

User manual

Frequency Inverter VECTOR 54 WT

Frequency Inverter for heat recovery

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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.

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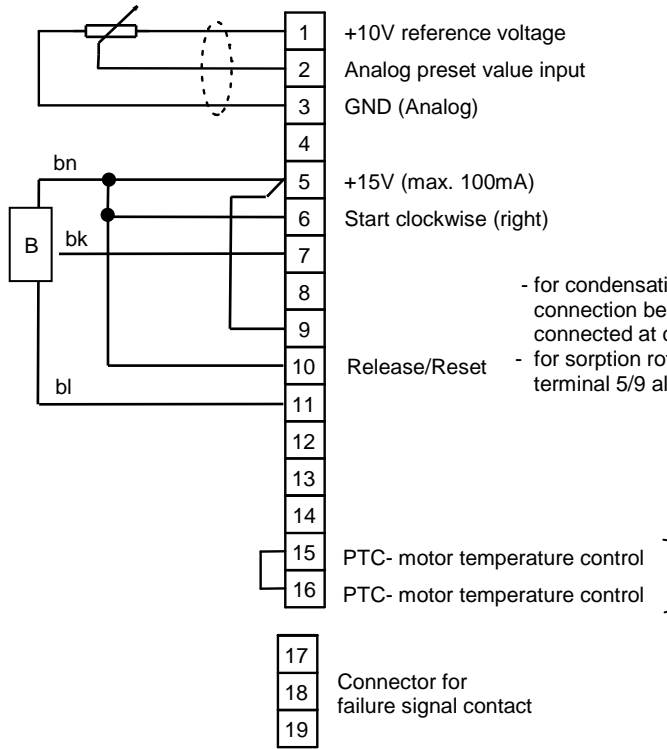
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Terminal-connection

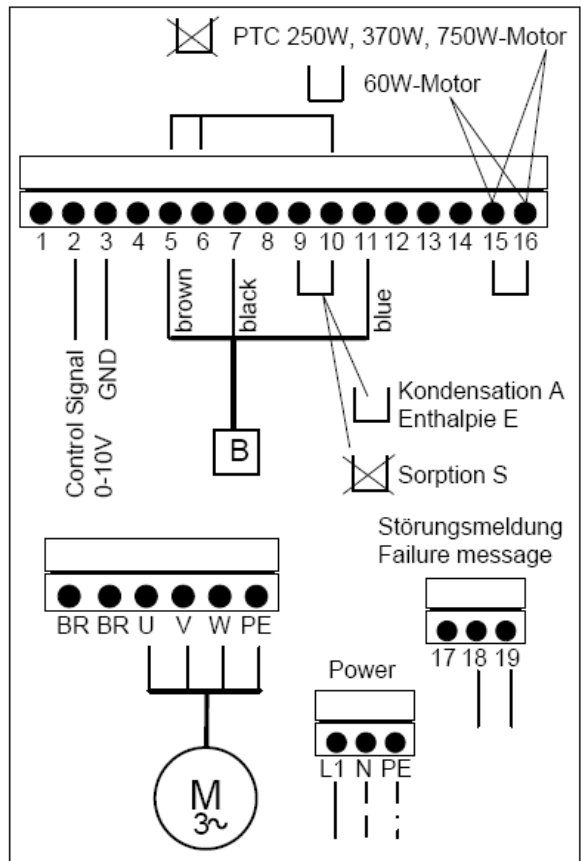
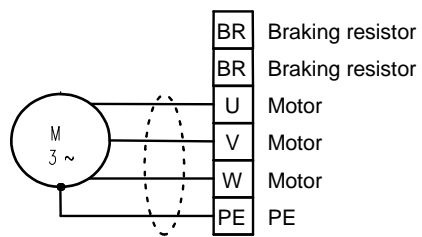
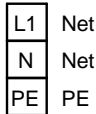
1 Phase



ATTENTION!
Please read this manual carefully and completely. Start with the installation and the commissioning up afterwards.

- for condensation-and enthalpy rotor there must be a connection between terminal 5/9. For lack of space connected at clamp 10 (see sketch below)
- for sorption rotor there is no connection between terminal 5/9 allowed

15/16 connection only when 60W Motor in use otherwise connect the motor cables



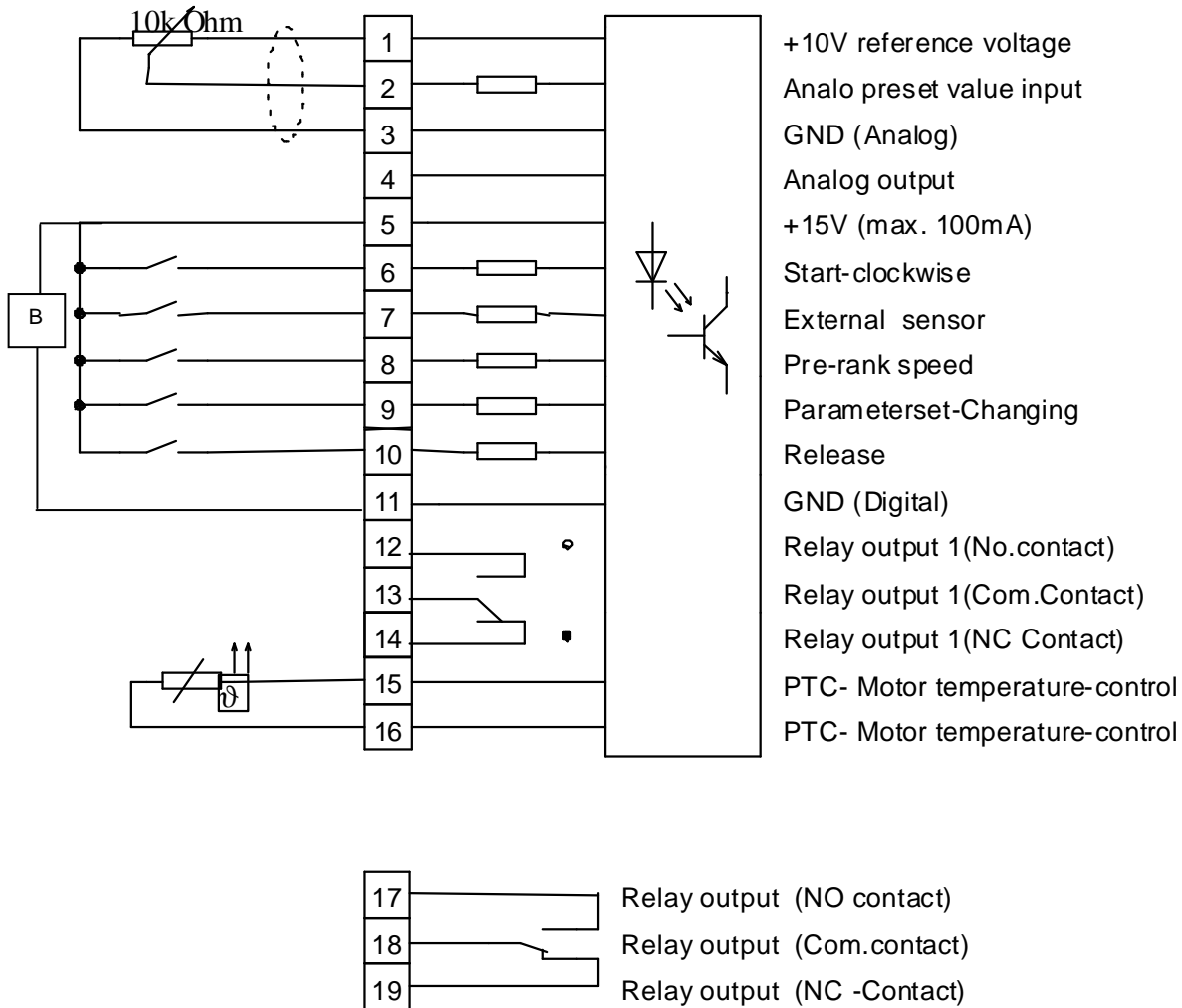
1. Short form of the connection diagram version Hoval

1.1 Terminal allocation scheme of the control inputs

The digital inputs (terminals 6,7,8, 9) are suitable for a control voltage range of 12 – 30V!
 The relay 1 (terminals 12, 13, 14) may cope with max. 30VDC/0.6A, 125VAC/0.3A!
 The relay 2 (terminals 17, 18, 19) may cope with max. 250V AC/0.7A!

