❶ **Safety information**
❷ **Preparation:** Suitable tools, installation site, weather protection
❸ **Mounting:** Mechanical installation
❹ **Connection:** Power and control connections
❺ **Testing:** Final testing before operation
❻ **Power-up**
❼ **Activation** of the converter parameters
❽ **Operation** and comprehensive functional test

INFORMATION
This guide does not contain any detailed installation, safety or operating instructions. Complete information can be found in the VERTIMO operating manual. Unpack the drive controller and inspect it. Notify your KOSTAL Industrie Elektrik sales partner immediately in the case of damage.

1 | SAFETY INFORMATION

DANGER!

Risk of death due to electrical shock!
Death or serious injury!
Life-threatening voltages are present in the VERTIMO. Only a qualified electrician may open and perform work on the device.

Risk of death due to electrical shock and discharge!
Death or serious injury!

The VERTIMO drive controller has high-voltage capacitors, which require some time to discharge even once disconnected from the main supply. Before starting any work, disconnect the main supply from the grid inputs. Then wait ten (10) minutes until the capacitors have discharged to a safe voltage level.

Always ground the device in accordance with DIN EN 61140; VDE 0140, NEC and other relevant standards.
The drive controller must be grounded with the motor in accordance with relevant regulations. Non-compliance may result in death or serious injury.

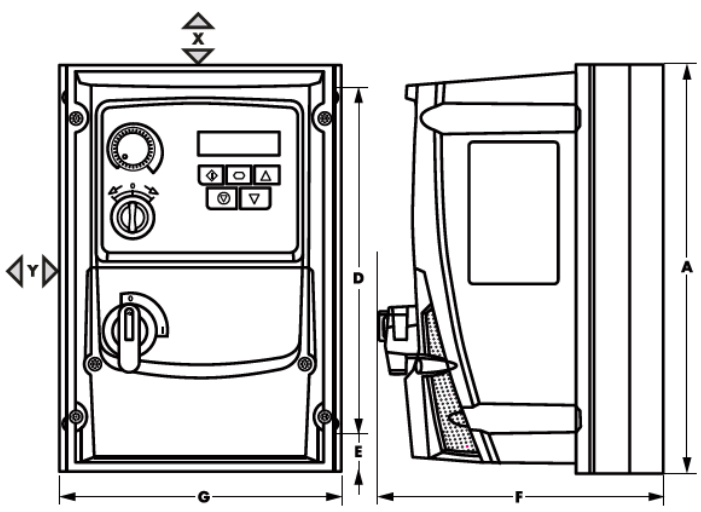
2 | PREPARATION

- The VERTIMO drive controller may be installed vertically only.
- Installation must take place on a suitable level and flame-resistant surface. Never store flammable materials near the drive controller.
- Refer to the technical data for information on installation sites that meet the drive controller specifications.
- The installation site should be vibration-free.
- Never mount the drive controller in areas with excessive moisture or in areas in which aggressive chemicals or potentially hazardous dust particles are suspended in the air.
- Do not install the device near high-temperature heat sources.
- Never expose the drive controller to direct sunlight.
  If necessary, install a suitable sun guard.
- The installation site must be frost-protected.
- Make sure that the airflow through the cooling elements of the drive controller is not obstructed. The drive controller generates a large amount of heat which should be dissipated by natural means.
  For this reason, the device must be installed with adequate clearance to fixed objects.
- If the location is subject to extreme variations in ambient pressure and temperature, a suitable pressure compensation valve must be installed in the gland plate.

INFORMATION
If the drive controller has been in storage for longer than 2 years, the DC link capacitors must be reformed before the drive controller is put back into operation. Further information can be found in the complete VERTIMO operating manual.

