

# MANUAL

3-phase Servo-Drive

**TVD3-230-xx-IN**

for ac synchro servo motors

with

an incremental encoder

TVD3-230-IN

**UNITEK**

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Ausgabe

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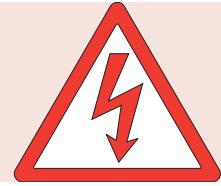
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# 1 Basic Information

Electronic equipment is not fault proof. This fact should be borne in mind for all possible operating conditions.

## ATTENTION - High voltage

AC 255V~, DC 400V=



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

If any uncertainty arises, the manufacturer or dealer should be contacted.

TVD3-230 devices are power electric parts used for regulating energy flow for power plants. Protection rating IP23.

### 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	89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG EN60204, EN50178, EN60439-1, EN60146, EN61800-3
IEC/UL	IEC364, IEC 664, UL508C, UL840
VDE Regulations	VDE100, VDE110, VDE160
TÜV Regulations	
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 operation of the devices is only permissible when the protective earth conductor (PE) is correctly connected!

If the protective earth conductor is not properly connected, bare housing parts may carry high voltages which are a danger to life!

The operation of the devices is only permissible when the switch cabinet is closed or secured. The control and power connections may be voltage-carrying without the axis operating!

The discharge time of the bus circuit is superior to 4 min!

Measure the voltage before any disassembly!

### Setting adjustments and installation

- should only be carried out by suitably trained personnel
- should only be carried out in accordance with health and safety guidelines
- should only be carried out when all voltages have been removed.

### QS

Test results are archived with the device serial number by the manufacturer.

### CE

The device adheres to the following: Guideline EU 89/336/EWG. EMV standards EN61000-2 and EN61000-4.

## General Information

The transistor 3-phase current servo-amplifier **SERVO-TVD3-230** in combination with the brushless dc motor (EC synchro-servo motor) provide a drive solution free of maintenance and with a wide dynamic control range. The drive displays the well-known good control characteristics of dc drives without the disadvantages of the carbon brushes' wear and the commutation limits.

The rotor moment of inertia is notably lower and the limit power is greater than with equally constructed dc motors. This results in up to 5 times higher acceleration values. The generated heat in the motor only occurs in the stator (cold shaft).

The motors always have the protection rating IP 65.

From the electrical view, the EC synchro motor is a synchro motor with a permanent magnet rotor and a three-phase current stator.

The physical characteristics correspond to those of dc motors, that is, the current is proportional to the torque and the voltage is proportional to the speed.

Current and voltage are precisely measured. The analog circuits are simply constructed.

It is possible to control the speed via the motor voltage, however, in order to achieve the best control precision, always the tacho control is used. The speed actual value is generated in the rotor position encoder plus incremental encoder).

The difference of the command value and the actual value is amplified in the speed control loop circuit (P-I-controller) of the servo-drive. This results in the current command value, which is transferred to the three phase current controllers by means of the rotor position signal. In the course of this the current magnetic field leads the rotor magnetic field by 90° electrically.

This field frequency is not controllable, it is automatically adjusted.

The motor currents are trapezoidal.

For dc and ac synchro servo amplifiers which are supplied by a dc bus, it must be checked that the energy is fed back into the bus during brake operation (winding machines, lifts, great centrifugal masses).

The ballast circuitry is rated for 3% duty cycle. An extended operating time can be achieved by additional external resistors. (Option)

### Information:

#### Further servo amplifiers for dc servo motors

For low power applications UNITEK SERVO-TV3&TV6, 24-120V, 6-12A  
UNITEK TV3.2

For high power applications UNITEK Classic Q2, Q6,  
up to 250V, 15-60A  
UNITEK TVQ6.2

#### Amplifiers for dc shunt-wound motors

From medium to highest power applications UNITEK Classic Q1, Q3,  
up to 550V, 15-2000A

#### Three-phase servo amplifiers for ac synchro servo motors

For low power applications UNITEK SERVO TVD3-2 -xx-bl, IN, RS,  
24-150V, 5-10A

For medium power applications UNITEK SERVO TVD6-2 -bl, N, RS,  
200V/400V, 5-25/40A

For high voltage applications UNITEK AS 250bl, AS 450RS  
UNITEK DS 400

For battery operation UNITEK series BAMO

# 1 Basic Information

## Applications

Machines and installations for all types with a drive power of up to 1.6kW.  
Especially as 4Q-servo-drive for feed axes where the following is required:

- high dynamic acceleration and braking cycles
- a wide control range
- high efficiency
- small motor dimensions
- highly repeatable, accurate and quiet moves
- 'cold shaft'

For speed or torque control or combined speed/torque control incorporated within or independent of position control loops.

Drives with constant speed as in conveyors, spindle drives, pumps, transversal or longitudinal pitch drives.

AC synchro-servo-drives are more compact than other electric drives.

## Particularly suitable for:

component equipment inserting machines, sheet-metal working machines, machine tools, plastic working machines, assembly machines, knitting and sewing machines, textile working machines, grinding machines, wood and stone working machines, metal working machines, food processing machines, robots and handling systems, conveyors, extruders, calenders, and many other machines and installations.

## Note

Use bl-drives where braking operations are predominant, e.g. when deceleration is mainly required:

- winding machines, lifts, great centrifugal masses

The braking energy is annihilated in the ballast circuitry or fed into the mains through the use of an external dc bus converter.

Energy compensation is possible for drives with several axes.

## Motor features

- protection rating IP 65
- compact
- suitable for rough surroundings
- suitable for high dynamic overload
- free of maintenance



## Build

- Switch cabinet mounting or 3HE plug-in device according to the VDE, DIN and EU regulations
- Standard analog control electronics
- Power electronics for 5A and 10A
- Galvanic isolation between the power connection and device ground (GND)

## Components

- IGBT power semiconductors, comfortably over-dimensioned
- Only components customary in trade and industrially standardised are used
- SMD basic equipment
- LED displays
- 4 position binary switches for system set-up
- Precision potentiometers for fine adjustment

## Characteristics

- \* Connection directly to the mains up to 230V~
- \* Potential-free control electronics
- \* Differential command value input
- \* Speed and torque control
- \* Static and dynamic current limiting
- \* Current command value output
- \* Measurement points for current and speed
- \* Enable logic
- \* Emergency stop
- \* Braking in case of a mains failure
- \* Temperature watchdog for the motor and the device

# 1 Basic Information

## Technical Data

### Power connection

Compact device	24V~ to 230V~ ±10%
Auxiliary voltage	20V~ +10%/-5%
	24V= +10%/-5%
Multiple axes combination with mains module	24V~ to 230V~ ±10%
Auxiliary voltage	20V~ +10%/-5%
Output voltage	max. 3 x 200V~

Specification				
Servo amplifier TVD3.230			5	10
Stationary current output	- continuous	A=	5	10
	-peak	A=	10	20
Max. el. power		W	900	1800
Max. dissipation power		W	45	75
Integrated quick ZW fuses		AF	12.5 - 16	12.5 - 16
Min. ballast resistance		Ohm	80	42
Dimensions - plug-in device		wxh	12TE/3HE	12TE/3HE
Cooling at	60% a. cyc.		self	self
	100% a. cyc.		self	fan
Dimensions - compact device		wxhxd	see 'Dimensions'	

Mains module TVD3-230N		10	30
Power supply	V= max.	1x 230V~	1x oder 3x 230V~
Output voltage	V= max.	360	
Output current	A= max.	10	30
Regen circuit with	V=	380	
Ballast power continuous	W	50	
Ballast power 1s	Ws	6000	

### Common specification

Protection rating	IP 23
Format	VDE 0100 group 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 by 2%/°C
Storage temperature range	-30°C to + 80°C
Speed control loop circuit	
- control precision	
without actual value error	± 0.5%
- control range	1: 1000

### Caution:

The maximum connection voltages 255V~, 360V= **must not** be exceeded even for short times.

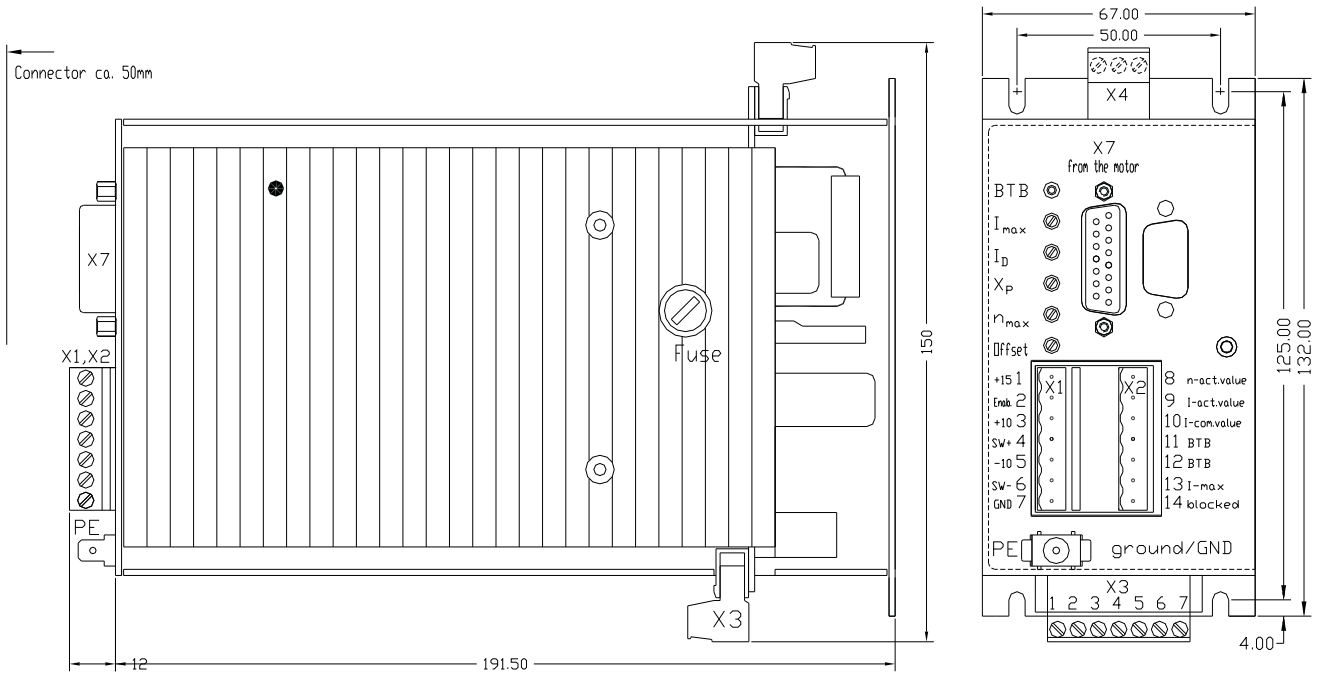
The regen circuit may be destroyed.



