AMK

AMKASYN

VARIABLE SPEED DRIVES

AMKASYN

Digital drive systems

Option card AE-PSC

- **Programmable control PS**
- **CAN Interface (CAN-S)**

Option card for AZ/AW systems in the version AZ-CNS
Option card for KU systems in the version KU-PSC

Product information

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 KU or AZ module without exerting force and secure with the screw on the front panel.

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Document overview for option card AE-PSC

The following documentation is available:

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

- What is the AE-PSC?
- By what is the CAN interface of AMK characterized?
- What advantages does the CAN bus have?
- How does CAN work?
- What does integrated PS functionality mean?
- Properties and application examples of the AE-PSC
- How is the CAN network configured?
- Principles for CANopen

2. Hardware description (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

3. CAN network configuration (AMK part No.:28684)

- Parameter settings in the AMKASYN system
- CANopen principles
- Network configuration with CANconv program
- Example of a configuration
- AMK Tool CANconv
- AMK Tool DVLader

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1 Abbreviations and explanations

AE-PSC	**A**MKASYN **E**xtension **PS C**AN
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
AZ/AW system	AMKASYN modular drive system, consisting of central module and inverter modules
AZ-CNS	AMKASYN option card for AZ modules
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.
DVLader	AMK auxiliary tool for flash database access
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
KU	AMKASYN digital compact converter
KU-PSC	AMKASYN option card for KU system
Life Guarding	NMT slave monitors whether the network node monitoring of the NMT master is performed.
PDO	**P**rocess **D**ata **O**bject
PS	**P**rogrammable control
R-PDO	**R**eceive **PDO**
SDO	**S**ervice **D**ata **O**bject
T-PDO	**T**ransmit **PDO**

2 Short description

2.1 What is the AE-PSC?

The option card AE-PSC (**A**MKASYN **E**xtension **PS C**AN) is a plug-in type card with integrated programmable control (PS) for programming tasks close to the drive, CANopen functionality as well as CAN-S interface.

Technical data:	Processor	C16x technology
	RAM	256 KBytes
	ROM (Flash)	external 512 kBytes (100000 PGM cycles, data, PS applications, ...)
	ext. interfaces	CAN-S (CAN), RS422, 1 galvanically separated binary input

The AE-PSC option card is available in 2 versions:

- for the **AZ/AW system**: **AZ-CNS**
- for the **KU system**: **KU-PSC**

The **KU-PSC** option card extends the KU basic functions by numerous drive-specific and freely programmable PS functions. By using the CAN interface the KU devices become CAN network subscribers which can in addition perform PS functions.

The **AZ-CNS** option card is used in combination with the AZ-PS5 option card as plug-on card. In this way the multi-axis AZ/AW system receives apart from the PS functionality a CAN interface and can be operated together with the KU system in CAN networks.

The two versions of the AE-PSC option card facilitate coupling the AZ/AW system with the KU system through a CAN network and offer additional PS functionality.

2.2 What characterizes the CAN interface from AMK?

The CAN interface integrated on the AE-PSC option card fulfils the standard CiA CAN 2.0B and extends this.
To satisfy the tasks of drive systems, the AMK CAN interface offers apart from the standard CAN data channel a synchronous clock signal as extension and is designated as CAN-S. Thus apart from the demand data (parameters, commands, diagnosis) in addition synchronous data (setpoints, actual values, real time bit messages) are transmitted exactly synchronized to one another.

The CAN-S interface consists of the CAN data channel and a synchronous clock signal with which all bus subscribers are synchronized exactly to a master clock.

The CAN communication is based on the CANopen standard, thus further components corresponding to the standard of external manufacturers can be integrated into the BUS system (e.g. I/Os or gateways). The following functionality is supported:

- CANopen Minimum Capability Device Boot-Up
- Node Guarding / Life Guarding
- Transmit PDOs
- Receive PDOs
- Client/Server SDOs
- Emergency Object
- Synchronization Object

2.3 What advantages does the CAN bus have?

CAN is especially suitable for systems with distributed intelligence and high reliability requirements. The CAN protocol facilitates efficient transmission both of digital input-output data and of data of higher communication such as parameters. CAN has an extensive error handling and a high effective transmission rate.