3 | MOUNTING

Mechanical dimensions – IP66 (NEMA 4X) closed units



Dimensions

Size	A		D		E		F		G	
	mm	in	mm	in	mm	in	mm	in	mm	in
1	232	9.13	189	7.44	25	0.98	179	7.05	161	6.34
2	257	10.12	200	7.87	28.5	1.12	187	7.36	188	7.40
3	310	12.2	251.5	9.90	33.4	1.31	252	9.92	211	8.3

Weight

Size	Weight	
	kg	lb
1	3.1	6.8
2	4.1	9
3	7.6	16.7

Mounting clearance

Size	X above and below		Y both sides	
	mm	in	mm	in
1	200	7.87	10	0.39
2	200	7.87	10	0.39
3	200	7.87	10	0.39

Mounting bolts and torques

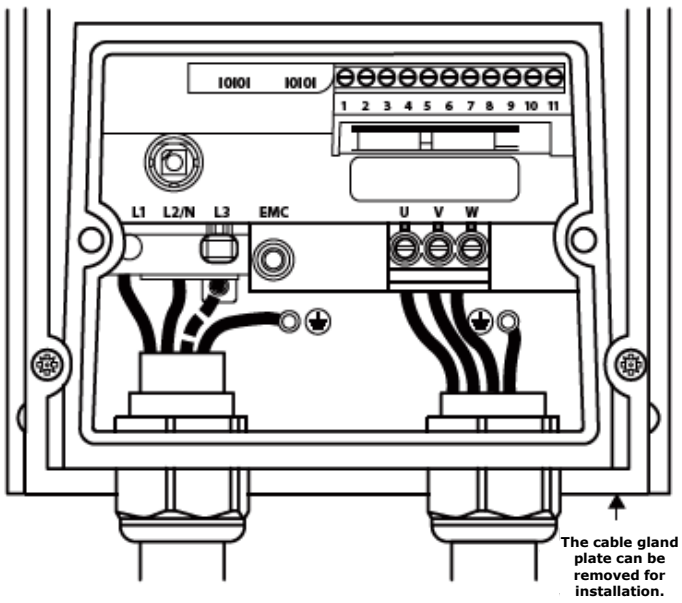
Mounting bolts		Torques		
Size		Size	Control connections	Supply terminals
All sizes	4 x M4 (#8)	All sizes	0.5 Nm (4.5 lb-in)	1 Nm (9 lb-in)

4 | CONNECTION

Cable selection

- For a single-phase supply, the power supply must be connected to terminals L1/L and L2/N.
- For a three-phase supply, the power supply must be connected to terminals L1, L2 and L3. The phase sequence is irrelevant.
- Only use shielded symmetrical cables in order to meet CE, C Tick and EMC requirements.
- IEC61800-5-1 stipulates fixed installation with a suitable disconnecting device installed between the VERTIMO drive controller and the AC power source. The disconnecting device must comply with the local safety standards (e.g. in Europe the machinery directive EN60204-1 “Safety of machinery”).
- All cables should be rated in line with local regulations. Guidelines concerning dimensioning are given in the section “Rated output table” of this quick setup guide.

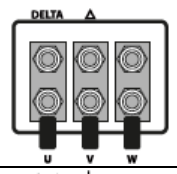
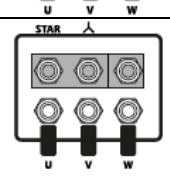
Wiring



Size	Diameters for cable glands		
	Power cable	Motor cable	Control cable
1	M20 (PG 13.5)	M20 (PG 13.5)	M20 (PG 13.5)
2	M25 (PG 21)	M25 (PG 21)	M20 (PG 13.5)
3	M25 (PG 21)	M25 (PG 21)	M20 (PG 13.5)
NOTE	**The typical thermal loss of the drive controller is approx. 3% of the operating load conditions. The figures stated above are only intended as guide values, and the ambient operating temperature of the drive controller MUST be observed at all times.**		

Connections of motor connection box

Most all-purpose motors are coiled for operation with a dual voltage supply. Details on this can be found on the type plate of the motor.
A STAR or DELTA configuration is usually selected for the operating voltage during installation of the motor. The STAR variant always provides the higher voltage value.