# Servo-Drive TVD3-230-xx-IN

Compact device

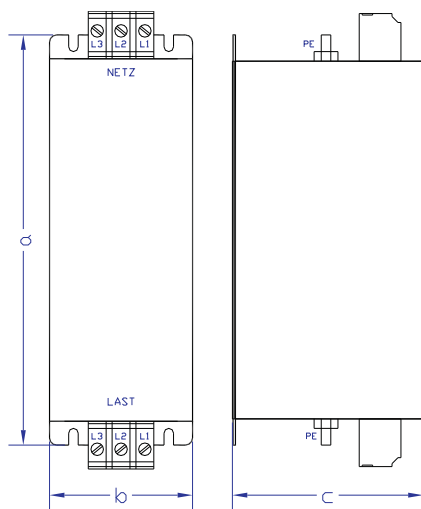
## Compact device dimensions



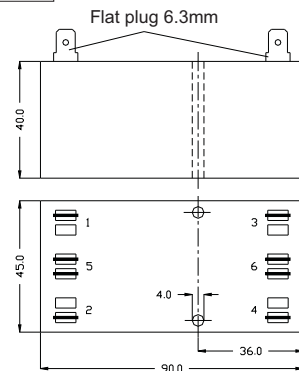
## Dimensions of the power line filters and chokes

Type	Voltage V~	Current A~	Dimensions hxwx d mm	Weight Kg
F250V-B90-16	1x250	1x16	45x90x40	0.32
FN3270H-35-33	3x480	3x35	66x180x70	0.50

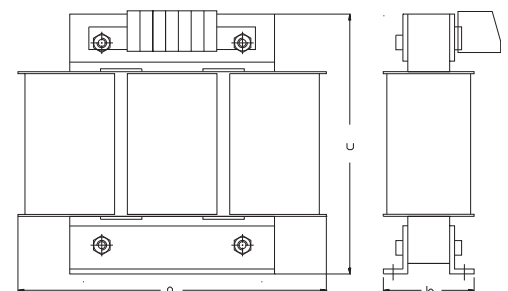
**F250-B90-16A**



**FN3270H-35-33**



Motor power chokes				
Choke type	Rated curr. A	Induct. mH	Dimensions a/b/c mm	Weight kg
MDD 1.3a	-2.5	3.5	80x48x90	1.1
MDD 1.6a	-5	1.9	95x54x108	1.3
MDD 1.6a	-10	1.0	95x58x108	1.4

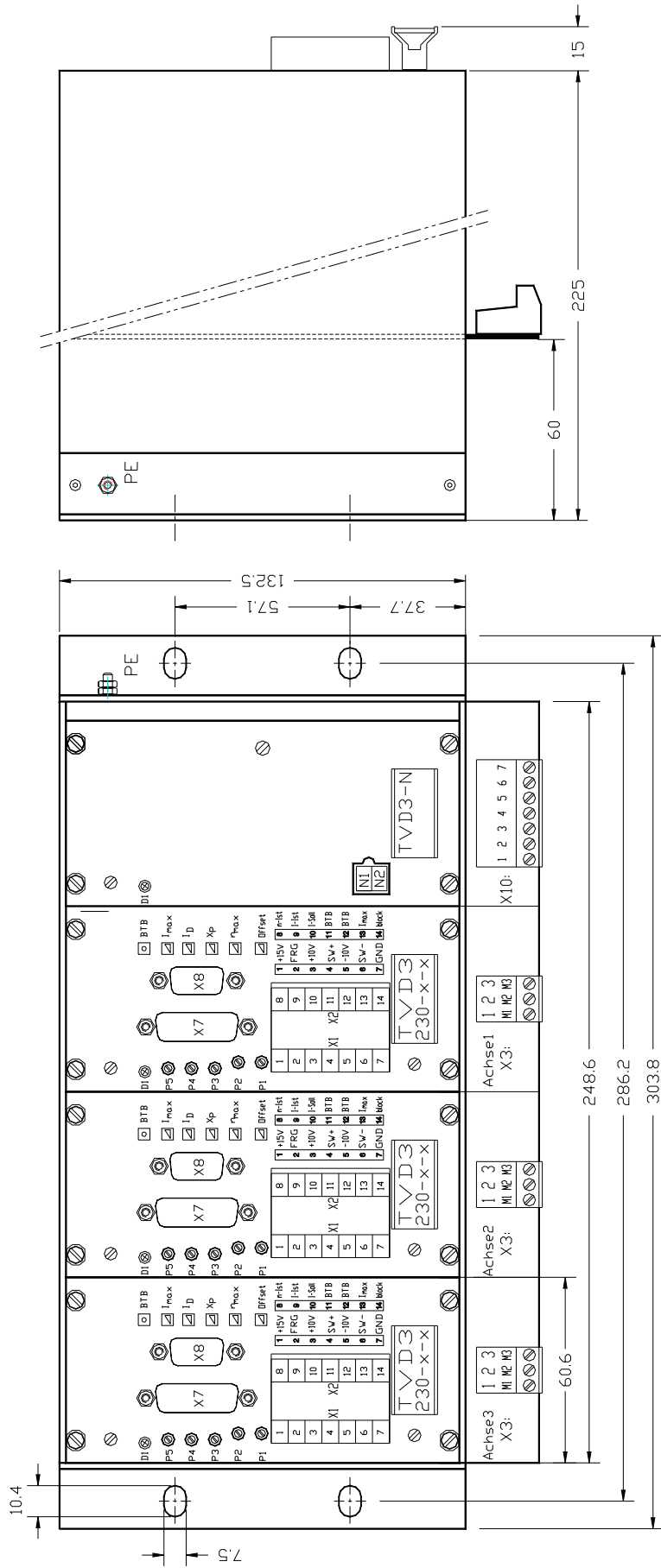
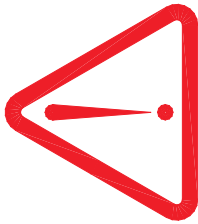




# 2 Mechanical Installation

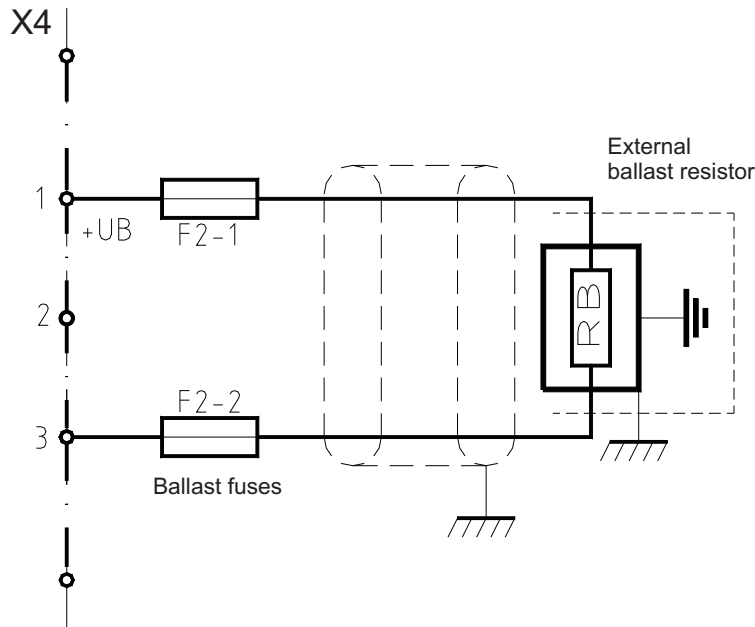
## Dimensions of a multiple axes combination

**Attention:**  
Do not switch on the amplifier  
before having fastened it with  
screws!  
Check the PE connection!



# Servo-Drive TVD3-230-xx-IN

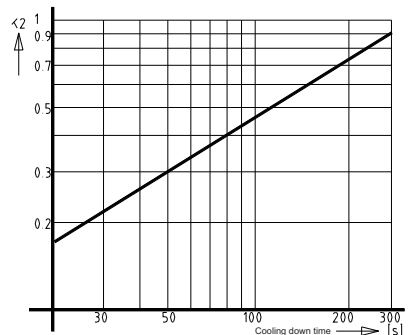
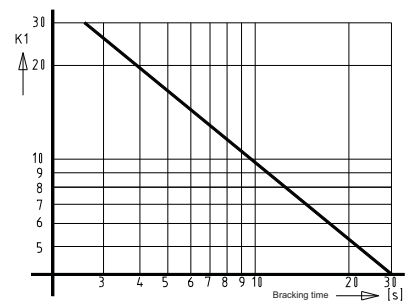
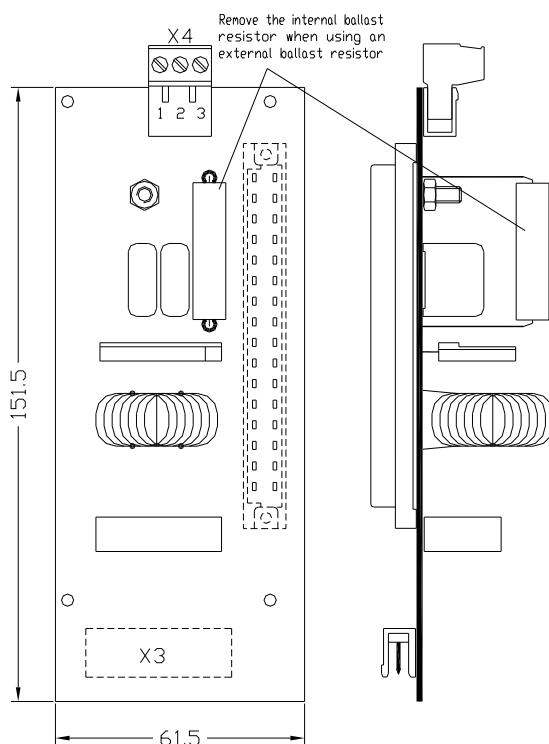
Regen circuit



