MOELLER

Hardware and Engineering

DE4-NET-S
Interface-Module for INTERBUS

03/01 AWB823-1288-GB

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© Moeller GmbH, Bonn

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Caution!

Dangerous Electrical Voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- According to their degree of protection frequency inverters may feature during operation live, bright metal, or possibly moving, rotating parts or hot surfaces.
- The impermissible removal of the necessary covers, improper installation or incorrect operation of motor or frequency inverter may cause the failure of the device and may lead to serious injury or damage.
- The relevant national regulations apply to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).

- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- Installations fitted with frequency inverters must be provided with additional monitoring and protective devices in accordance with the relevant safety regulations etc. Modifications to the frequency inverters using the operating software are permitted.
- All shrouds and doors must be kept closed during operation.
- In order to reduce hazards to persons or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety-related variables (speed, travel, end positions etc.)
  - Electrical or non-electrical system related measures (interlocks or mechanical interlocks).
  - Live parts or cable connections of the frequency inverter must not be touched after it has been disconnected from the power supply due to the charge in capacitors. Appropriate warning signs must be provided.

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About This Manual

In this manual you will find information that you require to set the parameters of the DE4-NET-S interface module to suit your requirements.

Furthermore, you will find a description of the design and the function of the DE4-NET-S interface module.

Abbreviations and symbols

The following abbreviations and symbols are used in this manual:

PNU:	Parameter number
Control system:	Primary control (PLC or PC), which administers all slaves in a bus system.

▶ Indicates actions to be taken

Provides useful tips and additional information

Attention!
Warns about material damage which can damage the product, adjacent equipment or data.

Caution!
Warns of the possibility of serious material damage to products, adjacent equipment or data and risk of serious or fatal personal injury.

For greater clarity, the name of the current chapter is shown in the header of every left-hand page and the name of the current section in the header of every right-hand page (except for the section title pages and the blank pages at the end of each section).

Legend for Figure 1:

① Host computer: PLC or PC with INTERBUS interface (Master)

② Other INTERBUS slaves (networked via the remote bus or bus terminal)

③ Frequency inverter DF4 with DE4-NET-S INTERBUS interface.

④ INTERBUS bus cable

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1 About This Interface

INTERBUS system

The INTERBUS bus system is designed as a ring with the incoming and outgoing lines integrated into the same bus cable. The ring goes from the interface of the host computer via all bus users and back. A differentiation is made between the remote bus and the peripheral bus. The connection between the remote and peripheral bus is formed by so-called bus terminals.

The bus system is a master – slave system; i.e. there is only one host computer (Master) but many INTERBUS slaves (users or participants).

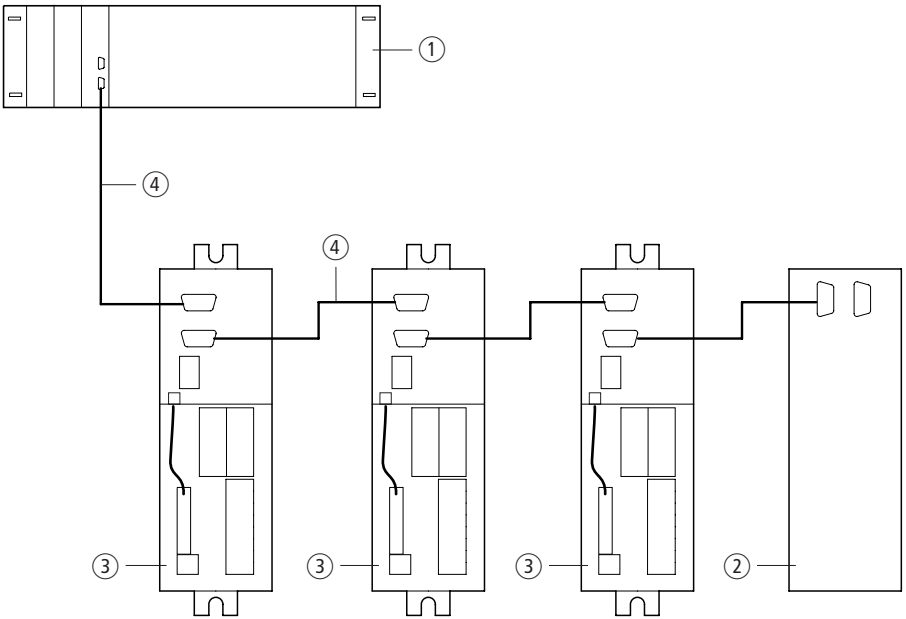

Figure 1: INTERBUS system design

INTERBUS interface

The interface module has the following type code:

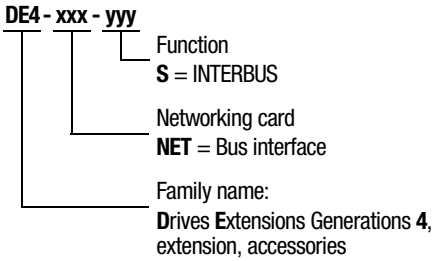

Figure 2: INTERBUS interface type code

The DE4-NET-S interface module couples the DF4 frequency inverter to the INTERBUS fast serial communication system from the Phoenix Contact company. The frequency inverter can be integrated into an automation system in this manner. This standardized system enables a dynamic, cyclic exchange of process data (e.g. setpoint and actual values) in the lower millisecond range. At the same time, parameter definition of intelligent devices such as DF4 series frequency inverters is possible. In this manner, access to all parameters of the frequency inverter is assured.

Standardized communication implies data exchange between two slaves and the determination of the most important device functions and parameters. More than 30 international manufacturers of drives have united to form the DRIVECOM User Group e.V. Based on the PROFIBUS standard (Part 2), this group has summarized the functionality in the DRIVECOM Profile Drive Engineering 21 document. This profile is implemented on the DE4-NET-S interface module.

The DRIVECOM Profile definition is a supplement to standardized communication for the user and forms the basis for a general agreement concerning data

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content and the behaviour of the devices. This determination of functions standardizes some significant drive parameters.

Features of the DE4-NET-S

The DE4-NET-S interface module has the following characteristics:

Network topology	Ring
Communication method	RS 422
Application profile	DRIVECOM Profile 21 standardized parameters, device functions
Interfaces	2 × RS 485
In INTERBUS line	Slave
Number of frequency inverters	63
Baud rate (kBit/s)	500
Process data	2 words DF4: 2 word input data/2 word output data
Process data exchange	Cyclic
Access to all parameters	Through parameter channel
Voltage supply	24 V DC ±10 %; max. 150 mA DF4-120 external only DF4-340 internal or external DF4-341 internal or external
Diagnostic LEDs	4
Simple installation	Yes

Design of the DE4-NET-S

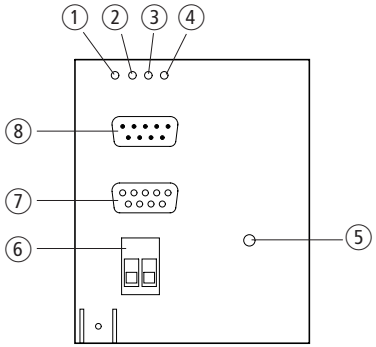

Figure 3: Design of the DE4-NET-S

① Green Bus LED for the supply voltage:
ON = supply voltage and connection to the frequency inverter available
OFF = no supply voltage, frequency inverter or external supply is switched off
FLASHING = supply voltage available, but a connection to the frequency inverter is not established (possibly switched off or in the initialization phase)

② Yellow Bus LED for communication:
ON = interface module is initialized, no communication from the master
OFF = interface module not yet initialized
QUICK FLASH (4 times per second) = communication active. Process data only.
SLOW FLASH (1 time per second) = communication active. PCP communication and process data.

③ Red drive LED for the DF4 operating status:
Refer to manual AWB823-1278-GB

④ Green drive LED for the DF4 operating status:
Refer to manual AWB823-1278-GB

⑤ Fixing screw of the DE4-NET-S interface

⑥ External supply (24 V DC ±10 %) for DE4-NET-S, always required with the DF4-120 series.

⑦ OUT (INTERBUS output), 9-pole SUB-D socket

⑧ IN (INTERBUS input), 9-pole SUB-D plug

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Manufacturer's declaration

We hereby declare that the electrical drive controllers described in this manual are electrical apparatus for controlling variable speed drives with three-phase motors. They are designed for installation in machines or for use in combination with other components within a machine or system. The drive controller are not machines as stipulated in the Machinery Directive 89/392/EEC.

Notes and recommendations for installation and intended usage are contained in this manual.

Operation of the machinery is not permitted until the associated machine has been confirmed to comply with the safety requirements of the Machinery Safety Directive (MSD) 89/392/EEC with the amendments 91/368/EEC .

Measures are described in this manual where the drive controller in a typical configuration will conform to EMC limit values. The electromagnetic compatibility of the machine depends on the type and the care taken during installation. Compliance to the EMC directives 89/336/EEC with the amendments 92/31/EEC with application in machinery is the responsibility of the user.

Intended use

The DE4-NET-S assembly is an optional assembly for the DF4-120 and DF4-34x series frequency inverters from Moeller. Frequency inverters are electrical apparatus for use in industrial power installations. They are designed for use in machinery to control variable speed drives. Further application notes can be found in the manual "AWB823-1278" for the respective frequency inverter.

Persons responsible for safety

At the time of delivery, the interface module corresponds with the latest state of technology and is considered to be safe in its operation.

The interface module can present a hazard if

- unskilled persons work on or with the interface module,
- it is used in ways or for purposes other than those intended by the manufacturer.

Operator

An operator is any natural or legal person who uses the interface module or by whose authority the interface module is used.

