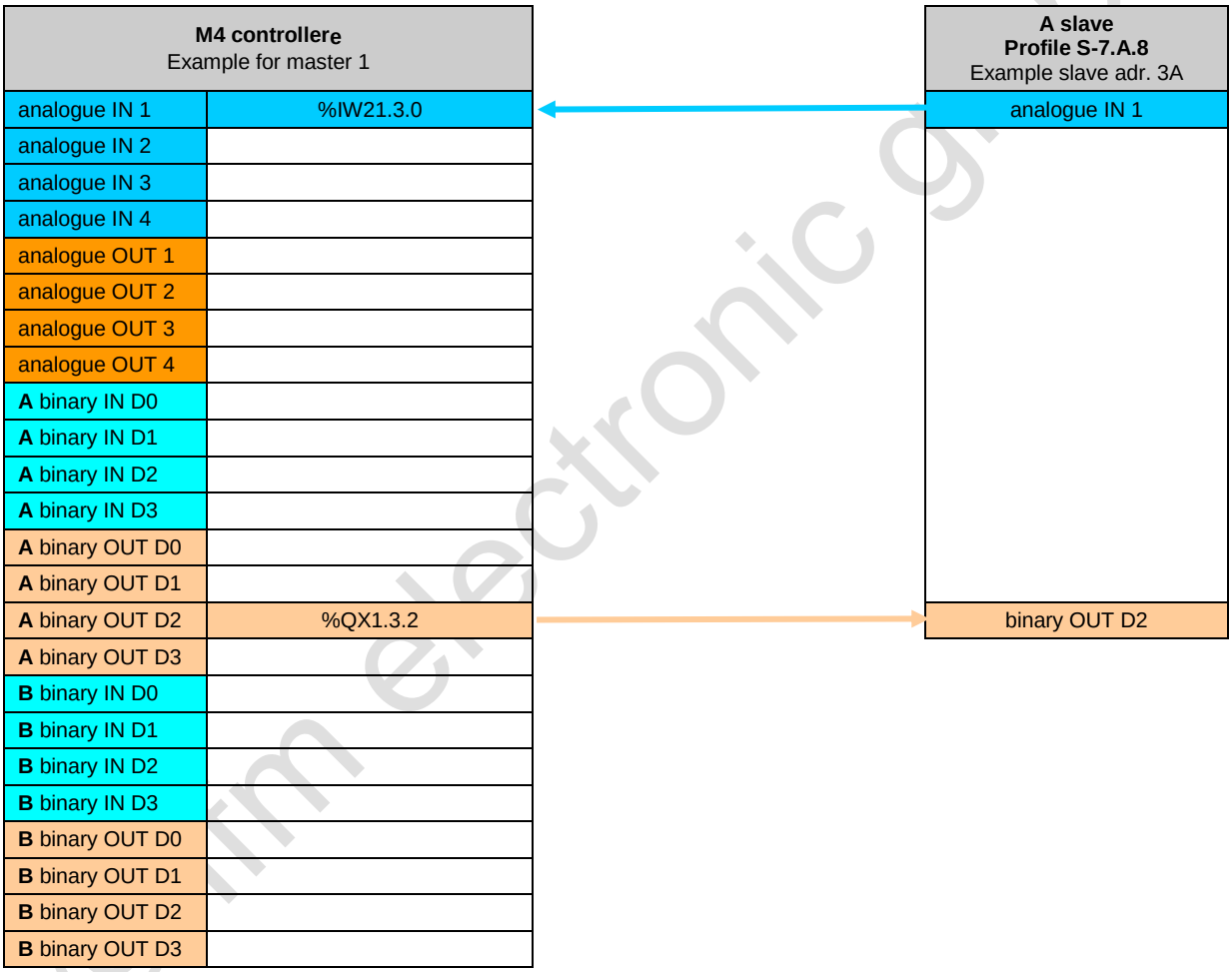
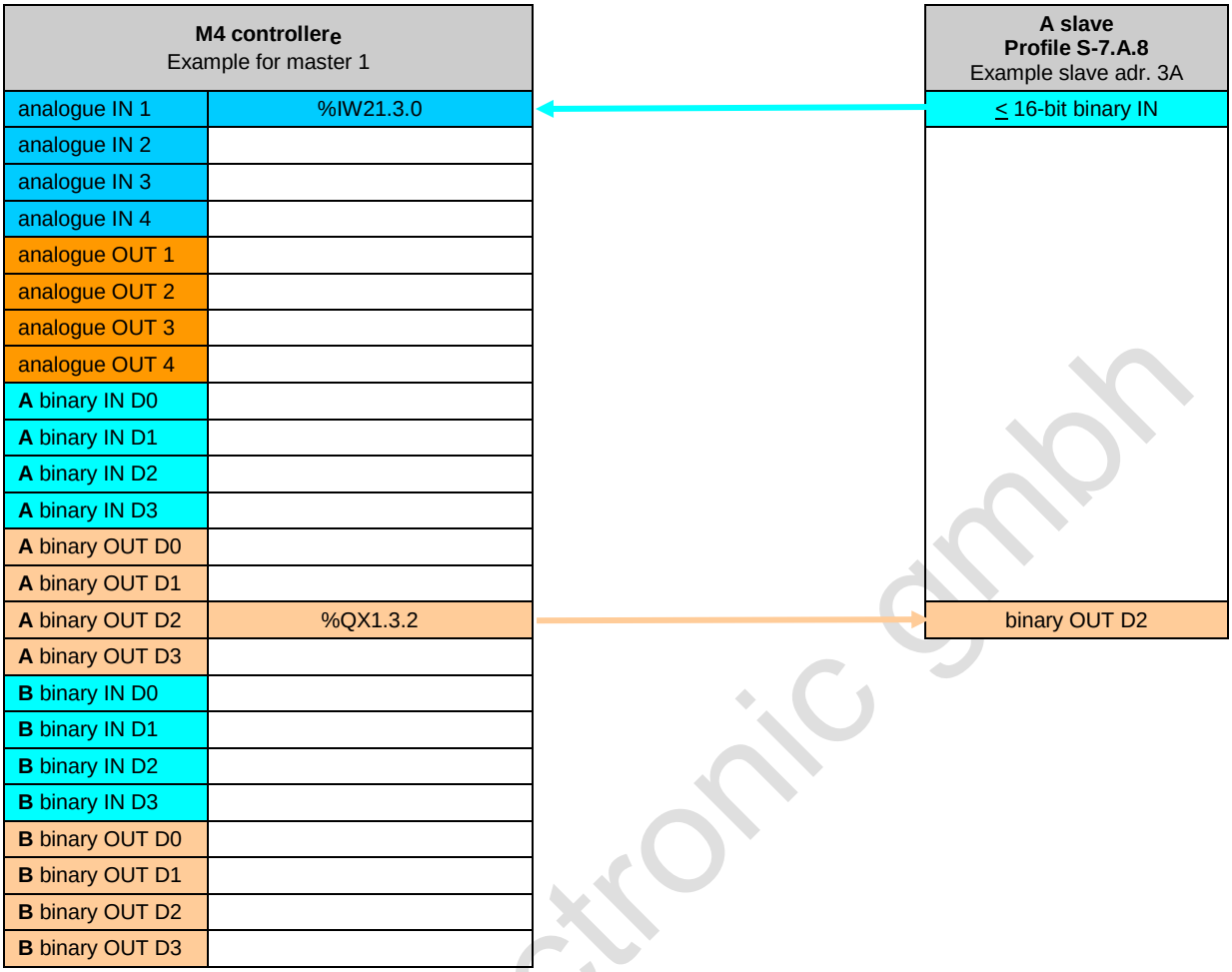


Figure: diagram for binary signals:



Data distribution of the B slave with profile S-7.A.8 in the M4 controllere

Slave:

- 1-channel analogue input OR
  ≤ 16-bit binary inputs
- 1 binary output
- 14/16-bit integer OR
  8/12/16-bit bit stream

Controllere:

- 1 input channel
- 1 binary output

Figure: diagram for analogue signals:

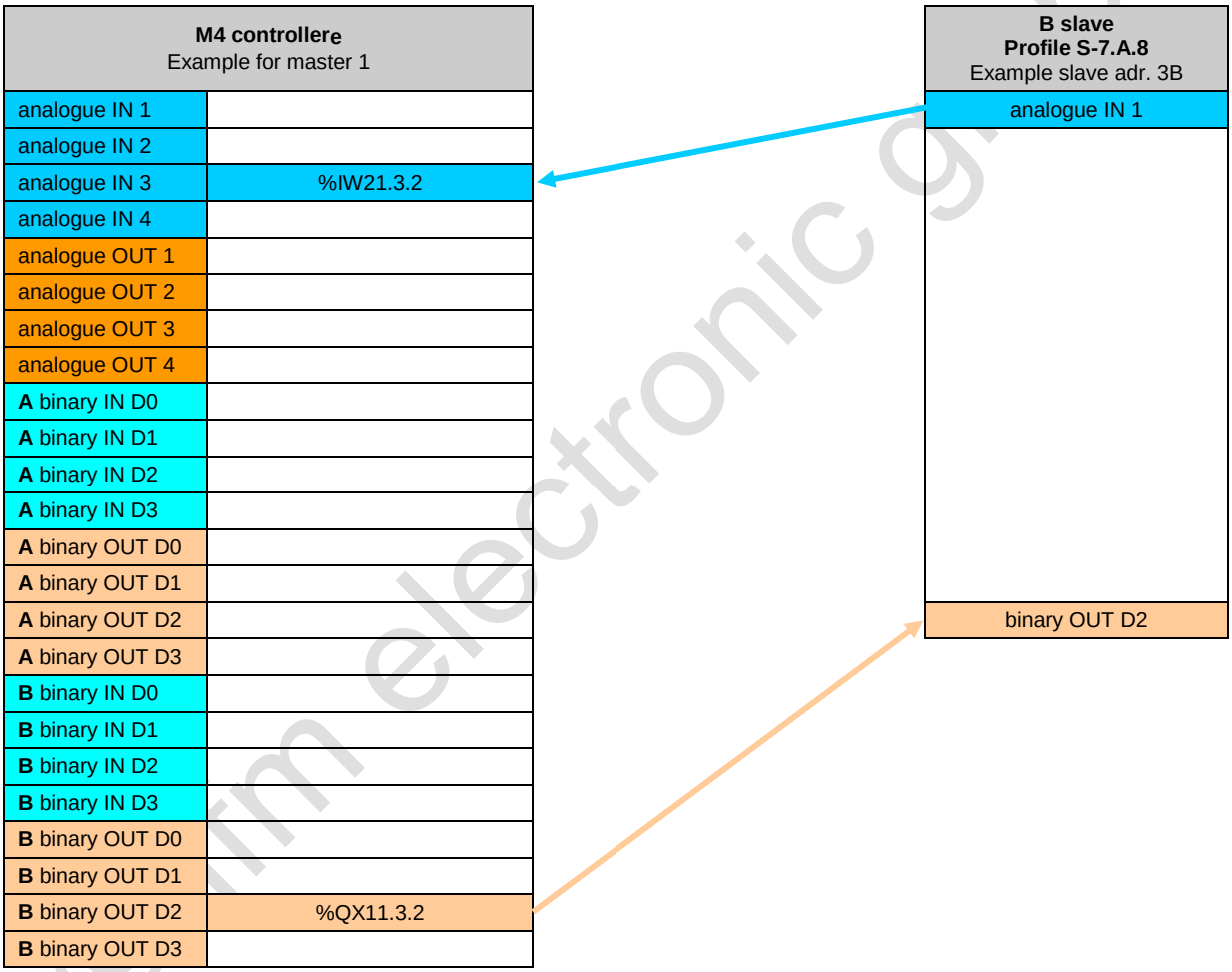
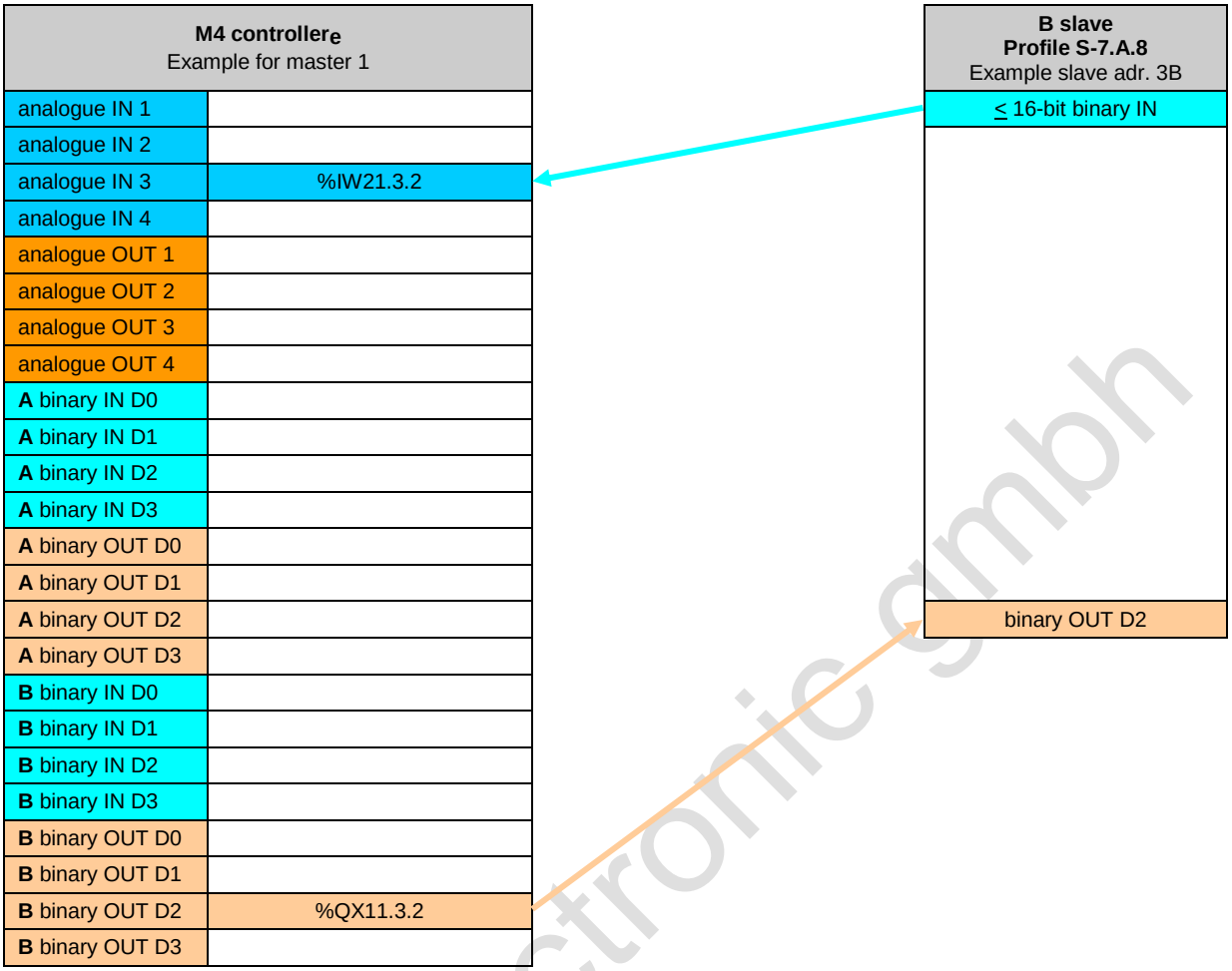


Figure: diagram for binary signals:



Data distribution of the A slave with profile S-7.A.9 in the M4 controllere

Slave:

- 2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 12/14-bit integer

Controllere:

- 2 input channels

Figure: diagram for analogue signals:

M4 controllere Example for master 1		**A slave Profile S-7.A.9** Example slave adr. 3A
analogue IN 1	%IW21.3.0	analogue IN 1
analogue IN 2	%IW21.3.1	analogue IN 2
analogue IN 3		
analogue IN 4		
analogue OUT 1		
analogue OUT 2		
analogue OUT 3		
analogue OUT 4		
A binary IN D0		
A binary IN D1		
A binary IN D2		
A binary IN D3		
A binary OUT D0		
A binary OUT D1		
A binary OUT D2		
A binary OUT D3		
B binary IN D0		
B binary IN D1		
B binary IN D2		
B binary IN D3		
B binary OUT D0		
B binary OUT D1		
B binary OUT D2		
B binary OUT D3		

Figure: diagram for binary signals:

M4 controller$_E$ Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	%IW21.3.1
analogue IN 3	
analogue IN 4	
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

A slave **Profile S-7.A.9** Example slave adr. 3A
≤ 16-bit binary IN
≤ 16-bit binary IN

Data distribution of the B slave with profile S-7.A.9 in the M4 controllere

Slave:

- 2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 12/14-bit integer

Controllere:

- 2 input channels

Figure: diagram for analogue signals:

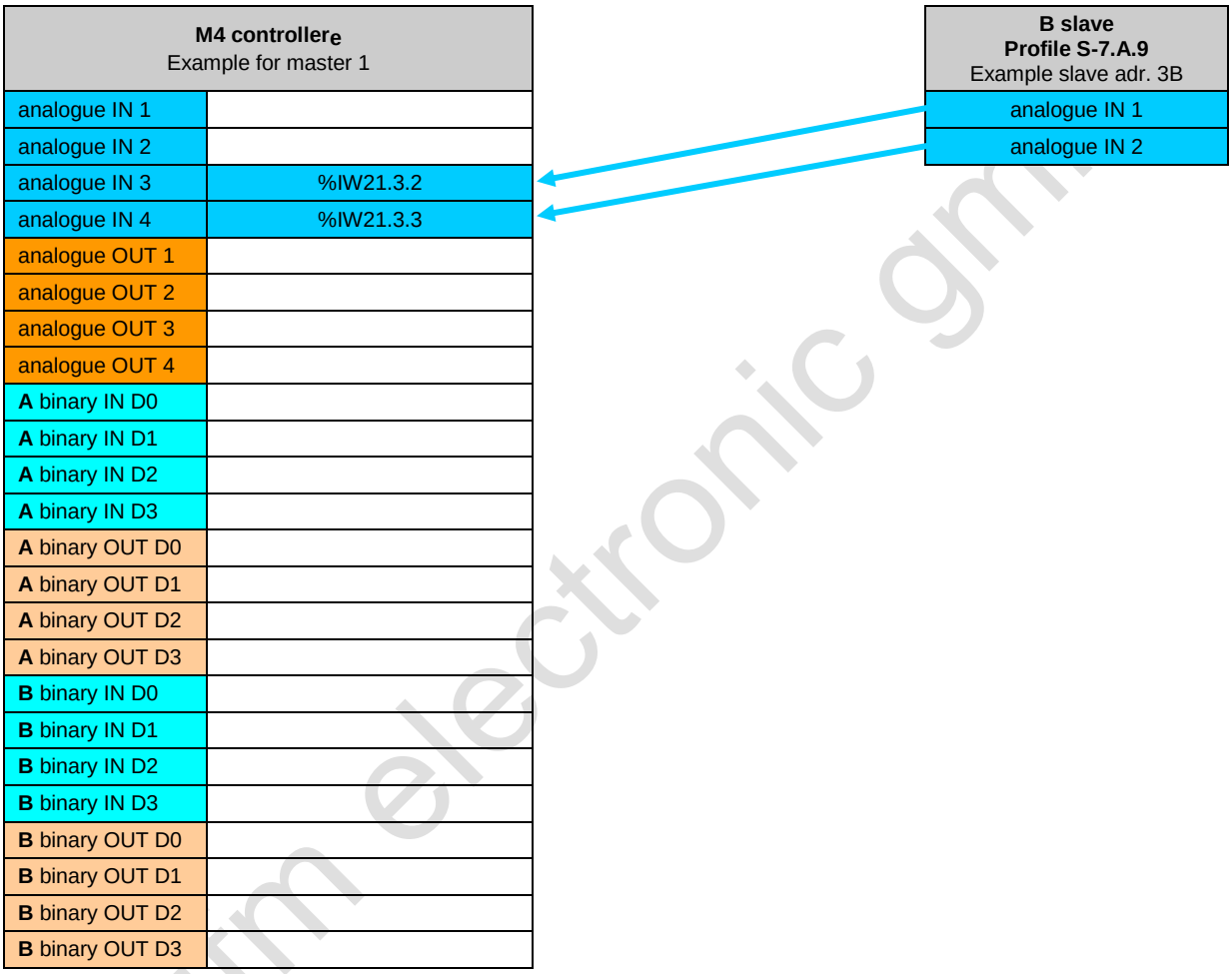


Figure: diagram for binary signals:

M4 controller$_E$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	%IW21.3.2
analogue IN 4	%IW21.3.3
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

B slave **Profile S-7.A.9** Example slave adr. 3B
≤ 16-bit binary IN
≤ 16-bit binary IN

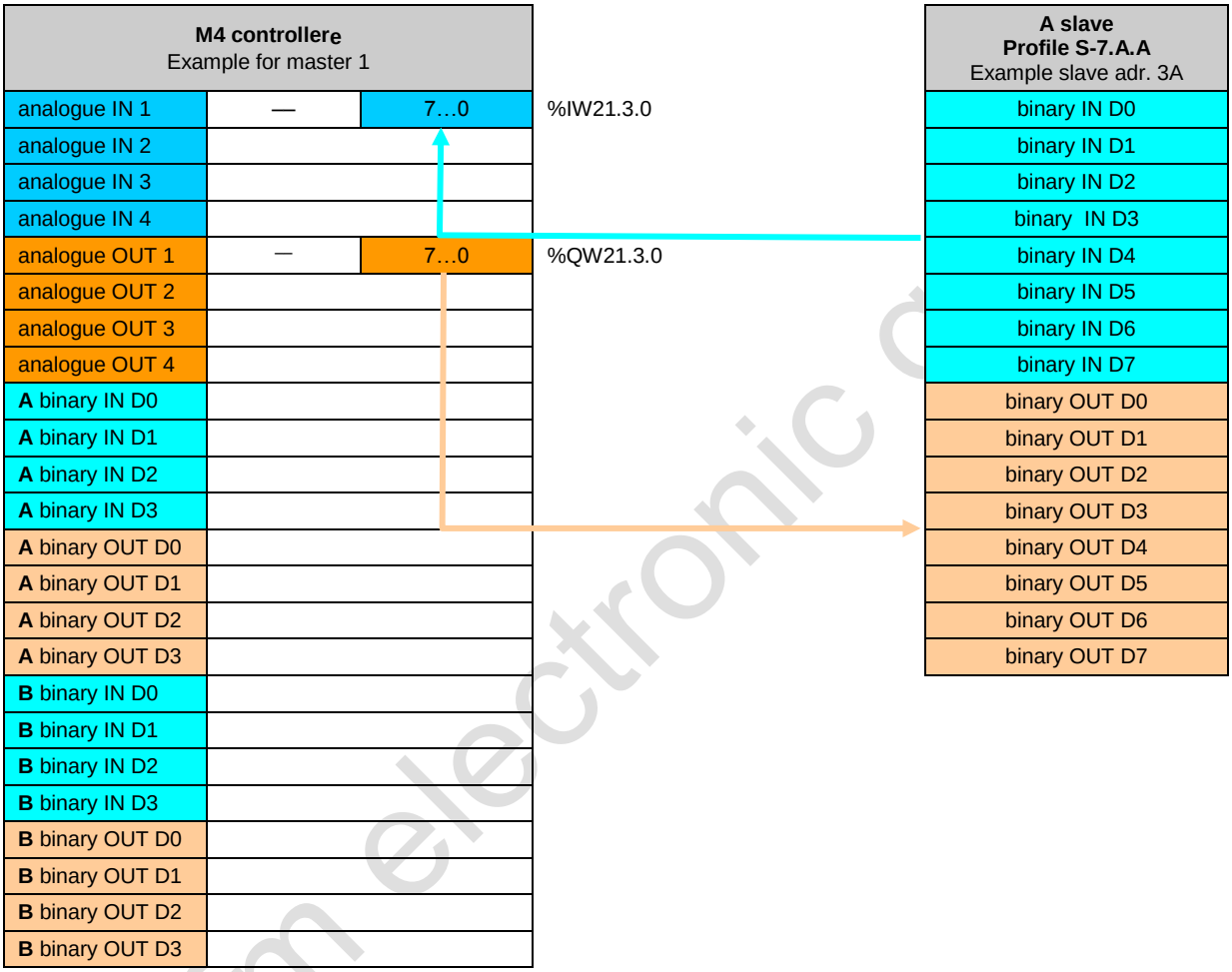
Data distribution of the A slave with profile S-7.A.A in the M4 controllere

Slave:

- 8 binary inputs + 8 binary outputs

Controllere:

- 1 input channel
- 1 output channel



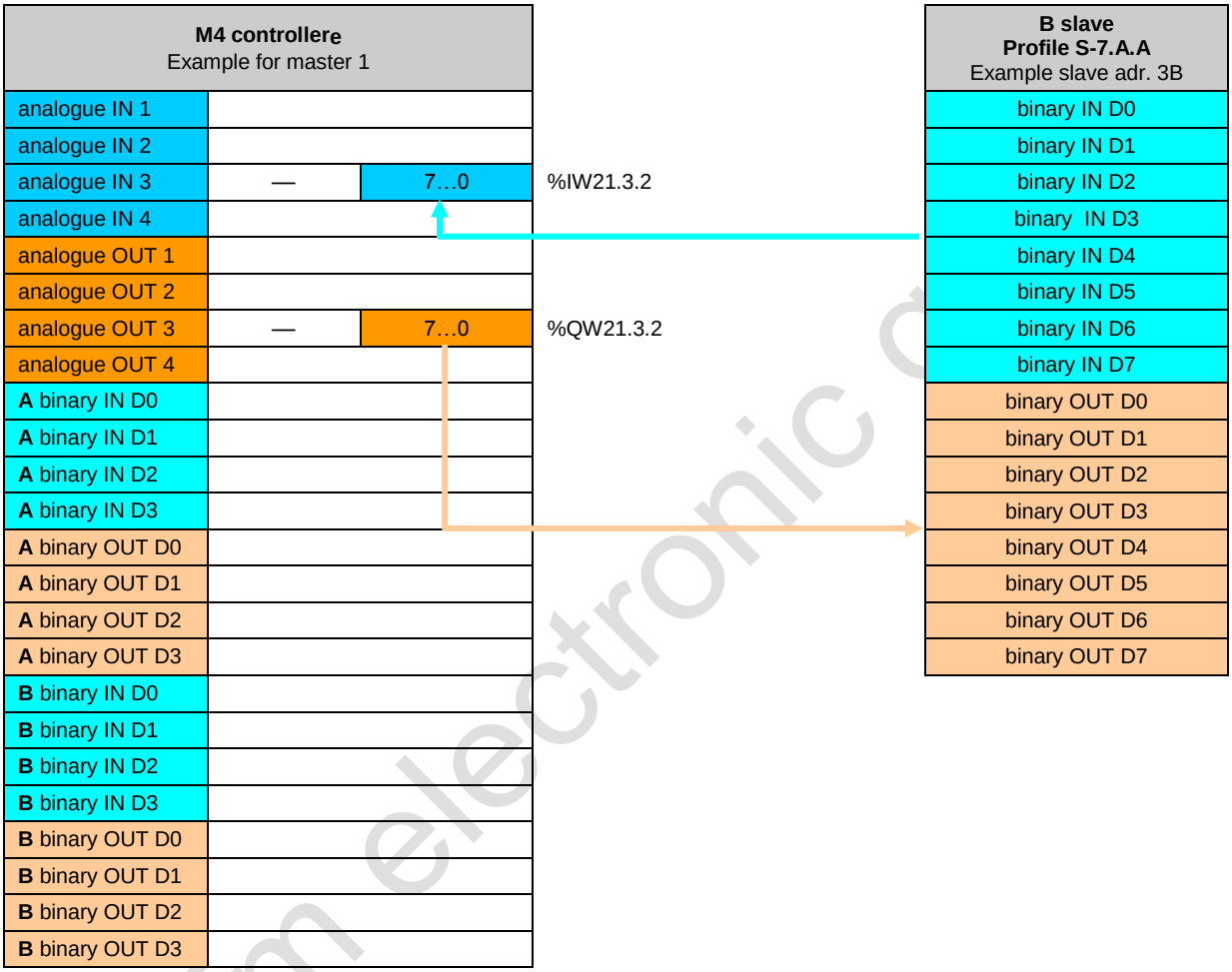
Data distribution of the B slave with profile S-7.A.A in the M4 controllere

Slave:

- 8 binary inputs + 8 binary outputs

Controllere:

- 1 input channel
- 1 output channel



Data distribution of the A slave with profile S-B.A.5 in the M4 controller$_e$

Slave:

- 0…2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 0…2-channel analogue outputs OR
  ≤ 32-bit binary outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controller$_e$:

- 2 input channels
- 2 output channels

Figure: diagram for analogue signals:

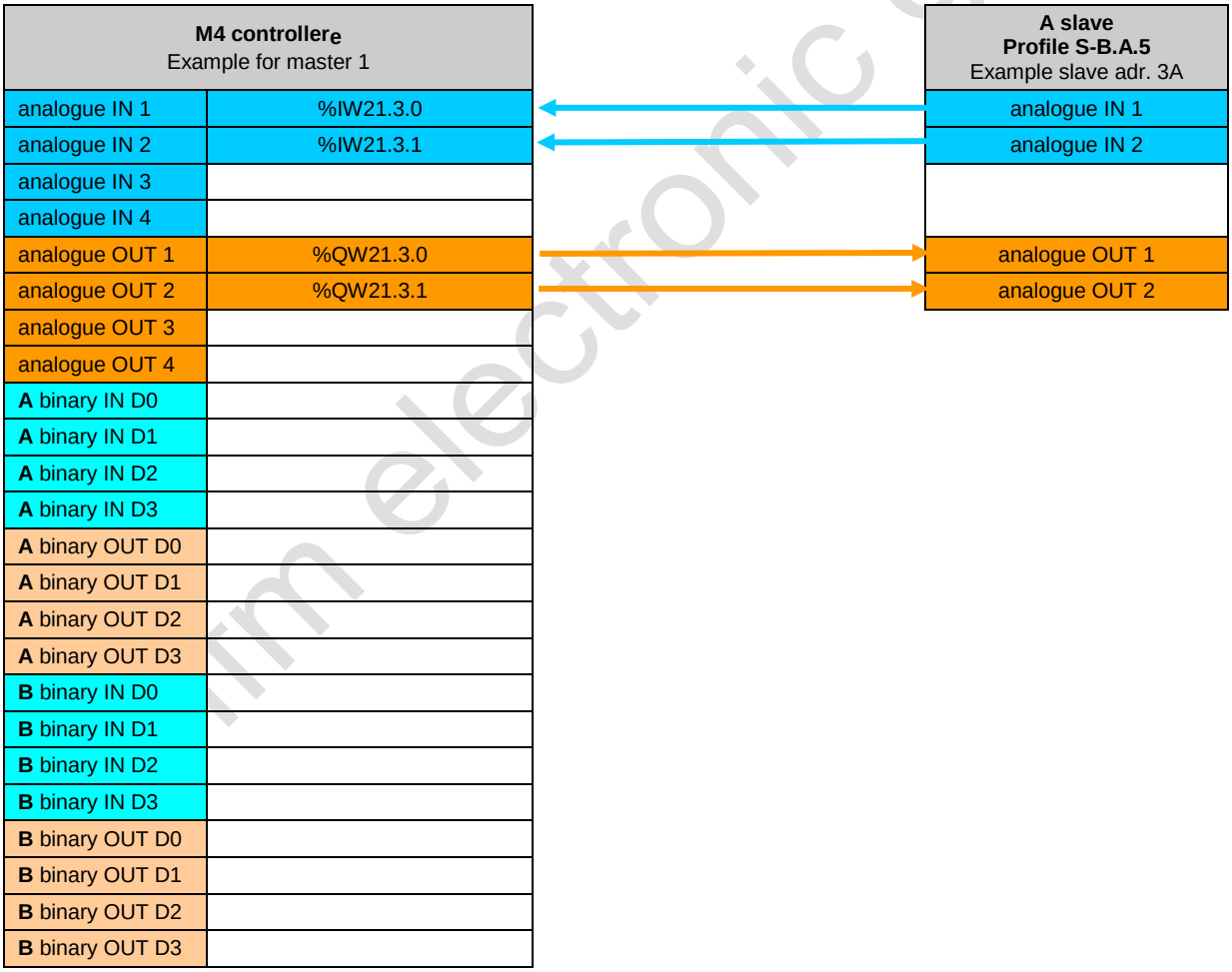


Figure: diagram for binary signals:

M4 controller$_E$ Example for master 1	
analogue IN 1	%IW21.3.0
analogue IN 2	%IW21.3.1
analogue IN 3	
analogue IN 4	
analogue OUT 1	%QW21.3.0
analogue OUT 2	%QW21.3.1
analogue OUT 3	
analogue OUT 4	
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

A slave **Profile S-B.A.5** Example slave adr. 3A
≤ 16-bit binary IN
≤ 16-bit binary IN
≤ 16-bit binary OUT
≤ 16-bit binary OUT

Data distribution of the B slave with profile S-B.A.5 in the M4 controller$_e$

Slave:

- 0…2-channel analogue inputs OR
  ≤ 32-bit binary inputs
- 0…2-channel analogue outputs OR
  ≤ 32-bit binary outputs
- 16-bit integer OR
  bit stream
- device string
- parameter string
- diagnostic string

Controller$_e$:

- 2 input channels
- 2 output channels

Figure: diagram for analogue signals:

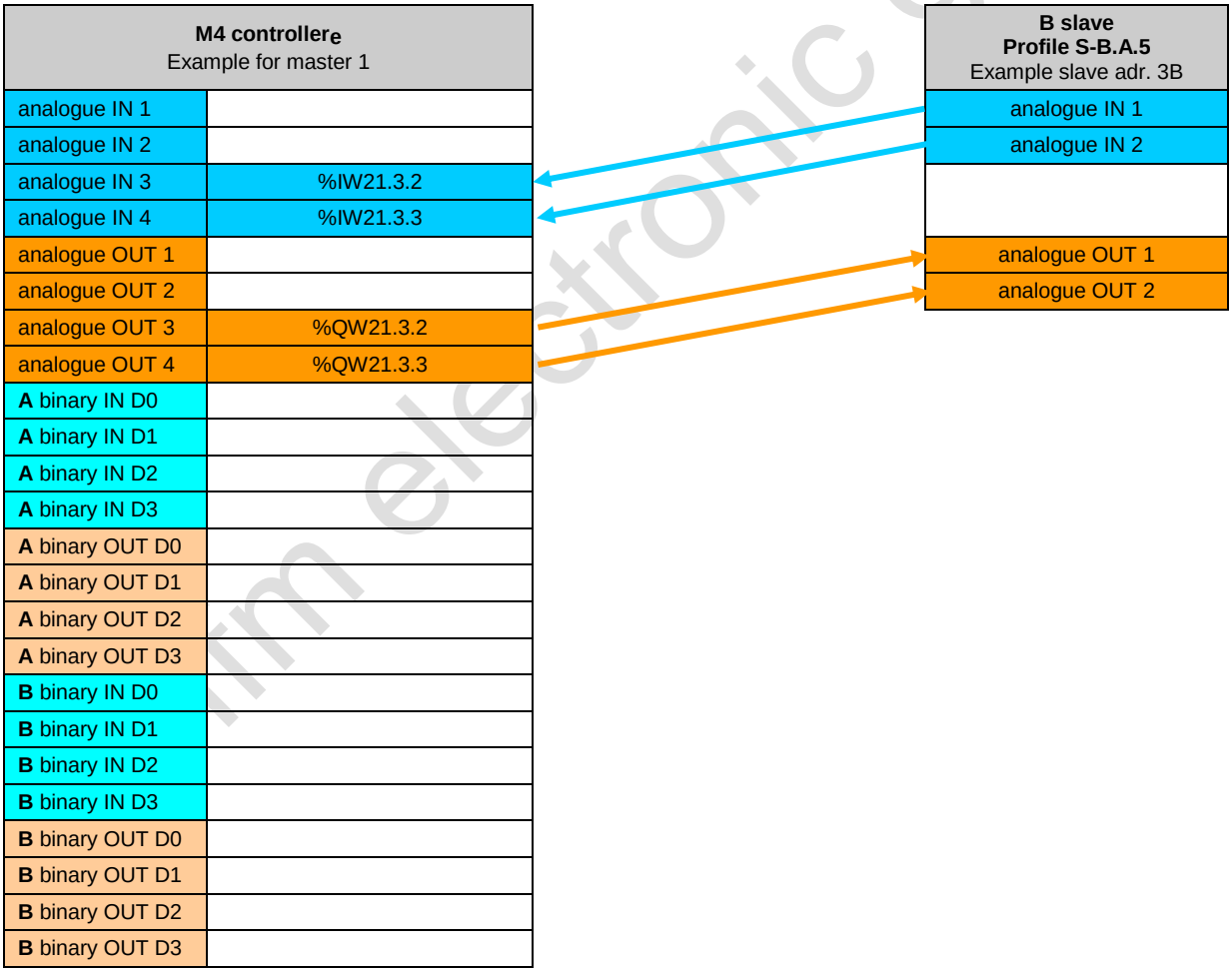


Figure: diagram for binary signals:

M4 controller$_E$ Example for master 1	
analogue IN 1	
analogue IN 2	
analogue IN 3	%IW21.3.2
analogue IN 4	%IW21.3.3
analogue OUT 1	
analogue OUT 2	
analogue OUT 3	%QW21.3.2
analogue OUT 4	%QW21.3.3
A binary IN D0	
A binary IN D1	
A binary IN D2	
A binary IN D3	
A binary OUT D0	
A binary OUT D1	
A binary OUT D2	
A binary OUT D3	
B binary IN D0	
B binary IN D1	
B binary IN D2	
B binary IN D3	
B binary OUT D0	
B binary OUT D1	
B binary OUT D2	
B binary OUT D3	

B slave **Profile S-B.A.5** Example slave adr. 3B
≤ 16-bit binary IN
≤ 16-bit binary IN
≤ 16-bit binary OUT
≤ 16-bit binary OUT

6 Installation

For installation of the controllere a 35 mm rail to DIN EN 50022 must be used. The device mounted on the DIN rail can be easily removed from the rail without any tools.

The housing shape was selected to match the current 24 V and AS-i power supplies from ifm electronic. Therefore the controllere having the same height of only 107 mm can be installed in most control cabinets with a height of 120 mm.

NOTICE

Risk of overheating by incorrect installation!
The controllere can overheat and be destroyed.

- ► Install the controllere only vertically in the control cabinet. This serves for an optimum heat dissipation from the device.
- ► When mounting, leave a gap of at least 30 mm above and below the device. Air circulation through the vents must not be hampered.

If the specified distances are adhered to, the device can be operated in a temperature range of 0 °C to +60 °C.

NOTICE

Electromagnetic interference caused by a frequency converter!
Frequency converters emit strong electromagnetic interference. This can interfere with the function of the AS-i controllere.

- ► Install the controllere outside the area of possible electromagnetic interference by neighbouring frequency converters.

7 Electrical connection

This chapter gives information about connection of the controllere to the power supply and the AS-i bus.

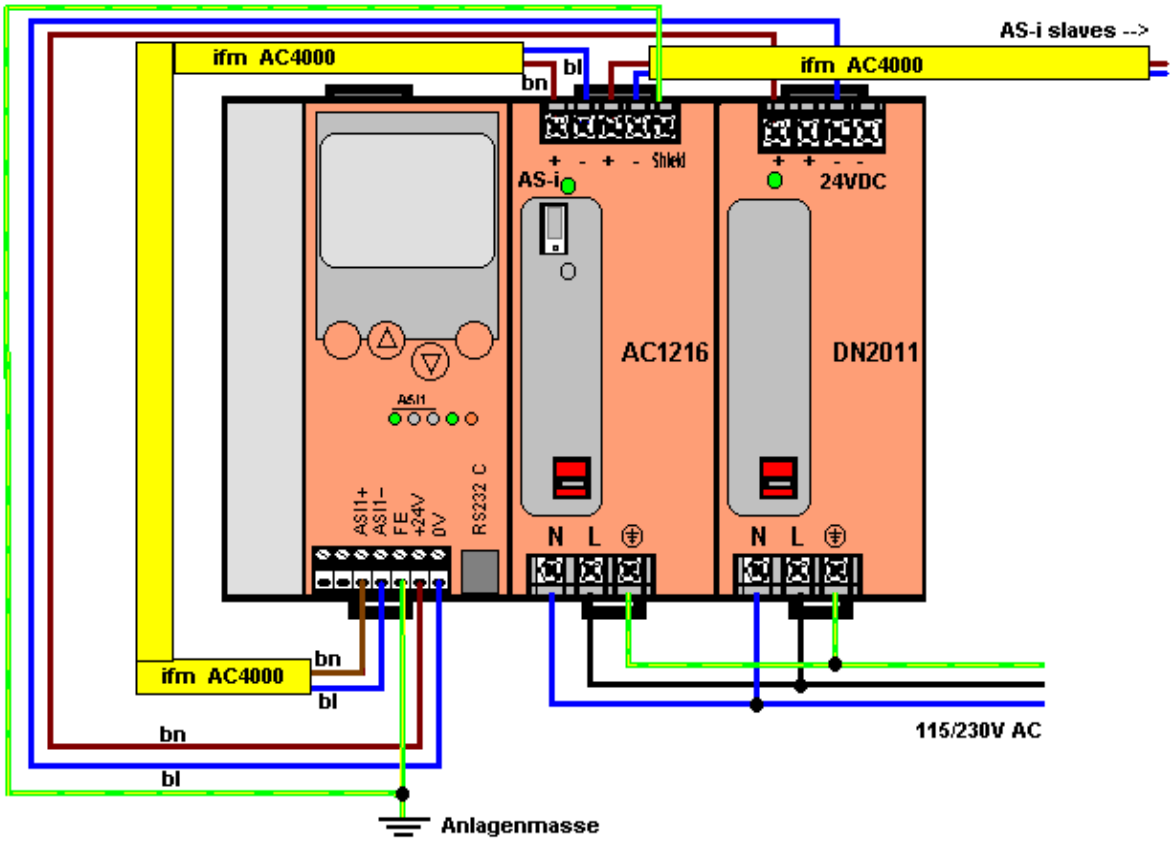


Figure: suggestion for wiring the controllere

⚠ WARNING

Risk by electric voltage!
Malfunction of the machine/plant in which the device is installed!
Damage or destruction of the devices by a short circuit when working while live.

- ► The device must be installed and connected by a qualified electrician.
- ► Disconnect power before connecting the controllere to avoid short circuits during installation.
- ► Adhere to the applicable standards and directives during installation (e.g. additional use of a fuse).
- ► Connect the terminals according to the terminal marking.
- ► The supply voltage (SELV) must not be connected to protective earth.
  Never connect the minus terminal to the FE terminal or to another terminal of the device.

