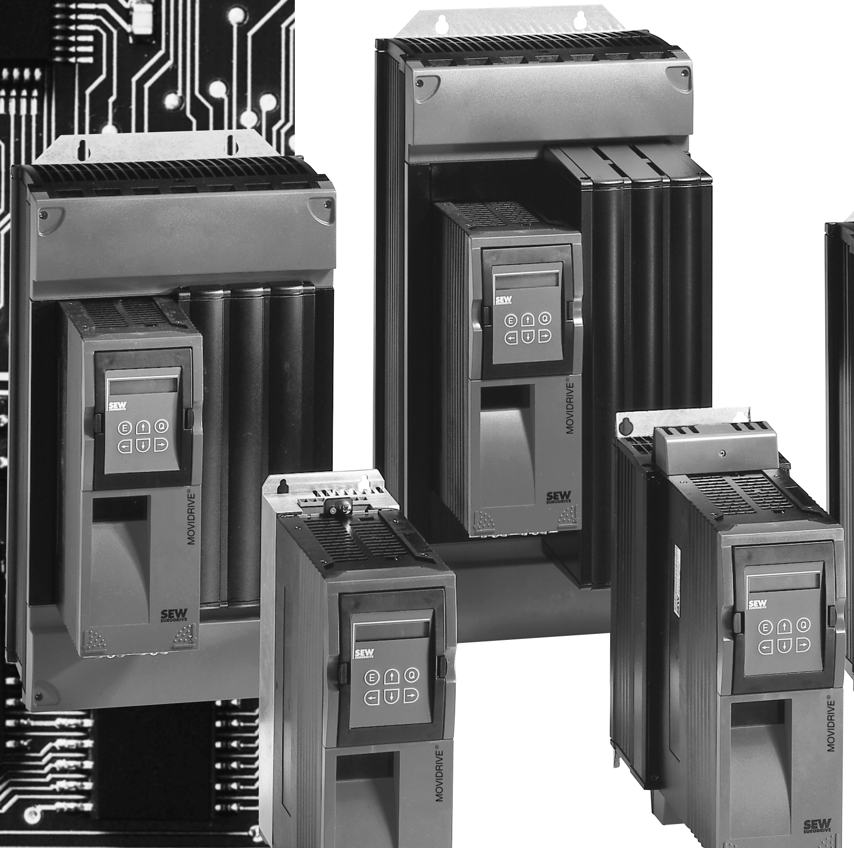
MOVIDRIVE®
Drive Inverters

Manual

Fieldbus Unit Profile with Parameter List

Edition 10/2000



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DIN EN ISO 9001

SEW
EURODRIVE

Important Notes

- **Read this manual carefully before you start installation and startup of MOVIDRIVE®drive inverters with fieldbus options.**
  This manual assumes that the user has access to and is familiar with the documentation on the MOVIDRIVE® system, in particular the manual and the operating instructions.

- **Safety notes:**
  Always observe the safety and warning instructions contained in this manual!
  Safety notes are marked as follows:

Electrical hazard, e.g., when working under live conditions.

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

Important instructions for safe and fault-free operation of the driven machine / system, e.g., presetting before startup.

- **General safety notes for bus systems:**
  The fieldbus unit profile gives you a communications system which allows you to match the MOVIDRIVE® drive inverter to the specifics of your application to a very high degree. As with all bus systems there is, however, the risk of parameters being changed which will not show outside (i.e., the inverter), but affect the behavior of the inverter. This may result in unexpected (although not uncontrolled) system behavior.

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

- Each unit is manufactured and tested to current SEW-EURODRIVE technical standards and specifications.
  The manufacturer reserves the right to make changes to the technical data and designs which are in the interest of technical progress.
  Following this information is required for fault-free operation and fulfillment of any warranty claims.

Changes compared to Edition 10/98 are indicated by a gray bar in the margin.

Contents

1 Introduction

This *Fieldbus Unit Profile Manual* describes the operation of the MOVIDRIVE® drive inverter when connected to a higher-level automation system via a fieldbus option pcb. In addition to descriptions of all the fieldbus parameters, the various control concepts and potential applications are dealt with in the form of brief examples of programs. The application examples are described both in graphic form and in Simatic-S5 syntax. These application examples can be used with almost all fieldbus option pcbs that fit the MOVIDRIVE® drive inverter.

In order to enable the MOVIDRIVE® to be connected simply and efficiently to the fieldbus system (e.g., PROFIBUS-DP, PROFIBUS-FMS, INTERBUS, etc.), the following more detailed documentation on fieldbus technology is required in addition to this *Fieldbus Unit Profile Manual*:

- User Manual for PROFIBUS (DFP11), INTERBUS (DFI11), CAN Bus (DFC11), DeviceNet (DFD11) options
- MOVIDRIVE® User Manual

The *PROFIBUS (DFP11), INTERBUS (DFI11), CAN Bus (DFC11) and DeviceNet (DFD11) Option User Manuals* describe the installation and startup of the option pcbs and give further application examples specifically for setting the drive inverter parameters via the corresponding fieldbus.

The *MOVIDRIVE® Manual* contains a list of all parameters of the drive inverter that can be read and written via various communication interfaces such as the RS-232 and RS-485 and via the fieldbus interface.

Fieldbus systems are increasing in significance in mechanical and industrial engineering. Not only can they bring about considerable savings in installation and maintenance costs, they also offer an ideal way of creating a digital network of intelligent sensors and actuators with higher-level automation systems such as programmable logic controllers (PLCs), industrial PCs (IPCs), etc.

Because of the large number of bus systems available on the market, designers and developers of industrial plants are nowadays often required to have a knowledge of more than one system since the end customer decides more and more which fieldbus system is to be used within a given system. Consequently, a universally applicable fieldbus interface which can support different fieldbus systems, is an absolute necessity for field equipment at the sensor/actuator level.

The startup and diagnostic facilities of the fieldbus systems are another major point. These days, diagnostics are generally carried out via the master module or via specific bus monitors (which can often only be operated by specialists), so intelligent field equipment should also provide extremely simple fieldbus diagnostic facilities.

The SEW MOVIDRIVE® drive inverters meet these requirements and can be linked to systems such as the open, standardized serial bus systems CAN bus, PROFIBUS-DP, PROFIBUS-FMS, INTERBUS, and DeviceNet by using a variety of fieldbus option pcbs. The MOVIDRIVE® also enables connections to other fieldbus systems to be made thanks to the powerful, universal structure of its fieldbus interface.

A major feature of the MOVIDRIVE® drive inverter is the fieldbus-independent, uniform behavior of the unit (unit profile) when controlled via a fieldbus. Because it operates independently of the fieldbus, it enables plant developers and PLC programmers to use different fieldbus systems with the same application program, i.e., the actual application concept and program can be implemented very easily with different fieldbus systems.

2 Overview of Functions

Thanks to its high-performance, universal fieldbus interface, the MOVIDRIVE® drive inverter enables connections to be made with higher-level automation systems via a wide range of fieldbuses, such as INTERBUS, PROFIBUS-DP, PROFIBUS-FMS, etc. The underlying behavior of the inverter, known as the unit profile, is independent of the fieldbus and is therefore uniform.

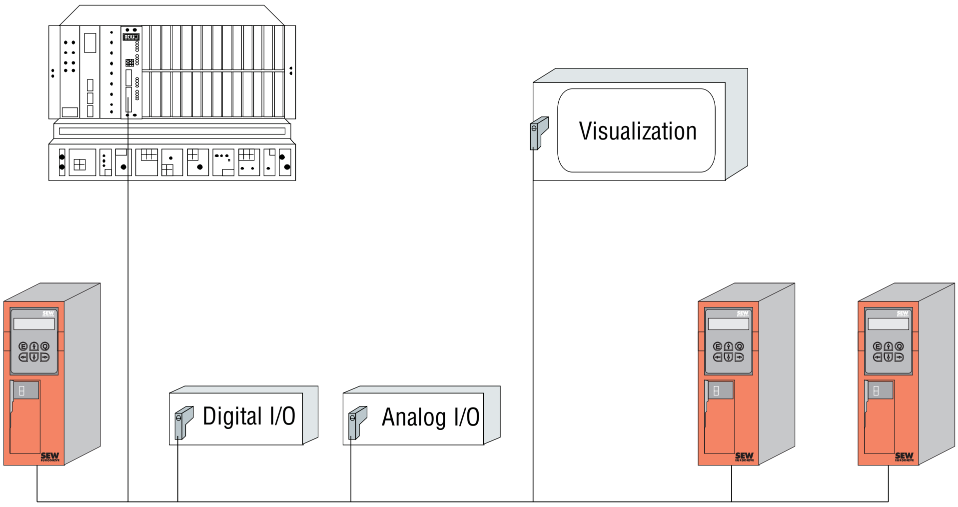

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Figure 1: Typical bus configurations in a field environment

MOVIDRIVE® offers digital access to all drive parameters and functions via the fieldbus interface. Control of the drive inverter is achieved through the fast, cyclical process data. This process data channel provides the facility to specify not only setpoint values (e.g., setpoint speed, ramp generator times for acceleration and deceleration, etc.), but also to trigger various drive functions such as enable, controller inhibit, stop, rapid stop, etc. This channel can also be used to read back actual values from the drive inverter, such as actual speed, current, unit status, error number or even reference messages.

Together with the sequence and positioning control system IPOS^{plus} integrated in the drive inverter, the process data channel can also be used as a direct connection between PLC and IPOS^{plus}. In this case, the process data are not evaluated by the drive inverter but, instead, directly by the IPOS^{plus} control program.

Whereas process data are generally exchanged in cycles, the drive parameters can also be read and written acyclically via functions such as READ and WRITE. This exchange of parameter data enables applications where all important drive parameters are stored in the higher-level automation unit to be implemented, thus avoiding manual adjustment of parameters on the drive inverter itself, which can often be very time-consuming.

The use of a fieldbus system requires additional drive system monitoring such as time-monitoring of the fieldbus (fieldbus timeout) or even special emergency stop concepts. The MOVIDRIVE® monitoring functions can be customized to your applications. The user can thus determine which error response the drive inverter should trigger in case of a bus error. 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). Since 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 terminals of the drive inverter.

The MOVIDRIVE® drive inverter offers numerous diagnostic options for startup and servicing. For instance, both the setpoints transmitted from the higher-level control unit and the actual values can be checked with the fieldbus monitor in the hand-held keypad. It also provides a lot of additional information on the status of the fieldbus option pcb. The PC software MX_SHELL offers even more convenient diagnostic options in that it provides a detailed display of the fieldbus and unit status information in addition to setting all drive parameters (including fieldbus parameters).

Process Data

The term *Process Data (PD)* refers to all time-critical (real time) data in a process which have to be processed or transferred at high speed. These data are characterized by the fact that they are highly dynamic and always up to date. Examples of process data are setpoints and actual values of the drive inverter, or peripheral conditions of limit switches. They are exchanged in cycles between the automation unit and the drive inverter.

Control of the MOVIDRIVE® drive inverter by means of process data takes place on the fieldbus system.

In general, the process input data and process output data should be treated separately. Thus, you can determine specifically for your applications which process output data (setpoints) will be transmitted from the controller to the drive inverter or which process input data (actual values) should be transferred by the MOVIDRIVE® drive inverter in the opposite direction (to the higher-level control unit).

3 Control and Setpoint Selection

Parameters can be assigned to the MOVIDRIVE® drive inverter via the fieldbus system immediately after the voltage supply has been switched on; no additional settings are necessary.

To control the drive inverter via the fieldbus system, the latter must first be switched to the relevant control source and setpoint source. The differentiation between control and setpoint source enables a multitude of combinations so that the drive is controlled via fieldbus, for example, and uses the analog setpoint as setpoint. The parameters for defining the process output data are then used by the drive inverter to correctly interpret the received process data.

The *P100 setpoint source* parameter determines which communications interface the drive inverter uses to process the setpoint.

100 setpoint source	RS485
	FIELDBUS
	SBus
	...

The *P101 control source* determines how the drive inverter should be controlled. The inverter expects the control word from the source which has been set with this parameter.

101 control source	TERMINALS
	RS485
	FIELDBUS
	SBus

Setting: TERMINALS

Control of the drive inverter is accomplished via binary inputs only and via the IPOS^{plus} control program, if necessary.

Setting: RS-485, FIELDBUS, SBus

The control word defined in the process output data channel is updated by the set control source (RS-485/FIELDBUS/system bus).

The binary inputs and IPOS^{plus} control program continue to participate in control.

3.1 Wiring Example

For safety reasons, the drive inverter must also be enabled on the terminal side **at all times** in order for it to be controlled via the fieldbus system. The terminals should therefore be wired or programmed so that the inverter is enabled via binary inputs.

The simplest method of enabling the drive inverter via the terminals is to provide binary input DI 00 (*/CONTROLLER INHIBIT* function) with a +24 V signal and to program binary inputs DI 01 and DI 03 to *NO FUNCTION*. Figure 2 demonstrates the wiring via the terminals and the parameterization for exclusive control of the drive inverter using the process data.

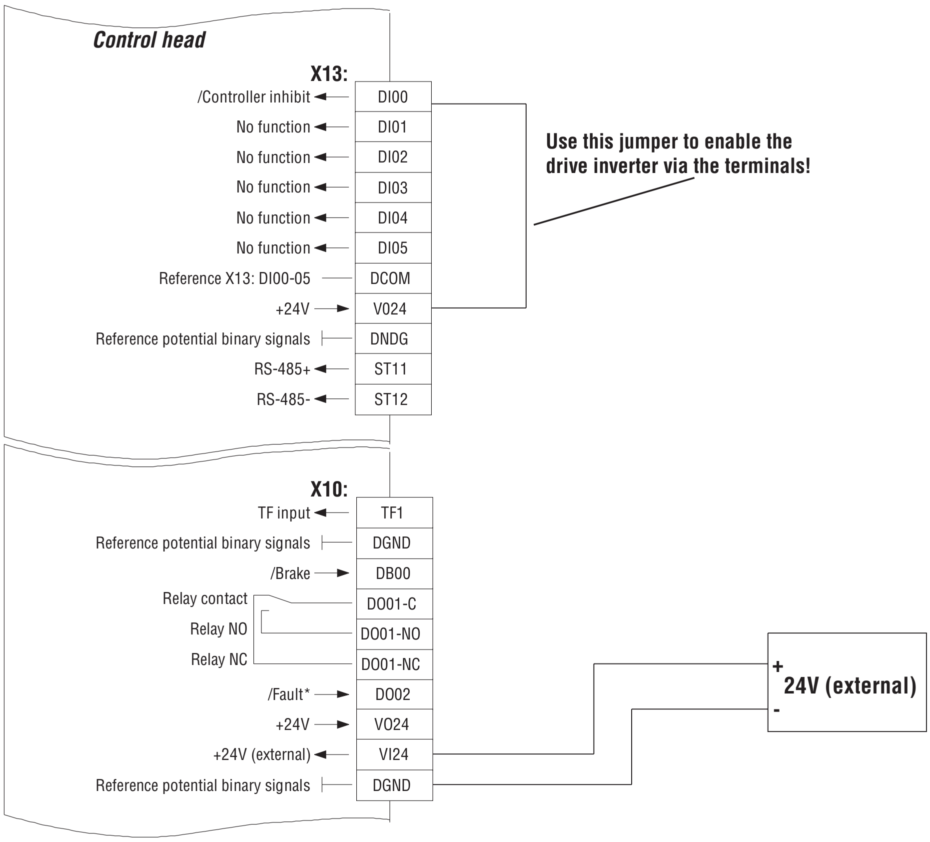

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Figure 2: Wiring example for control via process data (via RS-485, Fieldbus, SBus)

3.2 Process Data Configuration

The MOVIDRIVE® drive inverter can be controlled via the fieldbus system with one, two or three process data words. The number of process input data (PI) and process output data (PO) is identical.

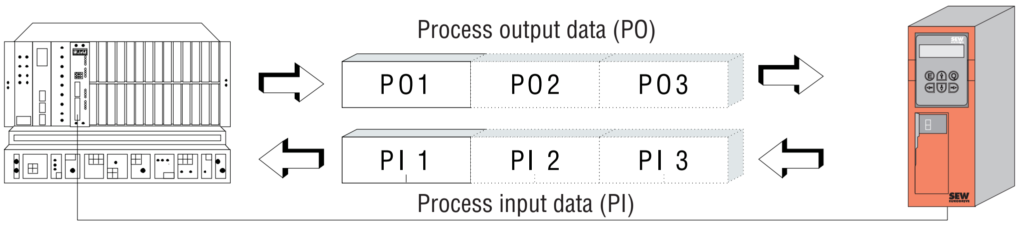

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Figure 3: Process data channel for the SEW MOVIDRIVE® drive inverter

The process data configuration settings are made via the fieldbus option pcb, either through hardware (e.g., DFI11) or via the fieldbus master at the start of the bus system (e.g., PROFIBUS-DP). The drive inverter automatically receives the correct setting from the fieldbus option. You can check the current process data configuration in the menu item *P090 Fieldbus PD Configuration* by means of the keypad or by means of MX_SHELL.

Depending on the type of fieldbus option used, PD configurations according to Table 1 can be used.

090 PD configuration	
1 process data word + parameter channel	1PD+PARAM
1 process data word	1PD
2 process data words + parameter channel	2PD+PARAM
2 process data words	2PD
3 process data words + parameter channel	3PD+PARAM
3 process data words	3PD

Table 1: Process data configuration for MOVIDRIVE®

The parameter channel is only of significance for fieldbus systems without layer 7 functionality, e.g., PROFIBUS-DP. Only the number of process data (i.e., 1PD..., 2PD... or 3PD...) is of interest when controlling the inverter by means of process data.

If programmable logic controllers are used as fieldbus masters, the process data are generally sent directly to the I/O or peripheral area. The I/O or peripheral area in the PLC must therefore make sufficient memory space available for the drive inverter process data (Figure 4). Addresses are usually allocated between the drive inverter process data and the PLC address area on the fieldbus master module.

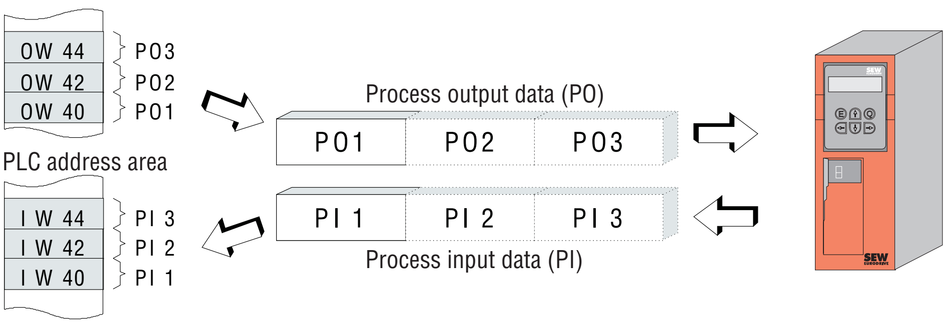

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Figure 4: Mapping of process data in the PLC

3.3 Process Data Description

The process data description defines the content of the process data to be transmitted. All three process data words can be assigned individually by the user.

The following six fieldbus parameters are available for defining the individual process data:

- P870 PO1 Setpoint Description
- P871 PO2 Setpoint Description
- P872 PO3 Setpoint Description
- P873 PI1 Actual Value Description
- P874 PI2 Actual Value Description
- P875 PI3 Actual Value Description

When one of the above-mentioned parameters is changed, acceptance of the process output data for setpoint processing via the fieldbus is automatically blocked. The process output data received will not be processed according to the new actual value and setpoint descriptions until the fieldbus parameter

- P876 Enable PO data = ON

is re-activated.

3.3.1 Setpoint Description for the PO Data

The *POx Setpoint Description* parameters define the content of the process output data words, which are sent via the fieldbus system from the higher-level automation unit (Figure 5).

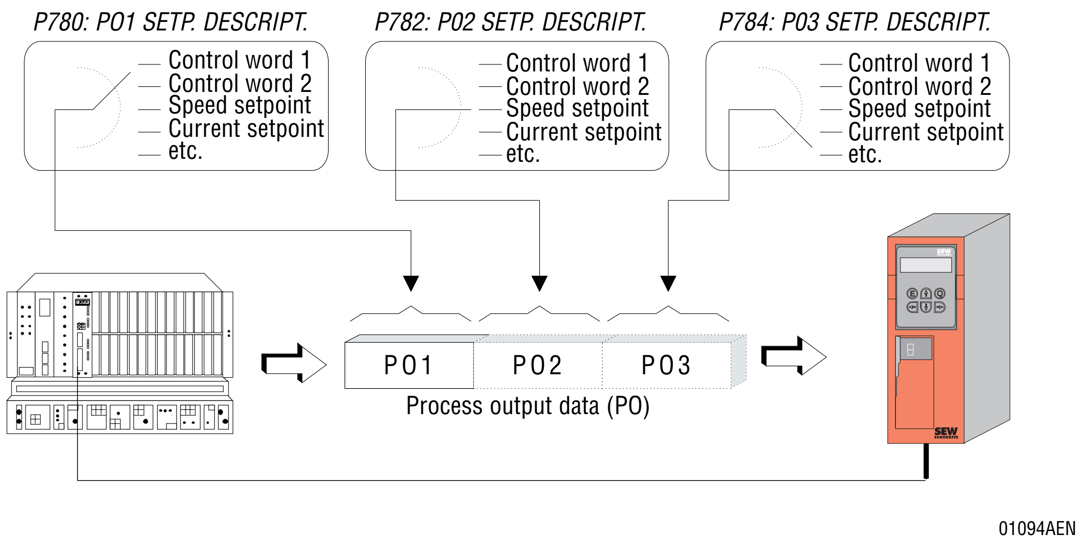

Figure 5: Setpoint description of the process output data (PO)

Process output data words PO1, PO2 and PO3 are used to transmit the setpoints listed in the following table through the process output data channel. You may decide yourself in which process data word you wish to transmit the more significant part (high) and the less significant part (low) respectively.

Assignment	Meaning	Scaling
NO FUNCTION	If the *NO FUNCTION* setting is active, the drive inverter will not use this process output data word for setpoint processing. The content of the process output data word programmed to *NO FUNCTION* will be ignored even though the higher-level control might specify a real setpoint via the fieldbus system. The NO FUNCTION setting only blocks the processing of this process output data word in the inverter system. However, you can always access the process output data via IPOS^{plus}.	
SPEED	The *SPEED* setting causes the MOVIDRIVE® drive inverter to interpret the setpoint transmitted in this process data word as speed setpoint if the set operating mode (P700 Operating Mode 1, P701 Operating Mode 2) permits a speed setpoint. If no speed setpoint has been programmed, even though a communications interface (FIELDBUS, RS-485, system bus) has been set as setpoint source, the drive inverter operates with Speed Setpoint = 0.	1digit = 0.2/min
CURRENT	The *CURRENT* setting causes the drive inverter to interpret the setpoint transmitted in this process data word as current setpoint if a variant with torque control has been set as operating mode *(P700 Operating Mode 1)*. Otherwise, the drive inverter ignores the current setpoint.	1digit = 0.1 % I_N
POSITION LO/HI	The *POSITION HI / POSITION LO* setting causes the drive inverter to transmit the received setpoint (generally a position setpoint) by these process output data as a 32-bit value directly to the IPOS^{plus} program in the IPOS variable *499 SP.PO.BUS (Setpoint Position Bus)*. Position setpoints must be spread over two process data words, since the position is generally entered as a signed 32-bit value. You must therefore specify the more significant position setpoint *(POSITION HI)* and the less significant position setpoint *(POSITION LO)*. Otherwise the drive inverter will not accept the process output data into the IPOS program.	
MAX. SPEED	The *MAX. SPEED* setting causes the MOVIDRIVE® drive inverter to interpret the transmitted setpoint as speed limit. The speed limit is therefore specified in the unit [1/min] and interpreted as absolute value for both directions of rotation. The supported range of values for the fieldbus speed limit corresponds to the range of values for the *P302 Maximum Speed 1* parameter. Entering the speed limit via the fieldbus will automatically deactivate the parameters *P302 Maximum Speed 1, P312 Maximum Speed 2*!	1digit = 0.2/min
MAX. CURRENT	The *MAX. CURRENT* setting causes the MOVIDRIVE® drive inverter to interpret the transmitted process output data as current limit. The current limit is specified in per cent of the inverter rated current in the unit [% In] and is interpreted as absolute value for both directions of rotation. The supported range of values for the fieldbus current limit corresponds to the range of values for parameter *P303 Current Limit 1*. The current limits that are adjusted using the parameter *P303 Current Limit 1* or *P313 Current Limit 2* also remain valid if the current limit is set via process data so that these parameters can be regarded as maximum effective current limit.	1digit = 0.1 % I_N
SLIP	The *SLIP* setting causes the MOVIDRIVE® drive inverter to interpret the transmitted process output data word as slip compensation value. Entering the slip compensation via the fieldbus will automatically deactivate parameters *P324 Slip Compensation 1* or *P334 Slip Compensation 2*. Entering the slip compensation via the process data channel only makes sense in the *VFC-N-CONTROL* operating mode since a change in the slip compensation may also have an indirect effect on the torque. The range of values for this slip compensation value is identical with the range of values for parameter *P324 Slip Compensation 1* and corresponds to a speed range of 0 - 500 1/min. If the slip specified in the process data is outside this range of values, the minimum or maximum will become effective if the specified slip is lower or higher than the given value range.	1digit = 0.2/min

Assignment	Meaning	Scaling
RAMP	The *RAMP* setting causes the MOVIDRIVE® drive inverter to interpret the transmitted setpoint as acceleration or deceleration ramp. The specified figure is the time in milliseconds and relates to a speed change of 3000 1/min. The rapid stop and emergency stop function is not affected by this process ramp. When the process ramp is transmitted through the fieldbus system, ramps t11, t12, t21 and t22 will become inactive.	1digit = 1 ms
CONTROL WORD 1 / CONTROL WORD 2	Assigning control word 1 or control word 2 to the process output data allows you to activate nearly all drive functions via the fieldbus system. For a description of control words 1 and 2 see the section "Definition of the Control Word".	
SPEED [%]	The *SPEED [%]* setting causes the MOVIDRIVE® drive inverter to interpret the setpoint transmitted in this process data word as a speed setpoint percentage. The relative speed setpoint always refers to the current applicable maximum limit of the speed, i.e., either P302/312 or MAX. SPEED or PO Speed Limit.	4000_{hex} = 100 % n_{max}
IPOS PO DATA	If the *IPOS PO DATA* setting is active, the drive inverter will not use this process output data word for setpoint processing. The content of the process output data word programmed to *IPOS PO DATA* is ignored by the inverter system and reserved exclusively for processing in the $IPOS^{plus}$ control program. In $IPOS^{plus}$, you can use the *GetSys PO Data* command for direct access to the process output data of the communications interfaces. Additional information can be found in the $IPOS^{plus}$ sequence and position control system manual.	Up to 48 bits, individually coded, can be exchanged between the higher-level automation unit and $IPOS^{plus}$.

Note:

STOP

Position setpoints must be transmitted consistently. Otherwise the servo controller may approach undefined positions since, for example, an old position setpoint low and a new position setpoint high may be active together!

Additional notes on maintaining data consistency and the programming techniques associated with it can be found in the project planning manual on the master interface module of your automation unit.

3.3.2 Special Cases of PO Data Processing

Separate setting of the process output data description allows a multitude of combinations to be set though not all of them make sense from a technical point of view.

In addition to the process output data from the fieldbus system the digital input terminals and, in special cases, the analog setpoint from the MOVIDRIVE® drive inverter are used, too.

No setpoint entry from the fieldbus	If a communications interface was set as setpoint source and no setpoint was programmed at the process output data description, the Setpoint = Zero is generated in the inverter.
No control word entry from the fieldbus	If a communications interface was set as control source and no control word was programmed at the process output data description, the *ENABLE* control command is entered in the inverter.
Duplicate usage of the process output data channel	If several process output data words contain the same setpoint description, only the process output data word which is read first will be valid. The processing sequence in the drive inverter is PO1 – PO2 – PO3, i.e., if PO2 and PO3 contain the same setpoint description, only PO2 will be effective. The content of PO3 will be ignored.

3.3.2.1 32-Bit Process Output Data

Process data which are longer than 16 bits and therefore occupy more than one process data word will only be processed by the inverter if they are completely mapped to the process data channel.

