MOVITRAC® 31.. Frequency Inverter

PROFIBUS Fieldbus Interface (FFP 31.. Option and Size 0/DP) Manual

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08/198/96

PROFI PROCESS FIELD BUS

0922 6818 / 0498

TÜV CERT DIN EN ISO 9001

SEW EURODRIVE

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

- **Safety notes:**
  Always follow the safety notes contained in this User Manual.
  Safety notes are marked as follows:

	**Electrical hazard,** e.g. during live working
	**Mechanical hazard,** e.g. when working on hoists
	**Important Instructions** for the safe and fault-free operation of the system, e.g. pre-setting before commissioning. Failure to follow these instructions may result in injury to people and damage to property.

- **General safety notes for bus systems:**
  The fieldbus option gives you a communications system which allows you to match the MOVITRAC® 31.. drive system 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 (not uncontrolled, though) system behaviour.

- **In this manual, cross-references are marked with a →, e.g.,**
  (→ MC_SHELL) means: Please refer to the MC_SHELL User 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 User 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 as well as the user interface herein described, 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.
  These instructions contain important information for servicing, they should therefore be kept in the vicinity of the unit.

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Preface

This manual for the PROFIBUS interface describes the procedure for installing the FFP 31C PROFIBUS option pcb in the inverter, for installing the MOVITRAC® 31.. size 0 with integrated PROFIBUS-DP interface and for commissioning MOVITRAC® 31.. frequency inverter when connected to a 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 inverter to PROFIBUS-DP or PROFIBUS-FMS in the form of brief commissioning examples.

In addition to this PROFIBUS Option User Manual, the following more detailed documentation on fieldbuses is also necessary in order to enable the MOVITRAC® 31.. to be connected simply and efficiently to the fieldbus system (e.g. PROFIBUS):

– User Manual Fieldbus Unit Profile MOVITRAC® 31.., part number 0922 7016

– User Manual Communications Interfaces and Parameter List MOVITRAC® 31..
part number 0923 0580

The MOVITRAC® 31.. Fieldbus Unit Profile Manual gives a detailed description of the fieldbus parameters and their codes and discusses various control concepts and application options in the form of brief commissioning examples.

The MOVITRAC® 31.. Parameter List contains a list of all the inverter parameters that can be read or written via the various communications interfaces such as the RS-232, RS-485, and via the fieldbus interface.

Note:
These instructions also apply to the inverter MOVITRAC® 31.. size 0 with integrated PROFIBUS-DP interface. Functions, which are not supported by this unit, are labeled with the note “(Not with MOVITRAC® 31.. size 0)”.

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Contents

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1 Introduction

Thanks to its high-performance, universal fieldbus interface, the MOVITRAC® 31.. inverter with the FFP 31C option enables connections to be made with higher-level automation systems via the open and standardized serial PROFIBUS-FMS and PROFIBUS-DP bus system.

In addition MOVITRAC® 31.. size 0 with PROFIBUS-DP with standard integrated DP Interface offers full inverter functionality with extremely compact design.

PROFIBUS-FMS

PROFIBUS-FMS (Fieldbus Message Specification) is designed for non-time-critical applications in automation engineering such as, for example, networking different automation systems of various manufacturers. In drive engineering the PROFIBUS-FMS is mainly used for visualization and parameter adjustment of drives, as larger, non-time-critical amounts of data can be exchanged in a simple way. PROFIBUS-FMS is defined in EN 50170 Volume 2 / DIN 19245 Part 2.

PROFIBUS-DP

PROFIBUS-DP (Decentralized Periphery) is mainly used for communication with decentralized peripherals, i.e. in the sensor/actuator field, where short system reaction times are required. The main task of PROFIBUS-DP is the fast cyclic data exchange between central automation units (PROFIBUS master) and decentralized peripherals, such as inverters. PROFIBUS-DP is defined in EN 50170 Volume 2 / DIN E 19245 Part 3.

PROFIBUS-FMS and PROFIBUS-DP can generally be operated on a joint transmission medium. If a joint transmission medium is used, however, the units which are to communicate directly with each other must be able to understand the same protocol option.

MOVITRAC® 31.. with FFP 31 = Combislave

With the FFP 31C PROFIBUS option pcb the MOVITRAC® 31.. inverter as Combislave unit supports both PROFIBUS-FMS and PROFIBUS-DP. This allows the 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 inverter using PROFIBUS-FMS. Of course the inverter may be controlled and parameters set using only PROFIBUS-DP or only PROFIBUS-FMS, too.

MOVITRAC® 31.. size 0 with integrated PROFIBUS-DP Interface

The MOVITRAC® 31.. size 0/DP inverter is already standard equipped with a PROFIBUS-DP interface. This allows the inverter to be controlled and parameters set via PROFIBUS-DP in the same way as the larger unit sizes with the option FFP 31.

MOVITRAC® 31.. and PROFIBUS

The inverter unit profile for PROFIBUS mode, i.e. the way the 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. the open standardized INTERBUS-S (FFI 11A option) sensor/ actuator bus.

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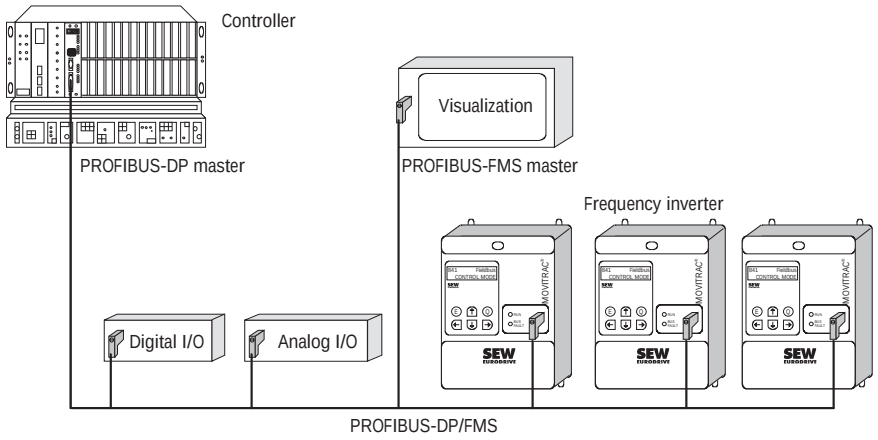

Fig. 1: PROFIBUS-DP and/or FMS with MOVITRAC®

MOVITRAC® 31.. offers digital access to all drive parameters and functions via the PROFIBUS interface. The 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 inverter, such as actual speed, current, unit status, error 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 inverter itself, which can be very time-consuming.

The PROFIBUS option pcb is designed so that all fieldbus specific settings, such as the station address or the default parameters, can be made by the option pcb by means of a hardware switch. These manual settings enable the 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 forward-looking version 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 recorded directly in the control program.

The use of a fieldbus system in drive technology requires additional monitoring functions, such as fieldbus timeout or special emergency stop concepts. The monitoring functions of the MOVITRAC® 31.. can be matched to the specific application for which it is to be used. This feature enables you, for instance, to specify which fault response the 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 inverter is operated in the fieldbus mode, fieldbus-independent emergency stop concepts can still be implemented via the inverter's terminals.

The MOVITRAC® 31.. inverter offers numerous diagnostic facilities for commissioning and servicing. For instance, both the setpoints transmitted from the higher-level control unit as well as the actual values can be checked with the fieldbus monitor in the hand-held keypad. It also provides you with a lot of additional information on the status of the fieldbus option pcb. The PC software MC_SHELL offers even more convenient diagnostic facilities in that it provides a detailed display of the fieldbus and unit status information as well as the facility to set all the drive parameters (including the fieldbus parameters).

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2 Assembly / Installation Instructions

The following section describes the assembly and installation of the MOVITRAC® 31.. inverters for the integration in a PROFIBUS network.

For MOVITRAC® 31.. size 1-4 the inverter is generally connected to the PROFIBUS via the FFP 31 option pcb. MOVITRAC® 31.. size 0 with PROFIBUS-DP have the PROFIBUS-DP interface already integrated in the basic unit. They only support the DP-option, whereas the FFP 31.. option pcb as combislave option supports PROFIBUS-DP as well as PROFIBUS-FMS.

2.1 Installing the FFP 31.. Option pcb

For size 1-4 the inverters are connected to the PROFIBUS via the FFP 31 option pcb. The option pcb is either supplied separately, so that you can fit yourself or, if specified when ordering an inverter, with the FFP 31 option pcb already installed inside the unit.

2.1.1 Scope of delivery

Unless the FFP 31 option pcb is already installed in the MOVITRAC® 31.. inverter, please check the scope of delivery. The scope of delivery consists of the following components:

– 1 FFP 31 (PROFIBUS FMS/DP) option pcb
– 3 fastening screws
– 1 housing cover

2.1.2 Supported inverter types

The FFP 31.. option pcb for connection to a PROFIBUS-FMS/DP system can be operated with MOVITRAC® 31.. size 1-4 as follows:

Option FFP 31A: With the inverters MOVITRAC® 31B with **service code of component 4 greater or equal 14** (→ Installation and Operating Instructions MOVITRAC® 31B section 4).

Option FFP 31C: With all inverters MOVITRAC® 31C size 1-4.

To adjust the fieldbus parameters you need a keypad for MOVITRAC® 31.. and/or the current PC program MC_SHELL !

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2.1.3 Assembly instructions

The FFP 31.. must only be installed by electronic equipment specialists, observing the following ESD protection measures:

- Before touching the pcb, make sure you have taken appropriate e.s.d. measures (wrist strap, conductive shoes etc.)
- Earth the units and work bench.
- Store the option pcb in its original packaging and only take it out shortly before installation.
- Hold the option pcb by its edge and do not touch unnecessarily.

Procedure for Fitting the Option PCB:

1. Ensure that the entire inverter system is voltage-free. Switch off the mains power and, if applicable, the external 24 V supply.
2. Take off the housing cover after removing the three recessed head screws.
3. Remove the right upper option pcb or the system EPROM pcb after undoing the screws. (→ see Fig. 2).
4. Fit the FFP 31 option pcb and fasten with three screws.
5. Remove cover strip above the option pcb slot from the housing cover.
6. Refit the housing cover and secure with the three recessed head screws.
7. Push on new cover for the PROFIBUS option pcb slot.

The FFP 31 option pcb is now completely fitted.

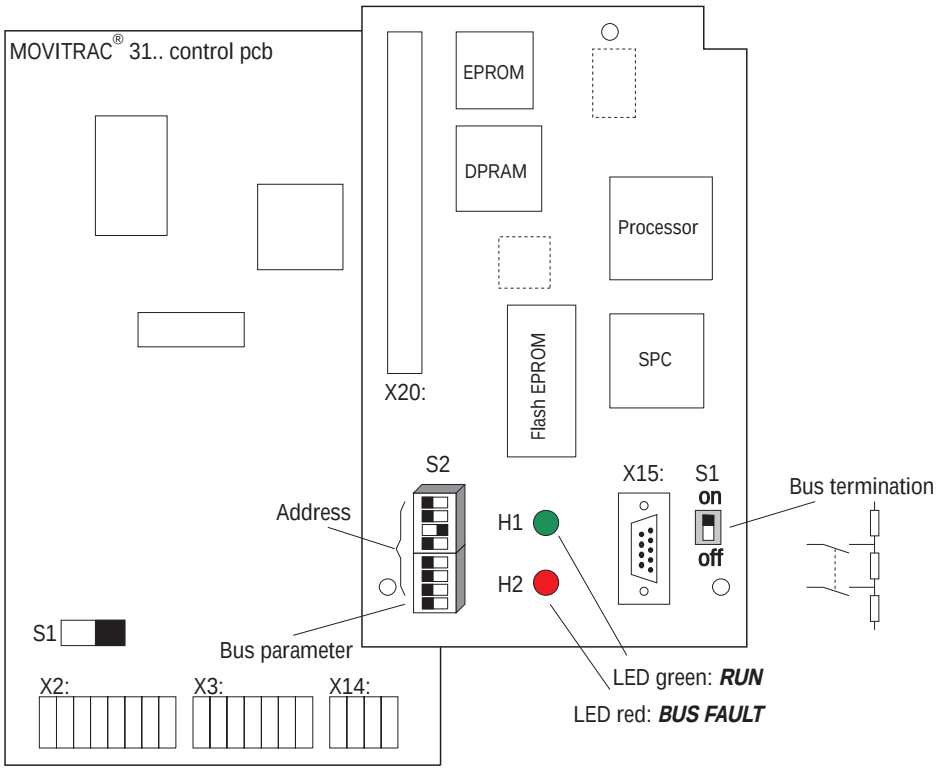

Fig. 2: The FFP 31 option

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2.2 Installation of the MOVITRAC® 31.. size 0/DP

The size 0 inverters (MOVITRAC® 31.. size 0/DP) have the PROFIBUS-DP interface already integrated in the basic unit. They only support the DP-option! Fig. 3 shows the general design of the MOVITRAC® 31.. size 0/DP.

1 LED green: RUN
2 LED red: BUS FAULT
3 DIP switch for setting of the station address
4 DIP switch for connecting/ disconnecting the bus terminating resistor
5 9-pin type D-socket for the bus connection

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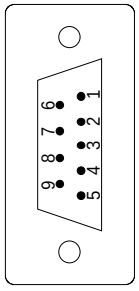
Fig. 3: Unit with PROFIBUS-DP interface and option FBG 31

2.3 Pin Assignment

The MOVITRAC® 31.. frequency inverter is connected to the PROFIBUS network via a 9-pin type D connector in accordance with EN 50170 V2 / DIN 19245 Part 3. Connection to the T bus is with an appropriately designed connector or a bus terminal. Fig. 4 shows the pin assignment. As the bus terminating resistors on the option pcb can be connected, it is not necessary to use a type D connector with integrated terminating resistors.

9-pin type D connector



Pin no.	Signal		RS-485 reference
1:	-	not assigned	
2:	-	not assigned	
3:	**RxD / TxD-P**	**receive/send data P**	**B/$\overline{B}$**
4:	CTNR-P	repeater control signal (TTL)	
5:	DGND	data reference potential (M5V)	C/$\overline{C}$
6:	VP	supply voltage plus (P5V)	
7:	-	not assigned	
8:	**RxD / TxD-N**	**receive/send data N**	**A/$\overline{A}$**
9:	DGND	data reference potential (M5V)	
Connector housing	Shield of the twisted two-wire cable		

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Fig. 4: Assignment of the 9 pin type D connector to EN 50170 V2 / DIN 19245 Part 3

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The MOVITRAC® 31.. frequency inverter is connected to the PROFIBUS system via a twisted, screened two-wire cable. The connection of the two-wire cable to the PROFIBUS connector is via pin 8 (A/$\overline{A}$) and pin 3 (B/$\overline{B}$). These two contacts are used for communication. The RS-485 signals A/$\overline{A}$ and B/$\overline{B}$ 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 (reference = pin 9).

2.4 Screening and Laying of the Bus Cables

The FFP 31 option pcb supports the RS-485 transmission technology and requires as a physical medium a screened, two-wire twisted-pair cable (cable type A) specified for PROFIBUS in accordance with EN 50170 V2 / DIN E 19245 Part 3 (→ Appendix).

Technically correct screening of the bus cable absorbs the electrical interference that can occur in an industrial environment. You will achieve the best screening 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 screening in the plug over as large an area as possible.
- Connect the screening at both ends of the bus cable
- Do not lay signal and bus cables parallel to power cables (motor leads), but wherever possible in separate cable conduits.
- In an industrial environment use metallic, earthed 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 earthed surfaces.

