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FACTORY AUTOMATION

Manual

VAM-CTR-KF-Rx

AS-Interface Master IP20



PEPPERL+FUCHS

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1 Declaration of Conformity

The serial AS-i Masters with integrated PLC functionality

- VAM-CTR-KF-R2; serial AS-Interface Master with RS232C interface
- VAM-CTR-KF-R3; serial AS-Interface Master with RS422 interface
- VAM-CTR-KF-R4; serial AS-Interface Master with RS485 interface

have been developed and produced in accordance with the applicable European standards and directives.



Note

The corresponding of conformity can be requested from the manufacturer.

The manufacturer of the product, Pepperl+Fuchs Group in D- 68307 Mannheim, possesses a certified quality assurance system in accordance with ISO 9001.

CE

ISO**9001**

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2 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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3 Safety

3.1 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.

3.2 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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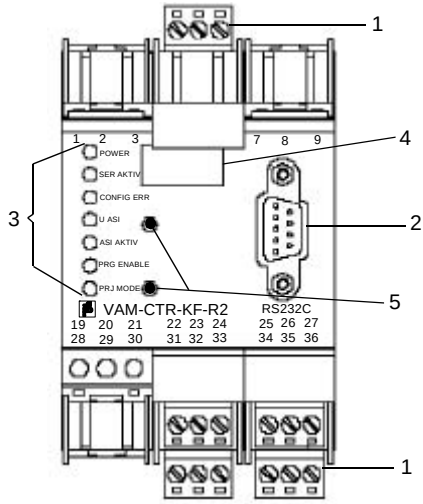
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4 Connections, Displays and Controls

4.1 Device Schematics

The following are found on the front of the AS-i Master (see diagram below):

1. Connection terminals for the AS-i circuit, also used for the power supply
2. A nine pin SUB-D connector as a serial interface (see chapter 4.4),
3. 7 LEDs
4. A four position, seven section display for indicating the gateway's operating status
5. 2 buttons for projecting the gateway..

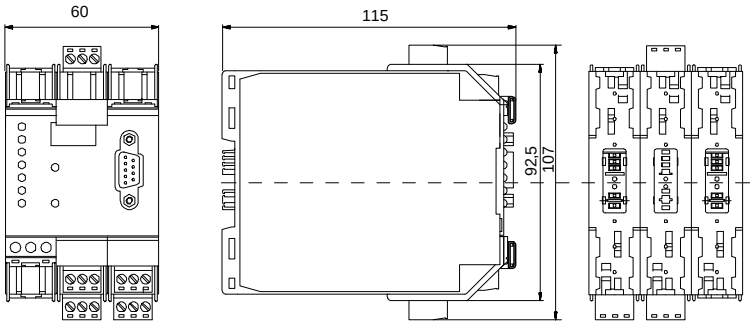


The following diagram provides the dimensions of the AS-i/-gateway.

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4.2 Displays and Controls

The seven LEDs on the front of the gateway signal the following:

power	The gateway is sufficiently supplied with power.
active	LED on: The serial interface is active. LED off: The serial interface is inactive.
config err	A configuration error is imminent . This means that with configuration errors, at least one projected slave is missing or the actual configuration data does not correspond with the reference configuration data for a projected and recognized slave.
U AS-i	The AS-i line is sufficiently supplied with power. (AS-i Flag "APO").
AS-i active	Standard operation is active (AS-i Flag "Protected Mode").
prg enable	Automatic address programming is possible (AS-i Flag "Auto_prog_available"). Precisely one slave is missing in the protected operating mode. This slave can be replaced with a slave of similar design and an address of 0. The gateway automatically programs the new slave to the faulty address and thereby resolves the configuration error.
prj mode	The gateway is in the projection mode (AS-i Flag "projecting_active").

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The two buttons have the following functions:

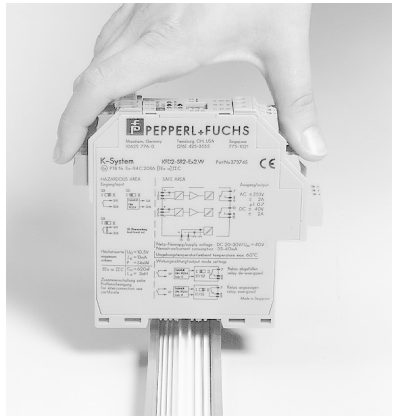
mode	Used to switch between the projection mode and the protected operating mode and to store the actual AS-i configuration as the reference configuration.
set	Selection and storage of an AS-i slave address.

4.3 Mounting and Connections

4.3.1 Mounting

The KF… design of the gateway can be mounted on a 35 mm DIN rail in accordance with EN 50022 and facilitates electrical connection through the "Power Rail". It is also possible to use the more conventional and expensive method of cable connections to terminals with this design.