7.1 Terminals on the controllere

Connection	Description
+24V / 0V	Supply voltage 24 V DC (20...30 V PELV), e.g. from the power supply D2011 of **ifm electronic** This supply must not be grounded! Power consumption: up to 500 mA depending on the device version
FE	Functional earth of the device
ASI1+	Bus cable AS-i master 1, positive pole (brown)
ASI1-	Bus cable AS-i master 1, negative pole (blue)
ASI2+	Bus cable AS-i master 2 (option), positive pole (brown)
ASI2-	Bus cable AS-i master 2 (option), negative pole (blue)
RS-232C	Serial programming interface

Further terminals for fieldbus and / or Ethernet programming interface are optional and described in separate manuals

The device is correctly connected to the functioning power supplies if the LED [24 V PWR] is lit after power on of the controllere.

7.2 The AS-i power supply

To operate an AS-i system a special AS-i power supply is required, e.g. AC1216 from ifm electronic. The AS-i power supply supplies the connected slaves with energy via the yellow AS-i cable and at the same time implements data decoupling from the voltage regulator of the power supply. Standard switched-mode power supplies do not feature data decoupling and are therefore not suited for use as AS-i current supply.

In the ifm AS-i power supplies the two terminals AS-i+ and AS-i- are designed redundantly, so that they can additionally be connected to the terminals ASI 1+ and ASI 1- of the controllere without additional terminals. The same applies to ASI 2+ and ASI 2- for the second AS-i master circuit.

For the operation of the optional second AS-i master a second AS-i power supply is required, because the two master circuits must be electrically separated. In addition, the AS-i power supply supplies the analogue input part of the controllere.

NOTICE

Overcurrent in case of short circuit!
Risk of damage to devices. In case of short circuits, the AS-i power supply provides the maximum current.

► Disconnect the power supply before connecting the controllere.

NOTICE

Interference or corruption of the AS-i signals possible.
When the AS-i network is grounded the signals AS-i+ and AS-i- are no longer symmetrical to the ground potential of the machine/plant.

o Do NOT ground the AS-i network.

► Connect the "Shield" terminal on the AS-i power supply to the machine ground (GND potential) so that it is well conductive.

7.3 Wiring and set-up of the slaves

In general, the AS-i devices are short-circuit proof and reverse-polarity protected. Control cabinet modules, however, should be wired while disconnected.

7.3.1 Connecting slaves

► Switch off the controller$_e$ and its supply.

NOTICE

Malfunction of the machine/plant in which the unit is installed!
Damage or destruction of the devices by a short circuit when working while live.

► The device must be installed and connected by a qualified electrician.

► Disconnect power before connecting the device to avoid short circuits during installation.

► Only install the controller$_e$ and the slaves while disconnected!

AS-i field modules can be installed without risk while live.

SmartLine modules:

► Connect (control cabinet) modules.

► Remove the Combicon connector with AS-i connection to enable automatic addressing of the slaves in rising order.

AS-i field modules:

AS-i field modules usually consist of a lower part for the connection of the yellow (and black) flat cable and an upper part with the electronics.

► Insert the cable in the lower parts, but do not yet screw/clamp the upper parts on the lower parts to enable automatic addressing of the slaves in rising order.

7.3.2 Switching on the controller$_e$ again

After power-on, the two power supplies supply the controller$_e$, the AS-i master and the AS-i bus with voltage. The green LED [PWR/COM] flashes because no valid slave has been detected yet.

In the next step the slaves must be addressed:
→ page 126, chapter Configuration

8 Operating and display elements

In this chapter you will become familiar with the elements on the controllere used:

- to operate the device
- to obtain information about the device and its configuration
- to set parameters for the device and the AS-i slaves.

8.1 Diagnostic LEDs

The three diagnostic LEDs on the controllere inform about the status of the AS-i masters and the connected systems:

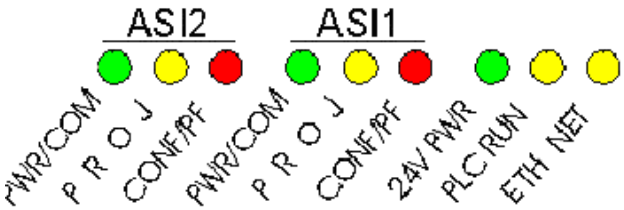


Figure: Diagnostic LEDs

About the figure "diagnostic LEDs":

- The LEDs [ASI2] including their labelling are an option for the second AS-i master
- The LED [ETH NET] including its labelling is an option for the Ethernet programming interface

Two designations for one LED, separated by a slash "/", signify:

- The first designation describes the status in case of a permanently lit LED (mostly normal operation) and
- the second designation describes the status in case of a flashing LED (mostly in case of a fault).

Diagnostic LEDs	LED colour	LED out	LED lit	LED flashes
ASI1 [PWR/COM] AS-i bus 1: **P**o**w**e**r** **Com**munication	Green	No supply for AS-i bus 1	AS-i supply available; at least 1 slave detected on the bus	AS-i supply available; no slave correctly detected on the bus
ASI1 [PROJ] AS-i bus 1: **Proj**ection	Yellow	Operating mode active	Configuration mode active; configuration monitoring deactivated	Configuration mode active; changeover to protected mode not possible because a slave with the address 0 is connected
ASI1 [CONF/PF] AS-i bus 1: **Conf**iguration **P**eriphery **F**ailure	Red	Configuration and periphery ok	Projected and current configuration do not match	Periphery fault detected on at least one connected slave
ASI2 [PWR/COM] AS-i bus 2: **P**o**w**e**r** **Com**munication	Green	No supply for AS-i bus 2	AS-i supply available; at least 1 slave detected on the bus	AS-i supply available; no slave correctly detected on the bus
ASI2 [PROJ] AS-i bus 2: **Proj**ection	Yellow	Operating mode active	Configuration mode active; configuration monitoring deactivated	Configuration mode active; changeover to protected mode not possible because a slave with the address 0 is connected
ASI2 [CONF/PF] AS-i bus 2: **Conf**iguration **P**eriphery **F**ailure	Red	Configuration and periphery ok	Projected and current configuration do not match	Periphery fault detected on at least one connected slave
[24V PWR]	Green	No 24 V operating voltage	24 V operating voltage available	---
[PLC RUN]	Yellow	Controller operates as a gateway	PLC program in the controller active	PLC program in the controller stopped
[EthNet]	yellow	no communication in the Ethernet	LED flashes for each data package	

8.2 Display

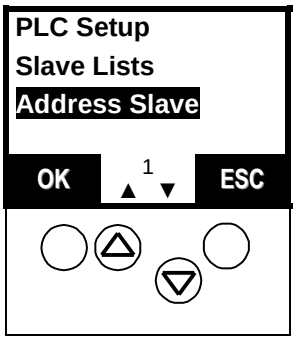
A text/graphics display in the controllere enables a detailed system diagnosis. With the four keys the device is easy to use. The bilingual structure of the menus and messages simplifies worldwide use of this device family. An intelligent message management generates priority-based diagnostic and error messages and supports the user during set-up.

Above the keys, the display dynamically indicates the corresponding functions.

After power-on of the controllere the device either displays a start screen with the ifm logo or - if available - a list of the errors in the connected AS-i systems. The system menu can be accessed by pressing the left [MENU] key.

8.2.1 What is what in the text/graphics display?

Normal menu screen



> Usually the menu shows 3 to 5 lines, similar to the screen on the left

> One menu line is displayed in an inverted manner:
This shows the active or selected entry. With [OK] the controllere changes to the corresponding menu screen.

> 1
Number of the menu screen

> Arrows [▲] or [▼]
Indication of which arrow keys can be pressed to scroll.

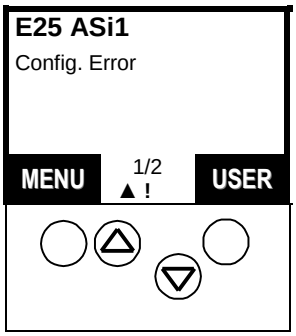
► Scroll through the menu points or increment the value with [▲] or [▼]
[▲] = scroll through the menu points or increment the value
[▼] = scroll through the menu points or decrement the value

► Select the marked menu point with [OK]

► Quit this menu with [ESC] to move to the previous menu level

Error screen

In case of a configuration error or failure the start screen of the text/graphics display will provide information as shown in the following screen:



Display of an error when the start screen was active

> E25 = error number
> → page 239, chapter Error description

> ASi1 = concerned AS-i master channel number

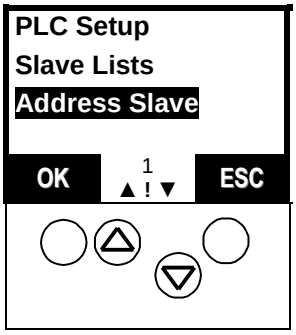
> Config. Error
> There is a configuration error

> 1/2
> First of 2 pages with error description

> Flashing "**!**"
> There is an error message

> LED [CONF/PF] lights

> Arrows [▲] / [▼]
> Indication of which arrow keys can be pressed to scroll



Indication of an error when any menu screen is active

> Flashing "**!**"
> There is an error message

> LED [CONF/PF] lights

> Arrows [▲] / [▼]
> Indication of which arrow keys can be pressed to scroll.

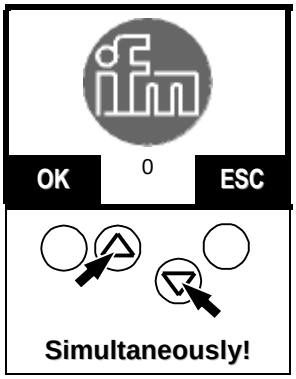
► Return to the start screen with [ESC]

> An error screen as described above appears

8.2.2 Text/graphics display: language selection

For the text/graphics display 2 languages are stored in the controller. You can change between the languages at any time.

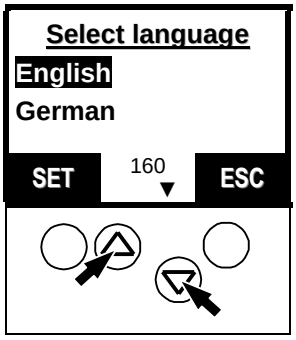
1.



> **Example**: current language = English

► Press [▲] and [▼] simultaneously for approx. 2 seconds

2nd

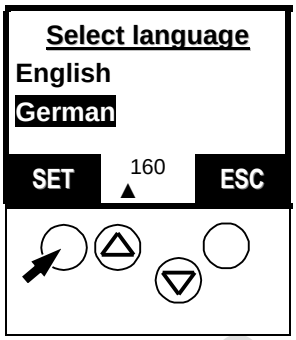


> Text/graphics display is reinitialised

> Indication of the current language

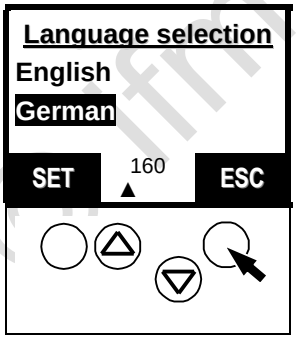
► Move to the requested language with [▲] or [▼]

3.



► Select the requested language with [SET]

4.



> The display changes over to the requested language

► Quit language selection with [ESC]

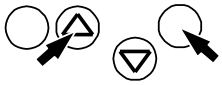
► That's it!

English is always available and is set as default language on delivery. The other language depends on the device version (→ AS-i catalogue). Therefore the menus shown in this manual are only in English.

8.2.3 Text/graphics display: contrast setting

If the text/graphics display is difficult to read, the contrast can be set:

> The display is too bright / too pale:



Simultaneously!

► Press these keys simultaneously.

> The contrast becomes higher/darker.

> The display is too dark:

Simultaneously!

► Press these keys simultaneously.

> The contrast becomes lower/brighter.

> The text/graphics display indicates nothing any more (only background illumination active).
All other functions of the controllere are not affected.

Simultaneously!

► Press [▲] and [▼] simultaneously for approx. 2 seconds

> Text/graphics display is reinitialised

> Language selection is active

► Quit language selection with [ESC]

The device automatically stores the last setting.

8.3 Key functions

The four keys on the controllere enable a quick and easy handling of the menu.

The keys [▲] and [▼] are used for menu selection and changing the displayed values. Menus with more than three options are adapted automatically. If it is possible to move upwards and downwards in the menu, this is indicated by means of small arrows in the middle of the lowest line of the display.

The two outer keys are function keys. Their function depends on the menu screen and is indicated in the lowest line of the display by means of inverted text.

Example:

- Here the left key is used for the function [OK], i.e. to confirm the selected menu item.
- The right key is used for the function [ESC], i.e. to return to the previous menu level.

9 Menu

NOTE

In this manual the menu texts are all in English.
→ page 96, chapter Text/graphics display: language selection

9.1 Menu overview

With [Menu] the main menus indicated below can be opened:

Main menu	Description	Page
Quick Setup	Quick setting of AS-i and fieldbus parameters	99
PLC Setup	Setting of PLC operating modes	100
Slave Lists	Display of status information of the slaves in lists	101
Address Slave	Individual addressing of slaves	102
Diagnostics	Display of status information of the masters and reset of the error counters	103
Master Setup	Set master operating modes	105
Fieldbus Setup	Set fieldbus parameters	106
Slave Info	Display of status information of individual active slaves	107
Slave Setup	Display or change of output data or parameters of individual slaves	108
System Setup	Set parameters for programming interfaces, update firmware, set access password, etc.	110
System info	Display of all system parameters	114

9.2 Main menu [Quick Setup]

Quick setting of AS-i and fieldbus parameters (password level 1 required)

Menu tree	Description
Quick Setup Config. all	► Configure all quickly → page 134 > The controllere changes to the configuration mode if not yet done. > The controllere checks all slaves connected (to both masters) and enters them as "projected" in its table. > The controllere changes to the protected mode.
Quick Setup Fieldbus Setup	► Configure fieldbus quickly → supplementary device manual fieldbus (option)

9.3 Main menu [PLC Setup]

Set PLC operating modes (password level 1 required)

Menu tree	Description
PLC Setup	PLC settings
PLC Setup PLC Settings	> Display of the current operating mode (→ page 119)
PLC Setup PLC Settings Run	► If available: start of the PLC program in the controllere > LED [PLC RUN] lights > The host on the fieldbus (option) can only access the actuators on the AS-i bus via the PLC program in the controllere
PLC Setup PLC Settings Stop	► Stop of the PLC programm in the controllere > LED [PLC RUN] flashes > The host on the fieldbus (option) can only access the actuators on the AS-i bus via the PLC program in the controllere
PLC Setup PLC Settings Gateway	► Change the controllere to gateway operation > LED [PLC RUN] goes out > The inputs/outputs on the AS-i bus are directly related to the corresponding inputs and outputs on the fieldbus master (option)
PLC Setup PLC Info	> Display of the information about the stored PLC program (if available): (→ page 176) • Program name • Program version • Storage data • Author of the program

9.4 Main menu [Slave Lists]

Display of status information of the slaves in lists

Menu tree	Description
Slave Lists AS-i master 1	
Slave Lists AS-i master 1 Detected Slaves AS-I 1	Detected slaves on AS-i master 1: (→ page 178) > Indication at which slave address in the bus the controllere has *detected* a slave (or several slaves) type A, B or S (standard) irrespective of whether the slave is active on the bus.
Slave Lists AS-i master 1 Projected Slaves AS-I 1	Projected slaves on AS-i master 1: (→ page 180) > Indication at which slave address a slave (or several slaves) type A, B or S (standard) is *projected* on the bus.
Slave Lists AS-i master 1 Activated Slaves AS-I 1	Activated slaves on AS-i master 1: (→ page 183) > Indication at which slave address the controllere has detected an *activated* slave type A, B or S (standard) on the bus. Only detected and projected slaves can be activated. The slave configuration is ok when all projected slaves on the bus have been detected and activated.
Slave Lists AS-i master 1 Periphery Fault AS-i 1	Periphery fault on AS-i master 1: (→ page 186) > Indication at which slave address in the bus the controllere has found one (or several) slaves type A, B or S (standard) with a wiring fault.
Slave Lists AS-i master 2	See AS-i master 1

9.5 Main menu [slave address]

Address slaves individually (password level 1 required)

Menu tree	Description
Address Slave Change Address	Slave addressing (→ page 130)
Address Slave Change Address AS-i Master 1	> Indication of the detected slave with the lowest address in the bus ► Scroll in the addresses of the detected slaves with the keys [▲] or [▼] ► After [OK]: change the current address with the keys [▲] or [▼] ► Adopt the new address with [OK]. As an alternative: ► Abort addressing and keep the old address with [ESC].
Address Slave Change Address AS-i Master 2	See slave addressing AS-i master 1
Address Slave Easy Startup	Easy start (→ page 127)
Address Slave Easy Startup AS-i Master 1	> Message: "Master 1 waiting for slave 0". Display of the next free slave address. ► Integration of a new slave (with the address 0) by simply connecting the slave to the bus: > The controllere automatically assigns the previously displayed slave address.
Address Slave Easy Startup AS-i Master 2	See AS-i master 1

9.6 Main menu [Diagnostics]

Display of status information of the masters and reset of the error counters

Menu tree	Description
Diagnostics AS-i Master 1	
Diagnostics AS-i Master 1 Voltage Disturbance	Power failure: → page 191 > Display of the number of power failure incidents on the AS-i bus.
Diagnostics AS-i Master 1 Configuration Error	Configuration errors: > Display of the number of found configuration errors since the last reset
Diagnostics AS-i Master 1 Telegram Error	Telegram errors: → page 195 > Display incorrect AS-i telegrams in per cent of the sent telegrams. ► After [MORE]: > Display of the number of active slaves > Display of the number of AS-i cycles per second

NOTE

For the evaluation of the information please note: The controllere polls A/B slaves connected as pairs (i.e. with the same address) only in every other cycle.

Diagnostics AS-i Master 1 Noisy Slaves	Noisy Slaves: → page 198 > Display of the number of disturbed telegrams of every active slave ► After [SORT]: > New sorting of the table by the number of disturbed telegrams.
Diagnostics AS-i Master 1 Reset Error Counter	Reset of the error counter (password level 1 required): → page 200 ► After [OK]: > Set all error counters to 0.
Diagnostics AS-i Master 1 Cycle time	Cycle time: → page 202 > Display of the longest cycle time of the system in [ms] since the last reset. ► After [CLEAR]: > Reset the previous measurement series and start a new measurement series.
Diagnostics AS-i Master 2	See AS-i master 1
Diagnostics Safety Master 1	Diagnosis of safety monitor on master 1
Diagnostics Safety Master 1 Read Monitor	Reading the status of the safety monitors → page 204 > Status information of OSSD (Output Signal Switching Device)

Menu tree	Description
Diagnostics Safety Master 1 Trigg. Slave	Reading the status of the safety slaves → page 207 > Status information of the input bits (code sequence)
Diagnostics Safety Master 1 Enable Monitor	Enabling an AS-i slave as safety monitor. Only after this can the controllere exchange the safety-related data with the safety monitor (special protocol). → page 210
Diagnostics Safety Master 1 Disable Monitor	Disabling an AS-i slave as safety monitor. → page 213
Diagnostics Safety Master 1 Setup Monitor	Setting the diagnosis by enable circuits or by all safety devices → page 216
Diagnostics Safety Master 1 Reset all	Resetting all set diagnostic states of the safety devices → page 219
Diagnostics Safety Master 2	See safety master 1

9.7 Main menu [Master Setup]

Set master operating modes

Menu tree	Description
Master Setup AS-i Master 1	Master setup AS-i master 1
Master Setup AS-i Master 1 Config all	AS-i master 1: configure all (password level 1 required) Requirements: - Operating mode = configure - No slave with the address 0 on the bus > Safety query: "Are you sure?" ► After [OK]: > The controllere checks all connected slaves (only on this master) and enters them as "projected" in its table. > The mode remains "configure".
Master Setup AS-i Master 1 Operation Mode	AS-i master 1: operating mode (password level 1 required) → page 116 > Display of the current setting
Master Setup AS-i Master 1 Operation Mode Protect. Mode	Operating mode "protected": > LED [PROJ] goes out. > Changes of the slaves are detcted (LED [CONF/PF] lights). Slaves with another projected profile are not activated.
Master Setup AS-i Master 1 Operation Mode Config. Mode	Operating mode "configure": > LED [PROJ] lights. > Changes of the slaves are detected (LED [CONF/PF] lights). All connected slaves are active.
Master Setup AS-i Master 1 Autoaddr. Mode	AS-i master 1: "Automatic addressing" mode (password level 1 required) > Display of the current setting ► Scroll between ON and OFF with [▲] or [▼] ► Adopt with [OK]. • Automatic addressing ON: Permits the replaced slave to be assigned the address of the old slave in the protected mode (default) • Automatic addressing OFF: The replaced slave must be manually set to the right address.

Menu tree	Description
Master Setup AS-i Master 1 Slave Reset	AS-i master 1: slave reset (password level 1 required) > Display of the current setting ► Scroll between ON and OFF with [▲] or [▼] ► Adopt with [OK]. • Slave reset ON: After changing the master to the protected mode the controllere briefly sets all slave outputs to 0 (default). • Slave reset OFF: The status of the slave outputs remains unchanged when switching to another operating mode.
Master Setup AS-i Master 2	See AS-i master 1

9.8 Main menu [Fieldbus Setup]

Setting of fieldbus parameters (password level 1 required)

Menu tree	Description
Fieldbus Setup	Fieldbus Setup → supplementary device manual fieldbus (option)

9.9 Main menu [Slave Info]

Display of status information of individual active slaves → page 222

Menu tree	Description
Slave Info AS-i Master 1	> Display of the detected slave with the lowest address in the bus. ► Scroll in the addresses of the detected slaves with [▲] or [▼] > After [OK]: current parameters of the selected slave (depending on the type of slave): • Data of the digital inputs and outputs (binary + hexadecimal) • Data of the analogue channels (decimal) • Entries in the lists of activated / detected / projected slaves with periphery fault • Slave profile configuration • Slave parameters • Number of telegram errors ► Scroll in the addresses of the detected slaves with [▲] or [▼] to display the same parameters of other slaves ► Continue to the next parameters with [MORE]. ► Abort with [ESC].
Slave Info AS-i Master 2	See AS-i master 1

9.10 Main menu [Slave Setup]

Display or change output data or parameters of individual slaves (password level 2 required)

⚠ WARNING

Risk of personal injury! Risk of material damage to the machine/plant!
After changing the slave outputs the output values remain unchanged.

The output values only change in the following cases:

- Manual new setting of the outputs via Slave Setup
- Start of the PLC program - the program processes the outputs
- Power off the controllere and restart

► Secure the concerned area.

► Only trained personnel is allowed to set outputs manually.

► Switch the outputs off again immediately after the end of the test.

Menu tree	Description
Slave Setup AS-i Master 1	> Display of the detected slave with the lowest address in the bus ► Scroll in the addresses of the detected slaves with [▲] or [▼] ► Select slave address with [OK]
Slave Setup AS-i Master 1 Digital output	> Display of current parameters of the selected slave → page 226 ► Change the value of the output signal with [▲] or [▼] and then [SET]. > The line "Current" adopts the setup value and the change is transferred to the outputs as long as the active PLC program in the controllere does not process these outputs. ► Abort with [ESC].
Slave Setup AS-i Master 1 Parameter value	> Display of current parameters of the selected slave → page 138 ► Change the parameter value in the line "Setup" with [▲] or [▼] and transfer it to the slave with [SET]. > If the value or change is not allowed: "Slave data invalid" ► Abort with [ESC].
Slave Setup AS-i Master 1 Analogue value	> Display of current data of the selected slave (depending on the type of slave): analogue values → page 226 ► After [OK]:

Menu tree	Description
Slave Setup AS-i Master 1 Analogue value Analogue channel 1 Analogue channel 2 Analogue channel 3 Analogue channel 4	► Scroll through the numbers of the analogue channels with [▲] or [▼] ► After [OK]: > Display of current data of the selected channel. ► Change the value of the analogue channel with [▲] or [▼] and then [SET]. > The line "Current" adopts the setup value and the change is transferred to the outputs as long as the active PLC program in the controllere does not process these outputs. ► Abort with [ESC].
Slave Setup AS-i Master 2	See AS-i master 1

9.11 Main menu [System Setup]

Set parameters for programming interfaces, update firmware, set access passwords, etc.

Menu tree	Description
System Setup Serial Port Baudrate	► Scroll between the possible baud rates of the serial interface with [▲] or [▼] → page 121 ► Confirm the selected value with [OK] Or: Abort with [ESC].
System Setup Ethernet Setup	► Only functionable if an Ethernet programming interface is available (option)! → supplementary device manual "Ethernet programming interface" (option)
System Setup Ethernet Setup IP Address	> Display of the current IP address. The arrow ↑ indicates the editable set of numbers. To change it, the DHCP setup must be OFF. ► Go to the next set of numbers with [➔] ► Change the set of numbers with [▲] or [▼] ► Once again [➔] after the last set of numbers > Display of new IP address ► Save new IP address with [OK] > Display of the message "WAIT" while saving > Return to the menu [IP Address]
System Setup Ethernet Setup SubNet Mask	> Display of the current subnet mask. The arrow ↑ indicates the editable set of numbers. To change it, the DHCP setup must be OFF. ► Go to the next set of numbers with [➔] ► Change the set of numbers with [▲] or [▼] ► Once again [➔] after the last set of numbers > Display of new subnet mask ► Save new subnet mask with [OK] > Display of the message "WAIT" while saving > Return to the menu [Subnetz mask]
System Setup Ethernet Setup Gateway Address	> Display of the current gateway address. The arrow ↑ indicates the editable set of numbers. To change it, the DHCP setup must be OFF. ► Go to the next set of numbers with [➔] ► Change the set of numbers with [▲] or [▼] ► Once again [➔] after the last set of numbers > Display of new gateway address ► Save new gateway address with [OK] > Display of the message "WAIT" while saving > Return to the menu [Gateway Address]

Menu tree	Description
System Setup Ethernet Setup Baudrate	► Scroll in the possible parameters with [▲] or [▼] ► Save new baud rate with [OK] > Display of the message "WAIT" while saving > Return to the menu [Baudrate].
System Setup Ethernet Setup Auto Negotiation	Automatic negotiation of the baud rate and transmission (full/half-duplex) between the Ethernet participants: ► Scroll between ON and OFF with [▲] or [▼] ► Adopt with [OK]. > Display of the message "Wait" while saving > Return to the menu [Auto Negotiation]
System Setup Ethernet Setup DHCP Setup	Automatic assignment of the IP address by an available DHCP server: ► Scroll between ON and OFF with [▲] or [▼] ► Adopt with [OK] > Display of the message "WAIT" while saving > Return to the menu [DHCP Setup]
System Setup Ethernet Setup MAC ID	> Display of the manufacturer identification number of the Ethernet participant in the network.
System Setup Modbus Setup	Only functionable if an Ethernet programming interface is available (option)! → supplement to the manual "Ethernet programming interface" (option) ► Scroll between enabling and disabling the Modbus support with [▲] or [▼] (password level 1 required)
System Setup Firmware Update	Update of the firmware (RTS Runtime System Software) (password level 3 required): → page 146 Requirement: PC/laptop with special software connected to serial interface
System Setup Firmware Update Runtime System	Update of the run time system > Display: "RTS Firmware: Connect to PC – Start now?" ► [OK] ► Start transmission on the PC > Transmission active
System Setup Firmware Update AS-i Master 1	Update of the AS-i master 1 ► [OK] > Display: "AS-i 1 Firmware: Connect to System – Start now?" ► [OK] ► Start transmission on the PC > Transmission active

Menu tree	Description
System Setup Firmware Update AS-i Master 2	See update of the AS-i master 1
System Setup Password	Prevents unauthorised changes on the controllere with a 4-digit password. → page 141 > Display: "Password – 0000" An arrow (↑) beneath shows the digit to be edited ► Go to the next digit with [➔] ► Change the digit with [▲] or [▼] ► Once again [➔] after the last digit > Display password ► Adopt with [OK] Abort with [ESC] > Return to the previous menu level If the password has been entered correctly, the corresponding parameter changes are possible; if the password is wrong they are blocked.
System Setup Factory default	► Start factory setting with [OK] (password level 3 required) → page 144 > Safety query "Are you sure?" ► [OK] > Reset the controllere to the factory setting. Some changes will only become effective after the next power-on. > In the process, PLC programs are not deleted. > The the process, fieldbus settings are not reset. > The password is reset to level 1.
System Setup System Errors	System setup errors → page **Fehler! Textmarke nicht definiert.** > History memory of the last system errors which must be acknowledged
System Setup System Specials	Special system features (password level 2 required)
System Setup System Specials Fall Back	Switch between FALL BACK VNC ON and FALL BACK VNC OFF The menu opened by the user is automatically exited if no key is pressed after a defined period.
System Setup System Specials RTS Error	Switch between RTS ERROR ON and RTS ERROR OFF The display of the Rxx system messages can be deactivated by means of this setting.
System Setup System Specials Bitmap Manual	> Display of saved background images ► Scroll with the keys [▲] or [▼] ► Abort with the right key

Menu tree	Description
System Setup System Specials Bitmap Cont.	> Alternating display of saved background images ► Abort with the right key
System Setup System Specials Power-ON time	> Display of the current operating time (days, hours, minutes, seconds) since the last power-on. ► Abort with [ESC]

9.12 Main menu [System Info]

Display all system parameters

Menu tree	Description
System Info	> Display of all system parameters: → page 233 • Hardware version RTS runtime system firmware version AS-i master 1 firmware version AS-i master 2 firmware version Fieldbus system version • RTS checksum Consistency checksum Linux kernel version Linux RAM disc version • Device serial number From here display only in the administrator mode (protected by password level 3): • Designers Developers Programmers • Admin Info (permanently updated): RTS cycles 100 ms each Max. RTS response time [ms] PLC cycle time [ms] Max. PLC cycle time [ms] ► Delete cycle time values with [CLEAR] ► Continue to scroll in the parameter list with [MORE] ► Back to the start menu with [MENU] or [ESC]

10 Operating modes

In this chapter you will learn (separately for AS-i master and PLC):

- Which operating modes are possible?
- What do the operating modes mean?
- Which operating mode should be used when?
- How are the operating modes selected?

10.1 Which operating modes are available for the AS-i master?

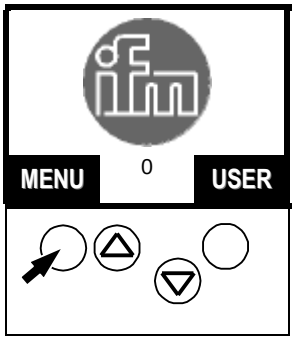
The master of the controllere can be used in the following operating modes:

Operating mode	Description	Use
Operation Mode	Protected mode > LED [PROJ] is out. > New slaves are only activated if they have been correctly projected before.	If no effect on the AS-i system is requested by removing or adding slaves. Changes to the projected constellation of the slaves are indicated as an error message: "Slave X not present" or "Slave X not projected" When replacing a faulty slave by an identical slave with the address 0 the system detects and adopts the new slave and assigns to it the address of the faulty slave.
Config. Mode	Configure > LED PROJ lights. > New slaves are immediately detected.	Only makes sense in case of planned changes to the AS-i system.

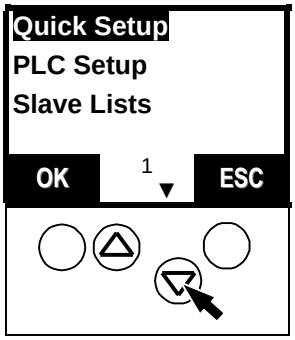
In principle, changes to the slaves which are connected to the master via AS-i are immediately detected. The LED [CONF/PF] lights as soon as there is a change compared to the projected status.

10.2 How are the operating modes for the AS-i master selected?

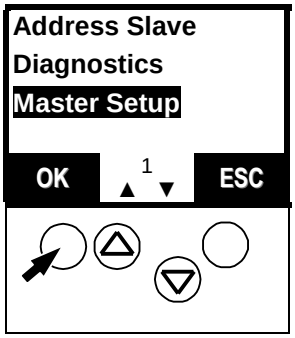
[MENU] > [Master Setup] > select master > [Operation Mode] > select mode > [OK]

1. 

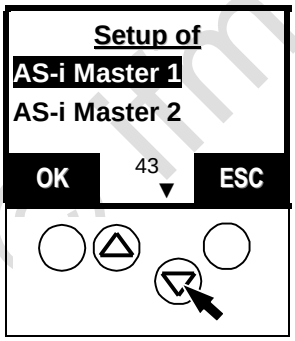
► Press [MENU]

2. 

► Press [▼] to scroll to [Master Setup]

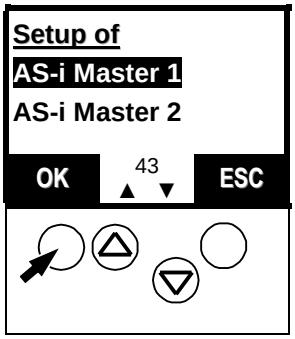
3. 

► Select [Master Setup] with [OK].

4. 

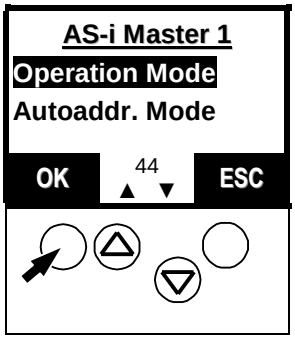
► If necessary, press [▼] to scroll to [Master 2]

5.



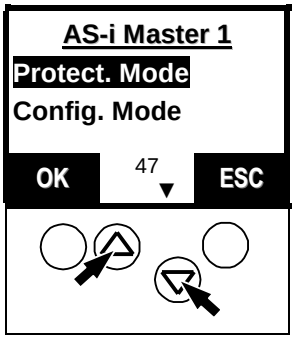
► Select AS-i master with [OK].

6.



► Select [Operation Mode] with [OK].

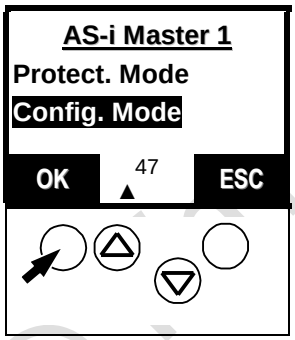
7.



> The marking shows the current operating mode.

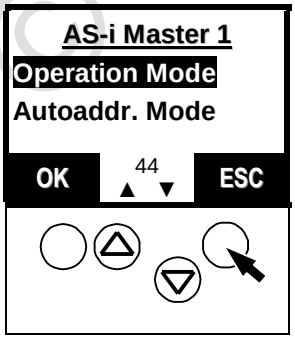
► Press [▲] or [▼] to scroll to other operating mode

8.



► Activate the selected operating mode with [OK].

10.



> LED [PROJ] lights when the "config" mode is active.

> LED [PROJ] is out when the "protected" mode is active.

► Press [ESC] several times to return to the start screen

> That's it.

10.3 Which operating modes are available for the PLC in the controllere?

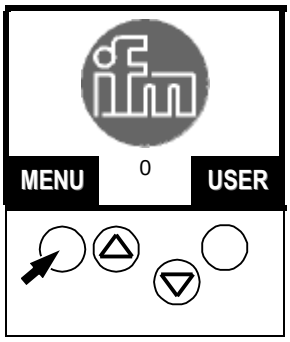
Operating mode	Description	Use
Run	PLC program start > The PLC program stored in the controllere is processed. > LED [PLC RUN] lights	Controlling of the inputs and outputs on the controllere by the PLC program
Stop	PLC program stop > The PLC program stored in the controllere is stopped. > LED [PLC RUN] flashes	Changes to the PLC program or to the slaves
Gateway	Controllere as gateway > LED [PLC RUN] goes out	The host on the fieldbus (option) directly accesses the actuators on the AS-i bus via the controllere.

NOTE

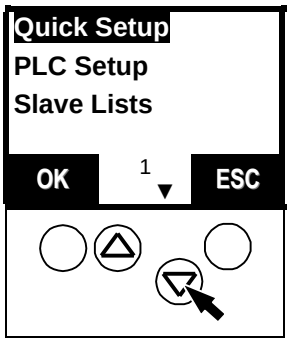
During changes to the PLC program or to the slaves the PLC program should be stopped to avoid malfunctions.

10.4 How are the operating modes for the PLC selected?

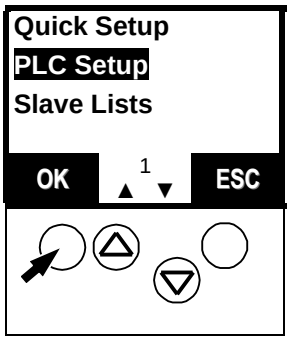
[MENU] > [PLC Setup] > [PLC Settings] > select operating mode > [OK]

1. 

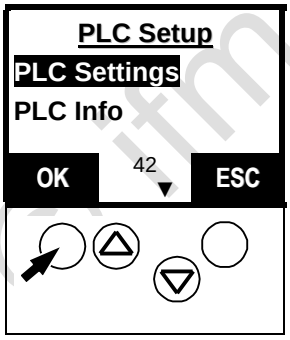
► Press [MENU]

2. 

► Press [▼] to scroll to [PLC Setup]

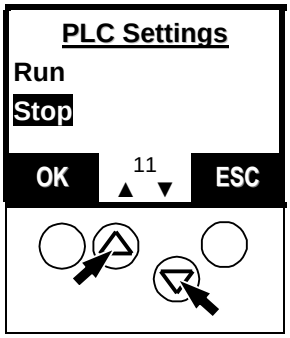
3. 

► Select [PLC Setup] with [OK]

4. 

► Select [PC Settings] with [OK]

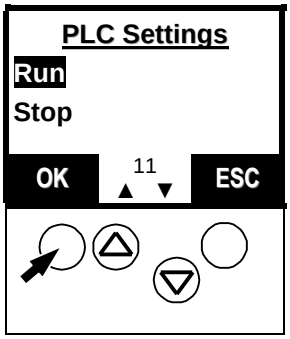
5.



> The marking shows the current operating mode.

► Press [▲] or [▼] to scroll to other operating mode

6.



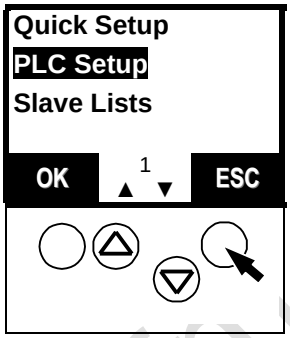
► Activate the selected operating mode with [OK]

NOTE

If no PLC program is loaded in the controller, an error message appears if you try to switch the PLC to the "Run" mode.

> The PLC goes into the operating mode "Stop".

7.



> LED [PLC RUN] lights when PLC program is running.

> LED [PLC RUN] flashes when PLC is stopped.

> LED [PLC RUN] is out when controller operates as gateway.

► Return to the start screen with [ESC]

> That's it.

11 Set-up

This chapter will show you how to set up the controllere quickly:

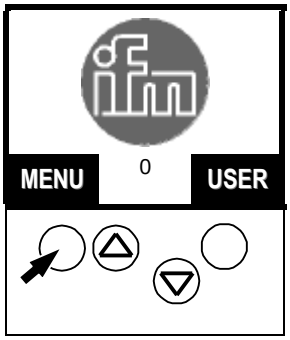
- Programming of the internal PLC
- Configuration of the connected slaves → page 126

After power-on the text/graphics display shows a start screen and possibly an error message of the connected AS-i .

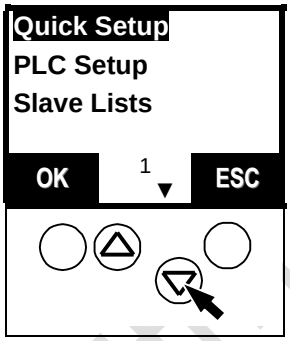
11.1 Set the baud rate of the serial interface

To set the parameters for the controllere via the PC or to program its PLC you must connect the two devices to each other. To do so, the serial interface RS-232C is used as standard. Here you learn how to set the transmission speed of the serial interface:

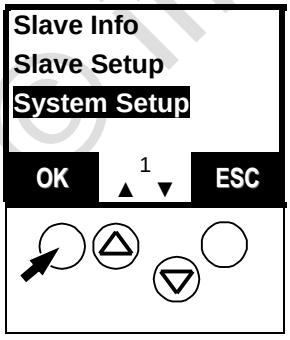
[MENU] > [System Setup] > [Ser. Port Baudr.] > select baud rate > [OK]

1. 

► Press [MENU]

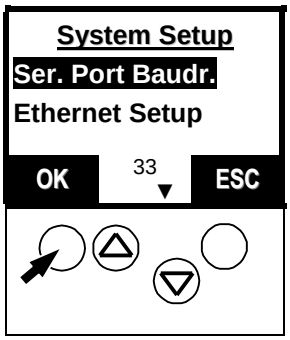
2. 

► Press [▼] to scroll to [System Setup]

3. 

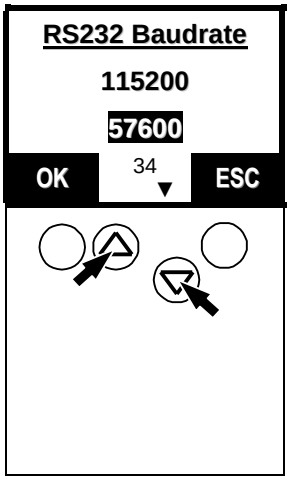
► Select [System Setup] with [OK]

4.



► Select [Ser. Port Baudr.] with [OK]

5.



> Display of current value

► Press [▲] or [▼] to scroll to the requested baud rate:
Selection:

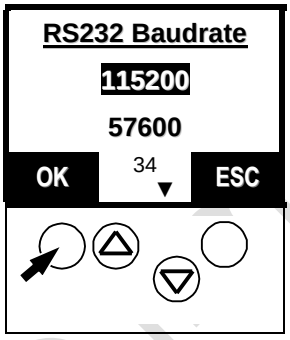
- 115 200 baud (factory setting)
- 57 600
- 38 400
- 19 200
- 9 600
- 4 800 or
- 2 400 Baud*

NOTE

Select the quickest connection which is possible without any problems with the devices used (PC, connection cable, controllere) and the electromagnetic interference on site.

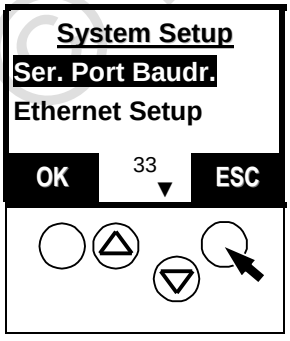
*) The setting 2 400 baud is reserved for HMIs and displays.

6.



► Select set baud rate with [OK]

7.



> Return to screen 33

► Press [ESC] twice to return to the start screen

> That's it!

