MOELLER

Hardware and Engineering

DV6-340-...
Vector Frequency Inverters

01/02 AWB8230-1415GB

1st published 2002, edition 01/02

Authors: Holger Friedrich, Jörg Randermann
Editor: Michael Kämper
Translator: Dominik Kreuzer

Warning!
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 in accordance with EN 50 110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- 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 (VDE 0100 Part 410) 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 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.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- 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 DV6 series frequency inverters.

This manual contains information you need to install, configure and operate the DV6 frequency inverters. The features, parameters and functions are described in detail, with examples for the most important applications. All information applies to the specified hardware and software versions.

Abbreviations and symbols

The following abbreviations and symbols are used in this manual:

EMC	**E**lectro **M**agnetic **C**ompatibility
ESD	**E**lectro**s**tatic **D**ischarge
HF	**H**igh **F**requency
IGBT	**I**nsulated **G**ate **B**ipolar **T**ransistor
PES	**P**ositive **E**arth connection of the cable **s**creen
PNU	**P**arameter **Nu**mber
WE	**R**adio-**f**requency **i**nterference (RFI)

All measurements are in millimeters unless otherwise stated.

In some of the illustrations, the enclosure of the frequency inverter and other components affecting equipment safety have been omitted for improved clarity. However, the frequency inverter must always be operated with the enclosure and all necessary components that affect equipment safety correctly fitted.

Read the manual thoroughly before you install and operate the frequency inverter. We assume that you have a good knowledge of engineering fundamentals and that you are familiar with the electrical systems and the applicable principles and are able to read, interpret and apply the information contained in technical drawings.

▶ Indicates instructions to be followed

→ Indicates useful tips and additional information

▽ **Caution!**
Warns of the possibility of minor material damage.

⚠ **Warning!**
Warns of the possibility of major material damage and minor injury.

⚠ **Warning!**
Warns of the possibility of major material damage and serious or fatal injury.

To improve legibility, the title of the current section is given at the top of each left-hand page and the current subsection at the top of each right-hand page, except on the title page of each section and the blank pages at the end of each section.

Changes

Publication date	Page	Keyword	New	Change	Omitted
01/02	202	PNU A042 to A343, default setting		✓	
	203	PNU A244, value 05			✓
	203	PNU A344, values 02 to 05			✓
	203	PNU A056 to A059, default setting	✓		
	211	PNU A029 instead of A027 after PNU A028		✓	
	212	PNU C087, gain, terminal AMI instead of AM		✓	
	212	PNU C088, default setting		✓	
	214 to 215	Parameter group H	✓		
	215	Parameter group U	✓		

1 About the DV6 frequency inverters

System overview

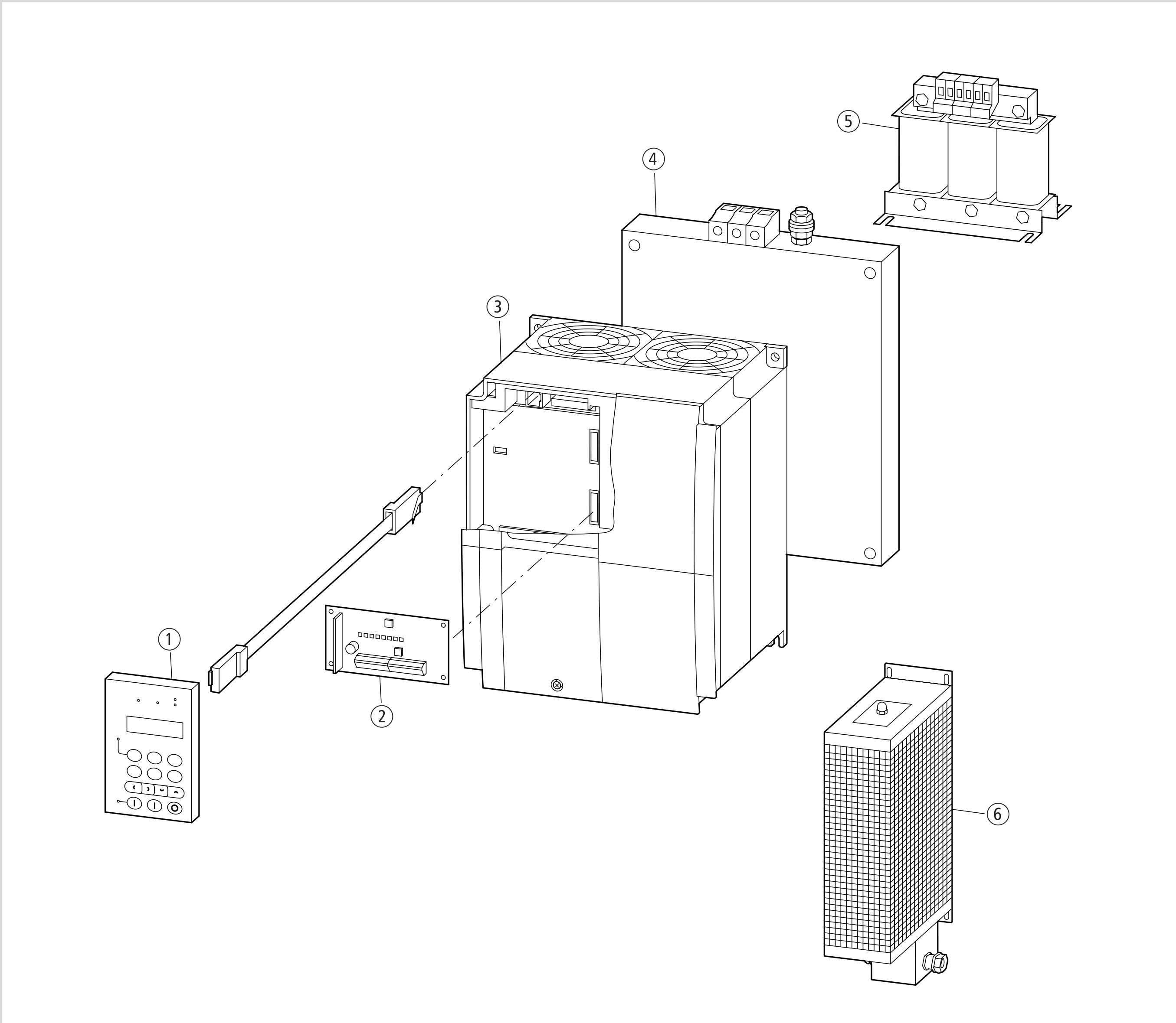


Figure 1: System overview

① DEX-DEY-10 external keypad
② Expansion module, for example for PROFIBUS-DP connection: DE6-NET-DP
③ DV6 frequency inverters
④ DE6-LZ... RFI filter
⑤ Mains choke
⑥ Braking resistor

Type code

Type codes and type designations of the DV6 frequency inverters:

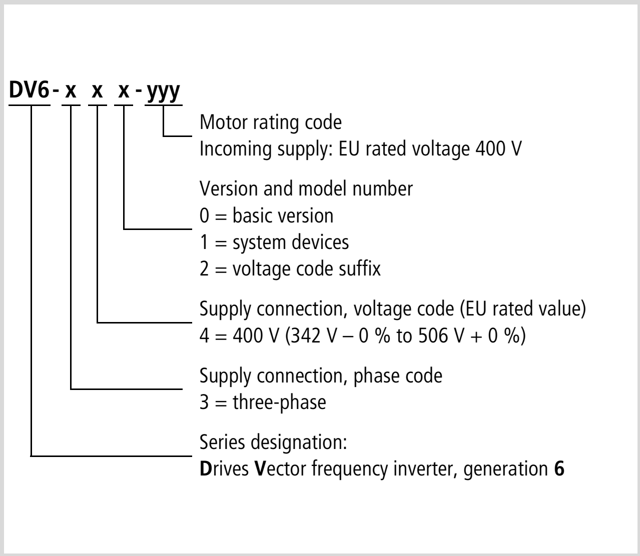


Figure 2: Type codes of the DV6 frequency inverters

Example:

DV6-340-11K	The DV6 frequency inverters
	Three-phase mains supply voltage: 400 V
	Assigned motor rating: 11 kW at 400 V

Inspecting the package content

The DV6 frequency inverter has been carefully packaged and prepared for delivery. The device may be transported only in its original packaging with a suitable transport system (see weight details). Observe the instructions and the warnings on the side of the packaging. This also applies after the device is removed from the package.

Open the packaging with suitable tools and inspect the contents immediately on delivery to ensure that they are complete and undamaged. The package should contain the following items:

- one DV6 frequency inverter,
- Installation instructions, AWA8230-1938,
- one CD containing:
  – this manual in PDF format and copies in other languages
  – the parameterization software
    Hardware requirements: PC with Windows 95/98/ME/2000/NT and the DEX-CBL-2M0-PC connecting cable

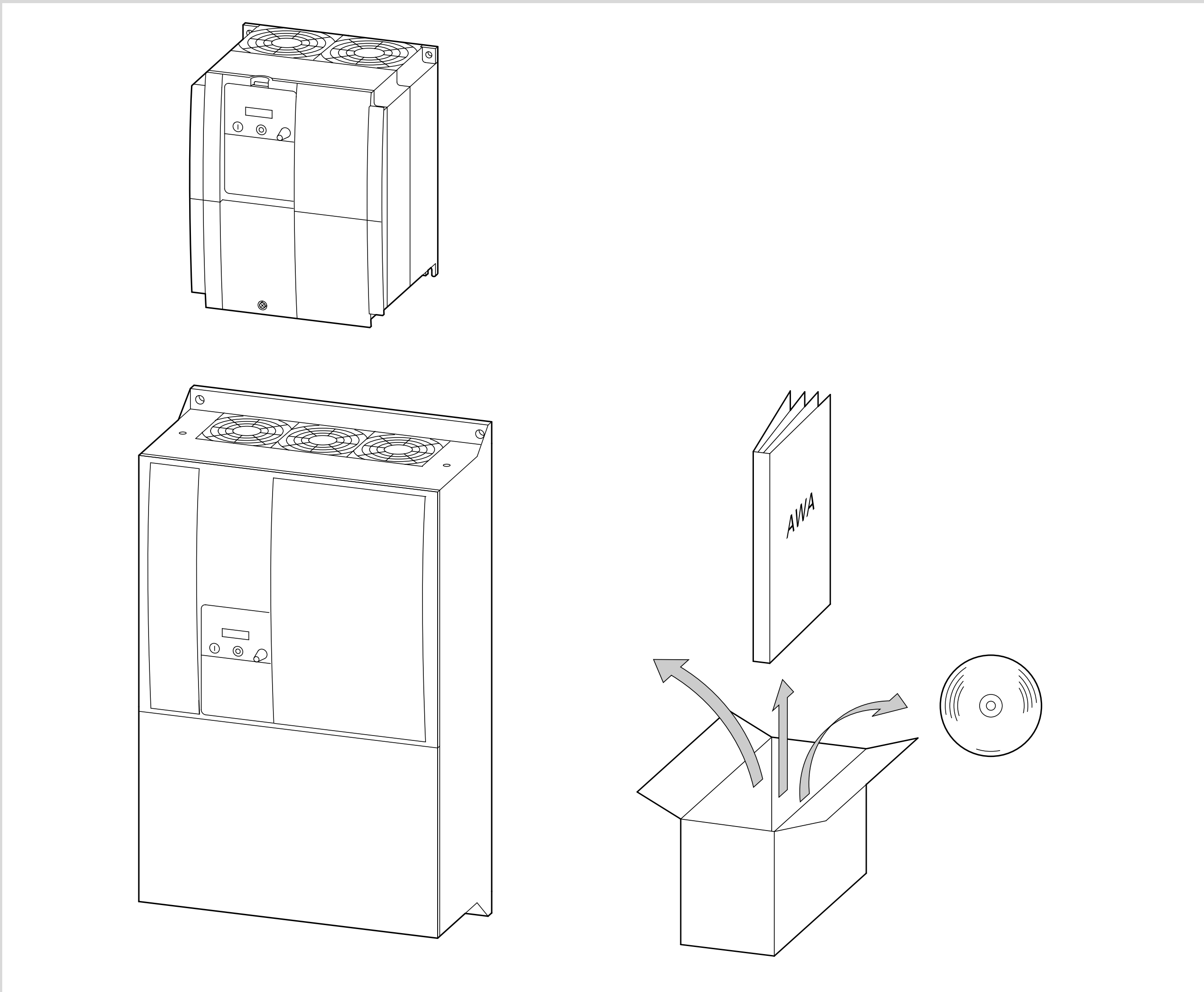


Figure 3: Package content

→ On the nameplate attached to the frequency inverter, check to ensure that the frequency inverter is the type which you have ordered.

Layout of the DV6

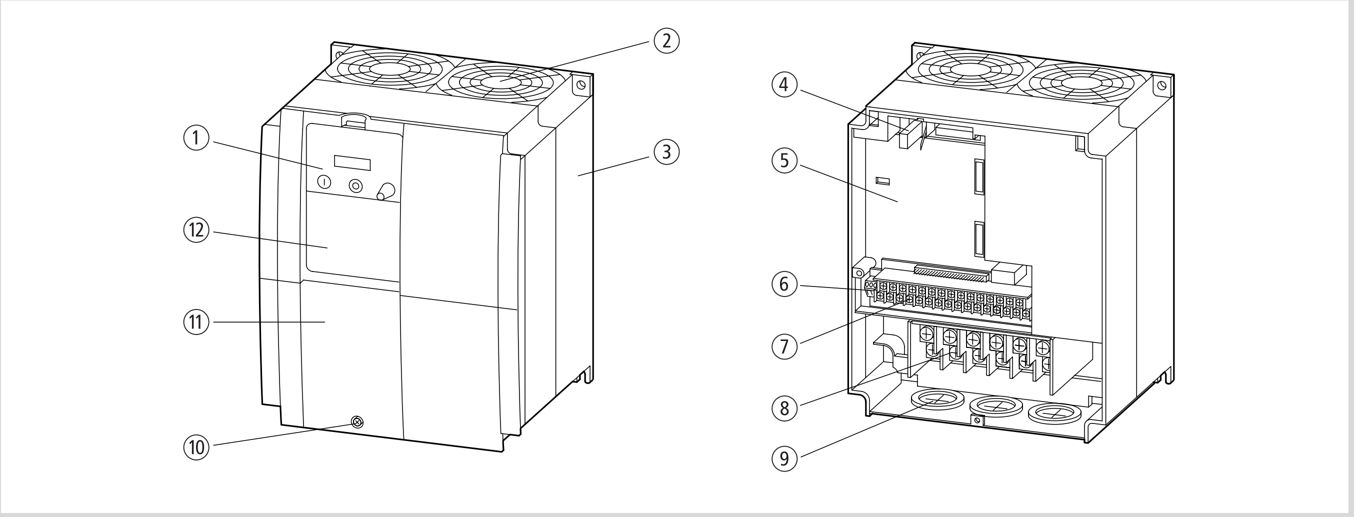


Figure 4: Physical features of the DV6

① Keypad
② Fan
③ Heat sink
④ Interface connector for keypad
⑤ Two slots for optional modules
⑥ RS 485 interface
⑦ Control signal terminals
⑧ Power terminals
⑨ Cable entry
⑩ Screw for opening the terminal shroud
⑪ Terminal shroud
⑫ Cover

Features of the frequency inverters

The DV6 frequency inverters convert the voltage and frequency of an existing three-phase supply to a DC voltage and use this voltage to generate a three-phase supply with adjustable voltage and frequency. This variable three-phase supply allows infinitlely adjustable speed control of three-phase asynchronous motors.

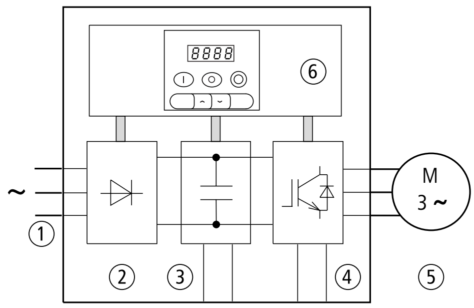


Figure 5: Function chart of the frequency inverter

① Supply through an interference suppressor
Mains voltage ΔU_{LN} (EU-rated voltages):
3-phase 400 V AC, 50/60 Hz

② The bridge rectifiers convert the AC voltage of the electrical supply to a DC voltage.

③ The DC link contains a charging resistor, smoothing capacitor and switched-mode power supply unit. It enables coupling of the DC bus voltage and the DC current supply:
DC bus voltage (ΔU_{ZK}) = $\sqrt{2}$ × mains voltage (ΔU_{LN})

④ IGBT power inverter:
The power inverter converts the DC voltage of the internal DC link to a variable three-phase alternating voltage with variable frequency. In conjunction with an external braking resistor, the braking transistor allows braking of motors with a high moment of inertia or during extended regenerative operation.

⑤ Output voltage (ΔU_2), motor connection:
three-phase, variable AC voltage, 0 to 100 % of the input voltage (ΔU_{LN})
Output frequency (f_2):
variable frequency, 0 to 400 Hz
Output rated current (I_{2N}):
2.5 to 260 A with about 1.5 times the starting current for 60 s, with a switching frequency of 5 kHz and at an ambient temperature of 40 °C
Motor connection, assigned shaft output (P_2):
0.75 to 132 kW at 400 V

⑥ Programmable control section with keypad and interface

Selection criteria

Select the frequency inverter according to the rated current of the motor. The rated output current of the frequency inverter must however, be greater than or equal to the rated current of the motor.

The following drive data is assumed to be known:

- Type of motor (three-phase asynchronous motor)
- Mains voltage = supply voltage of the motor (e.g. 3 ~ 400 V)
- Rated motor current (guide value, dependent on the circuit type and the supply voltage)
- Load torque (quadratic, constant, with 1.5 times the starting torque)
- Ambient temperature (maximum temperature 40 °C).

→ If several motors are connected in parallel to the output of a frequency inverter, the motor currents are subject to vector addition, i.e. the active in-phase current and reactive current components are added separately. When you select a frequency inverter, make sure that it can supply the total resulting current.

→ If you connect a motor to an operational frequency inverter, the motor draws a multiple of its rated current. When you select a frequency inverter, make sure that the starting current plus the sum of the currents of the running motors will not exceed the rated output current of the frequency inverter.

The rated output current of the frequency inverter can be found in the technical data in the appendix from Page 187.

Intended use

The DV6 frequency inverters are not domestic appliances. They are designed only for industrial use as system components.

The DV6 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 60204. The owner/operator of the equipment is responsible for ensuring that the machine is used in compliance with the relevant EU Directives.

The CE markings on the DV6 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).

In the described system configurations, DV6 frequency inverters are suitable for use in public and non-public networks. Depending on their location of use, additional, external filtering may be necessary.

Connection to IT networks (networks without a ground potential reference point) is not permitted as the devices internal filter capacitors connect the network to the ground potential (enclosure). On earth free networks, this can lead to dangerous situations or damage the device (isolation monitoring is required).

To the output of the frequency inverter (terminals U, V, W) you may not:

- connect a voltage or capacitive loads (e.g. phase compensation capacitor),
- connect multiple frequency inverters in parallel,
- make a direct connection to the input (bypass).

Observe the technical data and terminal requirements. For additional information, refer to the equipment nameplate or label and the documentation.

Any other usage constitutes improper use.

Service and guarantee

In the unlikely event that you have a problem with your Moeller frequency inverter, please contact your local sales office.

Please have the following data and information about your frequency inverter to hand:

- Exact frequency inverter type designation (→ nameplate)
- Date of purchase
- Detailed description of the problem which has occurred with the frequency inverter

If some of the information printed on the nameplate is not legible, please state only the information which is clearly legible.

Information concerning the guarantee can be found in the Moeller General Terms and Conditions of Sale.

2 Engineering

This section describes the "Performance features of the DV6" and the requirements and directives concerning the following:

- Connecting to the mains
- EMC guidelines

Performance features of the DV6

Ambient temperatures	
Operation[1)]	Ta = –10 to +40 °C at rated current I_e without derating, up to +50 °C at reduced pulse frequency of 2 kHz and output current reduced to 80 % I_e
Storage	Ta = –20 to +65 °C
Transport	Ta = –25 to +70 °C
Permissible environmental conditions	
Resistance to vibration	Impact and vibration: • DV6-340-007 to DV6-340-2K2: up to 5.9 m/s^2 (0.6 g) at 10 to 55 Hz • from DV6-340-4K0: up to 2.94 m/s^2 (0.3 g) at 10 to 55 Hz
Degree of pollution	VDE 0110 Part 2, pollution degree 2
Packaging	Dust proof packaging (DIN 4180)
Climatic conditions	Class 3K3 according to EN 50178 (non-condensing, average relative humidity 20 to 90 %)
Installation altitude	Up to 1000 m above sea level
Mounting position	Vertically suspended
Free surrounding areas	100 mm above and below device
Electrical data	
Emitted interference	IEC/EN 61800-3 (EN 55011 group 1, class B)
Noise immunity	IEC/EN 61800-3, industrial environment
Insulation resistance	Overvoltage category III according to VDE 0110
Leakage current to PE	Greater than 3.5 mA according to EN 50178
Degree of protection	IP20
Protection against direct contact	Finger and back-of-hand proof (VBG 4)
Protective isolation against switching circuitry	Safe isolation from the mains. Double basic isolation according to EN 50178
Protective measures	Overcurrent, earth fault, overvoltage, undervoltage, overload, overtemperature, electronic motor protection: I^2t monitoring and PTC input (thermistor or temperature contacts)
Open-/closed-loop control	
Modulation method	Pulse width modulation (PWM), V/*f* characteristics control (linear, quadratic)
Switching frequency	5 kHz (default), adjustable from 0.5 to 15 kHz
Torque	At start 1.5 × M_N for 60 s at assigned motor rating, every 600 s, 2 × M_N for 0.5 s
Output frequency	
Range	0.1 to 400 Hz
Frequency resolution	0.1 Hz, at digital setpoint, maximum frequency/1000 with analog setpoint value
Error limit at 25 °C ±10 °C	Digital setpoint definition ±0.01 % of the maximum frequency
	Analog setpoint definition ±0.2 % of the maximum frequency

Relay	
Changeover contact	• Contacts K11-K14 – 250 V AC, 2 A (resistive load) – 250 V AC, 0.2 A (inductive load, p.f. = 0.4) – 100 V AC, minimum 10 mA – 30 V DC, 8 A (resistive load) – 30 V DC, 0.6 A (inductive load, p.f. = 0.4) – 5 V DC, minimum 100 mA • Contacts K11-K12 – 250 V AC, 1 A (resistive load) – 250 V AC, 0.2 A (inductive load, p.f. = 0.4) – 100 V AC, minimum 10 mA – 30 V DC, 1 A (resistive load) – 30 V DC, 0.2 A (inductive load, p.f. = 0.4) – 5 V DC, minimum 100 mA
Internal voltages	
Control	24 V DC, maximum 30 mA
Setpoint definition	10 V DC, maximum 10 mA
Analog and digital actuation	
Analog inputs	• 1 input, 0 to 10 V, input impedance 10 kΩ • 1 input, 4 to 20 mA, load impedance 250 Ω • 1 input, +10 to –10 V, input impedance 10 kΩ
Digital inputs/outputs	8 inputs, user-configurable
	5 outputs, open collector (up to 27 V DC, 50 mA), user-configurable
Analog outputs	• 1 output for motor frequency or current, 10 V, up to 1.2 mA • 1 output, 0 to 10 V, up to 2 mA, user-configurable • 1 output, 4 to 20 mA, user-configurable
Keypad (built-in)	
Operation	6 function keys for controlling and parameterizing the DV6
Display	Four-digit, 7-segment display and ten LEDs (for status signals)
Potentiometer	Setpoint definition (0 to 270°)

1) If the frequency inverter is to be installed in a control panel, enclosure or similar installation, the temperature within the enclosure or control panel is considered to be ambient temperature T_a. The use of fans should be considered to ensure that the ambient temperature remains within permissible limits.

Connecting to the mains

The DV6 frequency inverters can not be used in every network configuration without limitations (network configuration according to IEC 364-3).

Mains configurations

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

- DV6 frequency inverters can be used without limitations in TT and TN networks. The ratings of the DV6 frequency inverters must, however, be observed.

Networks with earthed centre point (IT networks):

- The use of DV6 frequency inverters in IT networks is only permissible to a limited extent. In this case, a suitable device (isolation monitor) to monitor earth faults and isolates the frequency inverter from the mains must be used.

> **Caution!**
> In the event of an earth fault in an IT system, the capacitors of the frequency inverter which are switched to earth are subjected to a very high voltage, and safe operation of the frequency inverter is no longer guaranteed. To overcome this problem,fit additional isolating transformer to the frequency inverter's supply and earth the transformer's secondary side at its centre point to form, in effect, an individual TN network for the frequency inverter.

Mains voltage, Mains frequency

The ratings of the DV6 frequency inverters cover European and American standard voltages:

- 400 V, 50 Hz (EU) and 460 V, 60 Hz (USA)

The permissible mains voltage range is:

- 380/480 V: 342 V – 0 % to 528 V + 0 %

The permissible frequency range is 47 Hz – 0 % to 63 Hz + 0 %.

The motor rating to mains voltage assignments are listed in the appendix, Section "Technical Data", Page 185.

Interaction with p.f. correction equipment

The DV6 frequency inverters absorb only a small fundamental reactive power from the AC supply. A p.f. correction is therefore not necessary.

> **Caution!**
> Operation of DV6 series frequency inverters on the mains with p.f. correction equipment is only permitted when this equipment is dampened with chokes.

Fuses and cable cross-sections

The fuse ratings and cable cross-sections required for the network connection depend on the rating of the frequency inverter and the the drive's operating mode.

> **Caution!**
> When selecting the cable cross-section, take the voltage drop under load conditions into account. Compliance to further standards (e.g. VDE 0113, VDE 0289) is the responsibility of the user.

The recommended fuses and their assignment to the DV6 frequency inverters are listed in the appendix, Section "Cables and fuses", Page 194.

The national and regional standards (e.g. VDE 0113, EN 60204) must be observed and any required approvals (e.g. UL) at the site of installation must be fulfilled.

When the device is operated in a UL-approved system, only UL-approved fuses, fuse bases and cables must be used.

The leakage currents to ground (according to EN 50178) are greater than 3.5 mA. The PE terminal and the enclosure must be connected to the earth-current circuit.

> **Caution!**
> The prescribed minimum cross-sections of PE conductors (EN 50178, VDE 0160) must be observed. Use a PE conductor whose cross-section is as least as large as the terminal capacity of the power terminals.

Protection of persons and domestic animals with residual-current protective devices

Residual-current circuit breakers (RCCBs; also called earth-leakage circuit breakers or ELCBs). Universal current sensitive RCCBs according to EN 50178 and IEC 755.

	Identification on the residual-current circuit-breakers		
Logo	~	⏦	⎓ ⏦
Mode l	Alternating current sensitive (RCCB, Type AC)	Pulse current sensitive (RCCB, Type A)	Universal current sensitive (RCCB, Type B)

The frequency inverter has a built-in mains rectifier. When a frame fault occurs, a DC fault current can block the trip of the alternating current sensitive or pulse current sensitive residual-current circuit breaker, thereby preventing its protective function. We therefore recommend the use of:

- Universal RCCBs with a rated fault current ≧ 300 mA.

The approximate fault current values of the DV6 frequency inverters and their assigned radio interference filters are listed in the appendix, Section "Radio interference filters", Page 197.

Spurious tripping of a residual-current circuit breaker can be caused by the following:

- capacitive compensation currents in the cable screens, particularly with long, screened motor cables,
- simultaneous connection of multiple frequency inverters to the mains supply,
- the use of additional chokes and filters (radio interference filters, line filters).

▽ **Caution!**
Residual-current circuit breakers must be installed only on the primary side between the incoming supply and the frequency inverter.

⚠ **Warning!**
To prevent the risk of fire, use only cables, residual-current circuit breakers and contactors with the specified rating.

Mains contactor

The mains contactor is connected to the mains side input cables L1, L2, L3 and allows the DV6 frequency inverter on the supplying network to be switched on and off during operation and to be disconnected in the event of a fault.

Mains contactors and their assignment to the DV6 frequency inverters are listed in the appendix, Section "Mains contactors", Page 195.

Current peaks

In the following cases, a relatively high peak current can occur on the primary side of the frequency inverter (i.e. on the supply voltage side), which, under certain conditions, can destroy the input rectifier of the frequency inverter:

- Imbalance of the voltage supply greater than 3 %.
- The maximum power output of the point of supply must be at least 10 times greater than the maximum frequency inverter rating.
- If sudden voltage dips in the supply voltage are to be expected, e.g. :
  - a number of frequency inverters are operated on a common supply voltage
  - a thyristor system and a frequency inverter are operated on a common supply voltage
  - power factor correction devices are switched on or off

In these cases, a mains choke with about 3 % voltage drop at rated operation should be installed.

Mains choke

The mains choke (also called commutating choke or line reactor) is connected to the mains side input cables L1, L2, L3. It reduces the harmonics and therefore reduces the apparent mains current by up to 30 %.

A mains choke also limits any current peaks caused by potential dips (e.g. caused by p.f. correction equipment or earth faults) or switching operations on the mains.

The mains choke increases the lifespan of the internal DC link capacitors and therefore the lifespan of the frequency inverter. Its use is also recommended:

- with derating (temperatures above +40 °C, sites of installation more than 1000 m above sea level),
- with parallel operation of multiple frequency inverters on a single mains supply point,
- with DC link coupling of multiple frequency inverters (interconnected operation).

Mains chokes and their assignment to the DV6 frequency inverters are listed in the appendix, Section "Mains choke", Page 196.

Mains filters and radio interference filters

Mains filters are a combination of mains chokes and radio interference filters in a single enclosure. They reduce the current harmonics and dampen high frequency radio interference levels.

Radio interference filters only dampen high frequency radio interference levels.

▽ **Caution!**
The mains phase failure detection (PNU b006) does not operate correctly when a radio interference filter is installed.

▽ **Caution!**
When line filters or radio interference filters are used, the leakage current to earth increases. Observe this point when installing residual-current circuit breakers.

EMC guidelines

The limit values for emitted interference and immunity for variable speed drives are described in the **IEC/EN 61800-3** Product Standard.

If you use DV6 frequency inverters in European Union (EU) countries, you must observe the EMC Directive 89/336/EEC. The following conditions must be observed to comply with this Directive:

Supply voltage (mains voltage) for the frequency inverter:

- Voltage fluctuation ±10 % or less
- Voltage imbalance ±3 % or less
- Frequency variation ±4 % or less

If one of the conditions listed here cannot be fulfilled, you must install an appropriate mains choke (→ Section "Mains choke" in the appendix, Page 196).

EMC interference class

Installed according to the "EMC guidelines" in Kapitel „Installation", Page 21 and with the use of a radio interference filter, the DV6 frequency inverters conform to the following standards:

- Emitted interference: IEC/EN 61800-3 (EN 55011 group 1, class B)
- Noise immunity: EN 61800-3, industrial environment

With frequency inverters, performance related and emitted interference increases with the pulse frequency. The frequency at which performance-related interference occurs also increases with longer motor cables. When the assigned radio interference filter is used, the EN 61800-3 standard is complied to as follows:

	Conformity	
	General	Limited
First environment (public mains network)	Up to 10 m motor cable length at 15 kHz (maximum pulse frequency)	Up to 50 m[1)]
	Up to 20 m motor cable lengths with a switching frequency of up to 5 kHz	
Second environment (industrial)	Up to 50 m	Up to 50 m

1) This is a product with limited conformity as efined by IEC/EN 61800-3. This product can cause radio-frequency interference in domestic environments. In this case appropriate protection measures must be implemented by the user.

Noise immunity
Used with the assigned radio interference filters, the DV6 frequency inverters meet the interference immunity requirements of the EMC Product Standard IEC/EN 61800-3 for industrial environments (second environment) and for domestic use (first environment).

A "domestic environment" is defined here as a connection point (transformer feeder) to which domestic households are also connected.

For industrial systems, the EMC Directive requires electromagnetic compatibility with the environment as a whole. The Product Standard regards a typical drive system as a complete unit, i.e. the combination of frequency inverter, cables and motor.

Emitted interference and radio interference suppression
Used with the assigned radio interference filters, the DV6 frequency inverters meet the requirements of the EMC Product Standard IEC/EN 61800-3 for domestic use (first environment) and therefore also for the higher limit values of industrial environments (second environment).

To ensure compliance to the limit values, observe the following points:

- Reduction of performance related interference with line filters and/or radio interference filters including mains chokes
- Reduction of the electromagnetic emission interference by screening motor cables and signal cables
- Compliance with installation requirements (EMC-compliant installation).

3 Installation

The DV6 frequency inverters should be installed in a control panel or in a metal enclosure (e.g. IP54).

→ During installation or assembly operations on the frequency inverter, all ventilation slots and openings should be covered to ensure that no foreign bodies can enter the device.

Installing the DV6

The DV6 frequency inverters must be mounted vertically on a non-flammable background.

Mounting position

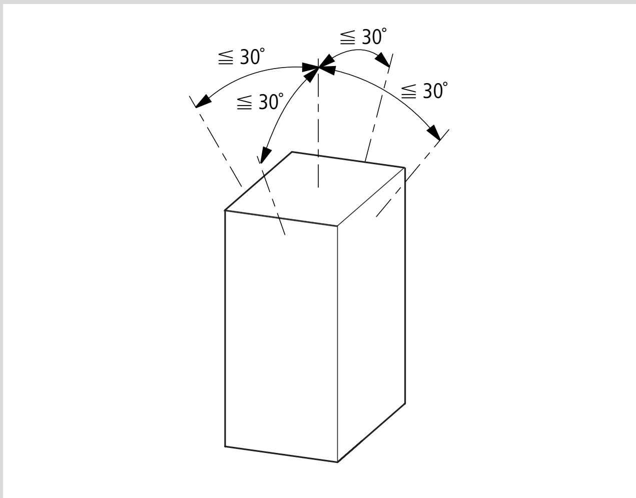


Figure 6: Mounting position

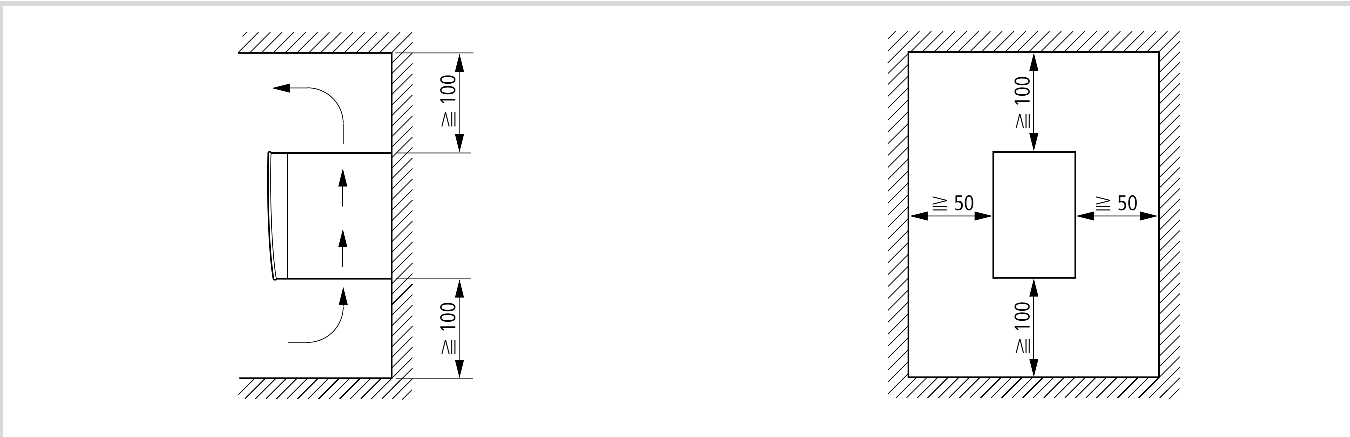


Figure 7: Installation dimensions

Weights and dimensions of the DV6 are listed in the appendix in Section “Weights and dimensions”, Page 193.

Mounting the DV6

Mount the DV6 frequency inverter as shown in Fig. 8 and tighten the screws to the following torque values (→ Table 1):

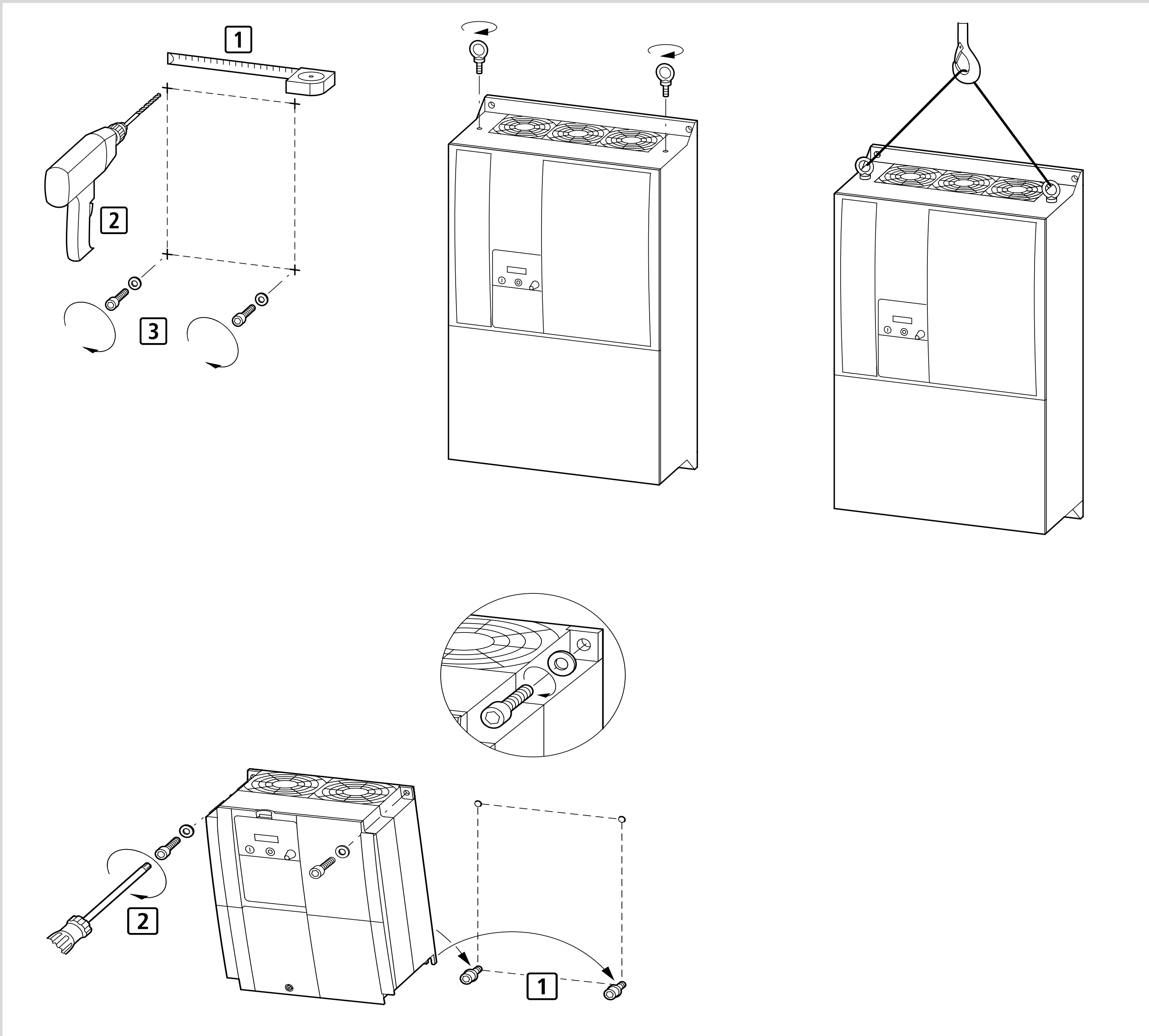


Figure 8: Mounting the DV6

Table 1: Tightening torques of the fixing screws

Ø [mm]		Nm	ft lb
6	M5	4	3.0
7	M6	4.9	3.6
10	M8	8.8	6.5

The fixing screw sizes are listed in the table below:

Table 2: Fixing screw sizes

DV6-340-...	a	b
075 1K5 2K2 4K0 5K5	130	241
11K	189	246
15K 18K5 22K	229	376
30K	265	510
37K 45K 55K	300	520
75K 90K	300	510
110K 132K	380	760

EMC compliance

EMC compliant installation

The frequency inverters operate with fast electronic switching devices e.g. transistors (IGBT). For this reason, radio interference can occur on the frequency inverter's output, which may effect other electronic devices in the direct vicinity, such as radio receivers or measurement instruments. To protect against this radio frequency interference (RFI), the devices should be screened and installed as far away as possible from the frequency inverters.

For an EMC-compliant installation, we recommend the following measures:

- Installation of the frequency inverter in a metallic, electrically conducting enclosure with a good connection to earth.
- Installation of a radio interference filter on the input of and immediately adjacent to the frequency inverter.
- Use of screened motor cables (short cable lengths).

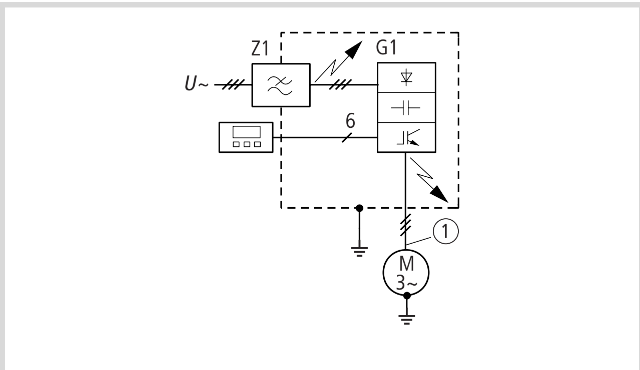


Figure 9: DV6 and radio interference filters in an insulated metal enclosure

Z1: RFI filter

G1: Frequency inverter

① Screened motor cable

▶ Earth the metallic enclosure using a cable which is as short as possible (→ Fig. 9).

Using the radio interference filter

The RFI filter should be installed immediately adjacent to the frequency inverter. The connection cable between the frequency inverter and filter should be as short as possible. If cables are longer than 30 cm, use screened cables.

The mounting surfaces for the frequency inverter and radio interference filter should be as free as possible from paint and oil residue.

Up to size DV6-340-22K frequency inverters, the assigned DE6-LZ... radio interference filters (→ Section "Radio interference filters", Page 197) are mounted underneath the inverter (footprint mounting).

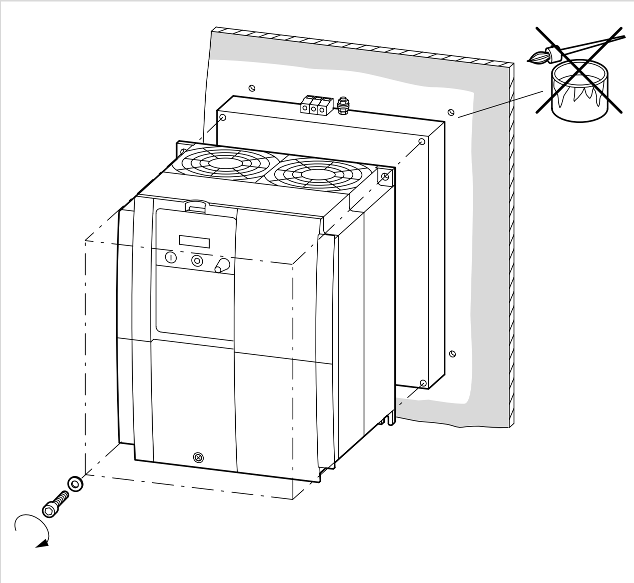


Figure 10: Footprint mounting

With the DV6-340-30K to DV6-340-132K frequency inverters, fit the radio interference filters on the side next to the device (book-type mounting). You can fit the RFI filter either to the left or the right of the frequency inverter.

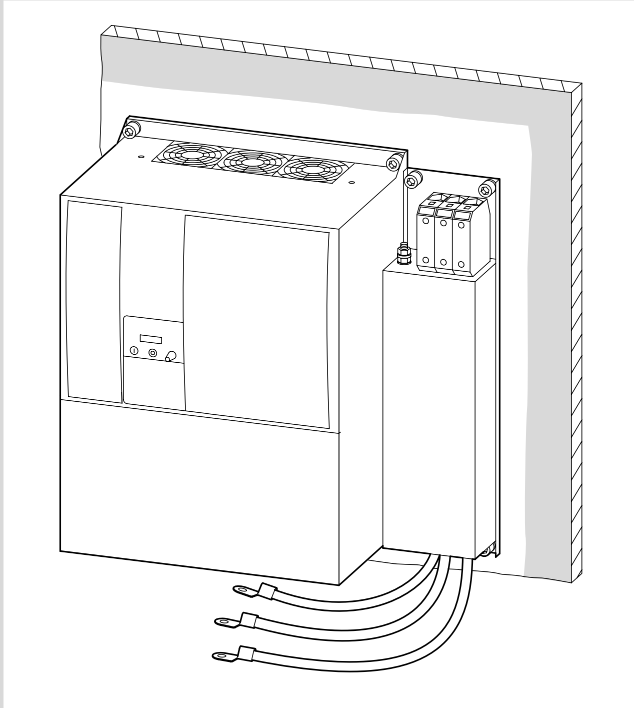


Figure 11: Book-type mounting (on right side in the example)

Radio interference filters produce leakage currents which, in the event of a fault (phase failure, load unbalance), can be larger than the rated values. To prevent dangerous voltages, the filters must therefore be earthed before use. As the leakage currents are high-frequency interference sources, the earthing connections and cables must have a low resistance and large contact surfaces.

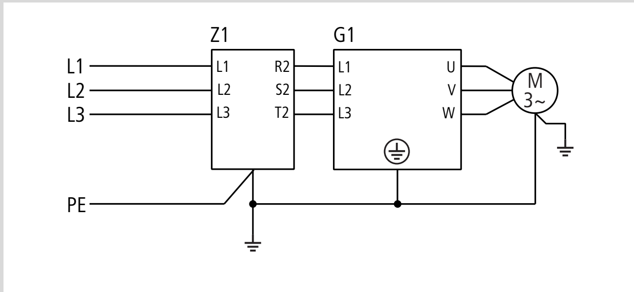


Figure 12: Earthing measures

Z1: RFI filter

G1: Frequency inverter

With leakage currents ≧ 3.5 mA, VDE 0160 and EN 60335, one of the following conditions must be fulfilled:

- the protective conductor has a cross-section ≧ 10 mm²,
- the protective conductor is monitored to ensure continuity, or
- an additional protective conductor is installed.

For DV6 frequency inverters, use the assigned DV6-LZ... filters.

EMC measures in the control panel

To ensure an 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-passivized). If there is no alternative, use contact and scraper washers to ensure contact with the base metal. Connect mounting plates to each other, and the cabinet doors with the cabinet, using contacts with large surface areas and short HF wires.

An overview or all EMC measures can be seen in the following figure.

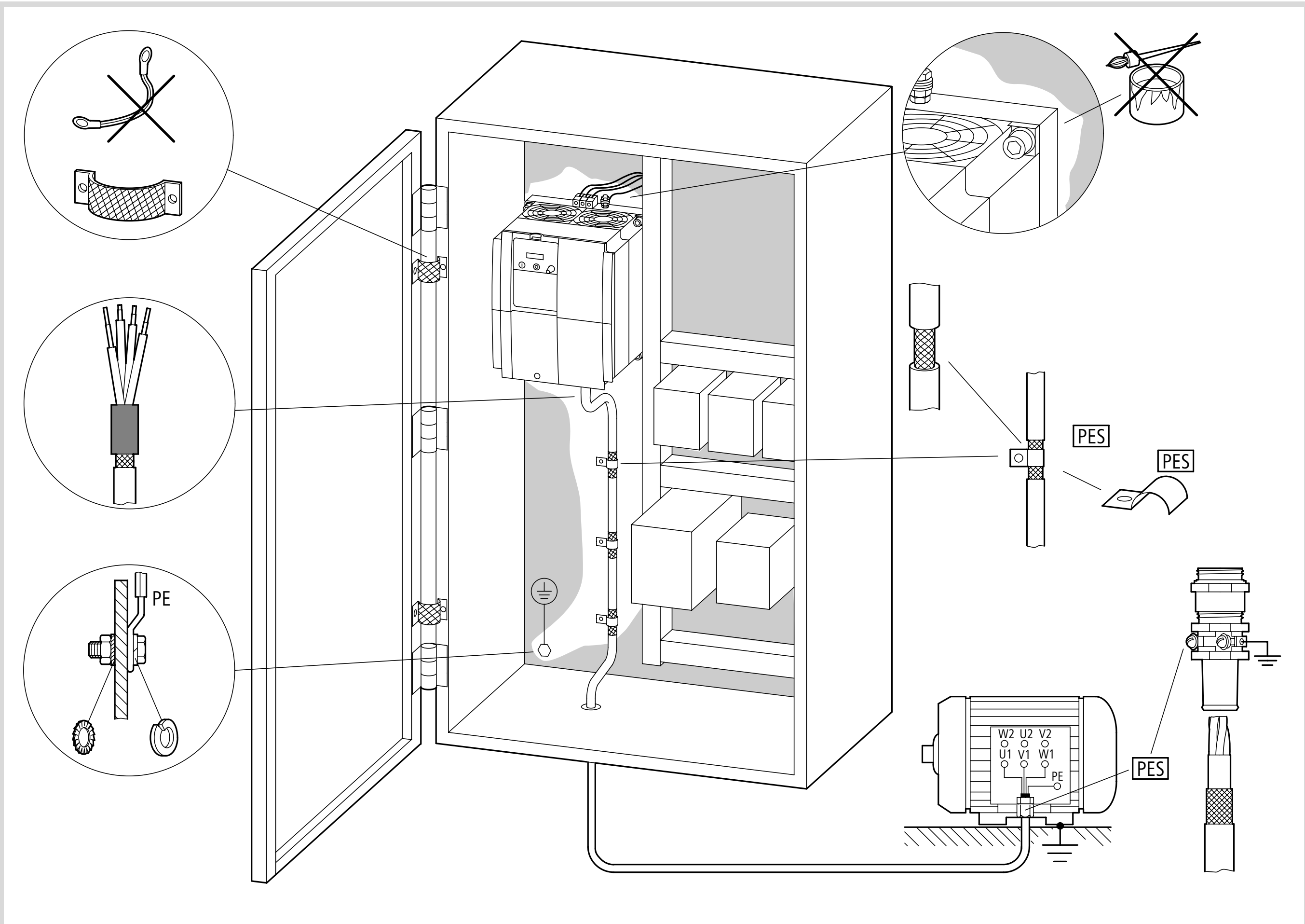


Figure 13: EMC-compliant setup

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

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

To prevent transfer of electromagnetic energy, lay interference-suppressed cables (e.g. the mains supply line 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 crossovers are unavoidable, cables should always cross at right angles to each other.

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

Earthing

Connect the base plate (mounting plate) with the protective earth using a short cable. lay all conducting components (frequency inverter, mains filter, motor filter, mains choke) with an HF wire, and the protective conductor in a star configuration from a central earthing point. This achieves the best results.

Make sure that the earthing measures have been correctly implemented (→ Fig. 14). No other device which has to be earthed should be connected to the earthing terminal of the frequency inverter. If more than one frequency inverter is used, the earthing cables should not form a closed loop.

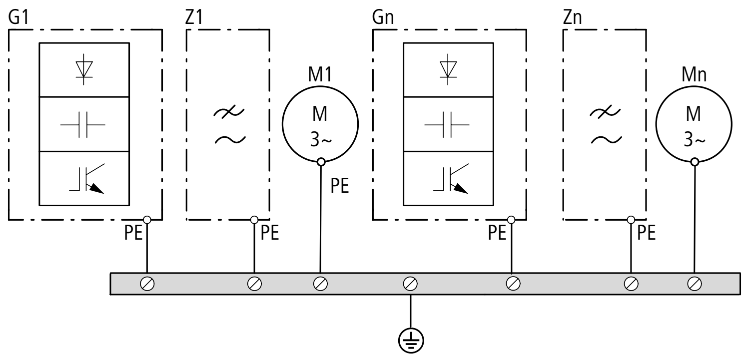


Figure 14: Star-type point-to-point earthing

Screening

Unscreened cables behave like antennae, 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 85 percent and an overlap angle of 90°.

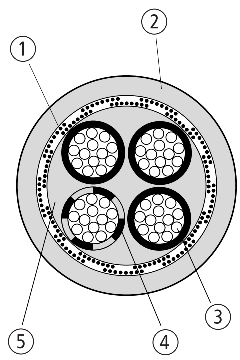


Figure 15: Sample motor cable

1. Copper screen braid
2. PVC outer sheath
3. Drain wire (copper)
4. PVC core insulation
   3 × black, 1 × green/yellow
5. Textile braid and PVC inner

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

Lay the cables for the supply voltage separately from the signal cables and control cables.

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

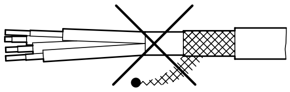


Figure 16: Inadmissible screen grounding (pigtails)

If contactors, maintenance switches, motor protection relays, motor chokes, 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 connection with a large contact surface. The free, unscreened connecting cables should not be longer than about 100 mm.

Example: Maintenance switch

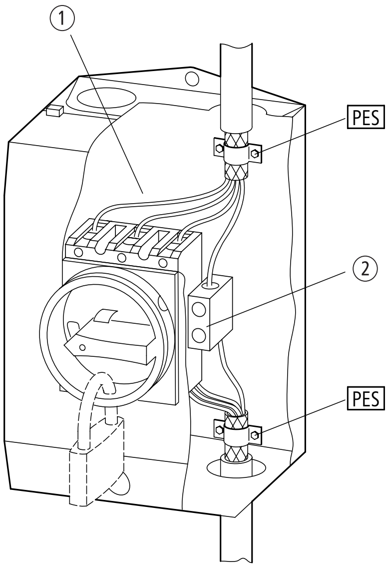


Figure 17: Maintenance switch, e.g. **T… in an enclosure**

① Metal plate

② Insulated PE terminal

In an EMC-compliant control cabinet (metal-enclosed, damped to about 10 dB), the motor cables do not need to be screened provided that the frequency inverter and motor cables are spatially separated from each other and arranged in a separate partition from the other control system components. The motor cable screening must then be connected with a large surface area connection at the control cabinet (PES).

The control cable and signal (analog setpoint and measured value) cable screens must be connected only at one cable end. The screen connection must have a large contact surface a low impedance. Digital signal cable screens must be connected at both cable ends, also with large-surface, low-resistance connections.

Electrical connection

This section describes how to connect the motor and the supply voltage to the power terminals, and the signal cables to the control terminals and the signalling relay.

Warning!
Carry out the wiring work only after the frequency inverter has been correctly mounted and secured. Otherwise, there is a danger of electrical shock or injury.

Warning!
Carry out wiring work only under zero voltage conditions.

Warning!
Use only cables, residual-current circuit breakers and contactors with a suitable rating. Otherwise there is a danger of fire.

The following illustration shows an overview of the connections.

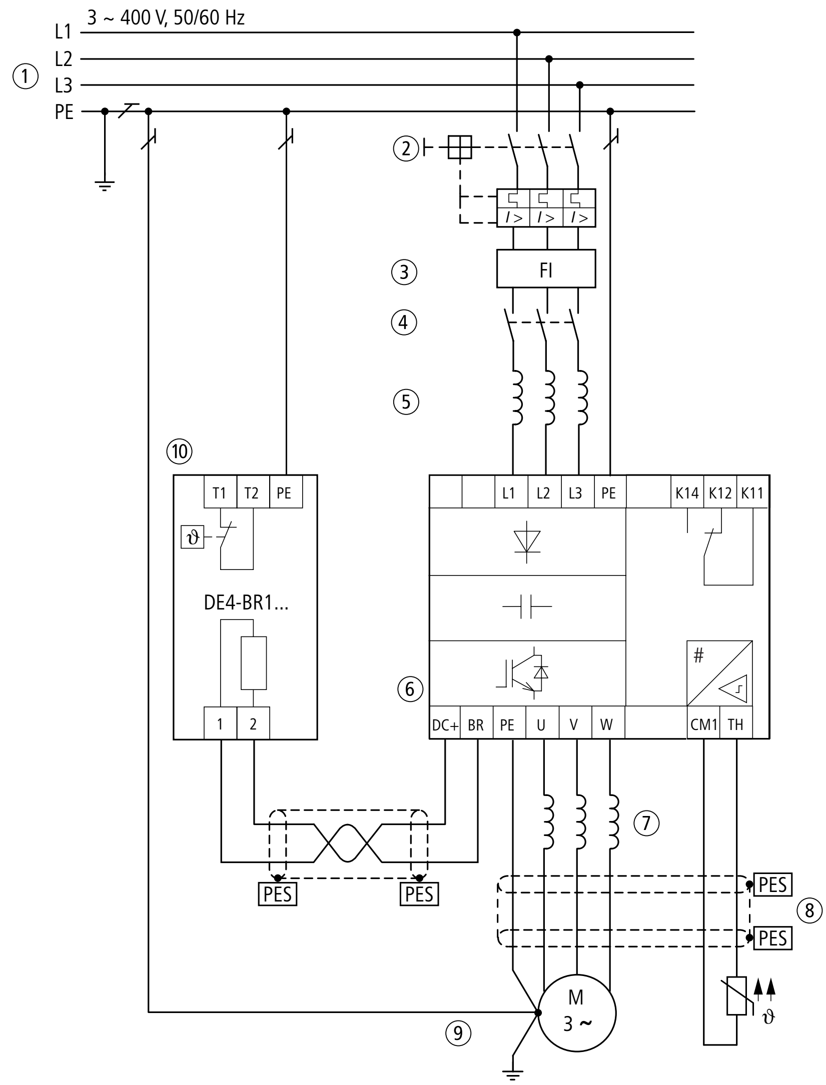


Figure 18: Power connection

① Network configuration, mains voltage, mains frequency
Interaction with p.f. correction 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, radio interference filter, line filter

⑥ Mounting, installation
Power connection
EMC measures
Example of circuits

⑦ Motor filter
d*u*/d*t* filter
Sinusoidal filter

⑧ Motor cables, cable length

⑨ Motor connection
Parallel operation of multiple motors on a single frequency inverter

⑩ Braking resistors, braking units
DC link coupling
DC supply

Connecting the power section

To connect the supply voltage, the motor cables and the signal relay terminals, open the front cover.

→ Complete the following steps with the specified tools and without the use of force.

Opening the terminal shroud

▶ Loosen the screw.

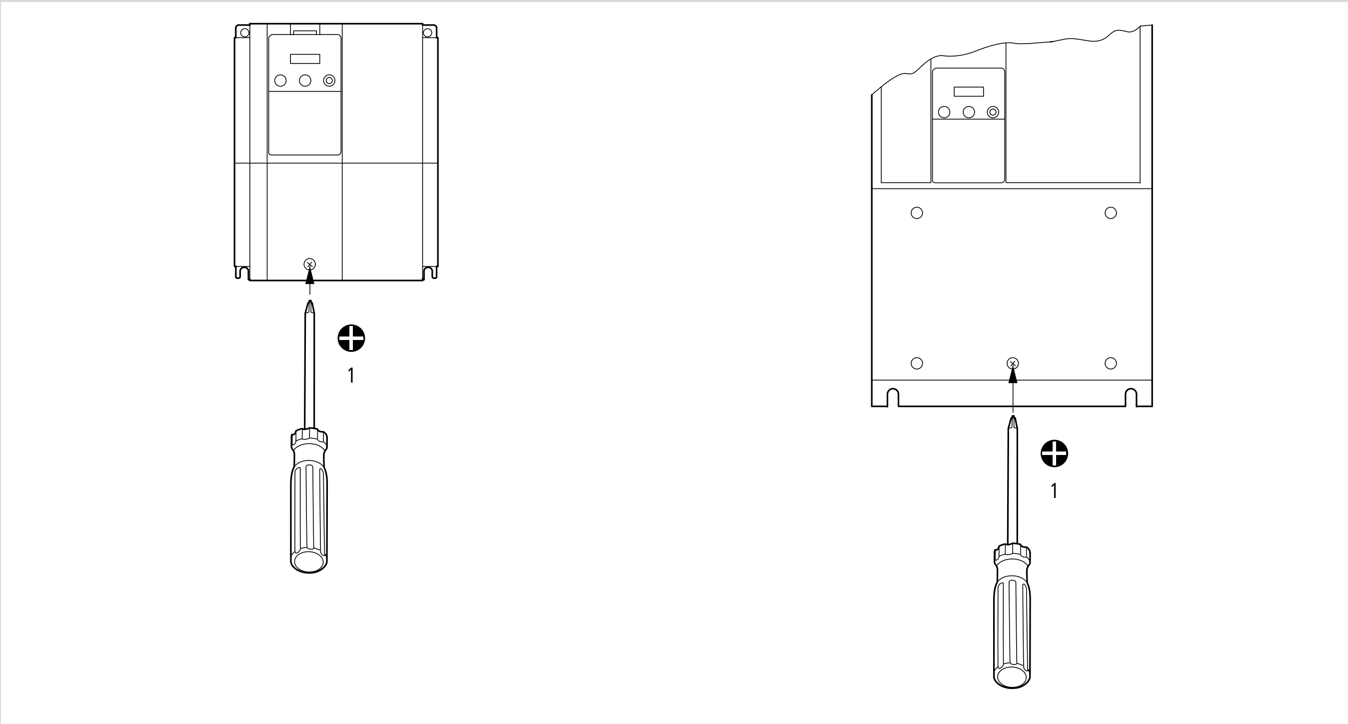


Figure 19: Loosening the screw

▶ Pull the terminal shroud upwards to remove it.

