

# MANUAL

## Thyristor – Motor-Controller Classic C2.2 – 230/180 – 12f galvanic isolated



Industrie Elektronik  
G m b H

Hans-Paul-Kaysser-Straße 1  
71397 Leutenbach – Nellmersbach

Tel.: 07195 / 92 83 – 0  
Fax: 07195 / 92 83 – 129  
[info@unitek-online.de](mailto:info@unitek-online.de)  
[www.unitek-online.de](http://www.unitek-online.de)

**Edition / Version**

01/2014      V 02

**1 Content**

2 Basic - Information ..... 2

2.1 Safety advice ..... 2

2.2 Standards and guidelines: ..... 2

2.3 General and features..... 4

2.4 Technical data ..... 5

3 Mechanical installation ..... 6

3.1 Dimension ..... 6

4 Electrical installation ..... 7

4.1 Connection diagram ..... 7

4.2 Diagramm ..... 8

4.3 Components ..... 9

5 Adjustment..... 10

5.1 Adjustment functions..... 10

5.2 Command / Actual Value ..... 11

5.3 Armature voltage regulation..... 12

5.4 Current / Speed controller ..... 13

5.5 Adjustment without measuring instruments..... 15

6 Warranty ..... 17

6.1 Warranty ..... 17

## 2 Basic - Information

### 2.1 Safety advice

Electronic equipment is not fault proof.

**Attention – High voltage  
360-550V~, 450-550V=  
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!**



### 2.2 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:

EU Guidelines:	2004/108/EG, 2006/95/EG, 2006/42/EG 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 also be ensured that the machine or equipment are fitted with device independent monitoring and safety features.

**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 electricians
- 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.

**2.3 General and features**

**Thyristor-control-unit**

- for inductive and resistive devices

**Build / Compact single-circuit-board device**

- switch cabinet mounting a
- according to the VDE, DIN and EU regulations
- plug-in screw terminal
- fully isolated power semiconductor
- field rectifer

**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.

**Components**

- fully insulated thyristor-bridge, comfortably over-dimensioned
- only components customary in trade and industrially standardized are used
- LED displays
- precision potentiometers for fine adjustments
- DIP-Switch for system settings

**Characteristics**

- ✓ Speed control of direct-current motors
- ✓ 1 quadrant mode, propel
- ✓ Power up to 2160 Watt
- ✓ Tachometer regulation
- ✓ armature voltage regulation with I\*R compensation
- ✓ torque control
- ✓ Cascade control speed power
- ✓ Current-voltage characteristic is a rectangle
- ✓ on/off-switch logic
- ✓ direct switchable mains connection

<b>Caution:</b>			
<b>Tachometer regulation</b>			
Device is	>>>	galvanic isolated	
<b>Armature voltage regulation</b>			
Device is	>>>	high-resistive conection to the mains	
Control-reference (clamp 5) must not be earthed.			

2.4 Technical data

**Limits**

power connection		230V~ +10%/-15%
output voltage	max.	180V=
rated current	max.	12 A=
input current	max.	13,2 A~
power (electric)	max.	2160 W
field voltage		210 V=
field current	max.	1 A=

**Characteristic**

control range	(d.c. tachometer)	1:300
accuracy	(excluding feedback error)	0,1%
control range	(armature voltage)	1:50
accuracy		3%
control range	(torque regulation)	1:50
accuracy		3%
command value supply		12V=, 10 mA
input command value	max.	12V=
actual value	max.	-180V=
enable logic	tipsafe	enabling time 100mS

