AK-30
Profibus-DP

Operating Manual for Axis Cassette with SSI Measuring Systems

Please keep for further use!

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Revision History

i *Note*

The cover of this document shows the current revision status and the date of the last changes. Since each individual page has its own revision status and date in the footer, this means that there may be several different revision statuses in the same document.

Drawings that are in the appendix have their own revision history.

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Foreword

The concept of axis plug-in units

Axis plug-in units are multi-purpose devices for use with industrial processes. They are compatible with various encoder systems. The software can be individually adapted to client-specific problems. To do this, you use a standardized set of parameters. To make keyboard and PC operation easier, all parameters that are irrelevant to the problem are masked-out.

Two PC programs are available for operation of the plug-in units. The PC-AK program is aimed at users who want preconfigured, unchangeable system settings for the job in hand. This program emphasises easy handling of the plug-in unit. In this connection, you only need to program a few encoder settings and cams. This keeps the application clear and easy. It is, however, no longer possible to take advantage of other solutions that the plug-in unit offers but are not supported by the PC program.

The second possible solution is available to users of the PCPK program: you can use it to deal with even the most complex applications. Specific accessing of all the parameters that are relevant to the client is possible. The modification options are controlled using three hierarchical coding levels. Users can decide for themselves which code is to be used to reach a specific parameter, i.e. you can enable the parameters that must be frequently adapted at your own machine.

Both programs are for archiving all the system settings and help you when printing the accessible parameters.

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1 Safety

1.1 General Danger Potential

Due to the internal register structure, the axis cassette is fitted with one error bit for each axis.

Operating errors which prevent the cassette from controlling correct functioning are signalled by setting an error bit on the axis in question. Acknowledgement of the error is needed to reset. This means that it is crucial to **integrate the error bits into your own safety concept** by means of the PLC's evaluation software

(See also the chapter entitled Safety Facilities)

All personnel that is involved in assembly, commissioning and operation of the device must

- be appropriately qualified
- follow these operating instructions.

Your safety and the safety of your property are at stake!

1.2 Safety Information

This operating manual contains instructions which you must closely follow to guarantee your own personal safety and to avoid material damage. The instructions are highlighted by a warning triangle and are represented as follows depending on the degree of exposure to danger:

⚠️ *Warning*
means that death, serious bodily injuries or considerable material damage may arise if the appropriate precautions are not taken.

⚠️ *Caution*
means that slight bodily injuries or material damage may arise if the appropriate precautions are not taken.

i *Note*
This shows important information or features and operating tips on the product used.

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1.2.1 Information about Installation

In most applications, the axis cassette is a component part of larger systems; this means that this information is a guideline for risk-free integration of the axis cassette in its environment.

⚠️ *Warning*

- Observe the safety and accident prevention regulations applicable to individual cases.

- In the case of systems with fixed connections (permanent systems) with no all-pole mains switch and/or fuses, you must install a mains disconnector or a fuse in the system installation; this facility must be connected to a protective earth.

- With devices running on mains power, check before commissioning whether the set rated voltage range matches the local mains voltage.

- With 24-V supply, ensure that there is safe electrical isolation of the extra-low voltage. Use only mains units manufactured in accordance with IEC 364 - 4 - 41 or HD 384.04.41 (VDE 0100 Part 410).

- Mains voltage fluctuations or variations from the rated value may not exceed the tolerances stated in the technical data; otherwise, functional failures and dangerous conditions cannot be ruled out.

- Take measures to ensure that after power dips or failures it is possible to continue operation correctly with an interrupted program. In this connection, danger conditions may not arise even for brief periods of time. If necessary, an **EMERGENCY STOP** must be forced.

- EMERGENCY STOP facilities in accordance with EN 60204/IEC 204 (VDE 0113) must continue to be effective in all the operating modes of the automation equipment. Unlocking the EMERGENCY STOP facilities must not lead to an uncontrolled or undefined restart.

- Install the connection and signal lines such that inductive and capacitive interference does not affect the automation functions.

- Install automation technology equipment and their operating elements such that they are adequately protected from being touched by accident.

- Ensure that cable or wire breaks on the signal side can not lead to undefined status conditions in the automation equipment by taking appropriate hardware and software measures with the I/O link.

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1.2.1.1 Screening

The use of electronic sensor active systems in modern machines demands a consistently and correctly executed interference suppression and wiring concept.
Meeting this condition is the only guarantee for perfect functioning of a system containing electronic measuring subsystems and of the cassette.

Recommended Screened Cable Wiring

Switching Cabinet

Measuring Systems

Machine

Control Unit

0V bar with screen terminal for measuring system cable

Measuring system and control cable

Power Unit

Power Cable

Ground cable 10 mm²
$(R_{\text{ground cable}} \ll R_{\text{screen}})$
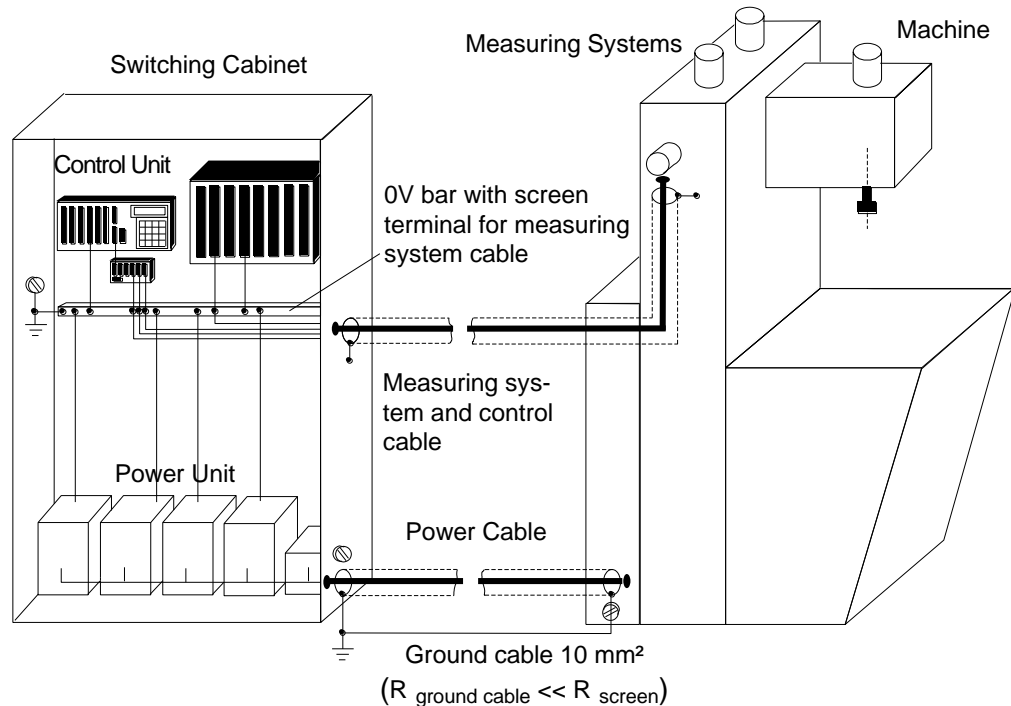
1.2.1.2 Interference Suppression Measures

- Lay the connection cable to the axis cassette a long way away from or physically separately from (screened) energy cables that carry interference.

- Use completely screened, well-earthed cables to ensure safe data transfer. In the case of differential data transfer (RS422, RS485, etc.) you must, additionally, use twisted-pair wires.

- Use cables with a minimum cross-section of 0.22 mm² for data transfer.

- Use a ground cables with a minimum cross-section of 10 mm² to avoid equipotential bonding currents across the screen. Note in this connection that the resistance of the ground cable is much lower than that of the screen.

- Wire the screen consistently laying wide areas on the special screen connection terminals.

- Avoid cables crossing. If this is unavoidable, they should cross at right angles only.

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1.3 Intended Use

The supplied axis cassette or encoder system is programmed using the **PC-AK** software. The application files on the PC-AK installation disk determine the use of the axis cassette. When you load the files, the cassette is preconfigured for a specific application. At this stage, the encoder parameters are set to a basic setting. For this reason, you still have to program various encoder settings for your particular applications.

As-supplied, the AK-30 axis cassette has the following features:

Encoder interface:	SSI
Inputs:	Preset (electronic adjustment)
Data interface:	PROFIBUS-DP (RS485)
Display interface:	RS422 for a maximum of 4 TA-MINI displays (actual position)
Programming interface:	RS232 / RS422
Number of axes:	4
CLASS2 operation:	Option
Optional user software:	Axis management of four measuring systems or cam controller
Type of protection:	IP54 (DIN 40 050)
Temperature range (operation):	0-55° C

⚠ *Warning*
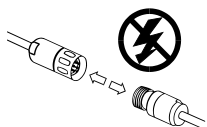
Only carry out wiring work and opening and closing electrical connections when the equipment is deenergized!
Short-circuits, voltage peaks, etc. can lead to malfunctions and uncontrolled status conditions in the system or to serious injury to human beings or damage to property.

Before switching on the system, check all the electrical connections!
Connections that have not been made correctly can lead to malfunctions; faulty connections can result in serious injury to human beings or damage to property.
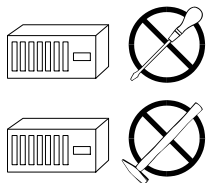
For safety reasons, it is forbidden to carry out mechanical or electrical changes to the axis cassette or the measuring systems!

i *Note*
It is crucial to comply with the commissioning, operating and programming instructions in this manual.

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1.4 Danger Due to Specific Types of Use

⚠️ *Caution*
A current flow that is too high will destroy the axis cassette!

- A maximum of ten encoders may be directly supplied from the cassette's power supply (encoder connector). If there are more than ten encoders, you must route the power supply separately.

