

MANUAL

3-phase Servo-Drive TVD3-230-xx-R/bl for ac synchro servo motors with a rotor position encoder and a brushless tachometer

TVD3-230-R/bl

UNITEK

Industrie Elektronik
G m b H

Hans-Paul-Kaysser-Strasse 1
D-71397 Leutenbach 3 - Nellmersbach

Tel.: 07195/9283-0
Fax 07195/928329
email info@unitek-online.de
Http// www.unitek-online.de

Version
1106-2

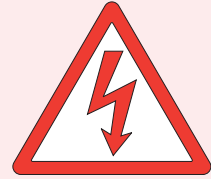
| Contents | Page |
|--|-------------|
| Safety advice, standards and guidelines | 3 |
| General Information | 4 |
| Applications | 5 |
| Build | 6 |
| Characteristics | 6 |
| Technical data | 7 |
| Dimensions compact device | 8 |
| Dimensions transformers and chokes | 8 |
| Dimensions multiple-axes combination | 9 |
| Regen circuit | 10 |
| Connections | 11 |
| Connection diagram | 12 |
| EMC advice | 13 |
| Connection advice | 14 |
| Connections - compact device X3 | 14 |
| Connections - mains module | 15 |
| Motor power connections | 15 |
| Command value | 17 |
| Current limiting | 18 |
| Actual value connection | 19 |
| Signals - drive ready BTB, analog parameter measurement | 20 |
| Terminal connections | 21 |
| Components | 22 |
| Circuit diagram | 24 |
| Adjustments | 25 |
| Adjustment advice | 26 |
| Command value integrator | 26 |
| Speed actual value | 27 |
| Current limiting | 28 |
| Speed control loop circuit | 29 |
| Adjustment without measurement equipment | 29 |
| Standard set-up | 30 |
| Commissioning | 31 |
| Faults | 32, 33 |
| Pulse signals | 34 |
| Protocol | 35 |
| Guarantee | 36 |

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.

It must also be ensured that the machine or equipment are fitted with device independent monitoring and safety features.

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.

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

- 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.

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 a speed control with speed actual value is used. The speed actual value is generated in the brushless tachometer.

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. The current command value and the current actual value are compared in the current control loop. This results in the PWM voltage. The PWM signals are transferred by means of the rotor position signal to the output stage. In the course of this the stator 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:

| | |
|-------------------------------------|---|
| For motors with incremental encoder | UNITEK TVD3-230-xx-IN |
| with resolver | UNITEK TVD3-230-xx-RS |
| with bl-tacho | UNITEK TVD3-230-xx-bl |
| For low-voltage applications | UNITEK TVD3-2-xx |
| For high power | UNITEK TVD6-2 -bl,IN,RS 200V/400V up to 25/40A |
| For digital servo controllers | UNITEK DS 400 200V/400V up to 50/100A |

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

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.

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, multiple axes mounting

Auxiliary voltage

24V~ bis 230V~ + 10%

20V~ +10%/-5%

24V= +10%/-5%

300mA/device

output voltage max.

3x200V~

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

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

Common specification

Protection rating

Format

Humidity rating

Site of installation

Operating temperature range

Extended operating temp. range

Storage temperature range

Speed control loop circuit

- control precision

without actual value error

- control range

IP 23

VDE 0100 group C, VDE 0160

class F acc. to DIN 40040

< 1000m above sea level

0 ... 45°C

up to 60°C reduced by 2%/°C

-30°C to + 80°C

± 0.5%

1: 1000

Caution:

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

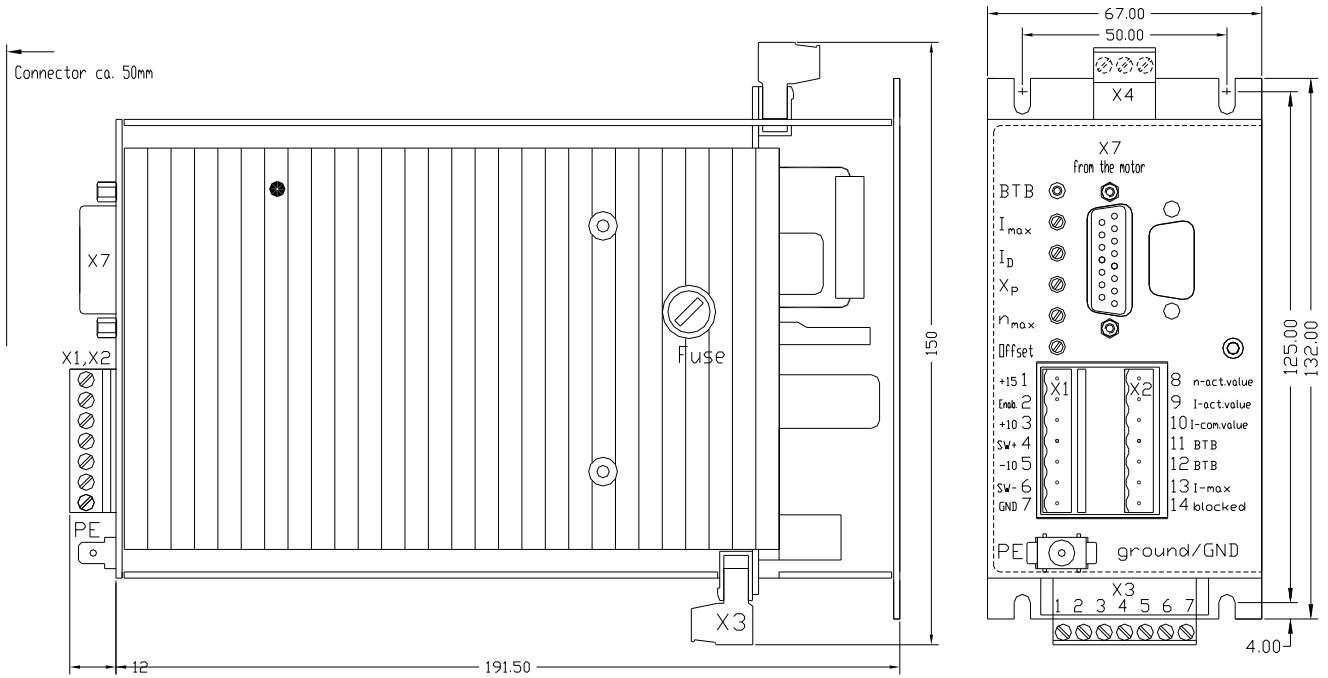
The regen circuit may be destroyed.



Transistor-Servo-Drive TVD3-230 -xx-R/bl

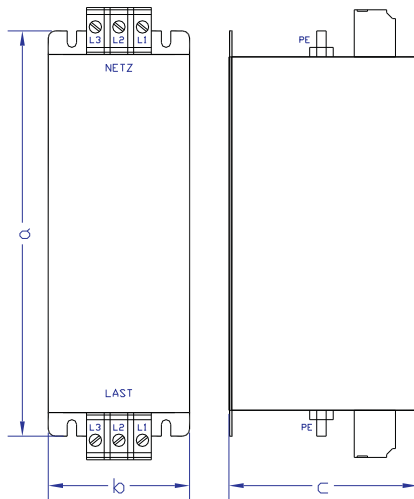
Compact device

Compact device dimensions



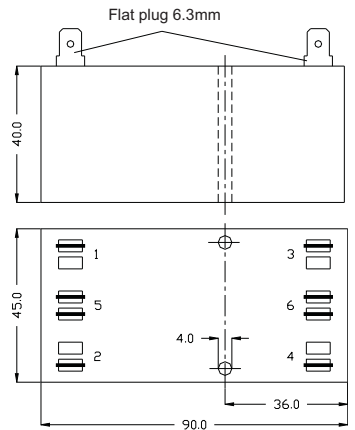
Dimensions of the power line filters und the chokes

| Type | Voltage V~ | Current A~ | Dimensions hwxwd mm | Weight Kg |
|---------------|---------------|---------------|------------------------|--------------|
| F250V-B90-16 | 1x250 | 1x16 | 45x90x40 | 0.32 |
| FN3270H-35-33 | 3x480 | 3x135 | 66x180x70 | 0.50 |

