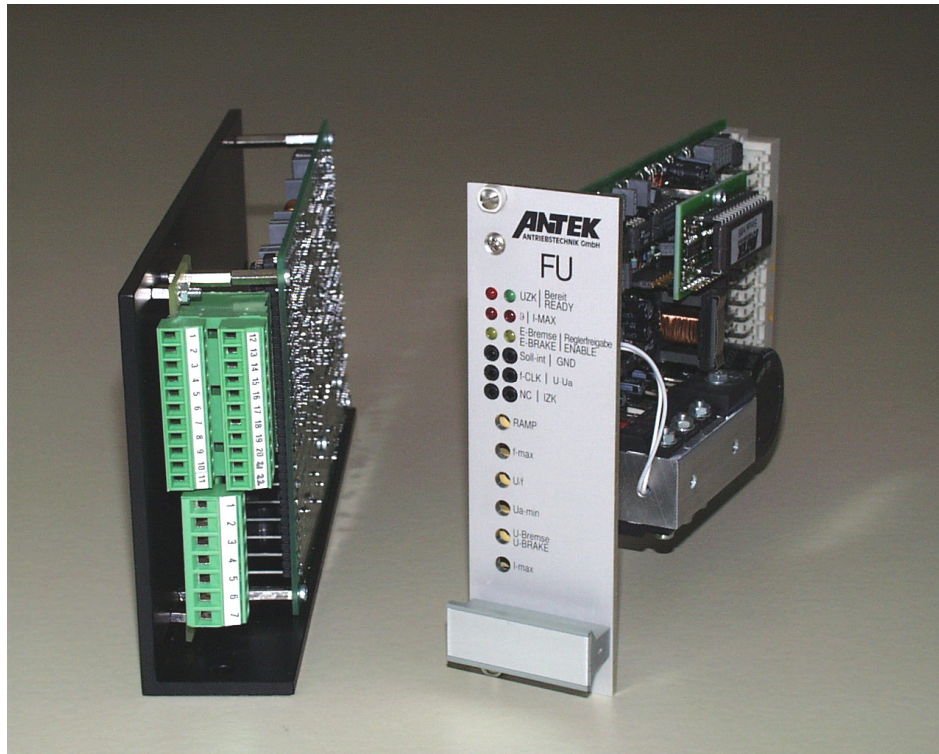


Operating Manual

Frequency Converter FU x AE - 85

for stepless speed control of 3-phase a.c. motors
power range up to 600 VA



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-Errors and omissions excepted, subject to alterations-

1. General information

1.1 Safety information



Electrical units are a source of danger.

Comply with the relevant laws and regulations when electrical units are used in installations and control systems which require observation of safety rules, and when carrying out installation work.

When working on live units, always comply with the current accident prevention regulations.

For reasons of safety and in order to maintain the documented system data and functions the unit or its components may only be repaired by the manufacturer.

No liability can be accepted if the drive parameters have an unsuitable, incorrect manual or automatic setting.

Incorrect handling may cause injuries and/or damage property!

Prior to installation technicians who are familiar with electrical drive equipment must read the unit handbook thoroughly.

Ensure that the voltage is not dangerous before touching electrical contacts.

The user must use independent monitoring units in order to ensure that a malfunctioning drive is stopped safely.

The user is responsible for installing and connecting the motor, the converter and auxiliary units pursuant to the acknowledged technical rules in the country of installation and other current regional regulations. In particular, cable dimensioning, shielding, earthing, disconnection, isolation and overcurrent protection must be taken into account.

Regulations pursuant to DIN 57100 are applicable.

1.2 Brief description

The static frequency converter is designed for the operation of stepless control of 3-phase a.c. standard motors. The frequency converter have a supply voltage of 20 ... 55 VAC and. 20 ... 85 VDC. The connections of the intermediate circuit voltage are lead through plug-in connections. Therefore can be held a free energy exchange of the compound operation of several converters from the controller family.

1.3 Extent of delivery

Controller completely prewired for insertion in card rack. The controller has been tested for correct functioning and continuous operation.

