STÖBER

PROFIBUS

Operation manual

Fundamentals

Configuration

Parameters

V 5.6-H or later

09/2013 en

STÖBER

Table of contents

1 Introduction 4
1.1 Purpose of the manual 4
1.2 Readers 4
1.3 Other manuals 4
1.4 Further support 5
2 Notes on Safety 6
2.1 Component part of the product 6
2.2 Operation in accordance with its intended use 6
2.3 Qualified personnel 7
2.4 Transportation and storage 7
2.5 Installation and connection 8
2.6 Service 8
2.7 Disposal 8
2.8 Presentation of notes on safety 9
3 Mounting 10
3.1 Install in MDS 5000 or SDS 5000 10
3.2 Installation in the FDS 5000 13
4 Electrical installation 16
4.1 Setup 16
4.2 Cable specifications 17
4.3 Connection of the bus cables to the inverter 18
5 Fundamentals of PROFIBUS 19
5.1 PROFIdrive profil version 3 19
5.2 Comparison of the PROFIBUS generations 20
5.3 Data transmission via PROFIBUS DP 21
5.3.1 Possible communication 21
5.3.2 User data communication 22
6 Bus diagnosis/LEDs 23

7 Configuration of the bus system 25
7.1 GSD file 25
7.2 Procedure for SIEMENS SIMATIC S7 and STEP 7 26
7.2.1 The HW-config 26
7.2.2 SFC Calls for data consistency 27
8 Prozess data transmission PZD 28
8.1 Parameter process data object (PPO) 28
8.2 The mapping 29
8.2.1 Example PPO4 with 12-Byte PZD area 30
9 Control with control and status bits 31
10 Switchable scaling 32
11 Parameter Overview 33
11.1 PROFIDRIVE parameter 33
11.2 PROFIBUS parameter/mapping/PKW1 33
11.3 List of the primary communication parameters 35
11.4 List of quick location of parameters 40
12 Appendix A 41
12.1 General characteristics 41
12.2 Parameter jobs and responses 41
12.3 DPV1 telegram sequences 46
12.3.1 DPV1 telegram frame 47
13 Appendix B PKW0 telegram 50
13.1 PKW0 mechanism 50
13.2 Further regulations for order/answer processing 53
13.3 Time sequence of a PKW0 service 53

1 Introduction

1.1 Purpose of the manual

This manual gives you information on the connection of the 5th generation of STÖBER inverters to the PROFIBUS fieldbus system. The structure of PROFIBUS and the principal procedures are also discussed.
Goals of the manual:

- Provide you with a basic knowledge of PROFIBUS communication.
- Offer you support when you design an application and configure communication.

1.2 Readers

Users who are familiar with the control of drive systems and have a knowledge of commissioning inverter systems are the target group of this manual.

1.3 Other manuals

The documentation of the MDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442297	V 5.6-H
Projecting manual	Installation and connection	442273	V 5.6-H
Operating manual	Set up the inverter	442285	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

The documentation of the FDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442293	V 5.6-H
Projecting manual	Installation and connection	442269	V 5.6-H
Operating manual	Set up the inverter	442281	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

The documentation of the SDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442301	V 5.6-H
Projecting manual	Installation and connection	442277	V 5.6-H
Operating manual	Set up the inverter	442289	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

You can find information on the POSITool software in the following manuals:

Manual	Contents	ID	Latest version[a)]
POSITool operating manual	Information on the basic functions of POSITool	442233	V 5.6-H
Programming manual	Information on programming with POSITool	441693	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

Note that the programming functionality of POSITool can only be used after training by STÖBER ANTRIEBSTECHNIK. You can find information on training at www. stoeber.de

1.4 Further support

For questions on the use of the 5th generation of STÖBER inverters and its EtherCAT interface which have not been answered by this manual, do not hesitate to contact us at

- telephone: +49 (0) 7231 582-1187 or
- E-Mail applications@stoeber.de

To make getting started with our software easier, we offer courses. Contact our training center at electronics@stoeber.de.

If you have questions about the documentation, please contact:

- E-mail: electronics@stoeber.de

If you have questions about training sessions, please contact:

- E-mail: training@stoeber.de

2 Notes on Safety

The devices may cause risks. For these reasons, comply with the following:

- The safety notes listed in the following sections and points
- The technical rules and regulations.

In addition, always read the appropriate documentation. STÖBER ANTRIEBSTECHNIK GmbH + Co. KG accepts no liability for damages caused by non-adherence to the instructions or applicable regulations. Subject to technical changes to improve the devices without prior notice. This documentation is purely a product description. It does not represent promised properties in the sense of warranty law.

2.1 Component part of the product

The technical documentation is a component part of a product.

- Since the technical documentation contains important information, always keep it handy in the vicinity of the device until the machine is disposed of.
- If the product is sold, disposed of, or rented out, always include the technical documentation with the product.

2.2 Operation in accordance with its intended use

The DP5000 accessory is only intended for establishing communication between devices from the 5th generation of STÖBER inverters and a PROFIBUS network. Improper use includes integration in other communication networks.

2.3 Qualified personnel

Since the devices may harbor residual risks, all configuration, transportation, installation and commissioning tasks including operation and disposal may only be performed by trained personnel who are aware of the possible risks. Personnel must have the qualifications required for the job. The following table lists examples of occupational qualifications for the jobs:

Activity	Possible occupational qualifications
Transportation and storage	Worker skilled in storage logistics or comparable training
Configuration	- Graduate engineer (electro-technology or electrical power technology) - Technician (m/f) (electro-technology)
Installation and connection	Electronics technician (m/f)
Commissioning (of a standard application)	- Technician (m/f) (electro-technology) - Master electro technician (m/f)
Programming	Graduate engineer (electro-technology or electrical power technology)
Operation	- Technician (m/f) (electro-technology) - Master electro technician (m/f)
Disposal	Electronics technician (m/f)

Tab. 2-1: examples of occupational qualifications

In addition, the valid regulations, the legal requirements, the reference books, this technical documentation and, in particular, the safety information contained therein must be carefully

- read
- understood and
- complied with

2.4 Transportation and storage

Inspect the delivery for any transport damage immediately after you receive it. Notify any damage to the transport company immediately. Do not operate the product if damaged. Store the device in a dry and dust-free room if you do not install it immediately

2.5 Installation and connection

The accessory installation instructions allow the following actions during the installation of accessories:

- The housing in the upper slot can be opened.

Opening the housing in another place or for other purposes is not permitted.

Installation and connection work are only permitted after the device has been isolated from the power!

Apply the 5 safety rules in the order stated before performing any work on the machine:

1. Enable. Also enable the auxiliary circuits.
2. Secure against restart.
3. Check that voltage is not present.
4. Earth and short circuit.
5. Cover adjacent live parts.

Information
Note that the discharge time of the DC link capacitors is 5 minutes. You can only determine the absence of voltage after this time period.

Afterwards you can carry out the work.

2.6 Service

Repairs must only be performed by STÖBER ANTRIEBSTECHNIK GmbH + Co. KG. Send faulty devices with a fault description to:
STÖBER ANTRIEBSTECHNIK GmbH + Co. KG
Abteilung VS-EL
Kieselbronner Str.12
75177 Pforzheim, Germany
GERMANY

2.7 Disposal

Please comply with the latest national and regional regulations! Dispose of the individual parts separately depending on their nature and currently valid regulations such as, for example:

- Electronic scrap (PCBs)
- Plastic
- Sheet metal
- Copper
- Aluminum

2.8 Presentation of notes on safety

NOTICE

Notice

means that property damage may occur

▶ if the stated precautionary measures are not taken.

⚠ CAUTION!

Caution

with warning triangle means that minor injury may occur

▶ if the stated precautionary measures are not taken.

⚠ WARNING!

Warning

means that there may be a serious danger of death

▶ if the stated precautionary measures are not taken.

⚠ DANGER!

Danger

means that serious danger of death exists

▶ if the stated precautionary measures are not taken.

Information
indicates important information about the product or a highlighted portion of the documentation which requires special attention.

3 Mounting

The DP 5000 fieldbus module (PROFIBUS DP-V1) must first be installed before the inverter of the 5th generation of STÖBER inverters can be integrated in a PROFIBUS system. The accessories are installed above the inverter display. We recommend ordering the option card with mounting and the inverter. If this is done, STÖBER ANTRIEBSTECHNIK will mount the DP 5000 before delivery.

3.1 Install in MDS 5000 or SDS 5000

⚠ WARNING!

Danger of injury/death and property damage due to electric shock!

▶ Before installing accessories, turn off all voltage supplies! Then wait 5 minutes for the DC link capacitors to discharge. Never begin with accessory installation until after this!

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).

