

# Operating manual

## Frequency converter M300-05-00 /-02

Duktor drive for 1 Unit

Replacement for FU3AM-05-00 /-02,  
pin- and mounting compatible



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- Errors and omissions excepted, subject to alterations -

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## 1. Preface and general

### 1.1 Brief description

- ◆ Frequency converters for the operation of three-phase motors
- ◆ Multiple voltage input 380...480 VAC 45 – 66Hz
- ◆ Temperature monitoring of the power amplifier and the motor
- ◆ Overvoltage and undervoltage monitoring of the intermediate circuit
- ◆ Set-point actual value monitoring in the controller mode
- ◆ Internal switched-mode power supply 24V

### 1.2 Advantages

- ◆ compact space-saving design
- ◆ Operation on standard, F / U appropriate standard motors (min. Inductance 2mH)
- ◆ Sinusoidal energizing the motor, that is, good run out even at low speeds
- ◆ Electrically isolated control electronics
- ◆ Overload protection by overcurrent shutdown
- ◆ change of rotation direction possible electronically

### 1.3 Extend of delivery

- 1 piece                      M300-05 (incl. EM726-00)  
                                    With cable kit and plug connector  
                                    Brief Description Retrofit M300-05

## 1.4 Disclaimer

### Liability

The information, data and instructions contained in this operating manual were up-to-date as of the date of publication. No claims may be made in respect of converters delivered previously on the basis of statements, illustrations/photos or descriptions contained in this operating manual.

The process-specific instructions and circuit extracts contained in this manual are recommendations. Their applicability to the task in hand must first be verified.

The firm ANTEK GmbH assumes no liability for the suitability of the processes described and the suggested circuits contained herein.

No liability will be assumed for damages or malfunctions caused by:

- ◆ disregarding this operating manual
- ◆ unauthorized modifications made to the converter
- ◆ operator errors
- ◆ improper working on and with the converter
- ◆ Operation of the converter in mountings or connections, other than those described in this manual.

### Warranty

Warranty claims are to be made to the manufacturer as soon as a fault / defect is discovered. The warranty will be voided by:

- ◆ improper use of the converter
- ◆ improper working on and with the converter
- ◆ arbitrary modifications to the converter

## 1.5 Definitions

### Qualified Personnel

Qualified personnel are persons who, due to their training, experience and instructions, as well as their knowledge of relevant standards and directives, safety-regulations, company policies, and entitled by those responsible for the safety of the system, are justified to carry out necessary tasks and recognize and avoid possible dangers.

(Definition for qualified employees per IEC 364)

### Operator

An operator is any natural person or legal entity who operates the converter, or in whose name the frequency converter is operated.

## 2. Safety

### 2.1 Operating Manual

This operating manual contains safety instructions for correct operation on and of the frequency converter, they are to be followed.

In addition to the general safety instructions contained in this chapter, the instructions contained in the manual text must also be followed.

No claim is made that the safety instructions are complete. Please contact the manufacturer in the event of questions or problems.

This manual must be available to all persons who work on or with the frequency converter and must remain in good, readable condition.

### 2.2 Symbols

In these instructions important explanations are highlighted with the following symbols:



Caution: this explanation indicates hazards which, under certain circumstances, may lead to personal injury or material damage.



Attention required / Check: please pay special attention to the points described.



Information: provides you with further information relating to the product.

### 2.3 General Safety Information

The frequency converter was state-of-the-art at the time of delivery and is considered principally safe to operate. The frequency converter may present certain dangers to personnel, the frequency converter or other assets of the operator when:

- ◆ non-qualified personnel work on or with the frequency converter,
- ◆ Operation of the converter in other mountings or connections, other than described in this manual.
- ◆ The frequency converter is improperly used.

Then exists danger for:

- ◆ Persons
- ◆ The frequency converter
- ◆ Other real value of the operator

The installations in which the frequency converter is incorporated must be designed so that they fulfil their functions when set up correctly and when used in accordance with the instructions in fault-free operation and do not cause any danger to persons. This also applies to the interaction of the frequency converter with the installation as a whole. In the case of applications in installations with technical safety requirements and with regard to installation, the relevant laws and regulations must be complied with (e.g. EN 57100, EN 60204).



Take additional measures to limit consequences of error functions which can prove to be dangerous for people:

- ◆ other independent devices which safeguard against possible malfunction of the frequency converter.
- ◆ electrical and non-electrical safety devices (locking or mechanical stops)
- ◆ measures covering the system

Take appropriate measures to see that in case of malfunctioning of frequency converter there is no material damage.

When work is being carried out on live equipment, the relevant accident prevention regulations must be obeyed.



For reasons of safety and of maintaining documented system data and functions, repairs to the unit or its components are to be carried out only by the manufacturer.

No liability is accepted for inappropriate, incorrect manual or automatic setting of the parameters for the drive.

## 2.4 Operator Responsibilities

Responsibilities of the operator or safety officer:



- ◆ to ensure adherence to all relevant directives, instructions and laws,
- ◆ to ensure that only qualified personnel operate on or with the frequency converter,
- ◆ to ensure that the operating manual is available to all personnel.
- ◆ to ensure that unqualified personnel do not work with the frequency converter.
- ◆ The operator is responsible for ensuring that the motor, the converter and ancillary equipment are installed and connected in accordance with the technical rules applicable in the country in which installation is taking place and with other regulations which are applicable regionally. In this context, special consideration must be given to cable.

## 2.5 Personnel

Only qualified personnel may work on or with the converter.