3.3.3 PI Data Processing

The process input data of the inverter (actual values, status information, etc.) can be read via all communications interfaces of the inverter and, therefore, are not coupled to the control and setpoint source.

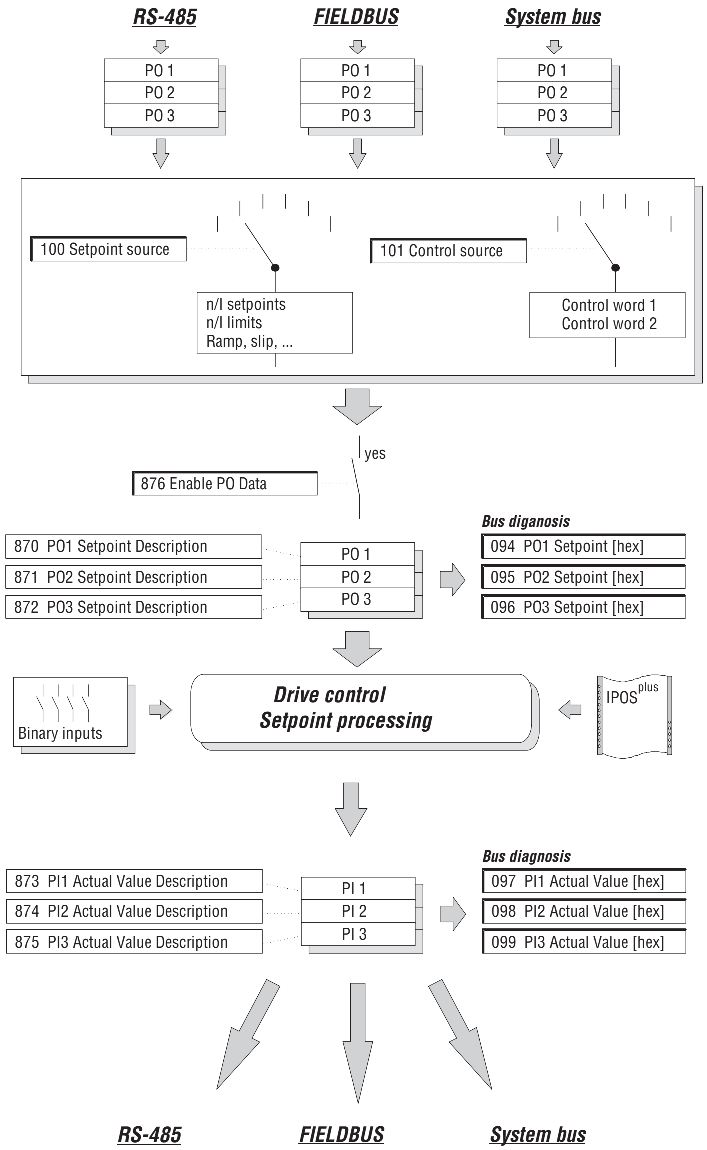

Figure 6: PO/PI data processing in the inverter

3.3.4 Actual Value Description of the PI Data

The *PI1–PI3 Actual Value Description* parameters define the content of the process input data words, which are sent via the fieldbus system from the drive inverter to the higher-level automation unit (Figure 7). Each process data word is defined by its own parameter, so that three parameters are required to describe the process input data.

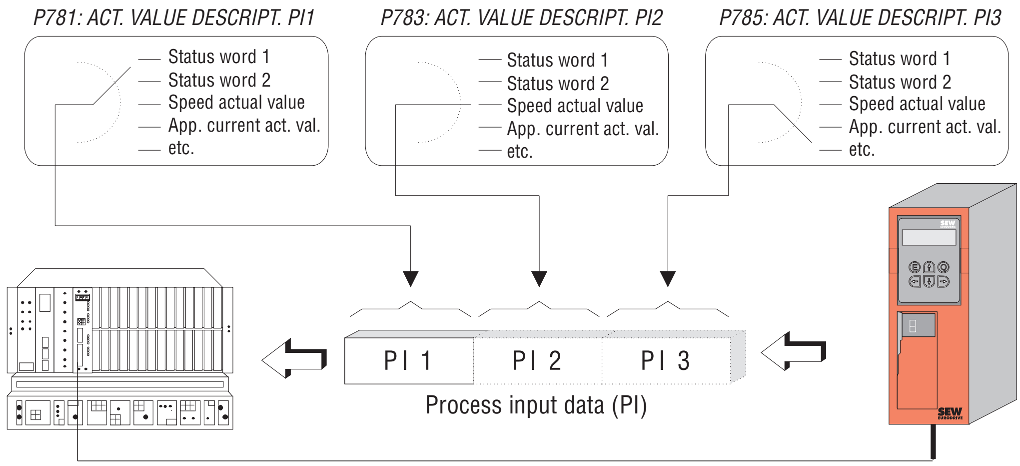

Figure 7: Actual value description of the process input data (PI)

Process input data words PI1 to PI3 serve to transfer the parameters listed below via the process data channel. 32-bit values, such as the actual position, are transmitted in two process data words. You may decide yourself in which process data word you wish to transmit the more significant part (high) and the less significant part (low) respectively.

Assignment	**Meaning**	**Scaling**
NO FUNCTION	If *NO FUNCTION* is assigned to a process input data word, the inverter system will not update this process input data word. In this case, MOVIDRIVE® will always return a value of 0000hex to the higher-level control system.	
SPEED	The *SPEED* setting causes the drive inverter to return the current speed actual value to the higher-level automation system in the unit [1/min]. The speed actual value can only be returned accurately if the drive inverter can determine the actual motor speed of a speed feedback facility. In a slip compensated application the difference to the real motor speed depends solely on the accuracy of the slip compensation set by the user.	1digit = 0.2/min
OUTPUT CURRENT	The *OUTPUT CURRENT* setting causes the drive inverter to return the current actual value of the output current in the unit [% In] (as percentage related to the rated current of the drive inverter) to the higher-level automation system.	1digit = 0.1 % I_N
ACTIVE CURRENT	Assigning a process input data word with *ACTIVE CURRENT* causes the drive inverter to return the current actual output value in the unit of [% In] to the higher-level automation system.	1digit = 0.1 % I_N
POSITION LO/HI	Position actual values must be spread over two process data words, since the position is generally transmitted as integer32. This means you have to specify both the *Position Actual Value High* and the *Position Actual Value Low*. The drive inverter will provide valid position actual values only in operating modes with speed feedback.	
STATUS WORD 1 / STATUS WORD 2	Assigning status word 1 or status word 2 to the process input data allows you to access status data, fault indicators and reference messages.	
SPEED [%]	The *SPEED [%]* setting causes the drive inverter to return the current relative speed actual value to the higher-level automation system in the unit [% n_{max}] / P302.	4000_{hex} = 100 % n_{max}

Assignment	Meaning	Scaling
IPOS PI DATA	If the *IPOS PI* (IPOS Process Input Data) setting is active, an individual actual value from the IPOS^{plus} program can be transmitted via the process input data to the higher-level control system. This system allows exchanging up to 48 bits, individually coded between the IPOS^{plus} program and the higher-level controller via the process data channel. Within IPOS^{plus} you can use the command *SetSys PI Data* to describe the process input data directly. Additional information can be found in the IPOS^{plus} sequence and position control system manual.	

3.3.5 Enable PO Data

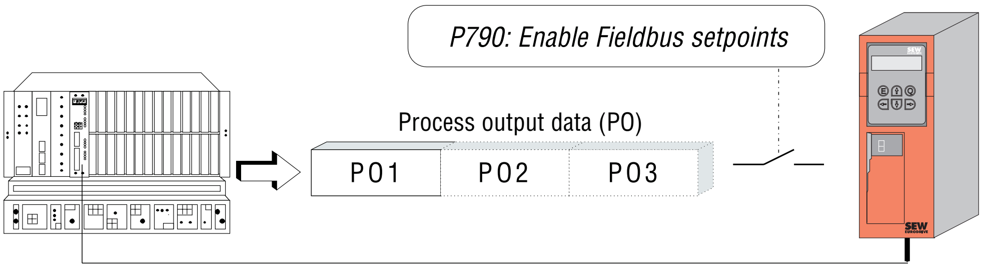

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Figure 8: Function of the Enable Fieldbus Setpoints *parameter*

When the *PO1-PO3 Setpoint Description* parameters are changed the process output data are automatically disabled through the setting *Enable PO Data = No*. Only when the setting *Enable PO Data = YES* is initiated (e.g., by the higher-level control) will the process output data channel be enabled again for processing.

NO	Process output data disabled; The inverter will continue to use the last valid (frozen) process output data for this setpoint processing until the fieldbus setpoints are activated again.
YES	Process output data enabled; The drive inverter uses the process output data from the master.

Table 2: Enable range of values for fieldbus setpoints

3.3.6 Scaling of the Process Data

Process data are always transmitted as hexadecimal data to facilitate their handling and processing by the system. Parameters with the same unit of measurement are given the same scaling to allow the setpoints and the actual values to be compared directly in the application program of the higher-level automation unit. There are four different process data types:

- Speed [1/min]
- Current [% rated current]
- Ramp [ms]
- Position [degrees].

The different control word and status word variants are coded as bit fields and are discussed in a separate section.

Process data	Type	Resolution	Reference	Range
Speed setpoint / Speed actual value / Speed limit / Slip compensation	Integer 16	1 digit = 0.2 min^{-1}		–6553,6 ... 0 ... +6553.4 min^{-1} 8000_{hex} ... 0 ... $7FFF_{hex}$
Relative speed setpoint [%] / Relative speed actual value [%]	Integer 16	1 digit = 0.0061 % (4000_{hex} = 100 %)	Maximum speed of the inverter	– 200 % ... 0 ... + 200 % – 0,0061 % 8000_{hex} ... 0 ... $7FFF_{hex}$

Process data	Type	Resolution	Reference	Range
Apparent current actual value / Active current actual value / Current setpoint / Current limit	Integer 16	1 digit = 0.1 % I_N	Drive inverter rated current	-3276.8 % ....0..... +3276.7 % 8000_{hex} .....0.....$7FFF_{hex}$
Process ramp up / Process ramp down	Unsigned 16	1 digit = 1 ms	delta-f = 50 Hz	0 ms ... 65535 ms 0000_{hex} ... $FFFF_{hex}$
Position actual value / Position setpoint	Integer 32	1 motor revolution = 4096 increments, i.e. 1digit = $\frac{360°}{4096}$		-188.743.680° ....0..... +188.743.679° -524 288 ....0.... +524287 motor revolutions 8000 0000 $_{hex}$ ... 0 ... 7FFF FFFF $_{hex}$ high low high low

If the motor is connected correctly, positive speed values correspond to CLOCKWISE direction of rotation or, in the case of hoisting applications, to CLOCKWISE = UP.

Examples

Process data	Value	Scaling	Transferred process data
Speed	CW 400 min^{-1}	$\frac{400}{0.2} = 2000_{dez} = 07D0_{hex}$	2000_{dec} or $07D0_{hex}$
	CCW 750 min^{-1}	$(-1)\frac{750}{0.2} = 3750_{dez} = F15A_{hex}$	-3750_{dec} or $F15A_{hex}$
Relative speed	CW 25% f_{max}	$25 \cdot \frac{16384}{100} = 4096_{dez} = 1000_{hex}$	4096_{dec} or 1000_{hex}
	CCW 75% f_{max}	$(-75)\frac{16384}{100} = -12288_{dez} = D000_{hex}$	-12288_{dec} or $D000_{hex}$
Current	45 % I_N	$\frac{45}{0.1} = 450_{dez} = 01C2_{hex}$	450_{dec} or $01C2_{hex}$
	115.5 % I_N	$\frac{115.5}{0.1} = 1155_{dez} = 0483_{hex}$	1155_{dec} or 0483_{hex}
Ramp	300 ms	300 ms $\rightarrow$ 300_{dec} = $012C_{hex}$	300_{dec} or $012C_{hex}$
	1.4 s	1.4 s = 1400 ms $\rightarrow$ 1400_{dec} = 0578_{hex}	1400_{dec} or 0578_{hex}
Position	35 revs CCW	-35 · 4096 = - 143360_{dec} = FFFD $D000_{hex}$	FFFD D000 $_{hex}$ high low
	19 revs CW	19 · 4096 = 77824_{dec} = 0001 3000_{hex}	0001 3000 $_{hex}$ high low

STOP

IMPORTANT!

When handling the position setpoints in the application program of the higher-level automation unit, make sure that both process output data words containing the position data are dealt with consistently, i.e., that the position setpoint high is always transmitted together with a position setpoint low! Otherwise the servo controller may approach undefined positions since, for example, an old position setpoint low and a new position setpoint high may be active together!

3.4 Definition of the Control Word

The control word is 16 bits long. Each bit has a drive inverter function assigned to it. The low byte comprises 8 function bits with a permanent definition each, which are always valid. The assignment of the more significant control bits varies for the different control words.

Functions, which the inverter does not generally support, cannot be activated via the control word either. In this case the individual control word bits are to be considered as reserved bits and set at logical 0 by the user!

3.4.1 Basic Control Block

The less significant part of the control word comprises 8 function bits, to which the most important drive functions are permanently assigned. Figure 9 shows the assignment of the basic control block.

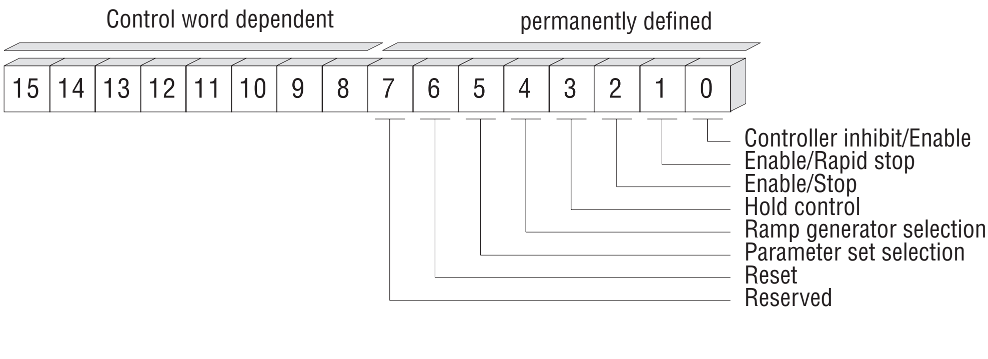


Figure 9: Basic control block for all control words

Table 3 shows the functionality of the single control bits.

Bit:	Functionality	Assignment
0	Controller inhibit	0 = Enable 1 = Inhibit controller, activate brake
1	Enable/Rapid stop	0 = Rapid stop 1 = Enable
2	Enable/Stop	0 = Stop with generator ramp or process ramp 1 = Enable
3	Hold control	0 = Hold control not active 1 = Hold control active
4	Ramp generator selection	0 = Ramp generator 1 1 = Ramp generator 2
5	Parameter set selection	0 = Parameter set 1 1 = Parameter set 2
6	Reset	0 = Not active 1 = Reset fault
7	Reserved	Reserved bits are to be set to zero!

Table 3: Bit coding of the basic control block (control word low byte)

3.5 Connecting Safety-Relevant Control Commands

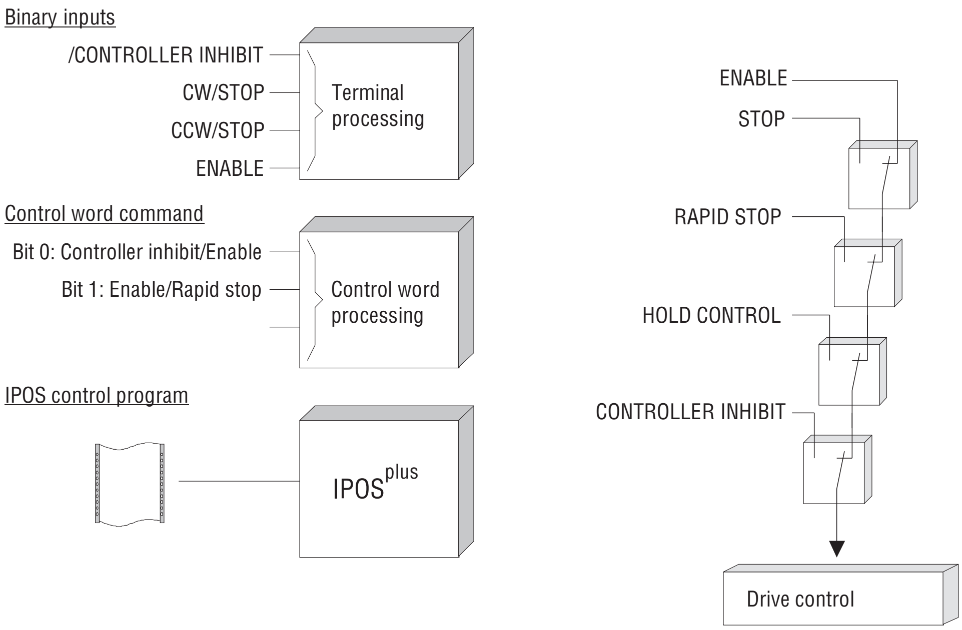
In general the control commands

- *CONTROLLER INHIBIT*
- *RAPID STOP*
- *STOP*
- *HOLD CONTROL*
- *ENABLE*

can be activated using the set control source, the binary inputs and the IPOS^{plus} control program at the same time. Safety-relevant connection of these control functions is processed through prioritizing the individual control commands. Figure 10 demonstrates that all three processing blocks (terminal processing, control word processing and IPOS^{plus} program) must generate the enable function to enable the drive inverter. However, as soon as one of the three processing blocks triggers a higher-priority control command (e.g., *STOP* or *CONTROLLER INHIBIT*), this command will become effective.

After power-on of the drive inverter, IPOS^{plus} generally furnishes the control command *ENABLE*, so that the drive can also be controlled without IPOS^{plus} program.

In general, the binary inputs also remain active if the drive inverter is controlled via the process data *(P101 Control Source = RS485/FIELDBUS/SBus)*. Safety-relevant functions such as Controller Inhibit and Enable are processed with equal priority both by the terminal strip and the fieldbus, i.e., for fieldbus control of the drive inverter, the drive inverter must first be enabled on the terminal side. All other functions, which can be activated both via terminals and via control word, are processed as OR functions.



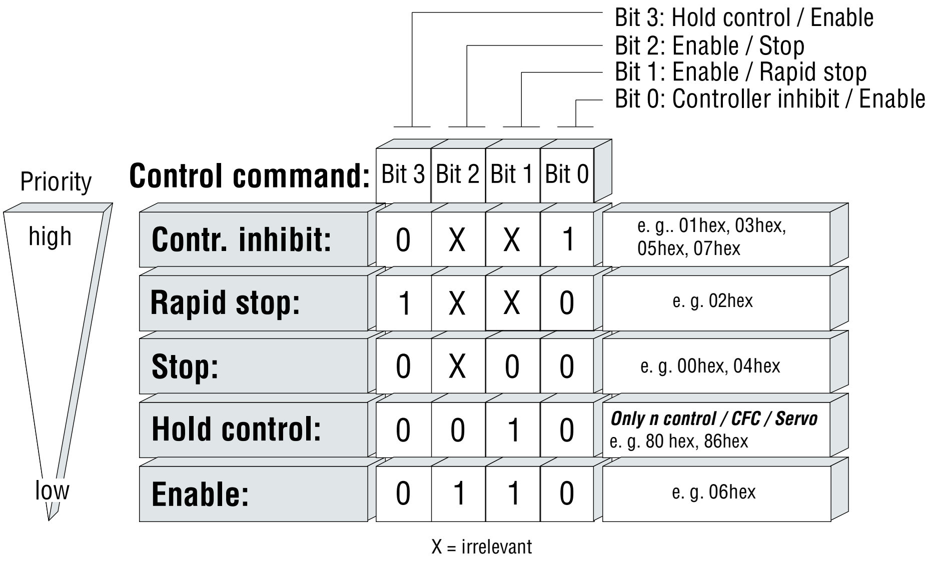
01274AEN

Figure 10: Connecting the safety-relevant control signals from the input terminals and the fieldbus

For safety reasons, the definition of the basic control block is such that the inverter uses control word entry 0000_{hex} to adopt safe state *No Enable,* since all common fieldbus master systems definitely reset the outputs to 0000_{hex} in case of a fault or malfunction! In this case the drive inverter will carry out a rapid stop and then activate the mechanical brake.

Controlling the Drive Inverter with Bit 0-3

When the drive inverter has been enabled via the terminals, it can be controlled with bit 0 – bit 2 or bit 0 – bit 3 for applications with speed feedback of the basic control block.



01275BEN

Figure 11: Coding of the control commands of the MOVIDRIVE® drive inverter

The *Enable* Control Command

The *Enable* control command enables the drive inverter via the fieldbus system. If the process ramp is transmitted together with the control command via the fieldbus system, this control command will use the specified ramp value as acceleration ramp. If not, the drive inverter will use the typical ramp generators *Ramp up* for this control command, depending on the selected parameter and ramp generator sets.

For the *Enable* control command to become active, all three bits must be switched to *Enable* (110_{bin}).

The *Controller Inhibit* Control Command

The *Controller Inhibit* control command allows you to disable the power output stages of the drive inverter and thus make them become high-resistance. At the same time the drive inverter will activate the mechanical motor brake causing the drive to stop immediately by way of mechanical braking. Motors which are not fitted with a mechanical brake will coast to rest when this control command is used.

To initiate the *Controller Inhibit* control command, it is sufficient to set *Bit 0: Controller Inhibit/ Enable* in the control word since all other bits are irrelevant. Consequently, this control bit has the highest priority in the control word.

The *Hold Control* Control Command

Setting bit 3 = 1 of the control word will activate the Hold Control function when the inverter is in speed control mode. This function causes the inverter to carry out a stop using the active generator ramp and then hold the position under hold control. For operating modes without speed feedback, this bit is not effective and the function is not activated.

The *Rapid Stop* Control Command

The *Rapid Stop* control command causes the drive inverter to ramp down the currently active rapid stop ramp. The set rapid stop ramps

- P136 T13 Stop Ramp (if parameter set 1 is active)
- P146 T23 Stop Ramp (if parameter set 2 is active)

will be active. The process ramp which may be specified via the fieldbus has no effect on the rapid stop!

This control command is activated with a reset of *Bit 1: Enable/Rapid Stop*.

The *Stop* Control Command

The Stop control command causes the drive inverter to ramp to rest. If the process ramp is transmitted together with the control command via the fieldbus system, this control command will use the specified ramp value as deceleration ramp. If not, the drive inverter will use the typical ramp generators Ramp Down for this control command, depending on the selected parameter and ramp generator sets.

The *Stop* control command is initiated using *Bit 2: Enable/Stop*.

Selecting the Effective Parameter Set

The effective parameter set is selected using bit 5 of the control word. Changing the parameter set is generally possible only in the *Controller Inhibit* status.

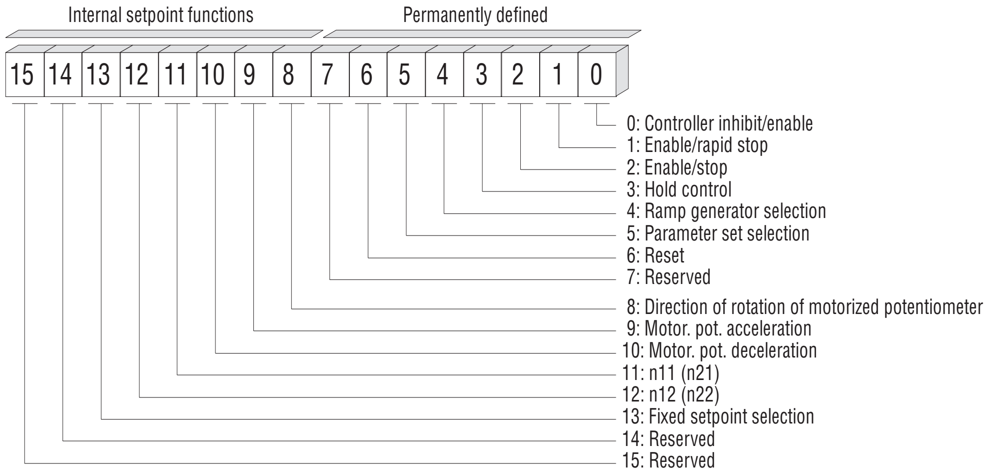
This bit is OR'd with the input terminal function *Parameter Set Selection*, i.e., the logic "1" on the input terminal OR in the control word bit will activate parameter set 2!

Reset after a Fault

Bit 6 of the control word resets the drive inverter via the process data channel in case of a fault. Every reset can only be initiated with a 0/1 edge in the control word.

3.5.1 Control Word 1

In addition to the most important drive functions contained in the basic control block, control word 1, in its more significant byte, contains function bits for internal setpoint functions which can be generated in the MOVIDRIVE® drive inverter.



00326AEN

Figure 12: Definition of control word 1

When using the internal setpoint functions, control word 1 enables you to control the inverter with only one process output data word in the I/O or peripheral section of the higher-level automation unit.

Table 4 shows the assignment of the higher-level control block with the internal setpoint functions.

Bit:	Functionality	Assignment
8	Direction of rotation for motor potentiometer	0 = Direction of rotation CW 1 = Direction of rotation CCW
9 10	Motor potentiometer acceleration Motor potentiometer deceleration	10 9 0 0 = No change 1 0 = Deceleration 0 1 = Acceleration 1 1 = No change
11 12	Selection of internal fixed setpoints n11...n13 or n21...n23	12 11 0 0 = Speed setpoint via process output data word 2 0 1 = Internal setpoint n11 (n21) 1 0 = Internal setpoint n12 (n22) 1 1 = Internal setpoint n13 (n23)
13	Fixed setpoint selection	0 = Fixed setpoints of the active parameter set can be selected via bit 11/12 1 = Fixed setpoints of the other parameter set can be selected via bit 11/12
14	Reserved	Reserved bits are generally to be set to zero!
15	Reserved	Reserved bits are generally to be set to zero!

Table 4: Assignment of higher-level control block of control word 1

When these internal setpoint functions are activated, entry of a speed setpoint via a different process output data word will no longer be effective!

Motorized Potentiometer Function via Fieldbus

Control of the motorized potentiometer setpoint function via fieldbus interface works the same as control via the standard input terminals.

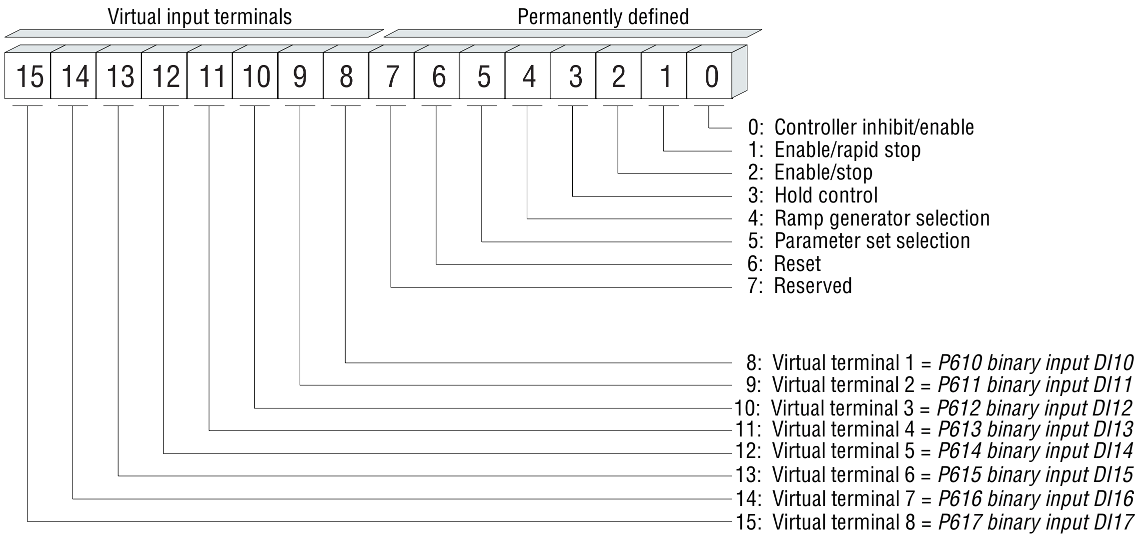
The process ramp which may be specified via another process output data word has no effect on the motorized potentiometer function. Only the motorized potentiometer ramp generators

- P150 T3 Ramp up
- P151 T4 Ramp down

are used.

