Hardware and Engineering

DV4 Frequency Inverter
DE4-IOM-STD-F Input/Output Module
DE4-KEY-... LCD Keypad

05/00 AWB 8230-1340GB

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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.

Contents

About This Manual

This manual describes the series DV4-120, DV4-322 and DV4-340 frequency inverters, the DE4-IOM-STD-F standard input/output module and the DE4-KEY-3 LCD keypad.

The manual contains special information required for configuring, installing and operating the DV4 frequency inverters. It provides a detailed description of the properties, parameters and functions, with examples of key applications All information applies to the specified hardware and software versions.

The optional DE4-IOM-STD-F module and the DE4-KEY-3 LCD keypad described in this manual are not part of the DV4 package content, but are required for its operation with the basic functions and for changing parameter settings.

The following abbreviations and symbols are used in this manual:

AIF:	Automation interface (interface for communication modules)
EMC:	Electromagnetic compatibility
FIF:	Function interface (internal interface for function modules)
IGBT:	Insulated gate bipolar transistor
PES:	PE (positive earth) screen connection
PNU:	Parameter number
WE:	

For greater clarity, the name of the current chapter is shown in the header of the left-hand page and the name of the current section in the header of the right-hand page.

Provides useful tips and additional information

Caution!
Indicates the possibility of minor material damage and minor injury.

Warning!
Indicates the possibility of moderate material damage and moderate injury.

Warning!
Indicates the possibility of serious material damage and serious or fatal injury.

Read this manual thoroughly before installing and commissioning the frequency inverters. It is assumed that you have a basic knowledge of physics and are familiar with handling electrical systems and interpreting technical drawings.

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1 About The Devices

System overview

The illustration overleaf provides an overview of the available devices.

Legend to Figure 1

① LCD keypad DE4-KEY-3

② Frequency inverter DV4...

③ Input/output module DE4-IOM-STD-F

④ LCD keypad DE4-KEY-H3

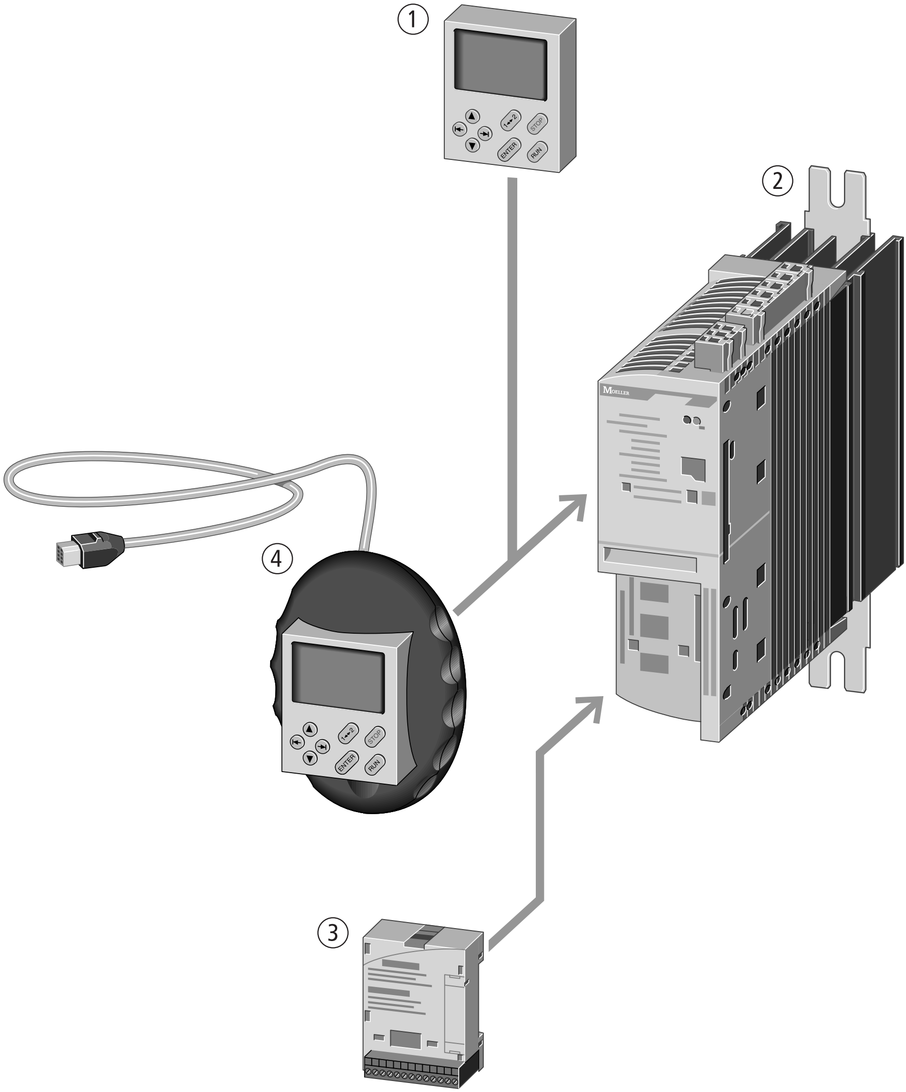

Figure 1: System overview

Type code and type designation of the DV4 series frequency inverters:

DV4 - **x** **x** **x** - **yyy**

Motor rating
Reference: EU rated voltage (230 V/400 V)

Version and model number
0 = basic version
1 = system devices
2 = voltage code suffix

Supply connection, voltage code (EU rated value)
2 = 230 V (100 V to 260 V 60 %)
4 = 400 V (320 V to 550 V 60 %)

Supply connection, phase code
1 = single-phase or two-phase
3 = three-phase

Family name:
Drives **V**ector frequency inverter, generation **4**
Drives, flow-controlled vector frequency inverter

Figure 2: Frequency inverter type code

Example:

DV4-120-075	Series DV4 vector frequency inverter
	Single-phase supply: Single-phase 230 V
	Basic version
	Assigned motor rating: 0.75 kW at 230 V 3-phase
DV4-322-1K5	Series DV4 vector frequency inverter
	Supply voltage: 230 V
	Single-, two- or three-phase supply
	Assigned motor rating: 1.5 kW at 230 V 3-phase
DV4-340-11K	Series DV4 vector frequency inverter
	Three-phase supply: 3-phase 400 V
	Basic unit
	Assigned motor rating: 11 kW at 400 V AC, 3-phase

Type code and type designation of the DE4 expansion modules described in this manual:

DE4 - xxx - yyy - zzz

Type code suffix
F = **f**unction interface (FIF) slot
K3 = accessories for DE4-**K**EY-**3**

Counter, version, technical specifications
2M5 = length **2.5 m**
3 = LCD keypad, version **3** (for DV4)
H3 = **h**and-held keypad with DE4-KEY-**3 LCD keypad**
K3 = accessories for DE4-**K**EY-**3**
STD = **St**an**d**ard

Type code
CBL = connecting cable
IOM = input/output module
KEY = LCD keypad
MNT = Mounting

Family name:
Drives **E**xtension unit, generation **4**
Drives, expansion modules (accessories)

Figure 3: Options type code

Example:

DE4-KEY-3	Expansion module, LCD keypad version 3 (for DV4 only)
DE4-KEY-H3	Expansion module, hand-held keypad with LCD keypad DE4-KEY-3 (for DV4 only)
DE4-MNT-K3	Expansion module, mounting frame for LCD keypad DE4-KEY-3
DE4-CBL-2M5-K3	Expansion module, 2.5 m connecting cable for LCD keypad DE4-KEY-3, mounting frame DE4-MNT-K3 and hand-held keypad DE4-KEY-H3
DE4-IOM-STD-F	Expansion module, standard I/O module in FIF slot

Features of the frequency inverters

The DV4 series frequency inverters convert the voltage and frequency of a 3-phase mains supply to a DC voltage and then generate 3-phase power with variable voltage and frequency. The variable 3-phase power output allows continuous adjustment of the speed of rotation of 3-phase induction motors.

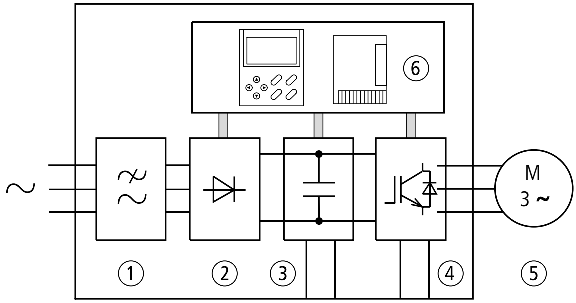

Figure 4: Function chart of a frequency inverter

① Supply through radio interference suppression filters

Mains voltage V_{LN} (EU rated voltage):
DV4-120 1-phase, 230 V, 50/60 Hz
DV4-322 1/3-phase, 230 V, 50/60 Hz
DV4-340 3-phase, 400 V, 50/60 Hz

② The single- or three-phase rectifier bridge converts the AC voltage into a DC voltage.

③ The internal DC link contains a charging resistor, a smoothing capacitor and a switched-mode power supply. It implements intermediate circuit coupling and direct current infeed:
Intermediate circuit voltage (V_{ZK}) = $\sqrt{2} \times$ mains voltage (V_{LN})

④ IGBT inverter and braking transistor:

The inverter converts the internal DC link voltage to 3-phase power with variable voltage and frequency. In combination with an external braking resistor, the braking transistor allows braking at higher moments of inertia or during prolonged regenerative operation.

⑤ Output voltage (V_2), motor connection:
three-phase AC with variable voltage, 0 to 100 % of input voltage (V_{LN})

Output frequency (f_2):
variable from 0 to 480 Hz

Rated output current (I_{2N}):
1.7 to 9.5 A with about 150 % startup current for 60 s at an operating frequency 8 kHz and an ambient temperature of 40 °C

Motor connection, assigned shaft output (P_2):
0.25 to 2.2 kW at 230 V
0.55 to 2.2 kW at 400 V

⑥ Programmable control section with slots for communication modules, e. g. LCD keypad, serial interface and function modules for analog and digital control commands.

DV4-...	**...-120**	**...-322**	**...-340**
Compact book-sized design	✓	✓	✓
Enclosure to protection class IP20	✓	✓	✓
Ambient operating temperature –10 to +55 °C	✓	✓	✓
Supply voltage V_{LN} = 1-phase, 230 V AC	✓	✓	–
Supply voltage V_{LN} = 3-phase, 230 V AC	–	✓	–
Supply voltage V_{LN} = 3-phase, 400 V AC	–	–	✓
Supply voltage V_{LN} = 3-phase, 500 V AC	–	–	✓
Integrated RFI filter	✓	✓	✓
Connection for interconnected DC link	–	✓	✓
Internal braking transistor	✓	✓	✓
1.8 × M_N for 60 s (rated motor output = rated output of DV4)	✓	✓	✓
Torque setting range 1:10, at constant speed from 3 to 50 Hz	✓	✓	✓
Speed control 1:50 (sensorless)	✓	✓	✓
Operating frequency 2 kHz, 4 kHz, 8 kHz, 16 kHz	✓	✓	✓
Vector control, *V/f* characteristic control (linear, quadratic)	✓	✓	✓
DC injection braking	✓	✓	✓

DV4-...	...-120	...-322	...-340
Motor flying restart circuit	✓	✓	✓
Relay (changeover contact, 230 V, 3 A AC; 24 V, 2 A DC)	1	1	1
Galvanically isolated digital inputs with programmable functions	4	4	4
Up to three fixed frequencies per parameter set	✓	✓	✓
TRIP-SET and TRIP-RESET functions	✓	✓	✓
Motor potentiometer	✓	✓	✓
Output frequency up to 480 Hz	✓	✓	✓
Motor flying restart circuit	✓	✓	✓
Frequency skip, blocking frequencies	✓	✓	✓
Four parameter sets	✓	✓	✓
Running time meter, on-time meter	✓	✓	✓
Temperature-dependent fan control	✓	✓	✓
PTC motor monitoring through integral evaluation	✓	✓	✓
Clip-on accessories for control and configuring (FIF interface)			
Input/output module DE4-IOM-STD-F	✓	✓	✓
Clip-on accessories for controlling and configuring (AIF interface)			
LCD keypad DE4-KEY-3 with parameter memory	✓	✓	✓
Hand-held keypad DE4-KEY-H3 with parameter storage (connecting cable DE4-CBL-2M5-K3 required)	✓	✓	✓
RS232/485 interface module DE4-COM-2X	✓	✓	✓
INTERBUS fieldbus module DE4-NET-S	✓	✓	✓
PROFIBUS DP fieldbus module DE4-NET-DP	✓	✓	✓
Suconet K fieldbus module DE4-NET-K	✓	✓	✓

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Selection criteria

The main factor for choosing the correct frequency inverter model is the rated motor current: the rated output current of the frequency inverter must be the same as or larger than the rated motor current.

It is assumed that the following drive data is known:

- Type of motor (3-phase induction motor),
- Mains voltage = rated motor voltage (e.g. three-phase, 400 V),
- Rated motor current (approximate value, depending on connection type and voltage),
- Torque characteristics (quadratic or constant, with starting torque 1.5 times operating torque),
- Ambient temperature (max. temperature 40 °C).

When several motors are connected in parallel to the output of a frequency inverter, the motor currents are added geometrically, i.e. separated into active and reactive current components. The chosen frequency inverter should have a sufficiently high rating to supply both the total apparent current and the reactive current component.

If a motor is connected to the output of the frequency inverter when the latter is already under power, the motor initially takes a current which is several times higher than its rated current. In this case, choose a frequency inverter whose rated output cannot be exceeded by the sum of the starting current and the currents of the running motors.

The rated output current of the different frequency inverter models can be found in the Technical data in the appendix.

Power dissipation P_V

The power dissipation P_V of the frequency inverter depends on the operating state of the connected motor. The values listed in the table below apply to rated operation of the motor parameters (rated motor output, 4-pole three-phase induction motor) at an ambient temperature of 40 °C.

Model	Power dissipation P_V in W	Motor rated power in kW
at V_{LN} = 230 V		
DV4-120-025	30	0.25
DV4-120-037	40	0.37
DV4-322-055	50	0.55
DV4-322-075	60	0.75
DV4-322-1K5	100	1.5
DV4-322-2K2	130	2.2
at V_{LN} = 400/460 V		
DV4-340-055	50	0.55
DV 4-340-075	60	0.75
DV 4-340-1K5	100	1.5
DV 4-340-2K2	130	2.2

General operating conditions

Admissible environmental conditions

Ambient temperatures	
Operation	Ta = –10 to +40 °C at rated current I_e without reduction in power, to +55 °C with a reduction of 2.5 % per Kelvin (at rated current I_e)
Storage	Ta = –25 to +60 °C
Transport	Ta = –25 to +70 °C
Vibration resistance	Acceleration-resistant to 2 g (Germanischer Lloyd, general requirements)
Degree of pollution	VDE 0110 Part 2, degree of pollution 2
Packaging	Dust packaging (DIN 4180)
Climatic conditions	Class 3K3 to EN 50 178 (non-condensing, average humidity 85 %)

Installation height	Up to 1000 m above sea level; above this up to 4000 m with a current drop of 5 % per 1000 m additional height.
Mounting position	Vertically suspended
Installation space	100 mm above and below
Electrical specifications	
Emitted interference	Requirements of EN 50 081-1
	Limit value class A to EN 55 011
	Limit value class B to EN 55 022
Interference immunity	Requirement of EN 61 800-3
	ESD, EN 61 000-4-2 severity 3
	(8 kV on air discharge, 6 kV on contact discharge)
	HF interference (enclosure), EN 61 000-4-3, severity 3 (10 V/m, 27 to 1000 MHz)
	Burst, EN 61 000-4-4, severity 3 and 4 (2 kV/5 kHz)
	Surge (in mains cables), EN 61 000-4-5, severity 3 (1.2/50 µs, 1 kV phase–phase, 2 kV phase–PE)
Insulation resistance	Overvoltage category III to VDE 0110
Discharge current to PE	greater than 3.5 mA to EN 50 178
Degree of protection	IP20 (ambient operating temperature of –10 to +55 °C)
Protection against accidental contact	Back-of-hand and finger-proof
Protective control circuit insulation	Safe isolation from mains. Double basic insulation to EN 50 178
Protective measures	Short-circuit, earth fault, overvoltage, tilting of motor, motor overtemperature: I^2t-monitoring and PTC input (thermistor or temperature contact)
Open-/closed-loop control	
Modulation process	Vector control, *V/f* characteristic control (linear, quadratic)
Operating frequency	8 kHz, switchable to 2 kHz, 4 kHz, 16 kHz
Torque	1.8 × M_N for 60 s at assigned motor rating
Torque setting range	1:10 (3 to 50 Hz at constant speed)
Sensorless speed control (without feedback)	
Min. output frequency	1 Hz (0 to M_N)
Manipulating range	1:50 (reference 50 Hz)
Accuracy	0.5 % (range 3 to 50 Hz)
Concentricity	±0.1 Hz (range 3 to 50 Hz)

Output frequency	
Range	–480 Hz to +480 Hz
Resolution, absolute	0.02 Hz
Resolution, normalized	Parameter 0.01 %, process data 0.006 % (2^{14})
Digital setpoint input	Accuracy ±0.005 Hz (= ±100 ppm)
Analog setpoint input	Linearity ±0.5 at 5 V or 10 V
	Temperature sensitivity +0.4 % (range 0 to +40 °C)
	Offset ±0 %
Relay	
Changeover contacts	230 V, 3 A AC
	24 V, 2 A DC to 200 V, 0.18 A DC
Braking transistor	Integrated, assigned external braking resistors
Option DE4-IOM-STD-F (input/output module for analog and digital control of the DV4)	
Analog inputs/outputs	1 input, optionally bipolar, cycle time 2 ms
Digital inputs/outputs	1 input for controller inhibit, 4 inputs, optionally one 0 to 10 kHz frequency input, input cycle time 1 ms
	1 output, cycle time 4 ms (smoothing time τ = 10 ms)
Optional DE4-KEY-3 (LCD keypad) and DE4-KEY-H3 (hand-held LCD keypad)	
Operation	8 function keys for controlling and configuring the DV4
Display only	LCD (liquid crystal display)
Memory	EEPROM
Connection	DE4-KEY-3 directly to AIF slot
	DE4-KEY-3 in mounting rack DE4-MNT-K3 via connecting cable DE4-CBL-2M5-K3 to AIF slot
	DE4-KEY-H3 via connecting cable DE4-CBL-2M5-K3 to AIF slot
Insulation voltage to reference earth (PE)	50 V AC
Degree of protection	IP55
Ambient temperature	
Operation	Ta = –10 to +55 °C
Transport	Ta = –25 to +60 °C
Storage	Ta = –25 to +60 °C
Climatic conditions	Class 3K3 to EN 50 178 (non-condensating, average rel. humidity 85 %)
DE4-MNT-K3	Mounting rack, panel cutout 45.3 × 45.3 mm
DE4-CBL-2M5-K3	Preassembled connecting cable for AIF slot, length 2.5 m

Intended use

The DV4 series frequency inverters are not domestic appliances. They are designed only for industrial use as system components.

The DV4 series frequency inverters 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.

After installation in a machine, the frequency inverters must not be taken into operation until the associated machine has been confirmed to comply with the safety requirements of Machinery Safety Directive (MSD) 89/392/EEC and meets the requirements of EN 60 204. The user of the equipment is responsible for ensuring that the machine use complies with the relevant EU Directives.

The CE test marks applied to the DV4 frequency inverter confirm that, when used in a typical drive configuration, the apparatus complies with the European Low Voltage Directive (LVD) and the EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

The DV4 series frequency inverters are suitable for use in public and non-public networks in the described system configuration. Depending on their location of use, external filtering may be necessary. Their connection to IT networks (networks without earth potential reference point) is not permitted, since the device’s internal EMC filter capacitors connect the network to the earth potential (enclosure). In networks, this can result in dangerous situations or damage to the device.

At the frequency inverter's output (terminals V, V, W), you must not:

- connect voltage or capacitive load (e.g.phase compensation capacitors),
- connect several frequency inverters in parallel,
- establish a direct connection (bypass) to the frequency inverter's input.

Observe the technical data and terminal requirements. Refer to the equipment nameplate or label and the documentation for more details.

Any other usage constitutes improper use.

Storage, transport, recycling

The DV4 series frequency inverters are carefully packaged and prepared for shipment. Transport may only take place in the original packing using suitable lifting and transport devices (see weight specifications). Observe the labels and instructions on the packaging. The instructions also apply to the unpacked equipment.

After receiving the delivery,

- check for external damage of the packaging;
- confirm that the details on the delivery note match your original order.

Open the packaging with suitable tools and check whether:

- parts have been damaged during transport;
- the equipment corresponds to the model that you ordered;
- the assembly instructions are enclosed.

In case of damaged, incomplete or incorrect shipment, please notify the responsible sales office.

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If a frequency inverter has been stored for more than two years without use, the capacity of the internal DC link capacitors may be impaired. They can be regenerated by applying no-load voltage to the frequency inverter for about two hours (no Controller Enable, terminal 28 = OFF) through the assigned mains choke for about two hours before its use. §

DV4 series frequency inverters can be recycled as electronic scrap in accordance with the currently applicable national regulations.

2 Engineering

This chapter describes the measures you should take before and during installation of the frequency inverter.

It deals with the following topics:

- Electrical connections
- Connection to the power supply
- EMC compliance
- Installation
- Circuit types

Electrical connections

The illustration overleaf provides an overview of the connections.

Legend for Figure 5

① Network configurations, mains voltage, mains frequency,
interaction with compensation systems

② Fuses and cable cross-sections

③ Protection of persons and domestic animals with residual current circuit breakers

④ Mains contactor

⑤ Mains choke, RFI filter, mains filter

⑥ Setup, installation
Connection of power cables
Measures to ensure in EMC compliance
Sample circuits

⑦ Motor choke
d*u*/d*t* filter
Sine-wave filter

⑧ Motor rating, cable length

⑨ Motor connection
Parallel operation of several motors with one frequency inverter

⑩ Braking resistors
Internal DC circuit coupling
DC supply

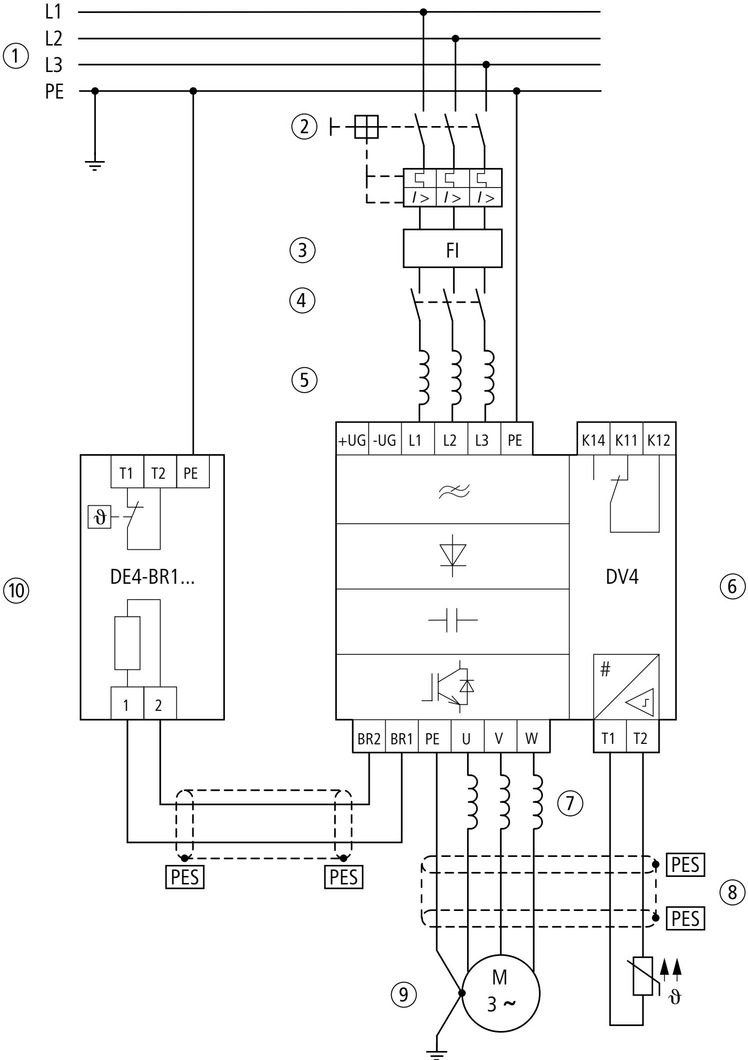


Figure 5: Connection of power lines

Supply connection

The DV4 series frequency inverters cannot be used without limitation in all network configurations (network configurations to IEC 364-3).

Network configurations

Networks with earthed centre point (TT/TN networks):

The DV4 series frequency inverters can be used in TT/TN networks without restriction. You should, however, observe the DV4 frequency inverter's rating.

☞ If several frequency inverters with single-phrase supply (DV4-120/DV4-322) are to be used in a network, the symmetrical distribution over the phases and the load applied to the common N conductor (network's r.m.s. current) must be taken into account. It may be necessary to increase the diameter of the N conductor.

Networks with isolated centre point (IT networks):

Unrestricted use of the DV4 series frequency inverters in IT networks is not possible. The network must be equipped with a suitable insulation monitoring device capable of recognizing an earth fault and isolating the frequency inverter from the network.

Caution!
When an earth fault occurs in an IT network, excess voltage is applied to the frequency inverter's capacitors, which are connected to earth, thereby preventing safe operation of the frequency inverter. An additional isolating transformer can be included in the frequency inverter's power supply to overcome this problem. The transformer's secondary side must be centrally earthed and must form a separate TN network for the frequency inverter.

Mains voltage, mains frequency

The ratings of the series DV4 frequency inverters take into account the European and American standard mains voltages:

230 V, 50 Hz (EU)/240 V, 60 Hz (USA) for DV4-120 and DV4-322,

400 V, 50 Hz (EU)/460 V, 60 Hz (USA) for DV4-340.

The permissible mains voltage range is:

230/240 V: 100 V –0 % to 264 V +0 %

400/460 V: 320 V –0 % to 550 V +0 %

The permissible frequency range is 48 Hz –0 % to 52 Hz +0 %.

Caution!
For single-phase supplies of less than 180 V, (series DV4-120 and DV4-322), the maximum output current must be reduced to 75 % of the rated operating current (PNU 0022).

The series DV4-340 devices can be connected to three-phase industrial mains with 500 V +10 %.

The assignment of motor ratings to mains voltages is listed in the appendix, section “Motors” from page 235.

Interaction with compensation devices

The DV4 series frequency inverters absorb only a very small fundamental component of the reactive power. Compensation is therefore not necessary.

Caution!
DV4 frequency inverters can be operated in networks with compensation devices if the compensation devices are of an inductance-capacitance type.

Fuses and cable cross sections

The fuse ratings and cable cross-sections used on the mains side depend on the frequency inverter’s power and on the drive’s control mode.

Caution!
When choosing cable cross-sections, allow for the voltage drop under load. The user is responsible for ensuring adherence to other applicable standards (e.g. VDE 0113, VDE 0289).

The recommended fuses and the assignment of DV4 frequency inverters are listed in the appendix, section “Fuses and cable cross-sections” from page 231.

You must observe the national and regional regulations (e.g. VDE 0113, EN 60 204) and fulfill the certification requirements at the installation site (e.g. UL).

For use in a UL approved system, only UL approved fuses, fuse bases, and cables must be used.

The leakage currents to PE (to EN 50 178) are greater than 3.5 mA. Both terminals marked PE and the enclosure must be connected to the earth circuit.

Caution!
The specified minimum cross sections of PE cables (EN 50 178, VDE 0160) must be maintained. The cross-section of the PE cable must be at least as large as the cross-section of the power cables.

Protection of personnel and domestic animals to DIN VDE 0100 with residual current circuit-breakers

Residual current circuit-breaker (RCCB) (in accordance with VDE 0100). Universal RCCBs to EN 50 178 and IEC 755.

	Markings on the residual current circuit-breaker		
Logo	~		
Model	Sensitive to AC (RCCB, type AC)	Sensitive to pulsating current (RCCB, type A)	Sensitive to all current (RCCB, type B)

The frequency inverters contain a mains rectifier. In case of a, a residual DC current can therefore prevent the AC or pulsating current RCCB from being triggered, leaving the system unprotected. We therefore recommend the use of:

- impulse-current-sensitive RCCBs with a rated current of ≧ 30 mA for frequency inverters with a single-phrase input (DV4-120, DV4-322).
- all-current-sensitive RCCBs with a rated current of ≧ 300 mA for frequency inverters with three-phase input (DV4-322, DV4-340).

The leakage current ratings of the DV4 frequency inverters are listed in the appendix, section “Leakage currents” from page 229.

False tripping of an RCCB can be caused in the following situations:

when capacitive equalizing currents occur in cable screens during normal operation, in particular in long, screened, motor cables;

when several frequency inverters are switched into the network at the same time;

when additional interference filters (RFI filters, mains filters) are used.

Caution!
RCCBs must be installed only on the mains side, between the supplying network and the frequency inverter.

Mains contactor

Connect the mains contactor to input cables L1, L2 and L3 (depending on type) on the mains side. The mains contactor allows the DV4 frequency inverters to be switched on and off during operation in the supplying network and to be switched off in case of a fault.

> **Caution!**
> After switching off the mains voltage, wait for at least three minutes before switching it on again (to allow the load resistors of the internal DC link capacitors to recover).

Mains contactors and their assignment to the DV4 frequency inverter are listed in the appendix, section “Mains contactors” from page 225.

Mains choke

Connect the mains choke (also called commutating reactor) to input cables L1, L2 and L3 (depending on type) on the mains side. They reduce the current harmonics, thereby lowering the apparent mains current by up to about 30 %.

A line reactor limits any additional current peaks caused by potential distortion (e.g. by compensation systems or earth faults) or switching operations on the network.

Mains chokes increase the lifespan of the DC link capacitors, and therefore of the frequency inverter. Their use is also recommended in the following cases:

- for single-phase supply (DV4-120, DV4-322); required for DV4-322-2K2,
- for output reduction (temperatures above +40 °C, installation heights above 1000 m a.s.l.),
- for parallel operation of several frequency inverters at a single network input point,
- for DC link coupling of several frequency inverters (interconnected operation).

Line reactors and their assignment to the DV4 frequency inverter are listed in the appendix, section “Mains choke” from page 227.

Mains filters, RFI filters

Mains filters are a combination of a mains choke and an RFI filter in a single enclosure. They reduce current harmonics and dampen high-frequency radio interference.

RFI filters dampen only high-frequency radio interference.

The DV4 series frequency inverters contain RFI filters for dampening high-frequency radio interference. This allows them to be used in networks of environment classes 1 and 2 to EN 61 800-3 without additional provisions. However, the EMC measures and the maximum motor supply cable length must be observed for this type of application.

Warning!
The use of mains filters or RFI filters increases the leakage current from the drive unit to earth. You should take this into account to when implementing FI filtering measures.

EMC measures

The limit values for emitted interference and immunity for variable-speed drives are specified in the EMC product standard (IEC/EN 61 800-3) and the European Amendment EN 61 800-3 A11.

The **product standard IEC/EN 61 800-3** applicable to variable-speed drives describes the requirements for applications in residential and commercial environments.

Interference immunity

The DV4 frequency inverters fulfill the requirements of the EMC product standard IEC/EN 61 800-3 for commercial environments (secondary environment) and therefore also for the lower interference immunity values in residential environments (primary environment).

Emitted interference and radio interference suppression

The DV4 frequency inverters fulfill the requirements of the EMC product standard IEC/EN 61 800-3 for residential environments (primary environment) and therefore also for the higher limit values in commercial environments (secondary environment).

A residential environment, in this case, is a connection (transformer output) to which private residences are also connected.

For industrial installations, EMC legislation requires complete electromagnetic compatibility with the environment. The product standard considers a typical drive system in its entirety, i.e. the combination of frequency inverter, cable and motor.

To maintain the limit values, you can take the following measures:

- Use mains filters or RFI filters – including a mains choke – to reduce interference from cables.
- Use screened motor cables and signal lines to reduce electromagnetic radiation interference.
- Adherence to installation instructions (EMC-compliant installation).

Setup

To ensure adherence to the EMC limit values, the system setup and wiring must be taken into account in addition to filtering on the network side. Poor earthing and screening reduce the effect of the RFI filter. The required levels of radio interference suppression can only be maintained through the combination of suitable filters and correct installation.

Installation

DV4 frequency inverters are attached by two mounting brackets. These are included in the package content and can be fitted in the provided slot in the heatsink.

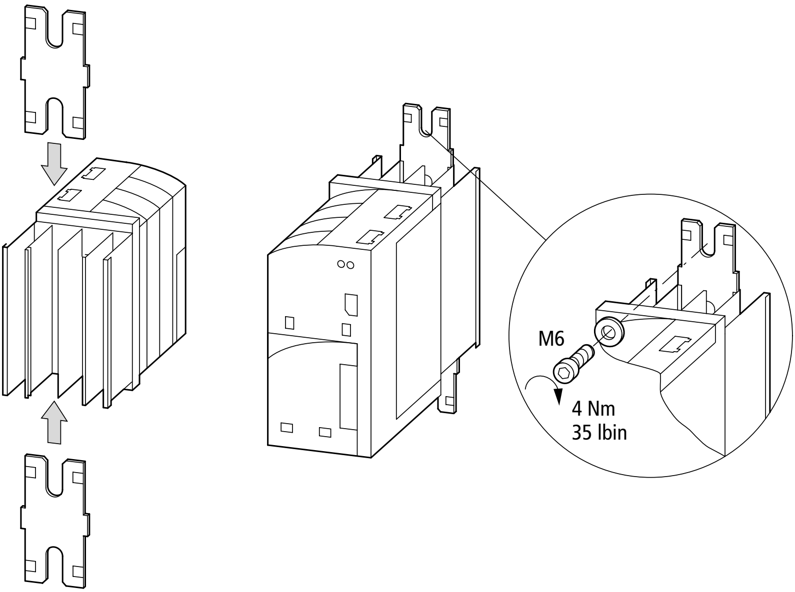


Figure 6: Fitting the mounting brackets and the DV4

DV4 frequency inverters are mounted vertically. Above and below the inverter, there must be a free space of at least 100 mm each. To either side, there must be free a space of at least 5 mm. The free space required at the front depends on the optional modules to be fitted and their connectors.

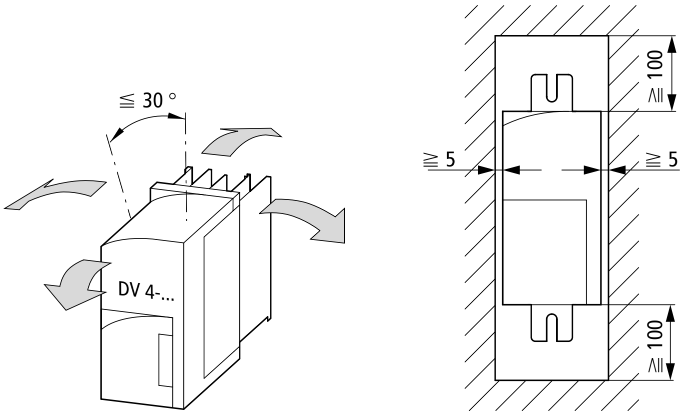


Figure 7: Mounting position

Weights and dimensions of the DV4 are listed in the appendix, section “Weights and dimensions” from page 250.

To ensure EMC-compliant setup, connect all metallic components of the devices and of the control cabinet with each other using a large cross-section conductor with good HF conducting properties. Do not make connections to painted surfaces (Eloxal, yellow chromated). If there is no alternative, use contact and scraper washers to ensure contact with the base metal. Connect mounting plates to each other and cabinet doors with the cabinet using contacts with large surface areas and short HF drain wires.

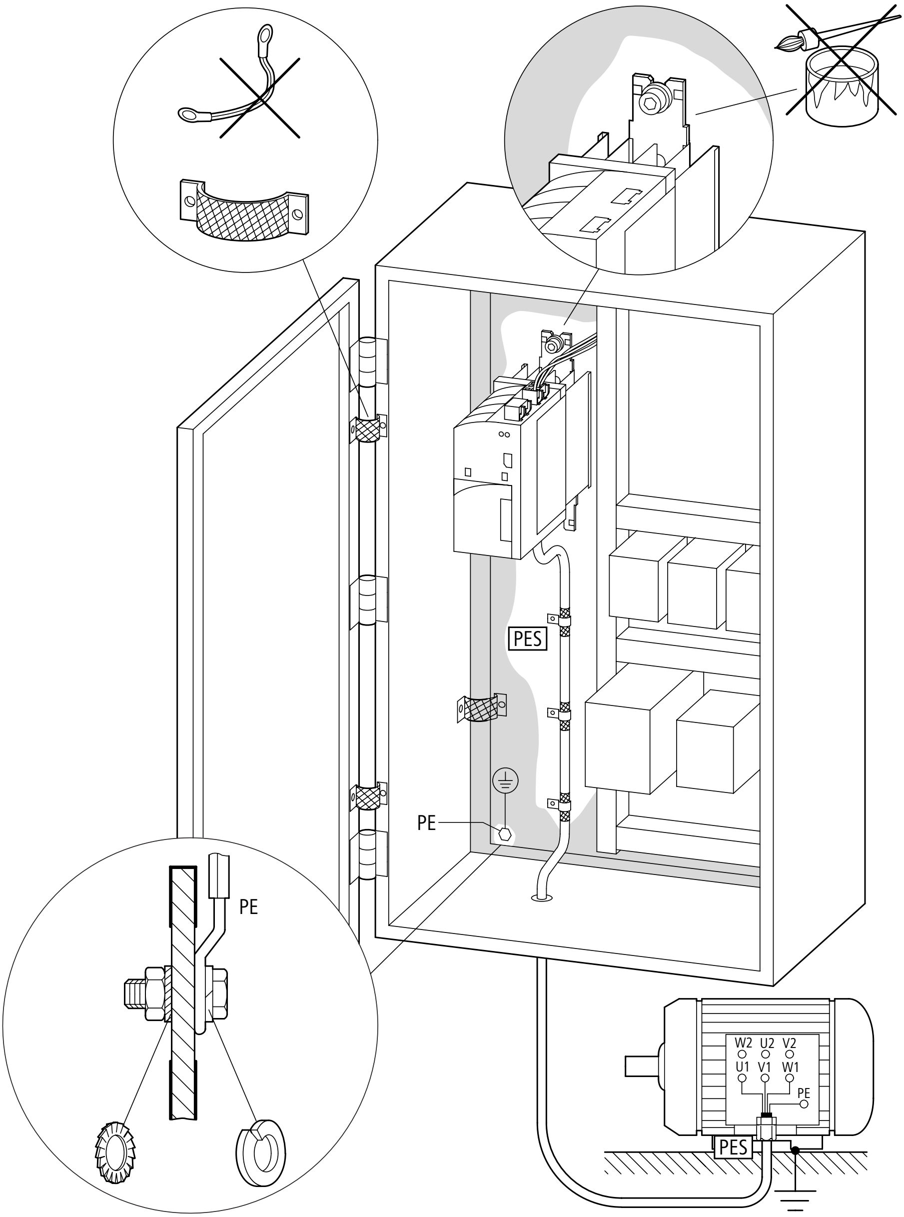


Figure 8: EMC-compliant setup

Fit additional RFI filters or mains filters and frequency inverters as closely as possible to each other and on a single metal plate (mounting plate).

Lay cables in the control cabinet as near as possible to the earth potential. Cables that hang freely act as antennas.

To prevent transfer of electromagnetic energy, lay interference-suppressed cables (e.g. mains supply before the filter) and signal lines as far away as possible (at least 10 cm) from HF-conducting cables (e.g. mains supply cable after a filter, motor power cable). This applies especially where cables are routed in parallel. Never use the same cable duct for interference-suppressed and HF cables. Where unavoidable, cables should always cross over at right angles to each other.

Never lay control or signal cables in the same duct as power cables. Analog signal cables (for transmission of readings, setpoints and correction values) must be screened.

Earthing

Connect the earth plate (mounting plate) with the protective earth using a short cable. To achieve the best results, all conducting components (frequency inverter, mains filter, motor filter, mains choke) should be connected by an HF drain wire, and the protective conductor should be laid in a star configuration from a central earthing point. §

Caution!
Because the internal filters cause increased leakage currents, you should always connect the frequency inverter via both PE terminals and the enclosure with the earth circuit.

Screening

Unscreened cables behave like aerials, i.e. they act as transmitters and receivers. To ensure EMC-compliant connection, screen all interference-emitting cables (frequency inverter/motor output) and interference-sensitive cables (analog setpoint and measured value cables).

The effectiveness of the cable screen depends on a good screen connection and a low screen impedance. Use only screens with tinned or nickel plated copper braiding: braided steel screens are unsuitable. The screen braid must have an overlap ratio of at least 70 to 80 percent and an overlap angle of 90°.

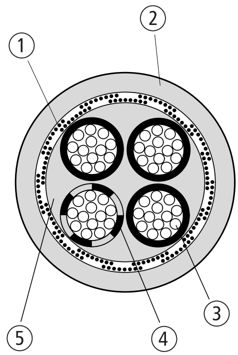


Figure 9: Sample motor cable

① Cu screen braid

② PVC outer sheath

③ Strands (Cu-strands)

④ PVC conductor insulation
3 × black, 1 × green/yellow

⑤ Textile braid and PVC inner material

The screened cable between frequency inverter and motor should be as short as possible. Connect the screen to positive earth (PES) at both ends of the cable using a large contact surface connection.

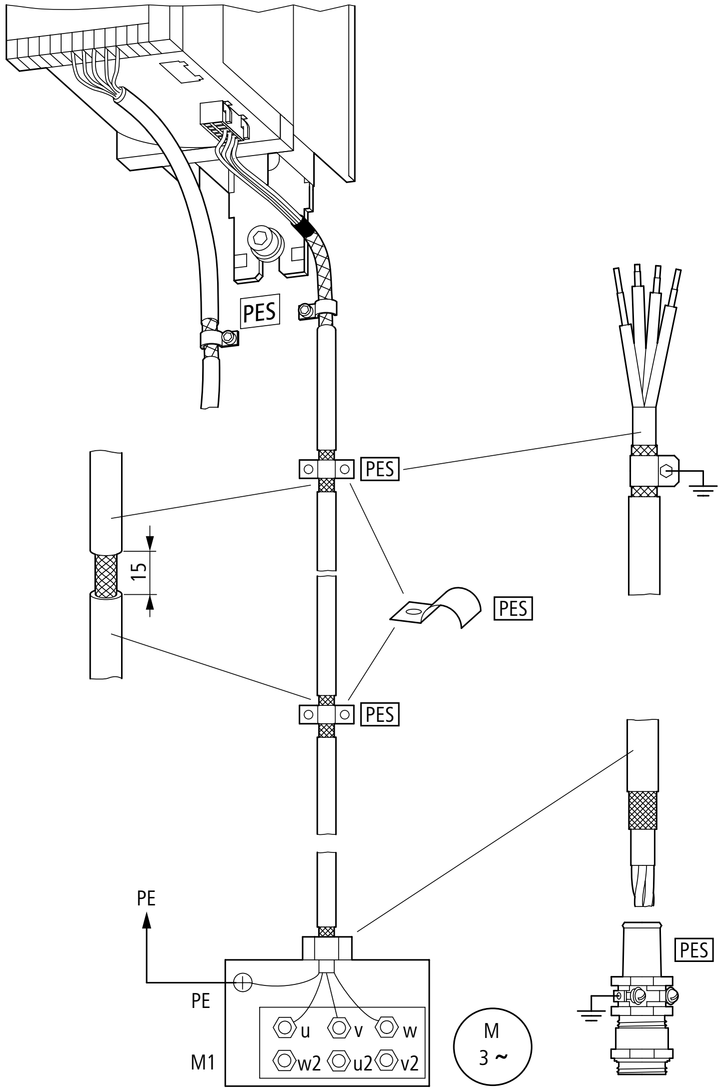


Figure 10: Connecting cable screens to PE

Never unpick the screening or use pigtails to make a connection.

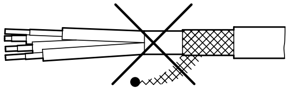


Figure 11: Inadmissible screen grounding (pigtails)

If contactors, motor protection relays, motor reactors, filters or terminals are installed in the motor cabling, interrupt the screen near these components and connect it to the mounting plate (PES) using a large contact surface connection. The free, unscreened connecting cables should not be longer then about 100 mm.

In an EMC-compliant control cabinet (metal-encased, attenuation about 10 dB), and provided that the frequency inverter and the motor cables are spatially separated from each other and housed in a separate compartment to the remaining control system, it is not necessary to screen the motor supply cable. The motor cable must then be screened across a large surface area at the control cabinet output (PES).

The control cable and signal (analog setpoint and measured value) cable screens must be connected only at one cable end. Connect the screen to earth using a large-area contact surface; ensure that the connection has a low impedance. Digital signal cable screens must be connected at both cable ends with large-surface, low-resistance connections.

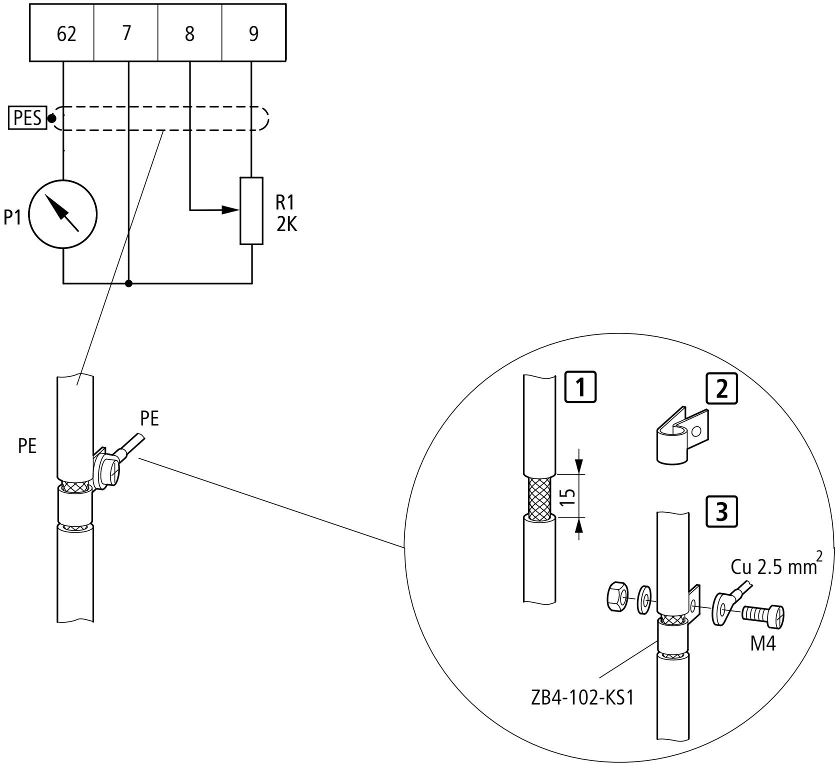


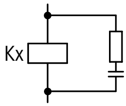
Figure 12: Connecting screens of analog signal cables

If earth potential differences are present (likely in large-scale installations and with branched system components), an additional potential equalization cable should be fitted.

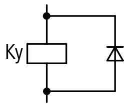
Suppressor circuit

The interference immunity of relay and transistor outputs can be increased by protecting the coils of contactors, solenoid valves, etc. with attenuators:

- AC voltage:
  Parallel connection of an RC filter
- DC voltage:
  Parallel connection of a free-wheeling diode



AC voltage



DC voltage

CE requirements for installation of the drive system

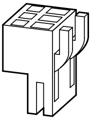
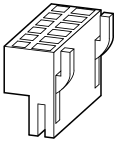
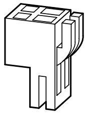
If devices that do not meet the CE requirements for interference immunity (EN 50 082-2) are operated in the vicinity of the frequency inverter, these devices can be affected by electromagnetic emissions from the frequency inverter.

