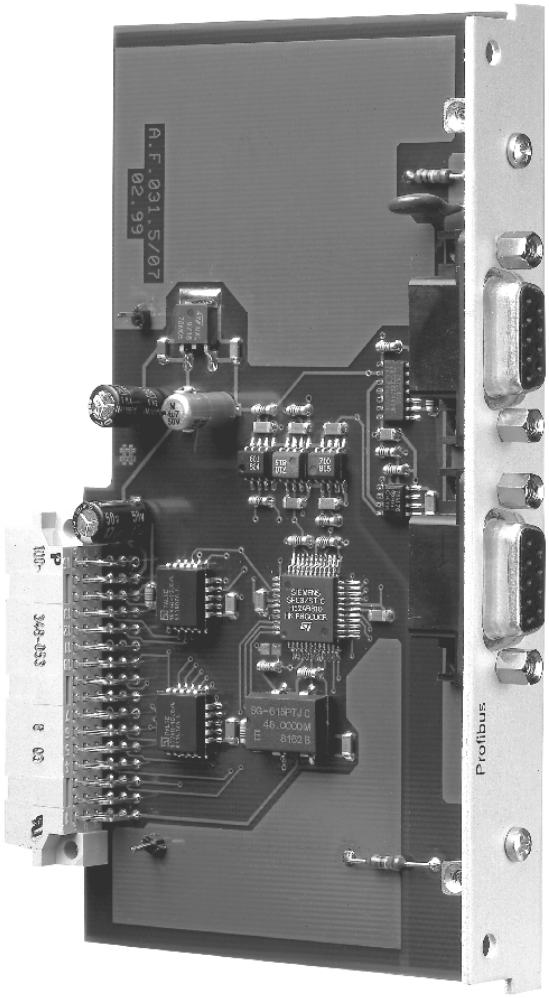
KOLLMORGEN
Seidel

Communication profile
PROFIBUS DP
Expansion card for
SERVOSTAR™ 600



Technical description

Edition 10/99

Previous editions

Edition	Comments
05 / 99	Preliminary version
10 / 99	First edition

SINEC is a registered trademark of Siemens AG
SERVO**STAR** is a registered trademark of Kollmorgen Motion Technologies Group

Technical changes to improve the performance of the equipment may be made without prior notice!

Printed in the Federal republic of Germany 10/99

Mat. No. 92142

All rights reserved. No part of this work may be reproduced in any form (by printing, photocopying, microfilm or any other method) or stored, processed, copied or distributed by electronic means, without the written permission of Kollmorgen Seidel.

Contents

		Diagram	Page
	Contents		3
	Safety instructions		5
	Directives and standards		6
	CE -conformance		6
I	**General**		7
I.1	About this manual		7
I.2	“Use as directed” for the PROFIBUS expansion card		7
II	**Installation / Commissioning**		9
II.1	Hard- and Software installation		9
II.1.1	Layout of the PROFIBUS expansion card		10
II.1.2	Fitting the PROFIBUS expansion card	- A.4.031.4/62	10
II.1.3	Connection methods		11
II.1.3.1	Connection diagram for SERVOSTAR™ 600	- A.4.031.1/41	11
II.1.4	Parameterization of the master-interface modules		12
II.1.4.1	Configuration of the control		12
II.1.4.2	Interface module CP5412 (A2)		13
II.1.5	Standard functions for data exchange with SERVOSTAR™		13
II.1.6	Handling module package SR6FC		13
II.2	Commissioning		14
II.2.1	Commissioning the basic functions of the servo amplifier		14
III	**Profile of SERVOSTAR™ 600**	- A.4.016.3/1	15
III.1	Parameter channel		16
III.1.1	Parameter ID (PKE)		16
III.1.1.1	Interpretation of the response IDs	- A.4.016.3/3	16
III.1.1.2	Profile-specific error numbers with response ID 7		17
III.1.2	Subindex IND	- A.4.016.3/3	17
III.1.3	Parameter value PWE		18
III.2	The process data channel	- A.4.016.3/3	18
IV	**Using the parameter channel**		19
IV.1	Read/write an amplifier parameter		19
IV.2	Summary of the SERVOSTAR™ parameter numbers		19
IV.2.1	List of the parameter numbers		20
IV.2.2	Profile parameters		22
IV.2.2.1	PNU 904/911: PPO-type write/read		22
IV.2.2.2	PNU 930: selector for operating modes		22
IV.2.2.3	PNU 963: baud rate		23
IV.2.2.4	PNU 965: PROFIDRIVE profile number		23
IV.2.2.5	PNU 970: default parameters		23
IV.2.2.6	PNU 971: non-volatile saving of parameters		23
IV.2.3	General parameters		24
IV.2.3.1	PNU 1000: instrument ID		24
IV.2.3.2	PNU 1001: manufacturer-specific error register		24
IV.2.3.3	PNU 1002: manufacturer-specific status register		25
IV.2.4	Position controller parameters		26
IV.2.4.1	PNU 1250: velocity multiplier		26
IV.2.4.2	PNU 1251: axis type		26
IV.2.5	Position data for the position-control mode		26
IV.2.5.1	PNU 1300: position		26
IV.2.5.2	PNU 1301: velocity		26
IV.2.5.3	PNU 1302: motion task type		27
IV.2.5.4	PNU 1304: acceleration time		27
IV.2.5.5	PNU 1305: deceleration time		27
IV.2.5.6	PNU 1306: acceleration jolt limiting		28
IV.2.5.7	PNU 1307: deceleration jolt limiting		28
IV.2.5.8	PNU 1308: next motion task		28
IV.2.5.9	PNU 1309: start delay		28
IV.2.5.10	PNU 1310: copy motion task		28
IV.2.6	Setup mode: position		28
IV.2.6.1	PNU 1350: homing		28
IV.2.6.2	PNU 1351: homing direction		28

Contents

Diagram Page

IV.2.7 Actual values . . . 28
IV.2.7.1 PNU 1401: speed . . . 28
IV.2.7.2 PNU 1402: incremental position: actual value . . . 28
IV.2.7.3 PNU 1403: SI-position: actual value . . . 28
IV.2.8 Digital I/O-configuration . . . 29
IV.2.8.1 PNU 1450 .. 1453: function of the digital inputs . . . 29
IV.2.8.2 PNU 1458/1459: function of the digital outputs . . . 30
IV.2.9 Analog configuration . . . 30
IV.2.9.1 PNU 1500: configuration of the analog input functions . . . 30
IV.2.9.2 PNU 1501/1506: configuration of the analog outputs . . . 30

V Process data channel . . . 31
V.1 Instrument control . . . 31
V.1.1 Control word (STW) . . . 33
V.1.2 Status word (ZSW) . . . 34
V.2 Operating modes . . . 34
V.2.1 Positioning (operating mode 2) . . . 35
V.2.2 Digital speed (operating mode 1) . . . 36
V.2.3 Analog speed (operating mode -1) [in preparation] . . . 36
V.2.4 Digital torque (operating mode -2) . . . 37
V.2.5 Analog torque (operating mode -3) [in preparation] . . . 37
V.2.6 Electronic gearing (operating mode -4) . . . 37
V.2.7 ASCII-channel (operating mode –16) . . . 38
V.2.8 Initial setting after switch-on (operating mode -126) . . . 38

VI Setup software . . . 39
VI.1 PROFIBUS menu . . . 39

VII Sample telegrams . . . 41
VII.1 Setting the operating mode . . . 41
VII.2 Enable the SERVOSTAR™ 600 . . . 41
VII.3 Set reference point . . . 42
VII.4 Start homing run - A.4.016.3/4 . . . 42
VII.5 Start jog mode . . . 44
VII.6 Start a motion task . . . 44
VII.7 Start a direct motion task, with following task . . . 44
VII.8 Polling a warning or error message . . . 45
VII.9 Writing a parameter . . . 45
VII.10 Read actual values . . . 45
VII.11 Write a parameter via the ASCII channel . . . 46

VIII Appendix . . . 47
VIII.1 Index . . . 47

Safety instructions

- **Warning signs: you must observe the important instructions in the text, which are indicated by the following symbols:**

  
  Danger from electricity and its effects

  
  General warning, general instructions

- **Only properly qualified personnel is permitted to carry out activities such as transport, installation, commissioning and maintenance. Properly qualified persons are those who are familiar with transport, installation, assembly, commissioning and operation of the products, and who have the appropriate qualifications for their job. The qualified personnel must know and observe the following directives and standards:**

- **IEC 364 and CENELEC HD 384 or DIN VDE 0100**
  IEC-Report 664 or DIN VDE 0110
  national accident prevention regulations or VBG 4

- **Read all the documentation for the servo amplifier before carrying out installation and commissioning. Incorrect handling of the servo amplifier can lead to injury to persons or material damage. It is vital that you keep to the technical data and information on connection requirements (nameplate and documentation).**

- **The servo amplifiers contain electrostatically sensitive components, that may be damaged by incorrect handling. Discharge your body before touching the servo amplifier. Avoid contact with highly insulating materials (artificial fabrics, plastic films etc.). Place the servo amplifier on a conductive surface.**

- **Do not open the units. Keep all covers and switchgear cabinet doors closed during operation. Otherwise there are deadly hazards with the possibility of severe damage to health or property.**

- **Depending on the degree of enclosure protection, servo amplifiers can have hot surfaces, and bare components that are live. Control and power cables may carry a high voltage, even when the motor is not rotating.**

- **Never undo the electrical connections of the servo amplifier when it is live. In unfavorable circumstances this can produce electrical arcing that is damaging both to persons and the equipment.**

- **Wait at least two minutes after disconnecting the servo amplifier from the supply voltage, before touching any normally live sections of the equipment (e.g. contacts, screwed connections) or undoing connections. Capacitors can have dangerous voltages present up to two minutes after switching off the supply voltages. To be sure, measure the voltage in the intermediate circuit (DC-link) and wait until it has fallen below 40V.**

Directives and standards

Servo amplifiers are components that are intended to be incorporated into electrical machines and plant.

When the servo amplifiers are incorporated into machines or plant, the intended operation of the servo amplifier is forbidden until it has been established that the machine or plant fulfills the requirements of the EC Machinery Directive 89/392/EEC and the EC EMC Directive (89/336/EEC). EN 60204 and EN 292 must also be observed.

In connection with the Low Voltage Directive 73/23/EEC, the harmonized standards of the EN 50178 series are applied to the servo amplifiers, together with EN 60439-1, EN 60146 and EN 60204.

The manufacturer of the machine or plant is responsible for ensuring that the machine or plant meets the limits that are laid down by the EMC regulations. Advice on the correct installation for EMC – such as shielding, grounding, arrangement of filters, handling of connectors and laying out the cabling – can be found in the assembly and installation instructions for the servo amplifier.

CE - conformance

Conformance with the EMC Directive 89/336/EEC is mandatory from the 1st. Of January 1996 for the supply of servo amplifiers within the European community.

The correct installation for EMC is shown in the installation instructions for the servo amplifier. These instructions also show the components that are required (cables, mains/line supply filter etc.).

Any deviation from the configuration and installation described in the documentation means that you will be responsible for carrying out new measurements to ensure that the regulatory requirements are met.

Only on condition that the components that we have specified are used and the installation rules are observed can we guarantee that the servo amplifier conforms to the following standards for industrial areas:

EC EMC Directive	**89/336/EEC**
EC Low Voltage Directive	**73/23/EEC**

I General

I.1 About this manual

This manual describes the wiring, commissioning, range of functions and software protocol for the PROFIBUS expansion card for the SERVOSTAR™ 600. It is part of the complete documentation of the SERVOSTAR™ 600 family of digital servo amplifiers.

The installation and commissioning of the servo amplifier, as well as all the standard functions, are described in the corresponding manuals.

Other parts of the complete documentation of the SERVOSTAR™ 600 family of digital servo amplifiers:

Title	Publisher	Order No.
Installation and Commissioning Instructions SERVOSTAR™	Seidel	90162
Quickstart manual, SERVOSTAR™	Seidel	92061
Description of functions, Setup Software SR600.EXE	Seidel	90635

Further documentation:

Title	Edition
SINEC Product Information S79200-A0737-X-02-7437	06/95
SINEC Installation Instructions S79200-A0737-X-01-7419	
SINEC Introduction CP5412 (A2) C79000-G8900-C068	01
SINEC DP-master operation planning with COML DP C79000-G8900-C069	01
SINEC DP-programming interface C79000-G8900-C071	01

This manual is intended for the use of qualified personnel with the following knowledge:

Wiring: ***trained electro-technical personnel***
Programming: ***experienced PLC programmers with PROFIBUS DP expertise***

We offer training and familiarization courses on request.

I.2 “Use as directed” for the PROFIBUS expansion card

The PROFIBUS expansion card is only to be fitted into servo amplifiers of the SERVOSTAR™ 600 series.
When the servo amplifier is operated via the PROFIBUS interface, the safety of personnel and machinery must be ensured through the control system that is used.
Observe the chapter “Use as directed” in the installation and commissioning instructions for the SERVOSTAR™ 600 servo amplifier.

The servo amplifiers are installed as components in electrical machines or plant, and must only be commissioned as integral components of such machines or plant.

Only on condition that the components that we have specified are used and the installation rules are observed can we guarantee that the servo amplifier conforms to the following standards for industrial areas:

EC EMC Directive	***89/336/EEC***
EC Low Voltage Directive	***73/23/EEC***

This page is deliberately left blank.

