AMK

AMKASYN

VARIABLE SPEED DRIVES

AMKASYN

Digital Drive Systems

Hardware Description Option card

- **Programmable controller PLC**
- **CAN BUS Interface (CAN-S)**

Optioncard for KE/KW-systems in the version KW-PLC
Optioncard for KU-systems in the version KU-PLC

Important notes

Due to possible destruction of components by static discharge, touching the electrical connections on the option card should be avoided.

Please attach option card directly from the packaging in the option slot of the drive without exerting force and secure the screw on the panal.

AMK Arnold Müller, Antriebs- und Steuerungstechnik GmbH & Co.KG, D-73230 Kirchheim/Teck,
Tel.: 07021/50 05-0, Telefax: 07021/50 05-176, E-Mail: info@amk-antriebe.de

Document overview for the option card AE-PLC

The following documentation is available:

1. Product information (AMK part No.:28681)

- What is the AE-PLC?
- Properties and application examples of the AE-PLC
- What does integrated PLC functionality mean?
- By what is the CAN interface of AMK characterized?
- What advantages does the CAN bus have?
- How does CAN work?

2. Hardware descriptions (AMK part No.:28621)

- Short description
- Installation instructions of the option card
- Important notes on handling
- Front panel and board structure
- Interfaces and pin assignment
- Parameter settings

3. CAN Network Configuration (AMK Teile-Nr.:28684)

- CANopen
- Synchronous and Asynchronous PDO transmission
- Predefinition Files
- Write a Concise Configuration File (CCF)
- Mapping Entry
- Index Table API (Application Interface)

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1 Abbreviations and explanations

AE-PLC	**A**MKASYN **E**xtension **PLC** (KU-PLC, KW-PLC)
APROS	AMK PS programming software
Arbitration	Bus access method; method with which access to the bus is regulated. Solution of the conflict if several stations want to send a message at the same time
Broadcasting	describes the possibility of addressing all subscribers to the network simultaneously
CAN	**C**ontroller **A**rea **N**etwork
CANconv	AMK Can converter auxiliary program for transferring the CAN network configuration to the master
ccb	**C**AN **c**onfiguration **b**inary file type *.ccb
ccf	**C**AN **c**onfiguration **f**ile *.ccf
CiA	**C**AN **i**n **A**utomation, international users and manufacturers group e.V.
Emergency Service	Bus fault characteristic on failure of one or several subscribers.
Telegram header	Header information of a message (e.g. priority...)
Ident number	(ID No.) Parameter for parameterizing the AMKASYN system
NMT service	Network management service (network initialization, bus error monitoring, status monitoring of the individual devices)
Node Guarding	Network node monitoring, is performed by the NMT master
Parameter	(ID No.) by which the AMKASYN systems are parameterized
KE/KW	AMKASYN compact rectifying unit / compact inverter
KU	AMKASYN digital compact converter
KU-PLC	AMKASYN option card for KU system
KW-PLC	AMKASYN option card for KE/KW system
Life Guarding	NMT slave monitors whether the network node monitoring of the NMT master is performed.
PDO	**P**rocess **D**ata **O**bject
PLC	**P**rogrammable **L**ogic **C**ontroller
R-PDO	**R**eceive **PDO**
SDO	**S**ervice **D**ata **O**bject
T-PDO	**T**ransmit **PDO**

2 Short description

The plug in option card AE-PLC (**A**MKASYN **E**xtension **PLC C**AN) with programmable controller PLC for programming applications conform to IEC 61131-3 standard integrates also a CAN BUS interface (CAN-S) with CANopen functionality conform to CiA Draft Standard 301 Version 4.01.
The option card can be used in the AMKASYN systems single drive series KU (option card KU-PLC) and the series KW (option card KW-PLC). They differ only in the front plate dimensions.

Without the front plate AMK intern both option cards are identified as "**AE**-PLC" card.

Install option card:
in KU: KU-PLC on top of the controller card KU-R01 in slot 2
KU-PLC on top of the controller card KU-R02 in slot 2
in KW: KW-PLC on top of the controller card KW-R02 in slot 1 or slot 2

CAN BUS interface

With the AE-PLC option card it is feasible to interface the AMKASYN system to a CAN Bus network.

