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2 Basic - Informationen

2.1 History

<table>
<thead>
<tr>
<th>Version</th>
<th>Modification</th>
<th>Date</th>
</tr>
</thead>
</table>

2.2 Safety advice

Electronic equipment is not fault proof.

**Attention – High voltage**

**AC250/440V~ - DC 180/300V=**  
**Shock hazard / Danger of life!!**

Before installation or commissioning begins, this manual must be thoroughly read and understood by the technical staff involved.

The devices are electrical equipment (EB) to the power electronics for the control of power flow in electrical power systems.

**Protection rating IP00.**

Control and power connections can voltage lead, works without the drive!

Measured before disassembly voltage!
2.3 Standards and guidelines:

The device and its associated components can only be installed and switched on where the local regulations and technical standards have been strictly adhered to:

EN 60204-1, EN292, EN50178, EN60439-1,
EN61800-3, ECE-R100
ISO 6469, ISO 26262, ISO 16750, ISO 20653, ISO12100

IEC/UL: IEC 61508, IEC364, IEC664, UL508C, UL840

VDE Regulations: VDE100, VDE110, VDE160

Trade body guidelines: VGB4

The user must ensure that in the event of:

- device failure
- incorrect operation
- loss of regulation or control

the axis will be safely de-activated.

It must be ensured that the machines, equipment or vehicles are fitted with device independent monitoring and safety feature.

Non-earthed systems (e.g. vehicles) need to be secured isolation monitors.

There must be no danger to persons and property arising!

Assembly
- should only be carried out when all voltages have been removed and the units are secured
- should only be carried out by suitably trained personnel

Installation
- should only be carried out when all voltages have been removed and the units are secured
- should only be carried out by suitably trained personnel for electrics
- should only be carried in accordance with health and safety guidelines

Adjustments and programming
- should only be carried out by suitable trained personnel with knowledge in electronic drives and their software
- should only be carried out in accordance with the programming advice
- should only be carried in accordance with health and safety guidelines
CE
When mounting the units into machines and installations the proper operating of the units may not be started until it is ensured that the machine, the installation, or the vehicle comply with the regulations of the EC machinery directive 2006/42/EG and the EMC guideline 2004/108/EG. On the installation and test conditions described in the chapter CE-advice it is adhered to the EC guideline 2004/108/EG including the EMC standards EN61000-2 and EN61000-4. A manufacturer’s declaration can be requested. The manufacturer of the machine or installation is responsible for observing the threshold values demanded by the EMC laws.

QS
The devices are archived with serial number and the test data from the manufacturer for 5 years. The inspection reports may be requested.

2.4 General and features

This manual describes the basic unit and is only in connection with the manual of the control electronics (e.g. REGxx) valid.

Manual use in connection with:
- an analogue control REGxx
- options

Build
- switch cabinet mounting a
- according to the VDE, DIN and EU regulations
- standard control electronics REG
- intrinsically safe power section with current control loop
- optional units
Galvanic isolation between
- the power section and the housing
- the power section and the control electronics

The distance of air gaps and leakage paths adhere to the VDE standards (>8mm).

Components
- fully insulated thyristor modules, comfortably over-dimensioned
- only components customary in trade and industrially standardized are used
- LED displays
- DIP-switches for the PI-adjustment of the current control loop
- precision potentiometers for fine adjustments
- plug-in jumpers for the system set-up

Characteristics

- Series Classic P1
- Thyristor drive for dc motors
- Power range 2,7kW to 12 kW
- Drive in the first quadrant
- Fast analogue current control
- 26-pin interface
- Features of the control electronics
- See manual REGxx or third-party product documentation
- Optional units
### 2.5 Technical Data

#### P1 230/180-x
- **Power connection:** 200 ... 250V~
- **Auxiliary voltage connection:** 200 ... 250V~
- **Output voltage:** max. +180=
- **Cooling:** self

<table>
<thead>
<tr>
<th>P1 230/180-x</th>
<th>15</th>
<th>25</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input current</strong></td>
<td>A~</td>
<td>16.5</td>
<td>27.5</td>
</tr>
<tr>
<td><strong>Output current</strong></td>
<td>A=</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>A=</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td><strong>El. power</strong></td>
<td>kW</td>
<td>2.7</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Input fuses</strong></td>
<td>input</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td><strong>Main choke</strong></td>
<td>Typ</td>
<td>K78-16</td>
<td>K84-25</td>
</tr>
<tr>
<td></td>
<td>mH</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Armature chokes</strong></td>
<td>Typ</td>
<td>EI135A-16</td>
<td>EI135B-24</td>
</tr>
<tr>
<td></td>
<td>mH</td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td><strong>Dimension W x H x D</strong></td>
<td>mm</td>
<td>200x160x112</td>
<td>200x160x120</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>kg</td>
<td>2.10</td>
<td>3.10</td>
</tr>
</tbody>
</table>