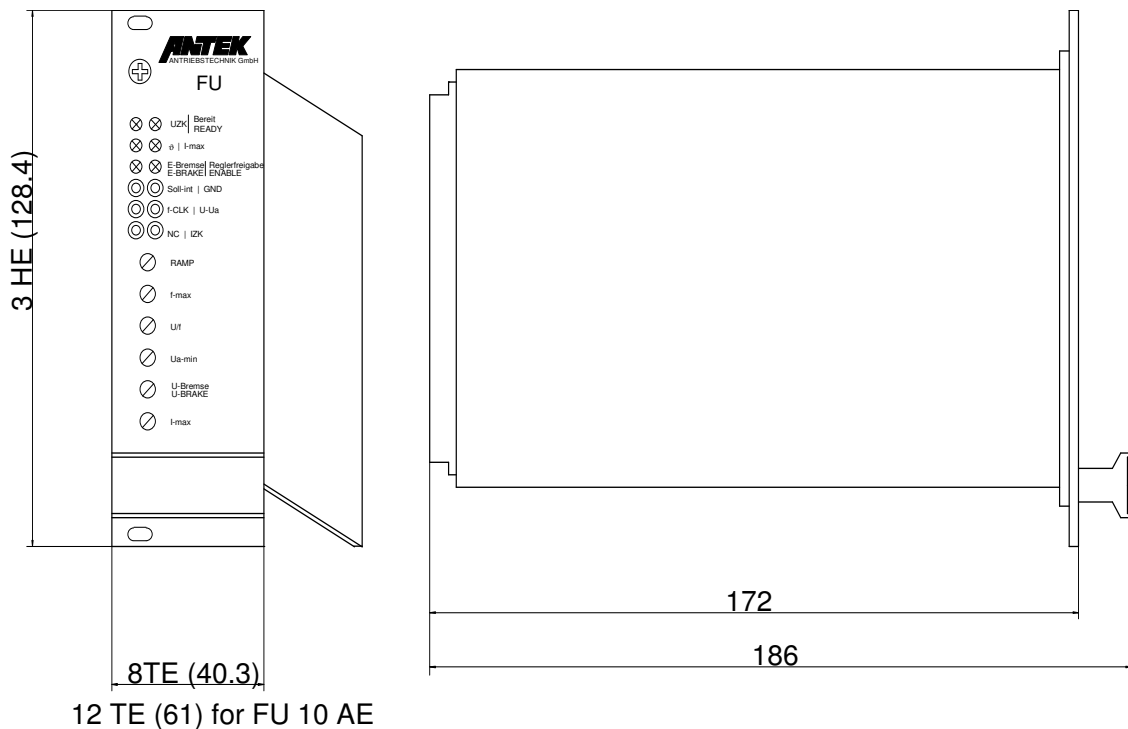
2. Technical data FU x AE-85

2.1 Specifications

Type:	FU 3 AE-85	FU 5 AE-85	FU 10 AE-85
Input voltage:	20 VAC -10% ... 55 VAC +10%, 50/60 Hz or 20 - 85 VDC		20 ... 85 VDC
Input current:	3 A	5,5 A	10,5 A
internal fuse:	3,15 A	6,3 A	no
Intermediate circuit voltage: (UZK)	20 ... 85 VDC		
max. output voltage:	0 ... 90% UZK (UZK depending of the supply voltage)		
max. output current:	5 A	10 A	15 A
Continuous current:	3 A	5 A	10 A
Nominal output power:	180 VA	300 VA	600 VA
Efficiency:		approx. 95%	
Power loss at no-load:		approx. 7 W	
Power loss at nominal load:	approx. 12 W	approx. 15 W	approx. 30 W
min. output inductivity:		2 mH	
Control range:		1 : 100	
Ambient temperature:		+ 5 ... + 40 °C	
Ventilation:		natural convection	
Fitting position:		card rack, cooling plate vertical	
Connection:	48-pin push-on terminal strip DIN 41612 structural shape E		
Geometry:	19" plug-in module, depth 160 mm * dimension of the board		
European standard size pc board 100 x 160 mm	3 HE x 8 TE	3 HE x 8 TE	3 HE x 12 TE
Standards and instructions:	DIN 57110b, EN 60204, EN 55011		