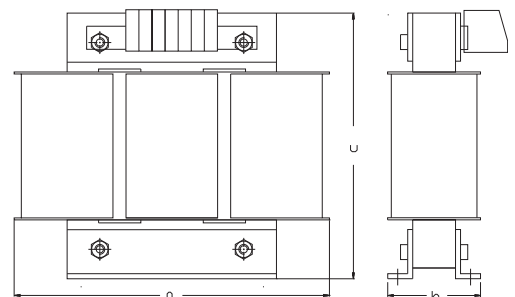


FN3270H-35-33

F250V-B90-16

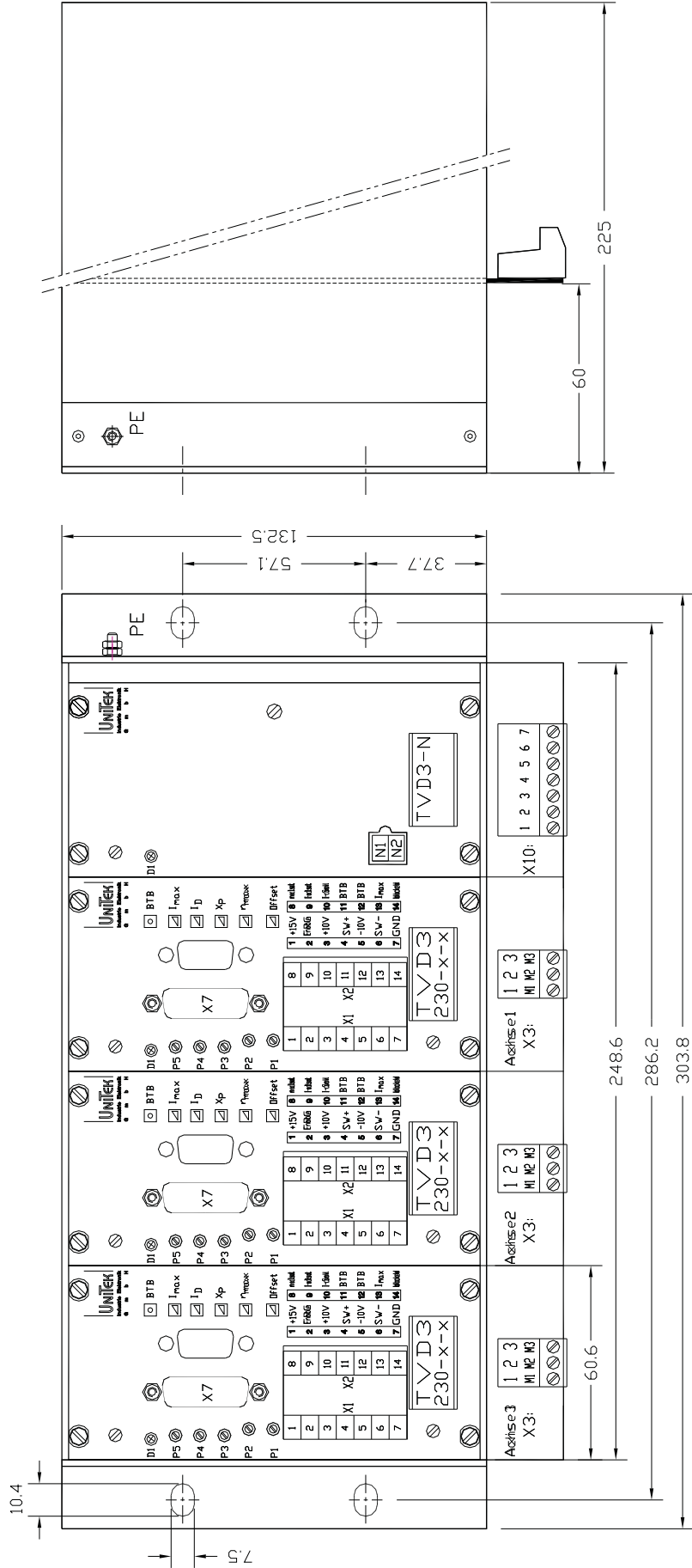
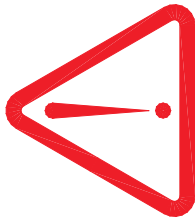


| Motor power chokes | | | | |
|--------------------|-----------------|-----------|---------------------|-----------|
| Choke | rated current A | Induct mH | Dimensions A/b/c mm | Weight kg |
| MDD 1.3a | -2.5 | 3.5 | 80x48x90 | 1.1 |
| MDD 1.6a | -5 | 1.9 | 95x54x108 | 1.3 |
| MDD 1.6b | -10 | 1.0 |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

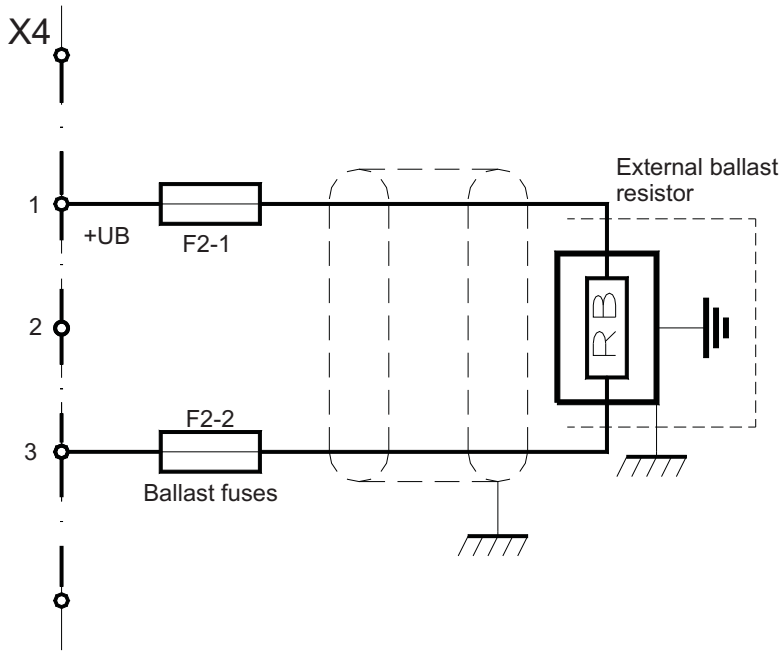


2 Mechanical Installation

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



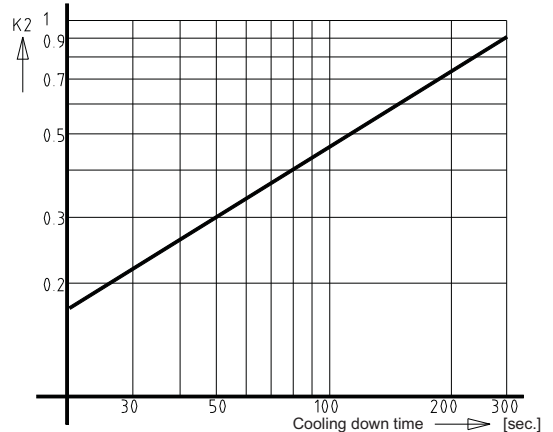
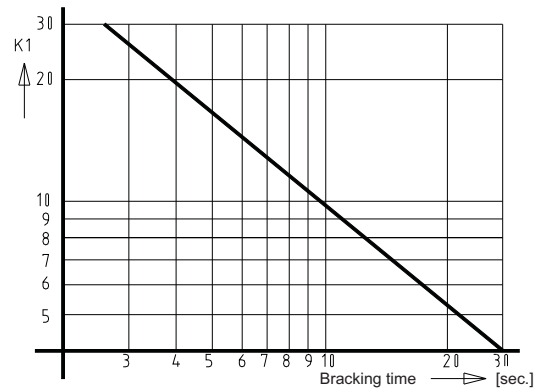
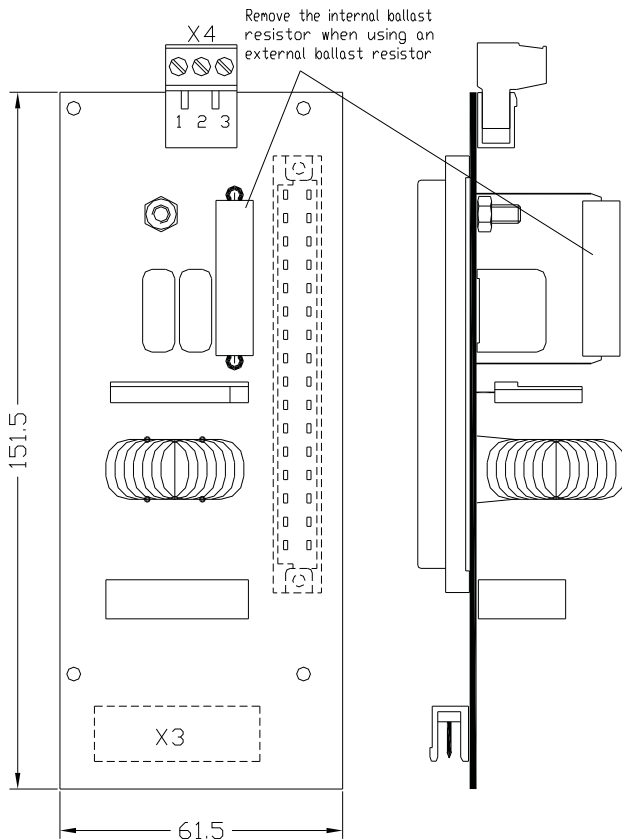
Transistor-Servo-Drive TVD3-230 -xx-R/bl



