FACTORY AUTOMATION

MANUAL

IRI-KHD2-4.RX / IRI-KHA6-4.RX

CONTROL INTERFACE UNIT
FOR 4 READ HEADS

PEPPERL+FUCHS

Table of Contents

Date of issue 27. 02 2002

Date of issue 27. 02 2002

1 Declaration of Conformity

The Control interfaces IRI-KHD2-4.RX and IRI-KHA6-4.RX have been developed and produced in accordance with the applicable European standards and directives.

Note

A corresponding declaration of conformity can be requested from the manufacturer.

The manufacturer of the product, Pepperl+Fuchs GmbH in D-68301 Mannheim, possesses a certified quality assurance system in accordance with ISO 9001.

CE

ISO**9001**

Date of issue 27.02.2002

Date of issue 27.02.2002

2 General information

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.

Date of issue 27.02.2002

Date of issue 27.02.2002

3 Safety

3.1 Intended Use

The control interface units IRI-KHD2-4.RX, IRI-KHA6-4.RX serve as part of the inductive identification system IDENT-I from Pepperl+Fuchs to connect to a high order computer (PLC, PC) with the PROFIBUS-DP interface (DIN 19245 T1 + T2, EN 50170).The control interface units are only to be used with the read/write heads and the code/data carriers from Pepperl+Fuchs.

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.

Warning

The devices IRI-KHD2-4.RX, IRI-KHA6-4.RX may only be operated by appropriately qualified personnel in accordance with this operating manual.

3.2 General safety information

Safety and correct functioning of the device cannot be guaranteed if any operation other than that described in this operating manual is performed.

Warning

The connection of the equipment and any maintenance work to be carried out with voltage applied to the equipment must only be performed by appropriately qualified electro-technical personnel.

In the case that a failure cannot be repaired, the device must be taken out of operation and protected against inadvertently being put back into operation.

Repair work may only be carried out by the manufacturer. Additions or modifications to the equipment are not allowed and void the warranty. The responsibility for the observance to local safety standards lies with the operator.

3.3 Functional safety/monitoring

The control interface units IRI-KHD2-4.RX, IRI-KHA6-4.RX operate on a microprocessor basis. Functional disturbances and equipment errors/faults are signalled with the LED "Run/Error" on the front of the device.

In addition function control via the PROFIBUS is possible by interrogating the diagnosis/status information. Device failure or breakdown of a read head can be detected and indicated by the master unit.

Date of issue 27.02.2002

Date of issue 27.02.2002

4 Installation

Code carriers with ferrite core can be mounted embeddable in steel (see data sheets). The surface with the Pepper+Fuchs logo must point towards the read head and must be installed "face-on" or raised. Only this way, a safe operation is ensured.

Flush mounting in metal reduce the read distance.

Versions with mounting links are available.

Attention

The code carriers should not be mounted recessed in metal, as the read distances could be impaired.

Attention

The read heads must not be mounted embeddable in metal.

The read distances and the maximum misalignment from the read axis are depending on the used code carrier (see data sheets).

Note

The maximum transmission rate is depending on the read distance.

Up to 4 read heads can be connected to the control interface. The control interface is connected to the computer via a serial interface.

Date of issue 27. 02. 2002

Date of issue 27. 02. 2002

5 Serial interface/DIP switches

The RS 232 serial interface is connected via the built-in 9-pin sub-D-connector. Alternatively, RS 422, RS 485 or 20 mA interfaces can be connected to the housing terminals.

The interface standard is selected by setting DIP switches S7 and S8 located on the upper face of control interface.

Standard	S7	S8
RS 232 / RS 485	open	open
RS 232 / RS 422	open	close
20 mA-current loop	close	open

Since the control interface unit incorporates only one serial interface, which operates with different drivers and receivers for the various standards, then only one standard interface may be connected at any one time.

The transmission rate (baud rate) is set with DIP switches S1, S2 and S3 as follows:

Transmission rate	S1	S2	S3
300 Bd	open	open	open
600 Bd	open	open	close
1 200 Bd	open	close	open
2 400 Bd	open	close	close
4 800 Bd	close	open	open
9 600 Bd	close	open	close
19 200 Bd	close	close	open
not defined	close	close	close

Data is transmitted using one start bit, 8 data bits, one stop bit and no parity bit. The control interface unit also responds to one-and-a-half and two stop bits.

In the basic fixed-code operating mode, the following data formats are possible:

8 data bits, no parity

7 data bits, even parity

7 data bits, odd parity

To set these transmission formats, the command RST (in upper or lower case, but not in combination) must be sent to the control interface unit immediately after power on. The control interface unit adjusts automatically to the required format.

In binary mode, the number of data bits to be transmitted is always 8. If 7 data bits are set, the control interface unit will return the error message “M5” in response to the command “SB”.

Date of issue 27.02.2002

5.1 RS 232 Interface

The RS 232 interface connections are routed to the 9-pin sub-D-connector as follows:

Data signal input	RxD	Pin 2
Data signal output	TxD	Pin 3
Clear to send input	CTS	Pin 8
Request to send output	RTS	Pin 7
Ground	GND	Pin 5

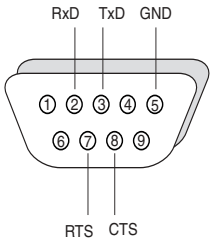


Bild 5.1: 9-pin Sub-D-connector with pin connection

The cable for connection to a PC should be as follows:

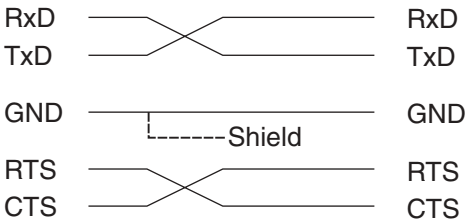


Bild 5.2: Connection cables PC

Date of issue 27.02.2002

5.2 RS 422 and RS 485 interfaces

With these two standards, the data signal is defined as the voltage differential between two conductors. Since possible interferences have the same effect on both conductors, provided a tightly twisted pair is used, a more secure data transmission is obtained than with the RS 232 interface, particularly at high transmission rates.