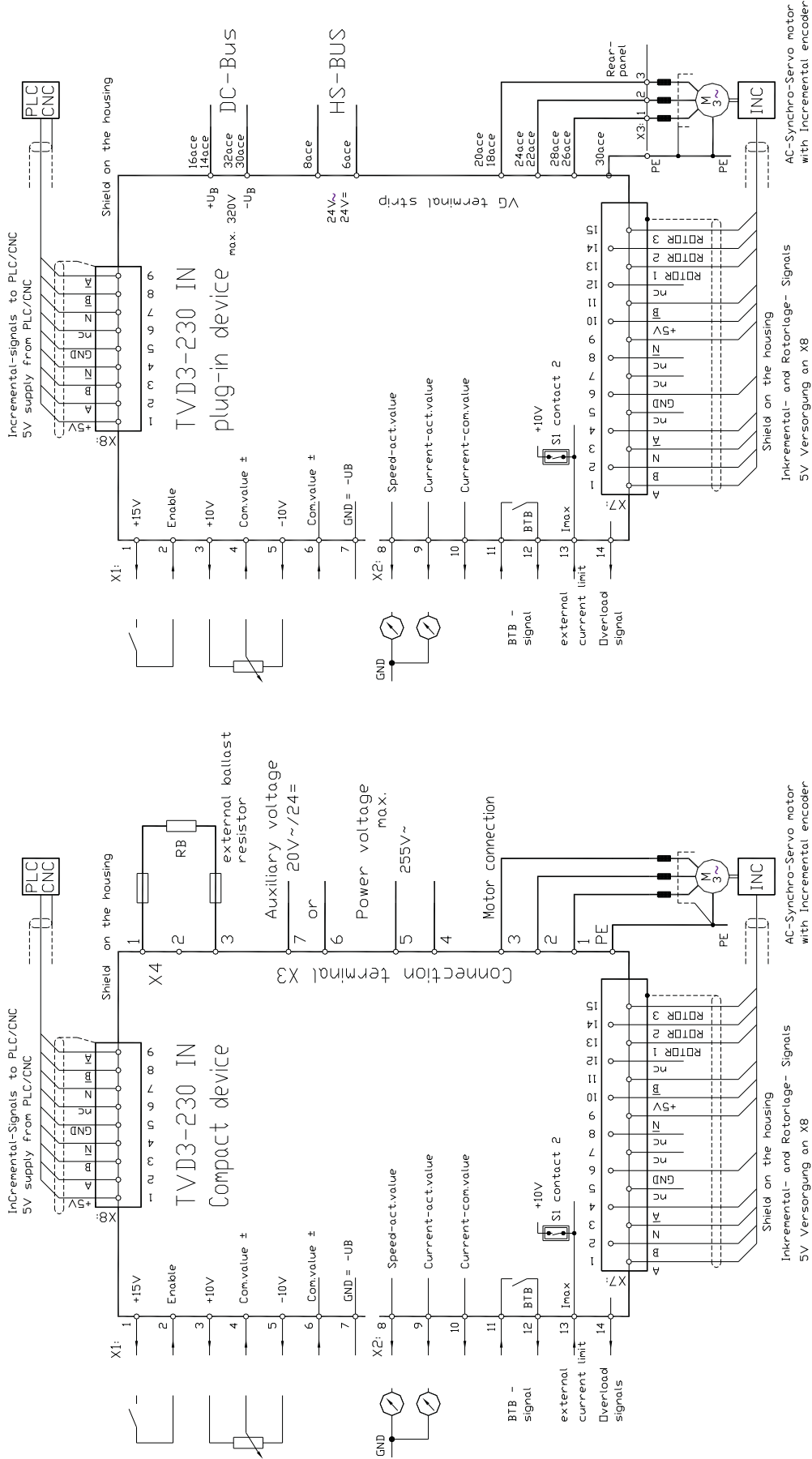
The energy arising during the braking operation is fed back into the bus circuit. The bus circuit capacitors can store only little energy. Any surplus of energy is transformed into heat in the ballast resistor in order to avoid an excessive voltage in the bus circuit.

The internal resistor has been rated for feed axes with small centrifugal masses.

Type TVD3-230-K	5A	10A
Internal resistance	100 Ohm	100 Ohm
Continuous power	50W	
Pulse power	6kW	
External resistance, min. Ohm	80	42
Fuse F2	6.3 AF	



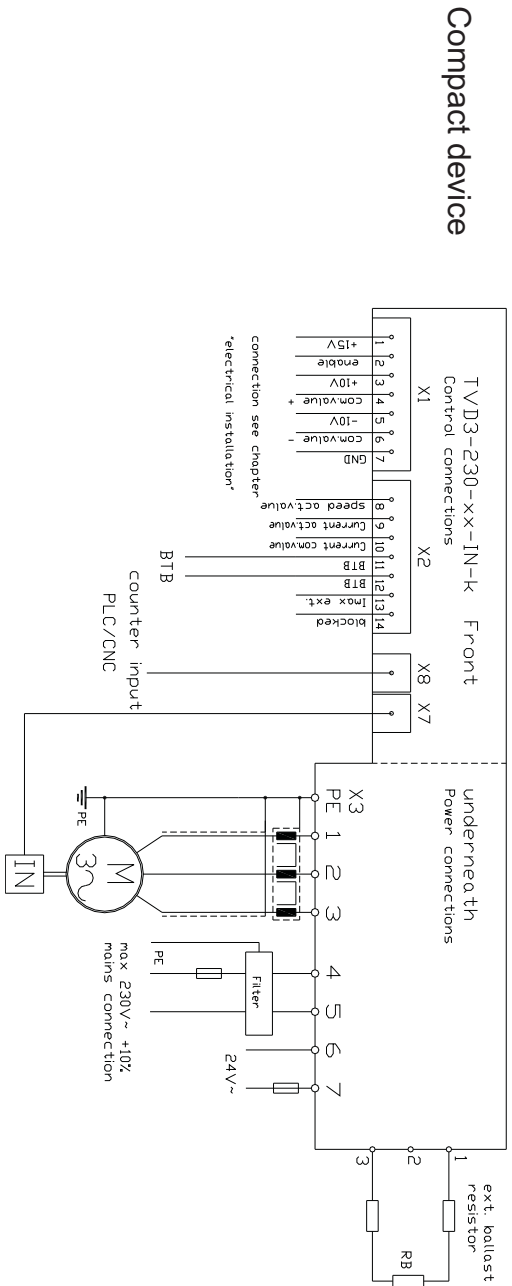
# 3 Electrical Installation



TVD-A788  
5.9.2000

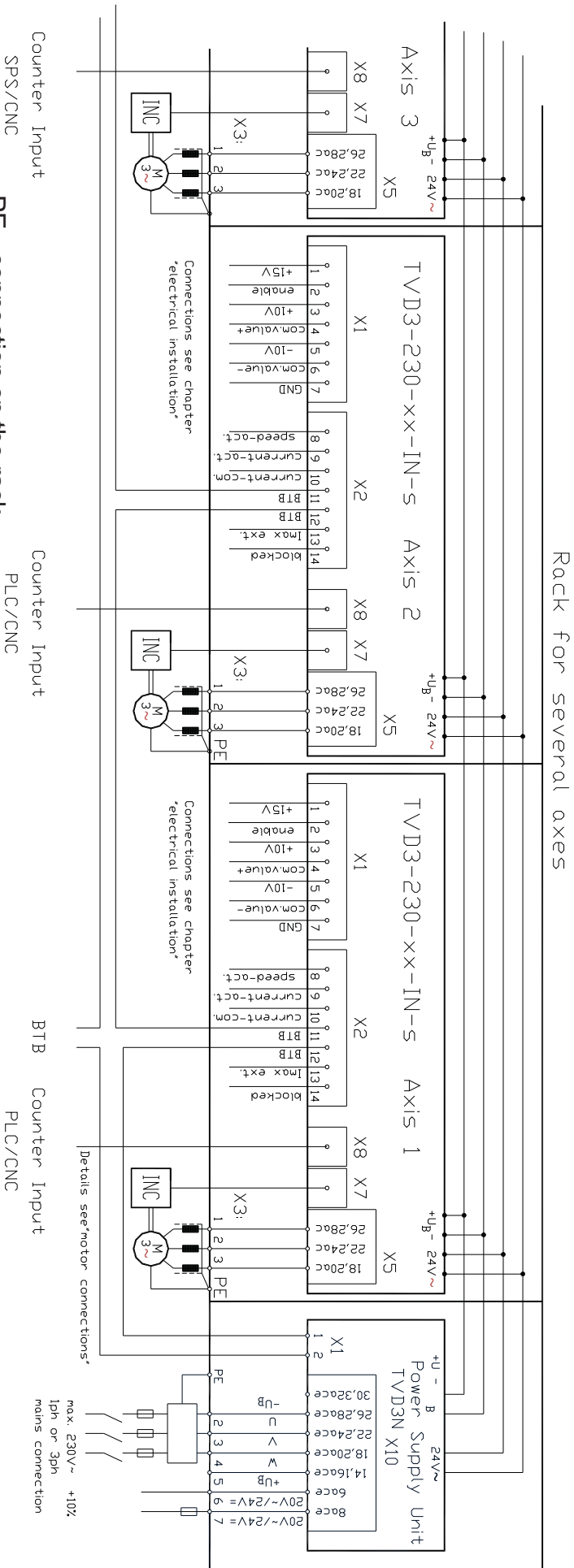
The operation of the devices is only permissible when the protective earth conductor (PE) is correctly connected!