3.5.2 Control Word 2

In addition to the function bits for the most important drive functions in the basic control block, control word 2, in its most significant section, contains the virtual input terminals. These terminals are freely programmable input terminals which, however, are not physically available since the requisite hardware (option pcbs) is not fitted. These input terminals are then mapped to the virtual input terminals of the fieldbus. Each virtual terminal is then assigned to an optional and **physically not available** input terminal and can be programmed to any function.



01118AEN

Figure 13: Control word 2 for MOVIDRIVE® with digital terminal expansion

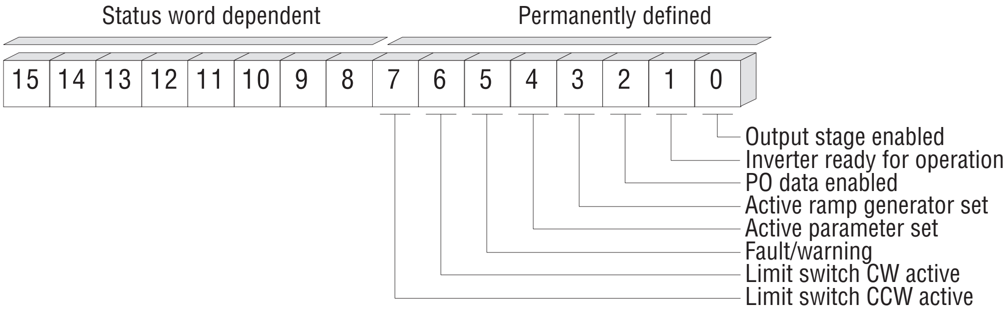
If the DIO11 has been fitted in the drive inverter in addition to the fieldbus option pcb, the inputs of the DIO11 have priority. In this case, the virtual inputs are not evaluated!

3.6 Definition of the Status Word

The status word is 16 bits long. The less significant byte, the basic status block, comprises 8 status bits with a permanent function, which reflect the most important drive conditions. The assignment of the more significant status bits varies for the different status words.

3.6.1 Basic Status Block

The basic status block of the status word contains status information which is required for nearly all drive applications.



01120AEN

Figure 14: Basic status block for all control words

Bit:	Status	Assignment
0	Enable output stage	0 = Output stage is inhibited (high resistance) 1 = Output stage is enabled
1	Inverter ready for operation	0 = Inverter not ready for operation (e.g., no supply voltage / fault) 1 = Inverter ready for operation
2	PO data enabled	0 = PO data inhibited 1 = PO data enabled
3	Active ramp generator set	0 = Ramp generator 1 1 = Ramp generator 2
4	Active parameter set	0 = Parameter set 1 1 = Parameter set 2
5	Fault/warning	0 = No fault/warning 1 = Fault/warning present
6	Limit switch CW active	0 = Not activated 1 = Limit switch CW activated
7	Limit switch CCW active	0 = Not activated 1 = Limit switch CCW activated

Table 5: Status information in the basic status block (status word low byte)

The *Inverter Ready for Operation* Signal

When the status bit 1 in the status word signals *Inverter Ready for Operation = 1*, then the drive inverter is ready to respond to control commands from an external control system. The drive inverter is not ready for operation if

- MOVIDRIVE® signals a fault
- the factory setting is active (setup)
- no supply voltage is present

The *PO Data Enabled* Signal

Status bit 2 signals with PO Data Enabled = YES that the drive inverter responds to control commands or setpoints from the communications interfaces. Figure 15 shows the required conditions in order for PO data to be enabled:

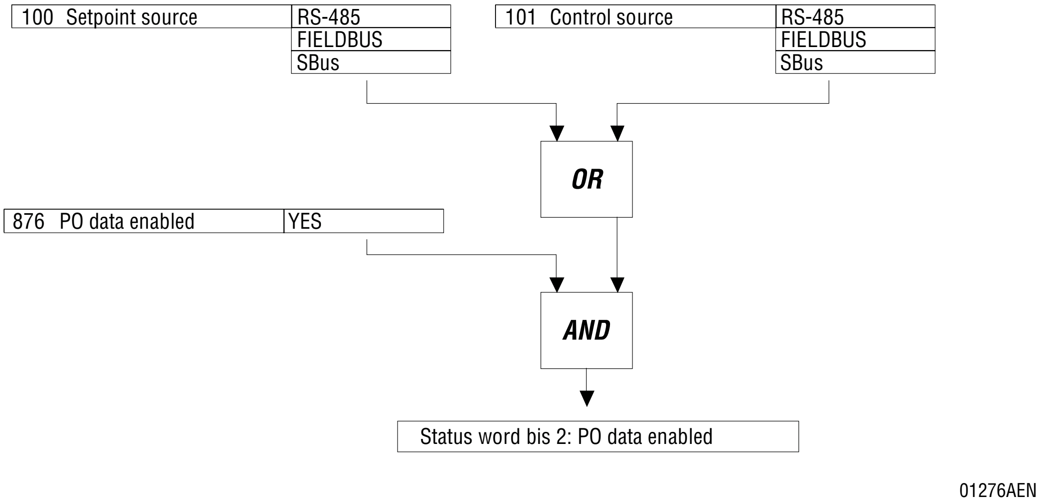


Figure 15: Definition of status word bit 2: PO data enabled

Fault/Warning

In bit 5 of the status word the drive inverter signals a fault that may have occurred or issues a warning. When a fault is signalled, the drive inverter is no longer ready for operation, whereas a warning may occur temporarily without affecting the operational performance of the drive inverter. For exact filtering of a fault we therefore recommend evaluating the status bit 1: *Ready for Operation* in addition to this fault bit (prerequisite: supply voltage ON).

Bit 1: *Ready for operation*	**Bit 5: *Fault/warning***	
0	0	Inverter not ready for operation
0	1	Fault
1	0	Inverter ready for operation
1	1	Warning

Table 6: Coding of a fault or warning

Limit Switch Processing

The limit switch processing is active if two drive inverter input terminals are programmed to *Limit Switch CW* or *Limit Switch CCW*. This will inform the higher-level controller about the current status of the limit switches and enable it to instruct the drive inverter to travel in the opposite direction. While the terminal signals of the limit switches are active when 0, the condition of the limit switches in the status word of the drive inverter is indicated by a high (1) level.

3.6.2 Status Word 1

In addition to the most important status data in the basic status block, status word 1, in the more significant status byte, alternately contains either *Unit Status* data or *Fault Code* data. Depending on the fault bit, the unit status is indicated if the fault bit = 0, whereas the fault code is displayed if a fault has occurred (fault bit = 1) (Figure 16). When the fault code is cleared, the fault bit is reset and the current unit status shown again. The meaning of the fault codes can be found in the *MOVIDRIVE®* manual.

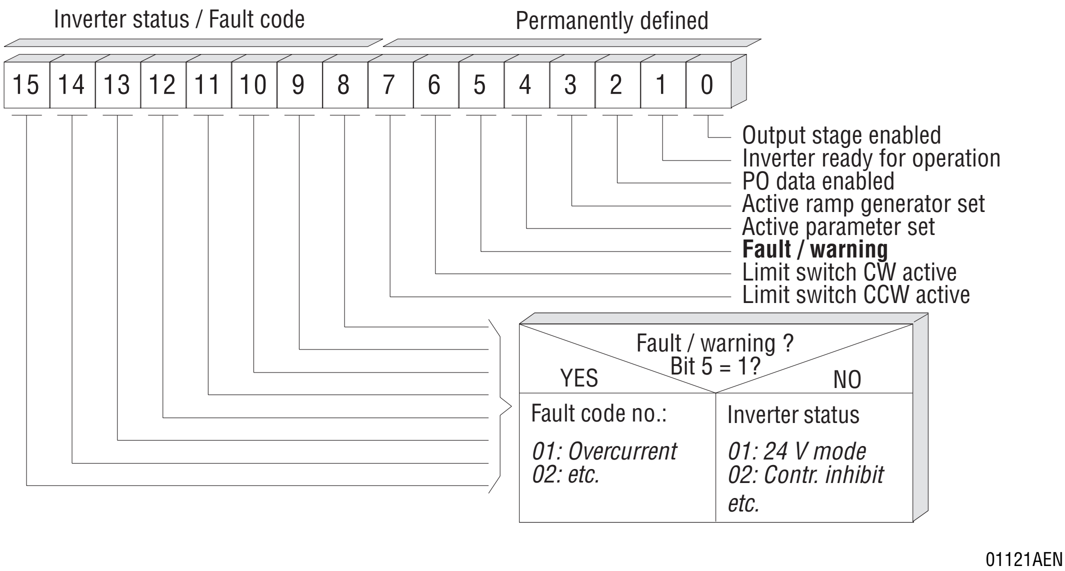


Figure 16: Assignment of status word 1

3.6.3 Status Word 2

In addition to the most important status data in the basic status block, status word 2, in the more significant status byte, contains the virtual output terminals DO10 – DO17. By programming the terminal functions of the output terminals you can process all the usual signals via the fieldbus system.

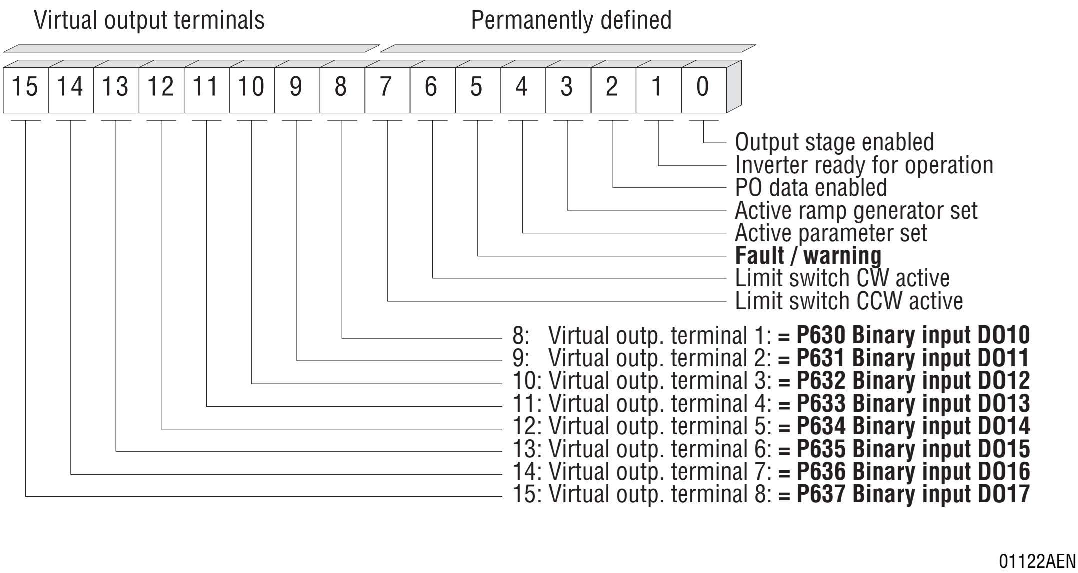


Figure 17: Assignment of status word 2

If the DIO11 has been fitted in the drive inverter in addition to the fieldbus option, the outputs of the DIO11 have priority. In this case, the virtual outputs are not activated!

4 Monitoring Functions

To ensure safe operation of the MOVIDRIVE® drive inverter via the communications interfaces, additional monitoring functions were implemented that, for example, trigger a drive function in case of a bus error that can be set by the user. Two independent parameters are available for each communications interface.

- *Timeout Interval*
- *Timeout Response*

These parameters allow the user to program an application-independent drive response in case of a communications error.

4.1 Timeout Error/Warning / Timeout Interval / Timeout Response

The drive inverter generates a timeout if no new process data are received within a set time-frame (timeout interval) via the bus system. The adjustable timeout response is used to define the fault variant (fault/warning) and the fault response of the drive.

MOVIDRIVE® generates a separate timeout error message for each communications interface:

Fieldbus:	F 28	F-BUS TIMEOUT
RS485:	F 43	RS485 TIMEOUT
System bus:	F 47	SBUS TIMEOUT

The timeout interval for the communications interfaces RS485 / system bus / fieldbus can be set separately.

RS485:	812	RS485 timeout interval	[s]	0.00	
System bus:	815	SBus timeout interval	[s]	0.10	
Fieldbus:	819	Fieldbus timeout interval	[s]	0.50	

The timeout response for the communications interfaces RS485 / system bus / fieldbus can be set separately.

831	FIELDBUS TIMEOUT response	RAPID STOP/WARNING
833	RS485-TIMEOUT response	RAPID STOP/WARNING
836	SBus TIMEOUT response	RAPID STOP/WARNING

Timeout monitoring is useful for all bus systems, although it may vary considerably for the different fieldbus systems.

Parameter name:	*Fieldbus timeout interval*
Unit:	Seconds [s]
Range:	0.01 s to 650.00 s in increments of 10 ms
Special case:	650.00 = Fieldbus timeout switched off
Factory setting:	0.5 s

Table 7: Range of values of the parameter Fieldbus monitoring time

IMPORTANT!

In the case of PROFIBUS-DP, the parameter *819 Fieldbus Timeout Interval* is set only through the response monitoring time which is configured in the DP master for the complete DP system. Manual setting of the parameter at the keypad or with the MX_SHELL user interface remains without effect and would be overwritten again at the next start-up of the PROFIBUS-DP.

5 Setting Inverter Parameters

The drive parameters of the inverter are read/written via the fieldbus system using the READ and WRITE services. Additional services can be executed via the MOVILINK® parameter channel for all bus systems. This parameter channel is available with all bus systems and described in detail below.

In addition, further programming instructions on the use of the MOVILINK® parameter channel via the different bus systems can be found in the documentation on the fieldbus option pcb.

5.1 Parameter Setting Procedure

Parameter setting of the MOVIDRIVE® drive inverter is generally carried out according to a client-server model, i.e., the drive inverter only supplies the information requested if asked to do so by the higher-level automation unit. Thus, MOVIDRIVE® invariably has server functionality only (Figure 18).

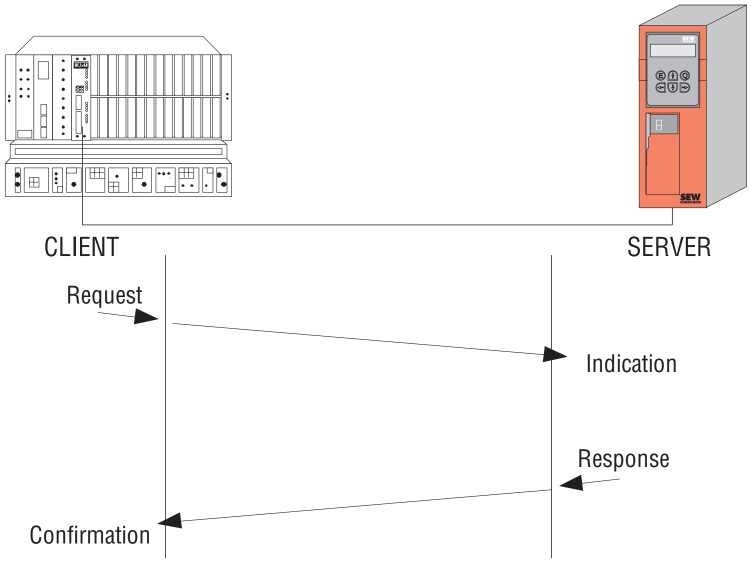


Figure 18: Parameter setting procedure according to the client-server model

To set the parameters of the drive inverter, functions such as READ or WRITE are normally provided from the master module or the higher-level automation unit that allow access to the most important drive parameters via standardized functions.

5.1.1 Index Addressing

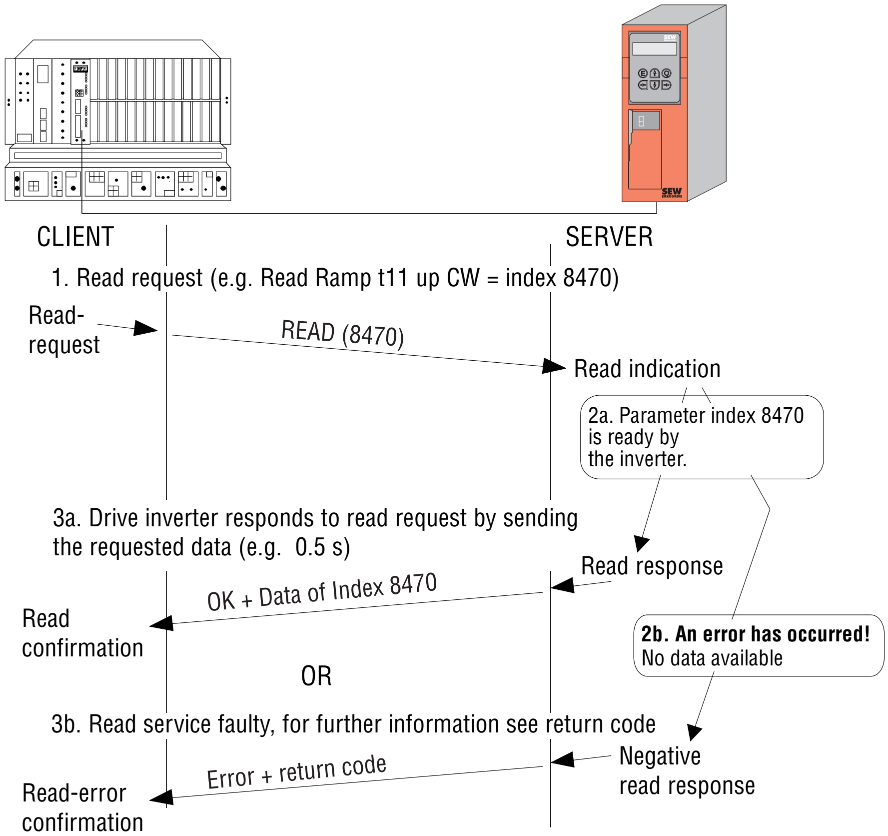
All MOVIDRIVE® drive inverter parameters are listed in the *MOVIDRIVE®* manual. Each parameter is assigned a specific number (index) under which the parameter can be read or written.

5.1.2 Data Length/Coding

The parameter data length for the MOVIDRIVE® drive inverter amounts to a constant 4 bytes for all parameters. Detailed information about coding, access attribute, etc., can be found in the *MOVIDRIVE® system manual*.

5.2 Reading a Parameter (READ)

Reading a parameter via the communications interfaces is carried out using a *Read Request* from the automation unit to the MOVIDRIVE® drive inverter.



01103AEN

Figure 19: Procedure for reading a parameter

If it is impossible to carry out the read service in the inverter, this is reported back to the automation unit by a negative answer *(Negative Read Response)*. The automation unit thus receives a negative confirmation *(Read Error Confirmation)* with a detailed breakdown of the error.

5.3 Writing a Parameter (WRITE)

Writing a parameter is carried out via the fieldbus interface in a similar way to reading a parameter.

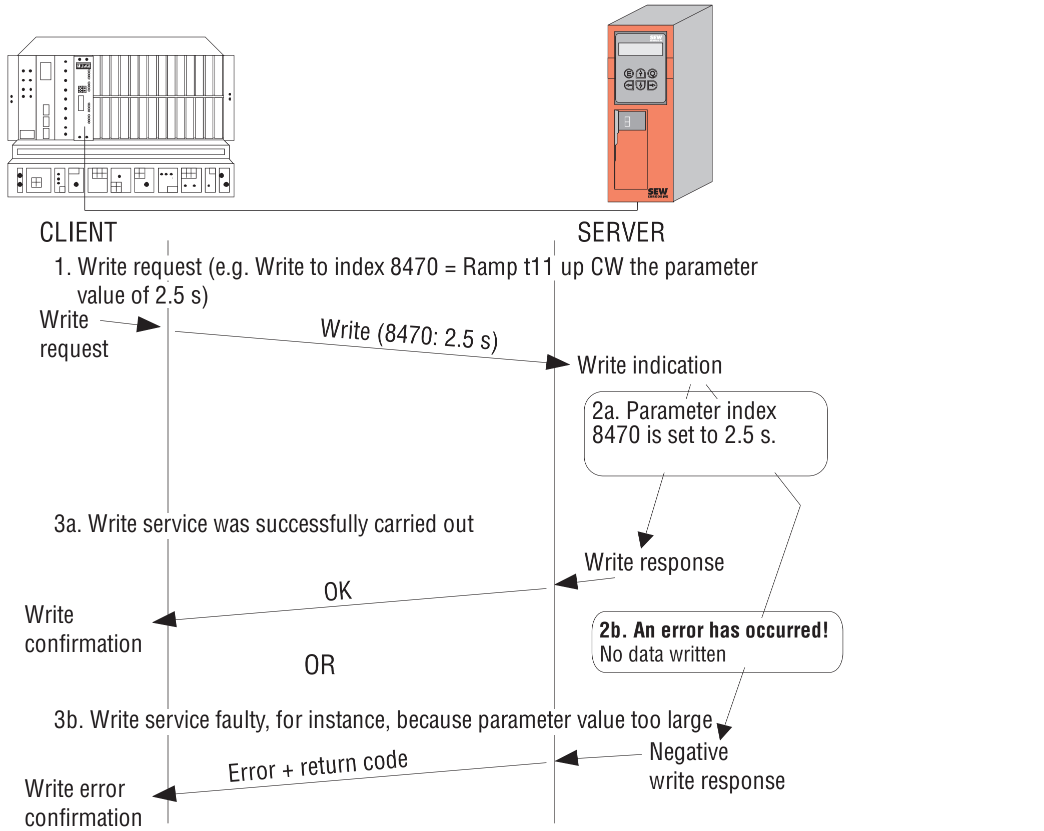


Figure 20: Procedure for writing a parameter

If it is impossible to carry out the write service in the drive inverter, e.g., if false parameter data have been passed over, this is reported back to the automation unit by a negative answer *(Negative Write Response)*. The automation unit thus receives a negative confirmation *(Write Error Confirmation)* with a detailed breakdown of the error.

5.4 Structure of the MOVILINK Parameter Channel

The MOVILINK parameter channel enables fieldbus-independent access to all drive parameters of the drive inverter and offers additional parameter services besides the common READ and WRITE parameter services.

The MOVILINK® parameter channel consists of a management byte, an index word, a reserved byte, and four data bytes.

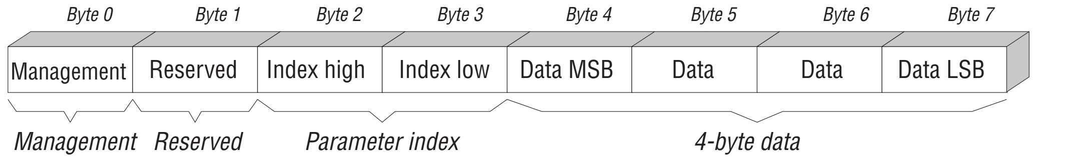


Figure 21: Structure of the parameter channel

5.4.1 Management of the Parameter Channel

The entire parameter adjustment procedure is co-ordinated using byte 0: *Management*. This byte makes important parameters available, such as service identifier, data length, version, and status of the executed service.

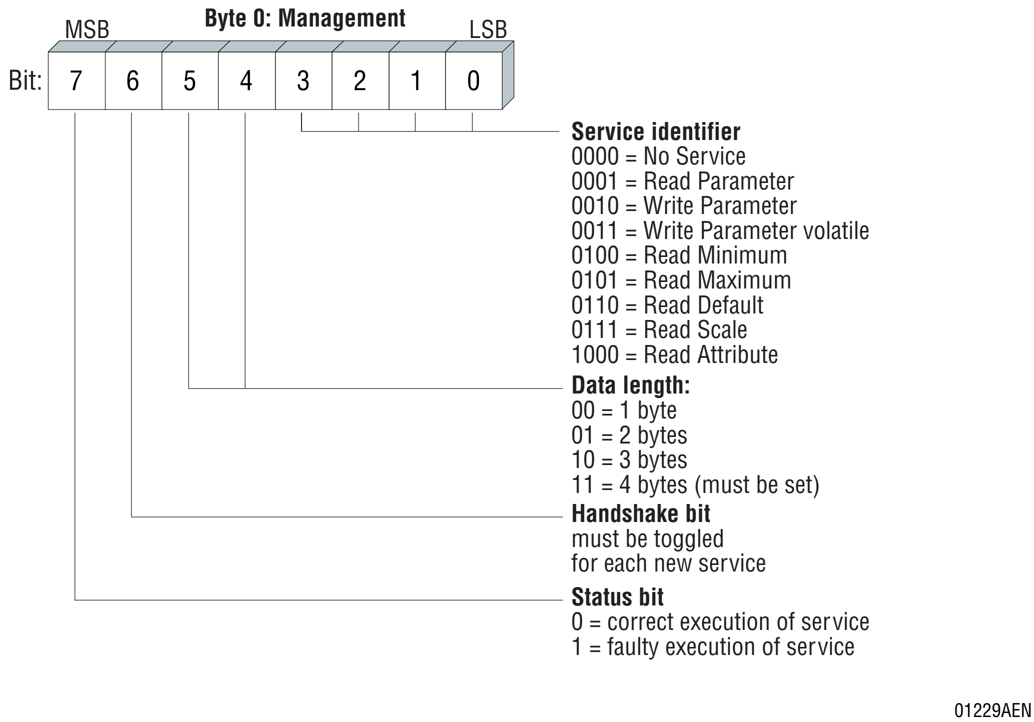


Figure 22: Structure of the management byte

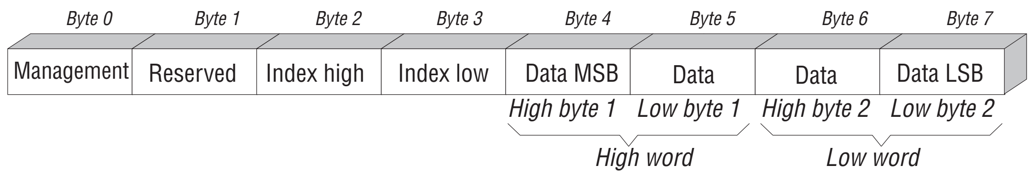
Bit 6 is used as a handshake bit between controller and drive inverter for the cyclical transmission variant. Since the parameter channel is transferred in each cycle, if necessary with the process data, execution of the service in the inverter must be edge-controlled using handshake bit 6. The value of this bit is therefore toggled each time a new service is to be executed. The drive inverter uses the handshake bit to signal whether the service has been executed or not. The service is executed as soon as the controller notices that the received and transmitted handshake bits are identical. Status bit 7 indicates whether the service was executed properly or whether it produced an error.

5.4.2 Index Addressing

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

5.4.3 Data Area

As shown in Figure 23, 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 for each service. The data are generally entered flush right, i.e., byte 7 contains the least significant data byte (LSB data), byte 4 correspondingly the most significant data byte (MSB data).



01277AEN

Figure 23: Definition of the data area in the parameter channel

5.4.4 Faulty Service Execution

Faulty service execution is signalled by setting the status bit in the management byte. If the received handshake bit is identical to the transmitted handshake bit, the drive inverter has executed the service. If the status bit indicates an error, the error code is entered in the data area of the parameter message (Figure 24). Bytes 4-7 provide the Return Code in a structured format.

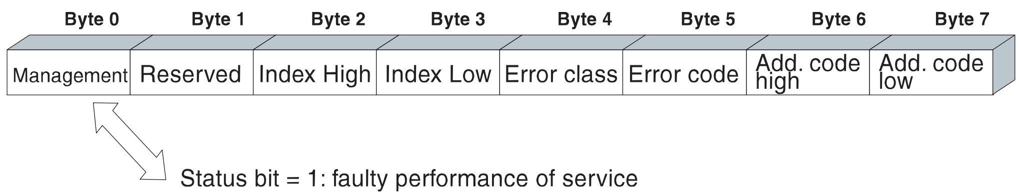


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Figure 24: Structure of the parameter channel in the event of faulty service execution

5.4.5 Description of Parameter Services

Bits 0–3 of the management byte are used to define the individual parameter services. The following parameter services are possible:

No Service

This coding signals that no parameter service is present.

Read Parameter

This parameter service is used to read a drive parameter.

Write Parameter

This parameter service is used for the nonvolatile writing of a drive parameter. The written parameter value is stored in nonvolatile memory (e.g., in an EEPROM). This service should not be used for cyclical write access since the memory modules allow only a limited number of write cycles.

