

Manual
Transistor-Servo-Drive
for
DC-Servo-Motors



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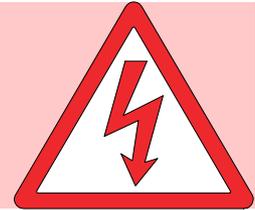
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Safety Advice

Electronic devices always involve the risk of failure.

Caution High Voltage

AC 230V~, DC 400V=



This manual has to be read carefully and must be understood by experts before installing the device.

If there are any doubts call your trader or the manufacturer.

The TVQ6 series is designed to regulate electrical currents; protection standard IP00.

Standards and Guidelines:

The device and it's associated components can only be installed and switched on where the local laws 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 | |
| - Regulations of Professional and Occupational bodies: | VGB4 |

The user has to assure that:

- after a failure of the device
- an incorrect handling,
- after a breakdown of the control unit etc.

the drive has to be brought to a secure operating condition.

Machines and installations are to be provided with supervisory and safety equipment, that is independent of the device.

Adjustment

- only by qualified personnel
- adhere to safety regulations

Installation work

- only when disconnected from all power lines

QS

The devices are archived by the manufacturer with their serial number.

CE

The EU-guide line 89/336/EWG with the Regulations EN61000-2 and EN61000-4 are observed.

General Information

The transistor servo amplifier TVQ6 forms together with the brushless direct current motor a propulsion unit distinguished by its high control performance.

Using a DC-motor the current is proportional to the torque and the voltage is proportional to the speed.

Current and speed are measured precisely.

The analogue regulation circuits of the servoamplifier are designed simply.

The speed actual value is generated from the tachogenerator or the armature voltage.

In the speed controller (P-I-controller) of the servo-drive is the difference of nominal value and actual value amplified.

The result is the current nominal value.

As occurs in all DC-, AC or ec-servo-amplifiers which are supplied by the dc-bus, when braking the feed-back of the energy in the dc-bus must be observed.

(winding machines, lifts, great centrifugal masses)

The ballast circuit is set for 3% on-period, higher duty cycles can be reached by mounting external resistors (Option).

Information:

Further servo amplifiers for DC-servo motors

| | |
|---------------|---|
| for low power | UNITEK series SERVO-TV3&TV6, 24-120V, 6-12A UNITEK series TVQ6.2 |
|---------------|---|

| | |
|------------------|--|
| for higher power | UNITEK series Classic Q2, Q6 up to 250V, 15-60A |
|------------------|--|

Motor controller for DC-shuntwound motors

from midrange to highest

| | |
|-------|--|
| Power | UNITEK series Classic Q1, Q3 up to 550V, 15-2000A |
|-------|--|

3-phase servo amplifiers for AC-synchro servo motors

| | |
|---------------|--|
| for low power | UNITEK series SERVO-TVD3-2 -xx-bl, IN, RS 24-15V, 5-10A |
|---------------|--|

| | |
|--------------------|---|
| for midrange power | UNITEK series SERVO-TVD6-2 -bl, IN, RS 200V and 400V, 5-25/40A |
|--------------------|---|

| | |
|----------------|--|
| for high power | UNITEK series AS 250bl, AS 450RS UNITEK series DS 400 |
|----------------|--|

| | |
|-----------------------|--------------------|
| for Battery-operation | UNITEK series BAMO |
|-----------------------|--------------------|

Application

for all kinds of machines up to 4KW drive power especially as 4Q-servo-drive in travel axes with

- high dynamic acceleration and deceleration cycles
- great regulation range
- high efficiency
- small motor size
- even and smooth travel

for speed or torque regulation or combined speed-torque regulation with or without superposed position controller.

drives with constant speed as in conveyors, lead screw drives, pumps or divider units.

For use in :

component insertion machines, metal-sheet working machines, machine tools, plastic working machines, assembly machines, knitting and sewing machines, textile working machines, grinding machines wood and stone working machines, food processing machines, robots and manipulators, storage access machines, extruder, calander and many other machines and installations .

Notice:

In drives which mainly require deceleration

For example:

-> lifting machines, lifts, great centrifugal masses.

The braking energy will be annihilated in the ballast circuit or re-fed to the mains using an external d.c.-to -a.c. inverter.

With several axes an energy compensation is possible.

Construction

Cubicle-mount compact device or 6HE-plug-in unit According to the VDE- DIN- and EU- regulations.

Standard analog regulation electronics.

Power section for 10A, 16A and 25A.

Wide-band chopper supply unit for the auxiliary voltages.

Power supply unit on the back panel circuit board .

Galvanic isolation between:

- Power section and Case
- Power section and regulation electronics
- Regulation electronics and logical inputs

The leakage distances are according to the CE regulations.

There are used:

- Fully isolated six-pack IGBT-power semiconductors,generous dimensioning.
- Only industrial standard components are used
- All ICs with external connections are mouted on high-quality sockets
- LED displays
- 16 digit binary switches for PI-setup of the speed regulator
- Precision trimmers for fine adjustment
- Plug-in jumpers for system setup.

Characteristics:

- * Direct power supply 230V~
- * Electronic starting current limitation
- * 2 differential reference inputs
- * Accelleration and decelleration ramp with second nominal value
- * Speed and torque regulation
- * Static and dynamic current limit
- * Current nominal value output
- * Test connectors for current and speed
- * Logical in- and outputs with optocouplers
- * Enable and end-switch logic
- * Integral disabling
- * Quick stop
- * Mains failure braking
- * Temperature control for motor and device
- * Parameter adjustments without soldering
- * 10 pin control connector

1 Basic - Information

Power Connection

Direct to the mains max. 1x 230V~ ±10%
 With autotransformer max. 3x 230V~ ±10%

Option : mains voltage 60 up to 180V~ adjustment by manufacturer required
 Specify mains voltage when ordering!

| Data: TVQ6-250- | | | 10 | 16 | 25 |
|---------------------------|--------|------------------|-----------------------------|----------------|------------|
| Output voltage | | V= | 250 | 250 | 250 |
| Output-standstill current | Steady | A= | 10 | 16 | 25 |
| | Peak | A= | 20 | 32 | 40 |
| Maximum electric power. | | W | 2000 | 3200 | 5000 |
| Fast fuses built in | | A | 20 | 20 | 20 |
| Dimensions Plug-in-uni | | WxH | 16TE | 16TE | 24TE 6HE |
| Cooling | | 60% ED 100%ED | convect fan | convect fan | fan fan |
| Switch cabinet mounting | | WxHxD | see dimensions page 9 to 11 | | |

Common specifications:

| | |
|---|---|
| Protection standard | IP 00 |
| Device layout | VDE 0100 group C VDE 0160 |
| Humidity stress | class F according to DIN 40040 |
| Operation altitude | <1000m above NN |
| Operation range | 0 ... 45°C (with external fan 0 ... 35°C) |
| Extended operation range | up to 60°C red. 2%/°C |
| Bearing range | -30°C up to + 80°C |
| Speed controller | |
| control precision (excl. act.value error) | ±0.1% |
| Control range | >1:1000 |
| Nominal value inputs | ±10V= |
| Logical inputs | > +10 ... +30V= |
| Logical outputs | > +14V, 6mA |