**Internal fuses**

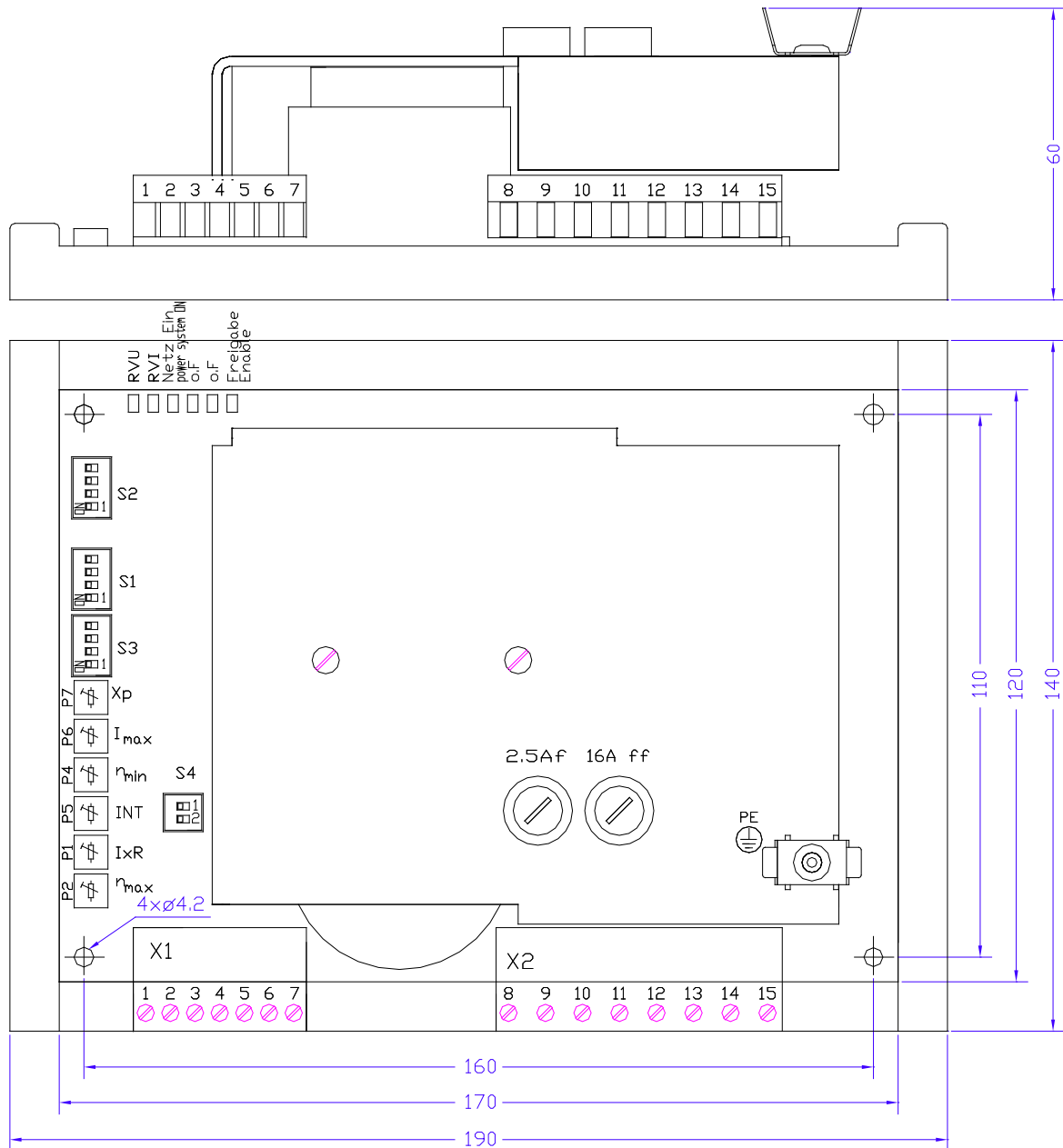
F1	2,5Af
F2	16 Aff

**Accessories**

mains choke	K78-16 F
isolation transformer	TE 17/3 F
smoothing choke	EI 135 A-12

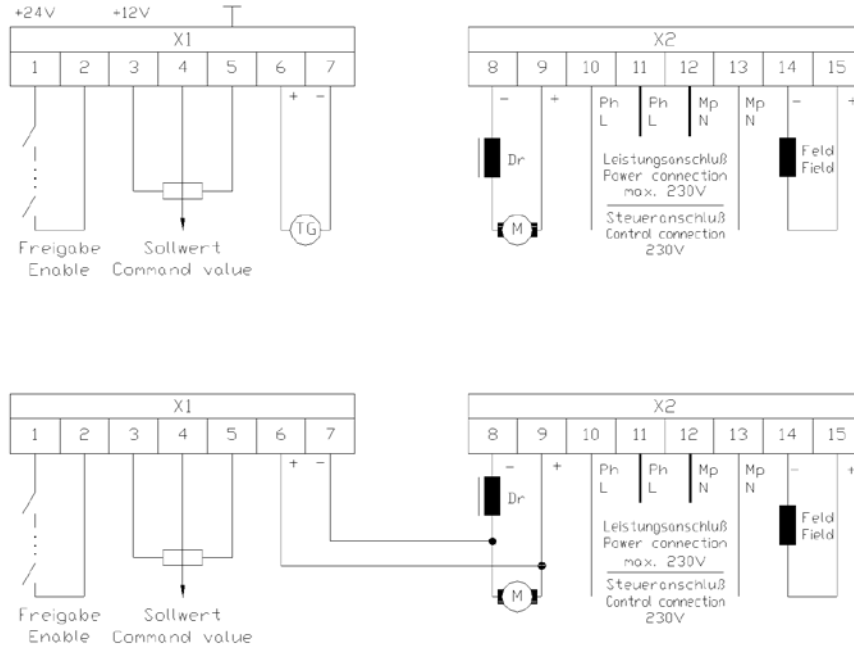
## 3 Mechanical installation

### 3.1 Dimension



## 4 Electrical installation

### 4.1 Connection diagram



### Power supply

#### Direct power supply

line	L	Clamp X2:11
neutral	N	Clamp X2:12
mains choke		K78-16F

