NetterVibration

CE

Operating instructions for Frequency converter Series NFC

December 2015
No.1510

These operating instructions are valid for **NFC 1-004/2**
NFC 1-007/4

Serving industry with vibration

Netter GmbH
Fritz-Lenges-Str. 3
55252 Mainz-Kastel

Table of contents

Scope of delivery

Check the packaging for any transport damage.
If the packaging is damaged, check the contents for completeness and any damage. Inform the carrier of any damage. Compare the scope of delivery with the delivery note.

1 General information

Information about the operating instructions

Use and storage of the operating instructions

These operating instructions must be read carefully before using the NFC series frequency converters. It forms the basis for all handling of the NFC and can be used for training purposes. The operating instructions must then be kept close to the product.

Targt group

The target group for these operating instructions is specialised technical personnel from the mechanical engineering sector who have a basic knowledge of electrical and mechanical engineering.
The NFC may only be installed, commissioned, maintained, repaired and dismantled by persons who have been instructed in the proper handling of the units.
Personnel who have not been trained in this way must not carry out any work on the NFC.

Copyright

Limitation of liability

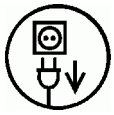
All technical information, data and instructions for installation, operation and maintenance contained in these operating instructions correspond to the latest status at the time of printing and are based on our previous experience and knowledge to the best of our knowledge.
No claims can be derived from the information, illustrations and descriptions in these instructions.

The manufacturer accepts no liability for damage caused by

- non-observance of the operating instructions,
- improper use,
- unauthorised repairs,
- technical modifications,
- use of unauthorised spare parts.

Translations are carried out to the best of our knowledge. ***Netter****Vibration* accepts no liability for translation errors, even if the translation was carried out by us or on our behalf. Only the original German text is binding.

The following information and hazard symbols are used in these operating instructions:

	**DANGER**	indicates a possible danger that could result in death or personal injury if this instruction is not followed.
	**WARNING**	indicates a possible danger that may result in personal injury and/or material damage if this warning is not observed.
	**DISCONNECT THE UNIT FROM THE POWER SUPPLY**	indicates a potential hazard that could result in personal injury if this warning is ignored.
	**IMPORTANT**	Note with particularly useful information and tips.
	**ENVIRONMENTALLY FRIENDLY DISPOSAL**	refers to the obligation of environmentally friendly disposal.

Information about the NFC

The rules and regulations of the local electrical engineering associations apply (e.g. IEC, VDE, ÖEVE, SEV etc.).

The installation work and operation of the unit must be carried out in accordance with the usual accident prevention regulations. The operator is responsible for the proper condition of the unit.

Electrical systems and stationary electrical equipment must be checked for proper condition at least every 4 years by a qualified electrician. Connecting cables with plugs and unit connecting cables must be checked for proper condition at least every 6 months by a qualified electrician.

2 Safety

Intended use
NFC series frequency converters are designed to control the speed of three-phase alternating current vibrators continuously from 0 to an adjustable maximum speed.
Any other use is considered improper use.
There are no independent safety devices.

Qualification of qualified personnel
Installation, commissioning, maintenance and troubleshooting of the frequency converters may only be carried out by authorised, qualified personnel.
All handling of the frequency converters is the responsibility of the operator.

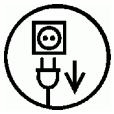
Accessories that ensure proper operation and safety must have a degree of protection suitable for the specific application.

WARNING

Netter*Vibration* **accepts no responsibility for damage to property or personal injury if technical modifications are made to the product or if the instructions and regulations in this operating manual are not observed.**

DANGER

Live parts can cause serious injury or even death.



DISCONNECT THE UNIT FROM THE POWER SUPPLY

When working on the frequency converters, they must be safely disconnected from the electrical mains. Proceed as follows:

1. switch off the frequency converter,
2. secure against restarting,
3. check that there is no voltage.

The following safety instructions must be followed during all phases of commissioning, operation, servicing and repair work. Failure to follow these instructions constitutes misuse of the unit.

DANGER

Earthing the unit:
To achieve optimum protection against accidental contact, the unit must be earthed, i.e. the PE terminal must be connected to the protective earth of the mains supply.