Write Parameter Volatile

This parameter service is used for the volatile writing of a drive parameter. The written parameter value is stored volatile in the RAM of the inverter and is lost when the drive inverter is switched off or when it is re-initialized after an error reset. After the inverter is switched on again, the last value written with Write Parameter is available again.

Read Minimum

This service is used to determine the smallest adjustable value (minimum) of a drive parameter. The coding is carried out in a similar way to that of the parameter value.

Read Maximum

This service is used to determine the largest adjustable value (maximum) of a drive parameter. The coding is carried out in a similar way to that of the parameter value.

Read Default

This service is used to determine the factory setting of a drive parameter. The coding is carried out in a similar way to that of the parameter value.

Read Scale

This service is used to determine the scaling of a parameter. In this case, the inverter returns a size index and a conversion index.

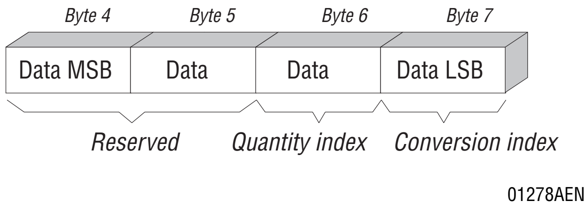


Figure 25: Coding of response data for Read Scale

Size Index

The size index is used for coding physical quantities. This index is used to transfer information to a communications partner indicating the physcial quantity of the corresponding parameter value. The coding is carried out according to the sensor technology / actuator technology profile of the Profibus user group (PNO). The entry FF_{hex} indicates that no size index has been set. However, the size index can be taken from the parameter list of the drive inverter.

Conversion Index

The conversion index is used to convert the transferred parameter into an SI base unit. The coding is carried out according to the sensor technology / actuator technology profile of the Profibus user group (PNO).

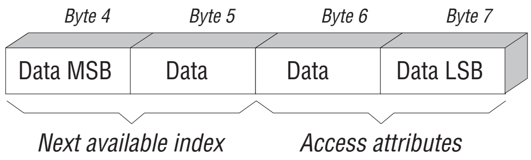
Example:	Drive parameter:	P131 Ramp t11 down CW
	Size index:	4 (= time)
	Conversion index:	–3 (10^{-3} = milli)
	Transferred numerical value:	3000_{dec}

The numerical value received via the bus is interpreted by the drive inverter as follows:

$$3000_{dec} \times 10^{-3} = 3 \text{ s}$$

Read Attribute

This service is used to read the access attributes and the index of the next parameter. Figure 26 shows the data coding for this parameter service.



01279AEN

Figure 26: Coding of response data for Read Scale

The access attributes are coded specifically for each unit. The attribute definition for the MOVIDRIVE® drive inverter can be taken from Figure 27.

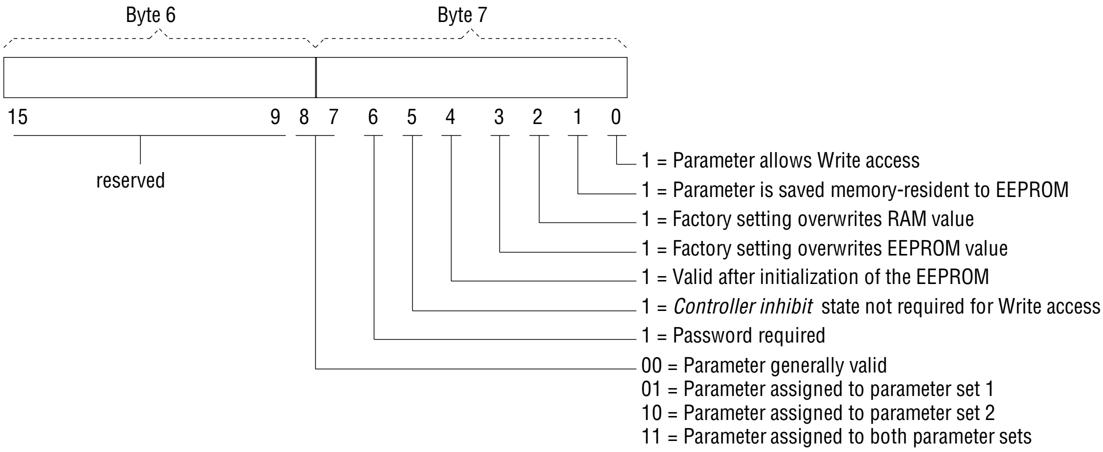


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Figure 27: Coding of access attributes for MOVIDRIVE®

5.5 Parameter Adjustment Return Codes

If parameters are wrongly adjusted, the drive inverter returns various return codes to the parameter setting master providing detailed information on the cause of the error. In general, the structural design of these return codes corresponds to EN 50170. The following components are distinguished:

- Error class
- Error code
- Additional code

These return codes apply to all communications interfaces of the MOVIDRIVE®.

5.5.1 Error Class

The error class component provides a more exact classification of the error type. The following error classes are differentiated according to EN 50170.

Class (hex)	Designation	Meaning
1	vfd state	Status error of the virtual field unit
2	application reference	Error in application program
2	definition	Definition error
4	resource	Resource error
5	service	Error at service execution
6	access	Access error
7	ov	Error in object list
8	other	Other error (see additional code)

Except for Error Class 8 = Other Error, the error class is generated by the communications software of the fieldbus card in case of a faulty communication. Return codes that are provided by the drive inverter system fall under the category Error Class 8 = Other Error. The more detailed error breakdown is achieved with the Additional Code component.

5.5.2 Error Code

The Error Code component allows for a more detailed breakdown of the error cause within the error class and is generated by the communications software of the fieldbus card in case of faulty communication. For Error Class 8 = Other Error, only Error Code = 0 (Other Error code) is defined. In this case, the detailed breakdown is achieved in the Additional Code.

5.5.3 Additional Code

The Additional Code contains SEW-specific return codes for faulty parameterization of the drive inverter. They are returned to the master under Error Class 8 = Other Error. The following table shows all possible codings for the Additional Code.

Add.-Code high (hex)	Add.-Code low (hex)	Meaning
00	00	No error
00	10	Illegal parameter index
00	11	Function/parameter not implemented
00	12	Read access only
00	13	Parameter lock is active
00	14	Factory setting is active
00	15	Value too large for parameter
00	16	Value too small for parameter
00	17	Required option pcb missing for this function/parameter
00	18	Error in system software
00	19	Parameter access only via RS485 process interface to X13
00	1A	Parameter access only via RS485 diagnostics interface
00	1B	Parameter is access-protected
00	1C	Controller inhibit required
00	1D	Illegal value for parameter
00	1E	Factory setting was activated
00	1F	Parameter was not saved in EEPROM
00	20	Parameter cannot be changed with enabled output stage

5.5.4 Special Case "Internal Communications Error"

The return code listed in the following table is returned if a communications error occurs between option card and inverter system. The parameter service transmitted via the fieldbus may not have been executed and should be repeated. If this error occurs again, the drive inverter must be completely switched off and back on again to perform a new initialization.

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

Error Correction

Repeat the read or write service. If the error occurs again, the drive inverter should be completely switched off and back on again. If this error occurs permanently, consult the SEW electronics service.

5.6 User Instructions for Adjusting Parameters

When adjusting the parameters of the MOVIDRIVE® drive inverter via the fieldbus system, all drive parameters can generally be accessed. However, since some of the drive parameters relate directly to communication via the fieldbus system, users should take note of the following instructions when adjusting parameters.

5.6.1 Setting Parameters in CONTROLLER INHIBIT Condition

Some parameters can be changed (written) only in the *CONTROLLER INHIBIT* drive state. The inverter signals this condition by a negative confirmation of the write service. The parameters featuring this limitation can be found in the parameter list. In general, these parameters can also be changed during an error or in the *24 V Operation* state.

5.6.2 Factory Setting

All parameters are reset to the default value when activating the factory setting. For fieldbus operation, this means that the fieldbus control mode is exited, and that all fieldbus parameters are reset to the default values.

Drive inverter parameters can be adjusted manually with the keypad, or with MX_SHELL, or via the communications interface in the form of a parameter download. The following procedure must be followed when the factory setting is activated via the communications interface and parameters of the drive inverter are then adjusted:

1. Parameter to be written *P802 Factory Setting = Yes*
2. Repeated reading of status word 1 or parameter *P802 Factory Setting* until factory setting has been completely activated and *P802 Factory Setting = No* or status word 1 is returned.
3. Writing of all drive parameters that differ from the factory setting (either by means of single write sentences or as a download parameter block)

STOP

IMPORTANT!

The drive inverter must be enabled on the terminal side in order for it to be controlled via the process data. This means that the drive will be enabled subject to certain preconditions being met after the factory setting has been activated. Therefore, before the factory setting is activated, care must be taken that the digital binary inputs following activation of the factory setting do not enable the drive inverter. For safety reasons, do not switch on the supply voltage until the parameter setting of the inverter has been finalized.

5.6.3 Cyclical Parameter Adjustments

During parameter adjustment, it should be kept in mind that all parameters written via the WRITE service of the fieldbus system are normally stored in the drive inverter. The MOVIDRIVE® drive inverter uses an EEPROM as resident storage, and the life of this storage is limited by the number of save operations. Therefore, if frequent parameter changes are made, you should use the MOVILINK parameter channel with the *Write Parameter Volatile* service. In this case, data will not be stored in the EEPROM but in the RAM of the inverter. This means that the parameter will only remain in effect until the unit is switched off or a re-initialization (e.g., via error reset) occurs.

The following procedure must be followed in fieldbus mode if the drive inverter has parameter set cyclically with the fieldbus system write service:

1. Activate factory setting.
2. Set drive inverter parameters in such a way that the basic function of the application is guaranteed. All parameters are stored memory-resident, and become effective after switching the inverter off and then on again, or after a reset.
3. Adjust parameters cyclically using only Write Parameter Volatile.

If the drive inverter is now switched on again or reset using the Reset function, the settings given in Point 2. will become effective again.

5.6.4 Parameter Lock

The parameter lock prevents adjustable parameters from being changed in any way by activation of *P803 Parameter Lock = Yes*. Activating the parameter lock is useful when the drive inverter parameters have been completely adjusted and no further changes are necessary. Among other things, this parameter enables you to stop any change to the drive parameters being made on the keypad, for example.

IMPORTANT!

STOP

The parameter lock prevents parameters being written altogether. Thus, the write access via the communications interfaces is also disabled while the parameter lock is active!

5.6.5 Download Parameter Block

A number of fieldbus option pcbs offer the possibility of downloading several drive parameters simultaneously from the higher-level automation unit to the drive inverter with one single write service. This downloading is carried out by a specific communications object, the *Download Parameter Block*.

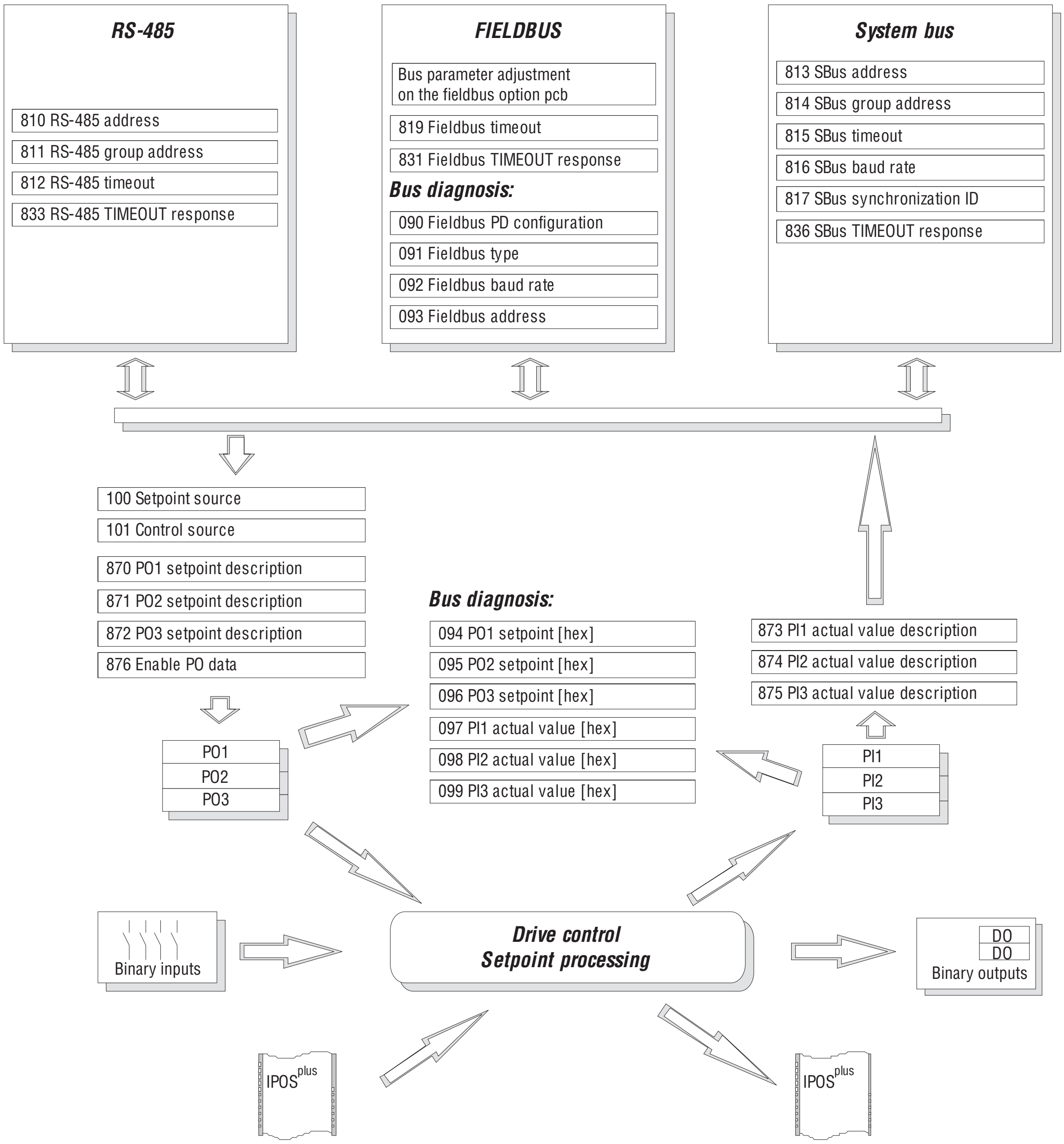
Observe the following note while using the download parameter block:

1. Do not carry out any factory setting within the download parameter block!
2. After activating the parameter *P803 Parameter Lock = Yes*, all subsequently written parameters are rejected.

6 Bus Diagnostics

The MOVIDRIVE® drive inverter provides a large amount of diagnostic information for fieldbus operation. In addition to the process data description parameters, diagnostic tools also include menu range P090 - P099, which contains the fieldbus monitor parameters. These parameters allow simple diagnostics of the bus application via DBG11.

This section will primarily explain the bus diagnostics parameters and the bus monitor integrated in the MX_SHELL. In addition, Figure 28 gives an overview of all communications parameters of the MOVIDRIVE® drive inverter. These parameters can, of course, be used for detailed diagnostics.



01281AEN

Figure 28: Overview of all communications parameters of MOVIDRIVE®

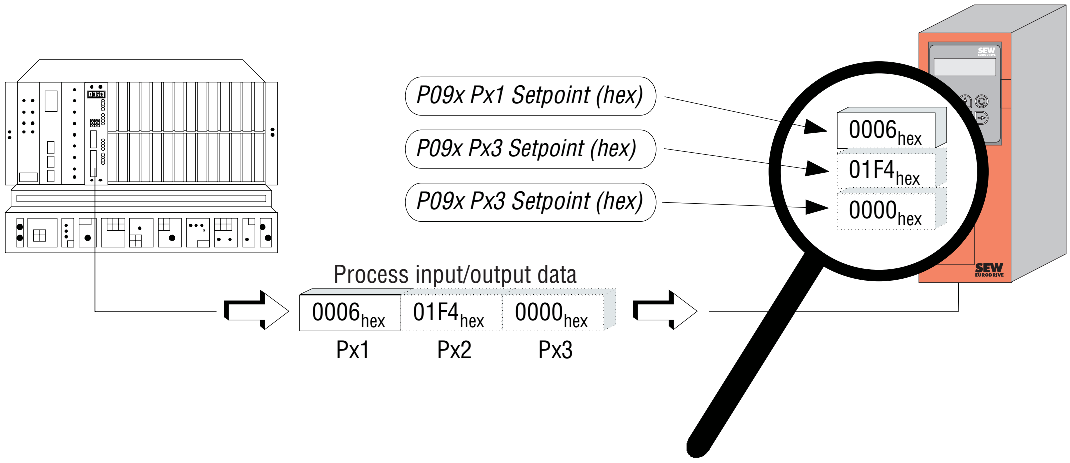
6.1 Diagnostics of Process Input Data/Output Data

Faulty operation of the drive inverter can normally be traced back to a faulty application program. This means that false control information or setpoints are occasionally sent to the drive inverter from the higher-level controller. As a result, it is often helpful to know what control information and setpoints the drive inverter is receiving and sending. User-friendly fieldbus master interface connections, e.g., rows of LEDs on the front cover, offer simple facilities for diagnostics of individual fieldbus process data.

In order to provide the user with even simpler access to these control values and setpoints, the MOVIDRIVE® drive inverter uses the fieldbus monitor parameters

- P094 PO1 Setpoint (hex)
- P096 PO2 Setpoint (hex)
- P098 PO3 Setpoint (hex)
- P095 PI1 Actual Value (hex)
- P097 PI2 Actual Value (hex)
- P099 PI3 Actual Value (hex)

to offer a direct insight into process data received and sent via the fieldbus system (Figure 29). Process data received from or sent by the drive inverter are passed via the serial interface to the keypad or to the MX_SHELL PC program. Despite the loss of process data cycles because of the varying transmission speeds, this diagnostics method has been shown in practice to be of assistance.



01105AEN

Figure 29: Process input data/output data diagnostics with MOVIDRIVE®

These fieldbus monitor parameters allow all process data to be checked in hexadecimal form using the drive inverter's keypad. In addition, the MX_SHELL PC program offers an interpretation of the process data conforming to the unit profile, such as a display of speed setpoints in units of [1/min].

6.2 MX_SHELL Bus Monitor

The process data monitor function can be used with the PC user interface MX_SHELL under the Bus Monitor menu item. This function provides a user-friendly method of startup and diagnostics for the use of the inverter in conjunction with the communications network. The two operating modes *Monitor* and *Control* provide a choice between a purely diagnostic mode in which the process data channels can only be viewed, and a control mode in which modifications can also be carried out via the PC.

6.2.1 Diagnostics Mode Using the MX_SHELL Bus Monitor

In *Monitor* operating mode, the MX_SHELL bus monitor allows the setpoints and actual values exchanged between the higher-level controller and the MOVIDRIVE® inverter to be continuously and clearly viewed and analyzed.

You will see all the information from the three process data channels, such as the description of the process input data PI1-PI3 (actual values) and process output data PO1-PO3 (setpoints) and their actual values as transmitted over the bus system.

6.2.2 Control Using the MX_SHELL Bus Monitor

In *Control* operating mode, the bus monitor can be used for manual control of the inverter via the PC. In this case, the inverter displays the same drive characteristics as it does when it is controlled via the communications interfaces. Among other things, this operating method can provide easy training in the process data control concepts of the MOVIDRIVE® inverter.

Since MX_SHELL communicates with the inverter via the serial interface, familiarity with the functionality of the inverter process data can also be acquired without the bus master by entering all setpoints manually via the bus monitor (*Control* mode).

6.3 Verification of Parameter Adjustment

All MOVIDRIVE® drive inverter parameters can be read or written via all communications interfaces. The keypad or the MX_SHELL PC program can be used for checking the adjustment of parameters.

It is consequently possible to use the serial interface to read and check parameters written using the fieldbus. The coordination between menu number of the hand-held keypad and the parameter index can be found in the documentation *MOVIDRIVE® Manual*.

In principle, no verification is necessary since the drive inverter responds with an appropriate error message if parameters have been wrongly adjusted.

6.4 Information about the Fieldbus Option

Further information about the fieldbus option is provided by bus diagnostics parameters P090-P093.

6.4.1 Process Data Configuration

The *P090 Fieldbus PD Configuration* parameter shows how many process data words are exchanged between the fieldbus master and the drive inverter, and whether the parameter channel is used. The parameter is set either with a hardware switch on the fieldbus option, or via the fieldbus master during the start-up of the bus system (e.g., PROFIBUS-DP).

6.4.2 Fieldbus Option Type

The *P091 Fieldbus Type* monitor parameter shows which fieldbus system will be supported by the fieldbus option pcb used. Because the fieldbus interface on the MOVIDRIVE®drive inverter is universal, this parameter is for information only.

6.4.3 Fieldbus Baud Rate

The *P092 Fieldbus Baud Rate* parameter shows the fieldbus baud rate in [kbaud]. Depending on the fieldbus system used, adjustments can be made either with a hardware switch on the fieldbus option or via automatic baud rate detection. If the baud rate cannot be detected, the value 0.00 is displayed.

6.4.4 Fieldbus Address

The *P093 Fieldbus Address* parameter shows the actual fieldbus station address of the drive inverter. Adjustment of this address is carried out using a hardware switch on the fieldbus option pcb (see the User Manual for the option pcb).

This parameter will be set to 0 for fieldbus systems which do not need station addressing.

7 Application Examples

This section features two application examples that demonstrate the startup of the MOVIDRIVE® inverter so that the communications interfaces RS-485, fieldbus or even the system bus can be used for the control of the drive. In principle, the application examples can be applied to all communications interfaces, although the following description concentrates on the fieldbus option pcb. If the RS-485 interface or the system bus is to be used, the control and setpoint source, timeout interval and response as well as bus-specific parameters such as address and, if necessary, baud rate must be set.

7.1 Control and Speed Selection

This example uses the process data description parameters that are valid based on factory settings:

- P870 PO1 Setpoint Description Control Word 1
- P871 PO2 Setpoint Description Speed Setpoint
- P872 PO3 Setpoint Description No Function
- P873 PI1 Actual Value Description Status Word 1
- P874 PI2 Actual Value Description Speed Actual Value
- P875 PI3 Actual Value Description No Function

This configuration allows you to implement a broad range of applications without having to change the process data assignment. Figure 30 shows the process data transmitted between the control unit and the inverter.

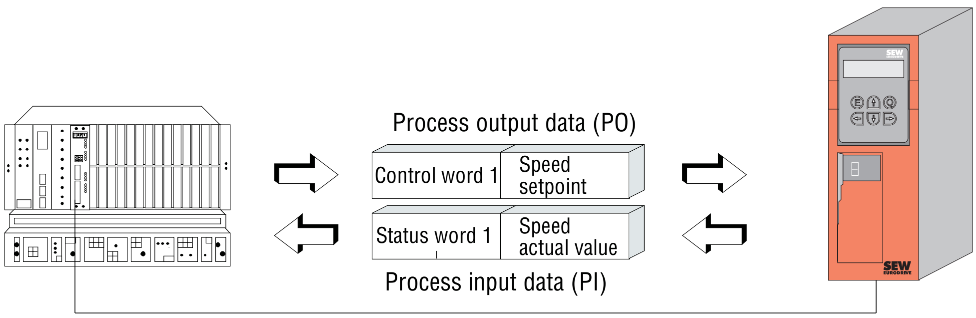


Figure 30: Application example for inverter control using two process data words

7.1.1 Objective

The drive inverter is to be controlled by means of two process data words. The process output data *Control Word 1* and *Speed Setpoint* are to be specified by the higher-level control unit. Conversely, the inverter is to return the process input data *Status Word 1* and *Speed Actual Value* to the higher-level control unit.

The application program is to control the following inverter functions:

1. The digital input I1.1 is to trigger the control commands *Enable* and *Stop*.
   I1.1 = 1: Enable
   I1.1 = 0: Stop
2. The digital input I1.2 is to trigger the control commands *Enable* and *Rapid Stop*.
   I1.2 = 1: Enable
   I1.2 = 0: Rapid Stop
3. The digital input I1.3 is to specify the speed setpoint.
   I1.3 = 1: 750 1/min CCW
   I1.3 = 0: 1000 1/min CW

Only parameter set 1 and ramp generator set 1 are used. The drive shall accelerate using an acceleration ramp generator of 1.5 s, decelerate using a deceleration ramp generator of 2 s, and carry out a rapid stop within 200 ms.

The inverter must also recognize a bus error that lasts longer than 100 ms and use the rapid stop to bring the drive to a standstill.

7.1.2 Startup

We recommend using the following method to implement this application example:

1. Wire the inverter in accordance with the installation and operating instructions.
   To operate with the fieldbus, connect the inverter to an external 24 V supply (terminals DI24 and DGND). Insert a jumper between terminals DI00 and VO24 in order to enable the inverter on the terminal side (Figure 31).

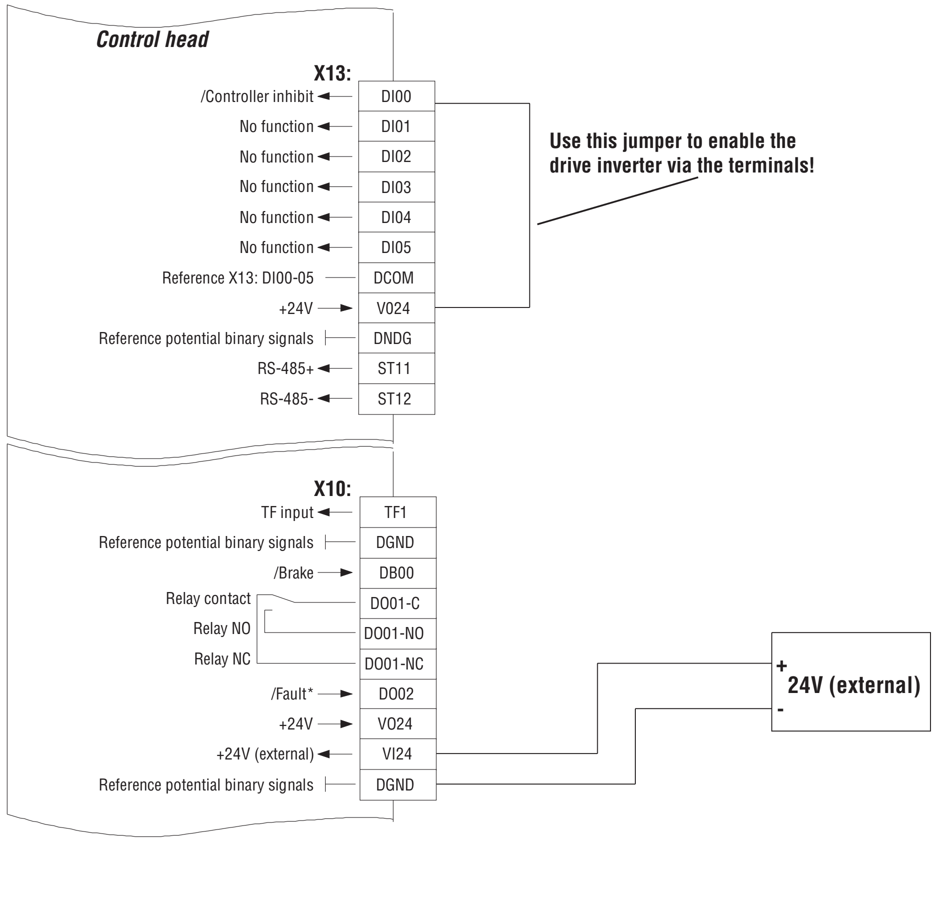


Figure 31: Wiring of the inverter for fieldbus application example 1

2. Set all the parameters specific to the fieldbus using the DIP switches on the fieldbus option pcb. For this example, configure the process data length to "2PD." For the option DFI11 (INTERBUS), for example, this can be done via the DIP switches on the option pcb. In the case of PROFIBUS-DP (option DFP11), the process data length is configured in the master module. Further information can be found in the user manuals on the relevant fieldbus option pcb.

3. Switch on the external 24 V supply.
   Since the inverter has not yet had parameters set for fieldbus operation, for safety reasons do not switch on the supply voltage at this time!

