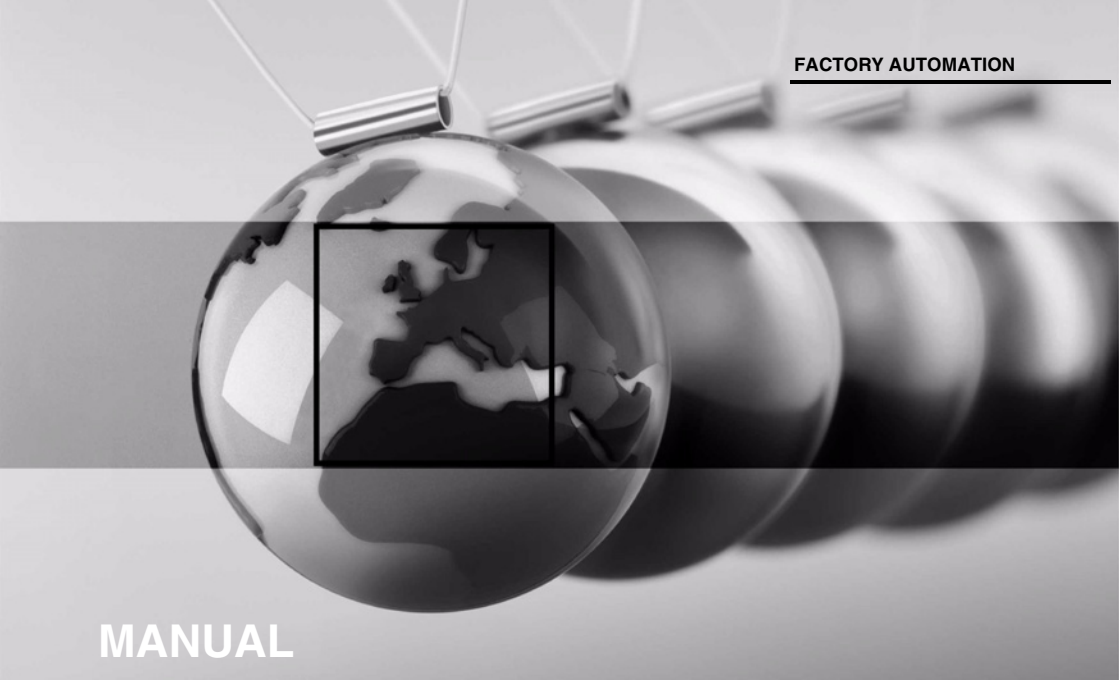

MANUAL

VBM-CTR-K20-R2

AS-INTERFACE/RS 232-MASTER

CE

PEPPERL+FUCHS
SENSING YOUR NEEDS

Table of Contents

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1 The Used Symbols

 Warning	This symbol warns the user of possible danger. Not following this warning can lead to personal injury or death and/or destruction of the equipment.

 Attention	This symbol warns the user of a possible failure. Not following this warning can lead to total failure of the device or any other connected equipment.

 Note	This symbol draws the user's attention to important information.

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2 Safety

2.1 Intended use

 Warning	The protection of operating personnel and the system against possible danger is not guaranteed if the control interface unit is not operated in accordance with its intended use. The device may only be operated by appropriately qualified personnel in accordance with this operating manual.

2.2 General safety information

 Warning	Safety and correct functioning of the device cannot be guaranteed if any operation other than that described in this operation manual is performed. Connecting the equipment and any maintenance work to be carried out with voltage applied to the equipment must exclusively be performed by appropriately qualified electrotechnical personnel. In case a failure cannot be repaired, the device must be taken out of operation and kept from inadvertently being put back into operation. Repair work is to be carried out by the manufacturer only. Additions or modifications to the equipment are not allowed and will void the warranty.

 Note	The operator is responsible for the observance of local safety standards.

2.3 Waste disposal

 Attention	• All devices and components are to be used properly! • Non-usable electrical components are hazardous waste and they should be disposed separatelly! • Local and national guide lines during waste disposal are to be respected!

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3 General Information

This operating instruction holds for the following device of the Pepperl+Fuchs Group:

AS-i 3.0 232 Master in Stainless Steel single master, control enabled	VBM-CTR-K20-R2 '# 195379

The AS-i masters with serial interface serve to control an AS-i circuit as a stand-alone device or can be connected to a host via the serial interface.

All AS-i functions can be called via the serial interface.

The AS-i data can be transmitted by using the standard protocol with a high transfer rate. With a rate of 57600 Baud (1200, 2400, 4800, 9600, 19200; 28800, 38400, 57600, 115200 Baud or automatic recognition) short cycle times for the data exchange via the serial interface can be realized.

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4 AS-i Specification 3.0

The AS-i 3.0 RS 232 Master already fulfil the current AS-i Specification 3.0.

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

Advanced Diagnostics

Diagnostics, which go far beyond the standard diagnostics facilitate the simple detection of the occassionally occuring configuration errors and further irritations towards the AS-i communication. So in case of an error the down time of machines can be minimized or you can initiate preventive maintenance.

Commissioning and monitoring

Commissioning, debugging and setting up of the AS-i parameters can be accomplished as follows:

- with the use of the 4 push-buttons on the fronside of the gateway, the display and the LEDs
- with the help of the software "AS-i Control Tools".

4.1 Accessories

- Software "AS-i Control Tools" full version
- AS-i Power Supply 4 A
- D-sub-data cable 9-pin, 1,8 m

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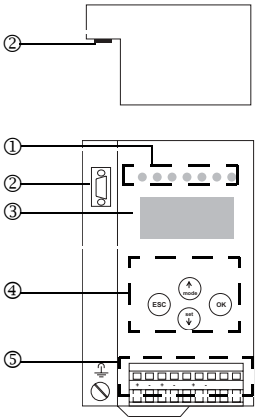
5 Connections, Displays and Operating Keys



On the front panel of the device in stainless steel housing are located:

- [1] LEDs
- [2] SUB-D connector as RS 232 interface
- [3] LC display
- [4] Push-buttons to configure the device
- [5] Terminals to connect the power supply and the AS-i circuit.

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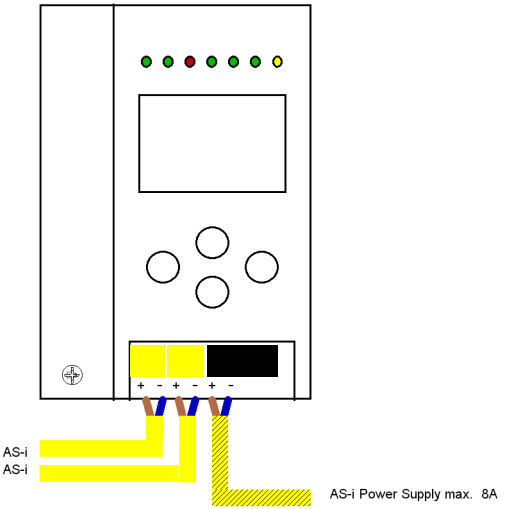
5.1 Single Master

5.1.1 Connections



Note	It is not allowed to connect AS-i power supplies or another master to the yellow marked cable.

Note	It is not allowed to connect slaves or repeaters to the hatched marked cable.

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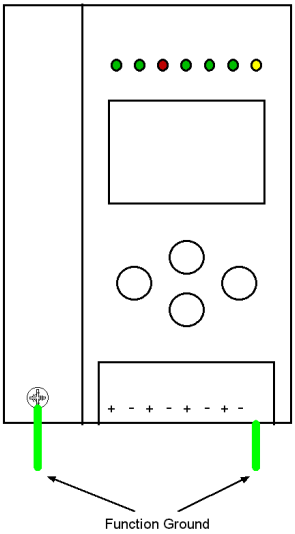
5.1.1.1 Function ground



Note	• The function ground can be connected either at the ground screw or at the terminal. • The function ground should be connected with a cable as short as possible to guarantee a good EMC property. • Therefore is to prefer to connect the ground via the ground screw.

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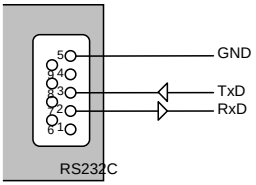
5.1.2 Serial interface

The AS-i Master with RS 232 sends on pin 2 of the sub-D connector (“RxD” signal)



and receives on pin 3 (“TxD” signal). Pin 5 of the sub-D connector carries the signal ground.

The collar of the connector and therefore the shield of the connector cable are connected galvanic with the ground terminal of the master.

During the data transmission, the AS-i Master with RS 232 acts as a DCE (“Data Carrier Equipment”). When connected to a DTE (“Data Terminal Equipment”) device such as a PC, the connecting cable should be wired straight through without any crossed wires.

To connect the AS-i Master to a PC, the D-sub data cable can be used. With the software "AS-i Control Tools" the AS-i Master can be put into operation.

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5.2 Display and operating elements

5.2.1 LED-display

There are seven light-emitting diodes on the front panel of the gateway . They have the following function:

Power The master's power supply is sufficient.

Ser. active Serial interface communication active via the serial interface. By AS-i Control an active Control program is shown additionally with this LED.

Config err Configuration error:
At least one configured slave is missing, at least one detected slave is not projected or for at least one projected and detected slave the actual configuration data does not match the nominal configuration data.
This LED flashes if there is at least one periphery fault at one AS-i slave in the AS-i network. If there are configuration errors as well as periphery faults, only configuration error is displayed.

U AS-i The AS-i circuit is sufficiently powered.

AS-i active Normal operation active (Flashes, if a B-slave is displayed).

prg enable Automatic address programming enabled.
Exactly one slave is missing in protected operating mode. The slave can be replaced by another slave of the same type with address zero. The master addresses the new slave to the faulty address and thus eliminates the configuration error.

prj mode The AS-i master is in configuration mode.

5.2.2 Push-buttons

The push-buttons cause the following:

Mode/⇑› Switching between configuration mode and protected operating mode and saving the current AS-i configuration as the nominal configuration.

Set/⇓ Selecting and assigning the address to a slave.

OK, ESC Changing to the advanced display mode (see <*chapter 7*>).

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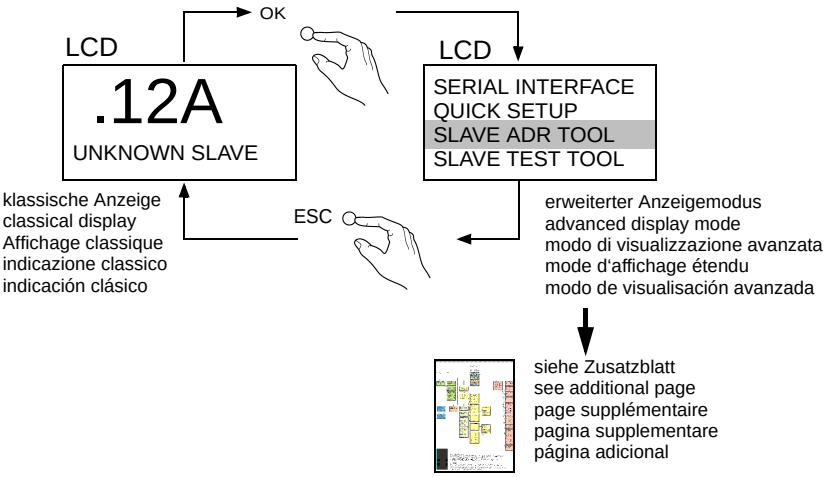
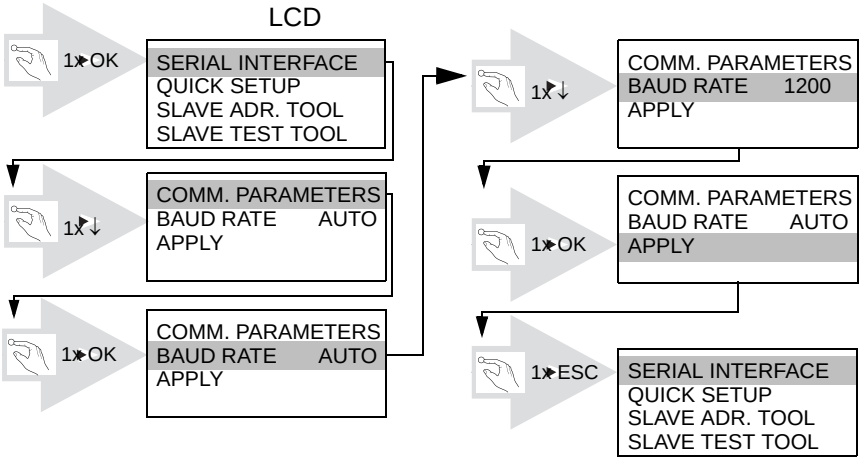
6 Commissioning

6.1 Switching to extended mode



6.2 Setting the baud rate



Das Gerät ist werkseitig auf AUTO (automatische Erkennung) eingestellt.
The device is set to AUTO (automatic recognition) at the factory.
L'appareil est réglé en usine AUTO (identification automatique).
L'apparecchio viene impostato AUTO dalla fabbrica (riconoscimento automatico).
El aparato viene ajustado de la fábrica en AUTO (automático reconocimiento).

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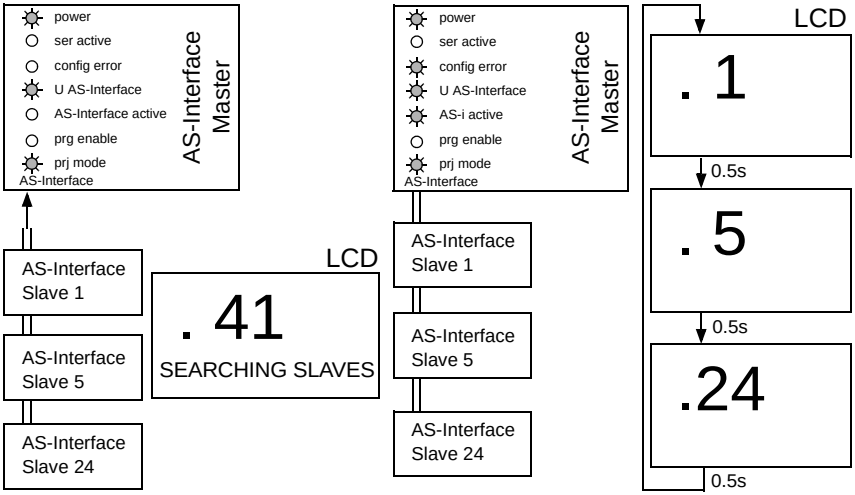
6.2.1 Connecting AS-i Slaves



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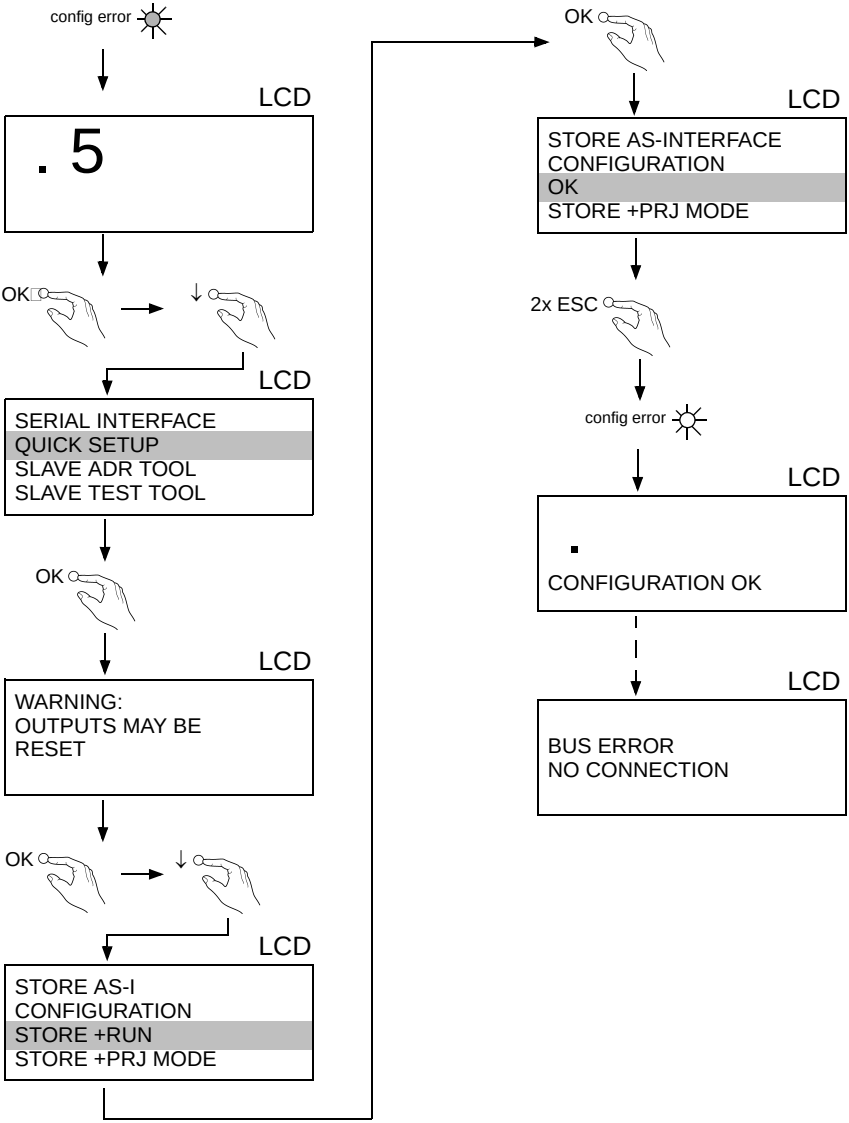
6.3 Quick setup



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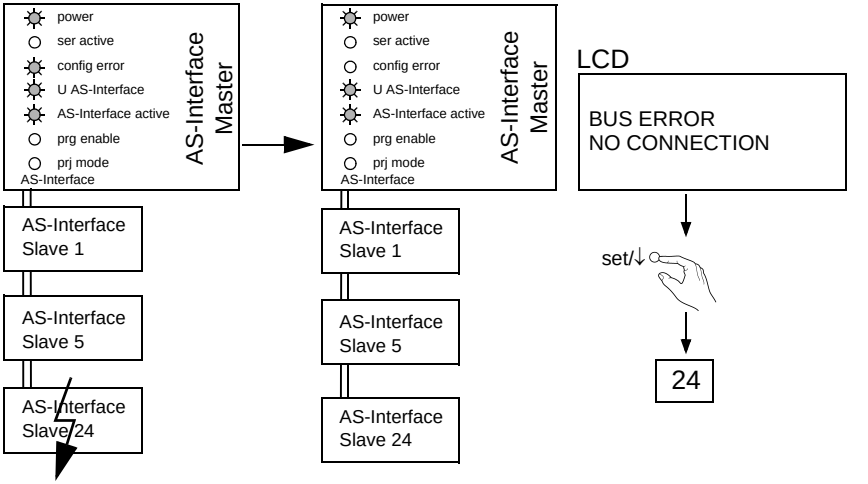
6.3.1 Error tracing

6.3.1.1 Incorrect slaves

6.3.1.2 Error display (last error)



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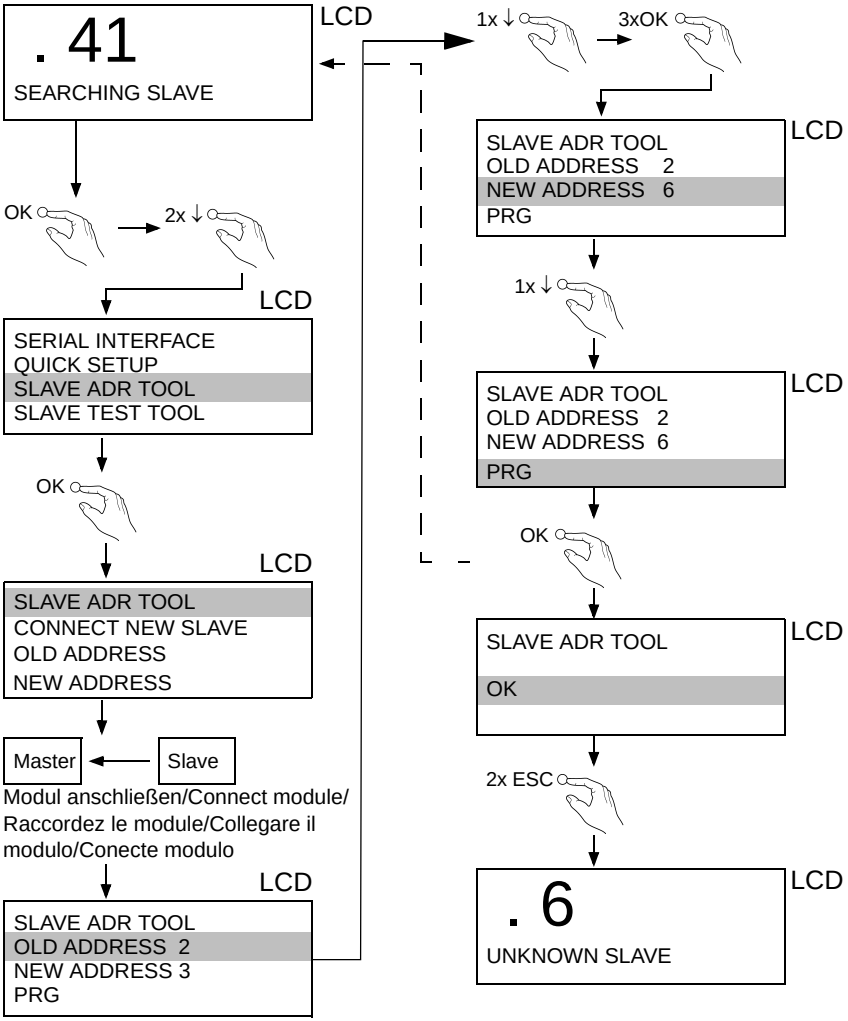
6.3.2 Addressing

6.3.2.1 Programming slave 2 to address 6



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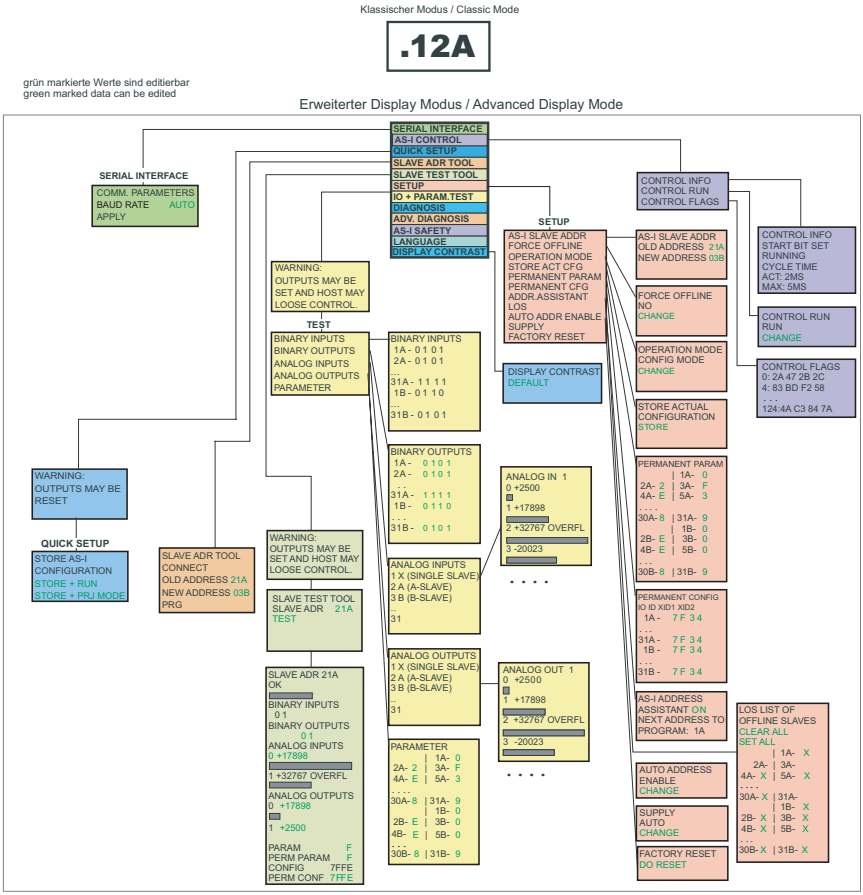
7 Operating in Advanced Display Mode

AS-i 3.0 RS 232-Master in Edelstahl: Inbetriebnahme/Commissioning



Grundsätzliche Bedienung
Das Gerät startet im traditionellen Modus. Mit ESC oder OK kann zwischen beiden Modi gewechselt werden. Im erweiterten Modus wird ein Cursor mit den beiden Pfeil-Tasten bewegt. OK bringt ins nächsthöhere Menü (in der Zeichnung weiter nach rechts). ESC bringt zurück ins vorherige Menü. Wenn Werte editiert werden, werden sie zunächst mit dem Cursor markiert, dann mit OK ausgewählt, mit den Pfeiltasten verändert und schließlich mit OK übernommen. ESC bricht das Editieren ab.