1.5 Danger Due to Accessories

⚠️ *Caution*
Mating connectors that are not correctly plugged in can lead to a cassette malfunction!

- Screw the mating connector tight to the connector provided for it.

1.6 Permissible Operators

Commissioning and operation of this/a device may only be carried out by qualified personnel. In the sense of the safety information, qualified personnel is considered to be people who are authorized to commission, ground and mark devices, systems and circuits in accordance with safety standards.

1.7 Safety Measures at the Place of Assembly

⚠️ *Warning*

Do not carry out welding work if the axis cassette has already been wired or is switched on!
Voltage fluctuations can destroy the axis cassette or affect its function.

Do not touch connector contacts with your hands!
Static charges could destroy electronic components of the axis cassette.

Unused inputs must not be wired (refer to the plug assignments)!

Keep to the voltage supply range: 15-30 V DC (± 5 % residual ripple)

i *Note*
Ensure that the assembly environment is protected from aggressive media (acid, etc.).

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1.8 Safety Facilities

i *Note*

For fault polling and acknowledgement, you must be familiar with all the functions and characteristics of the axis cassette. Since error handling is a complex topic, we will not be able to cover it entirely in this chapter. For this reason, we will refer at various locations in this manual to error handling and subjects directly connected with errors. You must therefore have read and understood the entire manual.

Error Polling and Acknowledging Errors

An axis signals an error by setting the error bit (the MSB of the encoder input data). IN this connection, the tolerable number of successive measuring errors exceeded the default setting of five. Up to eight errors are stored on each axis and they can be polled. The newest error is signalled first.

Errors are acknowledged by being read-out of the cassette and deleted from the error buffer. The error LED of the respective axis goes out when the buffer has been completely cleared.

Polling of errors from the PLC is activated as follows:

– In the DP standard parameter data block, set in the 9th byte (Operating instruction) bit 2^6 = "AK-30 Function".

– Specify the axis number (byte offset = +0) in the service control register

– Set the bits below in the service number:

Service number

Error polling	0000 0001
Activate special service	0100 0000

Word No.	Byte No.		Read Error of Axis 2
0	0	Axis Number	02
	1	Service Number	41

i *Note*

With all special services, the current status of bit "Select Preset" must always be transferred too.

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After carrying out special service Error Polling, the system enters the first error message in diagnostics field Return Value (computer offset 12) and in the "operating status" (diagnostic function, computer offset 8) sets bit 7 to 1 (=Programming) (Refer to chapter 3.4 "Structure of the AK-30-Internal Diagnostics Messages" on page 3-8).

Depending on the configured length, the system transfers 16 bytes to the master in CLASS1 operation or 62 bytes in CLASS2 operation. The mode is set when you program the cassette.

The first diagnostics message after an error occurs is sent automatically. The message contains set alarm messages (diagnostic function, computer offsets 7 and 11). The system does not enter error numbers (diagnostic function, computer offsets 12 to 18) until polling by means of special service Error Polling has been carried out; this also acknowledges the errors. Once all the errors have been acknowledged, the system resets the messages in Alarm, BBR and the error bit in the position status.

On the basis of the returned axis number, you can check whether the correct axis responded. As soon as the main and individual error number is zero, the error buffer is empty, the red error LEDs go out. If the same error number was read twice in succession, it was not possible to acknowledge the error. In one (CLASS2) diagnostics data record, the system polls up to four pairs of errors.

Cassette errors are generated if it is not possible to uniquely assign the error to an axis number. Errors are shown by the yellow LED. Cassette error messages are polled with axis number 0 in the service control register.

The cassette error messages that are not so relevant to position recording do nor result in an error bit being set in the status register (e.g. due to warnings). However, the corresponding LED is still lit up on the cassette.

Warning

Controlled and correct position values are only signalled on the PROFIBUS while the error bit is not set. When the error bit is set, you must stop the corresponding axis or system before entering it!

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2 Transportation/Commissioning

2.1 Transportation/Storage

Transportation Information

Do not drop the axis cassette or subject it to severe vibrations!
The device contains sensitive electronic components.

Use only original packaging materials!
Using incorrect packaging materials can lead to damage to the device in transit.

Storage

- Storage temperature: -20 to +50°C

- Store in a cool place.

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2.2 General

The AK-30 axis cassette is an intelligent interface module that connects up to four SSI measuring systems to the PROFIBUS-DP.

You can completely program the AK-30 using the PC-AK software. In this connection, you use this software to set memory addressing, the number of field bus axes, and the number of cam programs.

The AK-30 is supplied as standard with two internal application programs:

1 Axis management
2 Cam controller

Axis management is limited to acquiring or controlling the encoder actual values and transferring them to the PROFIBUS. The system can read out a maximum of four 30-bit binary-coded encoder actual values at the same time. The encoder parameters allow you to program any number of steps, even non-contiguous ones, after which the encoder starts from zero again.

Using the *cam controller* application, it is possible to operate a 30-path cam controller. The maximum number of different switching points depends on the memory allocation.
If you use only two encoders, you can, for example, reconfigure the axis cassette such that one 30-bit cam controller is implemented on each of axes 1 and 2 with axes 3 and 4 working as listeners of the actual positions of axes 1 and 2. This makes it possible to read the current actual positions in addition to the cam switching points.

Principle of Bus Structure and SSI Measuring System
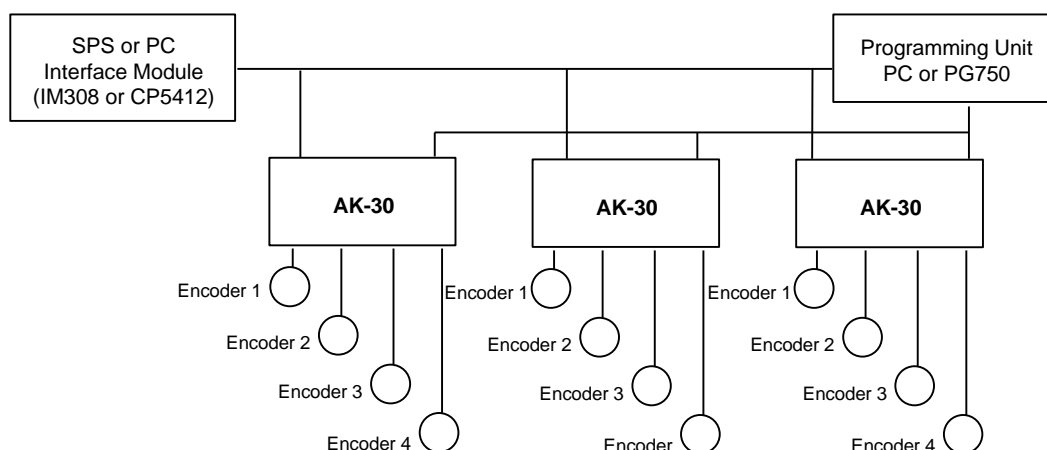
SSI Measuring System with Linear Absolute Path Sensors or Absolute Encoder

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2.3 Assembly

The AK-30 is assembled in the switching cabinet using a standardized mounting rail (not supplied with the AK-30).

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

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2.4 Commissioning (Encoder)

2.4.1 SSI Encoder Interface

⚠️ *Caution*

The "Preset" input on the encoder **must not be used** in conjunction with axis cassettes.

SSI is a synchronous serial transfer procedure for encoder positions. It has become the virtual standard with absolute encoders. The use of the RS422 interface means that adequately high transfer rates can be achieved.
At data transfer, the cassette places bundles of pulses on the pulse lines. Each time a pulse arrives at the encoder, it returns its information, which is located in a shift register, bit-by-bit to the cassette on the data lines. The data is clocked on by the positive edge of Clock + and the receiver loads the data half a clock pulse later. During the pause in transmission, the system always sets Data + from 0 to 1 after a brief period expires. In the example below, the receiver reads the encoder position as value
001 0111 0011 1101 0011 0010 (173D32 HEX).
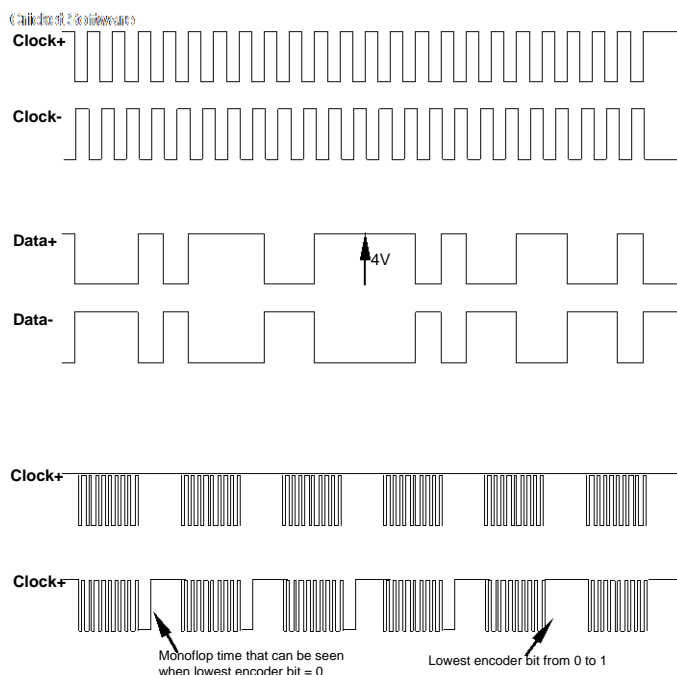
For safe data transfer, it is also possible to use encoders with a 28-bit checksum SSI. The checksum forms a BCH code, it is 15 bits long and has a Hamming distance of 6;: this means that it is always possible to detect up to five arbitrarily distributed errors or error bundles that can be up to 15 bits long. This allows very safe detection of faulty transfers, polarity-reversed clock or data lines or a missing encoder.