The gateway is snapped directly onto the DIN rail. When using the power rail, an electrical connection is automatically made (to the AS-i Bus) by snapping the gateway onto the rail leads..



4.3.2 Connection via the Power Rail

The PR05 power rail is an insert for the DIN rail in accordance with EN 50 022. The UPR 05 is delivered with the appropriate DIN rail.

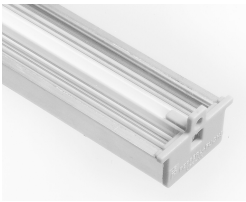
The 5 pin version of the power rail must be used during the establishment of AS-interface circuits. Two of the five power rails make up the AS-i bus.

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Lead breakage as well as a short circuit caused by the power rail is prevented due to the power rail's solid construction..



UPR 05



PR 05

4.3.3 Device Terminal Connections

In addition to or in combination with power rail connections, the KF… designs can be conventionally connected by means of removable device terminals. The terminal arrangement is shown below.

The device terminals consist of screw type cable piercing terminals which allow for the connection of 14 AWG cables (2.5 mm²). The connectors are 3 pin connectors; they can be keyed to prevent connection errors.

Removable terminals simplify the assembly of the switch encloser and allow for the replacement of components without taking the system off line.

4.3.4 Master Power Supply

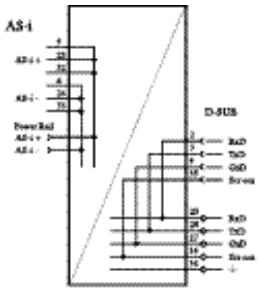
The master is powered by the AS-i network. An AS-i connection is established by means of the power rail or the device terminals. The terminal layout is displayed in the diagram below.

It is important to note when using the power unit that these AS-Interfaces are compatible and have the necessary decoupling coils.

4.4 The serial Interface

4.4.1 Connection of the AS-i Master with RS232C Interface

The pin allocation of the device terminals and the serial interface's SUB D connector are displayed in the following diagram:



Terminals
RS232C
interface

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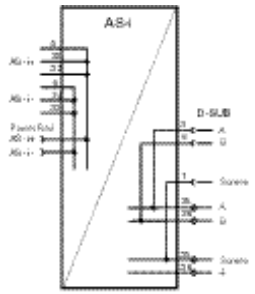
The AS-i master with an RS232C interface transmits across pin 2 of the SUB-D connector (signal "RxD") and receives across pin 3 (signal "TxD"). The signal ground is assigned to pin 5 of the SUB-D connector.

The connector's flange and subsequently, the interface cable's shielding are connected to the master's ground terminal.

The AS-i master functions as a DCE ("Data Carrier Equipment") during data transmission so that the connection cable with DTE ("Data Terminal Equipment", e.g. a PC), does not have any crossed leads.

4.4.2 Connection of the AS-i Master with an RS485 Interface

The pin allocation of the device terminals and the serial interface's SUB-D connector is displayed in the following diagram:



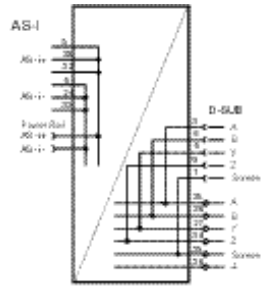
Terminals
RS485
interface

The AS-i master with an RS485 interface transmits and receives across pins 3 and 8 of the SUB-D connector.

RS485 signal "A" is therefore linked to pin 3 and signal "B" to pin 8. The interface cable's shielding is connected with the master's ground terminal via a capacitor in order to prevent leakage currents. It should be galvanically grounded at another location.

4.4.3 Connection of the AS-i Master with an RS422 Interface

The pin allocation of the device terminals and the serial interface's SUB-D connector are displayed in the following diagram:



Terminals
RS422
interface

The AS-i master with an RS422 interface receives across pins 3 and 8 ("A" and "B"), and transmits across pins 4 and 9 ("Y" and "Z") of the SUB-D connector.

As with the RS485 interface, the cable's shielding is only capacitively grounded and should be grounded at another location.

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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 LCD displays 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 ASI” does not light up) or there is no communication relationship between the master and the AS-i/Gateway, 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. If the display is empty, no slaves were detached on the AS-i circuit.

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

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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and all AS-i slaves detected by the master regardless of whether the detected AS-i slaves were projected before.

When delivered the AS-i Master is in configuration mode.

5.3 Protected Operating Mode



Note

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



Note

You leave the configuration mode 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.



Note

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 that address 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 (see chapter 8.1)(addressing directly or with the AS-i address assistant).

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-i Master 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.

Chose 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.

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 is will get the address zero and the display shows "00".

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

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.

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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.



