



# operating instructions

# QUICK START GUIDE

Frequency converter VAU4/3



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## Safety information

Δ	Warning of electrical shock! Danger to life!
	Electrical shock can cause serious injury or even death of persons. The frequency converter can be damaged as well.
	Warning of danger of other types! Risk of injury!
	Further sources of danger that can cause serious injury of persons. The frequency converter can be damaged as well.
	Warning of hot surfaces! Risk of injury!
	Warning of automatic start-up of the machine!
	Detailed information can be found in the VAU 4/3 operating instructions.
	Visit our homepage for this: www.becker-international.com

# VAU 4/3 $\rightarrow$ First steps



This quick start guide represents only an excerpt of the VAU 4/3 operating instructions. The latter should be read thoroughly before initial start-up.

The quick start guide contains safety instructions and helps the user to put the basic model of the VAU 4/3 into operation and to operate it with the default settings.

#### Intended use



Frequency converters are components that are intended for installation into electrical systems or machines.

When being installed into machines, the commissioning of the converters (i.e. running in normal operation) is not permitted until it has been determined that the machine at the date of commissioning complies with the relevant machinery directive including the EMC directive; EN 60204 must be observed.

The frequency converters comply with EC Machinery Directive 2006/42/EC.

The technical data as well as the specifications of the technical connection conditions can be found both on the specification plate and in this manual and must be observed.

### Preparatory measures



All tasks for transport, installation and commissioning as well as for servicing should be carried out by qualified technicians (IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN VDE 0110 and national accident prevention regulations).

Qualified technicians are persons that are familiar with the setting up, assembly, commissioning and operation of the product and have the appropriate qualifications for their tasks.

#### Setting up



The setting up and the cooling of the devices need to be done according to the directives of the corresponding pump documentation.

The frequency converters need to be protected against excessive strain. In particular, components must neither be bent nor insulation dimensions changed during transport and handling. Avoid touching electronic components and contacts.

Frequency converters contain electrostatically-endangered components that can be easily damaged by improper handling. Electrical components must neither be damaged mechanically nor destroyed (possible health hazard!).

#### **Electrical connection**



Frequency converters are components for use in industrial high-voltage systems and are operated with voltages that can cause serious injuries or even death if touched.

Installations and maintenance may only be done by **qualified electricians** and when the <u>device is free of voltage</u>. The operating instructions have to be available for these persons at all times and be dutifully observed by them.

On the circuit boards there are highly sensitive MOS semiconductor devices that are especially sensitive to static electricity. Therefore, please avoid touching the circuit boards or components with your hands or with metallic objects. Only the screws of the terminal strips may be touched by insulated screwdrivers when wires are connected.

The frequency converter is intended for permanent connection only and may not be operated without an effective earth connection that complies with the local regulations for high leakage currents

(> 3.5 mA). VDE 0160 prescribes the laying of a second earth line or an earth cross-section of at least 10 mm<sup>2</sup>.

If personal or fire protection is required when using the FC, all-current sensitive residualcurrent devices (type B RCD) must be used (in accordance with VDE 0664). They provide reliable protection for the high-frequency AC currents and the smooth and pulsating DC residual currents that occur during FC operation. Conventional type A residual-current devices are not suitable for this purpose.

When working on frequency converters that are electrically charged, the relevant national accident prevention regulations must be observed.

The local regulations on installing electrical systems as well as the accident prevention regulations must be observed.

The electrical installation is to be carried out according to the applicable regulations (e.g. cable cross-sections, fuses, earth lines).

Information on EMC-compliant installation – such as insulation, earthing, arrangement of filters and the laying of lines – can be found in the documentation for the frequency converters. Always observe these instructions also with CE-marked frequency converters. The responsibility of complying with the limits required by the EMC regulations lies with the manufacturer of the system or machine.

### Operation



During operation, frequency converters can have – depending on their type of protection – electrically charged, uncovered, and possibly even moving or rotating parts, as well as hot surfaces.

The device is charged with <u>dangerous voltage for up to 5 minutes</u> after being switched off. Opening the device or removing the covers or the operating unit is not permitted until 5 minutes after the voltage to the device has been switched off. Before switching on the power supply voltage <u>all covers need to be reattached</u>.

