AK30
SINEC L2-DP

Operating Manual

Date:	11.03.1996
Document No.:	TR - EAK - BA - GB - 0002 - 08
Soft state:	
File name:	TR-EAK-BA-GB-0002.DOC
Author:	ZIH / MÜJ

TR - Electronic GmbH
Eglishalde 6
D-78647 Trossingen

Telephone 07425 / 228-0
Telefax 07425 / 228-33

Imprint

TR-Electronic GmbH
Post box 78639
Eglishalde 6
D-78647 Trossingen
☎Tel. (0049) 07425/228-0

Guarantee

The information contained in this document can be modified without previous notice.TR Electronic offers no guarantee of any type referring to this operating manual, including but not limited to the legal guarantees for usual commercial quality and capability for a certain scope.

Printing

This manual has been prepared by means of a text formatting software on a DOS personal computer. The text has been printed in Arial.

Notations

Cursive notation stands for the title of a document or is used to lay special emphasis on something.

Extra-bold letters stand for the title of a document or is used to lay special emphasis on something.

`Courier` notation shows text which is visible on the display as well as menu selections of software.

"< >" concerns keys on the keyboard of your computer (as e.g. <RETURN>).

Notice

Messages appearing after the symbol "NOTICE" are marking important characteristics of the product used.

Revision History

Note:
The cover of this document shows the current revision status and the corresponding date. Since each individual page has its own revision status and date in the footer, there may be different revision statuses within the document.

Document created: 06.07.1995

Revision	Date
New fax number for representation in Thailand	31.10.1995
Supplementation: SPC transient data for output on a TA-MINI	11.03.1996

Contents

1 General notes

This operating manual is intended to assist you during the installing and commissioning and to enable a fast configuration of your system by means of the programming software PC-AK. This software assists cassette versions 6.04 (T) or above.

If you have questions concerning the commissioning please contact our specialized personnel.
(See TR agencies listed on the last page)

Unless something else is agreed, the delivery specification includes the following:

- A German operating manual with first delivery, further manuals upon request
- Counterplugs according to design and number of measuring systems used
- 15 pole SUB-D connector for programming device upon request
- Caps for the mini-combicon connectors upon request

2 Instructions concerning project work and commissioning

2.1 Procedure for commissioning

1. Comparison of the order data with the data on the rating plate

2. Preparation of the connecting cables using the corresponding cable cross sections.

3. Please pay attention to the interference suppression measures and instructions concerning the shieldwire.

4. Assembly of axis cassette and the measuring systems used, taking into consideration the assembly instructions.

5. Programming of the axis and system parameters with the software supplied with, taking into consideration the commissioning instructions.

2.2 Safety instructions

This operating manual comprises notices which you have to respect for your personal safety as well as for avoiding material damage. The instructions stand out by means of a warning triangle and are represented as follows according to degree of exposure to danger:

Warning
means that death, serious bodily injury or considerable material damage may arise if the corresponding precautions are not taken.

Caution
means that a slight bodily injury or a material damage may arise if the corresponding precautions are not taken.

Commissioning and operation of an unit may be realized only by qualified personnel. Qualified personnel in the sense of the safety instructions contained in this operating manual are persons who are authorized to commission, connect to ground and to mark unit, systems and electric circuits according to the standard of the security technology.

2.3 Instructions concerning project work and installation

As the product is mostly a component of larger systems in its application, these instructions are meant to give guidelines for the safe integration of the product in its environment.

Warning

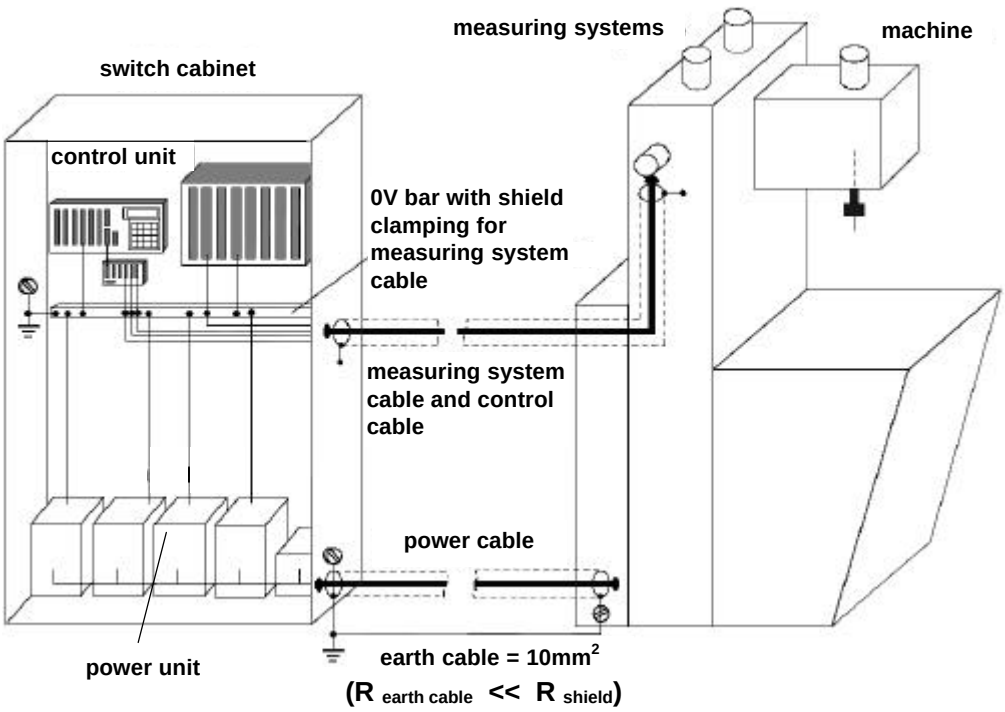
- The safety and accident prevention regulations valid for the specific case of use have to be observed.
- The EN (European Standards), VDE (Association of German Electricians) and DIN standards applying for your plant have to be observed.

2.4 Screening

The use of electronic sensor active systems in modern machines requires a consequently and correctly realized interference suppression and wiring concept.

The perfect functioning of a plant with electronic measuring systems and the cassette is guaranteed only under these conditions.

Recommendation for shield wiring



2.5 Instructions for project work

- Wire connecting line for axis cassette at a large distance, or separately from power lines loaded with interferences.
- Please use for data transmission a cable section of min. 0.22 mm².
- Cable section of earth cable with min. 10 mm² to avoid potential equalizing currents via the shield. In this connection please mind that the resistance of the earth cable has to be much smaller than that of the shield.
- Constant wiring of the shield, extensive rest on special shield connection terminals.

2.6 Instructions for commissioning

- Please carry out wiring works at the counter plug or in the switch cabinet only in dead condition.
- Before switching on the plant please check all connections from the counter plug to the switch cabinet.
- Remove or plug in counter plugs of signal or supply wires only in dead condition.
- Please do not carry out mechanical or electrical modifications at the axis cassette or the measuring systems.
- Commissioning according to safety instructions (page 4 and 5).

2.7 Operating notes:

- Include error bit of each axis into the safety concept by the electronic analysis.
- If one of the error LEDs lights the system must be switched off before entering the system.

3 Application of the component AK-30

The axis cassette AK-30 is an intelligent interface module to connect up to eight PNT measuring systems with the SINEC L2-DP.

AK-30 can be completely programmed with the software PC-AK. All parameters of the encoders are programmable with the SINEC L2-DP interface. User program, addressing of the memory, number of field bus axes and number of cam programs are set with the PC program.

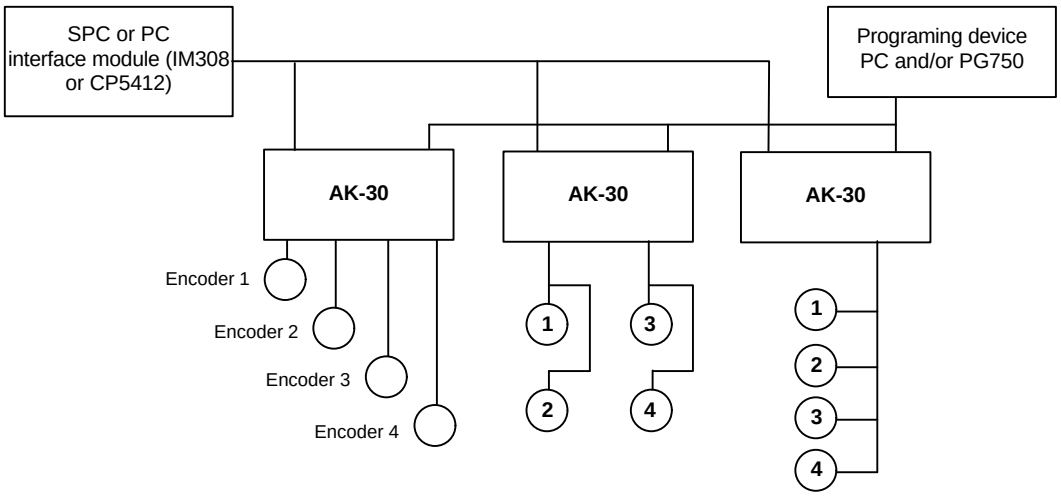
The delivery specification of the AK30 includes two internal user programs:

1. Axis control
2. Cam-switch

The function of the ***axis control*** is to record or control the actual values of the encoder and to transfer them to the SINEC bus. Up to 4 encoder values with 30 bit in binary code can be read out at the same time. Programming of the encoder enables any number of steps (fractions too) after which the encoder starts at 0 again.

The user program ***cam-switch*** offers the possibility to operate a 30 track cam switch. The maximum number of different switch points depends on the memory extension.
If only two encoders are used the axis cassette can be reconfigured in such a way that e.g. a 30 bit cam-switch each is realized on the axes 1 and 2, where the axes 3 and 4 work as listeners of the actual position of the axes one and two. This enable reading of the current actual positions additional to the cam switch points.