Basic Operation
The device starts in the traditional mode. You can switch between the two modes with ESC or OK. In the advanced mode the cursor is moved by both arrow buttons. Pushing OK puts you to the superior menue (in the drawing one step to the right side). ESC puts you back to the previous menue. To edit data you first mark them with the cursor and then select them with OK, change them with the arrow buttons and finally apply them with OK. Pushing ESC cancels the editing.

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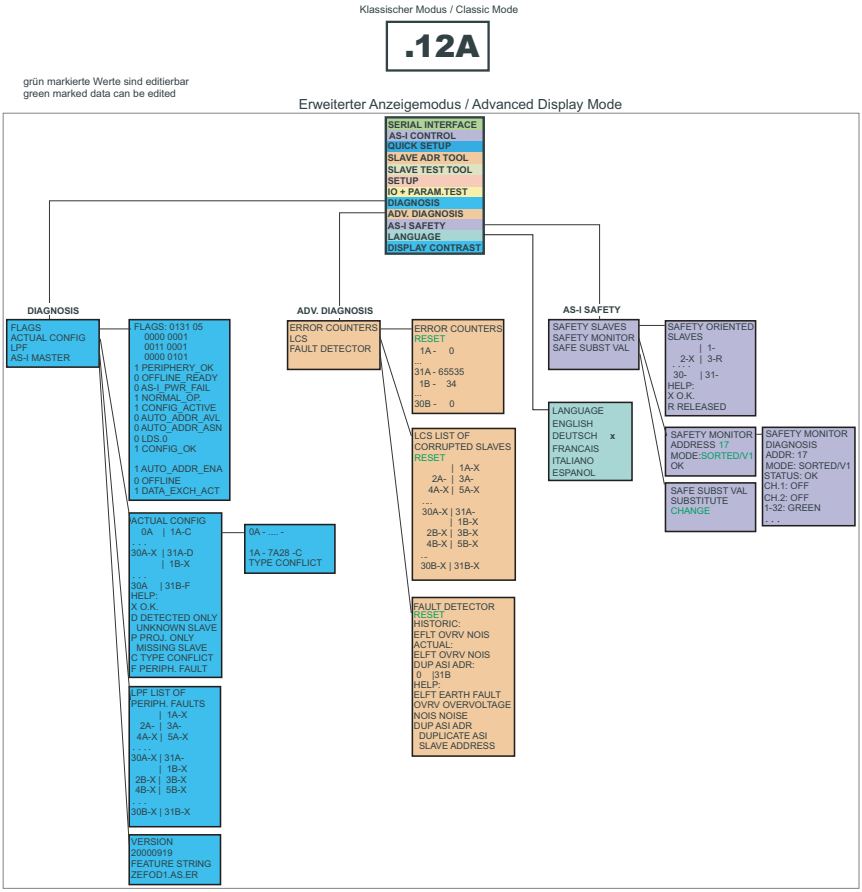
AS-i 3.0 RS 232-Master in Edelstahl: Inbetriebnahme/Commissioning



Grundsätzliche Bedienung

Das Gerät startet im traditionellen Modus. Mit ESC oder OK kann zwischen beiden Modi gewechselt werden. Im erweiterten Modus wird ein Cursor mit den beiden Pfeil-Tasten bewegt. OK bringt ins nächsthöhere Menü (in der Zeichnung weiter nach rechts). ESC bringt zurück ins vorherige Menü. Wenn Werte editiert werden, werden sie zunächst mit dem Cursor markiert, dann mit OK ausgewählt, mit den Pfeiltasten verändert und schließlich mit OK übernommen. ESC bricht das Editieren ab.

Basic Operation

The device starts in the traditional mode. You can switch between the two modes with ESC or OK. In the advanced mode the cursor is moved by both arrow buttons. Pushing OK puts you to the superior menue (in the drawing one step to the right side). ESC puts you back to the previous menue. To edit data you first mark them with the cursor and then select them with OK, change them with the arrow buttons and finally apply them with OK. Pushing ESC cancels the editing.

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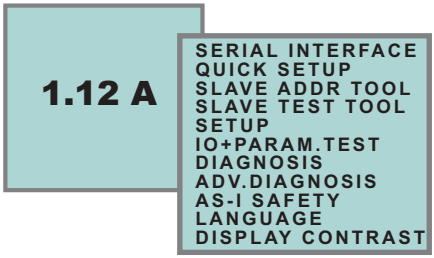
STOP Warning	In the classical mode, it is possible to change settings while the device is in operation. This can lead to failure of the plant (e. g. changing the address of an AS-i slave).

In the advanced mode, however, the settings are protected, as long as the superior fieldbus is running.



The device starts in the classical mode (see chapter 7). Press ESC to switch to the extended mode.

In the extended mode, the selection can be moved up and down with the arrow buttons.

Pressing OK will switch to the selected function or menu. Pressing ESC will switch back to the previous menu.

To edit data values highlight them with the selection bar, press OK, then change them with the arrow-buttons and confirm with OK. The ESC-button cancels the editing process.

All possible addresses are displayed one after the other from 1A to 31A and from 1B to 31B. Data for single slaves are displayed at the addresses 1A - 31A.

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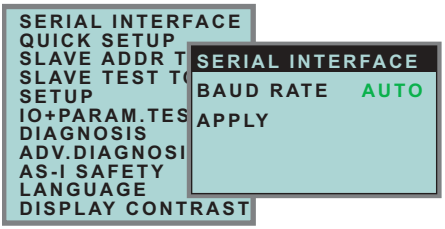
7.1 Serial interface



This function used is for setting and changing the serial interface baud rate.

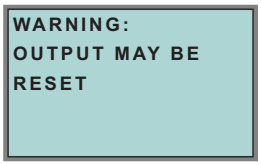
The number behind "Baud Rate" shows the actual transmission speed of the serial interface. You can select the following baudrates: 1200, 2400, 4800, 9600, 19200, 28800, 38400, 57600, 115000 baud or AUTO (automatic recognision), which is set as default.

Procedure:

1. Press the *mode* button to start setting the baud rate.
2. Press the *OK* button to change the baud rate.
3. Press the *mode* button and apply the new baud rate with *OK*.

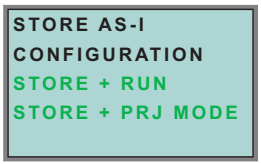
7.2 Quick setup

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



STOP Warning	Warning: outputs may be reset!

Pressing "OK" you switch to the submenu "Store AS-i Configuration".



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"Store+Run"

With "OK" you store the current AS-i network configuration and the attached slaves as the target configuration. The gateway changes into the protected operating mode.

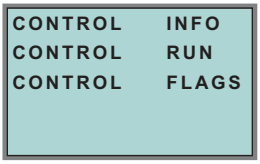
"Store+Prj Mode"

With "OK" you store the current AS-i network configuration and the attached slaves. The gateway remains in the *project mode*.

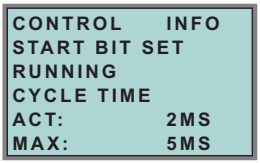
By pressing the "ESC" button you leave this menu and switch back to the main menu.

7.2.1 Control menu (option)

7.2.1.1 AS-i control



7.2.1.2 AS-i control information



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

START BIT SET: the control program was started.

START BIT RESET: the control program was stopped.

RUNNING: the control program is running.

STOPPED: the control program was stopped.

The control program can be stopped even though the start bit was set. Example: any configuration error occurs, or the master is in the configuration mode.

CYCLE TIME ACT: current cycle time of the control program.

CYCLE TIME MAX: maximal cycle time of the control program since its last start.

7.2.1.3 AS-i control run

CONTROL RUN: the control program can be stopped with this function. It modifies the start bit in the menu Control Info.

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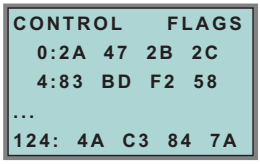
RUN: the control program has been started. Even if the start bit is set, the control program can be stopped; example: any cofiguration error occurs, or the master is in the configuration mode.

CHANGE: the configuration program is stopped.

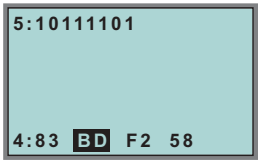
7.2.1.4 **AS-i control flags** (flag memory control program)



The control program can read and modify the flag memory with the function "AS-i Control flags".

A procedure of modifying flag memory:

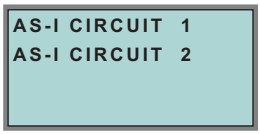
- select a line with soft keys
- press *OK* to open the selected menu



- select the required flag with hot keys (the selected flag appears in the upper line binary coded)
- press *OK* to edit the selected flag in the upper line.

7.3 Slave Adr Tool (slave addressing tool)

This function sets and changes the addresses of both new and configured AS-i slaves. This function replaces the handheld AS-i address programming device.



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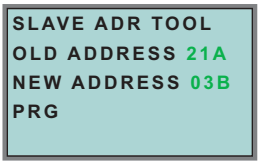
Please note that you must have selected the desired AS-i circuit using the arrow and the OK button when you operate a device with two AS-i circuits (see chapter 7.5.1).

Now the new slave can be connected to the AS-i circuit. After connecting the actual address of the slave is displayed by "OLD ADDRESS".and the notice "CONNECT NEW SLV" disappears.

To give the slave a new address choose the menu entry "NEW ADDRESS". Afterwards the address can be selected with the help of the arrow buttons.The (re-) addressing is carried out by selecting the menu entry "PRG" and pressing the OK button.



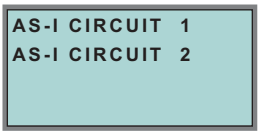
If an error occurs while addressing a slave, one of the following error messages is displayed for about 2 seconds:

Failed: SND:slave with old address has not been detected.
Failed: SD0:slave with address zero has been detected.
Failed: SD2:slave with new address has been detected.
Failed: DE:could not delete old address.
Failed: SE:error setting new address.
Failed: AT:new address could be stored temporarily only.
Failed: RE:error reading the extended ID-code 1.

7.4 Slave Test Tool

With this function a single AS-i slave can be tested.

Please note that you must have selected the desired AS-i circuit using the arrow and the OK button when you operate a device with two AS-i circuits (see chapter 7.5.1)



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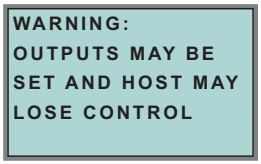
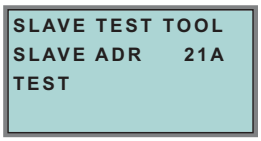
Now a warning message is displayed, that possibly by this test outputs are set and the host may loose control of the circuit.

To start the test press the OK button, to cancel press the button ESC.



In the following menu the slave to be tested has to be chosen by selecting the slave address.

Afterwards the test is started by confirming the menu entry "Test".



After finishing the test all relevant informations is displayed for the tested slave. A successful test is displayed with "OK" below the address of the tested slave.

The following information are displayed:

- Address of the tested slave
- Existing errors are indicated
- Binary inputs (digital inputs), see also “Binary input“, chapter 7.6.3
- Binary outputs (digital outputs), see also “Binary outputs“, chapter 7.6.4
- Analog inputs, see also “Analog inputs“, chapter 7.6.5
- Analog outputs, see also “Analog outputs“, chapter 7.6.6
- Param (actual parameters), see also “Parameter“, chapter 7.6.7
- Perm Param (projected parameters), see also “Permanent Param (projected parameter)“, chapter 7.5.7
- Config (actual configuration), see also “Actual Config (actual configuration)“, chapter 7.7.4
- Perm Conf (projected configuration), see also “Permanent Config (projected configuration data)“, chapter 7.5.8

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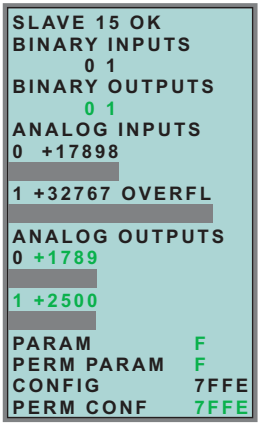
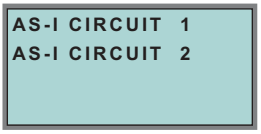


7.5 Setup (configuration of AS-i circuit)

7.5.1 AS-i circuit



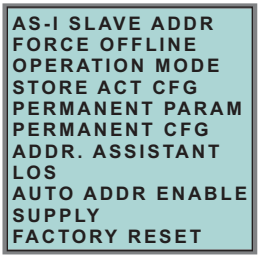
To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

The active circuit is marked by the cursor.

7.5.2 Description of setup mode



Within the menu "Setup", one of the following submenus can be chosen:

- AS-i Slave Addr (AS-i Slave Address)
- Force Offline (switch AS-i Master offline)

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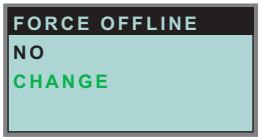
- Operation Mode
- Store Act Cfg (store actual detected configuration)
- Permanent Param (projected parameter)
- Permanent Cfg (projected configuration data)
- Addr. Assistant (address assistent)
- LOS (list of offline-slaves)
- Auto Adr Enable
- Supply (option by single master)
- Factory Reset (rest for the factory adjustment)

7.5.3 AS-i Slave Adr (set/change slave address)

With this function the address of a slave can be changed.

To change the address select the menu entry "OLD ADDRESS" and afterwards select the address of the slave which address should be changed. The new address of the slave has to be set in the menu entry "NEW ADDRESS". The addressing is carried out by pressing the OK button.

7.5.4 Force offline

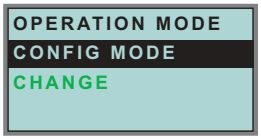


This function shows the current state of the AS-i Master:
Yes:AS-i Master is offline.
No:AS-i Master is online.

With "Change", this state can be modified.

Switching the AS-i master offline puts the AS-i circuit into the safe state. The AS-i master has to be offline if an AS-i slave should be addressed via the IR-interface.

7.5.5 Operation mode



This function shows the current operation mode of the AS-i master:
Protected Mode:Protected mode
Config Mode:Configuration mode

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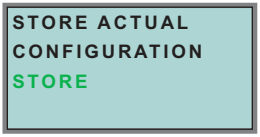
With "Change" the operation mode can be changed.

Only in configuration mode parameters and configuration data can be stored.

7.5.6 Store Act Cfg (store actual detected configuration)



This function can only be executed in configuration mode.

This function enables you to store the configuration of all slaves which are connected and detected on the selected AS-i circuit.

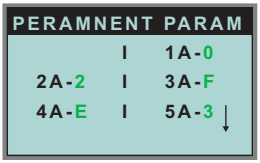
If "Store" was successful, the LED "Config error" is off. The configuration is stored, the configuration error has been eliminated.

If one of the connected slaves has a peripheral fault, the LED "Config error" will flash.

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

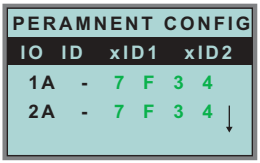
If an AS-i slave with address zero exists, storing the configuration will be confirmed with "OK". However, the configuration error remains because address zero is not a valid operating address for storing a slave.

7.5.7 Permanent Param (projected parameter)



This function allows you to set the permanent parameters. A list of all slaves is displayed from 1A - 31A and from 1B - 31B. The permanent parameters for single slaves are set from address 1A - 31A. The parameter is shown as a hexadecimal value behind the slave address.

7.5.8 Permanent Config (projected configuration data)



With this function the projected configuration data can be projected. The values for the configuration data are displayed behind the slave address in the following order:

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

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7.5.9 AS-i address assistent

The AS-i address assistant helps you to set up the AS-i circuit quickly. Once you have stored the AS-i configuration, the AS-i address assistant addresses a new AS-i slave with address zero to the desired address.

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

Assistant on: AS-i address assistant is switched on.
Assistant off: AS-i address assistant is switched off.

Procedure:

1. Store AS-i Configuration to the master. This can be done very comfortably with the Windows software AS-i-Control-Tools (Master | Write configuration to the AS-i Master ...), or directly with the fullgraphic display (see chapter 7.5.8).
2. All AS-i slaves have to be addressed to 0 or to the desired address. The slaves must be disconnected from the AS-i circuit.
3. Start the AS-i address assistant.
4. Now connect the AS-i slaves one after the other. The last line of the display of the AS-i address assistant shows which AS-i slave has to be connected next.

7.5.10 LOS (list of offline slaves)

See also "Advanced Diagnostics for AS-i Masters", chapter 8.

With "Clear all" and "Set all" you can delete or set a single bit for each AS-i slave address. Underneath there is a list of all slaves, by which the LOS bit can be set or deleted by individualy selecting of the LOS bit.

Empty field: LOS bit deleted
X: LOS bit set

7.5.11 Auto Adr Enable (enable automatic address)

With this function can the programming of the automatic address be released or locked.

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Meaning of the displayed mode:

Enable:Automatic address programming is released.
Disable:Automatic address programming is locked.

With "Change" the operation mode can be changed.

7.5.12 Factory reset

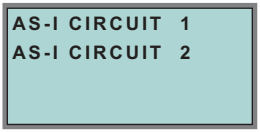
With this function the master can be reseted to the factory setting. The reset can be chosen by selecting the menu entry "DO RESET".

Warning

- This function should be used only in an emergency, since all attitudes transacted so far are put back to factory setting and thus perfect communication and functioning of the masters with the AS-i circle are ensured no more.
- The master and the AS-i circuit have to be recommissioned and reprojected again after a successful "Reset".
- In case of double masters the "Reset" acts on both AS-i masters!

7.6 IO + Param. Test

7.6.1 AS-i circuit



To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

The active circuit is marked by the cursor.

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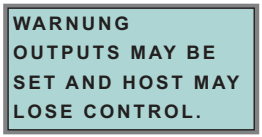
7.6.2 **IO + Param. Test** (Testing AS-i In- and Outputs as well as reading and writing AS-i Parameters)



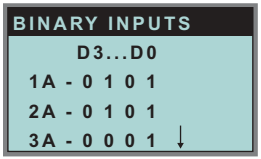
Before changing to the menu the following warning message will displayed:

"Warning: Outputs may be set and Host may lose control."

The menu "IO + Param.Test" enables you to choose one of the following submenus:

- Binary Inputs
- Binary Outputs
- Analog Inputs
- Analog Outputs
- Parameter

7.6.3 **Binary input**



This list shows the state of the binary inputs for all AS-i slaves.

0: Input deleted
1: Input set

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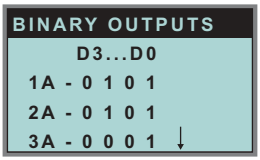
7.6.4 Binary outputs



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

0: Output deleted
1: Output set

The binary outputs can be changed after selecting the desired AS-i slave.

7.6.5 Analog inputs

This function shows the state of the analog inputs for all AS-i slaves.
The slave-types are characterized as follows:

X - single slave

A - A-slave

B - B-slave

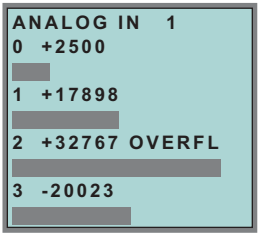
AB - A+B slave

...

The data of the slave B start ex channel 2!

The display is as follows:
AS-i slave address, hexadecimal 16 bit value, bar display indicating the input or output value.

An eventual value overflow is displayed by "Overfl" additionally.



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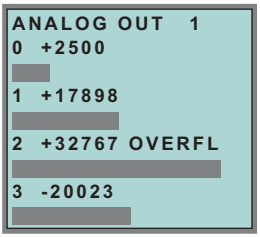
7.6.6 Analog outputs

This function shows the state of the analog outputs for all AS-i slaves.

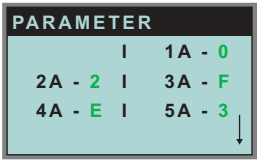
The display is as follows:
AS-i slave address, hexadecimal 16 bit value, bar display.

OVERFL displays any value overflows additionally.



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

7.6.7 Parameter



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

The actual AS-i parameters can be changed after selecting the desired slave address.