ℹ️ *Note*
With this transfer procedure, you should always use well-screened twisted pair cables to ensure interference immunity.

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2.4.2 Wiring

You must make the power connections below for each SSI encoder:

Encoder (SSI)			Axis Cassette AK30		
Clock +			1	CLK +	Encoder connector
Clock -			2	CLK -	Encoder connector
Dat +			3	Dat +	Encoder connector
Dat -			4	Dat -	Encoder connector
Operating voltage +(11-27) V			7	US	Encoder connector
Operating voltage. 0 V			8	GND	Encoder connector

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3 PROFIBUS-DP Data Interface

Data transfer is implemented via an RS485 BUS interface module with a Siemens controller and supports baud rates of between 9.6 and 12 Mbps. The DP standard data protocol guarantees easy integration in the and allows the programming of encoder settings. Bus connectors with switchable terminating resistors are available from Siemens.

The AK-30 derives the configuration data from the number of field bus axes, the number of bytes per encoder and the TA-MINIs to be displayed. If you are using listeners, the number of axes does not, of course, match the number of encoders. A listener makes it possible to transfer from a cam controller the actual value on the field bus in addition to the cam data.

Between one and four measuring systems are supported. The format of data output on the PROFIBUS is identical for both the axis management and cam controller application programs. In the first case, the useful data is in the form of binary encoder actual values; in the second case, it is cam patterns of 30 cam paths.

Four (or two) bytes, which must be consistently transferred, are assigned to each axis for actual value transfer. They are entered in the useful data section of the field bus protocol. The total number of input bytes to be transferred is set automatically in accordance with the programmed number of axes. The error bit shows whether the actual value was correctly determined. For special services, the service control register must always be transmitted to get an error acknowledgement.
If you do not have to keep the encoder or the preset value programmable via the field bus, you can do without the Encoder Output Data field (refer to page 3-2).

The cassette supports the protocol according to DIN E 19 245. In the configuration screen form of an IM308 you make an entry for each loaded axis. AK30 SSI is used as the station type. If two consistent bytes per axis are needed, identifier 92 applies. For four consistent bytes, you must enter 93 as the identifier. The identifiers that are used ensure data consistency.

A special service is used to detect and acknowledge errors. In this connection, the (special and miscellaneous) services do not result in interruptions in actual value acquisition. Services are executed as soon as the corresponding bit is set in field Service Valid. The requested error status condition is transferred to the controller in the diagnostics message frame. Depending on the Class1/2* setting, the system acknowledges and reads one or four error messages at the same time (refer to the chapters entitled Special Services on page 3-5 and Structure of the AK-30-Internal Diagnostics Messages on page 3-8). Error numbers are listed in the chapter entitled Disturbances.

i *Note*
Due to the Intel addressing procedure, you should note that the high and low bytes are reversed within a word in the error number (depending on the controller used).

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* CLASS2: Option with AK30 SSI

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3.1 PLC Input Data

Overview of Input and Output Data

			Reserved Memory	
Cassette Status		INPUT	2 bytes fixed	-
Encoder Input Data		INPUT	2 or 4 bytes per axis	Consistent
Service Controller		OUTPUT	2 bytes fixed	-
[Encoder Output Data]		[OUTPUT]	2 or 4 bytes per axis	Consistent
[External Display Data]		[OUTPUT]	3 bytes per TA-MINI	-

Identifier	Sequence of Identifiers		
	PLC INPUT DATA		
11	***Cassette Status***		
		Error status	2^7 = Cassette error
		Cycle	Shows the cycle number that the position values originate from.
4 (2) Bytes per encoder	***Encoder Input Data***		
93 (91)		Actual position of encoder 1	2^{31} = Error bit, 2^0 - 2^{29} data
93 (91)		[Actual position of encoder 2]	2^{31} = Error bit, 2^0 - 2^{29} data
93 (91)		[Actual position of encoder 3]	2^{31} = Error bit, 2^0 - 2^{29} data
93 (91)		[Actual position of encoder 4]	2^{31} = Error bit, 2^0 - 2^{29} data
	PLC OUTPUT DATA		
A1	***Service Control Register***		
		Axis number	No. 0 = Cassette, No. 1-4 = encoder
		Service number	
4 (2) Byte pro encoder	***[Encoder Output Data]***		
A3 (A1)		[Programming data of encoder 1]	Bit 2^0 - 2^{30} = Data Bit 2^{31} = Preset control
A3 (A1)		[Programming data of encoder 2]	Bit 2^0 - 2^{30} = Data Bit 2^{31} = Preset control
A3 (A1)		[Programming data of encoder 3]	Bit 2^0 - 2^{30} = Data Bit 2^{31} = Preset control
A3 (A1)		[Programming data of encoder 4]	Bit 2^0 - 2^{30} = Data Bit 2^{31} = Preset control
	[External Display Data]		
22		[Data of TA-MINI 1]	2^0 - 2^{19} Data, 2^{23} Sign
22		[Data of TA-MINI 2]	2^0 - 2^{19} Data, 2^{23} Sign
22		[Data of TA-MINI 3]	2^0 - 2^{19} Data, 2^{23} Sign
22		[Data of TA-MINI 4]	2^0 - 2^{19} Data, 2^{23} Sign

[ ] = optional

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The received data contains, in direct sequence, the actual values corresponding to the number of axes used and the number of bytes per axis. The system enters the data of axis 1 in the cassette first and the data of the highest axis number last. In this context, note that in most controllers the high and low bytes in a word address are reversed. In the configuration screen form, you enter identifier 93 for each axis if four bytes per axis are to be received and identifier 91 in the case of two bytes per encoder.

PLC INPUT DATA			
Address Offset Word Addressing	Address Offset Byte Addressing	Cassette Status Bytes	Identifier of Configuration Screen Form
0	0	Error status	11
	1	Cycle number	
		Act. pos. of axis no. 1	
1	2	Most significant byte	93 (91)*
	3		
2	4		
	5	Least significant byte	
		Act. pos. of axis no. 2	
3	6	Most significant byte	93 (91)*
	7		
4	8		
	9	Least significant byte	
		Act. pos. of axis no. 3	
5	10	Most significant byte	93 (91)*
	11		
6	12		
	13	Least significant byte	
		Act. pos. of axis no. 4	
7	14	Most significant byte	93 (91)*
	15		
8	16		
	17	Least significant byte	

* In the case of two bytes per encoder

3.1.1 Cassette Status

The cassette status consists of:

– the error status
– the cycle number

In the error status, the system sets the most significant bit if a cassette error has occurred. These errors are considered to be ones that cannot be uniquely assigned to an individual axis, including field bus errors as well as hardware errors. Cassette errors are shown by the yellow LED on the front of the cassette. They are cleared by using Axis number 0 to route error enquiries to the cassette until all the errors have been acknowledged.

The cycle number labels the measuring cycle of the position values. If the cycle number does not change, this means that all the positions have stayed the same.

With four encoders connected, it takes about half a second for the cycle counter to count all the numbers.

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3.1.2 Structure of the Actual Position Data

Error bit	Reserved	29	28	27	26	25	24

Most significant byte

23	22	21	20	19	18	17	16

15	14	13	12	11	10	9	8

7	6	5	4	3	2	1	0

Least significant byte

Bits 0 to 29 contain the useful data. The error bit is set if measurement does not return a valid position. Measurement is invalid if

- no encoder is connected
- more than five successive measured values are disturbed, or
- the programming data is faulty.

3.2 PLC Output Data

The PROFIBUS master module in your controller sends the "programming data" to the cassette. Error acknowledgement using special services needs only the first two bytes. If, however, you want to execute a preset during operation, you must use the With Programming Data setting. You make this setting, whether with or without programming data, in the field bus options (Cassette data; field bus options). In the configuration screen form, you enter an A3 (A1) for each encoder that is connected to the cassette .

In the Axis Number field, the PLC shows which axis is to respond. The response is in a diagnostics message. The triggered axis responds in the check-back field with the useful data. The set highest bit of the service number validates the data. The programming responses mirror the first 24 [8]* data bits and the service number. The mirrored data can be used to check programming.

Error polling is triggered by a special service. Services do not interrupt actual value transfer. The response is in the diagnostics check-back indication (refer to chapter 3.4 "Structure of the AK-30-Internal Diagnostics Messages" on page 3-8).

* In the case of two bytes per axis

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3.2.1 Service Control Register

The Service Control Register field must always be contained in the output data of the controller to the cassette. This field can be used to issue programming commands to the cassette. The control bits for transferring the services in the Service Number field are as follows:

– Execute special service and
– Execute command

whereby only one of the control bits can be set at any one time.

Service Number							
7	6	5	4	3	2	1	0
Command	Special Service	Service Field					

Service field with special service no.
Service field with command no.
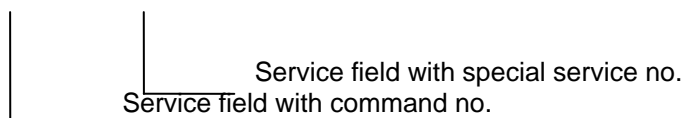
3.2.1.1 Special Services

Special services are organized bitwise. The system executes all the special services that are selected. The diagnostics message that is triggered after execution confirms execution. Long diagnostics is only sent in the case of CLASS2 operation with the Error Polling special service.

The following special services can currently be executed:

- Error polling
- Service (reset all errors)
- Choose preset value 1 or 2 for initiator input

The error bit is reset if all the errors of the axis in question could be acknowledged.

The service called Service clears all the errors of all the axes and the cassette. The other services respond to the transferred axis number.