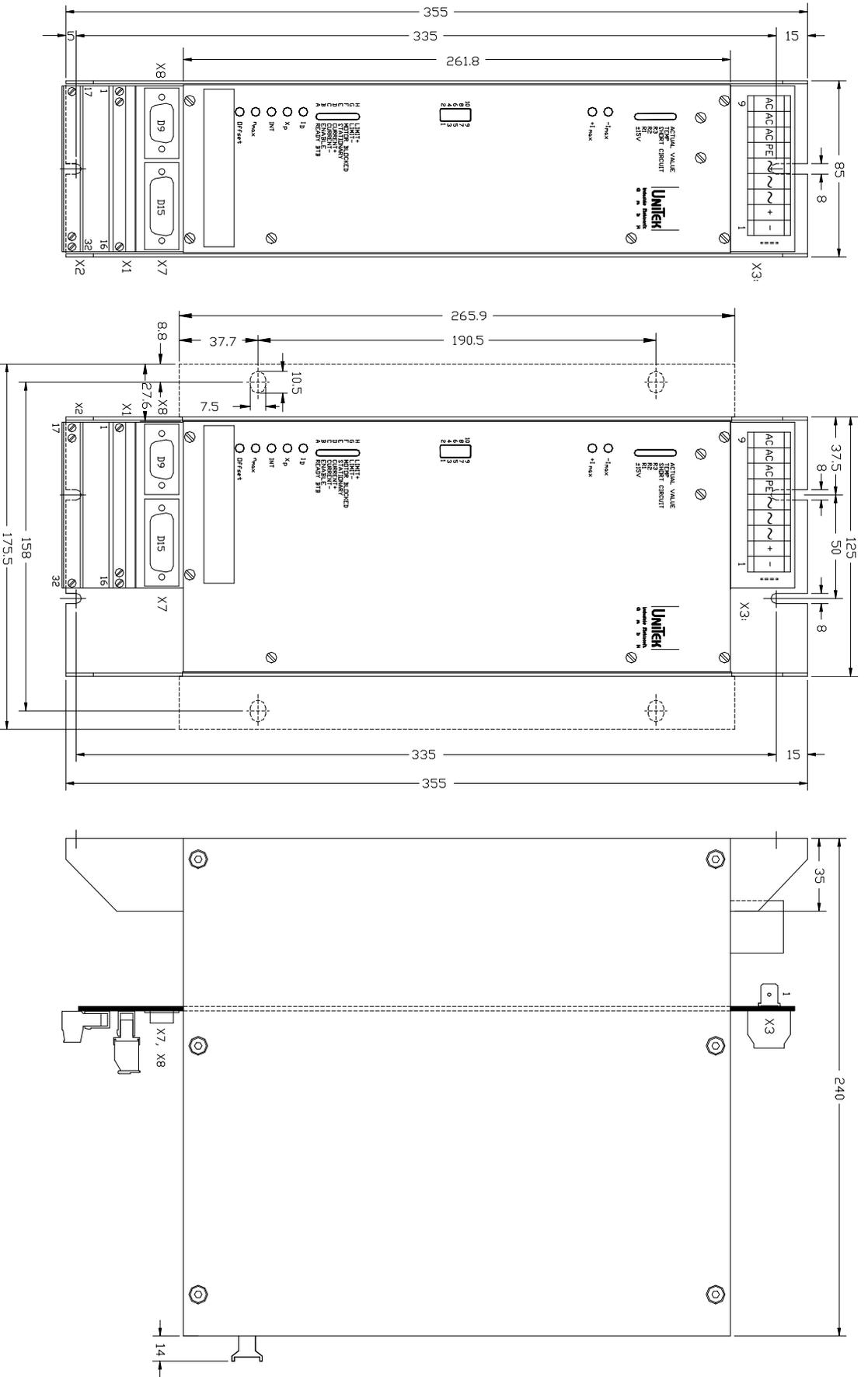
Caution:

| | |
|--|---------------------------------------|
| When order please specify: | |
| Notice duty cycle | Fan with 100% on period |
| Several axes with 16A rated current in one rack. | use external fan |
| Mains voltage <180V~ | charging circuit must be bridged |
| Exact torque regulation | Current controller with PI-switching |
| Great centrifugal mass | external ballast resistor >300Ω, 600Ω |