Important!

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

2.5 Bus Termination

If the MOVITRAC® 31.. frequency 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 (→ Fig. 5).

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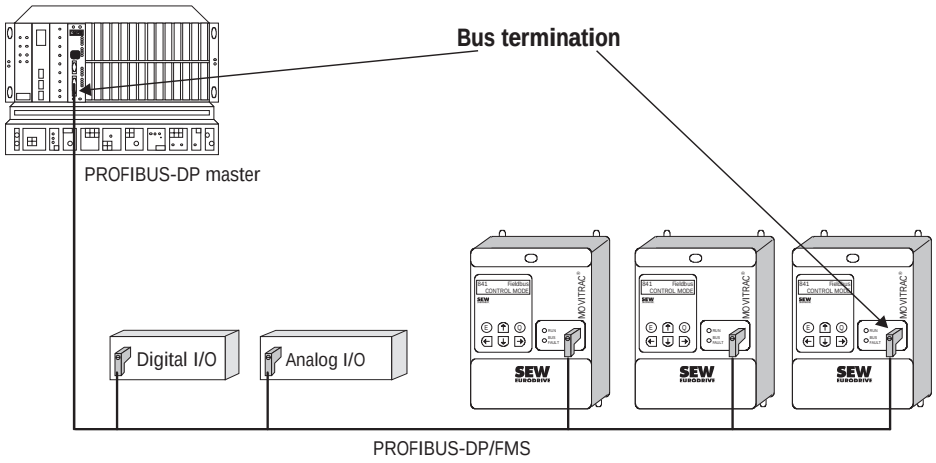

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Fig. 5: Bus termination at the beginning and end of a PROFIBUS segment

As the bus terminating resistors can be connected on the FFP 31 of the frequency inverter, it is not necessary to use a type D connector with integrated terminating resistors. With the appropriate DIP switch on the option pcb (→ Fig. 6) set to the "on" position the bus terminating resistors (in accordance with EN 50170 V2 / DIN E 19245 Part 3) can be connected.

The bus termination for cable type A is implemented in accordance with EN 5170 V2 /DIN E 19245 Part 3.

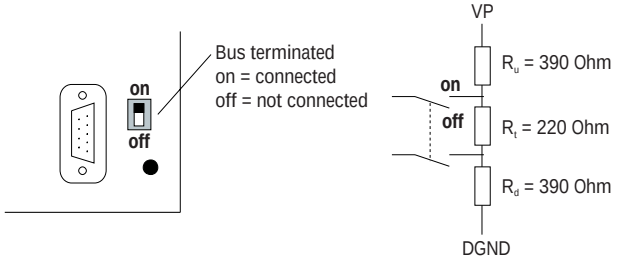

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Fig. 6: Activating the bus terminating resistors

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 MOVITRAC® 31... The address 127 is reserved for the broadcast service. Fig. 7 shows how the station address is set with the DIP switches.

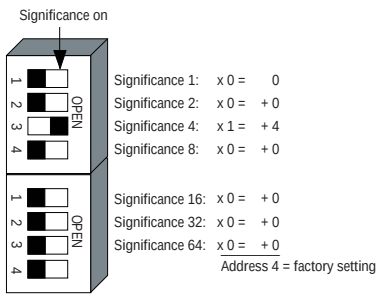

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Fig. 7: Setting the PROFIBUS station address

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It is not possible to change the PROFIBUS station address via the DIP switches while the inverter is running. If the station address is changed, the new station address will only be effective after the inverter has been switched off (including the 24 V supply) and then switched on again. The station address set on the frequency inverter can be displayed in the fieldbus monitor parameter P073 Fieldbus Address (see Fig. 7).

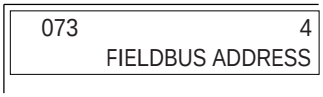

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Fig. 8: Displaying the current PROFIBUS station address

2.7 Setting the Bus Parameters (not for MOVITRAC® 31.., size 0)

The setting of the protocol option FMS/DP is not possible for MOVITRAC® 31.. size 0/DP, as the unit only supports PROFIBUS-DP. The corresponding DIP switch below the address setting is not assigned.

The default value for the bus parameters depends on the protocol option used. For straight PROFIBUS-DP mode the DIP switch must be set to DP. This will activate the default bus parameters (in particular the min. TSDR) in accordance with EN 50170 V2 / DIN E 19245 Part 3 for time-optimized DP mode. For mixed mode (FMS/DP) or straight FMS mode the DIP switch must be set to FMS (→ Fig. 9).

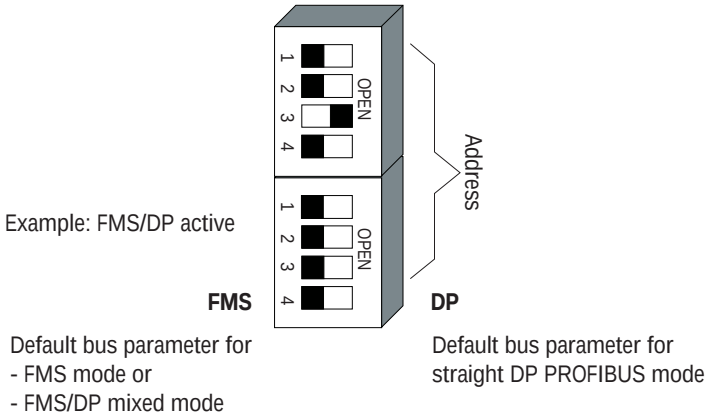

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Fig. 9: Setting the default-bus parameters to DIN 19245

This switch only serves to select the default bus parameters. Independent of the setting of this switch the 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 inverter has been switched off (including the 24 V supply) and switched on again.

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2.8 Display Elements

LED Green RUN	LED Red BUS FAULT	Meaning
Flashing at approx. 3 Hz	Off	Inverter is in initialization phase (only occurs immediately after switching on or resetting inverter) *)
On	Flashing at approx. 0.5 Hz	Configured station address is not within the permitted range (0...125) ⇒ set correct station address and switch the unit on again.
On	Irrelevant	Normal operation – the unit is working correctly
On	On	DP mode: a) During commissioning / accelerating: The inverter has not yet been set to data exchange mode by the DP master. b) The timeout period has elapsed without the inverter being addressed by the DP master. FMS mode: *) There is no active FMS-connection between FMS master and inverter. Mixed mode FMS/DP: *) Combination of the above.
On	Off	DP mode: The inverter is set to data exchange mode. FMS mode: *) There is an active FMS-connection between FMS master and inverter. Mixed mode FMS/DP: *) Combination of the above.
On / Flickering	Off	The inverter is parameterized via PROFIBUS-DP or FMS *) (read/write access).
Off	On	Hardware fault on the bus connection
Flashing at approx. 1 Hz	Flashing at approx. 1 Hz	Hardware fault on the bus connection

*) not for MOVITRAC® 31... size 0

The option pcb has two LEDs for status and fault indication of the option pcb and the connected bus system (Fig. 2). The table 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 Commissioning the Inverter

After installing the PROFIBUS option pcb and setting the station address and bus parameters (using the DIP switches), the MOVITRAC® 31.. inverter can be immediately parameterized via the fieldbus system without any further manual intervention. This means, for example, that after switching on the inverter, all drive parameters can be downloaded directly from the higher-level control via the PROFIBUS system.

To control the inverter via PROFIBUS, however, it must first be switched to the appropriate control mode. This is possible using the parameter P841 Control Mode. The factory setting for this parameter is STANDARD (control and setpoint processing via input terminals). Using the parameter P841 Control Mode = FIELDBUS, the inverter is programmed to accept setpoints from the fieldbus. MOVITRAC® 31.. now responds to process data sent from the higher-level control.

The activation of the fieldbus control mode is signalled to the higher-level control by the Fieldbus Mode Active bit in the status word.

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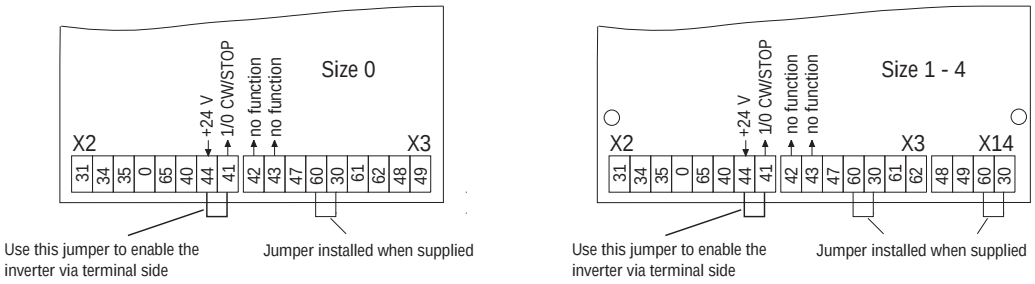
For safety reasons the inverter must also be enabled on the terminal side as well to permit control via the fieldbus system. The terminals are therefore to be wired or programmed in such a way that the inverter is enabled via the input terminals. The easiest way of enabling the inverter on the terminal side is, for example, to connect input terminal 41 (CW/STOP function) to a +24 V signal and program input terminals 42 and 43 to NO FUNCTION. Fig. 10 shows an example of the commissioning procedure for the MOVITRAC® 31.. inverter with a fieldbus interface.

Attention!

Carry out commissioning with mains voltage switched off and with the external 24 V-supply only. This prevents the drive from starting to move automatically during reprogramming. Switch on mains voltage only after completed setting of parameters.

1. ENABLE the inverter on the terminal side

Apply a +24 V signal on input terminal 41 (Function CW/STOP) (e.g. set jumper as shown below).



2. For setting inverter parameter only switch on 24 V supply (no mains voltage!)

3. Control mode = fieldbus

Set control and setpoint processing of the drive inverter to FIELDBUS in parameter P841.

841	FIELDBUS CONTROL MODE

4. Input terminal 42 = NO FUNCTION:

Program functionality of input terminal 42 to NO FUNCTION in parameter P600.

600	NO FUNCT. TERMINAL 42

5. Input terminal 43 = NO FUNCTION:

Program functionality of input terminal 43 to NO FUNCTION in parameter P601.

601	NO FUNCT. TERMINAL 43

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Fig. 10: Commissioning the inverter

For more information on commissioning and controlling the MOVITRAC® 31.. inverter please refer to the Fieldbus Unit Profile User Manual documentation.

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3 The PROFIBUS-DP Interface

PROFIBUS-DP (**D**ecentralized **P**eriphery) 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 inverters, via a fast serial link. Data exchange with these decentralized units is mainly cyclic. The central control system sends new process output data to all slaves in a message and reads in all process input data from the slaves (sensors, actuators) in the same message.

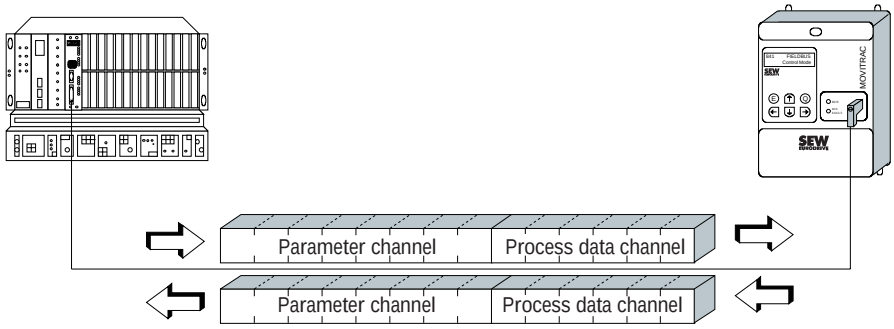
The considerable increase in speed of PROFIBUS-DP compared to PROFIBUS-FMS is primarily due to the fact that DP has no application layer (layer 7) and I/O data are transferred between the master and a slave in a single message cycle. A maximum of 246 bytes of I/O data can be transferred between the DP master and a DP slave. Normally, however, shorter data blocks (of up to 32 bytes) are used to increase efficiency still further. Consequently, the exchange of data via PROFIBUS-DP can be seen as a straight process communications procedure.

To enable the 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 inverter. The MOVITRAC® 31.. inverter can generally be operated using six different configurations. You have the option of only controlling the inverter by exchanging process data, or, in addition to controlling the inverter via process data, of reading or writing parameters using an additional parameter channel at the same time.

Fig. 11 provides a schematic representation of the exchange of data between the programmable automation unit (DP master) and the MOVITRAC® 31.. inverter (DP slave) using process data and parameter channels.



00945AEN

Fig. 11: Communication via PROFIBUS-DP

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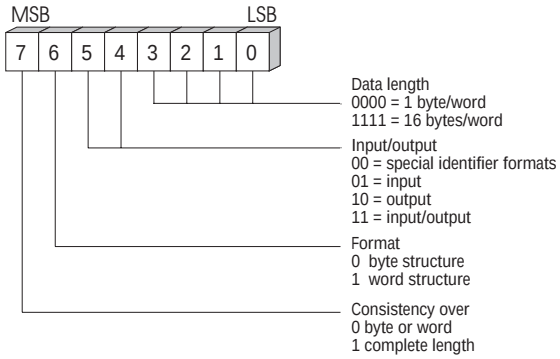
When commissioning the DP master, you have to specify which configuration is going to be used to operate the inverter. This configuration is then transferred to the inverter when the DP master is started up (with the DDLM_Chk_Cfg service). The inverter checks the transferred configuration data for plausibility before going into data transfer mode. The configuration data are coded in accordance with EN 50170 V2 / DIN E 19245 Part 3 and are discussed in the following section.

3.1.1 Description of the Configuration Data

The format of the configuration data is described in EN 50170 V2 / DIN E 19245 Part 3. Fig. 12 shows the Cfg_Data identifier byte which, according to EN 50170 V2 / 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 MOVITRAC® 31.. 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.



00949AEN

Fig. 12: Format of identifier byte Cfg_Data according to EN 50170 V2 / DIN E 19245 Part 3

The MOVITRAC® 31.. inverter supports six different process data configurations. To control the 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 inverter is required. This automatic configuring mechanism enables download applications to be implemented where the inverter can be completely controlled and parameterized via the bus system.

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To set these process data configurations, the 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 inverter must conform to the following conventions:

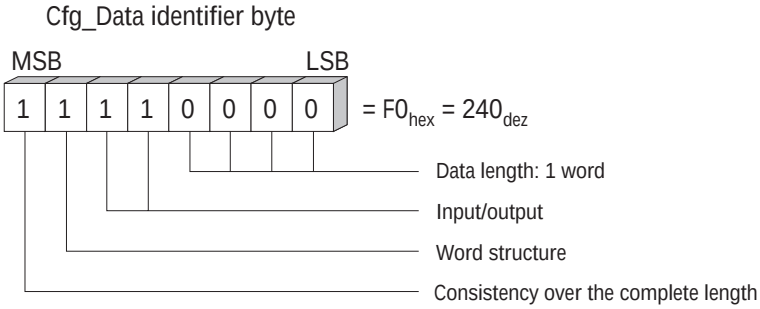
– The amount of input or output data must correspond to the contents of the following table.
– The number of input bytes and output bytes must be the same.

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

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

3.1.2 Configuring for 1 Process Data Word (1 PD)

Control of the MOVITRAC® 31.. inverter using only one process data word requires, for example, that the Cfg_Data identifier byte is coded as shown in Fig. 13. This code must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and DP slave can exchange a process data word.



