

FRC-F

VVVF Controller

for

Elevators

(as from Software 18.060.02)

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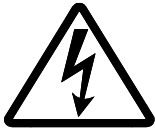
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Pictograms



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.

For finger touch-proof operation outside of the switching cabinet, the optional terminal covers must be installed.

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



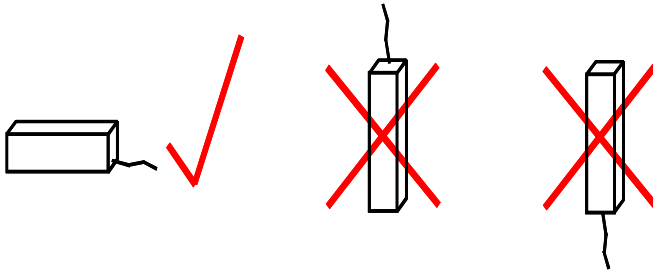
1.4 Installation of the Brake Resistor

Important note !

Due to the heat dissipation the brake resistor should always be fixed in the range of non-flammable bases. Above the brake resistor there must not be any inflammable objects. This is particularly important if devices with integrated brake resistor are installed.

For proper ventilation there should be **at least 50 cm** space above and below the brake resistor.

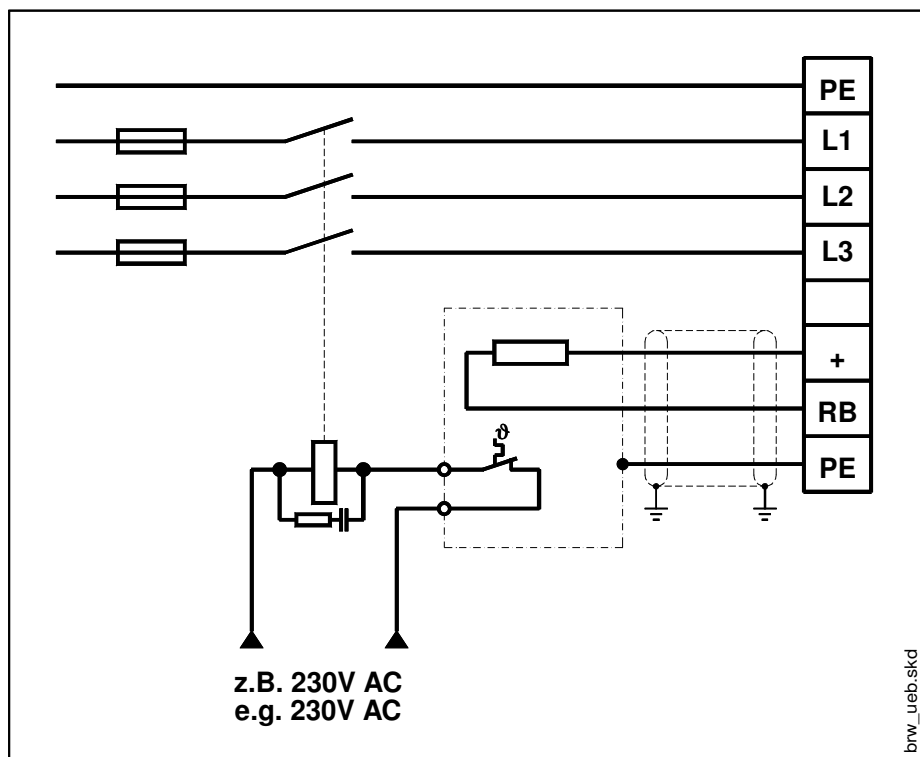
The brake resistor must be mounted in such a way, that the cable exit is on a side.



If the above mentioned recommendations are not considered, FIRE RISK exists !

It is recommended, to brake resistor with integrated temperature monitoring. These are optionally available at RST.

For this, please refer to the following wiring diagram.



In the case of devices with integrated brake resistor as well as external brake resistors with permissible ON-times > 20% or a higher power, this monitoring function is already included as a standard. For details, refer to **Chapter 4.2.1.5**.



1.5 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 an 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.

Inverters with integrated brake resistor must be fixed outside the cabinet. Please refer the safety hints section 1.4.



1.6 Connection of contactor coils

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

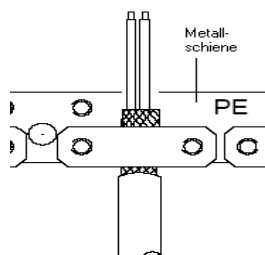
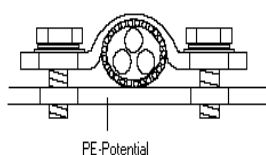
1.7 Contactor mounting plate

- 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.



1.8 Earthing

- On principle, use screened cables and lines only, for every connection to outside of the cabinet, i.e.:
 - Motor cable
 - Encoder cable
 - Brake resistor cable
 - Motor PTC resistor cable (if wired on VVVF controller)
 - DCP cable
 - Cable for shaft copying of control
- The cable from the encoder is to be screened up to the plug in the VVVF controller.
- The motor cable should be installed separately from the other cables, if possible.
- To obtain a proper earth connection, the harness shields of the cables must be connected to the PE base plate by means of metal clamps. The shields of the cables must be in **firm contact** with the clamp



1.9 Earth-leakage circuit-breaker

- The elevator should 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 could 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 (type B, DIN-VDE 0644-100).

1.10 Motor protectio by ptc-thermistor

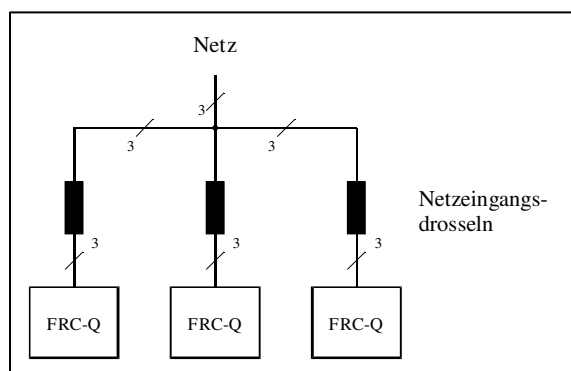
The evaluation of the motors ptc-thermistor is integrated in the software. It must be activated in the menu. As a standard, the evaluation is deactivated.

1.11 Motor protection switch

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

1.12 Mains feedback

To optimize any potential mains feedback, in particular if group drives are used, we recommend the use of three-phase commutation reactors. These are available at RST Elektronik upon request.



1.13 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.

2 Warranty

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


**Manufacturer Declaration in terms of
EG-EMV-Directive 89/336/EWG**

Herewith we declare that all following indexed VVVF-converters, meet the required EMV-regulation according to directive 89/336/EWG in all points.

Type: FRC-F1...F7 and FRC-Q8...Q11
Description: VVVF-converter für elevator drives

21.08.2006

Date


.....
Manufacturer signature
Hans Dekan, Managing Director

3 Technical Specification

Specifications subject to change without notice.

3.1 Connection to power supply

Voltage L1, L2, L3	180V ... 480V	Sizes 1-7
	180V ... 480V	Sizes 8-11
	180V ... 550V	Sizes 8-11 (special design)
Frequency	50 ... 60 Hz	
Voltage Fan	230V +-10%	Fan at sizes 6 – 11
	50 ... 60 Hz	
Fuse/ maximum connector cross section	F1	10A slow, 10 mm ²
	F2, F3	16A slow, 10 mm ²
	F4	25A slow, 10 mm ²
	F5	35A slow, 10 mm ²
	F6	40A slow, 10 mm ²
	F7	50A slow, 16 mm ²
	F8	63A slow, 35 mm ²
	F9	80A slow, 35 mm ²
	F10	100A slow, 50 mm ²
	F11	125A slow, 50 mm ²

3.2 Sizes

VVVF Controller		Motor power	Heat dissipation	Braking resistor
Type	I_N/I_{max} in[A] _{eff}	P_{shaft} in [kW] (with 400V supply)	in [W]	in [Ω] (OD = 20%, SD = 120s)
FRC-F1	8 / 16	ca. 4	170	68
FRC-F2	12 / 24	ca. 5,5	240	47
FRC-F3	16 / 32	ca. 7,5	300	33
FRC-F4	24 / 48	ca. 11	480	22
FRC-F5	32 / 64	ca. 15	660	18
FRC-F6	40 / 80	ca. 18,5	800	15
FRC-F7	48 / 96	ca. 22	1000	12
FRC-Q8	60 / 120	ca. 30	1200	9
FRC-Q9	75 / 150	ca. 37	1480	7,2
FRC-Q10	90 / 180	ca. 45	1800	6
FRC-Q11	110 / 208	ca. 55	2200	4,8

Notes:

The above stated voltage and power are specified for a setting up height of max. 1000 m. For bigger heights the output power will be reduced by 10% per 1000 m.

At travel speeds of more than 1,6 m/s and/or travel time of more than 30 seconds apply braking resistors of higher capacity respectively pulse duty factor OD.

When calculating the braking resistor please take note that the installation efficiency is very important. The above listed braking resistors are for standard installations. Further calculations for specific installations on request.

3.3 Ambient conditions

Operating temperature	10 ... 50 °C	
Cooling method	Air circulation	Sizes 1 to 5
	internal fan	Sizes 6 to 11
Maximum humidity	90%	
Maximum height	2000 m	above 1000 m power-reduction 1% per 100 m

3.4 Inputs/outputs

Digital and analogue inputs		
Digital input 1	+24V/10mA	Programmable (see Section 9.6.4)
Digital input 2		
Digital input 3		Emergency operation (see Section 9.10)
Analogue input	+10V	Analogue load measurement
Drive commands	+24V/10mA	V0, V1, V2, V3, V4, VN
Direction signals		R0, RU
Controller enable		GS
Digital outputs and relay outputs		
Relay EÜ	max. switching current * 250V~ / 8A 24V- / 8A 48V- / 0,8A	Levelling monitoring
Relay TÜ		Fault message
Relay ZB		Brake control
Relay ZS		Drive contactors control or signal motor magnetized
Digital output BÜ	+24V/50mA	Deceleration monitoring
Encoder		
Supply voltage	5V/15V/-15V +/-5%	Max. output current $I_{max}=150\text{ mA}$
TTL (5V)	500–4096 pulses, continuous adjustment	$n_{Max} = 3000\text{ rpm}$
HTL (+15V)		No. of encoder pulses ≤ 2048 : $n_{Max} = 3000\text{ rpm}$ No. of encoder pulses > 2048 : $n_{Max} = 1500\text{ rpm}$
Sinus (1Vss)		
Outputs for shaft copying of control		
Shaft copying A	+5V/ 30mA (+15V optional)	Incremental encoder signal A decoupled
Shaft copying B		Incremental encoder signal B decoupled
Motor PTC input		
Connection of PTC-thermistor	Switch point 3 kOhm	Standard PTC

* Only at resistive loads



If inductive loads are to be controlled with the relay contacts, they must be provided with appropriate protective circuitry (RC element, recovery diode). Otherwise, the relay contacts might wear out prematurely due to spark formation.

3.5 Scope of supply / accessories

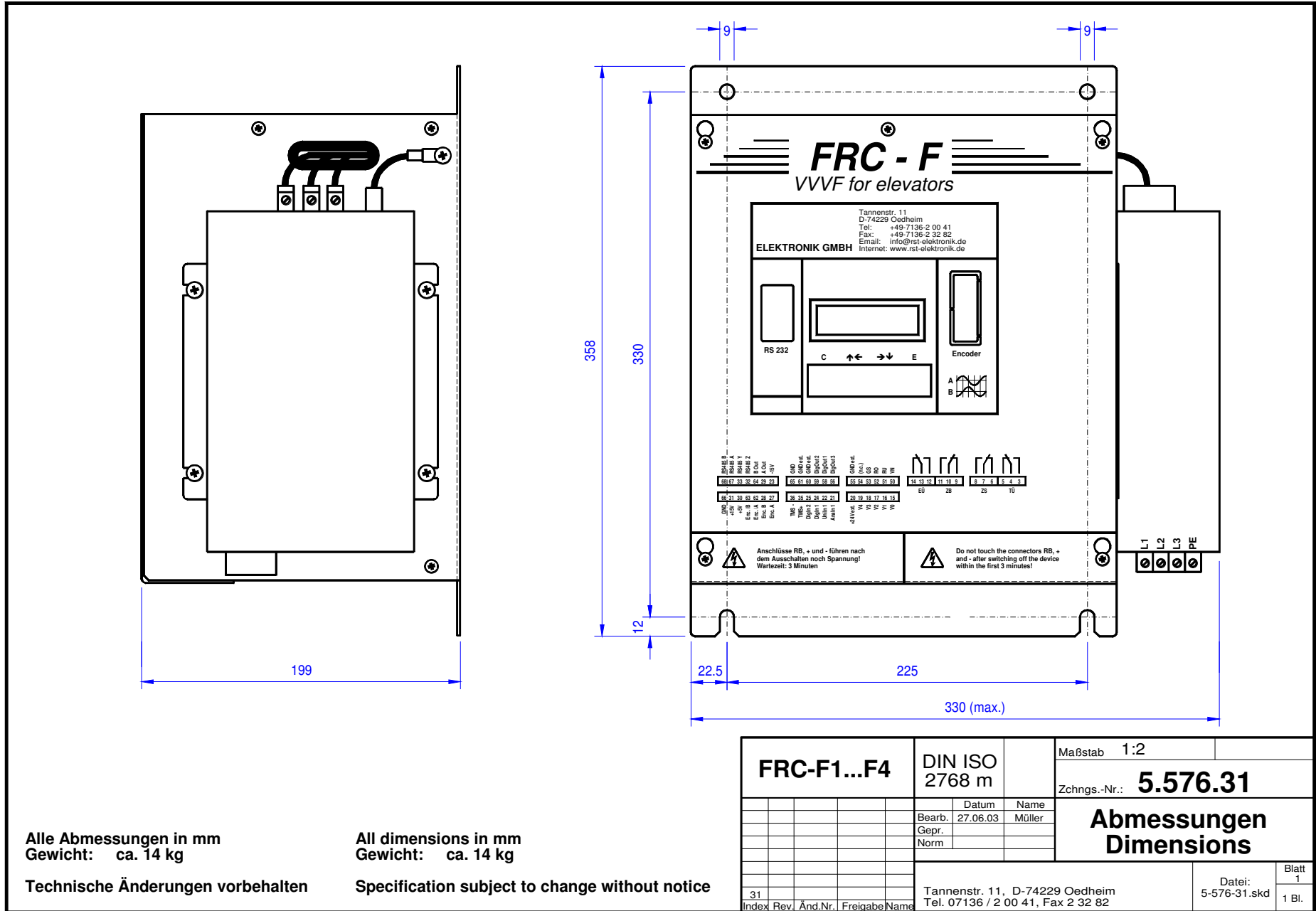
VVVF controller including mains filter	Standard scope of supply
Description of device	
Strain relief Q8..Q11	
Strain relief F1..F7	Accessories must be ordered separately
Braking resistor	
Mains input inductor	
Output inductor	
Terminal for remote setup of VVVF controller	
Setup software Power-Control	Download www.rst-elektronik.de

Note: If the VVVF controller is installed outside of the control cabinet, we recommend using the optional strain relief (accessory F1..F7).

3.6 Dimensions

VVVF controller	Dimensions in mm (height x width x depth)
FRC-F1	358 x 266 x 200
FRC-F2	358 x 266 x 200
FRC-F3	358 x 266 x 200
FRC-F4	358 x 266 x 200
FRC-F5	421 x 330 x 221
FRC-F6	421 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

For detailed dimensioned drawings, refer to the following pages.



