SICK

AS-i 2.1

AS-i Master RS 232C

ASI-M11320

User Manual

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SICK

EC Declaration of Conformity

In Compliance with the EC Directive on Electromagnetic Compatibility 89/336/EWG

We hereby declare that the devices (see page 2)

of the product family ASI-M.....

comply with the basic requirements of the EC Directive specified under Point 1. If an item of equipment listed overleaf is modified without our approval then this declaration loses its validity for this equipment.

We employ a quality system certified by the DQS (German Quality Assurance Society), No. 462, as per ISO 9001 and have therefore observed the regulations in accordance with module H as well as the following EC directives and EN standards during development and production:

1. ***EC directives***	EC EMC Directive 89/336/EEC as per 92/31/EEC, 93/68/EEC, 93/465/EEC		
2. ***Harmonized standards used***	EN 50081-2	Emitted interference, industry	Ed. 93-08
	EN 50295	Low-voltage switchgear and controlgear - Controller and device interface systems - Actuator Sensor interface (AS-i)	Ed. 99-03
	EN 61000-6-2	Electromagnetic compatibility Part 6-2: Immunity, industry	Ed. 99-04

Conformance of a type sample belonging to the above-mentioned product family with the regulations from the listed EC directives has been certified by:

Waldkirch/Br., den 30/08/01

ppa. Reglowicki
(Manager Marketing & Sales
Division Industrial Sensors)

i.V. Hertweck
(Manager Production
Division Industrial Sensors)

The declaration certifies conformance with the listed directives, but does not guarantee product characteristics. The safety instructions contained in the product documentation must be observed.

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1 The Used Symbols

Warning

This symbol warns the user of possible danger. Failure to heed this warning can lead to personal injury or death and/or damage to equipment.

Attention

This symbol warns the user of a possible failure. Failure to heed this warning can lead to total failure of the equipment or any other connected equipment.

Note

This symbol gives the user important hints.

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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.
The connecting of the equipment and any maintenance work to be carried out with voltage applied to the equipment must only be performed by appropriately qualified electrotechnical personnel.
In the case that a failure cannot be repaired, the device must be taken out of operation and kept from inadvertently 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 void the warranty.

Note

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

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3 General Information

This operating instruction is for use with the following devices of the SICK AG:

- ASI-M11320, Best.-Nr. 6 022 373

The AS-i master with serial interface and with mini-PLC serve to control an AS-Interface 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 B+W protocol with a high transfer rate. With a rate of 57600 Baud short cycle times for the data exchange via the serial interface can be realized. There are AS-i masters without mini-PLC on offer as well.

New Specification 2.1

The AS-i master already fulfils the new AS-i Specification 2.1. This means:

- Up to 62 AS-Interface slaves can be connected to each AS-i network.
- The transfer of analog signals via AS-i is integrated in the masters.
- All further functions of the new specification as e.g. the diagnosis of the AS-i peripheral fault are implemented.

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

The AS-i master with serial interface can be commissioned respectively programmed with the help of the software "AS-i Control Tools".

Commissioning, debugging and setting up of the AS-i parameters can be accomplished without software just with the use of two push-buttons, the display and the LEDs directly at the device.

Accessories (optional)

Software "AS-i Control Tools" ASI-CT210 (Article no. 6022501)

D-sub data cable DSL-RS232-02M (Article no. 6022468)

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4 Connections, Displays and Operating Keys

Devices in IP20:

On the front panel of the AS-i master with RS 232Cis:

- terminals to connect the power supply and the AS-i circuit
- a 9-pin SUB-D connector as interface connector (RS 232)
- 7 LEDs
- a LC display
- 2 push-buttons (devices with full-graphic display: 4 push-buttons) to configure the gateway

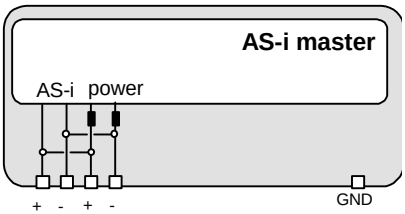
4.1 Power Supply Concepts and AS-i Connection Techniques

Note

The AS-i masters do not need a voltage supply of their own. They can be powered completely out of the AS-i line (the power consumption is about 200 mA from AS-i). An additional 24 V voltage source is not necessary. The AS-i master merely requires the connection to the AS-i line. When the AS-i power supply is switched on, the master starts to operate.

