ifm electronic

Supplementary device manual

EtherCAT interface in the AS-i controllerE

ecomat300

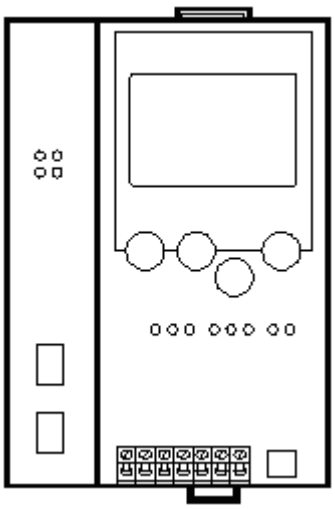
AC1391
AC1392

firmware version RTS 2.x

target from 15

for CoDeSys® from version 2.3

English



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Contents

1 On this manual

In this chapter we will give you an overview of the following points.

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

1.1 What do the symbols and formats mean?

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 may result.

NOTE

Important notes concerning malfunctions or disturbances.

Info

Other remarks

► ...	Request for action
> ...	Reaction, result
→ ...	"see"
abc	Cross-reference
[...]	Designation of keys, buttons or indications

1.2 What devices are described in this manual?

This manual describes the AS-i device family controllerE from **ifm electronic gmbh**.

- according to AS-i master specification 3.0 (M4)
- with a firmware from version RTS 2.3 onwards
- with the target from 15 onwards.
- with the option EtherCAT fieldbus interface

In this supplementary manual only the above-mentioned EtherCAT fieldbus interface is described. Higher-level or general information → Basic 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.
- You can also find a requested term quickly with the index at the end of the manual.
- At the beginning of a chapter we will give you a brief overview of its contents.

Headers		You can find the title of the current chapter in bold in the header of each page. Next to it you find the current title of the second order.
Footers		You can find the number of the page in the footer of each page.

Abbreviations and technical terms → chapter Terms, abbreviations (→ page 122).

We reserve the right to make alterations which can result in a change of contents of the instructions. You can find the current version on **ifm's** website at:
http://www.ifm-electronic.com/ifmde/web/asi_down.htm

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?

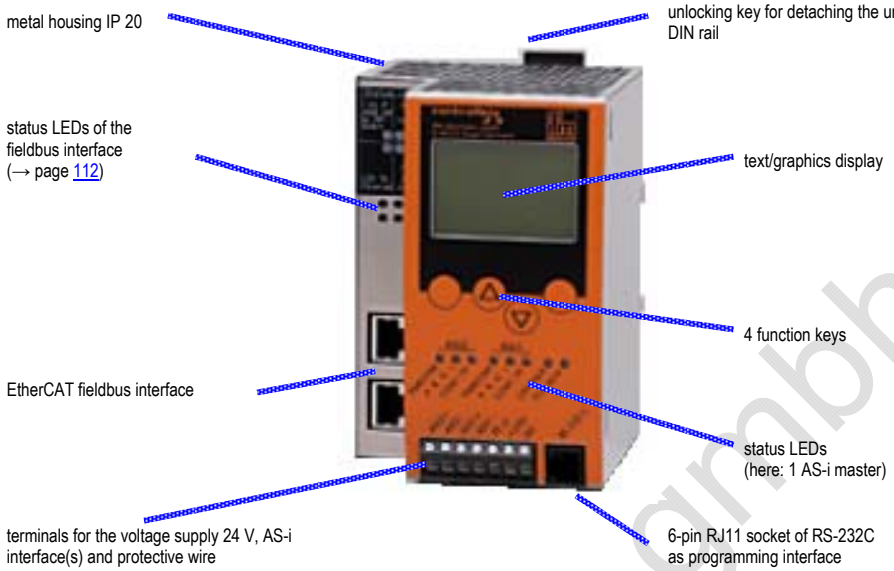


figure: overview controllerE

2 Safety instructions

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

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

2.1 General

→ separate basic instructions of the device manual

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 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 in this manual before working on and 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 mount, 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.

2.3 Functions and features

→ separate basic instructions of the device manual

3 System requirements

3.1 Information about the device

→ separate basic instructions of the device manual

This manual describes the AS-i controllerE device family from ifm electronic gmbh with the option EtherCAT fieldbus interface.

3.2 Information concerning the software

→ separate basic instructions of the device manual

3.3 Required accessories

Basic functions → separate basic instructions of the device manual

For configuration and programming you also need:

- the software "CoDeSys for Automation Alliance™" version 2.3 or higher (→ CD)
- for direct connection of the controllerE to a PC with serial interface:
  programming cable art. no. E70320

4 Getting started

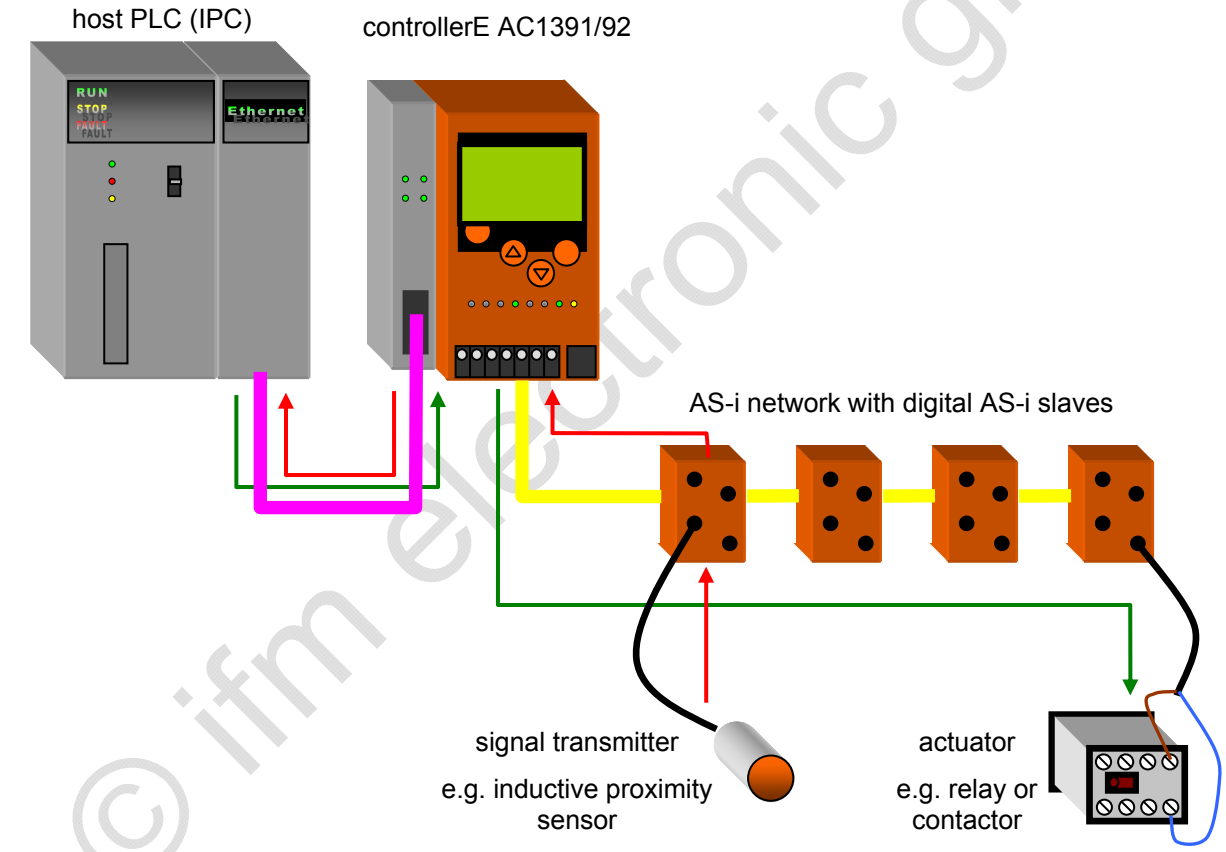
4.1 Overview

The chapter General set-up procedure (→ page 15) illustrates the general set-up procedure for the controllerE devices AC1391 / AC1392 by means of 2 flowcharts. Possible error states and the corresponding corrective measures are described in additional tables in this chapter.

The chapter "Connect the Beckhoff industrial PC via EtherCAT " (→ page 19) shows a configuration example of a connection between a Beckhoff industrial PC and the controllerE. These quick instructions presuppose the following:

- 16 bytes digital input and 16 bytes digital output data are to be exchanged between the connected host and the controllerE. Accordingly, the fieldbus modules 1 and 2 are both set to 16 bytes (→ pages 24 and 25).
- The controllerE and the industrial PC are switched on and connected to each other via Ethernet.

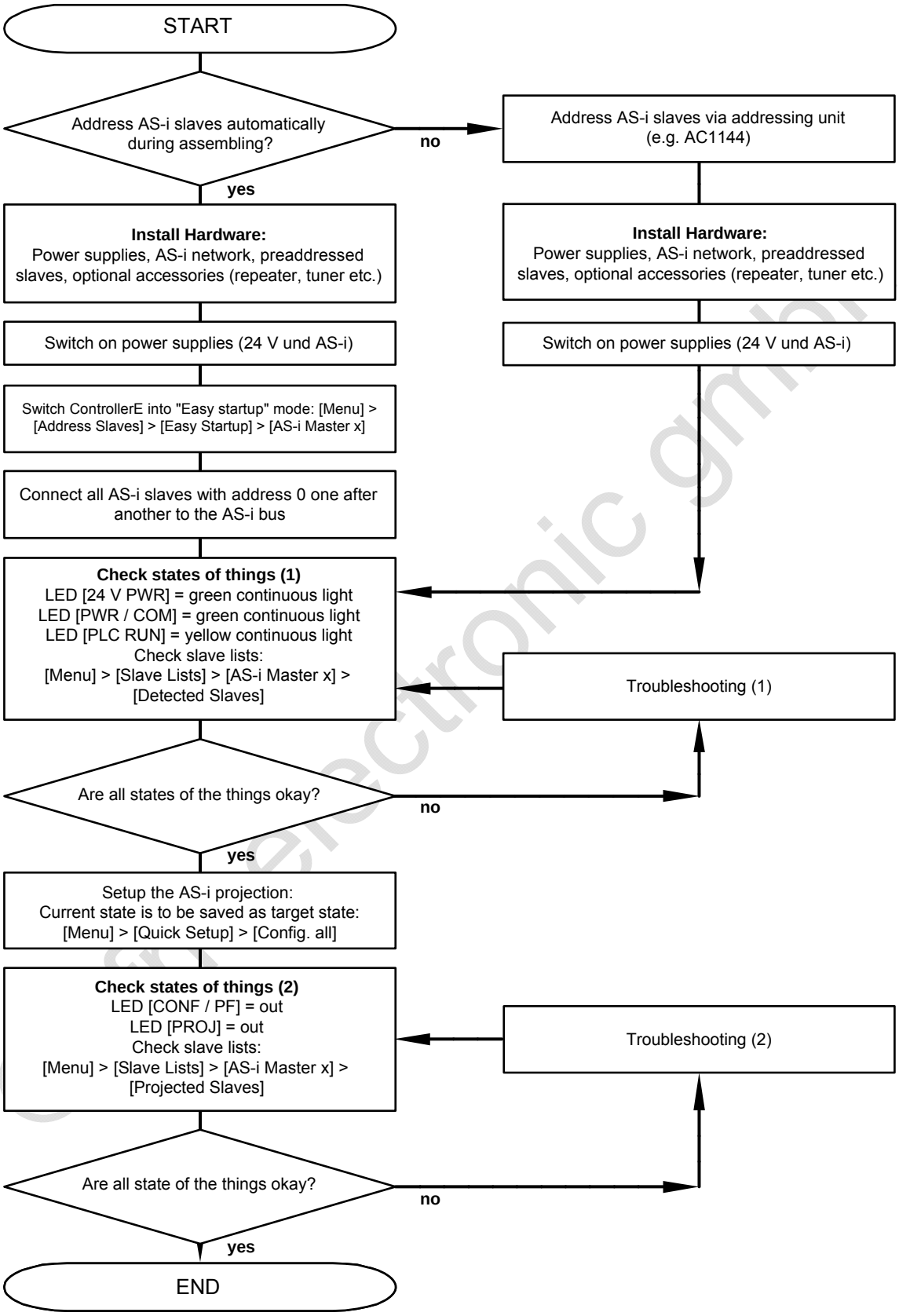
The following diagram is supposed to give an overview of the system structure and the corresponding data flow.



data flow of the input signals

data flow of the output signals

4.2 General set-up procedure



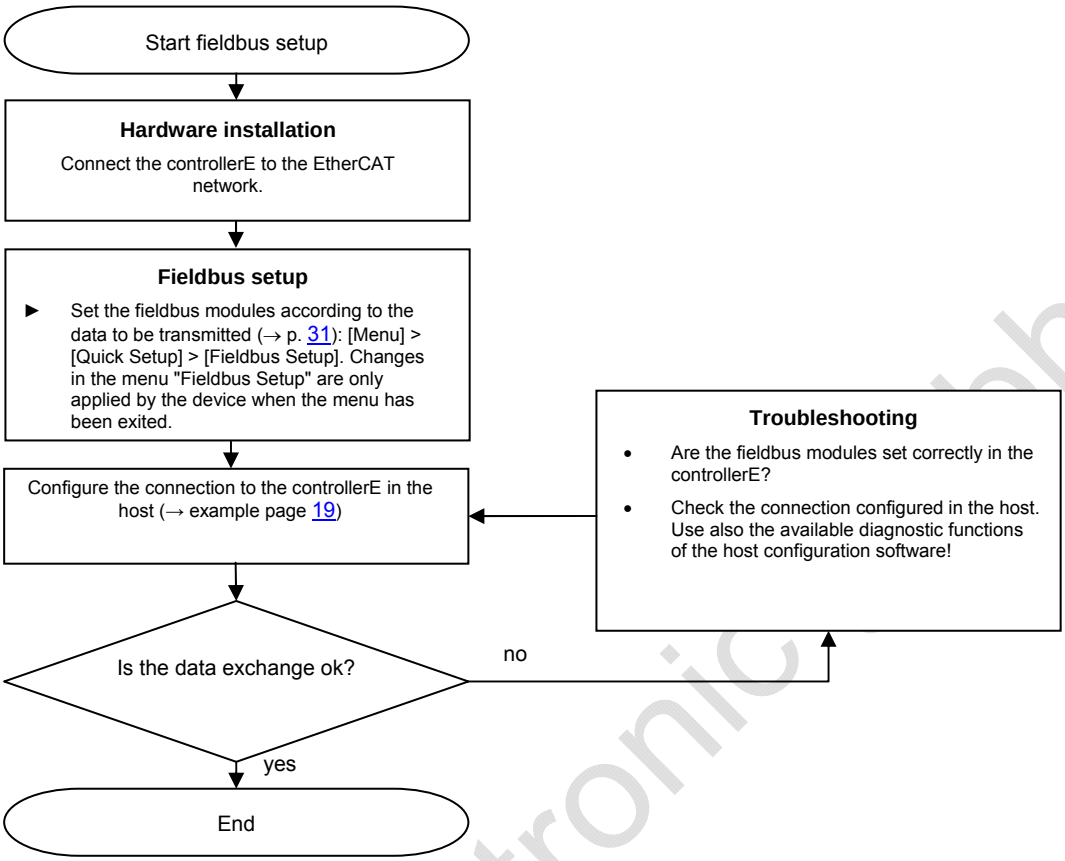
4.2.1 Troubleshooting (1)

Checkpoint	Status	Possible cause	Remedy
LED [24 V PWR]	out	24 V voltage supply not ok.	► Check 24 V voltage supply!
LED [PWR / COM]	out	AS-i voltage supply not ok.	► Check AS-i voltage supply!
	green flashing	AS-i voltage supply ok but no AS-i slave detected on the bus.	► Check wiring of the AS-i network! Adhere to the maximum admissible cable lengths!
LED [PLC RUN]	yellow flashing	The controllerE PLC is in the operating mode STOP.	► Switch PLC to the operating mode RUN! ([Menu] > [PLC Setup] > [PLC Settings] > [Run]) ► If switching is not possible: Is the project "CO_M4_xxx.pro" stored in the controllerE as a boot project? ([Menu] > [PLC Setup] > [PLC Info])
Slave lists (detected slaves)	The connected AS-i slaves are not detected correctly.	Wiring fault in the AS-i network.	► Check wiring of the AS-i network! Adhere to the maximum admissible cable lengths!
		There is double addressing, i.e. two or more participants have been set to the same AS-i address.	► Check the addresses of the connected AS-i slaves!

4.2.2 Troubleshooting (2)

Checkpoint	Status	Possible cause	Remedy
LED [CONF / PF]	red flashing	One of the connected AS-i slaves causes a periphery fault.	► Read the error messages on the display of the controllerE and determine the concerned slave address(es)! ► Read in the corresponding installation instructions of the concerned slaves what might cause a peripheral fault in the corresponding unit! ► Remove this cause!
	red permanently lit (configuration error)	The list of activated slaves does not correspond to the list of projected slaves.	► Check the wiring of the AS-i network, in particular the wiring of the slaves which are projected but not activated (→ [Menu] > [Slave Lists] >...)! ► Adhere to the maximum admissible cable lengths!
		The configuration of the AS-i network was changed after executing the function [Config all] (slave(s) added, slave(s) removed, slave(s) replaced by another type).	► Check the AS-i configuration! ► If the configuration is ok and the LED [CONF / PF] still is permanently lit: Repeat the function [Config all] ([Menu] > [Quick Setup] > [Config all])!
LED [PROJ]	yellow flashing	The AS-i master is in the Config mode. Switching to the protected mode is not possible because at least one slave with the address 0 was detected on the bus.	► Correct the AS-i configuration according to your requests! ► Repeat the function [Config all] ([Menu] > [Quick Setup] > [Config all])!
	yellow permanently lit	The AS-i master is in the config mode.	► Switch the AS-i master to the protected mode ([Menu] > [Master Setup] > [AS-i Master x] > [Operation Mode] > [Protected Mode)!

4.3 Fieldbus setup (overview)



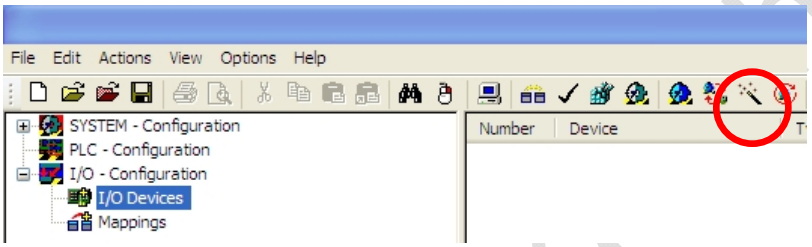
4.4 Connect the Beckhoff industrial PC via EtherCAT

► Copy manually the XML description file of the controllerE into the TwinCat directory …\TwinCAT\IO\EtherCAT. This is to be carried out only once: before the controllerE is used with TwinCAT for the first time.

