User manual

Frequency Inverter VECTOR basic

0,37 KW

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Warranty

According to the current general terms of delivery and payment MSF- Vathauer Antriebstechnik GmbH & Co. KG provides a warranty of 12 months (in single shift) after delivery on all electronic devices covering design, material or faulty workmanship.

MSF- Vathauer Antriebstechnik reserves the right to change the contents of this operation manual and the product specifications contained therein without prior notice.

Attention!

Read this manual carefully and completely.
Start with the installation and commissioning only after reading.

Technical changes reserved.

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1. Safety and application instructions for VECTOR basic

1.1. General

As long as any electrical equipment and machinery is switched on, the operator may touch voltage leading and non-isolated conductors or rotating parts as well as hot surfaces.
At removing the covers and the prescribed protections, in handling the machine improperly, or during service work or improper use, there is the danger of death or severe injuries or material damage.

All works with transport, installation and commissioning as well as maintenance have to be done by properly trained personnel (regard IEC 364 res. CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and national accident prevention regulations or VGB 4).

Qualified personnel in terms of these basic security considerations are persons that are used to installation; assembly, commissioning and operation of the product and that have qualifications according to their work (defined in IEC 364 or DIN VDE 0105).

1.2. Intended Usage

Frequency inverters are components for installation within machines that are operated in industrial plants.

The commissioning of the frequency inverter is prohibited until it is ascertained that the machine that includes the frequency inverters follows the restrictions of the EU directive 2006/42/EG (machine directive).

The frequency inverters match the protection goals of the low voltage directive 72006/95/EG and the harmonized norms of the series EN 50178/ DIN VDE 0160 in connection with EN 60439-1/ DIN VDE 0660 part 500 and EN 601146/ DIN VDE 0558.

The operation is only permitted according to the EMC directive (04/108/EG).

The technical data and information to connection conditions are to be found at the rating plate or the documentation and have to be completely fulfilled.

1.3. Transport and Storage

The considerations for transport, storage and the appropriate handling must be regarded.

Damages recognized after delivery must be immediately announced to the transport company. If applicable, notify the distributor before commissioning.

Regard the environmental conditions according to prEN 50178.

1.4. Installation

The installation and cooling of the device must be in accordance with the provisions of the relevant documentation.

The frequency inverters must be protected from excessive strain. They are to handle only in a way, so that no components are bent and / or isolating distances altered. The contact of electronic components and terminals must be avoided.

Frequency inverters contain electrostatic sensitive devices. These components can be easily destroyed by improper handling. Built-in electrical components must not be destroyed (potential health hazard).

1.5. Electrical connection

At working at current inverters with supplied power regard the valid national accident prevention regulations (e.g. VGB 4).

The electrical installation has to be done according to the valid directives (e.g. cable diameters, fuse protection, ground wire connection). More detailed information is to be found in the documentation.

Compliance with the limits for the plant according to the EMC juridical directive is in responsibility of the manufacturer of the plant. Considerations for the EMC-compatible installation like screening, grounding, alignment of filters and lying of cables are to be found in the documentation of the frequency inverters.

1.6. Operation

Plants that contain frequency inverters have to be provided, if applicable, with additional observation and security installations according to the concerning valid security directives, e.g. act on technical work equipment, accident prevention regulations etc. The documentation of the manufacturer has to be regarded.

After disconnection of the frequency inverters from the supply voltage, voltage conducting device parts and cable conductors must not be immediately touched because of possibly charged condensers. Please regard the according notification signs at the frequency inverters. During operation all covers must kept closed.

1.7. Maintenance and servicing

The documentation of the manufacturer has to be regarded.

1.8. Safety and Installation considerations

Frequency inverters from MSF-Technik are operating resources for the deployment in industrial high-voltage plants and are operated with voltages that may cause heavy injuries or death when touching!

- Installations and works may only be executed by qualified electrical trained personnel and at voltage free device. The user manual has to be available at any time and has to be consequently regarded.
- The local directives for building electrical plants and accident prevention regulations must be fulfilled.
  The device is up to 5 minutes after disconnecting from the voltage conducted with dangerous voltage. Due to this, opening of the device or removing the cover res. the I/O module and the display device is only permitted 5 minutes after disconnecting the device from voltage. Before turning the mains voltage on all covers must be mounted again.
- Also at motor standstill (e.g. due to electronics lock, short circuit at the output clamps or blocked drive) the voltage circuit clamps, motor clamps and clamps for the brake resistance may conduct dangerous voltage. A motor standstill is not identical with a galvanic disconnection from the mains voltage.
- Attention: The inverter may, depending on the settings, start automatically after powering the mains voltage.