Even if the motor is at a standstill (for instance because of electronic blockage, blocked drive or output terminal short circuit) the power cable terminals, motor terminals and terminals for the brake resistor may still <u>carry dangerous voltages</u>. A motor standstill <u>does not</u> mean that there is a galvanic separation from the mains.



**Notice**, under certain settings, the converter can start up automatically when switched on from the mains side.

Systems into which the frequency converters are installed must, if necessary, be equipped with additional monitoring and protective devices according to the relevant safety regulations, i.e. laws for technical tools and appliances, accident preventions regulations, and so forth.

There is a risk of serious injury for persons or material damage if required covers are removed without authorisation, if the device or its components are used improperly, or if installed or operated incorrectly.

Electrically charged parts and line connections must not be touched directly after frequency converters are disconnected from the supply voltage, as the capacitors may be charged. Observe the corresponding signs about this on the frequency converters.

During operation all covers must be kept closed.

The frequency converter is maintenance-free under normal operating conditions. If the air is dusty, the cooling surfaces should be cleaned regularly with compressed air.

	WARNING! DANGER TO LIFE!
4	The power pack may still be charged with voltage for up to 5 minutes after being switched off from the mains. Converter terminals, motor feeder lines and motor terminals may carry voltage.
	Touching open or exposed terminals, lines and device parts can cause serious injuries and even death!
$\mathbf{\wedge}$	CAUTION
	Children and the general public are prohibited from accessing the device.
	The device may be used only as intended by the manufacturer. Unauthorised modifications and use of spare parts and auxiliaries that are not sold or recommended by the manufacturer of the device can cause fires, electrical shocks and injuries.
	Store these operating instructions where they are easily accessible and place them in every user's hands.
	The heat sink and other metallic parts can reach temperatures of more than 70 °C.
	Keep sufficient space to neighbouring components.
	When working on the components allow for sufficient cooling time.

Warning:	This is a product of the limited sales class acc. to IEC 61800-3. In a residential environ				
	ment this product can cause high-frequency interferences, in which case the user can be				
required to take suitable measures.					
A suitable measure would be the employment of a recommended line filter.					

# Commissioning

After opening the terminal box cover you will find all the connection terminals of the frequency converter in the connection room.



Terminal	Connection	
L1, L2, L3	Mains feeder phase L1, L2, L3	
PE	Mains feeder earth line PE	
U, V, W	Connection strands motor winding U, V, W	
X, Y, Z	Feeder phase external ventilator phase L1, L2, L3 (optional)	

Connection terminals of the bottom row of the double-decker terminal block:

Terminal	Connection
(1) +24 V SELV <sup>1)</sup>	24 V DC fixed voltage output
(2) Digital 1	Digital input 1
Digital 2	Digital input 2
Digital 3	Digital input 3
(9) GND SELV	Signal earth
(9) GND SELV	Signal earth
(3) 0/210 V Analog Out 1	Analogue output 1 voltage output
0/420 mA Analog Out 1	Analogue output 1 current output
0/210 V Analog Out 2	Analogue output 2 voltage output
0/420 mA Analog Out 2	Analogue output 2 current output
(9) GND SELV	Signal earth

<sup>1)</sup> SELV: **S**afety **E**xtra Low **V**oltage

Connection terminals of the top row of the double-decker terminal block:

Terminal	Connection	
(8) +10V SELV	10 V DC fixed voltage output	
(7) 0-10V/0-20mA,	Analogue input 1 switchable voltage/current 0 – 10 V/2 – 10 V/0 – 20 mA/4 – 20 mA	
Analog In 1		
(6) –10+10V, Analog In 2	Analogue input 2, voltage input	
(4) RS485 A	Serial interface RS485 line A	
(5) RS485 B	Serial interface RS485 line B	
(9) GND SELV	Signal earth	
PT100 - 1A	Temperature input 1 connection A (PT100)	
PT100 - 1B	Temperature input 1 connection B (PT100)	
PT100 - 2A	Temperature input 2 connection A (PT100)	
PT100 - 2B	Temperature input 2 connection B (PT100)	
(9) GND SELV	Signal earth	