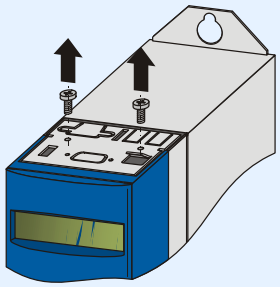
▶ Do not touch the contact surfaces.

You will need the following tools to install the DP 5000:

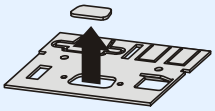
- TX10 Torx screwdriver
- Pliers
- Hexagon socket wrench, 4.5 mm

Installing the DP 5000

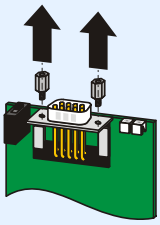
1. Unscrew the mounting screws and remove the cover plate:



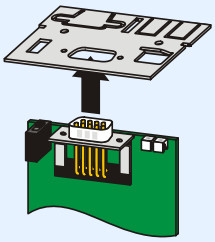
2. Remove the punched out metal section with the pliers:



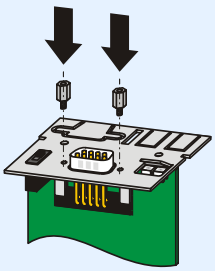
3. Remove the screws from the option PCB:



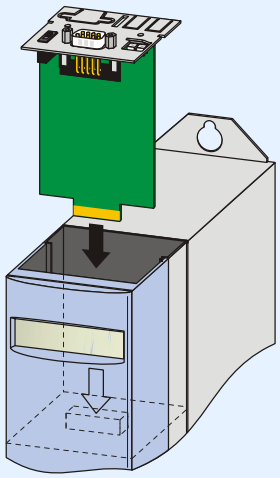
4. Stick the sub D plug connector of the PCB through the plate from below:



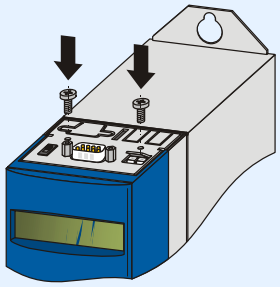
5. Secure the PCB to the plate with the screw in step 3:



6. Insert the option PCB in the inverter so that the gold contacts slide into the black terminal block:



7. Secure the plate to the inverter with the mounting screws:



⇨ You have installed the accessory.

3.2 Installation in the FDS 5000

⚠ WARNING!

Danger of injury/death and property damage due to electric shock!

▶ Before installing accessories, turn off all voltage supplies! Then wait 5 minutes for the DC link capacitors to discharge. Never begin with accessory installation until after this!

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).

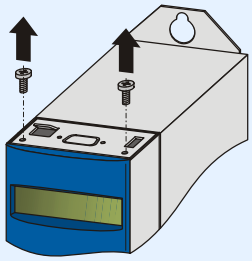
▶ Do not touch the contact surfaces.

You will need the following tools to install the DP 5000:

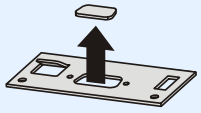
- TX10 Torx screwdriver
- Pliers
- Hexagon socket wrench, 4.5 mm

Installing the DP 5000 in an FDS 5000

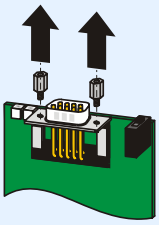
1. Unscrew the mounting screws and remove the cover plate:



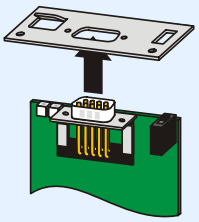
2. Remove the punched out metal section with the pliers:



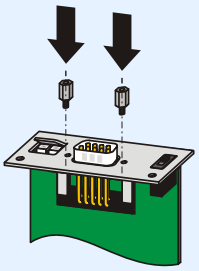
3. Remove the screws from the option PCB:



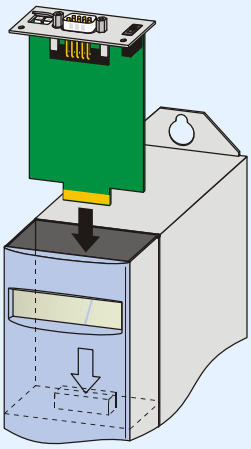
4. Stick the sub D plug connector of the PCB through the plate from below:



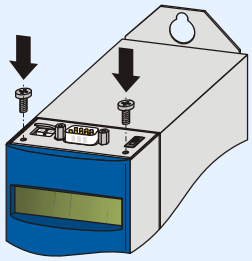
5. Secure the PCB to the plate with the screws from step 3:



6. Stick the option PCB in the inverter so that the gold contacts slide into the black terminal block:



7. Secure the plate to the inverter with the mounting screws:



⇨ You have installed the accessory.

4 Electrical installation

4.1 Setup

PROFIBUS DP consists of at least one bus segment. One segment consists of at least two but not more than 32 stations. They are all physically connected with a bus cable. One of the stations is the master. The master is the active station on PROFIBUS. It can send or request data to/from other stations. The slaves are the passive stations on PROFIBUS. They can only exchange data with the master when the master requests this.
Terminating resistors must be placed at the beginning and the end of the bus.

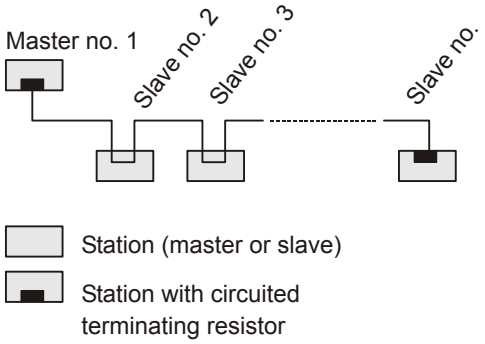


Fig. 4-1 Setup of a bus segment

If more than 32 stations are to operate on a bus or the maximum line length of a bus segment is exceeded, several bus segments must be coupled via RS 485 repeaters. The maximum number of masters and slaves within one bus segment must be decreased by one for every repeater used. The maximum number of masters and slaves over the entire bus system is 126. The maximum line length depends on the baud rate being used. The table below gives you the maximum permissible lengths for one segment and for all segments.
We strongly recommend NOT using stub lines in the setup. This is only permitted during commissioning. This bus system is usually set up with shielded, two-wire lines (RS 485). It can also be set up for special applications via fiber-optic conductors. STÖBER Antriebstechnik offers the coupling to the two-wire line. This permits a maximum distance of 10,000 m. When suitable measures are taken on the master side, slaves can be coupled or decoupled during operation without having to interrupt data communication on the bus.

Baud rate	one segment	all segments
9.6 to 187.5 kBaud	1000 m	10000 m
500 kBaud	400 m	4000 m
1.5 Mbaud	200 m	2000 m
3 to 12 Mbaud	100 m	1000 m

These distances only apply with suitable bus cable!

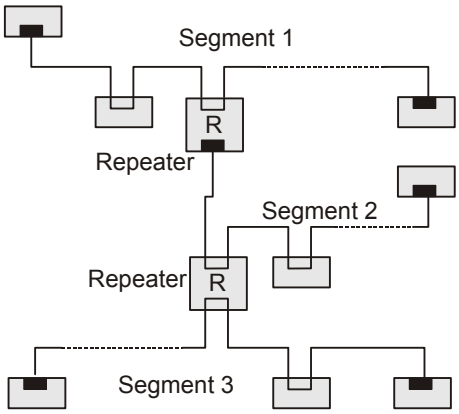


Fig. 4-2 Setup with more than 32 stations

4.2 Cable specifications

To ensure interference-free use of the above baud rates and distances, STÖBER ANTRIEBSTECHNIK recommends using cable type A with the folloeing specification described in PROFIBUS literature:

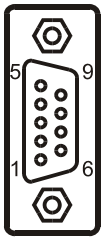
- Wave resistance: 135 to 165 Ω, at a measuring frequency of 3 to 20 MHz.
- Cable capacity: < 30 pF per meter
- Core cross section: > 0,34 mm²
- Loop resistance: < 110 Ohm per km
- Signal attenuation: Max. of 9 dB over the entire length of the line segment.
- Shielding: Braided copper shield or braided shield and foil shield.

Use of other types of cables is not recommended since then only slower baud rates and reduced distances may be possible.

4.3 Connection of the bus cables to the inverter

To connect PROFIBUS DP, the DP5000 option module is equipped with a 9-pin, sub D socket plug connector with the pin allocation specified in the PROFIBUS standard (see below).
To connect the bus cable(s), we recommend the use of suitable bus connection plugs which are offered by various manufacturers especially for PROFIBUS DP. The incoming and the outgoing bus cable can be inserted and screwed down in these plug connectors. There is no outgoing bus cable for the last station. In this case the sliding switch on the plug is set to "on" to switch on the bus terminating resistors.