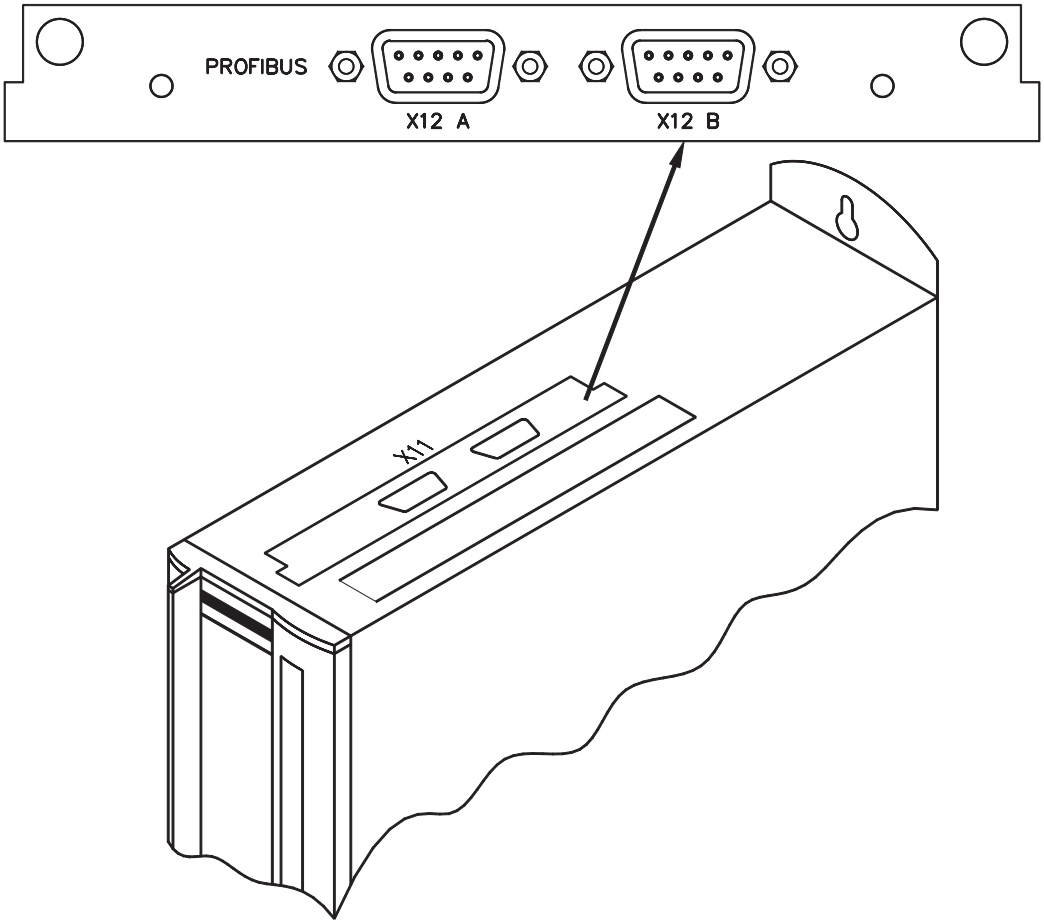
II Installation / Commissioning

II.1 Hard- and Software installation

Install and wire up the equipment only while it is electrically dead. Make sure that the switchgear cabinet is safely isolated (lock-out, warning signs etc.).
The individual supply voltages will not be switched on until commissioning is carried out.
Residual charges in the capacitors can still have dangerous levels several minutes after switching off the supply voltage. Measure the voltage in the intermediate (DC-link) circuit and wait until it has fallen below 40V.
Power and control connections can still be live, even though the motor is not rotating.
Electronic equipment is basically not failure-proof. The user is responsible for ensuring that, in the event of a failure of the servo amplifier, the drive is set to a state that is safe for both machinery and personnel, for instance with the aid of a mechanical brake.
Drives with servo amplifiers and PROFIBUS expansion cards are remote-controlled machines. They can start to move at any time without previous warning. Take appropriate measures to ensure that the operating and service personnel is aware of this danger.
Implement appropriate protective measures to ensure that any unintended start-up of the machines cannot result in dangerous situations for personnel or machinery. Software limit-switches are not a substitute for the hardware limit-switches in the machine.

Install the servo amplifier as described in the SERVOSTAR™ 600 installation manual.
The wiring for the analog setpoint input and the positioning interface, as shown in the wiring diagram in the installation manual, is not required.
Use the valid connection diagram in Chapter II.1.3.1 of this manual for the connection of the PROFIBUS expansion card.
Never break any of the electrical connections to the servo amplifier while it is live. This could result in destruction of the electronics. Because of the internal representation of the position-control parameters, the position controller can only be operated if the final limit speed of the drive at sinusoidal² commutation is not more than 7500 rpm. At trapezoidal commutation, the permitted maximum speed is 12000 rpm. All the data on resolution, step size, positioning accuracy etc. refer to calculatory values. Non-linearities in the mechanism (backlash, flexing, etc.) are not taken into account.
If the final limit speed of the motor has to be altered, then all the parameters that were previously entered for position control and motion blocks must be adapted.

II.1.1 Layout of the PROFIBUS expansion card



If you ordered the expansion card together with the servo amplifier, it will be delivered already inserted into the expansion slot of the servo amplifier and fixed by bolts.

The PROFIBUS expansion card has two 9-pole Sub-D female connectors wired in parallel.

The supply voltage for the expansion card is taken from the servo amplifier.

II.1.2 Fitting the PROFIBUS expansion card

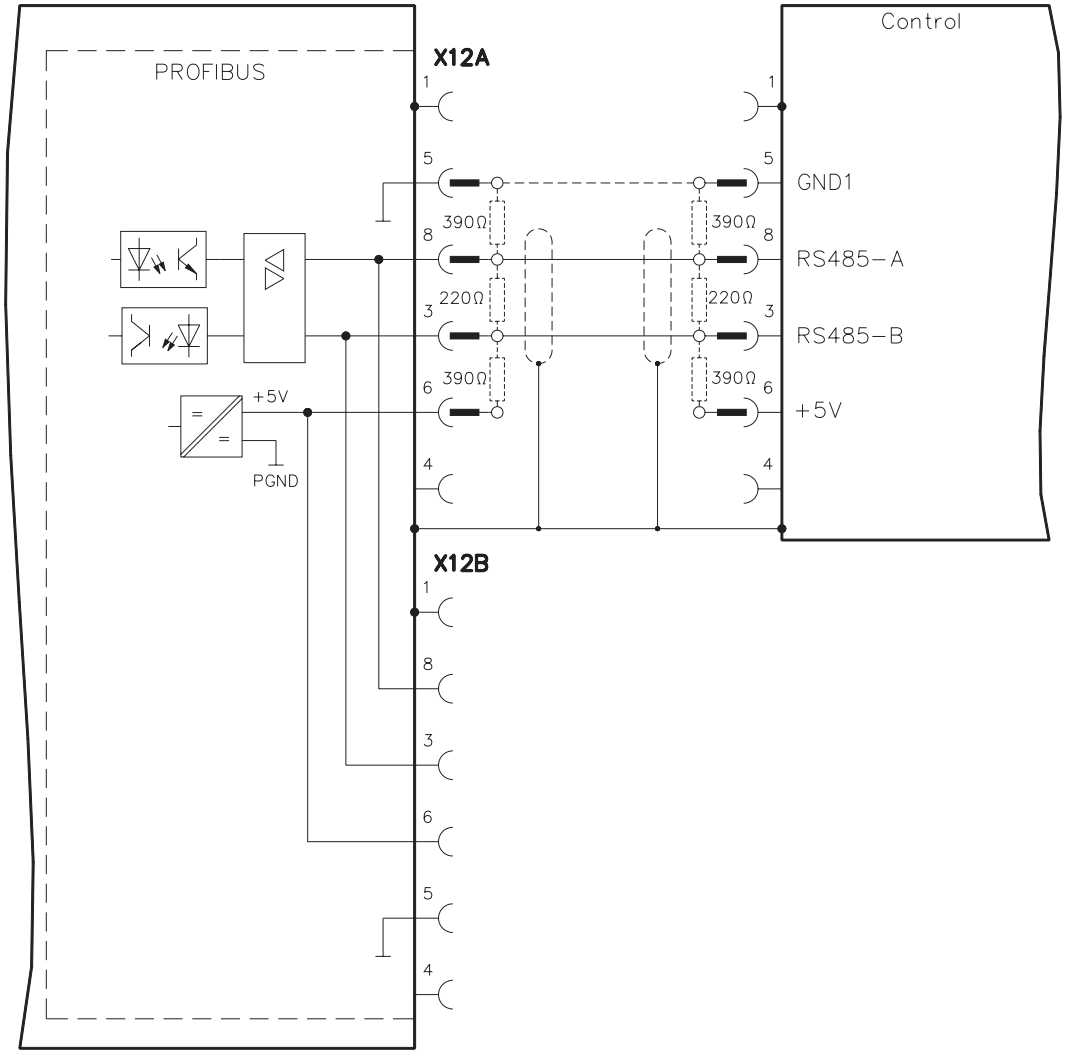
If you want to retrofit the PROFIBUS expansion card into the SERVOSTAR™, please observe the following:

- Unscrew the two relevant bolts and detach the cover from the expansion/option slot.
- Take care that no small items (such as bolts) fall into the open expansion slot.
- Push the expansion card carefully, and without twisting it, into the guide rails that are provided.
- Press the expansion card firmly into the slot, until the front cover sits on the fixing lugs. This ensures that the connector has a good contact.
- Screw the bolts in the front cover into the threaded holes in the fixing lugs.

II.1.3 Connection methods

Cable selection, cable layout, shielding, bus connectors, bus termination and propagation times are described in the “Installation guidelines for PROFIBUS-DP/FMS” from the PROFIBUS user organization (Order No. 2.111).

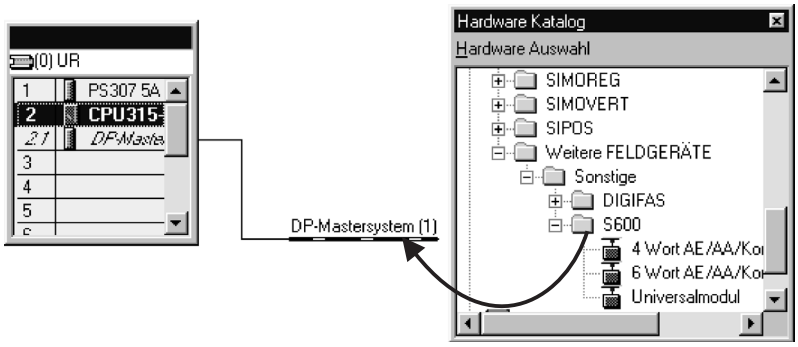
II.1.3.1 Connection diagram for SERVOSTAR™ 600



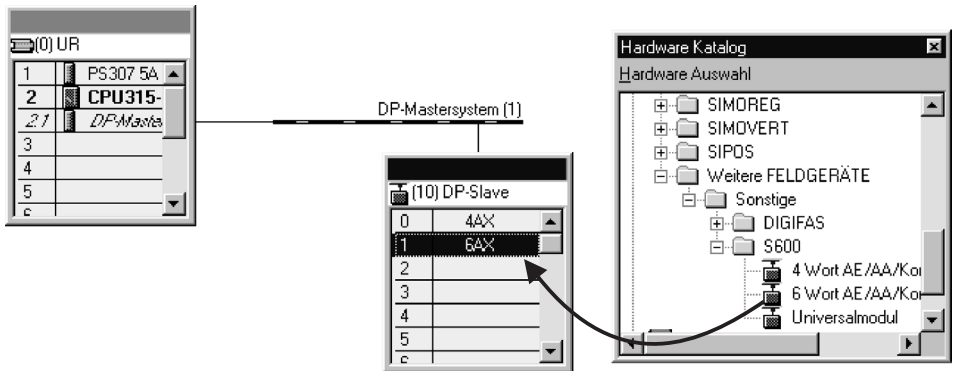
II.1.4 Parameterization of the master-interface modules

II.1.4.1 Configuration of the control

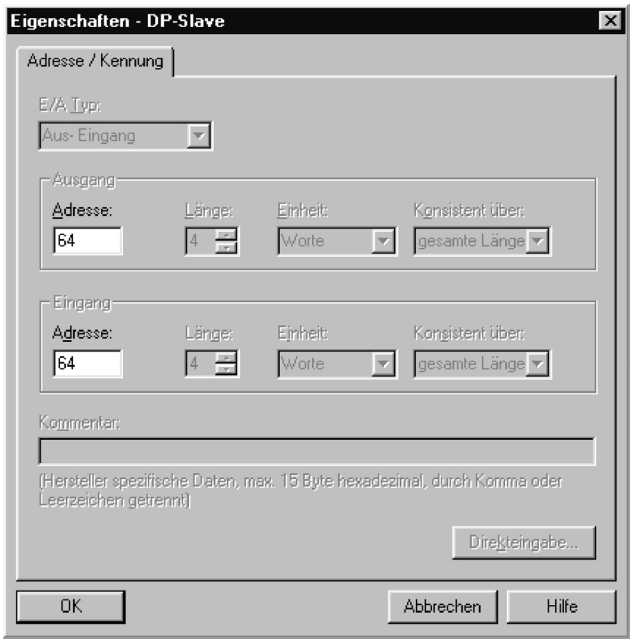
The graphics interface makes it very easy to configure the Siemens S7 for the PROFIBUS network. After you have set up the control layout, configure the interface module that is used as follows: Open the Hardware catalog and drag the symbol for the corresponding field unit onto the representation of the bus system (drag & drop). A window will then open automatically for the general parameterization of the field unit. Enter the address of the participant here.



Next, use the same method as above to drag the module from the Hardware catalog into the box for the field unit, whereby the 4-word module must lie in Cell 0 and the 6-word module in Cell 1.



Another window opens, in which you can set the parameters for the module.



II.1.4.2 Interface module CP5412 (A2)

The CP5412 (A2) is a plug-in card from Siemens, for AT-compatible PCs.
The DP-master operation is set up with the aid of the software tool COML DP.
Use our library file **KOLL045D.GSD** for the planning.
Further information can be found in the Siemens manual:
“DP-master operation planning with COML DP”.

II.1.5 Standard functions for data exchange with SERVOSTAR™

The Siemens function block package DVA_S7, Version 2.0 or higher is used.
The following function blocks (FC) are mandatory for each drive:
FC21, DPxxx-S as transmitter block **FC22**, DPxxx-E as receiver block
Also required are:

a) A data block (DB) “User data” (DBND), length 1 + 29 x (number of drives)

b) A data block “Parameter sets”, length 4 + 6 x (number of drives)

PPO-type 2 is used exclusively. FC21 and FC22 manage the data exchange and tracking of the PKW tasks between the PROFIBUS interface of the Simatic S7 and the transmit/receive port in DBND. The FC21 and the FC22 must (for each drive) have an absolute call at least once, either cyclically or through a timer control. The use of FC23 for setting up and pre-loading the data blocks is at the discretion of the user. The technical data and details of the application can be found in the Siemens manual.