Dimensions

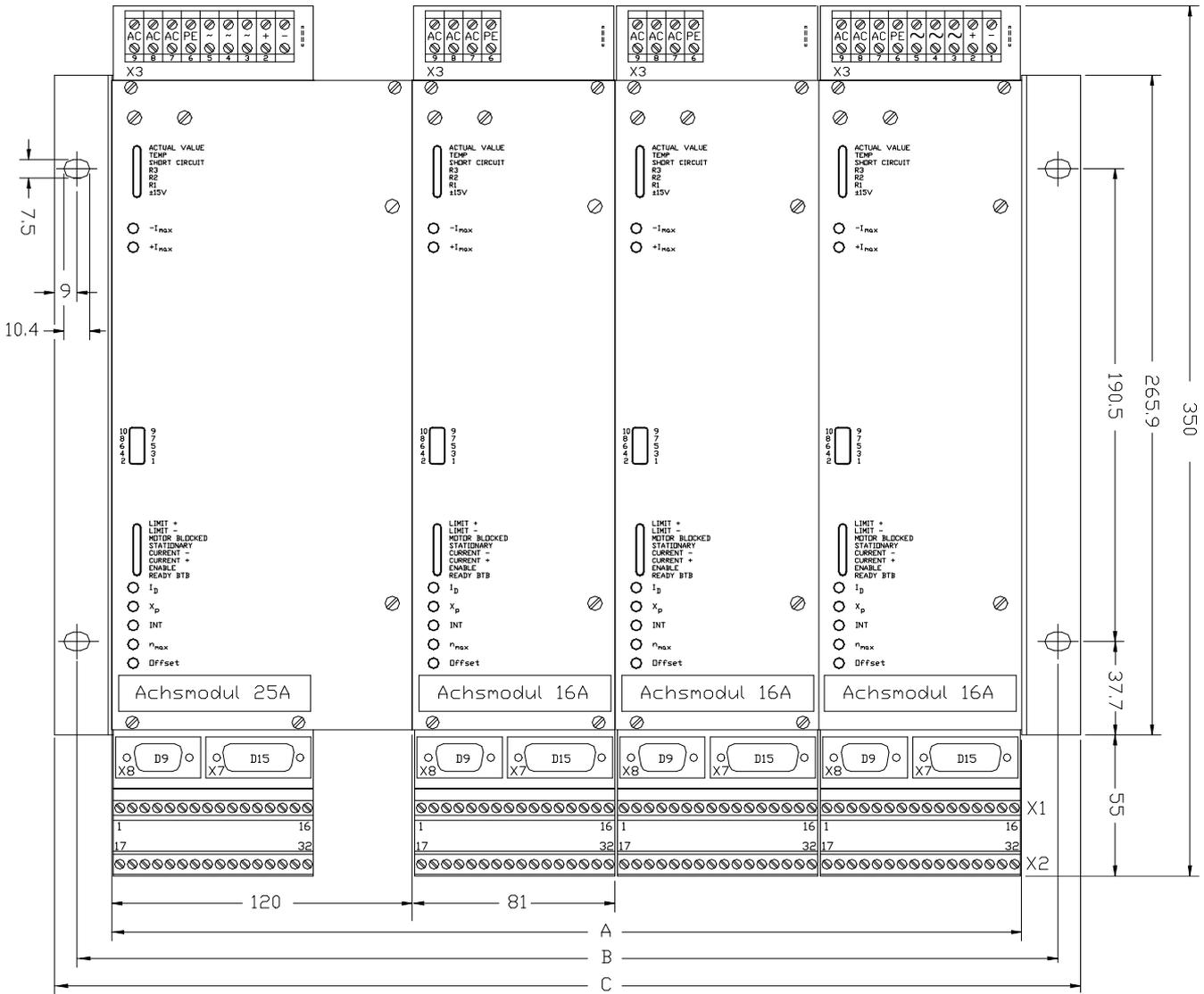
Compact device 10,16A

25A



2 Mechanical Installation

Multi axes combination



| Dimensions 6HE (mm) | | | | | |
|---------------------|---------------|--------|--------|--------|--------|
| Dimensions | plug-in units | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| A | 1xE+3 | 2xE+3 | 3xE+3 | 4xE+3 | 5xE+3 |
| B | 1xE+40 | 2xE+40 | 3xE+40 | 4xE+40 | 5xE+40 |
| C | 1xE+55 | 2xE+55 | 3xE+55 | 4xE+55 | 5xE+55 |