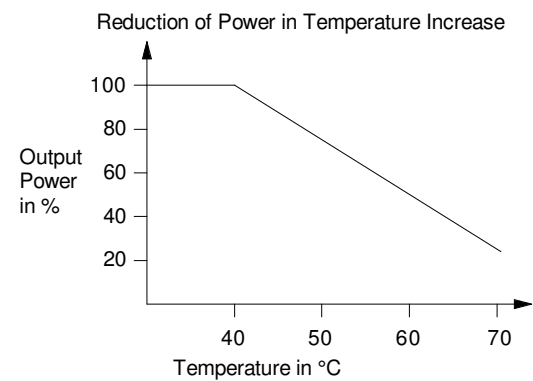
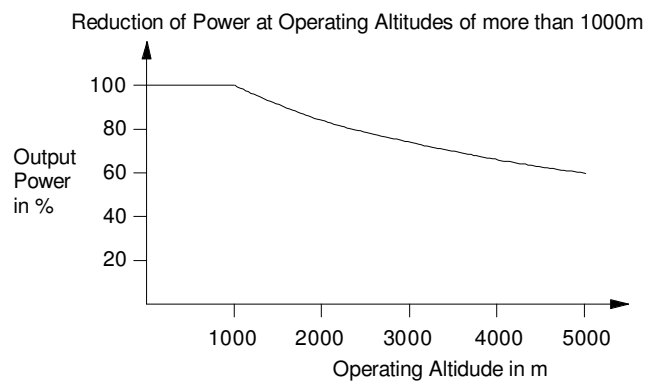


