MOVIDRIVE®
Drive Inverters

DFP11A PROFIBUS Fieldbus Interface

Manual

Edition 05/98

10/262/97

PROFI®
PROCESS FIELD BUS
BUS

C (UL)® (UL)®

TÜV
CERT
DIN EN ISO 9001

SEW
EURODRIVE

Important Notes

- **Read this Manual carefully before you start installation and commissioning work on MOVIDRIVE® drive inverters with PROFIBUS.**
  This Manual assumes that the user is familiar with and has at his disposal all relevant documentation on the MOVIDRIVE® system, in particular the MOVIDRIVE® Manual and the MOVIDRIVE® Installation and Operating Instructions.

- **Safety instructions:**
  Always follow the warnings and safety instructions contained in this Manual.
  Safety instructions are marked as follows:

  Mechanical hazard, e.g. when working on hoists.

  Electrical hazard, e.g. during live working.

  Important Instructions for the safe and fault-free operation of the driven machine / system, e.g. pre-settings before commissioning.

- **General safety instructions for bus systems:**
  The fieldbus option provides you with a communications system which allows you to match the MOVIDRIVE® drive inverter to the specifics of your application to a very high degree. As with all bus systems there is, however, the risk of a programming error in the program, which may result in unexpected (though not uncontrolled) system behaviour.

- In this manual, **cross-references** are marked with a → e.g.,
  (→ MX_SCOPE) means: Please refer to the MX_SCOPE Manual for detailed information or information on how to carry out this instruction.
  (→ Section x.x) means: Further information can be found in Section x.x of this Manual.

- Each unit is manufactured and tested to current SEW-EURODRIVE technical standards and specifications.
  The manufacturer reserves the right to make changes to the technical data and designs which are in the interest of technical progress.
  A requirement for fault-free operation and fulfilment of any rights to claim under guarantee is that these instructions and notes are followed.

- When we prepared this documentation, great care was taken to make it as easy to follow as possible so you could find all the information you need quickly and reliably. We would be pleased to find that you are satisfied with this new documentation.
  If you have any suggestions how we could improve this Manual even more to suit your specific requirements, please feel free to contact us any time.
  We look forward to hearing from you. Tel.: (+49) 7251 / 75-1120.

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1 Introduction

This PROFIBUS (DFP11) Option Manual describes the procedure for installing the DFP11 PROFIBUS option pcb in the drive inverter and for commissioning the MOVIDRIVE® drive inverter when connected to a PROFIBUS-DP or PROFIBUS-FMS fieldbus system.

In addition to describing all the settings on the fieldbus option pcb, this manual further discusses the various options for connecting the drive inverter to PROFIBUS-DP or PROFIBUS-FMS in the form of brief commissioning examples.

In addition to this PROFIBUS Option Manual, we recommend that you familiarize yourself with the following more detailed documentation on fieldbuses, which will provide you with the necessary information for simple and efficient connection of the MOVIDRIVE® to the PROFIBUS fieldbus system:

• MOVIDRIVE® Fieldbus Unit Profile Manual

The MOVIDRIVE® Fieldbus Unit Profile Manual gives a detailed description of the fieldbus parameters and their codes and discusses various control concepts and potential applications in the form of brief examples.

The MOVIDRIVE® Fieldbus Unit Profile Manual also contains the parameter list which is sorted in the order of the parameter numbers.

Thanks to this high-performance, universal fieldbus interface, the MOVIDRIVE® drive inverter with the DFP11 option can be connected to and controlled from higher-level automation systems via PROFIBUS-FMS and PROFIBUS-DP.

MOVIDRIVE® = Combislave

With the DFP11 PROFIBUS option pcb the MOVIDRIVE® drive inverter as Combislave unit supports both PROFIBUS-FMS and PROFIBUS-DP to DIN E 19245 Part 3 / EN 50170. This allows the drive inverter to be controlled via PLC and PROFIBUS-DP, for example, while at the same time a visualization system can read out and display on a PC screen actual values from the drive inverter using PROFIBUS-FMS. Of course the drive inverter may be controlled and parameterized using only PROFIBUS-DP or only PROFIBUS-FMS, too.

MOVIDRIVE® and PROFIBUS

The drive inverter device profile for PROFIBUS mode, for example the way the drive inverter operates and responds when in PROFIBUS mode, is independent of the type of fieldbus, and thus consistent for all fieldbus types. This allows the user to develop his drive applications independent of a particular fieldbus or change to another bus system, e.g. INTERBUS (DFI 11 option) without any problems.

MOVIDRIVE® offers digital access to all drive parameters and functions via the PROFIBUS interface. The drive inverter is controlled by the high-speed cyclic process data. This process data channel provides the facility to specify setpoints, such as setpoint speeds, ramp generator times for acceleration and deceleration etc., as well as various drive functions such as enable, controller inhibit, stop, rapid stop, etc. to be triggered. This channel can also be used to read back actual values from the drive inverter, such as actual speed, current, inverter status, fault number or reference messages.

Whereas process data are generally exchanged in cycles, the drive parameters can be read and written acyclically via the READ and WRITE services or the parameter channel. This exchange of parameter data enables applications where all major drive parameters are stored in the higher-level automation unit to be implemented, thus avoiding manual adjustment of parameters on the drive inverter itself.

The PROFIBUS option pcb is designed so that all fieldbus-specific settings, such as the station address or the default bus parameters, can be made on the option pcb by means of a hardware switch. These manual settings enable the drive inverter to be integrated into the PROFIBUS environment and switched on in a very short space of time. Parameters can be set fully automatically by the higher-level PROFIBUS master (parameter download). This innovation offers the benefits of a shorter commissioning period for the plant as well as simpler documentation of the application program, as all major drive parameter data can now be stored directly in the control program.
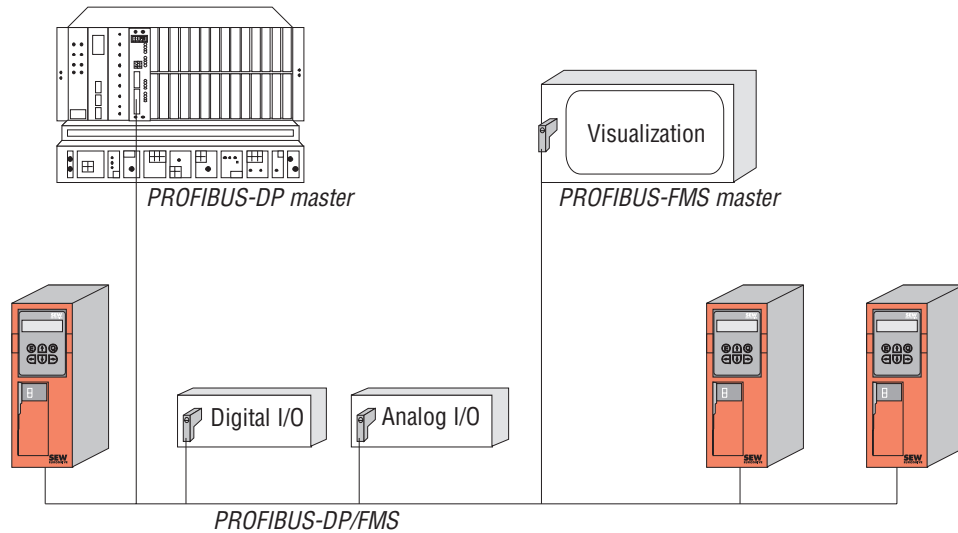
01061AEN

Fig 1: PROFIBUS-DP and/or FMS with MOVIDRIVE®

The use of a fieldbus system in drive technology requires additional monitoring functions, such as fieldbus timeout or rapid stop concepts. The monitoring functions of the MOVIDRIVE® can be matched to the specific application for which it is to be used. This feature enables you, for instance, to specify which response the drive inverter should trigger if an error should occur in the bus. A rapid stop will be practical for many applications, but it is also possible to freeze the last setpoints, so that the drive can continue with the last valid setpoints (e.g. conveyor belt). As the functionality of the control terminals is also ensured when the drive inverter is operated in the fieldbus mode, fieldbus-independent rapid stop concepts can still be implemented via the drive inverter's terminals.

The MOVIDRIVE® drive inverter offers numerous diagnostic facilities for commissioning and servicing. For instance, both the setpoints transmitted from the higher-level control system as well as the actual values can be checked with the integrated fieldbus monitor.

It also provides you with a lot of additional information on the status of the fieldbus option pcb. In combination with the MX_SHELL software the fieldbus monitor function offers convenient diagnostic facilities in that it provides a detailed display of the fieldbus and inverter status information as well as the facility to set all the drive parameters (including the fieldbus parameters).

2 Assembly / Installation Instructions

2.1 Supported Drive Inverter Types

The DFP11 option pcb for connection to a PROFIBUS-FMS/DP system can be used with all drive inverters of the MOVIDRIVE$^®$ family.

2.2 Fitting the Option PCB

Before you begin:

- Discharge yourself with appropriate measures (earthing band, conductive shoes, etc.) before touching the option pcb.
- Store the option pcb in the original package and only unpack immediately before installation.
- Do not touch the option pcb more often than necessary and hold only by the edges. Do not touch components.

Installation of the option pcb :

- Disconnect inverter from the supply. Switch off mains and, if applicable, 24 V supply.
- Take off the lower protective cover of the control unit.
- Untighten screws of the electronics shielding terminal.
- Remove black sheet metal cover.
- Insert option pcb into the guide rails of OPTION1 or OPTION2 slots.
- Press the front plate carefully to plug in option pcb. The pcb is correctly inserted when the front is flush with the controller pcb.
- Fasten electronics shielding terminal.
- Replace the protective cover of the control unit.
- Depending on the D type connector used, it may not be possible to replace the protective cover. This does not effect the enclosure of the unit.
- **The DFP11 option pcb is now completely fitted.**
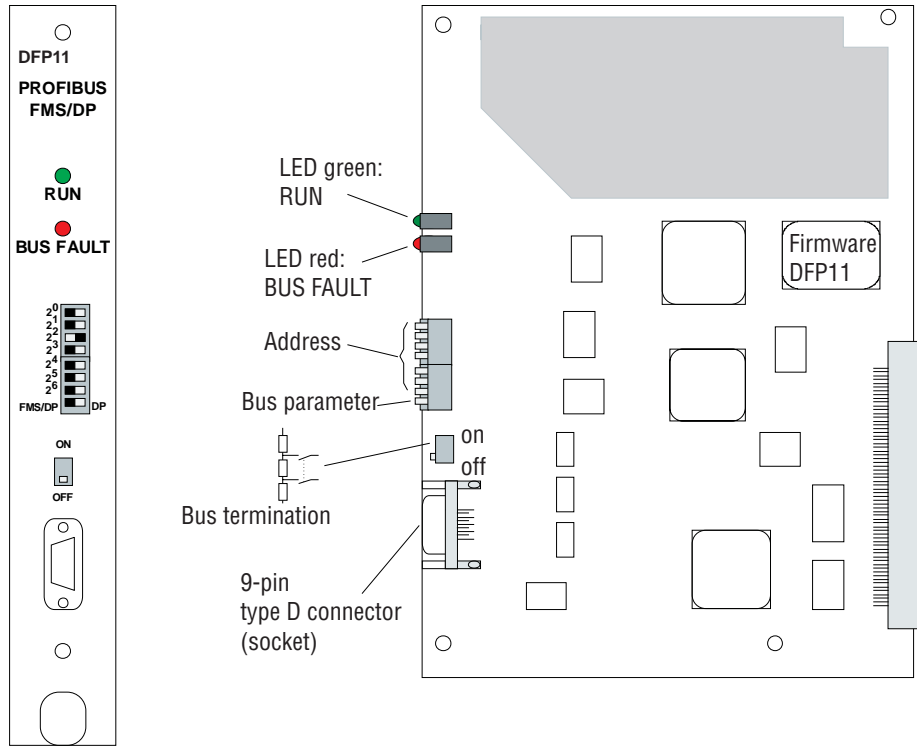
01062BEN

Fig. 2: The DFP11 option

2.3 Pin Assignment

The MOVIDRIVE® drive inverter is connected to the PROFIBUS network via a 9-pin type D connector in accordance with DIN 19245 Part 3 / EN 50170. Connection to the T-bus is with an appropriately designed connector or a bus terminal. As the bus terminating resistors can be connected on the option pcb, it is not necessary to use a type D connector with integrated terminating resistors.

	Pin no.	Signal		RS-485 reference
9-pin type D connector X30 01222AEN *Fig. 3*	1:	-	Not assigned	
	2:	-	Not assigned	
	3:	**RxD/TxD-P**	**Receive/send data P**	**B/B'**
	4:	CNTR-P	Repeater control signal (TTL)	
	5:	DGND	Data reference potential (M5V)	C/C'
	6:	VP	Supply voltage plus (P5V)	
	7:	-	Not assigned	
	8:	**RxD/TxD-N**	**Receive/send data N**	**A/A'**
	9:	DGND	Data reference potential (M5V)	
	Connector housing:	Shield of the twisted two-wire cable		

The MOVIDRIVE® drive inverter is connected to the PROFIBUS system via a twisted, shielded two-wire cable.

The connection of the two-wire cable to the PROFIBUS connector is via pin 8 (A/A') and pin 3 (B/B'). These two contacts are used for communication. The RS-485 signals A/A' and B/B' must be contacted the same on all PROFIBUS stations, as otherwise communication via the bus will not be possible.

Via pin 4 (CNTR-P) the PROFIBUS option pcb supplies a TTL control signal for a repeater or LWL adapter (reference = pin 9).

2.4   Shielding and Laying of the Bus Cables

The DFP11 PROFIBUS option pcb supports RS-485 transmission technology and requires as a physical medium a shielded, two-wire twisted-pair cable (cable type A) specified for PROFIBUS in accordance with DIN 19245 Part 3 (see Appendix).

