Inductive
Read/Write Identsystem
CIS3A-Mini

System - Manual
for
Read/Write Head CIT3A...
Evaluation Unit CIA3...

Ident No. 084727

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Contents

1 Overview

This manual describes technical features and function of the evaluation unit with serial interface cat. no. 077910 type CIA3SX1R1G08 and the communication with PC or SPS.

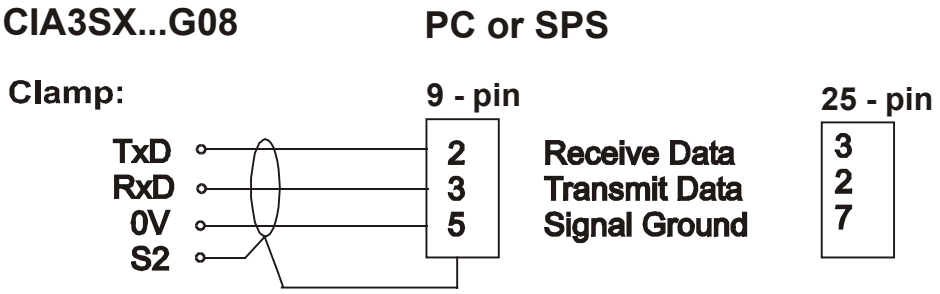
The transfer telegrams for the commands

- Program (write) data carrier
- Read data carrier

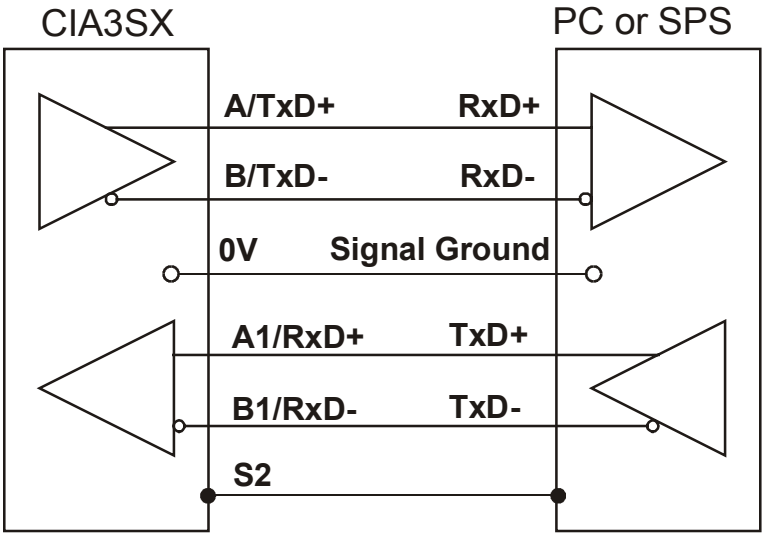
are based on the 3964R transfer procedure [1].

2 Connection and setup of the evaluation unit CIA3...

2.1 RS232-Interface:



2.2 RS422-Interface:



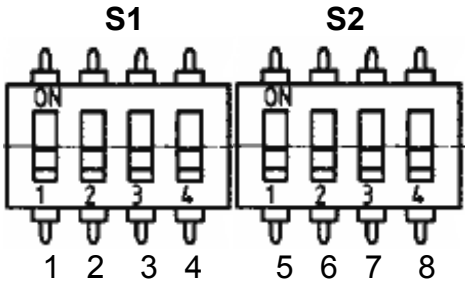
2.3 Notes on installation

- Do not connect the evaluation unit CIA3... as well as the read/write head CIT3... as long as **power is on**.

2.4 Settings

2.4.1 DIP switch settings

The settings of the DIP switches is only checked after the power-on cycle.
So it makes no sence to change the DIP switch setting during operation of the unit.
Changes are only valid after a power-off / power-on cycle.