R54/370 (Type 370-WT VECTOR IP54)

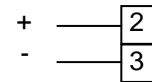
R54/750 (Type 750-WT VECTOR IP54)



Attention: All Motor- and control cables connected to the frequency inverter (apart from sensor for the rotation-control) have to be screened.

1.2 Control Signal

The control signal is to be connected at the pin



The controller is set with a control signal of square 0-10Volt
Other control signals are to be changed with a DIP-Switch

Attention: Do not lay the cable of the control signal parallel to the motor cable!

1.3 Rev setting



The rev has to be set depending on the rotor type.

Type A/E: (Parameter set 2) ' Enthalpie rotor, 10 U/min , you have to build-in a link between terminals 5 and 9

Type S: Sorption rotor, 18 U/min , no link between terminals 5 and 9
(Parameterset 1)

1.4 Setting of the rolling direction

If possible, the drive-belt should lead over the pulley coming from above.

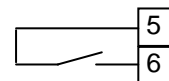
The direction of rotation has as a matter of priority to be taken into account at rotation heat exchangers with washing zone. An arrow then indicates this.

Exchanging two engine phases may change the direction of rotation.

1.5 Rotor start/stop

The rotor is started via terminal 6. The switch has to be included building sided and is controlled via the building automation control.

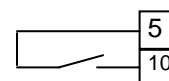
Start:



1.6 Release and reset

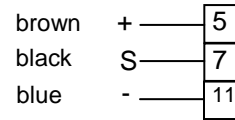
The frequency changer is released by allocation of the clamp 10. A connected terminal 10 is prerequisite that the rotor starts.

Likewise occurring disturbances are acknowledged with a short-time removal of the voltage at terminal 10. The switch has to be included building sided and is controlled via the building automation control.



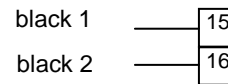
1.7 Rotor run supervision (B1)

The connection of the sensor for the rotor run supervision (B1) takes place at terminals 5, 7 and 11.



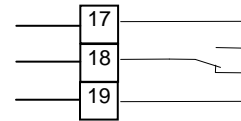
1.8 Thermo safety contact Engine

To protect the engine from an inadmissible overheating at a low rotational speed, the PTC-thermo safety contact of the engine must be attached. The guarantee expires at not attached engine safety contact on the engine.



1.9 Failure message

During operation terminals 17 – 18 of the relay are closed.
At failure or power shut-down terminals 18 - 19 are closed.

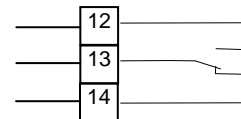


The relay contact may cope with a max. of 250V AC, 7A!

1.10 Message state of readiness

The regulator offers the possibility of distributing the ready status.
If mains voltage is available, the frequency inverter released and there aren't disturbances, the regulator is then operational, terminals 12 and 13 are closed.

The relay contact may cope with a max. of 30V/40mA!



1.11 Precedence speed

If no rule signal is available, the rotor can be turned with a constant speed (40 Hz) for revision purposes. A link between terminals 5 and 8 is used for it.



2. Safety and application instructions for the frequency-inverter

2.1 Danger

As long as any electrical equipment and machinery is switched on, the operator should not touch voltage cabling and non-isolated conductors or rotating parts when he removes the covers and the prescribed protections, in handling the machine improperly, or during service work or improper use, and may well cause personal injuries and 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. VENELEC 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).

Always electrically isolate and lock of the equipment before carrying out maintenance

2.2 Intended Usage

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

The commissioning of the frequency inverters is prohibited until it is ascertained that the machine that includes the frequency inverters follows the restrictions of the EU directive 89/ 392/ EWG (machine directive).

The frequency inverters meet the requirements of the low voltage directive 73/ 231/ EWG and the harmonized norms of the series prEN 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 (89/ 336/ EWG).

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.

2.3 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.

2.4 Installation

Installation and cooling of the devices must be according to the specifications of the concerning documentation.

The frequency inverters must be secured from improper operational demands. Take care to not bend electronic devices and/or change isolation distances. Avoid touching electronic elements and contacts.

Frequency inverters contain electrostatic imperiled elements. Improper handling may easily destroy these elements. Inbuilt electrical components must not be destroyed (health and safety risk in certain circumstances).

2.5 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 laying of cables are to be found in the documentation of the frequency inverters.

2.6 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.

2.7 Maintenance and servicing

The documentation of the manufacturer has to be regarded.

2.8 Safety and Installation considerations

Frequency inverters from MSF-Vathauer 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.
- The frequency inverter must not be operated without effective ground connection that fulfils the local directives for high leakage current (>3.5mA).

- At rotating current frequency inverters common FI circuit breakers as single protection are not applicable when the local directives do not allow a possible direct current component in the error current. The standard FI circuit breakers have to fulfill the new construction type acc. VDE 0664.

Attention! Danger to Life!

The power supply conducts voltage under certain circumstances for up to 5 minutes after turning off the mains voltage. Inverter terminals 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 F-D vector 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.

3. Assembly and Installation

3.1 Installation

The devices require adequate ventilation. Here are recommended values above and below the frequency inverter valid (above >100mm, below >120mm= free area).

Electrical parts (e.g. cable trench, contactor etc.) may be built within these limits. These objects recommend a minimum distance from the inverter depending on the height. This minimum distance is 2/3 of the object height. (Example: cable trench height 60mm → $2/3 * 60\text{mm} = 40\text{mm}$ distance). The build-in direction of the frequency inverter is principally vertical.

The hot air has to be dissipated above the inverter!

3.2 Cabling directives

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 earthing 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) is 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 guarantee 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, **where the dejam devices have to be connected at the contactor coil**. The dejamming is especially important when the contactors are controlled by the relays in the inverter.
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 switching 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!

3.3 Measures to secure the EMC

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

3.4 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). Parasitic current inductance and low-impedance potential compensation are important measures to reduce electromagnetic influences.

3.5 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. This is why, mains-filter and output chokes have been integrated into the FD Vector, and have, in fact, reached the EMC conformity. Additional, external filter may have a negative effect on the noise emission.

3.6 Screening

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.

3.7 Coupling into motor cables

The use of twisted core cables can essentially reduce inductive couplings into a circuit. Capacitive, inductive and electromagnetic interferences must be reduced by cable screens. 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!!!

4. Technical features

The Vector is a frequency-inverter with a modulated attachment, which in its basic offers excellent market value for goods by using simple applications. With extra integrated modules it can be alternated for a controlled drive with vector-control or upgraded to a positioning type.