Information
To ensure that bus termination functions correctly, the power supply may not be allowed to fail on the stations with circuited terminating resistors! To bypass the risk of a complete bus failure when the last station malfunctions, active bus terminating components can be used.
The inverters in the device series MDS 5000 and SDS 5000 with a separate 24-V control part power supply represent such components. In the device series FDS 5000, inverters with the identifier "/L" have a separate 24-V control part power supply.

PIN[a)]		Designation	Function
	1	nc	Not connected
	2	nc	Not connected
	3	B	RxD/TxD-P (send/receive data - plus)
	4	RTS	Direction control for repeater (plus)
	5	GND	Ground to +5 V
	6	+5V	Power for the terminating resistors
	7	nc	Not connected
	8	A	RxD/TxD-N (send/receive data - minus)
	9	nc	Not connected

a) View of sub D

5 Fundamentals of PROFIBUS

PROFIBUS is an open fieldbus standard for a wide variety of applications in manufacturing and process automation. The independence from manufacturers and the openness are ensured by international standard IEC 61158. For years now PROFIBUS has been one of the primary fieldbus systems on the international market.
PROFIBUS DP is a fast and cost-optimized communication system for use at the field level in which a controller (PROFIBUS master) with several slaves (drives, IOs, and so on) performs cyclic data communication.

5.1 PROFIdrive profil version 3

There are three types: PROFIBUS FMS, PROFIBUS DP and PROFIBUS PA.PROFIBUS DP offers high-speed cyclic communication for small amounts of data.
The PROFIBUS profile drive technology, called PROFIDrive, version 3, is a compatible continuation of the proven PROFIBUS profile for variable-speed drives, PROFIDrive, version 2. Today PROFIBUS communication is the standard for drive technology.
In addition to the PROFIBUS standard, the PROFIDrive profile specifies uniform device reactions and access procedures for the drive data. One of the new functions of version 3 is the parameter channel which uses the DP-V1 services of the acyclic communication.
STÖBER ANTRIEBSTECHNIK offers all inverters of the 5th generation of STÖBER inverters the capacity to connect to PROFIBUS DP (DP = Decentral Periphery) via the PROFIDrive profile. This turns these devices into intelligent DP slaves which can be operated by a PROFIBUS master (controller, PLS, PC). Bus operation is possible up to a maximum speed of 12 Mbaud. Two LEDs indicate the function of the option board, the status of the data transmission and any malfunction (see chapter 6).
When a PROFIBUS system is commissioned, the manuals/commissioning instructions of all involved components (DP master/controller, additional slaves, etc.) must be adhered to. For further information on PROFIBUS or PROFIDrive profile, go to www.profibus.com at the PROFIBUS User Organization.

5.2 Comparison of the PROFIBUS generations

This chapter summarizes the system characteristics applicable to drive technology and the system differences:

Simultaneous operation of different inverter generations on one controller is possible and easy (see figure). Only when the new acyclic services are used are an inverter of the 5th generation of STÖBER inverters and an appropriate master required. The use of these services does not interfere with the operation of the other stations. When an older controller is used which does not support acyclic services, operation with cyclic data (PZD and PKW) can be used.

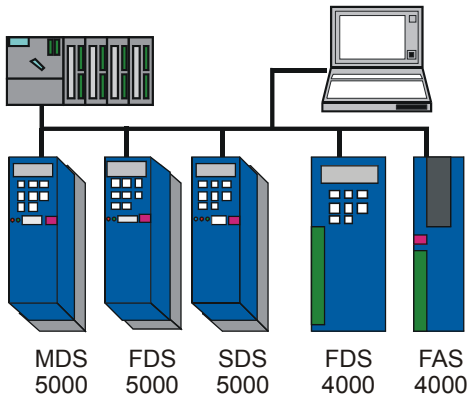


Fig. 5-1 Schematic setup with different types of STÖBER inverters

PROFIBUS	Standard Properties	New Features	Meaning for FDS 5000 / MDS 5000
DP-V0	Cyclic data communication (PZD + PKW)	—	Compatible with FDS 4000, ...
DP-V1	Zyklischer Daten-austausch identisch wie DP-V0	Acyclic services + alarm handling	New parameter channel, available as per PROFIDrive V3

5.3 Data transmission via PROFIBUS DP

5.3.1 Possible communication

Devices of the 5th generation of STÖBER inverters support cyclic and acyclic services with the DP-V1 option. This provides a wide variety of possible ways to communicate:

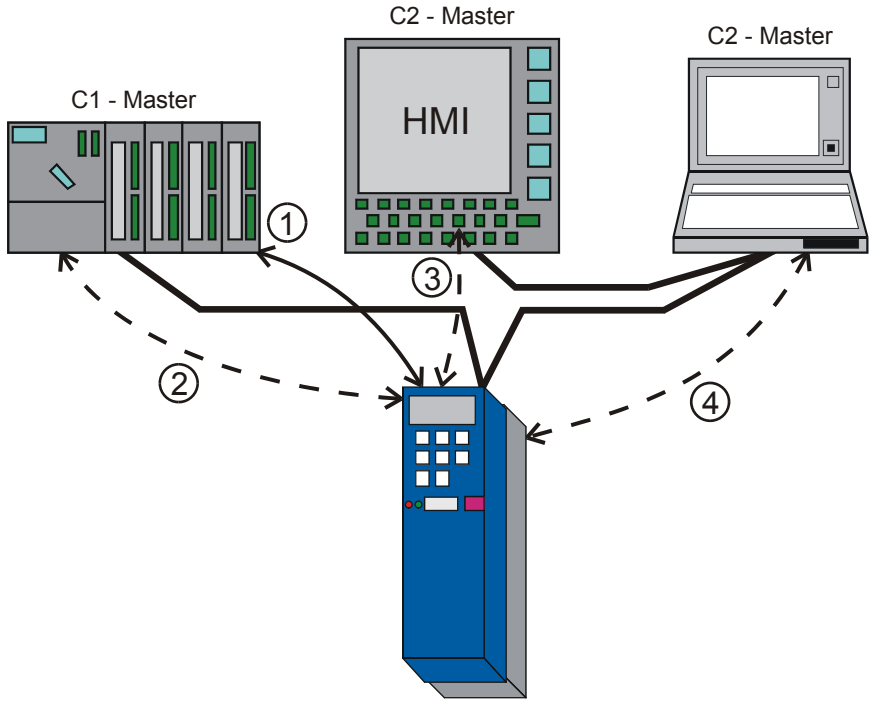


Fig. 5-2 Different communication options

1: Cyclic communication
2 - 4: Acyclic communication

Cyclic communication (1) is the simple exchange of user data via the data exchange telegram. Time critical process data (PZD) are exchanged between a class-1 master (C1) and the drive controller with cyclic communication. Such data include, for example, reference and actual values, and control and status information. A routine for parameter communication (of the familiar PKW channel as with the FDS 4000) can be implemented within the cyclic communication. There is always exactly one C1 master in each PROFIBUS setup. This master reads the GSD file, configures the drives, starts PROFIBUS and runs the cyclic communication. The C1 master is usually the controller (arrow 1).
The acyclic services (2-4) are available in DP-V1 for the transmission of new parameter jobs for controlling and monitoring the drives, parallel to true cyclic communication.

In contrast to cyclic communication, acyclic communication data are only exchanged when necessary. Acyclic communication is performed either via an appropriate routine within cyclic communication (for PKW routine, see PROFIDrive profile version 2) or via the DP-V1 routines READ and WRITE. This permits the connection of commissioning tools as class-2 master (C2) to PROFIBUS.
Several acyclic channels are available at the same time. The C1 master (the controller) maintains a continuously open connection to the inverter (MSAC1) which can be used as necessary by the controller program (arrow 2). In addition, the inverter provides the capacity for two connections (MSAC2) which can be established and used as necessary by C2 masters (e.g., an operator panel or a service PC).
Time wise on PROFIBUS, the cyclic data always have the highest priority. During each data exchange cycle, the master inserts an acyclic telegram when necessary. This does not noticeably affect the speed of PROFIBUS.

5.3.2 User data communication

The process data channel is used for high-speed transmission of data which are used for controlling and monitoring the running process and which require a particularly short transmission time. When the bus system is configured, the selection of the PPO type specifies whether the cyclic parameter channel is to be used and how many bytes the process data channel will have.

All parameters can be read and changed with the parameter channels. First, the PKW1 routine (which uses the acyclic services of PROFIBUS) specified by PROFIDrive version 3 is available and, second, the old PKW0 routine (which is embedded in the cyclic data) defined by PROFIDrive version 2 is offered. Because of the comprehensive capabilities and the access to all inverter parameters without exception, the new PKW1 routine should be used if possible:

Transmission Channel	Inverter with Option DP-V1 5000
Process data reference values from the bus to the processing on the device.	Depends on the configuration and setting of the parameter *A150 cycle time*.
Complete processing of a PKW0 service.	Approx. 16 to 64 ms Depends on the configuration!
PKW1 via acyclic services.	Approx. 16 to 64 ms Depends on the configuration!