#### Supply with isolation transformer

secondary voltage	230 V~
transformer type	TE 16/3 (F)
transformer fuse	16 A ff

### Motor connection

#### Motor – armature

positiv	clamp X2:9
negative	clamp X2:8

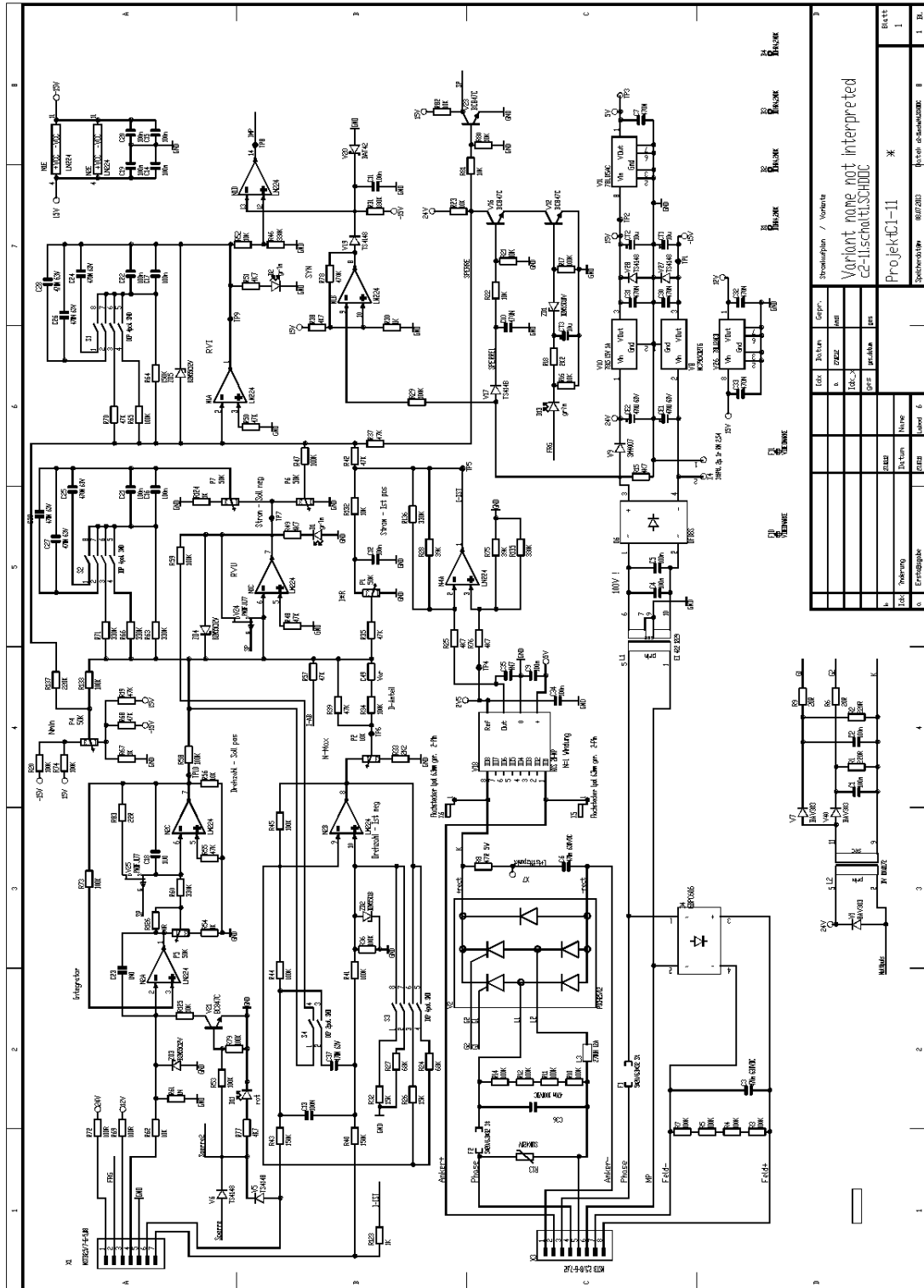
#### Motor-filed

positiv	clamp X2:15
negative	clamp X2:14

smoothing choke type	EI 135 A-12
----------------------	-------------



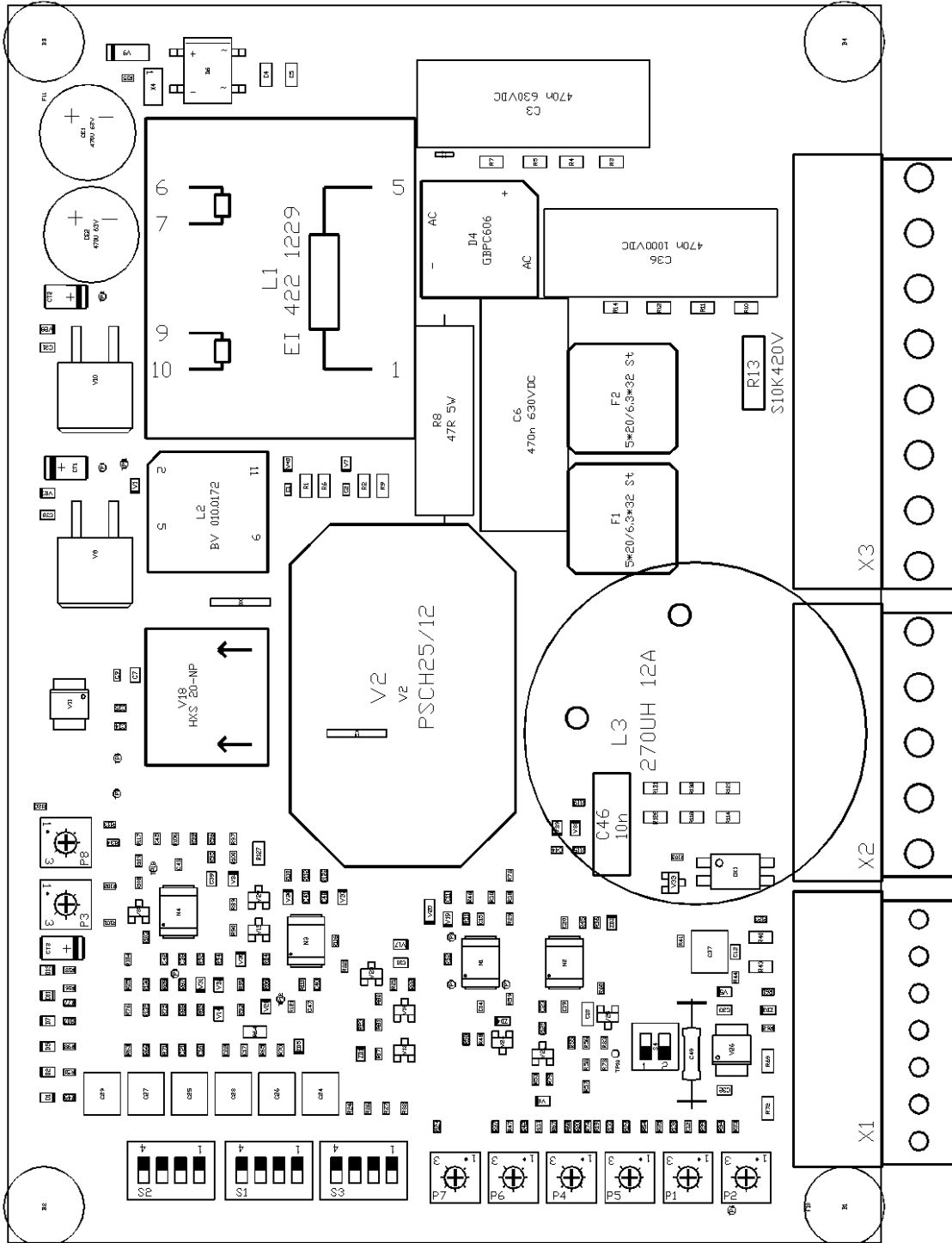
## 4.2 Diagramm



№	Имя	№	Имя
1	Имя	1	Имя