The CAN bus unites

- **Reliability**
- **Inexpensive system solutions**
- **Effective protocol**
- **Multi-master capability**
- **Decentralized bus access control by short reaction times**
- **Large offer of CAN "Tools" for start-up and service**

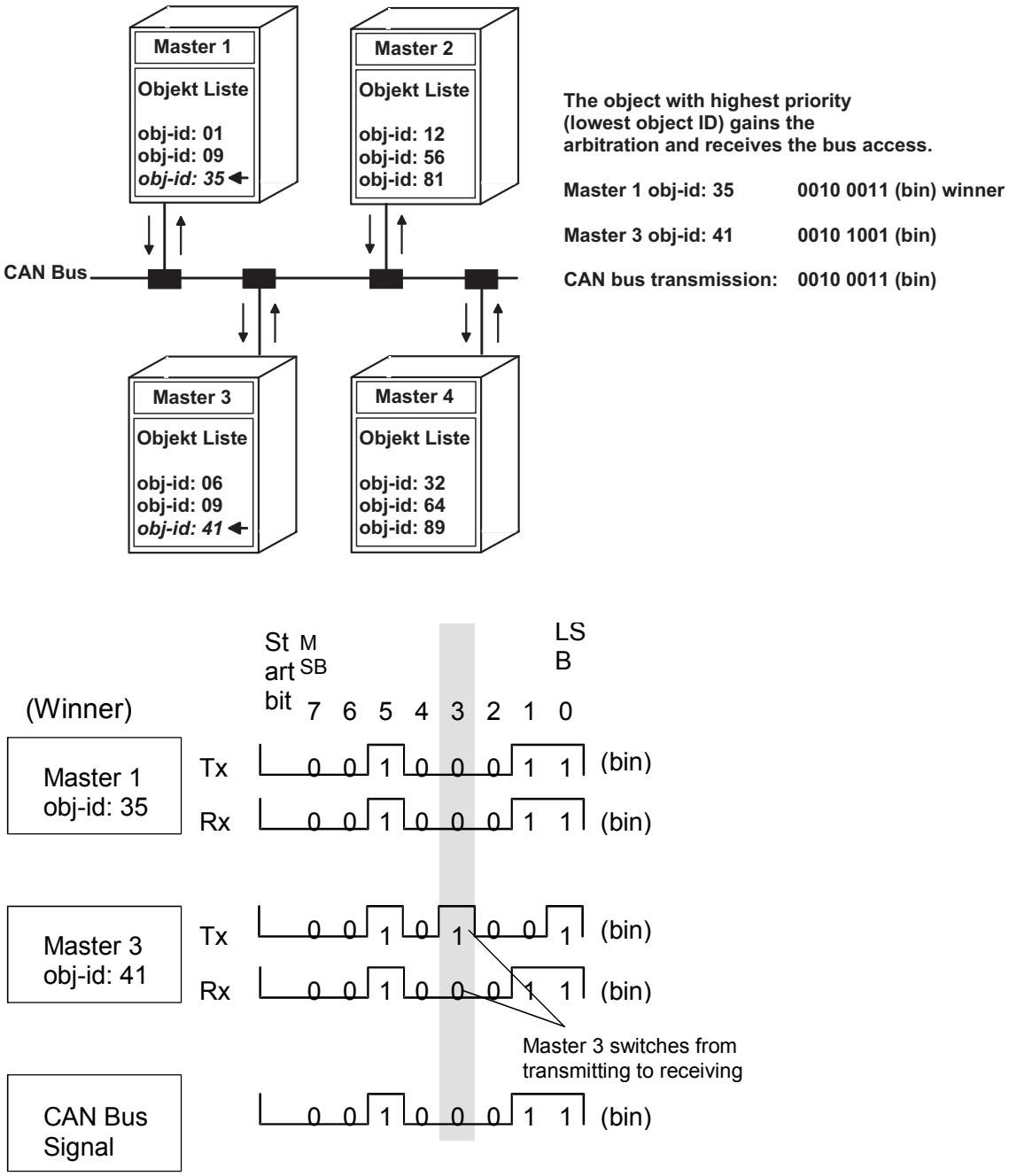
and thus makes it a popular network in practically all areas of industrial automation. Used in networking programmable control units with intelligent input and output devices, sensors and actors, it is used in versatile applications.