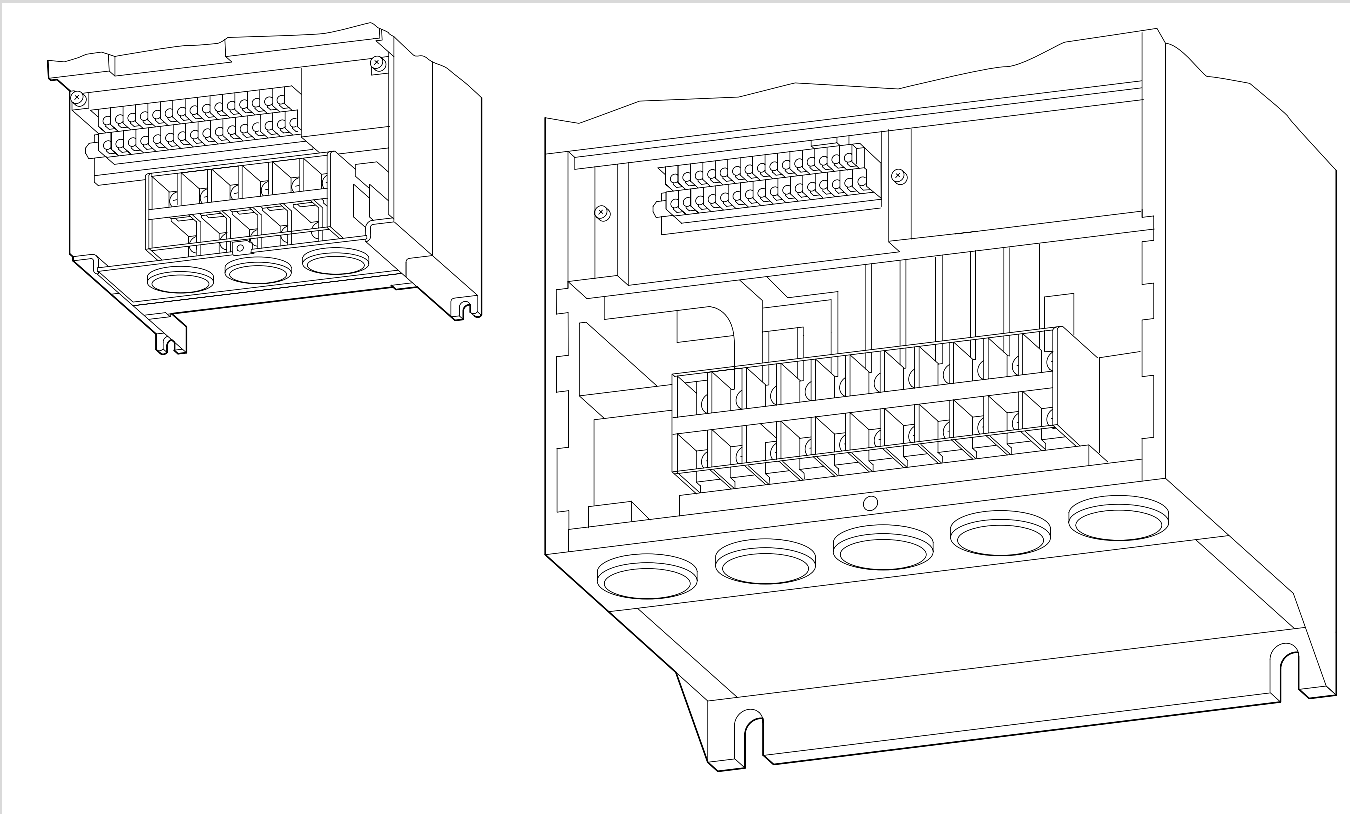


Figure 20: View of the power and control signal terminals

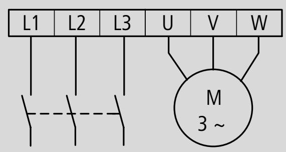
① Power terminals

② Control signal terminals

Power terminal arrangement

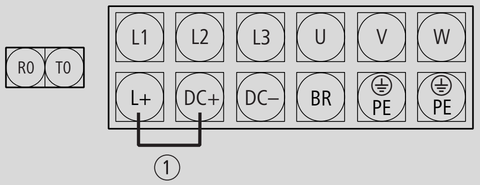
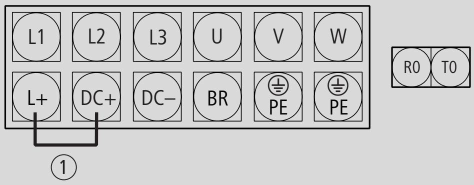
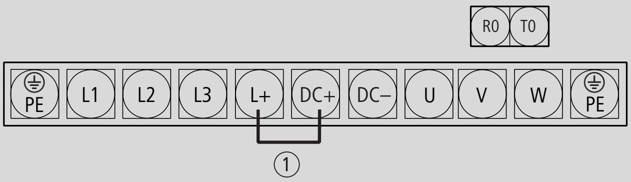
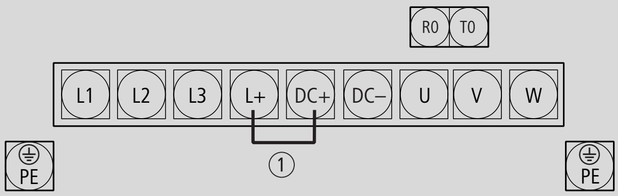
Table 3: Description of the power terminals

Terminal designation	Function	Description
L1, L2, L3	Supply voltage (mains voltage)	Three-phase mains voltage: Connection to L1, L2, L3
U, V, W	Frequency inverter output	Connection of a three-phase motor
L+, DC+	External DC choke	Normally, the terminals L+ and DC+ are fitted with a jumper. If a DC link choke is used, remove this jumper.
DC+, DC–	DC link	These terminals are used for connecting an optional braking resistor and for DC linking and supplying DC power to multiple frequency inverters.
BR, DC+	External braking resistance	These terminals are used for connecting an optional external braking resistor.
R0, T0	Control electronics supply voltage	The voltage supply for the control electronics is provided internally through connector J51 by tapping off L1 and L3. The control electronics can also be supplied externally.
⏚, PE	Earthing	Enclosure earthing (prevents dangerous voltages on the enclosure in the event of a malfunction)



The arrangement of the power terminals is shown in the figure below.

Table 4: Arrangement of the power terminals

DV6-340-075 to DV6-340-5K5	
DV6-340-7K5 DV6-340-11K	
DV6-340-15K to DV6-340-55K	
DV6-340-75K to DV6-340-132K	

① Internal connection. Remove if a DC link choke is used.

Power terminal connection

Warning!
Select a frequency inverter according to the available supply voltage (→ Section "Appendix", Page 185):

- DV6: Three-phase 400 V (342 to 528 V ± 0 %)

Warning!
Never connect mains voltage to the output terminals U, V and W. Danger of electrical shock or fire.

Warning!
Each phase of the supply voltage for the frequency inverter must be protected with a fuse (danger of fire).

Warning!
Make sure that all power cables are correctly tightened in the power section.

Warning!
The frequency inverter must be earthed. Danger of electrical shock or fire.

Laying the cables

Lay the cables for the power section separately from the signal cables and control cables.

The connected motor cables must be screened. The maximum cable length must not exceed 50 m. With larger cable lengths, a motor choke is required for d*u*/d*t* limitation

If the cable leading from the frequency inverter to the motor is longer than about 10 m, the fitted thermal overload relays (bimetallic relays) may malfunction due to high frequency harmonics. Install a motor filter on the output of the frequency inverter in this case.

Tightening torques and conductor cross-sections

Warning!
To prevent inadvertent loosening, tighten the screws on the terminals sufficiently (→ Table 5).

▶ Tighten the cable connections according to Table 5.

Table 5: Tightening torques and conductor cross-sections for the power terminals

L1, L2, L3 L+, DC+, DC–, BR U, V, W, PE DV6-340-	mm²	AWG	mm		Ø	Nm	⊕	Nm
075	1.5	20	< 13	M4	4.5	1.5	1	–
1K5	2.5	18						
2K2		16						
4K0		14						
5K5				M5	5.5	2.5		
7K5	4	10	< 17					
11K	6	8		M6	6.5	4.9		
15K	10	6						
18K5	16	6	< 18					
22K		4						
30K	25	3	< 23					
37K	35	1						
45K				M8	8.5	–	–	8.8
55K	2 × 35	1/0						
75K		2 × 1 (75 °C)	< 29					
90K	2 × 50			M10	10.5			13.7
110K	2 × 70	2 × 1/0	< 40					
132K		2 × 2/0						

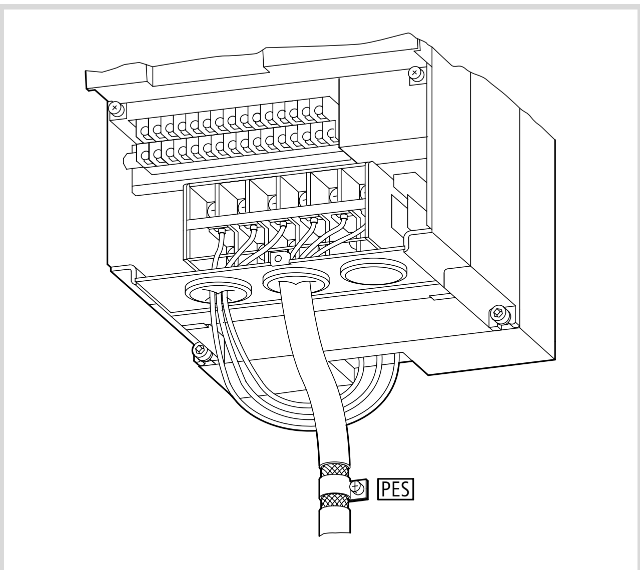


Figure 21: Cable connection to the power terminals

Connecting the supply voltage

▶ Connect the supply voltage to the power terminals L1, L2, L3 and PE:

Connecting external supply voltage for the control electronics

If you also want to program the DV6 frequency inverter with the power supply switched off, connect an external power supply (L1 and L3) to terminals R0 and T0. Tis is done as follows:

R0, T0	**mm^2**	**AWG**		**mm**		**Nm**	
DV6-340-...	1.5 to 2.5	16 to 14	8 to 10	9	M4	1.2 to 1.38	1

▶ Remove the screws on terminals R0 and T0 and remove connector J51.

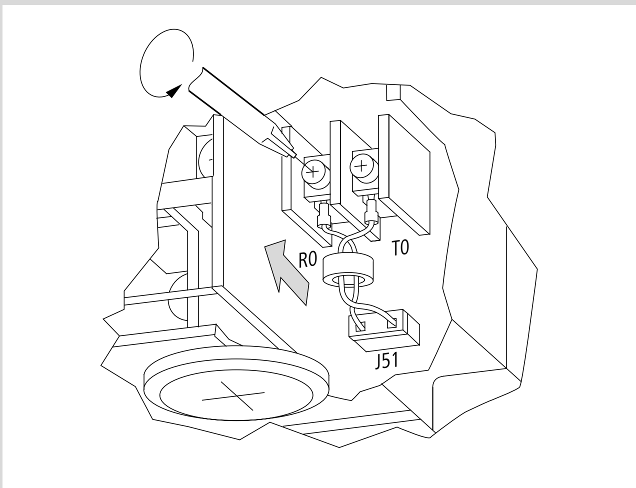


Figure 22: Remove the connection of J51 to R0 and T0

▶ Remove the ferrite rings from both cables.

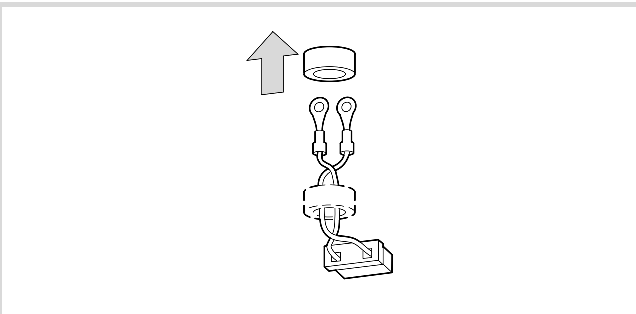


Figure 23: Remove the ferrite rings

▶ Push the ferrite rings onto both of the external supply voltage cables (L1 and L3).

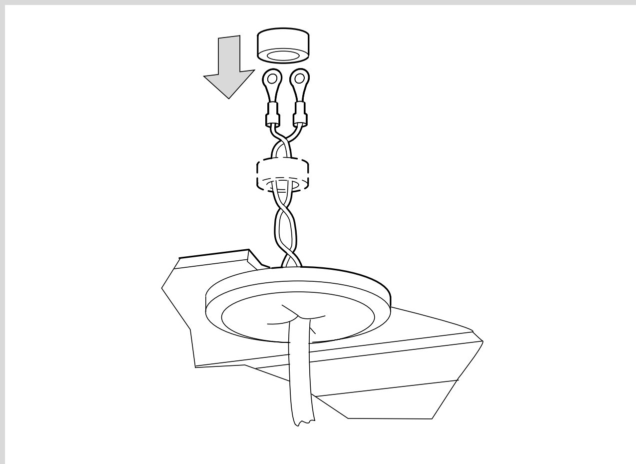


Figure 24: Push on the ferrite rings

▶ Screw on the cables of the external voltage supply to the terminals R0 and T0.

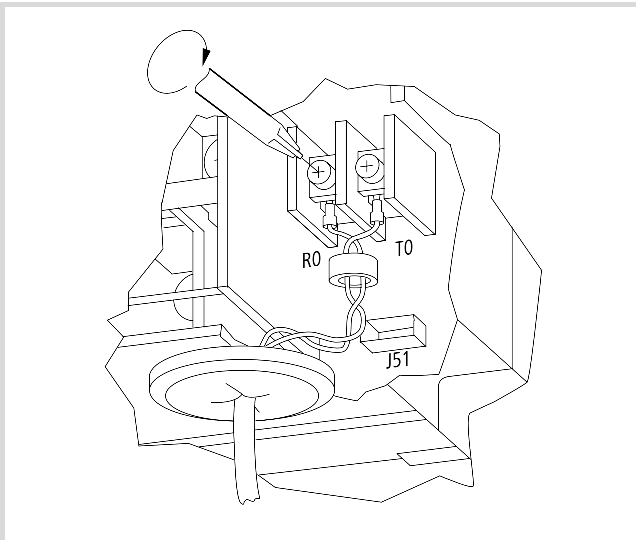


Figure 25: Connecting the external supply voltage

Connecting the motor cable

▶ Connect the motor cable to the U, V, W and PE terminals:

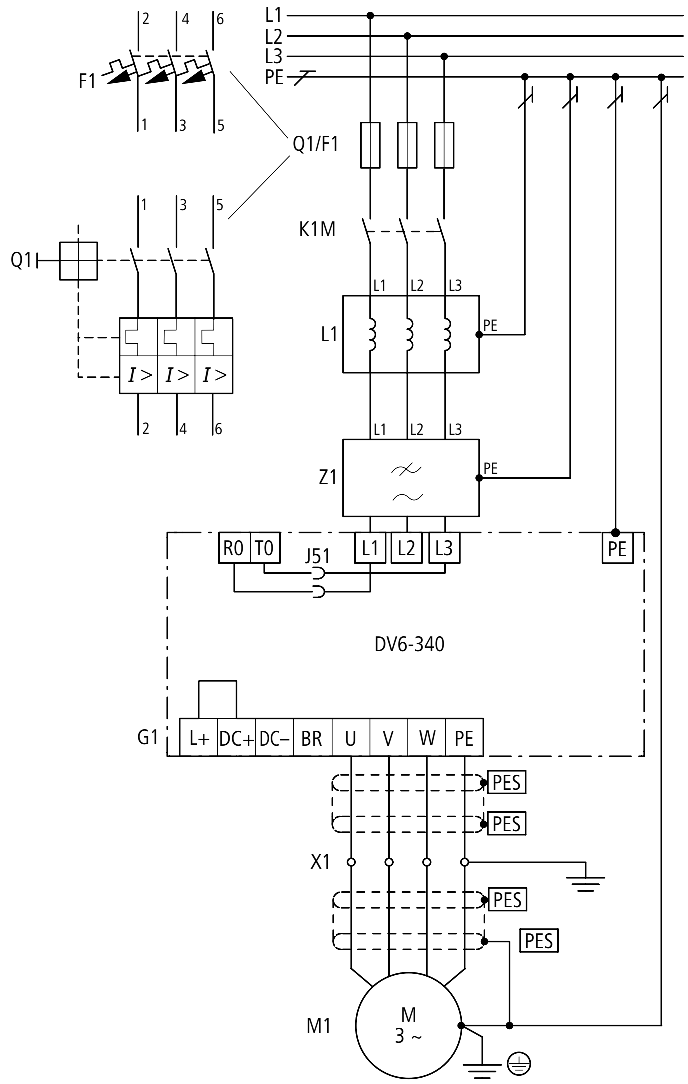


Figure 26: Power terminal connection

F1, Q1: Line protection

K1M: Mains contactor

L1: Mains choke

Z1: RFI filter

→ Observe the electrical connection data (rating data) on the rating label (nameplate) of the motor.

The stator winding of the motor can be connected in a star or delta configuration in accordance with the rating data on the name-plate.

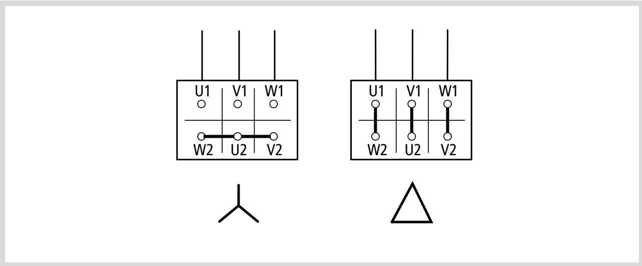


Figure 27: Connection types

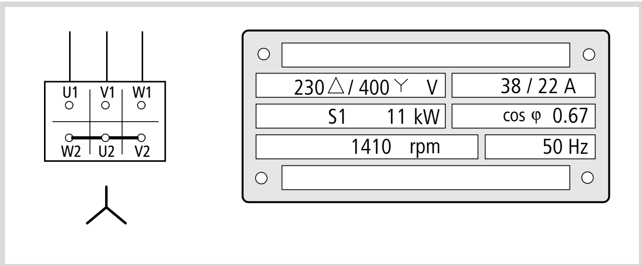


Figure 28: Example in motor star circuit

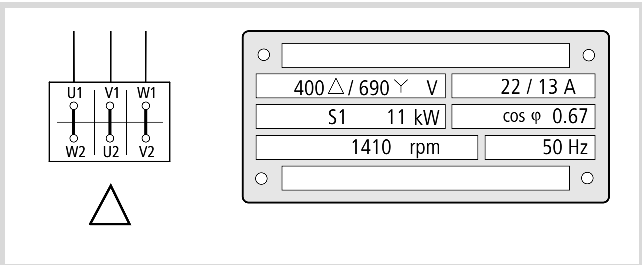


Figure 29: Example in motor delta circuit

> **Warning!**
> If motors are used whose insulation is not suitable for operation with frequency inverters, the motor may be destroyed.

If you use a motor filter or a sinusoidal filter here, the rate of voltage rise can be limited to values of about 500 V/µs (DIN VDE 0530, IEC 2566).

By default, the DV6 frequency inverters have a clockwise rotation field. Clockwise rotation of the motor shaft is achieved by connecting the motor and frequency inverter terminals as follows:

Motor	DV6
U1	U
V1	V
W1	W

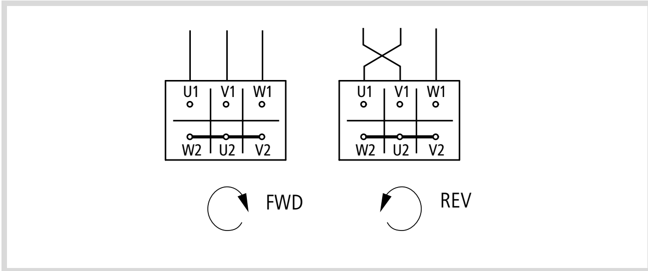


Figure 30: Direction of rotation, change of direction

With the DV6, the direction of rotation of the motor shaft can be reversed by:

- swapping two of the phase connections on the motor
- actuating terminal FW (clockwise) or 8
  (default: REV = anticlockwise)
- applying a control command through the interface or fieldbus interface connection

The speed of a three-phase motor is determined by the number of pole pairs and the frequency. The output frequency of the DV6 frequency inverter is indefinitely variable from 0.1 to 400 Hz.

Pole-changing three-phase motors (Dahlander pole-changing motors), rotor-fed three-phase commutator shunt motors (slipring rotor) or reluctance motors, synchronous motors and servo motors can be connected, provided they are approved for use with frequency inverters by the motor manufacturer.

> **Warning!**
> The operation of a motor at speeds above its rated speed (indicated on nameplate) can cause mechanical damage to the motor (bearings, unbalance) and the machinery to which it is connected and can lead to dangerous operating conditions!

> **Caution!**
> Uninterrupted operation in the lower frequency range (less than about 25 Hz) can lead to thermal damage (overheating) of self-ventilated motors. Possible countermeasures include over-dimensioning or external cooling independent of motor speed.
>
> Observe the manufacturers recommendations for operating the motor.

Parallel connection of motors to a single frequency inverter

DV6 frequency inverters can control several parallel-connected motors. If the motors are to run at different speeds, this must be implemented through the number of connected pole pairs and/or the gear transmission ratio.

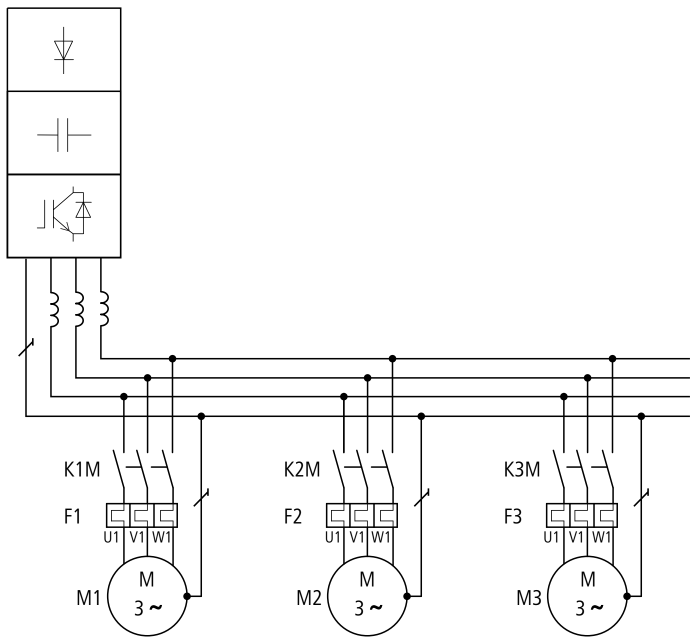


Figure 31: Parallel connection of multiple motors

Caution!
If a frequency inverter controls a number of motors in parallel, the contactors for the individual motors must be designed for AC-3 operation. Do not use the mains contactors listed in table in the appendix (Section "Mains contactors", Page 195). These mains contactors are designed only for the mains (primary) currents of the frequency inverter. If they are used in multiple-motor circuits, their contacts may weld.

Connecting motors inparallel reduces the load resistance at the frequency inverter output, reduces the total stator inductivity is and increases the leakage capacitance. As a result, the current distortion is larger than it is in a single-motor circuit. To reduce the current distortion, chokes or sinusoidal filters can be connected at the frequency inverter output.

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

→ Electronic motor protection can not be used when operating the frequency inverter with a several connected motors. You must however, protect each motor with thermistors and/or overload relays.

If motors with widely differing ratings (for example 0.75 kW and 4.0 kW) are connected in parallel to the output of a frequency inverter, problems may arise during starting and at low speeds. Motors with a low rating may be unable to develop the required torque. This is due to the relatively high ohmic resistances of their stators. They require a higher voltage during the start phase and at low speeds.

Motor cable

To ensure electromagnetic compatibility, use only screened motor cables. The length of the motor cable and the associated use of further components has an influence on the motor control mode and the performance characteristics. In parallel operation (multiple motors connected to the frequency inverter output), the resulting cable lengths l_{res} must be calculated:

$$l_{res} = \Sigma l_M \times \sqrt{n_M}$$

Σl_M: Sum of all motor cable lengths

n_M: Number of motor circuits

→ With long motor cables, the leakage currents caused by parasitic cable capacities can cause the "earth fault" message. In this case, motor filters must be used.

Keep the motor cables as short as possible as it will positively influence the drive's characteristics.

Motor choke, d*u*/d*t* filters, sinusoidal filters

Motor chokes compensate for capacitive currents with long motor cables and with grouped drives (multiple connection of parallel drives to a single inverter).

The use of motor chokes is recommended (observe the manufacturers instructions):

- for grouped drives
- for the operation of three-phase current asynchronous motors with maximum frequencies greater than 200 Hz,
- for the operation of reluctance motors or permanently excited synchronous motors with maximum frequencies above 120 Hz.

d*u*/d*t* filters are used for limiting the rate of voltage rise at the motor terminals to values below 500 V/µs. They should be applied for all motors with unknown or insufficient insulation withstand voltage.

Caution!
During the engineering phase, keep in mind that the voltage drop across motor filters and d*u*/d*t* filters can be up to 4 % of the frequency inverter's output voltage.

When sinusoidal filters are used, the motor supply voltage and current are almost sinusoidal.

Caution!
During the engineering phase, keep in mind that the sinusoidal filter must be matched to the output voltage and to the frequency inverter's pulse frequency.

The voltage drop on the sinusoidal filter can be up to 15 % of the frequency inverter's output voltage.

Bypass operation

If you want to have the option of operating the motor with the frequency inverter or directly from the mains supply, the incoming supplies must be mechanically interlocked:

Caution!
A changeover between the frequency inverter and the mains supply must take place in a voltage-free state.

Warning!
The frequency inverter outputs (U, V, W) must not be connected to the mains voltage (destruction of the device, risk of fire).

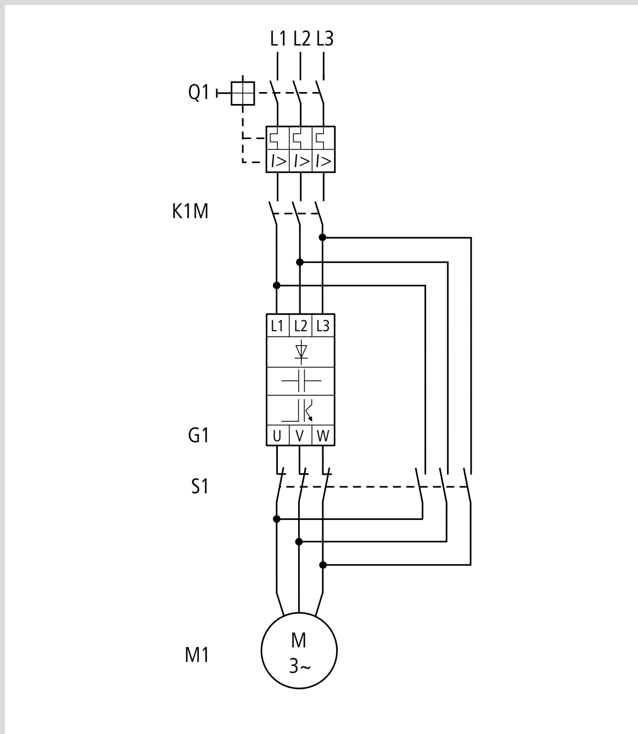
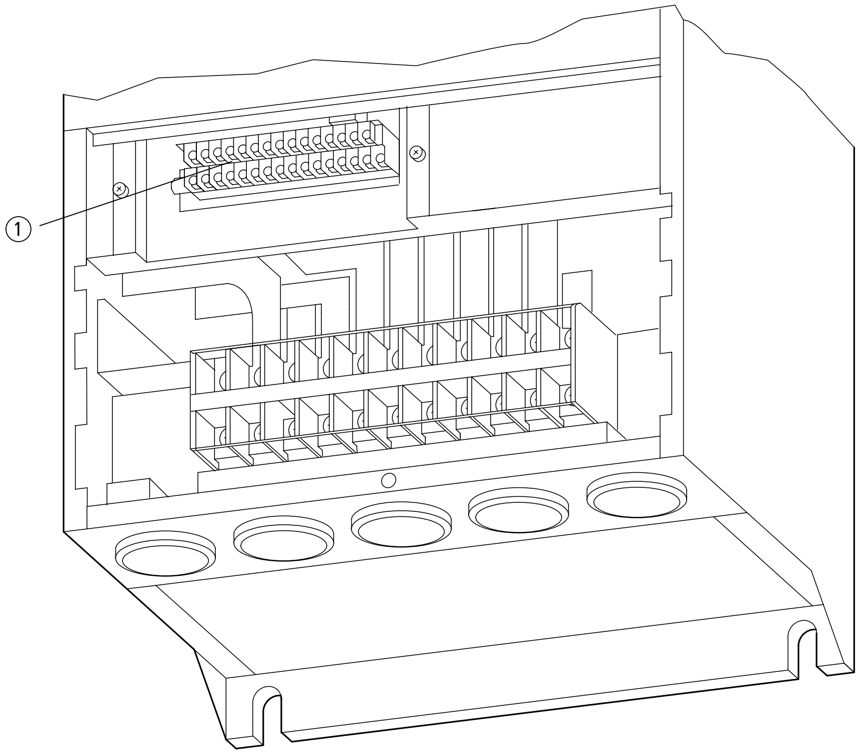


Figure 32: Bypass motor control

Connecting the control signal terminals

The figure below shows the arrangement of the individual control signal terminals.



h	O2	AM	FM	TH	FW	8	CM1	5	3	1	14	13	11	K14	
L	O	OI	AMI	P24	PLC	CM1	7	6	4	2	15	CM2	12	K11	K12

Figure 33: Location of the control signal terminals

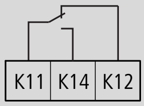
(1) Control signal terminals

ESD measures
Discharge yourself on an earthed surface before touching the frequency inverter and its accessories.
This prevents damage to the devices through electrostatic discharge.

Function of the control signal terminals

Table 6: Meaning of the control signal terminals

No.	Function	Level	WE	Technical data, description
Supply voltages				
h	Setpoint voltage output	+10 V ⎓	–	Supply voltage for external setpoint potentiometer. Load carrying capacity: 20 mA Reference potential: Terminal L
P24	Control voltage output	+24 V ⎓	–	Supply voltage for actuation of digital inputs 1 to 8 and FW. Load carrying capacity: 100 mA Reference potential: Terminal CM1
Reference potentials				
CM1	Reference potential	0 V	–	Reference potential terminals 1 to 8, FM, FW, TH and P24
CM2	External control voltage input	Up to 27 V	–	Connection: reference potential (0 V) of the external voltage source for the transistor outputs, terminals 11 to 15. Load carrying capacity: Up to 250 mA (sum of terminals 11 to 15)
L	Reference potential	0 V	–	Reference potential, terminals AM, AMI, H, O, OI and O2
PLC	Common connection, terminals 1 to 8 and FW	By default, the frequency inverters are supplied with a link between PLC and CM1, so that the potential on terminal PLC – and therefore on the digital inputs that are not energized – is 0 V (negative logic). If PLC is applied to P24, the control logic is positive.		
Digital inputs				
1	Digital input	HIGH = +12 to +27 V LOW = 0 to +3 V	RST = reset	PNP logic, configurable, R_i = 4.7 kΩ Reference potential: Terminal CM1
2			AT = analog input changeover	
3			JOG = jog mode	
4			FRS = controller inhibit	
5			2CH = second parameter set	
6			FF2 = fixed frequency 2	
7			FF1 = fixed frequency 1	
8			REV = anticlockwise operation	
FW	Digital input, clockwise operation		–	R_i = 4.7 kΩ Reference potential: Terminal CM1
Analog inputs				
O	Analog input	0 to +10 V ⎓	Frequency setpoint value (0 to 50 Hz)	R_i = 10 kΩ Reference potential: Terminal L
OI	Analog input	4 to 20 mA	Frequency setpoint value (0 to 50 Hz)	R_B = 250 Ω Reference potential: Terminal L
O2	Analog input frequency setpoint	–10 V to +10 V ⎓	–	Resolution: 12 bit Input impedance: 10 kΩ Reference potential: Terminal L
TH	Thermistor input		–	Minimum thermistor rating: 100 mW Reference potential: Terminal CM1

No.	Function	Level	WE	Technical data, description
Digital outputs				
11	Transistor output	Up to 27 V = CM2	Frequency setpoint reached	Configurable, open collector Load carrying capacity: Up to 50 mA
12			RUN (operation)	
13			Overload alarm	
14			Torque exceeded	
15			Intermittent mains failure	
Relay output				
K11	Programmable relay output		AL = fault message  	Default settings: • Operating signal: K11-K14 closed. • Fault message or power supply off: K11-K12 closed Characteristics of the relay contacts: • K11-K14 – Maximum 250 V AC/2 A (resistive) or 0.2 A (inductive, p.f. = 0.4); minimum 100 V AC/10 mA – Maximum 30 V DC/8 A (resistive) or 0.6 A (inductive, p.f. = 0.4); minimum 5 V DC/100 mA • K11-K12 – Maximum 250 V AC/1 A (resistive) or 0.2 A (inductive, p.f. = 0.4); minimum 100 V AC/10 mA – Maximum 30 V DC/1 A (resistive) or 0.6 A (inductive, p.f. = 0.4); minimum 5 V DC/100 mA
K12				
K14				
Analog outputs				
AM	Voltage output	0 to +10 V ⎓	Frequency actual value	Resolution: 8 bit Load carrying capacity: 2 mA Reference potential: Terminal L
AMI	Current output	4 to 20 mA		Resolution: 8 bit $R_B \leqq 250\ \Omega$ Reference potential: Terminal L
FM	Frequency output	0 to +10 V ⎓	Frequency actual value (0 to 50 Hz)	Configurable, monitored DC voltage; 10 V corresponds to set final frequency (50 Hz). Accuracy: ±5 % from final value Load carrying capacity: 1.2 mA Reference potential: Terminal CM1

Control signal terminal wiring

Wire the control signal terminals as appropriate for their application. For instructions for changing the function of the control signal terminals, → Kapitel „Programming the control signal terminals“, Page 53.

Caution!
Never connect terminal P24 with terminals L, H, OI or FM.

Caution!
Never connect terminal H with terminal L.

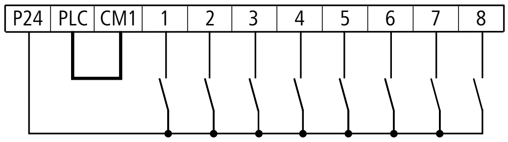
Use twisted or screened cables for connecting to the control signal terminals. Earth the screen on one side with a large contact area connection near the frequency inverter. The cable length should not exceed 20 m. For longer cables, use a suitable signal amplifier.

Actuating the digital inputs

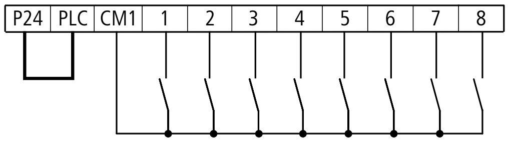
The DV6 has eight digital inputs, which are connected internally with terminal PLC. By default, power is supplied through the internal 24 V supply. For this purpose, terminals PLC and CM1 are connected with a jumper. If the digital inputs are to be supplied from an external source, remove this jumper.

The digital inputs can be operated both with positive (default setting) and with negative logic. To set it to negative logic, remove the jumper between terminals PLC and CM1 and connect terminals PLC and P24 with this jumper. If you are using an external power supply, you can connect the negative pole (positive logic) or the positive pole (negative logic) with terminal PLC.

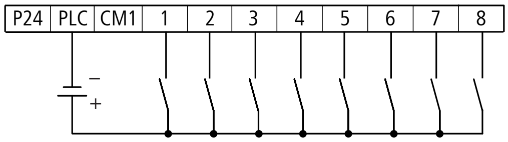
Actuating the digital inputs with **internal** supply voltage and **positive** logic (default)



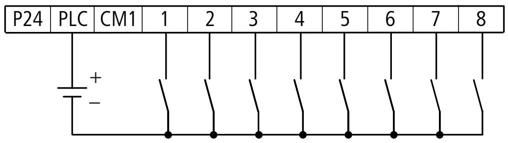
Actuating the digital inputs with **internal** supply voltage and **negative** logic



Actuating the digital inputs with **external** supply voltage and **positive** logic



Actuating the digital inputs with **external** supply voltage and **negative** logic



The figure below shows a sample protective circuit for the control signal terminals

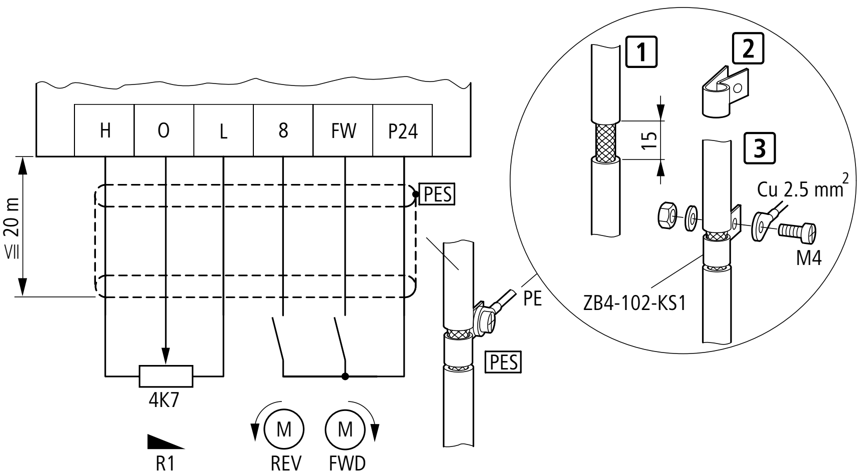


Figure 34: Control terminal connection (factory setting)

If a relay is connected to one of the digital outputs 11 to 15 or 12, connect a free-wheel diode in parallel to the relay to prevent destruction of the digital outputs through the self-induced e.m.f. which results when the relay is switched off.

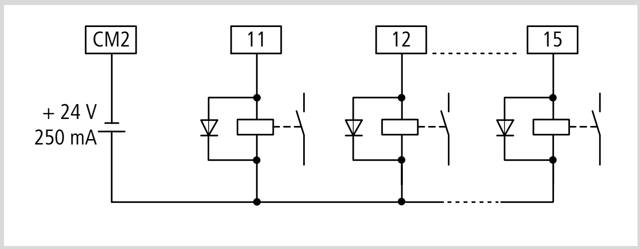


Figure 35: Relay with free-wheel diode

→ Use relays that switch reliably at 24 V ⎓ and a current of about 3 mA.

→ Route the control and signal cables separately from the mains and motor cables.

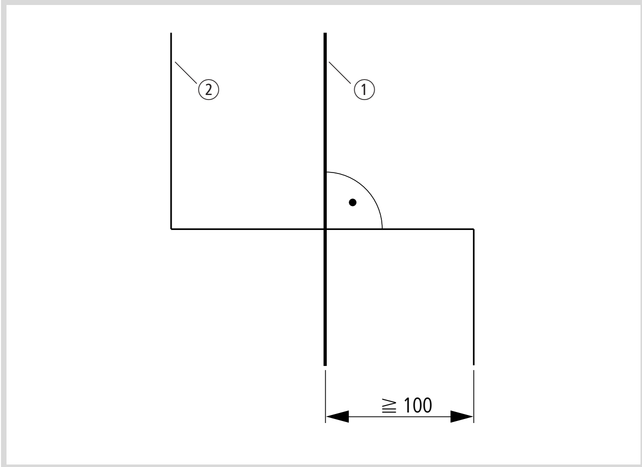


Figure 36: Crossover of signal and power cables

① Power cable: L1, L2, L3, U, V, W, L+, DC+, DC–, R0, T0

② Signal cables: H, O, OI, O2, L, FM, AM, AMI,1 to 8, 11 to 15, CM1, CM2, P24, TH, K11, K12, K14

Example for the protective circuit of the digital inputs using the internal P24 supply voltage or a separate external 24 V power supply:

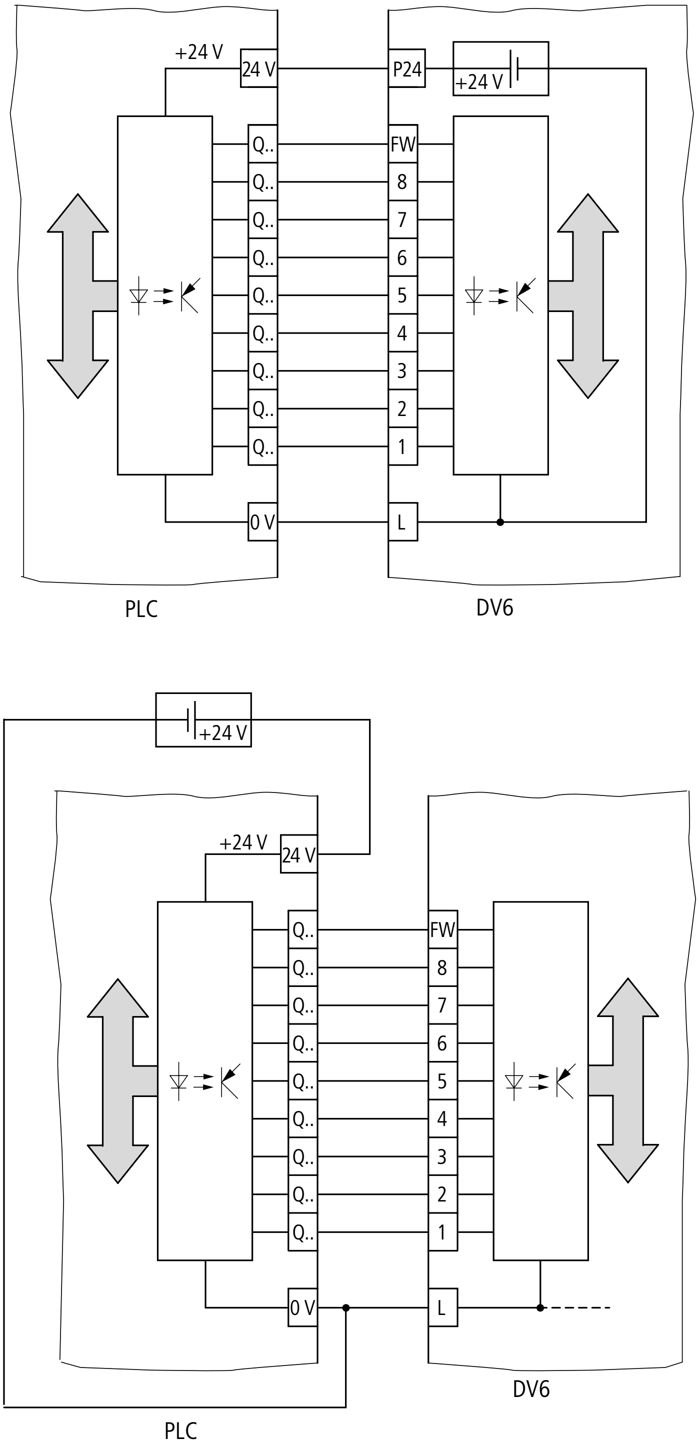


Figure 37: Actuating the digital inputs

Having made all cable connections, refit the terminal shroud on the frequency inverter and tighten the screw.

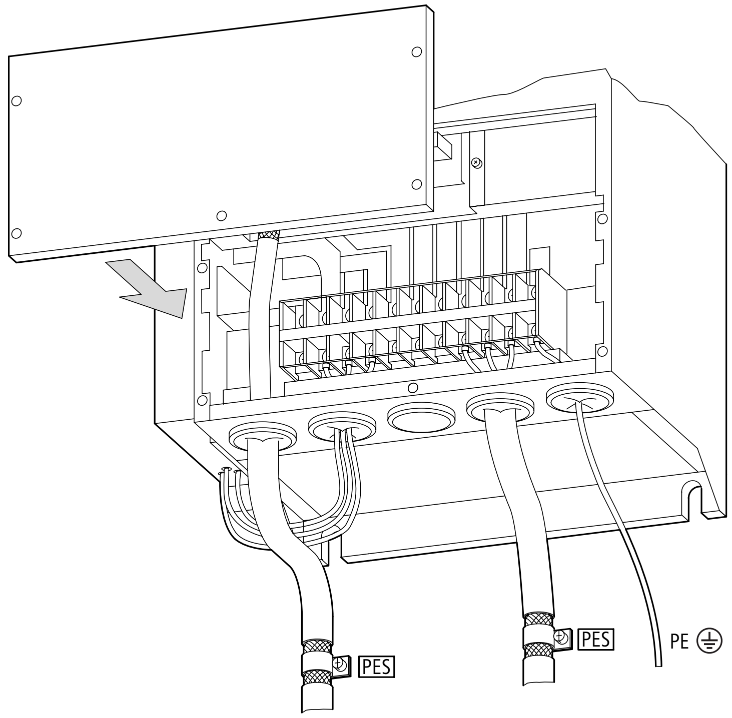


Figure 38: Close the terminal shroud

4 Operating the DV6

This section describes how to take the DV6 frequency inverter into operation and what you should observe during its operation.

Initial startup

Observe the following points before you take the frequency inverter into operation:

- Make sure that the power lines L1, L2 and L3 and the frequency inverter outputs U, V and W are connected correctly.
- The control lines must be connected correctly.
- The earth terminal must be connected correctly.
- Only the terminals marked as earthing terminals must be earthed.
- The frequency inverter must be installed vertically on a non-flammable surface (e.g. a metal surface).
- Remove any residue from wiring operations – such as pieces of wire – and all tools from the vicinity of the frequency inverter.
- Make sure that the cables connected to the output terminals are not short-circuited or connected to earth.
- Ensure that all terminal screws have been sufficiently tightened.
- Make sure that the frequency inverter and the motor are correct for the mains voltage.
- The configured maximum frequency must match the maximum operating frequency of the connected motor.
- Never operate the frequency inverter with opened power section covers.

Caution!
Do not carry out h.v. tests. Built-in overvoltage filters are fitted between the mains voltage terminals and earth, which could be destroyed.

→ Sparkover voltage and insulation resistance tests (megger tests) have been carried out by the manufacturer.

The control signal terminals are wired as follows.

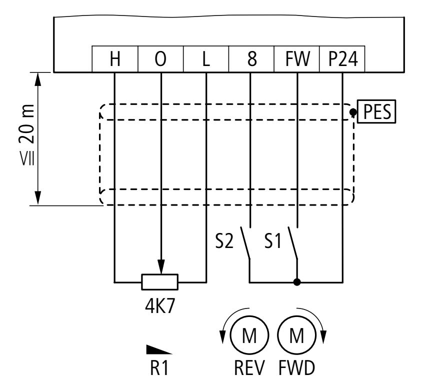


Figure 39: Connecting the control signal terminals (default settings)

▶ Switch on the supply voltage.

The POWER and Hz LEDs light up (keypad). The display should indicate 0.0.0.

▶ Close switch S1 (FW = clockwise operation).
▶ With potentiometer R1, you can set the frequency and therefore the motor speed.

The motor turns clockwise and the display indicates the set frequency.

▶ Open switch S1.

The motor speed is reduced to zero (display: 0.00).

▶ Close switch S2 (REV = anticlockwise operation).
▶ With potentiometer R1, you can set the frequency and therefore the motor speed.

The motor turns anticlockwise and the display indicates the set frequency.

▶ Open switch S2.

The motor speed is reduced to zero (display: 0.00).

If both switches S1 and S2 are closed, the motor will not start. If you close both switches during operation, the motor speed is reduced to zero.

Caution!
During or after intitial operation, check the following points to prevent damage to the motor:

- Was the direction of rotation correct?
- Has a fault occurred during acceleration or deceleration?
- Was the frequency displayed correctly?
- Did any unusual motor noise or vibration occur?

If a fault has occurred due to overcurrent or overvoltage, increase the acceleration or deceleration time (→ Section "Acceleration time 1", Page 121 and Section "Deceleration time 1", Page 122).

By default, the ON key and the potentiometer on the keypad (→ Fig. 40 and → Table 7) have no assigned function. For details about activating these devices, → Section "Setting the frequency and start signal parameters", Page 123.

LCD keypad

The following illustration shows the LCD keypad of the DV6.

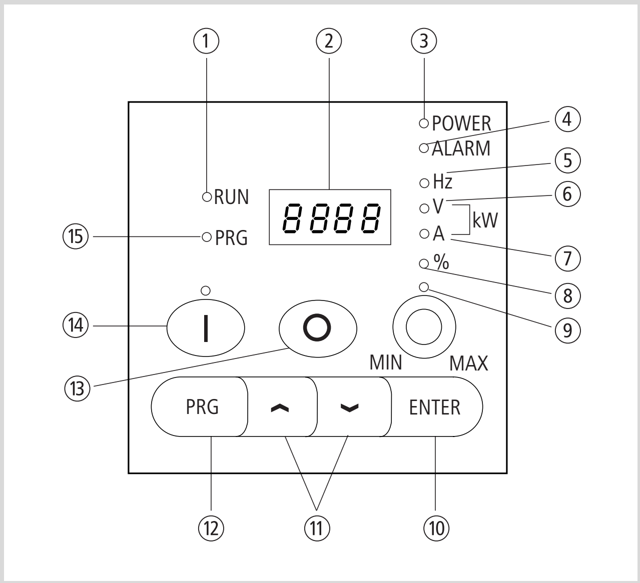


Figure 40: Keypad view

For an explanation of each of the elements, → Table 7.

Table 7: Explanation of the operating and indication elements

Number	Name	Explanation
①	RUN LED	LED lights up in **RUN mode** if the frequency inverter is ready for operation or operational.
②	7 segment display	Display for frequency, motor current, fault messages, etc.
③	POWER LED	LED is lit when the frequency inverter has power.
④	LED Alarm	LED is lit when a fault has occurred.
⑤	LED Hz	Indication in ②: Output frequency (Hz)
⑥, ⑦	LED V, A, kW	Indication in ②: Either output voltage (V) or output current (A) or a combined current and voltage factor (kW)
⑧	LED %	Indication in ②: Torque in %
⑨	Potentio-meter and LED	Frequency setpoint setting LED is lit when the potentiometer is activated.
⑩	ENTER key ENTER	This key is used for saving entered or changed parameters.
⑪	Arrow keys ⌃ ⌄	Selecting functions, changing numeric values ⌃ Increase ⌄ Reduce
⑫	PRG key PRG	Selecting and exiting the programming mode.
⑬	OFF key O	Stop the running motor and acknow-ledge a fault message. Active by default, also when actuation is through terminals.
⑭	On key and LED I	Starts the motor in the specified direc-tion (not active by default).
⑮	PRG LED	LED is lit during parameterization.

Operation with LCD keypad

The functions of the DV6 are organized in parameter groups. The following sections describe how to set the parameter values and how the setting menu is structured.

For a detailed description of the parameters, → Kapitel „Setting Parameters", Page 119.

Menu overview

The following figure shows the sequence in which the parameters appear on the display. Table 8 provides a brief description of the parameters.

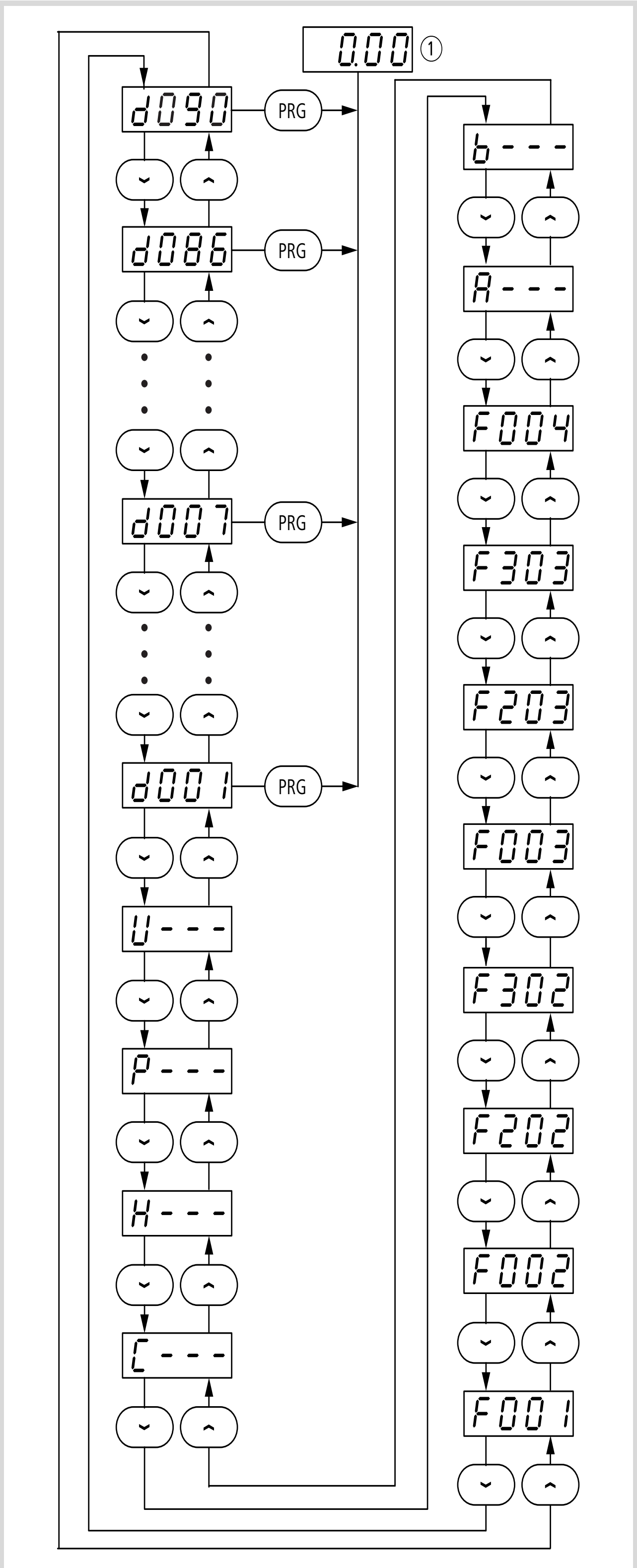


Figure 41: DV6 keypad menu structure

① The contents of this display depends on which display parameter (PNU d001 to d090) you have selected.

Table 8: Explanation of the parameters

Display	Explanation
Display parameter	
d001	Output frequency display
d002	Output current display
d003	Direction of rotation display
d004	PID feedback display
d005	Digital inputs 1 to 8 status
d006	Status of digital outputs 11 to 15
d007	Scaled output frequency
d012	Motor torque
d013	Output voltage
d014	Electrical input power
d016	Running time
d017	Mains On time
d080	Total fault count
d081	First (most recent) fault
d082	Second fault
d083	Third fault
d084	Fourth fault
d085	Fifth fault
d086	Sixth fault
d090	Warning
Basic parameters	
F001	Frequency setpoint adjustment
F002	Set acceleration time 1
F202	Set acceleration time 1 (second parameter set)
F302	Set acceleration time 1 (third parameter set)
F003	Set deceleration time 1
F203	Set deceleration time 1 (second parameter set)
F303	Set deceleration time 1 (third parameter set)
F004	Direction of rotation adjustment
Extended parameter groups	
A---	Extended functions group A
b---	Extended functions, group B
C---	Extended functions, group C
H---	Extended functions, group H
P---	Extended functions group P
U---	Extended functions group U

For a detailed description of the parameters, → Kapitel „Setting Parameters“, Page 119.

Changing display and Basic parameters

Press the PRG key to switch from display or RUN mode to programming mode. The PRG lamp lights up in this mode.

You can access the individual parameters or parameter groups with the UP and DOWN arrow keys (→ Fig. 41).

To access the programming mode, press the PRG key. You can modify the parameter values with the arrow keys.
Exceptions are the display parameters PNU d001 to d090. These parameters have no values. After you have selected a display parameter with the arrow keys, you can return to the display mode with the PRG key. The display then shows the selected display parameter (→ Section "Setting the display parameters", Page 120).

Parameter values can be accepted with the ENTER key or rejected with the PRG key.

To return to the display mode, press the PRG key in the display parameter range PNU d001 to d090.

Example for changing acceleration time 1: PNU F002
The frequency inverter is in display mode and the RUN lamp is lit.

▶ Press the PRG key.

The frequency inverter changes to the programming mode, the PRG lamp lights up and d001 or the most recently modified parameter appears on the display.

▶ Press the DOWN key until F002 appears on the display.
▶ Press the PRG key.

The set acceleration time 1 in seconds appears on the display (default value: 30.00).

▶ To change the set value, use the UP and DOWN arrow keys.

There are now two possibilities:

▶ Accept the displayed value by pressing the ENTER key.
▶ Reject the displayed value by pressing the PRG key.

The display shows F002.

▶ Press the UP key until d001 appears.
▶ Press the PRG key.

The frequency inverter changes to the display mode and displays the set frequency.

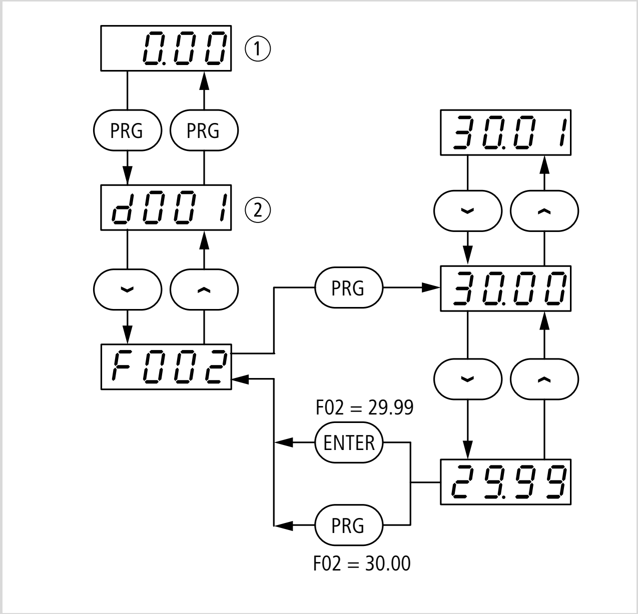


Figure 42: Change acceleration time 1

① Display dependent on the selected display parameter PNU d001 to d090
② Display of the most recently changed parameter

Changing the parameters of the extended parameter groups

The following example illustrates how to change PNU A03 of the extended parameter group A. You can also change the parameter values of groups B, C, H, P and U as described in the example. For a detailed description of the extended parameter groups, see from Section "Setting the frequency and start signal parameters", Page 123.

Example for changing the base frequency PNU A003
▶ Press the PRG key to change to the programing mode.

The most recently modified parameter appears on the display and the PRG lamp lights up.