### DIP switch block 1 with 4 switches

	Setting	Function		
DIP-switch 1 OFF		Speed set operation		
	ON	Controlled operation		
DIP-switch 2 OFF No control via RS485/field bus interface		No control via RS485/field bus interface		
	ON	Control via RS485/field bus interface		
DIP-switch 3 OFF No analogue control		No analogue control		
	ON	Analogue control		
DIP-switch 4	OFF	Pressure mode		
	ON	Vacuum mode		

### DIP switch block 2 with 2 switches

DIP switch 1	DIP switch 2	Analogue input 1	
OFF	OFF	0 – 10V	
OFF	ON	0 – 20mA	
ON	OFF	2 – 10V	
ON	ON	4 – 20mA	

### Relais

Function	Description			
	Relay 1 AOM	Aggregated operation message.		
		Device stands still:	11 - 12	
14 (24)		The device is turning at a speed > 0.	11 - 14	
12 (22)	Relay 2	Aggregated error message.		
	AEM	Fault-free operation:	21 - 22	
		Malfunction:	21 - 24	



# NOTE

All control voltages refer to a common reference potential (GND). 24 V can be taken from the respective terminals. The sum of the currents may not exceed 100 mA.

The local operation of the device is done on the operating panel as shown.



Pressing the  $\blacktriangle$  button increases the current nominal value;  $\blacktriangledown$  lowers it.

A malfunction can be acknowledged by pressing the ← button.

In normal operation the green LED chain indicates the magnitude of the currently set nominal value.

Every individual LED corresponds here to about 20% of the maximum settable value range.

If there is an error, then the green LED chain indicates the respective error code in combination with the continuously lit red LED.

### Table of possible error messages

Display	Malfunction
	Short circuit
	Overvoltage Intermediate circuit
	Undervoltage Intermediate circuit
	Overtemperature motor
	Mains interruption
	Offset current sensor
	Overtemperature Power output stage
	Overcurrent
	Inner temperature too high
	Charge relay defective
	I <sup>2</sup> *t limitation
	Earth fault
	Feldbus timeout
	IO controller defective
	RS485 timeout
	Alarm 1 or 2 or 3
	Alarm 1
	Alarm 2
	Alarm 3

## **Technical specifications**

		VAU4/3
Motor rated power	[kW]	4,0
Mains voltage		3 AC 400 – 480 V, ±10%, 47 … 63 Hz
Typical input current	[A]	13.0
Recommended mains fuse	surge-proof	16 A
Output voltage		3 AC 0 V – mains voltage
Output continuous current	[A]	9.5
Output frequency	[Hz]	0 - 400

		VAU4/3
Output voltage, External ventilator supply	[V]	3 AC mains voltage
Fuse, external ventilator supply (optional)	surge-proof	500 mA (T)
Maximum switch-on frequency per hour		12
Digital inputs Signal level, high status Signal level, low status		12 V – 30 V 0 V – 5 V
Analogue inputs, Transduction accuracy		10 bit
Analogue outputs maximum ampacity as current output maximum apparent ohmic resistance as current output		10 mA 1 kOhm
24 V DC fixed voltage output maximum ampacity		70 mA
10 V DC fixed voltage output maximum ampacity		30 mA
Potential-free contacts, max. load		230 V/2 A
Ventilation		air cooled by motor ventilator
Ambient temperature during operation	°C	0 – 50
Storage temperature	°C	-20 70
Maximum humidity		90% without condensation
Maximum installation altitude		Up to 1000 m above sea level without loss of performance
Weight	[kg]	5.6
Type of protection		IP 55
Maximum cross-section power supply	mm <sup>2</sup>	2.5
Maximum cross-section pilot wires	mm <sup>2</sup>	1.5
Maximum connection cross-section external ventilator	mm <sup>2</sup>	2,5
Terminal range, power cable:	mm	7.0 13, width across flats 25
Terminal range, pilot wires:	mm	4.5 9.0, width across flats 20

## Certifications

European EMC guidelines

If the VAU4/3 frequency converter is installed and operated according to the recommendations of these operating instructions, it fulfils all requirements of the EMC regulations according to the EMC product standards for motor driven systems EN 61800-3.

UR certification (Use in North America)



"Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 380...480Volts (three phase)" and "when protected by J class fuses." as indicated."

The VAU4/3 frequency converter is equipped with a motor overload protector.

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