The following assignments apply:
0   Cassette
1 to 4   Axis numbers 1 to 4

Check-back message service executed:
Special services trigger a short format diagnostics message. The Axis Number diagnostics field contains the axis number from the service control. The first field of the four-byte check-back field (computer offset 12) in diagnostics shows the detected status of the service number.

The result of error polling is entered in the diagnostics message.

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The bitwise subdivision of service numbers shown in the table below applies to the special services. All the set services are executed at the same time.

Service Execution		Services					
1 = Execute programming service	1 = Execute special service	Select Preset 0 = Preset 1 1 = Preset 2	-	-	-	Reset all errors 1 = reset	Error polling 0 = No 1 = Yes
1	1	X	0	0	0	X	X
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

i *Note*

With all special services, the current status of bit "Select Preset" must always be transferred too.

3.2.1.2 Programming Services

The programming services are numbered and need the Encoder Output Data optional field for execution. The value to be programmed is transferred to the output data. The following programming commands can be executed:

01   - Set preset value 1
02   - Set preset value 2

Execution of the services is always relative to the transferred axis number.
The following assignments apply:

1   Axis number 1
2   Axis number 2
3   Axis number 3
4   Axis number 4

Check-back message service executed:
Programming services also trigger a short format diagnostics message. The check-back message is issued in the same way as with the special service. In addition, however, the less significant three bytes of the diagnostic check-back field show the corresponding bytes of the transferred programming data.

3.2.2 Encoder Output Data

3.2.2.1 Programming Data

The encoder output data is 4- or 2- bytes-wide. In 4-byte mode, 29 bits of programming data are available with 14 being available in 2-byte mode.

3.2.2.2 Preset Function

If bit Service Execution Command is not set in the service number, the encoder output- data can be used for ongoing presets. Bits 2^0 to 2^{29} show the desired preset value. Bit 2^{31} shows the corresponding axis that a preset is to be executed. The system executes the preset as soon as bit Execute Preset (2^{31}) changes state from 0 to 1.
The system tells you the result of execution of a preset by means of a short-format diagnostics message. If execution was correct bit B6 in the Alarms diagnostics field is 0.

3.3 PLC Transfer Values for Output to a Display

Binary format information can be transferred to the AK-30 via the PLC's output register and be displayed via a TA-MINI (daughter display). The display range is –99 999 to +999 999. Detection of negative values is shown by the sign bit in the most-significant position (2^{23}). If it is set, the system outputs the value as negative. The hexadecimal value range that results from this is between 81869F (–99 999) and 0F423F (+999 999). If this range is exceeded, only the last six places can be seen in the display.

For each axis that you define in the PC-AK program for the output of external field bus data, you must reserve three bytes in the configuration input screen form for output of the display values. You do this by entering 22 in the configuration list. When making entries, start with the lowest-numbered axis. For output of external field bus data, you can define a maximum of eight axes.

Register Structure for External Field Bus Data:

Most-Significant Byte																Least-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 with data but represents an out-of-range condition; DX = the PLC value to be transferred in binary format to the AK-30

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3.4 Structure of the AK-30-Internal Diagnostics Messages

You can force calling of a diagnostics message using the Error Polling special service. The system then transfers to the master a diagnosis of the correct configured length (i.e. 16 bytes for CLASS1 operation and 62 bytes for CLASS2 operation).

The first diagnostics message after an error occurs is sent automatically. The message contains set alarm messages (diagnostic function, bytes 7 and 11). The system does not enter error numbers (diagnostic function, bytes 12 to 18) until polling by means of special service Error Polling has been carried out; this also acknowledges the errors. Once all the errors have been acknowledged, the system resets the messages in Alarm, BBR and the error bit in the position status.
After a special service has been executed, the system generates a diagnostic message to confirm execution.

CLASS1/CLASS2 Mode

You specify this at programming of the cassette using program PC-AK by checking the check box in the field bus parameters. The CLASS1/2 setting specifies the length of the diagnostics message for error polling:

-Class 1 = Short format
-Class 2 = Long format **

The diagnostics message is 16-bytes-long, the extended 62-byte message is used only in CLASS2 operation for special service Error Polling.

Short Format

Diagnostic function, AK-30	Number of Bytes	Computer Offsets	
– Extended diagnostic header, number of bytes	1	6	
– Alarms	1	7	B0=encoder measurement error B1=transfer error B2=outside measuring range B3=encoder missing * B5=service control faulty B6=programming data record faulty B7=Verify faulty
– Operating status	1	8	B0= - B1=Class1/2 B2=Commissioning B3=Scaling enable B4= - B5= - B6=Standard (=0), AK-30 function (=1) B7=Verify (=0) / Programming (=1)
– Encoder type	1	9	00=Singleturn, Rotary encoder 01=Multiturn, Rotary encoder 07=Linear encoder 0F=AK-30
– Axis number that returns error or that is to be programmed	1	10	01 - 08
– Still errors on axes 1 - 8 (one bit per axis)	1	11	2^0 = axis 1, 2^7 = axis 8
– Check-back field: error number (latest) ‖ Prog. value	2	12	Format: main error/single error
– Check-back field: error number (next oldest) ‖ Progr. value (less significant section)	2	14	
		16	

  * Can only be evaluated with SSI checksum encoders
 ** Cassette option

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Long Format *

Diagnostic function, AK-30 (new cassette format)	Number of Bytes	Computer Offsets	
– Extended diagnostic header, number of bytes	1	6	
– Alarms	1	7	B0=encoder measurement error B1=transfer error B2=outside measuring range B3=encoder missing ** B5=service control faulty B6=programming data record faulty B7=Verify faulty
– Operating status	1	8	B1=Class1/2 B2=Commissioning B3=Scaling enable B4=x B5=x B6=Standard(=0), AK-30 function (=1) B7=Verify (=0) /Programming (=1)
– Encoder type	1	9	00=Singleturn, Rotary encoder 01=Multiturn, Rotary encoder 07=linear encoder 0F=AK-30
– Axis number that returns error or that is to be programmed	1	10	01 - 08
– Still errors on axes 1 - 8 (one bit per axis)	1	11	2^0 = axis 1, ..., 2^7 = axis 8
– Error number (newest)	2	12	Format: main error/single error
– Error number (next oldest)	2	14	Format: main error/single error
– Error number (next oldest)	2	16	Format: main error/single error
– Error number (next oldest)	2	18	Format: main error/single error
– Profile version	2	20	Format: xx.xx
– Software version	2	22	Format: xx.xx
– Operating time	4	24	In 0.1 h units
– Original number of steps/rev	LA: steps/mm	4	28	As stated on rating plate
– Original number of revs	LA: Length in mm	2	32	As stated on rating plate
– Measuring length	4	34	Measuring length for (numerator/denominator) revs
– Measuring length in revs numerator	2	38	1-4088 and 4096
– Measuring length in revs denominator	2	40	1-4088
– Offset value	4	42	Measured value offset, scaled units
– Manufacturer offset value	4	46	Zero offset, original encoder unit.
– Article number	4	50	8-digit number
– Serial number article	2	54	0 - 9999
– Reserved for future use	6	56	
Number of bytes for user diagnostics	56	**62**	Number of bytes for diagnostics

  *   Only available in cassettes with CLASS2 operation
 **   Can only be evaluated with SSI checksum encoders

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3.5 Parameter Data Record

The parameter data record can be sent as a basic data record, an extended basic data record or as an extended parameter data record.

Basic data record

The basic data record, which is eight bytes long (up to offset 7), contains only data that is relevant to the field bus. In this case, the cassette sets the bits below in the Operating Instruction parameter field:

− Scaling enable (scaling function)
− AK-30 function

In diagnostics, the system checks back this field as Operating Status.

Extended basic data record *

The extended basic data record is nine bytes long and contains, in addition, the Operating Instruction parameter field. It makes possible activation and deactivation of the scaling function.

− Commissioning (test mode)
− Scaling enable (scaling function)
− AK-30 function

Bit B7, Verify/Programming has no effect in the extended basic data record.

	Extended Basic Data Record	**Number of Bytes**	**Computer Offsets**	
Extended basic data record	− Station status	1	0	B0-B2=x B3=WD on B4=Freeze Request B5=Sync Request B6=Unlock Request B7=Lock Request
	− WD_Fact 1,2	2	1	
	− MinTSDR	1	3	
	− Identnumber	2	4	
	− Group ident	1	6	
	− SpecUserPrm byte	1	7	
Basic data record	− Operating instruction	1	8	B0, B1=not used B2=Commissioning B3=Scaling enable B4= not used B5= not used B6=AK-30 function / 0=Standard B7=Verify (0) / Programming (1)
		0	**9**	Number

* Only possible in the case of cassettes with CLASS2 operation

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Extended Parameter Data Record *

Using the extended parameter data record, you can program and verify the encoder data of the axes. The length of the parameter data block is

(8 + 2 + (number of field bus axes) × 28) bytes.

The axis-dependent parameter data starts from offset 10 (direction of rotation) onwards and is 28 bytes long. This data record applies to axis 1. You append the other axes by adding a further 28 bytes of axis-dependent parameter data. Each axis-dependent parameter data record starts with the direction of rotation and ends with the reserved 2-byte field.