6 Bus diagnosis/LEDs

The DP 5000 option module is equipped with a green and a red LED. The LEDs indicate communication-specific states. This permits the PROFIBUS status to be diagnosed on the device.

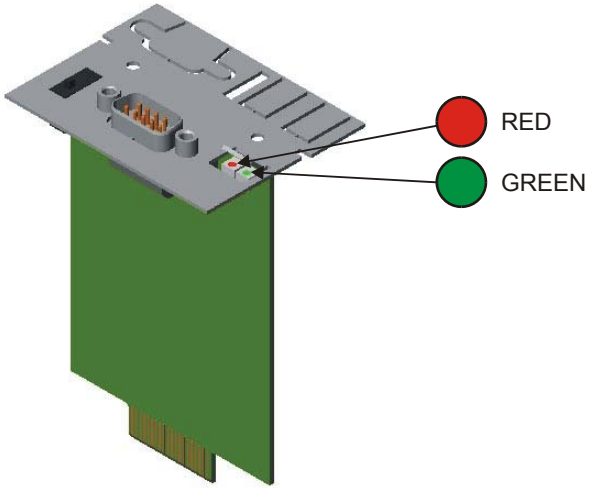


Fig. 6-1 View on LED

Red LED	Green LED	Bedeutung/Maßnahme
Off	Off	No connection between the inverter and the PROFIBUS board (board was not recognized or has failed. See parameter *E54 option module 1*).
Flashing	Off	PROFIBUS master stopped bus for more than 25 s (PLC in stop) or has failed or bus cable no longer connected (see parameter *A84 PROFI-Baud*).
Off	Flashing	Device is ready and is waiting for the PROFIBUS master to start or:When this state does not change although the PROFIBUS master has already attempted to establish a connection, this means that the applicable function blocks for PROFIBUS have not been downloaded to the inverter.
Off	On	Device was configured by PROFIBUS master and data communication was started.
Flashing	Flashing	PROFIBUS master stopped the bus just a few seconds ago (< 25 s) (PLC in stop) or has failed or bus cable is no longer connected (see parameter *A84 PROFI-Baud*).

The following diagnostic capabilities are available:

- The two LEDs on the option board DP 5000
- Parameter *A84 PROFIBUS Baudrate*

- Parameter *A86 PROFIBUS configuration*
- Parameter *A85 PROFIBUS diagnosis* (indication of internal inverter diagnostic information via the PROFIBUS interface).

Parameter *A85* is composed of the following bits:

Bit	Name	Meaning for Bit = 1
0	Shutdown-Fail	Problems during shutting down the PROFIBUS driver software
1	Data-Exchange	PROFIBUS is in the state of cyclic data communication with this station.
2	Wait for Param	Station is waiting to be parameterized by the PROFIBUS master.
3	Bus-Failure	Error on PROFIBUS
4	Acyc. Initiate 1	An acyclic connection has been established.
5	Acyc. Initiate 2	A second acyclic connection has been established.
6	MDS configured	Station has been configured by the PROFIBUS master.
7	Driver-Error	Error in the PROFIBUS driver software.
8	Application ready	Inverter firmware is ready for a connection to PROFIBUS.
9	LED red on	The red LED of the DP 5000 is now on.
10	LED green on	The green LED of the DP 5000 is now on.

7 Configuration of the bus system

7.1 GSD file

Wiring all bus stations together is not sufficient to commission PROFIBUS DP.
The following additional measures are required:

- Different bus addresses must be set on the master and on all slaves.
- With older slaves which are unable to find the baud rate automatically, the same baud rate must be set as on the master (the devices of the 5th generation of STÖBER inverters are able to find the baud rate automatically).
- The master must be informed as to how many slaves are connected together with their characteristics and bus addresses.

The baud rate must be set on the master under consideration of the segment lengths and the total distance of the bus.
This work is performed on the master side using configuration software. This software must read the device master data files (GSD files) from all stations. The GSD files are like electronic data sheets which contain the information on the PROFIBUS characteristics such as supported baud rates, supported modules, and so on. They are provided by the manufacturer for each PROFIBUS device. The GSD file for the devices of the 5th generation of STÖBER inverters has the designation STOE5005.GSD. The file can be downloaded from the Internet under www.stoeber.de.

Information
The change in the PROFIBUS address of a slave is not accepted until the next device startup of the bus master. This was standardized to prevent the occurrence of dangerous system states due to double/non-addressed stations. Before switch-off, it is imperative that the drive data be stored on the inverter safe from a power failure with *A00 save values* = 1. After action *A00* is concluded successfully, the device can be turned off and on. After this the new PROFIBUS address is active.

7.2 Procedure for SIEMENS SIMATIC S7 and STEP 7

Different configuration software is used for different PROFIBUS masters. How this works with the SIMATIC Manager for the SIMATIC S7 in version 5.1 will be explained with an example. At least version 5.1 SP4 of STEP 7 is required for use of DPV1 with STEP 7. The SIMATIC S7 CPUs must also support DPV1. For whether the particular CPU supports DPV1, see the CPU characteristics under the hardware manager.

7.2.1 The HW-config

To link in the GSD file in the STEP 7, open the menu "Extras" ✍ "Neue GSD Datei einbinden." Then display the GSD in the device catalog under "Extras" ✍ "Katalog Aktualisieren." This must done only once. After this, the inverter appears at the position as shown on the screen () in the hardware catalog. HW-Config in STEP 7 may look like this.

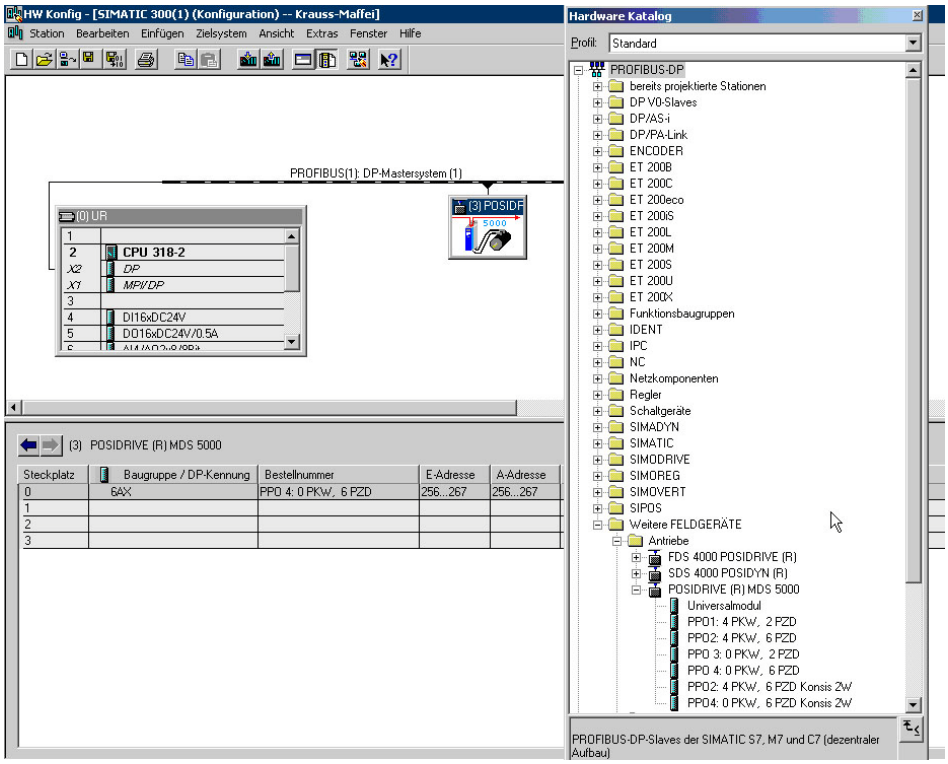


Fig. 7-1 HW-Config

It is not necessary to reserve a separate memory area for the acyclic services (DPV1). This means that no PPO type must be selected which supports PKW. Every PPO type has this capability with the DPV1 protocol.

7.2.2 SFC Calls for data consistency

To ensure data consistency on the bus, SIEMENS requires that SFCs 14 and 15 be used for data lengths longer than a double word. Direct accesses to the IO area via L PAW or L PEW are then NOT permitted. The SFCs must be called once per slave.