The operator and/or his/her safety officer must ensure that

- all standards, notes and laws are adhered to,
- the interface module is handled and operated only by qualified persons,
- the manual is available to all persons working on or with the interface module,
- unauthorized persons cannot access or carry out work on or with the interface module.

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Qualified personnel

Qualified persons are persons with the required education, training, experience and knowledge of applicable standards and regulations, accident prevention regulations and operating conditions, who have been authorized by the person responsible for the system's safety to carry out the required work and are able to recognize and avoid any dangers (definition of skilled personnel from VDE 105 or IEC 364).

If you have any questions or problems, please contact your Moeller dealership.

Disposal

The DE4-NET-S interface module consists of a variety of materials.

The following materials can be recycled:

- Metal
- Plastic
- Assembly instructions

The assembled circuit boards are made from materials that must be disposed of separately.

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2 Engineering

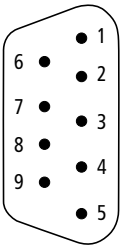
The technical procedures and circuit examples contained in the manual are provided as suggestions only. It is up to the user to verify that they can be applied to specific applications.

Caution!
Take appropriate measures to ensure that no personal injury or material damage can arise if the interface module fails.

INTERBUS input

Internal connection assignment

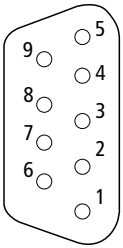
The 9-pole SUB-D plug is an RS-485 interface.



Pin	Name	Explanation
1	DO1	Not inverted
2	DI1	Not inverted
3	GND	Reference potential
6	$\overline{\text{DO1}}$	Inverted
7	$\overline{\text{DI1}}$	Inverted

INTERBUS output

The 9-pole SUB-D socket is an RS-485 interface.



Pin	Name	Explanation
1	DO2	Not inverted
2	DI2	Not inverted
3	GND	Reference potential
5	Vcc5	5 V DC
6	$\overline{DO2}$	Inverted
7	$\overline{DI2}$	Inverted
9	RBST	Signal input

Supply voltage

Caution!
The connections for the supply voltage may not be interchanged, as otherwise the DE4-NET-S interface module will be destroyed.

You can supply the interface with voltage in two ways:

externally via a plug-in screw terminal with 24 V DC ±10%

internally via the frequency inverter; the supply is established by plugging the interface module onto the frequency inverter, (with the exception of DF4-120)

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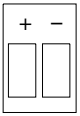
External supply voltage

Terminal assignment

If you want to supply the interface with an external voltage, this occurs via a 2-pole plug-in screw terminal.



Terminal	Name	Explanation
R	V	24 V DC/± 10%, 150 mA
S	GND	0 V potential

Potential isolation

With the connection of the DF4-120 or DF4-340 series frequency inverters to a host computer (PC), safe potential isolation (double basic insulation) according to VDE 0160 is required.

For this purpose, you can for example use an assembly for the host computer with additional potential isolation (refer to the respective manufacturers specifications).

Potential isolation of the supply voltage must also be considered with the wiring.

With DF4-341 frequency inverters, a double basic insulation according to VDE 0160 is provided and therefore further potential isolation is not required.

Preventing faults

Inspecting the cables and wiring

Caution!
In order to prevent capacitive and inductive coupling, lay the control, signal and power cables as far apart as possible. If a separated laying of the cables is not possible, cables which cause interference must be screened.

Electromagnetic interference can impair communication of the DF4-34x frequency inverters. To ensure reliable communication,

- keep the connection between the earthing point and the interface module as short as possible;
- avoid routing data and power cables in parallel for long distances;
- maintain a minimum distance of 30 cm between data cable and power cables;
- provide a connection between the interface module and the frequency inverter with the PE cable.

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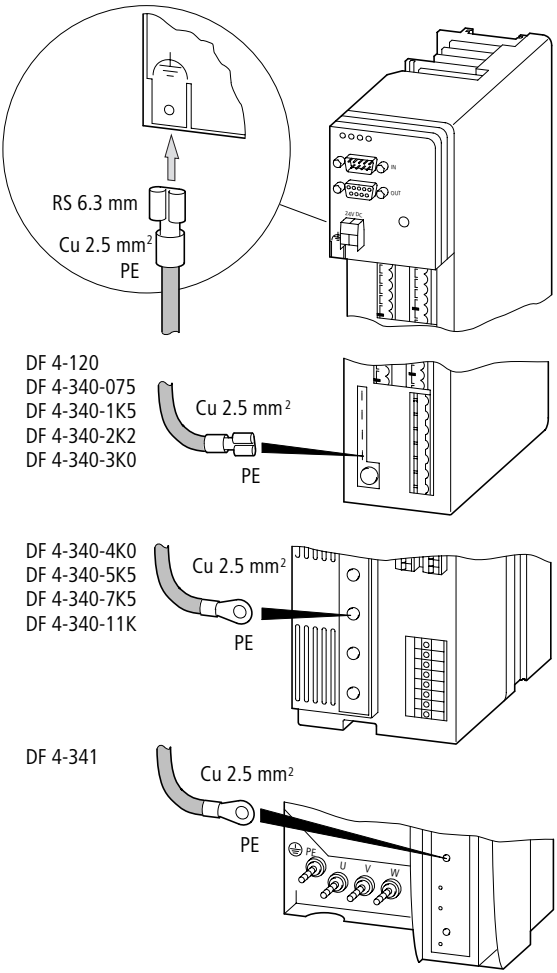

Figure 4: Data integrity using an additional PE cable

Communication data

Cycle time

The cycle time of the communication system is the time in which all process data is exchanged between the host computer and the field devices. It is calculated from the data located in the communication system. A frequency inverter of the DF4 series requires 48 Bits (1 communication data word + 2 process data words).

The cycle times may depend on the host computer system.

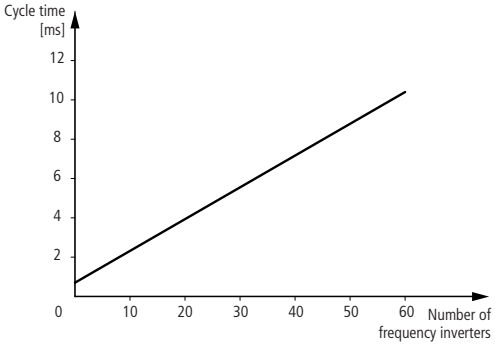

Figure 5: INTERBUS cycle time for the frequency inverter

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Execution time in the frequency inverter

The execution time in the frequency inverter is added to the INTERBUS transfer or cycle time. When execution times are considered, a differentiation must be made between the DF4-120 and DF4-34x series.

The cycle time of the bus system is independent of the execution times in the drive system.

DF4-120 execution time
With the DF4-120 series frequency inverters, many processing steps which are processed as a cycle are required.

A processing cycle consists of:

1. Writing of a control word or a setpoint value when the value has changed.
2. Alternate reading of the status word and the actual value.
3. Processing of PCP parameter access, when an order is present.

Time tolerances which are too large can result from the cyclic reading of status words and actual values. With Bit 15 (PI inhibt) of the DRIVECOM control word, alternate reading of the status word and the actual value can be suppressed.

PI inhibt = 0:
Status word and actual value refresh active

PI inhibt = 1:
Status word and actual value refresh not active

A suppression of processing stage 3 (PCP parameter) is not necessary, as it is controlled by the user.

Processing stage	Maximum execution time [ms]	Execution tolerance [ms]	Additional parameter [ms]
Parameter	70	–8	–
Setpoint	35	–8	150
Control word	35	–8	150
Actual value	35	–8	150
Status word	35	–8	150
Setpoint value + control word	70	–16	150
Setpoint value + control word + actual value + status word	140	–32	150

DF4-34x execution time

There is no interdependence between parameter and process data.

Parameter data: 30 ms + 20 ms

Process data: approx. 3 ms + 2 ms

Number of users

The maximum number of users depends on the host computer and on the I/O-range. The DRIVECOM compatible DF4 frequency inverter occupies 2 words (32 Bit) in both transfer directions. The additional communication data word is not displayed in the I/O range of the host computer.

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3 Installation

Items supplied

On delivery, immediately check that you have received all items listed in the delivery note. Moeller GmbH does not accept liability for claims made at a later date. The package contents of the interface module are:

- the DE4-NET-S interface module in an enclosure (degree of protection IP20)
- M3 fixing screw
- 2-pole plug-in screw terminal for the supply voltage
- DE4-NET-S installation instructions

Fitting to the frequency inverter

The DE4-NET-S interface module must be used only as an accessory for the DF4 frequency inverter series.

An external 24 V power supply is always required for the DF4-120 series frequency inverter. With the DF4-34x device series, voltage supply from the frequency inverter is possible.

- ▶ Plug the interface module into the front of the frequency inverter and snap it into place.
- ▶ Screw it on with the fixing screw as shown to ensure a reliable PE connection. Use a size 1 crosshead screw driver.

- ▶ Establish a PE connection between the frequency inverter and the interface module (see Page 17). The cable cross-section must be at least 2.5 mm^2.
- ▶ If necessary, connect an external 24 V DC ±10 % with the 2-pole plug-in screw terminal. An external supply is always necessary with DF4-120 series devices.

Do not use force to connect or remove the interface module.