# Servo-Drive TVD3-230-xx-IN



## Compact device

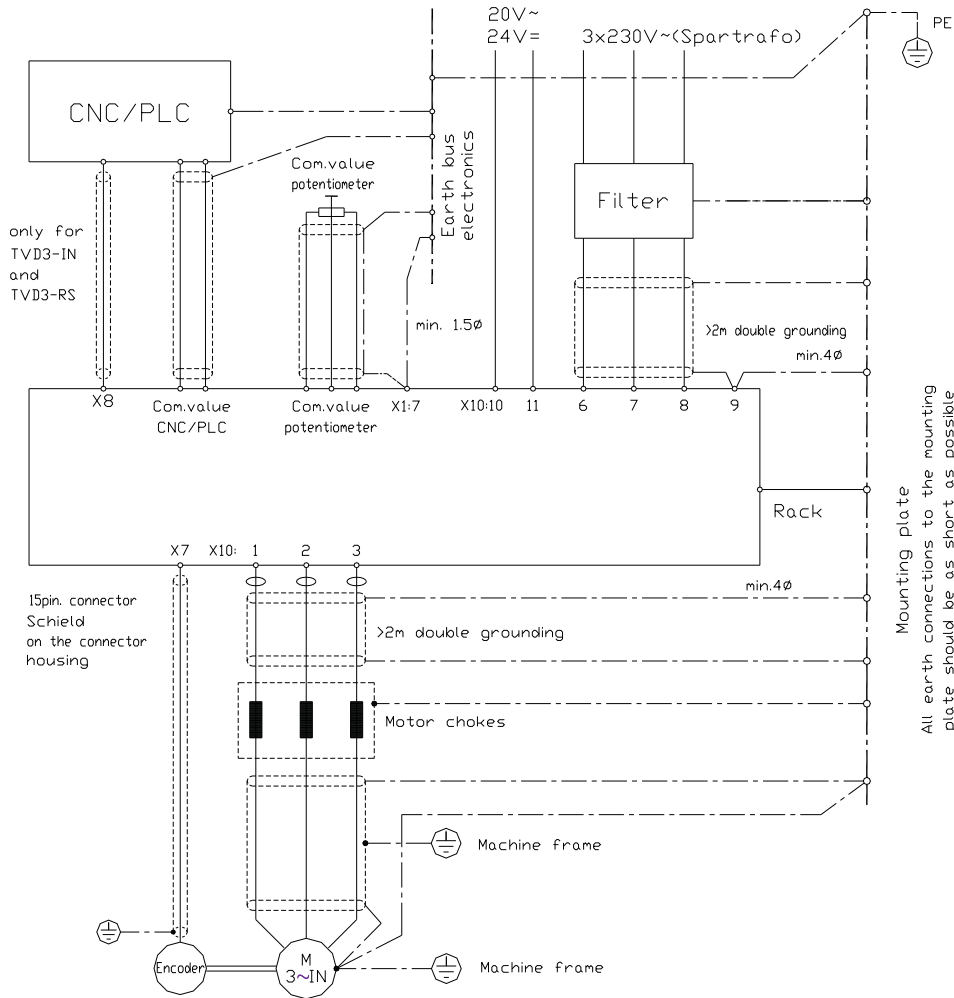
## Multiple axes combination



## Rack for several axes

## Connection diagram

# 3 Electrical Installation



## EMC Advice

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

- The device, the transformer, motor chokes and power line filter are conductively mounted on a 500x500x2 mm mounting plate.
- The mounting plate must be connected to ground using a 10mm<sup>2</sup> wire.
- The motor housing must be connected to ground using a 10mm<sup>2</sup> wire.
- The device ground X1:7 must be connected to the mounting plate using a 2.5mm<sup>2</sup> wire.
- PE bolt must be connected to the mounting plate using a 4mm<sup>2</sup> wire, l = 50mm.
- The rack ground screw must be connected to the mounting plate using a 4mm<sup>2</sup> wire, l = 50mm.

### Single-phase connection:

Filter type : F250V-B90-16  
 Conductor length between the device and the power line filter <100mm

### Three-phase connection:

Filter type : FN3270H-35-33

### Motor connection:

Motor conductor choke type: 5A= MD66-5 10A= MD78-10  
 Motor conductor l = 1.5m, 4-core, shielded.

Shield must be connected to the mounting plate on the device side as well as to the ground on the motor side.

### Connection of the control conductors:

All control conductors must be shielded, 1.5m. Shield must be connected to the ground.

## Warning:

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.

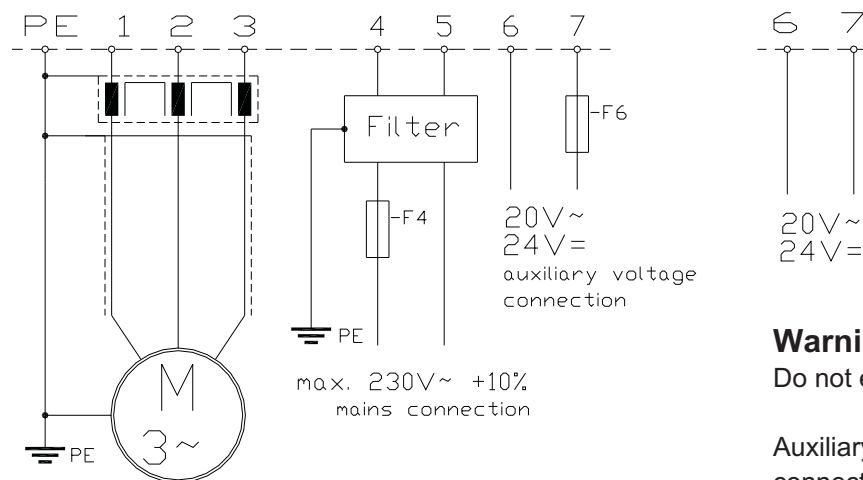
## Note:

- connection and operating instructions
- local regulations
- EU guideline 89/392/EWG
- VDE and TÜV regulations and Trade body guidelines
- CE and EMC advice



## Connection directly to the mains

### Connection of the compact device X3



## Warning:

Do not earth 20V~/24V=

Auxiliary voltage connection  
terminal X3:6, X3:7  
- from the mains module  
20V~/24V=  
- from the isolating transformer

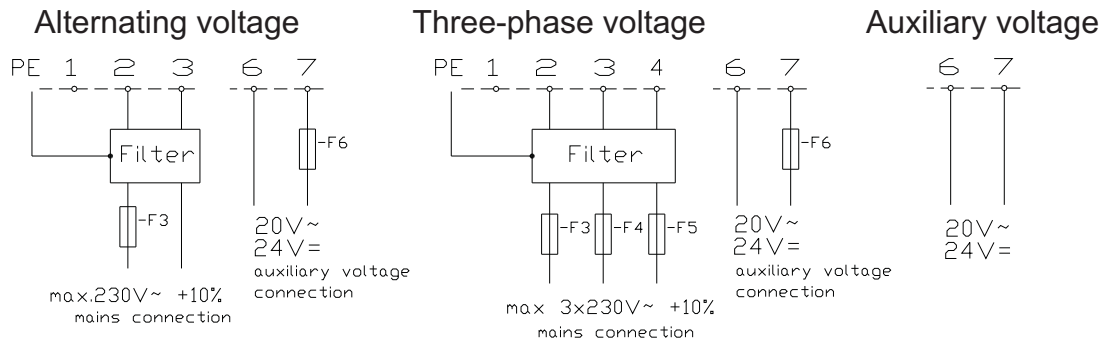
### Connection of the external ballast resistor

**Warning:** The maximum voltage 255V~ must not be exceeded!  
Check that the PE connection is correct!  
Auxiliary voltage 20V~ +10%/-5%



# 3 Electrical Installation

## Connection to the mains module X10



### Auxiliary voltage connection

terminal X3:6, X3:7

- from an external 24V~ source
- from the isolating transformer

### Warning:

- PE connection on the rack
- Do not earth 24V~



### Connecting cable

Dimensioning		5A-k	10A-k	Mains module 10A	Mains module 30A	Auxiliary voltage
Conductor cross-section	mm <sup>2</sup>	0.5	0.75	0.75	2.5	0.5
<b>Fuses</b>						
safety fuse	AF	6	10	10	25	1A
automatic cut-out - B	A	6	10	10	25	1A

### Motor power connection

Cable no.	PE	M1	M2	M3
Connection	PE bolt	X3:1	X3:2	X3:3

Motor cable for	5A	10A	thermo	brake
Cross-section	0.75	1.5	0.5	0.5

**Cable type** 3x motor conductor + PE **shielded**  
 + (if required: 2x thermo+2x brake)

### Shielding

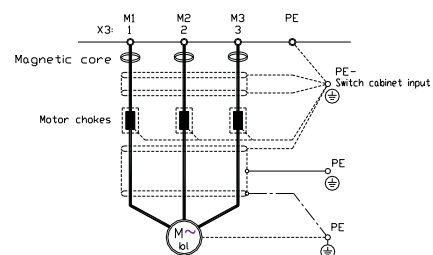
- with earth clamp
- directly to be connected to the switch cabinet input and to the motor
- multiple earthing in case of long conductor cables

### Magnetic cores

- against HF failures

### Motor chokes

- against LF failures
- against high leakage currents
- for motor efficiency



The connection advice is a general information and it is non-obligatory.

**Adhere to:**

- connection and operating instructions
- local regulations
- EU guideline 89/392/EWG
- VDE and TÜV regulations and Trade body guidelines



**Connection no. terminal connector**

X1:1 to X1:7 and X2:8 to X2:14

**Signal conductors**

Shielded and separated from power conductors, command value pairs twisted and shielded.

**Logic connections**

Relays with gold contacts or reed relays. Contact current 6mA

**Drive enable - internal logic voltage**

- internal logic voltage X1:1 +15V/10mA
- contact circuit between X1:1 and X1:2

**Drive enable - external logic voltage**

- drive enable voltage +10 to +30V X1:2
- GND X1:7

**Drive enabled**

- command value and speed control loop circuit are immediately active

**Drive disabled**

- emergency stop
- command value switched internally immediately to 0
- after 2 seconds speed control loop circuit is de-activated

**Braking in case of a mains failure**

Braking function

- command value switched to 0V in case of a mains failure
- max. braking time 150ms

Feed-back to the bus circuit



# 3 Electrical Installation

## Speed command value

Voltage source for command values  $\pm 10V$ , 10mA

+10V	X1:3
-10V	X1:5
GND	X1:7

## Command value inputs

- command value voltage max.  $\pm 10V$ =
- differential input
- input resistance 50 k $\Omega$
- relay contacts: use gold or reed contacts



## Attention:

Command value pairs should be twisted and shielded. The shield should be connected on one side only.

## Connections

Command value with an internal voltage source

Command value	X1:4 (signal)
	X1:7 (GND)

Bridge	X1:6 — X1:7
--------	-------------

## Command value from an external PLC/CNC voltage

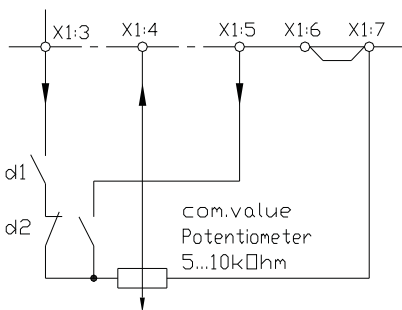
Command value	X1:4 (signal)
	X1:6 (GND)

## Command value current from an external PLC/CNC

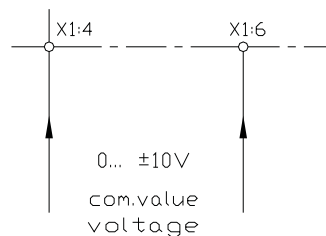
**Resistor** for a current command value of 0 to  $\pm 20mA$   $R_{com.} = 500\Omega$

Current command value	X1:4 (signal)
	X1:6 (GND)

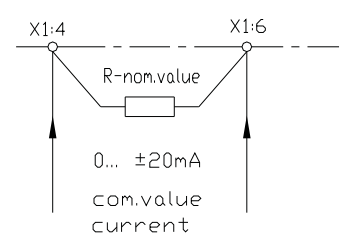
### Internal supply



### CNC/PLC



### Current command value



## Attention:

Do not use a command value current of 4 to 20mA !