#### P1 400/300-x
- **Power connection:** 360 ... 440V~
- **Auxiliary voltage connection:** 360 ... 440V~
- **Output voltage:** max. +300V=
- **Cooling:** self

<table>
<thead>
<tr>
<th>P1 400/300-x</th>
<th>15</th>
<th>25</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input current</strong></td>
<td>A~</td>
<td>16.5</td>
<td>27.5</td>
</tr>
<tr>
<td><strong>Output current</strong></td>
<td>A=</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>A=</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td><strong>El. power</strong></td>
<td>kW</td>
<td>4.5</td>
<td>7.5</td>
</tr>
<tr>
<td><strong>Input fuses</strong></td>
<td>input</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td><strong>Main choke</strong></td>
<td>Typ</td>
<td>K78-16</td>
<td>K84-25</td>
</tr>
<tr>
<td></td>
<td>mH</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Armature chokes</strong></td>
<td>Typ</td>
<td>EI135A-16</td>
<td>EI135B-24</td>
</tr>
<tr>
<td></td>
<td>mH</td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td><strong>Dimension W x H x D</strong></td>
<td>mm</td>
<td>200x160x112</td>
<td>200x160x120</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 2.6 Specification

**Specification**
- **Mains frequency**: 50 or 60Hz ±5%
- **Protection rating**: IP 00
- **Format**: VDE 0100 groupe C, VDE 0160
- **Humidity rating**: class F acc. to DIN 40040
- **Site of installation**: < 1000m above sea level
- **Operating temperature range**: 0 ... 45°C
- **Extended operating temp. range**: up to 60°C reduced 2%/°C
- **Storage temperature range**: -30°C to + 80°C

**Current control loop circuit**
- **Amplification**
  - Input signal: 0... + 10V=
  - Output signal: 0... + 200% type current
- **Enable**: +10V
- **Control precision**: ± 2%
- **Control range**: >1:50

**Speed control loop circuit (with REG)**
- **Control precision (without actual value error)**: ±0.1%
- **Control range**: > 1:200

## 2.7 Interface

**Interface control electronics X3**

<table>
<thead>
<tr>
<th>Function</th>
<th>Connector no</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 24V</td>
<td>X3: 1 and 2</td>
</tr>
<tr>
<td>+ 15V</td>
<td>X3: 3 and 4</td>
</tr>
<tr>
<td>- 24V</td>
<td>X3: 5 and 6</td>
</tr>
<tr>
<td>- 15V</td>
<td>X3: 7 and 8</td>
</tr>
<tr>
<td>Device GND</td>
<td>X3: 9, 10, 11, 12, 13, 14</td>
</tr>
<tr>
<td>I command value (GND)</td>
<td>X3: 15</td>
</tr>
<tr>
<td>I command value (Signal)</td>
<td>X3: 16</td>
</tr>
<tr>
<td>Current controller enable</td>
<td>X3: 17</td>
</tr>
<tr>
<td>Drive disable 1</td>
<td>X3: 18</td>
</tr>
<tr>
<td>Drive disable 2</td>
<td>X3: 19</td>
</tr>
<tr>
<td>n (speed) actual</td>
<td>X3: 20</td>
</tr>
<tr>
<td>I – (current) actual</td>
<td>X3: 21</td>
</tr>
<tr>
<td>Over current power section</td>
<td>X3: 22</td>
</tr>
<tr>
<td>Trigger angle 1</td>
<td>X3: 23</td>
</tr>
<tr>
<td>Trigger angle 2</td>
<td>X3: 24</td>
</tr>
<tr>
<td>Drive ready BTB</td>
<td>X3: 25</td>
</tr>
<tr>
<td>not assigned</td>
<td>X3: 26</td>
</tr>
</tbody>
</table>
3 Mechanical installation

3.1 Mounting / Dimensions
4 Electrical installation

4.1 Connections/Connection diagram
4.2 CE – Advice

The devices adhere to the EU guidelines 89/336/EWG and the technical standards EN61000-2 and 61000-4 provided that the following conditions are observed:

- the device, the power choke and the filter capacitors are mounted on a 500x500x2 mm mounting plate.
- The mounting plate must be connected to ground using a 10mm² wire.
- The motor housing must be connected to ground using a 10mm² wire.
- The device ground X1:8 must be connected to the mounting plate using a 2,5mm² wire , I = 50mm.
- Device PE screw be connected to the mounting plate using a 4mm² wire.