## 2.6 Instructions on unpacking, mounting and installation



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 allowed ambient temperature and the relative air humidity must not be exceeded (if required provide separate cooling).
- ◆ The converter causes power loss and heats up the environment. Ensure a sufficient distance from heat-sensitive equipment.
- ◆ In the event of contaminated cooling air (dust, fluff, aggressive gases and grease), which might adversely affect the functioning of the frequency converter, adequate counter-measures must be taken, e.g. separate air feed, installation of filters, regular cleaning, etc.
- ◆ The units are designed for mounting in suitable card racks.
- ◆ The unit must be mounted vertically.
- ◆ Ensure unimpeded access of cooling air and egress of discharged air. Clearances for incoming and outgoing air must be complied with.
- ◆ If the frequency converter is continuously exposed to oscillation or vibration, vibration absorbers may be required.

## 2.7 Electrical Installation

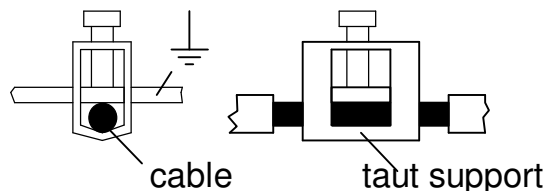


- ◆ The regulator contains components sensitive to electrostatics. Before installation and service work in the terminal clamp area, the staff must free itself of electrostatic electricity. The discharging can be achieved by touching a grounded metal surface beforehand.
- ◆ To protect the power supply cables, the recommended cable protection fuse is required
- ◆ The motor should be equipped with a temperature sensor. Evaluation can be performed by the regulator or a suitable analyzer.
- ◆ Control wiring and power cables must always be spatially separated from each other.
- ◆ Set-value inputs must be shielded.
- ◆ Conductor diameters for power supply and motor wiring must be at least 1,5 mm<sup>2</sup>!
- ◆ Observe the current local safety regulations.

## 2.8 Information on EMC

In order to warranty 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 separated 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 suppressor combinations, e.g. with RC elements, varistors or diodes.
- ◆ The braiding from signal lines are to be laid two-way (source and target), large-area and well-conducting to a ground<sup>1</sup>. In case of poor potential equalization between shielded connections, an additional balancing network of at least 10 mm<sup>2</sup> must be laid parallel to the braiding to reduce the 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 be grounded, but preferably both (additional shield effect).
- ◆ Unnecessary wire lengths are to be avoided. Coupling capacities and coupling inductances are thereby kept small.
- ◆ The braiding from leads, such as resolver or incremental tachometer 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.



<sup>1</sup>Generally, 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.



## 2.9 Operation of the frequency converter

Operate the frequency converter only if it is in perfect condition. The permissible conditions of use and output limits must be complied with.



Retrofitting, modifications or conversions of the frequency converter are **forbidden**. In all such cases, the manufacturer must be consulted.

The frequency converter is an item of equipment for use in industrial installations. During operation, these items of equipment have dangerous, live components. Consequently, during operation all covers must be fitted to the drive controller, in order to ensure full protection from contact with it.

The modules include electro statically sensitive CMOS und MOS components. Caution must be exercised in respect of electrostatic charges.

## 2.10 Important instructions on protective earthing

Because of the loss currents of the essential mains filter (>3.5 mA) via the protective earthing conductor (PE), according to DIN VDE 0160 the cross-sectional area of the lead-in wire of the protective earth wire to the switch cabinet must be at least 10 mm<sup>2</sup> Cu, or a second protective earth conductor must be laid electrically in parallel.



In the case of higher installed loads, the minimum cross-sectional area of the protective earth conductor must be in a corresponding relation to the cross-section of the outer conductors (see DIN 57100 Part 540).

The loss currents of the filter may be as high as 100 mA. Operation with FI earth leakage circuit breakers is therefore not possible.

## 2.11 Important instructions on routing of wires

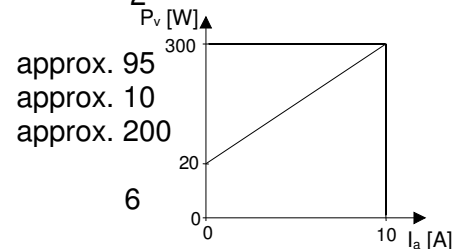
Control lines and power cables must always be routed separately with a gap between them. Tacho inputs, set point and analogue control inputs must be laid using shielded cables.



### 3. Technical data

#### 3.1 Technical data M300-05

Type		M300-05
Input voltage range $U_{\text{mains}}$ :	VAC	400 VAC -10% ... 480 VAC +6%
Input frequency:	Hz	50/60
Nominal input current $I_N$ :	AAC	4
Peak input current:	AAC	6,2
Connect load:	kVA	2,2
Fuse protection extern <sup>1</sup> :	A	10A
Output voltage $U_a$ :		0 ... $U_{\text{mains}}$
Nominal output phase current $I_a$ :	A	3
Peak output current:	AAC	4,1
Output frequency $f_{\text{out}}$ :	Hz	0 ... 100
Nominal output power S:	kW	1,5
Recommended motor power:	kW	1,5
Min. Output inductance L:	mH	2
Efficiency at nominal load:	%	approx. 95
Power loss at idling:	W	approx. 10
Power loss at nominal load:	W	approx. 200
Frequency output stage:	kHz	6
Set point input:	VDC	Digital 12 Bit with EM726-00
Mounting:		vertically
Ambient temperature:	°C/(°F)	5 ... 40 (41...104)
Cooling:		Forced cooling in fan
Humidity:	%	max. 90 not condensing!
Connection:		Plug terminals
Dimensions:		245 x 75 x 160 mm (H/W/D)
Weight:		1,6 kg
Protection:		IP 20
Standards and regulations:		EN 61800-5-1:2007 EN 61800-5-2:2007 EN ISO 13849-1/2:2008 EN 61800-3:2004+A1 :2012 EN 62061:2005 UL-Approbation