Attention! Danger to Life!
The power supply conducts voltage under certain circumstances for up to 5 minutes after turning off the mains voltage. Inverter clamps, drive cables and drive clamps may conduct voltage!
Touching open or free clamps, cables and device parts may cause heavy injuries or death!

Attention

- Children and the public must not have access to the device!
- The device may only be used for the purpose intended by the manufacturer. Unauthorized changes and the use of replacement parts and additional devices that are not sold or approved by the manufacturer may cause fire, electric shocks and injuries.
- Keep the manual in reach and make it available for every user!

European EMC directive

If the vector field power is installed according to the recommendations of this manual it fulfills the requirements of the EMC directive according to the EMC product norm for motor driven systems EN 61800-3

2. Assembly and Installation

2.1. Installation

The devices require adequate ventilation.

The hot air has to be dissipated above the inverter!

2.2. Cabling directives of superior controls

The frequency inverters are developed for the operation in industrial environments where high values of electromagnetic interferences are expected. In general, a professional installation ensures a riskless and error-free operation. If limits are required that exceed the EMC directive limits, the following directives are recommended.

1. Please make sure that all devices in the control cabinet are connected together at a shared grounding point or rail with short cores and great diameter are properly grounded. It is especially important that every control device connected to the inverters (e.g. automation devices) are connected via a short core with high diameter at the same grounding point like the inverter.
2. The PE conductor of the drive controlled by the inverter should preferably directly connected to the ground connection connected with the heat sink together with the PE of the power supply of the concerning inverter. The existence of a central grounding rail within the control cabinet and the connection of all ground cables to this rail normally guarantees an error-free operation.
3. As far as possible you should use screened cables for the control. The cable ends have to be terminated carefully and it must be taken care that the cores are not unscreened over long distances. The screen of analog set point cables should only be grounded at the frequency inverter single-sided. Not used cores of the control cores should be grounded.
4. The control cores have to be laid in the most possible distance from the load cores using separated cable trenches etc. Cable crosses should possibly get an angle of 90°.
5. Make sure that contactors and relays in the control cabinets are suppressed either by RC connection or varistors in case of AC contactors or by „ free wheeling diodes“ at DC contactors, wherein the interference suppression bust be attached to the coils. The suppression is especially important if the contactors are controlled by the relay in the frequency inverter (optional).
6. Use screened cores for the load connections and ground the screening at both ends, if possible directly at the PE output of the inverter.
7. If the drive should run within an environment sensible to electro-magnetic interference, the usage of interference filters is recommended to reduce the grid-bound and radiated interferences of the inverter. In this case install the filter as near as possible to the inverter and take care for grounding.
8. Choose the lowest possible toggle frequency. This minimizes the intensity of the electro-magnetic interference created by the frequency inverter.

At installation of the inverters you must not disregard safety directives!

2.3. Measures to secure the EMCV in machinery and plants

The following measures are to secure the EMC, which are of absolute necessity to the inverter technology. The inverter fulfils the demands of the high noise immunity and the slight-noise emissions for the usage in industries, under the guidelines of this manuals installation consideration.

2.4 Grounding, earthen, potential compensation

The correct professional grounding or earthen guarantees the protection of the staff against dangerous touch voltages (input, output and intermediate circuit voltage) and through parasitic current inductance and low-impedance potential compensation an important measure to reduce electromagnetic influences.

2.5. Filtering

Filters are inserted into the lead-bound transfer way between the source of interference and the interference suppressor, which is to reduce lead-bound transmissions and to increase the noise immunity. Additional, external filter may have a negative effect on the noise emission!

2.6. Screening signal- and control cables

Screening is used for decoupling fields between two spatially separate areas, i.e. is also used to decrease the emission of electromagnetic radiation and to increase the noise immunity. The consistent use of metal cases is one of the most important standard measures to safeguard the EMC.