Incoming supply voltage	Voltages according to type plate	Connection	
230	230 / 400	Delta	
400	400 / 690		
400	230 / 400	Star	

Information on UL conformity

The VERTIMO is designed to comply with UL requirements. To ensure full compliance with the regulations, the following must be fully observed:

Requirements on the input power supply	
Supply voltage	200 – 240 volts RMS for units with 230 volts rated voltage; permissible deviation of +/- 10%. Maximum 240 volts RMS.
	380 – 480 volts for units with 400 volts rated voltage; permissible deviation of +/- 10%; maximum 500 volts RMS.
Frequency	50 – 60 Hz +/- 5% deviation
Short-circuit line	All drive controllers are suitable for use with a mains grid that is able to supply a maximum short-circuit current of 100 kA, symmetrically with the specified maximum supply voltage, as long as protection with fuses of class J is provided.
Requirements regarding mechanical installation	
All VERTIMO units are intended for installation in controlled environments that meet the threshold value conditions listed in the section “Environment” of this quick setup guide.	
The drive controller can be operated in the temperature range specified in the section “Environment” of this quick setup guide.	
IP66 (NEMA 4X) units; installation permitted in environments with degree of contamination 2.	
Requirements on the electrical installation	
The incoming grid connection must be set up in accordance with the section “Input current supply” of this quick setup guide.	
Suitable power and motor cables should be selected in accordance with the data listed in the section “Rated output table” of this quick setup guide, and the NEC or other applicable, local codes.	
Motor cable	75°C copper must be used
Power cable connections and torques are given in the section “Mechanical dimensions” of this quick setup guide.	
Integrated “solid-state” short-circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in compliance with the NEC and additional local codes. Nominal values are given in the section “Rated output table” of this quick setup guide.	
Temporary overvoltage protection must be installed on the grid side of the device, must be 480 volts (phase to ground) and 480 volts (phase to phase), must be suitable for overvoltage category III and must provide protection in the event of a rated surge voltage with a voltage peak that withstands 2.5 kV.	
UL-listed cable shoes must be used for all bus bars and grounding connections.	
General requirements	
The VERTIMO provides motor overload protection in accordance with NEC (USA). In cases where a motor thermistor is not connected or used, monitoring of the thermal overload memory must be activated by means of the setting P-50 = 1. If a motor resistor is connected and this is connected to the drive controller, the connection must be set up in accordance with the information given in the section “Motor thermistor connection” of this quick setup guide.	
UL-compliant ingress protection (“type”) is only given if the cables are installed using a UL-recognised gland bush or inlet fitting for a flexible line system that satisfies the required degree of protection.	
In the case of electrical installation conduit systems, all glands must have the values specified by NEC.	
Not intended for installation with rigid cable conduit systems.	

Control terminal connections

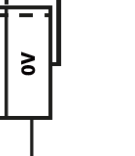
- All analogue signal cables must be adequately shielded. Twisted-pair cables are recommended.
- Where possible, all power and control cables are to be routed separately and never in parallel.
- The same cable must NOT be used for the signal level of different voltages, e.g. 24 V DC and 110 V AC.
- The maximum torque for control connections is 0.5 Nm.
- Diameter for cable inlet of control line: 0.05 – 2.5 mm² / 30 – 12 AWG.

Control terminal connections

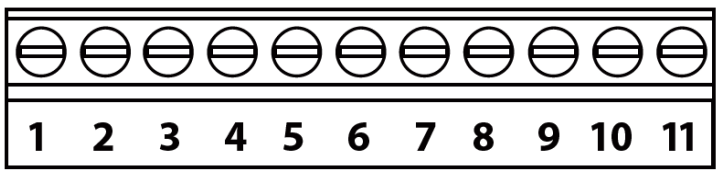
Switched units: Use of the internal control switch or potentiometer or use with the control connections of connected external control signals is possible.