▶ Press the UP or DOWN key until the extended parameter group A--- appears on the display.
▶ Press the PRG key.

A001 appears on the display.

▶ Press the UP key twice until A003 appears on the display.
▶ Press the PRG key.

The display shows the value entered under PNU A003 (default: 50.).

▶ To change the value, use the UP and DOWN arrow keys.

There are now two possibilities:

▶ Accept the displayed value by pressing the ENTER key.
▶ Reject the displayed value by pressing the PRG key.

The display shows A003.

▶ Press the PRG key.

The display shows A---.

▶ Press the UP key until d001 appears.
▶ Press the PRG key.

The frequency inverter changes to the display mode and displays the current frequency.

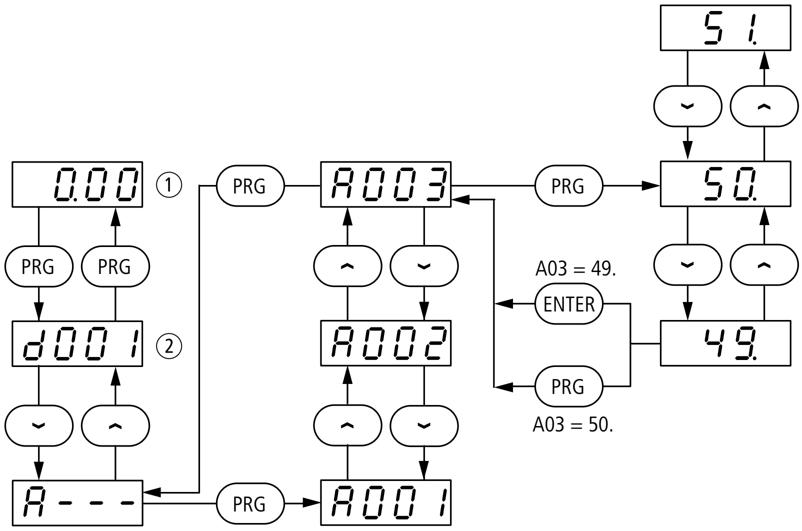


Figure 43: Change the base frequency (example with default setting)

① Display dependent on the selected display parameter PNU d001 to d090

② Display of the most recently changed parameter

Display after the supply voltage is applied

After the supply voltage is switched on, the last screen which was visible before switch off will reappear (but not within the extended parameter groups).

Connection examples

Operation using an external potentiometer

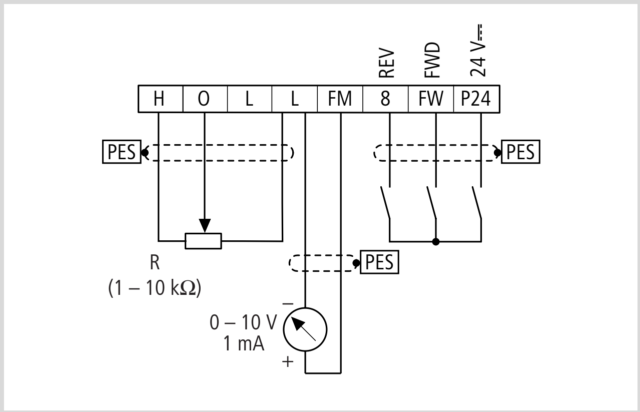


Figure 44: Connect an external potentiometer

Configuration of the parameters

PNU	Value	Function
a001	01	Setpoint definition through control signal terminal strip
a002	01	Start signal through FW(D)/REV terminals
F002	10	Acceleration time in s
F003	10	Deceleration time in s
–	–	FWD: Clockwise rotation on digital input FW
C008	01	REV: Start anticlockwise operation on digital input 8
C023	00	Indication of the output frequency (analog) through the measurement device connected to terminals L and FM
b081	80	Adjustment of the analog frequency display connected to terminals L and FM

Method of operation

You can start the frequency inverter in a clockwise direction with terminal FW and in an anticlockwise direction with terminal 8. If both terminals are closed simultaneously, a stop signal is issued.

With the externally connected potentiometer, the required frequency setpoint (voltage setpoint) can be defined.

You can use the measuring instrument to display the frequency (PNU C023 = 00) or the motor current (PNU C023 = 01). With PNU b081, you can match analog output FM to the measuring instrument's measuring range (indication: frequency or current).

Operation through an analog setpoint value

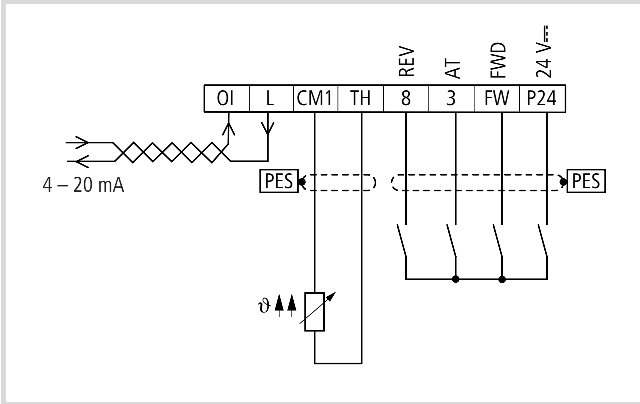


Figure 45: Analog setpoint definition

Configuration of the parameters

PNU	Value	Function
A001	01	Setpoint definition through control signal terminal strip
A002	01	Start signal through FW(D)/REV terminals
F002	10	Acceleration time in s
F003	10	Deceleration time in s
–	–	FWD: Start clockwise operation on digital input FW
C008	01	REV: Start anticlockwise operation on digital input 8
C003	16	AT: Changeover to current setpoint value (4 to 20 mA)

Method of operation

Inputs FW and 8 function exactly as described in the previous example.

With digital input 3 (configured as AT), you can change over from a voltage setpoint value (0 to 10 V) to a current setpoint value (4 to 20 mA).

Instead of a fixed or switched connection on terminal 3, you can set PNU C013 to 01. Digital input 3 is then configured as a break contact (NC).

The circuit example also includes a motor PTC thermistor. It is important to use a screened control cable and to lay the motor PTC thermistor cable separately from the other motor cables. However, the screen should be earthed at the inverter side only.

Operation with fixed frequencies

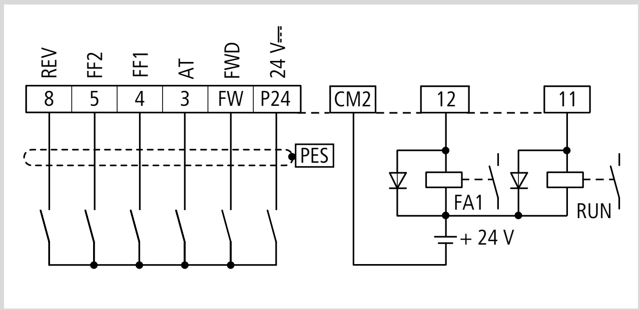


Figure 46: Fixed frequency definition

Configuration of the parameters

PNU	Value	Function
a001	01	Setpoint definition through control signal terminal strip
a002	01	Start signal through FWD/REV terminals
F002	10	Acceleration time in s
F003	10	Deceleration time in s
–	–	FWD: Clockwise rotation on digital input FW
C008	01	REV: Start anticlockwise operation on digital input 8
C003	16	AT: Changeover to current setpoint value (4 to 20 mA)
C004	02	FF1: Fixed frequency input 1
C005	03	FF2: Fixed frequency input 2
C021	00	RUN output signal on terminal 11
C022	01	FA1 output signal on terminal 12
a021	f_1	The fixed frequency to be applied when FF1 is active and FF2 is inactive is entered here.
a022	f_2	The fixed frequency applied when FF1 is inactive and FF2 is active is entered here.
a023	f_3	The fixed frequency is applied when FF1 and FF2 are both active is entered here.

Method of operation

Inputs FW and 8 function exactly as described in the first example.

With the activation of one or both fixed frequency inputs FF1 and FF2, the current frequency setpoint applied to the motor is replaced by the fixed frequency determined by FF1 and FF2, and the motor brakes or accelerates according to the fixed frequency applied. If neither of the fixed frequency inputs FF1 and FF2 is activated, the frequency setpoint is determined through analog inputs O (voltage setpoint value) or OI (current setpoint value). The wiring for these terminals is not shown in this circuit example. For the combination of the individual fixed frequency values, → Section "Fixed frequency selection (FF1 to FF4)", Page 69.

The circuit example also contains the parameter settings for one output signal each at terminals 11 and 12.The output signal type is configured with PNU C021 for digital output 11 and with C022 for digital output 12.

Operational warnings

Warning!
If the supply voltage recovers after an intermittent failure, the motor may restart automatically if a start signal is still present. If personnel is endangered as a result, an external circuit must be provided which prevents a restart after voltage recovery.

Warning!
If the frequency inverter has been configured so that the stop signal is not issued through the OFF key on the LCD keypad, pressing the OFF key will not switch off the motor.

Warning!
Before carrying out maintenance and inspection work on the frequency inverter, wait at least five minutes after the supply voltage has been switched off. Failure to observe this point can result in electric shock due to high equipment voltages.

Warning!
Never pull on the cable to unplug connectors (e.g. for fan or circuit boards).

Warning!
If a reset is issued after a malfunction, the motor will start automatically if a start signal is also present. To avoid the risk of serious or fatal injury to personnel, you must ensure that the start signal is not present before acknowledging a fault message with a reset.

Warning!
When the supply voltage for the frequency inverter is applied while the start signal is active, the motor will start immediately. Make sure that the start signal is not active before the supply voltage is switched on.

Warning!
Do not connect cables or connectors during operation when the supply voltage is switched on.

Caution!
To prevent a risk of serious or fatal injury to personnel, never interrupt the operation of the motor by opening the contactors installed on the primary or secondary side.

→ The ON key is functional only if the corresponding parameters of the frequency inverter have been configured accordingly (→ Section "Setting the frequency and start signal parameters", Page 123).

→ Before operating motors at frequencies above the standard 50 or 60 Hz, contact their manufacturers to verify that the motors are suitable for operation at higher frequencies. The motors could otherwise incur damage.

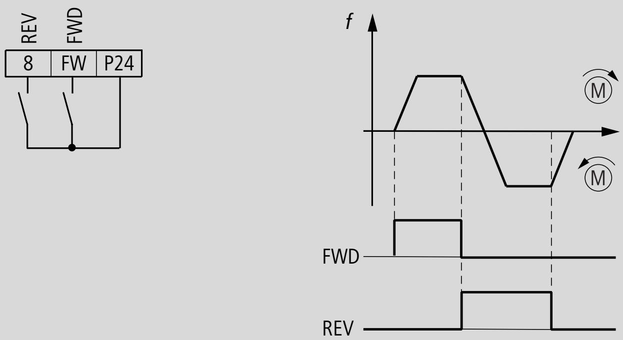
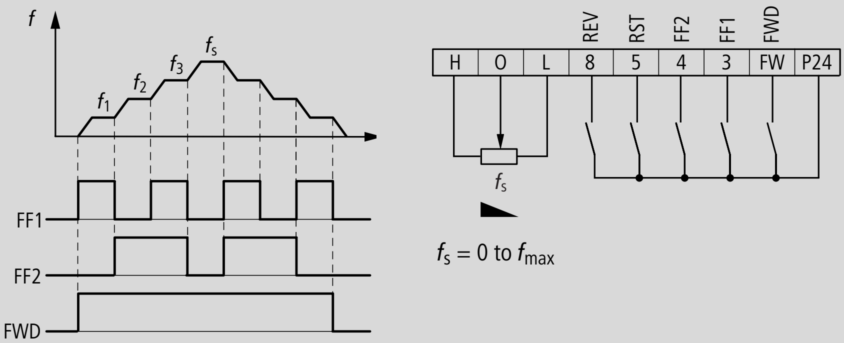
5 Programming the control signal terminals

This section describes how to assign various functions to the control signal terminals.

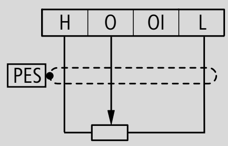
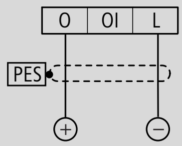
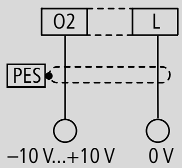
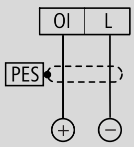
Overview

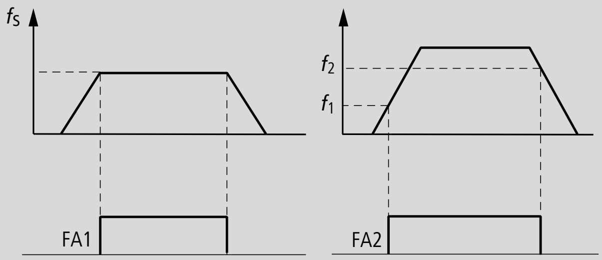
Table 9 provides an overview of the control signal terminals and a brief description of the functions which you can assign to the programmable digital inputs and outputs. For a detailed description of each function, → from Page 57.

Table 9: Description of the functions

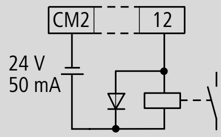
Name	Value[1)]	Function	Description
Digital inputs 1 to 8			Parameterizing PNU C01 to C08
REV	01	Anticlockwise operation (start/stop)	 REV input closed: motor starts up in an anticlockwise direction. REV input open: controlled motor deceleration to stop (anticlockwise). FW(D) and REV inputs closed simultaneously: controlled motor deceleration to stop.
FF1	02	Programmable fixed frequencies 1 to 4	Example: Four fixed frequencies 
FF2	03		
FF3	04		
FF4	05		For four fixed frequency stages (three programmable fixed frequencies and a setpoint value), two fixed frequency inputs (3 = FF1 and 4 = FF2) are required ($2^2 = 4$).
JOG	06	Jog mode	The jog mode, which is activated by switching on the JOG input, is used, for example, for setting up a machine in manual mode. When a start signal is received, the frequency programmed under PNU A38 is applied to the motor. Under PNU A39, you can select one of three different operating modes for stopping the motor.
DB	07	External brake	When the DB input is active, DC braking can be carried out.
SET	08	Selection of the second parameter set	Switching on SET allows you to select the second parameter set for setpoint frequency, torque boost, first and second acceleration/deceleration ramp and other functions. Parameters in the second parameter set are identified by a leading “2”, e.g. : PNU A**2**01

Name	Value[1)]	Function	Description
2CH	09	Second time ramp	Activates the second acceleration and deceleration time with PNU A92 and PNU A93 respectively
FRS	11	Controller inhibit (free run stop)	When FRS is switched on, the motor is immediately switched off and coasts to a stop.
EXT	12	External fault	When the EXT input is switched on, the fault signal activates PNU E12 and the motor switches off. The fault signal can be acknowledged, for example, with the RST input.
USP	13	Unattended start protection	When the USP input is switched on, unattended start protection is active. This prevents a motor restart when the voltage recovers after a mains failure while a start signal is present.
CS	14	Heavy mains starting	For starting drives with extremely high starting torques
SFT	15	Parameter protection	The parameter protection, which is activated by switching on the SFT input, prevents loss of the entered parameters by inhibiting write operations to these parameters.
AT	16	Setpoint input OI (4 to 20 mA) active	When the AT input is switched on, only setpoint value input OI (4 to 20 mA) is processed.
SET3	17	third parameter set	With the third parameter set, you can change the frequency inverter over to operate a third motor. Parameters in the third parameter set are identified by a leading "3", e.g. : PNU A**3**01
RST	18	Reset	To acknowledge a fault message, switch on the RST input. If a reset is initiated during operation, the motor will coast to a stop. The RST input is a make (NO) contact; it cannot be programmed as a break (NC) contact.
STA	20	Pulse start (3-wire)	These settings enable three-wire control of these three functions.
STP	21	Pulse stop (3-wire)	
F/R	22	Direction of rotation (3-wire)	
PID	23	Activation of PID control	Switching the internal PID controller on and off
PIDC	24	Resetting the integral component of the PID control	
CAS	26	Tacho-generator with vector control	When this input is activated, the speed controller operates with the values set under PNU H070, H071 and H072.
UP	27	Acceleration (motor potentiometer)	When input UP is switched on, the motor accelerates (available only if you have specified the frequency setpoint with PNU F001 or A020).
DWN	28	Deceleration (motor potentiometer)	When input DWN is switched on, the motor decelerates (available only if you have specified the frequency setpoint with PNU F001 or A020).
UDC	29	Reset frequency (motor potentiometer)	When the UDC input is switched on, the motor is controlled with the frequency set under PNU A020 (available only if you have specified the frequency setpoint with PNU F001 or A020).
OPE	31	Setpoint value through keypad	When this input is switched on, the frequency inverter operates with the frequency set at PNU F001.
SF1 to SF7	32 to 38	Bitwise fixed frequency selection	Motor control using a fixed frequency.
OLR	39	Current limit changeover	Change over to further current limitation parameters: PNU b024, b025, b026 (default: PNU b021, b022, b023)
TL	40	Torque limitation active	Only with vector control
TRQ1	41	Torque limitation 1 active	Inputs TRQ1 and TRQ2 provide bitwise control of the torque limits for the four quadrants.
TRQ2	42	Torque limitation 2 active	
PPI	43	P or PI control	Only with vector control

Name	Value[1)]	Function	Description
BOK	44	External brake enable signal confirmation	Confirmation of an external motor brake's Enable signal, for example on lifts, which the DV6 frequency inverter uses to monitor the brake's operating state.
ORT	45	Direction of rotation	Only with optional DE6-IOM-ENC module
LAC	46	Ramp function off	Only with optional DE6-IOM-ENC module
PCLR	47	Erase positioning deviations	Only with optional DE6-IOM-ENC module
STAT	48	Setpoint definition through module	Only with optional module
NO	no	–	No function
Non-programmable digital inputs			
FW	–	FWD = clockwise operation (start/stop)	Input FW(D) closed: motor starts up clockwise. Input FW(D) open: controlled motor deceleration from clockwise operation. FW(D) and REV inputs closed simultaneously: controlled motor deceleration to stop.
P24	–	24 V ⎓ for digital inputs	24 V ⎓ potential for digital inputs 1 to 8
Frequency setpoint input			
h	–	10 V setpoint voltage for external potentiometer	 *R*: 1 to 10 kΩ Resolution: 12-bit
O	–	Analog input for setpoint frequency through voltage signal (0 to 10 V ⎓)	 Input impedance: 10 kΩ $I \leqq 20$ mA Resolution: 12-bit
O2	–	Analog input for setpoint frequency through voltage signal (–10 to +10 V ⎓)	 Input impedance: 10 kΩ $I \leqq 20$ mA Resolution: 12-bit
OI	–	Analog input for setpoint frequency through current signal (4 to 20 mA)	 The OI input for a setpoint value from 4 to 20 mA is used only when the digital input configured as the AT input is closed. Load resistor: 250 Ω Resolution: 12-bit
L	–	0 V reference potential for setpoint inputs	If no digital input is configured as an AT input, the setpoint values O and OI are added together.
Analog outputs			
FM	–	Frequency output	You can assign the following variables to outputs AM, AMI and FM: Output frequency, motor current, torque, output voltage, input power, ramp frequency and thermal load ratio
AM	–	Voltage output (0 to 10 V, 8-bit)	
AMI	–	Current output (4 to 20 mA, 8-bit)	
L	–	0 V	0 V reference potential for the analog output

Name	Value[1)]	Function	Description
Programmable digital outputs 11 to 15			
RUN	00	RUN signal	The RUN signal is output during operation of the motor.
FA1	01	Signal when frequency is reached	 f_S = setpoint frequency
FA2	02	Signal when frequency is exceeded (1)	If a digital output is configured as FA1, a signal is issued as long as the setpoint value is reached. If a digital signal is configured as FA2, a signal is output as long as the frequencies defined under PNU C042 and PNU C043 are exceeded.
OL	03	Signal on overload	The OL signal is output when the overload alarm threshold (adjustable under PNU C041) is exceeded.
OD	04	Signal on PID control deviation	The OD signal is output when the PID control deviation set under PNU C044 is exceeded.
AL	05	Signal (alarm) on fault	The AL signal is issued when a fault occurs.
FA3	06	Frequency reached (1)	The FA3 signal is issued when the output frequency lies in the frequency range defined under PNU C042 and C043 (plus tolerance).
OTQ	7	Torque reached (exceeded)	The OTQ signal is output when the set torque is reached or exceed.
IP	8	Mains failure, immediate stop	The IP signal is issued on intermittent mains failure.
UV	9	Undervoltage signal	The UV signal is output on undervoltage.
TRQ	10	Torque limitation	The TRQ signal is output when the torque limits set under PNU b041 to b044 are reached.
RNT	11	Running time exceeded	The RNT signal is output when the running time set under PNU b034 is exceeded.
ONT	12	Mains On time exceeded	The ONT signal is output when the running time set under PNU b034 is exceeded.
THM	13	Motor thermal overload	The THM signal is output when the motor overload warning threshold set under PNU C061 is exceeded.
BRK	19	Enable signal for external brake	The BRK signal is output to enable an external brake; adjustable under PNU b120 to b126.
BER	20	Brake fault	The BER signal is output when the BOK input of the external brake is not deactivated; adjustable under PNU b120 to b126.
ZS	21	Zero speed	The ZS signal is output when the motor is at rest (zero speed).
DSE	22	Speed deviation exceeded	The DSE signal is output when the deviation of the actual speed from the setpoint value is greater than specified under PNU P027 (only with optional DE6-IOM-ENC module).
POK	23	Positioning	The POK signal is output when positioning has been completed (only with optional DE6-IOM-ENC module).

Connection of a signal relay to a digital output 11 to 15:



Transistor output (open collector) (maximum 27 V⎓, 50 mA)

Name	Value[1]	Function	Description
FA4	24	Frequency exceeded (2)	The FA4 signal is output when the frequency rises above the value under PNU C045 or falls below the value under PNU C046.
FA5	25	Frequency reached (2)	The FA5 signal is output when the frequency set under PNU C045 or C046 is reached (hysteresis).
OL2	26	Overload alarm 2	The OL2 signal is output when the motor current exceeds the value set under PNU C111.
CM2	–	0 V	0 V reference potential for programmable digital outputs 11 to 15. These are open collector outputs and are controlled through opto-couplers. CM2 is isolated from reference potential L.
Signalling relay[2]			
K11 K12 K14	–	Signalling relay contacts	During normal fault-free operation, terminals K11-K14 are closed. If a malfunction occurs or the supply voltage is switched off, the terminals K11-K12 are closed. Maximum permissible values: • 250 V ~; maximum load 2.5 A (purely resistive) or 0.2 A (with a power factor of 0.4) • 30 V ⎓; maximum load 3.0 A (purely resistive) or 0.7 A (with a power factor of 0.4) • Minimum required values: 100 V ~ at a load of 10 mA or 5 V⎓ at a load of 100 mA

1) To activate the function, enter this value in the corresponding parameter.
2) This output can be used as both a signal output and a normal digital output.

Analog outputs – AM, AMI and FM

The analog outputs provide various physical variables, which you can select and some of which you can adjust to meet your specific needs. Terminals AM, AMI and FM are connected to chassis through terminal L.

Voltage output (AM)

The AM terminal provides the variables listed in the table below in the form of a 0 to 10 V voltage signal.

- ▶ In PNU C028, specify the variable which the AM terminal is to provide.
- ▶ In PNU B080, specify the gain factor and in PNU C086 the offset.

PNU	Function	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b080	Gain, AM terminal	✓	✓	0 to 255	Gain of the voltage output	180
C028	Output, AM terminal	–	✓	00	Output frequency: 0 Hz to end frequency PNU A004 (→ Section "Maximum end frequency", Page 125)	00
				01	Output current: 0 to 200 %	
				02	Torque: 0 to 200 %	
				04	Output voltage: 0 to 100 %	
				05	Inverter input power: 0 to 200 %	
				06	Thermal load ratio: 0 to 100 %	
				07	Ramp frequency: 0 Hz to end frequency PNU A004 (→ Section "Maximum end frequency", Page 125)	
C086	Offset, AM terminal	✓	✓	0 to 10 V	Voltage increase	0.0

Current output (AMI)

The AMI terminal provides the variables listed in the table below in the form of a 4 to 20 mA current signal.

- ▶ In PNU C029, specify the variable which the AMI terminal is to provide.
- ▶ In PNU C087, specify the gain factor and in PNU C088 the offset.

PNU	Function	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C029	Output, AMI terminal	–	✓	00	Output frequency: 0 Hz to end frequency PNU A004 (→ Section "Maximum end frequency", Page 125)	00
				01	Output current: 0 to 200 %	
				02	Torque: 0 to 200 %	
				04	Output voltage: 0 to 100 %	
				05	Inverter input power: 0 to 200 %	
				06	Thermal load ratio: 0 to 100 %	
				07	Ramp frequency: 0 Hz to end frequency PNU A004 (→ Section "Maximum end frequency", Page 125)	
C087	Gain, AMI terminal	✓	✓	0 to 255	Current output gain	80
C088	Offset, AMI terminal	✓	✓	0 to 20 mA	Current increase	0.0

Frequency output (FM)

The FM terminal provides the variables listed in the table below in the form of a pulse-width modulated (PWM) signal (→ Fig. 47). An exception is the output frequency to which the value "03" is assigned which is output as a frequency modulated (FM) signal (→ Fig. 49).

- ▶ In PNU C027, specify the variable which the FM terminal is to provide.
- ▶ In PNU B081, specify the gain factor.

PNU	Function	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C027	Output, FM terminal	–	✓	00	Output frequency, PWM signal	00
				01	Output current	
				02	Torque: for SLV, 0 Hz SLV and vector control only	
				03	Output frequency: FM signal	
				04	Output voltage	
				05	Inverter input power	
				06	Thermal load ratio	
				07	Ramp frequency	
b081	Gain, FM terminal	✓	✓	0 to 255	Gain of the frequency output	60

PWM signal

The output signal is a square wave with a constant period of oscillation. Its pulse width is proportional to the current frequency value (0 to 10 V correspond to 0 Hz to the end frequency).

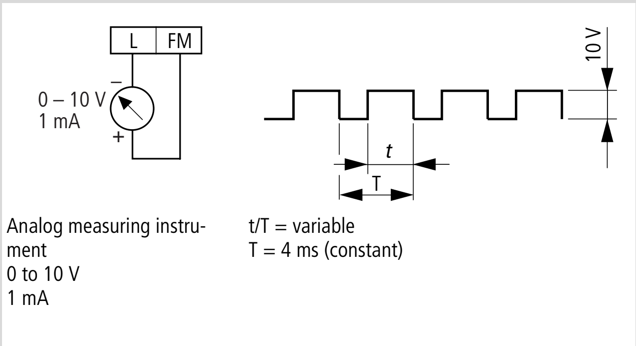


Figure 47: Connection of analog measuring instrument

If for example, a higher level of smoothing of the PWM signal is required for a motor current display, an external low-pass filter circuit is required.

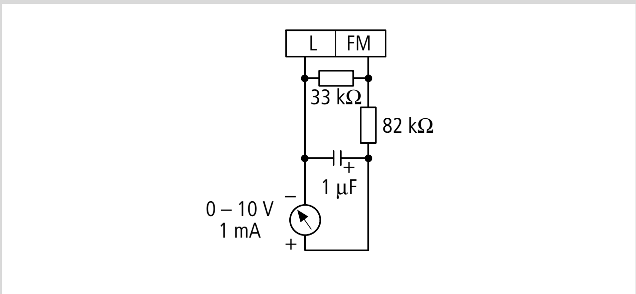


Figure 48: Example for a low-pass circuit

FM signal

The frequency of this signal (PNU C027 = 00) changes proportionally to the output frequency. The pulse duty factor remains constant at about 50 %. The output frequency at the FM terminal is ten times that of the DV6 frequency inverter’s maximum output frequency, i.e. up to 4 kHz. This signal does not have to be matched; its accuracy is monitored digitally.

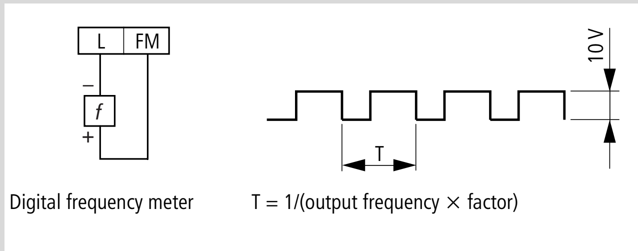


Figure 49: Digital frequency meter connection

Analog inputs, terminals O, O2 and OI

You can specify the setpoint frequency through three analog inputs:

- Terminal O: 0 to 10 V
- Terminal O2: –10 V to +10 V
- Terminal OI: 4 to 20 mA

The reference potential for the analog inputs is terminal L.

Frequency setpoint definition

By default, the frequency setpoint is defined through voltage input O (0 to +10 V). Alternatively, you can enter the setpoint value through one of the other analog inputs or a combination of two analog inputs. To do this, you must configure a digital input with the AT function (→ Section "Analog input changeover (AT)", Page 73). The two inputs are specified under PNU A005 and A006.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A005	AT selection	–	–	00	Changing over from O to OI	00
				01	Changing over from O to O2	
A006	O2 selection	–	–	00	O2 signal only	00
				01	Sum of signals at O2 and O or OI **without** direction reversal	
				02	Sum of signals at O2 and O or OI **with** direction reversal	

The table below shows how you can link analog inputs O, O2 and OI with PNU A005 and A006.

Main frequency setpoint value input	O2 signal sum	Reversal of direction with O2	AT input configured	A006	A005	Input AT
O	Yes	Yes	Yes	02	00	OFF
					01	
		No	Yes	01	00	OFF
					01	
	No	No	Yes	00	00	OFF
				00	01	
Add O + OI	Yes	Yes	No	00	–	–
				02		
		No		01		
O2	No	Yes	Yes	02	01	ON
				00		
		No		01		
OI	Yes	Yes	Yes	02	00	ON
	Yes	No		01		
	No	No		00		

Matching of terminals O, O2 and OI

With PNU C081 to C083 and PNU C121 to C123, you can adapt the analog setpoint signals at terminals O, O2 and OI to your requirements:

- Terminal O: 0 to +10 V
  - Setpoint signal matching: PNU C081
  - Zero point matching: PNU C121
- Terminal O2, –10 V to +10 V
  - Setpoint signal matching: PNU C083
  - Zero point matching: PNU C123
- Terminal OI: 4 to 20 mA
  - Setpoint signal matching: PNU C082
  - Zero point matching: PNU C122

Caution!
These parameters are not reset to their default values during initialization.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C081	Matching of terminal O	✓	✓	0 to 65530	Here, you can match the setpoint signal (0 to +10 V) supplied at analog input O with reference to the output frequency.	Depen-ding on DV6
C082	Matching of terminal OI				Here, you can match the setpoint signal (4 to 20 mA) supplied at analog input OI with reference to the output frequency.	
C083	Matching of terminal O2				Here, you can match the setpoint signal supplied at analog input O2 (–10 V to +10 V) with reference to the output frequency.	
C121	Zero-point matching, terminal O			0 to 6553 (65530)	Here, you can match the setpoint signal (0 to +10 V) supplied at analog input O with reference to the zero point.	
C122	Zero-point matching, terminal OI				Here, you can match the setpoint signal (4 to 20 mA) supplied at analog input OI with reference to the zero point.	
C123	Zero-point matching, terminal O2				Here, you can match the setpoint signal (–10 V to +10 V) supplied at analog input O2 with reference to the zero point.	

Analog setpoint value matching

The external setpoint signal can be specifically matched with parametersPNU A011 to A016 and A101 to A114, which are described below. A configurable voltage or current setpoint range can be assigned to a configurable frequency range.

Furthermore, analog setpoint signal filtering can be adjusted using PNU A016.

Matching analog input O

Figure 50 shows how to match the analog signal (0 to +10 V). With PNU A013 and A014, you specify the active voltage range. In PNU A011, you can set the starting point, and in PNU A012 the end point for the output frequency. If the line does not start at the origin, (PNU A011 and A013 > 0), specify the starting frequency with PNU A015. As long as the input signal is smaller than the value set in PNU A013, either 0 Hz (for PNU A015 = 00) or PNU A011 (for PNU A015 = 01) is output.

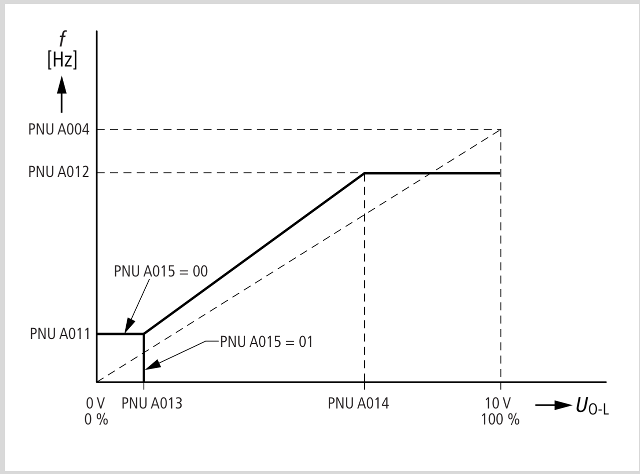


Figure 50: Setpoint matching, terminals O–L

PNU	Name	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	Function	WE
A011	Starting frequency, input O	–	✓	0.00 to 400 Hz	Here, you define the starting frequency for the minimum setpoint voltage (PNU A013).	0.00
A012	End frequency, input O	–	✓	0.00 to 400 Hz	Here, you define the end frequency for the maximum setpoint voltage (PNU A014).	0.00
A013	Minimum setpoint voltage, input O	–	✓	0 to 100 %	Minimum setpoint voltage as a percentage of the greatest possible voltage (+10 V).	0
A014	Maximum setpoint voltage, input O	–	✓	0 to 100 %	Maximum setpoint voltage as a percentage of the greatest possible voltage (+10 V).	100
A015	Condition for starting frequency for analog input O	–	✓	Determines the behaviour at setpoint values below the minimum setpoint value.		01
				00	The frequency defined under PNU A011 is applied to the motor.	
				01	A frequency of 0 Hz is applied to the motor.	
A016	Analog input filter time constant	–	✓	Averaging for attenuating any superimposed interference frequencies at analog inputs O, O2 or OI. The value between 1 and 30 specifies the number of values to be averaged.		8
				1	Low filtering effect, fast response to setpoint value changes	
				….		
				30	Strong filtering effect, delayed response to setpoint value changes	

Matching analog input OI

Figure 51 shows the matching possibilities for the 4 to 20 mA setpoint current. PNU A103 and A104 specify the active current range. In PNU A101, you can set the starting point, and in PNU A102 the end point for the output frequency. If the line does not start at the origin, (PNU A101 and A103 > 0), the starting frequency with PNU A105. As long as the input signal is smaller than the value entered under PNU A103, either 0 Hz (for PNU A105 = 00) or PNU A101 (for PNU A105 = 01) is output.

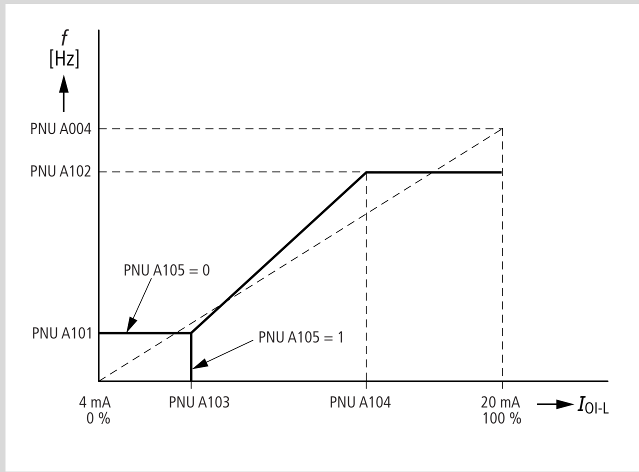


Figure 51: Setpoint current, terminals OI-L

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A101	Starting frequency, input OI	–	✓	0.00 to 400 Hz	Here, you define the starting frequency for the minimum setpoint current (PNU A103).	0.00
A102	End frequency, input OI	–	✓	0.00 to 400 Hz	Here, you define the end frequency for the maximum setpoint current (PNU A104).	0.00
A103	Minimum current setpoint, input OI	–	✓	0 to 100 %	Minimum setpoint value as a percentage of the highest possible current (20 mA).	20
A104	Maximum setpoint current, input OI	–	✓	0 to 100 %	Minimum setpoint value as a percentage of the highest possible setpoint current (20 mA).	100
A105	Condition for starting frequency for analog input OI	–	✓	Determines the behaviour at setpoint values below the minimum setpoint value.		01
				00	The frequency defined under PNU A101 is applied to the motor.	
				01	A frequency of 0 Hz is applied to the motor.	

Matching analog input O2

Figure 52 shows the matching possibilities for setpoint voltages from –10 to +10 V.

The associated operating range is specified with PNU A113 and A114 for the voltage, and with PNU A111 and A112 for the frequency. At a zero value, the setpoint polarity, and therefore the direction of rotation, are reversed. If the input voltage falls below the value specified in PNU A113, the DV6 frequency inverter outputs the frequency specified in PNU A111; if the input voltage is higher than PNU A114, the DV6 outputs the frequency specified in PNU A112.

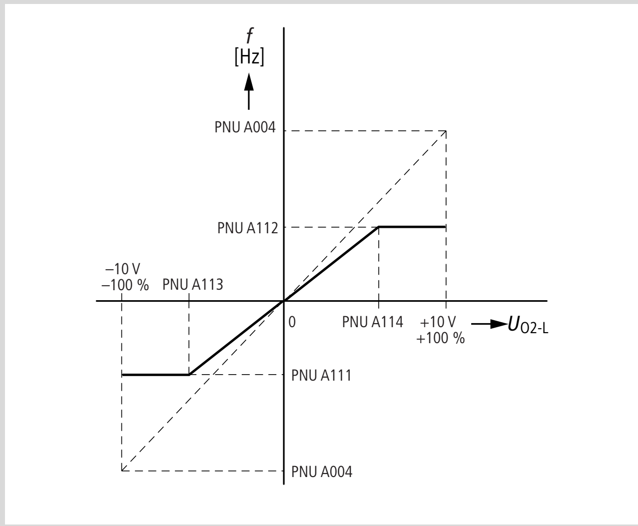


Figure 52: Setpoint matching, terminals O2-L

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A111	End frequency on direction reversal, input O2	–	✓	–400 to 400 Hz	Here, the end frequency that corresponds to the voltage setpoint value specified under PNU A113 is set.	0.00
A112	End frequency, input O2	–	✓	–400 to 400 Hz	Here, the end frequency that corresponds to the voltage setpoint value specified under PNU A114.	0.00
A113	Maximum setpoint voltage at direction reversal, input OI	–	✓	–100 to +100 %	The minimum setpoint value entered here is a prcentage of the highest possible setpoint voltage (–10 V to +10 V).	–100
A114	Maximum setpoint voltage, input OI	–	✓	–100 to +100 %	The maximum setpoint value entered here is a percentage of the highest possible setpoint voltage (–10 V to +10 V).	100

Programmable digital inputs 1 to 8

Various functions can be assigned to terminals 1 to 8. Depending on your requirements, you can configure these terminals as follows:

- anticlockwise start signal (REV),
- selection inputs for various fixed frequencies (FF1 to FF4),
- reset input (RST),
- etc.

The terminal functions for programmable digital inputs 1 to 8 are configured with PNU C001 to C008, i.e. with PNU C001, you specify the function of digital input 1, with PNU C002 the function for digital input 2, etc. Note, however, that you cannot assign the same function to two inputs at the same time.

Programmable digital inputs 1 to 8 are configured by default as make contacts. If, therefore, you want to activate the function of an input terminal, you must close the corresponding input (i.e. connect the input terminal to terminal P24). Conversely, to deactivate the input terminal, the input must be opened.

Caution!
If an EEPROM error occurs (fault message E 008), all parameters must be checked to ensure that they are correct (particularly the RST input).

Table 10: Digital inputs 1 to 8

PNU	Terminal	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	WE
C001	1	–	✓	→ Table 11	18
C002	2				16
C003	3				06
C004	4				11
C005	5				09
C006	6				03
C007	7				02
C008	8				01

For a detailed description of the input functions, see the pages listed in Table 11.

Table 11: Functions of the digital inputs

Value	Function	Description	→ Page
01	REV	Start/stop anticlockwise operation	68
02	FF1	First fixed frequency input	69
03	FF2	Second fixed frequency input	
04	FF3	Third fixed frequency input	
05	FF4	Fourth fixed frequency input	
06	JOG	Jog mode	79
07	DB	DC braking	88
08	SET	Selection of the second parameter set	86
09	2CH	Second acceleration and deceleration time	74
11	FRS	Motor shutdown and free run stop (coasting)	75
12	EXT	External fault	76
13	USP	Unattended start protection	77
14	CS	Heavy starting duty	91
15	SFT	Parameter protection	83
16	AT	Setpoint definition through current signal	73
17	SET3	Third parameter set	86
18	RST	Reset	78
20	STA	Pulse start (3-wire)	96
21	STP	Pulse stop (3-wire)	96
22	F/R	Direction of rotation (3-wire)	96
23	PID	Activation of PID control	–
24	PIDC	Reset integral component	–
26	CAS	Motor parameter changeover	–
27	UP	Acceleration (motor potentiometer)	84
28	DWN	Deceleration (motor potentiometer)	84
29	UDC	Reset frequency (motor potentiometer)	84
31	OPE	Setpoint value through keypad	93
32	SF1	Bitwise frequency selection	71
33	SF2		
34	SF3		
35	SF4		
36	SF5		
37	SF6		
38	SF7		
39	OLR	Current limit switch over	90

Value	Function	Description	→ Page
40	TL	Torque limitation active	94
41	TRQ1	Bitwise control of the torque limits PNU b041 to b044	94
41	TRQ2		94
43	PPI	P or PI control	98
44	BOK	Confirmation of brake enable signal	100
45	ORT	Direction of rotation	–[1]
46	LAC	Ramp function off	–[1]
47	PCLR	Erase positioning deviation	–[1]
48	STAT	Setpoint input through optional module	–[2]
no	NO	No function	–

1) → Manual AWB8240-1431.. for encoder module DE6-IOM-ENC

2) → Manual for the optional module

You can optionally configure the digital inputs as break (NC) contacts. To do this, enter 01 under PNU C011 to C018 (corresponding to digital inputs 1 to 8). An exception applies to the RST input (reset), which can only be operated as a make (NO) contact. FW is configured as a make (NO) contact under PNU C019.

Caution!
If you reconfigure digital inputs configured as FW or REV as break contacts (the default setting is as a make contact), the motor starts immediately. They should not be reconfigured as break contacts unless this is unavoidable.

Table 12: Configuring digital inputs as break contacts

PNU	Terminal	Value	Adjustable in RUN mode		Function	WE
			Normal	Extended		
C011	1	00 or 01	–	✓	00: Make contact 01: Break contact	00
C012	2					
C013	3					
C014	4					
C015	5					
C016	6					
C017	7					
C018	8					
C019	FW					

Start/stop

Clockwise rotation (FW)

When a digital input configured as FW is activated, the motor starts to run in a clockwise direction. When this input is deactivated, the motor is decelerated to a stop under frequency inverter control.

When the FW and REV inputs are activated simultaneously, the motor is decelerated to a stop under frequency inverter control.

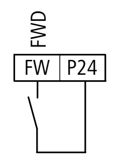


Figure 53: Digital input FW (start/stop clockwise)

Anticlockwise rotation (REV)

When a digital input configured as REV is activated, the motor starts to run in an anticlockwise direction. When the input is deactivated, the motor is decelerated to a stop under frequency inverter control.

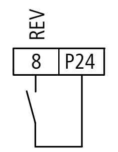


Figure 54: Digital input 8 configured as REV (start/stop anticlockwise)

Issue start signal

By default, the start signal is issued through the inputs configured as FW or REV. If however, the start signal is currently issued through the ON key on the keypad, enter the value 01 under PNU A002 (start signal through FW/REV input) (→ Section "Start signal", Page 123).

▶ Program one of the digital inputs 1 to 8 as REV by entering the value 01 under the corresponding PNU (C001 to C008).

By default, REV is assigned to digital input 8.

⚠ **Warning!**
If the frequency inverter supply voltage is applied when the start signal is activated, the motor will start immediately. Make sure, therefore, that the start signal is not active before the supply voltage is switched on.

⚠ **Warning!**
If the FW/REV input is opened (inactive state if FW/REV is configured as a make contact) and then it is reconfigured as a break contact, the motor will start immediately after the reconfiguration.

Fixed frequency selection (FF1 to FF4)

With the digital inputs configured as FF1 to FF4, you can select up to 16 user-definable fixed frequencies (including frequency setpoints), depending on which of the inputs is active or inactive (→ Table 13). It is not necessary to use all the fixed frequency selection inputs at the same time. Using only three inputs, for example, allows you to choose between eight fixed frequencies; with two fixed frequency selection inputs, four fixed frequencies are available for selection.

The fixed frequencies have a higher priority than all other setpoint values and can be accessed at any time through inputs FF1 to FF4 without needing to be enabled separately. Jog mode, to which the highest priority is assigned, is the only operation with a higher priority than the fixed frequencies.

Table 13: Fixed frequencies

Fixed frequency stage	PNU	Input FF4	FF3	FF2	FF1
$0 = f_s$	Frequency setpoint value	0	0	0	0
f_1	a021	0	0	0	1
f_2	a022	0	0	1	0
f_3	a023	0	0	1	1
f_4	a024	0	1	0	0
f_5	a025	0	1	0	1
f_6	a026	0	1	1	0
f_7	a027	0	1	1	1
f_8	a028	1	0	0	0
f_9	a029	1	0	0	1
f_{10}	a030	1	0	1	0
f_{11}	a031	1	0	1	1
f_{12}	a032	1	1	0	0
f_{13}	a033	1	1	0	1
f_{14}	a034	1	1	1	0
f_{15}	a035	1	1	1	1

0 = input deactivated
1 = input activated

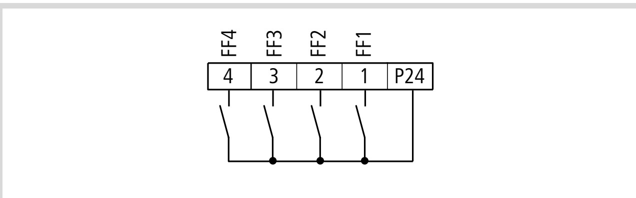


Figure 55: Digital inputs 1 to 4 configured as FF1 to FF4 (fixed frequency)

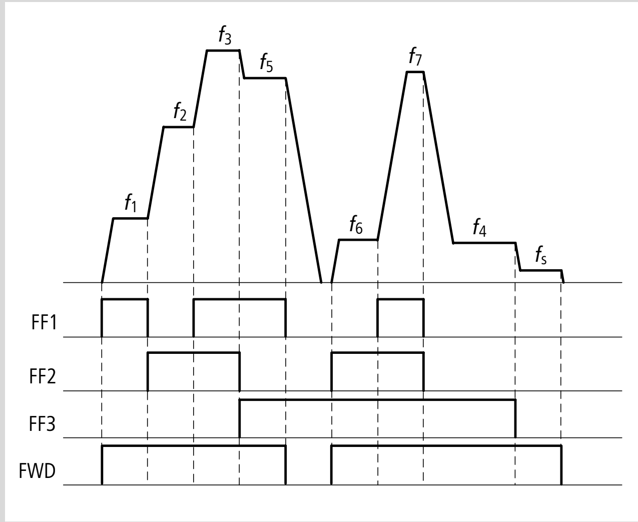


Figure 56: Function chart for FF1 to FF3 (fixed frequency control)

- ▶ Under PNU A019, enter the value 00 to activate the fixed frequencies FF1 to FF4.
- ▶ Program one or more of the digital inputs 1 to 8 as FF1 to FF4, by entering the values 02 (FF1) to 05 (FF4) under the corresponding PNU (C001 to C008).

By default, FF1 is preassigned to digital input 7 and FF2 to digital input 6.

The fixed frequencies can be programmed in two ways:

- by entering the fixed frequencies under PNU A021 to A035,
- by entering the fixed frequencies under PNU F001.

With PNU F001, you can change parameters even when the parameter protection (PNU b031) has been set (→ Page 83).

Entering the fixed frequencies under PNU A021 to A035

- ▶ Go to PNU A021 and press the PRG key.
- ▶ Use the arrow keys to enter the fixed frequency and confirm with the ENTER key.
- ▶ Enter the remaining fixed frequencies by repeating these steps for PNU A022 to A035.

Fixed frequency input under PNU F001

Before you can enter the frequencies under PNU F001, you must enter the value 02 in PNU A001.

- ▶ To select a fixed frequency stage, activate the digital inputs as listed in Table 13.
- ▶ Go to PNU F001.

The current frequency appears on the display.

- ▶ Use the arrow keys to enter the fixed frequency and confirm with the ENTER key.

The entered value is saved under the parameter which you have selected with the digital inputs (→ Table 13).

- ▶ Repeat these steps for your additional fixed frequencies.

Specifying the frequency setpoint

The frequency setpoint can be assigned in one of three ways, depending on PNU A001:

- with the potentiometer on the keypad, PNU A001 = 00;
- through analog input O (0 to 10 V), O2 (10 V to +10 V) or OI (4 to 20 mA), PNU A001 = 01 (default);
- with PNU F001 or PNU A020, PNU A001 = 02.

Selecting fixed frequencies

▶ Select the defined fixed frequencies by activating the respective digital inputs (→ Table 13).

Table 14: Fixed frequency parameters

PNU	Name	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	Function	WE
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V), OI (4 to 20 mA) or O2 (–10 V to +10 V ⎓)	
				02	Definition through PNU F001 and/or PNU A020	
				03	Definition through the RS 485 serial interface, terminals RP, 2 × SN and SP	
				04	Definition through optional card at slot 1	
				05	Definition through optional card at slot 2	
A019	Selection of fixed frequency actuation	–	–	00	Binary (FF1 to FF4)	00
				01	Bitwise (SF1 to SF7)	
A020 A220 A320	Frequency setpoint value	✓	✓	0 to 400 Hz	You can enter a frequency setpoint value. You must set PNU A001 to 02 for this purpose.	0.0
A021 A022 A023 ... A035	Fixed frequency	✓	✓		You can assign a frequency to each of the 15 fixed frequency parameters from PNU A021 to A035.	
F001	Display/input of frequency value	✓	✓		Display of the current frequency setpoint value or the current fixed frequency. Modified values are saved with the ENTER key according to the selection of the digital inputs configured as FF1 to FF4. Resolution ±0.1 Hz	

→ If one or more of the fixed frequencies exceeds 50 Hz, you must first increase the end frequency with PNU A (004 (→ Section "Maximum end frequency", Page 125).

→ Fixed frequency stage 0 (none of the inputs FF1 to FF4 are activated) corresponds to the frequency setpoint value. Depending on the value entered in PNU A001, this can be defined with the installed potentiometer, the setpoint value inputs O and/or OI or through PNU F001 and PNU A020.

Bitwise fixed frequency selection (SF1 to SF7)

With the digital inputs configured as SF1 to SF7, you can directly access up to seven fixed frequencies. To do this, enter the value 01 under PNU A019 (fixed frequency drive method) and directly assign a fixed frequency to each of the digital inputs.

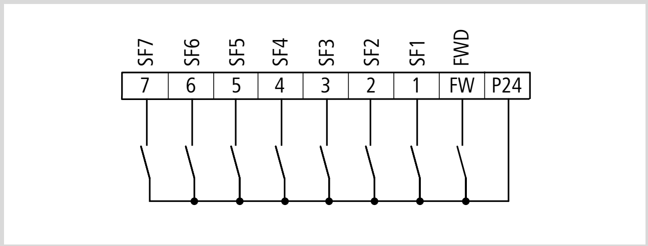


Figure 57: Digital inputs 1 to 7 configured as SF1 to SF7 (bitwise fixed frequency selection).

- ▶ Under PNU A019, enter the value 01 to activate the fixed frequencies SF1 to SF7.
- ▶ Program one or more of the digital inputs 1 to 8 as SF1 to SF7 by entering the following values under the corresponding PNU (C001 to C008):
  - SF1: 32
  - SF2: 33
  - SF3: 34
  - SF4: 35
  - SF5: 36
  - SF6: 37
  - SF7: 38

The fixed frequencies can be programmed in two ways:

- entering the fixed frequencies under PNU A021 to A027 (see below),
- entering the fixed frequencies under PNU F001 (see below).

With PNU F001, you can change parameters even when the parameter protection PNU b031 has been set (→ Page 83).

Entering the fixed frequencies under PNU A021 to A027

- ▶ Go to PNU A021 and press the PRG key.
- ▶ Use the arrow keys to enter the fixed frequency and confirm with the ENTER key.
- ▶ Enter the remaining fixed frequencies by repeating these steps for PNU A022 to A027.

Entering the fixed frequencies in PNU F001

Before you can enter the frequencies under PNU F001, you must set the value 02 in PNU A001.

- ▶ To select a fixed frequency stage, activate the digital input as listed in Figure 57.
- ▶ Go to PNU F001.

The current frequency appears on the display.

- ▶ Use the arrow keys to enter the fixed frequency and confirm with the ENTER key.

The entered value is saved in the parameter which you have selected with the digital input. If you have wired the inputs as shown in Figure 57, the value is saved under PNU A021 when digital input 1 is activated.

- ▶ Repeat these steps for your additional fixed frequencies.

Specifying frequency setpoints

The setpoint frequency can be assigned in one of three ways, depending on PNU A001:

- through the installed potentiometer on the keypad, PNU A001 = 00;
- through analog input O (0 to 10 V), O2 (–10 V to +10 V) or OI (4 to 20 mA), PNU A001 = 01 (default);
- through PNU F001 or PNU A020, PNU A001 = 02.

Selecting fixed frequencies

- ▶ The set fixed frequency values are selected by activating the corresponding digital inputs (→ Fig. 2).

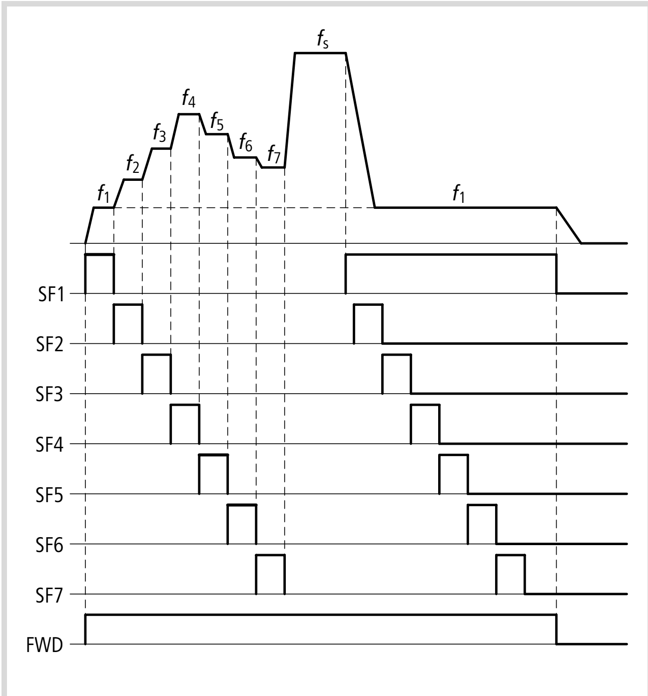


Figure 58: Function chart for SF1 to SF7 (bitwise fixed frequency selection)

f_s: Setpoint frequency

You do not have to use all seven inputs. You can, for example, set only one fixed frequency. The priority of the fixed frequencies is specified through the digital input. Fixed frequency SF1 has the highest, and SF7 die lowest priority (→ Fig. 2).

PNU	Name	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	Function	WE
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V), OI (4 to 20 mA) or O2 (–10 V to +10 V ⎓)	
				02	Definition through PNU F001 and/or PNU A020	
				03	Definition through the RS 485 serial interface, terminals RP, 2 × SN and SP	
				04	Definition through optional card at slot 1	
				05	Definition through optional card at slot 2	
A019	Selection of fixed frequency actuation	–	–	00	Binary (FF1 to FF4)	00
				01	Bitwise (SF1 to SF7)	
A020 A220 A320	Frequency setpoint value	✓	✓	0 to PNU A004	You can enter a frequency setpoint value. You must set PNU A001 to 02 for this purpose.	0.0
A021	Fixed frequency				You can assign a frequency to each of the seven fixed frequency parameters of PNU A021 to A027.	
A022						
A023						
...						
A027						
F001	Display/input of frequency value				Indication of the current frequency setpoint value or the current fixed frequency. To save modified values, press the ENTER key according to the selection of the digital inputs configured as SF1 to SF7 Resolution ±0.1 Hz	

Analog input changeover (AT)

When the digital input configured as AT is active, you can change over between analog inputs O and OI or between O and O2:

- O: 0 to +10 V,
- O2: –10 V to +10 V,
- OI: 4 to 20 mA.

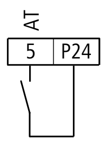


Figure 59: Digital input 5 configured as AT (setpoint definition through current signal)

Under PNU A001, enter the setpoint frequency input method. At the default value of 01, terminals O, O2 and OI are used for setpoint input.

▶ If it has not yet been correctly configured, set the PNU A001 to 01.

Under A005, specify whether activation of the AT input results in a changeover between O and OI or between O and O2.

▶ Program one of the digital inputs 1 to 8 as AT by entering the corresponding PNU (C001 to C008) to 16.

By default, AT is assigned to digital input 2.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A005	AT selection	–	–	00	Changing over from O to OI	00
				01	Changing over from O to O2	
A006	O2 selection	–	–	00	O2 signal only	00
				01	Sum of signals at O2 and O/OI **without** direction reversal	
				02	Sum of signals at O2/O or OI **with** direction reversal	

The table below shows how you can link analog inputs O, O2 and OI with PNU A005 and A006.

Main frequency setpoint value input	Input O2 as additive setpoint frequency input?	Reversal with O2?	Input AT present?	A006	A005	Input AT
O	Yes	Yes	Yes	02	00	Off
					01	
		No	Yes	01	00	Off
					01	
	No	No	Yes	00	00	Off
				00	01	
Add O + OI	Yes	Yes	No	00	–	–
				02		
		No		01		
O2	No	Yes	Yes	02	01	On
				00		
		No		01		
OI	Yes	Yes	Yes	02	00	On
	Yes	No		01		
	No	No		00		

Second time ramp 2CH

If the digital input configured as 2CH is active, the motor is accelerated or braked with the second acceleration or deceleration time. If the 2CH input is deactivated again, a changeover to the first acceleration/deceleration time takes place.

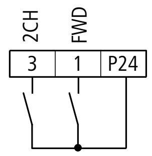


Figure 60: Digital input 3 configured as 2CH (second time ramp)

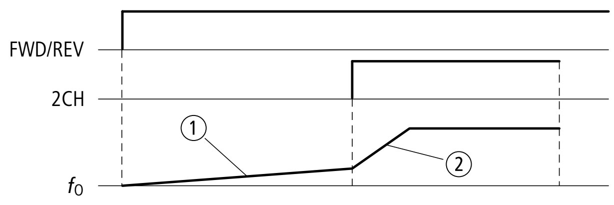


Figure 61: Function chart for 2CH (second acceleration time)

f_0: Output frequency

① First acceleration time

② Second acceleration time

- ▶ Under PNU A092 and PNU A093, set the required value for the second acceleration and deceleration time.
- ▶ Then, set PNU A094 to 00 so that the changeover to the second acceleration and deceleration time through the 2CH input is enabled (this is the default setting).
- ▶ Program one of the digital inputs 1 to 8 as 2CH, by setting the corresponding PNU (C001 to C008) to 09.

By default, 2CH is assigned to digital input 5.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A092 A292 A392	Second acceleration time	✓	✓	0.01 to 3600 s	Setting times for the second acceleration and deceleration time	15
A093 A293 A393	Second deceleration time					
A094 A294	Changeover from the first to the second time ramp	–	–	00	Changeover to the second time ramp if an active signal is present at a 2CH digital input.	00
				01	Changeover to the second time ramp when the frequencies entered in PNU A095 and/or A096 are reached	

→ If you set PNU A094 to 01, the changeover to the second acceleration or deceleration time can take place automatically at the frequency set under PNU A095 or A096 (→ Section "Time ramps", Page 148).