II.1.6 Handling module package SR6FC

The function block package includes a number of function blocks that make it possible to handle the SERVOSTAR™ 600 control functions very simply. It operates together with the function blocks FC21, FC22 and FC23 from the “Option package_S7”, Version 2.0.
A description of the individual function blocks can be found as a text file on the diskette that includes the function block package.

II.2 Commissioning

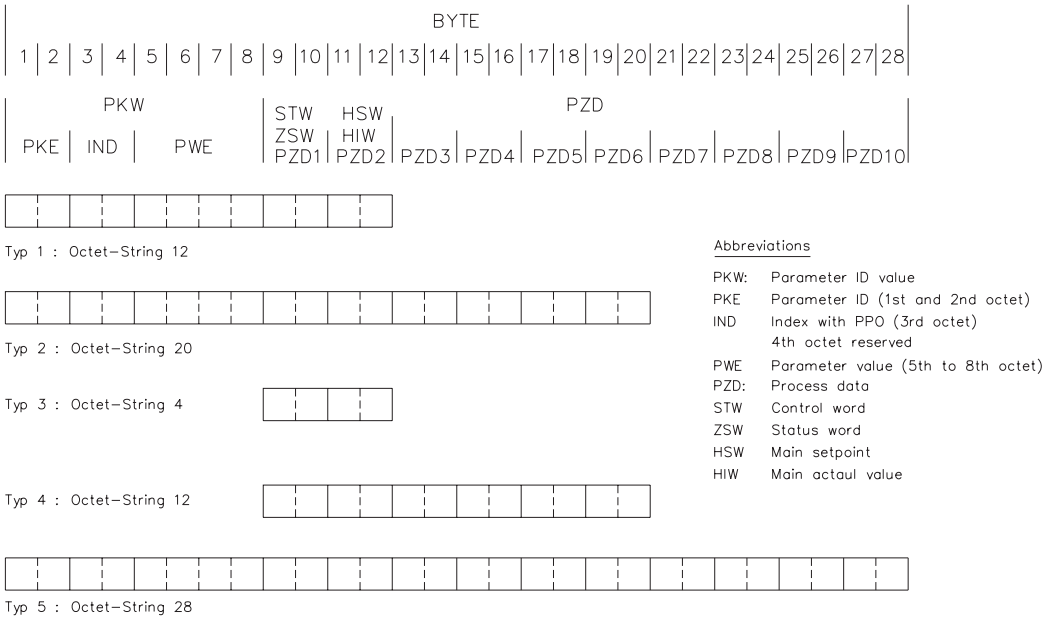
II.2.1 Commissioning the basic functions of the servo amplifier

Only properly qualified personnel with professional expertise in control and drive technology are permitted to commission the servo amplifier.

Check assembly + installation	Check that all the safety instructions, which are included in both the installation manual for the servo amplifier and in this manual, have been observed and implemented.
Connect PC, start SR600.EXE	Use the setup Software SR600.EXE for setting the parameters for the servo amplifier.
	***Caution!*** ***Make sure that any unintended movement of the drive cannot create a danger to personnel or machinery.***
Commission the basic functions	Now commission the basic functions of the servo amplifier and optimize the current and speed controllers. This part of commissioning is described in the “Quickstart” commissioning manual.
Save parameters	When the optimization is finished, save the controller parameters in the servo amplifier.
Test the bus connection	Remove the Enable signal (Terminal X3.16) and switch off the power supply for the servo amplifier. The 24V DC auxiliary voltage remains switched on.
Test the communication	Test the installation of the PROFIBUS connection and the interface for the PROFIBUS master. Check the PROFIBUS-DP parameter settings and the station configuration. Check the parameter settings for the PROFIBUS interface module. Check the PLC user program and the parameter settings for the function block packages DVA_S7 and SR6FC
Commission the position controller	Commission the position controller, as described in the “Quickstart” commissioning manual.

III Profile of SERVOSTAR™ 600

The PROFIBUS-profile PROFIDRIVE includes the following parameter process-data objects (PPO):



SERVOSTAR™ only uses the PPO-type 2 (with 4 words PKW-section and 6 words PZD-section). The PKW-section is used mainly for the transmission of parameters for the servo amplifier, the PZD-section is used principally for handling motion functions.

The instrument profile can be divided into two sections or data channels:

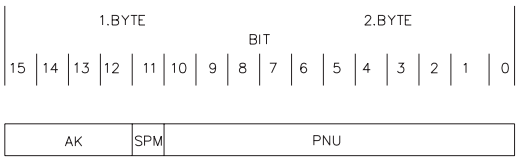
1. PKW-section (4 words)
2. PZD-section (6 words)

The PKW data channel can also be termed the service channel. The service channel only uses confirmed communication services, and is used by SERVOSTAR™ as a parameter channel.
This channel has no real-time capability.

The PZD data channel can also be termed the process data channel. The process data channel uses unconfirmed communication services. The response of the servo amplifier to an unconfirmed service can only be seen in the reaction of the instrument (status word, actual values).
This channel has real-time capability.

III.1 Parameter channel

III.1.1 Parameter ID (PKE)



Abbreviations

AK	task / response ID
SPM	Toggle-Bit for spontaneous message (not implemented at present)
PNU	Parameter number

Bold lines in the table are valid for SERVOSTAR™

Master —> Slave		Slave —> Master	
Task ID	Function	Response ID positive	Response ID negative
0	**no task**	**0**	**0**
1	**request parameter value**	1,**2**	**7**
2	alter parameter value [W]	1	7/8
3	**alter parameter value [DW]**	**2**	**7**/8
4	request description element	3	7
5	alter description element	3	7/8
6	request parameter value [A]	4,5	7
7	alter parameter value [A/W]	4	7/8
8	alter parameter value	5	7/8
9	request number of array elements	6	7
10	reserved		
11	reserved		
12	reserved		
13	reserved		
14	reserved		
15	reserved		

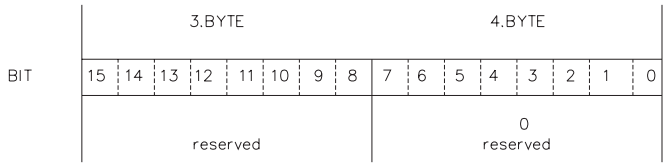
III.1.1.1 Interpretation of the response IDs

Response ID	Interpretation
0	**no task**
1	transmit parameter value
2	**transmit parameter value**
3	transmit description element
4	transmit parameter value
5	transmit parameter value
6	transmit number of array elements
7	**task not possible (with error no.)**
8	no operating authority for PKW interface
9	spontaneous message [W]
10	spontaneous message [DW]
11	spontaneous message [A/W]
12	spontaneous message [A/DW]

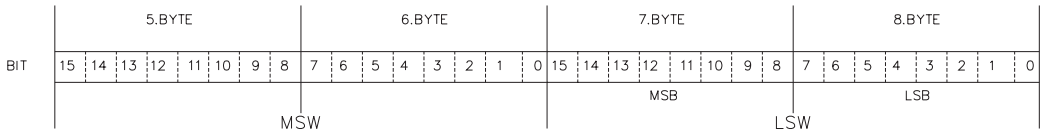
III.1.1.2 Profile-specific error numbers with response ID 7

Error no.	Description
0	**illegal PNU**
1	**parameter value cannot be changed**
2	**Lower or upper limit violated**
3	**Erroneous sub-index**
4	**no array**
5	**Incorrect data type**
6	**setting not allowed (can only be reset)**
7	Descriptive element cannot be changed
8	PPO-write, requested in IR, not available
9	descriptive data not available
10	access group incorrect
11	No parameter change rights
12	Password incorrect
13	Text cannot be read in cyclic data transmission
14	Name cannot be read in cyclic data transmission
15	text array not available
16	PPO-write missing
17	**task cannot be executed due to operating status**
18	**other error**
19-100	**reserved**
101	**faulty task ID**
102	**software error (command table)**
103	**only possible in disabled state**
104	**only possible in enabled state**
105	**BCC-error in the EEPROM data**
106	**only possible after task is stopped**
107	**wrong value [16,20]**
108	**wrong parameter (OCOPY x [- y] z)**
109	**wrong motion block no. (0,1..180,192..255)**
110	**wrong parameter (PTEACH x [y])**
111	**EEPROM write error**
112	**wrong value**
113	**BCC-error in motion block**
>113	**reserve**

III.1.2 Subindex IND



III.1.3 Parameter value PWE



The data for the PNU-variable is contained in the PWE, and is placed flush right:

4-byte data (double-word) PWE 5-8 (PWE 8 LSB)

Commands are transferred with task ID 3. If a command cannot be executed, the response identification AK = 7 signals the error, and an error number is given out. The error numbers are described in Chapter III.1.1.2.

III.2 The process data channel

Cyclical data are exchanged across the PROFIBUS through the process data section of the 20-byte telegram. Each PROFIBUS cycle triggers an interrupt in the SERVOSTAR™ 600. This has the effect that new process data are exchanged and processed. The interpretation of these process data depends on the operating mode that is set. The operating mode is set through a PROFIBUS parameter (PNU 930, see Chapter IV.2.2.2).

In all operating modes, the data word 1 of the process data (PZD1) in the direction from control system -> SERVOSTAR™ 600 is used for instrument control, and in the direction from SERVOSTAR™ 600 -> control system it has the function of a status indicator for the drive.

The interpretation of the process data PZD2 – PZD6 changes, depending on the operating mode, as can be seen in Chapter V.2.

Caution:
When the SERVOSTAR™ 600 is switched on, the operating mode that is set is always –126 (safe state). Before changing the operating mode, bit 10 of the control word STW must always be set to 0.
The new operating mode only becomes active when bit 10 of the control word is set to 1.

IV Using the parameter channel

The digital servo amplifiers of the SERVOSTAR™ 600 series have to be adapted to the circumstances of your machine. The parameters for the controllers are set using either the setup Software SR600.EXE or via the PROFIBUS.

IV.1 Read/write an amplifier parameter

Read (AK = 1) or write (AK = 3) amplifier parameters

To read or write an amplifier parameter, which is recognized by the parameter number (PNU), to the *volatile* memory of the SERVOSTAR™. The parameters that are stored in the SERVOSTAR™ can be transferred to the *non-volatile* memory by using the command "non-volatile parameter save" (PNU 971).

Telegram layout:

	Request	**Response**
PKE/AK	1 (read) / 3 (write)	2/ 7 if error
PKE/PNU	see IV.2.1	as transmitted
PWE	for AK = 3 see IV.2.1 for data type for AK = 1 data type irrelevant	for AK = 3 returns the PWE of the request for AK = 1 see IV.2.1 for data type

IV.2 Summary of the SERVOSTAR™ parameter numbers

All the parameter numbers for SERVOSTAR™ are listed in numerical order in the table in Chapter IV.2.1, with a short description. The parameter numbers in the range 900 – 999 are profile-specific for the PROFIBUS drive profile PROFIDRIVE. Parameter numbers > 999 are manufacturer-specific.
For better understanding, you can look up the ASCII commands which are in the column "SERVOSTAR™ ASCII command" in the user manual for the Setup Software SR600.EXE.
This section deals only with parameters that refer to the PROFIBUS expansion card and have not already been described in the setup software manual. The attachment runs via the ASCII-commands.

IV.2.1 List of the parameter numbers

PNU	Data type	Access	Description	SERVOSTAR™ ASCII command
Profile parameter				
904	UINT32	ro	Number of the supported PPO-write, always 2	-
911	UINT32	ro	Number of the supported PPO-read, always 2	-
918	UINT32	ro	Participant address on PROFIBUS	ADD
930	UINT32	r/w	Selector for operating mode	-
963	UINT32	ro	PROFIBUS baud rate	-
965	Octet-String2	ro	Number of the PROFIDRIVE profile (0302H)	-
970	UINT32	wo	Load default parameter set	RSTVAR
971	UINT32	wo	non-volatile parameter save	SAVE
Manufacturer-specific parameters SERVOSTAR™				
General parameters				
1000	Visible String4	ro	Instrument ID	-
1001	UINT32	ro	Manufacturer-specific error register	ERRCODE
1002	UINT32	ro	Manufacturer-specific status register	-
Speed controller parameters				
1200	UINT32	r/w	K_p – gain factor for speed controller	GV
1201	UINT32	r/w	T_n – integral-action time for speed controller	GVTN
1202	UINT32	r/w	PID – T_2 – time constant for speed controller	GVT2
1203	UINT32	r/w	Setpoint ramp+, speed controller	ACC
1204	UINT32	r/w	Setpoint ramp-, speed controller	DEC
1205	UINT32	r/w	Emergency stop ramp, speed controller	DECSTOP
1206	UINT32	r/w	Maximum speed	VLIM
1207	UINT32	r/w	Overspeed	VOSPD
1208	UINT32	r/w	Count direction	DIR
Position controller parameters				
1250	UINT32	r/w	Velocity multiplier for jogging/homing	VMUL
1251	UINT32	r/w	Axis type	POSCNFG
1252	INTEGER32	r/w	InPosition window	PEINPOS
1253	INTEGER32	r/w	Contouring error window	PEMAX
1254	INTEGER32	r/w	Position register 1	SWE1
1255	INTEGER32	r/w	Position register 2	SWE2
1256	INTEGER32	r/w	Position register 3	SWE3
1257	INTEGER32	r/w	Position register 4	SWE4
1258	UINT32	r/w	Denominator resolution	PGEARO
1259	UINT32	r/w	Numerator resolution	PGEARI
1260	UINT32	r/w	Minimum acceleration/braking time	PTMIN
1261	UINT32	r/w	Feed-forward factor for position controller	GPFFV
1262	UINT32	r/w	K_V - factor for position controller	GP
1263	UINT32	r/w	K_P - factor for position controller	GPV
1264	UINT32	r/w	T_n - integral-action time for position controller	GPTN
1265	UINT32	r/w	Maximum velocity for positioning mode	PVMAX
1266	UINT32	r/w	Configuration variable for software switch	SWCNFG
1267	UINT32	r/w	Configuration variable 2 for software switch	SWCNFG2