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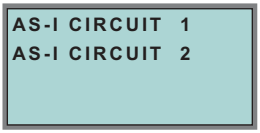
7.7 Diagnosis (normal AS-i diagnosis)

7.7.1 AS-i circuit



To reach this setup menu you have to change the desired AS-i circuit by using the arrow and the OK buttons.

The function is only implemented in the double master.

It makes possible to change the AS-i circuit that is currently active for being operated.

The active circuit is marked by the cursor.

7.7.2 Diagnosis (normal AS-i diagnosis)

The menu "Diagnosis" enables you to choose one of the following submenus:

- Flags (EC-Flags: Execution control flags)
- Actual Config (actual configuration)
- LPF (list of periphery faults)
- AS-i Master (Info)

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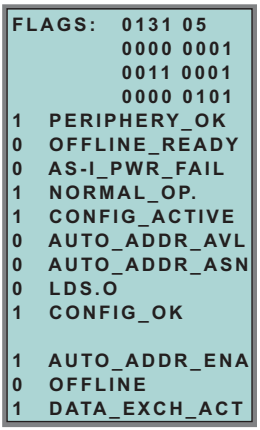
7.7.3 Flags



This function shows the EC-flags hexadecimaly, binary and as single bits beginning with the lowest-order bit.

Arrangement of the bits within the byte:

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

Byte 1:

Bit 0:Periphery_OK
This flag is set, if no AS-i slave signs a periphery fault.

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Byte 2:

Bit 0:Config_OK
The flag is set, if the projected configuration corresponds with the actual configuration.

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

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

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

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

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

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

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

Byte 3:

Bit 0:Data_Exch_Act
If the flag "Data Exchange Active" is set, the data exchange is released with the AS-i slaves in the data exchange phase. If the bit is not set, the data exchange with AS-i slaves will be locked. Instead of data telegramms READ_ID telegramms will be sent.
The bit is set by the AS-i master by change over in the offline phase.

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

Bit 2:Auto_Addr_Ena
This flag indicates if the automatic addressing is locked (bit = 0) or released (bit = 1) by the user.

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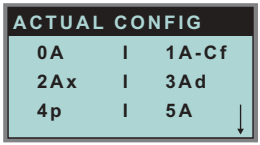
7.7.4 Actual Config (actual configuration)



This function shows the state of the actual configuration of the individual AS-i slaves.

At the end of the list there is a help text describing the abbreviations:

X (O.K.):The configuration data of the detected AS-i slave matches the projected configuration data.

D (Detected Only):An AS-i slave is detected at this address, but not projected.

P (Projected Only):An AS-i slave is projected at this address, but not detected.

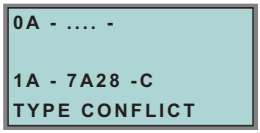
C (Type Conflict):The configuration data of the detected AS-i slave does not match the projected configuration data. The actual detected configuration of the connected AS-i slave is displayed.

F (Periph. Fault):The AS-i slave has a peripheral fault.

A (Duplicate Adr.):2 AS-i slaves in the indicated address

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

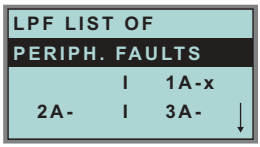
IO (I/O-configuration) ID (ID-configuration) xID1 (extended ID1)
xID2 (extended ID2)



Furthermore the state of the configuration is displayed in plain text.

If no AS-i slave is detected and no AS-i slave is projected at a certain address, four dots instead of the configuration data are displayed.

7.7.5 LPF (List of periphery faults)



The list shows AS-i slaves, which have released a peripheral fault.

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

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7.7.6 AS-i master (info)

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

Version xxxxxxxx (date of the firmware)

Feature String xxxxxxxxxxxxxxxx

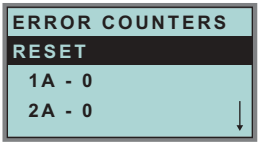
7.8 Adv. Diagnosis (advanced AS-i diagnosis)

See also "Advanced Diagnostics for AS-i Masters", chapter 8.

In the menu "Adv. Diagnosis", the following submenus can be found:

- Error Counters
- LCS (list of slaves, that produced a configuration error)
- Fault Detector

7.8.1 Error counters



This list shows the error counter for each single AS-i slave.

Furthermore the number of power failures on AS-i (APF) is displayed.

By selecting "Reset", the error counters are reset to 0.

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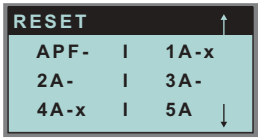
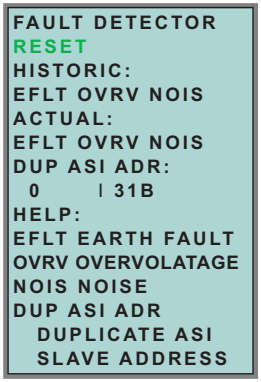
7.8.2 LCS (list of slaves having caused a configuration error)



This list shows for each single AS-i slave whether at least one configuration error was caused by an enormous telegram transmission. This function is especially important if the configuration error only occurs short-time.

Empty field: No error
X: AS-i slave caused a configuration error.

7.8.3 Fault detector



The menu "Fault Detector" shows information about the AS-i detector and allows deleting of the AS-i detector´s history. Furthermore a list of abbreviations in plain language can be found is in the section "Help".

By selecting "Reset" the history of the AS-i detector can be deleted.

In the section "Historic" the appeared error messages of the AS-i detector are listed since the last "Reset".

In the section "Actual" the actual appeared error messages of the AS-i detector are listed.

Following error messages are possible:

- Duplicate address (the 2 lowest slave addresses are displayed, at which a duplicate address exist).
- Earth faults
- Noise
- Overvoltage

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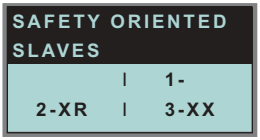
7.9 AS-i safety

This function shows information about the safety slaves and the safety monitor:

- Safety Slaves
- Safety Monitor
- Safety Substitute Value

7.9.1 Safety slaves (safety oriented slaves)



This list shows the "safety-directed input slaves" ("AS-i Safety at Work"), by which the safety function is released.

X:channel o.k.
R:channel has released

The first area corresponds with the channel 2, the second one with the channel 1. XR means also: channel 2 is OK and channel 2 has released.

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

- command interface/ function profile

or

- slave value substitute.

Both channels must have the same state, otherweise the indication will not be proper.

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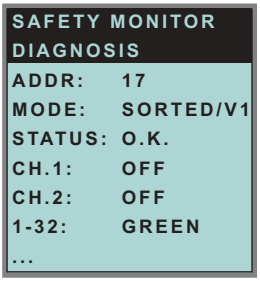
7.9.2 Safety monitor



The AS-i safety monitor reads the diagnosis data of the AS-i safety monitor and shows on the display. The meaning of the shown diagnosis can be seen in the description of the safety monitor.

7.9.3 Safety Subst Value

With this function the input-data-substitution by safety slaves can be turn off/on.

SUBSTITUTE

The input-data are replaced mit following values:

Both channels released: 0000bin

Channel 1 released: 0011bin

Channel 2 released: 1100bin

No channel has released: 1111bin

NO SUBSTITUTE

The safety slave input data are shown unmodified.

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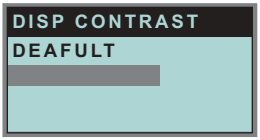
7.10 Display contrast



With this function display contrast can be adjusted.

Factory adjustment will be reloaded by selecting DEAFULT.

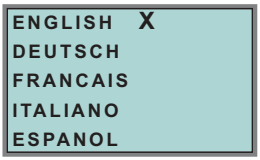
Approach to set the display contrast:

- select the bar line with soft keys
- verify with *OK* (the bar line flashes)
- set the display contrast with soft keys
- assume with *OK*.

If the contrast is completely misaligned, set it as follows:

- turn the master off
- press the buttons *MODE* + *SET* and hold them
- turn the master on.

7.11 Language of displayed messages



The list of **messages** (like "missing slave" or "unknown slave") that is shown on the screen, can be edited in the desired language by using the softkey + OK buttons. The current language is marked with "**x**".

Note	The menu-language is English. This attitude cannot be changed! It is only possible to change the language of displayed messages (like "missing slave" or "unknown slave").

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8 Advanced Diagnostics for AS-i Masters

The advanced AS-i diagnostics serve to locate occasionally occurring errors and to judge the quality of data transmission on AS-i without additional diagnostics tools.

AS-i Control Tools (software for comfortable commissioning of AS-i and programming of AS-i Control) supports the operation of the advanced diagnostics (LCS, error counters and LOS).

8.1 List of corrupted AS-i Slaves (*LCS*)

The *LCS* contains the history of the delta list. Besides the list of projected slaves (*LPS*), the list of detected slaves (*LDS*) and the list of activated slaves (*LAS*), a fourth list, the **list of corrupted slaves (*LCS*)**, is created by AS-i masters with advanced diagnostics in order to locate occasionally occurring short-time configuration errors. This list contains entries of all AS-i slaves which were responsible for at least one configuration error since powering up the AS-i master or reading the list. Short-time AS-i power failures are listed in the *LCS* at the position of AS-i slave with address 0.

Note	With every read-access the LCS will be deleted.

Note	The last short-time configuration error can also be displayed on the AS-i master: • Pressing the "Set" button of the AS-i master shows the AS-i slave which was responsible for the last short-time configuration error. If there was a short-time AS-i power failure the display shows "39" after pressing the "Set" button. • This function is only available if the device is in the normal operation mode of the protected mode (display empty) or in the off-line-phase.

8.2 Protocol analysis: counters of corrupted data telegrams

The AS-i master with advanced diagnostics has a counter of telegram repetitions for each AS-i slave, which count up every time a currupted data telegram has been found. This makes possible to judge the quality of the AS-i network, even if only a few corrupted telegrams occured and the AS-i slave did not cause any configuration errors.

Note	• The counter values can be read via the host interface and will be deleted with every read access. • The counter value is limited to 254. 255 will cause a counter overflow.

The protocol analysis is included in the sofware **AS-i Control Tools** (by using the command *Master* | *AS-i Diagnostics*).

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8.3 Offline phase on configuration errors (*LOS*)

The AS-i masters with advanced diagnostics offer the possibility to put themselves into the offline phase when a configuration error on the AS-Interface occurs. This way the security of the application can be ensured. The reaction to a configuration error is very fast and the host can be relieved from this task. If there are any problems on the AS-i network, the AS-i can be switched to a secure state.

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

- Every configuration error during normal operation in protected mode releases the off-line phase.

For each slave address, it can be chosen whether a configuration error on this address will cause the offline phase or not. This information is stored in the list of offline slaves (*LOS*).
The user himself can decide how the system reacts to a configuration error on the AS-i. The AS-i master can release the off-line phase in critical situations, i. e. only with certain slave addresses, whereas in less critical situations (if one of the other AS-i slaves has a configuration error) only the error message is sent to the host, but AS-i is still running.The parameterization "off-line phase on configuration error" is also supported by the "AS-i-Control-Tools" (command Master | Identity | Offline on configuration error).

Two ways to reset the error message "OFFLINE BY LOS" are possible:

1. Deleting of the complete list LOS of the affected AS-i circuit ("CLEAR ALL").

2. Voltage reset at the affected AS-i circuit.

8.4 Functions of the AS-i fault detector

8.4.1 Earth fault detector

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

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

This error limits the fail-safe characteristic of the AS-i transmission substantially.

Earth faults are indicated in the master´s display and AS-i Control Tools.

Note	For recognition of earth faults the master must be grounded with the function earth.

8.4.2 Noise detector

The noise detector detects alternating voltages on AS-i, which are not produced by AS-i master or AS-i slaves. These interference voltages can cause telegram disturbances.

A frequent cause are insufficiently shielded frequency inverters or awkwardly shifted cables.

Noises are indicated in the master´s display and the AS-i Control Tools.

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8.4.3 Overvoltage detector

Overvoltages are present, if the AS-i line, whose veins lie normally electrically symmetrically to the plant earth, are strongly electrically raised. A cause can be e.g. power-on procedures of large consumers. However sometimes overvoltages don´t generally disturb AS-i communication, but can release incorrect signals of sensors.

Overvoltages are indicated in the master´s display and the AS-i Control Tools.

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9 Operation via the Serial Interface

9.1 Configurating the Interface

When transferring data via the AS-i master's serial interface, the parameters must be set as follows:

Start bits	1
Data bits	8
Stop bits	1
Parity	none

The pin assignment for the SUB-D connector is described in chapter 5.1.2.

For the transmission speed, you can select 1200, 2400, 4800, 9600, 19200, 28800, 38400 or 57600 baud. If it has not received a valid host message since the last start-up, the master automatically adapts to the host.

When selecting the baud rate, the master starts with the transmission speed that it used during the last communication with the host before it was turned off. As soon as a valid message is received, the baud rate remains fixed until the next startup.

9.2 Message Structure

The AS-i master and the PC or PLC communicate with each other by exchanging messages. The host (PC or PLC in this case) functions as a master and the AS-i master as a slave, i.e. the AS-i master does not initiate any data communication but only responds to the host's messages.

The messages are structured as follows:

k	n	b_1	b_2		...		b_n	s

Command byte k:

The first byte of each message is the command byte, that determines the AS-i function and therefore the message type.

User data length n:

Indicates the number of user data bytes. Depending on the messages type, this number is between zero and 17.

User data bytes bi:

If no user data are to be transmitted with the message (usable data length $n \equiv 00_{hex}$), this field is not used.

Checksum s:

The lowest eight bits of the sum of all previously sent bytes are transmitted as the checksum. The checksum can also be calculated with the formula:

$$s = (k + n + \sum_{i=1}^{n} b_i) \bmod 256$$

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The AS-i master responds to a host message with a message of the same type but normally of different length, or it responds with an error message (command byte 75_{hex}, 1 byte usable data).

There can be some delay between host and slave messages since the master only responds after it has carried out the request it received with the message. The maximum processing times for the individual message types are shown in Appendix A. After the last character of the response message, the AS-i master is ready to receive again.

Example:

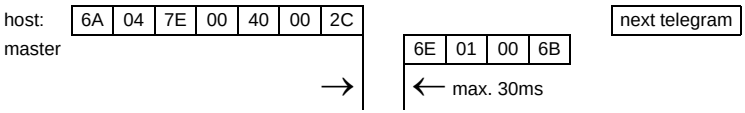
Addresses 1 through 6 and address 22 should be occupied in the list of projected slaves. The master is not in configuration mode, so it must not accept this request and answers with “not o.k.”.

host message:

k	$6A_{hex}$
n	04_{hex}
b_1	$01111110_{bin} = 7E_{hex}$
b_2	$00000000_{bin} = 00_{hex}$
b_3	$01000000_{bin} = 40_{hex}$
b_4	$00000000_{bin} = 00_{hex}$
s	$6A + 04 + 7E + 00 + 40 + 00 = 12C_{hex} \Rightarrow s = 2C_{hex}$

master message:

k	$6A_{hex}$
n	01_{hex}
b1	“not o.k.” = 00_{hex}
s	$6A + 01 + 00 = 6B_{hex}$



See chapter 11.1 for values of command byte, contents of data bytes for host- and master message and maximum processing times.

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10 Command Interface

10.1 Construction

Command interface call-instructions are described as follows:

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	–	circuit					
3	request parameter byte 1							
…	…							
36	request parameter byte 34							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	result						
3	response parameter byte 1							
…	…							
36	response parameter byte 34							

Command byte and T-bit are always part of the response. The T-bit is necessary to operate the command interface.

Circuit = 0 If an AS-i gateway with one AS-i master or the master 1 of an AS-i gateway with 2 masters should be chosen.

Circuit = 1 If master 2 of an AS-i gateway with 2 masters should be chosen.

The commands for reading and writinig exist in two variations. At the first variation the bits in the slave lists are arranged as usually with Pepperl+Fuchs products: Data for slave with lower address appear in the lower bits. The second variation is compatible to Siemens masters: The sequence of the bits in the slave lists bytes are inverse.

Switching between the two variations can be done with bit 2^6 in byte 2 of the request. If it is deleted, the Pepperl+Fuchs arrangement is selected, otherwise the Siemens compatible arrangement is selected.

The coding of requests for commands to reading and writing is following therefore:

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	command							
2	T	0	circuit					
3	Request parameter byte 1							
…	…							

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10.2 List of all commands

		Values for command			
see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 53	**AS-i 16-bit data**				
page 53	RD_7X_IN	50_{16}	Read 1 16-bit slave profile in.data	3	10
page 54	WR_7X_OUT	51_{16}	Write 1 16-bit slave profile out.data	11	2
page 54	RD_7X_OUT	52_{16}	Read 1 16-bit slave profile out.data	3	10
page 55	RD_7X_IN_X	53_{16}	Read 4 16-bit slave profile in.data	3	34
page 55	WR_7X_OUT_X	54_{16}	Write 4 16-bit slave profile out.data	35	2
page 56	RD_7X_OUT_X	55_{16}	Read 4 16-bit slave profile out.data	3	34
page 56	OP_RD_16BIT_IN_CX	$4C_{16}$	Read 16 channels 16-bit slave in.data	3	34
page 57	OP_WR_16BIT_IN_CX	$4D_{16}$	Write 16 channels 16-bit slave in.data	36	2
page 58	**Commands acc. to Profile S-7.4/S-7.5**				
page 58	WR_74_75_PARAM	$5A_{16}$	Write S-7.4/S-7.5-slave parameter	≥6	2
page 59	RD_74_75_PARAM	$5B_{16}$	Read S-7.4/S-7.5-slave parameter	4	≥3
page 60	RD_74_75_ID	$5C_{16}$	Read S-7.4/S-7.5-slave ID string	4	≥3
page 60	RD_74_DIAG	$5D_{16}$	Read S-7.4/S-7.5-slave diagnosis string	4	≥3
page 61	**Acyclic commands**				
page 61	WRITE_ACYC_TRANS	$4E_{16}$	Write acyclic transfer	≥7	2
page 63	READ_ACYC_TRANS	$4F_{16}$	Read acyclic transfer	5	≥2
page 64	**AS-i Diagnosis**				
page 64	GET_LISTS	30_{16}	Get LDS, LAS, LPS, Flags	2	29
page 66	GET_FLAGS	47_{16}	Get_Flags	2	5
page 67	GET_DELTA	57_{16}	Get list of config. diff.	2	10
page 68	GET_LCS	60_{16}	Get LCS	2	10
page 68	GET_LAS	45_{16}	Get_LAS	2	10
page 69	GET_LDS	46_{16}	Get_LDS	2	10
page 70	GET_LPF	$3E_{16}$	Get_LPF	2	10
page 70	GET_LOS	61_{16}	GET_LOS	2	10
page 71	SET_LOS	62_{16}	SET_LOS	10	2
page 72	GET_TECA	63_{16}	Get transm.err.counters	2	34
page 73	GET_TECB	64_{16}	Get transm.err.counters	2	34
page 73	GET_TEC_X	66_{16}	Get transm.err.counters	4	≥3
page 74	READ_FAULT_DETECTOR	10_{16}	Read Fault Detector	2	4
page 75	**Configuration of AS-i Master**				
page 75	SET_OP_MODE	$0C_{16}$	Set_Operation_Mode	3	2
page 76	STORE_CDI	07_{16}	Store_Actual_Configuration	2	2
page 76	READ_CDI	28_{16}	Read_Actual_Configuration	3	4

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Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 77	SET_PCD	25_{16}	Set_Permanent_Config	5	2
page 77	GET_PCD	26_{16}	Get_Permanent_Config	3	4
page 78	SET_LPS	29_{16}	SET_LPS	11	2
page 79	GET_LPS	44_{16}	Get_LPS	2	10
page 80	STORE_PI	04_{16}	Store_Actual_Parameter	2	2
page 80	WRITE_P	02_{16}	Write_Parameter	4	3
page 81	READ_PI	03_{16}	Read_Parameter	3	3
page 81	SET_PP	43_{16}	Set_Permanent_Parameter	4	2
page 82	GET_PP	01_{16}	Get_Permanent_Parameter	3	3
page 82	SET_AAE	$0B_{16}$	Set_Auto_Address_Enable	3	2
page 85	SLAVE_ADDR	$0D_{16}$	Change_Slave_Address	4	2
page 84	WRITE_XID1	$3F_{16}$	Write_Extended_ID-Code_1	3	2
page 84	**Other commands**				
page 85	IDLE	00_{16}	No request	2	2
page 85	READ_IDI	41_{16}	Read IDI	2	36
page 86	WRITE_ODI	42_{16}	Write ODI	34	2
page 86	READ_ODI	56_{16}	Read ODI	2	34
page 87	SET_OFFLINE	$0A_{16}$	Set_Off-Line_Mode	3	2
page 88	SET_DATA_EX	48_{16}	Set_Data_Exchange_Active	3	2
page 88	BUTTONS	75_{16}	Disable Pushbuttons	3	2
page 88	FP_PARAM	$7D_{16}$	„Functional Profile“ Param.	≥3	≥2
page 89	FP_DATA	$7E_{16}$	„Functional Profile“ Data	≥3	≥2
page 90	INVERTER	$7C_{16}$	Configure Inverter Slaves	12	4
page 90	MB_OP_CTRL_WR_FLAGS	0x85	Write Flags	≥5	2
page 91	MB_OP_CTRL_RD_FLAGS	0x86	Read Flags	4	≥3
page 91	RD_MFK_PARAM	0x59	Read SEW MFK21 Parameter	6	≥3

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10.2.1 Values for results

	Value	*Place*	*Meaning*
OK	00_{16}	–	execution without fault
HI_NG	11_{16}	HI	general fault
HI_OPCODE	12_{16}	HI	illegal value in command
HI_LENGTH	13_{16}	HI	length of the command interface is too short
HI_ACCESS	14_{16}	HI	no access right
EC_NG	21_{16}	EC	general fault"
EC_SND	22_{16}	EC	slave (source addr) not detected
EC_SD0	23_{16}	EC	slave 0 detected
EC_SD2	24_{16}	EC	slave (target addr) not decteced
EC_DE	25_{16}	EC	delete error
EC_SE	26_{16}	EC	set error
EC_AT	27_{16}	EC	address temporary
EC_ET	28_{16}	EC	extended ID1 temporary
EC_RE	29_{16}	EC	read (extended ID1) error

10.3 Commands of the Command Interface

10.3.1 AS-i 16-bit data

10.3.1.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 53	RD_7X_IN	50_{16}	Read 1 16-bit slave profile in.data	3	10
page 54	WR_7X_OUT	51_{16}	Write 1 16-bit slave profile out.data	11	2
page 54	RD_7X_OUT	52_{16}	Read 1 16-bit slave profile out.data	3	10
page 55	RD_7X_IN_X	53_{16}	Read 4 16-bit slave profile in.data	3	34
page 55	WR_7X_OUT_X	54_{16}	Write 4 16-bit slave profile out.data	35	2
page 56	RD_7X_OUT_X	55_{16}	Read 4 16-bit slave profile out.data	3	34
page 56	OP_RD_16BIT_IN_CX	$4C_{16}$	Read 16 channels 16-bit slave in.data	3	34
page 57	OP_WR_16BIT_IN_CX	$4D_{16}$	Write 16 channels 16-bit slave in.data	36	2

10.3.1.2 Read 1 16-bit Slave in.Data (RD_7X_IN)

With this command, the four 16 bit channels of an AS-i input slave according to the slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be read.

