AMK

AMKASYN

VARIABLE SPEED DRIVES

AMKASYN

Digital Drive Systems

AFP-S7-PB Driver Software

The PROFIBUS DP connection between the AMKASYN drive systems and the SIEMENS S7 PLC via the AMK Field bus Protocol AFP is supported by the AFP-S7-PB driver software.

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AMK

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Contents

Abbreviations

AFP	AMK Field bus Protocol
DB	Data block
FB	Function block
ID	ID-No., drive parameter
KU	Single drive compact inverter
KW	Compact inverter module series KE/KW
OB	Organization block
PG	Programming unit
QRF	Handshake “RF Inverter On”
QUE	Handshake “UE DC BUS Enable”
RF	Inverter On
SBM	READY Message
UE	DC BUS Enable

1 Introduction

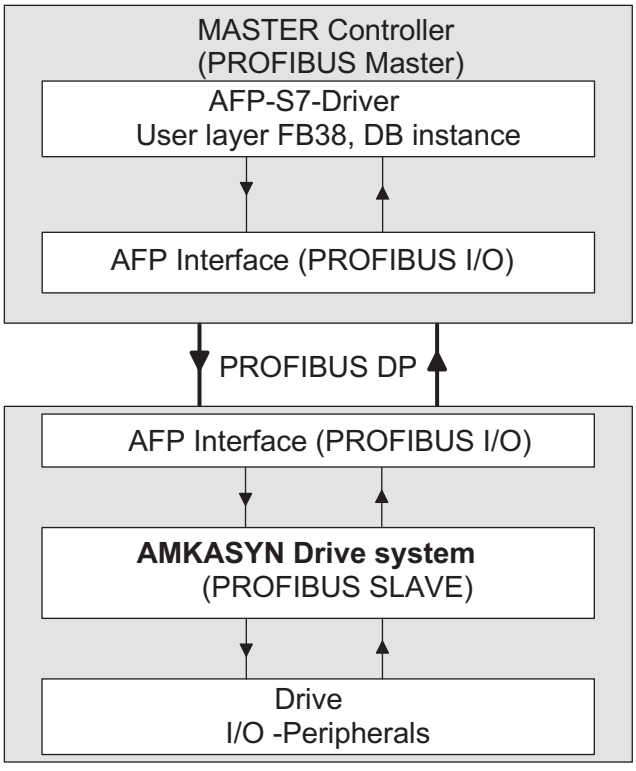
1.1 General description of the AFP-S7-PB driver

One or more AMKASYN inverters (KU, KW) can be addressed via PROFIBUS DP and the AFP interface from the SIEMENS S7 PLC by the AFP-S7-PB driver software.

The AFP protocol gives simple access to the AMK drive functionality.
8 bytes INPUT and 8 bytes OUTPUT data are defined by AFP for data transmission / reception.

On the SIEMENS S7 PLC the data exchange between the user PLC program and the AMKASYN inverter is controlled by the AFP-S7-PB driver.

Communication via AFP through PROFIBUS DP:



Functions which can be controlled by the AFP-S7-PB driver:

- **RF Inverter ON / OFF via bit "RF Inverter ON"**
- **General drive commanding**
- **Actual speed / actual position feedback for the S7 PLC**
- **Drive status evaluation**
- **Freely configurable handshake / acknowledgement bits**
- **Access to all AMKASYN parameters**
- **In case of a drive fault the error code is called up and provided automatically**
- **Exchange of data lists (read / write) between AMKASYN inverter and S7 PLC**
- **Trace function can be activated**
- **The actual version of the inverter software can be read**

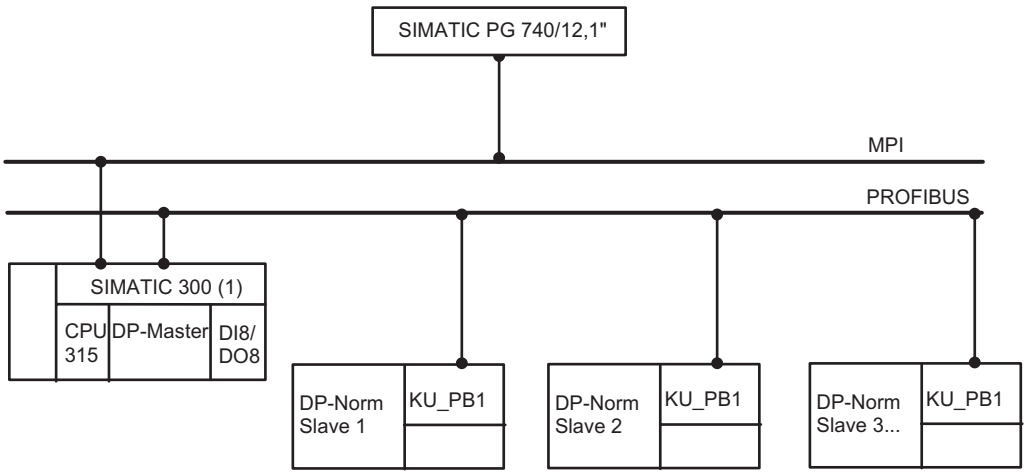
1.2 Configuration example

The AFP-S7 driver was implemented to a demo S7 PLC.
This demonstration system enables drive commanding through the SIEMENS programming unit PG740.

Components and overview diagram

- PLC Siemens SIMATIC S7-300
  - Power supply PS307 5A
  - CPU 315-2DP
  - Digital I / O module DI8/DO8x24V/0.5A
- AMKASYN compact inverter KU
  - KU0.7
  - KU-PB1 PROFIBUS DP interface option card
- AMKASYN 3-phase asynchronous servo motor
  -DV5-1-4-R00
- SIEMENS Programming unit
  - SIMATIC PG 740/12,1"
- Software SIMATIC Manager STEP 7 S7/M7m, Version 4.02

Structure



The driver software is multi axes capable: Several AMKASYN inverters (KW / KU)can be controlled by the AFP-S7-PB driver on the SIEMENS PLC.