4. Activate the factory setting.

802 Factory setting	ON

5. Set the setpoint source and control source parameter to FIELDBUS.

100 Setpoint source	FIELDBUS
101 Control source	FIELDBUS

6. Program the binary inputs DI01 – DI03 to NO FUNCTION to enable the inverter on the terminal side via the jumper (installed earlier).

600 Binary input DI01	NO FUNCTION
601 Binary input DI02	NO FUNCTION
602 Binary input DI03	NO FUNCTION

7. Program the fieldbus parameter *Fieldbus Timeout Interval* to *100 ms* and the parameter *FIELDBUS TIMEOUT* to *Rapid Stop* as set out in the objective.

819 Fieldbus timeout interval	0.10
831 Fieldbus timeout reponse	RAPID STOP/WARNING

   Caution: For PROFIBUS-DP, the setting of timeout interval is carried out via DP master.

8. Now enter all parameters specific to the drive, such as motor parameters, frequency characteristics, etc. (see MOVIDRIVE® Manual).

9. Enter the ramp generators for the acceleration, deceleration and rapid stop ramps. Since the first parameter set and its first ramp generator set are to be used, the ramp generators *t11 Ramp up CW/CCW*, *t11 Ramp down CW/CCW* and *t13 Stop Ramp* must be changed.

130 t11 Ramp up CW	[s]	1.50
131 t11 Ramp down CW	[s]	2.00
132 t11 Ramp up CCW	[s]	1.50
133 t11 Ramp down CCW	[s]	2.00
136 t13 Stop Ramp	[s]	0.20

All the parameters for this application have now been assigned.

7.1.3 S5 Application Program

As a prerequisite to the application program described below, the process input and output data on a Simatic S5 must be located at the peripheral addresses PW132 and PW134.

Read access:

```
L PW 132  Read status word 1
L PW 134  Read speed actual value
```

Write access:

```
T PW 132  Write control word 1
T PW 134  Write speed setpoint
```

To control the inverter only the two control word bits *Enable/Stop* and *Eable/Rapid Stop* must be changed. Figure 32 shows how the control word is mapped in the Simatic S5.

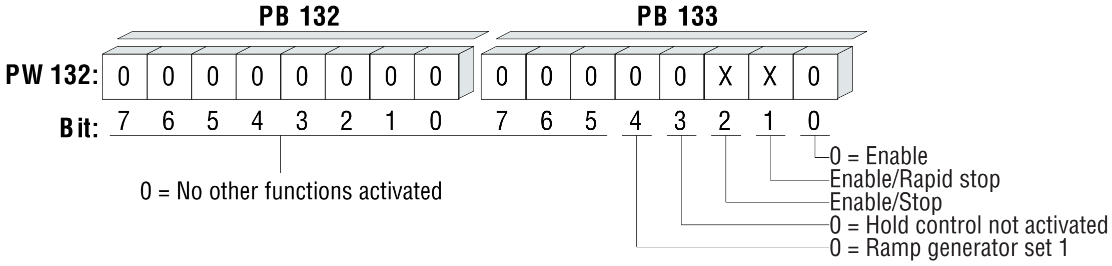


Figure 32: Control word mapping in the Simatic S5

Figure 33 shows the S5 program for this application example. In the upper section the setpoint is specified depending on input I1.3. Actual control of the inverter via the control word starts from the CONT jump flag. The control commands *Enable*, *Stop* and *Rapid Stop* are triggered depending on the digital inputs I1.1 and I1.2. These commands are coded as constant hex (KH) figures and transferred into the control word (PW132).

```
OB1:

     :SPA FB 10
NAME:SEW
     :BE
```

cyclically

```
FB 10:
     :U  E  1.3
     :SPB =CCW
     :L KF +5000   1000 1/min CW
     :T PW 134     as speed setpoint
     :SPA =STEU
LEFT :L KF -3750   750 1/min CCW
     :T PW 134     as speed setpoint
     :
CONT :U  E  1.1
     :U  E  1.2    Control command
     :SPB =ENAB    Trigger enable
     :
     :UN E  1.1
     :U  E  1.2    Control command
     :SPB =STOP    Trigger stop
     :
     :UN E  1.2    Control command
     :SPB =STOP    Trigger rapid stop
     :BEA
     :
ENAB :L KH 0006    Write enable
     :T PW 132     to control word
     :BEA
STOP :L KH 0002    Write stop
     :T PW 132     to control word
     :BEA
STOP :L KH 0000    Write rapid stop
     :T PW 132     to control word
     :BE
```

MD0282AE

Figure 33: Example of an S5 program for control of the MOVIDRIVE®inverter via process data

7.1.4 Start-up Parameter Setting via Fieldbus

The manual configuration procedure can also be carried out automatically by the higher-level fieldbus master, i.e., all the drive parameters can be set automatically via the fieldbus when the control system starts up. In order to automatically set start-up parameters, please consult the *MOVIDRIVE® Manual* to establish the fieldbus index and the coding for the relevant setting from the menu numbers given in the section.

Table 8 shows the indices and codings for start-up parameter setting taken from the Parameter List.

Menu no.	Parameter name	Setting	Fieldbus index (decimal)	Coding (4 byte hex)
802	Factory setting	ON	8594	00 00 00 01
100	Setpoint source	FIELDBUS	8461	00 00 00 03
101	Control source	FIELDBUS	8462	00 00 00 02
600	Binary input DI01	NO FUNCTION	8335	00 00 00 00
600	Binary input DI02	NO FUNCTION	8336	00 00 00 00
600	Binary input DI03	NO FUNCTION	8337	00 00 00 00
819	Fieldbus timeout interval	0.10 s	8606	00 00 00 64
831	Response timeout interval	RAPID STOP/ WARNING	8610	00 00 00 06
...	drive-specific	...	...	...
...	parameters…	...	...	...
130	t11 Ramp up CW	1.50 s	8470	00 00 05 DC
131	t11 Ramp down CW	2.00 s	8471	00 00 07 D0
132	t11 Ramp up CCW	1.50 s	8472	00 00 05 DC
133	t11 Ramp down CCW	2.00 s	8473	00 00 07 D0
136	t13 Stop Ramp	0.20 s	8476	00 00 00 C8

Table 8: Parameter coding for start-up parameter setting via fieldbus

The parameters listed in the table can now be transferred to the inverter in the required order, e.g., via individual write services or via the download parameter block if supported by the option pcb. However, please note that all other parameters can only be written once the factory settings have been completely activated.

7.2 Control with Relative Speed and Ramp

This example describes the control using three process data words. The process data description parameters are set as follows:

• P870	PO1 Setpoint Description	Control Word 1
• P873	PI1 Actual Value Description	Status Word 1
• P871	PO2 Setpoint Description	Speed Setpoint
• P874	PI2 Actual Value Description	Speed Actual Value
• P872	PO3 Setpoint Description	Ramp
• P87	PI3 Actual Value Description	Apparent Current Actual Value

Controlling the inverter using three process data words allows you to implement very powerful applications since communication between the fieldbus master and the inverter takes place via three process input and three process output data words.

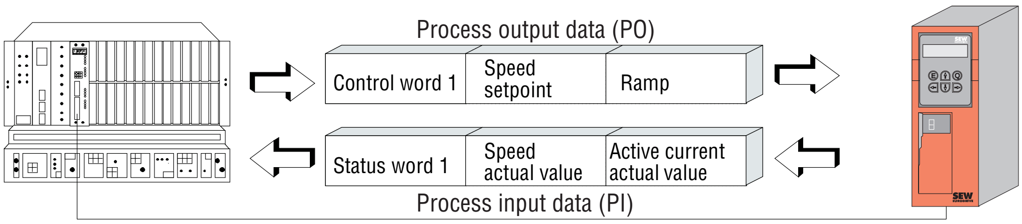


Figure 34: Application example for inverter control using three process data words

7.2.1 Objective

The drive inverter is to be controlled by means of three process data words. The process output data *Control Word 1*, *Speed [%] Setpoint* and *Ramp* are to be specified by the higher-level control unit. Conversely, the inverter is to return the process input data *Status Word 1*, *Speed [%] Actual Value* and *Output Current* to the higher-level control unit.

The application program is to control the following inverter functions:

1. The digital input I1.1 is to trigger the control commands *Enable* and *Stop*.
   I1.1 = 1: Enable
   I1.1 = 0: Stop
2. The digital input I1.2 is to trigger the control commands *Enable* and *Rapid Stop*.
   I1.2 = 1: Enable
   I1.2 = 0: Rapid Stop
3. The digital input I1.3 is to specify the relative speed setpoint.
   I1.3 = 1: 25 % of *P302 Maximum Speed 1*
   I1.3 = 0: 100 % of *P302 Maximum Speed 1*
4. In the application, the acceleration and deceleration ramp generators are continually recalculated by another function module and temporarily stored in the flag words
   MW 100: current acceleration ramp generator
   MW 102: current deceleration ramp generator
   .

Only parameter set 1 and ramp generator set 1 are used. The drive is to be accelerated or decelerated with the ramp that is specified via the fieldbus and that can be continually varied. The rapid stop shall take place within 200 ms.

The inverter must also recognize a bus error that lasts longer than 100 ms and must use the rapid stop to bring the drive to a standstill.

In an emergency stop situation, the inverter must carry out a rapid stop independently of the fieldbus operation, directly via the input terminals.

7.2.2 Startup

We recommend using the following method to implement this application example:

1. Wire the inverter in accordance with the operating instructions.
   To operate with the fieldbus, connect the inverter to an external 24 V supply (terminals DI24 and DGND). Insert a jumper between terminals DI00 and VO24 in order to enable the inverter on the terminal side (Figure 35).
   Connect the emergency stop switch with input terminal DI03 (Enable) on the inverter in order to enable the emergency stop function to operate independently of the fieldbus.

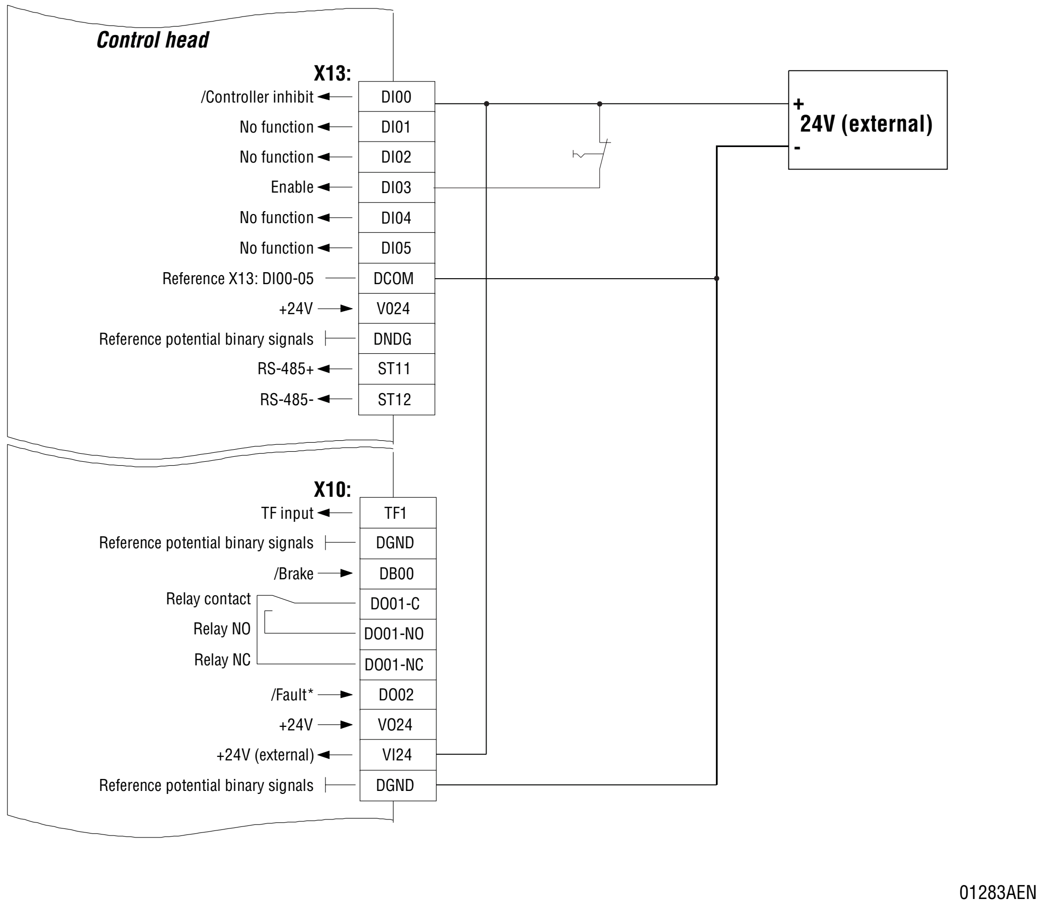


Figure 35: Wiring of the inverter with emergency stop function

2. Set all the parameters specific to the fieldbus using the DIP switches on the fieldbus option pcb. For this example, configure the process data length to "3PD." For the option DFI11 (INTERBUS), for example, this can be done via the DIP switches on the option pcb. In the case of PROFIBUS-DP (option DFP11), the process data length is configured in the master module. Further information can be found in the manuals on the relevant fieldbus option.

3. Switch on the external 24 V supply.
   Since the inverter has not yet had parameters set for fieldbus operation, for safety reasons do not switch on the supply voltage at this time!

4. Activate the factory setting.

802 Factory setting	ON

5. Set the setpoint source and control source parameter to FIELDBUS.

100 Setpoint source	FIELDBUS
101 Control source	FIELDBUS

6. As the description of process data PO1, PI1, PO2 and PI2 corresponds to the factory setting, you only have to change the process data description parameters for the third process data word to the setting specified.

871 PO2 Setpoint Description	SPEED [%]
872 PO3 Setpoint Description	RAMP
874 PI2 Actual Value Description	SPEED [%]
875 PI3 Actual Value Description	OUTPUT CURRENT

7. As you changed the setpoint description for the process input data, the inverter has automatically locked with *Enable PO Data = NO*. Re-enable the fieldbus setpoints with *Enable PO Data = YES*.

876 Enable PO data	YES

8. Program the binary inputs DI01 DI02 to NO FUNCTION to enable the inverter on the terminal side via the jumper (installed earlier).

600 Binary input DI01	NO FUNCTION
601 Binary input DI02	NO FUNCTION

9. Program the fieldbus parameter *Fieldbus Timeout Interval* to *100 ms* and the parameter *Fieldbus Timeout Response* to *Rapid Stop* as set out in the objective.

819 Fieldbus timeout interval [s]	0.10
831 Fieldbus timeout reponse	RAPID STOP/WARNING

   Caution! For PROFIBUS-DP, the setting of timeout interval is carried out via DP master!

10. Now enter all parameters specific to the drive, such as motor parameters, frequency characteristics, etc. (see MOVIDRIVE® Operating Instructions).

11. Enter the rapid stop ramp. Since the first parameter set and its first ramp generator set are to be used, you must change the parameter T13 Stop Ramp.

136 t13 Stop Ramp [s]	0.20

All the parameters for this application have now been assigned.

The fieldbus-independent rapid stop function is implemented by connecting the enable terminal directly with the emergency stop. In normal mode, the rapid stop switch is closed, so that the binary input DI03 has a +24 V signal level and the inverter is enabled. The drive is now controlled by the fieldbus by means of the control word.

In an emergency stop situation the emergency stop button is activated, the binary input DI03 receives a 0 V signal level and thus activates the rapid stop. The drive will now come to a standstill within 200 ms (configured rapid stop ramp), although the fieldbus is transmitting a different control command via the control word.

7.2.3 S5 Application Program

As a prerequisite to the application program described below, the process input and output data on a Simatic S5 must be located at the peripheral addresses PW132, PW134 andf PW136.

This program corresponds to a great extent to the S5 program from the previous application example.

Read access:

```
L PW 132  Read status word 1
L PW 134  Read speed actual value
L PW 136  Read apparent current actual value
```

Write access:

```
T PW 132  Write control word 1
T PW 134  Write speed setpoint
T PW 136  Write ramp
```

Figure 36 shows the S5 program for this application example. The current acceleration ramp is temporarily stored in the flag word MW100 and the current deceleration ramp in MW102. If the *Enable* command is triggered (jump flag ENAB), the current acceleration ramp generator is first transferred from MW100 to PW136 (ramp) and the *Enable* command is then transferred to the control word with the coding 0006_{hex}. Similarly, when the *Stop* command is given, the deceleration ramp generator is first transferred from MW102 to PW136 (ramp) and the *Stop* command is then transferred to the control word with the coding 0000_{hex}.

```
OB1:

     :SPA FB 10
NAME:SEW
     :BE
```

cyclically

```
FB 10:
     :U  E  1.3
     :SPB =CCW
     :L KF +5000   1000 1/min CW
     :T PW 134     as speed setpoint
     :SPA =CONT
LEFT :L KF -3750   750 1/min CCW
     :T PW 134     as speed setpoint
     :
CONT :U  E  1.1
     :U  E  1.2    Control command
     :SPB =ENAB    Trigger enable
     :
     :UN E  1.1
     :U  E  1.2    Control command
     :SPB =STOP    Trigger stop
     :
     :UN E  1.2    Control command
     :SPB =STOP    Trigger rapid stop
     :BEA
     :
ENAB :L MW 100     Write acceleration ramp
     :T PW 136     from MW 100
     :L KH 0006    Write enable
     :T PW 132     to control word
     :BEA
STOP :L MW 102     Write deceleration ramp
     :T PW 136     from MW 102
     :L KH 0002    Write stop
     :T PW 132     to control word
     :BEA
STOP :L KH 0000    Write rapid stop
     :T PW 132     to control word
     :BE
```

MD0293EN

Figure 36: Example of an S5 program for control of the MOVIDRIVE® inverter via process data

The process input data *Status Word 1*, *Speed [%] Actual Value* and *Output Current* can be processed with the load command (e.g., L PW 132).

Figure 36 shows the logical mapping of input and output terminals of the inverter to the status and control word 2 again. The I/O information can be programmed within the PLC via common logic commands.

7.3 Positioning with IPOS via Fieldbus

The position specification via fieldbus requires that an operating mode with speed feedback has been set.

This application example explains how to transfer position setpoints from the higher-level automation unit via fieldbus to the MOVIDRIVE® and further how to be able to use the functions of the internal positioning control IPOS^{plus} via fieldbus.

7.3.1 Objective

The MOVIDRIVE® drive inverter is to receive different position setpoints via the fieldbus system and execute the positioning process independently. The complete control is to be carried out by the fieldbus master. In addition, the current actual value of the position and the status of the drive inverter must be returned to the higher-level master.

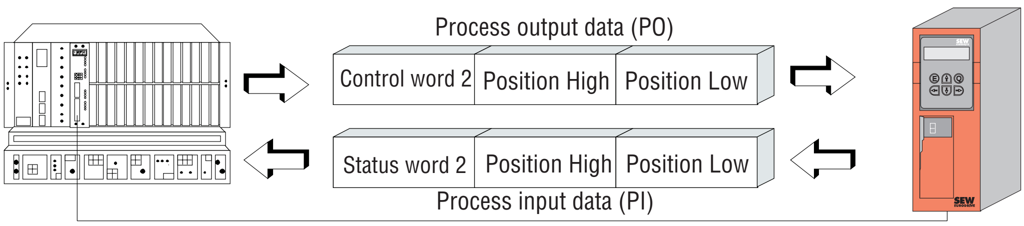
The drive inverter is to be controlled exclusively by control word 2. Only the limit switches CW/CCW are connected to the unit. A corresponding IPOS^{plus} automatic program is to be programmed for processing the setpoint position.

In case of a bus fault the drive must execute a rapid stop after 100 ms.

7.3.2 Process Data Description for Positioning Mode

Since, in this application example, the drive inverter is to receive control commands and the position setpoints via the fieldbus option pcb, the process data length must be set to 3PD (Figure 37). The following process output data description must be set for this application example:

- P870 PO1 Setpoint Description Control Word 2
- P871 PO2 Setpoint Description Position High
- P872 PO3 Setpoint Description Position Low



01298AEN

Figure 37: Application example for position specification via fieldbus

While *Position High* and *Position Low* must be programmed for the transfer of the position setpoints, the actual value description can be set at random.

For this application example, the process input data are described as follows:

- P873 PI1 Actual Value Description Status Word 2
- P874 PI2 Actual Value Description Position High
- P875 PI3 Actual Value Description Position Low

With this setting you have the possibility of constantly evaluating the current actual position and further status information of the drive via the process data channel.

With the virtual terminals of control word 2 and status word 2, a direct connection between the higher-level automation unit (fieldbus master) and the IPOS^{plus} automatic program can be decentrally implemented in the drive inverter. Therefore, the virtual input and ouput terminals can be directly processed or controlled in the IPOS^{plus} program. In this case the digital input and output terminals of the option DIO11, which is physically not available, are mapped onto the fieldbus system as virtual terminals within control word 2 or status word 2.

7.3.3 Startup

We recommend using the following method to implement this application example:

1. Wire the inverter in accordance with the operating instructions. To operate with the fieldbus, connect the inverter to an external 24 V supply (terminals VI24 and DGND). Connect the binary input DI00 to a +24 V signal, in order to enable the inverter on the terminal side (Figure 38). Connect the two hardware limit switches for CW/CCW.

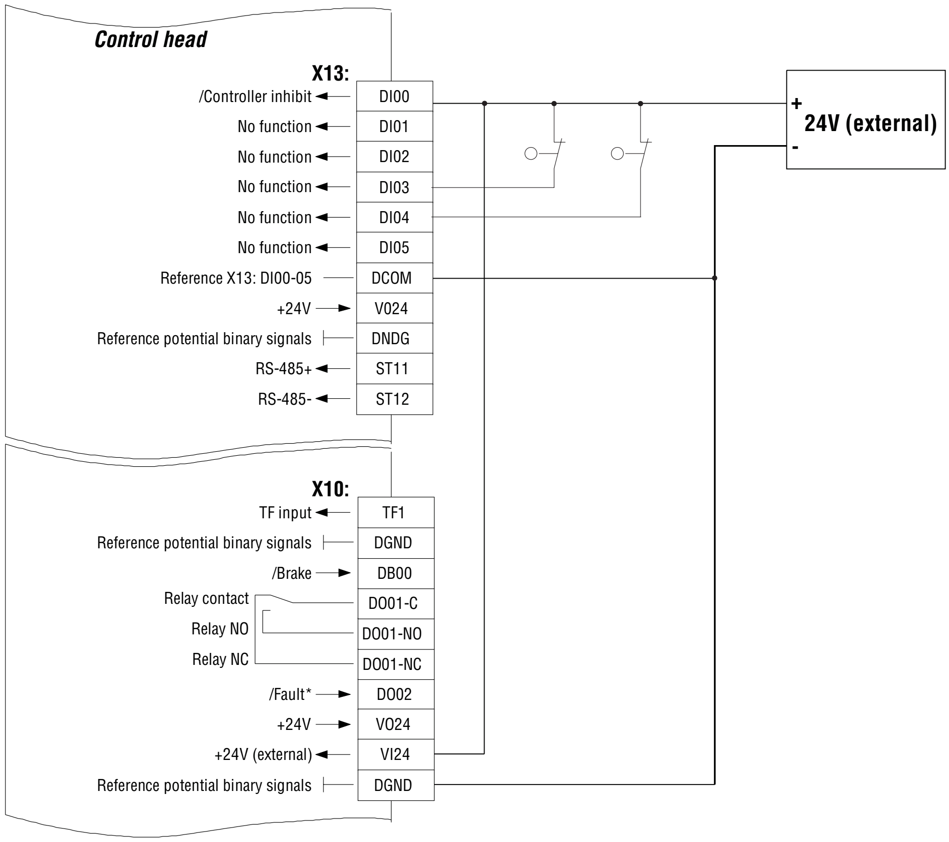


Figure 38: Wiring of the inverter for the application example

2. Set all the parameters specific to the fieldbus using the DIP switches on the fieldbus option pcb. For this example, configure the process data length to "3PD". For the option DFI11 (INTERBUS), for example, this can be done via the DIP switches on the option pcb. In the case of PROFIBUS-DP (option DFP11), the process data length is configured in the master module. Further information can be found in the manuals on the relevant fieldbus option.

3. Switch on the external 24 V supply.
Since the inverter has not yet had parameters set for fieldbus operation, for safety reasons do not switch on the supply voltage at this time!

4. Activate the factory setting.

802 Factory setting	ON

5. Set the setpoint source and control source parameter to FIELDBUS.

100 Setpoint source	FIELDBUS
101 Control source	FIELDBUS

6. Program the PO and PI data according to the application specification.

870 PO1 Setpoint Description	CONTROL WORD 2
871 PO2 Setpoint Description	POSITION HI
872 PO3 Setpoint Description	POSITION LO
873 PI1 Actual Value Description	STATUS WORD 2
874 PI2 Actual Value Description	POSITION HI
875 PI3 Actual Value Description	POSITION LO

7. Since you changed the setpoint description for the process input data, the inverter has automatically locked with *Enable PO Data = NO*. Re-enable the fieldbus setpoints with *Enable PO Data = YES*.

876 Enable PO data	YES

8. Program the binary inputs DI01 DI02 to NO FUNCTION to enable the inverter on the terminal side via the jumper (installed earlier).

600 Binary input DI01	NO FUNCTION
600 Binary input DI02	NO FUNCTION
600 Binary input DI03	/ES CCW
600 Binary input DI04	/ES CW

9. If additional control bits are to be exchanged between IPOS^{plus} program and the higher-level automation unit, the virtual terminals of control word 2 and status word 2 can be programmed to IPOS INPUT or IPOS OUPUT.

610 Binary input DI10	IPOS INPUT
610 Binary input DI11	IPOS INPUT
610 Binary input DI12	IPOS INPUT
610 Binary input DI13	IPOS INPUT
610 Binary input DI14	IPOS INPUT
610 Binary input DI15	IPOS INPUT
610 Binary input DI16	IPOS INPUT
610 Binary input DI17	IPOS INPUT

610 Binary output DO10	IPOS OUTPUT
610 Binary output DO11	IPOS OUTPUT
610 Binary output DO12	IPOS OUTPUT
610 Binary output DO13	IPOS OUTPUT
610 Binary output DO14	IPOS OUTPUT
610 Binary output DO15	IPOS OUTPUT
610 Binary output DO16	IPOS OUTPUT
610 Binary output DO17	IPOS OUTPUT

10. Program the fieldbus parameter *Fieldbus Timeout Interval* to *100 ms* as set out in the objective.

819 Fieldbus timeout interval [s]	0.10

Caution! For PROFIBUS-DP, the setting of timeout interval is carried out via DP master!

11. Enter the rapid stop ramp. Since the first parameter set and its first ramp generator set are to be used, you must change the parameter *T13 Stop Ramp*.

136 t13 Stop Ramp	[s]	0.20

12. Now enter all parameters specific to the drive, such as motor parameters, frequency characteristics, etc. (see MOVIDRIVE® Operating Instructions).

13. Set the machine parameters for IPOS^{plus} according to your application.

14. Set the reference travel to type 3 (= limit switch CW).

903 Reference travel type	3

15. Now enter the IPOS^{plus} program listed below. Figure 39 shows the minimum program for the use of the position setpoint of the fieldbus interface.