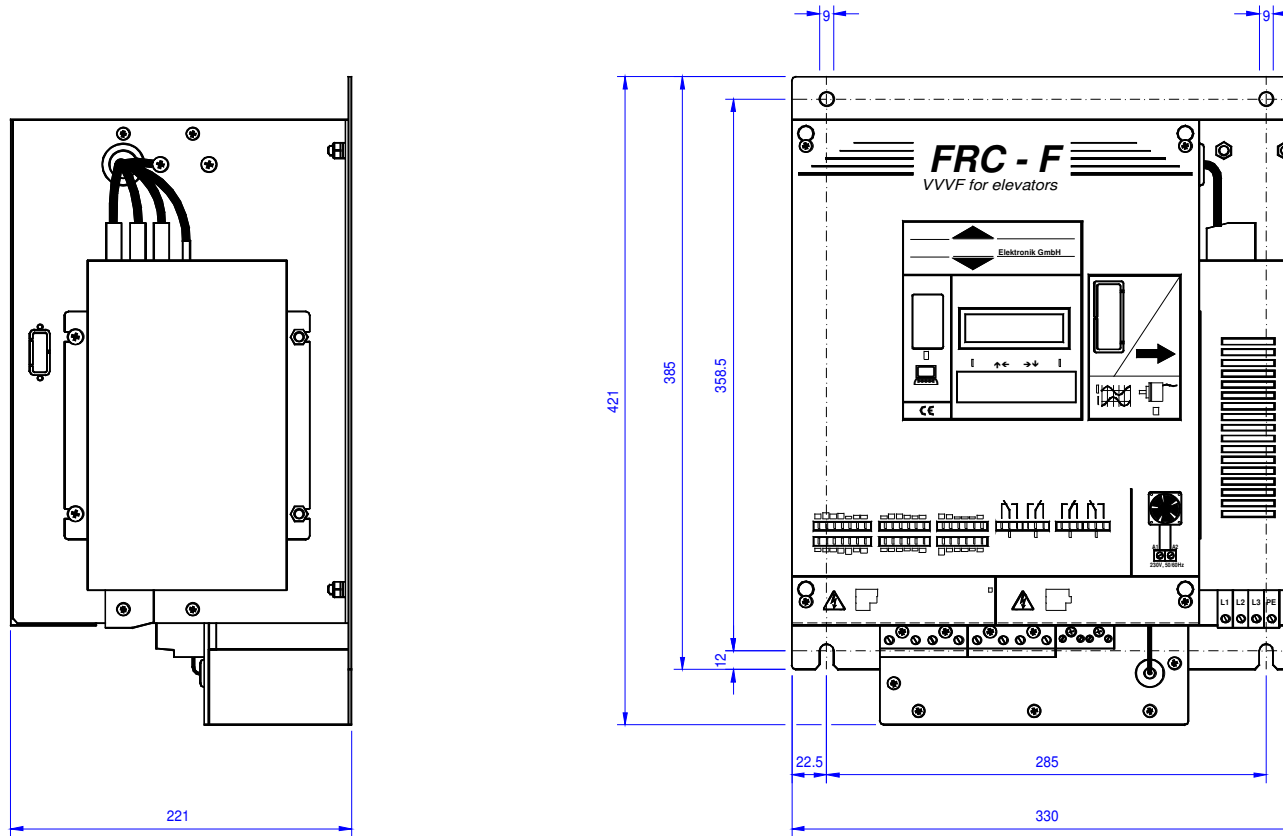
Alle Abmessungen in mm
 Gewicht: ca. 14 kg

All dimensions in mm
 Gewicht: ca. 14 kg

Technische Änderungen vorbehalten

Specification subject to change without notice

FRC-F1...F4		DIN ISO 2768 m	Maßstab 1:2
		Datum Name	Zchngs.-Nr.: 5.576.31
		Bearb. 27.06.03 Müller	Abmessungen Dimensions
		Gepr.	
		Norm	
31	Index Rev. And.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.



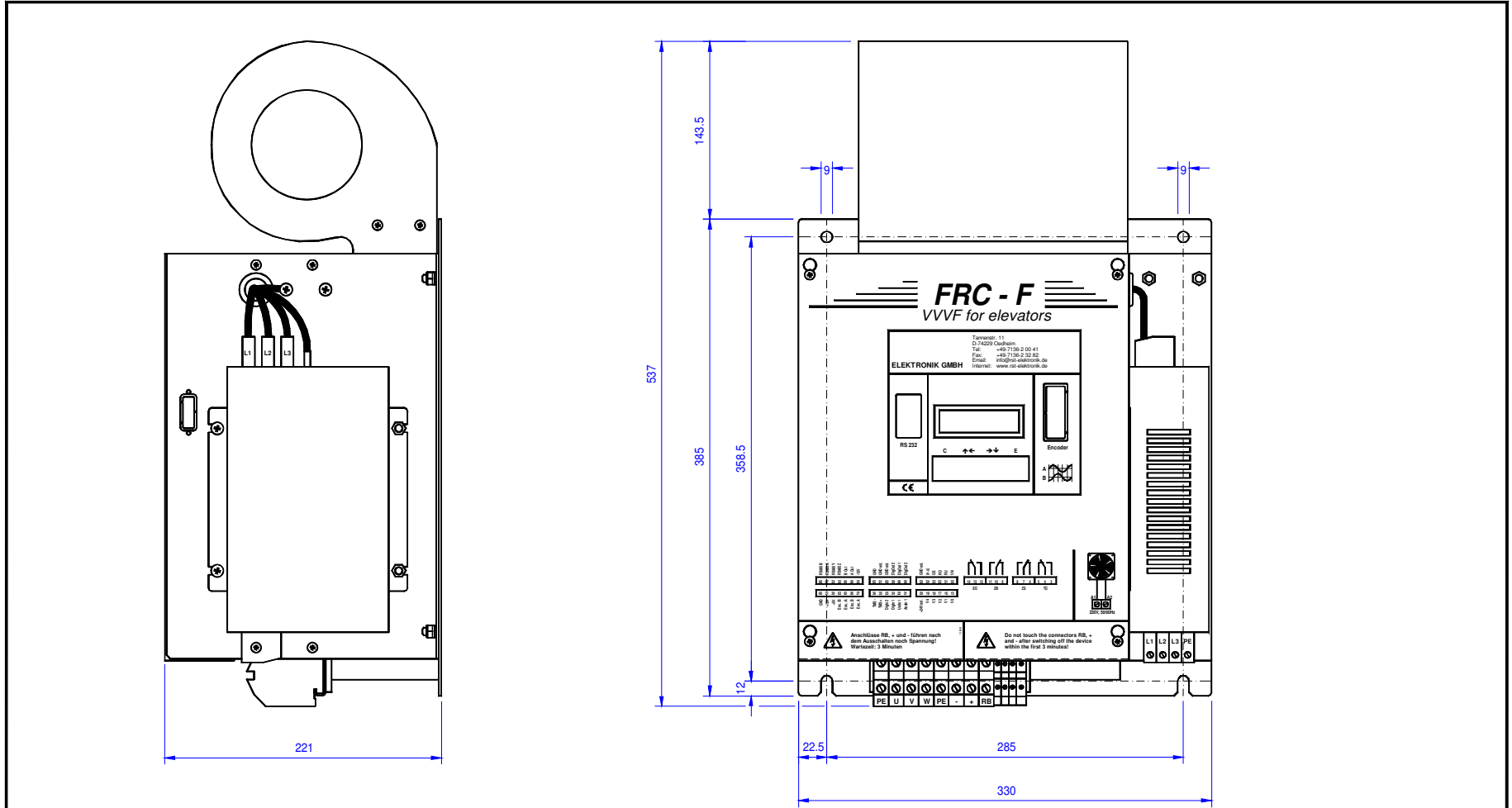
Alle Abmessungen in mm
Gewicht: ca. 22 kg

All dimensions in mm
Weight: appr. 22 kg

Technische Änderungen vorbehalten

Specification subject to change without notice

FRC-F5/F6		DIN ISO 2768m	Maßstab	1:3	Version	
			Zchngs.-Nr.:	5.588.32		
			Datum	27.12.04	Name	Müller
			Bearb.			
			Gepr.			
			Norm			
			Abmessungen Dimensions			
			Elektronik GmbH		Datei:	5-588-32
32					Blatt	1
31		25.09.03				1 Bl.
Index	Rev.	Änd.Nr.	Freigabe	Name		



Alle Abmessungen in mm
Gewicht: ca. 25 kg

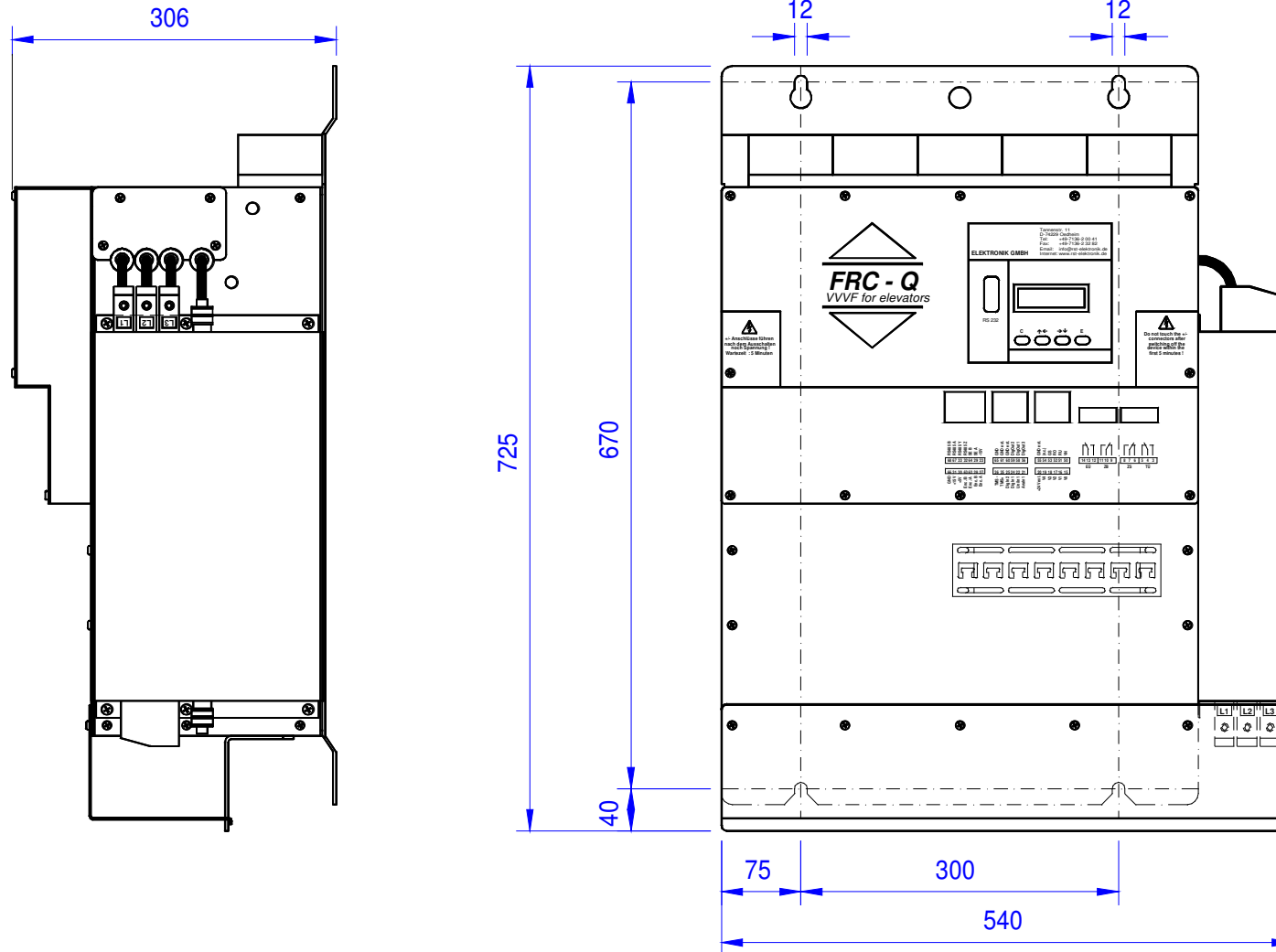
All dimensions in mm
Weight: appr. 25 kg

Technische Änderungen vorbehalten

Specification subject to change without notice

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

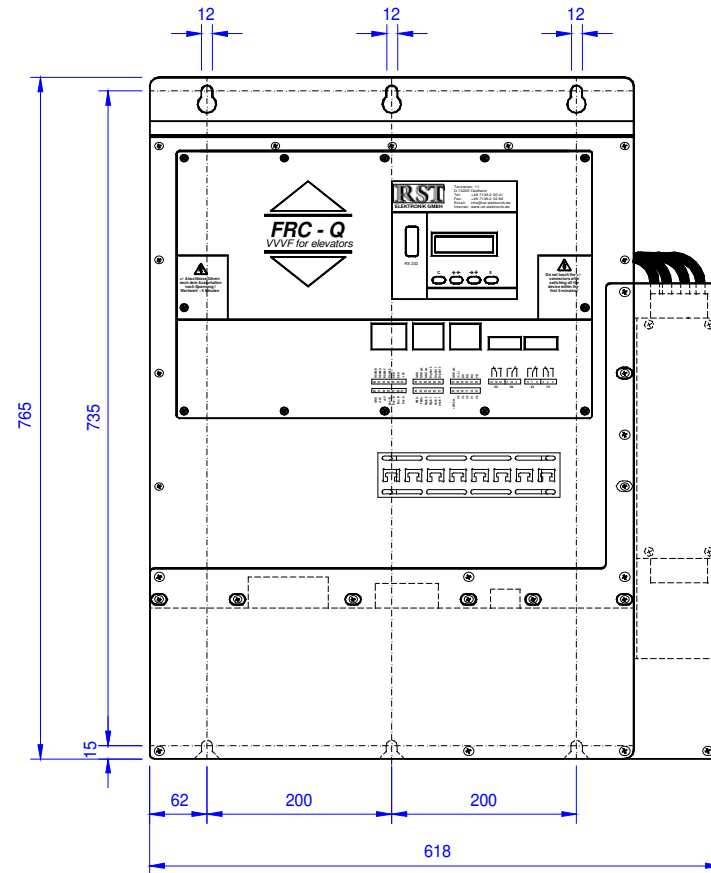
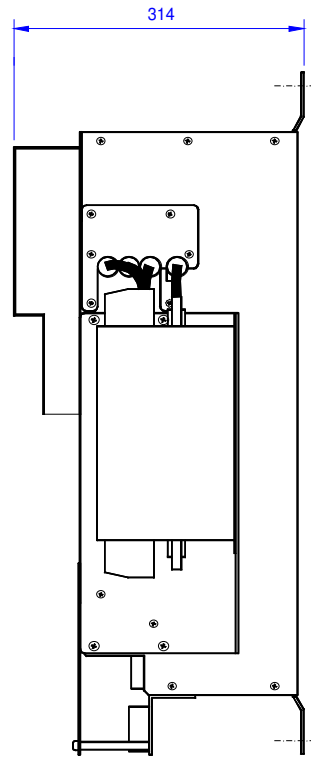
Abmessungen Dimensions



Alle Abmessungen 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
			Zchngs.-Nr.: 5.476.31	
			Außenabmessungen Dimensions	
			Datei: 5-476-31	
			Blatt 1	
			1 Bl.	
31	Tannenstr.11 D-74229 Oedheim			
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
			Zchngs.-Nr.: 5.508.31	
			Außenabmessungen	
			Dimensions	
31		Tannenstr.11 D-74229 Oedheim	Datei: 5-508-31.skd	Blatt 1
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 !

Operation of the VVVF controller with the cover removed is not permissible, since contact with live components is possible in this case.