The RS 422 standard provides a symmetrical four-wire connection that is insensitive to interference. The transmit and receive lines are separate, so that full duplex operation is possible.

With the RS 485 standard, the transmit and receive lines are coupled, permitting half-duplex operation only. The transmitter is disabled to allow the receipt of data. The ability of multi-point connections is not implemented in the control interface unit.

Connection details are shown in the diagram on page 3. Terminals 15 to 18 should be used for the RS 422. For the RS 485, Terminals 17 and 18 should be connected.

5.3 20 mA current loop or TTY interface

The TTY interface was originally designed for teletype control. Two pairs of conductors are used, one to send, and one to receive data.The data can be transferred in full duplex mode, which is not supported by the control interface unit. Current loop transmission is very resistant to interference and therefore offers secure data transmission, even where long lengths of cable are used.

The current loop connections of the control interface unit are galvanically isolated by opto-couplers. The control interface unit represents the passive side of the transmission, i.e. the current and voltage required for transmission must be provided at the other end.

5.4 Connection cables

The maximum cable length between the control interface unit and the host computer will vary according to the data transmission speed, the interface standard and the level of interference. For this reason it is only possible to give approximate values:

Standard	Max. cable length
RS 232	15 m
RS 422	1000 m
RS 485	1000 m
20 mA current loop	1000 m

A screened twisted twin-core cable with a minimum wire cross-section of 0.14 mm^2 should be used for the connection.

The screen of the read head lead is connected on both sides to earth (PE) with low resistence and low induction. For that the attached terminal block can be used (see figure 5.3). Please make sure that the screen is kept as small as possible.

Date of issue 27.02.2002

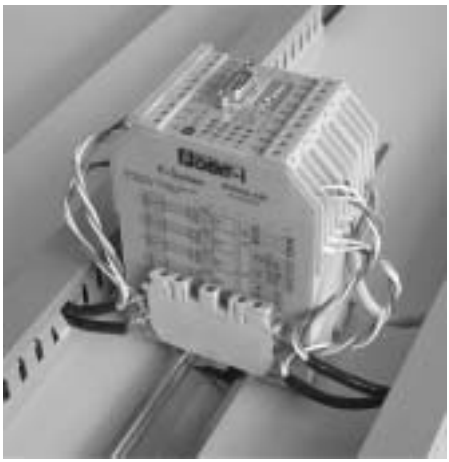


Bild 5.3: Terminal block with connecting cables

Read head cable lengths up to 50 m or 100 m are possible if the following conditions are satisfied:

up to 50 m read head cable:	cross sectional area of at least 4 x 0.25 mm^2 maximum resistance 78 Ohm/km maximum capacitance 90 pF/m (e.g. LIYC11C, Mukkenhaut & Nusselt MUNFLEX C11Y)
up to 100 m read head cable:	cross sectional area of at least 4 x 0.5 mm^2 maximum resistance 37 Ohm/km maximum capacitance 90 pF/m

Attention

With a cable length of 100 m, a series resistor of 82 Ohm must be fitted in the cable connected to the 'Reset' terminal of the control interface unit.

Since more EM interference can result with longer cable lengths, the maximum cable lengths given above might not be possible for some applications.

Note

If leads with double shielding are used, e.g. metallic wire mesh and metallic foil, they must be connected to each other using a low impedance connection at one end of the cable.

Many noise impulses come from the supply cables, e.g. switch-on current of a motor. For this reason, running the supply cables in parallel with the data/signal cables, especially in the same cable duct, should be avoided.

Date of issue 27.02.2002

6 Commands

The system responds to commands given via the serial interface. All commands consist of several ASCII characters and include the mode, read head number and data format but the read number and the data format may be omitted. In this case, either the previously selected values or the default settings are used. A comma must be inserted between the read head number and the data format. All commands are, as a general principe, terminated with the carriage return (<CR>) and line feed (<LF>) but these may be left out. It is of no consequence whether upper case or lower case letters are used for the commands.

Command structure:

Com<RHn>,<DF>	Com: Command mode RHn: Read head number (optional) DF: Data format (optional)

Command explanations:

Command mode	Explanation
R	**Read mode** The read head performs a single read operation. The control interface issues the code or sends an error message if no code carrier was present.
AR	**Autoread mode** The read head repeatedly performs read operations. This will continue until a code carrier comes within range of the read head. At this point the control interface issues the code and the read head stops reading. This mode can be interrupted by the input of a new command.
CAR	**Continuous autoread mode** This mode is equivalent to the AR mode in that the code carrier is read and the code returned. Thereafter the command remains active, i.e. the code carrier is read again and the code transmitted etc.
BAR	**Buffered autoread mode** In the continuous autoread mode, if a code carrier is stanionary in front of a read head, its code is constantly read and transmitted. Since all these codes must be processed by the control system, overloading may occur. To remedy this, the BAR command has been created by which a code is transmitted only once. This when a new code is identified or, if repeated attempts fail to read a code, a further code is sent. It must be realized that in an environment subject to strong interference, even though a code is sent repeatedly, it may eventually not be identified for a short period which will result in it being transmitted as a new code.