Functions of the DIP switches

Switch	Functions	Default settings	
1-1 (1)	OFF=9600 Baud or ON=28800 Baud	OFF	9600 Baud
1-2 (2)		OFF	
1-3 (3)		OFF	
1-4 (4)		OFF	
2-1 (5)		OFF	
2-2 (6)		OFF	
2-3 (7)		OFF	
2-4 (8)	ON= Data carrier read-only OFF= Data carrier read/write	OFF	Data carrier read/write

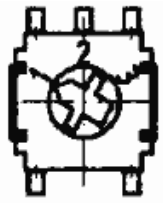
General note:
All presently un-used switches must be set “OFF”. Thus, possible problems can be avoided with functions which may be added in the future.

2.4.2 Interface setting

For the pre-setting of the interface type, the rotary switch "S3" is responsible.

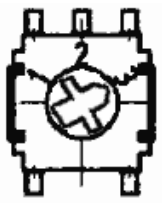
Default setting is RS232

Switch position 1



RS232

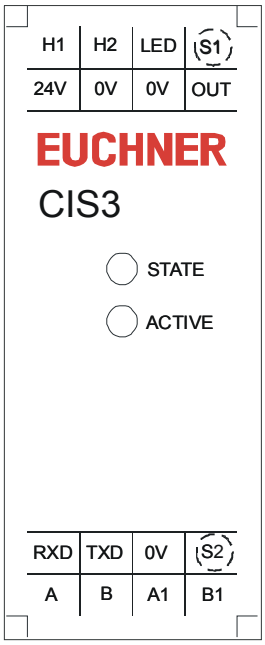
Switch position 3



RS422

2.5 Connector pinout / LED functions

Type label / LED's:



Read/write head connection

Power supply

STATE LED: Lights steady green, when the power is on.

ACTIVE LED: Lights steady yellow, when a functional data carrier is in the active range of the read/write head.

RS232-interface connectors

RS422-interface connectors

Connectors:

H1:	Analog connection 1 to the read/write head	cable-colour: brown
H2:	Analog connection 2 to the read/write head	cable-colour: white
LED:	Data carrier active	cable-colour: yellow
SH:	Shield connection for the read/write head cable	cable-colour: green + shield

24V:	Power supply +24V
0V:	Power supply 0V
0V:	Output signal "data carrier active" (GND)
OUT:	Output signal "data carrier active" (High +24V) (Concurrent with "ACTIVE LED" yellow)

RxD:	Receive data (RS232-Interface)
TxD:	Transmit data (RS232-Interface)
0V:	GND (RS232-Interface)
S2:	Shield connection for the data cable

A:	TxD+ (RS422-Interface)
B:	TxD- (RS422-Interface)
A1:	RxD+ (RS422-Interface)
B1:	RxD- (RS422-Interface)

3 Basic telegram structure

Each command and any related data blocks are transferred within the telegram frame in accordance with procedure 3964R from and to the ident system (figure 1).

With Protocol 3964R, the relevant receiver acknowledges the received telegram by returning an acknowledgement character (DLE). In the case of negative acknowledgement (NAK), the entire protocol is repeated. If it is not possible to transfer the protocol error-free after a total of six attempts, the operation is aborted.

3.1 Basic command structure

	Description	**Byte No.**	**C o n t e n t s ASCII**	**Acknowledgemer of the receiver + -**
Connection set-up	3964R procedure start		STX	
				DLE NAK
Telegram data max. 128 bytes (telegram core)	Number of telegram bytes	0		
	Command identification	1 2	T or R command	
	Header address	3	01_{hex}	
	User data description	4 5 6	Start address Start address Number of data items	
	User data	7 to n		
Connection cleardown	3964R Procedure end		DLE ETX BCC	
				DLE NAK

Figure 1: Basic command structure

3.2 Special features of the data transfer protocol 3964R [1]

The 3964R data transfer protocol is a comparatively reliable program for electronic data interchange between a control and a connected peripheral since data transfer is handled with a standardised protocol.

On controls with integrated 3964R driver (see [1] for instance), it is **not** necessary for the user to bother with the details of connection set-up and clear down respectively pay attention to data integrity. It suffices to transfer the telegram core to the 3964R driver via the program.

On controls without 3964R driver or if a Electronic-Key-System is connected to a PC, the user must, however, also program the connection set-up and clear down as well as the retry attempts.