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 $v = 2 \text{ m/sec} = 2 \text{ mm/msec}$
 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 9.6.1.5)

Table of stopping distances:

v [m/sec]	Stopping distance [m]			
	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

- Generally, the VVVF controller must be grounded. Grounding must be effected using a protection conductor of a size of **at least 10 mm²** (copper cable) (DIN EN 50178), even if the mains cable has a lower size.
- The PE connection of the VVVF controller must be connected with the main ground conductor of the control cabinet.
- The ground conductor shall be connected in **star form**. Connect the PE contacts of all components (braking resistor, reactor, motor, etc.) to the star point (main earthing point). This point should be as **close as possible to the VVVF controller**

cross section main cable	min. cross section PE-wire
< 10 mm ²	10 mm ²
> 10 mm ²	cross section of the main cable

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-F5 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, N** or **A1, A2** 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.

If the brake resistor is provided with a temperature monitor, connect it to terminals 20 (+24V) and 25 (DigIn2).

Activation of temperature monitor of brake resistor:

- Press buttons "E" and "C" simultaneously for 3 seconds to activate Service menu
- In menu "Extended" → "Service" → "Error release", set parameter "BRWProtect" to 1

Digital input 2 (DigIn2) at terminal 25 is now assigned this function permanently.

If the temperature sensor of the brake resistor is not connected or if it trips when it has detected that the temperature is too high, the error message "BRW Overtemp." will be displayed.

This error cannot be acknowledged and will result in a shut-down of the brake resistor.

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
66	GND	Ground connection
27	Signal track A	
28	Signal track B	
62	nc	
63	nc	
23	nc	

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 (optional +15 V)
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

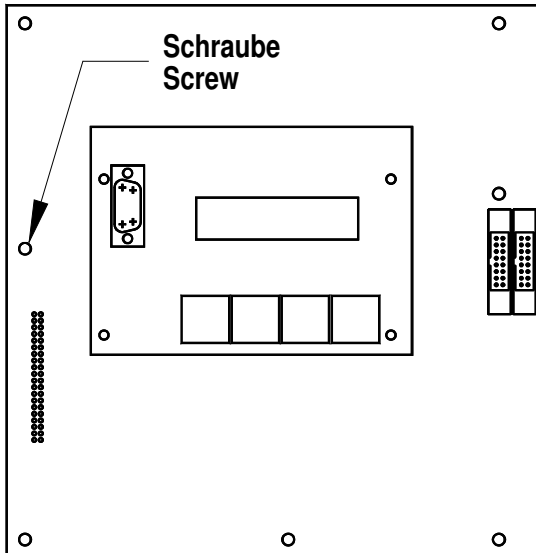
4.2.2.2.1 General

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**, the switching level is some 12 V.



Note: The reference potential of the internal voltages is not connected to PE as a standard. Connection can be established by replacing the plastic screw highlighted in the following illustration by a metal screw.



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	RO	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 9.6.4.3.2).

1 direction signal:

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

RO	Response
0	down-travel
1	up-travel

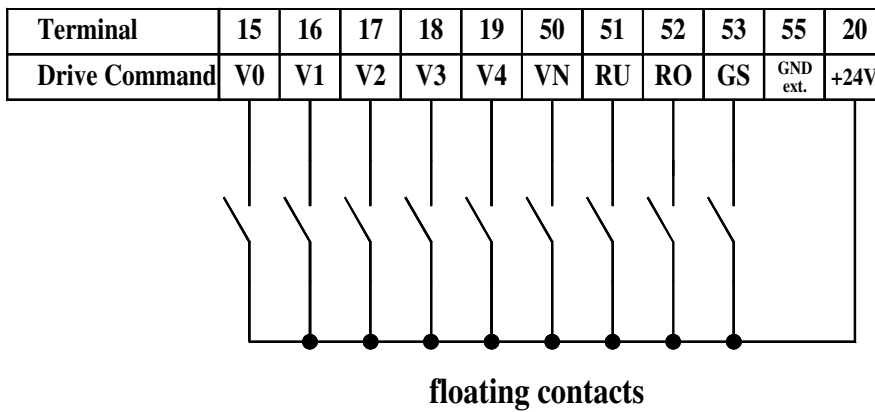
2 direction signals:

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

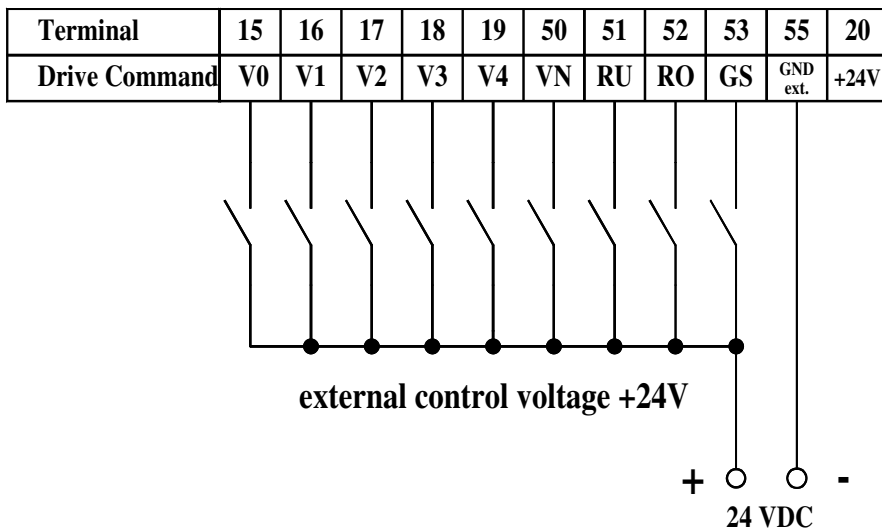
RU	RO	Response
0	0	none or stop
0	1	up-travel
1	0	down-travel
1	1	none or stop

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



4.2.2.2.5 Control via floating contacts, external control voltage



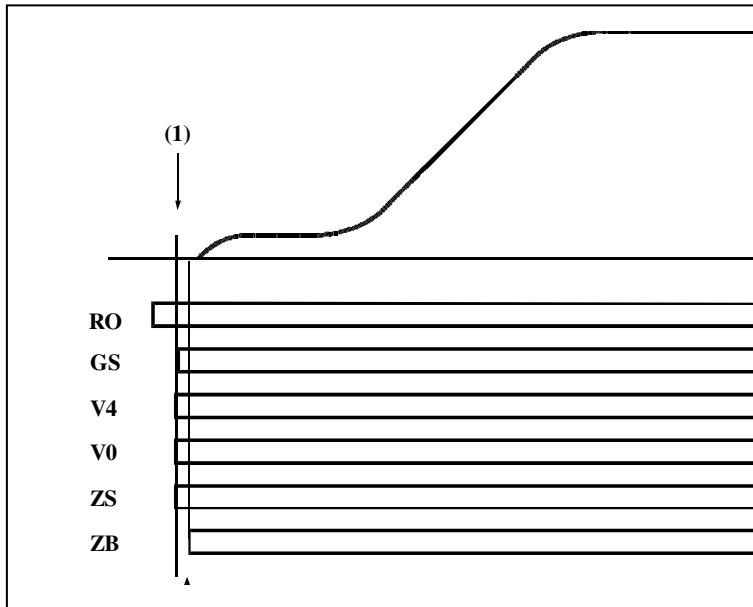
Important Note!

The positive potential of the 24 V supply voltage of the control unit and the VVVF controller must not be connected to one another, only the reference potential (ground) may be the same.

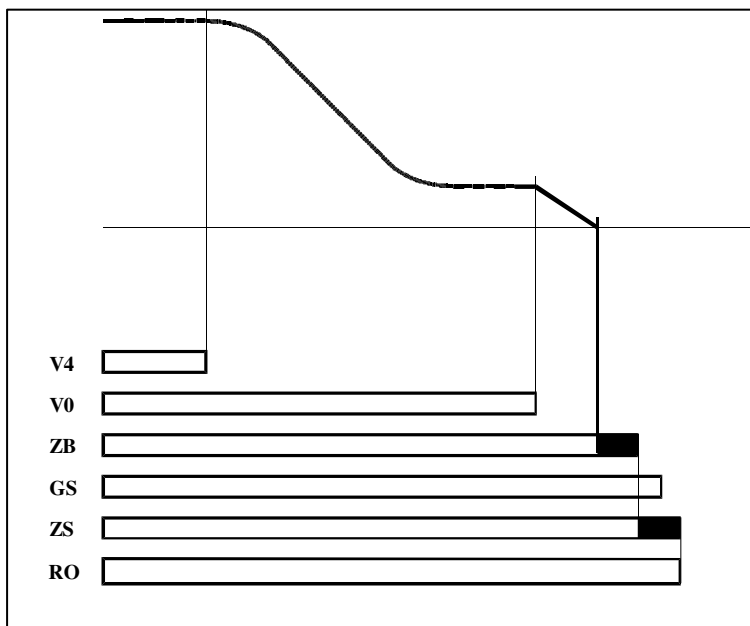
4.2.2.3 Signal procedures

4.2.2.3.1 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.

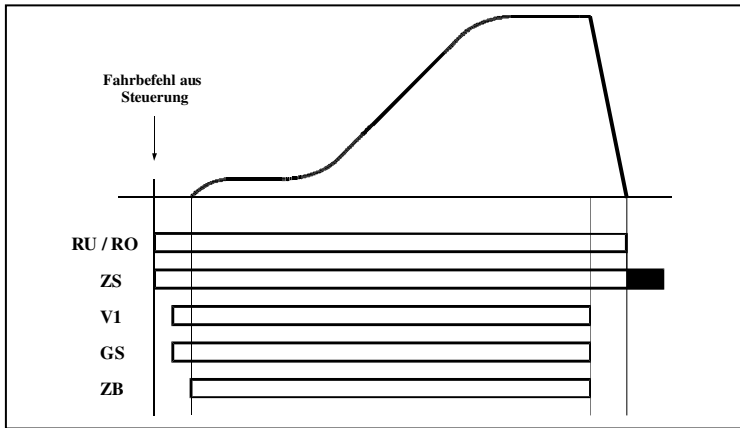


Explanations on stop procedure: As soon as the V4 command is withdrawn, the deceleration operation is initiated, as soon as the V0 command is withdrawn, the unit is decelerated to speed 0. After the unit has stopped, the relays ZS and ZB are switched off, the delay times can be parameterised.



4.2.2.3.2 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.



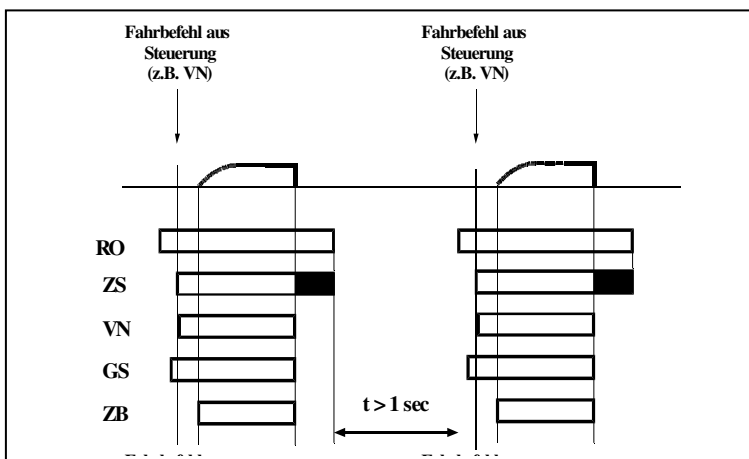
Important note!

Before the drive contactors open, the controller enable (input GS, terminal 53) at the VVVF controller must be withdrawn in order for the contactor to be de-energized. Do not use **the auxiliary contacts of the drive contactors** for this, as these contacts are not always leading contacts. By connecting a **small relay approved by us** parallel to the drive contactors, a correct timing is guaranteed.

In the case of gearless application, an electronic auxiliary relay is to be used (for more information, contact us).

4.2.2.3.3 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.

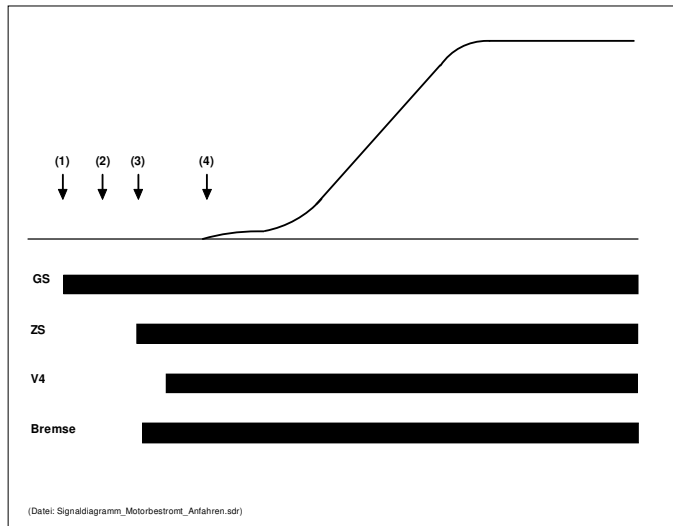


Make sure to wait for at least 1 sec. between two levelling operations so that the ropes and the mechanical equipment can settle. Otherwise it may happen that the elevator keeps levelling all the time without coming to a rest.

4.2.2.3.4 Signal procedure with signal „motor magnetized“

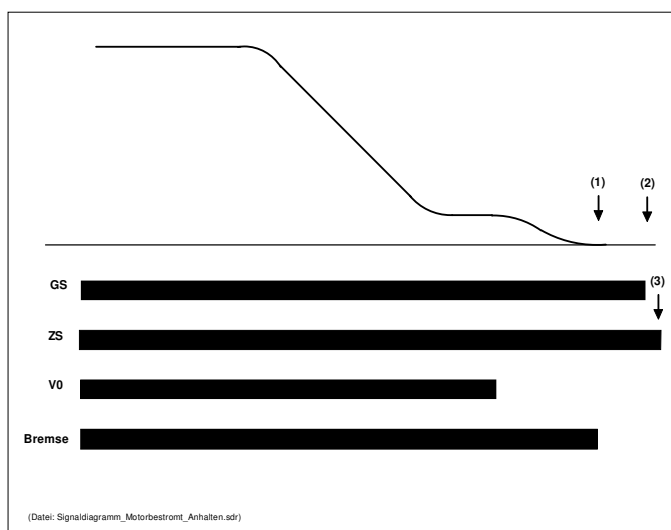
Explanations concerning starting:

- The control activates the drive contactors and switches on the signal **GS (1)**.
- The inverter switches on the output stage and energized the motor **(2)**.
- After the torque is available the inverter signals „motor magnetized“ with the relay **ZS (3)**.
- The control opens the brake and switches on the drive commands whereby the travel is started **(4)**.



Explanations concerning stopping:

- After removal of the driving command, the elevator control closes the brake (1).
- At expiration of a further time the control switches off the enable signal GS (2), whereby the current is switched off by the VVVF.
- As the current is 0, the VVVF switches off the signal "motor magnetized" (3) - relay ZS falls off.
- The control opens thereupon the driving contactors.



4.2.2.4 Digital inputs

Terminal	Function	Remark
21	Analog IN1	Analogue input 0 to 10 V, load measurement analogue
22	Digital IN3	Digital input + 24 V for emergency operation
24	Digital IN1	Digital input + 24V (programmable)
25	Digital IN2	Digital input + 24V (programmable)
60, 61	GND	Ground

4.2.2.5 Motor PTC input

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

4.2.2.6 Relay outputs

4.2.2.6.1 Connection contacts

Terminal	Function	Remark
3	normally open contact	Relay T \bar{U} (fault messages)
4	make contact	Relay T \bar{U} (fault messages)
5	normally closed contact	Relay T \bar{U} (fault messages)
7	make contact	Relay ZS (travel contactor control or motor magnetized signal)
8	normally open contact	Relay ZS (travel contactor control or motor magnetized signal)
10	make contact	Relay ZB (brake control)
11	normally open contact	Relay ZB (brake control)
12	normally closed contact	Relay E \bar{U} (signal for prematurely open doors)
13	make contact	Relay E \bar{U} (signal for prematurely open doors)
14	normally open contact	Relay E \bar{U} (signal for prematurely open doors)

4.2.2.6.2 Switching statuses

Relay	Status	Connection Terminal
E \bar{U}	VVVF controller de-energized	13 – 14
	Speed > Parameter E \bar{U}	13 – 14
	Speed < Parameter E \bar{U}	13 – 12
	Fault	13 – 12
T \bar{U}	VVVF controller de-energized	4 – 5
	VVVF controller in operation and OK	4 – 3
	Fault	4 – 5
ZS	Drive active	7 – 8
ZB	Drive active	10 – 11

4.2.2.7 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.

