FRC-Q
FRC-F

VVVF Controller

for

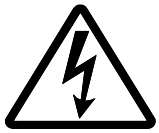
Elevators

(upon Software 18.050.04)

Contents

Pictograms

Important note! Comply in any case. Non-compliance may result in malfunction or damage.



Danger due to electrical voltage! Danger to life and limb!

Useful tip.

1 Important Notes

1.1 Safety Tips

- Depending on the class of their isolation, the surface of VVVF controllers can possibly be in circuit, bare or hot.
- Unadmitted removal of parts of the casing, improper use, wrong installation or operation are dangerous to life, injurious to health or can cause damages.
- Every work in connection with transport, installation and initiation as well as servicing is to be executed by competent persons labour.
- Skilled labour according to this basic safety tip includes field personnel familiar with the mounting, installation, initiation and operation of this product and qualified for this work.
- VVVF controllers are components of electric devices or machines. Their initiation, i.e. start of the destined operation, is subject to keeping to the EMC-regulations (89/336/EC).
- Technical specifications and information concerning conditions of connecting are to be read from the type label and the documentation and are by all means to be adhered to.

1.2 Retrofitting old systems

Before retrofitting a VVVF controller in an existing elevator ask your motor supplier, whether the isolation of the motor-winding is suitable for VVVF controller-operation.

If the motor originally has not been conceived for VVVF controller-operation, we recommend, however, to install an external inductor in addition to the integrated one. If you are not sure, please contact us. We will be pleased to advise you.

1.3 Installation of the VVVF controller

Please pay your special attention to the signal lines and power lines that they do not cross over each other nor lie in parallel in a mutual cable duct. For EMC-reasons, it is recommendable to separate them to prevent interference effects.

Appropriate **terminal covers with strain relief** are available from us for using the unit outside the control cabinet. In our VVVF with integrated contactors these are already included.

Install the braking resistor **outside** the cabinet, in order to avoid unnecessary heat dissipation to the electronic devices inside the cabinet.

Important note !
Due to the heat dissipation the brake resistor should always be fixed on non-flammable bases. For proper ventilation there should be at least 20 cm space above and below the brake resistor. If there are inflammable materials in the closer area, there should be a distance of 50 cm between the brake resistor and these materials.

This also applies to the contactor device with integrated brake resistor.

1.4 See to sufficient ventilation of the cabinet

Above and below the VVVF controller, leave space of at least 10 cm height, in order to provide sufficient ventilation.

Moreover, use a enclosure with perforated floor and ceiling, most probably your supplier of enclosures will offer appropriate pre-fabricated metal sheets. This will support ventilation and prevent thermal failure of electronic parts even in midsummer. If necessary, **forced ventilation** must be provided in the enclosure.

Temperature in the enclosure must be kept below 50°C at any operational situation. Failure or malfunction of the electronics will not be under warranty, if this temperature is exceeded.

For further information on power loss of the devices, please refer to **Section** 3.

1.5 Connection of contactor coils

To avoid inductive voltage peaks during contactor operation, they should be provided either with varistors or RC elements.

1.6 Contactor mounting plate

- The mounting plate must be well grounded
- In the case of a very high unit performance where contactor operation may cause significant mechanical vibration in the enclosure, the contactors should be equipped with rubber-metal vibration dampers.

1.7 Earthing

- On principle, use screened cables and lines only, for every connection to outside of the enclosure, i.e.:
  - from enclosure to motor
  - from enclosure to encoder
  - from enclosure to braking resistor
- The cable from the encoder is to be screened up to the plug in the VVVF controller. To earth the screening of the encoder cable, connect it to a cable clip of the VVVF controller.

1.8 Earth-leakage circuit-breaker

- The elevator must not be operated via an earth-leakage circuit-breaker, as the leakage current of the interference suppression capacitors contained in the VVVF controller and the interference suppression filter would operate this circuit-breaker. Should it nevertheless be inevitable to install an earth-leakage circuit breaker due to a special situation concerning the elevator, only use circuit-breakers admitted to VVVF controller-operation.

1.9 Motor protectio by ptc-thermistor

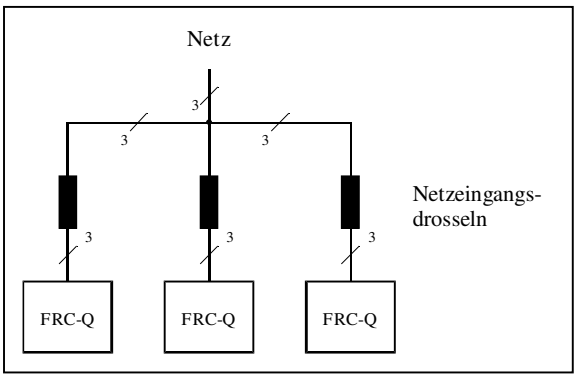
An element evaluating the ptc-thermistor is integrated in the VVVF controller.

1.10 Motor protection switch

Motor protection switches on principle do not suit a VVVF-controlled elevator drive and must therefore not be applied.

1.11 Group control

In cases where more than one drive is connected to the mains supply, we recommend that the drives were additionally isolated by three-phase commutation inductors (=line reactors).



1.12 Reactive current compensation

If capacitors compensating reactive current were connected directly to the motor connectors, they would destroy the VVVF controller, as due to the high switching frequency of the transistors a would-be short circuit would be created.

Reactive current compensation, if at all, is to be executed at the mains connection of the building, but never in the machine room.

1.13 Warranty

As for warranty please refer to our General Conditions. Demands going beyond these conditions are subject to a special agreement.

2 Standards

VVVF controllers FRC-Q/FRC-F comply with the following national and international standards and regulations:

CE - mark	European declaration of conformity
DIN EN 12015	Standards and regulations for the product family of elevators, escalators and passenger conveyors. EMC : emitted interference
DIN EN 12016	Standards and regulations for the product family of elevators, escalators and passenger conveyors. EMC- interference immunity
DIN IEC 60038	Standardised voltages
DIN EN 81 Part 1	Safety rules for the design and installation of elevators for persons and goods as well as small goods elevators Electrically operated elevators
DIN VDE 50178	Electrical power installations with electronic items
DIN EN 60439 Part 1	Control gear assemblies low-voltage control gear assemblies
DIN EN ISO 9001	Quality management, development, production, assembly and service

To comply with the relevant EMC-regulations, the following prerequisites are required:

Outside the cabinet, only screened cables and lines are to be used (except for mains supply line).

RST ELEKTRONIK GMBH

Certificate of Conformity according to

EC-EMC-Directive 89/336/EWG

A sample of product as detailed below has been tested and found to be in conformity with the EMC-regulations of the directive 89/336/EWG in all points.

Detailed information is shown in the EMC-test reports:

FRC-F1...F4: 28.001.01, 28.002.01, 28.003.01, 28.015.01
FRC-F5...F7: 28.013.01, 28.014.01, , 28.016.01

Model / Type: **FRC-F1...F7**

Identification: Electronic frequency inverter for elevator drives

Applied Harmonized Regulations:

DIN EN 61000-6-3: August 2002
DIN EN 61000-6-2: August 2002

28.10.2003
.....
Date

.....
Manufacturer-Signature

Writer: MM/28.10.2003
File: FRC-F_01E.SDW
Page : 1

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3 Technical Specification

With every detail we refer to a 4-pole one-speed A.C. synchronous and asynchronous motors. Modifications subject to technological progress will be possible at any time without prior notice.

Supply voltage (L1-L2-L3) :

FRC-F1 – FRC-F7: 230 ... 400 V ± 10%, 50/60 Hz
FRC-Q8 – FRC-Q11: 230 ... 400 V ± 20%, 50/60 Hz

Sizes :

VVVF Controller		Motor power	Heat dissipation
Type	I_N/I_{max} *in* A_{eff}	P_{shaft} *in kW (with 400V supply)*	*in W*
FRC-F1	8 / 16	approx. 4	170
FRC-F2	12 / 24	approx. 5,5	240
FRC-F3	16 / 32	approx. 7,5	300
FRC-F4	24 / 48	approx. 11	480
FRC-F5	32 / 64	approx. 15	660
FRC-F6	40 / 80	approx. 18,5	800
FRC-F7	48 / 96	approx. 22	1000
FRC-Q8	60 / 120	approx. 30	1200
FRC-Q9	75 / 150	approx. 37	1480
FRC-Q10	90 / 180	approx. 45	1800
FRC-Q11	110 / 208	approx. 55	2200

Range of supply :
- VVVF controller including mains filter
- Documentation

Accessories :
- Braking resistor
- Mains input inductor
- Mains output inductor
- Setting-software PowerControl for Windows
- Modem for remote data transmission

☞ **Note : At travel speeds of more than 1,6 m/s apply braking resistors with higher capacities !**

Power supply to electronic module of VVVF controller :

The VVVF controller supplies itself from the DC link. No separate power supply required.

Drive commands :

Floating contacts from control unit, voltage supply either from VVVF controller or from control voltage (refer to **4.2.2.2**).

Fault messages / Monitoring :

Status of the VVVF controller during operation is steadily monitored. Errors are indicated on the display in plain text and recorded in the error stack to enable an analysis. The collective fault signal relay **TÜ** drops out in the case of an error (see **Section 8.1**).

Monitoring of levelling speed - EÜ :

Gives the safety-relevant speed signal necessary for realising that the doors start opening already during levelling. Together with the door-zone monitoring in the control unit thus the safety regulations are fulfilled concerning the use of doors starting to open during slowing down.

Brake monitoring BÜ:

Digital signal (24V / 50mA) in case motor speed falls below a preset value.

Control of drive contactors ZS:

Relay for controlling the drive contactors.

Control of brake ZB:

Relay for controlling the brake.

Encoder :

Standard digital encoders with the following specification can be applied:

- square-wave encoder HTL, TTL - 2 x 500 to 2 x 4096 pulses enabling stepless variation, operation possible with (A, B) or 4 (A, -A, B, -B) signal tracks.
- sine-wave pulse encoder 2 x 500 to 2 x 2048 sine periods (**additional board required**).

Possible supply voltages :	+5V / +15V / ±15V
Maximum power input :	150 mA
Maximum permitted speed:	3000 rpm square wave encoder with 500 to 4096 pulses per rev. 3000 rpm sine wave encoder with 1024 to 2048 pulses per rev.

Reversing :

Reversing is initiated electronically. No reversing contactor required. Desired phase-rotation is set by signals **RO** and **RU.**

Setting of the VVVF controller :

The VVVF controller can completely be set by means of the integrated display with keyboard. As an alternative, setting can be done by a (Laptop-) **PC under Windows**.

Communication with the PC is done via an interface RS-232.

Connection to control :

- 6 drive speeds	V0, V1, V2, V3, V4, VN
- 2 direction signals	RU, RO
- drive enable	GS
- 4 relays	TÜ, ZS, ZB, EÜ
- 2 digital outputs	FRC ready, brake monitoring (24 V / 50 mA)
- 2 digital inputs +24V	programmable (see **Section 5.7.8.8**)
- 1 digital input +24V	emergency power mode (see **Section 5.10**)

Connection of PTC-thermistor:

Standard-PTC's, shut-off point at approx. 3 kΩ.

At VVVF's with integrated contactors a temperature-switch, that is fixed at the backside of the case, is connected in series for temperature supervision of the brake resistor. The temperature threshold-value is approx. 80 °C.

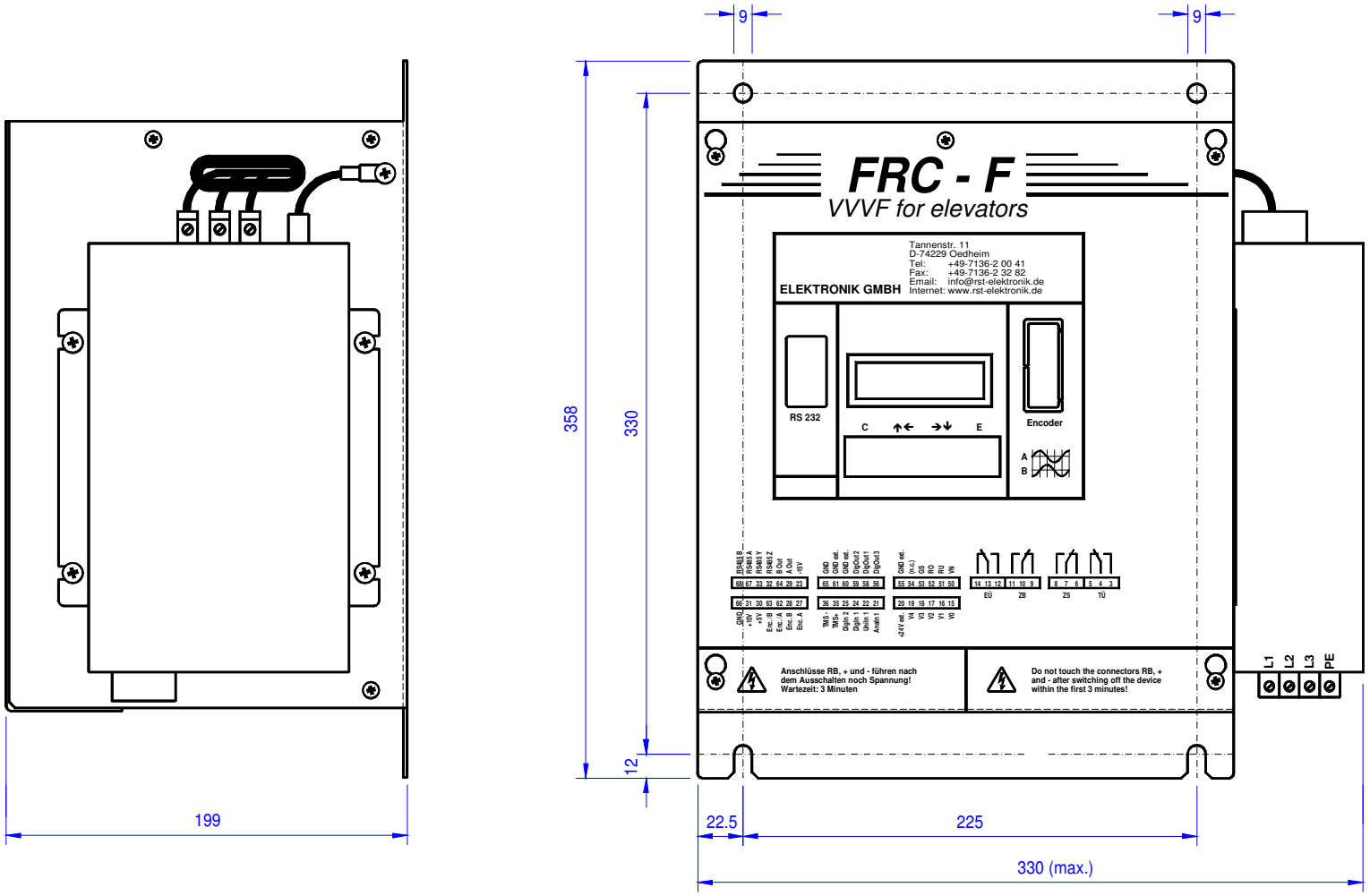
Principle of control :

Field-oriented vector control (closed loop)
Frequency-voltage control (open loop)

Range of temperature : + 10 ... + 50 °C

Dimensions :

VVVF Controller	Dimensions in mm
type	*length x width x depth*
FRC-F1	358 x 330 x 200
FRC-F2	358 x 330 x 200
FRC-F3	358 x 330 x 200
FRC-F4	358 x 330 x 200
FRC-F5	385 x 330 x 221
FRC-F6	385 x 330 x 221
FRC-F7	537 x 330 x 221
FRC-Q8	725 x 545 x 306
FRC-Q9	725 x 545 x 306
FRC-Q10	765 x 625 x 314
FRC-Q11	765 x 625 x 314



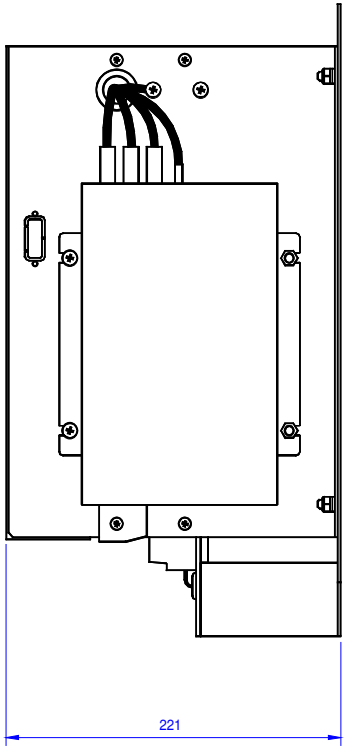
Alle Abmessungen in mm
Gewicht: ca. 14 kg

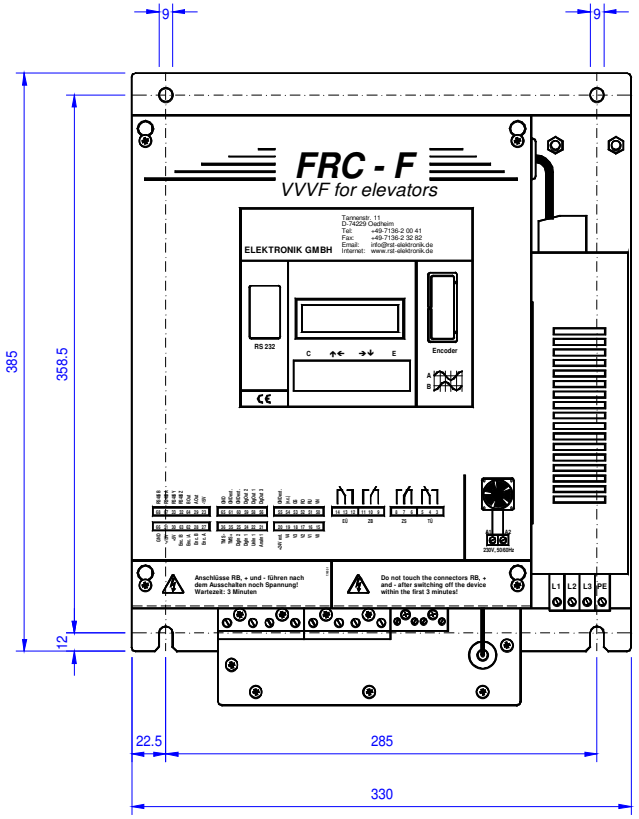
Technische Änderungen vorbehalten

All dimensions in mm
Gewicht: ca. 14 kg

Specification subject to change without notice

FRC-F1...F4	DIN ISO 2768 m		Maßstab 1:2		
			Zchngs.-Nr.: **5.576.31**		
		Datum	Name	**Abmessungen Dimensions**	
	Bearb.	27.06.03	Müller		
	Gepr.				
	Norm				
31 Index Rev. Änd.Nr. Freigabe Name	Tannenstr. 11, D-74229 Oedheim Tel. 07136 / 2 00 41, Fax 2 32 82		Datei: 5-576-31.skd	Blatt 1	1 Bl.