2	Имя	2	Имя
3	Имя	3	Имя
4	Имя	4	Имя
5	Имя	5	Имя
6	Имя	6	Имя
7	Имя	7	Имя
8	Имя	8	Имя

№	Имя	№	Имя
1	Имя	1	Имя
2	Имя	2	Имя
3	Имя	3	Имя
4	Имя	4	Имя
5	Имя	5	Имя
6	Имя	6	Имя
7	Имя	7	Имя
8	Имя	8	Имя

## 4.3 Components



## 5 Adjustment

### 5.1 Adjustment functions

Timing potentiometers			
No.	Abbreviation	Function	Range
P1	IxR	speed compensation when using armature voltage regulation	0 ... 40 %
P2	n <sub>max</sub>	fine adjustment maximum speed	80 ... 120 %
P5	INT	integration time limit	0,08 ... 5 Sek.
P4	n <sub>min</sub>	minimum speed	-0,2 ... +2 V
P6	I <sub>max</sub>	current limit	0 ... 100 %
P7	X <sub>P</sub>	amplification	3 ... ∞

Switches		
No.	Contact	Function
		<b>Current controller</b>
S1	1,2	integral-term
S1	3,4	proTermal-amplification
		<b>Speed controller</b>
S2	1,2	integral-term
S2	3,4	proTermal - amplification
		<b>Tachometer</b>
S3	1 ... 4	tacho-coarse balance
S4	2	tacho smoothing