Non-switched units: Require external control signals to be connected to the control connections.

Switched units: Standard functions and control switches

Switch position			POT	Comments
				Default factory configuration. Forward or reverse running with speed control by means of local potentiometer.
Reverse running	Stop	Forwards running	Used to set the output frequency	
Note	**Further functions available. Refer to the online documentation for further information.**			

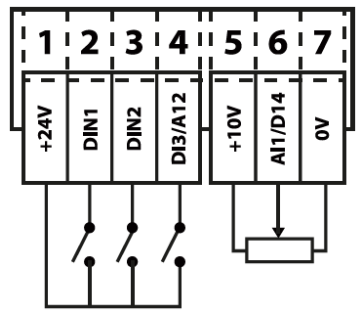
Use of control connections



+24 VDC	DI1	DI2	DI3 AI2	+10 VDC	DI4 AI1	GND	AO	GND	RL1	RL2

No.	Purpose	Function
1	+ 24 V DC 100 mA output	24 V DC output
2	DI1 digital input 1	Function defined by P-12 and P-15 See below for further information
3	DI2 digital input 2	
4	DI3 analogue input 3/ AI2 digital input 2	
5	+ 10 V DC 5 mA output	10 V DC output for external potentiometer
6	DI4 digital input 4/ AI1 analogue input 1	Function defined by P-12 and P-15. Signal format selected in P-16
7	GND	Ground, internally connected to terminal 9
8	Analogue output / digital output	Analogue: 0 to 10 V Digital: 0 to 24 V
9	GND	Ground, internally connected to terminal 7
10	RL1 output relay	Function defined in P-18. See parameter list
11	RL2 output relay	

Connection example

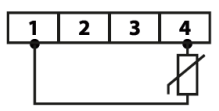


Default factory functions

No.	Description	
DI1	0 / 1	Open: Stop Closed: Operation
DI2	↻/↺	Open: Clockwise Closed: Anti-clockwise
DI3	Analogue target speed value / preset speed	Open: Target speed value from analogue target value source Closed: Target speed value from preset fixed speed 1 (P-20)
AI1	Analogue input for target speed value	Used to set the target speed value **NOTE** For devices with switch option, the internal connection is selected in P-16 by default. In the case of devices without switch option, an external connection or a 0 – 10 V reference can be connected. Further signal types can be used. Set P-16 to the correct format.
NOTE	**Further functions available. Refer to the online documentation for further information.**	

Motor thermistor connection

If a motor thermistor is used, the connection should be made as follows:

Control terminal strip	Additional information
	Compatible thermistor: PTC type, 2.5 kΩ trip value. ▪ The setting for P-15 must be selected such that the digital input 3 is defined as the external shutdown function, e.g. P15 = 3. Refer to the online documentation for further information. ▪ Set P-47 “PtC-tH”

5 | TESTING

6 | POWER-UP

7 | PUTTING INTO OPERATION

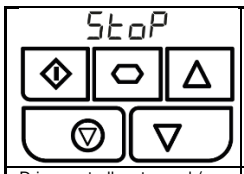
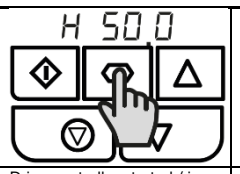
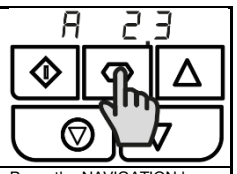
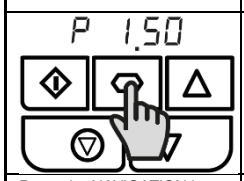
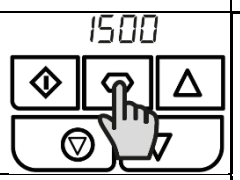
Operation