2.4 How does CAN work?

The CAN bus becomes a network in that messages of different priority are transmitted by broadcasting between all subscribers. The key concept is the so-called arbitration system which regulates the bus accesses of each subscriber.

If a subscriber wants to send a message (e.g. a PDO), then it sends a telegram header when the bus is free. The header contains an 11-bit object identifier (obj-id,COB-ID) which is assigned specifically to this message. The lowest significant object identifier has the highest priority, gains the arbitration and receives the bus access. Its message is sent without loss of time.

Figure 2-1 Arbitration principle



2.5 What does integrated PS functionality mean?

The integrated PS (programmable control) possesses the functionality of the AMK PS5 option card related to one axis. Up to 8 fast functions which are executed as interrupt function for the basic functions can be programmed by the user. The "APROS" program is available through the serial interface as programming tool.

The PS offers functions such as:

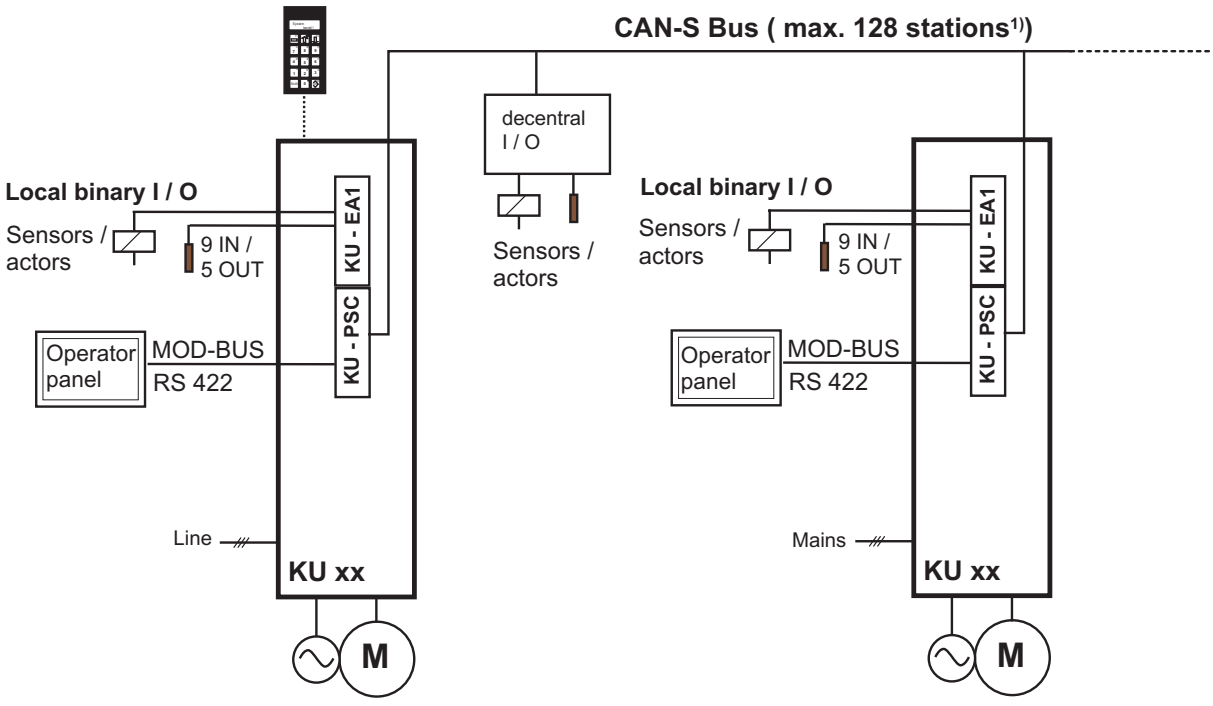
- **Electronic cam**
- **Register function**
- **Winder function**
- **Electronic camshaft controller**
- **Flying saw**
- **Traversing function**
- **Cut to register control**
- **Table interpolation**
- **Virtual master**
- **Homing cycle**
- **Resolving positioning**
- **Relative and absolute positioning**
- **„Teach in“ of position set points**
- **User programmable drive functions**