Technical specifications are based on 400 VAC mains input voltage, 1000 m installation height, unless otherwise stated

<sup>1</sup> **Note:**

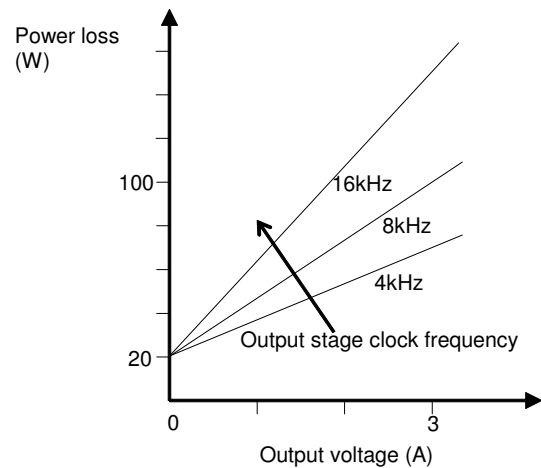
here is no fuse in the unit for the mains supply. It is essential to provide motor protecting switch, since the unit is not protected otherwise.

### 3.2 Limiting values

Heat sink temperature	80°
Air temperature	70°

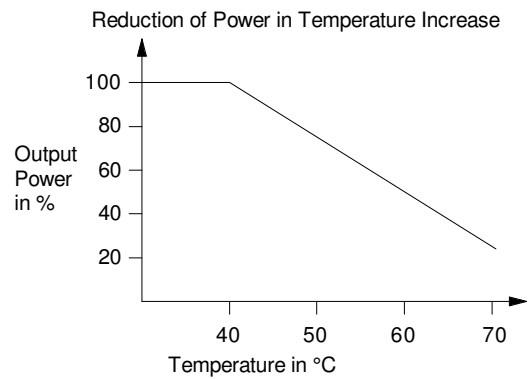
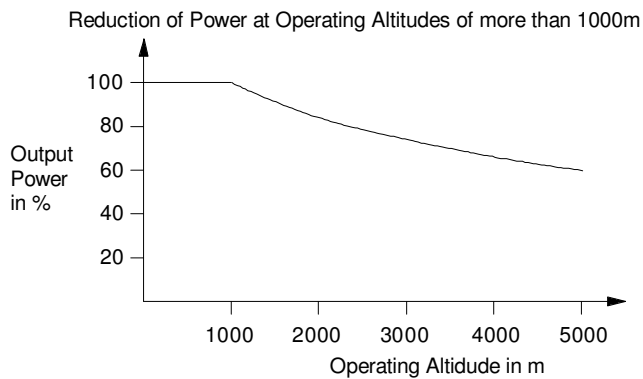
Temperatures are monitored in the converter!

### 3.3 Power loss diagram



### 3.4 Reduction of Power

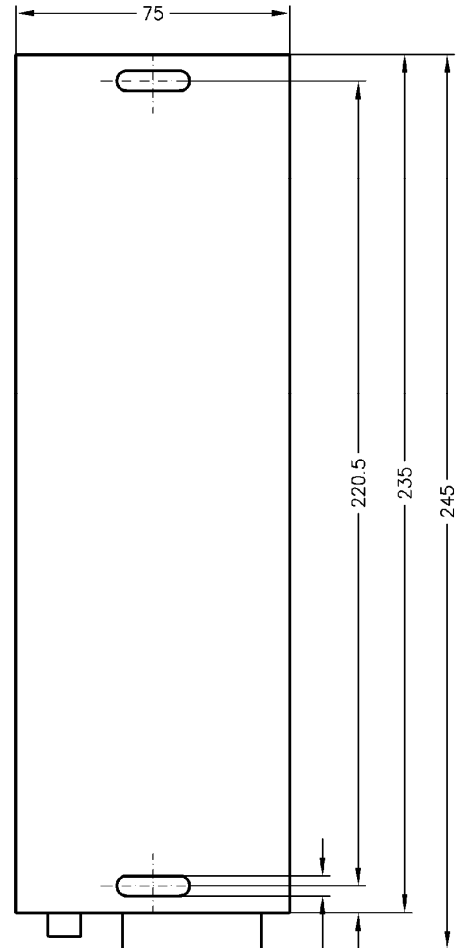
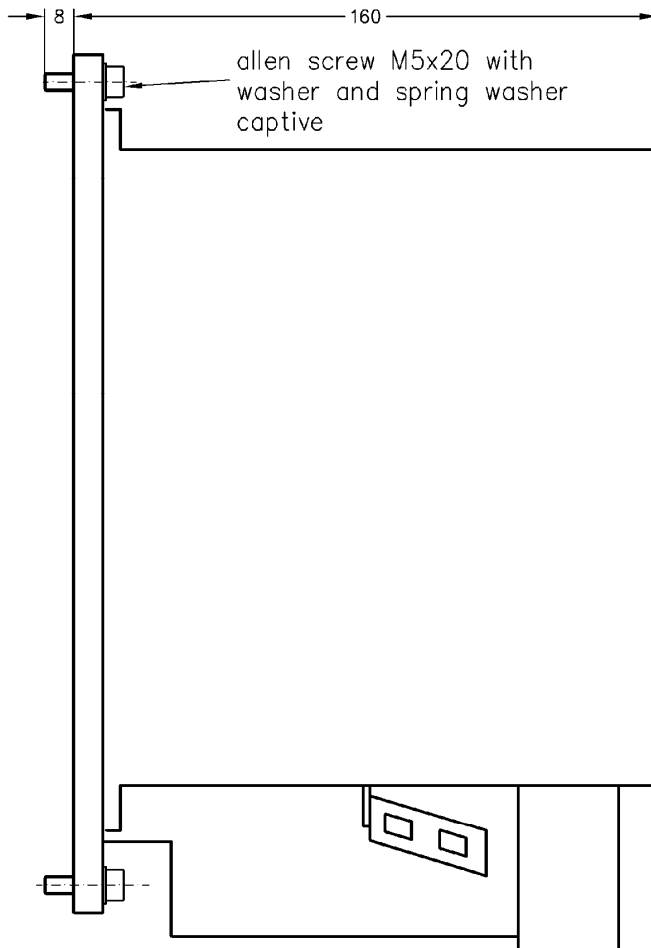
At operating altitudes of more than 1000 m above sea level or ambient temperatures over 40°C, the output of the converters is to be reduced to correspond to the following figures.