Terminal	Function	Remark
29	Signal A	Standard +5V , optional +15V
64	Signal B	Standard +5V , optional +15V
65, 66	GND	Ground

4.2.2.8 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	Ground

Remarks:

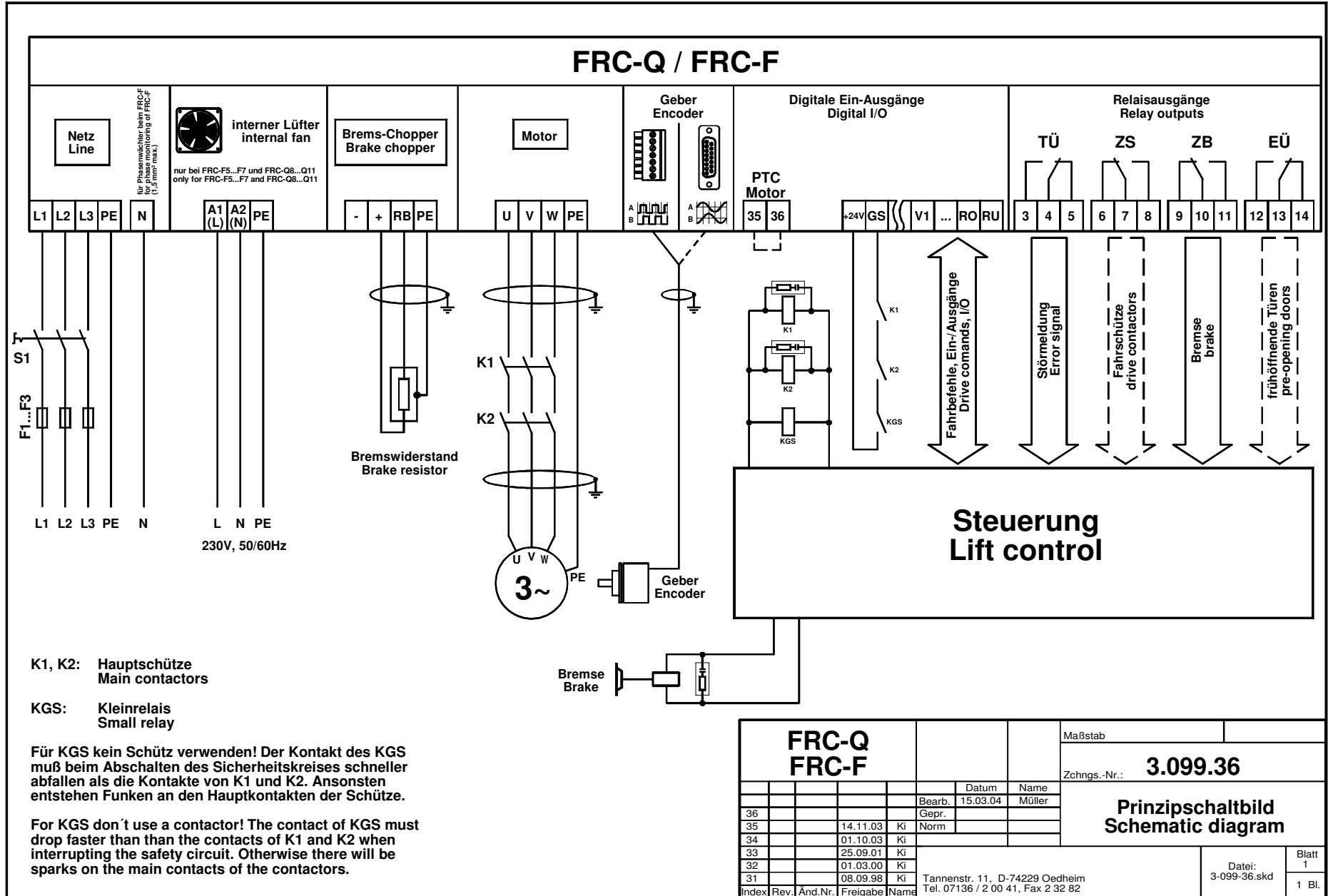
When the unit is switched on it will take several seconds until it is ready for service due to internal self-tests. During this time no travel commands from the control will be accepted. At **terminal 59** (controller ready) a "+24"-signal appears as soon as the unit is ready for service.

4.2.2.9 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.

If the DCP interface is not used, a terminal can be connected to the RS-485 interface for remote setup of the VVVF controller. The terminal is available at RST.

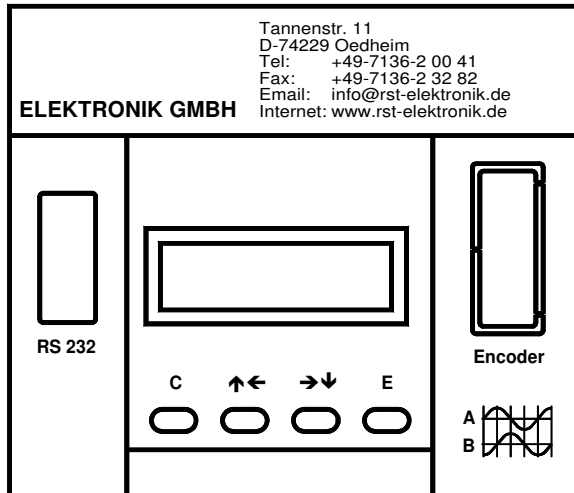


5 Commissioning

5.1 Use of the VVVF controller

5.1.1 Control elements

The user interface of the VVVF controller comprises a 4-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).



Currently, the following languages are supported:

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

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

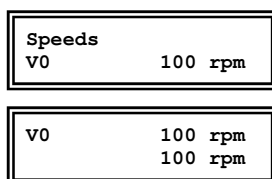
Key "E": Selection of the menu item displayed and scrolling down in sub-menus, acknowledgement of data entered and filing of modified parameters ("Enter").

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.

A help text will be displayed on some of the device parameters in the bottom line of the display.

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

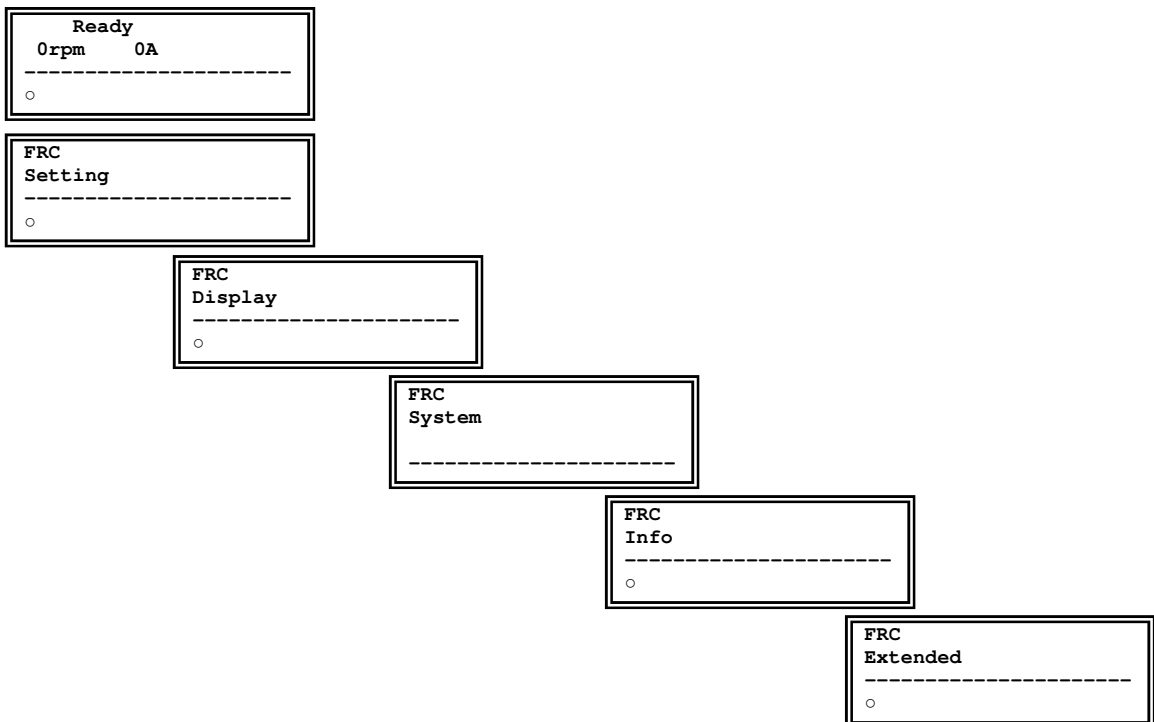
When the parameter has the required value, confirm it by pressing "E". Press "C" to cancel the action.

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.

6 Error messages

Operational errors are displayed by a flashing error message.

```
*** Error ***
encoder polarity
-----
1 Actual Faults
```

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. For a detailed list of all error messages refer to **Section 12.1**.

6.1 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:

6.1.1 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 TŪ 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".

6.1.2 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.

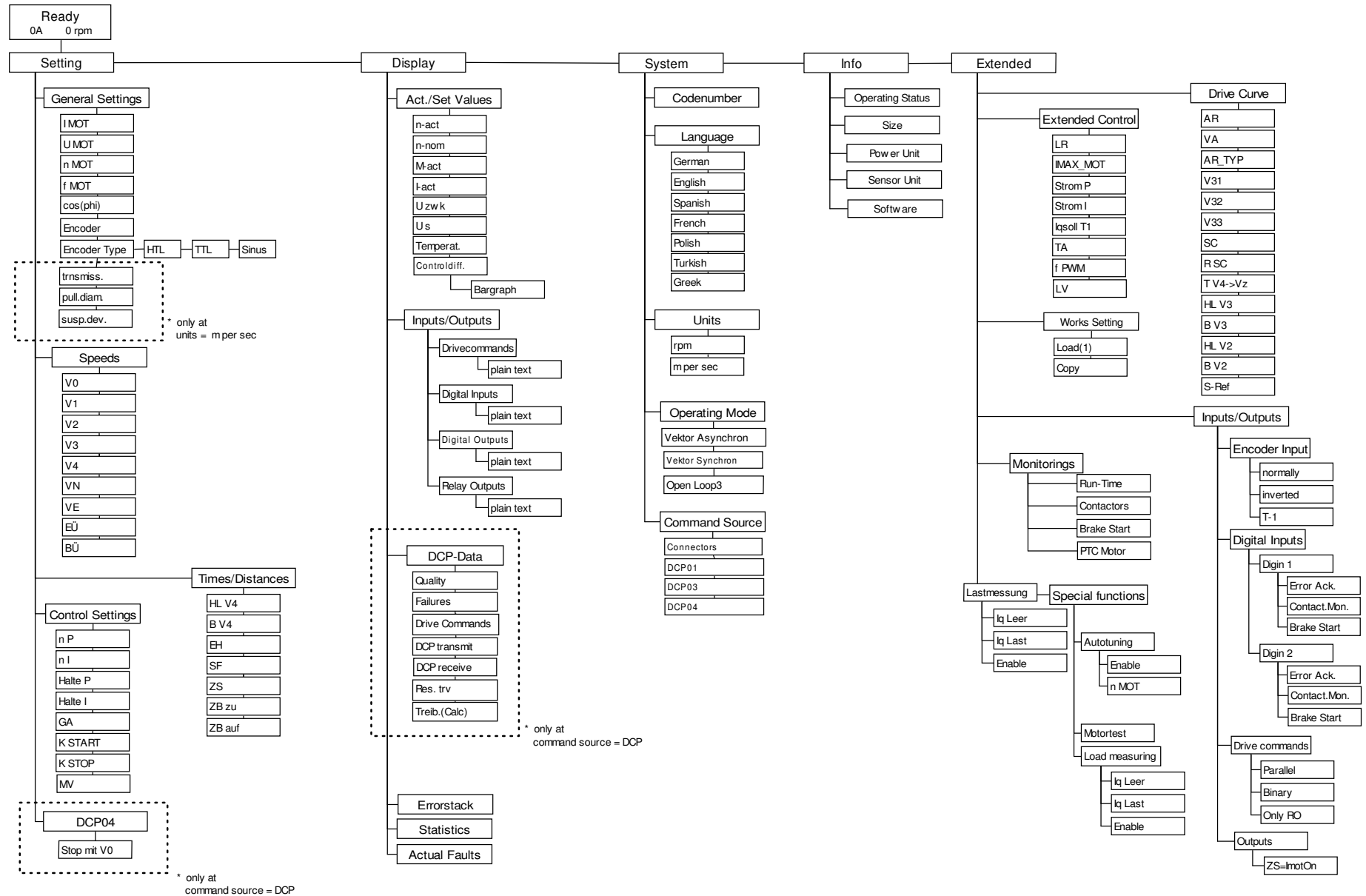
6.1.3 Acknowledgement by the unit itself by auto-fault reset

As a standard, an automatic error reset is activated in the VVVF controller. This function allows a maximum of 3 consecutive errors before the unit remains in error mode.

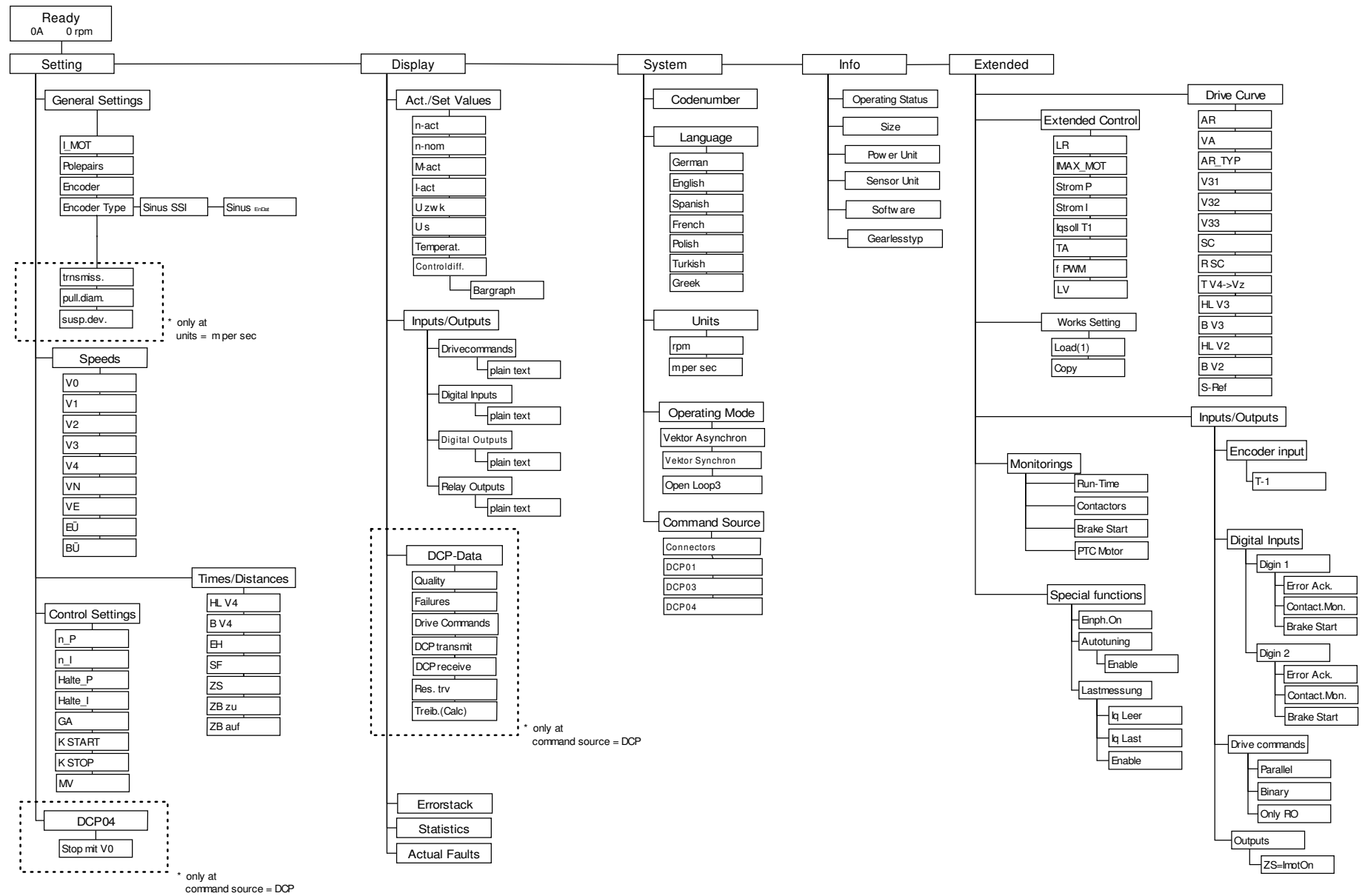
7 Menu overview

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 pages. To facilitate the setup, only the menus which are required for the corresponding operating mode of the unit are displayed.