3.2.1 Basic information on data transfer procedures with protocol [1]

Numerous conventions must be agreed upon for a data transfer procedure: Codes, operating modes, transfer speeds and the algorithmic transfer sequence. The stipulation of the algorithmic sequence is referred to as **transfer protocol** (*protocol for short*). A transfer protocol generally defines the following phases of data transfer:

- Connection establishment: Request from A to B for data transfer
- Data transfer from A to B
- Connection termination: End of data transfer

3.2.2 The transfer protocol 3964R [1]

Unlike non-protocol-based data transfer procedures, 3964R is a data transfer procedure with protocol. This means that the actual data to be transferred is enclosed in specific control characters. The 3964R driver allows comparatively reliable data transfer by virtue of the fact that the receiver must first signal to the transmitter that it is ready to receive (connection set-up) and, after data interchange, must acknowledge correct reception. Data integrity is enhanced by an additional block check character with the 3964R transfer protocol.

The 3964R driver interprets the following control characters:

- DLE (10_{hex}) **D**ata **L**ink **E**scape
- STX (02_{hex}) **S**tart of **Tex**t
- NAK (15_{hex}) **N**egative **A**c**K**nowledgement
- ETX (03_{hex}) **E**nd of **Tex**t

With the 3964R transfer protocol, a **block check character *(BCC for short)*** is transmitted for data integrity at the end of each data block. The block check character BCC is the **even longitudinal parity (exoring of all data bytes)** of a transmitted or received block. Generation **starts** with the **first user data byte (first byte of the telegram)** after connection set-up and **ends after** characters **DLE** and **ETX** on connection clear down.

3.2.2.1 Control sends [1]

The control sends the control character STX in order to set up the connection. If the peripheral responds before expiry of the acknowledgement delay time (QVZ, typically: 2 seconds) with control character DLE, the control system switches to transmit mode. If the peripheral responds with control character NAK or any other character (apart from DLE) or if the acknowledgement delay time elapses with no response, this means that connection set-up has failed. The procedure is aborted after a total of 6 unsuccessful attempts (specification of the 3964R protocol). If connection set-up is successful, the user information characters contained in the control's transmit buffer are transmitted to the peripheral at the selected transfer speed. The peripheral monitors the interval between the incoming characters. The interval between two characters may not exceed the character delay time (ZVZ, typically: 100 ms).

Each control character DLE (10_{hex}) contained in the user information **must** be transmitted **twice** so that the communication partner recognises that the data is user data and not the control character DLE. **(DLE doubling)**.

After transmission of the user data, the control appends the following characters as **end identifier**: DLE, ETX, BCC

The control then waits for an acknowledgement character from the peripheral. If the peripheral sends control character DLE within the acknowledgement delay time (QVZ, typically: 2 seconds), the data block has been accepted error-free. By contrast, if the peripheral responds with control character NAK or any other character or if the acknowledgement delay time elapses with no response, the control starts transmission again with connection set-up STX. The procedure is aborted and the control sends the control character NAK to the peripheral after a total of 6 unsuccessful attempts (specification of the 3964R protocol).

If the peripheral sends control character NAK during a running transmission, the control aborts the block and repeats it in the manner described above. In the case of any other character, the control initially waits for the character delay time (ZVZ) to elapse and then sends control character NAK in order to set the peripheral to idle state. The control then starts transmission again with connection set up STX.

3.2.2.2 Control receives [1]

If the control receives control character STX from the peripheral in idle state, it responds with DLE. If the control receives another character (apart from STX) in idle state, it waits for the character delay type (ZVZ, typically: 100 ms) to elapse and then sends the control character NAK. After each character, the next character is awaited during the character delay time (ZVZ). If the character delay time elapses without reception, control character NAK is sent to the peripheral.

If the control detects character string DLE ETX BCC, it terminates reception. It compares the received block check character BCC with the internally generated longitudinal parity. If the block check character is correct and no other reception error has occurred, the control sends control character DLE. If the BCC is incorrect, control character NAK is sent to the peripheral. A retry is then awaited. If it is not possible to receive the block error-free even after a total of 6 attempts (specification of the 3964R protocol), or if the retry is not started by the peripheral within the block waiting time of 4 seconds, the control aborts reception.