→ The value for the first acceleration and deceleration time is defined in PNU F001 and F002 (→ Section "Acceleration time 1", Page 121).

Controller inhibit and coasting (free run stop – FRS)

If you activate the digital input configured as FRS, the motor is switched off and coasts to a stop (for example if an Emergency-Stop is made). If you deactivate the FRS input, then, depending on the inverter's configuration, the frequency output is either synchronized to the current speed of the coasting motor or restarts at 0 Hz.

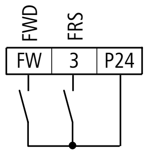


Figure 62: Configuration of digital input 3 as FRS ("free run stop", = controller inhibit) and FW as FWD (start/stop clockwise operation)

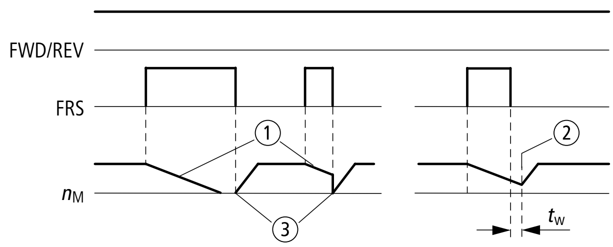


Figure 63: Function chart for FRS (control inhibit and free run stop)

n_M: Motor speed

t_W: Waiting time (setting under PNU b03)

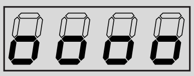
① Motor coasts to a stop

② Synchronization to the current motor speed

③ Restart from 0 Hz

- ▶ Use PNU b088 to specify whether the motor is to restart at 0 Hz after the FRS input has been deactivated, or if synchronization should take place after a waiting time specified under PNU b003. The frequency inverter recognizes the speed of the rotor and starts only when the frequency set at PNU b007 is reached.
- ▶ Program one of the digital inputs 1 to 8 as FRS by entering the value 11 under the corresponding PNU (C001 to C008).

By default, FRS is assigned to digital input 4.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b003	Waiting time until restart	–	✓	0.3 to 100 s	Here, set a time which is to expire before an automatic restart is initiated after a fault signal. This time can also be used in conjunction with the FRS function. During the delay, the following message appears on the LED display: 	1.0
b007	Synchroniza-tion frequency	–	✓	0 to 400 Hz	Frequency at which a restart is initiated.	0.00
b088	Motor restart after removal of the FRS signal	–	✓	00	0 Hz restart after deactivation of the FRS input	00
				01	Synchronization of the motor to the frequency set under PNU 007 after the waiting time set under PNU b003.	

External fault message (EXT)

When the digital input configured as EXT is activated, fault message E12 is issued (for example to be used as input for thermistor contacts). The fault message remains active even if the EXT input is deactivated again and must be acknowledged with a reset.

A reset can be carried out with:

- the RST input or
- the OFF key.
- Alternatively, the supply voltage can be switched off and on again.

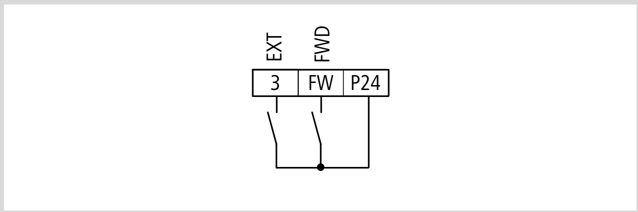


Figure 64: Digital input configured as FW (start/stop clockwise operation) and digital input 3 as EXT (external fault)

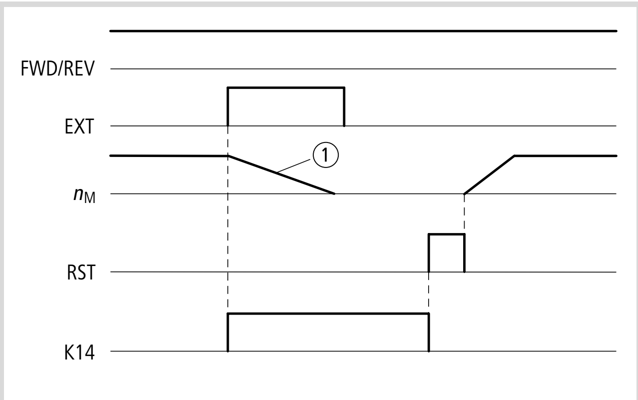


Figure 65: Function chart for EXT (external fault message)

n_M: Motor speed

K14: Signalling relay contact K14 (if the signalling relay has been set to 13 (THM) under PNU C026)

① Motor coasts to a stop

▶ Program one of the digital inputs 1 to 8 as EXT by entering the value 12 under the corresponding PNU (C001 to C008).

Warning!
After a reset, the motor restarts immediately if a start signal (FWD or REV) is active.

Unattended start protection USP

If the digital input configured as USP is activated, unattended start protection is also activated. This prevents a restart of the motor when the voltage recovers after a mains fault while a start signal (active signal on FWD or REV) is present. Fault message E13 is issued. E13 is cancelled by pressing the OFF key or with an active signal on the RST input. Alternatively, the start signal can be revoked.

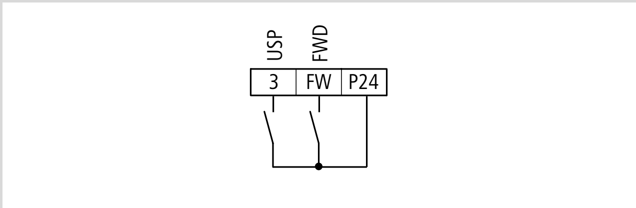


Figure 66: Digital input configured as FWD (start/stop clockwise operation) and digital input 3 as USP (unattended start protection).

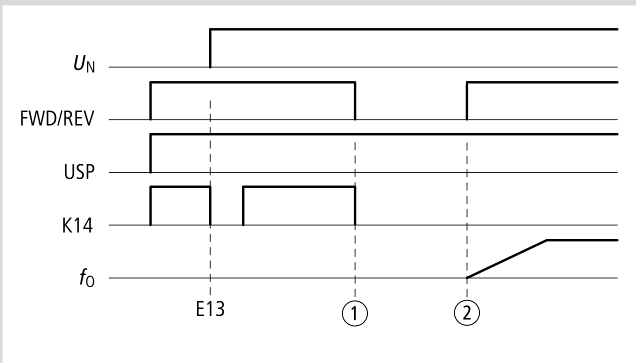


Figure 67: Function chart for USP (unattended start protection)

ΔU_N:Supply voltage

K14: Signalling relay contact K14

f_0: Output frequency

① Revoke start signal (alarm no longer present)

② Start signal

▶ Program one of the digital inputs 1 to 8 as USP by setting the corresponding PNU (C001 to C008) to 13.

Warning!
If unattended start protection is triggered (fault message E13) and the fault message is acknowledged with a reset command while a start signal is still active (input FWD or REV active), the motor will restart immediately.

→ If you issue a start signal within three seconds of reestablishing the power supply and unattended start protection is active, the unattended start protection is also triggered and issues fault message E13. When unattended start protection is used, you should therefore wait for at least three seconds before issuing a start signal to the frequency inverter.

→ Unattended start protection can still be activated when you issue a reset command through the RST input after an undervoltage fault message (E09) has occurred.

Reset (RST)

A fault message can be acknowledged by activating and subsequently deactivating (i.e. resetting) the digital input configured as RST.

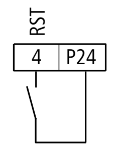


Figure 68: Digital input 4 configured as RST (reset)

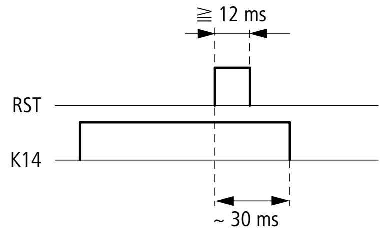


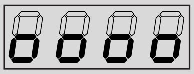
Figure 69: Function chart for RST (reset)

K14: Signalling relay contact K14

▶ Program one of the digital inputs 1 to 8 as RST by entering the value 18 under the corresponding PNU (C001 to C008).

By default, RS is assigned to digital input 1.

Under PNU C103, you can select how the frequency inverter responds after the reset signal drops out. You can specify whether the frequency inverter synchronizes to the frequency set under PNU b007 or starts at 0 Hz.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b003	Waiting time until restart	–	✓	0.3 to 100 s	Here, set a time which is to expire before an automatic restart is initiated after a fault signal. This time can also be used in conjunction with the FRS function. During the delay, the following message appears on the LED display: 	1.0
b007	Synchronization frequency	–	✓	0 to 400 Hz	Frequency at which a restart is initiated.	0.0
C102	Reset signal	✓	✓	00	Reset signal issued on a rising edge	00
				01	Reset signal issued on a falling edge	
				02	Reset signal issued on a rising edge, only if fault signal present	
C103	Behaviour on reset	–	✓	00	0 Hz start	00
				01	Synchronization to the motor speed	

Warning!
If a reset is carried out after a fault, the motor will start immediately if a start signal is applied simultaneously. To avoid the risk of serious or fatal injury to personnel, you must ensure that the start signal is not present before acknowledging an error message with a reset .

→ When a fault has occurred, the OFF key on the keypad acts as a RESET key, and can be used instead of the RST input to reset the fault.

→ If the RST input is active for more than four seconds, it can cause a false trip.

→ The RST input is always a make (NO) contact and cannot be programmed as a break (NC) contact.

→ Alternatively, you can acknowledge a fault message by briefly switching the supply voltage off and on again.

→ If a reset is initiated during operation, the motor coasts to a stop.

Jog mode (JOG)

When the digital input configured as JOG is activated, the motor can be operated in jog mode. This mode is used, for example, for manual setting up of a machine by issuing a start signal on the FW or REV input with a relatively low frequency without applying an acceleration ramp to the motor.

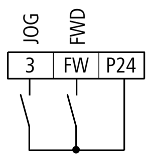


Figure 70: Digital input configured as FW (start/stop clockwise operation) and 3 as JOG (jog mode).

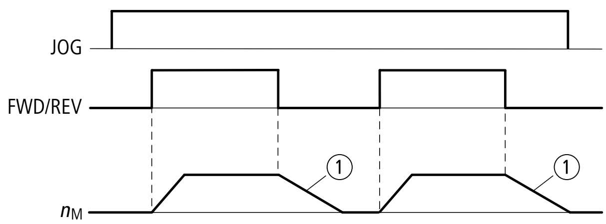


Figure 71: Function chart for JOG (jog mode)

n_M: Motor speed

(1) Depending on the setting of PNU A039
00: Free run stop (coast)
01: Deceleration ramp
02: DC braking

- Input under PNU A038 the frequency which is to be applied to the motor when jog mode is active.

Make sure that the frequency is not too high, as it is applied directly to the motor without an acceleration ramp. This could cause a fault message. Set a frequency below about 5 Hz.

- Because the start signal in jog mode is issued through the FWD- or REV input, PNU A002 must be set to 01.
- Under PNU A039, you determine how the motor is to be braked.
- Program one of the digital inputs 1 to 8 as JOG by entering the value 06 under the corresponding PNU (C001 to C008).

By default, JOG is assigned to digital input 3.

Caution!
Make sure that the motor has stopped before using jog mode.

PNU	Name	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	Function	WE
A002	Start signal	–	–	01	The signal for starting the motor is issued through the digital inputs configured as FW or REV.	01
				02	The signal for starting the motor is issued with the ON key on the keypad.	
A038	Frequency in jog mode	✓	✓	0 to 9.99 Hz	The frequency to be applied to the motor in jog mode.	1.0
A039	Type of motor stop in jog mode	–	✓	00	Stop signal active: the motor coasts to halt	00
				01	Stop signal active: the motor is decelerated to standstill using a deceleration ramp	
				02	Stop signal active: the motor is decelerated to standstill using DC braking	
				03	Jog mode without previous motor stop: the motor coasts to a halt	
				04	Jog mode without previous motor stop: the motor is decelerated to standstill using the deceleration ramp	
				05	Jog mode without previous motor stop: the motor is decelerated to standstill using DC braking	

→ Operation in jog mode is not possible when the jogging frequency set under PNU A038 is less than the start frequency set under PNU b082 (→ Section "Run signal (RUN)", Page 104).

→ Jog mode can only be activated when the frequency inverter is in the Stop state if the values 00 to 02 have been set under PNU C039.

Change over vector parameters (CAS)

Activating the digital input configured as CAS causes a change-over between the PI control parameters. PI control regulates the speed and is available only in vector control mode (PNU A044) (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV control
- 0 Hz SLV control
- Vector control with optional DE6-IOM-ENC module

When the CAS input is inactive or no digital input is configured as CAS, the following paramaters apply:

- PNU H050 (H250),
- PNU H051 (H251),
- PNU H052 (H252).

When the CAS input is active, the following parameters apply:

- PNU H070,
- PNU H071,
- PNU H072.

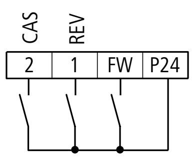
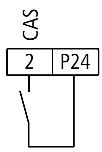
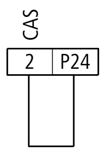


Figure 72: Digital input 1 configured as REV (start/stop anticlockwise operation) and 2 as CAS (change over vector parameters).

CAS	PNU	Active
	H050 (H250)	✓
	H051 (H251)	✓
	H052 (H251)	✓
	H070	–
	H071	–
	H072	–
	H050 (H250)	–
	H051 (H251)	–
	H052 (H251)	–
	H070	✓
	H071	✓
	H072	✓

▶ To activate vector control, enter one of the following values under PNU A044 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
  – 03: SLV control
  – 04: 0 Hz SLV control
  – 05: Vector control with optional DE6-IOM-ENC module.

▶ Program one of the digital inputs 1 to 8 as CAS by setting the corresponding PNU (C001 to C008) to 26.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A044 A244 A344	Voltage/frequency characteristic	–	–	00	*ΔU/f* characteristic, linear	00
				01	*ΔU/f* characteristic, quadratic, for example fans	
				02	User-definable	
				03	Sensorless vector control (SLV)1)	
				04	0 Hz SLV control1)	
				05	Vector control1) with optional DE6-IOM-ENC module	
H005	Motor constants	✓	✓	0.001 to 65.53	Gain Kp	1.590
H050	PI proportional gain	✓	✓	0.00 to 1000 %	P component of he PI control in vector control mode	100.0
H051	PI Integration gain	✓	✓	0.00 to 1000 %	I component of he PI control in vector control mode	100.0
H052	P proportional gain	✓	✓	0.01 to 10.00	P component of he P control in vector control mode	1.00
H070	PI proportional gain	✓	✓	0.00 to 1000 %	P component of he PI control in vector control mode	100.0
H071	PI Integration gain	✓	✓	0.00 to 1000 %	I component of he PI control in vector control mode	100.0
H072	P proportional gain	✓	✓	0.01 to 10.00	P component of the P control in vector control mode	1.00

1) If SLV control is active, you should set the pulse frequency to at least 2.1 kHz with PNU b083 (→ Section "Pulse frequency", Page 164).

PTC/NTC thermistor input, terminal TH

You can monitor the motor temperature during operation using analog input TH in connection with CM1 (chassis). You can connect either a PTC or an NTC thermistor to this input. This is defined under PNU b098. Under PNU b099, enter the resistance at which rthe device is switched off.

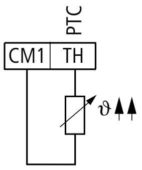


Figure 73: Connection, terminal TH

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b098	PTC/NTC selection	–	✓	00	No temperature monitoring	00
				01	PTC	
				02	NTC	
b099	Resistance threshold deactivation	–	✓	0 to 9999 Ω	When the entered value is reached, the input terminal is activated.	3000 Ω
C085	Thermistor matching	✓	✓	0.0 to 1000	Scaling factor for input terminal TH.	105

▶ To connect a thermistor, use a twisted cable and lay this cable separately.

Software protection (SFT)

When you activate the digital input configured as SFT, the configured parameters cannot be overwritten unintentionally.

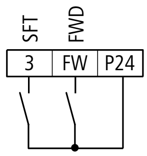


Figure 74: Digital input 3 configured as SFT (software protection)

- ▶ With PNU b031, specify whether software protection will also apply to the frequency setting under PNU F001.
- ▶ Then, program one of the digital inputs 1 to 8 as SFT by setting the corresponding PNU (C001 to C008) to 15.

Under PNU b031, you can specify whether you want to use the normal or extended parameter setting features in RUN mode. If you enter the value 10 under PNU b031, further parameters are available, which you can modify in RUN mode. These additional parameters are marked in the “Extended” column with a “✓”.

Adjustable in RUN mode	
Normal	Extended
–	✓

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b031	Software parameter protection	–	✓	00	Software protection through SFT input; all functions inhibited	01
				01	Software protection through SFT input; input through PNU F001 possible	
				02	Software protection without SFT input; all functions inhibited	
				03	Software protection without SFT input; input through PNU F001 possible	
				10	Extended parameters adjustable in RUN mode	

→ There is, however, an alternative method of software protection available which does not require an SFT input. For this, enter the value 02 or 03 under PNU b031 depending on whether software protection should also apply to the frequency setting under PNU F001 or not.

Motor potentiometer functions: accelerate (UP) – decelerate (DWN) – Reset frequency (UDC)

Accelerate (UP) and decelerate (DWN)

If you configure one of the programmable digital inputs as UP or DWN (or two programmable digital inputs as UP and DWN), an additional acceleration (with the UP input active) or deceleration (with the DWN input active) can be carried out, starting with the specified frequency setpoint.

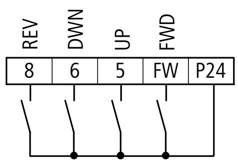


Figure 75: Digital input FW configured as FWD (start/stop clockwise operation), 5 as UP (acceleration), 6 as DWN (deceleration) and 8 as REV (start/stop anticlockwise operation)

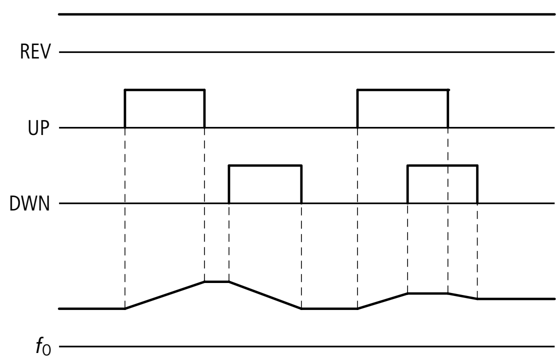


Figure 76: Function chart for UP/DWN (acceleration/deceleration – motor potentiometer)

f_0: Output frequency

- ▶ Because the terminal functions UP and DWN can be used only when the frequency setpoint has been specified with PNU F001 or A020, you need to make sure that PNU A001 contains the value 02.
- ▶ Then, program one or two of the digital inputs 1 to 8 as UP or DWN by setting the corresponding PNU (C001 to C008) to 27 or 28.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V) or OI (4 to 20 mA)	
				02	Definition through PNU F001 and/or PNU A020	
				03	Definition through RS 485	
				04	Definition through slot 1 for optional module	
				05	Definition through slot 2 for optional module	

The UP/DWN function is not available when jog mode has been activated (with active JOG input) or when the frequency setpoint definition is made through the analog input terminals.

The output frequency range for UP and DWN ranges from 0 Hz up to the end frequency specified under PNU A004 (→ Section "Maximum end frequency", Page 125).

The shortest permissible duration during which an UP or DWN input must be active is 50 ms.

When the input configured as UP is used, the frequency setpoint in PNU A020 is also increased or, in the case of DWN, reduced (→ Abb. 2).

Reset frequency (UDC)

If you configure one of the programmable digital inputs as UDC, you can use this input to reset the frequency set with the motor potentiometer to 0 Hz. PNU A020 is then reset to 0 Hz.

- ▶ Program one of the digital inputs 1 to 8 as UDC by entering the value 29 under the corresponding PNU (C001 to C008).

Behaviour on restart

With PNU C101, you can specify whether the frequency defined with UP/DWN, or the original frequency entered under PNU A020 is used when the DV6 frequency inverter is restarted.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C101	Use memory	–	✓	00	Use original frequency set under PNU A020	00
				01	Use saved UP/DWN setting	

Use second and third parameter set (SET/SET3)

When the digital input configured as SET/SET3 is active, the parameters from the second or third parameter set are used. This allows you to operate up to two additional motors with the same frequency inverter (although not at the same time) without having to reprogram the frequency inverter. The additional functions available in the second/third parameter set are listed in Table 15.

As soon as the SET/SET3 input is deactivated, the parameters of the default parameter set are used again.

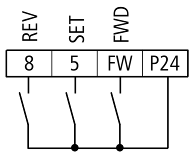


Figure 77: Digital input FW configured as FWD (start/stop clockwise operation), digital input 5 as SET (use second parameter set) and 8 as REV (start/stop anticlockwise operation)

- ▶ Program one of the digital inputs 1 to 8 as SET by setting the corresponding PNU (C001 to C008) to 08.
- ▶ Program one of the digital inputs 1 to 8 as SET3 by setting the corresponding PNU (C001 to C008) to 17.

The motor must have come to a standstill before the SET/SET3 input is activated.

If the SET/SET3 input is deactivated while the motor is running, the parameters of the second/third parameter set are used until the motor is stationary again.

Table 15: Functions with second and third parameter set

Description of the function	Parameter number (PNU)		
	Default	Second parameter set	Third parameter set
First acceleration time	F002	F202	F302
First deceleration time	F003	F203	F303
Base frequency	A003	A203	A303
Maximum end frequency	A004	A204	A304
Frequency setpoint (PNU A001 must be 02 for this)	A020	A220	A320
Voltage boost characteristics	A041	A241	–
Percentage voltage increase with manual boost	A042	A242	A342
Maximum boost relative to the base frequency	A043	A243	A343
V/F characteristic	A044	A244	A344
Maximum operating frequency	A061	A261	–
Minimum operating frequency	A062	A262	–
Second acceleration time	A092	A292	A392
Second deceleration time	A093	A293	A393
Type of changeover from first to second time ramp	A094	A294	–
Changeover frequency for changeover from first to second acceleration time	A095	A295	–
Changeover frequency for changeover from first to second deceleration time	A096	A296	–
Tripping current for electronic motor protection device	b012	b212	b312
Characteristic for electronic motor protection device	b013	b213	b313

Description of the function	Parameter number (PNU)		
	Default	Second parameter set	Third parameter set
Motor data, standard/auto	H002	H202	–
Motor rating	H003	H203	–
Number of motor poles	H004	H204	–
Motor constant K_p	H005	H205	–
Motor stabilization constant	H006	H206	H306
Motor constant R_1 (standard/autotuning)	H020/H030	H220/H230	–
Motor constant R_2 (standard/autotuning)	H021/H031	H221/H231	–
Motor constant L (standard/autotuning)	H022/H032	H222/H232	–
Motor constant I_0 (standard/autotuning)	H023/H033	H223/H233	–
Motor constant J (standard/autotuning)	H024/H034	H224/H234	–
P component of the PI controller	H050	H250	–
I component of the PI controller	H051	H251	–
P component of the P controller	H052	H252	–
Magnetization current limitation, 0 Hz SLV control	H060	H260	–

Activate DC braking DB

DC braking can be activated either through a digital input configured as DB or automatically when a specific frequency is reached.

▶ Program one of the digital inputs 1 to 8 as DB by entering the value 07 under the corresponding PNU (C001 to C008).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A051	DC braking	– –	✓	00	Inactive	00
				01	Active	
A052	Activation frequency			0 to 60 Hz	When this frequency is reached, the waiting time PNU A053 begins.	0.50
A053	Waiting time			0 to 5 s	DC braking begins after the time set here.	0.0
A054	Braking torque			0 to 100%	Applied DC braking torque	0
A055	Braking duration			0 to 60 s	This time starts when the waiting time entered under PNU A53 has expired.	0.0
A056	Characteristic			00	DC braking starts when the DB input is activated and ends when the time defined under PNU A055 has expired.	01
				01	DC braking starts when the DB input is activated and ends when the DB input is deactivated.	
A057	Starting braking torque			0 to 100%	Braking torque applied on initial brake application	0
A058	Starting braking time			0 to 60 s	Braking time before acceleration	0.0
A059	Pulse frequency	–	–	0.5 to 15 KHz	Pulse frequency of DC braking	5

▶ For automatic braking, enter 01 under PNU A051.
▶ Under PNU A052, enter the frequency at which DC braking is activated.
▶ Under PNU A053, enter the waiting time which is to expire after activation of the DB input before DC braking is activated.
▶ Under PNU A054, enter the braking torque between 0 and 100 %.
▶ Under PNU A055, enter the braking duration.
▶ Under PNU A056, specify the braking behaviour when the DB input is active.
▶ Under PNU A057, enter the starting braking torque (0 to 100 %) for braking the motor before acceleration.
▶ Under PNU A058, enter the duration for which DC braking is active before acceleration.
▶ Under PNU A059, set the pulse frequency (observe derating above 5 kHz) for DC braking.

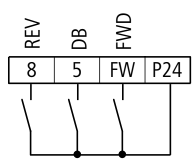


Figure 78: Digital input FW configured as FWD (start/stop clockwise operation), 8 as REV (start/stop anticlockwise operation), and 5 as DB (DC braking)

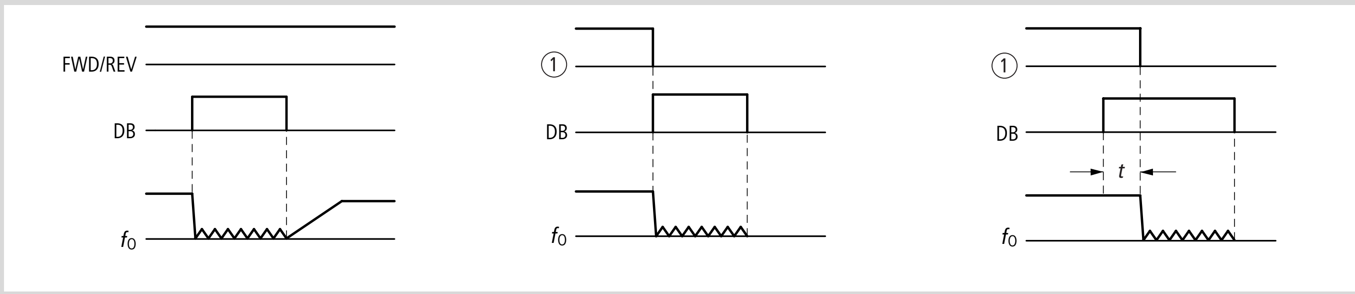


Figure 79: Function chart for DB (DC braking)

f_0: Output frequency

① Start signal through keypad

- ▶ Program one of the digital inputs 1 to 8 as DB by entering the value 07 under the corresponding PNU (C001 to C008).
- ▶ Then, under PNU A053, enter a waiting time *t* (→ Fig. 79) from 0 to 5.0 s, which is to expire after activation of the DB input before DC braking is activated.
- ▶ Under PNU A054, enter a braking torque between 0 and 100 %.

Change over current limit (OLR)

The frequency inverter monitors the motor current during acceleration and/or static operation. When the inverter reaches the overload limit, the output frequency is reduced to limit the load. This prevents a shutdown due to overcurrent caused by an excessive moment of inertia or sudden changes in the load torque.

You can define two different overload behaviours:

- PNU b021 to b023 or
- PNU b024 to b026.

By default, the values of PNU b021 to b023 are used. To use PNU b024 to b026, activate the digital input configured as OLR (change over current limit) (→ Fig. 80 and Table 16).

Under PNU b021/b024, you can define the overload limit.

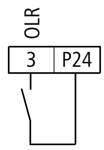
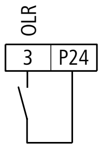
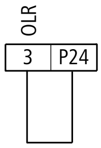


Figure 80: Digital input 3 configured as OLR (change over current limit)

Table 16: Changing over the current limit

OLR	PNU	Active
	b021	✓
	b022	✓
	b023	✓
	b024	–
	b025	–
	b026	–
	b021	–
	b022	–
	b023	–
	b024	✓
	b025	✓
	b026	✓

▶ Under PNU b021 to b023, define the overload behaviour for your first instance.
▶ Under PNU b024 to b026, define the overload behaviour for your second instance.
▶ Program one of the digital inputs 1 to 8 as OLR by entering the value 39 under the corresponding PNU (C001 to C008).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b021/ b024	Current limit characteristic	–	✓	00	Motor current limit not active	01
				01	Motor current limitation active on acceleration and constant speed	
				02	Motor current limitation active at constant speed	
				03	Motor current limit active in all operating states	
b022/ b025	Tripping current	–	✓	0.5 to 2.0 × I_e	Setting range of the tripping current as a multiple of the frequency inverter rated current, i.e. the range is given in amperes (A).	1.5× I_e
b023/ b026	Time constant	–	✓	0.1 to 30.0 s	When the set current limit is reached, the frequency is reduced to 0 Hz in the time set here. Caution: If possible, do not enter a value below 0.3 here!	1.00

Heavy mains starting (CS)

The CS function is used for starting drives with an extremely high starting torque directly from the mains. This means that a smaller, less expensive frequency inverter can be used, since the DV6 has to deliver only the motor full load current, not the high starting current (for example 50 A starting current, 15 A motor full load current).

To use this function, the system must be wired as shown in Figure 81.

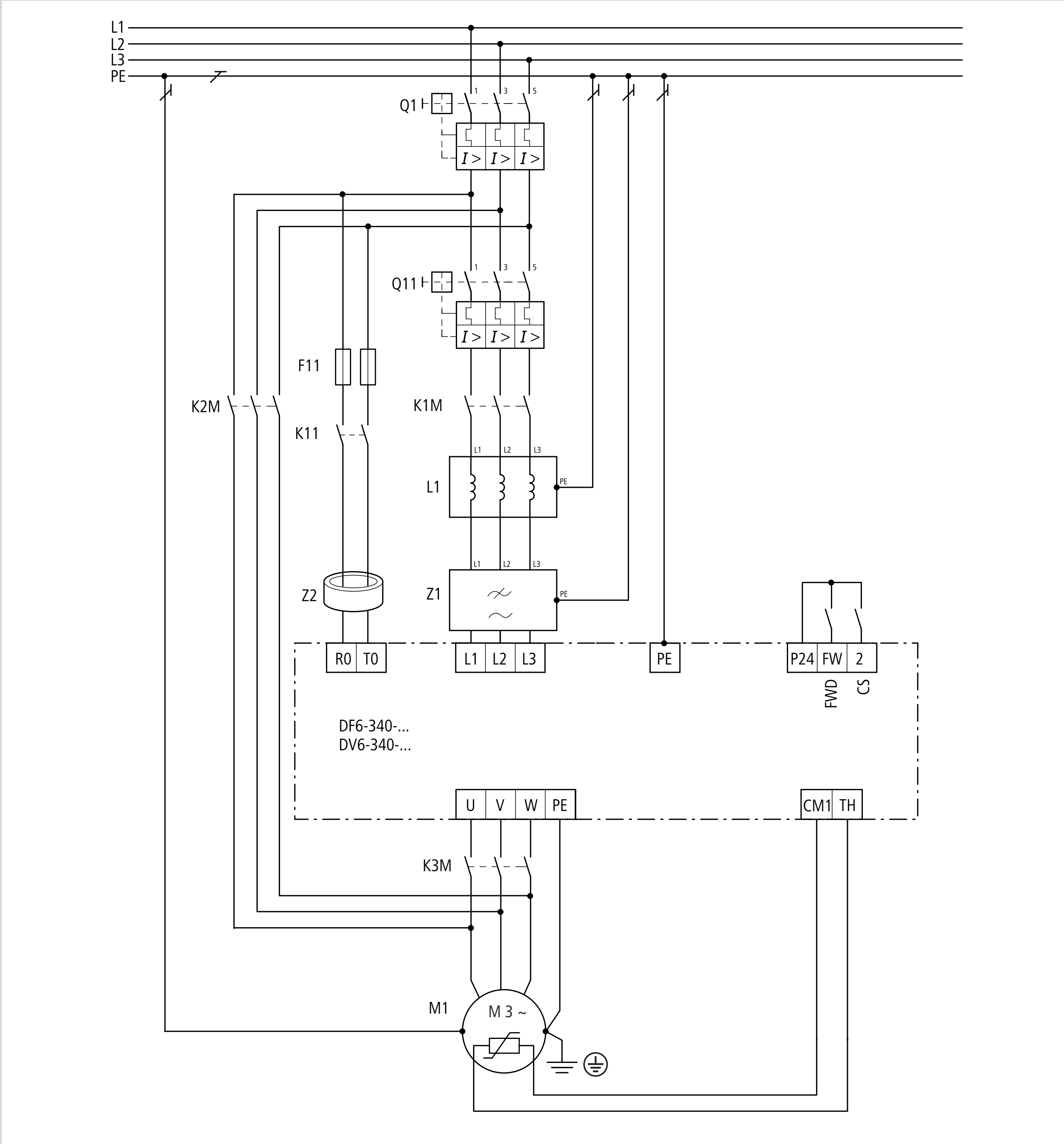


Figure 81: DV6 series frequency inverters with K2M bypass contactor, K3M motor contactor and K1M mains contactor

F11: 6 A miniature circuit-breaker, for example FAZ-B6

Actuation of the contactors consists of the following steps:

- The startup takes place through the K2M bypass contactor.
- Once the motor has accelerated, switch the K2M bypass contactor off and, with a delay (of 0.5 to 1.0 s), activate the K3M motor contactor.
- Then, switch the K1M mains contactor on and, at the same time, activate the digital input configured as CS.
- When the CS input is deactivated, the waiting time set under PNU b003 begins.
- Once this time has expired, the DV6 frequency inverter synchronizes to the motor speed and continues to run the motor.

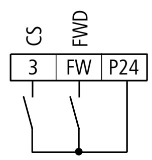


Figure 82: Digital input configured FW as FWD (start/stop clockwise operation) and 3 as CS (heavy mains starting)

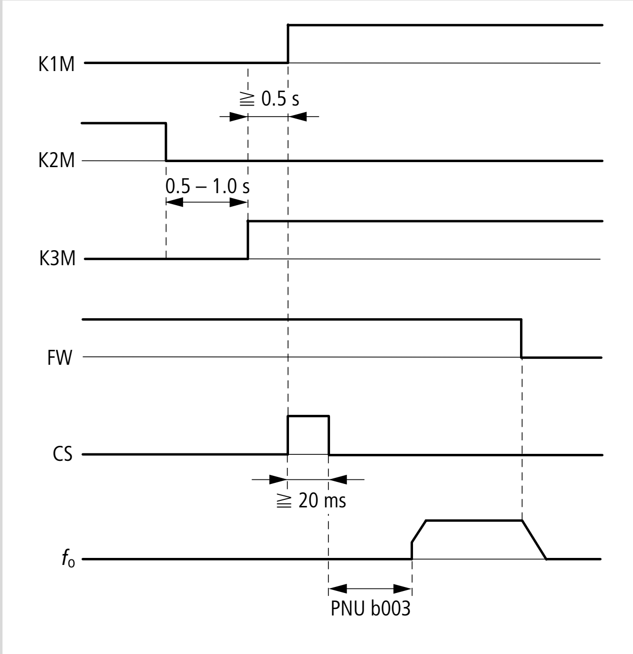
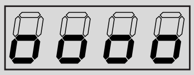


Figure 83: Function chart for CS (heavy mains starting)

▶ Program one of the digital inputs 1 to 8 as CS by entering the value 14 under the corresponding PNU (C001 to C008).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b003	Waiting time before restart	–	✓	0.3 to 100 s	Here, set a time which is to expire before an automatic restart is initiated after the supply voltage is connected. This time can also be used in conjunction with the FRS function. During the delay, the following message appears on the LED display: 	1.0

Setpoint value through keypad (OPE)

When you activate the digital input configured as OPE, an Enable signal must be issued with the ON key on the keypad. If, for example, you have entered the value 01 under PNU A001 (frequency setpoint input through analog input) and the value 01 under PNU A002 (start signal through digital input), these settings become invalid as soon as you activate the OPE input. PNU A002 then contain the value 02 (start signal through ON key) and the setpoint frequency under PNU A020 or PNU F001 becomes active. If you activate the OPE input while the inverter is in RUN mode, it decelerates and can then be started with the ON key on the device. If the start signal is still active, the frequency inverter accelerates to the previously set frequency again as soon as you deactivate the OPE input.

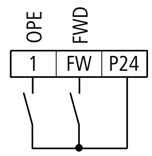


Figure 84: Digital output 11 configured as OPE (setpoint definition through keypad)

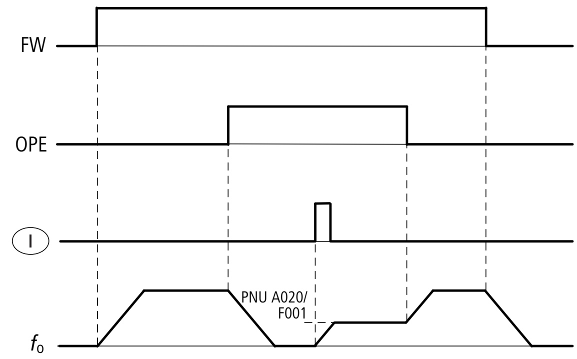


Figure 85: Function chart for OPE (setpoint definition through keypad)

f_O: Output frequency

▶ Program one of the digital inputs 1 to 8 as OPE by entering the value 31 under the corresponding PNU (C001 to C008).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V), O2 (±10 V) or OI (4 to 20 mA)	
				02	Definition through PNU F001 and/or PNU A020	
				03	Definition through RS 485 serial interface	
				04	Setpoint definition through the optional module in slot 1	
				05	Setpoint definition through the optional module in slot 2	
A002	Start signal	–	–	01	The motor start signal is issued through the FW input or a digital input configured as REV.	01
				02	The motor start signal is issued by the ON key on the keypad.	
				03	The motor start signal is issued through the RS 485 interface.	
				04	The motor start signal is issued through the optional module in slot 1.	
				05	The motor start signal is issued through the optional module in slot 2.	

Torque limitation (TL), torque selection (TRQ1 and TRQ2)

With the digital inputs configured as TL, TRQ1 and TRQ2, you can control the torque limitation. This function is based on the motor current limitation and is available only in vector control mode (PNU A044) (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV
- 0 Hz SLV
- Vector control with optional DE6-IOM-ENC module.

Under PNU b040, specify how the torque limits are defined.

TL – activate torque limitation
If you activate the digital input configured as TL, the torque limits under PNU b040 apply. Otherwise, the frequency inverter uses 200 % as its upper limit.

If no digital input is configured as TL, the 200 % upper limit also applies for torques.

TRQ1 and TRQ2 – bitwise selection of torque limits
With the digital inputs configured as TRQ1 and TRQ2, you can define the currently applicable torque limit PNU b041 to b044. To do this, enter the value 01 in PNU b040. The torque limit selected with TRQ1 and TRQ2 limit applies to all four quadrants.

TRQ1	TRQ2	Torque limit
On	Off	b041 (clockwise, drive mode)
On	Off	b042 (anticlockwise, regenerative mode)
On	On	b043 (anticlockwise, drive mode)
Off	On	b044 (clockwise, regenerative mode)

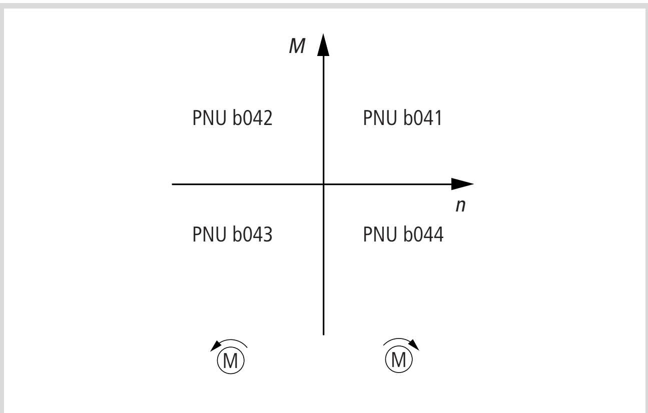


Figure 86: The four quadrants of a motor

n: Speed
M: Torque

Programming the digital inputs

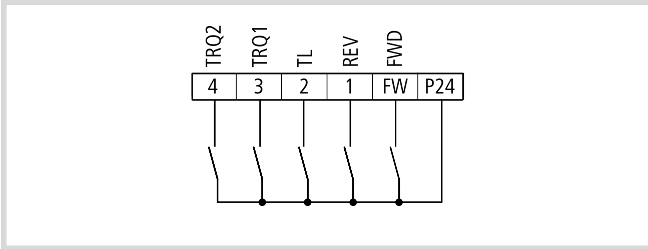


Figure 87: Digital input 1 configured as REV (start/stop anticlockwise operation), 2 as TL (activate torque limitation), 3 and 4 as TRQ1 and TRQ2 (bitwise selection of torque limits).

▶ To activate vector control, enter one of the following values in PNU A044 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
  – 03: SLV control
  – 04: 0 Hz SLV control
  – 05: Vector control with optional DE6-IOM-ENC module
▶ If you want to use TRQ1 and TRQ2, enter the value 01 under PNU b040.
▶ Program one of the digital inputs 1 to 8 as TL by setting the corresponding PNU (C001 to C008) to 40.
▶ Program one of the digital inputs 1 to 8 as TRQ1 by setting the corresponding PNU (C001 to C008) to 41.
▶ Program one of the digital inputs 1 to 8 as TRQ2 by setting the corresponding PNU (C001 to C008) to 42.

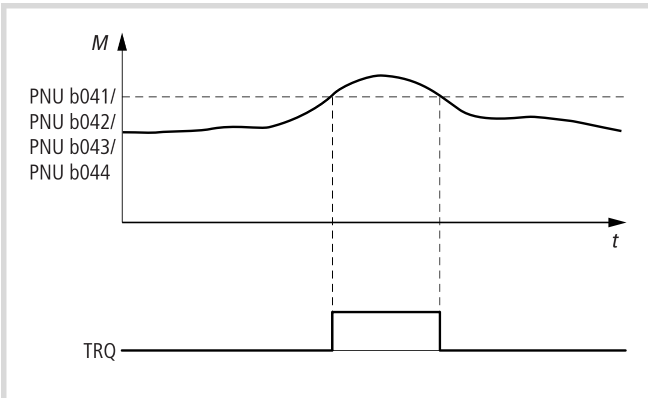


Figure 88: Function chart for torque limits

PNU	Name	Adjustable in RUN mode Normal	Adjustable in RUN mode Extended	Value	Function	WE
A044 A244 A344	Voltage/ frequency characteristic	–	–	00	*ΔU/f* characteristic, linear	00
				01	*ΔU/f* characteristic, quadratic, for example fans	
				02	User-definable	
				03	Sensorless vector control (SLV)[1)]	
				04	0 Hz SLV[1)]	
				05	Vector control[1)] with optional DE6-IOM-ENC module	
b040	Selection of torque limitation	–	✓	00	Torque limitation in all four quadrants (PNU b041 to b044)	00
				01	Changeover of torque limits through digital inputs (TRQ1 and TRQ2)	
				02	Torque limit through analog input O (0 to 10 V)	
				03	Torque limit through optional module on slot 1	
				04	Torque limit through optional module on slot 2	
b041	Torque limit, first quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b042	Torque limit, second quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b043	Torque limit, third quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b044	Torque limit, fourth quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b045	Response on reaching the torque limit	–	✓	00	Not active, waits until lower limit value exceeded before accelerating or decelerating	00
				01	Active, continues to accelerate or decelerate despite exceeded torque limit	
b046	Reverse rotation protection	–	✓	00	Anticlockwise operation is allowed.	00
				01	Anticlockwise operation is **not** allowed.	

1) If SLV control is active, you should set the pulse frequency to at least 2.1 kHz with PNU b083 (→ Section “Pulse frequency”, Page 164).

Three-wire control (STA – STP – F/R)

With digital inputs configured as STA, STP and F/R, you can operate the DV6 frequency inverter with three switches:

- STA: Start
- STP: Stop
- F/R: Reverse direction

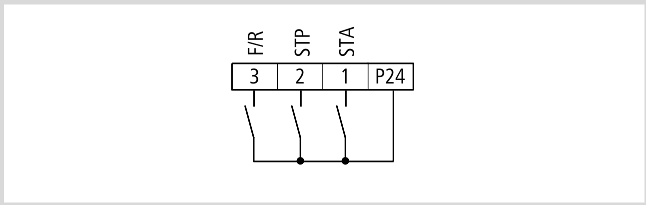


Figure 89: Digital input 1 configured as STA (pulse start), digital input 2 as STP (Pulse stop) and digital input 3 as F/R (reverse direction).

▶ Program three of digital inputs 1 to 8 as STA, STP and F/R, by entering the following values under the corresponding PNU (C001 to C008):
   – STA: 20
   – STP: 21
   – F/R: 22

The DV6 frequency inverter accelerates to the setpoint frequency entered under PNU A020.

▶ Under PNU A001, enter the value 02 (setpoint definition through PNU A020).
▶ Under PNU A002, enter the value 01 (start signal through digital inputs).
▶ Under PNU A020, enter the setpoint frequency.

If you want to start the inverter through the STA input, the STP input must be activated (inverse function, fail-safe). The signal must be applied for only a short time (pulse). If the STP input is deactivated, the motor is stopped. If the F/R input (pulse) is activated, the motor direction is reversed.

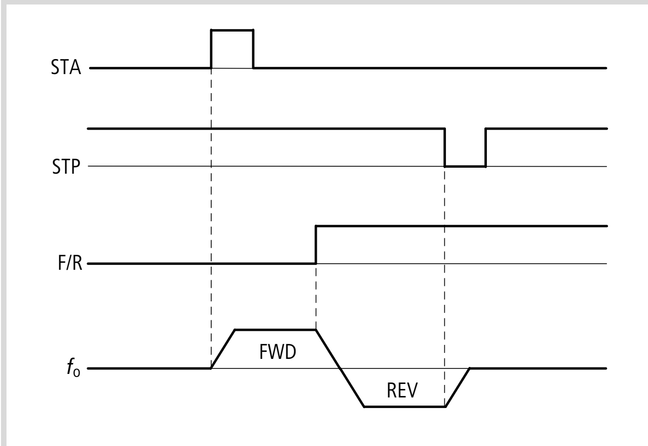


Figure 90: Function chart for STA (pulse start) STP (pulse stop) and F/R (direction reversal)

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V), OI (4 to 20 mA) or O2 (–10 V to +10 V ⎓)	
				02	Definition through PNU F001 and/or PNU A020	
				03	Definition through the RS 485 serial interface, terminals RP, 2 × SN and SP	
				04	Definition through optional card at slot 1	
				05	Definition through optional card at slot 2	
A002	Start signal	–	–	01	The motor start signal is issued through digital inputs, for example through the FW input or a digital input configured as REV.	01
				02	The motor start signal is issued by the ON key on the keypad.	
				03	The motor start signal is issued through the RS 485 interface.	
				04	The motor start signal is issued through the optional module in slot 2.	
				05	The motor start signal is issued through the optional module in slot 2.	
A020 A220 A320	Frequency setpoint value	✓	✓	0 to PNU A004	You can enter a frequency setpoint value. Set PNU A001 to 02 for this purpose.	0.0

Activating/deactivating PID control (PID)
Resetting PID and integral component (PIDC)

The digital input configured as PID is used for activating and deactivating PID control. For a detailed description of the built-in PID controller, see Section "PID controller", Page 134. PID control can be activated and deactivated through the PID input only if PID control has been enabled by entering the value 1 under PNU A071 (→ Section "PID control active/inactive", Page 137). When the PID input is activated, PID control is deactivated and the frequency inverter works in "normal" frequency control mode.

The digital input configured as PIDC resets the integral component of the PID control. When this input is activated, the integral component is reset to zero.

→ The PID and PIDC inputs are optional. If you want to keep PID control permanently active, you only need to set PNU A071 to 1.

→ Do not switch PID control on and off while the frequency inverter is in RUN mode (i.e. while the RUN lamp is lit).

→ Do not reset the integral component of the PID control while the frequency inverter is in RUN mode (i.e. while the RUN lamp is lit), since this could cause overcurrent tripping.

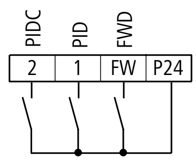


Figure 91: Digital input FW configured as FWD (start/stop clockwise), 1 as PID (activate/deactivate PID control) and 2 as PIDC (reset integral component)

- ▶ Program one of the digital inputs 1 to 8 as PID by setting the corresponding PNU (C001 to C008) to 23.
- ▶ Program one of the digital inputs 1 to 8 as PIDC by setting the corresponding PNU (C001 to C008) to 24.

Changeover from PI to P control (PPI)

When you activate the digital input configured as PPI, a changeover from PI to P control takes place. The PI controller regulates the motor speed in vector control mode. This changeover is useful, for example, if you want to operate a dual-motor drive through two DV6 frequency inverters.

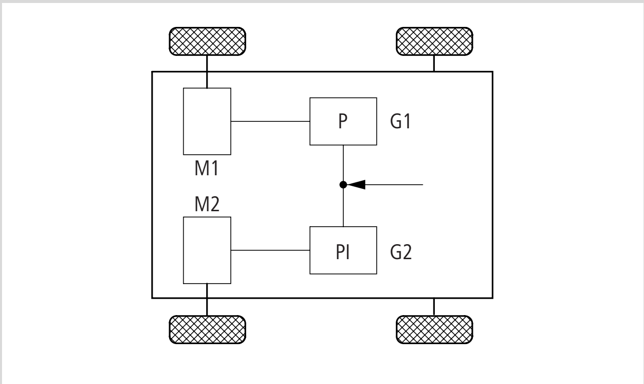


Figure 92: Drive with two motors and two frequency inverters

The first frequency inverter is then operated with PI control and the second with P control. The two frequency inverters are linked to each other through the analog current inputs and outputs. The frequency inverter with PI control outputs the current frequency through terminals AMI-L to the OI-L terminals of the second frequency inverter. The second frequency inverter works with P control.

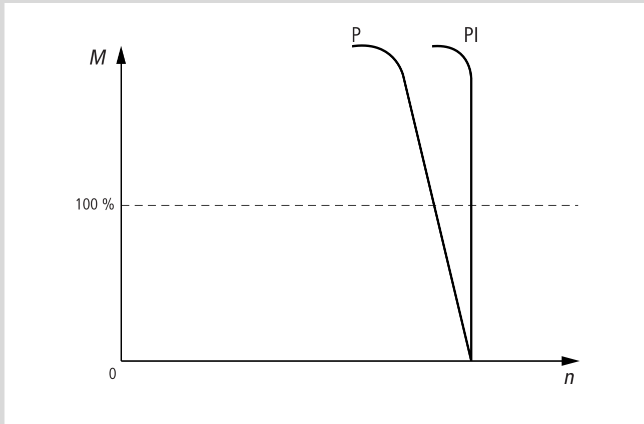


Figure 93: Function chart for PI and P control

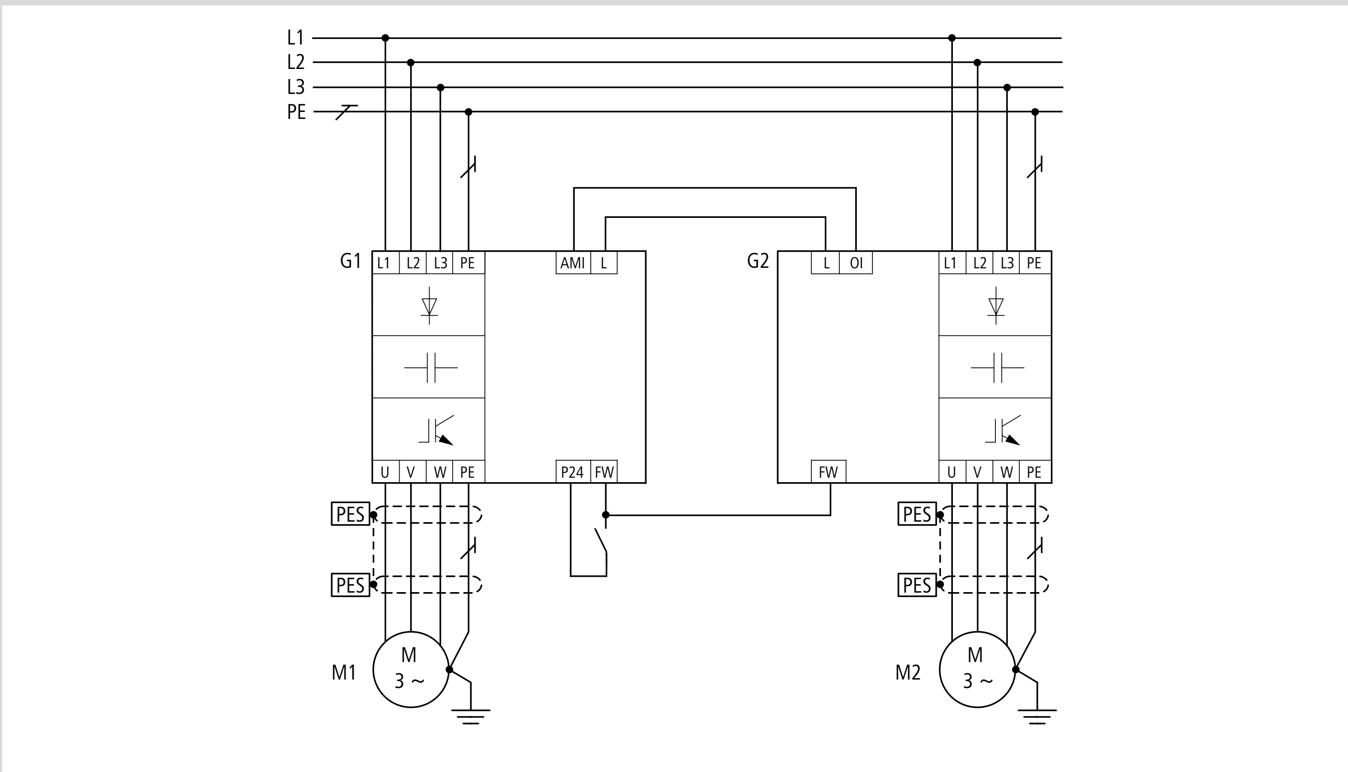


Figure 94: Controlling two motors with two frequency inverters

The PI TO P control changeover function is available only in vector control mode (PNU A044) (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV
- 0 Hz SLV
- Vector control with optional DE6-IOM-ENC module.

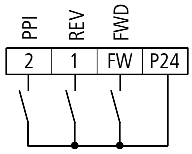


Figure 95: Digital input 1 configured as REV (start/stop anticlockwise operation) and 2 as PPI (changeover PI to P control) .

▶ To activate vector control, enter one of the following values under PNU A044 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
  – 03: SLV
  – 04: 0 Hz SLV
  – 05: Vector control with optional DE6-IOM-ENC module
▶ Program one of the digital inputs 1 to 8 as PPI by setting the corresponding PNU (C001 to C008) to 43.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A044 A244 A344	Voltage/ frequency characteristic	–	–	00	*ΔU/f* characteristic, linear	00
				01	*ΔU/f* characteristic, quadratic, for example fans	
				02	User-definable	
				03	Sensorless vector control (SLV)1)	
				04	0 Hz SLV1)	
				05	Vector control1) with optional DE6-IOM-ENC module	

1) If SLV control is active, set the pulse frequency to at least 2.1 kHz with PNU b083 (→ Section "Pulse frequency", Page 164).

Brake enable confirmation (BOK)

The digital input configured as BOK is used for monitoring an external brake, which is needed where heavy loads are to be lifted, such as for lift and crane controllers. When an external brake is employed, you should use the SLV (sensorless vector) or 0 Hz SLV control mode, which can provide a higher torque (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).

The BOK input of the DV6 is activated by the Enable signal of an external brake as long as the external brake is released.

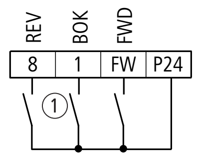


Figure 96: Digital input FW configured as FWD (start/stop clockwise operation), 1 as BOK (confirm brake enable) and 8 as REV (start/stop anticlockwise operation)

① Brake Released signal

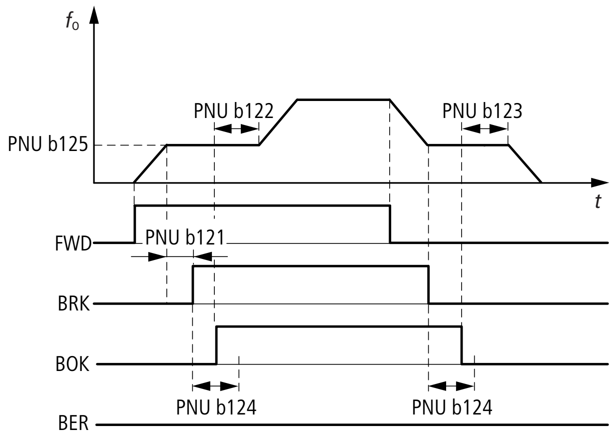


Figure 97: Brake control function chart

▶ Program one of the digital inputs 1 to 8 as BOK by setting the corresponding PNU (C001 to C008) to 44.

For detailed description of the extended parameter groups, → Section "Controlling an external brake", Page 169.

Programmable digital outputs 11 to 15

Programmable digital outputs 11 to 15 are open collector transistor outputs (→ Fig. 98), to which you can connect, for example, relays. These outputs can be used for various functions, for example to signal when a determined frequency setpoint is reached or when a fault occurs.

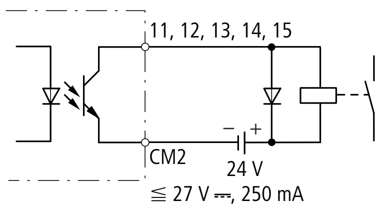


Figure 98: Digital output

Transistor output: up to 27 V ⎓, 250 mA

The terminal functions for programmable digital outputs 11 to 15 are configured under PNU C021 to C025 respectively, i.e. PNU C021 defines the function of digital output 11, PNU C022 the function of digital output 12, etc.

Table 17: Digital outputs 11 to 15

PNU	Terminal	Adjustable in RUN mode		Value	WE
		Normal	Extended		
C021	11	–	✓	→ Table 18	01
C022	12				00
C023	13				03
C024	14				07
C025	15				08

For a detailed description of the output functions, see the pages listed in Table 18.

Table 18: Functions of the digital outputs

Value	Function	Description	→ Page
00	RUN	Operation	104
01	FA1	Frequency setpoint reached	102
02	FA2	Frequency exceeded	102
03	OL	Overload signal	105
04	OD	PID control deviation exceeded	106
05	AL	Fault	107
06	FA3	Frequency (within range) reached	102
07	OTQ	Torque reached (exceeded)	110
08	IP	Mains failure, immediate stop	113
09	UV	Undervoltage signal	113
10	TRQ	Torque limitation	111
11	RNT	Running time exceeded	114
12	ONT	Mains On time exceeded	114
13	THM	Motor thermal overload	115
19	BRK	Release brake	108
20	BER	Brake fault	108
21	ZS	Zero speed	109
22	DSE	Speed deviation exceeded	–[1]
23	POK	Positioning	–[1]
24	FA4	Frequency exceeded	102
25	FA5	Frequency setpoint reached	102
26	OL2	Overload signal 2	105

1) → Manual AWB8230-1431.. for encoder module DE6-IOM-ENC

Programmable digital outputs 11 to 15 are configured by default as make contacts.

Optionally, you can configure the digital outputs as break (NC) contacts. To do this, enter 01 under PNU C031 to C35 (corresponding to digital outputs 11 to 15).

Table 19: Configuration of digital outputs as make contacts

PNU	Terminal	Value	Adjustable in RUN mode		Function	WE
			Normal	Extended		
C031	11	00 or 01	–	✓	00: Make contact 01: Break contact	00
C032	12					
C033	13					
C034	14					
C035	15					

Frequency arrival signal FA1/FA2/FA3/FA4/FA5

The digital output configured as FA1 is activated as soon as the setpoint frequency is reached (→ Fig. 99).

The digital output configured as FA2 is active while the frequencies defined under PNU C042 and C043 are exceeded (→ Fig. 101).