Note	A-Slaves map the data on channels 1 and 2. B-Slaves map the data on channels 3 and 4. Only values among 1 and 31 can be taken as a slave address.

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Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	50_{16}							
2	T	–	circuit					
3	–		0	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	50_{16}							
2	T	result						
3	channel 1, high byte							
…	…							
10	channel 4, low byte							

10.3.1.3 Write 1 16-bit Slave out.Data (WR_7X_OUT)

With this command, the four 16 bit channels of an AS-i output slave according to the slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be written.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	51_{16}							
2	T	–	circuit					
3	–		0	slave address				
4	channel 1, high byte							
…	…							
11	channel 4, low byte							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	51_{16}							
2	T	result						

10.3.1.4 Read 1 16-bit Slave out.Data (RD_7X_OUT)

With this command, the four 16 bit channels of an AS-i output slave according to the slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be read out of the AS-i/Master.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	52_{16}							
2	T	–	circuit					
3	–		0	slave address				

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	52_{16}							
2	T	result						
3	channel 1, high byte							
…	…							
10	channel 4, low byte							

10.3.1.5 Read 4 16-bit Slave in.Data (RD_7X_IN_X)

With this command, the four 16-bit channels of 4 AS-i input slaves with succesive addresses according to slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	53_{16}							
2	T	–	circuit					
3	–		0	1st slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	53_{16}							
2	T	result						
3	1st slave, channel 1, high byte							
…	…							
34	4th slave, channel 4, low byte							

10.3.1.6 Write 4 7.3 Slave out.Data (WR_7X_OUT_X)

With this command the four 16-bit channels of four AS-i output slaves with succesive addresses according to slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be written.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	54_{16}							
2	T	–	circuit					
3	–		0	1st slave address				
4	1st slave, channel 1, high byte							
…	…							
35	4th slave, channel 4, low byte							

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	54_{16}							
2	T	result						

10.3.1.7 Read 4 7.3 Slave out.Data (RD_7X_OUT_X)

With this command, the four 16-bit channels of four AS-i output slaves with successive addresses according to slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	55_{16}							
2	T	–	circuit					
3	–		0	1st slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	55_{16}							
2	T	result						
3	1st slave, channel 1, high byte							
…	…							
34	4th slave, channel 4, low byte							

10.3.1.8 Read 16 channels 16-bit Slave in.Data (OP_RD_16BIT_IN_CX)

With this command, the 16 channels of the 16-bit input-data for slaves with successive addresses according to slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be read

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4C_{16}$							
2	T	–	circuit					
3	1. slave							
4	1. channel							

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Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4C_{16}$							
2	T	result						
3	1. slave, channel 1, high byte							
4	1. slave, channel 1, low byte							
…	…							
33	16. channel, high byte							
34	16. channel, low byte							

10.3.1.9 Write 16 channels 16-bit slave out.Data (OP_WR_16BIT_IN_CX)

With this command, the 16 channels of the 16-bit input-data for slaves with successive addresses according to slave profile (S-7.3, S-7.4, S-7.5, S-7.A.8, S.A.9, S-7.A.A) can be written.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4D_{16}$							
2	T	circuit						
3	1. slave							
4	1. channel							
5	1. slave, 1. channel, high byte							
6	1. slave, 1. channel, low byte							
…	…							
35	16. channel, high byte							
36	16. channel, low byte							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4D_{16}$							
2	T	result						

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10.3.2 Commands acc. to Profile S-7.4/S-7.5

10.3.2.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 58	WR_74_75_PARAM	$5A_{16}$	Write S-7.4/S-7.5-slave parameter	≥6	2
page 59	RD_74_75_PARAM	$5B_{16}$	Read S-7.4/S-7.5-slave parameter	4	≥3
page 60	RD_74_75_ID	$5C_{16}$	Read S-7.4/S-7.5-slave ID string	4	≥3
page 60	RD_74_DIAG	$5D_{16}$	Read S-7.4/S-7.5-slave diagnosis string	4	≥3

10.3.2.2 WR_74_75_PARAM

Description:

- with this function the parameter string of a slave according to profile S-7.4 is being written

or

- the data tranfer with a slave according to profile S-7.5 is started.

If it is about a slave according to profile 7.5, data have to be registered into the buffer in the same form, as they have to be sent by AS-i.

Since the string can be longer than the command interface, it will partly be written into the buffer and then be transferred to the slave.

n is the length of the part of the string which should be written into the buffer from index i on.

If i ≡ 0, then the string is being transferred to the slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5A_{16}$							
2	T	–	circuit					
3	slave address							
4	i							
5	n							
6	buffer btye i							
…	…							
n+5	buffer byte i+n-1							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5A_{16}$							
2	T	results						

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10.3.2.3 RD_74_75_PARAM

Description:

- with this function the parameter string of a slave according to profile S-7.4 is being read

or

- the slave response according to profile S-7.5 is being read.

If it is about a slave according to profile 7.5, so have the data in the response buffer the following meaning:

FFh 00h: Transfer is still active

FFh xxh: Transfer finished with error

The first byte in the buffer notequal FFH: slave response. The response is in the same form registered in the buffer and transmitted over AS-i.

Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can read in parts from index i.

The first byte of the buffer is the length of the read string.

If $i \equiv 0$, the string is being read from the slave, otherwise the function responses out of the memory; the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5B_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5B_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

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10.3.2.4 RD_74_75_ID

With this function the ID string of a slave according to profile S-7.4 or the 16-bit slave configuration according to profile 7.5 is being read. Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can read in parts from index i.

The first byte of the buffer is the length of the read string.

If i ≡ 0, the string is being read from the slave, otherwise the function responses out of the memory, the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5C_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5C_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

By a 7.5 slave is the request always 1. The response byte contains the cyclic 16-bit slave configuration according to S-7.5 profile (analog/transparent bits are cancelled). If the response is 08h, that means that the cyclic 16-bit configuration could not be detected.

10.3.2.5 RD_74_DIAG

With this function the diagnosis string of a slave according to profile S-7.4 is being read. Since the string can be longer than the command interface, it is written into the buffer. The content of the buffer can be read in parts from indexi.

The first byte of the buffer indicates the length of the read string.

If i ≡ 0, the string is being read from the slave, otherwise the function responses out of the memory, the data can be read consistently.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5D_{16}$							
2	T	–	circuit					
3	slave address							
4	i							

Issue date - 25.4.2007

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$5D_{16}$							
2	T	result						
3	buffer byte i							
…	…							
n+2	buffer byte i+n-1							

10.3.3 Acyclic commands

10.3.3.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 61	WRITE_ACYC_TRANS	$4E_{16}$	Write acyclic transfer	≥7	2
page 63	READ_ACYC_TRANS	$4F_{16}$	Read acyclic transfer	5	≥2

10.3.3.2 WRITE_ACYCLIC_TRANS

This function activates different arts of acyclic transfer (S-7.4, S-7.5 and safety monitor). The results have to be read out with READ_ACYCLIC_TRANS. Even though this function runs in the background and doesnt hold the master during the transmission, it ist intended to act as a substitute for (RD_74_75_PARAM, WR_74_75_PARAM, RD_74_75_ID, RD_74_DIAG and „Safety at Work“- monitor diagnnostic).

Since the transferred data can be longer than the command interface, it is written into the buffer. The content of the buffer can be read in parts from index.

n is the length of the part string, that (from Index (i)) should be written in the buffer. The transmission proceeds, if i=0.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	4Eh							
2	circuit							
3	slave							
4	buffer Index (i) high							
5	buffer Index (i) low							
6	command[1]							
7	number of(n)							
8	data							
…	...							
x	data+n							

Issue date - 25.4.2007

1. Following commands are supported:
   1: S-7.4 ID string Read (no sent data required).
   2: S-7.4 Diag String Read (no sent data required).
   3: S-7.4 Param String Read (no sent data required).
   4: S-7.4 Param String Write (buffer contains sent string).
   5: S-7.5 Transfer. Buffer contains sent string in the same form, as the telegram, that have to be sent over AS-i.
   6: S-7.5 Cyclic 16-Bit Slave Configuration Read (analog/transparent bits are cancelled in the response). The cyclic 16-bit configuration cannot be detected, if the response is 08h.
   7: Safety Monitor sorted Read (no sent data required).
   8: Safety Monitor unsorted (all devices) Read (no sent data required).

Note	Please view <chapter 10.4.2 Monitor Diagnosis> for further information.

	Response							
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4E_{16}$							
2	response							

Issue date - 25.4.2007

10.3.3.3 READ_ACYCLIC_TRANS

With this call the response of the transfer command (started with WRITE_ACYCLIC_TRANS) is read out.

The first byte in the response buffer indicates the current command.

FF_{16} means transfer still active, FE_{16} means transfer interrupted with errors.

The both following bytes (high,low) set the lenght of the response buffer.

It is always recommended to read the data starting with the index i = 0.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4F_{16}$							
2	circuit							
3	slave							
4	buffer index (i) high							
5	buffer index (i) low							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$4F_{16}$							
2	response							
3	data							
...	...							
x	data+n							

The response data have the same format, as by commands RD_74_75_PARAM, RD_74_75_ID and „safety at work“-monitor diagnostics.

Issue date - 25.4.2007

10.3.4 AS-i Diagnosis

10.3.4.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 64	GET_LISTS	30_{16}	Get LDS, LAS, LPS, Flags	2	29
page 66	GET_FLAGS	47_{16}	Get_Flags	2	5
page 67	GET_DELTA	57_{16}	Get list of config. diff.	2	10
page 68	GET_LCS	60_{16}	Get LCS	2	10
page 68	GET_LAS	45_{16}	Get_LAS	2	10
page 69	GET_LDS	46_{16}	Get_LDS	2	10
page 70	GET_LPF	$3E_{16}$	Get_LPF	2	10
page 70	GET_LOS	61_{16}	GET_LOS	2	10
page 71	SET_LOS	62_{16}	SET_LOS	10	2
page 72	GET_TECA	63_{16}	Get transm.err.counters	2	34
page 73	GET_TECB	64_{16}	Get transm.err.counters	2	34
page 73	GET_TEC_X	66_{16}	Get transm.err.counters	4	≥3
page 74	READ_FAULT_DETECTOR	10_{16}	Read Fault Detector	2	4

10.3.4.2 Get Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) (GET_LISTS)

With this call, the following entries are read out of the AS-i/ Gateway:

- The list of active AS-i slaves (LAS)
- The list of detected AS-i slaves (LDS)
- The list of projected AS-i slaves (LPS)
- The flags according to the AS-i slave specification

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	O	circuit					

Issue date - 25.4.2007

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	LAS							
10	31B	30B	29B	28B	27B	26B	25B	24B
11	7A	6A	5A	4A	3A	2A	1A	0A
…	LDS							
18	31B	30B	29B	28B	27B	26B	25B	24B
19	7A	6A	5A	4A	3A	2A	1A	0A
…	LPS							
26	31B	30B	29B	28B	27B	26B	25B	24B
27	–							Pok
28	OR	APF	NA	CA	AAv	AAs	S0	Cok
29	–					AAe	OL	DX

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	30_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	LAS							
10	24B	25B	26B	27B	28B	29B	30B	31B
11	0A	1A	2A	3A	4A	5A	6A	7A
…	LDS							
18	24B	25B	26B	27B	28B	29B	30B	31B
19	0A	1A	2A	3A	4A	5A	6A	7A
…	LPS							
26	24B	25B	26B	27B	28B	29B	30B	31B
27	–							Pok
28	OR	APF	NA	CA	AAv	AAs	S0	Cok
29	–					AAe	OL	DX

Pok Periphery_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready

Issue date - 25.4.2007

Cok Config_Ok
AAe Auto_Address_Enable
OL Offline
DX Data_Exchange_Active

10.3.4.3 Get Flags (GET_FLAGS)

With this call, the following entry is read out of the AS-i/Master Gateway: the flags according to the AS-i slave specification.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	47_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	47_{16}							
2	T	response						
3								Pok
4	OR	APF	NA	CA	AAv	AAs	S0	Cok
5	–					AAe	OL	DX

Pok Periphery_Ok
This flag is set when no AS-i slave is signaling a peripheral fault.

S0 LDS.0
This flag is set when an AS-i slave with address 0 exists.

AAs Auto_Address_Assign
This flag is being set when the automatic address programming is possible (in other words, AUTO_ADDR_ENABLE = 1; no "incorrect" slave connected to the AS-i).

AAv Auto_Address_Available
This flag is set when the automatic address programming can be executed, exactly one AS-i slave is currently out of operation.

CA Configuration_Active
The flag is set in configuration mode and reset in protected mode.

NA Normal_Operation_Active
This flag is set when the AS-i master is in normal operation.

APF AS-i Power Fail
This flag is set when the voltage on the AS-i cable is too low.

OR Offline_Ready
The flag is set when the offline phase is active.

Issue date - 25.4.2007

Cok Config_Ok
This flag is set when the desired (configured) and actual configuration match.

AAe Auto_Address_Enable
This flag indicates whether the automatic address programming is enabled (bit = 1) or disabled (bit = 0) by the user.

OL Offline
This flag is set when the mode should be changed to OFFLINE or when this mode has already been reached.

DX Data_Exchange_Active
If the "Data_Exchange_Active" flag is set, the data exchange between AS-i master and slaves is available in the data exchange phase. If this bit is not set the data exchange is not available. The read ID telegrams are transmitted to the slave.
The bit is set if the AS-i master enters the offline phase.

10.3.4.4 Get Delta List (GET_DELTA)

The delta list contains the list of slave addresses with configuration errors.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	0	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	–
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	57_{16}							
2	T	result						
3	0	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

Issue date - 25.4.2007

10.3.4.5 Get list of corrupted Slaves (GET_LCS and GET_LCS_R6 (6CH))

The call GET_LCS_R6 (6CH) differs to the call GET_LCS in the half long LCS list.

With the bit 2^5 is selected if the upper (=1) or lower (=0) part of the LCS is read. Read first with 2^5 in order to create a local copy of the LCS. Reading with bit 2^5=1 transmits the upper part of the copy.

With the call GET_LCS, the List of Corrupted Slaves (*LCS*) is read out of the AS-i/ Master Gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	60_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

10.3.4.6 Get list of activated Slaves (GET_LAS)

With this call, the following entry is read out of the AS-i/Master Gateway: The list of activated slaves (*LAS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	O	circuit					

Issue date - 25.4.2007

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	45_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

10.3.4.7 Get list of detected AS-i Slaves (GET_LDS)

With this call, the following entry is read out of the AS-i/Master Gateway: The list of detected AS-i slaves (*LDS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	46_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

Issue date - 25.4.2007

10.3.4.8 Get list of peripheral faults (GET_LPF)

With this call, the list of peripheral faults (*LPF*) signaled by the AS-i slaves is read out from the AS-i master. The LPF is updated cyclically by the AS-i master. If and when an AS-i slave signals faults of the attached peripherals (for example broken wire) can be found in the description of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3E_{16}$							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

10.3.4.9 Get list of offline Slaves (GET_LOS)

With this call, the list of slaves causing the offline phase when a configuration error occurs in being read out (List of Offline Slaves, *LOS*).

The user can choose the reaction of the master when a configuration error occurs. The master can be switched off line when an important slave causes a configuration error; less important slaves can send an error to the host, AS-i however will not be switched offline.

Issue date - 25.4.2007

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	61_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

10.3.4.10 Set list of offline Slaves (SET_LOS and SET_LOS_R6 (6Dh))

The call **SET_LOS_R6 ($6D_{16}$)** differs to the call GET_LOS in the half long LOS list.

With the bit 2^5 is selected if the upper (=1) or lower (=0) part of the LOS is written.

With this call, the list of slaves causing the offline phase when a configuration error occurs in being defined (List of Offline Slaves, *LOS*).

The user can choose the reaction of the master when a configuration error occurs. The master can be switched offline when an important slave causes a configuration error; less important slaves can send an error to the host, AS-i however will not be switched offline.

Request (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	O	circuit					
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Issue date - 25.4.2007

Request (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	1	circuit					
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	62_{16}							
2	T	result						

10.3.4.11 Get transm.err.counters (GET_TECA)

Note	In order to get the real number of transcription errors, multiply the value with 2

With this call the error counters of all single slaves/A-slaves can be read (see chapter 8).

With every reading out of the counts, the error counters will be restarted.

The counts are being read out via the corresponding host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	63_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	63_{16}							
2	T	result						
3	APF							
4	slave 1A							
…	…							
34	slave 31A							

Issue date - 25.4.2007

10.3.4.12 Get transm.err.counters (GET_TECB)

Note	In order to get the real number of transcription errors, multiply the value with 2

With this call, the counts of the error counters for B-slaves are being read out (see chapter 8).

With every reading out of the counts, the error counters will be restarted.

The counts are being read out via the corresponding host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	64_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	64_{16}							
2	T	result						
3	APF							
4	slave 1B							
…	…							
34	slave 31B							

10.3.4.13 Get transm.err.counters (GET_TEC_X)

Beginning with a definite slave address, the counts of the n error counters are being read out with this call.

With every reading out the counts, the error counters will be restarted.

The counts are being read out via the correspondending host interface and will be deleted with every read access. The counter´s value is limited to 254. 255 will cause a counter overflow.

Issue date - 25.4.2007

The counts could be independent of the counters, which are displayed in the display of the gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	66_{16}							
2	T	–	circuit					
3	1. slave address							
4	number of counters							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	66_{16}							
2	T	result						
3	counter 1							
…	…							
n	counter n - 2							

10.3.4.14 Read fault detector (READ_FAULT_DETECTOR)

With this call all informations of the AS-i detector are read out. In the first byte are stored the values transferred in the moment, in the second all values since the last deleting. By it it is possible to recognize immediate, no more existing before messages also. The second byte is deleted by reading.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	10_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	10_{16}							
2	T	result						
3	DA	ST	US	ES	24 V	reserved		
4	DA	ST	US	ES	24 V	reserved		

DA duplicate address

ST noise

US over voltage

ES earth fault

24 V failure of the redundant 24V

Issue date - 25.4.2007

10.3.5 Configuration of AS-i Master

Note	Further diagnosis functions for "Safety at Work" and for availability (resp. for warnings) of integrated sensors are detailed explained in the chapter "Functional profiles" (chapter 10.4).

10.3.5.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 75	SET_OP_MODE	$0C_{16}$	Set_Operation_Mode	3	2
page 76	STORE_CDI	07_{16}	Store_Actual_Configuration	2	2
page 76	READ_CDI	28_{16}	Read_Actual_Configuration	3	4
page 77	SET_PCD	25_{16}	Set_Permanent_Config	5	2
page 77	GET_PCD	26_{16}	Get_Permanent_Config	3	4
page 78	SET_LPS	29_{16}	SET_LPS	11	2
page 79	GET_LPS	44_{16}	Get_LPS	2	10
page 80	STORE_PI	04_{16}	Store_Actual_Parameter	2	2
page 80	WRITE_P	02_{16}	Write_Parameter	4	3
page 81	READ_PI	03_{16}	Read_Parameter	3	3
page 81	SET_PP	43_{16}	Set_Permanent_Parameter	4	2
page 82	GET_PP	01_{16}	Get_Permanent_Parameter	3	3
page 82	SET_AAE	$0B_{16}$	Set_Auto_Address_Enable	3	2
page 85	SLAVE_ADDR	$0D_{16}$	Change_Slave_Address	4	2
page 84	WRITE_XID1	$3F_{16}$	Write_Extended_ID-Code_1	3	2

10.3.5.2 Set operation mode (SET_OP_MODE: Set_Operation_Mode)

This call switches between configuration mode and protected mode. In protected mode, only AS-i slaves entered in the LPS and whose expected and actual configurations match, are being activated.

In other words: The slaves are being activated if the I/O configuration and the ID codes of the detected AS-i slaves are identical to the configured values.

In configuration mode, all detected AS-i slaves (except for AS-i slave "0") are activated. This also applies to AS-i slaves for which there are differences between the expected and actual configuration.

The “OPERATION MODE” bit is stored permanently; in other words, it is retained after a cold/warm restart.

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When you change from configuration mode to protected mode, the AS-i master will do a warm restart (change to the offline phase followed by a change to the online mode).

Note	If an AS-i slave with address "0" is entered in the LDS, the AS-i/Master gateway cannot change from configuration mode to protected mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0C_{16}$							
2	T	–	circuit					
3	operation mode							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0C_{16}$							
2	T	result						

Meaning of bit operation mode:

0 = protected mode
1 = configuration mode

10.3.5.3 Store actual configuration (STORE_CDI)

With this call, the (actual) configuration data (I/O configuration, ID code, extended ID1 code and extended ID2 code) of all AS-i slaves are stored permanently in the EEPROM as the (expected) configuration data. The list of activated AS-i slaves (*LAS*) is adopted in the list of permanent AS-i slaves (*LPS*).

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart on the AS-i master).

This command can only be executed in the configuration mode.

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	07_{16}							
2	T	result						

10.3.5.4 Read actual configuration (READ_CDI)

With this call, the following configuration data of an addressed AS-i slave obtained by the AS-i master on the AS-Interface are read.

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

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The configuration data are specified by the manufacturer of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	28_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	28_{16}							
2	T	result						
3	xID2				xID1			
4	ID				I0			

Meaning of bit B:

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

B = 1B-slave

10.3.5.5 Set permanent configuration (SET_PCD)

This call sets the following configuration data for the addressed AS-i slave:

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are stored permanently on the EEPROM of the AS-i/Master gateway and are used as the expected configuration by the AS-i master in the protected mode. The configuration data are specified by the manufacturer of the AS-i slave.

If the addressed AS-i slave does not support an extended ID code 1/2, the value F_{hex} must be specified.

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart).