01164AEN

Fig. 13: Configuration data example for setting 1 input/output word (1 PD)

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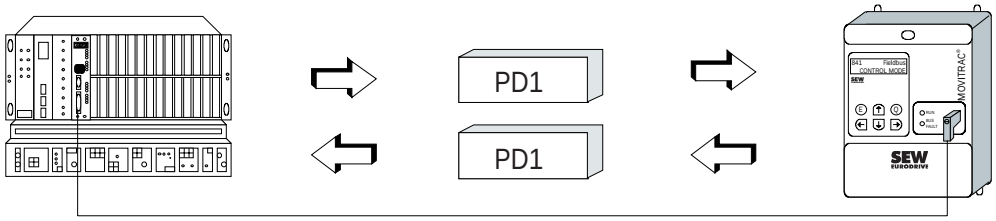
Fig. 14 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. frequency inverter via one process data word only. This configuration could be used, for example, to control the inverter with control word 1 and status word 1 (see SEW documentation *Fieldbus Unit Profile User Manual*).

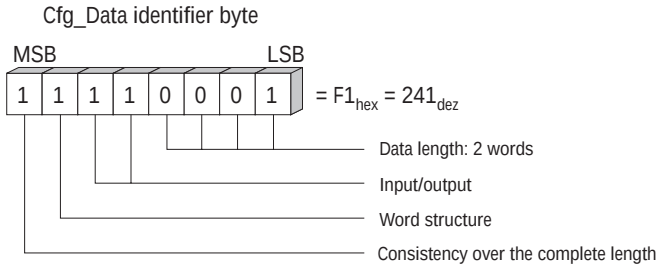


01165AEN

Fig. 14: Control of the inverter via 1 process data word

3.1.3 Configuring for 2 Process Data Words (2 PD)

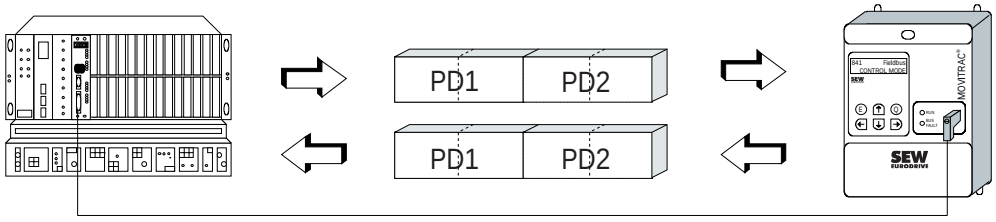
Control of the MOVITRAC® 31.. inverter using two process data words requires that the Cfg_Data identifier byte is coded as shown in Fig. 15. This code must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and DP slave can exchange two process data words.



01168A

Fig. 15: Configuration data example for setting 2 input/output words (2PD)

Fig. 16 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. frequency inverter via two process data words. The higher-level control system could use this configuration, for example, to send the process output data *Control Word 1* and *Speed Setpoint* and read in the process input data *Status Word 1* and *Speed Actual Value* (see SEW documentation *Fieldbus Unit Profile User Manual*).



01166AEN

Fig. 16: Control of the inverter via 2 process data words

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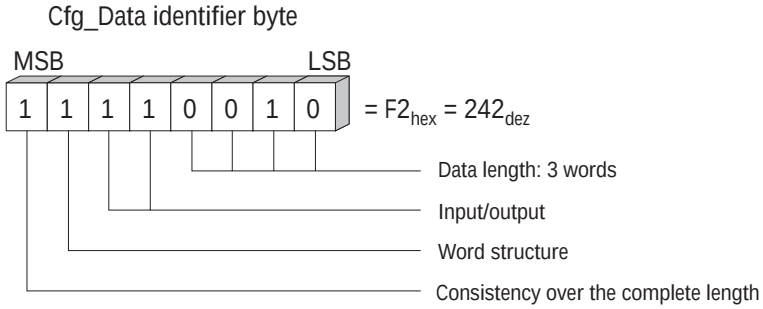
3.1.4 Configuring for 3 Process Data Words (3 PD)

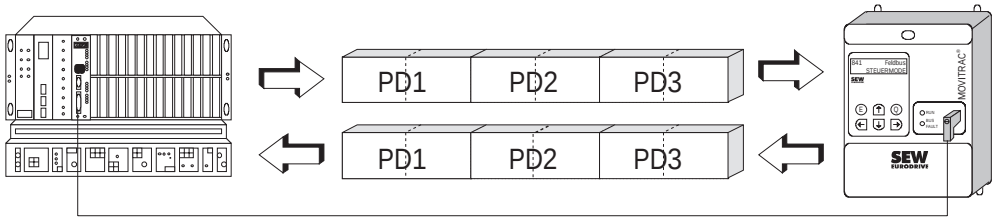
Control of the MOVITRAC® 31.. inverter using three process data words requires that the Cfg_Data identifier byte is coded as shown in Fig. 17. This code must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and DP slave can exchange three process data words.



01169AEN

Fig. 17: Configuration data example for setting 3 input/output words (3PD)

Fig. 18 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. frequency inverter via three process data words. The higher-level control system could use this configuration, for example, to send the process output data *Control Word 1*, *Speed Setpoint*, *Process Ramp* and read in the process input data *Status Word 1* and *Speed Actual Value, Apparent Current Actual Value* (see SEW documentation *Fieldbus Unit Profile User Manual* .

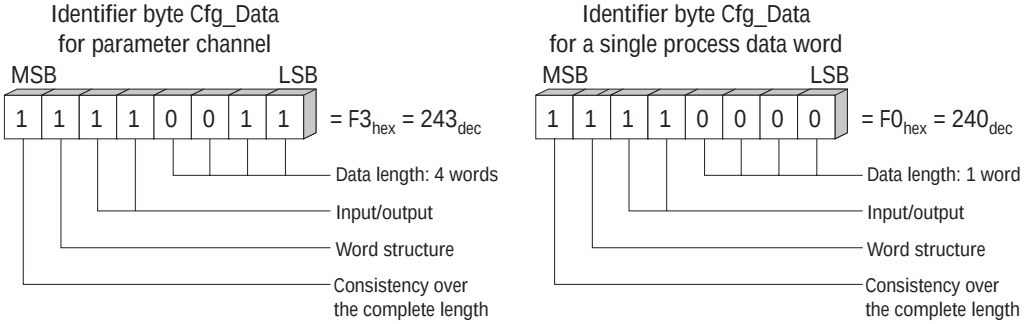


01167AEN

Fig. 18: Control of the inverter via 3 process data words

3.1.5 Configuring for 1 PD + Parameter Channel

Control of the MOVITRAC® 31.. inverter using one process data word 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 a single process data word. Fig. 19 shows how these two identifier bytes are coded. These codes must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and the DP slave can exchange the process data word as well as the parameter channel.



01170AEN

Fig. 19: Configuration example for parameter channel + 1 process data word

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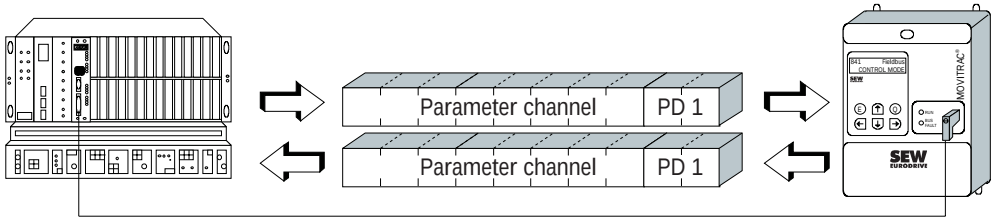
Fig. 20 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. inverter via one process data word and the parameter channel for reading and writing of drive parameters. The higher-level control system could use this configuration, for example, to control the inverter with *Control Word 1* and *Status Word 1* and access all drive parameters via the parameter channel (see SEW documentation *Fieldbus Unit Profile User Manual*).

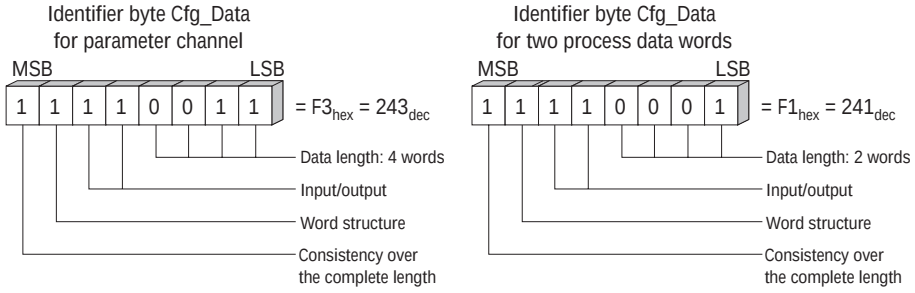


01171AEN

Fig. 20: Communication with 1 process data word and parameter channel

3.1.6 Configuring for 2 PD + Parameter Channel

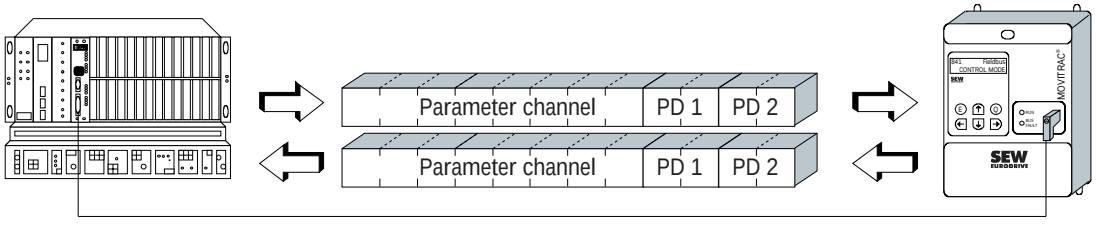
Control of the MOVITRAC® 31.. inverter using two process data words and an additional parameter channel requires two identifier bytes to be defined. Identifier byte 1 contains the code for the parameter channel, identifier byte 2 contains the code for two process data words. Fig. 21 shows how these two identifier bytes are coded. These codes must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and the DP slave can exchange two process data words as well as the parameter channel.



01172AEN

Fig. 21: Configuration example for parameter channel and 2 process data words

Fig. 22 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. inverter via two process data words and the parameter channel for reading and writing of drive parameters. This configuration could be used, for example, to control the inverter with *Control Word 1, Speed Setpoint* and *Status Word 1, Speed Actual Value* resp. and parameterize it via the parameter channel (→ *Fieldbus Unit Profile User Manual*).



01173AEN

Fig. 22: Communication with 2 process data words and parameter channel

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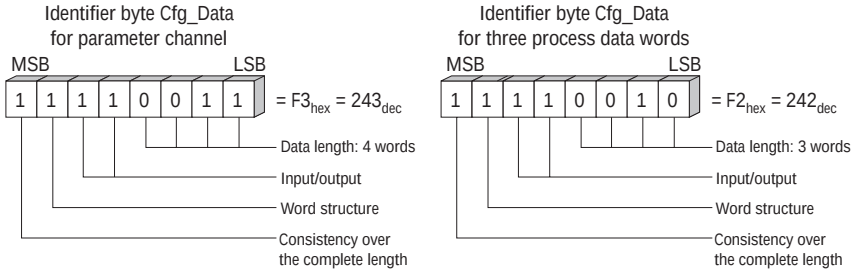
3.1.7 Configuring for 3 PD + Parameter Channel

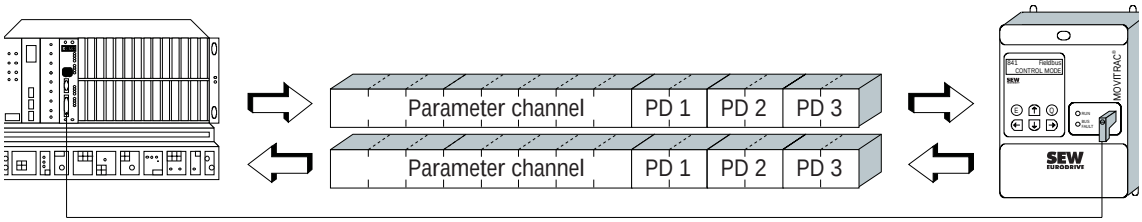
Control of the MOVITRAC® 31.. inverter using three process data words and an additional parameter channel requires two identifier bytes to be defined. Identifier byte 1 contains the code for the parameter channel, identifier byte 2 contains the code for three process data words. Fig. 23 shows how these two identifier bytes are coded. These codes must be sent to the inverter by the DP master when PROFIBUS-DP is started so that the DP master and the DP slave can exchange three process data words as well as the parameter channel.



01174AEN

Fig. 23: Configuration example for parameter channel + 3 process data words

Fig. 24 shows the communication between the automation unit (DP master) and the MOVITRAC® 31.. inverter via three process data words and the parameter channel for reading and writing of drive parameters. This configuration could be used, for example, to control the inverter with *Control Word 1, Speed Setpoint, Process Ramp* and *Status Word 1, Speed Actual Value, Apparent Current Actual Value* resp. and parameterize it via the parameter channel (see SEW documentation *Fieldbus Unit Profile User Manual)*.



01175AEN

Fig. 24: Communication with 3 process data words 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 units 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.

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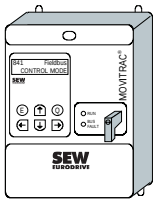


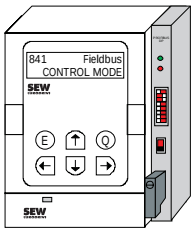
MOVITRAC® 31.. with Option FFP 31..
Ident-Number: 3100_{hex} or 12544_{dec}

01176AEN

Fig. 25: Ident number MOVITRAC® 31.. with FFP 31..

The ident number is defined as an unsigned 16-bit number (Unsigned16). The PROFIBUS User Group has specified the Ident Number 3100hex (12544dez) for the MOVITRAC® 31.. range of inverters (→ Fig. 25).

The PROFIBUS User Group has specified the Ident Number 3111hex (12561dez) for the inverters MOVITRAC® 31.. size 0 with PROFIBUS-DP (→ Fig. 26).



MOVITRAC® 31.. size 0 with PROFIBUS-DP
Ident-Number: 3111_{hex} or 12561_{dec}

01177AEN

Fig. 26: Ident number MOVITRAC® 31.. size 0 with PROFIBUS-DP

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 MOVITRAC® 31.. inverter maps the timeout period defined when the DP master is configured to parameter *571 Fieldbus Timeout* (Fig. 27). 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.

01178AEN

Fig. 27: A fieldbus timeout period of 200ms configured in the DP masker

When the timeout period expires, the inverter invokes the fault response specified beforehand in parameter *572 Timeout Response*. This means the response of the 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.

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01179AEN

Fig. 28: Fault message after the timeout period has elapsed

Expiry of the timeout period is indicated on the option pcb by the red *BUS FAULT* LED. At the same time, the inverter also indicates an error on its red Status LED. The error is displayed on the keypad or on the PC as *Error Fieldbus Timeout* (Fig. 28). Depending on the specified fault response, the inverter may have to be reset to restore its normal status.

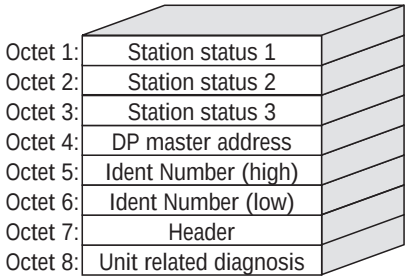
For a detailed description of the inverter's timeout behaviour, please refer to the *Fieldbus Unit Profile User Manual*.