2.2 View and dimensions

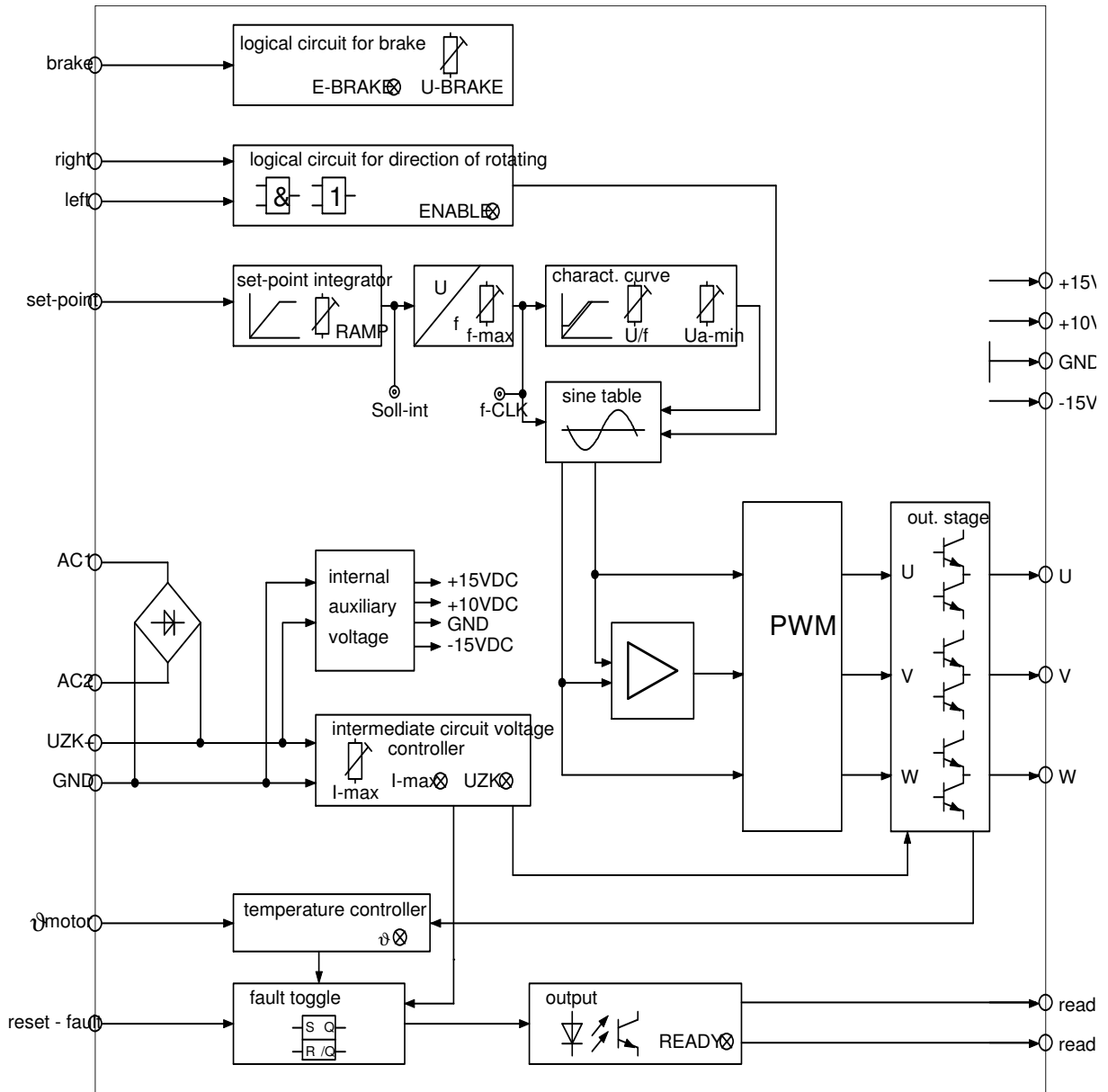


2.3 Power reduction

If installation heights are above 1000 m or temperatures above 40 °C, the output power of the converter must be reduced in accordance with the following graphs.



3. Block diagram



4. Connection

4.1 Precautions

General informations



Check for any transport damage after unpacking the control unit and before the initial start-up.

Check that all plug-in and screwed connections are secure.

Minimum requirements for installation site:

- ◆ The room should be as dust-free as possible (fit filters to control cabinets which have floor fans).
- ◆ The ambient temperature must be within the range 5-40 °C (if required provide separate cooling).
- ◆ The relative air humidity must not exceed 90%.
- ◆ The ambient air must not contain any corrosive gases.

The control unit causes power loss and heats the environment. Ensure that there is adequate distance between the control unit and heat-sensitive units.

The units are designed for installation in card racks.

The unit must be installed vertically.

The air flow of the unit must not be obstructed.

The air inlet and outlet must be kept clear.

Important information



Control lines and power cables are always isolated and must not be laid in close proximity.

Set-point input, analogue control inputs and measuring outputs must be installed with shielded cables.

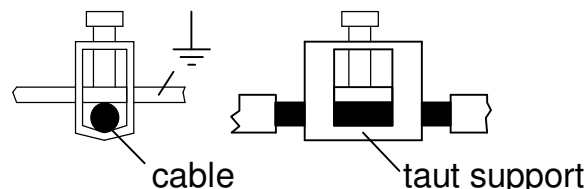
The feeder cross section for the supply lines and the motor lines must be at least 1 mm².

Look to the safety rules at the face.

Information on EMC

In order to guarantee electromagnetic compatibility (EMC) in your switch cabinets in an electrically raw environment, the following EMC rules are to be observed during construction and set-up:

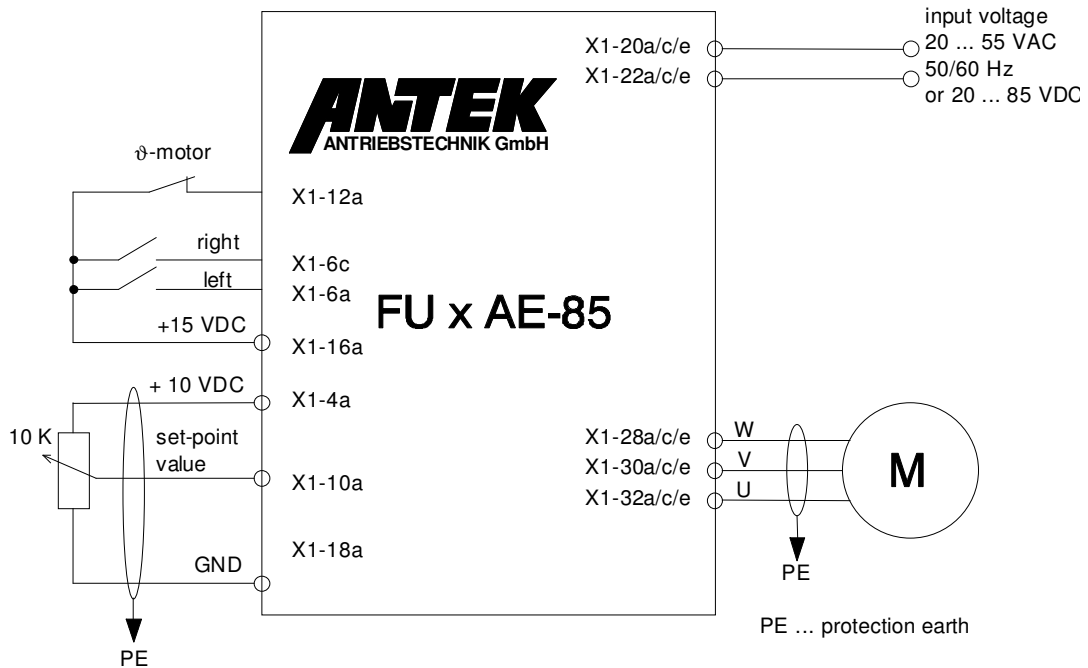
- ◆ All metallic parts of the switch cabinet are to be connected flatly and in a well-conducting manner (not lacquer on lacquer!). If necessary, use contact or scraper wafers. The cabinet door is to be connected with as short a circuit as possible via the metal powder tapes (upper, middle, lower).
- ◆ Signal lines and power cables are to be laid separate from each other in order to avoid coupling intervals. Minimum distance: 20 cm:
- ◆ Signal lines should be led to the cabinet from only one level, if possible. Unshielded lines from the same electrical circuit (outgoing and return circuit) are to be transposed, if possible.
- ◆ Contactors, relays and magnetic valves in the switch cabinet, if necessary in the adjacent cabinets, are to be wired with quench combinations, e.g. with RC elements, varistors, diodes.
- ◆ The screens from signal lines are to be laid two-way (source and target), large-area and well-conducting to a ground¹. In case of poor potential equalization between shielded connections, an additional balancing network of at least 10 mm² must be laid parallel to the screen to reduce the screen current.
- ◆ Wiring is not to be laid freely in the cabinet, but should rather lead as tightly as possible to the cabinet frame or to installation plates. This also applies to reserve cables. At least one end of them must lie grounded, but preferably both (additional shield effect).
- ◆ Unnecessary wire lengths are to be avoided. Coupling capacities and coupling inductances are thereby kept small.
- ◆ The screen from leads, such as resolver or incremental director cables, must be laid to the frame grounding. Approximately 2 cm of the insulation is to be removed in the area where the cable is to be led into the frame in order to expose the braided cable. The braided cable may not be damaged while removing the insulation. The cable is to be led at the position where the insulation has been removed by grounded terminals or taut supports.



¹Generally all metallic conducting parts which can be connected to a protective conductor, such as cabinet frames, motor frames, foundation grounding, etc. are designated as a ground.

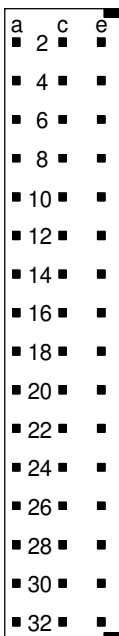
4.2 Minimum of terminal diagram

Connections of control unit



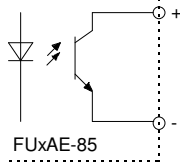
4.3 Description of terminals

Pin assignment X1 (48-pin push-on terminal strip DIN 41612 structural shape E)



PIN	a	c	e
2	ready+	ready+	ready-
4	+ 10 VDC		Bremse
6	right	brake	left
8			
10	set-point		
12	ϑ - motor		RESET - FAULT
14			
16	+15 VDC		-15 VDC
18	GND	GND	GND
20	AC1	AC1	AC1
22	AC2	AC2	AC2
24	GND	GND	GND
26	UZK+	UZK+	UZK+
28	W	W	W
30	V	V	V
32	U	U	U

Output:

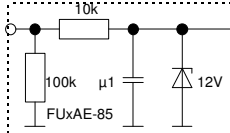


Definition of level
Blocking voltage max. 35 VDC
 $U_{CEsat} < 1V$ at 10 mA
Loading capacity max. 10 mA

X1-2c/2e ready

readiness at fault high-resistance.
Indication by LED „READY“ on the front panel.