Use of keypad

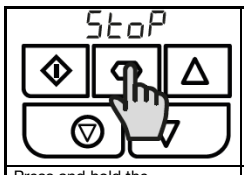
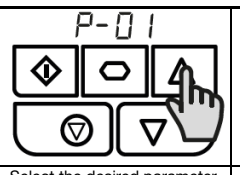
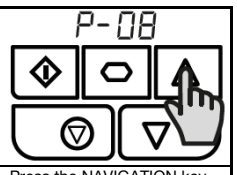
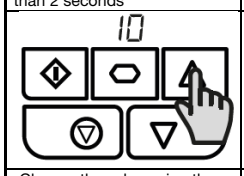
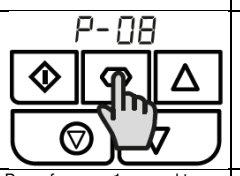
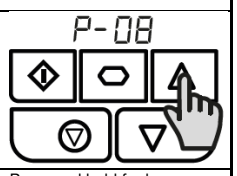
The drive controller is configured and its operation monitored via the keypad and display.

	NAVI-GATION	Used to display real-time data, access the parameter configuration and save changes.
	UP	Used to increase the speed in real-time mode and the parameter values in editing mode.
	DOWN	Used to decrease the speed in real-time mode and the parameter values in editing mode.
	RESET/ STOP	Used to reset after shutdown of the drive controller in response to an error. Used in keypad mode to stop the converter.
	START	Used in keypad mode to start the drive controller or to reverse the direction of rotation (if bidirectional keyboard mode is activated).

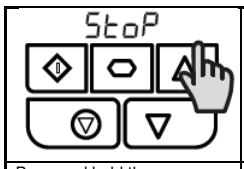
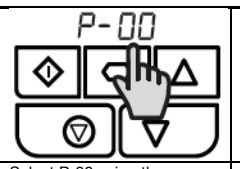
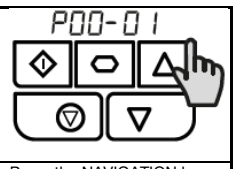
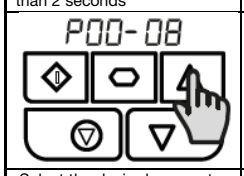
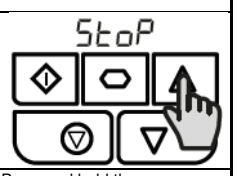
Operation displays

		
Drive controller stopped / deactivated	Drive controller started / in operation; display shows the output frequency (Hz)	Press the NAVIGATION key for max. 1 second. The display shows the motor current (A)
		
Press the NAVIGATION key for max. 1 second. The display shows the motor rating (kW)	If P-10 > 0, press the NAVIGATION key for max. 1 second to display the motor speed (rpm)	

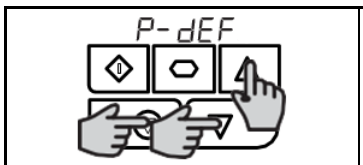
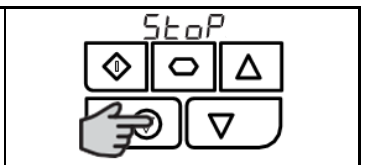
Changing parameters

		
Press and hold the NAVIGATION key for longer than 2 seconds	Select the desired parameter using the UP/DOWN key	Press the NAVIGATION key for max. 1 second
		
Change the value using the UP/DOWN key	Press for max. 1 second to return to the parameter menu	Press and hold for longer than 2 seconds to return to the operation display

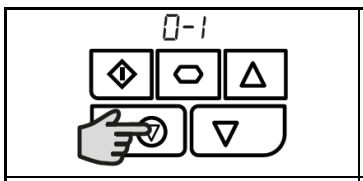
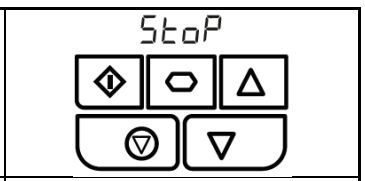
"Read only" access to parameters