Principle of the bus structure and the measurement bus



Measurement bus PNT for linear-absolute encoders or absolute encoders

For the PNT bus system the sending cables and receiving cables are through-connected at the connectors of the encoders. Therefore an interconnection of several encoders at larger distances by means of a VT6 module (distributor for 6 encoders) is permitted to enable a connection to the cassette with one common cable (e.g. by a trailing cable).

System parameters

The programmed data are saved in the battery-buffered RAM of the AK-30 and permanently in the EEPROM.

During the programming the measurement parameters are stored in the data memory of the AK-30 and simultaneously transferred to the connected measuring system.

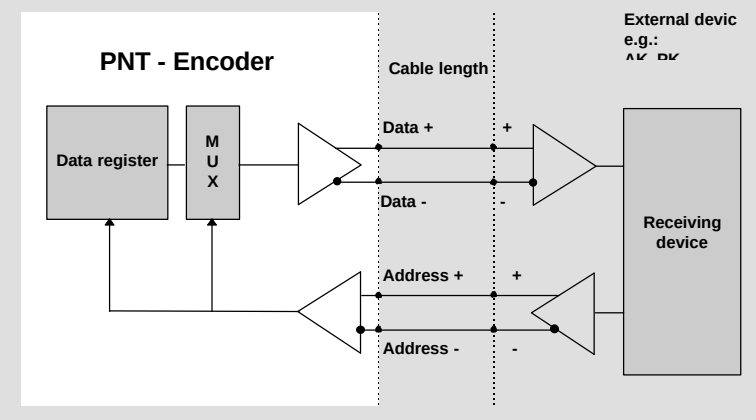
During the switch-on routine the identity of the stored parameters is checked (measuring system / AK-30) and an error message is generated in case of a deviation.

The encoders may also be programmed via the SINEC bus. A protocol with handshake is provided for that. The dialogue is described in chapter "Field bus SINEC L2-DP".

4 PNT Measuring system interface

The name of this interface derives from "**P**ROGRAMMABLE Encoder **N**E**T**". The ***PNT- Measuring system*** is programmed via the AK-30 by means of a PC or the SPC.

Block diagram



The PNT encoder enables the asynchronous data transmission with simultaneous high data integrity in a multiplexed RS422 bus with 2 data lines and 2 address lines. The connection of further cassettes to the same encoder is possible too (PNT/2; please request).

The interface works with parity check of the individual bytes and a check sum. The actual value inquiry enables a high data throughput (700µs per encoder for 307.2 kHz and 29 bit resolution of the encoder, cable length 200-800 m accord. to cross section).
This baud rate allows a favourable conventional wiring with twisted conductors. We recommend a screened cable for an interference-proof data transmission.

Encoder coding

When several encoders are connected a hardware or software coding of the encoders must to be set.
The hardware coding can be achieved directly at the installation place with the corresponding bridges in the counterplug of the encoder.
Encoders equipped with the 8 pole Harting connector cannot be numbered in the counterplug. They can be programmed with the software PC-AK or optionally with a coding per dip switch incorporated in the encoder. Access to this switch is possible by a small screw cap. If there are software and hardware codings the latter has priority.

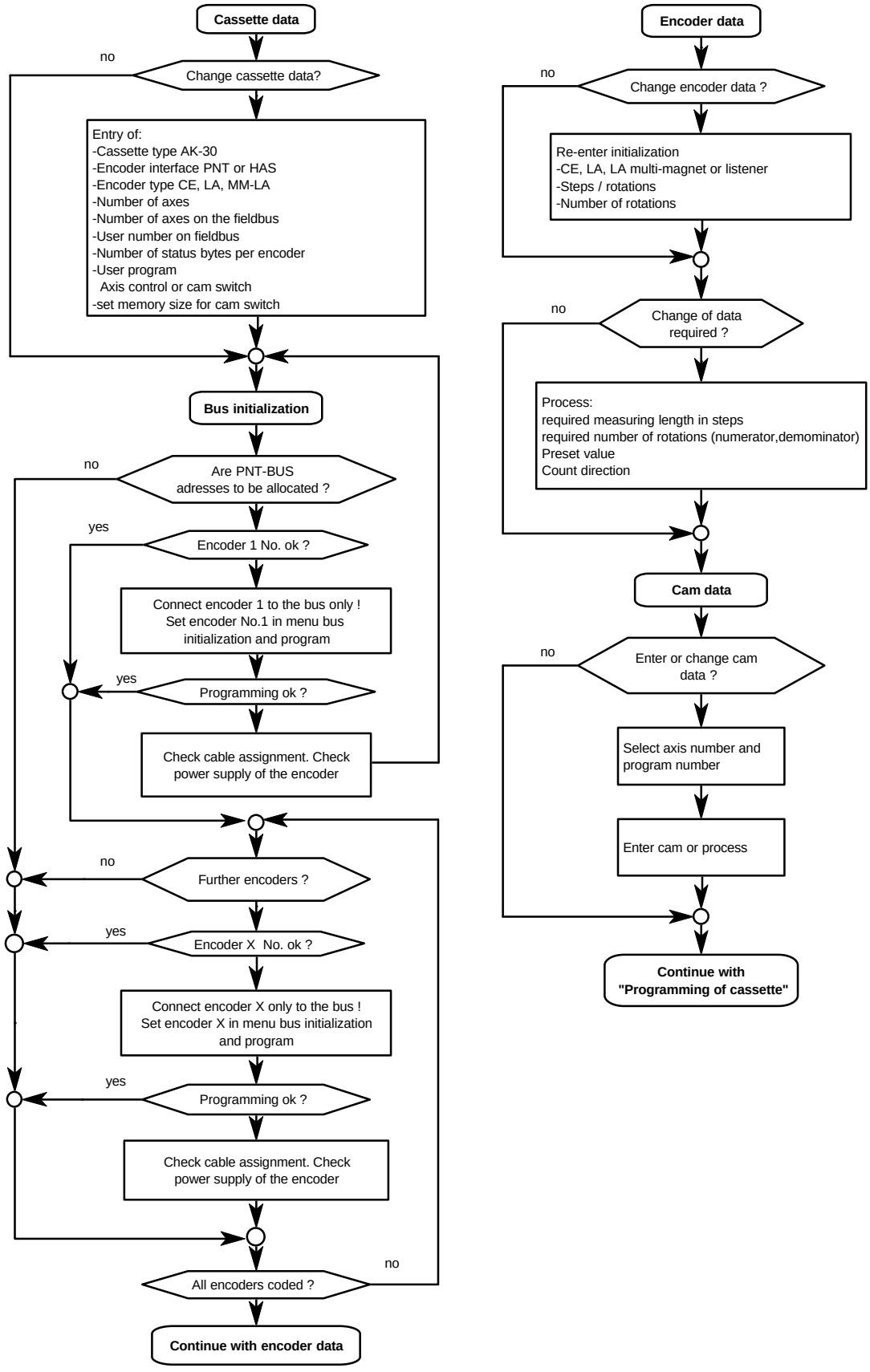
Preset input

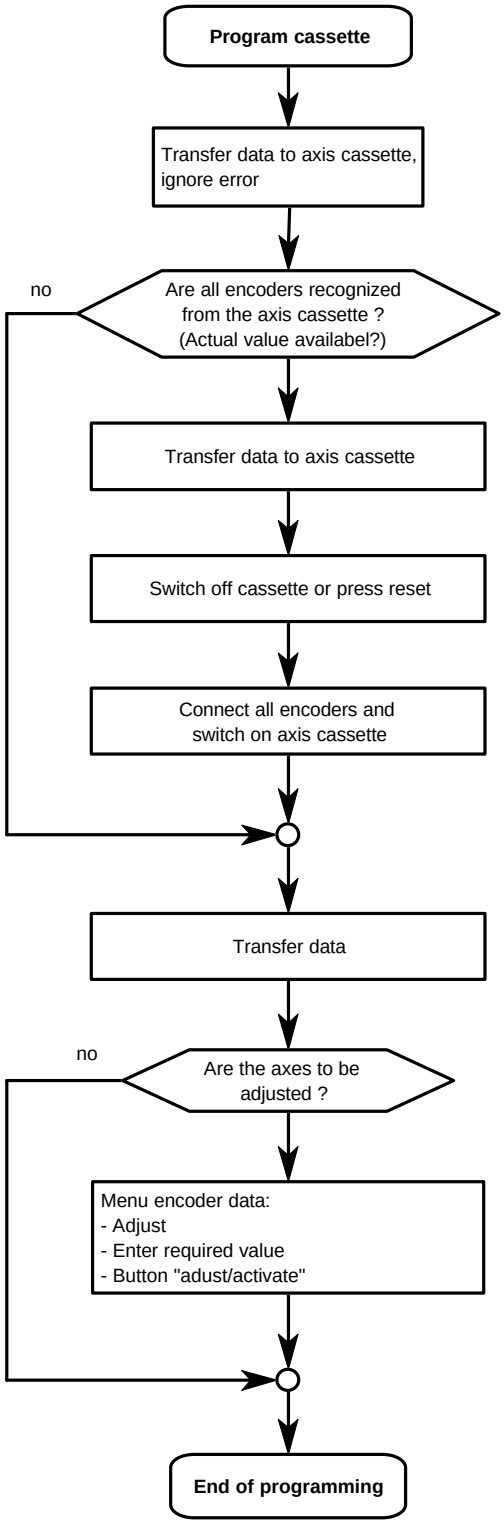
A preset is performed if a voltage of > 11 V is applied for approx. 10 ms at the respective preset input of the AK-30 for the encoders 1..4. The encoder is then set to the programmed preset value.