► Start the software "TwinCAT System Manager" on the PC.

► Mark the icon [I/O devices].

► Click on the icon [Magic wand] in the tool bar (→ figure)

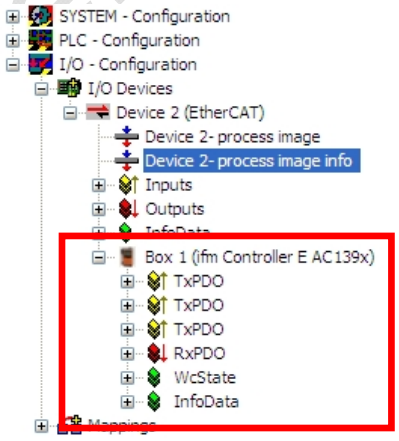


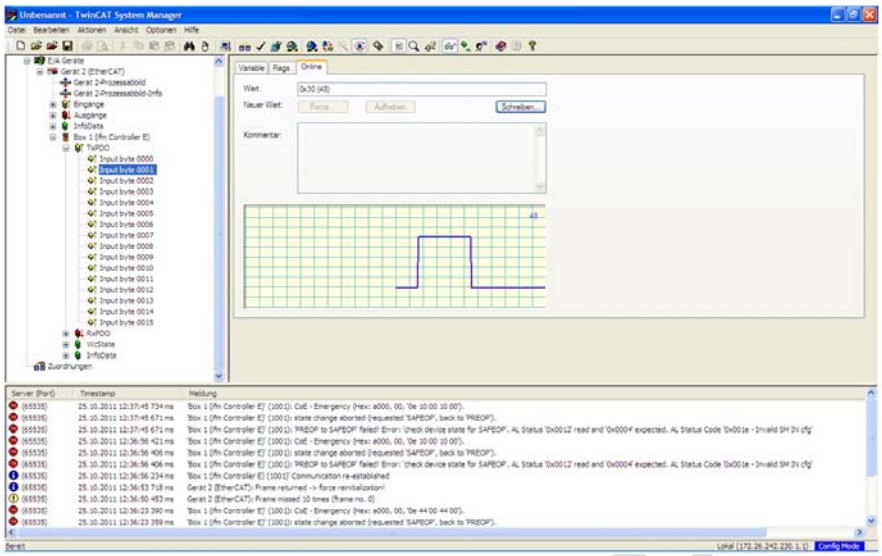
► Select the Ethernet interface.

► Confirm with [OK].

► Confirm with [Yes].

> The AC1391/92 controller appears below the selected interface. The I/O data set in the "Fieldbus Setup" are directly available in the transmit PDOs and the receive PDOs.



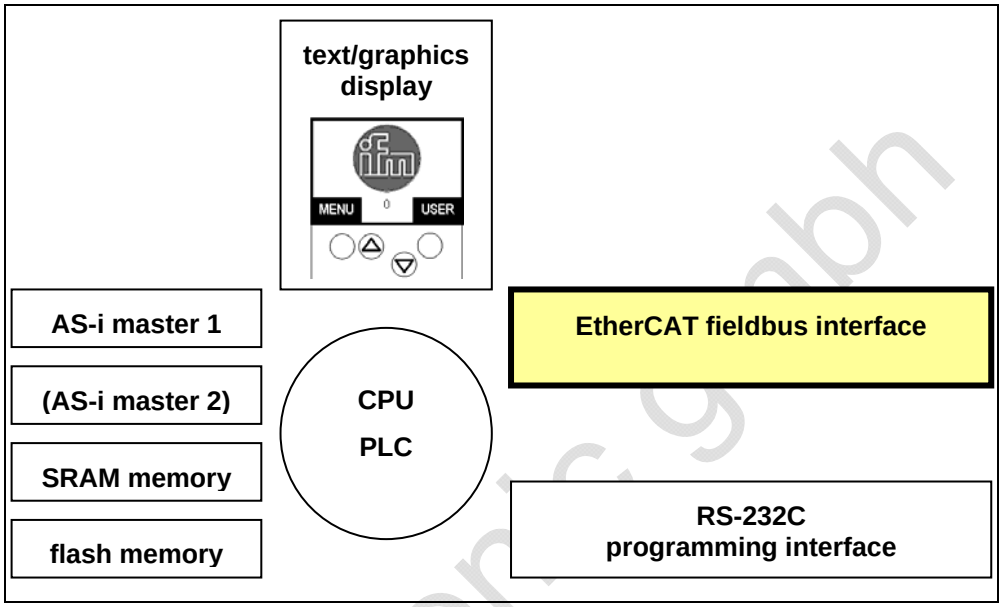
Input and output data can be read and written.	

5 Function

Basic functions → separate basic instructions of the device manual

5.1 Data management

The controllerE consists of different units:



This manual exclusively describes the following subject:

- With the optional **EtherCAT fieldbus interface** the device can be connected to other control systems.

5.2 The EtherCAT fieldbus interface

The AS-i controllerE devices AC1391 and AC1392 contain an EtherCAT fieldbus interface. Connection to the EtherCAT network is done via the integrated Ethernet 2-port switch.

The internal data exchange between the EtherCAT fieldbus interface and the PLC function in the controllerE is carried out via a transfer memory (dual-ported RAM or short DPRAM) which contains a maximum of 512 bytes of input data and 512 bytes of output data.

5.2.1 Connection of the hardware

The controllerE devices AC1391 and AC1392 contain an integrated Ethernet 2-port switch via which the devices can be connected to the Ethernet. For wiring, standard Ethernet cables with RJ45 connectors can be used.

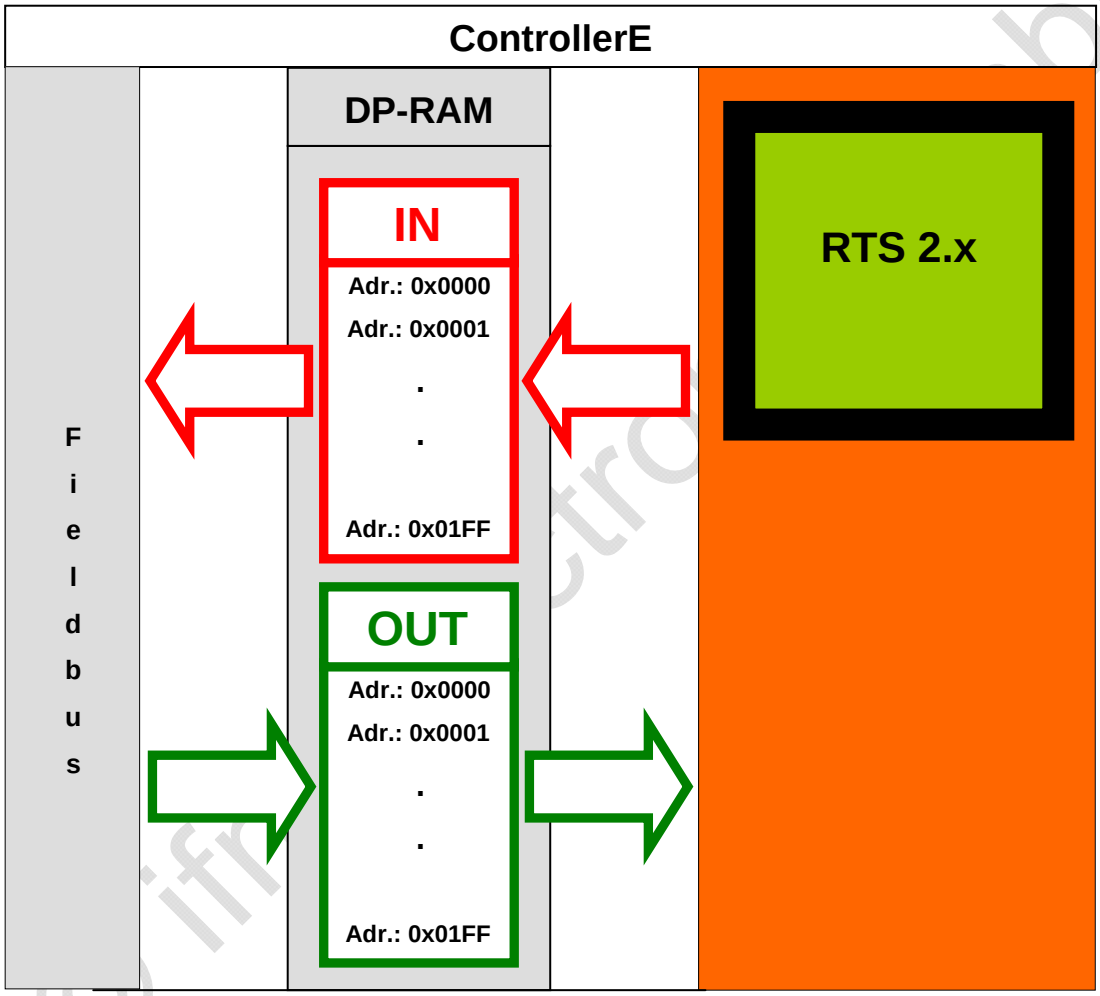
5.2.2 The dual-ported RAM

In order to understand the settings of the fieldbus interface it is important to understand the function of the dual-ported RAM. The dual-ported RAM, in the following called DP-RAM, is a memory range which constitutes the interface between the controllerE data and the data of the fieldbus interface. The DP-RAM consists of two different ranges:

- the so-called **IN** range which provides data from the controllerE to the fieldbus interface (controllerE output data)
- the so-called **OUT** range which provides data from the fieldbus interface to the controllerE (controllerE input data).

Both ranges have each a size of 512 bytes.

The following figure shows the correlations in the data flow:



5.3 The fieldbus modules

As with all controllerE units with fieldbus interface, the information to be exchanged is subdivided into logical blocks: the so-called fieldbus modules – in the following called modules. These modules often have a variable size (data length). The contents (the data) of the modules depend on the type of information to be transmitted. The modules can be set, activated / deactivated in the user menu [Fieldbus Setup].

When activating modules with controllerE output data (data from the controllerE to the fieldbus interface), these data are consistently copied in their set lengths and in the order of the activated module numbers into the IN range of the DP-RAM.

The activation of modules with controllerE input data (data from the fieldbus interface to the controllerE) specifies how the data of the DP-RAM OUT range are to be interpreted by the controllerE. Here, the sequence of the activated module numbers and the set length are decisive again. The EtherCAT controllerE devices provide 19 modules. The following table gives a quick overview of the modules and the setting options.

Module	Direction of data	Possible settings	Information about the setting values	
Module 1: digital input master 1(A) (→ page 24)	C ⇒ F	0…16	0 1...16	deactivated number of bytes
Module 2: digital output master 1(A) (→ page 25)	C ⇐ F			
Module 3: digital input master 2(A) (→ page 26)	C ⇒ F			
Module 4: digital output master 2(A) (→ page 26)	C ⇐ F			
Module 5: digital input master 1(B) (→ page 27)	C ⇒ F			
Module 6: digital output master 1(B) (→ page 28)	C ⇐ F			
Module 7: digital input master 2(B) (→ page 29)	C ⇒ F			
Module 8: digital output master 2(B) (→ page 29)	C ⇐ F			
Module 9: analogue multiplex input (→ page 30)	C ⇔ F	0 / 1	0 1	deactivated activated
Module 10: analogue multiplex output (→ page 32)	C ⇔ F			
Module 11: fieldbus data command channel (→ page 34)	C ⇔ F			
Module 12: fieldbus data PLC input (→ page 37)	C ⇐ F	0…128	0 1...128	deactivated number of bytes
Module 13: fieldbus data PLC output (→ page 38)	C ⇒ F			
Module 14: analogue input master 1 (→ page 39)	C ⇒ F	0…31	0 1...17 / 31	deactivated 4 words analogue data respectively
Module 15: analogue output master 1 (→ page 45)	C ⇐ F	0…17		
Module 16: analogue input master 2 (→ page 51)	C ⇒ F	0…31		
Module 17: analogue output master 2 (→ page 52)	C ⇐ F	0…17		
Module 18: fieldbus data diagnosis (→ page 53)	C ⇒ F	0 / 1 / 2	0 1 2	deactivated activated for master 1 activated for master 1 + 2
Module 19: host command channel (→ page 54)	C ⇔ F	0 / 1 / 2	0 1 2	deactivated activated (5 words) activated (18 words)

C ⇒ F	Data from the controllerE to the fieldbus interface (controllerE output data)
C ⇐ F	Data from the fieldbus interface to the controllerE (controllerE input data)
C ⇔ F	Bidirectional data (controllerE output data as well as controllerE input data)

5.3.1 Module 1 – digital input master 1(A)

Data content

Binary input data of the digital single or A slave of AS-i master 1

Direction of data

Data from the controllerE to the fieldbus interface

Module settings

Value range	0…16 [bytes]
0	module is deactivated
1…16	module is activated (details → data interpretation)

Data interpretation

In each transmitted byte, the digital signals of 2 AS-i slaves can be transmitted. The position of the data in this memory range depends on the AS-i address of the corresponding slave. Therefore the value to be set is based on the highest AS-i slave address of the used digital input slaves and not on the number of used slaves. The following table shows the allocation of AS-i slave addresses to the module settings. Given that the AS-i slave address 0 is not available for cyclical data exchange, this range is used for the transmission of status information of the AS-i master.

Setting value [byte]	AS-i slave addresses	
1	0 (status master)	1
2	2	3
3	4	5
4	6	7
5	8	9
6	10	11
7	12	13
8	14	15
9	16	17
10	18	19
11	20	21
12	22	23
13	24	25
14	26	27
15	28	29
16	30	31

Bit →	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Status information AS-i master			
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**
reserved	configuration error in the AS-i circuit or AS-i voltage too low	AS-i master is offline (AS-i data invalid)	peripheral fault in the AS-i circuit

Examples for module 1

Task 1:	The digital input signals of the AS-i slaves 1...3 are to be transmitted. To do so, to which value must module 1 be set at least?
Solution:	The highest used AS-i slave address is 3. According to the table, the data of the AS-i slave 3 are stored **in byte 2** of the module. Therefore, module 1 must be at least set to the value **2**.
Task 2:	The digital input signals of the AS-i slaves 2, 13 and 28 are to be transmitted. To do so, to which value must module 1 be set at least? Where can the data of slave 13 be found?
Solution:	The highest used AS-i slave address is 28. According to the table, the data of AS-i slave 28 **are stored in byte 15** of the module. Therefore module 1 must be at least set to the value **15**. The data of slave 13 are stored in byte 7 in the bits 0...3.

5.3.2 Module 2 – digital output master 1(A)

Data content	Binary output data of the digital single or A slaves of AS-i master 1
Direction of data	Data from the fieldbus interface to the controllerE
Module settings	Value range: 0…16 [bytes] 0: module is deactivated 1…16: module is activated (details → data interpretation)
Data interpretation	In each transmitted byte, the digital signals of 2 AS-i slaves can be transmitted. The position of the data in this memory range depends on the AS-i address of the corresponding slave. Therefore the value to be set is based on the highest AS-i slave address of the used digital output slaves and not on the number of used slaves. The following table shows the allocation of AS-i slave addresses to the module settings. The data range of the AS-i slave address 0 is not used.

Setting value [byte]	AS-i slave addresses	
1	0	1
2	2	3
3	4	5
4	6	7
5	8	9
6	10	11
7	12	13
8	14	15
9	16	17
10	18	19
11	20	21
12	22	23
13	24	25
14	26	27
15	28	29
16	30	31
Bit →	**7 6 5 4 3 2 1 0**	

Examples for module 2

Task 1:	The digital output signals of the AS-i slaves 1 and 2 are to be transmitted. To do so, to which value must module 2 be set?
Solution:	The highest used AS-i slave address is 2. According to the table, the data of the AS-i slave 2 are stored **in byte 2** of the module. Therefore, module 2 must be at least set to the value **2**.
Task 2:	The digital output signals of the AS-i slaves 5, 17 and 30 are to be transmitted. To do so, to which value must module 2 be set?
Solution:	The highest used AS-i slave address is 30. According to the table, the data of the AS-i slave 30 are stored **in byte 16** of the module. Therefore, module 2 must be set to the value **16**.

5.3.3 Module 3 – digital input master 2(A)

Data content	Binary input data of the digital single or A slave of AS-i master 2
Direction of data	Data from the controllerE to the fieldbus interface
Module settings	Value range: 0…16 [bytes] 0: module is deactivated 1…16: module is activated (details → data interpretation)
Data interpretation	→ module 1 (→ page 24)
Examples	→ module 1 (→ page 24)

5.3.4 Module 4 – digital output master 2(A)

Data content	Binary output data of the digital single or A slaves of AS-i master 2
Direction of data	Data from the fieldbus interface to the controllerE
Module settings	Value range: 0…16 [bytes] 0: module is deactivated 1…16: module is activated (details → data interpretation)
Data interpretation	→ module 2 (→ page 25)
Examples	→ module 2 (→ page 25)

5.3.5 Module 5 – digital input master 1(B)

Data content

Binary input data of the digital B slaves of AS-i master 1

Direction of data

Data from the controllerE to the fieldbus interface

Module settings

Value range	0…16 [bytes]
0	module is deactivated
1…16	module is activated (details → data interpretation)

Data interpretation

In each transmitted byte, the digital signals of 2 AS-i slaves can be transmitted. The position of the data in this memory range depends on the AS-i address of the corresponding slave. Therefore the value to be set is based on the highest AS-i slave address of the used digital input slaves and not on the number of used slaves. The following table shows the allocation of AS-i slave addresses to the module settings. The data range of the AS-i slave address 0 is not used.

Setting value [byte]	AS-i slave addresses	
1	0	1
2	2	3
3	4	5
4	6	7
5	8	9
6	10	11
7	12	13
8	14	15
9	16	17
10	18	19
11	20	21
12	22	23
13	24	25
14	26	27
15	28	29
16	30	31

Bit →	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Examples

→ module 1 (→ page 24)

5.3.6 Module 6 – digital output master 1(B)

Data content

Binary output data of the digital B slaves of AS-i master 1

Direction of data

Data from the fieldbus interface to the controllerE

Module settings

Value range	0…16 [bytes]
0	module is deactivated
1…16	module is activated (details → data interpretation)

Data interpretation

In each transmitted byte, the digital signals of 2 AS-i slaves can be transmitted. The position of the data in this memory range depends on the AS-i address of the corresponding slave. Therefore the value to be set is based on the highest AS-i slave address of the used digital output slaves and not on the number of used slaves. The following table shows the allocation of AS-i slave addresses to the module settings. The data range of the AS-i slave address 0 is not used.