Systems with AE-PLC work as central also as distributed intelligent nodes in a CAN bus network

The Can interface is conform to Standard CiA Can 2.0B. To solve the requirements of today's applications the AMK CAN interface supports additional to the standard CAN data line a synchronization signal line which is named CAN-S. CAN-S synchronizes the internal cycles of all AMK CAN bus nodes to each other.

The CAN BUS node number can be extended or reduced in an easy way.

Local drives with different PLC applications are linked together with the AE-PLC CAN bus interface to built up a network with distributed intelligent. This network supports data transmission in real time e.g. for transmit synchronous master set point and actual values of all axes.

The CAN-S interface contains the standard CAN data line und additional a synchronize signal to make slave axes exactly synchronous to a master setpoint.

PLC programming to IEC 61131-3 standard

The programming of the PLC with the windows based software CoDeSys (product of the company 3s Smart Solution GmbH) uses the IEC 61131-3 standard programming languages. The integrated AMK libraries offers extensive drive functionality to the programmer e.g. fast positioning profiles, cam controller, PID control, table interpolation… .
The libraries are harmonized to the target system of the AE-PLC.

In the non volatile memory (flash) can be stored projects up to 96kByte program code and 32kByte data code. The AE-PLC communicates with the PC via RS232 interface (COM Port 1 or 2) and the user panel input on the AMKASYN controller card.

Technical specification:		
	Performance:	approx. 2000 commands/ms (command) = one STL statement
	Prozessor	C16x technology
	PGM-memory (Flash):	96 kByte program memory, 1000000 PGM cycles
	external interfaces:	CAN-S (CAN), RS422

3 Installation of the option card AE-PLC

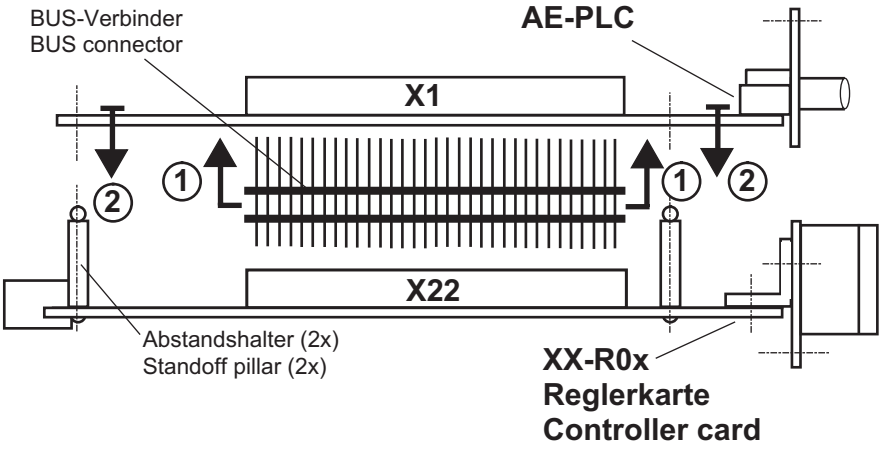
3.1 Important notes on handling

Because of possible destruction of components by static discharge, touching the electrical connections and the contacts on the solder and mounting side of the option card must be avoided. Discharge by touching PE must be caused before handling the option card.

3.2 Installation instructions for AE-PLC

The option card must be plugged onto the KU controller card and inserted in slot 2 (lower card shaft) (this place is covered by a blind panel on delivery):

1. Ensure that the AMKASYN system is disconnected from the power supply.
2. Remove the lower blind panel by loosening the two neck screws.
3. After loosening the two neck screws (on the right edge) withdraw the controller card. If slot 1 is also equipped, loosen the neck screws on the left edge of the front panel and carefully withdraw controller card with the option card as a unit. Place the withdrawn option card only on a non-conductive, padded surface.
4. Press the two snap-in plastic standoff pillars in the corresponding holes on the controller board.
5. Press the bus connectors with the longer pins fully into the jacks of the card AE-PLC.
6. Insert the bus connectors on the AE-PLC with the short pins into the jacks on the controller card and at the same time press the standoff pillars into the holes of the board AE-PLC.