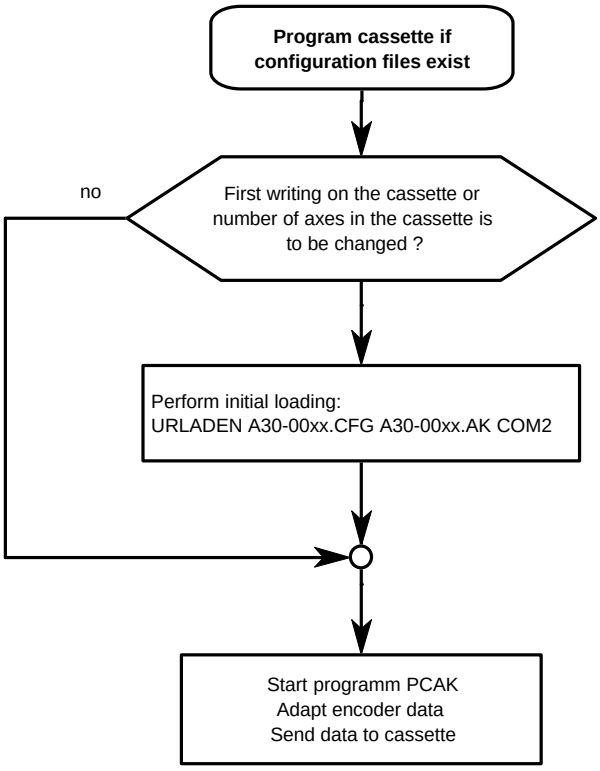
Warning

If the encoders are used in conjunction with the cassettes AKxx or PKxx, the external preset inputs at the encoder must only be used for devices with a delivery date starting 1995. The preset inputs at the axis cassette can be used instead.

5 Programming of the cassettes (flow charts)




Program cassette
Transfer data to axis cassette, ignore error
no
Are all encoders recognized from the axis cassette ? (Actual value availabel?)
Transfer data to axis cassette
Switch off cassette or press reset
Connect all encoders and switch on axis cassette
Transfer data
no
Are the axes to be adjusted ?
Menu encoder data:
- Adjust
- Enter required value
- Button "adust/activate"
End of programming


Program cassette if configuration files exist
no
First writing on the cassette or number of axes in the cassette is to be changed ?
Perform initial loading:
URLADEN A30-00xx.CFG A30-00xx.AK COM2
Start programm PCAK
Adapt encoder data
Send data to cassette

6 Fieldbus SINEC L2-DP

6.1 Description of the SINEC L2-DP interface

Data transmission is realized via a BUS activation accord. to RS485 with Siemens controllers and supports baud rates from 9.6 to 1500 kBaud. The data protocol guarantees an easy installation in the SINEC fieldbus and offers programming possibilities for the encoder settings and cams. The bus connectors with switchable load resistance are available from Siemens.

AK30 has a self-configuration according to the total numbers of axes. If listeners are used the number of axes inevitably does not correspond with the number of encoders. A listeners offers the possibility to transfer the actual value from a cam switch to the fieldbus.

As standard 1- 4 measuring systems are supported. An extension up to 8 systems is possible if necessary. The format of the data output via the SINEC bus is identical for the user programs axis control and cam-switch. The useful data in the first case are binary encoder values and in the other case cam pattern of 30 cam tracks.

For the actual value transmission 4 (or 2) bytes are assigned to each axis, which are transmitted consistently. They are entered in the user capability part of the fieldbus protocol. The total number of input bytes to be transmitted automatically depends on the programmed number of axes. The error bit indicates whether the actual value could be determined correctly.
If the encoders or the preset value should not be programmed via the fieldbus, the 6 output bytes of the programming message may be reduced by 4. The remaining 2 byte control the special commands (error acknowledgement).

The cassette supports the protocol "DP up to version 3.x". One entry per each axis which is read-in, is made in the configuration mask of a IM308. If 2 byte per axis are required, the identification 76 is to be entered. 77 must be entered as identification for 4 byte. If the cassette is configured with the PCAK software to "4 byte without programming ", identification 17 must be entered twice in the configuration mask. In case of "4 byte with programming " identification 17 must be entered six times. The used identifications guarantee the data consistency.

In order to recognize and acknowledge errors a special command is used. Special commands do not interrupt the recording of the actual value. As soon as the highest bit is set in the command number, the requested error status in the diagnosis telegram is transmitted to the control. The manual of the SINEC interface modules show examples for the read-in of the diagnosis. In the standard version the complete diagnosis consists of 8 data words. They are read via a word address in conjunction with a transfer command. The diagnosis for the interface modules is in the third and fourth word according to DP-standard (see page 15) and indicates a detailed error message. The error numbers are listed in the appendix.

Note:
Due to the addressing with the INTEL addressing procedure attention must be paid to the exchange of high or low byte within one word in the error number when interpreting the error message.

6.2 Dialogue to the axis cassette with handshake

Address assignment for the programming dialogue and the actual values

The receiving data contain in direct sequence the actual values according to number of used axes and number of byte per axes. The data of axis 1 in the cassette are entered first, the data of the highest axis number are entered last. For the most controls an exchanging of high and low byte within a word address must be considered. In the COM ET200 configuration mask the identification 77 will be entered for each axis, if 4 byte (2 words) per axis are received and identification 76 in case of 2 byte per encoder.

Adr. offset Word addressing	Adr. offset Byte addressing	Axis no.	Status bytes	Identification ET200 Configuration mask
0	0	**1**	Most significant byte	77
	1			
1	2			
	3		Low significant byte	
		Axis no.		
2	4	**2**	Most significant byte	77
	5			
3	6			
	7		Low significant byte	
		Axis no.		
4	8	**3**	Most significant byte	77
	9			
5	10			
	11		Low significant byte	
		Axis no.		
6	12	**4**	Most significant byte	77
	13			
7	14			
	15		Low significant byte	

The SINEC master module interface in your control sends the "programming data" (see page 22, control register) to the cassette in each inquiry. The error acknowledgement by means of the special commands requires the first two bytes only. If, however, the encoder shall be reprogrammed from the SPC (e.g. if the encoder is changed) or if a preset is to be carried out, then 6 programming bytes must be used. This setting whether with or without programming, can be done under the fieldbus options (cassette data, fieldbus options). In the COM ET200 configuration mask 17 is entered for each byte which is sent to the cassette. It is changed into 8DA after transfer.

Word No.	Byte No.		Identification ET200 Configuration mask
0	0	Axis number	17
	1	Command number	17
1	2	Data most significant byte	17
	3	Data	17
2	4	Data	17
	5	Data low significant byte	17

The SPC shows the answering axis in the field "axis number". If it concerns a programming command (bit special command=0), the answer is then shown by the status byte of the respective axis. The activated axis responds with its own 4 [2]* byte-field in the user capability. The highest bit of the command number set (handshake bit) declare the data to be valid. The programming answers reflect the first 24 [8]* data bit and the command number. The reflected data can be used to check the programming (see page 22, 23).
Error inquiries are activated by a special command. The transmission of actual values is not interrupted by this. The error answer can be find in the interface diagnosis (see page 15, error inquiry).

* for 2 byte per axis

6.3 Configuration parameter for COM ET200 mask entry

The cassette uses the profibus protocol "DP up to version 3.x". The following settings are recommended for the system parameter:

PLC-Parameter:
- Response monitoring **J**
- Acknowledge delay for stations failure **N**
- Diagnosis **J**

The other parameters can be adapted to the respective requirements.

In the entry mask for ***Configuration*** the proposed station type is kept to ET200U, the start addresses are determined and the cassette is defined according to the number of axes and the number of programming bytes.

The possible identifications have the following meaning:
76 for an encoder with 2 byte transmission (14 bit actual value, 1 error bit, 1 programming bit)
77 for an encoder with 4 byte transmission (30 bit actual value, 1 error bit, 1 programming bit)
17 for one byte of the control register.

Examples

1. The following example shows the mask for a cassette with 2 axes à 2 byte and the fieldbus option "without programming".

0.	1.	2.	3.	4.	5.	6.	7.
76	**76**	**17**	**17**				
8.	9.	10.	11.	12.	13.	14.	15.
16.	17.	18.	19.	20.	21.	22.	23.
24.	25.	26.	27.	28.	29.	30.	31.

2. In this example 7 axes à 4 byte with programming are required. The zeros on place 13 are filled in automatically.

0.	1.	2.	3.	4.	5.	6.	7.
77	**77**	**77**	**77**	**77**	**77**	**77**	**17**
8.	9.	10.	11.	12.	13.	14.	15.
17	**17**	**17**	**17**	**17**	**000**		
16.	17.	18.	19.	20.	21.	22.	23.
24.	25.	26.	27.	28.	29.	30.	31.

6.4 Error inquiry and error acknowledgement

An axis reports an important error with the set error bit (second highest bit in the status). The tolerance for the number of measuring error was exceeded. Up to eight errors are stored in each axis and can be called. The most recent error is reported first.

The errors are acknowledged while reading out of the cassette and deleted from the error buffer. The error LED of the axis concerned goes off as soon as the buffer is empty.

The SPC performs an error inquiry as follows:

-Define the axis number in the control register (byte offset = +0)
-Set the following bits in the control register

Programming mode	1000 0000
Special command	0100 0000
Error inquiry	0000 0001

Word No.	Byte No.		Reading error of axis 2
0	0	Axis number	02
	1	Command number	C1
1	2	Data most significant byte	XX
	3	Data	XX
2	4	Data	XX
	5	Data low significant byte	XX

In the cassette the single transmission of an error pair to the SINEC master is released by the positive edge on the bit ***programming operation***. Therefore this bit must be set only after all other data have been entered correctly. The information read by the cassette is provided under the diagnosis address.