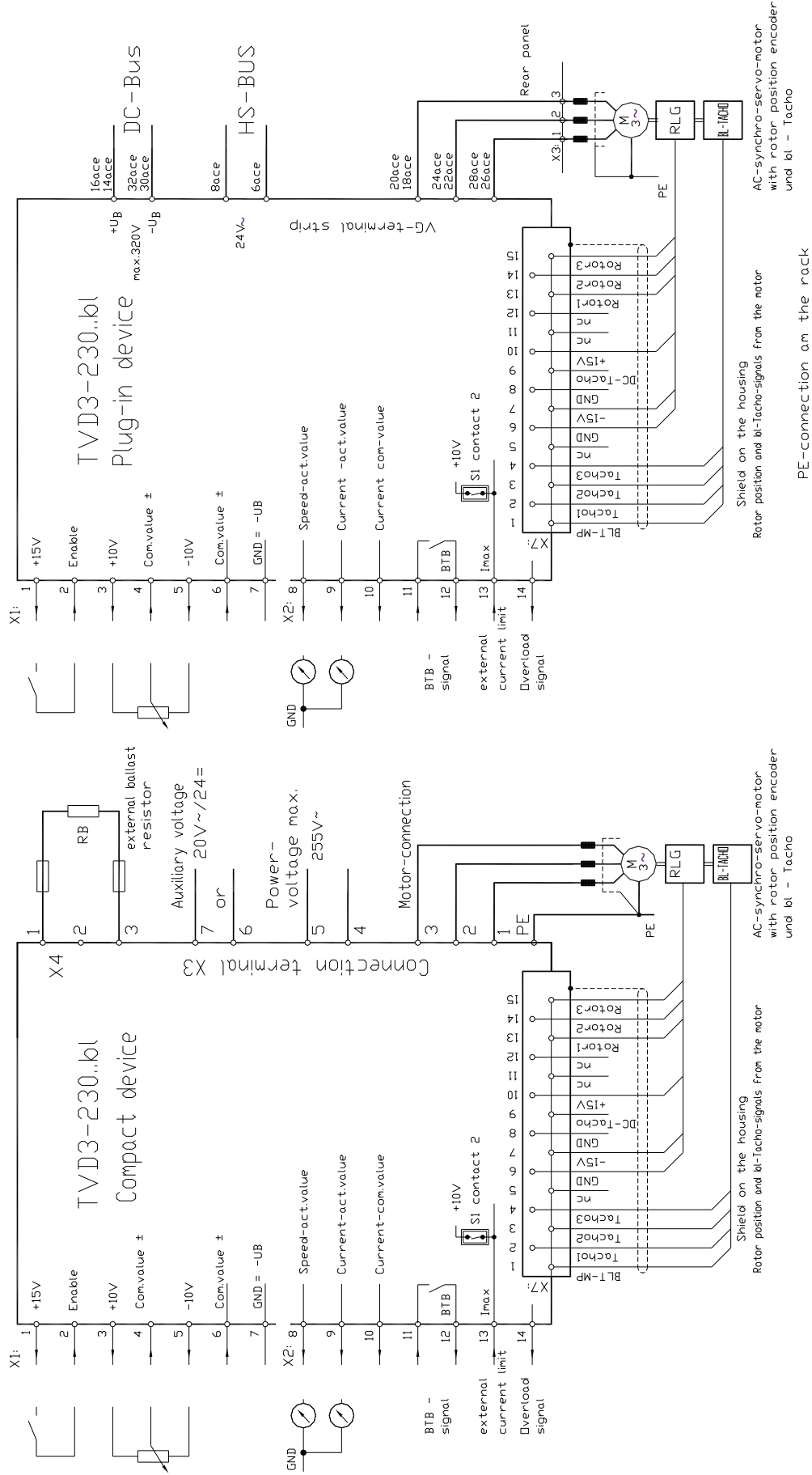
The energy arising during the braking operation is fed back into the bus circuit. The bus circuit capacitors can store only little energy. Any surplus of energy is transformed into heat in the ballast resistor in order to avoid an excessive voltage in the bus circuit.

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 | |
| Ext. resistance min. Ohm | 80 | 42 |
| Fuse F2 | 6.3 AF | |