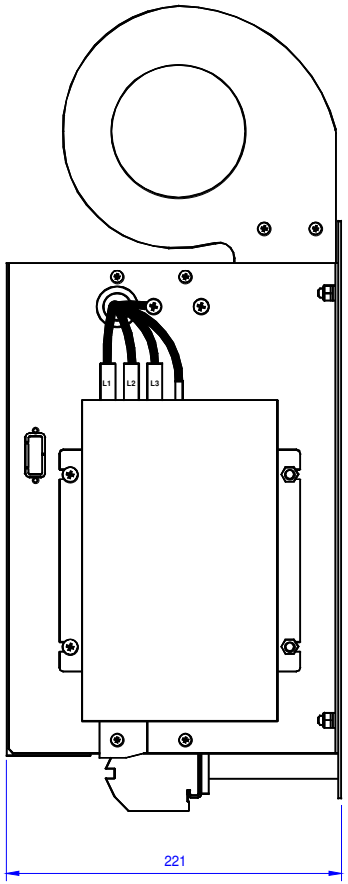
Alle Abmessungen in mm
Gewicht: ca. 22 kg

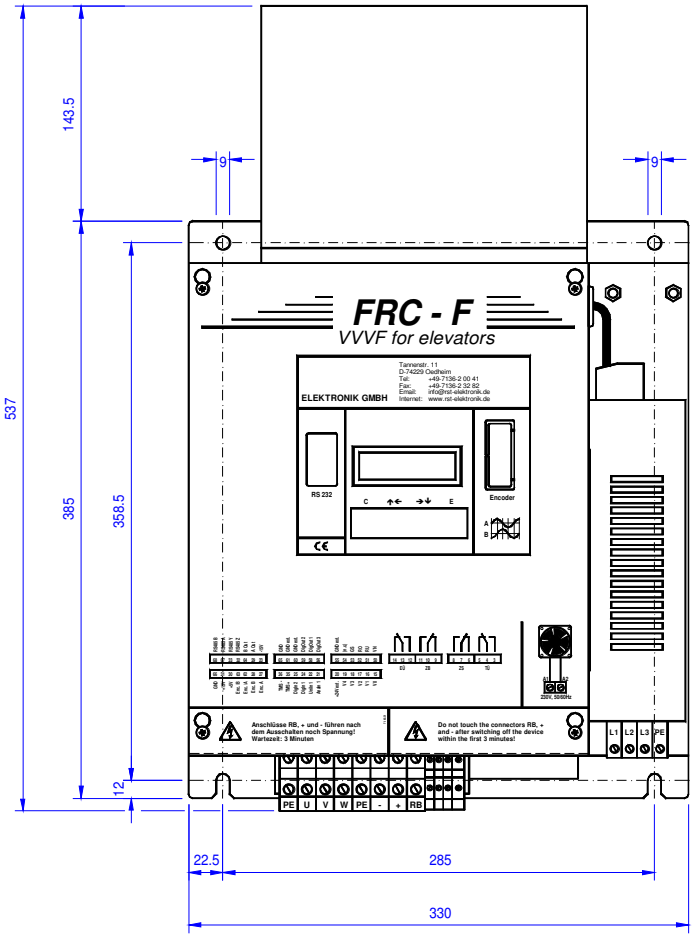
Technische Änderungen vorbehalten

All dimensions in mm
Weight: appr. 22 kg

Specification subject to change without notice

FRC-F5/F6					**DIN ISO 2768m**			Maßstab **1:3**	Version
								Zchngs.-Nr.: **5.588.31**	
						Datum	Name	**Abmessungen Dimensions**	
					Bearb.	25.09.03	Müller		
					Gepr.				
					Norm				
31					Tannenstr.11 D-74229 Oedheim			Datei: 5-588-31	Blatt 1
Index	Rev.	Änd.Nr.	Freigabe	Name					1 Bl.





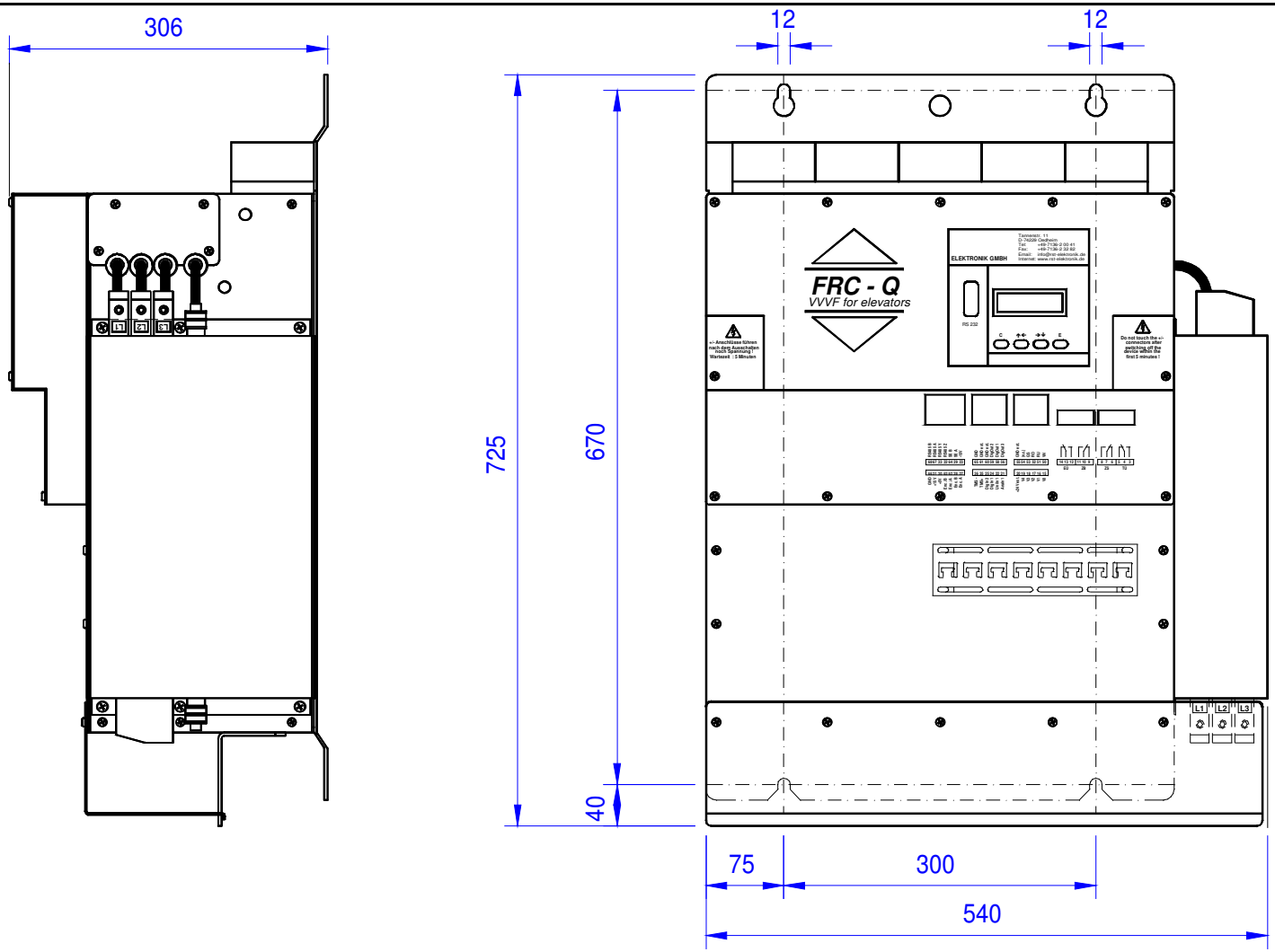
Alle Abmessungen in mm
Gewicht: ca. 25 kg

Technische Änderungen vorbehalten

All dimensions in mm
Weight: appr. 25 kg

Specification subject to change without notice

FRC-F7					**DIN ISO 2768m**		Maßstab **1:3**	Version
							Zchngs.-Nr.: **5.589.31**	
						Datum	Name	**Abmessungen Dimensions**
					Bearb.	25.09.03	Müller	
					Gepr.			
					Norm			
31					Tannenstr.11 D-74229 Oedheim		Datei: 5-589-31	Blatt 1
Index	Rev.	Änd.Nr.	Freigabe	Name				1 Bl.



Alle Abmssungen in mm
All dimensions in mm

Gewicht: ca. 57 kg
Weight: appr. 57 kg

FRC-Q8/9					**DIN ISO 2768 m**			Maßstab **1:4** / Version
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						Datum	Name	**Außenabmessungen Dimensions**
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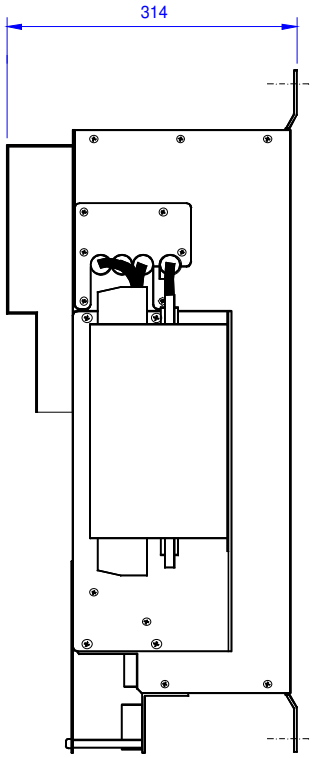
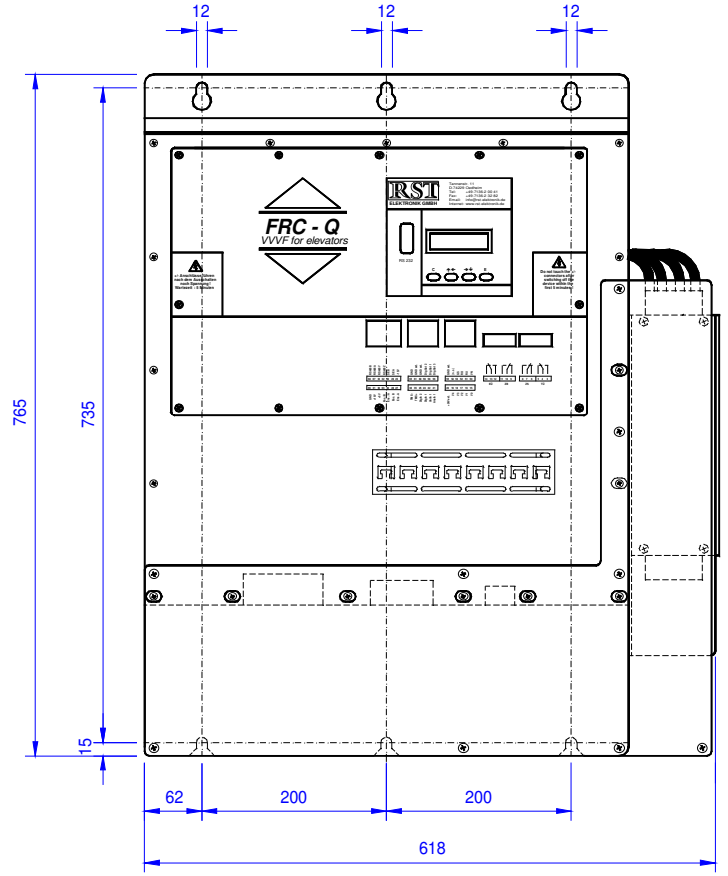
					Gepr.			
					Norm			
								Datei: 5-476-31 / Blatt 1
31					Tannenstr.11 D-74229 Oedheim			1 Bl.
Index	Rev.	Änd.Nr.	Freigabe	Name				





Alle Abmessungen in mm
All dimensions in mm

Gewicht: ca. _____ kg
Weight: appr. _____ kg

FRC-Q10/Q11					**DIN ISO 2768m**			Maßstab **1:5** / Version
						Datum	Name	Zchngs.-Nr.: **5.508.31**
					Bearb.	19.02.03	Müller	**Außenabmessungen Dimensions**
					Gepr.			
					Norm			
					Tannenstr.11 D-74229 Oedheim			Datei: 5-508-31.skd / Blatt 1 / 1 Bl.
31								
Index	Rev.	Änd.Nr.	Freigabe	Name				

4 Installation

By all means, please pay attention to the notes given in Section 1!

Danger !
Never carry out electrical work at live systems. Before carrying out any work, disconnect the unit from power supply. After disconnection of the power supply, the DC link will still remain live for several minutes !

4.1 Shaft installation

4.1.1 Deceleration distance / leveling switches

Shut-off points for fast speed V4 and creep speed V0 are to be adjusted for up and down to exactly equivalent distances at every landing (see following table).

Levelling switches to be adjusted independently from V4 to approx. 5-8 cm ahead of flush landing level, exactly symmetrical from both directions.

Empirically, the following distances make sense, depending on the travel speed:

Travel speed	Disconnection distance	Length of inductor plate or magnet assembly
0,5 – 1,25 m/sec	approx. 5 cm	2 x 5 cm = 10 cm
1,5 – 2,5 m/sec	approx. 8 cm	2 x 8 cm = 16 cm

Note : In case of direct landing approach, V0-disconnection points are of course annulled.

4.1.2 Direct landing

4.1.2.1 Landing without reference signal

Only one disconnection point for high-speed (V4) is required. It can be set by parameter B (deceleration ramp). During the deceleration, a **position controller** is active which controls the position exactly.

Conditions for a perfect direct landing approach :

- Disconnection point for V4 is to be adjusted exactly identical at all landings in order to warrant a uniform stopping accuracy.
- The braking command from the control must be reproducible exactly !

  Example : Running speed v = 2 m/sec = 2 mm/msec
  A deviation of **1 msec** would result in an inaccuracy of **2 mm** !

4.1.2.2 Landing with reference signal

Experience has shown that direct landing is hardly ever possible due to different parameters (slip, software runtimes, etc.) Most elevator control systems offer a signal which is activated at a definable distance from the leveling position (mostly in zone range). This signal can be used by the VVF controller to correct the deceleration ramp such that the exact leveling position is reached (see section 5.7.8.4.4)

Table of stopping distances:

	Stopping distance [m]			
v [m/sec]	**a=-0,6 m/sec**	**a=-0,8 m/sec**	**a=-1 m/sec**	**a=-1,2 m/sec**
0,5	0,76	0,71	0,68	0,65
0,6	0,91	0,84	0,79	0,76
0,7	1,08	0,98	0,92	0,87
0,8	1,26	1,13	1,05	1,00
0,9	1,47	1,30	1,20	1,13
1	1,68	1,48	1,35	1,27
1,1	1,92	1,67	1,52	1,41
1,2	2,17	1,87	1,69	1,57
1,3	2,44	2,09	1,88	1,73
1,4	2,72	2,32	2,07	1,91
1,5	3,03	2,56	2,28	2,09
1,6	3,34	2,81	2,49	2,28
1,7	3,68	3,08	2,72	2,47
1,8	4,03	3,36	2,95	2,68
1,9	4,40	3,65	3,20	2,89
2	4,78	3,95	3,45	3,12
2,1	5,19	4,27	3,72	3,35
2,2	5,60	4,60	3,99	3,59
2,3	6,04	4,94	4,28	3,83
2,4	6,49	5,29	4,57	4,09
2,5	6,96	5,66	4,88	4,35
2,6	7,44	6,04	5,19	4,63
2,7	7,95	6,43	5,52	4,91
2,8	8,46	6,83	5,85	5,20
2,9	9,00	7,25	6,20	5,49
3	9,55	7,68	6,55	5,80
3,1	10,12	8,12	6,92	6,11
3,2	10,70	8,57	7,29	6,44
3,3	11,31	9,04	7,68	6,77
3,4	11,92	9,52	8,07	7,11
3,5	12,56	10,01	8,48	7,45
3,6	13,21	10,51	8,89	7,81
3,7	13,88	11,03	9,32	8,17
3,8	14,56	11,56	9,75	8,55
3,9	15,27	12,10	10,20	8,93
4	15,98	12,65	10,65	9,32

4.2 Connection of VVVF controller

4.2.1 Power connections

4.2.1.1 Protective conductor

The protective conductor is to be **star-connected**.
Connect the protective conductor terminals of all components (braking resistor, inductor, motor, etc.) to the **star point** (main earth). This point should be as close to the VVVF controller as possible.

4.2.1.2 Connection to power supply

Select an appropriate **mains cable cross-section** (refer to VDE 0100 Part 523).

4.2.1.3 Fans

At devices bigger than FRC-F4 the power supply for the fan must be provided externally by the plant operator. The fan requires a supply voltage of 230V~/50Hz (60Hz). The fan power supply line must be fuse-protected (max. 6A).
The fan is connected to the terminals named L and N on the terminal block. Connection to PE is not mandatory, but should be done as the 2.5 mm² PE terminal if at all.

4.2.1.4 Motor phases

Select an appropriate **mains cross-section** (refer to VDE 0100 Part 523).

Connect the **motor phases U, V, W** using a **shielded cable**. Make sure the shield is connected to PE firmly (use a metal clamp) and as close as possible to the VVVF controller .

4.2.1.5 Braking resistor

Connect the **braking resistor** (terminals **+** and **RB**) using a **shielded cable**. Make sure the shield is connected to PE firmly (use a metal clamp) and as close as possible to the VVVF controller.

4.2.2 Low-voltage connections

4.2.2.1 Encoder

4.2.2.1.1 Square wave encoder

Connect the **incremental encoder** using a **shielded cable**. Make sure the shield is connected to PE firmly and as close as possible to the VVVF controller (use a metal clamp).
Make sure that the incremental encoder is connected to the VVVF controller correctly. The terminal assignment is as follows:

Terminal	Function	Remark
30	+5V	Supply voltage for TTL encoder
31	+ 15V	Supply voltage for HTL encoder
65, 66	GND	Encoder ground connection
27	Signal track A	
28	Signal track B	
62	Signal track -A	Track A inverted
63	Signal track -B	Track B inverted
23	-15 V	Supply voltage (not required for standard encoder)

Note : The inverted encoder outputs (-A, -B) are not mandatory for operation.

4.2.2.1.2 Sine encoder

Connect the sine encoder to the 15-pole D-SUB socket at the front plate of the VVVF controller (to the right of the display). **The VVVF controller must be switched off before connecting the sine encoder !**

The pin assignment of the D-SUB socket is as follows:

D-Sub Pin	Function	Remark
1	+ 5V	Supply voltage for TTL encoder
2	GND	Encoder ground connection
3	Sin A+	Sine track A
4	Sin A-	Sine track A
5	Data+	Data (only with ECN1313)
6	Sin B+	Sine track B
7	Sin B-	Sine track B
8	Data-	Data (only with ECN1313)
9	Sense+	Voltage feedback
10	free	
11	Sense-	Voltage feedback
12	R+	Zero pulse
13	R-	Zero pulse
14	Clock	Transmission clock pulse (only with ECN1313)
15	Clock-	Transmission clock pulse (only with ECN1313)

Note : Since sine encoders use relatively low signal levels, make sure to provide neat, continuous shielding. If the encoder is bought from us, the connection cable is already ready-made. If you do not use a ready-made encoder cable, make sure to use shielded connectors and to connect the shield properly.

4.2.2.2 Drive command inputs

4.2.2.2.1 General

The drive command inputs are designed for an operating voltage of +24V. The +24V control voltage is provided by the unit itself, but it can also be provided externally.
The **input current at +24 V** is some **10 mA**.

4.2.2.2.2 Overview

Terminal	Function	Remark
15	V0	Creep speed
16	V1	Inspection speed
17	V2	Intermediate speed
18	V3	Intermediate speed
19	V4	High speed
20	+24 V	Drive commands supply voltage
50	VN	Fine levelling
51	RU	Travel direction DOWN
52	R0	Travel direction UP
53	GS	Controller enable
55	GND	Travel command ground terminal

Remarks:
Via terminal GS (terminal 53) the output stage is de-energized immediately

4.2.2.2.3 Setting the direction

The VVVF controller can be operated either with 1 or 2 direction signals. Configuration is done via the software (see Section querverweis).