Setting value [byte]	AS-i slave addresses	
1	0	1
2	2	3
3	4	5
4	6	7
5	8	9
6	10	11
7	12	13
8	14	15
9	16	17
10	18	19
11	20	21
12	22	23
13	24	25
14	26	27
15	28	29
16	30	31
Bit →	**7 6 5 4**	**3 2 1 0**

Examples

→ module 2 (→ page 25)

5.3.7 Module 7 – digital input master 2(B)

Data content	Binary input data of the digital B slaves of AS-i master 2.
Direction of data	Data from the controllerE to the fieldbus interface
Module settings	Value range: 0…16 [bytes] 0: module is deactivated 1…16: module is activated (details → data interpretation)
Data interpretation	→ module 5 (→ page 27)
Examples	→ module 5 (→ page 27)

5.3.8 Module 8 – digital output master 2(B)

Data content	Binary output data of the digital B slaves of AS-i master 2
Direction of data	Data from the fieldbus interface to the controllerE
Module settings	Value range: 0…16 [bytes] 0: module is deactivated 1…16: module is activated (details → data interpretation)
Data interpretation	→ module 6 (→ page 28)
Examples	→ module 6 (→ page 28)

5.3.9 Additional notes on the modules 1...8

We recommend you to set the setting values of the modules 1...8 to even values, otherwise a byte offset might occur in the following modules.

5.3.10 Module 9 – analogue multiplex input

Data content

Analogue input data of the slaves of the AS-i masters 1 + 2

Note

The data of analogue input slaves with the following AS-i slave addresses can be read directly via the modules 14 (master 1) (→ page 39) and 16 (master 2) (→ page 51):

- 1...31 (setting 4 channels per slave)
- 1...31 (setting 1 channel per slave)

Changing the setting "Channels per slave" (→ page 111)

Module 9 has thus only to be used if the data cannot be directly read via the modules 14 or 16.

Direction of data

Bidirectional (2 words = 4 bytes in both directions)

Module settings

Value range	0 / 1
0	module is deactivated
1	module is activated (details → data interpretation)

Data interpretation

Using module 9, analogue input data of an AS-i slave with any AS-i address can be retrieved. The information which channel of which AS-i slave on which master is to be read must be given to the controllerE via the fieldbus interface. The controllerE replies to such a request with a copy of the request data and the corresponding analogue value. As a result, only one specific analogue value can be transmitted at a time by module 9. This process is called multiplexing.

Syntax:

Requirement: 4 bytes from the fieldbus interface to the controllerE

Byte	Bit							
	7	6	5	4	3	2	1	0
n	0	0	0	0	0	0	C	C
n+1	M	M	X	S	S	S	S	S
n+2	not used							
n+3	not used							

CC	channel number (0...3) corresponds to the effective channel designations 1...4 (labelling on the unit)
MM	master number (1 or 2)
X	0 = single or A slave 1 = B slave
SSSS	5 bit slave number (1…31)

controllerE response: 4 bytes from the controllerE to the fieldbus interface

Bytes n and n+1: copy of the request

Byte	Bit							
	7	6	5	4	3	2	1	0
n	E	E	E	E	0	0	C	C
n+1	M	M	X	S	S	S	S	S
n+2	analogue value (low byte)							
n+3	analogue value (high byte)							

E_4 = the selected channel is invalid (NOT valid flag),

E_5 = channel overflow (overflow flag),

E_6 = reserved,

E_7 = data exchange error with the slave (NOT transfer valid flag).

Example for module 9

Task: Channel 2 (according to the labelling on the unit) of the analogue input slave with the AS-i address 21 on master 2 is to be read.

Solution:

Requirement:

Word	**1**															
Byte	**1**								**0**							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1
	master 2		↓	slave 21											channel 2	
			single slave													

value

meaning

Word 2: not used

controllerE response:

Word 1: copy of word 1 of the request

Word 2: analogue value (integer)

5.3.11 Module 10 – analogue multiplex output

Data content

Analogue output data of the slaves of the AS-i masters 1 + 2

Note

The data of analogue output slaves with the following AS-i slave addresses can be written directly via the modules 15 (master 1) (→ page 45) and 17 (master 2) (→ page 52):

- 1...31 (setting 4 channels per slave)
- 1...31 (setting 1 channel per slave).

Changing the setting "Channels per slave" (→ page 111)

So, module 10 only has to be used if the data cannot directly be written via the modules 15 or 17.

If an analogue output is written simultaneously via the modules 10 and 15 or 17, the modules 15 or 17 have priority.

Direction of data

Bidirectional (2 words = 4 bytes in both directions)

Module settings

Value range	0 / 1
0	module is deactivated
1	module is activated (details → data interpretation)

Data interpretation

Using module 10, analogue output data of an AS-i slave with any AS-i address can be retrieved. The information which channel of which AS-i slave on which master is to be written must be given to the controllerE via the fieldbus interface, in addition to the analogue value. The controllerE replies to such a request with a copy of the request data. As a result, only one specific analogue value can be transmitted at a time by module 10. This process is called multiplexing.

Syntax:

Requirement: 4 bytes from the fieldbus interface to the controllerE

Byte	Bit							
	7	6	5	4	3	2	1	0
n	0	0	0	0	0	0	C	C
n+1	M	M	X	S	S	S	S	S
n+2	analogue value (low byte)							
n+3	analogue value (high byte)							

MM	master number (1 or 2)
X	0 = single or A slave 1 = B slave
SSSSS	5 bit slave number (1…31)
CC	channel number (0...3) corresponds to the effective channel designations 1...4 (labelling on the unit)

controllerE response: 4 bytes from the controllerE to the fieldbus interface

Bytes n and n+1: copy of the request

Byte	Bit							
	7	6	5	4	3	2	1	0
n	E	E	E	E	0	0	C	C
n+1	M	M	X	S	S	S	S	S
n+2	analogue value (low byte)							
n+3	analogue value (high byte)							

E_4 = the selected channel is invalid (NOT valid flag),

E_5 = reserved,

E_6 = the output value is not ok (NOT output valid flag),

E_7 = data exchange error with the slave (NOT transfer valid flag).

Example for module 10

Task: Channel 4 (according to the labelling on the unit) of the analogue output slave with the AS-i address 12 on master 1 is to be set to the value 5000.

Solution:

Requirement:

Word	**1**																
Byte	**1**								**0**								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	1	value
	master 1		↓	slave 12											channel 4		meaning
			single slave														

Word	**2**																
Byte	**1**								**0**								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	analogue value = 5000_{dec}

controllerE response:

Word 1: copy of word 1 of the request

Word 2: copy of word 2 of the request

5.3.12 Module 11 – fieldbus data command channel

<table>
<tr><td>Data content</td><td>Command channel data of the AS-i masters 1 + 2</td></tr>
<tr><td>Note</td><td>For a detailed description of the handling of the fieldbus data command channel and the different commands → page 55</td></tr>
<tr><td>Direction of data</td><td>Bidirectional (2 words = 4 bytes in both directions)</td></tr>
<tr><td>Module settings</td><td>
<table>
<tr><td>Value range</td><td>0 / 1</td></tr>
<tr><td>0</td><td>module is deactivated</td></tr>
<tr><td>1</td><td>module is activated (details → data interpretation)</td></tr>
</table>
</td></tr>
<tr><td>Data interpretation</td><td>The command channel gives the user the opportunity to read different data from the controllerE or to access defined functions of the controllerE via the fieldbus interface. The following table provides an overview of the available commands.
<table>
<tr><th>Command number</th><th>Description</th></tr>
<tr><td>1</td><td>read master flags</td></tr>
<tr><td>2</td><td>change operating mode</td></tr>
<tr><td>3</td><td>change current slave configuration</td></tr>
<tr><td>4</td><td>read projected slave configuration</td></tr>
<tr><td>5</td><td>reserved</td></tr>
<tr><td>6</td><td>read current slave parameters</td></tr>
<tr><td>7</td><td>change projected slave parameters (default values)</td></tr>
<tr><td>8</td><td>read list of active slaves (LAS)</td></tr>
<tr><td>9</td><td>read list of detected slaves (LDS)</td></tr>
<tr><td>10</td><td>read list of slaves with peripheral faults (LPF)</td></tr>
<tr><td>11</td><td>read list of projected slaves (LPS)</td></tr>
<tr><td>12</td><td>reserved</td></tr>
<tr><td>13</td><td>read telegram error counter of a slave</td></tr>
<tr><td>14</td><td>read configuration error counter</td></tr>
<tr><td>15</td><td>read AS-i cycle counter</td></tr>
<tr><td>16</td><td>change current slave parameters</td></tr>
<tr><td>17, 18</td><td>reserved</td></tr>
<tr><td>19</td><td>config all</td></tr>
<tr><td>20</td><td>reserved</td></tr>
<tr><td>21</td><td>save configuration in flash memory</td></tr>
<tr><td>22</td><td>reset telegram error counter</td></tr>
</table>
</td></tr>
<tr><td>Examples</td><td>Examples for the handling of the "fieldbus data command channel" → page 55</td></tr>
</table>

The commands are only executed if the command number (the first byte) changes.

Overview of the commands in module 11

Cmd. no.	Description	Byte 2	Byte 2	Byte 4
1	► read master flags	MM000000	0	–
	> response:	MM000000	master flags → page 56	
2	► change operating mode	MM000000	AS-i master preset operating mode	–
	> response:	MM000000	AS-i master current operating mode	–
3	► read current slave configuration	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave configuration data	
4	► read projected slave configuration	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave configuration data	
5	reserved	–	–	
6	► read slave parameters	MMXSSSSS	–	–
	> response:	MMXSSSSS	projected parameters	current parameters
7	► change projected slave parameters (default parameters)	MMXSSSSS	projected parameters	–
	> response:	MMXSSSSS	projected parameters	–
8	► read LAS	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave addresses from address group	
9	► read LDS	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave addresses from address group	
10	► read LPF	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave addresses from address group	
11	► read LPS	MMXSSSSS	–	–
	> response:	MMXSSSSS	slave addresses from address group	
12	reserved	–	–	
13	► read telegram error counter	MMXSSSSS	–	–
	> response:	MMXSSSSS	error counter	
14	► read configuration error counter	MM000000	–	–
	> response:	MM000000	error counter	
15	► read AS-i cycle counter	MM000000	–	–
	> response:	MM000000	current count value of the cycle counter	
16	► change current slave parameters	MMXSSSSS	parameters	–
	> response:	MMXSSSSS	reflected parameters	–
17, 18	reserved	–	–	–

Cmd. no.	Description	Byte 2	Byte 2	Byte 4
19	► Config all	MM000000	–	–
	> response:	MM000000	status	–
20	reserved	–	–	–
21	► save configuration in flash	MM000000	–	–
	> response:	MM000000	–	–
22	► reset telegram error counter	MMXSSSSS	–	–
	> response:	MMXSSSSS	–	–

5.3.13 Module 12 – fieldbus data PLC input

Data content	Up to 128 bytes of freely definable data
Direction of data	Data from the fieldbus interface to the controllerE
Module settings	Value range: 0…128 [bytes] 0: module is deactivated 1…128: module is activated (details → data interpretation)
Data interpretation	Module 12 "fieldbus data PLC input" contains the input data from the controllerE PLC's point of view, i.e. data which are for example sent by a higher-level PLC to the controllerE. These data can be accessed via the PLC user program of the controllerE. Access in the user program is carried out via the variables PLCinData[0] to PLCinData[127].

Example for module 12

Task:	Process data (temperature, pressure, counter values etc.) with a total length of 14 words are to be transmitted from a higher-level PLC to the controllerE. To which value must module 12 be set?
Solution:	14 words = 28 bytes → Module 12 must be set to a length of at least 28 bytes in order to transmit all data. In case of space between the different process data in the transmitted range of the higher-level PLC, this must also be taken into account for the data length.

5.3.14 Module 13 – fieldbus data PLC output

Data content	Up to 128 bytes of freely definable data
Direction of data	Data from the controllerE to the fieldbus interface
Module settings	Value range: 0…128 [bytes] 0: module is deactivated 1…128: module is activated (details → data interpretation)
Data interpretation	Module 13 "fieldbus data PLC output" contains output data from the controllerE PLC's point of view, i.e. data transmitted by the controllerE e.g. to a higher-level PLC or a PC. These data can be accessed via the PLC user program of the controllerE. Access in the user program is carried out via the variables PLCoutData[0] to PLCoutData[127].

Example for module 13

Task:	Process data with a total length of 50 bytes are to be transmitted by the controllerE to a higher-level PLC. To which value must module 13 be set?
Solution:	The data length is 50 bytes. → Thus, module 13 must be set to a length of at least 50 bytes in order to transmit all data.

5.3.15 Module 14 – analogue input master 1

Data content	Analogue input data of the analogue slaves to AS-master 1
Note	With module 14 the data of the analogue input slaves on AS-i master 1 with the following AS-i slave addresses can be directly read: • 1...31 (setting 4 channels per slave) • 1 ...31 (setting 1 channel per slave) Changing the setting "Channels per slave" (→ page 111) If an analogue input channel is to be read outside the ranges indicated above, module 9 (analogue multiplex input) must be used for reading these data.
Direction of data	Data from the controllerE to the fieldbus interface
Module settings	Value range: 0…31 (4 words of data for 4 channels per slave; 2 words of data for 1 channel per slave) 0: module is deactivated 1…31: module is activated (details → data interpretation)
Data interpretation	Table for input data for 4 channels per slave → page 40 Table for input data for 1 channel per slave → page 43 The following table shows an example of the assignment of analogue data under the following condition: • setting 4 channels per slave

Byte	Data content
n	low byte, slave 1, channel 1
n+1	high byte, slave 1, channel 1
n+2	low byte, slave 1, channel 2
n+3	high byte, slave 1, channel 2
...	...

Example for module 14

Task 1:	The value 12 is specified for module 14. The setting for channels per slave in the CoDeSys configuration window is equal to 1. What is the highest AS-i slave address whose data can be transmitted with this setting and how many words are transmitted in total?
Solution:	The highest AS-i slave address is 12. 24 words are transmitted. → in the "table for input data for 1 channel / slave"
Task 2:	To which minimum value must module 14 be set so that the data of the analogue input slave with the AS-i address 10 can be read (setting 4 channels per slave)? In which word in the range can the data of channel 3 of the said slave be found?
Solution:	The value to be set for module 14 is 10. The data of slave 10, channel 3 can be found in word 38 of the range.

Module 14 – table for input data for 4 channels per slave

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
1	4	0	1	1	1A	1
		1		2		2
		2		3	1B	1
		3		4		2
2	8	4	2	1	2A	1
		5		2		2
		6		3	2B	1
		7		4		2
3	12	8	3	1	3A	1
		9		2		2
		10		3	3B	1
		11		4		2
4	16	12	4	1	4A	1
		13		2		2
		14		3	4B	1
		15		4		2
5	20	16	5	1	5A	1
		17		2		2
		18		3	5B	1
		19		4		2
6	24	20	6	1	6A	1
		21		2		2
		22		3	6B	1
		23		4		2
7	28	24	7	1	7A	1
		25		2		2
		26		3	7B	1
		27		4		2
8	32	28	8	1	8A	1
		29		2		2
		30		3	8B	1
		31		4		2
9	36	32	9	1	9A	1
		33		2		2
		34		3	9B	1
		35		4		2
10	40	36	10	1	10A	1
		37		2		2
		38		3	10B	1
		39		4		2
11	44	40	11	1	11A	1
		41		2		2
		42		3	11B	1
		43		4		2

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
12	48	44	12	1	12A	1
		45		2		2
		46		3	12B	1
		47		4		2
13	52	48	13	1	13A	1
		49		2		2
		50		3	13B	1
		51		4		2
14	56	52	14	1	14A	1
		53		2		2
		54		3	14B	1
		55		4		2
15	60	56	15	1	15A	1
		57		2		2
		58		3	15B	1
		59		4		2
16	64	60	16	1	16A	1
		61		2		2
		62		3	16B	1
		63		4		2
17	68	64	17	1	17A	1
		65		2		2
		66		3	17B	1
		67		4		2
18	72	68	18	1	18A	1
		69		2		2
		70		3	18B	1
		71		4		2
19	76	72	19	1	19A	1
		73		2		2
		74		3	19B	1
		75		4		2
20	80	76	20	1	20A	1
		77		2		2
		78		3	20B	1
		79		4		2
21	84	80	21	1	21A	1
		81		2		2
		82		3	21B	1
		83		4		2
22	88	84	22	1	22A	1
		85		2		2
		86		3	22B	1
		87		4		2
23	92	88	23	1	23A	1
		89		2		2
		90		3	23B	1
		91		4		2

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
24	96	92	24	1	24A	1
		93		2		2
		94		3	24B	1
		95		4		2
25	100	96	25	1	25A	1
		97		2		2
		98		3	25B	1
		99		4		2
26	104	100	26	1	26A	1
		101		2		2
		102		3	26B	1
		103		4		2
27	108	104	27	1	27A	1
		105		2		2
		106		3	27B	1
		107		4		2
28	112	108	28	1	28A	1
		109		2		2
		110		3	28B	1
		111		4		2
29	116	112	29	1	29A	1
		113		2		2
		114		3	29B	1
		115		4		2
30	120	116	30	1	30A	1
		117		2		2
		118		3	30B	1
		119		4		2
31	124	120	31	1	31A	1
		121		2		2
		122		3	31B	1
		123		4		2

Module 14 – table for input data for 1 channel per slave

Value range	Sum of words	Word no.	For the setting 1 channel per slave	
			AS-i addr.	Channel
1	2	0	1(A)	1
		1	1B	1
2	4	2	2(A)	1
		3	2B	1
3	6	4	3(A)	1
		5	3B	1
4	8	6	4(A)	1
		7	4B	1
5	10	8	5(A)	1
		9	5B	1
6	12	10	6(A)	1
		11	6B	1
7	14	12	7(A)	1
		13	7B	1
8	16	14	8(A)	1
		15	8B	1
9	18	16	9(A)	1
		17	9B	1
10	20	18	10(A)	1
		19	10B	1
11	22	20	11(A)	1
		21	11B	1
12	24	22	12(A)	1
		23	12B	1
13	26	24	13(A)	1
		25	13B	1
14	28	26	14(A)	1
		27	14B	1
15	30	28	15(A)	1
		29	15B	1
16	32	30	16(A)	1
		31	16B	1
17	34	32	17(A)	1
		33	17B	1
18	36	34	18(A)	1
		35	18B	1
19	38	36	19(A)	1
		37	19B	1
20	40	38	20(A)	1
		39	20B	1
21	42	40	21(A)	1
		41	21B	1
22	44	42	22(A)	1
		43	22B	1
23	46	44	23(A)	1
		45	23B	1

Value range	Sum of words	Word no.	For the setting 1 channel per slave	
			AS-i addr.	Channel
24	48	46	24(A)	1
		47	24B	1
25	50	48	25(A)	1
		49	25B	1
26	52	50	26(A)	1
		51	26B	1
27	54	52	27(A)	1
		53	27B	1
28	56	54	28(A)	1
		55	28B	1
29	58	56	29(A)	1
		57	29B	1
30	60	58	30(A)	1
		59	30B	1
31	62	60	31(A)	1
		61	31B	1

5.3.16 Module 15 – analogue output master 1

Data content	Analogue output data of the analogue slaves on AS-i master 1
Note	With module 15 the data of the analogue input slaves on AS-i master 1 with the following AS-i slave addresses can be directly written: • 1...31 (setting 4 channels per slave) • 1 ...31 (setting 1 channel per slave) Changing the setting "Channels per slave" (→ page 111) If an analogue output channel outside the ranges indicated above is to be written, module 10 (analogue multiplex output) is to be used for writing these data.
Direction of data	Data from the fieldbus interface to the controllerE
Module settings	Value range: 0…17 (4 words of data for 4 channels per slave; 2 words of data for 1 channel per slave) 0: module is deactivated 1…16: module is activated for analogue output slaves 16...31 17: module is activated for analogue output slaves 1…31 (details see data interpretation)
Data interpretation	Table for output data for 4 channels per slave → page 46 Table for output data for 1 channel per slave → page 49 The following table shows an example of the assignment of analogue data under the following condition: • setting 4 channels / slave

Byte	Data content
n	low byte, slave 1, channel 1
n+1	high byte, slave 1, channel 1
n+2	low byte, slave 1, channel 2
n+3	high byte, slave 1, channel 2
...	...