Technically correct shielding of the bus cable absorbs the electrical interference that can occur in an industrial environment. You will achieve the best shielding results if you adopt the following measures:

- Hand-tighten the fixing screws of plugs, modules and equipotential bonding conductors.
- Only use plugs with metal or metal-plated housings.
- Connect the shielding in the plug over as large an area as possible.
- Connect the shielding at both ends of the bus cable
- Do not lay signal and bus cables parallel to power cables (motor cables), but wherever possible in separate cable conduits.
- In an industrial environment use metallic, grounded cable trays.
- Run signal cables and the associated equipotential bonding conductor as close as possible to each other, using the shortest route.
- Avoid extending bus cables through the use of connectors.
- Run the bus cables close to existing grounded surfaces.

Important:

In the event of fluctuations in the ground potential, a circulating current may flow through any shielding which may be connected at both ends and connected to the ground potential (PE). In this case, ensure there is adequate equipotential bonding in accordance with the relevant DIN VDE provisions.

2.5   Bus Termination

If the MOVIDRIVE® drive inverter is at the beginning or the end of a PROFIBUS segment, connection to the PROFIBUS network, as a rule, is not via a T bus with an incoming and outgoing PROFIBUS cable but directly with only one PROFIBUS cable. To avoid interferences on the bus system caused by reflections etc., the PROFIBUS segment must be terminated with bus terminating resistors on the physically first and last stations.

As the bus terminating resistors can be connected on the DFP11 option pcb of the drive inverter it is not necessary to use a type D connector with integrated terminating resistors.
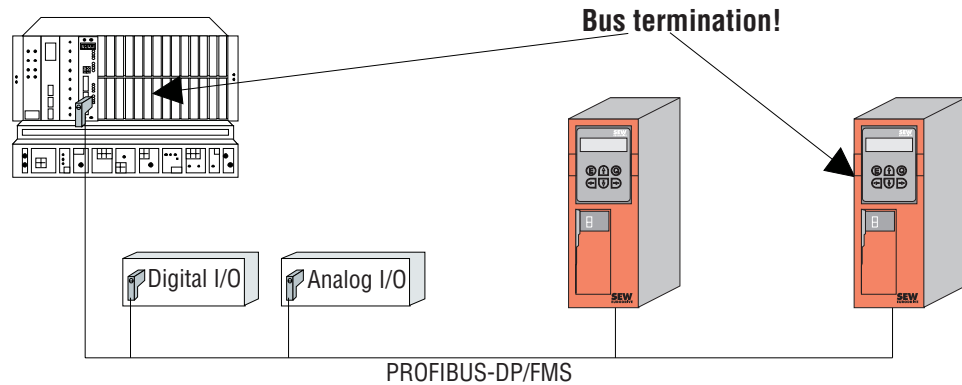
Fig. 4: Bus termination at the beginning and the end of a PROFIBUS segment

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Set the appropriate DIP switch to the "on" position in order to connect the bus terminating resistors. The bus termination for cable type A is implemented in accordance with DIN E 19245 Part 3 / EN 50170.
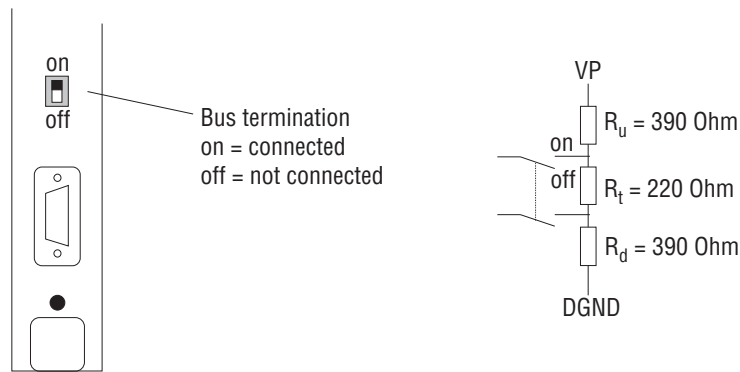
Fig. 5: Activating the bus terminating resistors

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2.6 Setting the Station Address

The PROFIBUS station address is set with the DIP switches on the option pcb. PROFIBUS supports the address range from 0 – 125. The address 126 is reserved for PROFIBUS-DP and is for setting the address via the bus interface. This feature is, however, not supported by the MOVIDRIVE®. The address 127 is reserved for the broadcast service.

Significance on

Significance 1:	x 0	= +0
Significance 2:	x 0	= +0
Significance 4:	x 1	= +4
Significance 8:	x 0	= +0
Significance 16:	x 0	= +0
Significance 32:	x 0	= +0
Significance 64:	x 0	= +0

Address = 4 (condition as delivered)
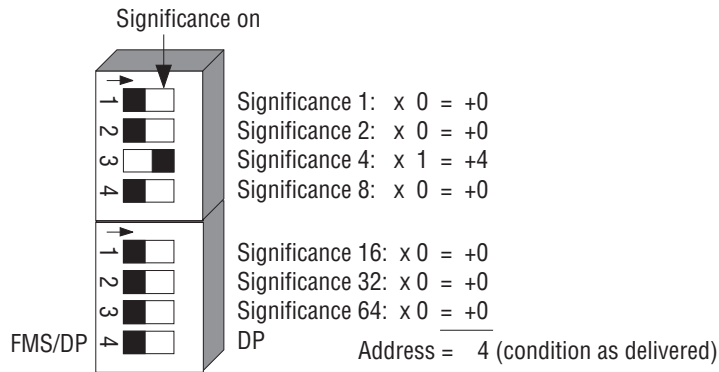
Fig. 6: Setting the PROFIBUS station address

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It is not possible to change the PROFIBUS station address via the DIP switches while the drive inverter is running. If the station address is changed, the new station address will only be effective after the drive inverter has been switched off (mains supply and 24 V supply ON/OFF) and then switched on again. The station address set for the drive inverter is displayed with the fieldbus monitor parameter P092 Fieldbus Address on the DBG Keypad or on the MX_SHELL.

| 092 | Fieldbus Address | 4 |

01223AEN

Fig. 7: Displaying the current PROFIBUS station address on the DBG Keypad or MX_SHELL

2.7 Setting the Bus Parameters

The default value setting for the bus parameters depends on the protocol version used. For straight PROFIBUS-DP mode the DIP switch must be set at DP. This will activate the default bus parameters (in particular the min. TSDR) for time-optimized DP mode in accordance with DIN E 19245 Part 3 / EN 50170. For mixed mode (FMS/DP) or straight FMS mode the DIP switch must be set at FMS.

Default bus parameters for
- FMS mode or
- FMS + DP mixed mode

Condition as delivered FMS/DP active

Default bus parameters for straight DP-PROFIBUS mode
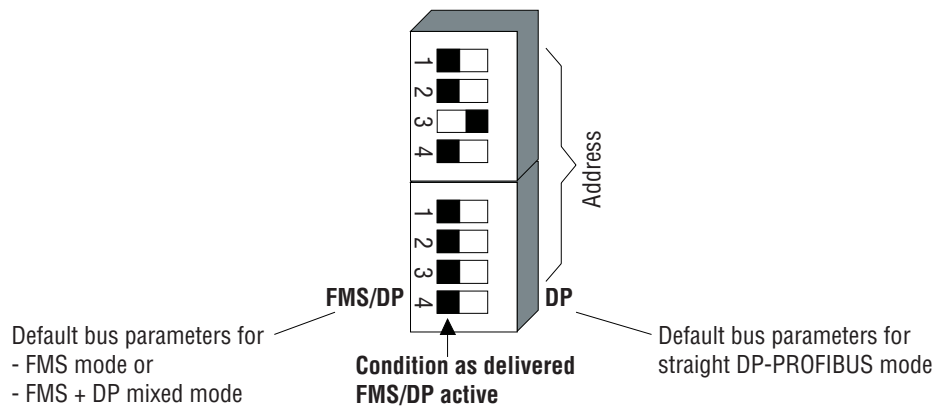
00083AEN

Fig. 8: Setting the default bus parameters to DIN 19245

This switch only serves to select the default bus parameters. Independent of the setting of this switch, the drive inverter at any time supports simultaneous use of the PROFIBUS protocol options FMS and DP (Combislave functionality).

Any change to this DIP switch setting will only become effective after the drive inverter has been switched off (mains supply and 24 V supply ON/OFF) and switched on again.

2.8 Display Elements

LED Green RUN	LED Red BUS FAULT	Meaning
Flashing at approx. 3 Hz	Off	Option pcb is being initialized (only immediately after drive inverter power-up or reset)
On	Flashing at approx. 0.5 Hz	Configured station address is not within the permitted range (0...126) → Set correct station address and switch the unit on again.
On	On	DP mode: a) When the drive inverter is being commissioned or run up: The drive inverter has not been set to data exchange mode by the DP master yet . b) The timeout period has elapsed, the drive inverter was not addressed by the DP master. FMS mode: There is no active FMS link between the FMS master and the drive inverter. Mixed mode FMS/DP: A combination of the above

LED Green RUN	LED Red BUS FAULT	Meaning
On	Off	DP mode: The drive inverter is in data exchange mode. FMS mode: There is an active FMS link between the FMS master and the drive inverter. Mixed mode FMS/DP: Combination of the above
On + flickering	Off	The drive inverter is being parameterized via PROFIBUS-DP or -FMS (Read/Write access operations)
Off	On	Hardware fault on the DFP11 option pcb
Flashing at approx. 1 Hz	Flashing at approx. 1 Hz	Hardware fault on the DFP11 option pcb
Flashing at approx. 1 Hz	On	Check the firmware version of the control pcb (basic unit).

Table 1: Meaning of the visual signals of the RUN and BUS FAULT LEDs

The option pcb has two LEDs for status and fault indication of the option pcb and the connected bus system (Fig. 2). Table 1 shows the meaning of the visual signals of these LEDs. While the green LED "RUN" indicates the operational status of the option pcb, the red LED "BUS FAULT" indicates the status of the PROFIBUS connection.

2.9   GSD File

All slave-specific features are stored in a device database file (GSD file). EN 50170 V2 / DIN E 19245 Part 3 describes the format of a GSD file. It can be used by the DP master for easy configuration of the DP slave. However, as some DP masters do not support this file format, additional type files are required. These files are enclosed to the fieldbus documentation package on a diskette. In addition, these files can be downloaded via modem or the Internet at the addresses below:

Internet:

http://www.SEW-EURODRIVE.com (all files)
http://www.PROFIUS.com (GSD files only)

Modem:

Siemens Schnittstellencenter Fürth
Tel.: +49 (911) 737972 (GSD and Siemens type files)

2.10 Commissioning the Drive Inverter

After installing the PROFIBUS option pcb the MOVIDRIVE® drive inverter can be immediately parameterized via the PROFIBUS system without any further adjustment. This means, for example, that after switching on the drive inverter, all parameters can be downloaded directly from the higher-level automation system.

To control the drive inverter via PROFIBUS, however, it must first be switched to control source (P101) and setpoint source (P100) = FIELDBUS. With the FIELDBUS parameter setting, the drive inverter is programmed to accept setpoints from the PROFIBUS. The MOVIDRIVE® drive inverter now responds to process data sent from the higher-level automation system.

The activation of the FIELDBUS control and setpoint sources is signalled to the higher-level control system by the Fieldbus Mode Active bit in the status word.

For safety reasons the drive inverter must also be enabled via the terminals to permit control via the fieldbus system. The terminals are therefore to be wired or programmed in such a way that the drive inverter is enabled via the input terminals. The easiest way of enabling the drive inverter via the terminals is, for example, to connect input terminal DIØØ (function /CONTROLLER INHIBIT) to a +24 V signal and program input terminals DIXØ1 .. DIØ3 to NO FUNCTION. An example of the commissioning procedure for the MOVIDRIVE® drive inverter with a fieldbus interface is given below.

Commissioning procedure for the MOVIDRIVE® drive inverter

1. Enable the output stage via the terminals.
    Apply a +24 V signal on input terminal DIØØ / X13.1 (function /CONTROLLER INHIBIT) (e.g. via jumper).
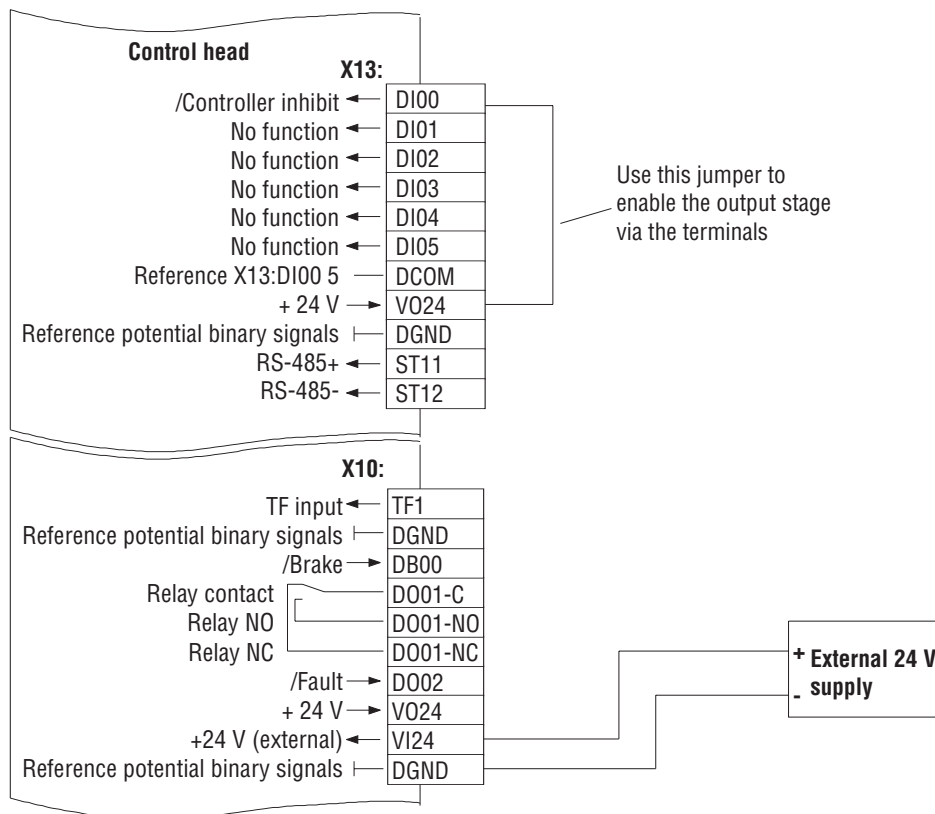
01234AEN

Fig. 9: Enabling the output stage via jumper

2. Switch on 24 V supply
   Switch on the external 24 V supply only (not the mains supply!) to program the drive inverter.