1 direction signal:
The desired direction is set by using terminal RO (terminal 52):

RO	Response
0	none or stop
1	up-travel

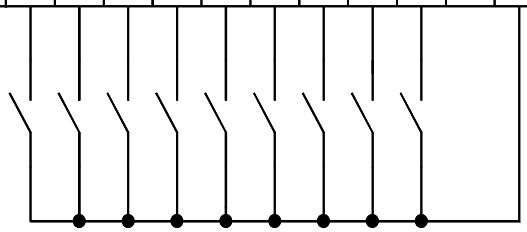
2 direction signals:
The desired direction is set by using terminals RU (terminal 51) and RO (terminal 52):

RU	RO	Response
0	0	none or stop
0	1	up-travel
1	0	down-travel
1	1	none or stop

If a direction signal fails during the travel operation, the controller starts a deceleration ramp and stops. A change of direction signals during the travel operation results in a direct change of the required value sign up to a speed of 25 rpm. In the case of higher speeds, the change of direction command is ignored for safety reasons and a warning message is signalled on the display.

4.2.2.2.4 Control via floating contacts, internal control voltage

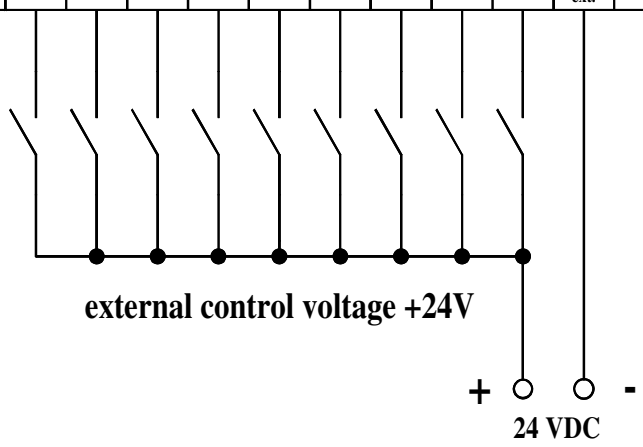
Terminal	15	16	17	18	19	50	51	52	53	55	20
Drive Command	V0	V1	V2	V3	V4	VN	RU	RO	GS	GND ext.	+24V



floating contacts

4.2.2.2.5 Control via floating contacts, external control voltage

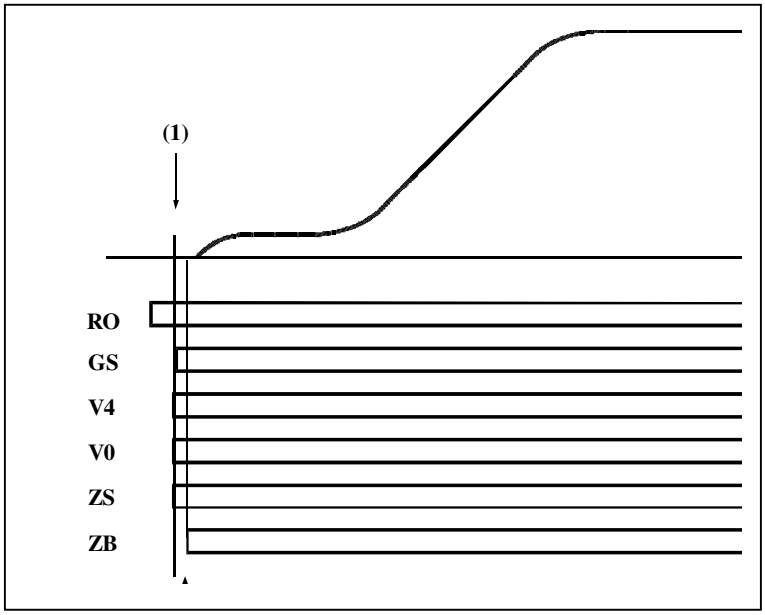
Terminal	15	16	17	18	19	50	51	52	53	55	20
Drive Command	V0	V1	V2	V3	V4	VN	RU	RO	GS	GND ext.	+24V



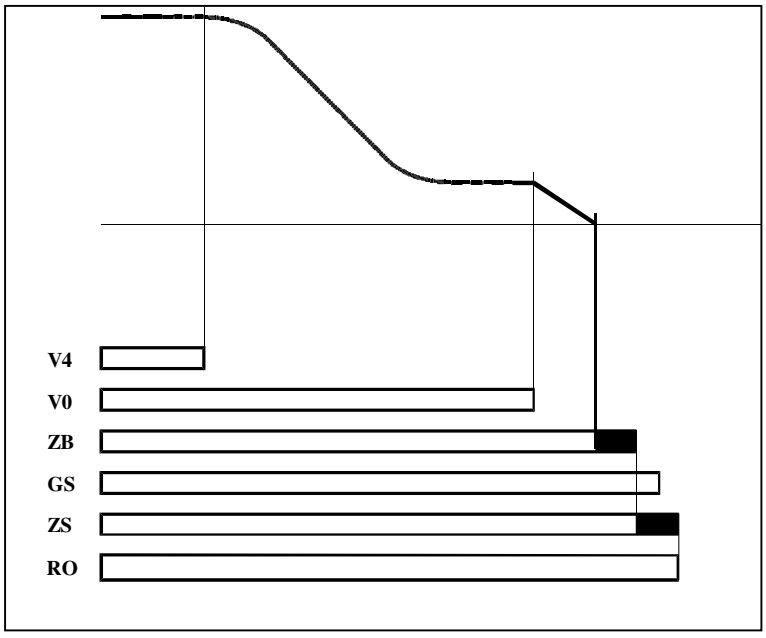
Important Note!
The +24 V supply voltages of the control and the VVVF controller must never be connected at the same time.

4.2.2.2.6 Signal procedure at normal operation (example: up-travel at V4)

Explanations on start-up: The **time** at which the travel commands are received does **not play any role**. As soon as the VVVF controller receives the controller enable (**GS**), direction signal (**RO** or **RU**) and a speed command (**V4**), the relay ZS (main contactors) and after the time *ZB auf* the relay ZB (brake) are activated and initiate the start-up operation.

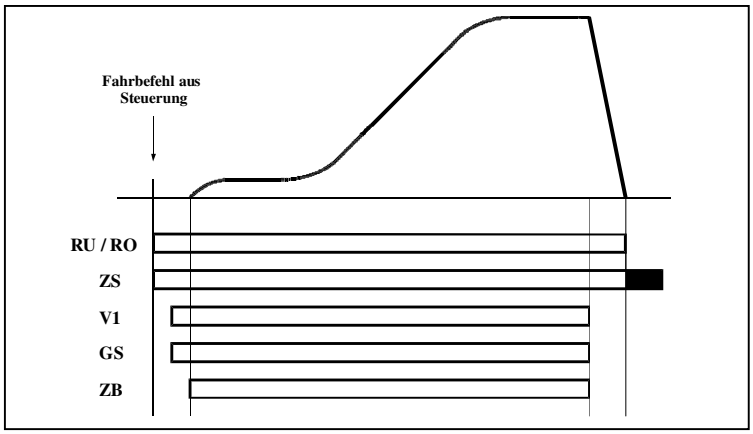


Explanations on stop procedure: As soon as the V4 command is withdrawn, the deceleration operation is initiated, as soon as the V0 command is withdrawn, the unit is decelerated to speed 0. After the unit has stopped, the relays ZS and ZB are switched off, the delay times can be parameterised.



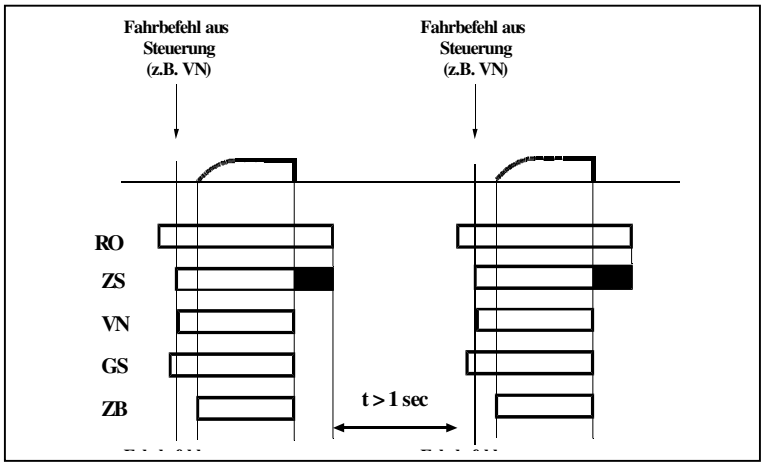
4.2.2.2.7 Signal procedure at inspection

Note: When the inspection pushbutton is released, the **control** closes the **brake** and opens the **main contactors**. The set value runs to 0 within 200 msec. The relay timing (ZB, ZS) of the VVVF controller **does not play any role** in this case.



4.2.2.2.8 Signal procedure for levelling operation

Note : When the flush landing level is reached, the **control** closes the **brake** and opens the **main contactors**. The set value runs to 0 within 200 msec. The relay timing (ZB, ZS) of the VVVF controller **does not play any role** in this case.



Make sure to wait for at least 1 sec. between two levelling operations so that the ropes and the mechanical equipment can settle. Otherwise it may happen that the elevator keeps levelling all the time without coming to a rest.

4.2.2.3 Digital inputs

Terminal	Function	Remark
21	Analog IN1	Analogue input 0 to 10 V, free
22	UniIn1	Digital-analogue input + 24 V for emergency operation
24	Digital IN1	Digital input + 24V (programmable)
25	Digital IN2	Digital input + 24V (programmable)
60, 61	GND_EXT	Ground inputs/outputs

4.2.2.4 Motor PTC input

Terminal	Function	Remark
35	TMS+	Motor PTC
36	TMS-	Motor PTC

4.2.2.5 Relay outputs

Terminal	Function	Remark
3	normally open contact	Relay TÜ (fault messages)
4	make contact	Relay TÜ (fault messages)
5	normally closed contact	Relay TÜ (fault messages)
6	normally closed contact	Relay ZS (travel contactor control)
7	make contact	Relay ZS (travel contactor control)
8	normally open contact	Relay ZS (travel contactor control)
9	normally closed contact	Relay ZB (brake control)
10	make contact	Relay ZB (brake control)
11	normally open contact	Relay ZB (brake control)
12	normally closed contact	Relay EÜ (signal for prematurely open doors)
13	make contact	Relay EÜ (signal for prematurely open doors)
14	normally open contact	Relay EÜ (signal for prematurely open doors)

4.2.2.6 Incremental encoder signals for shaft copying of the elevator control

Some elevator control systems use the output signals of the incremental encoder for shaft copying. The VVVF controller makes the processed encoder signals available at terminals 28 and 64.
Note : The outputs are open collector stages (without downstream driver stage). The maximum output current is **2 mA.**

Terminal	Function	Remark
29	Encoder A	TTL-level, fmax=200 kHz, Imax = 2 mA
64	Encoder B	HTL-level, fmax=70 kHz, Imax = 2 mA
65, 66	GND	Encoder ground connection

4.2.2.7 Digital outputs

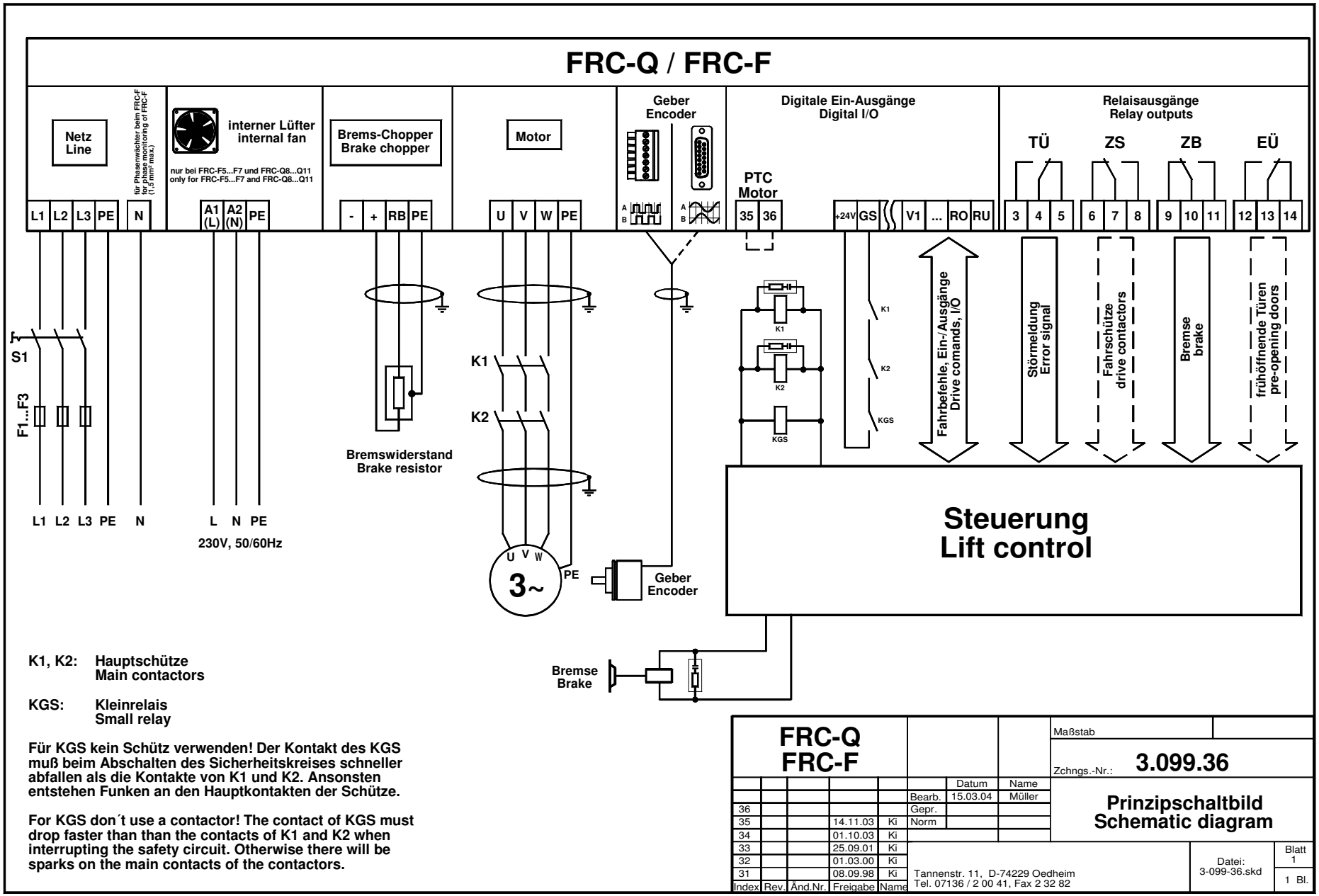
Terminal	Function	Remark
58	Digital Out 1	"Brake monitoring" output
59	Digital Out 2	"Controller ready" output
56	Digital Out 3	“Load direction” output
60, 61	GND_EXT	Ground inputs/outputs

Remarks:
When the unit is switched on it will take several seconds until it is ready for service due to internal self-tests. During this time no travel commands from the control will be accepted. At **terminal 59** (controller ready) a "+24"-signal appears as soon as the unit is ready for service.

4.2.2.8 RS-485 interface / DCP mode

Terminal	Function	Remark
32	RS485-Z	semi-duplex interface
33	RS485-Y	
67	RS485-A	semi-duplex interface
68	RS485-B	

To realize the DCP connection, terminal 67 and terminal 68 must be connected to the control system.



K1, K2: Hauptschütze
Main contactors

KGS: Kleinrelais
Small relay

Für KGS kein Schütz verwenden! Der Kontakt des KGS muß beim Abschalten des Sicherheitskreises schneller abfallen als die Kontakte von K1 und K2. Ansonsten entstehen Funken an den Hauptkontakten der Schütze.

For KGS don´t use a contactor! The contact of KGS must drop faster than than the contacts of K1 and K2 when interrupting the safety circuit. Otherwise there will be sparks on the main contacts of the contactors.

FRC-Q FRC-F							
						Datum	Name
					Bearb.	15.03.04	Müller
36					Gepr.		
35			14.11.03	Ki	Norm		
34			01.10.03	Ki			
33			25.09.01	Ki			
32			01.03.00	Ki			
31			08.09.98	Ki			
Index	Rev.	Änd.Nr.	Freigabe	Name			

Maßstab

Zchngs.-Nr.: **3.099.36**

Prinzipschaltbild
Schematic diagram

Tannenstr. 11, D-74229 Oedheim
Tel. 07136 / 2 00 41, Fax 2 32 82

Datei: 3-099-36.skd

Blatt 1

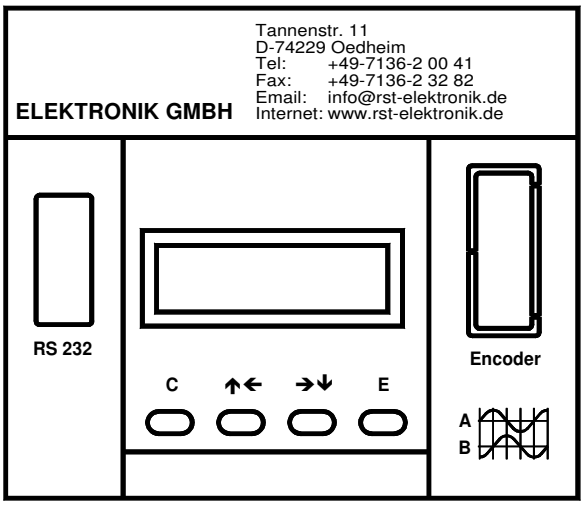
1 Bl.

5 Commissioning

5.1 Use of the VVVF controller

5.1.1 Control elements

The user interface of the VVVF controller comprises a 2-line LC-Display, a keyboard with 4 keys and a 9-pole SUB-D plug for connection of an external programming device (PC with PowerControl for Windows) or a modem.



Currently, the following languages are supported:

- German
- English
- Turkish
- Spanish
- French
- Polish

Every function of the controller is to be selected and set by the 4 keys. The following functions are allocated to the keys:

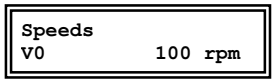
Key "**E**": Selection of the menu item displayed and scrolling down in sub-menus, acknowledgement of data entered and filing of modified parameters ("Enter").

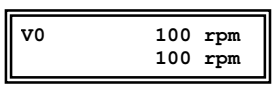
Key "**C**": Leaving submenus, rejecting modifications ("**Cancel**").

Arrow key "↑←": Moving on a menu level, increasing values

Arrow key "→↓": Moving on a menu level, reducing values

5.1.2 Entering parameter values





Entering values in order to change parameters is very easy by using the keyboard.
Press "E" to activate "Edit mode". Now the first line of the display shows the current value of the selected parameter. In the second line you can edit this value.

Use the ""↑←"" key to increase the value. Use the "➔↓" key to reduce it. The increment increases dynamically if the key is pressed continuously. In this way it is also very easy to change parameters over a very large range.