2.7. Coupling into motor cables

The use of twisted core cables can essentially reduce inductive couplings into a circuit. Cable screens must reduce capacitive, inductive and electromagnetic interferences. It is important to note that to reduce low frequency capacitive interference, it is often sufficient to place a one sided screening, whereas inductive and high frequency electromagnetic interference can only be prevented by screening both sides of the cable.
The screening must not be used as a protection earthen!!!

3. Technical Features

The VECTOR Basic is a frequency inverter with optimized price-performance relation and high protection level for simple applications up to 0.37 kW. The Assembly is made with mounting aids directly on the device.
Core is a DSP signal processor to generate the pulse pattern and to manage all applicable control tasks and ensuring the integrated protection.

With the 2-button user interface and through the 7 - segment - display parameterisation takes place as well as the monitoring of the operating parameters (see Chapter 4). The set values are saved internally by simultaneously by holding down the keys "Up" and "down".

3.1 Special functions

Due to an optimized internal EMC - Filter it is possible to operate an asynchronous motor, up to a length of 1 m, WITHOUT a shielded cable.
Over Push - In spring-loaded terminals a secure and fast connection option is given without special tools. Also the VECTOR Basic contains a restart - stop after power failure.

High operational safety due to

- High noise immunity and low noise emission by a standard input filter
- Short-circuit protection
- Potential separated nominal value input
- Temperature shutdown

4. Menu structure

Display

Here alternatively,
the nominal- or
actual value
is displayed

Menu entry after "Up" and "Down" are pressed simultaneously for 5 seconds

Menu (exit by menue point 20 or 21)

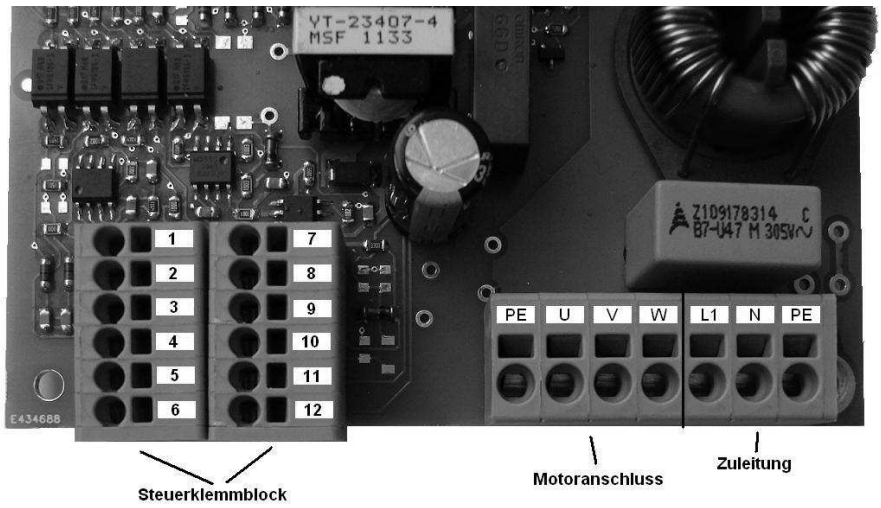
00 = Display Software version
01 = Ramp CW
02 = Running down ramp CW
03 = Running up ramp CCW
04 = Clockwise rotation deceleration ramp
05 = Boost
06 = Set Point
- 00 = Selection button with set point saving
- 01 = Analog Input selection
- 02 = Fixed frequency Selection (adjustable in menu point 10 and 11)
- 03 = Selection button without set point saving

07 = Display representation
- 00 = Nominal value selection
- 01 = Actual value selection

08 = Maximum output frequency
09 = Corner frequency
10 = Level of the fixed frequency for CW
11 = Level of the fixed frequency of counter clockwise rotation
12 = Factory setting (see section 6.12)
13 = Output relay function to assign
- 00 = Collective fault message
- 01 = Nominal value equal actual value
- 02 = Actual value equal frequency (Adjustable at menu 14)
- 03 = Over temperature internal
- 04 = Zero field frequency (motor turns)
- 05 = Motor over temperature (PTC)
- 06 = Error IGBT – Mod
- 07 = Short circuit motor
- 08 = Motor over current
- 09 = DC link overvoltage
- 10 = Set over current
- 11 = Frequency inverter ready for operation