Non-standard machines and installations must be tested for compliance with the EMC Directive, i.e. their adherence to the EMC limit values. These include machines and installations

- using unscreened cables
- using central interference suppression filters instead of matched radio interference suppression filters
- are operated without a mains choke

Connection in the power section

On the DV4 frequency inverters, power sections up to 2.2 kW are connected via spring-loaded plug-in terminals.

			
DV4-120-025	L1 / N / PE	PE / W / V / U / BR2 / BR1	T1 / T2
DV4-120-037	K14 / K11 / K12		
DV4-322-1K5	K14 / K11 / K12	+UG / -UG / L1 / L1 / L2/N / L3/N / PE	
DV4-322-2K2		PE / W / V / U / BR2 / BR1	
DV4-322-055		+UG / -UG / L1 / L2/N / L3 / PE	
DV4-322-075		PE / W / V / U / BR2 / BR1	
DV4-340-055			
DV4-340-075			
DV4-340-1K5			
DV4-340-2K2			

To feed the cable into the spring-loaded terminals, push the spring together using a suitable tool, e.g. a flathead screwdriver.

05/00 AWB8230-1340GB

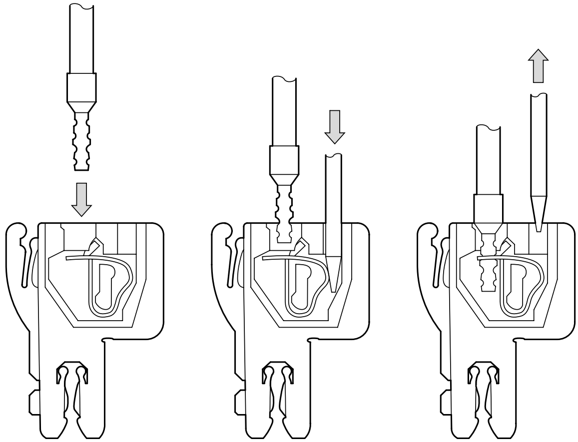
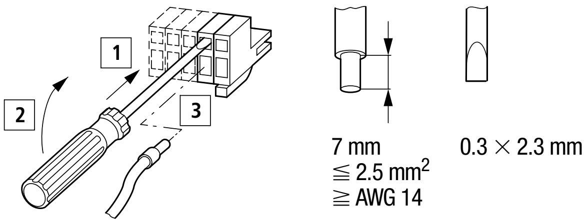


Figure 13: Spring-loaded plug-in terminals



Caution!
Fit the wires to the terminal strips before attaching the strips. Make sure that the power is switched off before inserting or removing the terminals. To ensure the mechanical an electrical safety of the terminal connectors, fit terminal strips even if they are not used.

230/240 V power section

Warning!
The DV4-120 frequency inverters must be connected only to single-phase, and the DV4-322 only to single- or three-phase networks with rated voltages of up to 240 V. Higher voltages destroy the devices.

Permissible mains voltage range:
100 V –0 % to 264 V +0 %

Warning!
The ratings listed in this manual assume a mains voltage range of 180 V –0 % to 262 V +0 %. At mains voltages below 180 V, the devices must be operated at max. 75 % of their current rating. In addition, the devices must be supplied via the assigned line reactor.

Terminals:
+UG, -UG internal DC link

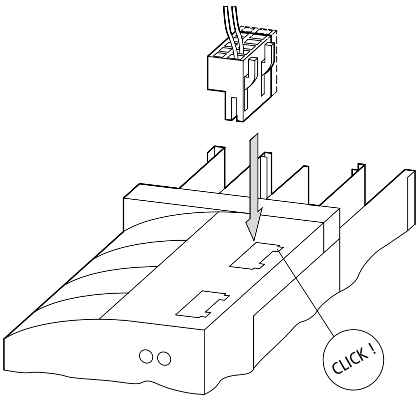
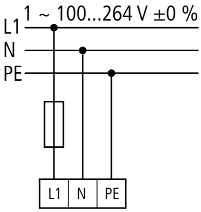
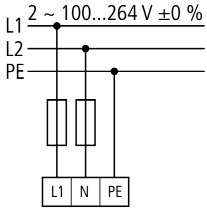
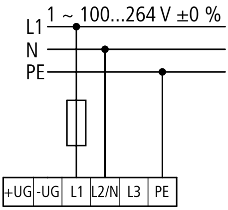
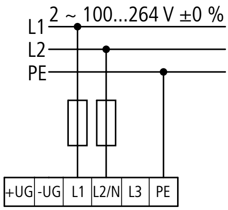
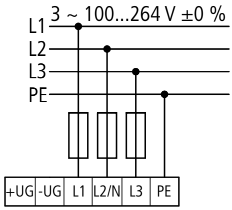
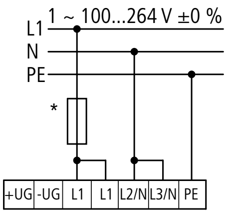
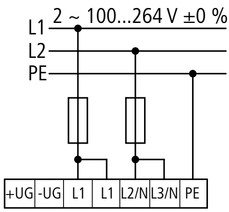
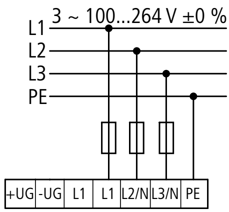
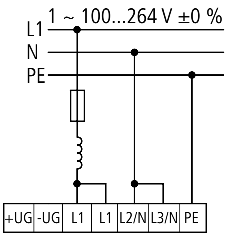
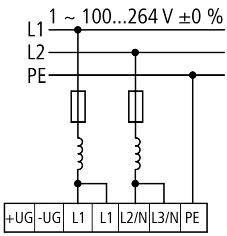
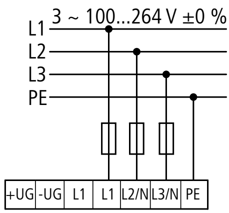
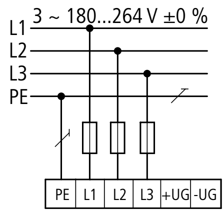
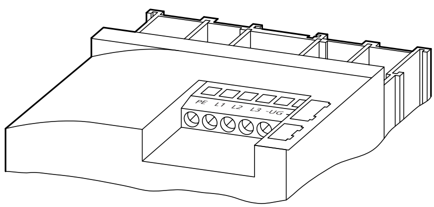


Figure 14: Connection to the power supply

DV4-120-025 DV4-120-037			
DV4-322-055 DV4-322-075			
DV4-322-1K5	 ①	 ①	
DV4-322-2K2	 ①, ②	 ①, ②	

① Connect two separate cables of at least 1.5 mm^2 (AWG 15) to the terminals.

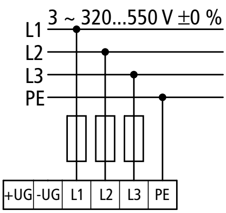
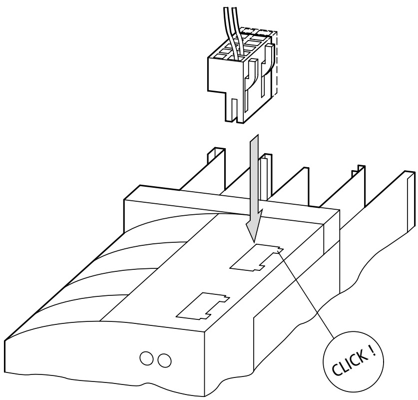
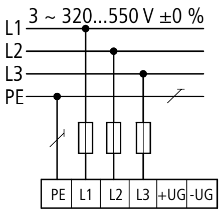
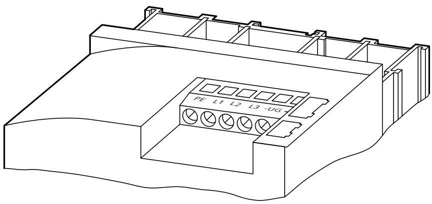
② Use only with mains choke or mains filter.

DV4-320-3K0 DV4-320-4K0 DV4-320-5K5 DV4-320-7K5		

400 V power section

Permissible mains voltage range:
320 V –0 % to 550 V +0 %

Terminals:
+UG, -UG internal DC link

DV4-340-055 DV4-340-075 DV4-340-1K5 DV4-340-2K2		
DV4-340-3K0 DV4-340-4K0 DV4-340-5K5 DV4-340-7K5 DV4-340-11K		

Connecting the relay output

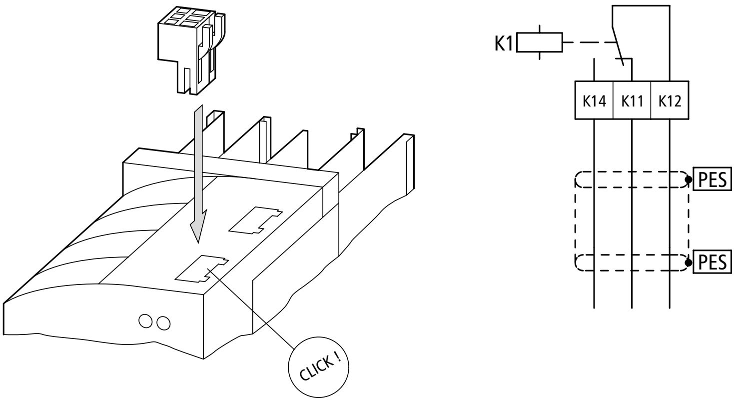


Figure 15: Relay connection

Terminal	Contact	Default setting (function)	Relay K1 energized	Technical data
K11	Break contact	Inverter ready to operate	Open	240 V/3 A single-phase 24 V DC/2 A to 200 V/0.18 A
K12	Middle contact	–	–	
K14	Make contact	Inverter ready to operate	Closed	

The function of relay K1 can be changed with PNU 0008 and 0416.

Caution!
The terminals of the relay output have a simple basic insulation (simple isolating distance). For increased shock protection, additional, external measures must be implemented.

Connecting thermistors

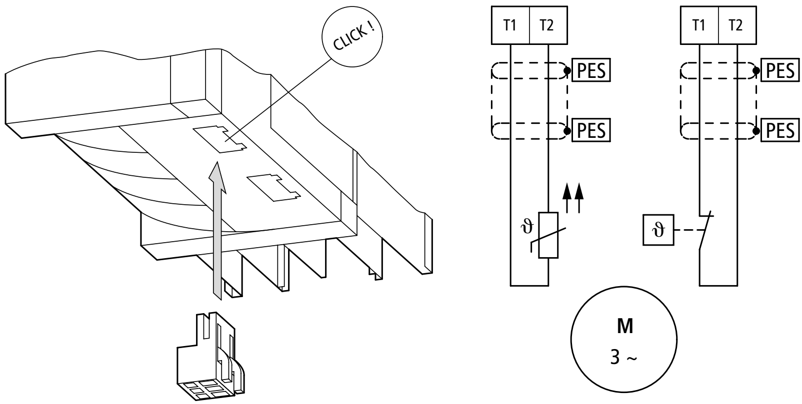


Figure 16: Thermistor connection

The input for connecting PTC thermistors for monitoring motor temperature complies with DIN 44 081 and DIN 44 082. The thermistor input can also be used for connecting a temperature switch (break contact). Thermistor input processing can be set with PNU 0119. By default, the thermistor input is deactivated.

When several motors are connected in parallel to a frequency inverter, the PTC thermistors or temperature switches can be connected in series. At a connection resistance $R \geqq 1.6\ k\Omega$, the configured error or warning message is triggered.

For a function test (PTC), the thermistor input can be protected with a variable resistor (potentiometer):

Fault or warning message at $R > 2\ k\Omega$

No message at $R < 250\ \Omega$

Motor connection output

The DV4 frequency inverters control the speed and torque of three-phase asynchronous motors.

At the DV4 frequency inverter’s output (terminals U, V, W), you must not:

- connect voltages,
- connect a capacitive load (e.g. phase compensation capacitor);
- connect other electronic devices (parallel connection of frequency inverters),
- establish a direct connection (bypass) to the frequency inverter’s input.

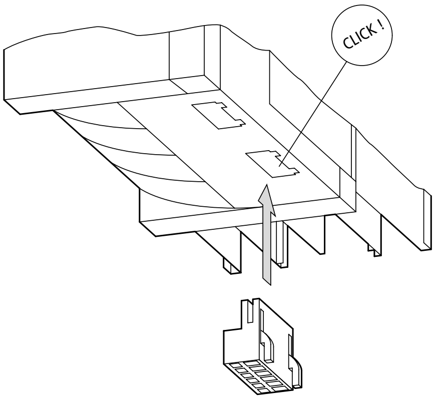


Figure 17: Connecting motors

Observe the electrical connection data (rating) on the motor’s rating plate (nameplate).

Depending on the motor’s rating, the motor’s stator winding can be connected in a star or delta configuration.

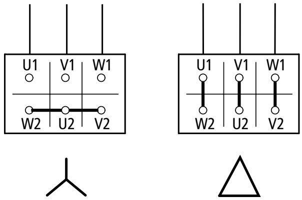


Figure 18: Circuit types

Example:

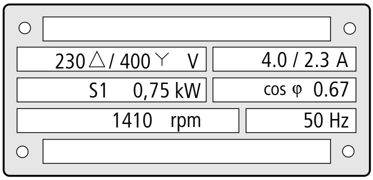


Figure 19: Motor’s rating plate

Frequency inverter	DV4-340-075	DV4-322-075
Mains voltage	400 V 3-phase	230 V single-phase
Supply current	3.3 A	9 A
Motor circuit	Star	Delta
Motor current	2.3 A	4 A
Motor voltage	0 to 400 V 3-phase	0 to 230 V 3-phase

Pole-changing three-phase motors (Dahlander motors), slipring three-phase motors (slipring inductors) or reluctance, synchronous and servomotors can be connected if they are manufacturer-approved for frequency inverter operation.

Warning!
Motors whose insulation is not suitable for use with frequency inverters can be destroyed in this type of use.

DV4 frequency inverters are factory configured for clockwise rotation of the output signal. Interconnect the motor and the frequency inverter as follows to ensure that the motor turns in a clockwise direction at the standard frequency inverter settings:

Motor	DV4
U1	U
V1	V
W1	W

Example: Star connection

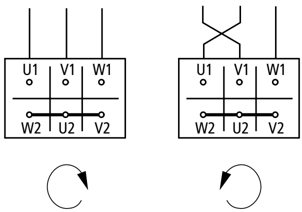


Figure 20: Direction of rotation

To reverse the motor's direction:

- swap two of the phase connections on the motor;
- apply the control signal to terminals E3 and E4 (DE4-IOM-STD-F);
- reverse the setpoint polarity (–10 to +10 V);
- configure PNU 0007 and PNU 0113 accordingly;
- set the DIP-switch on DE4-IOM-STD-F accordingly;
- change the polarity of the setpoint via the serial interface or a fieldbus connection.

The speed of a three-phase asynchronous motor is determined by the number of pole pairs and by the frequency. The output frequency of the DV4 frequency inverter is infinitely variable in the range 0 to 480 Hz.

Warning!
Operating the motor at speeds above its rated maximum speed (see rating plate) can cause mechanical damage of the motor (bearings, unbalance) and the connected machine, which may also result in dangerous operating conditions.

Caution!
Continuous operation in the lower frequency range (below about 25 Hz) can result in thermal damage (overheating) of self-ventilated motors. Possible solutions are to use a higher-rated motor or to fit a speed-independent external fan. Observe the manufacturer's operating data.

Motor reactor, d*u*/d*t* filter, sine-wave filter

Motor reactors compensate capacitive currents where long motor supply cables and group drives (several motors connected in parallel to one device) are used.

The use of motor chokes is recommended (observe motor manufacturer's data):

for three-phase asynchronous motors operated at maximum frequencies of 200 Hz or higher,

for drives with reluctance or permanently energized synchronous motors at maximum frequencies above 120 Hz.

d*u*/d*t* filters limit the voltage applied to the motor terminals to values below 500 V/µs. They should be used for motors with insulation of unknown or insufficient electrical strength.

Caution!
During configuration, keep in mind that the voltage drop at the motor choke or the d*u*/d*t* filters can be as high as four percent of the frequency inverter's output voltage.

When sine-wave filters are used, the motors are supplied with virtually sinusoidal voltage and current.

Caution!
During configuration, keep in mind that the sine-wave filter must be matched to the output voltage and the frequency inverter's clock frequency.
The voltage drop at the sine-wave filter can be up to 15 % of the frequency inverter output voltage.

Length of motor cable and admissible control mode

To ensure EMC compliance, use only screened motor cables. The length of the motor cables and the associated use of other components affect the motor control mode and the operating behaviour. The motor control mode can be configured with PNU 0014. For group drives (several motors connected to one device), the resulting cable length l_{res} must be calculated:

$$l_{res} = \text{sum of all motor cable length} \times \sqrt{\text{number of motor circuits}}$$

☞ Where long motor cables and frequency inverters with lower rated output power are used, leakage currents through parasitic cable capacitance can trigger the fault message “OCx”. Use a motor filter in these cases.

Try to keep the motor cables as short as possible since this has a positive effect on the drive’s response.

If, due to the motor’s terminal conditions, the absolute or resulting cable length is 200 m or above, contact your supplier.

Circuit types

Standard connection

In standard operation, the frequency inverter uses its internal power supply and the default settings. Screening and setup must meet EMC regulations as described in section section “EMC measures” from page 31.

Connecting motors in parallel to a frequency inverter

The DV4 frequency inverter can be used to control several motors in parallel. If the motors are to be run at different speeds, motors with a different number of pole pairs and/or gearboxes must be used.

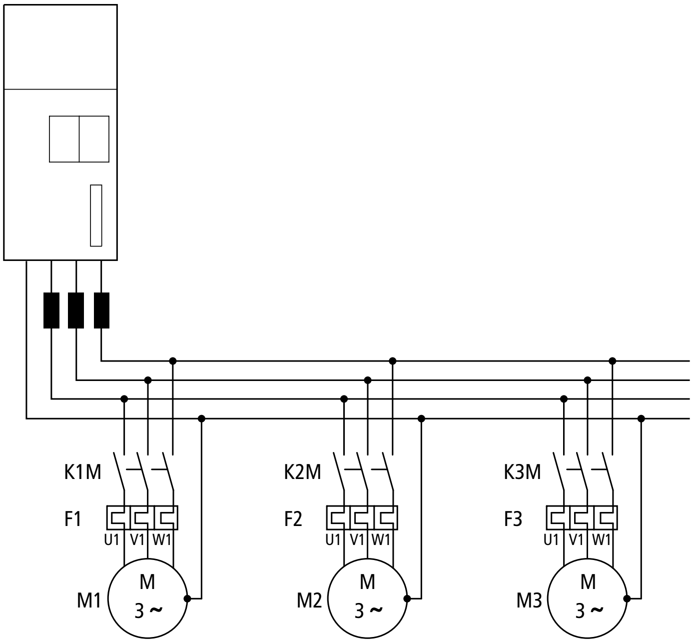


Figure 21: Parallel connection of several motors

Caution!
If you connect several motors in parallel to a single frequency inverter, you must dimension the mains contactors of each of the motors in accordance with utilization category AC-3. The mains contactors from the table in the appendix, section “Mains contactors” from page 225 are not suitable. These mains contactors are intended only for use on the infeed side of the frequency inverter. If they are used incorrectly, the contacts may weld.

If motors are connected in parallel, the load impedance at the frequency inverter output and the overall stator inductance decreases, while the stray capacitance of the cables increases. This can lead to an increased current distortion compared to single motors. To reduce current distortion, use chokes or sine-wave filters at the frequency inverter’s output.

The total current consumption of all connected motors must not exceed the frequency inverter’s rated output current I_{2N}.

If several motors are connected in parallel, electronic motor protection cannot be used. You must protect each motor separately with a thermistor and/or a bimetal relay.

If motors with large differences in rated output (e.g. 1.5 kW and 11 kW) are connected in parallel to the output of a frequency inverter, problems may arise at startup and at low speeds. In some cases, the motor with the smaller rated output may be unable to produce the required torque. Due to the relatively large resistive load in the stators of these motors, they require a higher voltage during startup and at low speeds.

Operation with interconnected internal DC link

Where several frequency inverters are used in parallel with interconnected internal DC links, DC energy can be exchanged between the motors. If one or more of the frequency inverters are operated in regenerative mode (braking mode), energy is recovered and fed back to the common DC link and/or back to the DC power feed. The energy can then be used by the interconnected frequency inverters that are operating in drive mode. This allows a reduced use of brake units and reduces power consumption.

If you are using frequency inverters with internal DC links, you must only connect frequency inverters whose DC link voltage is in the same range, e.g. 140 to 360 V DC or 450 to 620 V DC. The power connections to the common DC rail must be kept short.

From the table in the appendix, section “Fuses and cable cross-sections” from page 231, select the cable cross-section for +UG/–UG.

A low cable inductance can be achieved by using several DC linkbars connected in parallel and using several power cables in parallel between the frequency inverters and the shared DC linkbar. If necessary, twist the cables.

Use only assigned mains chokes/mains filters and DC link fuses.

Make sure that the mains supply to all interconnected frequency inverters can be switched on simultaneously.

☞ For DV4-120 series frequency inverters, make sure that the same phase connections are made on each one.

☞ To use frequency inverters of different series in interconnected operation, please contact the supplier for further details.

Interconnected operation, DV4-120-...

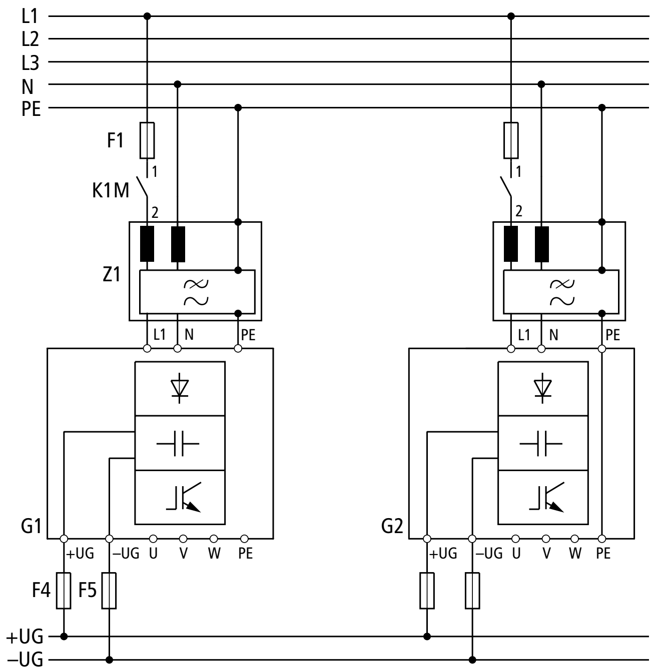


Figure 22: Single-phase AC supply with interconnected DC link

K1M	Mains contactor: use single-phase when supplied with 2 AC; PE; 190 to 260 V ±0 %; 45 to 65 Hz ±0 %
F1	Line protection: use single-phase when supplied with 2-phase AC; PE; 190 to 260 V ±0 %; 45 to 65 Hz ±0 %
F4, F5	Device protection on DC level
Z1	Mains choke/mains filter
G1, G2	Frequency inverter

Caution!
The contacts of all mains contactors must switch simultaneously. The input rectifier may otherwise be destroyed due to multiplication of the charging currents.

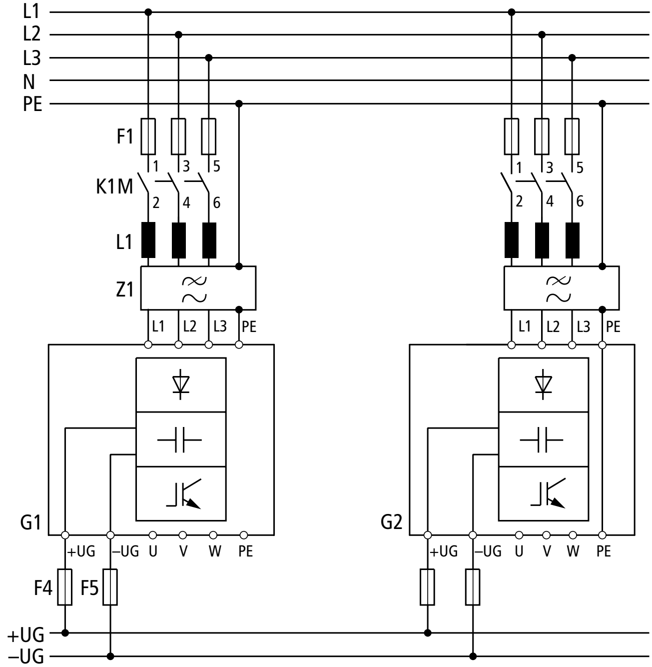


Figure 23: Single-phase AC supply with interconnected DC link

K1M	Mains contactor
F1	Line protection
F4, F5	Device protection on DC level
L1	Mains choke/mains filter
G1, G2	Frequency inverter
Z1	Radio interference suppression filter

Supply with DC voltage

Warning!
If the devices are supplied from a DC source, the voltage characteristics between +UG and PE, and between –UG and PE must be symmetrical. Earthing +UG or –UG destroys the frequency inverters.

3 Functional Description

Basic unit DV4...

Connect the frequency inverter according to the installation instructions and as described in chapter “Engineering”.

Parameter setting

You can set the parameters with the DE4-KEY-3 or DE4-KEY-H3 LCD keypad or the interface module. For further information, see sections “LCD keypad DE4-KEY-...”, “DE4-IOM-STD-F input/ output module” and chapter “Setting Parameters”.

Automation and function interface

The DV4 frequency inverters each have two interfaces for plug-in modules:

- AIF (automation interface), open interface,
- FIF (function interface), internal interface.

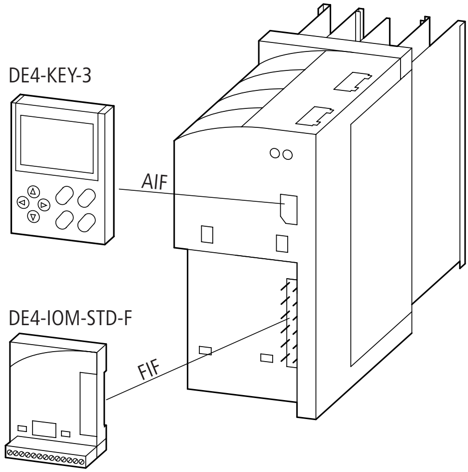


Figure 24: AIF and FIF

> The basic version of the DV4 frequency inverter is not equipped with control signal terminals. For frequency inverter operation, control signal terminals must be fitted to the DV4.

This manual describes the function of the DV4 with the standard DE4-IOM-STD-F I/O module. Insert this module in the FIF slot.

Via the internal FIF, an optional function module can be connected to the DV4's central processing unit (CPU). When the DV4 is switched on, voltage at network potential is supplied to the FIF. In the basic version of the DV4, the FIF is covered with two plastic caps. The inner cap contains a jumper to enable operation without control signal terminals.

Warning!
The DV4 frequency inverter must always be disconnected from power before modules are connected to or removed from the FIF. This also applies for removing the plastic covers on the basic version.

The DV4 frequency inverter must not be operated with an open FIF.

Note that the DV4 and the FIF can still carry dangerous voltages for up to three minutes after the power supply is switched off.

Work on the FIF must be carried out only by qualified personnel.

The open AIF (automation interface) allows connection and removal of modules during operation (while supply voltage is applied). Here, communication modules, such as an LCD keypad or fieldbus interfaces, can be connected.

Internal power feed

DV4 frequency inverters are supplied internally by the DC link via a switched-mode power supply. The supply voltage is fed to the internal FIF and the user AIF.

The FIF and AIF supply voltages are floating and

> **Warning!**
> Beside the floating supply voltage, the FIF interface also carries hazardous mains voltages.

isolated from each other. A double basic isolation is provided from the internal DC link voltage.

Communication modules (bus interface, serial interfaces) require voltage sources with a higher load rating to operate. The DV4 can provide this voltage through the AIF. The left row of pins of the AIF is configured as a switch for this purpose. On delivery, the middle and the upper pins are jumpered. To reroute the 20 volt FIF supply to the AIF, move this jumper to the middle and lower pins. This allows all DE4 communication modules to be supplied through the DV4’s AIF:

- DE4-COM-2X (RS232 or RS485)
- DE4-NET-K (Suconet K)
- DE4-NET-DP (PROFIBUS-DP)
- DE4-NET-S (INTERBUS)

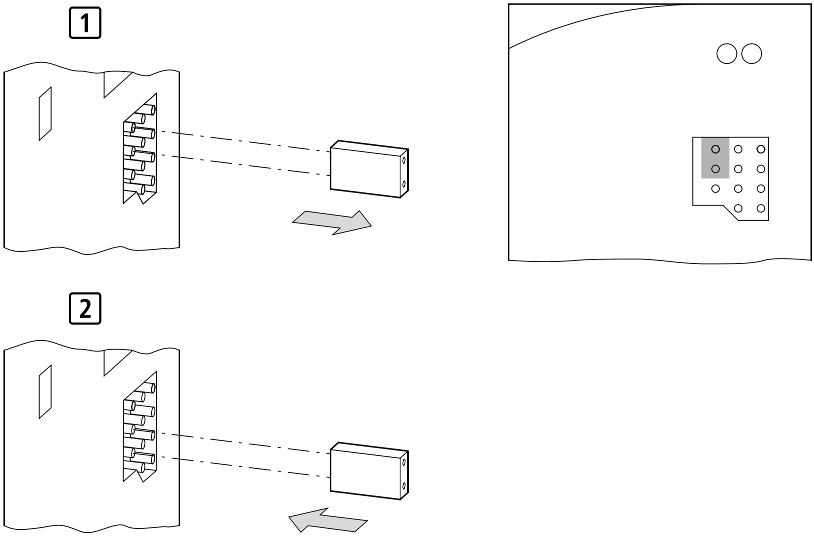


Figure 25: Jumper on AIF

DE4-IOM-STD-F input/output module

The DE4-IOM-STD-F input/output module enables digital and analog control of the DV4 frequency inverters. It contains a plug-in screw terminal strip with 13 terminals for the following functions:

- One analog input: 0 to +5 V, 0 to +10 V, –10 to +10 V, 0 to 20 mA, 4 to 20 mA, 4 to 20 mA open-circuit monitored
- One analog output: 0 to +10 V
- Five digital inputs
- One digital output (transistor)
- Voltage outputs: +5.2 V (supply voltage for setpoint potentiometer), +20 V (control voltage)

The analog and digital inputs and outputs are galvanically isolated. Their functions can be individually defined with parameters.

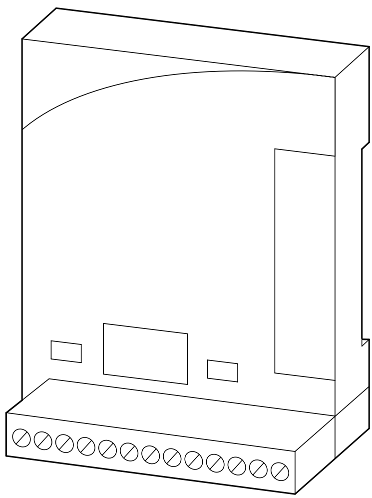


Figure 26: Standard input/output module

Type code

DE4 - IOM - STD - F

Type code suffix
F = function interface (FIF) slot

Counter, version, technical specifications
STD = standard

Type code
IOM = input/output module

Family name:
Drives **E**xtension unit, generation **4**

Fitting and removing the DE4-IOM-STD-F input/ output module

Warning!
The DV4 must be voltage-free before the DE4-IOM-STD-F input/output module is connected to or removed from the FIF.

Remove the outer protective cover with the enclosed screwdriver and keep in a safe place.

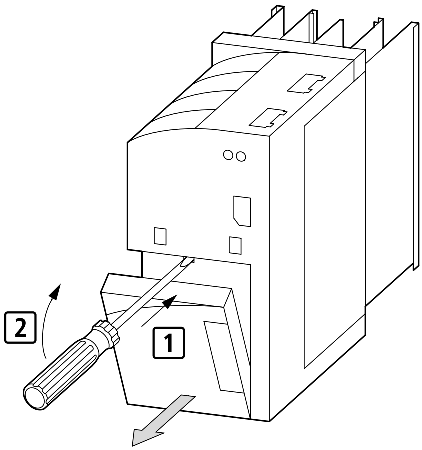


Figure 27: Removing the protective cover

Remove the FIF cover and keep it in a safe place.

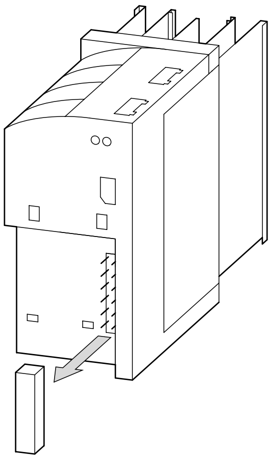


Figure 28: Removing the protective cover

Fit the DE4-IOM-STD-F to the FIF without terminal connections.

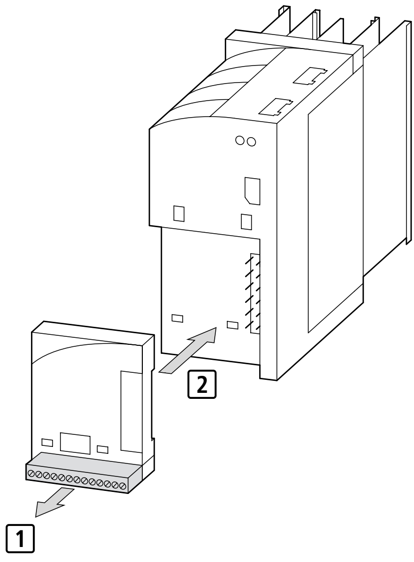


Figure 29: Fitting module

Terminal assignment
External connection of the DE4-IOM-STD-F I/O module is via a plug-in screw terminal strip. The terminals are floating and galvanically isolated from each other.

The following function blocks can be accessed through the I/O terminals:

Analog/digital converter

Internal device power supply

Digital control inputs

Transistor output

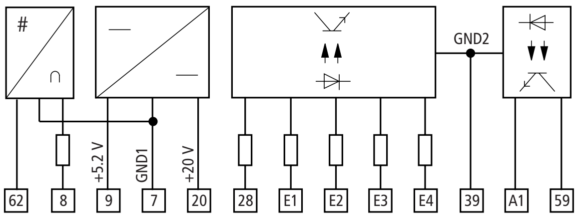


Figure 30: Terminal assignment

No.	Function	Name	Level	Default setting	Technical data, notes
7	Reference potential for analog signals	GND1	0 V	–	Isolated from terminal 39 (GND2)
8	Analog input		0 to +5 V 0 to +10 V –10 to +10 V 0 to 20 mA 4 to 20 mA 4 to 20 mA, open-circuit monitored	0 to +10 V	Voltage input $R_i \geqq 50$ kΩ Current input $R_B = 250$ Ω (load) Max. input current: 2 mA, Resolution: 10 bit, Linearity error: ±0.5 %, Temperature dependency: 0.3 % (0 to +60 °C), Range changeover with DIP switch and PNU 0034
9	Output, stabilized DC voltage source for setpoint potentiometer	V_{REF}	+5.2 V	–	Load rating: max. 10 mA Reference: Terminal 7 (GND1)

No.	Function	Name	Level	Default setting	Technical data, notes
20	Output, DC voltage source for driving digital inputs and outputs	V_{B20}	+20 V	–	Load rating: max. 40 mA = ΣI Reference: Terminal 7 (GND1) (connect terminal 7 with 39 (GND2)) $\Sigma I = I_{E1} + I_{E2} + I_{E3} + I_{E4} + I_{28} + I_{59}$
28	Digital input	EN	HIGH = +12 to +30 V, LOW = 0 to +3 V		Controller inhibit, HIGH = Start, R_i = 3k3, EN = Enable
39	Reference potential for digital signals	GND2	0 V	–	Isolated from terminal 7 (GND1)
59	DC supply input for A1		0/+20 V 0/+24 V	–	20 V from terminal 20 or 24 V from external voltage source
62	Analog output		0 to +10 V	Output frequency	Load rating: max. 2 mA, Resolution: 10 bit, Linearity error: ±0.5 %, Temperature dependency: 0.3 % (0 to 60 °C)
A1	Digital output	DIGOUT	0/U_{59}	Inverter ready to operate	V_{59} = +20 V for DC supply of terminal 20, max. 10 mA, V_{59} = +24 V for external DC supply, max. 50 mA Reference: terminal 39 (GND2)
E1	Digital input	DIGIN1	HIGH = +12 to +30 V, LOW = 0 to +3 V	FF1 (FF3)	PLC level, HTL, R_i = 3k3, HIGH = DCB = DC braking HIGH = CCW = counter-clockwise rotation, CW = clockwise rotation, direction reversal
E2	Digital input	DIGIN2		FF2 (FF3)	
E3	Digital input	DIGIN3		DCB	
E4	Digital input	DIGIN4		CW/CCW	

Connections for plug-in screw terminals

n	mm²	mm²	AWG	mm²	mm²
1×	0.14 to 1.5	0.14 to 1.5	28 to 16	0.25 to 0.5	0.25 to 1.5
2×	0.14 to 0.75	0.14 to 0.5	–	TWIN 0.5	0.25 to 0.34

It is advisable to wire up the screw terminals before attaching the terminal strip to the fitted module.

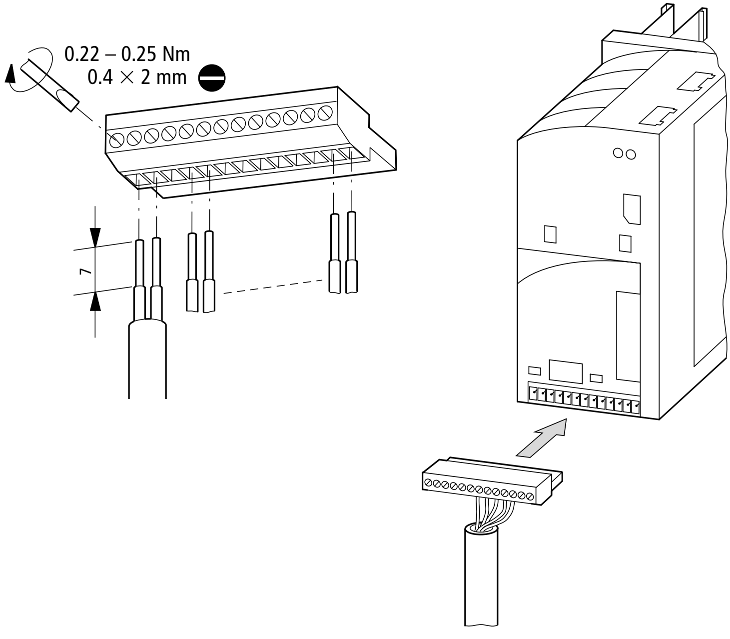


Figure 31: Wire up control signal terminals before plugging them in

Control voltages

The DV4 frequency inverters supply two internal control voltages via the DE4-IOM-STD-F module:

Terminal 9 – for the analog setpoint input (supply voltage for potentiometer)

Terminal 20 – for Enable signals (control inputs) and for the transistor output

Terminal 7 – is the zero potential for both signals

Terminal	Output voltage	Load rating
9	+5.2 V	max. 10 mA
20	+20 V	max. 40 mA $= \Sigma I = I_{E1} + I_{E2} + I_{E3} + I_{E4} + I_{28} + I_{59}$

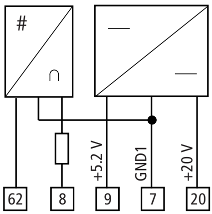


Figure 32: Terminal assignment

Earthing the zero potentials

To increase immunity to interference, it is advisable to earth the zero potentials. A cable cross-section of at least 1.5 mm^2 (AWG 16) should be used for this purpose. If terminals E1 to E4 and terminal 28 are supplied by the internal power feed (terminal 20), the voltage regulator's zero potential (terminal 7) and the zero potential of the control signal inputs (terminal 39) must be interconnected.

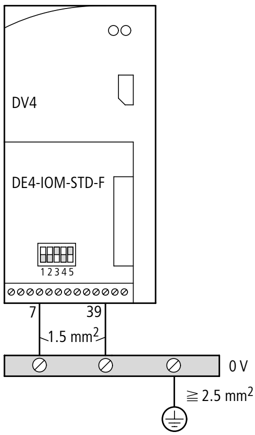


Figure 33: Connection for the zero potential

If several frequency inverters or PLCs are to be used in an installation, the zero potentials of each device must be interconnected point-to-point in a star configuration. Each of the devices must have a common earth at the “weakest” element, e.g. a PLC.

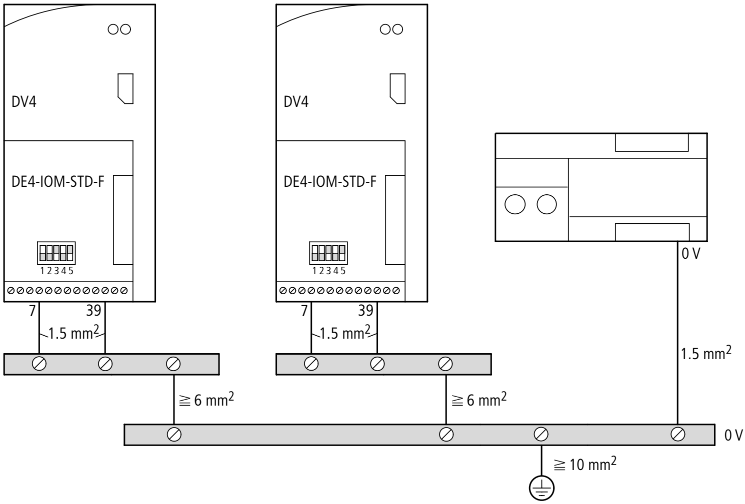


Figure 34: Earthing with star arrangement

Required minimum wiring for frequency inverter operation

DV4 frequency inverters can only function if terminal 28 of the DE4-IOM-STD-F I/O module is HIGH (+12 to +30 V).

Possible controller enable signals via terminal 28 (EN = Enable):

- of the internal control voltage of terminal 20 (+20 V)
- with an external control voltage (+24 V)

Reference point for terminal 28 is terminal 39 (GND2).

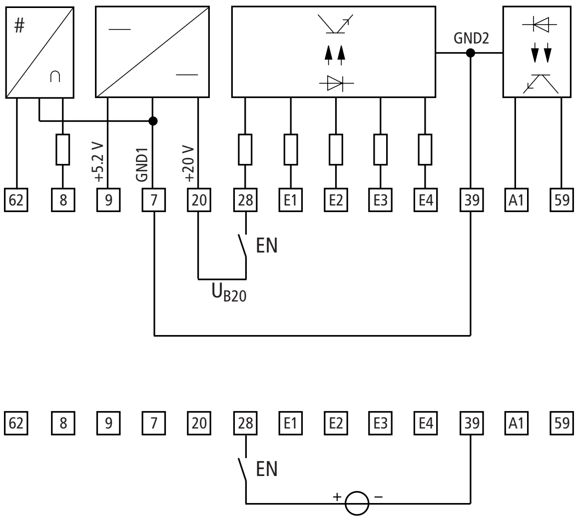


Figure 35: Minimum required wiring with internal or external control voltage

Digital Inputs, PLC interconnection

The digital inputs of I/O module DE4-IOM-STD-F (DV4) allow a direct connection with a programmable logic controller (PLC). To increase interference immunity, it is advisable to earth the zero potential of the control signal inputs (terminal 39) through an unpolarized capacitor (0.1 µF, 250 V DC).

If terminals E1 to E4 and terminal 28 are supplied with external voltage from a PLC, the zero potential of the PLC and the zero potential of the control signal inputs (terminal 39) must be interconnected.

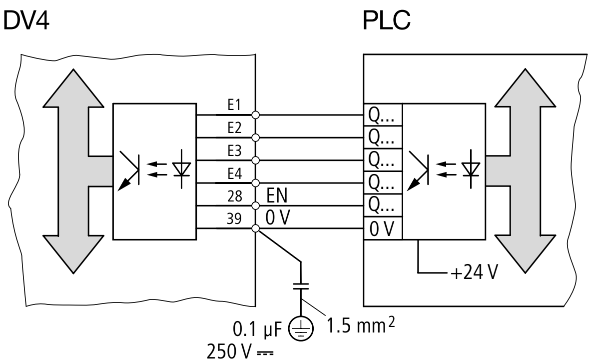


Figure 36: Protective circuit for PLC interconnection

If several frequency inverters in an installation are to be controlled by one PLC, the zero potentials of each device must be interconnected point-to-point in a star configuration. The devices must have a common earth at the “weakest” element, i.e. the PLC. In addition, terminal 39 must be capacitively earthed at each frequency inverter. The zero potential of the PLC can be directly earthed.

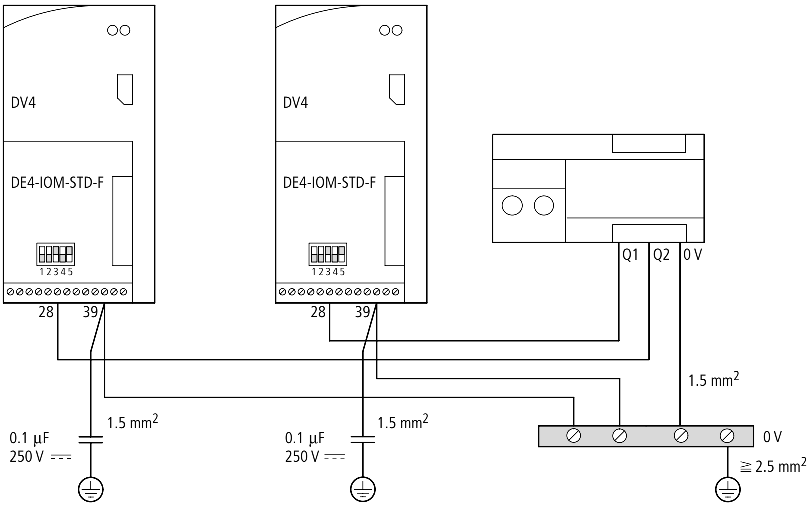


Figure 37: Grounding when a PLC is used

Frequency input E1

Digital input E1 of the DE4-IOM-STD-F can be used as frequency input. Terminal 39 is the reference point. The function must be activated with PNU 0113/024 or 0007 (f-In) and PNU 0005 (setpoint, actual value). The input frequency (0 and 10 kHz) can be set with PNU 0425.

The applied frequency signal must fulfill the following requirements:

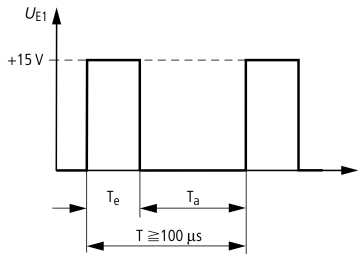


Figure 38: Admissible pulse form

T_e = HIGH: +12 to +30 V

T_a = LOW: 0 to +3 V

Pulse duty factor: T_e: T_a = 1:1 to 1:5

Speed control (frequency input E1)

Determining the actual frequency (output frequency of the encoder):

Select the number of pulses per revolution so as to maximize the output frequency. Sufficiently dynamic control is achieved when the output frequency of the pulse generator (f_{actual}) is 0.5 kHz at the motor's rated speed.

Determining the actual value frequency (output frequency of the pulse generator):

$$f_{actual} = \frac{z \times n}{60}$$

z = number of pulses per revolution (generator cams)

n = Speed of the detector [min^{-1}]

f_{actual} =output frequency of detector [Hz]

Example:

Speed control with a 3-wire sensor (Moeller ATI). DC supply from terminal 20 (DE4-IOM-STD-F). Observe the maximum load applied at terminal 20.

Recommendation: Sensor with a power consumption less than 20 mA.