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



If several slaves fail, they cannot be replaced automatically by the AS-i master. You must set their addresses manually. If this should not be done via the interface (using the AS-i Control Tools) or with a hand held addressing device, you can set them 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 assignment are eliminated the display is empty.

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 Operation via the Serial Interface

6.1 Configuring 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 4.4.

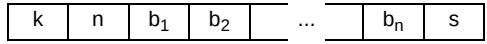
For the transmission speed, you can select 1200, 2400, 4800, 9600, 19200, 28800, 38400 or 57600 baud. If it has not received a valid host message since the last start-up, the master automatically adapts to the host.

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.

6.2 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:

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

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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:

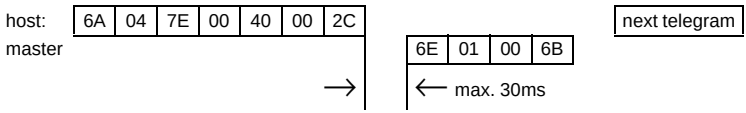
Addresses 1 through 6 and address 22 should be occupied in the list of projected slaves. The master is not in configuration mode, so it must not accept this request and answers with “not o.k.”.

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

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7 Advanced Diagnostics for AS-i Masters

The advanced AS-i diagnostics serves 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, Pepperl+Fuchs software for the comfortable commissioning of the AS-Interface and the programming of AS-i Control, will include the operation of the Advanced Diagnostics from version 3.0 on.

7.1 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. Was there a short-time AS-i power failure the display shows “39“ after pressing the “set“ button.

7.2 Error Counter: Counter of corrupted data telegrams

The AS-i Master with advanced diagnostics has an error counter for each AS-i slave, which is increased every time there is a corrupted AS-i telegram. This makes it possible to judge the quality of the AS-i network, even if only a few corrupted telegrams occurred 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 error counter is included in the command Master | AS-i Diagnostics of AS-i Control Tools version 3.0.

7.3 Off-line Phase on Configuration Errors

The AS-i Masters with advanced diagnostics offer the possibility to put themselves into the Off-line Phase when a configuration error on the AS-Interface occurs. In this

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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 version 3.0.

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8 Accessories for Putting AS-i into Operation and Test Tools

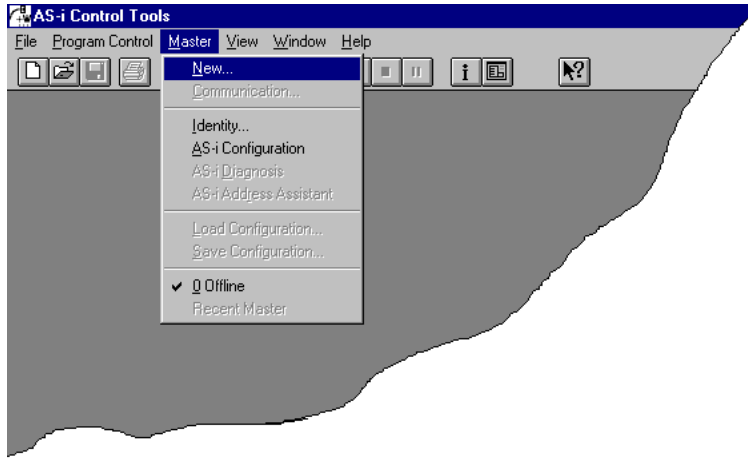
Putting AS-i into operation can be done very comfortably with the Windows software AS-i Control Tools. The software packages communicate with the AS-i Master via a serial cable.

Furthermore the AS-i Master can be controlled with own programs with the serial telegrams described in chapter 8.

8.1 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 manner.

1. For that purpose plug in the device to the D-SUB-connector and connect the device with a fully covered cable to the serial interface of your PC (RS232C, RS485, RS422).
2. Start the AS-i Control Tools.
3. Call the command Master | New.



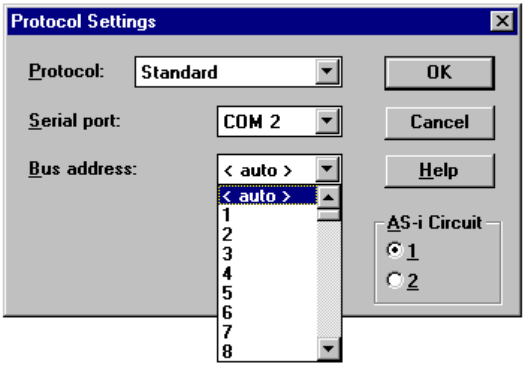
4. Choose the appropriate protocol (RS232C, RS485, RS422).