		
Press and hold the NAVIGATION key for longer than 2 seconds	Select P-00 using the UP/DOWN key	Press the NAVIGATION key for max. 1 second
		
Select the desired parameter for read access using the UP/DOWN key	Press the NAVIGATION key for max. 1 second to display the value	Press and hold the NAVIGATION key for longer than 2 seconds to return to the operation display

Resetting parameters

	
To reset the parameter values to their default factory settings, press and hold the UP, DOWN and STOP key for longer than 2 seconds. The display shows "P-dEF".	Press the STOP key. The display shows "P-dEF".

Resetting an error

	
Press the STOP key. The display shows "P-dEF".	

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8 | OPERATION

Parameters

Default parameters

Par.	Description	Min	Max	Default	Units
P-01	Maximum frequency/speed	P-02	500	50 (60)	Hz / rpm
P-02	Minimum frequency/speed	0	P-01	20.0	Hz / rpm
P-03	Acceleration ramp time	0	600	5	s
P-04	Deceleration ramp time	0	600	5	s
P-05	Stop mode / behaviour in the event of power failure	0	3	0	-
	Setting: Upon deactivation / Upon power failure				
	0: Ramp stop (P-04) / Run-on (energy recovery from the load to maintain operation)				
	1: Freewheeling / Freewheeling				
	2: Ramp stop (P-04) / Rapid ramp stop (P-24), freewheeling if P-24 = 0				
	3: Ramp stop (P-04) with AC motor flow braking / Rapid ramp stop (P-24), freewheeling if P-24 = 0				
	4: Ramp stop (P-04) / No action				
P-06	Energy optimisation	0	1	2	-
	Setting: Energy optimisation / VERTIMO energy optimisation				
	0: Deactivated / Deactivated				
	1: Activated / Deactivated				
	2: Deactivated / Activated				
	3: Activated / Activated				
P-07	Rated motor voltage / counter EMF at rated speed (PM/ BLDC)	0	250/500	230/400	V
P-08	Rated motor current	Depending on the rated output of the converter			A
P-09	Rated motor frequency	10	500	50 (60)	Hz
P-10	Rated motor speed	0	30000	0	rpm
P-11	Low-frequency torque boost	0	Depends on drive controller		%
P-12	Source for primary command	0	9	0	-
	0: Connection control / 5: PI control				
	1: Keyboard control in one direction / 6: Analogue PI sum control				
	2: Keyboard control in two directions / 7: CAN control				
	3: Modbus network control / 8: CAN control				
	4: Modbus network control / 9: Slave mode				
	Note: If P12 = 1, 2, 3, 4, 7, 8 or 9, an activation signal still has to be provided at the control terminals, digital input 1.				
P-13	Selection of operating mode	0	2	0	-
	0: Industry mode 1: Pump mode 2: Fan mode				
	Setting: Application / Current limit (P-54) / Torque characteristic curve / Rotating start (P-33) / Reaction to thermal overload limit value (P-60 index 2)				
	0: Industry / 150% / Constant / 0: Off / 0: Shutdown in response to error				
	1: Pump / 110% / Variable / 0: Off / 1: Reduction of maximum current limit value				
	2: Fan / 110% / Variable / 2: On / 1: Reduction of maximum current limit value				
P-14	Access code for advanced menu	0	65535	0	-