7. Push the controller card with the AE-PLC card as a whole carefully into the card shaft until the controller card is plugged securely in the mating connector.
8. Tighten the neck screws of the controller card and of the AE-PLC card.

3.3 Front plate and board structure

Figure 3-1 KU-PLC front plate and board structure

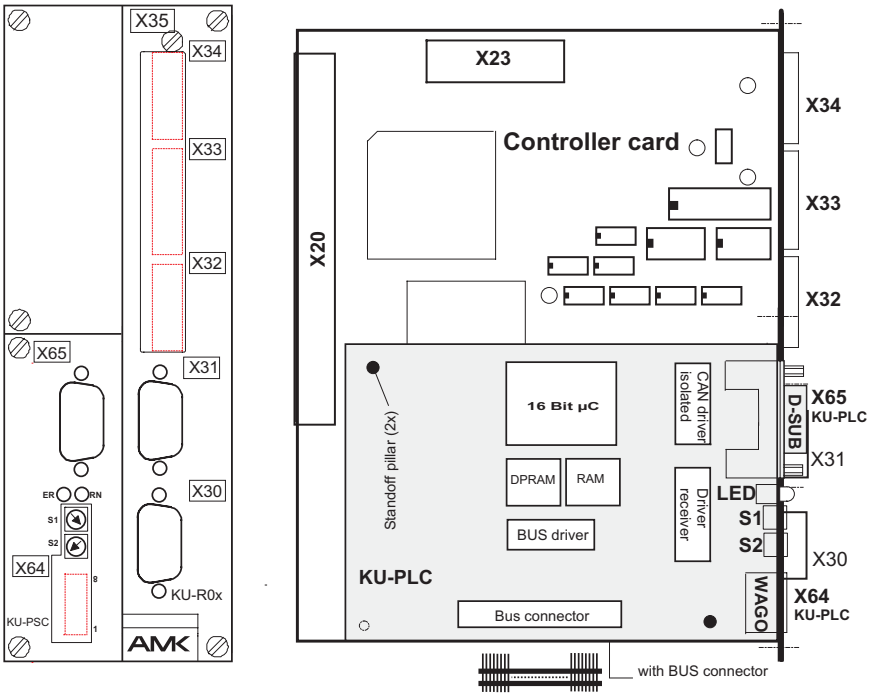
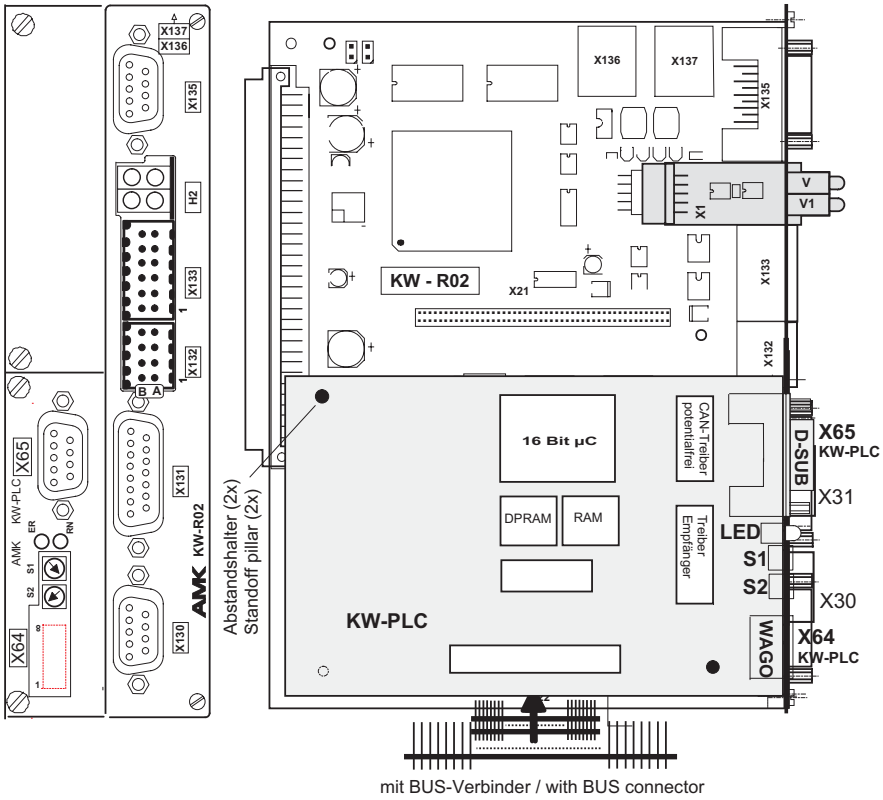


Figure 3-1 KW-PLC front plate and board structure



The KW-PLC can be used in slot 1 or 2.