Important!

Parameter *571 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 keypad or the MC_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 MOVITRAC® 31.. inverter can be performed using the DP service DDLM_Slave_Diag. The inverter also supports unit-related diagnosis. Fig. 27 shows the structure of the diagnostic data.



01181AEN

Fig. 29: Structure of the diagnostic data for the MOVITRAC® 31..

Octets 1-7 contain the diagnostic information according to EN 50170 V2 / 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 inverter (only then will external diagnostics be possible), octet 8 will also contain the fault code.

Important!

The unit-related diagnostic information is only updated every 800 ms. This means that an error 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 MOVITRAC® 31.. inverter (see Fieldbus Unit Profile User Manual).

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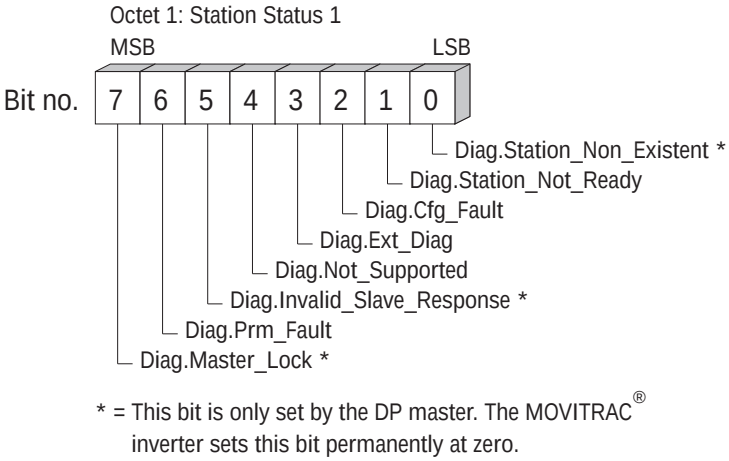
3.4.1 Data in Octet 1: Station Status 1

Fig. 30 shows the coding of octet Station Status 1 in accordance with EN 50170 V2 / 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.



01182AEN

Fig. 30: Coding of the octet Station Status 1 according to EN 50170 V2 / DIN E 19245 Part 3

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

Bit 7: Diag.Master_Lock

The frequency 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 FF_{hex} and not equal to its own address. It indicates that the MOVITRAC® 31.. frequency inverter has parameters set by a different master with the *DDLM Set_Prm* service.

Bit 6: Diag.Prm_Fault

This bit is set by the MOVITRAC® 31.. frequency 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 frequency 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 MOVITRAC® 31.. frequency inverter.

Bit 4: Diag.Not_Supported

This bit is set by the MOVITRAC® 31.. frequency inverter as DP slave if a function is requested which was not supported by the frequency inverter.

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Bit 3: Diag.Ext_Diag

This bit is set by the MOVITRAC® 31.. frequency 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 MOVITRAC® 31.. frequency inverter as DP slave. If the configuration data last received by the master do not correspond to the configuration data supported by the MOVITRAC® 31.. frequency inverter.

Bit 1: Diag.Station_Not_Ready

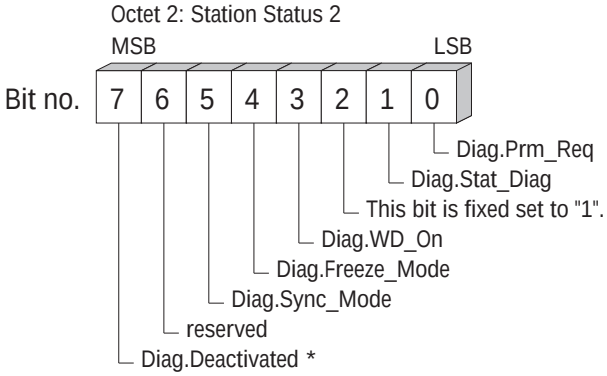
This bit is set by the MOVITRAC® 31.. frequency inverter as DP slave if the inverter is not ready for data exchange yet.

Bit 0: Diag.Station_Non_Existent

The frequency inverter as DP slave sets this bit permanently at zero. This bit is set by the DP master if the MOVITRAC® 31.. frequency inverter cannot be accessed via the bus. If this bit is set, the diagnostic bits in the master contain the status of the last diagnosis message of the frequency inverter or the initial value resp.

3.4.2 Data in Octet 2: Station Status 2

Fig. 31 shows the coding of octet Station Status 2 in accordance with EN 50170 V2 / DIN E 19245 Part 3. Station status 2 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.



01183AEN

Fig. 31: Coding of the octet station status 2 according to EN 50170 V2 / DIN E 19245 Part 3

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Bit 7: Diag.Deactivated

The frequency inverter as DP slave sets this bit permanently at zero.

This bit is set by the DP master if the MOVITRAC® 31.. frequency 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 frequency inverter as soon as it has received the Sync command.

Bit 4: Diag.Freeze_Mode

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

Bit 3: Diag.WD_On

This bit is set by the MOVITRAC® 31.. frequency inverter if the watchdog control is on.

Bit 2:

This bit is permanently set to one by the MOVITRAC® 31.. frequency inverter.

Bit 1: Diag.Stat_Diag

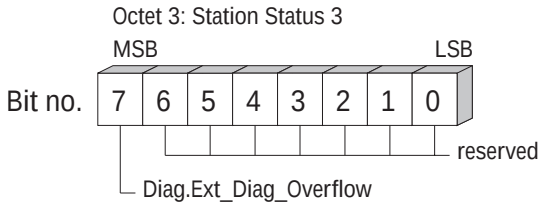
If the MOVITRAC® 31.. frequency inverter sets this bit, the DP master must pick up diagnostic data until this bit is cleared again.

Bit 0: Diag.Prm_Req

This bit is set by the MOVITRAC® 31.. frequency inverter if it needs to be parameterized and configured again. This bit remains set until the frequency inverter has been parameterized with DDLM_Set_Prm.

3.4.3 Data in Octet 3: Station Status 3

Fig. 32 shows the coding of octet Station Status 3 in accordance with EN 50170 V2 / DIN E 19245 Part 3. In station status 3 presently only bit 7 is relevant. Bits 0-6 are reserved.



01184AEN

Fig. 32: Coding of the octet Station Status 3 according to EN 50170 V2 / DIN E 19245 Part 3

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The individual bits have the following meaning in accordance with EN 50170 V2 / 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 to zero by the MOVITRAC® 31.. frequency 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 MOVITRAC® 31.. frequency inverter was parameterized with the DP service *DDLM_Set_Prm*. If the frequency inverter was not parameterized by a DP master, this octet contains the address FF_{hex}.

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.

3.4.6 Unit Related Diagnosis using Octet 7/8

The MOVITRAC® 31.. inverter supports unit related diagnosis. Unit related diagnostic information is only available when the inverter outputs a fault message or warning. By setting bit 3 *Diag.Ext_Diag* in octet 1 S*tation Status 1*, the 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). As the fault code is normally returned as external diagnostics information in one byte, octet 7 normally contains the value 02_{hex} (length 2 bytes) and octet 8 contains the error code from the inverter, the codes for which can be found in the *MOVITRAC® 31.. Parameter List* documentation.

3.5 Sync and Freeze Mode

In addition to the cyclic exchange of data, where the DP master 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 inverters into *Sync Mode*. The active setpoint values 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 (Fig. 33).

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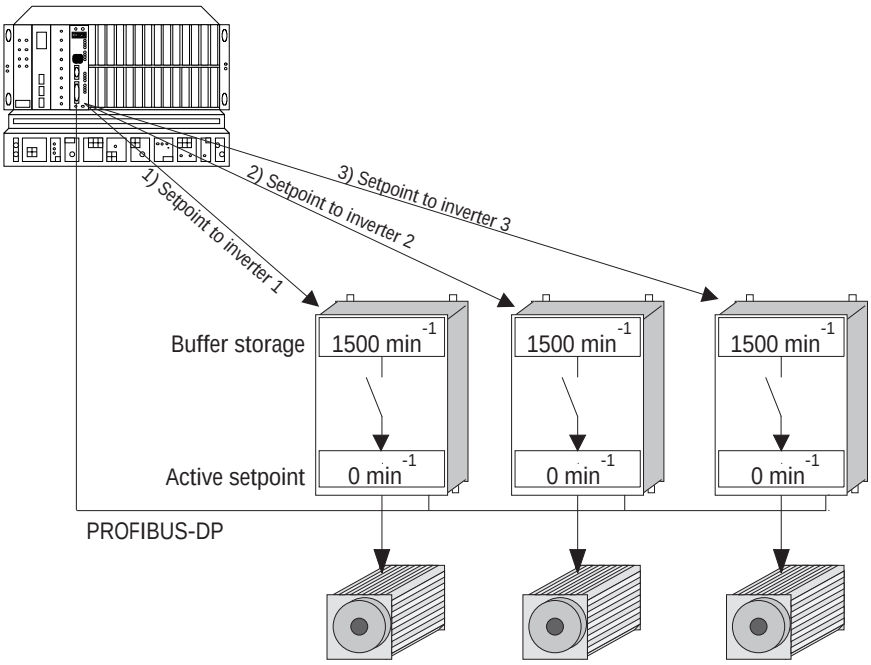

Fig. 33: Sending output data to the inverter and saving them temporarily

When a new Sync command is issued, all inverters simultaneously update their active setpoints with the value temporarily stored before (Fig. 34). In other words, the active setpoints are not updated until the new Sync command has been received. The inverters quit Sync mode when the *Unsync* control command is issued.

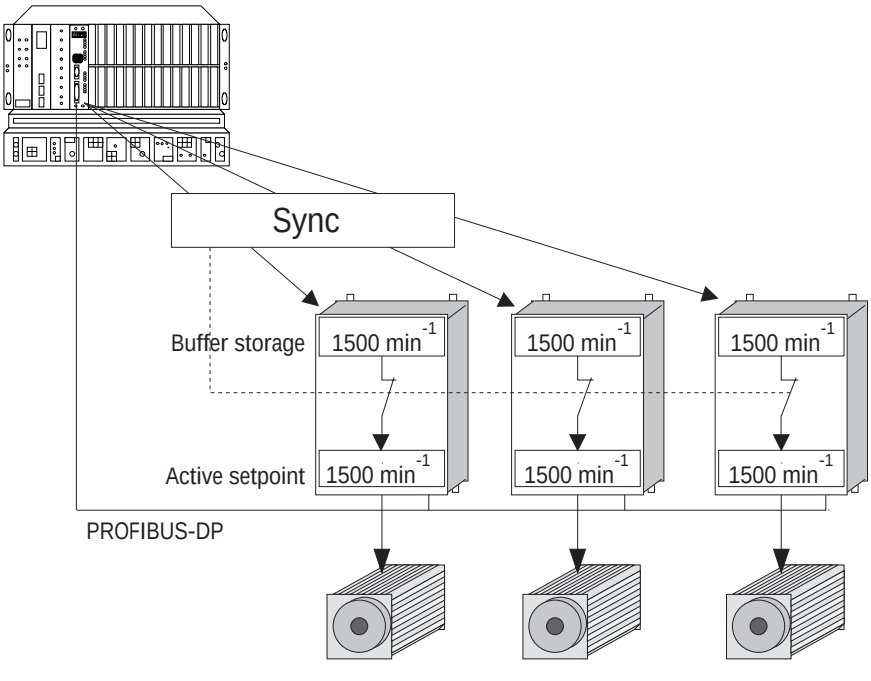

Fig. 34: Simultaneous activation of the new setpoints with the Sync command

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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 (Fig. 35).

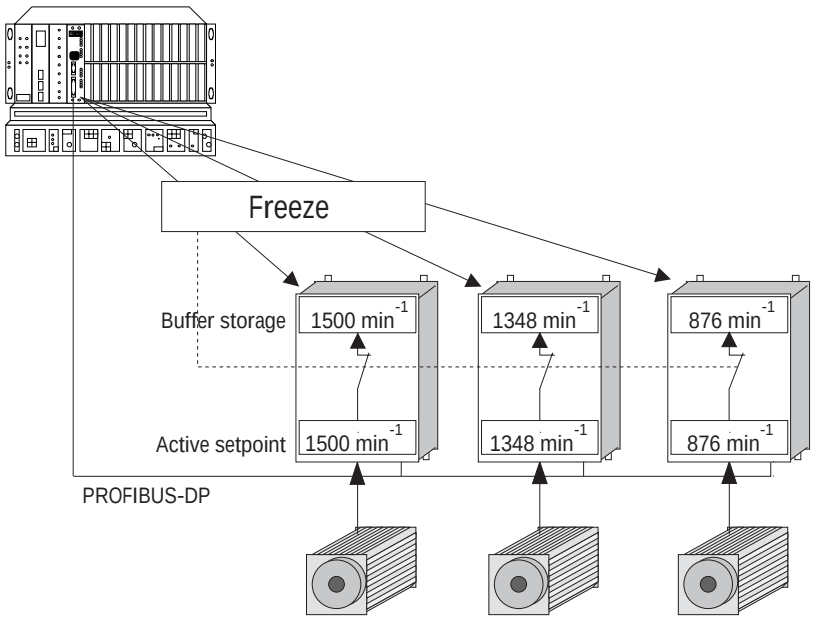

Fig. 35: Simultaneous freezing of the current actual values with the Freeze command

The master now has enough time to retrieve all the actual values from the inverters (Fig. 36). When a new Freeze command is received, all addressed inverters simultaneously save their current actual values. Freeze mode is quit when the *Unfreeze* control command is issued.

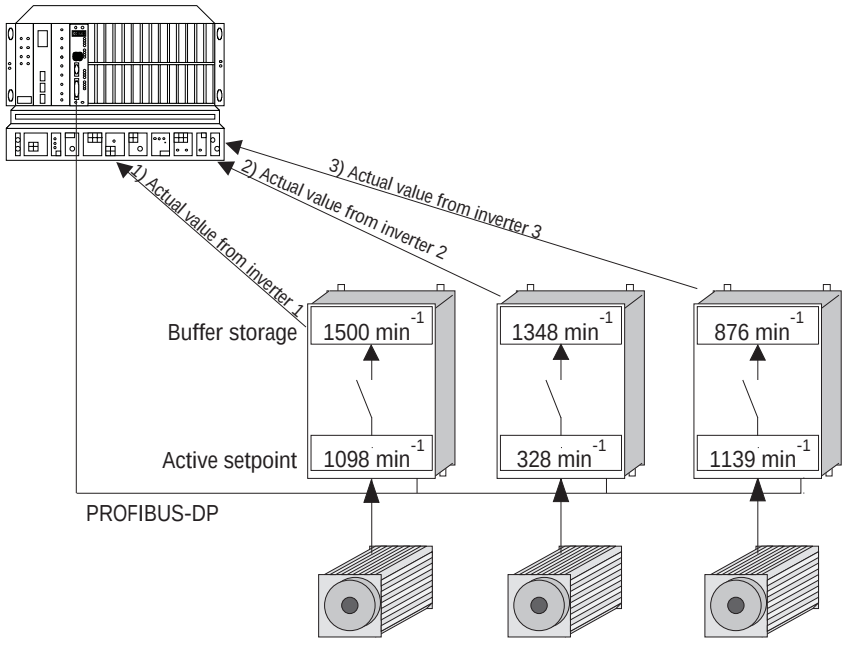

Fig. 36: Reading the frozen actual values

The MOVITRAC® 31.. inverter supports both *Sync Mode* and *Freeze Mode*. This makes it possible to group together a number of inverters and synchronize them using the Sync and Freeze commands. The Sync command enables you to activate the setpoints on all drives simultaneously. Similarly, the Freeze command permits the actual values from all the drives on the bus system to be read in at the same time.