14 = Final value frequency (in conjunction with relay function 02)
15 = Over Current limit (motor current)
16 = Adjustment for analog set point
17 = ON/OFF – Button activate/deactivate
18 = Minimal Output frequency
19 = Rotation of the periphery
20 = Exit menu with password loc
21 = Exit menu without a password lock

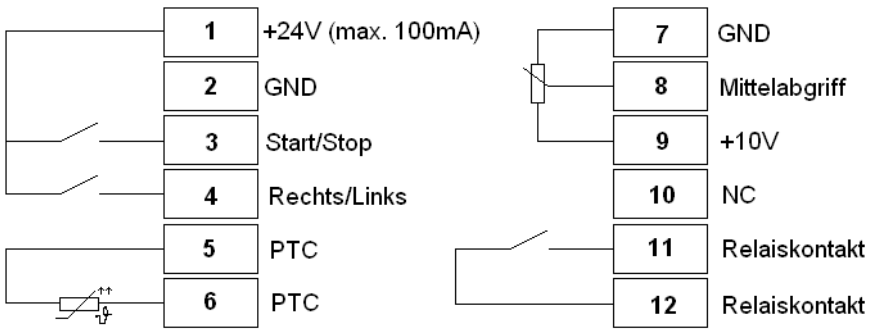
5. Connection diagrams



5.1. Minimum terminal connections

The minimum terminal assignment of the VECTOR Basic is next to the power- and motor cable a bridge of the PTC (terminals 5,6) and a circuit of the start input of 24V (bridging terminals 1 and 3). In the unconnected state of the terminal 4 (right / left-cw/ccw), the motor runs clockwise.

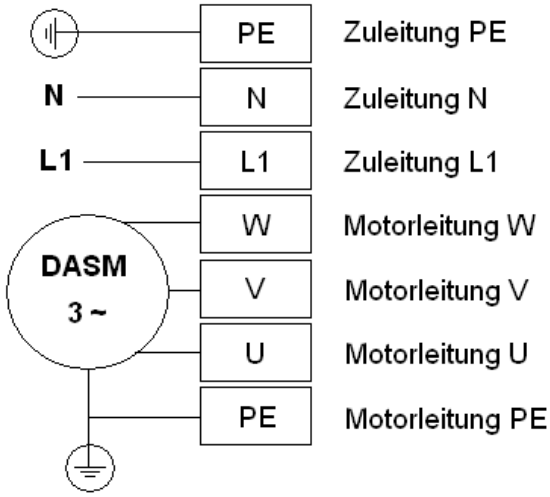
5.2. Wiring diagram control terminal block



The relay contact (NO contact) is to be loaded with max. 200V AC or 30V DC, 2A!

Attention:
The digital inputs (terminals 3,4) are designed for a control voltage range of 12 – 30V!

5.3. Pin assignment Power terminal block



6.0 Explanation of parameters

In the menu of the VECTOR Basic a variety of settings can be carried out.
Pushed by simultaneously holding the Up and Down keys the parameter menu is reached, to make individual adjustments. In the menu itself, there are 17 selections, which are described in the following. Once an adjustment has been made, it can be confirmed and stored by holding down the button Up and Down (7-segment display will flash briefly). While the user stays in the parameter assignment or in the password input, the display flashes with about 7.5Hz. A better overview is given.

6.0 Menu point 00 – Display Software Version

(Read only)

This menu point displays the software version. Number 10 corresponds to software version 1.2. This software version can only be read and not changed.

6.1. Menu point 01 – Running up ramp right (cw)

(Range from 1 to 99 in Hz/s)

From the set ramp results, in relation to the set maximum field frequency, the acceleration time. A ramp describes the field frequency change per unit. A ´steep' ramp is equivalent to a short running-up time. A' flat' ramp is equivalent to a long running-up time.
The set running-up times must always be application-specific, taking into account the physical realities resulting there from. Especially short running-up times can influence the motor stability or cause a switch-off of the inverter due to an excess current. A sensible feeling is also required in the selection of sufficiently long running-up times for large centrifugal masses

6.2. Menu point 02 – Running down ramp right (cw)

(Range from 1 to 99 in Hz/s)

Essentially, the explanations given in the section “Running-up times” also apply here.