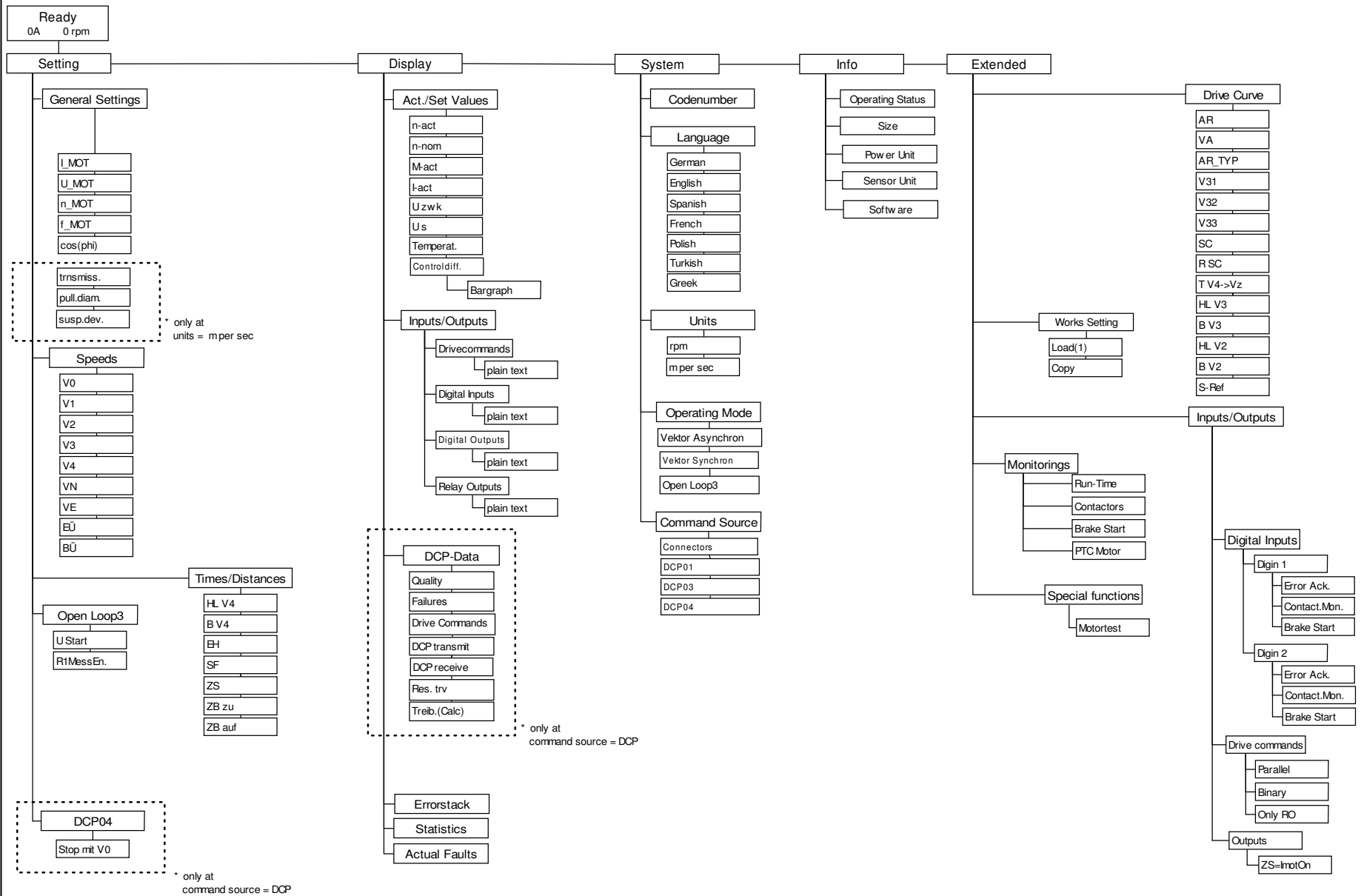
Menu overview for operating mode Vector Asynchronous



Menu overview for operating mode Vector Synchronous



Menu overview for operating mode Open Loop



8 Commissioning

8.1 Switching on the power supply

```

Setup - wait
*****
-----
○
    
```

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

```

      Ready
0rpm      0A
-----
○
    
```

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.

8.2 Selection of operating mode

8.2.1 Vector control with asynchronous machine

Note: In this operating mode, you will need an incremental encoder (sine or square).

```

System
Operating Mode
-----
○
    
```

In the *System Operating Mode* menu you can set up and control this mode.

```

Operating Mode
Vektor Asynchron
-----
○
    
```

8.2.2 Open Loop3

Note: In these operating mode, you do not need an incremental encoder.

```

System
Operating Mode
-----
○
    
```

In the *System Operating Mode* menu you can set up and control this mode.

```

Operating Mode
Open Loop 3
-----
○
    
```

8.2.3 Vector control with synchronous machine

Note: In this operating mode, you will need a Heidenhain absolute value encoder (EnDat od SSI).

```

System
Operating Mode
-----
○
    
```

In the *System Operating Mode* menu you can set up and control this mode.

```

Operating Mode
Vektor Synchron
-----
○
    
```

8.3 Adaptation of the controller parameters to the system

```

FRC-F
Setting
-----
o
    
```

Press the Enter key ("E") twice to open the General Settings menu. In order for the motor control to work at the optimum operating point, the system data must be entered:

```

Setting
General Settings
-----
o
    
```

Note: The data required depend on the operating mode selected.

8.3.1.1 Open Loop operating mode

See Section 9.9.

8.3.1.2 Operating Mode "Vector control with synchronous machine"

See Section 9.8.

8.3.1.3 Operating Mode "Vector control with asynchronous machine"

```

General Settings
I_MOT      32A
-----
o
    
```

rated motor current

```

General Settings
U_MOT      400V
-----
o
    
```

rated motor voltage

```

General Settings
n_MOT      1350rpm
-----
o
    
```

rated motor speed

```

General Settings
f_MOT      50Hz
-----
o
    
```

rated frequency of the motor voltage

```

General Settings
cos(phi)   80
-----
o
    
```

power factor of the motor. The value given on the type plate of the motor must be multiplied by 100.

```

General Settings
Geber      1024
-----
o
    
```

number of encoder pulses

```

General Settings
Gebertyp
-----
o
    
```

TTL: +5V encoder (supply voltage at terminal 30)
 HTL: +15V encoder (supply voltage at terminal 31)
 Sine: +1Vss sine encoder (supply voltage via D-SUB socket)

```

Encoder Type HTL(15V)
-----
o
    
```

```

Encoder Type
TTL(5V)
-----
o
    
```

```

Encoder Type
Sinus(1Vss)
-----
o
    
```



Please make sure that the supply voltage connection of the encoder is connected to the correct VVVF controller terminal (terminal 30 = +5V, terminal 31 = +15V).

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**.



In order to ensure a perfect driving behaviour, the rated speed must be adjusted at the VVVF controller. This speed must not be mixed up with the actual speed (V4). This is always less than 1500 rpm in the case of 50 Hz motors !

8.4 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

Ready	
0rpm	0A

o	

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

Running up V1	
300 rpm	17 A

o	

Running down V1	
-300 rpm	17 A

o	

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



Tip for checking the incremental encoder (only with Vector Asynchronous operating mode):

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:

Ready	
0rpm	0A

o	

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.

Ready	
231rpm	0A

o	

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 12.1**).

9 The Menu

9.1 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).

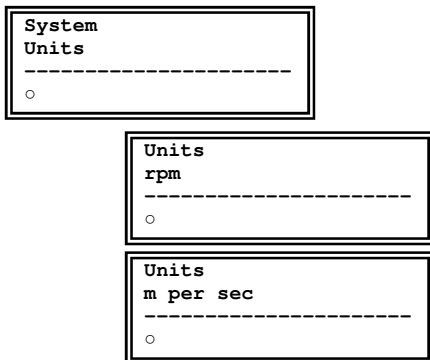
The following parameter-groups can be set in the 2 unit modes:

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 9.4.3.**



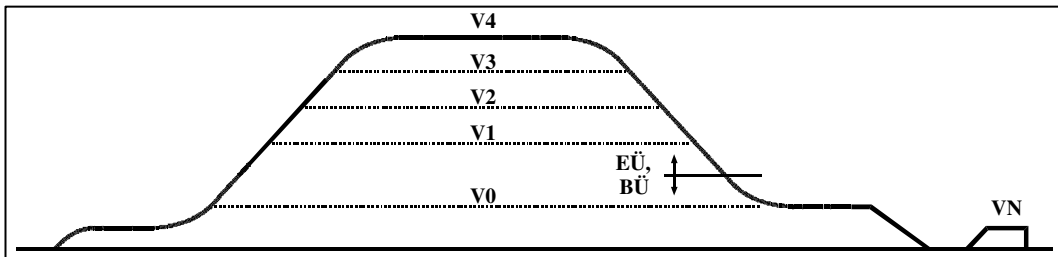
9.2 Setting – programming the converter

FRC Setting ----- ○

9.2.1 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 9.4.3**).



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 100.0rpm ----- ○
--

V0: creeping speed.

Speeds V1 300rpm ----- ○
--

V1: inspection operation speed.

Speeds V2 1000rpm ----- ○

V2: 1. intermediate speed.

Speeds V3 1380rpm ----- ○

V2: 2. intermediate speed.

Speeds V4 1380rpm ----- ○

V4: high speed.

Speeds VN 75.0rpm ----- ○

VN: leveling speed.

Speeds VE 100rpm ----- ○
--

VE: evacuation speed (the emergency mode is explained in **Section 9.10**).

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, exceeded, the relay is de-energised again.

Speeds	
BU	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 exceeded, 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 releveling function set **VN** to approx. 3% - 5% of the rated motor speed.



Note: Between repeated releveling 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.

The 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

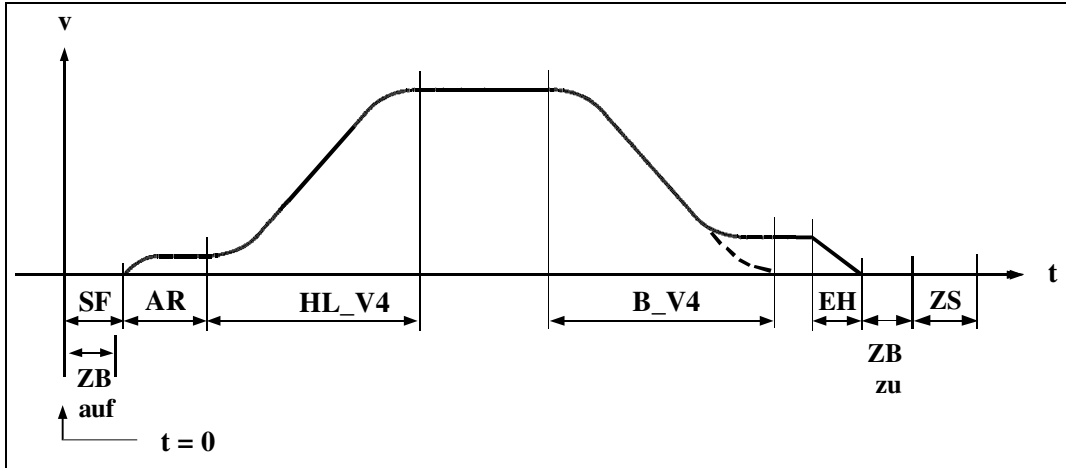
9.2.2 Setting the times/distances

Setting
Times/Distances

o

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 9.4.3)

The following parameters are available:

Times/Distances
HL V4 2500ms

o

Acceleration to speed V4

Times/Distances
B V4 2500ms

o

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/Distances
EH 1000ms

o

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/Distances
SF 300ms

o

Time lag between starting the travel curve and receiving a drive command.

Times/Distances
ZS 300ms

o

Time from applying the brakes to the relay ZS (main contactor) shutting off upon stopping.

Times/Distances
ZB zu 300ms

o

Time from stop (set value 0) until application of the brake (relay ZB shut-off).

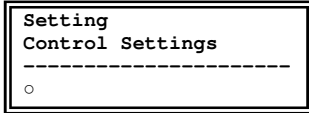
Times/Distances
ZB auf 300ms

o

Time from start command until opening of the brake (relay ZB activated).

Timing diagrams concerning the sequence of signals are given in **Chapter 4.2.2.3** .

9.2.3 Setting the speed controller



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.

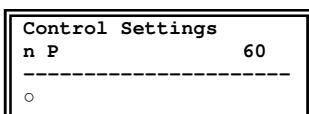
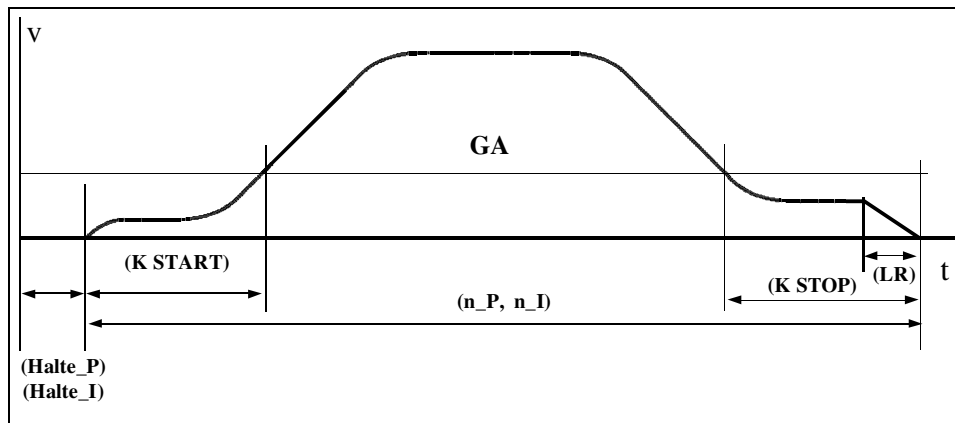
Regulator structure of the VVVF-controller:

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

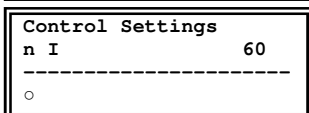
Stopping regulator (Halte P, Halte I): Only used for stopping the drive when the brake is opened. This regulator takes over the complete load and must therefore react very quickly in order to prevent the drive from turning away. If the default settings do not result in an optimum load take-over, the behaviour can be improved by decreasing the I-portion (Halte_I)

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.