If transmission errors (lost character, frame error, parity error) occur during reception, reception continues through to connection clear down and control character NAK is then sent to the peripheral. A retry in the manner described above is then awaited.

3.2.3 Summary of the most important points

- **DLE doubling:**
  In order for the control to be able to distinguish between control character DLE and any randomly occurring DLE as user information character, **a further DLE must be sent in the case of a DLE as user information character**. This means that if a byte with ASCII value DLE (10_{hex}) occurs within the telegram core, this character must be transmitted again so that it is not interpreted by the distant station as a control character for connection clear down.

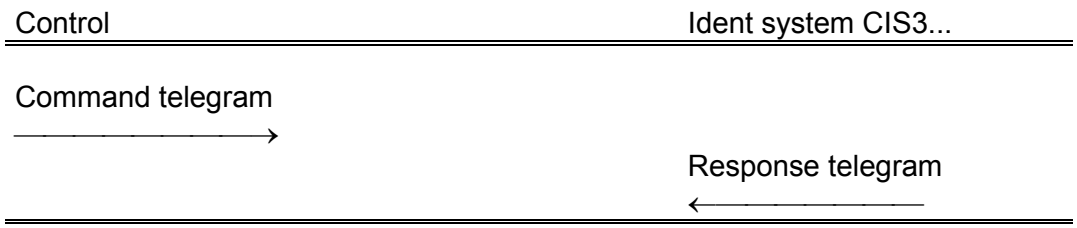
- **Block check character (BCC):**
  A block check character is sent at the end of each data block for data integrity. The block check character BCC is the **even longitudinal parity (exoring of all data bytes)** of a transmitted or received block. Generation **starts** with the **first user data byte (first byte of the telegram)** after connection set-up and **ends after** characters **DLE** and **ETX** on connection clear down.

- **Retry attempts in the case of errors:**
  If an error occurs for any reason during data transfer, **a total of 6 attempts** are made in order to transfer the data correctly.

4 Commands for reading and writing the read/write data carrier

Read and write operations are always initiated by the host control (PC, PLC) with a "command telegram".

The Electronic-Key-System then sends a response telegram to the control.



IMPORTANT !!!

Please note:
The memory of the read/write data carriers is organised in 4 byte blocks. So it is only possible to write complete 4-byte blocks (if you want to write only 3 bytes, you have to fill the 4th byte with a filler byte). You also have to pay attention to the start address: For the start address to write any data it is also only possible to use byte 0, byte 4, byte 8, byte 12 and so on.

This restriction is only valid for writing data into the data carrier! For reading it is possible to read every single byte on every address.

4.1 Write operation

The data carrier must be in front of the read/write head in case of this command and may be removed from the active range only after reception of the response telegram.

Please note:
It is only possible to work with a maximum of 32 bytes of user data per command telegram! If more data is required (max. 116 byte), it must be splitted to more than one command telegram.

Command telegram (telegram core, PLC → CIA3SX , see also figure 2):

TP (read/write head address) (start address) (number of bytes user data) (user data)

Response telegram (telegram core, CIA3SX → PLC, see also figure 3):

RF (read/write head address) (0,0) (status no.)

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		0B ... 7B	11 ... 123
1	Command	T	54	84
2	identification	P	50	80
3	Read/write head address		01	1
4	Start address of the		00	0
5	user data		00 ... 70	0 ... 112
6	Number of bytes of the user data		04 ... 20	4 ... 32
7 ... 122	User data	ASCII or hex resp. BCD (code-transparent)		

Figure 2: Command telegram "write data carrier" (telegram core)

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		07	7
1	Command	R	52	82
2	identification	F	46	70
3	Read/write head address		01	1
4	Padding data		00	0
5			00	0
6	Status number		**)	

Figure 3: Response telegram "write data carrier" (telegram core)

****) Status number 00 $_{hex}$: No error**
02 $_{hex}$: Data carrier not in active range
(more status numbers see chapter 8)

4.2 Read operation

Command telegram (telegram core, PLC → CIA3SX, see also figure 4):

TL (read/write head address) (start address) (number of bytes user data)

Response telegram (telegram core, CIA3SX → PLC, see also figure 5 or figure 6):

There are two different possible responses for this command

1. RL (read/write head address) (start address) (number of bytes user data) (user data)

or

2. RF (read/write head address) (0,0) (status no.)

The response telegram RL (see also figure 5) means error-free reception of the data.