Ausgabedatum 27.02.2002

Further system commands to operate the interface unit

There are further system commands which issue control instructions such as, for example, restart, changeover to binary mode or software number specification. The system commands are accomplished in normal as well as in binary mode. These commands do not specify any further parameters such as the read head number.

RST	**Restart** All previously programmed commands are interrupted by this command and the control interface is set to the default condition, i.e. no active read command and data format 10. The RST command determines the parity setting of the serial communication at switch on of the control interface. Since by this command the control interface recognizes the parameters for serial transmission, the command must consist of either all upper case or all lower case letters.
SB	**Set binary mode** All read data is transmitted at 8 data bits per byte. This format functions only when the serial interface is also set to transmit 8 data bits per byte and is recommended when rapid data transmission is called for. The SB command is only permissible when one of the data formats 28, 64 or 256 has been set beforehand by a read command. To quite the mode, an RST command is sent.
VER	**Version number** The software version and the copyright message are displayed by use of this command.

6.1 Read head number RHn

In the command mode, the read heads are specified as 1, 2, 3 or 4. If, instead of a read head number, an X is sent, the read heads are interrogated one in sequence (R mode). In the AR mode reading continues until a code carrier is read. With the CAR mode, all the read heads continue to read until a new command is entered.

At switch on, read head 1 is selected. If a read head number is not specified, the previously selected head remains effective. All read heads can be switched off by selecting read head 0. This is a good police for minimizing energy usage.

Ausgabedatum 27.02.2002

Pepperl+Fuchs GmbH • 68301 Mannheim • Telefon (06 21) 7 76-11 11 • Telefax (06 21) 7 76-27-11 11 • Internet http://www.pepperl-fuchs.com

Beispiele:

R1<CR><LF>	The read head 1 reads a code if a code carrier is available. If no code carrier is available within range of the read head an error message will be issued.
arx<CR><LF>	If, for example, the read heads 1, 3 and 4 are connected, they will be activated one by another. When a code carrier comes within range of the read head it will be read and transmitted.

6.2 Data formats DF

The data format can be specified in any command which expects a read code as pesonse. If the data format is not specified, the previously selected format remains effective. When the format is specified, it must be preceded by a comma in order to distinguish it from the read head number. At system switch on, format 10 is adopted and the data output is in ASCII characters. The binary representation can be selected by an SB command.

Data format	Explanation
10	This format is active following switching on and of the control interface after sending an RST command. All 64 bits of a cod carrier are read but only the 28 bits of user data are returned. A read head number is not returned. The first 12 bits are sent in hexadecimal and remaining 16 bits in denary. All information is then transferred as ASCII characters, the binary mode not being admissible. In the event of the binary mode being selected, an error message will be returned.
28	All 64 code carrier bits are read but only the 28 user data bits are returned. In the binary mode no denary conversion takes place. The code follows the read head number and is preceded by a space character.
64	A code carrier is read and all 64 bits returned in hexadecimal form.

In the basic setting, all data is delivered as ASCII characters but depending upon the data format this takes place in denary or hexadecimal form. In the binary mode all data is transmitted without conversion into ASCII characters. No distinction is made between denary and hexadecimal. In data format 10 - the basic setting - the binary mode is not admissible and the code is always transmitted as ASCII characters.

Ausgabedatum 27.02.2002

Example:

A code carrier contains the code A011C3E3B900F0F0 in hexadecimal form. The code shall be read by the heed 3.

In data format 10 the first 12 bits (A01h=1010 0000 0001b) are transmitted in hexadecimal form. The following 16 bits (1C3Eh = 0001 1100 0011 1110b) are converted into a binary number (1C3Eh =7230d). A read head number does NOT precede the code and hence the read head number "X" only makes sense when there is only one read head. Consequently, in the example, the following character is sent.

ASCII	A	0	1	7	2	3	0	<CR>	<LF>
Hex	41	30	31	37	32	33	30	0D	0A
Den.	65	48	49	55	50	51	48	13	10

No provision is made for the binary mode in data format 10.

In data format 28 the first 12 bits (A01h = 1010 0000 0001b) and the following 16 bits (1C3Eh = 0001 1100 0011 1110b) are separately converted into denary (A01h=2561d and 1C3Eh=7230d). The code follows the read head number and is preceded by a space character. Hence, the following character string is sent:

ASCII	3		2	5	6	1	7	2	3	0	<CR>	<LF>
Hex	33	20	32	35	36	31	37	32	33	30	0D	0A
Den.	51	32	50	53	54	49	55	50	51	48	13	10

Read head number

In the binary mode no denary conversion takes place. The read head number is determined by bits 4 and 5 of the first byte. The two most significant bits, 6 and 7, are set at 0.

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
	0	0	0	0	x	x	x	x	Read head 1
	0	0	0	1	x	x	x	x	Read head 2
	0	0	1	0	x	x	x	x	Read head 3
	0	0	1	1	x	x	x	x	Read head 4

The character "X" contains the first 4 code bits.

Ausgabedatum 27.02.2002

The following bytes are returned:

Hex	2A	01	1C	3E
Den.	42	1	28	62

Read head number

To save time <CR> <LF> is not sent.

In **data format 64** the following character string is sent:

ASCII	3		A	0	1	1	C	3	E	B	9	0	0	F	0	F	0	<CR>	<LF>
Hex	33	20	41	30	31	31	43	33	45	42	39	30	30	6	30	46	30	0D	0A
Den.	51	32	65	48	49	49	67	48	69	66	57	48	48	70	48	70	48	13	10

Read head number

The binary mode returns the following byte sequence:

Hex	02	A0	11	C3	E3	B9	00	F0	F0
Den.	2	160	17	195	227	185	0	240	240

Read head number

The read head numbers are transmitted by the first byte as illustrated below:

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
	0	0	0	0	0	0	0	0	Read head 1
	0	0	0	0	0	0	0	1	Read head 2
	0	0	0	0	0	0	1	0	Read head 3
	0	0	0	0	0	0	1	1	Read head 4

Ausgabedatum 27.02.2002

6.3 Error messages

Error messages are delivered via the serial interface according to circumstances. These messages consist of a letter and an error number which identifies the type of error. In data formats 28 and 64 the valid error messages are in brackets.