Proportional coefficient of the speed controller.



Integration time of the speed controller.

Control Settings	
Halte P	60

○	

Proportional coefficient of the stillstand controller.

Control Settings	
Halte I	250

○	

Integration time of the stillstand controller.

Control Settings	
GA	50 rpm

○	

Switch-over threshold for speed regulator amplification

Control Settings	
K START	100 %

○	

Increase of starting regulator's gain in refer to the speed regulator

Control Settings	
K STOP	100 %

○	

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.

9.3 Display/Scanning operating variables

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

FRC-F Display ----- ○

9.3.1 Display of actual and set values

9.3.1.1 Speed

Act./Set Values n-act 0 rpm ----- ○

Current motor speed

Act./Set Values n-nom 0 rpm ----- ○
--

Current speed set value

9.3.1.2 Motor current and torque

Act./Set Values M-act 0 % ----- ○
--

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.

Act./Set Values I-act 0 % ----- ○
--

Motor current (effective) in Amperes.

9.3.1.3 Other variables

Act./Set Values U zwk 550 v ----- ○
--

DC link voltage of converter

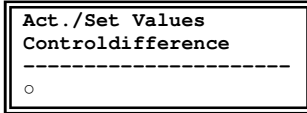
Act./Set Values U s 86 % ----- ○
--

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

Act./Set Values Temperat. 42 C ----- ○
--

Cooling body temperature

9.3.1.4 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



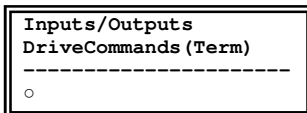
At rest, no control difference



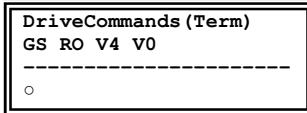
Drive (example), speed deviation actual-required = 15 rpm

9.3.2 Inputs/Outputs

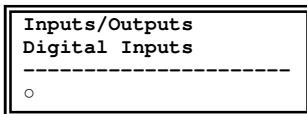
9.3.2.1 Drive commands



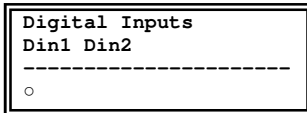
The read drive commands at the terminals are displayed as plain text.



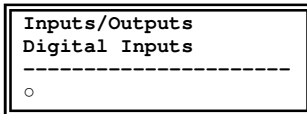
9.3.2.2 Digital inputs



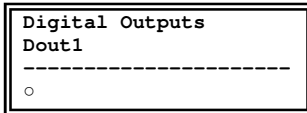
The read digital inputs are displayed as plain text.



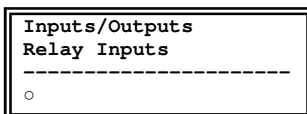
9.3.2.3 Digital outputs



The read digital outputs are displayed as plain text.



9.3.2.4 Relay outputs



The activated relay outputs are displayed as plain text.



9.3.3 Errorstack

```
Display
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. ..

```
StörNr05/10: 65432
Unterspannung ZWK
-----
Infos mit <E>○
```

Each fault is displayed with its order number and the number of travel operations at the time of the fault. Example on left-hand side: Fault number 5 "low voltage" occurred after 65432 travel operations

Use the E-button to open more information on the time of the error

```
UnterspannungZWK
I=10A          S(23)
Uist=50%  Vsoll=100rpm
UZWK=342V T=42 C
```

Example on left-hand side: At the time of the fault, the following parameters were measured:
 current = 10 A
 output voltage = 50 %
 rated speed = 100 rpm
 DC link voltage = 342 V
 temperature=42°C

Note: If the symbol [↑↓] appears on the bottom right of the display, it is one of several errors occurred at the same time. Use the arrow keys to obtain information on each of them.

```
Fehlerspeicher
...loeschen ? <E>
-----
○
```

When you leave the menu using the „C“ button, you can delete the error memory by pressing the Enter key „E“. However, this is only possible when the output stage is switched off, i.e. not while the elevator is moving. If you press the "C" button when asked if you want to delete the memory, the memory will not be deleted.

```
Fehlerspeicher
..wird geloescht
-----
○
```

9.3.4 Statistical data

Anzeigen Statistik ----- ○

From this data, the degree of utilization of the VVVF can be learned

Statistik Betriebszeit 1400 min ----- ○
--

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

Statistik Zeit aktiv 239 min ----- ○

Time during which the output stage was active, i.e. travel operations were performed.

Statistik Fahrtenzahl. 67890 ----- ○

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

Statistik RunI1.9 32 ----- ○

Number of travel operations during which the rated device current was exceeded by the factor **1.9**.

Statistik RunI1.5-1.9 132 ----- ○
--

Number of travel operations during which the rated device current was exceeded by the factor **1.5 to 1.9**.

Statistik RunI0.75-1.5 88 ----- ○
--

Number of travel operations during which the rated device current was exceeded by the factor **0.75 to 1.5**.

Statistik Zeit Tmax 0min ----- ○

Time during which the unit was operated at maximum temperature

9.3.5 Current errors

Display Actual Faults ----- ○
--

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.

*** Error *** Undervoltage DC ----- ○
--

9.4 System settings

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

FRC-F System ----- ○
System Codenumber ----- ○
System Language ----- ○
System Units ----- ○
System Operating Mode ----- ○
System Command Source ----- ○

9.4.1.1 Unit password protection

System Codenumber ----- ○
Codenumber Enter ----- ○
Codenumber 0 0 ----- ○
Codenumber ok... ----- ○
Codenumber Error ----- ○
Codenumber change ----- ○
Codenumber 0 0 ----- ○
Codenumber repeat ----- ○

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.

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

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.

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

Otherwise an error will be signalled.

Press "C" to quit editing mode.

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

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

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

Codenumber ok . . . ----- <input type="radio"/>
--

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

Codenumber Error ----- <input type="radio"/>

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.

9.4.2 Setting the language

System Language ----- <input type="radio"/>
--

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

Language German ----- <input type="radio"/>
--

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

Currently, the following languages are supported:

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

9.4.3 Selecting the unit mode (U/min 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).

```
System
Units
-----
o
```

```
Units
rpm
-----
o
```

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

```
Units
m per sec
-----
o
```

To select unit mode metres/second, press the "E" key.

```
Units
ok ..
-----
o
```

```
Setting
General Settings
-----
o
```

In the *Settings - General Settings* menu (see Section 0), three further parameters are displayed now:

```
General Settings
trnsmis      2650
-----
o
```

Here, you must enter the **transmission * 100**.

Example : Transmission = 53:2 --> entered value 26,5 * 100 = 2650

```
General Settings
Pull.dia     560
-----
o
```

Here, you must enter the pulley diameter in mm.

```
General Settings
Susp dev     1
-----
o
```

Here, you must enter the suspension of the cabin.

Example : 1:1 --> entered value 1, 2:1 --> entered value 2

9.4.4 Unit operating modes

```
System
Operating Mode
-----
o
```

The following operating modes can be used:

```
Operating Mode
Vektor Asynchron
-----
o
```

Field-oriented mode with asynchronous machine

```
Operating Mode
Open Loop 3
-----
o
```

F/U control with asynchronous machine (see **Section 9.9.1**)

```
Operating Mode
vektor Synchron
-----
o
```

Field-oriented mode with synchronous machine, gearless (see **Section 9.8**).

9.4.5 Selection of device control

System Command Source ----- <input type="radio"/>
--

Here, you can select between DCP and terminal control.

Command Source Connectors ----- <input type="radio"/>
--

Parallel drive command control

Command Source DCP01 ----- <input type="radio"/>

Serial control via DCP01 protocol

Command Source DCP03 ----- <input type="radio"/>

Serial control via DCP03 protocol

Command Source DCP04 ----- <input type="radio"/>

Serial control via DCP04 protocol

9.5 Information menu

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

FRC-F Info

Size FRC3 - 16A

Size of converter and rated current

Power unit Q1-Q7

Power unit version

Sensor unit -----

Information on additional unit for special encoders (sine encoder, ..), if applicable.

Software 18.050.01

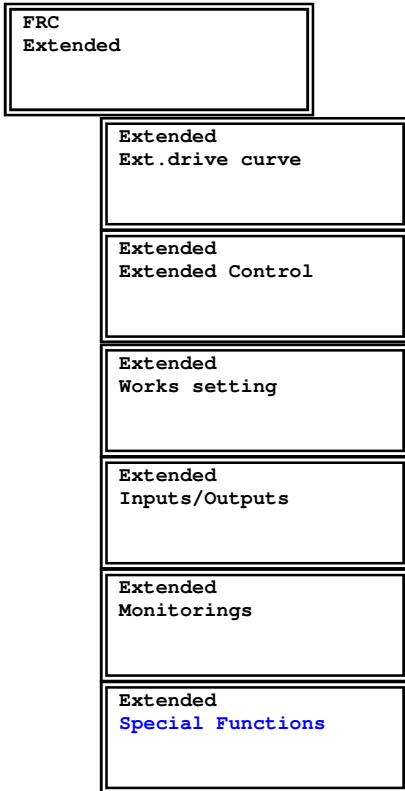
Software version.

Gearlesstyp GLAT1/60

If a gearless record was programmed in the factory, this record is displayed here.

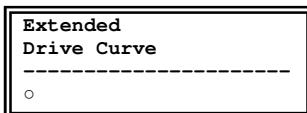
9.6 Extended menus

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

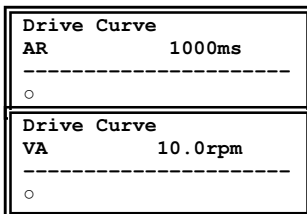


9.6.1 Extended Drive Curve

9.6.1.1 Setup of start-up behaviour

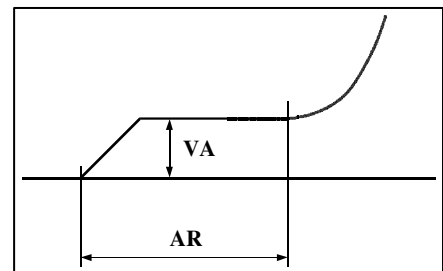


The following parameters affect the start-up behaviour:



Total start-up time up to transition to acceleration ramp.

Start-up speed



Drive Curve	
AR_TYP	1

<input type="radio"/>	

Selection between static or dynamic starting

Static (0): Set value start-up ramp starts after time AR only.

Dynamic (1): As soon as the act. speed has exceeded a minimum threshold (VA/2), the set value start-up ramp starts.

By selecting appropriate start-up parameters, a "smooth" start-up behaviour can be realized. The elevator overcomes static friction smoothly and without jerking.

9.6.1.2 Additional intermediate speeds

Drive Curve	
V31	1000rpm

<input type="radio"/>	

3. intermediate speed

Drive Curve	
V32	1000rpm

<input type="radio"/>	

4. intermediate speed

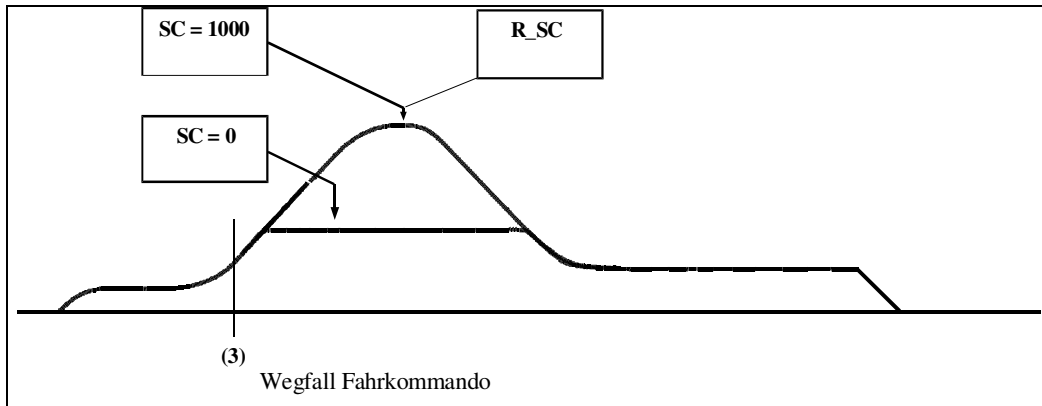
Drive Curve	
V33	1000rpm

<input type="radio"/>	

5. intermediate speed

9.6.1.3 Floor-to-Floor Correction

The unit works with automatic floor-to-floor correction taking constant courses independent of normal floor-to-floor or long travel operations.



If the travel command (3) is taken away 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.

Erw. Fahrkurve	
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.

Erw. Fahrkurve	
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.

9.6.1.4 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.

Ext. drive curve	
T V4->Vz	0ms

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.

Ext. drive curve	
HL_V3	0ms

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

Ext. drive curve	
B_V3	0ms

Ext. drive curve	
HL_V2	0ms

Ext. drive curve	
B_V2	0ms

9.6.1.5 Direct landing with reference signal

Ext. drive curve	
S-Ref	100mm

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 .9.4.3).

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.

9.6.2 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.

Proportional current regulator gain.

Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
Curr._I     4000
-----
```

P-gain current regulator.

Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
Curr._I     4000
-----
```

I-gain current regulator.

Note: Change parameters only after consultation with RST Elektronik.

```
Extended Control
Iqsoll_T1   0
P           10
-----
```

The variable of the speed controller can be smoothed 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.

```
Converter
f_PWM       15kHz
-----
```

PWM frequency of converter

```
Erw.-Regler
TypHaltr.   0
-----
```

Here you can adjust another controller type for load take-over

Note: Change parameters only after consultation with RST Elektronik.

```
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

9.6.3 Selection of works-setting

Extended Works setting -----
Works setting Load (1) 0 -----
Works setting Copy -----

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 !

9.6.4 Configuration of inputs and outputs

Extended Inputs/outputs -----

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

9.6.4.1 Encoder

Inputs/outputs Encoder input -----
--

Filtration of the encoder signal can be set here. This enables faulty sensor signals to be smoothened.

Encoder input T-1 0 -----
--

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

Encoder input normally -----

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.

Encoder input inverted -----

Note : In case synchronous machines are used this parameter is determined automatically and must not be changed for this reason !

9.6.4.2 Digital inputs

Inputs/outputs Digin 1 -----

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

Functionality of **digital input 1**:

Digin 1 Error Ack. (0) -----

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

Digin 1 Contact. Mon. (1) -----

"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.

Digin 1 Brake Start ----- ○

Function „**Monitoring of opening of brake upon start**“. Via a +24 V signal the VVVF controller is informed that the brake is open.

Inputs/outputs Digin 2 -----

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

9.6.4.3 Drive Commands

9.6.4.3.1 Encoding

Drive Commands Parallel -----

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

Drive Commands Parallel -----

Parallel encoding (standard).

Drive Commands Binary -----

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.19 (V4)	remark
STOP	0	0	0	0	
V0	1	0	0	0	creep speed
V1	0	1	0	0	inspection
V31	1	1	0	0	intermediate speed
VN	0	0	1	0	fine levelling
V0	1	0	1	0	creep speed
V32	0	1	1	0	intermediate speed
V33	1	1	1	0	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

9.6.4.3.2 Configuration of direction signals

Drive Commands OnlyRO1) 0 -----

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

9.6.4.4 Outputs

Inputs/Outputs	
Outputs	

Here the function of the VVVF outputs can be configured

Outputs	
ZS=Imot	1

By setting a 1 the inverter signals the magnetized motor by the relay ZS (s. chapter 4.2.2.3.4).

9.6.5 Further supervisions

Extended Monitorings	

Monitorings	
Run-Time	0

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.

Monitorings	
Contactors	0

The **monitoring function of the drive contactors** is activated here insofar as an appropriate digital input has been configured with this function (see Section 9.6.4.2).

Monitorings	
Brake Start	0

The monitoring of the brake is activated here (s. chapter 9.6.4.2).

Monitorings	
PTC Motor	0

o	

The monitoring of the motor-PTC is activated here.