3. Setpoint source = FIELDBUS / control source = FIELDBUS
   Set the setpoint source and the control source to FIELDBUS to control the drive inverter via fieldbus.

P100 Setpoint source = FIELDBUS
P101 Control source = FIELDBUS

4. Input terminals DIØ1 ... DIØ3 = NO FUNCTION
   Program the input terminals to NO FUNCTION.

P600 Programming terminal DIØ1 = NO FUNCTION
P601 Programming terminal DIØ2 = NO FUNCTION
P602 Programming terminal DIØ3 = NO FUNCTION

For more information on commissioning and controlling the MOVIDRIVE® drive inverter please refer to the Fieldbus Unit Profile Manual.

3 The PROFIBUS-DP Interface

PROFIBUS-DP (Decentralized Periphery) is the speed-optimized PROFIBUS option designed in particular for fast data exchange at the sensor/actuator level. DP is used by central automation systems (e.g. programmable logic controllers) to communicate with decentralized peripherals such as sensors and actuators, among them drive inverters, via a fast serial link. Data exchange with these decentralized units is mainly cyclic. The central automation system sends new process output data to all the peripheral units (slaves) in a message and reads in all process input data from the slaves (sensors, actuators) in the same message.

To enable the central automation system (DP master) to communicate with the DP slaves, it has to be given some important information regarding the DP interface of the connected slave. In addition to data relating to the type and amount of I/O data to be transferred, it also requires additional information regarding the identity of each DP slave.

3.1 Configuration of the DP Interface

To be able to define the type and amount of I/O data to be transferred, the DP master has to pass a certain configuration to the drive inverter. The MOVIDRIVE® drive inverter can generally be operated using six different configurations. You have the option of only controlling the drive inverter by exchanging process data, or, in addition to controlling the drive inverter via process data, of reading or writing parameters using an additional parameter channel at the same time.

Fig. 10 provides a schematic representation of the exchange of data between the central automation system (DP master) and the MOVIDRIVE® drive inverter (DP slave) using process data and parameter channels.

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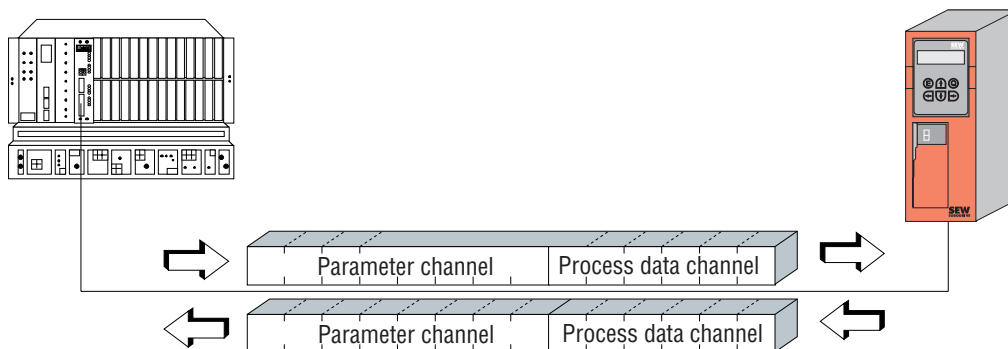*Fig. 10: Communication via PROFIBUS-DP*

When commissioning the DP master, you will have to specify which configuration is going to be used to operate the drive inverter. This configuration is then transferred to the drive inverter when the DP master is started up (using the DDLM_Chk_Cfg service). The drive inverter checks the transferred configuration data for plausibility before going into data exchange mode. The configuration data are coded in accordance with DIN E 19245 Part 3 /EN 50170 and are discussed in the next section.

3.1.1 Description of the Configuration Data

DIN E 19245 Part 3 describes the format of the configuration data. Fig. 11 shows the Cfg_Data identifier byte which, according to DIN E 19245 Part 3, is used to describe which I/O data are to be transferred between master and slave using PROFIBUS-DP.

In addition to specifying the data length in bits 0-3, you have to use bits 4 and 5 to define whether the transfer involves input and/or output data. Bit 6 indicates whether the data are to be transferred in byte or word format and bit 7 is used to specify the consistency with which the data are to be

handled by the bus system. For example, position values of the MOVIDRIVE® drive inverter should be transferred in a consistent manner, i.e. it has to be ensured that contiguous data are also transferred together and not, for example, that the least significant part of the position is transferred one bus cycle ahead of the more significant part.

00087AEN

Fig. 11: Format of the Cfg_Data identifier byte to DIN E 19245 Part 3

The MOVIDRIVE®drive inverter supports six different process data configurations. To control the drive inverter, you can define the amount of process data to be transferred using 1, 2 or 3 process data words and also enable/disable a parameter channel for read/write access to all drive parameters. This produces the following process data configurations:

- 1 process data word (1 PD)
- 2 process data words (2 PD)
- 3 process data words (3 PD)
- 1 process data word + parameter channel (1 PD + Param)
- 2 process data words + parameter channel (2 PD + Param)
- 3 process data words + parameter channel (3 PD + Param)

This configuration is set up solely via the DP master as the bus system is started up, so that no additional manual parameterizing of the drive inverter is required. This automatic configuring mechanism enables download applications to be implemented where the drive inverter can be completely controlled and parameterized via the bus system.

To set these process data configurations, the drive inverter supports a number of different codes for the Cfg_Data identifier byte. The process data configuration is allocated based on the amount of input and output data. A valid DP configuration sent from the DP master to the drive inverter must conform to the following conventions:

- The amount of input or output data must correspond to the contents of Table 2.
- The number of input bytes and output bytes must be the same.

Length of the input/output data	Meaning
2 bytes or 1 word	1 process data word
4 bytes or 2 words	2 process data words
6 bytes or 3 words	3 process data words
10 bytes or 5 words	1 process data words + parameter channel
12 bytes or 6 words	2 process data words + parameter channel
14 bytes or 7 words	3 process data words + parameter channel

Table 2: Possible data lengths of the DP configuration and their interpretation

The drive inverter interprets the length of the DP configuration passed to it as shown in Table 2. Two different process data configurations for PROFIBUS-DP are described below.

3.1.2 Configuring for 1 (2, 3) Process Data Word(s) (1 PD (2 PD, 3 PD))

Control of the MOVIDRIVE®drive inverter using 1 (2, 3) process data word(s) requires, for example, that the Cfg_Data identifier byte is coded as shown in Fig. 12. This code must be sent to the drive inverter by the DP master when PROFIBUS-DP is started so that the DP master and DP slave can exchange a process data word.
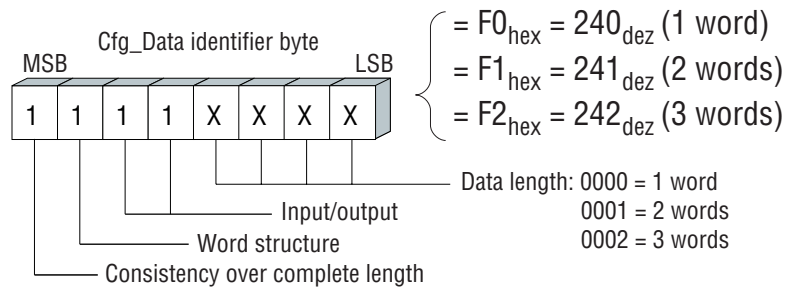
01224AEN

Fig. 12: Configuration data example for setting 1 (2, 3) input/output word(s) (1 PD (2 PD, 3 PD))

Fig. 13 shows the communication between the higher level automation unit (DP master) and the MOVIDRIVE®drive inverter via 1 (2, 3) process data word(s).
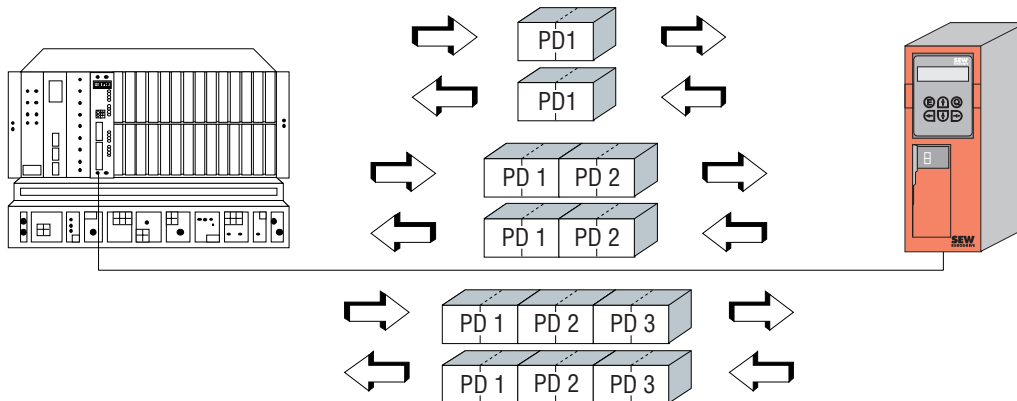
01225AEN

Fig. 13: Control of the drive inverter via 1 (2, 3) process data word(s)

3.1.3 Configuring for 1 PD (2 PD, 3 PD) + Parameter Channel

Control of the MOVIDRIVE® drive inverter using 1 (2, 3) process data word(s) and an additional parameter channel requires two identifier bytes to be defined. Identifier byte 1 contains the code for the parameter channel, identifier byte 2 contains the code for 1 (2, 3) process data word(s). Fig. 14 shows how this identifier byte for the parameter channel is coded. The identifier byte for the process data words is shown in Fig. 12. These codes must be sent to the drive inverter by the DP master when PROFIBUS-DP is started so that the DP master and the DP slave can exchange the process data words as well as the parameter channel.

Cfg_Data identifier byte for parameter channel

01226AEN

Fig. 14: Configuration example for parameter channel

Fig. 15 shows the communication between the higher level automation unit (DP master) and the MOVIDRIVE®drive inverter via 1 (2, 3) process data word(s) and the parameter channel for reading and writing of drive parameters.

01227AEN

Fig. 15: Communication with 1 (2, 3) process data word(s) and parameter channel

3.2 Ident Number

Each DP master and DP slave must have an individual identification number assigned to them by the PROFIBUS User Group so that the units connected to the bus can be uniquely identified. When the PROFIBUS-DP master is started, it compares the Ident Numbers of the connected DP slaves with those specified by the user. User data transfer is activated once the DP master has ascertained that the connected station addresses and unit types (Ident Numbers) agree with those specified. This process provides a high degree of security against configuration errors.
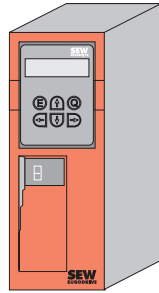
MOVIDRIVE®
Ident number: 6000_{hex} or 24576_{dec}

01072AEN

Fig. 16: Ident Number of the MOVIDRIVE® family

The Ident Number is defined as an unsigned 16-bit number (Unsigned16). The PROFIBUS User Group has specified the Ident Number 5100hex (24576dec) for the MOVIDRIVE®range of drive inverters (Fig. 16).

3.3 Watchdog Timer

Each DP slave must have a watchdog timer so it can detect a failure of the DP master or the communications link. If no data are transferred between the DP master and DP slave within the specified timeout period, the slave must automatically switch its outputs to a safe state.

The MOVIDRIVE®drive inverter maps the timeout period which is defined when the DP master is configured to parameter P791 Fieldbus Timeout (Fig. 25). This parameter consequently reflects the currently configured timeout period. If the watchdog timer is not active, the parameter will have a value of 650.00 seconds.

819	Fieldbus Time Out	[s]	0.20

01228AEN

Fig. 17: A fieldbus timeout period of 200 ms configured in the DP master

When the timeout period expires, the drive inverter invokes the fault response specified beforehand in parameter P831 Timeout Response. This means the response of the drive inverter when the bus goes down can be adapted to that of the drive application. For example, conveyor belts can continue to run at the most recent valid setpoint speed or brought to a stop very quickly.

Expiry of the timeout period is indicated on the option pcb by the red BUS FAULT LED. At the same time, the drive inverter also indicates an error in the 7-segment display, which is displayed as Error Fieldbus Timeout in the MX_SHELL user interface on your PC (Fig. 17). Depending on the specified fault response, the drive inverter may have to be reset to restore its normal status.

For a detailed description of the drive inverter's timeout behavior, please refer to the Fieldbus Communications Profile Manual.

Important!

Parameter P819 Fieldbus Timeout can only be set through the timeout period which is configured in the DP master for the whole DP system. Manual setting of this parameter with the MX_SHELL user interface has no effect, any setting would be overwritten when PROFIBUS-DP is started up the next time.