**Connection:**

- **Power choke type:** see technical data
- **Filter capacitors:** 0.5µF/600V~ 2 x 1µF (x) + 1 x 0,5µF (y)
- **Conductor length between the device and the power choke** <250mm

**Motor connection:**

- **Motor conductors** l = 1.5m, shielded
- **Tacho and all control lines** l = 1.5m, shielded
- **Shielding connected to PE**
The connection instructions are for general information and are not binding.

**Attention:**
The order of the connections to the connector numbers or screw terminals is obligatory.
All further advice is non-obligatory.

The input and output conductors may be altered or supplemented in accordance with the electrical standards.

**Note:**
- Connection and operating instructions
- Local regulations
- EG-guideline 89/392/EWG, 84/528/EWG, 86/663/EWEG
- VDE, TÜV regulations and Trade body guidelines
- CE advice, EMC

<table>
<thead>
<tr>
<th>Connection</th>
<th>Conductor minimal cross - section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type current</td>
<td>A</td>
</tr>
<tr>
<td>ac power supply</td>
<td>mm²</td>
</tr>
<tr>
<td>Cross sectional minimal</td>
<td></td>
</tr>
<tr>
<td>Motor line</td>
<td>mm²</td>
</tr>
<tr>
<td>Cross sectional minimal</td>
<td></td>
</tr>
<tr>
<td>Auxiliary voltage</td>
<td>mm²</td>
</tr>
<tr>
<td>Cross sectional minimal</td>
<td></td>
</tr>
</tbody>
</table>
4.3 Power supply

Switch on: the auxiliary voltage and the supply voltage simultaneously.

Switch off: the supply voltage after the auxiliary voltage.

Input filter: see CE-advice (Capital Electrical Installation)
Short conductor length to be used between the input filter and the device
Operation with 60Hz: switch S3 / contact 1 in position ON

Auxiliary voltage connection:

Connection: terminal X5:10, X5:11
Power supply: 230V~ or 400V~
Input current: 0,1 A
Phase position: regardless
Internal fuses: 2,5 Af

Attention:
note typelabel / control voltage xxx
4.4 Direct power connection/ with transformer

Direct power connection:

Connection:
- Phase L1: terminal X10:15
- Phase L2 (N): terminal X10:16
- Input fuse: super fast acting fuse
- Power choke: inductance >200µH

Power connection with a transformer:

- Transformer performance: 1,1 x continuous motor power
- Secondary voltage: 1,35 x motor power
- Trafosicherung: slow acting
- Eingangssicherung: super fast acting fuse

Attention:

- If the secondary voltage produced by the transformer are inferior to 60% of the rated device voltage, the voltage watchdog has to be adapted.
- These modifications may only be effected in the factory.
- The transformer secondary voltage has to be indicated on order.

Internal watchdog for fuse failures.
4.5 Motor connection

Connection
Motor- terminal X10:18
Motor+ terminal X10:17

Armature choke
Inductance \( L_4 \, (\text{mH}) = \frac{U_A}{I_A} \times 2.4 \)

An armature choke should always be used with a P1 device.

Turn in the armature circuit:
- DC circuit energized
- Release locked

Warning:
Faulty switching will create arcing across the switch contacts.

Power supply failure – brake resistor
- Break contact of the mains contactor K1
- In parallel to the motor armature
- Without separation from the device

Attention:
Power lines have to be shielded and routed separately from control lines!

For electro-magnetic interferences please refer to the CE advice.
4.6 Field connection

Connection

<table>
<thead>
<tr>
<th>Input</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field negative</td>
<td>X5:10, X5:12</td>
</tr>
<tr>
<td>Field positive</td>
<td>X5:13</td>
</tr>
</tbody>
</table>

Field voltage

![Diagram of field connection]

Power voltage

- 230V~
- 400V~
- 400V~ with N

Field voltage

- 210V=
- 360V=
- 210V=

Field current

- max. 1,5A

Fusing

- 2,5 Af

Control

- deleted
4.7 Actual value connection

**Tacho**
Suitable actual value encoders:
- DC tacho generator
- Brushless tacho generator with evaluation electronics
- Incremental encoders with evaluation electronics
- SC or three-phase tacho with rectification