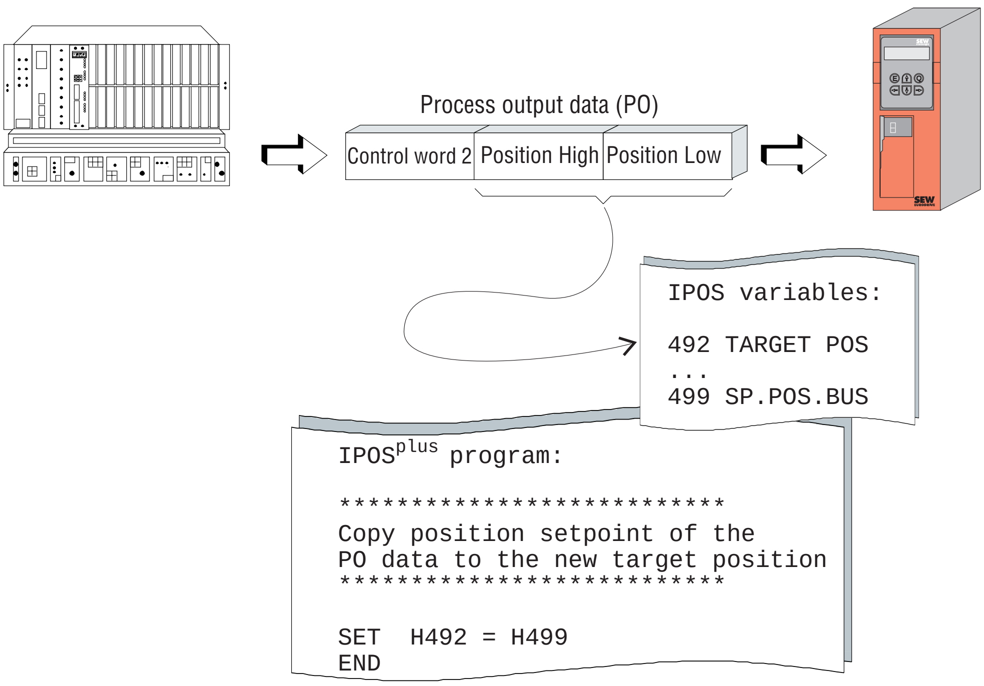


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Figure 39: Use of the position setpoint in the IPOS^{plus} program

The status of the virtual input terminals of control word 1 are automatically mapped to the IPOS variable *483 INPUT LVL*. The virtual output terminals of status word 2 can be set via IPOS variable *480 OPT.OUT.IP*.

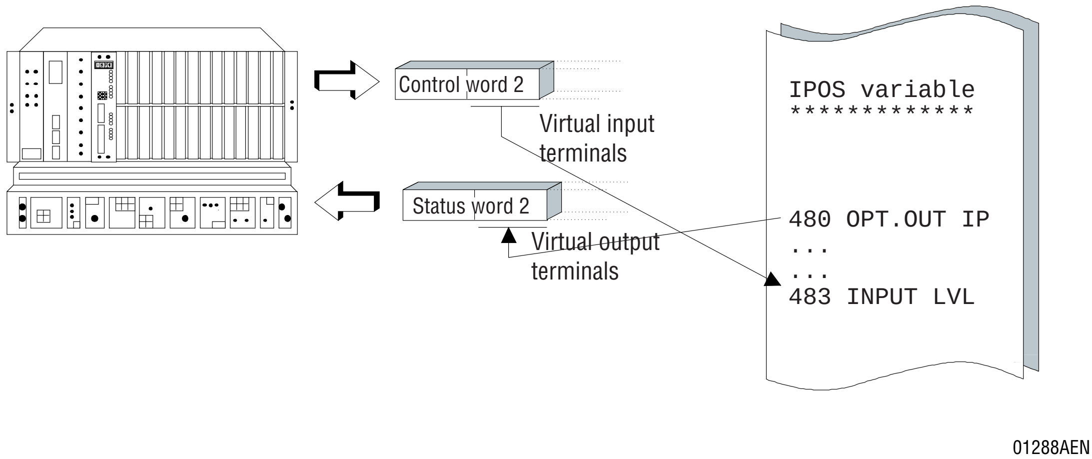

Figure 40: Fieldbus applications with IPOS automatic program and control word 2/status word 2

16. Activate the IPOS automatic program in the drive inverter by initiating the control command *Enable* via the fieldbus and start the IPOS program with MX_SHELL.

All the parameters for this application example have now been assigned.

7.3.4 S5 Application Program

If, for example, the process input and output data is mapped to the peripheral addresses PW132, PW134 and PW136 within a Simatic S5, the control and specification of the position setpoints can be implemented with the corresponding load and transfer commands.

Read access:

```
L PW 132  Read status word 2
L PW 134  Read actual value position high
L PW 136  Read actual value position low
```

Write access:

```
T PW 132  Write control word 2
T PW 134  Write setpoint position high
T PW 136  Write setpoint position low
```

IMPORTANT!

It is very important to make sure that the position values are treated consistently, i.e., that it is guaranteed that position high and position low provide the correct 32-bit position value within one program and bus cycle!

Additional information on data consistency and the programming techniques associated with it can be found in the manual for your master module.

7.4 Individual IPOS Process Data Communication

The IPOS^{plus} sequence and position control can be used for individual design of process data assignment. In this case, the process data serve only as a communications medium between the higher-level automation unit and the IPOS^{plus} control program. The content of these process data is transferred transparently and is not evaluated by the inverter system. This allows you to determine independently how to interpret the content of these process data.

This application example demonstrates how the process data can be used individually via IPOS^{plus}.

7.4.1 Objective

The process data are to exchange any information between the control program of the higher-level automation system and the IPOS^{plus} program. The inverter system will no longer evaluate the process data. Sensors connected to the binary inputs of the inverter can be evaluated in the IPOS^{plus} program or even passed on to the higher-level control unit via the PI data.

7.4.2 Process Data Description

The individual process data exchange between IPOS^{plus} and a higher-level automation unit can be implemented using the following process data description:

- P870 PO1 Setpoint Description IPOS PO DATA
- P871 PO2 Setpoint Description IPOS PO DATA
- P872 PO3 Setpoint Description IPOS PO DATA
- P873 PI1 Actual Value Description IPOS PI DATA
- P874 PI2 Actual Value Description IPOS PI DATA
- P875 PI3 Actual Value Description IPOS PI DATA

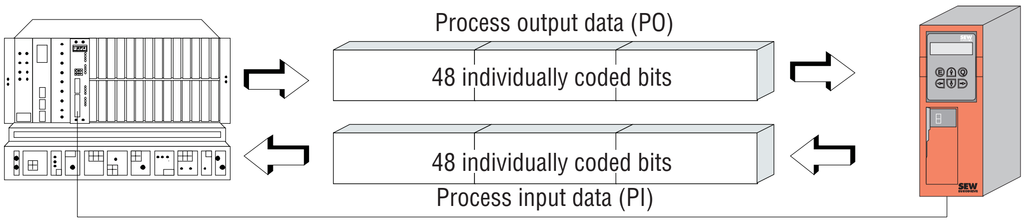

Figure 41: Application example for individual process data communication with IPOS^{plus}

The IPOS^{plus} control program can access the process output data at any time. To prevent the inverter system from evaluating these PO data, they are programmed to *IPOS PO DATA* in this application example. The process input data, on the other hand, must be programmed *IPOS PI DATA* so that they are updated only by the IPOS^{plus} control program.

7.4.3 Startup

We recommend using the following method to implement this application example:

1. Wire the inverter in accordance with the operating instructions. To operate with the fieldbus, connect the inverter to an external 24 V supply (terminals VI24 and DGND). Connect the binary input DI00 to a +24 V signal in order to enable the inverter on the terminal side. The remaining free inputs can be connected at random in the IPOS control program during programming to *IPOS Input*.

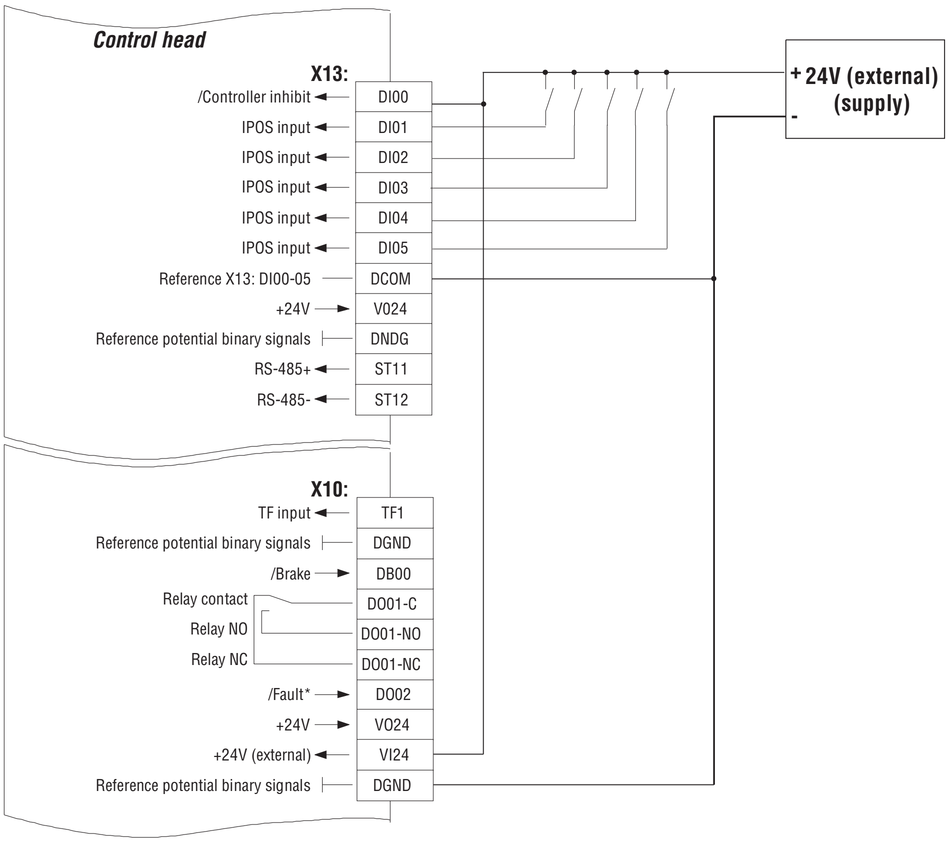

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Figure 42: Wiring example of the inverter for IPOS

2. Set all the parameters specific to the fieldbus using the DIP switches on the fieldbus option. For this example, configure the process data length to "3PD." For the option DFI11 (INTERBUS), for example, this can be done via the DIP switches on the option pcb. In the case of PROFIBUS-DP (option DFP11), the process data length is configured in the master module. Further information can be found in the documentation on the relevant fieldbus option.

3. Switch on the external 24 V supply.
   Since the inverter has not yet had parameters set for fieldbus operation, for safety reasons do not switch on the supply voltage at this time!

4. Activate the factory setting.

802 Factory setting	ON

5. Set the setpoint source and control source parameter to FIELDBUS.

100 Setpoint source	FIELDBUS
101 Control source	FIELDBUS

6. Program the PO and PI data according to the application specification.

870 PO1 Setpoint Description	IPOS PO DATA
871 PO2 Setpoint Description	IPOS PO DATA
872 PO3 Setpoint Description	IPOS PO DATA
873 PI1 Actual Value Description	IPOS PI DATA
874 PI2 Actual Value Description	IPOS PI DATA
875 PI3 Actual Value Description	IPOS PI DATA

7. Since you changed the setpoint description for the process input data, the inverter has automatically locked with *Enable PO Data = NO*. Re-enable the fieldbus setpoints with *Enable PO Data = YES*.

876 Enable PO data	YES

8. Program all binary inputs DI01 - DI05 to IPOS INPUT so that they can use the binary inputs in the IPOS control program and the inverter is enabled on the terminal side via the previously installed jumper.

600 Binary input DI01	IPOS INPUT
601 Binary input DI02	IPOS INPUT
602 Binary input DI03	IPOS INPUT
603 Binary input DI04	IPOS INPUT
604 Binary input DI05	IPOS INPUT

9. Program the fieldbus parameter Fieldbus Timeout Interval to 100 ms as set out in the objective.

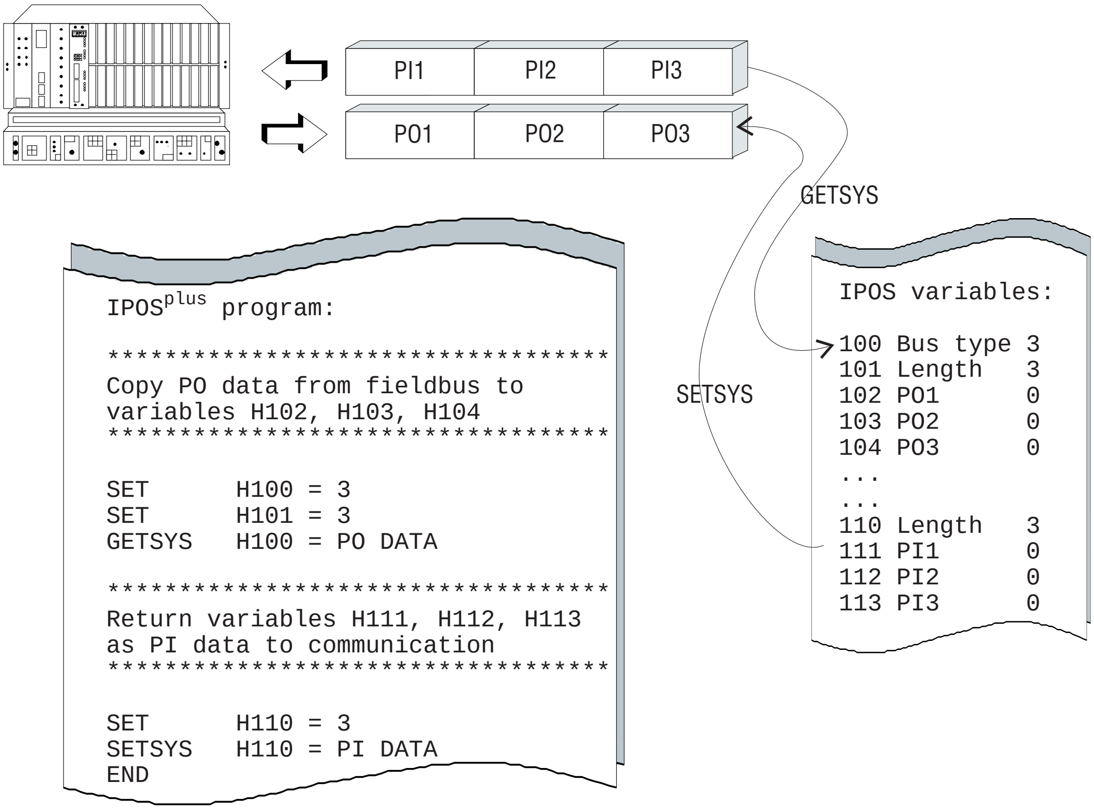
819 Fieldbus timeout interval [s]	0.10

Caution! For PROFIBUS-DP, the setting of the timeout interval is carried out via DP master!

10. Now enter all parameters specific to the drive, such as motor parameters, frequency characteristics, etc. (see MOVIDRIVE® Installation and Startup Instructions).

11. Set the machine parameters for IPOS according to your application.

12. Now enter the IPOS^{plus} program listed below. Figure 43 shows a minimum program for the individual use of the process input and output data.



01291BEN

Figure 43: Use of the position setpoint in the IPOS program

13. After starting the IPOS^{plus} control program, you can enable the inverter via the fieldbus and transmit position setpoints.

7.4.4 S5 Application Program

If, for example, the process input and output data is mapped to the peripheral addresses PW132, PW134 and PW136 within a Simatic S5, the PO and PI data can be individually controlled or evaluated with the corresponding load and transfer commands.

Read access:

```
L PW 132  PI1 = Read IPOS variable H111 low
L PW 134  PI2 = Read IPOS variable H112 low
L PW 136  PI3 = Read IPOS variable H113 low
```

Write access:

```
T PW 132  PO1 = Write IPOS variable H102 low
T PW 134  PO2 = Write IPOS variable H103 low
T PW 136  PO3 = Write IPOS variable H104 low
```

8 Parameter List Sorted by Parameter Number

Explanation of table heading:

Par. No.	= Parameter number as used in MX_SHELL or in the DBG11A
Parameter	= Parameter name
Index	= 16-bit index for addressing the parameter via interfaces
Unit/Index	= Index of units according to sensor/actuator technology profile of PNO Abbr. = Abbreviation of the unit of measure Sz. = Size index (e.g., 11 = Speed) Conv. = Conversion index (e.g., – 3 = 10^{-3})
Access	= Access attributes S = Save, even in case of a parameter lock RO = Read only R = Controller inhibit must be active during write RW = Read/Write N = During restart the value is written from EEPROM into RAM
Default	= Factory setting
Meaning/ Value range	= Meaning/Parameter value range

Data format

In general, all parameters are handled as 32-bit values. The representation is done in Motorola format.

High Byte	Low Byte	High Byte	Low Byte

Bit 2^{31} ... Bit 2^{0}

High Word | Low Word

MOVILINK® parameter:

The parameters are arranged in such a way that they can be found in the manufacturer-specific area of the drive profiles (DRIVECOM-INTERBUS, CANopen...). This results in the following area for the indices of the MOVILINK® parameters: 2000h (8192) ..... 5FFF (24575).

Start index	Number of indices	Contents
8192	108	Local parameters for fieldbus options / gateway
8300	1700	Drive parameters / display values / scope parameter
10000	300	Fault responses (max. 255 fault codes)
10300	300	Motor table Current (Id)
10600	400	Motor table Flow
11000	5000	IPOS variables (11000 + IPOS variable number)
16000	8575	IPOS program code
24575	-	End

Note for INTERBUS and Profibus FMS:

Access to the indices < 10000 is carried out directly via the services READ Request or WRITE Request of the fieldbus system.
All indices >= 10000 can be addressed only indirectly via the MOVILINK® parameter channel (index 8298//8299) (see User Manuals accompanying the options DFP/DFI).

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
0. Display values									
00. Process values									
000	Speed [1/min]	8318	207E	1/s	11	66	RO	0	
001	User display [ ]	8501	2135		0	-3	RO	0	
002	Frequency [Hz]	8319	207F	Hz	28	-3	RO	0	
003	Actual position [Inc]	8320	2080		0	0	RO	0	
004	Output current [% In]	8321	2081	%	24	-3	RO	0	
005	Active current [%In]	8322	2082	%	24	-3	RO	0	
006	Motor utilization 1 [%]	8323	2083	%	24	-3	N/RO	0	
007	Motor utilization 2 [%]	8324	2084	%	24	-3	N/RO	0	
008	DC link voltage [V]	8325	2085	V	21	-3	RO	0	
009	Output current [A]	8326	2086	A	22	-3	RO	0	
01. Status indicators									
010	Inverter status	8310	2076		0	0	RO	0	
011	Operating state	8310	2076		0	0	RO	0	Low word coded like status word 1
012	Fault status	8310	2076		0	0	RO	0	
013	Active parameter set	8310	2076		0	0	RO	0	
014	Heat sink temperature [°C]	8327	2087	°C	17	100	RO	0	
015	Operating hours [h]	8328	2088	s	4	70	N/RO	0	
016	Enable hours [h]	8329	2089	s	4	70	N/RO	0	
017	Energy [kWh]	8330	208A	Ws	8	5	N/RO	0	
02. Analog setpoints									
020	Analog input AI1 [V]	8331	208B	V	21	-3	RO	0	
021	Analog input AI2 [V]	8332	208C	V	21	-3	RO	0	
022	External current limit [%]	8333	208D	%	24	-3	RO	0	
03. Binary inputs of base unit									
030	Binary input DI00	8334	208E		0	0	R/RO	0	
031	Binary input DI01	8335	208F		0	0	N/R/RW	2	0...25, Step 1
032	Binary input DI02	8336	2090		0	0	N/R/RW	3	0...25, Step 1
033	Binary input DI03	8337	2091		0	0	N/R/RW	1	0...25, Step 1
034	Binary input DI04	8338	2092		0	0	N/R/RW	4	0...25, Step 1
035	Binary input DI05	8339	2093		0	0	N/R/RW	5	0...25, Step 1
036	Binary inputs DI00 ..DI05	8334	208E		0	0	N/R/RW	0	Bit 0 = DI00 ... Bit 5 = DI05
04. Binary inputs of option									
040	Binary input DI10	8340	2094		0	0	N/R/RW	0	0...25, Step 1
041	Binary input DI11	8341	2095		0	0	N/R/RW	0	0...25, Step 1
042	Binary input DI12	8342	2096		0	0	N/R/RW	0	0...25, Step 1
043	Binary input DI13	8343	2097		0	0	N/R/RW	0	0...25, Step 1
044	Binary input DI14	8344	2098		0	0	N/R/RW	0	0...25, Step 1
045	Binary input DI15	8345	2099		0	0	N/R/RW	0	0...25, Step 1
046	Binary input DI16	8346	209A		0	0	N/R/RW	0	0...25, Step 1
047	Binary input DI17	8347	209B		0	0	N/R/RW	0	0...25, Step 1

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
048	Binary inputs DI10 ..DI17	8348	209C		0	0	RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
05. Binary outputs of base unit									
050	Binary output DB00	8349	209D		0	0	RO	0	
051	Binary output DO01	8350	209E		0	0	N/RW	2	0...22, Step 1
052	Binary output DO02	8351	209F		0	0	N/RW	1	0...22, Step 1
053	Binary outputs DB00, DO01/2	8349	209D		0	0	RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
06. Binary outputs of option									
060	Binary output DO10	8352	20A0		0	0	N/RW	0	0...22, Step 1
061	Binary output DO11	8353	20A1		0	0	N/RW	0	0...22, Step 1
062	Binary output DO12	8354	20A2		0	0	N/RW	0	0...22, Step 1
063	Binary output DO13	8355	20A3		0	0	N/RW	0	0...22, Step 1
064	Binary output DO14	8356	20A4		0	0	N/RW	0	0...22, Step 1
065	Binary output DO15	8357	20A5		0	0	N/RW	0	0...22, Step 1
066	Binary output DO16	8358	20A6		0	0	N/RW	0	0...22, Step 1
067	Binary output DO17	8359	20A7		0	0	N/RW	0	0...22, Step 1
068	Binary outputs DO10 ..DO17	8360	20A8		0	0	RO	0	Bit 0 = DO10 ... Bit 7 = DO17
07. Device data									
070	Device type	8301	206D		0	0	RO	0	
071	Device rated current [A]	8361	20A9	A	22	-3	RO	0	
072	Option 1	8362	20AA		0	0	RO	0	0 = SHORT CIRCUIT 1 = invalid 2 = FIELDBUS 3 = DPI/DPA 4 = DRS 5 = AIO 6 = invalid 7 = DIO 8 = invalid 9 = NONE
073	Option 2	8363	20AB		0	0	RO	0	See menu no. 072 or index 8362
074	Firmware option 1	8364	20AC		0	0	RO	0	Example: 822609711 = 822 6097.11 1822609011 = 822 609X.11
075	Firmware option 2	8365	20AD		0	0	RO	0	
076	Firmware basic unit	8300	206C		0	0	RO	0	
08. Fault memory time t-x									
080	Fault t-0	8366	20AE		0	0	N/RO	0	
	Input terminals 1..6	8371	20B3		0	0	N/RO	0	Bit 0 = DI00 ... Bit 5 = DI05
	Input terminals (opt.) 1..8	8376	20B8		0	0	N/RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
	Output terminals 1..3	8381	20BD		0	0	N/RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
	Output terminals (opt.) 1..8	8386	20C2		0	0	N/RO	0	Bit 0 = DO10 ... Bit 7 = DO17
	Operating state	8391	20C7		0	0	N/RO	0	Low word coded like status word 1
	Heat sink temperature [°C]	8396	20CC	°C	17	100	N/RO	0	
	Speed [1/min]	8401	20D1	1/s	11	66	N/RO	0	
	Output current [%]	8406	20D6	%	24	-3	N/RO	0	
	Active current [%]	8411	20DB	%	24	-3	N/RO	0	
	Device utilization [%]	8416	20E0	%	24	-3	N/RO	0	
	DC link voltage [V]	8421	20E5	V	21	-3	N/RO	0	
	Operating hours [h]	8426	20EA	s	4	70	N/RO	0	
	Enable hours [h]	8431	20EF	s	4	70	N/RO	0	
	Parameter set	8391	20C7		0	0	N/RO	0	
	Motor utilization 1 [%]	8441	20F9	%	24	-3	N/RO	0	
	Motor utilization 2 [%]	8446	20FE	%	24	-3	N/RO	0	

Par. No.	Parameter		Index Dec	Index Hex	Unit/Index Abbr.	Sz.	Conv.	Access	Default	Meaning / Value range
082	Fault t-1		8367	20AF		0	0	N/RO	0	
	Input terminals	1..6	8372	20B4		0	0	N/RO	0	Bit 0 = DI00 ... Bit 5 = DI05
	Input terminals (opt.)	1..8	8377	20B9		0	0	N/RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
	Output terminals	1..3	8382	20BE		0	0	N/RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
	Output terminals (opt.)	1..8	8387	20C3		0	0	N/RO	0	Bit 0 = DO10 ... Bit 7 = DO17
	Operating state		8392	20C8		0	0	N/RO	0	Low word coded like status word 1
	Heat sink temperature	[°C]	8397	20CD	°C	17	100	N/RO	0	
	Speed	[1/min]	8402	20D2	1/s	11	66	N/RO	0	
	Output current	[%]	8407	20D7	%	24	-3	N/RO	0	
	Active current	[%]	8412	20DC	%	24	-3	N/RO	0	
	Device utilization	[%]	8417	20E1	%	24	-3	N/RO	0	
	DC link voltage	[V]	8422	20E6	V	21	-3	N/RO	0	
	Operating hours	[h]	8427	20EB	s	4	70	N/RO	0	
	Enable hours	[h]	8432	20F0	s	4	70	N/RO	0	
	Parameter set		8392	20C8		0	0	N/RO	0	
	Motor utilization 1	[%]	8442	20FA	%	24	-3	N/RO	0	
	Motor utilization 2	[%]	8447	20FF	%	24	-3	N/RO	0	
084	Fault t-2		8368	20B0		0	0	N/RO	0	
	Input terminals	1..6	8373	20B5		0	0	N/RO	0	Bit 0 = DI00 ... Bit 5 = DI05
	Input terminals	1..8	8378	20BA		0	0	N/RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
	Output terminals	1..3	8383	20BF		0	0	N/RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
	Output terminals (opt.)	1..8	8388	20C4		0	0	N/RO	0	Bit 0 = DO10 ... Bit 7 = DO17
	Operating state		8393	20C9		0	0	N/RO	0	Low word coded like status word 1
	Heat sink temperature	[°C]	8398	20CE	°C	17	100	N/RO	0	
	Speed	[1/min]	8403	20D3	1/s	11	66	N/RO	0	
	Output current	[%]	8408	20D8	%	24	-3	N/RO	0	
	Active current	[%]	8413	20DD	%	24	-3	N/RO	0	
	Device utilization	[%]	8418	20E2	%	24	-3	N/RO	0	
	DC link voltage	[V]	8423	20E7	V	21	-3	N/RO	0	
	Operating hours	[h]	8428	20EC	s	4	70	N/RO	0	
	Enable hours	[h]	8433	20F1	s	4	70	N/RO	0	
	Parameter set		8393	20C9		0	0	N/RO	0	
	Motor utilization 1	[%]	8443	20FB	%	24	-3	N/RO	0	
	Motor utilization 2	[%]	8448	2100	%	24	-3	N/RO	0	
086	Fault t-3		8369	20B1		0	0	N/RO	0	
	Input terminals	1..6	8374	20B6		0	0	N/RO	0	Bit 0 = DI00 ... Bit 5 = DI05
	Input terminals (opt.)	1..8	8379	20BB		0	0	N/RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
	Output terminals	1..3	8384	20C0		0	0	N/RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
	Output terminals	1..8	8389	20C5		0	0	N/RO	0	Bit 0 = DO10 ... Bit 7 = DO17
	Operating state		8394	20CA		0	0	N/RO	0	Low word coded like status word 1
	Heat sink temperature	[°C]	8399	20CF	°C	17	100	N/RO	0	
	Speed	[1/min]	8404	20D4	1/s	11	66	N/RO	0	
	Output current	[%]	8409	20D9	%	24	-3	N/RO	0	
	Active current	[%]	8414	20DE	%	24	-3	N/RO	0	
	Device utilization	[%]	8419	20E3	%	24	-3	N/RO	0	
	DC link voltage	[V]	8424	20E8	V	21	-3	N/RO	0	
	Operating hours	[h]	8429	20ED	s	4	70	N/RO	0	
	Enable hours	[h]	8434	20F2	s	4	70	N/RO	0	
	Parameter set		8394	20CA		0	0	N/RO	0	
	Motor utilization 1	[%]	8444	20FC	%	24	-3	N/RO	0	
	Motor utilization 2	[%]	8449	2101	%	24	-3	N/RO	0	