Higher torque in the lower performance area, lower temperature development as well as extended technical improvements for the user are only a part of the technical features. Protection against under- and overload, short circuit as well as the voltage system inverters are additional features.

The centre piece is a 16-bit signal processor with an internal flash for the renewal of the pulse and control-technique-duties.

Voltage system inverter for heat exchangers with sensor less drive-belt rips recognition.

At the predecessor model at least one to approx. 8 attenuators had to be distributed over the perimeter of the warmth wheel to state the running of the wheel by means of the procedures of the attenuators and inductive givers. When attaching the attenuators the right distance to the inductive giver had to be respected, what was often difficult because of a slight height blow of some wheels.

At the Vector the wheel is tested in periodical distances sensor less on drive-belt rip by means of a special procedure.

The test interrupts the predefined run of the wheel in the following way:

- 1.) Low run at the low seat pan adjusted in the current parameter sentence.
- 2.) Test on drive-belt rip (as a rule, the wheel stops)
- 3.) High run at the high seat pan adjusted in the current parameter sentence to approx. 60 Hz
- 4.) Low run at the low seat pan adjusted in the current parameter sentence
- 5.) Further operation of the normal mode

However, the VECTOR still offers the possibility of supervising the rotor run with an external sensor.

The practical design offers the following advantages:

- ☞ Different installation positions optimize the installation, and minimize the space requirement in the switch cabinet
- ☞ Integrated braking chopper

A plug-on type operator interface for different installation positions offers the following advantages:

- ☞ 3-line LC-display
- ☞ plain text display
- ☞ on-line parameterization

High operational safety due to:

- ☞ aluminum cases and standard input/output filters provide high noise immunity and only slight-noise emissions
- ☞ short-circuit protection (conditional)
- ☞ set value input isolated from potential
- ☞ the new CCDS-SYSTEM (current-control dynamic scan) prevents the inverter from switching-off at short time excess current flow (e.g. dynamic acceleration)

4.1 User interface

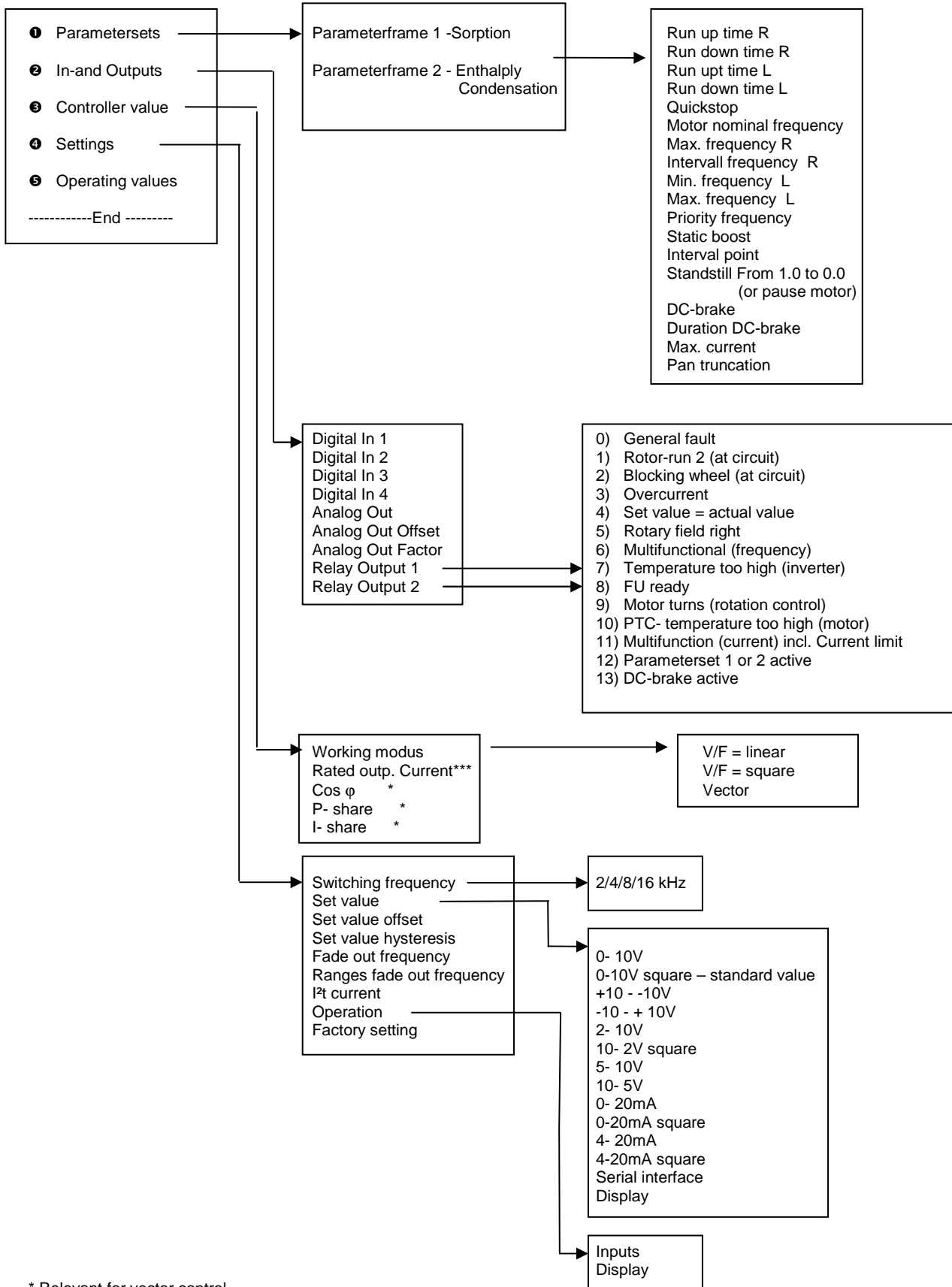
The Vector is available with integrated and pluggable user interface.

At the devices without integrated user interface this is available as an option.

For plug-in you open the great M40-screw joint at the upper lid. Beneath there is a RS232 socket for the PC connection and a 10-pin contact strip for the user interface. Put the plug of the user interfaces on the pin contact strip, so that the nose of the plug points up to the D-type socket.

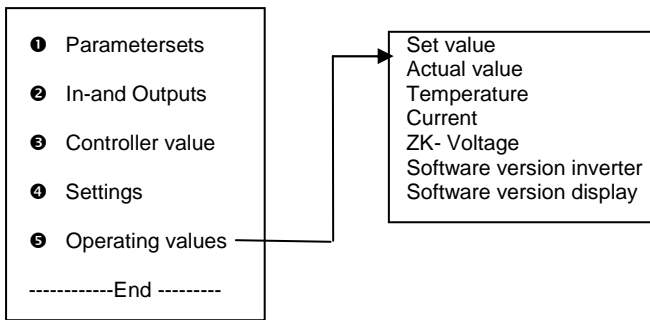
For changes of certain parameters you select the desired parameter as shown in the menu structure. The value can be changed by pushing the OK key and using the up/down keys. Storing is made by the OK key once more.