### 3.5 View and Dimensions

Size: 245x75x160mm (H/W/D).

(Device top)



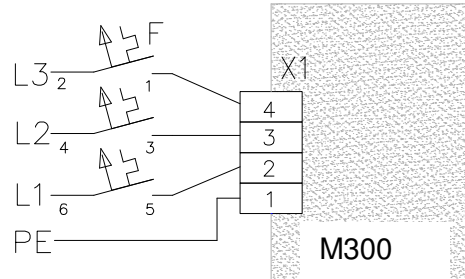
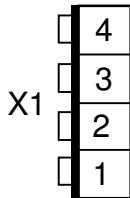
\*shifted mounting possible

(Device bottom)

Clearances supply air - and extract air 10 mm above and below the Converter!

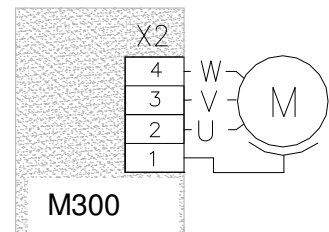
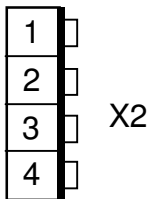
## 4. Description Connections

### 4.1 Mains connection connector X1 on device top



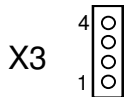
- |                  |   |
|------------------|---|
| <b>X1</b> -2, L1 | Mains connection  |
| -3, L2           |   |
| -4, L3           | external fuse see technical data                          |
| -1, PE           | Screw connection under bracket (See pic. PE - connection) |

### 4.2 Motor connection connector X2 on bottom of device

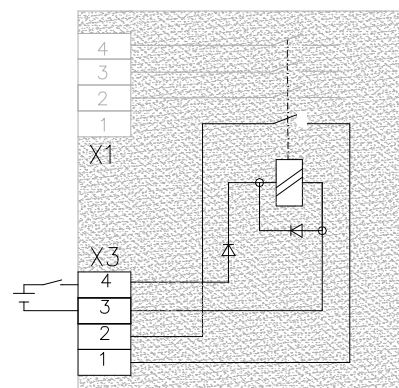


- |                 |   |
|-----------------|---|
| <b>X2</b> -2, U | Motor connection                                      |
| -3, V           | <b>Attention!!</b> Motor cable always shielded.       |
| -4, W           | Connect shield on both sides over a large area on PE. |
| -1, PE          |   |

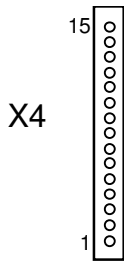
### 4.3 Connection input STO X3 on device top



- |                               |   |
|-------------------------------|---|
| <b>X3-1</b> auxiliary contact | Signal contact (N.O.)                             |
| <b>X3-2</b> auxiliary contact | Signal contact (N.O.)                             |
| <b>X3-3</b> 0V                | Mains protection coil                             |
| <b>X3-4</b> +VDC              | Mains protection STO<br>(Input controller enable) |

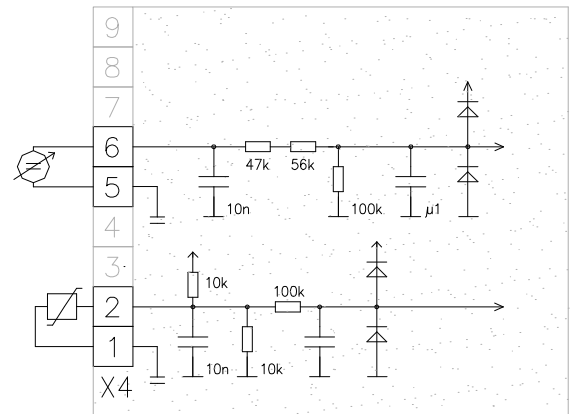


4.4 Control connection X4 on bottom of device



**X4-1 GND**  
**X4-2 Thermo**

Input for motor-thermal contact



Any thermo-contact (N.C. or N.O.) or thermo-sensor (NTC or PTC) against GND

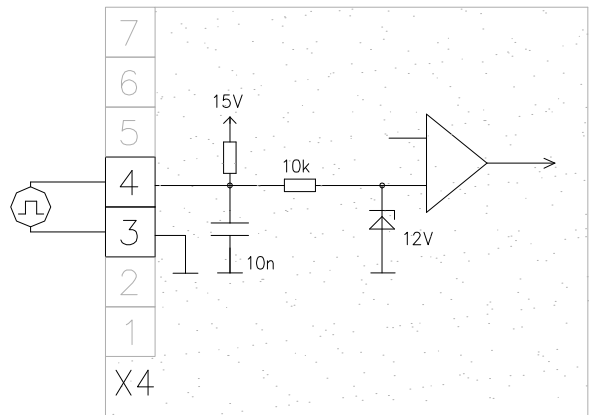
**X4-5 GND**  
**X4-6 Soil**

Analogue set value (Reference GND)