Do not use in explosive atmospheres!
Operating this unit in an explosive atmosphere (flammable gases, vapours or dusts) can lead to their ignition and must therefore be avoided.

It is prohibited to operate the unit in a damp environment or to expose it to rain or condensation.

The operator must observe the condition of the system with the utmost care. Compliance with the protective measures is mandatory. Any damage or faults in the system must be properly fixed.

The operating personnel are only authorised to operate the system. This means that the operating personnel are not authorised to open the unit or work on the vibrators. In the event of technical problems, the maintenance personnel must be consulted.

Improper work or changes to the electrical or mechanical pre-settings of the units can lead to consequential damage, which can be very expensive and result in long machine downtimes. The guarantee will be cancelled. The consequences must be borne by the person responsible.

DANGER

The prescribed protective measures must be strictly adhered to.
The system may only be operated if all connecting cables are fully connected and there is no damage or malfunction.

The operator of this unit must have it connected, commissioned and serviced by qualified personnel. The unit works with electrical voltages that can cause death. These voltages are still present even after the mains supply has been switched off. Therefore, after switching off the mains voltage, it is necessary to wait until the capacitors in the unit have discharged (wait at least 30 seconds).

This unit is not an electrical isolator. It is prohibited to work on the output lines when the mains supply is switched on, even if the connected motor is de-energised or the unit is disabled. Operation of this unit without a mechanical switch and without fuses in the mains cable is prohibited.

Avoid any contact with the electrical circuits of this unit. Any contact during operation can be life-threatening. The unit can also be damaged by static discharge if the circuits are touched.

3 Technical data

		NFC 1-004/2	NFC 1-007/4
Power feed:		230 V AC +/- 15 %	
Mains frequency:		50 - 60 Hz	
Pre-fuse:		6.3 A slow-blow	10 A slow-blow
Output voltage:		3 x 230 V AC	
Output frequency:		0 - 100 Hz	
Continuous nominal current (A):		3 A eff.	5.5 A eff.
Nominal motor power (kW):		375 W	750 W
Ambient temperature:		0 - 70 °C	
Dimensions (W×H×D):		101 x 151 x 70 mm	
Weight:		0.85 kg	0.88 kg

4 Transport and storage

IMPORTANT

Check the packaging for any transport damage.
If the packaging is damaged, check the contents for completeness and any damage. Inform the carrier of any damage.

The units are packaged ready for installation. The type plate is located on the NFC.
When transporting the NFC, ensure that it is not subjected to strong shocks or vibrations that could damage the unit.
The unit should be stored in a dry and clean environment.

If the NFC has to be stored for a longer period of time (up to a maximum of two years), the temperature in the storage room must not be below +5 °C or above +40 °C and the relative humidity must not exceed 60 %.

The NFC and the vibration drives must not be stored outdoors. If the components are stored outdoors, the electrical components (in the control cabinet and the vibration drives) are not protected against corrosion.

5 Installation

IMPORTANT

The vibrators may only be attached by authorised, qualified specialist personnel.
The specialised personnel must only work with tools suitable for the application.

IMPORTANT

During installation, always observe the safety instructions in chapter 2 and the accident prevention regulations!
The installation of the system must be carried out in accordance with the known local regulations (e.g. VDE regulations).

IMPORTANT

It is essential that you read the operating instructions for the frequency converter completely and carefully before installation and commissioning. The operator must ensure strict compliance with these instructions. Failure to do so will invalidate all claims.

DANGER

ATTENTION:
The electrical installation of the NFC may only be carried out by authorised specialist personnel.
The unit must not be opened while energised!
The qualified personnel must only work with insulated tools that are suitable for the application.
Accessories that ensure proper operation and safety must have a degree of protection suitable for the specific application.

DISCONNECT THE UNIT FROM THE POWER SUPPLY

When working on the NFC, it must be safely disconnected from the power supply. Proceed as follows:

1. enable NFC,
2. secure against being switched on again,
3. ensure that there is no voltage,
4. earth and short-circuit,
5. cover or isolate adjacent live parts.

IMPORTANT

Compliance with the EMC Directive must be ensured when operating the NFC.