PNU	Data type	Access	Description	SERVOSTAR™ ASCII command
Position data for the position control mode				
1300	INTEGER32	r/w	Position	O_P
1301	INTEGER16	r/w	Velocity	O_V
1302	UINT32	r/w	Motion task type	O_C
1304	UINT32	r/w	Starting time (acceleration)	O_ACC1
1305	UINT32	r/w	Braking time (deceleration)	O_DEC1
1306	UINT32	r/w	Jolt limiting (acceleration)	O_ACC2
1307	UINT32	r/w	Jolt limiting (deceleration)	O_DEC2
1308	UINT32	r/w	Number of next motion task	O_FN
1309	UINT32	r/w	Start delay for next motion task	O_FT
1310	2 * UINT16	wo	Copy a motion task	OCOPY
Position set-up mode				
1350	UINT32	r/w	Homing type	NREF
1351	UINT32	r/w	Homing direction	DREF
1352	UINT32	r/w	Acceleration ramp (jogging/homing)	ACCR
1353	UINT32	r/w	Braking ramp	DECR
1354	UINT32	r/w	Reference offset	ROFFS
1355	UINT32	ro	Homing run velocity	VREF
1356	UINT32	ro	Jogging velocity	VJOG
Actual values				
1400	INTEGER32	ro	Actual position 20 bits/turn	PRD
1401	INTEGER32	ro	Speed	
1402	INTEGER32	ro	Incremental position, actual value	
1403	INTEGER32	ro	SI-position, actual value	PFB
1404	INTEGER32	ro	SI-velocity, actual value	PV
1405	INTEGER32	ro	SI contouring error	PE
1406	INTEGER32	ro	RMS current	I
1407	INTEGER32	ro	SI-speed, actual value	V
1408	INTEGER32	ro	Heatsink temperature	TEMPH
1409	INTEGER32	ro	Internal temperature	TEMPE
1410	INTEGER32	ro	DC-bus (DC-link) voltage	VBUS
1411	INTEGER32	ro	Ballast power	PBAL
1412	INTEGER32	ro	I^2t - loading	I2T
1413	INTEGER32	ro	Running time	TRUN
Digital I/O configuration				
1450	UINT32	r/w	Function of digital input 1	IN1MODE
1451	UINT32	r/w	Function of digital input 2	IN2MODE
1452	UINT32	r/w	Function of digital input 3	IN3MODE
1453	UINT32	r/w	Function of digital input 4	IN4MODE
1454	INTEGER32	r/w	Auxiliary variable for digital input 1	IN1TRIG
1455	INTEGER32	r/w	Auxiliary variable for digital input 2	IN2TRIG
1456	INTEGER32	r/w	Auxiliary variable for digital input 3	IN3TRIG
1457	INTEGER32	r/w	Auxiliary variable for digital input 4	IN4TRIG
1458	INTEGER32	r/w	Function of digital input 1	O1MODE
1459	INTEGER32	r/w	Function of digital input 2	O2MODE
1460	UINT32	r/w	Auxiliary variable for digital output 1	O1TRIG
1461	UINT32	r/w	Auxiliary variable for digital output 2	O2TRIG
1462	UINT32	r/w	State of four digital inputs, Enable, 2 digital outputs	STATIO

PNU	Data type	Access	Description	SERVOSTAR™ ASCII command
Analog configuration				
1500	UINT32	r/w	Configuration of the analog input functions	ANCNFG
1501	UINT32	r/w	Configuration monitor function analog output 1	ANOUT1
1502	UINT32	r/w	Offset voltage for analog input 1	ANOFF1
1503	UINT32	r/w	Filter time constant for analog input 1	AVZ1
1504	UINT32	r/w	Scaling factor for velocity, analog input 1	VSCALE1
1505	UINT32	r/w	Scaling factor for current, analog input 1	ISCALE1
1506	UINT32	r/w	Configuration monitor function analog output 2	ANOUT2
1507	UINT32	r/w	Offset voltage for analog input 2	ANOFF2
1508	UINT32	r/w	Scaling factor for velocity, analog input 2	VSCALE2
1509	UINT32	r/w	Scaling factor for current, analog input 2	ISCALE2
Motor parameters				
1550	UINT32	r/w	Brake configuration	MBRAKE
1551	UINT32	r/w	Motor number from motor database	MNUMBER

Abbreviations in the "Access" column

The "Access" column shows which type of access (e.g read/write) is possible via the bus.

Abbrev.	Description
wo	"write only" access
ro	"read only" access
r/w	read/write access

IV.2.2 Profile parameters

IV.2.2.1 PNU 904/911: PPO-type write/read

These parameters describe the numbers of the supported PPO-types write und read.
Since only PPO-type 2 is supported (see Chapter III), this parameter is always set to 2.

IV.2.2.2 PNU 930: selector for operating modes

The "Selector for operating modes" is defined by the drive profile, and mirrors the operating modes of the drive profile to the operating modes of the SERVOSTAR™ 600. The following table shows a summary of the operating modes:

Caution!
If process data are exchanged across the PROFIBUS, then the operating modes of the drive profile must only be selected with PNU 930.

Operating mode of drive profile	Operating mode SERVOSTAR™ (ASCII command "OPMODE")	Description
2	8	Positioning mode according to PROFIDRIVE profile
1	0	Digital speed control according to PROFIDRIVE profile
0	-	reserved
-1	1	Speed control, analog setpoint provision (in preparation)
-2	2	Torque control, digital setpoint provision
-3	3	Torque control, analog setpoint provision (in preparation)
-4	4	Position control, electronic gearing
-5	5	Position control, external trajectory (in preparation)
-6 to -15	-	reserved
-16	-	ASCII channel for expanded parameterization
-17 to -125	-	reserved
-126	-	Initial settings when instrument is switched on

The individual operating modes are described in Chapter V.2. A change of operating mode can only be undertaken in connection with the control word.

The operating mode must be changed according to the following sequence:

1. **Inhibit setpoints and process data**
   Bit 10 in the control word is set to 0, so that no new setpoints will be accepted by the servo amplifier and no new control functions can be initiated. A new operating mode can, however, be selected while a motion function is being performed.
   The control word is only inhibited to the extent that the servo amplifier can always be switched into a safe state.
2. **Select the new operating mode with PNU 930**
   The new operating mode is selected with parameter 930 through the parameter channel, but not yet accepted.
3. **Set/receive the setpoints and actual values**
   Enter the corresponding setpoints in the setpoint area of the process data.
   Here you must take note that the normalization and data formats depend on the operating mode that is selected. The interpretation of the actual values is also altered (see Chapter IV.2.2.2). The user program must respond accordingly.
4. **Enable the setpoints**
   Bit 10 of STW is set to 1. The setpoints are immediately accepted and processed.
   The new actual values are output with the appropriate normalization and data format.

Caution
In the safe operating mode (-126), no motion functions can be initiated via the PROFIBUS. However, it is possible to perform motion functions with the aid of the setup Software. If the operating mode is changed, then motion functions can only be operated via the PROFIBUS. If the operating mode is changed via another communication channel, then the drive is emergency braked and the error F21 (Handling error, plug-in card) is signaled.

IV.2.2.3 PNU 963: baud rate

This parameter defines the index of the baud rate that is used for PROFIBUS communication, and can only be read. The baud rate is given out by the PROFIBUS-master.
The table below shows the indices with the according baud rates:

Index	0	1	2	3	4	5	6	7	8	9
Baud rate	12000	6000	3000	1500	500	187.5	93.75	45.45	19.2	9.6

IV.2.2.4 PNU 965: PROFIDRIVE profile number

This parameter can be used to read out the number of the PROFIDRIVE profile. Profile Number 3, Version 2 is used.

IV.2.2.5 PNU 970: default parameters

With this parameter you can reject all the parameters that are set and load the manufacturer's default values.

IV.2.2.6 PNU 971: non-volatile saving of parameters

With this parameter you can save all the parameter settings to the EEPROM. To do this, the parameter must have the value PWE = 1 when the transfer takes place.

IV.2.3 General parameters

IV.2.3.1 PNU 1000: instrument ID

The instrument ID consists of four ASCII characters, with the contents “S6xx”, whereby xx stands for the current level of the output stage (e.g. S606).

IV.2.3.2 PNU 1001: manufacturer-specific error register

The assignment of the error register can be seen in the following table. The explanation of the individual errors can be found in the assembly & installation instructions for the servo amplifier.

Bit	Description	
0	Error F01:	Heatsink temperature
1	Error F02:	Overvoltage
2	Error F03:	Contouring error (in preparation)
3	Error F04*:	Feedback
4	Error F05:	Undervoltage
5	Error F06*:	Motor temperature
6	Error F07*:	Auxiliary voltage
7	Error F08:	Overspeed
8	Error F09*:	EEPROM
9	Error F10*:	Flash-EEPROM
10	Error F11*:	Brake
11	Error F12*:	Motor phase
12	Error F13:	Internal temperature
13	Error F14*:	Output stage
14	Error F15:	I²t max.
15	Error F16:	Mains supply-BTB
16	Error F17*:	A/D-converter
17	Error F18*:	Ballast
18	Error F19:	Mains supply phase
19	Error F20*:	Slot error
20	Error F21*:	Handling error, plug-in card
21-30	Error F22 - F31*:	reserved
31	Error F32*:	System error

When the cause of the error has been cleared, the error state can be canceled by setting Bit 7 in the control word.
The error response of the SERVOSTAR™ 600 to the reset will differ, depending on the error that has occurred:
For errors that are marked by an asterisk, setting the reset bit initiates a cold-start of the drive, whereby the PROFIBUS communication to this instrument will also be interrupted for several seconds. Depending on the circumstances, this break in communication may have to be separately handled by the PLC.
For the other errors, the reset leads to a warm start, during which the communication will not be interrupted.

A description of the individual errors and recommendations for removing them can be found in the installation manual.

IV.2.3.3 PNU 1002: manufacturer-specific status register

The assignment of the bits for the status register can be seen in the following table:

Bit	Description
0	Warning 1: I^2t threshold exceeded (set, as long as I_{rms} is above the threshold)
1	Warning 2: Ballast power exceeded (set, as long as the set ballast power is exceeded)
2	Warning 3: Contouring error (is set as soon as difference between the actual position and the position-control trajectory exceeds the set value for PEMAX.) This is canceled by the command CLRFAULT or by activating the function ”Cancel error/contouring error”.
3	Warning 4: Threshold monitoring active (is set when the threshold monitoring time is exceeded). This is canceled by the command CLRFAULT or by activating the function ”Cancel error/contouring error”.
4	Warning 5: Mains supply phase missing (set, as long as one of the three mains supply phases cannot be detected).
5	Warning 6: Software limit-switch 1 has been activated (is set as soon as the position goes below the set position of software limit-switch 1, or if a motion task is started with a target position that lies below SWE1, at the same time, Bit 8 “Faulty motion task started” is set). This is canceled when the position goes above SWE1, and a positive speed/velocity setpoint is applied, or if a motion task is started with a target position within the valid range of movement.
6	Warning 7: Software limit-switch 2 has been activated (see above).
7	Warning 8: Faulty motion task has been started (is set if an attempt is made to start a non-existing motion task). This is canceled when a valid motion task is started.
8	Warning 9: No reference point was set at the start of the motion task (is set if a motion block is started without a previous homing run). This is canceled after completion of a homing run.
9	Warning 10: PSTOP active (is set as long as the hardware limit-switch PSTOP is active).
10	Warning 11: NSTOP active (is set as long as the hardware limit-switch NSTOP is active).
11	Warning 12: Motor default values were loaded (is set at switch-on of the amplifier if the motor number from the serial EEPROM and the motor number from the SINCOS encoder are different). If a valid motor number is entered, and the data are stored in the encoder and the internal EEPROM, the warning will stop being produced from the next switch-on of the encoder.
12	Warning 13: reserved
13	Warning 14: reserve
14	Warning 15: reserve
15	Warning 16: reserve
16	Motion task active (is set as long as a position control task is active - motion task, jogging, homing).
17	Reference point set (is set after a homing run, or when an absolute position (multi-turn) encoder is used. This is canceled when the amplifier is switched on, or when a homing run is started.
18	Actual position = home position (is set as long as the reference switch is activated).
19	InPosition (is set as long as the difference between the target position for a motion task and the actual position is smaller than PEINPOS. The InPosition signal is suppressed if a following task is started at the target position.
20	Position latch set (positive edge) – this is set if a rising edge is detected on the INPUT2 (IN2MODE=26) that is configured as a latch. This is canceled if the latched position is read out (LATCH16/LATCH32)
21	—
22	Position 1 reached (is set if the configured condition for this signal (SWCNFG, SWE1, SWE1N) is met. Depending on the configuration, this bit is set on exceeding SWE1, or going below SWE1, on reaching the InPosition window SWE1...SWE1N or on leaving the InPosition window SWE1...SWE1N.
23	Position 2 reached (see above)
24	Position 3 reached (see above)
25	Position 4 reached (see above)
26	Initialization completed (is set if the internal initialization of the amplifier is completed).
27	—
28	Speed = 0 (is set as long as the motor speed is below the standstill threshold VEL0).
29	Safety relay has been triggered (is set as long as the safety relay is open – AS-Option)
30	Output stage enabled (is set when software and hardware enables are set).
31	Error present (is canceled when the amplifier is switched on, or if the function “Cancel error” is called.

In the process data, Bits 16 to 31 of the manufacturer-specific status register are given out.
Warnings 3 and 4 can be reset through Bit 13 in the control word.

IV.2.4 Position controller parameters

IV.2.4.1 PNU 1250: velocity multiplier

This parameter is used to enter a multiplier for the jogging/homing velocity. The velocity for jogging/homing is given through PZD2 in the control word when jogging/homing is started.
The actual jog velocity is calculated according to the following formula:

$$V_{Jog,vel.}(32Bit) = V_{Jog,PZD2}(16Bit) \times multiplier(16Bit)$$

IV.2.4.2 PNU 1251: axis type

This parameter is used to define to which type the axis belongs. If a 0 is given as the parameter value, it is a linear axis. 1 means a rotary axis.

IV.2.5 Position data for the position-control mode

IV.2.5.1 PNU 1300: position

Since the SERVOSTAR™ 600 calculates all positioning operations internally only on an incremental basis, there are limitations on the usable range of values for distances that are given in SI units.
The range for the incremental position covers the values from -2^{31} to $(2^{31}-1)$.
The resolution that is determined by the PGEARO (PNU1258) and PGEARI (PNU1259) parameters and the variable PRBASE fix the sensibly usable range for positioning operations.
The variable PRBASE determines, through the equation $n = 2^{PRBASE}$, the number of increments per motor turn. The value of PRBASE can only be 16 or 20.
PGEARO contains the number of increments that must be traversed when the distance to be moved is PGEARI. The default values for PGEARO correspond to one turn.
The number of turns that can be covered are given as follows:
-2048..+2047 for PRBASE=16 and -32768..+32767 for PRBASE=20
The sensibly usable position range is derived as follows:

$$-2^{31} * \frac{PGEARI}{PGEARO} \ldots (2^{31}-1) * \frac{PGEARI}{PGEARO}$$ for PGEARI <= PGEARO or

$$-2^{31} \ldots (2^{31}-1)$$ for PGEARI > PGEARO

IV.2.5.2 PNU 1301: velocity

The usable range for the velocity is not limited by the available data area. It is limited by the maximum applicable speed nmax, which is given by the speed parameter VLIM as the final limit speed for the motor.