1.3 Brief AFP-S7-PB driver overview / structure

The AFP-S7-PB driver software consists of a function block (FB38) which is called-up by the cyclic organization block (OB1).
FB38 is an AMK specific function block which is used to control AMKASYN inverters (KW / KU) via the AFP interface and PROFIBUS DP.

An instance data block DB38 is assigned to **FB38** which represents the user interface for data exchange with the user PLC program.
According to the AFP protocol the data conversion and organization is realized in function block FB38 and the data exchange between DB38 and the user PLC program takes place.
Through direct input / output variables in FB38 the inverter can be directly controlled from FB38 in the user PLC program.

For more than one PROFIBUS station (inverter) FB38 must be called-up for each station with its assigned transmission DB instance.
The integration of additional AMKASYN inverters is described later on page 28.

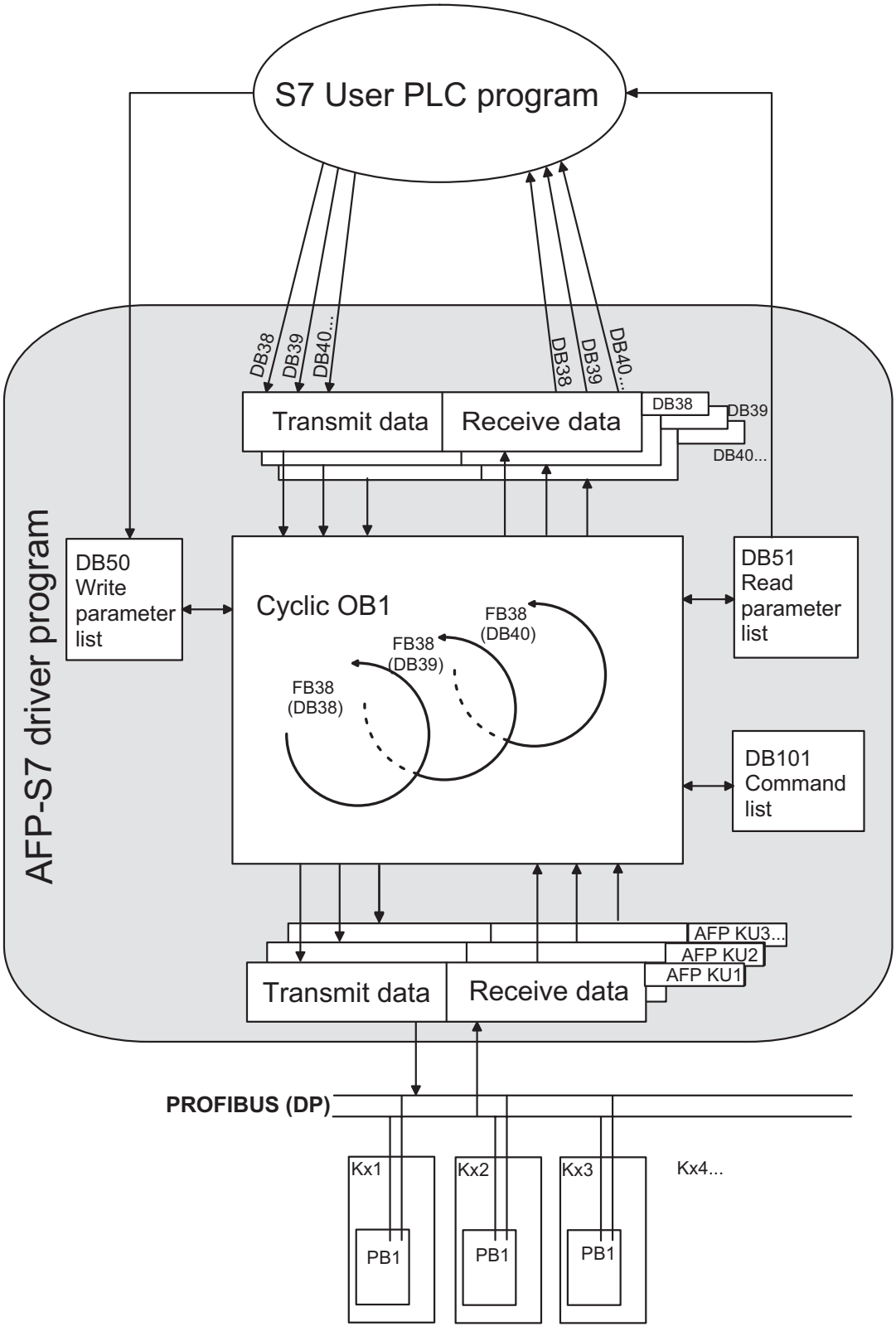
In the user layer of the **DB38 instance** static variables are stored which can be accessed by the user PLC program for data exchange.
There is a data transmission and receive area in the user layer.
Variables which have to be transmitted to the inverter (control data) are contained in the transmission area. Data from the drive (status data) are contained in the receive area.
The user PLC program can WRITE to and READ these transmission data blocks and thus it can transmit data to and receive data from the inverter.

Data blocks **DB50** and **DB51** are available for lists transfers.
By means of these data blocks the driver software organizes READ and WRITE of complete data lists between the S7 PLC and the inverter. In the user PLC program the number of list elements which have to be transmitted is defined, the data transmission then is managed by the driver (refer to chapter “Lists transfer” on page 21).

A “command list” can be created in data block **DB101** for direct commanding via input / output variables of FB38.
The “command list” consists of command blocks which are structured according to the transmission area requirements. By means of a command pointer the user PLC program simply can address the stored command and then transmit this command to the inverter.
Actual speed, actual position, error and status bits / messages are provided by the drive as output variables.

1.4 Overview graphics

AFP-S7-PB driver operating principle



2 Drive commanding through AFP-S7-PB driver

For drive commanding by the user PLC program variables are used which are listed in the “Variables declaration table”. Static variables (stat) are provided by the driver software via the **DB38 instance** and direct input / output variables in **FB38**.
By this two ways of drive commanding exist.

2.1 Drive commanding via static variables in DB38 instance

The static variables are local data of FB38 which are stored in the associated DB instance (DB38, DB39, DB40...). The DB38 instance represents the memory for FB38.
The user PLC program can address the static variables via the transfer DB instance.