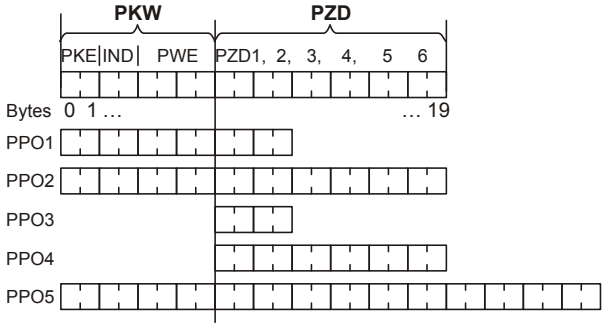
```
Netzwerk 4 : DB185 auf Prozessdaten ( PZD ) übertragen
Peripherieadresse aus Hardwareconfig entnehmen

      CALL  "DPWR_DAT"
       LADDR  :=W#16#100                // Hardware Adresse in Hex
       RECORD :=P#DB185.DBX0.0 BYTE 12
       RET_VAL:="DP_write_ret_val"

Netzwerk 5 : Prozessdaten ( PZD ) auf DB185 übertragen
Peripherieadresse aus Hardwareconfig entnehmen

      CALL  "DPRD_DAT"
       LADDR  :=W#16#100                // Hardware Adresse in Hex
       RET_VAL:="DP_read_ret_val"
       RECORD :=P#DB185.DBX12.0 BYTE 12
```

Fig. 7-2 SIEMENS SFC's 14/15

8 Prozess data transmission PZD

8.1 Parameter process data object (PPO)

The 5th generation of STÖBER inverters offer various telegram types in the GSD file for cyclic data transmission. The master selects one of the possibilities to configure the inverter and then start the bus. These possibilities are called parameter process data object (PPO types) and always contain the process data channel (PZD) and sometimes also a parameter channel (PKW0). The Devices of the 5th generation of STÖBER inverters provide five different PPO types to choose from for the establishment of this user data structure.
To be able to use the functionality of process data transmission, the applicable blocks must be activated by the PC software POSITool. This is done by selecting a suitable application in user-prompted commissioning and then downloading it to the inverter. PPO types 3 and 4 do not need a separate memory area for the PKW1 service of the DP-V1 protocol.



PKW : Parameter ID value
PZD : Process data
PKE : Parameter ID
IND : Subindex in byte 2, Byte 3 is reserved
PWE : Parameter value

Fig. 8-1 PPO-Typen

8.2 The mapping

Mapping manages the allocation of incoming data from the bus to the inverter parameters and vice versa.

Information
A new mapping does not become active until the following has taken place:
1. Back up the changed mapping with the *A00* function *Save values*.
2. Wait until the action is successfully completed.
3. Turn the device off and on again.

The new mapping is now active.

The following table describes the parameters required for mapping.

STÖBER Parameter	PNU/ Subindex	Description
A90 PZD Setpoint Mapping Rx A90.0 1. Mapped Parameter ... A90.5 6. Mapped Parameter	205A/0 ... 205A/5	Up to 6 parameters are selected here to which the received PZD data are copied with reference values (RV).
A91 PZD Setpoint Mapping 2Rx A91.0 1. Mapped Parameter ... A91.5 6. Mapped Parameter	205B/0 ... 205B/5	Up to 6 additional parameters can be selected here as necessary in which the received PZD data are copied.
A93 PZD Setpoint Len	205C / 0	Specifies the total data length in bytes which is to be accepted by PROFIBUS for the selected setting in *A90* and *A91*. The value corresponds to the sum of the data lengths of the correctly set parameters which can be mapped on PZD. If no value or wrong values are entered in *A90* and *A91*, the value 0 appears here (i.e., no data are accepted by PROFIBUS).
A94 PZD ActValue Mapping Tx A94.0 1. Mapped Parameter ... A94.5 6. Mapped Parameter	205E/0 ... 205E/5	Up to 6 parameters are selected here which are copied as actual values (AV) to the PZD data to be sent to the master.
A95 PZD ActValue Mapping 2Tx A95.0 1. Mapped Parameter ... A95.5 6. Mapped Parameter	205F/0 ... 205F/5	Up to 6 additional parameters can be selected here which are copied as actual values to the PZD data to be sent to the master.
A96 PZD ActValue Len	2061/0	Specifies the total data length in bytes which is to be transferred to PROFIBUS for the selected setting in *A94* and *A95*. The value corresponds to the sum of the data lengths of the correctly set parameters which can be mapped on PZD. If no value or wrong values were entered in *A94* and *A95*, the value 0 appears here (i.e., no data are accepted by PROFIBUS).

8.2.1 Example PPO4 with 12-Byte PZD area

Receiving area of th 5th generation of STÖBER inverters

Parameter	Value	Description	Length [Byte]
A90.0	*A180*	Device control byte	1
A90.1	*I211*	Motion control byte	1
A90.2	*I210*	Control word command posi	2
A90.3	*I213*	Target position	4
A90.4	*I230*	Override	2

- Total length: 10 byte
- Kept in reserve for this example: 2 byte

Sending area of the 5th generation of STÖBER inverters

Parameter	Value	Description	Length [Byte]
A90.0	*E200*	Device status byte	1
A90.1	*I201*	Motion status byte	1
A90.2	*I200*	Status word command posi	2
A90.3	*I203*	Current position	4
A90.4	*E100*	Current speed	2

- Total length: 10 byte
- Kept in reserve for this example: 2 byte

When the parameters *A90*/*A94* are set as described here, the data are automatically mapped by the inverter from and to the parameters.

9 Control with control and status bits

The control and status words depend on their use and the STÖBER template used. The demands on the control word differ for the individual applications (e.g., command positioning, fast reference value, etc.) and can be found in the particular application documentation.

10 Switchable scaling

Some of the device parameters can be scaled for the fieldbus transmission in the process data in two ways: Scaled as standard or with the native raw resolution of the 5th generation of STÖBER inveters. The scaling can be set with the parameter *A100*. With *A100*=0, all values are scaled as standard. With *A100*=1, the raw values are transferred to PROFIBUS. In this case there is no scaling to user-defined or physical units and the values are forwarded in the internal-inverter format instead. This relieves the main processor of the inverter.

11 Parameter Overview

All parameters of the inverter are available as communication objects via the PKW service (PKW0 or PKW1).

11.1 PROFIDRIVE parameter

PNU	Sub-index	Parameter name	STÖBER address	Data type	Value / meaning
918_{hex}	0	Node address	*A83*	5	Bus address
964_{hex}	0	Device Identification / Manufacturer	—	6 (U16)	267_{dez} = STÖBER
964_{hex}	1	Device Identification / Device type	—	6 (U16)	$4D44_{hex}$ = ASCII "MD" for MDS 5000
964_{hex}	2	Device Identification / Version	—	6 (U16)	0500_{hex} = V 5.00
964_{hex}	3	Device Identification / Firmware year	—	6 (U16)	—
964_{hex}	4	Device Identification / Firmware day / month	—	6 (U16)	—
965_{hex}	0	PROFIBUS profilnumber	—	—	0303_{hex} für PROFIdrive profile version 3

11.2 PROFIBUS parameter/mapping/PKW1

All STÖBER-specified drive parameters are stored as communication objects in the parameter number area from 2000_{hex} to $5FFF_{hex}$.

Information
Formula for the generation of: parameter number, axis and subindex:
- Parameter number (PNU) = 2000_{hex} + 200_{hex} * group (A=0, B=1, ...) + row.

- Subindex = Element number for record or array (e.g., *A00 0* = start, *A00.1*=progress, *A00.2*=result).

- Axis = Number of the physical axis. Values between 0 and 3 can be used here (when the table contains "global," the same memory location is addressed in every axis).

The letters of the groups apply to the following numbers (Attention, decimal indication):

A	**B**	**C**	D	**E**	F	**G**	**H**	**I**	**J**	K	**L**	**M**	N	**O**	P	**Q**	**R**	**S**	**T**	**U**	V	W	X	Y	**Z**
0	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	10	**11**	**12**	**13**	**14**	**15**	16	**17**	**18**	19	**20**	21	22	23	24	**25**

11.3 List of the primary communication parameters

You will need the following parameters when commissioning an inverter on PROFIBUS:

A00 Save values & start:	
When this parameter is activated, the inverter saves the current configuration and the parameter values in the Paramodule. After power-off, the inverter starts with the saved configuration. If the configuration data on the inverter and Paramodul are identical, only the parameters are saved (speeds up the procedure). **NOTE** Do not turn off the power of the control section (device version /L:24V, device version /H: supply voltage) while the action is being executed. If the power is turned off while the action is running this causes incomplete storage. After the device starts up again the fault "*ConfigStartERROR parameters lost" appears on the display. Only several 1000 storage procedures are possible per Paramodul. When this limit has almost been reached, result 14 is indicated after the storage procedure. When this happens, replace Paramodul as soon as possible.	
Axes:	Global
Data type:	—
Value:	0, 0, 0
PNU:	2000_{hex}
Subindex:	3
A83 Busaddress:	
Specifies the device address for operation with fieldbus. *A83* has no effect on communication via X3 with POSITool or another USS master.	
Axes:	Global
Data type:	5
Value:	3
PNU:	2053_{hex}
Subindex:	1
A84 PROFIBUS Baudrate:	
When operated with a device of the 5th generation of STÖBER inverters with option board "PROFIBUS DP," the baud rate found on the bus is *indicated*.	
Axes:	Global
Data type:	5
Value:	0=9600 Baud, ...
PNU:	2054_{hex}