Example for module 15

Task 1:	The value 7 is specified for module 15. The setting for channels per slave in the CoDeSys configuration window is equal to 1. The data of which AS-i slave addresses is transmitted and in how many words?
Solution:	The highest AS-i slave address is 22. 14 words are transmitted. → in the "table for output data for 1 channel per slave"
Task 2:	To which minimum value must module 15 be set so that data can be written to the analogue output slave with the AS-i address 19 (setting 4 channels per slave)? In which word in the range can the data of channel 2 of the said slave be found?
Solution:	The value to be set for module 15 is 4. The data of slave 19, channel 2 can be found in word 13 of the range. → in the "table for output data for 4 channels per slave"

Module 15 – table for output data for 4 channels per slave

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
17	124	0	1	1	1A	1
		1		2		2
		2		3	1B	1
		3		4		2
17	124	4	2	1	2A	1
		5		2		2
		6		3	2B	1
		7		4		2
17	124	8	3	1	3A	1
		9		2		2
		10		3	3B	1
		11		4		2
17	124	12	4	1	4A	1
		13		2		2
		14		3	4B	1
		15		4		2
17	124	16	5	1	5A	1
		17		2		2
		18		3	5B	1
		19		4		2
17	124	20	6	1	6A	1
		21		2		2
		22		3	6B	1
		23		4		2
17	124	24	7	1	7A	1
		25		2		2
		26		3	7B	1
		27		4		2
17	124	28	8	1	8A	1
		29		2		2
		30		3	8B	1
		31		4		2
17	124	32	9	1	9A	1
		33		2		2
		34		3	9B	1
		35		4		2
17	124	36	10	1	10A	1
		37		2		2
		38		3	10B	1
		39		4		2
17	124	40	11	1	11A	1
		41		2		2
		42		3	11B	1
		43		4		2
17	124	44	12	1	12A	1
		45		2		2
		46		3	12B	1
		47		4		2

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
17	124	48	13	1	13A	1
		49		2		2
		50		3	13B	1
		51		4		2
17	124	52	14	1	14A	1
		53		2		2
		54		3	14B	1
		55		4		2
17	124	56	15	1	15A	1
		57		2		2
		58		3	15B	1
		59		4		2
1 (17)	4 (124)	0 (60)	16	1	16A	1
		1 (61)		2		2
		2 (62)		3	16B	1
		3 (63)		4		2
2 (17)	8 (124)	4 (64)	17	1	17A	1
		5 (65)		2		2
		6 (66)		3	17B	1
		7 (67)		4		2
3 (17)	12 (124)	8 (68)	18	1	18A	1
		9 (69)		2		2
		10 (70)		3	18B	1
		11 (71)		4		2
4 (17)	16 (124)	12 (72)	19	1	19A	1
		13 (73)		2		2
		14 (74)		3	19B	1
		15 (75)		4		2
5 (17)	20 (124)	16 (76)	20	1	20A	1
		17 (77)		2		2
		18 (78)		3	20B	1
		19 (79)		4		2
6 (17)	24 (124)	20 (80)	21	1	21A	1
		21 (81)		2		2
		22 (82)		3	21B	1
		23 (83)		4		2
7 (17)	28 (124)	24 (84)	22	1	22A	1
		25 (85)		2		2
		26 (86)		3	22B	1
		27 (87)		4		2
8 (17)	32 (124)	28 (88)	23	1	23A	1
		29 (89)		2		2
		30 (90)		3	23B	1
		31 (91)		4		2
9 (17)	36 (124)	32 (92)	24	1	24A	1
		33 (93)		2		2
		34 (94)		3	24B	1
		35 (95)		4		2

Value range	Sum of words	Word no.	For the setting 4 channels per slave			
			AS-i addr.	Channel	AS-i addr.	Channel
10 (17)	40 (124)	36 (96)	25	1	25A	1
		37 (97)		2		2
		38 (98)		3	25B	1
		39 (99)		4		2
11 (17)	44 (124)	40 (100)	26	1	26A	1
		41 (101)		2		2
		42 (102)		3	26B	1
		43 (103)		4		2
12 (17)	48 (124)	44 (104)	27	1	27A	1
		45 (105)		2		2
		46 (106)		3	27B	1
		47 (107)		4		2
13 (17)	52 (124)	48 (108)	28	1	28A	1
		49 (109)		2		2
		50 (110)		3	28B	1
		51 (111)		4		2
14 (17)	56 (124)	52 (112)	29	1	29A	1
		53 (113)		2		2
		54 (114)		3	29B	1
		55 (115)		4		2
15 (17)	60 (124)	56 (116)	30	1	30A	1
		57 (117)		2		2
		58 (118)		3	30B	1
		59 (119)		4		2
16 (17)	64 (124)	60 (120)	31	1	31A	1
		61 (121)		2		2
		62 (122)		3	31B	1
		63 (123)		4		2

Module 15 – table for output data for 1 channel per slave

Value range	Sum of words	Word no.	For the setting 1 channel per slave	
			AS-i addr.	Channel
17	62	0	1(A)	1
		1	1B	1
17	62	2	2(A)	1
		3	2B	1
17	62	4	3(A)	1
		5	3B	1
17	62	6	4(A)	1
		7	4B	1
17	62	8	5(A)	1
		9	5B	1
17	62	10	6(A)	1
		11	6B	1
17	62	12	7(A)	1
		13	7B	1
17	62	14	8(A)	1
		15	8B	1
17	62	16	9(A)	1
		17	9B	1
17	62	18	10(A)	1
		19	10B	1
17	62	20	11(A)	1
		21	11B	1
17	62	22	12(A)	1
		23	12B	1
17	62	24	13(A)	1
		25	13B	1
17	62	26	14(A)	1
		27	14B	1
17	62	28	15(A)	1
		29	15B	1
1 (17)	2 (62)	0 (30)	16(A)	1
		1 (31)	16B	1
2 (17)	4 (62)	2 (32)	17(A)	1
		3 (33)	17B	1
3 (17)	6 (62)	4 (34)	18(A)	1
		5 (35)	18B	1
4 (17)	8 (62)	6 (36)	19(A)	1
		7 (37)	19B	1
5 (17)	10 (62)	8 (38)	20(A)	1
		9 (39)	20B	1
6 (17)	12 (62)	10 (40)	21(A)	1
		11 (41)	21B	1
7 (17)	14 (62)	12 (42)	22(A)	1
		13 (43)	22B	1
8 (17)	16 (62)	14 (44)	23(A)	1
		15 (45)	23B	1

Value range	Sum of words	Word no.	For the setting 1 channel per slave	
			AS-i addr.	Channel
9 (17)	18 (62)	16 (46)	24(A)	1
		17 (47)	24B	1
10 (17)	20 (62)	18 (48)	25(A)	1
		19 (49)	25B	1
11 (17)	22 (62)	20 (50)	26(A)	1
		21 (51)	26B	1
12 (17)	24 (62)	22 (52)	27(A)	1
		23 (53)	27B	1
13 (17)	26 (62)	24 (54)	28(A)	1
		25 (55)	28B	1
14 (17)	28 (62)	26 (56)	29(A)	1
		27 (57)	29B	1
15 (17)	30 (62)	28 (58)	30(A)	1
		29 (59)	30B	1
16 (17)	32 (62)	30 (60)	31(A)	1
		31 (61)	31B	1

5.3.17 Module 16 – analogue input master 2

Data content	Analogue input data of the analogue slaves to AS-master 2
Note	With module 16 the data of the analogue input slaves on AS-i master 2 with the AS-i slave addresses can be directly read. • 1...31 (setting 4 channels per slave) • 1 ...31 (setting 1 channel per slave) Changing the setting "Channels per slave" (→ page 111) If an analogue input channel is to be read outside the ranges indicated above, module 9 (analogue multiplex input) must be used for reading these data.
Direction of data	Data from the controllerE to the fieldbus interface
Module settings	Value range: 0...31 (4 words of data for 4 channels per slave; 2 words of data for 1 channel per slave) 0: module is deactivated 1...31: module is activated (details → data interpretation)
Data interpretation	→ module 14 (→ page 39)
Examples	→ module 14 (→ page 39)

5.3.18 Module 17 – analogue output master 2

<table>
<tr><td>Data content</td><td>Analogue output data of the analogue slaves on AS-i master 2</td></tr>
<tr><td>Note</td><td>With module 17 the data of the analogue input slaves on AS-i master 2 with the following AS-i slave addresses can be directly written:
• 1...31 (setting 4 channels per slave)
• 1 ...31 (setting 1 channel per slave)
Changing the setting "Channels per slave" (→ page 111)
If an analogue output channel outside the ranges indicated above is to be written, module 10 (analogue multiplex output) is to be used for writing these data.</td></tr>
<tr><td>Direction of data</td><td>Data from the fieldbus interface to the controllerE</td></tr>
<tr><td>Module settings</td><td><table><tr><td>Value range</td><td>0…17
4 words of data for 4 channels per slave
2 words of data for 1 channel per slave</td></tr><tr><td>0</td><td>module is deactivated</td></tr><tr><td>1…16</td><td>module is activated for analogue output slaves 16...31</td></tr><tr><td>17</td><td>module is activated for analogue output slaves 1…31</td></tr></table>(Details → data interpretation)</td></tr>
<tr><td>Data interpretation</td><td>→ module 15 (→ page 45)</td></tr>
<tr><td>Examples</td><td>→ module 15 (→ page 45)</td></tr>
</table>

5.3.19 Module 18 – fieldbus diagnostic data

Data content

Diagnostic data of the AS-i masters 1 and 2

Direction of data

Data from the controllerE to the fieldbus interface

Module settings

Value range	0…2
0	module is deactivated
1	13 words diagnostic data from AS-i master 1
2	13 words diagnostic data from AS-i masters 1 and 2 respectively

Data interpretation

General overview of the total diagnostic range

Word	Description
0	AS-i master 1: master flags
1...4	AS-i master 1: list of configuration faults
5...8	AS-i master 1: list of peripheral faults (LPF)
9...12	AS-i master 1: list of projected slaves (LPS)
13	AS-i master 2: master flags
14...17	AS-i master 2: list of configuration faults
18...21	AS-i master 2: list of peripheral faults (LPF)
22...25	AS-i master 2: list of projected slaves (LPS)

Details master flags

Bit	Name according to AS-i specification	Description
0	-	reserved
1	Configuration_Active	AS-i master is in the Config mode
2	LDS.0	one slave with the address 0 was detected
3	AS-i_Power_Fail	AS-i voltage is too low
4	NOT Periphery_OK	periphery fault
5	-	reserved
6	NOT Config_OK	configuration error
7	-	reserved
8...15	-	reserved

Details LDS, configuration error, peripheral fault (LPF)

Word	Bit [AS-i slave address]			
	15	...	1	0
n	15(A)	...	1(A)	0*
n + 1	31(A)	...	17(A)	16(A)
n + 2	15(B)	...	1(B)	-
n + 3	31(B)	...	17(B)	16(B)

* Only for LDS and list of configuration errors, otherwise not used.

List of detected slaves:	"1" at the corresponding position of an AS-i slave means: this slave is detected.
Configuration error:	"1" at the corresponding position of an AS-i slave means: this slave has caused a configuration error.
Peripheral fault:	"1" at the corresponding position of an AS-i slave means: this slave has caused a peripheral fault.

5.3.20 Module 19 – host command channel

Data content	Host command channel data of the AS-i masters 1 + 2
Note	For a detailed description of the handling of the host command channel and the different commands → next chapter.
Direction of data	Bidirectional (5/18 words in both directions)
Module settings	Value range: 0…2 0: module is deactivated 1: 5 words 2: 18 words
Data interpretation	The host command channel gives the user the opportunity to read different data from the controllerE or to access defined functions of the controllerE. The following table provides an overview of the available commands.
Examples	Examples of the individual commands → chapter The host command channel (→ page 76)

Command number	Description
0	execute no command
1	write parameters to a connected AS-i slave
3	adopt and save currently connected AS-i slaves in the configuration
4	change the list of the projected AS-i slaves (LPS)
5	set the operating mode of the AS-i master
6	readdress a connected AS-i slave
7	set the auto addressing mode of the AS-i master
9	change the extended ID code 1 in the connected AS-i slave
10...20	force analogue data transmission directly to/from 3 AS-i slaves each
28	deactivate the slave reset when changing to the protected mode
31	one-time execution of the "Extended safety monitor protocol" in the "Safety at Work" monitor
21	read ID string of an AS-i slave with profile S-7.4
33	read diagnosis string of an AS-i slave with profile S-7.4
34	read parameter string of an AS-i slave with profile S-7.4
35	write parameter string of an AS-i slave with the profile S-7.4
50	read current configuration AS-i slaves 0(A)...15(A)
51	read current configuration AS-i slaves 16(A)...31(A)
52	read current configuration AS-i slaves 0...15B
53	read current configuration AS-i slaves 16B...31B
54	read current parameters of a connected AS-i slave
55	read current AS-i slave lists
56	read projected configuration AS-i slaves 1(A)...15(A)
57	read projected configuration AS-i slaves 16(A)..31(A)
58	read projected configuration AS-i slaves 1B...15B
59	read projected configuration AS-i slaves 16B...31B
96	save data non-volatilely in the flash memory of the controllerE
97	carry out various settings in the controllerE
102	retrieve the status of the controllerE display
105	read the device properties of the controllerE

6 Module 11: fieldbus data command channel

→ page 35, table Overview of the commands in module 11

6.1 List of commands in module 11

Command number		Description	→ page
dec	hex		
01	01	read master flags	56
02	02	change operating mode	57
03	03	read current slave configuration	58
04	04	read projected slave configuration	59
05	05	- reserved -	–
06	06	read slave parameters	60
07	07	change projected slave parameters (default parameters)	61
08	08	read LAS (list of active slaves)	63
09	09	read LDS (list of detected slaves)	65
10	0A	read LPF (list of slaves with peripheral fault)	66
11	0B	read LPS (list of projected slaves)	67
12	0C	– reserved -	–
13	0D	read telegram error counter	69
14	0E	read configuration error counter	70
15	0F	read AS-i cycle counter	71
16	10	change current slave parameters	72
17	11	- reserved -	–
18	12	- reserved -	–
19	13	config all	73
20	14	- reserved -	–
21	15	save configuration in flash	74
22	16	reset telegram error counter	75

6.2 Module 11, command 1 – read master flags

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	01_{hex}					
2	MM		0					
3	not used							
4	not used							

MM = master no. (1…2)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	01_{hex}					
2	copy of the request							
3	→ table "Master flags"							
4	→ table "Master flags"							

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Master flags

Byte	Bit	If bit D6 = TRUE, then:
3	0	periphery of all connected slaves is ok (no peripheral fault)
	1	automatic addressing is enabled
	2	exchange of data with the slaves is active
	3...7	reserved
4	0	AS-i configuration is ok
	1	a slave 0 is detected
	2	automatic addressing is enabled
	3	automatic addressing is active
	4	configuration mode is active
	5	normal mode is active
	6	AS-i voltage fault has occurred
	7	offline phase completed

6.3 Module 11, command 2 – change operating mode

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0	
1	0	0	02_{hex}						
2	MM		0						MM = master no. (1…2)
3	0 = protected mode 1 = config mode								
4	not used								

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	02_{hex}					
2	copy of the request							
3	copy of the request							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

6.4 Module 11, command 3 – read current slave configuration

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	03_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	03_{hex}					
2	copy of the request							
3	extended ID code 2				extended ID code 1			
4	ID code				IO configuration			

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read current slave configuration of slave 7B on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	03	03 = command 3
2	47	(slave no. **7**) + (master no. **1 * 64**) = 71_{dec} = $\mathbf{47}_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	03	copy of the request
2	47	copy of the request
3	A7	A = ID code 7 = IO configuration
4	E0	E = extended ID code 2 0 = extended ID code 1

(corresponds to slave profile S 7.A.E = e.g. AC2255: 4 digital inputs, 2 digital outputs)

6.5 Module 11, command 4 – read projected slave configuration

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	04_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	04_{hex}					
2	copy of the request							
3	extended ID code 2				extended ID code 1			
4	ID code				IO configuration			

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read projected slave configuration of slave 16(A) on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	04	04 = command 4
2	50	(slave no. **16**) + (master no. **1 * 64**) + (32, if B slave) = 80_{dec} =**50_{hex}**
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	04	copy of the request
2	50	copy of the request
3	A7	A = ID code 7 = IO configuration
4	E0	E = extended ID code 2 0 = extended ID code 1

(corresponds to slave profile S 7.A.E = e.g. AC2255: 4 digital inputs, 2 digital outputs)

6.6 Module 11, command 6 – read slave parameters

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	06_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	06_{hex}					
2	copy of the request							
3	current parameter							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read slave parameter of slave 2(A) on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	06	06 = command 6
2	42	(slave no. **2**) + (master no. **1 * 64**) + (32, if B slave) = 66_{dec} =**42**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	06	copy of the request
2	42	copy of the request
3	03	current parameter
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

6.7 Module 11, command 7 – change projected slave parameters

NOTE

The projected parameters can only be changed if the AS-i master operates in the Config mode.
Activation → page 57

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	07_{hex}					
2	MM		X	SSSSS				
3	projected parameter							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	07_{hex}					
2	copy of the request							
3	copy of the request							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example → next page

Example: change projected slave parameters of slave 7B on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	07	07 = command 7
2	87	(slave no. **7**) + (master no. **1 * 64**) + (**32**, if B slave) = 135_{dec} **=87**$_{hex}$
3	0F	projected parameter
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	07	copy of the request
2	87	copy of the request
3	0F	copy of the request
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

6.8 Module 11, command 8 – read LAS (list of active slaves)

Slave group

The 2 feedback bytes can only give information about max. 16 slaves. Therefore the slaves are divided in 4 groups (→ following table).