An AS-i power supply has to be used which also supplies the AS-i master with power and can be connected to the AS-i cable like all the other AS-i components at any place.

4.1.1 Single Masters in IP20 with AS-i Power Supply



The terminals have the following functions:

+	"AS-i +", Actuator Sensor Interface, positive terminal
-	"AS-i -", Actuator Sensor Interface, negative terminal
GND	Ground terminal, used for better EMC. Should be connected with a short wire to machine GND.

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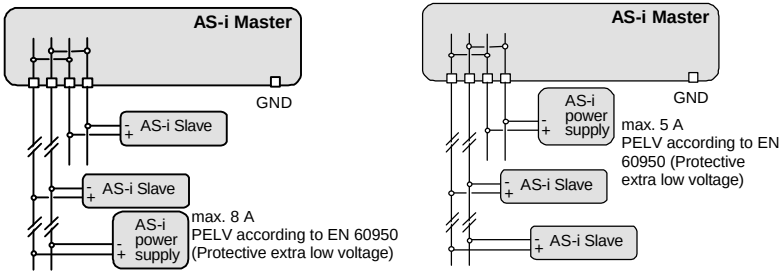
Connection samples for the AS-i power supply:

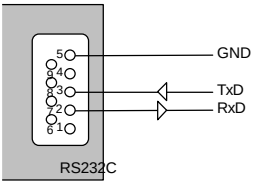
Warning



4.2 The Serial Interfaces

The serial interface has been designed as a 9-pin sub-D type socket that is located on the right side of the front plate.

4.2.1 AS-i Master with RS 232C



The AS-i master with RS 232C 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 232C 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 transmission cord (DSL-RS232-02M) can be used. With the software "AS-i Control Tools" (ASI-CT210) the AS-i master can be put into operation and and the mini PLC "AS-i Control" can be programmed.

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4.3 Display and Operating Elements

On the front panel of the AS-i master are seven light-emitting diodes, a two-digit display and two push buttons.

With the devices in IP65 the push buttons are situated inside of the housing to avoid liquids from entering. The top of the housing has to be screwed off to operate these push buttons.

4.3.1 LEDs of the Single Masters

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, or 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 blinks 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 ASI	The AS-i circuit is sufficiently powered.
ASI active	Normal operation active. (Blinks, if an 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.

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5 Operating the AS-i Master

5.1 Master Start-Up

After powering on, all segments of the figure display and all LEDs light up for approximately one second (self-test). Afterwards, the LEDs display the condition of their respective flags. The figure display shows the condition of the master:

40 Off-line Phase
The AS-i master initializes - there is no data communication on the AS-i.

If the AS-i circuit is insufficiently powered ("U AS-i" does not light up), the master remains in the off-line phase.

41 Detection Phase
Start of the start-up phase, where the system looks for slaves located on the AS-i. The master remains in the detection phase until it finds at least one slave.

42 Activation Phase
Condition at the end of the start-up operation where the parameters are transmitted to all connected and recognized slaves. This enables access to the AS-i slaves' data connections.

43[1] Start of Normal Operation
In normal operation the AS-i master can exchange data with all active slaves. It transmits management messages and looks for and activates newly connected slaves. During normal operation, the system keeps the maximum cycle time of 5 milliseconds.

5.2 Configuration Mode

The configuration mode serves to configure the AS-i circuit.

In the configuration mode, all recognized slaves are activated even when the desired and actual configurations do not match.

Pressing the "mode" button for at least five seconds switches the master to configuration mode. While in configuration mode, the yellow "prj mode" LED lights up.

The system then displays one after the other all detected slaves at a speed of two per second. First all "A" slaves and afterwards all "B" slaves. If a "B" slave is displayed, the "AS-i active" LED blinks. If the display is empty, no slaves were detached on the AS-i circuit.

1. Activation phase and the start of normal operation maybe so short that the numbers can not be seen in the display.

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In configuration mode, all recognized slaves are activated except of slave zero. The AS-i master is in normal operation. There is data exchange between the AS-i master and all AS-i slaves detected by the master regardless of whether the detected AS-i slaves were projected before.

When delivered the device is in configuration mode.

5.3 Protected Operating Mode

In contrast with the configuration mode in the protected mode there is only data exchange between the AS-i master and the projected AS-i slaves.