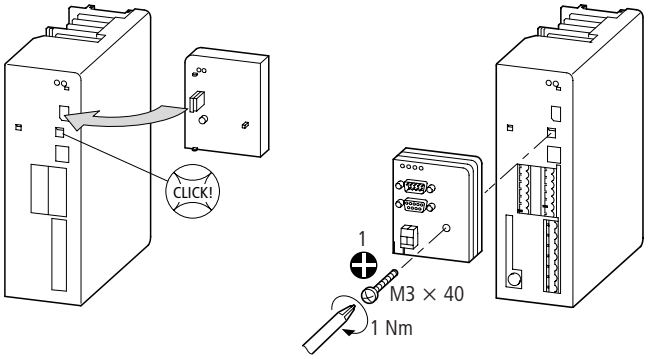

Figure 6: DE4-NET-S installation

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Wiring with the host computer

If you require potential isolation (double basic insulation) between the DF4 frequency inverter with the attached DE4-NET-S interface module and the host computer in accordance with VDE 0160, an additional potential isolation must be installed.

For this purpose, you can for example use a bus terminal or a host computer interface module with additional potential isolation (See the manufacturers specifications). Potential isolation of the supply voltage must also be considered.

Cable connections

The general cable connection can be found in Figure 1 on Page 5. The order designations for the INTERBUS connection cable can be found in the „Technical Data“ Appendix on Page 72.

4 Configuration/Parameter Definition

Communication channels

The INTERBUS transfers process data and parameters between the control system and the frequency inverters. The transferred data is divided into 2 logical communication channels for both of these differing tasks.

Process data channel
transfers process data such as setpoint and actual values, which have to be transferred in the shortest possible time. Process data which consists of small amounts of data, for example 2 words, are transferred in cycles in the ring feeder. In this manner, up to date input and output data is continuously exchanged between the control system and the frequency inverter.

PCP channel
(PCP = Peripherials Communication Protocol) transfers parameters with services according to the DRIVECOM standard. Parameters for example, are operating parameters, motor data and diagnostic information. Transfer of the parameters is usually not critical with respect to time. However, large amounts of data are involved.

Process data

Process data is a collection of many individual parameters in a data memory for the purpose of fastest possible transfer. This process data is exchanged in cycles between the frequency inverter and the master.

Process data is divided into:

Process output data
(PO data = DRIVECOM control word, setpoint value)

Process input data
(PI data = DRIVECOM status word, actual value)

The data flow should be examined from the point of view of the master, i.e. the PO data is data to the frequency inverter and the PI data is data from the frequency inverter.

The frequency inverter receives control information from the master and supplies status information to the frequency inverter.

Process data has a fixed length of 4 bytes. The parameter make-up is described in Section „Process data configuration“ on Page 44.

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Byte No.	Function	Index
Factory default setting of the process input data		
1 Word/High byte (Bit 8 to 15)	PIW 1 = DRIVECOM status word	6041 hex
2 Word1/Low byte (Bit 0 to 7)		
3 Word2/High byte (Bit 8 to 15)	PIW 2 = DRIVECOM speed actual value	6044 hex
4 Word2/Low byte (Bit 0 to 7)		
Factory default setting of the process output data		
1 Word/High byte (Bit 8 to 15)	POW 1 = DRIVECOM control word	6040 hex
2 Word1/Low byte (Bit 0 to 7)		
3 Word2/High byte (Bit 8 to 15)	POW 2 = DRIVECOM speed setpoint	6042 hex
4 Word2/Low byte (Bit 0 to 7)		

If a parameter is configured in the process output data, e.g. DRIVECOM control word in the table above, it is not possible to write directly to the parameter (e.g. Index 6040 hex).

DRIVECOM parameters

Parameter numbers/index

The frequency inverter parameters are addressed according to DRIVECOM via the index. The index for the Moeller parameter numbers is in the range between 22576 (5830 hex) and 24575 (5FFF hex).

The conversion formula is as follows:

Index = 24575 – Moeller parameter number

Index hex = 5 FFF hex – Moeller parameter number

In order to differentiate between both numbering systems, the identity “PNU” is placed in front of Moeller parameter numbers (the parameter number 000 becomes PNU 000).

Example:
The Moeller parameter PNU 001 (operating mode) can be accessed in the INTERBUS under the index 24574 (24575 – 1).

Moeller data types

The possible Moeller parameters with the respective value range should be taken from the DF4 “Hardware and Engineering” manual AWB823-1278.

The data of the Moeller parameters is mainly represented in a fixed support format with integer 32 data type with 4 decimal positions.

PNU 039 (JOG) = 150.4 Hz

Index = 24575 – 39 = 24536

Value of index 24536 = 1504000 decimal (0016F300 hex)

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Parameter sets

All frequency inverters of the DF4 series have 2 parameter sets whose parameters can be directly addressed with the interface. In order to receive the required parameter set, a parameter number offset setting must be made for the parameter set.

The parameters are addressed as follows:

Offset = 0, parameter set 1
(PNU 0000 to PNU 1999)

Offset = 2000, parameter set 2
(PNU 2000 to PNU 3999)

Use the parameter number offset “0” when a parameter is only available once. The parameters concerned can be read in the “DF4 Hardware and Engineering” manual.

Example for maximum field frequency (f_{max}):

f_{max} in parameter set 1:
PNU 0011

f_{max} in parameter set 2:
PNU 2011

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DRIVECOM parameter table

The parameters of the frequency inverter are standardized according to the DRIVECOM Profile 21.

Index		Parameter name	R/W	PZD	SP	Data Str.	Data type	Data No.	Data length
hex	dec								
6000	24576	PI data description	Ra/W	–	y	R	PBS	9	13
6001	24577	PO data description	Ra/W	–	y	R	PBS	9	13
6002	24578	PO data enable	Ra/W	–	n	S	OS	1	1
6003	24579	PD monitoring time	Ra/W	–	y	S	U16	1	2
6004	24580	PD monitoring time-selection parameter	Ra/W	–	y	S	I16	1	2
603F	24639	Fault parameter	Ra	–	n	S	U16	1	2
6040	24640	Control word	Ra/W	PIO	–	S	OS	2	2
6041	24641	Status word	Ra	PI	–	S	OS	2	2
6042	24642	Speed setpoint value	Ra/W	PIO	–	S	I16	1	2
6043	24643	Speed reference variable	Ra	–	–	S	I16	1	2
6044	24644	Speed actual value	Ra	PI	–	S	I16	1	2
6046	24646	Speed min. max. absolute value	Ra/W	–	n	A	U32	2	8
6048	24648	Speed acceleration	Ra/W	–	n	R	RS	2	6
6049	24649	Speed delay	Ra/W	–	n	R	RS	2	6
604A	24650	Speed quick stop (only DF4-34x)	Ra/W	–	n	R	RS	2	6
604B	24651	Setpoint value factor	Ra/W	–	y	A	I16	2	4
604D	24653	Number of poles	Ra/W	–	y	S	U8	1	1
604E	24654	Speed reference value	Ra/W	–	n	S	U32	1	4
604F	24655	Ramp-function time	Ra/W	–	n	S	U32	1	4
6050	24656	Slow-down time	Ra/W	–	n	S	U32	1	4
6051	24657	Quick stop time (DF4-34x only)	Ra/W	–	n	S	U32	1	4
6052	24658	Percentage setpoint value	Ra/W	PIO	–	S	I16	1	2
6053	24659	Percentage reference variable	Ra	–	–	S	I16	1	2
6054	24660	Percentage actual value	Ra	PI	–	S	I16	1	2

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Meaning

R/W	Read/Write authorization via the interface
Ra	Read always; read operations always permitted
Ra/W	Read always, read operations always permitted; write operations conditionally possible (e.g. dependent on PNU 001 (“Operating mode”) or operating status (Modification only with controller inhibit)
PZD	Map to INTERBUS process data (Index 6010 hex, 6011 hex)
PI	Process input data (from drive controller to control system)
PO	Process output data (from control system to drive controller)
PIO	Process input/output data (see PI and PO)
–	No process data mapping possible
SP	Nonvolatile storage of the parameter
y	Yes; parameter value will be saved
n	No; parameter value will not be saved
–	The parameter value is process dependent and will not be saved
Data Str.	Data structure
S	Simple variable (simple parameter) has a value. Addressing only possible with subindex “0”.
A	Array variable (field parameter) contains multiple variables of the same data type. Direct addressing of individual elements with subindex is possible. With subindex “0”, the entire parameter content is addressed.
R	Record variable (combined variable) contains multiple values, which can contain varying data types. Direct addressing of individual elements with subindex is possible. With subindex “0”, the entire parameter content is addressed.
Data type	Data type
BOL	Boolean (FALSE = 00 hex; TRUE = FF hex)
I8	Integer 8 ($-128 \leqq x \leqq 127$)
I16	Integer 16 ($-32768 \leqq x \leqq 32767$)
I32	Integer 32 ($-2147483648 \leqq x \leqq 2147483647$)
U8	Unsigned 8 ($0 \leqq x \leqq 255$)
U16	Unsigned 16 ($0 \leqq x \leqq 65535$)
U32	Unsigned 32 ($0 \leqq x \leqq 4294967295$)
OS	Octet-String. 8 Bit/Byte binary coded
VS	Visible string. Text, coded according to ISO 646
PBS	Process data description structure (Index 20 hex)
RS	Ramp structure (Index 21 hex) Subindex 1: U32 counter “Delta_Speed” in min^{-1} Subindex 2: U16 nominal “Delta_Time” in seconds
Data No.	Number of parameter elements
Data length	Entire length of the parameter in Bytes

DRIVECOM device control

If you control the DF4 series frequency inverter with the DE4-NET-S interface module via INTERBUS, the frequency inverter uses the standardized device states in accordance with DRIVECOM Profile 21.

With the DF4-120 device series, there is a minimal deviation with the malfunction reset.

The information concerning the current status of the devices (see Page 34) is available in the DRIVECOM "status word" parameter. Commands in the DRIVECOM "control word" parameter can change the status of the devices.