5. Menu structure



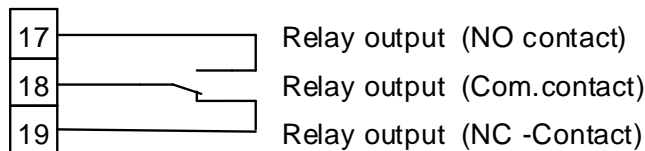
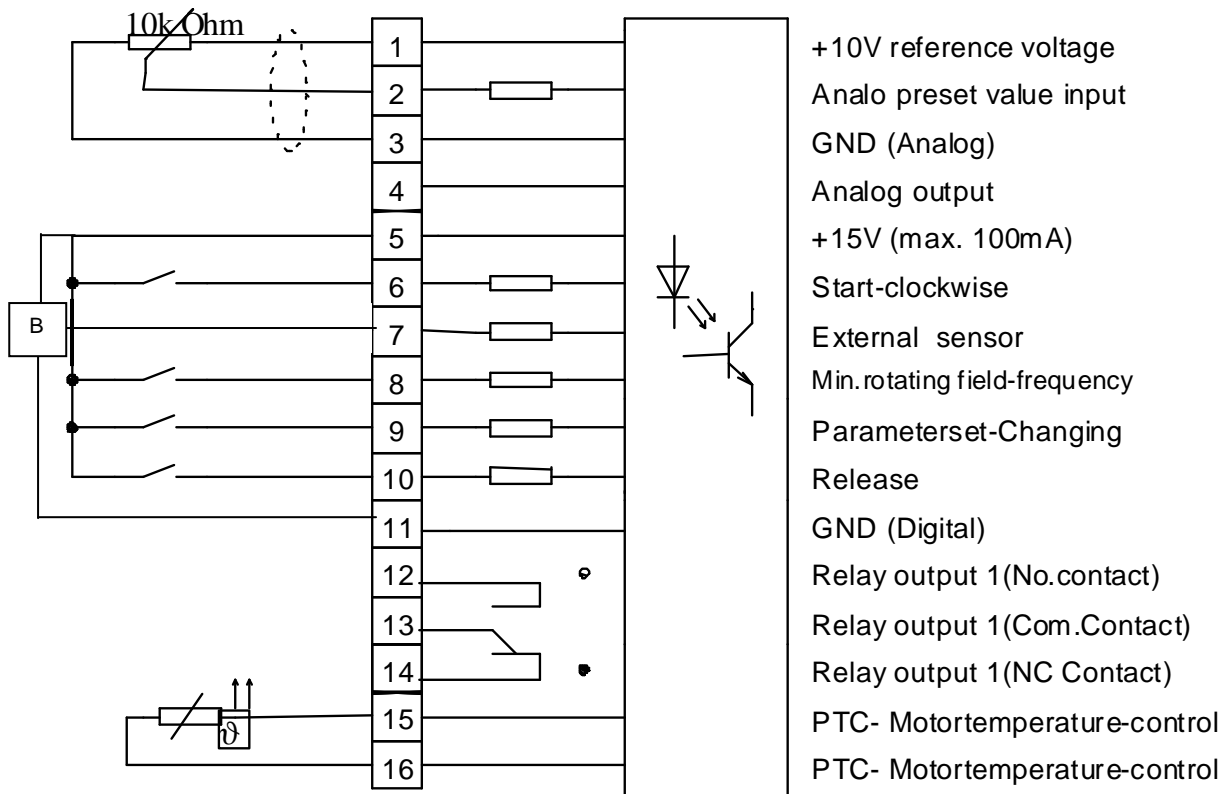
* Relevant for vector control

*** Relevant for vector control and drive-belt rip recognition



6. Connection

6.1. Connection I/O- Module



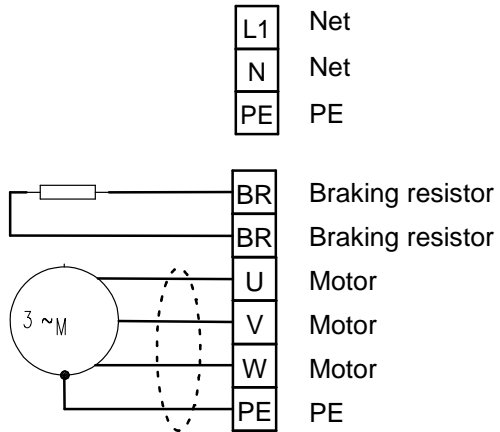
The Relay-contact 1 can be loaded at max. 30VDC/0,6A, 125VAC/0,3A!

The Relay-contact 2 can be loaded at max. 250VAC/7A!

Attention: The digital-inputs (terminals 6,7,8,9) are designed for a control voltage of 12 – 30V!

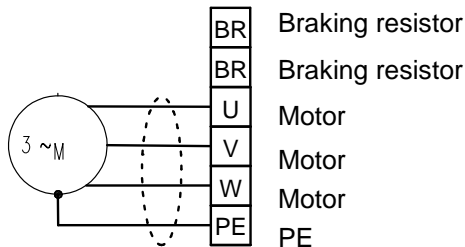
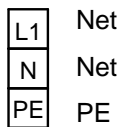
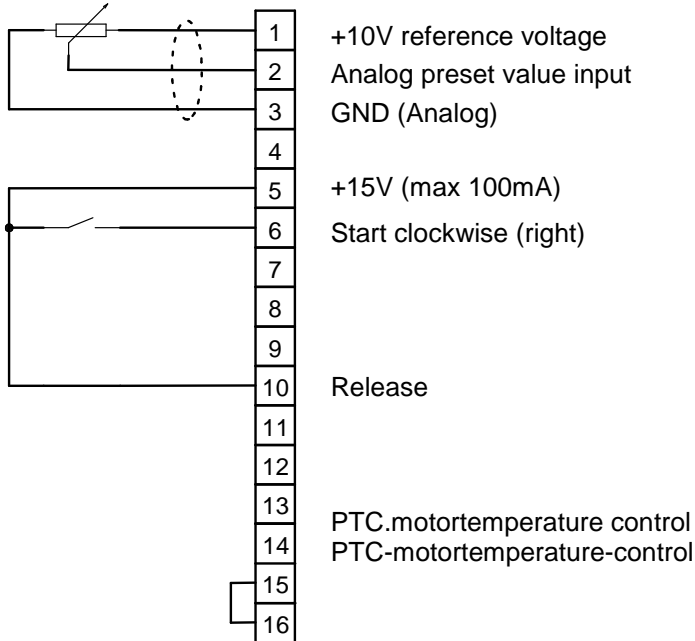
6.2 Power unit

Single phase



6.3 Minimum terminal-connection

Single phase



The above drawing shows the min. required terminal-connection of the digital inputs.

7. Programmable parameter sets

Two independent parametersets are available for the parameterization, in which the running-up,- running down-time as well as the min.-and max. rotating field –frequency for the right- and left rotation can be adjusted separately.

General note: Left rotation isn't provided at this model. Rotation change is carried out via mixing up the engine phases instead!

7.1 Running-up time

The high run of the wheel by means of an even acceleration is accounted as the ramp. A prolongation of the ramp is made by the reduction of the ramp steepness. A shortening is made by the rise of the ramp steepness ($\frac{Hz}{s}$ - high Hz value - short ramp, low Hz value - long ramp). At a short ramp, the final torque of the wheel is reached faster.

The quotient: maximum frequency/running-up time yields the so-called ramp. This designates the change of the rotating field frequency change per time 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.

The running-up times are separately adjustable for clockwise turnings.

7.2 Running-down time

The low run of the wheel by means of an even deceleration is accounted as the ramp. A prolongation of the ramp is made by the reduction of the ramp steepness. A shortening is made by the rise of the ramp steepness ($\frac{\text{Hz}}{\text{s}}$ - high Hz value - short ramp, low Hz value - long ramp). At a short ramp, the standstill of the wheel is reached faster.