Unit-grid dimension

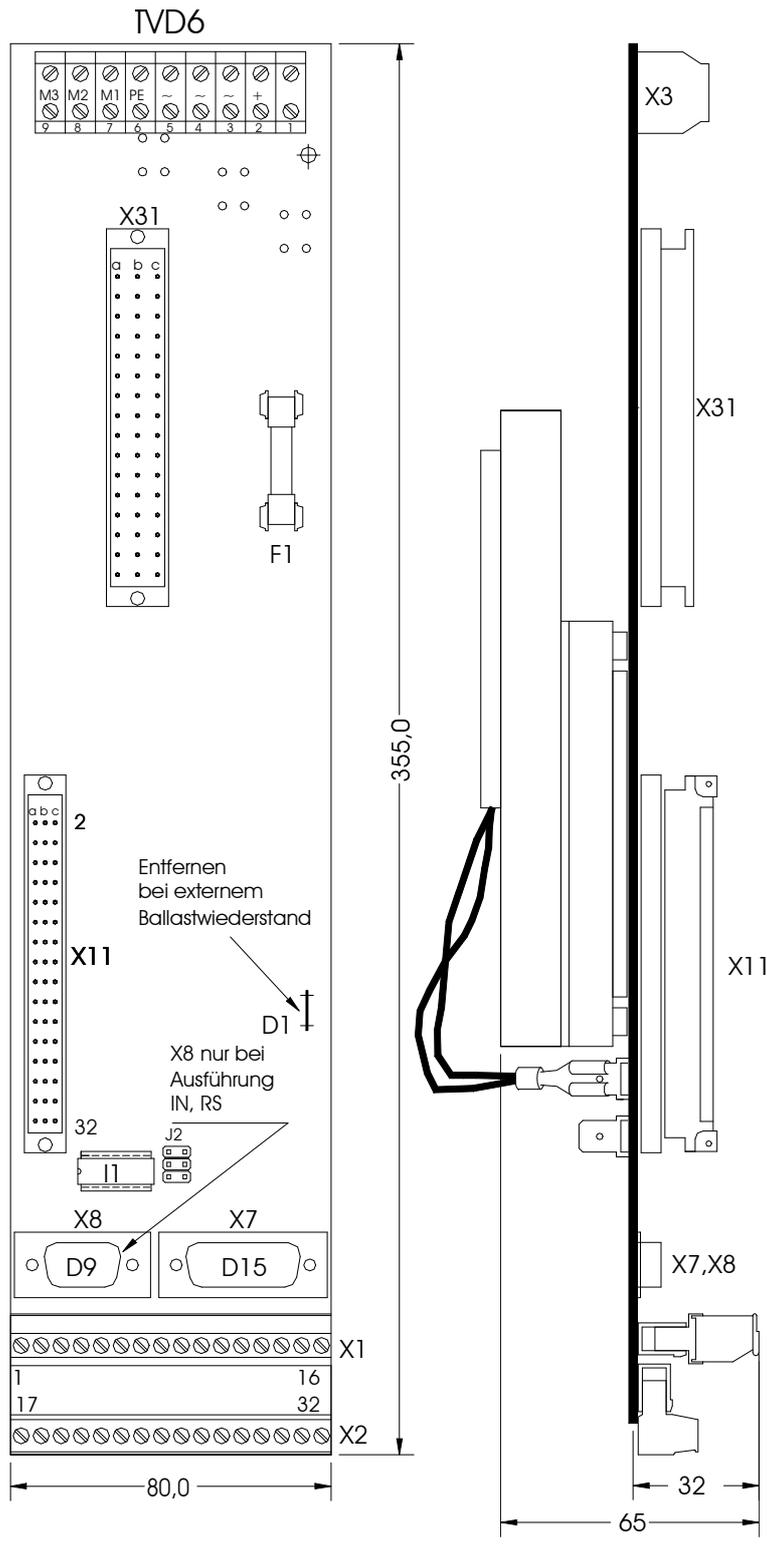
Rated current ≤ 16A

E= 81.28mm

Rated current 25A

E=121.92mm

Mounting height 255mm

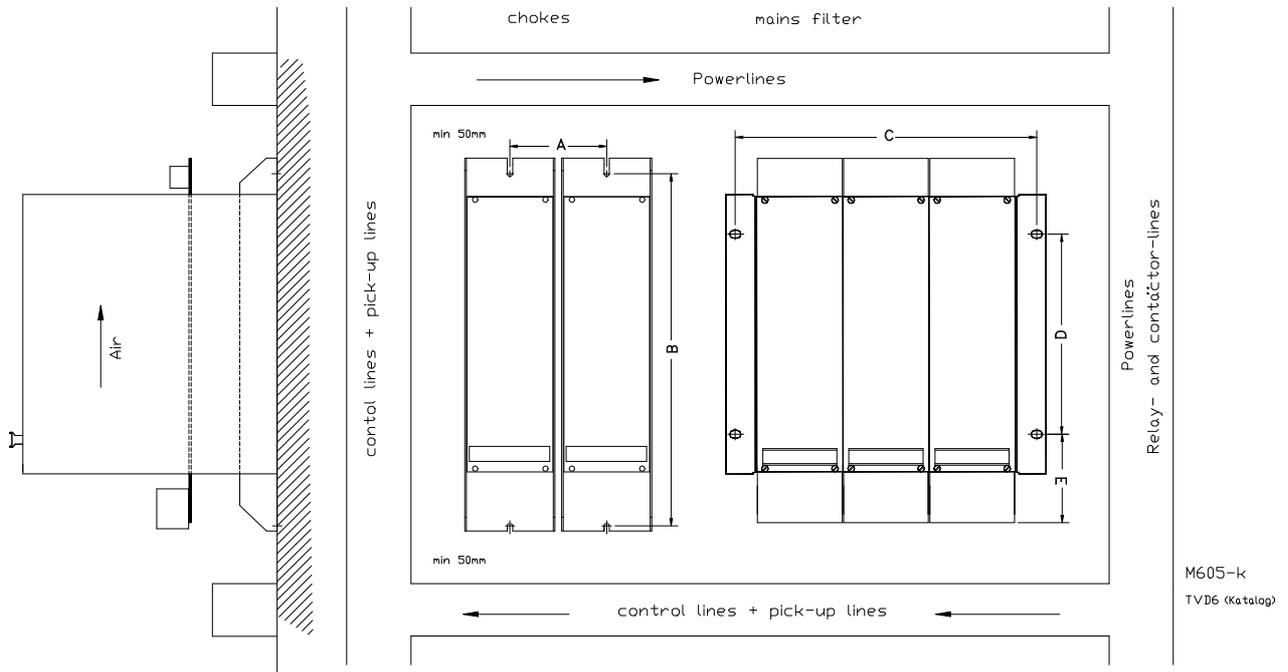


Power supply unit back panel with plug-in-device (without rack)

Rack

- High units : 6HE
- Wide units 10,16A device : 16TE
- Wide units 25A device : 24TE

Mixed 6HE, 3HE racks on request



Mounting dimensions (mm)

Compact device

| Current | A | B | C | D | E | thread |
|---------|-----|-----|-----|-------|----|--------|
| 10,16A | 95 | 335 | | | | M4 |
| 25-w | 135 | 335 | | | | M4 |
| 25-sw | 180 | | 158 | 190.5 | 55 | M5 |

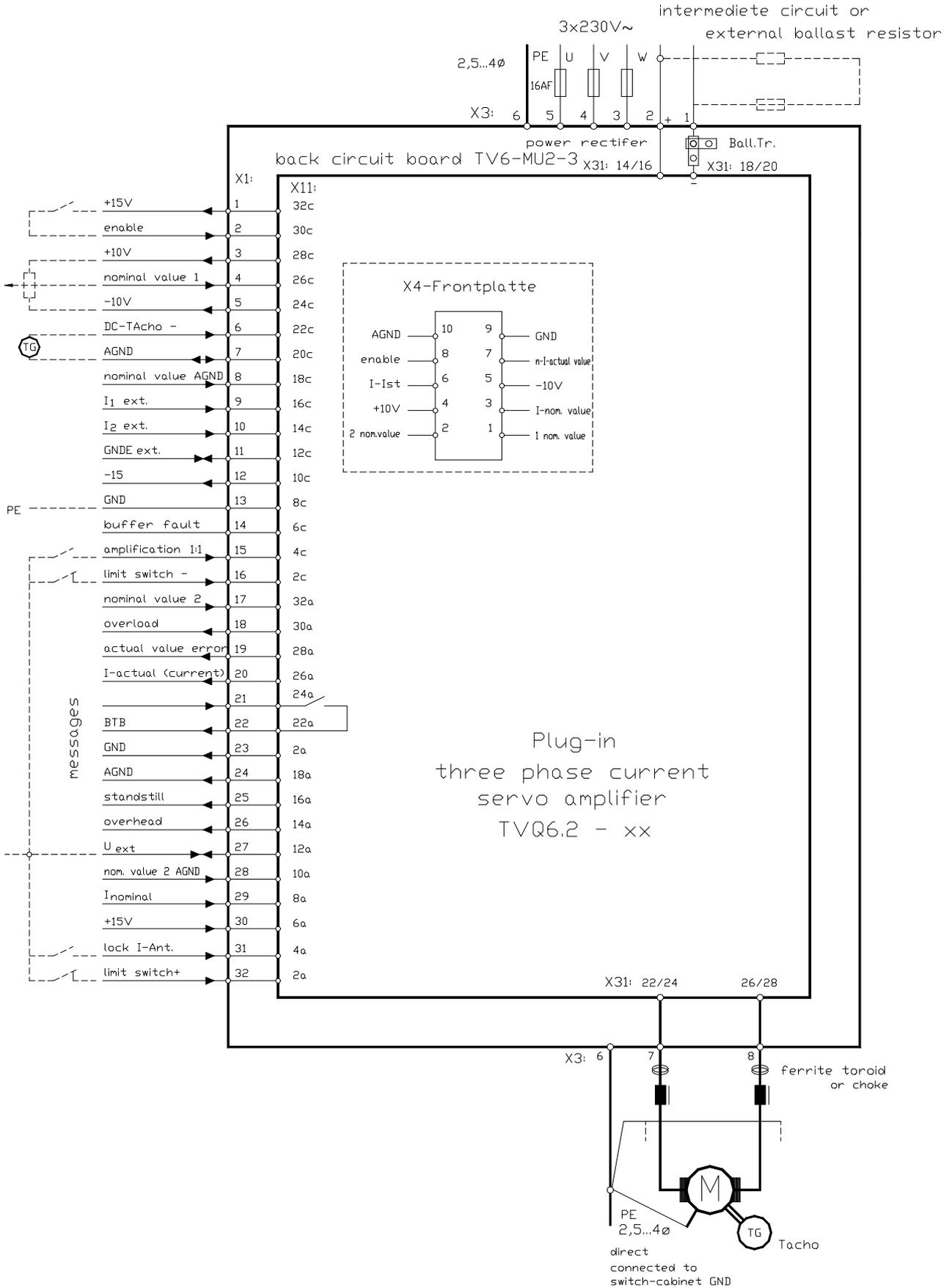
Multi-axes combination

| | A | C | D | E | thread |
|---------------|-------------------|-------------------|-------|----|--------|
| Wall mounting | $n \times E + 60$ | $n \times E + 40$ | 190.5 | 55 | M5 |