5.3.1 Switching to Protected Operating Mode

The configuration mode can be left by pressing the “mode” button.

Pressing the button shortly:

Exits the configuration mode without projecting the current AS-i configuration.

Pressing the button for more than five seconds:

Exits the configuration mode and projects the actual AS-i configuration. Simultaneously the actual AS-i configuration is stored as nominal configuration in the EEPROM.

If the system detects an AS-i slave with address zero on the AS-i, it can not leave the configuration mode.

In the protected operating mode, only AS-i slaves that are projected and whose actual configurations match the nominal configurations will be activated.

5.3.2 Configuration Errors in Protected Operating Mode

As long as there is no configuration error, the numeric display is turned off while in protected operating mode. Otherwise, the address with a faulty assignment is displayed. A faulty assignment occurs when a slave has been recognized or projected but cannot be activated.

If there are more than one faulty assignments the one that was first detected is displayed. Pressing the “set” button shortly displays the next higher faulty address.

Shortly appearing configuration errors are stored in the device (advanced AS-i diagnosis). The last error that occurred can be displayed by pressing the set button. If a short AS-i power failure is responsible for the configuration error the display shows a “39”.

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5.4 Assigning an AS-i Address in Configuration Mode

AS-i can be put into operation in a very comfortable manner by using the Windows software AS-i Control Tools ASI-CT210 (see chapter 9.1).

Furthermore you can use a hand held addressing device.

If you don't have neither a PC nor a hand held addressing device, address assigning of the AS-i slaves is also possible with the AS-imaster using the push buttons. How it works is described as follows.

5.4.1 Assigning a Slave Address

(assigning an available address to a slave with address zero)

In configuration mode, the addresses of all detected slaves are displayed one after the other. To display the next higher available operating address, press the "set" button shortly. Each time you press the "set" button, the next available address is displayed.

Choose the displayed address as your target address by pressing the button for more than five seconds. The address display blinks. The master is ready for programming; pressing the "set" button again addresses the connected slave with address zero to the target (blinking address).

Any errors will be displayed by their error codes according to chapter 10. Otherwise, the detected slaves are displayed again as described in chapter 5.2..

Note

Only slaves with address 0 can get a new address by the master.

Attention

There must not be two AS-i slaves with the same adrress on the AS-i circuit.

5.4.2 Erasing the Slave Address

(assigning address zero to a detected slave)

In configuration mode, the addresses of all recognized slaves are displayed one after the other. By pressing and releasing the "set" button, the master displays the next available address. If you press the button for more than five seconds while the address of a detected slave is displayed, this slave will get the address zero and the display shows "00".

When you release the button, the display continues to display the detected slaves.

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5.5 Programming the Address in Case of Configuration Errors

5.5.1 Automatic Address Assignment

Note

One of AS-i's great advantages is the automatic address assignment. If a slave fails, it can be replaced by one of the same type with address zero. The master will detect the replacement and automatically addresses the new slave with the address of the faulty one.

For automatic programming to work, some requirements must be met:

1. The AS-i master must be in the protected operating mode.
2. The "Auto_Address_Assign" release flag must be set.
3. Only one of the projected slaves may not be detected.

If these requirements are met, the AS-i master's "**prg enable**" LED lights up and a slave with address zero will be automatically assigned to the operating address of the missing slave. The "Automatic Address Assignment" can be activated and deactivated via the software "AS-i Control Tools".

Attention

If the two slaves have different configuration data, i.e. are not of the same type as far as AS-i is concerned, the automatic address assignment will not be carried out.

5.5.2 Manual Address Assignment

Note

If several slaves fail, they cannot be replaced automatically by the AS-i master. Then these addresses have to be set manually. If this should not be done via the host interface(using the AS-i Control Tools) or with a hand held addressing device, the slave addresses can also be changed with the help of the push buttons and the figure display of the device.

In protected operating mode, wrong assignments are displayed as errors (see chapter 5.3). By pressing the "set" button, you can display all faulty assignments one after the other. By pressing the "set" button for more than five seconds, you can select the currently displayed address as a potential target address, and the display starts to blink.

If the faulty slave was previously replaced by a slave with address zero, the new slave can now be programmed for the blinking address by pressing the "set" key again. As a requirement, the new slave's configuration data must match the configuration data for the blinking address.