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
088	Fault t-4	8370	20B2		0	0	N/RO	0	
	Input terminals 1..6	8375	20B7		0	0	N/RO	0	Bit 0 = DI00 ... Bit 5 = DI05
	Input terminals (opt.) 1..8	8380	20BC		0	0	N/RO	0	Bit 0 = DI 10 ... Bit 7 = DI17
	Output terminals 1..3	8385	20C1		0	0	N/RO	0	Bit 0 = DB00, Bit 1 = DO01, Bit 2 = DO02
	Output terminals (opt.) 1..8	8390	20C6		0	0	N/RO	0	Bit 0 = DO10 ... Bit 7 = DO17
	Operating state	8395	20CB		0	0	N/RO	0	Low word coded like status word 1
	Heat sink temperature [°C]	8400	20D0	°C	17	100	N/RO	0	
	Speed [1/min]	8405	20D5	1/s	11	66	N/RO	0	
	Output current [%]	8410	20DA	%	24	-3	N/RO	0	
	Device utilization [%]	8420	20E4	%	24	-3	N/RO	0	
	DC link voltage [V]	8425	20E9	V	21	-3	N/RO	0	
	Operating hours [h]	8430	20EE	s	4	70	N/RO	0	
	Enable hours [h]	8435	20F3	s	4	70	N/RO	0	
	Parameter set	8395	20CB		0	0	N/RO	0	
	Motor utilization 1 [%]	8445	20FD	%	24	-3	N/RO	0	
	Motor utilization 2 [%]	8450	2102	%	24	-3	N/RO	0	
09. Bus diagnostics									
090	PD configuration	8451	2103		0	0	N/S/RO	4	0 = PARAM + 1PD 1 = 1PD 2 = PARAM + 2PD 3 = 2PD 4 = PARAM + 3PD 5 = 3PD 6 = PARAM + 6PD 7 = 6PD 8 = PARAM + 10PD 9 = 10PD
091	Fieldbus type	8452	2104		0	0	S/RO	0	0 = NO FIELDBUS 1 = PROFIBUS FMS/DP 2 = INTERBUS 3 = reserved 4 = CAN 5 = PROFIBUS DP
092	Fieldbus baud rate	8453	2105		0	-3	S/RW	0	0...FFFFFFFFh, Step 1
093	Fieldbus address	8454	2106		0	0	S/RW	0	0...65535, Step 1
094	PO1 setpoint [hex]	8455	2107		0	0	S/RO	0	
095	PO2 setpoint [hex]	8456	2108		0	0	S/RO	0	
096	PO3 setpoint [hex]	8457	2109		0	0	S/RO	0	
097	PI1 actual value [hex]	8458	210A		0	0	RO	0	
098	PI2 actual value [hex]	8459	210B		0	0	RO	0	
099	PI3 actual value [hex]	8460	210C		0	0	RO	0	
1. Setpoints / ramp generators									
10. Setpoint specification									
100	Setpoint source	8461	210D		0	0	N/R/RW	0	0 = BIPOL./FIXED SETPOINT 1 = UNIPOL./FIXED SETPOINT 2 = RS485 3 = FIELDBUS 4 = MOTORPOTENTIOM. 5 = MOTORPOT+ANALOG1 6 = FIXEDSET+ANALOG1 7 = FIXEDSET*ANALOG1 8 = MASTER SBus 9 = MASTER RS485 10 = SBus

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
101	Control source	8462	210E		0	0	N/R/RW	0	0 = TERMINALS 1 = RS485 2 = FIELDBUS 3 = SBus
11. AI1 analog input									
110	AI1 scaling	8463	210F		0	-3	N/RW	1000	-10000...-0, Step 10 0...10000, Step 10
111	AI1 offset [mV]	8464	2110	V	21	-3	N/RW	0	-500...-0, Step 1 0...500, Step 1
112	AI1 operating mode	8465	2111		0	0	N/RW	1	0 = Reference 3000 1/min 1 = Reference N-MAX 2 = U-Off., N-MAX 3 = N-Off., N-MAX 4 = Expert characteristic curve 5 = N-MAX, 0-20mA 6 = N-MAX, 4-20mA
113	AI1 voltage offset [V]	8466	2112	V	21	-3	N/RW	0	-10000...-0, Step 10 0...10000, Step 10
114	AI1 speed offset [1/min]	8467	2113	1/s	11	66	N/RW	0	-5000000...-0, Step 200 0...5000000, Step 200
115	Filter setpoint [ms]	8468	2114	s	4	-6	N/RW	5000	0...1000, Step 1000 1000...20000, Step 10 20000...50000, Step 100 50000...100000, Step 1000
12. Analog inputs (optional)									
120	AI2 operating mode (opt.)	8469	2115		0	0	N/R/RW	0	0 = NO FUNCTION 1 = 0..+/-10V+Setpoint1 2 = 0..10V I limit 3 = ACTUAL VALUE CONTROLLER
13. Speed ramps 1									
130	t11 ramp up CW [s]	8470	2116	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
131	t11 ramp down CW [s]	8471	2117	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
132	t11 ramp up CCW [s]	8472	2118	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
133	t11 ramp down CCW [s]	8473	2119	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
134	t12 ramp UP=DOWN [s]	8474	211A	s	4	-3	N/RW	10000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
135	t12 S pattern	8475	211B		0	0	N/RW	0	0 = 0 1 = 1 2 = 2 3 = 3
136	t13 stop ramp [s]	8476	211C	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...20000, Step 1000

Par. No.	Parameter		Index		Unit/Index			Access	Default	Meaning / Value range
			Dec	Hex	Abbr.	Sz.	Conv.			
137	t14 emergency ramp	[s]	8477	211D	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...20000, Step 1000
14. Speed ramps 2										
140	t21 ramp up CW	[s]	8478	211E	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
141	t21 ramp down CW	[s]	8479	211F	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
142	t21 ramp up CCW	[s]	8480	2120	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
143	t21 ramp down CCW	[s]	8481	2121	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
144	t22 ramp UP=DOWN	[s]	8482	2122	s	4	-3	N/RW	10000	0...1000, Step 10 1000...10000, Step 100 10000...100000, Step 1000 100000...2000000, Step 10000
145	t22 S pattern		8483	2123		0	0	N/RW	0	See menu no. 135 or index 8475
146	t23 stop ramp	[s]	8484	2124	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...20000, Step 1000
147	t24 emergency ramp	[s]	8485	2125	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...20000, Step 1000
15. Motor potentiometer										
150	t3 ramp up	[s]	8486	2126	s	4	-3	N/RW	20000	200...1000, Step 10 1000...10000, Step 100 10000...50000, Step 1000
151	t3 ramp down	[s]	8487	2127	s	4	-3	N/RW	20000	200...1000, Step 10 1000...10000, Step 100 10000...50000, Step 1000
152	Save last setpoint		8488	2128		0	0	N/RW	0	0 = OFF 1 = ON
16. Fixed setpoints 1										
160	n11 internal setpoint	[1/min]	8489	2129	1/s	11	66	N/RW	150000	-5000000...-0, Step 200 0...5000000, Step 200
161	n12 internal setpoint	[1/min]	8490	212A	1/s	11	66	N/RW	750000	-5000000...-0, Step 200 0...5000000, Step 200
162	n13 internal setpoint	[1/min]	8491	212B	1/s	11	66	N/RW	1500000	-5000000...-0, Step 200 0...5000000, Step 200
	n11 internal setpoint	[%]	8489	2129	1/s	11	66	N/RW	150000	-5000000...-0, Step 200 0...5000000, Step 200
	n12 internal setpoint	[%]	8490	212A	1/s	11	66	N/RW	750000	-5000000...-0, Step 200 0...5000000, Step 200
	n13 internal setpoint	[%]	8491	212B	1/s	11	66	N/RW	1500000	-5000000...-0, Step 200 0...5000000, Step 200
17. Fixed setpoints 2										
170	n21 internal setpoint	[1/min]	8492	212C	1/s	11	66	N/RW	150000	-5000000...-0, Step 200 0...5000000, Step 200

Par. No.	Parameter	Index Dec	Index Hex	Unit/Index Abbr.	Unit/Index Sz.	Unit/Index Conv.	Access	Default	Meaning / Value range
171	n22 internal setpoint [1/min]	8493	212D	1/s	11	66	N/RW	750000	-5000000...-0, Step 200 0...5000000, Step 200
172	n23 internal setpoint [1/min]	8494	212E	1/s	11	66	N/RW	1500000	-5000000...-0, Step 200 0...5000000, Step 200
	n21 internal setpoint [%]	8492	212C	1/s	11	66	N/RW	150000	-5000000...-0, Step 200 0...5000000, Step 200
	n22 internal setpoint [%]	8493	212D	1/s	11	66	N/RW	750000	-5000000...-0, Step 200 0...5000000, Step 200
	n23 internal setpoint [%]	8494	212E	1/s	11	66	N/RW	1500000	-5000000...-0, Step 200 0...5000000, Step 200
2. Controller parameters									
20. Closed-loop speed control									
200	P gain n-controller	8495	212F		0	-3	N/RW	2000	100...32000, Step 10
201	Time constant n-controller [ms]	8496	2130	s	4	-6	N/RW	10000	0...1000, Step 1000 1000...20000, Step 10 20000...50000, Step 100 50000...200000, Step 1000 200000...300000, Step 2000 300000...1000000, Step 20000 1000000...3000000, Step 200000
202	P gain accel. feedforward	8497	2131		0	-3	N/RW	0	0...32000, Step 1
203	Filter accel. feedforward [ms]	8498	2132	s	4	-6	N/RW	0	0...1000, Step 1000 1000...20000, Step 10 20000...50000, Step 100 50000...100000, Step 1000
204	Filter speed actual value [ms]	8499	2133	s	4	-6	N/RW	0	0...1000, Step 1000 1000...20000, Step 10 20000...32000, Step 100
21. Hold controller									
210	P gain hold controller	8500	2134		0	-3	N/RW	500	100...32000, Step 10
22. Synchronous operation control									
220	P gain (DRS)	8509	213D		0	-3	N/RW	10000	1000...200000, Step 1000
221	Master gear unit factor	8502	2136		0	0	N/RW	1	1...3999999999, Step 1
222	Slave gear unit factor	8503	2137		0	0	N/RW	1	1...3999999999, Step 1
223	Mode selection	8504	2138		0	0	N/RW	0	0 = MODE 1 1 = MODE 2 2 = MODE 3 3 = MODE 4 4 = MODE 5 5 = MODE 6 6 = MODE 7
224	Slave counter [Inc]	8505	2139		0	0	N/RW	10	-99999999...-10, Step 1 10...99999999, Step 1
225	Offset 1 [Inc]	8506	213A		0	0	N/RW	10	-32767...-10, Step 1 10...32767, Step 1
226	Offset 2 [Inc]	8507	213B		0	0	N/RW	10	-32767...-10, Step 1 10...32767, Step 1
227	Offset 3 [Inc]	8508	213C		0	0	N/RW	10	-32767...-10, Step 1 10...32767, Step 1
23. Synchronous operation with synchronous encoder									
230	Synchronous encoder	8510	213E		0	0	N/R/RW	0	0 = OFF 1 = EQUAL 2 = CHAIN
231	Factor slave encoder	8511	213F		0	0	N/RW	1	1...1000, Step 1
232	Factor slave synchronous encoder	8512	2140		0	0	N/RW	1	1...1000, Step 1

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
24. Synchronous operation with catch-up									
240	Synchronous speed [1/min]	8513	2141	1/s	11	66	N/RW	1500000	0...5000000, Step 200
241	Synchr. ramp [s]	8514	2142	s	4	-3	N/RW	2000	0...1000, Step 10 1000...10000, Step 100 10000...50000, Step 1000
3. Motor parameters									
30. Limitings 1									
300	Start-Stop speed 1 [1/min]	8515	2143	1/s	11	66	N/RW	60000	0...150000, Step 200
301	Minimum speed 1 [1/min]	8516	2144	1/s	11	66	N/RW	60000	0...5500000, Step 200
302	Maximum speed 1 [1/min]	8517	2145	1/s	11	66	N/RW	1500000	0...5500000, Step 200
303	Current limit 1 [%In]	8518	2146	%	24	-3	N/RW	150000	0...150000, Step 1000
31. Limitings 2									
310	Start-Stop speed 2 [1/min]	8519	2147	1/s	11	66	N/RW	60000	0...150000, Step 200
311	Minimum speed 2 [1/min]	8520	2148	1/s	11	66	N/RW	60000	0...5500000, Step 200
312	Maximum speed 2 [1/min]	8521	2149	1/s	11	66	N/RW	1500000	0...5500000, Step 200
313	Current limit 2 [%In]	8522	214A	%	24	-3	N/RW	150000	0...150000, Step 1000
32. Motor compensation 1 (asynchr.)									
320	Automatic adjustment 1	8523	214B		0	0	N/RW	1	See menu no. 152 or index 8488
321	Boost 1 [%]	8524	214C	V	21	-3	N/RW	0	0...100000, Step 1000
322	IxR adjustment 1 [%]	8525	214D	V	21	-3	N/RW	0	0...100000, Step 1000
323	Premagnetization time 1 [s]	8526	214E	s	4	-3	N/RW	100	0...2000, Step 1
324	Slip compensation 1 [1/min]	8527	214F	1/s	11	66	N/RW	0	0...500000, Step 200
33. Motor compensation 2 (asynchr.)									
330	Automatic adjustment 2	8528	2150		0	0	N/RW	1	See menu no. 152 or index 8488
331	Boost 2 [%]	8529	2151	V	21	-3	N/RW	0	0...100000, Step 1000
332	IxR adjustment 2 [%]	8530	2152	V	21	-3	N/RW	0	0...100000, Step 1000
333	Premagnetization time 2 [s]	8531	2153	s	4	-3	N/RW	100	0...2000, Step 1
334	Slip compensation 2 [1/min]	8532	2154	1/s	11	66	N/RW	0	0...500000, Step 200
34. Motor protection									
340	Motor protection 1	8533	2155		0	0	N/RW	0	See menu no. 152 or index 8488
341	Type of cooling 1	8534	2156		0	0	N/RW	0	0 = SELF-VENTILATION 1 = EXTERNAL VENTILATION
342	Motor protection 2	8535	2157		0	0	N/RW	0	See menu no. 152 or index 8488
343	Type of cooling 2	8536	2158		0	0	N/RW	0	See menu no. 341 or index 8534
35. Rotational direction of the motor									
350	Rotational direction change 1	8537	2159		0	0	N/R/RW	0	See menu no. 152 or index 8488
351	Rotational direction change 2	8538	215A		0	0	N/R/RW	0	See menu no. 152 or index 8488
4. Reference messages									
40. Speed reference message									
400	Speed reference value [1/min]	8539	215B	1/s	11	66	N/RW	1500000	0...5000000, Step 200
401	Hysteresis [1/min]	8540	215C	1/s	11	66	N/RW	100000	0...500000, Step 1000
402	Delay time [s]	8541	215D	s	4	-3	N/RW	1000	0...9000, Step 100
403	Message = "1" at:	8542	215E		0	0	N/RW	0	0 = n < n ref 1 = n > n ref
41. Speed window message									
410	Window center [1/min]	8543	215F	1/s	11	66	N/RW	1500000	0...5000000, Step 200
411	Range width [1/min]	8544	2160	1/s	11	66	N/RW	0	0...5000000, Step 200

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
412	Delay time [s]	8545	2161	s	4	-3	N/RW	1000	0...9000, Step 100
413	Message = "1" at:	8546	2162		0	0	N/RW	0	0 = INTERNAL 1 = EXTERNAL
42. Speed setpoint/actual value comparison									
420	Hysteresis [1/min]	8547	2163	1/s	11	66	N/RW	100000	1000...300000, Step 1000
421	Delay time [s]	8548	2164	s	4	-3	N/RW	1000	0...9000, Step 100
422	Message = "1" at:	8549	2165		0	0	N/RW	1	0 = n <> n setp 1 = n = n setp
43. Current reference message									
430	Current reference value [%In]	8550	2166	%	24	-3	N/RW	100000	0...150000, Step 1000
431	Hysteresis [%In]	8551	2167	%	24	-3	N/RW	5000	0...30000, Step 1000
432	Delay time [s]	8552	2168	s	4	-3	N/RW	1000	0...9000, Step 100
433	Message = "1" at:	8553	2169		0	0	N/RW	0	0 = I < I ref 1 = I > I ref
44. Imax message									
440	Hysteresis [%In]	8554	216A	%	24	-3	N/RW	5000	5000...50000, Step 1000
441	Delay time [s]	8555	216B	s	4	-3	N/RW	1000	0...9000, Step 100
442	Message = "1" at:	8556	216C		0	0	N/RW	1	0 = I=Imax 1 = I<Imax
5. Control functions									
50. Speed monitoring									
500	Speed monitoring 1	8557	216D		0	0	N/RW	3	0 = OFF 1 = MOTORIC 2 = REGENERATIVE 3 = MOT.& REGENERAT.
501	Delay time 1 [s]	8558	216E	s	4	-3	N/RW	1000	0...10000, Step 10
502	Speed monitoring 2	8559	216F		0	0	N/RW	3	See menu no. 500 or index 8557
503	Delay time 2 [s]	8560	2170	s	4	-3	N/RW	1000	0...10000, Step 10
51. Synchronous operation monitoring									
510	Slave position tolerance [Inc]	8561	2171		0	0	N/RW	25	10...32768, Step 1
511	Prewarning Lag error [Inc]	8562	2172		0	0	N/RW	50	50...99999999, Step 1
512	Lag error limit [Inc]	8563	2173		0	0	N/RW	4000	100...99999999, Step 1
513	Delay Lag message [s]	8564	2174	s	4	-3	N/RW	1000	0...99000, Step 100
514	LED counter display [Inc]	8565	2175		0	0	N/RW	100	10...32768, Step 1
515	Delay position message [ms]	8566	2176	s	4	-3	N/RW	10	5...2000, Step 1
52. Mains-off control									
520	Mains-off response time [s]	8567	2177	s	4	-3	N/RW	0	0...5000, Step 1
521	Mains-off response	8753	2231		0	0	N/RW	0	0 = CONTROLLER INHIBIT 1 = EMERGENCY STOP
6. Terminal assignment									
60. Binary inputs of base unit									
600	Binary input DI01	8335	208F		0	0	N/R/RW	2	0 = NO FUNCTION 1 = ENABLE/STOP 2 = CW/STOP 3 = CCW/STOP 4 = n11/n21 5 = n12/n22

Par. No.	Parameter	Index Dec	Index Hex	Unit/Index Abbr.	Unit/Index Sz.	Unit/Index Conv.	Access	Default	Meaning / Value range
									6 = FIXED SETPOINT SWITCH. 7 = PARAM. SWITCH 8 = RAMP SWITCH 9 = MOTORPOT. UP 10 = MOTORPOT. DOWN 11 = /EXT. FAULT 12 = FAULT RESET 13 = /HOLDING CONTROL 14 = /ES CW 15 = /ES CCW 16 = IPOS INPUT 17 = REFERENCE CAM 18 = REF. TRAVEL START 19 = SLAVE FREEWHEELING 20 = SETPOINT TAKEOVER 21 = MAINS ON 22 = DRS SET ZERO POINT 23 = DRS SLAVE START 24 = DRS TEACH IN 25 = DRS MASTER RESTS
601	Binary input DI02	8336	2090		0	0	N/R/RW	3	See menu no. 600 or index 8335
602	Binary input DI03	8337	2091		0	0	N/R/RW	1	See menu no. 600 or index 8335
603	Binary input DI04	8338	2092		0	0	N/R/RW	4	See menu no. 600 or index 8335
604	Binary input DI05	8339	2093		0	0	N/R/RW	5	See menu no. 600 or index 8335
61. Binary inputs of option									
610	Binary input DI10	8340	2094		0	0	N/R/RW	0	See menu no. 600 or index 8335
611	Binary input DI11	8341	2095		0	0	N/R/RW	0	See menu no. 600 or index 8335
612	Binary input DI12	8342	2096		0	0	N/R/RW	0	See menu no. 600 or index 8335
613	Binary input DI13	8343	2097		0	0	N/R/RW	0	See menu no. 600 or index 8335
614	Binary input DI14	8344	2098		0	0	N/R/RW	0	See menu no. 600 or index 8335
615	Binary input DI15	8345	2099		0	0	N/R/RW	0	See menu no. 600 or index 8335
616	Binary input DI16	8346	209A		0	0	N/R/RW	0	See menu no. 600 or index 8335
617	Binary input DI17	8347	209B		0	0	N/R/RW	0	See menu no. 600 or index 8335
62. Binary outputs of base unit									
620	Binary output DO01	8350	209E		0	0	N/RW	2	0 = NO FUNCTION 1 = /MALFUNCTION 2 = READY FOR OPERATION 3 = OUTPUT STAGE ON 4 = PHASE SEQUENCE ON 5 = BRAKE OPEN 6 = BRAKE CLOSED 7 = MOTOR STANDSTILL 8 = PARAMETER SET 9 = SPEED REFERENCE 10 = SPEED WINDOW 11 = SETPOINT/ACTUAL VALUE COMPARISON 12 = CURRENT REFERENCE 13 = Imax MESSAGE 14 = /MOTOR UTILIZATION 1 15 = /MOTOR UTILIZATION 2 16 = /DRS PREWARNING 17 = /DRS LAG 18 = DRS SLAVE IN POS 19 = IPOS IN POSITION 20 = IPOS REFERENCE 21 = IPOS OUTPUT 22 = /IPOS MALFUNCTION
621	Binary output DO02	8351	209F		0	0	N/RW	1	See menu no. 620 or index 8350

Par. No.	Parameter	Index Dec	Index Hex	Unit/Index Abbr.	Unit/Index Sz.	Unit/Index Conv.	Access	Default	Meaning / Value range
63. Binary outputs of option									
630	Binary output DO10	8352	20A0		0	0	N/RW	0	See menu no. 620 or index 8350
631	Binary output DO11	8353	20A1		0	0	N/RW	0	See menu no. 620 or index 8350
632	Binary output DO12	8354	20A2		0	0	N/RW	0	See menu no. 620 or index 8350
633	Binary output DO13	8355	20A3		0	0	N/RW	0	See menu no. 620 or index 8350
634	Binary output DO14	8356	20A4		0	0	N/RW	0	See menu no. 620 or index 8350
635	Binary output DO15	8357	20A5		0	0	N/RW	0	See menu no. 620 or index 8350
636	Binary output DO16	8358	20A6		0	0	N/RW	0	See menu no. 620 or index 8350
637	Binary output DO17	8359	20A7		0	0	N/RW	0	See menu no. 620 or index 8350
64. Analog outputs optional									
640	Analog output AO1	8568	2178		0	0	N/RW	3	0 = NO FUNCTION 1 = RAMP INPUT 2 = SETPOINT SPEED 3 = ACTUAL SPEED 4 = ACTUAL FREQUENCY 5 = OUTPUT CURRENT 6 = ACTIVE CURRENT 7 = DEVICE UTILIZATION 8 = IPOS OUTPUT
641	Scaling AO1	8569	2179		0	-3	N/RW	1000	-10000...-0, Step 10 0...10000, Step 10
642	Operating mode AO1	8570	217A		0	0	N/RW	1	0 = OFF 1 = -10V..10V 2 = 0..20 mA 3 = 4..20 mA
643	Analog output AO2	8571	217B		0	0	N/RW	5	See menu no. 640 or index 8568
644	Scaling AO2	8572	217C		0	-3	N/RW	1000	-10000...-0, Step 10 0...10000, Step 10
645	Operating mode AO2	8573	217D		0	0	N/RW	1	See menu no. 642 or index 8570
7. Control functions									
70. Operating modes									
700	Operating mode 1	8574	217E		0	0	N/R/RW	0	0 = VFC 1 1 = VFC 1 & GROUP 2 = VFC 1 & HOIST 3 = VFC 1 & DC BRAKE 4 = VFC 1 & FLYING-RESTART 5 = VFC n-CONTROLLER 6 = VFC n-CONTR.& GRP. 7 = VFC n-CONTR.& HOIST 8 = VFC n-CONTR.& SYNC 9 = VFC n-CONTR.& IPOS 10 = VFC n-CONTR.& DPx 11 = CFC 12 = CFC & M-CONTROL 13 = CFC & IPOS 14 = CFC & SYNC. 15 = CFC & DPx 16 = SERVO 17 = SERVO & M-CONTROL 18 = SERVO & IPOS 19 = SERVO & SYNC. 20 = SERVO & DPx
701	Operating mode 2	8575	217F		0	0	N/R/RW	0	0 = VFC 2 1 = VFC 2 & GROUP 2 = VFC 2 & HOIST 3 = VFC 2 & DC BRAKE 4 = VFC 2 & FLYING-RESTART

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
71. Standstill current									
710	Standstill current 1 [%Imot.]	8576	2180	A	22	-3	N/RW	0	0...50000, Step 1000
711	Standstill current 2 [%Imot.]	8577	2181	A	22	-3	N/RW	0	0...50000, Step 1000
72. Setpoint stop function									
720	Setpoint stop function 1	8578	2182		0	0	N/RW	0	See menu no. 152 or index 8488
721	Stop setpoint 1 [1/min]	8579	2183	1/s	11	66	N/RW	30000	0...500000, Step 200
722	Start offset 1 [1/min]	8580	2184	1/s	11	66	N/RW	30000	0...500000, Step 200
723	Setpoint stop function 2	8581	2185		0	0	N/RW	0	See menu no. 152 or index 8488
724	Stop setpoint 2 [1/min]	8582	2186	1/s	11	66	N/RW	30000	0...500000, Step 200
725	Start offset 2 [1/min]	8583	2187	1/s	11	66	N/RW	30000	0...500000, Step 200
73. Brake function									
730	Brake function 1	8584	2188		0	0	N/RW	1	See menu no. 152 or index 8488
731	Brake opening time 1 [s]	8749	222D	s	4	-3	N/RW	0	0...2000, Step 1
732	Brake reaction time 1 [s]	8585	2189	s	4	-3	N/RW	200	0...2000, Step 1
733	Brake function 2	8586	218A		0	0	N/RW	1	See menu no. 152 or index 8488
734	Brake opening time 2 [s]	8750	222E	s	4	-3	N/RW	0	0...2000, Step 1
735	Brake reaction time 2 [s]	8587	218B	s	4	-3	N/RW	200	0...2000, Step 1
74. Speed jumping									
740	Jump center 1 [1/min]	8588	218C	1/s	11	66	N/RW	1500000	0...5000000, Step 200
741	Jump center 1 [1/min]	8589	218D	1/s	11	66	N/RW	0	0...300000, Step 200
742	Jump center 2 [1/min]	8590	218E	1/s	11	66	N/RW	1500000	0...5000000, Step 200
743	Jump center 2 [1/min]	8591	218F	1/s	11	66	N/RW	0	0...300000, Step 200
75. Master-slave function									
750	Slave setpoint	8592	2190		0	0	N/RW	0	0 = MASTER-SLAVE OFF 1 = SPEED (RS485) 2 = SPEED (SBus) 3 = SPEED (485+SBus) 4 = TORQUE (RS485) 5 = TORQUE (SBus) 6 = TORQUE (485+SBus) 7 = LOAD SHARING (RS485) 8 = LOAD SHARING (SBus) 9 = LOAD SHARING (485+SBus)
751	Scaling slave setpoint	8593	2191		0	-3	N/RW	1000	-10000...-0, Step 1 0...10000, Step 1
8. Device functions									
80. Setup									
802	Factory Setting	8594	2192		0	0	R/RW	0	0 = NO 1 = YES
803	Parameter Lock	8595	2193		0	0	N/S/RW	0	See menu no. 152 or index 8488
804	Reset statistics	8596	2194		0	0	RW	0	0 = NO 1 = FAULT MEMORY 2 = KWH COUNTER 3 = OPERATING HOURS
81. Serial communication									
810	RS485 address	8597	2195		0	0	N/RW	0	0...99, Step 1
811	RS485 group address	8598	2196		0	0	N/RW	100	100...199, Step 1
812	RS485 timeout interval [s]	8599	2197	s	4	-3	N/RW	0	0...650000, Step 10
813	SBus address	8600	2198		0	0	N/RW	0	0...63, Step 1
814	SBus group address	8601	2199		0	0	N/RW	0	0...63, Step 1
815	SBus timeout interval [s]	8602	219A	s	4	-3	N/RW	100	0...650000, Step 10