Subindex:	1
A85 PROFIBUS diagnostic:	
Indication of internal inverter diagnostic information on the PROFIBUS DP interface.	
Axes:	Global
Dat entyp:	6
Wert:	Bitfeld mit 16 Bits
PNU:	2055_{hex}
Subindex:	1
A86 PROFIBUS configuration:	
The inverter offers various ways (PPO types) to transfer cyclic user data via PROFIBUS DP. These can be configured in the GSD file STOE5005.gsd on the controller (bus master). This indication parameter can be used to check which of the possible configurations was chosen.	
Axes:	Global
Data type:	5
Value:	chosen configuration
PNU:	2056_{hex}
Subindex:	1
A90 PZD Setpoint Mapping:	
The target parameters are entered in *A90*/*A91* for the reference values/control bits which are sent by the PLC to the device via PROFIBUS. Example: When *A90.0* = *A180* is entered, this means that the first byte (length of *A180*) which is received by the bus is transferred to parameter *A180*. Subsequent data are transferred in the same way to the entered parameters. It is absolutely necessary that the length of the entered parameters be known.	
Axes:	Global
Data type:	7
Value:	see above
PNU:	$205A_{hex}$
Subindex:	6
A91 PZD Setpoint Mapping:	
The target parameters are entered in *A90*/*A91* for the reference values/control bits which are sent by the PLC to the device via PROFIBUS. Example: When entered in *A90.0* = *A180*, this means that the first byte (length of *A180*) which is received by the bus is transferred to parameter *A180*. The subsequent data are transferred in the same way to the entered parameters. It is absolutely necessary that the length of the entered parameters be known.	
Axes:	Global

Data type:	7
Value:	see above
PNU:	$205B_{hex}$
Subindex:	6
A93 PZD Setpoint Len:	
Indicator parameter which indicates the length in bytes of the expected process data with reference values (data from PROFIBUS master to inverter) for the current parameterization.	
Axes:	Global
Data type:	5
Value:	see above
PNU:	$205C_{hex}$
Subindex:	1
A94 PZD ActValue Mapping:	
The source parameters are entered in *A94*/*A95* which contain the actual values/ status bits of the inverter which are sent to the PLC via PROFIBUS. Example: When entered in *A94.0* = *E200*, this means that the first byte (length of *E200*) which is transferred by the bus contains the contents of parameter *E200*. The subsequent data are transferred via the bus in the same way. It is absolutely necessary that the length of the entered parameters be known.	
Axes:	Global
Data type:	7
Value:	see above
PNU:	$205E_{hex}$
Subindex:	6
A95 PZD ActValue Mapping:	
The source parameters are entered in *A94*/*A95* which contain the actual values/ status bits of the inverter which are sent to the PLC via PROFIBUS. Example: When entered in *A94.0* = *E200*, this means that the first byte (length of *E200*) which is transferred by the bus contains the contents of parameter *E200*. The subsequent data are transferred via the bus in the same way. It is absolutely necessary that the length of the entered parameters be known.	
Axes:	Global
Data type:	7
Value:	see above
PNU:	$205F_{hex}$
Subindex:	6

A97 PZD ActValue Len:	
Indicator parameter which indicates the length in bytes of the current process data with actual values (data from inverter to PROFIBUS master) for the current parameterization.	
Axes:	Global
Data type:	5
Value:	see above
PNU:	2061_{hex}
Subindex:	1
A100 Fieldbus scaling:	
The selection is made here between internal raw values and whole numbers for the representation/scaling of process data values during transmission via PZD channel. Regardless of this setting, the representation is always the whole number via PKW channel and the non cyclic parameter channel. **CAUTION** When "*0:integer*" is parameterized (scaled values), the runtime load increases significantly and it may become necessary to increase *A150 cycle time* to avoid the fault "*57:runtime usage*" or "*35:Watchdog*". With few exceptions, the PKW channel is always transferred in scaled format.	
Axes:	Global
Data type:	5
Value:	*0:Standard* *1:raw value*
PNU:	2064_{hex}
Subindex:	1
A109 PZD-Timeout:	

To keep the inverter from continuing with the last received reference values after a failure of PROFIBUS or the PROFIBUS master, process data monitoring should be activated. The RX block monitors the regular receipt of process data telegrams (PZD) which the PROFIBUS master sends cyclically during normal operation. The *A109 PZD-Timeout* parameter is used to activate this monitoring function. A time is set here in milliseconds. The default setting is 65535. This value and also the value 0 mean that monitoring is inactive. This is recommended while the inverter is being commissioned on PROFIBUS and for service and maintenance work. Monitoring should only be activated for the running process during which a bus master cyclically sends process data to the inverter. The monitoring time must be adapted to the maximum total cycle time on PROFIBUS plus a sufficient reserve for possible delays on the bus. Sensible values are usually between 30 and 300 msec. When process data monitoring is triggered on the inverter, the fault "*52:communication*" is triggered. * The *A109 PZD-Timeout* parameter is also used for communication via USS protocol for the USS-PZD telegram.

Axes:	Global
Data type:	
Value:	
PNU:	$206D_{hex}$
Subindex:	

11.4 List of quick location of parameters

List for quick location of the correct parameter numbers based on the STÖBER address:

Group	Start PNU	End PNU
A	2000_{hex}	$21FF_{hex}$
B	2200_{hex}	$23FF_{hex}$
C	2400_{hex}	$25FF_{hex}$
D	2600_{hex}	$27FF_{hex}$
E	2800_{hex}	$29FF_{hex}$
F	$2A00_{hex}$	$2BFF_{hex}$
G	$2C00_{hex}$	$2DFF_{hex}$
H	$2E00_{hex}$	$2FFF_{hex}$
I	3000_{hex}	$31FF_{hex}$
J	3200_{hex}	$33FF_{hex}$
K	3400_{hex}	$35FF_{hex}$
L	3600_{hex}	$37FF_{hex}$
M	3800_{hex}	$39FF_{hex}$
N	$3A00_{hex}$	$3BFF_{hex}$
O	$3C00_{hex}$	$3DFF_{hex}$
P	$3E00_{hex}$	$3FFF_{hex}$
Q	4000_{hex}	$41FF_{hex}$
R	4200_{hex}	$43FF_{hex}$
S	4400_{hex}	$45FF_{hex}$
T	4600_{hex}	$47FF_{hex}$
U	4800_{hex}	$49FF_{hex}$
V	$4A00_{hex}$	$4BFF_{hex}$
W	$4C00_{hex}$	$4DFF_{hex}$
X	$4E00_{hex}$	$4FFF_{hex}$
Y	5000_{hex}	$51FF_{hex}$
Z	5200_{hex}	$53FF_{hex}$

12 Appendix A

Information
Please note that the protocol described here can only be used with the 5th generation of STÖBER inverters.

This chapter discusses the structure of the PKW1 protocol in detail.

12.1 General characteristics

- 16-bit address each for parameter number and subindex.
- Transmission of whole arrays, areas thereof or the entire parameter description.
- Transmission of different parameters in one access (multi-parameter jobs).
- Only one parameter job is processed at a time (no pipelining).
- A parameter job/rely must fit in one data block (max. of 240 bytes). The maximum length of the data blocks can be less than 240 bytes due to slave characteristics or the bus configuration.
- "Multi-parameter" jobs are defined for optimized, simultaneous access to different parameters (e.g., HMI screens).
- There are no cyclic parameter jobs, in contrast to PKW0 (of DP-V0).

12.2 Parameter jobs and responses

This chapter provides detailed information on the organization of the protocol of the PKW1 standard which is only required when no SIMATIC S7 controller is used with our FB50.

A parameter job consists of three areas:
- Job header: ID for the job and the number of parameters which are accessed. Addressing of an axis for multiple-axis drives.
- Parameter address: Addressing of a parameter. The parameter address only appears in the job, not in the response.
- Parameter value: There is one area for the parameter value for each parameter. Parameter values appear only in either the job or in the response, depending on the job ID.

DPV1 parameter job:

Telegram portion	Byte	Function	Info
Job header	0	Job reference	—
	1	Job ID	—
	2	Axis	—
	3	Number of parameters	Fixed at 1
1. Parameter address	4	Attribut	—
	5	Number of elements	Fixed at 1
	6+7	Parameter number	—
	8+9	Subindex	—
1st parameter value (only for writing)	10	Format	—
	11	Number of values	—
	12 bis xx	Values	—

DPV1 parameter response:

Telegram portion	Byte	Function	Info
Response header	0	Job reference, echoed	—
	1	Response ID	—
	2	Axis, echoed	—
	3	Number of parameters	Fixed at 1
1st parameter value (only for writing)	4	Format	—
	5	Number of values	—
	6 bis xx	Values	—

Job header

- Job reference:

  Unique identification of the job/response pair for the master. The master changes the job reference with each new job (e.g., Modulo 255). The slave echoes the job reference in the response.
- Job ID:

  Two IDs are defined:

  01_{hex}Request/read parameter

  02_{hex}Change parameter

- Response ID:

  Echoing of job ID with additional info whether execution positive or negative.