The maximum velocity is thus given by:

$$v_{SI,\max} = n_{\max} \times \frac{PGEARI}{PGEARO} \times 2^{PRBASE}$$ with n_{max} in turns/second

or, in incremental units, as:

$$v_{incr.\max.} = n_{\max} \times 2^{PRBASE} \times \frac{250\mu s}{1\sec} = \frac{n_{\max}}{4000} \times 2^{PRBASE}$$ with n_{max} in turns/second

IV.2.5.3 PNU 1302: motion task type

Bit	Value	Meaning
0	0	The position value (Subindex 1) that is given is evaluated as an absolute position.
	1	The position value that is given is evaluated as a relative traversing distance. The two following bits then determine the type of relative motion.
1	0	If Bit 1and Bit 2 are set to 0 and Bit 0 set to 1, then the relative motion task is performed according to the “InPosition” bit.
	1	The new target position is given by the old target position plus the traversing distance. Bit 1 has priority over Bit 2.
2	0	If Bit 1and Bit 2 are set to 0 and Bit 0 set to 1, then the relative motion task is performed according to the “InPosition” bit.
	1	The new target position is given by the actual position plus the traversing distance.
3	0	no following task available
	1	There is a following task, but it must be defined through Subindex 0AH.
4	0	Change over to next motion task, with braking to 0 at the target position.
	1	Change over to next motion task, without standstill at the target position. The type of velocity transition is determined by Bit 8.
5	0	Change over to next motion task, without evaluating inputs.
	1	A following motion task is started by a correspondingly configured input.
6	0	Start the next motion task by Input State = Low.
	1	Start the next motion task by Input State = High or, if Bit 7 = 1, in any case after the delay time set by Subindex 0BH.
7	0	The next motion task is started immediately.
	1	The next motion task is started after the delay time set by Subindex 0BH or, if Bit 6 = 1, previously by a corresponding input signal.
8	0	Only for following motion tasks and Bit 4 = 1: from the target position for the previous motion task onwards, the velocity is altered to the value for the following motion task.
	1	The change of velocity is made so that the velocity at the target position of the previous motion task matches the value given for the following motion task.
9	-	reserved
10		
11		
12	0	Accelerations are calculated according to the run-up/acceleration and run-down/braking times for the motion task.
	1	A global acceleration value is used for the calculation of the run-up/acceleration and run-down/braking ramps (in preparation).
13	0	The target position and target velocity of a motion task are interpreted as increments.
	1	The target position and target velocity are recalculated as increments before the start of the motion task. The parameters PGEARI and PGEARO are used for this purpose.
14	0	The programmed velocity is used as the velocity for the motion task.
	1	The velocity for the motion task is determined by the voltage present on analog input SW1 at the start of the motion task.
15	-	reserved

IV.2.5.4 PNU 1304: acceleration time

This parameter defines the total time to reach the target velocity for the motion task.

IV.2.5.5 PNU 1305: deceleration time

This parameter defines the total time to reduce the velocity to 0 at the target position.

IV.2.5.6 PNU 1306: acceleration jolt limiting

This parameter defines the form of the acceleration ramp.
If a value ≠ 0 is entered here, then a sin²-ramp (S-curve) is used to reach the target velocity.
To employ sine²-ramps, the configuration variable SPSET has to be set to 1 (via the ASCII-channel or the ASCII-terminal in the setup software) and to be saved.

IV.2.5.7 PNU 1307: deceleration jolt limiting

This parameter defines the form of the braking/deceleration ramp.
If a value ≠ 0 is entered here, then a sin²-ramp (S-curve) is used for braking/deceleration.

IV.2.5.8 PNU 1308: next motion task

The motion task number of the motion task to be started can lie in the range 1 to 180 (motion tasks in EEPROM) or 192 to 255 (motion tasks in RAM).

IV.2.5.9 PNU 1309: start delay

This parameter is used to set a delay time before the start of a motion task.

IV.2.5.10 PNU 1310: copy motion task

This parameter can be used to copy motion tasks. The source motion task must be entered in the high-value portion of PWE (PZD 3 & 4) and the target motion task must be entered in the low-value portion of PWE (PZD 5 & 6).

IV.2.6 Setup mode: position

IV.2.6.1 PNU 1350: homing

This parameter can be used to determine which type of homing run should be applied. The assignment can be seen in the following table:

PWE	Type of homing run
0	Reference point at the present position
1	Initiator with resolver zero mark
2	Hardware limit-switch resolver zero mark
3	Initiator without resolver zero mark
4	Hardware limit-switch without resolver zero mark
5	Zero mark / feedback unit

IV.2.6.2 PNU 1351: homing direction

This parameter can be used to determine the direction of motion for homing runs. If a 0 is presented as the parameter value, then the direction of motion is negative; for a value 1 it is positive, and for a 2 it depends on the distance to the reference point in the direction in which the homing run started.

IV.2.7 Actual values

IV.2.7.1 PNU 1401: speed

The parameter value is the actual speed of the motor in rpm.

IV.2.7.2 PNU 1402: incremental position: actual value

The parameter value is the actual position value in increments.

IV.2.7.3 PNU 1403: SI-position: actual value

The parameter value is the actual SI-position value.

IV.2.8 Digital I/O-configuration

All settings for the digital inputs and outputs only become effective after being saved in the EEPROM and then switching off and on again, or making a cold start of the SERVOSTAR™ 600. The significance of the functions can be seen in the user manual for the setup Software.

IV.2.8.1 PNU 1450 .. 1453: function of the digital inputs

This parameter can be used to configure the digital inputs 1 to 4 individually.
The column “flank” describes the required signal at the digital input to actuate the corresponding function.

				Function n be employed with:			
PWE	**Function**	**Flank**	**Auxiliary variable (PNU 1454..1457)**	**PNU 1450**	**PNU 1451**	**PNU 1452**	**PNU 1453**
0	Off	-	-	x	x	x	x
1	Reset	↗	-	x			
2	PSTOP	↘Low-active	-			x	
3	NSTOP	↘Low-active	-				x
4	PSTOP+Intg.Off	↘Low-active	-			x	
5	NSTOP+Intg.Off	↘Low-active	-				x
6	PSTOP+NSTOP	↘Low-active	-			x	
7	P/Nstop+Intg.Off	↘Low-active	-			x	
8	SW1/SW2	High/Low	-	x	x	x	x
9	Fauftr_Bit	↗	-	x	x	x	x
10	Intg.Off	↗	-	x	x	x	x
11	1:1-control	High/Low	-	x	x	x	x
12	Reference	↗	-	x	x	x	x
13	ROD/SSI	High/Low	-	x	x	x	x
14	S_fehl_clear	↗	-	x	x	x	x
15	FStart_Folge	adjustable	-	x	x	x	x
16	FStart_Nr x	↗	Task number	x	x	x	x
17	FStart_IO	↗	-	x	x	x	x
18	Ipeak2 x	↗	of% Ipeak	x	x	x	x
19	Macro_IRQ	↗	-		x		
20	FStart_TIPP x	↗	v in rpm	x	x	x	x
21	U_Mon.off	↗	-	x	x	x	x
22	FRestart	↗	-	x	x	x	x
23	FStart2_Nr x	↗	Task number	x	x	x	x
25	Zero_latch	↗	-	x	x	x	x
32	Brake	↗	-	x	x	x	x

IV.2.8.2 PNU 1458/1459: function of the digital outputs

These parameters can be used to configure the two digital outputs individually.

PWE	Function	PWE	Function
0	Off	14	PosREG.3
1	n_act<x	15	PosREG.4
2	n_act>x	16	Next-InPos
3	Mains-BTB	17	Error/Warn
4	Ballast	18	Error
5	Sw_end	19	DC_Link>x
6	Pos.>x	20	DC_Link<x
7	InPos	21	ENABLE
8	Iist<x	22	Zero-pulse
9	Iist>x	23	Reserve
10	S_fault	24	Ref_OK
11	I²t	28	PosREG. 0
12	PosREG.1	29	PosREG. 5
13	PosREG.2		

IV.2.9 Analog configuration

All settings for the analog inputs and outputs only become effective after being saved in the EEPROM and then switching off and on again, or making a cold start of the SERVOSTAR™ 600. The significance of the functions can be seen in the user manual for the setup Software.

IV.2.9.1 PNU 1500: configuration of the analog input functions

This parameter can be used to configure the two analog inputs together.

PWE	Function
0	Xsetp = SW1
1	N_setp = SW1, Isetp = SW2
2	unused
3	Xsetp = SW1, Ipeak = SW2
4	Xsetp = SW1 + SW2
5	Xsetp = SW1 * SW2
6	Electr. gearing

IV.2.9.2 PNU 1501/1506: configuration of the analog outputs

This parameter can be used to configure the two analog outputs individually.

PWE	Function
0	Off
1	n act
2	I act
3	n setp
4	I setp
5	S_fault
6	Slot

V Process data channel

The process data channel is used for real-time communication. This channel can effectively be divided into two telegram portions:

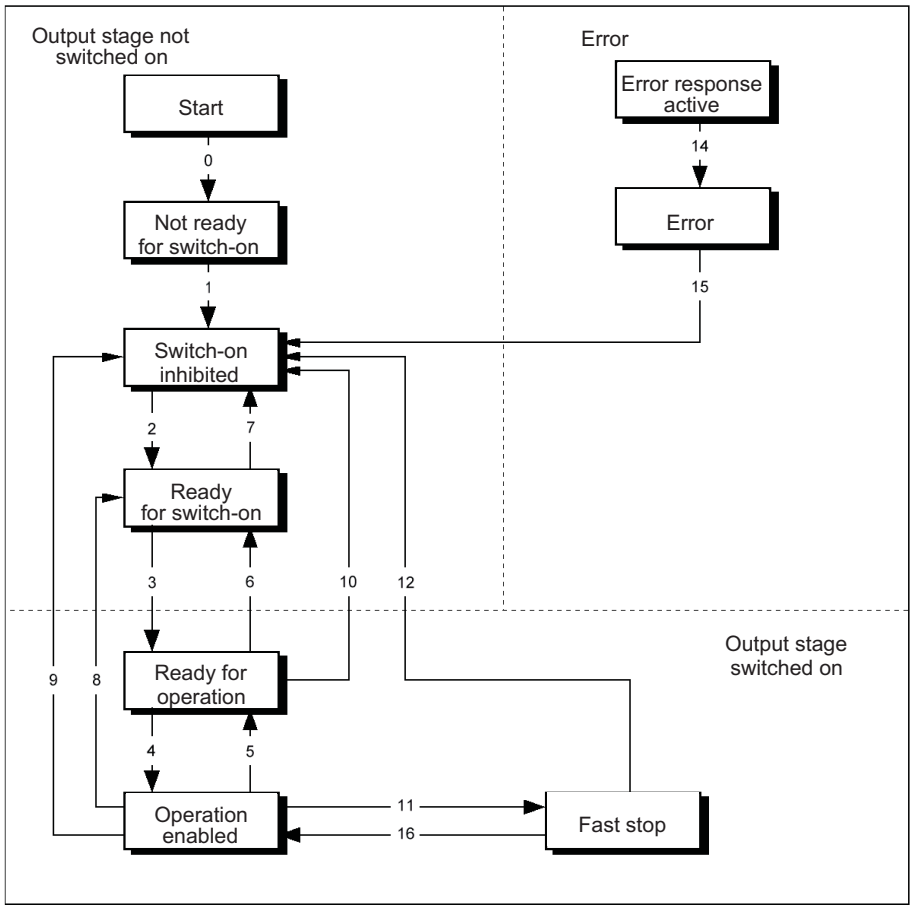
PZD1: Control word (STW) /Status word (ZSW) – instrument control
The control word and the status word are used to control the instrument and monitor the status of the instrument.

PZD2-6: Setpoint / actual values depending on the operating modes.
Setpoints and actual values such as position, velocity and current are exchanged in this section.

The availability of a process data channel is determined in the PROFIDRIVE drive profile. The significance of the process data is defined according to the operating mode. The process data that are used are determined in such a way that the real-time capability of this channel is optimally used. A central role is played by the parameter "Selector for operating modes" (see Chapter IV.2.2.2), that is used to choose between individual operating modes.
In the following, the instrument control is described first, and then the significance and functioning of the operating modes.

V.1 Instrument control

The control of the instrument is described with the aid of a state machine. The state machine is defined in the drive profile by a flow diagram for all operating modes. The following diagram shows the possible instrument states for the S600.



The following table describes the instrument states and the transitions.

States of the state machine

Not ready for switch-on	SERVOSTAR™ 600 is not ready for switch-on. No operation readiness (BTB) is signaled from the amplifier software.
Switch-on inhibited	SERVOSTAR™ 600 is ready for switch-on. Parameters can be transferred, DC-link (DC-bus) can be switched on, motion functions cannot be carried out yet.
Ready for switch-on	DC-link voltage must be applied. Parameters can be transferred, motion functions cannot be carried out yet.
Ready for operation	DC-link voltage must be switched on. Parameters can be transferred, motion functions cannot be carried out yet. Output stage is switched on (enabled).
Operation enabled	No error present. Output stage is switched on, motion functions are enabled.
Fast stop activated	Drive has been stopped, using the emergency stop ramp. Output stage is switched on (enabled), motion functions are enabled.
Error response active/error	If an instrument error occurs, the SERVOSTAR™ 600 changes to the instrument state “Error response active”. In this state, the power stage is switched off immediately. After this error response has taken place, it changes to the state “Error”. This state can only be terminated by the bit-command “Error-reset”. To do this, the cause of the error must have been removed (see ASCII command ERRCODE).