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) overvoltage 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.

If the special application does not admit longer running-down times, use a braking chopper to reduce the excessive intermediate circuit voltage.

The braking chopper will convert the energy produced in the generator operation into heat losses.

The running-down times are separately adjustable for clockwise turnings.

7.3 Fast stop

The low run of the wheel by means of an even deceleration is accounted as the ramp. A prolongation of the ramp is made by the reduction of the ramp steepness. A shortening is made by the rise of the ramp steepness ($\frac{\text{Hz}}{\text{s}}$ - high Hz value - short ramp, low Hz value - long ramp). At a short ramp, the standstill of the wheel is reached faster.

7.4. Motor frequency

Input of the frequency in Hz of the connected motor. See Ident-notice of the motor

7.5 Minimum rotating field frequency

The minimum rotating field frequency to be set in advance below which the inverter should not drop even if the lowest set value is applied to the analog input. The minimum rotating field frequency is separately adjustable for clockwise turnings.

Attention:

Only a pre-setting of a **min. frequency of 0 Hz** will result in a frequency of 0 Hz with an applied set value of 0 volt. With a set frequency above 0 Hz, a frequency of 0 Hz can only be obtained via a STOP.

7.6 Maximum rotating field frequency

The maximum rotating field frequency to be set in advance which the inverter should never exceed even if the highest possible set value (admissible range: 0 V to 10 V) is applied to the analog input. The maximum rotating field frequency is separately adjustable for clockwise and counterclockwise turnings.

7.7 Static boost

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: $V/f = \text{const}$. 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 $V/f = \text{constant}$ characteristics, all characteristics of the static BOOST end at the V/f characteristic. Good starting torques are achieved with a BOOST setting of 8%. Exaggerated high values result in an increased motor temperature which may destroy in the destruction of the motor by overhear, particularly if no separate fan is used. a high BOOST value can also cause an excessive curreant, which will likewise switch the inverter off.

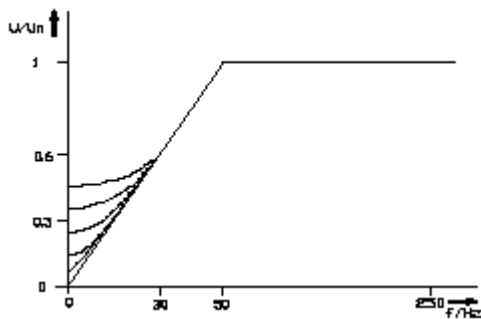


Figure 6.7.1 Standardized output voltage as a function of frequency and boost

7.8 Interval operation, downtime

If the set point drops below the value set under 'interval point' in the menu parameter set 1/2, the interval operation starts. This means periodical running for approx. 8 seconds with the rotating field frequency adjusted under interval frequency alternately with the downtime adjusted in the same menu A downtime of '0' causes deactivation of the interval operation.

A downtime of '0' causes deactivation of the interval operation

7.9 Test with sensor on rotor run supervision

In the corresponding parameter set, the parameter "external sensor" has to be set to '1'. The tripping time is dependent on the rotational speed of the rotor. At a high rotational speed, the triggering is faster than at a low rotational speed. I.e. At registration of an impulse triggered by an attenuator of the inductive giver a time dependent on the rotating field frequency available at this moment passes, after which a renewed impulse must be entered to not let go the voltage system inverter in malfunction. The time is graded in 10Hz steps. E.g. at a rotating field frequency above 100Hz, the time amounts 2 min., with lower than 10Hz it is 20 min. At rotational speed of '0', the internal time triggering is interrupted to prevent the system shutdown at specification of extremely long downtimes and only very short running times.

7.10 Current limit

At exceeding of the current limit set in the particular parameter sets the rotary field frequency is reduced to a value where the motor current is within the set current limit. The reduction may happen to a rotary field frequency of up to app. 8Hz.

7.11 External sensor

If the rotor blockade res. the drive-belt rip recognition should not happen sensor less, you have to connect a sensor, which is activated in the LCD, to the according digital input.

7.12 Test period

The interval for the drive-belt test can be adjusted parameter sentence depending in the menu item 'test period' in steps from 0.1 days up to 25 days. **The setting '0.0 days' means: no tests take place!**

Prerequisite for a faultless test is the setting of the 'engine nominal current' (to take from the engine type signpost) in the menu 'regulator values'.

A considerably too low setting of the engine nominal current tends to no rip recognition.

The test is carried out at assigned release independently of the present operating state in periodical intervals and interrupts this for a short time.

The first test is carried out at assigned release at power on within one minute. If drive-belt rip is determined, the engine is stopped and an error message (rotor standstill) is carried out. The error message can be moved back by a short-time removal of the release [10] or by disconnection of the voltage system inverter of the net.

7.13. Blocking current

Test on wheel blocking

The test on drive-belt rip a test on blocking of the wheel follows. To this end the motor is operated with a rotating field frequency of 60Hz and after reaching it the phase current is checked.

If this is greater or equal to that entered in the chosen parameter set under 'blocking current', the motor is stopped and the error message ('wheel blockage') is carried out.

Attention!!!

Beforehand, it is absolutely essential to detect the current consumption of the motor at 60 Hz at a.) normal operating conditions and b.) wheel blockage, to e.g. determine the mean average value from both as the shut-down current, which is entered under 'blocking current'!

Note: If the motor comes to a halt as the same time as the wheel blocking, a considerably larger current difference, which fundamentally makes the setting process easier, will be the result.

Important notes: Within a minute after the power-on -if appropriately parameterized- the first test is carried out regarding drive-belt rip and rotor blockade. Wrongly entered parameters which inevitably permanently lead to an error message (particular wrong height of the blocking flow 'for the determination of the rotor blockage and false setting of the nominal current' for the determination of the V-crack '), it is recommended to carry out all settings without release (0 volts at terminal 10) undisturbed.

An error message is reset by removing the release. Pressing the button 'up pointing arrow' moves the LC display back at taken release so that the error message disappears. After setting the release, the test is repeated within one minute, so that in the presence the events can be tracked.

8. In- and Outputs (I/O-Module)

8.1 Digital Inputs

The pins 6,7,8 and 9 are digital inputs and are assigned with the following functions

Clockwise start (right)

Counter clockwise start (left)

Minimum rotating field frequency fmin

Parameterset changeover 1-2

8.2. Min rotating field frequency

At high level at input -8- and present release, independently of the function start right, the rotating field frequency parameterized under 'pre-rank frequency' in the parameter set 1 res. 2 is laid.

8.3 Parameter set changeover 1-2

The current parameter set is chosen through the digital inputs. A parameter set wanted by wiring the corresponding inputs is taken over online.

8.4 Clockwise rotation start

If this function is activated, it will cause the motor to run up to speed at the set running-up time specified in the selected parameter set until the set value is reached and in the specified direction. Deactivation at an inactive Start will cause a run-down at the set ramp of the selected parameter set down to a standstill. If the ramp of the corresponding parameter set is deactivated, the shaft is immediately released.

8.5. External sensor

Connection of an external sensor if wheel blockade res. drive-belt rip recognition should not happen sensor less.

8.6 Release

Activating this input -10- initializes the control and the power circuit of the inverter to make it ready to operate state. The opening of the input immediately releases fast-stop function, whose running-down time is set in the parametersets.