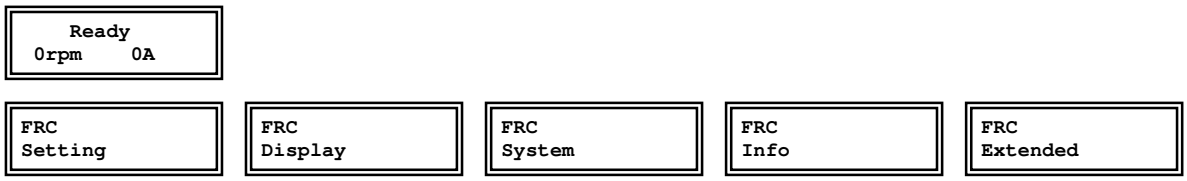
The adjustment range is limited by the minimum and maximum values of the corresponding parameters.

When the parameter has the required value, confirm it by pressing **"E"**. Press "**C**" to cancel the action.

☞ **Note : For safety reasons, parameters cannot be changed during a travel operation !**

5.1.3 Navigation in the menu

From the standard display, press the "E" key to enter the first menu level of the main menu (set-up).



Use the arrow keys to scroll through this menu level. The menu is designed as a circle, i.e. press "➔↓" when you are on "Extended" to return to "Setting".

This ring-like structure is found in all sub-menus, too.

Press the "**E**" key to open the first menu item of the selected main menu. Here, use the arrow keys to scroll through the individual menu items and press the "E" key to open the selected sub-menu.

Use the "**C**" key anywhere in the menu to return to the previous hierarchy level. "**C**" will always open the first item of the higher-order menu where you have branched into the sub-menu by using the "E" key.

If you press the "**C**" key in the first menu level (main menu), you will return to the standard display.

5.2 Factory settings, parameter overview

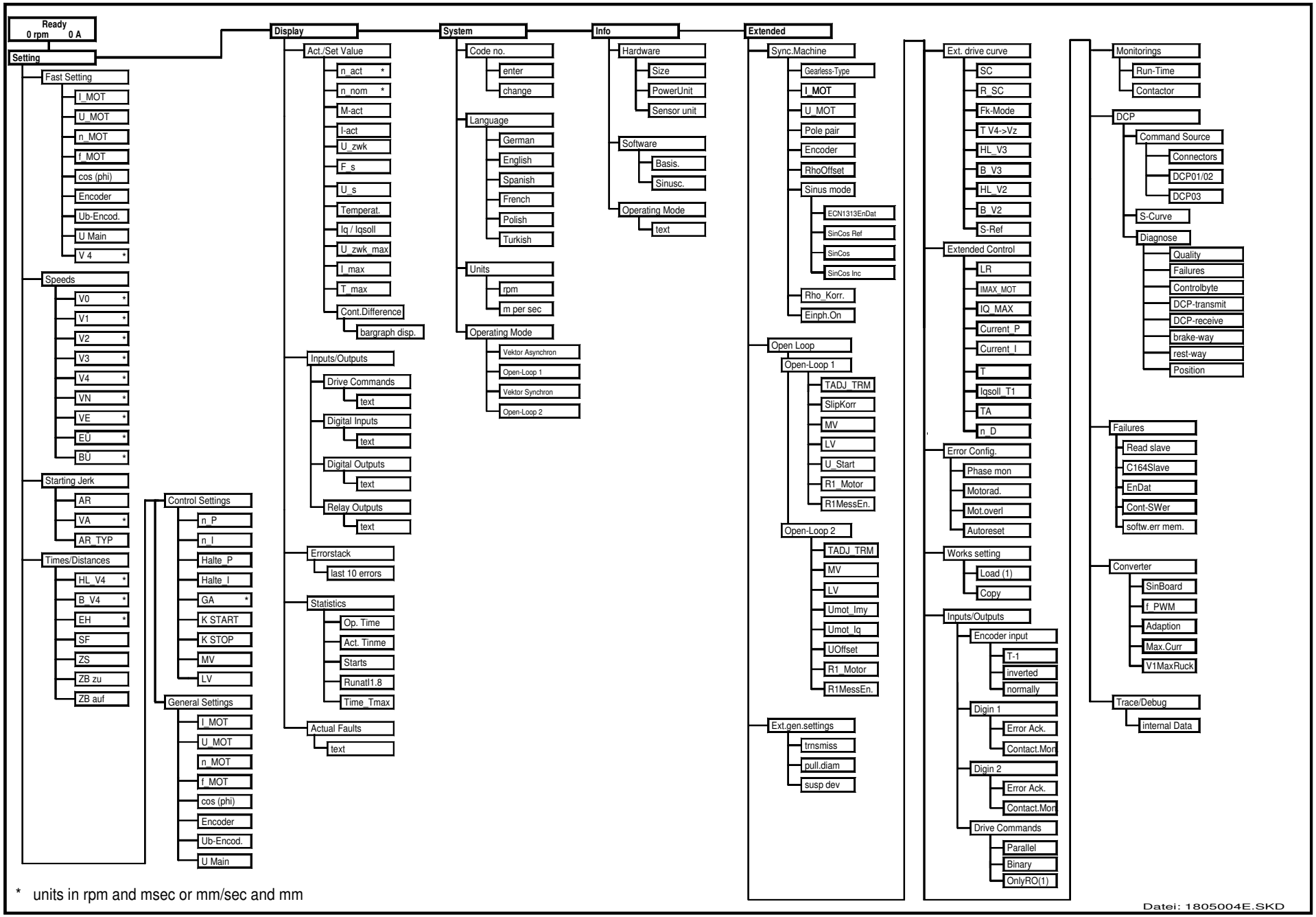
The parameters have been preset in our factory, so on installation of the elevator you can simply set the elevator parameters and then operate the elevator in a controlled manner. For easy setting the display offers a special- menu ***short setting***, in which the parameters are called up automatically.

Parameter	Display text	Setting range	Basic setting	Remark
Speed				
Creep speed	V0	1 - 630	100 rpm	mm/sec
Inspection	V1	1 - 1500	300 rpm	optionally in mm/sec
1st intermediate speed	V2	1 – 3000	1000 rpm	optionally in mm/sec
2nd intermediate speed	V3	1 - 3000	1380 rpm	optionally in mm/sec
High speed	V4	50 - 3000	1380 rpm	optionally in mm/sec
Fine leveling	VN	1 - 270	75 rpm	optionally in mm/sec
Evacuation speed	VE	1 - 630	100 rpm	optionally in mm/sec
Levilling monitoring	EÜ	0 - 1800	300 rpm	optionally in mm/sec
Deceleration monitoring	BÜ	0 - 1800	300 rpm	optionally in mm/sec
Starting behaviour				
time of starting jerk	AR	100 - 3000	1500 msec	
type of starting jerk (static, dynamic)	AR_TYP	0 - 1	1	Standard: dynamic
speed of starting jerk	VA	1 - 180	10 rpm	optionally in mm/sec
Times/Distances				
acceleration	HL_V4	1000 – 10000	2500 msec	in mm
deceleration ramp	B_V4	1000 – 10000	2500 msec	in mm
electrical stop	EH	300 - 3000	1000 msec	in mm
travel curve start time	SF	100 – 30000	300 msec	
delay time relay contactors	ZS	100 - 1000	300 msec	
delay time relay brake close	ZB_close	0 - 1000	200 msec	
delay time brake open	ZB_open	0 - 3000	100 msec	
Regulator				
gain speed regulator	n_P	2 - 200	30	
gain speed regulator	n_I	40 - 9999	1000 msec	
gain starting regulator	K_START	50 - 500	150 %	
gain starting regulator	K_STOP	50 - 500	150 %	
stillstand regulator	Halte_P	0 – 10000	30	
stillstand regulator	Halte_I	1 - 9999	1000	
limit starting regulator	GA	0 - 3000	90 rpm	
torque anticipation	MV	0 - 500	100	
load compensation	LV	100 - 900	500	
General settings				
nominal motor current	I_MOT	2 - 200	FRC-rated current	motor type plate
nominal motor voltage	U_MOT	150 - 700	400 V	motor type plate
nominal motor speed	n_MOT	50 - 3000	1350 rpm	motor type plate
nominal motor frequency	f_MOT	20 - 100	50 Hz	motor type plate
cos (phi)	cos(phi)	30 - 99	80	motor type plate
number of encoder pulses	Encoder	500 - 4096	1024	Square wave encoder
voltage supply for encoder	Ub-Encod.	5 - 15	5 V	Square wave encoder
Mains voltage	U_MAIN	220 - 440	400 V	Mains voltage
Extended menus				
Synchronous machine				
nominal motor current	I_MOT	2 – 200	FRC-rated current	motor type plate
nominal motor voltage	U_MOT	150 - 700	400 V	motor type plate
number of motor pole pairs	Pole pairs	1-100	2	motor type plate
number of encoder pulses	Encoder	500 - 4096	1024	Sine encoder
load angle offset	RhoOffset	-32768 - 32767	0	automatic measurement
encoder evaluation method	Sine mode		0	
load angle correction	Rho_corr	0 – 1	0	currently without function
Open-Loop 1				
rotor time constant	TADJ_TRM	0-1000	80	
slip correction	Slipcorr	0-32767	10000	
torque anticipation	MV	0-500	100	
load compensation	LV	100-900	500	
start-up voltage	U_Start	0-32000	4000	automatic determination
motor resistance	R1_Motor	700		automatic determination

Open-Loop 2				
rotor time constant	TADJ_TRM	0-1000	80	
torque anticipation	MV	0-500	100	
load compensation	LV	100-900	500	
magnetization	Umotor_Imy	0-100	7	automatic determination
torque	Umotor_Iq	0-100	0	automatic determination
Voltage offset	UOffset	0-500	0	automatic determination
Motor resistance	R1_Motor	700		automatic determination
Extended general settings				
transmission	trnsmiss	0-5000	0	actual transmission*100
Pulley diameter	pull. diam	0-1000	0 mm	
suspension	susp dev	0-5	0	
Extended travel curve				
floor to floor	SC	0 - 1000	500	
Roundings floor to floor	R_SC	0 - 1000	300	
Mode travel curve	FK-Mode	1 - 3	2	S-curve
Transitional time at speed changes	T V4->Vz	0 - 5000	0	Transitions V4 <-> V3 or V2
Acceleration time to speed V3	HL_V3	0 - 5000	0	in mm
Acceleration time to speed V2	HL_V2	0 - 5000	0	optionally in mm
Deceleration time from speed V3	B_V3	0 - 5000	0	optionally in mm
Deceleration time from speed V2	B_V2	0 - 5000	0	optionally in mm
Reference distance	S-Ref	0 - 500	0 mm	Position correction at direct landing
Extended regulator settings				
inertia	T	0 - 10	0	for V-belt drive
positioning controller	LR	0 - 300	100 %	Position controller amplification
scan time	TA	1000 - 10000	5000 usec	
torque limit	IQ_MAX	1 - 100	100 %	
Max. motor current	IMAX_MOT	100 - 300	200 %	
P-amplification current regulator	Strom_P	1-300	15	
I-amplification current regulator	Strom_I	1-32767	4000	
D-amplification speed regulator	n_D	0 - 100	0	
torque smoothening	Iqsoll_T1	0 - 5	0	
Error configuration				
enable error motor adaptation	motor ad.	0 - 1	1	error enabled
enable error phase failure	phase fail.	0 - 1	1	error enabled
enable error overload	overload	0 - 1	1	error enabled
Auto error reset	Auto reset	0 - 2	1	autom. error reset
Inputs/outputs				
Encoder input	T-1	0-4	0	smoothening of actual speed value
encoder input	direction	0-1	0	normal / inverted
Function digital input 1	Digin1	0-1	0	error reset/contactor monitoring
Function digital input 2	Digin2	0-1	0	error reset/contactor monitoring
encoding of drive commands	drive commands	0-1	0	parallel/binary
Configuration of direction signals	only RO(1)	0-1	0	RO or R0+RU
Monitoring				
runtime monitoring	runtime	0-600	0 sec	for contactor design only
contactor monitoring	cont.mon.	0-1	0	contactor drop-out monitoring
DCP				
command source		Terminals / DCP	Terminals	
s-shape of deceleration curve	S-curve	1 - 25	10	only effective in the case of DCP2
VVVF controller				
enable sine controller	SinBoard	0 - 1	0	only with additional evaluation unit
switching frequency of IGBT's	f_PWM	6 - 15	14 kHz	
enable current regulator adaptation	Adaption	0 - 1	0	automatic measurement
overload factor of VVVF-controller	Max.current	100 - 200	200 %	
Break-away torque for catching test	V1Maxjerk	0 - 1	0	only at V1

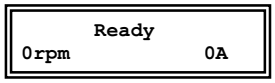
5.3 Menu overview

The menu has an hierarchical structure and assembles functions belonging to one another in easily understandable submenus. To facilitate work with the display-menu, the items are nearly the same as in the PC- Windows program. You will find a **complete summary of all sub-menus** on the following page.


Ready
0 rpm 0 A
Setting
Fast Setting
I_MOT
U_MOT
n_MOT
f_MOT
cos (phi)
Encoder
Ub-Encod.
U Main
V 4 *
Speeds
V0 *
V1 *
V2 *
V3 *
V4 *
VN *
VE *
EÜ *
BÜ *
Starting Jerk
AR
VA *
AR_TYP
Times/Distances
HL_V4 *
B_V4 *
EH *
SF
ZS
ZB zu
ZB auf
Control Settings
n_P
n_I
Halte_P
Halte_I
GA *
K START
K STOP
MV
LV
General Settings
I_MOT
U_MOT
n_MOT
f_MOT
cos (phi)
Encoder
Ub-Encod.
U Main
Display
Act./Set Value
n_act *
n_nom *
M-act
I-act
U_zwk
F_s
U_s
Temperat.
Iq / Iqsoll
U_zwk_max
I_max
T_max
Cont.Difference
bargraph disp.
Inputs/Outputs
Drive Commands
text
Digital Inputs
text
Digital Outputs
text
Relay Outputs
text
Errorstack
last 10 errors
Statistics
Op. Time
Act. Tinme
Starts
Runatl1.8
Time_Tmax
Actual Faults
text
System
Code no.
enter
change
Language
German
English
Spanish
French
Polish
Turkish
Units
rpm
m per sec
Operating Mode
Vektor Asynchron
Open-Loop 1
Vektor Synchron
Open-Loop 2
Info
Hardware
Size
PowerUnit
Sensor unit
Software
Basis.
Sinusc.
Operating Mode
text
Extended
Sync.Machine
Gearless-Type
I_MOT
U_MOT
Pole pair
Encoder
RhoOffset
Sinus mode
ECN1313EnDat
SinCos Ref
SinCos
SinCos Inc
Rho_Korr.
Einph.On
Open Loop
Open-Loop 1
TADJ_TRM
SlipKorr
MV
LV
U_Start
R1_Motor
R1MessEn.
Open-Loop 2
TADJ_TRM
MV
LV
Umot_Imy
Umot_Iq
UOffset
R1_Motor
R1MessEn.
Ext.gen.settings
trnsmiss
pull.diam
susp dev
Ext. drive curve
SC
R_SC
Fk-Mode
T V4->Vz
HL_V3
B_V3
HL_V2
B_V2
S-Ref
Extended Control
LR
IMAX_MOT
IQ_MAX
Current_P
Current_I
T
Iqsoll_T1
TA
n_D
Error Config.
Phase mon
Motorad.
Mot.overl
Autoreset
Works setting
Load (1)
Copy
Inputs/Outputs
Encoder input
T-1
inverted
normally
Digin 1
Error Ack.
Contact.Mon
Digin 2
Error Ack.
Contact.Mon
Drive Commands
Parallel
Binary
OnlyRO(1)
Monitorings
Run-Time
Contactor
DCP
Command Source
Connectors
DCP01/02
DCP03
S-Curve
Diagnose
Quality
Failures
Controlbyte
DCP-transmit
DCP-receive
brake-way
rest-way
Position
Failures
Read slave
C164Slave
EnDat
Cont-SWer
softw.err mem.
Converter
SinBoard
f_PWM
Adaption
Max.Curr
V1MaxRuck
Trace/Debug
internal Data
* units in rpm and msec or mm/sec and mm
Datei: 1805004E.SKD

5.4 Switching on the power supply

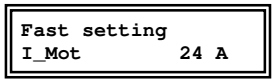
After switching on, the unit is running a self-test, which is demonstrated on the display by this message.

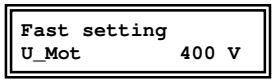


As soon as the unit is ready for operation, the standard display screen appears:
The standard display modus shows the actual operation mode of the unit in the first line, in the second line actual motor speed and actual motor current are displayed.

5.5 Adaptation of the controller parameters to the system

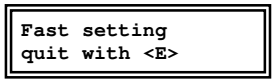
Press the Enter key ("**E**") twice to open the Fast Setting menu.
Use this menu to set all parameters which are necessary for an initial run. The converter leads you automatically to the relevant parameters where values have to be entered. These are:





- nominal motor current
- nominal motor voltage
- nominal motor speed
- nominal motor frequency
- cos(phi).
- number of encoder pulses
- encoder supply voltage
- mains voltage
- High speed V4.

---> The converter switches automatically to the next parameter as soon as a value has been entered.



The unit quits quick set-up as soon as the last menu parameter has been entered.
Quick set-up can also be aborted at any time using the **"C"** cancel key. It is also possible to jump between parameters within this menu using the cursor key and continue setting adjustments at any point.

General tips for the adaptation of the VVVF controller to the motor:

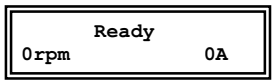
Some drive manufacturers (e.g. Schindler) always "stamp" their drives with the **synchronous speed** (no slip). This must not be mixed up with the **nominal speed** the drive achieves when loaded. The slip, i.e. the difference between the synchronous speed and the nominal speed is **approx. 2.5 to 4 %** in the case of **one-speed motors for VVVF controllers**. In the case of 50 Hz motors with 2 pole pairs, this corresponds to a nominal speed of approx. **1440 – 1465 rpm**. In the case of **pole-changing motors**, the slip is approx. **5 to 8 %**, which corresponds to a nominal speed of **1380 to 1425 rpm**.

☞ **To ensure a perfect travel behaviour, the nominal speed must be adjusted at the VVVF controller. This is always less than 1500 rpm in the case of 50 Hz motors !**

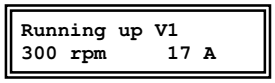
5.6 First travel operation

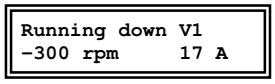
Issue travel command from the control system. The following commands are required for a travel operation at speed V1:

Travel up: GS, RO and V1
Travel down: GS, RU and V1



In the case of an upward movement of the cabin, a positive speed must be displayed.

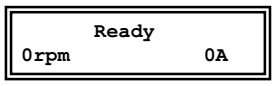




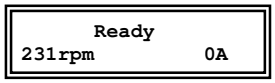
In the case of a downward movement, the value is negative.

Tip for checking the incremental encoder:

After entering system-related data, we recommend checking the general function of the incremental encoder before running for the first time. This can be done easily:



Call up the standard display on the unit's display. If you are in a sub-menu, press the **"C"** key as often as necessary until the following text is displayed.



Release brake briefly so that the cabin drifts upwards a few centimetres and observe the display at the same time. A **positive speed** must be displayed. If the speed is negative, the sensor tracks on the unit have to be reversed (terminal 27, 28 and 62, 63). If no speed is displayed, check the encoder connection and the entered data (number of encoder pulses and supply voltage) in the menu *General Settings.*

If the assignment between the sense of rotation of the motor (terminals U, V, W) and incremental encoder tracks is defective or if defective or no incremental pulses are detected, the motor runs for some 2 seconds before it is switched off and the error message "Wrong tacho polarity" and "no start-up" is displayed (see troubleshooting **Section 8.1**).