Attention:
For static variables there is a transmission and a receive area.
In the receive area only READ is permissible!
The static variables and their functionality are described in the „DB38 instance“ section

2.2 Drive commanding via direct variables in FB38

Direct data exchange with the user PLC program through direct input variables (type “in”) and output variables (type “out”) of FB38 is possible without storing them in the instance DB.
The most important input / output variables for drive commanding (data type “in” and “out”) are available in FB38. They are supplemented by many static variables in the DB38 instance by which a comprehensive evaluation of the control and status data can take place in the user PLC program.
The description of FB38 contains a list of its direct input / output variables and their meaning.
By means of a command pointer (refer to FB38 Input variables) the command list in DB101 is accessed for this kind of drive commanding.

For access to the static variables of the DB38 instance by the user PLC program symbolic addresses are used. The advantage by this is that the user PLC program remains compatible with the AFP-S7-PB driver also if the absolute addresses of the declared variables have been changed. The variables are called-up by their symbolic names not by their absolute numeric addresses.

3 AFP-S7-PB driver blocks and their functionality

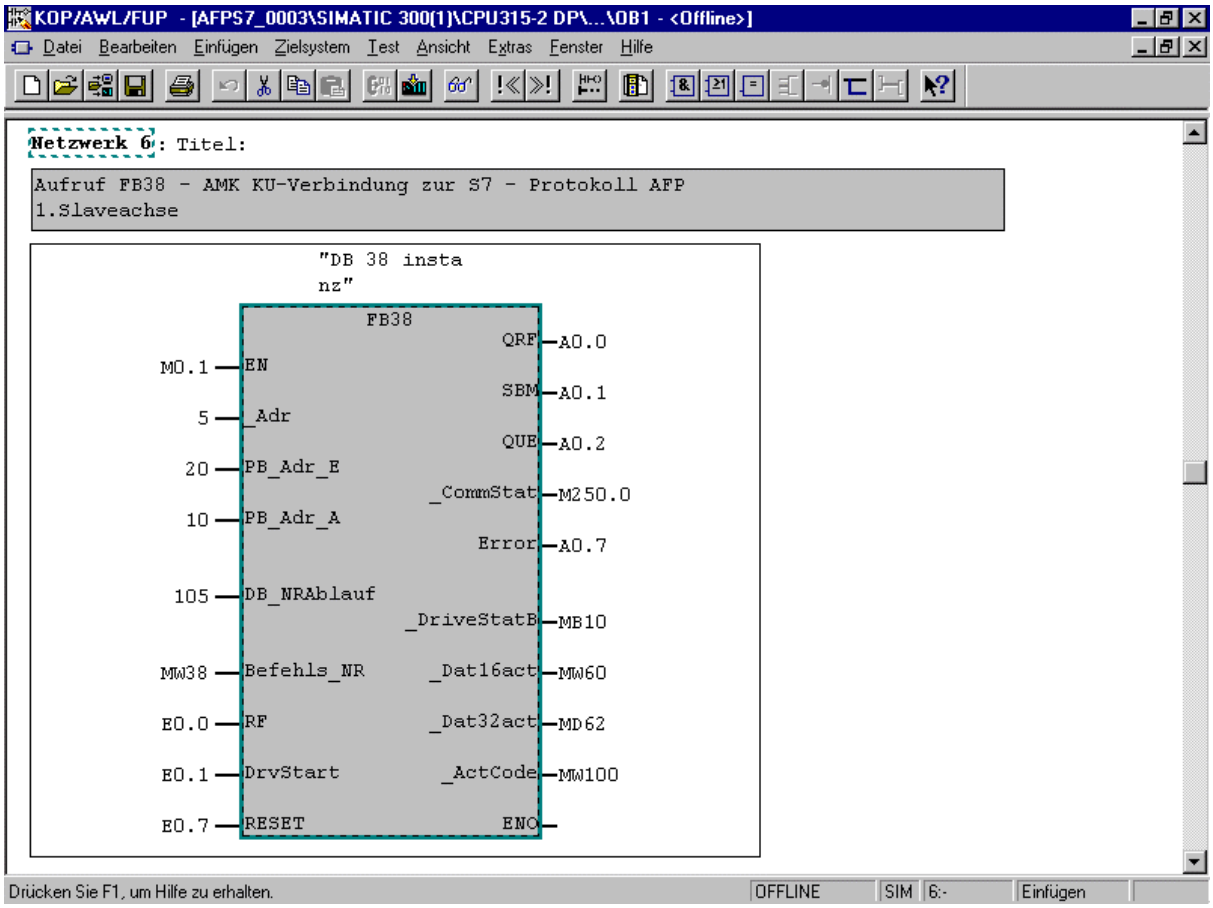
3.1 Organization block OB1

According to the number of the connected inverters FB38 is called-up in the cyclic organization block OB1.

3.2 Function block FB38

The AMK specific function block FB38 is used to command AMKASYN inverters from the SIEMENS PLC S7 through PROFIBUS and the AFP interface.
The function block FB38 takes over the data conversion and organization according to the AFP protocol. FB38 is called-up in the cyclic OB1 and it contains input and output variables which can be accessed directly from the user PLC program.

FB38 with input and output variables



A DB38 instance is assigned to FB38. For each connected KU / KW inverter FB38 must be called-up anew. For each FB38 call-up an instance DB (DB38, DB39, …) must be created and assigned to it.