4 Interface and Pin Assignment

4.1 CAN Bus interface

AE-PLC: X65

SUB-D-9-connector (male)

Pin	Code	Signal (Standard)
1	n.c.	n.c.
2	CAN_L	CAN-Low
3	GND	GND
4	CAN_S_L	CAN-S-Low (AMK)
5	n.c.	optional Shield
6	n.c.	optional GND
7	CAN_H	CAN-High
8	CAN_S_H	CAN-S-High (AMK)
9	n.c.	optional supply
10,11	PE	PE

The CAN bus line must be terminated with a 120 Ω resistor between CAN_L and CAN_H also CAN_S_L and CAN_S_H at the first and the last bus node.

For EMC conform connection of the CAN BUS:

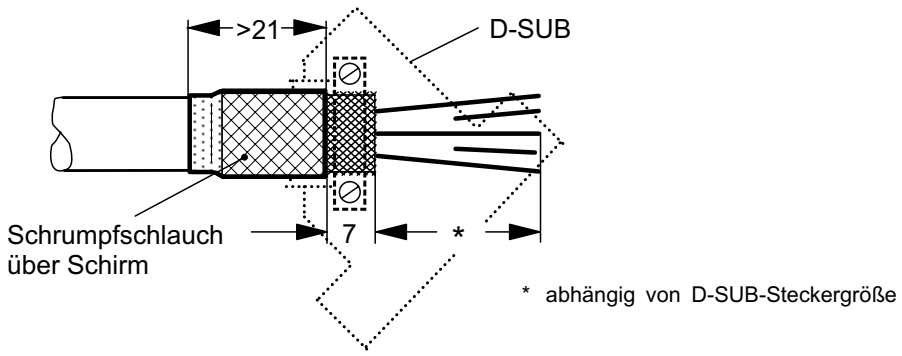
The shield of the cable must be connected at both sides. A 3 pair stranded cable with shield (e.g. Lapp-cable Unitronic LiYCY TP) and a SUB-D9-connector with metal housing has to be used. The shield must be connected to PE by using the screwed joint of housing of the SUB-D9.

Work schedule:

1. Strip the isolation of the cable
2. Retract the shield and coat it with a heat-shrinkable tube
3. Fix the shield with the greatest possible surface on the metal housing of the SUB-D9

Signal connections:

1. pair: signal CAN_H, CAN_L
2. pair: signal CAN_S_H, CAN_S_L
3. pair: signal GND



If shielded cables must be interrupted by connectors a continuous shield connection must be guaranteed by contacting the shield with all metallized connector housings. The shield may not be led via connector pins.

4.2 Serial interface RS422

AE-PLC: X64

WAGO terminal 8-pin

Pin	Code	Signal
1	TERM	Termination for RS422 if jumper with pin 6, then a bus termination is made (RS422)
2	GND	Signal Ground
3	TxD+	RS422 Transmit Data positive
4	TxD-	RS422 Transmit Data negative
5	RxD+	RS422 Receive Data positive
6	RxD-	RS422 Receive Data negative
7	-	n.c.
8	-	n.c.

The serial interface is designed physically as RS422 [1)]. After switching on the operating voltage it is initialized for the S-BUS communication.

The interface can be reprogrammed into another communication mode (e.g. RK512 for an external operator panel) by the PLC user program. This mode is valid up to switching off the operating voltage or up to changing the PLC user program.

1) RS485 software connection in preparation

4.3 Rotary coding switch

The bus subscriber address can be set on the front panel using hexadecimal rotary coding switches from 0 to 127. The set numerical value is recognized as bus subscriber address on bus initialization and transferred into the parameter ID34023.