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
816	SBus baud rate [kbaud]	8603	219B		0	0	N/RW	2	0 = 125 1 = 250 2 = 500 3 = 1000
817	SBus synchronization ID	8604	219C		0	-3	N/RW	0	0...2047000, Step 1000
818	CAN synchronization ID	8732	221C		0	-3	N/RW	1000	0...2047000, Step 1000
819	Fieldbus timeout interval [s]	8606	219E	s	4	-3	N/S/RW	500	0...650000, Step 10
82. Brake operation									
820	4-quadrant mode 1	8607	219F		0	0	N/RW	1	See menu no. 152 or index 8488
821	4-quadrant mode 2	8608	21A0		0	0	N/RW	1	See menu no. 152 or index 8488
83. Fault responses									
830	EXT. ERROR response	8609	21A1		0	0	N/RW	3	0 = NO RESPONSE 1 = DISPLAY FAULT 2 = INSTANT STOP/ FAULT 3 = EMERGENCY STOP/ FAULT 4 = RAPID STOP/FAULT 5 = INSTANT STOP/WARN. 6 = EMERGENCY STOP/WARN. 7 = RAPID STOP/WARN.
831	FIELDBUS TIMEOUT response	8610	21A2		0	0	N/RW	4	See menu no. 830 or index 8609
832	MOTOR OVERLOAD response	8611	21A3		0	0	N/RW	3	See menu no. 830 or index 8609
833	RS485-TIMEOUT response	8612	21A4		0	0	N/RW	7	See menu no. 830 or index 8609
834	LAG ERROR response	8613	21A5		0	0	N/RW	3	See menu no. 830 or index 8609
835	TF MESSAGE response	8616	21A8		0	0	N/RW	0	See menu no. 830 or index 8609
836	SBus TIMEOUT response	8615	21A7		0	0	N/RW	3	See menu no. 830 or index 8609
84. Reset behavior									
840	Manual reset	8617	21A9		0	0	S/RW	0	See menu no. 802 or index 8594
841	Auto reset	8618	21AA		0	0	N/RW	0	See menu no. 152 or index 8488
842	Restart time [s]	8619	21AB	s	4	-3	N/RW	3000	1000...30000, Step 1000
85. Scaling of speed actual value									
850	Scaling factor numerator	8747	222B		0	0	N/RW	1	1...65535, Step 1
851	Scaling factor denominator	8748	222C		0	0	N/RW	1	1...65535, Step 1
852	User unit	8772 8773	2244		0	0	N/RW	1768763 185	2 × ASCII characters
86. Modulation									
860	PWM frequency 1 [kHz]	8620	21AC		0	0	N/RW	0	0 = 4 1 = 8 2 = 12 3 = 16
861	PWM frequency 2 [kHz]	8621	21AD		0	0	N/RW	0	See menu no. 860 or index 8620
862	PWM fix 1	8751	222F		0	0	N/RW	0	See menu no. 152 or index 8488
863	PWM fix 2	8752	2230		0	0	N/RW	0	See menu no. 152 or index 8488
87. Process data description									
870	PO1 Setpoint Description	8304	2070		0	0	N/RW	9	0 = NO FUNCTION 1 = SPEED 2 = CURRENT 3 = POSITION LO 4 = POSITION HI 5 = MAX. SPEED 6 = MAX. CURRENT

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
									7 = SLIP 8 = RAMP 9 = CONTROL WORD 1 10 = CONTROL WORD 2 11 = SPEED [%] 12 = IPOS PO DATA
871	PO2 Setpoint Description	8305	2071		0	0	N/RW	1	See menu no. 870 or index 8304
872	PO3 Setpoint Description	8306	2072		0	0	N/RW	0	See menu no. 870 or index 8304
873	PI1 Actual value description	8307	2073		0	0	N/RW	6	0 = NO FUNCTION 1 = SPEED 2 = OUTPUT CURRENT 3 = ACTIVE CURRENT 4 = POSITION LO 5 = POSITION HI 6 = STATUS WORD 1 7 = STATUS WORD 2 8 = SPEED [%] 9 = IPOS PI DATA
874	PI2 Actual value description	8308	2074		0	0	N/RW	1	See menu no. 873 or index 8307
875	PI3 Actual value description	8309	2075		0	0	N/RW	2	See menu no. 873 or index 8307
876	Enable PO data	8622	21AE		0	0	N/S/RW	1	See menu no. 152 or index 8488
9. IPOS parameters									
90. IPOS reference travel									
900	Reference offset [Inc]	8623	21AF		0	0	N/RW	0	-7FFFFFFFh...-0, Step 1 0...7FFFFFFFh, Step 1
901	Reference speed 1 [1/min]	8624	21B0	1/s	11	66	N/RW	200000	0...5000000, Step 200
902	Reference speed 2 [1/min]	8625	21B1	1/s	11	66	N/RW	50000	0...5000000, Step 200
903	Reference travel type	8626	21B2		0	0	N/RW	0	0...7, Step 1
91. IPOS travel parameter									
910	Gain X-controller	8627	21B3		0	-3	N/RW	500	0...32000, Step 10
911	Positioning ramp 1 [s]	8628	21B4	s	4	-3	N/RW	1000	10...500, Step 1 500...2000, Step 10 2000...10000, Step 200 10000...20000, Step 1000
912	Positioning ramp 2 [s]	8696	21F8	s	4	-3	N/RW	1000	10...500, Step 1 500...2000, Step 10 2000...10000, Step 200 10000...20000, Step 1000
913	Travel speed CW [1/min]	8629	21B5	1/s	11	66	N/RW	1500000	0...5000000, Step 200
914	Travel speed CCW [1/min]	8630	21B6	1/s	11	66	N/RW	1500000	0...5000000, Step 200
915	Speed feedforward [%]	8631	21B7		0	-3	N/RW	100000	-199990...-0, Step 10 0...199990, Step 10
916	Ramp form	8632	21B8		0	0	N/RW	0	0 = LINEAR 1 = SINUS 2 = SQUARE
92. IPOS monitoring									
920	SW limit switch CW [Inc]	8633	21B9		0	0	N/RW	0	-7FFFFFFFh...-0, Step 1 0...7FFFFFFFh, Step 1
921	SW limit switch CCW [Inc]	8634	21BA		0	0	N/RW	0	-7FFFFFFFh...-0, Step 1 0...7FFFFFFFh, Step 1
922	Position window [Inc]	8635	21BB		0	0	N/RW	50	0...32767, Step 1
923	Lag error window [Inc]	8636	21BC		0	0	N/RW	5000	0...7FFFFFFFh, Step 1
93. IPOS special functions									
930	Override	8637	21BD		0	0	N/RW	0	See menu no. 152 or index 8488

Par. No.	Parameter	Index		Unit/Index			Access	Default	Meaning / Value range
		Dec	Hex	Abbr.	Sz.	Conv.			
94. IPOS encoder									
941	Source actual position	8729	2219		0	0	N/RW	0	0 = MOTOR ENCODER (X15) 1 = EXT. ENCODER (X14) 2 = ABSOLUTE ENCODER (DIP)
942	Encoder factor numerator	8774	2246		0	0	N/RW	1	1...32767, Step 1
943	Encoder factor denominator	8775	2247		0	0	N/RW	1	1...32767, Step 1
95. DIP									
950	Encoder type	8777	2249		0	0	N/R/RW	0	0 = NO ENCODER 1 = VISOLUX EDM 2 = T&R CE65,CE100 MSSI 3 = RESERVED 4 = RESERVED 5 = RESERVED 6 = STEGMANN AG100 MSSI 7 = SICK DME-3000-111 8 = STAHL WCS2-LS311
951	Counter direction	8776	2248		0	0	N/R/RW	0	0 = NORMAL 1 = INVERTED
952	Switching frequency [%]	8778	224A	%	24	-3	N/R/RW	100000	1000...200000, Step 100
953	Position offset	8779	224B		0	0	N/RW	0	-7FFFFFFFh...-0, Step 1 0...7FFFFFFFh, Step 1
954	Zero offset	8781	224D		0	0	N/RW	0	-7FFFFFFFh...-0, Step 1 0...7FFFFFFFh, Step 1
955	Encoder scaling	8784	2250		0	0	N/R/RW	0	0 = x 1 1 = x 2 2 = x 4 3 = x 8 4 = x 16 5 = x 32 6 = x 64

9 Parameter List Sorted by Index Numbers

Index	Par. no.	Parameter
8300	076	Firmware base unit
8301	070	Device type
8304	870	PO1 Setpoint Description
8305	871	PO2 Setpoint Description
8306	872	PO3 Setpoint Description
8307	873	PI1 Actual value description
8308	874	PI2 Actual value description
8309	875	PI3 Actual value description
8310	010	Inverter status
8310	013	Active parameter set
8310	012	Fault status
8310	011	Operating state
8318	000	Speed [1/min]
8319	002	Frequency [Hz]
8320	003	Actual position [Inc]
8321	004	Output current [% In]
8322	005	Active current [%In]
8323	006	Motor utilization 1 [%]
8324	007	Motor utilization 2 [%]
8325	008	DC link voltage [V]
8326	009	Output current [A]
8327	014	Heat sink temperature [°C]
8328	015	Operating hours [h]
8329	016	Enable hours [h]
8330	017	Energy [kWh]
8331	020	Analog input AI1 [V]
8332	021	Analog input AI2 [V]
8333	022	External current limit [%]
8334	030	Binary input DI00
8335	031	Binary input DI01
8335	600	Binary input DI01
8336	032	Binary input DI02
8336	601	Binary input DI02
8337	602	Binary input DI03
8337	033	Binary input DI03
8338	034	Binary input DI04
8338	603	Binary input DI04
8339	604	Binary input DI05
8339	035	Binary input DI05
8340	610	Binary input DI10
8340	040	Binary input DI10
8341	611	Binary input DI11
8341	041	Binary input DI11
8342	612	Binary input DI12
8342	042	Binary input DI12

Index	Par. no.	Parameter
8343	043	Binary input DI13
8343	613	Binary input DI13
8344	044	Binary input DI14
8344	614	Binary input DI14
8345	615	Binary input DI15
8345	045	Binary input DI15
8346	046	Binary input DI16
8346	616	Binary input DI16
8347	617	Binary input DI17
8347	047	Binary input DI17
8349	050	Binary output DB00
8350	620	Binary output DO01
8350	051	Binary output DO01
8351	621	Binary output DO02
8351	052	Binary output DO02
8352	060	Binary output DO10
8352	630	Binary output DO10
8353	061	Binary output DO11
8353	631	Binary output DO11
8354	632	Binary output DO12
8354	062	Binary output DO12
8355	633	Binary output DO13
8355	063	Binary output DO13
8356	064	Binary output DO14
8356	634	Binary output DO14
8357	635	Binary output DO15
8357	065	Binary output DO15
8358	636	Binary output DO16
8358	066	Binary output DO16
8359	637	Binary output DO17
8359	067	Binary output DO17
8361	071	Device rated current [A]
8362	072	Option 1
8363	073	Option 2
8364	074	Firmware option 1
8365	075	Firmware option 2
8366	080	Fault t-0
8367	082	Fault t-1
8368	084	Fault t-2
8369	086	Fault t-3
8370	088	Fault t-4
8371	080	Input terminals 1..6
8372	082	Input terminals 1..6
8373	084	Input terminals 1..6
8374	086	Input terminals 1..6
8375	088	Input terminals 1..6
8376	080	Input terminals (opt.) 1..8
8377	082	Input terminals (opt.) 1..8

Index	Par. no.	Parameter	
8378	084	Input terminals (opt.)	1..8
8379	086	Input terminals (opt.)	1..8
8380	088	Input terminals (opt.)	1..8
8381	080	Output terminals	1..3
8382	082	Output terminals	1..3
8383	084	Output terminals	1..3
8384	086	Output terminals	1..3
8385	088	Output terminals	1..3
8386	080	Output terminals (opt.)	1..8
8387	082	Output terminals (opt.)	1..8
8388	084	Output terminals (opt.)	1..8
8389	086	Output terminals (opt.)	1..8
8390	088	Output terminals (opt.)	1..8
8391	080	Operating state	
8391	080	Parameter set	
8392	082	Operating state	
8392	082	Parameter set	
8393	084	Parameter set	
8393	084	Operating state	
8394	086	Operating state	
8394	086	Parameter set	
8395	088	Parameter set	
8395	088	Operating state	
8396	081	Heat sink temperature	[°C]
8397	083	Heat sink temperature	[°C]
8398	085	Heat sink temperature	[°C]
8399	087	Heat sink temperature	[°C]
8400	089	Heat sink temperature	[°C]
8401	081	Speed	[1/min]
8402	083	Speed	[1/min]
8403	085	Speed	[1/min]
8404	087	Speed	[1/min]
8405	089	Speed	[1/min]
8406	081	Output current	[%]
8407	083	Output current	[%]
8408	085	Output current	[%]
8409	087	Output current	[%]
8410	089	Output current	[%]
8411	081	Active current	[%]
8412	083	Active current	[%]
8413	085	Active current	[%]
8414	087	Active current	[%]
8415	089	Active current	[%]
8416	081	Device utilization	[%]
8417	083	Device utilization	[%]
8418	085	Device utilization	[%]
8419	087	Device utilization	[%]
8420	089	Device utilization	[%]

Index	Par. no.	Parameter	
8421	081	DC link voltage	[V]
8422	083	DC link voltage	[V]
8423	085	DC link voltage	[V]
8424	087	DC link voltage	[V]
8425	089	DC link voltage	[V]
8426	081	Operating hours	[h]
8427	083	Operating hours	[h]
8428	085	Operating hours	[h]
8429	087	Operating hours	[h]
8430	089	Operating hours	[h]
8431	081	Enable hours	[h]
8432	083	Enable hours	[h]
8433	085	Enable hours	[h]
8434	087	Enable hours	[h]
8435	089	Enable hours	[h]
8441	080	Motor utilization 1	[%]
8442	082	Motor utilization 1	[%]
8443	084	Motor utilization 1	[%]
8444	086	Motor utilization 1	[%]
8445	088	Motor utilization 1	[%]
8446	080	Motor utilization 2	[%]
8447	082	Motor utilization 2	[%]
8448	084	Motor utilization 2	[%]
8449	086	Motor utilization 2	[%]
8450	088	Motor utilization 2	[%]
8451	090	PD configuration	
8452	091	Fieldbus type	
8453	092	Fieldbus baud rate	
8454	093	Fieldbus address	
8455	094	PO1 setpoint	[hex]
8456	095	PO2 setpoint	[hex]
8457	096	PO3 setpoint	[hex]
8458	097	PI1 actual value	[hex]
8459	098	PI2 actual value	[hex]
8460	099	PI3 actual value	[hex]
8461	100	Setpoint source	
8462	101	Control source	
8463	110	AI1 scaling	
8464	111	AI1 offset	[mV]
8465	112	AI1 operating mode	
8466	113	AI1 voltage offset	[V]
8467	114	AI1 speed offset	[1/min]
8468	115	Filter setpoint	[ms]
8469	120	AI2 operating mode (opt.)	
8470	130	t11 ramp up CW	[s]
8471	131	t11 ramp down CW	[s]
8472	132	t11 ramp up CCW	[s]
8473	133	t11 ramp down CCW	[s]

Index	Par. no.	Parameter	
8474	134	t12 ramp UP=DOWN	[s]
8475	135	t12 S pattern	
8476	136	t13 stop ramp	[s]
8477	137	t14 emergency ramp	[s]
8478	140	t21 ramp up CW	[s]
8479	141	t21 ramp down CW	[s]
8480	142	t21 ramp up CCW	[s]
8481	143	t21 ramp down CCW	[s]
8482	144	t22 ramp UP=DOWN	[s]
8483	145	t22 S pattern	
8484	146	t23 stop ramp	[s]
8485	147	t24 emergency ramp	[s]
8486	150	t3 ramp up	[s]
8487	151	t3 ramp down	[s]
8488	152	Save last setpoint	
8489		n11 internal setpoint	[%]
8489	160	n11 internal setpoint	[1/min]
8490	161	n12 internal setpoint	[1/min]
8490		n12 internal setpoint	[%]
8491	162	n13 internal setpoint	[1/min]
8491		n13 internal setpoint	[%]
8492	170	n21 internal setpoint	[1/min]
8492		n21 internal setpoint	[%]
8493	171	n22 internal setpoint	[1/min]
8493		n22 internal setpoint	[%]
8494		n23 internal setpoint	[%]
8494	172	n23 internal setpoint	[1/min]
8495	200	P gain n-controller	
8496	201	Time constant n-controller	[ms]
8497	202	P gain accel. feedforward	
8498	203	Filter accel. feedforward	[ms]
8499	204	Filter speed actual value	[ms]
8500	210	P gain hold controller	
8501	001	User display	[ ]
8502	221	Master gear unit factor	
8503	222	Slave gear unit factor	
8504	223	Mode selection	
8505	224	Slave counter	[Inc]
8506	225	Offset 1	[Inc]
8507	226	Offset 2	[Inc]
8508	227	Offset 3	[Inc]
8509	220	P gain (DRS)	
8510	230	Synchronous encoder	
8511	231	Factor slave encoder	
8512	232	Factor slave synchronous encoder	
8513	240	Synchronous speed	[1/min]
8514	241	Synchr. ramp	[s]
8515	300	Start-Stop speed 1	[1/min]

Index	Par. no.	Parameter	
8516	301	Minimum speed 1	[1/min]
8517	302	Maximum speed 1	[1/min]
8518	303	Current limit 1	[%In]
8519	310	Start-Stop speed 2	[1/min]
8520	311	Minimum speed 2	[1/min]
8521	312	Maximum speed 2	[1/min]
8522	313	Current limit 2	[%In]
8523	320	Automatic adjustment 1	
8524	321	Boost 1	[%]
8525	322	IxR adjustment 1	[%]
8526	323	Premagnetization time 1	[s]
8527	324	Slip compensation 1	[1/min]
8528	330	Automatic adjustment 2	
8529	331	Boost 2	[%]
8530	332	IxR adjustment 2	[%]
8531	333	Premagnetization time 2	[s]
8532	334	Slip compensation 2	[1/min]
8533	340	Motor protection 1	
8534	341	Type of cooling 1	
8535	342	Motor protection 2	
8536	343	Type of cooling 2	
8537	350	Rotational direction change 1	
8538	351	Rotational direction change 2	
8539	400	Speed reference value	[1/min]
8540	401	Hysteresis	[1/min]
8541	402	Delay time	[s]
8542	403	Message = "1" at:	
8543	410	Window center	[1/min]
8544	411	Range width	[1/min]
8545	412	Delay time	[s]
8546	413	Message = "1" at:	
8547	420	Hysteresis	[1/min]
8548	421	Delay time	[s]
8549	422	Message = "1" at:	
8550	430	Current reference value	[%In]
8551	431	Hysteresis	[%In]
8552	432	Delay time	[s]
8553	433	Message = "1" at:	
8554	440	Hysteresis	[%In]
8555	441	Delay time	[s]
8556	442	Message = "1" at:	
8557	500	Speed monitoring 1	
8558	501	Delay time 1	[s]
8559	502	Speed monitoring 2	
8560	503	Delay time 2	[s]
8561	510	Slave position tolerance	[Inc]
8562	511	Prewarning Lag error	[Inc]
8563	512	Lag error limit	[Inc]

Index	Par. no.	Parameter
8564	513	Delay Lag message [s]
8565	514	LED counter display [Inc]
8566	515	Delay position message [ms]
8567	520	Mains-off response time [s]
8568	640	Analog output AO1
8569	641	Scaling AO1
8570	642	Operating mode AO1
8571	643	Analog output AO2
8572	644	Scaling AO2
8573	645	Operating mode AO2
8574	700	Operating mode 1
8575	701	Operating mode 2
8576	710	Standstill current 1 [%Imot.]
8577	711	Standstill current 2 [%Imot.]
8578	720	Setpoint stop function 1
8579	721	Stop setpoint 1 [1/min]
8580	722	Start offset 1 [1/min]
8581	723	Setpoint stop function 2
8582	724	Stop setpoint 2 [1/min]
8583	725	Start offset 2 [1/min]
8584	730	Brake function 1
8585	732	Brake reaction time 1 [s]
8586	733	Brake function 2
8587	735	Brake reaction time 2 [s]
8588	740	Jump center 1 [1/min]
8589	741	Jump width 1 [1/min]
8590	742	Jump center 2 [1/min]
8591	743	Jump width 2 [1/min]
8592	750	Slave setpoint
8593	751	Scaling slave setpoint
8594	802	Factory Setting
8595	803	Parameter Lock
8596	804	Reset statistics
8597	810	RS485 address
8598	811	RS485 group address
8599	812	RS485 timeout interval [s]
8600	813	SBus address
8601	814	SBus group address
8602	815	SBus timeout interval [s]
8603	816	SBus baud rate [kbaud]
8604	817	SBus synchronization ID
8606	819	Fieldbus timeout interval [s]
8607	820	4-quadrant mode 1
8608	821	4-quadrant mode 2
8609	830	EXT. ERROR response
8610	831	FIELDBUS TIMEOUT response
8611	832	MOTOR OVERLOAD response
8612	833	RS485-TIMEOUT response

Index	Par. no.	Parameter
8613	834	LAG ERROR response
8615	836	SBus TIMEOUT response
8616	835	TF MESSAGE response
8617	840	Manual reset
8618	841	Auto reset
8619	842	Restart time [s]
8620	860	PWM frequency 1 [kHz]
8621	861	PWM frequency 2 [kHz]
8622	876	Enable PO data
8623	900	Reference offset [Inc]
8624	901	Reference speed 1 [1/min]
8625	902	Reference speed 2 [1/min]
8626	903	Reference travel type
8627	910	Gain X-controller
8628	911	Positioning ramp 1 [s]
8629	913	Travel speed CW [1/min]
8630	914	Travel speed CCW [1/min]
8631	915	Speed feedforward [%]
8632	916	Ramp form
8633	920	SW limit switch CW [Inc]
8634	921	SW limit switch CCW [Inc]
8635	922	Position window [Inc]
8636	923	Lag error window [Inc]
8637	930	Override
8696	912	Positioning ramp 2 [s]
8729	941	Source actual position
8732	818	CAN synchronization ID
8747	850	Scaling factor numerator
8748	851	Scaling factor denominator
8749	731	Brake opening time 1 [s]
8750	734	Brake opening time 2 [s]
8751	862	PWM fix 1
8752	863	PWM fix 2
8753	521	Mains-off response
8772	852	User unit
8774	942	Encoder factor numerator
8775	943	Encoder factor denominator
8776	951	Counter direction
8777	950	Encoder type
8778	952	Switching frequency [%]
8779	953	Position offset
8781	954	Zero offset
8784	955	Encoder scaling

Appendix

Size and Conversion Index from Sensor/Actuator Technology PNO Profile

Physical quantity	Size index	Unit	Abbreviation	Conversion index
	0	no dimension		0
Length	1	Meter Millimeter Kilometer Micrometer	m mm km µm	0 –3 3 –6
Area	2	Square meter Square millimeter Square kilometer	m^2 mm^2 km^2	0 –6 6
Volume	3	Cubic meter Liter	m^3 l	0 –3
Time	4	Second Minute Hour Day Millisecond Microsecond	Second min h d ms µs	0 70 74 77 –3 –6
Force	5	Newton Kilonewton Meganewton	N kN MN	0 3 6
Pressure	6	Pascal Kilopascal Millibar Bar	Pa kPa mbar bar	0 3 2 5
Mass	7	Kilogram Gram Milligram Ton	kg g mg t	0 –3 –6 3
Energy, work	8	Joule Kilojoule Megajoule Watthour Kilowatthour Megawatthour	J kJ MJ Wh kWh MWh	0 3 6 74 75 76
Power	9	Watt Kilowatt Megawatt Milliwatt	W kW MW mW	0 3 6 –3
Apparent power	10	Volt-Ampere Kilovolt-Ampere Megavolt-Ampere Millivolt-Ampere	VA kVA MVA mVA	0 3 6 –3
Speed	11	1/second 1/minute 1/hour	s^{-1} min^{-1} h^{-1}	0 67 72
Angle	12	Radiant Second Minute (Alt-)Degree Centesimal degree (Gon)	rad " ' o g	0 79 78 80 81
Velocity	13	Meter/second Millimeter/second Millimeter/minute Meter/minute Kilometer/minute Millimeter/hour Meter/hour Kilometer/hour	m/s mm/s mm/min m/min km/min mm/h m/h km/h	0 –3 66 67 68 71 72 73

Physical quantity	Size index	Unit	Abbreviation	Conversion index
Flow	14	Cubicmeter/second Cubic meter/minute Cubic meter/hour Liter/second Liter/minute Liter/hour	m^3/s m^3/min m^3/h l/s l/min l/h	0 67 72 –3 66 71
Mass flow	15	Kilogram/second Gram/second Ton/second Gram/minute Kilogram/minute Ton/minute Gram/hour Kilogram/hour Ton/hour	kg/s g/s t/s g/min kg/min t/min g/h kg/h t/h	0 –3 3 66 67 68 71 72 73
Torque	16	Newtonmeter Kilonewtonmeter Meganewtonmeter	Nm kNm MNm	0 3 6
Temperature	17	Kelvin Degree Celsius Degree Fahrenheit	K °C °F	0 100 101
Temperature difference	18	Kelvin	K	0
Entropy	19	Joule/(Kelvin × kg) kJ/(K × kg) MJ/(K × kg)	J/(K × kg) kJ/(K × kg) MJ/(K × kg)	0 3 6
Enthalpy	20	Joule/kilogram Kilojoule/kilogram Megajoule/kilogram	J/kg kJ/kg MJ/kg	0 3 6
Electric potential	21	Volt Kilovolt Millivolt Microvolt	V kV mV µV	0 3 –3 –6
Electric current	22	Ampere Milliampere Kiloampere Microampere	A mA kA µA	0 –3 3 –6
Electric resistance	23	Ohm Milliohm Kiloohm Megaohm	Ω mΩ kΩ MΩ	0 –3 3 6
Ratio	24	Per cent	%	0
Relative humidity	25	Per cent	%	0
Absolute humidity	26	Gram/kilogram	g/kg	–3
Relative change	27	Per cent	%	0
Frequency	28	Hertz Kilohertz Megahertz Gigahertz	Hz kHz MHz GHz	0 3 6 9

Conversion index	A (conversion factor)	1/A (inverse conversion factor)	B (offset)
0	1.E+0	1.E+0	0
1	10 = 1.E+1	1.E–1	0
2	100 = 1.E+2	1.E–2	0
3	1000 = 1.E+3	1.E–3	0
etc.			
–1	0.1 = 1.E–1	1.E+1	0

Conversion index	A (conversion factor)	1/A (inverse conversion factor)	B (offset)
–2	0.01 = 1.E–2	1.E+2	0
–3	0.001 = 1.E–3	1.E+3	0
etc.			
66	1.E–3/60 = 1.667 E–5	6.000 E+4	0
67	1/60 = 1.667 E–2	6.000 E+1	0
68	1.E+3/60 = 1.667 E+1	6.000 E–2	0
69			0
70	60	1.667 E–2	0
71	1.E–3/3600 = 2.778 E–7	3.6 E+6	0
72	1/3600 = 2.778 E–4	3.6 E+3	0
73	1.E+3/3600 = 2.778 E–1	3.6	0
74	3600	1/3600 = 2.778 E–4	0
75	3600 × 1.E+3 = 3.600 E+6	2.778 E–7	0
76	3600 × 1.E+6 = 3.600 E+9	2.778 E–10	0
77	86 400	1/86 400 = 1.157 E–5	0
78	π / 10 800 = 2.909 E–4	3.438 E+3	0
79	π / 648 000 = 4.848 E–6	2.063 E+5	0
80	π / 180 = 1.745 E–2	5.730 E+1	0
81	π / 200 = 1.571 E–2	6.366 E+1	0
100	1	1	273.15 K
101	5/9 = 0.5556	1.8	255.37 K

Application example:

The conversion values should be used as follows:

(physical value in multiples or fractions) =
(carry over × unit) × A + B

Example:

Transmission via the bus:

Numerical value	Size index	Conversion index
1500	4	–3

The receiver allocates the following values to these transmitted values:

4 → Measured variable “Time”
–3 → Unit of measure “milliseconds”
→ 1500 ms = 1500 s × A + B = 1500 s × 0.001 + 0 s = 1.5 s

Conversion indices larger than +64 generally carry a special meaning that must be be taken from the table listed above. These units include units such as day, hour, minute and non-SI-compatible units such as Fahrenheit, etc.

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