# Servo-Drive TVD3-230-xx-IN

## External current limiting

Voltage source for an external current limit

+10V/10mA	X1:13
GND	X1:7

## Range

0 ... + 5V	>>>	0 to 100% rated device current
0 ... +10V	>>>	0 to 200% rated device current
internal over-current watchdog	>>>	max. 1sec.

## Current limit input

Max. input voltage +10V

Input resistance 10 kΩ

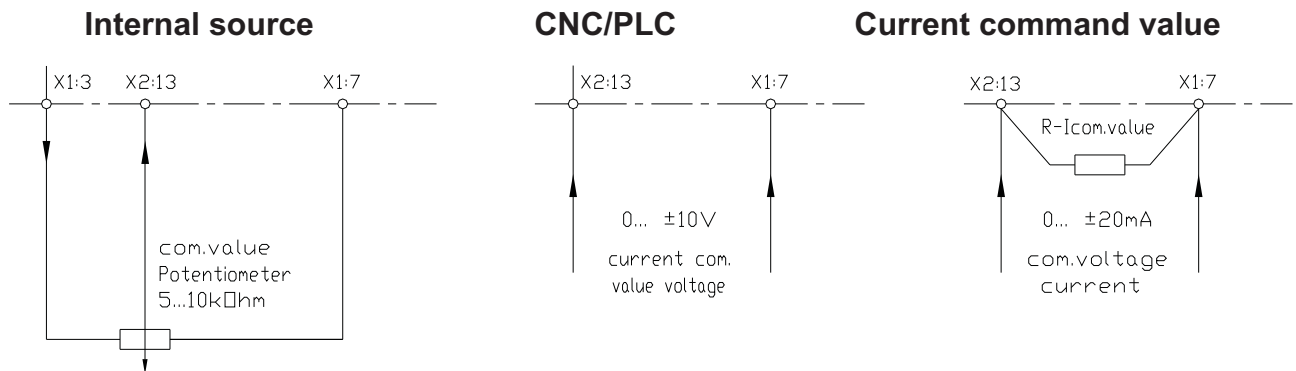
Internal attenuation with potentiometer  $I_{max1}$

Relay contacts: use gold or reed contacts

Switch S1, contact 2 = OFF

## Connections

Current limit	X2:13	(signal)
	X1:7	(GND)



## Attention:

When internally adjusting the current limit  
Switch S1 >>> contact 2 = ON



# 3 Electrical Installation

## Actual value connection

### Connector X7

- 15-pin D-connector
- metallized plastic housing
- shield connected to the housing

**Cable:** supply 2 x 0.5 plus signal 12 x 0.14 shielded

### Connections

Function	Colour (recommended)	Pin no.
Channel A	grey	1
Channel B	yellow	2
Channel N(Z)	black	3
Channel /A	white	4
Channel /B	green/white	11
Channel /N(/Z)	pink	9
+5 ± 0.2V 150mA	violet 0.5	10
GND	blue 0.5	6
Thermal sensor	red/white	6
Thermal sensor	orange	12
Rotor position 1	brown	13
Rotor position 2	green	14
Rotor position 3	red	15

Pin no. 6 is double-coated.

For motors without thermal sensor >> bridge between pin no. 6 and 12

### Attention:

It is absolutely necessary to observe the motor-specific connection data sheets. Appendix A



### Connector X8

- 9-pin D-connector
- metallized plastic housing
- shield connected to the housing

**Cable:** supply 2 x 0.5 plus signal 12 x 0.14 shielded

### Connections

Function	Colour (recommended)	Pin no.
Channel A	grey	2
Channel B	yellow	3
Channel N(Z)	black	7
Channel /A	white	9
Channel /B	green/white	8
Channel /N(/Z)	pink	4

Incremental encoder supply

+5/150mA	violet 0.5	1
GND	blue 0.5	5

**Always connect +5V and GND!!!**

## Drive ready - BTB signal

### Relay RL1

Signal contact X2:11 - X2:12  
Switch rating max. 48V, 0.5A

The BTB contact signals to the PLC/CNC that the drive is functional.  
The BTB signals of several axes can be connected in series.

Delay time after switching on the power supply >>> max. 1sec.

### Display

Drive ready	LED bright green	contact closed
Drive not ready	LED bright red	contact open
Fault	LED bright red	contact open

### BTB contact drops in case of

over-temperature controller, motor	saved
over-voltage	saved
short-circuit, short-circuit to earth	saved
voltage error	not saved
bus circuit error	not saved

To clear the error re-enable the drive (switch off/on)

### Attention:

**In any case** the BTB contact (drive ready) must always be used with the CNC/PLC or wired into the emergency stop circuit.

It is possible that the drive initiates motion without being instructed to do so.

Fault memory

Fault saving is not effective for all errors!



### Signal blocked

Current demand	normal	Overload
Output X2:14	>+12V	<+2V

### Analog parameter measurement outputs

Function	Motor current	Speed
Connector	X2:9 - X1:7	X2:8 - X1:7
Measured value	2,5V = Type current 5,0V = peak current unipolar positive	Tacho voltage at the input of the divider bipolar
Output resistance	1 kΩ	4.7 kΩ

# 3 Electrical Installation

## Control connections

Function	Terminal no.
+ 15 Volt (for enable)	X1: 1
Enable input(+10 to +30 Volt)	X1: 2
+ 10 Volt (for command value)	X1: 3
Command value + input	X1: 4
- 10 Volt (for command value)	X1: 5
Command value - input	X1: 6
GND	X1: 7
Speed actual value output	X2: 8
Current actual value output	X2: 9
Current command value output	X2: 10
BTB contact	X2: 11
BTB contact	X2: 12
External current limit input	X2: 13
blocked output	X1: 14

## Power connections - compact device

Function	Terminal no.
Motor 1	X3: 1
Motor 2	X3: 2
Motor 3	X3: 3
Power	X3: 4
Voltage	X3: 5
Auxiliary voltage	X3: 6, X3: 7
external ballast resistor	X4:1-X4:3

## Power connections - plug-in unit

Function	Plug-in connector	Terminal no.
Bus circuit - (UB-)	X5: 30, 32 ace	
Motor 1	X5: 26, 28 acc	X3: 1
Motor 2	X5: 22, 24 ace	X3: 2
Motor 3	X5: 18, 20 ace	X3: 3
Bus circuit + (UB+)	X5: 14, 16 ace	
20V~/24V=	X5: 8 ace	
20V~/24V=	X5: 6 ace	

## Mains module - plug-in unit

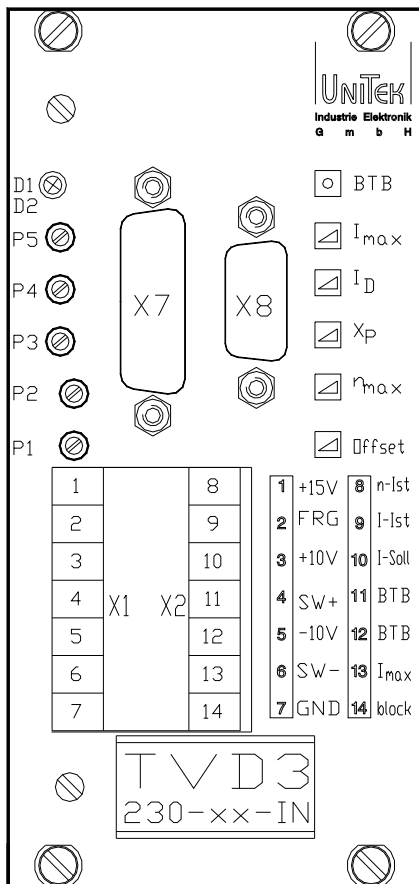
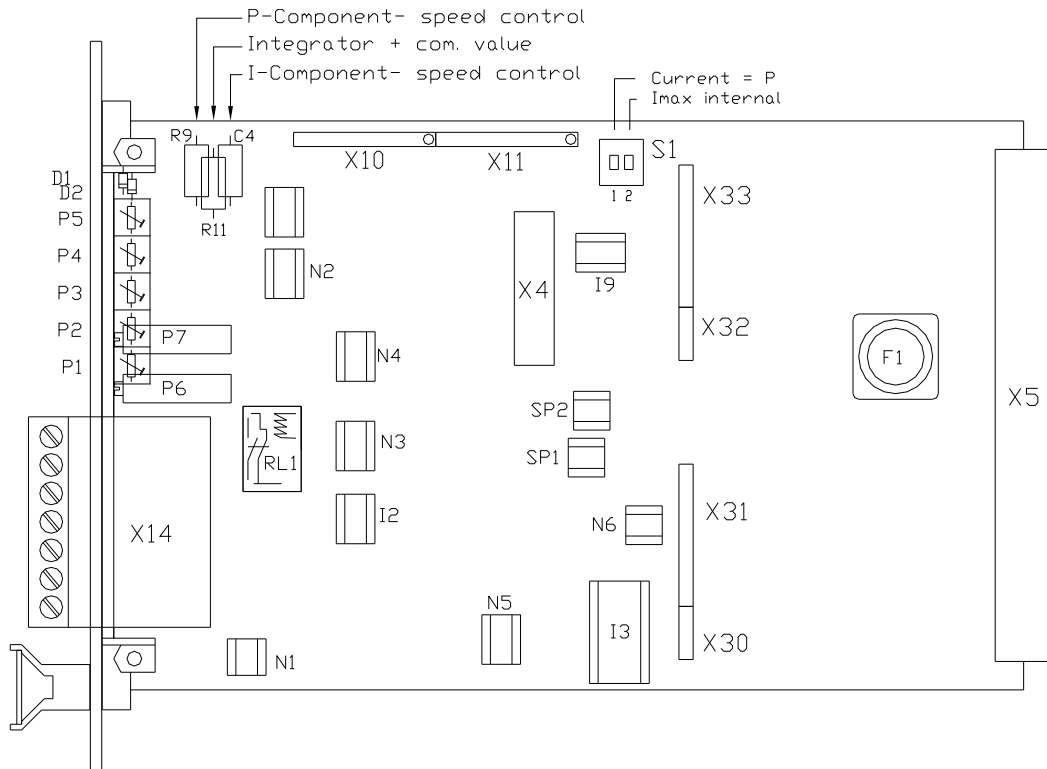
Function	Plug-in connector	Terminal no.
Bus circuit - (UB-)	X5: 30, 32 ace	X10: 1
Power U	X5: 26, 28 acc	X10: 2
Power V	X5: 22, 24 ace	X10: 3
Power W	X5: 18, 20 ace	X10: 4
Bus circuit + (UB+)	X5: 14, 16 ace	X10: 5
Auxiliary voltage	X5: 8 ace	X10: 6
	X5: 6 ace	X10: 7