Under the diagnosis address for a bus user only one word information can be read. As the complete information is more extensive, SPC program has to enter first under the diagnosis address which word is to be indicated. The 4 bytes of the interface diagnosis are within the complete diagnosis information. The interface diagnosis contains the error information of the cassette:

Byte	Interface diagnosis	
0	Axis number (0 - 8)	
1	static readiness for operation	2^0 = position bounces or is missing 2^1 = Data difference to the encoder 2^3 = LA at the end of the measurement or below 0
2	Main error number	corresponds to an accumulative error number
3	Single error number	detailed error cause within the accumulative error

The interface diagnosis is in the diagnosis message (setting accord. to DP-standard) under the following addresses:

Word address		
0		
1		
2		
3		
4		Axis number
5	static readiness for operation	Main error number
6	Single error number	
7		
8		

With the following illustrative program the interface diagnosis can be read by the SPC program. The diagnosis address 252 and the station number 3 is assumed.

```
L  KY 3,4
T  PW 252
L  PW 252
T  MW 100          ;axis number

L  KY 3,5
T  PW 252
L  PW 252
T  MW 101          ;Static readiness for operation and main error number

L  KY 3,6
T  PW 252
L  PW 252
T  MW 102          ;Single error number
```

By means of the reported axis number it can be determined whether the axis cassette did already answer, because the requested axis answers with the same number. As soon as main error number and single error number became zero, the error buffer is empty and the error LEDs stop lightning. If the same error number is read twice, the error could not be acknowledged. This is the case if e.g. the encoder has been changed and therefore the data of the encoder do not correspond to the data stored in the cassette.

Special errors are generated if an error cannot be assigned clearly to an axis number. There is no status bit for **special errors** to report the occurrence of an error to the SPC. The yellow error LED shows them optically. The special error messages are requested with axis number 0 in the control register.

The error messages of the cassette less relevant for the position recording do not lead to an error bit set in the status register (e.g. by warnings). Nevertheless the corresponding error LED lights at the cassette. Therefore it is recommended to perform the special error inquiry in the background, e.g. at an interval of 1 to 10 seconds, even when the error bit is not set.

Checked and correct position values are recorded on the SINEC bus only unless the error bit is set. If the error bit is set the corresponding axis must be stopped.

6.5 SPC transient data for output on a display

Information in binary format can be transmitted to the AK-30 via the output registers of the SPC or indicated on the slave display TA-MINI (Monitor). The following range can be indicated
- 99 999 to + 999 999. Negative values are indicated with a sign in the most significant place (= 2^{23}). If this bit is set the value will be indicated as a negative value. The resulting hexadecimal range of value is 81869F (- 99 999) to 0F423F (+ 999 999). The last 6 digits are displayed only if this range will be exceeded.

For each axis, which has been defined in the PC-AK program for the output of external fieldbus data, 3 bytes must be reserved in the COM ET200 input mask for the output of the display value. This is realized by the entry of three identifications "17" each in the configuration list of the ET200. They are always added to the existing fields for the error transmission (2 bytes) and the programming (4 bytes). The entry starts with the lowest axis number. Up to eight axes can be defined for the output of external fieldbus data.

Register structure for external fieldbus data:

most significant byte																**lowest significant byte**							
2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
VZ	X	X	X	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx	Dx

VZ = sign bit (1=negative output, 0=positive output); X = can be assigned to data, but is an overload; DX = the value to be transmitted from the SPC to the AK30 in binary format

6.5.1 COM ET200 configuarion mask

The usable identifications have the following meaning:
76 for an encoder with 2 byte transmission (14 Bit actual value, 1 error bit, 1 programming bit)
77 for an encoder with 4 byte transmission (30 Bit actual value, 1 error bit, 1 programming bit)
17 for one byte of the control register.

Examples

1. The following example shows the mask for a cassette with 2 axes à 2 byte and the fieldbus option "without programming". In addition 3 axes shall transmitt external fieldbus data to a display. The zeros on place 13 are filled in automatically.

0.	1.	2.	3.	4.	5.	6.	7.
76	**76**	**17**	**17**	**17**	**17**	**17**	**17**
8.	9.	10.	11.	12.	13.	14.	15.
17	**17**	**17**	**17**	**17**	**000**		
16.	17.	18.	19.	20.	21.	22.	23.
24.	25.	26.	27.	28.	29.	30.	31.

The bytes of the SPC to be transmitted to the cassette consist of the following:

Word No.	Byte No.									Identification ET200 Configuration mask
0	0	Axis number	**-**	**-**	**-**	2^4	2^3	2^2	2^1	2^0	17
	1	Command number	X	X	X	2^4	2^3	2^2	2^1	2^0	17
1	2	Monitor-Data most significant byte	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
	3	Monitor-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
2	4	Monitor-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17
	5	Monitor-Data most significant byte	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
3	6	Monitor-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
	7	Monitor-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17
4	8	Monitor-Data most significant byte	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
	9	Monitor-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
5	10	Monitor-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17
	11	zeros are filled in automatically									0

2. In this example 2 axes à 4 byte "with programming" are required. In addition 2 axes shall transmitt external fieldbus data to a display.

0. **77**	1. **77**	2. **17**	3. **17**	4. **17**	5. **17**	6. **17**	7. **17**
8. **17**	9. **17**	10. **17**	11. **17**	12. **17**	13. **17**	14.	15.
16.	17.	18.	19.	20.	21.	22.	23.
24.	25.	26.	27.	28.	29.	30.	31.

The bytes of the SPC to be transmitted to the cassette consist of the following:

Word No.	Byte No.									Identification ET200 Configuration mask
0	0	Axis number	**-**	**-**	**-**	2^4	2^3	2^2	2^1	2^0	17
	1	Command number	X	X	X	2^4	2^3	2^2	2^1	2^0	17
1	2	Programming-Data most significant byte	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}	17
	3	Programming-Data	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
2	4	Programming-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
	5	Programming-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17
3	6	Monitor-Data most significant byte	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
	7	Monitor-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
4	8	Monitor-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17
	9	Monitor-Data most significant byte	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	17
5	10	Monitor-Data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	17
	11	Monitor-Data least significant byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	17

Notice:

corresponds to status register (AK)

corresponds to control register (AK)

corresponds to output register (AK)

The external fieldbus data (transient value for the monitor) are in the output register. If the axes 2 and 5 are defined for the external fieldbus data in the PCAK program, the data for the least significant axis (2) must be indicated first in the output register and then the data of the next higher axis (5).

6.5.2 Cassette configuration for the output of external fieldbus data in the PCAK program

Settings refer to the first example in chapter
"COM ET200 Configuration mask"

It is assumed that the encoders are connected to axis 1 and 2 (fieldbus axes) of the cassette. The axes 3 to 5 should be used for the external field bus data.

- Load configuration: File name.cfg / 5 axes axis control /TA-MINI
- Define type of encoder for axis 1 and 2: rotary encoder/linear encoder
- Define axis 3 to 5 as listener (equal to encoder type *no own encoder*), e.g. for axis no. 1. This setting is absolutely necessary as by this the cassette will search an encoder for these axis numbers.
- For the setting of the external monitors *no display (none)* or the *encoder position* can be defined for the axes 1 to 2.
  For the axes 3 to 5 the setting *fieldbus data* must be defined.
- Set the number of field bus axes below the option *Field bus* to 2
  Mark *1 word/axis without programming*. This setting is equal to one encoder with 2 byte transmission (Singleturn) without programming. Assign number 3 to 124 for station address.
- Activate the function *SEND DATA TO AK* in the menu *COMMUNICATION*.

Notice:

A coding (binary) according to the axis number must be carried out at the connecter of the TA-MINI (slave display) (see also chapter pin assignment: ***Connector of the serial interfaces***).

6.6 SINEC L2-DP programming commands

6.6.1 Encoder parameterization by SINEC L2-DP

The following parameters of PNT encoders can be programmed directly from an axis cassette by means of the user software PC-AK on a PC or by the SINEC bus:

- direction of rotation, - preset adjustment
- measuring length in steps - measuring length in turns,

Additionally to this the original resolution per rotation and the number of physical resolvable turns can be read out directly. After switching on the cassette compares these values with the programmable parameters in the encoder. Programming of the encoders takes place by sending all parameters to the cassette. The data are transferred with the command "program encoder " (see chapter "Implemented programming commands for SINEC bus").

Programming mode
The programming mode can be used for commissioning, replacement of an encoder and to perform a preset. Bit 39 is to be set in the control register after the correct application of all programming data to activate the programming mode. More details about the handshake can be found on page 25. The message "Data difference" in the static readiness can be deleted only by reprogramming of the encoder.

Normal mode
In normal mode the status register is read. Programming commands are not executed. The 32 bit information contains 30 bit for the actual value or the cam data, one error bit and one bit for the differentiation between normal and programming mode. If the error bit is set the error LED of the corresponding axis lights. The error number can be read by means of the special commands and also acknowledged. The error LED goes off after all errors have been acknowledged.

Programming commands
Programming of the connected encoders and the cam switch points is enabled with these commands. Transmission of the commands is controlled by the handshake bit 39 in the control register of the SPC program. No actual values or cams of the activated axis can be transferred while a command is performed, as the programming data are sent back (reflected) to the SPC for test reasons.

Example of a programming command

Preset of axis 1 to the value 3E6 HEX (=1000)

Control register	
01 00 00 00 03 E6	SPC prepares data
01 A6 00 00 03 E6	Validate preset function
01 A6 00 00 03 E6	SPC waits for execution
01 00 00 00 03 E6	Reset command request
01 00 00 00 03 E6	Wait for acknowledgement of reset by AK

Status register of axis 1	
00 01 7E 55	Actual value display
00 01 7E 57	Actual value display
A6 00 03 E6	Command was recognized and executed
A6 00 03 E6	Wait for reset of command request
00 00 03 E6	Back to actual value display after reset of handshake bit

Special commands

Contrary to the programming commands the special commands are not set back. Special commands do not have a numbering! Each bit set marks a special command to be performed. All marked special commands are executed immediately. The special command bits 2^1 to 2^4 are not used at the moment.