Extended Parameter Data Block	Number of Bytes	Computer Offsets	
− Station status	1	0	B0-B2=x B3=WD on B4=Freeze Request B5=Sync Request B6=Unlock Request B7=Lock Request
− WD_Fact 1,2	2	1	
− MinTSDR	1	3	
− Identnumber	2	4	
− Group ident	1	6	
− SpecUserPrm byte	1	7	B0=Dis Start B1=Dis Stop B2=WD Base
− Operating instruction	1	8	B1=Class1/2 B2=commissioning B3=Scaling enable B4=x B5=x B6=AK-30 function / 0=Standard B7=Verify/Programming
− Free (valid in entire cassette)	1	9	
− Direction of rotation	1	10	0=increase clockwise 1=increase counter clockwise
− Encoder type	1	11	01=Multiturn, Rotary encoder 07=linear encoder
− Free	1	12	
− Free	1	13	
− Original number of steps/rev LA: in mm	4	14	1-131072
− Original number of revs | LA: steps/mm	2	18	1-8192
− Measuring length	4	20	Measuring length for (numerator/ denominator) revs
− Measuring length in revs numerator	2	24	
− Measuring length in revs denominator	2	26	
− Offset value	4	28	Measured value offset, scaled units
− Manufacturer offset value (zero offset)	4	32	Zero offset, Original encoder unit.
− Free	2	36	
		38	Number (only one axis available)
	Number of bytes/axis		
		28	

*   Only possible in the case of cassettes with CLASS2 operation

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"Measuring length numerator and denominator" parameter
You must program the measuring length with a numerator and a denominator if the resolution of the measuring length refers to a fraction of the Original Number of Revs rather than to the entire number. In this case, you must not enter a measured value offset in Offset Value. The cassette automatically sets the parameter to 0. If you leave the numerator or the denominator as zero, diagnostics automatically issues the following long-format message:

Numerator = Number of original revs
Denominator = 1

Example:

If you make the following entry,
Numerator = 9
Denominator = 2
the desired Measuring Length number of steps is distributed across 9 / 2 (4.5) revolutions. After this, the encoder starts at position 0 again.

3.6 Configuration Parameters for COM ET200 Screen Form Input

The cassette uses the DP standard PROFIBUS protocol.

In the AK-30's *configuration screen form,* you specify the addresses and define the cassette in accordance with the number of axes and the number of programming bytes. The sequence of identifiers must correspond to the structure of the message frame (refer to page 3-3).

You must use the following identifiers:

11: 2-byte cassette status

91: 2-byte encoder input data (14-bit actual value, 1 error bit, 1 programming bit)/with consistency

93: 4-byte encoder input data (30-bit actual value, 1 error bit, 1 programming bit)/with consistency

A1: 2-byte encoder output data/with consistency

A3: 4-byte encoder output data/with consistency

A1: Service controller register

22: 3-byte external display data

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Examples

1. The example below shows the screen form for a cassette with two 2-byte axes and the Without Programming field bus option.

Identifiers	
11	Cassette status (2-byte error status and cycle number)
91	Encoder 1 (2 bytes)
91	Encoder 2 (2 bytes)
A1	Service controller register (2 bytes with axis and service numbers)

2. In this example, we want four 4-byte axes with programming.

Identifiers	
11	Cassette status (2-byte error status and cycle number)
93	Encoder 1 (4 bytes)
93	Encoder 2 (4 bytes)
93	Encoder 3 (4 bytes)
93	Encoder 4 (4 bytes)
A1	Service controller register (2 bytes with axis and service numbers)
A3	Programming data of encoder 1 (4 bytes)
A3	Programming data of encoder 2 (4 bytes)
A3	Programming data of encoder 3 (4 bytes)
A3	Programming data of encoder 4 (4 bytes)

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3. The example below show the necessary inputs for a cassette with two 2-byte axes and the Without Programming field bus option; in addition, we want three axes to transfer external field bus data to a display.

Identifiers	
11	Cassette status (2-byte error status and cycle number)
91	Encoder 1 (2 bytes)
91	Encoder 2 (2 bytes)
A1	Service controller register (2 bytes with axis and service numbers)
22	External display data, 3 bytes (1st axis)
22	External display data, 3 bytes (2nd axis)
22	External display data, 3 bytes (3rd axis)

The PLC bytes to be transferred to the cassette are structured as follows:

Word No.	Byte No.										Identifier in Configuration Screen Form
0	0	Axis number	-	-	-	2^4	2^3	2^2	2^1	2^0	A1
	1	Service number	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	2	Display data MSBy	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	22
	3	Display data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
2	4	Display data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
	5	Display data MSBy	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	22
3	6	Display data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
	7	Display data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
4	8	Display data MSBy	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	22
	9	Display data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
5	10	Display data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	

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4. In this example, we want two 4-byte axes With Programming; in addition, two axes are to transfer external field bus data to a display.

Identifiers	
11	Cassette status (2-byte error status and cycle number)
93	Encoder 1 (2 bytes)
93	Encoder 2 (2 bytes)
A1	Service controller register (2 bytes with axis and service numbers)
A3	Programming data of encoder 1, 4 bytes
A3	Programming data of encoder 2, 4 bytes
22	External display data, 3 bytes (1st axis)
22	External display data, 3 bytes (2nd axis)

The PLC bytes to be transferred to the cassette are structured as follows:

Word No.	Byte No.										Identifier in Configuration Screen Form
0	0	Axis number	-	-	-	2^4	2^3	2^2	2^1	2^0	A1
	1	Service number	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	2	Programming data MSBy	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}	A3
	3	Programming data	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	
2	4	Programming data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
	5	Programming data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
3	6	Programming data MSBy	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}	A3
	7	Programming data	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	
4	8	Programming data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
	9	Programming data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
5	10	Display data MSBy	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	22
	11	Display data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
6	12	Display data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
	13	Display data MSBy	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	22
7	14	Display data	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	
	15	Display data LSBy	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	

i   *Note*

The external field bus data (transfer values for display) is located in the axis cassette's output register. If, for example, you define in PC-AK axes 2 and 5 for the external field bus data, the data of the less-significant axis (2) must be stated first and then the data of the next highest axis (5).

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3.7 Cassette Configuration for Output of External Field Bus Data in Program PC-AK

The settings refer to the first example in the previous chapter entitled
Configuration Parameters for COM ET200 Screen Form Input.

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

Load configuration: filename.cfg/5 axes axis management/TA-MINI

Specify the encoder type for axes 1 and 2: rotary encoder/linear scale

Define axes 3 to 5 as listeners (corresponds to encoder type *no own encoder*), e.g. with axis no. 1. This setting is compulsory, since it forces the cassette to look for an encoder on these axis numbers.

For setting of the external displays, you can choose for axes 1 to 2 whether *No display (none)* or *encoder position* is output.
For axes 3 to 5, you must specify the *fieldbus data* setting.

In the Field bus option, set the number of field bus axes to 2. In the selection field, highlight *1 Word/axis without programming.* This setting corresponds to an encoder with two-byte transfer (single-turn) without programming. You can assign numbers 3 to 124 for the station address.

In the *Communication* menu, activate function *SEND DATA TO AK.*

i   *Note*

Carry out binary coding in accordance with the axis number on the connector of the TA-MINI (daughter display). See also the chapter entitled Pin Assignments: ***Connectors of the Serial Interfaces).***

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4 Programming (PC-AK Program)

4.1 Cabling for Programming and Operation

Encoder (SSI)		Axis Cassette AK30		
Clock +	←	1	CLK +	Encoder male conn.
Clock -	←	2	CLK -	Encoder male conn
Dat +	→	3	Dat +	Encoder male conn
Dat -	→	4	Dat -	Encoder male conn
Operating voltage +(11-27) V	←	7	24 V	Encoder male conn
Operating voltage 0 V	←	8	0 V	Encoder male conn

PC Link 9-pin SUB-D, female conn.					
DCD	1				
RxD	2	←	3	RS232 RC	15-pin SUB-D
TxD	3		4	RS232 TM	15-pin SUB-D
DTR	4				
GND	5	←	15	0 V	15-pin SUB-D
DSR	6				
RTS	7				
CTS	8				
RI	9				
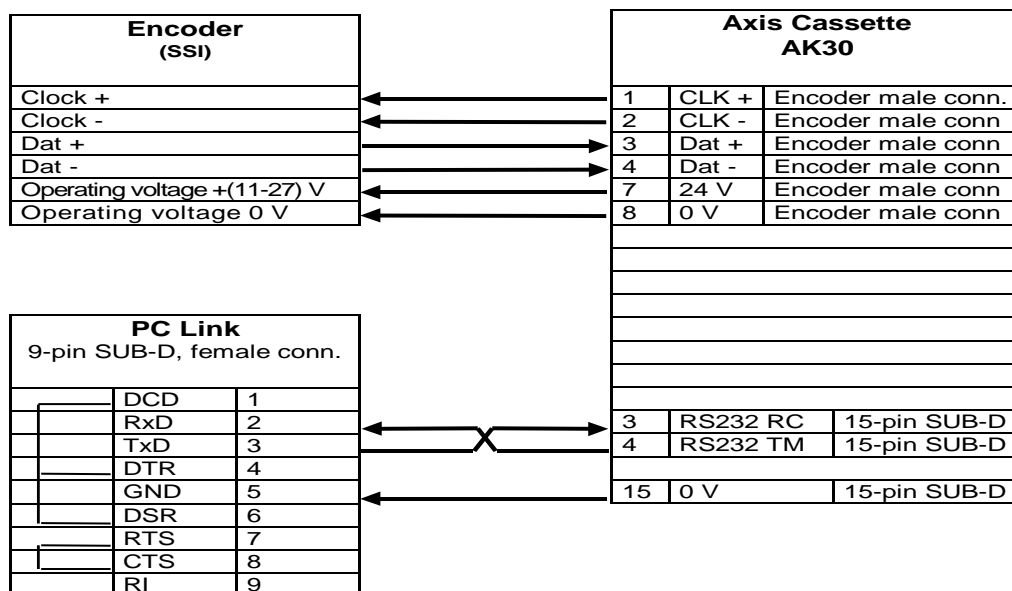
4.2 Programming Encoder Data

i

Note

You do not carry out programming on the encoder itself. The cassette receives the encoder position and manages the encoder itself in accordance with the set direction of rotation and the scaling.