The digital output configured as FA3 is activated when the frequency defined under PNU C042 is reached during acceleration. As soon as this frequency is left, FA3 is deactivated again. During deceleration, FA3 responds in the same way at the frequency set under PNU C043 (→ Fig. 102).

The digital output configured as FA4 is active while the frequencies defined under PNU C045 and C046 are exceeded (→ Fig. 101).

The digital output configured as FA5 is activated when the frequency defined under PNU C045 is reached during acceleration. As soon as this frequency is left, FA3 is deactivated again. During deceleration, FA3 responds in the same way at the frequency set under PNU C046 (→ Fig. 102).

To achieve a certain hysteresis, signals FA1 to FA5 are each activated with f_1 before the switching threshold is reached and deactivated again with f_2 on leaving the switching threshold. f_1 and f_2 are:

- f_1 = 1 % of the end frequency (PNU A004, A204, A304)
- f_2 = 2 % of the end frequency (PNU A004, A204, A304)

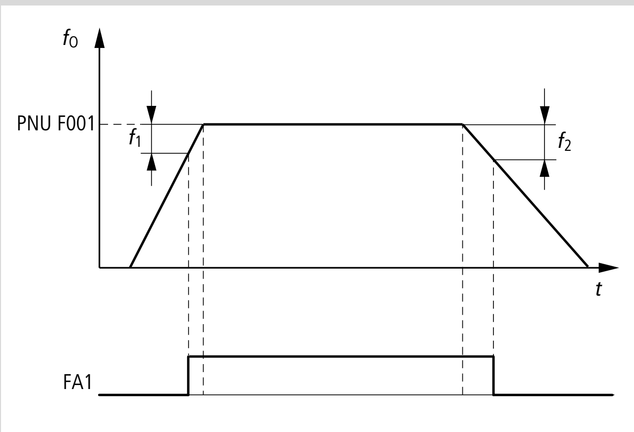


Figure 99: Function chart for FA1 (frequency reached)

f_o: Output frequency
f_1: 1 % of the end frequency (PNU A004, A204, A304)
f_2: 2 % of the end frequency (PNU A004, A204, A304)
F001: Setpoint value

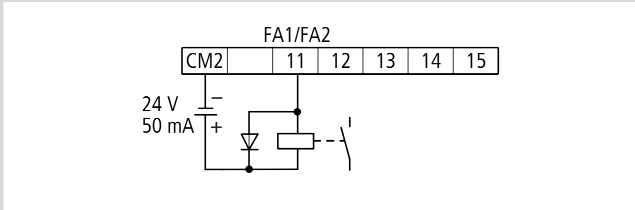


Figure 100: Digital output 11 configured as FA1/FA2 (frequency reached/exceeded)

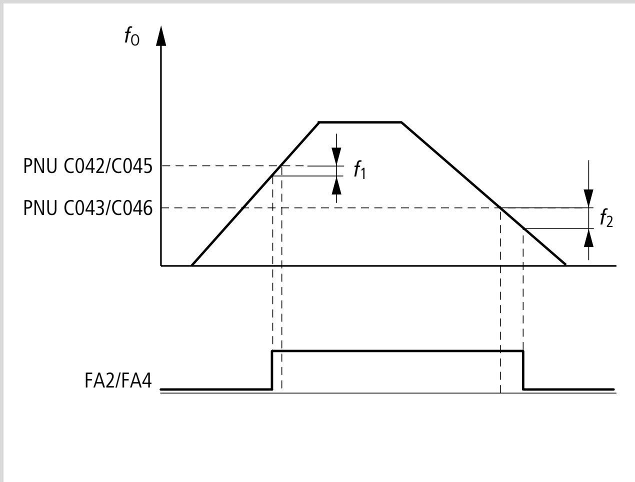


Figure 101: Function chart for FA2 (frequency exceeded)/FA4

f_o: Output frequency
f_1: 1 % of the end frequency (PNU A004, A204, A304)
f_2: 2 % of the end frequency (PNU A004, A204, A304)

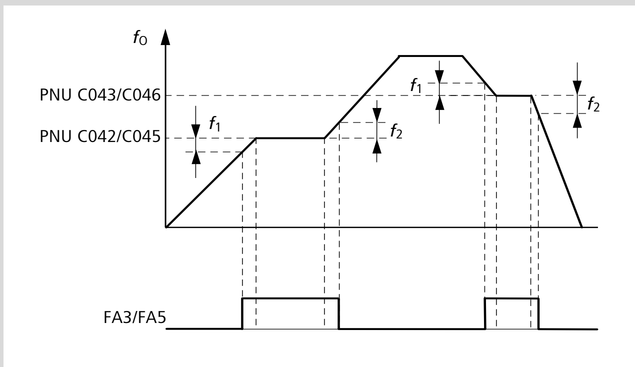


Figure 102: Function chart for FA3 (frequency reached)/FA5

f_o: Output frequency
f_1: 1 % of the end frequency (PNU A004, A204, A304)
f_2: 2 % of the end frequency (PNU A004, A204, A304)

▶ To configure a programmable output as FA2, set the frequency under PNU C042, at which the FA2 signal is to be generated in the acceleration phase.
▶ With PNU C043, set the respective frequency which is to remain active until the FA2 signal is deactivated during deceleration.

- Do the same for FA3.
- For FA4 and FA5, set the switching thresholds under PNU C045 for acceleration and under PNU C046 for deceleration.
- Then, program one of the digital outputs 11 to 15 as FA1 to FA5 output by entering one of the following values under the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12:
  - FA1: 01
  - FA2: 02
  - FA3: 06
  - FA4: 24
  - FA5: 25

By default, FA1 is assigned to digital output 11.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C042	Frequency switching threshold during acceleration	–	✓	0 to 400 Hz	The digital output configured as FA2 or FA3 (11 to 15) is activated when the frequency entered here is exceeded during acceleration.	0.0
C043	Frequency switching threshold during deceleration				The digital output configured as FA2 or FA3 (11 to 15) remains active as long as the actual frequency remains higher than the frequency entered during deceleration (→ Fig. 101 and Fig. 102).	
C045	Frequency switching threshold during acceleration (2)				The digital output configured as FA4 or FA5 (11 to 15) is activated when the frequency entered here is exceeded during acceleration (→ Fig. 101 and Fig. 102).	
C046	Frequency switching threshold during deceleration (2)				The digital output configured as FA4 or FA5 (11 to 15) remains active as long as the actual frequency remains higher than the frequency entered during deceleration (→ Fig. 101 and Fig. 102).	

Run signal (RUN)

The digital output configured as RUN remains activated as long as a frequency not equal to 0 Hz is present, i.e. as long as the motor is driven in a clockwise or anticlockwise direction. The RUN signal is also active during DC braking.

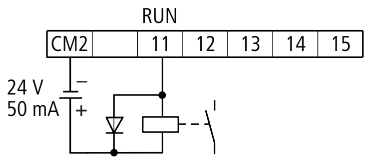


Figure 103: Digital output 11 configured as RUN (Run signal)

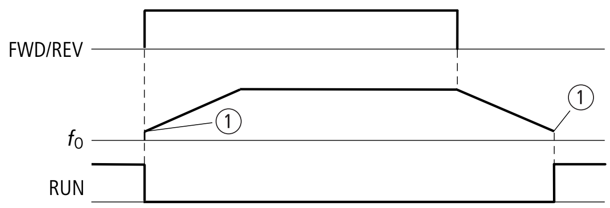


Figure 104: Function chart for RUN (Run signal)

f_O: Output frequency

① At PNU b082 set starting frequency

▶ Program one of the digital outputs 11 to 15 as RUN output by setting the value 00 in the corresponding PNU (C021 to C025) or in PNU C026 for signalling relay contacts K11-K12.

By default, RUN is assigned to digital output 12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b082	Increased starting frequency	–	✓	0.5 to 9.9 Hz	A higher starting frequency results in shorter acceleration and deceleration times (for example to overcome high frictional resistance). If the frequency is too high, fault message E02 may be issued. Up to the set starting frequency, the motor starts without a ramp function.	0.5

Overload signal OL, OL2

The digital output configured as OL or OL2 is activated when a freely selectable motor current is exceeded. The OL/OL2 output is active as long as the motor current is higher than this threshold.

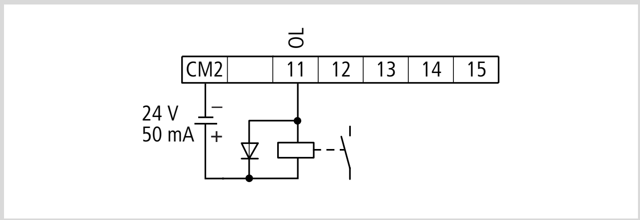


Figure 105: Digital output 11 configured as OL/OL2 (overload signal)

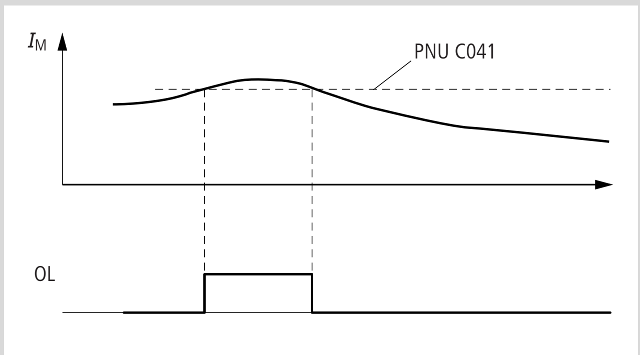


Figure 106: Function chart for OL (overload signal)/OL2

- If you configure a programmable digital output as OL, you must, under PNU C041, enter the current at which, when exceeded, the OL signal is activated.
- To configure a programmable digital output as OL2, define the current under PNU C111 at which, when exceeded, the OL2 signal is activated.
- Then, program one of the digital outputs 11 to 15 as OL output by setting the corresponding PNU (C021 to C025) to 03.
- Then, program one of the digital outputs 11 to 15 as OL2 output by setting the corresponding PNU (C021 to C025) to 26.

By default, OL is assigned to digital output 13.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C040	Overload alarm signal	–	✓	00	Always	01
				01	Only at constant speed	
C041	Overload alarm threshold			0 to 2 × I_e 1)	The current value entered here determines when the OL signal is activated.	I_e 1)
C111					The current value entered here determines when the OL2 signal is activated.	

1) Frequency inverter rated current

PID control deviation (OD)

The digital output configured as OD is activated when a user definable PID deviation (of the actual value from the setpoint value) is exceeded. The OD output remains active as long as this differential is exceeded.

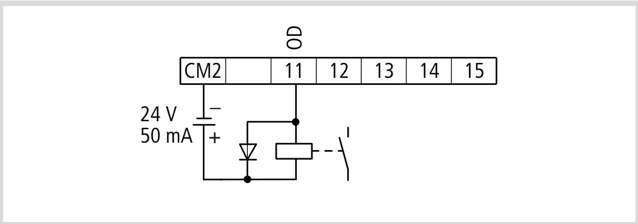


Figure 107: Digital output 11 configured as OD (PID control deviation)

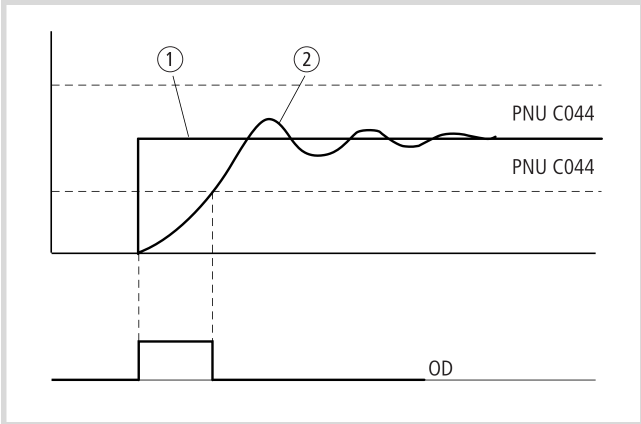


Figure 108: Function chart for OD (PID control deviation)

① Setpoint
② Actual value

▶ If you configure a programmable digital output as OD, you must also, under PNU C044 enter the threshold at which the OD signal will activate when the value is exceeded.
▶ Program one of the digital outputs 11 to 15 as OD by entering the value 04 in the corresponding PNU (C021 to C025) or in PNU C026 for signalling relay contacts K11-K12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C044	PID regulator deviation	–	✓	0 to 100%	If the deviation between the setpoint and actual value exceeds the value entered here when PID control is active, the OD signal is activated.	3.0

Fault signal (AL)

The digital output configured as AL is activated when a fault has occurred.

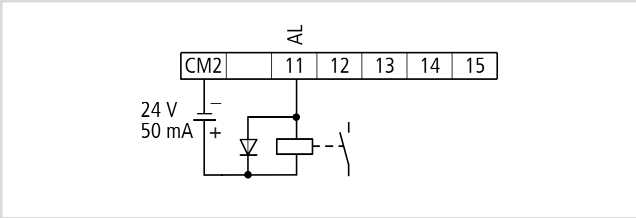


Figure 109: Digital output 11 configured as AL (fault occurrence)

▶ Program one of the digital outputs 11 to 15 as AL by setting the corresponding PNU (C021 to C025) to 05.

By default, AL is assigned to signalling relay K1 (terminal K11, K12, K14).

Please note that the programmable digital outputs (including the one configured as AL) are open collector types and therefore have different electrical characteristics than the signalling relay outputs (terminals K11, K12 and K14). In particular, the maximum voltage and current carrying capacity ratings are significantly lower than those of the relay outputs.

After the frequency inverter supply voltage has been switched off, the AL output remains active until the DC bus voltage has dropped below a certain level. This time depends, among other factors, on the load applied to the inverter.

The delay from the time a fault occurs until the AL output is activated is about 300 ms.

Release brake (BRK) and brake fault (BER)

The digital outputs configured as BRK and BER are used for controlling an external brake or an emergency brake. A brake is needed in application involving the lifting of heavy loads, such as lift and crane controllers. If an external brake is used, you should use the SLV (sensorless vector) or 0 Hz SLV control mode, which can provide a higher torque (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).

To release the brake, the DV6 frequency inverter issues the BRK signal.

The DV6 issues the BER signal when:

- the time set under PNU b124 has expired and the digital input configured as BOK is not activated (acceleration),
- the time set under PNU b124 has expired and the digital input configured as BOK is not deactivated (deceleration),
- the time set under PNU b121 has expired and the Brake Enable current defined under PNU b126 was not reached.

Together with the BER output, the frequency inverter issues fault message E36.

Warning!
When the frequency inverter issues a fault message, it also deactivates the output to the motor controller. In this case, the motor is not stopped by the frequency inverter. For applications in which safety is an issue, you must therefore provide an emergency brake.

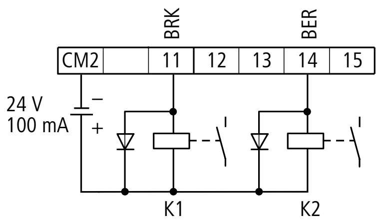


Figure 110: Digital output 11 configured as BRK (release brake) and 14 as BER (brake fault).

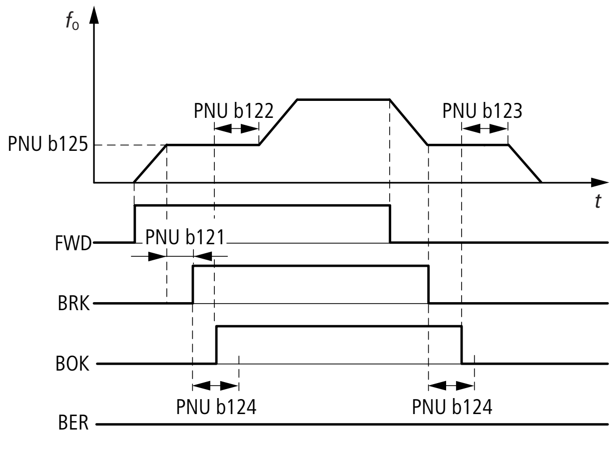


Figure 111: Brake control function chart

- ▶ Program one of the digital outputs 11 to 15 as BRK by entering the value 19 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.
- ▶ Program one of the digital outputs 11 to 15 as BER by entering the value 20 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

For a detailed description of the extended parameter groups, → Section "Controlling an external brake", Page 169.

Zero frequency (ZS)

The digital output configured as ZS becomes active when the frequency falls below the frequency set under PNU C063.

▶ Program one of the digital outputs 11 to 15 as ZS by entering the value 21 in the corresponding PNU (C021 to C025) or under PNU C026 for the signalling relay contacts K11-K12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C063	Frequency threshold for ZS output	–	✓	0 to 100 Hz	When the actual frequency falls below this frequency, the ZS output is activated.	0.00

Torque exceeded (OTQ)

When the torque limits set under PNU C055 to C058 are reached or exceeded, the DV6 frequency inverter activates the digital output configured as OTQ.

This function is available only in vector control mode (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV (sensorless vector) control
- 0 Hz SLV control
- Vector control with optional DE6-IOM-ENC module

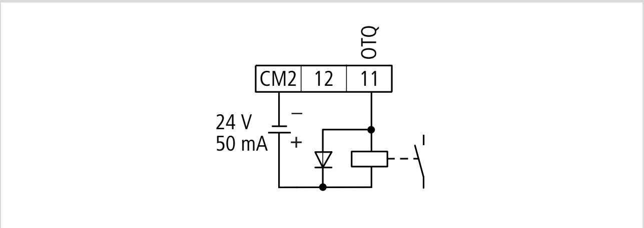


Figure 112: Digital output 11 configured as OTQ (torque exceeded)

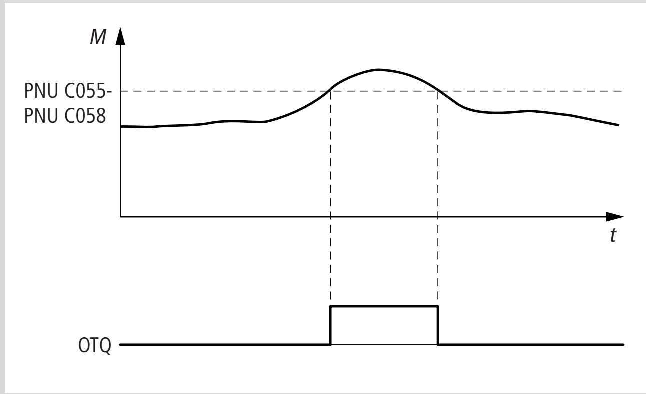


Figure 113: Function chart for OTQ (torque exceeded)

▶ Program one of the digital outputs 11 to 15 as OTQ by entering the value 07 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

By default, OTQ is assigned to digital output 14.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C055	Torque threshold (clockwise, drive mode)	–	✓	0 to 200 %	To DV6-340-55k	100
				0 to 180 %	From DV6-340-75K	
C056	Torque threshold (anticlockwise, regenerative mode)			0 to 200 %	To DV6-340-55k	
				0 to 180 %	From DV6-340-75K	
C057	Torque threshold (anticlockwise, drive mode)			0 to 200 %	To DV6-340-55k	
				0 to 180 %	From DV6-340-75K	
C058	Torque threshold (clockwise, regenerative mode)			0 to 200 %	To DV6-340-55k	
				0 to 180 %	From DV6-340-75K	

Torque limitation (TRQ)

When the set torque limits are reached or exceeded, the DV6 frequency inverter activates the digital output configured as TRQ.

This function is available only in vector mode (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV (sensorless vector) control
- 0 Hz SLV control
- Vector control with optional DE6-IOM-ENC module

To use a TRQ output, you must first configure one of the digital inputs 1 to 8 as TL (activate torque limitation) (→ Section "Torque limitation (TL), torque selection (TRQ1 and TRQ2)", Page 94).

Under PNU b040, specify how the torque limits are defined.

Under PNU b041 to b044, set the torque limits for the motor's four quadrants.

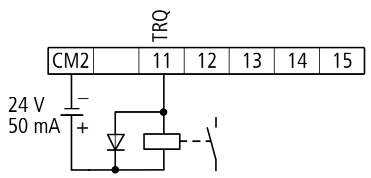


Figure 114: Digital output 11 configured as TRQ (torque limitation).

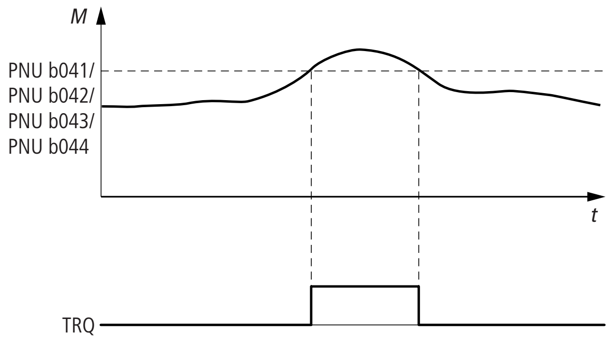


Figure 115: Function chart for TRQ (torque limitation)

▶ To activate vector control, enter one of the following values under PNU A044 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
  – 03: SLV control
  – 04: 0 Hz SLV control
  – 05: Vector control with optional DE6-IOM-ENC module

▶ Under PNU b040, specify how the torque limits are defined.

▶ If you have entered the value 00 under PNU b040, enter the torque limits for each of the motor's four quadrants under PNU b041 to b044.

▶ Program one of the digital inputs 1 to 8 as TL by setting the corresponding PNU (C001 to C008) to 40.

▶ Program one of the digital outputs 11 to 15 as TRQ by entering the value 10 in the corresponding PNU (C021 to C025) or under PNU C026 for the signalling relay contacts K11-K12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A044 A244 A344	Voltage/ frequency characteristic	–	–	00	*ΔU/f* characteristic, linear	00
				01	*ΔU/f* characteristic, quadratic, for example fans	
				02	User-definable	
				03	Sensorless vector control (SLV)1)	
				04	0 Hz SLV1)	
				05	Vector control1) with optional DE6-IOM-ENC module	
b040	Selection of torque limitation	–	✓	00	Torque limitation in all four quadrants (PNU b041 to b044)	00
				01	Changeover of torque limits through digital inputs (TRQ1 and TRQ2)	
				02	Torque limit through analog input O (0 to 10 V)	
				03	Torque limit through optional module in slot 1	
				04	Torque limit through optional module in slot 2	

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b041	Torque limit, first quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b042	Torque limit, second quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b043	Torque limit, third quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	
b044	Torque limit, fourth quadrant	–	✓	0 to 200 %	For DV6-340-075 to DV6-340-45K	150
				0 to 180 %	For DV6-340-55k to DV6-340-132K	
				no	For all variables: function not active.	

1) If SLV control is active, you should set the pulse frequency to at least 2.1 kHz with PNU b83 (→ Section “Pulse frequency“, Page 164).

Instant stop (IP) and undervoltage (UV)

The UV (undervoltage) and IP (instant stop) signals can be assigned to one of the digital outputs 11 to 15.

The UV output is activated when the internal DC link voltage falls below a specified limit value. The CPU monitors the DC link voltage, and as soon as it falls below a particular value, the output voltage is switched off to prevent the device from being damaged. This is important since, when the drive requires full power and the DC link voltage falls, the current rises, which can lead to an unexpected disconnection due to overload or overcurrent.

The IP output is activated when the supply voltage fails or an overvoltage occurs. With this function, the input voltage is monitored, allowing a disconnection to take place more quickly.

Voltage monitoring does not work if a phase failure occurs at the main power supply (L1, L2, L3) and the control electronics are supplied externally through the R0-T0 terminals.

▶ Program one of the digital outputs 11 to 15 as IP by entering the value 08 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.
▶ Program one of the digital outputs 11 to 15 as UV by entering the value 09 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

By default, IP is assigned to digital output 15.

Running time (RNT) and Mains On time (ONT)

The DV6 frequency inverter counts the time for which it is in RUN mode (the running time) and time for which it is connected to mains power ΔU_{LN} (the Mains On time). The digital output configured as RNT becomes active when the running time set under PNU b034 is exceeded. The digital output configured as ONT also accesses parameter PNU b043. The ONT output becomes active when the DV6 is connected to the supply voltage ΔU_{LN} longer than the time set under PNU b043. You can configure either one of the digital outputs as RNT or ONT, but not both at the same time.

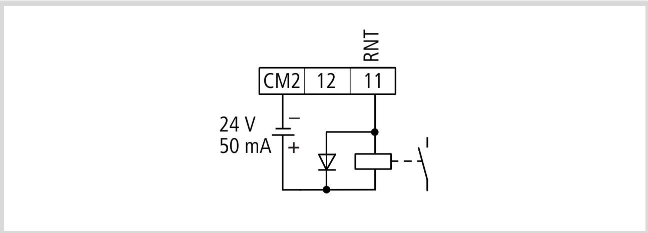


Figure 116: Digital output 11 configured as RNT (running time)

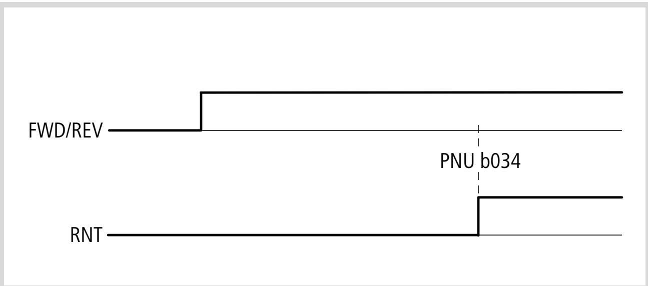


Figure 117: Function chart for RNT (running time)

▶ Program one of the digital outputs 11 to 15 as RNT by entering the value 11 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

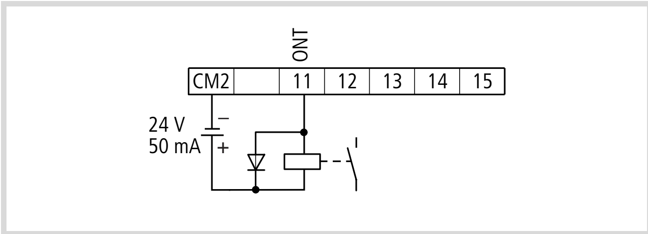


Figure 118: Digital output 11 configured as ONT (Mains On time)

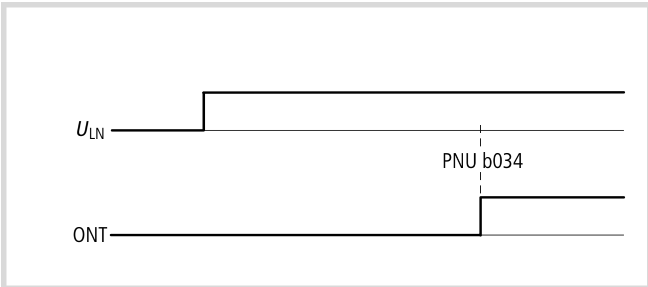


Figure 119: Function chart for ONT (Mains On time)

ΔU_{LN}: Supply voltage

▶ Program one of the digital outputs 11 to 15 as ONT by entering the value 12 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b034	Running time or Mains On time exceeded	–	✓	0 to 65530 h	When the time entered her is exceeded, either the digital output configured as RNT (running time) or the digital output configured as ONT (Mains On time) becomes active.	0

Motor thermal overload (THM)

The DV6 frequency inverters simulate a bimetal element to protect the motor. With its default setting, it exhibits the illustrated characteristic.

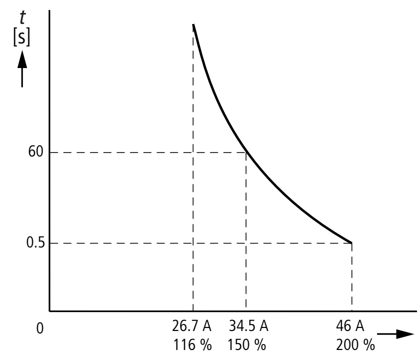


Figure 120: Example of tripping characteristic using a DV6-340-11K with the tripping current set at 46 A

t: Tripping time

I: Motor current

For a detailed description of how to set parameters PNU b012 to b020 for tripping, see → Section "Electronic motor protection"Page 154.

If the motor current is greater than the set tripping current (dependent on the frequency inverter), the DV6 frequency inverter issues fault message E05 and switches the output voltage ΔU_2 off. With a digital output configured as THM, the frequency inverter outputs a signal before issuing the fault message. The THM output is activated when the motor exceeds the current set under PNU C061 (the tripping current in %). The magnitude of the tripping current depends on the tripping characteristic defined under PNU b013 (→ Section "Electronic motor protection", Page 154).

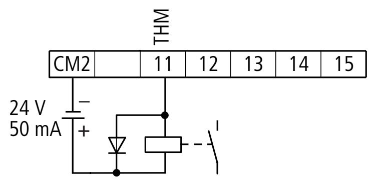


Figure 121: Digital output 11 configured as THM (motor thermal overload)

- ▶ Under PNU C061, enter the percentage value of the tripping characteristic at which the THM output is activated.
- ▶ Program one of the digital outputs 11 to 15 as THM by entering the value 13 in the corresponding PNU (C021 to C025) or under PNU C026 for signalling relay contacts K11-K12.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C061	Thermal overload warning	–	✓	0 to 100 %	The entered value relates to the tripping characteristic set under PNU b012 to b020. When the value set here is exceeded, the digital output configured as THM is activated.	80

Digital fault message output

With this function, you can define whether the DV6 issues a 3-bit encoded signal to digital outputs 11 to 13 or a 4-bit encoded signal to outputs 11 to 14 when a fault message is issued.

▶ Under PNU C062, specify the digital fault message output.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C062	Digital fault message	–	✓	00	No output to the digital outputs	00
				01	3-bit encoded output to digital outputs 11 to 13	
				02	4-bit encoded output to digital outputs 11 to 14	

The table below shows all digital fault messages.

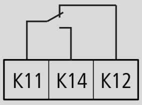
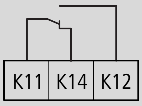
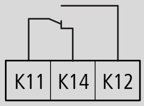
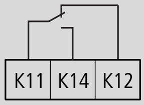
Digital output				4-bit encoded		3-bit encoded	
14	13	12	11	Fault message	Cause	Fault message	Cause
0	0	0	0	None	–	None	–
0	0	0	1	E01 to E04	Overcurrent	E01 to E04	Overcurrent
0	0	1	0	E05	Overload	E05	Overload
0	0	1	1	E07, E15	Overvoltage	E07, E15	Overvoltage
0	1	0	0	E09	Undervoltage	E09	Undervoltage
0	1	0	1	E16	Intermittent mains failure	E16	Intermittent mains failure
0	1	1	0	E30	IGBT fault	E30	IGBT fault
0	1	1	1	E06	Braking device overload	–	–
1	0	0	0	E08, E11, E23	• EEPROM fault • CPU fault • GA fault	–	–
1	0	0	1	E10	Fault in current transformer	–	–
1	0	1	0	E12, E13, E35, E36	• External fault message • Unattended start protection triggered • Thermistor fault • External brake fault	–	–
1	0	1	1	E14	Earth fault	–	–
1	1	0	0	–	–	–	–
1	1	0	1	E21	Overtemperature in power section	–	–
1	1	1	0	E24	Mains phase failure	–	–
1	1	1	1	E50 to E79	• RS 485 fault • Slot 1 or 2 fault • Fault 0 to 9	–	–

Signalling relay terminals K11, K12, K14

If a fault occurs, the signalling relay (changeover) is triggered. The switching conditions can be programmed as required.

By default, the signalling relay output is used for signalling faults, but you can also use it as a normal programmable digital output. To do this, enter a suitable value under PNU C026 (default value: 05, output used for signalling faults).

Table 20: Default setting of the signalling relay

Default setting of the signalling relay				**Reconfigured signalling relay terminals (PNU C036 = 00)**			
Fault or DV6 switched off 		**Run signal** 		**Fault message** 		**Run signal or DV6 switched off** 	
Voltage	**Operating state**	**K11-K12**	**K11-K14**	**Voltage**	**Operating state**	**K11-K12**	**K11-K14**
On	Normal	Open	Closed	On	Normal	Closed	Open
On	Fault	Closed	Open	On	Fault	Open	Closed
Off	–	Closed	Open	Off	–	Closed	Open

▶ Under PNU C026, enter the type of signalling.

▶ Use the above table to configure contact K11-K12 or K11-K14 as make or break contacts under PNU C036.

PNU	Name	Adjustable in RUN mode Normal	Extended	Value	Function	Page	WE
C026	Signal at signalling relay output	–	✓	00	RUN: Operation	104	05
				01	FA1: Frequency reached	102	
				02	FA2: Frequency exceeded	102	
				03	OL: Overload alarm	105	
				04	OD: PID system deviation exceeded	106	
				05	AL: Fault	107	
				06	FA3: Frequency (within range) reached	102	
				07	OTQ: Torque reached (exceeded)	110	
				08	IP: Mains failure, immediate stop	113	
				09	UV: Undervoltage	113	
				10	TRQ: Torque limitation	111	
				11	RNT: Running time exceeded	114	
				12	ONT: Mains On time exceeded	114	
				13	THM: Motor thermal overload	115	
				19	BRK: Enable signal for external brake	108	
				20	BER: Brake fault	108	
				21	ZS: Zero speed	–1)	
				22	DSE: Speed deviation exceeded	–1)	
				23	POK: Positioning	–1)	
				24	FA4: Frequency exceeded	102	
				25	FA5: Frequency reached	102	
				26	OL2: Overload alarm 2	105	
C036	Signalling relay output	–	✓	00	K11-K14 close with a fault message	–	01
				01	K11-K14 close when the supply voltage is applied	–	

1) → Manual AWB82401-1431... for DE6-IOM-ENC encoder module

After a fault has occurred, the associated fault message is retained even after the voltage supply is switched off. This fault message can therefore be recalled from fault history register when voltage has been switched back on. However, the inverter is reset when the device is switched off, i.e. the fault message will not be output at the signalling relay's terminals after the inverter is switched back on.

→ If however, the fault signal is to be retained even after the inverter is switched back on, a latching (self maintaining) relay should be used.

Note that, when the signalling relay output is configured as a break contact (default setting), there is a delay from the time the supply voltage is switched on until the AL output is closed, and that a fault message for the AL output therefore appears for a short time after the supply is switched on.

6 Setting Parameters

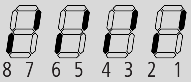
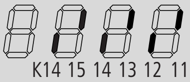
The parameters listed in this section can be set using the keypad.

The adjustment and setting possibilities listed below are arranged thematically according to their function to provides a clear overview of all parameters assigned to a particular functional area (e.g. Section "DC braking (DCB)", PNU A051 to A059).

With the second and third parameter sets, you can assign additional values to some of the parameters. For these parameters, the PNU column contains a second or third value. The parameters of the first parameter set have a "0" after the letter, for example F**0**02. The parameters of the second parameter set have a "2" after the letter, for example F**2**02, and those of the third parameter set a "3", for example F**3**02. For a summary of all all parameters of the second and third parameter sets, → Section "Use second and third parameter set (SET/SET3)", Page 86.

Setting the display parameters

This section describes the parameters with which you can set the display of the LCD keypad.

PNU	Name	Function
d001	Output frequency in Hz	Output frequency display from 0.5 to 360 Hz. The "Hz" lamp on the keypad lights up.
d002	Motor current in A	Indication of the output current from 0.01 to 999.9 A (filtered indication with a time constant of 100 ms). The "A" lamp on the keypad lights up.
d003	Direction of rotation	Display: • F for clockwise operation (forward), • r for anticlockwise operation (reverse), • 0 for stop
d004	Actual value × factor	Only with active PID control. The factor is set under PNU A075 and can have a value from 0.01 to 99.99; the default setting is 1.0.
d005	Status of digital inputs 1 to 8	 Example: Digital inputs 1, 3, 5 and 7 are activated. Digital inputs2, 4, 6 and 8 are deactivated.
d006	State of digital outputs 11 to 15 and fault signal output	 Example: Digital outputs 11, 13 and 15 are activated. Digital outputs 12 and 14, and signal output K14 are deactivated.
d007	Output frequency × factor	Indication of the product of the factor (PNU b086) and the output frequency in the range 0.01 to 99990. Examples: • Display indication 11.11 corresponds to 11.11, • 111.1 corresponds to 111.1, • 1111. corresponds to 1111, • 1111 corresponds to 11110.
d012	Motor torque	
d013	Output voltage	0 to 600 V
d014	Electrical input power	0.0 to 999.9 kW
d016	Running time	0 to 999, in 1000 h/unit
d017	Power on time	0 to 999 h, 1000 to 9999 h (100 to 999 kh)
d080	Total fault count	
d081	First (most recent) fault	Display of the most recent fault message and (after the PRG key is pressed) the output frequency, motor current and DC bus voltage at the time the fault occurred. If there is no current fault message, the display shows ---
d082	Second fault	Display of second from last fault message. If neither the second from last or third from last fault message has been saved, the display shows ---
d083	Third fault	Display of third from last fault message. If the third from last fault message has not been saved, the display shows ---
d084	Fourth fault	Display of fourth from last fault message. If the fourth from last fault message has not been saved, the display shows ---
d085	Fifth fault	Display of fifth from last fault message. If the fifth from last fault message has not been saved, the display shows ---
d086	Sixth fault	Display of sixth from last fault message. If the sixth from last fault message has not been saved, the display shows ---
d090	Warning	

Basic functions

Input/display frequency value

PNU F001 indicates the current setpoint frequency or the current fixed frequency. You can change the frequencies with the arrow keys and save them according to the setting in PNU A001 and fixed frequency steps FF1 to FF4 (digital inputs) (→ Section "Fixed frequency selection (FF1 to FF4)", Page 69).

With PNU F001, you can modify parameters even though the parameter protection PNU b031 is set (→ Page 83).

Display/input frequency setpoint value
If you have not activated any fixed frequencies, PNU F001 displays the frequency setpoint value.

The frequency setpoint value can be assigned in one of three ways, dependent on PNU A001:

- through the installed potentiometer on the keypad, PNU A001 = 00;
- through analog inputs, PNU A01 = 01 (default):
  – O (0 to 10 V),
  – O2 (–10 V to +10 V) or
  – OI (4 to 20 mA),
- through PNU F001 or PNU A020, PNU A001 = 02.

If you specify the setpoint frequency with PNU A020 (→ Page 123), you can enter a new value under PNU F001, which is automatically saved to PNU A020:

▶ Change the present value with the arrow keys.
▶ Save the modified value with the ENTER key.

The saved value is automatically written to PNU A020.

Displaying/entering fixed frequencies
If you have activated the fixed frequencies through functions FF1 to FF4 of the digital inputs, PNU F001 indicates the selected fixed frequency.

For details about changing the fixed frequencies, → Section "Entering the fixed frequencies in PNU F001", Page 71.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
F001	Input/indication of frequency setpoint value	✓	✓	0.5 to 360 Hz 0.0 to 400 Hz	Resolution ±0.1 Hz The setpoint can be defined using various methods: • With PNU F001 or A020: Enter the value 02 under PNU A001. • With the potentiometer on the keypad: Enter the value 00 under PNU A001. • With a 0 to 10 V or a –10 to +10 V voltage signal or a 4 to 20 mA current signal at input terminals O or OI: Enter the value 01 under PNU A001. • With the digital inputs configured as FF1 to FF4. After selection of the required fixed frequency stage using FF1 to FF4, the frequency for the respective stage can be entered. The display of the setpoint value is independent of which method was used to set the setpoint value.	0.0

Acceleration time 1

Acceleration time 1 defines the time in which the motor reaches its end frequency after a start signal is issued.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
F002 F202 F302	Acceleration time 1	✓	✓	0.01 to 3600 s	Resolution of 0.01 s at an input of 0.01 to 99.99 Resolution of 0.1 s at 100.0 to 999.9 Resolution of 1 s at 1000 to 3600 s	30.0

Deceleration time 1

Deceleration time 1 defines the time in which the motor brakes to 0 Hz after a stop signal.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
F003 F203 F303	Deceleration time 1	✓	✓	0.1 to 3600 s	Resolution of 0.01 s at an input of 0.01 to 99.99 Resolution of 0.1 s at 100.0 to 999.9 Resolution of 1 s at an input of 1000 to 3600	30.0

Direction of rotation

The direction of rotation defines the direction in which the motor turns after a start signal is issued.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
F004	Direction of rotation	–	–	00	The motor runs in a clockwise direction.	00
				01	The motor runs in an anticlockwise direction.	

Setting the frequency and start signal parameters

This section describes the methods for adjusting and setting the start signal and basic frequency parameters.

Definition of frequency setpoint value

With PNU A001, specify the method of defining the setpoint frequency:

- using the potentiometer on the keypad
- through analog input O (0 to 10 V), O2 (–10 to +10 V) or OI (4 to 20 mA)
- through PNU F001 or PNU A020
- through the RS 485 serial interface
- through slot 1 or 2 for optional modules

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V), O2 (±10 V) or OI (4 to 20 mA)	
				02	Definition through PNU F001 and/or PNU A020	
				03	RS 485 serial interface	
				04	Setpoint definition through the optional module in slot 1	
				05	Setpoint definition through the optional module in slot 2	
A020	Frequency setpoint value	✓	✓	0.01 to 400 Hz	You can enter a frequency setpoint value. To do this, enter the value 02 under PNU A001.	0.0
F001	Indication/ input of frequency value	✓	✓		Indication of the current frequency setpoint value or the current fixed frequency. Modified values are saved with the ENTER key according to the selection of the digital inputs configured as FF1 to FF4 (→ Section "Fixed frequency selection (FF1 to FF4)", Page 69). Resolution ±0.01 Hz	

Start signal

With PNU A002, you specify how the start signal is to be issued:

- through digital inputs, for example the FW input or a digital input configured as REV,
- with the ON key on the keypad,
- through the RS 485 serial interface,
- through slot 1 or 2 for optional modules.

.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A002	Start signal	–	–	01	The motor start signal is issued through digital inputs, for example through the FW input or a digital input configured as REV.	01
				02	The motor start signal is issued with the ON key on the keypad.	
				03	The motor start signal is issued through the RS 485 interface.	
				04	The motor start signal is issued through the optional module in slot 2.	
				05	The motor start signal is issued through the optional module in slot 2.	

Base frequency

The base frequency is the frequency at which the output voltage has its maximum value.

PNU	Name	Adjustable in RUN mode		Value	WE
		Normal	Extended		
A003 A203 A303	Base frequency	–	–	30 to 400 Hz	50

Maximum end frequency

If there is a constant-voltage frequency range beyond the base frequency defined with PNU A003, this range is defined with PNU A004. The maximum end frequency must not be smaller than the base frequency.

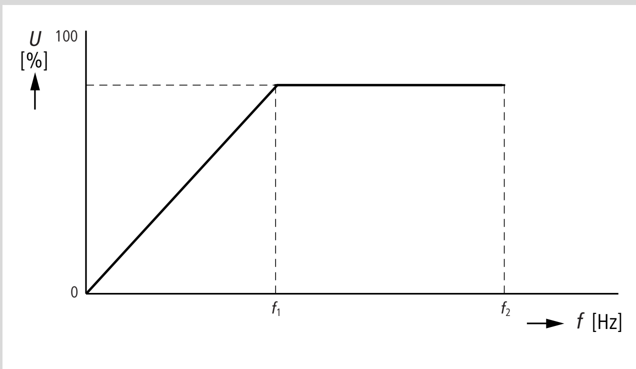


Figure 122: Maximum end frequency

f_1: Base frequency

f_2: Maximum end frequency

PNU	Name	Adjustable in RUN mode		Value	WE
		Normal	Extended		
A004 A204 A304	Maximum end frequency	–	–	30 to 400 Hz	50

Voltage/frequency characteristic and voltage boost

Boost

The boost function increases the voltage of the *U/f* characteristic (and consequently boosting the torque) in the lower frequency range. Manual voltage boost raises the voltage in the frequency range from the starting frequency (default setting: 0.5 Hz) to half the base frequency (25 Hz at the default setting of 50 Hz) in every operating state (acceleration, static operation, deceleration), irrespective of the motor load. With automatic voltage boost, by contrast, the voltage is increased according to the motor load. A voltage boost may cause a fault message and trip due to the higher currents involved.

Manual voltage boost only has an effect when PNU A044 contains the value 00 (default, linear *ΔU/f* characteristic) or 01 (quadratic *ΔU/f* characteristic).

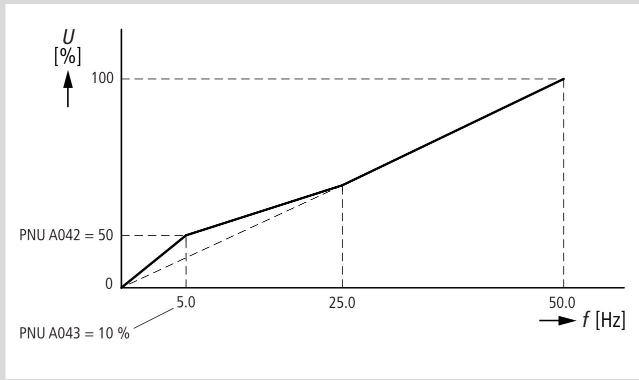


Figure 123: Voltage boost characteristics

Parameter settings:
A041 = 00
A042 = 50
A043 = 10.0
A044 = 00
A045 = 100

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A041 A241	Voltage boost characteristics	–	–	00	Manual voltage boost, increase always active	00
				01	Automatic voltage boost, increase on demand	
A042 A242 A342	Manual boost percentage	✓	✓	0.0 to 20 %	Setting the voltage increase with manual boost.	1.0
A043 A243 A343	Maximum voltage boost at 1 % of the base frequency	✓	✓	0.0 to 50 %	Setting the frequency with the highest voltage boost as a percentage of the base frequency (PNU A003).	5.0

Voltage/frequency characteristics

Under PNU A044 and A045, adjust the behaviour of the DF6 to match its load. Under PNU A044, set the torque characteristics of the DV6 frequency inverter (see below). Under PNU A045, set the voltage gain of the DV6 frequency inverter. PNU A045 relates to the voltage set under PNU A082.

Linear *ΔU/f* characteristic
For a constant torque, enter the value 00 under PNU A044 (default). The DV6 frequency inverter then increases the output voltage ΔU_2 on a linear ramp up to the base frequency in PNU A003.

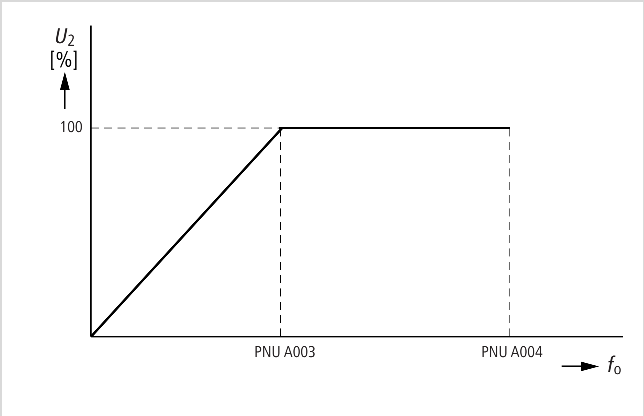


Figure 124: Linear $\Delta U/f$ characteristic

ΔU_2:Output voltage

f_O: Output frequency

Quadratic $\Delta U/f$ characteristic

For a reduced torque, enter the value 01 under PNU A044. The DV6 frequency inverter then increases the output voltage ΔU_2 on a linear ramp up to ten percent of the base frequency in PNU A003. Then, the DV6 increases ΔU_2 on a quadratic ramp (reduced) to the transition frequency in PNU A003.

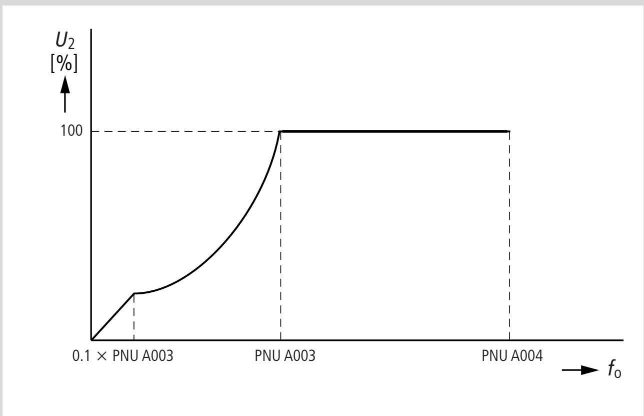


Figure 125: Quadratic $\Delta U/f$ characteristic

ΔU_2:Output voltage

f_O: Output frequency

Adjustable $\Delta U/f$ characteristic

For a freely programmable torque, enter the value 02 under PNU A044. Under PNU b100 to b113, you can assign seven different frequency-voltage pairs to the DV6. However, the frequencies f_1 to f_7 must have increasing values for this: $f_1 \leqq f_2 \leqq f_3 \leqq ... \leqq f_7$. The voltages ΔU_{1O} to ΔU_{7O} are freely adjustable.

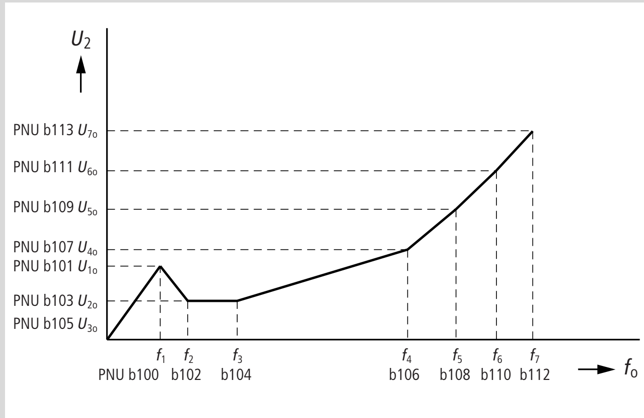


Figure 126: Adjustable $\Delta U/f$ characteristic

ΔU_2:Output voltage

f_O: Output frequency

f_7 can be up to the maximum frequency of the DV6. ΔU_{7O} can be up to the input voltage ΔU_1 or the voltages set under PNU A082.

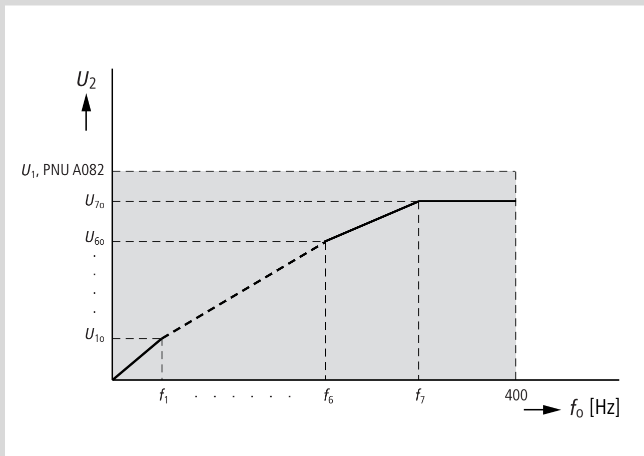


Figure 127: Limits of the freely adjustable $\Delta U/f$ characteristic

ΔU_2:Output voltage

f_O: Output frequency

If you use the adjustable $\Delta U/f$ characteristic, the following parameters are no longer valid:

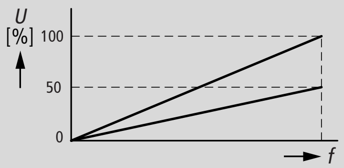
- PNU A003: Base frequency
- PNU A004: End frequency
- PNU A041: Voltage boost characteristic

SLV and 0 Hz SLV control

With SLV and 0 Hz SLV control, you can achieve a high torque output and speed stability. For a detailed description of SLV control, → Section “SLV and autotuning“, Page 171.

Vector control with optional DE6-IOM-ENC module

If you are using a DE6-IOM-ENC feedback (encoder) module and want to use it to regulate the motor torque, set PNU A044 to 05. For a detailed description of, see manual AWB8240-1416... for the encoder module.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A044 A244 A344	Voltage/ frequency characteristic	–	–	00	Linear V/*f* characteristic (constant torque).	00
				01	Quadratic V/*f* characteristic (reduced torque)	
				02	User-definable	
				03	Sensorless vector control (SLV)[1] is active	
				04	0 Hz SLV[1] is active	
				05	Vector control[1] with optional DE6-IOM-ENC module	
A045	Output voltage	✓	✓	20 to 100 % of the input voltage	 The output voltage can be set from 20 to 100 % of the input voltage.	100
b100	Frequency coordinate f_1	–	–	0 to 400 Hz	First frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b101	Voltage coordinate ΔU_{1o}	–	–	0 to ΔU_1[2] or PNU A082	First voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b102	Frequency coordinate f_2	–	–	0 to 400 Hz	Second frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b103	Voltage coordinate ΔU_{2o}	–	–	0 to ΔU_1[2] or PNU A082	Second voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b104	Frequency coordinate f_3	–	–	0 to 400 Hz	Third frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b105	Voltage coordinate ΔU_{3o}	–	–	0 to ΔU_1[2] or PNU A082	Third voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b106	Frequency coordinate f_4	–	–	0 to 400 Hz	Fourth frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b107	Voltage coordinate ΔU_{4o}	–	–	0 to ΔU_1[2] or PNU A082	Fourth voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b108	Frequency coordinate f_5	–	–	0 to 400 Hz	Fifth frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b109	Voltage coordinate ΔU_{5o}	–	–	0 to ΔU_1[2] or PNU A082	Fifth voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b110	Frequency coordinate f_6	–	–	0 to 400 Hz	Sixth frequency coordinate of the $\Delta U/f$ characteristic[3]	0
b111	Voltage coordinate ΔU_{6o}	–	–	0 to ΔU_1[2] or PNU A082	Sixth voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0
b112	Frequency coordinate f_7	–	–	0 to 400 Hz	Sevenths frequency coordinate of the $\Delta U/f$ characteristic[3]	0

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b113	Voltage coordinate ΔU_{7o}	–	–	0 to ΔU_1[2] or PNU A082	Sevenths voltage coordinate of the $\Delta U/f$ characteristic[3]	0.0

1) If SLV control is active, you should set the pulse frequency to at least 2.1 kHz with PNU b083 (→ Section “Pulse frequency”, Page 164).

2) ΔU_1 = input voltage of the DV6

3) You do not have to set all frequency and voltage coordinates. The DV6 automatically calculates the characteristic curve.

DC braking (DCB)

To activate DC braking for decelerating the motor:

- apply a Stop signal (PNU A051 = 01)
- activate the digital input configured as DB (→ Section "Activate DC braking DB", Page 88).

By applying a pulsed DC voltage to the motor stator, a braking torque is induced in the rotor and acts against the rotation of the motor. With DC braking, a high level of stopping and positioning accuracy can be achieved.

Under PNU A051, specify whether DC braking is activated automatically when the frequency set under PNU A052 is reached and/or when the DB input is activated.

Under PNU A052, enter the frequency at which DC braking is activated when PNU A051 is set to 00.

Under PNU A053 enter the waiting time which is to elapse before DC braking becomes active after activation of the DB input or when the set startup frequency is reached.

Under PNU A054 enter the braking torque between 0 and 100 %.

Under PNU A055 enter the braking duration.

Under PNU A056, specify the braking behaviour when the DB input is active:

- 00: DC braking starts when the DB input is activated and ends only when the time defined under PNU A055 has expired.
- 01: Braking starts as soon as the DB input is active and ends when the DB input is deactivated.

DC braking can also be activated before motor acceleration, for example in lifting and conveying applications (releasing the mechanical holding brake) or with drives which are operated using process variables, such as fans, pumps and compressors.

Under PNU A057, set the braking torque before acceleration (0 to 100 %). The motor is then braked before starting.

Under PNU A058, set the braking duration during acceleration.

Under PNU A059, set the pulse frequency for DC braking. For values above 5 kHz observe derating (see below).

Caution!
DC braking results in additional heating of the motor. You should therefore configure the braking torque (PNU A054 and A057) as low and the braking duration (PNU A055 and A058) as short as possible.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A051	DC braking	–	✓	00	Automatic DC braking disabled	00
				01	Automatic DC braking activated	
A052	Activation frequency	–	✓	0 to 60 Hz	When PNU A051 is set to 01, DC braking is activated when the actual frequency falls below the frequency entered here.	0.50
A053	Waiting time for deceleration	–	✓	0 to 5 s	When the frequency set with PNU A052 is reached or when the DB input is activated, the motor coasts for the time entered here before DC braking is activated.	0.0
A054	Braking torque for deceleration	–	✓	0 to 100%	Setting range for the braking torque during motor deceleration.	0
A055	Braking duration for deceleration	–	✓	0 to 60 s	The time during which DC braking is active during deceleration.	0.0
A056	Behaviour on activation of the DB input	–	✓	00	DC braking starts when the DB input is activated and ends only when the time defined under PNU A055 has expired.	01
				01	Braking starts as soon as the DB input is active and ends when the DB input is deactivated.	
A057	Braking torque for acceleration	–	✓	0 to 100%	Setting range for the braking torque before the motor is accelerated.	0

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A058	Braking duration for acceleration	–	✓	0 to 60 s	The time during which DC braking is active before acceleration.	0.0
A059	Braking frequency f_B	–	–	0.5 to 15 kHz	Pulse frequency for DC braking; applies to DV6-340-075 to DV6-340-55K (observe derating).	3.0
				0.5 to 10 kHz	Pulse frequency for DC braking; applies to DV6-340-75K to DV6-340-132K (observe derating).	

Derating for DC braking

The DV6 frequency inverters use the braking frequency f_B, which can be adjusted under PNU A059, to generate the required voltage for DC braking. This is not identical with the pulse frequency during motor operation set under PNU b083. The higher the set braking frequency, the lower is the relative braking torque M_B (→ Fig. 128 and Fig. 129).

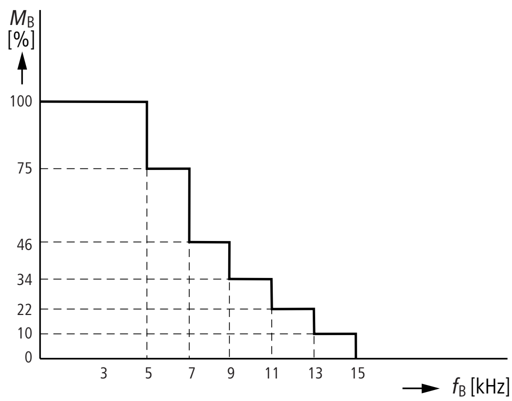


Figure 128: Derating for DC braking
DV6-340-075 to DV6-340-55K

M_B: Braking torque
f_B: Braking frequency

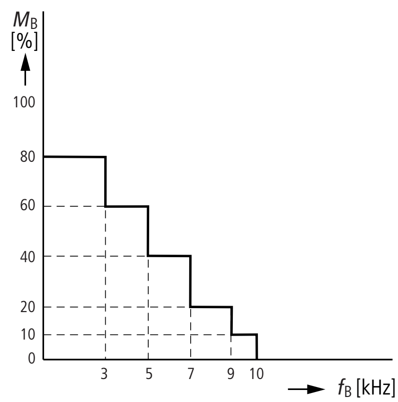


Figure 129: Derating for DC braking
DF6-340-75K to DF6-340-132K

M_B: Braking torque
f_B: Braking frequency

Operating frequency range

The frequency range specified with the values entered under PNU b082 (starting frequency) and PNU A004 (end frequency), can be limited with PNU A061 and A062 (→ Fig. 130). As soon as the frequency inverter receives a start signal, it applies the frequency set under PNU A062.

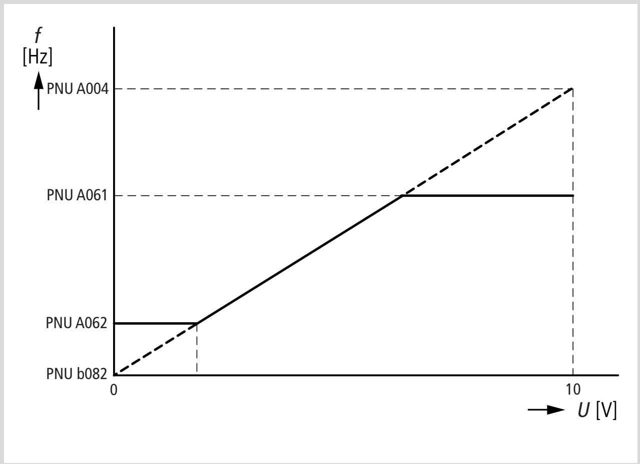


Figure 130: Upper frequency limit (PNU A061) and lower frequency limit (PNU A062)

To avoid resonance within the drive system, three frequency jumps can be programmed under PNU A063 to A068. In the example (→ Fig. 131), the first frequency jump (PNU A063) is at 15 Hz, the second (PNU A065) at 25 Hz and the third (PNU A067) at 35 Hz. The jump widths (adjustable under PNU A064, A066 and A068) are set to 1 Hz in the example.