If the drive system is integrated in a CAN network, then the PS card processes the data incoming through the CAN interface, transmits data to other subscribers and makes the drive thus to an intelligent decentralized subscriber in the CAN bus network.

2.6 Properties and application examples of the AE-PSC

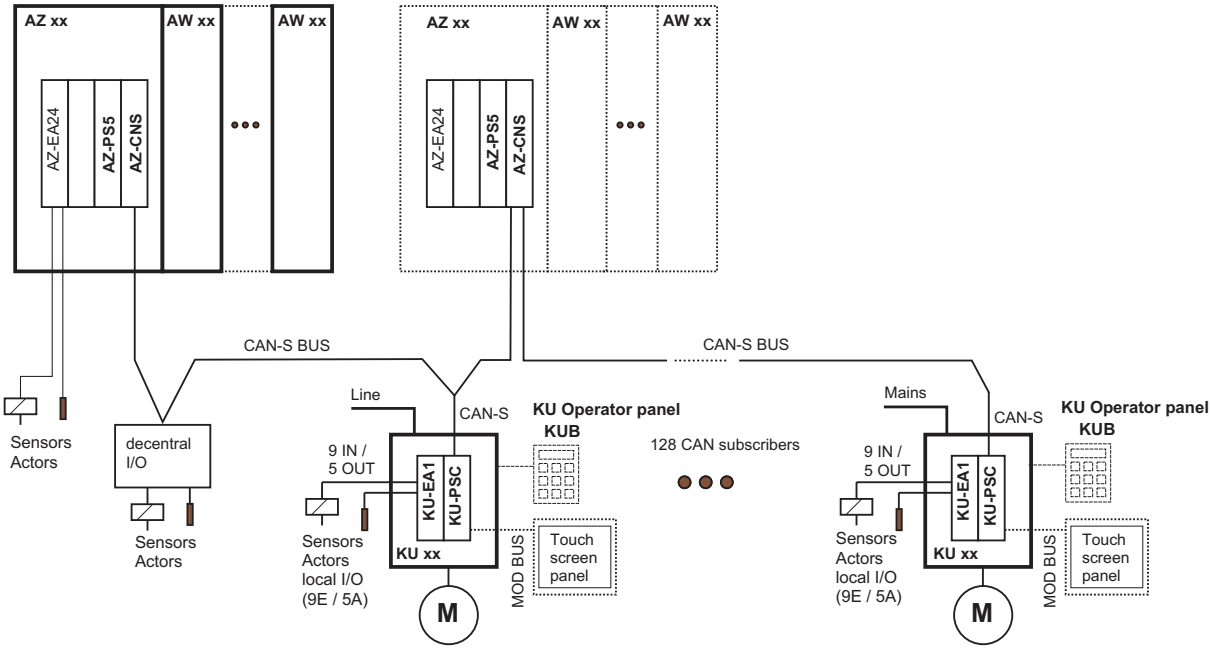
- **CANopen** and **PS functionality**
- Support of the CANopen Communication Profiles CiA DS-301
- CAN master / slave
- CAN-S (CAN with additional synchronous clock control), decentralized CAN network stations are synchronized exactly to the master clock
- Hardware synchronization of telegrams (e.g. master control setpoints are executed with CAN-S synchronously in the slaves)
- Cycle time can be set between 1 and 8 ms through parameters
- System parameter setting
- System diagnostics
- RS422 connection
- Different communication telegrams (e.g. Modbus, RK512) e.g. for external operator panel
- Handling of local binary inputs and outputs
- Application-specific drive functions can be programmed
- AMK-specific function blocks for complex drive commanding e.g. electronic cams, flying saw, winder, electronic camshaft controller, ...
- PS functionality with up to 8 simultaneously running „Fast Functions“ („Cyclic Functions“).