Digital control inputs:



Definition of level
HIGH - level = +12 ... +35 VDC
LOW - level = 0 ... +2 VDC or open
Reference potential: GND
Input resistance: $R_i = 10\text{ k}\Omega$

X1-6a right

Enable clockwise rotation (cw)

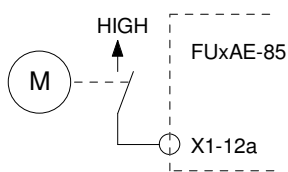
X1-6c brake

Brake function at X1-6a *right* = LOW
and X1-6e *left* = LOW and X16-c *brake* = HIGH
The motor is energised if a standing rotating field exists.
Adjustment of the voltage at trimmer „U-Brake“. No braking to stop. A long and high energised motor cause a overheating of the motor.

X1-6e left

Enable counter-clockwise rotation (ccw)

X1-12a ϑ - motor

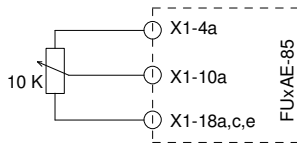
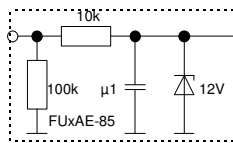


Connection for protective motor switch (break contact)
HIGH = motor all right
LOW = motor on over temperature, the switching off is time delayed (approx. 50 s).
If a protective motor switch is not used, the PIN X1-12a must be connected on high level.

X1-12e RESET-FAULT

LOW - HIGH - flank make a reset of the internal fault toggle
(This input can be switched parallel to another control input, for example ENABLE, to sap the wiring).
If the supply voltage is connected to the control unit the reset is automatically made after a delay time off approx. 1s.

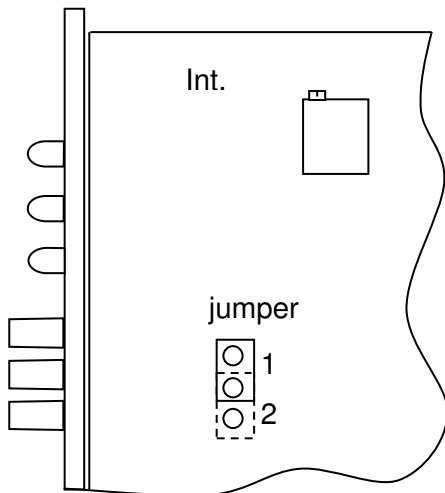
**Analogue input:
X1-10a set-point**



Input for manual speed selection
Input voltage: 0 ... 10 VDC
Input resistance: $R_i > 100 \text{ k}\Omega$
Reference potential: GND

Warning! Set-point lines generally shielded.

For set-point selection over potentiometer use the connection diagram left.



Set-point selection is choosable with internal set-point potentiometer.

Selection by jumper :

Adjustment 1 = internal Set-point selection
Adjustment 2 = external Set-point selection

Analogue outputs:

X1-16a +15 VDC
X1-16e -15 VDC

Auxiliary voltage for external components
Current carrying capacity: each output max. 20 mA
Reference potential: GND

X1-4a + 10 V

Auxiliary voltage for external components for example Set-point potentiometer
Current carrying capacity: max. 2 mA
Reference potential: GND

Input voltage:

X1-20a/c/e AC1
X1-22a/c/e AC2

Inputs for alternating voltage to supply the control unit and the motor U_e : 20 ... 55 VAC
(If a constant-voltage supply $U_e = 20 \dots 85 \text{ VDC}$ is used, the positive polarity is connected to X1-20a/c/e).

Warning!

Always connect all pins a/c/e parallel because current carrying capacity of the push-on terminal strip.

Intermediate circuit voltage:

X1-26a/c/e UZK+

Intermediate circuit voltage (20 ... 85 VDC) for

- ◆ Compound operation of several control units
- ◆ common ballast module
- ◆ common supply module (constant-voltage supply)

Warning!

Always connect all pins a/c/e parallel because current carrying capacity of the push-on terminal strip.

Motor connections:

X1-28a/c/e U

Motor connection

X1-30a/c/e V

Motor lines always shielded

X1-32a/c/e W

Always use a large-surface screen.

Warning!

Always connect all pins a/c/e parallel because current carrying capacity of the push-on terminal strip.