Error message	Explanation
E1 (M0)	Hardware fault in the control interface.
E1 (M1)	Memory fault (RAM) in the control interface.
E1 (M2)	Memory fault (PROM) in the control interface.
E9 (M3)	The received command not understood.
E9 (M4)	Parity error in serial communication.
M5 (M5)	Binary mode not admissible in the selected data mode.
E0 (M6)	The addressed read head is not connected or is not functionally ready.
E2 (M7)	Code carrier is not readable or is not present.
E3 (M8)	Parity check on the read code revealed an error.

Note

*All error messages are followed by a **<CR>** and **<LF>** command.*

Example:

By the interface is sent the command “X”. This command is not defined and the message “M2 <CR> <LF>” is returned.

ASCII	M	2	<CR>	<LF>
Hex	33	32	0D	0A
Den.	51	50	13	10

6.4 Example of a program written in Basic

```
10 OPEN “COM1: 9600, n, 8, 1, CS, DS, CD, LF” AS #1
20 PRINT # 1, “AR1”
30 INPUT # CODE$
40 PRINT CODE$
50 GOTO 20
```

Ausgabedatum 27.02.2002

Pepperl+Fuchs GmbH • 68301 Mannheim • Telefon (06 21) 7 76-11 11 • Telefax (06 21) 7 76-27-11 11 • Internet http://www.pepperl-fuchs.com

7 Technical Data

7.1 General specifications

The control interface unit is connected via the serial interface to a higher-order control system (see figure 7.1).

The control interface unit receives the commands for reading the code carriers via this interface.

Up to 4 read heads can be connected to the control interface unit. The read heads can be queried individually or cyclically.

By means of DIP-switches three different operating modes can be selected at the control interface unit: fixcode, 3964R protocol with RK512 interpreter or 3964R protocol without RK512 Interpreter.

With the "fixcode" operating mode, serial communication takes place via ASCII characters. All commands consist of multiple ASCII characters.

The control interface unit supports the computer coupling procedure 3964R, which was developed for programmable logic controllers; the commands are inserted into the telegram frame of the procedure.

In addition, the RK512 interpreter can be used in combination with fetch telegrams.

Using the software IDENT 98 it is easy to communicate with the system. It describes the system and the commissioning. A demonstration software is included in the scope of delivery.

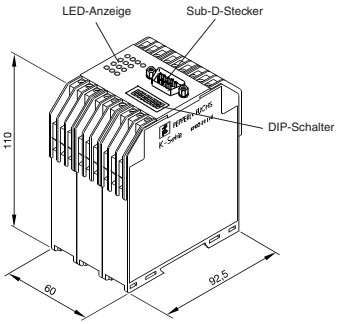


Bild 7.1: External view of the interface unit IVI-KHD2-4HRX/IVI-KHA6-4HRX

Date of issue 27.02.2002

7.2 Connection diagram and terminal assignments

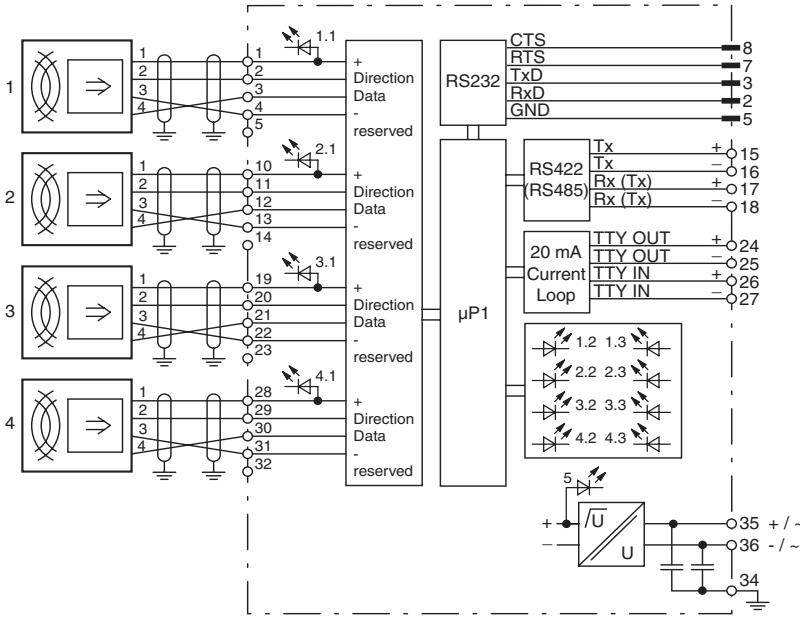


Bild 7.2: Connection diagram for the control interface unit IVI-KHD2-4.RX/IVI-KHA6-4.RX

List of terminal assignments

Terminal	Function
1	supply voltage read head 1 (plus)
2	„direction“ read head 1
3	„data“ read head 1
4	supply voltage read head 1 (minus)
5	reserved
6	PROFIBUS RxD/TxD-P
7	reserved
8	reserved
9	reserved
10	reserved
11	reserved
12	reserved
13	supply voltage read head 2 (plus)
14	„direction“ read head 2