8.7 Analog Output

The analog output can be connected with different functions like e.g. the rotary field frequency in 1/10 Hz (address 38). The complete list of analog output functions is to be found in the appendix.

8.8 Analog Output Offset

This function allows you to shift the output voltage of the analog output from the zero point.

8.9 Analog Output Factor

This function spreads the output voltage for a configurable factor.

8.10 Digital Output

The relay output 1 and 2 can be set with the following functions:

- 0) Sum error message
- 1) Rotor standstill
- 2) Wheel blockade
- 3) Overcurrent
- 4) Set point = effective value
- 5) Rotary field right direction
- 6) Multi-function (frequency)
- 7) Overtemperature inverter
- 8) FU ready for operation
- 9) Motor turning (zero observation)
- 10) PTC overtemperature (Motor)
- 11) Multi-function (current) incl. current limit
- 12) Parameter set 1 or 2 active
- 13) Direct current brake active

Note: It has to be taken into account that at the drive-belt rip test the rotating field frequency is varied and therefore also the exits react correspondingly: Multifunction, analog output, set point = actual value, engine turns!!!

9. Controller values

9.1 Working mode

A selection can be made between the linear V/f characteristic (with the output voltage proportional to the rotating field frequency) and the square characteristic ("fan characteristic" with a squared output voltage

increase in relation to the rotating field frequency). The reference point is the kink frequency. As a third option is the usage for Vector-control

9.2 Motor-nominal-current

Input of the motor-nominal-current according to the rating plate of the connected DC-motor

9.3 Motor Cos Phi

Input of the power factor according to the rating plate of the connected DC-motor

9.4 P section

Setting of the P section of the PI controller, which only affects the VECTORCONTROLLING

9.5 I section

Setting of the I section of the PI controller, which only affects the VECTORCONTROLLING

Note: To ensure the correct function of the frequency inverters, the motor nominal current, the G/ratio Cos φ and the motor nominal frequency must be according to the rating plate of the connected motor!

10 Settings

10.1 Switching (clock) frequency

The frequency, be which the inverter of the power circuit is switched.

The following values are possible: 2, 4, 8, and 16 kHz.

Annotation: With the exception of 16 kHz, the switching (clock) frequency will be noticed as a more or less loud secondary noise. The lower the switching (clock) frequency, the lower the switching power losses in the power circuit, the less the inverter will warm up. The best motor characteristics are achieved from 2 kHz upwards. The switching (clock) frequency of 16 kHz should only be used in exceptional cases due to the increased heating of the inverter. If this is used a sufficient ventilation of the inverter must be guaranteed and the power may have to be reduced.

10.2 Set Point Specification

In the menu 'set point specification' a square reference can be produced between an analog set point specification with reference to f-max and the resulting rotating field frequency with the choice of a square set point specification.

Example:

f-max=100Hz

Analog set point: 0 V 2,5 V 5,0 V 7,5 V 10 V

Set point (linear): 0 Hz 25 Hz 50 Hz 75 Hz 100Hz

Set point (square): 0 Hz 6,2 Hz 25 Hz 56,2Hz 100 Hz

The actual value of the rotating field frequency follows the set point regarding the current ramp.

Regardless of the setting of the preset value in the menu structure a setting **must** also be done with the DIP-switch on the I/O-module according to the following table.

Type of Set value	S1	S2	S3	S4	S5
0...10V	On	Off	Off	On	Off
-10...+10V	Off	On	Off	On	Off
0...20mA	On	Off	On	On	Off
4...20mA	On	Off	On	On	Off
0-100kHz	Off	Off	Off	Off	On

The preset value of the inverter must be wired regardless of which preset value specifications is selected.

10.3 Set value - Offset

Offset Specification (e.g. to compensate for parasitic noise).

Figures in the following two diagrams show how the original characteristic is influenced by a positive or negative offset.

The setting of the set value offset follows in steps of 0.1 Hz.

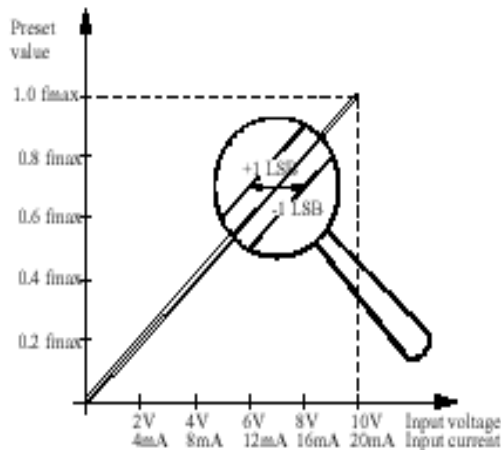


Figure 8.3.1
Preset value offset at a
preset assignment of
0-10V, 0-20mA

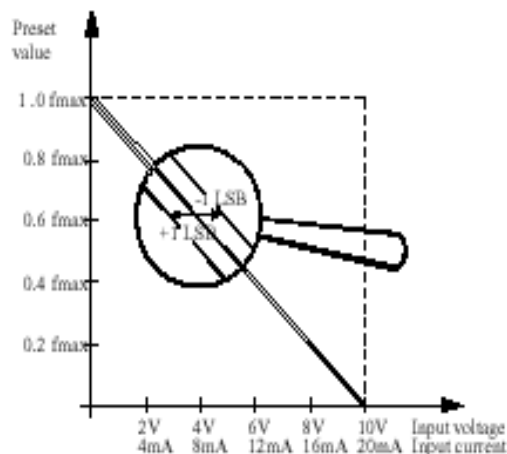


Figure 8.3.2
Preset value offset at a
preset assignment of
0-10V, 20-0mA

10.4 Set value - Hysteresis

The set hysteresis value is used to stabilize the specified rotating field frequency.

10.5 Fade out frequency1, fade out frequency2

To suppress resonance effects in drive systems, a frequency range can be defined in which no stationary operation will be possible. The definition of a frequency range is made by means of programming a fade-out frequency ± 2 Hz. A reference value specification within this range causes an offset of the actual value (refer to figure 9.5.1) above or below the limit frequencies.

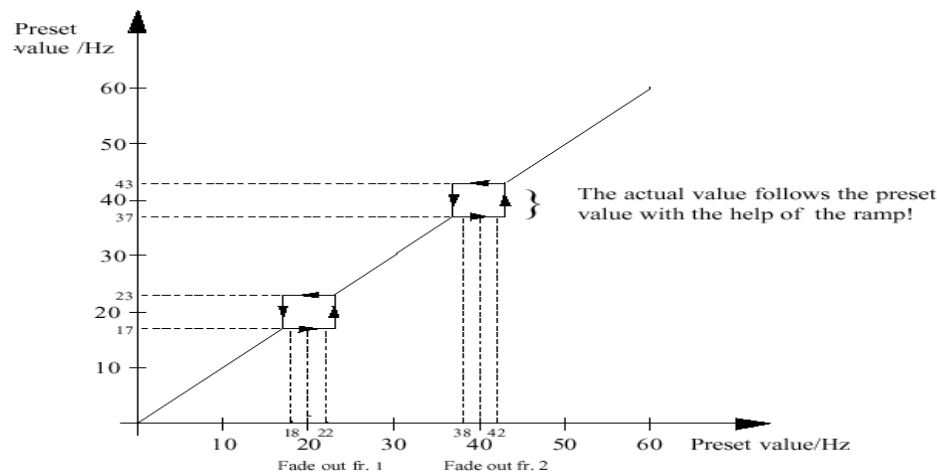


Figure 10.5.1 Rotating field frequency by use of the fade out frequencies

10.6 I²t current

The I²t function is used to avoid a thermal overload of the motor, and/or to avoid a motor operation over an extended period of time in an unintended operating status (e.g. shaft blocking). For this purpose, the current value must remain above the normal operating status. A long period of time must be entered accordingly to avoid a shutdown of the inverter caused by short current peaks.