**Encoder connections** (see page 19)

**PE connection** on the housing or the rack

# Servo-Drive TVD3-230-xx-IN

## Components



### Display

**D1 green**

**BTB**

**D2 red**

**fault**

### Potentiometer

P5

$I_{max}$

P4

$I_D$

P3

$X_P$

P2

$n_{max}$

P1

offset

### Connector

X7

encoder input

X8

encoder output

X1:1

+15V

X1:2

enable

X1:3

+10V

X1:4

com. value + (-)

X1:5

-10V

X1:6

com. value - (+)

X1:7

GND

X2:8

n-act. value

X2:9

I-act. value

X2:10

I-com. value

X2:11-12

BTB contact

X2:13

ext. current limit

X2:14

blocked

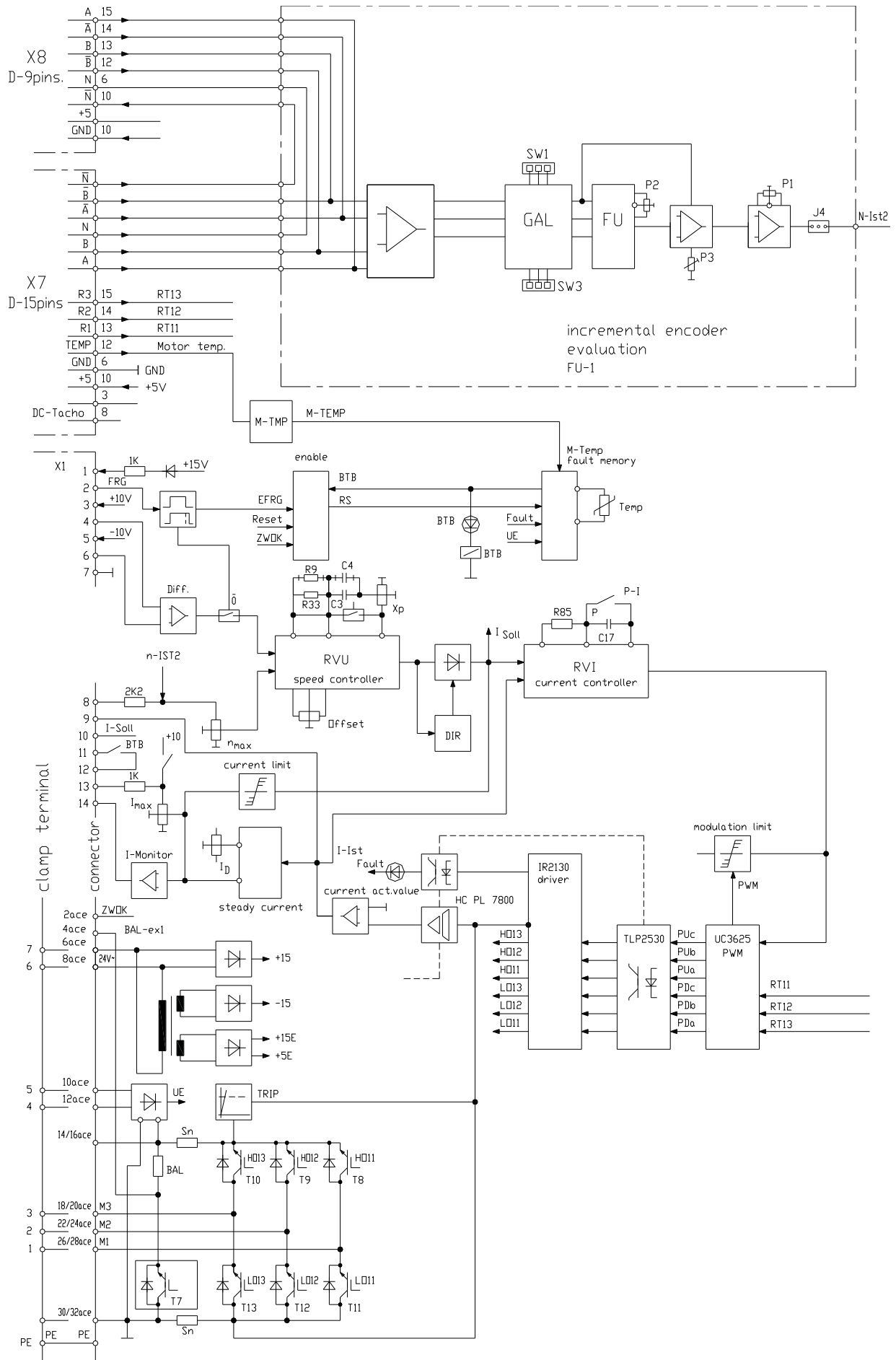
# 4 Device Overview

---

Free

# Servo-Drive TVD3-230-xx-IN

## Circuit diagram





# 4 Device Overview

## Adjustments

### Function

Actual value adjustment

Internal current limit

External current limit

Continuous current

Amplification P-component

Amplification I-component

Integrator

Zero adjustment

### Component

Poti P2 ( $n_{max}$ )

Switch S1 > contact 2=ON  
Poti P5 ( $I_{max}$ )

Switch S1 > contact 2=OFF  
Poti P5 ( $I_{max}$ )

Poti P4 ( $I_D$ )

Resistor R9  
Poti P3 ( $X_P$ )

Capacitor C4

Resistor R11

Poti P1 (offset)

Switch S1			
Function	contact	ON	OFF
Current limit	2	internal	external
Current amplification	1	P	PI

LED display		
BTB	green	LED D1
fault	red	LED D2

Signals outputs		
Function	Designation	Terminal no.
Speed	n-actual value	X2:8
Current	I-actual value	X2:9
Current comand value	I-command value	X2:10
blocked	+12V/10mA	X2:14
BTB - contact	BTB fault	X2:11, X2:12

## Adjustments

- to be carried out only by qualified personnel
- observe all safety regulations
- follow the correct adjustment sequence

## Pre-settings

Actual value	>>> switch S1 (on FU1-x)
Current limit internal/external	>>> switch S1, contact 2
Current control P- PI	>>> switch S1, contact 1

## Optimisation

Actual value adjustment	$n_{max}$ adjustment
Current control	switch S1, contact 2 (stand. set-up > ON)
Current limits	$I_{max}$ , $I_D$ -a djustment
Speed control	$X_P$ - adjustment, variable components
Zero point	offset adjustment
Path-/position control	in the CNC/PLC

## Attention:

Always optimise beginning with the innermost control loop and work out. Sequence: current loop>speed loop>position loop (CNC/PLC)

Test points		
Measurement	max.	Connector
Command value	$\pm 10V$	X1:4
Speed act. value at the output of the divider	$\pm 5V$	X2:8
Current actual value unipolar	+ 5V	X2:9
Current com. value (control function speed controller)	- 10V	X2:10

Command value		
Function	max.	Connector
Input signal	$\pm 10V=$	X1:4
Input GND		X1:6
Signal- and GND connection can be swapped.		

## Command value as current signal

Command value from an external current source      0 to  $\pm 20mA$   
 External load resistance for the command value      0 to max.  $\pm 10V$

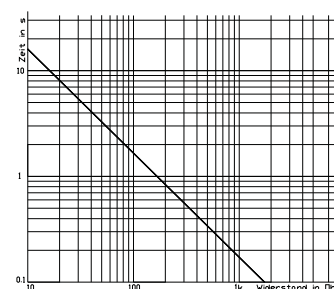
Com. value resistance  $R_{-com}[\Omega] = \text{com.value voltage} / \text{com. value current (max. } 500\Omega)$

## Command value integrator

Integration time = R11 (see table below)

## Attention:

Do not use a command value current of 4 to 20mA.



# 5 Adjustment

## Speed actual value from the incremental encoder

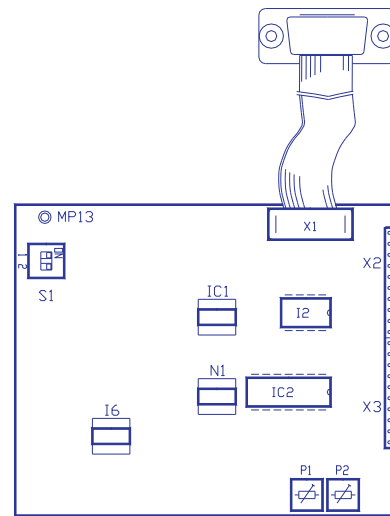
### Evaluation electronics subprint FU 1-x

**Attention:**

Observe in any case the motor-specific connection data sheets (see appendix A).

**Connection test**

Motor turning anti-clockwise  
(looking onto the rear side of the motor, DIN)  
There is only one correct connector configuration.



**Rotor position encoder**

Signal sequence X7:15//X7:15+X7:14//X7:14//  
X7:14+X7:13//X7:13//X7:13+X7:15//

**Tacho signal X2:8**

uniform speed-proportional voltage, no sawtooth voltage

**Pre-settings - with switch S1**

Adjustment range of the potentiometer n <sub>max</sub> at a com. value of 10V							
Pulse encoder on the motor Pulses	Switch position		Multipl. factor  x	Adjustment range 1/min		Frequency	
	S1-1			n <sub>max</sub>	Poti- position kHz		
	On	OFF			left		right
1024	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4	950	1700	64 ... 116	
1024	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	1900	3400	64 ... 116	
1024	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	3800	7000	64 ... 116	
2048	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	950	1700	64 ... 116	
2048	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	1900	3500	64 ... 116	

**Attention:**

Speeds <950 or 1700...1900 are only possible by adapting the command value.  
Frequency limit 20 kHz

**Command value from the potentiometer:**

- with a 1V command value: adjust the speed to 10% of the maximum required
- with a 10V command value: make fine adjustment to achieve 100% (max. speed).

**Command value from a CNC/PLC:**

- with a 0.8V command value: adjust the speed to 10% of the maximum required

**Direction change:**

Swap the command value connections X1:4, X1:6



## Current limiting

Peak current	range 0 to 200% rated current Poti $I_{max}$ (P5) max. reset time 1sec.
Continuous current	range 5 to 100% rated current Poti $I_D$ (P4)

### Internally resetting current limits

Current limit	Function	Limit
Overload	Time	Continuous current
Signal to X2:14	blocked	
The lowest current limit is effective!		

### Peak current

Internal current limit (standard set-up)		
Adjustment	Switch	Poti
$I_{max}$	S1, contact 2=ON	$I_{max1}$ (P5)

External current limit			
Adjustment	Input	Switch	Poti
$I_{max}$	X1:9 0 to +10V	S1, Kontakt 2=OFF	$I_{max1}$ (P5)
The external current limiting voltage can internally be reduced by means of the potentiometer $I_{max}$ .			

### Continuous current

The motor protection for both torque directions is adjusted to motor rated current by means of the potentiometer  $I_D$  (P4).