When inappropriate short running-down ramps are selected (especially with large centrifugal masses) over voltages in the intermediate circuit can cause a switch-off of the inverter. Since in this state of operation, the rotating field frequency applied to the motor is slightly less than the frequency of the motor shaft, energy will be fed back (generator operation) resulting in an inadmissible increase of the intermediate circuit voltage in the inverter and switches off.

6.3. Menu point 03 – Running up ramp left (ccw)

(Range from 1 to 99 in Hz/s)

Description, see menu point 01.

6.4. Menu point 04 – Running down ramp left (ccw)

(Range from 1 to 99 Hz / s)

Description, see menu point 02

6.5. Menu point 05 – Static Boost

(Range from 0 to 30 in %)

Deviating from the linear V/f characteristics, this voltage increase is specified in percent of the nominal voltage to increase the starting torque at low rotating field frequencies.

With low rotations, the copper resistance of the stator winding strongly influences the operating characteristics of the motor. Without a voltage correction, the breakdown torque is significantly reduced towards low rotating field frequencies. During slow starts, it could happen that the motor does not start due a too high breakaway torque to be obtained. By using a voltage increase - the so-called BOOST - the starting torque is increased. The amount of the BOOST is specified in percentage of the nominal voltage at 0 Hz. Starting at this value, the voltage is continually raised with an increasing frequency and thus approaches the normal (linear) V/f characteristic: V/f = const. A constantly available voltage increase is called ´static BOOST´. The range of the voltage increase extends to about a frequency of up to of 2/3 of the kink frequency. To prevent a torque jump during the transition of the BOOST to the V/f=constant characteristics, all characteristics of the static BOOST end at the V/f characteristic. Good starting torques is achieved with a BOOST setting of 8%. Exaggerated high values results in an increased motor temperature, which may destroy in the destruction of the motor by, overheat, particularly if no separate fan is used. a high BOOST value can also cause an excessive currant, which will likewise switch the inverter off.

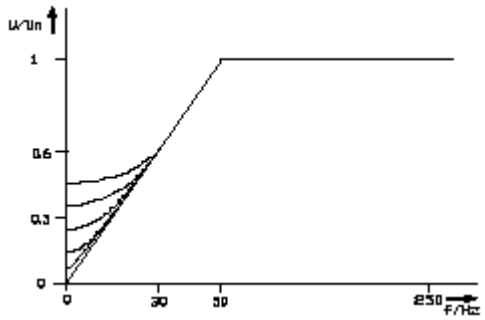


Bild 6.5.1 Output voltage as a function of frequency and boost

6.6. Menu point 06 – Setpoint

The VECTOR offers four basic options for setpoint, which can be set in this menu point. The set point input via the buttons located on the device "Up" and "Down" is standard preset in the factory settings and can be saved with 00 in menu point 06. Under 01 the setpoint input via the analog input is activated. Here, for example, a potentiometer may be connected. By saving a 02 you reach a target value via a pre-fixed frequency. This fixed frequency can be changed under Menu point 10 + 11.

6.7. Menu point 07 – Display representation

Under this menu item the nominal value can be displayed with 00 or the actual value with 01 in operation.

6.8. Menu point 08 – Maximum field frequency

(Range from1 to 99 in Hz)

Previously to be set maximum field frequency, which the inverter should not exceed, even at maximum set point.

6.9. Menu point 09 – Nominal motor frequency

(Range from 30 to 99 in Hz)

Enter the rated frequency of the connected motor in Hz (corner frequency).

6.10. Menu point 10 – Level of fixed frequency right

(Range from 0 to Fmax in Hz)

To be set level of the fixed frequency which should be fixed as set point.
The range is between 0 and the maximum output frequency (maximum of 99Hz).

6.11. Menu point 11 – Level of fixed frequency left (ccw)

(Range from 0 to Fmax in Hz)

See menu point 10.