Status	Function
NOT-READY-TO-SWITCH-ON	The frequency inverter is in the initialization phase and not yet ready for operation. The device status changes automatically to the "READY-TO-SWITCH-ON" status.
SWITCH-ON-DISABLED	The frequency inverter is inhibited (NEN) and waits for the "Shutdown" command.
READY-TO-SWITCH-ON	The frequency inverter is inhibited (NEN) and waits for the "Switch on" command.
SWITCHED-ON	The frequency inverter is inhibited (NEN) and waits for the "operation-enabled" command.
OPERATION-ENABLED	The frequency inverter is enabled (EN). However, in this device status, the automatic impulse inhibit can be set.
MALFUNCTION-REACTION-ACTIVE	A malfunction (TRIP) has been identified, and a time related malfunction dependent reaction is initiated.
MALFUNCTION	The frequency inverter is in the "MALFUNCTION" (TRIP) state.
QUICK-STOP-ACTIVE	In the "OPERATION-ENABLED" device state, the "quick stop" command has been issued. A controlled sequence (Quick stop ramp) is applied. After the sequence has been complete, switch over to the "SWITCH-ON-DISABLED" device status occurs automatically.

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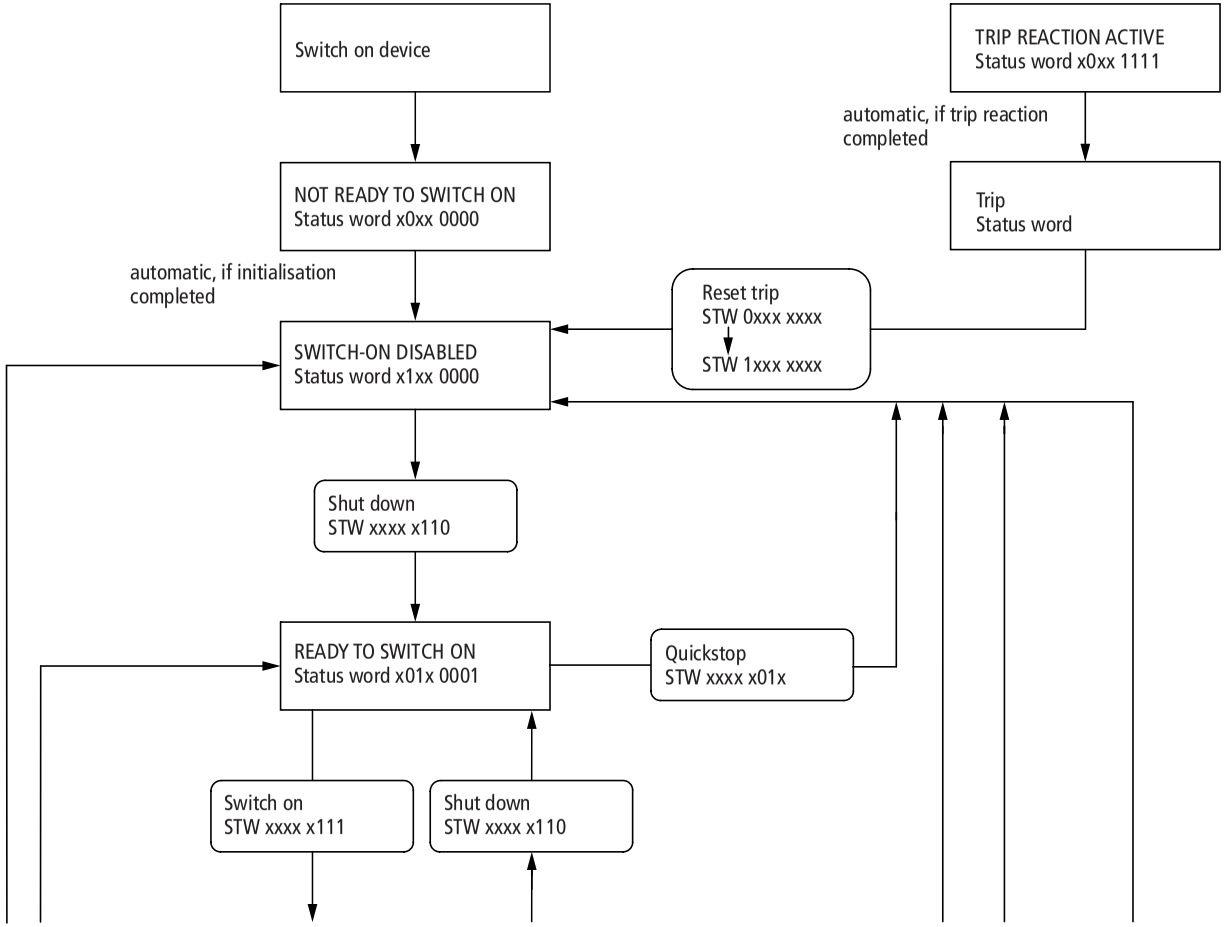
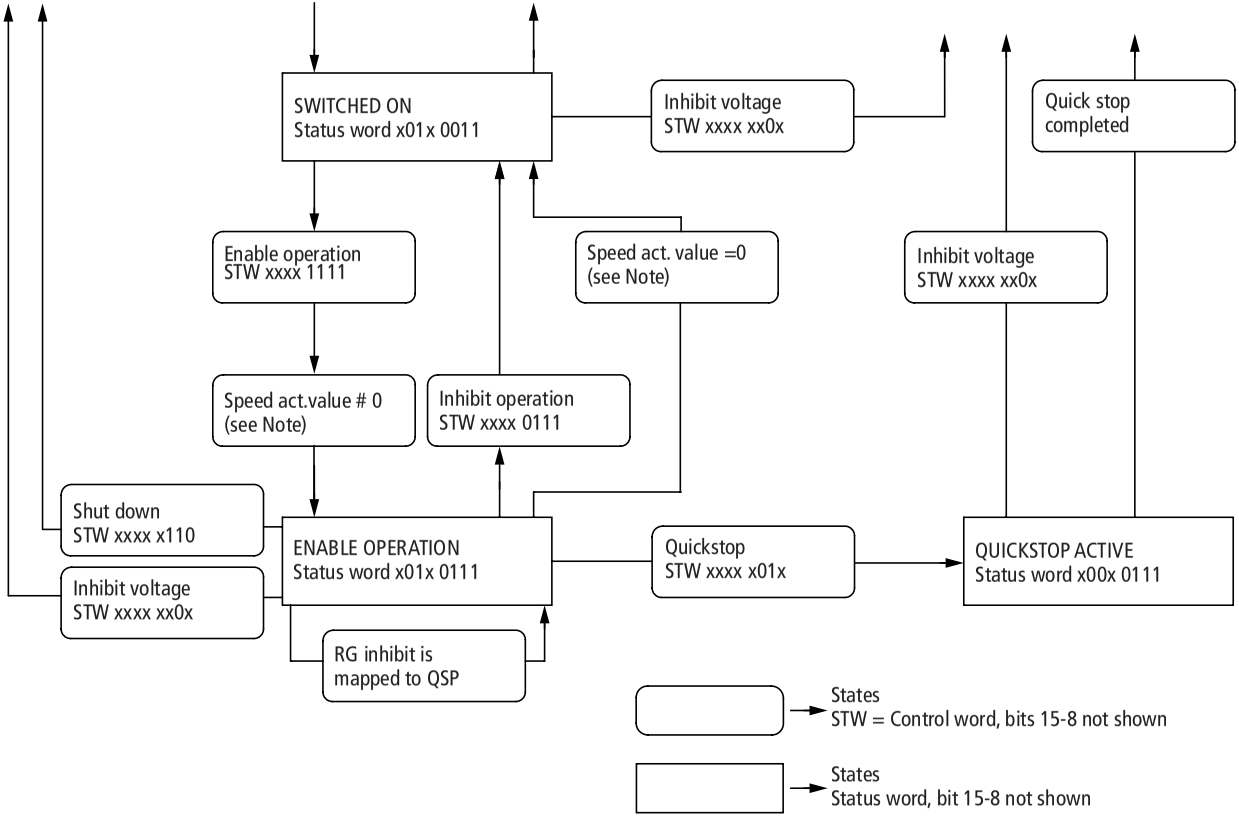
Command[1)]	**Control word**	**Function**
Shutdown	Bit 0 = 0	Command for the transition from various device states to the “READY-TO-SWITCH-ON” device status.
Switch-on	Bit 0 = 1	Command for the transfer to the “SWITCHED-ON” device status.
Operation enabled	Bit 3 = 1	Command for the transfer to the “OPERATION-ENABLED” device status. Controller inhibit is canceled.
Inhibit operation	Bit 3 = 0	Command for the transfer to the “SWITCHED-ON” device status. Controller inhibit is initiated.
Disable voltage	Bit 1 = 0	Command for the transfer to the “SWITCH-ON-DISABLED” device status. Controller inhibit is initiated.
Quick-stop (QSP)	Bit 2 = 0	Command for the transfer to the “SWITCH-ON-DISABLED” device status. If the frequency inverter was enabled, a controlled sequence will be undertaken with the quick-stop ramp.
Malfunction/TRIP	–	A malfunction has been detected by the frequency inverter. A controlled sequence may be required with some malfunctions (device dependent). When this is complete, the “MALFUNCTION” device status is initiated.
Reset malfunction/ TRIP	Bit 7 = (0 → 1)	With the DF4-340 device series, this command is used for acknowledgment of a malfunction. If a malfunction is no longer present, the frequency inverter switches over to the “SWITCH-ON-DISABLED” condition.