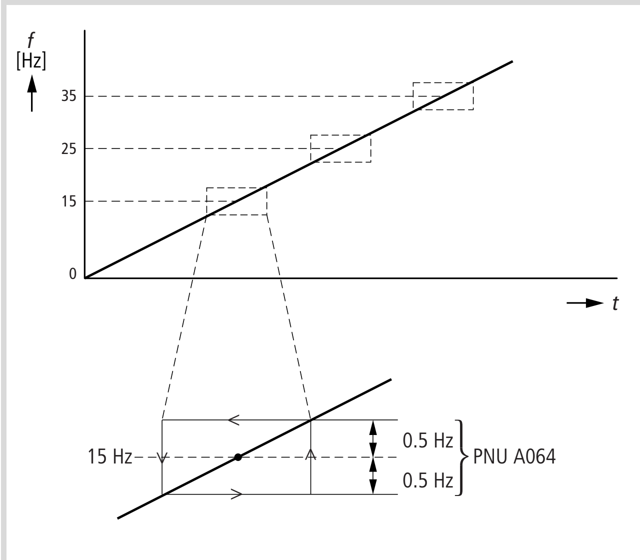


Figure 131: Frequency jumps

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A061 A261	Maximum operating frequency	–	✓	0 to 400 Hz	This function can be deactivated by entering 0.0	0.0
A062 A262	Minimum operating frequency			0 to 400 Hz		0.0
A063	First frequency jump			0 to 400 Hz		0.0
A064	First jump width			0 to 10 Hz		0.5
A065	Second frequency jump			0 to 400 Hz		0.0
A066	Second jump width			0 to 10 Hz		0.5
A067	Third frequency jump			0 to 400 Hz		0.0
A068	Third jump width			0 to 10 Hz		0.5

Acceleration pause

With this function, you can specify a pause in the acceleration ramp, during which the output frequency remains constant. If the frequency inverter is overloaded during acceleration, for example when accelerating heavy loads or when starting motors in reverse, you can use this function to define a rest period in which no acceleration takes place to prevent frequency inverter overload. Under PNU A069, specify the frequency at which the pause is to start. PNU A070 determines the duration of the pause.

With motors running in reverse, this function keeps the output voltage and output frequency low until the motor has stopped and is running in the required direction before accelerating at the specified acceleration ramp.

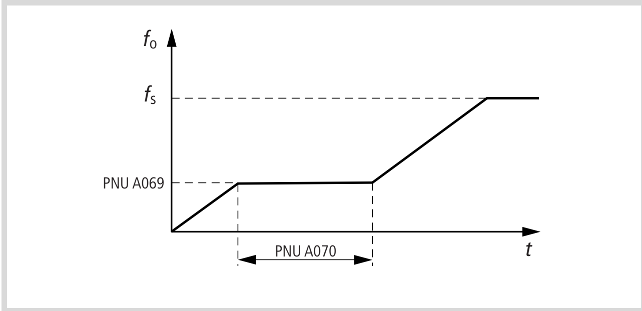


Figure 132: Function chart for acceleration waiting time

f_O: Output frequency

f_S: Setpoint frequency

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A069	Waiting time frequency	–	✓	0 to 400 Hz	When this frequency is reached, the pause begins.	0.00
A070	Waiting time			0 to 60 s	Setting the waiting time.	0.0

PID controller

The DV6 frequency inverters have PID control as standard. This can be used, for example, for flow and throughput controllers with fans and pumps. PID control has the following features:

- The setpoint value can be issued through the frequency inverter keypad or through an external digital signal (fixed frequencies). Sixteen different setpoint values are possible. In addition, the setpoint can be defined with an analog input signal (0 to 10 V or 4 to 20 mA).
- With the DV6, the actual value signal can be fed back using an analog input voltage (up to 10 V) or an analog input current (up to 20 mA).
- The permissible range for the actual value signal feedback can be specifically matched (e.g. 0 to 5 V, 4 to 20 mA, or other ranges).
- With the aid of a scale adjustment, you can match the setpoint signal and/or the actual value signal to the actual physical quantities (such as air or water flow, temperature, etc.) and view them on the display.

PID control

"P" stands for **p**roportional, "I" for **i**ntegral and "D" for **d**ifferential. In control engineering, the combination of these three components is termed PID closed-loop control, PID regulation or PID control. PID control is used in numerous types of application, e.g. for controlling air and water flow or for controlling pressure and temperature. The output frequency of the inverter is controlled by a PID control algorithm to keep the deviation between the setpoint and actual value as small as possible. The figure below illustrates PID control in the form of a block diagram:

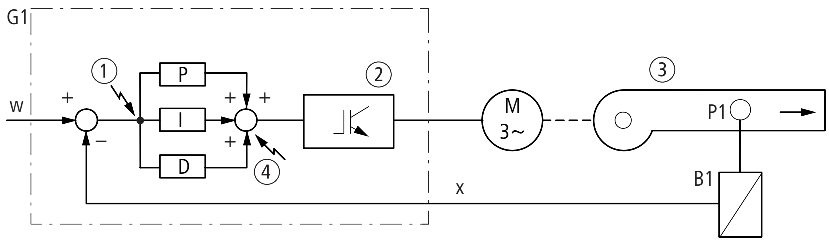


Figure 133: PID control block diagram

G1: DV6 series frequency inverters
w: Setpoint value
x: Actual value
P1: Controlled variable
B1: Measured value converter

① System deviation
② Inverter
③ Fans, pumps or similar devices
④ Setpoint frequency

→ PID control is only possible after the type of setpoint value and actual value used have been defined.

The example in the following figure shows a fan control system:

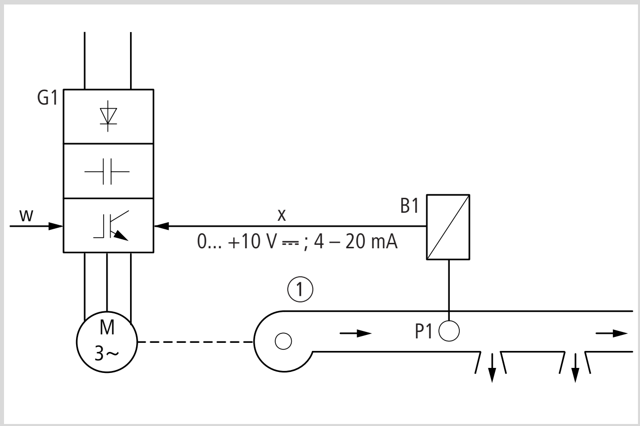


Figure 134: Example of a fan control system

G1: DV6 series frequency inverters

w: Setpoint value

x: Actual value

P1: Controlled variable

B1: Measured value converter

① Fan

P: Proportional component

This component ensures that the output frequency and the system deviation are proportional to each other. With PNU A072, you can specify the proportional gain (K_p) in percent.

The following figure illustrates the relationship between system deviation and output frequency. A large value of K_p results in a quick response to a change of the system deviation. If, however, K_p is too large, the system becomes unstable.

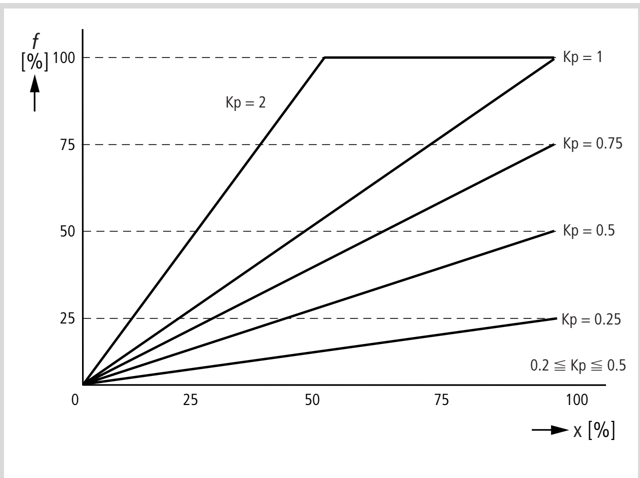


Figure 135: Proportional gain K_p

x: System deviation

The maximum output frequency in Figure 135 is defined as 100 %. In PNU A072, you can set K_p to between 0.2 and 5.0.

I: Integral component

This component results in a correction of the output frequency by integration of the system deviation. In the case of purely proportional control, a large system deviation causes a large change in the output frequency. It follows, then, that if the system deviation is very small, the change in the output frequency is also very small. The problem is that the system deviation cannot be completely eliminated. Hence the need for an integral component.

The integral component causes a continuous adding up of the system deviation so that the deviation can be reduced to zero. The reciprocal value of the integration gain is the integration time $T_i=1/K_i$.

For the DV6 frequency inverters, set the integration time (T_i). The value can be between 0.5 s and 3600 s. To disable the integral component, enter 0.0.

D: Differential component

This component causes a differentiation of the system deviation. Because pure proportional control uses the current value of the system deviation and pure integral control the values from previous actions, a certain delay in the control process always occurs. The D component compensates for this behaviour.

Differential control corrects the output frequency using the rate of change of the system deviation. The output frequency can therefore be compensated very quickly.

K_d can be set between 0 and 100 s.

PID control

PID control combines the P, I and D components described in the previous sections. In order to achieve the optimum control characteristics, each of the three PID parameters must be set. Uniform control behaviour without large steps in the output frequency is guaranteed by the proportional component; the integral component minimizes the existing system deviation the steady-state and the differential component ensures a quick response to a rapidly changing actual value signal.

As differential control is based on the differentiation of the system deviation, it is very sensitive and also responds to unwanted signals – such as interference – which can result in system instability. Differential control is normally not required for flow, pressure and temperature control.

Setting the PID parameters

Values for the PID parameters must be chosen depending on the application and the system's control characteristics. The following points are important to achieve effective PID control:

- A stable steady-state behaviour
- A fast response
- A small system deviation in the steady state

Parameters K_p, T_i and K_d must be set within the stable operating range. As a general rule, increasing one of the parameters K_p, K_i (= reduction of T_i) and K_d results in a faster system response. A very large increase however, causes system instability, as the returned actual value will begin to oscillate, in the worst case, resulting in divergent behaviour (→ Fig. 136 to Fig. 139):

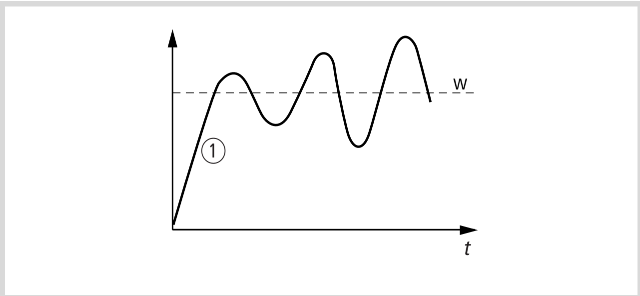


Figure 136: Divergent behaviour

w: Setpoint value

① Output signal

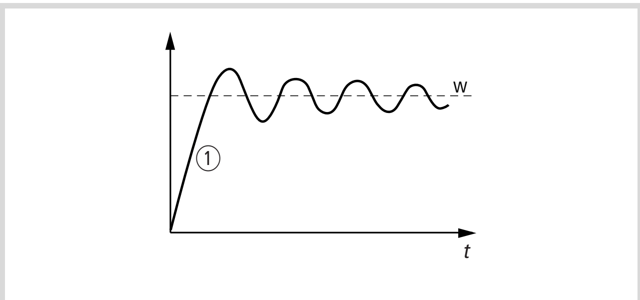


Figure 137: Oscillation, dampened

w: Setpoint value

① Output signal

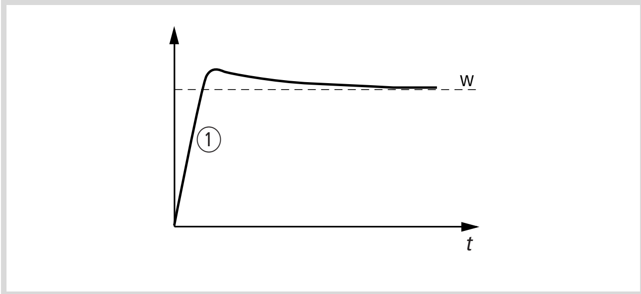


Figure 138: Good control characteristics

w: Setpoint value

① Output signal

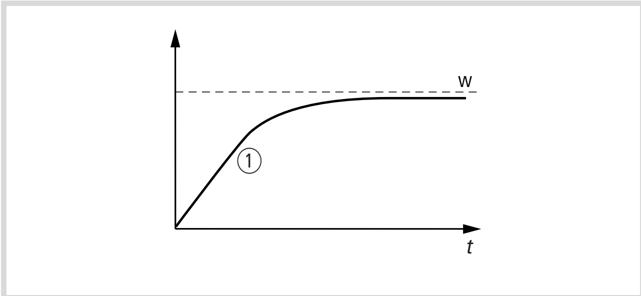


Figure 139: Slow control, large static system deviation

w: Setpoint value

① Output signal

The following table provides guidelines for setting each parameter.

Table 21: Setting the controller regulation times

A setpoint change	causes a slow response	Increase proportional component (K_p)
	causes a fast but unstable reaction	Set a lower P component
Setpoint and actual value	differ greatly	Reduce integral component (T_i)
	approach each other after oscillation	Set a higher I component
After increasing K_p	the response is still slow	Increase D component (K_d)
	the response is still unstable	Set a lower D component

Structure and parameters of the PID controller

PID control active/inactive

DV6 frequency inverters can operate in one of the following two control modes:

- Frequency control active (i.e. PID control inactive)
- PID control active

You can change over between the two modes with PNU A071 (PID control active/inactive).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A071	PID control active/inactive	–	✓	00	PID control is not used (inactive)	00
				01	PID control is used (active)	

Frequency control is the standard control method used by many frequency inverters. A setpoint value is defined by a control unit (keypad) as an analog voltage or current signal, or through a four bit wide digital command applied to the control signal terminals.

With PID control, the inverter's output frequency is controlled by a control algorithm to ensure that the deviation between the setpoint and actual value is kept at zero.

Parameter

The following figure illustrates which parameters are effective in different areas of the PID block diagram. The specified parameters (for example PNU A072) correspond to the frequency inverter's built-in keypad:

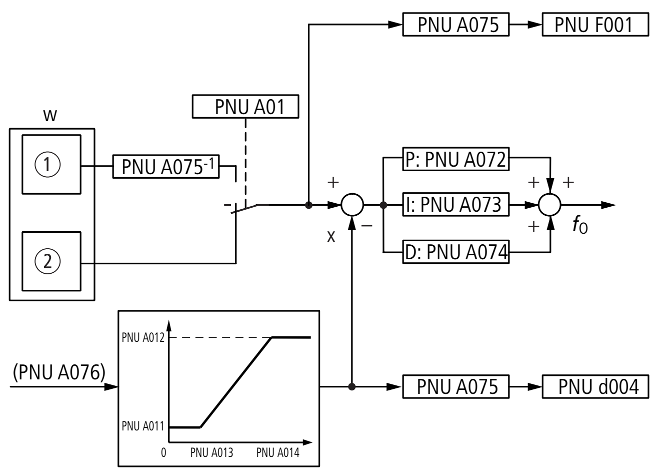


Figure 140: PID control parameters

w: Setpoint value

x: Actual value

f_0: Output frequency

① Frequency definition with keypad, fixed frequency

② Analog definition with potentiometer, analog inputs, current or voltage

PNU	Function	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A001	Defined frequency setpoint	–	–	00	Definition with the potentiometer on the keypad	01
				01	Definition through analog input O (0 to 10 V) or OI (4 to 20 mA)	
				02	Definition through PNU F001 and/or PNU A020	
A011	Frequency with minimum setpoint value	–	✓	0 to 400 Hz	Here, the frequency that corresponds to the minimum voltage setpoint value under PNU A013 is set.	0.0
A012	Frequency with maximum setpoint value	–	✓	0 to 400 Hz	Here, the frequency that corresponds to the maximum voltage setpoint value under PNU A014 is set.	0.0
A013	Minimum setpoint value	–	✓	0 to 100 %	The minimum setpoint value entered here relates to the maximum possible voltage or current setpoint (10 V or 20 mA).	0
A014	Maximum setpoint value	–	✓	0 to 100 %	The maximum setpoint value entered here relates to the maximum possible voltage or current setpoint (10 V or 20 mA).	100
d004	Actual value × factor	✓	✓	–	Only with active PID control. The factor is set under PNU A075 and can have a value from 0.01 to 99.99. The default value is 1.0.	–
F001	Input/display frequency value	✓	✓	0.1 to 400 Hz	Resolution ±0.1 Hz The setpoint can be defined using various methods: • With PNU F001 or A020: Enter the value 02 under PNU A001. • With the potentiometer on the keypad: Enter the value 00 under PNU A001. • With a 0 to 10 V voltage signal or a 4 to 20 mA current signal at input terminals O or OI: Enter the value 01 under PNU A001. • With the digital inputs configured as FF1 to FF4. After selection of the required fixed frequency stage using FF1 to FF4, the frequency for the respective stage can be entered. The display of the setpoint value is independent of which method was used to set the setpoint value.	0.0
A072	P component of the PID control	✓	✓	0.2 to 5.0	Adjustment range of the proportional component of the PID control	1.0
A073	I component of the PID control	✓	✓	0 to 3600 s	Adjustment time T_i of the integral component of the PID control	1.0
A074	D component of the PID control	✓	✓	0.0 to 100 s	Adjustment time T_d of the differential component of the PID control	0.0
A075	Setpoint factor of the PID control	–	–	0.01 to 99.99	The display of the frequency setpoint or actual value can be multiplied by a factor, so that process related quantities (e.g. flow or similar) can be displayed instead of the frequency.	1.00
A076	Input actual value signal for PID control	–	–	00	Actual value signal present on analog input OI (4 to 20 mA)	00
				01	Actual value signal present on analog input O (0 to 10 V)	

Internal regulator-based calculations

All calculations within the PID algorithm are carried out in percentages, so that different physical units can be used, such as

- Pressure (N/m^2),
- Flow rate (m^3/min),
- Temperature (°C), etc.

The setpoint and returned actual values can, for example, also be compared as percentages.

A useful scaling function is also available (PNU A075). When these parameters are used, you can define the setpoint directly as the required physical quantity and/or display setpoint and actual values as physical quantities suitable for the process.

In addition, an analog signal matching is available (PNU A011 to A014), with which you can define a range based on the actual value feedback signal. The following graphs illustrate the mode of operation of this function.

Setpoint definition

There are three ways of defining the setpoints:

- Keypad
- Digital control signal terminal input (4 bit)
- Analog input (terminals O–L or OI–L)

If the digital setpoints are defined through the control signal terminals, define the required setpoint value in PNU A021 to A035. The setting procedure is similar to the one which is used in frequency regulation mode (i.e. with deactivated PID control) for setting the respective fixed frequencies (→ Section "Fixed frequency selection (FF1 to FF4)", Page 69).

Actual value feedback and actual value signal matching

You can specify the actual value signal as follows:

- With an analog voltage on control signal terminal O (maximum 10 V)
- With an analog current on control signal terminal OI (maximum 20 mA)

With PNU A076, select one of the two available methods.

To adapt the PID control to the respective application, the actual value feedback signal can also be matched as shown in Figure 141:

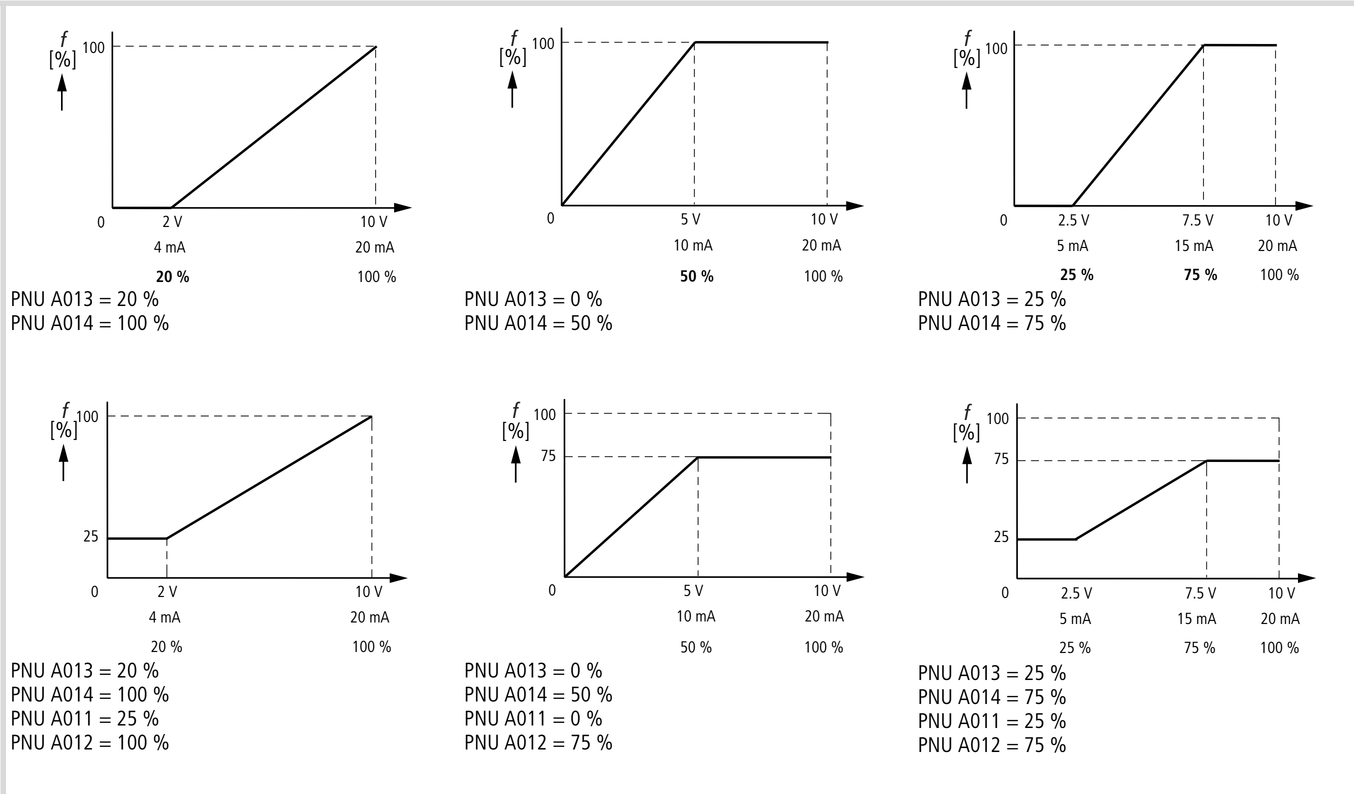


Figure 141: Analog actual value signal matching

As shown by the graphs, the setpoint value must be within the valid range on the vertical axis if you have set functions PNU A011 and A012 to a value not equal to 0. Because there is no feedback signal, stable control cannot otherwise be guaranteed. This means that the frequency inverter will either

- output the maximum frequency,
- go to stop mode, or
- output a lower limit frequency.

Scaling adjustment

Scaling adjustment and scaling allow the setpoint and actual value to be displayed and the setpoint value to be entered directly in the correct physical unit. For this purpose, 100 % of the returned actual value is taken as a basis. By default, inputs and displays are based on 0 to 100 %.

Example: In the first diagram in Figure 141, 20 mA of the feedback signal correspond to 100 % of the PID internal factor. If for example the current flow is 60 m^3/min with a feedback signal of 20 mA, the parameter is set to 0.6 with PNU A075 (= 60/100). With PNU d004, the process-corrected value can be displayed and the setpoint value can be entered directly as a process-corrected quantity.

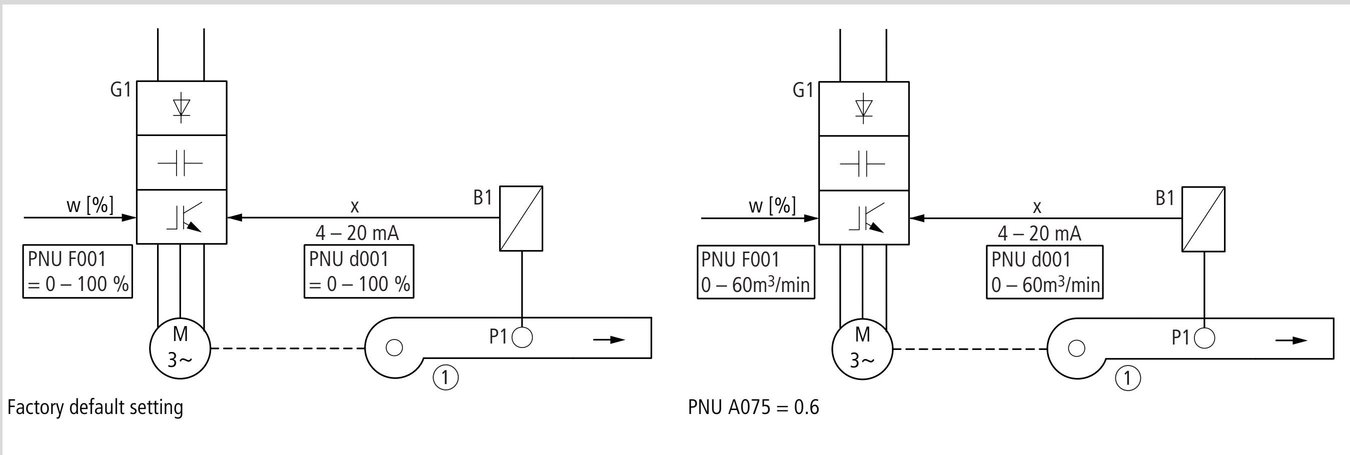


Figure 142: Example for scaling adjustment

w: Setpoint value

x: Returned actual value

① Fan

Summary of the relevant parameters

The DV6 frequency inverters use the same parameters for both frequency control and PID modes. The designations of the respective parameter relate only to frequency control mode, as this mode is used in most cases. When PID mode is used, some of the parameters have other designations.

The table below contains an explanation of these parameters for both frequency control mode and PID mode:

PNU	Meaning of the parameters when used in	
	Frequency control mode	PID mode
d004	–	Indication of the returned actual value
F001	Indication of the output frequency	Indication of the setpoint value
A001	Frequency setpoint definition	Setpoint definition
A011	Frequency at minimum setpoint value (units: Hz)	Feedback percentage actual value for lower acceptance threshold (units: %)
A012	Frequency at maximum setpoint value (units: Hz)	Feedback percentage actual value for upper acceptance threshold (units: %)
A013	Minimum setpoint value (units: Hz)	Lower acceptance threshold for voltage or current on the actual value input (units: %)
A014	Maximum setpoint value (units: Hz)	Upper acceptance threshold for voltage or current at the actual value input (unit: %)
A021 to A035	Fixed frequencies 1 to 15	Digital adjustable setpoint values 1 to 15

PNU	Meaning of the parameters when used in	
	Frequency control mode	PID mode
A071	–	PID control active/inactive
A072		P component of the PID control
A073		I component of the PID control
A074		D component of the PID control
A075		Setpoint factor of the PID control
A076		Input actual value signal for PID control

Settings in frequency control mode

Before you use PID mode, you must configure the parameters in frequency control mode. Observe the following two points:

Acceleration and deceleration ramp

The output frequency calculated with the PID algorithm is not immediately available at the frequency inverter output, as the output frequency is affected by the set acceleration and deceleration times. Even if, for example, a large D component is defined, the output frequency is significantly influenced by the acceleration and deceleration time, and this causes unstable control behaviour.

To achieve stable behaviour in every PID control range, the acceleration and deceleration times should be set as low as possible.

After every acceleration and deceleration ramp parameter change, parameters PNU A072, A073 and A074 must be readjusted.

Frequency jumps/frequency range

Frequency jumps must be defined to meet the following requirement: A change to the feedback actual value signal must not occur during execution of a frequency jump. If a stable operating point exists within a frequency jump range, an oscillation between the end values of this range occurs.

Configuration of setpoint value and actual value

In PID mode, you must first specify how the setpoint is to be defined and where the actual value is to be supplied. The table below lists the required settings:

Actual value input	Setpoint definition				
	Built-in keypad	Digitally through control terminals (fixed frequencies)	Integrated potentiometer	Analog voltage at O-L	Analog current at OI-L
Analog voltage (O-L: 0 to 10 V)	PNU A001 = 02 PNU A076 = 01	PNU A001 = 02 PNU A076 = 01	PNU A001 = 00 PNU A076 = 01	–	PNU A001 = 01 PNU A076 = 01
Analog current (OI–L: 4 to 20 mA)	PNU A001 = 02 PNU A076 = 00	PNU A001 = 02 PNU A076 = 00	PNU A001 = 00 PNU A076 = 00	PNU A001 = 01 PNU A076 = 00	–

The setpoint value and the actual value cannot be supplied through the same analog input terminal.

Note that the frequency inverter brakes and stops according to the set deceleration ramp as soon as a stop signal is issued in PID operation.

Scaling

Set the scaling to the process-corrected physical unit as required by your application, for example to flow, pressure or temperature. For a detailed description, → Section "Scaling adjustment", Page 141.

Setpoint adjustment through digital inputs

The following points must be observed when defining the setpoint through the digital inputs (4 bit):

Assignment of the digital inputs

The DV6 frequency inverters have eight programmable digital inputs. Assign functions FF1 to FF4 to four of the inputs using PNU C001 to C006 to correspond to inputs 1 to 6 of the inverter.

Adjustment of the setpoint values

First, select the required number of different setpoints (up to 16) from the table below. Under PNU A021 (corresponds to the first setpoint value) to A035 (corresponds to the 15th setpoint value), enter the desired setpoint value. PNU A020 and F001 correspond to setpoint 0.

→ If the setpoints are to be scaled, note that they must be entered as process-corrected quantity values in accordance with this scaling.

No.	FF4	FF3	FF2	FF1	Setpoint number (PNU)
1	0	0	0	0	Setpoint value 0 (PNU A020 or F001)
2	0	0	0	1	Setpoint value 1 (PNU A021)
3	0	0	1	0	Setpoint value 2 (PNU A022)
4	0	0	1	1	Setpoint value 3 (PNU A023)
5	0	1	0	0	Setpoint value 4 (PNU A024)
6	0	1	0	1	Setpoint value 5 (PNU A025)
7	0	1	1	0	Setpoint value 6 (PNU A026)
8	0	1	1	1	Setpoint value 7 (PNU A027)
9	1	0	0	0	Setpoint value 8 (PNU A028)
10	1	0	0	1	Setpoint value 9 (PNU A029)
11	1	0	1	0	Setpoint value 10 (PNU A030)
12	1	0	1	1	Setpoint value 11 (PNU A031)
13	1	1	0	0	Setpoint value 12 (PNU A032)
14	1	1	0	1	Setpoint value 13 (PNU A033)
15	1	1	1	0	Setpoint value 14 (PNU A034)
16	1	1	1	1	Setpoint value 15 (PNU A035)

1: On
0: Off

If, for example, you only require up to four different setpoint values, only FF1 and FF2 need to be used; for five to eight different setpoint values, only FF1 to FF3 are required.

Activating PID mode

▶ Under PNU A071, enter the value 01.

You can make this entry at the very start, before defining all other settings.

Example for setting K_p and T_i

As for the parameter changes, check the output frequency or the feedback actual value signal with an oscilloscope (→ Fig. 136 to Fig. 139, Page 136).

Use two different setpoint values and switch between them using the digital control signal terminals.

The output should then always exhibit a stable behaviour.

Adjustment of the P component

Begin by setting only the P component, but not the I component and the D component.

▶ First, enter a very small proportional component under PNU A072 and check the result.
▶ If necessary, slowly increase this value until an acceptable output behaviour has been achieved.

Alternatively, set a very large P component and observe the behaviour of the output signal. If the behaviour is unstable, set a lower value and observe the result. Repeat this process.

If the behaviour is unstable, reduce the P component.

The P component is correct when the system deviation reaches a static state within acceptable limits.

Setting the integral component and matching K_p

▶ First, in PUN A073, enter a very small integral component.
▶ Set the P component a little lower.

If the system deviation does not decrease, reduce the integral component a little. If the performance becomes unstable as a result, reduce the P component.

▶ Repeat this process until you have found the correct parameter settings.

Note about the AVR function

If you have configured the AVR function (PNU A081) to 02 so that it is deactivated only during deceleration when PID control is active, there is, depending on the application, a danger that the motor will “knock”. In other words, instead of running smoothly, the motor accelerates and decelerates alternately. In this case, set the AVR function to 01 (OFF).

Application examples

This section contains some setting examples of practical applications.

Flow control

In the example shown in the figure below, the setpoint values are 150 m^3/min and 300 m^3/min:

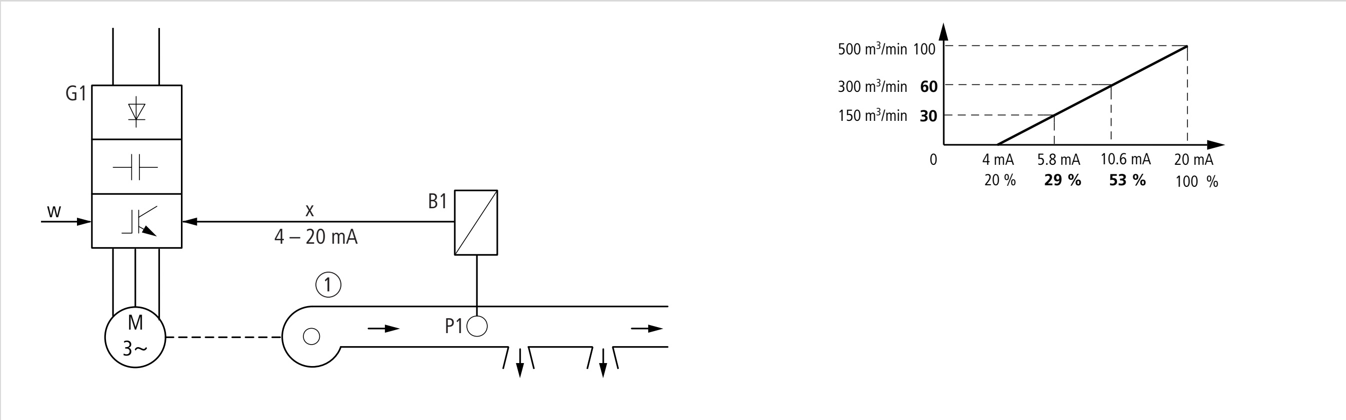


Figure 143: Examples for flow control

w: Setpoint value, 4-bit digital

x: Feedback actual value (500 m^3/min at 20 mA)

B1: Measured value converter

P1: Flow sensor

① Pump

PNU	Meaning in PID control mode	Value	Notes
F001	Setpoint	150	Direct input of “150 m^3/min”, since the scaling factor has been set
A001	Frequency setpoint input	02	Keypad
A011	Feedback percentage actual value for lower acceptance threshold (units: %)	0	0 %
A012	Feedback percentage actual value for upper acceptance threshold (units: %)	100	100 %
A013	Lower acceptance threshold for voltage or current on the actual value input (in %)	20	20 %
A014	Upper acceptance threshold for voltage or current on the actual value input (in %)	100	100 %
A021	Digitally adjustable setpoint value 1	300	300 m^3/min
A071	PID control active/inactive	01	PID mode active
A072	P component of the PID control	–	Application dependent
A073	I component of the PID control	–	
A074	D component of the PID control	–	
A075	Setpoint factor of the PID control	5.0	100 % at 500 m^3/min
A076	Input actual value signal for PID control	00	Feedback from OI-L terminal

Temperature control

With the flow control in the previous example, the frequency inverter's output frequency increases if the feedback signal is less than the setpoint and falls if the feedback signal is greater than the setpoint. With temperature control, the opposite behaviour must be implemented: if the temperature is above the setpoint, the inverter must increase its output frequency to increase the speed of the connected fan.

The following figure contains an example for temperature control with the two setpoints 20 and 30 °C:

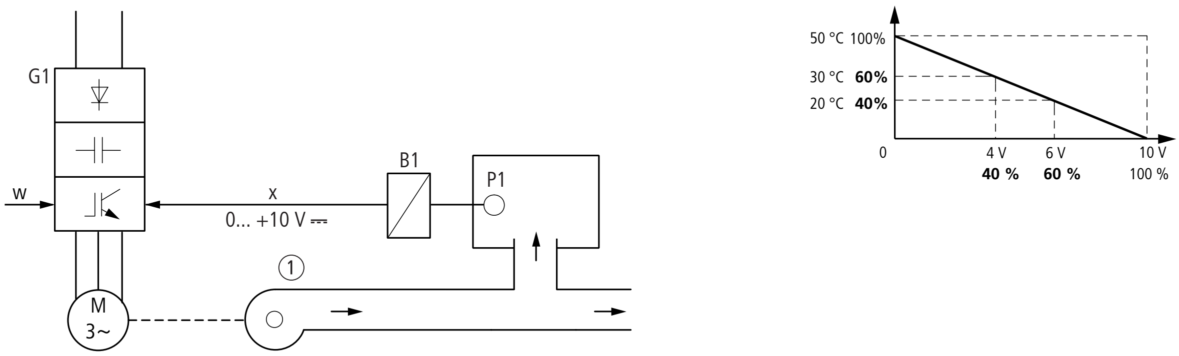


Figure 144: Example of temperature control

w: Setpoint value, 4 Bit digital

x: Feedback actual value (50 °C at 10 V)

B1: Measured value converter

P1: Temperature sensor

① Fan

PNU	Meaning in PID control mode	Value	Notes
F001	Setpoint	20	Direct input of "20 °C", as the scaling factor has been set
A001	Frequency setpoint input	02	Keypad
A011	Feedback percentage actual value for lower acceptance threshold (units: %)	100	100 %
A012	Feedback percentage actual value for upper acceptance threshold (units: %)	0	0 %
A013	Lower acceptance threshold for voltage or current on the actual value input (in %)	0	0 %
A014	Upper acceptance threshold for voltage or current on the actual value input (in %)	100	100 %
A021	Digitally adjustable setpoint value 1	30	30 °C
A071	PID control active/inactive	01	PID mode active
A072	P component of the PID control	–	Application dependent
A073	I component of the PID control	–	
A074	D component of the PID control	–	
A075	Setpoint factor of the PID control	0.5	100 % at 50 °C
A076	Input actual value signal for PID control	01	Feedback from O-L terminal

Automatic voltage regulation (AVR)

The AVR function stabilizes the motor voltage if there are fluctuations on the DC bus voltage. These deviations result from, for example

- unstable mains supplies or
- DC bus voltage dips or peaks caused by short acceleration and deceleration times.

A stable motor voltage provides a high level of torque, particularly during acceleration.

Regenerative motor operation (without AVR function) results in a rise in the DC bus voltage in the deceleration phase (particularly with very short deceleration times), which also leads to a corresponding rise in the motor voltage. The increase in the motor voltage causes an increase in the braking torque. Under PNU A081, you can therefore deactivate the AVR function for deceleration.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A081	Characteristic of the AVR function	–	–	00	AVR function active during entire operation.	02
				01	AVR function is not active.	
				02	AVR function active during operation except for deceleration	
A082	Motor voltage for AVR function	–	–	380, 400, 415, 440, 460, 480	400 V series: 380, 400, 415, 440, 460, 480 V	400

If the mains voltage is higher than the rated motor voltage, enter the mains voltage under PNU A082 and reduce the output voltage under PNU A045 to the rated motor voltage.

Example: At 440 V mains voltage and 400 V rated motor voltage, enter, under PNU A082 the value 440 and, under PNU A045, the value 91 % (= 400/440 × 100 %).

Energy-saving mode

Energy-saving mode is intended especially for pump and fan applications with reduced torque characteristics. In this mode, the output voltage is automatically adapted to the motor load, thereby drawing no more energy from the mains than required for operation.

When you enter the value 01 under PNU A085, you can adapt the response time of the energy-saving mode under PNU A086. A short response time achieves more accurate, and a long response time less accurate voltage matching.

The value 02 under PNU A085 activates fuzzy logic optimized energy-saving.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A085	Energy-saving mode	–	–	00	Energy-saving mode not active	00
				01	Energy-saving mode active	
				02	Energy-saving mode with active fuzzy logic	
A086	Response time	✓	✓	0 to 100 s	Response time for voltage matching	50.0

Time ramps

During operation, you can change over from the time ramps set under PNU F002 and F003 to those programmed under PNU A092 and A093. You can do this either by applying an external signal to input 2CH at any time or when the frequencies configured under PNU A095 and A096 are reached.

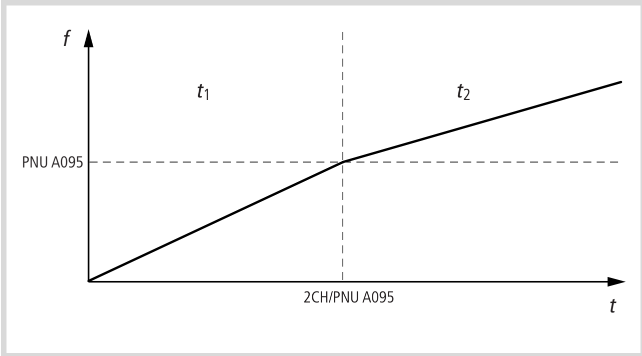


Figure 145: Time ramps

t_1: Acceleration time 1

t_2: Acceleration time 2

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A092 A292 A392	Second acceleration time	✓	✓	0.01 to 3600 s	Setting times for the second acceleration and deceleration time 0.1 to 999.9 s; resolution: 0.1 s 1000 to 3000 s; resolution: 1 s	15
A093 A293 A393	Second deceleration time					
A094 A294	Changeover from the first to the second time ramp	–	–	00	Changeover to the second time ramp if an active signal is present on a 2CH digital input.	00
				01	Changeover to the second time ramp when the frequencies entered in PNU A095 and/or A096 are reached	
A095 A295	Acceleration time changeover frequency	–	–	0.00 to 400.0 Hz	Here, set a frequency at which the changeover from the first to the second acceleration time is to take place.	0.0
A096 A296	Deceleration time changeover frequency	–	–	0.00 to 400.0 Hz	Here, set a frequency at which the changeover from the first to the second deceleration time is to take place.	0.0

Acceleration and deceleration characteristics

Under PNU A097, define the characteristic of the acceleration ramp. This applies to the first and second time ramp. You can choose between four options (→ Fig. 146):

- Linear acceleration, value 00 (default)
- S-curve characteristic for acceleration, value 01
- U-curve characteristic for acceleration, value 02
- Inverted U-curve characteristic for acceleration, value 03

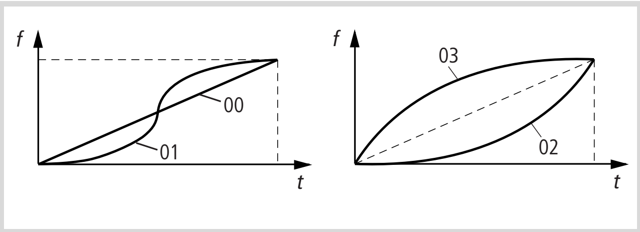


Figure 146: Acceleration characteristics

Under PNU A098, define the characteristic of the deceleration ramp in the same way as for acceleration (→ Fig. 147):

- Linear deceleration, value 00 (default)
- S-curve characteristic for deceleration, value 01
- U-curve characteristic for deceleration, value 02
- Inverted U-curve characteristic for deceleration, value 03

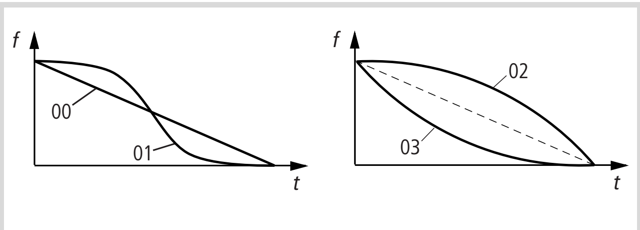


Figure 147: Deceleration characteristics

In addition, you can define the curvature of the S- and U-curve characteristics. Ten values are available for this purpose. Value 01 means the smallest curvature, value 10 the greatest (→ Fig. 148). PNU A131 contains the curvature for acceleration, PNU A132 the curvature for deceleration.

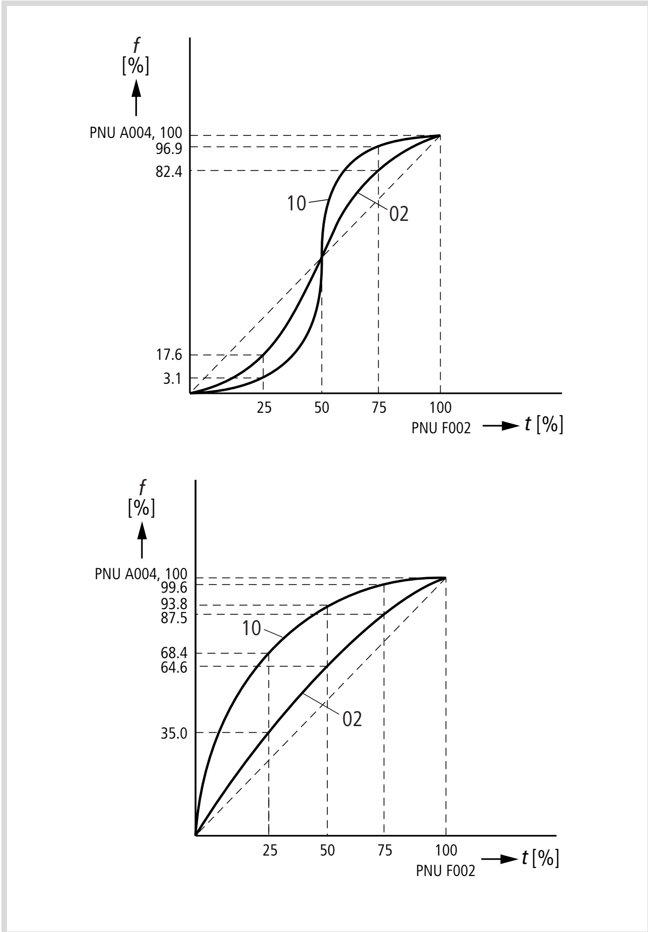


Figure 148: Curvature of the S- and U-curve characteristics

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
A097	Acceleration characteristic	–	–	00	Linear acceleration of the motor at the first and second time ramps	00
				01	S-curve characteristic for acceleration of the motor at the first and second time ramps	
				02	U-curve characteristic for acceleration of the motor at the first and second time ramps	
				03	Inverted U-curve characteristic for acceleration of the motor at the first and second time ramps	
A098	Deceleration characteristic	–	–	00	Linear deceleration of the motor at the first and second time ramps	00
				01	S-curve characteristic for deceleration of the motor at the first and second time ramps	
				02	U-curve characteristic for deceleration of the motor at the first and second time ramps	
				03	Inverted U-curve characteristic for deceleration of the motor at the first and second time ramps	
A131	Curvature of acceleration characteristic	–	✓	01	Smallest curvature of the acceleration ramp	02
				...		
				10	Largest curvature of the acceleration ramp	
A132	Curvature of deceleration characteristic	–	✓	01	Smallest curvature of the deceleration ramp	02
				...		
				10	Largest curvature of the deceleration ramp	

Automatic restart after a fault

Warning!
When a fault has occurred, this function initiates an automatic restart of the frequency inverter if a start signal is present after the set waiting time has expired. Make sure that an automatic restart does not present a danger to personnel.

With the default settings, each fault triggers a fault message. An automatic restart is possible after the following fault messages have occurred:

- Overcurrent (E01 to E04, up to four restart attempts within ten minutes before a fault message is issued)
- Overvoltage (E07 and E15, up to three restart attempts within ten minutes before a fault message is issued)
- Undervoltage (E09 and E16, up to 16 restart attempts within ten minutes before a fault message is issued)

Under PNU b001, define the restarting behaviour.

With PNU b002 and b003, define the behaviour on failure of the power supply (→ Fig. 149 and Fig. 150).

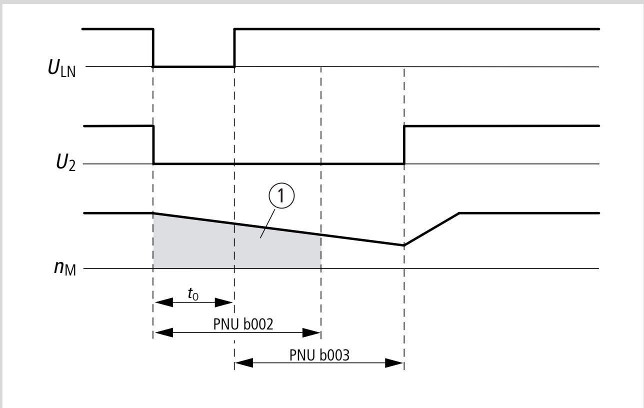


Figure 149: Duration of power supply failure shorter than defined under PNU b002

ΔU_{LN}: Supply voltage
ΔU_2: Output voltage
n_M: Motor speed
t_0: Duration of supply failure
① Free run stop (coasting)

Under PNU b007, define the frequency threshold below which the frequency inverter accelerates the motor from 0 Hz on a restart

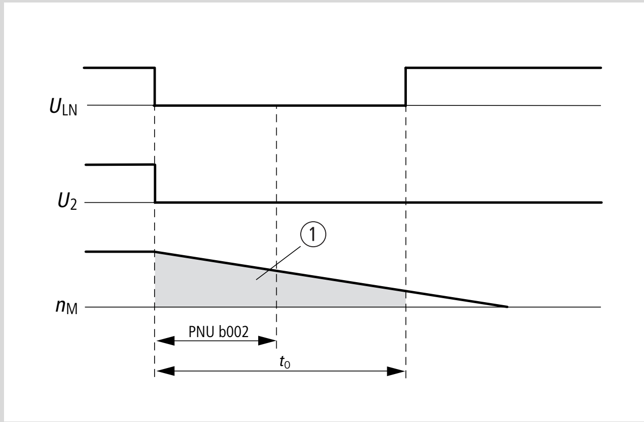


Figure 150: Duration of power supply failure greater than defined under PNU b002

ΔU_{LN}: Supply voltage
ΔU_2: Output voltage
n_M: Motor speed
t_0: Duration of supply failure
① Free run stop (coasting)

Under PNU b004, define how the DV6 frequency inverter responds to an intermittent power supply failure or undervoltage.

With PNU b005, define whether the DV6 frequency inverter attempts a restart up to 16 times or indefinitely in the event of an intermittent power supply failure or undervoltage.

With PNU b006, you can activate phase failure detection. This function can not be used if an RFI filter is installed upstream of the frequency inverter.

(→ Fig. 151 and Fig. 152).

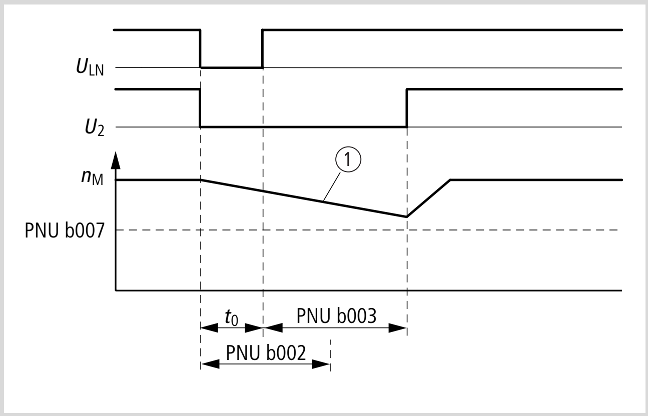


Figure 151: Motor frequency higher than set under PNU b007

ΔU_{LN}: Supply voltage

ΔU_2: Output voltage

n_M: Motor speed

t_0: Duration of supply failure

① Free run stop (coasting)

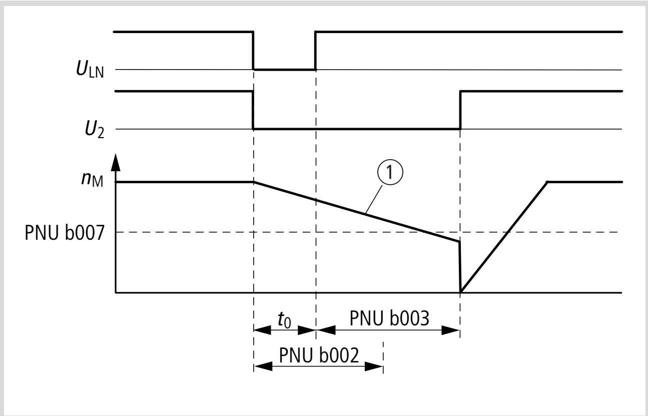


Figure 152: Motor frequency lower than set under PNU b007

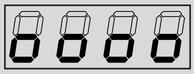
ΔU_{LN}: Supply voltage

ΔU_2: Output voltage

n_M: Motor speed

t_0: Duration of supply failure

① Free run stop (coasting)

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b001	Restart mode	–	✓	00	The above fault messages are displayed when the associated fault occurs (restart is not activated).	00
				01	A restart takes place at the starting frequency after the time set under PNU b003 has elapsed.	
				02	After the time set under PNU b003 has elapsed, the frequency inverter synchronizes to the current motor rotation speed and the motor accelerates for the set acceleration time.	
				03	After the time set under PNU b003 has elapsed, the inverter synchronizes to the current motor rotation speed and the motor brakes for the set deceleration time. A fault message is then displayed.	
b002	Permissible power failure duration	–	✓	0.3 to 1.0 s	Here, set a time duration for which the undervoltage condition is met without the corresponding fault message in E09 being issued.	1.0
b003	Waiting time before restart	–	✓	0.3 to 100 s	Here, set a time which is to expire before an automatic restart is initiated after a fault signal. This time can be used in conjunction with the FRS function. During the waiting time, the following message appears on the LED display: 	1.0
b004	Fault message issued immediately	–	✓	00	In the event of an intermittent power supply failure or undervoltage, the frequency inverter does **not** go into fault status.	00
				01	In the event of an intermittent power supply failure or undervoltage, the frequency inverter goes into fault status.	
				02	In the event of an intermittent power supply failure or undervoltage **at standstill or during deceleration**, the frequency inverter does **not** go into fault status.	
b005	Number of restart attempts	–	✓	00	16 restart attempts at intermittent supply failure or undervoltage.	00
				01	The number of restart attempts is not limited.	
b006	Mains phase failure detection1)	–	✓	00	Inactive	00
				01	Active	
b007	Synchronization frequency	–	✓	0 to 400 Hz	When the frequency corresponding to the motor speed is higher than the frequency programmed here, the frequency inverter synchronizes itself with the motor speed and accelerates to the setpoint value. When the frequency corresponding to the motor speed is lower than the frequency programmed here, the frequency inverter starts at 0 Hz.	0.00

1) Phase failure detection can not be used if you are using the DV6 frequency inverter with an RFI filter.

Electronic motor protection

Using an electronically simulated bimetallic strip, the DV6 frequency inverters can provide thermal monitoring of the connected motor. With PNU b012, you can match the electronic motor protection to the full load current of the motor. If the values entered here exceed the rated motor current, the motor cannot be monitored with this function. In this case, PTC thermistors or bimetal contacts in the motor windings must be used.

Caution!
At low motor speeds, the output of the motor cooling fan is diminished, and the motor may overheat despite its overload protection. You should therefore provide protection with PTC thermistors or bimetal contacts.

Let us assume you have a DV6-340-11K. The motor full load current is 23 A. The setting range goes from 4.6 A = 0.2 × 23 A to 27.6 A = 1.2 × 23 A. Figure 153 shows the tripping characteristic when PNU b012 contains the value 23.

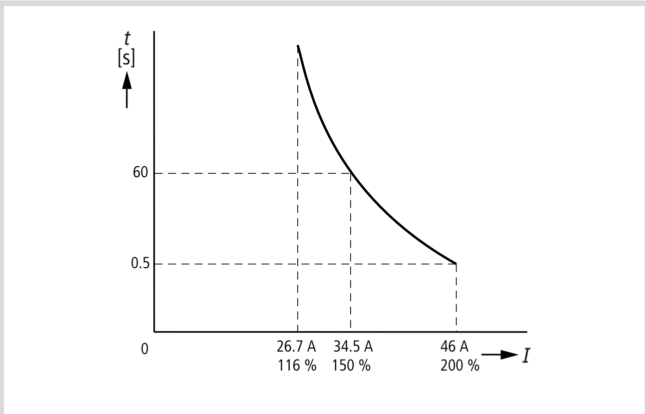


Figure 153: Tripping current characteristic at I_e = 23 A

Use PNU b013 to match the overload protection to your load conditions. You have three options (→ Fig. 154 to Fig. 156):

- Increased overload protection; value: 00
- Normal overload protection; value: 01 (default)
- Adjustable overload protection; value: 02

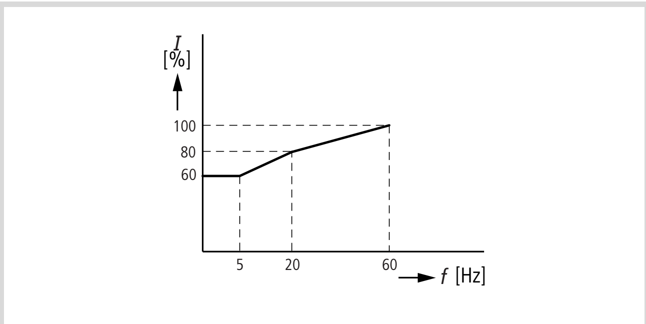


Figure 154: Increased overload protection (PNU b013 = 00)

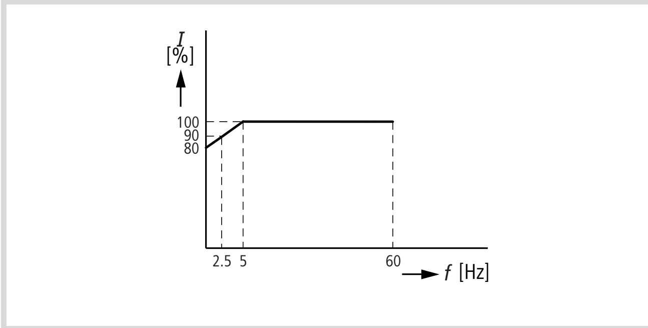


Figure 155: Normal overload protection (PNU b013 = 01)

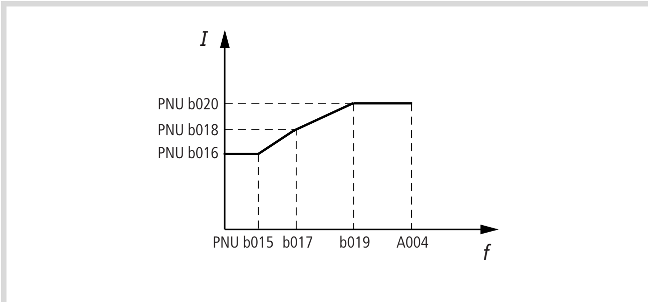


Figure 156: Adjustable overload protection (PNU b013 = 02)

Tripping characteristics at increased overload protection

With increased overload protection (PNU b013 = 00), the tripping current is reduced, for example, by 80 % at 20 Hz (→ Fig. 154). Accordingly, the tripping characteristic is offset to smaller current values (→ Fig. 157).

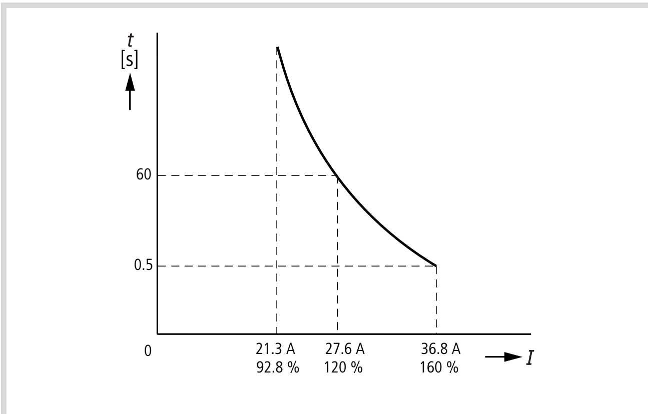


Figure 157: Tripping characteristic for increased overload protection at 20 Hz and I_e = 23 A

Tripping characteristic at normal overload protection

With normal overload protection (PNU b013 = 01), the tripping current is reduced, for example, by 90 % at 2.5 Hz (→ Fig. 155). Accordingly, the tripping characteristic is offset to smaller current values (→ Fig. 158).