KU-PSC



1) 128 nodes at 250kBit/s, 32 nodes at 1Mbit/s, AMK Master supports 32 nodes

AZ-CNS



1) 128 nodes at 250kBit/s, 32 nodes at 1Mbit/s, AMK Master supports 32 nodes

2.7 CAN bus network expansion

The maximum achievable spatial network expansion of the CAN network is limited decisively by the increasing series resistance of the bus lines, the input resistances of the subscriber nodes and the transmission rate.

The following table shows the relationship:

Transmission rate	Bus line length	Nominal bit time*
1000 kbit/s	30 m	1 µs
800 kbit/s	50 m	1.25 µs
500 kbit/s	100 m	2 µs
250 kbit/s	250 m	4 µs
125 kbit/s	500 m	8 µs
62.5 kbit/s	1000 m	20 µs
20 kbit/s	2500 m	50 µs
10 kbit/s	5000 m	100 µs

* Nominal bit time describes the time which is required to transmit one bit.

3 How is the CAN network configured?

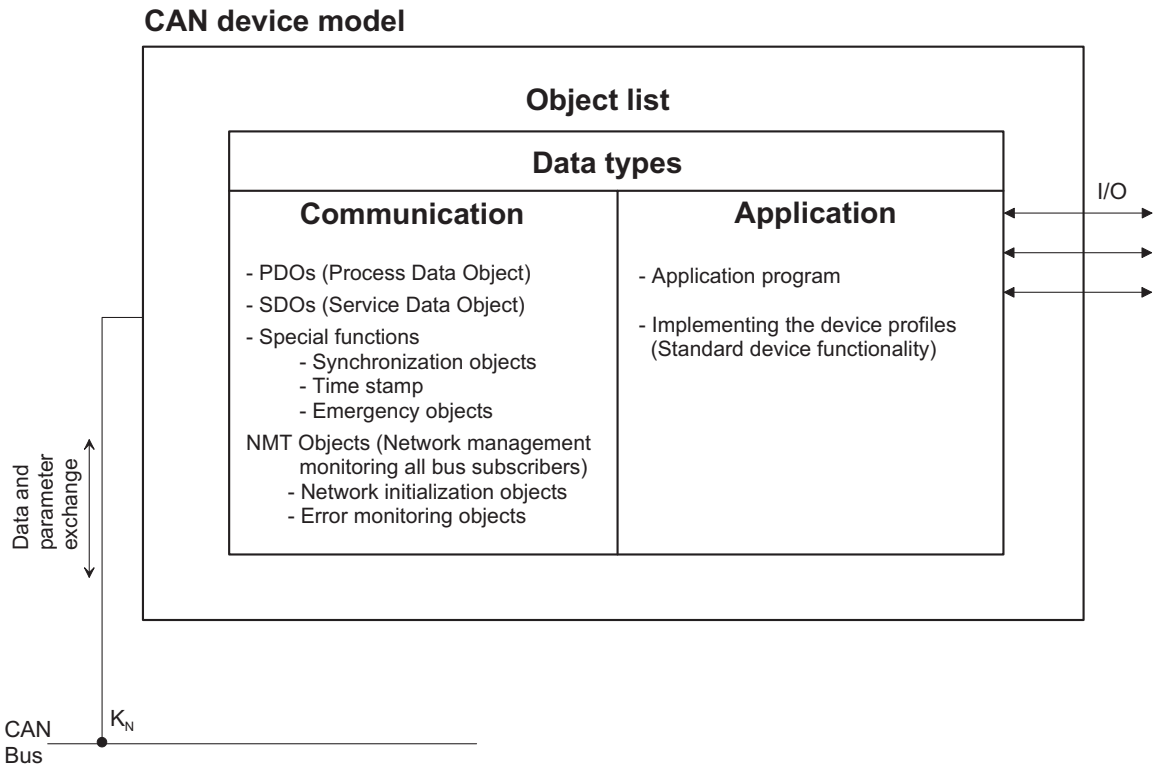
3.1 Principles of CANopen

3.1.1 Object list

Each CANopen device has a CANopen object list. The object list is divided into different areas. There are areas for the description of the data types, of the communication and of the application. All data which can be exchanged through the CAN network are represented by corresponding objects in the object list. Access to entries of the object list is made through a 16-bit index and an 8-bit subindex.

The object list is the data and parameter interface of the node to the CAN network. It describes the device with regard to its application and communication properties.