If it is not possible to read a data carrier, an RF response telegram is received (see also figure 6). The status number then indicates the cause of the error.

Byte No.	Description	Contents		
		ASCII	hex	decimal
0	Number of telegram bytes		07	7
1	Command	T	54	84
2	identification	L	4C	76
3	Read/write head address		01	1
4	Start address of		00	0
5	user data		00 ... 70	0 ... 112
6	Number of bytes of user data		01 ... 74	1 ... 116

Figure 4: Command telegram "read data carrier" (telegram core)

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		08 ... 7B	8 ... 123
1	Command	R	52	82
2	identification	L	4C	76
3	Read/write head address *)		01	1
4	Start address of		00	0
5	user data		00 ... 73	0 ... 115
6	Number of bytes of user data		01 ... 74	1 ... 116
7 ... 122	User data	ASCII or hex resp. BCD (code-transparent)		

Figure 5: Response telegram "read data carrier read/write" (telegram core)

Byte No.	Description	Contents ASCII	Contents hex	Contents Decimal
0	Number of telegram bytes		07	7
1	Command	R	52	82
2	identification	F	46	70
3	Read/write head address		01	1
4	Padding data		00	0
5			00	0
6	Status number		**)	

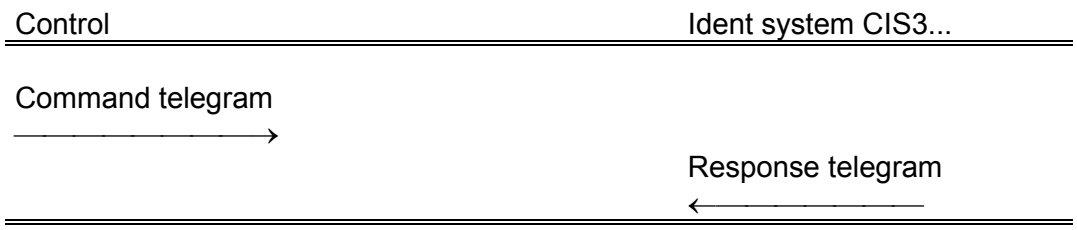
Figure 6: Response telegram "Read data carrier read/write (status)" (telegram core)

****) Status number** **02_{hex} : Data carrier not in active range**
(more status numbers see chapter 8)

5 Commands for reading the data carrier read-only

Read operations are always initiated by the host control (PC, PLC) with a "command telegram".

The ident system then sends a response telegram to the control.



IMPORTANT !!!

Please note:
The data carrier read-only contains a unique 5-byte serial number. This number is lasered-in during the production process of the data carrier and is stored absolutely indestructible. The serial number is used for secure distinction of every single data carrier. For this secure distinction it is necessary to evaluate all 5 bytes completely.

5.1 Read operation

Command telegram (telegram core, PLC → CIA3SX, see also figure 7):

TL (read/write head address) (start address) (number of bytes user data)

Response telegram (telegram core, CIA3SX → PLC, see also figure 8 or figure 9):

There are two different possible responses for this command

1. RL (read/write head address) (start address) (number of bytes user data) (user data)

or

2. RF (read/write head address) (0,0)(status no.)

The response telegram RL (see also figure 8) means error-free reception of the data.

If it is not possible to read a data carrier, an RF response telegram is received (see also figure 9). The status number then indicates the cause of the error.