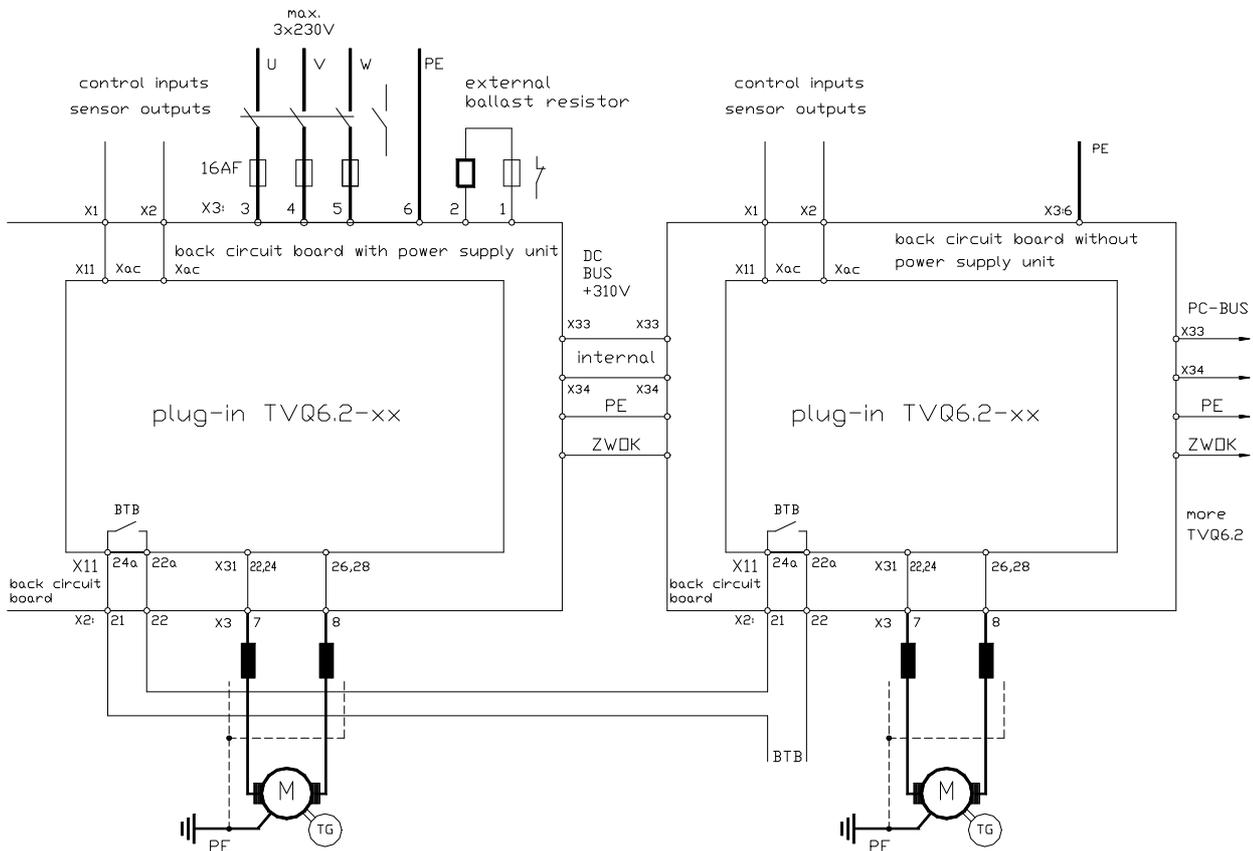
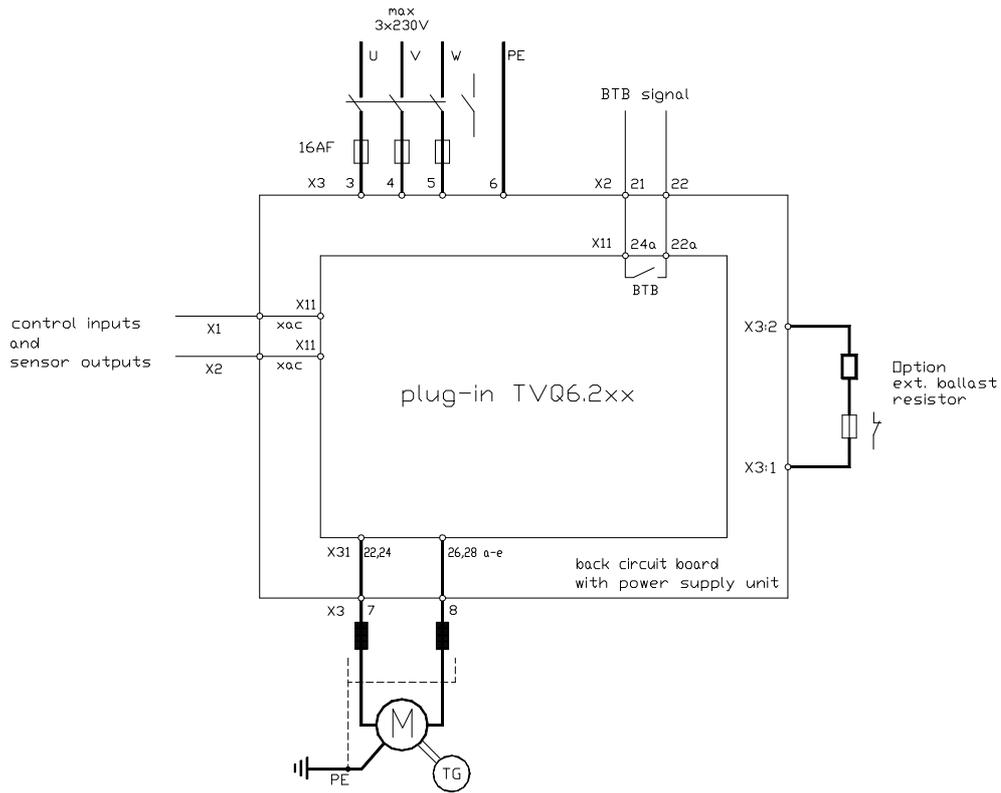
Rated current = 10,16A E = 81.28mm

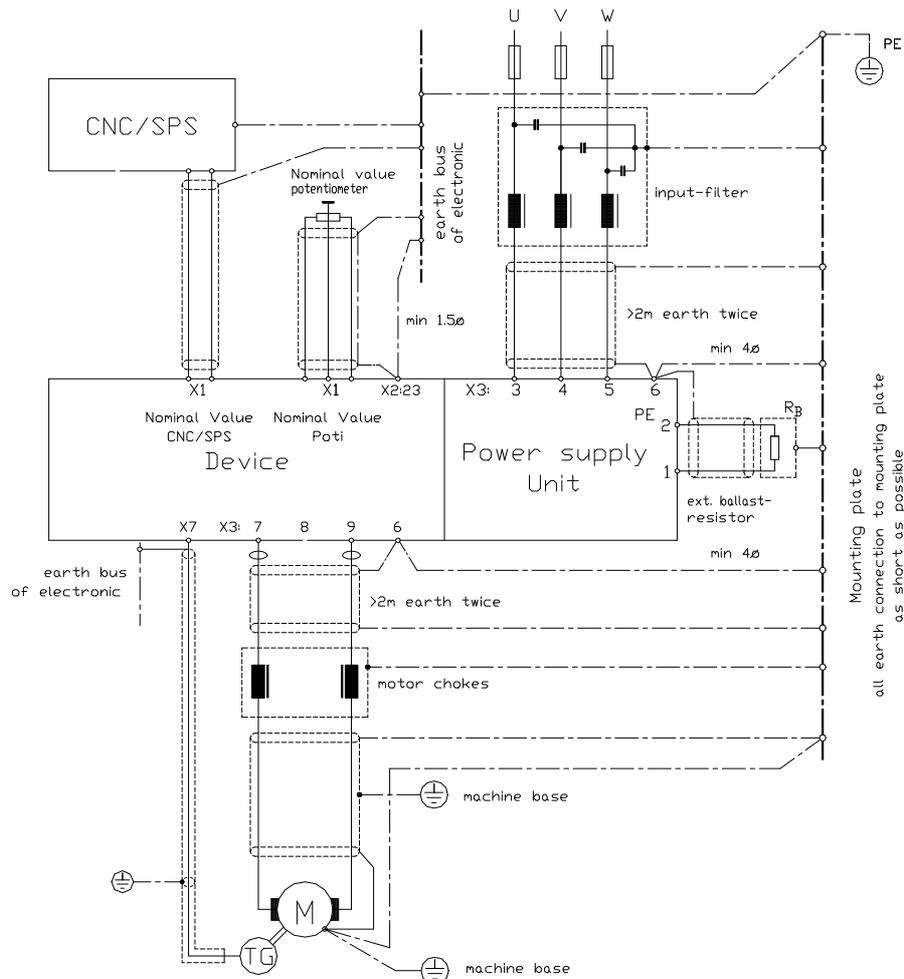
Rated current = 25A E = 121.92mm

n = number of plug-in units



3 Electrical Installation





The devices are according to EU-regulation 89/336/EWG, the standards EN 50081-2 and prEN 50082-2 will be observed under the following conditions.