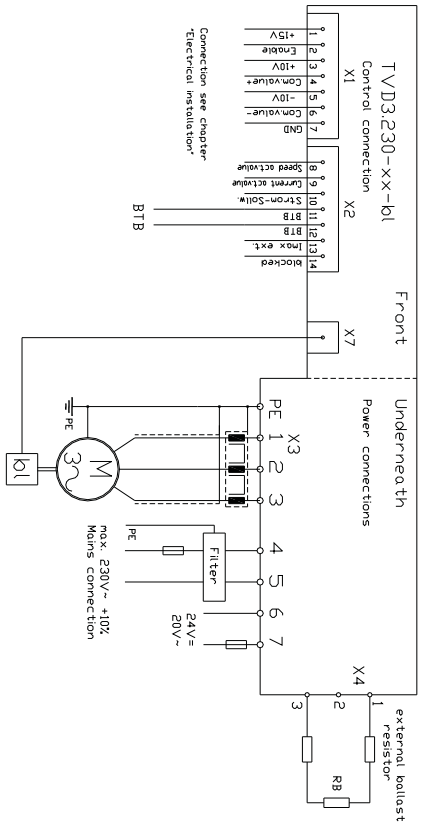
3 Electrical Installation



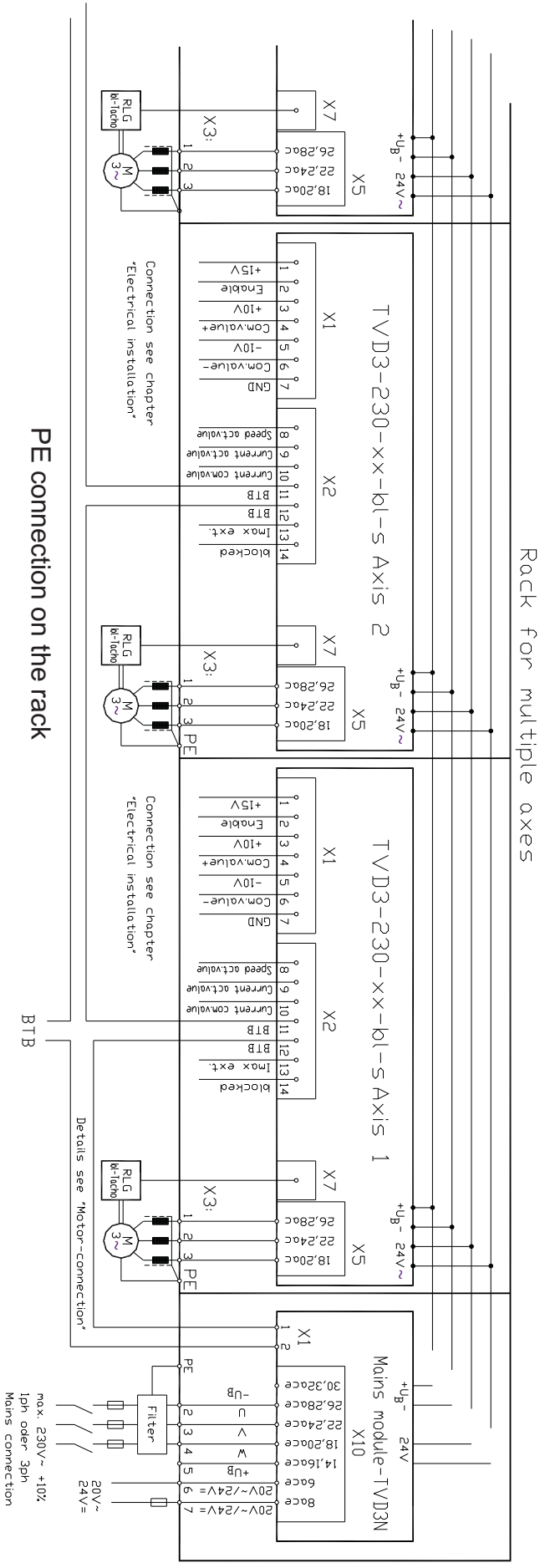
The operation of the devices is only permissible when the protective earth conductor (PE) is correctly connected!

Transistor-Servo-Drive TVD3-230 -xx-R/bl

Compact device



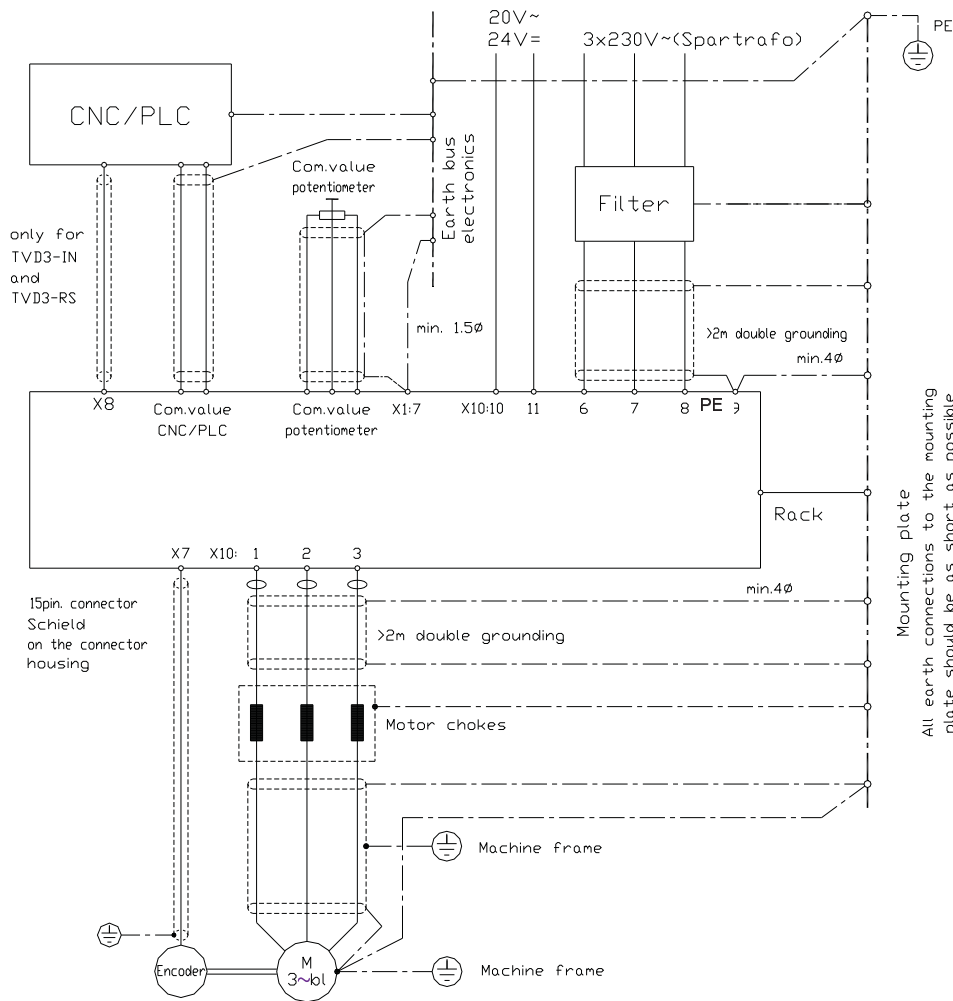
Multiple axes combination



PE connection on the rack

Connections diagram

3 Electrical Installation



EMC Advice

The devices adhere to the EU guidelines 89/336/EEG and the technical standards EN 61000-2 and 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 10mm² wire.
- The motor housing must be connected to ground using a 10mm² wire.
- The device ground X1:7 must be connected to the mounting plate using a 2.5mm² wire.
- PE bolt must be connected to the mounting plate using a 4mm² wire, l = 50mm.
- The rack ground screw must be connected to the mounting plate using a 4mm² 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.

Transistor-Servo-Drive TVD3-230 -xx-R/bl

Warning:

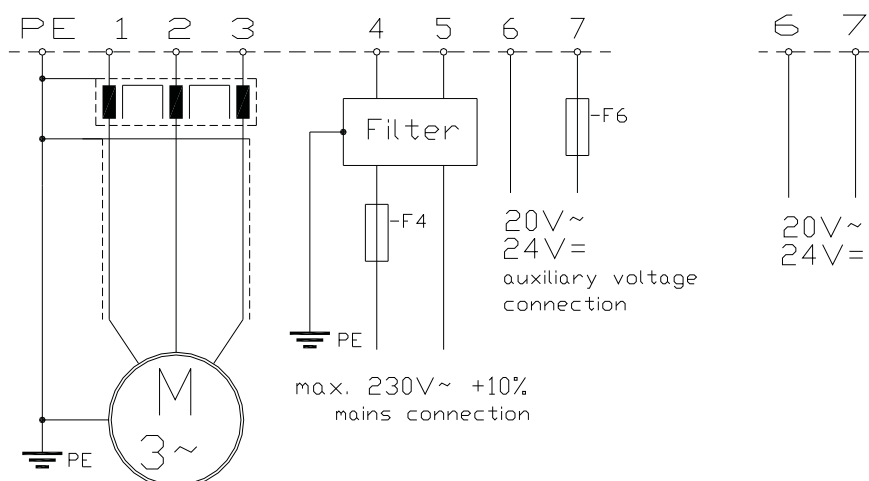
The order of the connections to the connector numbers or screw terminals is obligatory. All further advice is non-obligatory. The input and output conductors may be altered or supplemented in accordance with the electrical standards.

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 of the compact device X3



Warning:

Do not earth 20V~

Auxiliary voltage connection terminal X3:6, X3:7

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

Warning: The maximum voltage 255V~ must not be exceeded!

Check that the PE connection is correct!