The following special commands are possible at the moment:

Fetch and acknowledge axis error (indicate axis number, error inquiry set)
Fetch and acknowledge cassette error (set axis number to 0, , error inquiry set)
Perform selection of preset 1 or 2 for initiator input.

The error bit is reset after all errors of the axis concerned could be acknowledged.

Special commands are activated by setting the special command bit. The command byte has the format shown in the table below:
The result of the error inquiry is entered in the diagnosis message.

The division of the command number by bits shown in the table below is valid for special commands. All set commands are executed simultaneously.

	Handshake 0 = Normal mode 1 = Programming mode	Special commands 0 = inactive 1 = active	Preset selection 0 = Preset 1 1 = Preset 2	-	-	-	-	Send an error message to the component diagnosis 0 = no 1 = yes
	1	1	X	0	0	0	0	X
Bit	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Notice:

When switching between preset 1 and 2, the actual status of the bit "preset section" must always be transferred too for error inquiries.

Example of a special command

Error reading in axis 1

Control register

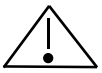
01 61 xx xx xx xx	SPC prepares data
01 E1 xx xx xx xx	Error reading function valid
01 E1 xx xx xx xx	SPC waits for an execution
01 E1 xx xx xx xx	Wait until diagnosis is received
01 00 xx xx xx xx	Reset command request
To reset error bit:	
01 E1 xx xx xx xx	Error reading function valid
01 E1 xx xx xx xx	SPC waits for an execution
01 E1 xx xx xx xx	Wait until diagnosis is received
01 00 xx xx xx xx	Reset command request

Status register of axis 1

40 01 7E 55	Actual value display shows an error
40 01 7E 55	Actual value display
40 01 7E 56	Actual value display
40 01 7E 57	Error message is entered into the component diagnosis (e.g. 03/05) entered--> Component diagnosis = 01 01 03 05
40 01 7E 58	Actual value display shows further errors
40 01 7E 55	Actual value display
40 01 7E 56	Actual value display
40 01 7E 57	Error message is entered into component diagnosis (e.g. 00/00) entered--> Component diagnosis = 01 00 00 00
00 01 7E 58	Reset error bit as error buffer is empty
00 01 7E 58	Actual value display

Byte	Bit no	**Control register** Programming-telegram to AK30
	47	-
	46	-
	45	-
+ 0	44	Axis number 2^4
	43	Axis number 2^3
	42	Axis number 2^2
	41	Axis number 2^1
	40	Axis number 2^0
	39	0=Normal mode 1=Programming mode
	38	0=Command no. 01-1F 1=Special commands
	37	0 = Read 1 = Write
+ 1	36	Command number 2^4
	35	Command number 2^3
	34	Command number 2^2
	33	Command number 2^1
	32	Command number 2^0
	31	Programming data 2^{31}
	30	Programming data 2^{30}
	29	Programming data 2^{29}
+ 2	28	Programming data 2^{28}
	27	Programming data 2^{27}
	26	Programming data 2^{26}
	25	Programming data 2^{25}
	24	Programming data 2^{24}
	23	Programming data 2^{23}
	22	Programming data 2^{22}
	21	Programming data 2^{21}
+ 3	20	Programming data 2^{20}
	19	Programming data 2^{19}
	18	Programming data 2^{18}
	17	Programming data 2^{17}
	16	Programming data 2^{16}
	15	Programming data 2^{15}
	14	Programming data 2^{14}
	13	Programming data 2^{13}
+ 4	12	Programming data 2^{12}
	11	Programming data 2^{11}
	10	Programming data 2^{10}
	9	Programming data 2^9
	8	Programming data 2^8
	7	Programming data 2^7
	6	Programming data 2^6
	5	Programming data 2^5
+ 5	4	Programming data 2^4
	3	Programming data 2^3
	2	Programming data 2^2
	1	Programming data 2^1
	0	Programming data 2^0

Bit no	**Status register** Acknowledgement from AK30 (1x per axis) 4 byte per axis Reply programming telegram	Actual value display axis control	Cam switch
31	**1=Programming mode**	**0=Normal mode**	**0=Normal mode**
30	0 = Programming ok 1 = Error	0 = Encoder ok 1 = Error	0 = Encoder ok 1 = Error
29	0 = Read 1 = Write	Actual position 2^{29}	Track 30
28	Command number 2^4	Actual position 2^{28}	Track 29
27	Command number 2^3	Actual position 2^{27}	Track 28
26	Command number 2^2	Actual position 2^{26}	Track 27
25	Command number 2^1	Actual position 2^{25}	Track 26
24	Command number 2^0	Actual position 2^{24}	Track 25
23	Programming data 2^{23}	Actual position 2^{23}	Track 24
22	Programming data 2^{22}	Actual position 2^{22}	Track 23
21	Programming data 2^{21}	Actual position 2^{21}	Track 22
20	Programming data 2^{20}	Actual position 2^{20}	Track 21
19	Programming data 2^{19}	Actual position 2^{19}	Track 20
18	Programming data 2^{18}	Actual position 2^{18}	Track 19
17	Programming data 2^{17}	Actual position 2^{17}	Track 18
16	Programming data 2^{16}	Actual position 2^{16}	Track 17
15	Programming data 2^{15}	Actual position 2^{15}	Track 16
14	Programming data 2^{14}	Actual position 2^{14}	Track 15
13	Programming data 2^{13}	Actual position 2^{13}	Track 14
12	Programming data 2^{12}	Actual position 2^{12}	Track 13
11	Programming data 2^{11}	Actual position 2^{11}	Track 12
10	Programming data 2^{10}	Actual position 2^{10}	Track 11
9	Programming data 2^9	Actual position 2^9	Track 10
8	Programming data 2^8	Actual position 2^8	Track 9
7	Programming data 2^7	Actual position 2^7	Track 8
6	Programming data 2^6	Actual position 2^6	Track 7
5	Programming data 2^5	Actual position 2^5	Track 6
4	Programming data 2^4	Actual position 2^4	Track 5
3	Programming data 2^3	Actual position 2^3	Track 4
2	Programming data 2^2	Actual position 2^2	Track 3
1	Programming data 2^1	Actual position 2^1	Track 2
0	Programming data 2^0	Actual position 2^0	Track 1



Notice:
The data bytes read back are output in the SPC interchanged word by word

The bytes +2, +3, +4, and +5 in the control register are only available if 4 Bytes "with programming" were defined in the field bus options.
This is necessary if commands of the list of the implemented programming commands are required (e.g. preset)).
Otherwise only the special commands are available.

Byte	Bit no	**Control-Register** Programming telegram to AK30
+ 0	47	-
	46	-
	45	-
	44	Axis number 2^4
	43	Axis number 2^3
	42	Axis number 2^2
	41	Axis number 2^1
	40	Axis number 2^0
+ 1	39	0=Normal mode 1=Programming mode
	38	0=Command no. 01-1F 1=Special commands
	37	0 = Read 1 = Write
	36	Command number 2^4
	35	Command number 2^3
	34	Command number 2^2
	33	Command number 2^1
	32	Command number 2^0
+ 2	31	Programming data 2^{31}
	30	Programming data 2^{30}
	29	Programming data 2^{29}
	28	Programming data 2^{28}
	27	Programming data 2^{27}
	26	Programming data 2^{26}
	25	Programming data 2^{25}
	24	Programming data 2^{24}
+ 3	23	Programming data 2^{23}
	22	Programming data 2^{22}
	21	Programming data 2^{21}
	20	Programming data 2^{20}
	19	Programming data 2^{19}
	18	Programming data 2^{18}
	17	Programming data 2^{17}
	16	Programming data 2^{16}
+ 4	15	Programming data 2^{15}
	14	Programming data 2^{14}
	13	Programming data 2^{13}
	12	Programming data 2^{12}
	11	Programming data 2^{11}
	10	Programming data 2^{10}
	9	Programming data 2^9
	8	Programming data 2^8
+ 5	7	Programming data 2^7
	6	Programming data 2^6
	5	Programming data 2^5
	4	Programming data 2^4
	3	Programming data 2^3
	2	Programming data 2^2
	1	Programming data 2^1
	0	Programming data 2^0

Bit no	**Status-Register** Acknowledgement from AK30 (1x per axis) 2 byte per axis Reply programming telegram	Actual value display Axis control	Cam-switch
15	**1=Programming mode**	**0=Normal mode**	**0=Normal mode**
14	0 = Programming ok 1 = Error	0 = Encoder ok 1 = Error	0 = Encoder ok 1 = Error
13	0 = Read 1 = Write	Actual position 2^{13}	Track 14
12	Command number 2^4	Actual position 2^{12}	Track 13
11	Command number 2^3	Actual position 2^{11}	Track 12
10	Command number 2^2	Actual position 2^{10}	Track 11
9	Command number 2^1	Actual position 2^9	Track 10
8	Command number 2^0	Actual position 2^8	Track 9
7	Programming data 2^7	Actual position 2^7	Track 8
6	Programming data 2^6	Actual position 2^6	Track 7
5	Programming data 2^5	Actual position 2^5	Track 6
4	Programming data 2^4	Actual position 2^4	Track 5
3	Programming data 2^3	Actual position 2^3	Track 4
2	Programming data 2^2	Actual position 2^2	Track 3
1	Programming data 2^1	Actual position 2^1	Track 2
0	Programming data 2^0	Actual position 2^0	Track 1

The status informationen can only be requested as 16 bit value if:

- all axes of this cassette require at least 14 bit to represent the actual value or the cam information.

The bytes +2, +3, +4, and +5 in the control register are only available if 4 byte "with programming" were defined in the field bus options.
This is necessary if commands of the list of the implemented programming commands are required (e.g. preset).
Otherwise only the special commands are available.