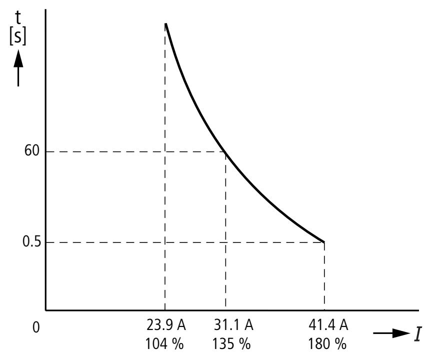


Figure 158: Tripping characteristic for constant overload protection at 2.5 Hz and I_e = 23 A

Tripping characteristic at adjustable overload protection

Here, you can freely select the tripping characteristic (PNU b013 = 02) by entering the appropriate currency and frequency coordinates under PNU b015 to b020 (→ Fig. 156). These must be within the limits shown (→ Fig. 159).

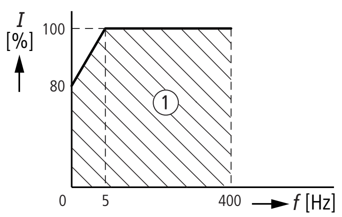


Figure 159: Setting range for the adjustable overload protection

① Setting range

The tripping curve then has the following characteristic, represented by the frequency set under PNU b018 (→ Fig. 160).

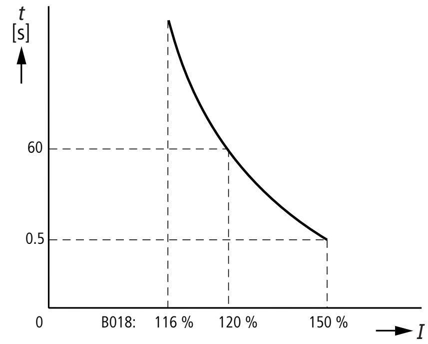


Figure 160: Tripping characteristic for adjustable overload protection using PNU b018

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b012 b212 b312	Tripping current for electronic motor protection device	–	✓	0.2 to 1.2 × I_e[1)]	Setting range of the tripping current as a multiple of the frequency inverter rated current, i.e. the range is given in amperes (A).	I_e[1)]
b013 b213 b313	Characteristic for electronic motor protection device	–	✓	The electronic thermal protection of the motor in the low speed range can be increased to improve thermal monitoring of the motor at low frequencies.		01
				00	Enhanced motor protection	
				01	Normal overload protection	
				02	Adjustable under b015 to b020	
b015	Frequency 1	–	✓	0.0 to 400 Hz	Frequency 1 for electronic motor protection device	0
b016	Tripping current 1	–	✓	0.0 to 1000 A	Tripping current 1 for electronic motor protection device	0.0
b017	Frequency 2	–	✓	0.0 to 400 Hz	Frequency 2 for electronic motor protection device	0
b018	Tripping current 2	–	✓	0.0 to 1000 A	Tripping current 2 for electronic motor protection device	0.0
b019	Frequency 3	–	✓	0.0 to 400 Hz	Frequency 3 for electronic motor protection device	0
b020	Tripping current 3	–	✓	0.0 to 1000 A	Tripping current 3 for electronic motor protection device	0.0

1) Inverter rated current

Current limit

With the current limit setting, the motor current can be limited. To reduce the load current, the frequency inverter ends the frequency increase in the acceleration phase or reduces the output frequency during static operation as soon as the output current rises above the current limit set with this function, (the time constant for control at the current limit is defined under PNU b023 or b026). As soon as the output current drops below the set current limit, the frequency increases again to the configured setpoint value. The current limit can be deactivated for the acceleration phase, so that higher currents for acceleration are allowed for brief periods (→ PNU b021 or b024).

With PNU b024 to b026, you can program a second current limit, which can be called up through digital input OLR (→ Section "Change over current limit (OLR)", Page 90).

The current limit can not prevent a fault message being issued and the frequency inverter being switched off due to a sudden overcurrent, for example caused by a short circuit.

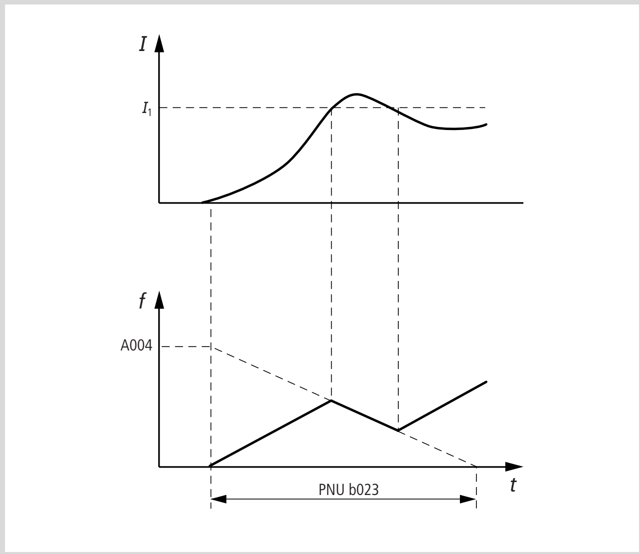


Figure 161: Current limit

I_M: Motor current

I_1: Current limit

Caution!
Note that the current limit cannot prevent a fault message and shutdown due to a sudden overcurrent (e.g. caused by a short-circuit).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b021	Current limit characteristic 1	–	✓	00	Motor current limit not active	01
				01	Motor current limit active in all operating states	
				02	Motor current limit not active during acceleration	
				03	Motor current limitation is active in every operating state. If the motor current limit is reached in regenerative mode, the frequency is increased until the current has fallen below the set motor current limit.	
				04	Motor current limitation to achieve higher starting currents is not active in the acceleration phase. If the motor current limit is reached in regenerative mode, the frequency is increased until the current has fallen below the set motor current limit.	
b022	Tripping current 1	–	✓	0.5 to 2 × I_e	Setting range of the tripping current as a multiple of the frequency inverter rated current, i.e. the range is given in amperes (A).	1.5 × I_e 1)
b023	Time constant 1	–	✓	0.1 to 30 s	When the set current limit is reached, the frequency is reduced in the time specified here. Caution: If possible, do not enter a value below 0.3 here!	1.0

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b024	Current limit characteristic 2	–	✓	00	Motor current limit not active	01
				01	Motor current limitation active in all operating states	
				02	Motor current limitation not active during acceleration	
				03	Motor current limitation active in every operating state. If the motor current limit is reached in regenerative mode, the frequency is increased until the current has fallen below the set motor current limit.	
				04	Motor current limitation to achieve higher starting currents not active in the acceleration phase. If the motor current limit is reached in regenerative mode, the frequency is increased until the current has fallen below the set motor current limit.	
b025	Tripping current 2	–	✓	0.5 to 2 × I_e	Setting range of the tripping current as a multiple of the frequency inverter rated current, i.e. the range is given in amperes (A).	1.5× I_e 1)
b026	Time constant 2	–	✓	0.1 to 30 s	When specified current limit is reached, the frequency is reduced in the time set here. Caution: If possible, do not enter a value below 0.3 here!	1.0

1) Inverter rated current

Parameter protection

Under PNU b031, you can specify whether you want to use the normal or extended parameter setting features in RUN mode. If you set the value 10 under PNU b031, further parameters are available which can be modified in the RUN mode. These additional parameters are marked "✓" in the Extended column.

Adjustable in RUN mode	
Normal	Extended
–	✓

The five following methods of parameter protection are available:

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b031	Software parameter protection	–	✓	00	Parameter protection through SFT input; all functions inhibited	01
				01	Parameter protection through SFT input; input through PNU F01 possible	
				02	Parameter protection without SFT input; all functions inhibited	
				03	Parameter protection without SFT input; input through PNU F01 possible	
				10	Extended parameters adjustable in RUN mode	

Controlled deceleration

Normally, in the event of a power failure or an Emergency-Stop, the motor coasts to a halt without frequency inverter control. In some applications, however, it is necessary to control the motor's deceleration. This function is provided for such cases.

To use this function, the power supply for connections R0 and T0 must be changed.

> **Warning!**
> Before working on the DV6, isolate the device from its power supply. Risk of fatal injury from electrical current.

By default, terminals R0 and T0 are connected to phases L1 and L3 through connector J51 (→ Fig. 162).

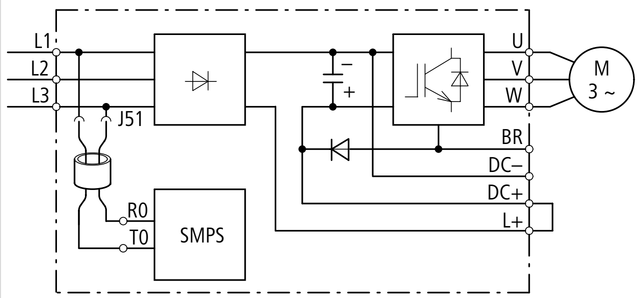


Figure 162: Default connection of terminals R0 and T0

SMPS: DV6 control electronics

For controlled deceleration to work, you must connect terminals R0 and T0 to DC+ and DC– (→ Fig. 163).

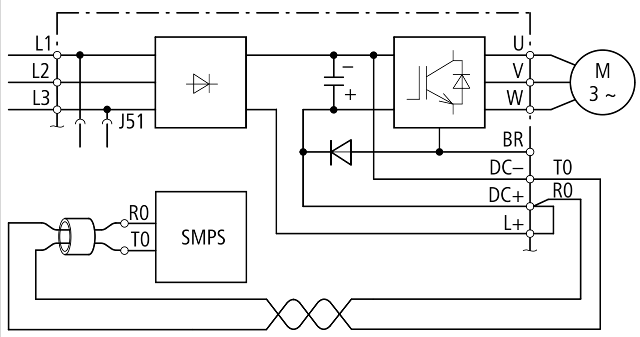


Figure 163: Connecting terminals R0 and T0 to DC+ and DC–

SMPS: DV6 control electronics

Proceed as follows:

- ▶ Release the two screws of terminals R0 and T0. Remove connector J51 with the cable from the circuit board (retain the plug).

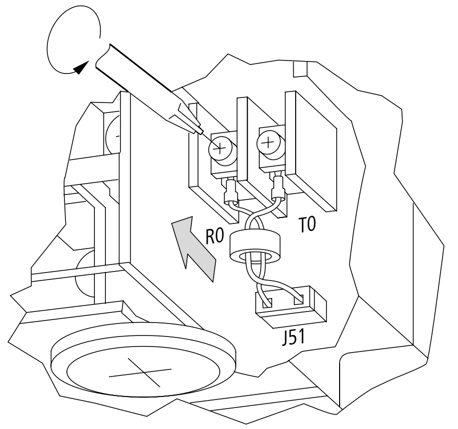


Figure 164: Disconnect J51 from terminals R0 and T0

- ▶ Connect a cable to terminal R0, which is long enough to reach terminal DC+ (do not connect yet).
- ▶ Connect a cable to terminal T0, which is long enough to reach terminal DC– (do not connect yet).
- ▶ Remove the ferrite rings from the connector cable (J51) and guide the new cable through the ferrite rings.

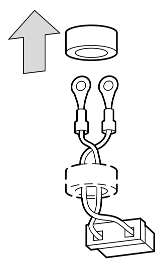


Figure 165: Remove the ferrite rings.

- ▶ Twist the two cables with each other.
- ▶ Connect terminal R0 to DC+ and terminal T0 to DC–.

With this wiring arrangement, the motor can feed the frequency inverter's control electronics when the power supply is switched off.

If the mains power fails during controlled deceleration (PNU b050 = 01), deceleration starts as soon as the internal DC link voltage ΔU_{DC} falls below the threshold set under PNU b051. To ensure that the control electronics are supplied with power, the current output frequency f_O is reduced by the frequency jump set under PNU b054. The motor then runs in regenerative mode and feeds the internal DC link voltage ΔU_{DC}. Deceleration now takes place after the set deceleration ramp (PNU b053). If, due to a high mass inertia, the internal DC link voltage ΔU_{DC} becomes excessively high, the deceleration ramp is interrupted until the voltage falls below the threshold defined under PNU b052.

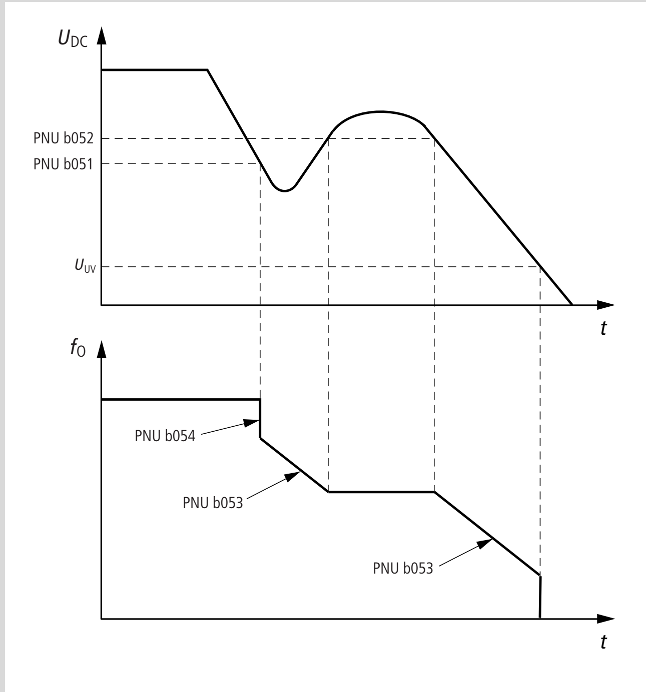


Figure 166: Function chart for controlled deceleration

ΔU_{DC}: Internal DC link voltage

ΔU_{UV}: Voltage threshold for the control electronics

f_O: Output frequency

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b050	Controlled deceleration	–	–	00	Controlled deceleration is **not** active.	00
				01	Controlled deceleration is active.	
b051	Starting voltage for deceleration	–	–	0 to 1000 V	When the internal DC link voltage falls below this value, controlled deceleration starts	0.0
b052	Voltage for ramp stop	–	–	0 to 1000 V	When the internal DC link voltage rises again, the deceleration ramp PNU b053 is interrupted.	0.0
b053	Deceleration time	–	–	0.01 to 3600 s	During this time, the motor is decelerated.	1.00
b054	Frequency jump	–	–	0.00 to 10.00 Hz	The frequency inverter reduces the output voltage by this value so that the motor works in regenerative mode.	0.00

Other functions

Inhibit direction of rotation

Under PNU b035, you can specify whether clockwise or anticlockwise motor operation is permitted.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b035	Inhibit direction	–	–	00	Motor can run in both directions	00
				01	Motor can only run clockwise	
				02	Motor can only run anticlockwise	

Starting behaviour

With the two parameters PNU b036 and b082, you can specify the voltage ramp and the frequency for starting the motor.

Voltage ramp

If the overcurrent trip is triggered at an increased starting frequency, you can reduce the starting current and the torque with PNU b036.

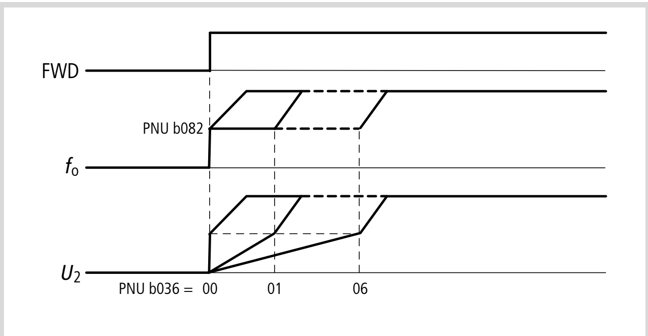


Figure 167: Function chart for voltage ramp reduction

f_o: Output frequency

ΔU_2:Output voltage

Starting frequency

Under PNU b082, you can set the frequency at which the motor is to start.

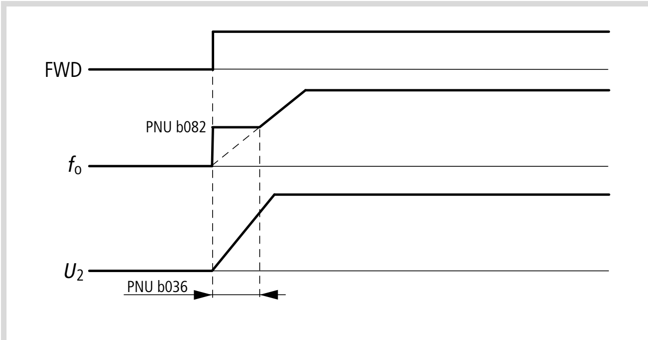


Figure 168: Function chart for starting frequency

f_o: Output frequency

ΔU_2:Output voltage

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b036	Voltage ramp to starting frequency	–	✓	00	Start without voltage reduction.	06
				01	Minimum voltage reduction, approx. 6 ms	
				...		
				06	Maximum voltage reduction, approx. 36 ms	
b082	Increased starting frequency	–	✓	0.1 to 9.99 Hz	The motor starts with this frequency.	0.5

Display mode

With this function, you can specify the parameters which the DV6 displays. Only these displayed parameters can then be changed:

- All parameters: PNU b037 = 00 (default)
- Parameters which are relevant to the programmed parameters: PNU b037 = 01
- Only the parameters saved under PNU U001 to U012: PNU b0037 = 02 (→ Section “User-defined parameters – parameter group U“, Page 176)

All parameters: PNU b037 = 00 (default)
By default, the DV6 displays all parameters and all parameters can be changed.

Relevant parameters: PNU b037 = 01
With this setting, the DV6 displays only those parameters which are connected with ones that are already programmed. If, for example you set a constant *ΔU/f* characteristic under PNU A044 (default value: 00), the parameters for an adjustable *ΔU/f* characteristic are not shown (PNU b100 to b113). The table below shows, which parameters are hidden when this option is set.

PNU	Value	PNUs which are hidden when PNU b037 is set to 01	Function
A001	01	A005, A006, A011 to A016, A101 to A105, A111 to A114, C081 to C083, C121 to C123	Analog inputs O, OI, O2
A002	01, 03, 04, 05	b087	OFF key disabled
A019	00	A028 to A035	Fixed frequencies
C001 to C008	02, 03, 04, 05		
A044, A244	02	b100 to b113	Voltage and frequency characteristic
A051	01	A052 to A059	DC braking
A071	01	A072 to A076, C044	PID control
A094	01	A095 to A096	Second time ramp
A294	01	A295 to A296	
b013, b213, b313	02	b015 to b020	Electronic motor protection
b021	01, 02	b022, b023	Overcurrent limit
b024	01, 02	b025, b026	Overcurrent limit 2
b095	01, 02	b090, b096	BRD function
C001 to C008	06	A038, A039	Jog mode
	08	F202, F203, A203, A204, A220, A241 to A244, A261, A262, A292 to A296, b212, b213, H202 to H206, H220 to H224, H230 to H234, H250 to H252, H260	Second parameter set
	11	b088	Motor shutdown and free run stop
	17	F302, F303, A303, A304, A320, A342 to A344, A392, A393, b312, b313, H306	third parameter set
	18	C102	Reset
	27, 28, 29	C101	Acceleration/deceleration motor potentiometer
A044	00, 01	A041 to A043	Voltage boost function
	04	H060	0 Hz limitation
A244	00, 01	A241 to A243	Voltage boost function
	04	H260	0 Hz limitation
A044	03, 04, 05	b040 to b046, H001, H002, H005, H020 to H024, H030 to H034, H050 to H052, H060, H070 to H072	
A244	03, 04	b040 to b046, H202, H205, H220 to H224, H230 to H234, H250 to H252, H260, H070 to H072	
A097	01, 02, 03	A131	Curvature of acceleration ramp
A098	01, 02, 03	A132	Curvature of acceleration ramp

PNU	Value	PNUs which are hidden when PNU b037 is set to 01	Function
b098	01, 02	b099, C085	Thermistor function
b050	01	b051 to b054	Behaviour on power failure
b120	01	b121 to b126	Brake control
C021 to C025, C026	02, 06	C042, C043	Frequency reached signal
	03	C040, C041	Overcurrent signal
	07	C055 to C058	Overload
	21	C063	0 Hz signal
	24, 25	C045, C046	Frequency reached signal
	26	C111	Overload signal 2

Parameters U001 to U012, PNU b037 = 02
In parameter group U, you can save any twelve parameters → Section "User-defined parameters – parameter group U", Page 176), When you set PNU b037 to 02, only these and PNU b037 are shown.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b037	Display mode	–	✓	00	All parameters are shown.	00
				01	Only relevant parameters are shown.	
				02	Only PNU b037 and the parameters entered in PNU U001 to U012 are shown.	

Pulse frequency

High pulse frequencies result in less motor noise and lower power losses in the motor but a higher dissipation in the power amplifiers and more noise in the mains and motor cables. You should therefore set the pulse frequency as low as possible.

During DC braking, the pulse frequency is automatically reduced to 1 kHz.

PNU	Name	Adjustable in RUN mode		Value	WE
		Normal	Extended		
b083	Pulse frequency	–	–	0.5 to 15 kHz	5

Initialization

Two different types of initialization are available:

- Clearing the fault history register
- Restoring the default parameter settings

To delete the fault history register or to restore the factory default settings, proceed as follows:

▶ Make sure, that PNU b085 contains the value 01.

▶ Under PNU b084 (initialization), enter 00, 01 or 02.

▶ Press the ENTER key to save the value.

▶ On the keypad, press both arrow keys and the PRG key at the same time and keep them pressed.

▶ While holding the arrow and PRG keys, briefly press the OFF key.

▶ Now release all keys again. The display shows d 001.

Initialization is now complete.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b084	Initialization	–	–	00	Clearing the fault history register	00
				01	Restoring the factory default settings	
				02	Deleting the fault history register and restoring the default settings	

Country version

Here, define the country-specific parameter set which will be loaded during initialization (→ PNU b084).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b085	Country version	–	–	00	Japan	01
				01	Europe	
				02	USA	

Frequency factor for display through PNU d007

The product of the output frequency and this factor is displayed under PNU d007.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b086	Frequency factor	✓	✓	0.1 to 99.9	The product of the value displayed under PNU d001 and this factor is displayed at PNU d007. This value is also available at the FM terminal.	1.0

Inhibit of the OFF key

The OFF key located on the keypad or remote operating unit can be inhibited here.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b087	OFF key disabled	–	✓	00	OFF key always active	00
				01	OFF key not active with control through the FWD/REV terminals	

Motor restart after cancellation of the FRS signal

Activation of the digital input configured as FRS (free run stop: coasting) causes the inverter to shut down, leaving the motor to coast freely. Two options are available to determine the frequency inverter's behaviour after deactivation of the FRS input.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b088	Motor restart after removal of the FRS signal	–	–	00	0 Hz restart after deactivation of the FRS input	00
				01	Synchronization of the motor to the current motor speed after the waiting time entered under PNU b003.	

Controlling the built-in braking transistor

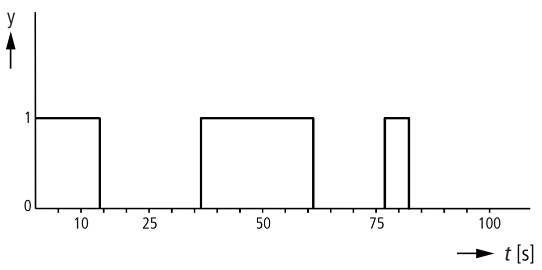
The DV6 has built-in braking transistor, which is controlled with the following parameters.

Relative permissible duty factor of the built-in braking transistor
Enter the permissible relative duty factor of the DV6's built-in braking transistor here. The value entered here is a percentage of the longest permissible (continuous) total running time of the braking transistor, which is 100 s.

Using an example of three braking operations within 100 seconds, the illustration below shows the effect of the relative duty factor:

The current relative duty factor T in this example is 44 %.

If, for example, you set PNU b090 to 40 %, a fault message is issued.



$$T = \frac{14\ s + 25\ s + 5\ s}{100\ s} \times 100\ \% = 44\ \%$$

Figure 169: Example: Braking duration

y: Braking

If the braking transistor is operated for a longer period than the value entered here, fault message E06 is issued.

The assigned external Braking resistor must not fall below the following minimum values:

DV6-340-	Assigned rating at 400 V kW	Minimum resistance at DF = 10 % Ω	Minimum resistance at DF = 100 % Ω
075	0.75	100	300
1K5	1.5	100	300
2K2	2.2	100	300
4K0	4.0	70	200
5K5	5.5	70	200
7K5	7.5	50	150
11K	11.0	50	150

Connect the external braking resistor to terminals BR and DC+. The maximum cable length between frequency inverter and braking resistor must not be greater than five metres.

If you are using an external braking device, enter 0 % under PNU b090 and remove any external braking resistors at terminals BR and DC–.

Under PNU b095, specify when the built-in braking transistor is to operate.

Under PNU b096, set the voltage threshold at which the built-in braking transistor becomes active.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b090	Relative permissible duty factor of the built-in braking transistor	–	✓	0 to 100 %	To deactivate the relative permissible duty factor of the built-in braking transistor, enter 0 %.	0
b095	Enable built-in braking transistor	–	✓	00	Do not enable braking transistor	00
				01	Enable braking transistor in RUN mode	
				02	Always enable braking transistor	
b096	Voltage threshold of built-in braking transistor	–	✓	660 to 760 V	With PNU b095 = 01 or 02, the built-in braking transistor is switched in when the internal DC link voltage reaches this value.	720

Type of motor stop

Specify here, how the motor is to decelerate when the OFF button is pressed:

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b091	Type of motor stop	–	–	00	Deceleration using the deceleration ramp	00
				01	Free run stop (coasting)	

Fan control

With PNU b092, you can specify when the fan will operate.

If you enter the value 01 here, the fan runs for one minute after the frequency inverter power supply is switched on, allowing you to make sure that the fan is working correctly. The fan also continues to run for five minutes after the connected motor has stopped to dissipate residual heat.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b092	Fan control	–	–	00	Fan is always switched on	00
				01	Fan is switched on only while the connected motor is running.	

Debug mode

Under PNU C091, set debug mode.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
C091	Debug mode	–	✓	00	Debug mode is displayed.	00
				01	Debug mode is **not** displayed.	

Controlling an external brake

You can use the DV6 frequency inverter to control an external brake, which is needed where heavy loads are to be lifted, for example in lift and crane applications. When an external brake is employed, you should use the SLV (sensorless vector) or 0 Hz SLV control mode, which can provide a higher torque (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).

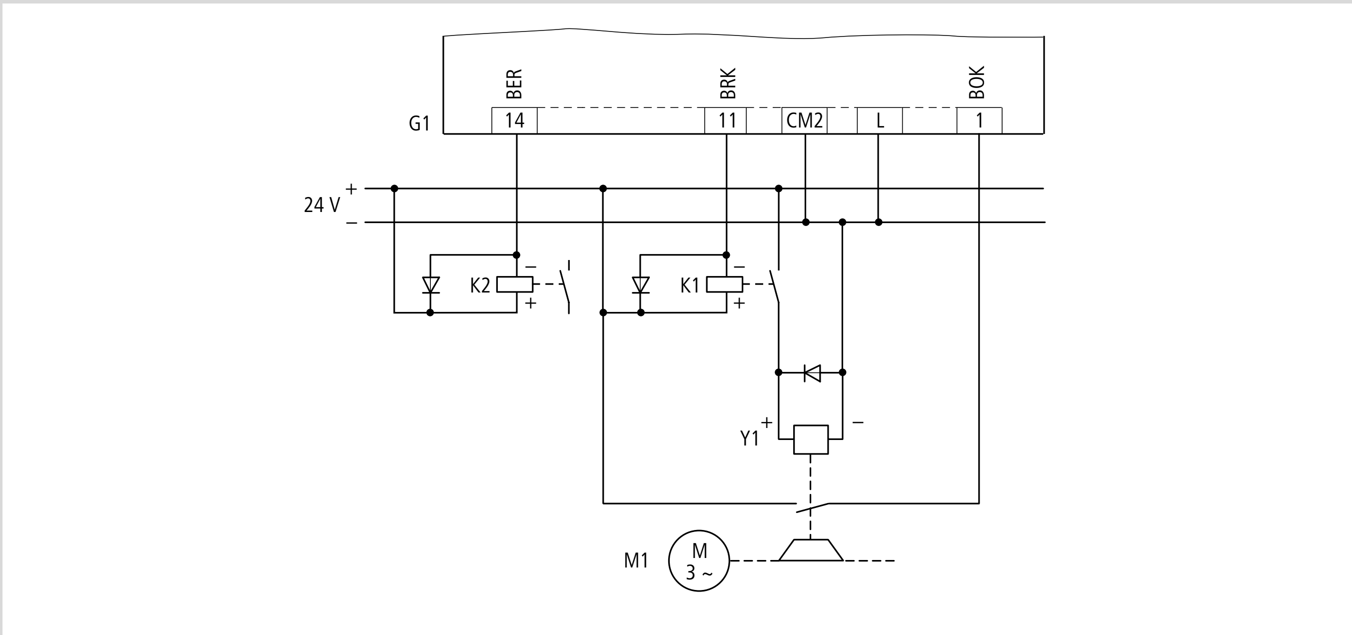


Figure 170: Brake control

G1: Frequency inverter
K1: Brake ON
K2: Emergency brake or alarm system
Y1: Brake

▶ To control an external brake, enter 01 in PNU b120 (brake control active).

The brake control on startup consists of the following steps (→ Fig. 171). The brake is activated after the frequency inverter applies a frequency to the motor:

- When the frequency inverter receives a start signal, it accelerates the motor at the defined starting ramp to the frequency at which the brake is enabled (PNU b125).
- The Release Brake confirmation waiting time set under PNU b121 begins.
- When the waiting time set under PNU b121 has expired, one of two things happens:
  - The Brake Enable current (PNU b126) was reached: The digital output configured as BRK is activated (release brake).
  - The Brake Enable current (PNU b126) was **not** reached: The digital output configured as BER is activated (brake fault).
- As soon as the BRK signal (release brake) is issued to the external brake, the Braking Confirmation waiting time set under PNU b124 begins. During this time, the frequency inverter waits for confirmation that the brake has been released. The confirmation must activate one of digital inputs 1 to 8 which has been configured as BOK.
- If the BOK input is activated within the Brake Confirmation wait time set under PNU b124, the waiting time for acceleration defined under PNU b122 begins.
- After the waiting time set under PNU b122, the frequency inverter accelerates the motor to the setpoint frequency.

- If, during the Brake Confirmation waiting time in PNU b124, the BOK input is not activated (i.e. the brake has not released), the following happens:
  - The BRK output (release brake) is deactivated.
  - The BER output (brake fault) is activated.
  - The DV6 frequency inverter issues fault message E32.

Warning!
When the frequency inverter issues a fault message, it also switches the output to the motor controller. In this case, the motor is not stopped by the frequency inverter. For applications in which safety is an issue, you must therefore provide an emergency brake.

When a stop signal is issued, the DV6 frequency inverter does the following (→ Fig. 171). The brake is activated before the motor has come to a standstill:

- The DV6 frequency inverter decelerates the motor down to the brake release frequency (PNU b125).
- The BRK output (release brake) is deactivated, i.e. the brake should engage.
- The waiting time set under PNU b124 starts and the frequency inverter continues to output the same frequency (PNU b125).
- Within this time, the external brake must deactivate the BOK input.
  If the BOK input is not deactivated, the frequency inverter activates the BER output and issues fault message E36.
- As soon as the BOK input is deactivated, the waiting time before Stop set under PNU b123 begins.
- When the waiting time in PNU b123 has expired, the frequency inverter decelerates the motor to 0 Hz.

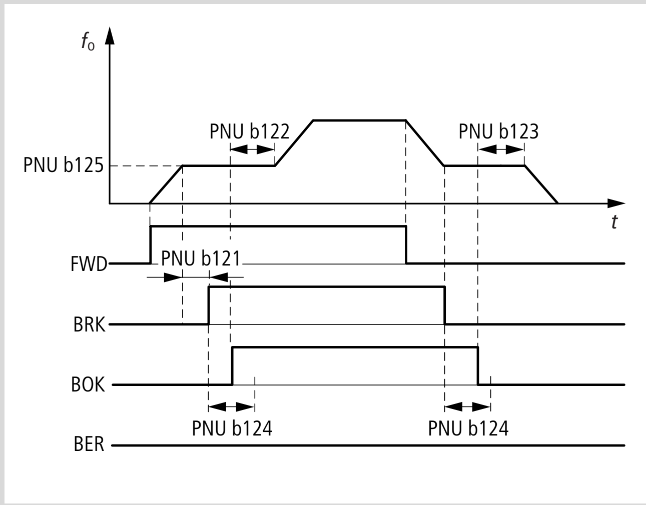


Figure 171: Brake control function chart

▶ Program one of the digital inputs 1 to 8 as BOK by setting the corresponding PNU (C001 to C008) to 44.
▶ Program one of the digital outputs 11 to 15 as BRK by setting the corresponding PNU (C021 to C025) to 19.
▶ Program one of the digital outputs 11 to 15 as BER by setting the corresponding PNU (C021 to C025) to 20.
▶ Program PNU b121 to b126 according to your application.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
b120	Brake control	–	✓	00	Inactive	00
				01	Active	
b121	Brake released confirmation waiting time			0 to 5 s	This is the time which the DV6 waits after the Enable frequency (PNU b125) is reached before activating the output configured as BRK (release brake).	0.00
b122	Waiting time before acceleration			0 to 5 s	This is the time which the DV6 waits after activating the input configured as BOK before accelerating the motor to the setpoint frequency.	0.00
b123	Waiting time before stop			0 to 5 s	This is the time which the DV6 waits after deactivating the input configured as BOK before decelerating the motor to 0 Hz.	
b124	Confirm Braking wait time			0 to 5 s	During this time, the confirmation that the brake has been applied must reach the BOK input. Otherwise, the DV6 deactivates the BRK output, activates the BER output (brake fault) and issues fault message E36.	
b125	Brake enable frequency			0 to 400 Hz	At this frequency, the DV6 activates the digital output configured as BRK after the waiting time set under PNU b121.	
b126	Brake enable current			0 to $2 \times I_e$	Minimum current required to activate the output configured as BRK.	I_e

SLV and autotuning

This section describes the function of the SLV (sensorless vector) control and how to automatically determine motor data with the autotuning function.

SLV (sensorless vector control)

SLV control can be used instead of the *U*/*f* characteristic to obtain even higher torques at lower speeds and to achieve an even greater speed stability, and therefore even steadier motor operation.

To achieve this, the present motor current and motor voltage are used to calculate the magnetization current (machine flux-generating component) and the resistive current (torque-generating component). In combination with the motor constants defined by the motor type (which you can either configure manually or determine automatically with autotuning), these two current components are sufficient for an optimal motor control.

The actual control is implemented with a powerful microprocessor built into the frequency inverter. Even though SLV control does not require actual motor speed feedback, (hence the term "sensorless"), it is nearly as powerful as vector control with motor speed feedback.

You can choose between two versions of SLV control:

- Standard SLV control
- 0 Hz range SLV control

Standard SLV control

Before you can use standard SLV control, you need to make the following settings:

▶ Under PNU A044 (or PNU A244 for the second parameter set), enter the value 03 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
▶ Under PNU H002 (or PNU H202), specify whether the standard motor data (value 00), the standard autotuning data (value 01) or the adaptive autotuning data (value 03) will be used.

To use the standard autotuning data in the second parameter set, enter the value 01 under PNU H202.

The adaptive autotuning data is only available for the first parameter set.

Motor data	Parameter set		
	1	2	3
Standard motor data	✓	✓	✓
Autotuning motor data	✓	✓	–
Adaptive autotuning data	✓	–	–

▶ Under PNU H003 (or PNU H203), enter the motor rating, and under PNU H004 (or PNU H204), the number of motor poles.
▶ If necessary, change the controller's response speed with PNU H005 and (if motor resonance arises) the motor stabilization constant with PNU H006.

0 Hz range SLV control

This function improves the torque characteristics in the range 0 to 2.5 Hz.

▶ Under PNU A044 (or PNU A244 for the second parameter set), enter the value 04 (→ Section "Voltage/frequency characteristic and voltage boost", Page 126).
▶ Then, continue as described in Section "Standard SLV control".

Autotuning

With the autotuning function, the motor constants of the connected motors can be automatically determined and written to the memory locations of PNU H030 to H034 (standard parameter set) or PNU H230 to H234 (second parameter set). You do not have to enter the constants manually in this case.

Before you carry out an autotuning, do the following:

▶ Under PNU F002 and F003, enter the first acceleration and deceleration time.

To allow autotuning to correctly determine the motor's moment of inertia, the same value must be entered in both parameters. The smaller the entered acceleration and deceleration time, the faster can autotuning be carried out. Make sure that no fault messages occur and that the first parameter set is selected.

The Autotuning function can not be used in conjunction with PID control and the frequency inverter must not be in RUN mode.

Make sure, that the motor rating is no more than one stage below the frequency inverter rating, as the autotuning function could not otherwise obtain correct data.

- ▶ Then, under PNU H003, enter the motor rating and under PNU H004 the number of motor poles.
- ▶ Under PNU A001, enter the value 02, so that the setpoint frequency can be set using PNU A020.
- ▶ Under PNU A003, enter the base frequency (default: 50 Hz) and then, under PNU A020, the setpoint frequency. If this parameter is set to 0 Hz, autotuning can not be carried out.
- ▶ Under PNU A082, enter the motor voltage for the AVR function.
- ▶ Because DC braking must not be used, enter the value 00 under PNU A051.
- ▶ Under PNU H001, select the autotuning mode: If the motor can be run to determine the autotuning data, enter 01 here (during autotuning, the motor is accelerated up to 80 % of its base frequency); if autotuning is to be carried out without running the motor, enter 02.

> ⚠ **Warning!**
> Make sure that it is admissible to run the motor. The frequency inverter runs the motor for a few seconds in both directions without torque limitation.

To start autotuning, issue the start signal (for example with the ON key). To determine the motor data, autotuning first applies AC and DC voltage to the stationary motor.

If you have entered 02 under PNU H001, two further autotuning runs with motor operation are carried out: First, the motor is accelerated to 80 % of the base frequency specified under PNU A003 and decelerated again to standstill; then, the motor is accelerated again, but this time to the setpoint frequency entered under PNU A020.

If autotuning is interrupted during data acquisition because of

- power failure,
- operation of the Off key, or
- interruption of the On signal,

the frequency inverter has to be reset to its default settings (→ Section "Initialization", Page 165).

Under PNU H002, specify whether you want to use the standard motor data, the standard autotuning data or the adaptive autotuning data.

Standard autotuning

Autotuning is carried out once after the start signal is issued and the corresponding values are written to PNU H030 to H034 (or PNU H230 to H234 if PNU H002 is set to 01).

Adaptive autotuning

Due to the heat generated by the motor during operation, the motor constants R_1 may change. With this function, these constants can be re-read when the motor is at standstill. This is achieved by applying a DC voltage to two motor windings for up to five seconds. If a start signal is received during that time, this has priority over the adaptive autotuning procedure.

- ▶ Carry out standard autotuning once.
- ▶ Activate adaptive autotuning by entering 02 Under PNU H002.
- ▶ Deactivate standard autotuning by entering 00 under PNU H001.
- ▶ Issue a start signal (for example with the ON key).

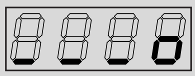
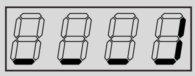
Let the motor run until it has reached its operating temperature.

- ▶ Issue a stop signal (for example with the OFF key) and wait five seconds before issuing another command.

If you are actuating an external brake, adaptive autotuning is carried out only after actuation of the brake.

> → You should activate adaptive autotuning only after you have carried out standard autotuning.

> → If a new start signal is issued after the five seconds, adaptive autotuning is terminated. No new message appears on the display and the data for the last acquisition remains saved.

Once autotuning is completed successfully, the following message appears on the LED display:	
If an error has occurred during autotuning, the following is displayed:	

The running characteristics of unstable motors can be improved with PNU H006. If the motor is running unstably, check first whether the set motor rating (PNU H003) and the set number of poles (PNU H004) corresponds with the connected motor. If the rating of the connected motor exceeds the output power of the frequency inverter, reduce the stability constant. If the motor is running poorly, you can also reduce the pulse frequency (PNU b083) or change the output voltage (PNU A045).

The table below lists the parameters of the autotuning function. Parameters which are only defined automatically are marked "(autotuning)" in the Name column.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
H001	Autotuning mode	–	–	00	Autotuning not active	00
				01	Carry out autotuning (only at motor standstill)	
				02	Carry out autotuning with motor operation	
H002 H202	Motor data to be used	–	–	00	Use default motor data	00
				01	Use autotuning data (single autotuning procedure)	
				02	Use autotuning data (multiple autotuning procedures)	
H003 H203	Motor rating	–	–	0.2 to 160 kW	Enter the motor rating. • 0.2 to 75 kW: DV6-340-075 to DV6-340-55K • 0.2 to 160 kW: From DV6-340-75K	Depending on DV6
H004 H204	Number of motor poles	–	–	2/4/6/8	Enter the number of motor poles	4
H005 H205	Motor constant K_p	✓	✓	0.01 to 99	Motor gain factor	1.59
H006 H206 H306	Motor stabilization constant	✓	✓	0 to 255	0 function is not active	100
H020 H220	Motor constant R_1	–	–	0 to 65.53 Ω	Stator impedance	Depending on DV6
H021 H221	Motor constant R_2 1)	–	–	0 to 65.53 Ω	Rotor resistance	
H022 H222	Motor constant L	–	–	0 to 655.3 mH	Motor inductivity	
H023 H223	Motor constant I_o	–	–	0 to 655.3 $A_{r.m.s.}$	Motor current	
H024 H224	Motor constant J 2)	–	–	1 to 1000	Moment of inertia of the motor relative to the load	
H030 H230	Motor constant R_1 (autotuning)	–	–	–	Here, the parameters determined with autotuning are saved. They cannot be set manually. The manually adjustable motor constants can be configured with PNU H20 to H24 or H220 to H224.	Depending on DV6
H031 H231	Motor constant R_2 (autotuning)	–	–			
H032 H232	Motor constant L (autotuning)	–	–			
H033 H233	Motor constant I_o (autotuning)	–	–			
H034 H234	Motor constant J (autotuning)	–	–			

1) In case of an over-compensation, reduce R_2

2) The greater J, the slower the motor responds; the smaller J, the faster it responds (J = moment of inertia of the motor relative to the load)

If SLV control is active, set the pulse frequency in PNU b083 to at least 2.1 kHz (→ Section "Pulse frequency", Page 164). If the motor drives a very small load, (i.e. has a low moment of inertia), it may whip or jolt. If this is the case, do the following:

- ▶ Set the motor stabilization constant (PNU H006) accordingly and reduce the pulse frequency (PNU b083).
- ▶ Deactivate the AVR function by entering 01 in PNU A081.

PI controller

The PI controller regulates the motor speed in vector control mode. This function is available only in vector mode (→ Section "Voltage/frequency characteristic and voltage boost", Page 126):

- SLV (sensorless vector) control
- 0 Hz SLV control
- Vector control with optional DE6-IOM-ENC module.

With a digital input configured as PPI, you can change over from PI to P control (→ Section "Changeover from PI to P control (PPI)", Page 98).

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
H050 H250	P component of the PI control	✓	✓	0 to 1000 %	Proportional component of the PI control, **without** a digital input configured as PPI	100.0
H051 H251	I component of the PI control	✓	✓	0 to 1000 %	Integral component of the PI control, **without** a digital input configured as PPI	100.0
H052 H252	P component of the P control	✓	✓	0.00 to 10.00	Proportional component of the P control, **without** a digital input configured as PPI	1.00
H060 H260	0 Hz SLV magnetization current limitation	✓	✓	0 to 100 %	Maximum value for the magnetization current at 0 Hz SLV	100
H070	P component of the PI control with changeover	✓	✓	0 to 1000 %	Proportional component of the PI control, **with** a digital input configured as PPI	100.0
H071	I component of the PI control with change-over	✓	✓	0 to 1000 %	Integral component of the PI control, **with** a digital input configured as PPI	100.0
H072	P component of the P control with change-over	✓	✓	0.00 to 10.00	Proportional component of the P control, **with** a digital input configured as PPI and with active input	1.0

User-defined parameters – parameter group U

With parameter group U (user), you can group any parameters for quick access. You can save up to twelve editable and display parameters in this group, to give you quick access to your most frequently used parameters. The default value of the U parameters is "no" (no function). You do not have to confirm your selection with the ENTER key. The most recently selected parameter is saved automatically.

Example: Saving acceleration time 1 (PNU F002) in PNU U001:

The DV6 is in the display mode and the RUN lamp is lit.

▶ Press the PRG key.

The DV6 changes to programming mode, the PRG lamp lights up and d001 or the most recently modified parameter appears on the display.

▶ Press the DOWN key until U--- appears on the display.
▶ Press the PRG key. U001 appears on the display.
▶ Press the PRG key. no appears on the display.
▶ Press the UP or DOWN key until F002 appears on the display.
▶ Press the PRG key.

The set acceleration time 1 in seconds appears on the display (default value: 30).

▶ You can change the set value with the UP and DOWN arrow keys.

There are now two possibilities:

▶ Accept the set value by pressing the ENTER key.
▶ To reject the set value, press the PRG key.

F002 appears on the display. PNU F002 is now saved under PNU U001.

▶ Press the PRG key. U001 appears on the display.
▶ Press the PRG key. U--- appears on the display.
▶ Press the UP or DOWN key until d001 appears on the display.
▶ Press the PRG key. The DV6 changes to display mode and displays the set frequency.

You can now change PNU F002 by calling up PNU U001:

▶ Go to parameter group U. The display shows U---.
▶ Press the PRG key. U001 appears on the display.
▶ and press the PRG key again. F002 appears on the display.

You can now change the value of PNU F002.

PNU	Name	Adjustable in RUN mode		Value	Function	WE
		Normal	Extended			
U001	User-defined parameters	–	✓	PNU A001 to P032	Under PNU U001 to U012, you can save frequently used parameters.	no
U002						
U003						
U004						
U005						
U006						
U007						
U008						
U009						
U010						
U011						
U012						

7 Messages

This section lists the messages the DV6 frequency inverter issues and explains their meaning.

Fault messages

When an overcurrent, overvoltage or undervoltage occurs, the output of the DV6 frequency inverter is disabled to protect the DV6 from damage. The connected motor then coasts to a stop. The inverter remains in this condition until the fault message is acknowledged with the OFF key or the RST input.

State of frequency inverter on fault message

The frequency inverter's state when a fault occurs provides additional information to help rectify the fault. Some fault messages indicate the status of the DV6 frequency inverter with a number after the point. E07.2, for example, means that fault 7 has occurred while the frequency inverter was in status 2.

The individual states are described in the table below

Status code	DV6 status
---.0	Reset
---.1	Stop
---.2	Deceleration
---.3	Static operation
---.4	Acceleration
---.5	f_0 stop
---.6	Start
---.7	DC braking
---.8	Current limit
---.9	Autotuning

Fault message display

Display	Cause	Description
E01	Overcurrent in the output stage in static operation	If the output current reaches an excessive level, the output voltage is switched off. This happens when • the frequency inverter's output is short-circuited, • the motor is blocked, • an excessive load is suddenly applied to the output.
E02	Overcurrent in the output stage during deceleration	
E03	Overcurrent in the output stage during acceleration	
E04	Overcurrent in the output stage in standstill	
E05	Overload	The internal electronic motor protection has switched off the output voltage because the motor was overloaded.
E06	Overload	If the duty factor of the built-in braking transistor of the DV6 is too great, the braking transistor is switched off (the generated overvoltage disconnects the output voltage).
E07	Overvoltage	The output voltage has been switched off because the motor was operating regeneratively.
E08	EEPROM fault	If the program memory does not operate reliably due to radio frequency interference or excessive temperature, the output voltage is switched off. If the supply voltage is switched off while the RST input is active, an EEPROM fault occurs when the supply voltage is reapplied.
E09	Undervoltage	If the DC voltage is too low, the output voltage is switched off (correct function of the electronics is no longer possible; problems such as overheating of the motor and insufficient torque may arise).
E10	Fault in current transformer	The output voltage is disconnected when a fault occurs in the built-in current transformer of the DV6.
E11	Processor malfunction	The processor does not operate correctly. The output voltage is switched off.
E12	External fault message	The output voltage is switched off due to an external fault message which is present on a digital input configured as an EXT input.

Display	Cause	Description
E13	Restart inhibit activated	The mains voltage was switched on or an intermittent interruption in the supply voltage has occurred while unattended start protection (input USP) was active.
E14	Ground fault	Earth faults between the U, V or W terminals and earth are being reliably detected. A protective circuit prevents destruction of the frequency inverter, but does not protect the operating personnel.
E15	Mains overvoltage	If the supply voltage is higher than permitted, the output voltage is switched off 100 s after the voltage supply has been switched on.
E16	Intermittent mains failure	An intermittent mains failure of at least 15 ms has occurred. This message appears when the duration of the mains failure is longer than the time entered under PNU b002 (→ Section "Automatic restart after a fault", Page 151).
E21	Overtemperature	If the temperature sensor installed in the power section records an operating temperature above the permissible limit value, the output voltage is switched off.
E23	Gate array fault	Internal communication error between CPU and gate array
E24	Mains phase failure	One of the three mains phases has failed.
E30	IGBT fault	If an excessive current is applied at an IGBT (transistor in the power end stage), the output voltage is switched off to protect the transistor.
E35	PTC fault message	If the resistance of the external PTC thermistor connected to the PTC input (terminals TH and CM1) is too high, the output voltage is switched off.
E36	External brake fault	If the frequency inverter activates the external brake and does not receive a status signal from the brake within the time entered under PNU b024 (→ Section "Controlling an external brake", Page 169), the output voltage is switched off.
----	Undervoltage	The frequency inverter attempts a restart because the input voltage is too low. If the restart fails, this fault message is issued to save the undervoltage fault and the frequency inverter is switched off.
E60 to E69	Fault, expansion module 1	A fault has occurred in expansion modules 1 or 2 or their connections. For further information, refer to the manuals for the affected expansion module.
E70 to E79	Fault, expansion module 2	

Fault history register

The DV6 frequency inverter has a fault history register. The frequency inverter saves the six most recent fault messages, which you can retrieve under PNU d081 to d086. PNU d081 shows the most recent fault message, PNU d082 last but one, etc. When a new fault occurs, it is saved to PNU d081 and all older faults are moved on by one PNU (PNU d081 → d082, PNU d082 → d083, etc.) In addition to fault messages E01 to E079, the frequency inverter saves the following information:

- Output frequency
- Motor current
- Internal DC link voltage
- Running time (total time for which the inverter is in RUN mode),
- Mains On time (total time)

▶ Go to one of the display parameters, PNU d081 to d086.
▶ Press the PRG key.

If a fault message has been saved, it appears on the display, for example E07.2. To view further information about the fault, use the UP and DOWN arrow keys (→ Fig. 172). To return to the display mode, press the PRG key.

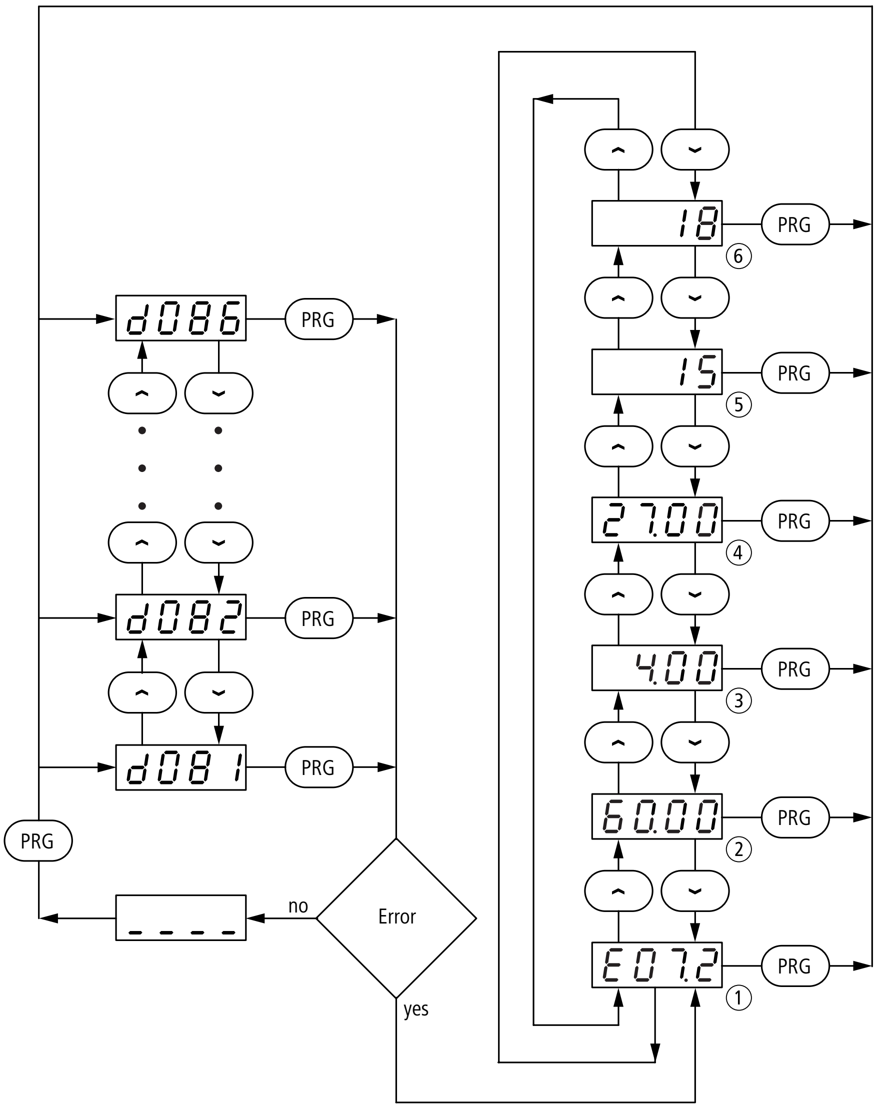
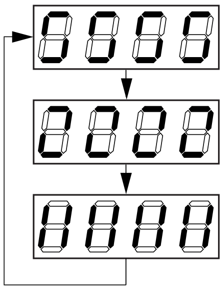
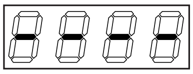
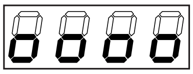
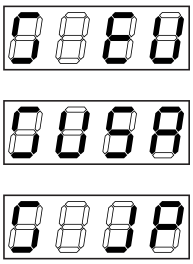
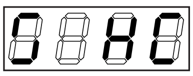
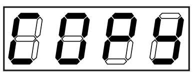
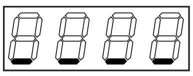


Figure 172: Information in the fault history register

① Fault message number
② Output frequency
③ Motor current
④ Internal DC link voltage
⑤ Running time (total time for which the inverter is in RUN mode)
⑥ Mains On time (total time)

Other messages

This section describes the messages issued by the DV6 frequency inverter, for example in standby mode when mains power is switched off.

Display	Cause
	The frequency inverter is in standby mode or a reset signal is active.
	The mains voltage has been switched off.
	The waiting time before automatic restart is counting down (PNU b001 and b003, → Section "Automatischer Wiederanlauf nach Störung", Page 153).
	The default settings have been selected and the frequency inverter is in the initialization phase (PNU b084 and b085, → Section "Initialisieren", Page 167). The values for the European market (EU) are being initialized. For non-European models, versions for North America (USA) and Japan (JP) are available.
	Initialization of the fault history register
	Copy station – copying in progress.
	No data available, e.g. display under PNU d081 and d086, when the fault history register is empty the display under PNU d004, when PID control is not active.

Warnings

Conflicting parameter inputs (for example minimum operating frequency PNU A062 > end frequency PNU A004). In addition, the PRG LED flashes until the parameters are corrected.

The following warnings may be issued:

Display	Function		
H001 H201	Maximum operating frequency, PNU A061 (A261)	>	End frequency, PNU A004 (A204, A304)
H002 H202	Minimum operating frequency, PNU A062 (A262)	>	
H004 H204 H304	Nominal motor frequency, PNU A003 (A203, A303)	>	
H005 H205 H305	Setpoint frequency, PNU F001 or PNU A020 (A220, A320)	>	
H006 H206 H306	Fixed frequencies 1 to 15, PNU A021 to A035	>	
H012 H212	Minimum operating frequency, PNU A062 (A262)	>	Maximum operating frequency, PNU A061 (A261)
H015 H215	Setpoint frequency, PNU F001 or PNU A020 (A220, A320)	>	
H016 H216	Fixed frequencies 1 to 15, PNU A021 to A035	>	
H021 H221	Maximum operating frequency, PNU A061 (A261)	<	Minimum operating frequency, PNU A062 (A262)
H025 H225	Setpoint frequency, PNU F001, PNU A020 (A220, A320)	<	
H031 H231	Maximum operating frequency, PNU A061 (A261)	<	Increased starting frequency, PNU b082
H032 H232	Minimum operating frequency, PNU A062 (A262)	<	
H035 H235 H335	Setpoint frequency, PNU F001 or PNU A020 (A220, A320)	<	
H036	Fixed frequencies 1 to 15, PNU A021 to A035	<	
H037	Jogging frequency, PNU A038	<	
H085 H285 H385	Setpoint frequency, PNU F001 or PNU A020 (A220, A320)	=	Frequency jump 1 to 3 ± jump width, PNU A063 to A068[1)]
H086	Fixed frequencies 1 to 15, PNU A021 to A035	=	

Display	Function		
H091 H291	Maximum operating frequency, PNU A061 (A261)	>	User-configurable *ΔU/f* characteristic, frequency 7, PNU b112
H092 H292	Minimum operating frequency, PNU A062 (A262)	>	
H095 H295	Setpoint frequency, PNU F001 or PNU A020 (A220, A320)	>	
H096	Fixed frequencies 1 to 15, PNU A021 to A035	>	
H110	User-configurable *ΔU/f* characteristic, frequency 1 to 6, PNU b100, b102, b104, b106, b108 and b110	>	
	User-configurable *ΔU/f* characteristic, frequency 2 to 6, PNU b100, b102, b104, b106, b108 and b110	<	User-configurable *ΔU/f* characteristic, frequency 1, PNU b100
	User-configurable *ΔU/f* characteristic, frequency 1, PNU b100	>	User-configurable *ΔU/f* characteristic, frequency 2, PNU b102
	User-configurable *ΔU/f* characteristic, frequency 3 to 6, PNU b104, b106, b108 and b110	<	
	User-configurable *ΔU/f* characteristic, frequency 1 and 2, PNU b100 and b102	>	User-configurable *ΔU/f* characteristic, frequency 3, PNU b104
	User-configurable *ΔU/f* characteristic, frequency 4 to 6, PNU b106, b108 and b110	<	
	User-configurable *ΔU/f* characteristic, frequency 1 to 3, PNU b100, b102 and b104	>	User-configurable *ΔU/f* characteristic, frequency 4, PNU b106
	User-configurable *ΔU/f* characteristic, frequency 5 and 6, PNU b108 and b110	<	
	User-configurable *ΔU/f* characteristic, frequency 1 to 4, PNU b100, b102, b104 and b106	>	User-configurable *ΔU/f* characteristic, frequency 5, PNU b108
	User-configurable *ΔU/f* characteristic, frequency 6, PNU b110	<	
	User-configurable *ΔU/f* characteristic, frequency 1 to 5, PNU b100, b102, b104, b106 and b108	>	User-configurable *ΔU/f* characteristic, frequency 6, PNU b110
H120	Electronic motor protection, frequency 2 and 3, PNU b017 and b019	<	Electronic motor protection, frequency 1, PNU b015
	Electronic motor protection, frequency 1, PNU b015	>	Electronic motor protection, frequency 2, PNU b017
	Electronic motor protection, frequency 3, PNU b019	<	
	Electronic motor protection, frequency 1 and 2, PNU b015 and b017	>	Electronic motor protection, frequency 3, PNU b019

1) The frequency jump is automatically set to the lowest frequency jump (frequency jump – jump width).