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3.6 Control via PROFIBUS-DP

The 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 peripherals area of the controller and can thus be addressed in the usual manner (Fig. 37).

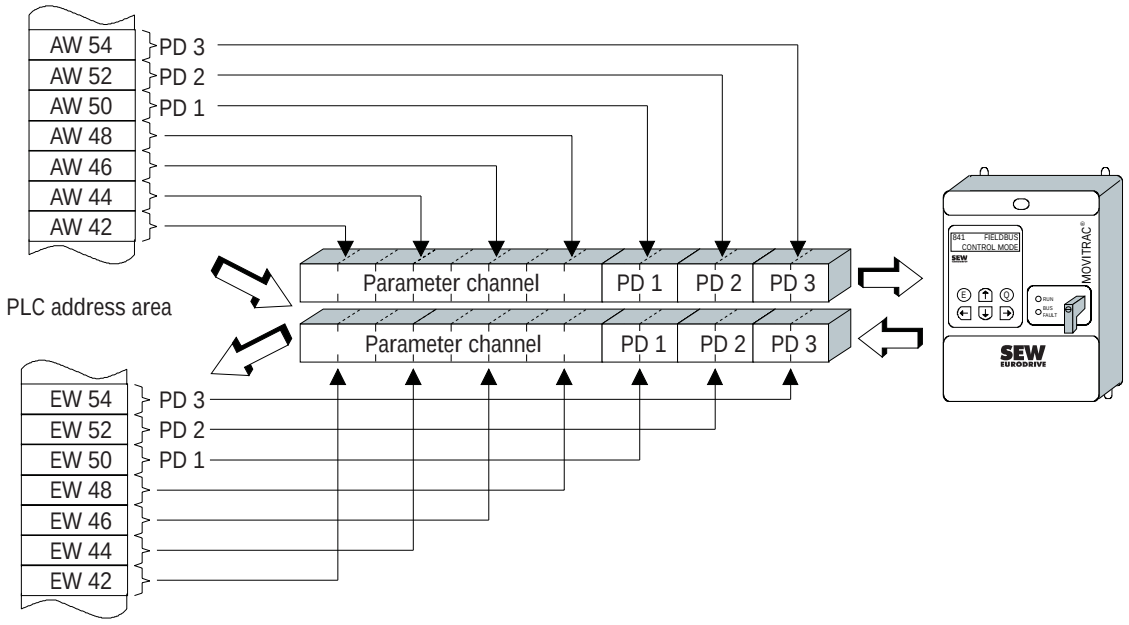

Fig. 37: Allocation of the PLC I/O area

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. 37, Example 1 shows the syntax for handling the process input and output data of the MOVITRAC® 31.. inverter. The factory setting for the process data channel is shown as a comment.

Example 1: Inverter control via the process data

```
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 1/min)

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

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

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3.7 Parameter setting via PROFIBUS-DP

The inverter parameters are read and written by the READ and WRITE services of the application layer (layer 7). If there is no layer 7, as in the case of PROFIBUS-DP, a suitable application layer must be emulated, i.e. mechanisms for setting the inverter parameters must be created.

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. 38).

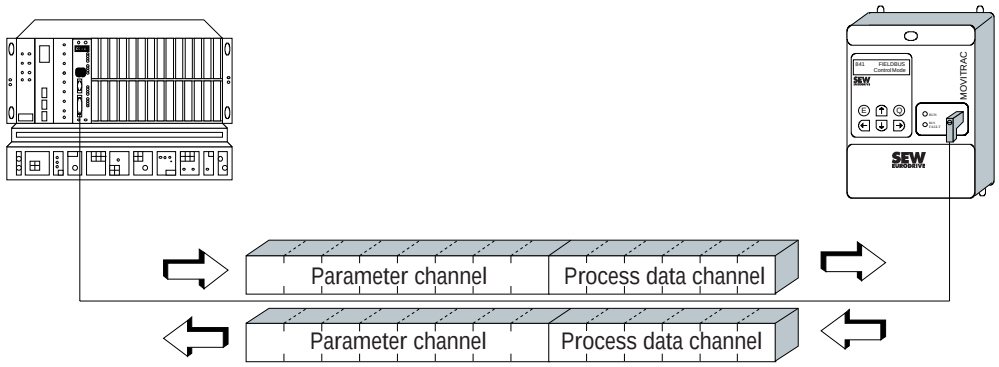

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Fig. 38: Parameter process data object for PROFIBUS-DP

Fig. 39 shows the structure of the parameter channel. It generally consists of a management byte, an index word, a reserved byte and four data bytes.

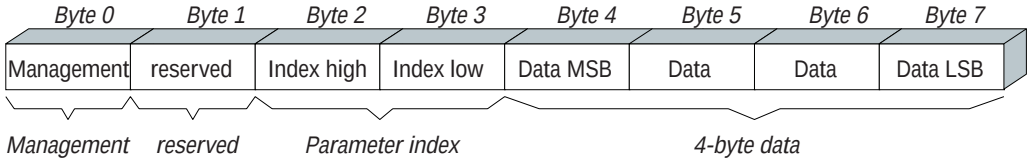

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Fig. 39: Structure of the parameter channel

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. 40 shows that bits 0, 1 and 2 contain the service identifier, in other words, they define which service is to be executed. Bit 3 is currently reserved and should generally remain set to zero. Bit 4 and bit 5 contain the data length in bytes for the Write service, which in the case of SEW inverters should normally be set to 4 bytes.

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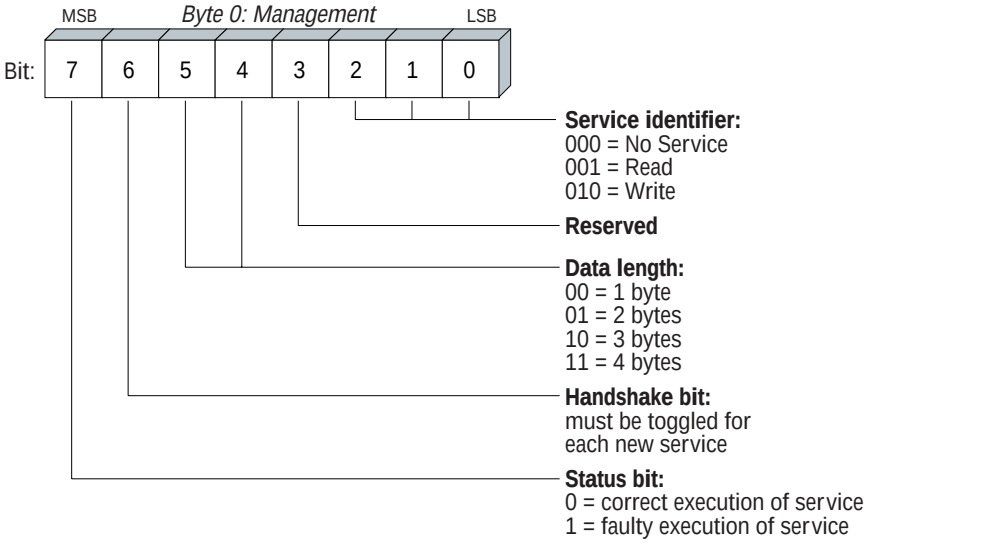

Fig. 40: Structure of the management byte

Bit 6 is used as a handshake between controller and inverter. It initiates the execution of the transferred service in the inverter. As the parameter channel is transferred in each cycle with the process data, particularly with PROFIBUS-DP, execution of the service in the inverter must be edge controlled using the handshake bit 6. The value of this bit is therefore toggled each time a new service is to be executed. The inverter uses the handshake bit to signal whether the service has been executed or not. The service is executed as soon as the controller notices that the received and transmitted handshake bits correspond. Status bit 7 indicates whether the service was executed properly or produced an error.

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 an 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 to 0x00.

Data Area

As shown in Fig. 41 the data are contained in byte 4 to byte 7 of the parameter channel. This allows a maximum of 4 byte data to be transmitted 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).

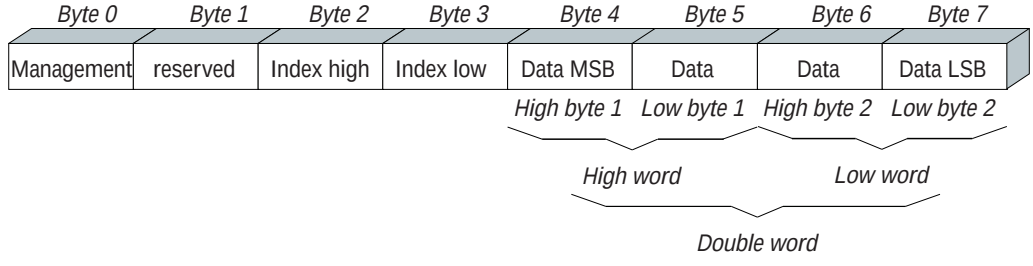

Fig. 41: Definition of the data area in the parameter channel

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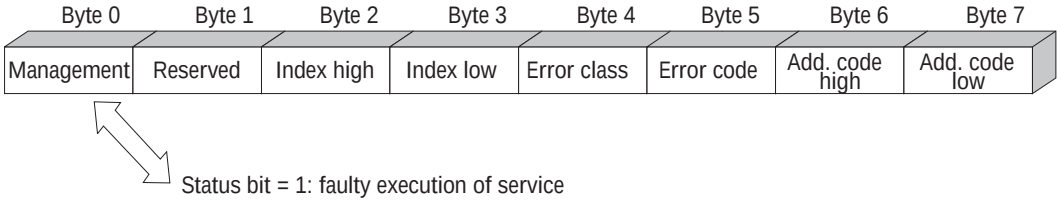
Faulty Execution of Service

Faulty execution of service is signalled by setting the status bit in the management byte. If the received handshake bit is identical to the transmitted handshake bit, the 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. 42). Bytes 4-7 provide the Return Code in a structured format (see the section Return Codes).



01190AEN

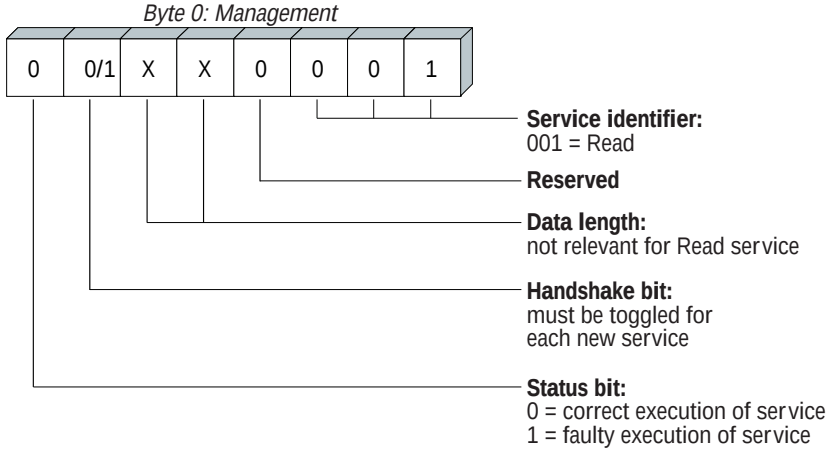
Fig. 42: Structure of the parameter channel in the event of faulty execution of service

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 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.



01191AEN

Fig. 43: Coding of the READ service in the management byte

Fig. 43 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 inverter when the handshake bit is toggled. For example, the Read service could be activated by entering the codes 01_{hex} or 41_{hex} in the management byte.

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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 inverter by toggling the handshake bit.

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

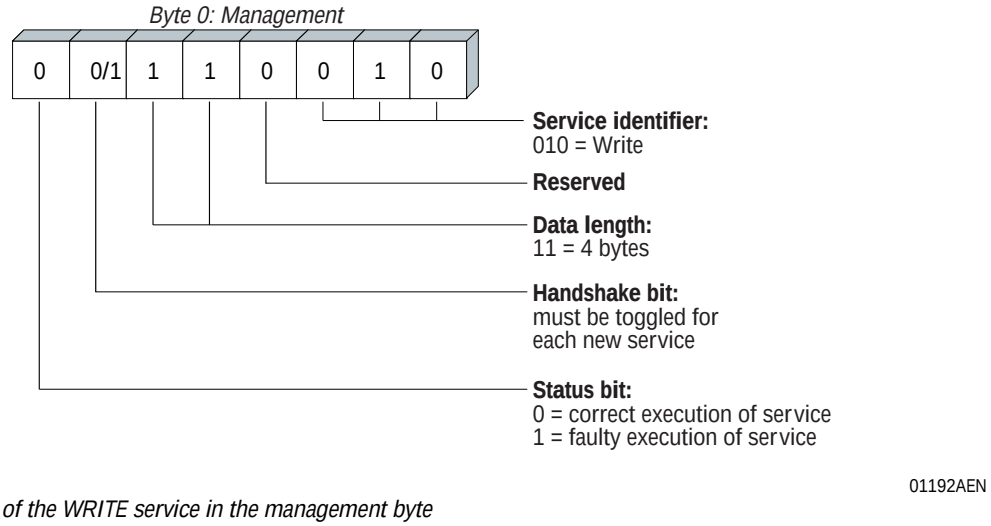

Fig. 44: Coding of the WRITE service in the management byte

Fig. 44 shows how the WRITE service is coded in the management byte. The data length for all SEW inverters is 4 bytes. Transfer of this service to the inverter is by toggling the handshake bit. A WRITE service to SEW inverters therefore generally has the management byte code 32hex or 72hex.

3.7.4 Sequence of Parameter Adjustment via PROFIBUS-DP

Using the WRITE service as an example, Fig. 45 shows the parameterizing sequence between controller and inverter on PROFIBUS-DP. To simplify the sequence, only the management byte of the parameter channel is shown in Fig. 45.

While the controller sets up the parameter channel for the Write service, the 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 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 inverter. The controller recognizes that the received handshake bit is now the same as the one sent and can then prepare a new parameter adjustment.

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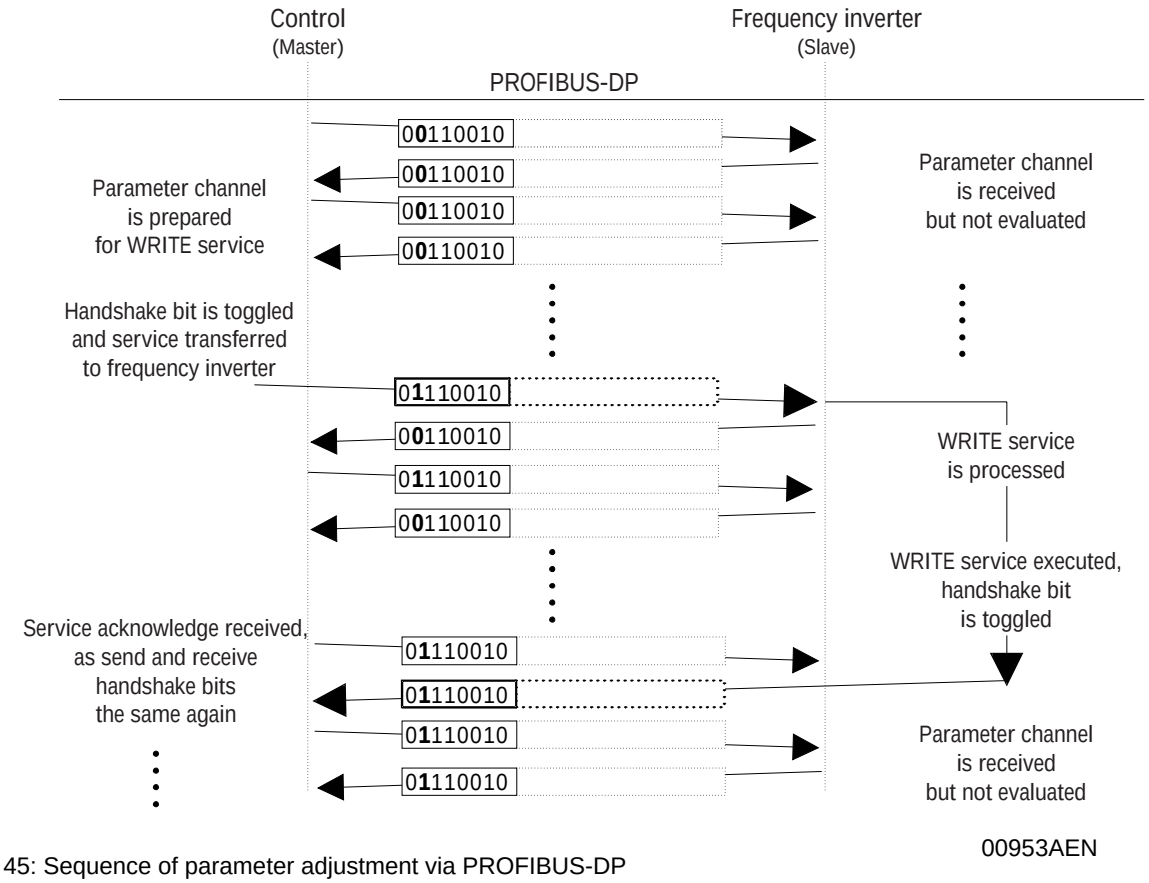

Fig. 45: Sequence of parameter adjustment via PROFIBUS-DP

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-232 and RS-485. The majority of the parameters is transmitted in 4-byte BCD format. 32-bit values are directly entered in the parameter channel as 4-byte hex values.
For details of the data formats and value ranges of the individual parameters please refer to the SEW documentation MOVITRAC® 31.. Parameter List.

3 .8 The GSD File

In a unit-basic data-file (GSD file) all slave specific characteristics are stored. The structure of the GSD file is defined in the EN 50170 V2 / DIN E 19245 Part 3. This file can be used by the DP master for simple configuring of the DP slave. As some DP masters, however, do not support this file format, additional type files are required. These files are enclosed on a disc with the fieldbus documentation package. Further you can obtain these files via modem or Internet at any time under the SEW-EURODRIVE and PROFIBUS web sites.

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4 The PROFIBUS-FMS Interface

The MOVITRAC® 31.. inverters offer via the FFP 31.. option pcb besides the standard conform PROFIBUS DP interface an FMS interface in accordance with EN 50170 V2 / DIN E 19245 Part 2. Both interfaces can be used parallel (Combislave).

4.1 FMS Services

With the FFP 31C option pcb, the MOVITRAC® 31.. inverter supports the FMS services shown in Fig. 46. These FMS services conform to the definitions in the sensor/actuator profile.

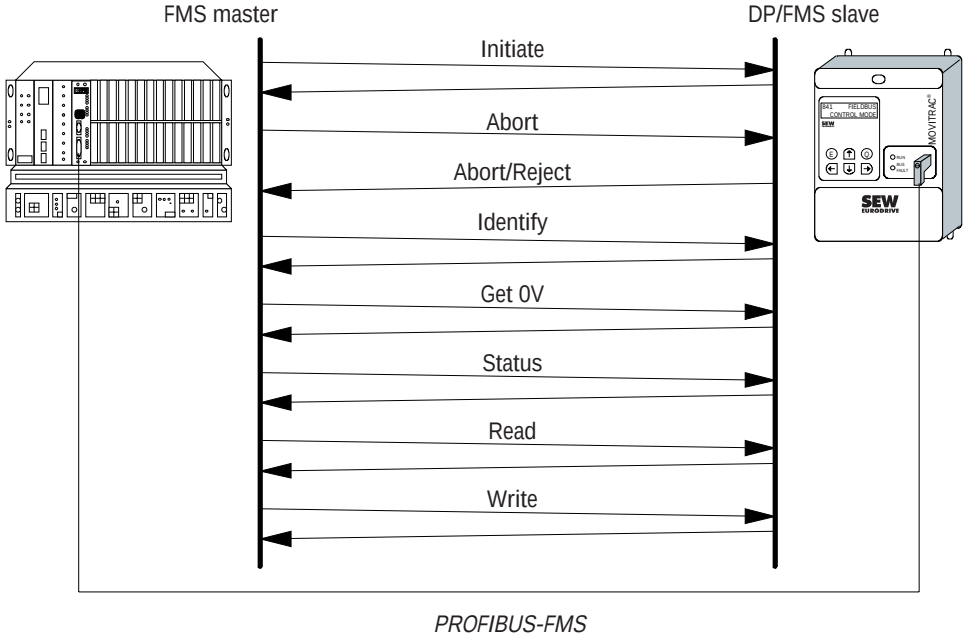

Fig. 46: FMS services supported by the MOVITRAC® 31..frequency inverter

4.1.1 Initiate

With the FMS service (establish link), a communications link is established between an FMS master and the MOVITRAC® 31.. 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 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 MOVITRAC® 31.. inverter do not match. The 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 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 a third time to reinstate the communications link.

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4.1.2 Abort

An existing communications link between the FMS master and the MOVITRAC® 31.. 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 MOVITRAC® 31...

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 a third time to reinstate the communications link.

4.1.3 Reject

With the FMS service *Reject*, the MOVITRAC® 31.. inverter rejects an illegal FMS service. The inverter indicates to the FMS master that this is an illegal or invalid service.

4.1.4 Identify

With the FMS service *Identify*, the MOVITRAC® 31.. inverter passes the following data to the FMS master for definite identification:

```
vendor_name:   SEW-Eurodrive GmbH & Co
model_name:    MOVITRAC
revision:      821XXXYYZZ   (Number of inverter system software)
```

4.1.5 Get-OV

With the FMS service *Get-OV*, the FMS master can retrieve the object description of the MOVITRAC® 31.. inverter. In general all drive parameters are described as communications objects. More precise information about object descriptions can be found in Section 4.2.

The MOVITRAC® 31.. inverter supports both the short as well as the long form of the FMS service *Get-OV*.

4.1.6 Status

With the FMS service *Status,* the FMS master can check the logical communications status of the FFP 31C option of the MOVITRAC® 31.. inverter. The *Local Detail* attribute is not supported by the inverter.

4.1.7 Read

With the FMS service *Read,* the FMS master can read all the communications objects (drive parameters) of the MOVITRAC® 31.. inverter. All drive parameters as well as their codings are listed in detail in the documentation MOVITRAC® 31.. *Parameter List*.

4.1.8 Write

With the FMS service *Write*, the FMS master can write all the drive parameters of the MOVITRAC® 31... If a drive parameter is assigned an invalid value (e.g. value too high), the inverter generates a *Write Error Response* giving the precise cause of the error (see Section Return Codes).

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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. The following table shows the structure of the object list of the MOVITRAC® 31.. inverter.

Normally, the whole object list is always generated when the inverter is switched on. To also be able to guarantee full access to all parameters via PROFIBUS-FMS. If additional drive parameters are added in the future, the generated object list is larger than the number of drive parameters implemented. Access to objects that cannot be directly mapped to a drive parameter is rejected with a negative response. The index area is divided into two logical areas. The drive parameters are addressed with indices from 1000_{dec}.

The parameter index can be obtained from the SEW manual *MOVITRAC® 31.. Parameter List.* Indices below 1000_{dec} are handled directly by the PROFIBUS option pcb and should not be regarded as drive parameters of the inverter.

Fieldbus index (decimal)	Name of the communications object
988	1 process output data word (1 PO)
989	2 process output data words (2 PO)
990	3 process output data words (3 PO)
991	1 process input data word (1 PI)
992	2 process input data words (2 PI)
993	3 process input data words (3 PI)
994	Min Tsdr
995	DP station diagnosis data (SlaveDiag)
996	Download Parameter Block
997	Universal Write parameter
998	Universal Read pointer
999	Universal Read parameter
1000 + Parameter index	Drive parameter for MOVITRAC® 31.. (Parameter index see SEW documentation MOVITRAC® 31.. *Parameter List*)

4.2.1 Object Description of the Drive Parameter

The drive parameters of the MOVITRAC® 31.. inverter are described in detail in the SEW documentation *MOVITRAC® 31.. Parameter List*. In addition to the parameter index, i.e. the number with which you can address the appropriate parameter via the communications interfaces of the inverter, you will find further information about the coding, range of values and meaning of the parameter data.

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To access all drive parameters via PROFIBUS-FMS, you must add the value 1000 dec to the index shown in the parameter list to access the fieldbus index. In general, you can apply the following formula:

Fieldbus Index = Parameter Index + 1000 dec

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 inverter itself carries out the appropriate testing and if necessary supplies a return code. The following table shows the object descriptions of all drive parameters.

Index:	Parameter Index + 1000_{dec}
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:	-

4.2.2 Objects for Process Data Communication

For process data communication via FMS six communications objects are available which are described in the following table.

Fieldbus index	Index	Functionality
988	1 process output data word (1 PO)	1) Only FMS mode: Transmission of a process output data word from the master to the 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.*
989	2 process output data words (2 PO)	1) Only FMS mode: Transfer of two process output data words form master to the inverter with the FMS service *Write*. 2) In mixed mode (DP/FMS): Reading two process output data words specified by the DP master (e.g. for visualization) with the FMS service *Read.*
990	3 process output data words (3 PO)	1) Only FMS mode: Transfer of three process output data words from the master to the inverter with the FMS service *Write.* 2) In mixed mode (DP/FMS): Reading three process output data words specified by the DP master (e.g. for visualization) with the FMS service *Read.*
991	1 process input data word (1 PI)	Reading a process input data word (PD 1) with the FMS service *Read.*
992	2 process input data words (2 PI)	Reading two process input data words (PD1, PD 2) with FMS service *READ.*
993	3 process input data words (3 PI)	Reading three process input data words (PD1, PD2, PD3) with FMS service *Read*.

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In straight PROFIBUS-FMS mode, an FMS master can control the MOVITRAC® 31.. inverter via the process data channel using the communication objects listed in the table. 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 can be exchanged using the objects “3 PI” and “3 PO”. Fig. 45 shows the various ways of accessing communications objects in mixed mode (DP/FMS).

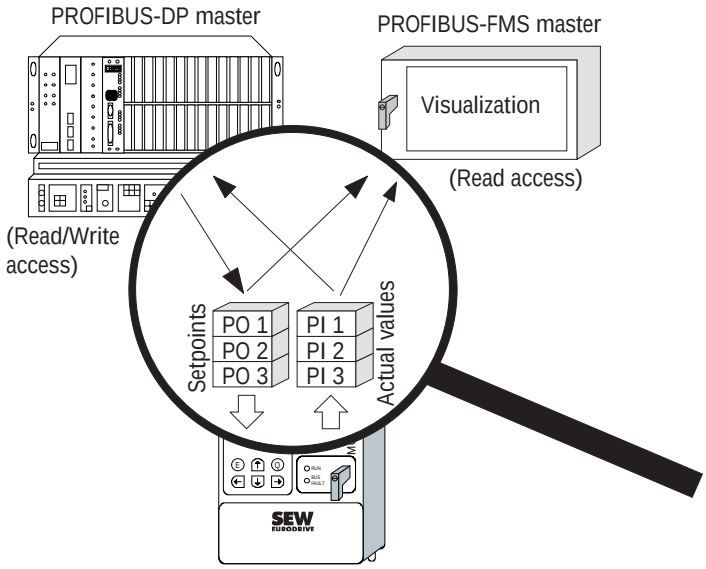

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Fig. 47: Process data access of DP master and FMS master in mixed mode (DP/FMS)

Process Output Data Objects

The following tables show the communications objects for the process output data (setpoints from master to inverter). In straight FMS mode, the FMS master can use the FMS service *Write* to write these objects and thus control the 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:	988
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:	-

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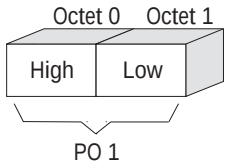
Fig. 48 shows the structure of the object “1 process output data word (1 PO)”.

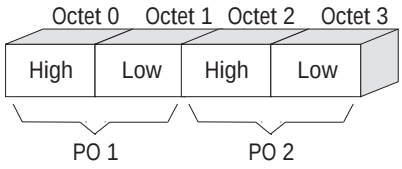


01196AEN

Fig. 48: Structure of the object “1 process output data word (1 PO)”

Index:	989
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:	-

Fig. 49 shows the structure of the object “2 process output data words (2 PO)”.

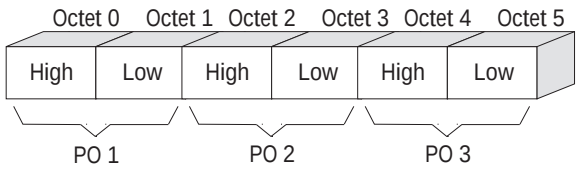


01197AEN

Fig. 49: Structure of the object “2 process output data words (2 PO)”

Index:	990
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:	-

Fig. 50 shows the structure of the object “3 process output data words (3 PO)”.



01198AEN

Fig. 50: Structure of the object “3 process output data words (3 PO)”

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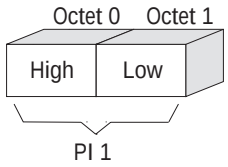
Process Input Data Objects

The following tables show the communications objects for the process input data (actual values of the inverter). These objects can only be read with the FMS service *Read*.

Index:	991
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	2 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all
Name[16]:	-
Extension length:	-

Fig. 51 shows the structure of the object "1 process input data word (1 PI)".

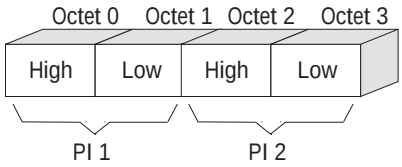


01199AEN

Fig. 51: Structure of the object "1 process input data word (1 PI)"

Index:	992
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	4 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all
Name[16]:	-
Extension length:	-

Fig. 52 shows the structure of the object "2 process input data words (2 PI)".



01200AEN

Fig. 52: Structure of the object "2 process input data words (2 PI)"

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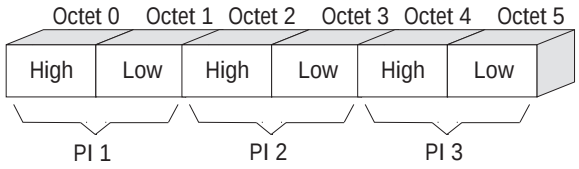
Index:	993
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	6 Byte
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all
Name[16]:	-
Extension length:	-

Fig. 53 shows the structure of the object “3 process input data words (3 PI)”.



01201AEN

Fig. 53: Structure of the object “3 process input data words (3 PI)”

4.2.3 “Min Tsdr” Object

Where several PROFIBUS masters are present, it is often necessary to modify the response delay time (min T_{SDR}). This has to be done when the inverter responds faster than the master can switch between send and receive. EN 50170 V2 / 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 (→ Fig. 9). This DIP switch is used to toggle between the *min* T_{SDR} default value for straight DP applications and the *min* T_{SDR} default value for mixed FMS/DP applications. Depending on the baud rate set the default values for the minimum response delay time defined in EN 50170 V2 / DIN 19245 are selected.

The FMS object “Min Tsdr” can then be used to read or write the *min* T_{SDR} bus parameter directly. When the inverter is powered up again (mains and 24 V), however, the *min* T_{SDR} default value will again be operative.

Index:	994
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:	-

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Important!

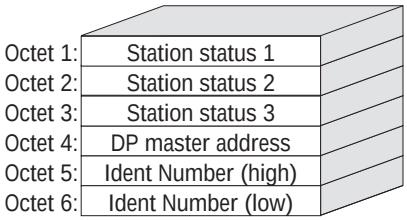
Changing *min* T_{SDR} can cause major malfunctions across the entire PROFIBUS network and should therefore only be done by PROFIBUS experts. As a rule, the default setting according to DIN 19245, which is set using the DIP switch on the option pcb, is more than adequate. These DIN 19245 default values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

4.2.4 "DP Station Diagnosis" Object

The diagnostic messages of the 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*. The following provides a definition of this communications object.

Index:	995
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:	-

The "DP Station Diagnosis" object consists of six octets, structured as shown in Fig. 54. The assignment of the individual octets is conform with EN 50170 V2 / DIN 19245 (Part 3) and is not discussed in detail here.



01202AEN

Fig. 54: Structure of the "DP Station Diagnosis" object

4.2.5 "Download Parameter Block" Object

The "Download Parameter Block" object enables a maximum of 38 MOVITRAC® 31.. drive parameters to be written at the same time. This means you can use this object to set inverter parameters 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. 55 shows the structure of the "Download Parameter Block" object.

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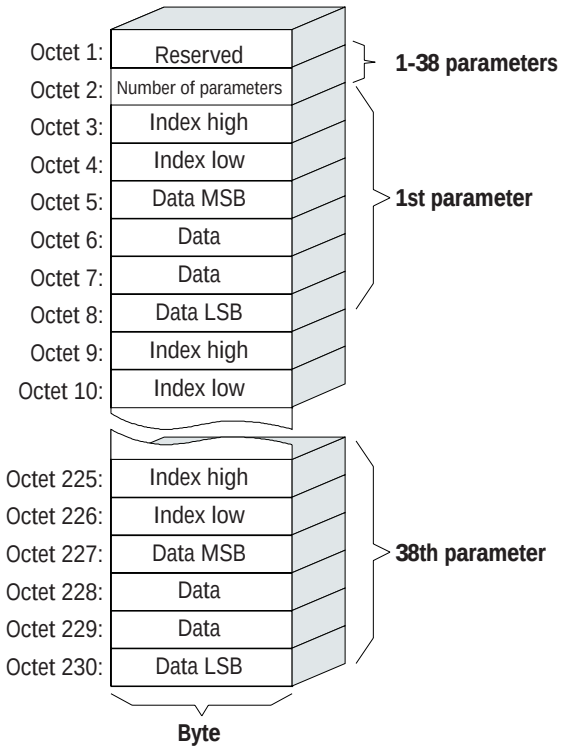

00955AEN

Fig. 55: 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 the following table.

Index:	996
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:	-

With the WRITE service to the “Download Parameter Block” object, a parameter setting mechanism is started in the fieldbus option pcb that successively transmits to the 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 following example).

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Example: Error writing the 11th parameter

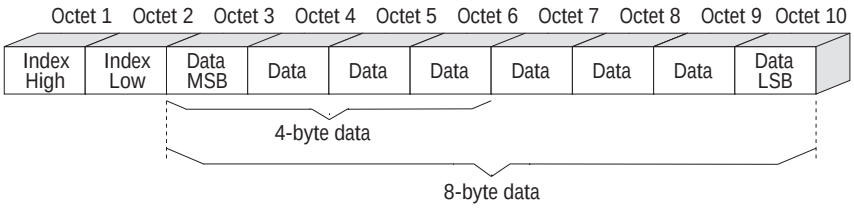
```
Write Error Response:
Error Class:              8        Other
Error Code:               0        Other
Additional Code High:     11dec    Error writing parameter 11
Additional Code Low:      15 hex   Value too large
```

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 inverter and remain unchanged.

4.2.6 "Universal Write Parameter" Object

This object permits any parameter to be written, regardless of the size and content of the object list on the fieldbus option pcb.

The parameter value to be written is shown together with the index in a 10-byte data area of the "Universal Write" object. The parameter values can be four or eight bytes long depending on the drive parameter. The length can be obtained from the current parameter list for the respective unit. The parameter data must be entered left justified in every case (Fig. 56).



01203AEN

Fig. 56: Structure of the "Universal Write" object

The "Universal Write" object is only handled locally on the fieldbus option pcb; i.e. it does not represent a drive parameter and is defined as shown in the following table.

Index:	997
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	10
Local address:	-
Password:	-
Access groups:	-
Access rights:	Write all
Name[16]:	-
Extension length:	-

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4.2.7 "Universal Read" Functionality Objects

The Universal Read objects form the counterpart to Universal Write. The Universal Read objects permit reading of any parameter independent of the object list being used. The execution of a Universal Read takes place using both the

"Universal Read Pointer" and "Universal Read Data" objects.

The fieldbus index (read pointer) to be read by the inverter is first entered in the "Universal Read Pointer" object using the FMS service *Write*. The value of the drive parameter is then read via the "Universal Read Data" object with the FMS service *Read*. To avoid having to rewrite the read pointer after each operation when reading a consecutive series of parameters, the Universal Read also has an auto-increment function where the read pointer ("Universal Read Pointer" object) is incremented by a specified amount each time the "Universal Read Data" object is read. This number is set together with the read pointer and stored in the "Universal Read Pointer" object.