6.7 Implemented programming commands for SINEC bus

Command-no. for progr.	Write command	Read command	Data
1	Rotational direction of the encoder	Rotational direction of the encoder	0= clockwise incrementaling direction of rotation 1= counterclockwise incrementaling direction of rotation
2	Measuring length in steps -1	Measuring length in steps -1	17 to 2^{24} -1 via SINEC L2-DP 17 to 2^{28} via PC
3	Measuring length rotations numerator	Measuring length rotations numerator	1 - 4088, and 4096
4	Preset value 1	Preset value 1	max. measuring length in steps -1. The pre-programmed value is taken over with positive edge at the preset input. Condition: Select preset 1 via special command
5	Preset value 2	Preset value 2	max. measuring length in steps -1. The pre-programmed value is taken over with positive edge at the preset input. Condition: Select preset 2 via special command
6	Preset adjustment	Error request / acknowledge (only independent of the axis, that means special error) The error request empties the special error buffer. The most recent error is sent back first.	Write: max. measuring length -1 2. Byte always 0 3. Byte main error of the special error 4. Byte single error number
7	Listening function, encoder type and encoder interface	Listening function, encoder type and encoder interface	2. Progr. byte listener function 0 = no listener 1..4 = listener for axis 1 - 4 3. Progr. byte parameter encoder type 0 = encoder 1 = LA 4. Progr. byte parameter encoder interface 0 = PNT 2 = HAS
8	Programming of encoder number (effects a data transfer in the encoder)	-	Write: Hex 20 as collective address (connect only one encoder to the bus)
9	Measuring length denominator of number of turns	Measuring length denominator of number of turns	1 - 4088 and max. measuring length numerator of number of turns
A	Original steps / turns	Original steps / turns	see type plate encoder CE
	Original steps / mm	Original steps / mm	see type plate linear measuring system LA
B	Original number of turns	Original number of turns	see type plate encoder CE
	Original rod length in mm	Original rod length in mm	see type plate linear measuring system LA
C	Number of data byte of the encoder	Number of data byte of the encoder	Number of data byte for the transmission of the encoders to AK-30. Standard setting = 3 byte (24 Bit) 2 = two byte, 16 Bit 3 = three byte, 24 Bit 4 = four byte, 32 Bit
D	free		
E	Programming of the encoder	Error request / acknowledge (only independent of the axis) The most recent error is sent back first and is simultaneously deleted from the error buffer. After deletion of all errors, the error bit is reset in the actual value display. A data difference cannot be acknowledged. To do this switch on the cassette again.	2. Progr. byte static readiness of the encoder 2^0 = position bounces or is missing 2^1 = Data difference 2^3 = LA out of the measuring range or below 0 3. Progr. byte: Main error number (2^7 is set for differentiation in case of errors) 4. Progr. byte: Single error number

Command-No. for progr.	**Write command**	**Read command**	**Data**
F	Cam program no..	Cam program no.	0 to max. cam program no.
10	Cam track	Cam track	1 to 32
11	Switch-on point	Switch-on point	0 to max. measuring length in steps -1
12	Switch-off point and execution of programming	-	0 to max. measuring length in steps -1

Comments:
With the preset adjustment a fixed value can be programmed within the measuring range (e.g. machine zero point). The preset value is activated via the preset input and thus the actual value of the encoder is set to the stored value (see page 9). The write command E causes programming of the encoder. For this the command numbers 1, 2, 3, 4, 7, 9, A, B, and C must contain correct values.
Which one of the stored preset values will be used depends on the last special command transmission (see page 21).

Some of the parameters may have an effect before executing the write command E.
After programming of the encoder all parameters in the AK-30 are checked, calculated and the results are saved in the encoder. This ensures a correct position measurement and the conformity of the data with the PNT encoder.

After each switch-on of the cassette the conformity of the cassette data with the encoder data is checked. In case of data differences the error bit is set permanently.

Principle of the command transaction

	Actions of the host	**Actions of the AK30**
1	Host is in normal mode, that means bit 39 is 0 in the programming telegram	AK30 displays actual values with the status and the status bit 31 shows normal mode (=0)
2	Host defines axis number, command number and data.	AK30 displays actual values with the status
3	Host sets the bit in the control register to 1 (= programming mode)	AK30 displays actual values with the status
4		AK30 identifies the command and reflects the command and the programming data in the status of the selected axis, as soon as the programming is completed and sets bit 31 in the status (= programming mode)
5	Host identifies the execution of the command and resets bit 39 to 0 (= normal mode)	
6		AK30 identifies the normal mode, resets bit 31 to 0 and displays the actual position

7 Programming of the AK-30 by PC

Programming of the cassette by means of the program PCAK

1	**Calling of the PC program** Connect the power supply of the AK 30, connect PC cable, select *Read cassette error* in the menu. If timeout is displayed, please check the connecting cable and whether COM1 was used for the data transmission to the cassette. The program works with the mouse. The mouse can be connected to COM2. If you want to use COM2 for the transmission to the cassette, please call the program with: PCAK COM2	**Working with the PC program** Page up and down in the fields of the menu line with the cursor keys <↑> and <↓>. Hot keys are available by entering the marked letter and pressing <ALT>. The switch board sections in the submenus can be activated directly without pressing the <ALT> - key. Entries are possible in the active window only.

2	Programming of the following parameters in the PC menus:	
	-Cassette type:	Definition of the cassette to be programmed, AK-10, AK-20, AK-30
	-Cassette data:	
	Number of axes	Generally one encoder per axis, except: axes which have been defined as listeners.
	Number of field-bus axis	Indicates how much of the connected axes are to be output on the fieldbus.
	User programs	The ***axis control*** is limited to the acquisition and monitoring of the actual value of this axis. The cam-switch controls the defined cam program with the recorded actual value and can output 24 cam paths cam instead of the actual value to the fieldbus.

3	Transfer data which have been programmed so far to the cassette.	Error messages of not-connected axes are ignored for the moment.

4	When the hardware addressing of the encoder is not used, coding of the encoder must follow now, otherwise go to next step.	
	Define encode number in menu c*assette data*	Connect only one encoder to the bus, call BUSINIT, enter the required encoder number and release PROGRAMMING. If the encoder is connected correctly, the correct coding is confirmed. Do the same procedure for all further encoders.
	Switch on and off the cassette	The encoders which could be recorded during switch on and for which there is an "axis" in the cassette, are used only.

5	Programming of the encoder data	
		The encoder data are transferred to the encoder and saved there by a new transmission of all programmed data to the cassette. During each switch-on the programmed encoder data in the cassette are compared against those in the encoder. Deviations will lead to error messages. If this transmission causes a timeout error, select --> *read device error* in the menu and repeat the transmission. The programmed data are saved permanently in the AK-30 only in case of a successful transmission.

6	Initial loading	
	Call with URLADEN A30-xxxx.CFG A30-xxxx.AK	After you got configuration files (FILE-NAME.CFG) for your special application together with your cassette, this function must be called always if the number of axis changes.

Programming of the measuring length in steps

Example

Given:

1000 steps/turns and 3,5 turns
If the number of turns is a number with a decimal point, an integral fraction must be formed. In this case 35 must be programmed for measuring length rotations (numerator), and 10 for measuring length rotations (denominator).
Enter always "1" in the numerator for integral rotations.

$$\text{Measuring length in steps} = \text{steps/turns} \times \frac{\text{Measuring length rotations (numerator)}}{\text{Measuring length rotations (denominator)}} - 1$$

$$\text{Measuring length in steps} = \left[1000 \times (35/10)\right] - 1 = 3499$$

8 Cam-switch

Cam-switch, standard for 30 tracks
Programming via PCs with the software PC-AK

A defined axis with the user program cam-switch automatically disposes of 30 tracks. If more than 30 tracks are to be activated by the encoder at the same time, further axes are defined as "listeners". This reduces the number of connectable encoders. The cams are output via the SINEC bus.

Examples:

4 encoders to 1 AK-30 = 4 x 30 tracks or 30 bit actual values
2 encoders to 1 AK-30 = 2 x (2 x 30), or 1 x 30 -and 3 x 30 tracks
etc.

The maximum number of different saved switch points is 1400 for a
32 kB memory (standard). Saving of more than 1400 switch points upon request.

max. 250 cam switch points/axis (for 4 axes), required memory /axis 4 kB
max. 650 cam switch points/axis (for 2 axes), required memory /axis 8 kB
max. 1400 cam switch points/axis (for 1 axes), required memory /axis 16 kB

For dimensioning of the memory size each switch point which is different to all the others, is counted. For this reason any number of cams can be programmed on one track (corresponds to one hardware output), as long as the maximum number of switch points is not exceeded.

The cam is switched on from the switch-on point to the switch-off point. A "revolving" cam can be programmed too. A "revolving" cam is programmed only if the switch-on point is larger than the switch-off point, e.g. the programming from 2000 to 1000 switches off from 1000 to 1999, switches on from 2000 to the end of the encoder and on again from 0 to 999. Overlapping cams on one track cannot be entered -> the cam entered last is taken. This is also valid for cams to be extended, because the range of the complete cam must be entered then.

The first switch point is always the starting point, the second one the switch-off point. The switch-off point is also the first position with status "0". One cam on the complete rotation of the encoder from 1000 to 2000 performs a switch-off from 0 to 999, a switch-on from 1000 to 1999 and a switch-off for the rest.

Definitions of the positions are made in the customer-specific units, given by the scaling. If the active cam program number is set to 0 no cams will be calculated any more.