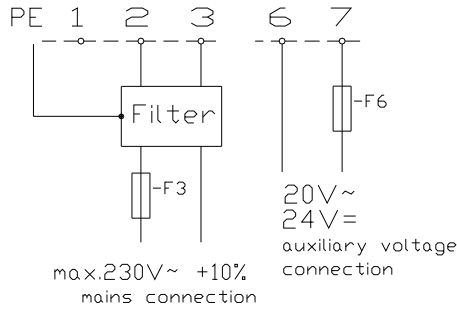
Auxiliary voltage 20V~/24V= +10%/-5%



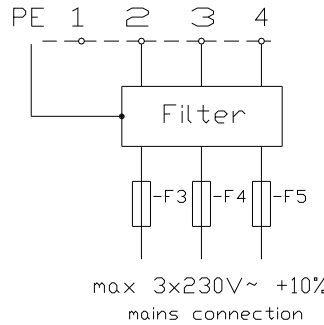
3 Electrical Installation

Connection to the mains module X10

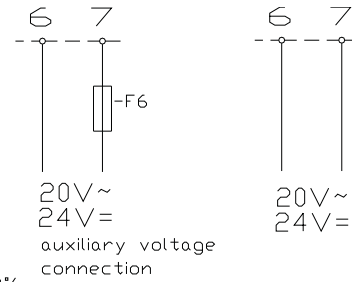
Alternating voltage



Three-phase voltage



Auxiliary voltage



Auxiliary voltage connection terminal X3:6, X3:7

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

Warning:

PE connection on the rack

| Connecting cable | | | | | | |
|-------------------------|-----------------|------|-------|------------------|------------------|-------------------|
| Dimensioning | | 5A-k | 10A-k | Mains module 10A | Mains module 30A | Auxiliary voltage |
| Conductor cross-section | mm ² | 0.5 | 0.75 | 0.75 | 2.5 | 0.5 |
| Fuse - safety fuse | AF | 6 | 10 | 10 | 25 | 0.5 |
| -automatic cut-out B | A | 6 | 10 | 10 | 25 | |

| 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

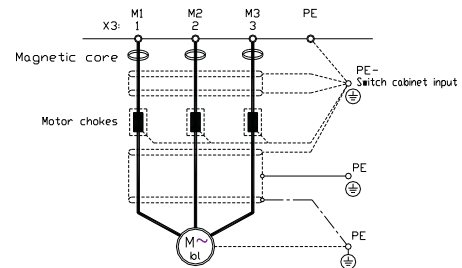
- with earth clamp
- directly to be connected to the switch cabinet input and to the motor
- multiple earthing in case of long conductor cables

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 Ω
- 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

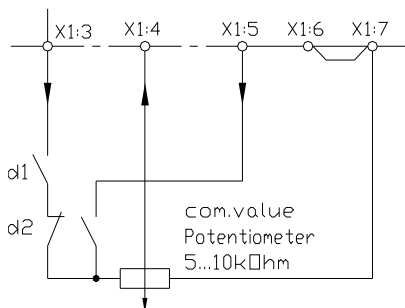
| | |
|---------------|---------------|
| Command value | X1:4 (signal) |
| | X1:6 (GND) |

Command value current from an external PLC/CNC

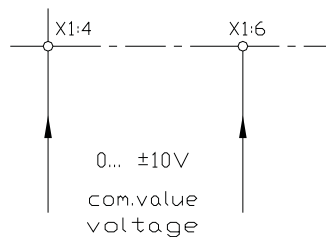
Resistor for a current command value of 0 to $\pm 20mA$ $R_{com.} = 500\Omega$

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

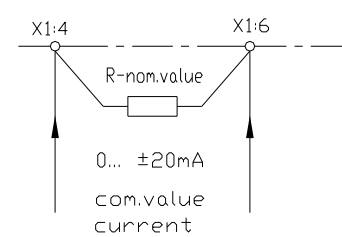
Internal supply



CNC/PLC



Current command value



Attention:

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



Transistor-Servo-Drive TVD3-230 -xx-R/bl

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}

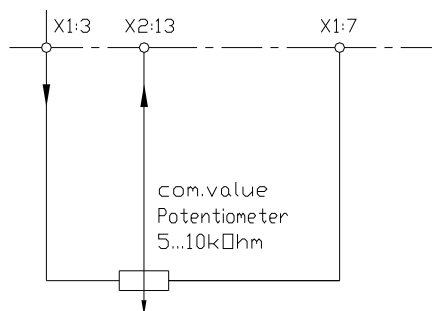
Relay contacts: use gold or reed contacts

Switch S1, contact 2 = OFF

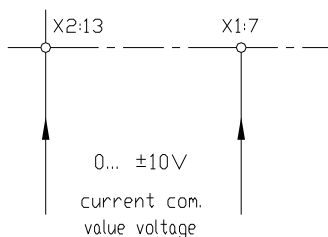
Connections

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

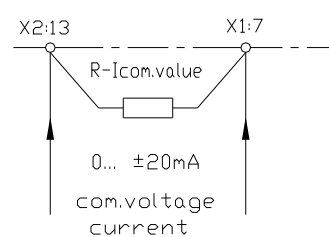
Internal source



CNC/PLC



Current com. value



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: | up to 10m | 12 x 0.14 shielded |
| | > 10m | 12 x 0.25 shielded |

Connections

| Function | Colour (recommended) | Pin no. |
|------------------|----------------------|---------|
| Bl-tacho mp | grey | 1 |
| Bl-tacho phase 1 | yellow | 2 |
| Bl-tacho phase 2 | black | 3 |
| Bl-tacho phase 3 | white | 4 |
| +15V | violet | 10 |
| GND | blue | 6 |
| Thermal sensor | pink | 6 |
| Thermal sensor | orange | 12 |
| Rotor position 1 | brown | 13 |
| Rotor position 2 | green | 14 |
| Rotor position 3 | red | 15 |

Additional connection when using a dc tacho:

| | | |
|-----------------|--------|---|
| -15V | grey | 7 |
| dc tacho signal | yellow | 9 |
| dc tacho GND | black | 8 |

(The BL-tacho connections at pin no. 1 and 4 are removed)
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



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 | not 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 |

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 | |

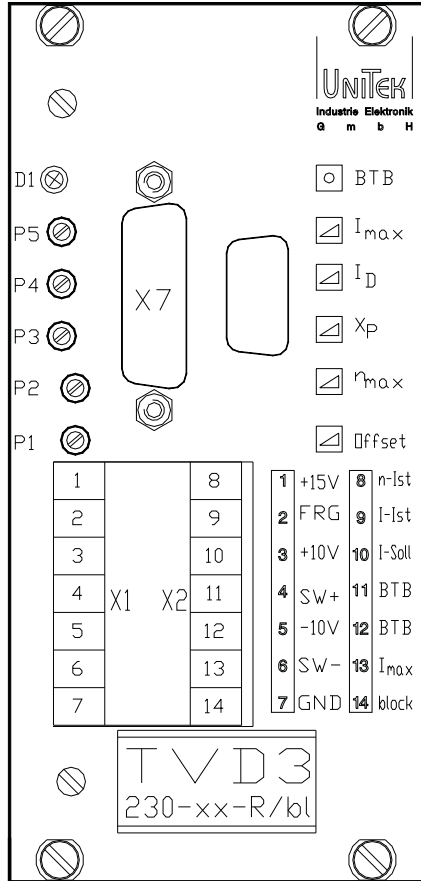
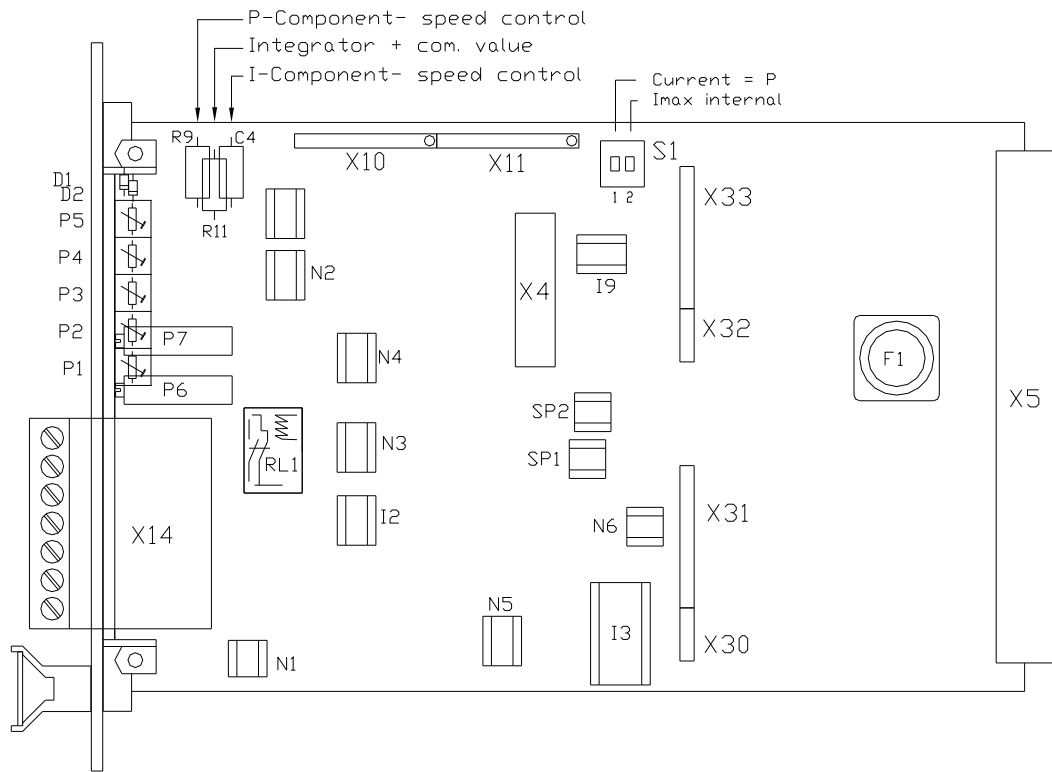
Mains module - plug-in unit

| 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)