Transitions of the state machine

Transition 0	Event	Reset / 24V supply is switched on
	Action	Initialization started
Transition 1	Event	Initialization successfully completed, SERVOSTAR™ 600 switch-on inhibit
	Action	none
Transition 2	Event	Bit 1 (inhibit voltage) and Bit 2 (fast stop) are set in the control word (command: shutdown). DC-link voltage is present.
	Action	none
Transition 3	Event	Bit 0 (switch-on) is also set (command: switch-on)
	Action	Output stage is switched on (enabled). Drive has torque.
Transition 4	Event	Bit 3 (operation enabled) is also set (command: operation enable)
	Action	Motion functions are enabled, depending on the operating mode that is set.
Transition 5	Event	Bit 3 is canceled (command: inhibit)
	Action	Motion functions are disabled. Drive is braked, using the relevant ramp (depends on operating mode).
Transition 6	Event	Bit 0 is canceled (ready for switch-on).
	Action	Output stage is switched off (disabled). Drive has no torque.
Transition 7	Event	Bit 1 or Bit 2 is canceled.
	Action	(Command: “Fast stop” or “Inhibit voltage”)
Transition 8	Event	Bit 0 is canceled (operation enabled -> ready for switch-on)
	Action	Output stage is switched off (disabled) - motor loses torque.
Transition 9	Event	Bit 1 is canceled (operation enabled -> switch-on inhibited)
	Action	Output stage is switched off (disabled) - motor loses torque.
Transition 10	Event	Bit 1 or 2 are canceled (ready for operation -> switch-on inhibited)
	Action	Output stage is switched off (disabled) - motor loses torque.
Transition 11	Event	Bit 2 is canceled (operation enabled -> fast stop)
	Action	Drive is stopped, using the emergency ramp. The output stage remains enabled. Setpoints are canceled (e.g motion block number, digital setpoint).
Transition 12	Event	Bit 1 is canceled (fast stop -> switch-on inhibited)
	Action	Output stage is switched off (disabled) - motor loses torque.
Transition 13	Event	Error response active
	Action	Output stage is switched off (disabled) - motor loses torque.
Transition 14	Event	Error
	Action	none
Transition 15	Event	Bit 7 is set (error -> switch-on inhibited)
	Action	Acknowledge error (depending on error – with/without reset)
Transition 16	Event	Bit 2 is set (fast stop -> operation enabled)
	Action	Motion function is enabled again.

The state transitions are affected by internal events (e.g. switching off the DC-link voltage) and by the flags in the control word (Bits 0, 1, 2, 3, 7).

V.1.1 Control word (STW)

With the aid of the control word, you can switch from one instrument state to another. In the diagram for the state machine you can see which instrument states can be reached by which transitions. The momentary instrument state can be taken from the status word.

Several states may be passed through during a telegram cycle (e.g. Ready for switch on → Ready for operation → Operation enabled).

The bits in the control word can be (operating-) **mode-dependent** or **mode-independent**.

The following table describes the bit assignment in the control word.

Bit	Name	Commentary
0	Switch on	—
1	Inhibit voltage	—
2	Fast stop, switch-on inhibited	1 -> 0 drive brakes using emergency ramp, axis is disabled
3	Operation enabled	—
4	Fast stop (inhibit ramp function generator)	1 -> 0 drive brakes using emergency ramp
5	Pause (stop rfg)	Mode-dependent, 1 -> 0 stops motion
6	Setpoint enable	mode-dependent
7	Reset Fault	only effective with errors
8	Jogging (on/off)	mode-dependent
9	reserved	—
10	PZD (enable/inhibit)	—
11	Start homing run (edge)	mode-dependent
12	Manufacturer-specific	reset the position
13	Manufacturer-specific	acknowledge warnings
14	Manufacturer-specific	only position mode: Bit14 = 1: PZD section is interpreted as direct motion block (velocity 32-bit, position 32-bit, motion block type 16-bit Bit14 = 0: PZD section (HSW) is interpreted as motion block number
15	Manufacturer-specific	reserve

Depending on the bit combination in the control word, a corresponding control command is defined. The following table shows the bit combinations and also determines the priorities of the individual bits, in case several bits are altered in one telegram cycle.

Command	Bit 13	Bit 7	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Transitions
Shutdown	X	X	X	X	1	1	0	2, 6, 8
Switch-on	X	X	X	X	1	1	1	3
Inhibit voltage	X	X	X	X	X	0	X	7, 9, 10, 12
Fast stop (disable)	X	X	X	X	0	1	X	7, 10,11->12
Fast stop (enable)	X	X	0	1	1	1	1	11
Inhibit operation	X	X	X	0	1	1	1	5
Enable operation	X	X	1	1	1	1	1	4, 16
Reset error	X	1	X	X	X	X	X	15
Acknowledge warnings	1	X	X	X	X	X	X	-

Bits labeled with X are irrelevant.

Mode-dependent bits in the control word:

Mode	Bit 5	Bit 6	Bit 8	Bit 11
Position	**Motion block**: The parameter that is set in the motion block is used. **Setup operation**: The parameter that is set as a ramp for homing and jogging is used	Start a motion task with every transition edge (toggle bit).	Start jogging	Start homing
Digital speed	Drive brakes, using the preset speed ramp.	Setpoint enable	reserved	reserved
Digital current	reserved	Setpoint enable	reserved	reserved
Analog speed	reserved	reserved	reserved	reserved
Analog current	reserved	reserved	reserved	reserved
Trajectory	reserved	reserved	reserved	reserved

Priority of the Bits 6, 8, 11 in position-control mode: 6 (high), 11, 8 (low).

V.1.2 Status word (ZSW)

With the aid of the status word, the instrument state can be represented and the transmitted control word can be verified. If an unexpected condition is reported, as the result of a transmitted control word, then first of all the boundary conditions for the expected instrument state must be clarified (e.g. enable of the output stage – hardware + software, application of the DC-link voltage).

The bits in the status word can be **mode-dependent** or **mode-independent.**
The following table describes the bit assignment in the status word.

Bit	Name	Commentary
0	Ready for switch-on	---
1	Switched on	---
2	Operation enabled	---
3	Error	see ASCII command ERRCODE
4	Voltage inhibited	---
5	Fast stop	---
6	Switch-on inhibit	---
7	Warning	see ASCII command STATCODE
8	Setpoint / actual value monitoring	only in position-control mode: contouring error indicator
9	Remote	not supported, fixed to 1
10	Setpoint reached	only in position mode: In Position
11	Limit active	not supported at present
12	Mode-dependent	reserved
13	Mode-dependent	reserved
14	Manufacturer-specific	reserved
15	Manufacturer-specific	reserved

States of the state machine:

State	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not ready for switch-on	0	X	X	0	0	0	0
Switch-on inhibit	1	X	X	0	0	0	0
Ready for switch-on	0	1	X	0	0	0	1
Ready for operation	0	1	X	0	0	1	1
Operation enabled	0	1	X	0	1	1	1
Error	0	X	X	1	0	0	0
Error response	0	X	X	1	0	0	0
Fast stop active	0	0	X	0	1	1	1

V.2 Operating modes

The selection of a new operating mode is described in detail in the chapter on the parameter channel. This procedure must be observed and adhered to.

WARNING
Appropriate precautionary measures against damage caused by faulty presentation of data formats or normalization of the setpoints must be taken by the user.

The possible operating modes are described below. Operating modes with a positive number (1,2) are defined in the drive profile. Operating modes with a negative number (-1,-2...) are labeled in the drive profile as being manufacturer-specific modes.

V.2.1 Positioning (operating mode 2)

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	motion task no. or v_{setp}*	-	-	-	-
ZSW	n_{act} (16-bit)	actual position (32-bit)		manufacturer-specific status	-

*: for jogging/homing

Deviating assignment of the process-data sections with STW Bit 14=1:

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	direct motion task: V_{setp} (32-bit)		position setpoint (32-bit)		motion block type
ZSW	n_{act} (16-bit)	actual position (32-bit)		manufacturer-specific status	-

Motion task number

The motion task number of the motion task to be started can lie in the range 1 to 180 (motion tasks in EEPROM) or 192 to 255 (motion tasks in RAM).

Actual speed (16-bit)

The representation of the 16-bit actual speed value is normalized to the parameter for overspeed VOSPD $n_{act16} = \frac{n_{act}}{VOSPD} \times 2^{15}$

Actual position (32-bit)

The range for the incremental position covers values from -2^{31} to $(2^{31}-1)$, whereby one turn corresponds to 2^{PRBASE} increments.

Manufacturer-specific status

In the process data, the upper 16 bits of the manufacturer-specific status register (PNU 1002) are made available. The numbering starts again from 0.
The significance of the status register bits can be seen in the table in Chapter IV.2.3.3.

Speed setpoint for a direct motion task

The usable range for the speed is not limited by the available data area. It is limited by the maximum achievable speed nmax, which is given by the speed parameter VLIM as the final limit speed for the motor.
The maximum speed is derived from the following formula:

$v_{SI,\max} = n_{\max} \times \frac{PGEARI}{PGEARO} \times 2^{PRBASE}$ or, as an incremental value, from:

$v_{incr.\max.} = n_{\max} \times 2^{PRBASE} \times \frac{250\mu s}{1sec} = \frac{n_{\max}}{4000} \times 2^{PRBASE}$, in each case with n_{max} in revs/sec

Position setpoint for a direct motion task

The SERVOSTAR™ 600 calculates all positioning operations internally only on an incremental basis, so there are limitations on the usable range of values for distances that are given in SI units.
The range for the incremental position covers the values from -2^{31} to $(2^{31}-1)$.
The resolution that is determined by the PGEARO (PNU1258) and PGEARI (PNU1259) parameters and the variable PRBASE fix the sensibly usable range for positioning operations.
The variable PRBASE determines, through the equation $n = 2^{PRBASE}$, the number of increments per motor turn. The value of PRBASE can only be 16 or 20.
PGEARO contains the number of increments that must be traversed when the distance to be moved is PGEARI. The default values for PGEARO are 1048576 (PRBASE = 20) or 65536 (PRBASE = 16) and correspond to one turn.
The number of turns that can be covered are given as follows:
-2048..+2047 for PRBASE=16 and -32768..+32767 for PRBASE=20
The sensibly usable position range is derived as follows:

$-2^{31} * \frac{PGEARI}{PGEARO} \ldots (2^{31}-1) * \frac{PGEARI}{PGEARO}$ for PGEARI <= PGEARO, or

$-2^{31} \ldots (2^{31}-1)$ for PGEARI > PGEARO

Motion block type

The various types of motion block are described in Chapter IV.2.5.3.

V.2.2 Digital speed (operating mode 1)

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	N_{Setp}	-	-		-
ZSW	n_{act}	-	incremental actual position 32-bit		manuf.-specific status

Deviating assignment of the process data sections with STW Bit 14=1:

PZD 1	**PZD 2**	**PZD 3**	PZD 4	PZD 5	PZD 6
STW	n_{Setp} (32-bit)		-		-
ZSW	n_{act} (32-bit)		incremental actual position 32-bit		manuf.-specific status

Deviating assignment of the process data sections with STW Bit 15=1:

PZD 1	PZD 2	PZD 3	**PZD 4**	**PZD 5**	PZD 6
STW	N_{Setp}	-	-		-
ZSW	n_{act}	-	position (20 bits/turn and 16 turns)		manuf.-specific status

Actual speed (16-bit)

The representation of the 16-bit actual speed value is normalized to the parameter for the overspeed VOSPD $n_{act16} = \frac{n_{act}}{VOSPD} \times 2^{15}$

Actual position (32-bit)

The range for the incremental position covers values from -2^{31} to $(2^{31}-1)$.
Here one turn corresponds to 2^{PRBASE} increments.

Manufacturer-specific status

In the process data, the upper 16 bits of the manufacturer-specific status register (PNU 1002) are made available. The numbering starts again from 0.
The significance of the status register bits can be seen in the table in Chapter IV.2.3.3.

Speed setpoint (16-bit)

The 16-bit speed setpoint is normalized to the parameter for the overspeed VOSPD.

$$n_{setp16} = \frac{n_{setp}}{VOSPD} \times 2^{15}$$

Position

The actual position value is an incremental value with a resolution of 24 bits.
Her one turn corresponds to 2^{PRBASE} increments.
So $2^{24 - PRBASE}$ turns can be represented.

Speed values (32-bit)

The digital speed values are converted according to the formula.

$$n_{setp\,/\,act}(in\ rpm) = \frac{n_{setp\,/\,actdig.}}{VOSPD} \times 2^{31}$$

V.2.3 Analog speed (operating mode -1) [in preparation]

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
-	-	-	-	-	-

V.2.4 Digital torque (operating mode -2)

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	I_{setp}	-	-	-	-
ZSW	I_{act}	incremental actual position (32-bit, value range 24-bit))		manuf.-specific status	-

Actual position (32-bit)

The range for the incremental position covers values from -2^{31} to $(2^{31}-1)$.
Here one turn corresponds to 2^{PRBASE} increments.

Manufacturer-specific status

In the process data, the upper 16 bits of the manufacturer-specific status register (PNU 1002) are made available. The numbering starts again from 0.
The significance of the status register bits can be seen in the table in Chapter IV.2.3.3.

Digital current values (16-bit)

The digital current values are converted as follows: $$I[A] = \frac{digital\ current\ setpoint}{1640} \times I_{max}$$

V.2.5 Analog torque (operating mode -3) [in preparation]

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
-	-	-	-	-	-

V.2.6 Electronic gearing (operating mode -4)

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	-	-	-	-	-
ZSW	n_{act}	actual position (32-bit)		manuf. status	-

Actual speed (16-bit)

The representation of the 16-bit actual speed value is normalized to the parameter for the overspeed VOSPD $$n_{act16} = \frac{n_{act}}{VOSPD} \times 2^{15}$$

Actual position (32-bit)

The range for the actual position covers values from -2^{31} to $(2^{31}-1)$.
Here one turn corresponds to 2^{PRBASE} increments..

Manufacturer-specific status

In the process data, the upper 16 bits of the manufacturer-specific status register (PNU 1002) are made available. The numbering starts again from 0.
The significance of the status register bits can be seen in the table in Chapter IV.2.3.3.

V.2.7 ASCII-channel (operating mode –16)

PZD 1	PZD 2	PZD 3	PZD 4	PZD 5	PZD 6
STW	10 bytes of ASCII-data				
ZSW	10 bytes of ASCII-data				

The operating mode “ASCII-channel” is used for parameterizing the SERVOSTAR™ 600.