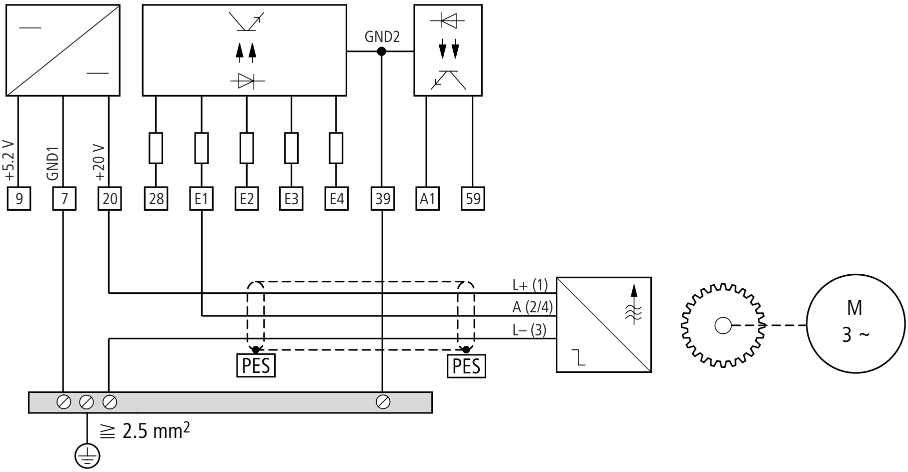


Figure 39: Speed control with 3-wire sensor

Example:

Pulse generator with external power supply

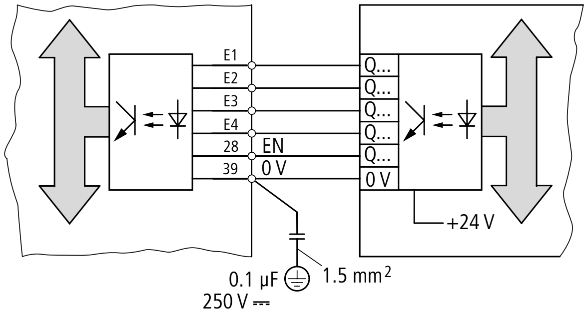
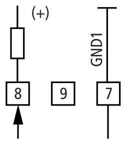
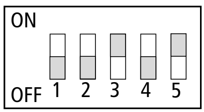


Figure 40: Speed control with pulse generator

Analog setpoint input

Analog setpoints can be entered via terminal 8 of the DE4-IOM-STD-F. Terminal 7 is the reference point.





AIN1	**1**	**2**	**3**	**4**	**5**	**PNU 0034**
0 to +5 V	OFF	OFF	ON	OFF	OFF	0
0 to +10 V	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**0 (default)**
0 to 20 mA	OFF	OFF	ON	ON	OFF	0
4 to 20 mA	OFF	OFF	ON	ON	OFF	1
4 to 20 mA ocm	OFF	OFF	ON	ON	OFF	3
–10 to +10 V	ON	ON	OFF	OFF	OFF	2

ocm = open-circuit-monitored

The range and function of the analog input can be freely configured (PNU 0005 and 0034).

☞ Parameter 0034 and the DIP switch must be set to the same range, otherwise the setpoint signal will be interpreted incorrectly.

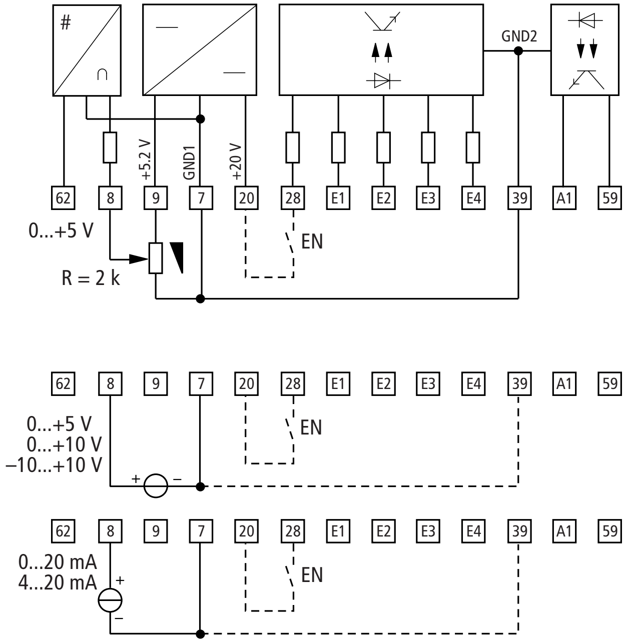


Figure 41: Wiring example: analog setpoint input

☞ To increase interference immunity, all analog signal cables should be screened and the screen should be earthed with a large surface-area connection near the setpoint source at one cable end.

Reference variable for several drives

Example: analog setpoint voltage

- Preferred value for external potentiometer: 2 kW
- Load rating of terminal 9 (DE4-IOM-STD-F): max. 10 mA
- Max. input current per device: approx. 1 mA ($R_i > 50\ k\Omega$)

Example: current setpoint (4 to 20 mA)

- Internal load resistance of the DV4: 250 Ohm

Warning!
The zero potential (terminal 7) of the DE4-IOM-STD-F must not be earthed in this device configuration. It may be necessary to galvanically isolate the current setpoint.

Analog output

An analog signal of 0 to +10 V is available at terminal 62 of the DE4-IOM-STD-F. Terminal 7 is the reference point.

Terminal 62 enables the direct connection of an analog measuring instrument. The output signal is freely programmable with PNU 0111. By default, a signal proportional to the output frequency is produced, 0 to +10 V corresponding to 0 to 50 Hz (f_{max}).

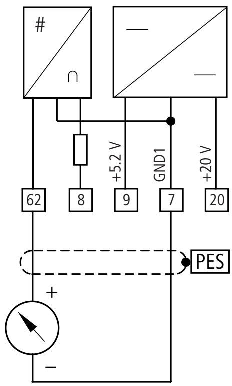


Figure 42: Monitor signal

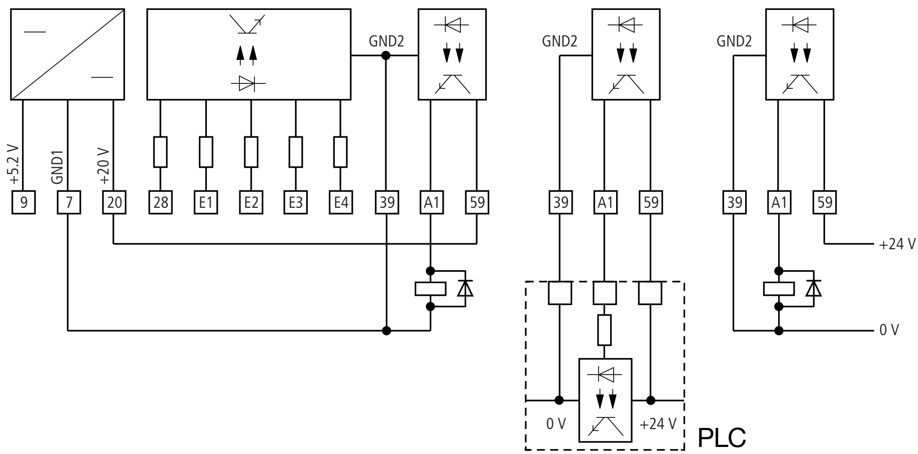
Digital output

The digital transistor output (terminal A1) of the DE4-IOM-STD-F allows direct application of the control signal to a PLC input or an external relay. The possible current load depends on the voltage source used at terminal 59:

10 mA at +20 V for the internal voltage source (terminal 20). Precondition: Reference point GND2 (terminal 39) and GND1 (terminal 7) must be interconnected in this case.

50 mA at +24 V for an external voltage source. Precondition: Reference point GND2 (terminal 39) must be connected to zero potential of the external source.

The function of the digital output is freely programmable (PNU 0117 and 0416). The default is fault message TRIP (DCTRL-TRIP).



Internal voltage source

External voltage sources

Figure 43: Digital output

LCD keypad DE4-KEY-...

Basic operation

The frequency inverter can be configured for specific applications. The configuration settings are arranged in parameters and subindices.

The parameters can be configured either with the DE4-KEY-3 or DE4-KEY-H3 LCD keypad or using interface modules. The LCD keypad and the interface modules are both available as accessories. The basic unit does not have digital or analog inputs and outputs. These I/Os are available with accessory modules DE4-IOM-STD-F and DE4-IOM-APP-F.

☞ The parameters and functions associated with the device's analog and digital inputs and outputs (except for relay output K1 and the PTC input) can be used only in connection with accessory modules DE4-IOM-STD-F and DE4-IOM-APP-F.

☞ For a detailed description of the individual parameters and functions, see chapter "Setting Parameters".

The parameter table can be found in the appendix (from page 256).

For the purpose of accepting parameter value changes, parameters fall into one of three categories:

Acceptance without confirmation
The values of these parameters are accepted permanently as soon as they are changed.
In the parameter table in the appendix (from page 256), these parameters are marked **ONLINE**.

Acceptance with confirmation
The device accepts the changed parameter value only after the ENTER key is pressed.
In the parameter table in the appendix (from page 256), these parameters are marked **ENTER**.

Acceptance with confirmation on controller inhibit
The changed parameter value is accepted only when the frequency inverter is disabled and after the ENTER key is pressed.
In the parameter table in the appendix (from page 256), these parameters are marked **ENTER+IMP**.

Symbols and function keys

Function keys

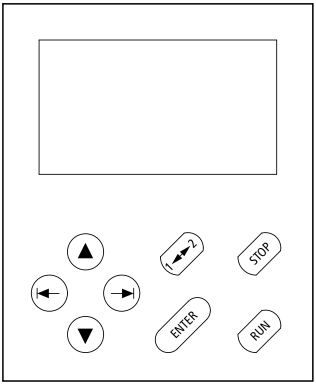


Figure 44: LCD keypad DE4-KEY-3

Function keys

Key	Function	Notes
RUN	Enable frequency inverter or start drive	Controller inhibit cancelled: terminal 28 = HIGH
STOP	Disable frequency inverter CINH or quickstop (QSP)	STOP key function configured with PNU 0469
1↔2	Function bar changeover	Changeover between function bars 1 and 2
⇤ ⇥	Changeover right/left in the active function bar	Highlight the selected function
▲ ▼	Increase or reduce selected value For fast change: keep key pressed	Only flashing parameter values can be modified
ENTER	Save parameter values	Parameters with a flashing ⯁ must be saved before they are accepted
	STORE on the display indicates that the values have been saved	Parameters without flashing ⯁ are accepted automatically when they are modified
		Parameters without ⯁ are for display only and cannot be modified

Display elements

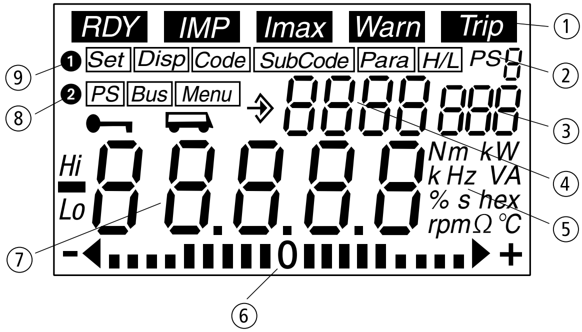


Figure 45: Display elements

① Status indicators
② Active parameter set to be edited
③ Subindex
④ Parameter number
⑤ Parameter unit
⑥ Bar graph display
⑦ Parameter value
⑧ Function bar 2
⑨ Function bar 1

Display only	Function	Note
Status indicators		
RDY	Device is ready for operation	–
IMP	Impulse disable is active	Power outputs are disabled
Imax	Current limit has been exceeded	Current limit settings in PNU 0022 (drive), PNU 0023 (regenerative)
Warn	Warning active	e.g. PTC input active
Trip	Fault active	Device is in fault status
Bar graph display		
	Display in percent of the current parameter value set with PNU 0004	Default setting: PNU 0056 = device capacity utilization Indicated range –180 to +180 % (each segment is equal to 20 %)

Display only	Function	Note
Function bar 1		
Set	Setpoint input is made with LCD keypad (PNU 0140)	Not possible when password protection is active (display = LOC)
Disp	Display functions: Memory location 1 of the USER menu (parameter value of PNU 0517/001) For execution of active parameter set	Active each time supply is switched on
Code	Parameter selection	The active parameter number is displayed as a 4-digit number (PNUXXXX _ _ _)
SubCode	Subindex selection	The active subindex is displayed with 3 digits (PNU_ _ _ _ xxx)
Para	Change of active parameter or Subindex	The current value is displayed with 5 digits
H/L	Values with more than 5 digits are displayed	H = higher digits "HI" displayed L = lower digits "LO" displayed
Function bar 2		
PS	Selection of parameter sets 1 to 4	Indication of selected parameter set only for changing parameters The parameter set can be activated only via the control signal terminals (PNU 0007, 0113/013, /014).
Bus	Reserved	
Menu	Menu selection	USER menu: list of parameters selected with PNU 0517 Always active when power is on
		ALL Menu: list of all parameters
		FUNCI: Only specific parameters for expansion modules

In combination with the LCD keypad, the DV4 frequency inverters have a USER menu and an ALL menu. Their default values are chosen so that it is not usually necessary to make changes for standard applications.

Once the mains power is switched on and the LCD keypad connected, the initialization phase begins, which takes several seconds. Initially, the USER menu is active.

If the default settings have not been changed, the current output frequency (PNU 0050) is displayed:

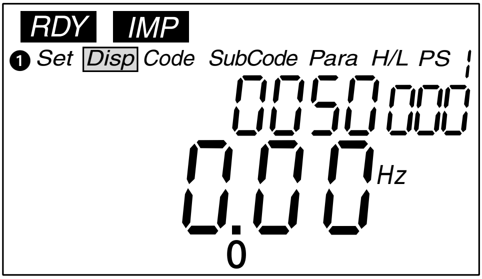


Figure 46: Display with default settings

The USER menu

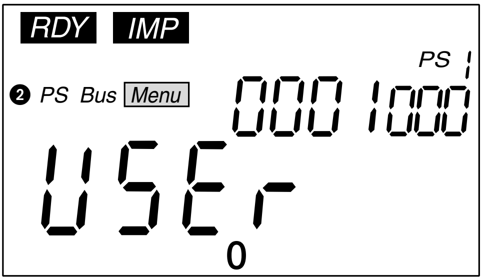


Figure 47: Viewing User menu entries

The USER menu lists 10 parameters from the ALL menu (see table below),

providing quick access to the most important functions. These menus can be customized for specific applications (see PNU 0517).

Ten memory locations are available in PNU 0517 for this purpose. Here, the numbers of the parameters to be displayed can be specified (see example "Changing the USER menu").

With additional password protection (see PNU 0094), access can be restricted to the parameters listed in the USER menu.

Loading defaults

With a parameter set transfer (PNU 0002), the device can be reset to its default settings (see table below).

Default settings in USER menu:

PNU	Default settings			
	Parameter value			
Display				
0050	–	–480 to +480 Hz	Display only	Present output frequency f_2
Setpoint input range				
0034	0	0 to +5 V, 0 to +10 V or 0 to +20 mA	Terminal 8	Input 8[1]
Digital inputs[1]				
0007	0	FF1/3	Terminal E1	HIGH = fixed frequency 1 = 20 Hz
		FF2/3	Terminal E2	HIGH = fixed frequency 2 = 30 Hz E1+E2 = HIGH = fixed frequency 3 = 40 Hz
		DCB	Terminal E3	HIGH = DC braking active
		R/L	Terminal E4	LOW = clockwise rotation HIGH = anticlockwise rotation
Speed limitation				
0010	0.00 Hz	f_{min}		Minimum output frequency
0011	50.00 Hz	f_{max}		Maximum output frequency

PNU	Default settings		
	Parameter value		
Drive parameters			
0012	5.00 s	+a	Acceleration time
0013	5.00 s	–a	Deceleration time
0015	50.00 Hz	*V/f* rated frequency	transition frequency of *V/f* characteristic
0016	0.00 %	V_{min} pull up	Pull up of motor voltage
Parameter set transfer			
0002	0	Function executed	Parameter transfer completed
		1 = default setting ⇒ PAR1	Overwrite parameter set 1 with default setting
		2 = default setting ⇒ PAR2	Overwrite parameter set 2 with default setting
		3 = default setting ⇒ PAR3	Overwrite parameter set 3 with default setting
		4 = default setting ⇒ PAR4	Overwrite parameter set 4 with default setting
		10 = LCD keypad ⇒ PAR1 to PAR4	Overwrite all parameter sets (1 to 4) with data from the LCD keypad
		11 = LCD keypad ⇒ PAR1	Overwrite selected parameter set (one of 4) with data from the LCD keypad
		12 = LCD keypad ⇒ PAR2	
		13 = LCD keypad ⇒ PAR3	
		14 = LCD keypad ⇒ PAR4	
		20 = PAR1 to PAR4 ⇒ LCD keypad	Copy all parameter sets (1 to 4) to the LCD keypad

1) Function only available with module DE4-IOM-STD-F

Viewing USER menu entries

You can browse through the entries in the USER menu with the following keystrokes.

	Keystrokes	Display only	Explanation
1.		Disp XX.XX Hz	Memory location 1 of the USER menu (parameter value of the function defined in PNU 0517/001) is displayed: Displays the current output frequency
2.	⇥	Code	The current parameter number in the USER menu flashes.
3.	▲▼	XXXX	Selects the parameter number and displays the associated value.

The ALL menu

The ALL menu provides access to all device parameters.

Setting and saving parameter values

The USER menu does not provide access to all device parameters.

To select, change and save parameter values, you may have to switch to the ALL menu:

		Keystrokes	Display only	Explanation	Example
1.	Connect keypad		Disp XX.XX Hz	Memory location 1 of the USER menu (parameter value of the function defined in PNU 0517/001) is displayed:	
2.	If it is not already displayed, switch to the ALL menu	1↔2	②	Function bar 2 is active	
3.		⇤⇥	Menu	Menu is selected	
4.		▲▼	ALL	Change between USER and ALL menu Select ALL menu	
5.		1↔2	①	Confirm selection Switch to function bar 1	
(6.)	Disable frequency inverter	STOP	RDY IMP	Frequency inverter disable required only for changing parameters PNU 0002, 0148, 0174 and 0469	

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		Keystrokes	**Display only**	**Explanation**	**Example**
7.	Setting parameters	⇤ ⇥	Code	The selected parameter number flashes	The value “3” is to be assigned to subindex PNU 0113/ 003
8.		▲ ▼	XXXX	Select parameter number	0113
9		⇥	SubCode 001	Select subindex Parameters without subindex automatically jump to Para	
10.		▲ ▼	XXX	Select subindex	003
11.		⇥	Para	Switch to parameter value In the example, value of subindex	
12.		▲ ▼	XXXXX	Set parameter value In the example, parameter value 3 (terminal 3)	3
13.		ENTER	STORE	When ◈ flashes: Confirm change with ENTER	
		⇤		When ◈ does not flash: Change is accepted automatically No ◈ symbol: ENTER is inactive	
14.				To modify further parameters, repeat from 7.	

Key parameters in the ALL menu

The table below lists some of the parameters in the ALL menu used in commissioning with their default values.

PNU	Default settings		
	Parameter value		
Current limit			
0022	150 %	I_{max}	Drive current limit
0023	150 %	I_{maxGen}	Regenerative current limit
Motor control mode			
0014	2	Linear characteristic (V/f = const.) with constant V_{min} pull up	
Analog input[1)]			
0005	0	Designation: 8	Setpoint input via terminal 8
Operating mode[1)]			
0001	0	Setpoint input and control via terminals	
Digital output[1)]			
0117	1	Designation: A1	Trips on error message (TRIP)
Relay output			
0008	0	Designation: K1	Inverter ready to operate
Operating frequency			
0018	2	8 kHz	Operating frequency of the inverter

1) Function only available with module DE4-IOM-STD-F

Changing between parameter sets
Changing between the individual parameter sets is only necessary for changing parameters.

The parameter set can be activated only through control signal terminals E1 to E4 (available, for example, on accessory module DE4-IOM-STD-F). To do this, you must configure the control signal terminals accordingly with PNU 0007 or 0113/013, / 014.

The number of the parameter set that is active during operation is indicated as follows:

Function bar	Function bar mode	Indication of active parameter set
①	Disp	PS 1

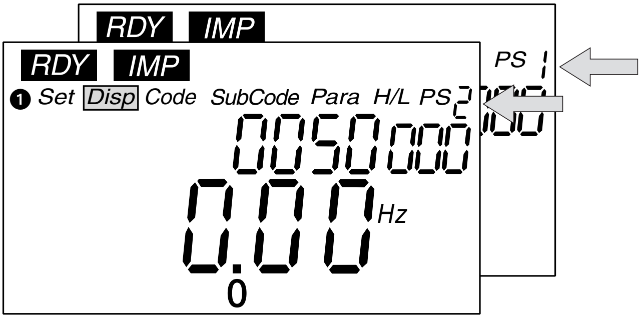

Figure 48: Changing between parameter sets

In this example, parameter set 1 is active. After the changeover via the control signal terminals, a “2” appears under PS if the display is set to DISP. The parameter set is now active in the device.

		Keystrokes	Display only	Explanation	Example
1.	Select function	1↔2	②	Function bar 2 is active	Select parameter set 2
2.		⇤ ⇥	PS	Select parameter set function	
3.	Select parameter set	▲ ▼	1 to 4	Select parameter set number	2
4.		1↔2	①	Confirm selection Switch to function bar 1	
5.	Set parameter			To set parameters in the parameter set, proceed as described above.	

Customizing the USER menu (with the ALL menu)

The parameters accessible in the USER menu can be defined with PNU 0517.

Procedure:

		Keystrokes	Display only	Explanation	Example
1.	Switch to the ALL menu	1↔2	2	Function bar 2 is active	
2.		⇤ ⇥	Menu	Menu is selected	
3.		▲ ▼	ALL	Change between USER and ALL menu Select ALL menu	
4.		1↔2	1	Confirm selection Switch to function bar 1	
5.	Select parameter number of the USER menu	⇥	Code	Select the parameter	Change memory location 2 to PNU 0014 (motor control mode)
6.		▲	0517	Select parameter number of the USER menu	0517
7.	Select memory location	⇤ ⇥	SubCode 001	Memory location 1 of USER menu Default: PNU 0050 = output frequency	
8.		▲	001 to 010	Select subindex	002
9.	Modify parameter value	⇥	Para 34	Switch to subindex value 34 = setpoint input range	
10.		▲ ▼	XXXXX	Use arrow keys to enter desired parameter value. No validity check of the entered parameter takes place. To delete the existing value, enter “0”	14
11.		ENTER	STORE	Confirm parameter value input	
12.				To modify further parameters, repeat from 7.	

Setpoint input through LCD keypad

A setpoint can be entered directly via the LCD keypad:

		Keystrokes	Display only	Explanation
1.	If it is not already displayed, switch to function bar 1	1↔2	①	Switch to function bar 1
2.		⇤	Set	Select setpoint input PNU 0140
3.		▲▼	0140 32.00 Hz	Enter the setpoint, e.g. 32 Hz

The following display appears:

Figure 49: Setpoint input through LCD keypad

Activating password protection

With this function, the device parameters can be protected against unauthorized access.

		Keystrokes	Display only	Explanation	Example
1.	Switch to the ALL menu	1↔2	②	Function bar 2 is active	
2.		⇤⇥	Menu	Menu is selected	
3.		▲▼	ALL	Change between USER and ALL menu Select ALL menu	
4.		1↔2	①	Confirm selection Switch to function bar 1	

		Keystrokes	Display only	Explanation	Example
5.	Enter password	⇥	Code	Select the parameter	Enter password: 123
6.		▲	0094	Select parameter number for the password	
7.		⇥	Para	Switch to parameter value	
8.		▲	XXXXX	Set password number	123
9.		ENTER	STORE	Confirm entered password	
10.	To activate the password, switch to the USER menu	1↔2	②	Function bar 2 is active	
11.		⇤ ⇥	Menu	Menu is selected	
12.		▲ ▼	USER	Select USER menu Password protection is active immediately	
13.		1↔2	①	Switch to function bar 1 Key symbol indicates: “Password protection active”	

Temporarily disabling password protection
To change protected parameters, password protection can be temporarily disabled:

		Keystrokes	Display only	Explanation	Example
1.	Call up password-protected function	by selecting the protected ALL menu	PASS 0 🔑	Indication appears when the password-protected functions are called “0” flashes	Temporarily deactivate password protection 123
2.	Temporarily deactivate password protection	▲	PASS XXXX 🔑	Set password	123
3.		ENTER	ALL	Confirm password The key symbol disappears	
4.		1↔2	①	Function bar 1 is active	
5.	All functions can be accessed	⇤ ⇥	Code	Select CODE All parameters can be accessed ALL menu is active	
6.	Switch to the USER menu to reactivate password protection	1↔2	②	Function bar 2 is active	
7.		⇤ ⇥	Menu	Menu is selected	
8.		▲ ▼	USER	Switch between USER and ALL menu Select USER menu Password protection is active immediately	

Password protection is also activated by switching off the power supply.

Removing password protection
Password protection can be permanently disabled as follows:

		Keystrokes	Display only	Explanation	Example
1.	Select the protected ALL menu	1↔2	②	Function bar 2 is active	
2.		⇤ ⇥	Menu	Menu is selected	
3.		▲	PASS 0	"0" flashes	Remove password 123
4.		▲	PASS XXXX	Set password number	123
5.		ENTER	ALL	Confirm entered password	
6.		1↔2	①	Function bar 1 is active	
7.	Permanently disable password protection	⇥	Code	Select the parameter	
8.		▲	0094	Select parameter number for the password	0094
9.		⇥	Para	Switch to parameter value	
10.		▲	0	Delete password by entering "0" (zero)	0
11.		ENTER	STORE	Confirm input	

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4 Setting Parameters

The parameters and functions described here can be accessed and edited with the DE4-KEY-3 or DE4-KEY-H3 LCD keypad.

For information about how to use the LCD keypad, refer to chapter 3, section “LCD keypad DE4-KEY-...”.

The parameters and functions associated with the frequency inverter’s analog and digital inputs and outputs (except for relay output K1 and the PTC input) can be used only in connection with accessory modules DE4-IOM-STD-F and DE4-IOM-APP-F.

Changeable parameters

Setpoint input (operating mode)

With the setpoint input (operating mode), you can specify the input channels that are used for control, setpoint input and setting parameters.

The setpoint for the controller is stored in nonvolatile memory and is not affected by mains supply interruptions.

Caution!
If an enable signal is applied to terminal 28, the frequency inverter may start automatically if the operating mode is changed and the mains supply is switched on again.

PNU	Name	Value	Function	Default setting
0001	Setpoint input (operating mode)	0	Setpoint input via terminal 8	0
		1	Setpoint input via the parameter channel of an AIF bus module	
		2	Setpoint input via terminal 8	
		3	Setpoint input via the data channel of the AIF bus module Parameterization via interface module	

If the device is not controlled via an interface, the DE4-IOM-STD-F or DE4-IOM-APP-F module must be connected to the function interface (FIF) for analog setpoint input.

If PNU 0001 = 0 to 3, the frequency inverter can be controlled via terminals, the LCD keypad and an interface (see appendix). If the terminal functions should remain active, the appropriate terminal configuration must be defined in PNU 0113 after PNU 0001 is set. Setpoint inputs via the LCD keypad always take effect in addition to the set setpoint source.

When the setpoint input is changed over, the drive can start when a controller enable signal is received.

If the setpoint input is made via the process data channel of an AIF bus module, PNU 0001 must be set to 3 so that process data can be evaluated.

If PNU 0001 = 3, QSP is set after the mains supply is switched on.

Cancelling:

Using a PC: control word PNU 0135, bit 3 = 0;

Using an LCD keypad: PNU 0469 = set 2,

Pressing the RUN key.

Transferring parameter sets

With PNU 0002, the parameter sets of the controlled device and the expansion modules can be managed. Depending on the value of PNU 0002, a parameter set is either overwritten with the default value or transferred from/to LCD keypad DE4-KEY-3. Parameter sets can also be transferred to other DV4 devices by this method.

PNU	Name	Value	Function	Default setting
0002	Parameter set transfer	0	Function executed	0
		Parameter set transfer of controlled device		
		1	Overwrite PAR1 with default value	
		2	Overwrite PAR2 with default value	
		3	Overwrite PAR3 with default value	
		4	Overwrite PAR4 with default value	
		10	Overwrite all parameter sets (PAR1 to PAR4) with data from the LCD keypad	
		11	Overwrite PAR1 with data from LCD keypad	
		12	Overwrite PAR2 with data from LCD keypad	
		13	Overwrite PAR3 with data from LCD keypad	
		14	Overwrite PAR4 with data from LCD keypad	
		20	Copy all parameter sets (PAR1 to PAR4) from controlled device to LCD keypad	

Changing between parameter sets

The DV4 frequency inverters have four parameter sets, which can be selected during operation. This makes additional acceleration and deceleration times and/or nine additional fixed frequencies available. Each parameter set contains all configurable parameters. With a few exceptions, all parameters of all four sets can have different values. The exceptions are listed in the appendix under "Parameters" on page 255, where they are marked accordingly.

In order to switch between parameter sets 1 and 2, use the PAR function shown in the table under section "Terminal configuration, digital inputs E1 to E4" on page 112).

If you also want to use parameter sets 3 and 4, assign function PAR3/4 to the desired terminal in PNU 0113/014.

To switch between the individual parameter sets, PAR, PAR2/4 or PAR3/4 of the parameter set changeover function must be assigned to the same terminals in all parameter sets.

☞ The parameter sets are executed only if they have been activated through the terminals.

☞ If different motor control modes (PNU 0014) have been defined in the two parameter sets, switch between parameter sets only when the controller inhibit is active.

☞ If the automatic changeover function is activated via the internal DC link voltage (PNU 0988 ≠ 0), a parameter set changeover via the terminal is not possible.

Parameterization via fixed terminal configuration:

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
4, 8, 15, 17, 18, 35, 36, 37, 44, 45	*)	HIGH	*)	*)	Changeover to parameter set 2 At LOW, parameter set 1 is reactivated.
1, 3, 6, 7, 12, 24, 33, 38, 46, 51	*)	*)	HIGH	*)	

*) Terminal assignment depends on value of PNU 007

Parameter set changeover via free terminal configuration:
A parameter set changeover between all four parameter sets can be freely assigned to terminals E1 to E4 with PNU 0113/013 or /014.

The digital inputs can be inverted with PNU 0114.

The current parameter set in each case is shown under DISP on the display.

Device address, baud rate

If several drives are connected in parallel via an RS485 interface at the AIF, each station on the line is assigned a unique address, which can specified here. The possible address ranges for the various bus interfaces are listed in the applicable interface manual.

PNU	Name	Value	Function	Default setting
0009	Device address	1 to 99	Only for RS232/485, PROFIBUS-DP interface module on the AIF	1
0125	Baud rate	0 = 9600 1 = 4800 2 = 2400 3 = 1200 4 = 19200	Baud rate for RS232/485 interface on AIF	0

Communication behaviour

If you operate the frequency inverter with an interface module (on the AIF) or a function module, PNU 0126 (on the FIF) can be used to specify how the frequency inverter should behave if communication with the interface/function module has failed (interface faulty or not connected).

PNU	Name	Value	Function	Default setting
0126	Communication behaviour	0	No response on communication error between frequency inverter and interface on the AIF	2
			No response on communication error between frequency inverter and function module on the FIF	
		1	On a communication error between the frequency inverter and the interface on the AIF, disconnection with error message CE0 is issued.	
			No response on communication error between frequency inverter and function module on the FIF	
		2	No response on communication error between frequency inverter and interface on the AIF	
			If a communication error occurs between the frequency inverter and the function module on the FIF, the controller is switched off and error message CE5 is issued.	
		3	On a communication error between the frequency inverter and the interface on the AIF, disconnection with error message CE0 is issued.	
			If a communication error occurs between the frequency inverter and the function module on the FIF, the controller is switched off and error message CE5 is issued.	

Control parameters

Terminal configuration, digital inputs E1 to E4

PNU 0007 is used to specify the assignment of the digital inputs. The default setting is 0. There are 52 different combinations as described in the table below. Use the terminal configuration from the table to set individual inputs. Other assignments are not possible under PNU 0007. Note also that not all functions are available at the same time and that some function combinations are mutually exclusive.

PNU 0007 =	Terminal			
	E1	E2	E3	E4
0	FF1, FF2, FF3		DCB	R/L
1			PAR	R/L
2			QSP	R/L
3	FF1	DCB	PAR	R/L
4		PAR	QSP	R/L
5		EF	DCB	R/L
6			PAR	R/L
7	EF	DCB		R/L
8		PAR	QSP	R/L
9	FF1	EF		R/L
10	DOWN	UP	EF	R/L
11			DCB	R/L
12			PAR	R/L
13			QSP	R/L
14	FF1	DCB	R/QSP	L/QSP
15		PAR	R/QSP	L/QSP
16	FF1, FF2, FF3		R/QSP	L/QSP
17	DCB	PAR	R/QSP	L/QSP
18	EF		R/QSP	L/QSP
19		DCB	R/QSP	L/QSP
20	FF1	EF	R/QSP	L/QSP

Function

FF1 = fixed frequency 1
FF2 = fixed frequency 2
FF3 = fixed frequency 3
DCB = DC injection braking
R/L = combined preselection of rotation direction
PAR = parameter set selection
QSP3 = quickstop
EF = external fault
DOWN = motor potentiometer, reduce value
UP = motor potentiometer, increase value
R/QSP = clockwise rotation, quickstop on error
L/QSP = anticlockwise rotation, quickstop on error
RA/MO = changeover remote access/manual
DIS-I operation
DIS-PID = deactivate I-component of PID controller
f-In = deactivate PID controller
= digital 0 to 10 kHz frequency input

Changes to PNU 0007 are copied into the corresponding subindex of PNU 0113/xxx.
If PNU 0113/xxx was freely configured, PNU 0007 is set to 255.
Caution!
Changes under PNU 0007 also affect the settings under PNU 0113/xxx.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
21	DOWN	UP	R/QSP	L/QSP	
22	FF1		R/QSP	L/QSP	
23	DOWN		R/L	RA/MO	
24			PAR		
25			DCB		
26			FF1		
27			EF		
28	f-In	DIS-I	FF1, FF2, FF3		
29			DCB	FF1	
30			QSP	FF1	
31				DCB	
32				EF	
33			PAR	QSP	
34			L/QSP	R/QSP	
35		PAR	FF1, FF2, FF3		
36			QSP	DCB	
37			QSP	FF1	
38		EF	PAR	FF1	
39			FF1, FF2, FF3		
40			QSP	FF1	
41			DCB	FF1	
42			DCB	QSP	
43			QSP	R/L	
44		PAR	DOWN	UP	
45		PAR	QSP	R/L	
46	FF1	QSP	PAR	RA/MO	
47	FF1	RA/MO	L/QSP	R/QSP	

FF1 = fixed frequency 1
FF2 = fixed frequency 2
FF3 = fixed frequency 3
DCB = DC injection braking
R/L = combined preselection of rotation direction
PAR = parameter set selection
QSP3 = quickstop
EF = external fault
DOWN = motor potentiometer, reduce value
UP = motor potentiometer, increase value
R/QSP = clockwise rotation, quickstop on error
L/QSP = anticlockwise rotation, quickstop on error
RA/MO = changeover remote access/manual
DIS-I operation
DIS-PID = deactivate I-component of PID controller
f-In = deactivate PID controller
= digital 0 to 10 kHz frequency input

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
48	f-In	DIS-I	DCB	DIS-PID	
49		QSP	FF1		
50		DIS-I	FF1		
51		DIS-I	PAR	DCB	
255	PNU 0113 has been freely configured				Display only Important! Changes under PNU 0007 also affect the settings under PNU 0113/xxx.

Free terminal configuration, digital inputs

DV4 frequency inverters also allow the digital inputs to be freely configured. This configuration is implemented with PNU 0113/xxx by assigning a function (subindex) to one of the control signal terminals E1 to E4. The parameter value corresponds with the number of the input terminal.

Example:

The external fault function EF should be mapped to digital input E3.

If a parameter has subindices, PNU and subindex must be delimited with “/”

by entering “3” in PNU 0113/011.

Settings already made under PNU 0007 are automatically copied into the corresponding subindex of PNU 0113/xxx.

If PNU 0113 was freely configured, this is indicated by entry -255- in PNU 0007.

The digital inputs can be inverted with PNU 0114.

PNU/ subindex	Name	Value	Function	Default setting
0113/xxx	Free configuration of digital inputs	See[1,2,3]		
/001	FF1		Fixed frequency 1 (in combination with FF2 and FF3) PNU 0113/001 — PNU 0113/002 — Active value LOW — LOW — PNU 0046 HIGH — LOW — FF1 LOW — HIGH — FF2 HIGH — HIGH — FF3	1
/002	FF2		Fixed frequency 2 (in combination with FF1 and FF3)	2
/003	R/L	See[1,2,3]	Combined preselection of rotation direction PNU 0113/003 — Active value LOW — Clockwise HIGH — Anticlockwise	4

PNU/ subindex	Name	Value	Function	Default setting
/004	QSP		Quickstop, when PNU 0113/004 = LOW	255
/005	RFG1-STOP		Stopping the ramp generator for main setpoint	255
/006	RFG1-0		Reset ramp generator input for main setpoint to 0	255
/007	UP		Motor potentiometer, increase value	255
/008	DOWN		Motor potentiometer, reduce value	255
/009	Reserved			255
/010	CINH		Controller inhibit, when PNU 0113/010 = LOW	255
/011	EF		External fault, when PNU 0113/011 = LOW	255
/012	TRIP-RESET		Reset fault	255
/013	PAR2/4		Parameter set selection (only when PNU 0988 = 0) PNU 0113/013 / PNU 0113/014 / Active value LOW / LOW / PAR1 HIGH / LOW / PAR2 LOW / HIGH / PAR3 HIGH / HIGH / PAR4	255
/014	PAR3/4		Parameter set selection (only when PNU 0988 = 0)	255
/015	DCB		DC injection braking	3
/016	Reserved			255
/017	RA/MO		Changeover, remote access/manual operation	255
/018	DIS-I		Deactivate I-component of PID controller	255
/019	DIS-PID		Deactivate PID controller	255
/020	Reserved			255
/021	FREEZE-PID		Freeze PID controller output at current value	255
/022	R/QSP		Clockwise rotation, quickstop on error	255
/023	L/QSP		Anticlockwise rotation, quickstop on error	255
/024	f-In		Digital 0 to 10 kHz frequency input	255

1) E1 = 1, E2 = 2, E3 = 3, E4 = 4
2) Note: 0 = not assigned, 255 = not assigned
3) 1 to 4 = digital inputs E1 to E4

Level inversion, digital inputs E1 to E4

The level of digital inputs E1 to E4 can be inverted with PNU 0114. The binary value determines the inputs' level pattern.

The input value is the corresponding decimal value.

PNU	Name	Value	E4 2^3	E3 2^2	E2 2^1	E1 2^0	Default setting
0114	Level inversion, digital inputs	0	0	0	0	0	0
		1	0	0	0	1	0 = input not inverted when HIGH is active 1 = input inverted when LOW is active
		2	0	0	1	0	
		3	0	0	1	1	
		to	*)	*)	*)	*)	
		15	1	1	1	1	

*) Terminal assignment depends on value of PNU 007

Configuration of frequency input E1

Digital input E1 can also be used as a frequency input. Function f-In must be assigned to input E1 under PNU 0113/024 or PNU 0007 for this purpose.

In PNU 0005 (values 1, 2, 3, 5, 6, 7), define how this signal is to be interpreted. With the following parameters, you can configure or calibrate the frequency input. The set frequency internally corresponds to f_{max} (PNU 0011).

The specified maximum frequency value is the maximum frequency that the input can process. If the input frequency is exceeded, it can be proportionally readjusted with PNU 0426. The gain always has the same effect on the signal and the offset.

A setting of 100 % corresponds to a gain factor of 1.

Example:

A gear on the motor shaft delivers six impulses per revolution. The motor should be operated at 1500 rpm. The maximum frequency occurring at E1 can be calculated as follows:

$$\text{max. frequency} = \frac{1500}{60\ \text{s}} \times 6 = 150\ \text{Hz}$$

Frequency input E1 is configured with PNU 425 = 0, (frequency = 100 Hz, max. frequency = 300 Hz). The input frequency at E1 is normalized to the preset frequency of 100 Hz, ensuring that an input frequency of 100 Hz corresponds internally with the output frequency specified in PNU 0011. Gain E1, PNU 0426, is calculated as follows:

$$\text{PNU 0426} = \frac{100\ \text{Hz}\ (f_{\text{Norm}})}{150\ \text{Hz}\ (f_{\text{s}})} \times \frac{50\ \text{Hz}}{\text{PNU 0011}} \times 100\ \%$$

f_{Norm} = normalizing frequency from PNU 0425

f_s = sensor frequency at 50 Hz output frequency

Each change of PNU 0011 requires a corresponding modification of PNU 0426.

PNU	Name	Value	Frequency [Hz]	Resolution	Sampling rate [s]	max. frequency [Hz]	Default setting
0425	Configuration of frequency input E1	0	100	1/200	1	300	2
		1	1000	1/200	0.1	3000	
		2	10000	1/200	0.01	10000	
		3	10000	1/1000	0.05	10000	
		4	10000	1/10000	0.5	10000	

PNU	Name	Value	Default setting
0426	GAIN, gain E1	–1500.0 to 1500.0 %	100
0427	Offset E1	–100.0 to 100.0 %	0.0

Controller enable, terminal 28 (EN)

The controller must be enabled before the frequency inverter can be started. Controller enable is set with terminal 28 as follows:

LOW = controller not enabled

HIGH = controller enabled

If you are using the optional DE4-KEY-3 LCD keypad, terminal 28 and the RUN/STOP key are logically connected in series. If you press the STOP key on the keypad or apply a LOW signal to terminal 28, the controller cannot be started again until the HIGH signal is applied to terminal 28 and the RUN key pressed on the keypad.

If you have disabled the frequency inverter using the LCD keypad and then removed the LCD keypad, you must do one of the following to reenable the controller:

Turn the mains supply off and on again (the drive starts up immediately).

Reconnect the LCD keypad and press the RUN key.

The drive starts at 0 Hz. If the motor is still rotating, a regenerative overload may occur, which may damage the frequency inverter.

If the frequency inverter is being controlled via the serial interface module, the software enable must be set in addition to the hardware enable at terminal 28.

Controller inhibit CINH

Terminal 28, RUN (LCD keypad) and CINH (PNU 0113/010) are logically connected in series.

With PNU 0113/010, the function CINH can be assigned to one of the terminals E1 to E4. Controller inhibit CINH is active when PNU 0113/010 = HIGH. An inversion with PNU 0114 is possible. By default, PNU 0113/010 is not active.

With PNU 0040, the frequency inverter can be disabled and reenabled, and the controller inhibit status can be displayed:

0 = controller inhibit active

1 = controller inhibit not active, controller enabled

The controller can be enabled only when terminal 28 is HIGH (no inversion possible).

When the controller inhibit is activated, the drive spins down freely. This status is indicated with IMP on the display and by the flashing green LED on the frequency inverter.

☞ When controller inhibit is active, only the power outputs are disabled: the frequency inverter is not isolated from the mains.

The controller inhibit can also be changed with the control word (STW), PNU 0135 (bit 9).

Flying restart circuit, automatic restart

With PNU 0142, the startup behaviour of the frequency inverter at power-on, after a mains power interruption or on restart after a controller inhibit (CINH) can be defined. The flying restart circuit synchronizes a coasting motor with the frequency inverter (e.g.following a power interruption).

If PNU 0143 is set to 0 or 1, the frequency inverter determines the speed of the rotating motor, starts up and accelerates or decelerates to the specified setpoint at the set acceleration or deceleration times. If PNU 0143 contains a “2” or “3”, the corresponding output frequency is immediately applied to the motor.

The flying restart circuit should not be used where several motors with differing rotating masses are being controlled. Motors with a low rotating mass can start up or reverse direction in a short space of time after the controller is enabled.

If the controller is enabled through terminal 28, the flying restart option will cause the motor to start immediately (e.g. following a power supply interruption or a fault). If the automatic start function is disabled, the frequency inverter waits for a LOW/HIGH change at terminal 28 before energizing the motor.

PNU	Name	Value	Function	Default setting
0142	Start options	0	Automatic start disabled, flying restart circuit deactivated	1
		1	Automatic start if terminal 28 = HIGH, flying restart circuit inactive	
		2	Automatic start disabled, flying restart circuit activated	
		3	Automatic start if terminal 28 = HIGH, flying restart circuit inactive	

PNU	Name	Value	Function	Default setting
0143	Selection of flying restart procedure	0	The motor speed is determined in the range from f_{max} (PNU 0011) to 0 Hz	0
		1	The motor speed is determined in the range from the most recent output frequency to 0 Hz	
		2	On controller enable, the present frequency setpoint is applied to the motor	
		3	After controller enable, the PID controller actual value is applied to the motor as per PNU 0005	

Controlled ramp-down following mains failure

Some applications also require a controlled ramp-down of the motor to standstill on mains failure or when power is disconnected.

This function is provided by the DV4 frequency inverters and can be used with or without an external braking resistor. A changeover between parameter sets PAR1 and PAR2 results in a changeover between regenerative and drive operation. The changeover threshold is defined by the value in PNU 0988.

PNU	Name	Value	Function	Default setting
0988	Voltage threshold of internal DC link for parameter set changeover	0 to 200 %	Changeover of parameter set PAR1 or PAR2 in relation to the internal DC link voltage	0 %

If the value in PNU 0988 is greater than 0, a parameter set changeover through terminals, PC or bus is no longer possible. The value of PNU 0988 is the same in all parameter sets.

Function configuration

The table below describes how functions are configured.

PNU	Settings in PAR1 (active on mains failure)	Settings in PAR2 (active in normal operation)
0988	Setting the switching threshold for parameter set changeover: PNU 0988 corresponds to 100 % supply voltage (230 V or 400 V) PNU 0988 is matched to the undervoltage on the supply side as follows: Supply voltage 230 V or 400 V: 10 % undervoltage, set PNU 0988 = 75 to 85 % Supply voltage 460 V: 10 % undervoltage, set PNU 0988 = 75 to 98 %	
0113/ 004	**Terminal configuration with quickstop in normal operation**	
	Map the quickstop function to one of the inputs E1 to E4	Assign and connect quickstop to the input in PAR2 that quickstop is assigned to in PAR1; do not invert
	Invert the input programmed with the quickstop function with PNU 0114	
	Terminal configuration without quickstop in normal operation	
	Map the quickstop function to one of the inputs E1 to E4	Do not use the input to which quickstop is assigned in PAR1
	Do not connect any devices to the input with the quickstop function	

In addition to the deceleration ramp, the DV4 frequency inverters have a “quickstop ramp”. When the quickstop function is activated, the frequency inverter ramps down at the quickstop ramp time. The quickstop ramp time is configured with PNU 0105.