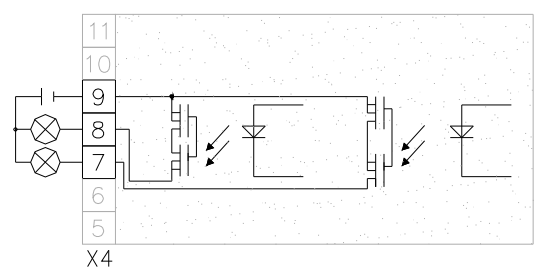
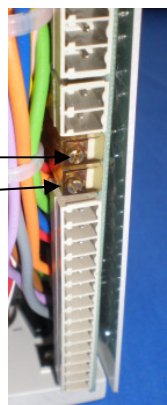
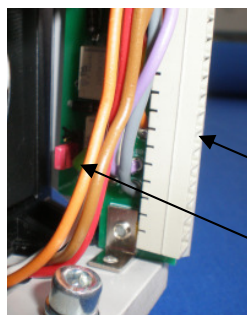
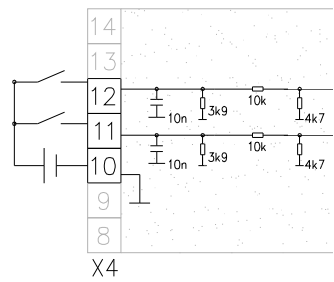
0 ... 10VDC input resistance = 100kOhm

**X4-3 GND**  
**X4-4 Tacho**

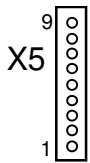
Input f. impulse device tacho (2-wire technology)



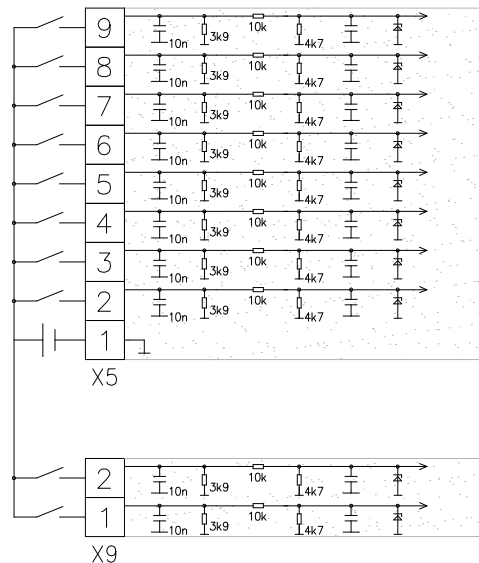
Special impulse device for ANTEK drives

<p><b>X4-7 Set-Actual OK</b>  <b>X4-8 Ready</b>  <b>X4-9 COM+</b></p>	<p>Signaling contact (potential-free): set speed achieved (only in controller mode)                  Ready signaling contact (potential-free)                  Reference point for X4-8 and X4-7 (potential-free)</p>  <p style="text-align: center;">X4</p> <p style="text-align: center;">Loading capacity of the signaling outputs: 0,2A, 35VDC or 25VAC</p>												
<p><b>X4-10 GND</b>  <b>X4-11 N2 or SW_3</b>  <b>X4-12 N1 or SW_2</b></p> 	<p>Reference mass for X4-11 ... X4-15                  Fixed speed N2 or digital set value, Bit 3                  Fixed speed N1 or digital set value, Bit 2</p>   <p style="text-align: center;">X4</p> <p style="text-align: center;">Jumper selection Setpoint</p> <p>In connection with the jumper selection set value“ -&gt; „analogue“: N1, N2 or „digital“: SW_2, SW_3</p> <p>Fixed set values: Selection via jumper on board A727 behind X4 (see picture). With the input signals fixed speed N1 and fixed speed N2, two fixed speeds or the analog setpoint input can be selected by binary coding.</p> <table border="1" data-bbox="534 1400 1324 1545"> <thead> <tr> <th>LOGIC DIAGRAM:</th> <th>Fixed speed N1</th> <th>Fixed speed N2</th> </tr> </thead> <tbody> <tr> <td>Analogue set value</td> <td>LOW</td> <td>LOW</td> </tr> <tr> <td>Fixed set value n1</td> <td>HIGH</td> <td>LOW</td> </tr> <tr> <td>Fixed set value n2</td> <td>LOW</td> <td>HIGH</td> </tr> </tbody> </table> <p>Parameterization of fixed setpoints via 2 potentiometers between terminal block X4 and X9.</p> <p>Level definition digital inputs: High = 18...30 VDC                  Low = -5...1 VDC</p>	LOGIC DIAGRAM:	Fixed speed N1	Fixed speed N2	Analogue set value	LOW	LOW	Fixed set value n1	HIGH	LOW	Fixed set value n2	LOW	HIGH
LOGIC DIAGRAM:	Fixed speed N1	Fixed speed N2											
Analogue set value	LOW	LOW											
Fixed set value n1	HIGH	LOW											
Fixed set value n2	LOW	HIGH											
<p><b>X4-13 L/R</b>  <b>X4-14 RF</b>  <b>X4-15 Reset</b></p>	<p>High: counter-clockwise rotation, Low: clockwise rotation                  Controller enable                  Low-High-Flank = fault reset</p> <p>Level definition digital inputs: High = 18...30 VDC                  Low = -5...1 VDC</p>												