6.12. Menu point 12 – Factory settings

The activation of the factory setting causes the overwriting of all parameters with factory preset values:

Running up ramp right (cw)	: 50 Hz
Running down ramp right/cw	: 50 Hz
Running up ramp left/ccw	: 50 Hz/s
Running down ramp left/ccw	: 50 Hz/s
Boost	: 5 %
Setpoint	: Pushbutton with setpoint saving
Display setting	: Set point
Max. Output frequency	: 50 Hz
Corner frequency	: 50 Hz
Fixed frequency right/cw	: 0 Hz
Fixed frequency left/ccw	: 0 Hz
Output relay	: Collective fault message
Final value frequency	: 0 Hz/s
Over current value	: 2,0 A
Power ON/OFF – Button	: Activated
Min.Output frequency at analogue	: 5 Hz
Display illustration	: Normal
Parameter menu	: Not password protected

6.13. Menu point 13 – Output relay

This menu point allows conditions to choose when to switch the output relays:

00 = Collective fault message
01 = Set point value is actual value
02 = Actual value equal frequency (Frequency selectable in Menu 14)
03 = Over temperature internal
04 = Rotating field frequency unequal zero (Motor rotates)
05 = Motor over temperature (PTC)
06 = Fault IGBT module
07 = Short circuit motor
08 = Motor over current
09 = DC link overvoltage
10 = Set over current
11 = Frequency inverter ready for operation

6.14. Menu point 14 – Final value frequency

(Range from 0 to Fmax in Hz)

Under the menu point Output relay (menu point 13) it is possible under condition 02, to switch the output relay when a certain frequency output is reached. This frequency can be adjusted in this menu.

6.15. Menu point 15 – Over current

(Range from 0,4 to 2,5A in 0,1A steps)

This menu point allows you to switch off the motor during a permanent over current. This means the value on the 7-segment display shows the current in A (example: xx => x, x A). If the current is continuously (approx. 75 sec) greater than the set value, then it is switched off. This shutdown can only work reliable for motors between 0.12 kW and 0.37 kW. The setting 26 (equivalent to 2.6 A) disables the over current shutdown

6.16. Menu point 16 – Adjustment for analogue set point

This menu point provides for an adjustment for the analogue set point. If required, e.g. an external potentiometer to set to the maximum value and select menu item point 16 and hold down buttons Up / Down together until the display flashes briefly.

6.17. Menu point 17 – ON7Off – activate/deactivate

For operating the inverter, the final stage of the inverter must be released.
This is done by pressing the ON/OFF – button.
In the absence of the mains voltage an uncontrolled running of the inverter is thereby avoided.
If this feature is not desired, the buttons can be deactivated under this menu point.

Selection 00 = ON/OFF – button is deactivated
Selection 01 = ON/OFF – button is activated (factory default)

6.18 Menu point 18 – Minimum frequency for analog set point

(From 0 to Fmax in Hz)

Under the menu point 06 the set point can be adjusted. If an analog set point input is desired, then the set factory minimum output frequency (5Hz) can be changed here.

6.19 Menu point 19 – Turning the periphery

The rotation of the periphery results in a 180° rotation of the 7-segment-display and also the two Up and Down-pushbuttons are reversed. This makes it possible to intuitively operate the peripherals on its head.

Selection 00 = Screen display normal
Selection 01 = Display rotated by 180° and reverse buttons

6.20 Menu point 20 – Password lock

When selecting the menu item 20, the menu will be exit with a password lock. Due to this barrier, the Up and Down buttons are deactivated and can only be unlocked by entering the password (number 43). Both pushbuttons have to be pressed (like for the menu entry) to enable entering a password.

6.21. Menu point 21 – Exit the menu

This selection will exit the menu

7. In- and Outputs

Terminals 3 and 4 are digital inputs and are assigned for the following functions:

Terminal 3: Start / Stop
Terminal 4: Left / Right cw/ccw

7.1. Start/Stop

The activation leads to the release of the pulses. After additionally the inverter has been enabled (buttons "ON / OFF") than this function performs the acceleration of the motor with the set-up time until reaching the set point with the said rotation.
The inactivation affects the running down with the set running down ramp down to the standstill.

7.2. Clockwise/Counter clockwise

In unconnected state the motor is always running right. When activating this function the motor is running counter clockwise. When changing from clockwise to counter clockwise rotation during operation, the motor moves in the current direction of the running down ramp to 0 Hz and accelerates after at the acceleration ramp in the opposite direction of rotation.