Date of issue 27.02.2002

Terminal	Function
15	„data“ read head 2
16	supply voltage read head 2 (minus)
17	reserved
18	PROFIBUS RxD/TxD-N
19	reserved
20	reserved
21	reserved
22	reserved
23	reserved
24	reserved
25	supply voltage read head 3 (plus)
26	„direction“ read head 3
27	„data“ read head 3
28	supply voltage read head 3 (minus)
29	reserved
30	reserved
31	reserved
32	reserved
33	reserved
34	reserved
35	reserved
36	reserved
37	supply voltage read head 4 (plus)
38	„direction“ read head 4
39	„data“ read head 4
40	supply voltage read head 4 (minus)
41	reserved
42	ground bus/identification system
43	reserved
44	reserved
45	reserved
46	ground power supply
47	L+ or L
48	L- or N)

Date of issue 27.02.2002

7.3 Technical data

Order number	IVI-KHD2-4.RX	IVI-KHA6-4.RX
Power supply		
Operation voltage	18 V DC ... 32 V DC Residual ripple ≤ 10 $\%_{SS}$	90 V AC ... 253 V AC 50 ... 60 Hz
Power consumption	4 W	8 VA

Interface	
Interface options (selected via S7 and S8)	RS 232 or RS 422 or RS 485 TTY 20 mA (current loop) passive
Protocol	ASCII, 3964R with interpreter, 3964R without interpreter
Transmission rate	300 ... 19 200 Bit/s

Number of read heads	max. 4
Read/write head power supply	100 mA/16,5 V DC ± 5 %

Ambient conditions	
Operating temperature	-25 °C to +70 °C (248 to 343 Kelvin)
Storage temperature	-25 °C to +85 °C (248 to 358 Kelvin)
Humidity	max. 75 % relative of air humanity
Type of protection acc. to EN 60529	IP 20
Interface immunity as in:	EN 50081-2 (permitted interference) EN 50082-2 (noise immunity)

Mechanical data	
Construction type	60 mm terminal housing
Mounting	Snap-mounted on standard rail to DIN 46277 or screwed fixing to DIN 43602
Vibration resistance when installed as specified	To DIN IEC 721 Part 3-5 Class 5M2
Housing method	Makrolon 6485
Flammability class	UL94
Connections	self opening terminals, max. core cross-section 2x2,5 mm^2 Built-in 9-pin Sub-D-connector

Date of issue 27.02.2002

8 Operating control interface units using the 3964R protocol

8.1 Notes on the 3964R protocol

The 3964R procedure was defined to allow the transfer of data via a serial point-to-point connection in which the majority of data errors and time-outs are detected and corrected by the protocol. The 3964R protocol is an asynchronous bit-serial transmission procedure. A character frame consists of one start bit, 8 data bits, one even parity bit and one stop bit.

Start bit	0 LSB	1	2	3	4	5	6	7 MSB	Even parity	Stop bit

The transmission rate is set via DIP switches S1, S2, and S3.

Communication always starts with a **command message** either to transmit data (SEND messages) or to fetch data (FETCH messages).

The control interface unit replies with a "Response" message, with or without data.

A SEND message comprises a message header and data. A FETCH message comprises a message header only.

The **message header** consists of 10 bytes of information about the data target in the case of a SEND message, or information on the data source, in the case of a FETCH message.

If the RK 512 Interpreter is used, the message header is structured as follows:

Byte	Code	Description	Check
1	00h	Message	yes
2	00h	Identifier	yes
3	'E'	Message "input"	yes
4	x	Type of data	no
5	xx	Target address of data (high)	no
6	xx	Target address of data (low)	no
7	yy	Volume of data (high)	no
8	yy	Volume of data (low)	no
9	FFh	Coordination marker	no
10	FFh	Coordination marker	no

Date of issue 27.02.2002

8.1.1 Byte description:

1	Message identification, 00h, or FFh for any follow-up message
2	Message identification, always 00h
3	SEND ('A') or FETCH ('E') command. Byte 3 is an ASCII character
4	Command type, .i.e. type of data to be transmitted 'D' = Data block Byte 4 is an ASCII character
5 and 6	Target address for SEND, or source address for FETCH Byte 5 = DB number, Byte 6 = DW number
7 and 8	Volume of user data to be transmitted, in bytes or words, depending on data type
9	Byte number of the coordination marker, or FFh when no coordination marker is defined. In the case of control interface units, this byte is always FFh.
10	Bits 0 to 3: Bit number of coordination marker. If no coordination marker is defined, this byte is always Fh. Bits 4 to 7: CPU number, expressed as a digit from 1 to 4. If no CPU number is specified, but there is a coordination marker, it is taken as 0h. Where there is neither a CPU number nor a coordination marker, it is Fh. In the case of control interface unit, this is always FFh.

The control interface unit do not use bytes 4 to 8. Their content is copied in the response message.

8.1.2 Handshake procedure

To establish communication, the control system sends the ASCII control character STX (Start of Text). The control interface unit responds with the ASCII character DLE (Data Link Escape), after which the user information is transmitted. Whenever it appears in the user data, the character DLE is sent twice. When the data has been transmitted, the control system inserts the characters DLE ETX BCC, indicating the end of transmission, and waits for a DLE acknowledge character from the control interface unit. The data is verified with the block check character, BCC. BCC is the longitudinal even parity (EXOR logic operation on all data bytes) of the block transmitted or received. The calculation begins with the first byte of user data after communication is established and ends after the characters DLE ETX when communication is terminated.