This command can only be executed in the configuration mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	25_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	xID2				xID1			
5	ID				I0			

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	25_{16}							
2	T	result						

Meaning of bit B:

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

B = 1B-slave

10.3.5.6 Get extended permanent configuration (GET_PCD)

This call reads the following configuration data (configured data) of an addressed AS-i slave stored on the EEPROM of the AS-i master:

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are specified by the manufacturer of the AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	26_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	26_{16}							
2	T	result						
3	xID2				xID1			
4	ID				I0			

Meaning of bit B:

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

B = 1 B-slave

10.3.5.7 Set list of projected slaves (SET_LPS and SET_LPS_R6 (6Bh))

The command **SET_LPS_R6 (6Bh)** differs from the command **SET-LPs** in:

- no empty byte (3)
- half so long LPS list

With the bit 2^5 is selected if the upper (=1) or lower (=0) part of the LCS is read.

With this call, the list of configured AS-i slaves is transferred for permanent storage in the EEPROM of the master.

When this command is executed, the AS-i master changes to the offline phase and then changes back to the normal mode (warm restart).

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This command can only be executed in the configuration mode.

Request (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	0	circuit					
3	00_{16}							
4	7A	6A	5A	4A	3A	2A	1A	–
…	…							
11	31B	30B	29B	28B	27B	26B	25B	24B

Request (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	1	circuit					
3	00_{16}							
4	–	1A	2A	3A	4A	5A	6A	7A
…	…							
11	24B	25B	26B	27B	28B	29B	30B	31B

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	29_{16}							
2	T	result						

10.3.5.8 Get list of projected slaves (GET_LPS)

With this call, the following entry is read out of the AS-i/Master Gateway: The list of projected AS-i slaves (*LPS*).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	O	circuit					

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0A
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

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Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	44_{16}							
2	T	result						
3	0A	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24B	25B	26B	27B	28B	29B	30B	31B

10.3.5.9 Store actual parameters (STORE_PI)

With this call, the configured parameters stored on the EEPROM are overwritten with the current, permanently stored (actual) parameters; in other words, the current parameters of all AS-i slaves are stored.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	04_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	04_{16}							
2	T	result						

10.3.5.10 Write parameter (WRITE_P)

The AS-i slave parameter value transferred with the command is passed on to the addressed AS-i slave.

The parameter is stored in the AS-i/Master only temporarily and is not stored as a configured parameter in the EEPROM!

The AS-i slave transfers its current parameter value in the response (parameter echo). This can deviate from the value that has just been written according to the AS-i master specification.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	02_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	–				parameter			

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	02_{16}							
2	T	result						
3	–				slave response			

Meaning of bit B:

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

10.3.5.11 Read parameter (READ_PI: Read_Parameter)

This call returns the current parameter value (actual parameter) of an AS-i slave sent by the AS-i/Master. This value must not be confused with the parameter echo that is supplied by the AS-i slave as a response to the write_p job.

This command can not be used for a directly reading of an AS-i parameter out of an AS-i slave.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	03_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	03_{16}							
2	T	result						
3	–				PI			

Meaning of bit B:

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

10.3.5.12 Set permanent parameter (SET_PP)

With this call, a parameter value for the specified AS-i slave is configured. The value is stored permanently in the EEPROM of the gateway.

The configured parameter value is transferred only when the AS-i slave is activated after turning on the power supply on the AS-i/Master Gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	43_{16}							
2	T	–	circuit					
3	–		B	slave address				
4	–				PP			

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	43_{16}							
2	T	result						

10.3.5.13 Get permanent parameter (GET_PP)

With this call, a slave-specific parameter value stored on the EEPROM of the AS-i/ Master Gateway is read.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	01_{16}							
2	T	–	circuit					
3	–		B	slave address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	01_{16}							
2	T	result						
3	–				PP			

Meaning of bit B:

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

B = 1 B-slave

10.3.5.14 Set auto address enable (SET_AAE)

This call can enable or disable the "automatic address programming" function.

The AUTO_ADDR_ENABLE bit is stored permanently; in other words, it is retained after a warm/hot restart on the AS-i master.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0B_{16}$							
2	T	–	circuit					
3	Auto_Address_Enable							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0B_{16}$							
2	T	result						

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10.3.5.15 Change slave address (SLAVE_ADDR)

With this call, the AS-i address of an AS-i slave can be modified.

This call is mainly used to add a new AS-i slave with the default address "0" to the AS-Interface. In this case, the address is changed from "AS-i slave address old" = 0 to "AS-i slave address new".

This change can only be made when the following conditions are fulfilled:

1. An AS-i slave with “AS-i slave address old” exists.
2. If the old AS-i slave address is not equal to 0, an AS-i slave with address "0" cannot be connected at the same time.
3. The "AS-i slave address new" must have a valid value.
4. An AS-i slave with "AS-i slave address new" must not exist.

Note	When the AS-i slave address is changed, the AS-i slave is not reset, in other words, the output data of the AS-i slave are retained until new data are received at the new address.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0D_{16}$							
2	T	–	circuit					
3	–		B	source address				
4	–		B	target address				

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0D_{16}$							
2	T	result						

Meaning of bit B:

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

B = 1 B-slave

Issue date - 25.4.2007

10.3.5.16 Write AS-i slave extended ID1 (WRITE_XID1)

With this call, the extended ID1 code of an AS-i slave with address "0" can be written directly via the AS-i cable. The call is intended for diagnostic purposes and is not required in the normal master mode.

The AS-i master passes the extended ID1 code on to the AS-i slave without any plausibility check.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3F_{16}$							
2	T	–	circuit					
3	–				xID1			

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$3F_{16}$							
2	T	result						

10.3.6 Other commands

10.3.6.1 Overview of the commands

Values for command

see page	*Command*	*Value*	*Meaning*	*Req Len*	*Res Len*
page 84	**Other commands**				
page 85	IDLE	00_{16}	No request	2	2
page 85	READ_IDI	41_{16}	Read IDI	2	36
page 86	WRITE_ODI	42_{16}	Write ODI	34	2
page 86	READ_ODI	56_{16}	Read ODI	2	34
page 87	SET_OFFLINE	$0A_{16}$	Set_Off-Line_Mode	3	2
page 88	SET_DATA_EX	48_{16}	Set_Data_Exchange_Active	3	2
page 88	BUTTONS	75_{16}	Disable Pushbuttons	3	2
page 88	FP_PARAM	$7D_{16}$	„Functional Profile“ Param.	≥3	≥2
page 89	FP_DATA	$7E_{16}$	„Functional Profile“ Data	≥3	≥2
page 90	INVERTER	$7C_{16}$	Configure Inverter Slaves	12	4
page 90	MB_OP_CTRL_WR_FLAGS	0x85	Write Flags	≥5	2
page 91	MB_OP_CTRL_RD_FLAGS	0x86	Read Flags	4	≥3
page 91	RD_MFK_PARAM	0x59	Read SEW MFK21 Parameter	6	≥3

Issue date - 25.4.2007

10.3.6.2 IDLE

When the value of "command" is zero, no request will be fulfilled.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	00_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	00_{16}							
2	T	result						

10.3.6.3 Read input data image (READ_IDI)

With this call, the input data values of all AS-i slaves are read out of the AS-i/Master Gateway in addition to the cyclic data exchange. Though the command READ_IDI transmits all execution control flags (byte 3 and byte 4).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	41_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	41_{16}							
2	T	result						
3	–							Pok
4	OR	APF	NA	CA	AAv	AAs	s0	Cok
5	–				slave 1A			
6	slave 2A				slave 3A			
…	…							
36	slave 30B				slave 31B			

Pok Periphery_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready
Cok Config_Ok

Issue date - 25.4.2007

10.3.6.4 Write output data image (WRITE_ODI)

With this call the output data values of all AS-i slaves are written in addition to the cyclic data exchange.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	42_{16}							
2	T	–	circuit					
3	–				slave 1A			
4	slave 2A				slave 3A			
…	…							
34	slave 30B				slave 31B			

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	42_{16}							
2	T	result						

10.3.6.5 Read output data image (READ_ODI)

With this call, the output data values of all AS-i slaves is being read out of the AS-i/ Master Gateway.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	56_{16}							
2	T	–	circuit					

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	56_{16}							
2	T	result						
3	–				slave 1A			
	slave 2A				slave 3A			
…	…							
34	slave 30B				slave 31B			

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10.3.6.6 Set offline mode (SET_OFFLINE)

This call switches between online and offline mode.

The online mode is the normal operating state for the AS-i master. The following jobs are processed cyclically:

- During the data exchange phase, the fields of the output data are transferred to the slave outputs for all AS-i slaves in the LAS. The addressed AS-i slaves submit the values of the slave inputs to the master when the transfer was free of errors.
- This is followed by the inclusion phase in which existing AS-i slaves are searched and newly added AS-i slaves are entered in the LDS or LAS.
- In the management phase, jobs by the user such as writing parameters are executed.

In the offline mode, the AS-i/Master Gateway processes jobs by the user only. (Jobs that involve the immediate addressing of an AS-i slave are rejected with an error). There is no cyclic data exchange with the AS-i slaves.

When offline, the AS-i circuit is in a safe state.

The OFFLINE = TRUE bit is not permanently stored; in other words, following a cold/warm restart, the AS-i/Master Gateway is once again in the online mode.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0A_{16}$							
2	T	–	circuit					
3	Off-Line							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$0A_{16}$							
2	T	result						

The master changes to the offline phase, if there is a 1 written in byte 3.

The master will change to online mode if there is a 0 written in byte 3.

Issue date - 25.4.2007

10.3.6.7 Release data exchange (SET_DATA_EX)

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	48_{16}							
2	T	–	circuit					
3	Data_Exchange_Active							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	48_{16}							
2	T	result						

10.3.6.8 BUTTONS

With this call, the use of the buttons can be enabled/disabled.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	75_{16}							
2	T	–	circuit					
3	Buttons disabled							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	75_{16}							
2	T	result						

10.3.6.9 FP_PARAM

This command is used for parametrization of "functional profiles".

The content of the request and response bytes depends on the called function (see chapter 10.4).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	–	circuit					
3	function							
4	request byte 1							
…	…							
n	request byte n-3							

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Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	result						
3	response byte 1							
…	…							
n	response byte n-2							

10.3.6.10 FP_DATA

This command is used for the data exchange with "functional profiles".

The content of the request and response bytes depends on the called function (see chapter 10.4).

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	–	circuit					
3	function							
4	request byte 1							
…	…							
n	request byte n-3							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	reponse byte 1							
…	…							
n	response byte n-2							

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10.3.6.11 Inverter

With this call, an AS-i slave for frequency inverters is switched from cyclical mode to the transmission mode of four 16-bit values, in order to operate again with the selected AS-i destination parameter.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7C_{16}$							
2	T	–	circuit					
3	slave address							
4	destination parameter							
5	value 1, high byte							
6	value 1, low byte							
7	value 2, high byte							
8	value 2, low byte							
9	value 3, high byte							
10	value 3, low byte							
11	value 4, high byte							
12	value 4, low byte							

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7C_{16}$							
2	T	result						

10.3.6.12 Write Flag

Use this command to write the flag of a control program.

The control program of devices with control functions takes on data from the interface.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x85							
2	T	–	circuit					
3	introductory address							
4	number n							
5	number 1							
...	...							
n	number n							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x85							

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Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
2	T	result						

10.3.6.13 Read Flag

Use this command to read out the flags of a control program.

The control program of devices with control functions takes on data from the interface.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x86							
2	T	–	circuit					
3	introductory address							
4	number n							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x86							
2	T	result						
3	data 1							
...								
n	data n							

10.3.6.14 READ_MFK_PARAM

Use this command to read multiple commands of a SEW MFK21 slave.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x59							
2	T	–	circuit					
3	slave							
4	index high							
5	index low							
6	number (n)							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0x59							
2	T	result						
3	prm byte (index)							
4	prm byte (index+1)							
n+2	prm byte (index+n-1)							

Issue date - 25.4.2007

10.4 Functional profiles

10.4.1 "Safety at Work" List 1

Note	This function has been implemented only for reasons of the downwards compatibility. By AS-i 3.0 Masters, the state of the "safety input slaves" is specified on the image of the input data (0000 released).

Function: 00_{16}

List of "safety-directed input slaves" ("AS-i Safety at Work"), whose safety function is released.

Safety-directed input slaves have the profile S-7.B or S-0.B (IO = 0 or 7, ID = B, see chapter 10.3.5.4: Read Actual Configuration).

The "Safety at Work" list 1 is a bit list which contains a bit for each possible slave address (1 - 31). This list is written in the bytes 5 until 8 in the response of the command of the command interface. Additionally, the reponse contains the ec-flags of the AS-i master in the bytes 3 and 4 (see chapter 10.3.4.3: "Get Flags").

The bits of the "Safety at Work" list 1 are set if the safety function of the slave is activated (e.g. emergency button pressed). The bit is only set at security slaves when both contacts are released, otherwise the bits have the value 0. "Normal" (non-security) slaves also have the value 0.

Since the safety monitor is also being activated when a safety slave is missing or if the AS-i circuit is shut off (offline active), the ec-flags will also be transmitted. It is sufficient however to monitor the group error message Cok (configuration error). As long as no configuration error, the list of the "safety-directed input slaves" can be used.

Configured safety slaves which are not available, and available slaves sending a wrong coder order, will not be entered in this list.

With the bit "O", the sequence of the bits within the "Safety at Work" list 1 can be chosen.

Cok Config_Ok
S0 LDS.0
AAs Auto_Address_Assign
AAv Auto_Address_Available
CA Configuration_Active
NA Normal_Operation_Active
APF APF
OR Offline_Ready
Pok Periphery_Ok

Example for O ≡ 0:

Configuration OK,
periphery OK (no peripheral fault),
2 safety slaves with released safety function,
AS-Inferface addresses 4 and 10

Issue date - 25.4.2007

1 safety slave with unreleased safety function,
AS-Inferface address 5.

Reponse: 7E 00 01 25 10 04 00 00

Function: $0D_{16}$

There is a funktion **$0D_{16}$** in addittion to the function **00_{16}** . The funktion **$0D_{16}$** has no EcFlags in the response. The response falls short for 2 bytes.

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	0Dh							

Response (by O ≡ 0)								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	response						
3	7	6	5	4	3	2	1	–
4	15	14	13	12	11	10	9	8
5	23	22	21	20	19	18	17	16
6	31	30	29	28	27	26	25	24

Response (by O ≡ 1)								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	response						
3	–	1	2	3	4	5	6	7
4	8	9	10	11	12	13	14	15
5	16	17	18	19	20	21	22	23
6	24	25	26	27	28	29	30	31

10.4.2 "Safety at Work" Monitor diagnosis

Function: 02_{16}

Since the "Safety at Work" monitor can generate more than 32 Byte diagnosis data, these must be read with several command interface calls. The byte 5 declares the start index in the field of the diagnosis data.

If the start index is 0, new data is fetched from the monitor. Otherwise, the function will respond out of the memory; the data can be read consistently.

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10.4.2.1 Setting of the AS-i diagnosis

Note	The function ***unsorted diagnosis*** is available only with monitors in the version 2.0 and higher. The function ***sorted diagnosis*** is available with all monitors.

The setting of the AS-i diagnosis takes place in the window "*Information about monitor and bus*" of the *configuration software* ***asimon*** for the AS-i safety monitor.

- Call up the menu *Edit/Information about monitor and bus*

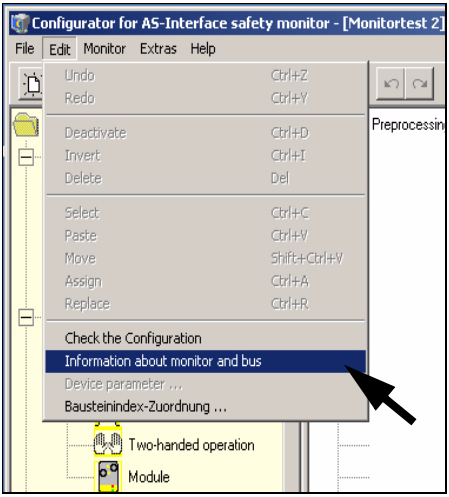

Fig. 1. Calling of Information about monitor and bus

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- Set *the function range* in the window *Information about monitor and bus*

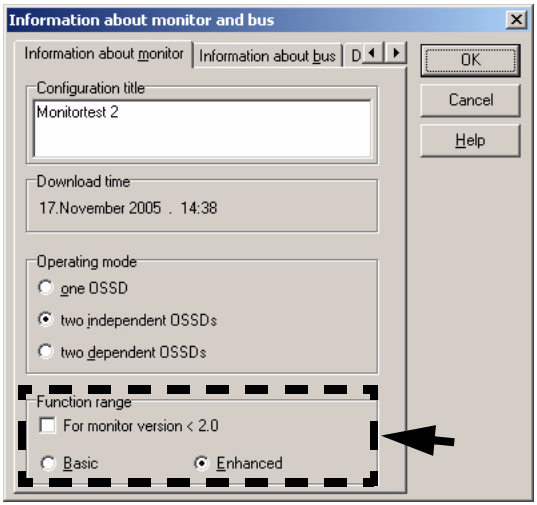

Fig. 2. Setting of function range

- Select in the window *Information about monitor and bus* the tab *Diagnosis/Service*
- Select within the range *Data selection* ***sorted*** (sorted by OSSD) or ***unsorted*** (all devices)

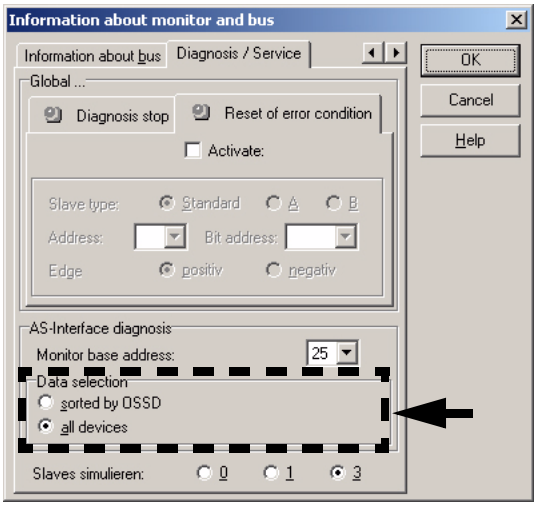

Fig. 3. Data selection (sorted/unsorted)

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10.4.2.2 Enhanced diagnosis

Since the "Safety at Work“ monitor diagnosis is longer than the maximum size of the command interface, it must be read with several adjacent requests.

The byte 5 (‘index’) declares the start index in the array of diagnostic data. If this start index is 0, the whole diagnosis is fetched from the monitor and stored to an internal buffer. Otherwise, the AS-i Master will respond out of the internal buffer. Thus, even though several requests are necessary to read the whole buffer, data integrity is maintained.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	L[1]	U[2]	circuit				
3	02_{16}							
4	slave address							
5	index							

1. L=1 long diagnosis for advanced monitor
2. U=1 unsorted diagnosis (all devices)

Response								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	diagnosis byte #index+0							
4	diagnosis byte #index+1							
…	…							
n	diagnosis byte #index+n-3							

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The diagnosis array is set up as follows:

Safety Monitor Diagnosis Array "*basic function range*" and "*sorted by OSSD*"								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	state of monitor							
2	state of OSSD1							
3	state of OSSD2							
4	number of devices not green, OSSD1							
5	number of devices not green, OSSD2							
6	device index 32, OSSD1							
7	color of device 32, OSSD1							
8	device index 33, OSSD1							
9	color of device 33, OSSD1							
…	…							
68	device index 63, OSSD1							
69	color of device 63, OSSD1							
70	device index 32, OSSD2							
71	color of device 32, OSSD2							
…	…							
132	device index 63, OSSD2							
133	color of device 63, OSSD2							

Safety Monitor Diagnosis Array "*enhanced function range*" and "*sorted by OSSD*"								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	state of monitor							
2	state of OSSD1							
3	state of OSSD2							
4	number of devices not green, OSSD1							
5	number of devices not green, OSSD2							
6	device index 32, OSSD1							
7	color of device 32, OSSD1							
8	device index 33, OSSD1							
…	…							
133	color of device 95, OSSD1							
134	device index 32, OSSD2							
…	…							
261	color of device 95, OSSD2							

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Safety Monitor Diagnosis Array "*basic function range*" and "*all devices*"								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	state of monitor							
2	state of OSSD1							
3	state of OSSD2							
4	number of devices not green							
5	—							
6	device index 32							
7	color of device 32							
8	device index 33							
9	color of device 33							
…	…							
68	device index 63							
69	color of device 63							
70	device index 32							
71	assignment of device 32 to OSSD							
…	…							
132	device index 63							
133	assignment of device 63 to OSSD							

Safety Monitor Diagnosis Array "*enhanced function range*" and "*all devices*"								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	00_{16}							
1	state of monitor							
2	state of OSSD1							
3	state of OSSD2							
4	number of devices not green							
5	—							
6	device index 32							
7	color of device 32							
8	device index 33							
…	…							
133	color of device 95							
134	device index 32							
135	assignment of device 32 to OSSD2							
…	…							
261	assignment of device 95 to OSSD							

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Possible assignment:

00_{16}: preprocessing

01_{16}: OSSD 1

02_{16}: OSSD 2

03_{16}: OSSD 1+2

80_{16}: device does not exist

See the " Safety at Work“ monitor documenation for a description of the codes used for monitor state, OSSD state, device colors and assigments to OSSDs.

10.4.3 Integrated AS-i Sensors: Warnings

Function: 03_{16}

List of integrated AS-i sensors according to profile S-1.1 (without extended addressing) or profile S-3.A.1(with extended addressing), by which the input data bit D1 ("Warning") being deleted.

For creating of this list CDI and IDI are used only. Integrated AS-i slaves which are projected but not existing therefore are not entered here.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	03_{16}							

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	7A	6A	5A	4A	3A	2A	1A	0
…	…							
10	31B	30B	29B	28B	27B	26B	25B	24B

Response if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	0	1A	2A	3A	4A	5A	6A	7A
…	…							
10	24A	25A	26A	27A	28A	29A	30A	31A

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10.4.4 Integrated AS-i sensors: Availability

Function: 04_{16}

List of the integrated slaves according to profile S-1.1 whose input data bits D2 ("Availability") are deleted.

For creating this list, CDI and IDI are used only. Integrated AS-i slaves which are projected but not existing therefore are not entered here.

Request								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	O	circuit					
3	04_{16}							

Response (if O ≡ 0)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	7	6	5	4	3	2	1	0
…	…							
6	31	30	29	28	27	26	25	24

Response (if O ≡ 1)								
byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
3	0	1	2	3	4	5	6	7
…	…							
6	24	25	26	27	28	29	30	31

10.4.5 Replacement of Safety Slaves input data

Function $0F_{16}$

Use this function to replace safety slaves input data with "interpretation data". If the function is active, so have safety slaves input data the following meaning:

Bit 0,1: 00=channel 1 has released 11=channel 1 has not released.