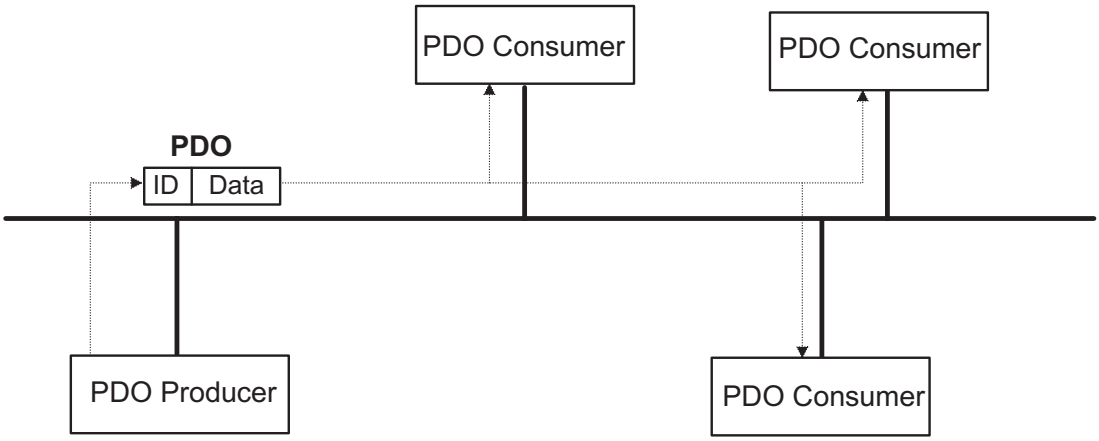
Figure 3-1 CANopen communication model



3.1.2 Real time communication

So-called PDOs (Process Data Objects) are used for exchanging real time data. PDO communication can be described with the producer / consumer model. The process data are transmitted by a node (producer) and received by one or several nodes (consumers). PDOs are not confirmed by the receiver. In PDOs all maximum 8 data bytes of a CAN frame are available for the data exchange.

Figure 3-2 Process Data Object PDO



3.1.3 Communication profile

The communication profile is the part of the object list which determines the communication properties of a node (see object list figure). Therefore the communication profile of the object list contains entries which describe the properties of PDOs.

3.2 Configuration of a CAN network

The configuration of a CAN network consists now in assigning suitable values for the application to the entries of the object list. An important part of this configuration is the assignment of parameters for T-PDOs and R-PDOs.

The following questions must be clarified for the configuration of a CAN network:
- Which nodes should be subscribers in the network?
- Which data should be exchanged between the nodes?
- When and how frequently must which data be exchanged?
- Which priorities do the data to be exchanged have?