Reference potential:

X1-18a/c/e

Reference potential for output, digital control inputs,

X1-24a/c/e

analogue input, analogue output and intermediate circuit voltage

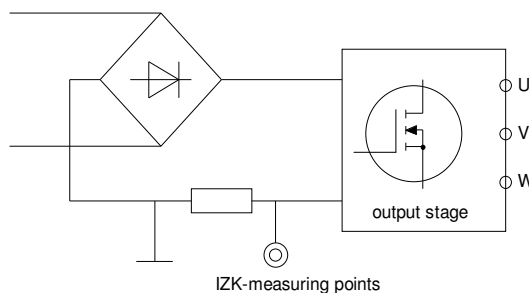
5. Service - information

5.1 LED-displays

READY (GN)	Control unit ready, if the LED doesn't light, although the control unit is switched-on, one of the following faults are activated.
UZK (RD)	<ul style="list-style-type: none"> ◆ Intermediate circuit voltage to low (UZK < 15 VDC) ◆ Intermediate circuit voltage to high (UZK > 90 VDC)
ϑ (RD)	<ul style="list-style-type: none"> ◆ Over temperature on the heat sink (switch-off at 80 °C) ◆ Connection for protective motor switch is activated
I-max (RD)	The tuned-in current limit is crossed (trimmer I-max)
E-BRAKE (YE)	Electrical brake function is selected (see chapter 4.3)
ENABLE (YE)	ENABLE right or left is selected

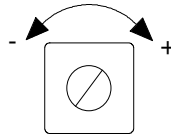
5.2 Measuring points

Soll-int	Set-point value after the set-point integrator (10 V = f-max) adjustable at trimmer „f-max“ (see chapter 5.3)
GND	Reference potential of all measuring points
f-CLK	$f - CLK = f - out \cdot 1024$ or $f - out = ((f - CLK) / 1024)$ f-out ... output frequency of the control unit
U-Ua	Proportion from the motor voltage of UZK
IZK	Intermediate circuit current 100 mV/A



5.3 Trimming potentiometer

All the trimming potentiometers which are required for adjusting the controller to the particular application are located on the front of the unit.

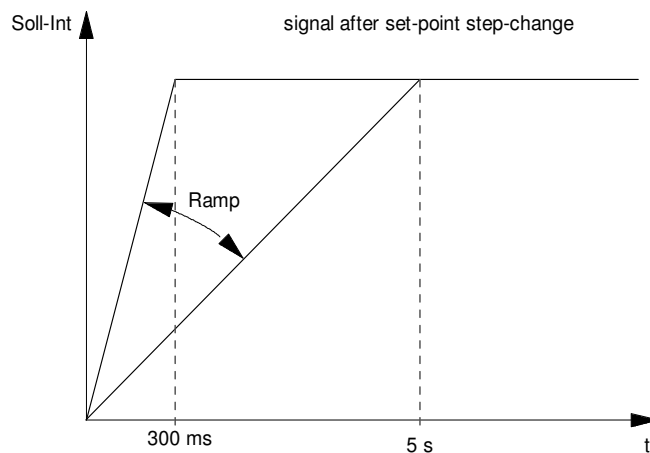


RAMP

„set-point ramp“

Specify set-point step-change (0 ... 10 V) at the set-point input and set the desired speed with the trimmer „RAMP“.

Setting range: 300 ms ... 5 sec.

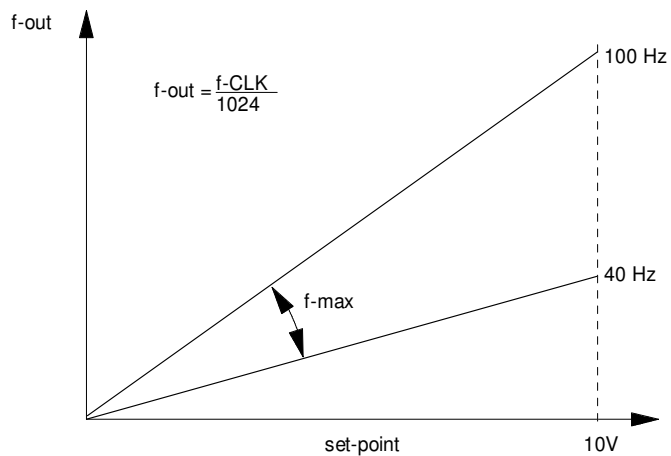


f-max

Adjustment of the max. output frequency (f-out).