When querying the slave lists any slave number from the requested slave group is to be indicated.

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

*) LAS and LPS have no slave 0, therefore this bit is set to 0!

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	08_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	08_{hex}					
2	copy of the request							
3	→ table "Slave group" above							
4	→ table "Slave group" above							

provides the addresses of the active slaves in this address group

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example → next page

Example: read LAS (list of active slaves) of slave group 1 on master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	08	08 = command 8
2	42	(slave no. **2**) → group 1 + (master no. **1 * 64**) + (32, if B slave) = 66_{dec} =**42**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	08	copy of the request
2	42	copy of the request
3	03_{hex} = 00000011_{bin}	→ table page 63 group 1: slave 8(A) is active slave 9(A) is active
4	FE_{hex} = 11111110_{bin}	→ table page 63 group 1: slaves 1(A) to 7(A) are active

6.9 Module 11, command 9 – read LDS (list of detected slaves)

The 2 feedback bytes can only give information about max. 16 slaves. Therefore the slaves are divided in 4 groups (→ table page 63).

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	09_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	09_{hex}					
2	copy of the request							
3	→ table "Slave group" → page 63							
4	→ table "Slave group" → page 63							

provides the addresses of the detected slaves in this address group

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read LDS (list of detected slaves) of slave group 3 on AS-i master 2

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	09	09 = command 9
2	A5	(slave no. **5**) → group 3 + (master no. **2 * 64**) + (**32**, if B slave) = 165_{dec} = **A5**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	09	copy of the request
2	A5	copy of the request
3	03_{hex} = 00000011_{bin}	→ table page 63 group 3: slaves 8B and 9B were detected
4	FE_{hex} = 11111110_{bin}	→ table page 63 group 3: slaves 1B to 7B were detected

6.10 Module 11, command 10_{dec} ($0A_{hex}$) – read LPF (list of slaves with peripheral fault)

The 2 feedback bytes can only give information about max. 16 slaves. Therefore the slaves are divided in 4 groups (→ table page 63).

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	$0A_{hex}$					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	$0A_{hex}$					
2	copy of the request							
3	→ table "Slave group" → page 63							
4	→ table "Slave group" → page 63							

provides the addresses of the slaves with peripheral fault in this address group

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read LPF (list of slaves with peripheral fault) of slave group 2 on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	0A	0A = command 10
2	54	(slave no. **20**) → group 2 + (master no. **1 * 64**) + (32, if B slave) = 84_{dec} =**54_{hex}**
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	0A	copy of the request
2	54	copy of the request
3	02_{hex} = 00000010_{bin}	→ table page 63 group 2: slave 26(A) indicates peripheral fault
4	20_{hex} = 00100000_{bin}	→ table page 63 group 2: slave 21(A) indicates peripheral fault

6.11 Module 11, command 11_{dec} ($0B_{hex}$) – read LPS (list of projected slaves)

The 2 feedback bytes can only give information about max. 16 slaves. Therefore the slaves are divided in 4 groups (→ table page 63).

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	$0B_{hex}$					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	$0B_{hex}$					
2	copy of the request							
3	→ table "Slave group" → page 63							
4	→ table "Slave group" → page 63							

provides the addresses of the projected slaves in this address group

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example → next page

Example: read LPS (list of projected slaves) of slave group 2 on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	0B	0B = command 11
2	54	(slave no. **20**) → group 2 + (master no. **1 * 64**) + (32, if B slave) = 84_{dec} =**54_{hex}**
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	0B	copy of the request
2	54	copy of the request
3	02_{hex} = 00000010_{bin}	→ table page 63 group 2: slave 26(A) is projected
4	FE_{hex} = 11111110_{bin}	→ table page 63 group 2: slaves 17(A) to 23(A) are projected

6.12 Module 11, command 13_{dec} ($0D_{hex}$) – read telegram error counter

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	$0D_{hex}$					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	$0D_{hex}$					
2	copy of the request							
3	error counter low byte							
4	error counter high byte							

provides the number of errors during the exchange of data between the slave and the master since power on or reset

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read telegram error counter of slave 1 on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	0D	0D = command 13
2	41	(slave no. **1**) + (master no. **1 * 64**) + (32, if B slave) = 65_{dec} =**41**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	0D	copy of the request
2	41	copy of the request
3	20	Error counter = 0020_{hex} = 0032_{dec} → Since the last power on of the controllerE or reset of the counter 32 incorrect telegrams have occurred during the exchange of data.
4	00	

6.13 Module 11, command 14_{dec} ($0E_{hex}$) – read configuration error counter

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	$0E_{hex}$					
2	MM		0					
3	not used							
4	not used							

MM = master no. (1…2)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	$0E_{hex}$					
2	copy of the request							
3	error counter low byte							
4	error counter high byte							

provides the number of the configuration errors of the master since power on or reset

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read configuration error counter on AS-i master 2

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	0E	0E = command 14
2	80	(master no. **2 * 64**) = 128_{dec} =**80_{hex}**
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	0E	copy of the request
2	80	copy of the request
3	03	error counter = 0003_{hex} = 0003_{dec} → Since the last power on of the controllerE or the reset of the counter, 3 configuration errors have occurred.
4	00	

6.14 Module 11, command 15_{dec} ($0F_{hex}$) – read AS-i cycle counter

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	$0F_{hex}$					
2	MM		0					
3	not used							
4	not used							

MM = master no. (1…2)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	$0F_{hex}$					
2	copy of the request							
3	cycle counter low byte							
4	cycle counter high byte							

provides the number of the AS-i cycles of the master since power on

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: read AS-i cycle counter of AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	0F	0F = command 15
2	40	(master no. **1 * 64**) = 64_{dec} =**40**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	0F	copy of the request
2	40	copy of the request
3	CA	cycle counter = $04CA_{hex}$ = 1226_{dec} → Since the last power on of the controllerE, 1226 cycles have been performed in the AS-i master 1.
4	04	

By carrying out several measurements the number of cycles per time unit can be measured.

6.15 Module 11, command 16_{dec} (10_{hex}) – change current slave parameters

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	10_{hex}					
2	MM		X	SSSSS				
3	preset value parameter							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	10_{hex}					
2	copy of the request							
3	feedback value parameter							
4	not used *)							

feedback value can be different from preset value

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: change slave parameter of slave 7 on AS-i master 1 to the value "F"

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	10	10 = command 16
2	47	(slave no. **7**) + (master no. **1 * 64**) + (32, if B slave) = 71_{dec} =**47**$_{hex}$
3	0F	preset value parameter
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	10	copy of the request
2	47	copy of the request
3	0F	feedback value can be different from preset value
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

6.16 Module 11, command 19_{dec} (13_{hex}) – Config all

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	13_{hex}					
2	MM		0					
3	not used							
4	not used							

MM = master no. (1…2)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	13_{hex}					
2	copy of the request							
3	status							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: Config all on AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	13	13 = command 19
2	40	(master no. **1 * 64**) = 64_{dec} =**40**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	13	copy of the request
2	40	copy of the request
3	80	status
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

6.17 Module 11, command 21_{dec} (15_{hex}) – save the configuration in flash

Structure

Request from fieldbus master

Bit	7	6	5	4	3	2	1	0
Byte								
1	0	0	15_{hex}					
2	MM		0					
3	not used							
4	not used							

MM = master no. (1…2)

Response from controllerE

Bit	7	6	5	4	3	2	1	0
Byte								
1	D7	D6	15_{hex}					
2	copy of the request							
3	not used *)							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: save AS-i configuration in flash for AS-i master 1

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	15	15 = command 21
2	40	(master no. **1 * 64**) = 64_{dec} =**40**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	15	copy of the request
2	40	copy of the request
3	xx	not used *)
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

6.18 Module 11, command 22_{dec} (16_{hex}) – reset telegram error counter of a slave

Structure

Request from fieldbus master

Bit / Byte	7	6	5	4	3	2	1	0
1	0	0	16_{hex}					
2	MM		X	SSSSS				
3	not used							
4	not used							

MM = master no. (1…2)

X = slave type (0…1)
0 = standard / A slave
1 = B slave

SSSSS = slave no. ($0…31_{dec}$)

Response from controllerE

Bit / Byte	7	6	5	4	3	2	1	0
1	D7	D6	16_{hex}					
2	copy of the request							
3	not used *)							
4	not used *)							

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

Legend

D7	1 bit	error code	0 = no error occurred 1 = error occurred during the command processing
D6	1 bit	command code	0 = command processed, buffer response valid 1 = command in process, channel used

Example: reset telegram error counter of slave 7(A) on AS-i master 2

Request from fieldbus master

Byte no.	Value [hex.]	Meaning
1	16	16 = command 22
2	87	(slave no. **7**) + (master no. **2 * 64**) + (32, if B slave) = 135_{dec} =**87**$_{hex}$
3	xx	not used
4	xx	not used

Response from controllerE

Byte no.	Value [hex.]	Meaning
1	16	copy of the request
2	87	copy of the request
3	xx	not used *)
4	xx	not used *)

*) **IMPORTANT:** For the request only read the required bytes. Unused bytes can contain information of previous queries.

7 The host command channel

The module 19 (→ page 54) contains an extended command channel which can have a length of 5 or 18 words. A PLC with EtherCAT interface can be used as host system. The commands are always triggered by the host by a corresponding entry in its output data range. The controllerE responds then in the input data area of the host system.

7.1 Syntax of the host command channel

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	U	U	U	U	U	C	C	C	C	C	C	C	C
2	R	R	R	S	S	S	S	S	R	R	L	L	L	L	L	L
3...18	parameter data of the command to be executed															

1st word:

RR = 2 bits reserved;

M = 0 = AS-i master 1
M = 1 = AS-i master 2

UUUUU = 5 bits user ID 0...31 (a change of the user ID starts the command call)

CCCCCCCC = 1 byte command number

2nd word: reserved for 7.4 commands:

RRR = 3 bits reserved;

SSSSS = 5 bits slave address

RR = 2 bits reserved

LLLLLL = 6 bits number of the data bytes to be sent

3...18th word: command data

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E	B	M	U	U	U	U	U	C	C	C	C	C	C	C	C
2	R	R	S	S	S	S	S	F	R	R	L	L	L	L	L	L
3...18																

1st word:

E = 0 = no error detected
E = 1 = error when executing the command

B = 0 = command executed
B = 1 = command in process

M = 0 = AS-i master 1
M = 1 = AS-i master 2

UUUUU = 5 bits reflected user ID 0...31

CCCCCCCC = 1 byte reflected command number

2nd word: reserved for 7.4 commands:

RR = 2 bits reserved, the highest bit changes during execution;

SSSSS = 5 bits slave address

F = error bit:
F = 1 = error when executing the command

RR = 3 bits reserved

LLLLLL = 6 bits number of the data bytes received

3...18th word: command data

NOTE

If a command is to be executed, the user ID must be changed! Changing the command number alone does not start the execution.

If a command is to be executed several times, the user ID must be changed accordingly, e.g. by counting up. Counting up should not take place until the preceding command has been completed:

In the 1st word of the command response 2 bits indicate the status of the command channel:

D15 = 1 → error occurred while processing the command
D15 = 0 → no error occurred
D14 = 1 → command in process, channel used
D14 = 0 → command processed, buffer response valid.

7.2 Host commands

Command number		Description
decimal	hexadecimal	
0	0	execute no command
1	1	write parameters to a connected AS-i slave (change current slave parameters)
3	3	adopt and save currently connected AS-i slaves in the configuration
4	4	change the list of the projected AS-i slaves (LPS)
5	5	set the operating mode of the AS-i master
6	6	readdress a connected AS-i slave
7	7	set the auto addressing mode of the AS-i master
9	9	change the extended ID code 1 in the connected AS-i slave
10...20	A...14	force analogue data transmission directly to / from 3 AS-i slaves each
28	1C	deactivate the slave reset when changing to the protected mode
31	1F	one-time execution of the "Extended safety monitor protocol" in the "Safety at Work" monitor
21	15	read ID string of an AS-i slave with profile S-7.4
33	21	read diagnosis string of an AS-i slave with profile S-7.4
34	22	read parameter string of an AS-i slave with profile S-7.4
35	23	write parameter string of an AS-i slave with the profile S-7.4
50	32	read current configuration AS-i slaves 0(A)...15(A)
51	33	read current configuration AS-i slaves 16(A)...31(A)
52	34	read current configuration AS-i slaves 0...15B
53	35	read current configuration AS-i slaves 16B...31B
54	36	read current parameters of a connected AS-i slave
55	37	read current AS-i slave lists
56	38	read projected configuration AS-i slaves 1(A)...15(A)
57	39	read projected configuration AS-i slaves 16(A)..31(A)
58	3A	read projected configuration AS-i slaves 1B...15B
59	3B	read projected configuration AS-i slaves 16B...31B
96	60	save data non-volatilely in the flash memory of the controllerE
97	61	carry out various settings in the controllerE
102	66	retrieve the status of the controllerE display
105	69	read the device properties of the controllerE

7.2.1 Command 0, 16#0 – execute no command

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M = 0	user ID					command number = 00							
2…18	not used								not used							

Example:

1st word: 16#0300
command number = 0,
AS-i master 1 (M=0),
user ID changes from 0 to 3

2…18th word: 16#0000 (not used)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M = 0	user ID					reflected command number = 00							
2…18	not changed								not changed							

Example:

1st word: 16#0300
reflected command number = 0,
user ID changes from 0 to 3

2…18th word: 16#0000 (not changed)

7.2.2 Command 1, 16#1 – write parameters to a connected AS-i slave (change current slave parameters)

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 1							
2	reserved = 0								reserved = 0							
3	16#00								AS-i slave 4B = 16#24							
4	16#00								parameter value to be written = 16#03							

Example:

1st word: 16#0901
command number = 1,
AS-i master 1 (M=0),
user ID changes from 0 to 9

2nd word: 16#0000 (reserved)

3rd word: 16#0024
slave address 4**B** (for B slaves: add 16#20 (bit 5 = 1)!)

4th word: 16#0003
parameter value to be written

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 01							
2	reserved								reserved							
3	16#00								parameter value read back = 16#03							

Example:

1st word: 16#0901
reflected command number = 1,
user-ID changes from 0 to 9

2nd word: 16#0000 (reserved)

3rd word: 16#0003
parameter value read back; might differ from the value to be written (so-called reflected parameters)

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 01							
2	reserved								reserved							
3	16#00								error code = 16#0A							

Example:

1st word: 16#8901
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#000A
error code 16#0A: slave is not in LAS

Possible error codes:

16#01	no slave response or master is in the offline mode at the time of the command call
16#0A	slave is not in the LAS
16#0B	parameter or address invalid
16#14	master in the wrong operating mode, here: is not in the normal mode

7.2.3 Command 3, 16#3 – adopt and save currently connected AS-i slaves in the configuration

Note: This command can only be executed without error when the addressed AS-i master is in the Config mode.

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M = 0	user ID					command number = 03							
2…18	not used								not used							

Example:

1st word: 16#0C03
command number 3,
AS-i master 1 (M=0),
user ID changes from 0 to 12

2…18th word: 16#0000 (not used)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M = 0	user ID					reflected command number = 03							
2…18	not changed								not changed							

Example:

1st word: 16#0C03
reflected command number = 3,
user ID changes from 0 to 12

2…18th word: 16#0000 (not changed)

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M = 0	user ID					reflected command number = 03							
2	reserved								reserved							
3	16#00								error code = 16#14							

Example:

1st word: 16#8C03
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0017
error code 16#17: master is not in the Config mode

Possible error codes:

16#17	master is not in the Config mode

7.2.4 Command 4, 16#4 – change the list of the projected AS-i slaves (LPS)

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 04							
2	reserved = 00								reserved = 00							
3	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)	res
4	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)
5	15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
6	31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B

Example:

1st word: 16#0204
command number 4,
user ID changes to 2

2nd word: 16#0000 (reserved)

3rd word: 16#003E
slaves 1 to 5 are to be projected

4th word: 16#8000
slave 31(A) is to be projected

5th word: 16#0002
slave 1B is to be projected

6th word: 16#0001
slave 16B is to be projected

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 04							

Example:

1st word: 16#0204
reflected command number = 4,
user ID changes to 2

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 4							
2	reserved								reserved							
3	16#00								error code = 16#14							

Example:

1st word: 16#8204
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0014
error code = 16#0014: master is not in the Config mode

Possible error codes:

16#14	master in the wrong operating mode, here: is not in the Config mode

7.2.5 Command 5, 16#5 – set the operation mode of the AS-i master

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 05							
2	reserved = 00								reserved = 00							
3	16#00								activate the Config mode = 16#01							

Example:

1st word: 16#0105
command number 5,
user ID changes to 1

2nd word: 16#0000 (reserved)

3rd word: 16#0001
1 = activate the Config mode,
0 = protected mode)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 05							

Example:

1st word: 16#0105
reflected command number = 5,
user ID changes to 1

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 05							
2	reserved								reserved							
3	16#00								error code = 16#03							

Example:

1st word: 16#8105
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0003
error code = 16#03: slave with address 0 connected

Possible error codes:

16#03	slave with address 0 connected

7.2.6 Command 6, 16#6 – readdress connected AS-i slave

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 06							
2	reserved = 00								reserved = 00							
3	16#00								old slave address 9B = 16#29							
4	16#00								new slave address 11A = 16#0B							

Example:

1st word: 16#0806
command number 6,
user ID changes to 8

2nd word: 16#0000 (reserved)

3rd word: 16#0029
old slave address 9B, for B slaves: add 16#20

4th word: 16#000B
new slave address 11A

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 06							

Example:

1st word: 16#0806
reflected command number = 6,
user ID changes to 8

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 6							
2	reserved								reserved							
3	16#00								error code = 16#03							

Example:

1st word: 16#8806
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0003
error code = 16#03: slave with address 0 connected

Possible error codes:

16#01	no slave response or: master is in the offline mode at the moment of the command call
16#02	no slave with the old address found
16#03	slave with address 0 connected
16#04	no slave with the new address found
16#05	error when deleting the old address
16#06	error when reading the IO configuration
16#07	error when writing the new address or extended ID code 1
16#08	new address could only be saved temporarily
16#09	extended ID code 1 could only be saved temporarily
16#0B	parameter or address invalid
16#14	master in the wrong operating mode, here: is not in the normal mode

7.2.7 Command 7, 16#7 – set the auto address mode of the AS-i master

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 07							
2	reserved = 00								reserved = 00							
3	16#00								automatic addressing activated = 16#01							

Example:

1st word: 16#0407
command number 7,
user ID changes to 4

2nd word: 16#0000 (reserved)

3rd word: 16#0001
1 = automatic addressing possible
0 = automatic addressing is deactivated

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 07							

Example:

1st word: 16#0407 (reflected command number 7, user ID changes to 4)

7.2.8 Command 9, 16#9 – change the extended ID code 1 in the connected AS-i slave

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 09							
2	reserved = 00								reserved = 00							
3	16#00								slave address 17 = 16#11							
4	16#00								new "extended ID code 1" = 16#08							

Example:

1st word: 16#0F09
command number 9,
user ID changes to 15

2nd word: 16#0000 (reserved)

3rd word: 16#0011
slave address 17 = 16#11

4th word: 16#0008
new "extended ID code 1" is 8

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 09							

Example:

1st word: 16#0F09
reflected command number = 9,
user ID changes to 15

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 09							
2	reserved								reserved							
3	16#00								error code = 16#07							

Example:

1st word: 16#8F09
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0007
error code = 16#07: slave does not support extended ID code

Possible error codes:

16#01	no slave response or: master is in the offline mode at the moment of the command call
16#02	no slave with the new address found
16#03	slave with address 0 connected
16#07	error when writing the extended ID code 1
16#09	extended ID code 1 could only be saved temporarily
16#0B	address is invalid

7.2.9 Commands 10...20, 16#0A..16#14 – force analogue data transmission directly to/from 3 AS-i slaves respectively

With these commands the analogue input or output data of 3 slaves can be overwritten. The commands are assigned to 3 slaves addresses each:

Command number		Slaves		
decimal	hexadecimal			
10	**16#0A**	1	2	3
11	**16#0B**	4	5	6
12	**16#0C**	7	8	9
13	**16#0D**	10	11	12
14	**16#0E**	13	14	15
15	**16#0F**	16	17	18
16	**16#10**	19	20	21
17	**16#11**	22	23	24
18	**16#12**	25	26	27
19	**16#13**	28	29	30
20	**16#14**	31	-	-

Table: Assignment command number – slave numbers

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 10 (16#0A)							
2	reserved = 00								reserved = 00							
3	output data AS-i slave 1, channel 0															
4	output data AS-i slave 1, channel 1															
5	output data AS-i slave 1, channel 2															
6	output data AS-i slave 1, channel 3															
7	16#00								O3	V3	O2	V2	O1	V1	O0	V0
8	output data AS-i slave 2, channel 0															
9	output data AS-i slave 2, channel 1															
10	output data AS-i slave 2, channel 2															
11	output data AS-i slave 2, channel 3															
12	16#00								O3	V3	O2	V2	O1	V1	O0	V0
13	output data AS-i slave 3, channel 0															
14	output data AS-i slave 3, channel 1															
15	output data AS-i slave 3, channel 2															
16	output data AS-i slave 3, channel 3															
17	16#00								O3	V3	O2	V2	O1	V1	O0	V0

Example:

1st word: 16#0901
command number A,
AS-i master 1 (M=0),
user ID changes to 1

2nd word: 16#0000 (reserved)

3rd word: 16#0169
output data AS-i slave 1, channel 0

4th word: 16#0202
output data AS-i slave 1, channel 1

5th word: 16#0395
output data AS-i slave 1, channel 2

6th word: 16#1033
output data AS-i slave 1, channel 3

7th word: 16#0055
overflow and **v**alid bits for AS-i slave 1:
O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

8th word: 16#2009
output data AS-i slave 2, channel 0

9th word: 16#2202
output data AS-i slave 2, channel 1

10th word: 16#0195
output data AS-i slave 2, channel 2

11th word: 16#1022
output data AS-i slave 2, channel 3

12th word: 16#0055
overflow and **v**alid bits for AS-i slave 2:
O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

13th word: 16#3339
output data AS-i slave 3, channel 0

14th word: 16#1102
output data AS-i slave 3, channel 1

15th word: 16#1953
output data AS-i slave 3, channel 2

16th word: 16#1234
output data AS-i slave 3, channel 3

17th word: 16#0055
overflow and **v**alid bits for AS-i slave 3:
O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

Vx: **V**alid:
Vx = 0 = data invalid,
Vx = 1 = data valid;
output data must be valid (Vx = 1) to be enabled in the AS-i slave!

Ox: **O**verflow
Ox = 0 = data is in the valid range,
Ox = 1 = data is in the invalid range
(especially in case of input modules when the measuring range is not reached or exceeded)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#0A							
2	reserved								reserved							
3	input data or reflected output data AS-i slave 1, channel 0															
4	input data or reflected output data AS-i slave 1, channel 1															
5	input data or reflected output data AS-i slave 1, channel 2															
6	input data or reflected output data AS-i slave 1, channel 3															
7	16#00						TV	OV	O3	V3	O2	V2	O1	V1	O0	V0
8	input data or reflected output data AS-i slave 2, channel 0															
9	input data or reflected output data AS-i slave 2, channel 1															
10	input data or reflected output data AS-i slave 2, channel 2															
11	input data or reflected output data AS-i slave 2, channel 3															
12	16#00						TV	OV	O3	V3	O2	V2	O1	V1	O0	V0
13	input data or reflected output data AS-i slave 3, channel 0															
14	input data or reflected output data AS-i slave 3, channel 1															
15	input data or reflected output data AS-i slave 3, channel 2															
16	input data or reflected output data AS-i slave 3, channel 3															
17	16#00						TV	OV	O3	V3	O2	V2	O1	V1	O0	V0

Example:

1st word: 16#0901
reflected command number A,
user ID changes to 1

2nd word: 16#0000 (reserved)

3rd word: 16#3169 (slave 1 is a 4-channel input slave)
input data AS-i slave 1, channel 0

4th word: 16#2202
input data AS-i slave 1, channel 1

5th word: 16#1395
input data AS-i slave 2, channel 1

6th word: 16#0033
input data AS-i slave 1, channel 3

7th word: 16#0055
o**v**erflow and **v**alid bits for AS-i slave 1:
TV = 1, OV = 0, O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

8th word: 16#2229 (slave 2 is a 2-channel input slave)
input data AS-i slave 2, channel 0

9th word: 16#2332
input data AS-i slave 2, channel 1

10th word: 16#7FFF
no valid value for channel 2

11th word: 16#7FFF
no valid value for channel 3

12th word: 16#0055 **o**verflow and **v**alid bits for AS-i slave 2:
TV = 1, OV = 0, O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

13th word: 16#3339 (slave 3 is a 4-channel output slave)
output data AS-i slave 3, channel 0

14th word: 16#1102
output data AS-i slave 3, channel 1

15th word: 16#1953
output data AS-i slave 3, channel 2

16th word: 16#1234
output data AS-i slave 3, channel 3

17th word: 16#0055 **o**verflow and **v**alid bits for AS-i slave 3:
TV = 1, OV = 1, O3 = 0, V3 = 1, O2 = 0, V2 = 1, O1 = 0, V1 = 1, O0 = 0, V0 = 1

OV: (**O**utput **v**alid):
OV = 1 = the AS-i slave has received valid data at least once in the last 3 seconds
OV = 0 = the AS-i slave has not received any valid output values for at least 3.5 seconds,
or: it is an input slave.

TV: (**T**ransfer **v**alid):
TV = 1 = the last value transmission to the AS-i slave was carried out correctly,
TV = 0 = the last transmission to the AS-i slave was faulty.

Since this flag [TV] evaluates the last value transfer cycle which was last completed, the response is delayed by up to 140 ms.

7.2.10 Command 28, 16#1C – deactivation of the slave reset when changing to the protected mode

When changing from the Config mode to the protected mode, all slaves are normally briefly reset (reset). This may lead to problems when the system is running. In such cases the "deactivation of the slave reset" prevents the short deactivation of the slave outputs during the change of the operating mode.

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 28 (16#1C)							
2	reserved = 00								reserved = 00							
3	16#00								offline phase = 16#00 or no offline phase = 16#01							

Example:

1st word: 16#041C
command number 1C,
user ID changes to 4

2nd word: 16#0000 (reserved)

3rd word: 16#0001
0 = offline phase when changing to the protected mode,
1 = no offline phase

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#1C							

Example:

1st word: 16#041C
reflected command number 1C,
user ID changes to 4

7.2.11 Command 31, 16#1F – one-time execution of the "Extended safety monitor protocol" in the "Safety at Work" monitor.

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	0	user ID					command number = 31 (16#1F)							
2	reserved = 00								reserved = 00							
3	subcommand = 0								0	0	0	AS-i slave address				
4…16	not used								not used							
17	field number = 0								data length = 0							
18	not used								not used							

Example:

1st word: 16#071F
command number 16#1F,
user ID changes to 7

2nd word: 16#0000 (reserved)

3rd word: 16#001E
subcommand 0 = one-time execution of the "Extended safety monitor protocol"
"Safety at work" monitor with the address 30 =16#1E

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	0	user ID					reflected command number = 16#1F							
2	reserved								reserved							
3	subcommand = 0								0	0	0	AS-i slave address				
4	LEDs OSSD 1				LEDs OSSD 2				data call 1				data call 0			
5	OSSD2 not green								OSSD1 not green							
6	1st colour output circuit 1								1st module address output circuit 1							
7	2nd colour output circuit 1								2nd module address output circuit 1							
8	3rd colour output circuit 1								3rd module address output circuit 1							
9	4th colour output circuit 1								4th module address output circuit 1							
10	5th colour output circuit 1								5th module address output circuit 1							
11	6th colour output circuit 1								6th module address output circuit 1							
12	1st colour output circuit 2								1st module address output circuit 2							
13	2nd colour output circuit 2								2nd module address output circuit 2							
14	3rd colour output circuit 2								3rd module address output circuit 2							
15	4th colour output circuit 2								4th module address output circuit 2							
16	5th colour output circuit 2								5th module address output circuit 2							
17	6th colour output circuit 2								6th module address output circuit 2							
18	field number = 0/1								0							

Description of the different fields:

Word no. 4:

LEDs OSSD 1				LEDs OSSD 2				Meaning
15	14	13	12	11	10	9	8	
0	0	0	0	0	0	0	0	green = contacts of the output circuits closed
0	0	0	1	0	0	0	1	yellow = start-up / restart disable active
0	0	1	0	0	0	1	0	yellow flashing or red: = contacts of the output circuits open
0	0	1	1	0	0	1	1	red flashing = error on the level of the monitored AS-i components
0	1	X	X	0	1	X	X	reserved

Data call 1				Data call 0				Meaning
7	6	5	4	3	2	1	0	
1	0	0	0	0	0	0	0	protective operation, everything OK (not available, not configured or depending output circuits are displayed as [OK])
1	0	0	1	0	0	0	1	protective operation, output circuit 1 off
1	0	1	0	0	0	1	0	protective operation, output circuit 2 off
1	0	1	1	0	0	1	1	protective operation, both output circuits off
1	1	0	0	0	1	0	0	configuration operation: power On.
1	1	0	1	0	1	0	1	configuration operation
1	1	1	0	0	1	1	0	reserved / not defined
1	1	1	1	0	1	1	1	configuration operation: fatal device error, RESET or device exchange required
1	X	X	X	1	X	X	X	no current diagnostic information available, please wait

Word no. 5:

OSSD2 not green			OSSD1 not green			Meaning
12...15	11	8…10	4...7	3	0...2	
reserved	0	0	reserved	0	0	no modules, responses of the data calls in the words 6...17 are not relevant
reserved	0	1...6	reserved	0	1...6	number of modules in output circuit 1 is 1...6
reserved	0	7	reserved	0	7	number of modules in the output circuit 1 is > 6

Word no. 6...17:

Module address 1...6 in output circuit 1/2:
Indicates the index of the module of the configuration. The module address which was defined in the program ASIMON is indicated.

Colour 1...6 in the output circuit 1/2:

3	2	1	0	Meaning
0	0	0	0	green, permanently lit
0	0	0	1	green, flashing
0	0	1	0	yellow, permanently lit
0	0	1	1	yellow, flashing
0	1	0	0	red, permanently lit
0	1	0	1	red, flashing
0	1	1	0	grey, out

Example: "Safety at Work" monitor has not triggered:

1st word: 16#071F
reflected command number 1F,
user ID changes to 7

2nd word: 16#0000 (reserved)

3rd word: 16#001E
reflected subcommand 0 and AS-i slave address 30

4th word: 16#0000
green: contacts of the output circuits closed

5th word: 16#0000
both output circuits green

6...17th word: 16#xxxx
not relevant because 5th word = 16#0000

18th word: 16#0100
field number = 1

"Safety at Work" monitor has triggered:

1st word: 16#071F
reflected command number 1F,
user ID changes to 7

2nd word: 16#0000 (reserved)

3rd word: 16#001E
reflected subcommand 0 and AS-i slave address 30

4th word: 16#2211
16#2xxx: output circuit 1 red:
16#x2xx: invalid, see word 5;
16#xx11: protective operation, output circuit 1 off

5th word: 16#0003
OSSD2 green; OSSD1 not green, provides 3 modules which are not green

6th word: 16#0421
module 33, 16#21 red permanently lit

7th word: 16#0422
module 34, 16#22 red permanently lit

8th word: 16#0423
module 35, 16#23 red permanently lit

9...11th word: 16#xxxx
not relevant because low byte of 5th word = 16#03 → 3 modules relevant

12...17th word: 16#xxxx
not relevant because high byte of 5th word = 16#00 → green, no module relevant

18th word: 16#0100
field number = 1

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M	user ID					reflected command number = 16#1F							
2	reserved								reserved							
3	16#00								error code							

Example:

1st word: 16F
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0011
error code = 16#0011: no slave with the profile S-7.F.F on the slave address

Possible error codes:

16#00 **16#01** **16#02**	general errors during command processing
16#0A **16#0B** **16#0C**	internal protocol error
16#10	subcommand invalid
16#11	no slave with the profile S-7.F.F on the slave address
16#16	the monitor with the address was changed in the protocol mode
16#20	the command could not be processed within the specified time
16#EE	fatal error during command execution

7.2.12 Command 21, 16#15 – read ID string of an AS-i slave with profile S-7.4

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R = 0	R = 0	M	user ID					command number = 21 (16#15)							
2	R	R	R	AS-i slave address					R	R	length to be sent (here = 0)					
3…18	not used								not used							

Example:

1st word: 16#0215
command number 16#15,
user ID changes to 2

2nd word: 16#0300
slave address 3

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#15							
2	TG	R	AS-i slave address					F	R	R	number of bytes to be received					
3	I/O	2D	DT start			DT count			Mux field			E type				
4	number of parameters to be read								EDT Read			reserved		Diag	reserved	
5	EDT Write			reserved					number of parameters to be written							
6	device-specific information								manufacturer identification							
7…16	device-specific information								device-specific information							
17	reserved								number of bytes received							
18	reserved								reserved							

Example:

1st word: 16#0215
reflected command number = 16#15,
user ID changes to 2

2nd word: 16#0604
slave address shifted 1 bit to the left = 6,
4 bytes of ID data

or:
2nd word: 16#8604
the most significant bit changes after every execution

3rd word: 16#2D01
1st word of the ID string of slave 3

4th word: 16#0203
2nd word of the ID string of slave 3

...

17th word: 16#0008
here: device transmits an ID string of 8 bytes length

S = sequence bit
Length: 1 bit
Permitted values: 0./1
Meaning:
1 = data transmission not yet completed, at least one more packet follows.
0 = data transmission completed.

TG = toggle bit
Length: 1 bit
Permitted values: 0/1
Meaning: value changes for each command execution

F = error bit
Length: 1 bit
Permitted values: 0/1
Meaning: =
0 = no error occurred
1 = an error occurred during execution, e.g. slave does not have the profile S-7.4

Mux field = number of multiplexed data words
Length: 3 bits
Permitted values: 0…3
Meaning: number = value in "Mux field" +1

E type = characterises the slave as regards functionality and data structure
Length: 5 bits
Permitted values: 0...31
Meaning:
0 = reserved
1 = transmitted values are measured values
2 = transmitted values are 16 digital bit values
3 = normal operation in 4-bit mode (4I/4O)
4...31 = reserved

I/O = direction of data for the devices with E type ≠ 3
Length: 1 bit
Permitted values: 0/1
Meaning:
0 = input,
1 = output

Number of parameters to be read = number of bytes which can be read as a parameter string
Length: 8 bits
Permitted values: 0...219
Meaning:
0 = no parameter string readable,
1...219 = number of bytes

Number of parameters to be written = number of bytes which can be written as a parameter string
Length: 8 bits
Permitted values: 0...219
Meaning:
0 = no parameter string readable,
1..219 = number of bytes

2D = double data transfer (redundancy) possible
Length: 1 bit
Permitted values: 0/1
Meaning:
0 = simple data transfer
1 = double data transfer

DT start = triple start (information for the driver in the master)

DT count = number of data triples (information for the driver in the master)

EDT read = reserved for later profiles

EDT write = reserved for later profiles

Diag = slave supports the 7.4 diagnosis string
Length: 1 bit
Permitted values: 0/1
Meaning:
0 = diagnosis string is not supported
1 = diagnosis string is supported

Manufacturer identification = defined manufacturer number assigned by AS-International

Device-specific information = as an option more bytes for the device-specific device description

Response controllerE >> host in case of a fault:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 1	B = 0	M = 0/1	user ID					reflected command number = 16#15							
2	reserved								reserved							
3	16#00								error code							

Example:

1st word: 16#8A03
error bit set: error when executing the command

2nd word: 16#0000 (reserved)

3rd word: 16#0014
error code = 16#0014: invalid S-7.4 command / master not in the normal mode

Possible error codes:

16#0C	faulty S-7.4 protocol sequence
16#0D	S-7.4 protocol aborted (timeout)
16#0E	invalid AS-i slave address for the S-7.4 protocol (e.g. B slaves)
16#0F	AS-i slave has terminated the S-7.4 string
16#10	AS-i S-7.4 no longer connected (no longer in LAS)
16#11	another S-7.4 transfer to the addressed AS-i slave is already active
16#12	previous segmented S-7.4 transfer not yet completed
16#13	invalid S-7.4 data length
16#14	invalid S-7.4 command / master not in the normal mode

7.2.13 Command 33, 16#21 – read diagnosis string of an AS-i slave with profile S-7.4

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	S = 0	M	user ID					command number = 33 (16#21)							
2	R	R	R	AS-i slave address					R	R	length to be sent (here = 0)					
3…18	not used								not used							

Bit S in the first word signals the receiver that a large data packet is transmitted in several partial sequences:
S = 1: data transmission not yet completed, at least one more packet follows.
S = 0: data transmission completed.