### Default setup

#### Tachometer regulation

Switch on the position ON: S1-1, S1-4, S2-1, S2-3, S3-1 to S3-4

#### Armature voltage regulation 180V=

Switch on the position ON: S1-1, S1-4, S2-1, S2-3, S3-1 to S3-4

#### Torque regulation

Switch on the position ON: S1-1, S1-4, S4-1

**All other Switches on position OFF!**

## 5.2 Command / Actual Value

### Command value

Command value voltage

Command value potentiometer

input resistance

input voltage

resistance >1 kΩ (2,5 ... 10 kΩ)

50 kΩ

0 ... max. +12 V=

### Using a current source

external load resistance

12V / 20 mA = 0,6 kΩ

### Integrator

#### Setup

trimmer INT P5

turn clockwise to increase time

#### Range

0,08 up to 5 Sec.

### Actual Value

Tachometer regulation

DC - tachometer

a.c. – or three-phase current tachometer

tachometer voltage

IxR potentiometer

with rectification

maximum -180 V=

P1 counter-clockwise stop!

### Caorse adjustment of the tachometer (switches settings)

Tachovoltage	S3-1	S3-2	S3-3	S3-4
90 ... 180V	ON	ON	ON	ON
60 ... 140V	ON	OFF	ON	OFF
20 ... 60V	OFF	ON	OFF	ON
11 ... 20V	OFF	OFF	OFF	OFF

### Speed fine adjustment

#### Setup

trimmer

trimmer

turn clockwise to increase speed

$n_{min}P4$

$n_{max}P2$

#### range

-0,2 ... 2 V command value

50 % of coarse adjustment

**Achtung:** balance first  $n_{min}$  secondly  $n_{max}$  balance



## 5.3 Armature voltage regulation

Armature voltage regulation				
Adjustment switch S3				
Armature volt.	S3-1	S3-2	S3-3	S3-4
90 ... 180 V	ON	ON	ON	ON
60 ... 140 V	ON	OFF	ON	OFF
20 ... 60 V	OFF	ON	OFF	ON
11 ... 20 V	OFF	OFF	OFF	OFF

## Speed-fine adjustment

## Setup

trimmer  $n_{\min}$  P4trimmer  $n_{\max}$  P2

turn clockwise to increase speed

## Range

-0,2 ... 2V command value

50% of coarse adjustment



**Caution:** balance **first**  $n_{\min}$ , **secondly**  $n_{\max}$  balance

## IxR Compensation

- voltage drop caused by the internal resistance of the motor

- compensated by current proportional speed slope

## Setup

potentiometer IxR P1

turn clockwise to increase compensation

## Range

0 ... 40 %

-set speed to 10%

-increase load up to 100 %

-increase compensation

-load speed &gt;&gt;&gt; idling speed

**Caution:**

When using armature voltage control, than the ground of the unit is connected to line potential via high-ohm resistors.

## Torque regulation

-speed regulator amplification set to 1. Switch S4-1 closed

-switch S2 all contacts in OFF

-no tacho, no armature voltage

-switch S1-1, S1-4 closed

## 5.4 Current / Speed controller

### Current

#### Current limit

##### Setup

trimmer I<sub>max</sub> P6  
 turn clockwise to increase current limit  
 measure current

##### Range

0 ... 100 %

>>> amperemeter in armature circuit

#### PI-settings of the current regulator

Setup with switch S1

P-values	amplification	S1-3	S1-4
150 KΩ	0,68	OFF	OFF
60 KΩ	0,27	OFF	ON
35 KΩ	0,16	ON	OFF
26 KΩ	0,12	ON	ON

I-values	S1-1	S1-2
0,22 μF	OFF	OFF
0,8 μF	ON	OFF
1,2 μF	OFF	ON
1,8 μF	ON	ON

Integral – time constant = I-value x P-value x 4

### Speed controller

#### PI-setting of the speed regulator

Setup with DIP switch S2

P-values	amplification	S2-3	S2-4
330 KΩ	3,3	OFF	OFF
165 KΩ	1,65	ON	OFF
110 KΩ	1,1	ON	ON

I-values	S2-1	S2-2
0,22 μF	OFF	OFF
0,69 μF	ON	OFF
1,20 μF	OFF	ON
1,69 μF	ON	ON

Integral-time constant = I-value x P-value x 4

Setting	Amplification	Range
trimmer	X <sub>P</sub> P7	3 ... ∞
turn clockwise for more amplification		

Device not enabled, command value zero

## Switch on the mains

the motor must be at standstill without a torque

## Closed enable switch

LED D1 „Freigabe (=enable)“ must glow.