Fig. 57 shows an example of how Universal Read works without the auto-increment function.

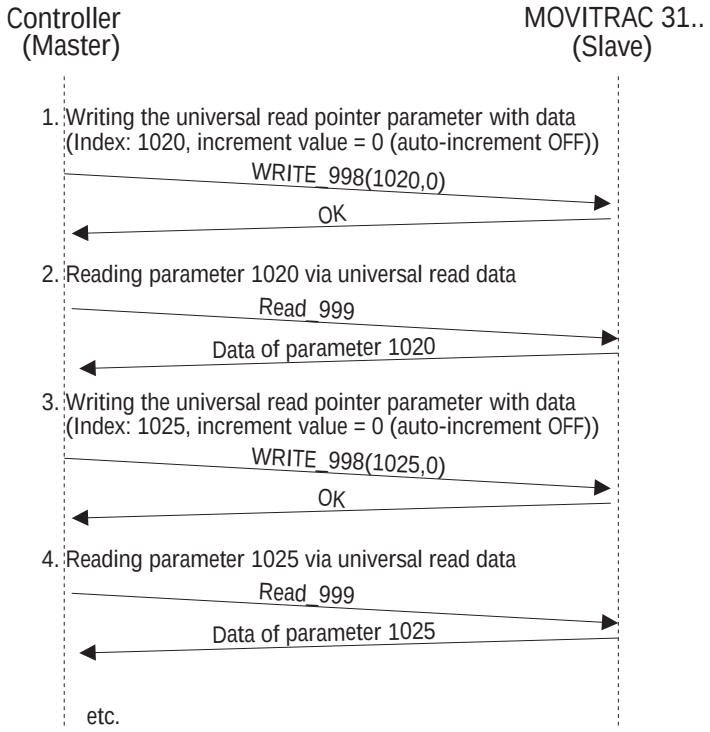

Fig. 57: Universal Read service without auto-increment function

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Fig. 58 shows an example of how Universal Read works using the auto-increment function.

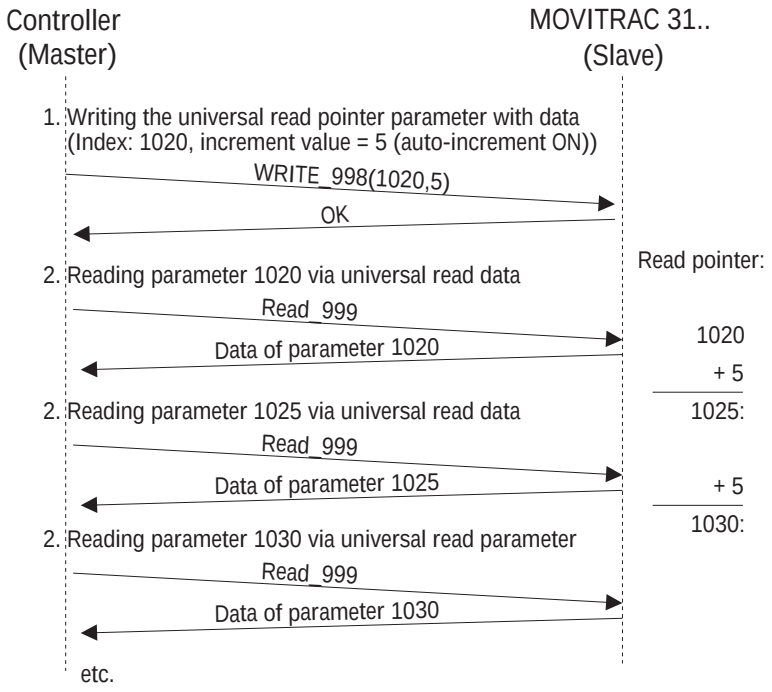

Fig. 58: Universal Read service with auto-increment function

"Universal Read Pointer" Object

The "Universal Read Pointer" object contains within its 4 data bytes both the fieldbus index to be read as a read pointer as well as the number used in auto-increment mode. Fig. 59 shows the structure of this object.

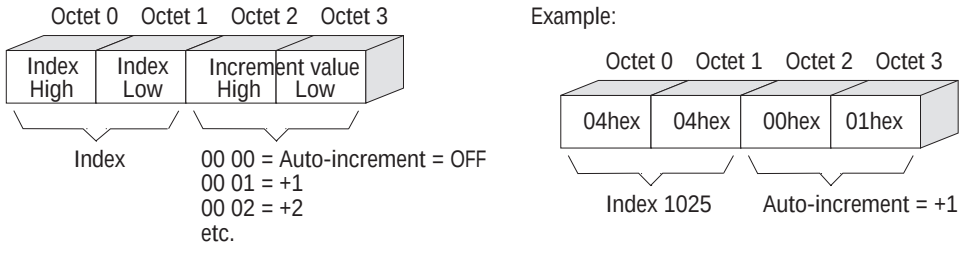

Fig. 59: Structure of the Universal Read Pointer parameter

When the auto-increment mode is active (increment value greater than 0), the index is increased after reading the "Universal Read Data" object by the predefined increment value. The default value of this object is

Index:	1000 dec
Auto increment:	0 = OFF

The auto-increment value is generally treated as having no sign, i.e. the value is generally added.

The "Universal Read Pointer" object is only handled locally on the fieldbus option pcb and is defined as shown in the following table.

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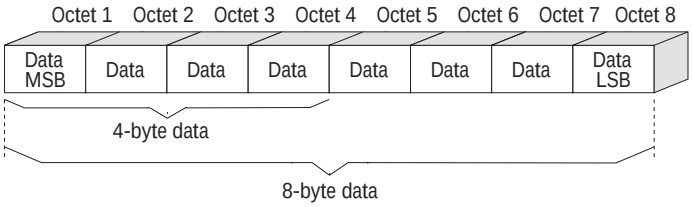
Index:	998
Object code:	7 (Simple variable)
Data type index:	10 (Octet string)
Length:	4
Local address:	-
Password:	-
Access groups:	-
Access rights:	Read all / Write all
Name[16]:	-
Extension length:	-

"Universal Read Data" Object



01209AEN

Fig. 60: Structure of the Universal Read Data parameter

Accessing this parameter using the FMS service *Read* returns the value of the read pointer held in the "Universal Read Pointer" object. Fig. 60 shows the structure of this object.

The number of valid data can be determined from the Parameter List. Data are generally entered left justified, i.e. beginning with the most significant byte in octet 1.

The "Universal Read Data" object is only handled locally on the fieldbus option pcb and is defined as shown in the following table.

Index:	999
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:	-

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4.3 Communications Relationship List (CRL)

The communications relationships between the MOVITRAC® 31.. inverter and the FMS master are stored in the Communications Relationship List (CRL). You will need this CRL data to configure an FMS master that is to communicate with the MOVITRAC® 31.. inverter via PROFIBUS-FMS.

4.3.1 CRL Definition

The communications relationship lists for the PROFIBUS-FMS contain various elements of definition which are briefly discussed below. For a more detailed explanation please refer EN 50170 V2 / DIN 19245 Part 2.

Communications Reference (CREF)

All the links contained in the Communications Relationship List are numbered sequentially with a Communications Reference CREF. In accordance with the sensor/actuator profile, the CRL for the MOVITRAC® 31.. inverter contains the Communication References CREF2 to CREF10. These CREFs represent the logical communications links from the point of view of the MOVITRAC® 31.. inverter.

The CREFs in the CRL of the inverter have no significance as far as configuring on the FMS master is concerned, as they describe the communication relationships from the point of view of the inverter. The FMS master defines its communications relationships in its own CRL.

Link Type (TYPE)

The *TYPE* field in the CRL defines the type of link between two PROFIBUS stations. A distinction is generally made between a master-master and a master-slave communications link. As the MOVITRAC® 31.. inverter is to be considered a PROFIBUS slave station, the CRL only contains the link types for the master-slave relationship. The following table shows the link types supported by the MOVITRAC® 31.. inverter.

TYPE	Meaning
MSAZ	Master-slave link for acyclic data transfer without slave initiative
MSAZ_SI	Master-slave link for acyclic data transfer with slave initiative
MSZY	Master-slave link for cyclic data transfer without slave initiative
MSZY_	Master-slave link for cyclic data transfer with slave initiative

Link Attribute (ATTR)

The *ATTR* link attribute indicates whether the link is an **o**pen (o) or a **d**efined communications link. In the case of an open link, the address (RADR) and the service access point (RSAP) of the communication partner are only entered as the link is being established. To ensure the inverter will work properly with the various FMS masters (PROFIBUS conformance), all communication links of the MOVITRAC® 31.. inverter are implemented as open links.

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Service Access Points (LSAP, RSAP)

Service access points form the interface between the application layer (layer 7) and the data link layer (layer 2) of a PROFIBUS station across which messages are transferred.

From the point of view of the inverter, the *LSAP* (*Local Link Service Access Point*) is the local service access point of the MOVITRAC® 31.. inverter where the message crosses the interface between layer 2 and layer 7. Consequently, the *RSAP* (*Remote Service Access Point*) as seen by the MOVITRAC® 31.. inverter is the service access point of the FMS master where the message crosses the interface between layer 2 and layer 7 of the FMS master.

As the inverter does not know the *RSAP*, it is entered automatically only as the link is being established. The CRL for the inverter therefore contains the entry *All*.

Station Address of the FMS Master (RADR)

The station address of the FMS master wishing to communicate with the inverter via this communications relationship is entered in the RADR (Remote Address) field. As the address of the FMS master can change, it is only entered as the link is established. The CRL for the inverter therefore contains the entry *All.*

Flow Control Counters (SCC, RCC, SAC, RAC)

The flow control counters indicate the maximum number of services running in parallel. The following table shows the meaning of the individual CRL entries.

Abbreviation	Meaning	
SCC	Send Confirmed Request Counter	Number of parallel confirmed services send
RCC	Receive Confirmed Request Counter	Number of parallel confirmed services receive
SAC	Send Acknowledged Request Counter	Number of parallel unconfirmed services send
RAC	Receive Acknowledged Request Counter	Number of parallel unconfirmed services receive

Control Interval Times (ACI, CCI)

These CRL entries specify the time intervals used in the monitoring of a communications link, i.e. the inverter checks whether any data was transferred during the specified time interval. If this is not the case, communication is aborted. The time interval applies to both cyclic (Cyclic Control Interval, CCI) as well as acyclic links (Acyclic Control Interval, ACI).

Protocol Data Unit Size (max PDU Size)

This CRL entry indicates the maximum size of the protocol data unit (max PDU size). It comprises four entries as per following table.

Abbreviation	Meaning
Send HiPrio	Maximum size of the protocol data unit for high priority send messages
Send LoPrio	Maximum size of the protocol data unit for low priority send messages
Rec. HiPrio	Maximum size of the protocol data unit for high priority receive messages
Rec. LoPrio	Maximum size of the protocol data unit for low priority receive messages

Supported FMS Services (Features Supported)

This CRL entry specifies which services the MOVITRAC® 31.. inverter supports in the relevant communications relationship.

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4.3.2 Communications Relationship Lists of the Inverter

The following tables show the individual communications relationships supported by the MOVITRAC® 31.. inverter. Although the inverter does not use any Event services, i.e. the inverter cannot execute any slave initiatives, communication links with slave initiatives are supported. Even though the *Physical Read* and *Physical Write* services are supported according to the CRL, no *Physical Write* access can be performed.

cRL for master-slave, cyclic, Read:

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
2	MSZY	O	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		

CRL for master-slave, cyclic, Write:

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
3	MSZY	O	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		

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

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		

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CRL for master-slave, cyclic, 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		

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

CREF	Type	ATTR	LSAP	RSAP	RADR	SCC	RCC	SAC	RAC	ACI/CCI
6	MSAZ_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.indication Write.indication Phys.-Read.ind Phys.-Write.ind Get-OV-long.indication Event-Notification.request*
Send LoPrio	241		
Rec. HiPrio	0		
Rec. LoPrio	241		
			Acknowledge-Event-Notification.ind*
			Alter-Event-Condition-Monitoring.ind*

CRL for master-slave, acyclic:

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.indication Write.indication Phys.-Read.ind Phys.-Write.ind Get-OV-long.indication
Send LoPrio	241		
Rec. HiPrio	0		
Rec. LoPrio	241		

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

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.indication Write.indication Phys.-Read.ind Phys.-Write.ind Get-OV-long.indication Acknowledge-Event-Notification.ind* Alter-Event-Condition-Monitoring.ind*
Send LoPrio	241		
Rec. HiPrio	0		
Rec. LoPrio	241		

Though FMS services for event processing which are marked with an (*) are offered in the CRL, they are not supported by the MOVITRAC® 31.. frequency inverter.

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4.4 Communications Relationship List of the Master

A CRL corresponding to the CRL in the inverter must be configured in the FMS master to be able to communicate with the MOVITRAC® 31.. 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 be 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 $RCC_{Master} = SCC_{Slave}$).

The following table shows a communications relationship list specified in the master referring to an inverter with the station address 8 and the CREF 7.

Example of a master CRL for an acyclic master slave link:

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	Write.req
Send LoPrio	241		Phys.-Read.req	Phys.-Write.req
Rec. HiPrio	0		Get-OV-long.req	
Rec. LoPrio	241			

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5 Parameter Adjustment Return Codes

If parameters are adjusted incorrectly, different return codes are sent back from the drive inverter to the parameterizing master, providing detailed information about the cause of the error. These return codes are generally structured according to EN 50170 V2 / 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 Profile User 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 when setting the inverter parameters via the parameter channel. Only the READ and WRITE services are supported. The following table 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	-

Error rectification:

Check bits 0..2 in the management byte of the parameter channel. Only the entries 001_{bin} for the READ service and 010_{bin} for the WRITE service are permitted.

5.2 Incorrect Specification of the Data Length in the Parameter Channel

When setting parameters via the parameter channel a data length not equal 4 data bytes was specified in the READ or WRITE service. The following table shows the return code.

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

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.

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5.3 Internal Communications Errors

The return code shown in the following table is returned if a communications error has occurred between the option pcb and the inverter system. It may be that the parameter adjustment service transferred via fieldbus was not performed and should be repeated. If this error recurs the frequency 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	-

Error rectification:

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

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6 Program Example

The following program example shows the parameter adjustment of the SEW-frequency inverters MOVITRAC® 31.. via Sinec-L2-DP.

System requirements:

It is assumed, that the inverter has been configured with parameter channel and that the parameter channel is projected onto the peripheral addresses starting at PW 184.

Program functionality:

Parameter P120 T11 ramp UP is read or written. For controlling the program the use of MC_SHELL version 2.4 and up is recommended. With this program you can look at the value written via fieldbus on the PC or alter the value read via fieldbus using the PC. When writing via fieldbus the ramp value is set to 9.50 s. In this example the writing process is initiated via input 4.1. The reading process, in this example, is carried out with the input 4.0.

The read data can be displayed via control/variables in the marker words MW 184 – MW 190. The contents are as follows:

MW 184 = received administration byte / reserve byte
MW 186 = received parameter index
MW 188 = received data high or error class / error code
MW 190 = received data low or additional code high / low
MW 194 = sent administration byte / reserve byte

Program example:

```
      :
      :U     E    4.0          M1.0 activates the one time
      :UN    M    1.0          execution of the read service.
      :U     M    1.0          It is reset automatically after
      :                        FB 101 is executed.
      :
      :U     M    1.0
      :SPB   FB   101
Name :DP-READ
READ :       M    1.0
BUSY :       M    1.1
      :
      :U     M                 Writing is not possible during the
      :BEB   :                 reading process, as always only
      :                        one service can be  transferred
      :                        via the parameter channel.
      :
      :                        ____________________________
      :
      :U     E    4.1          M1.2 activates the one time
      :UN    M    1.2          execution of the write service.
      :U     E    1.2          It is reset automatically after
      :                        FB 102 is executed.
      :U     M    1.2          ATTENTION!
      :SPB   FB   102          For cyclic writing set
Name :DP-WRITE                 P802 save EEPROM = OFF
WRIT :       M    1.2
BUSY :       M    1.3
      :BE
```


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Function blocks:

FB101

```
Network 1
Name :DP-READ     E/A/D/B/T/Z: E     BI/BY/W/D: BI
Des  :READ
Des  :BUSY
      :UN   =READ          IF (do not execute FB)
      :BEB                 THEN end of block
      :                    ELSE
      :L    PW  184        Store received administration
      :T    MW  184        byte temporarily
      :
      :U    =BUSY          IF (service execution active)
      :SPB  =CHEK          THEN = continue with
      :                    evaluation
      :                    ELSE
      :L    KH  3100       Execute new read service
      :T    MW  194
      :
      :L    KF  +1025      Index 1025 =
      :T    PW  186        P120 T11 ramp UP
      :
      :UN   M   184.6      IF (received handshake bit = 0)
      :S    M   194.6      THEN send-handshake bit = 1
      :U    M   184.6
      :R    M   194.6      ELSE send-handshake bit = 0
      :
SEND  :L    MW  194
      :T    PW  184        Send administration byte
      :
      :S    =BUSY          Wait for service confirmation
      :
CHEK  :U    M   184.6      IF ((received handshake bit = 1
      :UN   M   194.6      AND sent handshake bit = 0)
      :0)                  OR
      :UN   M   184.6  01  (received handshake bit = 0
      :U    M   194.6  01  AND sent handshake bit = 1))
      :)               01
      :BEB                 THEN end of block
      :                    ELSE
      :                    Service confirmation received
      :
      :L    PW  186        Save recommended parameter
      :T    MW  186        index
      :                    in case of fault (M184.7 = 1)
      :                    the fault code is displayed
      :                    otherwise the data read
      :L    PW  188        Data high or
      :T    MW  188        Error class, error code
      :L    PW  190        Data low or
      :T    MW  190        Additional code high, low

      :RB   =BUSY          Enable service execution and
      :RB   =READ          repeated execution of the FB
      :
      :BE
```

FB 102

```
Network 1
Name :DP-WRITE    E/A/D/B/T/Z: E     BI/BY/W/D: BI
Des  :WRIT
Des  :BUSY
      :UN   =WRITE         IF (do not execute FB)
      :BEB                 THEN end of block
      :                    ELSE
      :L    PW  184        store received administration
      :T    MW  184        byte temporarily
      :
      :U    =BUSY          IF (service execution active)
      :SPB  =CHEK          THEN = continue with
      :                    evaluation
      :                    ELSE
      :L    KH  3200       Execute new WRITE service
      :T    MW  194
      :
      :L    KF  +1025      Index 1025 =
      :T    PW  186        Write
      :                    P120 T11 ramp UP
      :
      :L    KH  0000       Write BCD data 00 00 09 50
      :T    PW  188        for 9.50 s
      :L    KH  0950
      :T    PW  188
      :
      :
      :UN   M   184.6      IF (received handshake bit = 0)
      :S    M   194.6      THEN send-handshake bit =1
      :U    M   184.6
      :R    M   194.6      ELSE send-handshake bit =0
      :
SEND  :L    MW  194
      :T    PW  184        Send administration byte
      :
      :S    =BUSY          Wait for service confirmation
      :
CHEK  :U    M   184.6      IF ((received handshake bit = 1
      :UN   M   194.6      AND sent handshake bit = 0)
      :0)                  OR
      :UN   M   184.6  01  (received handshake bit = 0
      :U    M   194.6  01  AND sent handshake bit = 1))
      :)               01
      :BEB                 THEN end of block
      :                    ELSE
      :                    Service confirmation received
      :
      :L    PW  186        Save recommended parameter
      :T    MW  186        index in case of fault
      :                    (M184.7 = 1)
      :                    the fault code is displayed
      :
      :L    PW  188
      :T    MW  188        Error class, error code
      :L    PW  190
      :T    MW  190        Additional code high, low

      :RB   =BUSY          Enable service execution and
      :RB   =READ          repeated execution of the FB
      :
      :BE
```


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7 Technical Data

7.1 Technical Data FFP 31.. Option

Option pcb type Part number	**FFP 31A** 822 198 7	**FFP 31C** 822 317 3
Supported unit types	With the MOVITRAC® 31B inverters with **service code of the component 4 greater or equal 14** (→ Installation and Operating Instructions MOVITRAC® 31B section 4).	With all MOVITRAC® 31C units size 1-4
Aids for commissioning/ diagnosis	Keypad FBG 31B PC program MC_SHELL	Keypad FBG 31C PC program MC_SHELL
Protocol options	PROFIBUS-DP in accordance with EN 50170 Volume 2 / DIN E 19245 Part 3 PROFIBUS-FMS in accordance with EN 50170 Volume 2 / DIN 19245 Part 2 Mixed operation PROFIBUS DP/FMS (Combislave)	
Supported baud rates	Automatic baud rate recognition of: 9.6 kBaud 187.5 kBaud 19.2 kBaud 500 kBaud 93.75 kBaud 1500 kBaud	
Connection system	9-pin type D-connector	
Bus termination	Connectable for cable type A (up to 1.5 MBaud) in accordance with EN 50170 V2 / DIN E 19245 Part 3	
Station address	0...125 settable via DIP switch	
Default bus parameter	Response delay time (Min Tsdr) for FMS/DP selectable via DIP switch	
GSD file	SEW_3100.GSD	

PD configurations:

1. slot	**2. slot**	**Meaning**
$F0_{hex}$	-	1 process data word
$F1_{hex}$	-	2 process data words
$F2_{hex}$	-	3 process data words
$F3_{hex}$	$F0_{hex}$	4 word parameter channel + 1 process data word
$F3_{hex}$	$F1_{hex}$	4 word parameter channel + 2 process data words
$F3_{hex}$	$F2_{hex}$	4 word parameter channel + 3 process data words

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7.2 Technical data MOVITRAC® 31C.. size 0/DP

Supported unit types	MOVITRAC® 31C size 0 with integrated PROFIBUS-DP interface
Aids for commissioning/diagnosis	Keypad FBG 31C PC program MC_SHELL
Protocol options	PROFIBUS-DP in accordance with EN 50170 Volume 2 / DIN E 19245 Part 3
Supported baud rates	Automatic baud rate recognition of: 9.6 kBaud 19.2 kBaud 93.75 kBaud 187.5 kBaud 500 kBaud 1500 kBaud
Connection system	9-pin type D-connector
Bus termination	Connectable for cable type A (up to 1.5 MBaud) in accordance with EN 50170 V2 / DIN E 19245 Part 3
Station address	0...125 settable via DIP switch
GSD file	SEW_3100.GSD

Part numbers: U_N = 3 x 230 V

MOVITRAC® -type	Part number
31C005-233-4-20	826 449 X
31C011-233-4-20	826 450 3

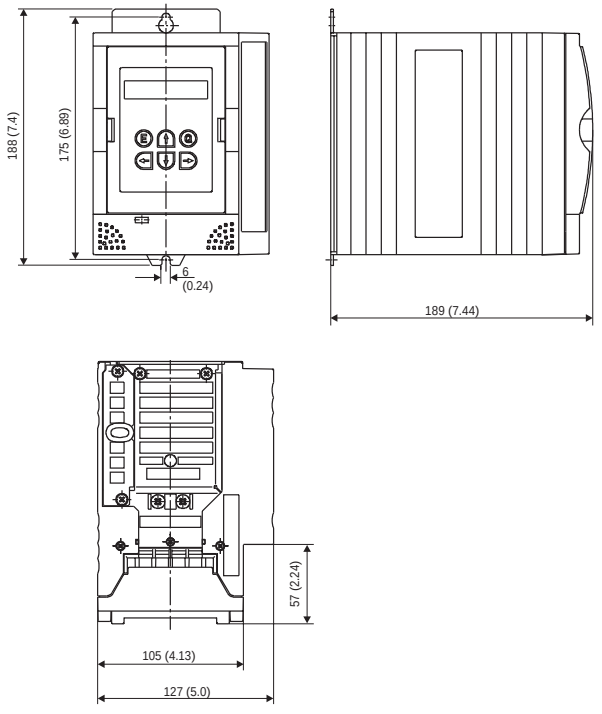
U_N = 3 x 380...500 V

MOVITRAC® -type	Part number
31C005-503-4-20	826 445 7
31C007-503-4-20	826 446 5
31C011-503-4-20	826 447 3
31C014-503-4-20	826 448 1

PD configurations:

1. slot	2. slot	Meaning
$F0_{hex}$	-	1 process data word
$F1_{hex}$	-	2 process data words
$F2_{hex}$	-	3 process data words
$F3_{hex}$	$F0_{hex}$	4 word parameter channel + 1 process data word
$F3_{hex}$	$F1_{hex}$	4 word parameter channel + 2 process data words
$F3_{hex}$	$F2_{hex}$	4 word parameter channel + 3 process data words

Dimension drawing:



01125AXX

Fig. 61: Dimensions MOVITRAC® 31C size 0/DP in mm (inches)

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Appendix A

The definition for cable type A for PROFIBUS-DP is set forth in EN 50170 V2 / DIN E 19245 Part 3 as follows:

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

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Index

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