1) see Figure on Page 34, 35


Switch on device
NOT READY TO SWITCH ON
Status word x0xx 0000
automatic, if initialisation completed
SWITCH-ON DISABLED
Status word x1xx 0000
Shut down
STW xxxx x110
READY TO SWITCH ON
Status word x01x 0001
Switch on
STW xxxx x111
Shut down
STW xxxx x110
Quickstop
STW xxxx x01x
Reset trip
STW 0xxx xxxx
STW 1xxx xxxx
TRIP REACTION ACTIVE
Status word x0xx 1111
automatic, if trip reaction completed
Trip
Status word


SWITCHED ON
Status word x01x 0011
Inhibit voltage
STW xxxx xx0x
Quick stop
completed
Enable operation
STW xxxx 1111
Speed act. value =0
(see Note)
Inhibit voltage
STW xxxx xx0x
Speed act.value # 0
(see Note)
Inhibit operation
STW xxxx 0111
Shut down
STW xxxx x110
ENABLE OPERATION
Status word x01x 0111
Quickstop
STW xxxx x01x
QUICKSTOP ACTIVE
Status word x00x 0111
Inhibit voltage
STW xxxx xx0x
RG inhibit is
mapped to QSP
States
STW = Control word, bits 15-8 not shown
States
Status word, bit 15-8 not shown
Note:
Only for DF-34x with activated automatic
DC braking (PNU 0106/PNU 2106 # 0)

DRIVECOM control word (6040 hex)

Data format: Octet string

The “control word” parameter is used for control of the frequency inverter. It contains commands for the state changes and other important control commands.

The individual bit control commands of the control word are dependent on other bit positions. Using the overview on Page 38, you can see which bits are interdependent and how they are to be set in order that the required command is effective.

Layout of the “control word” parameter

Bit	Name (DRIVECOM)	Function
0	Switch-on	0 = controller inhibit 1 = controller enable
1	Disable voltage	0 = voltage inhibit activated 1 = voltage inhibit not activated
2	Quick stop	0 = quick stop 1 = quick stop not activated
3	Enable operation	0 = controller inhibit 1 = controller inhibit not activated
4	Ramp-function generator inhibit	Inhibit of the ramp-function generator. The quick stop function activates; without the frequency inverter changing the device status. 0 = ramp-function generator inhibit (quick stop) 1 = ramp-function generator not activated
5	UNUSED stop ramp-function generator	DF4-120: unused DF4-34x: output of the ramp-function generator (speed/ramp function generator) is “shutdown”. 0 = stop ramp-function generator 1 = stop ramp-function generator not activated

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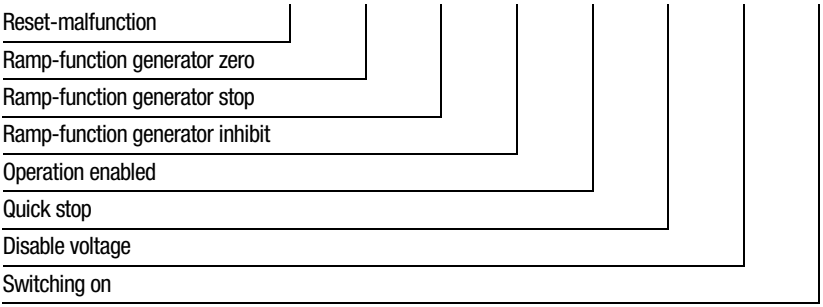
Bit	Name (DRIVECOM)	Function
6	UNUSED Ramp-function generator (RFG) zero	DF4-120: unused DF4-34x: Input of the ramp-function generator (speed ramp function generator) is set to “0”. Results in a controlled sequence with set slope. 0 = ramp function generator zero 1 = ramp-function generator zero not activated
7	Reset-malfunction	Reset after a malfunction (TRIP). A bit change from 0 to 1 must occur. A full initialization occurs on the DF4. The frequency inverter does not accept commands during this time.
8	Reserved	Not used
9	Reserved	Not used
10	Reserved	Not used
11	Manufacturer-specific	Not used
12	Manufacturer-specific	Switch over of the parameter set: 0 = parameter set 1 1 = parameter set 2
13	Manufacturer-specific	DC brake (DCB): 0 = do not activate DC braking 1 = activate DC braking
14	Manufacturer-specific	Not used
15	Manufacturer-specific	DF4-120: PI inhibit Inhibit update of the frequency inverter PO data. Refresh of the status and actual information on the process channel can be inhibited in order to transfer control information at more precisely definable times. 0 = read status and actual value 1 = do not read status and actual value DF4-34x: unused

		Bits of the control word							
Bit	**Device state commands**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
1	Shutdown	–	–	–	–	–	1	1	0
2	Switching on	–	–	–	–	–	1	1	1
3	Operation enabled	–	–	–	–	1	1	1	1
4	Inhibit operation	–	–	–	–	0	1	1	1
5	Disable voltage	–	–	–	–	–	–	0	–
6	Quick stop	–	–	–	–	–	0	1	–
8	Reset-malfunction	0 → 1	–	–	–	–	–	–	–



Note:
0 = bit state is “0”
1 = bit state is “1”
– = bit state is undefined and is irrelevant

You can issue multiple commands simultaneously. Please note that bit 0 has to change its state in order to change the “SWITCH-ON-DISABLED” state. This function prevents uncontrolled start-up of the drive during switch on.

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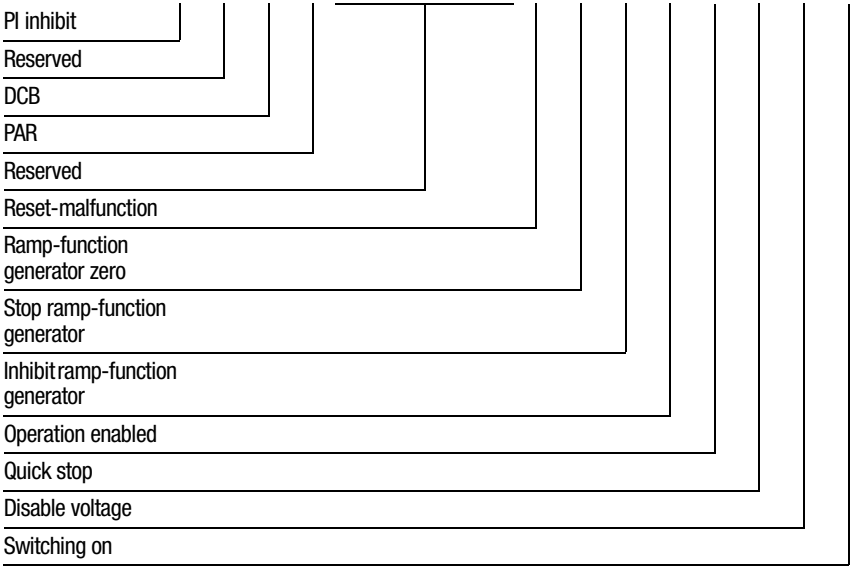
Bit	Control commands	Bits of the control word 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4	Ramp-function generator inhibit	–	1	0	–	–	–	–	–	–	–	–	0	1	1	1	1
5	Ramp-function generator stop	–	–	0	–	–	–	–	–	–	–	0	1	1	1	1	1
6	Ramp-function generator zero	–	–	0	–	–	–	–	–	–	0	1	1	1	1	1	1
12	PAR	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
13	DC brake	–	–	1	–	–	–	–	–	–	–	–	1	1	1	1	1
15	PI inhibit	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–



Note:
0 = bit state is “0”
1 = bit state is “1”
– = bit state is undefined and is irrelevant

DRIVECOM status word (6041 hex)

Data format: Octet string

The “status word” presents compact frequency inverter related information. It contains status information concerning the status of the devices and further important information.

Exact and precise information concerning the current status of the device can only be obtained by the combination of the device status information bits (Bit 0, 1, 2, 3, 4, 5, 6). The interrelationship can be found in the overview on Page 42.

Layout of the “status word” parameter

Bit	Name (DRIVECOM)	Function
0	Ready to switch on	0 = state not yet “READY-TO-SWITCH-ON” 1 = state at least “READY-TO-SWITCH-ON”
1	SWITCHED-ON	0 = state not yet “SWITCHED-ON” 1 = state at least “SWITCHED-ON”
2	OPERATION-ENABLED	0 = state not yet “OPERATION-ENABLED” 1 = state “OPERATION-ENABLED”
3	Trip	0 = no malfunction (TRIP) 1 = malfunction (TRIP) has occurred
4	Voltage-disabled	0 = command applied 1 = command not applied
5	Quick stop	0 = command applied 1 = command not applied
6	Switch-on disabled	0 = state not “SWITCH-ON-DISABLED” 1 = state “SWITCH-ON-DISABLED”
7	Warning (Group warning)	0 = no warning 1 = warning (overtemperature)