In the main menu of PC-AK, choose *Encoder data.* The system opens the ***Encoder data*** window. You can program the following parameters:

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4.2.1 Encoder Type

Using this parameter, you must specify the encoder system that is to be run on the axis cassette. You can choose between rotary encoders and linear scales; in the case of an axis cassette with several axes, you can in addition choose *no own encoder.*

If you choose a rotary type encoder, you must enter the values of the encoder resolution in the program. In the input lines, keep paging using the arrow keys until you find the values stated on the encoder's rating plate.
If you choose linear scale type, you must enter on the input line the rod length stated on the rating plate.
If you choose *no own encoder,* you must, in the case of an axis cassette with several axes, enter on the input line the axis number that this particular axis is to monitor.

i   *Note*
If you do not correctly enter the encoder's original data, transfer of the data to the axis cassette is not possible or operation is not permissible.

4.2.2 Edit

Here you edit the parameters necessary for scaling the actual value.

Rotary Encoder:

The following formula applies to the scaling parameters:

$$\text{Number of steps/rev} = \frac{\text{Steps per measuring length}}{\dfrac{\text{Revs per measuring length numerator}}{\text{Revs per measuring length denominator}}}$$

i   *Note*
In the case of linear paths, the revs per measuring length numerator should always be 1, and the revs per measuring length denominator should always be a power of two.

Linear Scale:

The following formula applies to the scaling parameters:

$$\text{Number of steps/mm} = \frac{\text{Steps per measuring length}}{\text{Length of rod in mm}}$$

Depending on the individual application, you should change these formulae appropriately to calculate unknown parameters.

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Explanation of Terms

Measuring Length

In the case of rotary encoders, the measuring length indicates the total number of re-solved steps. Since counting starts at zero, the final value of the number of encoder steps is one step less than the measuring length. After this, the system starts counting from zero again. With linear scales, the actual value indicator shows End of Measurement when the lowest point is reached. This is not the case until after the value of the measuring length.

Number of Revs per Measuring Length

The number of revs per measuring length indicates the number of revolutions the en-coder is to go through until the number of steps per measuring length is reached. Since this can be either an integer (with a denominator of 1), or an odd-numbered transmission ratio can arise, you must enter the ratio as a fraction.

4.2.3 Adjust

This opens a dialog window in which the system displays the actual value of the cur-rently selected axis. If you enter a value and then click on the *Adjust* pushbutton the encoder value is set to the one you entered.

4.2.4 Programming Encoder Parameters

In the PC-AK main menu, pull down the *Communication* menu and select item *SEND DATA TO AK.*

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4.3 Cam Programming

In the PC-AK main menu, click on the `Cam data` pushbutton. The system opens the *Cam data* window and presents the options for cam programming described below. In the cam table, the window always shows the current cams of the highlighted axis with the selected cam program. You can activate the axis or program number by clicking on the first two pushbuttons, `SELECT AXIS` and `SELECT PROGRAM` respectively.

4.3.1 Insert (new cam)

This opens a dialog window in which you can insert a **new cam** in the currently selected cam table.

4.3.2 Edit

This opens a dialog window in which you can edit the cam that is currently selected in the cam table.

4.3.3 Teach In

This opens a dialog window containing an actual value display of the current axis in which you can apply the switching points of a new cam directly from the actual value display.

4.3.4 Delete

This deletes the cam that is currently selected in the cam table.

4.3.5 Move

This opens a dialog window in which you can shift by an integer value all the cams of a path or all the cams of all the paths.

4.3.6 Insert (new program)

This adds a new program number in the program list that can be selected in the `PROGRAM` menu.

4.3.7 Deleting Cams and Cam Programs

In the `PROGRAM` menu, click on the `DELETE` pushbutton. The system opens the *Delete* window and offers the following options:

- Delete all cams of the current program
- Delete the currently selected program
- Delete all cam programs of the selected axis

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4.3.8 Programming Cam Parameters

In the PC-AK main menu, pull down the *Communication* menu and select item *SEND DATA TO AK.*

4.3.9 Activate

This **activates** in the axis cassette the **cam program** that is currently selected in the program list. This must always be carried out so that the axis cassette can execute the corresponding cam program.

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5 Disturbances

5.1 Fault Analyses

Fault analysis plays a significant role in the global concept. The comprehensive error messages are to be enable you to specify the causes of faults as precisely as possible as well as to determine the necessary remedies.

The PC-AK program completely supports the fault analysis system. You read out faults by pulling down the *TRANSFER* menu and choosing the first menu item, READ DEVICE FAULTS.

By means of the field bus, you can use a special service to poll the cause of the fault and acknowledge it.

5.2 Structure of the Error Message

Main errors are structured in accordance with the different sources. Single errors indicate the exact source of the fault. The example below shows how you should read errors:

> ### Error format: 03 / 43

where F03 is the main error and 43 is the associated single error. This means that you can look in the decimal column of the main error list to find the message:

> ### Transmission of encoder disturbed, more measuring errors occurred in succession than programmed

With single errors, the main error is of type 0x/... This means that the encoder error list applies. In the list you will find for number 43 in the decimal column the following text:

> ### Filter constant reached: Check sum error in the correctly received character string

This makes it clear that the encoder has reported correctly but more errors occurred in succession in the transfer path than were specified by the Maximum Number of Encoder Errors in Succession filter. In the list of single errors, a remedy number 3 is also shown. You can look up this additional information in the chapter entitled Remedies which contains a description of possible causes, information about observation options and recommended remedies.

The cassette stores a maximum of eight errors on each axis. All the axis-specific errors are indicated by Fxx in the lists below. If the error has an S instead of an F, the error in question is a non-axis-specific cassette error. To acknowledge the error, use a special service to read it out and with this to delete it from the error buffer. Non-axis-specific errors are triggered in the special service with axis number 0.

The Warnings error type has no additional information.

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5.3 Error Lists

5.3.1 Main Error List

	Main error		Meaning of the error:	Remedy see single error list type
	dec.	hex.		
			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 differs 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 / ..

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5.3.2 Single error lists

Error 0x / ..			Encoder error	Remedies
	dec	hex	Meaning of the single error:	
F	01	01	Timeout during transmission, sending register never empty	1
F	03	03	Timeout during transmission, sending register never empty	1
F	04	04	Buffer overflow after the 12. character received (PNT)	2
F	05	05	CRC error in the character string received	3
F	06	06	Not 11 characters in the receiving buffer for data request as expected (PNT)	2
F	07	07	Not CR as 11. character for data request as expected (PNT)	2
F	08	08	Received encoder number not identical with requested encoder (PNT)	4, 3
F	09	09	Buffer overflow during receiving, more characters received than expected (without parity error) (PNT)	5
F	10	0A	Encoder sets error bit	6
F	11	0B	Timeout in RECEIVE, at least 1 character was read (PNT)	7
F	12	0C	Encoder (LA rod) out of measuring range	8
F	13	0D	Encoder (LA rod) below zero	8
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	16	10	SSI encoder not connected or data lines twisted	
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 (PNT)	
F	41	29	Filter constant reached: Parity error in the received character string	
F	42	2A	Filter constant reached: 1.char. correctly transferred does not correspond to the correct encoder or the encoder indicates an error (PNT)	
F	43	2B	Filter constant reached: Check sum error in the correctly received character string	3
F	44	2C	Filter constant reached: Velocity exceeds limit	10
F	45	2D	Filter constant reached: Acceleration too high	10
F	46	2E	Filter constant reached: Change of rotational direction exceeds the minimum speed	10
F	47	2F	Filter constant reached: Position bounces	10
F	48	30	Filter constant reached:Ttimeout lasted too long	7
F	50	32	Encoder preset not executed correctly (encoder not identical or set error bit)	4
F	51	33	Encoder preset not executed correctly (Timeout during preset delivery to PNT-3encoder)	11
F	52	34	Requirements for preset function missing(system ready=1, no encoder, listener, encoder in timeout, preset running)	11
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 4x / ..			Programming error	Remedies
	dec	hex	Meaning of the single error:	
F	04	04	Functions for PC dialogue not active	401
F	05	05	a programming in this range of the axis via another programming unit takes place at the moment	402
F	11	0B	Data value above limit value	408
F	12	0C	Data value below limit value	408
F	13	0D	Data value out of sequence	409
F	14	0E	Preset value too great as value ≥ measuring length	410
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	413
F	18	12	local memory of this axis too small for this program type	414
F	19	13	Axis number not supported by this cassette	415
F	50	32	Axis does not exist	425
F	51	33	Axis does not exist, therefore programming of this axis via PC dialogue not possible	426
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	An LA parameter is inadmissible set to zero	
F	86	56	Division by zero, that means a calculated parameter is zero contrary to expectations	

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Error 6x / ..			PC and fieldbus error	Remedies
	dec	hex	Meaning 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	602
F	07	07	Part of the command invalid, that means not within the range of 0 to z (H'30 to H'74)	603
F	10	0A	Too much characters for one command of the command chain	605
F	11	0B	Input buffer overflow, command unusable	606
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	611
F	24	18	Preset value too large	612
F	26	1A	Encoder number invalid, as listening to own axis not possible	
F	27	1B	Program type not supported by this cassette	614
F	28	1C	Local memory of this axis too small for this program type	615
F	29	1D	Axis number not supported by this cassette	614
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	42	2A	Profibus DP, deviation in configuration length	
F	44	2C	Service controller error	
F	48	30	Hardware error in field bus driver	
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	Remedies
	dec	hex	Meaning 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	