3.4 Diagnostic Data

Station diagnosis of the MOVIDRIVE® drive inverter can be performed using the DP service DDLM_Slave_Diag. The drive inverter also supports unit-related diagnosis. Fig. 18 shows the structure of the diagnostic data.
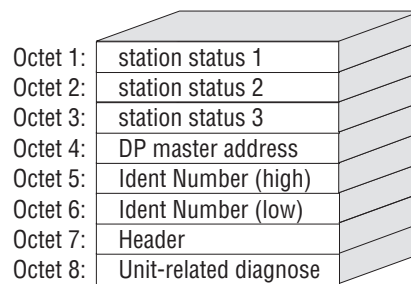

Octet 1:	station status 1
Octet 2:	station status 2
Octet 3:	station status 3
Octet 4:	DP master address
Octet 5:	Ident Number (high)
Octet 6:	Ident Number (low)
Octet 7:	Header
Octet 8:	Unit-related diagnose

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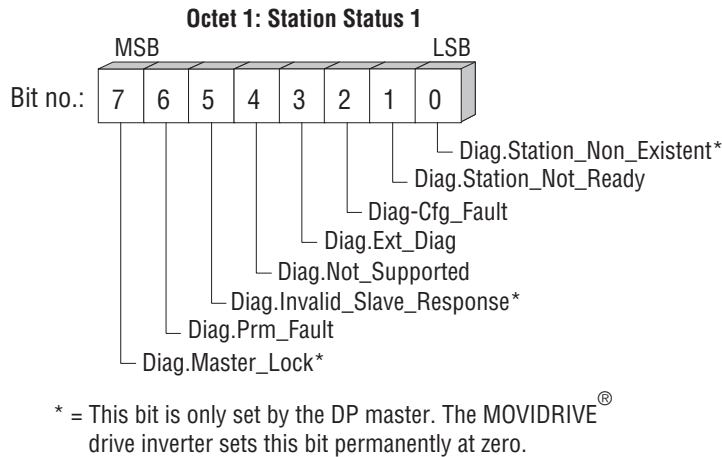*Fig. 18: Structure of the diagnostic data for the MOVIDRIVE®*

Octets 1-7 contain the diagnostic information according to DIN E 19245 Part 3. As the header of the unit-related diagnostic data, a value of 2 in octet 7 indicates that the unit-related diagnostics are 2 bytes in length (incl. header). If there is a fault on the drive inverter, octet 8 will also contain the fault code (only then will external diagnosis be possible).

Important!

The unit-related diagnostic information is only updated every 800 ms approx. This means that a fault message may not be output for 800 ms after the fault occurs. A much faster and simpler method of detecting faults can be implemented using status word 1 of the MOVIDRIVE® drive inverter.

3.4.1 Data in Octet 1: Station Status 1

Fig. 19 shows the coding of octet Station Status 1 in accordance with DIN E 19245 Part 3. Station status 1 comprises information which is either generated by the master or by the DP slave itself. The bits which are controlled by the master are generally set to zero by the DP slave. In the following the individual status bits will be discussed in greater detail.

Octet 1: Station Status 1

MSB   LSB

Bit no.:   7   6   5   4   3   2   1   0

└─ Diag.Station_Non_Existent*
└─ Diag.Station_Not_Ready
└─ Diag-Cfg_Fault
└─ Diag.Ext_Diag
└─ Diag.Not_Supported
└─ Diag.Invalid_Slave_Response*
└─ Diag.Prm_Fault
└─ Diag.Master_Lock*

* = This bit is only set by the DP master. The MOVIDRIVE®
drive inverter sets this bit permanently at zero.

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Fig. 19: Coding of the octet Station Status 1 to DIN E 19245 Part 3

The individual bits have the following meaning in accordance with DIN E 19245 Part 3:

Bit 7: Diag.Master_Lock

> The drive inverter as DP slave sets this bit permanently at zero. This bit is set by the DP master (class 1) if the address in octet 4 is not equal FFhex and not equal to its own address. It indicates that the MOVIDRIVE® drive inverter was parameterized by a different master with the DDLM Set_Prm service.

Bit 6: Diag.Prm_Fault

> This bit is set by the MOVIDRIVE® drive inverter as DP slave if the last parameter message (DDLM_Set_Prm) was incorrect, e.g. incorrect length, incorrect Ident Number, etc.

Bit 5: Diag.Invalid_Slave_Response

> The drive inverter as DP slave sets this bit permanently at zero. This bit is set by the DP master if an invalid response was received from the MOVIDRIVE® drive inverter.

Bit 4: Diag.Not_Supported

> This bit is set by the MOVIDRIVE® drive inverter as DP slave if a function was requested which is not supported by the drive inverter.

Bit 3: Diag.Ext_Diag

> This bit is set by the MOVIDRIVE® drive inverter as DP slave. It indicates that a diagnostic entry has been made in the unit-related diagnosis section (see octet 8: Unit-related Diagnosis).

Bit 2: Diag.Cfg_Fault

> This bit is set by the MOVIDRIVE® drive inverter as DP slave if the configuration data last received by the master do not correspond to the configuration data supported by the MOVIDRIVE® drive inverter.
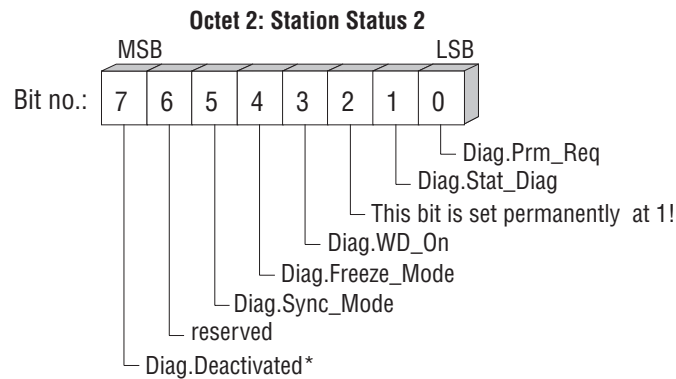
Bit 1: Diag.Station_Not_Ready

This bit is set by the MOVIDRIVE® drive inverter as DP slave if the drive inverter is not ready for data exchange yet.

Bit 0: Diag.Station_Non_Existent

The drive inverter as DP slave sets this bit permanently at zero. This bit is set by the DP master if the MOVIDRIVE® drive inverter cannot be accessed via the bus. If this bit is set, the diagnostic bits in the master contain the status of the last diagnostic message of the drive inverter or the initial value.

3.4.2 Data in Octet 2: Station Status 2

Fig. 20 shows the coding of octet Station Status 2 in accordance with DIN E 19245 Part 3. Station status 2 comprises information which is generated either by the master or the DP slave itself. The bits which are controlled by the master are generally set at zero by the DP slave. In the following the individual status bits will be discussed in greater detail.

Octet 2: Station Status 2

Bit no.: 7 6 5 4 3 2 1 0

- Diag.Prm_Req
- Diag.Stat_Diag
- This bit is set permanently at 1!
- Diag.WD_On
- Diag.Freeze_Mode
- Diag.Sync_Mode
- reserved
- Diag.Deactivated*

* = This bit is set by the DP master only. The MOVIDRIVE® drive inverter sets this bit permanently at zero.

01074AEN

Fig. 20: Coding of the octet Station Status 2 to DIN E 19245 Part 3

The individual bits have the following meaning in accordance with DIN E 19245 Part 3:

Bit 7: Diag.Deactivated

The drive inverter as DP slave sets this bit permanently at zero.
This bit is set by the DP master if the MOVIDRIVE® drive inverter was identified as non-active in the DP slave parameter set and taken off the cyclic processing.

Bit 6: Reserved

Bit 5: Diag.Sync_Mode

This bit is set by the drive inverter as soon as it has received the Sync command.

Bit 4: Diag.Freeze_Mode

This bit is set by the drive inverter as soon as it has received the Freeze command.

Bit 3: Diag.WD_On

This bit is set by the MOVIDRIVE® drive inverter if the watchdog timer is on.

Bit 2:

This bit is permanently set at one by the MOVIDRIVE® drive inverter.

 Bit 1: Diag.Stat_Diag

> If the MOVIDRIVE®drive inverter sets this bit, the DP master must pick up diagnostic data until this bit is cleared again.

Bit 0: Diag.Prm_Req

> This bit is set by the MOVIDRIVE® drive inverter if it needs to be parameterized and configured again. This bit remains set until the drive inverter has been parameterized with DDLM_Set_Prm.

3.4.3 Data in Octet 3: Station Status 3

Fig. 21 shows the coding of octet Station Status 3 in accordance with DIN E 19245 Part 3. In station status 3 only bit 7 is relevant at the moment. Bits 0-6 are reserved.
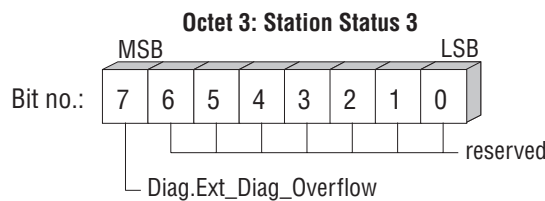
00139AEN

Fig. 21: Coding of the octet Station Status 3 to DIN E 19245 Part 3

The individual bits have the following meaning in accordance with DIN E 19245 Part 3:

Bit 7: Diag.Ext_Diag_Overflow

> If this bit is set more diagnostic information is present than specified in Ext_Diag_Data. This bit is generally set at zero by the MOVIDRIVE® drive inverter.

Bits 6-0: Reserved

3.4.4 DP Master Address in Octet 4

In this octet the address of the DP master is entered, by which the MOVIDRIVE® drive inverter was parameterized with the DP service DDLM_Set_Prm. If the drive inverter was not parameterized by a DP master, this octet contains the address FFhex.

3.4.5 Ident Number in Octet 5/6

The manufacturer identification for the DP slave type is allocated by the PROFIBUS User Group. This Ident Number can be used both for checking purposes and for exact unit identification. The MOVIDRIVE® drive inverter enters the Ident Number 6000hex in this octet, the more significant part (60hex) is entered in octet 5, the less significant part (00hex) is entered in octet 6 of the Ident Number.

3.4.6 Unit-related Diagnosis using Octet 7/8

The MOVIDRIVE® drive inverter supports unit-related diagnosis. Unit-related diagnostic information is only available when the drive inverter outputs a fault message or warning. By setting bit 3 Diag.Ext_Diag in octet 1 Station Status 1, the drive inverter indicates to the master that unit-related diagnostic information is available. The unit-related diagnostic information is stored in octet 7 and more specifically in octet 8. As the header of the unit-related diagnostic data, octet 7 contains the length of the unit-related diagnostics (incl. header byte). As the fault code is normally returned as external diagnostic information in one byte, octet 7 normally contains the value 02hex (length 2 bytes) and octet 8 contains the fault code from the drive inverter.

3.5 Sync and Freeze Mode

In addition to the cyclic exchange of data, where the DP master (higher level automation unit) addresses all slave stations in turn, the DP master also has the ability to send various control commands to all slaves or just a group of slaves (multicast functions). These control commands permit event-driven synchronization of the DP slaves.

The Sync control command switches the drive inverters into Sync Mode, for example. The active setpoints are frozen when in this mode. The DP master now has enough time to send the new process output data (setpoints) to those stations currently in Sync mode.

When a new Sync command is issued, all drive inverters simultaneously update their active setpoints with the value temporarily stored beforehand. In other words, the active setpoints are not updated until the new Sync command has been received. The drive inverters quit Sync mode when the Unsync control command is issued.

The Freeze control command switches the addressed slaves into Freeze Mode. The present status of the inputs (actual values) is frozen when in this mode.

The master now has enough time to retrieve all the actual values from the drive inverters. When a new Freeze command is received, all addressed drive inverters simultaneously save their current actual values (temporarily). The drive inverters quit Freeze mode when the Unfreeze control command is issued.
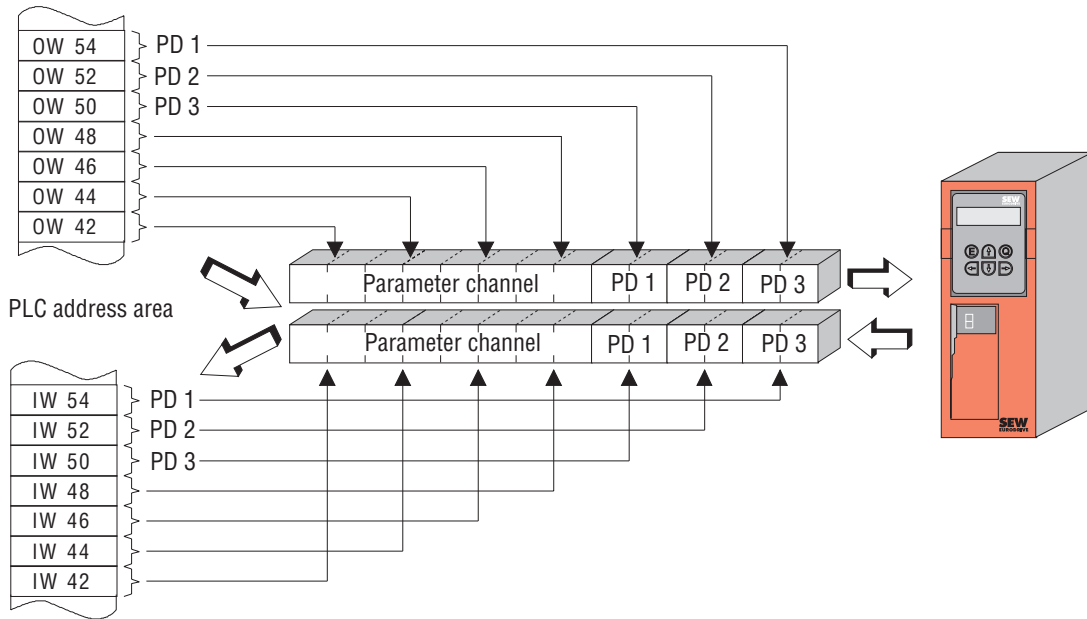
3.6 Control via PROFIBUS-DP

The drive inverter is controlled via the process data channel, which can be one, two or three I/O words in length. These process data words are, for example when a programmable logic controller is being used as DP master, stored in the I/O or peripheral area of the control system and can thus be addressed in the usual manner (Fig. 22).