Bit 2,3: 00=channel 2 has released, 11=channel 2 has not released.

Note	This command replaces the old command MB_FP_LSS_ENABLE

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Set:

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	–	circuit					
3	$0F_{16}$							
4	safety slaves[1]							

1. Value: 0= no substitute value, 1=substitute value for safety slaves

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	result						

Read:

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	–	circuit					
3	$0F_{16}$							

Response								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7E_{16}$							
2	T	result						
4	safety slaves[1]							

1. Value: 0= no substitute value, 1=substitute value for safety slaves

10.4.6 List of Safety Slaves

Function 10_{16}

Use this function to find out the addresses of safety slaves.

Read:

Request								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	O[1]	circuit					
3	10_{16}							

1. O = orientation

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Response (by O ≡ 0)								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	result						
3	7	6	5	4	3	2	1	0
…	…							
6	31	30	29	28	27	26	25	24

Response (bei O ≡ 1)								
Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	$7D_{16}$							
2	T	result						
3	0	1	2	3	4	5	6	7
…	…							
6	24	25	26	27	28	29	30	31

10.5 Command Interface examples

You can find actual command interface examples in the download area of the homepage.

10.5.1 Reading 16-bit input values

Command RD_7X_IN: Reading of 16-bit input values.

Meaning of the bytes:

Request: RD_7X_IN	
Byte 1	50_{hex} (RD_7X_IN)
Byte 2	00_{hex} (master 1, single master)
Byte 3	$1D_{hex}$ (slave address 29)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The call of the command interaface has not been answered with the valid values since the toggle bit has not been set.

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Set of toggle bit:

Request	
Byte 1	50_{hex}
Byte 2	80_{hex} (toggle bit, result)
Byte 3	$1D_{hex}$ (slave address 29)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Result: See chapter 10.2.1 "Values for results"

Response	
Byte 1	50_{hex}
Byte 2	80_{hex} (toggle bit, master1)
Byte 3	16-bit channel 1 high $byte_{hex}$
Byte 4	16-bit channel 1 low $byte_{hex}$
Byte 5	16-bit channel 2 high $byte_{hex}$
Byte 6	16-bit channel 2 low $byte_{hex}$
Byte 7	16-bit channel 3 high $byte_{hex}$
Byte 8	16-bit channel 3 low $byte_{hex}$
Byte 9	16-bit channel 4 high $byte_{hex}$
Byte 10	16-bit channel 4 low $byte_{hex}$
Byte 11	00_{hex} not used
Byte 12	00_{hex} not used

To get the input data again, the T-bit has to be reset again.

10.5.2 Store current configuration to the AS-i master

1. Switch master to configuration mode
2. Write the current slave configuration to the master
3. Switch master to protected mode
4. Wait until master is in normal (protected) operation mode

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12-byte management

1. Switch master to config mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

Master is now in configuration mode.

Result = 0 ⇒ No error, for other result codes see chapter 10.2.1 "Values for results".

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2. Write the actual slave configuration to the master

Request: STORE_CDI	
Byte 1	07_{hex} (STORE_CDI)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: STORE_CDI	
Byte 1	07_{hex} (STORE_CDI)
Byte 2	80_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The current configuration data has been written.

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3. Set master to protected mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master has now been ordered to switch to the protected mode. It must be maintained now until the master changes into the operation mode.

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4.Wait until master is in normal operation mode (and protected mode)

Reading out the flags until NA (Normal Operation Active) has been set.

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response								
Byte 1	47_{hex}							
Byte 2	80_{hex} (T = 1, result = 0)							
Byte 3	-	-	-	-	-	-	-	POK
Byte 4	OR	APF	NA	CA	AAv	AAs	S0	COK
Byte 5						AAe	OL	DX
Byte 6	00_{hex}							
…								
Byte 12	00_{hex}							

The flag NA has to be set before the application is started. In case it is not set, the flags have to be read out until this flag has been set to 1.

The flag NA indicates that the master is in normal operation mode.

Normal operation mode is necessary to run the application safely.

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10.5.3 Store new configuration for all slaves

1. Switch master in configuration mode
2. Write slave configuration to master
3. Write new list of projected slaves (*LPS*)
4. Write permanent parameter (*PP*) to master
5. Switch master to protected mode
6. Wait until master is in normal operation Mode (and protected mode)

12-byte management

1. Set master in config mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Set the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	01_{hex} (= config mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

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Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master is now in configuration mode.

Result: See chapter 10.2.1 "Values for results".

2. Write single configuration to master

Writing a configuration of an AS-i slave to the master.

For example:

16-bit input 4 CH at address 4 (Slave datasheet)
ID: 3_{hex}
ID2: E_{hex}
IO: 7_{hex}
ID1: F_{hex}

Request: SET_PCD	
Byte 1	25_{hex} (SET_PCD)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	EF_{hex} (ID + IO to configurate)
Byte 5	37_{hex} (xID2 + xID1 to configurate)
Byte 6	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

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Set the toggle bit:

Request: SET_PCD	
Byte 1	$0C_{hex}$ (SET_PCD)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	EF_{hex} (ID + IO to configurate)
Byte 5	37_{hex} (ID + IO to configurate)
Byte 6	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	25_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
Byte 4	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The single slave configuration for the 16-bit module is written.

This command must be repeated for all 31 A-slaves and all 31 B-slaves. If you don't connect a slave to an address, write F_{hex} for ID, IO, ID1, ID2.

3. Write new list of projected slaves

Write the complete LPS of your AS-i circuit.

Every bit in the LPS corresponds to one slave after the following scheme:

Byte0/Bit 0:slave 0/0A - can not be set!
Byte1/Bit 1:slave 1/1A
...
Byte3/Bit 7:slave 31/31A
Byte4/Bit 0:slave 0B - can not be set!
Byte4/Bit 1:slave 1B
...

Byte7/Bit 7:slave 31B
The slave is projected if the bit is set.

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Example above: 16-bit module at address 4 ⇒ Set bit 4/byte 0:

Request: SET_LPS	
Byte 1	29_{hex} (SET_LPS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	10_{hex} (LDS byte 0)
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 11	00_{hex} (LDS byte 7)
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: SET_LPS	
Byte 1	29_{hex}
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex}
Byte 4	10_{hex} (LDS byte 0)
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 11	00_{hex} (LDS byte 7)
Byte 12	00_{hex}

Response	
Byte 1	29_{hex}
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The new list of protected slaves (LPS) is written.

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4. Write permanent parameter (power on parameter) to master

Example as above:16-bit module at address 4 with PP = 07_{hex}

Request: SET_PP	
Byte 1	43_{hex} (SET_PP)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	07_{hex} (PP to write (use low nibble))
Byte 5	00_{hex} (LDS byte 1)
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0

Setting the toggle bit:

Request: SET_PP	
Byte 1	43_{hex} (SET_PP)
Byte 2	80_{hex} (T = 0, master 1, single master)
Byte 3	04_{hex} (slave address to write to master)
Byte 4	07_{hex} (PP to write (use low nibble)
Byte 5	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	43_{hex}
Byte 2	80_{hex} (T = 1, Result = 0)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

The permanent parameter for the 16-bit module is written.

This command must be repeated for all 31 A-slaves and all 31 B-slaves. If you don't connect a slave to an address, write the default value to the master (F_{hex}) as a permanent parameter.

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5. Switch Master to Protected Mode

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: SET_OP_MODE	
Byte 1	$0C_{hex}$ (SET_OP_MODE)
Byte 2	80_{hex} (T = 1, master 1, single master)
Byte 3	00_{hex} (= protected mode)
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	$0C_{hex}$
Byte 2	80_{hex} (T = 1, result = 0)
Byte 3	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

The master has now been ordered to switch to protected mode.

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6. Wait until master is in normal (protected) operation mode

Read out the flags, until the NA (Normal Operation Active) has been set.

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
…	…
Byte 12	00_{hex}

Response	
Byte 1	00_{hex} (or old values)
Byte 2	00_{hex} (or old values)
…	…
Byte 12	00_{hex} (or old values)

No result because toggle bit = 0.

Setting the toggle bit:

Request: GET_FLAGS	
Byte 1	47_{hex} (GET_FLAGS)
Byte 2	00_{hex} (T = 0, master 1, single master)
Byte 3	00_{hex}
Byte 4	00_{hex}
…	…
Byte 12	00_{hex}

Response								
Byte 1	47_{hex}							
Byte 2	80_{hex} (T = 1, result = 0)							
Byte 3	-	-	-	-	-	-	-	POK
Byte 4	OR	APF	NA	CA	AAv	AAs	S0	COK
Byte 5						AAe	OL	DX
Byte 6	00_{hex}							
…								
Byte 12	00_{hex}							

The flag NA has to be set before the application is started. In case it is not set, the flags have to be read out until this flag has been set to 1.

The flag NA indicates that the master is in normal operation mode.

Normal operation mode is necessary to run the application safely.

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The flag NA indicates that the master is in the normal operating mode which is necessary for the application to run safely.

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11 Including the AS-i Master in own programs

AS-i master can directly communicate with own programs with the help of the serial telegrams. There are two methods to do this:

1. Direct communicating with the AS-i master from own programs with the help of the serial telegrams, described in the following chapter 11.1.
2. If the environment is Windows: Using DLLs .

11.1 Telegrams of the serial communication

11.1.1 Message structure

The messages have the following structure:

k	n	b_1	b_2	...	b_n	s

Command byte k:
: Message ID character.

User data length n:
: Number of user data bytes (zero to 17).

User data bytes b_i:
: If user data length $n \equiv 00_{hex}$, this field is not used

Checksum s:
: The lowest eight bits of the sum of all previously sent bytes are transmitted as the checksum. The checksum can also be calculated with the formula:

$$s = (k + n + \sum_{i=1}^{n} b_i) \bmod 256$$

The AS-i master responds to a host message with a message of the same type but normally of different length, or it responds with an error message (command byte 75_{hex}, 1 byte usable data).

Example: For a change of the operating address from 7 to 26, the nessages would lok like this:

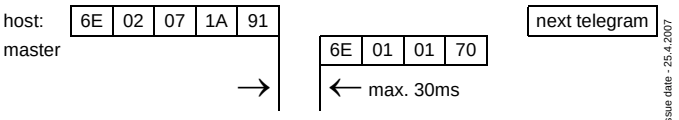
Host message:

command byte k:	$6E_{hex}$
user data length n:	02_{hex}
user data byte b_1:	old slave address = $7E_{hex}$
user data byte b_2:	new slave address = $1A_{hex}$
checksum s:	$6E + 02 + 07 + 1A = 91_{hex}$

Master message (master responds with “O.K.”):

command byte k:	$6A_{hex}$
user data length n:	01_{hex}
user data byte b_1:	*status* = “O.K.” = 00_{hex}
checksum s:	$6A + 01 + 00 = 6B_{hex}$

maximum reaction time of the master: 30ms



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11.1.2 Synopsis of the command bytes

k	Message	AS-i Specification		Pepperl +Fuchs
		2.04	2.1	Extensions
01_{hex}	data exchange of all input and output data			✓
02_{hex}	read output data			✓
03_{hex}	write AS-i flags			✓
10_{hex}	read input data		✓	
11_{hex}	write output data		✓	
12_{hex}	write configured parameters		✓	
13_{hex}	read configured parameters		✓	
14_{hex}	write actual parameters		✓	
15_{hex}	read actual parameters		✓	
16_{hex}	store actual parameters		✓	
17_{hex}	write configuration data		✓	
18_{hex}	read configuration data		✓	
19_{hex}	store actual configuration		✓	
$1A_{hex}$	read actual configuration		✓	
$1B_{hex}$	write LPS		✓	
$1C_{hex}$	read LPS		✓	
$1D_{hex}$	read LAS		✓	
$1E_{hex}$	read LDS		✓	
$1F_{hex}$	read AS-i flags		✓	
29_{hex}	set operating mode		✓	
$2A_{hex}$	write offline		✓	
$2B_{hex}$	write data exchange active		✓	
$2C_{hex}$	change slave address		✓	
$2D_{hex}$	write auto address enable		✓	
$2F_{hex}$	execute AS-i command		✓	
36_{hex}	read LPF		✓	
37_{hex}	write extended ID code 1		✓	
40_{hex}	read 16 bit data			✓
41_{hex}	write 16 bit data			✓
42_{hex}	16 bit data transmission control			✓
50_{hex}	read LCS			✓
51_{hex}	read error counters			✓

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k	Message	AS-i Specification		Pepperl +Fuchs
		2.04	2.1	Extensions
52_{hex}	read LOS			✓
53_{hex}	write LOS			✓
55_{hex}	reserved for baud rate search			
61_{hex}	write configured parameters	✓		
62_{hex}	read configured parameters	✓		
63_{hex}	write actual parameters	✓		
64_{hex}	read actual parameters	✓		
65_{hex}	store actual parameters	✓		
66_{hex}	write configuration data	✓		
67_{hex}	read configuration data	✓		
68_{hex}	store actual configuration	✓		
69_{hex}	read actual configuration	✓		
$6A_{hex}$	write LPS	✓		
$6B_{hex}$	read LPS	✓		
$6C_{hex}$	read LAS	✓		
$6D_{hex}$	read LDS	✓		
$6E_{hex}$	change slave address	✓		
$6F_{hex}$	execute AS-i command	✓		
71_{hex}	read input data	✓		
70_{hex}	write output data	✓		
72_{hex}	read execution control flags	✓		
73_{hex}	set operating mode	✓		
74_{hex}	write host interface flags	✓		
75_{hex}	error telegram			✓
76_{hex}	exchange all input and output data			✓
77_{hex}	write selected output data			✓
78_{hex}	read selected output data			✓
79_{hex}	disable automatic programming	✓		
$7A_{hex}$	watchdog test			✓
$7B_{hex}$	set watchdog			✓
$7C_{hex}$	lock front panel operation			✓
$7D_{hex}$	read master version			✓
$7E_{hex}$	activate master			✓
$7F_{hex}$	download AS-i control program			✓

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k	Message	AS-i Specification		Pepperl +Fuchs
		2.04	2.1	Extensions
80_{hex}	start AS-i control program			✓
81_{hex}	read output data			✓
82_{hex}	change master address			✓
83_{hex}	upload AS-i control program			✓
84_{hex}	read user memory (flags)			✓
85_{hex}	write user memory (flags)			✓
88_{hex}	advanced diagnostics			✓
89_{hex}	write LOS			✓
$8A_{hex}$	read LOS			✓
$8B_{hex}$	exchange all process data			✓
$8C_{hex}$	write actual parameter			✓
$8D_{hex}$	read configuration data of all AS-i ciruits			✓
$8E_{hex}$	configure all AS-i circuits			✓

11.1.3 Message descriptions

In tables of the following pages are listed for each communication message the command byte k, the content of the data byte b_i for host and master massage and the maximum reaction time t_{max} of the master.

The master returns the status byte, if there would otherwise be no user data. Normally, it takes on only one of the two following values:

status = 0: error while executing a host request
status = 1: no error while executing a host request

The recommendable communication messages are printed bold.

Commands according to the previous AS-i Master Specification (2.04)

message	k	b_i (host message)	b_i (master message)	t_{max}
read input data	71_{hex}	-	$b_1...b_{16}$: input data	10ms
write output data	70_{hex}	$b_1...b_{16}$: output data	b_1: status	10ms
write configured parameters	61_{hex}	b_1: slave address b_2: parameters	b_1: status	30ms
read configured parameters	62_{hex}	b_1: slave address	b_1: parameters	20ms
write actual parameters	63_{hex}	b_1: slave address b_2: parameters	b_1: counter-read parameters (inverted in case of error)	20ms
read actual parameters	64_{hex}	b_1: slave address	b_1: parameters	20ms
store actual parameters	65_{hex}	-	b_1: status	200ms
write configuration data	66_{hex}	b_1: slave address b_2: configuration data	b_1: status	30ms
read configuration data	67_{hex}	b_1: slave address	b_1: configuration data	10ms

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Commands according to the previous AS-i Master Specification (2.04)				
message	k	b_i (host message)	b_i (master message)	t_{max}
store actual configuration	68_{hex}	-	b_1: status	200ms
read actual configuration	69_{hex}	b_1: slave address	b_1: configuration data	10ms
write LPS	$6A_{hex}$	b_1 ... b_4: LPS	b_1: status	30ms
read LPS	$6B_{hex}$	-	b_1 ... b_4: LPS	10ms
read LAS	$6C_{hex}$	-	b_1 ... b_4: LAS	10ms
read LDS	$6D_{hex}$	-	b_1 ... b_4: LDS	10ms
read execution control flags	72_{hex}	-	b_1: execution control flags	10ms
set operating mode	73_{hex}	b_1 = 0: protected operating mode b_1 = 1: configuration mode	b_1: status	100ms
write host interface flags	74_{hex}	b_1: host interface flag	b_1: status	30ms
change slave address	$6E_{hex}$	b_1: old slave address b_2: new slave address	b_1: status b_1=1: no error b_1=2: slave whose address should be changed not detected b_1=3: slave with address 0 detected b_1=4: address to which the slave should be programmed is already occupied. b_1=5: slave could not be programmed to address 0 b_1=6: slave could not be set for new operating address b_1=7: new operatind address could not be stored in slave's EEPROM	30ms
execute AS-i command	$6F_{hex}$	b_1: slave address b_2: information part of the master request	b_1: response from slave b_2: status	30ms

Additional Commands beyond the AS-i Master Specification 2.04				
message	k	b_i (host message)	b_i (master message)	t_{max}
exchange all input and output data[a]	**76_{hex}**	**b_1...b_{16}: output data**	**b_1: execution control flags** **b_2...b_{17}: input data**	**10ms**
write selected output data[b]	77_{hex}	b_1: first slave addresse b_2: amount of slaves b_3...b_{18}: output data	b_1: status	10ms
read selected input data[b]	78_{hex}	b_1: first slave address b_2: amount of slaves	b_1: execution control flags b_2...b_{17}: input data	10ms
read output data	81_{hex}	-	b_1...b_{16}: output data	10ms

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Additional Commands beyond the AS-i Master Specification 2.04

message	k	b_i (host message)	b_i (master message)	t_{max}
write parameter field	$8C_{hex}$	b_1: slave address b_2: actual parameters	b_1: status	10ms
read configured data of all AS-i circuits	$8D_{hex}$	b_1: number of the AS-i circuit b_2: slave address	b_1: status b_2: configured parameter b_3: configured data	10ms
configure all AS-i circuits	$8E_{hex}$ $8D_{hex}$	Request 1(start): $b_1...b_2$: FF_{hex} $b_3...b_4$: 00_{hex} Request 2 (data): b_1: number of the AS-i circuit b_2: slave address b_3: parameter of the slave b_4: configured data of the slave Request 3 (commit): $b_1...b_2$: FF_{hex} $b_3...b_4$: 01_{hex} -	 b_1: status	300ms -
read master version	$7D_{hex}$	b_1: ≡ 0: versions number (8 Bytes) b_1: ≡ 1: master name part 1 (17 Bytes) b1: ≡ 2: master name part 2 (17 Bytes) b_1: ≡ 3: master version (17 Bytes) b_1: ≡ 4: installied software and host interface flags (17 Bytes)	b_1: version information (8 or 17 bytes)	10ms
activate/deactivate watchdog[c] for serial communication	$7B_{hex}$	b_1= 0: deaktiviert watchdog b_1= 1: watchdog timeout * 10ms	b_1: status	10ms
read watchdog status for serial communication	$7A_{hex}$	-	b_1= 0: watchdog not aktive b_1= 1: max. watchdog time * 10ms	10ms
lock/unlock front panel operation	$7C_{hex}$	b_1= 0: front panel operation enabled b_1= 1: front panel operation disabled	b_1: status	10ms
error message	75_{hex}	only sent by the AS-i master!	b_1: error code Bit 0: checksum error Bit 1: time-out Bit 2: unknown command Bit 3: illogical message length Bit 4: illogical number of user data bytes Bit 5: watchdog timer expired Bit 6: command execution error	-

a. Recommended command because of least overhead: the AS-i master only has to wait once for the response of the slaves.

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b. The comands “write selected output data” and “read selected input data” will only be executed, if the AS-i master is in normal operation mode.

c. If the watchdog has been activated, AS-i will go into the offline phase. By sending this message again AS-i leaves the off-line phase.