After the address has been successfully set, the next faulty assignment is displayed and the address assignment can begin from the start. Otherwise, the system displays an error code (chapter 10). When all faulty assignments are eliminated the display is empty.

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5.6 Error Messages

The system displays error codes for error messages that do not point to faulty assignments on the AS-i circuit. The code numbers are larger than 50 and are therefore outside the slave address range. These codes are described in the appendix, chapter 10.

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6 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.

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

6.1 List of Corrupted AS-i Slaves (*LCS*)

To locate occasionally occurring short-time configuration errors the AS-i masters with advanced diagnostics manage beside the list of projected slaves (*LPS*), the list of detected slaves (*LDS*) and the list of activated slaves (*LAS*) a forth list, the **list of corrupted slaves (*LCS*)**. 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 represented 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 device is in the normal operation mode of the protected mode (display empty) or in the off-line-phase.

6.2 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 is increased everytime there is a corrupted data telegram. 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 means counter overflow.

The protocol analysis is included in the command master | AS-i Diagnostics of "AS-i Control Tools".

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6.3 Off-line Phase on Configuration Errors (LOS)

The AS-i master with advanced diagnostics offers the possibility to put themselves into the off-line Phase when a configuration error on the AS-Interface occurs. In 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-interface 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 can be chosen whether a configuration error on this address will release the off-line phase or not. This information is stored in the List of Off-line Slaves (*LOS*).
  The user himself can decide how the system reacts to a configuration error on the AS-Interface. The AS-i master can release the off-line phase in critical situations, i. e. only with certain slave addresses, while in less critical situations (if one of the other AS-i slaves have a configuration error) only the error message configuration error is sent to the host, but AS-i is still running.

The parameterization of off-line phase on configuration error is also supported by the "AS-i Control Tools" ASI-CT210 (command Master | Identity | Offline on configuration error).

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7 Operation via the Serial Interface

7.1 Configuring the Interface

When transferring data via the 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 4.2.

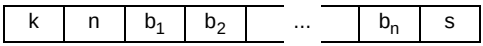
For the transmission speed, you can select 1200, 2400, 4800, 9600, 19200, 28800, 38400 or 57600 baud. If it has not received a valid host message since the last start-up, the master automatically adapts to the host.

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.

7.2 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:



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:

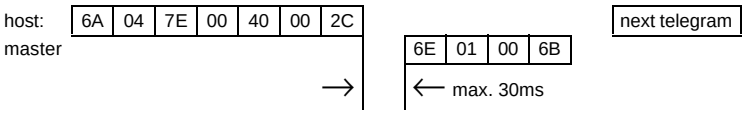
Addresses 1 through 6 and address 22 should be occupied in the list of projected slaves. The master is not in configuration mode, so it must not accept this request and answers with “not o.k.”.

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

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8 Including the AS-i Master in Own Programs

The 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 8.1.
2. If the environment is Windows: Using DLLs of .

8.1 Telegrams of the Serial Communication

8.1.1 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: $6A + 01 + 00 = 6B_{hex}$

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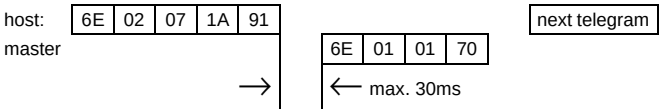
maximum reaction time of the master: 30ms



8.1.2 Synopsis of the Command Bytes

k	Message	AS-i Specification		Extensions
		2.04	2.1	
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			✓

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k	Message	AS-i Specification		
		2.04	2.1	Extensions
41_{hex}	write 16 bit data			✓
42_{hex}	16 bit data transmission control			✓
50_{hex}	read LCS			✓
51_{hex}	read error counters			✓
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			✓

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k	Message	AS-i Specification		Extensions
		2.04	2.1	
$7C_{hex}$	lock front panel operation			✓
$7D_{hex}$	read master version			✓
$7E_{hex}$	activate master			✓
$7F_{hex}$	download AS-i control program			✓
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			✓

8.1.3 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

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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 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
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 slaveadresse b_2: amount of slaves b_3...b_{18}: output data	b_1: status	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}
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
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	$8E_{hex}$	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}		300ms
	$8D_{hex}$	-	b_1: status	-
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

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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}
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.