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		07	7
1	Command	T	54	84
2	identification	L	4C	76
3	Read/write head address		01	1
4	Start address of		00	0
5	user data		00	0
6	Number of bytes of user data		05	5

Figure 7: Command telegram "read data carrier read-only" (telegram core)

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		0C	12
1	Command	R	52	82
2	identification	L	4C	76
3	Read/write head address		01	1
4	Start address of		00	0
5	user data		00	0
6	Number of bytes of user data		05	5
7 ... 11	User data	ASCII or hex resp. BCD (code-transparent)		

Figure 8: Response telegram "read data carrier read-only" (telegram core)

Byte No.	Description	Contents ASCII	Contents hex	Contents decimal
0	Number of telegram bytes		07	7
1	Command	R	52	82
2	identification	F	46	70
3	Read/write head address		01	1
4	Padding data		00	0
5			00	0
6	Status number		****)**	

Figure 9: Response telegram "Read data carrier read-only (status)" (telegram core)

****) Status number** **02_{hex}** **Data carrier not in active area**
(more status numbers see chapter 8)

5.2 Example, how to read a data carrier read-only

The DIP switch of the evaluation unit has to be set to data carrier read-only prior to power on (see chapter 2.4.1).

Data carrier no. 1 in active range:

Command telegram to read the data carrier read-only:

07	T	L	01	00	00	05

Response telegram:

12	R	L	01	00	00	05	X1	X2	X3	X4	X5

(X1 - X5 = data)

Data carrier no. 2 in active range:

Command telegram to read the data carrier read-only:

07	T	L	01	00	00	05

Response telegram:

12	R	L	01	00	00	05	X1	X2	X3	X4	X5

(X1 - X5 = data)

And so on...

6 Command overview

Description	Command telegram	Response telegram
Program data-carrier	(number of telegram bytes) **TP** (read/write head address) (start address) (number of bytes user data) (user data)	(number of telegram bytes) **RF** (read/write head address) (status no.)
Read data-carrier	(number of telegram bytes) **TL** (read/write head address) (start address) (number of bytes user data)	(number of telegram bytes) **RL** (read/write head address) (start address) (number of bytes user data) (user data) *or* (number of telegram bytes) **RF** (read/write head address) (status no.)

7 Status messages

00_{hex}: **No error**

02_{hex}: **Data carrier not in active range**

03_{hex}: **Read operation aborted**
or
Parity bit error for data carrier read-only

04_{hex}: **Error while programming or while check-reading the data carrier**

05_{hex}: **Write operation aborted.**
(Data carrier moved out of active range during write operation)

06_{hex}: **Write operation aborted.**
Start address or number of bytes is not a multiple of the block size "4"

07_{hex}: **Data carrier is out of active range (in TG mode only)**

16_{hex}: **Data length larger than 16 bytes**

18_{hex}: **Read attempt if EKS is set on data carrier read-only and data carrier read/write is inserted**

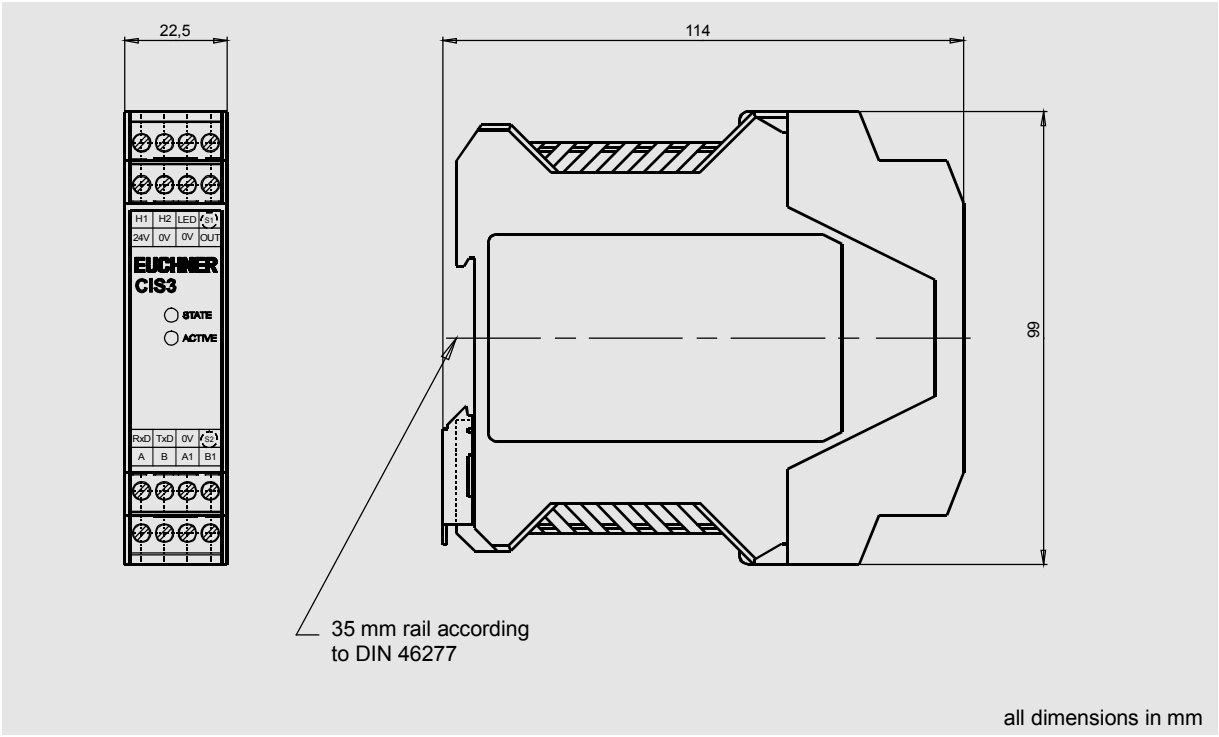
$1D_{hex}$: **Read operation of a data carrier read-only with a set "number of bytes user data" more than 5 bytes, or the start address of user data is ≠ byte 0**