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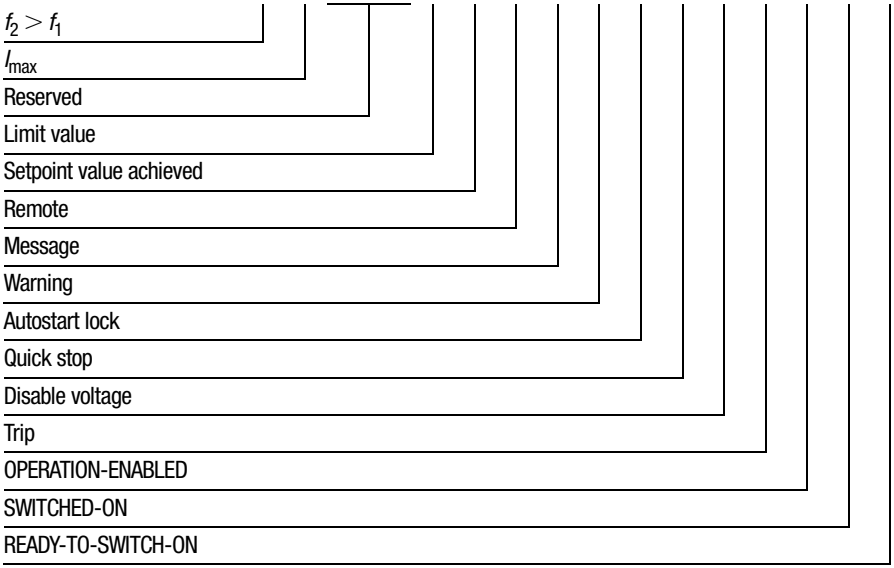
Bit	Name (DRIVECOM)	Function
8	Message (Group message)	Automatic set and reset of the impulse inhibit in the "OPERATION-ENABLED" device state. 0 = no message 1 = message available (IMP)
9	Remote	Bus access authorization, dependent of PNU 001 (operating mode): 0 = (PNU 001 $\neq$ 3) 1 = (PNU 001 = 3)
10	Setpoint value achieved	Status of the speed/frequency deviation 0 = ($RFG_{input} \neq RFG_{output}$) 1 = ($RFG_{input} = RFG_{output}$)
11	Limit value	Status of the speed limitation 0 = limitation not operational 1 = limitation operational
12	Reserved	Not used
13	Reserved	Not used
14	I_{max}	I_{max} (current limit reached) 0 = current limit not reached 1 = current limit exceeded
15	$f_2 > f_1$	$f_2 > f_1$ 0 = ($f_2 \leqq f_1$) 1 = ($f_2 > f_1$)

Device states	Bits of the status word															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
NOT-READY-TO-SWITCH-ON	–	–	–	–	–	–	–	–	–	0	–	–	0	0	0	0
SWITCH-ON-DISABLED	–	–	–	–	–	–	–	–	–	1	–	–	0	0	0	0
READY-TO-SWITCH-ON	–	–	–	–	–	–	–	–	–	0	1	–	0	0	0	1
SWITCHED-ON	–	–	–	–	–	–	–	–	–	0	1	–	0	0	1	1
OPERATION-ENABLED	–	–	–	–	–	–	–	–	–	0	1	–	0	1	1	1
MALFUNCTION	–	–	–	–	–	–	–	–	–	0	–	–	1	0	0	0
MALFUNCTION-REACTION-ACTIVE	–	–	–	–	–	–	–	–	–	0	–	–	1	1	1	1
QUICK-STOP-ACTIVE	–	–	–	–	–	–	–	–	–	0	0	–	0	1	1	1



Note:
0 = bit state is “0”
1 = bit state is “1”
– = bit state is undefined and is irrelevant

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Monitoring

Process data monitoring time (6003 hex)

Set a monitoring time in Index 6003 hex. If the data transfer is inactive for a time which is longer than the set monitoring time, the action which has been set with the “Process data monitoring selection parameter” (Index 6004 hex) is activated.

The value 65535 indicates that the monitoring is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6003 hex	0	S	U16	0 to 65535 (switched off)

Process data monitoring selection parameter (6004 hex)

With this parameter, you determine which action the frequency inverter is to initiate after the process data monitoring time (PZD watch-dog) has timed-out.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6004 hex	0	S	I16	0 no action 2 “Disable voltage” Controller inhibit (NEN) with latching in the “SWITCH-ON-DISABLED” state 3 “Quick-stop” Quickstop (QSP) with latching in the “SWITCH-ON-DISABLED” state

Process data configuration

Process data is a collection of many individual parameters in a data memory for the purpose of fastest possible transfer. This process data is exchanged in cycles between the frequency inverter and the master. A typical example is the “speed setpoint value” parameter (Index = 6042 hex) and the control word (Index = 6040 hex). These are compiled to the process output data (output data from master).

Configuration is undertaken with the “Process input data description” (Index = 6000 hex) and “Process output data description” (Index = 6001 hex).

In the table, you will find the process data description structure of the parameters (Index = 20 hex) and the meaning of the inputs for bytes, words and double word parameters.

Subindex	Data type	Function			
		(general)	(Byte PZD)	(Word PZD)	(Double word PZD)
1	U8	Process data length value is fixed at 4			
2	U16	Index for	1st PZD byte	1st PZD word	1st PZD Dword
3	U8	Subindex for	1st PZD byte	1st PZD word	1st PZD Dword
4	U16	Index for	2nd PZD byte	0 = not used	0 = not used
5	U8	Subindex for	2nd PZD byte	0 = not used	0 = not used
6	U16	Index for	3rd PZD byte	2nd PZD word	0 = not used
7	U8	Subindex for	3rd PZD byte	2nd PZD word	0 = not used
8	U16	Index for	4th PZD byte	0 = not used	0 = not used
9	U8	Subindex for	4th PZD byte	0 = not used	0 = not used

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The length of the process data is entered in the first subindex. Subsequently, the parameter which occupies each process data byte is described.

The address of the parameter which is comprised of the index and subindex serves as the description. If a word parameter (16 Bit) is applied to the process data, the parameter address (Index, Subindex) is entered in the first byte and the second byte is unused. However, it must contain a “0”. Accordingly, with double word parameters (32 Bit), 3 bytes will remain unused. The configuration can be changed collectively (Subindex = 0) or selectively.

To ensure data consistency with process output data, the “Process output data enable” is necessary.

Example 1:
Reconfigure process input data:

Assignment of the 2nd PZD word with a percentage actual value (Index = 6054 hex)

Index = 6000 hex
Subindex = 6 hex
Value = 6054 hex

Example 2:
Reconfigure process output data:

1. Inhibit process output data
   Index = 6002 hex
   Subindex = 0 hex
   Value = 0 hex

2. Assignment of the 2nd PZD word with a percentage setpoint value (Index = 6052 hex)
   Index = 6001 hex
   Subindex = 6 hex
   Value = 6052 hex
3. Enable process output data
   Index = 6002 hex
   Subindex = 0 hex
   Value = 0F hex

Process input data description (6000 hex)

Data format: Process data description structure (Index 20 hex).

This is the description of the process data which the frequency inverter issues to the master (input data for the master).

The description can be assigned with the profile parameters which are assigned with PZD attributes “PI” or “PIO” (see Page 30). The value of subindex “1” cannot be changed.

The factory default setting applies to the entire DE4 frequency inverter series:

Subindex	Value (hex)	Function
1	04	Number of PZD bytes
2	6041	Status word
3	00	No input
4	00	No input
5	00	No input
6	6044	Speed actual value
7	00	No input
8	00	No input
9	00	No input

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Process output data description (6001 hex)

Data format: Process data description structure (Index 20 hex).

This index describes the process data that the frequency inverter receives from the master (output data for the master).

The description can be assigned with the profile parameters which are assigned with PZD attribute “PIO” (see Page 30). The value of subindex “1” cannot be changed.

The factory default setting applies to the entire DE4 frequency inverter series:

Subindex	Value (hex)	Function
1	04	Number of PZD bytes
2	6040	Control word
3	00	No input
4	00	No input
5	00	No input
6	6042	Speed setpoint value
7	00	No input
8	00	No input
9	00	No input

Process output data enable (6002 hex)

You can inhibit or enable the process output data (output data from the master) via this index. More information concerning the application of this parameter can be found in Section „Process data configuration“ on Page 44.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6002 hex	0	S	0S-1	00 hex inhibit data 0F hex enable data

RPM/speed channel

Pole number (604D hex)

This index defines the number of poles with asynchronous motors and serves with the conversion of frequency values to speed values and vice versa. Only whole integer values can be written.

Index	Subindex	Data Str.	Data type	Value range/Initialization
604D hex	0	S	U8	2 to 254

Setpoint factor (604B hex)

With the “setpoint factor” index, you change the resolution or the setting range of the setpoint value definition. It is comprised of numerators and denominators. The setpoint value is multiplied by the setpoint factor and the actual values (reference variable, actual value) with the inverse of the setpoint factor.

Index	Subindex	Data Str.	Data type	Value range/Initialization
604B hex	1	A	I16	–32768 to +32767 1; setpoint factor “numerator”
604B hex	2	A	I16	–32768 to +32767 1; setpoint factor “denominator”

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Speed reference value (604E hex)

The “rpm reference value” (speed reference value) applies for the relative speed parameters such as

Percentage setpoint value

Percentage actual value

Ramp-function time

The profile parameter is mapped to the Moeller parameter PNU 011 (conversion to frequency values). The parameter determines the internal maximum rpm which is also active via terminal control.

Index	Subindex	Data Str.	Data type	Value range/Initialization
604E hex	0	S	U32	PNU 011 [rev/min]

Speed setpoint (6042 hex)

The required rpm is set with the index. As soon as the speed setpoint is written, the “percentage setpoint” also changes.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6042 hex	0	S	I16	–32768 to +32767 RPM setpoint value [rev/min]

Speed command variable (6043 hex)

The “rpm command variable” (speed command variable) is multiplied by the inverse of the setpoint factor.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6043 hex	0	S	I16	–32768 to +32767 RPM ramp function generator [rev/min]

Speed actual value (6044 hex)

In the “RPM actual value” (speed actual value), the current RPM is displayed.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6044 hex	0	S	I16	–32768 to +32767 RPM actual value [rev/min]

Speed min-max-amount (6046 hex)

With the “speed min-max-amount” index, the speed is limited in the upper and lower range. The maximum and minimum speed setpoint values are selected via the subindex.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6046 hex	1	A	U32	0 to 32000 minimum speed [rev/min]
	2	A	U32	0 to +32000 (PNU 011) maximum speed [rev/min]

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Percentage setpoint (6052 hex)

This index issues the speed setpoint value in percent and relevant to the speed reference value. 100 % corresponds to the value 16383. As soon as the "percentage setpoint" index is written, the value of the "speed setpoint" index also changes.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6052 hex	0	S	I16	–32768 to +32767 speed setpoint value [100 % = 16383]

Percentage command variable (6053 hex)

The value of the speed command variable is a percentage in this case. It relates to the speed reference value. 100 % corresponds to the value 16383. The setpoint command variable is multiplied by the inverse of the setpoint factor.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6053 hex	0	S	I16	–32768 to +32767 speed command variable [100 % = 16383]

Percentage actual value (6054 hex)

In the "percentage actual value", the current speed actual value is defined in percent relevant to the speed reference value. 100 % corresponds to the value 16383.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6054 hex	0	S	I16	–32768 to +32767 speed actual value [100 % = 16383]

Ramp min. function

In the DRIVECOM profile, 2 ramps exist for the speed setpoint; one of the ramps is relative and the other is absolute.