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Error 9x / ..			Hardware and check error	Remedies
	dec	hex	Meaning of the single error:	
F	05	05	An attempt was made to reprogram an encoder into an existing encoder no. (PRGBNR)	900, 905
F	06	06	No entry in list of existing encoders, no listeners or "axis without encoder"	900, 906
F	09	09	Send register interface A (encoder) not empty for 5ms --> Position measurement jams	900, 907
F	10	0A	Send register interface D (TA-Mini) does not become empty	900, 908
F	11	0B	Value for memory length too large; the largest possible value is taken	900, 911
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	900, 913
F	14	0E	No position free in table	900, 914
S	18	12	FPGA; wrong type or defective	
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 (PNT)	
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	923
F	33	21	Division by 0 or overflow	923
F	34	22	No encoder connected	900, 934
F	39	27	Encoder position invalid or data difference PNT encoder <->cassette	
F	40	28	Interrupt (IRQ0) not identifiable	938
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	900, 960
F	75	4B	Interbus module accepts only 1, 2 or 4 axes. Wrong value is overwritten with 4	962

5.4 List of Warnings

No. of Warnings			Warnings	
(W+Exx)	dec	hex	Meanings 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	

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5.5 Remedies

5.5.1 Encoder errors

No		
1	**Cause:**	-Probably a hardware or software error in the cassette
	Remedy:	-Replace the cassette
2	**Cause:**	-On programming the encoder, 11-byte long frames are exchanged. If more than 11 bytes are received, this is an error. This also applies if the encoder doesn't read the expected CR as the 11th character.
	Observation:	-At switch-on of the AK/PK, all the edited axes try to read their encoders and to compare their programming to the cassette data. If three attempts fail to do this, error messages are generated.
	Remedy:	-Switch off and on again; -Replace the encoder if the error doesn't occur with all the encoders; -Replace the cassette;
3	**Cause:**	-At transfer of encoder frames, experience has shown that disturbances occur. *The Encoder settings/time constant for F3* structure parameter specifies the number of faulty transmissions in succession after which an error must be reported. The system counts all faulty transmissions (checksums or parity) and evaluations (timeout, speed, acceleration).
	Observation:	-In *encoder error* display mode, eight criteria for the cause of the fault are shown. Deletion is carried out once you have deleted the last error in the display from the keyboard.
	Remedy:	-If the error occurs very frequently, you should check the wiring: -Cable screened? -Connection to screen node? Can you pull on the connecting cables without them coming out of the terminals? -Have you used a screened cable of adequate cross-section? -No hum loops laid (star-shaped distribution)? -Does the interferer produce too many high-frequency portions (e.g. frequency converter), in this case, it may be sensible to ground the start and end points of the screen. -Possibly try another screen node.
4	**Cause:**	-The encoder must acknowledge the control word identically. If this is not the case, the wrong encoder responded or the transfer was disturbed.
	Remedy:	-If the error occurs very frequently, change the encoder; possible disturbance to frame see remedy 3.
5		
6	**Cause:**	-The encoder detects the error itself and reports it.
	Remedy:	-Change the encoder;
7	**Cause:**	-If the encoder hasn't responded 1.6 ms after position polling, the encoder is in a timeout. If this status continues more often than the structure parameter *encoder settings/time constant for F3* allows, an error is shown in the display. After this, the system polls the encoder 3-4 times per second. Positioning procedures are rerouted to traversing without encoder and timed.
	Observation:	-In *encoder error* display mode, eight criteria for the cause of the fault are shown. Deletion is carried out once you have deleted the last error in the display from the keyboard.
	Remedy:	-Check the cabling for loose contacts if the error occurs frequently and particularly after mechanical vibrations.
8	**Cause:**	-Magnet of LA bar not in acquirable range.
	Observation:	-FFFFFF hexadecimal is displayed as the position value.
	Remedy:	-Place magnet of LA bar in acquirable range.
9	**Cause:**	-At switch-on of the cassette, the system checks all the encoder parameters for identity with the ones stored internally. If errors are acknowledged but not removed, disturbances may occur that cannot be easily classified. In the case of closed-loop controlling axes, acknowledgement is by removing the "system ready" input.
	Observation:	-If the data in the cassette still seems OK, you can carry out programming again using the *encoder settings/encoder data transfer* structure parameter. With this programming item, it is, however, possible to read back the encoder into the cassette.
	Remedy:	-Check the values and adapt them
10	**Cause:**	-At transfer of encoder frames, experience has shown that disturbances occur. The *Encoder settings/time constant for F3* structure parameter specifies the number of faulty transmissions in succession after which an error must be reported. The system counts all faulty transmissions (checksums or parity) and evaluations (timeout, speed, acceleration). In some (very rare) cases, a frame can pass the CRC and doesn't show a parity error and still be caused by a transfer disturbance. If these errors occur frequently, they may be caused by a faulty encoder.
	Observation:	-In *encoder error* display mode, eight criteria for the cause of the fault are shown (A = acceleration error, V = speed error). Deletion is carried out once you have deleted the last error in the display from the keyboard.
	Remedy:	-If the error occurs very frequently , change the encoder.
11	**Cause:**	-A preset (i.e. setting the current encoder value to a desired value) can only be programmed if the system physically detects the encoder, since this reprograms it. At this time, no closed-loop controlling axis may be actively involved in controlling (*system ready* input = 0 for all axes). A listener can only shift its encoder value, compared to the original axis, via the zero offset structure parameter.
	Remedy:	-All system ready inputs = 0 for all axes.

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5.5.2 Programming errors

No		
401	**Cause:**	-For safety reasons, the execution of functions was locked to prevent accidental triggering. This applies to execution
		on the keypad as well as from the PC.
	Remedy:	-First, the function must be activated. One-off execution is then enabled. After execution, the system is locked again.
408	**Cause:**	-Out of range on the upper or lower permissible extreme value. Normally, the error only occurs with AKxx devices.
409	**Cause:**	-The extreme values are not exceeded, however, some specific intermediate values are not allowed. (Example: for desired encoder revolutions, only powers of 2 are allowed, i.e. 1,2,4,8,16 ... 8192)
410	**Cause:**	-The preset value must be less than the measuring length. The value scale cannot be shifted by an addition across all the measured values. In other words, the first measured value is always zero.
413	**Cause:**	-The desired application program cannot be implemented in this software version.
414	**Cause:**	-Each application program needs a minimum amount of memory to be able to run reasonably. This is the current list:
		1KB AV axis management 2KB NSW cam controller 1KB DIFF difference monitoring
415	**Cause:** **Remedy:**	-Access to these axis numbers is not possible in principle in this device. -Contact TR-Electronic.
417	**Cause:**	-Access for this file runs via the program pointer and the line pointer within the program. One line can have several
	on	columns. Depending on the file type, the limit values may change. In addition, the limit values may be dependent
		programming (specification of the total entries and their distribution in programs).
	Observation:	-Check the axis memory and programming in mode *structure* ,*file lengths* and *file distributions* [90-95, 80-84].
	Remedy: memory	-Increase the amount of axis memory if the existing amount is too small (maximum of 64 KB); -redistribute
		within the axis if it is not completely used.
426	**Cause:**	-An axis exists as soon as you reserve memory and specify an application program.

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5.5.3 PC - errors

No		
602	**Cause:**	-Commands comprise at least three characters followed by a closing ASCII CR character. (Axis number/command/checksum/CR). On receiving the closing character, the system processes the command.
	Observation:	-In mode *display, look through serial PC input buffer* [7A], the correctly received characters can be shown in the display.
603	**Cause:**	-In the serial commands, only the ASCII characters from 0 to 9 and A to z are valid. They can easily be output to a control screen.
605	**Cause:**	-A serial single command consists of a maximum of 12 characters. Overwriting is interpreted as a syntax error. The system doesn't process the command.
	Observation:	-In mode *display, look through serial PC input buffer* [7A], the correctly received characters can be shown in the display.
606	**Cause:**	-The serial command memory has a maximum capacity of 60 commands. If the sixtieth character isn't a closing character, the system rejects the entered characters.
	Observation:	-In mode *display, look through serial PC input buffer* [7A], the correctly received characters can be shown in the display.
608	**Cause:**	-The PC dialogue accesses the programming parameters via programming lists that often match the mode lists. The error indicates an invalid list has been chosen. The data cannot be assigned.
	Observation:	-In mode *display, look through serial PC input buffer* [7A], the correctly received characters can be shown in the display.
609	**Cause:** several on	-Access for this file runs via the program pointer and the line pointer within the program. One line can have several columns. Depending on the file type, the limit values may change. In addition, the limit values may be dependent on programming (specification of the total entries and their distribution in programs).
	Observation:	-Check the axis memory and programming in mode *structure ,file lengths* and *file distributions* [90-95, 80-84].
	Remedy: memory	-Increase the amount of axis memory if the existing amount is too small (maximum of 64 KB); -redistribute within the axis if it is not completely used.
611	**Cause:**	-The extreme values are not exceeded, however, some specific intermediate values are not allowed. (Example: for desired encoder revolutions, only powers of 2 are allowed, i.e. 1,2,4,8,16 ... 8192)
612	**Cause:**	-The preset value must be less than the measuring length. The value scale cannot be shifted by an addition across all the measured values. In other words, the first measured value is always zero.
614	**Cause:**	-Access to these axis numbers is not possible in principle in this device.
	Remedy:	-Contact TR-Electronic.
615	**Cause:**	-Each application program needs a minimum amount of memory to be able to run reasonably. This is the current list: 1KB AV axis management 2KB NSW cam controller 1KB DIFF difference monitoring

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5.5.4 Hardware and check errors