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 new 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	

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

message	k	b_i (host message)	b_i (master message)	t_{max}
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	
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

8.1.4 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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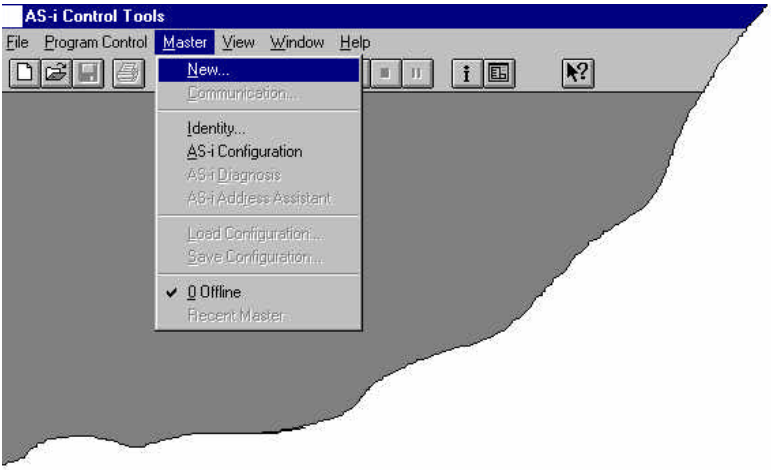
9 Commissioning Tools and Accessories

The AS-i circuit on the AS-i master can be put into operation with the comfortable Windows software "AS-i Control Tools" (ASI-CT210).

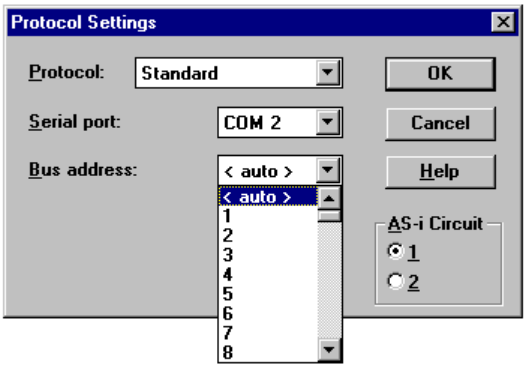
The software package communicates with the AS-i master via a serial cable (DSL-RS232-02M).

9.1 Windows Software AS-i Control Tools

1. For that purpose connect the device with a fully covered cable (DSL-232-02M) to the serial interface of your PC.
2. Start the AS-i Control Tools.
3. Call the command Master | New.



4. Choose Standard as protocol.
5. Do the appropriate settings. (e.g. serial interface COM 2, station address <auto>, AS-i circuit 1)



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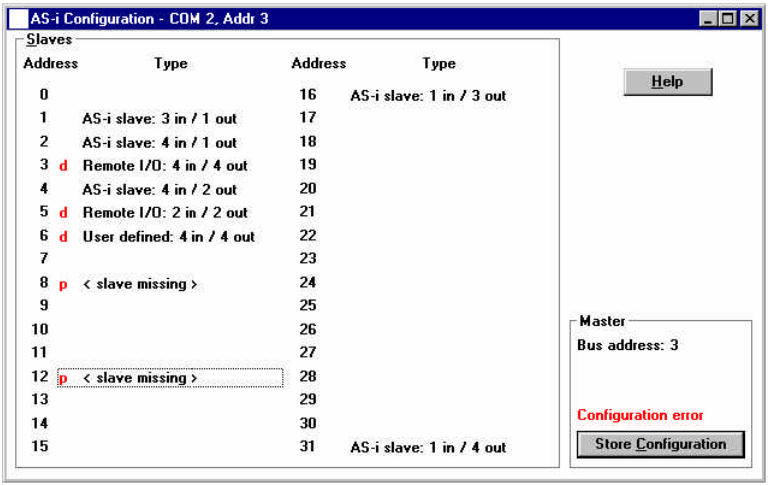
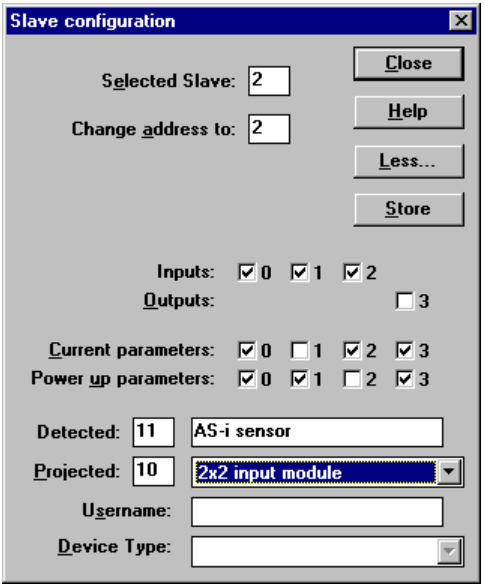
6. Call the command Master | AS-i configuration.
   The AS-i configuration editor will be started. All detected and projected AS-i slaves are displayed in this window.