PNU	Settings in PAR1 (active on mains failure)	Settings in PAR2 (active in normal operation)
0105	**Quickstop at mains failure without external braking resistor**	
	The quickstop ramp time is set so that a controlled ramp-down to standstill can take place: Set the same time as specified in PAR2 Switch the power supply off PAR1 becomes active Reduce value and switch power until the overvoltage message (OU) is issued during ramp-down To set the final value, increase this value by about 20 %	Set the time required for the application
	Quickstop at mains failure with external braking resistor	
	Set the same time as specified in PAR2	Set the time required for the application
	Reduce the value and switch the power until the desired ramp-down time is achieved	

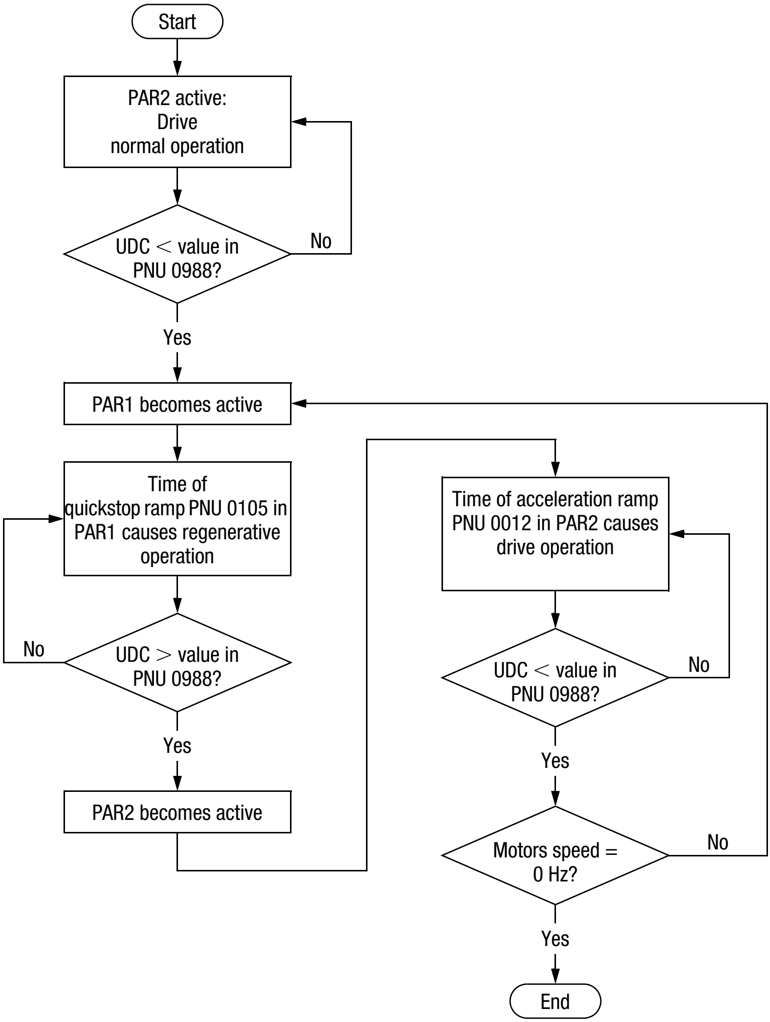

Figure 50: Controlled ramp-down on mains failure

When the mains voltage is interrupted, the following process is executed:

1. The internal DC link voltage V_{DC} falls below the value in PNU 0988.
2. Parameter set PAR1 is activated.
3. Time of quickstop ramp PNU 0105 in PAR1 causes regenerative operation
4. The internal DC link voltage V_{DC} rises above the value in PNU 0988.
5. Parameter set PAR2 is activated.
6. Acceleration ramp PNU 0012 in PAR2 causes drive operation.

The process restarts at step 1 and is repeated until the motor speed is approximately 0 Hz.

If the mains voltage is restored while the motor still spins, it is accelerated again to the specified setpoint at the acceleration ramp defined in PNU 0012. In contrast to the flying restart circuit (PNU 0142/0143), there is no delay here, the drive being restarted directly.

Reversing the motor

Control signal terminals E3 and E4 are used to specify the direction of rotation of the motor. Depending on the terminal configuration of PNU 0007 and PNU 0113 or depending on the level inversion, the direction of rotation is preselected with or without open circuit protection.

Warning!
For parameter values PNU 0007 = 0 to 13, 23, 43 or 45 – no open circuit protection – a wire breakage can result in unintentional reversal of the motor.

The motor reversal can also be freely configured to terminals E1 to E4 with PNU 0113/003.

The digital inputs can be inverted with PNU 0114.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
0 to 13, 43, 45	*)	*)	*)	[R/L]	LOW = clockwise rotation HIGH= anticlockwise rotation
23	DOWN	UP	[R/L]	RA/MO	
14 to 22	*)	*)	[R/QSP]	[L/QSP]	Motor reversal with quickstop
34, 47	*)	*)	[L/QSP]	[R/QSP]	[R/QSP] [L/QSP] LOW LOW Quickstop HIGH LOW Clockwise rotation LOW HIGH Anticlockwise rotation HIGH HIGH The motor direction is not reversed. The initially applied signal determines the direction of rotation while the motor is running. If the power is switched on and E3 and E4 are HIGH, the controller executes a quickstop.

*) Terminal assignment depends on value of PNU 007

Entering the frequency setpoint with the LCD keypad

With PNU 0140, the frequency setpoint can be entered using the cursor keys on the LCD keypad (see chapter 3 in section “Setpoint input through LCD keypad” on page 100). To reverse the motor, a negative frequency setpoint can also be entered here.

The frequency setpoint in PNU 0140 remains saved when mains power is switched off. It always has an additive effect on other setpoint sources, such as the analog setpoint, fixed frequencies, motor potentiometers or frequency inputs.

PNU	Name	Value	Function	Default setting
0140	f_{set}	–480 to +480 Hz	Additive frequency setpoint	0

Motor potentiometer function

Setpoint input with the Motor potentiometer function is active only for certain values of PNU 0007. The setpoint can be changed with the specified acceleration (PNU 0012) and deceleration (PNU 0013) times.

The DE4-IOM-STD-F or DE4-IOM-APP-F is usually required to implement the motor potentiometer function. The Motor potentiometer function can also be freely mapped to terminals E1 to E4 with PNU 0113/007 or /008.

The digital inputs can be inverted with PNU 0114. The fixed frequencies have priority over the motor potentiometer function.

With PNU 0265, the starting value for the motor potentiometer at power-on can be defined.

<table>
<tr><th rowspan="2">PNU 0007 =</th><th colspan="4">Terminal</th><th rowspan="2">Function</th></tr>
<tr><th>E1</th><th>E2</th><th>E3</th><th>E4</th></tr>
<tr><td>10, 11, 12, 13, 21, 23 to 27</td><td>[DOWN]</td><td>[UP]</td><td>*)</td><td>*)</td><td rowspan="2">Motor potentiometer

[DOWN] [UP]
LOW LOW Approach 0 Hz at quickstop ramp (PNU 0105)
HIGH LOW Approach f_{min} (PNU 0010) with deceleration time (PNU 0013), if PNU 0010 was previously exceeded
LOW HIGH Approach f_{max} (PNU 0011) with acceleration time (PNU 0012)
HIGH HIGH The motor speed remains unchanged. The last applied value is frozen.</td></tr>
<tr><td>44</td><td>f-In</td><td>PAR</td><td>[DOWN]</td><td>[UP]</td></tr>
</table>

*) Terminal assignment depends on value of PNU 007

PNU	Name	Value	Function	Default setting
0265	Starting value, motor potentiometer	0	Starting value = actual value at Power Off is saved and approached again on Power On	3
		1	Starting value = PNU 0010 f_{min} is approached on Power On	
		2	Starting value = 0 Hz After Power On, the starting value is 0 Hz	
		3	Starting value = Power Off UP/DOWN = LOW applied Deceleration at quickstop ramp PNU 0105 to 0 Hz	
		4	Starting value = PNU 0010 UP/DOWN = LOW applied Deceleration at quickstop ramp PNU 0105 to 0 Hz	
		5	Starting value = 0 Hz UP/DOWN = LOW applied Deceleration at quickstop ramp PNU 0105 to 0 Hz	

The motor potentiometer setpoint is stored on the following events:

Power Off

Controller inhibit

TRIP messages

When the quickstop function is activated, reset the motor potentiometer at the quickstop ramp (PNU 0105) to 0 Hz.

Motor potentiometer function in combination with fixed frequency value
The setpoint can be changed with the specified acceleration (PNU 0012) and deceleration (PNU 0013) times.

The motor potentiometer, in the combination UP and DOWN, responds as already described earlier. However, the fixed frequency has priority here over the motor potentiometer setpoint and is approached when function FF1 is active.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
22	[FF1]	[UP]	[R/QSP]	[L/QSP]	
	HIGH	HIGH	HIGH	LOW	FF1 (PNU 0037) is approached in a clockwise direction
	HIGH	HIGH	LOW	LOW	Deceleration at quickstop ramp (PNU 0105) to 0 Hz
	HIGH	HIGH	LOW	HIGH	FF1 (PNU 0037) is approached in an anticlockwise direction
	HIGH	HIGH	HIGH	HIGH	The present condition remains unchanged (frozen)
	LOW	HIGH	HIGH	LOW	Clockwise rotation, increase setpoint to f_{max} (PNU 0105)
	LOW	HIGH	LOW	HIGH	Anticlockwise rotation, increase setpoint to f_{max} (PNU 0105)
	LOW	LOW	LOW	LOW	Deceleration at quickstop ramp (PNU 0105) to 0 Hz
	LOW	LOW	LOW	HIGH	Deceleration at quickstop ramp (PNU 0105) to 0 Hz

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
26	[DOWN]	[UP]	[FF1]	RA/MO	
	LOW	HIGH	LOW	LOW	Increase setpoint to f_{max} (PNU 0105)
	LOW	HIGH	HIGH	LOW	FF1 (PNU 0037) is approached
	LOW	LOW	LOW	LOW	Deceleration at quickstop ramp (PNU 0105) to 0 Hz

If you have programmed the fixed frequency [FF1] higher than the present motor potentiometer setpoint, the frequency inverter only accelerates to the present setpoint of the motor potentiometer. If the fixed frequency [FF1] is less than the present motor potentiometer setpoint, the fixed frequency [FF1] is approached without restrictions.

Fixed setpoint

You can configure three fixed inverter frequencies with values between 0 and 480 Hz. Negative fixed frequencies result in motor reversal.

PNU	Name	Value	Function	Default setting
0037	Fixed frequency 1	–480.0 to 480.0 Hz	Fixed setpoints	20 Hz
0038	Fixed frequency 2			30 Hz
0039	Fixed frequency 3			40 Hz

Blocking frequencies and bandwidth

Depending on the parameter selected in PNU 0007 and the value to which terminals E1 and E2 (HIGH/ LOW) are set, the fixed setpoint can be selected directly. Fixed setpoint selection can also be freely mapped to terminals E1 to E4 with PNU 0113/001 or /002.

The digital inputs can be inverted with PNU 0114.

<table>
<tr><th rowspan="2">PNU 0007 =</th><th colspan="4">Terminal</th><th rowspan="2">Function</th></tr>
<tr><th>E1</th><th>E2</th><th>E3</th><th>E4</th></tr>
<tr><td>3, 4, 5, 6, 9,
14, 15, 20,
22, 46, 47</td><td>[FF1]</td><td>*)</td><td>*)</td><td>*)</td><td>HIGH = activates fixed frequency 1
LOW = reverts to programmed default setpoint (e.g. analog input)</td></tr>
<tr><td>26, 49, 50</td><td>*)</td><td>*)</td><td>[FF1]</td><td>*)</td><td rowspan="4">[FF1] [FF2] Active value
LOW LOW Default setpoint
HIGH LOW Fixed frequency 1 active
LOW HIGH Fixed frequency 2 active
HIGH HIGH Fixed frequency 3 active</td></tr>
<tr><td>29, 30, 37,
38, 40, 41</td><td>*)</td><td>*)</td><td>*)</td><td>[FF1]</td></tr>
<tr><td>0, 1, 2, 16</td><td>[FF1]</td><td>[FF2]</td><td>*)</td><td>*)</td></tr>
<tr><td>28, 35, 39</td><td>*)</td><td>*)</td><td>[FF1]</td><td>[FF2]</td></tr>
</table>

*) Terminal assignment depends on value of PNU 007

For fixed frequency setpoints, the f_{min} setting (PNU 0010) has no effect; only the f_{max} setting (PNU 0011) is always effective. If you have set a fixed frequency setpoint above f_{max}, the frequency inverter will never exceed the set f_{max} value.

Blocking frequencies

Certain output frequencies can cause mechanical resonance at the drive. Blocking frequencies can be used to disable these output frequencies during steady-state operation. The suppressed frequency range is specified with bandwidth Δf, which acts symmetrical to the set blocking frequency.

A setting of 480.00 Hz disables this function.

PNU	Name	Value	Default setting
0625	Blocking frequency 1	0.00 to 480.00 Hz	480.00 Hz
0626	Blocking frequency 2		
0627	Blocking frequency 3		
0628	Suppression bandwidth	0.00 to 100.00 %	0.00 %

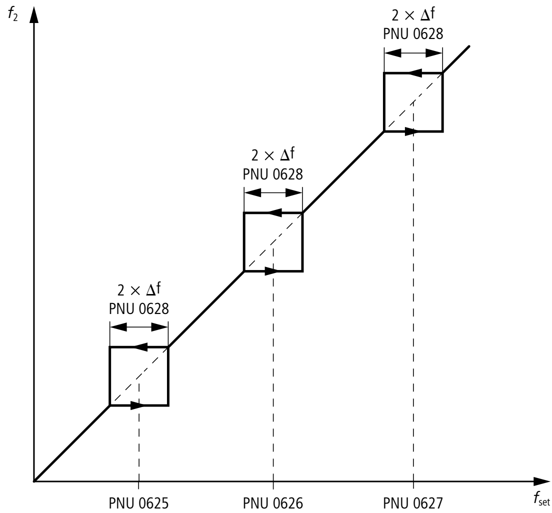

Figure 51: Blocking frequencies and their effective bandwidths

The effective suppression bandwidth is calculated as follows:

$$\text{Bandwidth } \Delta f\,[\text{Hz}] = f_s\,[\text{Hz}] \times \frac{\text{PNU 0628 [\%]}}{100\ \%}$$

f_s = blocking frequency

Analog setpoint input

Specify the analog setpoint through terminals 7 and 8 (DE4-IOM-STD-F). Depending on the signal range, you need to set DIP switches 1 to 5 on the module front and select the corresponding parameter value in PNU 0034.

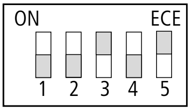

Figure 52: Default position of DIP switch

Parameter setting		DIP switch setting					Explanation
PNU 0034 =	**Setpoint input range Terminal 8**	**1**	**2**	**3**	**4**	**5**	
0	0 to 5 V	OFF	OFF	ON	OFF	OFF	
0	**0 to 10 V**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**Default setting**
0	0 to 20 mA	OFF	OFF	ON	ON	OFF	
1	4 to 20 mA	OFF	OFF	ON	ON	OFF	
3	4 to 20 mA	OFF	OFF	ON	ON	OFF	Open-circuit monitoring activates error message: Sd5, at $I < 4$ mA
2	–10 to 10 V	ON	ON	OFF	OFF	OFF	Reversal on polarity change (f_{min} (PNU 0010) has no effect)
4 to 13	–	–	–	–	–	–	Reserved

DV4 frequency inverters allow additional matching of the analog input signal.

PNU	Name	Value	Function	Default setting
0026	OFFSET analog input	–200.0 to 200.0 %	Offset, analog input, terminal 8 The maximum value in PNU 0034 corresponds to 100 %	0.0
0027	GAIN analog input	–1500.0 to 1500.0 %	Gain, analog input, terminal 8 100 % = gain 1 negative gain and negative offset invert setpoint input	100.0

With PNU 0026, the signal characteristic can be shifted.

In connection with PNU 0239 (lower frequency limit), a setpoint “dead zone” can also be set up.

With PNU 0027, the level of the signal characteristic can be increased.

The gain always has the same effect on the offset and the setpoint signal. However, the setpoint signal is processed only within the setpoint range specified in PNU 0034, independent of the set gain.

The minimum output frequency f_{min} (PNU 0010) corresponds to 0 % setpoint signal. If the offset is not 0 % and/or the setpoint input is inverted, a value below f_{min} is also possible.

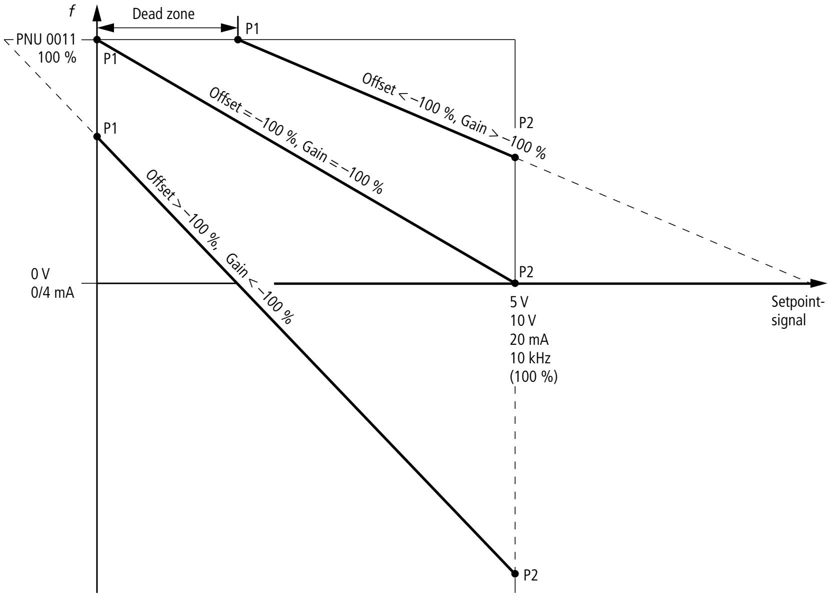

Figure 53: Setpoint inversion

Points P1 and P2 represent any position of the signal line. They are calculated with the equations below, whereby the point coordinate prefixes must be taken into account.

Example:

You want to implement an inverted speed input with direction reversal.

P1 setting:
In the range 0 to +2 V, there should be a dead zone in the setpoint signal. At a setpoint signal of +2 V (20 % of 10 V), the drive should already be running at its maximum speed (PNU 0011).

P2 setting:
At a setpoint signal of +10 V (100 % of 10 V), the drive should run at 30 % of its maximum speed in the opposite direction. Due to the direction reversal, –30 % is to be expected here.

Gain V (PNU 0027) or offset O (PNU 0026) are calculated as follows:

$$V\,[\%] = \frac{f(P2) - f(P1)}{V(P2) - V(P1)} \times 100\,\% = \frac{(-30\,\%) - 100\,\%}{100\,\% - 20\,\%} \times 100\,\% = (-162.5\,\%)$$

$$O\,(P2)[\%] = \frac{f(P2)\,\%}{V\,[\%]} \times 100\,\% - V(P2)\,[\%] = \frac{(-30\,\%)}{(-162.5\,\%)} \times 100\,\% - 100\,\% = (-81.5\,\%)$$

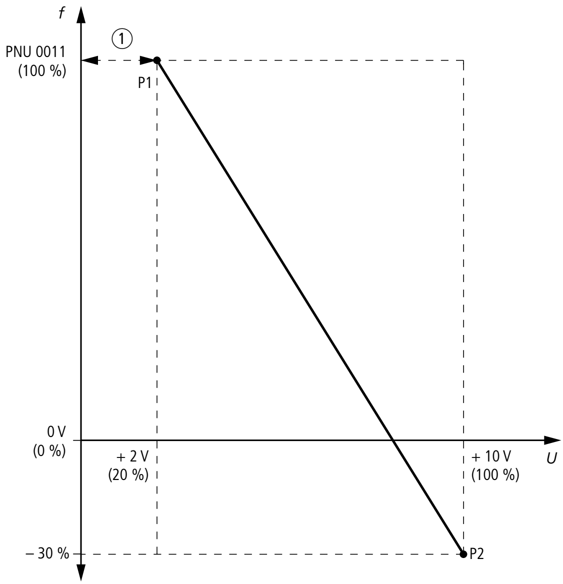

Figure 54: Example of setpoint scaling

f: Output frequency

V: Setpoint signal

① Dead zone
In the dead zone (0 to 2 V), the drive is already running at its maximum speed (100 % of the value in PNU 0011)

② Range from +2 V to +8 V
The speed is inversely proportional to the setpoint. At a setpoint signal of +8 V, the output frequency is 0 Hz.

③ Range from +8 V to +10 V
If the setpoint is raised further, the drive will reverse. The direction of rotation is reversed in this range. At a maximum setpoint of +10 V, the output frequency is –30 % of the value in PNU 0011.

Selecting the signal channel

PNU 0005 specifies the signal to be assigned to the analog input at terminal 8, or the digital frequency input E1.

PNU	Name	Value	Function	Default setting
0005	Configuration of analog input signals	0	Setpoint via terminal 8	0
		1	Setpoint via terminal 8 with setpoint addition via frequency input E1	
		2	Setpoint via frequency input E1 with setpoint addition via terminal 8	
		3	Setpoint via frequency input E1 and torque limitation via terminal 8 (load regulation) (not for PNU 0014 = 5)	
		4	Setpoint for sensorless torque regulation via terminal 8 and speed limitation via PNU 0011 (only for PNU 0014 = 5, torque input)	
		5	Setpoint for sensorless torque regulation via terminal 8 and speed limitation via frequency input E1 (only for PNU 0014 = 5, torque input)	
		6	Operation with PID controller: Setpoint via terminal 8 (analog) Actual value via frequency input E1 (digital)	
		7	Operation with PID controller: Setpoint via frequency input E1 (digital) Actual value via terminal 8 (analog)	
		200	All digital and analog input signals supplied by function module PROFIBUS, Suconet K or INTERBUS to the FIF	

Internal signal channels

The DV4 frequency inverters have two internal setpoint channels, designated NSET1-N1 and NSET1-N2, and an additive setpoint channel, NSET1-NADD.

Only one of the two setpoint channels is active at any one time (dependent on the RA/MO function). The additive setpoint channel and the frequency setpoint supplied by the LCD keypad (PNU 0140) always apply in addition to the active channel.

The setpoints can be viewed under the following PNUs:

NSET1-N1 => PNU 0046

NSET1-N2 => PNU 0044

PCTRL1-NADD => PNU 0049

The setpoint sources assigned to the respective channels depends on the parameter value settings in PNU 0001, 0005 and 0007 (see table in the appendix from page 323). These values affect the internal setpoint channels, to which setpoint sources are then automatically assigned.

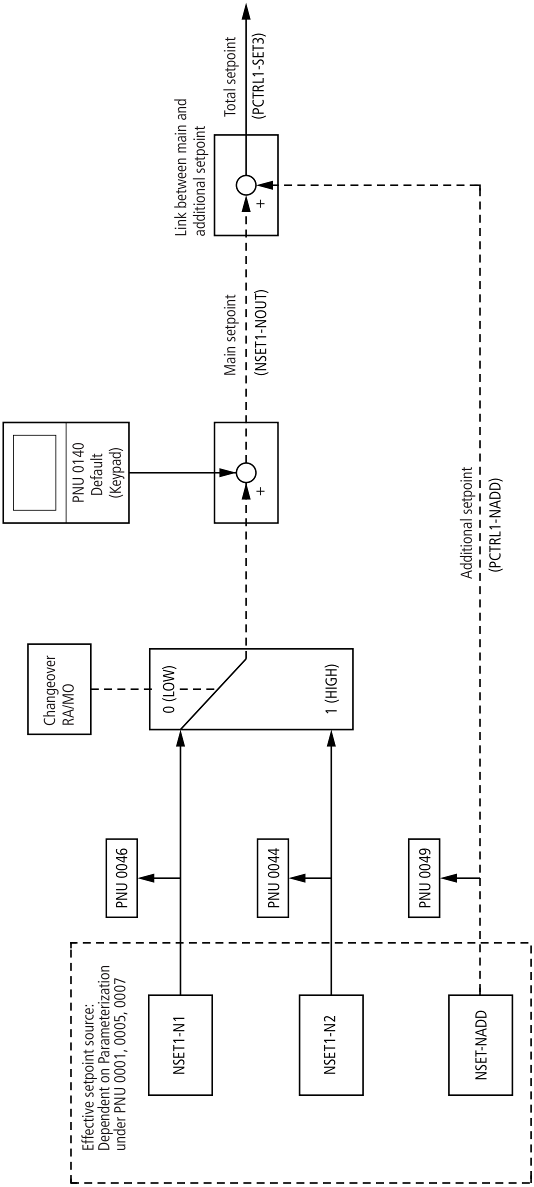

Figure 55: Structure of the internal signal channels

Remote/manual changeover

The two setpoint channels NSET1-N1 and NSET1-N2 can be toggled with the RA/MO function, allowing a changeover from remote access (RA) to manual operation (MO).

The table below lists a number of changeover possibilities and the required setpoint channel configurations.

Changeover from ...	to ...	PNU 0001	PNU 0005	PNU 0007
Bus operation (AIF), LCD keypad or PC	Analog setpoint terminal 8	3	0	0 to 9 20 to 14 28 to 43 43 to 51
Bus operation (AIF), LCD keypad or PC	Motor potentiometer	3	0	23 to 27
Motor potentiometer	Analog setpoint terminal 8	2/0	0	23 to 27

With PNU 0007, the changeover can be programmed to the control signal terminal E3 or E4.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
23 to 27, 46	*)	*)	*)	[RA/MO]	Remote/manual changeover LOW = remote access active (setpoint channel NSET1-N1) HIGH = manual operation active (setpoint channel NSET1-N2)
47	*)	*)	[RA/MO]	*)	

*) Terminal assignment depends on value of PNU 007

The RA/MO function can also be freely mapped to terminals E1 to E4 with PNU 0113/017. The digital inputs can be inverted with PNU 0114.

The fixed frequencies [FF] work independently of the RA/MO changeover.

The STOP key on the LCD keypad is not active in manual operation.

On changeover to manual operation (MO), any active CINH or quickstop safety functions are reset. When changing back from manual operation (MO) to remote access (RA), you should therefore ensure that the control system reactivates these functions.

PID controller

When operating with the internal PID controller, slip compensation should be disabled (PNU 0021 = 0.0).

For process-optimized control of pressure, temperature, speed, level, flow rate, compensator position, etc. and similar control applications, DV4 frequency inverters are equipped with a PID controller. By default, the PID controller is inactive (PNU 0238 = 2).

If analog setpoint actual values are used (two analog inputs required), the frequency inverter must be equipped with a DE4-IOM-APP-F module to establish an open-loop control circuit.

PNU	Name	Value	Function		Default setting
0070	P-component	0.00 to 300.00	Gain,	0.00 = P-component inactive	1.00
0071	I-component	10 to 9999	Reset time,	9999 = I-component inactive	100
0072	D-component	0.0 to 5.0	Differential component,	0.0= D-component inactive	0.0
0074	Effect of PID controller	0.0 to 100.0 %	Control factor of process controller, influences stability of controller (especially important when PNU 0238 = 1)		0.0

PNU	Name	Value	Function	Default setting
0238	Frequency precontrol	0	No precontrol Only the process controller output is active Process controller has full effect	2
		1	Precontrol (total setpoint + process controller) Process controller has limited effect	
		2	No precontrol Only the total setpoint is active Process controller has no effect (inactive)	

The resulting total setpoint (PCTRL1-SET3) is the sum of the main setpoint (NSET1-N1 or NSET1-N2) and the additive setpoint (PCTRL1-NADD).

Selecting the PID actual value channel
To select the PID actual value channel, set the required combination for controlled operation (parameter value 6 or 7) in PNU 0005. These parameters have an equal influence on the actual value channel and the setpoint channel.

PNU	Name	Value	Function
0005	Configuration of analog input signals	6	Operation with PID controller: Setpoint via terminal 8 (analog) Actual value via frequency input E1 (digital)
		7	Operation with PID controller: Setpoint via frequency input E1 (digital) Actual value via terminal 8 (analog)

Under PNU 0051, the current actual value at the controller input can be viewed.

Selecting the PID setpoint channel
With the settings described earlier for the PID actual value channel in PNU 0005, the PID setpoint channel is already defined.

Without the DE4-IOM-APP-F module with PNU 0005 = 7, the setpoint can be entered as a digital fixed frequency or with the LCD keypad:

PNU	Name	Value	Function	Default setting
0145	PID setpoint source	0	Total setpoint (main setpoint plus additive setpoint)	0
		1	Digital setpoint input (LCD keypad) input in PNU 0181	
		2	Setpoint input at FIF operation (PNU 0005 = 200) via internal PID setpoint channel	
0138	Indication of setpoint PCTRL1-SET1	–480.00 to 480.00 Hz	Indication of frequency setpoint via internal PID setpoint channel (PCTRL1-SET1), (PNU 0145 = 2)	
0181	Input, digital setpoint	–480.00 to 480.00 Hz	The PID setpoint can be entered via the LCD keypad here. The value remains stored at Power Off (PNU 0145 = 1)	0.00

Effect of PID controller

The value for the effect of the PID controller (PNU 0074) relates to f_{max} (PNU 0011) and should be set as low as possible. It is calculated as follows:

$$\text{Value of PNU 0074 [\%]} = \frac{\text{PNU 0050} - \text{PNU 0051}}{\text{PNU 0011}} \times 100\ \%$$

Example:

The effect should be defined for values PNU 0011 = 50 Hz, PNU 0050 = 53 Hz and PNU 0051 = 50 Hz:

$$\text{Value of PNU 0074 [\%]} = \frac{53\ \text{Hz} - 50\ \text{Hz}}{50\ \text{Hz}} \times 100\ \% = 6\ \%$$

Taking into account tolerances, PNU 0074 should be set to 10 %.

Limitation of minimum output frequency
The lower frequency limit f_{unt}, which must also be maintained in PID controller operation, can be set with PNU 0239.

Negative values in PNU 0239 may result in a direction reversal during controller operation. You should therefore set PNU 0239 to 0.00 Hz.

Disabling the integral component
By disabling the integral component, you can avoid excessive excitation of the drive, for example at startup with compensator position control. The integral component can then be reactivated once it has settled. This can be achieved in one of two ways:

1. The function can be activated and disabled via a control signal terminal:

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
28 to 34, 48, 50, 51	*)	[DIS-I]	*)	*)	Disabling the integral component HIGH = reset time, I-component disabled

*) Terminal assignment depends on value of PNU 007

The "disable integral component" function can also be freely mapped to terminals E1 to E4 with PNU 0113/018.

The digital inputs can be inverted with PNU 0114.

2. This function can be activated and disabled with PNU 0184 depending on a frequency threshold (PCTRL1-NOUT):

PNU	Name	Value	Function	Default setting
0184	Disable integral component via frequency threshold	0.0 to 25.0 Hz	At output frequencies below PNU 0184, the I-component is disabled 0.0 Hz = function disabled	0.0

Disabling the PID controller output
The PID controller output can also be disabled via the control signal terminals.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
48, 49, 50	*)	*)	*)	[DIS-PID]	Disabling the PID controller HIGH = PID output supplies no signal

*) Terminal assignment depends on value of PNU 007

The "disable PID controller" function can also be freely mapped to terminals E1 to E4 with PNU 0113/019.

The digital inputs can be inverted with PNU 0114.

Freezing the PID controller output
The PID controller output can also be frozen at the current value via the control signal terminals. This function can be freely mapped to terminals E1 to E4 with PNU 0113/021.

PNU	Name	Function
0113/021	[FREEZE-PID]	Freezing the PID controller output HIGH = PID output remains at current value

The digital inputs can be inverted with PNU 0114.

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Guideline values for the P-, I- and D-components
The values in PNU 0071 result in the following reset times:

Value in PNU 0071	Resulting reset time T_N
10 to 5000	10 to 5000 ms
5000 to 6000	5 to 10 s
6000 to 7000	10 to 100 s
7000 to 8000	100 to 1000 s
8000 to 9998	1000 to 9998 s

The table below provides guidelines values for pressure, flow and speed control. In general, an additional fine adjustment is required:

Value in PNU ...	Gases	Liquids	Speed control
0070	0.1	0.02 to 0.1	5
0071	5000 (5 s)	200 to 1000 (0.2 to 1 s)	100 (0.1 s)
0072	0	0	0

Quickstop $-a_{Quick}$

Quickstop can be configured irrespective of setpoint input (operating mode, PNU 0001) with terminals E2, E3 and E4.

The quickstop function can also be freely mapped to terminals E1 to E4 with PNU 0113/004, /022 or /023.

The digital inputs can be inverted with PNU 0114.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
2, 4, 8, 9, 13, 30, 31, 32, 36, 37, 40, 43, 45	*)	*)	LOW	*)	Activate quickstop
46, 49	*)	LOW	*)	*)	
33, 42	*)	*)	*)	LOW	

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
14 to 22, 34, 47	*)	*)	LOW	LOW	Activate quickstop when drive running
			HIGH	HIGH	Activate quickstop when power is applied

*) Terminal assignment depends on value of PNU 007

In addition to the deceleration ramp, the DV4 frequency inverters have a “quickstop ramp”. When the quickstop function is activated, the frequency inverter ramps down at the quickstop ramp time. The quickstop ramp time is configured with PNU 0105.

PNU	Name	Value	Function	Default setting
0105	Quickstop	0.00 to 1300.00	Ramp time for quickstop [s]	5.00

If the ramp time in braking operation is too short, the OU error message appears and the controller inhibit is automatically set.

DC injection braking is activated when the speed drops below the configured value (response threshold, automatic DC braking). PNU 0019 is used for adjusting the automatic DC injection braking response threshold. When the time for DC injection braking (PNU 0106) has expired, the controller inhibit is set.

If PNU 0469 is set to 2, a quickstop is also performed when the STOP key on the LCD keypad is pressed.

In PID controller operation, quickstop is not active.

DC injection brake

DC injection braking is used to rapidly bring the motor to a standstill without the use of a brake unit. In this case, all of the brake energy is dissipated in the motor as heat.

With PNU 0035, you can choose between inputting a braking current or a braking voltage. The level of the braking current or the braking voltage can be set with PNU 0036. The required braking torque is about 20 to 30 % of the rated motor torque and is therefore lower than the braking torque required with an external braking resistor.

External DC braking
External DC braking is activated by the application of a HIGH signal to terminals E1 to E4 or with the control word.

The DC braking function can also be freely mapped to terminals E1 to E4 with PNU 0113/015.

The digital inputs can be inverted with PNU 0114.

PNU 0007 =	Terminal				Function
	E1	E2	E3	E4	
17	HIGH	*)	*)	*)	As long as E1 = HIGH, DC braking is performed
3, 7, 14, 19	*)	HIGH	*)	*)	As long as E2 = HIGH, DC braking is performed
0, 5, 11, 25, 29, 41, 42, 48	*)	*)	HIGH	*)	As long as E3 = HIGH, DC braking is performed
31, 36, 51	*)	*)	*)	HIGH	As long as E4 = HIGH, DC braking is performed

*) Terminal assignment depends on value of PNU 007

PNU	Name	Value	Function	Default setting
0035	DCB braking	0	Braking voltage is specified with PNU 0036	0
		1	Braking current is specified with PNU 0036	
0036	Level of braking voltage or braking current	0 to 150 %	Device-dependent value, relative to rated device voltage or current	4.00 %
0107	Time for external DCB brake	1.00 to 999.00	Ends DC injection braking after expiry of the specified time	999.0 s

Caution!
Longer operation at high braking current can cause overheating of the motor.

Automatic DC injection braking
If the total setpoint (PCTRL1-SET3) drops below the configured response threshold (PNU 0019), DC injection braking is applied automatically for the holding time specified with PNU 0106. The frequency inverter then goes into controller inhibit mode.

PNU	Name	Value	Function	Default setting
0196	Activation of automatic DCB	0	Activates automatic DC injection braking when total setpoint falls below specified response threshold: Total setpoint (PCTRL1-SET3) < PNU 0019	0
		1	Activates automatic DC injection braking when the total setpoint (PCTRL1-SET3) and the setpoint applied to ramp generator input 1 (NSET1-RFG1-IN) falls below the value of PNU 0019: (PCTRL1-SET3) < PNU 0019 and (NSET1-RFG1-IN) < PNU 0019	
0019	Response threshold for auto DCB	0.00 to 480	Value below which automatic DC injection braking becomes active 0.00 Hz = auto DCB disabled	0.10 Hz
0106	Time for auto DCB	0.00 to 999.00	Ends automatic DC injection braking after expiry of the specified time 0.00 s = auto DCB disabled	0.50 s

Braking operation with internal braking transistor

For braking operations with larger mass inertia moments or for prolonged regenerative operation, the DV4 frequency inverters have an internal braking transistor.

An external braking resistor – available as an optional extra – must be connected to the corresponding frequency inverter terminals. If the switching threshold of the internal DC link voltage is exceeded, the braking transistor switches this braking resistor into the circuit. The mechanical braking energy is then converted to heat energy by the resistor.

With PNU 0174, the switching threshold can be adjusted to match the network voltage.

At a setting of 110 %, the braking transistor is disabled.

The default setting of 100 % corresponds to a switching threshold of V_{DC} = 780 V, taking into account a maximum network overvoltage of 10 percent.

PNU	Name	Value	PNU 0174 [%]	Network voltage V_{Net} [V]	Switching threshold V_{DC} [V]	Default setting
0174	Switching threshold V_{DC} of the braking transistor	78 to 110 %	100	500	780	100 %
			96	480	749	
			92	460	718	
			88	440	686	
			83	415	647	
			80	400	624	
			78	380	608	

On the DV4 inverters with 240 V supply voltage, the switching threshold of 375 V cannot be changed.

AC braking

Alternatively to DC braking, AC braking can also be used in motor control mode PNU 0014 = 2 “Linear characteristic (*V/f* = const.)”. This allows shorter braking times to be achieved at supply voltages up to about 400 V. Conversely, DC braking achieves shorter braking times at higher supply voltages. This function is implemented with the parameter set changeover depending on the internal DC link voltage (see also PNU 0988, controlled deceleration after supply failure). The parameters configured in parameter set 2 result in over-excitation, leading to a decay of the energy in the motor.

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Function configuration

The table below describes how functions are configured.

PNU	Settings in PAR1 (active in normal operation)	Settings in PAR2 (active in braking operation)
0988	Set the switching threshold for parameter set changeover. Choose the following values depending on the supply voltage: 230 V, 400 V = 112 % 440 V = 123 % 460 V = 129 % 480 V = 134 % 500 V = 140 %	
0013, 0105	Set the braking time required for the application	Enter the deceleration time at maximum centrifugal load without triggering the message “Overvoltage OU”
0015	Set the rated or transition frequency (e.g. 50 Hz) required for the application	At least 25 % of the value of PNU 0015 in PAR1 Depending on drive rating Guideline: About 50 % at 2.2 kW At lower ratings, reduce value At higher ratings, increase value
0016	Set the voltage pull-up V_{min} (e.g. 5 %) required for the application	Up to five times the value of PNU 0016 in PAR1 Depending on drive rating Guideline: a factor of about 3 at 2.2 kW At lower ratings, increase factor At higher ratings, reduce factor

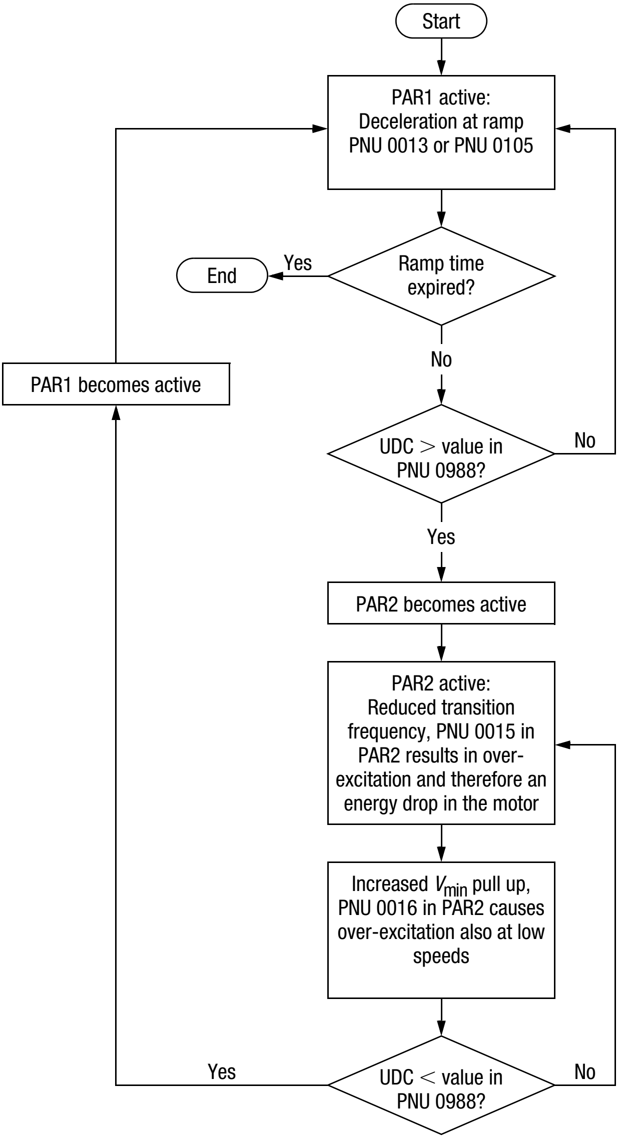

Figure 56: AC braking (sequence of operation)

External error input

With this function, external error handling using the controller inhibit function can be incorporated in the frequency inverter’s control system. The table below shows at which values (PNU 0007) and which terminal assignment the external error is triggered.

The external error function can also be freely mapped to terminals E1 to E4 with PNU 0113/011.

The digital inputs can be inverted with PNU 0114.

PNU 0007 =	**Terminal**				**Function**
	E1	**E2**	**E3**	**E4**	
7, 8, 18, 19	LOW	*)	*)	*)	External error is triggered (EEr message) and activates controller inhibit at LOW signal at indicated terminal and configuration
5, 6, 9, 20, 38 to 43	*)	LOW			
10, 27		*)	LOW		
32			*)	LOW	

*) Terminal assignment depends on value of PNU 007

Motor control mode

The motor control mode setting is used to configure the frequency inverter to its specific application. You must verify in each case whether the default settings can be changed. Controller inhibit must be active before the motor control mode is changed.

PNU	**Name**	**Value**	**Function**	**Default setting**
0014	Motor control mode	2	Linear characteristics with constant V_{min} pull-up (V/f = const.)	2
		3	Quadratic characteristic with constant V_{min} pull-up ($V \sim f^2$)	
		4	Vector control	
		5	Sensorless torque control with speed limitation Torque setpoint as set in PNU 0005	

Vector control, motor control mode 4
The DV4 frequency inverters have a sensorless vector control system, with which a significantly larger torque, improved concentricity and a reduced energy consumption at idle can be achieved, especially at low speeds, compared to systems using conventional *V/f* function generator control.

Typical fields of application for vector control include drives with higher dynamic requirements and starting torques.

In connection with slip compensation, PNU 0021, it can also be used for sensorless speed control. This avoids, for example, the speed fluctuations that are otherwise caused by significant load changes.

☞ In motor control modes 4 and 5, only the motor ratings assigned in the frequency inverter must be connected. They must be at least two performance categories lower.

To achieve optimum control in control mode 4 or 5, identification of the connected motor (see PNU 0148) or the correct input of its specifications is an absolute necessity.

Caution!
You should not use vector control if several motors with different loads or ratings are being operated with a single frequency inverter.

Torque limitation in motor control modes 2, 3 and 4
With PNU 0005 = 3, you can set torque limitation via the analog input at terminal 8. The torque limit value is then maintained by the automatic speed adjustment.

PNU 0047 indicates the torque limit value in percent of rated motor torque.

If the torque limit value is to be entered via the analog input, PNU 0027, “GAIN”, must be adjusted accordingly. The value to be entered there is calculated as follows:

$$\text{GAIN \%} = \frac{32768\ \text{Hz} \times M_{max}}{\text{PNU 0011} \times 100\ \%}$$

M_{max} = maximum admissible motor torque limit value in % of rated motor torque

32768 corresponds to 100 % rated motor torque.

Example:

PNU 0011 = 50 Hz, M_{max} = 40 %

$$\text{GAIN \%} = \frac{32768\ \text{Hz} \times 40\ \%}{50\ \text{Hz} \times 100\ \%} = 262.14$$

Sensorless torque control, motor control mode 5
In sensorless torque control, a constant torque is used. A speed limit (e.g. maximum output frequency in PNU 0011) is specified, which is not exceeded (speed limitation). This function is used, for example, for winding drives.

The torque setpoint or the speed limitation value is selected as specified in PNU 0005 = 4 or 5.

Feedback of the actual value is not required due to the absence of a sensor.

PNU 0047 indicates the torque setpoint in percent of rated motor torque.

If the torque is to be entered via the analog input, PNU 0027 or PNU 0426 , “GAIN”, must be adjusted accordingly. The value to be entered there is calculated as follows:

$$\text{GAIN \%} = \frac{32768\ \text{Hz} \times M_{max}}{\text{PNU 0011} \times 100\ \%}$$

M_{max} = maximum admissible motor torque setpoint in % of rated motor torque

32768 corresponds to 100 % rated motor torque.

Example:

PNU 0011 = 50 Hz, M_{max} = 40 %

$$\text{GAIN \%} = \frac{32768\ \text{Hz} \times 40\ \%}{50\ \text{Hz} \times 100\ \%} = 262.14$$

M_{max} is then the torque setpoint in percent of the rated motor torque.

Linear characteristic, motor control mode 2/ quadratic characteristic, motor control mode 3

The linear characteristic curve provides a constant torque curve across the whole speed range up to the rated *V/f* frequency (PNU 0015).

The quadratic characteristic (for drives with quadratic load torque behaviour, such as pumps and fans) results in lower losses through magnetization reversal and reduced noise generation by the motor. However, in the case of large moments of inertia, the motor may not be able to provide the necessary torque.

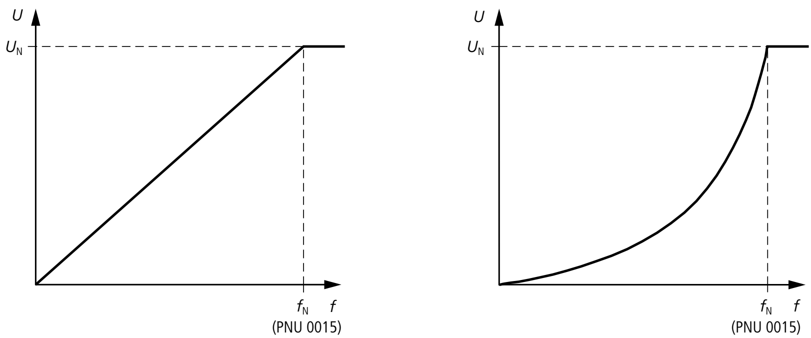

Figure 57: Linear and quadratic frequency behaviour

V_{min} pull-up

To allow the motor to generate a larger torque in control mode 2 or 3 and operate at frequencies approaching zero, the voltage must be elevated due to the motor's ohmic resistance. The extent of this voltage pull-up, V_{min}, can be specified with PNU 0016.

At V_{min} pull-up, the characteristic curve begins at the specified voltage before rising as shown in figure 58. Because this value is set for operation under load, the motor incurs higher losses at no-load operation. Voltage pull-up is ideally suited to

- applications with several motors
- three-phase reluctance motors
- three-phase sliding rotor motors
- Special-purpose motors

In motor control modes 4 and 5, V_{min} pull-up has no effect.

PNU	Name	Value	Function	Default setting
0016	V_{min}-pull-up	0.00 to 40.0 %	V_{min} specifies the voltage pull-up at zero frequency	Device-dependent

Warning!
Excessive V_{min}-values result in an increased thermal load and possible damage of the motor.

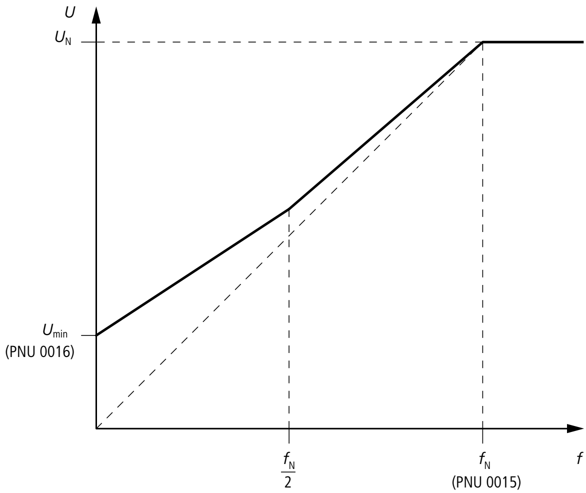

Figure 58: Characteristic of V_{min} voltage pull-up

V/f rated frequency

The characteristic point (transition frequency) PNU 0015 is usually determined by the motor rating and the frequency inverter's rated voltage. An incorrectly specified characteristic can result in reduced torque or overheating of the motor.