Commands according to the AS-i Master Specification (2.1)

message	k	b_i (host message)	b_i (master message)	t_{max}
read input data	10_{hex}	-	b_1: status b_2, b_3: execution control flags b_4...b_{35}: input data	
write output data	11_{hex}	b_1...b_{32}: output data	b_1: status	
write configured parameter	12_{hex}	b_1: slave address b_2: parameter	b_1: status	
read configured parameter	13_{hex}	b_1: slave address	b_1: status b_2: parameter	
write actual parameter	14_{hex}	b_1: slave address b_2: parameter	b_1: status b_2: counter-read parameter (inverted in case of error)	
read actual parameter	15_{hex}	b_1: slave address	b_1: status b_2: parameter	
store actual parameters	16_{hex}	-	b_1: status	
write configuration data	17_{hex}	b_1: slave address b_2, b_3: configuration data	b_1: status	
read configuration data	18_{hex}	b_1: slave address	b_1: status b_2, b_3: configuration data	
store actual configuration	19_{hex}	-	b_1: status	
read actual configuration	$1A_{hex}$	b_1: slave address	b_1: status b_2, b_3: configuration data	
write LPS	$1B_{hex}$	b_1 ... b_8: LPS	b_1: status	
read LPS	$1C_{hex}$	-	b_1: status b_2 ... b_9: LPS	
read LAS	$1D_{hex}$	-	b_1: status b_2 ... b_9: LAS	
read LDS	$1E_{hex}$	-	b_1: status b_2 ... b_9: LDS	
read AS-i flags	$1F_{hex}$	-	b_1: status b_2, b_3: execution control flags b_4: host interface flags	
set operating mode	29_{hex}	b_1 = 0: protected mode b_1 = 1: configuration mode	b_1: status	
set offline	$2A_{hex}$	b_1 = 0: leave offline-phase b_1 = 1: switch to offline-phase	b_1: status	
activate data exchange	$2B_{hex}$	b_1 = 0: deactivate data exchange b_1 = 1: activate data exchange	b_1: status	

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Commands according to the AS-i Master Specification (2.1)				
message	k	b_i (host message)	b_i (master message)	t_{max}
change slave address	$2C_{hex}$	b_1: old slave address b_2: new slave address	b_1: status b_1=1: no error b_1=2: slave whose address should be changed not detected b_1=3: slave with address 0 detected b_1=4: address to which the slave should be programmed is already occupied. b_1=5: slave could not be programmed to address 0 b_1=6: slave could not be set for new operating address b_1=7: new operatind address could not be stored in slave's EEPROM b_1=0: other error	
automatic address assigning	$2D_{hex}$	b_1 = 0: disable automatic address assigning b_1 = 1: enable automatic address assigning	b_1: status	
execute AS-i command	$2F_{hex}$	b_1: slave address b_2: information part of the master request	b_1: response from slave b_2: status	
read LPF	36_{hex}	-	b_1: status b_2 ... b_9: LPF	
write extended ID code 1 of slave 0	37_{hex}	b_1: extended ID code 1	b_1: status b_1 = 1: no error b_1 = 2: slave with address 0 not detected b_1 = 6: error with setting extended ID code 1 b_1 = 8: extended ID code 1 stored only temporarily b_1 = 0: other error	

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Additional Commands beyond the AS-i Master Specification
(for Masters according to Specification 2.1)

message	k	b_i (host message)	b_i (master message)	t_{max}
exchange all input and output data[a]	**01_{hex}**	**b_1: host interface flags** 2^0: Data_Exchange_Active 2^1: Off-Line 2^2: Auto_Address_Enable **$b_2...b_{33}$: output data**	**b_1, b_2: execution control flags** b_1, 2^0: Config_OK b_1, 2^1: LDS.0 b_1, 2^2: Auto_Address_Assign b_1, 2^3: Auto_Address_Available b_1, 2^4: Configuration_Active b_1, 2^5: Normal_Operation_Active b_1, 2^6: AS-i Power Fail b_1, 2^7: Offline_Ready b_2, 2^0: Periphery_OK **$b_3...b_{34}$:input data**	
output data lesen	02_{hex}	-	$b_1...b_{32}$: output data	
write AS-i flags	03_{hex}	b_1: host interface flags 2^0: Data_Exchange_Active 2^1: Off-Line 2^2: Auto_Address_Enable	-	
error telegram	75_{hex}	only sent by the AS-i Master!	b_1: error code Bit 0: checksum error Bit 1: time-out Bit 2: unknown command Bit 3: illogical message length Bit 4: illogical number of user data bytes Bit 5: watchdog timer expired Bit 6: command execution error	

a. Recommended command because of least overhead: the AS-i master only has to wait once for the response of the slaves.

Additional Commands for 16 Bit Transmissions
(e.g. Analog Input or Output Slaves) (for Masters according to Specification 2.1)

message	k	b_i (host message)	b_i (master message)	t_{max}
read 16 bit data	40_{hex}	b_1: slave address	$b_1...b_7$: 4 channels with 16 bit data each	
write 16 bit data	41_{hex}	b_1: slave address $b_2...b_8$: 4 channels with 16 bit data each	-	
enable/disable 16 bit transmission	42_{hex}	b_1: bitfield Bit 0 = 0: start Bit 0 = 1: stop Bit 1 = 1: reset	-	

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Additional Commands for RS 232C Masters				
message	k	b_i (host message)	b_i (master message)	t_{max}
activate master	$7E_{hex}$	b_1, b_2: address of the master to be activated	b_1: status	20ms

Additional Commands for AS-i Control				
message	k	b_i (host message)	b_i (master message)	t_{max}
write 16 controller program bytes (download)	$7F_{hex}$	b_1, b_2: start address b_2...b_{18}: 16 bytes of the controller program	b_1: status	200ms
read 16 controller program bytes (upload)	83_{hex}	b_1, b_2: start adress	b_1...b_{16}: 16 bytes of the controller program	10ms
read AS-i control status	83_{hex}	b_1, b_2: $FFFF_{hex}$	b_1: AS-i control flags b_2: 00_{hex} b_3, b_4: current cycle time b_5, b_6: maximum cycle time	10ms
start/stop controller program	80_{hex}	b_1: start/stop code	b_1: status	20ms
reset controller program	80_{hex}			3000ms
read user memory (flags)	84_{hex}	b_1: start address b_2: amount of bytes to be transmitted (max. 16)	b_1...: user memory	10ms
write user memory (flags)	85_{hex}	b_1: start address b_2: amount of bytes to be transmitted (max. 16) b_3...: user memory	b_1: status	10ms

Commands for Advanced AS-i Diagnostics				
message	k	b_i (host message)	b_i (master message)	t_{max}
advanced diagnostics	88_{hex}	b_1: selection	n=0: b_1-b_{15}: slave 1 - 31 n=1: b_1-b_{15}: slave 0 - 15 n=2: b_1-b_{15}: slave 16 -31	10ms
write LOS	89_{hex}	b_1 ... b_4: slaves 0 - 31	b_1: error status	10ms
read LOS	$8A_{hex}$	-	b_1 ... b_4: slaves 0 - 31	10ms

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Commands for Advanced AS-i Diagnostics (for Master according to Specification 2.1)				
message	k	b_i (host message)	b_i (master message)	t_{max}
read LCS	50_{hex}	-	b_1 ... b_8: LCS	
read error counters	51_{hex}	b_1: choice (a)	choice a=0: b_1 ... b_{32}: slaves 0 - 31 or 0A - 31A choice a=1: b_1 ... b_{32}: slaves 0B -31B	
read LOS	52_{hex}	-	b_1 ... b_8: LOS	
write LOS	53_{hex}	b_1 ... b_8: LOS	-	

Commands for Backward Compatibility with Older Master Versions				
message	k	b_i (host message)	b_i (master message)	t_{max}
enable/disable automatic programming	79_{hex}	$b_1 \equiv 0$: disable $b_2 \equiv 1$: enable	b_1: status	30ms

11.1.4 Representation of information in the user data bytes

Input and output data

For each slave, a four-digit binary number can be entered as input and output data. Input and output data can therefore range from 0 to 15 (or hexadecimal 0 to F).

For serial transmission, the data for two slaves are combined in a single byte. With message “q” (read input data, 71_{hex}), the master therefore sends 32/2 = 16 bytes of user data.

byte 0	byte1	...	byte 15
slave 0, slave 1	slave2, slave 3	...	slave 30, slave 31

The entries for low slave addresses are transmitted first. Byte 0, bits 0 through 3 (lower nibble) thus contains the input data of the slave with operating address zero; the upper nibble of the user data byte 15 contains the data of slave 31.

byte								
bit	0	1	2	3	4	5	6	7
slave	slave 0				slave 1			

For the AS-i master according to specification 2.1 the following information applies additionally:

- The bytes 0 to 15 contain data for the slaves 0 to 31 or 0A to 31A.
- The bytes 16 to 31 contain data for the slaves 0B to 31B.

byte 16	byte17	...	byte 15
slave 0B, slave 1B	slave2B, slave 3B	...	slave 30B, slave 31B

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Slave lists

The AS-i slave lists LPS, LDS, LAS, LCS and LOS are built up as follows:

byte	0								1							
bit	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
slave	0[a]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

a. LDS and LCS only

byte	2								3							
bit	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
slave	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Meaning of the lists:

LPS List of Projected Slaves

LDS List of Detected Slaves

LAS List of Activated Slaves

LCS List of Corrupted Slaves
List of those slaves, that have caused a short-time configuration error.

LOS List of Off-line Slaves
List of those slaves, with that in case of configuration error the AS-i master shall switch to the Off-line phase.

For the AS-i master according to specification 2.1 the following information applies additionally:

- The bytes 0 bis 3 contain the entries for the slaves 0 to 31 or 0A to 31A.
- The bytes 4 bis 7 contain the entries for the slaves 0B bis 31B

byte	4								5							
bit	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
slave	0B[a]	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B	12B	13B	14B	15B

a. LDS and LCS only

byte	6								7							
bit	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
slave	16B	17B	18B	19B	20B	21B	22B	23B	24B	25B	26B	27B	28B	29B	30B	31B

Furthermore there is another list for the AS-i master according to specification 2.1:

LPF List of Peripheral Faults
List of those slaves, where a peripheral occured.

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AS-i configuration data

Each AS-i slave informs about its type with the AS-i configuration data. This data consists of one byte, the lower four bits representing the ID code, the upper four bits the I/O code.

byte	0							
bit	0	1	2	3	4	5	6	7
	ID code				I/O code			

For the AS-i master according to specification 2.1 there is an additional second byte for the AS-i configuratíon data:

In this byte the lower four bits represent the extended ID code 2, the upper four bits the extended ID code 1:

byte	1							
bit	0	1	2	3	4	5	6	7
	ext. ID code 2				ext. I/O code 1			

Execution control flags

The execution control flags are transmitted in the diagnosis telegram, if the gateway is operated in the professional mode.

When set (=1), the individual bits have the following meaning:

Bit 0:	*Config_OK*	no configuration error
Bit 1:	*LDS.0*	slave with address 0 present
Bit 2:	*Auto_Address_Assign*	automatic programming permitted
Bit 3:	*Auto_Address_Available*	automatic programming available
Bit 4:	*Configuration_Active*	configuration mode active
Bit 5:	*Normal_Operation_Active*	normal operation active
Bit 6:	*APF*	AS-i power failure
Bit 7:	*Offline_Ready*	off-line mode active

For the AS-i master according to specification 2.1 there is an additional second byte for the execution control flags:

Bit 0:	*Periphery_OK*	no peripheral error
Bit 1-7:		not used

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Host interface flags

The setting of the host interface flags has the following effects:

Bit 0:	*Data_Exchange_Active*	The data communication between AS-i master and slaves is active
Bit 1:	*Off-line*	The AS-i master is set into offline phase
Bit 2:	*Auto_Address_Enable*	The automatic programming is disabled (This flag is stored non-volatile)

Installed software/Host interface flags (message $7D_{hex}$)

If message $7D_{hex}$ ("read master version") is sent with a "4" in the host message's data byte, the AS-i master responds with a 17 bytes long character string (16 letters, zero terminated).

The letters have the following explanations:

Byte 0 (**C/c**, **D/d**, **Z/z**)
The responding AS-i master is an AS-i control.
The capital 'C' means that a controller program is currently being executed. A lower-case 'c' means that either the start flag has not been set or that the AS-i master's status does not permit the execution.
If D/d instead of C/c is displayed, it is the newer software version of AS-i Control II.

Byte 1 (**B/b**)
The responding master has a bus-capable RS 485 or RS 422 interface. The messages $7E_{hex}$ (activate master) and 82_{hex} (change master address) can be processed.

Byte 2 (**F/f**)
The responding AS-i master is featured with an AS-i error counter.

Byte 3 (**E/e**)
The responding AS-i master is featured with an EMC test mode.

Byte 4 (**D/d**)
The responding AS-i master is featured with advanced diagnostics.

Byte 5 (**C/c**)
The responding AS-i master is featured the function off-line by configuratiion error.

Byte 6 (**./2**)
The responding AS-i master manages one (´.´) or two (´2´) AS-i circuits.

Byte 7 not used

Byte 8 (**D/d**)
The "*data_exchange_active*" host interface flag is set/erased.

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Byte 9 (**O/o**)
The "*off-line*" host interface flag is set/erased.

Byte 10 (**A/a**)
The "*auto_address_enable*" host interface flag is set/erased.

Byte 11 not used

Byte 12 (**./A**)
The AS-i master is according to the new AS-i master specification 2.1 (AAS-i).

Byte 13 not used

Byte 14 (**W/w**)
The serial watchdog was activated/deactivated.

Byte 15 (**T/t**)
The operation of the AS-i master via the front panel buttons is enabled/disabled.

AS-i control flags, start/stop code

Bit 0:	*start_flag*	if bit 0 is set, the controller program is executed as soon as the AS-i master's status permits (this flag is stored non-volatile).
Bit 1:	*reset_bit*	the controller program is read from the EEPROM prior to the start. In addition, the user memory (flag bytes) is erased (necessary after each download), not returned as AS-i control flag).
Bit 2:	*ignore_config_errors*	if bit 2 is erased, the controller program is stopped as soon as an AS-i configuration error occurs (this flag is stored non-volatile).
Bit 3:	*auto_start*	if bit 3 is set, AS-i control waits for a push on the "set" button before it restarts the controller programm (this flag is stored non-volatile).
Bit 4:	*counter_map*	if bit 4 is set, the counter registers of the 15 counters can be accessed by M 96.0 to M 125.7 (this flag is stored non-volatile).

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12 Commissioning Tools and Accessories

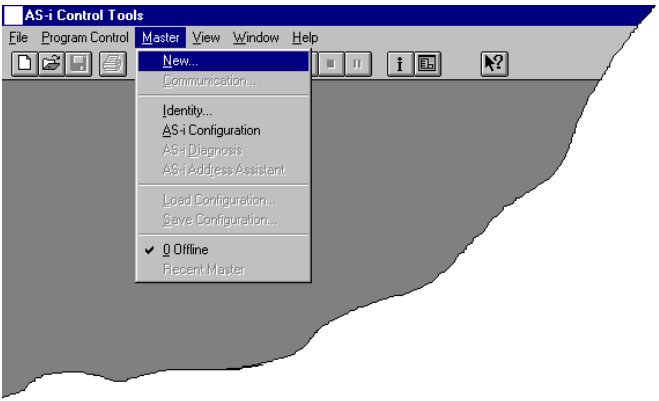
The Windows based software "AS-i Control Tools" is designed to make the commissioning of the AS-icircuit on the AS-i master so easy as possible.

The software package communicates with the AS-i master via a serial cable.

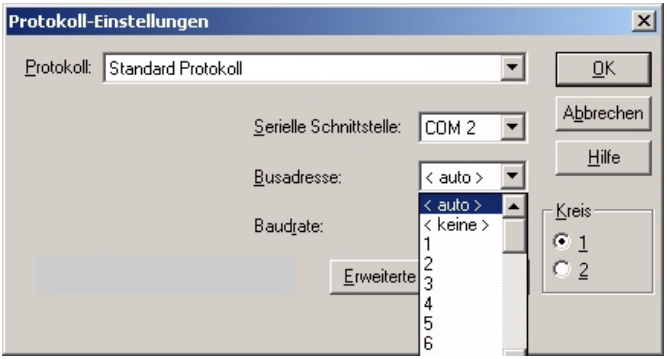
12.1 Windows software AS-i Control Tools

The Windows software "AS-i Control Tools" enables you to configure the AS-i circuit in a very comfortable way.

1. connect the device with a fully covered cable to a serialinterface of your PC.
2. Start the AS-i-Control-Tools.
3. Call the command Master | New.



4. Choose **Standard** as protocol.



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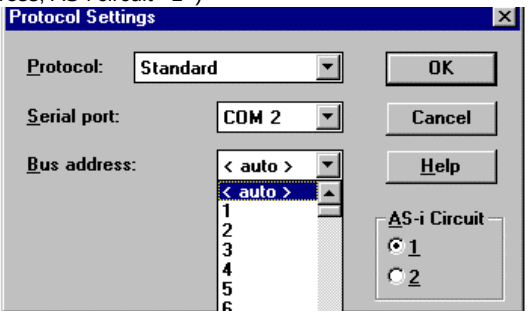
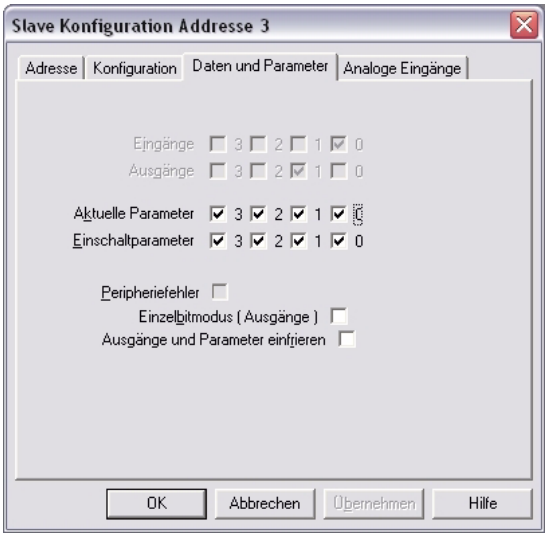
5. Do the appropriate settings. (e.g. interface, COM 1, station addressbus-address, AS-i circuit <1>)



6. Call the command Master | AS-i configuration.
   The AS-i configuration editor will be started. All detected and projected AS-i slaves are displayed in this window.
7. Click on a slave entry to open the dialog box slave configuration.



Changing a slave address, setting AS-i parameters or AS-i configuration data is possible here. Additionally, inputs and outputs can be tested.

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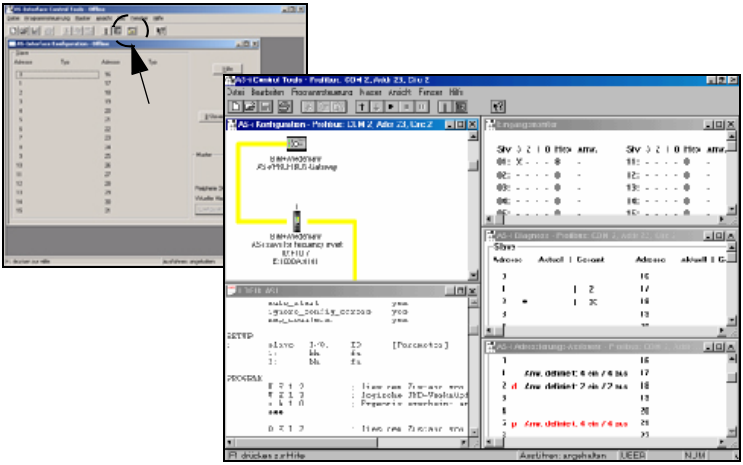
8. Click in the main menu on the second button from the right side to acquire a graphic presentation of the "AS-i Control Tools".



A very easy approach to configure the AS-i circuit is connecting each AS-i slave to the line and setting the AS-i slave address one after the other. After that press the button “Store configuration” to adopt the detected AS-i circuit to the AS-i master as projected data.

Furthermore you can use the **AS-i Address Assistant**. This tool automatically changes the address of an AS-i slave to the desired address after connecting the slave to the AS-i line. The desired AS-i configuration can be created offline before and then be stored to a file. When building up the plant you only have to connect the AS-i slaves to the AS-i line one after the other.

Further descriptions to all features of the software can be obtained from the integrated help.

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13 Appendix: Codes indicated by the Display

In the basic state of the configuration mode, the display shows the addresses of all detected slaves at a rate of two per second one after the other. A blank display indicates that the *LDS* is empty, no slaves were detected.

In the basic state of the protected operating mode, the display is either blank or displays the address of a faulty assignment (see chapter 6.1.1).

During manual address programming, the slave address display has a different meaning (see chapter 6.2.7).

All displayed numbers bigger than 31 which can not be interpreted as a slave address are status or error messages of the master. They have the following meanings:

39	Advanced AS-i diagnostics: After pressing the 'set'-button a short-time AS-i power failure occured.
40	The AS-i master is in offline phase.
41	The AS-i master is in detection phase.
42	The AS-i master is in activation phase.
43	The AS-i master starts the normal operating mode.
70	Hardware error: The AS-i master's EEPROM cannot be written.
71	Wrong PIC-type.
72	Hardware error: wrong PIC-processor.
73	Hardware error: wrong PIC-processor.
74	Checksum error in the EEPROM.
75	Error in the internal RAM.
76	Error in the external RAM.
77	AS-i control software error: Stack overflow (AS-i control II)
78	AS-i control software error: Checksum error in the control program.
80	Error while attempting to exit the configuration mode: A slave with address zero exists.
81	General error while changing a slave address.

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82	The front panel operation is blocked. Until repowering-up the device can only be accessed from the host via the interface.
83	Program reset of the AS-i Control programm: The AS-i Control programm is being read out of EEPROM and copied into the RAM.
88	Display test while starting up the AS-i master
90	Error while changing a slave address in protected operating mode: No slave with address 0 existing.
91	Error while changing slave address: Target address is already used.
92	Error while changing slave address: New address could not be set.
93	Error while changing slave address: New address could only be stored volatilely in the slave.
94	Error while changing the slave address in protected operating mode: Slave has wrong configuration data.
95	The error 95 is caused by a superfluous slave and not by a missing slave. That is why the slave address is ocupated by this superfluous slave. (In the protected mode the slave addresses which caused any configuration error can be displayed by pressing the SET button. AS-i master without graphical display are not able to differentiate between a missing slave, an incorrect slave or a redundant slave. All incorrect addresses are displayed. By pressing the SET button 5 sec. the displayed address starts to flash. Pressing the SET button again the master attempts to program the slave at the address 0 to the incorrect address.)

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14 Appendix: Installation Instruction

14.1 Listing of all described gateways

Note	Please see **chapter 3, "General Information," on page 8** for a list of all devices described in this installation instruction.

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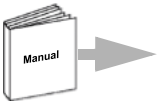
14.2	**VBM-CTR-K20-R2** **# 195379**

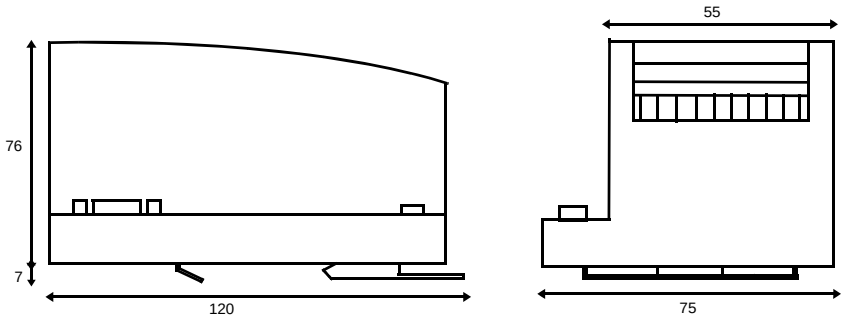
AS-i 3.0 RS 232-Master in Edelstahl
AS-i 3.0 RS 232 Master in Stainless Steel
Passerelle RS 232 AS-i 3.0 en boîtier inox
Master RS 232 AS-i 3.0 d'acciaio inox /
Pasarela RS 232 AS-i 3.0 en acero inoxidable



Dokumentation AS-i 3.0 RS 232-Master (deutsch)
Documentation AS-i 3.0 RS 232 Master (english)

Attention	Die Geräte dürfen nur von Fachpersonal aufgebaut, angeschlossen und in Betrieb genommen werden! / Only qualified staff is allowed to mount, connect and set up the modules! / Les modules ne doivent être montés, raccordés et mis en service que par du personnel qualifié! / Gli apparecchi possono essere montati, collegati e messi in funzione soltanto da personale specializzato! / Los aparatos sólo pueden ser montados, conectados y puestos en servicio por personal técnico especializado!