4.5 Digital 12-bit set value parallel input X5, X9, on bottom side of device



<b>X5-1 GND</b>	Reference potential for digital set value inputs
<b>X5-2 SW_4</b>	digital set point, Bit 4
<b>X5-3 SW_5</b>	digital set point, Bit 5
<b>X5-4 SW_6</b>	digital set point, Bit 6
<b>X5-5 SW_7</b>	digital set point, Bit 7
<b>X5-6 SW_8</b>	digital set point, Bit 8
<b>X5-7 SW_9</b>	digital set point, Bit 9
<b>X5-8 SW_10</b>	digital set point, Bit 10
<b>X5-9 SW_11</b>	digital set point, Bit 11
<b>X9-1 SW_0</b>	digital set point, Bit 0
<b>X9-2 SW_1</b>	digital set point, Bit 1

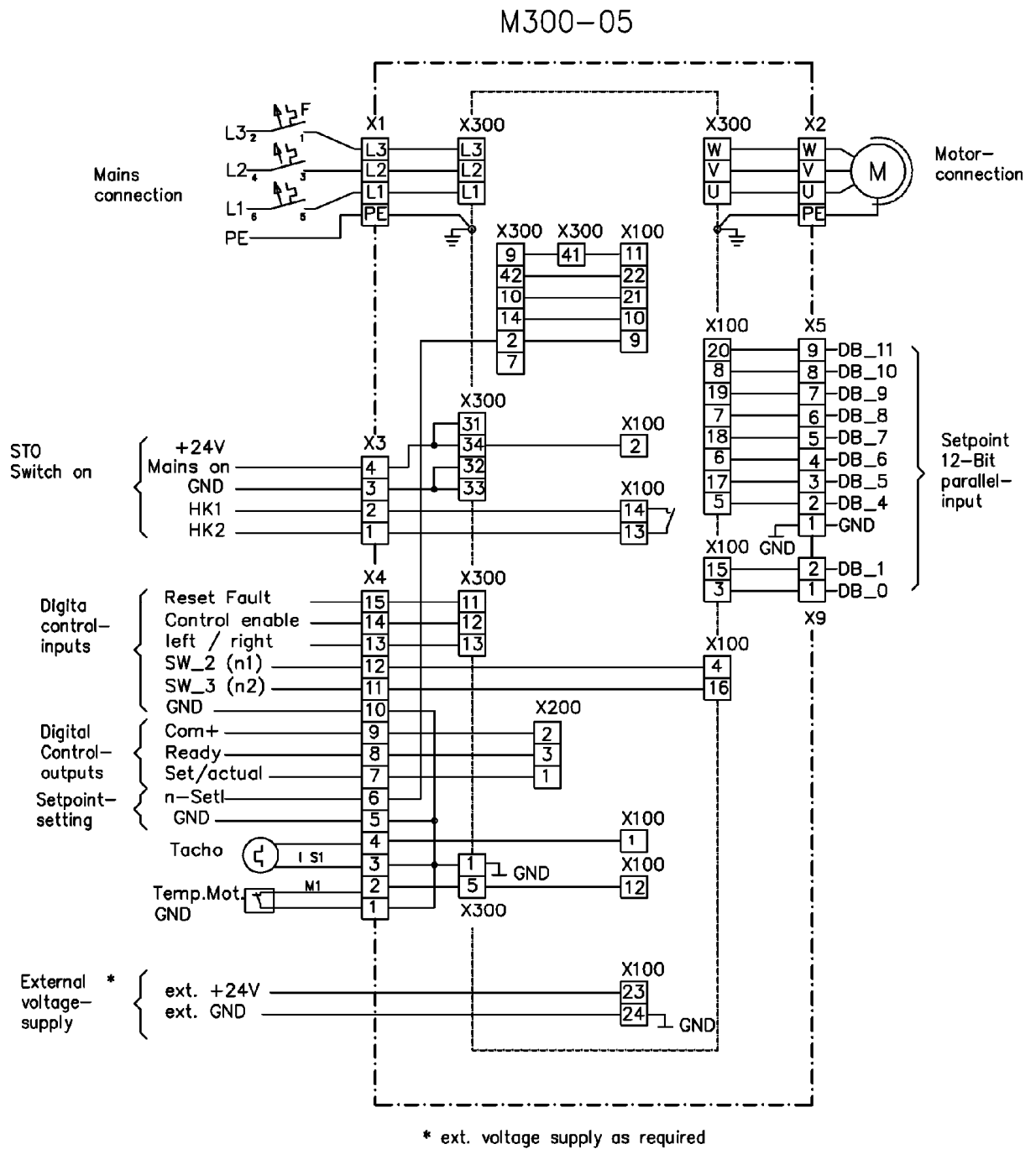


Note: For compatibility reasons the inputs SW\_2 and SW\_3 are to be found on X4-12 and X4-11. If less than 12-bits are to be used, the low ordered bits SW\_0 and SW\_1 must be on Low (and/or open).