**Connection**
Control electronics (see MANUAL REGxx)

- in case of a positive command value
- Tacho positive X1:8b
- Tacho negative X1:9
- Shield X1:8

**Armature voltage**

**Ground referenced actual value**
- fuses 2 x 0,1A/500V directly in the armature circuit
- for armature voltage >180V additional resistors are required
- Use unit EXZU-UA1 (Manufacturer)
5 Adjustment

5.1 Circuit diagrams
5.2 Current controller

PI loop circuit

Adjustments with the DIOP switch S2

Optimization of the current controller

- Connect an oscilloscope across the current actual value X3:21
- Current command value step-change 1V X3:16
- Increase the current command value by 1V steps to 10V
- Alter the P-amplification by means of the DIP switches S2:1 and S2:2
- Optimal adjustment (see fig. 1)
- Not permissible adjustment (see fig. 2)
- Alter in integral part by means of the DIP switches S2:3 and S2:4

Oscilloscope – Current adjustment

Grafic 1: setting optimal
Grafic 2: amplifier too high
Grafic 3: P-amplifier small
5.3 Displays

Some important functions are indicated by LEDs:

<table>
<thead>
<tr>
<th>Display</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive ready</td>
<td>BTB</td>
</tr>
<tr>
<td>Current controller enable</td>
<td>enable</td>
</tr>
<tr>
<td>Triggering enabled</td>
<td>enable triggering</td>
</tr>
<tr>
<td>Current command value direction</td>
<td>RVI-1</td>
</tr>
</tbody>
</table>

The green LEDs indicate the active states!

**BTB-signal – Drive ready**

<table>
<thead>
<tr>
<th></th>
<th>X3:25</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BTB-signal</td>
<td>&gt;+10V</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>&lt;+2V</td>
<td></td>
</tr>
</tbody>
</table>

**Error**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary voltage supply</td>
<td>+24V, +15V, -15V</td>
</tr>
<tr>
<td>Power supply:</td>
<td></td>
</tr>
<tr>
<td>Fuse failure</td>
<td></td>
</tr>
<tr>
<td>Under-voltage</td>
<td></td>
</tr>
</tbody>
</table>

In case of errors or failure the power section is internally disabled without delay.

**Measurements:**

Measure instruments: multi meter for current and voltage

Shunt or clamp-on ammeter

Measure faults: mean value >> actual value

acc. to the form factor approx. 1 bis 5 %

**Measured values**

with a positive command value

Voltage X10:18 negative / X10:17 positive max. 0,75 x power supply

Current Ammeter in the motor circuit

**Measured values across REG**

Speed X2:109 -5V (10V) for ±100% speed

Current X2:111 +5V (10V)f for ±200% current

GND X2:104
6 Commissioning

6.1 Commissioning

Connection advice
Connect the drive in accordance with the P1 manual and the control electronics manual (e.g. REG).

Attention:
Check the power supply voltage with that specified on the type plate.
Insert correct fuses according to the technical data.
Check the field voltage connection and the motor and tacho connections.
For 60 Hz applications set the DIP switch S3, contact 1 to ON

Commissioning
Basic connections – Mains supply, field, tacho or armature feedback, drive enable, command value.
For armature voltage control the tacho watchdog must be switched off.

Drive enable switch open or drive enable voltage 0V:
Command value 0 V
Switch S9 adjust to tacho voltage
For armature voltage control adjust to 0
Switch S4 position 2
Switch S5 position 6
I_{\text{max}1}\text{- Potentiometer } = \text{ left full scale}
I_{\text{max}2}\text{- Potentiometer } = \text{ adjust to approx. } 10\% \text{ of full scale}
Potentiometer X_{p} adjust to 50\%
Potentiometer I_{o} = 100\%
Potentiometer I_{xR} = \text{ left full scale}
Potentiometer n_{\text{max}} = \text{ left full scale}
Potentiometer INT = \text{ left full scale}

Apply the voltage:
LED L3 (BTB) and LED L7 (stationary) must light.
All other LEDs are off.

Close the switch drive enable or apply a drive enable voltage of 10V:
LED L1 and L2 must also light.
The drive must be at a standstill or turn slowly (offset, n_{\text{min}}).
If the drive accelerates in the correct direction, the polarity of the tacho voltage and the armature voltage feedback must be changed.
If the drive accelerates in the wrong direction, the polarity of the armature of the field must be changed.