  01_{hex}Request parameter, positive

  81_{hex}Request parameter, negative (job could not be executed, either partially or completely).

  02_{hex}Change parameter, positive

  82_{hex}Change parameter, negative (job could not be executed either partially or completely).

  With a negative response, an error number is transferred instead of the parameter value.
- Axis:
  Addressing of an axis when a POSISwitch® is used. This means that the same DP-V1 connection can be used to access different axis with a separate parameter number area for each on the drive.

  Value range: 0 to 3.
- Number of parameters:
  Specifies the number of subsequent areas, parameter address and/or parameter value for multiple parameter jobs. "Number of parameters" = 1 for simple jobs.

  Value range: 1 to 37 (restricted by DP-V1 telegram length)

Parameter address

- Attribute:

  Type of object which is being accessed.

  10_{hex} = Value

  20_{hex} = Description, not implemented

  30_{hex} = Text, not implemented
- Number of elements

  Number of array elements which are being accessed.

  Value range: 0, 1 to 117 (restricted by DP-V1 telegram length)

  Special case: Number of elements = 0

  Access to values: Recommended for non-indexed parameters for compatible conversion of the parameter job to a PKW job in accordance with PROFIDrive profile version 2 (differentiation between "request/change parameter value" and "request/change parameter value (array)").
- Parameter number PNU

  Addresses the parameter which is being accessed.

  Value range: 1 to 65535. See parameter list.
- Subindex

  Addresses first array element of the parameter or text array or the descriptive element which is being accessed.

  Value range: 0 to 65535. See parameter list.

Parameter value

- Format
  Must only be supplied in exceptional cases for write jobs.

Value	Meaning
01_{hex}	Boolean
02_{hex}	Integer 8
03_{hex}	Integer 16
04_{hex}	Integer 32
05_{hex}	Unsigned 8
06_{hex}	Unsigned 16
07_{hex}	Unsigned 32
08_{hex}	Floating Point
11	Double
17	Posi 64
28	String 8
29	String 16
30	String 80
31	U8 Array64
40	Zero
41	Byte
42	Word
43	Double word (standard)
44	Error

- Number of values: When a multiple-parameter job is not being used, a 1 should appear here.
- Values: Contents of the parameter.
- Error numbers

Error numbers in PKW0 parameter responses

Error number	Meaning	Use for	Additional info
00_{hex}	Illegal parameter number	Access to a non-existent parameter.	0
01_{hex}	Parameter value cannot be changed	Modification access to a parameter value that cannot be changed.	Subindex
02_{hex}	Upper or lower value limit has been exceeded	Modification access with value outside the value limits.	Subindex

Error number	Meaning	Use for	Additional info
03_{hex}	Wrong subindex	Access to a non-existent subindex.	Subindex
04_{hex}	No array	Access with subindex to a non-indexed parameter.	0
05_{hex}	Wrong data type	Modification access with value which does not match the data type of the parameter.	0
11_{hex}	Job cannot be executed due to operating state	Access is not possible for temporary reasons which are not specified further.	0
65_{hex}	Wrong job ID	—	—
66_{hex}	Internal communication failed	Example: no configuration loaded	—
67_{hex}	Reserved	—	—
77_{hex}	Access not permitted by user level	—	—
79_{hex}	Scaling error	—	—
$7C_{hex}$	Value in definition gap (see selection)	—	—
$7D_{hex}$	Collision with other values	—	—
83_{hex}	Error in pre-read function	—	—
84_{hex}	Error in post-write function		
Rest	Reserved		

12.3 DPV1 telegram sequences

The data in the write request correspond to the parameter job. The data in the read response correspond to the parameter response.

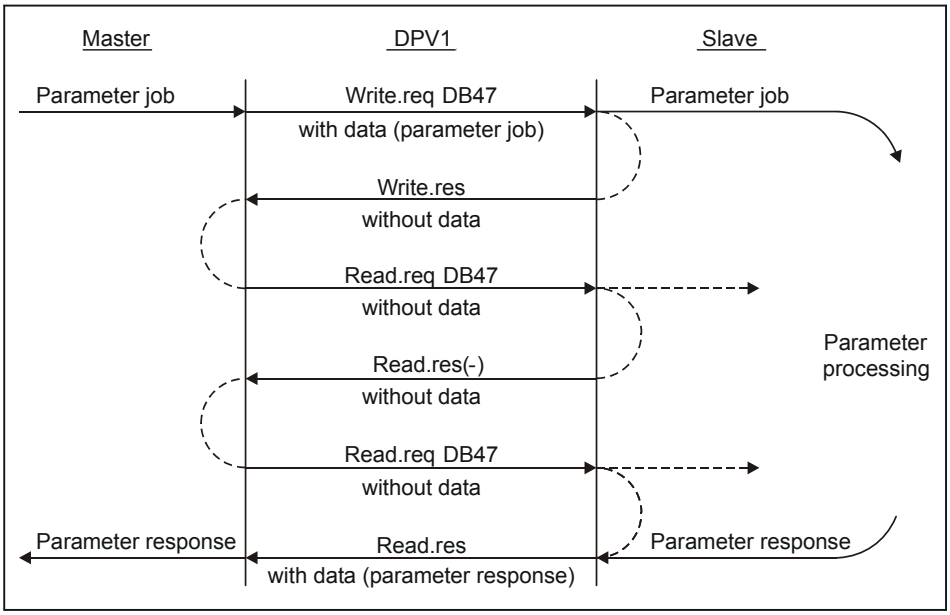


Fig. 12-1 Telegram sequence via DPV1

12.3.1 DPV1 telegram frame

Normal case

The following four DPV1 telegrams are used to transmit a parameter job/ parameter response pair:

Transmission of the parameter job in a DPV1 write request

DPV1-Write-Header	Function_Num = $5F_{hex}$ (write)	Slot_Number = ...
	Index = 47	Length = (data)
DPV1-Data (length)	Parameter job ...	
	...	

1. Abbreviated acknowledgment of the parameter job with the DPV1 write response (without data):

DPV1-Write-Header	Function_Num = $5F_{hex}$ (write)	Slot_Number = (echoed)
	Index = (echoed)	Length = (echoed)

2. Request for the parameter response in a DPV1 read request (without data):

DPV1-Read-Header	Function_Num = $5E_{hex}$ (read)	Slot_Number =
	Index = 47	Length = MAX

3. Transmission of the parameter response in the DPV1 read response:

DPV1-Read-Header	Function_Num = $5E_{hex}$ (read)	Slot_Number = (echoed)
	Index = (echoed)	Length = (data)
DPV1-Data (length)	Parameter response ...	
	...	

Meaning and use of the elements in the DPV1 header:

- Function_Num: ID for DPV1 service (read, write, error).
- Slot_Number:

  DPV1: In the request: Addressing of a real or virtual module on the slave. In the response: Echoed.

  PROFIDrive: No evaluation

- Index (data block):
  DPV1: In the request: Addressing of a data block on the slave. In the response: Echoed.
  PROFIDrive: Data block number 47 defines for parameter jobs and responses.
- Length:
  DPV1: In the write request and read response, the length of the transferred data in bytes.
  PROFIDrive: Length of the parameter job/response.
  DPV1: Length of the parameter job/response.
  PROFIDrive: Maximum possible length.
  DPV1: In the write response, the data length accepted by the slave.
  PROFIDrive: Echoing of the length from the write request.

Errors

In case an error occurs, a DPV1-read or write request is answered with an error response:

4) DPV1 error response:

DPV1 error	Function_Num= DF_{hex} (error write)= DE_{hex} (error read)	Error_Decode = 128 (DPV1)
	Error_Code_1	Error_Code_2 = (don't care ✍ always = 0)

- Error_Decode
  DPV1: ID, to be interpreted like Error_Code1/2.
  PROFIDrive: Always 128 (DPV1 codes)
- Error_Code_1
  DPV1: Division into error class (4 bits) and error code (4 bits)
- PROFIDrive
  Use of certain numbers
- Error_Code_2
  DPV1: User-specific
  PROFIDrive: Not used (always = 0).