10.7 Regulation

This menu item regulates the setting if the frequency inverter runs through the I/O-module or the display

10.8 Factory settings

The factory setting is activated by the display and causes an overwriting of every parameter with the preset factory values.

11. Operating values

The "Operating values" menu item enables an operation status request with regard to the following visible messages:

12. Application notes

12.1 Dynamic braking with a brake chopper

The built-in brake chopper equipped with an external braking resistor enables dynamic braking of large masses and does not initiate a switch-off of the inverter.

When braking a centrifugal mass at a relatively short running-down time (brake time), the mass inertia of the entire drive works as a generator torque.

This braking operating is equivalent to an energy feedback of the drive resulting in a temporary circuit voltage increase up to the point where the excessive voltage switch-off is initiated.

By routing this brake energy into a resistor, the switching off can be prevented.

The brake chopper compares the temporary circuit voltage with a reference voltage which has a voltage level below the over-voltage tripping level. When the reference voltage is exceeded a power transistor connects the braking resistor to the temporary circuit voltage. The resistor then converts the power generated by the motor into a heat loss.

The brake power can be calculated as a function of the activation time (ED) of the braking resistors.

Thus the brake chopper can be individually adapted to the drive.

If a brake resistor is used for braking, the braking energy is usually dissipated equally via the master and the slave (no coupling).

Recommendations for the selection of brake resistors

Vector	Resistor	Peak power	I _{max}
370	100Ω	1kW	2,5A
550	100Ω	1kW	2,5A
750	100Ω	1kW	2,5A

The resistors used must be suited to the current and the peak power. The electric strength of the resistors must be 1000V.

The necessary average braking power is calculated from the peak and the operating time of the chopper.

$$\text{Nom. power (W)} = \frac{\text{operating-time ED (s)} * \text{peak power (W)}}{\text{Cycle time (s)}}$$

The practice showed that for most applications, resistors with a nominal continuous power of 60 Watts are sufficient.

12.2 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 torque 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.

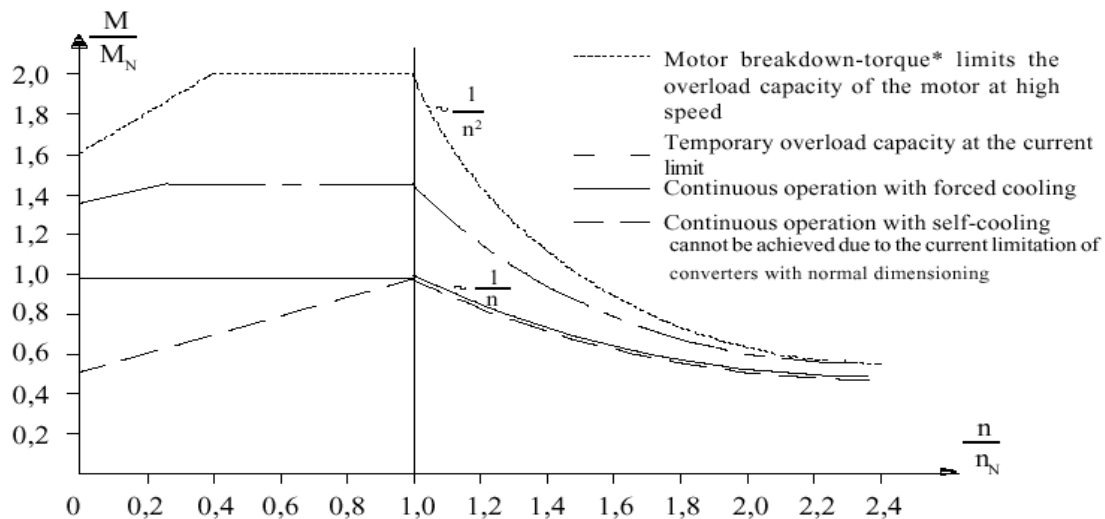
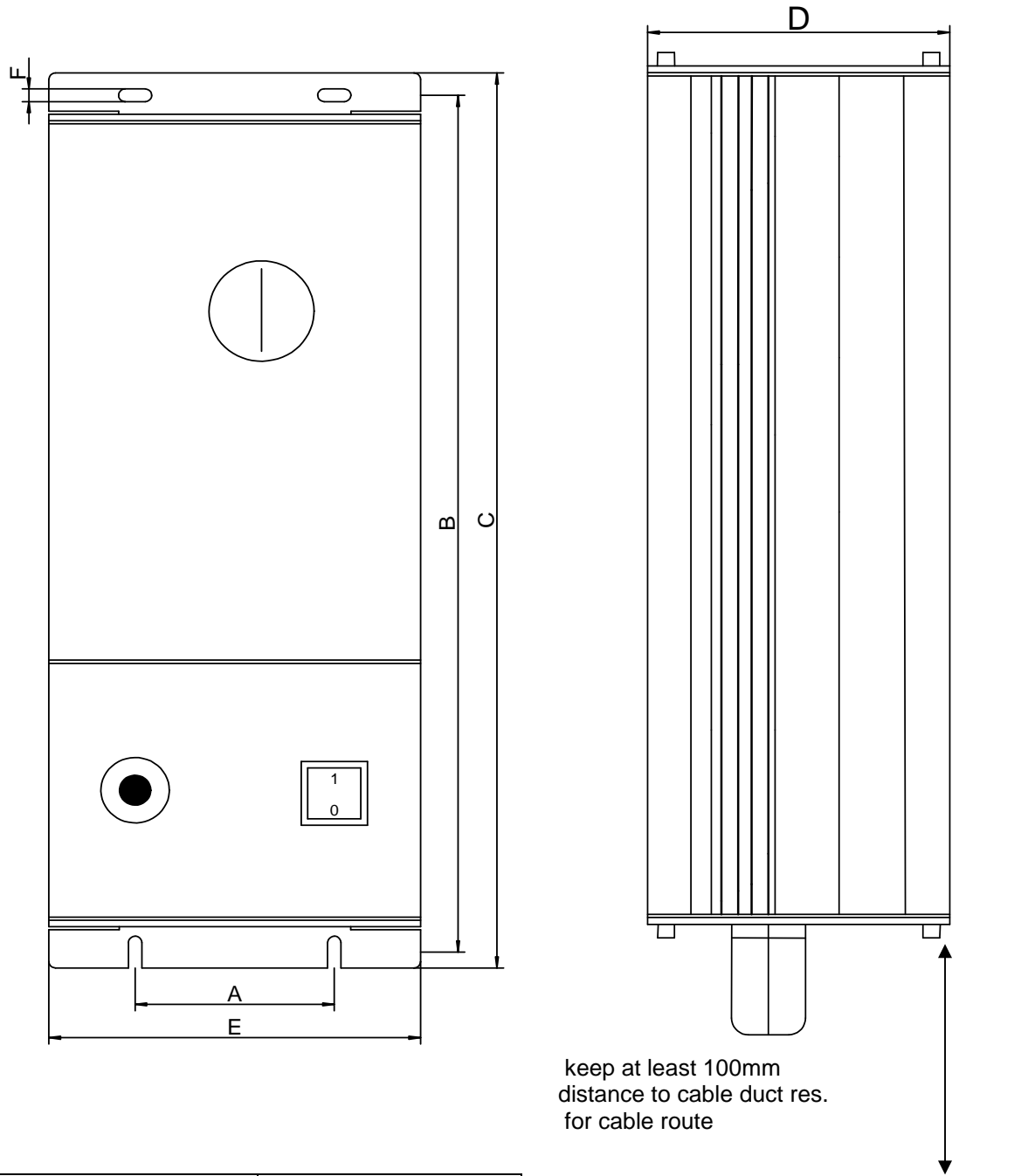