Device, transformer, motor chokes and mains filter fixed on a 500x500x2 mm mounting board.
 Mounting board and motor frame connected to gnd with a 10mm² wire.
 Devices reference X1:13 connected to mounting board with a 2.5mm² wire.
 Device-PE-screw connected to mounting board with a 50mm long 4mm² line.

Single-phase power supply:

mains filter Type : up to 16A = FE1-16
 linelength device - mains filter <100mm

Three-phase power supply:

mains filter Type : up to 16A = FE3-16
 up to 25A = FE3-25
 linelength transformer - mains filter <500mm
 linelength device - mains filter <100mm

Motor connection:

motor chokes Type : 10A = MD78-10
 16A = MD84-20
 5A = MD84-30

motor line 1,5m long, 4core shielded. Shielding on device side fixed to mounting board and on motor side flächig connected to PE.

Contol lines supply:

All lines shielded <1.5m. Shielding fixed to PE

3 Electrical Installation

Connetion Advice

Caution:

The connection advice concerning the individual attachments of the connections to the plug numbers or terminals are binding.

All further advices to this are not binding.

The input and output lines can be altered or completed in consideration of the electrical regulations.

Notice:

- connection advice and operation advice
- local technical regulations
- EU-machine regulation 89/392/EWG

Input filters:

(See EMC advices on page 14)

short line length between input filter and device or shielded line.

Parasitic current switch

- Bauart nach DIN VDE 0664
- tripping current > 200mA
- only combined with other safety precaution

Connection to 230 V~ Mains

2-phase connection 1x 230V~

compact device up to 10A.

multi axis combination up to 20A

3-phase connection 3x 230V~

with >10A (multi axis combination > 20A) necessary

Connection lines, Fuses

| Dimensioning | | 10A | 16A | 25A | max. 30A |
|--------------------------|-----------------|------|-----|-----|----------|
| Cross section | mm ² | 0.75 | 1.5 | 2.5 | 2.5 |
| Fusing | | | | | |
| blow-out fuse | AF | 10 | 16 | 25 | 30 |
| automatic circuit braker | A | 10 | 16 | 25 | 25 |

electronical starting current limitation to 7A~

Connection to 400V~ Netz

2-phase or 3-phase connection

Auto- or isolationtransformer

One transformer for several devices

Notice:

- rate contactor according to transformer inrush current.
- time-lag fuses before transformer
- fuse value according to transformer current
- fast fuses after transformer
- fuse value per powersupply unit max. 30AF

Transformer power (Example):

Primay voltage 400V~

Secondary voltage 230V~

AutotransformerTransformer rated current [VA] = $0.6 \times 230 \times I_M \times GLF \times nF$ **Isolationtransformer**Transformer rated current [VA] = $1.42 \times 230 \times I_M \times GLF \times nF$

IM = sum of motor currents

GLF = coincidence factor

nF = speed ratio- factor

GLF =

1 with 1 motor

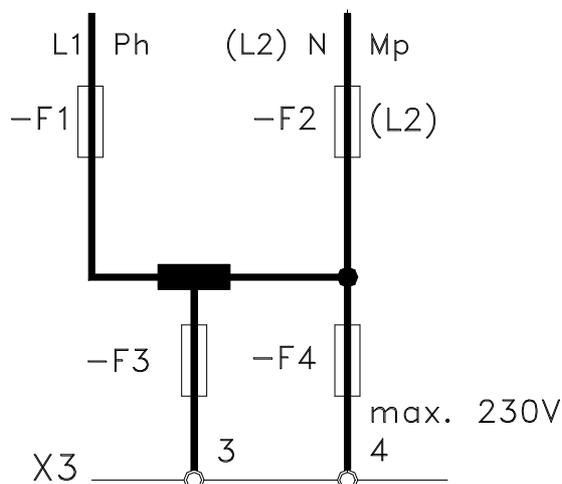
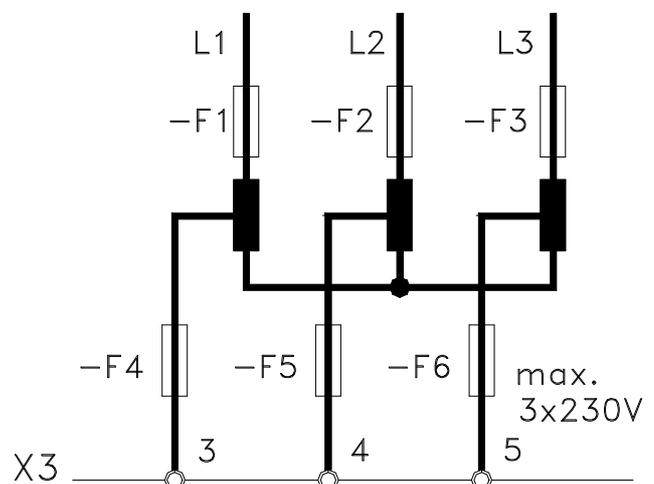
0.5 ... 0.7 with 2 motors

0.4 ... 0.6 more than 2 motoren

nF =

effective speed

maximum speed

2-phase-voltage**3-phase-voltage**

3 Elektrical Installation

Motor Power connection

| | | | | |
|---------------|------|------|------|------|
| Line number | PE | M1 | M2 | M3 |
| Connection X3 | X3:6 | X3:7 | X3:8 | X3:9 |

X3:6 is internally connected with the devices PE-bolt.

| | | | | | |
|---------------|--|-----|-----|--------|-------|
| motor line at | 10A | 16A | 25A | thermo | brake |
| Cross section | 1.5 | 1.5 | 2.5 | 0.75 | 0.75 |
| kind of cable | 3x motor line shielded + PE + (if required: 2x thermo + 2x brake) | | | | |

Shielding with earth clamp

connected directly with the entry of the switch cabinet and the motor earth manifold