FB38 Input variables

Input variables Type „in“	Meaning
EN	“ENABLE”: If logic „1“, FB is executed, if logic „0” the FB is not executed.
_Adr	PROBIFUS Station address acc. to ID34023
PB_Adr_E	Start address of the input byte (refer to hardware configuration)
PB_Adr_A	Start address of the output byte (refer to hardware configuration)
DB_NRAblauf	DB-No. für command list, e.g. DB101. This DB must exist, else the commanding also via static variables is not executed.
Befehls_NR	Command pointer: Points at the command in the command list DB e.g. DB101. **If the pointer addresses a not existing or not permissible command no commanding is executed.**
RF	RF Inverter On: Value = 0: RF OFF, value = 1: RF ON The RF bit in FB38 is logical ANDed with the RF bit „DriveCtrl“ as a static variable. Only with value “1” in both bits the signal RF Inverter ON is activated on the inverter.
DrvStart	By the raising edge of this bit the command in the command list DB, addressed by the command pointer, is executed. **There is an EXCLUSIVE OR connection between the FB38 bit „DrvStart“ and the static variable „DrvStart“, i.e. only one bit may have the value „1“ else no commanding takes place.**
RESET	By the raising edge of this bit active commands are stopped by the AFP command “STOP” (AFP code “220”) and handshake signals are reset. The drive changes to op. mode “speed control” with digital setpoint “0”. In case of a drive error “FL Error Reset” is activated before the “STOP” command is executed. **Prerequisite for Error Reset: Bit „DrvStart “ must be “0”!**

FB38 Output variables

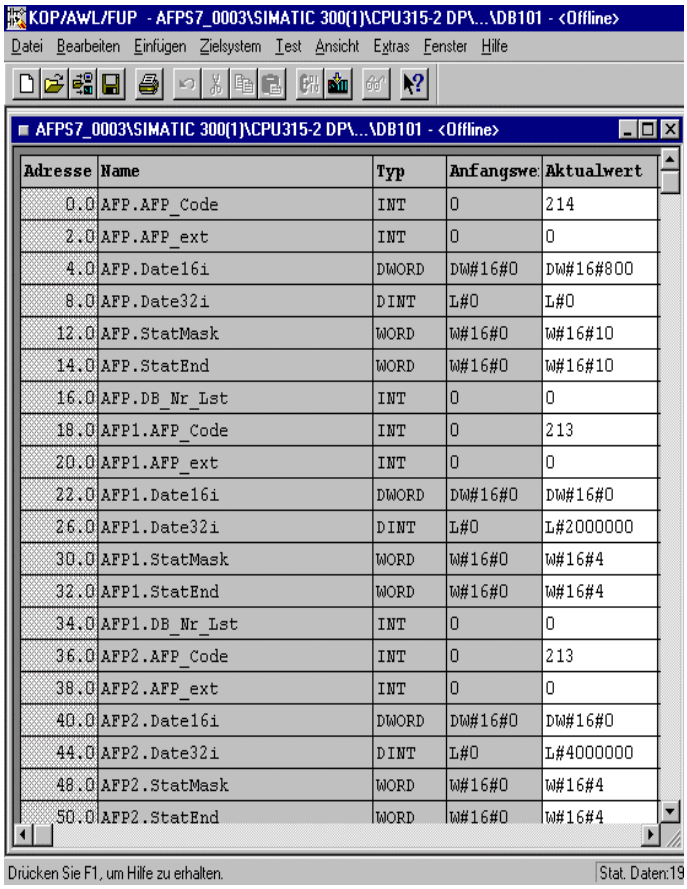
Output variables Type „out“	Meaning
QRF	“RF Inverter ON” handshake
SBM	“READY”: With SBM = 0, the AMKASYN error code is entered into static variable „DriveError“
QUE	“UE DC BUS ENABLE” handshake (“1” → DC BUS OK)
_CommStat	Value=0: Handshake prerequisite acc. to DB_NRAblauf met Value=1: Handshake prerequisite acc. to DB_NRAblauf not met
Error	AFP-S7-PB Driver error Value=0: No error Value=1: Error. The error code comes from static variable „CommErr“ (refer to error list, page 24)
_DriveStatB	AFP Status byte according to ID34029
_Dat16act	Actual speed (refer to page 27 “Inverter parameters”)
_Dat32act	Actual position (refer to page 27 “Inverter parameters”)
_ActCode	Reflects the last executed AFP command

3.3 DB101 Command list

The “Command list” is a user interface, created as a data block DB (e.g. DB101).
This user interface consists of command fields which contain selected variables of the DB instance transmission area. Each command field represents a dummy commanding. The number of commands depends on the number of the created fields. By moving the command pointer in FB38 the user PLC program can select commands stored in the command list and can switch over between them.

By a acknowledgement bit pattern the step criterion for the next command is defined.
For extensions several successive commands are copied into the corresponding command list DB (here DB101). To create additional command lists copy the existing DB101 and rename it.
Direct access to the command list is possible via the input variables of FB38. For this, through input variable „DB_NRAblauf“ the DB No. is defined which contains the command list. Variable „Befehls_NR“ is the command pointer which addresses the related command in the command list.
The maximum value for the command pointer must be defined in OB1 (refer to OB1, network 4, the line commented as „//maximale Befehls Nr. Ablauf DB“).

DB101 Command list



Adresse	Name	Typ	Anfangswe	Aktualwert
0.0	AFP.AFP_Code	INT	0	214
2.0	AFP.AFP_ext	INT	0	0
4.0	AFP.Date16i	DWORD	DW#16#0	DW#16#800
8.0	AFP.Date32i	DINT	L#0	L#0
12.0	AFP.StatMask	WORD	W#16#0	W#16#10
14.0	AFP.StatEnd	WORD	W#16#0	W#16#10
16.0	AFP.DB_Nr_Lst	INT	0	0
18.0	AFP1.AFP_Code	INT	0	213
20.0	AFP1.AFP_ext	INT	0	0
22.0	AFP1.Date16i	DWORD	DW#16#0	DW#16#0
26.0	AFP1.Date32i	DINT	L#0	L#2000000
30.0	AFP1.StatMask	WORD	W#16#0	W#16#4
32.0	AFP1.StatEnd	WORD	W#16#0	W#16#4
34.0	AFP1.DB_Nr_Lst	INT	0	0
36.0	AFP2.AFP_Code	INT	0	213
38.0	AFP2.AFP_ext	INT	0	0
40.0	AFP2.Date16i	DWORD	DW#16#0	DW#16#0
44.0	AFP2.Date32i	DINT	L#0	L#4000000
48.0	AFP2.StatMask	WORD	W#16#0	W#16#4
50.0	AFP2.StatEnd	WORD	W#16#0	W#16#4

Each command from the command list can be called-up via the command pointer „Befehls_NR“ in FB38. All AFP commands can be entered into the command list.