While the process input data (actual values) are being read, e.g. using the Load command in the case of Simatic S5, the process output data (setpoints) can be sent using the Transfer commands. Referring to Fig. 22, Example 1 shows the syntax for handling the process input and output data of the MOVIDRIVE®drive inverter. The factory setting for the process data channel is shown as a comment.

```
L IW 50      Load PD1 (status word 1)
L IW 52      Load PD2 (speed actual value)
L IW 54      Load PD3 (no function)

L KH 0006
T OW 50      Write 6hex to PD1 (control word 1 = enable)

L KF +1500
T OW 52      Write 1500 dec to PD2 (speed setpoint = 300 rpm)

L KH 0000
T OW 54      Write 0 hex to PD3 (no function, sent value without effect
```

Example: Controlling the drive inverter via the process data

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Fig. 22: Allocation of the PLC I/O area

For details of the control via the process data channel, in particular the coding of the control and status words, please refer to the Fieldbus Unit Profile Manual.

3.7 Parameter adjustment via PROFIBUS-DP

In the case of PROFIBUS-DP, access to the drive parameters is via the MOVILINK parameter channel which, in addition to the standard READ and WRITE services, offers a variety of other parameter services.

3.7.1 Structure of the Parameter Channel

The parameterizing of field units using fieldbus systems, which do not provide an application layer, requires the emulation of the most important functions and services, such as READ and WRITE for the reading and writing of parameters. In the case of PROFIBUS-DP, this requires a Parameter Process Data Object (PPO) to be defined. This PPO is transferred cyclically and in addition to the process data channel contains a parameter channel through which acyclic parameter values can be transferred (Fig. 23).

Fig. 24 shows the structure of the parameter channel. It generally consists of a management byte, an index word, a reserved byte and four data bytes.
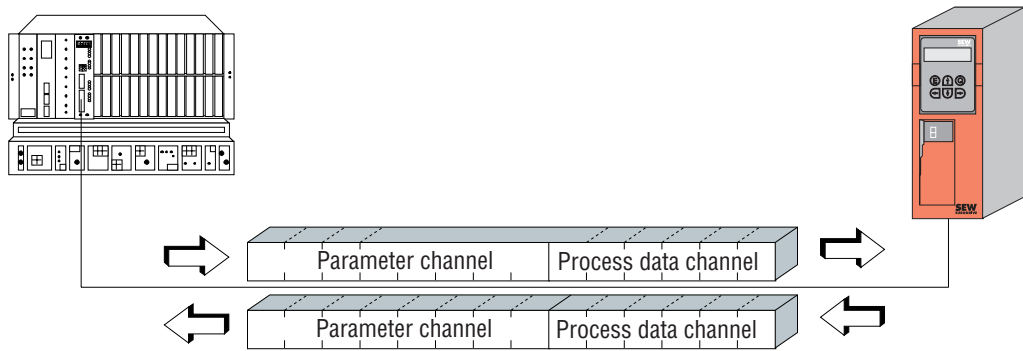

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Fig. 23: Parameter process data object for PROFIBUS-DP

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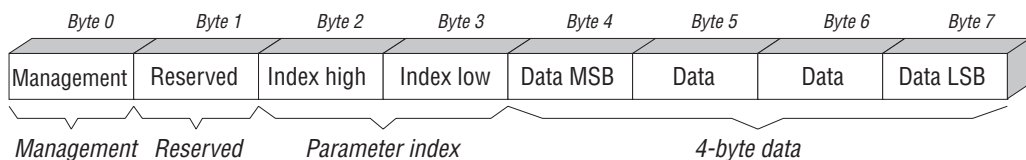*Fig. 24: Structure of the parameter channel*

3.7.1.1 Management of the Parameter Channel

The entire parameter adjustment procedure is co-ordinated using byte 0: Management. This byte makes important parameters, such as Service Identifier, data length, version and status, of the executed service available. Fig. 25 shows that bits 0, 1, 2 and 3 contain the service identifier, in other words, they define which service is to be executed. Bit 4 and bit 5 contain the data length in bytes for the Write service, which in the case of SEW drive inverters should normally be set to 4 bytes.
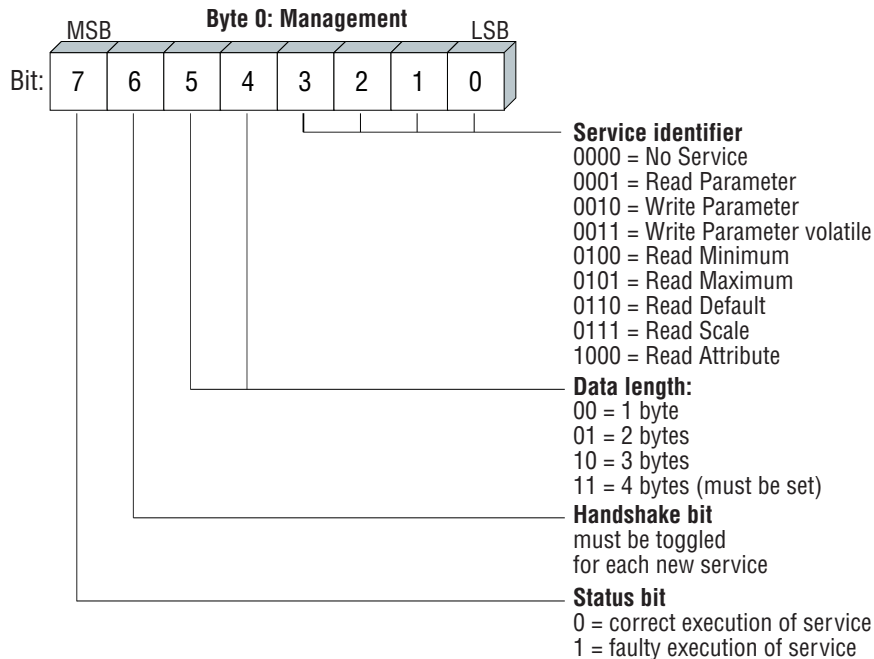

Fig. 25: Structure of the management byte

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Bit 6 is used as a handshake between the control system and the drive inverter. It initiates the execution of the transferred service in the drive inverter. As the parameter channel is transferred in each cycle with the process data, particularly with PROFIBUS-DP, execution of the service in the drive inverter must be initiated by signal transition using the handshake bit 6. The value of this bit is therefore toggled each time a new service is to be executed. The drive inverter uses the handshake bit to signal whether the service has been executed or not. The service is executed when the handshake bit received by the control system corresponds to the handshake bit sent. Status bit 7 indicates whether the service was executed properly or produced a fault.

3.7.1.2 Index Addressing

Byte 2: Index High and byte 3: Index Low are used to identify the parameter to be read or written via the fieldbus system. The parameters of a drive inverter are addressed using a standard index, irrespective of the type of fieldbus system. Byte 1 should be considered reserved and must generally be set at 0x00.

3.7.1.3 Data Area

As shown in Fig. 26 the data are contained in byte 4 to byte 7 of the parameter channel. This allows a maximum of 4-byte data to be transferred per each service. The data are generally entered flush right, i.e. byte 7 contains the least significant data byte (data LSB), byte 4 correspondingly the most significant data byte (data MSB).
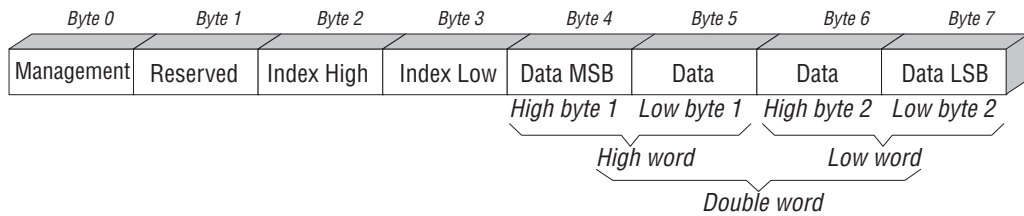
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Management	Reserved	Index High	Index Low	Data MSB	Data	Data	Data LSB
				High byte 1	Low byte 1	High byte 2	Low byte 2
				High word		Low word	
				Double word			

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Fig. 26: Definition of the data area in the parameter channel

3.7.1.4 Faulty Execution of Service

Faulty execution of service is signalled by setting the status bit in the management byte. If the received handshake bit is identical to the transferred handshake bit, the drive inverter has executed the service. If the status bit indicates an error, the error code is entered in the data area of the parameter message (Fig. 27). Bytes 4-7 provide the Return Code in a structured format (see the section Return Codes).
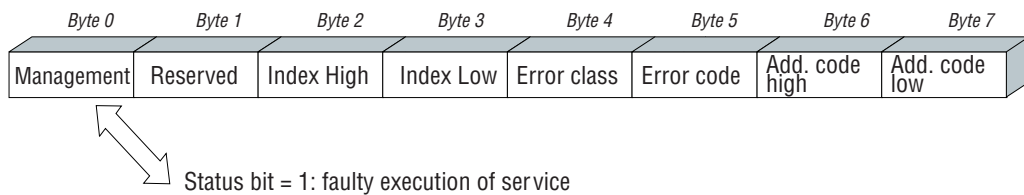
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Management	Reserved	Index High	Index Low	Error class	Error code	Add. code high	Add. code low

Status bit = 1: faulty execution of service

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Fig. 27: Structure of the parameter channel in the event of faulty execution of service

3.7.2 Reading a Parameter via PROFIBUS-DP (Read)

When executing a READ service via the parameter channel, the handshake bit should not be toggled until the entire parameter channel has been set up accordingly for the service in question, as the parameter channel is transferred on a cyclic basis. Adhere to the following sequence of operations to read a parameter:

1. Enter the index of the parameter to be read in byte 2 (Index High) and byte 3 (Index Low).
2. Enter the Service Identifier for the Read service in the management byte (byte 0).
3. Transfer the Read service to the drive inverter by toggling the handshake bit.

As this is a Read service, the transferred data bytes (bytes 4 ...7) and the data length (in the management byte) are ignored and therefore do not need to be entered.

The inverter now processes the Read service and returns the acknowledgement by toggling the handshake bit.
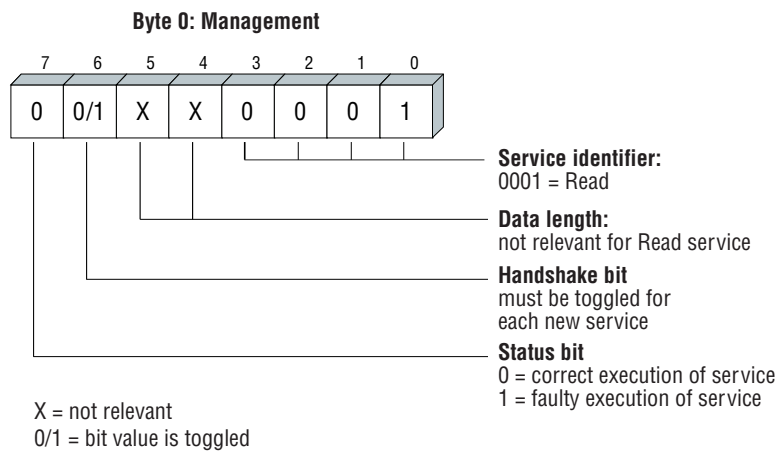

Byte 0: Management

7	6	5	4	3	2	1	0
0	0/1	X	X	0	0	0	1

Service identifier:
0001 = Read

Data length:
not relevant for Read service

Handshake bit
must be toggled for
each new service

Status bit
0 = correct execution of service
1 = faulty execution of service

X = not relevant
0/1 = bit value is toggled

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Fig. 28: Coding of the READ service in the management byte

Fig. 28 shows how the READ service is coded in the management byte. The data length is not relevant so only the Service Identifier for the READ service has to be entered. The service is activated in the drive inverter when the handshake bit is toggled. For example, the Read service could be activated by entering the codes 01hex or 41hex in the management byte.

3.7.3 Writing a Parameter via PROFIBUS-DP (Write)

When executing a WRITE service via the parameter channel, the handshake bit should not be toggled until the entire parameter channel has been set up accordingly for the service in question, as the parameter channel is transferred on a cyclic basis. Adhere to the following sequence of operations to write a parameter:

1. Enter the index of the parameter to be written in byte 2 (Index High) and byte 3 (Index Low).
2. Enter the data to be written in bytes 4...7.
3. Enter the Service Identifier for the Write service in the management byte (byte 0).
4. Transfer the Write service to the drive inverter by toggling the handshake bit.

The drive inverter now processes the Write service and returns the acknowledgement by toggling the handshake bit.

Fig. 29 shows how the WRITE service is coded in the management byte. The data length for all SEW drive inverters is 4 bytes. Transfer of this service to the drive inverter is by toggling the handshake bit. A WRITE service to SEW drive inverters therefore generally has the management byte code 32hex or 72hex.
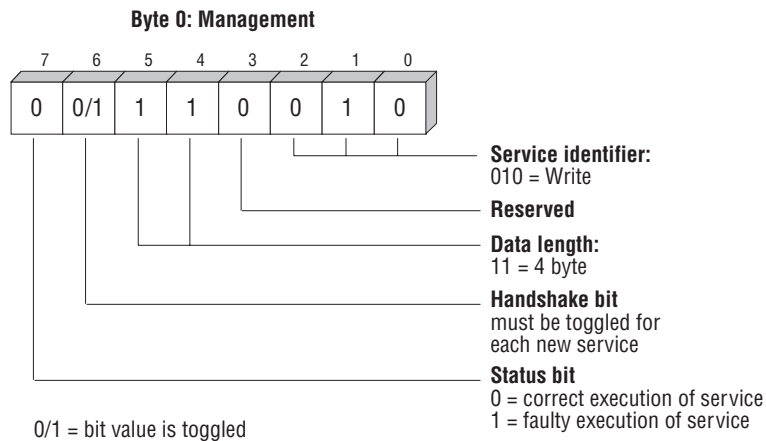

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Fig. 29: Coding of the WRITE service in the management byte

3.7.4 Sequence of Parameter Adjustment via PROFIBUS-DP

Using the WRITE service as an example, Fig. 30 shows the sequence of parameter adjustment between control system and drive inverter on PROFIBUS-DP. To simplify the sequence, only the management byte of the parameter channel is shown in Fig. 30.