### Measuring adjusted values:

- Do not connect motor
  - Set the command value and enable >>> switch off/on
- Measured current command value X2:10 (5V = rated current)

Command value	Measured value $I_{max}$ (approx 1sec.)	Measured value $I_D$
+5V	0 bis max.10V	0.25 bis max. 5V
- 5V	0 bis max.10V	0.25 bis max. 5V

### Current actual values

Measured current act. value X2:9  $I_{max}$  = 0 to +5V  
 $I_D$  = 0.12 to +2.5V

### Attention:

for an exact torque control:

- a PI-current control switching is necessary
- the device is adjusted to P-control in the factory
- change from P to PI control in the current control loop



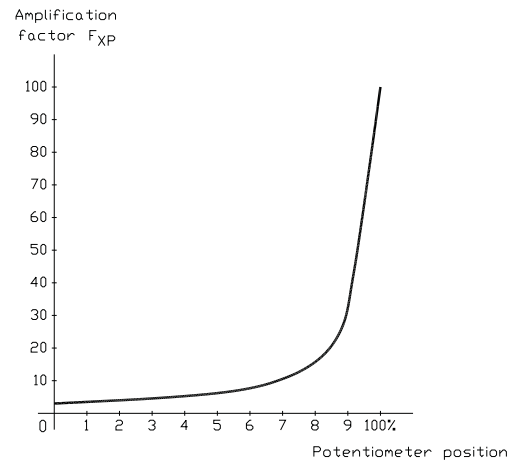
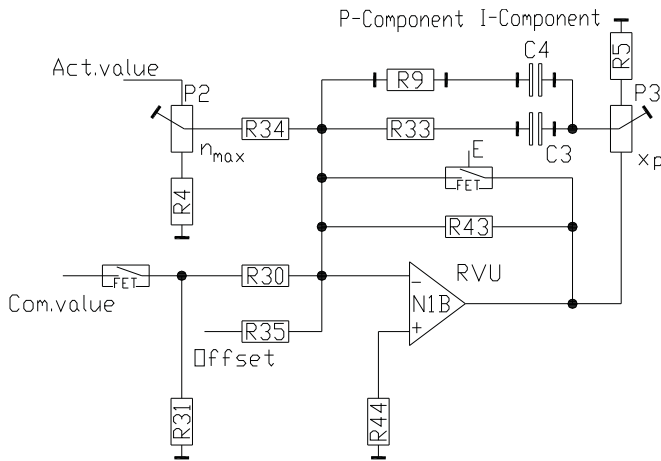
# 5 Adjustment

## Speed control loop circuit

- variable components R9, C4
- amplification potentiometer P3 (X<sub>P</sub>)
- Take over the adjusted values when the device is exchanged

## Standard set-up

- fixed R, C values: 220kΩ, 22nF
- amplification potentiometer X<sub>P</sub> to 50%
- suits the majority of drives



## Adjustment without measurement equipment

- Connect the motor,
- |                |                |
|----------------|----------------|
| command value  | = 0            |
| X <sub>P</sub> | = 50%          |
| R, C           | = basic values |

## Enable the drive

- Turn the potentiometer X<sub>P</sub> clockwise until the axis begins to oscillate
- Turn the potentiometer X<sub>P</sub> anti-clockwise until the oscillations disappear
- Turn the potentiometer X<sub>P</sub> another 2 clicks anti-clockwise

Drive behaviour:	
Amplification too low	amplification too high
Long-wave oscillations 1 to 0.1Hz	short oscillations 30 to 200Hz
Large overshoots	vibrates during acceleration
Overruns destination position	vibrates during braking and in position

## Attention:

Drive connected to CNC/PLC controllers

For the maximum speed output from the controller, adjust the speed command value to between 8V and 9V by means of the potentiometer n<sub>max</sub>.



## Standard set-up

Before commissioning check the following connections

Nominal power supply	24V~ ... 230V~	±10%
Auxiliary voltage	20V~/24V=	+10%/-5%

**Caution:** The maximum voltage must not be exceeded even for short times



## Power connections

- Protection earth	PE contact
- Mains + auxiliary voltage	1x or 3x 230V~ + auxiliary voltage 20V~/24V=
- Motor	3x motor conductors + protect. conductor + shield
- Encoder connection	observe the motor-specific connection data sheets

## Compact device

- Power supply	compact	terminals X3:4, X3:5,
- Auxiliary voltage	compact	terminals X3:6, X3:7
- Motor connection	compact	terminals X3:1, X3:2, X3:3
- Protective conductor		earth connection on the housing
- Motor earth connection		earth connection on the housing

## Multiple axes combination

- Power supply	mains module	terminals X10:2, X10:3, X10:4
- Auxiliary voltage	20V~/24V=	terminals X10:6, X10:7
- Motor connection	axis	terminals X3:1, X3:2, X3:3
- Protection earth		earth screw on the housing
- Motor-earth connection		earth screw on the housing

## Always observe the connection advice

**Encoder connection X7** observe the motor-specific connection data sheets (see appendix A)

## Control connections

- Enable	contact between X1:1 and X1:2
- Command value	signal X1:4, GND X1:6 in case of an internal poti supply, bridge between X1:6-X1:7

## Standard set-up for the first commissioning

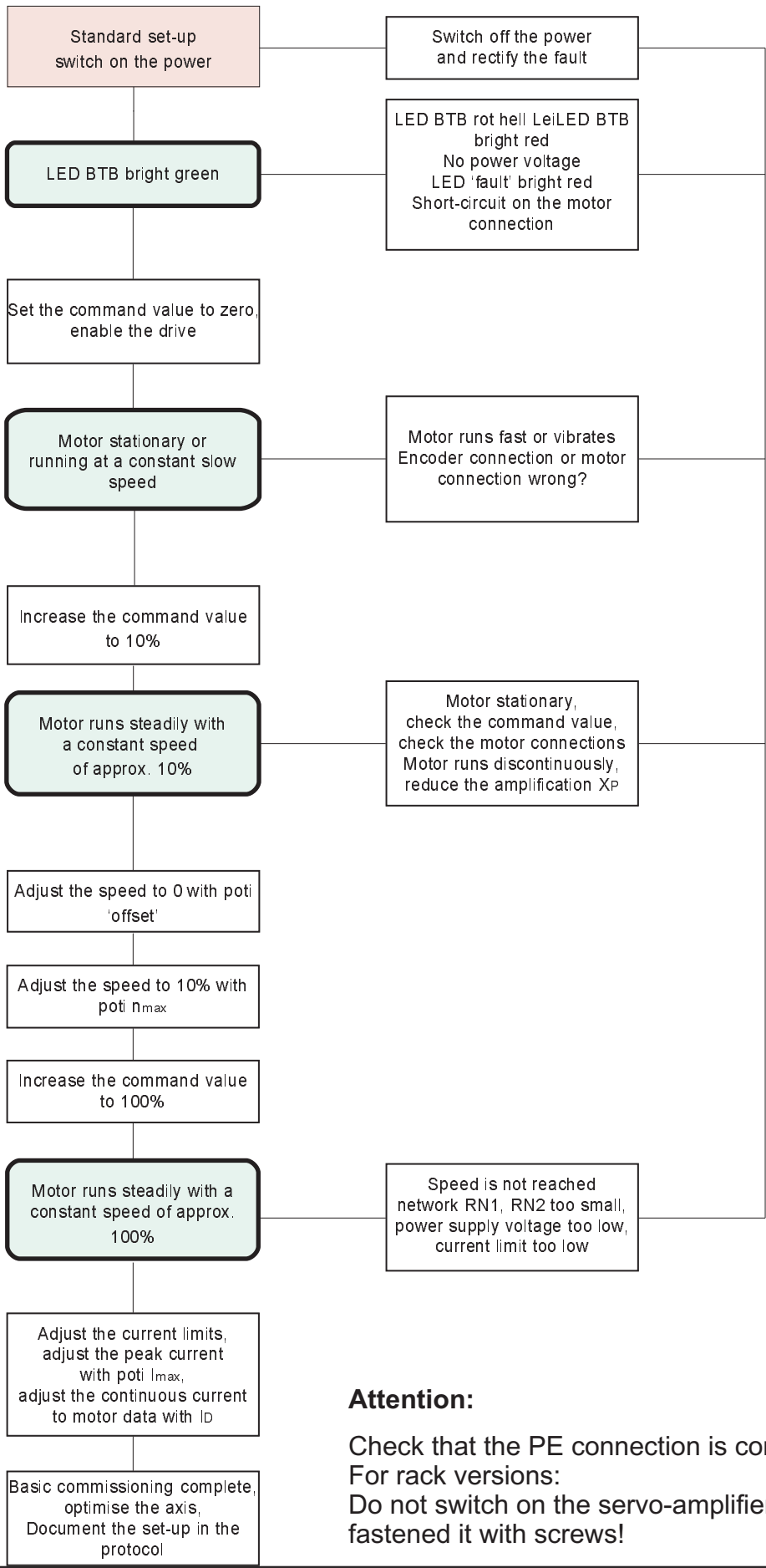
Potentiometer	$I_{max1}$	peak current	20%
Potentiometer	ID	continuous current	100%
Potentiometer	XP	amplification	50%
Potentiometer	$n_{max}$	speed	left full scale
Switch	S1	contact 1= ON contact 2= ON	

## Attention:

The operation of the devices is only permissible when the protective earth conductor (PE) is correctly connected!