Increase the command value voltage to approx. 10%:
The drive must accelerate to approx. 10% of the speed. If the rotation direction is wrong, change the polarity of the tacho and the field or the polarity of the tacho and the armature.
Commissioning

**Current controller amplification:**
(Switch S2 on the power section)
The current amplification is adjustment to a low armature circuit inductance (all switch „on”).
High inductance values can lead to motor oscillation which cannot be influenced by means of the speed controller. In this case, first set switch S2-2 to “off”.
If the drive still does not run smoothly, set the switch S2-1 to “off”.
The current response can be measured by means of an oscilloscope across the test point X4:20.

**Speed controller amplification:**
Adjust on the REG board.
Adjust the P-term to the lowest possible setting from 1 to 5 (switch S4).
Adjust the l-term to match the axis momentum (switch S5).

- large axis momentum - high adjustment value
- small axis momentum - low adjustment value

With the command value set to 10% speed, increase the amplification by turning the potentiometer Xp clockwise. When the drive begins to oscillate, reduce the amplification by turning the potentiometer anti-clockwise by approximately 10%.

For the fine adjustment of the amplification the control response should be measured by means of an oscilloscope across the test point X4:15.

**Further adjustment:**
Such as speed, peak current, continous current, etc. (rf. to the manual REG).

**Switch OFF:**
If the switch „drive enable“ is opened, or the drive enable voltage is switched to 0V, LED L1 and L2 will extinguish and the drive will be disabled.
DS1:K4 in position OFF.
After approx. 2s the thyristor triggering circuit is disabled.

**Commissioning adjustment:**
The adjustment should be documented in the protocol and the adjustment potentiometer should be sealed with a suitable lacquer.
### 6.2 Protocol (commissioning)

<table>
<thead>
<tr>
<th>Customer</th>
<th>Machine No.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device</td>
<td>Series No.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control voltage</th>
<th>Device Series No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V~]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power voltage</th>
<th>Device Series No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V~]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field voltage</th>
<th>Device Series No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V=]</td>
<td></td>
</tr>
</tbody>
</table>

### Input REGxx

<table>
<thead>
<tr>
<th>Enable</th>
<th>Contact ?</th>
<th>Voltage [V=]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Nominal value</th>
<th>Type</th>
<th>Voltage [V=]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Auxiliary nom. value</th>
<th>Type</th>
<th>Voltage [V=]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Current nom. value</th>
<th>I_{max1} extern</th>
<th>Voltage [V=]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Current nom. value</th>
<th>I_{max2} extern</th>
<th>Voltage [V=]</th>
</tr>
</thead>
</table>

### Speed control settings REGxx

#### Switches

<table>
<thead>
<tr>
<th>Tacho-adjustment</th>
<th>S9</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-term</td>
<td>S4</td>
<td>Position</td>
</tr>
<tr>
<td>I-term</td>
<td>S5</td>
<td>Position</td>
</tr>
<tr>
<td>D-term</td>
<td>S8</td>
<td>Position</td>
</tr>
</tbody>
</table>

#### Poti-Stellungen

<table>
<thead>
<tr>
<th>Speed</th>
<th>n_{max}</th>
<th>P4</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak current</td>
<td>I_{max1}</td>
<td>P5</td>
<td>Position</td>
</tr>
<tr>
<td>Peak current</td>
<td>I_{max2}</td>
<td>P6</td>
<td>Position</td>
</tr>
<tr>
<td>Continuous current</td>
<td>I_D</td>
<td>P7</td>
<td>Position</td>
</tr>
<tr>
<td>Integrator</td>
<td>INT</td>
<td>P1</td>
<td>Position</td>
</tr>
<tr>
<td>Amplification</td>
<td>Xp</td>
<td>P3</td>
<td>Position</td>
</tr>
<tr>
<td>IxR Compensation</td>
<td>IxR</td>
<td>P2</td>
<td>Position</td>
</tr>
</tbody>
</table>

#### DIP Switches

<table>
<thead>
<tr>
<th>ON</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No.</td>
</tr>
</tbody>
</table>
### Commissioning P1xx with REGxx

#### Setting - Current controller

<table>
<thead>
<tr>
<th>Switch setting</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch S2</td>
<td>open</td>
<td>(off)</td>
</tr>
<tr>
<td></td>
<td>closed</td>
<td>(on)</td>
</tr>
<tr>
<td>Switch S3 / Contact 1</td>
<td>60Hz</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>50Hz</td>
<td>OFF</td>
</tr>
</tbody>
</table>