While the control system sets up the parameter channel for the Write service, the drive inverter simply receives and returns the parameter channel. The service is first activated when the handshake bit has changed, in this case from 0 to 1. The drive inverter then looks at the parameter channel and processes the Write service, and responds to all messages, though with the handshake bit still = 0. Confirmation that the service has been executed is indicated by the change of the handshake bit in the response message from the drive inverter. The control system recognizes that the received handshake bit is now the same as the one sent and can then prepare a new parameter adjustment.
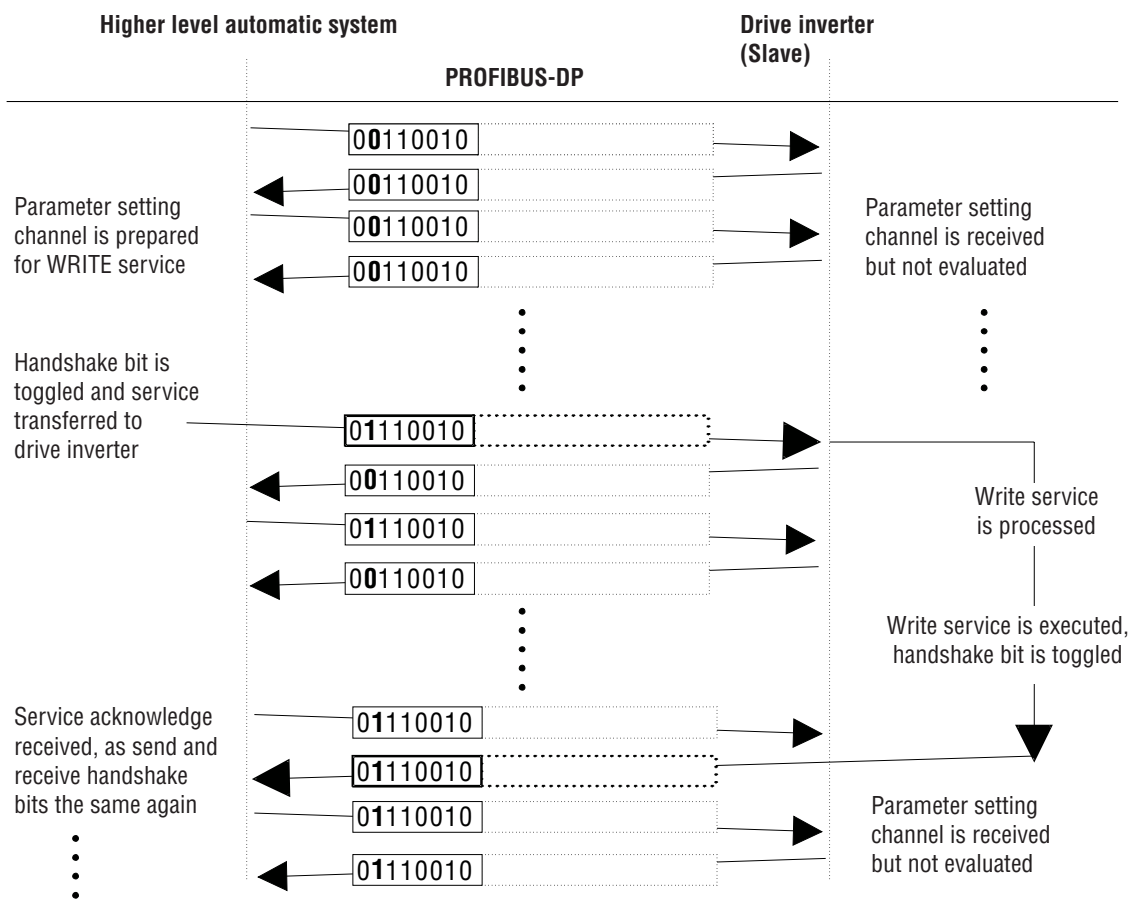
Fig. 30: Sequence of parameter adjustment via PROFIBUS-DP

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3.7.5 Parameter Data Format

When parameterizing via the fieldbus interface the same parameter coding is used as when parameterizing via the serial interfaces RS-485 or the system bus.

For details of the data formats and value ranges of the individual parameters please refer to the SEW MOVIDRIVE® Parameter List documentation.

4 The PROFIBUS-FMS Interface

With the DFP11 option the MOVIDRIVE® drive inverter offers an FMS interface conforming to DIN 19245 Part 2.

4.1 FMS Services

With the DFP11 option, the MOVIDRIVE® drive inverter supports the FMS services shown in Fig. 31. These FMS services conform to the definitions in the sensor/actuator profile. As mostly only the READ and WRITE services as well as the establish link and abort link services are used for communication with the MOVIDRIVE® drive inverter, only these will be discussed below. For more detailed information please refer to DIN 19245 Part 2.
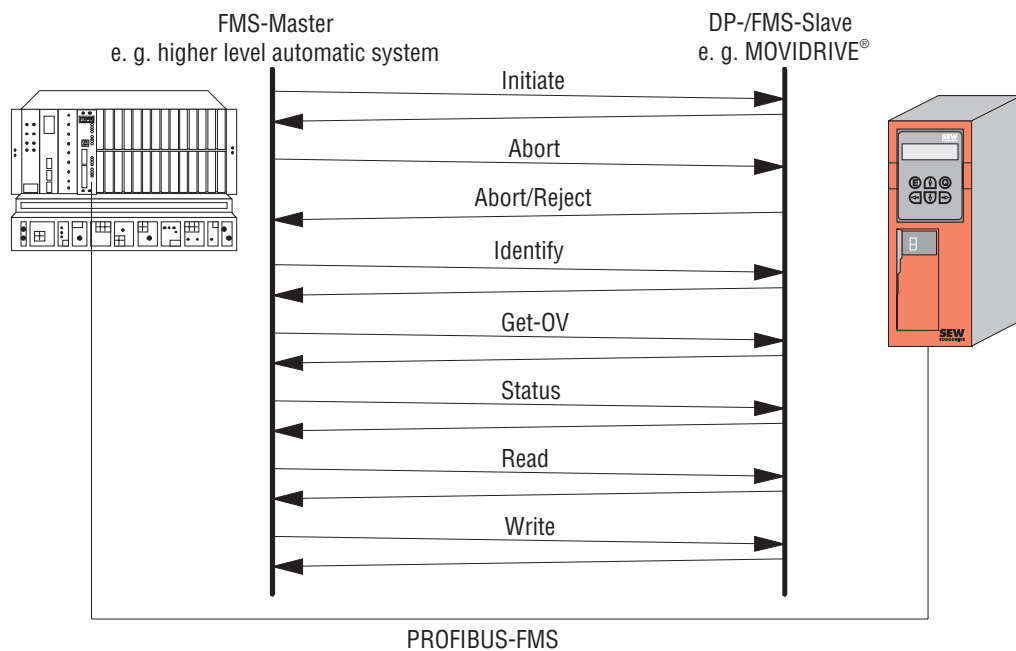

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Fig. 31: FMS services supported by the MOVIDRIVE® drive inverter

4.1.1 Initiate

With the FMS service Initiate (establish link), a communications link is established between an FMS master and the MOVIDRIVE® drive inverter.

The establishment of the link is always performed by the FMS master. As the link is being established, various conventions regarding the communications link are checked, e.g. FMS services supported, user data length, etc. If the link is successfully established, the drive inverter answers with a positive Initiate Response.

If the link could not be established, then the conventions regarding the communications link between the FMS master and MOVIDRIVE® drive inverter do not match. The drive inverter will answer with an Initiate Error Response. In this event, compare the configured communications relationship list of the FMS master with that of the drive inverter.

The attempt to establish an already existing communications link again generally leads to Abort. The communications link will then no longer exist so the FMS service Initiate will have to be performed again to reinstate the communications link.

4.1.2 Abort

An existing communications link between the FMS master and the MOVIDRIVE® drive inverter is cleared using the FMS service Abort. Abort is an unacknowledged FMS service and can be initiated both by the FMS master as well as by the MOVIDRIVE®.

The attempt to establish an already existing communications link again generally leads to Abort. The communications link will then no longer exist so the FMS service Initiate will have to be performed again to reinstate the communications link.

4.1.3 Read

With the FMS service Read, the FMS master can read all the communications objects with index < 9999 (drive parameters) of the MOVIDRIVE® drive inverter. All drive parameters as well as their codes are listed in detail in the MOVIDRIVE® Parameter List documentation.

4.1.4 Write

With the FMS service Write, the FMS master can write all the drive parameters with index < 9999 of the MOVIDRIVE®. If a drive parameter is assigned an invalid value (e.g. value too high), the drive inverter generates a Write Error Response giving the precise cause of the error (see section Return Codes).

4.2 Object List

With the FMS services Read and Write, the FMS master can access all the communications objects defined in the object list.

All drive parameters that can be accessed via the bus system are described as communications objects in the static object list. All objects in the static object list are addressed via a fieldbus index. Table 3 shows the structure of the object list of the MOVIDRIVE® drive inverter.

Index (decimal)	Designation of the communications object
8288	1 process output data word (1 PO)
8289	2 process output data words (2 PO)
8290	3 process output data words (3 PO)
8291	1 process input data word (1 PI)
8292	2 process input data words (2 PI)
8293	3 process intput data words (3 PI)
8294	Min Tsdr
8295	DP station diagnosis data (SlaveDiag)
8296	Download Parameter Block
8297	Reserved
8298	MOVILINK® parameter channel, cyclic
8299	MOVILINK® parameter channel, acyclic
8300	Drive parameter for MOVIDRIVE® (Parameter index see SEW MOVIDRIVE® Parameter List documentation)

Table 3: Structure of the MOVIDRIVE® static object list

4.2.1 Object Description of the Drive Parameters

The drive parameters of the MOVIDRIVE$^{®}$ drive inverter are described in detail in the SEW MOVIDRIVE$^{®}$ Parameter List documentation. In addition to the parameter index, i.e. the number with which you can address the appropriate parameter via the communications interfaces of the drive inverter, you will find further information about the coding, range of values and meaning of the parameter data.

The drive parameters up to index 9999 can be addressed directly via the FMS services READ and WRITE. All other parameters such as IPOS variables and programs, for example, can only be addressed via the MOVILINK$^{®}$ parameter channel. The object description in the object list is identical for all drive parameters. Even parameters that can only be read are given the attribute Read All/ Write All in the object list, as the drive inverter itself carries out the appropriate testing and if necessary supplies a return code. Table 4 shows the object descriptions of all drive parameters.

Index:	8300 - 9999
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	4
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 4: Object description of the MOVIDRIVE$^{®}$ drive parameters
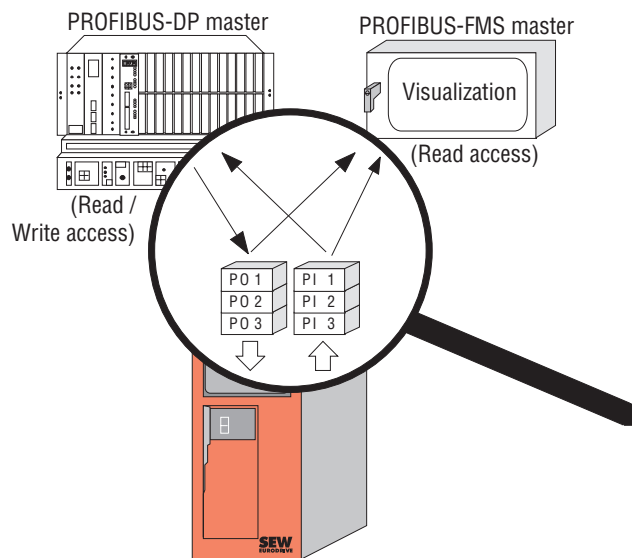
4.2.2 Objects for Process Data Communication

For process data communication via FMS six communications objects are available which are described in Table 5.

Fieldbus index	Designation	Functionality
8288	1 process output data word (1 PO)	1) Only FMS mode: Transfer of a process output data word from the master to the drive inverter with the FMS service Write. 2) In the mixed mode (DP/FMS): Reading a process output data word specified by the DP master (e.g. for visualization) with the FMS service Read.
8289	2 process output data words (2 PO)	1) Only FMS mode: Transfer of two process output data words from the master to the drive inverter with the FMS service Write. 2) In mixed mode (DP/FMS): Reading of two process output data words specified by the DP master (e.g. for visualization) with the FMS service Read.
8290	3 process output data words (3 PO)	1) Only FMS mode: Transfer of three process output data words from the master to the drive inverter with the FMS service Write. 2) In mixed mode (DP/FMS): Reading of three process output data words specified by the DP master (e.g. for visualization) with the FMS service Read.
8291	1 process input data word (1 PI)	Reading of one process input data word (PD 1) with the FMS service Read.
8292	2 process input data words (2 PI)	Reading of two process input data word (PD 1, PD 2) with FMS service Read.
8293	3 process input data words (3 PI)	Reading of three process input data word (PD 1, PD 2, PD3) with FMS service Read.

Table 5: Functionality of the process data objects

In straight PROFIBUS-FMS mode, an FMS higher level automatic system can control the MOVIDRIVE® drive inverter via the process data channel using the communications objects listed in Table 5. The process output data are transferred during this process to the appropriate process output data object by the Write service. Process input data are read by the Read service into the relevant process input data object. Whereas the process input data objects can generally only be read, the process output data objects have both Read and Write access. So in mixed mode (DP/FMS), for example, the process output data sent by the DP master can be read and visualized by the FMS master.

The data consistency required for the exchange of data via PROFIBUS-FMS is achieved by providing the appropriate communications objects for each process data length. With a process data length of 3, for example, process data exchange will only be consistent with the objects "3 PI" and "3 PO". Fig. 32 shows the various ways of accessing communications objects in mixed mode (DP/FMS).

01078AEN

*Fig. 32: Process data access of DP master and FMS master in mixed mode (DP/FMS)*

4.2.2.1 Process Output Data Objects

Table 6, Table 7 and Table 8 show the communications objects for the process output data (setpoints from master to drive inverter). In straight FMS mode, the FMS master can use the FMS service Write to write these objects and thus control the drive inverter via the process data channel. Furthermore, in mixed mode (DP/FMS) an FMS master can use the FMS service Read to read (and if necessary visualize) the setpoints specified by a DP master via PROFIBUS-DP.