The transition frequency has a decisive effect on the current, torque and output behaviour of the motor. If the frequency inverter is used in motor control mode 4 (vector control), the transition frequency setting also has an effect on the internal motor model parameters.

PNU	Name	Value	Function	Default setting
0015	*V/f* rated frequency	7.5 to 960.0 Hz	Transition frequency of the rated voltage	50 Hz

Example:

For the DV4-340 frequency inverters with a rated voltage V_{Netz} = 400 V three-phase, the motor data V_{NMot} = 380 V and f_{NMot} = 50 Hz results in the following points on the characteristic curve:

$$\text{PNU 0015} = \frac{400\ \text{V}}{380\ \text{V}} \times 50\ \text{Hz} = 52.6\ \text{Hz}$$

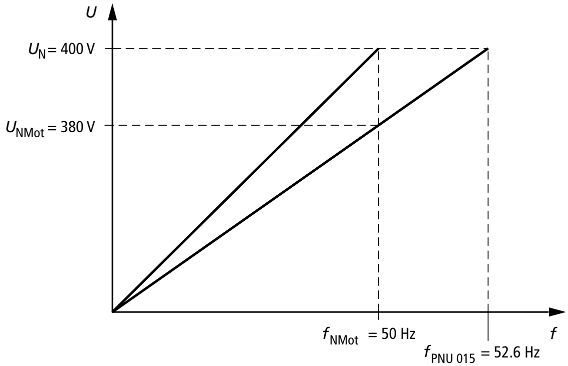

Figure 59: Calculating the transition frequency (PNU 0015)

If a motor parameter identification is performed, the determined values are automatically entered in PNU 0015.

Supply voltage fluctuations during operation are levelled out by an internal supply voltage compensation and do therefore not have to be taken into account in the settings.

Maximum and minimum frequency

The maximum and minimum frequencies do not influence the *V/f* characteristic curve, but limit the range in which the frequency inverter can be continually operated. The value f_{min} represents the lower limit and f_{max} the upper limit.

Warning!
If f_{max} is set too high, the motor can incur mechanical damage due to excessive centrifugal forces.

PNU	Name	Value	Function	Default setting
0010	f_{min}	0.0 to 480.0 Hz	Minimum setpoint frequency for analog setpoints (setpoint normalizing factor: 0 %)	0
0011	f_{max}	7.5 to 480.0 Hz	Maximum setpoint frequency for analog setpoints (setpoint normalizing factor: 100 %)	50 Hz
0239	f_{unt}	–480.00 to 480.00 Hz	Lower frequency limit, independent of the setpoint	–480 Hz

When the frequency inverter starts at 0 Hz, the range up to f_{min} (PNU 0010) is not skipped, but is traversed at the ramp time. In steady-state operation, values between 0 Hz and f_{min} are not possible. In this case, the frequency inverter automatically approaches f_{min}. Parameter f_{max} (PNU 0011) is the upper limit, which must not be exceeded under any circumstances. f_N is the rated frequency (transition frequency) set with PNU 0015. f_{max} is used for normalizing the setpoint and is always 100 % of the setpoint (right endstop of potentiometer). f_{min} always corresponds to 0 %. Depending on the value of f_{max}, the rated speed of the motor is already reached at a low analog setpoint.

☞ The function PNU 0010 has no effect if the setpoint input is bipolar (–10 to +10 V).

The motor speed is never allowed to fall below f_{unt} (PNU 0239). This value can therefore be used, for example, to protect against dry running of pumps.

With a setting of PNU 0239 > 0 Hz, the motor can be run only in one direction.

If PNU 0239 > PNU 0011, no value between 0 Hz and PNU 0239 is possible in steady-state operation. The frequency inverter then automatically approaches f_{unt}.

☞ If you want to operate the motor above the rated speed, you should contact the motor manufacturer.

☞ f_{max} limits fixed frequencies that were programmed too high. You should only change f_{max} if the controller inhibit function is active.

☞ If f_2 is greater than300 Hz, avoid operating frequencies below 8 kHz.

☞ f_{min} only acts on the analog setpoint, not the fixed frequencies.

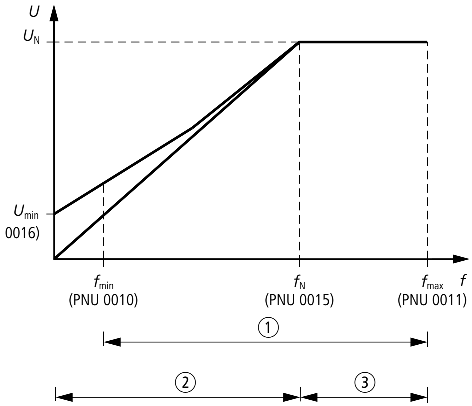

Figure 60: Speed range

① Usable motor speed range
② M = constant
③ M ~ 1/f

Motor data, input or automatic identification

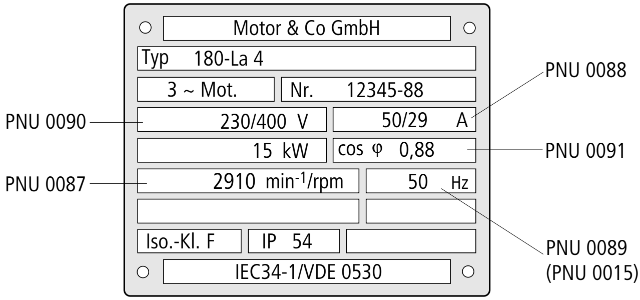

Figure 61: Motor name plate

PNU	Name	Value	Default setting
0084	Motor stator resistance	0.000 to 64.000 Ω	0.000
0087	Rated motor speed	300 to 16000 rpm	1390
0088	Rated motor current	0.0 to 480.0 A	Device-dependent, 0 to 2 $\times$ I_n
0089	Rated motor frequency	10 to 960 Hz	50 Hz
0090	Rated motor voltage	50 to 500 V	Device-dependent
0091	Motor cos φ	0.40 to 1.0	Device-dependent
0092	Motor stator inductance	0.0 to 2000.0 mH	0.0
0148	Motor parameter identification	0 = identification disabled 1 = identification active	0

The DV4 frequency inverters have an automatic motor identification function for establishing the ratings of the connected motor. The function measures the stator resistance and calculates the stator inductance from the entered data. This measurement also takes the influence of the motor’s power cable into account. Parameters PNU 0015 and 0021 are automatically calculated and assigned.

To use motor control mode 4 (vector control) or 5, (sensorless torque control), you must carry out the motor identification during the initial setup.

Because the measurements are taken while the rotor is stationary, the driven machine does not have to be disconnected and its brakes do not have to be drained.

If no load is applied to the motor, only a small angular misalignment of the rotor can occur.

The identification should be carried out with a cold motor. During operation, the motor data is then corrected automatically to compensate for temperature changes.

☞ You must enter the values for PNU 0087, 0088, 0089, 0090 and 0091 from the motor's ratings plate, since these also have a decisive effect on slip compensation, no-load current and I^2t-monitoring. Take the type of circuit (star or delta) into which the motor is connected into account, and enter this data accordingly.

To carry out the motor identification:

Disable the frequency inverter. Activate controller inhibit via terminal 28.

Enter values from motor ratings plate in PNU 0087, 0088, 0089, 0090 and 0091.

Enter PNU 0148 = 1

Confirm input with ENTER. The message STORE appears.

Enable the frequency inverter. Disable controller inhibit via terminal 28 and, if necessary, press the RUN key.

During identification, which takes about 30 seconds, the green LED on the frequency inverter flashes quickly.

When identification is complete, the LED flashes at its normal rate again and IMP is set.

To start, disable controller inhibit again via terminal 28 and, if necessary, press the RUN key.

You can also assign and change the values for PNU 0084 and 0092 manually.

The acquired motor data applies to the currently active parameter set. To copy the motor data to another parameter set, this parameter set must first be activated via the digital inputs.

With PNU 0002, the acquired data can also be copied to other parameter sets.

Ramp times

The ramp generator delays the setpoint change, thereby allowing the specified acceleration or deceleration of the frequency inverter to take place.

PNU	Name	Value	Function	Default setting
0012	+a	0.0 to 1300.0 s	Main setpoint: Acceleration time from 0 Hz to f_{max}	5 s
0013	–a	0.0 to 1300.0 s	Main setpoint: Deceleration time from f_{max} to 0 Hz	
0220	$+a_{Additive}$	0.0 to 1300.0 s	Additive setpoint (PCTRL1-NADD): Acceleration time from 0 Hz to f_{max}	
0221	$-a_{Additive}$	0.0 to 1300.0 s	Additive setpoint (PCTRL1-NADD): Deceleration time from f_{max} to 0 Hz	
0182	Integration time for S-ramp	0.00 to 50.00	For smooth acceleration of main setpoint 0.00 = linear ramp 0.00 $>$ 0 = s-shaped ramp	0

Under normal conditions, DV4 frequency inverters can be operated continuously at the current limit. To achieve this, the frequency inverter automatically reduces the setpoint in order to operate the drive at lower speeds with a lower load. This has the result, however, that speed changes can no longer be carried out at the configured ramp times when the current limit is reached. If the load does not drop off quickly enough with the motor speed, and if the entered times are too short, the frequency inverter may trigger error OC5 (device overload).

The entered acceleration and deceleration times are relative to the change in output frequency in the range from 0 Hz to the maximum speed (f_{max}) in PNU 0011.

The effect of PNU 0182 depends on the chosen ramp form, and therefore also facilitates jolt-free acceleration and deceleration of the drive. This parameter has no effect on the additive setpoint.

The ramp generator input of the main setpoint can also be set to zero with the configuration under PNU 0113/006 [RFG1-0]. As long as this function is active, the drive decelerates to 0 Hz at the deceleration time specified in PNU 0013.

With PNU 0113/005 [RFG1-STOP], the ramp generator can also be stopped. As long as this function is active, the ramp, and therefore the output frequency, can be frozen at its current value.

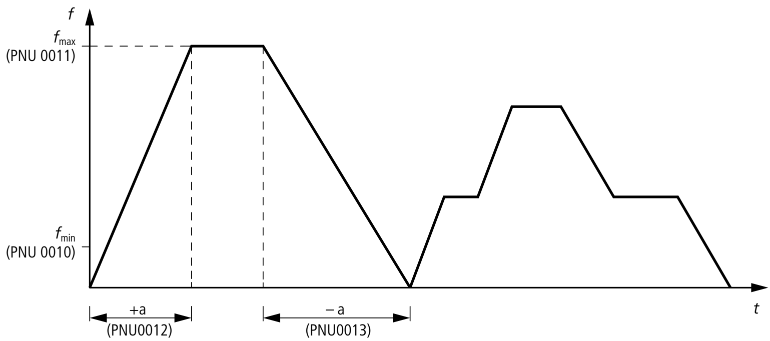

Figure 62: Ramp times

Current limit values

The frequency inverter is provided with a current limit control which affects the dynamic behaviour under load. The measured load is compared with the configured values for a drive load (PNU 0022) and a regenerative load (PNU 0023).

When the current limit is reached, the acceleration ramp time is increased. At increasing load at constant speed, the output frequency may be reduced down to 0 Hz. If the current is still excessive, the I^2t-calculator triggers an overcurrent signal after a certain time.

When the frequency inverter reaches the regenerative current limit, the deceleration ramp is extended and the output frequency increased up to max. f_{max} until the current drops back below the set limit.

If the load torque on the motor increases suddenly, for example because the drive is blocked, an overcurrent shutdown may be triggered (error signal OCX).

The best current control is achieved by the use of a brake resistor or interconnected frequency inverters.

With PNU 0077 and 0078, the current limiter and therefore the dynamic behaviour at the current limit can also be influenced. The default control values are chosen to prevent the drive from stalling. Especially for load regulation of larger moments of inertia, it may be advisable to adapt the control parameters.

At operating frequenciesbelow 8 kHz, you must reduce current limitation (derating at higher operating frequencies). The values of I_{max} for 60 seconds are listed in the Technical data in the appendix.

PNU	Name	Value	Function	Default setting
0022	I_{max}	30 to 150 %	Current limit, drive operation	150 %
0023	I_{maxGen}	30 to 150 %	Current limit, regenerative operation	150 %
0077	Gain I_{max}	0.00 to 16.00	P-component, at +0.00 = disabled	0.25
0078	Reset time I_{max}	12 to 9990 ms	I-component, at 9990 = disabled	65

In motor control mode 2 or 3 (PNU 0014), the regenerative current limit can be disabled by setting PNU 0023 to 30 %.

The current limit values relate to the rated output current at an operating frequency of 8 kHz.

Slip compensation

When a load is applied to the drive, motor slippage increases, resulting in a decreased motor speed. The slippage can be partly compensated for with the settings in PNU 0021. This setting is effective in all motor control modes (PNU 0014).

In order to calibrate slip compensation, run the motor at no-load and measure the motor speed that is reached. Then run the motor under load and adjust the slip compensation to reach the same speed again.

Caution!
If the value of this parameter is set too high, the frequency inverter may become unstable.

PNU	Name	Value	Function	Default setting
0021	Slip compensation	–50.0 to 50.0	Balancing load-dependent speed fluctuations	0.0 %

Slippage in motor control modes 2 and 3 (PNU 0014) increases when PNU 0021 is greater than 0. This can be useful, for example, when multiple motors are being controlled, since it reduces the response of the drives to large torque surges.

When a motor identification (PNU 0148) is carried out, PNU 0021 is configured automatically. During operation with the internal PID controller, PNU 0021 should be set to 0.0.

Operating frequency

This parameter is used to adjust the operating frequency of the inverter. You do not normally need to change the default setting.

In the following cases, however, it may be advisable to change this setting:

Operating frequency 2 or 4 kHz:
Improved torque characteristics at small setpoints

Operating frequency 16 kHz:
Reduced noise generation by the motor
Good sine-wave shape of motor current in applications with setpoints above 150 Hz

Caution!
Adjustment of the operating frequency (PNU 0018) does not automatically change the current limits.

PNU	Name	Value	Function	Default setting
0018	Operating frequency	0	2 kHz	2
		1	4 kHz	
		2	8 kHz	
		3	16 kHz	
0144	Operating frequency reduction	0	No operating frequency reduction	1
		1	Automatic operating frequency reduction at (heatsink temperature ϑ_{max}) –5 °C	

Higher operating frequencies increase the losses in the frequency inverter. Accordingly, the current limits must be derated in this case.

Automatic operating frequency reduction (PNU 0144) affects the behaviour of the frequency inverter at operating frequencies of 8 kHz and 16 kHz.

PNU 0144 =	Function
0	At operating frequencies of 8 kHz and 16 kHz and when ϑ_{max} is exceeded, the inverter is disabled and the TRIP signal set. The motor then spins down.
1	At operating frequencies of 8 kHz and 16 kHz and when ϑ_{max} = –5 °C is exceeded, the operating frequency is automatically reduced to 4 kHz. and operation is maintained. The operating frequency reduction results in an increased noise generation by the motor.

Oscillation damping

Oscillation damping optimizes motor operation. You may have to adjust this parameter for motors whose rated output is lower than that of the frequency inverter, for example for motors with a large number of poles and for special-purpose motors. This parameter can also be adjusted to minimize the occurrence of resonance in the drive.

PNU	Name	Value	Function	Default setting
0079	Oscillation damping	0 to 80	Reduction of vibration under no load	Device-dependent

The speed range at which vibrations occur is approached and then reduced by gradually changing PNU 0079.

Frequency signal

The frequency signal value (f_1) can be adjusted with PNU 0017. The frequency can have a value between 0.0 and 480.0 Hz. If the output frequency f_2 exceeds the set value ($f_2 > f_1$), relay K1 picks up. By default, f_1 is set to 0 Hz.

The function of relay output K1 can be programmed with PNU 0008 = 7.

Read-only parameters

Display

Some parameters that are measured by the frequency inverter during operation can be displayed on LCD keypad DE4-KEY-3.

Some display values can also be calibrated as process variables with PNU 0500 or 0501.

PNU	Name	Value	Function
0004	Bar graph display	Default: PNU 0056 = device load –180 to +180 %	The value of the PNU selected from this table is indicated in %
0044	Setpoint 2 NSET1-N2	–480.00 to +480.00 Hz	Display only
0046	Setpoint 1 NSET1-N1	–480.00 to +480.00 Hz	Display only
0047	Torque setpoint or torque limit value	0 to 400.00 %	The rated motor torque determined by motor identification is used as the reference value Display only
0049	Additive setpoint	–480.00 to +480.00 Hz	Display and input
0050	Output frequency f_2	–480.00 to +480.00 Hz	Display only
0051	Output frequency f_2 with slip compensation	–480.00 to +480.00 Hz	
0052	Motor voltage	0 to 1000 V	
0053	DC link voltage	0 to 1000 V	
0054	Apparent motor current	0 to 400 A	
0056	Inverter load	–255 to 255 %	
0061	Heatsink temperature	0 to 255 °C	Display only, TRIP “OH” when heatsink temperature > +85 °C
0138	Setpoint via internal PID setpoint channel (PCTRL1-SET1)	–480.00 to +480.00 Hz	Indication of frequency setpoint in FIF operation (PNU 0005 = 200)

Analog output signal for monitoring

To monitor the frequency inverter, various process variables can be output via the analog output (terminal 62) as normalized voltages. The following functions can be mapped to the output:

PNU	Name	Value	Function
0111	Output frequency f_2	0	10 V corresponds to value in PNU 0011
	Inverter load	1	5 V corresponds to rated motor torque when PNU 0014 = 4 (vector control), otherwise to rated device current
	Apparent motor current	2	5 V corresponds to rated device current
	DC link voltage	3	10 V corresponds to 1000 V (400 V supply) 10 V corresponds to 380 V (230 V supply)
	Motor rating	4	5 V corresponds to rated motor output
	Motor voltage	5	8 V corresponds to rated motor output
	1/output frequency f_2	6	3.3 V corresponds to value in PNU 0050 = 0.4 $\times$ PNU 0011
	Output frequency f_2 within set limits	7	0 V corresponds to f_{min} (PNU 0010) 10 V corresponds to f_{max} (PNU 0011)
	Operation with PID controller (PNU 0238 = 0, 1): PID actual value Operation without PID controller (PNU 0238 = 2): output frequency without slippage	8	10 V corresponds to f_{max} (PNU 0011)
	Inverter ready to operate	9	Parameter values 9 to 25 correspond to the functions under PNU 0008 or 0117 (digital outputs, parameter values 0 to 16). According to their logical condition, they can also be mapped to the analog output with the following levels: LOW = 0 V HIGH = 10 V
	TRIP signal	10	
	Motor running	11	
	Motor running, CW rotation	12	
	Motor running, CCW rotation	13	
	Output frequency $f_2 = 0$	14	
	Frequency setpoint, f_{set} reached	15	
	$f_2 > f_1$ threshold reached	16	
	I_{max} limit reached For PNU 0014 = 5: torque setpoint reached	17	

PNU	Name	Value	Function
0111	(heatsink temperature ϑ_{max}) – 5 °C	18	
	TRIP or $f_2 > f_1$ or IMP active	19	
	PTC warning	20	
	Drive belt monitor: apparent motor current < current threshold	21	For drive belt monitoring (21 to 23): Apparent motor current = PNU 0054 Current threshold = PNU 0156 (in % of I_N frequency inverter) $f_2 > f_1$ = PNU 0017
	Apparent motor current < current threshold and $f_2 > f_1$ reached	22	
	Apparent motor current < current threshold and ramp generator 1: input = output	23	
	Motor phase failure warning	24	
	Minimum output frequency f_{min} (PNU 0010) reached	25	
	Reserved	26	
	output frequency without slippage	27	10 V corresponds to f_{max} (PNU 0011)
	PID actual value	28	
	PID setpoint	29	
	PID output	30	
	Ramp generator input	31	
	Ramp generator output	32	

The analog output (terminal 62) can still be adjusted during operation with the gain and offset settings.

PNU	Name	Value	Function	Default setting
0108	GAIN analog output	0 to 255	Gain, analog output (gain to PNU 0111)	213 (corresponds to 10 V)
0109	OFFSET analog output	–10.00 to 10.00 V	Offset, analog output (offset to PNU 0111)	0.00

Bar graph display

The bar graph appears at the bottom of the display on the LCD keypad and indicates the selected parameter as soon as power is switched on, providing a graphical indication of operating data.

PNU	Name	Value	Function	Default setting
0004	Bar graph display	1 to 989	Indication of the selected operating parameters in the form of a bar graph on the display. Range: –180 to 180 %. All PNU values can be displayed.	56

To program the bar graph, enter the parameter number of the value to be displayed in PNU 0004.

Absolute display of a process variable

Here, the parameters relating to the rotating field frequency (PNU 0010, 0011, 0017, 0019, 0037, 0038, 0039, 0044, 0046, 0049, 0050, 0051, 0138, 0139, 0140, 0181, 0239, 0625, 0626 and 0627) are matched to a process variable to be controlled, e.g. a speed. The parameters then indicate the absolute value of the process variable without the unit “Hz”.

PNU	Name	Value	Function	Default setting
0500	Display factor for processing speed, numerator	1 to 25000	Conversion factor (numerator) from a physical value to a process variable	2000
0501	Display factor for processing speed, denominator	1 to 25000	Conversion factor (denominator) from a physical value to a process variable	10

Calibration

The displayed value is calculated as follows:

$$\text{Display under PNU xxxx} = \frac{\text{Value of PNU xxxx}}{200} \times \frac{\text{PNU 0500}}{\text{PNU 0501}}$$

Example:

Changing the display from frequency to motor speed.

For PNU 0011 = f_{max} = 50 Hz, a display value of 1500 is desired. The value is displayed without units.

$$\text{Display under PNU 0011} = \frac{\text{Value of PNU xxxx}}{200} \times \frac{\text{PNU 0500}}{\text{PNU 0501}}$$

$$1500 = \frac{50}{200} \times \frac{\text{PNU 0500}}{\text{PNU 0501}}$$

e.g. PNU 0500 = 6000, PNU 0501 = 1

The previously specified parameters are always matched.

Running time meter

The running time meter shows the time during which:

- the frequency inverter is enabled (running time: PNU 0178)
- the frequency inverter is connected to the mains power (power-on time: PNU 0179)

A duration of 0 to 65,000 hours can be displayed.

Monitoring functions

Digital outputs

If the DV4 frequency inverter is equipped with a DE4-IOM-STD-F module, two digital outputs are available.

Different functions can be assigned independently to each of these outputs.

The function selection procedure is the same for both outputs.

Output	Type/terminals	Configuration under ...	Default setting
K1	Relay output/changeover switch K11, K12, K14	PNU 0008	0
A1	Transistor output/A1, 59	PNU 0117	1

PNU	Name	Value	Function of K1, A1
0008 0117	Inverter ready to operate	0	Supply on, no fault
	TRIP signal	1	Fault
	Motor running	2	$f_2 > 0$ Hz
	Motor running, CW rotation	3	Direction change, $f_2 > 0$ Hz
	Motor running, CCW rotation	4	Direction change, $f_2 > 0$ Hz
	Output frequency $f_2 = 0$	5	Output frequency is 0 Hz
	Frequency setpoint, f_{set} reached	6	f_2 has reached setpoint
	$f_2 > f_1$ threshold reached	7	Value of PNU 0017 exceeded
	I_{max} limit reached For PNU 0014 = 5: Torque setpoint reached	8	Motor current has reached limit value in PNU 0022 (I_{max} motor.) or 0023 (I_{max} gener.) &$§
	(heatsink temperature ϑ_{max}) – 5 °C	9	Max. heatsink temperature – 5 °C reached
	TRIP or $f_2 > f_1$ or IMP active	10	Error message if PNU 0017 exceeded, or impulse disable active
	PTC warning	11	Motor overtemperature

PNU	Name	Value	Function of K1, A1
0008 0117	Apparent motor current < current threshold	12	For drive belt monitoring: Apparent motor current = PNU 0054 (display) Current threshold = PNU 0156 (in % relative to I_N frequency inverter) Adjustment of value for frequency message $f_2 > f_1$ in PNU 0017
	Apparent motor current < current threshold and $f_2 > f_1$ reached	13	
	Apparent motor current < current threshold and ramp generator 1: input = output	14	
	Motor phase failure warning	15	Motor phase absent or interrupted
	Minimum output frequency f_{min} reached	16	Speed of f_{min} (PNU 0010) reached
	PAR2/PAR4 active	17	Parameter set PAR2 or PAR4 active
	Impulse disable, IMP active	18	
	Ramp generator 1: input = output	19	
	Controller inhibit, CINH active	20	
	Overvoltage in internal DC link	21	
	Motor running, CCW rotation	22	
	PAR3/PAR4 active	23	Parameter set PAR3 or PAR4 active
	PID input = PID output	24	

Switching window for digital outputs

The two functions

"Frequency setpoint, f_{set} reached" and

"Ramp generator 1: input = output"

in PNU 0008 and 0117 respectively become active within a "switching window". This switching window is equivalent to the main setpoint (NSET1-RFG1-IN) applied to ramp generator 1.

Example:

The functions "frequency setpoint, f_{set} reached" is set. The setpoint is 30 Hz and PNU 0185 is set to 10 % ($\pm$ 3 Hz).

The output switches when the output frequency moves into the range between 27 and 33 Hz. If a new analog setpoint is specified, the window moves accordingly with the setpoint.

PNU	Name	Value	Function	Default setting
0185	Switching window	0 to 80 %	PNU 0185 = 0 % => $\pm$ 0.5 % relative to value in PNU 0011 PNU 0185 $>$ 0 % => $\pm$ value relative to the main setpoint applied to the ramp generator (NSET1-RFG1-IN)	0

Level inversion, digital outputs

The level of digital outputs K1 and A1 can be inverted with PNU 0416. The binary value determines the outputs' level pattern.

The input value is the corresponding decimal value.

PNU	Name	Value	A1 2^1	K1 2^0	Default setting
0416	Level inversion, digital outputs	0	0	0	0
		1	0	1	0 = output not inverted when HIGH is active 1 = output inverted when LOW is active
		2	1	0	
		3	1	1	

Thermal monitoring (*I^2t monitoring)*

I^2t monitoring allows sensorless thermal monitoring of self-ventilated three-phase motor. The load limit can be set between 0 and 100 % with PNU 0120. The default is 0 %.

PNU	Name	Value	Function	Default setting
0120	*I^2t monitoring*	0 to 200 %	Sensorless thermal motor monitoring	0 %

Calibration

Enter a load limit for the connected motor relative to the frequency inverter's rated output current. If this value is exceeded for a longer period of time, the frequency inverter switches off with the fault OC6.

The current limits, which are set with PNU 0022 and 0023, have only an indirect influence on the I^2t calculation. With them, operation of the frequency inverter at maximum load (PNU 0056) can be avoided.

If an unsuitable frequency inverter model is used, the rated output current can be much higher than the rated motor current. Reduce the parameter of PNU 0120 by the factor of the mismatch.

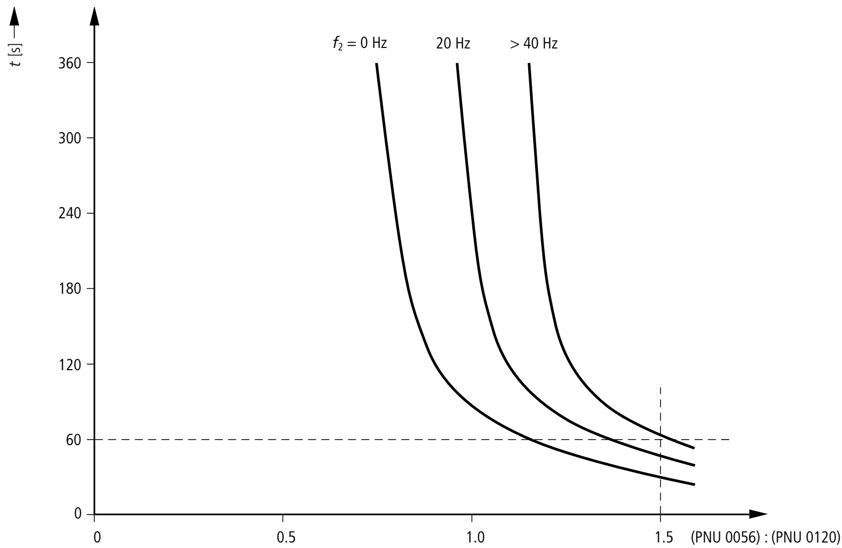

Figure 63: I^2t monitoring

Example:

At PNU 0120 = 100 % and a load PNU 0056 = 150 %, the device switches off after 60 seconds when $f_2 > 40$ Hz, or earlier if $f_2 < 40$ Hz.

Caution!
Each time the supply is switched on, the calculated I^2t *value is reset to zero. The frequency inverter does not have a thermal memory.*

The setting PNU 0120 = 0 deactivates the thermal trip.

PTC input terminals

The input is suitable for connecting PTC thermistors conforming to DIN 44 081 and DIN 44 082. With a PTC thermistor, the motor temperature can be measured and incorporated in frequency inverter monitoring. This input can also be used to connect a temperature switch (break contact).

On the frequency inverter, the input is marked as terminal T1 and T2.

PNU	Name	Value	Function	Default setting
0119	Function of PTC input	Earth fault detection OC2 active		0
		0	PTC input disabled. Disable earth fault detection if it triggers unintentionally	
	Earth fault detection	1	PTC input active, TRIP and controller inhibit are set	
		2	PTC input active, warning is issued	
		Earth fault detection OC2 disabled		
		3	PTC input inactive	
		4	PTC input active, TRIP and controller inhibit are set	
		5	PTC input active, warning is issued	

The TRIP or warning signal is triggered at a resistance of about 1.6 kΩ.

Disable earth fault detection if it triggers unintentionally.

In multi-motor operation with a single frequency inverter, it is advisable to monitor temperatures using temperature switches (break contacts) that are connected in series (motor phase failure recognition).

With this function, any motor phase failures at the frequency inverter's output site can be recognized.

PNU	Name	Value	Function	Default setting
0597	Configuration of motor phase failure recognition	0	Function disabled, phase failure is not recognized	0
		1	TRIP error message = LP1, bus: 32	
		2	Warning = LP1, bus: 182 The warning signal can also be issued via the digital outputs with PNU 0008 or 0117 = 15.	
0599	Current limit value of motor phase failure recognition	1 to 50 %	Response threshold for motor phase failure recognition This value is relative to the frequency inverter's rated output current	5 %

STOP key function

The function that is performed when the STOP key is pressed can be configured as follows:

PNU	Name	Value	Function	Default setting
0469	Function of the STOP key	0	Disabled, no function assigned to the STOP key	1
		1	CINH, controller inhibit is set	
		2	QSP, run down at quickstop ramp	

Saving parameters

PNU	Name	Value	Function	Default setting
0003	Do not save parameters in volatile memory	0	Parameters are not saved in the EEPROM Data loss on power off	1
		1	Parameters are saved in the EEPROM Cyclic changing of parameters via bus module is not permitted	

Diagnostics

With the diagnostics parameter, the status of the frequency inverter can be displayed. The following operating conditions are reported with PNU 0183:

PNU	Name	Value	Function
0183	Diagnostics	0	No fault
		102	TRIP active
		104	“Overvoltage” (OU) or “Undervoltage” (LU) signal active
		142	IMP, impulse disable
		151	QSP, quickstop active
		161	DCB, DC brake active
		250	Warning active

Password

The password only provides access to the USER menu. To enable it, enter a four-digit number in PNU 0094.

When the existing password is disabled, all other functions can be accessed.

PNU	Name	Value
0094	Password	0001 to 9999

Displaying fault messages

The four most recent faults are stored in a stack register in the frequency inverter. The messages are stored in a stack register. When a new fault occurs, the oldest fault is discarded from the stack and the others are moved down one position. The faults can be found in the following parameter numbers:

PNU	Name	Function
0161	Current fault	Saves the specified fault (fault code)
0162	Previous fault	
0163	Second from last fault	
0164	Third from last fault	
0168	Current fault	Indicates the number of the current fault

On the LCD keypad, fault messages are displayed in the form of fault codes (see table below). When the serial interface module is used, only the fault numbers are transmitted.

Fault codes

Fault number	Fault code	Fault
0	---	No fault
11	OC1	Short circuit
12	OC2	Earth fault
13	OC3	Inverter overload (during acceleration) or short-circuit
14	OC4	Inverter overload (during deceleration)
15	OC5	Overload in steady-state operation
16	OC6	Motor overload (I^2t overload)
32	LP1	Fault in motor phase (TRIP)
50	OH	Heatsink overtemperature ($>$ +85 °C)
53	OH3	PTC monitoring (TRIP), motor overtemperature
54	OH4	Overtemperature of drive controller interior
61	CE0	Communication error at AIF
71	CCr	System fault
72	Pr1	Error in parameter transmission, parameter set PAR1 transmitted incorrectly
73	Pr2	Parameter set PAR2 transmitted incorrectly
75	Pr	Error in parameter transmission, all parameter sets transmitted incorrectly

Fault number	Fault code	Fault
76	rST	Fault on AUTO TRIP RESET, more than 8 fault messages in 10 minutes
77	Pr3	Parameter set PAR3 transmitted incorrectly
78	Pr4	Parameter set PAR4 transmitted incorrectly
79	Pr5	Internal fault
81	PT5	Timeout error during parameter set transfer
85	Sd5	Open circuit at analog input, current loop interrupted at setpoint range 4 to 20 mA, setpoint current < 4 mA
91	EEr	External error
105	H05	Internal CPU fault (checksum error)
140	Id1	Incorrect motor parameter identification
182	LP1	Fault in motor phase (warning)
203	OH51	PTC monitoring (warning), no PTC thermistor connected
1020	OU	Internal DC link overvoltage (message only)
1030	LU	Internal DC link undervoltage (message only)

Resetting fault messages (TRIP-RESET)

You can select whether faults are reset manually or automatically. AUTO-TRIP RESET automatically resets faults after the time specified in PNU 0171. Only the faults listed in the table below are reset automatically. Switching the power supply on and off always initiates a TRIP-RESET.

Caution!
Switching the power supply on and off always initiates a TRIP-RESET. If more than eight AUTO-TRIP-RESETS are performed within ten minutes, the device sets TRIP with the message rST (counter exceeded). This message is displayed on the LCD keypad.

PNU	Name	Value	Function	Default setting
0043	TRIP-RESET	0 (read)	No current fault	
		0 (write)	Reset fault by writing 0	
		1	Fault has occurred	
0170	TRIP-RESET procedure	0	Manual TRIP-RESET: by switching power supply with STOP key on LCD keypad with LOW signal at terminal 28 with HIGH signal at PNU 0113/012, [TRIP-RESET], level inversion with PNU 0114 with PNU 0135 bit 11 with PNU 0043	0
		1	As 0 but with additional AUTO-TRIP- RESET Fault reset after expiry of delay in PNU 0171	
		2	TRIP-RESET by switching power supply, terminal 28 or through function module or communication module; no AUTO- TRIP-RESET	
		3	TRIP-RESET only by switching power supply	
0171	Delay for AUTO-TRIP-RESET	0 to 60 s	Duration after a fault before an AUTO-TRIP-RESET is performed	0.00

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5 Operation

Commissioning with the DE4-IOM-STD-F module

DV4-120/322
By default, the frequency inverters are set up to drive a 4-pole, 230 V, 50 Hz three-phase motor.

DV4-340
By default, the frequency inverters are set up to drive a 4-pole, 400 V, 50 Hz three-phase motor.

Caution!
Before switching the frequency inverter on, make sure that the maximum permissible environmental influences are not being exceeded. The frequency inverter must not show signs of internal moisture (condensation). Condensation can occur if the frequency inverter is stored in a cool place. If moisture has entered the device, dry it out completely before use.

Caution!
Electrical installation and commissioning must be carried out by suitably qualified personnel, which is responsible for ensuring that appropriate earthing and power cable protection is provided in accordance with currently applicable local and national regulations. The motor must be protected against overload.

Do not carry out voltage breakdown tests on any components of the frequency inverter. To measure signal voltages, use a suitable measuring device (internal resistance at least 10 kΩ/V).

Switching on

Before switching on the frequency inverter, ensure that the following conditions are fulfilled:

- When using internal control voltages: Terminals 7 and 39 are jumpered.
- The frequency inverter is ready to operate approx. 2 seconds after the power is switched on.
- Default setting: clockwise rotation when terminal E4 is LOW (0 to 3 V).
- For anticlockwise rotation: Terminal E4 HIGH signal (+12 to +30 V).
- The setpoint is specified (default: 0 to +10 V), adjustable setpoint signal at terminal 8.

Enable the frequency inverter with a HIGH signal on terminal 28.

☞ To configure the frequency inverter's parameters for specific applications, the LCD keypad (DE4-KEY-3) or a communication model is required.

Commissioning with LCD keypad DE4-KEY-3

The setpoint can also be specified directly with the LCD keypad under function bar 1, menu item SET (PNU 0140) (see section “Setpoint input through LCD keypad” on page 100).

To start and “stop the drive, the RUN and STOP keys can also be used.

Operation

If you are going to switch to motors that are already running, activate the start condition function (flying restart circuit), PNU 0142.

Switches or contactors in the outgoing side (motor side) of the frequency inverter are permissible for implementing safety functions (e.g. emergency stop). Note, however, that switching operations on the motor side can result in fault messages when the controller is enabled.

Caution!
If the frequency inverter is operated cyclically, do not switch on more than once every three minutes. Otherwise the internal starting current limit may be exceeded.

The DV4 frequency inverters are equipped with a temperature-controlled fan control circuit.

The fans operate only when the factory preset temperature is exceeded.

When switching on the power with the controller enabled, the fault message OCx (short circuit or earth fault in operating status x) may be shown on the display of the LCD keypad (see chapter 6 in section “Fault messages during operation” from page 203).

On a single-phase supply, the DV4-322-2K2 frequency inverter must be operated with an appropriate mains choke or mains filter.

Warning!
All terminals of the frequency inverter can carry dangerous voltages up to three minutes after the power is switched off. Do not work on the terminals or within the unit under any circumstances within that time. Never open the unit when the mains power supply is switched on, as fatal injury could otherwise result.

Warning!
Never open the unit when the mains power supply is switched on, Wait at least three minutes after switching off before working on the terminals or inside the unit. Not doing so may result in fatal injury.

Warning!
Frequency inverters are electrical apparatus for use in industrial power installations. During operation, the components of the frequency inverter and drive can carry dangerous voltages. They may also have moving or rotating parts and hot surfaces. These present a risk of serious injury.

Warning!
The unauthorized removal of the necessary covers and incorrect installation and operation of the motor or frequency inverter can lead to failure of the unit, serious injury to operating personnel or damage to equipment.

Caution!
If the direction of rotation of the motor is specified with PNU 0007 = 0 to 13, 23, 43 or 45, or with PNU 0113/003, an open circuit or control voltage failure can cause the motor to reverse.

Caution!
If the drive is not uncoupled from the mains power supply when stationary (with the mains contactor or mains switch), a fault may cause the motor to start unintentionally.

Caution!
If you use the flying restart function (PNU 0142 = 2 or 3) for machines with low moments of inertia and low friction, the motor may briefly turn or reverse direction when the controller is enabled.

If the frequency inverter has been in storage for more than two years, the capacity of the internal DC link capacitors may be impaired. Before using the frequency inverter, you should therefore connect it to the mains supply at no load for 2 hours to regenerate the capacitors.

6 Diagnostics

Warning!
All terminals of the frequency inverter can carry dangerous voltages up to three minutes after the power is switched off. Do not work on the terminals or within the unit under any circumstances within that time. Never open the unit while the mains power supply is switched on, as fatal injury could otherwise result.

When replacing fuses, use only the specified types.

Troubleshooting

Motor does not turn

Possible causes:

- Incorrect connection at the motor
- Mechanical blockage of motor
- DC link voltage too low
- Controller inhibited (terminal 28 = LOW, STOP key pressed, internal cover – jumper – is missing)
- Automatic start disabled
(PNU 0142 = 0 or 2, LOW/HIGH changeover at terminal 28 required)
- Setpoint = 0
- DC injection braking (DCB) active
- Quickstop function (QSP) active
- FF setpoint activated, but no frequency specified

- TRIP signal received
- Mechanical motor brake is not released
- Incorrect parameter set active
- Motor control mode PNU 0014 = 4 or 5, but a motor parameter identification was not performed
- Mutually exclusive functions are assigned to a control signal terminal in PNU 0113
- The internal voltage source of module DE4-IOM-STD-F, terminal 20, is used, and the jumper between terminals 7 and 39 is missing

Motor does not turn smoothly

Possible causes:

- Faulty motor cable
- Maximum current set too low in PNU 0022 and 0023
- Motor under- or overexcited (check values in PNU 0015, 0016 and 0014)
- Motor data not or incorrectly matched (check values in PNU 0084 and 0087 to 0092 and, if necessary, perform motor parameter identification (PNU 0148))

Excessive current consumption by motor

Possible causes:

- Value in PNU 0016 too high
- Value in PNU 0015 to low
- Motor data not or incorrectly matched (check values in PNU 0084 and 0087 to 0092 and, if necessary, perform motor parameter identification (PNU 0148))

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Motor speed too high

Possible causes:

The frequency inverter generates output frequencies up to 480 Hz. If an unsuitable motor is being used, this can lead to dangerous overspeed.

Motor turning, setpoints are “0”

An additive setpoint was specified with the SET function of the LCD keypad (f_{set}, PNU 0140).

Connected motor is overheating

Possible causes:

Excessively long operation of the DC injection brake

Excessively long operation of self-cooled motors at low speeds

Check configuration in PNU 0014, 0015 and 0016

Check motor cabling

Fault messages and remedies

Caution!
Frequency inverters contain electrostatically sensitive components. Before performing installation and servicing work in the terminal area of the device, make sure that you do not carry an electrostatic charge: discharge yourself by touching the PE terminal screw or another earthed metal surface in the control cabinet.

LEDs

The frequency inverter contains two LEDs that indicate its operating status.

Green	Red	Operating status
On	Off	Controller enabled
On	On	Power switched on, autostart disabled
Flashing	Off	Inverter disabled
Off	Flashing (1-second cycle)	Fault message, check PNU 0161
Off	Flashing (0.4-second cycle)	Undervoltage trip
Fast flashing	Off	Motor parameter identification in progress

Monitoring signals

During a monitoring signal, impulse disable (LCD keypad display shows IMP) is set. The impulse disable is automatically cancelled as soon as the fault has been cleared.

The messages listed in the following table are displayed on LCD keypad DE4-KEY-3.

Message	Fault	Cause	Remedy
LU	Undervoltage	Supply voltage too low	Check supply voltage or connect device to the correct supply
		DC voltage too low	
		400 V device connected to 240 V supply	
OU	Overvoltage	Supply voltage too high	Check supply voltage
		Power recovery mode (braking mode)	Increase deceleration time Operation with braking transistor: Check dimensioning and connection of the braking resistor, and, if necessary, adapt the switching threshold in PNU 0174 to the network voltage
		Creeping earth fault on the motor side	Check motor supply cable and motor for earth fault (disconnect motor from frequency inverter)

Fault messages on Power On

A complete test of the hardware and the settings is carried out when the power is switched on.

When switching on the power with the controller enabled, the fault message OCx (short circuit/ earth fault) may be triggered.
Where long motor cables and frequency inverters with lower output rating are used, leakage currents through parasitic line capacitance can trigger the fault message OCx. Use a motor choke or motor filter in these cases.

Message	Fault	Cause
OC1[1)]	Short circuit	Terminal short circuit on the motor side due to: Faulty motor cable Capacitive load current in motor cable Fault between turns in motor
OC2[1)]	Earth fault	Frame fault in motor or in motor cable Capacitive load current in motor cable
EEr	External error	External signal source has triggered Signal received via digital input [EF]

1) If these fault messages occur when the power is switched on, check the cabling before resetting the fault message.

Fault messages during operation

When an error message is issued, the controller is disabled. When the DE4-KEY-3 LCD keypad is connected, the fault is displayed on it.

Fault messages that have been reset are recorded. The faults are stored for display in parameters PNU 0161 to 0164. Up to four fault messages are stored, the most recently acknowledged fault being recorded in PNU 0162.

Message	Fault	Cause	Remedy
---	No fault	–	–
CCR	System fault	Strong interference injection on control lines	Screen control lines
		Chassis or ground loops in wiring	–
Id1	Faulty motor parameter identification	Motor not connected	Connect the motor
OC1	Short circuit in motor	Faulty motor cable	Check motor cable for short circuit Check motor
		Fault between turns in motor	
OC2	Earth fault	Frame fault in motor or motor cable	Check motor or motor cable if necessary, fit motor filter
		Capacitive load current in motor cable too high	
OC3	Device overload during acceleration; short circuit	Acceleration time set too short	Increase acceleration time (PNU 0012) Check wiring Check drive layout
		Faulty motor cable	
		Fault between turns in motor	
OC4	Inverter overload during deceleration	Deceleration time set too short	Increase deceleration time (PNU 0013) Check dimensioning of brake resistor Connect brake resistor
OC5	Inverter overload	Frequent or excessively long accelerations at overcurrent	Check inverter settings Check drive layout
		Excessive load	
OC6	Motor overload (thermal, I^2t-overload)	Inadmissible continuous current	Check drive layout Check setting of PNU 0120
		Frequent or excessively long acceleration	
OH	Heatsink overtemperature $>$ +85 °C	Ambient temperature $>$ 60 °C	Improve cooling Check ambient temperature in control cabinet Clean heatsink Check drive layout
		Heatsink excessively dirty	
		Excessive currents or frequent and excessively long acceleration	
OH3	PTC monitoring	Motor too hot	Reduce motor load Check drive layout Check motor for fault between turns Check wiring to PTC thermistor input

Message	Fault	Cause	Remedy
OH4	Inverter overtemperature	Temperature inside inverter too high	Reduce inverter load Improve cooling Check inverter fan
OH 51	PTC monitoring (warning)	PTC thermistor not connected	Connect PTC thermistor or disable monitoring
LP1	Motor phase fault (warning)	Failure of one or several motor phases	Check motor supply cables Check V_{min} pull-up Check motor output Check value in PNU 0599
		Motor current too low	
rSt	Fault at AUTO-TRIP-RESET	More than 8 fault messages in 10 minutes	Depends on the fault message
EEr	External error	Signal received via digital input [EF]	Check external signal source
Pr	Error in parameter transmission	Error in communication with the LCD keypad	Before controller enable, repeat data transfer or reload default settings
		All parameter sets are corrupt	
Pr1	PAR1 incorrectly transmitted	Error in communication with the LCD keypad	
		PAR1 is corrupt	
Pr2	PAR2 incorrectly transmitted	Error in communication with the LCD keypad	
		PAR2 is corrupt	
Pr3	PAR3 incorrectly transmitted	Error in communication with the LCD keypad	
		PAR3 is corrupt	
Pr4	PAR4 incorrectly transmitted	Error in communication with the LCD keypad	
		PAR4 is corrupt	
PT5	Timeout error during parameter set transfer	Data flow from LCD keypad or PC interrupted, e.g.LCD keypad was disconnected during transmission	
Pr5	Internal fault		Contact your customer service centre
H05	Internal CPU fault (checksum error)	Strong electromagnetic interference, interference voltage, etc.	