DANGER

A suitable supply cable must be used during installation. Cables and protective conductors must be connected in accordance with regulations.
The electrical cables must be laid carefully. Care must be taken to ensure that the cables are not chafed by vibrating parts.
Check that the electrical cables and their plugs are in perfect condition at regular intervals (generally every six months). Any faults discovered must be rectified immediately.
Protect the cable from high temperatures, lubricants and cutting edges.

6 Start-up and operation

When commissioning the NFC, the provisions and regulations of the local electrical engineering associations (e.g. VDE) and the known accident prevention regulations must be observed.

The following points must be checked by a qualified technician on the system when it is switched off:

- The cables must be undamaged and laid in accordance with the recognised regulations and standards (e.g. VDE, OEVE, SEV, etc.).
- Any malfunctions that may have occurred must be correctly rectified immediately.
- ***Netter****Vibration* should be informed of any major faults in the unit. Interventions of any kind may only be carried out with our express authorisation.
- **Tampering with or changing the settings on the frequency converter without the authorisation of *Netter****Vibration*** **will invalidate the warranty.**
- Work on the unit and the electrical equipment may only be carried out by a qualified technician.
- The regulations of the recognised CENELEC members (e.g. VDE) also apply.
- It must be ensured that the system is in perfect electrical condition.
- Protective measures on the system, equipment earthing.

7 General description

The frequency converters of types NFC 1-004/2 and NFC 1-007/4 are designed to control the speeds of 3-phase AC vibrators continuously from 0 to an adjustable maximum speed.

The units operate at a clock frequency of approx. 10 kHz (switchable to 16 kHz). This makes it possible to achieve outstanding smooth running and jerk-free operation even at low speeds.
The units are designed for 2-quadrant operation (driving in both directions of rotation). Braking is possible up to the power corresponding to the power loss of the motor, whereby the motor is overexcited (with overvoltage) in braking mode, i.e. the motor power loss will be greatly increased in braking mode.
The units can be switched to different operating modes using a DIP switch:

In **"Normal mode"**, the frequency range extends up to 150 Hz. The "Boost" trimpot can be used to increase the motor voltage in the lower speed range. This results in a direct current in the motor at frequency 0, which enables braking to a standstill. This direct current is automatically switched off 4 s after reaching frequency 0 (this is necessary for reasons of motor heating).

In **"Pump mode"**, the maximum frequency is limited to 55 Hz and the ramp is fixed at 5 s.
The "Boost" and "Ramp" trimpots are ineffective in this operating mode. In pump mode, the frequency-voltage ratio is reduced with decreasing frequency. As a result, the drive is operated in partial load mode with significantly reduced power loss.

In **"High frequency mode"**, the maximum frequency can be set to values up to 600 Hz. In this operating mode, the clock frequency is generally 16 kHz and the required voltage-frequency ratio for the motor is set using the "Boost" trimpot.

The operating mode **"1-phase mode"** enables a 2-phase motor to be operated without an additional capacitor. The main winding and the auxiliary winding are connected directly to the frequency converter.

The **"Long ramp"** operating mode switches the setting range of the ramp time from 0.2 - 15 s to 4 - 300 s (based on a frequency step of 150 or 600 Hz). The long ramp cannot be used in pump mode.

In the **"Motor potentiometer"** operating mode, the motor speed can be set using 2 buttons.
The **"200 Hz"** operating mode causes the converter to automatically ramp up to 200 Hz with a ramp of approx. 1 s; all trimpots and control signals are ineffective.

The operating mode may only be switched when the power supply is switched off. After switching off the mains voltage, wait at least 30 seconds before switching or any other intervention.

Mains, motor and control connections are designed with plug-in terminals. To protect the units from moisture, dust, contact, mechanical shocks and vibration, the electronics in the cast aluminium housing are embedded in a soft synthetic resin casting compound.

The control inputs of the units are insulated against the mains and motor cables (in accordance with VDE 0884).

The units are protected against direct short circuits or earth faults on the motor cables.

The electronic current or power limitation is set so that a power of approx. 150 % of the rated power is available in the temperature range from 0 °C to 70 °C. The units are equipped with a thermal monitoring system that blocks the function if an operating temperature of approx. 85 °C is exceeded. This block must be acknowledged by switching the operating voltage off and on again.
The units are controlled with an analogue signal 0…10 V or 0…20 mA or 4…20 mA. The input circuit is adapted to the corresponding control signal using jumpers B1 and B2 (see chapter 9, switching examples for the control unit).