With this channel, just as with any terminal program, ASCII data can be exchanged with the servo amplifier via the RS232 interface. The control of the communication is performed by handshake bits in the control and status words.
The assignment is as follows:

Bit 12: **Control word**
Any transition edge on this bit informs the SERVOSTAR™ that valid ASCII data are available in its process data input section, i.e. that with effect from this moment valid data must have been entered into the PZD transmission section PZD 2 - PZD 6 by the control system.
Status word
The SERVOSTAR™ confirms that it has accepted the ASCII data, by a transition edge on this bit.

Bit 13: **Status word**
The SERVOSTAR™ uses a “1” in this bit to signal that the ASCII buffer now contains valid data. A transition edge of Bit 14 in the control word STW can be used to make the SERVOSTAR™ write the buffer contents to the PZD reception section of the bus-master.

Bit 14: **Control word**
Any transition edge on this bit requests the SERVOSTAR™ to write the contents of its filled ASCII buffer to the receive process data of the bus master
Status word
The SERVOSTAR™ uses a transition edge on this bit to signal that the ASCII buffer data have been written to the process data.

When transmitting ASCII data, the following must be observed:

1. Every ASCII command must be terminated by the “CR LF” character sequence.
2. If the ASCII command (with CR LF) is shorter than the 10 characters that are available, then the rest of the telegram must be filled up with bytes with a content 0x00.
3. ASCII commands that are longer than 10 characters must be divided into more than one telegram, whereby a maximum of 30 characters can be sent before the buffer must be read out once.

When evaluating the responses to the transmitted ASCII command, the following must be observed:

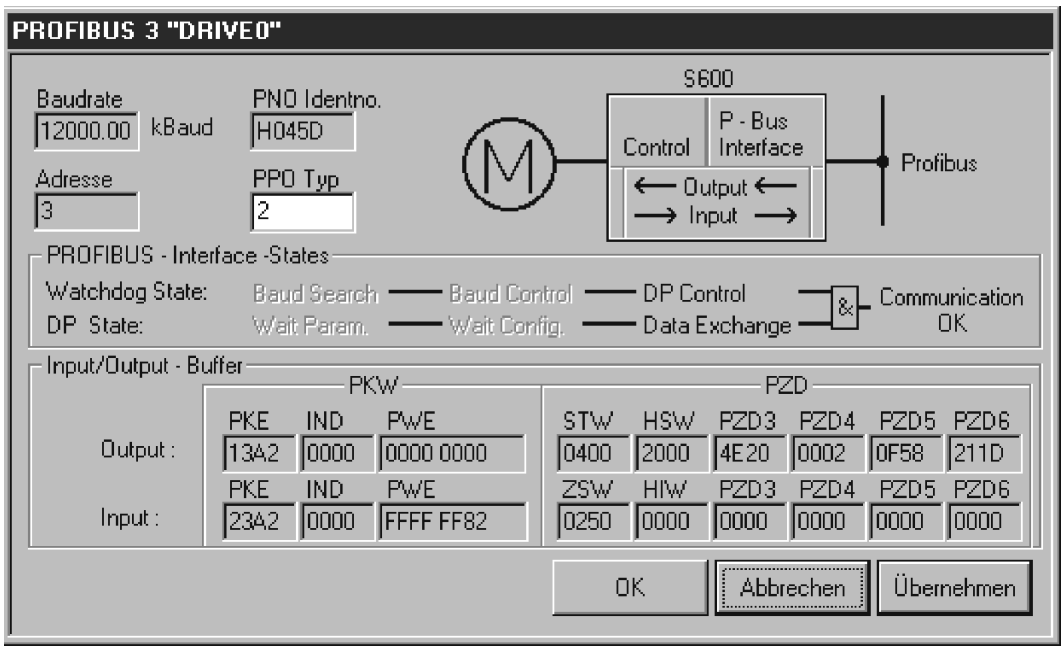
1. The ASCII response is always terminated by an “End of Text” (EOT = 0x04) character.
2. Response telegrams can include less than 10 bytes of user data, without the response being concluded. The telegram must then be filled up with bytes with the value 0x00.
3. After reading out the buffer, Bit 13 of the status word is reset to “0”, until the buffer is filled again.
   The designation of the end of the ASCII response is in all cases “End of Text”.

V.2.8 Initial setting after switch-on (operating mode -126)

In this state, it is indeed possible to control the state machine, but motion functions cannot be initiated.

VI Setup software

VI.1 PROFIBUS menu



On the menu page “Amplifier” the “PROFIBUS” screen will appear. Beyond this is a screen page that displays the PROFIBUS-specific parameters, the bus status, and the data words in the transmit and receive directions, as seen by the bus-master. This page is helpful when searching for errors and commissioning the bus communication.

Baud rate: The baud rate that is given by the PROFIBUS master is shown here.

PNO identification: The PNO identification is the number for SERVOSTAR™ in the list of ID-numbers of the PROFIBUS user organization.

Address: Station address of the amplifier. The address is set up on the screen page “Basic setup” (see function descriptions in the setup Software).

PPO type: SERVOSTAR™ 600 only supports PPO-type 2 of the PROFIDRIVE profile.

Bus status: Shows the present status of the bus communication. Data can only be transferred across the PROFIBUS when the “Communication OK” message appears.

Input: The last bus object that was received by the master.
Here PKE: Response to “Request operating mode number”
PWE: Operating mode -126

Output: The last bus object that was sent by the master.
Here PKE: “Request operating mode number”

the data for input/output are only transferred, if the threshold monitoring for the SERVOSTAR™ 600 has been activated in the master’s hardware configuration.

This page is deliberately left blank.

VII Sample telegrams

VII.1 Setting the operating mode

After switch-on or a reset the SERVOSTAR™ is in the operating mode -126, in which it cannot perform any motion functions. To be able to carry out positioning operations (motion tasks, jogging, homing), it must be set to the position-control mode.
The procedure to do this is as follows:

a) Set the control word Bit 10 (PZD1, Bit 10) to 0.
This invalidates the process data for the SERVOSTAR™ 600.

Byte 9	10	11	12
xxxx x0xx	xxxx xxxx	xxxx xxxx	xxxx xxxx
STW		HSW	

b) Transmit a parameterization telegram for the operating mode setting.

Byte 1	2	3	4	5	6	7	8
0011 0011	1010 0010	xxxx xxxx	xxxx xxxx	0000 0000	0000 0000	0000 0000	0000 0010
PKE		IND		PWE			

The bits in the PKE section have the following significance:
Bit 0 to 10 = PNU 930, Bit 12 to 15 = AK 3 (see also Chapter III.1.1)

The SERVOSTAR™ sends a response telegram with AK = 2 and mirrors (identical) the values for PNU and PWE.

c) Switch on the new operating mode by setting the control word Bit 10 to 1.
This validates the process data.

If, for example, point a) is not observed, the SERVOSTAR™ transmits a negative answer: (response ID=7)

Byte 1	2	3	4	5	6	7	8
0111 0011	1010 0010	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0001
PKE		IND		PWE			

The number that is transferred in the PWE section represents the error number, and can be looked up in the table in Chapter III.1.1.2. In this case, error no. 17, “Task impossible because of operating state” will be signaled.

VII.2 Enable the SERVOSTAR™ 600

The hardware enable signal must be applied, as a precondition for enabling the SERVOSTAR™ via the PROFIBUS.
The enable can be made by setting the bit combination for the “Operation enabled” state in the control word.

Byte 9	10	11	12
xxx0 x1xx	0011 1111	xxxx xxxx	xxxx xxxx
STW		HSW	

The SERVOSTAR™ then reports back the corresponding state in its status word, or indicates a warning or error message.

Byte 9	10	11	12
xxxx xx1x	0010 0111	xxxx xxxx	xxxx xxxx
ZSW		HSW	

VII.3 Set reference point

Warning:
Take care that the position of the reference point permits the following positioning operations. The parameterized software limit-switches in the SERVOSTAR™ may not be effective. The axis could then drive up to the hardware limit-switch or the mechanical stop. There is a danger of damage being caused.

The control word Bit 12 = 1 defines the momentary position as being the reference point. It is followed by the reply: status word Bit 12 = 1, reference point set. The positioning functions are enabled. **The shifting of the zero point (NI-offset) is ineffective.**
The replay “Reference point set” is made through Bit 17 in the manufacturer-specific status register (PNU 1002) or Bit 1 (manufacturer status of the process data).

Conditions:

PNU930 ≠ -16	Controller enabled	ZSW Bit 1 = 1
No motion function active	ZSW Bit14 = 0	

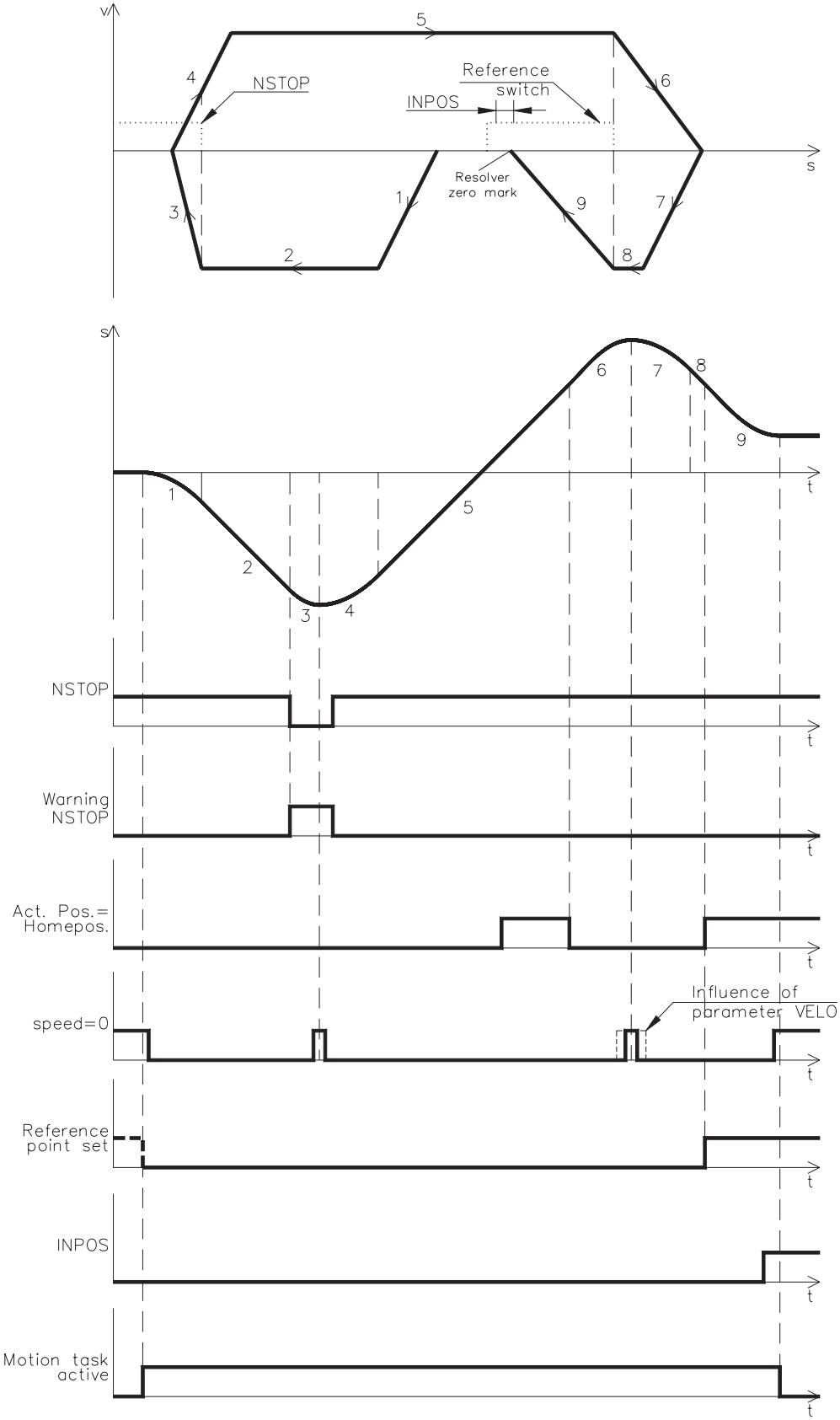
VII.4 Start homing run

After switching on the 24V auxiliary voltage the system must first of all carry out a homing run. Take care that the position of the machine zero point (reference point) permits the following positioning operations. The parameterized software limit-switches in the SERVOSTAR™ may not be effective. The axis could then drive up to the hardware limit-switch or the mechanical stop. There is a danger of damage being caused.
If the reference point (machine zero point) is approached too fast, with high moments of inertia in the system, then it might be overrun, and the axis could then drive up to the hardware limit-switch or the mechanical stop. There is a danger of damage being caused.

The homing run is started by STW, Bit 11 = 1. The start of the homing run is detected by a positive transition edge for Bit 11.
If Bit 11 is set to 0 again, before the reference point has been reached, then the homing run is canceled. Bit 12 ZSW remains at 0 (reference point not set).
A set reference point is a precondition for all the positioning functions of the linear axis.
The reference point switch is wired up to a digital input on the SERVOSTAR™.
Depending on the type of homing run, you can freely shift the zero crossing point of the motor shaft within one turn, by using the parameter “Zero-point offset” (NI-offset). Furthermore, you can fix the position value to be the reference point by using the reference offset.
After the homing run, the drive signals “InPosition”, thereby enabling the position controller.
The velocity for the homing run is transmitted with the main setpoint, as a 16-bit value. Multiplying this by the value of parameter 1250 determines the 32-bit speed. The sign is not evaluated.

Conditions :
State of the state machine = “Operation enabled”
No warning message (ZSW Bit 7 = 0)

The following diagram uses the homing run Type 1 (negative direction of motion, positive rotation, starting point in negative direction relative to the reference switch) as an example to illustrate the signal sequence of the relevant bits in the manufacturer-specific state.



After the homing run has been completed, Bit 11 STW must be set to 0 again.

Alternatively, the reference point can also be set at the actual position.
This can be achieved by setting Bit 12 STW, or by setting the homing run Type 0 with parameter 1350 and subsequent start of the homing run by Bit 11 STW .