Setting range 40 ... 100 Hz

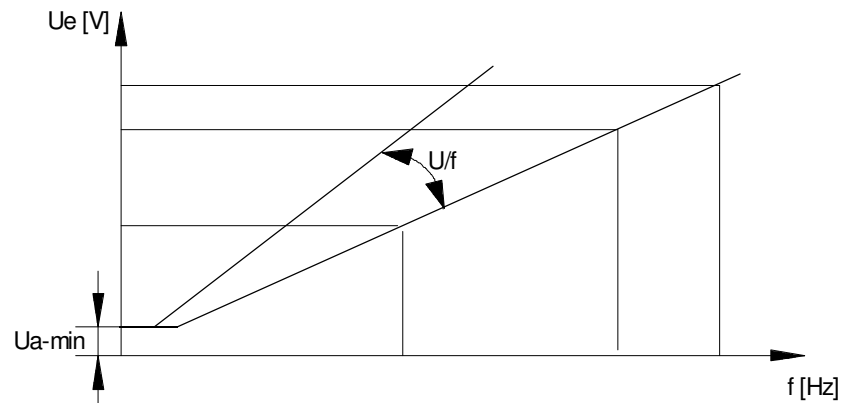
1. Adjust max. set-point voltage (10V)
2. Adjust the desired max. output frequency at the trimmer „f-max“
3. Control at measuring point „f-CLK“



U/f

U/f ease curve

Adjustment of the voltage-frequency characteristic curve.



Ua-min

Raise the output voltage in order to compensate the winding resistance at low frequencies. Specify a low speed and rotate the Ua-min until the desired motor speed is obtained.

Warning! If the setting is too high, the motor will overheat. Check the motor current.

U-BRAKE

Adjustment of the brake voltage see chapter 4.3

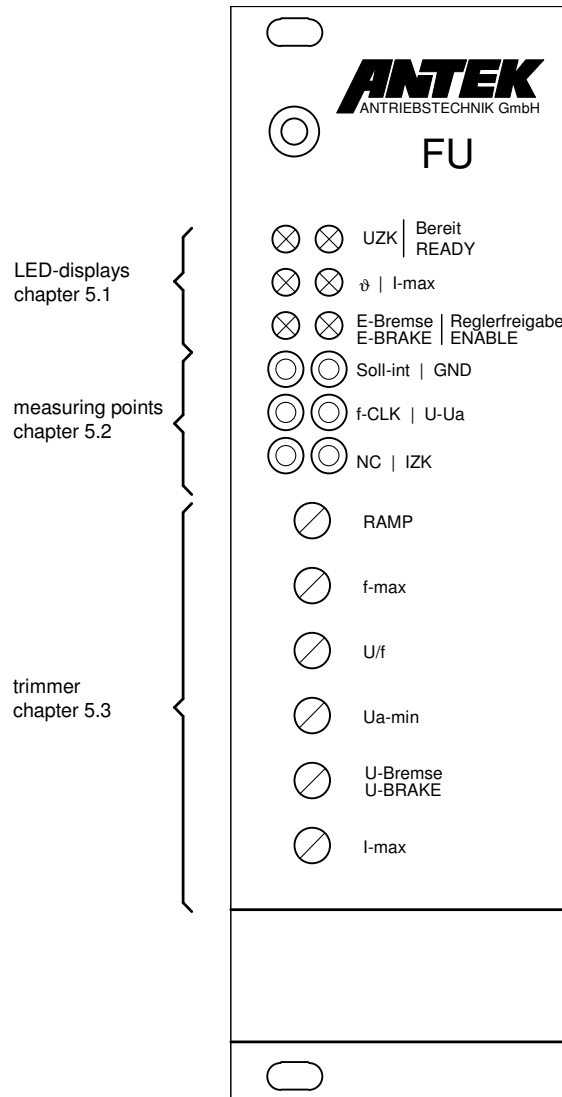
I-max

Adjustment of peak current see chapter 5.1

5.4 Acknowledgement of fault messages

- ◆ OFF / ON supply voltage
- ◆ LOW - HIGH - flank to control input
X2-12c reset fault

6. Front view



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