Attention! If the converter is connected for control with 0…10 V or potentiometer, it supplies half the set maximum frequency when the setpoint input is open! An open setpoint input should therefore be avoided.

The release circuit and the direction of rotation control of the units expect a closed loop (contact) or +24 V (PLC) as the release signal.

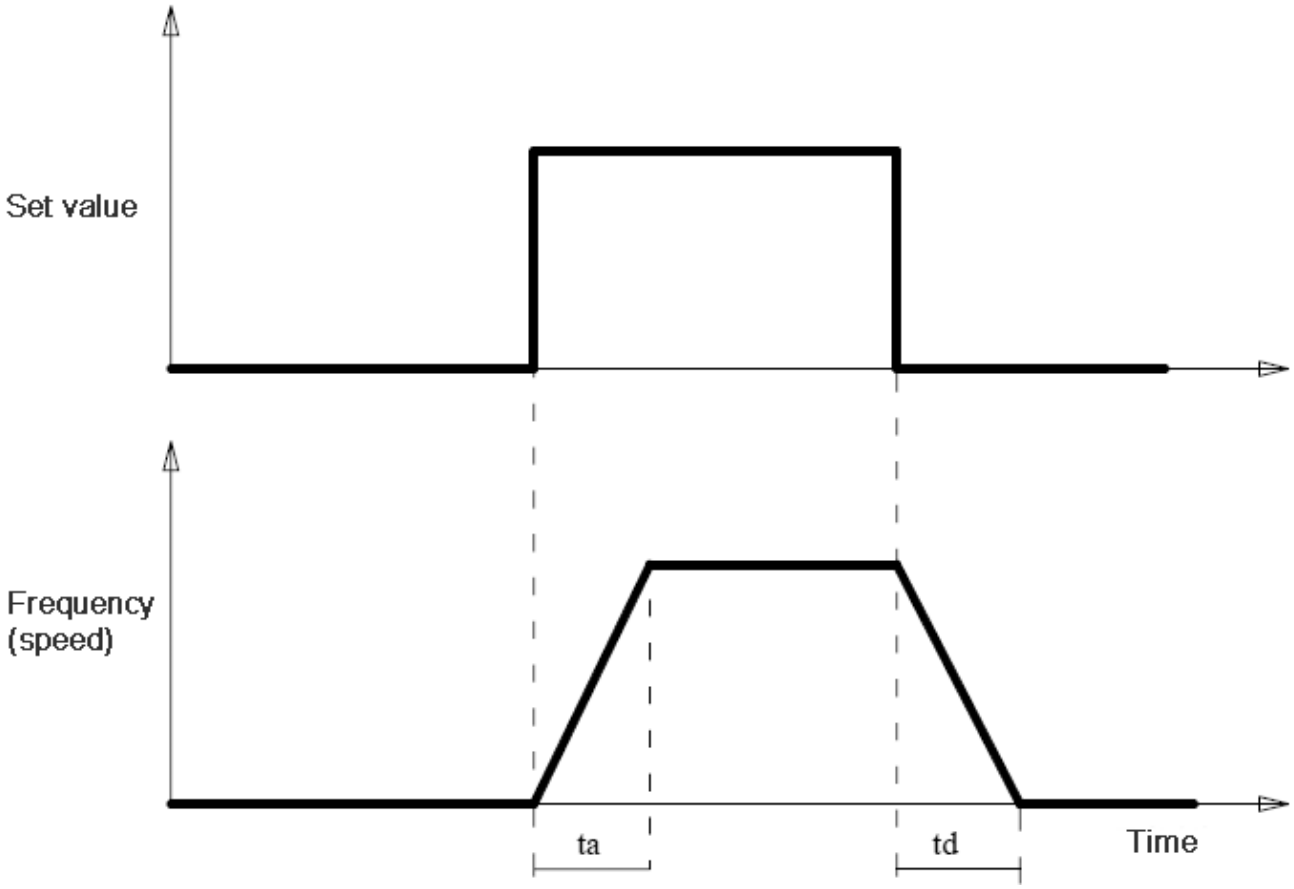
The motor temperature monitoring is designed so that resistance values of less than 1040 ohms are analysed as a closed loop and values above this as an open loop. This makes it possible to loop a PTC thermistor sensor or a thermistor into this circuit.