Level definition digital inputs: High = 18...30 VDC  
 Low = -5...1 VDC

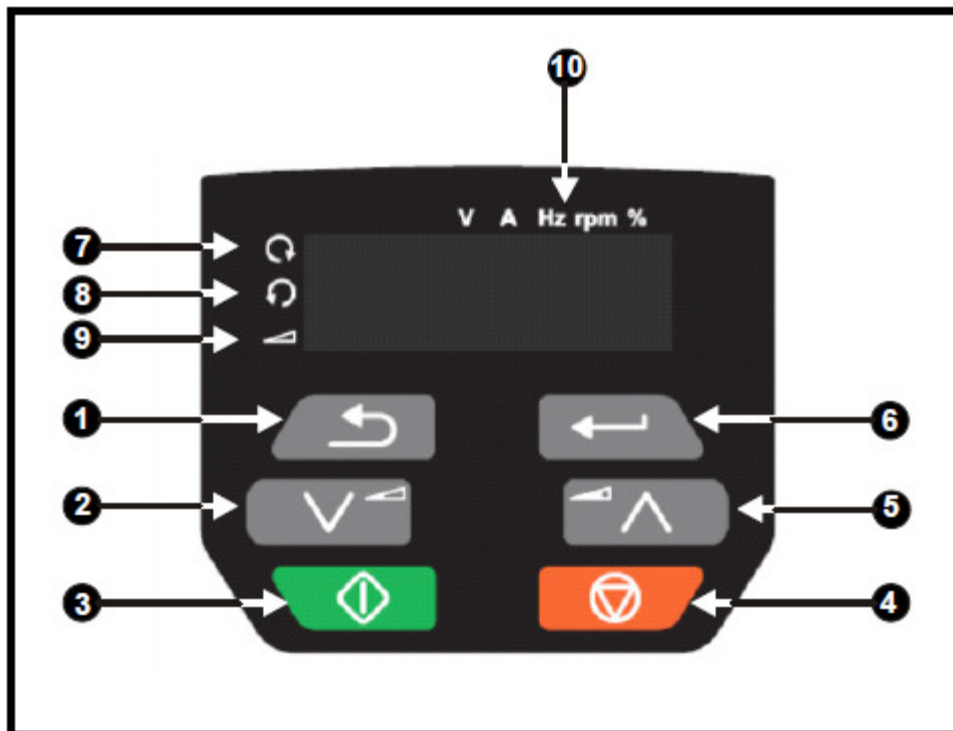


4.6 Connection



## 5. Commissioning

### 5.1 Keypad



- |                         |                             |
|-------------------------|-----------------------------|
| 1. Escape – Key         | 7. Display clockwise        |
| 2. Down- Key            | 8. Display anti clockwise   |
| 3. Start- Key (green)   | 9. Display Keypad-Set point |
| 4. Key Stop/RESET (red) | 10. Display: Unit           |
| 5. Up - Key             |                             |
| 6. Return - Key         |                             |

### 5.2 Key functions

The Keypad includes:

Up and Down Keys – to navigate through the parameter structure and change parameter values.

Enter - used to switch between modes for parameter editing and parameter display. This button can also be used to switch between the Slot menu and the parameter display.

Escape key - to complete the modes parameter editing and parameter display.

Start button - is used to execute a "Start" - command, if the keypad mode is selected.

Stop / Reset - Key - is used to reset the drive. In keypad mode, this key can be used to stop command.

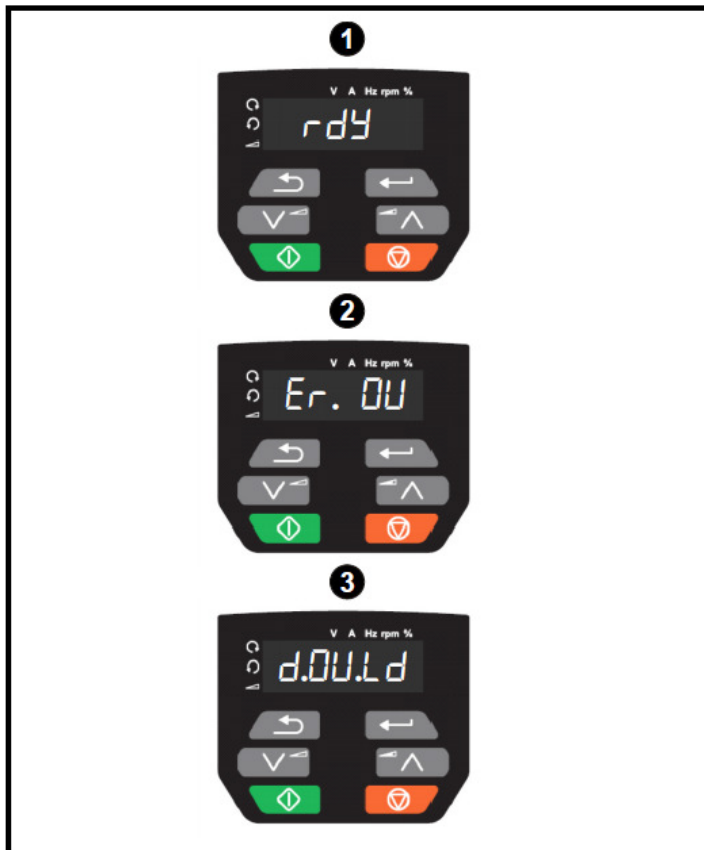
### 5.3 Acknowledge fault messages

The fault message remains stored until it is reset defined. This can be done by:

- ◆ • ON / OFF supply voltage (min. 30 sec.)
- ◆ • LOW-HIGH edge at the input "reset-fault".
- ◆ • Red button on the converter

### 5.4 Fault diagnosis

The display shows, various information about the application status. Displays the various status categories on the display:



- |                       |                                |
|-----------------------|--------------------------------|
| 1 – Ready-Status      | rdy = Ready                    |
| 2 – Fault condition   | Er. = Error                    |
| 3 – Warning condition | Display of the error „d.OU.LD“ |

See also description: Unidrive M300/301 Step 10, 12  
„Status indications “

The last error message can be checked in parameter 10.020.