NOTE

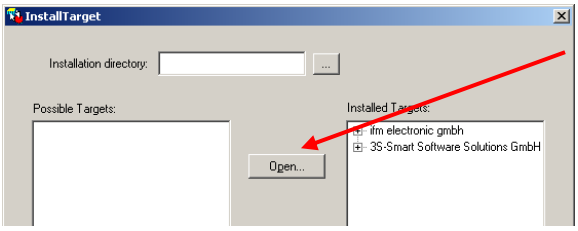
► Set the same value on the PC!
→ page 124, chapter RS-232C

11.1.1 Install target for the controllere

► Install the current target for the AS-i controllere, if not yet done:

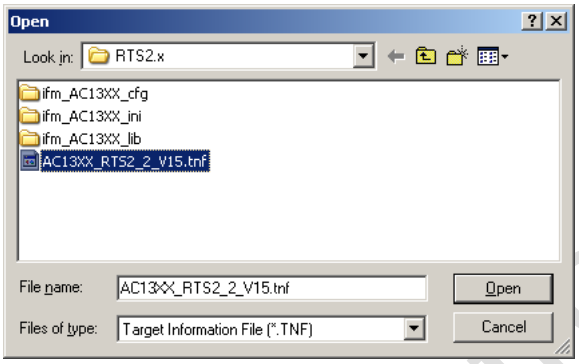
1. ► Click on [Start] > [Programs] > [CoDeSys] > [InstallTarget] on the PC

2.



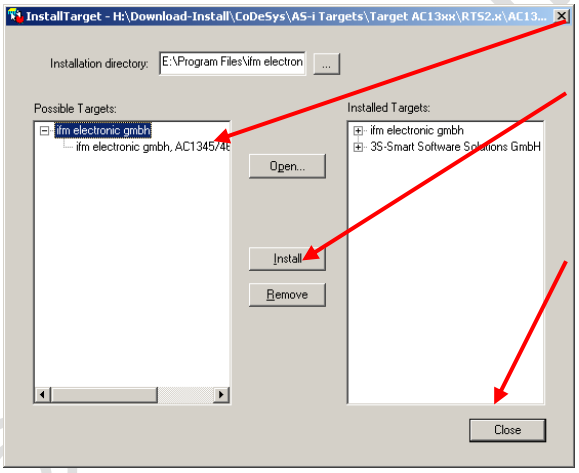
► Click on [Open] to open the installation file "Target Information File" (*.TNF)

3.



► Select the source directory for the new target (from the installation CD) and confirm with [Open]

4.



► Mark the target for the controllere (→ figure)

► Start installation with [Install]

> Message "The installation directory does not exist. Create?"
OR:
Message "The target ... already exists. Overwrite it?"

► Confirm with [Yes]

> Target is being installed

► Finish with [Close]

> That's it! The new target is installed.

11.1.2 Connect the programming device

RS-232C

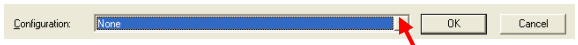
To connect the PC with the programming software to the serial interface RS-232C of the controllere, you need the programming cable with 1 Sub-D-9 connector (female) and 1 RJ11 connector:
→ Article no. E70320

► Connect the PC to the controllere using the above-mentioned cable

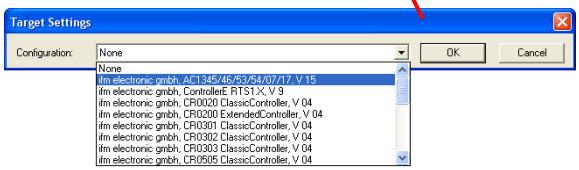
► Start the programming software CoDeSys® 2.3 on the PC

► Create a new project in CoDeSys®

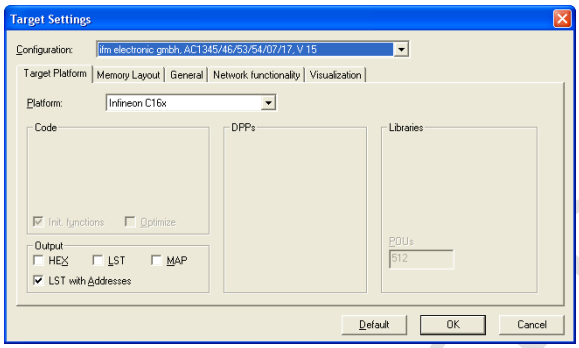
► Set target system:

1. 

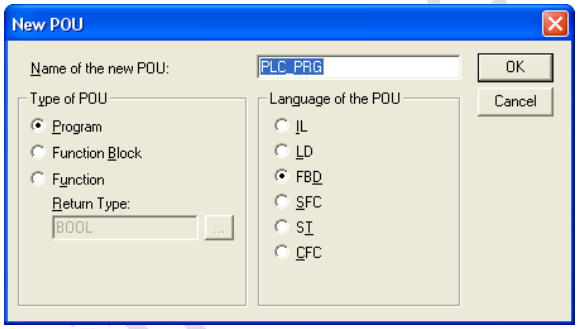
► Click on the symbol [▼]

2. 

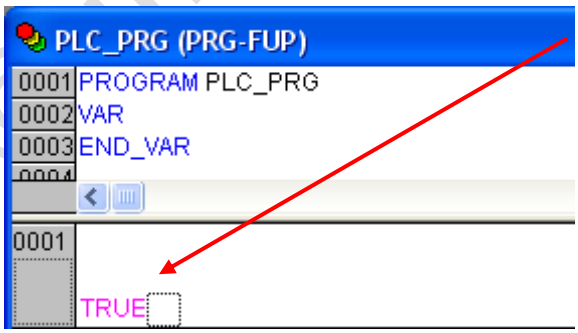
► Select a valid target for the controllere and confirm with [OK]

3. 

► Confirm with [OK]

4. 

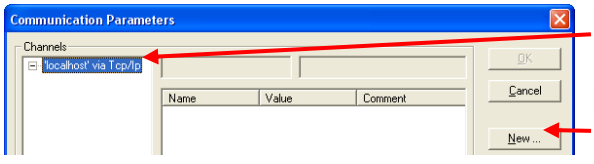
► Confirm the new POU "PLC_PRG" with [OK]

5. 

► Replace "???" by "TRUE" in the first network

► PC key [Enter]

> The first "program" is provisionally finished.

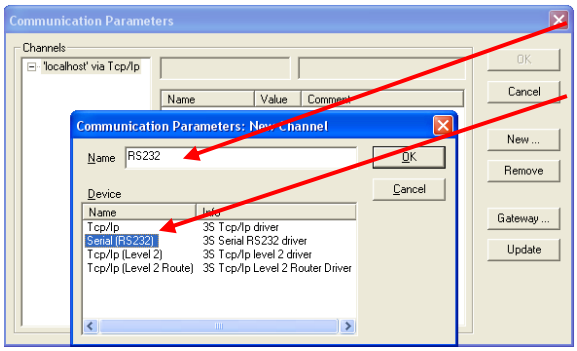
6. 

► Menu sequence [Online] > [Communication Parameters]

► Mark the uppermost line in the column [Channels]

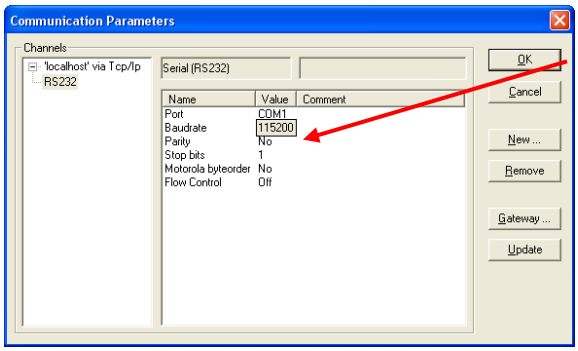
► Click [New…]

7.



- ► Enter "RS 232" as name
- ► Select [Serial (RS232)] as device
- ► Confirm with [OK]

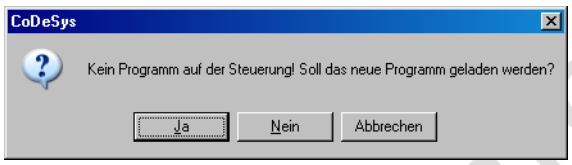
8.



- ► Double-click to change the baud rate step by step until the value corresponds to the setting in the controllere
  → page 121
- ► Adopt with [ENTER]
- ► Confirm with [OK]
- ► Test connection with the menu sequence [Online] > [Login]

> If response "Communication Error", then:

- ► change the baud rate step by step and test communication again



> If there is a connection between the PC and the controllere, then message → figure

In the supplementary device manual "PLC programming with CoDeSys® 2.3" more detailed information about the use of the programming system "CoDeSys for Automation Alliance" is given. This manual can be downloaded free of charge from **ifm's** website at:
→ www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]

Ethernet (option)

To connect the PC with the programming software directly to the optional Ethernet programming interface of the controllere, you need a cross-over patch cable Cat5 with RJ45 connector on both sides.
→ article no. EC2080

Description of the Ethernet programming interface:
→ separate supplementary manual for this device manual.

11.2 Configuration

In this chapter you will learn the methods how to address slaves using the controllere.

> **NOTE**
>
> Every address is allowed in the system only once so that the AS-i master can communicate with every slave individually.
>
> Slaves with the address 0 do not operate on the bus.
>
> The manufacturers of AS-i slaves always deliver their devices with the address 0.
>
> The controllere displays an error message and does not process slaves with wrong addresses or addresses which have been assigned twice.

11.2.1 Permissible slave addresses

Single slaves	(0), 1...31
A/B slaves	(0A), 1A...31A, 1B...31B *)

*) The address 0B is not possible.

- If an address has been assigned to a single slave, this address must not be assigned as an A or B address. Addresses assigned to A/B slaves must not be assigned to single slaves.
  Example of non permissible address assignment: 17, 17A
- If an address has been assigned to an A slave, this address may also be assigned as B address. A/B slaves share one address number.
  Example of permissible address assignment: 17A, 17B
- Maximum number of slaves per master: 31 single slaves or 62 A/B slaves

11.2.2 Automatic addressing of individual slaves

Now address the slaves. This is possible by means of the keys and the text/graphics display on the controllere. In the mode "Easy Startup" the controllere can address the slaves automatically in rising order if the slaves are connected to the bus one after the other.

NOTE

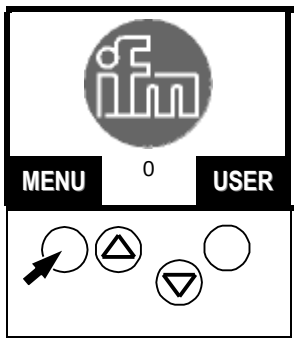
However, this automatic process only works without problems if the slave to be connected has the address 0! If the slave has already been used in another system, it will probably already have an address other than 0.

In such a case, the controllere does not react to the connection of the new slave. This slave is not automatically addressed.

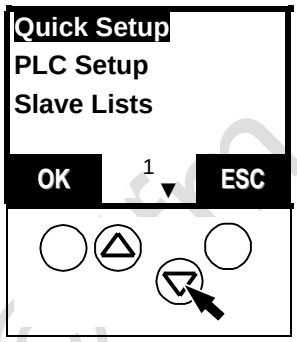
Then → page 130, chapter Manual slave addressing.

Password level 1 required → page 142, chapter Password setting

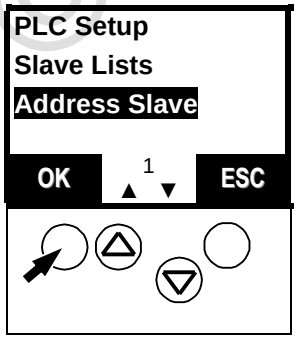
[MENU] > [Address Slave] > [Easy Startup] > select master > connect slave > [ESC]

1. 

► Press [MENU]

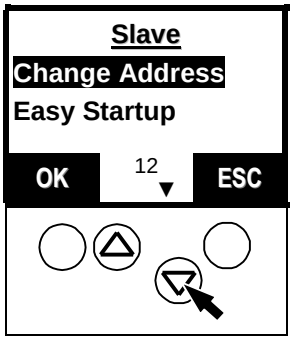
2. 

► Press [▼] to scroll to [Address Slave]

3. 

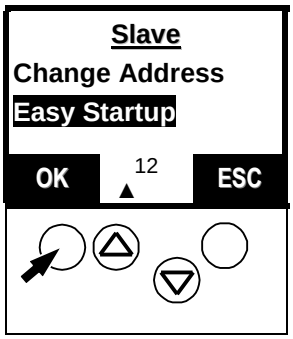
► Select [Address Slave] with [OK]

4.



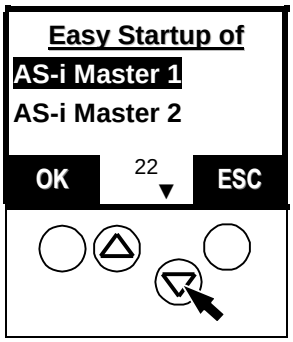
► Press [▼] to scroll to [Easy Startup]

5.



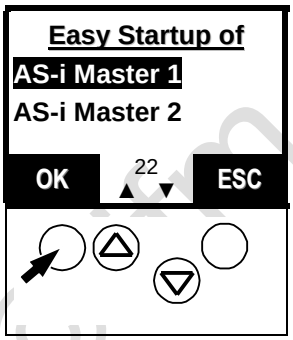
► Select [Easy Startup] with [OK]

6.



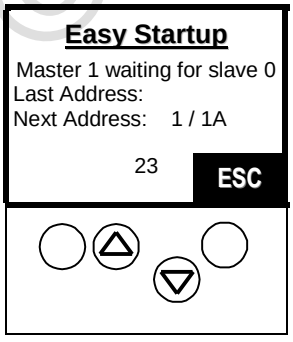
► If necessary, press [▼] to scroll to AS-i master 2

7.



► Select requested AS-i master with [OK]

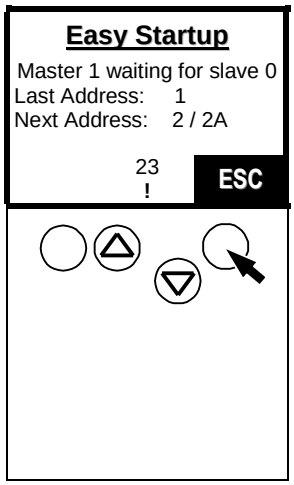
8.



> The controller is waiting for a slave with the address 0 to be activated on or connected to master 1.

► Take a slave which still has the address 0 and connect it to the AS-i bus or activate it.

9.



> The controllere automatically assigns the lowest available address to this slave

> The controllere displays the address assigned to the new slave and, below, the next available slave address.

> LED [PWR/COM] no longer flashes, but lights: At least one active slave is now correctly detected.

> LED CONF/PF lights: There is (at least) one new slave on the bus which the controllere does not yet have in its projection list.

When all slaves have been addressed:

► Return to the start screen with [ESC]

NOTE

► Only connect one new slave at a time in the mode "Easy Startup"!

> When the controllere finished the integration of the new slave, the display "Waiting for Slave 0" is shown again.

► Note the address assigned under "Last address" for this slave.

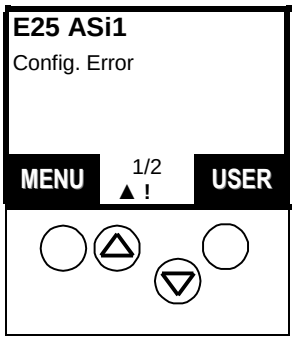
► Then you can connect the next slave with the address 0.

11.2.3 Manual slave addressing

The old slave address is not 0? The automatic procedure described above (→ page 127), however, only works without problems if the slaves to be connected have the address 0! If the slaves have already been used in another system, the slaves probably already have another address. In such a case, the controllere does not react to the connection of the new slave.

► Remove these slaves from the system.

In the following section we will show you how the addresses of the devices can be changed.



► End automatic addressing:
Press [ESC] several times to return to the start screen (→ figure).

You would like to integrate a slave in the AS-i bus which has already been assigned an address but now needs a new address?

Prerequisites:

- Neither the "old" nor the new address of the slave is allowed on the bus.
- Connecting a slave with the address 0 to the AS-i bus is not allowed.

► If necessary, temporarily remove the existing slave with the correct "old" address from the bus.

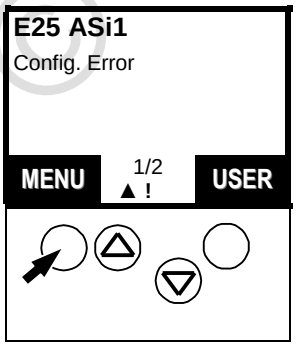
► Install or activate the new slave on the bus.

NOTE

Password level 1 required → page 142, chapter Password setting

[MENU] > [Address Slave] > [Change Address] > select master > select old slave address > [OK] > select new slave address > [OK] > [MORE] orr [ESC]

1.



> The display on the left appears instead of the ifm start screen: "Config. error"

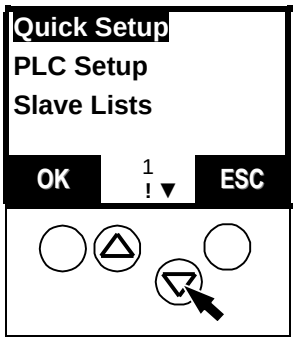
> LED [CONF/PF] lights

Cause: There is (at least) one new slave on the bus which is not yet in the projection list of the the controllere.

Note: error description
→ page 239, chapter Error description

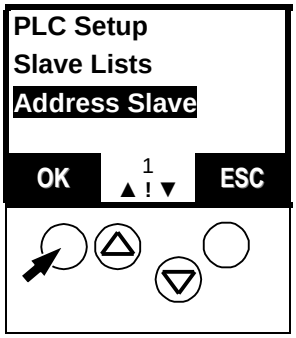
► Press [MENU]

2.



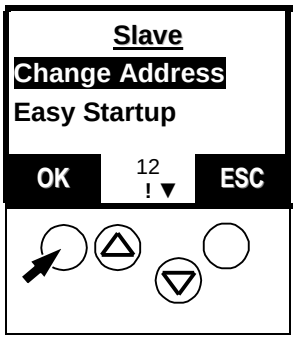
► Press [▼] to scroll to [Address Slave]

3.



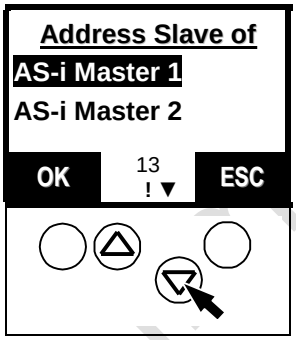
► Select [Address Slave] with [OK]

4.



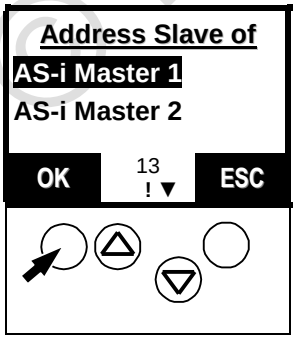
► Select [Change Address] with [OK]

5.



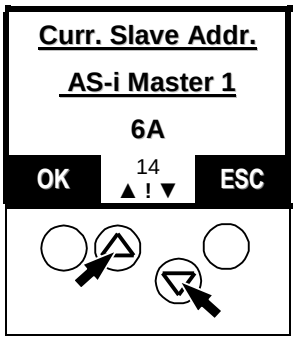
► If necessary, press [▼] to scroll to AS-i master 2

6.



► Select requested AS-i master with [OK]

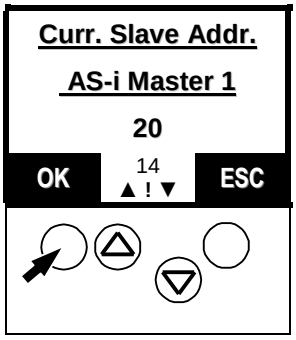
7.



> Display of the lowest found valid slave address

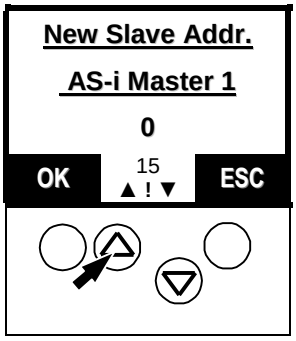
► Press [▲] or [▼] to scroll to the slave whose address is to be changed

8.



► Select the requested slave with [OK]

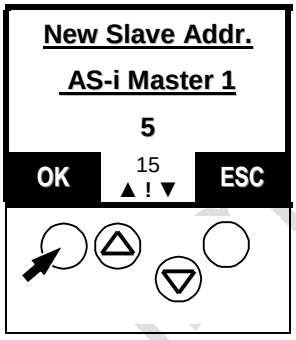
9.



> Display of neutral slave address 0

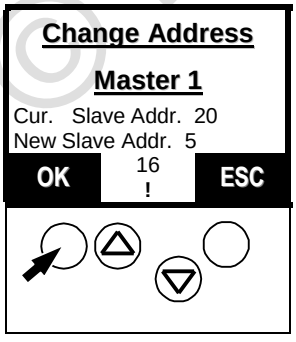
► Press [▲] to scroll to the requested slave address

10.



► Select new slave address with [OK]

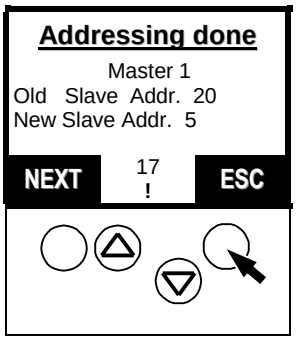
11.



> Display of old and new slave address

► Confirm the new slave address with [OK]

12.



> Display of the message "WAIT" while saving

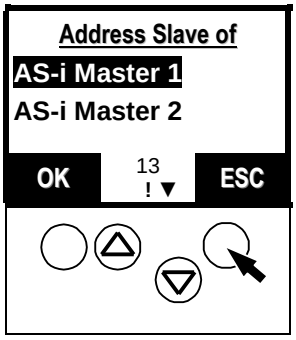
> Display of the change made (→ figure)

> LED [CONF/PF] lights: configuration error

► Press [MORE] to repeat steps 7 to 12 for another slave whose address is to be changed

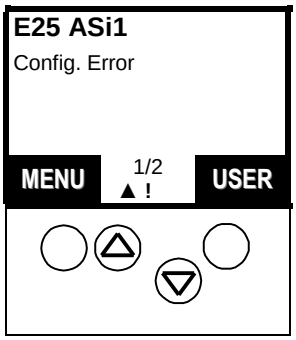
► Finish slave addressing with [ESC]

13.



► Return to the start screen with [ESC]

14.



> The display on the left appears instead of the ifm start screen: "configuration error"

In the next section we will show you how to finish the configuration.

11.2.4 Finish configuration

NOTE

Now all slaves are present on the bus with the correct address.

But the error message ("!") keeps on flashing and the LED [CONF/PF] lights?

Cause: The controllere detected all slaves on the bus but the slaves are not yet - at least not all slaves - in the "list of projected slaves" LPS.

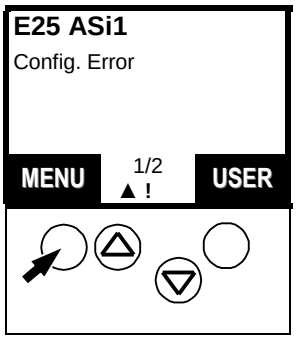
This means: The error message "Config. Error" is displayed as long as there is a difference between the detected and configured slaves.

Help: In the mode "Quick Setup" enter all detected slaves in the configuration list by pressing a key.

Password level 1 required → page 142, chapter Password setting

[MENU] > [Slave Lists] > select master > [Detected Slaves]

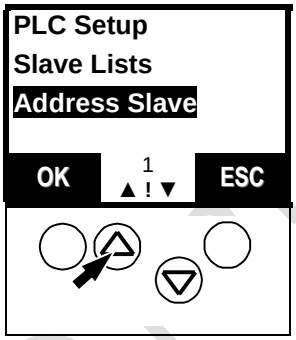
1.



> The display on the left appears instead of the ifm start screen: "Config. Error"

► Press the key [MENU]

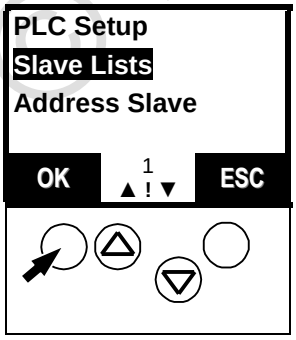
2.



> The controllere shows the last used menu item

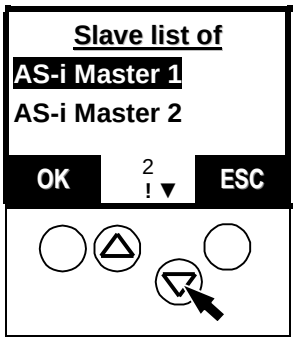
► Press [▲] to scroll to [Slave Lists]
Reason: Check the configuration made so far in the list of detected slaves LDS.

3.



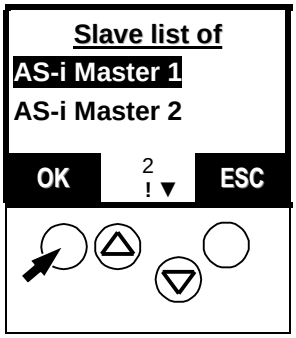
► Select [Slave Lists] with [OK]

4.



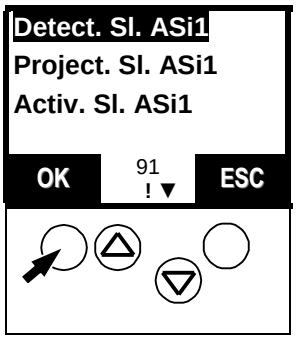
► If necessary, press [▼] to scroll to master 2

5.



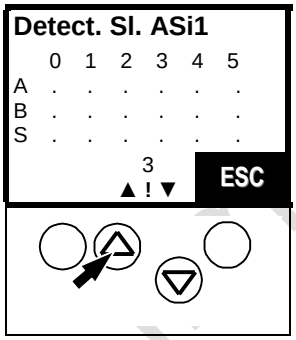
► Select requested master with [OK]

6.



► Select [Detected Slaves] with [OK]

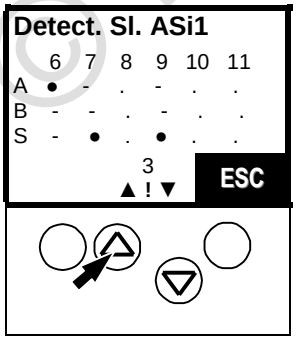
7.



> A table of detected slaves is displayed.
Here: no slaves have been detected on master 1 with the addresses 0 to 5.

► If necessary, press [▲] to scroll to the next address block

8.



> A table of detected slaves is displayed.
In this **example**:

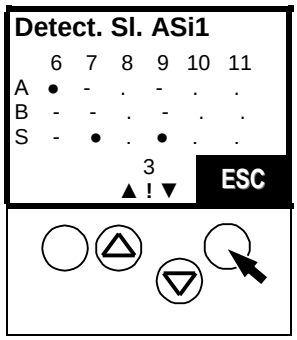
• an A/B slave has been detected as A slave at the address 6

• a single slave has been detected at the addresses 7 and 9

► Check found slave addresses and compare them to the draft

► If necessary, press [▲] to scroll to the next address block

9.



- If all detected slaves are to be entered in the configuration list:

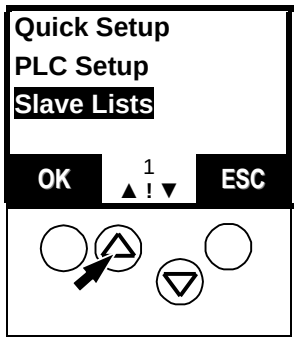
► Press [ESC] three times to return to the menu [Slave Lists] (continue → below)

- If incorrect slave addresses are to be reassigned:
  → page 130, chapter Manual slave addressing

Enter detected slaves in the configuration list

[Quick Setup] > [Config. all] > [OK]

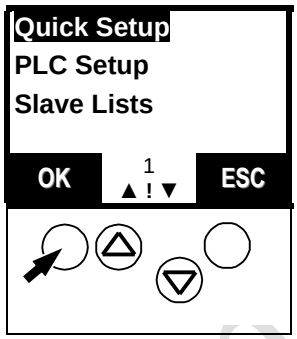
10.



> The controllere shows the last used menu item

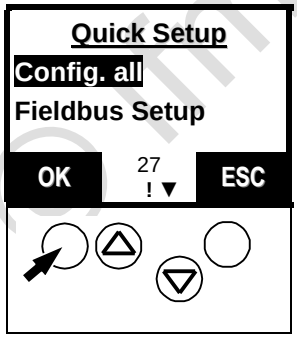
► Press [▲] to scroll to [Quick Setup]
Reason: Enter all detected slaves in the configuration list by pressing a key.

11.



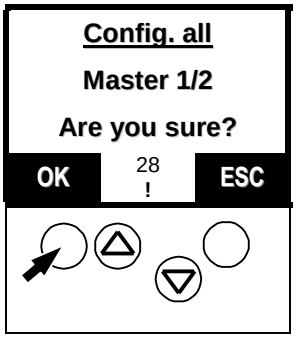
► Select [Quick Setup] with [OK]

12.



► Select [Config. all] with [OK]

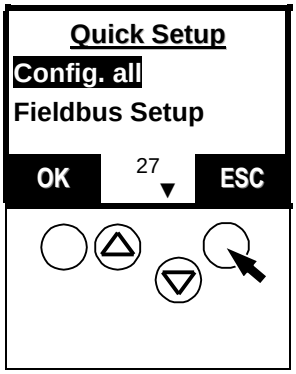
13.



> Display of safety query

► Confirm with [OK]

14.



> Display of the message "WAIT" while saving

> Error message "!" goes out

> The display on the left appears

> Red LED [CONF/PF] goes out

> Yellow LED [PROJ] goes out because the device now automatically activates the "protected mode"

► Press [ESC] twice to return to the start screen

> That's it!

11.3 Change slave parameter data

The default parameter value for the slaves is "0Fh".

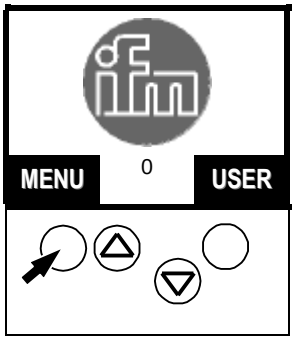
Example for a useful parameter change: Unused analogue input channels generate a periphery fault of the module. By changing parameters you can block unused channels so that the module does not trigger a periphery fault.

Please note the corresponding remarks in the instructions of the modules.

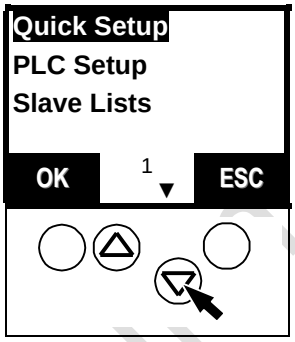
NOTE

Password level 2 required → page 142, chapter Password setting
Changed values are not adopted in case of a wrong password level

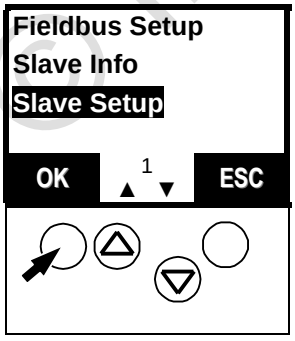
[MENU] > [Slave Setup] > select master > select slave > [Parameter value] > change parameter value > [SET]

1. 

► Press [MENU]

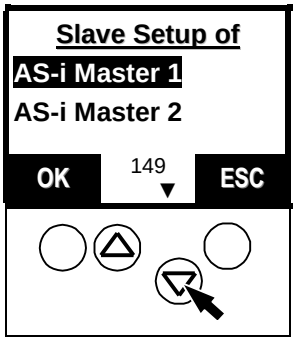
2. 

► Press [▼] to scroll to [Slave Setup]

3. 

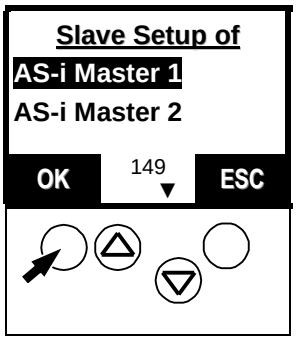
► Select [Slave Setup] with [OK]

4.



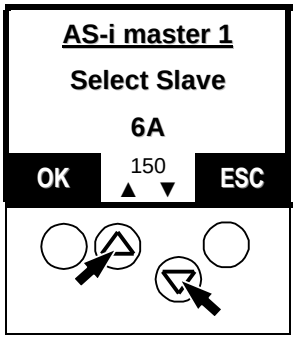
► If necessary, press [▼] to scroll to master 2

5.



► Select requested master with [OK]

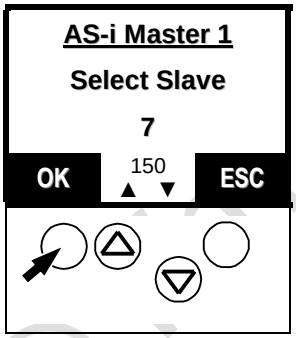
6.



> Display of the lowest found valid slave address

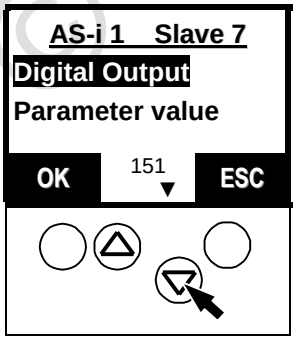
► If necessary, press [▲] or [▼] to scroll to another slave

7.



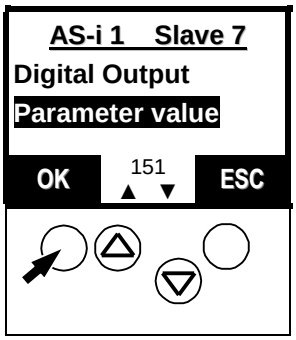
► Select requested slave with [OK]

8.



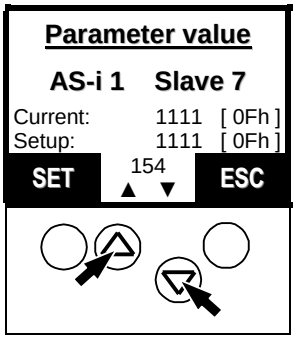
► Press [▼] to scroll to [Parameter value]

9.



► Select [Parameter value] with [OK]

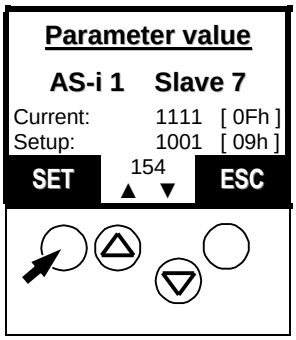
10.



> Display of current and setup parameter values as binary value and hex value

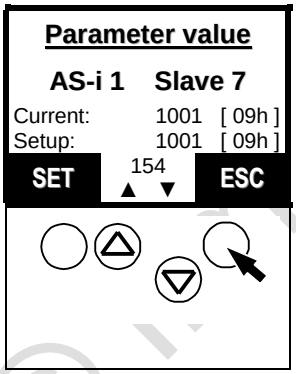
► Press [▲] or [▼] to set the parameter setup value

11.



► Save new parameter data on the slave with [SET]
Keep the key [SET] pressed until the change has been made!

12.



> Setup value of the parameter data is copied to the current parameter data

If the setup value of the parameter data for this slave is not permitted:

> Display of error message: "Invalid slave data"

► Repeat steps 10...12 with corrected values

► Press [ESC] five times to return to the start screen

► That's it!

11.4 Password protection

11.4.1 General

In the menu [System Setup] in the menu item [Password] the operation can be restricted or enabled. On delivery, the device is in the user mode (= password level 1). By entering an invalid password (e.g. 1000) all menu items which can change settings are disabled. This disabling is the password level 0 (end user mode).

⚠ WARNING

Risk for persons and plant/machine by access of unauthorised users to special menus of the controllere.

► Change the password to level 0 again as soon as the work in a higher password level has been completed. → page 142, chapter Password setting

11.4.2 Password levels

Password level	Operating mode	Password	Note
0	end user mode	as required	
1	user mode	CE01	factory setting
2	service mode	E02C	

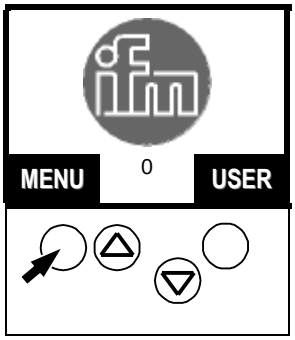
Main menu	2nd menu level	Required password level
Quick Setup	All	1
PLC Setup	all	1
Address Slave	All	1
Diagnostics	Reset Error Counter	1
Master Setup	Config all	1
Master Setup	Operation Mode	1
Master Setup	Autoadr. Mode	1
Master Setup	Slave Reset	1
Fieldbus Setup	All	1
System Setup	Modbus Setup	1
System Setup	Firmware Update	3 *)
System Setup	Factory default	3 *)
System Setup	System Specials	2
System Info	Admin Info	3 *)
Slave Setup	All	2
All other menus	All	0

*) Please contact your AS-i sales specialist if you want to work with the password level 3.

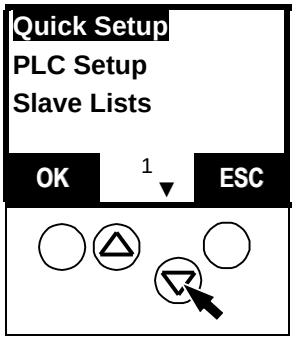
The set password is immediately valid when entered and remains effective until the setting is changed.

11.4.3 Password setting

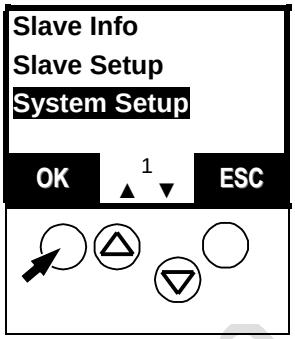
[MENU] > [System Setup] > [Password] > change password > [OK]

1. 

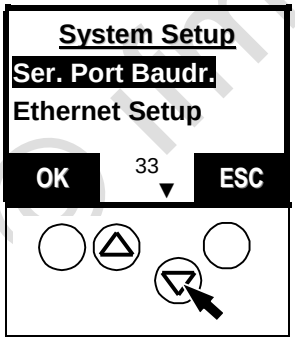
► Press [MENU]

2. 

► Press [▼] to scroll to [System Setup]

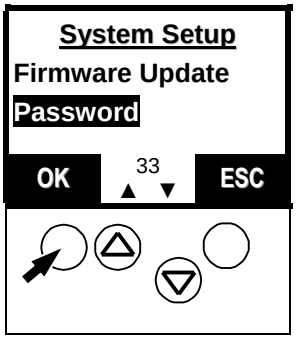
3. 

► Select [System Setup] with [OK]

4. 

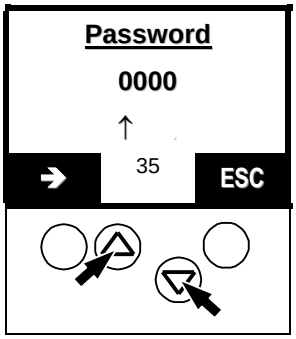
► Press [▼] to scroll to [Password]

5.



► Select [Password] with [OK]

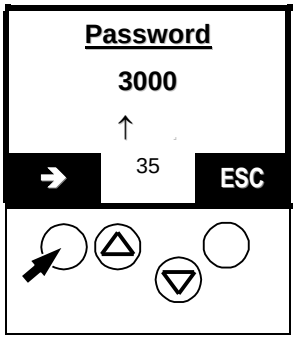
6.



> Display password "0000"
The arrow ↑ points to the digit which can be changed

► Press [▲] or [▼] to change the digit in the range 0...F

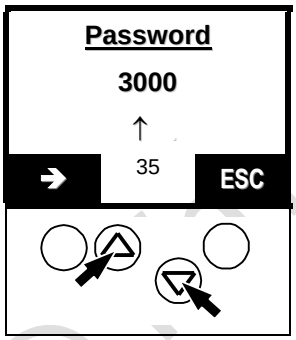
7.



> Display of password changed so far

► Move to the next digit with [➔]

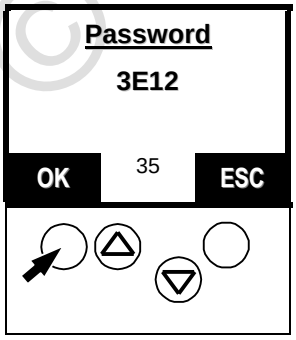
8.



> Display of password changed so far
The arrow ↑ points to the digit which can be changed

► Repeat steps 6...7 for all digits

9.



► Set new password with [OK]

NOTE
The set password is immediately valid when entered and remains effective until the setting is changed.

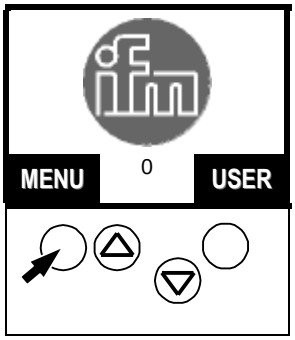
11.5 Reset to factory settings

You work with a used controllere (e.g. from a test project). You want to restore the factory settings of the controllere to prepare it for the new project?

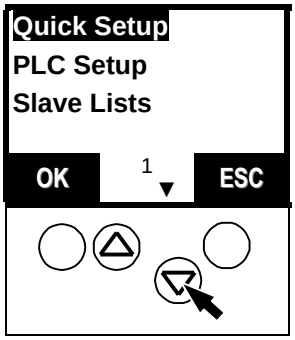
NOTE

Password level 3 required → page 142, chapter Password setting
For the administrator mode please contact your AS-i sales specialist.

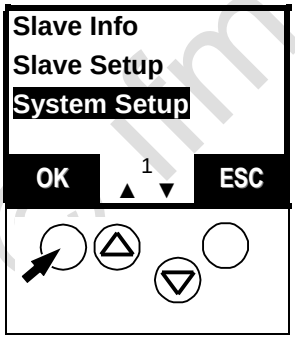
[MENU] > [System Setup] > [Factory default] > 2x [OK]

1. 

► Press [MENU]

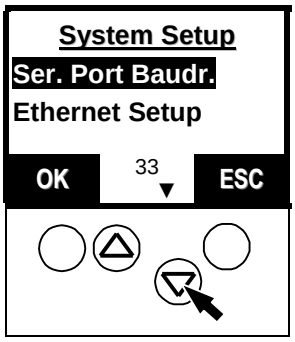
2. 

► Press [▼] to scroll to [System Setup]

3. 

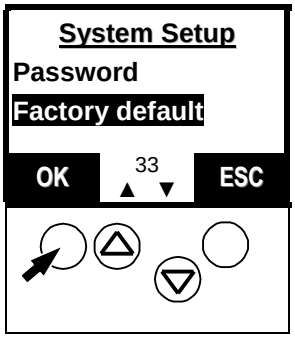
► Select [System Setup] with [OK]

4.