Absolute ramps in the DRIVECOM profile are:

"Speed acceleration"

"Speed deceleration"

The absolute ramps are deactivated in the factory default setting.

Relative ramps in the DRIVECOM profile are:

"Ramp-function time"

"Slow-down time"

The "ramp min. function" determines the slower ramp and activates it.

Speed acceleration (6048 hex)

The "speed acceleration" index is the absolute speed ramp for acceleration. The rate of ramp rise determines the "Delta_Speed" and "Delta_Time" parameters. The parameters are mapped to PNU 012 "acceleration time" via the "ramp min. function".

If the parameter "Delta_Time = 0", the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6048 hex	1	RS (21 hex)	U32	0 to 4294967295 Delta_Speed [rev/min]
	2	RS (21 hex)	U16	0 to 65535 (0 = ramp switched off) Delta_Time [s]

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Speed deceleration (6049 hex)

The “speed deceleration” index is the absolute speed ramp for the sequence. The rate of ramp rise determines the parameters “Delta_Speed” and “Delta_Time”. The parameters are mapped to PNU 013 “deceleration time” via the “ramp min. function”.

If the parameter “Delta_Time = 0”, the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6049 hex	1	RS (21 hex)	U32	0 to 4294967295 Delta_Speed [rev/min]
	2	RS (21 hex)	U16	0 to 65535 (0 = ramp switched off) Delta_Time [s]

Speed quick-stop (604A hex)

The “speed quick-stop” parameter is only available on the DF4-34x device series.

The “speed quick-stop” index is the absolute speed ramp for the sequence with the device control commands

“Quick-stop”

“RFG inhibit”

or the QSP terminal function

The rate or ramp rise determines the parameters “Delta_Speed” and “Delta_Time”. The parameters are mapped to PNU 105 “quick-stop ramp” via the “ramp min. function”.

If the parameter “Delta_Time = 0”, the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
604A hex	1	RS (21 hex)	U32	0 to 4294967295 Delta_Speed [rev/min]
	2	RS (21 hex)	U16	0 to 65535 (0 = ramp switched off) Delta_Time [s]

Ramp-function time (604F hex)

The “ramp-function time” index is the relative speed ramp for acceleration. With the relative speed ramp, the ramp rate of rise is determined by the “ramp-function time” parameter with respect to the “speed reference value“.

$$\text{Slope} = \frac{\text{speed reference value (Index = 604E hex)}}{\text{ramp-function time (Index = 604E hex)}}$$

The parameter is mapped to PNU 012 “acceleration time” via the “ramp min. function”.

With the “ramp-function time = 0”, the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
604F hex	0	S	U32	0 to 495000 (max PNU 012/2) Delta_Time [ms]

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Ramp-down time (6050 hex)

The “ramp-down time” index is the relative speed ramp for the sequence. With the relative speed ramp, the ramp rate of rise is determined by the “sequence time” parameter with respect to the “speed reference value”.

$$\text{Slope} = \frac{\text{speed reference value (Index = 604E hex)}}{\text{ramp-function time (Index = 6050 hex)}}$$

The parameter is mapped to PNU 013 “acceleration time” via the “ramp min. function”.

With the “slow-down time = 0”, the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6050 hex	0	S	U32	0 to 495000 (max PNU 013/2) Delta_Time [ms]

Quick-stop time (6051 hex)

The “quick-stop time” parameter is only active on the DF4-34x device series.

The “quick-stop time” index is the relative speed ramp for the sequence with the device control commands

“Quick-stop”

“RFG inhibit”

or the QSP terminal function

With the relative ramp, the ramp rate of rise is determined by the “quick-stop” parameter with respect to the “speed reference value”.

$$\text{Slope} = \frac{\text{speed reference value (Index = 604E hex)}}{\text{ramp-function time (Index = 6051 hex)}}$$

The parameter is mapped to PNU 105 “quick-stop ramp” (with DF4-120 PNU 013) via the “ramp min. function”.

With “quick-stop time = 0”, the ramp is switched off.

Index	Subindex	Data Str.	Data type	Value range/Initialization
6051 hex	0	S	U32	0 to 495000 (max PNU 105/2) Delta_Time [ms]

PCP communication services

The DF4 series frequency inverters support the following PCP communication services:

Initiate	Establish a connection from the master to the frequency inverter
Abort	Disconnect the connection
Status	Read the status of the frequency inverter
Get-OV	Read out the object directory
Identify	Identification of the frequency inverter
Read	Reading of parameters
Write	Writing of parameters

The transfer parameters which are available can be taken from the control system manual.

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CRL entries

Enter the following values in a master CRL (communication relationship list), to ensure communication between the master and the interface module:

Communication reference	2
Connection type	Master-slave, acyclic
Connection attribute	Defined
Max-PDU Sending-High-Prio	0
Max-PDU Sending-Low-Prio	64
Max-PDU Receiving-High-Prio	0
Max-PDU Receiving-Low-Prio	64
Supported Services Request	80 30 00 hex
Supported Services Response	00 00 00 hex
Max. SCC	1
Max. RCC	0
Max. SAC	0
Max. RAC	0

Initiate

The initiate service logically connects 2 slaves with one another. The frequency inverter returns the following parameters:

	Value	**Function**
Profile-Number	21 hex	DRIVECOM Profile Version 1
Password	0	Password function not supported
Access Groups	0	Access groups do not exist
Access Protection Supported	TRUE (FF hex)	Access protection is supported
Version OV	0	–

Abort

The Abort service disconnects a logical communication connection.

Status

This service supplies status information concerning the frequency inverter. The frequency inverter returns the following parameters:

Status	Value	Function
Logical Status	0 ready for communication (PNU 001 = 3) 2 limited number of services (PNU 001 ≠ 3)	Information concerning the current operating state (PNU 001 = operating mode) of the frequency inverter with regard to communication
Physical Status	0 inverter ready to operate device status "OPERATION-ENABLED" 1 partially ready for operation all other device states	Information concerning the current operating status of the frequency inverter.
Local Detail	"Status word" parameter	24 bit value, which contains the "Status word" (Index 6041 hex) profile parameter in bits 0 to 15. Bits 16 to 23 are set to "0".

Get-OV

The GET-OV service reads out the object description for each parameter and data type.

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Identify

The identify service identifies the frequency inverter. The frequency inverter returns the following parameters:

	Value	Function
Device manufacturer name	“Lenze Aerzen”	Company name as a visible string
Device name	Visible string with 15 characters	Device identity
Device version	Visible string with 15 characters	Device software versions

Device name

Each device designation is comprised of four character device designations and a space. If a device is not available, the section is filled with spaces.

Example:
“8201 2111”

Basic unit	8201
Interface module	2111

Character number														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8	2	0	1		2	1	1	1						

Device designation
Basic unit

Device designation
Interface

Space
No device

Device version

Each device version is comprised of a two character version, two character variant and a one character variant version. If a device is not available, the section is filled with spaces.

Example:
“2100013000”

Basic unit	V2.1/no variant/no variant version
Interface module	V1.3/no variant/no variant version

Character number														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	1	0	0	0	1	3	0	0	0					

Device version
Basic unit (e.g. “V2.1”)

Device version
Interface (e.g. “V0.1”)

Space

Read/Write

The “Read service” reads the parameter. It issues the value or a possible fault message.

The “Write service” writes the parameter. It issues an acknowledgment or a possible fault message.

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The DF4 series frequency inverters support the following error messages:

Error Class	Error Parameter	Additional Parameter [hex]	Function
6	3	00	No access rights
6	5	10	Impermissible command parameter
6	5	11	Invalid subindex
6	5	12	Data length too long
6	5	13	Data length too small
6	6	00	Object is not a parameter
6	7	00	Object does not exist
6	8	00	Data types do not correspond
8	0	00	Order cannot be executed
8	0	20	Order cannot be executed at the moment
8	0	21	Non-executable due to local control
8	0	22	Non-executable due to device operating status
8	0	30	Out of value range or can only be changed during controller inhibit
8	0	31	Parameter value too large
8	0	32	Parameter value too small
8	0	33	Sub-parameter out of value range
8	0	34	Sub-parameter value too large
8	0	35	Sub-parameter value too small
8	0	36	Max. value < min. value
8	0	41	Communication object cannot be mapped to the process data
8	0	42	Process data length exceeded
8	0	43	Collision with other values, general

5 Operation/Diagnostics

Commissioning

Use the interface module only in perfect working condition.

Attention!
Before switching on the mains voltage, inspect all wiring for short circuits, earth faults and to make sure that it is complete.

To ensure safe operation, observe the guidelines in the user manuals of the master controller and the frequency inverter.