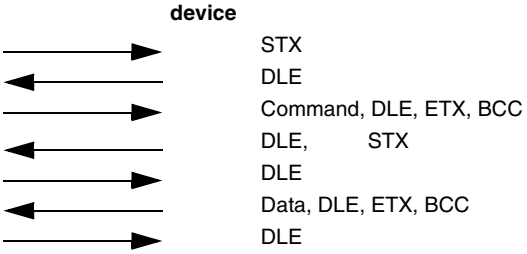
The control system sends the control character STX to establish communication. If the control interface unit responds with DLE before the time-out for acknowledgment, the protocol switches to send mode. If the control interface unit responds with NAK or any character other than DLE, or if the acknowledgment time delay elapses without a response, communication fails. With Siemens control systems, the procedure is abandoned after 6 unsuccessful attempts, and the error is registered in the coordination byte KBS.

Date of issue 27.02.2002

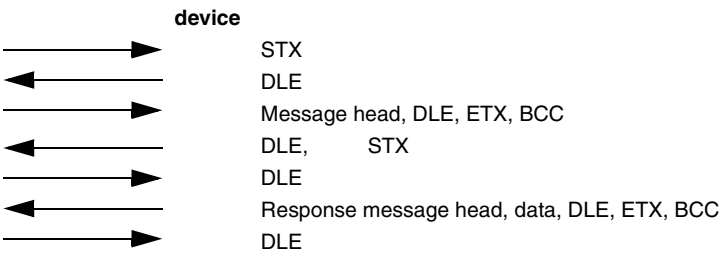
The control system terminates the reception when it receives the character sequence DLE ETX BCC. It compares the block check character (BCC) received with the built-in longitudinal parity. If the block check character is correct, and no other receive errors have occurred, the control system transmits DLE. If the BCC is incorrect, NAK is transmitted to the control interface unit, and a repetition of the process is awaited. The control system terminates the reception if the data block cannot be received without error after a (programmable) number of attempts, or if the repeat transmission is not initiated within the (programmable) block delay time.

8.1.3 Basic structure of all messages

1.) Without Interpreter RK512

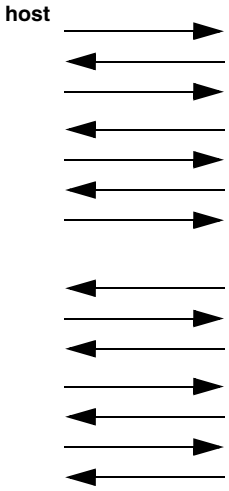


2.) With Interpreter RK512, communication involving FETCH messages



Date of issue 27.02.2002

3.) With interpreter RK512, communication involving send-messages



8.1.4 Data exchange via FETCH messages involving 3964R with RK512

This type of data exchange is possible only in the basic fixed code operating mode.

The first time a FETCH message is received, the control interface unit switches into a "Read" mode in which all read heads connected to the control interface unit are interrogated continuously.

For each correctly received FETCH message, the control interface unit returns a response message, in which the status of all 4 read heads (always 20 bytes) is transmitted.There are 5 bytes for each read head. The data length for a read head is the same whether or not a code has been read.

Each head has a "Read Sequence number" (8 bits) which is incremented whenever

- two codes are read in succession, and the first differs from the second
- two identical codes are read in succession, and the first of these has been transmitted to the control system

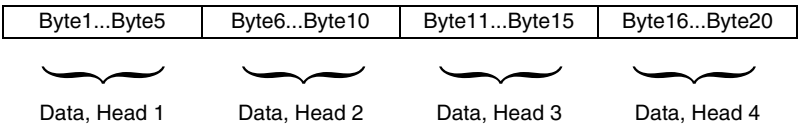


Bild 8.1: Structure of message data

Date of issue 27.02.2002

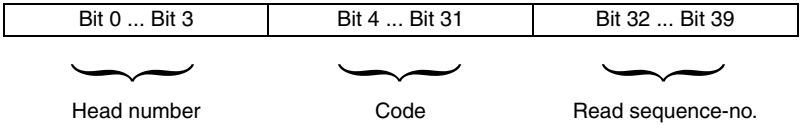


Bild 8.2: Data record of a read head after reading a code

Example: 1A650DC455,i.e.:Read head 1,Code A650DC4,Read sequence-no.55

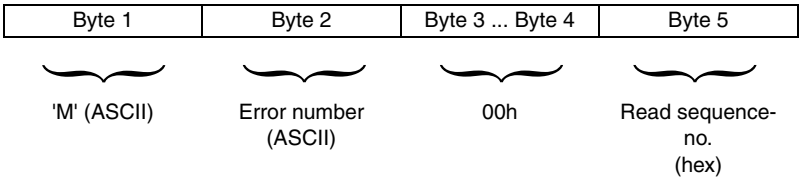


Bild 8.3: Data record of a read head after failure to read a code (Read head, specific error and status)

Example: 'M''6'000034

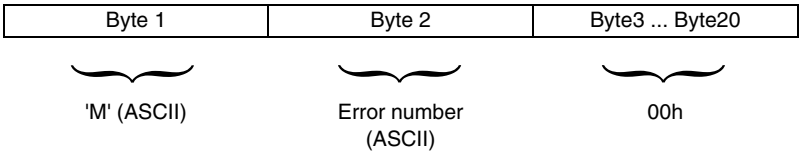


Bild 8.4: Data record of the message in the event of a faulty device r

Example: 'M' '1' 00000000000000000000000000000000000000

8.1.5 Data exchange via 3964R with RK512 involving SEND messages

The commands are transmitted in the form of data contained in a SEND message. Responses to the command received are transmitted to the control system via a SEND-message. The possible responses to a command are as follows:

- Fixed code command.: Codes, error messages
- Read/write commands.: Data, error messages, negative acknowledgment of a write command
- Operating mode commands: Positive or negative command acknowledgment

The message parameters in the response message are obtained from the initializing SEND message. This gives the user the opportunity to place the required data in the appropriate address space. The following parameters are required from the initializing SEND message:

Parameter	Permissible range
Number of target data block	3 ... FFh
Start address in target data block	0 ... FFh
CPU number	any
Coordination marker	FFFFh

The only restriction is in relation to the data type. The data can be transmitted in a single data block only. Accordingly, send and receive data are organized in words. If the selected data format has a data length consisting of an odd number of bytes, a byte, value 00h, is added. The same applies to the transmission of a command from the control system to the control interface unit.