## 5.5 Parameter set Frequency Converter

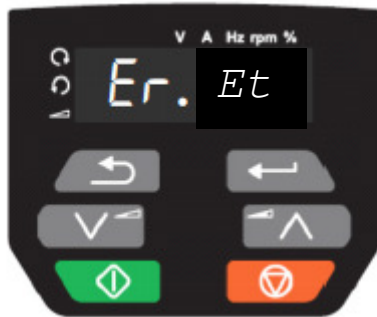
### M300-05-00 Parameter values:

00.001	Max. Setpoint limitation	<b>100Hz</b>
00.008	Motor nominal voltage	<b>205V</b>
00.039	Motor nominal frequency	<b>50Hz</b>
00.006	Motor nominal current	<b>3,2A</b>
00.007	Motor nominal speed	<b>1500 rpm</b>
00.002	Acceleration ramp	<b>3 s</b>
00.003	Deceleration ramp	<b>3 s</b>
00.016	Analog Input 1 Scaling	<b>0,500</b>

### M300-05-02 Parameter values:

00.001	Max. Setpoint limitation	<b>100Hz</b>
00.008	Motor nominal voltage	<b>205V</b>
00.039	Motor nominal frequency	<b>50Hz</b>
00.006	Motor nominal current	<b>3,2A</b>
00.007	Motor nominal speed	<b>3000 rpm</b>
00.002	Acceleration ramp	<b>3 s</b>
00.003	Deceleration ramp	<b>3 s</b>
00.016	Analog Input 1 Scaling	<b>1,000</b>

## 5.6 Thermo contact Motor



Error message Er. Et = External fault, this was linked to the thermal contact in the motor and indicates an interruption of the contact!

(opener contact N.C.) With overheating the F / U is disabled and the ready signal contact (X1-11 - X1-12) set to malfunction with a time delay (about 30 seconds).  
Reference GND = High Temperature OK.  
Low = Temperature too high

## 5.7 Switch thermal contact PTC / NTC

On the converter Positive as well as negative logic for the thermal input can be evaluated.

PTC Parameter	00.011	OFF	(at > Temp. = voltage increases)
NTC Parameter	00.011	ON	(at > Temp. = contact opens = voltage decreases)

In the menu 0 select parameter 00.011 (09.015 Logic Function 2...).

For this, the key Enter (6) is pressed 2 times, so that the number blinks in the submenu level right after the comma. Now make go with arrow key to 00.011 and press Enter again.

On the display „ON“ appears, with renewed pressing the Enter key you get into the mode "change", where now „ON“ flashes. With the arrow key down switch to „OFF“ an confirm with the enter key. Press the escape key (1) twice to return to the menu level.

Set the parameter to ON for the FU3AM replacement with NTC switch in the motor.

NTC parameter 00.011 "ON" (09.015) (with> Temp. = Contact opens = voltage drops)

## 5.8 Parameter storage in converter

To save the parameters in the converter permanently, in the menu xx.000 the parameter has been set to "SAVE and the key RESET (4) must be pressed.

Switch to on any submenu level xx.000 by pressing the enter key and here select the input with the enter key (display flashes) then use the arrow key to "Save" and use the enter key to acknowledge (blinking stops). Now press the RESET key. Thereafter, the parameters in the converter are stored. And the display returns to "non".

## 5.9 Fault diagnosis

Fault diagnosis	Error cause	Debugging
LED „Ready“ does not lit up	- Mains voltage too low / too high	- Check mains voltage
	- UDC too big or too small	- Check mains voltage
	- Regenerative energy is too large	- Check ballast resistant
	- IZK to large	- check wiring - reduce motor load
Motor does not start	- controller temperature too high	- let cool motor or controller
	- motor temp. too high	- reduce motor load
	- Heat sink temperature too high	- control ventilation
Motor does not start	- line fault	- check motor phases
Controller vibrates	- PI behavior set incorrectly	- Setting the control behavior on application
Motor runs roughly	- EMV - PI behavior set incorrectly - Actual pulses wrong	- connect ground reference of the analog or digital inputs- - Shielding the analog or digital inputs. Sensor signals and motor cable over a large area grounded - Set Pi behavior
Device goes when starting on fault, note error	- Motor blocked - Motor, wire defective - Ramp time too small - Fault displayed	- make motor move freely - exchange motor, cable - enlarge ramp time - Error Evaluation with Chap. 12 in manual M300
Er. Et	- thermal fault motor	- check pin 5

### 5.10 EMC-Filter (earth leakage currents)

The converter is supplied with the internal EMC filter. For instructions on removing the internal filter, refer to section 4.5.2 of the "Unidrive M300 Quick Start Guide en.iss7.pdf" Removing the Internal EMC Filter on page 22.



With internal filter the leakage current per converter is 5,7mA at 415V, 50Hz, without filter, the leakage current is <1mA.

The specifications refer only to the converter, the leakage currents of motor or motor cable are not considered!

#### **Attention:**



For a leakage current > 3.5mA, a permanent fixed ground connection shall be provided with two independent conductors, each with a cross-section equal to or greater than that of the mains cable. To make this easier, the converter is equipped with two earth terminals. Both ground connections are necessary to comply with the EN 61800-5-1: 2007 standard.