Transistor-Servo-Drive TVD3-230 -xx- R/bl

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

X1:1 +15V
X1:2 enable
X1:3 +10V
X1:4 com.value+ (-)
X1:5 -10V
X1:6 com.value- (+)
X1:7 GND

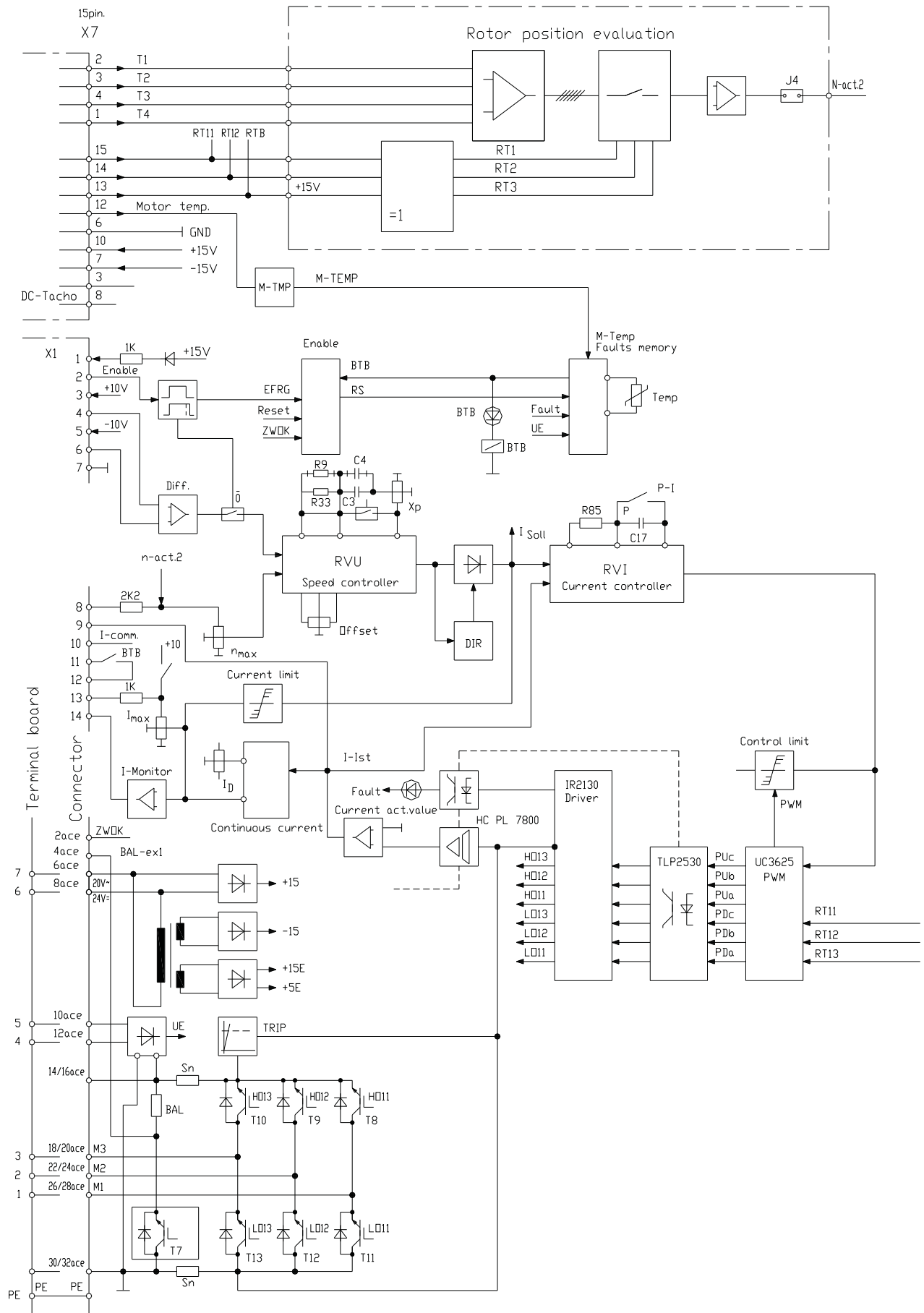
X2:8 n-act. value
X2:9 I-act. value
X2:10 I-com. value
X2:11-12 BTB contact
X2:13 external current limit
X2:14 blocked

4 Device Overview



Transistor-Servo-Drive TVD3-230 -xx- R/bl

Circuit diagram



4 Device Overview

Adjustments

| Function | Component |
|----------------------------------|--|
| Actual value adjustment | Poti P2 (n_{max}) |
| Internal current limit | Switch S1 > contact 2=ON Poti P5 (I_{max}) |
| External current limit | Switch S1 > contact 2=OFF Poti P5 (I_{max}) |
| Continuous current | Poti P4 (I_D) |
| Amplification P-component | Resistor R9 Poti P3 (X_P) |
| Amplification I-component | Capacitor C4 |
| Integrator | Resistor R11 |
| Zero adjustment | Poti P1 (offset) |

Current command value blocked I-command value +12V/10mA X2:10
 X2:14

| 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 |

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

Transistor-Servo-Drive TVD3-230 -xx-R/ bl

Adjustment advice

Adjustments

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

Pre-settings

| | |
|---------------------------------|--------------------------------------|
| Actual value | >>> network RN1, RN2 (on TVD-RGL-bl) |
| Current limit internal/external | >>> switch S1, contact 2 |
| Current control P- PI | >>> switch S1, contact 1 |

Optimisation

| | |
|-------------------------|---|
| Actual value adjustment | nmax adjustment |
| Current control | switch S1, contact 2 (stand. set-up > ON) |
| Current limits | Imax, ID-adjustment |
| Speed control | XP-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)

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

| Command value | | |
|---|------------|-----------|
| Function | max. value | Connector |
| Input signal | ± 10V= | X1:4 |
| Input GND | | X1:6 |
| The signal and the GND connection can be swapped. | | |

Command value as current signal

Command value from an external current source
 External load resistance for the command value
 Command value resistance R-com[Ω] =
 com. value voltage/com. value current (max. 500Ω)

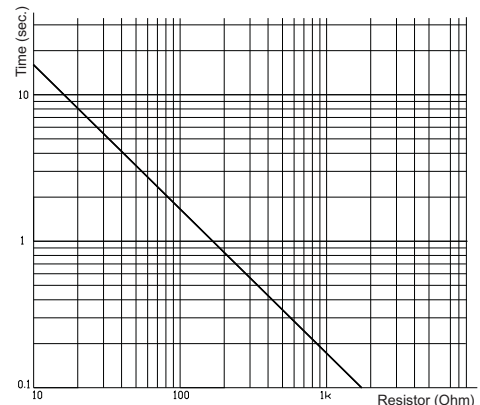
0 to ± 20mA
 0 to max. ±10V

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 with rotor position encoder

- internal actual value generation
- no pre-setting
- fine adjustment with poti n_{max} (P2)
- rotor position and fine adjustment >>> see below

Speed actual value

Evaluation electronics subprint TVD-RLG-bl

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 acc. to 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+X7:14//

Attention:

When all of the 3 rotor signals are inferior to 8V, the encoder conductor is interrupted.

Tacho signal X2:8

uniform speed-proportional voltage, no saw-tooth voltage

Pre-settings

- with the resistance network RN1, RN2 (resistance values $< = \text{speed} >$)
- Resistance value (Ohm) = tacho voltage x max. speed
- Standard adjustment for 3000 min¹

Fine adjustment with potentiometer n_{max} (P2)

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).