Example: "Double-sided" read command

Data transmitted to the control interface unit: 02 00

Communication errors or errors relating to the message structure are transmitted in the 4th character of the response message.

Value	Significance
0Ch	The data type specified is not valid
10h	Bytes 1 and 2 of the message were not 00h
14h	The data block specified is not permissible
34h	The quantity of data sent was incorrect
36h	Incorrect message sequence

Bild 8.5: Error numbers for message errors

8.1.6 Data exchange without the RK512 Interpreter

The command and data structure are the same as when using the protocol with the RK512. The RK512-specific message header and message exchange sequence are not used.

Date of issue 27.02.2002

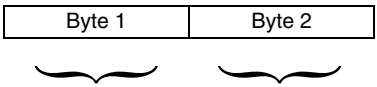
8.2 Command interpreter, systems for fixed code and read/write commands

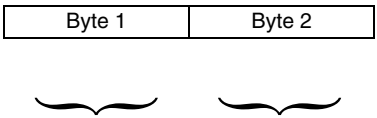
8.2.1 Command structure

The mode commands described below behave in the same way as the corresponding standard commands. For each mode command received, with the exception of the RST command, the control interface unit responds with a message transmitting the status of the control interface unit. The commands are transmitted to the control interface unit in the form of data in a SEND message. The commands are encoded byte by byte. The control interface unit acknowledges the commands with a further SEND message, in which the status corresponding to the command is transmitted.

8.2.2 Mode commands

Description	Hex identifier	Parameter
Reset	01h	00h
Double-sided read	02h	00h





Example: Correct transmission of the "Double-sided read" command

Transmitted to the control interface unit: '02 00'
Transmitted to the control system: '02 00'

Note

No message is transmitted in response to an RST command!

Date of issue 27.02.2002

Fixed code read commands

Command	Hex identifier
Read Fixed code	20h
Buffered Read Fixed code	21h

Read commands for the basic fixed code operating mode with read head number

When a read head is specified in a command, it is interrogated once only. The result (code or error message) will then be transmitted in a SEND message. After successful transmission, the control interface unit waits for another command.

Byte 1	High Byte 2	Low Byte 2	High Byte 3	Low Byte 3	Byte 4... Byte 6
20h	0	Head Status	Head-no.	Code	Code

Example: A code was read at read head 4

Read-command without read head number

All connected heads are interrogated once. The codes which are read are transmitted in packed form in a message. The data structure is as for commands R1 … R4.

Example: A code was read at read head 2 and 4.

Response:20 0A 1A 66 0C 8F 4A 65 11 78

Date of issue 27.02.2002

Buffered auto read with read head number

Command initialization takes place once only, through the transmission of a SEND message containing the command. A read head specified in the command will be interrogated continuously. If a faulty read head is detected, the control interface unit cancels the command, transmits the error status and waits for a further command. Errors relating to communication between the read head and the code carrier (no code carrier available) are suppressed.

Codes are transmitted only when:

- a new code is read
- at least 5 unsuccessful read attempts have occurred between two successful readings of identical codes

Together with the code data, an 8-bit wide read sequence number is transmitted, which is incremented whenever two non-identical codes are read in succession, or when at least 5 unsuccessful attempts to read occur between the reading of two identical codes.

Byte 1	High Byte 2	Low Byte 2	High Byte 3	Low Byte 3	Byte 4... Byte	Byte 7
21h	0	Head Status	Head-no.	Code	Code	Read sequence -no.

Example: A code was read at head 4, read sequence-no. 34h

Response:21 08 4A 65 13 0C 34

Buffered auto read without read head number

The command description is the same as for the BAR command, except that all connected read heads are interrogated continuously. After successful reading of a code carrier, all connected read heads will be interrogated again, and all codes read will be transmitted in a message.

Date of issue 27.02.2002

8.2.3 Read commands

Command	Hex identifier
Auto Read Bytes	57h
Single Read Bytes	77h

Read commands for data carriers

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Command	Head-no.	Data start 1	Data start 2	Quantity

Example: A single read attempt at head-no. 3. Read 5 bytes starting at address 0Ah (=10) : 77 03 00 0A 05

Structure of the response message after the data has been read

Byte 1	High Byte 2	Low Byte 2	Byte 3	Byte 4 ... Byte n
Command	0	Status/Head	Head-no.	Data