#### Measuring value

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armature voltage max.</td>
<td>[V]</td>
<td></td>
</tr>
<tr>
<td>Armature current peak</td>
<td>[A]</td>
<td></td>
</tr>
<tr>
<td>Armature current steady</td>
<td>[A]</td>
<td></td>
</tr>
<tr>
<td>Tachometer voltage max.</td>
<td>[V]</td>
<td></td>
</tr>
<tr>
<td>Acceleration X4:16</td>
<td>[V/ms]</td>
<td></td>
</tr>
<tr>
<td>Integrator X4:14</td>
<td>[V/ms]</td>
<td></td>
</tr>
</tbody>
</table>

#### Motor data

Identification / name plate specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer: Type</td>
<td>Serien-Nr.</td>
</tr>
<tr>
<td>Motor voltage [V]</td>
<td>Motor current [A]</td>
</tr>
<tr>
<td>Field voltage [V]</td>
<td>Field current [A]</td>
</tr>
<tr>
<td>Tacho voltage [V/min⁻¹]</td>
<td>Tachometer type</td>
</tr>
<tr>
<td>Brake [V]</td>
<td>Fan [V]</td>
</tr>
<tr>
<td>Nominal speed [U/min]</td>
<td></td>
</tr>
</tbody>
</table>
### Error diagnosis

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor does not run</td>
<td>-Wrong power supply and motor connections</td>
</tr>
<tr>
<td></td>
<td>-Activated fuses</td>
</tr>
<tr>
<td></td>
<td>-Missing enable or command value</td>
</tr>
<tr>
<td></td>
<td>-Current limit too low</td>
</tr>
<tr>
<td></td>
<td>-Missing BTB</td>
</tr>
<tr>
<td>Motor speeds up</td>
<td>-Wrong polarity of the actual value (Tacho armature voltage)</td>
</tr>
<tr>
<td></td>
<td>-Values of the tacho switch S9 too low</td>
</tr>
<tr>
<td></td>
<td>-Command value too high</td>
</tr>
<tr>
<td></td>
<td>For armature voltage control</td>
</tr>
<tr>
<td></td>
<td>-Field current too low</td>
</tr>
<tr>
<td></td>
<td>-Fuses, armature voltage feedback activated</td>
</tr>
<tr>
<td>Motor runs unsteadily</td>
<td>-Mechanical defect of the tacho</td>
</tr>
<tr>
<td></td>
<td>-Tacho malfunction</td>
</tr>
<tr>
<td></td>
<td>-Amplification on the speed controller too low or too high</td>
</tr>
<tr>
<td></td>
<td>-Wrong PID parameter</td>
</tr>
<tr>
<td></td>
<td>-Command value errors</td>
</tr>
<tr>
<td></td>
<td>-Amplification of the current controller too low or too high</td>
</tr>
<tr>
<td>No motor torque</td>
<td>-Current limits too low</td>
</tr>
<tr>
<td></td>
<td>-Field current too low</td>
</tr>
<tr>
<td></td>
<td>-Mechanical overload of the axis</td>
</tr>
</tbody>
</table>
8 Warranty

8.1 Warranty

UNITEK warrants that the device is free from material and production defects. Test results are recorded and archived with the serial number.

The warranty time begins from the time the device is shipped, and lasts two years.

UNITEK undertakes no warranties for devices which have been modified for special applications.

During the warranty period, UNITEK will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. UNITEK specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by UNITEK.

For products returned to UNITEK for warranty service, the buyer shall prepay shipping charges to UNITEK and UNITEK shall pay shipping charges to return the product to the buyer.

However, the buyer shall pay all shipping charges, duties and taxes for products returned to UNITEK from another country.

The foregoing warranty shall not apply to defects resulting from:
- improper or inadequate repairs effected by the buyer or a third party,
- non-observance of the manual which is included in all consignments,
- non-observance of the electrical standards and regulations,
- improper maintenance
- acts of nature.

All further claims on transformation, diminution and replacement of any kind of damage, especially damage, which does not affect the UNITEK device, cannot be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed. This limitation does not affect the product liability laws as applied in the place of manufacture (i.e. Germany).

UNITEK reserves the right to change any information included this MANUAL.
All connection circuitry described is meant for general information purposes and is not mandatory.
The local legal regulations, and those of the standards authorities have to be adhered to. UNITEK does not assume any liability, expressively or inherently, for the information contained in this MANUAL, for the functioning of the device or its suitability for any specific application.

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The onus is on the reader to verify that the information here is current.