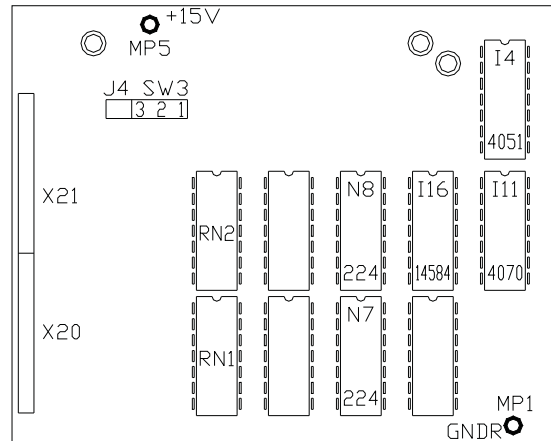
Command value from a CNC/PLC:

- 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

BI-tacho with rotor position encoder



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, contact 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
(5V = rated current)

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

Current actual values

| | | | |
|-------------------------------|------|-----------|-----------------|
| Measured current actual 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
- switch S1, contact 1 = OFF



Transistor-Servo-Drive TVD3-230 -xx-R/ bl

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 | mains module | 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)

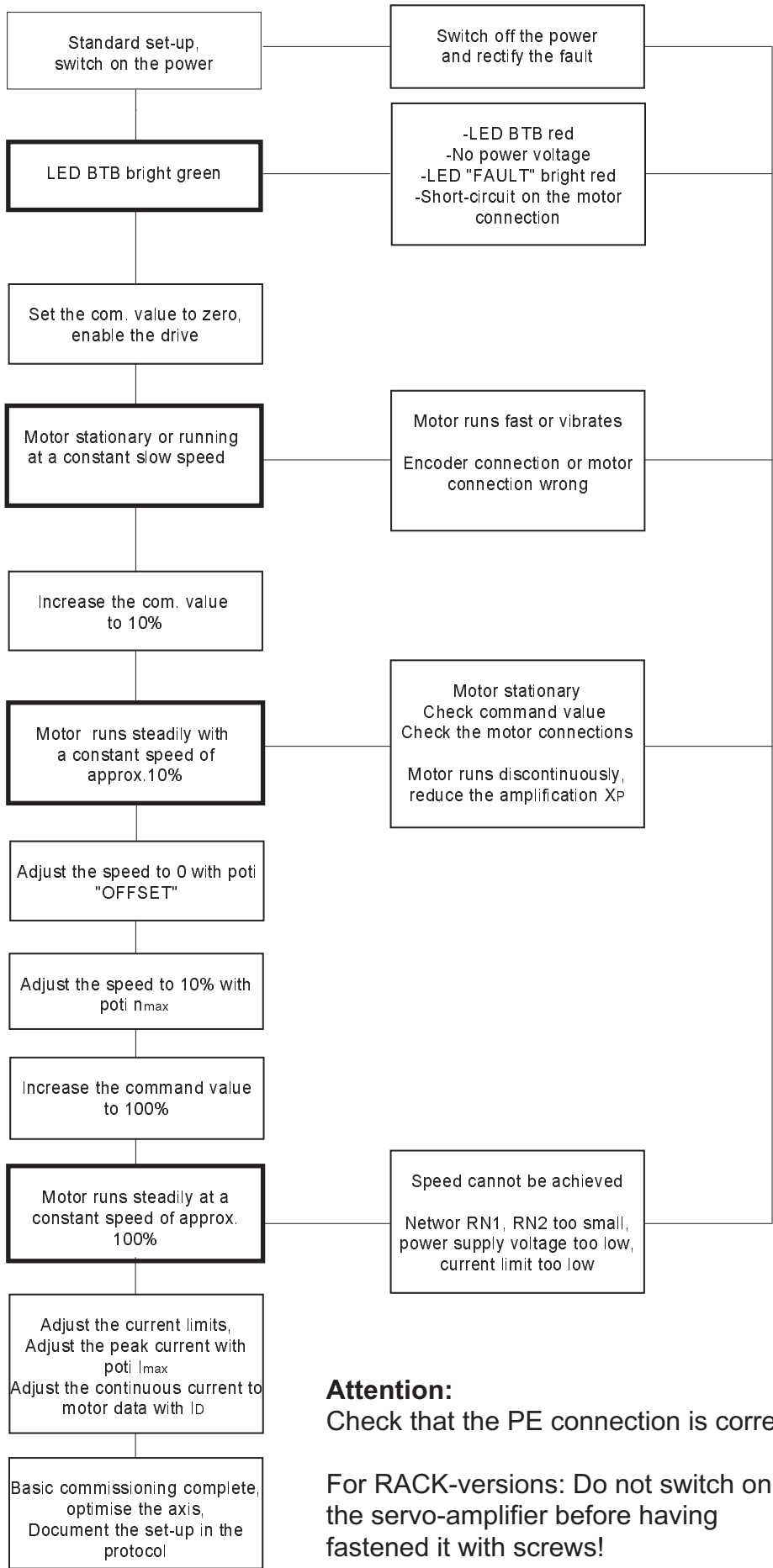
Control connections

| | |
|-----------------|---|
| - 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 | I_D | continuous current | 100% |
| Potentiometer | X_P | amplification | 50% |
| Potentiometer | n_{max} | speed | left full scale |
| Switch | S1 | contact 1 | = ON |
| | | contact 2 | = ON |

6 Commissioning



Attention:
Check that the PE connection is correct!

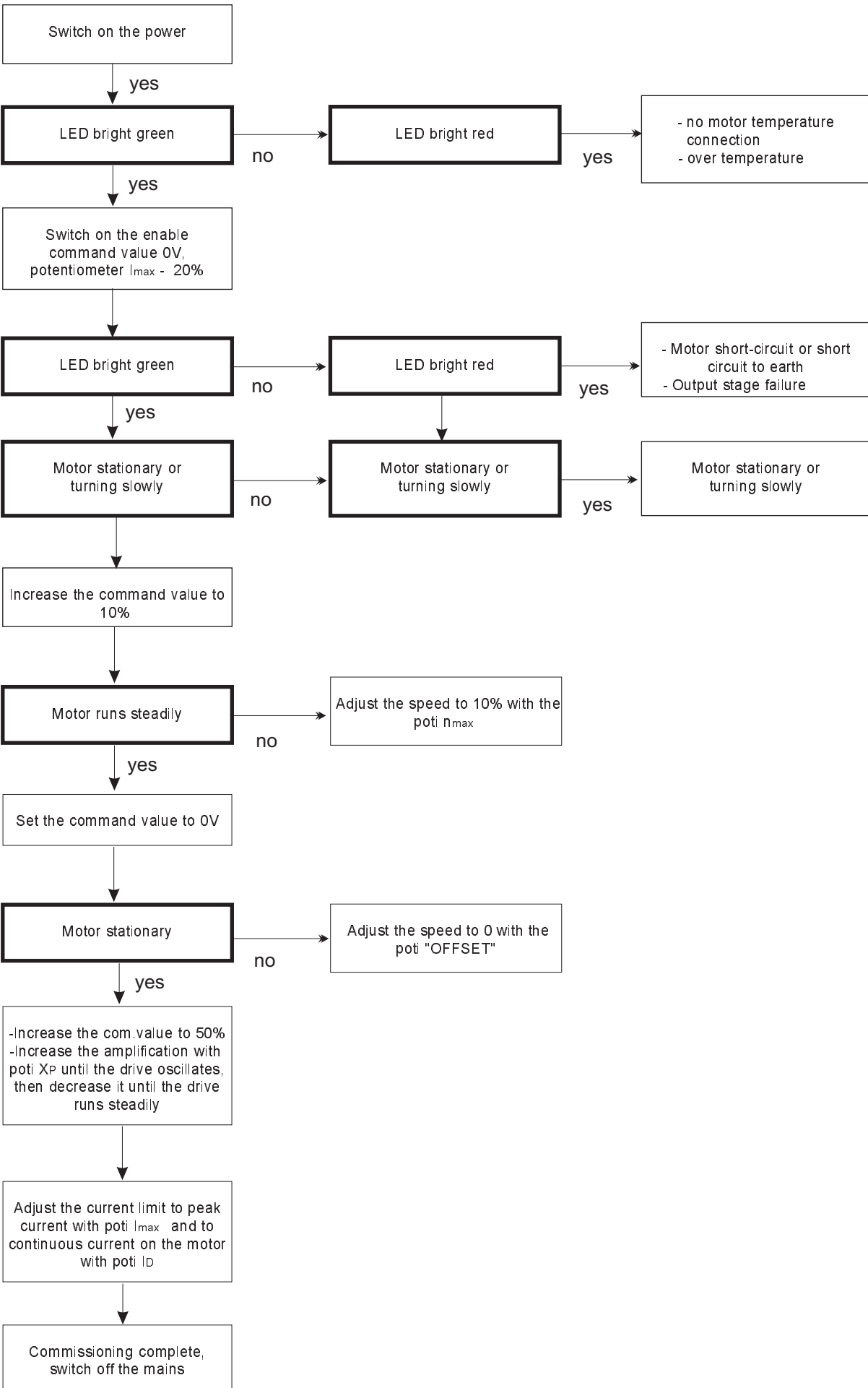
For RACK-versions: Do not switch on the servo-amplifier before having fastened it with screws!