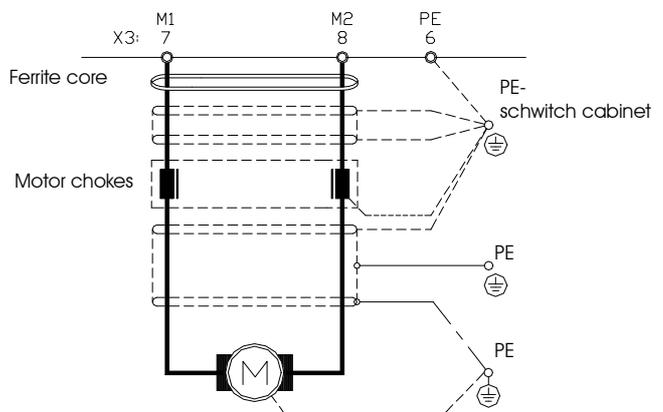
If there long lines earth several times

Ferrit cores

- against HF-disturbance

Motor Chokes

- against LF-disturbance
- against high discharge current
- for high efficiency of the motor
- for the duration of the motors life



External ballast resistor

dimensioning:
average of the brake power per axis

$$P_{\text{brake}} [\text{W}] = \frac{1 \times J_g \times n^2}{2} - \frac{J_g^2 \times a \times n}{M_M} \times f$$

| | | | |
|-------|---|------------------------------------|-------------------|
| J_g | = | motor- and effective load torque | $[\text{kgm}^2]$ |
| n | = | maximum speed | $[\text{s}^{-1}]$ |
| M_M | = | maximaum motor torque | $[\text{Nm}]$ |
| a | = | deceleration | $[\text{s}^{-2}]$ |
| f | = | repeating frequency of the braking | $[\text{s}^{-1}]$ |

To change on back panel power supply unit:

- remove solding bridge D

Notice:

| | | |
|---------------------------|-----|--|
| External ballast resistor | >>> | minimum resistance 20Ω |
| Internal ballast resistor | | $27\text{W}/50\Omega$, at 3% on-period = 1.5 kW |

Control Connections

The connecting advices are for general information and without obligation

Notice:

- **Connecting- and operating instructions**
- **Local regulations**
- **EU-machine regulation**

Connector numbers

Clamp connectors X1: 1 up to X1:16 and X2 : 17 up to X2 : 32

Signal lines

shielded and separated from power lines
nominal value lines paired twisted and shielded

Logical connections

Relay with golden pins or reed relay. Maximum currenxy on contact 6mA.

Internal Logical voltage 15V=

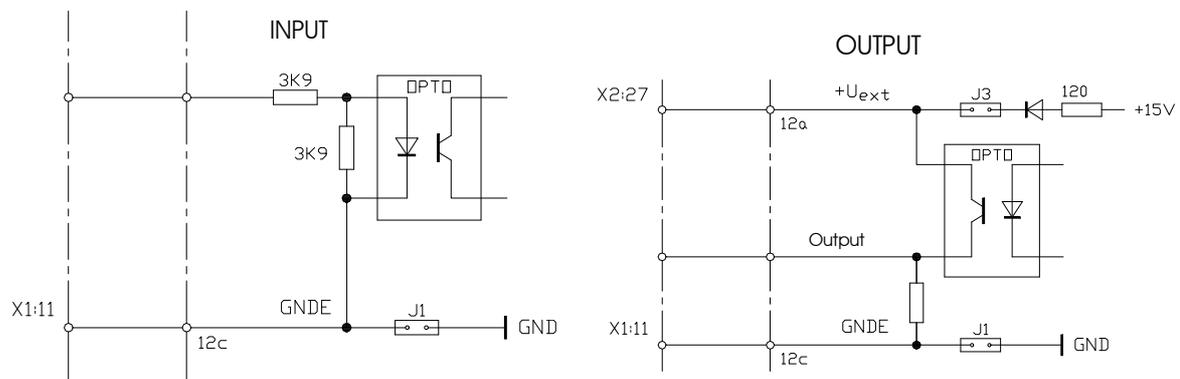
- not galvanic isolated
- with relay control
- Jumper J1 and J3 plugged

External logical voltage

- galvanic isolated
- used with SPS or CNC
- UEXT +15 bis 30V= at clamp X2:27
- GNDE at clamp X1:11
- Jumper J1 and J3 unplugged
- residual ripple of the logical voltage <20%

Default setup: Jumper J1 and J3 plugged.

Inputs and outputs with optocoupler



3 Elektrical Installation

Enable

Enable >> active with positive voltage

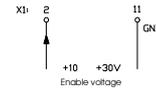
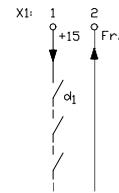
Jumper SW1 position 2-3 (default setup)

Enable - relay contact

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

Enable -external Logical voltage

- Enable voltage X1:2 +10 ... +30V



Enable >> active at zero point

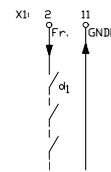
Jumper SW1 Position 1-2 (US-version)

Enable - relay contact

- Logic-zero point X1:11
- Contact chain between X1:2 and X1:11

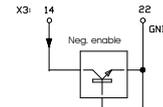
Enable -external logical voltage

- Enable voltage X1:2 0V



Switching on enable

- Nominal value and speed controller are released at once
- LED D1B bright



Switching off enable

Jumper J2 plugged (quick stop) (default setup)

- nominal value is internally and immediately set to zero (deceleration)
- LED D1B dark.
- after 5 seconds >> speed controller locked.

Jumper J2 unplugged (free running down)

- Speed controller locked at once.
- LED D1B dark.

Notice:

Jumper SW1 Pos: 2-3 > enable aktive at > +10V (default setup)
 Pos: 1-2 > enable aktive at zero point

Jumper J2 plugged > quick stop (default setup)
 Unplugged > free running down

Limit Switches

Limit switch inputs

Enable for

- positive nom. value direction

LED 1D >> contact between X2:27 and X1:16

- negative nom. value direction

LED 1H >> contact between X2:27 and X2:32

Limit switch functions

Contact

Closed

open

Function

enable > LED bright

direction locked

limit switch is occupied >> contact open >> drive decelerates

Changing nominal value direction

- drive moves from limit switch

- limit switch cleared >> contact closed

Caution:

Without limit switch >> connection between X2:27, X2:32 and X1:16

Integral switching off

Function - relay contact

Contact Speed controller

open P-I regulation

Closed P- regulation

Function - external logical voltage

Voltage X2:31 Speed controller

<2V P-I regulation

>10V P- regulation

Caution:

Notice optimization advices.

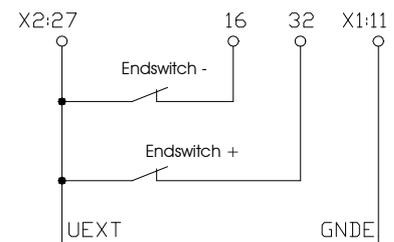
Mains failure Braking

braking function

- at mains failure nominal value is set immediately to zero

- Phases monitoring switched off (Jumper J1 on back panel)

generatoric rear feed into the intermediate circuit.