3.4 DB38 Instance as user interface

A user interface is defined in DB38 in which the static variables for FB38 with their actual values are stored. These variables are transmission variables for control data and receive variables for status data. Direct access to the variables of the instance is possible via their variable names (symbolic addresses).

Each AMKASYN (PROFIBUS) station is identified by its instance DB-No.

1st Axis: First FB38 call-up with instance DB38
2nd Axis: Second FB38 call-up with instance DB39
3rd Axis: Third FB38 call-up with instance DB40 and so on.

The functionality listed below is offered by the DB38 instance:

Drive commanding
Actual values display
Error messages
Handshake / acknowledgement messages
Lists transfer
Trace function

The following list contains all transmission / receive variables with their associated addresses. Through these variables all data can be accessed which must be exchanged between the S7 PLC and the drive for drive commanding via PROFIBUS.

3.4.1 Control variables (transmission area)

8 bytes control data are defined in the transmission area which are transferred to the drive. The commands to the drive according the table below must be entered into the transition area of the transfer data block before initiating the command by bit „DrvStart".

Static variables in DB instance transmission area

Transmission variable (address)	Bit	Meaning
„Adr“ (DBW 30)		Entry of the BUS station address in parameter ID34023 (Only informal. The PROFIBUS station addresses are agreed upon the system configuration in the SIMATIC Manager.)
„CommCtrl“ (DBX 32.7) (DBX 32.6)	Bit 7 Bit 6 Bit 5...0	**„DrvStart“** By the raising edge of this bit all variable values of the transmission area are activated. The AFP command with the associated 16 bit / 32 bit setpoint is executed on the drive. **„Trace Ein/Aus“** Value 0: Trace OFF Value 1: Trace ON reserved (these bits must be set to „0“)
„DriveCtrl“ (DBX 34.7):	Bit 7 Bit 6...0	**RF** (Inverter ON) This bit activates Inverter ON (drive under control). The drive is now able to accept and execute drive commands. RF OFF: Motor deceleration to standstill in speed control with digital setpoint „0“. Deceleration ramp according to ID32782. At standstill the motor then is without torque. reserved (these bits must be set to „0“)
„AFP.Code“ (DBW 36)		AFP command for the selected drive commanding (according to „AFP Command list“). Command execution by 0 → 1 transition of bit „DrvStart“.
„AFP.Ext“ (DBW 38)	=0 =1	Command is executed Extended command (refer to page 26 „READ / WRITE Lists“)
„AFP.Date16i“ (DBD 40)		16bit data acc. to AFP command overview, e.g. Setpoint
„AFP.Date32i“ (DBD 44)		32bit data acc. to AFP command overview, e.g. Setpoint

Transmission variable (address)	Bit	Meaning
„AFP.StatMask“ (DBW 48)		Status mask for evaluation of the relevant acknowledgement bits from variable „DriveStat“ (refer to page 26 “Configuration acknowledgement bits ID34029”
„AFP.StatEnd“ (DBW 50)		Bit comparison between the selected bits in „AFP.StatMask“ and the actual bits status in „DriveStat“. At coincidence: → „CommStat“=0, else the acknowledgement for the higher ranking controller is delayed until coincidence is found.
„AFP.DB_Nr_Lst“ (DBW 52)		Command "Read list" (RDBLK) Entry of the destination DB-No. to which the list elements must be transferred. This DB must be available as a global DB. It is the user’s responsibility to prepare the data block for the required length of the data list. Command “Write list” (WRBLK, WRBLKT) Entry of the destination DB-No. to which the list elements must be transferred. This DB must be available as a global DB. It is the user’s responsibility to prepare the data block for the required length of the data list.

3.4.2 Status variables (receive area)

8 bytes status data are defined in the receive area which are transferred from the drive to the S7 driver. Handshake / acknowledgement bits, actual values and drive status bits are contained in the receive area of the transfer data block.

Attention: The receive area is a READ ONLY memory area.
Writing to this area by the user PLC program is not permitted!

Static variables in DB instance receive area

Receive variable (address)	Bit	Meaning
„CommStat“ (DBW 56)	=0:Ready =1: Busy =2: Error	Variable „CommStat“ indicates the commanding status. Commanding handshakes: Drive ready for commanding. If „StatMask“=0 the “Ready” handshake is output after command execution, else the acknowledgement for the higher ranking controller is delayed until coincidence is found. Command execution active. At this time a new commanding is not accepted because handshake coincidence is missing. Error, Error code in „CommErr“
„CommErr“		Error code as AFP-S7-PB driver errors if variable

Receive variable (address)	Bit	Meaning
(DBW 58)		„CommStat“ contains “2” for “Error”. For „Error codes“ refer to page 24 „Error list“
„DriveStat“ (DBX 61.7) (DBX 61.6)	Bit15 Bit14 Bit13...8 Bit7...0	QRF “RF Inverter On” handshake QUE “UE DC BUS enable” handshake reserved (these bits must be set to „0“) freely configurable acknowledgement bits (ref. to page 26)
„ActCode“ (DBW 62)		Actual AFP command is reflected from transmission area variables „AFP.Code“ and „AFP.Ext“
„Dat16o“ (DBW 64)		16bit data After AFP command execution the associated 16bit data according to the AFP command overview is provided in this variable.
„Dat32o“ (DBD 66)		32bit data After AFP command execution the associated 32bit data according to the AFP command overview is provided in this variable.
„Dat16act“ (DBW 70)		Data container for the cyclic 16bit actual value display, e.g. actual speed (refer to “Configuration AMKASYN page 26)
„Dat32act“ (DBD 72)		Data container for the cyclic 32bit actual value display, e.g. actual position (refer to “Configuration AMKASYN page 26)
„DriveError“ (DBW 76)		The first detected error code is incorporated in „DriveError“ in case of a drive error (for error codes refer to AMKASYN documentation “Diagnostic messages”).
„KU_Version“ (DBW 78)		AMKASYN Software version (it is read on each system initialisation): >>XXXX<<
„WeekYear“ (DBW 80)		Week/Year of the actual software version: >>WWYY<<
„Trace.Ptr“ (DBW 82)		Trace pointer (from 1 to 5), points to the last recorded AFP trace.
(Trace1) **„Trace.T1.CTRL“** (DBW 86)	Bit15 Bit14 Bit13...8 Bit7-0	Each “Trace” consists of the following information: AFP control word (from drive → S7): RF BTG reserved Command byte „AFP.Code“
„Trace.T1.Date16i“		16bit Setpoint to the drive