8. Motor protection

Despite a high-grade sine modulation, additional losses occur in the motor in powering standard 3-phase asynchronous motors. Even at nominal revolutions, these losses require a power reduction the extent on which essentially depends on the exploitation of the temperature limits of the motor.

For drives of a square counter-torque (e.g. fans) and 50 Hz as maximum rotating field frequency, the imposed power reduction is usually around 0 - 10%.

For drives of a constant counter-torque (compressors, conveyer belts, etc.), the power reduction has to be selected accordingly larger, depending on the range of the adjustment.

To guarantee the safe operation of a motor in the adjustment range, the stationary load torque must lie below the continuous operating characteristic of the motor to guarantee a safe operation of a motor. During operation and starting, the drive will momentarily be in a position to submit or corresponding to the current limitation of the inverter. The setting of the voltage increase (static Boost) essentially determines the maximum torque below 10 Hz. During a continuous operation, an excessive high boost setting for the lower rotating field frequency range (up to 15 Hz) can cause the motor to overheat

A comprehensive thermal protection of the self-cooling motor can be achieved by means of a temperature sensor (e.g. PTC thermistor or thermal time-delay switch) built into the motor.
For revolutions above 120% of the nominal speed, the performance of the motor has to be checked.

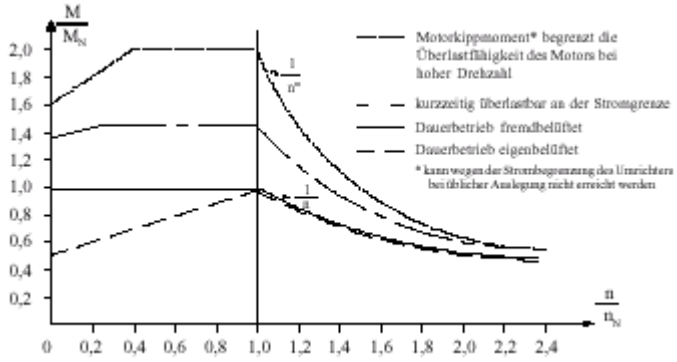


Figure 8.1: Operating characteristics of a frequency-controlled asynchronous machine