5.7 The Menu

5.7.1 Selection of units

The setting of the speeds and the distances/times can be done either in reference to the motor speed (rpm) or in reference to the cabin speed (m/sec).

The following parameter-groups can be set in the 2 unit modes:

Refer to:	**Motor**	**or**	**cabin**
Speeds:	**rpm**	**or**	**m/sec**
Ramps:	**msec**	**or**	**mm**

If you want to set the units in meter/second you must enter the correct values for transmission, pulley-diameter and suspension correctly. **If one of these parameters is not entered, the unit mode can't be changed from rpm to m/sec.**

As a standard, the unit mode is set to rpm. The following illustrations all show rpm unit mode.

The steps for changing the unit mode to m/sec. are explained in detail in **Section 5.7.6.3**.

```
System
Units
```

```
Units
rpm
```

```
Units
m per sec
```

5.7.2 Error messages

Operational errors are displayed by a flashing error message.

```
   *** Error ***
encoder polarity
```

In the second line of the display is shown the cause of the error in plain text

Sometimes, the controller recognises several errors at a time. In this case, a list of these errors is displayed. You can scroll through this list using the arrow keys.

5.7.3 Acknowledging faults

The unit returns to its normal operating mode after a fault has been acknowledged and the standard message is shown on the display - as long as the fault has been rectified. The following possibilities are available for acknowledging faults:

5.7.3.1 Manual acknowledgement using the unit's keyboard

Press the Enter key ("E") on the converter. If the cause of the error is still present (e.g. "overtemperature"), the error message can be deleted from the display, but the TÜ relay remains open (safety circuit open). The error is still active in the background. The error message can be activated again in the menu "Display" - "Errors".

5.7.3.2 External acknowledgement by a +24V signal

Application of a +24V signal to the appropriate digital input. The converter only reacts to the positive voltage edge ("permanent acknowledgement" not possible) for safety reasons.

5.7.3.3 Acknowledgement by the unit itself by auto-fault reset

Activate/deactivate in the **Fault Configuration** menu (see **Section 5.7.8.6**).

5.7.4 Setting – programming the converter

```
FRC
Setting
```

```
Setting
Fast setting
```

```
Setting
Speeds
```

```
Setting
Starting Jerk
```

```
Setting
Times
```

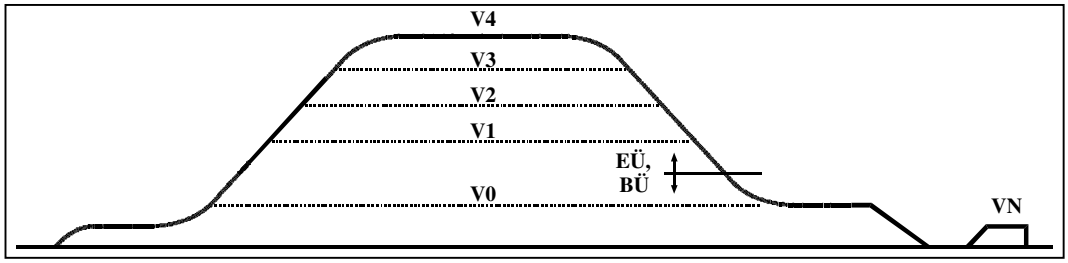
```
Setting
Control Settings
```

```
Setting
General Settings
```

5.7.4.1 Setting speeds

```
Setting
Speeds
```

By this item set the different operating speeds. As a standard, the speed is set in rpm (revolutions per minute). The setting refers to the speed of the motor shaft. Alternatively, you can set the speeds in mm/second **(Section 5.7.6.3)**.



Speeds

By key **„E“** branch to the different speeds. By key **„C“** return to the main menu.

The following operating speeds can be set.

```
Speeds
V0          100rpm
```

V0: creeping speed.

```
Speeds
V1          300rpm
```

V1: inspection operation speed.

Speeds V2 1000rpm	V2: 1. intermediate speed.
Speeds V3 1000rpm	V3: 2. intermediate speed.
Speeds V4 1380rpm	V4: high speed.
Speeds VN 75rpm	VN: leveling speed.
Geschw. VE 100rpm	VE: evacuation speed (the emergency mode is explained in **Section** 5.10).
Speeds EÜ 300rpm	EÜ: Assisting the function „doors starting to open during slowing down". As soon as during slowing down the speed falls below the set value, the related relay „EÜ“ is energised. The elevator control unit is able to recognise this signal and initiates door opening. If the set speed is, however, exceded, the relay is de-energised again.
Speeds BÜ 300rpm	BÜ: Brake monitoring. . If the motor speed falls below this value, the output **Digital Out1** (terminal 58) is activated, if the set speed is exceded, the output is reset again. By means of this function it is possible to monitor the braking function.

In case of **doors starting to open during slowing down**, for the EÜ-releasing point choose a value that allows an operation in compliance with EN 81 resp. TRA.

For the relevelling function set **VN** to approx. 3% - 5% of the rated motor speed.

☞ **Note:** Between repeated relevelling operations by all means a pause of **at least 1 sec** each is to be kept, in order that mechanical components and particularly the ropes can settle.

he speeds are set in rpm. A conversion from rpm to cabin speed (m/sec) is possible with the following formula.

$$VKN[m/sec] = \frac{n[1/min] * pi * DD[m]}{KZU * IW * 60}$$

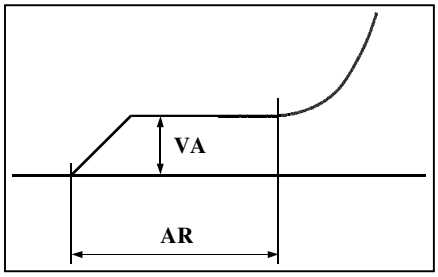
$$n[1/min] = \frac{VKN[m/sec] * KZU * IW * 60}{pi * DD[m]}$$

n: **motor speed in revolutions per minute (rpm)**
VKN: cabin speed in m/sec
KZU: suspension
IW: transmission ratio
DD: driving pulley diameter in m

5.7.4.2 Setting the starting behaviour

Setting
Starting jerk

By the items of this menu the behaviour of the elevator during starting is defined.



By pressing key **„E“,** you can branch in the items of the menu to set the parameters. By key **„C“** you return to the main menu.

ehaviour of the elevator during starting is defined by the following parameters:

Starting jerk	
AR	1000ms

Duration of the whole starting operation

Anfahrruck	
VA	10rpm

Starting motor speed

Starting jerk	
AR_TYP	1

You can choose between a static or a dynamic curve:
static (0): after the time AR the acceleration begins.
dynamic (1): if the actual speed has reached a minimum threshold (VA/2", the acceleration ramp starts.

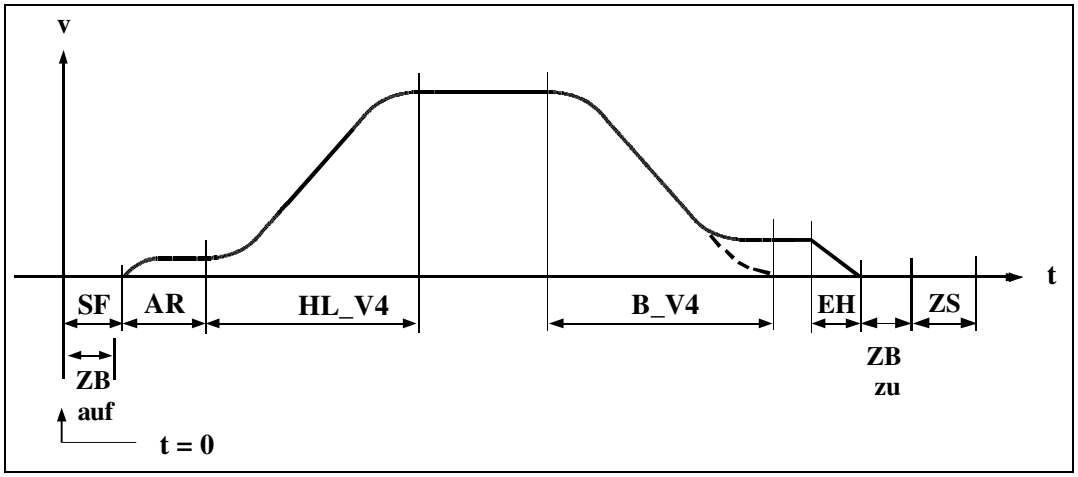
Appropriate setting of the starting parameters will result in a „smooth“ starting. The elevator car will smoothly and without jerk be freed from the frictional grip.

5.7.4.3 Setting the times/distances

Setting
Times

The form of the drive curve is stipulated using these parameters.

By pressing key **„E“,** you can branch in the items of the menu to set the parameters. By key **„C“** you return to the main menu



You can set the ramps in milliseconds or in millimetre (**See section 5.7.6.3)**

The following parameters are available:

Times HL_V4 2500ms	Acceleration to speed V4
Times B_V4 2500ms	Deceleration from V4 to standstill in the case of direct landing. In the case of travel to V0, the set value is reduced proportionally to the ratio V4/V0.
Times EH 1000ms	Duration of the braking ramp "electrical stop". This ramp is initiated as soon as the drive command V0 is ceased. Time „EH“ defines the time to elapse after cease of V0 up to standstill.
Times SF 300ms	Time lag between starting the travel curve and receiving a drive command.
Times ZS 300ms	Time from applying the brakes to the relay ZS (main contactor) shutting off upon stopping.
Times ZB zu 200ms	Time from stop (set value 0) until application of the brake (relay ZB shut-off).
Times ZB auf 100ms	Time from start command until opening of the brake (relay ZB activated).

Timing diagrams concerning the sequence of signals are given in **Chapter 4.2.2.2 .**

5.7.4.4 Setting the speed controller

Setting Control settings

The items of this menu define the behaviour of the speed controllers.

By pressing key **„E“,** you can branch in the items of the menu to set the parameters. By key **„C“** you return to the main menu

Explanation of terms **P (Proportional)** and **I (Integral)** - amplification of controller:

- With the **P**-factor it is possible to define an **immediate response** to speed deviations, i.e. it is responsible for the immediate response of the controller. High values result in rough running (vibrations).
- The I-component is responsible for the accuracy of the controller. Through the I-component, the controller generates a continuously increasing torque until there is a deviation between the set value and the actual value (system deviation). The I-portion determines how fast the torque increases - the smaller the I-portion (integration time) the faster the torque increases. Values which are too low may result in instability of the control system (vibrations).

The factory settings are relatively "soft" so that the controller will work in the stable range in any case. Generally, the basic factory settings are sufficient to ensure a satisfactory travel and control behaviour. The controller settings must be optimised in special cases only.

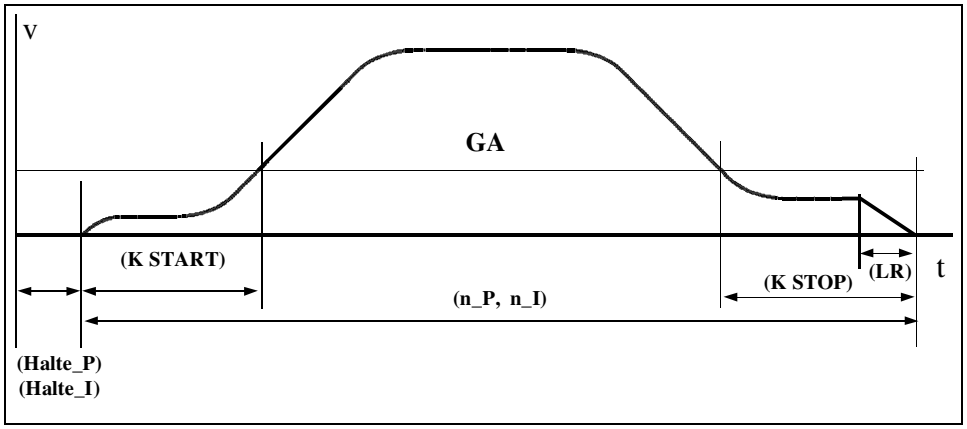
Regulator structure of the VVVF-controller:

In order to enable optimum control of the whole travel range, several regulators are used:

Stopping regulator (**Halte_P, Halte_I**): Only used for stopping the drive when the brake is opened

Speed regulator (**n_P, n_I**): Activated during the travel operation. The amplification can be changed as from a definable speed threshold (**GA**). The amplification values for acceleration and deceleration can be set separately (**K START, K STOP**).

Position regulator (LR): During the deceleration operation, a position regulator is active.



Control settings n_P 30

Proportional coefficient of the speed controller.

Control settings n_I 1000

Integration time of the speed controller.

Control settings Halte_P 30

Proportional coefficient of the stillstand controller.
.

Control settings Halte_I 1000

Integration time of the stillstand controller.

Control settings GA 49 rpm	Switch-over threshold for speed regulator amplification
Control settings K START 150%	Increase of starting regulator's gain in refer to the speed regulator
Control settings K STOP 150%	Increase of stopping regulator's gain in refer to the speed regulator
Control settings MV 100	Torque pre-control during acceleration and deceleration. Overshooting and undershooting after the ramps can be eliminated with this parameter.
FU operating mode 4 LV 500%	Preset load for load equilibrium: A basic torque is preset when the brake is opened (static load compensation). This parameter is to be set in percent. LV = 500 means symmetrical weight equilibration, no preset torque. Values < 500 mean a preset torque in down direction. Values < 500 mean a preset torque in up direction. A difference of 100 equals a preset torque of 10 %. Example : LV = 400 -> a preset torque of 10% in down direction LV = 700 -> a preset torque of 20% in up direction

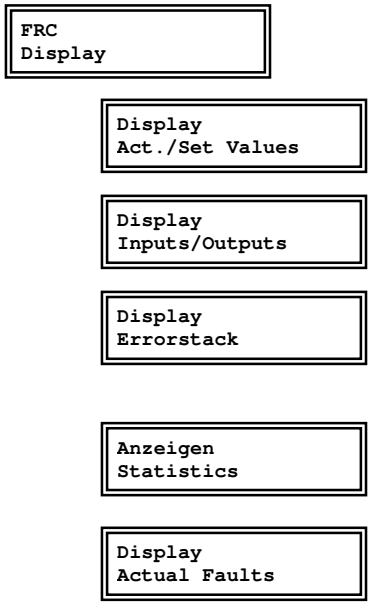
5.7.4.5 Adapting the unit to the system

In order for the vector control to work at the optimum operating point, the system data must be entered:

General settings I_MOT 32A	rated motor current
General settings U_MOT 400V	rated motor voltage
General settings n_MOT 1350rpm	rated motor speed
General settings f_MOT 50Hz	rated frequency of the motor voltage
General settings cos(phi) 80	power factor of the motor. The value given on the type plate of the motor must be multiplied by 100.
General settings Encoder 1024	number of encoder pulses
Anlagedaten Ub Encod. 5V	incremental encoder supply voltage. Please make sure that the encoder is connected to the corresponding terminal of the converter(terminal 30 = +5V, terminal 31 = +15V).
Anlagedaten U Main 400V	Mains voltage

5.7.5 Display/Scanning operating variables

In this menu the operating variables of the converter are displayed.



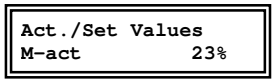
5.7.5.1 Display of actual and set values

5.7.5.1.1 Speed

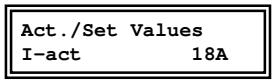
Current motor speed

Current speed set value

5.7.5.1.2 Motor current and torque

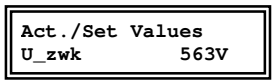


converter torque output related to its maximum torque. Note : In the case of drives under load (e.g. "empty down"), the maximum displayed torque should not be more than 80 % in order to ensure there is sufficient reserve for control.

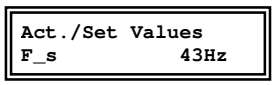


Motor current (effective) in Amperes.

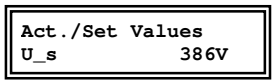
5.7.5.1.3 Other variables



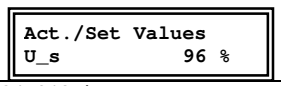
DC link voltage of converter



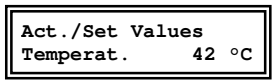
Stator frequency of motor



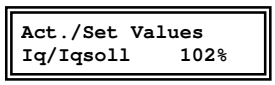
Stator voltage of motor in Volts. Voltage losses due to dead times and transition resistances are not considered, thus the actual motor voltage is slightly lower.



Stator voltage of motor in %, related the maximum value.



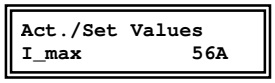
Cooling body temperature



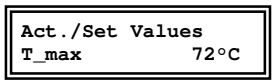
Information on the converter/motor adaptation. This parameter is only used for service purposes.

5.7.5.1.4 Maximum value storage

Maximum value storage for DC link voltage. Is deleted when the unit is switched off.



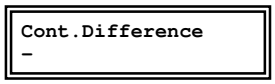
Maximum value storage for current. Is deleted when the unit is switched off.



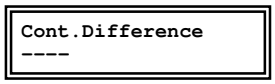
Maximum value storage for temperature. Is deleted when the unit is switched off.

5.7.5.1.5 Bar graph display of deviation between required and actual speeds

The response to setpoint changes by the regulator, i.e. its precision shown on a bar diagram, can be evaluated in this menu. One line is displayed when at rest. Each additional line means a further difference between actual and required speed of 5 rpm.



At rest, no control difference



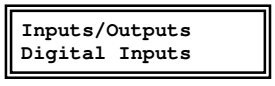
Drive (example), speed deviation actual-required = 15 rpm

5.7.5.2 Display of inputs/outputs

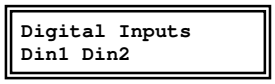
5.7.5.2.1 Drive commands

The read drive commands are displayed as plain text.

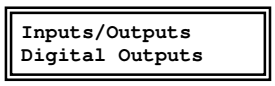
5.7.5.2.2 Digital inputs



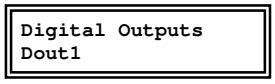
The read digital inputs are displayed as plain text.



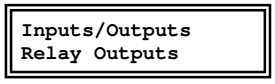
5.7.5.2.3 Digital outputs



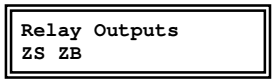
The read digital outputs are displayed as plain text.



5.7.5.2.4 Relay outputs

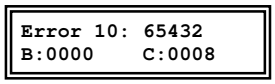


The activated relay outputs are displayed as plain text.

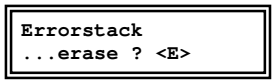


5.7.5.3 Display of errorstack

The unit is equipped with an internal memory filing the 10 latest errors. By this menu item, the memory can be read.
When this menu item is called in, at first the latest error (highest error No.) is displayed. By key **"🡻🡺"** you can scroll down to error No. 1. ..



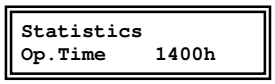
Each error is displayed with its number, the number of travels at which the error occurred and a code number of the error.
To read the cause of the error in plain text, press „**E**“. Basing on the error code, a list of plain texts is determined, which you can scroll through by means of the arrow keys. By **C**“ you can return to the display of the error.
Example left: Fault number 5, "undervoltage", occurring at 65432 elevator drives.



While leaving the menu, you have the possibility to erase the memory by pressing the “**E**” key. This, however, is only possible with the output stage switched off, i.e. not during a travel operation. With the “**C**” key you can leave the menu without erasing the memory.