Message	Fault	Cause	Remedy
Sd5	Open circuit at analog input, at setpoint range 4 to 20 mA	Current loop interrupted (setpoint current < 4 mA)	Check circuit at analog input
CE0	Communication error at AIF	Transmission through AIF interface interrupted	Firmly insert communication module into the terminal
CE5	TIMEOUT error	Operation with module on FIF: Internal fault	Check settings

Appendix

Standards and operational requirements

Standard type	Standard	Name	Limit values
Protection class	IP20		
Interference immunity	Requirements of EN 61 800-3		
	EN 61 000-4-2	ESD (electrostatic discharge on enclosures and heatsinks	Severity 3, 6 kV for contact discharge, 8 kV for air discharge
	EN 61 000-4-3	HF interference (enclosure) electromagnetic fields Frequency range 27 to 1000 MHz	Severity 3, 10 V/m
	EN 61 000-4-4	Burst, fast transients	Severity 3/4, 2 kV/5 kHz
	EN 61 000-4-5	Surge voltage testing on network cables	Severity 3, for 50 μs: 1 kV phase–phase, 2 kV phase–PE
Emitted interference	Requirements of EN 50 081-1 Limit value class A to EN 55 011 Limit value class B to EN 55 022		
Insulation resistance	VDE 0110	Overvoltage category III	
Admissible contamination	VDE 0110, Part 2	Degree of pollution 2	
Admissible humidity	EN 50 178	Average relative humidity, non-condensing	Class 3K3, 85 %
Vibration resistance	Acceleration-resistant to 2 g (Germanischer Lloyd, general requirements)		
Conformity	CE	The Low-Voltage Directive (73/23/EEC) and the harmonized standards of the EN 50 178 (VDE 0160) series in conjunction with EN 60 439-1 (VDE 0660-500) and EN 60 146 (VDE 0558)	
Approvals	UL 508 UL 508C	Industrial Control Equipment Power Conversion Equipment	
Qualified personnel	All transport, installation, commissioning and maintenance work must be carried out by suitably qualified personnel (observe IEC 60 364 and CENELEC HD384 or VDE 0100 and IEC Report 664 or VDE 0110 and national accident prevention regulations)		

Technical data, DV4-120/DV4-322

☞ Observe N-conductor load for symmetrical network distribution of several inverters (see electrical installation).

Operation at 150 % overload (normal operation)
Supply connection, 230 V single-phase

Type DV4-...			...-120-025	...-120-037	...-322-055	...-322-075	...-322-1K5	...-322-2K2
Supply voltage		V_{LN} [V]	230 V, 50/60 Hz single-phase Admissible range: 100 V –0 % to 264 V +0 %; 48 Hz –0 % to 62 Hz +0 %					
Alternative DC supply to +UG, –UG		V_{DC} [V]	Not possible		140 V DC –0 % to 360 V +0 %			
Rated supply current without mains choke/mains filter		I_{LN} [A]	3.4	5	6	9	15	18[2)]
Power dissipation (operation at I_{N8})		P_V [W]	30	40	50	60	100	130
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz, **8 kHz (default)**, 16 kHz					
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	1.7	2.4	3	4	7	9.5
	8 kHz (default)	$\boldsymbol{I_{N8}}$ **[A]**	**1.7**	**2.4**	**3**	**4**	**7**	**9.5**
	16 kHz	I_{N16} [A]	1.1	1.6	2	2.6	4.6	6.2

Type DV4-...			**...-120-025**	**...-120-037**	**...-322-055**	**...-322-075**	**...-322-1K5**	**...-322-2K2**
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	2.5	3.6	4.5	6	10.5	14.2
	8 kHz (default)	**I_{max8} [A]**	**2.5**	**3.6**	**4.5**	**6**	**10.5**	**14.2**
	16 kHz	I_{max16} [A]	1.7	2.3	2.9	3.9	6.9	9.3

Type DV4-...		**...-120-025**	**...-120-037**	**...-322-055**	**...-322-075**	**...-322-1K5**	**...-322-2K2**
Output power	**S_{N8} [kVA]**	**0.68**	**1**	**1.2**	**1.6**	**2.8**	**3.8**
Motor voltage[1)]	V_2 [V]	0 to 3 × V_{LN}					
Motor frequency	f_2 [Hz]	0 to 50 Hz, max. 480 Hz					
Assigned motor rating, 4-pole ASMs, at 230 V 3-phase (kW)/240 V 3-phase (HP)	P_N [kW]	0.25	0.37	0.55	0.75	1.5	2.2
	P_N [HP]	0.34	0.5	0.75	1	2	3

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

Operation at 120 % overload
Supply connection, 230 V single-phase

Operation at increased rated output

Benefit:
Use of a more powerful motor in continuous operation for typical applications such as pumps and fans with quadratic load characteristic.

☞ Operation is permissible only at the stated supply voltage ranges and operating frequencies $\leqq$ 4 kHz.

☞ Observe N-conductor load for symmetrical network distribution of several inverters (see electrical installation).

Type DV4-...			...-120-025	...-322-055	...-322-075	...-322-1K5
Supply voltage		V_{LN} [V]	230 V, 50/60 Hz single-phase Admissible range: 180 V –0 % to 264 V +0 %; 48 Hz –0 % to 62 Hz +0 %			
Alternative DC supply to +UG, –UG		V_{DC} [V]	Not possible	140 V DC –0 % to 360 V +0 %		
Rated supply current without mains choke/mains filter		I_{LN} [A]	4.1	7.2	9	18
Power dissipation (operation at $I_{N2/4}$)		P_V [W]	30	50	60	100
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz			
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	2	3.6	4.8	8.4
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	2.5	4.5	6	10.5
Output power		S_{N8} [kVA]	0.8	1.4	1.6	2.8
Motor voltage[1)]		V_2 [V]	0 to 3 × V_{LN}			
Motor frequency		f_2 [Hz]	0 to 50 Hz, max. 480 Hz			
Assigned motor rating, 4-pole ASMs, at 230 V 3-phase (kW)/240 V 3-phase (HP)		P_N [kW]	0.37	0.75	1.1	2.2
		P_N [HP]	0.5	1	1.5	3

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

With DV4-120-037 and DV4-120-322-2K2, a higher rated motor cannot be used in continuous operation.

Technical data, DV4-320/DV4-322

Operation at 150 % overload (normal operation)

Supply connection, 230 V three-phase

Type DV4-...			**...-322-055**	**...-322-075**	**...-322-1K5**	**...-322-2K2**	**...-320-3K0**	**...-320-4K0**	**...-320-5K5**	**...-320-7K5**
Supply voltage		V_{LN} [V]	230 V, 50/60 Hz 3-phase Admissible range 100 V –0 % to 264 V +0 %; 48 Hz –0 % to 62 Hz +0 %							
Alternative DC supply to +UG, –UG		V_{DC} [V]	140 V DC –0 % to 360 V +0 %							
Rated supply current without mains choke/mains filter		I_{LN} [A]	3.9	5.2	9.1	12.4	15.6	21.3	29.3	28[2)]
Power dissipation (operation at I_{N8})		P_V [W]	50	60	100	130	150	190	250	320
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz, **8 kHz (default)**, 16 kHz							
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	3	4	7	9.5	12	16.5	22.5	28.6
	8 kHz (default)	$\boldsymbol{I_{N8}}$ **[A]**	**3**	**4**	**7**	**9.5**	**12**	**16.5**	**22.5**	**28.6**
	16 kHz	I_{N16} [A]	2	2.6	4.6	6.2	7.8	10.7	14.6	18.6
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	4.5	6	10.5	14.2	18	24.8	33.8	42.9
	8 kHz (default)	$\boldsymbol{I_{max8}}$ **[A]**	**4.5**	**6**	**10.5**	**14.2**	**18**	**24.8**	**33.8**	**42.9**
	16 kHz	I_{max16} [A]	2.9	3.9	6.9	9.3	11.7	16.1	22	27.3

Type DV4-...		**...-322-055**	**...-322-075**	**...-322-1K5**	**...-322-2K2**	**...-320-3K0**	**...-320-4K0**	**...-320-5K5**	**...-320-7K5**
Output power	**S_{N8} [kVA]**	**1.2**	**1.6**	**2.8**	**3.8**	**4.8**	**6.6**	**9**	**11.4**
Motor voltage[1]	V_2 [V]	0 to 3 × V_{LN}							
Motor frequency	f_2 [Hz]	0 to 50 Hz, max. 480 Hz							
Assigned motor rating, 4-pole ASMs, at 230 V 3-phase (kW)/240 V 3-phase (HP)	P_N [kW]	0.55	0.75	1.5	2.2	3	4	5.5	7.5
	P_N [HP]	0.75	1	2	3	4	5	7.5	10

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

Operation at 120 % overload
Operation at increased rated output

Benefit:
Use of a more powerful motor in continuous operation for typical applications such as pumps and fans with quadratic load characteristic.

Operation is permissible only at the stated supply voltage ranges and operating frequencies $\leqq$ 4 kHz.

Type DV4-...			...-322-055	...-322-075	...-322-1K5	...-320-3K0	...-320-5K5
Supply voltage		V_{LN} [V]	230 V, 50/60 Hz 3-phase Admissible range: 100 V –0 % to 264 V +0 %; 48 Hz –0 % to 62 Hz +0 %				
Alternative DC supply to +UG, –UG		V_{DC} [V]	140 V DC –0 % to 360 V +0 %				
Rated supply current without mains choke/mains filter		I_{LN} [A]	4.2	5.2	10.4	15.6	29.3[2)]
Power dissipation (operation at $I_{N2/4}$)		P_V [W]	50	60	100	150	250
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz				
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	3.6	4.8	8.4	14.4	27
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	4.5	6	10.5	18	33.8
Output power		$S_{N2/4}$ [kVA]	1.4	1.6	2.8	4.8	9.0
Motor voltage[1)]		V_2 [V]	0 to 3 × V_{LN}				
Motor frequency		f_2 [Hz]	0 to 50 Hz, max. 480 Hz				
Assigned motor rating, 4-pole ASMs, at 230 V 3-phase (kW)/240 V 3-phase (HP)		P_N [kW]	0.75	1.1	2.2	4	7.5
		P_N [HP]	1	1.5	3	5	10

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

With DV4-322-2K2, DV4-320-4K0 and DV4-320-7K5, a higher rated motor cannot be used in continuous operation.

Technical data, DV4-340

Operation at 150 % overload (normal operation)

Supply connection, 400 V three-phase

Type DV4-340-...			...-055	...-075	...-1K5	...-2K2	...-3K0	...-4K0	...-5K5	...-7K5	...-11K
Supply voltage		V_{LN} [V]	400 V, 50/60 Hz 3-phase Admissible range: 320 V –0 % to 550 V +0 %; 48 Hz –0 % to 62 Hz +0 %								
Alternative DC supply to +UG, –UG		V_{DC} [V]	450 V DC –0 % to 770 V +0 %								
Rated supply current without mains choke/mains filter		I_{LN} [A]	2.5	3.3	5.5	7.4	9	12.3	16.8	21.5	21[2)]
Power dissipation (operation at I_{N8})		P_V [W]	50	60	100	130	145	150	230	300	410
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz, **8 kHz (default)**, 16 kHz								
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	1.8	2.4	3.9	5.6	7.3	9.5	13	16.5	23.5
	8 kHz (default)	$\boldsymbol{I_{N8}}$ **[A]**	**1.8**	**2.4**	**3.9**	**5.6**	**7.3**	**9.5**	**13**	**15.5**	**23.5**
	16 kHz	I_{N16} [A]	1.2	1.6	2.5	3.6	4.7	6.1	8.4	10.7	13
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	2.7	3.6	5.9	8.4	11	14.2	19.5	24.8	35.3
	8 kHz (default)	$\boldsymbol{I_{max8}}$ **[A]**	**2.7**	**3.6**	**5.9**	**8.4**	**11**	**14.2**	**19.5**	**24.8**	**35.3**
	16 kHz	I_{max16} [A]	1.8	2.4	3.9	8.4	7.0	9.1	12.6	16	19.5

Type DV4-340-...		**...-055**	**...-075**	**...-1K5**	**...-2K2**	**...-3K0**	**...-4K0**	**...-5K5**	**...-7K5**	**...-11K**
Output power	**S_{N8} [kVA]**	**1.3**	**1.7**	**2.7**	**3.9**	**5.1**	**6.6**	**9**	**10.8**	**16.3**
Motor voltage[1]	V_2 [V]	0 to 3 × V_{LN}								
Motor frequency	f_2 [Hz]	0 to 50 Hz, max. 480 Hz								
Assigned motor rating, 4-pole ASMs, at 400 V 3-phase (kW)/460 V 3-phase (HP)	P_N [kW]	0.55	0.75	1.5	2.2	3	4	5.5	7.5	11
	P_N [HP]	0.75	1	2	3	4	5	7.5	10	15

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

Operation at 120 % overload
Operation at increased rated output

Benefit:
Use of a more powerful motor in continuous operation for typical applications such as pumps and fans with quadratic load characteristic.

Operation is permissible only at the stated supply voltage ranges and operating frequencies ≦ 4 kHz.

Type DV4-340-...			...-055	...-075	...-2K2	...-3K0	...-4K0	...-7K5
Supply voltage		V_{LN} [V]	400 V, 50/60 Hz 3-phase Admissible range: 320 V –0 % to 550 V +0 %; 48 Hz –0 % to 62 Hz +0 %					
Alternative DC supply to +UG, –UG		V_{DC} [V]	450 V DC –0 % to 770 V +0 %					
Rated supply current without mains choke/mains filter		I_{LN} [A]	2.2	2.9	6.6[2)]	9	12.3	21.5
Power dissipation (operation at I_{N8})		P_V [W]	50	60	130	145	180	300
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz,					
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	2.2	2.9	6.7	8.7	11.4	19.8
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	2.7	3.6	8.4	11	14.2	24.8
Output power		$S_{2/4}$ [kVA]	1.5	2	4.7	6.1	7.9	13.7

Type DV4-340-...			...-055	...-075	...-2K2	...-3K0	...-4K0	...-7K5
Motor voltage[1]		V_2 [V]	0 to 3 × V_{LN}					
Motor frequency		f_2 [Hz]	0 to 50 Hz, max. 480 Hz					
Assigned motor rating, 4-pole ASMs, at 400 V 3-phase (kW)/460 V 3-phase (HP)		P_N [kW]	0.75	1.1	3	4	5	11
		P_N [HP]	1	1.5	3	5	7.5	15

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

With DV4-340-1K5, DV4-340-5K5 and DV4-340-11K, a higher rated motor cannot be used in continuous operation.

Operation at 150 % overload (normal operation)
Supply connection, 500 V three-phase

Type DV4-340-...			**...-055**	**...-075**	**...-1K5**	**...-2K2**	**...-3K0**	**...-4K0**	**...-5K5**	**...-7K5**	**...-11K**
Supply voltage		V_{LN} [V]	500 V, 50/60 Hz 3-phase Admissible range: 320 V –0 % to 550 V +0 %; 48 Hz –0 % to 62 Hz +0 %								
Alternative DC supply to +UG, –UG		V_{DC} [V]	450 V DC –0 % to 770 V +0 %								
Rated supply current without mains choke/mains filter		I_{LN} [A]	2,	2.6	4.4	5.8	7.2	9.8	13.4	17.2	16.8[2)]
Power dissipation (operation at I_{N8})		P_V [W]	50	60	100	130	145	150	230	300	410
Operating frequency		f_{PWM} [kHz]	2 kHz, 4 kHz, **8 kHz (default)**, 16 kHz								
Rated output current	2 kHz, 4 kHz	$I_{N2/4}$ [A]	1.4	1.9	3.1	4.5	5.8	7.6	10.4	13.2	18.8
	8 kHz (default)	**I_{N8} [A]**	**1.4**	**1.9**	**3.1**	**4.5**	**5.8**	**7.6**	**10.4**	**13.2**	**18.8**
	16 kHz	I_{N16} [A]	0.9	1.2	2	2.9	3.8	4.9	6.8	8.6	12.2
Maximum admissible output current for 60 s	2 kHz, 4 kHz	$I_{max2/4}$ [A]	2.7	3.6	5.9	8.4	11	14.2	19.5	24.8	35.3
	8 kHz (default)	**I_{max8} [A]**	**2.7**	**3.6**	**5.9**	**8.4**	**11**	**14.2**	**19.5**	**24.8**	**35.3**
	16 kHz	I_{max16} [A]	1.8	2.3	3.8	5.5	7.1	9.3	12.7	16.1	22.9
Output power		**S_{N8} [kVA]**	**1.3**	**1.7**	**2.7**	**3.9**	**5**	**6.6**	**9**	**11.5**	**16.3**
Motor voltage[1)]		V_2 [V]	0 to 3 × V_{LN}								
Motor frequency		f_2 [Hz]	0 to 50 Hz, max. 480 Hz								
Assigned motor rating, 4-pole ASMs, at 500 V 3-phase (kW)/460 V 3-phase (HP)		P_N [kW]	0.55	0.75	1.5	2.2	3	4	5.5	7.5	11
		P_N [HP]	0.75	1	2	3	4	5	7.5	10	15

1) With upstream mains choke or mains filter, the max. output voltage (V_2) is reduced to about 96 % supply voltage (V_{LN})

2) Operate only with upstream mains choke/mains filter.

Control inputs/outputs of the DE4-IOM-STD-F

Terminal	Functions	Name	Default	Current consumption/load rating
Digital inputs/outputs				
E1	Configurable inputs (PNU 0007) e.g. clockwise rotation, anticlockwise rotation, DC injection braking, fixed frequency, quickstop, external fault, motor potentiometer, parameter set changeover	DIGIN1	Fixed frequencies E1 = 20 Hz E2 = 30 Hz E1 + E2 = 40 Hz	PLC signal, HTL HIGH = +12 to +30 V LOW = 0 to +3 V R_i = 3.3 kOhm E1 as frequency input (PNU 0425): 0 to 10 kHz (level 0/+15 V)
E2		DIGIN2		
E3		DIGIN3	DC injection braking HIGH = active	
E4		DIGIN4	Clockwise/anticlockwise rotation LOW = clockwise HIGH = anticlockwise	
28	Input, controller inhibit	EN	HIGH = enable LOW = disable	PLC signal, HTL HIGH = +12 to +30 V LOW = 0 to +3 V R_i = 3.3 kOhm
A1	Output	DIGOUT	Fault message	+24 V/50 mA (external) or +20 V/10 mA (V_{B20})
59	DC supply input for A1	EXT24	–	external +24 V
39	Reference potential for digital signals	GND2	–	0 V Isolated from terminal 7 (GND1)

Terminal	Functions	Name	Default	Current consumption/load rating
Analog inputs/outputs				
8	Input for analog setpoint	0 to +5 V, 0 to +10 V, –10 to +10 V, 0 to 20 mA, 4 to 20 mA, 4 to 20 mA (open-circuit monitored)	0 to +10 V	Max. input current: 2 mA Resolution: 10 bit Linearity error: +/–0.5 % Temperature dependency: 0.3 % (0 to +60 °C) Range changeover with DIP switch and PNU 0034 Input resistance: Voltage signal: >50 kOhm Current signal: 250 Ω (load)
62	Output, monitor, freely programmable with PNU 0111	Motor current, internal DC link voltage, output frequency	Output frequency 0 to +10 V = 0 to 50 Hz	Rating: 2 mA Resolution: 10 bit Linearity error: +/– 0.5 %
Power supply				
7	Reference potential for analog signals	GND1	–	0 V Isolated from terminal 39 (GND2)
20	Output, DC voltage source for driving digital inputs and outputs	V_{B20}	–	20 V Rating: max. 40 mA Reference: terminal 7 (GND1)
9	Output, stabilized DC voltage source for setpoint potentiometer	V_{REF}	–	Rating: max. 10 mA Reference: terminal 7 (GND1)

Type-dependent parameter values

PNU 0016 = V_{min} elevation
PNU 0036 = voltage/current for DC braking

Frequency inverter Model	PNU 0016	PNU 0036	Step size for PNU 0016 and PNU 0036
DV4-120-025	3.20 %	4.00 %	0.01 %
DV4-120-037	3.20 %	4.00 %	0.01 %
DV4-322-055	3.00 %	3.75 %	0.01 %
DV4-322-075	3.00 %	3.75 %	0.01 %
DV4-322-1K5	2.80 %	3.50 %	0.01 %
DV4-322-2K2	2.60 %	3.25 %	0.01 %
DV4-320-3K0	2.60 %	3.25 %	0.01 %
DV4-320-4K0	2.40 %	3.00 %	0.01 %
DV4-320-5K5	2.40 %	3.00 %	0.01 %
DV4-320-7K5	2.20 %	2.75 %	0.01 %
DV4-340-055	3.00 %	3.75 %	0.01 %
DV4-340-075	3.00 %	3.75 %	0.01 %
DV4-340-1K5	2.80 %	3.50 %	0.01 %
DV4-340-2K2	2.40 %	3.00 %	0.01 %
DV4-340-3K0	2.20 %	2.75 %	0.01 %
DV4-340-4K0	2.00 %	2.50 %	0.01 %
DV4-340-5K5	1.80 %	2.25 %	0.01 %
DV4-340-7K5	1.60 %	2.00 %	0.01 %
DV4-340-11K	1.60 %	2.00 %	0.01 %

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Mains contactors

Assigned mains contactors

> The mains contactors listed here assume the network's rated current (I_{LN}) without mains choke/mains filter. Their selection is based on the thermal current (AC-1).
> If they are used with an upstream mains choke/ mains filter, the input current on the network side is reduced by about 30 % and the maximum output voltage of the frequency inverter (V_2) to about 96 % of the supply voltage (V_{LN}).

Operation with assigned motor rating at rated voltage:

150 % overload (normal operation)

120 % overload (operation at higher rated output)

P1DIL00M

DIL00M

P1DIL00M

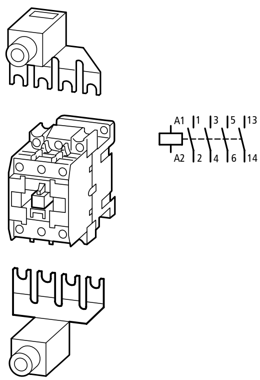

Figure 64: Mains contactor at single-phase connection

Model	Network rated current (I_{LN}) in [A]							Mains contactor	
	Single-phase 230 V[1)]		3-phase 230 V		3-phase 400 V		3-phase 500 V	open/ enclosed	Model
	150 %	120 %	150 %	120 %	150 %	120 %	150 %	I_{th} AC-1	
DV4-120-025	3.4	4.1						20/16	DIL00M
DV4-120-037	5	–[3)]						20/16	DIL00M
DV4-322-055	6	7.2	3.9	4.2				20/16	DIL00M
DV4-322-075	9	(9)[2)]	5.2	(5.2)[2)]				20/16	DIL00M
DV4-322-1K5	15	(18)[2)]	9.1	10.4				20/16	DIL00M
DV4-322-2K2	18	–[3)]	12.4	–[3)]				20/16	DIL00M
DV4-320-3K0			15.6	15.6				20/16	DIL00M
DV4-320-4K0			21.3	-[3)]				35/30	DIL0M
DV4-320-5K5			29.3	(29.3)[2)]				35/30	DIL0M
DV4-320-7K5			(28)[2)]	–[3)]				35/30	DIL0M
DV4-340-055					2.5	2.9	2	20/16	DIL00M
DV4-340-075					3.3	(2.8)[2)]	2.6	20/16	DIL00M
DV4-340-1K5					5.5	–[3)]	4.4	20/16	DIL00M
DV4-340-2K2					7.3	(6.1)[2)]	5.8	20/16	DIL00M
DV4-340-3K0					9	9	7.2	20/16	DIL00M
DV4-340-4K0					12.3	(12.3)[2)]	9.8	20/16	DIL00M
DV4-340-5K5					16.8	–[3)]	13.4	20/16	DIL00M
DV4-340-7K5					21.5	(21.5)[2)]	17.2	35/30	DIL0M
DV4-340-11K					(21)[2)]	–[3)]	(16.8)[2)]	35/30	DIL0M

1) For a single-phase supply connection, supplement mains contactor DIL00M with parallel connector set P1DIL00M (connect terminals 1, 3, 5 and 2, 4, 6). P1DIL00M consists of two parallel connectors. The fourth pole can be snapped off.

2) Operate only with connected mains choke/mains filter.

3) Continuous operation with a more powerful motor is not possible.

Mains choke

When a mains choke is used, the frequency inverter’s maximum permissible output voltage (V_2) is reduced to about 96 % of the supply voltage (V_{LN}).

The table below assumes operation at the respective rated voltage with the assigned motor ratings (see Technical data) for:

150 % overload (normal operation)

120 % overload (operation at higher rated motor output)

Network currents (I_{LN}) in operation with the assigned mains choke

Model	Network voltage	150 % overload			120 % overload		
		I_{LN} [A]	Mains choke[1]	L [mH]	I_{LN} [A]	Mains choke[1]	L [mH]
DV4-120-025	Single-phase 230 V	3	DE4-LN1-037	9	3.5	DE4-LN1-037	9
DV4-120-037		4.2			see[2]		
DV4-322-055		5.2	DE4-LN1-075	5	6.3	DE4-LN1-075	5
DV4-322-075		7.5			9	DE4-LN1-1K5	3.5
DV4-322-1K5		12.5	DE4-LN1-1K5	3.5	16	DE4-LN1-2K2	1.6
DV4-322-2K2		18	DE4-LN1-2K2	1.6	see[2]		
DV4-322-055	3-phase 230 V	2.7	DE4-LN3-075	7	3.3	DE4-LN3-1K5	4.5
DV4-322-075		3.6	DE4-LN3-1K5	4.5	4.4	DE4-LN3-2K2	1.6
DV4-322-1K5		6.3	DE4-LN3-3K0	2.5	7.6	DE4-LN3-4K0	1.6
DV4-322-2K2		9	DE4-LN3-4K0	1.6	see[2]		
DV4-320-3K0		12	DE4-LN3-5K5	1.6	14.4	DE4-LN3-7K5	1.2
DV4-320-4K0		16	DE4-LN3-7K5	1.2	see[2]		
DV4-320-5K5		21	DE4-LN3-11K	1.2	25.2	DE4-LN3-15K	1.2
DV4-320-7K5		28	DE4-LN3-15K	1.2	see[2]		

Model	Network voltage	150 % overload			120 % overload		
		I_{LN} [A]	Mains choke[1)]	L [mH]	I_{LN} [A]	Mains choke[1)]	L [mH]
DV4-340-055	3-phase 400 V	2	DE4-LN3-075	7	2.1	DE4-LN3-075	7
DV4-340-075		2.3			2.8		
DV4-340-1K5		3.9	DE4-LN3-1K5	4.5	see[2)]		
DV4-340-2K2		5.1	DE4-LN3-2K2	5	6.1	DE4-LN3-3K0	2.5
DV4-340-3K0		7	DE4-LN3-3K0	2.5	8.4	DE4-LN3-4K0	1.6
DV4-340-4K0		8.8	DE4-LN3-4K0	1.6	12.3	DE4-LN3-5K5	1.6
DV4-340-5K5		12	DE4-LN3-5K5	1.6	see[2)]		
DV4-340-7K5		15.4	DE4-LN3-7K5	1.2	21.5	DE4-LN3-11K	1.2
DV4-340-11K		21	DE4-LN3-11K	1.2	see[2)]		
DV4-340-055	3-phase 500 V	1.4	DE4-LN3-075	7	see[2)]		
DV4-340-075		1.8					
DV4-340-1K5		3.1					
DV4-340-2K2		4.1	DE4-LN3-1K5	4.5			
DV4-340-3K0		5.6	DE4-LN3-3K0	2.5			
DV4-340-4K0		7	DE4-LN3-3K0	2.5			
DV4-340-5K5		9.6	DE4-LN3-5K5	1.6			
DV4-340-7K5		12.3	DE4-LN3-5K5	1.6			
DV4-340-11K		16.8	DE4-LN3-11K	1.2			

1) For technical specifications of mains chokes DE4-LN..., see installation instructions AWA 8240-1711

2) Continuous operation at 500 V is not possible with a more powerful motor.

Leakage currents

Discharge currents from the frequency inverters (without upstream mains filter) to earth (PE) according to EN 50 178

☞ The values below are intended as a guideline. Actual values may vary depending on local conditions (power supply network, motor cable capacitance, length of motor cable, etc.)

Model	Supply connection	Clock frequency	V_1 to IEC 60 990 (r.m.s. value)[1)]	calculated current $I_{PE} = V_1/500\ \Omega$
DV4-120-025	Single-phase 230 V AC, 2-phase 230 V AC	2/4/8/16 kHz	6.2 V	12.4 mA
DV4-120-037				
DV4-322-055		2/4/8/16 kHz	6.75 V	13.5 mA
DV4-322-075				
DV4-322-1K5		2/4/8/16 kHz	6.75 V	15.5 mA
DV4-322-2K2[2)]				
DV4-322-055	3-phase 230 V	2/4/8/16 kHz	6.75 V	13.5 mA
DV4-322-075				
DV4-322-1K5		2/4/8/16 kHz	6.75 V	15.5 mA
DV4-322-2K2				
DV4-320-3K0		–	–	–
DV4-320-4K0		–	–	–
DV4-320-5K5		–	–	–
DV4-320-7K5		–	–	–

Model	Supply connection	Clock frequency	V_1 to IEC 60 990 (r.m.s. value)[1)]	calculated current $I_{PE} = V_1/500\ \Omega$
DV4-340-055 DV4-340-075	3-phase 400 V	2/4 kHz	5.5 V	11 mA
		8 kHz	6.5 V	13 mA
		16 kHz	5.8 V	11.6 mA
DV4-340-1K5 DV4-340-2K2		2/4 kHz	5.9 V	11.8 mA
		8 kHz	7.8 V	15.6 mA
		16 kHz	6.3 V	12.6 mA
DV4-340-3K0 DV4-340-4K0 DV4-340-5K5		–	–	–
		–	–	–
		–	–	–
DV4-340-7K5		–	–	–
DV4-340-11K[2)]		–	–	–

1) The readings were taken with a low-capacitance motor cable of 50 metres length. The results assume motor operation at no-load condition.

2) Operate only with upstream mains choke.

Fuses and cable cross-sections

Operation at 150 % overload (normal operation)

Connect both PE terminals.

The table below assumes operation at the respective rated voltage and the assigned motor ratings (see Technical data).

Model	Supply connection	VDE	UL[1)]	Moeller	L1, L2, L3, N, U, V, W, PE (2×) mm²	AWG
DV4-120-025	Single-phase 230 V, 2 AC 230 V	M6 A	5 A	FAZ-1N-B6, FAZ-2-B6	1	17
DV4-120-037		M10 A	10 A	FAZ-1N-B10, FAZ-2-B10	1.5	15
DV4-322-055		M10 A	10 A	FAZ-1N-B10, FAZ-2-B10	1.5	15
DV4-322-075		M16 A	15 A	FAZ-1N-B16, FAZ-2-B16	2.5	14
DV4-322-1K5		M20 A	20 A	FAZ-1N-B20, FAZ-2-B20	2 × 1.5	2 × 15
DV4-322-2K2[2)]		M20 A	20 A	FAZ-1N-B20, FAZ-2-B20	2 × 1.5	2 × 15
DV4-322-055	3-phase 230 V	M6 A	5 A	PKZM0-6,3	1	17
DV4-322-075		M10 A	10 A	PKZM0-10	1.5	15
DV4-322-1K5		M16 A	15 A	PKZM0-16	2.5	14
DV4-322-2K2		M16 A	15 A	PKZM0-16	2.5	14
DV4-320-3K0		M20 A	20 A	PKZM0-20	4	11
DV4-320-4K0		M25 A	25 A	FAZ-3-B25	6	9
DV4-320-5K5		M35 A	35 A	FAZ-3-B32	6	9
DV4-320-7K5		M35 A	35 A	FAZ-3-B32	6	9

Model	Supply connection				L1, L2, L3, N, U, V, W, PE (2×)	
		VDE	UL[1]	Moeller	mm²	AWG
DV4-340-055	3-phase 400 V	M6 A	5 A	PKZM0-6,3	1	17
DV4-340-075		M6 A	5 A	PKZM0-6,3	1	17
DV4-340-1K5		M10 A	10 A	PKZM0-10	1.5	15
DV4-340-2K2		M10 A	10 A	PKZM0-10	1.5	15
DV4-340-3K0		M16 A	15 A	PKZM0-16	2.5	13
DV4-340-4K0		M16 A	15 A	PKZM0-16	2.5	13
DV4-340-5K5		M20 A	20 A	PKZM0-20	6	9
DV4-340-7K5						
DV4-340-11K[2]						

1) Tripping characteristic “H” or “K5” (UL-approved fuses and fuse holders)

2) Operate only with upstream mains choke.

Operation at higher rated output

120 % overload for applications with quadratic load characteristic, e.g. pumps and fans.

Connect both PE terminals.

Operation is permissible only at operating frequencies ≦ 4 kHz. The table below assumes operation at the respective rated voltage with the assigned increased motor ratings (see Technical data).

Model	Supply connection	VDE	UL[1]	Moeller	L1, L2, L3, N, U, V, W, PE (2×) mm²	AWG
DV4-120-025	Single-phase 230 V, 2 AC 230 V	M6 A	5 A	FAZ-1N-B6, FAZ-2-B6	1	17
DV4-120-037		see[3]				
DV4-322-055		M10 A	10 A	FAZ-1N-B10, FAZ-2-B10	1.5	15
DV4-322-075		M16 A	15 A	FAZ-1N-B16, FAZ-2-B16	2.5	14
DV4-322-1K5[2]		M20 A	20 A	FAZ-1N-B20, FAZ-2-B20	2 × 1.5	2 × 15
DV4-322-2K2		see[3]				
DV4-322-055	3-phase 230 V	M6 A	5 A	PKZM0-6,3	1	17
DV4-322-075		M10 A	10 A	PKZM0-10	1.5	15
DV4-322-1K5		M16 A	15 A	PKZM0-16	2.5	14
DV4-322-2K2		see[3]				
DV4-320-3K0		M20 A	20 A	PKZM0-20	4	11
DV4-320-4K0		see[3]				
DV4-320-5K5		M35 A	35 A	FAZ-3-B32	6	9
DV4-320-7K5		see[3]				
DV4-340-055	3-phase 400 V	M6 A	5 A	PKZM0-6,3	1	17
DV4-340-075[2]		M6 A	5 A	PKZM0-6,3	1	17
DV4-340-1K5		see[3]				
DV4-340-2K2[2]		M10 A	10 A	PKZM0-10	1.5	15
DV4-340-3K0		M16 A	15 A	PKZM0-16	2.5	11
DV4-340-4K0		M16 A	15 A	PKZM0-16	2.5	11
DV4-340-5K5		see[3]				
DV4-340-7K5		M32 A	32 A	FAZ-3-B32	6	9
DV4-340-11K		see[3]				

1) Tripping characteristic “H” or “K5” (UL-approved fuses and fuse holders)

2) Operate only with upstream mains choke.

3) Continuous operation with a more powerful motor is not possible.

Assembly/Installation

Terminal tightening torque in the power section

Model	Nm
DV4-120-025	N/A (plug connection)
DV4-120-037	
DV4-322-055	
DV4-322-075	
DV4-322-1K5	
DV4-322-2K2	
DV4-320-3K0	0.5 to 0.6 Nm
DV4-320-4K0	
DV4-320-5K5	
DV4-320-7K5	
DV4-340-055	N/A (plug connection)
DV4-340-075	
DV4-340-1K5	
DV4-340-2K2	
DV4-340-3K0	0.5 to 0.6 Nm
DV4-340-4K0	
DV4-340-5K5	
DV4-340-7K5	
DV4-340-11K	

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Motors

The tables below assume normal operation at 150 % overload.

The two tables assume motor operation with a screened motor cable up to 20 m length at limit value class A. For operation at limit value class B, motor cables up to 1 m length are permissible for single-phase supplies and up to 10 m length for three-phase supplies.

The listed motor ratings are intended as a guideline. A precise assignment is possible only by comparison of the rated currents of the frequency inverter and the motor.

The following motor ratings (shaft output) in kilowatts apply to four-pole motors built to European standards (three-phase asynchronous motors).

Model	Construction type	Assigned motor ratings at V_{LN}					
		Single-phase 115 V[1)] [kW]	Single-phase 230 V [kW]	3-phase 115 V [kW]	3-phase 230 V [kW]	3-phase 400 V [kW]	3-phase 500 V [kW]
DV4-120-025	1	0.06	0.25				
DV4-120-037		0.12	0.37				
DV4-322-055	2	0.18	0.55	0.25	0.55		
DV4-322-075		0.25	0.75	0.37	0.75		
DV4-322-1K5	3	0.55	1.5	0.75	1.5		
DV4-322-2K2		0.75	2.2	1.1	2.2		
DV4-320-3K0	4			1.5	3		
DV4-320-4K0				2.2	4		
DV4-320-5K5	5				5.5		
DV4-320-7K5				3	7.5		
DV4-340-055	2					0.55	0.75
DV4-340-075						0.75	1.5

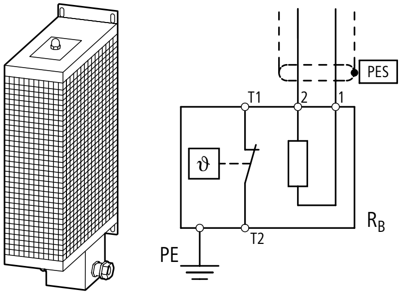
Model	Construction type	Assigned motor ratings at V_{LN}					
		Single-phase 115 V[1)] [kW]	Single-phase 230 V [kW]	3-phase 115 V [kW]	3-phase 230 V [kW]	3-phase 400 V [kW]	3-phase 500 V [kW]
DV4-340-1K5	3					1.5	2.2
DV4-340-2K2						2.2	3
DV4-340-3K0	4					3	4
DV4-340-4K0						4	5.5
DV4-340-5K5						5.5	7.5
DV4-340-7K5	5					7.5	11
DV4-340-11K						11	15

1) For single-phase supplies and supply voltages below 180 V, the current applied to the DV4-120-... and DV4-322-... frequency inverters must be reduced to about 75 % of the rated current due to the harmonic load. The motor ratings listed here take this derating into account.
The rated currents of the corresponding 230 V motors must be increased by 10 to 15 % compared to the ratings of 200 V and 208 V motors.

The following motor ratings (shaft output) in HP (horse power) apply to four-pole, North American asynchronous motors (NEC 1987 table 430-150 and CSA-C22.1-1986, table 44).

Model	Construction type	Assigned motor ratings at V_{LN}				
		Single-phase 230 V [HP]	3-phase 115 V [HP]	3-phase 230 V [HP]	3-phase 460 V [HP]	3-phase 480 V [HP]
DV4-120-025	1					
DV4-120-037						
DV4-322-055	2					
DV4-322-075		0.5		0.5		
DV4-322-1K5	3	0.75		0.75		
DV4-322-2K2		1.5	0.75	1.5		
DV4-320-3K0	4		1	2		
DV4-320-4K0			1.5	3		
DV4-320-5K5	5					
DV4-320-7K5			3	5		
DV4-340-055	2				0.75	0.75
DV4-340-075					1	1
DV4-340-1K5	3				2	2
DV4-340-2K2					3	3
DV4-340-3K0	4					4
DV4-340-4K0					5	5
DV4-340-5K5					7.5	7.5
DV4-340-7K5	5				10	10
DV4-340-11K					15	15

Braking resistor DE4-BR1-...



Construction design:

Cemented, wire-wrapped resistors,

in a perforated, hot-galvanized sheet enclosure,

Protection class IP 20,

with temperature switch (break contact, > 120 oC),

with terminal box.

The table below assumes frequency inverter operation at the respective rated voltage with the assigned motor ratings (see technical data, normal operation, 150 % overload).

The resistors are dimensioned for a duty factor of 10 %. Max. 15 s braking at peak power (P_{PEAK}), then at least 150 s recovery time at I = 0 A.

Model	R [Ω]	P_D [W]	P_{PEAK} [kW]	Assigned frequency inverters
DE4-BR1-082-245	82	245	1.7	DV4-322-2K2
DE4-BR1-100-200	100	200	1.4	DV4-322-1K5
DE4-BR1-200-100	200	100	0.7	DV4-322-055
				DV4-322-075
DE4-BR1-240-285	240	285	2	DV4-340-2K2
DE4-BR1-370-215	370	215	1.5	DV4-340-1K5

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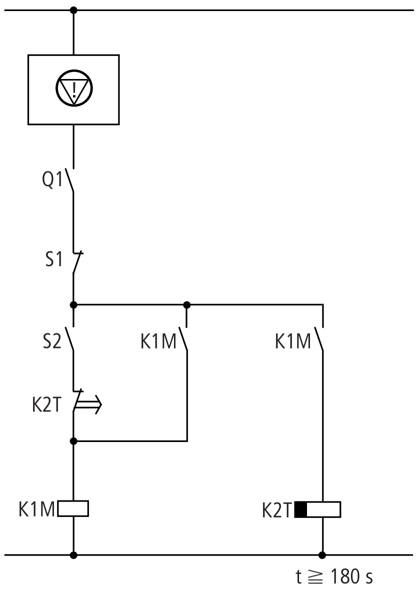
Model	R [Ω]	P_D [W]	P_{PEAK} [kW]	Assigned frequency inverters
DE4-BR1-470-050	470	50	0.3	DV4-120-025
				DV4-120-037
				DV4-340-055
DE4-BR1-470-140	470	140	1	DV4-340-075

Further technical specifications are listed in the installation instructions (AWA8240-1711) for braking resistor DE4-BR1-...

DV4 as softstarter

For the Softstarter function, a setpoint must be defined, e.g. 50 Hz in PNU 0140 via LCD keypad DE4-KEY-3 or DE4-KEY-H3.

Control circuit

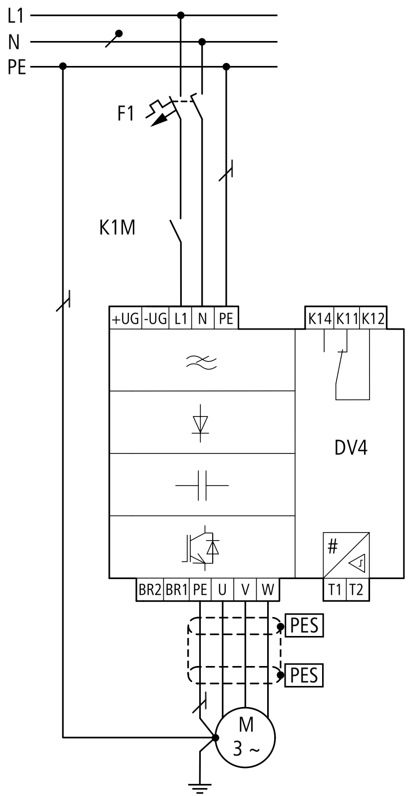


With the Start command and the default setting of the DV4, the assigned motor accelerates to the value set in PNU 0140 (e.g. 50 Hz). When the Stop command is issued, the drive spins down uncontrolled.

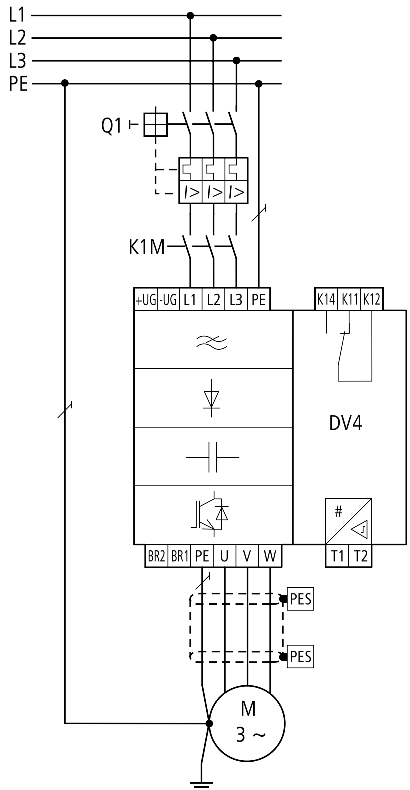
Before it is restarted, it must be left to recover for at least 180 seconds. The contact of K2T closes when power is switched off and acts as a restart check in this example.

(Emergency stop symbol):	EMERGENCY STOP
S1:	Stop
S2:	Start
K1M:	Mains contactor
K2T:	Restart monitoring

Wiring

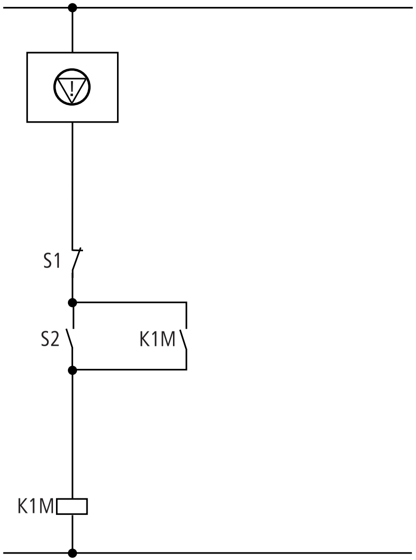


Single-phase supply connection (DV4-120)



Three-phase supply connection (DV4-322/DV4-340)

Control circuit



Default setting

The setpoint input is made via potentiometer R1 at the internal setpoint voltage of +5.2 V. Note: Set DIP switch 5 to OFF.

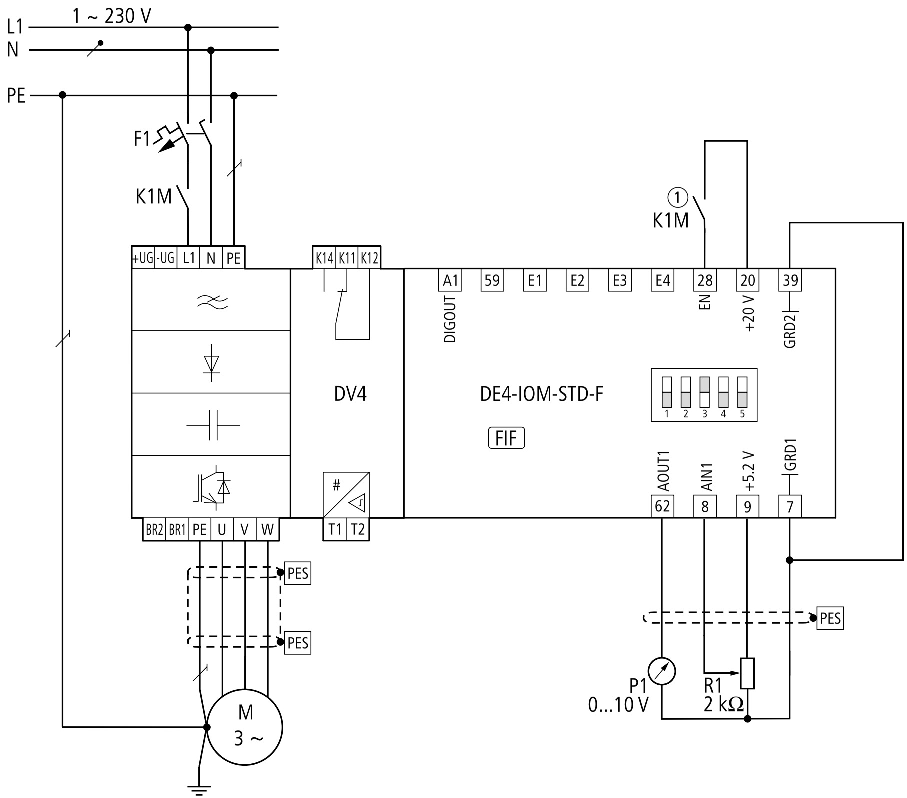
Measuring device P1 for frequency or speed indication with analog value 0 to +10 V.

The controller enable signal is issued via terminal 28 at the internal control voltage of +20 V (terminal 20); 0 V connection, terminal 7 to terminal 39.

The drive accelerates and decelerates over the default period of 5 s.