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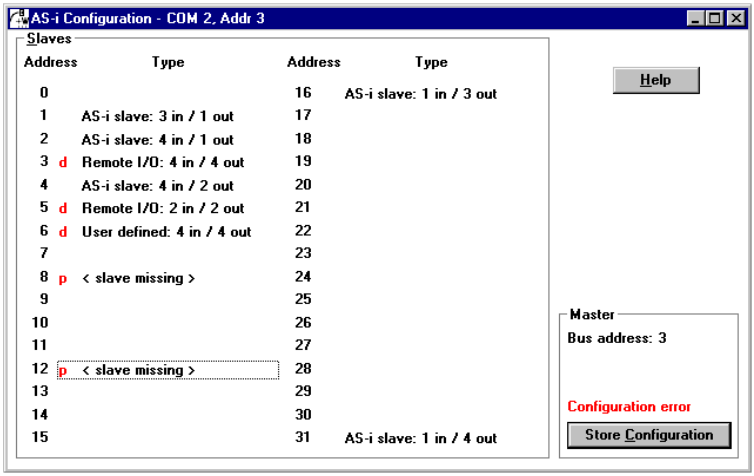
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5. Do the appropriate settings (e.g. serial interface COM 2, station address <auto>, AS-i circuit 1)



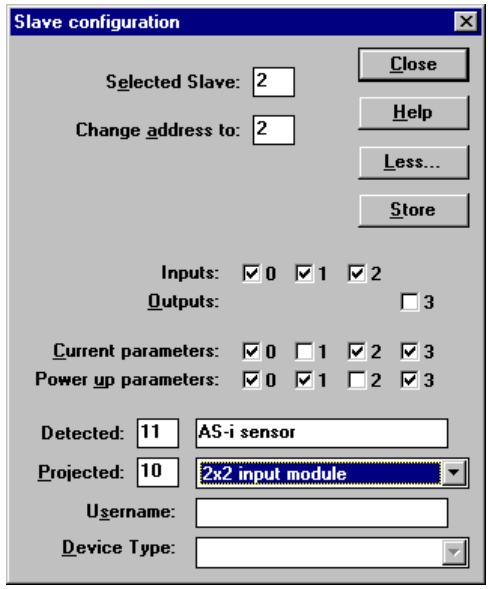
6. Call the command Master | AS-i configuration.
   The AS-i configuration editor will be started. All detected and projected AS-i slaves are displayed in this window.



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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.

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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9 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 three 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 9.1.
2. If the environment is Windows: Using DLLs of Pepperl+Fuchs.

9.1 Telegrams of the Serial Communication

9.1.1 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:

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

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: $6E + 02 + 07 + 1A = 91_{hex}$

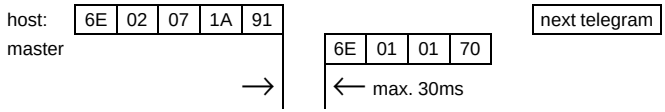
Master message (master responds with "O.K."):
- command byte k: $6A_{hex}$
- user data length n: 01_{hex}
- user data byte b_1: *status* = “O.K.” = 00_{hex}
- checksum s: $6A + 01 + 00 = 6B_{hex}$

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maximum reaction time of the master: 30ms



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9.1.2 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 circuits			✓
$8E_{hex}$	configure all AS-i circuits			✓

9.1.3 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

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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}
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
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	$8E_{hex}$	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. watchdogtime * 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 Offline 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	
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 new 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 RS232C-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 RS485- and RS422-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
change master address	82_{hex}	b_1: old master address b_2: new master address	b_1: status	30ms

Additional Commands for AS-i Double-Masters				
message	k	b_i (host message)	b_i (master message)	t_{max}
Exch[a]ange all process data (write *ODI*, read *ec*-flags and *IDI*)	**$8B_{hex}$**	**b_1...b_{16}: output data AS-i circuit 1** **b_{17}...b_{32}: output data AS-i circuit 2**	**b_1: ec-flags AS-i circuit 1** **b_2...b_{17}: input data AS-i circuit 1** **b_{18}: ec-flags AS-i circuit 2** **b_{19}...b_{34}: input data AS-i circuit 2**	**10ms**

a. This message makes no difference, which of the AS-i circuits has been activated.

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

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Additional Commands for AS-i Control				
message	k	b_i (host message)	b_i (master message)	t_{max}
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

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

9.1.4 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

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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

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. nur bei LDS und LCS

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.

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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. nur bei LDS und LCS

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.

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			

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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

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, null-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.

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Byte 1	(**B/b**) The responding master has a bus-capable RS485 or RS422 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.
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.

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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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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:

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 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.
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 from the host via the interface.
83	Program reset of the AS-i Control programm: The AS-i Control programm is just readed 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.
95	Error while changing slave address in protected operating mode: The configuration error caused by one slave too many (instad by 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.	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 LCD 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 "mode"-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 LCD 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 master is now finished.	

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