The warning is no longer displayed when the above conditions no longer apply. The input settings are reset to their default values (initialization).

8 Troubleshooting

Fault	Condition	Possible cause	Remedy
The motor will not start.	There is no voltage present at outputs U, V and W.	Is voltage applied to terminals L1, L2 and L3? If yes, is the ON lamp lit?	Check terminals L1, L2, L3 and U, V, W. Switch on the supply voltage.
		Does the LED display on the keypad indicate a fault (E… … …)?	Analyze the cause of the fault signal (→ Section "Messages", Page 177). Acknowledge the fault message with the reset command (e.g. by pressing the OFF key).
		Has a start signal been issued?	Issue the start signal with the ON key or through the FWD/REV input.
		Has a setpoint frequency been entered under PNU F001 (only for control using operator panel)?	Under PNU F001, enter a setpoint frequency.
		Are the setpoint definitions through the potentiometer correctly wired to terminals H, O and L?	Check that the potentiometer is connected correctly.
		Are inputs O, O2 or OI correctly connected for external setpoint definition?	Check that the setpoint signal is correctly connected.
		Are the digital inputs configured as RST or FRS still active?	Deactivate RST and/or FRS. Check the signal on digital input 1 (default setting: RST).
		Has the correct source for the frequency setpoint (PNU A001) been set? Has the correct source for the start signal (PNU A002) been set?	Correct PNU A001 as appropriate. Correct PNU A002 as appropriate. (→ Section "Setting the frequency and start signal parameters", Page 123)
	There is voltage present at outputs U, V and W.	Is the motor blocked or is the motor load too high?	Reduce the load acting on the motor. Test the motor without load.
The motor turns in the wrong direction.	–	Are output terminals U, V and W correctly connected? Does the connection of terminals U, V and W correspond with the direction of rotation of the motor?	Connect output terminals U, V and W correctly to the motor according to the required direction of motor rotation (generally the sequence U, V, W causes clockwise operation).
		Are the control signal terminals correctly wired?	Use control signal terminal FW(D) for clockwise operation and REV for anticlockwise operation.
		Has PNU F004 been configured correctly?	Under PNU F004, set the required direction of rotation.
The motor will not start.	–	A setpoint value is not present on terminal O, O2 or OI.	Check the potentiometer or the external setpoint generator and replace if necessary.
		Is a fixed frequency accessed?	Observe the sequence of priority: the fixed frequencies always have priority over the inputs O, O2 or OI.
		Is the motor load too high?	Reduce the motor load as the overload limit will prevent the motor reaching its normal speed if there is an overload.

Fault	Condition	Possible cause	Remedy
The motor does not operate smoothly.	–	Are the load changes on the motor too high?	Select a frequency inverter and motor with a higher performance. Reduce the level of load changes.
		Do resonant frequencies occur on the motor?	Mask these frequencies with the frequency jumps (PNU A063 to A068, → Section "Operating frequency range", Page 132) or change the pulse frequency (PNU b083, → Section "Pulse frequency", Page 164).
The drive speed does not correspond with the frequency	–	Is the maximum frequency set correctly?	Check the set frequency range or the set voltage/frequency characteristic.
		Are the rated speed of the motor and the gearbox reduction ratio correctly selected?	Check the rated motor speed or the gearbox reduction ratio.
The saved parameters do not correspond to the entered values.	Entered values have not been saved.	The supply voltage was switched off before the entered values were saved by pressing the ENTER key.	Reenter the affected parameters and save the input again.
		After the supply voltage was switched off, the entered and saved values are transferred into the internal EEPROM. The supply voltage should remain off for at least six seconds.	Enter the data again and switch off the supply voltage for at least six seconds.
	The values of the copy unit were not accepted by the frequency inverter.	After copying the parameters of the external keypad DEX-KEY-10 into the frequency inverter, the supply voltage was left on for less than six seconds.	Copy the data again and leave the supply voltage on for at least six seconds after completion.
It is not possible to make any inputs.	The motor cannot be started or stopped or setpoint values cannot be set.	Are PNU A001 and A002 configured correctly?	Check the settings under PNU A001 and A002 (→ Section "Setting the frequency and start signal parameters", Page 123).
	No parameters can be set or changed.	Has the software parameter protection been activated?	Deactivate the parameter protection with PNU b031 (→ Section "Parameter protection", Page 159), so that all parameters can be changed again.
		Has the hardware parameter protection been activated?	Deactivate the digital input configured as SFT (→ Section "Software protection (SFT)", Page 83).
The electronic motor protection activates (fault message: E 05).		Is the manual voltage boost set too high? Were the correct settings made for the electronic motor protection?	Check the boost setting and the electronic motor protection setting. (→ Section "Voltage/frequency characteristic and voltage boost", Page 126)

To be observed when saving changed parameters:

After saving changed parameters with the ENTER key, no inputs can be made using the keypad of the frequency inverter for at least six seconds. If, however, a key is pressed before this time elapses, or if the reset command is issued or the frequency inverter is switched off, the data may not be correctly saved.

Appendix

Technical Data

DV6-340-...	075	1K5	2K2	4K0	5K5	7K5	11K	15K	18K5
Protection class according to EN 60529	IP20								
Overvoltage category	III								
Maximum permissible effective motor power in kW; data for four pole three-phase current asynchronous motors	0.75	1.5	2.2	4.0	5.5	7.5	11.0	15.0	18.5
Maximum permissible apparent motor power in kVA at 400 V	1.7	2.6	3.6	5.9	8.3	11.0	15.9	22.1	26.3
Maximum permissible apparent motor power in kVA at 480 V	2.0	3.1	4.4	7.1	9.9	13.3	19.1	26.6	31.5
Primary side: Number of phases	Three-phase								
Primary side: Rated voltage	342 V ~ – 0 % to 528 V ~ + 0 %, 47 to 63 Hz								
Secondary side: Rated voltage	Three-phase 380 to 480 V ~ Corresponding to the primary side rated voltage If the primary voltage drops, the secondary voltage also drops.								
Primary side: Rated current in A	2.8	4.2	5.8	9.5	13.0	18.0	25.0	35.0	42.0
Secondary side: Rated current in A	2.5	3.8	5.3	8.6	12.0	16.0	23.0	32.0	38.0
Secondary side: Frequency range	0.1 to 400 Hz With motors which are operated at rated frequencies above 50/60 Hz, the maximum possible motor speed should be observed.								
Frequency error limits (at 25 °C ±10 °C)	• Digital setpoint value: ±0.01 % of the maximum frequency • Analog setpoint value: ±0.2 % of the maximum frequency								
Frequency resolution	• Digital setpoint value: 0.1 Hz • Analog setpoint value: Maximum frequency/1000								
Voltage/frequency characteristic	• Constant torque • Reduced torque • Increased (SLV-controlled) torque • Vector-controlled torque (only with optional DE6-IOM-ENC module) • User-programmable $\Delta U/f$ characteristic								
Permissible overcurrent	150 % for 60 s, 200 % for 0.5 s (once every ten minutes)								
Acceleration/deceleration time	0.01 to 3600 s with linear and nonlinear characteristic (applies also for second and third acceleration/deceleration time)								
Torque during start	• 200 % at 0.5 Hz with SLV control • 150 % in the range 0 to 2.5 Hz with 0 Hz range SLV control and motor one rating class smaller than DV6 • 100 % with vector control								
Braking torque									
With feedback to the capacitors: reduced braking torque at frequencies exceeding 50 Hz.	Approx. 50 %		Approx. 20 %				Approx. 10 %		
With external braking resistor	200 %			140 %	100%		70 %	–	
With external braking unit	–							40 to 200 %	
With DC injection braking	Braking occurs at frequencies below the minimum frequency (minimum frequency, braking time and braking torque are user-definable)								

DV6-340-...		075	1K5	2K2	4K0	5K5	7K5	11K	15K	18K5
Inputs										
Frequency setting	Keypad	Setting through keys or potentiometer								
	External signals	• 0 to 10 V ⎓, input impedance 10 kΩ; • –10 V to +10 V ⎓, input impedance 10 kΩ; • 4 to 20 mA, load impedance 250 Ω • Potentiometer ≧ 1 kΩ, recommended 4.7 kΩ								
Clockwise/anticlockwise operation (start/stop)	Keypad	ON key (for Start) and OFF key (for Stop); default setting = clockwise operation								
	External signals	• Digital input FW for clockwise operation (FWD) • Digital input programmable as REV for anticlockwise operation								
Digital control inputs programmable as		• REV: Start/stop anticlockwise operation • FF1 to FF4: Fixed frequency selection • JOG: Jog mode • DB: DC braking active • SET: Second parameter set active • 2CH: Second time ramp • FRS: Free run stop • EXT: External fault message • USP: Unattended start protection • CS: Heavy mains starting • SFT: Software protection • AT: Use setpoint value 4 to 20 mA • SET3: Third parameter set active • RST: Reset • STA: Pulse start (3-wire) • STP: Pulse stop (3-wire) • F/R: Direction (3-wire) • PID: PID control active • PIDC: Reset integral component of PID control • CAS: Tacho-generator with vector control • UP: Remote access, acceleration • DWN: Remote access, deceleration • UDC: Reset frequency with remote control • OPE: Setpoint value through operator panel • SF1 to SF7: Bitwise fixed frequency selection • OLR: Change over current limit • TL: Torque limitation active (only with vector control) • TRQ1: Torque limitation 1 active (clockwise, in drive mode) • TRQ2: Torque limitation 2 active (anticlockwise, regenerative) • PPI: P or PI control (only with vector control) • BOK: Brake enable confirmation • ORT: Direction of rotation (only with optional DE6-IOM-ENC module) • LAC: Ramp function Off • PCLR: Delete positioning deviation (only with optional DE6-IOM-ENC module) • STAT: Setpoint definition through module (only with optional DE6-... module) • NO: No function								

DV6-340-...	075	1K5	2K2	4K0	5K5	7K5	11K	15K	18K5
Outputs									
Digital signalling outputs programmable as	• RUN: Motor operational • FA1/FA2: Frequency reached/exceeded • FA3/FA4/FA5: Frequency reached (1)/frequency exceeded (2)/frequency reached (2) • OD: PID deviation exceeded • OL: Overload • AL: Fault • QTQ: Torque reached/exceeded • IP: Mains failure • UV: Undervoltage • TRQ: Torque limitation • RNT: Running time exceeded • ONT: Mains On time exceeded • THM: Motor thermal overload • BRK: Enable signal for external brake • BER: Brake fault • ZS: Zero speed (only with optional DE6-IOM-ENC module) • DSE: Speed deviation exceeded (only with optional DE6-IOM-ENC module) • POK: Positioning (only with optional DE6-IOM-ENC module) • OL2: Overload alarm 2								
Analog outputs	• Frequency output: $I \leqq 1.2$ mA, pulse-width modulated signal (PWM) • Voltage output: 0 to 10 V ⎓, $I \leqq 2$ mA • Current output: 4 to 20 mA, load impedance 250 Ω The following variables can be output: • Output frequency, PWM • Output current • Torque (only SLV control, vector control and 0 Hz SLV control) • Output frequency, frequency-modulated (terminal FM only) • Output voltage • Power consumption • Thermal load ratio • Ramp frequency								
Signalling relay	Relay contact as a two-way switch; relay energized with a fault								
Further features (excerpt)	• Autotuning • Automatic voltage regulation • Unattended start protection • Variable amplification and output voltage reduction • Frequency jumps • Minimum/maximum frequency limitation • Output frequency display • Fault history register available • Freely selectable pulse frequency: 0.5 to 15 kHz • PID control • Automatic torque boost • On/OFF fan control • Second and third parameter set selectable • Vector control – SLV (sensorless vector) control – 0 Hz SLV control – Vector with feedback (only with optional DE6-IOM-ENC module)								
Safety features	• Overcurrent • Overvoltage • Undervoltage • Overtemperature • Ground fault • Overload • Electronic motor protection • Current transformer fault • Dynamic braking function (regenerative)								

DV6-340-...	075	1K5	2K2	4K0	5K5	7K5	11K	15K	18K5
Ambient conditions									
Ambient temperature	–10 to +50 °C From about +40 to +50 °C, the pulse frequency should be reduced to 2 kHz. The output current should be less than 80 % of the rated current in this case.								
Temperature/humidity during storage	–25 to 70 °C (for short periods only, e.g. during transport) 20 to 90 % relative humidity (non condensing)								
Permissible vibration	Maximum 5.9 m/s^2 (= 0.6 g) at 10 to 55 Hz								
Installation height and location	Maximum 1000 m above sea level in a housing or control panel (IP54 or similar)								
Optional accessories	• Remote operating unit: DEX-KEY-10 • Choke to improve the power factor • DE6-LZ...-V4 RFI filter • Expansion modules – Encoder module: DE6-IOM-ENC – PROFIBUS-DP module: DE6-NET-DP								

DV6-340-...		22K	30K	37K	45K	55K	75K	90K	110K	132K
Protection class according to EN 60529		IP20								
Overvoltage category		III								
Maximum permissible effective motor power in kW, details for four pole three-phase current asynchronous motors		22.0	30.0	37.0	45.0	55.0	75.0	90.0	110	132
Maximum permissible apparent motor power in kVA at	400 V	33.2	40.1	51.9	62.3	76.2	103.2	121.9	150.3	180.1
	480 V	39.9	48.2	62.3	74.8	91.4	123.8	146.3	180.4	216.1
Primary side: Number of phases		Three-phase								
Primary side: Rated voltage		342 V ~ – 0 % to 528 V ~ + 0 %, 47 to 63 Hz								
Secondary side: Rated voltage		Three-phase 380 to 480 V ~ Corresponding to the primary side rated voltage If the primary voltage drops, the secondary voltage also drops.								
Primary side: Rated current in A		53.0	63.0	83.0	99.0	121	164	194	239	286
Secondary side: Rated current in A		48.0	58.0	75.0	90.0	110	149	176	217	260
Secondary side: Frequency range		0.1 to 400 Hz With motors which are operated at rated frequencies above 50/60 Hz, the maximum possible motor speed should be observed.								
Frequency error limits (at 25 °C ±10 °C)		• Digital setpoint value: ±0.01 % of the maximum frequency • Analog setpoint value: ±0.2 % of the maximum frequency								
Frequency resolution		• Digital setpoint value: 0.1 Hz • Analog setpoint value: Maximum frequency/1000								
Voltage/frequency characteristic		• Constant torque • Reduced torque • Increased (SLV-controlled) torque • Vector-controlled torque (only with optional DE6-IOM-ENC module) • User-programmable *ΔU/f* characteristic								
Permissible overcurrent		150 % for 60 s, 200 % for 0.5 s (once every ten minutes)								
Acceleration/deceleration time		0.01 to 3600 s with linear and nonlinear characteristic (applies also for second and third acceleration/deceleration time)								

DV6-340-...		**22K**	**30K**	**37K**	**45K**	**55K**	**75K**	**90K**	**110K**	**132K**
Torque during start		• 200 % at 0.5 Hz with SLV control • 150 % in the range 0 to 2.5 Hz with 0 Hz range SLV control and motor one rating class smaller than DV6 • 100 % with vector control					• 180 % at 0.5 Hz with SLV control • 130 % in the range 0 to 2.5 Hz with 0 Hz range SLV control and motor one rating class smaller than DV6 • 100 % with vector control			
Braking torque										
with feedback in to the capacitors: reduced braking torque at frequencies exceeding 50 Hz.		Approx. 10 %								
with external braking resistor		–								
with external braking unit		35 to 200 %	110 to 170 %	90 to 150 %	70 to 120 %	60 to 100 %	45 to 70 %	40 to 60 %	30 to 50 %	25 to 40 %
with DC injection braking		Braking occurs at frequencies below the minimum frequency (minimum frequency, braking time and braking torque are user-definable)								
Inputs										
Frequency setting	Keypad	Setting through keys or potentiometer								
	External signals	• 0 to 10 V ⎓, input impedance 10 kΩ; • –10 V to +10 V ⎓, input impedance 10 kΩ; • 4 to 20 mA, load impedance 250 Ω • Potentiometer ≧ 1 kΩ, recommended 4.7 kΩ								
Clockwise/anticlock-wise operation (start/stop)	Keypad	ON key (for Start) and OFF key (for Stop); default setting = clockwise operation								
	External signals	• Digital input FW for clockwise operation (FWD) • Digital input programmable as REV for anticlockwise operation								

DV6-340-...	22K	30K	37K	45K	55K	75K	90K	110K	132K
Digital control inputs programmable as	• REV: Start/stop anticlockwise operation • FF1 to FF4: Fixed frequency selection • JOG: Jog mode • DB: DC braking active • SET: Second parameter set active • 2CH: Second time ramp • FRS: Free run stop • EXT: External fault message • USP: Unattended start protection • CS: Heavy mains starting • SFT: Software protection • AT: Use setpoint value 4 to 20 mA • SET3: Third parameter set active • RST: Reset • STA: Pulse start (3-wire) • STP: Pulse stop (3-wire) • F/R: Direction (3-wire) • PID: PID control active • PIDC: Reset integral component of PID control • CAS: Tacho-generator with vector control • UP: Remote access, acceleration • DWN: Remote access, deceleration • UDC: Reset frequency with remote control • OPE: Setpoint value through operator panel • SF1 to SF7: Bitwise fixed frequency selection • OLR: Change over current limit • TL: Torque limitation active (only with vector control) • TRQ1: Torque limitation 1 active (clockwise, in drive mode) • TRQ2: Torque limitation 2 active (anticlockwise, regenerative) • PPI: P- or PI control (only with vector control) • BOK: Brake enable confirmation • ORT: Direction of rotation (only with optional DE6-IOM-ENC module) • LAC: Ramp function Off • PCLR: Delete positioning deviation (only with optional DE6-IOM-ENC module) • STAT: Setpoint definition through module (only with optional DE6-... module) • NO: No function								
Outputs									
Digital signalling outputs programmable as	• RUN: Motor operational • FA1/FA2: Frequency reached/exceeded • FA3/FA4/FA5: Frequency reached (1)/frequency exceeded (2)/frequency reached (2) • OD: PID deviation exceeded • OL: Overload • AL: Fault • QTQ: Torque reached/exceeded • IP: Mains failure • UV: Undervoltage • TRQ: Torque limitation • RNT: Running time exceeded • ONT: Mains On time exceeded • THM: Motor thermal overload • BRK: Enable signal for external brake • BER: Brake fault • ZS: Zero speed (only with optional DE6-IOM-ENC module) • DSE: Speed deviation exceeded (only with optional DE6-IOM-ENC module) • POK: Positioning (only with optional DE6-IOM-ENC module) • OL2: Overload alarm 2								

DV6-340-...	22K	30K	37K	45K	55K	75K	90K	110K	132K
Analog outputs	• Frequency output: $I \leqq$ 1.2 mA, pulse-width modulated signal (PWM) • Voltage output: 0 to 10 V ⎓, $I \leqq$ 2 mA • Current output: 4 to 20 mA, load impedance 250 Ω The following variables can be output: • Output frequency, PWM • Output current • Torque (only SLV control, vector control and 0 Hz SLV control) • Output frequency, frequency-modulated (terminal FM only) • Output voltage • Power consumption • Thermal load ratio • Ramp frequency								
Signalling relay	Relay contact as a two-way switch; relay energized with a fault								
Further features (excerpt)	• Autotuning • Automatic voltage regulation • Unattended start protection • Variable amplification and output voltage reduction • Frequency jumps • Minimum/maximum frequency limitation • Output frequency display • Fault history register available • Freely selectable pulse frequency: 0.5 to 15 kHz • PID control • Automatic torque boost • On/OFF fan control • Second and third parameter set selectable • Vector control – SLV (sensorless vector) control – 0 Hz SLV control – Vector with feedback (only with optional DE6-IOM-ENC module)								
Safety features	• Overcurrent • Overvoltage • Undervoltage • Overtemperature • Ground fault • Overload • Electronic motor protection • Current transformer fault • Dynamic braking function (regenerative)								

DV6-340-...	22K	30K	37K	45K	55K	75K	90K	110K	132K
Ambient conditions									
Ambient temperature	–10 to +50 °C From about +40 to +50 °C, the pulse frequency should be reduced to 2 kHz. The output current should be less than 80 % of the rated current in this case.								
Temperature/humidity during storage	–25 to 70 °C (for short periods only, e.g. during transport) 20 to 90 % relative humidity (non condensing)								
Permissible vibration	Up to 5.9 m/s^2 (= 0.6 g) at 10 to 55 Hz		Up to 2.94 m/s^2 (= 0.3 g) at 10 to 55 Hz						
Installation height and location	Maximum 1000 m above sea level in a housing or control panel (IP54 or similar)								
Optional accessories	• Remote operating unit: DEX-KEY-10 • Choke to improve the power factor • DE6-LZ...-V4 RFI filter • Expansion modules – Encoder module: DE6-IOM-ENC – PROFIBUS-DP module: DE6-NET-DP								

Weights and dimensions

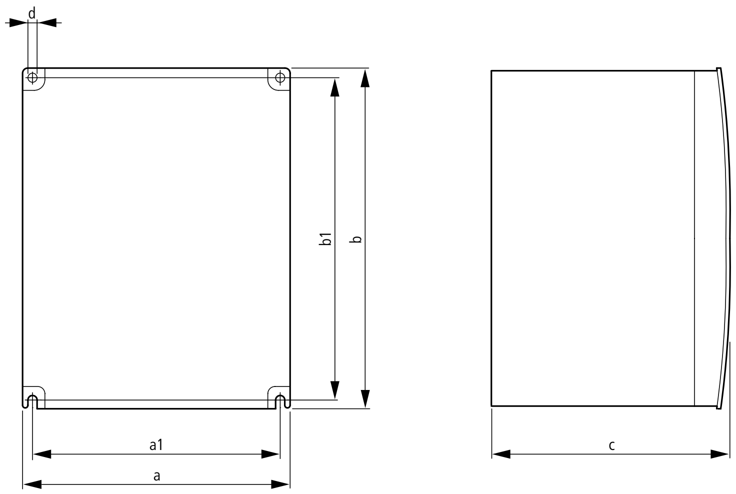


Figure 173: DV6 dimensions

DV6-340-	a	a1	b	b1	c	∅	[kg]
075 1K5 2K2 4K0 5K5	159	130	260.5	241	152	6	3.5
7K5 11K	216	189	266	246	183	7	5.0
15K 18K5 22K	256	229	396	376	212	7	12
30K	310	265	540	510	202	10	20
37K 45K 55K	390	300	550	520	255.2	10	30
75K 90K	390	300	700	670	275.2	12	60
110K 132K	480	380	740	710	293.2	12	80

Cables and fuses

The cross-sections of the cables and line protection fuses used must correspond with local standards. The values are laid out for three-phase, 400 V mains connections.

DV6-340-	VDE	UL1)	Moeller	L1, L2, L3, U, V, W, PE mm²	AWG
075	M6 A	10 A	PKM0-6,3	1.5	20
1K5	M6 A	10 A	PKM0-6,3	2.5	18
2K2	M10 A	10 A	PKM0-10	2.5	16
4K0	M10 A	15 A	PKM0-10	2.5	14
5K5	M16 A	15 A	PKM0-16	2.5	12
7K5	M20 A	20 A	PKM0-20	4	10
11K	M32 A	30 A	PKM0-25	6	8
15K	M40 A	40 A	PKZM4-40	10	6
18K5	M50 A	50 A	PKZM4-50	16	6
22K	M50 A	60 A	PKZM4-58	16	4
30K	M63 A	70 A	PKZM4-63	25	3
37K	M80 A	90 A	NZM7-80N-OBI	35	1
45K	M100 A	125 A	NZM7-100N-OBI	35	1
55K	M125 A	125 A	NZM7-125N-OBI	2 × 35	1/0
75K	M160 A	175 A	NZM7-160N-OBI	2 × 35	2 × 1
90K	M200 A	200 A	NZM7-200N-OBI	2 × 50	2 × 1
110K	M250 A	250 A	NZM7-250N-OBI	2 × 70	2 × 1/0
132K	M315 A	300 A	NZM10-400N/ZM400	2 × 70	2 × 2/0

1) Approved fuses (class J, 600 V) and fuse holders

Use cables with a larger cross-section for supply voltage and motor cables which exceed about 20 m in length.

Control cables should be screened, and have a cross-section of 0.14 to 1.5 mm².

Signalling relay output, cross-section of 0.75 to 1.5 mm². About 5 to 6 mm of the cable ends should be stripped.

Mains contactors

→ The mains contactors listed here assume the network's rated current (I_{LN}) without mains choke or mains filter. Their selection is based on the thermal current (AC-1).

Caution!
Jog mode must not be used through the mains contactor (rest period ≧ 180 s between switching off and on)

DV6-340-	DV6 phase current I_{LN} [A]	Mains contactor Open/enclosed I_{th} AC-1 [A]	Model
075	2.8	20/16	DILEEM
1K5	4.2		
2K2	5.8		
4K0	9.5	20/16	DIL00M
5K5	13		
7K5	18		
11K	25	35/30	DIL0M
15K	35		
18K5	42	55/44	DIL1M
22K	53		
30K	63	90/80	DIL2M
37K	83		
45K	99	100/–	DIL3M80
55K	121	160/–	DIL4M115
75K	164		
90K	194	225/–	DILM185
110K	239	250/–	DILM225
132K	286	300/–	DILM250

Mains choke

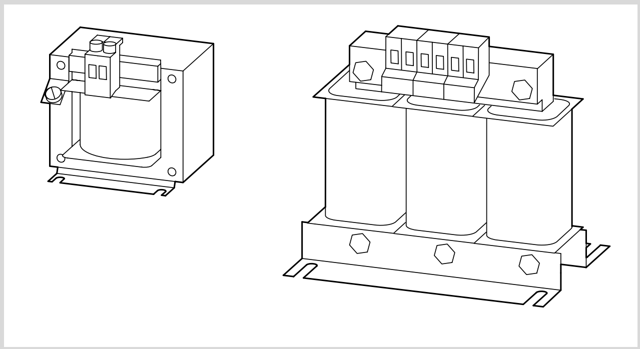


Figure 174: DE4-LN... mains chokes

→ Mains chokes reduce the magnitude of the current harmonics up to about 30 % and increase the lifespan of frequency inverters and upstream-connected switching devices.

→ When the frequency inverter is working at its rated current limit, the mains choke causes a reduction of the frequency inverter's maximum output voltage (U_2) to about 96 % of mains voltage (U_{LN}).

DV6-340-	Mains current (I_{LN}) of the DV6 without mains choke	Assigned mains choke
075	2.8	DE4-LN3-075
1K5	4.2	DE4-LN3-2K2
2K2	5.8	DE4-LN3-3K0
4K0	9.5	DE4-LN3-4K0
5K5	13	DE4-LN3-7K5
7K5	18	DE4-LN3-11K
11K	25	DE4-LN3-15K
15K	35	DE4-LN3-15K
18K5	42	DE4-LN3-22K
22K	53	DE4-LN3-30K
30K	63	DE4-LN3-45K
37K	83	DE4-LN3-45K
45K	99	DE4-LN3-55K
55K	121	DE4-LN3-75K
75K	164	DE4-LN3-90K
90K	194	DDK3,2-9,2
110K	239	DDK4,0-9,2
132K	286	DDK4,0-9,2

→ For technical data for the DE4-LN series mains chokes, see installation instructions AWA8240-1711, for those of the DDK series, refer to the main Industrial Switchgear catalogue.

Radio interference filters

RFI filters have discharge currents to earth, which, in the event of a fault (phase failure, load unbalance), can be higher than the rated values. To avoid dangerous voltages, the filters must be earthed before use.

For discharge currents ≧ 3.5 mA, VDE 0160 and EN 60335 specify that

- the protective conductor must have a cross-section ≧ 10 mm^2 or
- a second protective conductor must be connected, or
- the continuity of the protective conductor must be monitored.

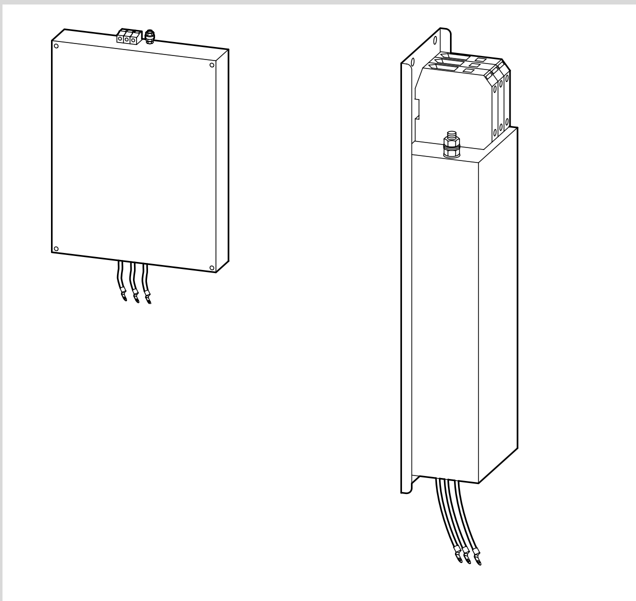


Figure 175: RFI filter

→ Radio interference filters DE6-LZ3-013-V4 to DE6-LZ3-064-V4 can be mounted below (footprint mounting) or – from DE6-LZ3-080-V4 – to the side of the frequency inverter (book-type mounting).

The table below lists radio interference filters with their matching frequency inverters.

DV6-340-	RFI filter	Nominal voltage ΔU_e V	Maximum leakage current in rated operation mA	Maximum leakage current under fault conditions mA	Power loss of RFI filter at rated operation W
075	DE6-LZ3-013-V4	3 ~ 480 + 10 %	< 30	180	12
1K5					
2K2					
4K0					
5K5					
7K5	DE6-LZ3-032-V4			280	14
11K					
15K	DE6-LZ3-064-V4			550	36
18K5					
22K					
30K	DE6-LZ3-080-V4			690	32
37K	DE6-LZ3-115-V4			750	38
45K					
55K	DE6-LZ3-125-V4			750	45
75K	DE6-LZ3-220-V4			380	60
90K					
110K	DE6-LZ3-013-V4			600	50
132K					

Standard form for user defined parameter settings

The DV6 series frequency inverters have programmable parameters. In the free Setpoint columns below, you can list the changes you have made from the default settings.

PNU	Function	Units	Default	Page	Setpoint		
A001	Frequency setpoint input through • 00: Potentiometer • 01: Analog inputs O, O2 or OI • 02: PNU F001 or A020 • 03: RS 485 serial interface • 04: Optional module in slot 1 • 05: Optional module in slot 2	–	01	123			
A002	Start signal definition through • 01: Input FWD/REV • 02: ON key • 03: RS 485 serial interface • 04: Optional module in slot 1 • 05: Optional module in slot 2	–	01	124			
A003	Base frequency	[Hz]	50	125			
A203	Base frequency (second parameter set)	[Hz]	50	125			
A303	Base frequency (third parameter set)	[Hz]	50	125			
A004	Maximum end frequency	[Hz]	50	125			
A204	Final frequency (second parameter set)	[Hz]	50	125			
A304	End frequency (third parameter set)	[Hz]	50	125			
A005	AT selection • 00: AT input switches between analog input O and OI • 01: AT input switches between analog input O and O2	–	00	61			
A006	O2 selection • 00: O2 signal only • 01: Sum of signals at O2 and O/OI **without** direction reversal • 02: Sum of signals at O2 and O/OI **with** direction reversal	–	00	61			
A011	Frequency at minimum setpoint value (terminal O-L)	[Hz]	0.00	63			
A012	Frequency at maximum setpoint value (terminal O-L)	[Hz]	0.00	63			
A013	Minimum setpoint value (terminal O-L)	[%]	0	63			
A014	Maximum setpoint value (terminal O-L)	[%]	100	63			
A015	Starting frequency (terminal O-L) • 00: Apply PNU A011 to motor • 01: Apply 0 Hz to motor	–	01	63			
A016	Analog input filter time constant	–	8	63			
A019	Fixed frequency selection • 00: Binary selection through digital inputs FF1 to FF4 • 01: Bitwise selection through digital inputs SF1 to SF7	–	00	70			
A020	Frequency setpoint definition (PNU A001 must be 02)	[Hz]	0.00	70			
A220	Frequency setpoint definition (PNU A001 must be 02) (second parameter set)	[Hz]	0.00	70			
A320	Frequency setpoint definition (PNU A001 must be 02) (third parameter set)	[Hz]	0.00	70			

PNU	Function	Units	Default	Page	Setpoint		
A021	1st fixed frequency	[Hz]	0.00	70			
A022	Second fixed frequency	[Hz]	0.00	70			
A023	Third fixed frequency	[Hz]	0.00	70			
A024	Fourth fixed frequency	[Hz]	0.00	70			
A025	Fifth fixed frequency	[Hz]	0.00	70			
A026	Sixth fixed frequency	[Hz]	0.00	70			
A027	Seventh fixed frequency	[Hz]	0.00	70			
A028	Eighth fixed frequency	[Hz]	0.00	70			
A029	Ninth fixed frequency	[Hz]	0.00	70			
A030	Tenth fixed frequency	[Hz]	0.00	70			
A031	Eleventh fixed frequency	[Hz]	0.00	70			
A032	Twelfth fixed frequency	[Hz]	0.00	70			
A033	13th fixed frequency	[Hz]	0.00	70			
A034	14th fixed frequency	[Hz]	0.00	70			
A035	15th fixed frequency	[Hz]	0.00	70			
A038	Frequency in jog mode	[Hz]	1.00	80			
A039	Motor stop in jog mode through • 00: Free run • 01: Deceleration ramp • 02: DC braking • 03: Without prior stop signal, motor coasts to halt • 04: Without prior stop signal, stopping with deceleration ramp • 05: Without prior stop signal, stopping with DC braking	–	00	80			
A041	Voltage boost characteristics • 00: Manual • 01: Automatic	–	00	126			
A241	Boost characteristic (second parameter set) • 00: Manual • 01: Automatic	–	00	126			
A341	Boost characteristic (third parameter set) • 00: Manual • 01: Automatic	–	00	126			
A042	Percentage voltage increase with manual boost	[%]	1.0	126			
A242	Percentage voltage increase with manual boost (second parameter set)	[%]	1.0	126			
A342	Percentage voltage increase with manual boost (third parameter set)	[%]	1.0	126			
A043	Maximum boost at x % of the base frequency	[%]	5.0	126			
A243	Maximum boost at x % of the base frequency (second parameter set)	[%]	5.0	126			
A343	Maximum boost at x % of the base frequency (third parameter set)	[%]	5.0	126			

PNU	Function	Units	Default	Page	Setpoint		
A044	*U*/*f* characteristic • 00: Constant torque curve • 01: Reduced torque curve • 02: User-definable • 03: SLV control active • 04: 0 Hz SLV control active • 05: Vector control with optional DE6-IOM-ENC module.		00	128			
A244	Δ*U*/*f* characteristic (second parameter set) • 00: Constant torque curve • 01: Reduced torque curve • 02: User-definable • 03: SLV control active • 04: 0 Hz SLV control active		00	128			
A234	Δ*U*/*f* characteristic (third parameter set) • 00: Constant torque curve • 01: Reduced torque curve • 02: User-definable		00	128			
A045	Output voltage	[%]	100	128			
A051	DC braking • 00: Inactive • 01: Active		00	130			
A052	DC braking starting frequency	[Hz]	0.5	130			
A053	DC braking waiting time on deceleration	[s]	0.0	130			
A054	DC braking torque on deceleration	[%]	0	130			
A055	DC braking duration on deceleration	[s]	0.0	130			
A056	Behaviour on activation of the DB input • 00: Starts on activation of the input, ends after PNU A055 • 01: Runs as long as input is active		01	130			
A057	DC braking torque on acceleration	[%]	0	130			
A058	DC braking duration on acceleration	[s]	0.0	131			
A059	DC braking frequency	[kHz]	5.0	131			
A061	Maximum operating frequency	[Hz]	0.00	132			
A261	Maximum operating frequency (second parameter set)	[Hz]	0.00	132			
A062	Minimum operating frequency	[Hz]	0.00	132			
A262	Minimum operating frequency (second parameter set)	[Hz]	0.00	132			
A063	1st frequency jump	[Hz]	0.00	132			
A064	Jump width of the 1st frequency jump	[Hz]	0.50	132			
A065	Second frequency jump	[Hz]	0.00	132			
A066	Jump width of the second frequency jump	[Hz]	0.50	132			
A067	Third frequency jump	[Hz]	0.00	132			
A068	Jump width of the third frequency jump	[Hz]	0.50	132			
A069	Acceleration pause waiting frequency	[Hz]	0.00	133			
A070	Acceleration pause waiting duration	[s]	0.00	133			
A071	PID control • 00: Inactive • 01: Active		00	137			
A072	P component of the PID control		1.0	138			

PNU	Function	Units	Default	Page	Setpoint		
A073	I component of the PID control	[s]	1.0	138			
A074	D component of the PID control	[s]	0.0	138			
A075	Setpoint factor of the PID control	[%]	1.00	138			
A076	Input actual value signal for PID control • 00: Input OI • 01: Input O		00	138			
A081	AVR function • 00: Active • 01: Inactive • 02: Inactive during deceleration		02	146			
A082	Motor voltage for AVR function	[V]	230/400	146			
A085	Energy-saving mode • 00: Not active • 01: Active • 02: With fuzzy-logic active		00	147			
A086	Response time in energy-saving mode	[s]	50	147			
A092	Second acceleration time	[s]	15.0	74			
A292	Second acceleration time (second parameter set)	[s]	15.0	74			
A392	Second acceleration time (third parameter set)	[s]	15.0	74			
A093	Second deceleration time	[s]	15.0	74			
A293	Second deceleration time (second parameter set)	[s]	15.0	74			
A393	Second deceleration time (third parameter set)	[s]	15.0	74			
A094	Switch-over from the 1st time ramp to the second time ramp through • 00: Input 2CH • 01: PNU A095 or A096		00	74			
A294	Switch-over from the 1st time ramp to the second time ramp through • 00: Input 2CH • 01: PNU A095 or A096 (second parameter set)		00	74			
A095	Changeover frequency from first to second acceleration time	[Hz]	0.00	148			
A295	Changeover frequency from first to second acceleration time (second parameter set)	[Hz]	0.00	148			
A096	Changeover frequency from first to second deceleration time	[Hz]	0.00	148			
A296	Changeover frequency from first to second deceleration time (second parameter set)	[Hz]	0.00	148			
A097	Acceleration characteristic • 00: Linear • 01: S-curve • 02: U curve • 03: Inverted U curve		00	150			
A098	Deceleration characteristic • 00: Linear • 01: S-curve • 02: U curve • 03: Inverted U curve		00	150			
A101	Analog input OI starting frequency	[Hz]	0.00	64			
A102	Analog input OI end frequency	[Hz]	0.00	64			

PNU	Function	Units	Default	Page	Setpoint		
A103	Analog input OI starting current	[%]	20	64			
A104	Analog input OI end current	[%]	100	64			
A105	Analog input OI condition for starting frequency 00: Start at PNU A101 02: Start at 0 Hz		01	64			
A111	Analog input O2 starting frequency	[Hz]	0.00	65			
A112	Analog input O2 end frequency	[Hz]	0.00	65			
A113	Analog input O2 starting voltage	[%]	–100	65			
A114	Analog input O2 end voltage	[%]	100	65			
A131	Curvature of acceleration characteristic, values from 01 to 10		02	150			
A132	Curvature of deceleration characteristic, values from 01 to 10		02	150			

PNU	Function	Units	Default	Page	Setpoint		
b001	Restart mode • 00: Fault message • 01: 0 Hz Start • 02: Synchronization to current motor speed and acceleration • 03: Synchronization and deceleration		00	153			
b002	Permissible power failure duration	[s]	1.0	153			
b003	Waiting time before restart	[s]	1.0	153			
b004	Fault message issued immediately • 00: **No** fault on intermittent mains failure • 01: Fault on intermittent mains failure • 02: **No** fault on intermittent mains failure at standstill and deceleration		00	153			
b005	Number of restart attempts • 00: 16 restart attempts • 01: Unlimited number of restart attempts		00	153			
b006	Mains phase failure detection • 00: Not active • 01: Active		00	153			
b007	Synchronization frequency on return of mains power	[Hz]	0.00	153			
b012	Tripping current for electronic motor protection device	[A]	I_e (inverter)	156			
b212	Tripping current for electronic motor protection device (second parameter set)	[A]	I_e (inverter)	156			
b312	Tripping current for electronic motor protection device (third parameter set)	[A]	I_e (inverter)	156			
b013	Characteristic for electronic motor protection device • 00: Enhanced protection • 01: Normal protection • 03: User-definable protection		01	156			
b213	Characteristic for electronic motor protection device (second parameter set) • 00: Enhanced protection • 01: Normal protection • 03: User-definable protection		01	156			

PNU	Function	Units	Default	Page	Setpoint		
b313	Characteristic for electronic motor protection device (third parameter set) • 00: Enhanced protection • 01: Normal protection • 03: User-definable protection		01	156			
b015	Frequency 1 for user-definable motor protection characteristic	[Hz]	0	156			
b016	Tripping current 1 for user-definable motor protection characteristic	[A]	0.0	156			
b017	Frequency 2 for user-definable motor protection characteristic	[Hz]	0	156			
b018	Tripping current 2 for user-definable motor protection characteristic	[A]	0.0	156			
b019	Frequency 3 for user-definable motor protection characteristic	[Hz]	0	156			
b020	Tripping current 3 for user-definable motor protection characteristic	[A]	0.0	156			
b021	Motor current limitation 1 • 00: Inactive • 01: Active in every operating status • 02: Inactive during acceleration, otherwise active • 03: Active in every operating state; in regenerative operation, the current is increased • 04: Inactive during acceleration; in regenerative operation, the current is increased		01	157			
b022	Tripping current 1 for motor current limitation	[A]	$I_e \times 1.5$	157			
b023	Time constant 1 of motor current limitation	[s]	1.00	157			
b024	Motor current limitation 2 • 00: Inactive • 01: Active in every operating status • 02: Inactive during acceleration, otherwise active • 03: Active in every operating state; in regenerative operation, the current is increased • 04: Inactive during acceleration; in regenerative operation, the current is increased		1	158			
b025	Tripping current 1 for motor current limitation	[A]	$I_e \times 1.5$	158			
b026	Time constant 1 of motor current limitation	[s]	1.0	158			
b031	Software dependent parameter protection • 00: Via SFT input; all functions inhibited • 01: Via SFT input; function F01 possible • 02: Without SFT input; all functions inhibited • 03: Without SFT input; function F01 possible • 10: Extended parameters adjustable in RUN mode		01	159			
b034	Running time or Mains On time signal	[h]	0	114			
b035	Inhibit direction 00: Motor can run in both directions 01: Motor can only run clockwise 02: Motor can only run anticlockwise		00	162			
b036	Voltage ramp to starting frequency • 00: Start without voltage reduction • 01: Minimum voltage reduction, approx. 6 ms • ... • 06: Maximum voltage reduction, approx. 36 ms		06	162			

PNU	Function	Units	Default	Page	Setpoint		
b037	Display mode • 00: All parameters • 01: Relevant parameters • 02: Parameters saved under PNU U001 to U012		00	164			
b040	Selection of torque limitation • 00: All four quadrants • 01: Changeover to digital inputs TRQ1 and TRQ2 • 02: Analog input O • 03: Optional module in slot 1 • 04: Optional module in slot 2		00	95			
b041	Torque limit, first quadrant	[%]	150	95			
b042	Torque limit, second quadrant	[%]	150	95			
b043	Torque limit, third quadrant	[%]	150	95			
b044	Torque limit, fourth quadrant	[%]	150	95			
b045	Response on reaching the torque limit • 00: Wait with acceleration or deceleration until below limit • 01: No response		00	95			
b046	Reverse rotation protection • 00: Anticlockwise operation allowed • 01: Anticlockwise operation **not** allowed		00	95			
b050	Controlled deceleration • 00: Active • 01: Not active		00	161			
b051	Starting voltage for deceleration	[V]	0.0	161			
b052	Voltage for ramp stop	[V]	0.0	161			
b053	Deceleration time for ramp stop	[s]	1.00	161			
b054	Frequency jump on ramp stop	[Hz]	0.00	161			
b080	Gain factor, analog output AM		180	57			
b081	Gain factor, analog output FM		60	59			
b082	Increased starting frequency (e.g. with high level of friction)	[Hz]	0.50	104			
b083	Carrier frequency	[kHz]	5.0	164			
b084	Initialization causes • 00: Clearing of the fault history register • 01: Selection of default settings • 02: Deleting the fault history register and restoring the default settings		00	165			
b085	Country version • 00: Japan • 01: Europe • 02: USA		01	165			
b086	Frequency factor for indication through PNU d07		1.0	165			
b087	OFF key • 00: Always active • 01: Not active with control through the FWD/REV terminals		00	165			
b088	Motor restart after removal of the FRS signal • 00: With 0 Hz • 01: With current motor speed		00	166			

PNU	Function	Units	Default	Page	Setpoint		
b090	Permissible relative percentage duty factor for built-in braking transistor	[%]	0.00	167			
b091	Type of motor stop when Off button is pressed • 00: Braking/deceleration ramp • 01: Free run stop		00	168			
b092	Configuration of fan operation • 00: Fan always switched on • 01: Fan switched on only when motor running		00	168			
b095	Enable built-in braking transistor • 00: Not enabled • 01: Enabled in RUN mode • 02: Always enabled		00	167			
b096	Voltage threshold for braking transistor	[V]	720	167			
b098	Selection of PCT or NTC • 00: No temperature monitoring • 01: PTC • 02: NTC		00	82			
b099	Resistance threshold for thermistor input	[Ω]	3000	82			
b100	User-definable *U*/*f* characteristics, frequency coordinates 1	[Hz]	0	128			
b101	User-definable *U*/*f* characteristics, voltage coordinates 1	[V]	0.0	128			
b102	User-definable *U*/*f* characteristics, frequency coordinates 2	[Hz]	0	128			
b103	User-definable *U*/*f* characteristics, voltage coordinates 2	[V]	0.0	128			
b104	User-definable *U*/*f* characteristics, frequency coordinates 3	[Hz]	0	128			
b105	User-definable *U*/*f* characteristics, voltage coordinates 3	[V]	0.0	128			
b106	User-definable *U*/*f* characteristics, frequency coordinates 4	[Hz]	0	128			
b107	User-definable *U*/*f* characteristics, voltage coordinates 4	[V]	0.0	128			
b108	User-definable *U*/*f* characteristics, frequency coordinates 5	[Hz]	0	128			
b109	User-definable *U*/*f* characteristics, voltage coordinates 5	[V]	0.0	128			
b110	User-definable *U*/*f* characteristics, frequency coordinates 6	[Hz]	0	128			
b111	User-definable V/f characteristics, voltage coordinates 6	[V]	0.0	128			
b112	User-definable *U*/*f* characteristics, frequency coordinates 7	[Hz]	0	128			
b113	User-definable *U*/*f* characteristics, voltage coordinates 7	[V]	0.0	129			
b120	Brake control • 00: Not active • 01: Active		00	170			
b121	Brake released confirmation waiting time	[s]	0.00	170			
b122	Waiting time before acceleration	[s]	0.00	170			

PNU	Function	Units	Default	Page	Setpoint		
b123	Waiting time before stop	[s]	0.00	170			
b124	Waiting time to brake confirmation	[s]	0.00	170			
b125	Brake enable frequency	[Hz]	0.00	170			
b126	Brake enable current	[A]	I_e	170			

PNU	Function	Units	Default	Page	Setpoint		
C001	Function of digital input 1 • 01: REV, anticlockwise operation • 02: FF1, first fixed frequency input • 03: FF2, second fixed frequency input • 04: FF3, third fixed frequency input • 05: FF4, fourth fixed frequency input • 06: JOG, jog mode • 07: DB, DC braking • 08: SET, second parameter set • 09: 2CH, second time ramp • 11: FRS, controller inhibit • 12: EXT, external fault • 13: USP, unattended start protection • 14: CS, heavy mains starting • 15: SFT, parameter protection • 16: AT, Analog input selection • 17: SET3, third parameter set • 18: RST, reset • 20: STA, three-wire control start signal • 21: STP, three-wire control stop signal • 22: STA, three-wire control direction • 23: PID, activate PID control • 24: PIDC, reset I component of PID control • 26: CAS, tacho-generator with vector control • 27: UP, remote access/acceleration • 28: DWN, remote access/deceleration • 31: OPE, setpoint through keypad • 32 to 38: Bitwise fixed frequencies • 39: OLR, change over current limit • 40: Torque limitation active • 41: TRQ1, torque limitation 1 active • 42: TRQ2, torque limitation 2 active • 43: PPI, PI to P control changeover • 44: BOK, brake enable confirmation • 45: ORT, direction of rotation • 46: LAC, ramp function Off • 47: PCLR, delete positioning deviation • 48: STAT, setpoint definition through optional module • NO: No function		18	66			
C002	Function of digital input 2 (values → PNU C001)		16	66			
C003	Function of digital input 3 (values → PNU C001)		06	66			
C004	Function of digital input 4 (values → PNU C001)		11	66			
C005	Function of digital input 5 (values → PNU C001)		09	66			
C006	Function of digital input 6 (values → PNU C001)		03	66			
C007	Function of digital input 7 (values → PNU C001)		02	66			
C008	Function of digital input 8 (values → PNU C001)		01	66			

PNU	Function	Units	Default	Page	Setpoint
C011	Digital input 1 • 00: Make contact • 01: Break contact		00	67	
C012	Digital input 2 (values → PNU C011)		00	67	
C013	Digital input 3 (values → PNU C011)		00	67	
C014	Digital input 4 (values → PNU C011)		00	67	
C015	Digital input 5 (values → PNU C011)		00	67	
C016	Digital input 6 (values → PNU C011)		00	67	
C017	Digital input 7 (values → PNU C011)		00	67	
C018	Digital input 8 (values → PNU C011)		00	67	
C019	Digital input FW (values → PNU C011)		00	67	
C021	Signal on digital output 11 • 00: RUN signal • 01: FA1, frequency reached • 02: FA2, frequency exceeded • 03: OL, overload • 04: OD, PID deviation exceeded • 05: AL, fault • 06: FA3, frequency reached (1) • 07: OTQ, torque reached (exceeded) • 08: IP, mains failure, immediate stop • 09: UV, undervoltage • 10: TRQ, torque limitation • 11: ONT, Mains On time exceeded • 12: RNT, Running time exceeded • 13: THM, motor thermal overload • 19: BRK, enable signal for external brake • 20:BER, brake fault • 21: ZS, zero frequency • 22: DSE, speed deviation exceeded • 23: POK, positioning • 24: FA4, frequency exceeded (2) • 25: FA5, frequency reached (2) • OL2, overload alarm 2		01	101	
C022	Signal at digital output 12 (values → PNU C021)		00	101	
C023	Signal at digital output 13 (values → PNU C021)		03	101	
C024	Signal at digital output 14 (values → PNU C021)		07	101	
C025	Signal at digital output 15 (values → PNU C021)		08	101	
C026	Signal at relay terminals K11-K12 (values → PNU C021)		05	118	
C027	Output, FM output • 00: Output frequency, PWM signal • 01: Output current • 02: Torque, SLV control only • 03: Output frequency, FM signal • 04: Output voltage • 05: Inverter input power • 06: Thermal load ratio • 07: Ramp frequency		00	59	

PNU	Function	Units	Default	Page	Setpoint		
C028	Output, AM output • 00: Output frequency, PWM signal • 01: Output current • 02: Torque, SLV control only • 04: Output voltage • 05: Inverter input power • 06: Thermal load ratio • 07: Ramp frequency		00	58			
C029	Output, AMI output (values → PNU C028)		00	59			
C031	Digital output 11 • 00: Make contact • 01: Break contact		00	101			
C032	Digital output 12 (values → PNU C031)		00	101			
C033	Digital output 13 (values → PNU C031)		00	101			
C034	Digital output 14 (values → PNU C031)		00	101			
C035	Digital output 15 (values → PNU C031)		00	101			
C036	Relay terminals K11-K12, signalling relay (values → PNU C031)		01	118			
C040	Overload alarm signal • 00: Always • 01: Only at constant speed		01	105			
C041	Threshold for overload alarm at digital outputs 11 to 15	[A]	I_e	105			
C042	Frequency from which FA2 is switched on during acceleration	[Hz]	0.00	103			
C043	Frequency from which FA2 is switched off during deceleration	[Hz]	0.00	103			
C044	PID control deviation (from the maximum setpoint value)	[%]	3.0	106			
C045	Frequency from which FA3/FA5 is switched on during acceleration	[Hz]	0.00	103			
C046	Frequency from which FA4/FA5 is switched off during deceleration	[Hz]	0.00	103			
C055	Torque threshold, clockwise in drive mode	[%]	100	110			
C056	Torque threshold, anticlockwise in regenerative mode	[%]	100	110			
C057	Torque threshold, anticlockwise in drive mode	[%]	100	110			
C058	Torque threshold, clockwise in regenerative mode	[%]	100	110			
C061	Thermal overload warning	[%]	80	115			
C062	Fault message, digital, to digital outputs • No output • 3-bit encoded output to terminals 11 to 13 • 4-bit encoded output to terminals 11 to 14		00	116			
C063	Frequency threshold for digital output ZS	[Hz]	0.00	109			

PNU	Function	Units	Default	Page	Setpoint		
C070	Programming through: • 02: LCD keypad • 03: RS 485 serial interface • 04: Optional module in slot 1 • 54: Optional module in slot 2		02	→ current version: ftp://ftp.moeller.net/DRIVES/ DOCUMENTATION/AWB/index.html			
C071	Baud rate • 03: 2400 bit/s • 04: 4800 bit/s • 05: 9600 bit/s • 06: 19200 bit/s		04				
C072	Address, value 01 to 32		1				
C073	Data word length: 7 or 8 bit		7				
C074	Parity • 00: None • 01: Even • 02: Odd		00				
C075	Stop bits: 1 or 2		1				
C078	Transmission waiting time	[ms]	0				
C081	Compensation of setpoint signal at terminal O		Depending on inverter model	62			
C082	Compensation of setpoint signal at terminal OI			62			
C083	Compensation of setpoint signal at terminal O2			62			
C085	Thermistor matching		105	82			
C086	Offset, AM terminal	[V]	0.0	58			
C087	Gain, AMI terminal		80	59			
C088	Offset, AMI terminal		Depending on inverter model	59			
C091	Debug mode		00	168			
C101	Use saved UP/DWN setting • 00: Use PNU A020 • 01: Use saved UP/DWN frequency		00	85			
C102	Reset signal • 00: On rising edge • 01: On falling edge • 02: On rising edge, only on fault		00	78			
C103	Behaviour with reset • 00: 0 Hz start • 01: Synchronization to motor speed		00	78			
C111	Overload alarm threshold	[A]	I_e	105			
C121	Zero-point matching, terminal O		Depending on inverter model	62			
C122	Zero-point matching, terminal OI			62			
C123	Zero-point matching, terminal O2			62			

PNU	Function	Units	Default	Page	Setpoint		
d001	Output frequency display	–	–	120	–	–	–
d002	Output current display	–	–	120	–	–	–
d003	Direction of rotation display	–	–	120	–	–	–
d004	PID feedback display	–	–	120	–	–	–
d005	Digital inputs 1 to 8 status	–	–	120	–	–	–
d006	Status of digital outputs 11 to 15	–	–	120	–	–	–
d007	Scaled output frequency	–	–	120	–	–	–
d012	Motor torque	–	–	120	–	–	–
d013	Output voltage	–	–	120	–	–	–
d014	Electrical input power	–	–	120	–	–	–
d016	Running time	–	–	120	–	–	–
d017	Power on time	–	–	120	–	–	–
d080	Entire count of malfunctions which occurred	–	–	120	–	–	–
d081	First fault (last fault which occurred)	–	–	120	–	–	–
d082	Second fault	–	–	120	–	–	–
d083	Third fault	–	–	120	–	–	–
d084	Fourth fault	–	–	120	–	–	–
d085	Fifth fault	–	–	120	–	–	–
d086	Sixth fault	–	–	120	–	–	–
d090	Warning	–	–	120	–	–	–

PNU	Function	Units	Default	Page	Setpoint		
F001	Frequency setpoint value	[Hz]	0.0	121			
F002	Acceleration time 1	[s]	30.0	121			
F202	Acceleration time 1 (second parameter set)	[s]	30.0	121			
F302	Acceleration time 2 (third parameter set)	[s]	30.0	121			
F003	Deceleration time 1	[s]	30.0	122			
F203	Deceleration time 1 (second parameter set)	[s]	30.0	122			
F303	Deceleration time 1 (third parameter set)	[s]	30.0	122			
F004	Direction of rotation • 00: Clockwise rotation • 01: Anticlockwise rotation	–	00 (clockwise)	122			

PNU	Function	Units	Default	Page	Setpoint
H001	Autotuning mode • 00: Autotuning not active • 01: Autotuning/motor operation • 02: Autotuning/motor standstill		00	173	
H002	Selection of motor data • 00: Standard motor • 01: Use autotuning data		00	173	
H202	Selection of motor data (second parameter set) • 00: Standard motor • 01: Use autotuning data		00	173	
H003	Motor rating: 0.2 to 160 kW	[kW]	Depending on inverter model	173	
H203	Motor rating: 0.2 to 160 kW (second parameter set)	[kW]		173	
H004	Number of motor poles: 2/4/6/8		4	173	
H204	Number of motor poles (second parameter set)		4	173	
H005	Motor constant K_p		1.59	173	
H205	Motor constant K_p (second parameter set)		1.59	173	
H006	Motor stabilization constant		100	173	
H206	Motor stabilization constant (second parameter set)		100	173	
H306	Motor stabilization constant (third parameter set)		100	173	
H020	Motor constant R_1	[Ω]	Depending on inverter model	173	
H220	Motor constant R_1 (second parameter set)	[Ω]		173	
H021	Motor constant R_2	[Ω]		173	
H221	Motor constant R_2 (second parameter set)	[Ω]		173	
H022	Motor constant L	[mH]		173	
H222	Motor constant L (second parameter set)	[mH]		173	
H023	Motor constant I_0	[A]		173	
H223	Motor constant I_0 (second parameter set)	[A]		173	
H024	Motor constant J	[Nm]		173	
H224	Motor constant J (second parameter set)	[Nm]		173	
H030	Autotuning: Motor constant R_1			173	Do not change these parameters!
H230	Autotuning: Motor constant R_1 (second parameter set)			173	
H031	Autotuning: Motor constant R_2			173	
H231	Autotuning: Motor constant R_2 (second parameter set)			173	
H032	Autotuning: Motor constant L			173	
H232	Autotuning: Motor constant L (second parameter set)			173	
H033	Autotuning: Motor constant I_0			173	
H233	Autotuning: Motor constant I_0 (second parameter set)			173	
H034	Autotuning: Motor constant J			173	
H234	Autotuning: Motor constant J (second parameter set)			173	
H050	P component of PI control	[%]	100.0	175	
H250	P component of PI control (second parameter set)	[%]	100.0	175	
H051	I component of PI control	[%]	100.0	175	
H251	I component of PI control (second parameter set)	[%]	100.0	175	

PNU	Function	Units	Default	Page	Setpoint		
H052	P component of P control		1.00	175			
H252	P component of P control (second parameter set)		1.00	175			
H060	Magnetization current limitation, 0 Hz SLV control	[%]	100	175			
H260	Magnetization current limitation, 0 Hz SLV control (second parameter set)	[%]	100	175			
H070	P component of the PI controller with changeover	[%]	100.0	175			
H071	I component of the PI controller with changeover	[%]	100.0	175			
H072	P component of the P controller with changeover		1.00	175			

PNU	Function	Units	Default	Page	Setpoint		
U001	User-defined parameters		no	176			
U002			no	176			
U003			no	176			
U004			no	176			
U005			no	176			
U006			no	176			
U007			no	176			
U008			no	176			
U009			no	176			
U010			no	176			
U011			no	176			
U012			no	176			

Index