Index:	8288
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	2 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 6: Description of the object "1 process output data word (1 PO)"

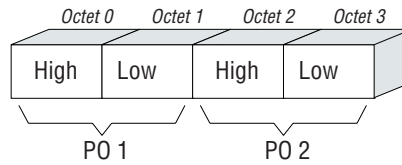Fig. 33 shows the structure of the object "1 process output data word (1 PO)".
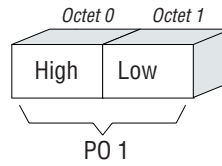
Fig. 33: Structure of the object "1 process output data word (1 PO)"

Index:	8289
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	4 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 7: Description of the object "2 process output data words (2 PO)"

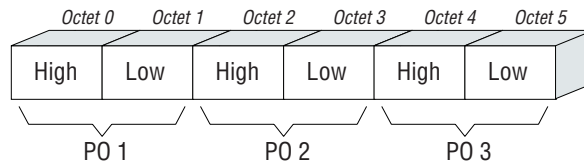Fig. 34 shows the structure of the object "2 process output data words (2 PO)".

Fig. 34: Structure of the object "2 process output data words (2 PO)"

Index:	8290
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	6 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 8: Structure of the object "3 process output data words (3 PO)"

Fig. 35 shows the structure of the object "3 process output data words (3 PO)".

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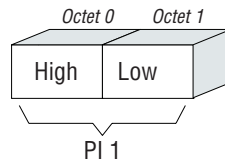*Fig. 35: Structure of the object "3 process output data words (3 PO)"*

4.2.2.2 Process Input Data Objects

Table 9, Table 10 and Table 11 show the communications objects for the process input data (actual values of the drive inverter). These objects can only be read with the FMS service Read.

Index:	8291
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	2 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 9: Description of the object "1 process input data word (1 PI)"

Fig. 36 shows the structure of the object "1 process input data word (1 PI)".

00158AEN

Fig. 36: Structure of the object "1 process input data word (1 PI)"

Index:	8292
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	4 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 10: Description of the object "2 process input data words (2 PI)"

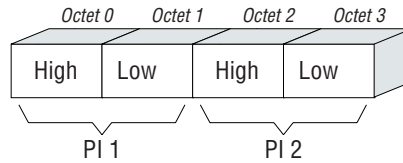Fig. 37 shows the structure of the object "2 process input data words (2 PI)".

00159AEN

Fig. 37: Structure of the object "2 process input data words (2 PI)"

Index:	8293
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	6 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 11: Structure of the object "3 process input data words (3 PI)"

Fig. 38 shows the structure of the object "3 process input data words (3 PI)" .
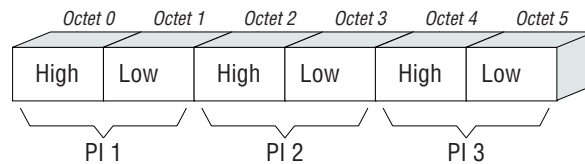
00160AXX

Fig. 38: Structure of the "3 process input data words (3 PI)" object

4.2.3 "Min Tsdr" Object

Where several PROFIBUS masters (higher level automation system) are present, it is often necessary to modify the response delay time (min TSDR). This has to be done when the drive inverter responds faster than the master can switch between send and receive. DIN 19245 defines default values with which every PROFIBUS master or slave in a PROFIBUS network can safely be operated.

This minimum response delay time for PROFIBUS is set using the DIP switch on the option pcb (see Fig. 8). This DIP switch is used to toggle between the min TSDR default value for straight DP applications and the min TSDR default value for mixed FMS/DP applications. The default values for the minimum response delay time defined in DIN 19245 will be chosen depending on the selected baud rate.

The FMS object "Min Tsdr" can then be used to read or write the min TSDR bus parameter directly. Table 12 shows the definition of the min TSDR object. When changing min TSDR remember that when the drive inverter is powered up again (mains supply and 24 V supply ON/OFF), however, the min TSDR default value will again be operative.

Index:	8294
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	1 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 12: Description of the "Min Tsdr" object

Important

Changing min TSDR can cause major malfunctions across the entire PROFIBUS network and should therefore only be done by PROFIBUS experts. As a rule, the default setting according to DIN 19245, which is set using the DIP switch on the option pcb, is more than adequate. These DIN 19245 default values guarantee stable operation of the PROFIBUS network.

4.2.4 "DP Station Diagnosis" Object

The diagnostic messages of the drive inverter in DP mode are stored in this object. The DP master can retrieve these diagnostic data using the DP service DDLM_SlaveDiag. An FMS master can retrieve these diagnostic messages via this communications object using the FMS service Read. Table 13 provides a definition of this communications object.

Index:	8295
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	6
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 13: Description of the "DP Station Diagnosis" object

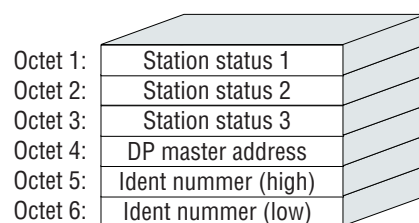| Octet 1:	Station status 1
Octet 2:	Station status 2
Octet 3:	Station status 3
Octet 4:	DP master address
Octet 5:	Ident nummer (high)
Octet 6:	Ident nummer (low)

00161AEN

Fig. 39: Structure of the "DP Station Diagnosis" object

The "DP Station Diagnosis" object consists of six octets, structured as shown in Fig. 39. The contents of the individual octets conform to DIN E 19245 (Part 3) and are not discussed here.

4.2.5 "Download Parameter Block" Object

The "Download Parameter Block" object enables a maximum of 38 MOVIDRIVE[®] drive parameters to be written at the same time. This means you can use this object to parameterize the drive inverter in the start-up phase with only one Write service call. Since, as a rule, only a few parameters have to be altered, this parameter block with a maximum of 38 parameters is adequate for almost all applications. The user data area is fixed at 38 x 6 + 2 bytes = 230 bytes (octet string type). Fig. 40 shows the structure of the "Download Parameter Block" object.

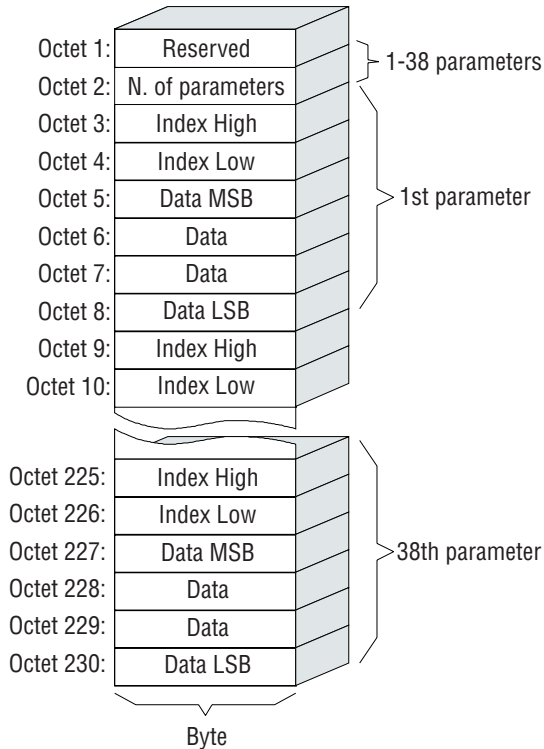00162AEN

Fig. 40: Structure of the "Download Parameter Block" object

The "Download Parameter Block" object is only handled locally on the fieldbus option pcb and is defined as shown in Table 14.

Index:	8296
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	230
Local address:	-
Password:	-
Access groups:	-
Access rights:	Write all
Name[16]:	-
Extension length:	-

Table 14: Description of the "Download Parameter Block" object

With the WRITE service to the "Download Parameter Block" object, a parameterization mechanism is started in the fieldbus option pcb that successively transfers to the drive inverter all the parameters in the user data area of the object.

After successfully processing the Download Parameter Block, i.e. all parameters transferred from the FMS-master have been written, the Write service is ended with a positive Write Response. In the event of an error, a negative Write Response is returned. In this event, the return code will contain more precise details about the type of error and, in addition, the parameter number (1..38) where the error occurred (see example).

```
Write Error Response:
Error Class:        8      Other
Error Code:         0      Other
Additional Code High: 11dec  Error writing parameter 11
Additional Code Low:  15 hex Value too large
```

Example: Error writing parameter 11

If an error occurs when a parameter is written, processing of the parameter block is aborted. All parameters in the block following the faulty parameter are not transmitted to the drive inverter and remain unchanged.

4.2.6 "MOVILINK Cyclic Parameter Channel" Object

This object is 8 bytes long and comprises the cyclic MOVILINK® parameter channel. All MOVILINK® communications services can be executed by Reading and Writing to this object in alternating cycles. The communications service is executed only when the handshake bit is toggled in the management byte. The MOVILINK® parameter channel permits access to all indices, including the IPOS variable and program memory.

Fig. 41 shows the structure of this communications object. For the structure of the parameter channel please refer to the "MOVILINK® Communications Device Profile" Manual and the DP Section of this Manual.
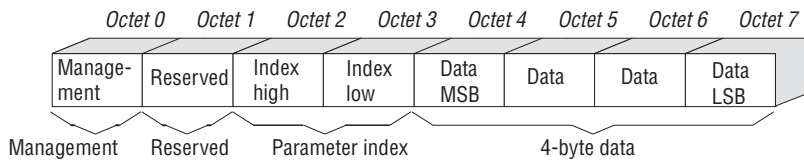
01236AEN

Fig. 41: Structure of the "MOVILINK Cyclic Parameter Channel"object

The "MOVILINK Cyclic Parameter Channel" object is only handled locally on the fieldbus option pcb and is defined as shown in Table 15.

Index:	8298
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	8
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all/Write all
Name[16]:	-
Extension length:	-

Table 15: Definition of the "MOVILINK Cyclic Parameter Channel" object

Fig. 42 shows the sequence of parameter access via the cyclic MOVILINK® parameter channel. The inverter will only start executing the service when the master has toggled the handshake bit in the parameter channel. To do this, the master has to read the parameter channel at the beginning of the parameter adjustment in order to maintain the present status of the handshake bit in the inverter. The master can now initiate the evaluation of the parameter channel in the inverter by toggling the handshake bit. The inverter will then execute the service coded in the parameter channel and enter the service acknowledgement in the parameter channel. The master will receive the service acknowledgement with the next Read access to the "MOVILINK Cyclic Parameter Channel".
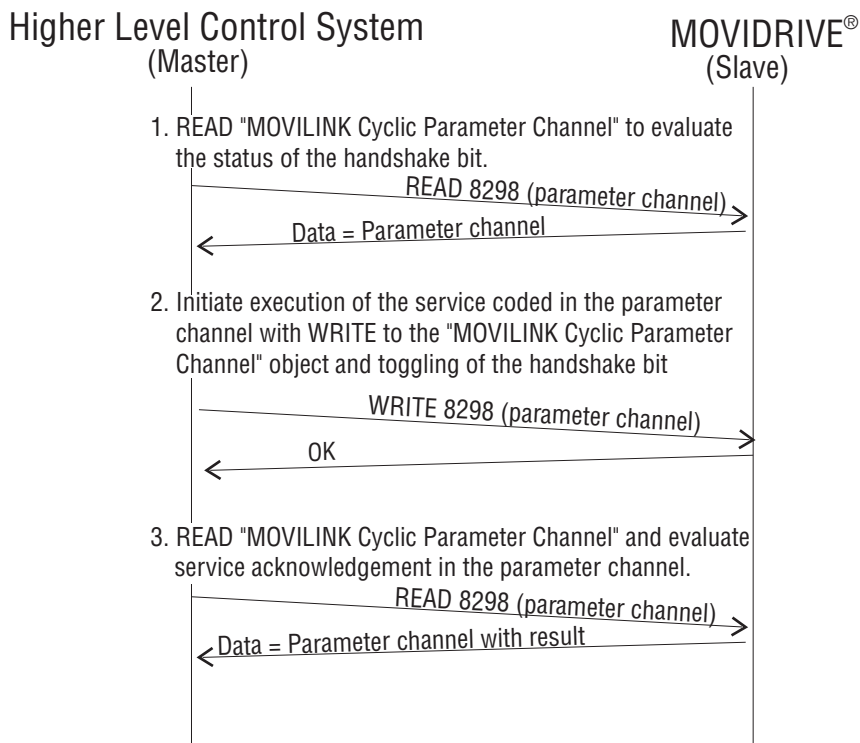

01237AEN

Fig. 42: Sequence of the cyclic FMS services for parameter access with "MOVILINK Cyclic Parameter Channel"

4.2.7 "MOVILINK Acyclic Parameter Channel" Object

The "MOVILINK Acyclic Parameter Channel" object is 8 bytes long and comprises the MOVILINK® parameter channel. This object can be used for acyclic parameter access, i.e. the drive inverter will execute the service coded in the parameter channel each time it receives a WRITE service to this object. The handshake bit is not evaluated. Fig. 43 shows the structure of the "MOVILINK Acyclic Parameter Channel" communications object. For the structure of the parameter channel please refer to the "MOVILINK® Communications and Device Profile" documentation and the DP Section of this Manual.
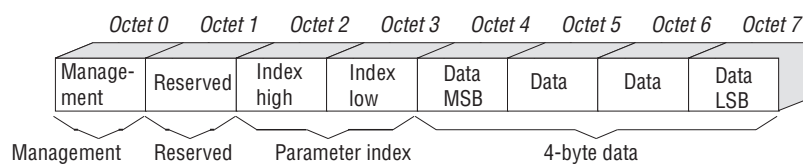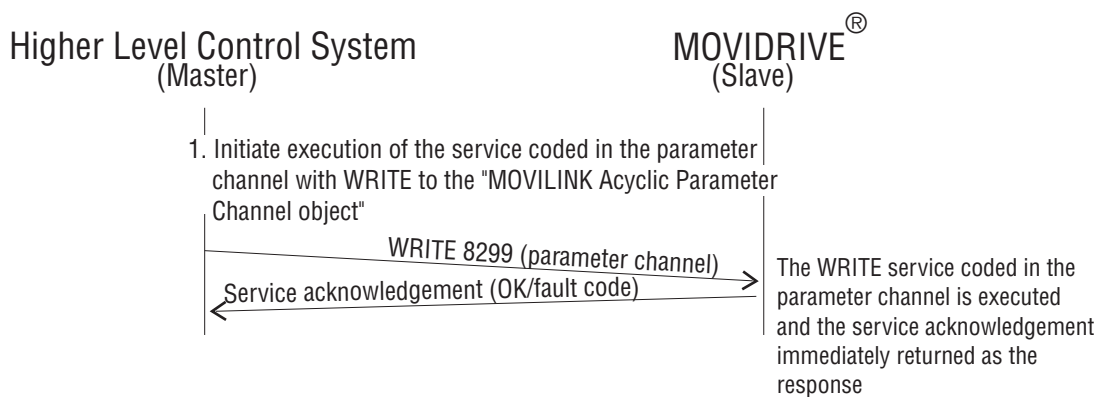

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Fig. 43: Structure of the "MOVILINK Acyclic Parameter Channel" object

When the drive inverter is parameterized via the acyclic MOVILINK® parameter channel, a distinction is made between the following two operations:

1) Parameter channel executes a Write service.