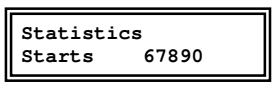
5.7.5.4 Display of statistical data

From this data, the degree of utilization of the converter can be learned.

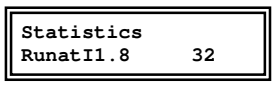


Operating time in which the unit was connected to mains supply.

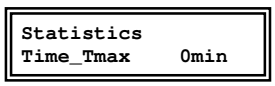
Time in which the output stage was active, i.e. travel operations were carried out.



Number of travel operations carried out. Switching on and off the output stage is interpreted as a travel operation.



Number of travel operations carried out in which the rated unit current was exceeded by a factor of **1.8**.



Time in which the unit was operated at maximum temperature.

5.7.5.5 Display of current errors

```
Display
Actual Faults
```

```
***  Fault  ***
Undervoltage ZWK
```

This menu can be used for checking any errors which may be present but are not flashing on the display. This is the case if the error display was shifted to the background using the "**E**"-key.

5.7.6 System settings

Here you set parameters referring to the unit but not to the elevator plant or its operation.

```
FRC
System
```

```
System
Code no.
```

```
System
Language
```

```
System
Units
```

```
System
Op. Mode
```

5.7.6.1 Unit password protection

```
System
Code no.
```

You can protect your settings (parameters) against unauthorised modification by a code of 4 digits at a maximum. If a code defined, you will be requested to enter this code when you try to change a parameter. You will have to enter this code correctly, otherwise you cannot change parameters.

```
Code no.
enter
```

By the following menu items, you can organise your code:

```
Code no.        0
                0
```

Entering a code previously defined. The unit will ask you to enter the code. Activate the editing mode by pressing the "**E**" key and enter the code.

```
Code no.
ok...
```

If the code entered complies with the code saved in the unit, a corresponding message will be displayed.

```
Code no.
Error
```

Otherwise an error will be signalled.

Press "**C**" to quit editing mode.

```
Code no.
change
```

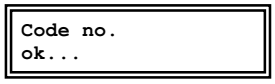
Entering a new code or editing a previously defined code. The unit will ask you to enter a code.

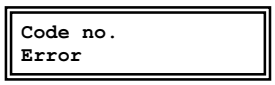
```
Code no.        0
                0
```

Activate the editing mode by pressing the "**E**" key and enter the code.

```
Code no.
repeat
```

The unit will ask you to enter the code again. Activate the editing mode by pressing the "**E**" key and enter the code again.





If both codes entered match, a corresponding message will be displayed and the code will be activated.

Otherwise, an error message will be displayed and the code entered will be rejected.

Enter code "0" to switch off the code check. You can use any code value other than "0".
When the unit leaves the factory, it is not code-protected.

5.7.6.2 Setting the language

Here, you can set the language to be used for all texts and messages on the display.

The selected language is activated by pressing the **"E"** key.

Currently, the following languages are supported:

- German
- English
- Turkish
- Spanish
- French
- Polish

5.7.6.3 Units - rpm or m/sec

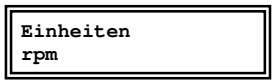
The setting of the speeds and the distances/times can be done either in reference to the motor speed (rpm) or in reference to the cabin speed (m/sec).

The following parameter-groups can be set in the 2 unitmodes:

Speeds: **motor speed [rpm]** or **cabin speed [m/sec]**

Ramps: **Time [msec]** or **distance [mm]**

If you want to set the units in meter/second you must enter the correct values for transmission, pulley-diameter and suspension correctly (**see Section 5.7.8.3**). **If one of these parameters is not entered, the unit mode can't be changed from rpm to m/sec.**



As a standard, the unit mode is set to rpm.

5.7.6.4 Unit operating modes

System Operating Mode	The following operating modes can be used:
Operating Mode Vektor Asynchron	Field-oriented mode with asynchronous machine
Operating Mode Open Loop 1	F/U control with asynchronous machine (see **Section 5.9.1**)
Operating Mode Vektor Synchron	Field-oriented mode with synchronous machine, gearless (see **Section 5.8**).
Operating Mode Open Loop 2	F/U control with asynchronous machine (see **Section 5.9.2**)

5.7.7 Information menu

Here, you can find information on the unit, which is useful in particular when it comes to telephone service.

FRC
Info

Info
Hardware

Info
Software

Info
Operating Mode

5.7.7.1 Hardware

Info
Hardware

Select the menu by using the "E" key. Once opened, you can scroll through the individual submenus using the arrow keys

Size FRC3 - 16A	Size of converter and rated current
Power unit Q1-Q7	Power unit version
Encoder unit -----	Information on additional unit for special encoders (sine encoder, ..), if applicable. Incremental encoders do not require an additional unit.

5.7.7.2 Software

Info
Software

Select the menu by using the "E" key. Once opened, you can scroll through the individual submenus using the arrow keys

Software Basis 18.050.01

Software version basic controller.

Software Sinusc. 0

Software version sind-controller.

5.7.7.3 Operating mode

Info Operating Mode

Operating Mode Vektor Asynchron

The acitvated Operating Mode is displayed (s. **Abschnitt** Fehler! Verweisquelle konnte nicht gefunden werden.).

5.7.8 Extended menus

Here, you will find functions which are not (or rarely) needed for the standard operation of the converter.

FRC Extended

Extended Synch. Machine

Extended Open Loop

Extended Ext.gen.settings

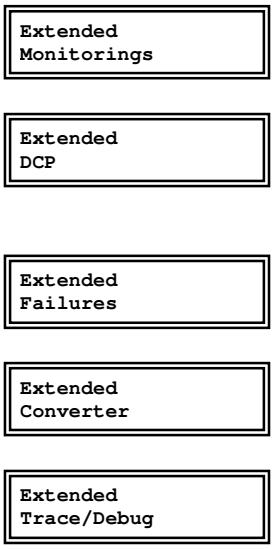
Extended Ext.drive curve

Extended Extended Control

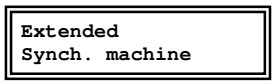
Extended Error Config.

Extended Works setting

Extended Inputs/Outputs



5.7.8.1 Synchronous machine

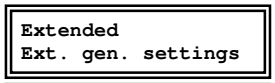


This menu contains the parameters for an operation with synchronous machines (see **Section 5.8**).

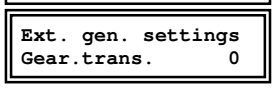
5.7.8.2 Open-Loop Mode

This menu contains the parameters for an operation without incremental encoder (see **Section 5.9**).

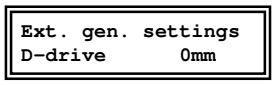
5.7.8.3 Extended general settings



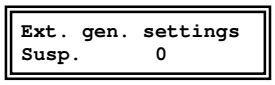
In order to change the units from rpm to m/sec information on the pulley diameter, transmission and suspension of the cabin are required.



Here, you must enter the **transmission * 100**.
Example : Transmission = 53:2 --> entered value 26,5 * 100 = 2650

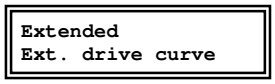


Here, you must enter the pulley diameter in mm.



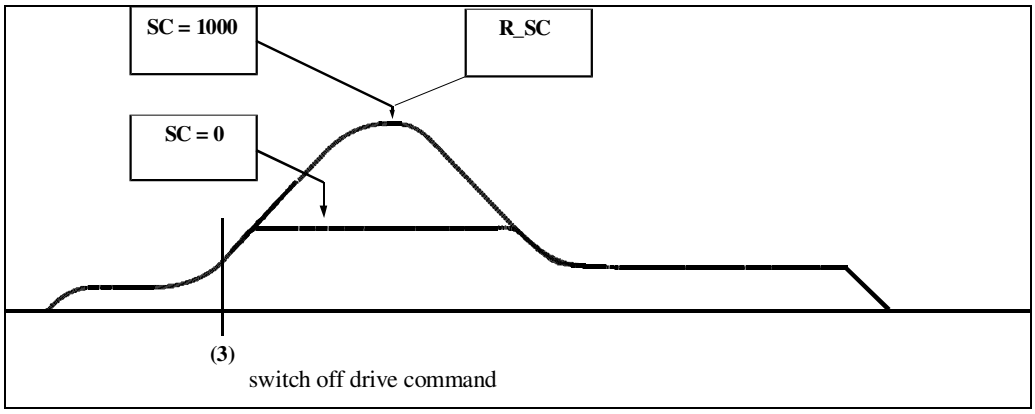
Here, you must enter the suspension of the cabin.
Example : 1:1 --> entered value 1, 2:1 --> entered value 2

5.7.8.4 Extended drive curve settings



5.7.8.4.1 Floor to floor correction

The VVVF controller operation comprises an automatic floor to floor correction, providing distances covered at low speed, regardless of the overall length of the travel (between two adjacent landings or over a long distance).



If the drive command (3) is cancelled during the acceleration ramp, a floor-to-floor travel operation is initiated. The shape of this floor-to-floor travel operation, however, can only be influenced significantly using the parameters SC and R-SC if the drive command is cancelled early, so that there is a sufficient distance available for the required shape of the curve. If the travel command is cancelled a short time before the final speed is reached, the shape of the curve cannot be varied.

Ext. drive curve SC 500

(1) High values for SC result in high speeds and correspondingly short travel times.
(2) Low values for SC result in low speeds and correspondingly long travel times.

Ext. drive curve R_SC 300ms

With R_SC the rounding of the curve can be set. R=0: no rounding
R=1000: max. rounding

☞ **Note : The floor-to-floor travel operation is intended for high speed V4 only !**

The distance of the floor-to-floor travel calculation to be covered is determined from V4 and B_V4.

5.7.8.4.2 Set value - ramp shape

Here, you can change the basic S-shape of the acceleration and deceleration ramps.

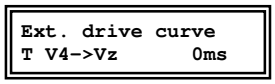
Ext. drive curve FK-Mode 2

1: higher peak acceleration at the turning point
2: comfortable setting (standard)
3: linear ramp without S-shape

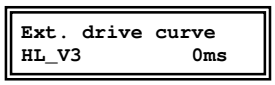
5.7.8.4.3 Speed transitions

As a standard, high speed V4 is used as the basis for the set value ramps. That means, HL and B relate to this speed. If acceleration is to be done to another speed, e.g. V2, the calculation of the acceleration time is done such that the acceleration is the same as in the case of acceleration to V4. As a result the ramp times are shorter by the factor of the selected speed divided by V4. In the case of speed transitions with a small difference this means that small ramp times with small roundings are generated, which can result in an uncomfortable driving behaviour.
Using the following parameters, this calculation based on the constant acceleration can be avoided, and **the required sections of the travel curve can be set individually**.

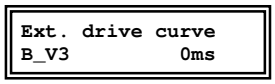
Activation is done by entering values **greater than 500 msec**, smaller values are automatically set to 0 and ignored by the travel curve calculator.

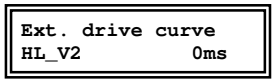


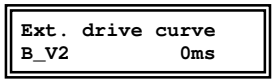
With this parameter, the transition time (independent of the speed difference) can be set from V4 to one of the intermediate speeds V3 or V2.



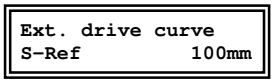
Here, you can adjust the ramp times and distances to the corresponding intermediate speed individually.







5.7.8.4.4 Direct landing with reference signal



If a reference signal is available which is to be evaluated, the distance of the reference signal from the leveling position must be entered here.

Activation of reference function:
Set parameter **S_REF** to a value **> 0** to activate the function.
The required system data (transmission, pulley diameter and suspension) must be entered correctly (see Section ....). **If one of these data is not entered, i.e. if the corresponding parameter value is 0, the reference function cannot be activated!**

The reference function is only possible for speeds V3 and V4 !

Terminal functionality:
If the function is activated, **V0 terminal** is used for connection of the reference signal. **Speed V0 is not used in this case**. Note that some controllers (wrongly) use V0 for inspection travel operations. This is no longer possible if the reference function is activated. In this case, V1 must be used.

Reference signal of the elevator controller:
When the zone is reached, the reference signal must be switched to +24V and remain HIGH until the end of the travel operation.

5.7.8.5 Extended control settings

```
Extended
Extended Control
```

```
Extended Control
LR            100%
```

In the case of a deceleration to stop, i.e. during **stopping** or a **direct landing** operation, a **position controller** is active. This controller continuously compares the actual position to the set position and compensates any deviations. This is a prerequisite for an exact landing operation. By increasing the parameter LR, the position controller can be reinforced and position deviations can be balanced faster. If you enter 0, the position controller is switched off completely.
Note : An excessive gain can result in vibrations when the elevator stops.

```
Extended Control
IMAX_MOT       200%
```

Limitation of maximum motor current.

```
Extended Control
IQ_MAX         200%
```

Maximum output torque of the controller. The torque output of the converter can be reduced (e.g. for TÜV inspections, for test purposes).

```
Extended Control
Current_P      15
```

Proportional current regulator gain.
Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
Current_I      4000
```

I-gain current regulator.
Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
T               0
```

In the case of highly dynamic systems such as V-belt drives, a "software flywheel" can be activated here. This results in a smoother travelling behaviour. The appropriate setting must be determined in tests.

```
Extended Control
Iqsoll_T1       0
```

The variable of the speed controller can be smoothened in order to obtain a smoother behaviour.
Note: High values can result in vibration.

```
Extended Control
TA          5000us
```