Receive variable (address)	Bit	Meaning
(DBW 88)		
„Trace.T1.Date32i“ (DBD 90)		32 bit Setpoint to the drive
„Trace.T1.Status“ (DBW 94)		AFP Status word (from drive → S7)
	Bit15	Q_RF
	Bit14	Q_BTG
	Bit13	Q_Code
	Bit12	Q_Err
	Bit11...8	reserved
	Bit7...0	configured handshake/acknowledgement bits ID34029
„Trace.T1.Date16o“ (DBW 96)		16bit data from drive to S7
„Trace.T1.Date32o“ (DBD 98)		32 bit data from drive to S7
Trace2 (DBW 102...DBD 114)		Refer to Trace1
Trace3 (DBW 118...DBD 130)		Refer to Trace1
„Trace4“ (DBW 134...DBD 146)		Refer to Trace1
Trace5 (DBW 150...DBD 162)		Refer to Trace1

3.4.3 Drive commanding via static variables

Each AFP command is described by its command code. For drive commanding the command code must be in **„AFP.Code“**. The AMKASYN documentation „AFP“ contains all AFP commands.
The raising edge of bit **„DrvStart“** activates the entered command and all related variable values from the transmission area are processed. The **„DrvStart“** bit is part of variable **„CommCtrl“**.

Inverter ON (RF) in variable **„DriveCtrl“** is a realtime bit and it becomes effective directly after the raising edge of bit „DrvStart“.

The 16bit data and 32bit data related to the respective AFP command is written to variable **„AFP.Date16i“** and **„AFP.Date32i“**. For their contents (e.g. setpoint values) refer to „Command overview“ in the AFP documentation.

AFP commands which output read data after command execution transfer these data into receive variable **„Date16o“** respectively **„Date32o“**. For the content of these data container refer to the AFP Command overview. It is depending on the respective AFP command.

The last command executed by the drive is reflected to variable **„ActCode“** in the receive area.

3.4.4 Commanding example

Variables transmission area

Transmission area

Variable	Content	Meaning
"Adr"	5	BUS Station address
"CommCtrl"	Bit 7 6 5 4 3 2 1 0 Value 1 1 0 0 0 0 0 0	Bit7 provides "Start" rising edge Bit6 turns Trace function on
"DriveCtrl"	Bit 7 6 5 4 3 2 1 0 Value 1 0 0 0 0 0 0 0	Inverter ON (RF) is set by bit 7
"AFP.Code"	214	AFPcommanding code for drive function Homing cycle
"AFP.Ext"	0	List function inactive
"AFP.Date16i"	Bit high Byte ID32926 low Byte ID147 Value 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0	Homing cycle only to reference pulse, no reference switch evaluation
"AFP.Date32i"	20000	From reference position (x_i=0) the axis moves to position 20000 increments and stops there
"AFP.StatMask"	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Value **1** 0 0 0 0 0 0 0 **1** 0 **1** **1** 0 0 0 0	The bits "In Pos." (Bit3), "Axis is referenced" (Bit4), "At standstill" (Bit6) and RF (Bit15) shall be evaluated
"AFP.StatEnd"	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Value **1** 0 0 0 0 0 0 0 0 **1** 0 **1** **1** 0 0 0	The homing cycle is acknowledged as soon as the masked of "DriveStat" indicate coincidence
"AFP.DB_Nr_Lst"	0	Only required for list transfers

Receive area

Variable	Content	Meaning
"CommStat"	0	READY, drive function correctly terminated
"CommErr"	0	No driver error
"DriveStat"	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Value **1** 1 0 0 0 0 0 0 0 **1** 1 **1** **1** 1 1 1	The drive provides the following bit messages: Drive "In Position", "At standstill", "Axis referenced" and RF ist set (ON)
"ActCode"	214	Command reflection
"Date16o"	0	No 16bit data from the drive during homing cycle
"Date32o"	0	No 32bit data from the drive during homing cycle
"Dat16act"	0	Zero speed (standstill) after homing cycle
"Dat32act"	20000	Actual position, axis at 20000 increments as commanded
"DriveError"	0	No drive error
"KU_Version"	5010	AMKASYN Software Version
"WeekYear"	4299	WWYY
"Trace.Ptr"	2	Last entries in Trace 2
"Trace. T2.CTRL"	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Value 1 0 0 0 0 0 0 0 1 1 0 1 0 1 1 0	AFP control word from S/ to the drive
"Trace. T2.Date16i"	Bit high Byte ID32926 low Byte ID147 Value 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0	16bit setpoint to the drive
"Trace. T2.Date32i"	20000	32bit setpoint to the drive
"Trace. T2.Status"	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Value 1 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1	AFP status word from drive to S7
"Trace. T2.Date16o"	0	16bit data from drive to S7
"Trace. T2.Date32o"	0	32bit data from drive to S7

3.4.5 Actual value display

An update of the actual value output through variables **„Dat16act“** and **„Dat32act“** takes place by an automatic call-up of AFP command „B_ANZ“ also if the appropriate AFP channel in the meantime was used for parameter transfer.
The „B_ANZ“ command automatically is initiated by the driver program after each reading of data.

3.4.6 Trace

The last 5 commands can be tracked by the “Trace” functionality. The Trace is located in the instance DB for FB38. Each Trace contains AFP input data (control data) and output data (status data).

Commands for actual value update are also recorded by the Trace.
The trace functionality is turned ON / OFF by bit 6 of variable **„CommCtrl“ .**

The value of variable **„Trace.Ptr“** addresses the Trace data container to which the last executed command was transferred.