Example:

1st word: 16#0721
S = 0: sequence here always 0,
command number 16#21,
user ID changes to 7

2nd word: 16#0300
slave address 3

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	S	M	user ID					reflected command number = 16#21							
2	TG	R	AS-i slave address					F	R	R	number of bytes to be received					
3	diagnosis string 1								diagnosis string 0							
4…16	diagnosis string 2...27															
17	diagnosis string 29								diagnosis string 28							
18	reserved								reserved							

Example:

1st word: 16#0721
S = 0: last sequence, reflected command number 16#21,
user ID changes to 7

2nd word: 16#0608
slave address shifted 1 bit to the left = 6,
8 bytes of diagnosis data

or:
2nd word: 16#8608
the most significant bit changes after every execution

3rd word: 16#2D01
1st word of the diagnosis data of slave 3

4th word: 16#0203
2nd word of the diagnosis data of slave 3

5th word: 16#1122
3rd word of the diagnosis data of slave 3

6th word: 16#3344
4th word of the diagnosis data of slave 3

NOTE

The control bytes defined in profile 7.4 with follow and valid bits are filtered out by the system.

7.2.14 Command 34, 16#22 – read parameter string of an AS-i slave with profile S-7.4

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	S = 0	M	user ID					command number = 34 (16#22)							
2	R	R	R	AS-i slave address					R	R	length to be sent (here = 0)					
3…18	not used								not used							

Bit S in the first word signals the receiver that a large data packet is transmitted in several partial sequences:
S = 1: data transmission not yet completed, at least one more packet follows.
S = 0: data transmission completed.

Example:

1st word: 16#0822
command number 16#22,
user ID changes to 8

2nd word: 16#0300
slave address 3

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	S	M	user ID					reflected command number = 16#22							
2	TG	R	AS-i slave address					F	R	R	number of bytes to be received					
3	parameter string 1								parameter string 0							
4…16	parameter string 2…27															
17	parameter string 29								parameter string 28							
18	reserved								reserved							

Example:

1st word: 16#0822
reflected command number = 16#22,
user ID changes to 8

2nd word: 16#0604
slave address shifted 1 bit to the left = 6,
4-byte parameter string

or:
2nd word: 16#8604
the most significant bit changes after every execution

3rd word: 16#1234
1st word of the parameter string of slave 3

4th word: 16#5678
2nd word of the parameter string of slave 3

NOTE

The control bytes defined in profile 7.4 with follow and valid bits are filtered out by the system.

7.2.15 Command 35, 16#23 – write parameter string of an AS-i slave with profile S-7.4

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	S	M	user ID					command number = 35 (16#23)							
2	R	R	R	AS-i slave address					R	R	length to be sent					
3	parameter string 1								parameter string 0							
4…11	parameter string 2…17															
12	parameter string 19								parameter string 18							
13...18	not used								not used							

Bit S in the first word signals the receiver that a large data packet is transmitted in several partial sequences:
S = 1: data transmission not yet completed, at least one more packet follows.
S = 0: data transmission completed.

Example:

1st word: 16#0923
command number 16#23,
user ID changes to 9

2nd word: 16#0304
slave address 3,
4-byte parameter string to be sent

3rd word: 16#1AF4
1st word of the parameter string for slave 3

4th word: 16#5BB8
2nd word of the parameter string for slave 3

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	S	M	user ID					reflected command number = 16#23							
2	TG	R	AS-i slave address					F	R	R	number of bytes to be received					
3...18	reserved								reserved							

Example:

1st word: 16#0923
reflected command number = 16#23,
user ID changes to 9

2nd word: 16#0604
slave address shifted 1 bit to the left = 6,
4-byte parameter string

or:
2nd word: 16#8604
the most significant bit changes after every execution

NOTE

The number of the bytes to be sent must be divisible by 2 since the system always transmits only multiples of 2 bytes in the S7.4 protocol.

The control bytes defined in profile 7.4 with follow and valid bits are completed automatically by the system. Therefore, without segmentation, this command is limited to 20 bytes of parameter data. Larger data volumes must be divided into several segments.

7.2.16 Command 50, 16#32 – read current configuration AS-i slaves 0(A)…15(A)

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 50 (16#32)							
2	reserved = 00								reserved = 00							
3...18	not used								not used							

Example:

1st word: 16#0232 (command number 16#32, user ID changes to 2)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#32							
2	reserved								reserved							
3	slave 0, ID2				slave 0, ID1				slave 0, ID code				slave 0, IO conf.			
4	slave 1(A), ID2				slave 1(A), ID1				slave 1(A), ID code				slave 1(A), IO conf.			
5…17	...				...				...				...			
18	slave 15(A), ID2				slave 15(A), ID1				slave 15(A), ID code				slave 15(A), IO conf.			

Example:

1st word: 16#0232
reflected command number = 16#32,
user ID changes to 2

2nd word: 16#00FF (reserved)

3rd word: 16#FFFF
current configuration slave 0:
ID2 =F, ID1=F, ID=F and IO=F

4th word: 16#EF03
current configuration slave 1(A):
ID2 =E, ID1=F, ID=0 and IO=3

...

18th word: 16#EF37
current configuration slave 15(A):
ID2 =E, ID1=F, ID=3 and IO=7

7.2.17 Command 51, 16#33 – read current configuration AS-i slaves 16(A)…31(A)

→ command 50

7.2.18 Command 52, 16#34 – read current configuration AS-i slaves 0...15B

→ command 50

7.2.19 Command 53, 16#35 – read current configuration AS-i slaves 16B...31B

→ command 50

7.2.20 Command 54, 16#36 – read current parameters of a connected AS-i slave

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 54 (16#36)							
2…18	not used								not used							

Example:

1st word: 16#0636
command number 16#36,
user ID changes to 6

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#36							
2	reserved								reserved							
3	parameters slave 4(A)					parameters slave 3(A)			parameters slave 2(A)				parameters slave 1(A)			
4	parameters slave 8(A)					parameters slave 7(A)			parameters slave 6(A)				parameters slave 5(A)			
5	parameters slave 12(A)					parameters slave 11(A)			parameters slave 10(A)				parameters slave 9(A)			
6	parameters slave 16(A)					parameters slave 15(A)			parameters slave 14(A)				parameters slave 13(A)			
7	parameters slave 20(A)					parameters slave 19(A)			parameters slave 18(A)				parameters slave 17(A)			
8	parameters slave 24(A)					parameters slave 23(A)			parameters slave 22(A)				parameters slave 21(A)			
9	parameters slave 28(A)					parameters slave 27(A)			parameters slave 26(A)				parameters slave 25(A)			
10	Parameters slave 1B					parameters slave 31(A)			parameters slave 30(A)				parameters slave 29(A)			
11	parameters slave 5B					parameters slave 4B			parameters slave 3B				parameters slave 2B			
12	parameters slave 9B					parameters slave 8B			parameters slave 7B				parameters slave 6B			
13	parameters slave 13B					parameters slave 12B			parameters slave 11B				parameters slave 10B			
14	parameters slave 17B					parameters slave 16B			parameters slave 15B				parameters slave 14B			
15	parameters slave 21B					parameters slave 20B			parameters slave 19B				parameters slave 18B			
16	parameters slave 25B					parameters slave 24B			parameters slave 23B				parameters slave 22B			
17	parameters slave 29B					parameters slave 28B			parameters slave 27B				parameters slave 26B			
18	not used					not used			parameters slave 31B				parameters slave 30B			

Example:

1st word: 16#0636
reflected command number = 16#36,
user ID changes to 6

2nd word: 16#00FF (reserved)

3rd word: 16#4321
parameters from slave 1 (value = 1) to slave 4 (value = 4)

4th word: 16#8765
parameters from slave 5 (value = 5) to slave 8 (value = 8)

...

9th word: 16#6543
parameters from slave 29(A) (value = 3) to slave 31(A) (value = 5), slave 1B (value = 6)

...

17th word: 16#FE98
parameters from slave 26B (value = 8) and slave 29B (value = F)

18th word: 16#0098
parameters from slave 30B (value = 8) and slave 31B (value =9)

7.2.21 Command 55, 16#37 – read current AS-i slave lists

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 55 (16#37)							
2...18	not used								not used							

Example:

1st word: 16#0737
command number 16#37,
user ID changes to 7

Response controllerE >> host:

Word no.		Bit															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1		E = 0	B = 0	M	user ID					reflected command number = 16#37							
2		reserved								reserved							
3	LAS	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)	res
4		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)
5		15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
6		31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B
7	LDS	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
8		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)
9		15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
10		31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B
11	LPF	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)	res
12		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)
13		15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
14		31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B
15	LPS	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)	res
16		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)
17		15B	14B	13B	12B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	res
18		31B	30B	29B	28B	27B	26B	25B	24B	23B	22B	21B	20B	19B	18B	17B	16B

Example:

1st word: 16#0637
reflected command number = 16#37,
user ID changes to 7

2nd word: 16#00FF (reserved)

3rd word: 16#0102
LAS slaves (0) to 15(A); here: slaves 1 and 8 active

4th word: 16#8001
LAS slaves 16(A) to 31(A); here: slaves 16 and 31 active

5th word: 16#0102
LAS slaves (0B) to 15B; here: slaves 1B and 8B are active

6th word: 16#8001
LAS slaves 16B to 31B; here: slaves 16B and 31B are active

7th word: 16#0102
LDS slaves (0) to 15(A); here: slaves 1 and 8 detected

8th word: 16#8001
LDS slaves 16(A) to 31(A); here: slaves 16 and 31 detected

9th word: 16#0102
LDS slaves (0B) to 15B; here: slaves 1B and 8B are detected

10th word: 16#8001
LDS slaves 16B to 31B; here: slaves 16B and 31B are detected

11th word: 16#0100
LPF slaves (0) to 15(A), here: peripheral fault on slave 8

12th word: 16#0001
LPF slaves 16(A) to 31(A); here: peripheral fault on slave 16

13th word: 16#0002
LPF slaves (0B) to 15B; here: peripheral fault on slave 1B

14th word: 16#8000
LPF slaves 16B to 31B; here: peripheral fault on slave 31B

15th word: 16#0102
LPS slaves (0) to 15(A); here: slaves 1 and 8 projected

16th word: 16#8001
LPS slaves 16(A) to 31(A); here: slaves 16 and 31 projected

17th word: 16#0102
LPS slaves (0B) to 15B; here: slaves 1B and 8B are projected

18th word: 16#8001
LPS slaves 16B to 31B; here: slaves 16B and 31B are projected

7.2.22 Command 56, 16#38 – read projected configuration AS-i slaves 1(A)..15(A)

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	M	user ID					command number = 56 (16#38)							
2…18	not used								not used							

Example:

1st word: 16#0238
command number 16#38,
user ID changes to 2

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	M	user ID					reflected command number = 16#38							
2	reserved								reserved							
3	slave 0, ID2				slave 0, ID1				slave 0, ID code				slave 0, IO conf.			
4	slave 1(A), ID2				slave 1(A), ID1				slave 1(A), ID code				slave 1(A), IO conf.			
5…17	...				...				...				...			
18	slave 15(A), ID2				slave 15(A), ID1				slave 15(A), ID code				slave 15(A), IO conf.			

Example:

1st word: 16#0238
reflected command number = 16#38,
user ID changes to 2

2nd word: 16#00FF (reserved)

3rd word: 16#FFFF
here not used since slave 0 cannot be projected

4th word: 16#EF03
projected config. slave 1(A),
ID2 =E, ID1=F, ID=0 and IO=3

...

18th word: 16#EF37
slave 15(A),
ID2 =E, ID1=F, ID=3 and IO=7

7.2.23 Command 57, 16#39 – read projected configuration AS-i slaves 16(A)...31(A)

→ command 56

7.2.24 Command 58, 16#3A – read projected configuration AS-i slaves 1B…15B

→ command 56

7.2.25 Command 59, 16#3A – read projected configuration AS-i slaves 16B…31B

→ command 56

7.2.26 Command 96, 16#60 – save data non-volatilely in the flash memory of the controllerE

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	R	user ID					command number = 96 (16#60)							
2	reserved = 00								reserved = 00							
3	16#00								area number							
4…18	not used								not used							

Example:

1st word: 16#0960
command number 16#60,
user ID changes to 9

2nd word: 16#0000 (reserved)

3rd word: 16#0002
area number = 2 saves the configuration of AS-i master 1 in a non-volatile manner
area number = 3 saves the configuration of AS-i master 2 in a non-volatile manner

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	R	user ID					reflected command number = 16#60							
2	reserved								reserved							
3	16#00								area number							

Example:

1st word: 16#0960
reflected command number = 16#60,
user ID changes to 9

2nd word: 16#00FF (reserved)

3rd word: 16#0002
reflected area number

7.2.27 Command 97, 16#61 – carry out various settings in the controllerE

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	R	user ID					command number = 97 (16#61)							
2	reserved = 00								reserved = 00							
3	16#00								command number							
4...18	not used								not used							

Example:

1st word: 16#0861
command number 16#61
user ID changes to 8

2nd word: 16#0000 (reserved)

3rd word: 16#0002
command number = 16#10 changes the operating mode of the PLC

4th word: 16#0002
value = 2 → sets the operation mode of the PLC to RUN
value = 1 → stops the PLC
value = 0 → activates the gateway mode

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	R	user ID					reflected command number = 16#61							
2...18	reserved								reserved							

Example:

1st word: 16#0861
reflected command number = 16#61,
user ID changes to 8

7.2.28 Command 102, 16#66 – retrieve the status of the controllerE display

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	R	user ID					command number = 102 (16#66)							
2	reserved = 00								reserved = 00							
3	16#00								command number = 16#01							
4...18	not used								not used							

Example:

1st word: 16#0766
command number 16#66
user ID changes to 7

2nd word: 16#0000 (reserved)

3rd word: 16#0001
command number = 16#10 changes the operating mode of the PLC

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	R	user ID					reflected command number = 16#66							
2	reserved								reserved							
3	pressed keys															
4	active menu area															
5	process error occurred															
6	currently displayed menu window															
7	activated system language															
8…18	reserved															

Example:

1st word: 16#0766
reflected command number = 16#66,
user ID changes to 7

2nd word: 16#0000 (reserved)

3rd word: 16#0008 (currently the right key is being pressed)
bit 0: left key
bit 1 key [▲]
bit 2: key [▼]
bit 3: right key

4th word: 16#00A0 (currently the system menu is active)
16#00A0: system menu is active
16#00A1: user menu is active
16#00AE: process error display is active (E10...E30)
16#00AF: system error display is active (acknowledgement required)

5th word: 16#0001
1 = process error occurred,
0 = no process errors occurred

6th word: 16#001B
menu number 27 (16#1B) → [Quick Setup] is displayed

7th word: 16#0000
0 = the English menus are displayed
1 = switched to the second system language

7.2.29 Command 105, 16#69 – read the device properties of the controllerE

Request from the host >> controllerE:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	R	R	R	user ID					command number = 105 (16#69)							
2...18	not used								not used							

Example:

1st word: 16#0669 (command number 16#69 user ID changes to 6)

Response controllerE >> host:

Word no.	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	E = 0	B = 0	R	user ID					reflected command number = 16#69							
2	reserved								reserved							
3	2M	DP	EN	reserved					PLC mode							
4	reserved								Anybus type							
5	reserved								flash memory type							
6	hardware version															
7	RTS firmware version number															
8	RTS firmware release number															
9	AS-i master 1 firmware version number															
10	AS-i master 1 firmware release number															
11	AS-i master 2 firmware version number															
12	AS-i master 2 firmware release number															
13	Linux kernel version															
14	Linux ramdisk version															
15…18	reserved															

Example:

1st word: 16#0669
reflected command number = 16#69,
user ID changes to 6

2nd word: 16#0000 (reserved)

3rd word: 16#4008
here: Profibus DP controllerE with an AS-i master,
without Ethernet programming interface,
signal preprocessing not used

2M = device has 1 or 2 AS-i masters:
0 = device has 1 AS-i master
1 = device has 2 AS-i masters

DP = device with/without fieldbus interface Profibus DP:
0 = fieldbus interface Profibus DP not available
1 = fieldbus interface Profibus DP available

EN = device with/without programming interface:
0 = Ethernet programming interface not available
1 = Ethernet programming interface available

PLC mode:
1 = PLC in RUN,
2 = PLC in STOP,
4 = PLC stops at the breakpoint,
8 = gateway mode

4th word: 16#000B (Anybus type used)
16#0001: Anybus Profibus DP
16#0004: Anybus EtherCAT
16#0005: Anybus EtherCAT
16#0009: Anybus Ethernet IT
16#000A: Anybus Ethernet/IP
16#000B: ifm Profibus DP
16#000C: no fieldbus module detected

5th word: 16#0002 (flash memory type)

6th word: 16#1000 (hardware version)

7th word: 16#0002 (1st part of the RTS firmware version, here: 02.218B)
version number 02.xxxx

8th word: 16#218B (2nd part of the RTS firmware version, here: 02.218B)
release number xx.218B

9th word: 16#0000 (1st) part of the AS-i master 1 firmware version, here: 0.238A)
version number 0.xxxx

10th word: 16#238A (2nd part of the AS-i master 1 version, here: 0.238A)
release number x.238A

11th word: 16#0000 (1st part of the AS-i master 2 firmware version, here: 0.238A)
version number 0.xxxx

12th word: 16#238A (2nd part of the AS-i master 2 version, here: 0.238A)
release number x.238A

13th word: 16#0196 (Linux Kernel version: 406)

14th word: 16#0A6E (Linux ramdisc version: 10.110)

8 Special settings

8.1 Setting [Number of channels per analogue slave]

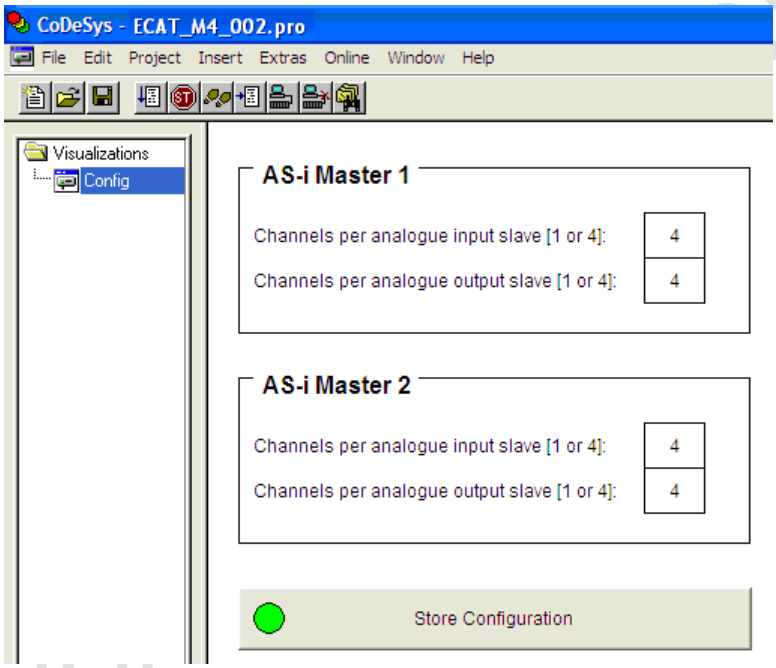
The number of channels per analogue slave can be set separately for each of the groups listed below. A setting always concerns the whole group; a slave-specific assignment is not possible. The settings are only carried out via the controllerE configuration and programming software CoDeSys. It is not possible to view and edit these parameters via the display of the controllerE. The CoDeSys software and the required programming cable are not included in the scope of delivery of the controllerE and have to be ordered separately.