# 6 Commissioning

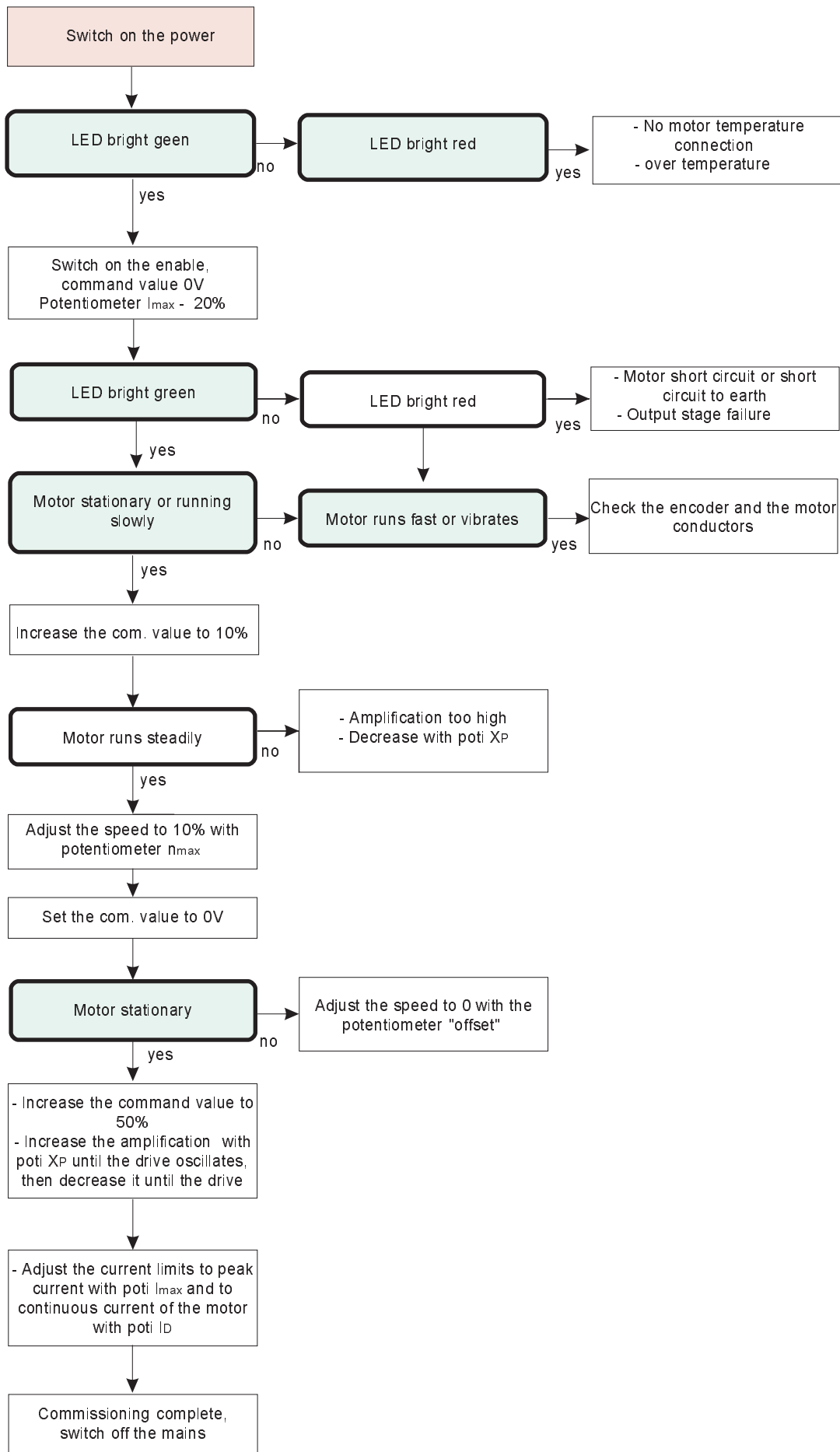


**Attention:**  
 Check that the PE connection is correct!  
 For rack versions:  
 Do not switch on the servo-amplifier before having  
 fastened it with screws!

Fault	Causes
LED dim green	<ul style="list-style-type: none"> <li>- Over-temperature</li> <li>- no temperature connection of the encoder cable</li> </ul>
LED bright red	<ul style="list-style-type: none"> <li>- Short-circuit on the motor connection</li> <li>Final stage fault</li> <li>- Over-voltage</li> </ul>
Motor stationary, no torque	<ul style="list-style-type: none"> <li>- no enable, current limit I<sub>max</sub> at left full scale</li> <li>- Motor connection interrupted</li> </ul>
Motor stands in one position, runs jerky or oscillates in one position	<ul style="list-style-type: none"> <li>- Encoder or motor cables mixed up or interrupted</li> </ul>
Motor speeds up	<ul style="list-style-type: none"> <li>- Motor or rotor position encoder cores leading or lagging by 120° in the rotating field</li> </ul>
Motor runs unsteadily	<ul style="list-style-type: none"> <li>- Incremental encoder cores mixed up or interrupted</li> <li>- Amplification X<sub>p</sub> too high</li> <li>- Command value failures</li> </ul>
Amplifier switches to failure, LED bright red	<ul style="list-style-type: none"> <li>- Phase short-circuit or short-circuit to earth, BTB fault,</li> <li>- Output stage failure</li> </ul>
Speed cannot be adjusted with poti n <sub>max</sub>	<ul style="list-style-type: none"> <li>- Switch S1 on FU 1-x wrong</li> </ul>
Mains module switches to failure during braking	<ul style="list-style-type: none"> <li>- Braking energy too high</li> <li>- Over-voltage in the bus circuit</li> </ul>
Mains module switches immediately to failure when being switched on	<ul style="list-style-type: none"> <li>- Under-voltage</li> <li>- Over-voltage</li> </ul>

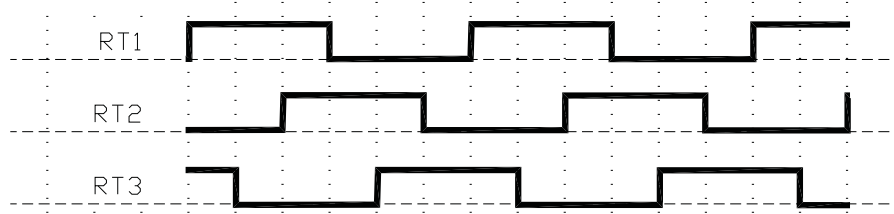


# 7 Faults

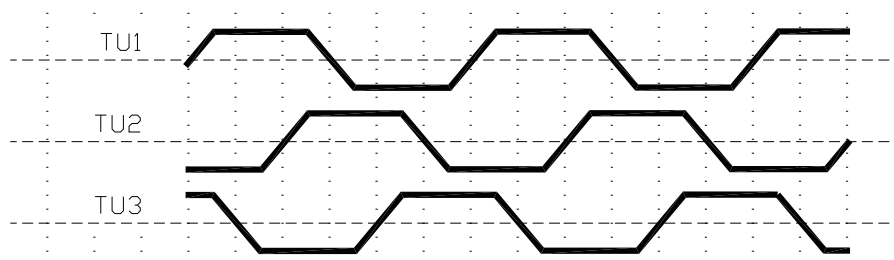


## Functional diagram bl/ec motor amplifier

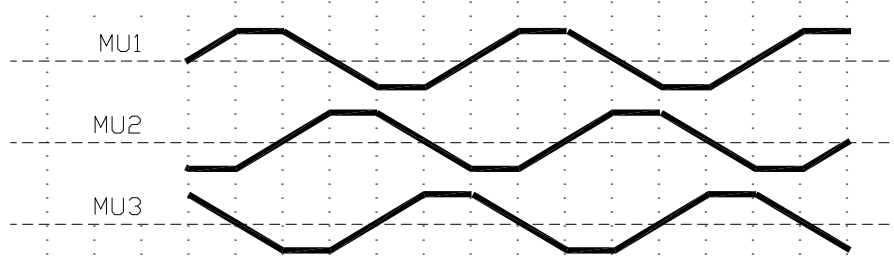
### Rotor position encoder



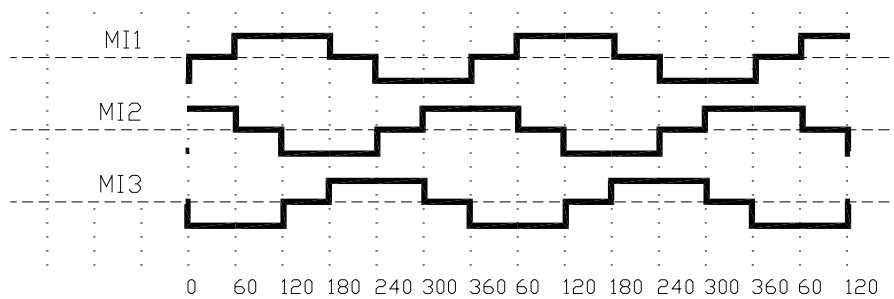
### Tachomer voltage



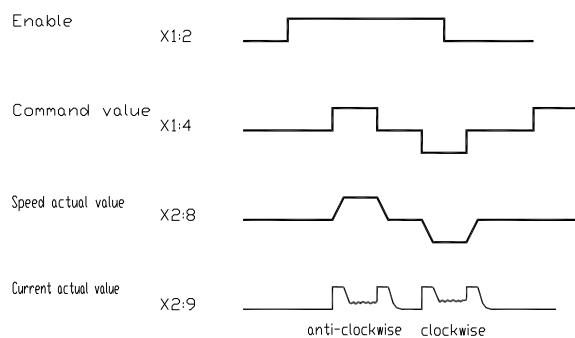
### Motor voltage



### Phase current

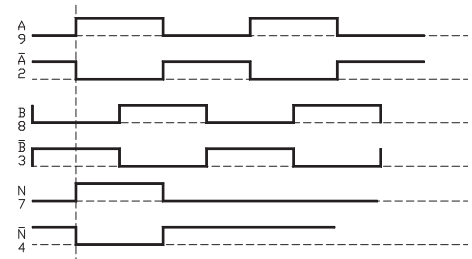


### TVD3 - Signal scheme



Incremental outputs  
D-connector X8

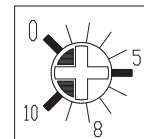
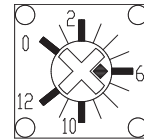
GND = X8:5  
+5V = X8:1



Motor running (locking on the shaft)

# 8 Protocol

Customer .....	Machine no. ....
Device .....	Serial no. ....
Connection voltage	[ V=,V~] .....
<b>Inputs</b>	
Enable	Contact ? ..... Voltage [V=] .....
Command value 1	Type ..... Voltage [V=] .....
Current com. value $I_{max1}$	external ..... Voltage [V=] .....
<b>Actual value settings - evaluation</b>	
bl-Tacho	Network RN1, RN2 Value[kΩ] .....
IN-Evaluation	Switch S1-1, 1-2 Position .....
RS-Evaluation	Switch RS-S1/S2 ON/OFF Position .....
<b>Speed control loop settings</b>	
<b>Variable components</b>	
P-Component	R9 Value.....
I-Component	C4 Value.....
<b>Potentiometer settings</b>	
Speed	n <sub>max</sub> P2 Position .....
Pea Current	I <sub>max</sub> P5 Position .....
Continuous current	ID P4 Position .....
Amplification	XP P3 Position .....
Offset	Offset P1 Position .....
Current control loop settings P/PI Switch S1, contact 1 ON/OFF	
<b>Measured data</b>	
Motor voltage	max. ....
Motor current	peak ..... continuous .....
<b>Motor Data</b>	
Manufacturer .....	Type .....
Serial number .....	
Encoder type .....	IMP ..... Voltage .
Motor voltage .....	Motor current .....
Brake .....	Fan .....



## Guarantee

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

The guarantee time begins from the time the device is shipped, and lasts one year. Unitek undertakes no guarantee 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.

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