3.4.7 Lists transfer

For data lists transfer a AFP WRITE or READ command has to be called up with the number of list elements which have to be transferred.
A program loop is activated in the driver program for list transfer. Corresponding to the number of list elements the loop is repeated until the total list is transferred.
The function List transfer is activated by assigning value”1” to variable **„AFP.Ext“.**
If this value is „0“ each AFP command according to the AFP documentation is executed once after „Start“.

The destination ID-No. of the list transfer is defined in the 16bit data “Date16i”.
From the destination ID-No. the list elements then are read or written.

The 32bit data defines the number of list elements which have to be transferred.

The transferred list elements are written into a global DB which must be sized for the number of list elements. This destination DB is specified in variable **„AFP.DB_Nr_Lst“.**

Example Read list

Read list „Temporary parameters ID270“ to DB50

Entry to transmission area:

Variable	Value	Meaning
AFP.Code	8	Command code (RDBLK)
AFP.Ext	1	Extended command (here: List function)
AFP.Date16i	270	ID-No. of the list to be read
AFP.Date32i	26	Number of elements to be read from the list
AFP.StatMask	0	Command execution is handshaked by „CommStat“=0
AFP.StatEnd	0	Command execution is handshaked by „CommStat“=0
AFP.DB_Nr_Lst	50	Assigned DB-No. for storage of the read / written list elements. Before call-up this **global** DB must be created with sufficient block length.
DrvStart	0->1	Edge change

Wait for commanding status:

CommStat	=0	READY, Drive is ready for next commanding

The content of DB50 can be read from the programming unit PG if it is called-up by the SIMATIC manager in online mode.
There is an automatic update of the actual value display after each reading of data with subsequent output of READY acknowledgement (CommStat=0).

Example Write list

The list „Temporary parameters“ from DB50 shall be transferred to “User list 1” (ID 32798)

Entry to receive area:

Variable	Wert	Bedeutung
AFP.Code	9	Command code (WRBLKT)
AFP.Ext	1	Extended command (here: List function)
AFP.Date16i	32798	ID-No. of the list to be written
AFP.Date32i	26	Number of elements to be written from the list
AFP.StatMask	0	Command execution is handshaked by „CommStat“=0
AFP.StatEnd	0	Command execution is handshaked by „CommStat“=0
AFP.DB_Nr_Lst	50	DB-No., in which the source data are stored for the list to be written.
DrvStart	0->1	Edge change

Warten auf Kommandierungsstatus:

CommStat	=0	READY, Drive is ready for next commanding

Attention : The first two list elements (0 and 1) are required for header information. The defined list lenght must include these 2 list elements.

3.4.8 Handshakes / acknowledgements

For handshake / acknowledgement bits variable **„DriveStat“** (16bit) is available.
8 bits can be configured by the user by entry of the corresponding code of the bit in ID 34029 (for the codes refer to “Parameters” documentation, chapter “Bit assignment to binary outputs”).

For masking the bits which are relevant for monitoring and evaluation must be set to “1” in variable **„AFP.StatMask“.** Bits with „0“ assignment are not evaluated.

In variable **„AFP.StatEnd“** is defined if bit value „1“ or „0“ has to be evaluated for the acknowledgement of the bits selected in „AFP.StatMask“. The masked bits in variable „AFP.StatEnd“ are compared with variable „DriveStat“, which provides the actual drive status according to the configuration in ID34029. If the masked bits in „DriveStat“ indicate the required status the execution of the actual command is acknowledged via variable **„CommStat“** with value “0”.

If there is no coincidence between the masked bits of „AFP.StatEnd“ and „DriveStat“ the command acknowledgement is delayed until coincidence is detected.

3.4.9 Error messages

It must be distinguished between drive errors and driver errors:

Drive errors

In case of a drive error its error code is indicated in variable **“DriveError”** (refer to “Diagnostic messages” documentation). The S7 driver automatically reads the error code from the drive.
Only the code of the first error detected in the drive is contained in „DriveError“. Subsequent errors are not automatically read by the driver!
secondary faults can be read by AFP command „RD_Err“.

Driver errors

Variable „**CommStat“**=2 indicates a driver error.
„CommErr“ contains the error code of the detected driver error (refer to table “Error codes for driver errors”).

Error codes for driver errors

Error code	Meaning
1	- No DB Entry in variable „DB_NRAblauf“. - Entry command pointer in variable „Befehls-NR“ > DB length
3	Drive errorr, read error mesage from variable „DriveError“.
4	Inadmissible command during a positioning cycle
10	List function error Inadmissible entry into variable „AFP.DB_Nr_Lst“ Inadmissible entry into variable „AFP.Ext“ Inadmissible entry into variable „DB_NRAblauf“
11	List function error Number of list elements > defined DB length. The DB length must correspond to the number of list elements plus two elements for header information.
14	Error SFC 14: Consistent data reading (refer to Siemens manual) Error can be displayed via variable “Fehler_14”.
15	Error SFC 15: Consistent data reading (refer to Siemens manual) Error can be displayed via variable “Fehler_15”.

3.5 Global DB50 and DB51

DB50 and DB51 must be created as global data blocks. They are required for function „List transfer“. Access to the read list data is possible if DB51 is called-up online.
Data can be written into the list elements of DB50. This list then can be transferred into an AMKASYN list parameter, e.g. “Userlist 1” ID32798.
Both data blocks must prepared for the entry of the respective number of list elements including the header information.

3.6 Variables table Vat5, Vat6, Vat10

By a variables table the driver variables can be controlled and observed online.
Vat5 and Vat6 are created for the two preconfigured slaves.
Vat10 contains a list of all static variables of the user interface.

4 Commissioning

4.1 S7 Configuration for PROFIBUS interfacing

First the PROFIBUS connection between the SIEMENS S7 PLC and the AMKASYN drive system must be established. The “Geraetestammdatei” GSD (AE-PB1.gsd) must be loaded to the S7 from the AMK floppy disk.
In the SIEMENS hardware configuration the “Universal module” and ”Consistence over the entire length” must be selected. This module is component of the AMK GSD file. It contains 8 bytes inputs and 8 bytes outputs as defined in the AFP protocol.