: EMERGENCY STOP
S1: Off
S2: On
K1M: Mains contactor

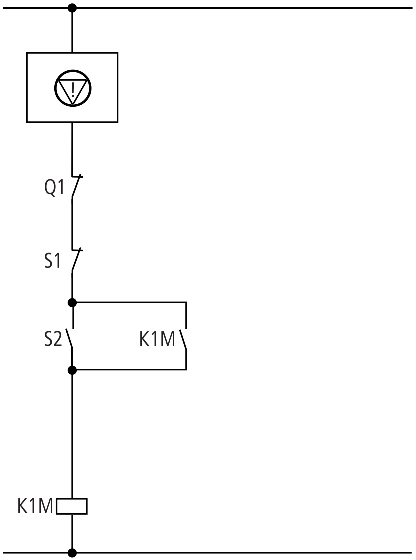
Wiring



① Controller enable

Frequency inverter DV4-322/DV4-340, I/O module DE4-IOM-STD-F, Networking module Suconet K DE4-NET-K

Control circuit



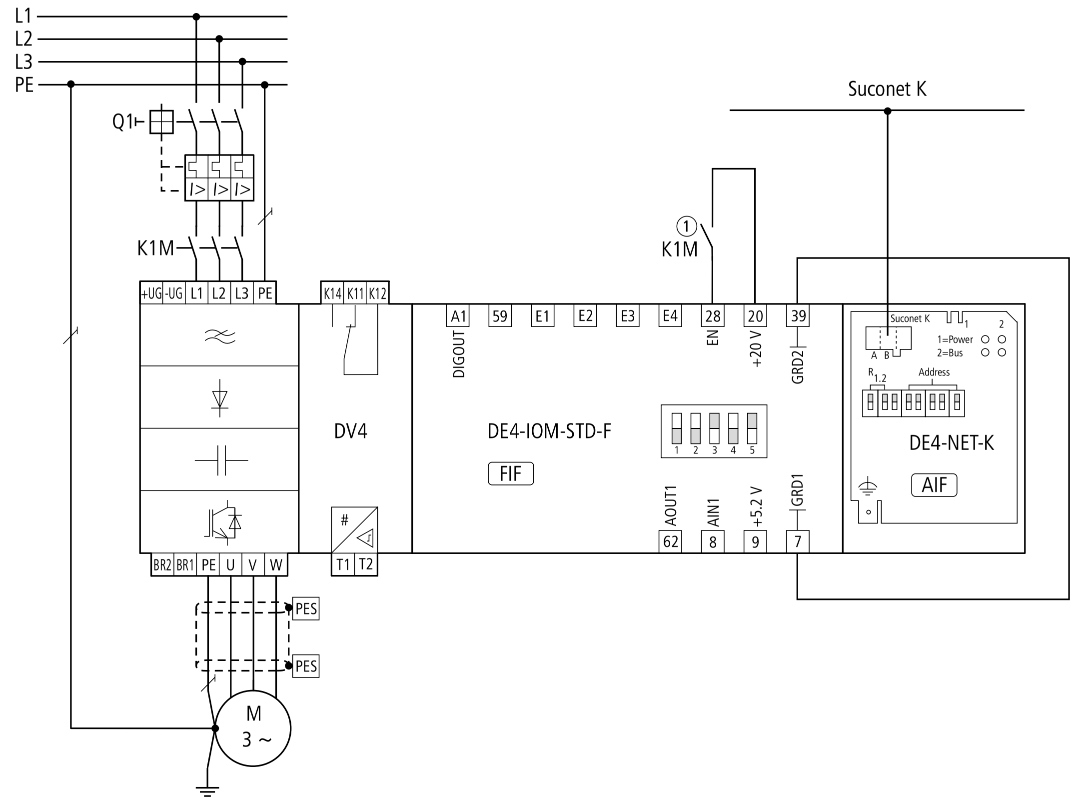
The controller enable signal is issued via terminal 28 at the internal control voltage of +20 V (terminal 20); 0 V connection, terminal 7 to terminal 39.

The drive is controlled via the fieldbus.

To interface with another fieldbus, e.g.PROFIBUS-DP, the DE4-NET-K module must be replaced with the DE4-NET-DP module.

(EMERGENCY STOP symbol):	EMERGENCY STOP
S1:	Off
S2:	On
K1M:	Mains contactor

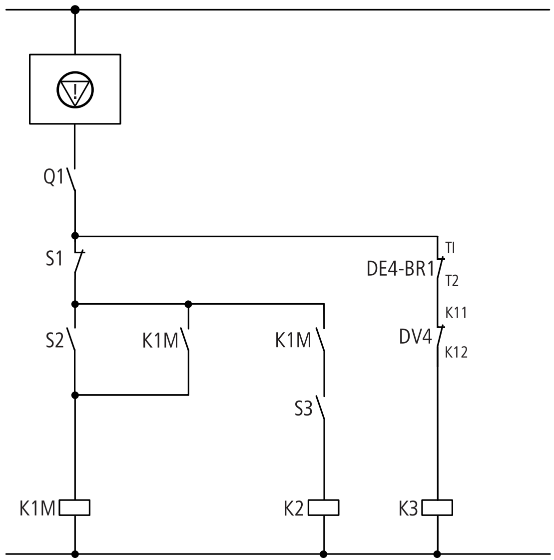
Wiring



① Controller enable

Frequency inverter DV4-322/DV4-340, I/O module DE4-IOM-STD-F, LCD keypad DE4-KEY-3, braking resistor DE4-BR1

Control circuit



: EMERGENCY STOP		K1M:	Mains contactor
S1:	Off	K2:	Enable
S2:	On	K3:	Overload message, braking system activated
S2:	Start		

External control voltage +24 V:

Controller enable, terminal 28

Clockwise rotation (R)/quickstop = terminal E3

Anticlockwise rotation (L)/quickstop = terminal E4

Connect reference point (terminal 39) with 0 V of external voltage source

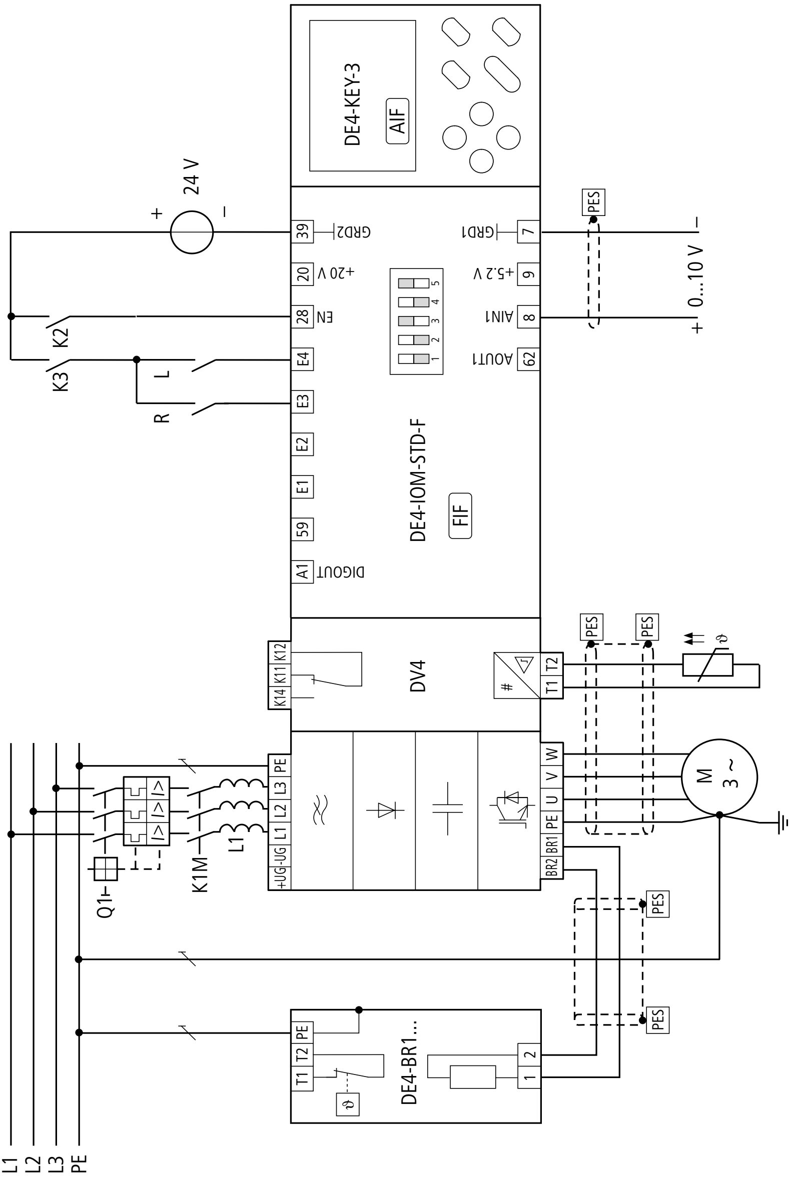
Analog setpoint input 0 to +10 V at terminal 8; reference point, terminal 7.

Thermistor connection T1/T2: PTC warning via DV4 relay K11/K12 (parameters PNU 0008 and PNU 0119)

Temperature monitoring of braking resistor DE4-BR1 (T1/T2).

L1 = mains choke for reduction of current harmonics.

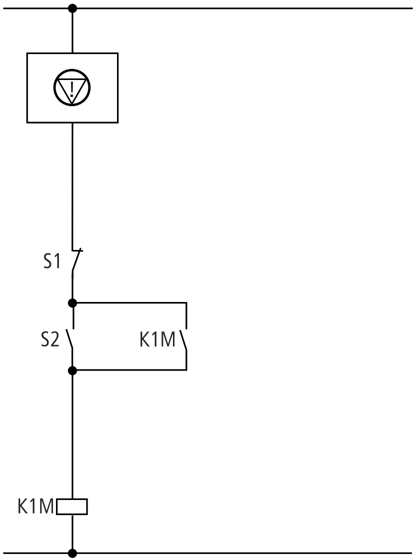
Wiring


L1
L2
L3
PE
Q1
K1M
L1
24 V
+
–
K2
K3
L
R
DE4-KEY-3
AIF
DE4-IOM-STD-F
FIF
39
GRD2
20
+20 V
28
EN
E4
E3
E2
E1
59
A1
DIGOUT
7
GRD1
9
+5.2 V
8
AIN1
62
AOUT1
PES
0...10 V
DV4
K14
K11
K12
T1
T2
+UG
-UG
PE
BR2
BR1
U
V
W
M
3 ~
DE4-BR1...
1
2

Frequency inverter DV4-322-2K2, I/O module DE4-IOM-STD-F

Control circuit

If a single-phase power supply is used, the DV4-322-2K2 must not be operated with mains choke DE4-LN1-2K2.



The DV4 must be connected to the power supply by two separate cables (each 1.5 mm^2, parallel connection).

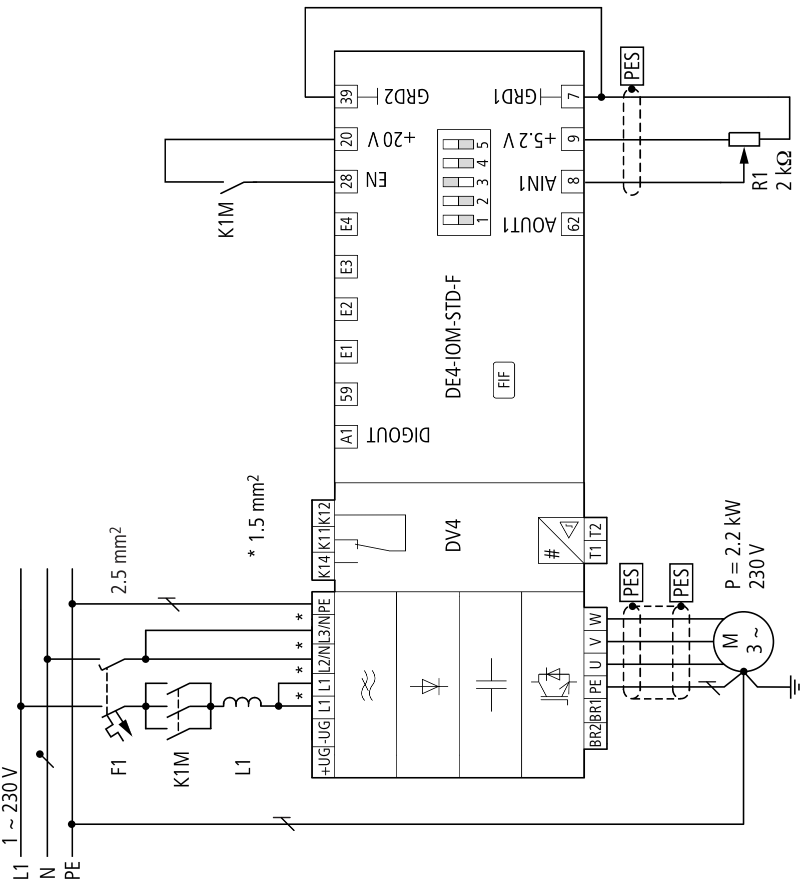
F1 = circuit-breaker FAZ 1N-B25.

The setpoint input is made via potentiometer R1 at the internal setpoint voltage of +5.2 V. Note: Set DIP switch 5 to OFF.

The controller enable signal is issued via terminal 28 at the internal control voltage of +20 V (terminal 20); 0 V connection, terminal 7 to terminal 39.

:	EMERGENCY STOP
S1:	Off
S2:	On
K1M:	Mains contactor

Wiring


L1
N
PE
1 ~ 230 V
2.5 mm²
F1
K1M
L1
* 1.5 mm²
+UG -UG L1 L1 L2/N L3/N PE
K14 K11 K12
DV4
T1 T2
BR2 BR1 PE U V W
PES
P = 2.2 kW
230 V
M
3 ~
DE4-IOM-STD-F
FIF
A1 DIGOUT
59
E1
E2
E3
E4
28 EN
20 +20 V
39 GRD2
K1M
62 AOUT1
8 AIN1
6 +5.2 V
7 GRD1
1 2 3 4 5
R1
2 kΩ

Weights and dimensions

All devices and modules are supplied with installation instructions (AWA), which describe and illustrate the procedures, tools and accessories needed for their installation.

Assembly instructions:

AWA 8230-1703	DV4 frequency inverters up to 2.2 kW
AWA 8230-1722	DV4 frequency inverters from 3 to 11 kW
AWA 8240-1708	ICD keypad DE4-KEY-3
AWA 8240-1728	I/O module DE4-IOM-STD-F

Frequency inverter DV4

During assembly, take the weight and dimensions of the frequency inverter into account. Use appropriate tools and handling and lifting equipment (lifting trolley and/or crane for larger weights). Improper handling and the use of incorrect tools can damage the frequency inverter.

Model	a [mm]	a1 [mm]	b [mm]	b1 [mm]	b2 [mm]	c [mm]	c1 [mm]	kg	Construction type
DV4-120-025	60	30	170	150	120	140	16	0.6	1
DV4-120-037									
DV4-322-055			220	200	180	140		0.95	2
DV4-322-075									
DV4-322-1K5			295	275	240		1)	1.22	3
DV4-322-2K2									
DV4-320-3K0	100	50	270	255	180	140	16	2.8	4
DV4-320-4K0									
DV4-320-5K5	125	62.5			240		2)	3.7	5
DV4-320-7K5									

Model	a [mm]	a1 [mm]	b [mm]	b1 [mm]	b2 [mm]	c [mm]	c1 [mm]	kg	Construction type
DV4-340-055	60	30	220	200	180	140	16	0.95	2
DV4-340-075									
DV4-340-1K5			270	255	240		[1]	1.22	3
DV4-340-2K2									
DV4-340-3K0	100	50					16	2.8	4
DV4-340-4K0									
DV4-340-5K5									
DV4-340-7K5	125	62.5					[2]	3.7	5
DV4-340-11K									

[1] For side mounting, the adjustable mounting bracket DE4-MNT-SA (optional) must be used

[2] Side-mounting is not possible

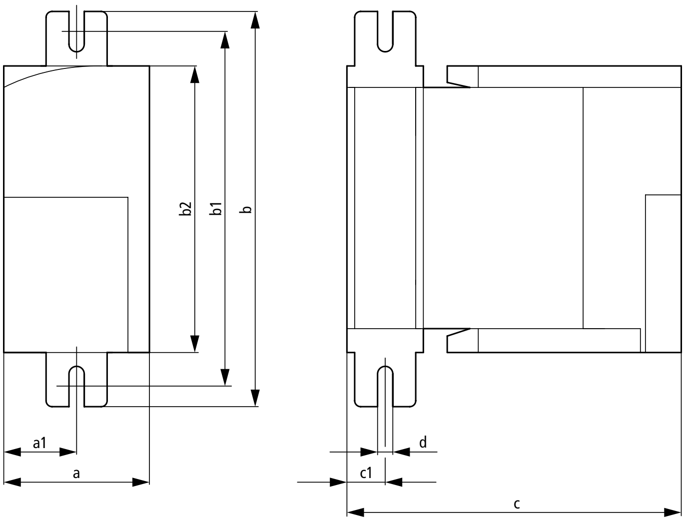


Figure 65: Dimension drawing, DV4 to 2.2 kW

LCD keypad DE4-KEY-3

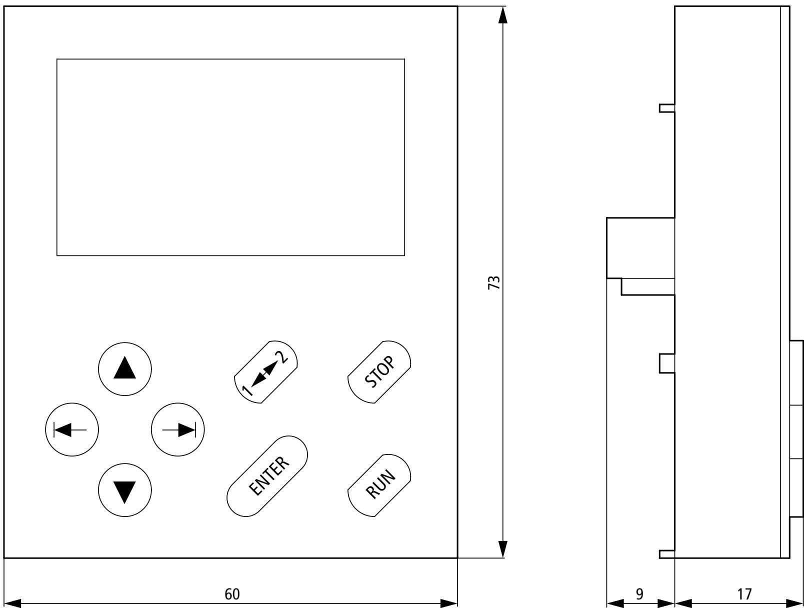


Figure 66: Dimension drawing, LCD keypad DE4-KEY-3

I/O module DE4-IOM-STD-F

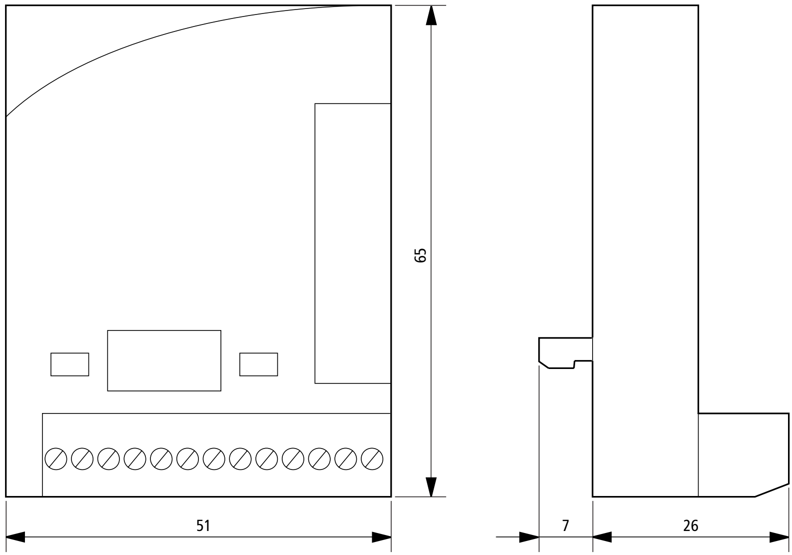


Figure 67: DE4-IOM-STD-F

Parameters

List of all parameters in numerical order.

Some of the following parameters and functions can be addressed only with expansion modules.

Equipment

Abbreviation	Use
PNU	Parameter number
PNU XXXX*	The value of the parameter is the same in all parameter sets.
PNU XXXX (EXP)	This parameter or parameter value is available only when an expansion module (e.g. DE4-IOM-APP-F) is connected to the FIF interface
PNU XXXX (APP)	This parameter or parameter value is available only when a DE4-IOM-APP-F expansion module is used
ONLINE	Immediate transfer of values
ENTER	Values accepted when ENTER is pressed
ENTER + IMP	Values accepted when controller inhibit active and ENTER is pressed
DISPLAY	The parameter value is for display only and cannot be changed
rw	Parameter is read/write
ro	Parameter is read-only

Parameter types

The following parameter types are defined:

Model	Use
Fix32	The parameter value is a 32 bit value with prefix, decimal with 4 decimal places
Bit16	The information is 16 bits long and encoded bitwise (status bits, control bits)
VS	String format
VH	ASCII hexadecimal format

Parameters (numeric listing)

PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0001		Setpoint input (operating mode)	Setpoint input, control always possible via terminals and LCD keypad/PC (AIF)	0	via terminal 8, 1U/1I (analog input AIN1)	Fix32	ro/rw	ENTER	0	106 314
				1	Via LCD keypad or parameter channel of an AIF bus module					
				2	via terminal 8, 1U/1I (analog input AIN1)					
				3	Via process data channel of an AIF bus module					
0002*		Parameter set transfer	Selected parameter set(s) (PARx) of frequency inverter:	0	Transfer completed	Fix32	ro/rw	ENTER + IMP	0	107
			Overwrite with default setting	1	Overwrite PAR1 with default value					
				2	Overwrite PAR2 with default value					
				3	Overwrite PAR3 with default value					
				4	Overwrite PAR4 with default value					
			Overwrite with data from LCD keypad	10	Overwrite all parameter sets (PAR1 to PAR4) with data from LCD keypad					
				11	Overwrite PAR1 with data from LCD keypad					
				12	Overwrite PAR2 with data from LCD keypad					
				13	Overwrite PAR3 with data from LCD keypad					
				14	Overwrite PAR4 with data from LCD keypad					
			Copy to LCD keypad	20	Copy all parameter sets (PAR1 to PAR4) from frequency inverter to LCD keypad					
0002* (EXP)			Selected parameter set(s) (FPARx) of expansion module to FIF:		Parameter set transfer for expansion module on FIF only (does not apply to DE4-IOM-STD-F)					
			Overwrite with default setting	31	Overwrite FPAR1 with default values					
				32	Overwrite FPAR2 with default values					
				33	Overwrite FPAR3 with default values					
				34	Overwrite FPAR4 with default values					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0002* (EXP)			Overwrite with data from LCD keypad	40	Overwrite all parameter sets (FPAR1 to FPAR4) with the data from the LCD keypad					
				41	Overwrite FPAR1 with data from LCD keypad					
				42	Overwrite FPAR2 with data from LCD keypad					
				43	Overwrite FPAR3 with data from LCD keypad					
				44	Overwrite FPAR4 with data from LCD keypad					
			Copy to LCD keypad	50	Copy all parameter sets (FPAR1 to FPAR4) of the expansion module to the LCD keypad					
			Selected parameter set(s) (PARx and FPARx) of frequency inverter and expansion module to FIF:		Parameter set transfer for frequency inverter and expansion module to FIF. During operation with DE4-IOM-APP-F, always transfer the parameter sets for frequency inverter and module together. (does not apply to DE4-IOM-STD-F)					
			Overwrite with default setting	61	Overwrite PAR1 and FPAR1 with default values					
				62	Overwrite PAR2 and FPAR2 with default values					
				63	Overwrite PAR3 and FPAR3 with default values					
				64	Overwrite PAR4 and FPAR4 with default values					
			Overwrite with data from LCD keypad	70	Overwrite all parameter sets (PAR1 to PAR4 and FPAR1 to FPAR4) with the data from the LCD keypad					
				71	Overwrite PAR1 and FPAR1 with data from LCD keypad					
				72	Overwrite PAR2 and FPAR2 with data from LCD keypad					
				73	Overwrite PAR3 and FPAR3 with data from LCD keypad					
				74	Overwrite PAR4 and FPAR4 with data from LCD keypad					
			Copy to LCD keypad	80	Copy all parameter sets (PAR1 to PAR4 and FPAR1 to FPAR4) to the LCD keypad					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0003*		Do not save parameters in volatile memory		0	Parameters are not saved in the EEPROM. Data loss on power off	FIX32	ro/rw	ENTER	1	187
				1	Parameters are saved in the EEPROM. Cyclic changing of parameters via bus module is not permitted					
0004*		Bar graph display	Graphic display of operating data	56	All code positions possible 56 = device utilization (PNU 0056) Bar graph display shows selected variable in % after Power On Range –180 to +180 %	Fix32	ro/rw	ENTER	56	176 179
0005		Configuration of analog input signals		0	Setpoint via terminal 8, 1U/1I	Fix32	ro/rw	ENTER	0	140 145 314
				1	Setpoint via terminal 8, 1U/1I with setpoint addition via frequency input E1					
				2	Setpoint via frequency input E1 with setpoint addition via terminal 8, 1U/1I					
				3	Setpoint via frequency input E1 and torque limitation via terminal 8, 1U/1I (load regulation) (not possible if PNU 0014 = 5)					
				4	Setpoint for sensorless torque regulation via terminal 8, 1U/1I and speed limitation via PNU 0011 (only when PNU 0014 = 5, torque input)					
				5	Setpoint for sensorless torque regulation via terminal 8, 1U/1I and speed limitation via frequency input E1 (only when PNU 0014 = 5, torque input)					
				6	Operation with PID controller: Setpoint via terminal 8, 1U/1I (analog) Actual value via frequency input E1 (digital)					
				7	Operation with PID controller: Setpoint via frequency input E1 (digital) Actual value via terminal 8, 1U/1I (analog)					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range					Data type	Access rights	Accept-ance	Default	See page
0005 (APP)				8	Setpoint via terminal E1 with setpoint addition via terminal 2U/2I								
				9	Operation with PID controller: Setpoint via terminal 1U/1I Actual value via terminal 2U/2I								
0005				200	All digital and analog input signals supplied to the FIF by function module PROFIBUS, Suconet K or INTERBUS								
0007		Terminal configuration, digital inputs	Fixed configuration, digital inputs E1 to E4		E1	E2	E3	E4	Fix32	ro/rw	ENTER	0	109ff 128ff 133 143 147 151
				0	FF1, FF2, FF3		DCB	R/L					
				1			PAR						
				2			QSP						
				3	FF1	DCB	PAR						
				4		PAR	QSP						
				5		EF	DCB						
				6			PAR						
				7	EF	DCB							
				8		PAR	QSP						
				9	FF1	EF							
				10	DOWN	UP	EF						
				11			DCB						
				12			PAR						
				13			QSP						

FF1 = fixed frequency 1
FF2 = fixed frequency 2
FF3 = fixed frequency 3
DCB = DC injection braking
R/L = combined selection of direction
PAR = parameter set selection
QSP = quickstop
EF = external fault
DOWN = motor potentiometer, reduce value
UP = motor potentiometer, increase value
R/QSP = clockwise rotation, quickstop on error
L/QSP = anticlockwise rotation, quickstop on error
RA/MO = remote/manual changeover
DIS-I = disable I-component of PID controller
DIS-PID = disable PID controller
f-In = digital frequency input, 0 to 10 kHz

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PNU	Sub-index	Name	Notes, internal designations, etc.
0007			

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Value range					Data type	Access rights	Accept-ance	Default	See page
14	FF1	DCB	R/QSP	L/QSP					109ff 128ff 133 143 147 151
15		PAR							
16	FF1, FF2, FF3								
17	DCB	PAR							
18	EF								
19		DCB							
20	FF1	EF							
21	DOWN	UP							
22	FF1								
23	DOWN		R/L	RA/MO					
24			PAR						
25			DCB						
26			FF1						
27			EF						

PNU	Sub-index	Name	Notes, internal designations, etc.	Value range					Data type	Access rights	Accept-ance	Default	See page
0007					E1	E2	E3	E4					109ff 128ff 133 143 147 151
				28	f-In	DIS-I	FF1, FF2, FF3						
				29			DCB	FF1					
				30			QSP						
				31				DCB					
				32				EF					
				33			PAR	QSP					
				34			L/QSP	R/QSP					
				35		PAR	FF1, FF2, FF3						
				36			QSP	DCB					
				37				FF1					
				38		EF	PAR						
				39			FF1, FF2, FF3						
				40			QSP	FF1					
				41			DCB						
				42				QSP					
				43			QSP	R/L					
				44		PAR	DOWN	UP					
				45			QSP	R/L					
				46	FF1	QSP	PAR	RA/MO					
				47		RA/MO	L/QSP	R/QSP					
				48	f-In	DIS-I	DCB	DIS-PID					
				49		QSP	FF1						
				50		DIS-I							
				51			PAR	DCB					
				52 to 249	Reserved								
				255	PNU 0113 was freely configured Display only Do not change PNU 0007, since settings in PNU 0113 could be lost								

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0008		Relay output K1 (configuration)	K1		Configuration of relay output K1	Fix32	ro/rw	ENTER	0	181
			DCTRL1-RDY	0	Ready to operate					
			DCTRL1-TRIP	1	TRIP signal					
			DCTRL1-RUN	2	Motor running					
			DCTRL1-RUN-R	3	Motor running/CW rotation					
			DCTRL1-RUN-L	4	Motor running/CCW rotation					
			DCTRL1-NOUT=0	5	Output frequency $f_2 = 0$					
			MCTRL-RFG1=NOUT	6	Frequency setpoint, $f_{setpoint}$ reached					
			PCTRL1-F2>F1	7	$f_2 > f_1$ threshold reached					
			MCTRL1-IMAX	8	I_{max} limit reached For PNU 0014 = 5: torque setpoint reached					
			DCTRL1-OH-WARN	9	(heatsink temperature ϑ_{max}) – 5 °C					
			DCTRL1-IMP	10	TRIP or $f_2 > f_1$ or IMP active					
			DCTRL1-PTC-WARN	11	PTC warning					
			DCTRL1-IMOT<ILIM	12	Apparent motor current $<$ current threshold					
			DCTRL1-(IMOT<ILIM)-F2>F1	13	Apparent motor current $<$ current threshold and $f_2 > f_1$ reached					
			DCTRL1-(IMOT<ILIM)-RFG1=0	14	Apparent motor current $<$ current threshold and ramp generator 1: input = output					
			DCTRL1-LP1-WARN	15	Motor phase failure warning					
			PCTRL1-NMIN	16	Minimum output frequency f_{min} reached					
			DCTRL1-PAR-B0	17	PAR2/PAR4 active					
			DCTRL1-IMP	18	Impulse disable, IMP active					
			NSET1-RFG1=0	19	Ramp generator 1: input = output					
			DCTRL1-CINH	20	Controller inhibit, CINH active					
			DCTRL1-OV	21	Overvoltage in internal DC link					
			DCTRL1-L	22	Anticlockwise rotation					
			DCTRL1-PAR-B1	23	PAR3/PAR4 active					
			PCTRL1-SET=ACT	24	PID input = PID output					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0008 (APP)			DCTRL1-(IMOT>ILIM)-RFG-I=0	25	Apparent motor current> current threshold and ramp generator 1: input = output					
			MSET1=MACT	26	Torque threshold reached					
			PCTRL1-LIM	27	PID output limitation reached					
			E1	28	Mapping of input terminal E1					
			E2	29	Mapping of input terminal E2					
			E3	30	Mapping of input terminal E3					
			E4	31	Mapping of input terminal E4					
			E5	32	Mapping of input terminal E5					
			E6	33	Mapping of input terminal E6					
0009*		Device address		1 to 99	Only for RS232/485, PROFIBUS-DP interface module on the AIF	Fix32	ro/rw	ENTER	1	110
0010		Minimum output frequency	No effect for bipolar setpoint input		0.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	0.00	165
0011		Maximum output frequency			7.50 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	50.00	165
0012		+a Acceleration time, main setpoint	Frequency change 0 Hz to PNU 0011		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00	169
0013		–a Deceleration time, main setpoint	Frequency change, PNU 0011 to 0 Hz		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00	155 169
0014		Motor control mode		2	Linear characteristic with constant V_{min} pull-up (V/f = const.)	Fix32	ro/rw	ENTER	2	154 157
				3	Quadratic characteristic with constant V_{min} pull-up ($V \sim f^2$)					154 157
			Motor identification in PNU 0148 required	4	Vector control					
				5	Sensorless torque regulation with speed limitation Torque setpoint according to setting in PNU 0005					
0015		V/f rated frequency	Characteristic transition frequency		7.50 to 960.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	50.00	155 163
0016		V_{min} pull-up		$>$	0.00 to 40.00 %, (0.2 %) Device-dependent default	Fix32	ro/rw	ONLINE	$<$	155 162
0017		Frequency signal $f_2 > f_1$	Response threshold $f_2 > f_1$, reference setpoint		0.00 to 480.00 Hz, (0.02 Hz) Threshold (PCTRL1-NOUT)	Fix32	ro/rw	ONLINE	0.00	181

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0018		Operating frequency		0	2 kHz	Fix32	ro/rw	ENTER	2	174
				1	4 kHz					
				2	8 kHz					
				3	16 kHz					
0019		Response threshold for auto DCB			0.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	0.0 Hz	152
0021		Slip compensation			–50.0 to +50.0 %, (0.1 %)	Fix32	ro/rw	ONLINE	0.0 %	169
0022		I_{max} limit, drive			30.0 to +150.0 %, (1 %)	Fix32	ro/rw	ONLINE	150 %	172
0023		I_{max} limit, regenerative	PNU 0023 = 0 and PNU 0014 = 2, 3, function disabled		30.0 to +150.0 %, (1 %)	Fix32	ro/rw	ONLINE	150 %	172
0026*		OFFSET Analog input	Offset, analog input trm. 8, 1U/1I (AIN1-OFFSET)		–200.0 to +200.0 %, (0.1 %)	Fix32	ro/rw	ONLINE	0.0 %	136
0027*		GAIN Analog input	Gain, analog input trm. 8, 1U/1I (AIN1-GAIN)		–1500 to +1500.0 %, (0.1 %)	Fix32	ro/rw	ONLINE	100.0 %	136
0034*		Setpoint input range Terminal 8	Observe function module switch position PNU 0010 has no effect when PNU 0034 = 2	0	0 to 5 V, 0 to 10 V, 0 to 20 mA	Fix32	ro/rw	ENTER	0	135
				1	4 to 20 mA					
				2	–10 to +10 V					
			Fault message Sd5	3	4 to 20 mA, open-circuit monitored					
				4 to 13	Reserved					
0034* (APP)	001	Setpoint input range Terminal 8, 1U/1I Observe jumper settings of the DE4-IOM-APP-F expansion module!		0	0 to 5 V, 0 to 10 V					
			PNU 0010 has no effect	1	–10 V to +10 V					
				2	0 to 20 mA					
				3	4 to 20 mA					
			Fault message Sd5	4	4 to 20 mA, open-circuit monitored					
	002	Setpoint input range Terminal 8, 2U/2I Observe jumper settings of the DE4-IOM-APP-F expansion module!		0	0 to 5 V, 0 to 10 V					
			PNU 0010 has no effect	1	–10 V to +10 V					
				2	0 to 20 mA					
				3	4 to 20 mA					
			Fault message Sd5	4	4 to 20 mA, open-circuit monitored					
0035*		DCB braking	Selection of DCB	0	Braking voltage specified with PNU 0036	Fix32	ro/rw	ENTER	0	152
				1	Braking current specified with PNU 0036					
0036		Level of braking voltage or braking current	DCB voltage/current	>	0 to 150 %, (0.02 %) Device-dependent default	Fix32	ro/rw	ONLINE	<	152

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0037		Fixed frequency 1	FF1		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	20.00 Hz	132
0038		Fixed frequency 2	FF2		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	30.00 Hz	132
0039		Fixed frequency 3	FF3		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	40.00 Hz	132
0040*		Controller inhibit	CINH	0	Controller inhibit active	Fix32	ro/rw	ENTER		
				1	Controller inhibit disabled, controller enabled					
0043*		TRIP RESET	Reset fault	0	Reset fault by entering 0	Fix32	ro/rw	ENTER		191
				1	Fault has occurred					
0044*		Setpoint 2	NSET1-N2		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		176
0046*		Setpoint 1	NSET1-N1		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		176
0047*		Torque setpoint or torque limit value	MCTRL1-MSET		0 to 400 % PNU 0014 = 5: torque setpoint PNU 0014 = 2, 3, 4: torque limit value	Fix32	ro	DISPLAY		176
0049*		Additive setpoint	PCTRL1-NADD		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		176
0050*		Output frequency f_2	MCTRL1-NOUT		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		176
0051*		Output frequency f_2 with slip compensation	Output frequency with slip compensation (MCTRL1-NOUT+SLIP) or for PNU 0238 = 0, 1: Process controller actual value (PCTRL1-ACT)		–480.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		176
0052*		Motor voltage	MCTRL1-VOLT		0 to 1000 V	Fix32	ro	DISPLAY		176
0053*		DC link voltage	MCTRL1-DCVOLT		0 to 1000 V	Fix32	ro	DISPLAY		176
0054*		Apparent motor current	MCTRL1-IMOT		0 to 400 A	Fix32	ro	DISPLAY		176
0056*		Inverter load	MCTRL1-MOUT		–255 to 255 %	Fix32	ro	DISPLAY		176
0061*		Heatsink temperature			0 to 255 °C	Fix32	ro	DISPLAY		176
0070		P-component	Gain		0.00 to 300.00, (0.01) 0.00 = P-component disabled	Fix32	ro/rw	ONLINE	1.00	144
0071		I-component	Reset time		10 to 9999 s, (1 s) 9999 = I-component disabled	Fix32	ro/rw	ONLINE	100	144
0072		D-component	Differential component		0.0 to 5.0, (0.1) 0.0= D-component inactive	Fix32	ro/rw	ONLINE	0.0	144
0074		Effect of PID controller	PID control		0.0 to 100.0 %, (0.1 %)	Fix32	ro/rw	ONLINE	0.0 %	144
0077*		Gain, I_{max} controller	Behaviour at current limit		0.00 to 16.00, (0.01) 0.00 = P-component disabled	Fix32	ro/rw	ONLINE	0.25	172
0078*		Reset time, I_{max} controller			12 to 9990 ms, (1 ms) 9990 = I-component disabled	Fix32	ro/rw	ONLINE	65 ms	172

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0079		Oscillation damping		>	0 to 80, (1) Device-dependent default	Fix32	ro/rw	ONLINE	<	175
0080		Service code			Adjustments only by Moeller service!	Fix32	ro/rw	ONLINE	0.02 Hz	
0084		Motor stator resistance			0.000 to 64.000 Ω, (0.001 Ω)	Fix32	ro/rw	ONLINE	0.000	167
0087		Rated motor speed			300 to 16000 rpm, (0.001 rpm)	Fix32	ro/rw	ONLINE	1390 rpm	167
0088		Rated motor current		>	0.0 to 480.0 A, (0.1 A) Device-dependent default, 0.0 to 2.0 × output current of frequency inverter	Fix32	ro/rw	ONLINE	<	167
0089		Rated motor frequency			10 to 960 Hz, (1 Hz)	Fix32	ro/rw	ONLINE	50 Hz	167
0090		Rated motor voltage		>	50 to 500 V, (1 V) Device-dependent default	Fix32	ro/rw	ONLINE	<	167
0091		Motor cos φ		>	0.40 to 1.0, (0.1) Device-dependent default	Fix32	ro/rw	ONLINE	<	167
0092		Motor stator inductance			0.0 to 2000.0 mH, (0.1 mH)	Fix32	ro/rw	ONLINE	0.0 mH	167
0093*		Device ID			XXXY	Fix32	ro	DISPLAY		
0094*		User password	Free access only to USER menu		0 to 9999, (1) 0 = password protection disabled	Fix32	ro	ENTER	0	188
0099*		Software version			X.Y	Fix32	ro	DISPLAY		
0105		Quickstop ramp	Deceleration time for QSP		0.0 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	125 150 155
0106		Time for auto DCB	Stop time, auto DCB when below PNU 0019		0.0 to 999.00 s, (0.01 s) 0.00 s = auto DCB disabled 999.00 s = ∞	Fix32	ro/rw	ONLINE	0.50 s	152
0107		Time for external DCB	Stop time for DCB when triggered via terminal/ control word		0.0 to 999.00 s, (0.01 s) 999.00 s = ∞	Fix32	ro/rw	ONLINE	999.00 s	152
0108*		GAIN Analog output, terminal 62	AOUT1-GAIN		0 to 255, (1)	Fix32	ro/rw	ONLINE	213	178
0109*		OFFSET Analog output, terminal 62	AOUT1-OFFSET		–10.00 to 10.00, (0.01 V)	Fix32	ro/rw	ONLINE	0.00 V	178
0110 (APP)		Configuration, analog output terminal 63	AOUT2-IN	0 to 38	Output of analog signals at terminal Configuration options, see following PNU 0111 2 = apparent motor current	Fix32	ro/rw	ONLINE	2	

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0111		Configuration Analog output, terminal 62	AOUT1-IN Output of analog signals at terminal Parameter values from 9 to 25 correspond with the digital functions of relay output K1 (PNU 0008) or digital output A1 (PNU 0117) (0 to 16): LOW = 0 V, HIGH = 10 V			Fix32	ro/rw	ENTER	0	177
			MCTRL1-NOUT+SLIP	0	Output frequency f_2 10 V/20 mA/9.75 kHz correspond to value in PNU 0011					
			MCTRL1-MOUT	1	Inverter load 5 V/10 mA/4.875 kHz correspond to rated motor torque for vector control (PNU 0014 = 4), otherwise rated device current (active current/PNU 0091)					
			MCTRL1-IMOT	2	Apparent motor current 5 V/10 mA/4.875 kHz correspond to inverter rated current					
			MCTRL1-DCVOLT	3	DC link voltage 10 V/20 mA/9.75 kHz correspond to DC 1000 V (400 V mains) DC 380 V (240 V supply)					
				4	Motor rating 5 V/10 mA/4.875 kHz correspond to motor rated power					
			MCTRL1-VOLT	5	Motor voltage 8 V/16 mA/7.8 kHz correspond to motor rated voltage					
			MCTRL1-1/NOUT	6	1/output frequency (1/PNU 0050) 3.3 V/6.6 mA/3.218 kHz correspond to PNU 0050 = 0, 4 × PNU 0011					
			NSET1-PNU 0010 – PNU 0011	7	Output frequency within set limits 0 V/0 mA/4 mA/0 kHz are equivalent to $f = f_{min}$ (PNU 0010) 10 V/20 mA/9.75 kHz correspond to $f = f_{max}$ (PNU 0011)					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
			PCTRL1-ACT MCTRL1-NOUT	8	PID actual value Operation with PID controller (PNU 0238 = 0, 1) Operation without process controller (PNU 0238 = 2): Output frequency at zero slippage 10 V/20 mA/9.75 kHz correspond to PNU 0011					
0111			DCTRL1-RDY Parameter values 9 to 25 correspond to functions of K1 (PNU 0008) or A1 (PNU 0117) (0 to 16)	9	Ready to operate					177
			DCTRL1-TRIP	10	TRIP error message					
			DCTRL1-RUN	11	Motor running					
			DCTRL1-RUN-R	12	Motor running/CW rotation					
			DCTRL1-RUN-L	13	Motor running/CCW rotation					
			DCTRL1-NOUT=0	14	Output frequency $f_2 = 0$					
			MCTRL1-RFG1=NOUT	15	Frequency setpoint, $f_{setpoint}$ reached					
			PCTRL1-F2>F1	16	$f_2 > f_1$ threshold reached					
			MCTRL1-IMAX	17	I_{max} limit reached PNU 0014 = 5: torque setpoint reached					
			DCTRL1-OH-WARN	18	(heatsink temperature ϑ_{max}) – 5 °C					
			DCTRL1-TRIP-F2>F1-IMP	19	TRIP or $f_2 > f_1$ or impulse disable (IMP) active					
			DCTRL1-PTC-WARN	20	PTC warning					
			DCTRL1-IMOT<ILIM	21	Apparent motor current $<$ current threshold for belt monitoring Apparent motor current = PNU 0054 Current threshold = PNU 0156					
			(DCTRL1-(IMOT<ILIM)-F2>F1)	22	Apparent motor current $<$ current threshold and $f_2 > f_1$ threshold reached					
			(DCTRL1-(IMOT<ILIM)-RFG-I=0)	23	Apparent motor current $<$ current threshold and ramp generator 1: input = output					
			DCTRL1-LP1-WARN	24	Motor phase failure warning					
			PCTRL1-NMIN	25	Minimum output frequency (PNU 0010) reached					
				26	Reserved					
			MCTRL1-NOUT	27	Output frequency at zero slippage					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
			PCTRL1-ACT	28	PID actual value					
			PCTRL1-SET	29	PID setpoint					
			PCTRL1-OUT	30	PID output					
			NSET1-RFG1-IN	31	Ramp generator input, frequency					
			NSET1-NOUT	32	Ramp generator output, frequency					
0111 (APP)			PCTRL1-PID-OUT	33	Direct PID output signal					
			PCTRL1-NOUT	34	PID output signal before addition point					
			AIN1-OUT The following applies for the settings: 0027 = 0414/1 or 0026 = 0413/1	35	Input signal at terminal 1U/1I, evaluated with GAIN (0027, 0414/1) and OFFSET (0026, 0413/1)					
			DFIN1-OUT	36	Frequency signal f-In evaluated with GAIN (0426) and OFFSET (0427)					
			MPOT1-OUT	37	Mapping of motor potentiometer output					
			AIN2-OUT	38	Input signal at terminal 2U/2I, evaluated with GAIN (0414/2) and OFFSET (0413/2)					
0112 (APP)		Configuration, frequency output Terminal A4	DFOUT1-IN	0 to 38	Output of frequency signal to terminal Configuration options, see PNU 0111 3 = internal DC link voltage	Fix32	ro/rw	ENTER	3	
0113		Free configuration of digital inputs			Assign functions to control signal terminals E1 to E4 (DE4-IOM-STD-F) or E1 to E6 (DE4-IOM-APP-F)	Fix32	ro/rw	ENTER		115
	001		NSET1-FF1/3		FF1: fixed frequency 1 (in combination with FF2 also FF3)				1	
	002		NSET1-FF2/3		FF2: fixed frequency 2 (in combination with FF1 also FF3) PNU 0113/001 / PNU 0113/002 / Active value: LOW / LOW / PNU 0046 HIGH / LOW / FF1 LOW / HIGH / FF2 HIGH / HIGH / FF3				2	
	003		DCTRL1-R/L		R/L combined direction preselection, CW/CCW rotation				4	
	004		DCTRL1-QSP		QSP Quickstop				255	124