$4X_{hex}$: **General error.**
Try once again to read or write the data carrier

42_{hex}: **Error during programming data carrier read/write.**
Data carrier in *read* range but not in *write* range

8 Technical data of the evaluation unit CIA3SX

Bestell-Nr.
077910



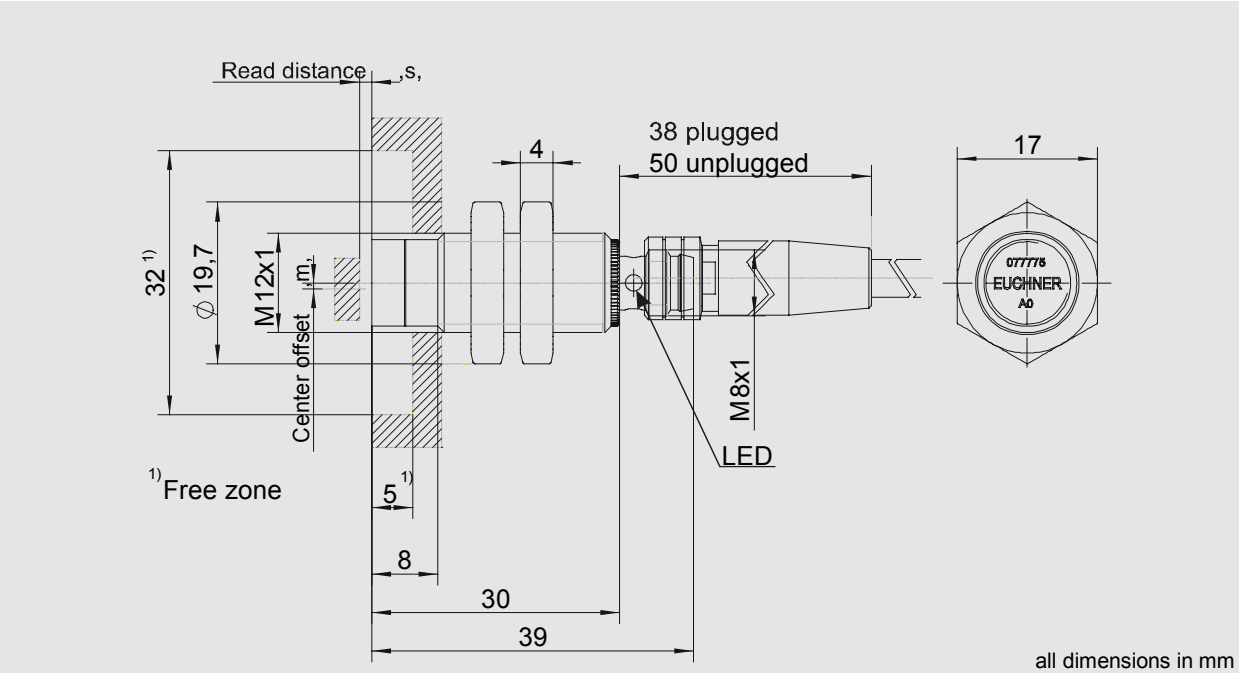
Technical data

Parameter	Value			Unit
	min.	nom.	max.	
Housing	Plastic (PA 6.6)			
Environmental protection	IP 20			
Operating temperature	0		+55	°C
Storage temperature	-25	-	+70	°C
Installation method	35 mm rail in accordance with DIN 46277			
Number of read/write heads	1 read/write head			
Connection type	Plug-in screw terminals			
Connection terminals	0,14	-	2,5	mm^2
Operating voltage U_B (regulated, residual ripple < 5%)	20	24	25	V=
Permanent power consumption (without load)	-	120	140	mA
Interface, data transfer				
Interface to the host control	serial RS232 / RS422 (selectable via DIP switch)			
Data transfer protocol	3964R			
Baud rate	9,6		28,8	kBaud
	(selectable via DIP switch)			
Data format	1 start bit, 8 data bits, 1 parity bit (even parity), 1 stop bit			
Cable length RS232			5	m
Cable length RS422			1000	m
LED indicators	STATE-LED green: “Power On" (in operation) ACTIVE-LED* yellow: "Data carrier active"			

* The ACTIVE-LED lits yellow, if an operating data carrier is in the active range

9 Technical data of the read/write head CIT3

Bestell-Nr.
077940



Technical data

Parameter	Value			Unit
	min.	nom.	max.	
Housing	Brass, nickel plated			
Environmental protection	IP 65			
Operating temperature	0		+50	°C
Storage temperature	-25		+70	°C
Installation method	non flush			
Operating voltage U_B	*via CIA3SX*			