Faults

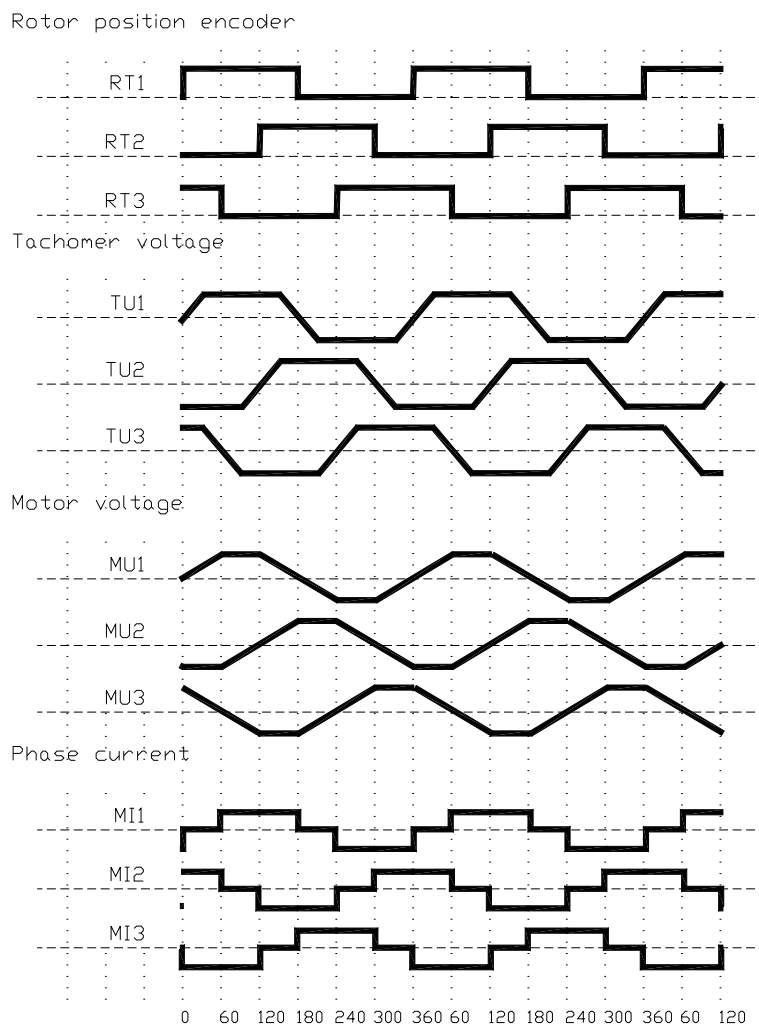
| Fault | Causes |
|--|--|
| LED 'fault' bright red | <ul style="list-style-type: none"> - Over-temperature - no temperature connection of the encoder cable - Short-circuit on the motor connection - Final stage fault - Over-voltage |
| Motor stationary, no torque | <ul style="list-style-type: none"> - no enable, current limit I_{max} at left full scale - Motor connection interrupted |
| Motor stands in one position, runs jerky or oscillates in one position | <ul style="list-style-type: none"> - Encoder conductor or motor conductor mixed up or interrupted |
| Motor speeds up | <ul style="list-style-type: none"> - Motor or rotor position cores leading or lagging by 120° in the rotating field |
| Motor runs unsteadily | <ul style="list-style-type: none"> - Encoder cores mixed up or interrupted - Amplification X_p too high - Command value failures |
| Amplifier switches to failure, LED bright red | <ul style="list-style-type: none"> - Phase short-circuit or short-circuit to earth, <li style="padding-left: 20px;">BTB fault, - Output stage failure |
| Speed cannot be adjusted with poti n _{max} | <ul style="list-style-type: none"> - Resistance network RN1, RN2 on the evaluation electronics TVD-bl wrong |
| Mains module switches to failure during braking | <ul style="list-style-type: none"> - Braking energy too high - Over-voltage in the bus circuit |
| Mains module switches immediately to failure when being switched on | <ul style="list-style-type: none"> - Under-voltage - Over-voltage |

7 Fault Diagnosis

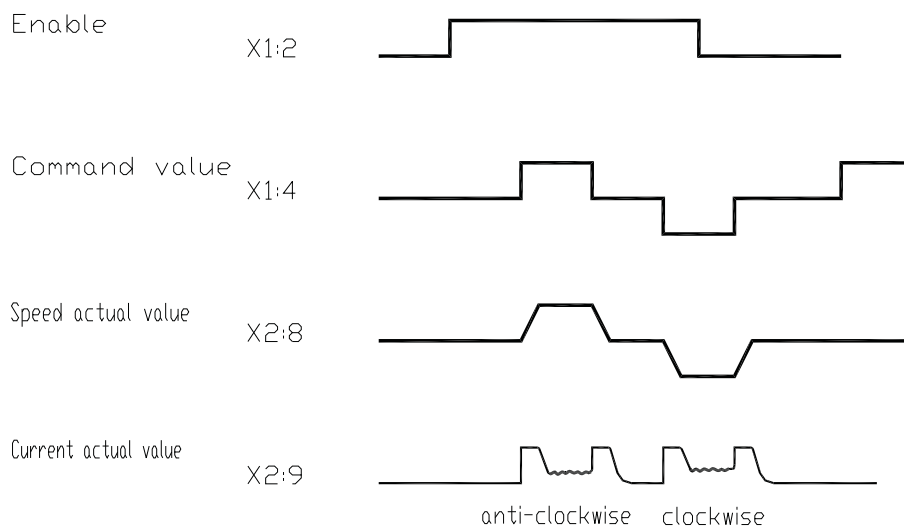


Transistor-Servo-Drive TVD3-230-xx-R/bl

Functional diagram bl/ec motor amplifier



TVD3 - Signal scheme



Motor running (locking on the shaft)

8 Protocol

Customer

Machine no.

Device

Serial no.

Connection voltage

[V=,V~]

Inputs

Enable Contact ?

Voltage [V=].

Command value 1 Type

Voltage [V=].

Current com.value I_{max1} external.

Voltage [V=].

Actual value settings - evaluation

bl-Tacho Network RN1, RN2

Value[kΩ]

IN-Evaluation Jumper SW1, 1-2/2-3

Position

RS-Evaluation Switch RS-S1/S2 ON/OFF

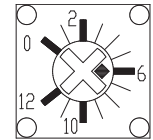
Position

Speed control loop settings

Variable components

P-Component R9 Value

I-Component C4 Value



Potentiometer settings

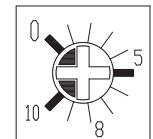
Speed n_{max} P2 Position

Pea Current I_{max} P5 Position

Continuous current I_D P4 Position

Amplification X_P P3 Position

Offset P1 Position



Current control loop settings

P/PI Switch S1, contact 1 ON/OFF

Measured data

Motor voltage max.

Motor current peak continuous

Motor Data

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.

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 in 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.