Bild 12.2.1 Operating characteristics of a frequency-controlled asynchronous machine

13. Technical data

	Type	Vector 370/2-1-54-G1-WT	Vector 750/2-1-54-G1-WT
Output motor side	Output power of apparatus	KVA 0,85	KVA 1,6
	Max. motor power	0,37 kW	0,75 kW
	Rated output current	2,2A	4,0 A
	Max. output voltage	3 x 230 V	
	Output frequency	0 – 400 Hz	0 – 540 Hz
	Output choke	Internal	Internal
Input Mains side	Input voltage	230V±15%	230V ± 15%
	Mains filter	Internal	Internal
	Mains frequency	50 / 60 Hz	50 / 60 Hz
	Fusing (no motor protection)	6 A T	8 A T
General Data	Protection class	IP 54	IP 54
	Ambient temperature	0 – 40 °C	0 – 40 °C
	Ambient humidity	20 – 90 % rel. Not dewing	20 – 90 % rel. Not dewing
	Power loss	Ca. W 35	Ca. 45 W
	Power reduction at 16 kHz: Installation height above 3000m 1% per 100m		

13.1 Measurements



Measurements	FD Vector 54
A	65 mm
B	270 mm
C	282 mm
D	90 mm
E	112 mm
F	5 mm

14. Annex

14.1. Parameterset 1 and 2

Characteristics	Value range	Parameter set 1 sorption rotor without bridge CI.5-9 Default setting	Parameter set 2 Condensation rotor/ Enthalpie rotor with bridge CI.5-9 Default setting
Run.-up time right	0,1 – 1000 Hz/s	1,5 Hz /sec	1,5 Hz /sec
Run-down time right	0,1 – 1000 Hz/s	1,5 Hz /sec	1,5 Hz /sec
Run-up time left	0,1 – 1000 Hz/s	1,5 Hz /sec	1,5 Hz /sec
Run-down time left	0,1 – 1000 Hz/s	1,5 Hz /sec	1,5 Hz /sec
Faststop	0,1 – 1000 Hz/s	1,5 Hz /sec	1,5 Hz /sec
Motor nominal frequency	0 – 400 Hz	50 Hz.	50 Hz.
Interval frequency right	0 – 400 Hz	7 Hz.	7 Hz.
Max. frequency right	0 – 400 Hz	92,0 Hz.	50,0 Hz.
Interval frequency left	0 – 400 Hz	- 7 Hz.	- 7 Hz.
Max. frequency left	0 – 400 Hz	- 92,0 Hz.	- 50,0 Hz.
Priority frequency	0 – 400 Hz	40,0 Hz.	40,0 Hz.
Static boost	0 – 30 %	18 %	18 %
Interval point	0 – 30 Hz	5 Hz.	5 Hz.
Standstill	0 – 30 Min	1 min	1 min
Test period	0,0 – 25,0 Days	0	0
Blockade Current	0 – 30 A	0,8 A	0,8 A
Current Limit	0 – 100 A	20,0 A	20,0 A
External Sensor	0, 1	1	1

14.2. In -and Outputs

Characteristics	Variables	Factory settings
Digital input 1	Start right	Start clockwise (right)
Digital input 2	External Sensor	Start counterclockwise (left)
Digital input 3	Minimal frequency	Minimal frequency
Digital input 4	Parameter set changeover 1-2	Parameter set changeover
Analog output	36,38,40,41,57,58,59	38 (Actual rev.)
Analog output Offset	1- 1024 Bit	0000 Bit
Analog output factor	1- 9999	1139
Digital output 1 Pin 12/13/14	Sum error message Rotor standstill Wheel blockade	Sum error message (Relay output 2)
Relay output 2 Pin 17/18/19	Over current Set value = Actual value Rotary field right Multifunction (frequency) Over temperature FU stand by Motor turns (zero observation) Over temperature motor (PTC) Multifunction (current) Parameter 1 / 2 activated DC-brake activated	FU stand by (Relay output 1)

14.3. Error messages

Occurring errors are shown on the LCD in plain text res. by means of the blinking red LED.

The red LED blinks according to the at this time present error for a certain amount of times followed by a short break and then starts all over again with the blinking cycle. The following error assignments are available

Label	Value range	
red LED	2*blink = Rotor standstill 3*blink = Wheel blockade 4*blink = overtemp. engine (PTC) 5*blink = overtemp. inverter 6*blink = error power device	

14.4. Regulation values

Characteristics	Variables	Factory setting
Working mode	Linear V/f characteristic Square V/f characteristic Vectorcontrolling	Linear V/f characteristic
Motor-nominal-current	0- 20A	1,5A
Motor Cos. φ	0,00-1,00	0,76
P- share PI- controller	0- 9999	10
I- share PI- controller	0- 9999	40

14.5. Settings

Characteristics	Variables	Factory setting
Switching (clock) frequency	2,4,6,8,16kHz	2kHz
Set value assignment	0- 10V 0-10V square +10 - -10V -10 - + 10V 2- 10V 2-10V square 5- 10V 10- 5V 0- 20mA 0-20mA square 4- 20mA 4-20mA square Interface Display	0- 10V square
Set value offset	0,0- 100Hz	0Hz
Set value hysteresis	0,0- 100,0	0
Fade out frequency	0,0- 400,0Hz	0Hz
Field fade out frequency	0,0- 200,0Hz	0Hz
I ² t- current	0,0- 30,0A	20,0A
Operation	Inputs Display	Inputs

14.6. Analog output

The following shows the address and with it the connection to the function of the analog output.

Address	Function
36	Set- speed
38	Actual- speed
40	Module temperature
41	Intermediate circuit voltage
57	Phase current U
58	Phase current V
59	Phase current W

15. Fault list to the frequency inverter for heat exchangers

Message over current (6*flash = Error power device)

Check engine and engine line on short circuit
 Check screen on short circuit
 Remove engine line at the frequency inverter and check **FC LED in FC**

Message rotor standstill (2*flash = rotor standstill, 3*blink = wheel blockade)

Check switching distance of the sensor
 Check sensor line on cable disruption
 Check frequency inverter setting on "sensor supervision"
 Watch LED at the sensor, at switching the sensor the LED is on

Message engine temperature too high (4*flash = Excess temperature engine)

Check whether the engine is equipped with a PTC
 Check the engine temperature manually (Shut down temperature approximately at 130°C).
 Engine cools down after switching off again, error message remains active until the new initialization.
 Examine contacts at the frequency inverter
 Check cable disruption emergency (if necessary, insert a bridge into the clamp for checking)

Message frequency inverter temperature too high (5*flash = Excess temperature inverter)

Check the inverter temperature manually
 FC cools down after switching off again, error message remains active until the new initialization.
 Check current consumption of the frequency inverter
 Check the static boost (active at low rotating field frequency)
 Adjust switching (clock) frequency on 2 kHz.
 Check environmental temperature