Examples for different cam programs

Cam position	Cam tracks					
	1	2	3	.	.	30
10255	0	0	1			1
11000	1	1	0			1
12800	1	0	1			0
13900	0	0	1			1
17000	1	1	0			1
22345	0	0	0			1
25688	1	1	0			0

Cam program 1

10500	0	1	1			1
11508	1	0	1			1
12000	1	1	1			0
17654	0	1	0			0
22788	1	0	0			0
85666	0	1	1			1
95567	1	0	1			1
110100	1	1	0			0

Cam program 2

There are delays at the edges of the cams caused by the scanning of the encoders with a grid of approx. 0.7 ms (per axis). These delay times add up for several encoders. Therefore the edges of the most optimum switch points may deviate by these delay times.

9 Electric characteristics

Power supply:	15 - 30 V / DC, 5 % residual ripple
Power consumption (without encoder):	max. 4 Watt
Programming optionally:	PCs or PG 750 (Siemens) or directly via SINEC bus with measurement parameter
Programming interface:	RS 232 and RS 422
Measurement interface:	PNT bus, RS-422, for max. 8 CE/LA/LP-measuring systems
SINEC L2-DP interface:	RS-485 2-wire fieldbus with galvanic separation
Display interface:	RS-422 for max. 8 TA-Mini displays for actual positions
Read-in cycle time, per PNT encoder:	all user programs, approx. 600 - 750 µs
User software optionally:	Axis control of 8 measuring systems with 30 bit actual values each or cam-switch (max. 8 x 30 tracks)
Memory (standard):	EEPROM
Memory (option):	RAM battery-buffered for ring and gear lines and several axes
Memory extension (optionally):	32 kB / 128 kB
Min. distance between the magnets:	for multi-magnet LA = 50 mm

10 Pin assignment

SINEC	9-pole SUB-D	-
1	-	-
2	-	
3	RxD / TxD -P	Data line B
4	RTS	Request To Send
5	M5V2	Data reference potential
6	P5V2	Supply-Plus
7	-	
8	RxD / TxD -N	Data line
9	-	

The connector pins 3 and 8 are only through-connected for all users

Encoder 1-4	8-pole Mini Combicon	
1	Adr+	Addresses +
2	Adr-	Addresses -
3	Dat+	Data +
4	Dat-	Data -
5	Pr+	Preset 1 + *
6	Pr-	Preset 1 - *
7	24V	24 V DC (to encoder)
8	0V	0 V DC (to encoder)

Supply	8-pole Mini Combicon		
1	Disp-	Display Data -	
2	Disp+	Display Data +	
3			
4			
5	24V	24V DC	Supply for
6	0V	0V DC	next cassette
7	24V	24V DC	
8	0V	0V DC	

Please see note on page 9.

Connector of the serial interfaces

Pin	**Short name**	**Interface name**	**Inter-face**	**Meaning**		**PC-lacing 9-pole SUBD**	**TA-MINI 15-pole SUBD-socket**
1	RS422 -	RS422	S2	Ext. display (TA-MINI)			1
2	RS422 +	(2-wire)	S2	Ext. display(TA-MINI)			2
3	RS232 RC	RS232	S1	Receive	<--	3	
4	RS232 TM		S1	Send	-->	2	
5	Send PC -	RS422	S1	Send, channel B			
6	Send PC +		S1	Send, channel A			
7	Receive PC +		S1	Receive channel A			
8	Receive PC -		S1	Receive channel B			
9							
10							
11							
12							
13							
14	US			24V DC for TA-MINI	-->		14
15	GND			ground	-->	5	15
						bridge 1 DCD + 4 DTR + 6 DSR!	5, 7, 9 and 11 are jumpered against 24 V in accordance with the axis number
						bridge 7 RTS + 8 CTS	

Connector types

Counter connector 8-pole with flange

Type Mini-combicon* Article-no. 62-005-012

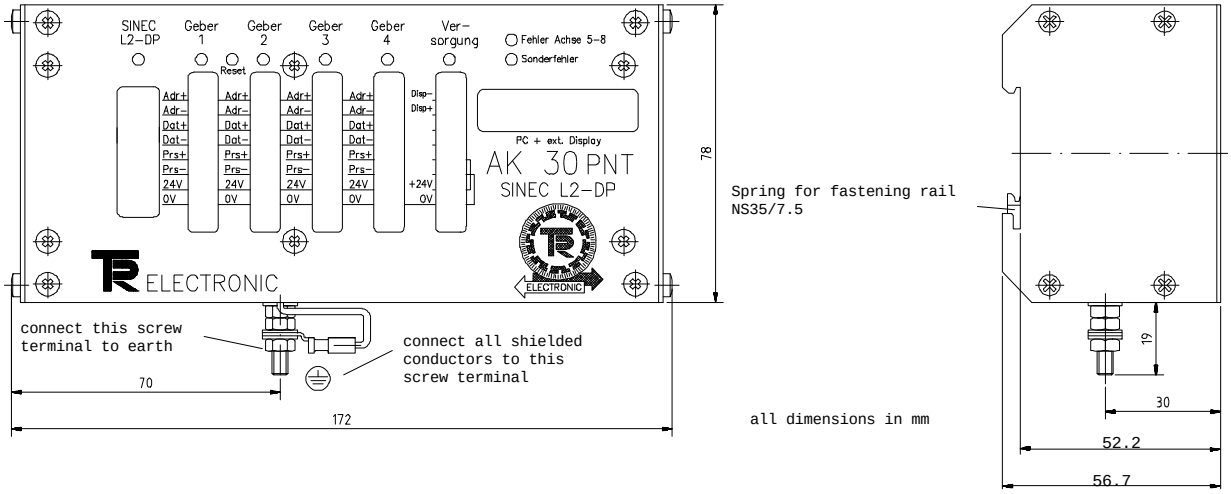
Cap 8-pole Type Mini-combicon Article-no. 64-035-002
Connector 15 pole SUB-D ** Article-no. 62-000-045
Cap for SUB-D connector ** Article-no. 64-000-187

* If ordered separately remove the terminal strip coding dependent on the intended terminal strip

** Required only for programming via PCs.

11 Mechanical data

Dimensional drawing



The AK-30 is mounted to the switch cabinet by means of a mounting rail. (Not contained in the delivery specification of the AK30)

Mounting rail NS 35/7,5 according to DIN EN 50 022

Mounting height:
Mounted rail measured above the SUB-D connector max. 95 mm

Mechanic characteristics

Dimensions: ..... 172 x 78 x 56 mm

Material: ..... Aluminium varnished

Protection: ..... IP 54 (DIN 40 050)

Temperature range: ..... 0 - 55 °C

Weight: ..... approx. 0,7 kg

12 Delivery specification of the axis cassette AK30 SINEC L2-DP

Designation	Standard	Option
AK - 30 cassette	Protection, IP54	
AK - 30 with Rose protective cover		Protection, IP65
Total memory extension	32 KB RAM + EEPROM	
User program	Axis control	
User program	Cam-switch	
Programming software	PC-AK	
Counterplug	Mini-combicon 8-pole (accessory)	
Cap for Mini-combicon 8-pole		5 caps
PC - counterplug (accessory)	15-pole SUB-D	
Operating manual	German	English
Slave display TA-MINI		6-digit LED display (accessory)

13 Appendix

The error diagnosis has a great importance in the total concept. Point of the extensive error messages is to give the reason for the messages as fast as possible if required. Error analysis and elimination of errors is completely supported by the PC. Errors can be read out via the serial PC interface and lead directly to the error text concerned. Via the fieldbus the cause of the error can be requested and acknowledged with a special command.
A division into rough analysis (= main error number) and precise analysis (= single error number) is made in the display of the cassette. Take error F05/22 as an example. The main error F05 "encoder data differ from programmed data in the cassette" can be find in the main error list ". To find the date which differs refer to the single error number. The first number of the 2-digit main error number (here=0) indicates the error category list for the single error. Assuming that the single error 22 is reported, 0x will be found in the list for error category: " Scaling of encoder differs ".
The cassette saves eight errors in each axis maximum. All axis-dependent errors are mentioned with Fxx in the list shown below. If there is a S instead of F, it is an axis-independent special error. The error is read out via a special command for acknowledgement and the error buffer is deleted. Axis-independent errors are activated in the special command with axis number 0.
The type of error "Warnings" has not additional error information.

13.1 Main error list

Main error				Remedy see
	dec.	hex.	Significance of the error:	single error list type
			Encoder error	
F	01	01	Encoder measurement disturbed (velocity, acceleration, out of measuring range, ...)	0x / ..
F	02	02	Encoder not connected	0x / ..
F	03	03	Transmission of encoder disturbed, more measuring errors occurred *in succession* than programmed	0x / ..
F	05	05	Encoder data differ from programmed data in the cassette	0x / ..
F	07	07	Preset not executed correctly	0x / ..
			Programming error	
F	41	29	Programming data out of tolerance	4x / ..
F	44	2C	Pointer to programming data out of tolerance	4x / ..
F	45	2D	Parameter does not exist in this axis	4x / ..
F	46	2E	Axis does not exist	4x / ..
F	49	31	No authorization for programming	4x / ..
			PC- and fieldbus error	
S	60	3C	Transmission error from PC (wrong CRC, parity, ...)	6x / ..
S	61	3D	Command not correct (CRC ok)	6x / ..
F	62	3E	Pointer to programming tables invalid (list no., ...)	6x / ..
F	63	3F	Programmed data value out of tolerance	6x / ..
F	64	40	SINEC L2-DP error	6x / ..
			Cam error	
F	80	50	Programming data not correct	8x / ..
F	81	51	Pointer to programming data not correct	8x / ..
F	82	52	Not enough memory	8x / ..
F	85	55	Detected destroyed cam in the memory	8x / ..
F	86	56	Position to calculate cam pattern invalid	8x / ..
			Hardware and check error	
F	90	5A	System limit reached or system conflicts (e.g. analogue 1 already assigned)	9x / ..
F	91	5B	Memory capacity exhausted	9x / ..
S	92	5C	External RAM-memory missing	9x / ..
S	93	5D	Hardware error	9x / ..
S	94	5E	Encoder error (encoder not readable, timeout overdue, Pos. -measurement jammed, ...)	9x / ..
S	95	5F	Unexpected arithmetic calculation (e.g. division by 0)	9x / ..
S	96	60	Unexpected interrupt	9x / ..
F	97	61	Unexpected value of parameter delivered	9x / ..
F	99	63	Readiness for operation missing	9x / ..