7. Click on a slave entry to open the dialogbox slave configuration.



This dialog box is for changing a slave address, setting AS-i parameters or AS-i configuration data. Additionally you can test inputs and outputs.

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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.

Moreover you can use the **AS-i Address Assistant**. This tool changes automatically the address of an AS-i slave to the desired address after plugging the slave to the AS-i line. The desired AS-i configuration can be created off-line before and stored to a file. When you build up the plant you only have to plug 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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10 Appendix: Displays of the Figure Display

In the basic state of the configuration mode, the display shows one after the other the addresses of all detected slaves at a rate of two per second. A blank display means that the *LDS* is empty, i.e. 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 5.3.2).

During manual address programming, the slave address display has a different meaning (see chapter 5.4 and 5.5).

All displayed numbers that are bigger than 31 and therefore 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: If a 39 appears on the display after pressing the 'set'-button a short-time AS-i power failure occured.
40	The AS-i master is in off-line 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.
66	Baudrate search
70	Hardware error: The AS-i master's EEPROM cannot be written to.
72	Hardware error: The PIC processor does not respond.
73	Hardware error: The PIC processor does not respond.
74	Checksum error in the EEPROM.
75	Error in the external 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.
82	The front panel operation is blocked. Until the next power-up of the AS-i master the accessing to the device only from the host via the interface.
83	Program reset of the AS-i Control programm: The AS-i Control programm is just 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 occupied.
92	Error while changing slave address: New address could not be set.
93	Error while changing slave address: New address could only be stored volatile in the slave.
94	Error while changing slave address in protected operating mode: Slave has wrong configuration data.

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95	Error while changing slave address in protected operating mode: The configuration error was caused by one slave too many (instead of one missing slave).

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11 Appendix: The First Commissioning of AS-i

Note

In this chapter an example is given of how to put an AS-i network into operation quickly and easily and without the need for external devices. The addressing of the components connected to the AS-i network can be performed directly on the AS-i master. It is of course more comfortable to do the addressing with a hand-held programming device or with the Windows software AS-i Control Tools. However, it is possible to configure even complex networks using only the AS-i master.

What to do ?	**How to go about it?**
See to it that the AS-i master is properly supplied with power.	Using AS-i master with power supply “A”: Connect the AS-i power supply unit to the terminals AS-i + and AS-i - of the master, connect the ground terminal. Turn on the power supply.
After the self-test: the LEDs “power”, “config err”,”U ASI” and “prj mode” are on. The figure display shows “40”: the AS-i master is in the off-line phase. Shortly after that a “41” will be displayed: the AS-i master stays in the detection phase.	
Switch the device to the projecting mode, if the yellow LED does not light up.	Press the “modeMODE”-button for approx. five seconds.
The yellow LED “prj mode” lights up. The device is now in projecting mode.	
Add a slave with the address 0 to the AS-i line.	Connect the slave's terminals with the terminals AS-i +/- of the master.
The green LED “ASI active” lights up. The figure display shows “0”. This means the AS-i master has detected the slave.	
Change the slave address to address 1.	Select address 1 by pressing the “set” button shortly, if necessary repeatedly. When a “1” appears on the display press the “set” button for approx. five seconds until the display blinks. Press again shortly the “set” button to assign the new address to the slave.
The AS-i master detects the slave with address 1 and displays “1”.	
Connect another slave with address 0 to the AS-i line and allocate the address 2 to it.	Connect the slave to the AS-i line. The addressing is the same as for the previous slave.
The addresses of all slaves detected are now displayed sequentially.	
Change to the protected operating mode and store the AS-i configuration.	Leave the configuration mode by pressing the “mode” button for at least five seconds until the “prj mode” LED goes out.
The configuration of the AS-i master is now finished.	

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