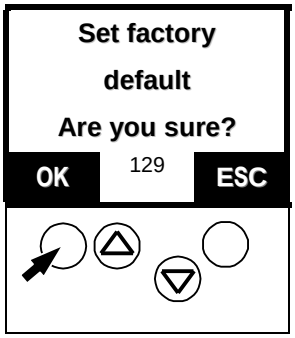
► Press [▼] to scroll to [Factory default]

5.



► Select [Factory default] with [OK]

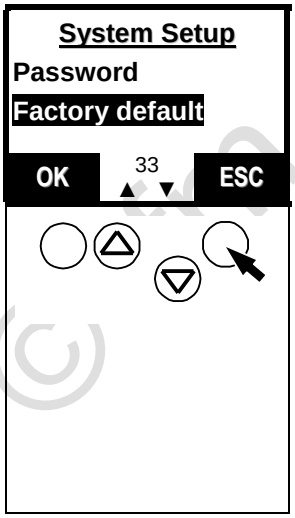
6.



> Display of safety query

► Confirm with [OK]

7.



> Reset of the controllere to factory default. Some changes will become effective only after the next power on.

> PLC programs are not deleted.

> Fieldbus settings are not reset.

> The password is reset to level 1.

> Return to screen 33

► Press [ESC] twice to return to the start screen

► Switch the device off and on again

> The language of the controllere is reset to English.

> The baud rate of the serial interface is reset to 115 200 baud.

> That's it!

11.6 Firmware update

> **NOTE**
>
> To update the operating system of the controllere you need a special software which is not generally available for security reasons.
>
> If needed, please contact our AS-i sales specialist.

11.7 Character sets

The controllere has 3 different character sets used in the menu:

- 16-pixel high proportional font
- 8-pixel high proportional font
- 8-pixel high, 6-pixel wide font for tables

Table of characters:

0		32	space	64	@	96	`	128	Ç	160	á	192	└	224	
1		33	!	65	A	97	a	129	ü	161	í	193	┴	225	ß
2		34	"	66	B	98	b	130	é	162	ó	194	┬	226	
3		35	#	67	C	99	c	131	â	163	ú	195	├	227	
4		36	$	68	D	100	d	132	ä	164	ñ	196	─	228	
5		37	%	69	E	101	e	133	à	165	Ñ	197	┼	229	
6		38	&	70	F	102	f	134	å	166	ª	198		230	µ
7		39	'	71	G	103	g	135	ç	167	º	199		231	
8		40	(	72	H	104	h	136	ê	168	¿	200	╚	232	
9		41	)	73	I	105	i	137	ë	169	⌐	201	╔	233	
10		42	*	74	J	106	j	138	è	170	¬	202	╩	234	
11		43	+	75	K	107	k	139	ï	171	½	203	╦	235	
12		44	,	76	L	108	l	140	î	172	¼	204	╠	236	
13		45	-	77	M	109	m	141	ì	173	¡	205	═	237	
14		46	.	78	N	110	n	142	Ä	174	«	206	╬	238	
15		47	/	79	O	111	o	143	Å	175	»	207		239	
16	▶	48	0	80	P	112	p	144	É	176	░	208		240	
17	◀	49	1	81	Q	113	q	145	æ	177	▒	209		241	±
18	↕	50	2	82	R	114	r	146	Æ	178	▓	210		242	
19	‼	51	3	83	S	115	s	147	ô	179	│	211		243	
20	¶	52	4	84	T	116	t	148	ö	180	┤	212		244	
21	§	53	5	85	U	117	u	149	ò	181		213		245	
22	▬	54	6	86	V	118	v	150	û	182		214		246	
23	↨	55	7	87	W	119	w	151	ù	183		215		247	
24	↑	56	8	88	X	120	x	152	ÿ	184		216		248	
25	↓	57	9	89	Y	121	y	153	Ö	185	╣	217	┘	249	
26	→	58	:	90	Z	122	z	154	Ü	186	║	218	┌	250	
27	←	59	;	91	[	123	{	155	ø	187	╗	219	█	251	
28	∟	60	<	92	\	124	¦	156	£	188	╝	220	▄	252	
29	↔	61	=	93	]	125	}	157	¥	189		221		253	²
30	▲	62	>	94	^	126	~	158	Pt	190		222		254	■
31	▼	63	?	95	_	127	⌂	159	ƒ	191	┐	223	▀	255	

12 Programming

In the supplementary manual "PLC programming with CoDeSys® 2.3" you will obtain more detailed information about the use of the programming system "CoDeSys for Automation Alliance". This manual can be downloaded free of charge from ifm's website at:
→ www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]

12.1 Deviations from the indications in the programming manual

As opposed to the information in the programming manual, the following particularities apply to the controllere:

- Retain variables are not automatically stored. To do so, the function block "Store_Retain" must be called.
- Task management is not implemented.
- Persistent variables are not implemented.
- Target visualisation is not possible.

12.2 Online changes in the PLC

To reduce the data volume to be transmitted to the controllere, CoDeSys® only transmits the changed POUs to the PLC. This accelerates programming in case of program changes during set-up. The term "Online Change" describes a function of the device allowing a change to the PLC program without interrupting the program. So the processing of the changed PLC program is possible without resetting the outputs.

⚠ WARNING

Dangerous, uncontrolled machine states!

The changeover to the changed PLC project can take up to 100 ms in case of "Online Change". During this time the outputs remain in their current state. The PLC data is not initialised after "Online Change".

► Stop the machine/system or bring it into a safe state before changing the PLC program in the controllere.
→ page 118, chapter How are the operating modes for the PLC selected?

12.3 Boot project / source code

The project loaded in the controllere is at first only stored in the volatile SRAM, just like the AS-i configuration. This means it will be lost if the controllere is no longer supplied with 24 V.

Boot process:
When the supply voltage of the controllere is switched on, the operating system copies the programs and data stored as boot project to the SRAM where they are executed (boot process). After this, the AS-i masters receive their configuration data. The AS-i masters initialise the AS-i slaves and start the data transfer to the slaves.

12.3.1 Create boot project

⚠ WARNING

Dangerous, uncontrolled machine states!

The flash process can take 5 to 20 seconds when creating a boot project!
During this time the outputs remain in their current state.

► Stop the machine/system or bring it into a safe state before creating a boot project or saving the AS-i configuration
→ page 118, chapter How are the operating modes for the PLC selected?

When the configuration of an AS-i system is finished and the PLC project tested, this information must be non-volatilely stored in the flash memory. This is done in CoDeSys® via [Online] > [Create boot project].

12.3.2 Transmit source code from the PC to the controllere

The controllere gives you the option of automatically transmitting the source code of the boot project to the controllere. What for?

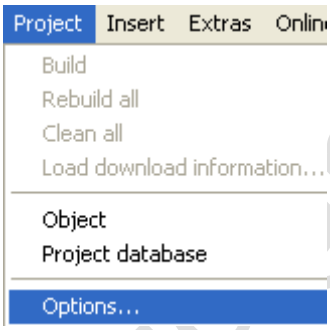
The source code contains all the data of your project, i.e. also the comments of your programs. If this data is stored in the controllere, a service technician can continue to work with the program on the machine, even if he does not have the original project on his PC.

The controllere has memory space of approx. 130 Kbytes for the source code. For larger files (→ size indicated in the download window) the source code download is aborted.

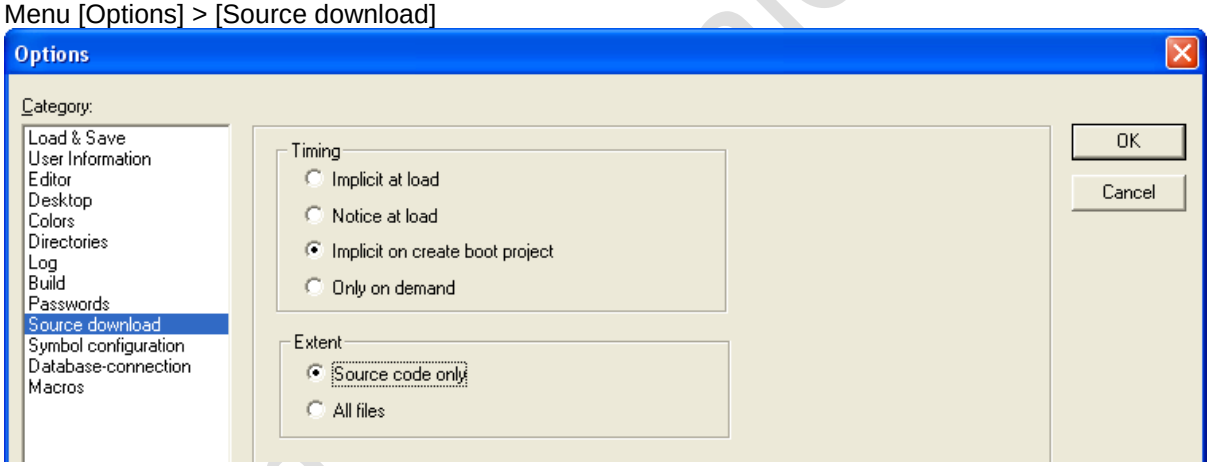
The setting shown here automatically sends the source data together with the boot project to the controllere.

► To do so, the following option must be activated in the CoDeSys® program:

► [Project] > [Options...] > select [Source download]



Menu [Options] > [Source download]



► Timing = [Implicit on create boot project]
Extent = [Source code only]

► Confirm with [OK]

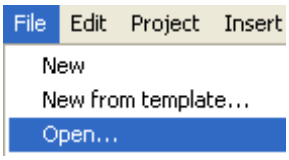
> The source code is also transmitted to the controllere when creating the boot project

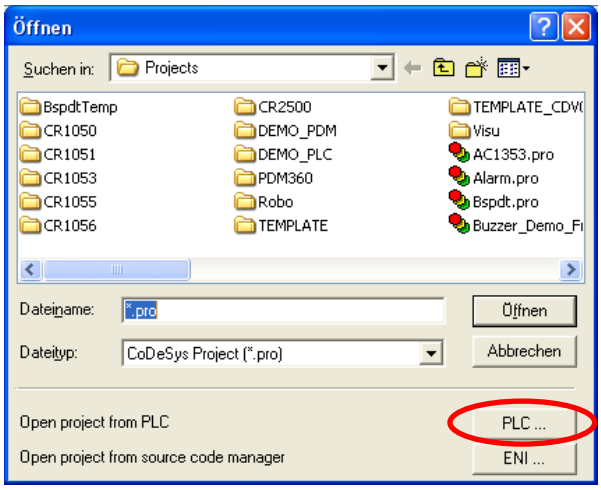
12.3.3 Transmit source code from the controllere to the PC

Your project was transmitted as source code from the PC to the controllere and is available there. It is now also possible to transmit the source code from the controllere to the PC.

To demonstrate this, save and close your current project.

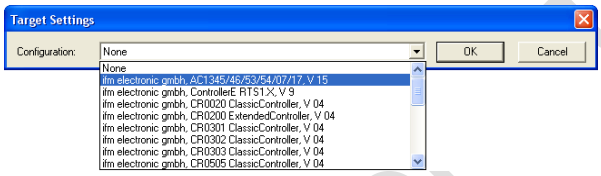
► In CoDeSys® menu [File] > [Open…]





► Click on [PLC…]:
[Open project from PLC]

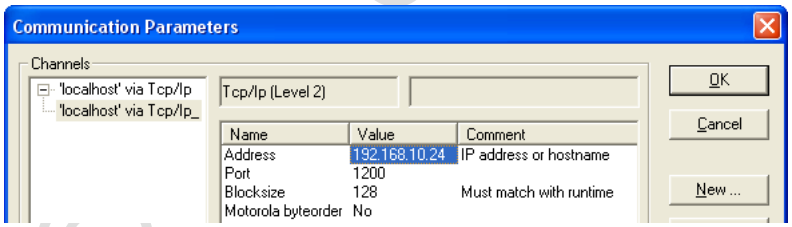
► Click on the symbol [▼]



► Select the target suitable for the controllere used

► Confirm with [OK]

► In the "Online" menu select [Communication Parameters]



► Select the setting (→ CoDeSys® manual) which matches the setting in the controllere

► See for yourself that the project transmitted from the controllere corresponds to your original project.

12.4 Remanent PLC data (flags)

Three types of data can be stored in the PLC:

- Remanent variable (in CoDeSys® declared as retain variable)
- Volatile variable (if not declared as "retain variable")
- Remanent flags: MW 0...79
- Volatile flags MW 80...127

Like all other data, the remanent variables are stored in the volatile SRAM memory and are not automatically saved in the flash memory! The library ifm_Asi_Utils_xxxxxx.lib contains a function to save 1 KWords of remanent variables if needed.

NOTICE

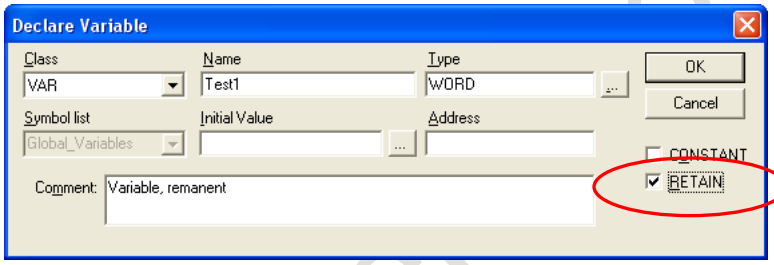
Due to the design the maximum number of possible write cycles for the flash memory is limited.

o Do not save data cyclically! Loss of data due to the destruction of the memory is possible!

► Store remanent variables separately only if needed.

For this reason, only statical information such as formulations or target times should be stored in the remanent storage area. When the voltage is restored, the area of the remanent variables with the last stored values is restored.

Remanent variables are declared as "Retain variables" in CoDeSys®:



In addition, there are the remanent flag words MW 0...MW 79 to store dynamic values such as counter values. In case of power failure these 80 words are automatically saved by the operating system and restored when the voltage is restored. The flags in MW 80...MW 127 are not remanent!

12.5 System variables

System variables in the controllere can be indirectly accessed via a special table of pointers at the basic address FFB00 h.

The easiest way to use these system calls is to integrate the supplied library ifm_AsiUtils_010000.lib in your project.

The library applies to controllere devices with the firmware RTS 2.x and replaces the previous libraries "ecoasi20.lib" and "ecoasi21.lib".

12.6 Overview PLC addresses

The PLC addesses (IEC addresses) consist of several elements in the indicated order:

Start character	%	The definition of an address starts with "%"
Data type	I	Inputs (of sensors) are defined by an "I" for input
	Q	Outputs (of actuators) are defined by a "Q" for output
	M	Flags are defined by an "M"
Data length	X	Bit information is defined by an "X"
	B	Bytes (= 8 bits) are defined by a "B"
	W	Words (= 2 bytes = 16 bits) are defined by a "W"
Identification	(m)	Indication of the AS-i master
Slave address	(s)	Indication of the slave address

12.6.1 Example pushbutton module

An AS-i pushbutton module AC2088 is connected to the master 1 as slave 6B. At which addresses are the pushbuttons and indicators accessible in the PLC program?

The data sheet specifies: AS-i profile = S-B.A.E

Assignment	LED red	LED green	Pushbutton red	Pushbutton green
Data bit	D0	D1	D2	D3

This results in the following addresses for the PLC program in the controllere:

	Pushbutton	Indicator
green	%IX11.6.3	%QX11.6.1
red	%IX11.6.2	%QX11.6.0

The following pages will show examples of IEC addresses in the PLC of the controllere.

12.6.2 IEC addresses in the PLC of the controllere

For the digital slave inputs and outputs

%	I	B	1.	7	
%	Q	X	12.	2	.3

Data area	Type of access	Identification	Slave address	Data bit
I = input Q = output	B = byte X = bit	1 = S/A slave on master 1 2 = S/A slave on master 2 11 = B slave on master 1 12 = B slave on master 2	1 = slave 1 2 = slave 2 … 31 = slave 31	If type of access = X: 0 = D0 1 = D1 2 = D2 3 = D3

S/A slave = single slave or A slave

For the analogue slave inputs and outputs

%	I	W	21.	6	.0
%	Q	W	22.	9	.3

Data area	Type of access	Identification	Slave address	Data channel	
I = input Q = output	W = word	21 = master 1 22 = master 2	1 = slave 1 2 = slave 2 … 31 = slave 31	0 =	1st channel S/A slave
				1 =	2nd channel S/A slave
				2 =	3rd channel single slave or: 1st channel B slave
				3 =	4th channel single slave or: 2nd channel B slave
				4 =	status

S/A slave = single slave or A slave

A/B slaves have max. 2 analogue channels

Status information of analogue slaves

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	analogue data channel 0 from/to slave 1 or: analogue data channel 0 from/to slave -A															
1	analogue data channel 1 from/to slave 1 or: analogue data channel 1 from/to slave 1A															
2	analogue data channel 2 from/to slave 1 or: analogue data channel 0 from/to slave 1B															
3	analogue data channel 3 from/to slave 1 or: analogue data channel 1 from/to slave 1B															
4	TIB	TOB	TIA	TOA	TVB	OVB	TVA	OVA	O3	V3	O2	V2	O1	V1	O0	V0
5	analogue data channel 0 from/to slave 2 or: analogue data channel 0 from/to slave 2A															
6	analogue data channel 1 from/to slave 2 or: analogue data channel 1 from/to slave 2A															
7	analogue data channel 2 from/to slave 2 or: analogue data channel 0 from/to slave 2B															
8	analogue data channel 3 from/to slave 2 or: analogue data channel 1 from/to slave 2B															
9	TIB	TOB	TIA	TOA	TVB	OVB	TVA	OVA	O3	V3	O2	V2	O1	V1	O0	V0

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
…	…															
150	**analogue data channel 0 from/to slave 31 or: analogue data channel 0 from/to slave 31A**															
151	**analogue data channel 1 from/to slave 31 or: analogue data channel 1 from/to slave 31A**															
152	**analogue data channel 2 from/to slave 31 or: analogue data channel 0 from/to slave 31B**															
153	**analogue data channel 3 from/to slave 31 or: analogue data channel 1 from/to slave 31B**															
154	**TIB**	**TOB**	**TIA**	**TOA**	**TVB**	**OVB**	**TVA**	**OVA**	**O3**	**V3**	**O2**	**V2**	**O1**	**V1**	**O0**	**V0**

Legend:

Vn	Validity bit "valid" for channel number n = 0...3 **NOTE:** set Vn = "1" for analogue **out**put slaves!
On	Bit "overflow" for channel number n = 0…3
OVA	Channel-independent bit "output data valid" of A slave CTT1: 0 = more than 3.5 s have elapsed since the last update of the output values 1 = slave requests new output data within the next 3 s CTT2…CTT5: 0 = slave receives no new output data 1 = slave receives new output data
TVA	Channel-independent bit "transmission valid" of A slave/single slave: 0 = error during transmission or: timeout 1 = transmission of analogue input/output data OK
OVB	Channel-independent bit "output data valid" of B slave: CTT1: 0 = more than 3.5 s have elapsed since the last update of the output values 1 = slave requests new output data within the next 3 s CTT2…CTT5: 0 = slave receives no new output data 1 = slave receives new output data **NOTE:** only valid for analogue **out**put slaves. Set OVB = 0 for **in**put slaves!
TVB	Channel-independent bit "transmission valid" of B slave: 0 = error during transmission or: Timeout 1 = transmission of analogue input/output data OK
TIA	Slave transmits analogue input data...
TIB	0 = in the analogue mode (15 bits, with sign) 1 = in the transparent mode (16 bits, without sign)
TOA	slave receives analogue output data...
TOB	0 = in the analogue mode (15 bits, with sign) 1 = in the transparent mode (16 bits, without sign)

For flags

%	M	X	125	.0
%	M	B	164	
%	M	W	82	
%	M	D	41	

Data area	Type of access	—	IEC address index	Data bit
M = flag	X = bit	not used	words 0…79 = remanent words 80…127 = not remanent	0...15 bit access in the defined word address 16...2047* bit access to the words following the defined word address
	B = byte		bytes 0…159 = remanent bytes 160…255 = not remanent	—
	W = word		words 0…79 = remanent words 80…127 = not remanent	
	D = double word		double words 0...39 = remanent double words 40...63 = not remanent	

* Maximum data bit number for defined word address 0. If the defined word address is, for example, 126, the maximum data bit number is 31 (access to bit 15 of flag word 127) because otherwise the length of the flag area is exceeded.

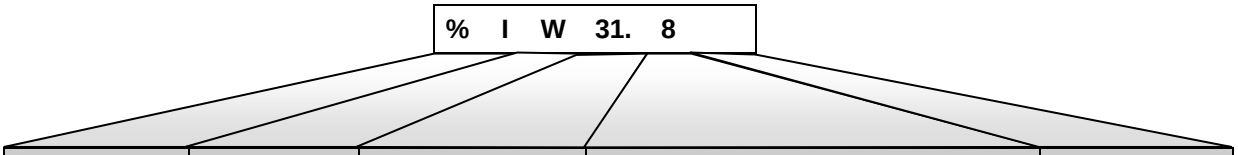
Examples:

%MX17.16 = %MX18.0 %MX0.2047 = %MX127.15 %MX126.31 = %MX127.15

Relationship between double word, word and byte

MD0				remanent
MW1		**MW0**		
MB3	**MB2**	**MB1**	**MB0**	
MD1				
MW3		**MW2**		
MB7	**MB6**	**MB5**	**MB4**	
…				
MD39				
MW79		**MW78**		
MB159	**MB158**	**MB157**	**MB156**	
MD40				not remanent
MW81		**MW80**		
MB163	**MB162**	**MB161**	**MB160**	
MD41				
MW83		**MW82**		
MB167	**MB166**	**MB165**	**MB164**	
…				
MD63				
MW127		**MW126**		
MB255	**MB254**	**MB253**	**MB252**	

For configuration data (slaves 0…31B)



Data area	Type of access	Identification	IEC address index		—
I = input	W = word	31 = master 1 32 = master 2	0…63 96…159	current configuration projected configuration	not used

Current Configuration Data (CDI)

Word address for master 1: xx = 31 for master 2: xx = 32	Of slave	Word address for master 1: xx = 31 for master 2: xx = 32	Of slave
%IWxx.0	0	%IWxx.32	*)
%IWxx.1	1(A)	%IWxx.33	1B
%IWxx.2	2(A)	%IWxx.34	2B
%IWxx.3	3(A)	%IWxx.35	3B
%IWxx.4	4(A)	%IWxx.36	4B
%IWxx.5	5(A)	%IWxx.37	5B
%IWxx.6	6(A)	%IWxx.38	6B
%IWxx.7	7(A)	%IWxx.39	7B
%IWxx.8	8(A)	%IWxx.40	8B
%IWxx.9	9(A)	%IWxx.41	9B
%IWxx.10	10(A)	%IWxx.42	10B
%IWxx.11	11(A)	%IWxx.43	11B
%IWxx.12	12(A)	%IWxx.44	12B
%IWxx.13	13(A)	%IWxx.45	13B
%IWxx.14	14(A)	%IWxx.46	14B
%IWxx.15	15(A)	%IWxx.47	15B
%IWxx.16	16(A)	%IWxx.48	16B
%IWxx.17	17(A)	%IWxx.49	17B
%IWxx.18	18(A)	%IWxx.50	18B
%IWxx.19	19(A)	%IWxx.51	19B
%IWxx.20	20(A)	%IWxx.52	20B
%IWxx.21	21(A)	%IWxx.53	21B
%IWxx.22	22(A)	%IWxx.54	22B
%IWxx.23	23(A)	%IWxx.55	23B
%IWxx.24	24(A)	%IWxx.56	24B
%IWxx.25	25(A)	%IWxx.57	25B
%IWxx.26	26(A)	%IWxx.58	26B
%IWxx.27	27(A)	%IWxx.59	27B
%IWxx.28	28(A)	%IWxx.60	28B
%IWxx.29	29(A)	%IWxx.61	29B
%IWxx.30	30(A)	%IWxx.62	30B

Word address for master 1: xx = 31 for master 2: xx = 32	Of slave	Word address for master 1: xx = 31 for master 2: xx = 32	Of slave
%IWxx.31	31(A)	%IWxx.63	31B

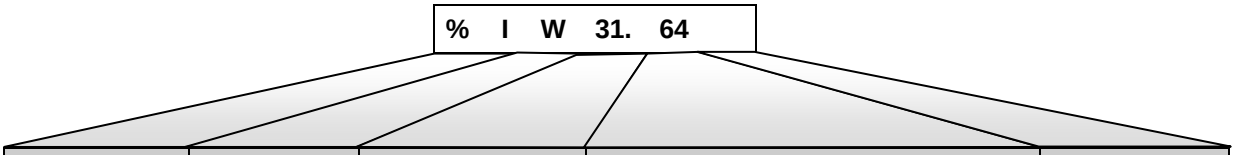
*) The address 0B is not possible, therefore these values are set to 0 by default.

Projected configuration data (CDI)

Word address for master 1: xx = 31 for master 2: xx = 32	Of slave	Word address for master 1: xx = 31 for master 2: xx = 32	Of slave
%IWxx.96	0(A)	%IWxx.128	*)
%IWxx.97	1(A)	%IWxx.129	1B
%IWxx.98	2(A)	%IWxx.130	2B
%IWxx.99	3(A)	%IWxx.131	3B
%IWxx.100	4(A)	%IWxx.132	4B
%IWxx.101	5(A)	%IWxx.133	5B
%IWxx.102	6(A)	%IWxx.134	6B
%IWxx.103	7(A)	%IWxx.135	7B
%IWxx.104	8(A)	%IWxx.136	8B
%IWxx.105	9(A)	%IWxx.137	9B
%IWxx.106	10(A)	%IWxx.138	10B
%IWxx.107	11(A)	%IWxx.139	11B
%IWxx.108	12(A)	%IWxx.140	12B
%IWxx.109	13(A)	%IWxx.141	13B
%IWxx.110	14(A)	%IWxx.142	14B
%IWxx.111	15(A)	%IWxx.143	15B
%IWxx.112	16(A)	%IWxx.144	16B
%IWxx.113	17(A)	%IWxx.145	17B
%IWxx.114	18(A)	%IWxx.146	18B
%IWxx.115	19(A)	%IWxx.147	19B
%IWxx.116	20(A)	%IWxx.148	20B
%IWxx.117	21(A)	%IWxx.149	21B
%IWxx.118	22(A)	%IWxx.150	22B
%IWxx.119	23(A)	%IWxx.151	23B
%IWxx.120	24(A)	%IWxx.152	24B
%IWxx.121	25(A)	%IWxx.153	25B
%IWxx.122	26(A)	%IWxx.154	26B
%IWxx.123	27(A)	%IWxx.155	27B
%IWxx.124	28(A)	%IWxx.156	28B
%IWxx.125	29(A)	%IWxx.157	29B
%IWxx.126	30(A)	%IWxx.158	30B
%IWxx.127	31(A)	%IWxx.159	31B

*) The address 0B is not possible, therefore these values are set to 0 by default.

For parameter data (slaves 1(A)…31B)



Data area	Type of access	Identification	IEC address index		—
I = input	W = word	31 = master 1 32 = master 2	64….79 160…175	current parameters reflected parameters	not used

Current parameter data

Word address for master 1: xx = 31 for master 2: xx = 32	Bits 12...15	Bits 8...11	Bits 4...7	Bits 0...3
	Current parameter data of slave...			
%IWxx.64	4(A)	3(A)	2(A)	1(A)
%IWxx.65	8(A)	7(A)	6(A)	5(A)
%IWxx.66	12(A)	11(A)	10(A)	9(A)
%IWxx.67	16(A)	15(A)	14(A)	13(A)
%IWxx.68	20(A)	19(A)	18(A)	17(A)
%IWxx.69	24(A)	23(A)	22(A)	21(A)
%IWxx.70	28(A)	27(A)	26(A)	25(A)
%IWxx.71	1B	31(A)	30(A)	29(A)
%IWxx.72	5B	4B	3B	2B
%IWxx.73	9B	8B	7B	6B
%IWxx.74	13B	12B	11B	10B
%IWxx.75	17B	16B	15B	14B
%IWxx.76	21B	20B	19B	18B
%IWxx.77	25B	24B	23B	22B
%IWxx.78	29B	28B	27B	26B
%IWxx.79	reserved		31 F	30 F

Reflected parameter data

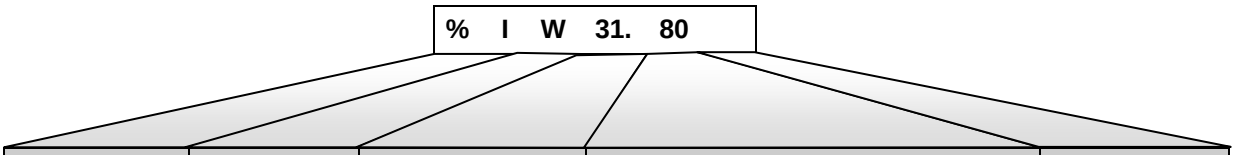
Word address for master 1: xx = 31 for master 2: xx = 32	Bits 12...15	Bits 8...11	Bits 4...7	Bits 0...3
	Reflected parameters of slave...			
%IWxx.160	4(A)	3(A)	2(A)	1(A)
%IWxx.161	8(A)	7(A)	6(A)	5(A)
%IWxx.162	12(A)	11(A)	10(A)	9(A)
%IWxx.163	16(A)	15(A)	14(A)	13(A)
%IWxx.164	20(A)	19(A)	18(A)	17(A)
%IWxx.165	24(A)	23(A)	22(A)	21(A)
%IWxx.166	28(A)	27(A)	26(A)	25(A)
%IWxx.167	1B	31(A)	30(A)	29(A)
%IWxx.168	5B	4B	3B	2B
%IWxx.169	9B	8B	7B	6B
%IWxx.170	13B	12B	11B	10B
%IWxx.171	17B	16B	15B	14B
%IWxx.172	21B	20B	19B	18B
%IWxx.173	25B	24B	23B	22B
%IWxx.174	29B	28B	27B	26B
%IWxx.175	reserved		31B	30B

Examples:

Reflected parameter data of slave 6B on master 2: → %IW32.169 (bits 0…3)

Current parameter for slave 6B on master 2: → %IW32.73 (bits 0…3)

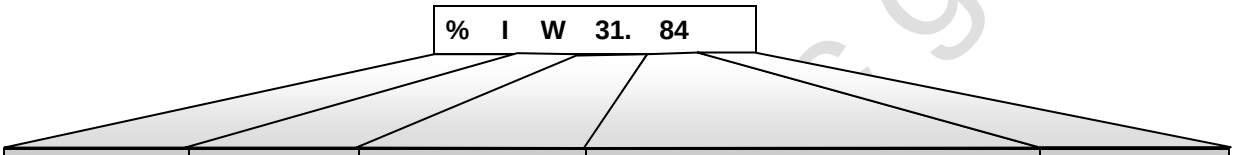
For the slave list LAS (list of active slaves)



Data area	Type of access	Identification	Slave selection	—
I = input	W = word	31 = master 1 32 = master 2	80 = LAS of the slaves 1(A)…15(A) 81 = LAS of the slaves 16(A)…31(A) 82 = LAS of the slaves 1B…15B 83 = LAS of the slaves 16B…31B	not used

Details → page 160, chapter Slave lists

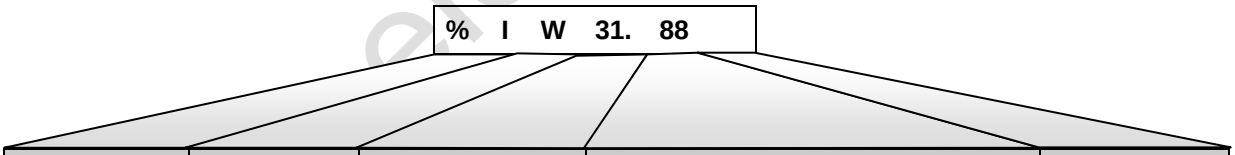
For the slave list LDS (list of detected slaves)



Data area	Type of access	Identification	Slave selection	—
I = input	W = word	31 = master 1 32 = master 2	84 = LDS of the slaves 1(A)…15(A) 85 = LDS of the slaves 16(A)…31(A) 86 = LDS of the slaves 1B…15B 87 = LDS of the slaves 16B…31B	not used

Details → page 160, chapter Slave lists

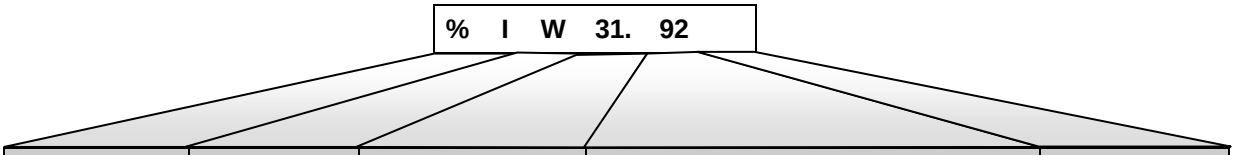
For the slave list LPF (list of slaves with periphery faults)



Data area	Type of access	Identification	Slave selection	—
I = input	W = word	31 = master 1 32 = master 2	88 = LPF of the slaves 1(A)…15(A) 89 = LPF of the slaves 16(A)…31(A) 90 = LPF of the slaves 1B…15B 91 = LPF of the slaves 16B…31B	not used

Details → page 160, chapter Slave lists

For the slave list LPS (list of projected slaves)



Data area	Type of access	Identification	Slave selection	—
I = input	W = word	31 = master 1 32 = master 2	92 = LPS of the slaves 1(A)…15(A) 93 = LPS of the slaves 16(A)…31(A) 94 = LPS of the slaves 1B…15B 95 = LPS of the slaves 16B…31B	not used

Details → page 160, chapter Slave lists

Slave lists

For the diagnosis of the AS-i system the controllere provides lists for every master:
LAS = list of active slaves
LDS = list of detected slaves
LPF = list of slaves with periphery fault
LPS = list of projected slaves

Each of the different slaves lists is stored in four words (word no. 0...3).

In the following table you will find the addresses of the four words in which the corresponding slave lists are stored.

Word no.	Word address for master 1: xx = 31 for master 2: xx = 32			
	LAS	LDS	LPF	LPS
0	%IWxx.80	%IWxx.84	%IWxx.88	%IWxx.92
1	%IWxx.81	%IWxx.85	%IWxx.89	%IWxx.93
2	%IWxx.82	%IWxx.86	%IWxx.90	%IWxx.94
3	%IWxx.83	%IWxx.87	%IWxx.91	%IWxx.95

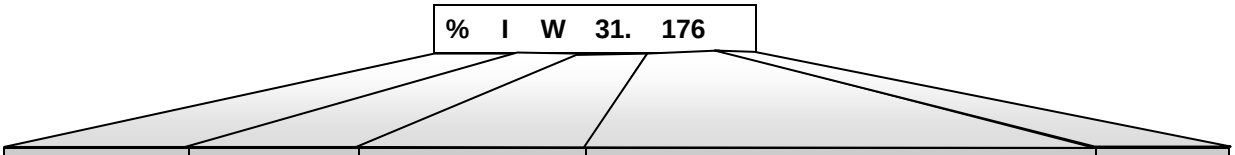
The bit assignment of these words (i.e. to which bit the slave information is assigned) is shown below.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word	Slave															
0	15 (A)	14 (A)	13 (A)	12 (A)	11 (A)	10 (A)	9 (A)	8 (A)	7 (A)	6 (A)	5 (A)	4 (A)	3 (A)	2 (A)	1 (A)	0 *)
1	31 (A)	30 (A)	29 (A)	28 (A)	27 (A)	26 (A)	25 (A)	24 (A)	23 (A)	22 (A)	21 (A)	20 (A)	19 (A)	18 (A)	17 (A)	16 (A)
2	15 B	14 B	13 B	12 B	11 B	10 B	9 B	8 B	7 B	6 B	5 B	4 B	3 B	2 B	1 B	res
3	31 B	30 B	29 B	28 B	27 B	26 B	25 B	24 B	23 B	22 B	21 B	20 B	19 B	18 B	17 B	16 B

*) LAS and LPS have no slave 0, so these values are set to 0 by default!

Examples:
Information about standard slave 16 is stored in word no. 1, bit no. 0.
Information about slave 28B is stored in word no. 3, bit no. 12.

For the slave telegram error counters



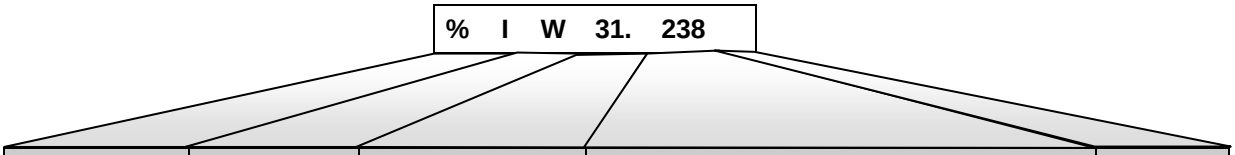
Data area	Type of access	Identification	IEC address index	—
I = input	W = word	31 = master 1 32 = master 2	176…237 = error counters of the slaves 1(A)…31B	not used

Slave telegram error counters

Word address for master 1: xx = 31 for master 2: xx = 32	Error counter for slave	Word address for master 1: xx = 31 for master 2: xx = 32	Error counter for slave
%IWxx.176	1(A)	%IWxx.207	1B
%IWxx.177	2(A)	%IWxx.208	2B
%IWxx.178	3(A)	%IWxx.209	3B
%IWxx.179	4(A)	%IWxx.210	4B
%IWxx.180	5(A)	%IWxx.211	5B
%IWxx.181	6(A)	%IWxx.212	6B
%IWxx.182	7(A)	%IWxx.213	7B
%IWxx.183	8(A)	%IWxx.214	8B
%IWxx.184	9(A)	%IWxx.215	9B
%IWxx.185	10(A)	%IWxx.216	10B
%IWxx.186	11(A)	%IWxx.217	11B
%IWxx.187	12(A)	%IWxx.218	12B
%IWxx.188	13(A)	%IWxx.219	13B
%IWxx.189	14(A)	%IWxx.220	14B
%IWxx.190	15(A)	%IWxx.221	15B
%IWxx.191	16(A)	%IWxx.222	16B
%IWxx.192	17(A)	%IWxx.223	17B
%IWxx.193	18(A)	%IWxx.224	18B
%IWxx.194	19(A)	%IWxx.225	19B
%IWxx.195	20(A)	%IWxx.226	20B
%IWxx.196	21(A)	%IWxx.227	21B
%IWxx.197	22(A)	%IWxx.228	22B
%IWxx.198	23(A)	%IWxx.229	23B
%IWxx.199	24(A)	%IWxx.230	24B
%IWxx.200	25(A)	%IWxx.231	25B
%IWxx.201	26(A)	%IWxx.2xx	26B
%IWxx.202	27(A)	%IWxx.233	27B
%IWxx.203	28(A)	%IWxx.234	28B
%IWxx.204	29(A)	%Wxx.235	29B
%IWxx.205	30(A)	%IWxx.236	30B
%IWxx.206	31(A)	%IWxx.237	31B

Example:
Error counter slave 7 on master 1: → %IW31.182

For the configuration error counter

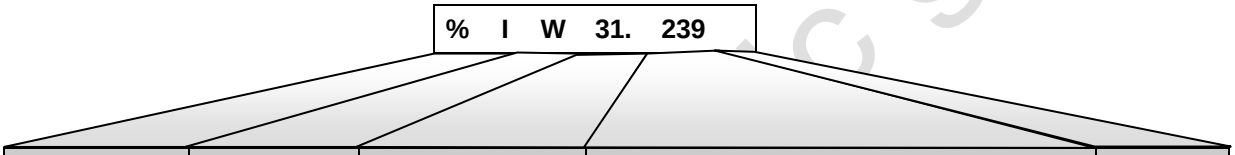


Data area	Type of access	Identification	IEC address index	—
I = input	W = word	31 = master 1 32 = master 2	238 = configuration error counter	not used

Configuration error counter

Word address	Configuration error counter
%IW31.238	Master 1
%IW32.238	Master 2

For the AS-i cycle counter



Data area	Type of access	Identification	IEC address index	—
I = input	W = word	31 = master 1 32 = master 2	239 = AS-i cycle counter	not used

AS-i cycle counter

Word address	AS-i error counter
%IW31.239	Master 1
%IW32.239	Master 2

For the master flags

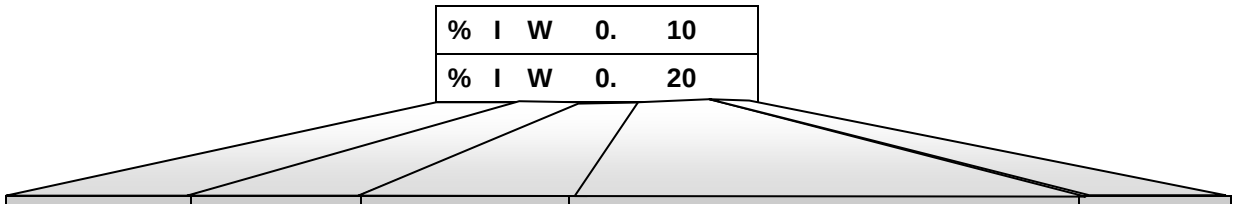
%	I	W	31.	240	
%	I	X	32.	241	.8

Data area	Type of access	Identification	Word selection	Data bit no.
I = input	W = word X = bit	31 = master 1 32 = master 2	240 = master flags word 1 241 = master flags word 2	If type of access = X: 0…15

Word address for master 1: xx = 31 for master 2: xx = 32	Bits	Bit = TRUE means:
%IWxx.240	0	"No slave reset" When executing the function "Config all" (via the menu or command channel of the controller$_e$) the slaves are NOT reset as described in the AS-i specificaiton.
	1...15	Reserved
%IWxx.241	0	"Config OK" There is no configuration error. The configuration of all AS-i slaves in the network complies with the projection data.
	1	"LDS.0" One slave with the AS-i address 0 was detected on the master.
	2	Reserved
	3	Reserved
	4	"Configuration_Active" The controller$_e$ is in the configuration mode
	5	"Normal_Operation_Active" The AS-i master is in normal operation: it communicates with at least one slave.
	6	"AS-i_Power_Fail" AS-i voltage is too low
	7	Reserved
	8	"Periphery_OK" None of the active AS-i slaves signals a periphery fault
	9	"Auto_Address_Enable" The mode "automatic addressing of the slaves" is activated on this master.
	10...15	Reserved

Examples:
To read the bit LDS.0 "slave 0 detected" for master 1, the address %IX31.241.1 is used; for master 2 the address %IX32.241.1 is used.