13.2 Single error lists

Error 0x / ..			Encoder error
	dec.	hex.	Significance of the single error:
F	01	01	Timeout during transmission, sending register never empty
F	03	03	Timeout during transmission, sending register never empty
F	04	04	Buffer overflow after the 12. character received
F	05	05	CRC error in the character string received
F	06	06	Not 11 characters in the receiving buffer for data request as expected
F	07	07	Not CR as 11. character for data request as expected
F	08	08	Received encoder number not identical with requested encoder
F	09	09	Buffer overflow during receiving, more characters received than expected (without parity error)
F	10	0A	Encoder sets error bit
F	11	0B	Timeout in RECEIVE, at least 1 character was read
F	12	0C	Encoder (LA rod) out of measuring range
F	13	0D	Encoder (LA rod) below zero
F	14	0E	Position value > resolution for rotary encoder, value rejected
F	15	0F	Position value after calculation of the measuring length still greater than resolution, value rejected
F	18	12	Data difference when comparing PNT encoder / cassette : resolution / mm (LA rod)
F	19	13	Data difference when comparing PNT encoder / cassette : measuring length in mm (LA rod)
F	20	14	Data difference when comparing PNT encoder / cassette : Rotational direction
F	21	15	Data difference when comparing PNT encoder / cassette : Desired number of turns
F	22	16	Data difference when comparing PNT encoder / cassette : Scaling number
F	23	17	Data difference when comparing PNT encoder / cassette : Number of data byte for transmission
F	24	18	Data difference when comparing PNT encoder / cassette : Format of actual position
F	25	19	Data difference when comparing PNT encoder / cassette : Scan mode
F	26	1A	Data difference when comparing PNT encoder / cassette : External preset value
F	27	1B	Data difference when comparing PNT encoder / cassette : Steps/turn
F	28	1C	Data difference when comparing PNT encoder / cassette : Resolvable turns
F	29	1D	Data difference when comparing PNT encoder /measurement coupling for multi-magnet LA
F	30	1E	Own encoder of this axis not connected
F	31	1F	The encoder for which a listener is defined does not exist
F	32	20	Scan mode 3 used, but axis 1 not connected (axis 1 has no actual values without pos. inquiry)
F	40	28	Filter constant reached: buffer overflow, more correct characters received than expected
F	41	29	Filter constant reached: Parity error in the received character string
F	42	2A	Filter constant reached: 1. character correctly transferred does not correspond to the correct encoder or the encoder indicates an error
F	43	2B	Filter constant reached: Check sum error in the correctly received character string
F	44	2C	Filter constant reached: Velocity exceeds limit
F	45	2D	Filter constant reached: Acceleration too high
F	46	2E	Filter constant reached: Change of rotational direction exceeds the minimum speed
F	47	2F	Filter constant reached: Position bounces
F	48	30	Filter constant reached:Ttimeout lasted too long
F	50	32	Encoder preset not executed correctly (encoder not identical or set error bit)
F	51	33	Encoder preset not executed correctly (Timeout during preset delivery to encoder)
F	52	34	Requirements for preset function missing(system ready=1, no encoder, listener, encoder in timeout, preset running)
F	54	36	Preset value exceeds the range (larger than scaling number)
F	60	3C	Received break / Framing-error on encoder interface
F	61	3D	Overrun-error on encoder interface
F	62	3E	Parity-error on encoder interface

Error 1x / ..			Position control
	dec.	hex.	Significance of the single error:
F	22	16	Speed limit exceeded
F	30	1E	Out of programmed measuring length: No encoder preset executed or encoder moved while the cassette was switched off
F	31	1F	Out of programmed measuring length: Encoder moved too far while switched off

Error 4x / ..			Programming error
	dec.	hex.	Significance of the single error:
F	04	04	Functions for PC dialogue not active
F	05	05	a programming in this range of the axis via another programming unit takes place at the moment
F	11	0B	Data value above limit value
F	12	0C	Data value below limit value
F	13	0D	Data value out of sequence
F	14	0E	Preset value too great as value ≥ measuring length
F	16	10	Encoder number invalid, as listening to own axis is not possible
F	17	11	User program type not supported by this cassette
F	18	12	local memory of this axis too small for this program type
F	19	13	Axis number not supported by this cassette
F	48	32	Axis does not exist
F	49	33	Axis does not exist, therefore programming of this axis via PC dialogue not possible
F	52	34	The axis from which a listener wants to fetch values, does not exist
F	53	35	Non-existing TA-MINI is activated
F	54	36	The axis for which the difference should be calculated, does not exist
F	72	48	Searched axis no. not included in list of connected encoders
F	80	50	An encoder parameter is inadmissible set to zero
F	81	51	Invalid encoder type, rotary encoder, LA and multi-magnet LA permitted only
F	82	52	Overflow in division
F	83	53	Overflow in multiplication
F	84	54	Invalid parameter for gear programming (denominator of number of turns<> 1)
F	85	55	A LA parameter is inadmissible set to zero
F	86	56	Division by zero, that means a calculated parameter is zero contrary to expectations

Error 6x / ..			PC and fieldbus error
	dec.	hex.	Significance of the single error:
F	01	01	Interface error (parity error, overrun error, framing error) command unusable
F	02	02	Check sum error in PC dialogue
F	06	06	Only two characters received, that means no complete command
F	07	07	Part of the command invalid, that means not within the range of 0 to z (H'30 to H'74)
F	10	0A	Too much characters for one command of the command chain
F	11	0B	Input buffer overflow, command unusable
F	12	0C	Address out of address range of this cassette, but setting to "send driver always on "
F	21	15	Data value above limit value
F	22	16	Data value below limit value
F	23	17	Data value out of sequence
F	24	18	Preset value too large
F	26	1A	Encoder number invalid, as listening to own axis not possible
F	27	1B	Program type not supported by this cassette
F	28	1C	Local memory of this axis too small for this program type
F	29	1D	Axis number not supported by this cassette
F	30	1E	Cam type invalid, not enabled for this device
F	40	28	Configuration comparison not correct
F	41	29	Address of the cassette not between 3 and 124 or number of bytes set wrong
F	50	32	Command from the fieldbus invalid
F	51	33	Axis activated by the fieldbus does not exist
F	52	34	Fieldbus error, programming values can only be values up to 24 bit, but the called value is larger

Error 8x / ..			Cam error
	dec.	hex.	Significance of the single error:
F	02	02	Cam position too large (PC dialogue)
F	03	03	Cam position not increasing when programmed by PC list (PC dialogue)
F	04	04	No cam switched on at this position under this track
F	05	05	Cam position too large (programming via parallel inputs)
F	07	07	Listener axis: Encoder parameter differs from master axis
F	10	0A	Program pointer to cam outside the range (too large or =0, for cam program. via parallel inputs)
F	12	0C	Program pointer to cam outside the range (PC dialogue)
F	21	15	Not enough lines free in the cam program
F	22	16	No storage location reserved for cams (total number of cam positions = 0)
F	36	24	LA rod: Position below zero (negative value)
F	37	25	LA rod out of measuring range
F	38	26	Position measurement shows invalid value

Error 9x / ..			**Hardware and check error**
	dec.	hex.	Significance of the single error:
F	05	05	An attempt was made to reprogram an encoder into an existing encoder no. (PRGBNR)
F	06	06	No entry in list of existing encoders, no listeners or " axis without encoder"
F	09	09	Send register interface A (encoder) not empty for 5ms --> Position measurement jams
F	10	0A	Send register interface D (TA-Mini) does not become empty
F	11	0B	Value for memory length too large; the largest possible value is taken
F	12	0C	Current memory selection not possible; first initialization takes place
F	13	0D	Memory capacity too small for program type set --> "Axis not used " is set
F	14	0E	No position free in table
S	20	14	No 32K-RAM inserted
F	28	1C	Division by 0 during initialization (boot)
F	29	1D	Division by 0 in position processing
F	30	1E	Ostensible no time difference between two scannings
F	31	1F	Time difference smaller than physically possible --> overflow of the time base counter
F	32	20	Division by 0 for limit value calculation
F	33	21	Division by 0 or overflow
F	34	22	No encoder connected
F	39	27	Encoder position invalid or data difference PNT encoder <->cassette
F	40	28	Interrupt (IRQ0) not identifiable
F	42	2A	NMI of watchdog in micro controller. No post-triggering
F	44	2C	Character string from encoder out of step
F	59	3B	Decimal point for TA-Mini out of valid range
F	65	41	Function number for cam functions out of valid limits
F	75	4B	Interbus module accepts only 1, 2 or 4 axes. Wrong value is overwritten with 4

			Warnings
	dec.	hex.	Significance of the warnings:
W	01	01	Change of rotational direction above minimum velocity, filter constant without importance
W	05	05	Overflow in calculation of resolution of linear stroke, position cannot be shown in 1/10mm / s
W	06	06	For encoder type = LA linear is absolutely necessary (denominator of number of turns must be 1)
W	10	0A	Encoder moved while the cassette was switched off, but the positions seems to be in the pull-in range
W	11	0B	Accumulator defective? Data copied from EEPROM --> preset must be executed!
W	12	0C	Accumulator defective? Even data from the EEPROM unusable--> Basic initialization was executed!
W	15	0F	Axis is listener --> Programming of encoder parameter must be identical to master axis
W	16	10	No. of the active cam program exceeds the number of cam programs --> no program activated