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range	Data type	Access rights	Accept-ance	Default	See page
	005		NSET1-RFG1-STOP	RFG1-STOP Ramp generator 1 stop for main setpoint				255	
	006		NSET1-RFG1-0	RFG1-0 Set ramp generator input 1 for main setpoint to 0				255	
0113	007		MPOT1-UP	UP Motor potentiometer, increase value				255	
	008		MPOT1-DOWN	DOWN Motor potentiometer, decrease value				255	
	009		Reserved	Reserved				255	
	010		DCTRL1-CINH	CINH Controller inhibit				255	
	011		DCTRL1-TRIP-EF	EF External fault				255	117
	012		DCTRL1-TRIP-RESET	TRIP-RESET Reset fault				255	115
	013		DCTRL1-PAR2/4	PAR2/4 Parameter set selection (only when PNU 0988 = 0)				255	109
	014		DCTRL1-PAR3/4	PAR3/4 Parameter set selection (only when PNU 0988 = 0) PNU 0113/013 / PNU 0113/014 / Active value: LOW / LOW / PAR1 HIGH / LOW / PAR2 LOW / HIGH / PAR3 HIGH / HIGH / PAR4				255	109
	015		MCTRL1-DCB	DCB DC injection braking				3	117
0113 (APP)	016		PCTRL1-RFG2-LOADI	The PID actual value is applied to the PID ramp generator (PCTRL1-RFG2)				255	
0113	017		DCTRL1-RA/MO	RA/MO Remote/manual changeover				255	
	018		PCTRL1-I-DIS-I	DIS-I Disable I-component of PID controller				255	
	019		PCTRL1-PID	DIS-PID Disable PID controller				255	

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range	Data type	Access rights	Accept-ance	Default	See page
	020		Reserved	Reserved				255	
	021		PCTRL1-FREEZE	FREEZE-PID Freeze PID controller output at current value				255	
0113	022		DCTRL1-R/QSP	R/QSP Clockwise rotation, quickstop on error				255	
	023		DCTRL1-L/QSP	L/QSP Anticlockwise rotation, quickstop on error				255	
	024		DFIN1-f-In	f-In Digital frequency input 0 to 10 kHz				255	
0113 (APP)	025		PCTRL1-FOLL1-0	Run follow-up controller to 0 Hz at reset ramp (PNU 0193)				255	
	026			Reserved				255	
	027			Reserved				255	
	028			Reserved				255	
	029		PCTRL1-FADING	Disable PID output				255	
	030		PCTRL1-INV-ON	Invert PID output				255	
	031		PCTRL1-NADD-OFF	Deactivate additive setpoint (PCTRL1-NADD)				255	
	032		PCTRL1-RFG2-0	Run PID ramp generator (PCTRL1-RFG2) to 0 at ramp PNU 0226				255	
0114 0114 (APP)		Signal inversion, digital inputs E1 to E4 (DE4-IOM-STD-F) or E1 to E6 (DE4-IOM-APP-F)	DIG-IN	The decimal selection digit determines the inputs' signal patterns: 0: Ex is not inverted (HIGH active) 1: Ex is inverted (LOW active)	Fix32	ro/rw	ENTER	0	117

	E6 2^5	E5 2^4	E4 2^3	E3 2^2	E2 2^1	E1 2^0
0	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
...	...	...	...	...	...	...
15	0	0	1	1	1	1
...	...	...	...	...	...	...
63	1	1	1	1	1	1

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0117		Transistor output A1 (configuration)	DIGOUT1		The same functions 0 to 24 or to 33 (APP) from PNU 0008 are available 1 = TRIP message	Fix32	ro/rw	ENTER	1	181
0118 (APP)		Transistor output A2 (configuration)	DIGOUT2		The same functions 0 to 33 (APP) from PNU 0008 are available 0 = ready for operation	Fix32	ro/rw	ENTER	0	
0119		PTC input (configuration)		0	PTC input inactive Earth fault detection OC2 active	Fix32	ro/rw	ENTER	0	186
				1	PTC input active Earth fault detection OC2 active TRIP triggered					
				2	PTC input active Earth fault detection OC2 active Warning issued					
				3	PTC input inactive Earth fault detection OC2 active Warning issued					
				4	PTC input active Earth fault detection OC2 disabled TRIP triggered and controller inhibit is set					
				5	PTC input active Earth fault detection OC2 disabled Warning issued					
0120		I^2t shutdown	Temperature monitoring		0 to 200 %, (1 %) 0 = I^2t shutdown disabled	Fix32	ro/rw	ONLINE	0 %	184
0125*		Baud rate	Baud rate for RS232/485 interface on AIF	0	9600 baud	Fix32	ro/rw	ENTER	0	110
				1	4800 baud					
				2	2400 baud					
				3	1200 baud					
				4	19200 baud					
0126*		Communication behaviour	Behaviour on communication fault	0	No response on communication error between frequency inverter and interface on the AIF No response on communication error between frequency inverter and function module on the FIF	Fix32	ro/rw	ONLINE	2	111

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0126*		Communication behaviour	Behaviour on communication fault	1	On communication error between frequency inverter and interface on the AIF, disconnection with CE5 error message. No response on communication error between frequency inverter and function module on the FIF	Fix32	ro/rw	ONLINE	2	111
				2	No response on communication error between frequency inverter and interface on the AIF On communication error between frequency inverter and function module on the FIF, disconnection with CE5 error message.					
				3	On communication error between frequency inverter and interface on the AIF, disconnection with CE5 error message. On communication error between frequency inverter and function module on the FIF, disconnection with CE5 error message.					
0127		Setpoint input selection	For bus operation	0	Setpoint input, absolute value in Hz via PNU 0046 or process channel	Fix32	ro/rw	ENTER	0	
				1	Setpoint input, normalized value, via PNU 0141 (0 to 100 %) or process channel (16384 = PNU 0011)					
0135		Control word	For interface/bus operation only		Control through parameter channel	Bit16	ro			120
			NSET1-FF1/3	0	Bit 0/1 00 = frequency setpoint (PNU 0046) active 10 = fixed frequency 1, [FF1] (PNU 0037) active 01 = fixed frequency 2, [FF2] (PNU 0038) active 11 = fixed frequency 3, [FF3] (PNU 0039) active					
			NSET1-FF2/3	1						
			DCTRL1-R/L	2	[R/L] 0 = CW rotation 1 = CCW rotation					
			DCTRL1-QSP	3	[QSP] 0 = do not enable quickstop 1 = enable quickstop					
			NSET1-RFG1-STOP	4	[RFG1-STOP] 0 = enable ramp generator 1 = pause ramp generator					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0135			NSET1-RFG1-0	5	[RFG1-0] 0 = do not set ramp generator input to 0, but enable 1 = set ramp generator input to 0 and run ramp –a (PNU 0013) to zero setpoint	Bit16	ro			120
			MPOT1-UP	6	[UP] 0 = do not activate motor potentiometer UP 1 = activate motor potentiometer UP					
			MPOT2-DOWN	7	[DOWN] 0 = do not activate motor potentiometer DOWN 1 = activate motor potentiometer DOWN					
				8	Reserved					
			DCTRL1-CINH	9	[CINH] 0 = controller enable 1 = controller inhibit					
			DCTRL1-TRIP-EF	10	[EF] 1= external fault (frequency inverter indicates external error (EEr)) 0 = reset external fault (the fault must be acknowledged with a TRIP-RESET)					
			DCTRL1-TRIP-RESET	11	[TRIP-RESET] Edge from 0 to 1 triggers TRIP-RESET					
			DCTRL1-PAR2/4 DCTRL1-PAR3/4	12 13	Bit 12/13 00 = parameter set 1, [PAR1] active 10 = parameter set 2, [PAR2] active 01 = parameter set 3, [PAR3] active 11 = parameter set 4, [PAR4] active					
			MCTRL1-DCB	14	[DCB] 0 = do not activate DC injection braking 1 = activate DC injection braking					
				15	Reserved					
0138*		Indication of setpoint PCTRL1-SET1	PCTRL1-SET1		–480.00 to +480.00 Hz, (0.02 Hz) Indication of frequency setpoint via internal PID setpoint channel (PCTRL1-SET1), (PNU 0145 = 2)	Fix32	ro	ENTER		146 176
0140*		Additive frequency setpoint (f_{set})	NSET1-NADD		–480.00 to +480.00 Hz, (0.02 Hz) Direct input via keypad	Fix32	ro/rw	ENTER		129
0141*		Setpoint, normalized	Only for bus operation and PNU 0127 = 1		–100.00 to +100.00 %, (0.01 %) Reference is PNU 0011	Fix32	ro/rw	ENTER		

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0142		Start condition		0	Automatic start disabled, flying restart circuit inactive	Fix32	ro/rw	ENTER	1	121
				1	Automatic start if terminal 28 = HIGH, flying restart circuit inactive					
				2	Automatic start disabled, flying restart circuit activated					
				3	Automatic start if terminal 28= HIGH, flying restart circuit inactive					
0143*		Selection of flying restart procedure	The motor speed is determined in the specified range	0	The motor speed is determined in the range from f_{max} (PNU 0011) to 0 Hz	Fix32	ro/rw	ENTER	0	122
				1	The motor speed is determined in the range from the most recent output frequency to 0 Hz					
				2	On controller enable, the current frequency setpoint is applied to the motor					
				3	After controller enable, the PID controller actual value is applied to the motor as specified in PNU 0005					
0144		Operating frequency reduction		0	No operating frequency reduction	Fix32	ro/rw	ENTER	1	174
				1	Automatic operating frequency reduction at (heatsink temperature q_{max}) – 5 °C					
0145*		PID setpoint source	PCTRL1-SET3	0	Total setpoint (main setpoint plus additive setpoint)	Fix32	ro/rw	ENTER	0 Hz	146
			PCTRL1-SET2	1	Digital setpoint input (LCD keypad) input in PNU 0181					
			PCTRL1-SET1	2	Setpoint input in FIF operation (PNU 0005 = 200) via internal PID setpoint channel					
0148*		Motor parameter identification	Determination of motor data	0	0 = identification disabled (completed)	Fix32	ro/rw	ENTER + IMP	0	167
				1	1 = Identification active (start identification)					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0150		Status word	For interface/bus operation only		Frequency inverter status via parameter channel	Bit16	ro			
			DCTRL1-PAR-B0	0	Bit 0 0 = parameter set 1 or 3 active 1 = parameter set 2 or 4 active					
			DCTRL1-IMP	1	0 = power outputs enabled 1 = IMP active, power outputs inhibited					
			MCTRL1-IMAX	2	0 = current limit not reached 1 = current limit reached (for PNU 0014 = 5: torque setpoint reached)					
			MCTRL1-RFG1=NOUT	3	0 = output frequency $f_2 \neq$ frequency setpoint 1 = output frequency $f_2 =$ frequency setpoint					
			NSET1-RFG1=0	4	0 = ramp generator, input ≠ output 1 = ramp generator, input = output					
			PCTRL1-f2>f1	5	0 = $f_2 \neq f_1$ 1 = $f_2 = f_1$					
			DCTRL1-NOUT=0	6	0 = output frequency $f_2 \neq 0$ 1 = output frequency $f_2 = 0$					
			DCTRL1-CINH	7	0 = controller inhibit active 1 = controller inhibit not active (enabled)					
			Device status	8						
				9	Bit 11 10 9 8					
				10	0 0 0 0 = initialization phase					
				11	0 0 0 1 = autostart lock					
					0 0 1 1 = operation inhibited					
					0 1 0 0 = flying restart circuit active					
					0 1 0 1 = DCB, DC brake active					
					0 1 1 0 = Operation enabled					
					0 1 1 1 = message active					
					1 0 0 0 = TRIP, fault active					
			DCTRL1-OH-WARN	12	0 = no warning 1 = (heatsink temperature q_{max}) – 5 °C reached					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0150			DCTRL1-0V	13	0 = no overvoltage 1 = overvoltage					
			DCTRL1-L	14	0 = R (CW) 1 = CCW rotation					
			DCTRL1-RDY	15	0 = not ready for operation (fault) 1 = ready for operation (no fault)					
0156*		Current threshold			0 to 150 %, (1 %) % relative to I_e frequency inverter	Fix32	ro/rw	ONLINE	0 %	
0161*		Present fault	Fault code		Display of fault memory content	Fix32	ro	DISPLAY		189
0162*		Previous fault				Fix32	ro	DISPLAY		189
0163*		Second from last fault				FIX32	ro	DISPLAY		189
0164*		Third from last fault				FIX32	ro	DISPLAY		189
0168*		Present fault	Error number of the current error			FIX32	ro	DISPLAY		189
0170		TRIP-RESET procedure		0	Manual TRIP-RESET, no AUTO-TRIP-RESET	Fix32	ro/rw	ENTER	0	191
				1	As 0 but with additional AUTO-TRIP-RESET (time in PNU 0171)					
				2	TRIP-RESET by switching power supply, terminal 28 or via function module or communication module; no AUTO-TRIP-RESET					
				3	TRIP-RESET only by switching power supply					
0171		Delay for AUTO-TRIP-RESET	Time until AUTO-TRIP-RESET takes place		0.00 to 60.00 s, (0.01 s)	Fix32	ro/rw	ONLINE	0.00 s	191
0174*		Switching threshold V_{DC} of the braking transistor	Active only on 400 V inverters		78 to 110 %, (1 %) 100 % = switching threshold 780 V DC 110 % = braking transistor switched off	Fix32	ro/rw	ENTER + IMP	100 %	153
0178*		Operating time meter	Total time for which device was enabled (CINH = HIGH)		(h)	Fix32	ro	DISPLAY		
0179*		Power On time meter	Total time for which the power supply was on		(h)	Fix32	ro	DISPLAY		
0181*		Input, digital PID setpoint	PCTRL1-SET2 Input of PID setpoint via LCD keypad		–480.00 to +480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	0.00 Hz	146
0182*		Integration time for S-ramp			0.00 to 50.00 s, (0.01 s) PNU 0182 = 0.00, linear ramp	Fix32	ro/rw	ONLINE	0.00 s	169

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0183*		Diagnostics		0	No fault	Fix32	ro	DISPLAY		188
				102	TRIP active					
				104	“Overvoltage” (OU) or “Undervoltage” (LU) signal active					
				142	IMP, impulse disable					
				151	QSP, quickstop active					
				161	DCB, DC brake active					
				250	WARN, warning active					
0184*		Disable integral component via frequency threshold			0.0 to 25 Hz, (0.1 Hz) PNU 0184 = 0.0 Hz, function disabled Switches I-component off at output frequency < PNU 0184 Threshold (PCTRL1-NOUT)	Fix32	ro/rw	ONLINE	0.0 Hz	147
0185*		Switching window	Switching window for “frequency setpoint reached” (MCTRL1-NOUT) or “Ramp generator 1: input = output” (NSET1-RFG1-I=0)		0 to 80 %, (1 %) Window at PNU 0185 = 0 %: ± 0.5 % relating to value in PNU 0011 Window at PNU 0185 > 0 %: ± PNU 0185 relating to value at ramp generator input 1 (NSET1-RFG1-IN)	Fix32	ro/rw	ONLINE	0 %	183
0189* (APP)		Output signal Follow-up controller	PCTRL1-FOLL1-OUT		–480.00 to +480.00 Hz, (0.02 Hz)	Fix32	ro	DISPLAY		
0190* (APP)		Linking of main and additive setpoint	PCTRL1-ARITH1		Linking with mathematical functions: X = NSET1-NOUT = main setpoint Y = PCTRL1-NADD = additive setpoint	Fix32	ro/rw	ENTER	1	
				0	X + 0					
				1	X + Y					
				2	X – Y					
				3	X × Y					
				4	X / Y					
				5	X / (1 – Y)					
0191 (APP)		$+a_{follow-up}$ Acceleration time of follow-up controller	Time from 0 Hz to f_{max}		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	
0192 (APP)		$-a_{follow-up}$ Deceleration time, follow-up controller	Time from f_{max} to 0 Hz		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0193 (APP)		Reset follow-up controller	Time from f_{max} to 0 Hz, Run follow-up controller to 0		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	
0194 (APP)		Lower threshold, follow-up controller	% relative to PNU 0011. Lower limit of PNU 0194 breached: controller runs towards –0011 at 0191 or 0192		–200.00 to +200.00 %, (0.01 %)	Fix32	ro/rw	ONLINE	–200.00 %	
0195 (APP)		Upper threshold, follow-up controller	% relative to PNU 0011. PNU 0195 exceeded: controller runs towards +0011 at 0191 or 0192		–200.00 to +200.00 %, (0.01 %)	Fix32	ro/rw	ONLINE	200.00 %	
0196*		Activation of automatic DCB	PCTRL1-SET3 = total setpoint	0	Auto DCB active at PCTRL1-SET3 < PNU 0019	Fix32	ro/rw	ENTER	0	152
			NSET1-RFG1-IN = setpoint at ramp generator input 1	1	Auto DCB active at PCTRL1-SET3 < PNU 0019 and NSET1-RFG1-IN < PNU 0019					
0200*		Software ID number			Display at PC only	VS	ro	PC-DISPLAY		
0201*		Software creation date			Display at PC only	VS	ro	PC-DISPLAY		
0220*		$+a_{additive}$ Acceleration time, additive setpoint	PCTRL1-NADD = additive setpoint Time from 0 Hz to f_{max}		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	169
0221*		$-a_{additive}$ Deceleration time, additive setpoint	PCTRL1-NADD = additive setpoint Time from f_{max} to 0 Hz		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	5.00 s	169
0225 (APP)		$a_{PID\ setpoint}$ Acceleration time, PID setpoint	PID setpoint Time from 0 Hz to f_{max} for PCTRL1-RFG2		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	0.00 s	
0226 (APP)		$-a_{PID\ setpoint}$ Decelerationtime, PID setpoint	PID setpoint Time from f_{max} to 0 Hz for PCTRL1-RFG2		0.00 to 1300.00 s, (0.02 s)	Fix32	ro/rw	ONLINE	0.00 s	
0228 (APP)		Fade-in time time, PID controller	0.000 = pass through PID output unchanged		0.000 to 32.000 s, (0.001 s)	Fix32	ro/rw	ONLINE	0.000 s	
0229 (APP)		Fade-out time, PID controller	0.000 = pass through PID output unchanged		0.000 to 32.000 s, (0.001 s)	Fix32	ro/rw	ONLINE	0.000 s	
0230 (APP)		Lower limit, PID output	PID output limitation % relative to PNU 0011		–200.00 to +200.00 %, (0.01 %)	Fix32	ro/rw	ONLINE	–100.00 %	
0231 (APP)		Upper threshold, PID output	PID output limitation % relative to PNU 0011		–20.000 to +2,0.00 %, (0.01 %)	Fix32	ro/rw	ONLINE	100.00 %	
0232 (APP)		OFFSET for inverse characteristic, PID	% relative to PNU 0011		–200.0 to +200.0%, (0.1 %)	Fix32	ro/rw	ONLINE	0.00 %	
0233* (APP)		Deceleration time for PCTRL1-LIM signal	Debouncing time for digital output		0.000 to 65.000 s, (0.001 s)	Fix32	ro/rw	ONLINE	0.000 s	

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0234* (APP)		Deceleration time for signal PCTRL1-SET = ACT	Debouncing time for digital output		0.000 to 65.000 s, (0.001 s)	Fix32	ro/rw	ONLINE	0.000 s	
0235* (APP)		Response threshold PID setpoint = actual value	PCTRL1-SET=ACT		0.00 to 480.00 Hz, (0.01 Hz)	Fix32	ro/rw	ONLINE	0.00 Hz	
0238		Frequency precontrol		0	No precontrol Only the process controller output is active Process controller has full effect	Fix32	ro/rw	ENTER	2	145
				1	Precontrol (total setpoint + process controller) Process controller has limited effect					
				2	No precontrol Only the total setpoint is active Process controller has no effect					
0239		f_{unt}, lower frequency limit	Absolute limit, irrespective of setpoint		–480.00 to +480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	–480.00 Hz	165
0240 (APP)		Invert PID output	PCTRL1-INV-ON via LCD keypad/PC or parameter channel	0	Do not invert PID output	Fix32	ro/rw	ENTER	0	
				1	Invert PID output					
0241 (APP)		Enable PID controller	PCTRL1-FADING via LCD keypad/PC or parameter channel	0	Enable PID	Fix32	ro/rw	ENTER	0	
				1	Disable PID					
0242 (APP)		PID inverse control	PCTRL1-NADD-OFF via LCD keypad/PC or parameter channel	0	Output frequency rises as the actual value increases	Fix32	ro/rw	ENTER	0	
				1	Output frequency falls as the actual value increases					
0243 (APP)		Deactivate additive setpoint		0	Additive setpoint active	Fix32	ro/rw	ENTER	0	
				1	Additive setpoint not active					
0244 (APP)		PID root function	Link PID actual value with root function	0	Root function not active	Fix32	ro/rw	ENTER	0	
				1	Root function $\sqrt{\text{PCTRL1-ACT}}$ active					
0245* (APP)		Selection of torque comparison value for MSET1=MACT		0	Value of signal source at MCTRL1-MSET (depending on PNU 0001, 0005, 0007)	Fix32	ro/rw	ENTER	0	
				1	Value from PNU 0250					
0250* (APP)		Torque threshold	MCTRL1-MSET1		–200.00 to +200.00 %, (0.1 %)	Fix32	ro/rw	ONLINE	0.0 %	
0252* (APP)		Differential threshold for MSET1 = MACT			0.0 to 100.0 %, (0.1 %)	Fix32	ro/rw	ONLINE	0.0 %	
0254* (APP)		Deceleration time for signal MSET1 = MACT	Debouncing time for digital output		0.000 to 65.000 s (0.001 s)	Fix32	ro/rw	ONLINE	0.000 s	
0265*		Starting value, motor potentiometer		0	Starting value = actual value at Power Off is saved and approached again on Power On	Fix32	ro/rw	ENTER	3	130

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
				1	Starting value = PNU 0010 f_{min} is approached on Power On					
				2	Staring value = 0 Hz After power on, the starting value is 0 Hz					
				3	Staring value = Power Off UP/DOWN = LOW, deceleration at QSP ramp PNU 0105 to 0 Hz					
				4	Staring value = PNU 0010 UP/DOWN = LOW, deceleration at QSP ramp PNU 0105 to 0 Hz					
				5	Staring value = 0 V UP/DOWN = LOW, deceleration at QSP ramp PNU 0105 to 0 Hz					
0372*		Function module identification		0	No function module	Fix32	ro	DISPLAY		
				1	DE4-IOM-STD-F					
				6	DE4-IOM-APP-F, DE4-NET-K-F, DE4-NET-DP-F					
				10	No valid ID					
0395		LONGWORD	Process input data		Only for bus operation, The control word and main setpoint are transferred to the frequency inverter in a telegram Bit 0 to 15: Mapping of control word PNU 0135 Bit 16 to 31: Mapping of setpoint 1 (NSET1-N1, PNU 0046)	B32	ro			
0396*		LONGWORD	Process output data		Only for bus operation, The control word and main setpoint are transferred from the frequency inverter in a telegram Bit 0 to 15: Mapping of status word PNU 0150 Bit 16 to 31: Mapping of output frequency f_2 (MCTRL1-NOUT, PNU 0050)	B32	ro			
0413* (APP)	001	OFFSET Analog inputs	1U/1I (AIN1-OFFSET)		–200.0 to +200.0 % (0.1 %) The following applies for the settings: PNU 0413/1 = PNU 0026	Fix32	ro/rw	ONLINE	0.0	
	002		2U/2I (AIN2-OFFSET)		–200.0 to +200.0 %, (0.1 %)					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0414* (APP)	001	GAIN Analog inputs	1U/1I (AIN1-GAIN)		–1500.0 to +1500.0 %, (0.1 %) The following applies for the settings: PNU 0414/001 = PNU 0027	Fix32	ro/rw	ONLINE	100.0	
	002		2U/2I (AIN2-GAIN)		–1500.0 to +1500.0 %, (0.1 %)					
0416		Signal inversion, digital outputs A2 available only with DE4-IOM-APP-F			The decimal selection digit determines the outputs' signal patterns: 0: output is not inverted (HIGH active) 1: output is inverted (LOW active)	Fix32	ro/rw	ENTER	0	184
					A2 A1 Relay K1					
				0	0 0 0					
				1	0 0 1					
				2	0 1 0					
				3	0 1 1					
0416 (APP)				4	1 0 0					
				5	1 0 1					
				6	1 1 0					
				7	1 1 1					
0420* (APP)	001	GAIN, analog outputs	Trm. 62 (AOUT1-GAIN)		0 to 255, (1) The following applies for the settings: PNU 0420/001 = PNU 0108	Fix32	ro/rw	ONLINE	213	
	002		Trm. 63 (AOUT2-GAIN)		0 to 255, (1)					
0422* (APP)	001	OFFSET Analog outputs	Trm. 62 (AOUT1-OFFSET)		–10.00 to 10.00 V, (0.01 V) The following applies for the settings: PNU 0422/001 = PNU 0109	Fix32	ro/rw	ONLINE	0.00	
	002		Trm. 63 (AOUT2-OFFSET)							
0423* (APP)	001	Deceleration, digital outputs	Relay output K1		0.000 to 65.000 s, (0.001 s) Debouncing the digital outputs	Fix32	ro/rw	ONLINE	0.000	
	002		Digital output A1 (DIGOUT1)							
	003		Digital output A2 (DIGOUT2)							
0424* (APP)	001	Analog output signal range Observe jumper settings of the expansion module!	Trm. 62 (AOUT1)	0	0 to 10 V, 0 to 20 mA	Fix32	ro/rw	ONLINE	0	
				1	4 to 20 mA					
	002		Trm. 63 (AOUT2)	0	0 to 10 V, 0 to 20 mA					
				1	4 to 20 mA					

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range	Frequency	Reso-lution	Scanning rate	Max. frequency	Data type	Access rights	Accept-ance	Default	See page
0425*		Configuration, frequency-input E1 (single-channel evaluation, DFIN1)	"Frequency" = corresponds to internal f_{max} (PNU 0011) "Max. frequency" = maximum frequency that the input can process						Fix32	ro/rw	ENTER	2	118
				0	100 Hz	1/200	1 s	300 Hz					
				1	1 kHz	1/200	100 ms	3 kHz					
				2	10 kHz	1/200	10 ms	10 kHz					
				3	10 kHz	1/1000	50 ms	10 kHz					
				4	10 kHz	1/10000	500 ms	10 kHz					
0425* (APP)				5	100 kHz	1/400	2 ms	100 kHz					
				6	100 kHz	1/1000	5 ms	100 kHz					
				7	100 kHz	1/2000	10 ms	100 kHz					
		Configuration, frequency input E1, E2 (two-channel evaluation, DFIN1)		10	100 Hz	1/200	1 s	300 Hz					
				11	1 kHz	1/200	100 ms	3 kHz					
				12	10 kHz	1/200	10 ms	10 kHz					
				13	10 kHz	1/1000	50 ms	10 kHz					
				14	10 kHz	1/10000	500 ms	10 kHz					
				15	100 kHz	1/400	2 ms	100 kHz					
				16	100 kHz	1/1000	5 ms	100 kHz					
				17	100 kHz	1/2000	10 ms	100 kHz					
0426*		GAIN E1, E2 (APP)	Total gain, frequency inputs E2 available only with DE4-IOM-APP-F		–1500.0 to +1500.0 %, (0.1 %)				Fix32	ro/rw	ONLINE	100 %	119
0427*		OFFSET E1, E2 (APP)	Total offset, frequency inputs E2 available only with DE4-IOM-APP-F		–100.0 to +100.0 %, (0.1 %)				Fix32	ro/rw	ONLINE	0.0 %	119
0428* (APP)		GAIN A4, frequency output	DFOUT1-OUT		0.0 to +1500.0 %, (0.1 %)				Fix32	ro/rw	ONLINE	100 %	
0469*		Function of STOP key	Specifies the function to be performed when the key is pressed	0	Key disabled				Fix32	ro/rw	ENTER + IMP	1	187
				1	CINH, controller inhibit is set								
				2	QSP, decelerate to stop at quickstop ramp								
0500*		Display factor for processing speed	Matching of phase-sequence-related parameters to a process variable to be controlled, e.g.speed		1 to 25000, (1)				Fix32	ro/rw	ONLINE	2000	179
0501*		Display factor for processing speed, denominator			1 to 25000, (1)				Fix32	ro/rw	ONLINE	10	179

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PNU	Sub-index	Name	Notes, internal designations, etc.	Value range		Data type	Access rights	Accept-ance	Default	See page
0502* (APP)		Unit of process variable	The process value is displayed on the selected device		0: _ / 6: rpm / 13: % / 18: W	Fix32	ro/rw	ONLINE	0	
					1: ms / 9: _C / 14: kW / 19: hex					
					2: s / 10: Hz / 15: N / 34: m					
					4: A / 11: kVA / 16: mV / 35: h					
					5: V / 12: Nm / 17: mW / 42: mH					
0517*		USER-MENU			All parameters can be selected for display or access	Fix32	ro/rw	ENTER		
	001		Memory location 1		Current output frequency f_2				50	
	002		Memory location 2		Setpoint input range				34	
	003		Memory location 3		Digital inputs				7	
	004		Memory location 4		Minimum output frequency				10	
	005		Memory location 5		Maximum output frequency				11	
	006		Memory location 6		Acceleration time				12	
	007		Memory location 7		Deceleration time				13	
	008		Memory location 8		Transition frequency of *V/f* characteristic				15	
	009		Memory location 9		Pull-up of motor voltage				16	
	010		Memory location 10		Parameter set transfer				2	
0597*		Configuration of motor phase failure recognition		0	Disabled	Fix32	ro/rw	ENTER	0	187
				1	TRIP error message					
				2	Warning					
0599*		Current limit value of motor phase failure recognition	Response threshold; reference is the frequency inverter's rated current		1 to 50 %, (1 %)	Fix32	ro/rw	ENTER	5 %	187
0625*		Blocking frequency 1			0.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	480.00 Hz	134
0626*		Blocking frequency 2			0.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	480.00 Hz	134
0627*		Blocking frequency 3			0.00 to 480.00 Hz, (0.02 Hz)	Fix32	ro/rw	ONLINE	480.00 Hz	134
0628*		Suppression bandwidth	Applies to PNU 0625, 0626, 0627		0.00 to 100.00 %, (0.01 %)	Fix32	ro/rw	ONLINE	0.00 %	134
0988*		Voltage threshold of internal DC link for parameter set changeover	Changeover of parameter set PAR1 or PAR2 depending on the internal DC link voltage		0.00 to 200 % (1 %) PNU 0988 = 0% changeover disabled If PNU 0988 > 0, no parameter set changeover via the terminal is possible	Fix32	ro/rw	ONLINE	0 %	123 155

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Signal channel selection table

Depending on functions PNU 0001, 0005 and 0007, the frequency inverter's signal channels can be internally linked to various signal sources.

Signal channel name	Description
NSET1-N1	Setpoint channel 1
NSET1-N2	Setpoint channel 2
PCTRL1-NADD	Additive setpoint channel
PCTRL1-SET1	Internal PID setpoint channel
PCTRL1-ACT	PID actual value
MCTRL1-MSET	Torque setpoint or torque limit value

Signal channel name	Description	Assigned signal inputs on device, name
AIN1-OUT	Analog input	Terminal 8
DFIN1-OUT	Frequency input	Control signal terminal E1 (configured with [f-In])
AIF-IN.W1	Input word, AIF	Communication module, keypad, on AIF
FIF-IN	Input word FIF	Communication module, expansion module on FIF
MPOT1-OUT	Motor potentiometer setpoint	Control signal terminals E1 to E4 configured with [UP] or [DOWN]

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Example for changeover between motor potentiometer function and analog setpoint input:
You want to change over between the motor potentiometer function (MPOT1-OUT) and the analog setpoint input, terminal 8 (AIN1-OUT), via control signal terminal E4.

Refer to the selection table for the signal channels on page 318.

In PNU 0007, set one of the parameter values to between 23 and 27.

Inputs E1 and E2 are then configured with the motor potentiometer function and input E4 with the RA/MO changeover function. This terminal configuration can also be defined in PNU 0113.

Because the RA/MO changeover always takes place between signal channels NSET1-N1 and NSET1-N2, the desired signal sources must also be associated with these two channels. The table shows that this is the case, for example, for the combination NSET1-N1 = MPOT1-OUT and NSET1-N2 = AIN1-OUT.

To obtain this combination, the following parameter values must be set according to the table:

PNU 0005 = 0

PNU 0001 = 0 or 2

Combination possibilities without motor potentiometer function

Parameter	Parameter value(s)
PNU 0007	**0** to **9** **14** to **20** **28** to **43** **45** to **51**

Parameter		PNU 0001		
	Parameter value	**0/2**	**1**	**3**
PNU 0005	**0**	NSET1-N1 = AIN1-OUT NSET1-N2 = AIN1-OUT	NSET1-N2 = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT
	1	NSET1-N1 = AIN1-OUT NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT
	2	NSET1-N1 = DFIN1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT
	3	NSET1-N1 = DFIN1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	4	NSET1-N1 = DFIN1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	5	NSET1-N1 = DFIN1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	6	NSET1-N1 = AIN1-OUT NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT
	7	NSET1-N1 = DFIN1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT
	200	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN

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Combination possibilities with motor potentiometer function, without RA/MO changeover

Parameter	Parameter value(s)
PNU 0007	**10** to **13** **21** to **22** **44**

Parameter		PNU 0001		
	Parameter value	**0/2**	**1**	**3**
PNU 0005	**0**	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT	NSET1-N2 = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT
	1	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT
	2	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT
	3	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	4	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	5	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT
	6	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT
	7	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT
	200	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN

Combination possibilities with motor potentiometer function and RA/MO changeover

Parameter	Parameter value(s)
PNU 0007	**23** to **27**

Parameter		PNU 0001		
	Para-meter value	0/2	1	3
PNU 0005	**0**	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT	NSET1-N2 = MPOT1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT
	1	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N2 = MPOT1-OUT PCTRL1-NADD = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT PCTRL1-NADD = DFIN1-OUT
	2	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N2 = MPOT1-OUT PCTRL1-NADD = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT PCTRL1-NADD = AIN1-OUT
	3	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT
	4	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT
	5	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT MCTRL1-MSET = AIN1-OUT
	6	NSET1-N1 = MPOT1-OUT NSET1-N2 = AIN1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N2 = MPOT1-OUT PCTRL1-ACT = DFIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT PCTRL1-ACT = DFIN1-OUT
	7	NSET1-N1 = MPOT1-OUT NSET1-N2 = DFIN1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N2 = MPOT1-OUT PCTRL1-ACT = AIN1-OUT	NSET1-N1 = AIF-IN.W1 NSET1-N2 = MPOT1-OUT PCTRL1-ACT = AIN1-OUT
	200	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN	NSET1-N1 = FIF-IN NSET1-N2 = FIF-IN PCTRL1-NADD = FIF-IN PCTRL1-SET1 = FIF-IN PCTRL1-ACT = FIF-IN MCTRL1-MSET = FIF-IN

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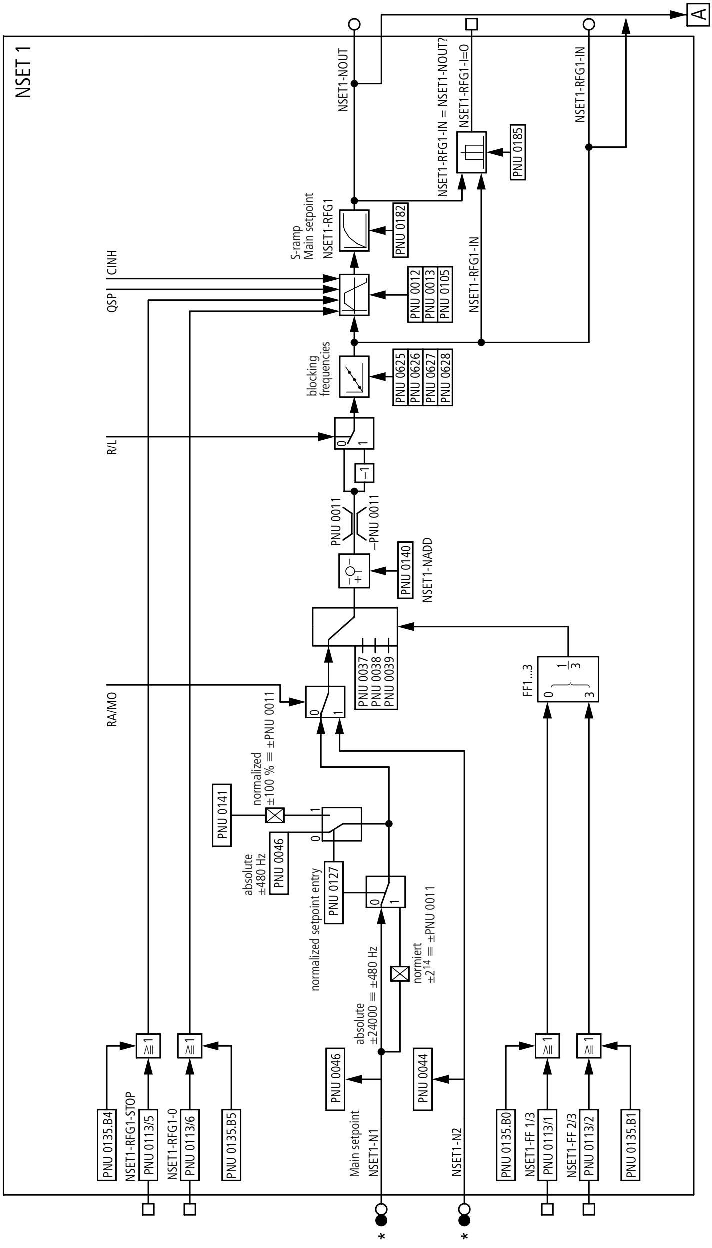
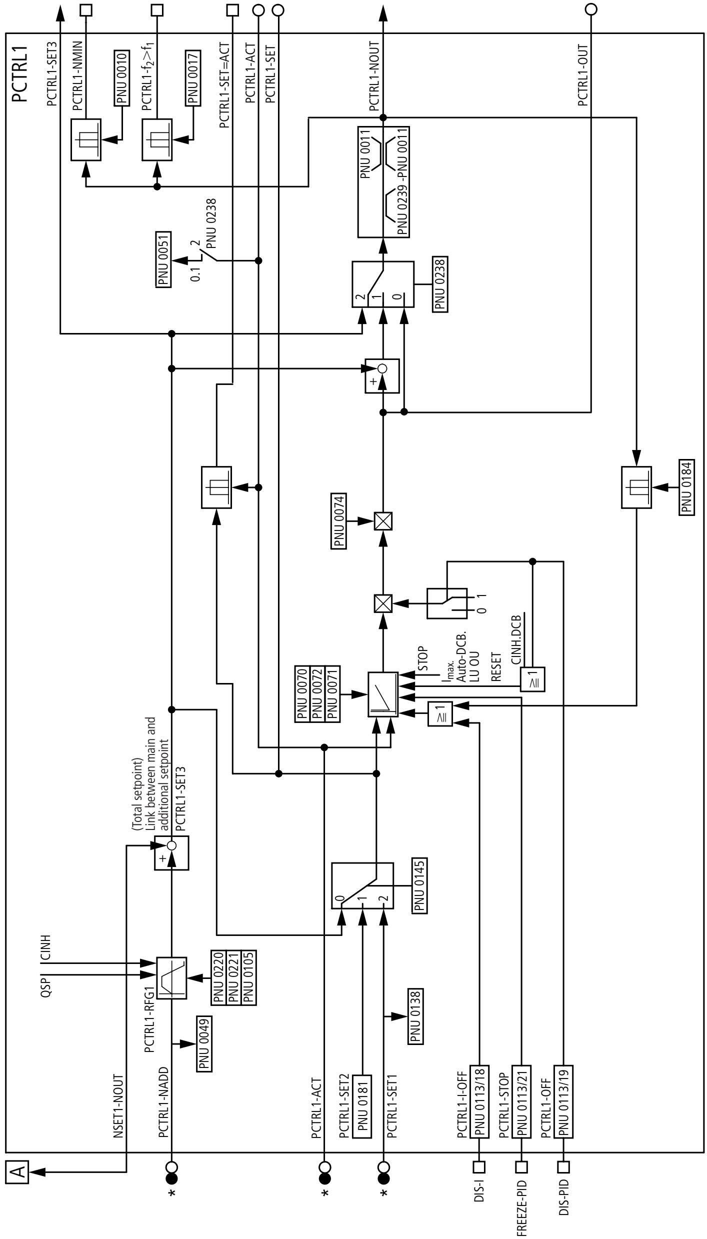
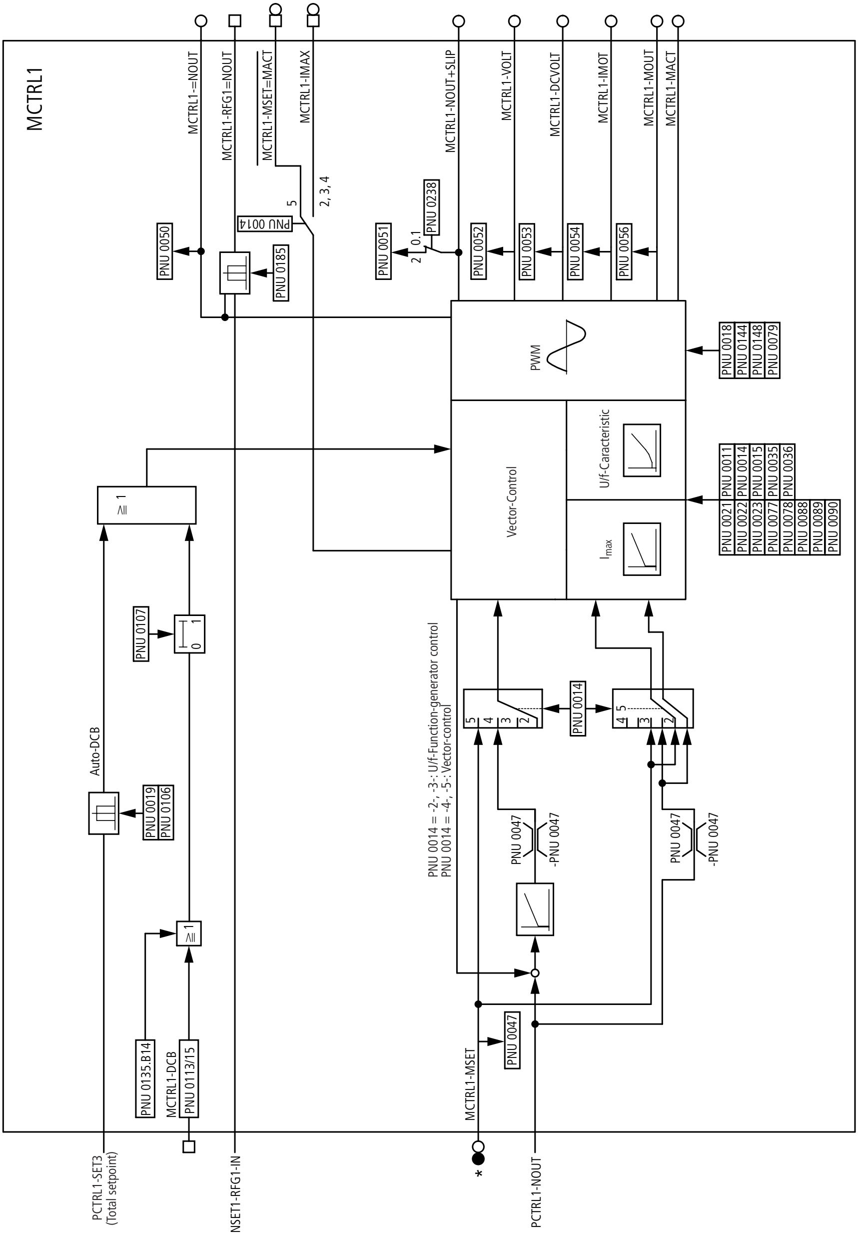
Block diagrams

The following block diagrams illustrate the internal signal flow. They are intended as an aid to selecting suitable signal sources. The links of the digital inputs/outputs with the internal function blocks are also shown.

Symbol	Use
* ○●	Analog signal source, assignment dependent on PNU 0001, 0005, 0007. See page 314
—□	Digital output
□—	Digital input
—▶	Permanent signal interconnection
—○	Analog output signal


NSET 1
NSET1-NOUT
NSET1-RFG1-IN = NSET1-NOUT?
NSET1-RFG1-I=0
NSET1-RFG1-IN
A
PNU 0185
S-ramp
Main setpoint
NSET1-RFG1
PNU 0182
CINH
QSP
PNU 0012
PNU 0013
PNU 0105
NSET1-RFG1-IN
blocking
frequencies
PNU 0625
PNU 0626
PNU 0627
PNU 0628
R/L
–1
PNU 0011
–PNU 0011
PNU 0140
NSET1-NADD
RA/MO
PNU 0037
PNU 0038
PNU 0039
FF1...3
normalized
±100 % ≡ ±PNU 0011
PNU 0141
absolute
±480 Hz
PNU 0046
normalized setpoint entry
PNU 0127
absolute
±24000 ≡ ±480 Hz
normiert
±2^14 ≡ ±PNU 0011
PNU 0135.B4
NSET1-RFG1-STOP
PNU 0113/5
NSET1-RFG1-0
PNU 0113/6
PNU 0135.B5
PNU 0046
Main setpoint
NSET1-N1
PNU 0044
NSET1-N2
PNU 0135.B0
NSET1-FF 1/3
PNU 0113/1
NSET1-FF 2/3
PNU 0113/2
PNU 0135.B1
≥1
*


PCTRL1
PCTRL1-SET3
PCTRL1-NMIN
PNU 0010
PCTRL1-f2>f1
PNU 0017
PCTRL1-SET=ACT
PCTRL1-ACT
PCTRL1-SET
PCTRL1-NOUT
PCTRL1-OUT
PNU 0011
PNU 0239
PNU 0051
PNU 0238
PNU 0074
PNU 0184
PNU 0070
PNU 0072
PNU 0071
STOP
Auto-DCB.
LU OU
RESET
CINH.DCB
(Total setpoint)
Link between main and
additional setpoint
PCTRL1-SET3
QSP
CINH
PCTRL1-RFG1
PNU 0220
PNU 0221
PNU 0105
PNU 0049
PNU 0145
PNU 0138
NSET1-NOUT
PCTRL1-NADD
PCTRL1-ACT
PCTRL1-SET2
PNU 0181
PCTRL1-SET1
PCTRL1-I-OFF
PNU 0113/18
PCTRL1-STOP
PNU 0113/21
PCTRL1-OFF
PNU 0113/19
A
DIS-I
FREEZE-PID
DIS-PID


MCTRL1
MCTRL1-=NOUT
MCTRL1-RFG1=NOUT
MCTRL1-MSET=MACT
MCTRL1-IMAX
MCTRL1-NOUT+SLIP
MCTRL1-VOLT
MCTRL1-DCVOLT
MCTRL1-IMOT
MCTRL1-MOUT
MCTRL1-MACT
PNU 0050
PNU 0185
PNU 0014
5
2, 3, 4
PNU 0051
PNU 0238
2
0, 1
PNU 0052
PNU 0053
PNU 0054
PNU 0056
PWM
PNU 0018
PNU 0144
PNU 0148
PNU 0079
Vector-Control
U/f-Caracteristic
I_{max}
PNU 0011
PNU 0014
PNU 0015
PNU 0035
PNU 0036
PNU 0021
PNU 0022
PNU 0023
PNU 0077
PNU 0078
PNU 0088
PNU 0089
PNU 0090
≥ 1
Auto-DCB
PNU 0019
PNU 0106
PNU 0107
PNU 0014 = -2-, -3-: U/f-Function-generator control
PNU 0014 = -4-, -5-: Vector-control
PNU 0047
-PNU 0047
PNU 0135.B14
MCTRL1-DCB
PNU 0113/15
MCTRL1-MSET
PNU 0047
PCTRL1-SET3
(Total setpoint)
NSET1-RFG1-IN
*
PCTRL1-NOUT

UL approval

C UL US	**Warnings!** The device has no overspeed protection. Must be provided with external or remote overload protection. Suitable for use on a circuit capable of delivering no more than 5000 A r.m.s. symmetrical current, 240 V maximum (240 V devices) or 500 V maximum (400/500 V devices) respectively. Use 60/75 °C or 75 °C copper wire only. Must be installed in a pollution degree 2 macro-environment.

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