DPV1 error class and code for PROFIDrive

Error_Class (from DPV1-Spec)	Error_Code (from DPV1-Spec)	PROFIDrive application
0_{hex} ... 9_{hex} = reserved	—	—

Error_Class (from DPV1-Spec)	Error_Code (from DPV1-Spec)	PROFIDrive application
A_{hex} = application	0_{hex} = read error 1_{hex} = write error 2_{hex} = module failure 3_{hex} to 7_{hex} = reserved 8_{hex} = version conflict 9_{hex} = feature not supported A_{hex} to F_{hex} = user specific	—
B_{hex} = access	0_{hex} = invalid index 1_{hex} = write length error 2_{hex} = invalid slot 3_{hex} = type conflict 4_{hex} = invalid area 5_{hex} = state conflict 6_{hex} = access denied 7_{hex} = invalid range 8_{hex} = invalid parameter 9_{hex} = invalid type A_{hex} to F_{hex} = user specific	$B0_{hex}$ =Data block does not exist, DB47: Parameter jobs not supported. $B5_{hex}$ =Access to DB47 temporarily impossible due to internal processing state. $B7_{hex}$ =Write DB47 with error in DB47 header.
C_{hex} = resource	0_{hex} = read constrain conflict 1_{hex} = write constrain conflict 2_{hex} = resource busy 3_{hex} = resource unavailable $4_{hex}..7_{hex}$ = reserved $8_{hex}..F_{hex}$ = user specific	—
$D_{hex}...F_{hex}$ = user specific	—	—

13 Appendix B PKW0 telegram

13.1 PKW0 mechanism

Information
The PKW0 mechanism described here is compatible with the 4th generation of STÖBER inverters.

When PPO type 1 or 2 is selected during configuration of PROFIBUS DP, the "parameter ID value (PKW0)" routine defined in PROFIDRIVE is available for parameter communication. However, not all parameters, displays and actions of the inverter can be accessed. Excluded are parameters with a number greater than 255, a length greater than 32 bits (text parameters) or indexed parameters with an index greater than 19. The axis is selected via *A11.1* as shown below.
A11.1 = 0 Axis 1 or 2 depending on PNU
A11.1 = 1 (=2/3) Axis 13 or 4 depending on PNU
A11.1 itself can be accessed via:
PNU_{dez} = 1000 + 20 * 0 + 1 = 1001
Subindex = 11.

In the old PROFIDrive profile version 2, only 11 bits were provided for a parameter number. That severely restricted the available address area. Fourth-generation STÖBER Antriebstechnik inverters locate their parameters in the area of the PNU between 1000_{dec} to 1999_{dec}. To be able to offer downwards compatibility, the old PKW0 routine is still available with the same addresses. The entire scope of parameters available today with the various data types cannot be imaged on this, however. Specification of parameter number and subindex for the access via PROFIBUS can be created from the coordinates of the particular parameter in the menu of the inverter. The following rules apply:

PNU_{dec}	=	1000 + 20 * letter of the menu coordinate + 500 for axis 2 (used to be parameter record 2) + 1 * index
$Subindex_{dec}$	=	Counting value of the menu coordinate

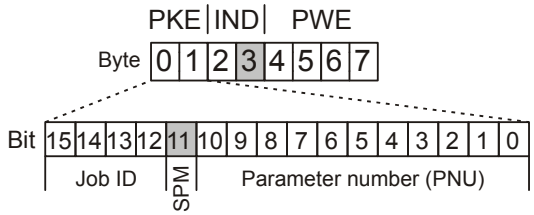
The letters of the menu coordinates apply to the following numbers

A	**B**	**C**	D	**E**	F	**G**	**H**	**I**	**J**	K	**L**	**M**	N	**O**	P	**Q**	**R**	**S**	**T**	**U**	V	W	X	Y	**Z**
0	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	10	**11**	**12**	**13**	**14**	**15**	16	**17**	**18**	19	**20**	21	22	23	24	**25**

The parameters from the groups B.. to G.. exist once in axis 1 and then again in axis 2. The menu only contains one coordinate. For access via PROFIBUS, the parameter numbers for the parameters for axis 1 are selected from 1000 to 1499 and for axis 2 starting at 1500.

The bits for the parameter number, job and response ID are located within the two-byte parameter ID. (The SPM bit for spontaneous message processing is not supported.) The master sends to the inverter the job ID, the parameter number, the subindex and, during write accesses, the new value. The device then answers with the response ID, parameter number, subindex and, during read accesses, with the current value. All values are represented as double words (4 bytes in length) on PROFIBUS. This means that the master no longer needs to recognize and distinguish between the data sizes of byte, word and double word. The job ID is used to differentiate between reset, write and read jobs. The master (PLC) must repeat the same job at least until the applicable response arrives from the PROFIBUS slave.

Bytes for parameter ID (PKW)



PKE : Parameter ID
IND : Subindex in byte 2. Byte 3 is reserved
PWE : Parameter value

Fig. 13-1 Organization of job identifier and PNU

Job ID	Meaning
0	No job (reset job)
1	Request parameter value (read)
3	Change parameter value (write)
Rest	Do not use!

The devices of the 5th generation of STÖBER inverters respond to the same bit positions with the response ID. The response ID remains unchanged until the current job is finished. The job ID must be maintained constant as long as this has not occurred.

Response ID	Meaning
0	No response or also: OK for job ID "no job"
2	Transfer parameter value (sent to master)
7	Job cannot be executed

The inverter deletes all response bytes together with the response ID 0. With response ID 2, the parameter number and the subindex are echoed from the job in the response. The inverter continues sending the complete response until the master formulates a new job. With read accesses to indicator values, the inverter

always cyclically sends new current values until the master formulates a new job. When the device responds with *7:Job cannot be executed*, the least significant byte of the parameter value (PWE) (thus in byte 7) contains the applicable error number.

Error numbers in PKW0 parameter responses

Error number	Meaning	Use for	Additional info
00_{hex}	Illegal parameter number	Access to a non-existent parameter.	0
01_{hex}	Parameter value cannot be changed	Modification access to a parameter value that cannot be changed.	Subindex
02_{hex}	Upper or lower value limit has been exceeded	Modification access with value outside the value limits.	Subindex
03_{hex}	Wrong subindex	Access to a non-existent subindex.	Subindex
04_{hex}	No array	Access with subindex to a non-indexed parameter.	0
05_{hex}	Wrong data type	Modification access with value which does not match the data type of the parameter.	0
11_{hex}	Job cannot be executed due to operating state	Access is not possible for temporary reasons which are not specified further.	0
65_{hex}	Wrong job ID	—	—
66_{hex}	Internal communication failed	Example: no configuration loaded	—
67_{hex}	Reserved	—	—
77_{hex}	Access not permitted by user level	—	—
79_{hex}	Scaling error	—	—
$7C_{hex}$	Value in definition gap (see selection)	—	—
$7D_{hex}$	Collision with other values	—	—
83_{hex}	Error in pre-read function	—	—
84_{hex}	Error in post-write function		
Rest	Reserved		

13.2 Further regulations for order/answer processing

- To ensure that the inverter with PROFIBUS interface always stops responding to the last job and is ready for the next job, the job ID "no job" must be briefly sent.
- Transmission on the bus takes place in Motorola format (Big-endian): High parameter value is sent first both within a word and the words within a double word.
- When no information is needed from the PKW interface during cyclic operation, the job ID should be set to "no job".

13.3 Time sequence of a PKW0 service

In the following example for a controller, the transfer commands for the 16 bit format should be given and the parameter *D00 SW-Accel* from axle 1 should be changed to the value 300 ms/3000 rpm.
Find the values from the parameter list:

- PNU = $1000 + 20 \times 3 + 0 + 0 = 1060_{dec} = 424_{hex}$, subindex = 1
- Parameter value $300_{dec} = 12C_{hex}$.

Step	Set PLC output byte (xx = old content)	Explanation
1	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 xx xx xx xx	Delete parameter identification, subindex and reserved byte 3.
2	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 xx xx xx xx	Wait until the input bit of the inverter has the response identification 0. In addition, mask out bits 4 to 7 and check they are set to 0. The PNU of the last task could still occupy the other bits and byte 1. The waiting time depends on the bus cycle time (number of subscribers).
3	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 01 2C	Expand parameter value 12C to 4 byte and enter in bytes 4 to 7.
4	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 01 2C	Enter subindex 1 in byte 2.
6	Byte: 0 1 2 3 4 5 6 7 Hex value: 34 24 00 00 00 00 01 2C	Enter parameter number 424_{hex} in bits 0 … 10 of the PKE and enter task identification 3 in bits 12 … 15, bit 11 remains 0.
7	Byte: 0 1 2 3 4 5 6 7 Hex value: 34 24 00 00 00 00 01 2C	Wait until a response arrives in the input byte, e.g. Byte: 0 1 2 3 4 5 6 7 Hex value: 24 24 00 00 00 00 00 00 The 2 in byte 0 indicates the response identification *Transfer parameter value*. In this sway, the new value has been transferred from the inverter without errors.
8	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 xx xx	Delete the parameter identification again to shorten the waiting time for the next PKW service.

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