Example: Response to the above read command: 77 04 03 11 22 33 44 55

Structure of the response message in the event of an error

Byte 1	High Byte 2	Low Byte 2	Byte 3
command	8	Status/Head	Status/Error

Example: Response to the above read command if no code was read: 77 80 07

Date of issue 27.02.2002

8.2.4 Admissible Parameters

Head number	Hex identifier	
	Nibble	Byte
1	1	1
2	2	2
3	3	3
4	4	4
X	5	5

Bild 8.6: Structure of the "Read head-no." nibble and the "Head-no" byte

BIT	Read-head
0	1
1	2
2	3
3	4

Bild 8.7: Structure of the head status nibble when no errors detected

8.3 Error and status messages when using the 3964R protocol

Hex Value	Signification
00	No error
01	Memory error in control interface unit after RAM test
02	Memory error in control interface unit after ROM test
03	Unable to understand command
04	Parity error in serial communication
05	Write error
06	Read head not connected or not ready
07	No code or data carrier is available, or an error has occurred during data transfer between code or data carrier and control interface unit
08	Parity or CRC error during transmission with code or data carrier
09	Address or quantity of data outside valid range
0A	Programmable Array Logic (PAL) frozen in read head
0B	Watchdog reset
0C	Echo error in inductive transmission
0D	Function not available with the selected data carrier
0E	A read head of older technology is connected
0F	Synchronization error at nibble interface
10	Battery low (applies only to 8 and 32 kilobyte data carriers), but the command was executed successfully
11	Acknowledgment error in transmission to data carrier
12	Too much data for 2 messages

Date of issue 27.02.2002

Date of issue 27.02.2002

9 ASCII Table

hex	dez.	ASCII	hex	dez.	ASCII	hex	dez.	ASCII	hex	dez.	ASCII
00	0	NUL	20	32	Space	40	64	@	60	96	‘
01	1	SOH	21	33	!	41	65	A	61	97	a
02	2	STX	22	34	“	42	66	B	62	98	b
03	3	ETX	23	35	#	43	67	C	63	99	c
04	4	EOT	24	36	$	44	68	D	64	100	d
05	5	ENQ	25	37	%	45	69	E	65	101	e
06	6	ACK	26	38	&	46	70	F	66	102	f
07	7	BEL	27	39	‘	47	71	G	67	103	g
08	8	BS	28	40	(	48	72	H	68	104	h
09	9	HT	29	41	)	49	73	I	69	105	i
0A	10	LF	2A	42	*	4A	74	J	6A	106	j
0B	11	VT	2B	43	+	4B	75	K	6B	107	k
0C	12	FF	2C	44	,	4C	76	L	6C	108	l
0D	13	CR	2D	45	-	4D	77	M	6D	109	m
0E	14	SO	2E	46	.	4E	78	N	6E	110	n
0F	15	SI	2F	47	/	4F	79	O	6F	111	o
10	16	DLE	30	48	0	50	80	P	70	112	p
11	17	DC1	31	49	1	51	81	Q	71	113	q
12	18	DC2	32	50	2	52	82	R	72	114	r
13	19	DC3	33	51	3	53	83	S	73	115	s
14	20	DC4	34	52	4	54	84	T	74	116	t
15	21	NAK	35	53	5	55	85	U	75	117	u
16	22	SYN	36	54	6	56	86	V	76	118	v
17	23	ETB	37	55	7	57	87	W	77	119	w
18	24	CAN	38	56	8	58	88	X	78	120	x
19	25	EM	39	57	9	59	89	Y	79	121	y
1A	26	SUB	3A	58	:	5A	90	Z	7A	122	z
1B	27	ESC	3B	59	;	5B	91	[	7B	123	{
1C	28	FS	3C	60	<	5C	92	\	7C	124	|
1D	29	GS	3D	61	=	5D	93	]	7D	125	}
1E	30	RS	3E	62	>	5E	94	^	7E	126	~
1F	31	US	3F	63	?	5F	95	_	7F	127	DEL

Date of issue 27.02.2002

Date of issue 27.02.2002

Date of issue 27.02.2002

Date of issue 27.02.2002

With regard to the supply of products, the current issue of the following document is applicable:
The General Terms of Delivery for Products and Services of the Electrical Industry, as published by the Central Association of the 'Elektrotechnik und Elektroindustrie (ZVEI) e.V.',
including the supplementary clause "Extended reservation of title"

We at Pepperl+Fuchs recognise a duty to make a contribution to the future.
For this reason, this printed matter is produced on paper bleached without the use of chlorine.

One Company, Two Divisions.

Factory Automation Division

Product Range

- Digital and analogue sensors
- in different technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
- Incremental and absolute rotary encoders
- Counters and control equipment
- Identification Systems
- AS-Interface

Areas of Application

- Machine engineering
- Conveyor or transport
- Packaging and bottling
- Automotive industry

Process Automation Division

Product Range

- Signal conditioners
- Intrinsically safe interface modules
- Remote Process Interface (RPI)
- Intrinsically safe field bus solutions
- Level control sensors
- Process measuring and control systems engineering at the interface level
- Intrinsic safety training

Areas of Application

- Chemical industry
- Industrial and community sewage
- Oil, gas and petrochemical industry
- PLC and process control systems
- Engineering companies for process systems

Service Area

Worldwide sales, customer service and consultation via competent and reliable Pepperl+Fuchs associates ensure that you can contact us wherever or whenever you need us. We have subsidiaries worldwide for your convenience.

The Pepperl+Fuchs Group

USA Headquarters
Pepperl+Fuchs Inc. · 1600 Enterprise Parkway
Twinsburg, Ohio 44087 · Cleveland-USA
Tel. (330) 4 25 35 55 · Fax (330) 4 25 93 85
e-mail: sales@us.pepperl-fuchs.com

Asia Pacific Headquarters
Pepperl+Fuchs Pte Ltd. · P+F Building
18 Ayer Rajah Crescent · Singapore 139942
Tel. (65) 7 79 90 91 · Fax (65) 8 73 16 37
e-mail: sales@sg.pepperl-fuchs.com

Worldwide Headquarters
Pepperl+Fuchs GmbH · K•nigsberger Allee 87
68307 Mannheim · Germany
Tel. +49 621 7 76-0 · Fax +49 621 7 76-10 00
http://www.pepperl-fuchs.com
e-mail: fa-info@de.pepperl-fuchs.com

PEPPERL+FUCHS