S1 → low Nibble S2 → high Nibble

If both switches are set to 0, then the value in ID34023 bus subscriber address is valid. The slave addresses 2...127 are permitted (address 1 reserved for master). The selected addresses must agree with those in the CAN configuration file “consice configuration file (ccf)”.

4.4 Light emitting diodes

The two LEDs attached to the front panel indicate the current state of the software:

LED	Farbe	Bedeutung
1	red	Software in error state or no PLC application in the memory CAN bus error
2	geen illuminated: green blinking:	System RUN System and CAN is in RUN mode

5 Parameter setting

For synchronize CAN slaves to a CAN master all drives must have the same cycle time base. In every node must be set ID2 SERCOS cycle, ID32958 Cycle time 16 bit position setpoint value and ID34024 BUS transmission rate to the same value.

5.1 Communication parameters

See also ID32799 configuration peripheries for activate/deactivate field bus and/or programmable controller PS functionality.

ID-Number	Name	Value	Designation
ID34023	BUS participant address	e.g.5h	e.g. 5h [1]
ID34024	BUS transmission rate [kbit/s]		range:10kBaud-1MBaud [3]
ID34025	BUS mode	0h 2h	1: CAN-slave 2: CAN-master [2]
ID34026	BUS mode attribute		[4]
ID34027	BUS failure behaviour		see ID34027
ID34028	BUS output rate		not yet supported

1) The BUS participant address is valid, if the hexadecimal rotary coding switches S1 and S2 on the option card Kx-PSC/PLC are set to zero. Is the value unequal to zero the value of S1, S2 will be set to ID34023. The range of participant addresses is (01h to 7Fh) 1...127. The address 1 is reserved for the CAN BUS master.

2) ID34023 and the rotary coding switches S1 and S2 are ignored. Entry of value 2h sets this axis as CAN BUS master with node address No. 1.

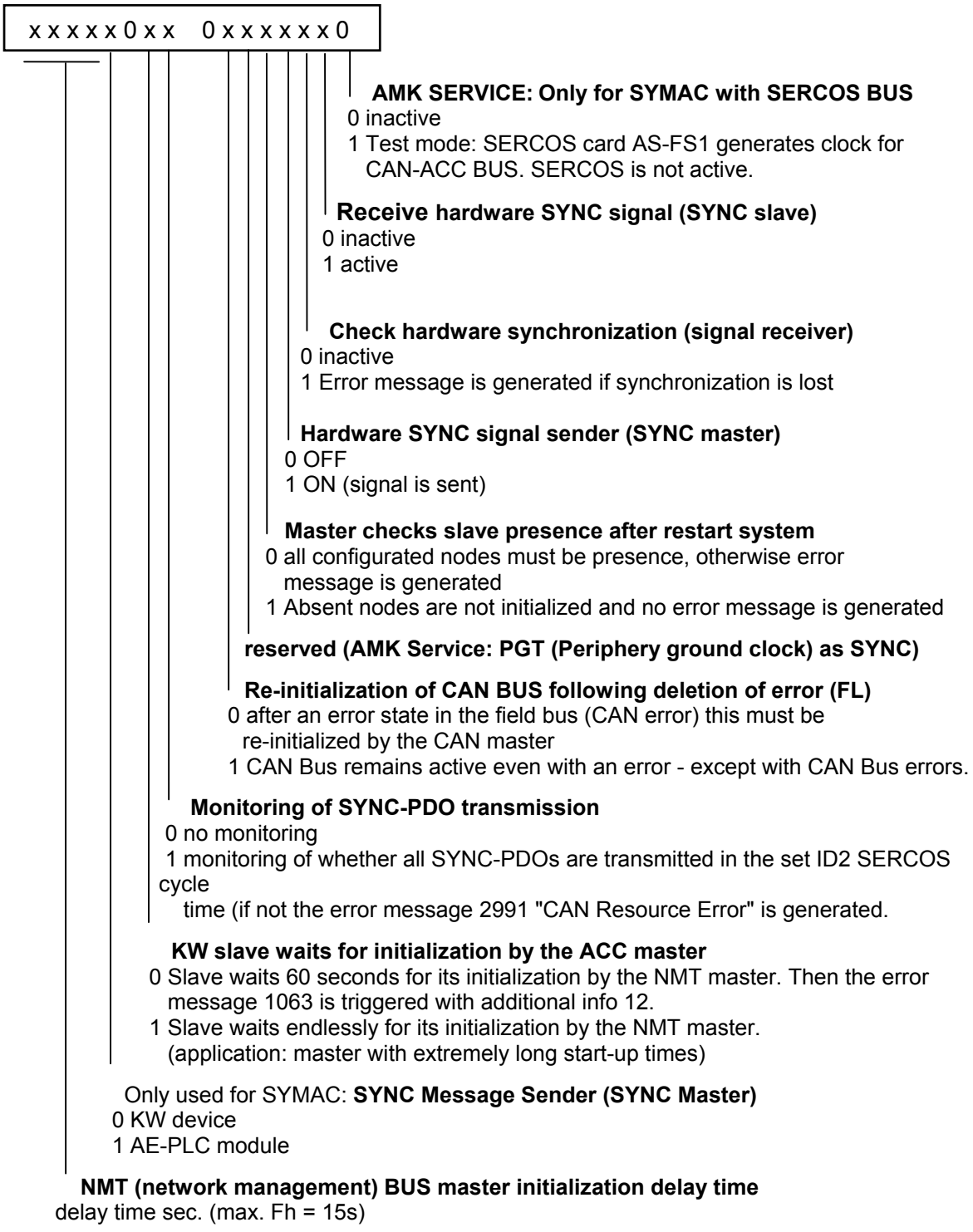
3) permissible values:

1000,00	1Mbaud;
800,00	800kbaud;
500,00	500kbaud;
250,00	250kbaud;
125,00	125kbaud;
50,00	50kbaud;
20,00	20kbaud;
10,00	10kbaud;

If invalid value is entered the transmission rate will be set to the defaut value of 20 kbaud.

4) **ID34026 "Bus mode attribute"**

this parameter defines the differentiating features of the CAN BUS.



reserved bits are preassigned with 0.

Example:

Master:

ID34026 = 3048h
- 3 sec. Delay time for initialization
- all configured nodes are cheked of presence
- new initialization of the bus after error reset
- hardware synchronization ON

Slave:

ID34026 = 6h
- Hardware synchronization slave ON
- Check synchroization slave ON

5.2 System parameters

ID32799 Configuration of peripherals

This parameter determines:

- squarewave pulses input X34
- activation/deactivation of PLC functionality
- activation/deactivation of Fieldbus functionality

ID 32799=00**ab**00**cc hex**

0 0 **a b** 0 0 **c c** **hex**

cc - setting code for squarewave pulses input (X34)

Entry	Meaning
0	2 squarewave pulses in quadrature (90° offset between track1 and 2)
1	Counting pulses track 1, direction signal track 2
2	Forward pulses track 1, backward pulses track 2

b - PLC function

Entry	Meaning
0	function deactivated (default) If Kx-PSC/PLC is plugged in error message **1376** is generated, hint to activate or deactivate required function
1	PLC active
2...E	reserved
F	function deactivated, no error message will be generated

a - function fieldbus

Entry	Meaning
0	fieldbus deactivated (default) If Kx-PSC/PLC is plugged in error message **1376** is generated, hint to activate or deactivate required function
1	fieldbus active (e.g.. CAN, ...)
2...E	reserved
F	fieldbus deactivated, no error message will be generated

Example:

ID32799 = 0x 00 11 00 00

- squarewave pulses in quadrature (90° offset between track1 and 2)
- fieldbus active
- PLC active

Caution: All pulse encoder inputs must be at defined levels, otherwise the described functions are not guaranteed.

5.3 Position parameters

ID32958 Cycle time 16 Bit position setpoint value

The specified raster in which 16-bit position set point values (e.g. set pulses for synchronous running) are sampled; can be set as a multiple of 0.5 ms.

Note:
If 16-bit position set point values are specified (e.g. by AE-PLC) then depending on the application the same value must in certain circumstances be entered in ID32958 and in ID2 "SERCOS cycle time".