Slowly turn up command value potentiometer.

The motor must accelerate according to the command value voltage.

(if the motor accelerates straight up to top speed, the actual value

connection clamp 6-7 must be swapped).

## Speed adjustment

actual value-coarse adjustment >>> switch S3  
using 1V command value

with Poti  $n_{max}$  (P2) >>> setup 10% speed

with Poti  $n_{min}$  (P4) >>> setup minimum speed

10V command value

with Poti  $n_{max}$  (P2) >>> trim 100% speed

## Current adjustment

Amperemeter in armature circuit

turn Poti  $I_{max}$  to counter-clockwise stop

block motor (disconnect field)

with turning clockwise Poti's  $I_{max}$  (P6) >>> trim motor current

## Amplification speed regulation

default setup	P-Amplification I-term	S2 -3 = ON S2 -1 = ON	S2 -4 = OFF S2 -2 = OFF
large centrifugal mass	>>>	S2-2 S2-3	closed open
frictional load	>>>	S2-2 and S2-4 S2-1 and S2-2	closed open
Fine adjustment		Potentiometer XP (P7)	
turn right	>>>	LED D2 (RVU)	flickers
turn left	>>>	LED D2	shines steady

The brightness of LED D2 shows the current demand of the drive.

## 5.5 Adjustment without measuring instruments

Connect motor,

command value	=	10 %
<b>XP</b>	=	50 %
switch S2-3	=	ON
switch S2-4	=	OFF

Enable controller

Turn Potentiometer **XP** turn right until the drive swings.  
LED D1 (RVU) flickers.

### If there is no oscillation:

- Switch S2-3 in position OFF
- adjust oscillation with Potentiometer **XP**
- LED D1 (RVU) flickers
- turn Potentiometer **XP** left until the oscillation dies down
- LED D1 (RVU) shines steady
- turn **XP**-Poti 2steps left

Adjust S2-1 und S2-2 so , that the drive runs smoothly after about two oscillation when there was a command value jump off 50%.

### Response of the drive:

Amplification too low:  
long-period oscillations 1... 0.1Hz  
long overshoots

Amplification too high  
short-period oscillations 30 ... 200 Hz  
vibrates during acceleration



## Advice to EU-Regulation 89/336/EWG

The standards EN61000-2 und EN61000-4 will be observed under the following conditions:

### Tacho regulation

Device, mains choke or transformer and armature choke fixed on a 500x500x2 mounting board.  
Motor interference-suppressed with collector-capacitor.  
Mounting board and motor frame connected to earth with 10mm<sup>2</sup> wires.  
Clamp 5 connected to earth with 2.5 mm<sup>2</sup> wire.

### Power supply with mains choke:

Main choke with filter Type K 78-16 F  
Line length choke-device 200 mm  
Armature choke Type EI 135 A- 12  
Line length choke-device 200 mm

### Power supply with isolation transformer:

Transformer with filter Type TE 17/3 F  
Line length transformer-device 200mm  
Armature choke Type EI 135 A- 12  
Linelength choke-devive 200 mm

### Control signals:

All wires twisted <1.5 m – noc shield

## 6 Warranty

### 6.1 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.

**All rights are reserved.**

Copying, modifying and translations lie outside **UNITEK's** liability and thus are not prohibited.

**UNITEK's** products are not authorised for use as critical components in the life support devices or systems without express written approval.

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