2) Parameter channel executes a Read service.

1) Parameter channel executes a Write service

If a Write service is executed via the acyclic parameter channel (e.g. Write Parameter, Write Parameter Volatile) the inverter will return the service acknowledgement for this service after it has executed the service. If the Write access produces a fault, the corresponding fault code is returned.

This variant has the advantage that by sending one WRITE MOVILINK® Parameter Channel the Write services can be executed and the service be acknowledged by the evaluation of the FMS confirmation (Fig. 44).

Higher Level Control System (Master)   MOVIDRIVE® (Slave)

1. Initiate execution of the service coded in the parameter channel with WRITE to the "MOVILINK Acyclic Parameter Channel object"

WRITE 8299 (parameter channel)

Service acknowledgement (OK/fault code)

The WRITE service coded in the parameter channel is executed and the service acknowledgement immediately returned as the response

01238AEN

Fig. 44: Execution of Write services via the acyclic MOVILINK® parameter channel

2) Parameter channel executes a Read service

If a Read service is executed via the acyclic parameter channel (e.g. Read Parameter, Read Default, etc.), the inverter will enter the read data in the parameter channel together with the service acknowledgement when the service has been executed. For the master to receive these data an FMS-READ access to the acyclic parameter channel must be executed. Therefore, to carry out Read services via the parameter channel, an FMS-WRITE service followed by an FMS-READ service are required. Fig. 45 shows this sequence.
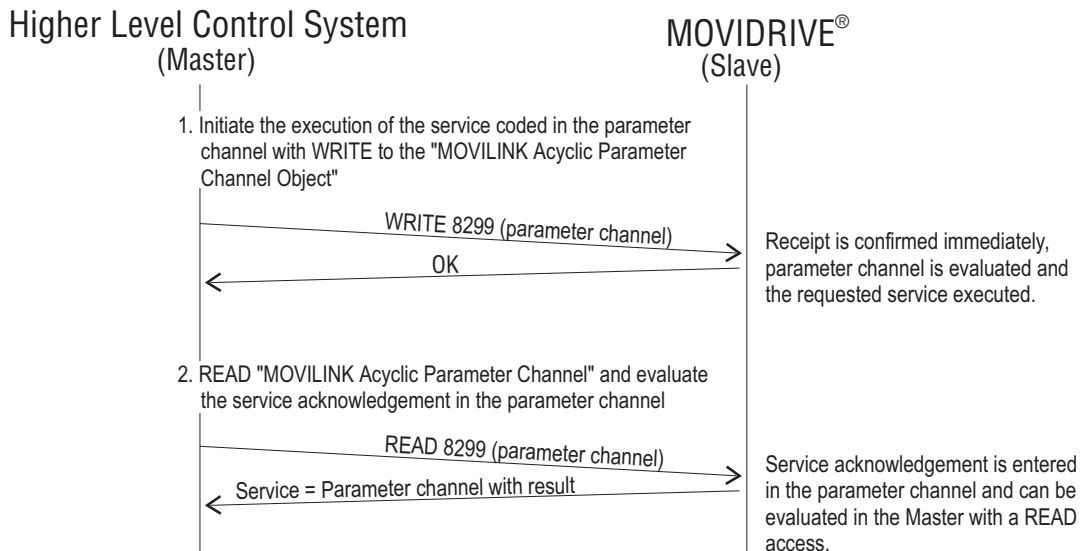

Fig. 45: Execution of the Read services via the acyclic MOVILINK $^{®}$ parameter channel

01239AEN

The "MOVILINK$^{®}$ Acyclic Parameter Channel" object is only handled locally on the fieldbus option pcb and is defined as shown in Table 16.

Index:	8299
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	8
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

Table 16: Definition of the "MOVILINK Acyclic Parameter Channel" object

4.3   Communications Relationship List (CRL)

The communications relationships between the MOVIDRIVE$^{®}$ drive inverter and the FMS master are stored in the Communications Relationship List (CRL). You will need these CRL data to configure an FMS master that is to communicate with the MOVIDRIVE$^{®}$ drive inverter via PROFIBUS-FMS.

5 Parameter Adjustment Return Codes

If parameters are adjusted incorrectly, different return codes are sent back from the drive inverter to the higher level automation system, providing detailed information about the cause of the error. These return codes are generally structured according to DIN 19245 Part 2. A distinction is made between the following elements

- Error class
- Error code
- Additional code

These return codes are described in detail in the Fieldbus Communications Profile Manual and are not part of this documentation. However, the following special cases can arise in connection with a PROFIBUS-FMS/DP:

5.1 Incorrect Service Code in the Parameter Channel

An incorrect service was specified for the management and reserved bytes when parameterizing the drive inverter via the parameter channel. Table 17 shows the return code for this special case.

	Code (dec)	Meaning
Error class:	5	Service
Error code:	5	Illegal parameter
Add. code high:	0	-
Add. code low:	0	-

Table 17: Return code in the case of incorrect coding of bits 0 and 1 in the parameter channel

Error rectification:

Check bits 0 and 1 in the parameter channel.

5.2 Incorrect Specification of the Data Length in the Parameter Channel

When parameterizing via the parameter channel a data length not equal 4 data bytes was specified in the Read or Write service. Table 18 shows the return code.

	Code (dec)	Meaning
Error class:	6	Access
Error code:	8	Type conflict
Add. code high:	0	-
Add. code low:	0	-

Table 18: Return code for incorrect length in the parameter channel (length ≠ 4)

Error rectification:

Check bit 4 and bit 5 for the data length in the management byte of the parameter channel. Both bits must be 1.

5.3   Internal Communications Error

The return code shown in Table 19 is returned if an internal communications error has occurred. It may be that the parameter adjustment service transferred via fieldbus was not executed and should be repeated. If this error recurs the drive inverter must be switched off and then on again to reinitialize the unit.

	Code (dec)	Meaning
Error class:	6	Access
Error code:	2	Hardware fault
Add. code high:	0	-
Add. code low:	0	-

Table 19: Return code if an internal communications error has occurred

Error rectification:

Repeat the READ or WRITE service. If the error recurs you should briefly disconnect the drive inverter from the mains supply and then switch it on again. If the error persists, consult the SEW Service Department.

6   Technical Data

SEW No. for Profibus Option PCB:
822 724 1

Profibus protocol options:
- PROFIBUS-FMS to DIN 19245 Part 2
- PROFIBUS-DP to DIN E 19245 Part 3
- Mixed mode PROFIBUS-FMS/DP (Combislave)

Auto-baud detect for:
- 9.6 kBaud
- 19.2 kBaud
- 93.75 kBaud
- 187.5 kBaud
- 500 kBaud
- 1500 kBaud

Connection system:
- 9-pin type D connectors
- Pin assignment to DIN 19245 Part 1 / EN 50170

Bus termination:
- Connectable for cable type A (up to 1500 kBaud) to DIN E 19245 Part 3 / EN 50170

Station address:
- 0-125 settable via DIP switch

Default bus parameter:
- Min TSDR for FMS/DP and DP mode selectable via DIP switch

Name of GSD file:
- SEW_6000.GSD

DP Ident Number:
- 6000hex = 24576dec

DP configurations for DDLM_Chk_Cfg:
- F0 hex = 1 process data word (1 I/O word)
- F1hex = 2 process data words (2 I/O words)
- F2hex = 3 process data words (3 I/O words)
- F3hex, F0hex = parameter channel + 1 process data word (5 I/O words)
- F3hex, F1hex = parameter channel + 2 process data words (6 I/O words)
- F3hex, F2hex = parameter channel + 3 process data words (7 I/O words)

Commissioning tools:
- MX_SHELL software, version V1.00 and higher
- DBG11 control keypad

Appendix

Appendix A

The definition for cable type A for PROFIBUS-DP is set forth in DIN E 19245 Part 3:

Parameter:	Cable type A PROFIBUS-DP
Surge impedance	135 ... 165 Ohm (3 ... 20 MHz)
Capacitance per unit length	< 30 pF/m
Loop resistance	< 110 Ohm/km
Core diameter	> 0.64 mm
Core cross-section	> 0.34 mm^2

Appendix B

CRL Definition

The communications relationship lists for the PROFIBUS-FMS contain various elements of definition. For a more detailed explanation please refer to DIN 19245 Part 2.

The following tables show the individual communications relationships supported by the MOVIDRIVE$^®$ drive inverter. Although the drive inverter does not use any Event services, i.e. the drive inverter cannot execute a slave initiative, communications links with slave initiative are supported. Whereas the Physical Read and Physical Write services are supported according to the CRL, no Physical Write access can be executed.

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
2	MSZY	0	20	All	All	0	0	0	0	3000

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	00 00 00 00 20 00	Read.indication
Send LoPrio	241		
Rec. HiPrio	0		
Rec. LoPrio	241		

Table 20: CRL for master-slave, cyclic, Read

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
3	MSZY	0	21	All	All	0	0	0	0	3000

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	00 00 00 00 10 00	Write.indication
Send LoPrio	241		
Rec. HiPrio	0		
Rec. LoPrio	241		

Table 21: CRL for master-slave, cyclic, Write

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
4	MSZY_SI	O	22	All	All	0	0	1	0	3000

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	241	00 00 10 00 20 00	Read.indication
Send LoPrio	241		Event-Notification.request*
Rec. HiPrio	0		
Rec. LoPrio	241		

Table 22: CRL for master-slave, cyclic, with slave initiative, Read

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
5	MSZY_SI	O	23	All	All	0	0	1	0	3000

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	241	00 00 10 00 10 00	Write.indication
Send LoPrio	241		Event-Notification.request*
Rec. HiPrio	0		
Rec. LoPrio	241		

Table 23: CRL for master-slave, cyclic, with slave initiative, Write

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
6	MSZY_SI	O	24	All	All	0	1	1	0	0

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	00 00 10 80 33 06	Read.ind
Send LoPrio	241		Write.ind
Rec. HiPrio	0		Phys.-Read.ind
Rec. LoPrio	241		Phys.-Write.ind
			Get-OV-long.indication
			Event-Notification.request*
			Acknowledge-Event-Notification.ind*
			Alter-Event-Condition-Monitoring.ind*

Table 24: CRL for master-slave, acyclic with slave initiative

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
7	MSAZ	O	25	All	All	0	1	0	0	0

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	00 00 00 80 33 00	Read.ind Write.ind
Send LoPrio	241		Phys.-Read.ind
Rec. HiPrio	0		Phys.-Write.ind
Rec. LoPrio	241		Get-OV-long.indication

Table 25: CRL for master-slave, acyclic

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
8	MSAZ	O	26	All	All	0	1	0	0	0

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	00 00 00 80 33 06	Read.ind Write.ind
Send LoPrio	241		Phys.-Read.ind
Rec. HiPrio	0		Phys.-Write.ind
Rec. LoPrio	241		Get-OV-long.indication
			Acknowledge-Event-Notification.ind*
			Alter-Event-Condition-Monitoring.ind*

Table 26: CRL for master-slave, acyclic, with event notification for cyclic connections

Though FMS services for event processing which are marked with an asterisk (*) are offered in the CRL, they are not supported by the MOVIDRIVE® drive inverter.

Communications Relationship List of the Master

A CRL corresponding to the CRL in the drive inverter must be configured in the FMS master to be able to communicate with the MOVIDRIVE® drive inverter via PROFIBUS-FMS. The master CRL must conform to the following conventions:

1. The FMS master may expect no more services from the slave than supported by the latter. The "Features supported" parameter may therefore only contain the service primitives (Request) that are defined as indications in the corresponding slave CRL.

2. The size of the Receive PDU (Rec. HiPrio, Rec.LoPrio) of the master must at least be that of the Send PDU (Send HiPrio, Send LoPrio) of the slave.

3. The corresponding flow control counters must agree ($SCC_{Master} = RCC_{Slave}$ and $RCC_{Master} = SCC_{Slave}$).

Table 27 shows a communications relationship list specified in the master referring to a drive inverter with the station address 8 and the CREF 7.

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
3	MSAZ	D	NIL	25	8	1	0	0	0	0

max PDU Size:		Features supported	Supported FMS services
Send HiPrio	0	80 33 00 00 00 00	Read.req
Send LoPrio	241		Write.req
Rec. HiPrio	0		Phys.-Read.req
Rec. LoPrio	241		Phys.-Write.req
			Get-OV-long.req

Table 27: Example of a master CRL for an acyclic master-slave link

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Worldwide.**

SEW-EURODRIVE right around the globe is your competent partner in matters of power transmission with manufacturing and assembly plants in most major industrial countries.