Dynamic data transmission to CIA3SX		2		kBit/s
Connection	4-pole M8 plug connector (shielded)			
Cable length		5	15	m
LED indicators	ACTIVE-LED yellow: Data carrier active			

Notes on installation

- The length of the connection cable for the read head must not be increased (inline connection not permitted).

10 Parts list (overview)

CIS3A-Mini components

Article	Description	Cat. No.
Data carrier with 40 Bit fixed code memory	CIS3AP10D05KH040	077 865
Data carrier with 116 Byte EEPROM memory	CIS3APX10D05KH01K	077 785
Evaluation unit	CIA3SX1R1G08	077 910
Read/write head	CIT3ASX1N12ST	077 940
Connecting cable (2 m) (read/write head ⇔ evaluation unit)	LIYCY 4X0,25X02000-M8-1F Connecting cable 4-pole socket	084 641
Connecting cable (5 m) (read/write head ⇔ evaluation unit)	LIYCY 4X0,25X05000-M8-1F Connecting cable 4-pole socket	084 642
Connecting cable (10 m) (read/write head ⇔ evaluation unit)	LIYCY 4X0,25X10000-M8-1F Connecting cable 4-pole socket	084 643
Connecting cable (15 m) (read/write head ⇔ evaluation unit)	LIYCY 4X0,25X15000-M8-1F Connecting cable 4-pole socket	084 644

Software and Documentation for CIS3A-Mini

Article		Cat. No.
CIA3A-Mini manual		084 727
ActiveX-Module for Windows® applications		077 855

Bibliography

[1] SIEMENS **Manuals :**
Connection components for S7 controls

CP 340 Point-to-point-Communication
Installation and Parameter Assignment *SIEMENS-Order no.* 6ES7340-1AH00-8BA0

CP 341 Point-to-point-Communication
Installation and Parameter Assignment *SIEMENS-Order no.* 6ES7341-1AH00-8BA0

CP 441 Point-to-point-Communication
Installation and Parameter Assignment *SIEMENS-Order no.* 6ES7441-1AH00-8BA0