Proceed in the following sequence during switch on:

- Configure your control system in order to enable communication with the DE4-NET-S. Set the following values for process data communication:
  Number of process data words: 2 (32 Bit)
  INTERBUS identity: 227 (dec)
- Set the communication relationship list (CRL, see Page 57), so that all frequency inverter parameters can be accessed via PCP communication.
- Switch on the frequency inverter and if applicable, the external supply for the DE4-NET-S. The green Bus LED (see Page 8) must light up or flash.

An internal initialization between the frequency inverter and the DE4-NET-S interface module occurs. Initialization is complete when the green Bus LED lights continuously and the yellow Bus LED (see Page 8) lights up or flashes. You can now communicate with the frequency inverter.

- First of all, the “Initiate” PCP service must be executed so that all frequency inverter parameters can be accessed via PCP communication. It is then possible to access the parameters via the “Read” and “Write” PCP services.

The parameters on the DF4-120 can only be set when the controller inhibit is active. This is achieved with the DRIVECOM device status:

“SWITCH-ON-DISABLED”

“READY-TO-SWITCH-ON”

“SWITCHED-ON”

“MALFUNCTION”

- During the initial start-up of the DF4-34x frequency inverter series, deactivate the automatic DC braking (PNU 106 = 0, PNU 216 = 0). This assures DRIVECOM compatibility.

Example for PCP-Write 1:
Index: 24575 – 106 = 24469 = 5F95 hex
Subindex: 0
Value: 0 (0 × 10000)

Example for PCP-Write 2:
Index: 24575 – 2106 = 22469 = 57C5 hex
Subindex: 0
Value: 0

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▶ Set the PNU 001 (operating mode) from “0” to “3”, so that the frequency inverter can be controlled via INTERBUS.

Index	Subindex	PNU 001 (operating mode)			
		Value	Control source	Setpoint source	Parameter source
5FFE hex	0	0	Terminal	Terminal	INTERBUS
		1	Terminal	DE4-KEY-1	INTERBUS
		2	Terminal	Terminal	INTERBUS
		3	INTERBUS	INTERBUS	INTERBUS

Example for PCP-Write: PNU 001 = 3
Index: 5FFE hex
(results from 5FFF hex – PNU 001)
Subindex: 0
Value: 30000 dec
(results from 3 × 10000)

Terminal 28 (controller enable) is always active and must be connected to high during INTERBUS operation (see DF4 “Hardware and Engineering” manual). Only then will the INTERBUS enable the frequency inverter (DRIVECOM device status “OPERATION-ENABLED”).

The frequency inverter accepts programming and control data from the INTERBUS. The DRIVECOM process data (see Page 30) controls the frequency inverter. The frequency inverter is enabled with the DRIVECOM control word, and device statii are represented with the DRIVECOM status word.

Enable frequency inverter

The standard enable of the frequency inverter is subject to the following procedure:

- ▶ Define the speed setpoint (2nd process word; POW2; value ≠ 0).
- ▶ Using the DRIVECOM control word, switch over to the “READY-TO-SWITCH-ON” device state (POW1 = 0000 0000 0111 1110 bin = 007E hex).
- ▶ Wait with the DRIVECOM status word until the “READY-TO-SWITCH-ON” device state has been achieved (PIW = xxxx xxxx x01x 0001 bin).
- ▶ Using the DRIVECOM control word, switch over to the “OPERATION-ENABLED” device state (POW1 = 0000 0000 0111 1111 bin = 007F hex).
- ▶ Wait with the DRIVECOM status word until the “OPERATION-ENABLED” device state has been achieved (PIW1 = xxxx xxxx x01x 0111 bin).

PIW = Process input word

POW = Process output word

DF4-120 peculiarities

The parameter definition (parameters without process data) is only possible with a controller inhibit; the DRIVECOM device status must not be equal to “OPERATION-ENABLED”. The parameters will be accepted with controller enable but will then be discarded.

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Attention!
A TRIP-RESET (reset of malfunctions) should only be undertaken via the INTERBUS.
If you undertake a malfunction reset with terminal 28 when the frequency inverter during operating mode PNU 001 = 3 (control via INTERBUS) is in the “malfunction” state, the frequency inverter may start for a short period.

After the “malfunction reset” command, an re-initialization of the DF4-120 is undertaken. The frequency inverter does not accept commands during this time.

Attention!
Always send the direction of rotation definition with a low speed setpoint value first and then the new speed setpoint value.
With a simultaneous setpoint and direction of rotation change via the DRIVECOM speed setpoint, a brief speed change in the wrong direction may occur.

DF4-34x peculiarities

When the frequency inverter is switched on for the first time, the automatic DC brake must be deactivated in both parameter sets.

▶ Set PNU 160 = 0 and PNU 216 = 0.

If the automatic DC brake (DCB) is activated (DCB stop time PNU 160 ≠ 0), the frequency inverter changes automatically after the DCB stop time has timed out and the speed is “0” from the “OPERATION-ENABLED” to the “SWITCHED-ON” device state.

Diagnostics

Malfunction code (603F hex)

Data format: Octet string

The malfunction code supplies a DRIVECOM profile compatible error code when the frequency inverter is in the malfunction state (TRIP). In the Moeller parameters PNU 161 to PNU 164 (Index 5F5E hex to 5F5B hex), the malfunction history is listed.

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The table displays the current DRIVECOM malfunction code which can be generated at present:

Fault code (Moeller)	Fault parameter (DRIVECOM)		Function
	hex	dec	
OC	2300	8960	General overcurrent
OC1	2320	8992	Short-circuit, overload
OC2	2330	9008	Earth fault
OC3	2213	8723	Overcurrent in acceleration ramp
OC4	2214	8724	Overcurrent in the sequence
OC5	2311	8977	I^*t monitoring
OC6	2312	8978	I^2t monitoring
OU1	3211	12817	Overvoltage in sequence
OUE	3212	12818	Overvoltage error
LU1	3130	12592	Phase failure
LP1	3130	12592	Phase failure
LP3	3100	12544	Mains voltage
FE	3140	12608	Mains frequency error
LF	3142	12610	Mains frequency too low
OF	3141	12609	Mains frequency too high
OH	4210	16656	Heatsink overtemperature
OH3	4310	17168	Motor overtemperature
CCr	6010	24592	System fault
Pr	6310	25360	Parameter reset
OL	2300	8960	Outputs overcurrent
EEr	9000	36864	External TRIP

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Appendix

Technical Data

Communication method	RS 422
Network topology	Ring
Max. number of frequency inverters	63
Max. cable length between two slaves	400 m
INTERBUS slaves	Slave
Communication profile	PCP 1.5
Drive profile	DRIVECOM Profile 21
Baud rate [kBit/s]	500
Admissible pollution	Pollution degree 2 according to VDE 0110 Part 2
Permissible humidity rating	Relative humidity 80 %, non-condensing
Isolation voltage	
Bus system for control electronics/ power section	270 V AC
Bus system to reference earth/PE	50 V AC
Bus system to the control terminals	DF4-120: 0 V AC (no potential isolation) DF4-340: 50 V AC (single basic insulation) DF4-341: 270 V AC (single basic insulation)
Ambient temperature	0 to 45 °C
Voltage supply	24 V DC ±10 %, max. 150 mA
Protocol specific data	
Process data words (PZD)	2 (32 Bit)
Parameter data words	1 (16 Bit)
INTERBUS identity	227 (dec) or E3 (hex)
Max. PDU length	64 Byte
Supported services	Initiate Get OV Write Abort Identify Status Read

Accessory INTERBUS components (Phoenix Contact ordering codes)[1)]	
Installation manual	Technical data for self-assembly of the connection cables IBS SYS INST UM (Order No. 27 54 28 6)
Remote bus cable	Bus connection between IP20 remote bus slaves (each individual prefabricated cable requires both components)
Available by the meter	BS RBC Meter-T (Order No. 28 06 28 6)
Fabrication	IIBS DSUB9-KONFEK-T (Order No. 27 58 46 0)

1) The order codes and technical data of the non-Moeller component manufacturer are provided for reference purposes only. Certified data should be taken from the documentation of the original manufacturer.

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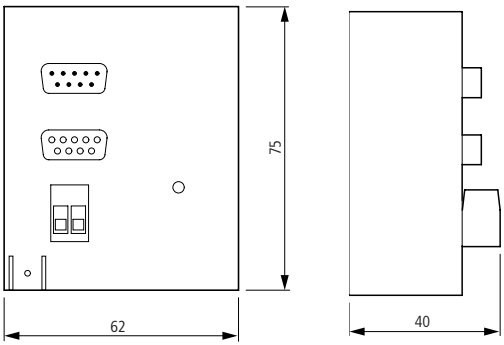
Standards and specifications

Electronic equipment for use in power installations	DIN VDE 0160, 5.88
Specifications for power installations	DIN VDE 0100
Degrees of protection provided by enclosures:	EN 60529, 10.91
Base material for printed circuits	DIN IEC 249 Part 1, 10.86; DIN IEC 249 Part 2-15, 12.89
Grid system for printed circuits	DIN IEC 326 Part 1, 10.90; EN 60097, 9.93
Insulation coordination for equipment within low voltage systems	DIN VDE 0110 Part 1-2, 1.89; DIN VDE 0110 Part 20, 8.90
Electrical static discharge (ESD)	prEN 50082-2, 8.92, IEC 801-2, 9.87 (VDE 0843, Part 2)
Electromagnetic compatibility; generic immunity standard	prEN 50082-2, 8.92, IEC 801-4, 9.87 (VDE 0843, Part 4)
Electromagnetic compatibility; generic emission standard	EN 50081-2, 3.94; EN 55011 (VDE 0875, Part 11, 7.92)
Limits of radio interference from radio frequency apparatus and installations	VDE 0871, 6.78

Dimensions



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