The units provide an operating message (converter OK) if mains voltage is present and there is no fault.

The control connections must be shielded from a length of 2 metres. Below this length, shielding of the control connections is only necessary if strong interference is to be expected.

8 Function of the setpoint integrator

8.1 Normal or high-frequency mode



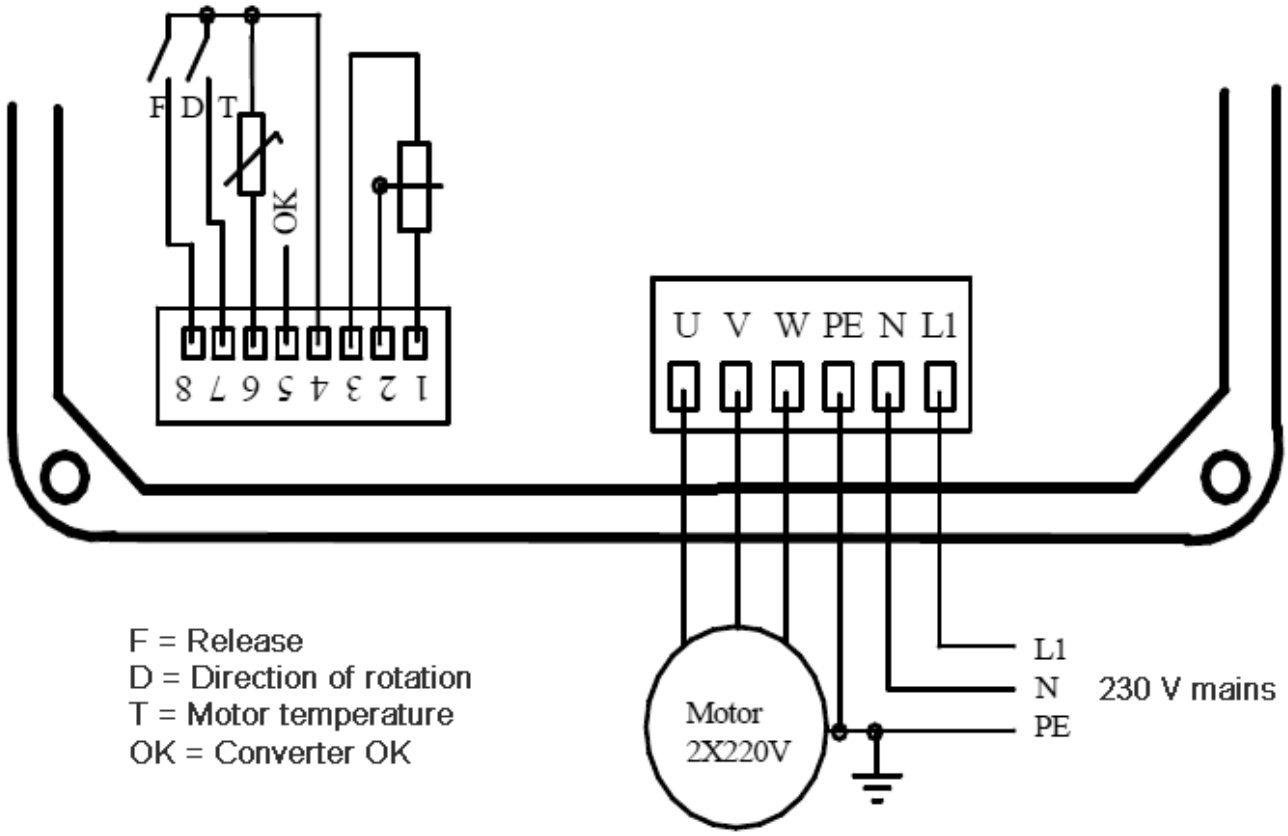
The ramp time t can be set with trimpot P2.
With switch DS 5 set to “off”, the range of t = 0.1 - 15 s is related to a frequency step of 150 Hz in normal operation and 600 Hz in high-frequency operation.
With switch DS 5 set to “on”, the range is from t = 1.5 - 250 s.