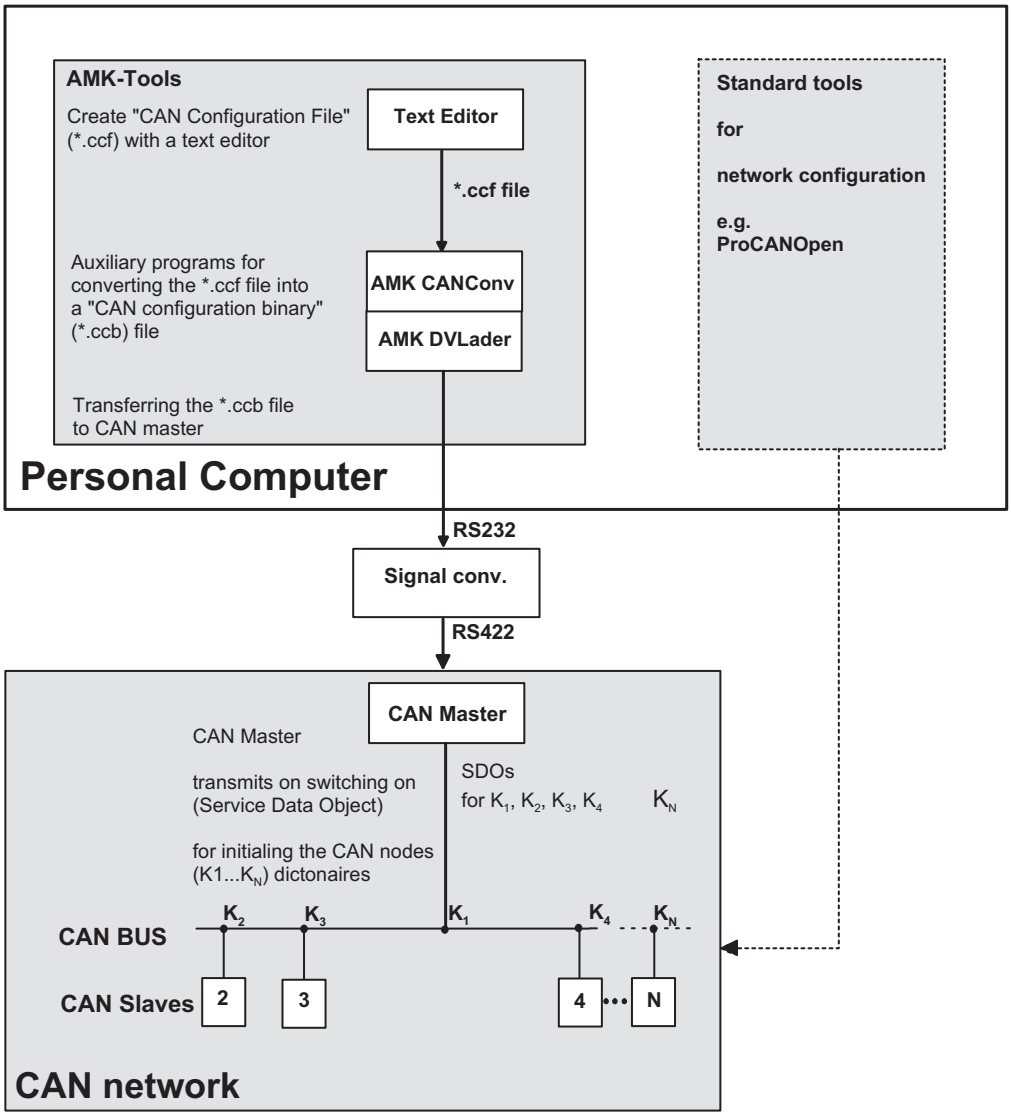
The answers to these questions result in the values for the parameters of PDOs.

Parameters for T-PDOs and R-PDOs are assigned by means of a CAN configuration file (*.ccf). The contents of the CAN configuration file is a list of value assignments for entries in the object lists of the nodes. This file can be created with a standard Windows text editor.

The "CAN Configuration File" is transmitted through the serial interface to the master AE-PSC card after completion with the AMK auxiliary tools CANconv and DVLader. With these data the CAN master firstly initializes its own dictionary and then the dictionaries of the other network nodes through SDOs (Service Data Object).

The following overview illustrates the procedure.

Figure 3-3 Overview of CAN network configuration



The details on communication through CANopen are in:

CiA Draft Standard 301 CANopen Application Layer and Communication Profile

Further assistance for creating a CAN configuration with AMK tools can be found in the documentation for the option card AE-PSC **CAN Network configuration**.