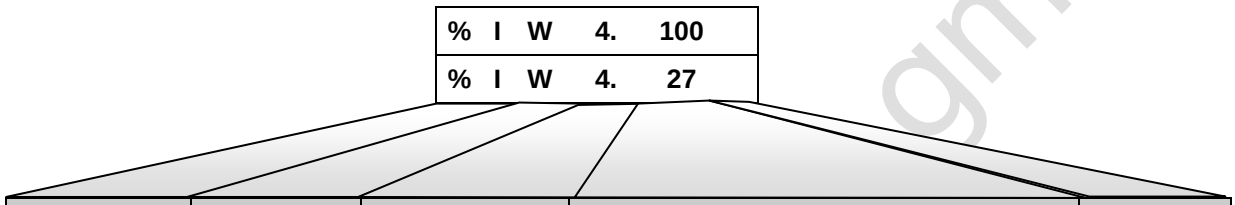
For the fieldbus data from/to the PLC of the controllere



Data area	Type of access	Identification	IEC address index	—
I = input Q = output	W = word	0 (fixed value)	0...63 = word x of the data field	not used

NOTE: Only applies to devices with fieldbus interface. The Ethernet programming interface is NOT considered as a fieldbus interface.

For the extended data from/to the PLC of the controllere



Data area	Type of access	Identification	IEC address index	—
I = input Q = output	W = word	4 (fixed value)	0…255 = word x of the data field	not used

12.6.3 Examples for addressing

Slave	Selection	Parameters	Address examples
Binary single or A slave	All 4 bits in one byte	Output byte of slave 22 on master 1	%QB1.22
		Input byte of slave 6A on master 2	%IB2.6
	Individual bit	Bit 3 (input) of slave 24 on master 2	%IX2.24.3
		Bit 0 (output) of slave 8 on master 1	%QX1.8.0
Binary B slaves	All 4 bits in one byte	Output byte of slave 22B on master 1	%QB11.22
		Input byte of slave 6B on master 2	%IB12.6
	Individual bit	Bit 3 (input) of slave 24B on master 2	%IX12.24.3
		Bit 0 (output) of slave 8B on master 1	%QX11.8.0
Analogue slaves	All 16 bits in one channel (word)	Analogue input in 3rd channel of slave 31 on master 1	%IW21.31.2
		Analogue input in 1st channel of slave 31A on master 1	%IW21.31.0
		Analogue input in 1st channel of slave 31B on master 1	%IW21.31.2
		Analogue output from 4th channel of slave 17 on master 2	%QW22.17.3
		Analogue output from 2nd channel of slave 17B on master 2	%QW22.17.3
	Status (channel 5) → table page 153	Status of slave 31(A) on master 2	%IW22.31.4
		Status of slave 31B on master 2	%IW22.31.4
Flags	Complete flag wod	Flag word 21 (remanent)	%MW21
	Individual byte	Flag byte 162 (not remanent)	%MB162
	Individual bit	Bit 8 from flag word 21 (remanent)	%MX21.8

12.6.4 Further examples

Data	Master	Slave	Address examples
Current parameter data (bits 0...3) → page 158	2	6B	%IW32.73
Reflected parameter data (bits 0...3) → page 158	2	6B	%IW32.169
Slave error counter → page 161	1	7	%IW31.182
	2	6B	%IW32.212
Configuration error counter → page 162	1	--	%IW31.238
AS-i cycle counter → page 162	2	--	%IW32.239

NOTE

All addresses in these further examples can only be read as WORD addresses. A breakdown into individual bits is only possible by copying the word to a symbolic address and retrieving this address bit by bit.

Example:

```
0001 PROGRAM PLC_PRG
0002 VAR
0003     LASMaster1 AT %IW31.81:WORD;
0004     LPSMaster2 AT %IW32.83:WORD;
0005     LASSlave16M1: BOOL;
0006     LPSSlave22BM2: BOOL;
0007 END_VAR
0008
```

copy %IW31.81 to LASMaster1

copy %IW32.83 to LPSMaster2

```
0001
    LASMaster1.0———LASSlave16M1
```

Query:
master 1, slave 16 / 16A in the list of active slaves

output to LASSlave16M1

```
0002
    LPSMaster2.6———LPSSlave22BM2
```

Query:
master 2, slave 22B in the list of projected slaves

output to LPSSlave22BM2

NOTE

A flag word consists of two flag bytes.

Flag word %MW(n) corresponds to the flag bytes %MB(2n) and %MB(2n+1).
→ page 155, table Relationship between double word, word and byte

Example:
Flag word %MW21 corresponds to the flag bytes %MB42 and %MB43.

12.7 Access digital slave inputs/outputs via PLC

Digital slave I/Os can be accessed in 3 ways.

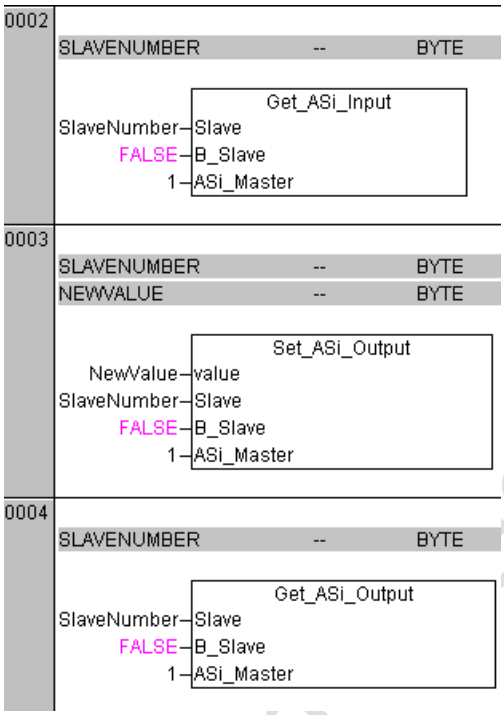
12.7.1 Access via addresses

Description → page 152, chapter Overview PLC addresses

12.7.2 Access via function calls

Description of the circuits of the function blocks
→ library ifm_Asi_Utils_xxxxxx.lib

Examples:



read slave inputs as byte

set slave outputs as byte

read slave outputs as byte

12.7.3 Indexed data access via the table of pointers

Using pointers you can have direct access to the stored information.

Example:

```
0001 FUNCTION Get_ASi_Input : BYTE
0002 VAR_INPUT
0003     Slave:BYTE;
0004     B_Slave:BOOL;
0005     ASi_Master:BYTE;
0006 END_VAR
0007
0008 VAR
0009     pSlaveInCyc: POINTER TO POINTER TO ARRAY [1..64] OF BYTE;
0010     sl: BYTE;
0011 END_VAR
```

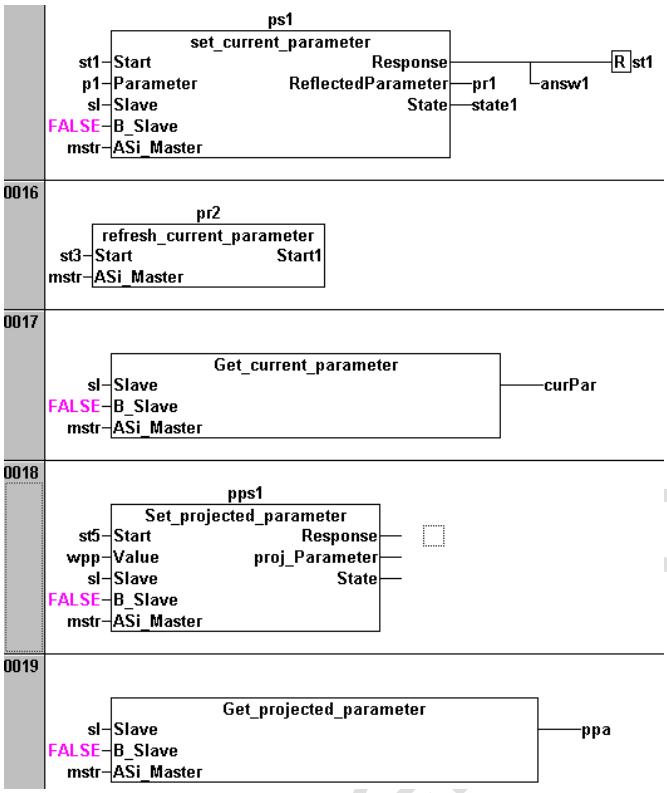
```
0001 sl := slave;
0002
0003 IF (sl = 0) OR (sl > 64) THEN
0004     Get_ASi_Input := 0;
0005     RETURN;
0006 END_IF
0007
0008 IF B_slave AND (sl < 32) THEN
0009     sl := sl + 32;
0010 END_IF
0011
0012 IF ASI_Master = 2 THEN
0013     pSlaveInCyc := PointerList + 16#C4;
0014 ELSE
0015     pSlaveInCyc := PointerList + 16#24;
0016 END_IF
0017
0018 Get_ASi_Input := pSlaveInCyc^^[sl]AND 16#0F;
0019
```

For detailed information → supplementary manual "PLC programming withCoDeSys® 2.3"

12.8 Read and write slave parameters via PLC

> **NOTE**
>
> Access to slave parameters is not trivial. Therefore always use the function calls in the library ifm_Asi_Utils_xxxxxx.lib.

Examples:



Changes the parameter in the slave "sl" on master "mstr"

After the change of a parameter the parameter list for the master "mstr" must be updated in the controllere.

Reads the current parameter value from slave "sl" and provides the value as "curPar"

Writes the value "wpp" as projected parameter for slave "sl" in the parameter list of the controllere

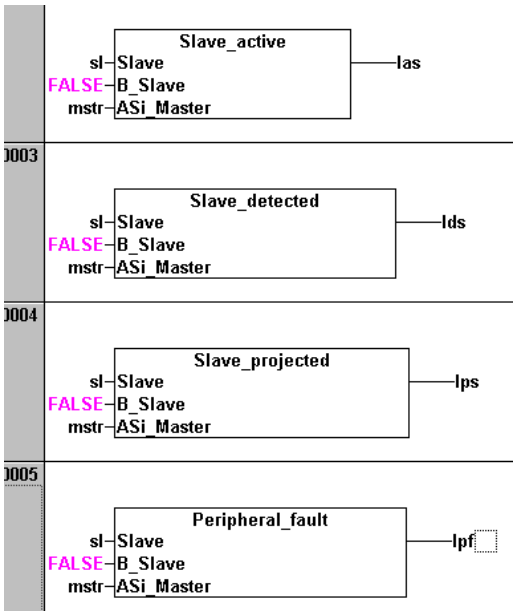
Reads the projected parameter for slave "sl" from the parameter list in the controllere and provides the value as "ppa"

12.9 Read in AS-i slave lists via PLC

Using the function calls from the library ifm_Asi_Utils_xxxxxx.lib the slave lists can be readas shown below.

Examples:

a) Access via function blocks



Query whether a slave with the address "sl" is active on the bus of master "mstr". If so:

> las = TRUE

Query whether a slave with the address "sl" is detected on the bus of master "mstr". If so:

> lds = TRUE

Query whether a slave with the address "sl" is projected on the bus of master "mstr". If so:

> lps = TRUE

Query whether there is a periphery fault on the slave with the address "sl". If so:

> lpf = TRUE

b) Access with pointers

```
0008    pLAS: POINTER TO POINTER TO ARRAY [0..3] OF WORD;
0009    LASx: ARRAY [0..3] OF WORD;
0011
0012 IF ASi_Master = 2 THEN
0013    pLAS := PointerList + 16#E0;
0014 ELSE
0015    pLAS := PointerList + 16#40;
0016 END_IF
0017 LASx := pLAS^^;
```

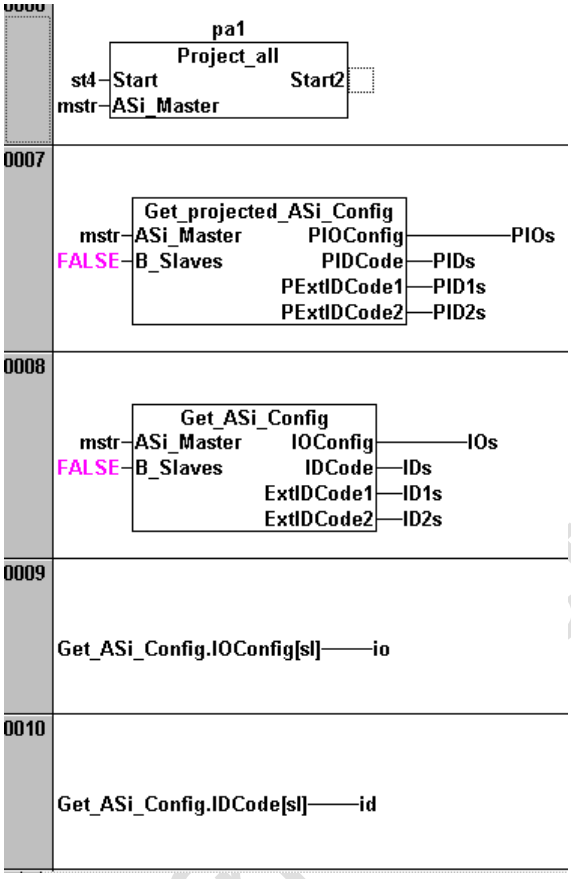
For detailed information → supplementary manual "PLC programming with CoDeSys® 2.3"

12.10 Configure AS-i slaves via PLC

The library ifm_Asi_Utils_xxxxxx.lib also contains function calls to reconfigure the AS-i system…

- to revise the configuration table
- to re-address slaves
- to check the configuration
- etc.

Examples:



Function block: All slaves detected on master "mstr" are entered as projected in the LPS of the controllere.

Program: reads the projected configuration of all A or single slaves on AS-i master "mstr"

Program: reads the current configuration of all A or single slaves on AS-i master "mstr"

Program: copies the current I/O configuration of the slave "sl" on master "mstr" to the variable "io"

Requirement: first call the function block Get_ASi_Config

Program: copies the current ID code of the slave "sl" on master "mstr" to the variable "id"

Requirement: first activate the function block Get_ASi_Config

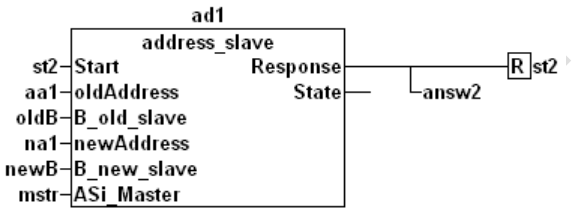
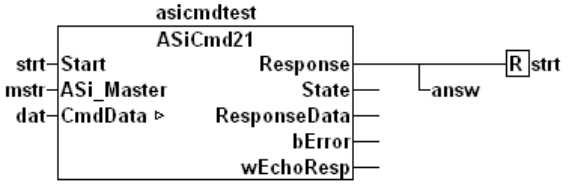
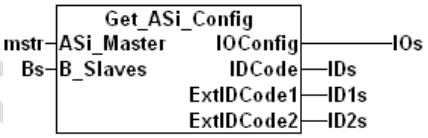
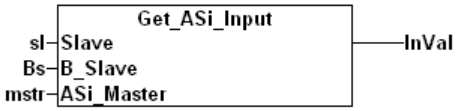
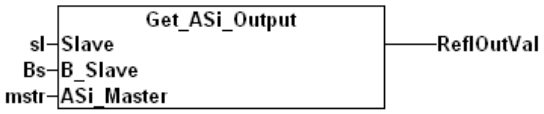
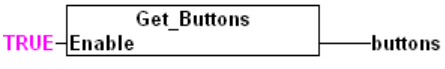
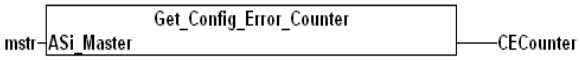
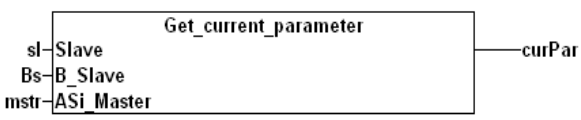
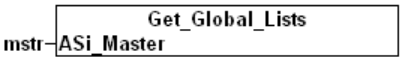
Note on the network 0007 / 0008:
If the parameter "B_Slaves" is " True ", the corresponding statement applies to the "configuration of all B slaves".

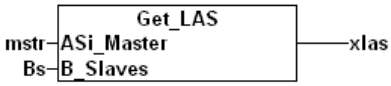
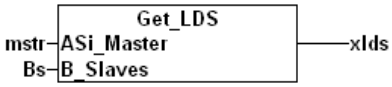
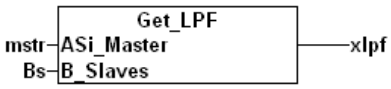
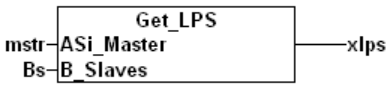
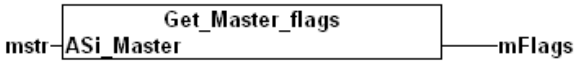
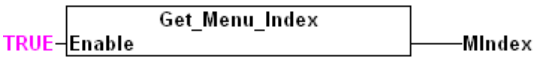
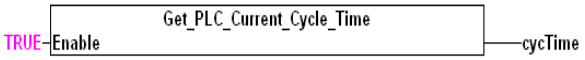
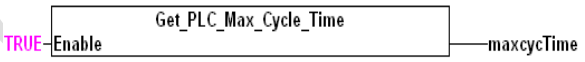
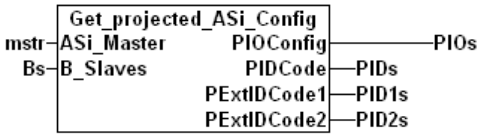
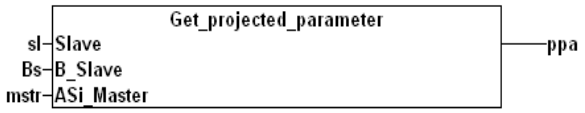
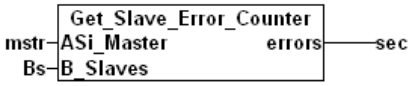
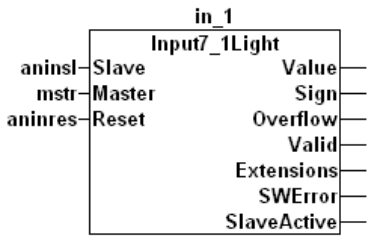
12.11 Overview system blocks

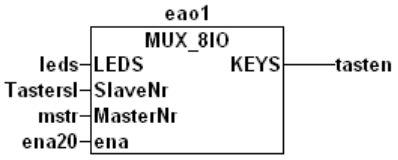
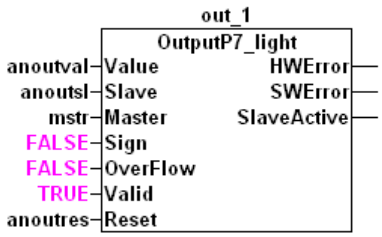
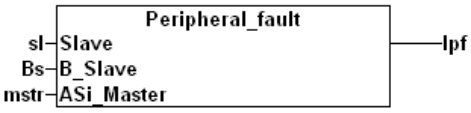
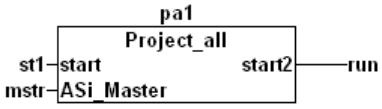
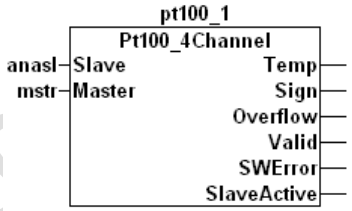
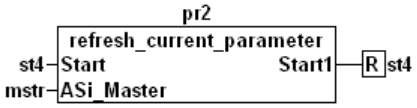
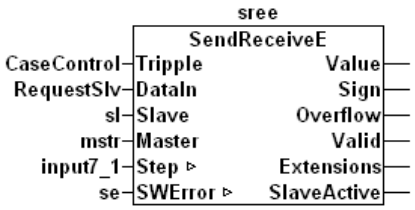
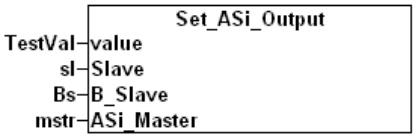
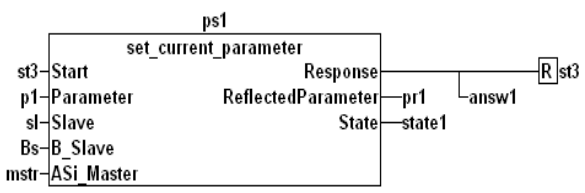
In addition to the CoDeSys® standard libraries, another system library for the controllere is on the CD:

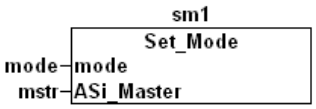
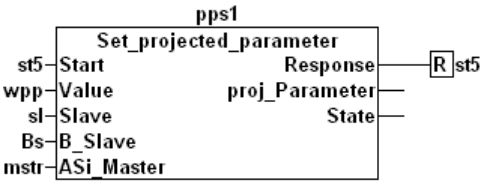
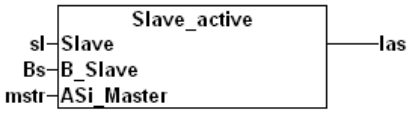
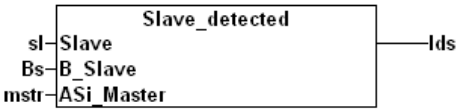
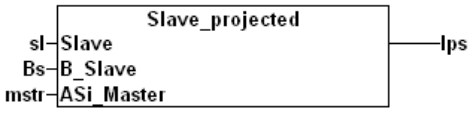
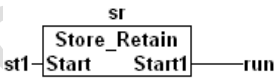
ifm_Asi_Utils_xxxxxx.lib contains the blocks necessary for working with AS-i slaves version 2.x. In new projects the blocks of this library should be used for access to AS-i system information.

12.11.1 ifm_Asi_Utils_xxxxxx.lib blocks

Changing the slave address from "oldAddress" to "newAddress" as soon as "Start" changes to TRUE	
Execution of an AS-i command (possible commands → description "command channel" in separate fieldbus manual)	
Reading the current configuration information of a connected AS-i slave	
Reading the current input values of an AS-i slave	
Reading the current output values of an AS-i slave	
Reading which key of the controllere is actuated	
Reading the configuration error counter	
Reading the current parameters of an AS-i slave	
Updating the global slave lists	

Reading the list of active slaves LAS	
Reading the list of detected slaves LDS	
Reading the list of slaves which detect an external periphery fault LPF	
Reading the list of projected slaves LPS	
Reading the current status of AS-i master flags	
Reading the menu index in the controllere	
Reading the current PLC cycle time in [ms]	
Reading the maximum PLC cycle time in [ms]	
Reading the projected configuration information of an AS-i slave	
Reading the projected parameter values of an AS-i slave	
Reading the current number of faulty AS-i telegrams of an AS-i slave	
Only for 7.1 slaves Reading analogue input of a slave type 7.1	

Multiplex reading and writing of 8 bits of a slave Transmit 2 data bits and 2 address bits per cycle in 4 cycles	
Only for 7.1 slaves Writing analogue output of a slave type 7.1	
If the slave detects an external periphery fault, the output is TRUE	
Updating AS-i configuration on an AS-i master as soon as "Start" changes to TRUE	
Requires library I71Light.lib Reading analogue inputs of a PT100 slave type 7.1	
After changing one or several parameters of AS-i slaves, the set of parameters must be updated by a positive edge on "Start"	
Called by the function block "Input7_1Light" Organises the communication with the analogue inputs of slaves type 7.1	
Setting the outputs of a slave to the contents of "value"	
Setting the current parameters of a slave as soon as "Start" changes to TRUE	

Selection of the operating mode of an AS-i master 1 = configuration mode 0 = protected mode	
Setting the projected parameters of an AS-i slave	
The output is TRUE if the slave is activated	
The output is TRUE if the slave is detected	
The output is TRUE if the slave is projected	
Stores the variables defined as VAR_RETAIN in the flash memory **IMPORTANT:** Due to the limited possible write accesses to the flash memory this command must not be carried out cyclically!	

More details → software description

13 Operation

In this chapter you will learn what you can do with the controllere during operation.

13.1 Selection of the PLC operating mode

→ page 118, chapter Which operating modes are available for the PLC in the controllere?
→ page 119, chapter How are the operating modes for the PLC selected?

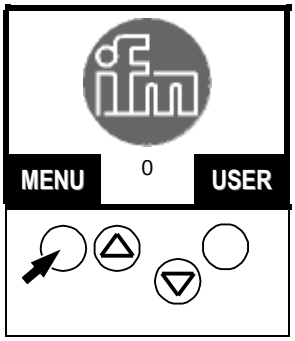
13.2 Information about the stored PLC program

The controllere shows the data of the currently stored PLC program:

NOTE

Password level 1 required → page 142, chapter Password setting

[MENU] > [PLC Setup] > [PLC Info]

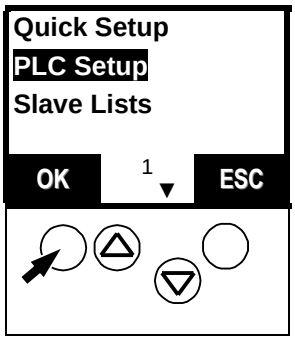
1. 

► Press the key [MENU]

2. 

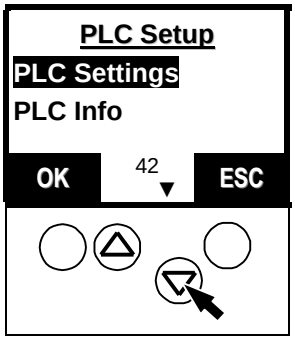
► Press [▼] to scroll to [PLC Setup]

3.



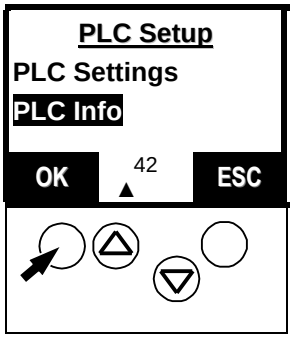
► Select [PLC Setup] with [OK]

4.



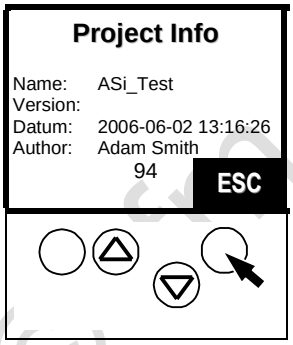
► Press [▼] to scroll to [PLC Info]

5.



► Select [PLC Info] with [OK]

6.



> Name = file name of the PLC program

> Version = PLC program version, if stored in the project

> Date = date + time when the project was stored on the PC

> Author = name stored as author in the project

► Press [ESC] three times to return to the start screen

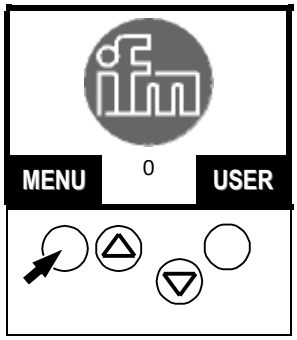
> That's it!

13.3 Display of detected slaves (list)

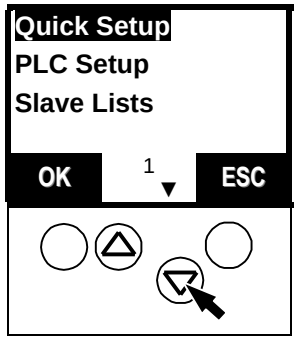
Indication at which slave address the controllere *detected* a slave (or several slaves) type A, B or S (standard) on the bus irrespective of whether the slave is active on the bus.

Definition: A slave is considered to be detected by an AS-i master if the slave is activated and has sent the master its identifier.

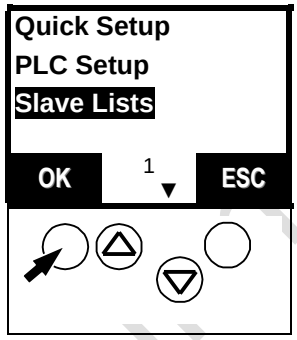
[MENU] > [Slave Lists] > select master > [Detected Slaves]

1. 

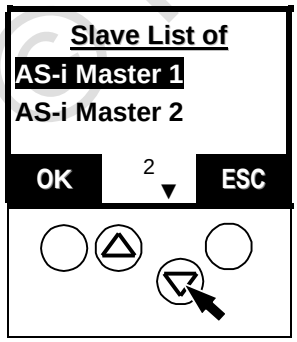
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Slave Lists]

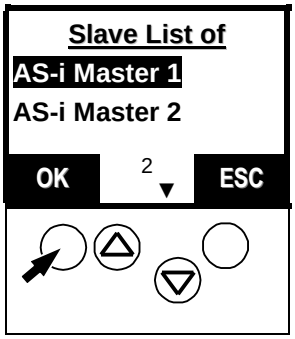
3. 

► Select [Slave Lists] with [OK]

4. 

► If necessary, press [▼] to scroll to AS-i master 2

5.

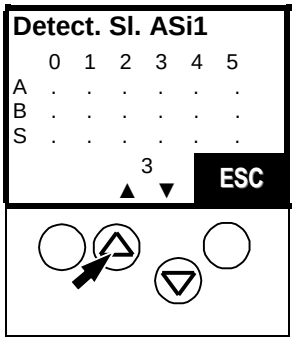


► Select requested AS-i master with [OK]

6.

► Select [Detect. Sl.] with [OK]

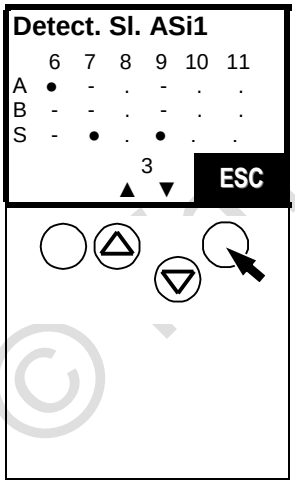
7.



> A table of detected slaves is displayed.
Here: no slaves were detected on master 1 with the addresses 0 to 5.

► If necessary, press [▲] to scroll to the next address block

8.



> A table of detected slaves is displayed.
In this **example**:

• An A/B slave was detected as A slave at address 6, a single slave was detected at the addresses 7 and 9.

•

► Note found slave addresses

► If necessary, press [▲] to scroll to the next address block

► Press [ESC] four times to return to the start screen

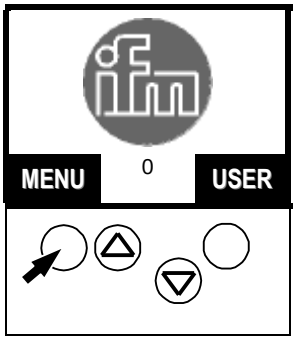
> That's it!

13.4 Display of projected slaves (list)

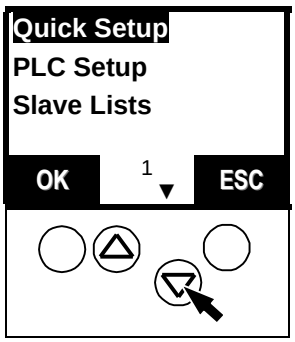
Indication at which slave address one (or several) slaves type A, B or S (standard) are *projected* on the bus.

Definition: A slave is considered to be projected on an AS-i master if the slave is entered in the "list of projected slaves" (LPS) in the controllere. To be entered in the LPS, the slave must be activated at this time and have a valid, unique address.

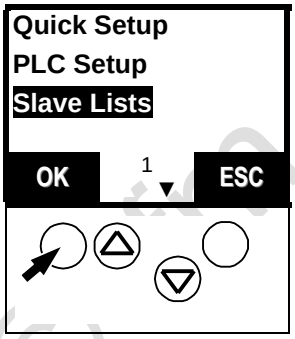
[MENU] > [Slave Lists] > select master > [Project. Sl.]

1. 

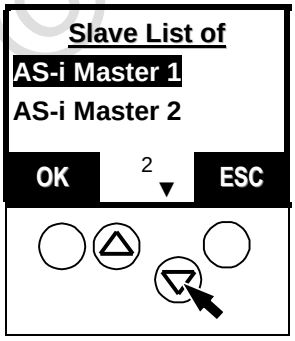
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Slave Lists]

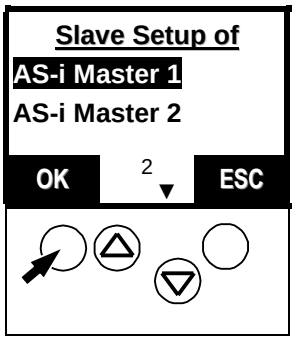
3. 

► Select [Slave Lists] with [OK]

4. 

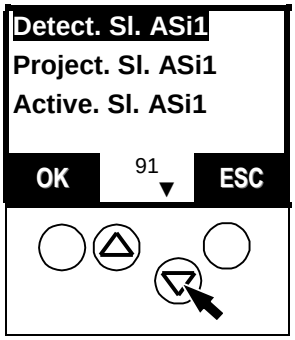
► If necessary, press [▼] to scroll to AS-i master 2

5.



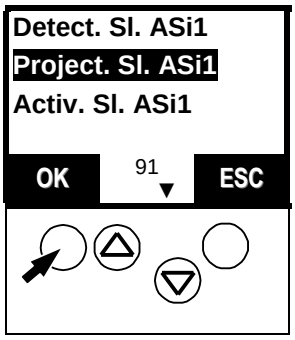
► Select requested AS-i master with [OK]

6.



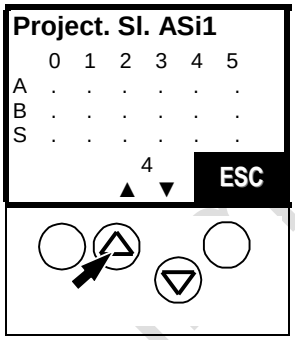
► Press [▼] to scroll to [Project. Sl.]

7.



► Select [Project. Sl.] with [OK]

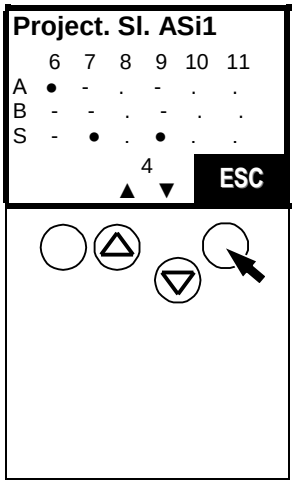
8.



> A table of projected slaves is displayed.
Here: No slaves were projected on master 1 with the addresses 0 to 5.

► If necessary, press [▲] to scroll to the next address block

9.



> A table of projected slaves is displayed.
In this **example**:

- An A/B slave was projected as A slave at the address 6,
- a single slave was projected at the addresses 7 and 9.

► Note found slave addresses

► If necessary, press [▲] to scroll to the next address block

► Press [ESC] four times to return to the start screen

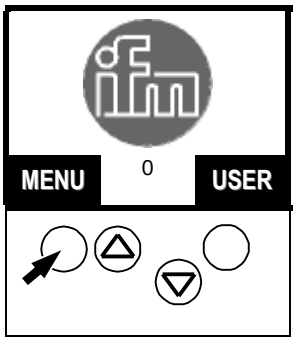
> That's it!

13.5 Display of active slaves (list)

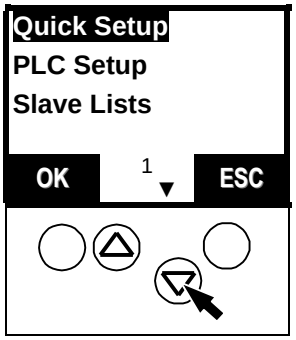
Indication at which slave address the controllere detected an *active* slave type A, B or S (standard) on the bus.

Definition: A slave is considered to be active on an AS-i master if the AS-i master cyclically exchanges data with the slave.

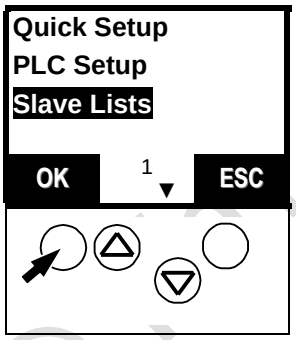
[MENU] > [Slave Lists] > select master > [Activated Slaves]

1. 

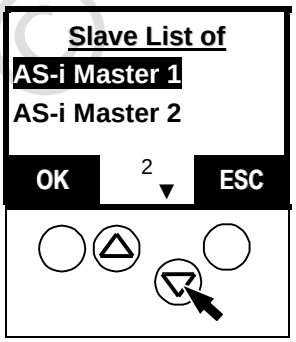
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Slave Lists]

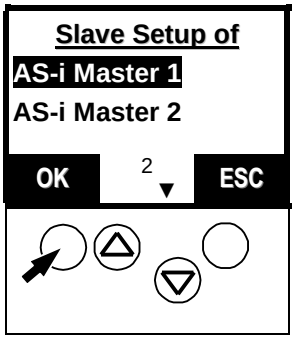
3. 

► Select [Slave Lists] with [OK]

4. 

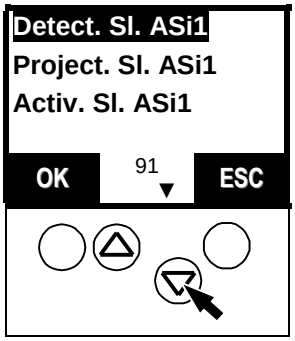
► If necessary, press [▼] to scroll to AS-i master 2

5.



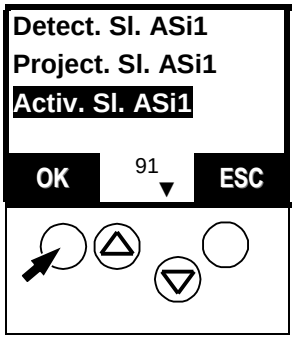
► Select requested AS-i master with [OK]

6.



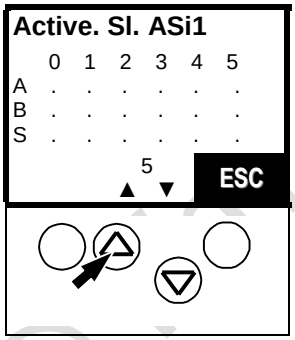
► Press [▼] to scroll to [Activ. Sl.]

7.



► Select [Activ. Sl.] with [OK]

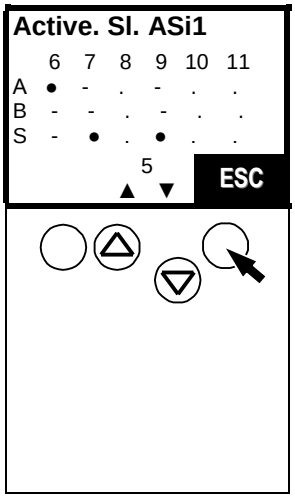
8.



> A table of activated slaves is displayed.
Here: no slaves were detected on master 1 with the addresses 0 to 5.

► If necessary, press [▲] to scroll to the next address block

9.



> A table of activated slaves is displayed.
In this **example**:

- An A/B slave was detected as active A slave at address 6,
- an active single slave was detected at the addresses 7 and 9.

► Note found slave addresses

► If necessary, press [▲] to scroll to the next address block

► Press [ESC] four times to return to the start screen

> That's it!

13.6 Display of slaves with periphery fault (list)

Indication at which slave address the controllere found one (or several) slaves type A, B or S (standard) on the bus with a wiring fault.

The LED [CONF/PF] flashes as soon as there is a periphery fault.

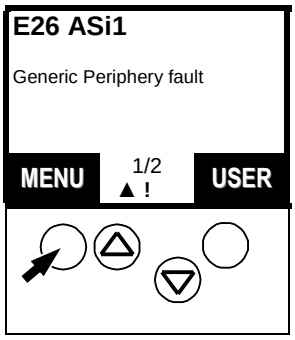
What is a periphery fault? Periphery faults depend on the used slaves and can have different causes.

Examples:

- A slave with analogue inputs is projected but does not receive a signal in the defined value range on one of its enabled inputs (faulty electrical connection to the sensor).
- External 24V voltage supply missing on one slave which needs it.

[MENU] > [Slave Lists] > select master > [Periphery Fault]

1.

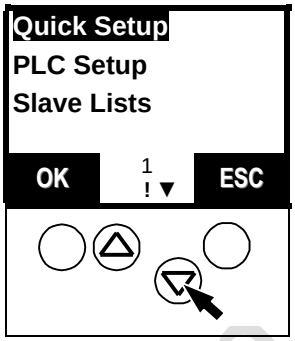


> LED [CONF/PF] flashes

> The display on the left appears instead of the ifm start screen: → periphery fault

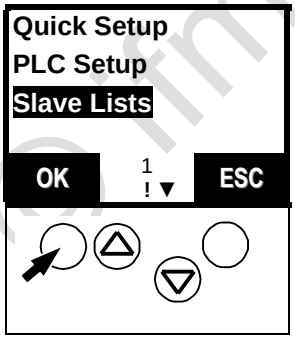
► Press the key [MENU]

2.



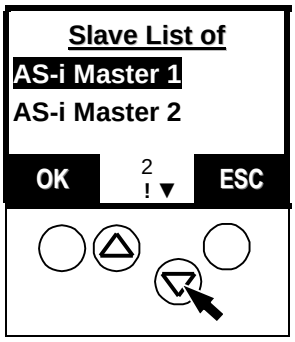
► Press [▼] to scroll to [Slave Lists]

3.



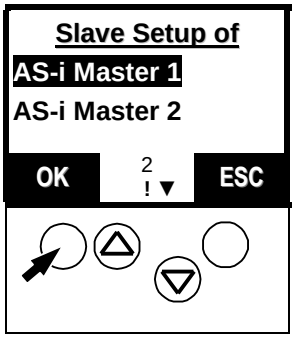
► Select [Slave Lists] with [OK]

4.



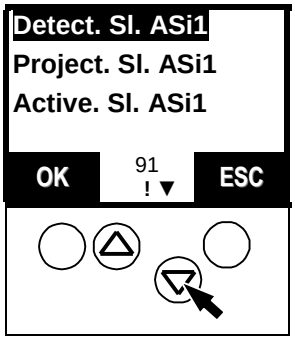
► If necessary, press [▼] to scroll to AS-i master 2

5.



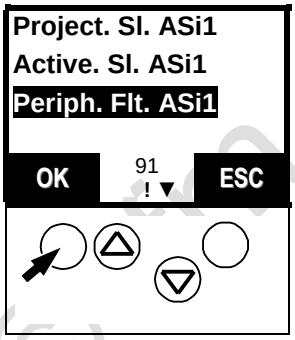
► Select requested AS-i master with [OK]

6.



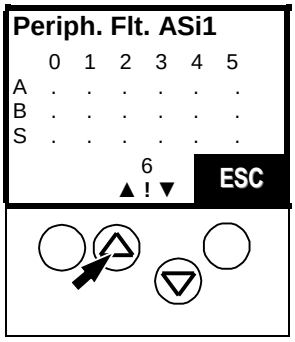
► Press [▼] to scroll to [Periph. Flt.]

7.



► Select [Periph. Flt.] with [OK]

8.