8.2 Pump mode

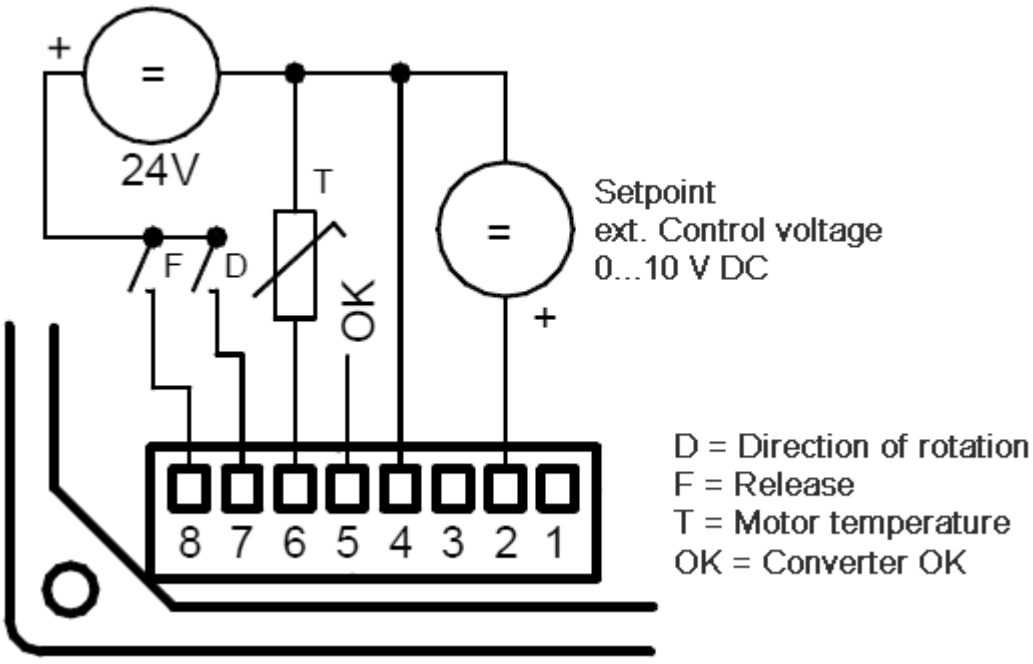
In pump mode (DS 2 “on”), the ramp time is fixed at 7 s for a frequency step of 55 Hz.

9 Electrical connection and switching examples for controlling the converter

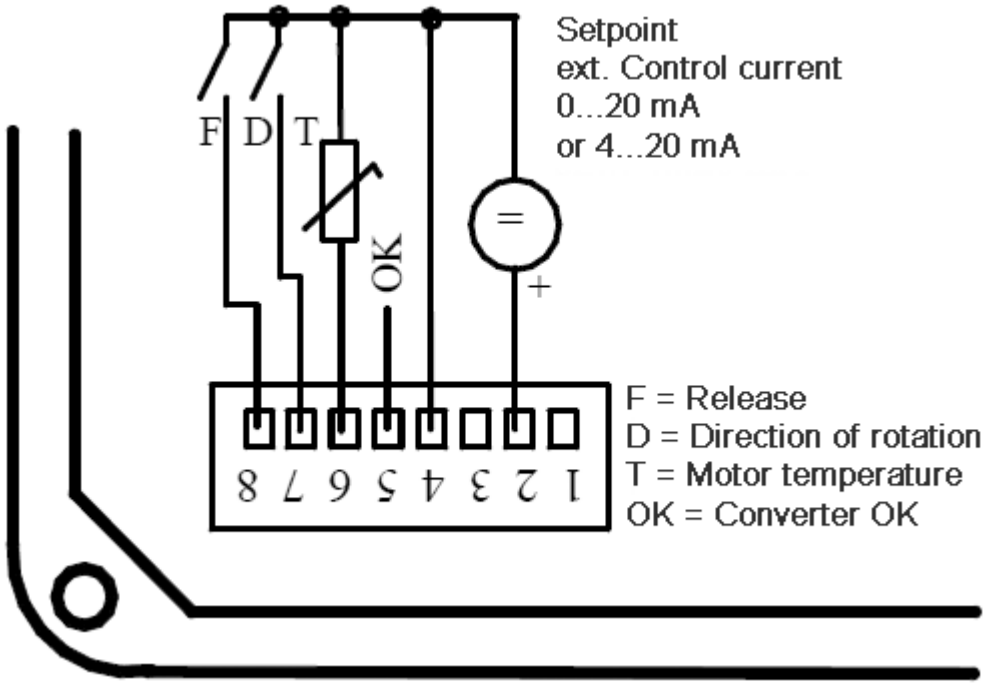
9.1 Control with potentiometer:



9.2 Control with external voltage 0 - 10 V, enable and direction of rotation controlled with +24 V:

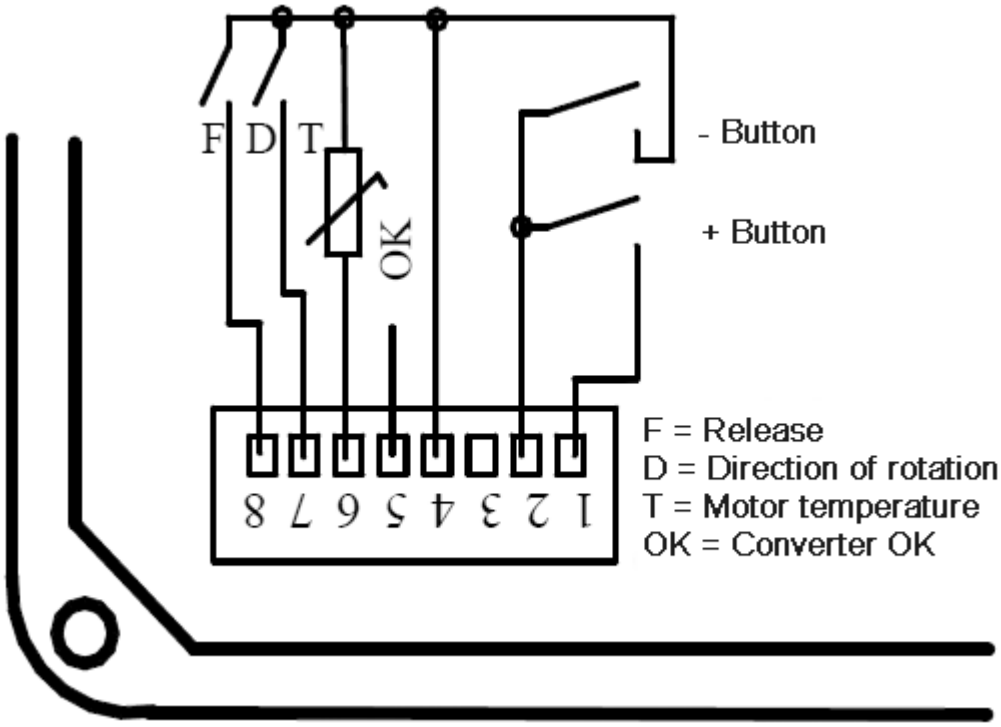


9.3 Control with current 0 - 20 mA or 4 - 20 mA:



9.4 Control with 2 keys

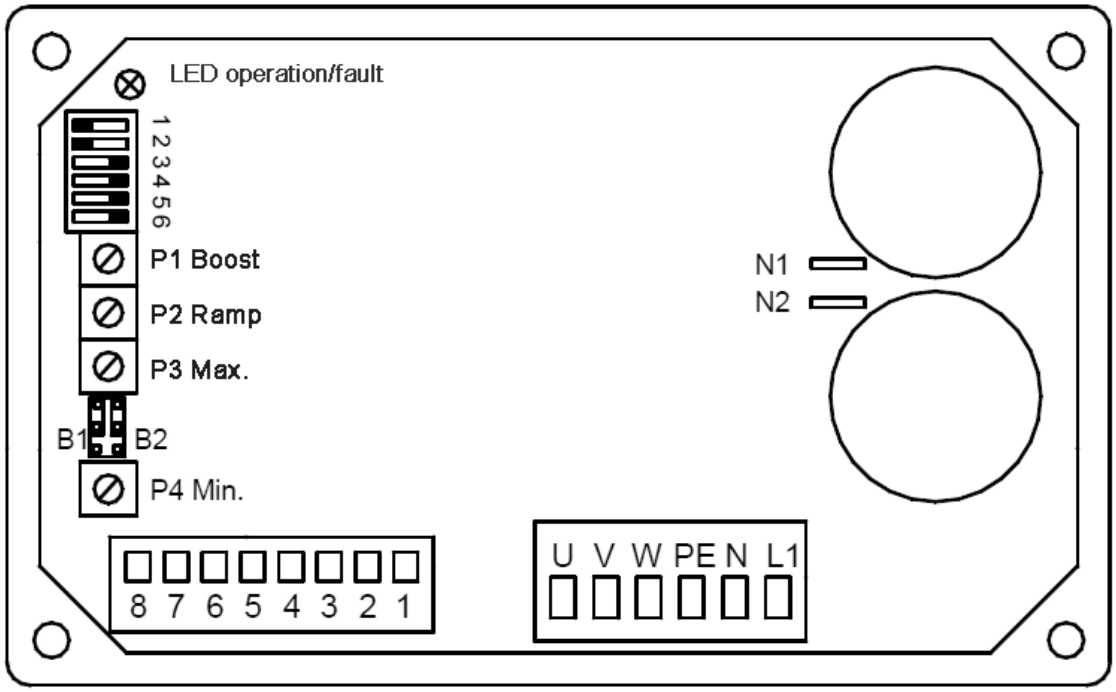
Operating mode “Motor potentiometer”:



10 Setting and commissioning the converter

As it is no longer possible to adjust the converter once it has been installed, all parameters and limit values must be set before installation.
It is recommended that the setting is carried out during the incoming inspection.

10.1 Position of the switches, bridges and potentiometers:



Switching from 230 V to 115 V:
The unit is switched to a mains voltage of 115 V by connecting the two plug-in lugs N1 and N2 with bare wire.
Caution: Operating a 115 V unit on 230 V will destroy it!

10.2 Selecting the required operating mode:

	DS1	DS2
Normal mode	ON	ON
Pump mode	OFF	ON
High frequency mode	ON	OFF
1-phase mode	OFF	OFF

<u>Selection of additional functions (can be combined):</u>		
Motorised potentiometer function:	DS 3	ON
Clock frequency switchover to 16 kHz:	DS 4	ON
Long ramp:	DS 5	ON
Converter not self-starting:	DS 6	ON

<u>Selection of control options:</u>	
Control with potentiometer or external setpoint 0...10 V:	B1 and B2 open
Control with 0...20 mA:	B1 plugged in, B2 open
Control with 4...20 mA	B1 and B2 plugged in

10.3 Setting the trimpots in “Normal mode”, “1-phase mode”:

I. Connecting the mains, motor and control circuit.
II. Switch on mains, close enable contact. Turn the setpoint potentiometer to the right stop.
III. Set the required maximum frequency on trimpot P3 (measure the motor speed if necessary!)
IV. Turn the setpoint potentiometer to the left stop. If necessary, set the required minimum speed on trimpot P4.
V. Change the setpoint value abruptly, observe the reaction of the motor.
VI. Set the ramp time on trimpot P2 to the required value.
VII. Set boost (voltage increase in the lower speed range) on trimpot P1. Adjust according to the requirements of the machine to be driven.

10.4 Setting in “High frequency mode”:

The setting is made as in 10.3, but in this operating mode the voltage-frequency ratio required for the respective motor is set at P1. The “Boost” function is omitted.

10.5 Setting in “Pump mode”:

The settings are made as in 10.3, but points 10.3IV and 10.3V are omitted. Once these settings have been made, the converter can be put into operation.

11 Annex

11.1 Disposal

The parts and packaging material must be disposed of in an environmentally friendly manner, depending on the material.

ENVIRON-MENTALLY FRIENDLY DISPOSAL

All units can be disposed of via ***Netter****Vibration*.
The valid disposal prices are available on request.

11.2 Attachments

Attachments:

IMPORTANT

Further information available on request:
Prospect No. 36 etc.