According to the SIEMENS manual the GSD file has to be installed (STEP 7 SIEMENS Manual, from Chapter 7.7)

Excerpt of „Siemens Benutzerhandbuch“ Step7 Kapitel 7-14 (German issue):

> **Falls der DP-Slave nicht im Fenster „Hardware Katalog“ erscheint:**
> Falls ein DP-Slave nicht im Fenster „Hardware Katalog“ erscheint, muß die entsprechende GSD-Datei nach dem Start von STEP7 in dem Verzeichnis “\STEP7\S7DATA\GSD“ installiert werden und anschließend ist Menübefehl >EXTRAS<, >GSD-DATEIEN AKTUALISIEREN< aufzurufen. Der DP-Slave erscheint dann im Fenster „Hardware Katalog“ unter „Weitere Feldgeräte“. Den gesamten Ordner „AE-PB1“ mit der Maus an die Profibusschiene ziehen und dort platzieren.

4.2 De-archive of the AFP-S7-PB Driver project

Project **„S7_0047.arj“** on the floppy disk must de-archived by the SIMATIC Manager.
For this start the SIMARIC Manager an select >De-archive< in menu >File<..

4.3 Configuration Hardware

The customer specific SIEMENS Hardware for the project must be configured in file >Hardware<.

On the project delivered by AMK already 2 PB1 modules are preconfigured at the PROFIBUS-DP Master system.

KU/KW-Slave	Station address	IN addresses	OUT addresses
1st	5	20...27	10...17
2nd	6	40...47	30...37

4.4 AMKASYN parameters configuration

A PROFIBUS option card (KU/KW-PB1) must be installed on the inverter for PROFIBUS interfacing.

The AMKASYN drive parameters of the table below must be set for PROFIBUS-DP communication.

Additional parameter information is provided in the AMKASYN documentation “Parameters”. The following parameters represent a selection of specific parameters for PROFIBUS communication. Depending on the application more parameters can be required.

4.4.1 Communication parameters

Depending on the slot where the option card is installed the communication parameters must be entered as “Instance 1” for slot 1 or “Instance 2” for slot 2!

ID.No.	Designation	Default value	Setting for PROFIBUS-DP
ID34023	Bus station address	0000h	here: 0005h
ID34024	Bus transmission rate kbits/s	0.0	0
ID34025	Bus Mode	0001h	0001h
ID34026	Bus Mode attribute	0000h	0000h
ID34027	Bus failure behaviour	0000h	0000h
ID34028	Bus output rate	0000h	0000h
ID34029	Bus status bits		Assignment see “Table”

Assignment example for ID34029:

Handshake / acknowledgement	Element No. According to AFP documentation [1)]	Bit code according to „Parameters“ documentation	Status bit No. in ID34029
Reserved for	0		
Internal use	1		
SBM	2	33029	Bit 0
QUE	3	33030	Bit 1
$n_{act}=n_{set}$ acc. to ID157	4	330	Bit 2
In Position acc. to ID57	5	336	Bit 3
Drive referenced	6	33036	Bit 4
Position synchronous	7	33014	Bit 5
At standstill (ID124)	8	331	Bit 6
Not assigned	9		Bit 7

1) Element 0 and 1 are preassigned by the system. These elements may not be changed by the user !

Bit 0 must be used for „SBM“ READY message !
The assignment to all the other bits can be selected by the user depending on his application.

4.4.2 System parameters

ID-No.	Designation	Default value	Setting for PROFIBUS-DP
ID32795	Source UE DC BUS Enable	0000h	0007h *
ID32796	Source RF Inverter On	0000h	0007h *

* Value “7h” selects “AFP” as source

4.4.3 Inverter parameters

ID-No.	Designation	Default value	Setting for PROFIBUS-DP
ID32785	Configuration 16bit message	0084h	33090h *
ID32786	Configuration 32bit message	0040h	51h *

* The settings are for actual speed in the 16bit message and actual position in the 32bit message.
From table “Codes for inverter messages” in the Parameters documentation different assignments can be selected.

5 Incorporate more BUS stations

5.1 Parameter setting

The individual station address of each additional BUS station must be entered in ID34023 (Instance 1 or 2 depending on the slot which is used for the PROFIBUS option card!).
All the other parameters must be set in the same way as described before.

5.2 PROFIBUS Connection

All Slaves must be connected to the PLC through PROFIBUS.
The PROFIBUS connection to the drive takes place through to the associated option card Kx-PB1.
If the PROFIBUS is working in order the green LED on option card Kx-PB1 is lit.

5.3 SIMATIC-Manager Configuration

An additional axis as DB SLAVE must be created under **"Configuration hardware"**.
For this an existing SLAVE axis can be copied and renamed. A station number and the start address of the input and output byte must be assigned to the newly added KU / KW axis. The values must be different from the values of the already existing stations.

A new **FB38** must be added in **OB1** for the new created axis.

An **individual DB instance** must be assigned to the new FB38.
For the existing axis are these the DB38 instance and the DB39 instance. For additional axes DB40 instance, DB41 instance, … can be created. New instance DBs must be entered into the symbol table and must be assigned FB38.

The corresponding addresses or flags have to be assigned to the input and output variables at FB38.

Insert the copied drive to the Profibus Master at any postion

Setting of the DB SLAVE properties:
-Pull folder "AE-PB1" from the hardware catalog to the DP Master bar.
-Mark the added station. At the bottom left of the screen a table opens:
„Baugruppe/DP-Kennung - Bestellnummer - E-Adresse - A-Adresse...!"
Pull „Universalmodul" from the "Hardwarekatalog" to this table.
The following windows opens:
„Neben den EA Adressen muss die Datenlänge auf 8 Byte eingestellt werden".
(Beside the I/O addresses the data length must be set to 8 bytes)

7 Imprint

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Purpose **AFP-S7-PB Driver Software description**

Part number **28200**

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- The device setup and the application
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