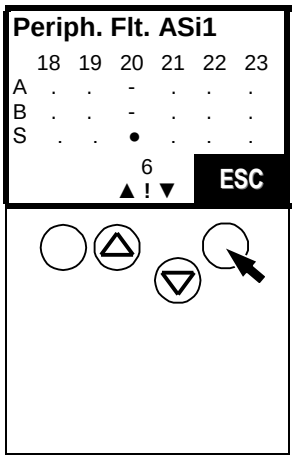


> A table of the slaves with periphery fault is displayed.

• Here: No slaves with periphery fault were detected on master 1 with the addresses 0 to 5.

► If necessary, press [▲] to scroll to the next address block

9.



> A table of the slaves with periphery fault is displayed.

• Here: A single slave with periphery fault was detected at address 20

► Note found slave addresses

► If necessary, press [▲] to scroll to the next address block

► Press [ESC] four times to return to the start screen

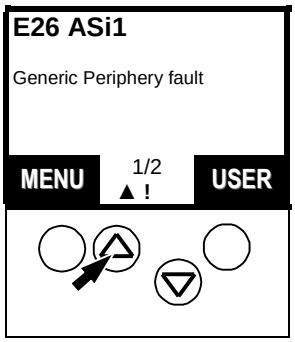
> That's it!

13.7 Display of slave with periphery fault

Indication at which slave address the controllere found a slave type A, B or S (standard) on the bus with a wiring fault (periphery).

→ page 186, chapter Display of slaves with periphery fault (list)

1.

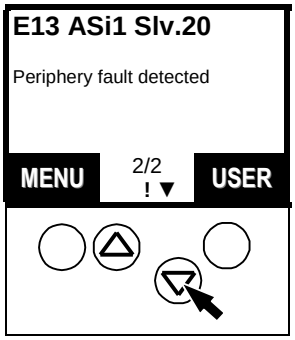


> LED [CONF/PF] flashes

> The display on the left appears instead of the ifm start screen: Periphery fault on AS-i master 1:

► Press [▲] to scroll to [Slave Lists]

2.



> LED [CONF/PF] flashes

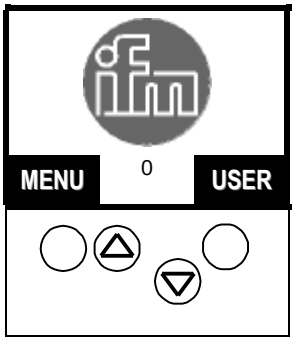
> Slave 20 on AS-i master 1 signals periphery fault

► Press [▼] to return to the start screen

13.8 Detection of an unknown slave address

If the address of a connected slave is not known, you can easily find out the slave address:

1.

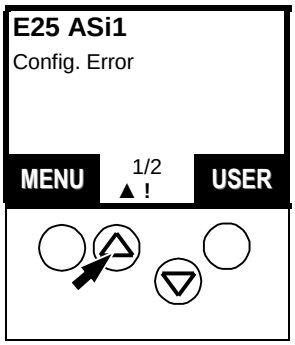


> The LED [PROJ] is out.

► If the LED [PROJ] lights, change the master to "protected mode".
→ page 116, chapter How are the operating modes for the AS-i master selected?

► Remove the unknown slave from the bus.

2.



> The display on the left appears instead of the ifm start screen: "Configuration error"

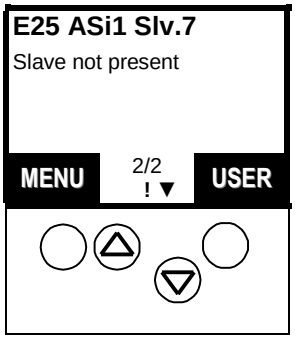
> LED [CONF/PF] lights

Cause: Slaves which the controllere has in its projection list cannot be found on the bus.

Note: error description
→ page 239, chapter Error description

► Press [▲] to scroll to the error screen

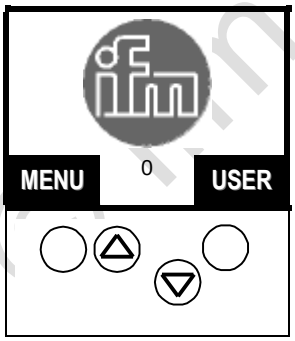
3.



> Display of error message:
"AS-i master 1: slave 7 not present"
In this **example**: The unknown slave has the address 7.

► Connect the removed slave again

4.



> That's it: The ifm start screen is displayed again

13.9 Number of AS-i voltage failures on the AS-i master

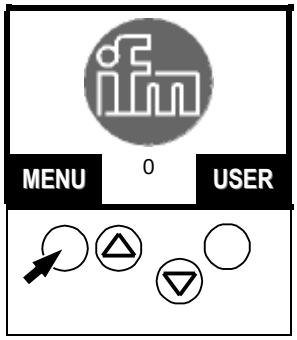
How often was an inadmissible decrease or interruption of the voltage supply of the AS-i bus responsible for system failures? The controllere shows it:

Here you cannot see in detail when which fault occurred.
→ page 239, chapter Error description

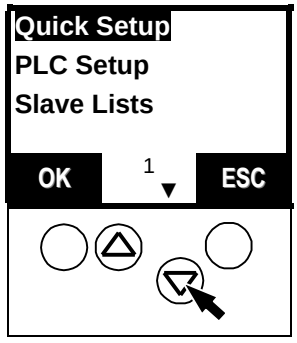
The error counter is reset...

- when the device is switched off and on again
- with the function "Reset error counter", → page 200

[MENU] > [Diagnostics] > select master > [Voltage Disturbance]

1. 

► Press the key [MENU]

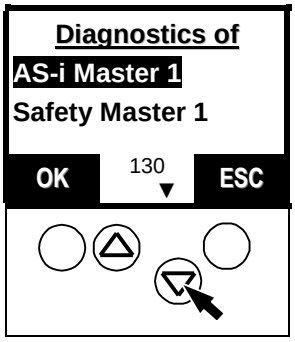
2. 

► Press [▼] to scroll to [Diagnostics]

3. 

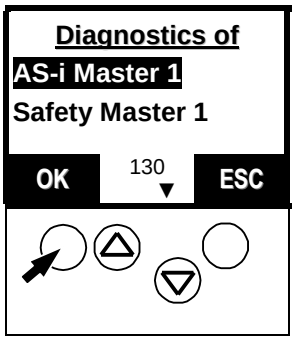
► Select [Diagnostics] with [OK]

4.



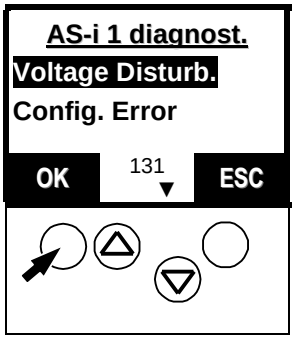
► If necessary, press [▼] to scroll to another master

5.



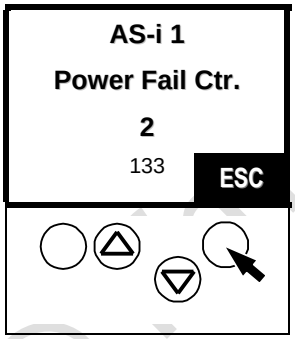
► Select requested master with [OK]

6.



► Select [Voltage Disturb.] with [OK]

7.



> Display of the number of failures of the AS-i supply on the master

Reset error counter: → page 200

► Press [ESC] four times to return to the start screen

13.10 Number of the configuration errors on the master

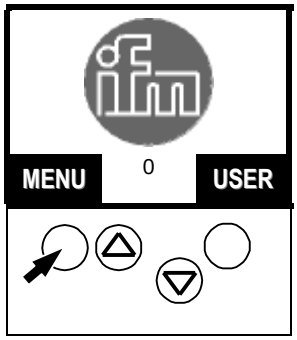
Display of the number of configuration errors on the master.

Here you cannot see in detail when which fault occurred.
→ page 239, chapter Error description

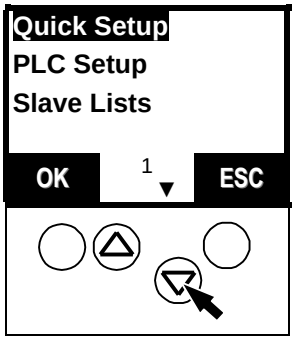
The error counter is reset...

- when the device is switched off and on again
- with the function "Reset error counter", → page 200

[MENU] > [Diagnostics] > select master > [Config. Error]

1. 

► Press the key [MENU]

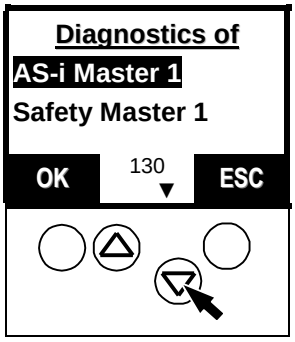
2. 

► Scroll to [Diagnostics] with [▼]

3. 

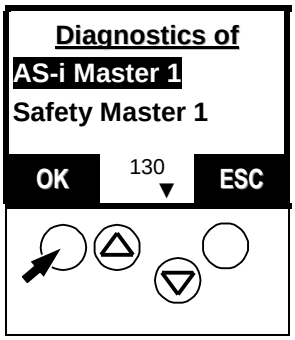
► Select [Diagnostics] with [OK]

4.



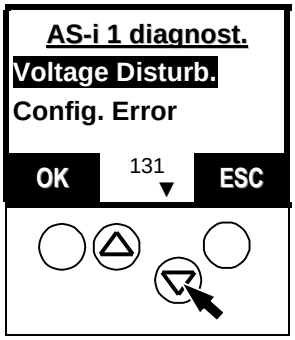
► If necessary, press [▼] to scroll to another master

5.



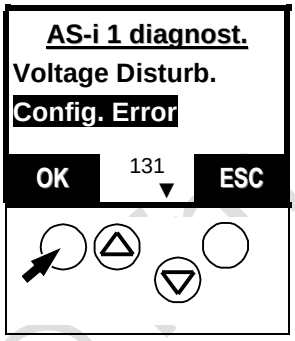
► Select requested master with [OK]

6.



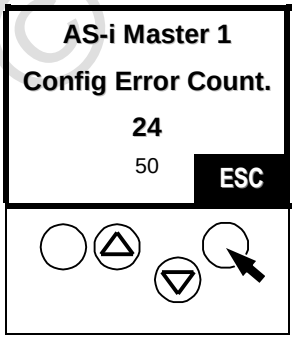
► Press [▼] to select [Config. Error]

7.



► Select [Config. Error] with [OK]

8.



> Display of the number of configuration errors on the master

Reset error counter:
→ page 200

► Press [ESC] four times to return to the start screen

13.11 AS-i telegram errors on the master

A telegram error means that the expected response telegram from a slave is not received within a defined time or that the signal sequences in the response telegram cannot be interpreted by the AS-i master.

Examples:

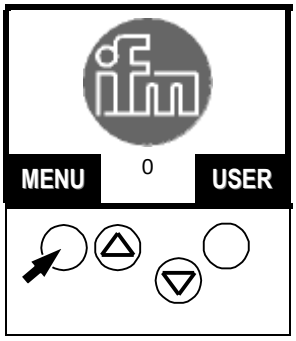
- The AS-i line is asymmetrically operated due to an electrical fault (earth fault on one side). In this case the AS-i signal can no longer be clearly detected.
- The electrical AS-i connection to an AS-i slave is not ok.
- Interference by the electric environment of the AS-i network (EMC) affects the AS-i telegram traffic.

Here you cannot see in detail when which fault occurred.
→ page 239, chapter Error description

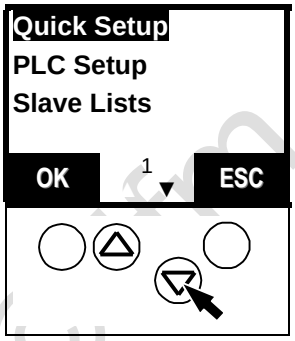
The error counter is reset...

- when the device is switched off and on again
- with the function Reset error counter, → page 200

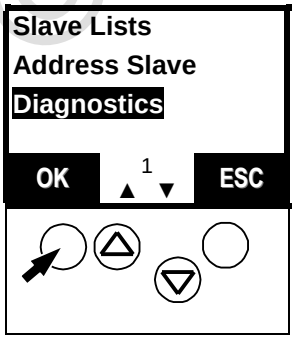
[MENU] > [Diagnostics] > select master > [Telegram Error]

1. 

► Press the key [MENU]

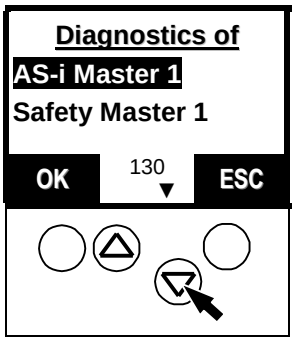
2. 

► Press [▼] to scroll to [Diagnostics]

3. 

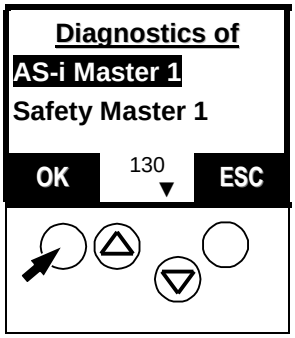
► Select [Diagnostics] with [OK]

4.



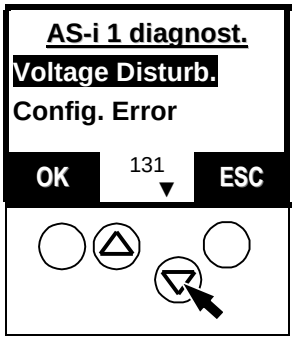
► If necessary, press [▼] to scroll to another master

5.



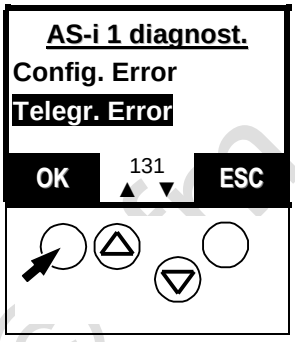
► Select requested master with [OK]

6.



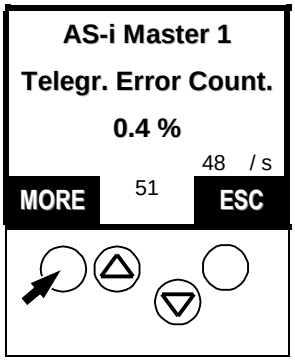
► Press [▼] to scroll to [Telegr. Error]

7.



► Select [Telegr. Error] with [OK]

8.

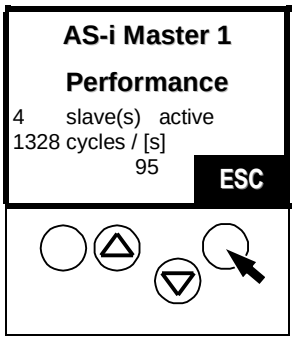


> Dynamic display of AS-i telegram errors in per cent of the transmitted telegrams

> Dynamic display of AS-i telegram errors per second

► Scroll to the next screen with [MORE]

9.



> Dynamic display of the performance of this master:

- Number of active slaves
- Number of AS-i cycles per second

► Press [ESC] four times to return to the start screen

13.12 Number of disturbed telegrams on the master (from noisy slaves)

You want to know how many disturbed telegramsthe different slaves have transmitted (since the last [Reset Error Count.])? The controllere shows it, sorted by the number of disturbed telegrams.

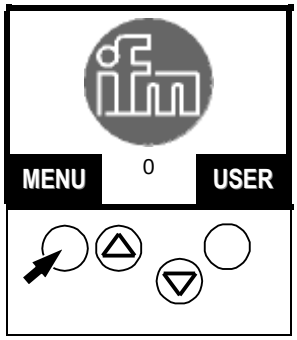
Here you cannot see in detail when which error occurred.
→ page 239, chapter Error description

The error counter is reset...

- when the device is switched off and on again
- with the function Reset error counter, → page 200

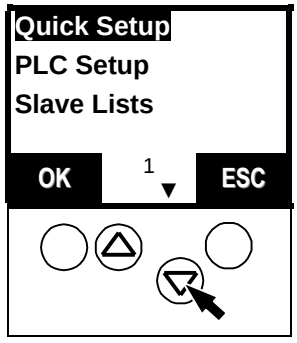
[MENU] > [Diagnostics] > select master > [Noisy Slaves]

1.



► Press the key [MENU]

2.

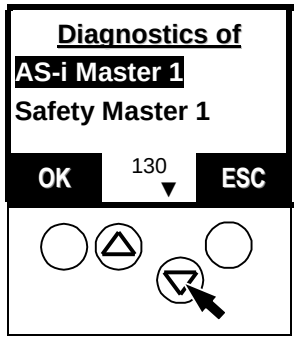


► Press [▼] to scroll to [Diagnostics]

3.

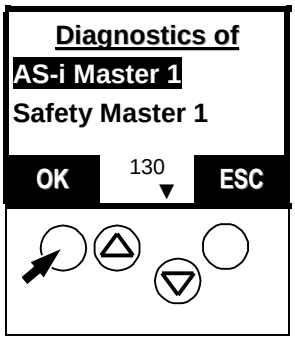
► Select [Diagnostics] with [OK]

4.



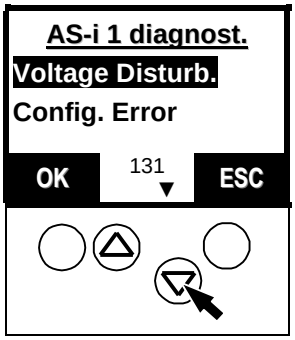
► If necessary, press [▼] to scroll to another master

5.



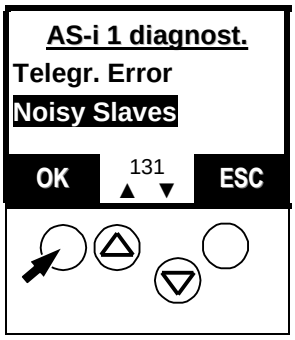
► Select requested master with [OK]

6.



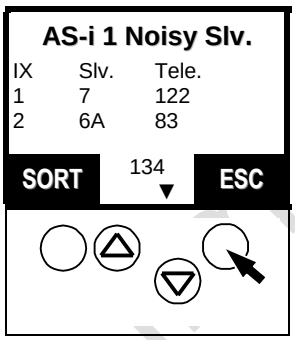
► Press [▼] to scroll to [Noisy Slaves]

7.



► Select [Noisy Slaves] with [OK]

8.



> Dynamic display of the number of disturbed telegrams of the different slaves, sorted by frequency of occurrence:

- Column "IX":
  Number of rank order (frequency)
- Column "Slv.":
  Address of the slave
- Column "Tele.":
  Number of disturbed telegrams

► Sort again by current rank order with [SORT]

► Press [▲] or [▼] to scroll to the slaves with higher or lower rank order

As an alternative:

► Press [ESC] four times to return to the start screen

13.13 Reset error counter

Here you learn how to reset the error counters in the diagnostic memory of the controllere .

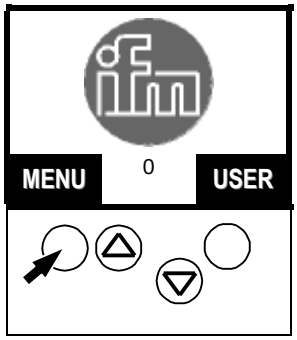
NOTE

You should reset the diagnostic memory of the controllere only after the analysis of the values stored so far.

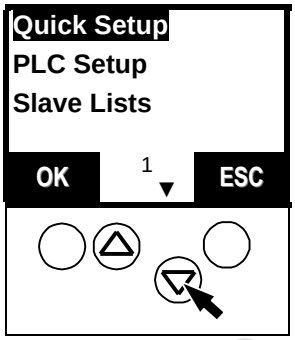
The reset process cannot be reversed.

Password level 1 required → page 142, chapter Password setting

[MENU] > [Diagnostics] > select master > [Reset Error Counter] > [OK]

1. 

► Press the key [MENU]

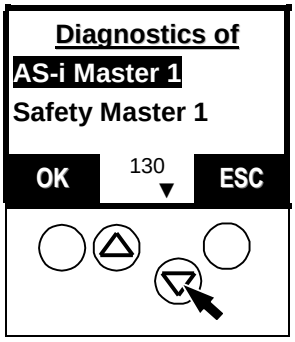
2. 

► Press [▼] to scroll to [Diagnostics]

3. 

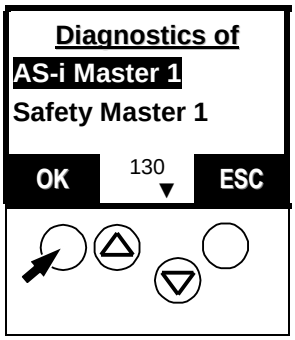
► Select [Diagnostics] with [OK]

4.



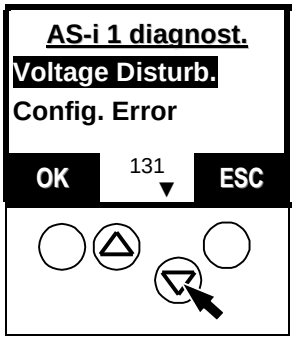
► If necessary, press [▼] to scroll to another master

5.



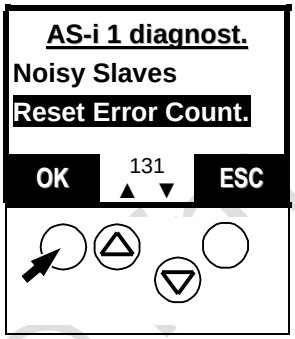
► Select requested master with [OK]

6.



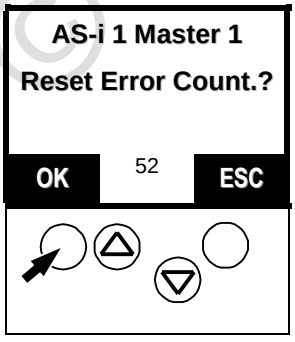
► Press [▼] to scroll to [Reset Error Count.]

7.



► Select [Reset Error Count.] with [OK]

8.



> Safety query:
"Reset Error Count.?"

► Reset all error counters with [OK]

> Return to screen 131

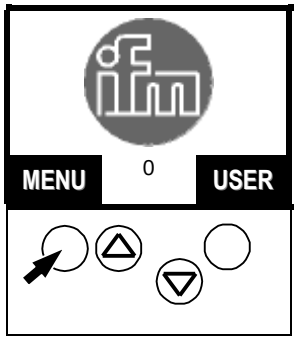
As an alternative:

► Scroll to screen 131 with [ESC] without changing the error counters

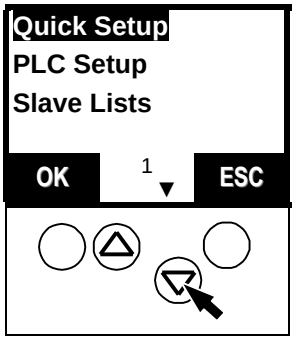
13.14 Display of the longest cycle time

Display of the longest cycle time of the system in [ms] since the last reset or after the last power on of the device:

[MENU] > [Diagnostics] > select master > [Cycle time]

1. 

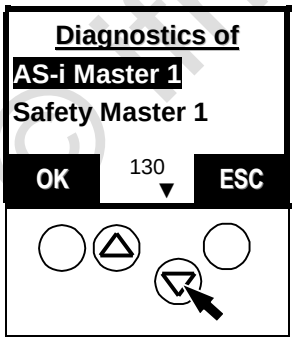
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Diagnostics]

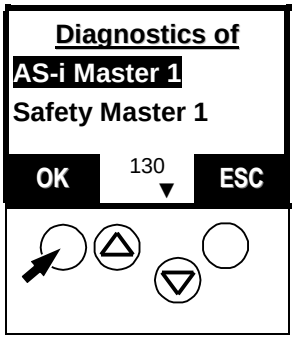
3. 

► Select [Diagnostics] with [OK]

4. 

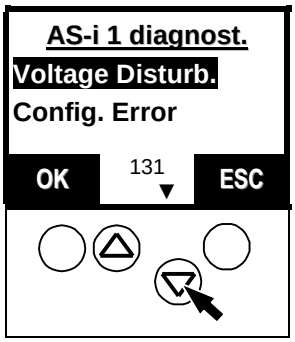
► If necessary, press [▼] to scroll to another master

5.



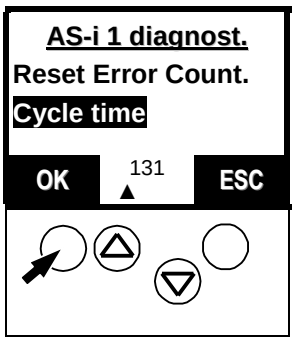
► Select requested master with [OK]

6.



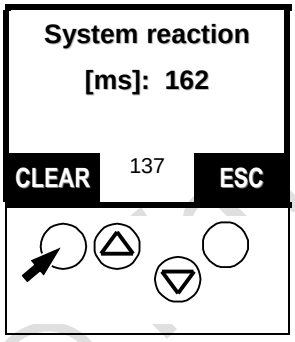
► Press [▼] to scroll to [Cycle time]

7.



► Select [Cycle time] with [OK]

8.



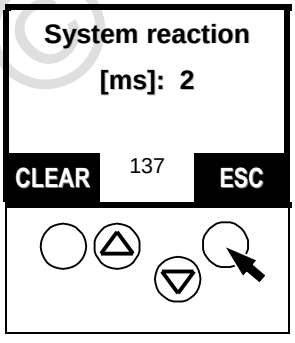
> Display of the longest cycle time of the AS-i system in [ms] since the last reset

► To update the display open the screen again:
Keys [ESC] > [OK] > [OK]

> Value increases or remains unchanged

► Set cycle time measurement series to 0 with [CLEAR]

9.



> Reset of the previous measurement series

> Start of the new measurement series

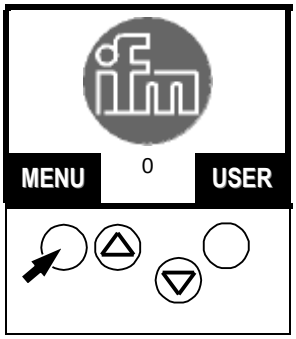
► Press [ESC] three times to return to the start screen

13.15 Read states of the safety monitor

Using the following method the controllere shows you the current data of the AS-i safety monitor.

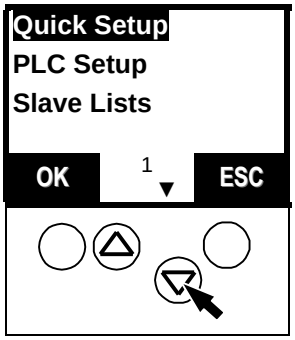
[MENU] > [Diagnostics] > select safety master > [Read Monitor]

1.



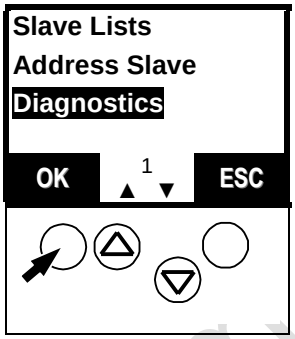
► Press the key [MENU]

2.



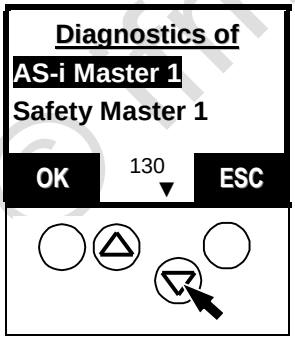
► Press [▼] to scroll to [Diagnostics]

3.



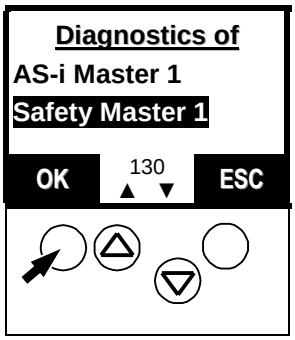
► Select [Diagnostics] with [OK]

4.



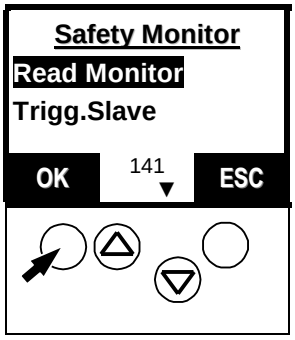
► Press [▼] to scroll to requested safety master

5.



► Select requested master with [OK]

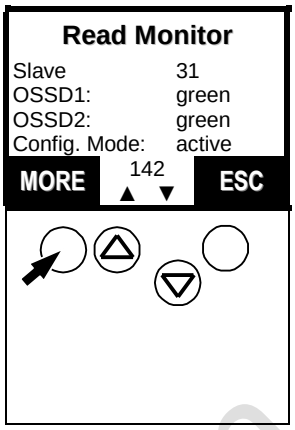
6.



► Select [Read Monitor] with [OK]

a) No safety device triggered

7.



> Display of the current data of the safety monitor:

- Slave = configured AS-i slave address
- OSSD1 = LED colour* for enable circuit 1
- OSSD2 = LED colour* for enable circuit 2
- Configuration mode active / not active
  = operating mode of the safety monitor

► Scroll to more data with [MORE]

OR:

► Return to screen 141 with [ESC]

* red = relay contact interrupted: a safety device has triggered

yellow = relay contact interrupted + restart disable = ready to start

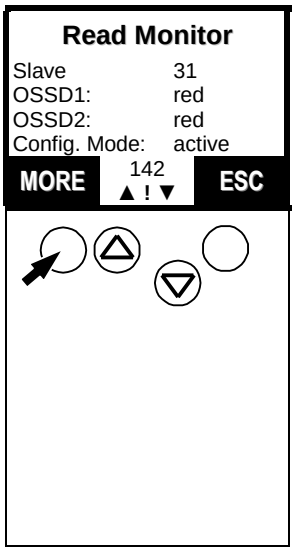
green = relay contact closed: safety devices ok

NOTE

Depending on the connected safety devices (one / two channels) the displays of OSSD1 and OSSD2 may be different.

b) Safety device triggered

7.



> Display of the current data of the safety monitor:

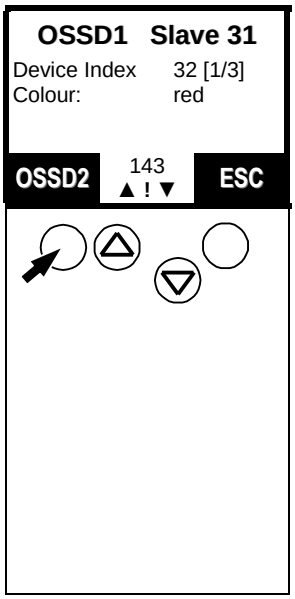
- Slave = configured AS-i slave address
- OSSD1 = LED colour* for enable circuit 1
  Here: enable circuit interrupted
- OSSD2 = LED colour* for enable circuit 2
  Here: enable circuit interrupted
- Configuration mode active / not active
  = operating mode of the safety monitor
  (not active = Run mode)

► Scroll to more data with [MORE]
(only possible in case of an error)

OR:

► Return to screen 141 with [ESC]

8.



> Display of the data of enable circuit 1:

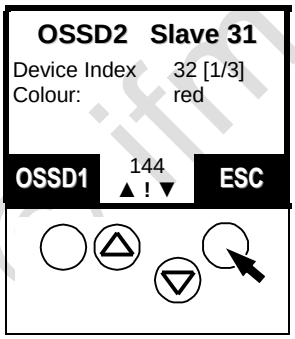
- Slave = configured AS-i slave address
- Device index (according to the configuration of the safety monitor with the software "ASIMON")
- [1/3] = display of the first of 3 sub-indexes
  Sub-index 1 = sensor
  Sub-index 2 = start condition
  Sub-index 3 = relay contact
- LED colour* for enable circuit 1
- Press [▲] or [▼] to scroll between the status messages of the other concerned index devices

► Scroll to enable circuit 2 with [OSSD2]

OR:

► Return to screen 141 with [ESC]

9.



Like screen 143, but for OSSD2

► Scroll to enable circuit 1 with [OSSD1]

OR:

► Return to screen 141 with [ESC]

* red = relay contact interrupted: a safety device triggered

yellow = relay contact interrupted + restart disable = ready to start

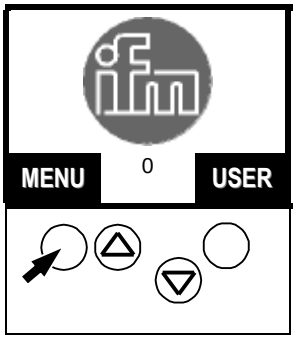
green = relay contact closed: safety devices ok

13.16 Read states of safety slaves

Using the following method the controllere shows you the current data of the AS-i safety slaves.

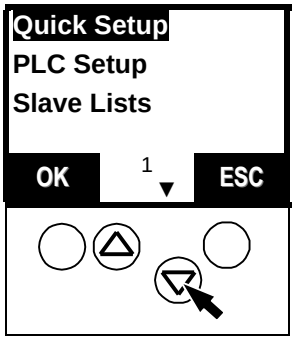
[MENU] > [Diagnostics] > select safety master > [Trigg. Slaves]

1.



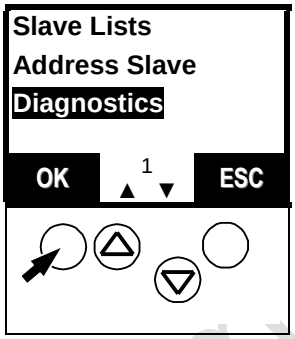
► Press the key [MENU]

2.



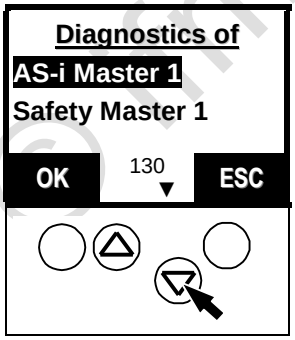
► Press [▼] to scroll to [Diagnostics]

3.



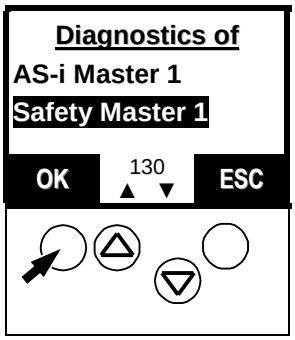
► Select [Diagnostics] with [OK]

4.



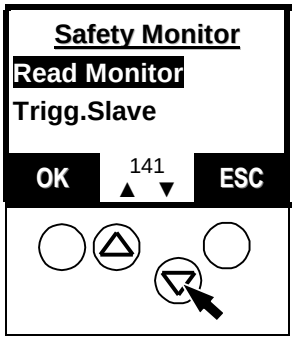
► Press [▼] to scroll to requested safety master

5.



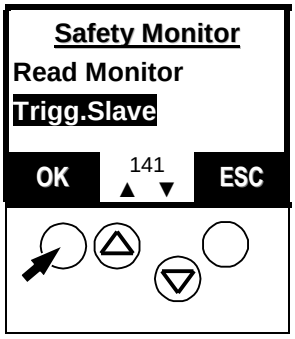
► Select requested master with [OK]

6.



► Press [▼] to scroll to [Trigg.Slave]

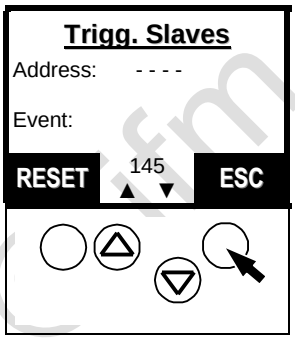
7.



► Select [Trigg.Slave] with [OK]

a) Safety sensor not actuated / not triggered

8.



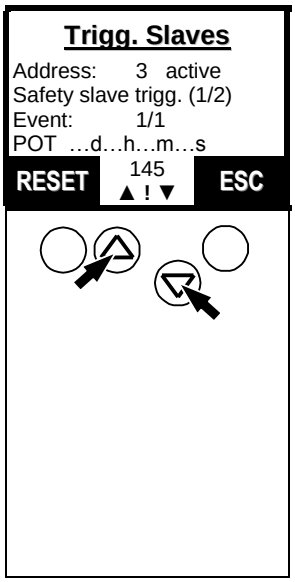
> Display of the current data of the first detected and triggered safety slave

• Here: no sensor triggered
No further displays / functions

► Return to screen 141 with [ESC]

b) Safety sensor actuated / not triggered

8.



> Display of the current data of the first detected and triggered safety slave

- Address = current address of the safety slave on the safety monitor
  Active = sensor triggered
  Inactive = sensor not / no longer triggered
- (1/2) = display/number of triggered sensors
- Event 1/1 = no./number* of triggered sensors
- POT (Power On Time) shows the time elapsed since power-on until the occurrence of the trigger event

► Press [▲] or [▼] to scroll between several triggered sensors

► [RESET] deletes the display of the slaves which are no longer triggered
Sensors still triggered remain displayed

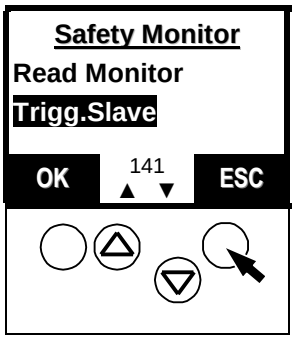
► Return to screen 141 with [ESC]

NOTE

The events (1/1 → 1/2) are automatically counted up as soon as another sensor triggers.

Counting down carried out only after [RESET].

9.



► Press [ESC] three times to return to the start screen

> That's it!

13.17 Set AS-i address(es) of the safety monitor(s)

Using the following method you set the same AS-i address for the safety monitor in the controllere that you have already stored in the safety monitor with the "ASIMON" safety parameter setting software.

Therefore the controllere can now exchange data with the safety monitor via a special protocol.

More information on the protocol → device manual of the safety monitor.

⚠ WARNING

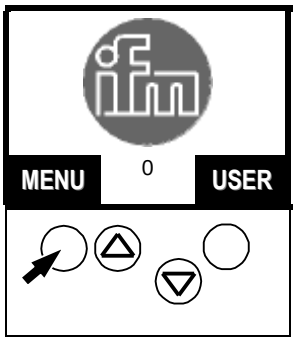
The protocol changes output states of the slaves set via the protocol.

Danger for people and machine by uncontrolled machine states.

► Only set AS-i safety monitors in this menu.

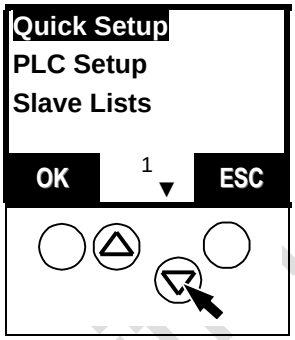
[MENU] > [Diagnostics] > select safety master > [Enable Monitor]

1.



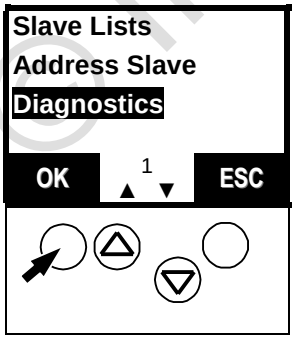
► Press the key [MENU]

2.



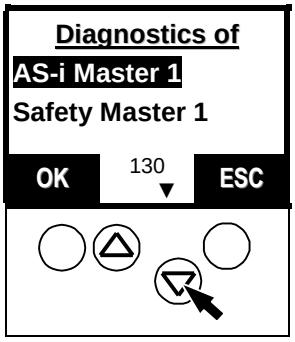
► Press [▼] to scroll to [Diagnostics]

3.



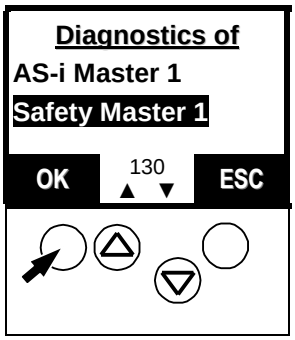
► Select [Diagnostics] with [OK]

4.



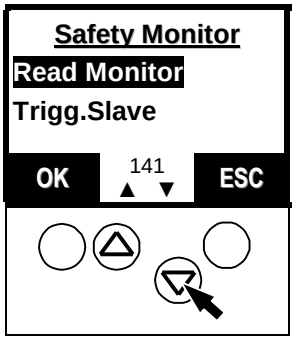
► Press [▼] to scroll to requested safety master

5.



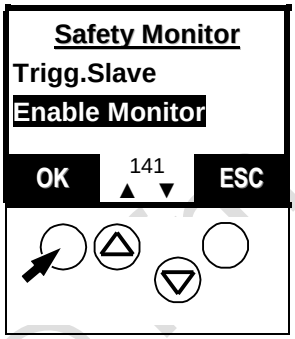
► Select requested master with [OK]

6.



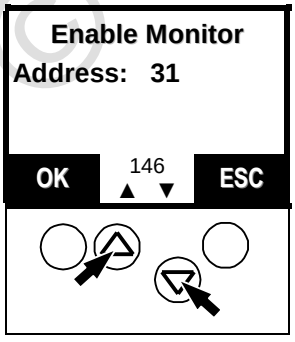
► Press [▼] to scroll to [Enable Monitor]

7.



► Select [Enable Monitor] with [OK]

8.



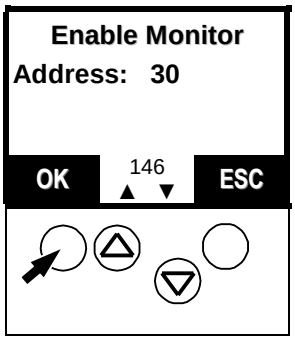
> Display safety note

► Acknowledge with [OK]

> Display of the address of the first found safety monitor

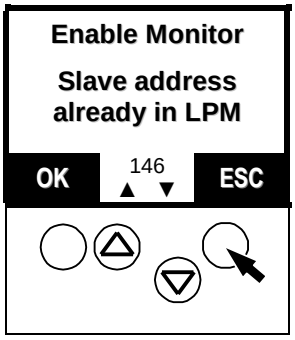
► Press [▲] or [▼] to scroll to the requested safety monitor
IMPORTANT: Select the same setting as with "ASIMON" in the safety monitor

9.



► Confirm the requested address of the safety monitor with [OK]

10.



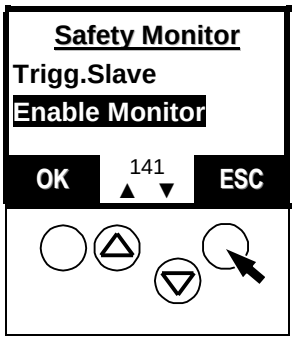
> Message that the selected address was found in the list of projected monitors (LPM)

> Controller$_e$ enters the AS-i address of the safety monitor in its list of participants

> Therefore the controller$_e$ can now exchange data with the safety monitor via a special protocol.

► Return to screen 141 with [ESC]

11.



► Press [ESC] three times to return to the start screen

> That's it!