14.2.1 Dimensions



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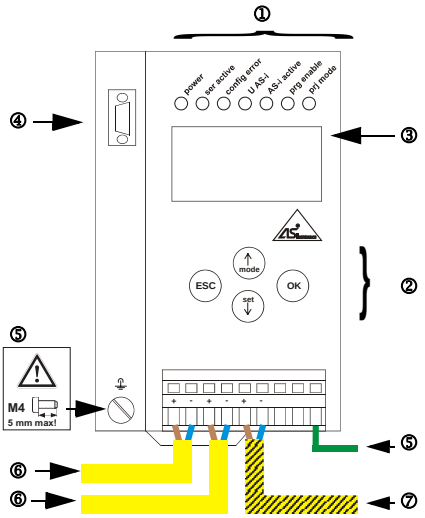
14.2.2 Front view and connections



Hinweis/Hint/Remarque/Indicazione/Nota

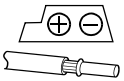
Am Kabel für das Netzteil dürfen keine Slaves oder Repeater angeschlossen werden.
Am Kabel für den AS-i-Anschluss dürfen keine AS-i-Netzteile oder weitere Master angeschlossen werden.

At the cable for power supply no slaves or repeaters may be attached.
At the cable for AS-i circuit no power supplies or further masters may be attached.

Au câble pour l'alimentation aucun esclave ou répéteur peut ne pas être attaché.
Au câble pour le circuit AS-i aucune alimentation ou autre maître ne peut être attachée

Al cavo per il alimentazione nessun schiavi o ripetitore possono essere fissati.
Al cavo per il AS-i circuito nessun alimentazione o ulteriore padrone possono essere fissati.

En el cable para l´alimentación ningunos esclavos o repetidores pueden ser unidos.
En el cable para la alimentación AS-i no se debe conectar ningún esclavo o repetidor.



Temperature rating for cable: 60/75°C
Use copper conductors only

1 x 0.5 - 1.5 mm² (16AWG/kcmil: min. 24/max.12)

Operating temperature: 0°C … +55°C

① LED-Statusanzeige
② Tasten für Handbedienung
③ LCD-Anzeige
④ Serieller Anschluss
⑤ Erde
⑥ AS-i-Kreis 1
⑦ AS-i-Netzteil

① LED status display
② Buttons for hand operation
③ LCD display
④ Serial connection
⑤ Ground
⑥ AS-i circuit 1
⑦ Power supply

① Affichage d'état DEL
② Boutons pour commande manuelle
③ Affichage LCD
④ Raccordement périodique
⑤ Terre
⑥ Bus AS-i 1
⑦ Alimentation AS-i

① Visualizzazione di stato LED
② Pulsanti per le impostazioni manuali
③ Visualizzazione LCD
④ Collegamento di serie
⑤ Terra
⑥ Circuito AS-i 1
⑦ Alimentazione AS-i

① LED visualización
② Teclas para accionamiento manual
③ Display LCD
④ Conexión serial
⑤ Tierra
⑥ Circuito 1 AS-i
⑦ Alimentación AS-i

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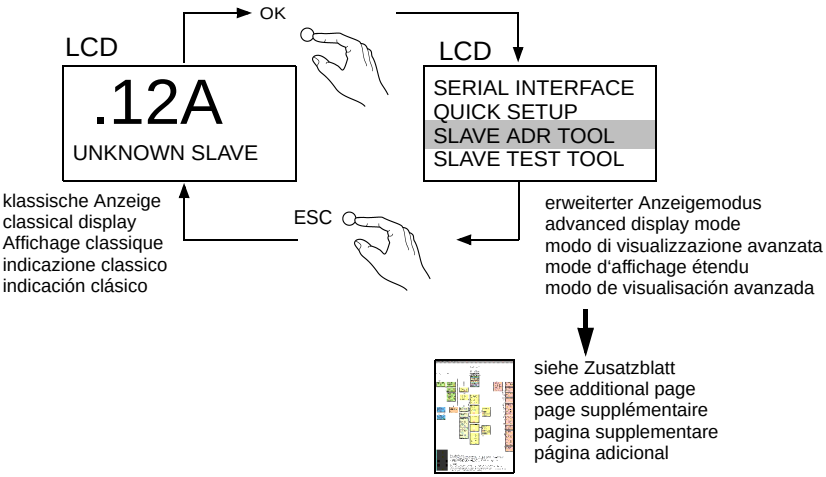
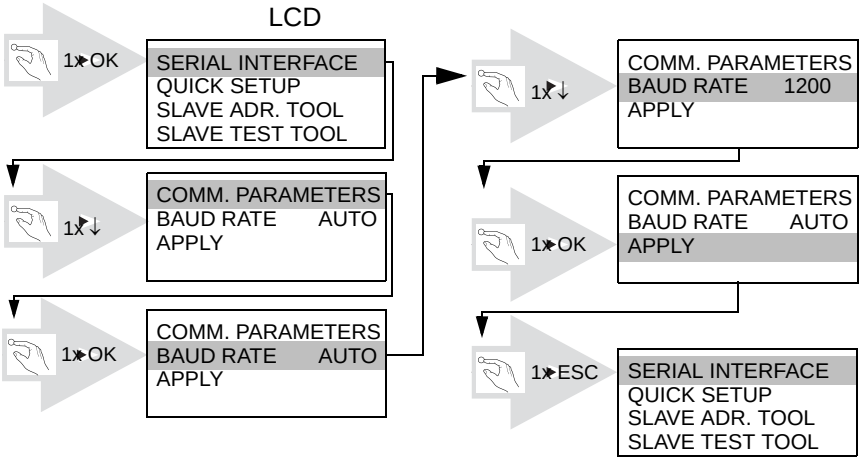
14.2.3 Startup

14.2.3.1 Switching to extended display mode



14.2.4 Setting the baud rate



Das Gerät ist werkseitig auf AUTO (automatische Erkennung) eingestellt.
The device is set to AUTO (automatic recognition) at the factory.
L'appareil est réglé en usine AUTO (identification automatique).
L'apparecchio viene impostato AUTO dalla fabbrica (riconoscimento automatico).
El aparato viene ajustado de la fábrica en AUTO (automático reconocimiento).

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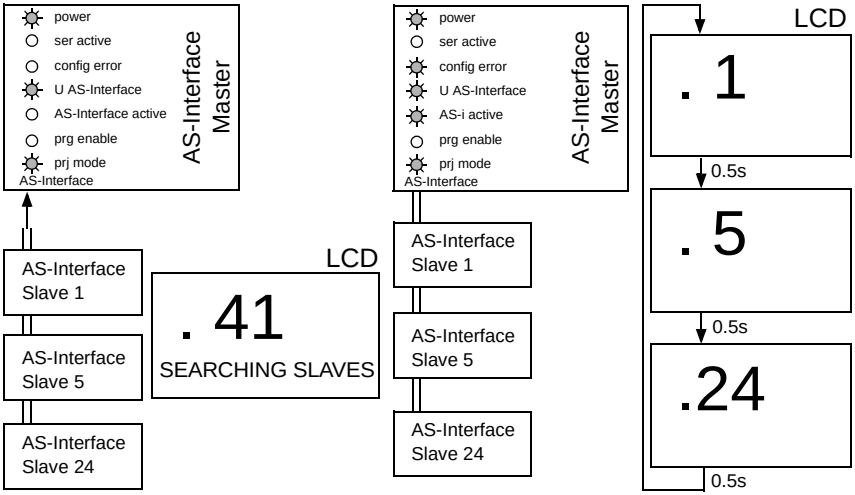
14.2.5 Connecting AS-i Slaves



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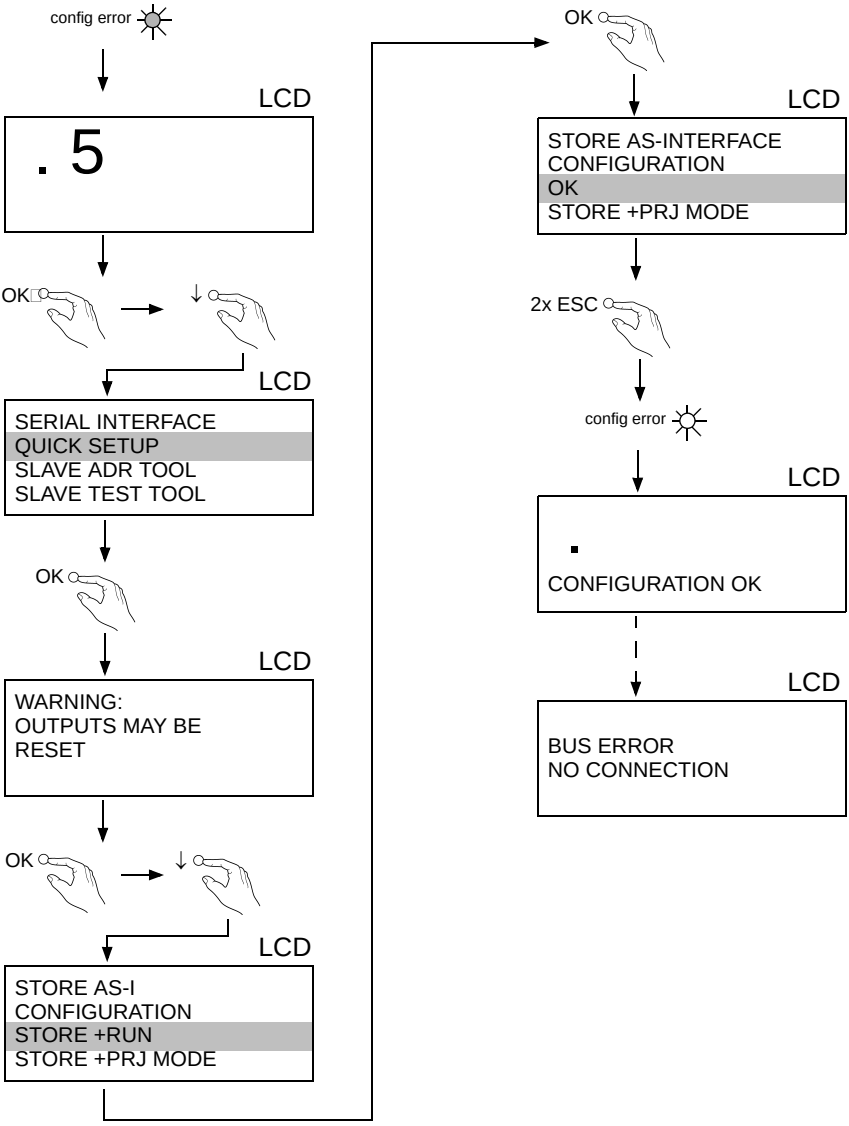
14.2.6 Quick setup



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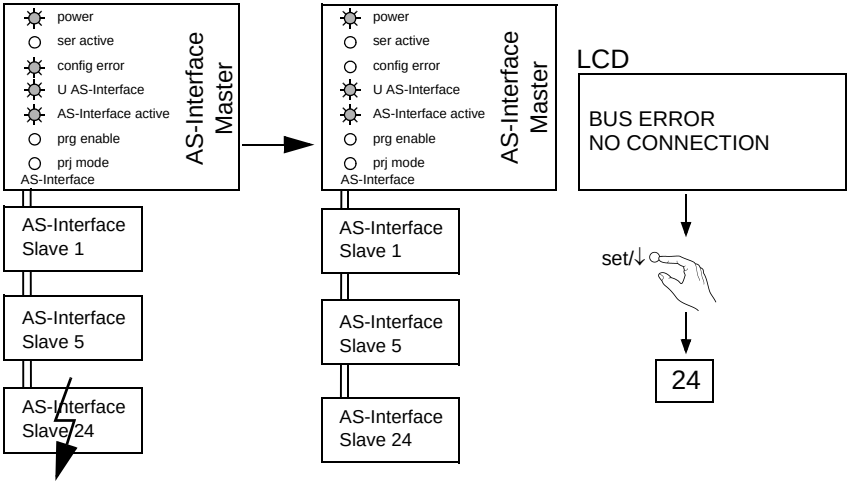
14.2.7 Error tracing

14.2.7.1 Incorrect slaves

14.2.7.2 Error display (last error)



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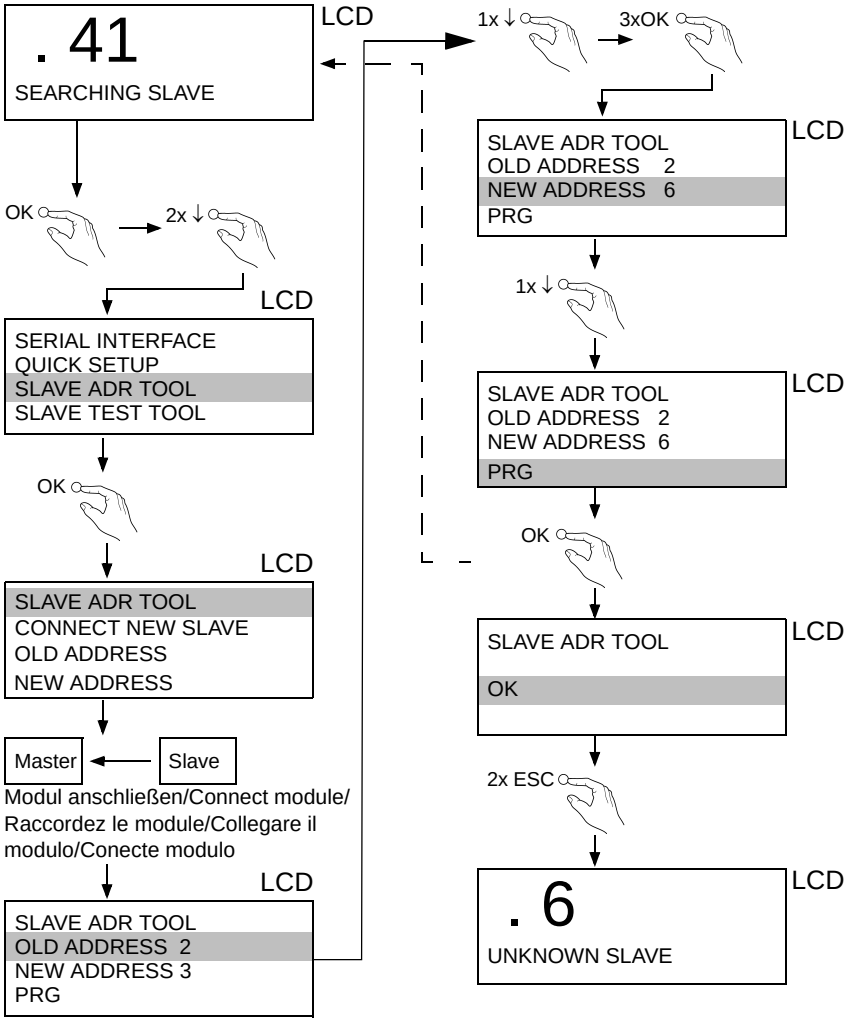
14.2.8 Addressing

14.2.8.1 Program slave 2 to address 6



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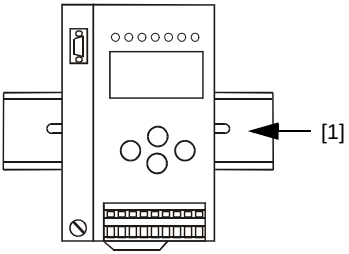
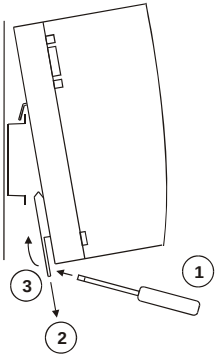
14.2.9 Montage

auf Montageplatte mit 35-mm-Hutschiene ①
on mounting plate with 35 mm top-hat rail ①
sur plaque de montage avec profilé-support 35 mm ①
su piastra di montaggio con guida DIN 35 mm ①
sobre placa de montaje con guía simétrica de 35 mm ①





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15 Glossary: AS-i Terms

A/B slave

AS-i slave with extensible addressing: The address range of an A/B slave runs from 1A to 31A and from 1B to 31B. As the master needs the fourth output data bit for switching between A and B address, A/B slaves only have three output data bits maximum.

Activation phase

In the activation phase the detected slaves are activated by sending the parameter. This is indicated by a "42" on the Master's Display. This phase takes only 10 ms, tops, to short to be displayed.

AS-i power fail

Voltage drop on the AS-i line; by falling below an assigned value the master changes to the ⇒ *Off-line phase*.

Inclusion phase

After the data exchange with all AS-i slaves the master is searching for new slaves. For this purpose an detection telegram is sent to one AS-i address and in case of an answer the master tries to read the ⇒ *actual configuration* of the slave. Depending on the mode (⇒ *protected mode* or ⇒ *configuration mode*) and on the actual configuration the detected slave will be activated.

After each data exchange with all AS-i slaves only one detection telegram is sent to one slave address. So the AS-i cycle is always one telegram longer as expected from the number of activated slaves (⇒ LAS).

Autoprog flags

Auto Address Enable; flag from the Host to the AS-i Master

With this flag, automatic addressing can be enabled or inhibited.
This flag is stored non-volatile in the Master.

Auto Address Assign, Auto Adress Possible; flag from the AS-i Master to the Host

The automatic programming is not inhibited and there is no configuration error.
A failing slave could be addressed automatically.

Auto Address Available, flag from the AS-i Master to the Host

Exactly one AS-i slave is missing and the automatic programming is not inhibited.
If a slave with the address 0 and the profile of the missing slave is connected, it receives the address of the missing slave automatically.

IO-Code

The first digit of the slave profile indicates the number of inputs and outputs of the slave. A 4I/4O slave e.g. is associated to "7", a slave with 4 digital Inputs to "0".

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Detection phase

In the detection phase at start-up the master is scanning for AS-i slaves. It remains in this phase until at least one slave is detected. If the master remains in the detection phase this means that no slave was found. The reason for this may be a wrong power supply or a wiring error.

The detection phase is displayed by code "41".

Protected mode

In protected mode only those slaves are activated which are registered in the ⇒ *LPS* and whose actual configuration matches with the target configuration.

See ⇒ *configuration mode*. This mode is intended for the normal operation, since all AS-i protective measures are activated.

ID code

The ID code is unchangeably set by the manufacturer of the AS-i slave. The AS-i Association defines the ID codes assigned to a certain category of slaves. All ⇒ *A/B slaves* e.g. possess the ID code "A".

ID1 code, extended ID1 code

The ID1 code is specified by the manufacturer of the slave. In contrast to the other codes defining the profile this code can be modified by the master or by an addressing unit. The user should make use of this possibility only in exeptional cases, otherwise ⇒ *configuration errors* may occur.

To make the distinction between the A and the B addresses in the case of A/B slaves, the bit with the highest value of the ID1 code is used. That is why only the three lowest bits are relevant for these slaves. Since this code has been introduced with the new AS-i specification 2.1, it is also called extended ID1 code.

ID2 code, extended ID2 code

The ID2 code is unchangeably set by the manufacturer of the slave. The AS-i Association defines the ID2 codes assigned to a certain category of slaves. All two-channel 16-bit input slaves with the profile S-7.3 possess the ID2 code "D". Since this code has been introduced with the new AS-i specification 2.1, it is also called extended ID2 code.

Actual configuration

The configuration data of all slaves detected by the master. The configuration data of one slave, the ⇒ *slave profile*, consists of:

⇒ *IO code*, ⇒ *ID code*, ⇒ *extended ID1code 1*, ⇒ *extended ID2 code*.

Actual parameter

The AS-i parameter that have been sent last to the AS-i slave, in contrary to ⇒ permanent parameters.

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Configuration Error/Config Error

An configuration error is indicated, when target and actual configuration of the connected slaves do not match. The following cases may result in configuration errors:

Missing slave:A slave entered in the ⇒ *LPS* is not available

Erroneous type of slave:The ⇒ *slave profile* of the connected slave does not comply with the configured one.

Unknown slave:A connected slave is not entered in the ⇒ *LPS*.

LAS - List of Activated Slaves

The master exchanges IO data with the slaves entered in the LAS. In the proteced mode only those detected slaves (⇒ *LDS*) are activated which are expected by the master and are entered in the ⇒ *LPS*. In the configuration mode all slaves entered in the ⇒ *LDS* are activated.

LDS - List of Detected Slaves

All slaves from which the master was able to read the ⇒ *slave profile* are entered in the LDS.

LPF - List of Peripheral Faults

There is a list of peripheral faults only for masters fulfilling the new specification 2.1. This list includes an entry for each slave that signals a ⇒ *peripheral fault*.

LPS - List of Projected Slaves

The list of projected slaves includes all slaves expected by the master. All entries of the ⇒ *LDS* are taken over to the LPS by storing the actual configuration (except for a not addressed slave with the address 0).

Offline phase

In the offline phase all input and output data is reset. This phase is entered at start-up of the master, after a ⇒ *AS-i power fail*, and at the transition of the ⇒ *configuration mode* to the ⇒ *protected mode*.

Furthermore the master can actively be put into the offline phase with the offline flag.

During the offline phase, masters with a display show code "40".

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Peripheral fault

A peripheral fault is shown on the master and on the slave by a red flashing LED.

Depending on the slave type it is possible to visualize an overflow, an overload of the sensor's power supply or another fault regarding the peripheral equipment of the slave.

Permanent configuration

The configuration data of all expected slaves stored in the master (⇒ *slave profile*). If the permanent configuration differs from the ⇒ *actual configuration*, there is a configuration error.

Permanent parameter

The parameter stored in the master that are sent to the slave after start-up of the master in the ⇒ *activation phase*.

Configuration mode

During the configuration mode the master exchanges data with all connected slaves, no matter which of the slaves are projected. In this mode it is possible to commission a system without being obliged to configure it before.

See also ⇒ *protected mode*.

Single slave

Compared to an ⇒ *A/B slave* a single slave can only be addressed from the address 1 to 31; the fourth data output bit can be used. All slaves of the older specification 2.0 are single slaves.

There are also slaves fulfilling the new specification 2.1 that are single slaves, e.g. the newer 16-bit slaves.

Slave profile

The configuration data of a slave consisting of:

⇒ *IO code*, ⇒ *ID code*, ⇒ *extended ID1 code*, ⇒ *extended ID2 code*.

The slave profile is to differentiate between the different slave categories. It is specified by the AS-i Association and preset by the slave manufacturer.

AS-i 2.0 slaves do not have extended ID1 and ID2 codes. In this case an AS-i master 2.1 enters "F" the extended ID1 and the extended ID2 code.

Issue date - 25.4.2007

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04/2007