The source code for the required driver project has to be requested separately from **ifm electronic gmbh**.

Group	Possible setting values [Number of channels per slave]
analogue inputs of AS-i master 1	1 or 4*
analogue outputs of AS-i master 1	1 or 4*
analogue inputs of AS-i master 2	1 or 4*
analogue outputs of AS-i master 2	1 or 4*

* preset value

The following figure shows the visualisation screen in which the settings can be carried out. Click on [Store Configuration] to store the changed configuration.



9 Operating and display elements

Diagnostic LEDs → separate basic device manual

Key functions → separate basic device manual

Display basic functions → separate basic device manual

9.1 Status LEDs on the network connection

4 status LEDs on the controllerE inform about the status of the EtherCAT interface and the systems connected to it:

RUN	☼	☼	**ERR**
Link/Activity 1	☼	☼	**Link/Activity 2**

Figure: status LEDs on the network connection

9.1.1 LED [RUN]

LED status	Description
out	module in the INIT state
green flashing	module in the PRE-OPERATIONAL state
green (1x, pause)	module in the SAFE-OPERATIONAL state
permanently green	module in the OPERATIONAL state

9.1.2 LED [ERR]

LED status	Description
out	EtherCAT communication is active
red flashing	general configuration error
red (1x, pause)	the application has changed the EtherCAT operating status automatically
red (2x, pause)	SYNC manager timeout
permanently red	application watchdog timeout (e.g. PLC not in the operating mode RUN)

9.1.3 LED [Link/Activity x], x = 1 or 2

LED status	Description
out	no Ethernet connection detected on port x
permanently green	Ethernet connection detected on port x
green flashing irregularly	exchange of Ethernet packages on port x

9.2 Display

Display basic functions → separate basic device manual

10 Menu

NOTE

All menu texts in this manual are in English.

Basic functions → separate basic instructions of the device manual

10.1 Main menu [Quick Setup]

Setting and reading of the fieldbus parameters (password level 1 required).

Details → page 116, chapter „Setting and reading of the fieldbus parameters“

Menu tree	Explanation
Quick Setup Fieldbus Setup	> Display of the fieldbus module 1 ► Change fieldbus module 1 using the keys [▲] / [▼] ► After pressing [OK]: > Display of the fieldbus module 2 … ► Change fieldbus module 19 using the keys [▲] / [▼] ► After pressing [OK]: > Display of the fieldbus module 1 … ► After pressing [ESC] twice: > Return to the start screen

10.2 Main menu [Fieldbus Setup]

Setting and reading of the fieldbus parameters (password level 1 required).
Details → page 116, chapter „Setting and reading of the fieldbus parameters“

Menu tree	Explanation
Fieldbus Setup	> Display of the fieldbus module 1 ► Change fieldbus module 1 using the keys [▲] / [▼] ► After pressing [OK]: > Display of the fieldbus module 2 … ► Change fieldbus module 19 using the keys [▲] / [▼] ► After pressing [OK]: > Display of the fieldbus module 1 … ► After pressing [ESC] twice: > Return to the start screen

11 Set-up

This chapter shows you how to get the EtherCAT fieldbus interface started quickly.

11.1 Basic settings of the fieldbus interface

The necessary settings of the EtherCAT fieldbus interface of the controllerE can be made by means of the integrated display and the four operating keys. In the menu [Fieldbus Setup] the user can make all the necessary basic settings or view the present configuration.

[Menu] > [Fieldbus Setup] **or**
[Menu] > [Quick Setup] > [Fieldbus Setup])

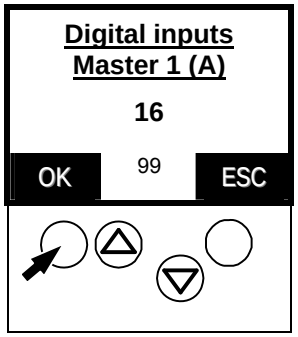
11.2 Parameter setting of the controllerE

11.2.1 Parameter setting of slaves in the controllerE

Set the parameters of the slaves in the AS-i controllerE as described in the basic device manual.

11.3 Setting and reading of the fieldbus parameters

1st



> Indicates that the fieldbus module 1 (digital input master 1(A)) with a length of 16 bytes is activated.

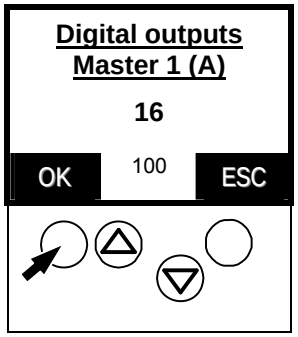
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

2.



> Indicates that the fieldbus module 2 (digital output master 1 (A)) with a length of 16 bytes is activated.

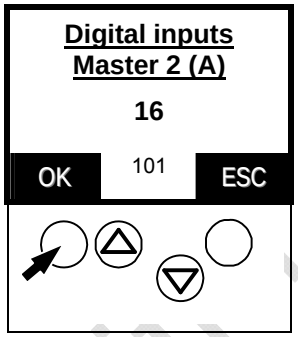
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

3.



> Indicates that the fieldbus module 3 (digital input master 2(A)) with a length of 16 bytes is activated.

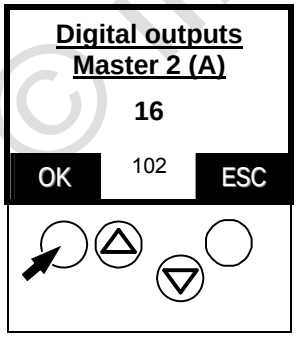
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

4.



> Indicates that the fieldbus module 4 (digital output master 2 (A)) with a length of 16 bytes is activated.

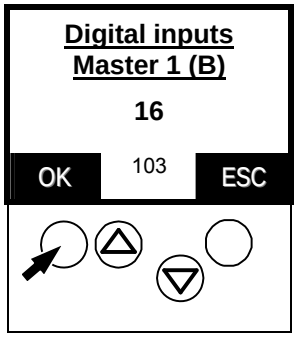
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

5.



> Indicates that the fieldbus module 5 (digital input master 1B) with a length of 16 bytes is activated.

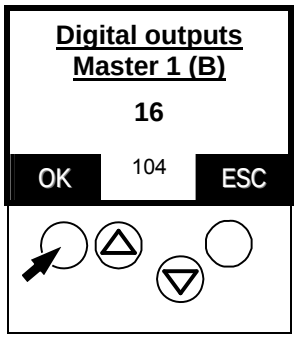
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

6.



> Indicates that the fieldbus module 6 (digital output master 1B) with a length of 16 bytes is activated.

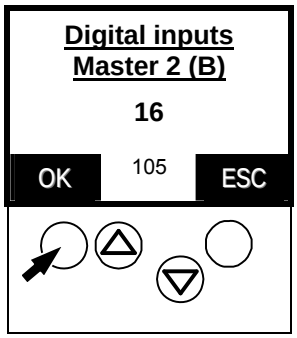
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

7.



> Indicates that the fieldbus module 11 (digital input master 2B) with a length of 16 bytes is activated.

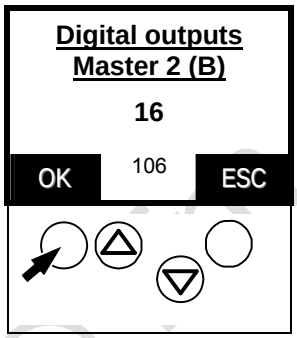
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

8.



> Indicates that the fieldbus module 8 (digital output master 2B) with a length of 16 bytes is activated.

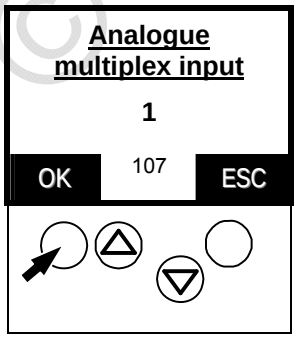
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

9.



> Indicates that the fieldbus module 9 (analogue multiplex input) is activated.

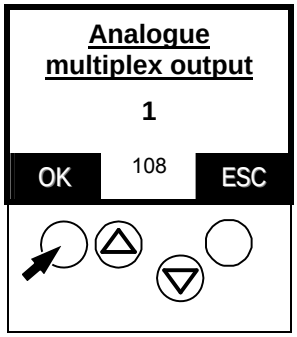
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

10.



> Indicates that the fieldbus module 10 (analogue multiplex output) is activated.

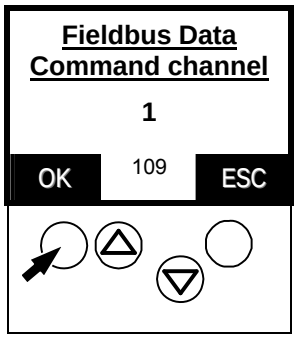
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

11.



> Indicates that the fieldbus module 11 (fieldbus data command channel) is activated.

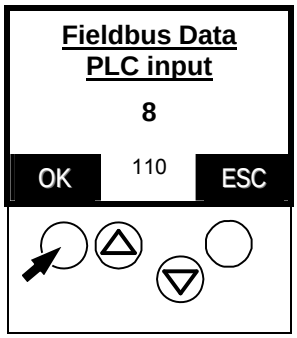
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

12.



> Indicates that the fieldbus module 12 (fieldbus data PLC input) with a length of 8 bytes is activated.

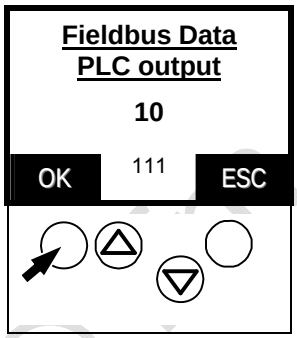
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

13.



> Indicates that the fieldbus module 13 (fieldbus data PLC output) with a length of 10 bytes is activated.

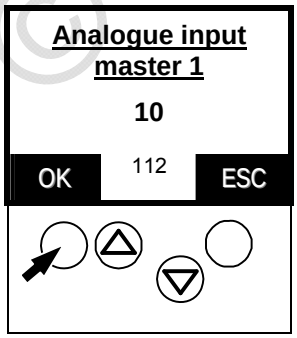
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

14.



> Indicates that the fieldbus module 14 (analogue input master 1) with a length of 10 * 4 words is activated.

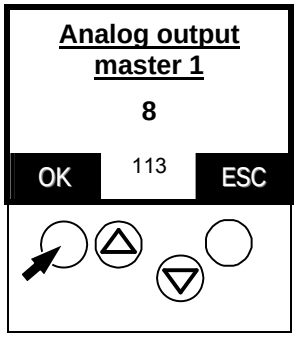
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

15.



> Indicates that the fieldbus module 15 (analogue output master 1) with a length of 8 * 4 words is activated.

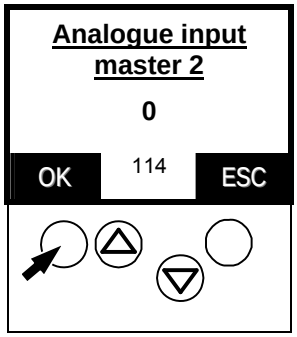
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

16.



> Indicates that the fieldbus module 16 (analogue input master 2) is not activated.

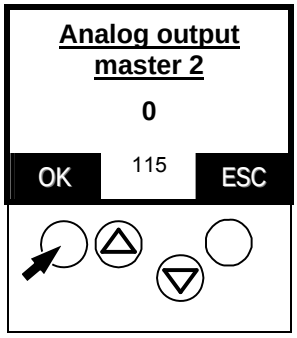
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

17.



> Indicates that the fieldbus module 17 (analogue output master 2) is not activated.

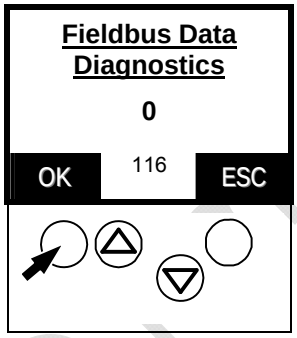
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

18.



> Indicates that the fieldbus module 18 (fieldbus data diagnosis) is not activated.

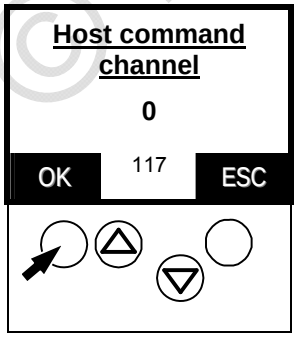
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

19.



> Indicates that the fieldbus module 19 (command channel) is not activated.

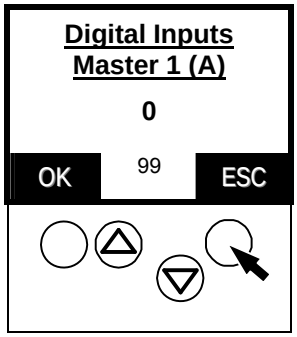
► Use [▲] / [▼] to change the setting.

► Use [OK] to acknowledge the changed setting and scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

20.



> Repetition of the display series (→ step 1)

► Use [OK] to scroll to the next display.

OR:

► Use [ESC] to return to screen 99 (digital inputs master 1 (A)].

11.4 Store system parameters

→ Basic device manual

12 Terms, abbreviations

A/B slave	→ Slave with an A or B being appended to its address number and which may therefore be present twice on the → master.
Address	This is the "name" of the bus participant. All participants need a 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.
Baud	Baud, abbrev.: Bd = unit of measurement of the speed of data transmission. 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
Operating system	Basic program in the device, establishes the connection between the hardware of the device and the user software.
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 large data volumes. It is available in different variants, e.g. EtherCAT, CAN in Automation (CiA) or → EtherCAT. CAN can be used e.g. as a supplier for AS-i over long 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
DHCP	DHCP = **D**ynamic **H**ost **C**onfiguration **P**rotocol = protocol for the dynamic configuration by the → host DHCP is a protocol that provides dynamic configuration of IP addresses and associated information. The protocol supports use of IP addresses which are only available in a limited number by a centralised management of the address assignment. The participant logs on to 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 interfere with their environment and must not be adversely affected by external electromagnetic interference.
EtherCAT	EtherCAT is an → Ethernet-based fieldbus initiated by the company Beckhoff. The aim of the development was to achieve extremely short cycle times → jitter for exact synchronisation (≤ 1 µs) and low hardware costs.

Ethernet	Ethernet is a widely used, manufacturer-independent technology which enables transmission of data in the network. 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	Access, 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 between AS-i and higher-level fieldbus systems such as Ethernet-DP, EtherCAT, 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. → Ethernet-DP slave).
GSD	**G**eneric **S**tation **D**escription Describes the interface to the device to be connected to the fieldbus. The file is provided on the ifm CD (→ folder "Gateway").
Host	The controller in the hierarchy above the AS-i master, e.g. a PLC or a processor.
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.
Jitter	By jitter is understood a slight fluctuation in accuracy in the transmission cycle when transmitting digital signals. More generally, jitter in transmission technology means an abrupt and undesired change of the signal characteristics.
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	**L**ight **E**mitting **D**iode Light-emitting diode, also luminescent diode, an electronic element with a high, coloured luminosity in a small area, with a negligible power dissipation.
LFS	**L**ist of **F**ailed **S**laves = list of slaves with projection errors In this slave list the controllerE enters the slaves with a projection error on 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 = manufacturer's serial number → ID = **Id**entifier Every network card has a MAC address, a clearly defined worldwide unique numerical code, more or less a kind of serial number. Such a 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 (→ cyclical 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 the 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 logical units (unit IDs) in a physical device. To do so, the 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 Group Schneider in 1994.
OSSD	OSSD = **O**utput **S**ignal **S**witching **D**evice = output signal of a switching device, here: output signal of an AS-i safety monitor
Password	The handling can be restricted or enabled in the menu [System Setup], menu item [Password]. 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 blocked.
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 mean?“

Polling	to poll = to count votes The controller master fetches the data from every participant in the system successively: Master calls participant 1. Participant 1 replies with its current data (actual values). Master transfers more data (target values) to participant 1, if needed. Participant 1 acknowledges reception of the data. Etc. , the same procedure for each further participant. Cyclical 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.
Ethernet	Fieldbus system for larger data volumes, it requires special cables, complex connection technology. Available in different versions as Ethernet-DP or -PA. The Ethernet-DP can be used as a supplier for AS-i over long distances. Corresponding → gateways are available.
Ethernet-DP	Ethernet-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 (similar to → Ethernet-FMS). Data rates up to 12 Mbits/s on twisted two-wire cables and/or fibre optics are possible.
Ethernet-PA	Ethernet-PA (**P**rocess **A**utomation) is used for the control of measurement devices by a process control system in process technology. This ETHERNET variant is suitable for hazardous areas (zones 0 and 1). Here, 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 of safety extra low voltage circuits must neither be connected to ground nor to protective wires 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 value 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 in the bus have a unique address.→ Difference: Single slaves whose address numbers may only occur once on the → master and A/B slaves with an A or B being appended to their address number which may therefore be present in the → master twice.
Target	The target indicates the target system on which 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.
XML	The **Ex**tensible **M**arkup **L**anguage, abbreviated **XML**, is a markup language that is used to represent hierarchically structured data in a textual data format. XML is used among others for the platform- and implementation-independent exchange of data between computer systems. For the controllerE AC1391/92 the characteristics of the device regarding EtherCAT are described in an XML file.
Cycle time	This is the time for one cycle. The following 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 described in *detail* is written in *italics*.