VII.5 Start jog mode

Jog mode is started in a similar manner to homing. To start, Bit 8 STW must be set. The jog velocity is given by the product of the 16-bit main setpoint in PZD2 and the multiplier defined by parameter 1250. The sign of the main setpoint determines the direction of movement.

It is not necessary to have a reference point set for jogging.

VII.6 Start a motion task

Motion tasks are started by a transition edge (positive or negative) at Bit 6 STW.
Bit 14 STW is used to decide whether a stored motion task or a direct motion task should be carried out.

Conditions:

Hardware enable is present.
Amplifier is in the “Operation enabled” state.
For linear axis: reference point is set.

Example: start the EEPROM motion task number 10:

Byte 9	10	11	12
0000 0100	0F*11 1111	0000 0000	0000 1010
STW		HSW	

* F stands for a transition edge, the state of Bit 6 STW also depends on the previous state.

By setting Bit 5 in the manufacturer-specific status, the amplifier indicates that it has accepted the motion task and is carrying it out.

VII.7 Start a direct motion task, with following task

If the motion task data are to be freely defined, then a direct motion task must be used. In this case, the target position, velocity and type of motion task are transferred to the process data, together with the call of the motion task. If required, further parameters for this motion task (e.g. ramps) can be transferred previously by parameter tasks.

First of all, the number of the following task is transferred by parameter 1308:

Byte 1	2	3	4	5	6	7	8
0011 0101	0001 1100	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	0001 0100
PKE		IND		PWE			

After the amplifier has confirmed the acceptance of the data, the direct motion task can be started:

Target position 135000 µm

Velocity 20000 $\frac{\mu m}{s}$

Motion task type
- relative to actual position
- with following motion task
- without pause
- setpoint velocity for the following task should already be reached at the target position (only makes sense if there is no change of direction)
- use SI units

Byte 1	2	3	4	5	6
0100 0100	0F*11 1111	0000 0000	0000 0000	0100 1110	0010 0000
PZD1		PZD2		PZD3	
STW		v_{setp}			

Byte 7	8	9	10	11	12
0000 0000	0000 0010	0000 1111	0101 1000	0010 0001	0001 1101
PZD4		PZD5		PZD6	
s_{setp}				motion block type	

* F stands for a transition edge, the state of Bit 6 STW also depends on the previous state.

VII.8 Polling a warning or error message

If a warning or error message is present, then parameter 1001 or 1002 can be interrogated to find out the number of the warning or error.

VII.9 Writing a parameter

Parameter v_max is used as an example to show how control parameters are transmitted from the master to the SERVOSTAR™.

Parameter number: **1265** 100 1111 0001
Parameter value: **350000** µm/s 0100 0011 1010 1111 0000 0000 0000 0000

Byte 1	2	3	4	5	6	7	8
0000 0100	1111 0001	0000 0000	0000 0000	0100 0011	1010 1111	0000 0000	0000 0000
PKE		IND		PWE			

Note: after an error has occurred in parameter transmission (AK = 7), a “Zero telegram” should be transmitted, i.e. the 8 bytes of the transmit telegram from the PLC should be kept at 0, until the SERVOSTAR™ 600 has responded with a zero telegram.

VII.10 Read actual values

Cyclical actual value request

This PKW task switches on the reading of an actual value. The actual value will now be transmitted with each cyclical telegram – until a new PKW task is presented.

Telegram layout:

	Request	Response
PKE/AK	1	2
PKE/PNU	Parameter number of the actual values (1400..1413)	as transmitted
IND	0 = read	0
PWE	no significance	actual value
HSW	no significance	no significance

VII.11 Write a parameter via the ASCII channel

The KP value for the current controller is to be set through the ASCII channel.
The command is then MLGQ_0.985. Here the understroke stands for an empty character. Since every telegram only has 10 positions available for the transmission of ASCII characters, the termination of the line (“CR LF”) must be transmitted in a second telegram.
Conditions:

ASCII mode is switched on (PNU 930 = -16)
Bit 13 STW = 0 (if necessary, toggle Bit 14 STW until Bit 13 STW = 0)

Procedure:

1. Write data to PZD 2..6 and invert Bit 12 STW

Byte 1	2	3	4	5	6
0001 0000	0000 0000	0100 1101	0100 1100	0100 0111	0101 0001
PZD1		PZD2		PZD3	
STW		“M”	“L”	“G”	“Q”

Byte 7	8	9	10	11	12
0010 0000	0011 0000	0010 1110	0011 1001	0011 1000	0011 0101
PZD4		PZD5		PZD6	
“_”	“0”	“.”	“9”	“8”	“5”

2. Wait for the transition edge on Bit 12 ZSW
3. Continue writing data to PZD 2..6 and invert Bit 12 STW

Byte 1	2	3	4	5..12
0000 0000	0000 0000	0000 1101	0000 1010	0000 0000
PZD1		PZD2		PZD3..6
STW		“CR”	“LF”	

4. Wait for the transition edge on Bit 12 ZSW
5. Wait until Bit 13 ZSW = 1
6. Invert Bit 14 STW
7. Wait until Bit 14 ZSW = 1
8. The servo amplifier sends a response telegram

Byte 1	2	3	4	5	6
0110 0010	0000 0000	0100 1101	0100 1100	0100 0111	0101 0001
PZD1		PZD2		PZD3	
STW		“M”	“L”	“G”	“Q”

Byte 7	8	9	10	11	12
0010 0000	0011 0000	0010 1110	0011 1001	0011 1000	0011 0101
PZD4		PZD5		PZD6	
“_”	“0”	“.”	“9”	“8”	“5”

9. Repeat steps 5 to 8 until a response telegram indicates “EOT”.

Byte 1	2	3	4	5	6	7..12
0000 0010	0000 0000	0000 1101	0000 1010	0000 0100	0000 0000	0000 0000
PZD1		PZD2		PZD3		PZD4..6
STW		“CR”	“LF”	“EOT”		

Note: The sequence of response telegrams shown above is only one of many possibilities (for the same response from the servo amplifier). Because of the transmission rate and the internal synchronization mechanism, it can happen that process data sections remain empty and so the response is broken into segments. This could possibly alter the number of response telegrams.

VIII Appendix

VIII.1 Index

	Text	Page
A	acceleration time	27
	actual position value	
	incremental	28
	SI-units	28
	analog inputs	30
	analog outputs	30
	axis type	26
B	baud rate	23
C	commissioning	14
	complete documentation	7
	connection diagram	11
	connection methods	11
	control word	33
D	data format, parameter	18
	deceleration time	27
	default parameters	23
	digital inputs	29
	digital outputs	30
E	error numbers	17
	error register	24
F	fitting	10
H	homing	42
	homing direction	28
	homing type	28
I	incremental position	26
	installation	9
	instrument control	31
	instrument ID	24
	instrument profile	15
	interface modules	12
J	jog mode	44
	jolt limiting	
	acceleration	28
	deceleration	28
L	layout	10
M	motion task	
	copy	28
	start	44
	type	27
N	next motion task	28
O	operating modes	34
P	parameter channel	16
	parameter description	22
	parameter ID	16
	parameter numbers	20
	parameter value	18
	parameterization of the amplifier	18
	parameterization of the CP5412 (A2)	13
	PLC programming	13
	PNU list	20
	position data	26
	process data channel	18
	PROFIDRIVE profile number	23
R	read actual values	45
	read/write amplifier parameter	19
	response IDs	16
S	safety instructions	5
	sample telegram	41
	saving	23
	set reference point	42
	setup software	39
	speed	28
	standard function blocks	13
	start delay	28
	state machine	32
	status register	25
	status word	34
	subindex	17
V	velocity	26
	velocity multiplier	26

Vertrieb und Service / Sales and Service / Agence et Services

Bundesrepublik Deutschland/
Germany/Allemagne

Kollmorgen Seidel GmbH & Co. KG
Verkaufsniederlassung Nord
Heinrich-Albertz- Str. 40
29221 Celle
Tel.: +49(0)5141 - 98 10 40
Fax: +49(0)5141 - 98 10 41

Kollmorgen Seidel GmbH & Co. KG
Verkaufsniederlassung West
Wacholderstr. 40-42
40489 Düsseldorf
Tel.: +49(0)203 - 99 79 - 180
Fax: +49(0)203 - 99 79 - 118

Kollmorgen Seidel GmbH & Co. KG
Verkaufsniederlassung Süd-West
Lessingstr. 41
75015 Bretten
Tel.: +49(0)7252 - 97 39 040
Fax: +49(0)7252 - 97 39 055

Kollmorgen Seidel GmbH & Co. KG
Verkaufsniederlassung Süd-Ost
Landsbergerstr. 17
86947 Weil
Tel.: +49(0)8195 - 99 92-50
Fax: +49(0)8195 - 99 92-33

Servo-Dyn
Technik GmbH
Münzgasse 10
01067 Dresden
Tel.: +49(0)351 - 49 05 793
Fax: +49(0)351 - 49 05 794

Dänemark/Denmark/Danemark

DIGIMATIC
Ormhöjgaardvej 12-14
8700 Horsens
Tel.: +45 - 76 26 12 00
Fax: +45 - 76 26 12 12

Finnland/Finland/Finlande

Drivematic OY
Hevosenkenkä 4
28430 Pori
Tel.: +358 - 2 - 61 00 33 11
Fax: +358 - 2 - 61 00 33 50

Frankreich/France/France

Kollmorgen Seidel GmbH & Co. KG
Parc technologique St.Jacques
2 rue Pierre et Marie Curie
54320 Maxéville
Tel.: +33(0)3 83 95 44 80
Fax: +33(0)3 83 95 44 81

Großbritannien/
Great Britain/Royaume-Uni

Kollmorgen
PO Box 147, KEIGHLEY
West Yorkshire, BD21 3XE
Tel.: +44(0)15 35 - 60 76 88
Fax: +44(0)15 35 - 68 05 20

Heason Technologies Group
Claremont Lodge
Fontwell Avenue
Eastergate Chichester PO20 6RY
Tel.: +44(0)12 43 - 54 54 00
Fax: +44(0)12 43 - 54 45 90

Italien/Italy/Italie

M.C.A. s.r.l.
Via f. Turati 21
20016 Pero (Mi)
Tel.: +39(0)02 - 33 91 04 50
Fax: +39(0)02 - 33 90 85 8

Niederlande/
Netherlands/Pays-Bas

Dynamic Drives
Jan van der Heydenstraat 24a
2665 JA Bleiswijk
Tel.: +31(0)10 - 52 15 490
Fax: +31(0)10 - 52 18 994

Schweden/Sweden/Suéde

S D T AB
25467 Helsingborg
Tel.: +46(0)42 - 380 800
Fax: +46(0)42 - 380 813
Stockholm
12030 Stockholm
Tel.: +46(0)8 - 640 77 30
Fax: +46(0)8 - 641 09 15
Göteborg
42671 Västra Frölunda
Tel.: +46(0)31 - 69 62 60
Fax: +46(0)31 - 69 62 69

Schweiz/Switzerland/Suisse

Kollmorgen Seidel GmbH & Co. KG
Buhnrain 30
8052 Zürich
Tel.: +41(0)1 - 300 29 65
Fax: +41(0)1 - 300 29 66

Spanien/Spain/Espagne

BROTOMATIC S.L.
C/San Miguel de Acha, 2 Pab.3
01010 Vitoria (ALAVA)
Tel.: +34 945 - 24 94 11
Fax: +34 945 - 22 78 32

Systempartner / System partners / Partenaires du systéme

Bundesrepublik Deutschland/
Germany/Allemagne

Werner P. Hermes
Ingenieurbüro
Turmstr. 23
40750 Langenfeld
Tel.: +49(0)212 - 65 10 55
Fax :+49(0)212 - 65 10 57

EAT GmbH
Elektronische Antriebstechnik
Hanferstraße 23
79108 Freiburg
Tel: +49(0)761 - 13 03 50
Fax:+49(0)761 - 13 03 555

IBK Ingenieurbüro Keßler GmbH
Dachtmisser Str. 10
21394 Kirchgellersen
Tel: +49(0)4135 - 12 88
Fax:+49(0)4135 - 14 33

Großbritannien/
Great Britain/Royaume-Uni

Motor Technology Ltd.
Unit 1
Chadkirk Industrial Estate
Otterspool Road
Romiley, Stockport
Cheshire SK6 3LE
Tel.: +44(0)161 - 42 73 641
Fax : +44(0)161 - 42 71 306

Niederlande/
Netherlands/Pays-Bas

Kiwiet
Ingenieurbüro
Helenaveenseweg 35
5985 NK Panningen (Grashoek)
Tel.: +31(0)77 - 30 76 661
Fax: +31(0)77 - 30 76 646

Schweiz/Switzerland/Suisse

Bobry Servo Electronic AG
Zentralstr. 6
6030 Ebikon
Tel.: +41(0)41- 440 - 77 22
Fax : +41(0)41 - 440 - 69 43

Italien/Italy/Italie

Servo Tecnica
Viale Lombardia 20
20095 Cusano Milanino (MI)
Tel.: +39 (0)02 - 66 42 01
Fax: +39 (0)02 - 66 40 10 20

Türkei / Turkey / Turquie

Robotek Otomasyon Teknolojileri
Ali Nihat Tarlan CAD.
Kartal Sk. No: 16/7
Üstbostancý ÝSTANBUL
Tel: +90 216 464 50 64 pbx
Fax: +90 216 464 50 72

Griechenland/Greece/Grèce

Alpha Motion
5 - 7 Alkamenoys Str.
104.39 Athens
Tel.: +30 1 82 27 470
Fax: +30 1 82 53 787

Australien/Australia/Australie

Motion Technologies PTY. Ltd.
1/65 Alexander Avenue
Taren Point NSW 2229
Sydney
Tel.: +61 (0)295 24 47 82
Fax: +61 (0)295 25 38 78

Kollmorgen Seidel GmbH & Co. KG

Hausanschrift

Wacholderstr. 40-42
D - 40489 Düsseldorf
Tel.: +49(0)203 - 99 79 - 0
Fax: +49(0)203 - 99 79 - 155
Internet : http://www.kollmorgen-seidel.de

Postanschrift

Postfach 34 01 61
D-40440 Düsseldorf

Kollmorgen

Motion Technologies Group

201 Rock Road
Radford, VA 24141, USA
Tel.: +1 540 - 639 - 24 95
Fax: +1 540 - 731 - 08 47
Internet : http://www.kollmorgen.com