Advanced parameters

Par.	Description	Min	Max	Default	Units
P-15	Selection of digital input function	0	17	0	-
P-16	Signal format for analogue input 1	See below		U0-10	-
	U 0-10: Unidirectional, external 0-10 volt reference / pot				
	b 0-10: Bidirectional, external 0-10 volt reference / pot				
	A 0-20: External 0-20 mA signal				
	t 4-20: External 4-20 mA signal				
	r 4-20: External 4-20 mA signal				
	t 20-4: External 20-4 mA signal				
	r 20-4: External 20-4 mA signal				
	U 10-0: External 10-0 volt signal				
	In-Pot: **Switched units only:** Internal potentiometer				
P-18	Function selection for relay output	0	9	1	-
	0: Drive controller activated (in operation) / 5: Output current ≥ threshold value				
	1: Drive controller intact / 6: Output frequency < threshold value				
	2: With target frequency (speed) / 7: Output current < threshold value				
	3: Shutdown of drive controller in response to error / 8: Analogue input 2 > threshold value				
	4: Output frequency ≥ threshold value / 9: Converter ready for operation				
P-20	Preset frequency / speed 1	-P-01	P-01	5	Hz/rpm
P-21	Preset frequency / speed 2	-P-01	P-01	25	Hz/rpm
P-22	Preset frequency / speed 3	-P-01	P-01	40	Hz/rpm
P-23	Preset frequency / speed 4	-P-01	P-01	P-09	Hz/rpm
P-24	2nd ramp time (rapid stop)	0	600	0	s
P-25	Function selection for analogue output	0	11	8	-
	Digital output mode. Logic 1 = + 24 DC				
	0: Drive controller activated (in operation) / 4: Output frequency ≥ threshold value				
	1: Drive controller intact / 5: Output current ≥ threshold value				
	2: With target frequency (speed) / 6: Output frequency > threshold value				
	3: Shutdown of drive controller in response to error / 7: Output current < threshold value				
	Analogue output mode				
	8: Output frequency (motor speed) / 10: Output power				
	9: Output current (motor) / 11: Load current				
P-31	Selection of start mode using keyboard	0	7	1	-
	0: Minimum speed, keypad start / 4: Current speed, keypad start				
	1: Last speed, keypad start / 5: Preset speed 4, keypad start				
	2: Minimum speed. terminal activation / 6: Current speed, terminal start				
	3: Last speed, terminal activation / 7: Preset speed 4, terminal start				
P-33	Flying restart	0	2	0	-
	0: Deactivated				
	1: Activated				
	2: Activated in the case of shutdown in response to an error, drop in voltage or freewheeling stop				
P-34	Brake chopper active (not size 1)	0	4	0	-
	0: Deactivated				
	1: Activated with software protection				
	2: Activated without software protection				
	3: Activated with software protection				
	4: Activated without software protection				
P-38	Parameter access lock	0	1	0	-
	0: Unlocked 1: Locked				
P-39	Offset of analogue input 1	- 500	500	0	%
P-40	Index 1: Scaling factor display	0	16.000	0	-
	Index 2: Scale source display	0	3	0	-
P-41	PI controller – proportional gain / P component	0	30	1	-
P-42	PI controller – integral time / I component	0	30	1	s
P-43	Operating mode of PI controller	0	1	0	-
	0: Direct operation				
	1: Reverse operation				
	2: Direct operation, wake-up at full speed				
	3: Reverse operation, wake-up at full speed				

Par.	Description	Min	Max	Default	Units
P-44	Selection of target value source for PI controller	0	1	0	-
	0: Digital preset target value 1: Analogue input 1 target value				
P-45	Digital PI target value	0	100	0	%
P-46	Selection of PI feedback source	0	5	0	-
	0: Analogue input 2 / 3: Intermediate circuit voltage				
	1: Analogue input 1 / 4: Analogue 1 – analogue 2				
	2: Motor current / 5: Greatest (analogue 1 – analogue 2)				
P-47	Signal format for analogue input 2	-	-	-	U0-10
	U 0-10: Unidirectional, external 0 – 10 volt reference / pot / r 4-20: External 4 – 20 mA signal				
	A 0-20: External 0 – 20 mA signal / t 20-4: External 20 – 4 mA signal				
	t 4-20: External 4-20 mA signal / r 20-4: External 20-4 mA signal				
	Ptc-th: Motor thermistor				
P-48	Timer for standby mode	0	25	0	s
P-49	PID standby hysteresis	0	100	5	%
P-50	User output relay hysteresis	0	100	0	%