In case low-pulse encoders are used, the scanning time of the speed controller can be increased in order to obtain a better speed resolution. If the scanning time is too long, this can result in control vibrations.
After changing the scanning time, the unit must be switched off and on again in order for the new setting to become effective.
Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
n_D             0
```

Here, you can activate a differential (D) controller component. Normally, this is not required for the elevator application.

5.7.8.6 Configuring fault behaviour

Extended Error config.

It is possible to programme the reaction of the unit to certain fault conditions. This establishes whether an occurrence of a fault leads immediately to the system locking and a TÜ cumulative fault signal being triggered (TÜ-relay).

The parameters can be either 0 or 1.

1: Error is displayed.
Motor is stopped.
TÜ is released.
Drive commands are not accepted.

0: Error is displayed.
Elevator operation is continued.
TÜ not released by this error.
Drive commands are accepted.

The following fault messages can be masked off:

Error config. Phase mon 1

Depending on the hardware design, the devices are equipped with a phase monitor which monitors the mains voltage and responds if one or more phases fail.

Error config. Motorad. 1

"Motor adjustment": is triggered if the travel contactors are open or if the automatic current regulator optimisation function fails.

Error config. Mot.overl 1

"Motor overload" is released if the motor is overloaded. Significant discrepancy between power consumption and rated current. (Power consumption is much higher.)

Error config. Autoreset 1

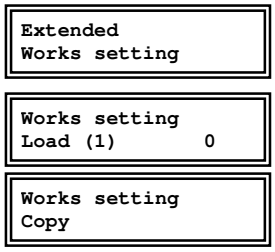
Automatic acknowledgement of faults which have occurred is possible with the "**Auto fault reset**" parameter. The following configurations are possible:
Parameter value 0: The unit switches immediately to lock
Parameter value 1: In the event of a fault, the unit carries out an internal acknowledgement and is ready again after 3 seconds. This automatic acknowledgement is carried out a maximum of three times in direct series. The occurrence of a 4th fault causes the unit to switch to lock mode.
Parameter value 2: The number of fault acknowledgements is unlimited. In this case, locking should be taken over by control after a defined number of start attempts.

Note : The control must switch off all drive commands if a controller fault (TÜ) occurs in order to trigger automatic fault acknowledgement. The unit carries out internal fault acknowledgement after 3 seconds and is then ready again to accept drive commands.

The cause of the fault is shown on the display if the unit is in lock mode. The fault signal can be acknowledged by applying a signal (+24V) to an appropriately configured digital input (see **Section 5.7.3.2**)or by pressing "E". The unit does not have to be switched off.

Independent from the settings described, every error is recorded by the error stack.

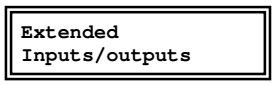
5.7.8.7 Selection of works-setting



In this menu you can call up the works-setting of the device by entering a 1 at menu-item “load”. For storing this parameters, the item “copy” must be chosen.

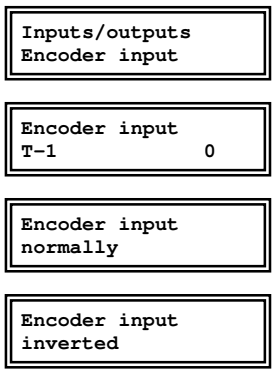
Attention, by doing this operation, all parameter-settings are overwritten !

5.7.8.8 Configuration of inputs and outputs



In this menu, you can configure the inputs and outputs of the unit.

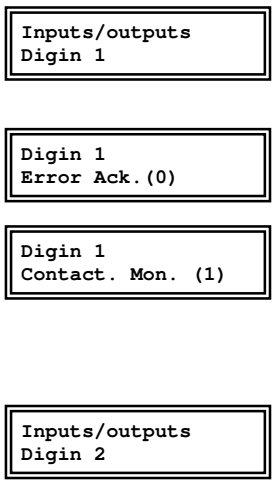
5.7.8.9 Encoder



Filtration of the encoder signal can be set here. This enables faulty sensor signals to be smoothened.
Note : A high filtration degree (e.g. T filter = 4) can lead to a worsening of control behaviour and cause vibrations on systems susceptible to vibration

Here you can revise the rotational sense assignment of the encoder signals. The same effect can be achieved by exchanging wires A and B or -A and -B at the converter terminals.
Note : In case synchronous machines are used (**see Section 5.8.2**) this parameter is determined automatically and must not be changed for this reason !

5.7.8.10 Digital inputs



Here, you can configure the 2 digital inputs of the converter:

Functionality of **digital input 1:**

"**External fault acknowledgement input**" function. A fault can be acknowledged by an external +24V signal on this input.

"**Monitoring drive contactors**" function. This function is only required in combination with our converter with integrated contactors. The drive contactors are checked for a drop at a standstill (500 msec after opening the ZS relay) via auxiliary contacts.

Functionality of **digital input 2:**
(see digital input 1)

5.7.8.11 Drive Commands

5.7.8.11.1 Encoding

Here, you can select between parallel and binary encoding of the drive commands

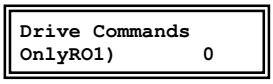
Parallel encoding (standard).

Binary encoding.

For binary encoding of the drive commands, controller inputs V1, V2, V3, V4 are used. The assignment is as follows:

Drive Speed VVVF	term. 16 (V1)	term. 17 (V2)	term. 18 (V3)	term.18 (V4)	remark
STOP	0	0	0	0	
V0	1	0	0	0	creep speed
V1	0	1	0	0	inspection
V1	1	1	0	0	Inspection
VN	0	0	1	0	fine levelling
V0	1	0	1	0	creep speed
V2	0	1	1	0	1 st intermediate speed
V2	1	1	1	0	1 st intermediate speed
V2	0	0	0	1	1 st intermediate speed
V3	1	0	0	1	2 nd intermediate speed
V4	0	1	0	1	high speed

5.7.8.11.2 Configuration of direction signals



Here, the VVVF controller can be configured for operation with only one direction signal. To do this, the parameter must be set to 1.

5.7.8.12 Further supervisions

Watchdog timer. A watchdog timer can be activated with this, i.e. the unit switches off and the relevant fault signal is displayed if the set driving time is exceeded. The minimum running time is 20 sec.; at smaller values, the watchdog timer is deactivated and 0 is displayed.

The **monitoring function of the drive contactors** is activated here insofar as an appropriate digital input has been configured with this function (see **Section 5.7.8.10**).

5.7.8.13 Operating with DCP-Interface

Extended DCP

5.7.8.13.1 General information on DCP operation

The DCP protocol is an RS-485 protocol designed specifically for elevator applications for data exchange between the control system and frequency converter and is already being used in practice and serves as a replacement for parallel control via the drive command terminals. This telegram does not only enable a drive and position control but also remote control of the converter from the control system.

5.7.8.13.2 Operating modes

The type of operating mode is shown on the control display. The appropriate operating mode is recognised from the incoming telegram and activated automatically.

5.7.8.13.2.1 DCP01 und DCP03 - Drive without pre-set braking distance

This operating mode is chosen most frequently because it represents the normal operating mode by shaft switch.

5.7.8.13.2.2 DCP02 - Drive with pre-set braking distance

The control system determines the braking distance to be covered for the converter.

5.7.8.13.3 Wiring

The converter terminals 67 (RS485-A) and 68 (RS485-B) must be connected with the respective control terminals. Furthermore, on the converter, connecting terminals 67 and 33 must be connected and terminals 68 and 32 must be connected (wire bridges) in order to enable half-duplex operation. A screened twisted-pair cable is recommended for the connection of the control and converter in series. The fault signal relay TÜ and the relay for the main contactor ZS should be wired as before. The relay ZB for the mechanical brake is replaced by a control bit in the telegram and therefore does not have to be wired.
The signal GS still has to be connected to terminal 53 for safety reasons. The auxiliary contacts of the drive contactors can be used to generate the signal insofar as these are activated direct from the control system upon starting.

5.7.8.13.4 Activation of the serial converter control (DCP mode)

First the control source must be set to “DCP” to activate the DCP mode.

DCP Command Source

To do so, call up the menu **"Extended" - "DCP"** and scroll through the sub-menus using the cursor keys until you reach the menu section alongside.

Command Source Connectors

Call up the parameter choice using the **"E"** key. The terminal control is set to standard here.

Command source DCP01/02

Command source DCP03

Using the cursor keys, you can choose the DCP-Mode**.** Confirm this by pressing the enter key **"E"**.

The control source is now re-parameterised to DCP while the message "OK..." appears on the display. The unit must be switched off and then on again after about 30 seconds in order for this change to become effective. The converter now expects telegrams from the control system.

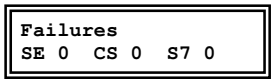
5.7.8.13.5 Connection monitoring

If no or defective telegrams are received during the travel operation, the VVVF-controller switches over to fault mode.

Press the Enter key again to switch over to terminal control and deactivate DCP mode. Press "C" to quit.

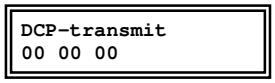
5.7.8.13.6 Diagnostics menu

Here, the connection quality is displayed [per mil].
Example :
1000% : error rate 0 per mil
998 % : error rate 2 per mil (of 1000 telegrams, 2 are defective)

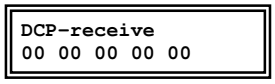


Here, several telegram error counters are provided indicating the current telegram status.

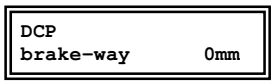
Here, the DCP control byte is displayed



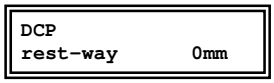
telegrams the converter sends to the control system



telegrams the converter receives from the control system.



The braking distance is displayed here by the control system.



The remaining distance which still has to be covered is displayed here.

Here, the current stop position of the cabin in the well is indicated (only in DCP03 - is transmitted by the controller).

5.7.8.13.7 Setting the S- curve at DCP02

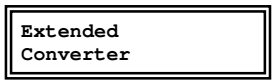
The following parameters can be set:

If the control-system is presetting the braking distance, you can set the shape of the deceleration ramp.
S-curve = 0: strong deceleration, fast reach of the levelling position
S-curve = 25: smooth deceleration, slow reach of the levelling position
Note: The suitable value range for this parameter is between 5 and 15. If you select a higher value, this may result in abrupt deceleration when the levelling position is reached, since too much distance is covered at the beginning due to the flat shape.

5.7.8.14 Extended Error menu

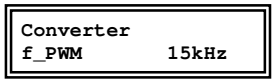
Here, you can read out details of certain errors. This menu will be needed only after consultation with us (via the telephone) and will not be explained in detail here.

5.7.8.15 Converter-specific settings

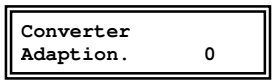


These parameters should only be changed after consultation with us (via the telephone).

Enabling of sine encoder evaluation unit.



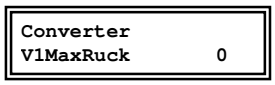
PWM frequency of converter



enabling/disabling the automatic current controller adaptation. If the adaptation is enabled, a current controller adaptation is carried out at the beginning of the first travel operation after a change of the motor parameters.

overload factor of VVVF-controller.

5.7.8.16 Loosening the cabin from the safety catch, travel at increased break-away torque



If you enter 1 for the travel speed V1, a set value jump will be prescribed. As a result, a jerk-like torque will be built up and the cabin can be loosened from the safety catch more easily.

5.7.8.17 Trace/Debug

In this menu, you can record and display internal variables. This is done for test and analysis purposes and is not intended for the user.

5.8 Use with synchronous machines / gearless

Extended Sync.machine	In this menu, you will find the parameters which are required for using the unit with synchronous machines.

5.8.1 Parameterization

5.8.1.1 Automatic setup by using pre-defined data records

Sync.machine Gearless-Type	Here, you will find a list of gearless types whose complete parameter records are saved in the unit.
Gearless-Type Schindler	Press the E-key to select the required manufacturer.
Schindler PMS230-A1060	Use the arrow keys to scroll through the list.
Schindler ok ...	Press the E-key to select a drive type.

☞ Now all parameters are configured for operation.

5.8.1.2 Manual setting of the parameters

Sync.machine I_MOT 32A	Rated motor current.
Sync.machine U_MOT 400V	Rated motor voltage.
Sync.machine Pole pair 2	Number of pole pairs of the motor.
Sync.machine Encoder 1024	Number of encoder pulses, number of sine periods / revolution.
Sync.machine RhoOffset 0	Angle offset between encoder zero point and electrical zero point of motor winding (360° correspond to 8192). Note: This parameter is determined automatically by the unit during calibration (see below).
Synch.machine Sine mode	Sine evaluation method, depending on encoder type. Press E-key to open the selection list:
Sine mode ECN1313 EnDat	Use of ECN1313 absolute value encoder with EnDat interface from Heidenhain.
Sine mode SinCos Ref	Sine/cosine with zero pulse. Referencing required after switching on the supply voltage.
Sine mode SinCos	Sine/cosine encoder for use with asynchronous machines.
Sine mode SinCos Inc	Incremental evaluation of sine/cosine encoder (for tests only).

Synch.machine Rho_corr 0	Currently without function
Synch.machine Einph.On 0	Activation of calibration (see **Section** 5.8.2)

5.8.2 Calibration - determination of angle offset

5.8.2.1 Use with absolute value encoder ECN1313 from Heidenhain

5.8.2.1.1 Calibration

To enable operation of the synchronous machine it is necessary to measure the angle offset between the encoder zero point and the electrical zero point of the motor winding (**calibration**).

Important note: The measurement must be carried out with free-rotating motor and without load (slag rope)!

The following steps must be carried out:

Activation of calibration:

Synch.machine Einph.On 1	Measurement in menu extended-synchronous machine-calibration=1. Definition of drive commands by means of restoring control
< Info > Calibration active	Motor turns until the measurement is complete, the status of the measurement is displayed.
< Info > Rem. drive comm.!	Now, cancel all drive commands.
< Info > Rho: -3204	The measured angle offset is displayed Save the result by pressing the "E" key. Press the "C" key to quit.
< Info > Save ? ...	

Now, the drive is ready for operation.

To check the function issue travel commands again. **The drive must rotate correctly.** The displayed current must be 0.

5.8.2.1.2 Checking the rotational sense assignment

Check if the sense of rotation complies with the command issued, i.e. if the motor turns **UP** when command **RO** is issued. If yes, the calibration is complete, if no, exchange 2 motor phases (e.g. U and V) and start the measurement again (see **"Calibration"**).

5.8.2.2 Use with sin/cos encoders with zero pulse

Info Referencing

Info Calibration

The processes are the same as in the case of **calibration**. Before a calibration can be carried out, the **encoder zero point** must be found. The unit carries out this **referencing** operation automatically when travel commands are issued. As soon as the zero point is determined, calibration takes place.

☞ Note : After switching on the supply voltage, the zero point of the encoder must always be determined before the first travel operation. The search for the zero point is carried out automatically by the converter as soon as travel commands are issued, i.e. the elevator control system "does not know what's going on". Until the encoder zero pulse is found, the system runs **uncontrolled at rated motor current**. Then, the travel operation is continued with speed control without interruption. In the case of gearless drives the elevator may cover a distance of several meters until the zero pulse is reached! For this reason, these encoders should not be used with gearless drives.

5.9 Open-Loop Mode

☞ **Note:**

- **Operation without encoder feedback can result in increased heating of the motor and a worse travel behaviour than in the case of an operation with field-oriented vector control.**
- **Due to the different operating principle, the stopping accuracy in the case of U/F operation will always be slightly worse than in the case of operation with field-oriented vector control.**
- **In open-loop mode, the maximum traveling speed is 1 m/s.**

5.9.1 Open-Loop 1 (F/U control with slip compensation)

5.9.1.1 Parameter overview

The setup menu comprises the following parameters:

Open-Loop 1 TADJ_TRM 80

Adaptation of motor rotor time constants.

Open-Loop 1 SlipKorr 8000

Slip reduction in the case of low speeds.

Open-Loop 1 MV 100%

Torque pre-control during acceleration and deceleration.

Open-Loop 1 LV 500%

Preset load for load equilibrium: A basic torque is preset when the brake is opened (static load compensation).

Open-Loop 1 U_Start 3000

Start voltage (automatic setting).

Open-Loop 1 R1_Motor 700

Stator resistance of one motor winding (automatic setting).

Open-Loop 1 R1MessEn 0

Activation of automatic motor measurement.

5.9.1.2 Setup of converter

5.9.1.2.1 Activating the operating mode

First, the converter must be set to the appropriate operating mode. For this, open the system-operating mode menu.

Select the operating mode **Open Loop 1**.

5.9.1.2.2 Automatic measurement of motor parameters

The unit carries out a measurement of the motor characteristic and adjusts the corresponding parameters for the motor control automatically. In this operating mode you can measure the motor parameters once or during each travel operation.

☞ To ensure an error-free measurement, the system data must be entered correctly (see **Section** 5.5) !

Go to menu *Extended - Open Loop - Open Loop 1.* Use the E-key to open the menu. Select parameter *R1MessEn.*

Enter "1" to activate the measurement.

Issue travel command. After switching on the output stage the unit will determine the stator resistance and the required starting voltage of the motor within a few milliseconds.

Then, the travel operation is carried out and the parameter *R1MessEn* is set to 0.

Note :
Normally, it is sufficient to measure the motor parameters once during commissioning. However, if the travel behaviour worsens significantly if the motor gets hotter, this is due to the fact that the motor parameters depend on the temperature.

In this case you can activate a permanent measurement by entering "2". Now, the unit will carry out a measurement upon each start. In this way, motor parameter changes which are due to an increased motor temperature are considered.

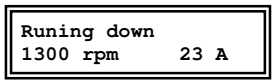
Carry out travel operation in both directions.

5.9.1.2.3 Setup of dynamics

During the measurement, the unit has adjusted all relevant parameters such that the motor current and voltage are sufficient for travel curves in elevator applications.

If, in the case of very dynamic acceleration ramps, the actual value does not follow the required value properly during acceleration, the parameter **MV** must be increased.

5.9.1.2.4 Adjusting the speed accuracy



The motor speed should be checked with a hand-held speed counter. The actual value must be compared to the set value which can be shown on the display. **To check the speed, high speed should be activated for several seconds since the unit compensates the slip and adjusts the speed accordingly during constant-speed travel.** If no speed counter is available, the duration of the creep speed up/down indicates if the travel speed is the same in both directions (braking distances must of course be the same in both directions).

In case the high speed empty down is too high, the parameter value **TADJ_TRM** must be reduced, if the speed is too low, it must be increased (in steps of 10-20).

With this parameter it is possible to adjust a slip correction in the case of low speeds. In this way, the accuracy of the landing speed and thus the stopping accuracy can be adjusted perfectly. However, a manual speed counter is required to measure the landing speed. This parameter should be changed in steps of 1000.

5.9.1.2.5 Static load compensation

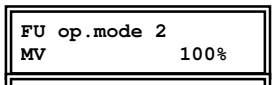
With this parameter, the initial torque upon releasing of the brake can be determined (static load compensation). The load compensation is entered in per cent (see **Section 5.7.4.4**)..

5.9.2 Open-Loop 2 (F/U control with characteristic adjustment)

5.9.2.1 Parameter overview