9.6.6 Special functions

9.6.6.1 Loosening cabin from safety catch

Sonderfunktionen	
V1MaxRuck	0

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. Additionally, the maximum VVVF controller current is output. This function must be activated again after each attempted start, i.e. the value for V1MaxRuck is reset to 0 after each attempted start.

9.6.6.2 Automatic measurement of motor characteristic

Sonderfunktionen	
Tuning	0

Enter 1 to activate a motor characteristic measurement. This enables an optimum torque utilization of the machine. Please carry out this measurement only after consulting RST-Elektronik.

9.6.6.3 Automatic test of motor connection upon the start of drive

Sonderfunktionen	
Motortest	1

If you enter a 1, the connection to the motor is checked upon each start of a drive. In this way, wiring defects or open contactors are detected immediately.

9.6.6.4 Determination of angle offset in synchronous machines

Sonderfunktionen	
Einhf.On	1

See **Section 9.8.2.**

9.6.6.5 Evaluation of an analogue load measuring unit

Sonderfunktionen	
Lastmessung	

By evaluating an analogue load measurement signal 0-10V, the VVVF controller can output a torque even before the brake is opened. This prevents the drive from turning away.

AVERDI GmbH in Berlin is a supplier of analogue load measurement systems.

In order to enable a load compensation, two calibration measurements are required: One measurement with empty cabin and one measurement at half load or, even better, at full load. The VVVF controller carries out the measurement automatically.

9.6.6.5.1 Calibration with empty cabin

Please move the cabin to the middle of the shaft to minimize the error caused by the weight of the rope.

Lastmessung	
Iq Leer	100%

The measurement is activated by setting parameter *Iq Leer* to 100.

Then issue a restore command - the VVVF controller carries out a load measurement within the next 3 seconds.

Lastmessung	
Iq Leer	-46%

After the measurement, the parameter is set from 100 to the determined value.

Now the load point for the empty cabin is determined.

9.6.6.5.2 Calibration with load in cabin

Lastmessung	
Iq Last	100%

The procedure is the same as described in **Section 9.6.6.5.1**. You only have to use parameter *Iq Last*.

9.6.6.5.3 Further information on calibration

For the calibration of the load points, the cabin must be moved to the middle of the shaft in order to minimize the error due to the weight of the rope. It is important that the stopping regulator be parameterised such that the cabin movement is balanced properly at the end of the waiting time (3 seconds). This should be reached after a few hundred milliseconds. With a stopping regulator setting which is too soft, no load calibration is possible !

9.6.6.5.4 Enabling the function

Lastmessung	
Enable	1

After the calibration, the analogue load compensation must be enabled by setting parameter *Enable* to 1.

9.7 Operation with DCP-Interface

9.7.1 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.

9.7.2 Wiring

The converter terminals 67 (RS485-A), 68 (RS485-B) and 65 or 66 (GND) 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 relays are replaced by a control bit in the telegram and therefore they don't 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.

9.7.3 Activation of DCP control

System Command Source ----- <input type="radio"/>
--

Please select the required DCP operation mode (see **Section 9.4.5**).

After selecting DCP control mode, the unit must be switched off and then on again after about 30 seconds. The VVVF controller now expects telegrams from the control system.

9.7.4 DCP01

Command Source DCP01 ----- <input type="radio"/>

Control of the travel commands is effected via the DCP protocol and no longer via the travel command terminals.

The feedback for the brake and travel contactors is also transferred via the DCP protocol.

9.7.5 DCP03

Command Source DCP03 ----- <input type="radio"/>

Extended version of DCP01 telegram with increased data throughput

9.7.6 DCP04

Command Source DCP04 ----- ○

9.7.6.1 General information on DCP04 mode

In this operation mode, the travel information from the elevator controller are processed further in the VVVF controller.

In order for the VVVF controller to perform a correct conversion of the cabin data to the movement of the motor, the following plant data must be entered correctly:

- Transmission ratio
- Pulley diameter
- Suspension

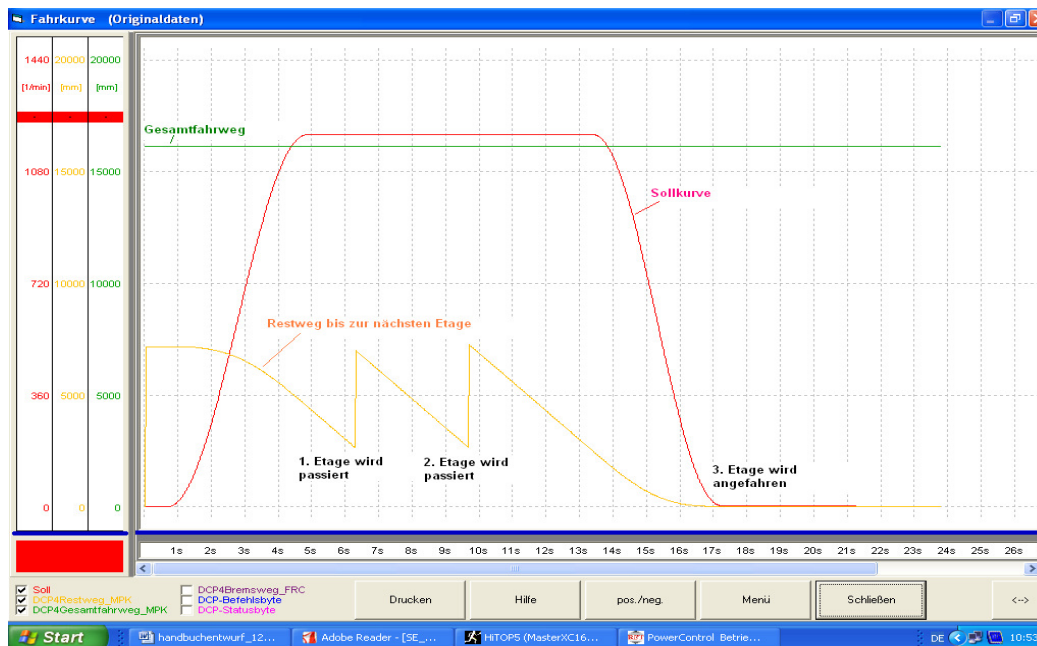
If not all data is known, the VVVF controller will make a suggestion for the the pulley diameter in a diagnosis menu.

Before the start of the travel operation, there will be an exchange of data between the controller and the VVVF controller.

The controller informs the VVVF controller about the overall travel route. Based on this information, the VVVF controller calculates the optimum travel profile and informs the controller about the brake path.

In this way, the controller can react very flexibly to incoming calls.

During the travel operation, the VVVF controller will be supplied with cabin position data continuously to enable direct landing at the stop position.



Important ! To ensure an optimum landing curve, it must be made sure that the speed controller (Menu **Setup – Controller**) is set up correctly. Experience has shown that the values should be in the following range:

Asynchronous machine:

- n_P : 50 ... 100
- n_I : 50 ... 200

Synchronous machine:

- n_P : 100 ... 300
- n_I : 5 ... 10

9.7.6.2 Commissioning

After entering the plant data correctly, you will have to check if the encoder systems of the VVVF controller and the controller correspond to one another.

Anzeigen DCP-Data ----- <input type="radio"/>
DCP-Data Treib. (Calc) 562 mm ----- <input type="radio"/>
General Settings ----- <input type="radio"/>
General Settings pull.diam. 562 mm ----- <input type="radio"/>

To do this, please move several metres **in the same direction several times**, in inspection or recovery mode, and check the calculated pulley diameter of the VVVF controller in the display menu. This value should correspond to the parameterized value as much as possible.

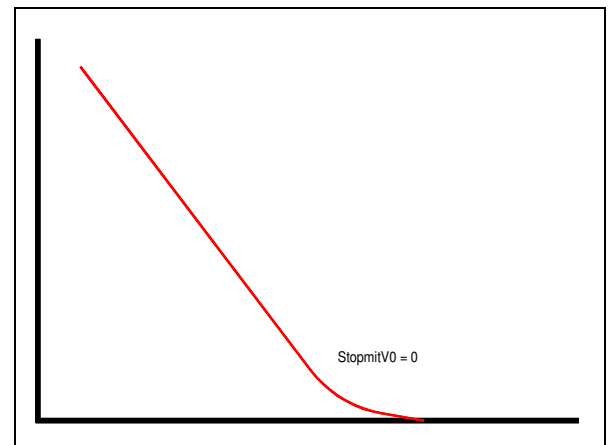
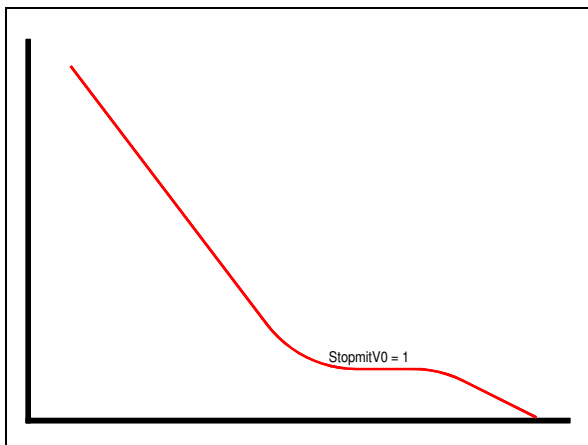
If not, please adjust the suggested pulley diameter in the menu *Setup – Plant data*.

9.7.6.3 DCP4 Setup options

FRC Setting ----- <input type="radio"/>
Setting DCP04 ----- <input type="radio"/>
DCP04 Stop mit V0 0 ----- <input type="radio"/>

When DCP04 mode is activated, the corresponding setup menu is enabled.

Here, you can set up the stopping behaviour.



Note: Setting **StopmitV0 = 1** delivers the better travel experience because the acceleration disappears in the brief constant phase which allows the mechanics to settle even before stopping.

9.7.7 Connection monitoring

```

*** Error ***
DCP-Error
-----
o
    
```

If no or defective telegrams are received during a travel operation, the VVVF controller switches over to fault mode. The fault message contact is released again as soon as error-free telegrammes are received from the controller. In this case, the fault display can be acknowledged by pressing the Enter key.

```

*** Warning ***
DCP-Connection
-----
o
    
```

In standstill, a warning is issued when the connection is defective.

9.7.8 DCP diagnosis

This menu is enabled only if the inverter is addressed via the DCP protocol (see Section 9.7).

```

DCP-Data
Quality      1000%
-----
o
    
```

Here, the quality of the connection is displayed per thousand.
 Example:
 1000% : error quota 0 per thousand
 998 % : error quota 2 per thousand (of 1000 telegrammes, 2 are defective)

```

Errors
SE 0 CS 0 S7 0
-----
o
    
```

Here, several telegramme error counters are included providing detailed information on the current telegramme status.

```

DCP Drive Commands
GS RO V4
-----
o
    
```

Travel commands the VVVF controller generates from the DCP commands.

```

DCP-Transmit
00 00 00
-----
o
    
```

Telegrammes the VVVF controller sends to the controller.

```

DCP-Receive
00 00 00 00 00
-----
o
    
```

Telegrammes, the VVVF controller receives from the controller.

```

DCP-Diagnose
VKorr      237
-----
o
    
```

Output value of DCP position controller

```

DCP-Diagnose
Treib. (Calc)  237 mm
-----
o
    
```

Calculated pulley diameter

9.8 Use with synchronous machines / gearless

9.8.1 Entering the general plant data

```
Ready
0 rpm      0 A
-----
```

```
FRC-F
Setting
```

Press the Enter key ("E") twice to open the General Settings menu. At first, you will have to enter the data correctly.

```
Setting
General Settings
-----
```

```
General Settings
I_MOT      32A
-----
```

rated motor current

```
General Settings
Pole pair  2
-----
```

Number of pole pairs of the motor.

```
General Settings
Encoder    1024
-----
```

Number of encoder pulses, number of sine periods / revolution.

```
Gebertyp
Encoder Type
-----
```

Use of ECN1313 or ECN113 absolute value encoder with EnDat interface from Heidenhain.

```
Encoder Type
Sinus SSI
-----
```

Use of ECN113 absolute value encoder with SSI interface from Heidenhain.

```
General Settings
RhoOffset  0
-----
```

Angle offset between encoder zero point and electrical zero point of the motor winding.
 Note: This parameter is determined by the unit automatically during calibration (see below) and must not be changed after correct calibration.

9.8.2 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)! Even slight frictional torques may distort the measurement such that no proper operation is possible.

The following steps must be carried out:

Activation of calibration:

```
Extended
Special Functions
-----
```

```
Extended
Einp.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.**

9.8.3 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**").

9.9 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.

9.9.1 Open-Loop 3

9.9.1.1 Parameter overview

Open-Loop 3	
U_Start	3000

Start voltage (automatic setting).

Open-Loop 3	
R1_Motor	700

Stator resistance of one motor winding (automatic setting).

Open-Loop 3	
R1MessEn	0

Activation of automatic motor measurement.

9.9.1.2 Setup of converter

9.9.1.2.1 Activating the operating mode

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

System	
Operating Mode	

Select the operating mode **Open Loop 3**.

Operating mode	
Open-Loop 3	

9.9.1.2.2 Entering the plant data

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.

9.9.1.2.3 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 !

Setting	
Open-Loop 3	

Go to menu *Setting - Open Loop3*. Use the E-key to open the menu. Select parameter *R1MessEn*.

Open-Loop 3	
R1MessEn	1

Enter "1" to activate the measurement.

Open-Loop 3	
R1MessEn	0

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.

Open-Loop 3	
R1MessEn	2

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.

Note:

If the torque is insufficient (e.g. motor stops during slow down), the parameter **U_Start** must be increased.

Open-Loop 3	
U_Start	3000

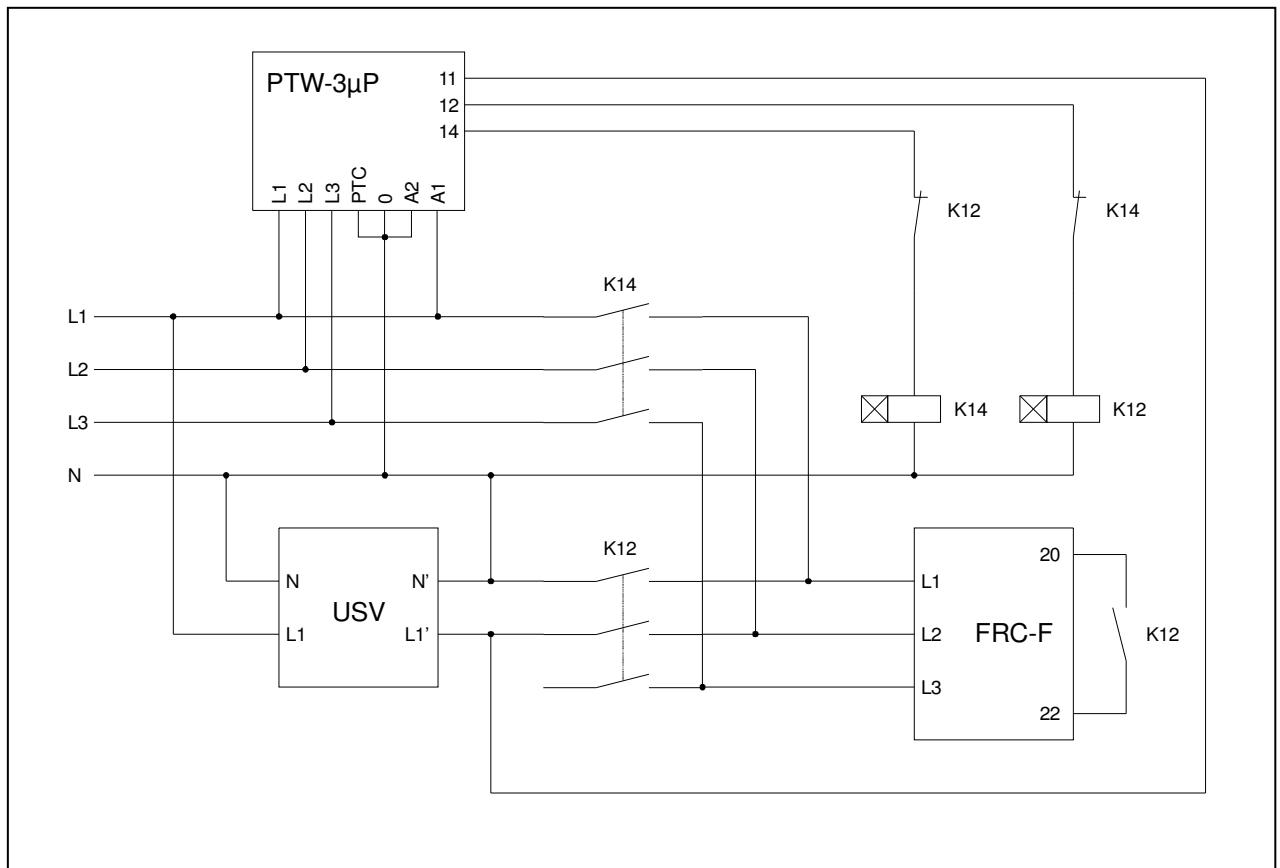
9.10 Emergency current evacuation with UPS

9.10.1 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.

9.10.2 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-3 μ P** 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-3 μ P**, 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.

9.10.3 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:

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

- η_M motor efficiency
- P_M rated motor power
- U_M rated motor voltage
- I_M rated motor current
- cos φ_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:

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

- 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.

9.10.4 Particularities of the VVVF-controller during evacuation

Through High level (+24V) at the digital input **DigIn3** (terminal 22), the VVVF-controller is informed that **evacuation mode** is active.

The VVVF-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 **Digital IN3**.
- **The maximum speed is limited by the parameter VE (evacuation speed).**

10 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.

11 FRC-Q with integrated drive contactors

11.1 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.

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 be fixed on an inflammable base (e.g. concrete wall). For proper ventilation of the braking resistance there should be at least 50cm space above and below the unit.

Above the device / brake resistor, there must not be any inflammable objects.



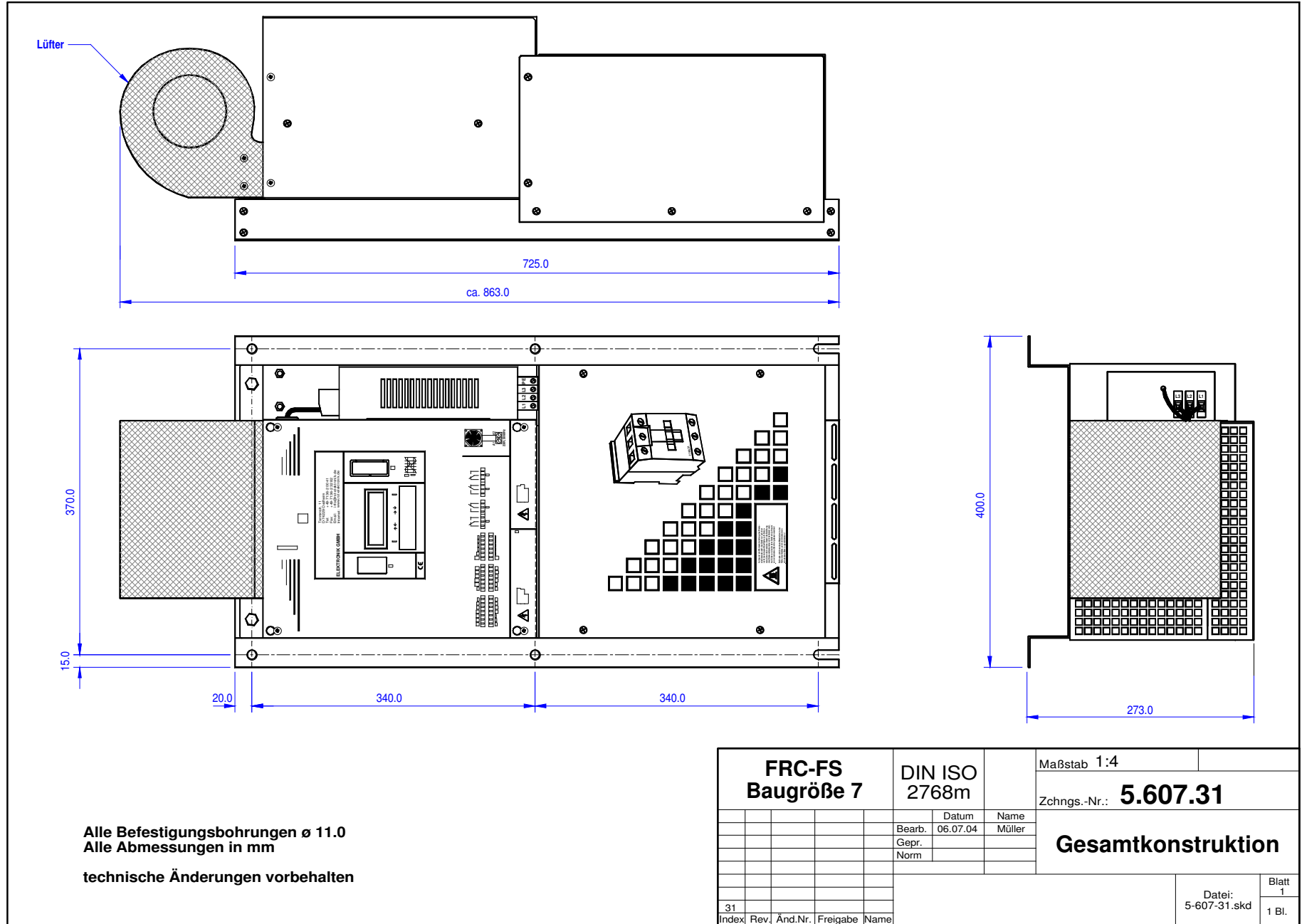
If the above instructions are not followed, there is the RISK OF FIRE!

11.2 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	863 mm	275 mm

11.2.1 Housing



11.2.2 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.

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. The shield is grounded at the top at the connector.

11.2.3 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***.

12 Errors and Warnings

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

12.1 Error messages at the converter

12.1.1 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.

12.1.2 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.

12.1.3 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 .

12.1.4 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.

Main supply voltage too low.

Compare system data with motor type plate.

12.1.5 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.

12.1.6 Overvoltage DC

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

12.1.7 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").

12.1.8 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.

12.1.9 Motor temperature

Triggered:
The resistance between terminals 35 and 36 is higher than 3 kOhm, i.e. the PTC has responded

Causes and remedy:
Motor overheated
If no motor PTC is connected, a wire jumper must be installed between terminals 35 and 36.
+24 V fuse in unit defective

12.1.10 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.

12.1.11 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.

12.1.12 Runtime error

Triggered:

The programmed runtime monitor has responded.

Causes and remedy:

Deactivate runtime monitor or increase time.

12.1.13 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.

12.1.14 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.

12.1.15 Calibration

Causes and remedy:

An error has occurred during the calibration of the synchronous machine.

Consult RST.

12.1.16 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.

12.1.17 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.

12.1.18 Sine amplitude

Triggered:

Amplitude of sine signals is outside of permissible range.

Causes and remedy:

sine encoder defective

Wrong D-SUB connector configuration, or connector not plugged.

Check sine encoder wiring.

Consult RST.

12.1.19 EnDat BUS OPEN, EnDat Timeout , EnDat CRC

Triggered:

Error during initialization of absolute value encoder.

Causes and remedy:

Absolute value encoder defective

SSI protocol selected.

Wrong D-SUB connector configuration, or connector not plugged.

Check sine encoder wiring.

Consult RST.

12.1.20 EnDat STRICHZAHL

Triggered:

Wrong number of encoder pulses adjusted.

Causes and remedy:

Correct parameter.

12.1.21 SSI BUS OPEN, SSI Timeout

Triggered:

Error during initialization of absolute value encoder.

Causes and remedy:

Absolute value encoder defective

EnDat protocol selected.

Wrong D-SUB connector configuration, or connector not plugged.

Check sine encoder wiring.

Consult RST.

12.1.22 n-Max Synchron

Triggered:

Max. speed of gearless drive was exceeded.

Causes and remedy:

Consult RST.

12.1.23 Overload FU

Triggered:

The current limit of the inverter was exceeded

Causes and remedy:

Brake applied during travel operation.

Consult RST.

12.1.24 Timeout ZS=Imot

Triggered:

Only when using the function "motor magnetized".

Causes and remedy:

Consult RST.

12.1.25 SSC-Error

Triggered:

Internal VVVF controller error

Causes and remedy:

Switch VVVF controller off, after approx. 30 sec. switch it on again. If error occurs repeatedly, circuit board may be defective.

12.1.26 No calibration

Triggered:

VVVF controller is used in Open-Loop 3 mode and the motor was not calibrated before (see Section 9.9.1)

Causes and remedy:

Activate automatic measurement of motor parameters

12.1.27 Overvoltage mains, low voltage mains, phase sequence mains

Triggered:

phase monitoring (if installed) of VVVF controller triggered.

Causes and remedy:

consult RST

12.1.28 DCP04 Remaining distance

Triggered:

Only in DCP04 mode. Remaining distance has negative values, remaining distance does not change for 100 msec during deceleration, remaining distance increases during the deceleration ramp.

Causes and remedy:

Transmission error in DCP protocol. Check if DCP cable is shielded and the shield is connected to PE correctly. Consult RST.

12.1.29 Timeout Brake Start

Triggered:

If brake controller is activated and no feedback on opening of the brake is received within 5 seconds after actuation of the ZB relay.

Causes and remedy:

Check brake, check wiring.

12.2 Warnings at converter

12.2.1 Temperature

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

12.2.2 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).

12.2.3 No Refsignal

Direct landing with reference signal: No reference signal was detected within the permissible time.

12.2.4 Load meas. error

Calibration of analog load measurement: Output voltage of load measurement unit with load is not sufficiently higher than in the case of an empty cabin. Thus, no correct calibration possible.

12.2.5 No +5V

Internal device voltage +5 V missing. Check fusible cut-out

12.2.6 No +15V

Internal device voltage +15 V missing. Check fusible cut-out.

12.2.7 No +24V

Internal device voltage +24 V missing. Check fusible cut-out.

12.2.8 DCP connection

The DCP connection to the control system is defective or interrupted.

12.2.9 Drive Commands !?

During the calibration (synchronous machine) the drive commands were switched off too early so the measurement couldn't finished correctly.

12.2.10 Control Times !?

During stopping the control switches off the GS Signal before the inverter has switched off the power stage.

13 Factory Settings, Parameter Overview

Parameter	Display text	Setting range	Basic setting	Remark
Speeds				
creep speed	V0	1 - 630	100 rpm	alternatively in mm/sec
inspection	V1	1 - 1500	300 rpm	alternatively in mm/sec
1. intermediate speed	V2	1 - 3000	1000 rpm	alternatively in mm/sec
2. intermediate speed	V3	1 - 3000	1380 rpm	alternatively in mm/sec
high speed	V4	50 - 3000	1380 rpm	alternatively in mm/sec
fine levelling	VN	1 - 270	75 rpm	alternatively in mm/sec
evacuation	VE	1 - 630	100 rpm	alternatively in mm/sec
levelling monitoring	EÜ	0 - 1800	300 rpm	alternatively in mm/sec
deceleration monitoring	BÜ	0 - 1800	300 rpm	alternatively in mm/sec
Times/Distances				
startup	HL_V4	1000 - 10000	2500 msec	alternatively in mm
deceleration ramp	B_V4	1000 - 10000	2500 msec	alternatively in mm
electrical stop	EH	300 - 3000	1000 msec	alternatively 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_zu	0 - 1000	200 msec	
delay time brake open	ZB_auf	0 - 3000	100 msec	
Regulator				
gain speed regulator	n_P	2 - 200	60	
gain speed regulator	n_I	40 - 9999	500 msec	
gain starting regulator	K_START	50 - 500	100 %	
gain starting regulator	K_STOP	50 - 500	100 %	
stopping regulator	Halte_P	0 - 10000	60	
stopping regulator	Halte_I	1 - 9999	250	
limit starting regulator	GA	0 - 3000	50 rpm	
Torque anticipation	MV	0 - 500	100	
Plant Data Asynchronous				
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	Geber	500 - 4096	1024	Square wave encoder
encoder type	Gebertyp		TTL	TTL/HTL/Sine
Plant data synchronous				
rated motor current	I_MOT	2 - 200	FRC rated current	motor type plate
number of pole pairs	Polpaare	1-100	2	motor type plate
no. of encoder pulses	Geber	500 - 4096	1024	Sine encoder
encoder type				sine EnDat / sine SSI
rotor angle offset	RhoOffset	-8192 - 8192	0	automatic measurement
transmission ratio	Getr.üb.	0-5000	0	actual transmission*100
pulley diameter	D-Treib.	0-1000	0 mm	
suspension	Aufhäng.	0-5	0	
Open loop 3				
start-up voltage	U_Start	0-32000	4000	automatic determination
motor resistance	R1_Motor	700		automatic determination
DCP04				
stopping curve	StopmitV0	0-1	0	

Extended menus				
Extended travel curve				
time of starting jerk	AR	100 - 3000	500 msec	
type of starting jerk (static, dynamic)	AR_TYP	0 - 1	1	Standard: dynamic
speed of starting jerk	VA	1 - 180	10 U/min	alternatively in mm/sec
intermediate speed	V31	1 - 3000	1380 U/min	alternatively in mm/sec
intermediate speed	V32	1 - 3000	1380 U/min	alternatively in mm/sec
intermediate speed	V33	1 - 3000	1380 U/min	alternatively in mm/sec
floor to floor correction	SC	0 - 1000	500	
roundings floor to floor	R_SC	0 - 1000	300	
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	alternatively in mm
acceleration time to speed V2	HL_V2	0 - 5000	0	alternatively in mm
deceleration time from speed V3	B_V3	0 - 5000	0	alternatively in mm
deceleration time from speed V2	B_V2	0 - 5000	0	alternatively in mm
Reference distance	S-Ref	0 - 500	0 mm	position correction in direct landing
Extended regulator settings				
positioning controller	LR	0 - 300	100 %	position controller gain
scan time	TA	1000 - 10000	5000 usec	
max. motor current	IMAX_MOT	100 - 300	195 %	
P-amplification current regulator	Strom_P	1-300	15	
I-amplification current regulator	Strom_I	1-32767	4000	
torque smoothening	Iqsoll_T1	0 - 5	0	
load compensation	LV	100 - 900	500	
Switching frequency	f_PWM	4-15	15	
stopping regulator, type	TypHaltr.	0-2	0	
Inputs/outputs				
encoder input	T-1	0-4	0	smoothening of actual speed value
encoder input	Richtungssinn	0-1	0	normal / inverted
function digital input 1	Digin1	0-1	0	error reset/contactator monitoring
function digital input 2	Digin2	0-1	0	error reset/contactator monitoring
drive commands encoding	Fahrbeefhle	0-1	0	parallel/binary
direction signals configuration	nur RO	0-1	0	RO or R0+RU
Outputs	ZS=Imot	0-1	0	motor magnetized
Monitoring				
runtime monitoring	Laufzeit	0-600	0 sec	for contactor design only
brake monitoring at start	Brake Start	0-1	0	contactor drop-out monitoring
monitoring of Motor PTC	PTC Motor	0-1	0	
Special functions				
break-away torque for catching test	V1MaxRuck	0 - 1	0	only possible at V1
motor connection test	Motortest	0 - 1	1	test enabled
Analogue load measurement				
work point load	IqLast	0-100		automatic measurement
work point empty	IqLeer	0-100		automatic measurement
enable load compensation	Enable	0-1	0	enabled with 1