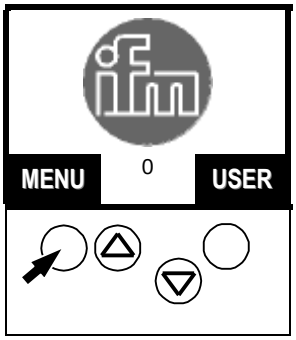
13.18 Reset the AS-i address(es) of the safety monitor(s)

With the following method you delete the AS-i address of the safety monitor in the controllere.

IMPORTANT:
Therefore the controllere processes the safety monitor just like an ordinary slave (4I/4O) - without taking safety-related data into account.

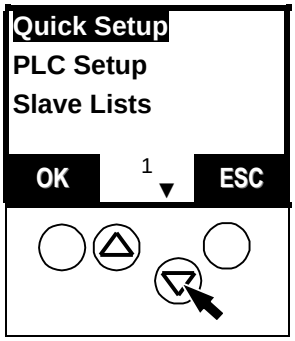
[MENU] > [Diagnostics] > select safety master > [Disable Monitor]

1.



► Press the key [MENU]

2.

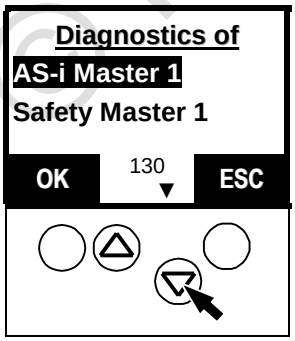


► Press [▼] to scroll to [Diagnostics]

3.

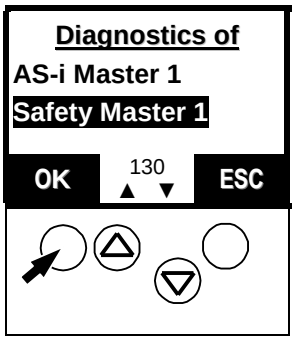
► Select [Diagnostics] with [OK]

4.



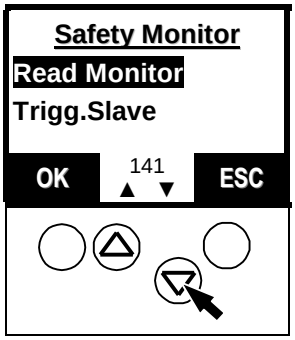
► Press [▼] to scroll to requested safety master

5.



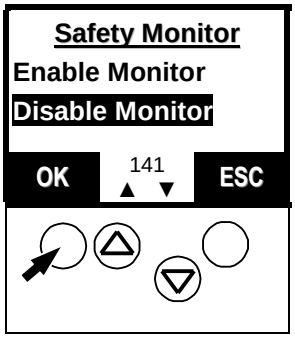
► Select requested master with [OK]

6.



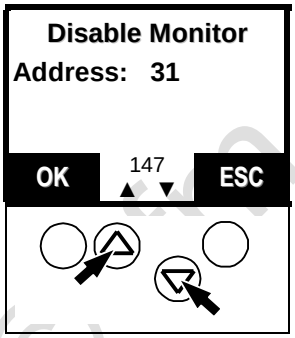
► Press [▼] to scroll to [Disable Monitor]

7.



► Select [Disable Monitor] with [OK]

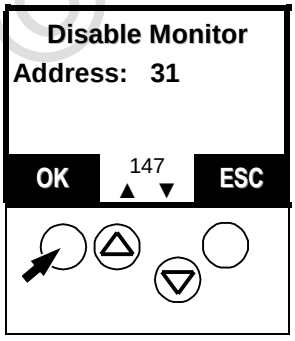
8.



> Display of the address of the first found safety monitor

► Press [▲] or [▼] to scroll to the requested address of the safety monitor

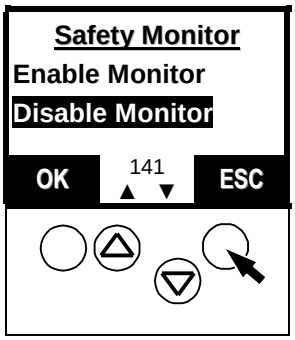
9.



► Confirm the requested address of the safety monitor with [OK]

► Confirm safety query with [OK]

10.



> The controllere deletes the AS-i address from its list of participants

> Therefore the controllere processes the safety monitor just like an ordinary slave - without taking safety-related data into account.

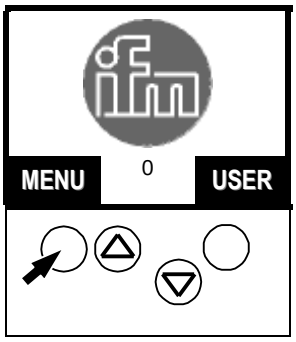
► Press [ESC] three times to return to the start screen

> That's it!

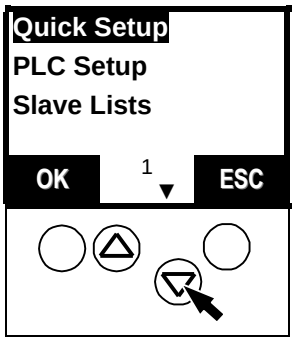
13.19 Set the diagnostic characteristics of the safety monitor

With the following method you set in the controllere how the safety monitor was configured with "ASIMON".

[MENU] > [Diagnostics] > select safety master > [Setup Monitor]

1. 

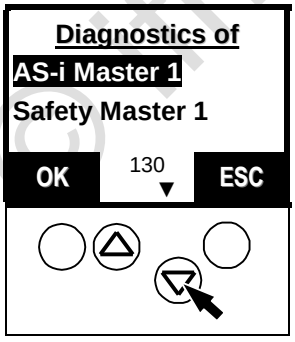
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Diagnostics]

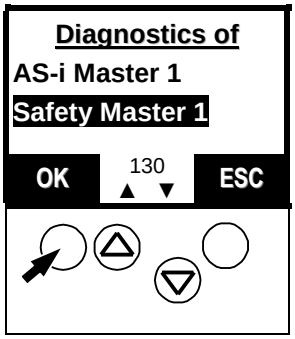
3. 

► Select [Diagnostics] with [OK]

4. 

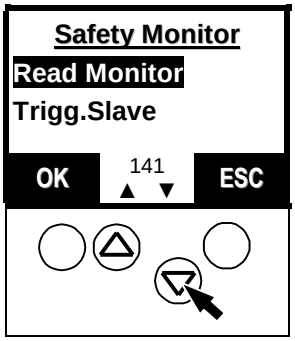
► Press [▼] to scroll to requested safety master

5.



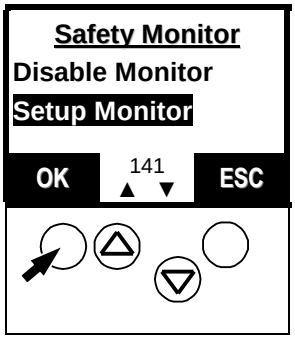
► Select requested master with [OK]

6.



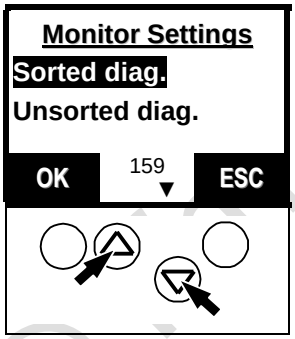
► Press [▼] to scroll to [Setup Monitor]

7.



► Select [Setup Monitor] with [OK]

8.

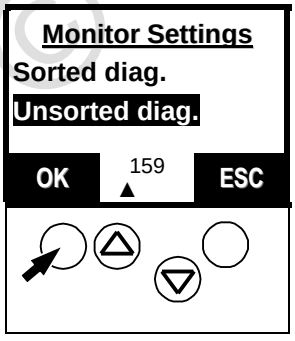


> Display of the current setting of the safety monitor (marked line = active):

- Sorted = sorting by enable circuits
- Unsorted = sorting by numbers of the safety devices

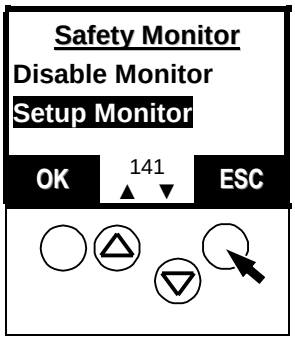
► Press [▲] or [▼] to scroll to the requested setting
IMPORTANT: Select the same setting as selected for the safety monitor via "ASIMON"

9.



► Confirm setting with [OK]

10.



► Press [ESC] three times to return to the start screen

> That's it!

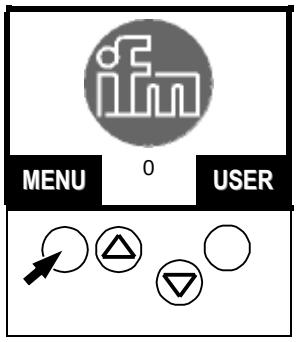
13.20 Reset diagnostic states of safety devices

Using the following method you delete the stored diagnostic states of the safety devices.

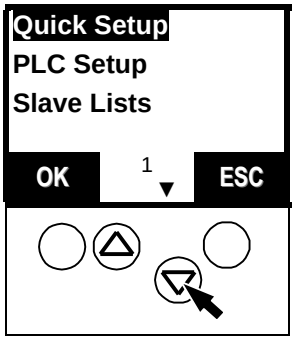
NOTE

Password level 1 required → page 142, chapter Password setting

[MENU] > [Diagnostics] > select safety master > [Reset all] > [OK]

1. 

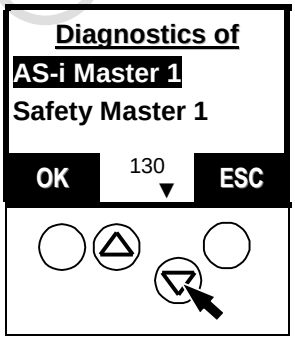
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Diagnostics]

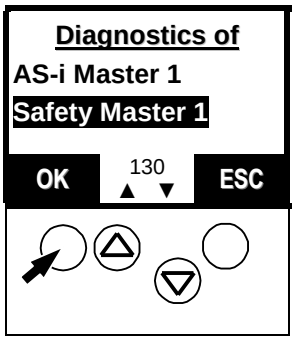
3. 

► Select [Diagnostics] with [OK]

4. 

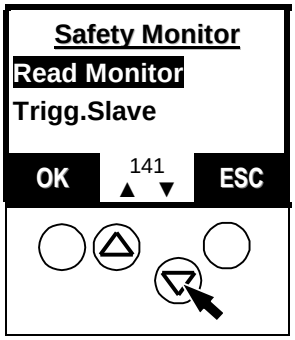
► Press [▼] to scroll to requested safety master

5.



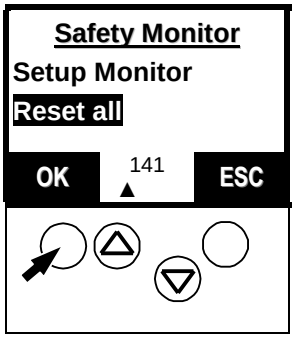
► Select requested master with [OK]

6.



► Press [▼] to scroll to [Reset all]

7.



► Select [Reset all] with [OK]

► Confirm safety query with [OK]

8.

> The controllere deletes the entries in the event list

► Press [ESC] twice to return to the start screen

> That's it!

13.21 Change operating mode of the AS-i master

Please refer to the following chapters in the manual:

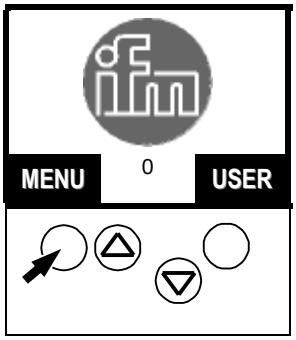
→ page 115, chapter Which operating modes are available for the AS-i master?

→ page 116, chapter How are the operating modes for the AS-i master selected?

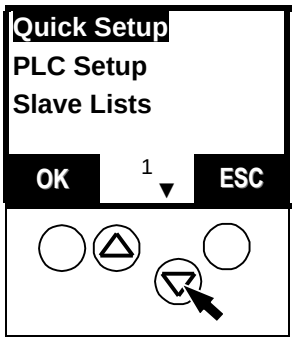
13.22 Display of slave data

You want to know how the individual slaves are configured?This is how to see it:

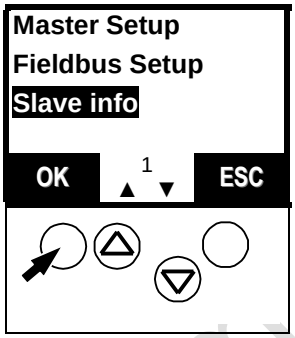
[MENU] > [Slave info] > select master

1. 

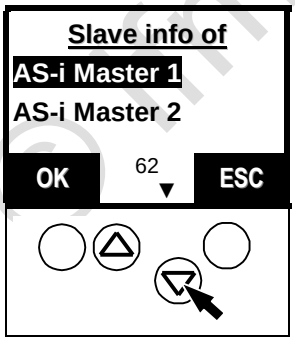
► Press the key [MENU]

2. 

► Press [▼] to scroll to [Slave Info]

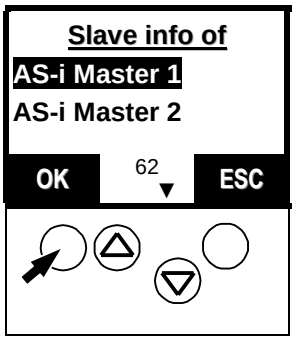
3. 

► Select [Slave info] with [OK]

4. 

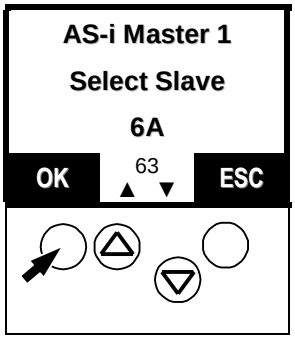
► If necessary, press [▼] to scroll to master 2

5.



► Select requested master with [OK]

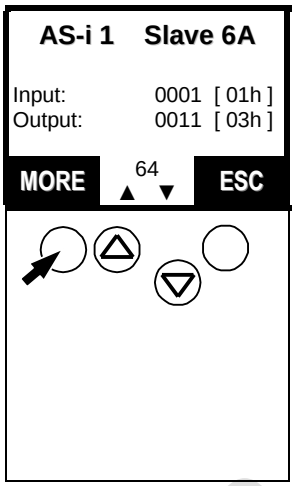
6.



> Display of the lowest found valid slave address

► If necessary, press [▲] or [▼] to scroll to another slave address which is active on the master

7.



> Dynamic display of the digital inputs and outputs as binary value and hex value:

- Input: digital inputs
- Output: digital outputs

► Press [▲] or [▼] to scroll to any other slave address

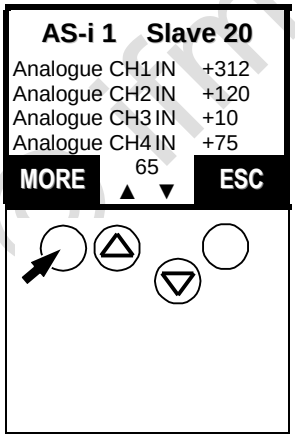
> Display of values of the other slave address.
If the address is not assigned to an active slave: display of values as "0000 [00h]"

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

8.



> Dynamic display of the analogue (input) channels as decimal values:

- If the slave has no analogue channel:
  Display of the value as ". . . . . "
- If no CTT slave:
  - analogue inputs: "IN" in front of the value
  - analogue outputs: "OUT" in front of the value

► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

9.

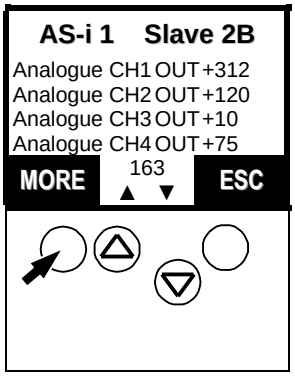


Figure only for CTT slaves

> Dynamic display of the analogue output channels as decimal values:

- If the slave has no analogue channel:
  Display of the value as ". . . . . "

► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

10.

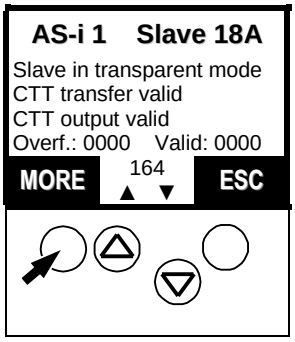


Figure only for CTT slaves

> Dynamic display of the flags of the analogue channels:
  Meaning → page 153, chapter Status information of analogue slaves

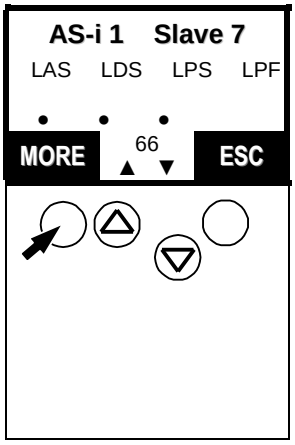
► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

11.



> Display in which slave lists the slave is entered:

- LAS: list of activated slaves
- LDS: list of detected slaves
- LPS: list of projected slaves
- LPF: list of slaves with periphery fault

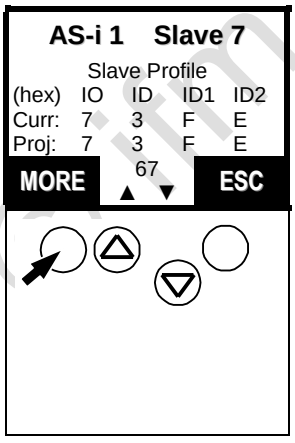
► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

12.



> Display of configuration data of the slave:

- Current: current value of the slave
  Here: slave type = S-7.3.E
  or, if the slave is not activated on the master:
  display "F F F F"
- Projected: value which is entered in the configuration table

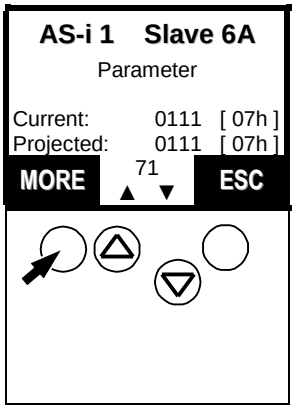
► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

13.



> Display of slave parameters
> as binary value and hex value:
> default setting: "1111 [0Fh]"

- Current: current value of the slave
- Projected: value which is entered in the configuration table

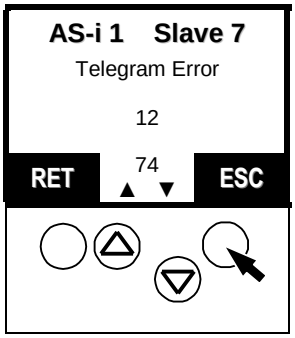
► Press [▲] or [▼] to scroll to any other slave address

► Scroll to the next screen with [MORE]

As an alternative:

► Return to screen 62 with [ESC]

14.



> Display of the number of telegram errors

► Press [▲] or [▼] to scroll to any other slave address

► Return to screen 63 with [RET]

► Press [ESC] three times to return to the start screen

13.23 Set output values

For testing it can be useful to set the value of an output without influence by the PLC program. The controllere helps you.

⚠ WARNING

Risk of personal injury! Risk of material damage to the machine/plant!
After the change of the slave outputs the output values remain unchanged.

The output values only change in the following cases:

- Manual new setting of the outputs via Slave Setup
- Starting the PLC program - the program processes the outputs
- Switching the controllere off and on again

► Secure the concerned area.

► Only trained personnel is allowed to set outputs manually.

► Switch the outputs off again immediately after the end of the test.

NOTE

Password level 2 required → page 142, chapter Password setting

NOTE

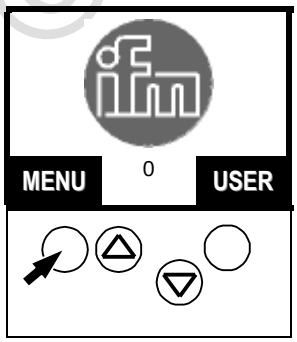
Changes to the outputs are not effective in the following cases:

- The PLC is in the RUN mode (LED [PLC RUN] lights).
- AND: The corresponding outputs are processed by the PLC.
- Changes of digital outputs on analogue modules.
- Changes of analogue outputs on digital modules.

► Switch PLC to the operating mode STOP
→ page 118, chapter How are the operating modes for the PLC selected?

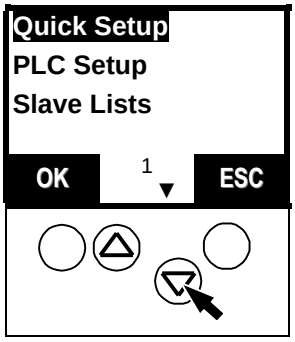
> LED [PLC RUN] flashes

[MENU] > [Slave Setup] > select master > select slave

1. 

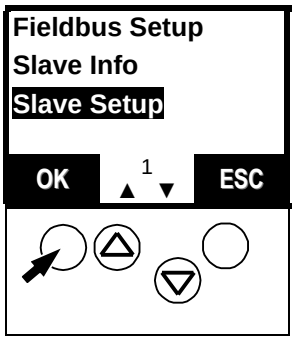
► Press the key [MENU]

2.



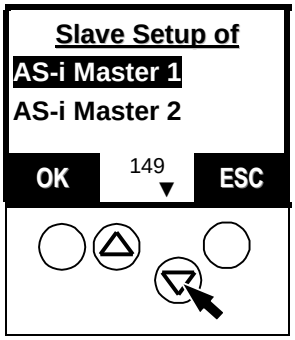
▶ Press [▼] to scroll to [Slave Setup]

3.



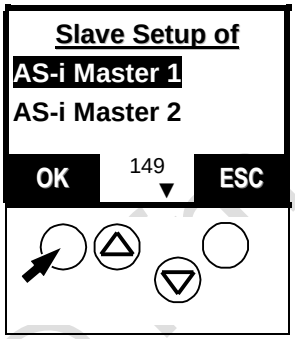
▶ Select [Slave Setup] with [OK]

4.



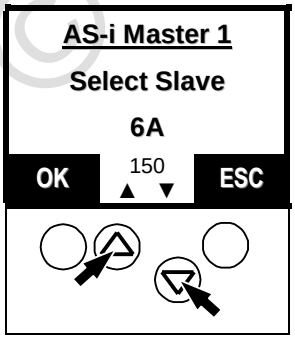
▶ If necessary, press [▼] to scroll to AS-i master 2

5.



▶ Select requested AS-i master with [OK]

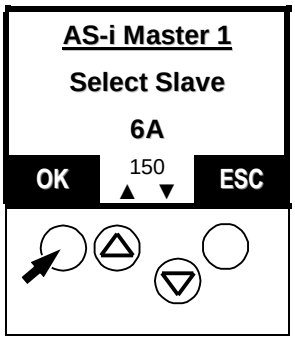
6.



> Display of the lowest found valid slave address

▶ If necessary, press [▲] or [▼] to scroll to another slave address

7.

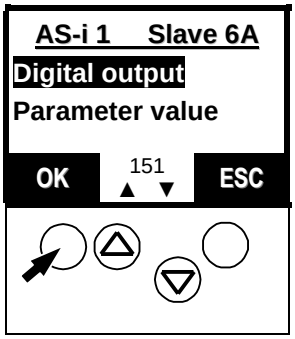


► Select requested slave with [OK]

Continue with: Set digital output → page 229
Continue with: Set analogue output → page 231

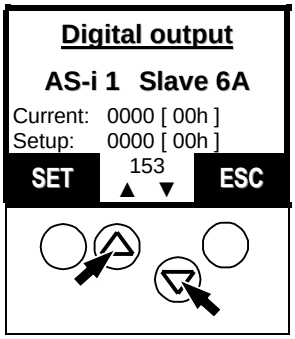
13.23.1 Set digital output

8.



► Select [Digital output] with [OK]

9.

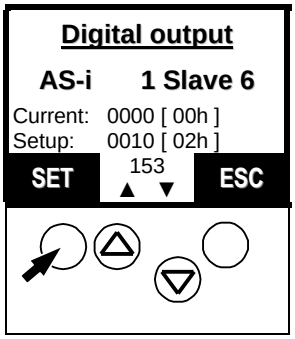


> Current = digital outputs current value binary / hexadecimal

> Setup = digital outputs setup value binary / hexadecimal

► Press [▲] or [▼] to set the requested setup value

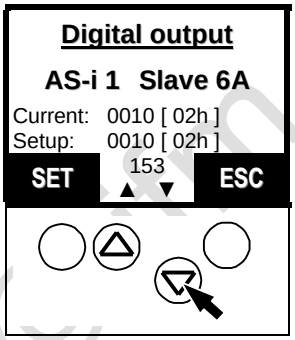
10.



> Setup = set setup value

► Transmit setup value set with [SET] to the outputs of the slave

11.

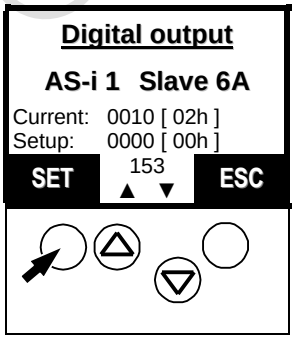


> Value in "Current" adopts value from "Setup"

> Outputs on the slave are switched accordingly. Set outputs remain switched until a new setup or start of the PLC changes the outputs again.

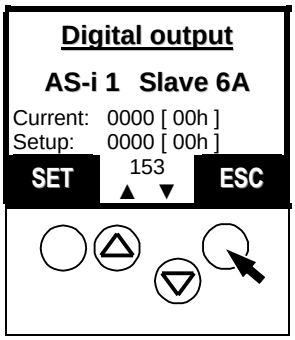
► Set setup value "0000" with [▼]

12.



► Transmit the setup value set with [SET] to the outputs of the slave

13.



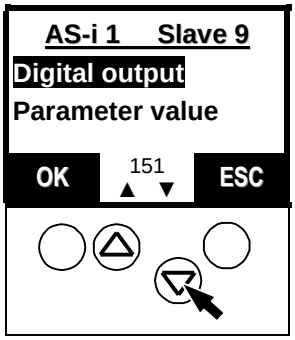
> Value in "Current" adopts value from "Setup"

> Outputs on the slave are switched accordingly. Set outputs remain switched until a new set-up or start of the PLC changes the outputs again.

► Press [ESC] twice to return to screen 150

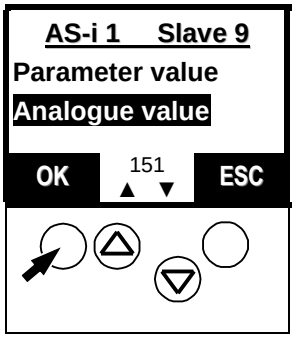
13.23.2 Set analogue output

8.



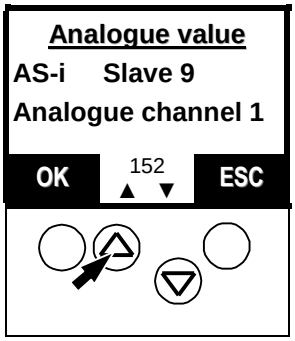
► Press [▼] to scroll to [Analogue value]

9.



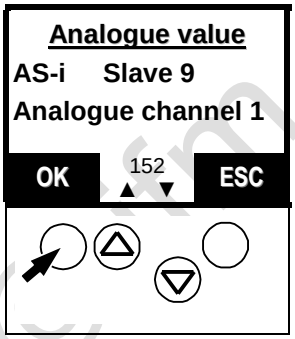
► Select [Analogue value] with [OK]

10.



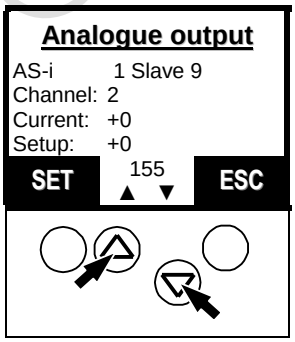
► Press [▲] to scroll to the requested analogue channel

11.



► Select requested analogue channel with [OK]

12.

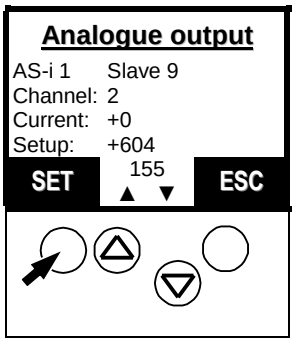


> Current = analogue output channel current value

> Setup = analogue output channel setup value

► Press [▲] or [▼] to set requested setup value
Brief pressing: step increment 1
Long pressing: step increment 100

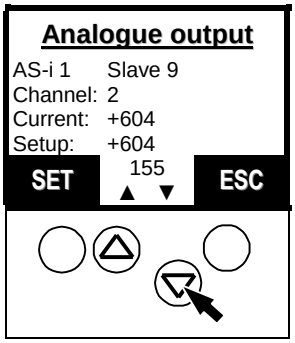
13.



> Setup = set setup value

► Transmit setup value set with [SET] to the outputs of the slave

14.

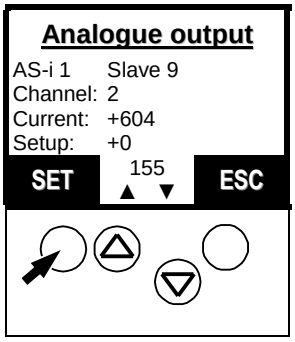


> Display in "Current" adopts value from "Setup"

> Outputs on the slave are switched accordingly. Set outputs remain switched until a new setup or start of the PLC changes the outputs again.

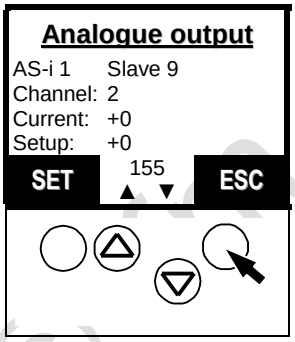
► Press [▼] to set the setup value "0"

15.



► Transmit setup value set with [SET] to the outputs of the slave

16.



> Display in "Current" adopts value from "Setup"

> Outputs on the slave are switched accordingly. Set outputs remain switched until a new setup or start of the PLC changes the outputs again.

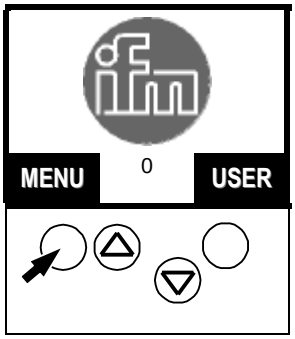
► Press [ESC] twice to return to screen 150

13.24 Display system parameters

Here the controllere gives you all the information it has about itself.

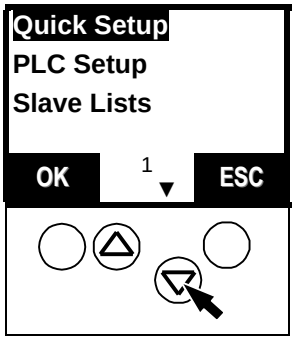
[MENU] > [System Info]

1.



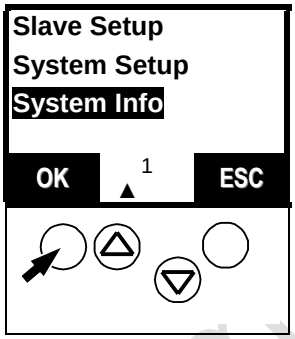
► Press the key [MENU]

2.



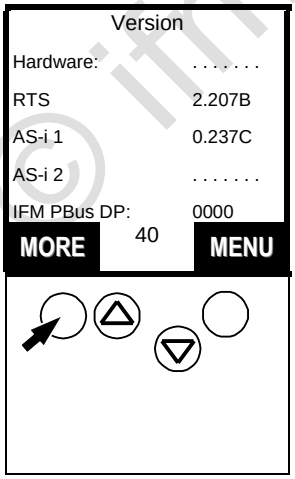
► Scroll to [System Info] with [▼]

3.



► Press [OK] to select [System Info]

4.



> Display of system versions:

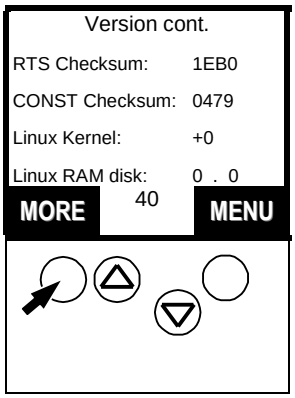
- Indication of the hardware version
- Operating system version of the controllere
- Operating system version for master 1
- Operating system version for master 2
- The integrated fieldbus is Profibus DP with the indication of the ifm version

► Scroll to the next screen with [MORE]

As an alternative:

► Scroll to screen 1 with [MENU] (main menu)

5.



> Display of system versions: 2nd screen

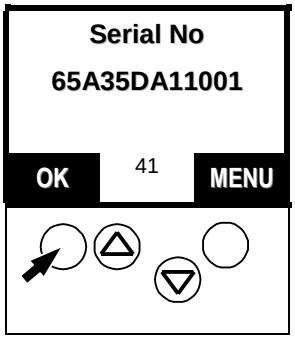
- Checksum of the operating system
- Checksum of the system constants
- Version of the kernel of the Linux operating system
- Version of the Linux memory driver

► Scroll to the next screen with [MORE]

As an alternative:

► Scroll to screen 1 with [MENU] (main menu)

6.



> Display of the serial number of the controllere

► Scroll to next screen with [OK]

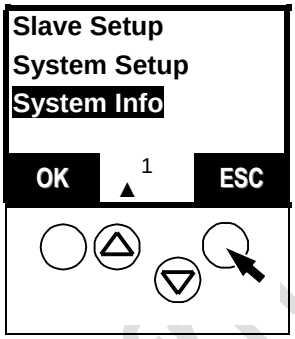
As an alternative:

► Scroll to screen 1 with [MENU] (main menu)

NOTE

For more displays:
Password level 3 required →page142, chapter Password setting

7.



► Return to start screen with [ESC]

> That's it!

14 Scale drawing

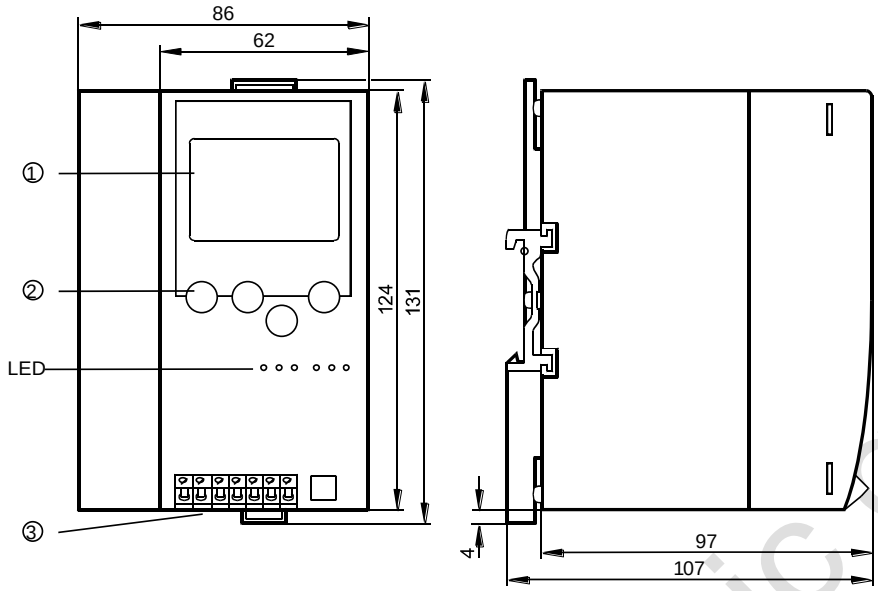


Figure: dimensions of the controllere

15 Technical data

15.1 General data

Operating voltage	20...30 V DC (PELV)
Current consumption	< 0.5 A (depending on the implemented options)
Operating temperature	0...+60 °C
Storage temperature	-20...+70 °C
Protection rating to DIN 40050	IP 20
Housing material	Aluminium, galvanised steel
Fixing	on 35 mm Din rail
Housing dimensions	106.3 x 85.5 x 123.6 mm

15.2 Data AS-i master

Number of AS-i masters	1 (standard) or 2 (optional)
AS-Interface profile	M4 according to version 3.0
AS-Interface voltage	26.5...31.6 V (special AS-i power supply)
Current consumption from AS-i	0.01 A / master
Microcontroller	Infineon C1610 microcontroller
Supported V2.1 features	• A/B slaves • Periphery fault detection • Analogue plug + play (profiles 7.3 / 7.4 / CTT1) • Extended ID codes
Supported V3.0 features	• CTT2…CTT5
Other features	• AS-i cycle counter • Communication error counter per slave • Configuration error counter • Change to the protected mode without resetting the AS-i system

15.3 Data serial interface RS-232C

Baud rates	9 600, 19 200, 38 400, 57 600, **115 200** bits/s
Communication parameters	8 data bits, no start bit, 1 stop bit, no parity
Connection	RJ11 Western socket, 6-pole
Protocol	Automation Alliance standard protocol

15.4 Data PLC

Microcontroller	Infineon C165 microcontroller	
SRAM	1 Mbyte	
Flash memory	1 Mbyte	
PLC program memory	228 kbytes	
Program size	up to 19000 commands in IL (simple binary commands)	
Data memory	196 kbytes	
Remanent flags	160 bytes	%MW0...%MW79
Retain area	2 kbytes (stored by PLC command)	
Programming languages	• Instruction list • Function block diagram • Ladder diagram • Sequential function chart • Continuous function chart • Structured text All languages according to IEC 61131-3	
POUs	• Programs • Functions • Function blocks	
Operations	• Binary combinations • Arithmetic • Moving and rotating • Comparisons • Mathematical functions • Text processing • Jumps and return	

Data types	• Binary • Fixed point (byte, word, double word) • Floating point • String • Array • Structure • Pointer • Date and time
Processing times	< 1µs for simple bit or integer operations
Flags	4096 bits (= 256 bytes), of these bits 1280 bits remanent (= 160 bytes) Approx. 190 kbytes can be addressed symbolically
Timers	> 300
Counters	> 300
Binary inputs (AS-i)	max. 496
Binary outputs (AS-i)	max. 496
Analogue inputs (AS-i)	max. 248 channels
Analogue outputs (AS-i)	max. 248 channels

16 Error description

There are 2 differents types of error messages in the controllere:

Handling errors and internal system errors:

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after the following actions:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Boot errors (error codes E10...E30):

- Error message appears instead of the start screen.
- No interruption of the menu operation.
- Exclamation mark flashes in the text/graphics display in the middle of the line at the bottom (only if configuration mode is deactivated).
- The error message disappears again as soon as the error has been corrected.

The following tables are sorted in groups by error code.

16.1 Boot errors: error codes B00...B11

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after the following actions:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
B00	Controller Boot error After power-on of the device, an error was found during initialisation of the individual device components. For further details please refer to the following error messages.	► Check further error messages.
B01	Master initialization Failed initialisation of the masters. Possible causes: • Unacceptable interference on the 24 V power supply. • Unacceptable interference on the AS-i power supply. • Unacceptably high electrostatic charges and electromagnetic fields in close proximity of the device.	► Grounding the device via the rail. ► Connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device.
B02	Master2 initialization	→ B01
B03	General FAT failure An error was found in the data field of the "File Allocation Table" FAT.	► Check further error messages.
B04	Only one master detected The operating system can only detect 1 master in the controllere although communication with 2 masters must be possible. Possible causes: hardware fault.	► Replace controllere and project again.
B05	Two masters detected The operating system can detect 2 masters in the controllere although communication with only 1 master is allowed. Possible cause: hardware fault.	► Replace controllere and project again.
B06	Fieldbus type not expected During the automatic detection of the integrated fieldbus no enabled fieldbus module could be detected. Possible cause: hardware fault.	► Replace controllere and project again.

Error message	Cause(s)	Remedy
B07	Number of master mismatch When the version releases of the masters were checked some invalid information was received. Possible cause: Hardware fault.	► Replace controllere and project again.
B08	Exec. of PLC blocked by user When the device was started the automatic start of the PLC program was disabled by the user. The left function key of the device was pressed during power-on.	► Release function key during power-on. or: ► No action because this is requested.
B09	Reserved	—
B10	Master 1 firmware obsolete The AS-i master firmware does not contain functions required for the RTS operating system.	► Updating the AS-i master firmware to the required minimum version.
B11	Master 2 firmware obsolete → B10	→ B10

16.2 AS-I system errors: error codes E10...E32

- Error message appears instead of the start screen.
- No interruption of the menu operation.
- Exclamation mark flashes in the text/graphics display in the middle of the line at the bottom (only if configuration mode is deactivated).
- The error message disappears again as soon as the error has been corrected.

Error message	Cause(s)	Remedy
E10	Slave not activated The slave was detected in the system but not activated by the master. Detected slave profile does not correspond to the projected slave profile and the master is in the "protected mode".	► Check slave profile: [Menu] > [Slave Info]: → page 222, chapter Display of slave data ► Connect slave with the right profile. ► Project slaves again: [Menu] > [Quick Setup]: → page 134, chapter Finish configuration
E11	Slave not present Slave is indicated in the "list of projected slaves" LPS but not detected on the AS-i master.	► Check slave connections. ► Connect slave again.
E12	Slave not projected Slave was detected on the AS-i bus but is missing in the "list of projected slaves" LPS.	► Project slaves again: [Menu] > [Quick Setup]: → page 134, chapter Finish configuration
E13	Periphery fault detected	→ page 186, chapter Display of slaves with periphery fault (list) → page 189, chapter Display of slave with periphery fault
E14	Safety slave alert	Error message not active at present.
E15	CTT1 analog protocol failure	Error message not active at present.
E20	ASI Power Fail The master is in the "protected mode" and detects that the AS-i voltage supply is not higher than 28 V. This message is only generated if at least one slave is projected.	► Check AS-i voltage supply on the master and replace, if necessary.
E21	No slave detected The master is in the "protected mode" and detects that no slave is connected to the AS-i bus. This message is only generated if at least one slave is projected.	► Check slave connections. ► Check AS-i line.