The setup menu comprises the following parameters:

Adaptation of motor rotor time constants.



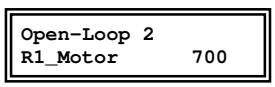
Torque pre-control during acceleration and deceleration.

Preset load for load equilibrium: A basic torque is preset when the brake is opened (static load compensation).

Magnetization current of the motor (automatic setting).

Acceleration current (automatic setting).

Voltage offset of converter (automatic setting).



Stator resistance of one motor coil (automatic setting).

Activation of automatic motor measurement.

5.9.2.2 Setup of converter

5.9.2.2.1 Activating the operating mode

First, the converter must be set to the appropriate operating mode. For this, open the system-operating mode menu.

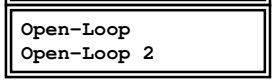
Select the operating mode **Open Loop 2**.

5.9.2.2.2 Automatic measurement of motor parameters

The unit carries out a measurement of the motor characteristic and adjusts the corresponding parameters for the motor control automatically.

☞ To ensure an error-free measurement, the system data must be entered correctly (see **Section** 5.5) !

To measure the motor parameters, please adjust the control system to "restore" or "inspection".



Go to menu *Extended - Open Loop - Open Loop 2.* Use the E-key to open the menu. Select parameter *R1MessEn.*

Enter "1" to activate the measurement.

Enter a travel command via the feedback control system.

The travel contactors must pick up and the measurement is started. The duration of the measurement is approx. **5 seconds**.

After the measurement, the drive will start - cancel travel command. The parameter *R1MessEn* is set to 0.

Now, the unit has measured the stator resistance of the motor and the voltage offset of the converter and adjusted the optimum current vectors. The drive is ready for service now. The control system can be switched to normal mode again.

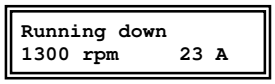
Carry out travel operation in both directions.

5.9.2.2.3 Setup of dynamics

During the measurement, the unit has adjusted all relevant parameters such that the motor current and voltage are sufficient for travel curves in elevator applications.

If, in the case of very dynamic acceleration ramps, the actual value does not follow the required value properly during acceleration, the parameter **MV** must be increased.

5.9.2.2.4 Adjusting the speed accuracy



The motor speed should be checked with a hand-held speed counter. The actual value must be compared to the set value which can be shown on the display. If no speed counter is available, the duration of the creep speed up/down indicates if the travel speed is the same in both directions (braking distances must of course be the same in both directions).

In case the high speed is too high, the parameter value **TADJ_TRM** must be reduced, if the speed is too low, it must be increased.

5.9.2.2.5 Static load compensation

With this parameter, the initial torque upon releasing of the brake can be determined (static load compensation). The load compensation is entered in per cent (see **Section** 5.7.4.4).

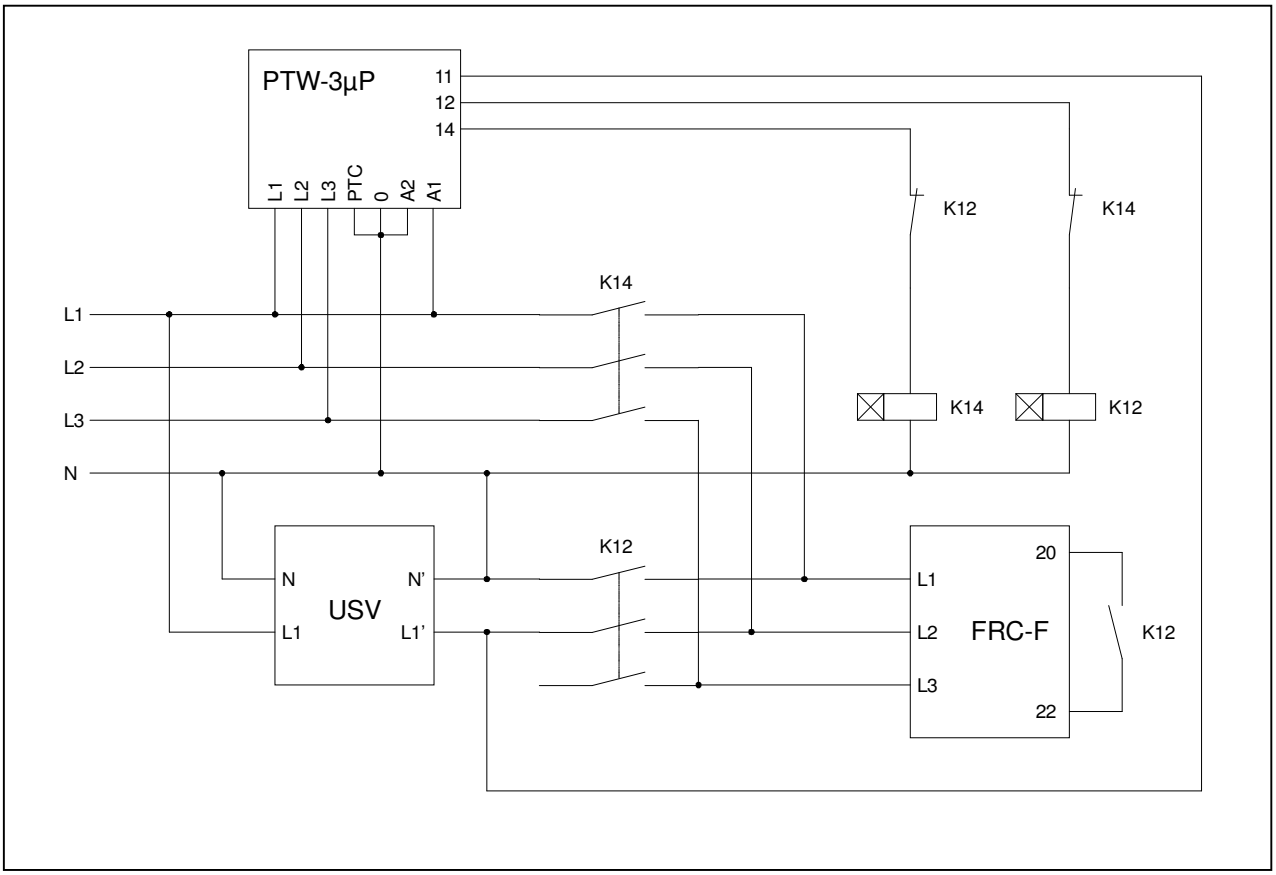
5.10 Emergency current evacuation with UPS

5.10.1 General

In the case of a power failure, it is possible with the VVVF controller to execute a travel operation at reduced speed. The maximum travel duration and speed primarily depend on the UPS used. The frequency converters are designed for using cost-efficient one-phase uninterruptible power supplies in evacuation mode. In this case, power is supplied directly at Phases L1 and L2; an expensive charging circuit for the intermediate circuit and battery management are not required.

5.10.2 Wiring

The following illustration shows the circuit diagram of an automatic switch-over to UPS mode as well as the return to mains mode. A phase monitoring relay type ***PTW-3µP*** which is available at RST Elektronik is used for monitoring the mains voltage.



Function:
In standard mode, the internal relay has picked up at terminals 11-12-14. Thus, mains contactor K14 is engaged, too. Since the two contactors K12 and K14 must not have picked up at the same time, they are interlocked in three ways: first via the internal change-over switch of the ***PTW-3µP***, second through the interlock via the auxiliary normally-closed contacts and third via a pick-up delay of the contactors (approx. 3 to 5 s).

In the case of a mains failure, the internal phase monitoring relay and thus K14 drop out. After the time delay, K12 picks up and supplies the VVVF controller (one phase) from the UPS via the input phases L1 and L2. Via the auxiliary make contact of K12, the internal 24V supply voltage is applied to terminal 22 (Uniln1). In this way, the VVVF-controller is informed that emergency mode is activated. Low-voltage monitoring is deactivated for this operating mode.

If the mains supply is restored, ***PTW-3µP*** switches back to standard mode: K12 drops out and K14 picks up after a time delay.

Since the ***PTW-3µP*** is programmed such that a complete disconnection of all 3 phases does not trigger a fault, a failure of phases L2 and L3 would not be recognized. If, however, terminal "0" is connected to the neutral conductor, this operating status is taken into account, too.
However, if L1 fails, the ***PTW-3µP*** has no supply voltage. In this case, too, the internal relay drops out as required. Indication of the operating status, however, is no longer possible.

5.10.3 Dimensioning of UPS

For determining the required apparent power of the UPS, the motor efficiency must be determined first using the information indicated on the type plate:

$$\eta_M = \frac{P_M}{\sqrt{3} \cdot U_M \cdot I_M \cdot \cos \varphi_M} \quad [1]$$

η_M motor efficiency
P_M rated motor power
U_M rated motor voltage
I_M rated motor current
$\cos \varphi_M$ displacement factor of motor

The apparent power of the UPS required for evacuation travel operations to the next floor at nominal load and 5 % of the nominal speed can be determined as follows:

$$S_{USV} \approx \left(\frac{1,2}{\eta_M} - 1,1 \right) \cdot P_M \quad [2]$$

S_{USV} apparent power of UPS
P_M Rated motor power at rated speed and nominal load
η_M motor efficiency

The following requirements must be met:

* The calculated motor efficiency is at least 75%.
* Operation is effected with field-oriented control, i.e. no open-loop mode.
* The output voltage of the UPS is at least 220 ~ even under load.
* The crest factor (peak current/effective current ratio) of the UPS is at least 3:1 (caution: the peak current is not the effective start-up or acceleration current).
* Other consumers such as controller, cabin lighting, well lighting, etc. must always be taken into account.
* If a stop other than the nearest possible stop is to be approached, the bridging time of the UPS under full load must be greater than the time required for traveling through the well at evacuation speed.

5.10.4 Particularities of the VVVF-controller during evacuation

Through High level (+24V) at the digital input **UniIn1** (terminal 22), the VVVF-controller is informed that **evacuation mode** is active.

The VVV-controller has a digital output **DigOut3** (terminal 56) through which the load situation after opening of the brake are signaled.

- High level (+24V): cabin is heavier than counterweight. recommended direction = DOWN
- Low level (0V): cabin is lighter than counterweight. recommended direction = UP

Through an evaluation of this signal by the controller, the evacuation can be effected in the "easier" direction.

In evacuation mode, the following applies:

- Undervoltage monitoring of the intermediate circuit is suppressed.
- **Before the travel command is issued,** evacuation mode must be activated via **UniIn1**.
- Independent of the current travel commands, the operation is carried out at evacuation speed **VE.**
- To enable a travel operation, **UniIn1** a**nd** a „normal“ travel command (**V1, V2, V3, V4, VN**) must be present.
- The travel operation is continued as long as UniIn1 is active with a travel command. **A stop can be effected by withdrawing the UniIn1, the travel command or both signals**.

5.11 Remote data transmission per modem

5.11.1 General

With the new PowerControl software it is possible to carry out remote settings on the frequency converter via the telephone network (RDT- remote data transmission). Two modems are required for this.
The data communications connection is mainly used for **"remote monitoring"** (e.g. reading out the fault memory, operating parameters). With the modem connection, you have the same possibilities for settings and displays on the laptop/PC as if you were connected directly with the unit.

Note : Certain parameters (system data, delay routes) should only be changed per data communications when an engineer is on site at the system.

5.11.2 Modem on laptop/PC

The modem must be connected with the serial interface of the laptop/PC using a standard serial interface cable (1:1 connection) and plugged into the telephone network.

5.11.3 Modem on FRC-Q

The modem is connected to the telephone network via the external interface module and the serial interface of the converter.

Note : Only one unit may be connected to the converter interface at a time. A fault occurs if the modem and laptop are connected at the same time!

5.11.3.1 Configuration of modem on the converter

The configuration of the modem on the converter must be as follows:

Settings	Command*)	Important!
Echo: off	E0	N O T E ! The modem must be capable of storing this data permanently.
Answer on DDE: off	Q1	
Pick-up after 1st ring	S0=1	
DDE-speed: 9600/N/8/1	S23=58	
Disconnect after 15 sec. without carrier	S7=15	
save current configuration	&W0	
configuration upon switching on	&Y0	
*) command depending on type of modem used		

The modem can be configured to required settings using the PowerControl software (see PowerControl software manual).
We recommend buying a modem pre-configured by us.

6 Service and maintenance

Modern electronic components have a long service life and are not subject to mechanical wear and tear. Therefore, the VVVF controller normally needs no maintenance.

Within the range of the standard elevator maintenance, however, check the connectors for tight fit and contacts of the output relays with regard to arc erosion.

At elevators in contaminated environments (chemical and similar industries), it may be necessary to blow off dust and dirt from the printed circuit boards and power components in order to avoid creepage current and flashover.

Also it might be necessary to remove dust from the ribs of the heat sink. In office and residential buildings, however, this is normally not necessary.

Encoders which are not directly flanged to the machine or integrated in it, but only indirectly connected to the motor shaft by a driving belt (in most cases toothed belts), regularly need to be checked with regard to sufficient belt tension.

7 FRC-Q with integrated drive contactors

7.1 General

The frequency converter can also be supplied with integrated drive contactors. The drive contactors correspond to utilisation category AC3 and are fitted with auxiliary contactors. The unit can also be ordered with further components. Internal wiring in compliance with customer specifications.

A ***Plug & Play system*** is being offered where the frequency converter is just plugged into the control system. This avoids any possibility of wiring mistakes on site. Until now, the interface between the elevator control and the VVVF is realized with nearly all control-manufacturers.

The complete unit is enclosed in a housing so that it can be fastened to a wall outside the enclosure.
The braking resistance is integrated in the unit up to size 6.

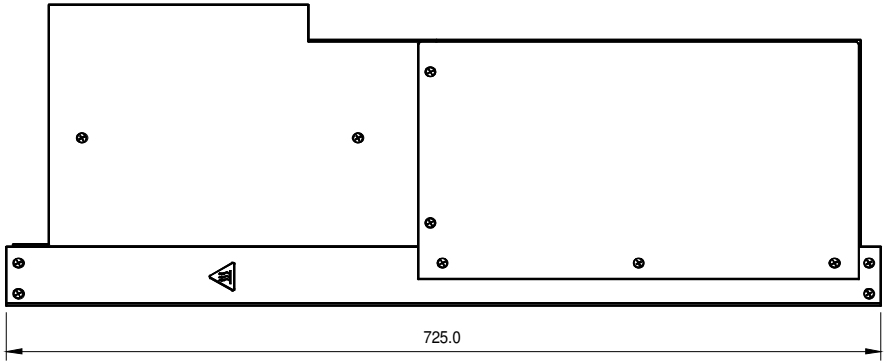
Warning: Due to the heat dissipation of the brake resistor the unit should always fixed on an inflammable base (e.g. concrete wall). For proper ventilation of the braking resistance there should be at least 20cm space above and below the unit.
If there are inflammable materials in the closer area, there should be a distance of 50cm between the unit and these materials.

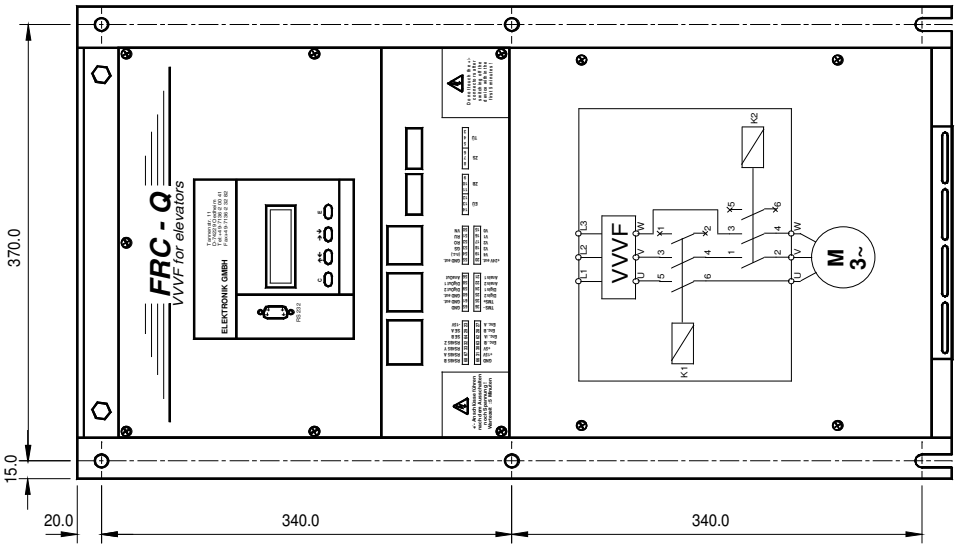
7.2 Technical Specification

The currents correspond to that of the standard unit.

housing	Dimensions		
	Width	Height	Depth
FRC-F1...F6	400 mm	725 mm	275 mm
FRC-F7	400 mm	864 mm	275 mm

7.2.1 Housing



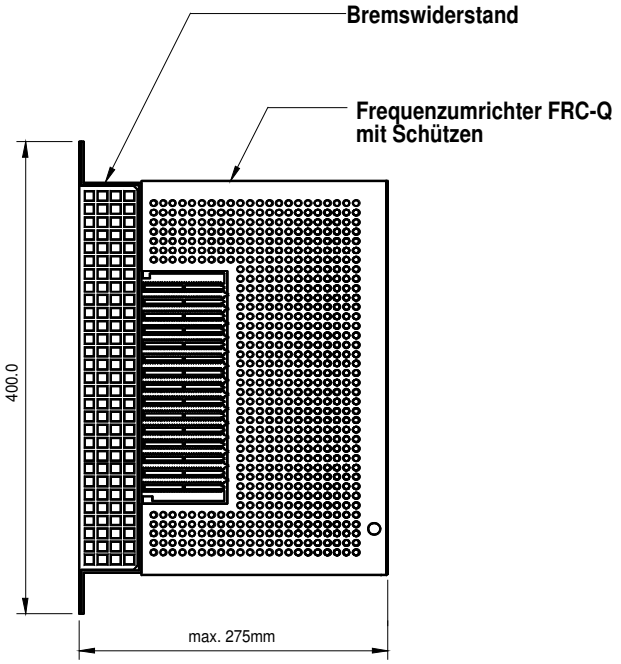


Alle Befestigungsbohrungen ø 11.0

technische Änderungen vorbehalten

Aufgrund der Wärmeentwicklung des Bremswiderstandes darf das Gerät nur auf einer nicht brennbaren Oberfläche (z.B. Betonwand) montiert werden. Damit die Belüftung des Bremswiderstandes nicht behindert wird, muß über und unter dem Gerät ein Luftraum von mindestens 20cm frei gelassen werden.

Befinden sich brennbare Materialien in der Nähe des Gerätes, so ist ein Abstand von mindestens 50cm zu gewährleisten!



FRC-QS / BRW Baugröße 1...6					DIN ISO 2768m			Maßstab 1:4
								Zchngs.-Nr.:
						Datum	Name	
					Bearb.	10.08.00	Müller	**Gesamtkonstruktion mit integriertem Bremswiderstand**
					Gepr.			
					Norm			
32								
31		-------		Ki	Tannenstr. 11, D-74229 Oedheim Tel. 07136 / 2 00 41, Fax 2 32 82		Datei: abmf1f6.skd	Blatt 1
Index	Rev.	Änd.Nr.	Freigabe	Name				1 Bl.

7.2.2 Fastening the cables

The cable inlet is through the lower opening. On standard designs, the cable fastening plate is located on the underside of the unit's mounting plate.

The cable fastening plate provides strain relief for the cables and screens the cables. Connect the cables as follows:

unshielded cables:

- Fasten with provided cable binders in the holes in the middle of the panel.

shielded cables:

- Uncover cable shield.
- Select appropriate cable clip.
- Insert provided plate nuts at required points so that the smooth surface is facing upwards.
- Using provided M4 screws, fasten clip in place in the plate nuts.

The sensor cable is also fed into the housing from below, through the opening with the split cable bush to the plug-in terminals and fastened to the cable fastening plate using a cable clip.
The cable routing for any connected motor PTC thermistor is exactly the same as for the sensor cable, but in this case it is fastened using a cable binder.

7.2.3 Wiring

The mains supply line is connected to the terminals *"L1-L2-L3-PE"*. On units with integrated miniature circuit breakers, the neutral wire must be connected to the terminal marked in blue.

The brake resistor lead is connected to the terminals *"RB"* and *"+"* and *"PE"*. In the case of units with integrated braking resistance, no external wiring is required.

The motor lead is connected direct to the contacts marked *"U-V-W"* and the PE terminal.

The control cable is just plugged into the control system on ***Plug&Play units.***

8 Troubleshooting

Note : The following compilation covers the most common errors and warnings.

8.1 Error messages at the converter

8.1.1 Encoder polarity

Triggered:
Signs of set and actual value do not correspond.

Causes and remedy:
Assignment of motor sense of rotation and incremental encoder tracks is not correct. During up-movement of the
cabin, a positive speed must be displayed.
Exchange pulse encoder track A and B or -A and -B or 2 motor phases.

8.1.2 No start-up

Triggered:
Despite set value and 100 % torque, not actual movement recognized.

Causes and remedy:
The incremental encoder is not connected properly or is defective Check if a speed is displayed when the cabin is moving.
The encoder pulses of the incremental encoder are parameterized incorrectly.
The brake does not open, i.e. motor is overloaded.
The motor produces too little torque because the converter was not adjusted to the motor correctly.

8.1.3 Overspeed

Triggered:
Actual speed is higher than V4 + 20 %

Causes and remedy:
Uncontrolled opening of the brake without converter activity.
Opening of traveling contactors during a travel operation.
Tachometer defective or fault signal injection on the tachometer lead .

8.1.4 Control Deviation

Triggered:
The deviation between the set and actual value is greater than 20 % of V4 for 3 seconds.

Causes and remedy:
Motor not adjusted to the converter correctly.
Motor overloaded.
Converter too small.

Compare system data with motor type plate.

8.1.5 Overcurrent

Triggered:
Current value exceeds the maximum converter current.

Causes and remedy:
Short-circuit in the converter output circuit, e.g. due to motor damage or wrong wiring.
Check wiring
Measure motor.

8.1.6 Overvoltage DC

Here, it has to be assumed that the power in the brake operation can no longer fed from the DC-link. Possibly the braking resistor is connected incorrectly or defective.
Increased mains voltage can also cause this error.

8.1.7 Undervoltage DC

Triggered:
DC-link voltage falls below a certain value.

Causes and remedy:
Too low mains voltage (e.g. emergency power operation in the case of generator overload, temporary (construction) power supply with small supply cable cross-section, mains voltage reductions
areas with "soft network").

8.1.8 Motor adaptation

Triggered
An error occurred during current controller setup.
Motor-converter connection interrupted.

Causes and remedy:
Travel contactors not picked up.
Contacts of travel contactors worn out.
Wiring error.

8.1.9 Temperature KK. (Overtemperature)

Triggered
Temperature increases above a limit.

Causes and remedy:
Too high ambient temperature.
No ventilation opening in the enclosure.
Converter too small.

8.1.10 DCP error

Triggered:
Defective or no telegrams from control system

Causes and remedy:
DCP connection cable twisted and shielded ?
Shields connected to PE properly ?

Switching of the travel contactors under current.

8.1.11 Runtime error

Triggered:
The programmed runtime monitor has responded.

Causes and remedy:
Deactivate runtime monitor or increase time.

8.1.12 Contactor error

Triggered:
Travel contactors still picked up 0.5 seconds after the ZS relay was switched off

Causes and remedy:
Check if the contactors are still activated after 0.5 seconds after switching off the ZS relay.

8.1.13 Power unit

Triggered:
The error message is generated by the power modules of the converter.

Causes and remedy:
High EMC impact.
Converter defective
Check shields and RC-elements of contactors.
Check if large interference sources (e.g. large machines, …) are located near the converter.
Replace converter.

8.1.14 Calibration

Causes and remedy:
An error has occurred during the calibration of the synchronous machine.
Consult RST.

8.1.15 Earth fault

Triggered:
The measured earth fault current exceeds the permissible value.

Causes and remedy:
High EMC impact.
Motor defective.
Check shields and RC-elements of contactors.
Check if large interference sources (e.g. large machines, …) are located near the converter.
Measure motor.

8.1.16 Motor overload

Triggered:
The load limit of the motor was exceeded.

Causes and remedy:
Wrong parameterisation.
Incremental encoder defective.
Motor possibly too small.
Check parameterisation.
Consult RST.

8.1.17 Phase failure

Triggered:
The phase monitor has responded.

Causes and remedy:
Mains voltage too low.
Mains phase failure.
Check mains supply.

8.1.18 Referencing

Triggered:
The encoder zero pulse was not found.

Causes and remedy:
Wrong parameterisation (menu synchronous machine - sinmode).
Wiring error.

sine encoder defective.
Consult RST.

8.1.19 SSC Error

Triggered:
Defective internal telegrams.

Causes and remedy:
Printed circuit board defect.

Remedy:
Replace circuit board or converter

8.1.20 Sine controller

Triggered:
The sine evaluation unit detected an error.

Causes and remedy:
Parameterised number of pulses of ECN1313 encoder does not correspond to the actual number of pulses.
Amplitudes of sine signals are outside of permissible range.
Check sine encoder wiring.

8.2 Warnings at converter

8.2.1 Direction signals

A change of the direction signals at speed > 25 rpm was detected. This warning can occur in particular in inspection mode. For safety reasons the unit ignores a change of direction above a minimum speed of 25 rpm.

8.2.2 Temperature

The cooling body temperature has exceeded the pre-warning limit.

8.2.3 Motor data o.k. ?

No slip was considered when setting the system data parameters. Possibly, the synchronous speed (e.g. 1500) was parameterised instead of the rated speed (e.g. 1450) (see **Section** 5.5).

8.2.4 Version PowerCtr

The device has recognized that the setting software on your PC in not compatible with the controllersoftware. Parametermodifications with the PC are not possible. However, the drive-curves can be displayed and stored on your PC.