Advanced parameters

Par.	Description	Min	Max	Default	Units
P-51	Motor control mode	0	5	0	-
	0: Control mode for vector speed				
	1: V / F mode				
	2: PM control mode for vector speed				
	3: BLDC control mode for vector speed				
	4: Synchronous reluctance motor control mode for vector speed				
	5: LSPM motor vector speed control				
P-52	Auto-tune of motor parameters	0	1	0	-
	0: Deactivated 1: Activated				

Technical data

Environment

Ambient temperature range	
Closed drives:	- 10…40°C (frost- and condensation-free)
Ambient storage temperature range:	- 40…60°C
Maximum altitude:	2000 m. Derating above 1000 m: 1%/100 m
Maximum humidity:	95%, non-condensing

Rated output table

Size	kW	HP	Input current	Fuse/ MCB (type B)		Maximum cable size		Output current	Recommended brake resistance
				Non-UL	UL	mm	AWG	A	Ω
200 – 240 (+/- 10%) V single-phase input, three-phase output									
1	0.37	0.5	3.7	10	6	8	8	2.3	-
1	0.75	1	7.5	10	10	8	8	4.3	-
1	1.5	2	12.9	16	17.5	8	8	7	-
2	1.5	2	12.9	16	17.5	8	8	7	100
2	2.2	3	19.2	25	25	8	8	10.5	50
380 – 480 (+/- 10%) V 3-phase input, 3-phase output									
1	0.75	1	3.5	6	6	8	8	2.2	-
1	1.5	2	5.6	10	10	8	8	4.1	-
2	1.5	2	5.6	10	10	8	8	4.1	250
2	2.2	3	7.5	16	10	8	8	5.8	200
2	4	5	11.5	16	15	8	8	9.5	120
3	5.5	7.5	17.2	25	25	8	8	14	100
3	7.5	10	21.2	32	30	8	8	18	80
3	11	15	27.5	40	35	8	8	24	50
4	15	20	34.2	40	45	16	5	30	30
4	18.5	25	44.1	50	60	16	5	39	22
4	22	30	51.9	63	70	16	5	46	22

Note The specified dimensions correspond to the maximum possible cable sizes that may be connected to the converter. Cables should be selected at the time of installation and in accordance with the local cabling codes or guidelines.

Problem solving

Error code messages

Error code	No.	Description
O I-b	01	Brake channel overcurrent
OL-br	02	Overload of brake resistor
O- I	03	Overcurrent at output
I_t-trP	04	Motor thermally overloaded (I2t)
O-voLt	06	Intermediate circuit overvoltage
U-voLt	07	Intermediate circuit undervoltage
O-t	08	Cooler overheating
U-t	09	Undertemperature
E-trIP	11	External shutdown in response to error
SC-Obs	12	Loss of communication on internal bus
FLt-dc	13	DC ripple too high
P-LOSS	14	Shutdown in response to error due to loss of an input phase
h O-I	15	Overcurrent at output
th-FLt	16	Defective thermistor at cooling element
dAtA-F	17	Internal memory error (IO)
4-20 F	18	4-20 mA signal lost
dAtA-E	19	Internal memory error (DSP)
F-Ptc	21	Shutdown of motor PTC thermistor
FAn-F	22	Cooling fan error (IP66 only)
O-tEMP	23	Internal converter temperature too high
OUt-F	26	Output error
AtF-02	41	Auto-tune error
SC-F01	50	Error due to loss of communication on Modbus
SC-F02	51	Shutdown in response to error due to failure of CAN communication

Note After tripping due to overcurrent or overload (3, 4, 5, 15), the frequency converter must NOT be reset until the reset time has expired; this is to prevent damage.