9. Technical Data

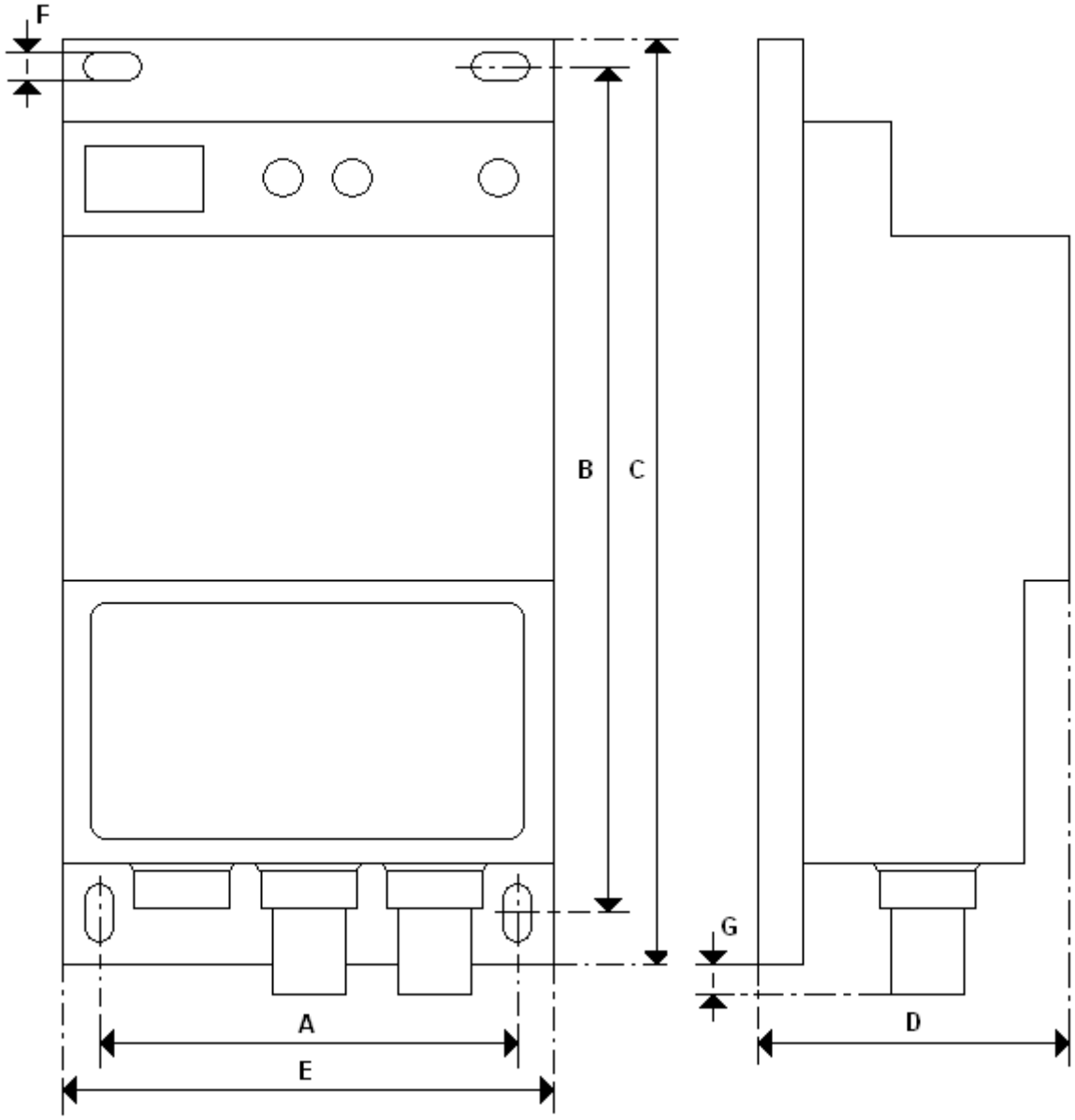
9.1. Electrical Data

	Type	Vector basic 370
Output motor side	Output power of apparatus	0,55 kVA
	Max. Motor power	0,37 kW
	Rated output current	1,95 A
	Max. Output voltage	3 x 230 V
	Output frequency	0 – 99 Hz
	EMC – Filter	Internal
Input Mains side	Nominal voltage	230 V ± 10 %
	Mains filter	Internal
	Mains frequency	50 Hz
	Fusing (no motor protection)	6 A T
General Data	Protection class	IP 44
	Ambient temperature	0 – 40 °C
	Ambient humidity	20 – 90 % rel. Not dewing

Note on the mains filter and RCD:

The leakage caused by the filter network requires a FI - protective switch of the class B.

9.2.Measurments VECTOR-basic - standard



Measurements	VECTOR Basic
A	75,5 mm
B	205 mm
C	220 mm
D	69 mm / 90 mm*
E	104,5 mm
F	5,5 mm
G	11,5 mm

* With Vector Basic with integrated potentiometer or analogue emergency stop

10. Versions- of VECTOR basic

The VECTOR basic is available in following version:

The VECTOR basic - POT is equipped with a set-point potentiometer. This is the setting the motor speed. The push—buttons for speed settings are not in operation.

The order number is: 10 100001 0315.

Please note that this version change the Dimension "D" to the device dimensions due to the potentiometer.

VECTOR basic EMERGENCY STOP is equipped with emergency stop switch push-button.
The VECTOR basic EMERGENCY STOP will be delivered with an all-pole EMERGENCY STOP push-button to switch OFF the mains.

The order number is: 10 100001 0318.

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Please note that this version change the Dimension "D" to the device dimensions due to the Emergency Stop push-button. .

10.1 Options

If a shielded motor cable is necessary (more than 1m length), an optional EMC-kit - are additionally ordered and mounted on the heat sink of the VECTOR basic. This EMC-kit causes a shield connection with strain relief and prevents pigtail connections.

The order number is: 10 100001 0316

11. Error Messages

Errors that occur are shown on the 7 - segment display in abbreviated form. Preceded by an E (error) with a numeral. The digit indicates the currently applied error:

Error number	Meaning
E1	Overcurrent CC
E2	Overvoltage CC
E3	Over temperature internal
E4	Overcurrent HW shutdown
E5	Error IGBT module
E6	Motor too hot (PTC)
E7	Overcurrent set limit

Note: By setting / resetting of the start / stop signal - the error can be reset.

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Notes

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