No		
900	**Cause:**	-This group of errors contains conflicts with the hardware and software: not enough memory, faulty hardware, unexpected function numbers, etc.
901	**Cause:**	-The desired output is busy or four axes have already each occupied an analog interface.
	Observation:	-Check in mode *structure parameters travel settings, number of analogue interface.* Use the MODE and > keys to move to the next axis (displayed in the status field at the top left), and check the other axes.
903	**Cause:**	-You can create a maximum of seven closed-loop control axes (programs: REGS, REGA, WZWZ, WZWA). Up to four of them can have analog closed-loop control (programs: REGA, WZWA). You can use the rest of the application programs in any way you like.
	Observation:	-In mode *memory allocation of individual axes, processing program*, you can check the used application program. Use the MODE and > keys to move to the next axis (displayed in the status field at the top left), and look through the other axes.
	Remedy:	-If you have created superfluous axes, you can delete them. In *mode memory allocation of individual axes, processing program,* you can delete the application program or cancel completely the memory allocation. **Important**: Before creating a new axis, you must back up to PC the ones that have already been programmed and restore them to the cassette after you have finished creation -Use another cassette
905	**Cause:**	-After switch-on, the system registers all the encoders that belong to a programmed axis ("edited axes"). These encoder numbers are blocked for non-associated encoders, i.e. ones that are connected but not used. If only one encoder is connected, it probably already has the desired number. In this case, you can continue data programming (mode structure encoder settings, encoder data transfer, programming the encoder).
	Observation:	-At switch-on of the cassette, keep pressing the MODE key until the text ENCODER X (where X is the number of the encoder) is shown in the display. Release the MODE key and keep pressing ENTER until the text is cleared.
	Remedy:	-
906	**Cause:**	-The cassette cannot find an axis that needs an actual value. The status may also occure briefly if the axes memory allocation is changed.
	Remedy:	-Define the application program in *memory allocation* mode.
907	**Cause:**	-There may be a disturbance in the serial interface chip (this may be due to a bad reset pulse) or the timeout interrupt isn't functioning or there is an, as yet, undetected software error.
	Remedy:	-
908	**Cause:**	-The serial interface for the TA-Mini does not respond as expected. The chip may be defective.
911	**Cause:**	-A maximum of 64 kB per axis can be used. Depending on the version, 32 or 128 kB is available. The memory reserved for this axis up to now is exhausted.
	Observation:	-
	Remedy:	-
913	**Cause:**	-The basic versions of these programs need more than 0.5 kB of memory.
	Remedy:	-In mode *memory allocation of individual axes*, assign more memory. First save the data of already programmed axes, since after changing memory the axes are initialized from scratch.
914	**Cause:**	-The reserved memory for this table is exhausted. In mode *structure parameters, file lengths*, the desired upper limit is set too low. You may have chosen a number of subfiles in mode *structure parameters, file lengths* that is too high.
	Observation:	-With the cam controller, the system shows the number of available switching points in *mode display, free positions.*
	Remedy:	-Adapt the parameters. Before changing memory sizes, back up already programmed data to the PC and restore it to the cassette after making your changes. **Important**: If mode *memory allocation of individual axes* is involved, you must back up **all** the axes!
921	**Cause:**	-To precalculate a traversing curve, you must generate a characteristic curve. It may comprise a maximum of 2,500 points (= characteristic A). The first portion of the points specifies how the machine is to be smooth-started
	and	stopped (characteristic B). This must be less than characteristic A (e.g. 10 - 100). The characteristic curve
	applies	to all controlling axes at the same time. You carry out individual adaptation in the structure parameters of the
	individual	axes. Characteristic A is the same as the shortest path in encoder steps to resolve a ramp of 0 to 10 V.
	Observation:	-Via positioning response
923	**Cause:**	-An entered parameter was probably not saved correctly.
	Remedy:	-You should report this error to TR-Electronic immediately, since this is an error in the softwaref. Send TR a copy of the programming data, check the circumstances of the error and try to reproduce and document them.

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934	**Cause:**	-The system can't find an encoder. In this case the readiness relay trips. Encoders are registered at switch on. The system doesn't detect encoders that are clipped on at a later time (mode display actual value = 0). Encoders
	that	go down after registration, on the other hand, are regularly polled (at approximately 0.2- to 0.5-second intervals).
	The	failure may be due to: -a wire break; -too low encoder power supply (with relatively long lines and too small a
	cable	cross-section); -relatively severe disturbances of the measuring lines; -high-resistance or loose connecting con-
	tacts	in the encoder line (plug!); -encoder being wrongly addressed;
	Observation:	-Mode *display, actual value*. -Check the polling signals on the serial address lines on the encoder (Channels A and B are inverted in each case, i.e. if a line is at approximately 3.5 - 4.5 V, the other one goes to 0 - 1.5 V). Only one polling byte is transferred: the encoder number is coded in it.
	Remedy:	-
935	**Cause:**	-The system constantly checks the driver outputs for whether the data is pending correctly at the connector. If there are deviations, the relay for readiness trips. If the error occurs when the output plug is not connected (close
	the	checking bridge!), you can assume that either the driver is damaged or that there is a disturbance in the refer-
	ence	reading path (in this case, the outputs switch correctly). If the error only occurs when the connector is plugged-in,
	the	error may be caused by severe electrical disturbances to the parallel cabling, or the output is getting a fixed distur bance potential (e.g. ground or supply voltage) or there is a short-circuit.
	Observation:	-
936	**Cause:**	-The checking bridge from 32a to 32c is missing on the output plug or the checking input for it is electrically disturbed. The relay output of the readiness contact trips.
	Remedy:	-Close the bridge with a short wire (press the pins in the mating connector together and solder them). The relay closes after the disturbance has been removed and you acknowledge the error.
937	**Cause:**	-The checking bridge from 32a to 32c is missing on the output plug or the checking input for it is electrically disturbed. The relay output of the readiness contact trips.
	Remedy:	-Close the bridge with a short wire (press the pins in the mating connector together and solder them). The relay closes after the disturbance has been removed and you acknowledge the error.
938	**Cause:**	-Under certain circumstances, the system may not process the application program.
	Observation:	-
	Remedy: ment	-Send TR a copy of the programming data, check the circumstances of the error and try to reproduce and docu-
		them.
950	**Cause:**	-In the course of a traversing curve, specific conditions of the calculated parameters have to be kept to, depen- ding on the direction of travel. Normally, these errors should not occur, even if there are disturbed encoder sig-
	nals. It	is, however, conceivable that access errors to memory could be caused by faulty encoder programming (that the integrated checks didn't detect as being wrong) or a disturbance in the memory allocation (e.g. HF radiation into
	the	memory, or similar). -It may be that this is a software error that hasn't yet been detected.
	Remedy: ment	-Send TR a copy of the programming data, check the circumstances of the error and try to reproduce and docu-
		them.
960	**Cause:**	-The programming options have already checked the data for consistency. For this reason, a cassette program- med via a PC or keypad should not show this error. There may be a disturbance in the memory allocation (e.g. HF radiation into the memory, or similar) that leads to access errors to memory. -The memory may have been created by an old software version but is being managed by a newer one. -It may be that this is a software error that hasn't yet been detected.
	Remedy: ment	-Send TR a copy of the programming data, check the circumstances of the error and try to reproduce and docu-
		them.
962	**Cause:**	-The current standard of field bus links using the Phoenix-Contact ASIC only allows processing of 1, 2, or 4 encoders on the Interbus-S. Any additional existing encoders are automatically reduced to four.
968	**Cause:**	-Under normal conditions, this system interrupt may not appear.
	Remedy:	-You should report this error to TR-Electronic, since it is a software or hardware error.
970	**Cause:**	-This is a classical software crash. Normally functioning hardware should not show this error.
	Observation:	-After the reset, an error is in the ring buffer.
	Remedy:	-If programming of a particular parameter leads to the error, program it back to the old value. If programming no longer responds, reboot the system.(At switch-on, keep the bottom three keys pressed).

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6 Appendix

6.1 Technical Data

Operating Voltage: .... 15-30 V DC (± 5% residual ripple)

Power Consumption (No Load): .... Maximum of 4 watts

Programming Unit: .... PG 750 (Siemens) or PC or
directly via the PROFIBUS-DP

Programming Interface: .... RS232 / RS422

SSI Encoder Interface
    Clock input:: .... Line driver, potential-separated
    Data output RS422 (2-wire)
    Encoder type: .... Standard SSI, 24-bit, binary/Gray, without data
security or
SSI binary with checksum
for max. of 4 CE/LA/LP measuring systems

Cycle Time: .... Approx. 2 ms for 4 axes

PROFIBUS-DP Data Interface: .... RS485, 2-wire field bus with galvanic separation

Display Interface: .... RS422 for max. of 4 TA-MINI displays of actual
position

User Software, Option of: .... Axis management of 4 measuring systems with
30-bit actual values each or
Cam controller (max. of 4 x 30 paths)
The user programs can be combined

Data Storage: .... EEPROM, FRAM

Storage Capacity: .... 32 kB: this means that a maximum of 1400 differ-
ent cam switching points can be programmed on
one axis, i.e. a total of approximately 2,500

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6.2 Accessories

Mating connector set

	Art. No.	Consisting of
AK-30 Basic Unit	62 220 014	5 x 8-pin, Type Minicombicon

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6.3 General Information on Wiring/Pin Assignments

⚠️ *Warning*

Unlisted pins must not be connected!

⚠️ *Caution*

The Preset input **on the encoder must not be used** in conjunction with axis cassettes.

Preset Input
Connecting the Pre + (Preset) input on the AK-30 sets the position value to the one programmed. You can enter the preset value in PC-AK in the *Encoder data* menu, item *Edit*.
In this context, the Pre – (Preset) input must be permanently connected to " 0" potential.
The last state of the special service (bit 2^5 00X0 0000) dictates whether preset value 1 or 2 is used for execution of the preset function. For a more detailed description, refer to Special Services on page 3-5.

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