Error message	Cause(s)	Remedy
E22	Slave 0 detected The master is in the "protected mode" and detects a slave with the address 0 on the AS-i bus. This message is only generated if the profile of the missing slave on the AS-i bus is identical to the profile of the slave with the address 0.	► Change master to "configuration mode": → page 116, chapter How are the operating modes for the AS-i master selected?
E23	Slave 0 bad profile The master is in the "protected mode" and detects a slave with the address 0 on the AS-i bus. This message is only generated if the profile of the missing slave on the AS-i bus is different from the profile of the slave with the address 0.	► Check and replace slave. ► Project slaves again: [Menu] > [Quick Setup] → page 134, chapter Finish configuration
E24	Autoaddress not enabled The master is in the "protected mode" and detects a slave with the address 0 on the AS-i bus. This message is only generated if the profile of the missing slave on the AS-i bus is identical to the profile of the slave with the address 0, the "automatic addressing" in the master, however, was not activated.	► Activate "automatic addressing" in the master: → page 127, chapter Automatic addressing of individual slaves
E25	Config. error The master is in the "normal operating mode" and detects a projection error. Possible causes: • The profiles of the detected slaves are different from those of the projected slaves. • One or more slaves are additionally detected on the AS-i bus. • One or several slaves are missing on the AS-i bus.	► Check the detected and projected slave profile in the menu [Slave Info]. → page 222, chapter Display of slave data ► Check the entries of slaves in the lists LAS, LDS, LPS, LPF in the menu [Slave Lists]. → page 178, chapter Display of detected slaves (list) → page 180, chapter Display of projected slaves (list) → page 183, chapter Display of active slaves (list) → page 186, chapter Display of slaves with periphery fault (list)
E26	Generic Periphery fault The master is in the "mormal operating mode" and detects that at least one slave on the AS-i bus signals a periphery fault.	→ page 186, chapter Display of slaves with periphery fault (list) → page 189, chapter Display of slave with periphery fault

Error message	Cause(s)	Remedy
E27	Normal operation inactive The master signals that it is not in the "normal operating mode". Possible causes:	
	1. When booting the system no slave was connected to the device or no slave was projected.	► Connect at least 1 slave to the device and reboot the system.
	2. The master detects an AS-i voltage below 22 V and therefore goes into the "offline mode".	► Check AS-i voltage supply on the master and replace, if necessary.
	3. The master received a request from the operating system to change to the "offline mode".	► Check AS-i voltage supply on the master and replace, if necessary.
	4. The master found a transfer error in the communication with the operating system.	► Switch PLC off and on again. ► Replace controller and project again.
	Other causes which can lead to an error message directly after power-on:	
	5. Initialisation of the master after power-on of the device was not successful.	► Switch PLC off and on again. ► Replace controller and project again.
	6. The master has not yet received the projection nor the projected parameters from the operating system.	► Wait. ► If too long: → 5.
	7. The master has not yet been started by the operating system.	► Wait. ► If too long: → 5.
E28	State PLC cmd channel Command channel detects an invalid state.	► Check the request of the PLC command channel (1st word).
E29	Unknown MUX field identifier The transmission between AS-I master and PLC processor has been deranged.	► Check data accesses via pointers into area < 4000_h of your PLC program. ► Check the electrical environment about unacceptable high electro-magnetic fields and static charging. ► Check the grounding of the device.
E30	Safety slave triggered (1) The first safety contact of the specified AS-I slave is opened.	► Bring the slave into the safe state.
E31	Safety slave triggered (2) The second safety contact of the specified AS-I slave is opened.	► Bring the slave into the safe state.

Error message	Cause(s)	Remedy
E32	Safety slave triggered (1/2) The master detected a "safe slave" on the AS-i line whose inputs are constantly switched to LOW for a period > 64 ms.	► Bring the slave into the safe state.

16.3 FAT errors: Error codes F01...F10

FAT = File Allocation Table (part of the memory management)

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. Error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
F01	Bad FAT checksum The checksum of the FAT contains an invalid value. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	► Grounding the device via the rail. ► Connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device. ► Repeat command.
F02	Bad FAT header The identifier in the header of the FAT contains an invalid entry. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	→ F01
F03	Bad FAT ID The field ID of a FAT area contains an invalid value. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	→ F01
F04	Virgin FAT found The FAT contains no entry. Possible cause: The user completely deleted the flash memory.	► Replace the device and project again.
F05	Bad NV field checksum The checksum of the remanent data within the FAT contains an invalid value. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	► Grounding the device via the rail. ► Connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device. ► Repeat command.
F06	Bad NV field ID The field ID of the remanent data contains an invalid value. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	→ F05

Error message	Cause(s)	Remedy
F07	NV pointer invalid range The start address of the remanent data is outside the permitted area. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	→ F05
F08	FAT storage An error occurred during the storage of the FAT. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	→ F05
F09	NV field storage An error occurred during the storage of the remanent data. Possible cause: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	► Repeat command.
F10	General NV mirror switching When changing to the mirror area of the remanent data a fault has occurred. Possible causes: unacceptable interference on the 24 V supply during the storage operation of the data in the flash memory.	► Repeat command.

16.4 Flash errors: error codes F20...F30

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
F20	General flash error This error message contains all failed operations which have to do with the integrated flash memory. For further details see the following error messages.	► Check further error messages.
F21	Bad flash command The operating system received an invalid command for the flash memory. Possible cause: error in the PLC command	► Check and correct command. ► Repeat command.
F22	Flash sector erasure The flash memory did not meet the request to delete a flash sector. Possible cause: access to the flash memory which is currently processing commands.	► Repeat command.
F23	Flash write verify failed The data to be stored in the flash memory could not be verified. Possible cause: access to the flash memory which is currently processing commands.	► Repeat command.
F24	Flash device: timeout The flash memory signals timeout during the execution of a command. Possible cause: access to the flash memory which is currently processing commands.	► Repeat command.
F25	Flash device: command The flash memory received an invalid command. Possible cause: software error in the operating system.	► Check and correct command. ► Repeat command.

Error message	Cause(s)	Remedy
F26	Flash system timeout The operating system found a timeout during the execution of a flash command. Possible cause: access to the flash memory which is currently processing commands.	► Repeat command.
F27	Erasure PLC sectors in Flash The attempt to delete the sectors in which the PLC program is stored failed. Possible causes:	
	1. Sectors were disabled to protect them against overwriting (AC1325 and AC1326).	Command not possible.
	2. Access to the flash memory which is currently processing commands	► Repeat command.
	3. Flash memory faulty	► Replace the device and project again.
F28	Storage PLCPRG in Flash Storing the PLC program in the flash memory failed. Possible causes:	
	1. Sectors were disabled to protect them against overwriting (AC1325 and AC1326).	Command not possible.
	2. Access to the flash memory which is currently processing commands.	► Repeat command.
	3. Flash memory faulty	► Replace the device and project again.
F29	Storage of the remanent data in the flash failed Storing the remanent data in the flash module failed (%MB... [Var_Retain]). Possible causes:	
	1. Access to the flash memory which is currently processing commands	► Repeat command.
	2. Flash memory faulty	► Replace the device and project again.
F30	PLC program write-protected The attempt to store the PLC program in the flash memory failed. Possible cause: The PLC program was protected against overwriting.	► Remove the write protection with the program `freeflash.pro`.

16.5 Information errors: error code I01

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
I01	Flash Sector switched The runtime system RTS changed to another flash sector to store the remanent data.	No error, just a message for the user.

16.6 AS-i master command errors: error codes M01...M44

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
M01	Command execution error During the execution of an AS-i command an error occurred which prevented execution. For further details see the following error messages.	► Check further error messages.
M02	Slave not found An attempt was made to access a slave with an AS-i command which is not on the AS-i bus. The slave is not in the LDS.	► Check slave connections . ► Connect slave again.
M03	Slave 0 found The master detects a slave with the address 0 on the AS-i bus and can therefore not execute the command. **Example**: The address of a slave is to be changed while a slave with the address 0 is present on the AS-i bus.	► Remove slave with the address 0 or address correctly.
M04	Slave with same address found During the execution of a command the master detects that there is already a slave at the requested address on the AS-i bus. **Example**: The address of a slave is to be changed to an address which is already assigned to another slave on the AS-i bus.	► Remove one of the slaves with double address. ► Readdress the remaining slave. ► Connect removed slave again.
M05	Delete of old slave address The attempt to reprogram a slave to address 0 failed. **Example**: AS-i slave has a limited number of possibilities to change the address, these are now exhausted.	► Replace slave.
M06	Reading Extended ID Code 1 The master receives no or no valid response when reading the "Extended ID code 1". **Example**: attempt to readdress an A/B slave to another address.	► Repeat command.

Error message	Cause(s)	Remedy
M07	Writing to slave failed:	
	1. The attempt of the master to readdress a slave to the new target address failed.	► Repeat command.
	2. Writing the "extended ID code 1" to slave 1 failed. **Example**: attempt to readdress an A/B slave to another address.	► Repeat command.
M08	New address temporary stored During the readdressing of a slave the new address could not be written to the slave because the slave is no longer detected on the AS-i bus. Possible causes:	
	1. Double addressing	► Remove one of the slaves with double address. ► Readdress remaining slave. ► Connect removed slave again.
	2 Major bus interference	► Remove cause of the interference.
M09	Extended ID1 temporary stored While writing the "ID Code 1" to the slave the code could not be written to the slave because the slave is no longer detected on the AS-i bus. Possible causes:	
	1. Double addressing	► Remove one of the slaves with double address. ► Readdress remaining slave. ► Connect removed slave again.
	2. Major bus interference	► Remove cause of the interference.
M10	Slave not in LAS The master detects that a slave has not been activated. Possible causes: The slave profile in the projection data is not identical to the profile of the detected slave and the master is in the "protected mode".	► Change master to the "configuration mode": → page 116, chapter How are the operating modes for the AS-i master selected? ► Check and replace slave. ► Project slaves again: [Menu] > [Quick Setup]: → page 134, chapter Finish configuration

Error message	Cause(s)	Remedy
M11	Slave data invalid This error message has a multiple meaning and depends on the requested command:	
	1. Slave readdressing Address 32 = 0B was indicated as target address.	Address 0B is not valid. ► Write valid address.
	2. Write parameter The attempt was made to write a value greater than 7_h to an A/B slave, ID=A_h.	► Write valid value.
M12	7.3/7.4 sequence failure During the transfer according to the "7.4 slave protocol" the master detected an error in the triple sequence of the slave. Possible causes:	
	1. Interference on the bus	► Remove cause of the interference.
	2. Software error in the AS-i slave	► Contact the AS-i specialist or manufacturer.
M13	Host timeout on 7.4 During the transfer according to the "7.4 slave protocol" the master detected a timeout in the communication with the operating system. Possible cause: Long PLC cycle which unacceptably slows down the transfer of the individual 7.4 segments of the operating system or PLC to the master: t > 1 s. If this occurs, the master ends the started 7.4 transfer and restarts the normal exchange of data with the concerned slave.	► Shorten PLC cycle by optimising the program. ► Avoid program loops and complex arithmetic operations.
M14	Invalid address This error message has a multiple meaning and depends on the requested command:	
	1. The attempt was made to write a parameter to slave 0.	► Correct slave address.
	2. During readdressing the address 0 or 0B was indicated as start and target address.	► Indicate valid address.
	3. During the attempt to write the "extended ID code 1" the address 0 was used.	► Indicate valid address.

Error message	Cause(s)	Remedy
M15	Slave aborted 7.4 The addressed 7.4 slave stopped the transfer. Possible cause: Error in the 7.4 data of the PLC. Possible causes:	
	1. Interference on the bus	► Remove cause of the interference.
	2. Software error in the AS-i slave	► Contact slave manufacturer.
M16	Slave deleted while 7.4 runs During an active 7.4 protocol transfer the slave was deleted from the list of active slaves by the master. Possible cause: interference on the bus.	► Remove cause of the interference.
M17	7.4 transfer busy The attempt was made to start a new 7.4 transfer during an active 7.4 protocol transfer.	► Repeat command.
M18	7.4 Host sequence failure The sequence bit was set to 1 by the host or the PLC although a value below 30 was indicated in the "Dlen" data field.	► Correct value "Dlen". or: ► Change sequence bit.
M19	7.4 Invalid data length, not MOD 3 divisor The indicated data length "Dlen" is no multiple of the factor 3.	► Correct value "Dlen" A 7.4 protocol transfer always consists of several data triples.
M20	Unknown command Master received an unknown command.	► Check the cause of the wrong command and correct.
M21	Safety monitor protocol error During the processing of the safety monitor protocol a transmission error occurred. Possible cause: interference on the bus	► Check and correct the cause of the wrong command.
M22	Timeout command	► Remove cause of the interference.
M23	Command preconditions failed Missing the necessary requirements for the requested master command.	► Correct the concerning parameters.
M24…M32	Not defined	Reserved
M33	Internal safety protocol error Error during processing of the protocol of the safety monitor on the AS-i line, phase "Init A".	► Improve the transmission quality of the AS-I wiring.

Error message	Cause(s)	Remedy
M34	Internal safety protocol error Error during processing of the protocol of the safety monitor on the AS-i line, phase "Init B".	► Improve the transmission quality of the AS-I wiring.
M35	Timeout on Safety Protocol Timeout during processing of the protocol of the safety monitor on the AS-i line.	► Improve the transmission quality of the AS-I wiring.
M36	SubCmd invalid The subcommand entry of the command _PCS_SAFETY_MONITOR is invalid.	► Use a permitted sub-command.
M37	Slaveaddress has no profile S-7.F.F The slave to be added to the list "LPM" (list of projected monitors) does not have the allowed profile in the CDI data.	► Correct the slave address to this of a slave with profil S-7.F.
M38	Slaveaddress out of valid range 1..31 The slave to be added to the list "LPM" does not have the allowed address.	► Correct the slave address to a value $1…31_{10}$.
M39	LPM already full The LPM list is already full so that no other entries can be added.	► Delete a non-used slave out of the LPM.
M40	Slaveaddress already in LPM	► Delete the slave out of the LPM.
M41	Slaveaddress not found in LPM	► Save the slave in the LPM.
M42	Monitor protocol changed The protocol of the safety monitor was interrupted during processing.	Only information for user. ► The last received data may be not consistent und should be requested again.
M43	HostCmd loop timeout Processing the command "_PCS_SAFETY_MONITOR" could not be started within the allowed time.	► Check the PLC command channel about a cyclical usage and interrupt this.
M44	Internal safety protocol error During processing of the protocol of the safety monitor an error occurred in the internal "AS-i master state machine".	► AS-I master must be cofigured new.

16.7 RTS errors: error codes R01...R46

RTS = RunTime System (operating system of the controllere)

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
R01	Unknown RTS operating mode The set operating mode of the device ("RUN" / "STOP" / "GATEWAY") is unknown to the operating system. Possible cause: modification of the device from a gateway variant into a device with PLC support.	► Switch off the device and keep the left function key pressed during the switch-on operation.
R02	Master1: MUX field failure During the transfer of the MUX fields by the operating system the master detected an invalid field number. Possible causes:	
	1. Overwriting parts of the operating system by the PLC	► Check the cause of the wrong command and correct. ► Reinstall the operating system.
	2. Unacceptable interference on the 24 V supply	► Grounding the device via the rail. ► Connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device. ► Repeat command.
R03	Master2: MUX field failure	→ R02
R04	Master1: Protocol Error (EDET) The master detected a protocol error during the transfer of the data fields.	→ R02
R05	Master2: Protocol Error (EDET)	→ R02
R06	General RTS program failure The operating system detected an invalid status in the process while executing the program internally. Possible cause: operating system software error.	► Reinstall the operating system.
R07	Projecting mode not active The attempt was made to execute an AS-i command which is only allowed in the "configuration mode".	► Change master to the operating mode "configuration mode": → page 116, chapter How are the operating modes for the AS-i master selected?

Error message	Cause(s)	Remedy
R08	No PLC program loaded The attempt was made to start a PLC program although no program had been loaded to the controllere.	► Load PLC program to the controllere: → page 124, chapter Connect the programming device
R09	RS-232 frame error (Baudrate) The hardware of the integrated serial interface chip found a transmission error in the RS-232C data flow. Possible causes:	
	1. Baud rate setting in the controllere is different from the setting in the PC.	► Adapt baud rate: → page 121, chapter Set the baud rate of the serial interface
	2 Other programs (e.g. Messenger) are using the RS-232-interface of the PC	► Exit other programs on the PC.
R10	RS-232 buffer overflow A buffer overflow was found in the serial receive buffer of the RS-232C interface. Possible causes:	
	1. RS-232 telegram too long or baud rate too high	► Check driver or reduce baud rate.
	2. Faulty connection cable between PC and RS-232C connection on the controllere	► Replace connection cable.
R11	RS-232 parity check The parity check of the serial data flow of the RS-232C interface failed. Possible cause: electromagnetic interference	► Reduce interference on the RS-232 cable by means of the following measures: - Screen cable - Reduce cable length - Remove interfering source
R12	ASC0 handler switched The decoding of the serial data flow was changed. Possible cause: during the serial data flow, command to change to the test mode / normal operating mode of the device.	► Remove error in the protocol driver.
R13	24V power unstable During normal operation voltage drops below 18 V were found on the 24 V power supply cable.	► Stabilise the 24 V supply voltage so that it is permanently above 20 V. Better: ► Use of the switched-mode power supply.

Error message	Cause(s)	Remedy
R14	24V power fail restart The voltage failure of the 24V power supply caused the device to start again.	► Acknowledge message > Controllere resumes normal operating mode. In future: ► Stabilise the 24 V supply voltage so that it is permanently above 20 V. Better: ► Use switched-mode power supply.
R15	C165 Watchdog timeout The main processor found timeout. Possible causes:	
	1. Unacceptable interference on the AS-i power supply 2. Unacceptably high electrostatic charges and electromagnetic fields in close proximity of the device	► Grounding the device via the rail. ► Connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device.
	3. Hardware fault	► Replace controllere and project again.
	4. Operating software error	► Reinstall operating system.
R16	Software restart The main processor detected a restart of the device which was not triggered by a voltage failure.	► Check cause, possibly supported by further error messages.
R17	Wait for 24V power After power-on of the device an unacceptably low 24 V power supply of < 18 V was detected.	► Acknowledge message. > Controllere resumes normal operating mode. In future: ► Stabilise the 24 V supply voltage so that it is permanently above 20 V. Better: ► Use switched-mode power supply.
R18	Master1: Host WDT failure During the continuous communication of the master with the operating system the master found a timeout. Possible causes:	
	1. Voltage drops on the 24 V power supply cable	► Use switched-mode power supply to supply the device.
	2. Operating system software error	► Reinstall operating system.
R19	Master2: Host WDT failure	→ R18

Error message	Cause(s)	Remedy
R20	*Only in AC1345/46, AC1355/56 and AC1365/66* Profibus DP configuration The configuration of the Profibus master for the device is not valid. Possible causes: • Module lengths incorrect • Number of modules incorrect • Sum of the data lengths across all modules too large	► Check received data lengths in the menu [Fieldbus Setup].
R21	*Only in AC1345/46, AC1355/56 and AC1365/66* No ifm DP interface detected A Profibus DP card is expected in the device, however, it was not detected. Possible cause: wrong operating system in the device: e.g.: AC1325 operating system software in AC1311.	► Install valid operating system.
R22	*Only in AC1345/46, AC1355/56 and AC1365/66* DP parameter invalid The parameter setting of the Profibus master for the device is not valid. Possible causes: • Structure of the parameter field incorrect • Length of the parameter field incorrect • Coding of the different parameters does not correspond to the specification	► Adopt parameter field from the GSD file and modify it according to the specification.
R23	*Only in AC1345/46, AC1355/56 and AC1365/66* DP parameter download The attempt to download the current / projected parameters of the AS-i slaves via the Profibus failed. Possible causes: • The slave to which the parameter was to be written was deleted from the list of detected slaves. • During the execution of the AS-i command "Write Parameter" a timeout was detected.	► Disconnect from the Profibus master. ► Reestablish the connection to the Profibus master. > Download the current / projected parameters of the AS-i slaves via the Profibus.

Error message	Cause(s)	Remedy
R24	Missing positive CPTE edge During communication with the master a change in the state of the control signal was not detected. Possible cause: operating system software error.	► Reinstall operating system.
R25	Master1: Unnormal operation The master signals that it is not in the "normal operating mode". Possible causes:	
	1. The master detects an AS-i voltage below 22 V and therefore goes into the "offline mode".	► Use of a switched-mode power supply to supply the device.
	2. The master received a request from the operating system to go to the "offline mode".	► Check cause of the wrong command and correct
	3. The master found a transmission error in the communication with the operating system.	→ R15
	4. Although connected to the AS-i power supply, the master found no slave on the AS-i bus.	► Check and correct wiring on the AS-i bus
	Other causes which can lead to an error message directly after power-on:	
	5. Initialisation of the master during power-on of the device failed.	→ page240, error message B01
	6. The master has not yet received the projection nor the projected parameters from the operating system.	→ page240, error message B01
	7. The master has not yet been started by the operating system.	→ page240, error message B01
R26	Master2: Unnormal operation	→ R25
R27	*Only for AC1305/06, AC1325/26* Profibus PLC access violation The PLC tried to access the protected address area of Profibus DP ASIC. Possible cause: A PLC project supporting an Anybus fieldbus card was loaded.	► Remove functions from the PLC project which control the Anybus card.
R28	Execution password protected. A function of the device was requested which is not allowed with the currently active password.	► Select higher password level: → page 142, chapter Password setting

Error message	Cause(s)	Remedy
R29	PC command unknown Unknown command received in the operating mode "test mode" of the device.	► Check the cause of the wrong command and correct.
R30	PC checksum failure In the operating mode "test mode" of the device an invalid checksum was found in the data flow.	► Configure data flow according to the specification.
R31	Menu not available The selected menu could not be displayed. Possible causes:	
	1. Required hardware is not available in the device	► Check data sheet.
	2. Required hardware was not detected when switching on the operating system RTS	► Switch the device off and on again.
R32	RTS checksum failure The checksum of the runtime system does not correspond to the stored checksum. Possible causes:	
	1. Flash memory faulty	► Replace faulty device.
	2. Strong ESD fields with unacceptable grounding of the device	► Minimise ESD fields. ► Correct grounding of the device.
R33	*Only for AC1353/54* No ifm ENET module detected The requierd Ethernet module could not be detected. Possible cause: faulty device	► Replace faulty device.
R34	Error in font data The data of the character set is not correct. Possible causes:	
	1. No data is available in the areas where font data is expected.	► Store the font data at the correct area.
	2. The expected formatting is not correct.	► Correct the formatting.

Error message	Cause(s)	Remedy
R35	Error in menu text Possible causes:	
	1. No data is available in the areas where menu text is expected.	► Store the menu text data at the correct area.
	2. The expected formatting is not correct	► Check and correct the formatting.
R36	Error in User Language Text of the user language is incorrect	► Check and correct the user language.
R37	Error in text format The indicated text format is incorrect	► Check and correct the formatting.
R38	*Only for AC1353/54* Command Request Eth.-Module The command for the Ethernet module could not be executed. Possible cause: No communication with the Ethernet module possible.	► Contact the AS-i specialist or manufacturer.
R39	*Only for AC1353/54* Request Timeout Eth.-Module Timeout occurred during the execution of a command of the Ethernet module.	► Repeat command.
R40	Const data checksum failure A checksum error occurred in the const. areas (character sets, system language, user language) of the runtime system.	► Reinstall operating system.
R41	*Only for AC1353/54* Zonetimeout DPRAM Timeout occurred during the communication between the runtime system and the Ethernet interface via DPRAM	► Switch off device for approx. 2 s, then switch on again. ► If error accours again contact the AS-i specialist or manufacturer.
R42	State error Eth.-Module The Ethernet interface has an invalid status.	→ R41
R43	Zonetimeout Netvar A timeout occurred during the communicaton of the network-global variables between the runtime system and the Ethernet interface via DPRAM.	→ R41
R44	Invalid AS-i command The via PLC command channel requested AS-I command number is not valid.	► Correct command number

Error message	Cause(s)	Remedy
R45	*Only in AC1345/46, AC1355/56 and AC1365/66* DP module 12 legal word access In the configuration of the Profibus DP modules a bad value for the interface memory was detected.	► Correct memory address.
R46	*Only in AC1345/46, AC1355/56 and AC1365/66* Internal DP stack error	► Send device to manufacturer.

16.8 Timeout errors: error codes T00...T13

- Menu operation interrupted.
- Error message superposes menu screen.
- Error message only disappears after:
  1. Error removed AND
  2. error message acknowledged with the right function key.

Error message	Cause(s)	Remedy
T00	Timeout communication master The operating system detected a timeout during communication with the master. Possible causes: • Unacceptable interference on the 24 V power supply. • Unacceptable interference on the AS-i power supply. • Unacceptably high electrostatic charges and electromagnetic fields in close proximity of the device.	► Grounding of the device via the rail, connection of the FE terminal to the machine ground. ► Use of a switched-mode power supply to supply the device.
T01	Timeout system cycle A system cycle took too long. Possible cause: overwriting of parts of the operating system in SRAM by the PLC.	► Check the cause of the wrong command and correct.
T02	Timeout ASI1 cmd channel 1 The operating system detected a timeout during the execution of a command for master 1 on channel 1. Possible cause: overwriting of the status information of the command channel by the PLC.	► Check the cause of the wrong command and correct.
T03	Timeout ASI1 cmd channel 2	→ T02
T04	Timeout ASI2 cmd channel 1	→ T02
T05	Timeout ASI2 cmd channel 2	→ T02
T06	Timeout PLC cycle A PLC cycle took too long. Possible cause: closed loop within the PLC.	► Check the cause of the wrong command and correct.

Error message	Cause(s)	Remedy
T07	Timeout command channel During the execution of a command started by the PLC a timeout was found. Possible causes: overwriting of the status information of the command channel by the PLC or an installed fieldbus	► Check the cause of the wrong command and correct.
T08	Timeout command channel request During the attempt to start a command on the command channel a timeout was detected. Possible causes:	
	1. Overwriting of the status information of the command channel by the PLC.	► Check the cause of the wrong command and correct.
	2. Permanent use of the command channel by the installed fieldbus	
T09	Timeout Fieldbus communication A timeout was detected during the communication of the device with the connected fieldbus. This monitoring is active after the device communicated via the connected fieldbus for the first time. Possible causes:	
	1. Fieldbus master stopped communication.	► Check the cause of the wrong command and correct.
	2. Connection cable interrupted.	► Check connection cable and correct.
T10	Timeout on master mode Changing the master to another operating mode failed. Possible cause: When changing to the "protected mode" the master detected a slave with the address 0 and therefore cannot change to this operating mode.	► Correct slave address. ► Repeat command.
T11	Timeout MUX actualisation A timeout was found during the update of the MUX fields, e.g.: analogue values of the slaves 1..31. Possible causes:	
	1. Overwriting of parts of the operating system by the PLC.	► Check the cause of the wrong command and correct.
	2. Interference on the 24 V power supply cable.	► Use of a switched-mode power supply to supply the device.

Error message	Cause(s)	Remedy
T12	*Only in AC1345/46, AC1355/56 and AC1365/66* Timeout send DP diagnosis The DP user diagnosis could not be transmitted. Possible causes:	
	1. Interference on the Profibus DP	► Check wiring of the Profibus system.
	2. The DP master no longer exchanges data with the device	► Check function of the Profibus master and the connection.
T13	*Only in AC1353/54/55/56* Timeout Glob.-Networkvariables The network-global variables could not be received / transmitted within 1 s. Possible causes: • Connection to host server lost. • Ethernet cable is no longer connected to the next Ethernet switch/hub.	► Check connection cables and terminals and correct. ► Controller using global networkvariables must be in run mode. ► Max. response time for UDP protocol must be ≤ 200 ms.

16.9 List of errors

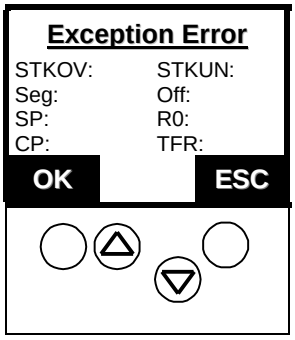
Incorrect behaviour	Cause(s)	Remedy
The controllere does not display the start screen after power-on. > Text/graphics display blank or not readable > LEDs light / flash mazily	• Error in the contents of the PLC memory, e.g.: program error in the boot project	► Switch off the device ► Press the left function key and keep it pressed ► Switch on the device again > Display can be read again ► Release the function key > PLC memory and boot project are irretrievably deleted ► Check PLC program in the PC and correct ► Store PLC program in the controllere and create it as boot project
	• Electromagnetic incompatibility	o Voltage supply does not correspond to AS-i rule? ► Rectify o Grounding not as specified? ► Rectify o Strong interference by neighbouring machines? ► If possible: change location ► Rectify or screen interfering machines
The text/graphics display is shaded. > Error message R16 appears.	AS-i supply voltage is < 18.2 V	o Overload of the AS-i power supply: too many slaves on one AS-i bus ► Distribute slaves to several AS-i masters ► Each AS-i master needs its own power supply
The text/graphics display indicates nothing any more (only background illumination active). All other functions of the controllere are not affected.	System error	► Press [▲] and [▼] at the same time for approx. 2 s > Text/graphics display is reinitialised > Language selection is active ► Quit language selection with [ESC]

Incorrect behaviour	Cause(s)	Remedy
The LDS slave list shows no slave with the address 0 although such a slave has just been connected.	At least one other slave with the address 0 is connected to the master.	► Remove last slave with the address 0 from the bus. ► Program the old slave with the address 0 to the intended address (→ page 127 or page 130). ► Connect the removed slave again. ► Reconfigure the controllere → page 134.
2 identical slaves with the same address on the AS-i master.	1. Application slave replacement: • Slave was replaced • The new slave did not have the address "0" before	> Red LED on the slave lights: slave was not correctly addressed. > Error message on the master: "slave not present".
	2. Application set-up: • Master in the configuration mode. • New slave addressed using handheld addressing unit and then connected.	> If the address is already occupied, the red LED on the slave lights: slave was not correctly addressed.
	3. Application set-up: • Master not in configuration mode.	> For al readdressed and connected slaves the red LEDs light: slaves were not correctly addressed. ► Reconfigure controllere → page 134. > If slaves with different profile: Red LED on the slave lights: slave was not correctly addressed. > If slaves with the same profile: First everything ok until different input signals, then message "configuration error".
The controllere does not react to the key being pressed or only with a long delay. > Error messages R02 to R05	The cycle time of the PLC is > 300 ms. Other processes in the controllere have priority.	► Check and rectify PLC program.
When changing the address of A/B slaves the controllere sometimes freezes in the "Wait" display.	System error.	► Quit the menu item with [ESC] (= right key).

16.10 How does the controllere react in case of an error?

Errors displayed during operation	Reaction
The slave is disconnected from the AS-i bus.	Slave without watchdog: Output signals remain unchanged. Slave with watchdog: Outputs switched off. AS-i master as PLC: **IMPORTANT**: evaluate the slave failure in the PLC program. If necessary: stop the machine/plant.
The AS-i master is disconnected from the fieldbus.	AS-i master as gateway: Outputs switched off. AS-i master as PLC: Input signals from the fieldbus master are reset. PLC triggers AS-i outputs with "0". **IMPORTANT**: evaluate the fieldbus failure in the PLC program. If necessary: stop the machine/plant.
Controllere fails as fieldbus slave.	Effect → description of the fieldbus master (host).

16.11 Hardware error, exception error



> The main processor detected an exception error

> All current activities are interrupted

► Power the controllere off and on again

► If without success: Note down the displayed information and contact a sales specialist

NOTE

If this error message is shown immediately after power-on, the execution of the PLC program can be prevented:

► During power-on press the left function key of the device and keep it pressed.

> The PLC program is declared "non valid", no longer initialised and no longer executed.

The following information in the TFR register provides details concerning the cause of the error:

TFR register															
D15	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
NMI	STKOF	STKUF	–	–	–	–	–	UNDOPC	–	–	–	PRTFLT	ILLOPA	ILLINA	ILLBUS

Bit	Name	Possible error source
NMI	Non maskable interrupt	Hardware
STKOF	Stack overflow	PLC program / hardware
STKUF	Stack underflow	PLC program / hardware
UNDOPC	Unknown machine command	PLC program / hardware
PRTFLT	32-bit execution code error	PLC program / hardware
ILLOPA	Invalid access to 16-bit operand	PLC program / hardware
ILLINA	Invalid jump address	PLC program / hardware
ILLBUS	Invalid access to external bus	Hardware

Examples:

TFR 0004 Invalid access to 16-bit operand, e.g. by the PLC

TFR 0002 Invalid jump address, e.g. by the PLC

17 Maintenance, repair and disposal

In case of correct use no maintenance and repair measures are necessary. Only the manufacturer is allowed to repair the device. If necessary, the device can be cleaned by qualified personnel using a dry cloth after disconnecting all connected circuits.

After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

18 Terms and abbreviations

A/B slave	→Slave with an A or B being appended to its address number and which is therefore allowed twice on →the master.
Address	This is the "name" of the bus participant. All participants need a clearly defined unique address so that the signals can be exchanged without problem.
AS-i	AS-i = **a**ctuator **s**ensor **i**nterface Bus system for the first binary field level.
ASIMON	Software for configuration of the AS-i safety monitor Download of the demo version: → www.ifm.com > Select country/language > [Service] > [Download] > [Bus system AS-Interface]
Baud	Baud, abbrev.: Bd = unit of measurement for the data transmission speed. Do not confuse baud with "bits per second" (bps, bits/s). Baud indicates the number of changes of state (steps, cycles) per second over a transmission length. But it is not defined how many bits per step are transmitted. The name baud can be traced back to the French inventor J. M. Baudot whose code was used for telex machines. 1 MBd = 1024 x 1024 Bd = 1 048 576 Bd
Bus	Serial data transmission of several participants on the same cable.
CAN	CAN = **C**ontroller **A**rea **N**etwork CAN is a priority-controlled fieldbus system for larger data volumes. It is available in different variants, e.g. CANopen, CAN in Automation (CiA) or →DeviceNet. CAN can be used e.g. as a supplier for AS-i over larger distances. Corresponding →gateways are available.
CoDeSys®	CoDeSys for Automation Alliance associates companies of the automation industry whose hardware devices are all programmed with the widely used IEC 61131-3 development tool CoDeSys®. CoDeSys® is a registered trademark of 3S – Smart Software Solutions GmbH, Germany.
Controllere	Master in the AS-i bus system of the generation E
DeviceNet	Fieldbus system for larger data volumes based on →CAN technology, requires special cables, complex connection technology. Can be used e.g. as a supplier for AS-i over longer distances. Corresponding →gateways are available.
DHCP	DHCP = **D**ynamic →**H**ost **C**onfiguration **P**rotocol DHCP is a protocol which offers the dynamic configuration of IP addresses and thus coherent information. The protocol supports use of IP addresses which are only available in limited number by a centralised management of the address assignment. The participant logs onto a server with this service when it is switched on in a network for the first time. The server assigns a local free IP address to the participant.
EMC	EMC = **E**lectro **M**agnetic **C**ompatibility According to the EC directive (89/336 EEC) regarding electromagnetic compatibility (short EMC Directive) there are requirements regarding the capacity of electrical and electronic equipment, installations, systems or components to operate satisfactorily in the given electromagnetic environment. The devices must not interfer with their environment and must not be negatively influenced by external electromagnetic interference.

Ethernet	Ethernet is a widely used, manufacturer-independent technnology which enables transmission of data in the network at a speed of 10 or 100 million bits per second (Mbps). Ethernet belongs to the family of so-called "optimum data transmission" on a non exclusive transmission medium. The concept was developed in 1972 and specified as IEEE 802.3 in 1985.
FE	FE = **F**unctional **E**arth Functional earth is a reference potential which is not connected to protective earth or only connected when special measures are taken. The functional earth serves as equalisation of potential for an ungrounded installation (e.g. SELV).
Fieldbus	A →bus for industrial applications: mechanically extremely robust and excellent data protection
Firmware	Basic program in the device, virtually the operating system The firmware establishes the connection between the hardware of the device and the user software.
Gateway	Coupler Gateways enable connection of completely different systems. Gateways are used when two incompatible network types are to be connected by converting the protocol of one system to the protocol of the other system. Here: Connection of AS-i to higher-level fieldbus systems such as →Profibus DP, →DeviceNet, Interbus-S or other interfaces, e.g. RS-485. The device includes an AS-i master which is directly coupled to the →host interface (e.g. →Profibus DP slave).
Host	The controller in the hierarchy above the AS-i master, e.g. a PLC or a processor, also called "fieldbus master".
ID	ID = **Id**entifier Name to differentiate the devices / participants connected to a system.
IP address	IP = **I**nternet **P**rotocol The IP address is a number which is necessary to clearly identify an internet participant. For the sake of clarity the number is written in 4 decimal values, e.g. 127.215.205.156.
LAS	**L**ist of **A**ctive **S**laves In this slave list the controllere enters the slaves detected as active for this AS-i master.
LDS	**L**ist of **D**etected **S**laves In this slave list the controllere enters the slaves detected as present for this AS-i master.
LED	LED = **L**ight **E**mitting **D**iode Light emitting diode, an electronic component with high coloured luminosity at small volume with a negligible power dissipation.
LFS	**L**ist of **F**ailed **S**laves In this slave list the controllere enters the slaves with a projection error on this AS-i master..
LPM	**L**ist of **P**rojected **M**onitors In this slave list the controllere enters the safety monitors projected for this AS-i master.
LPS	**L**ist of **P**rojected **S**laves In this slave list the controllere enters the slaves projected for this AS-i master.

MAC ID	MAC = **M**anufacturer's **A**ddress **C**ode →ID = **Id**entifier Every network card has an MAC address, a clearly defined worldwide unique numerical code, more or less a kind of serial number. Such an MAC address is a sequence of 6 hexadecimal numbers, e.g. "00-0C-6E-D0-02-3F".
Marginalia	Marginal column beside a text used for notes and comments. Because of its outstanding position well suited for quickly finding certain sections in the text.
Master	Handles the complete organisation on the bus. The master decides on the bus access time and polls the →slaves cyclically.
Master-slave communication	AS-i strictly operates to the master-slave principle. The master polls all slaves one after the other in always the same order. Only one master per network line is allowed (→cyclic polling).
MBd	→Baud
Modbus	The Modbus protocol is a communication protocol based on a →master/slave architecture and was generated by Modicon* in 1979 for communication with its PLCs. In industry, Modbus has become a de facto standard. Modbus/TCP is based on →Ethernet-TCP/IP. Modbus/TCP ports the protocol defined for the serial interface to TCP. The →IP address clearly identifies each device in a network. Therefore the slave address was used to identify one of several log i cal units (unit IDs) in a physical device. To do so, extended IP-addressing is used. **Example**: 192.168.83.28.1 means unit ID 1 on IP address 192.168.83.28. *) Modicon passed from AEG to Groupe Schneider in 1994.
Operating system	Basic program in the device, establishes the connection between the hardware of the device and the user software.
OSSD	OSSD = **O**utput **S**ignal **S**witching **D**evice here: output signal of an AS-i safety monitor
Password	In the menu item [Password] of the menu [System Setup] the operation can be restricted or enabled. When delivered, the device is in the user mode. By entering an invalid password (e.g. 1000) all menu items which can change settings are disabled. → page 141, chapter Password protection
PELV	PELV = **P**rotective **E**xtra **L**ow **V**oltage Functional extra low voltage with safe separation, grounded variant of SELV. Extra low voltage with safe separation (grounded variant of SELV). The specification as PELV system to IEC364-4-41 (initially DIN VDE 0100-410:1997-01) covers a measure to protect against direct and indirect contact with dangerous voltages by a "safe separation" between primary and secondary side in the device (e.g. power supply to PELV specification). For this reason no separate PE conductor is required in a PELV system. It is allowed to ground circuits and / or bodies in a PELV system.
Pictograms	Image symbols which convey information by a simplified graphic representation. → page 9, chapter What do the symbols and formats stand for?

Polling	The controller master gets the data from every participant in the system one after the other: 1. Master calls participant 1 2. Participant 1 responds with its current data (current values) 3. Master transfers more data (target values) to participant 1, if needed 4. Participant 1 acknowledges reception of the data etc. the same procedure for all other participants. Cyclic polling: AS-i master cyclically polls the data of all →slaves in the bus (see above). The data is updated in the →master after max. 5 ms. If A/B slaves are used, the →cycle time can be 10 ms.
Profibus	Fieldbus system for larger data volumes, requires special cables, complex connection technology. Different variants are available: →Profibus FMS, DP or PA. Profibus DP can be used e.g. as a supplier for AS-i over longer distances. Corresponding →gateways are available.
Profibus FMS	Profibus FMS (**F**ieldbus **M**essage **S**pecification) to network controllers - no longer standardised as from 2007
Profibus DP	Profibus DP (**D**ecentralised **P**eriphery) to trigger sensors and actuators by a central controller in production technology. In particular the numerous standard diagnostic options are important. More applications are the connection of "distributed intelligence", i.e. networking of several controllers among each other (similar to →Profibus-FMS). Data rates up to 12 Mbits/s on twisted two-wire cables and/or fibre optics are possible.
Profibus PA	Profibus PA (**P**rocess-**A**utomation) is used to control field devices by means of a process control system in process technology. This PROFIBUS variant is suitable for hazardous areas (zones 0 and 1). Only a small current flows on the bus cables in an intrinsically safe circuit so that even in case of a problem no sparks are produced. The disadvantage of this variant is the slower data transmission rate.
Remanent	Remanent data is protected against data loss in case of power failure. The operating system for example automatically copies the remanent data to a flash memory as soon as the voltage supply falls below a critical value. If the voltage supply is available again, the operating system loads the remanent data back to the RAM memory. The data in the RAM memory of a controller, however, is volatile and normally lost in case of power failure.
RTS	RTS = **R**un**T**ime **S**ystem Runtime systems are basic versions of applications. These minimum versions are supplied with certain products to meet the prerequisites for the execution of the actual product or to be able to look at or use results generated by this product on other processors: Making available all routines required to execute a program in a programming language, e.g. interactions with the operating system, memory requirements, error routines, inputs and outputs.

SELV	SELV = **S**afety **E**xtra **L**ow **V**oltage Active parts integrated in SELV circuits must not be connected to ground or protective conductors of other circuits. They must be safely separated from active parts with higher voltage. SELV circuit = secondary circuit (output voltage) which is rated and protected so that its voltages do not exceed a safe value in case of correct operation (of the power supply) or in case of a single fault (of the power supply). SELV circuits are separated from the input voltage (mains voltage) by double or enhanced insulation. The voltage must not exceed 60 V DC (or 42.4 V AC).
Single slave	→Slave whose address number may only occur once on the →master.
Slave	Passive participant on the bus, only responds on request of the →master. Slaves have a clearly defined and unique →address in the bus. A distinction is made between: • Single slaves whose address • number may only be present once on the master and A/B slaves with an A or B being appended to the address number and which may therefore be present twice.
Target	The target indicates the target system where the PLC program is to run. The target contains the files (drivers) required for programming and parameter setting.
Unit ID	→Modbus
Watchdog	In general the term watchdog is used for a component of a system which watches the function of other components. If a possible malfunction is detected, this is either signalled or suitable program branchings are activated. The signal or the branchings serve as trigger for other co-operating system components which are to solve the problem.
Cycle time	This is the time for a cycle. The following process happens: PLC cycle: The PLC program performs one complete run. AS-i cycle: all AS-i slaves are updated (5...10 ms).

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NOTE

nn-n The indication of the page where you can find some information about the keyword is written in normal characters.

ii-i The indication *of* the page where the keyword is detailed is written in *italics*.

Table of keywords

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