3 Elektrical Installation

Speed nominal value

voltage source for nominal values $\pm 10V$, 10mA
 +10V X1:3
 -10V X1:5
 GND X1:8

If the internal voltage source is used >> Jumper S11, S12 plugged

Nominal value inputs

- Maximum nominal value voltage $\pm 10V$
- Input resistance 50 k Ω
- Relay contacts: gold or reed contacts

Nominal value lines paired twisted and shielded. Shield connection on one side

Connection

| Nom.value | Connection | Jumper | Function | Measuring point |
|-------------|-------------------------------|--------------------|----------------|-----------------------|
| nom.value 1 | X1:4 (Signal) X1:8 (GND) | | direct | X4:1 X4:10 |
| nom.value 2 | X2:17 (Signal) X2:28 (GND) | SW2 1-2 SW2 2-3 | direct ramp | X4:2 X4:2 X4:10 |

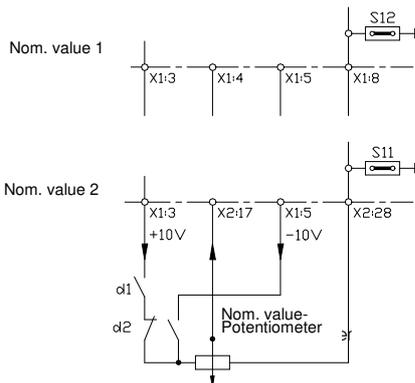
Jumper positions

| Function | Jumper | Position | default setup |
|-------------------------------|--------|---------------------|---------------|
| Nominal value 1 | | | |
| Differential input | S12 | unplugged | |
| Using internal voltage source | S12 | plugged | *** |
| Sollwert 2 | | | |
| Differential input | S11 | unplugged | |
| Using internal voltage source | S11 | plugged | *** |
| With ramp (integrator) | SW2 | plugged in pos. 2-3 | *** |
| Without ramp | SW3 | plugged in pos. 1-2 | |
| Without nom. value 2 | SW2 | unplugged | |

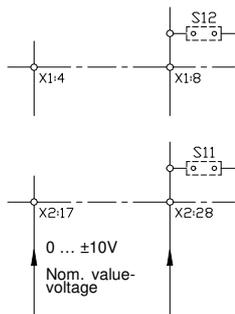
Resistor for nominal value current 0 ... $\pm 20mA$

| | | |
|-----------------|------|--------------|
| Nominal value 1 | R121 | 500 Ω |
| Nominal Value 2 | R4 | 500 Ω |

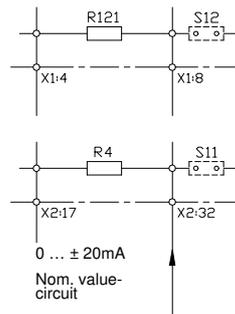
internal supply



CNC/SPS



nom.value current



External current limitation

Voltage source for external current limit
+10V/10mA X1:3

Control range:

| | | |
|------------------------------|-----|----------------------------|
| 0 ... + 5V | >>> | 0 up to 100% rated current |
| 0 ... +10V | >>> | 0 up to 200% rated current |
| Internal overcurrent control | >>> | max. 5sec. |

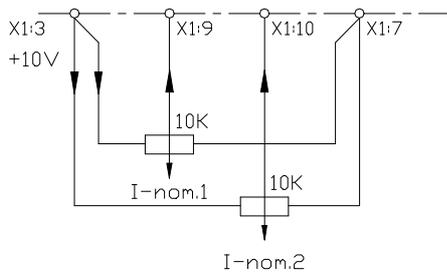
Inputs

Maximum input voltage +10V
Input resistance 10kΩ
Internal attenuation with potentiometer I_{max1}, I_{max2}
Relay contacts: gold or reed contacts

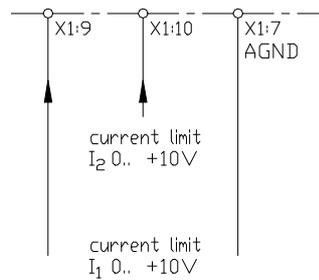
Connection

| Current limit | connection | jumper | measuring point |
|---------------|------------------------------|---------------|-----------------|
| Positive | X1:9 (signal) X1:7 (GND) | S19 unplugged | X4:3 X4:10 |
| Negative | X1:10 (signal) X1:7 (GND) | S20 unplugged | X4:3 X10 |

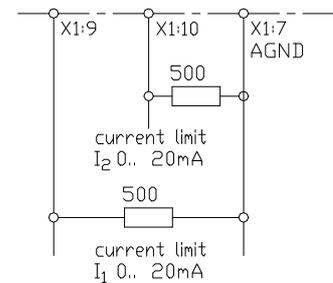
Internal supply



CNC/SPS



nominal value



Caution:

With internal current limit adjustment >>> jumper S19, S20 plugged.

3 Electrical Installation

Ready for Operation Signal BTB

Relay

Signal contact X2:21 - X2:22
 Contact values max. 48V, 0.5A

The ready for operation signal (BTB) shows the control (CNC/SPS) that the drive is in working order.
 Connect BTB-signals of several axes in series.

delay after switching on the mains >> max. 1 sec.

Indication

| | | |
|---------------------|----------------|----------------|
| Ready for Operation | LED D1A bright | contact closed |
| Error | LED D1A dark | contact open |

Ready for operation turns off with

| | | |
|----------------------------|-------------|-----------------------|
| Individual fault | BTB-LED D1A | Individual fault- LED |
| actual value error | dark | LED D2H bright |
| Overtemperature | dark | LED D2G bright |
| Short, line-to-earth fault | dark | LED D2F bright |
| Voltage error | dark | LED D2B bright |
| Buffer error | dark | LED D2A bright |

Caution:

In any case use BTB-contact with CNC/SPS -Control !

Analogue measuring outputs

| Function | Motor current | Speed |
|------------------------|---|-------------------------------|
| Connection | X2:20 - X2:24 | X1:6 - X1:7 |
| Measuring value before | 2.5V = rated current 5V = peek current | tachometer voltage attenuator |
| Output resistance | unipolar positive 1 kΩ | bipolar 4.7 kΩ |

Signal outputs

logical outputs with opto-coupler

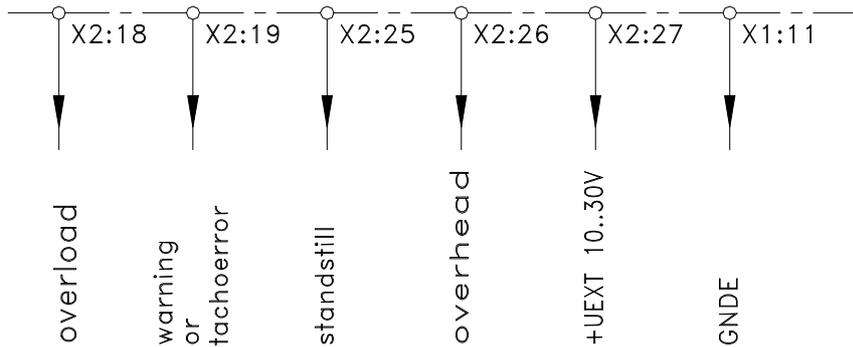
- wire break securebei in case of error output is locked
- Output voltage 10 ... 30V=
- Output current 5mA
- Output resistance 1kΩ

Overview of signal outputs

| Signal | Function | Output | Indication | stored |
|-----------------|--------------------------|--------|------------|--------|
| Buffer | power supply error | X1:14 | LED 2A | yes |
| Overload | blocked | X2:18 | LED 1F | no |
| Standstill | Speed < 1% | X2:25 | LED 1E | no |
| Overtemperature | motor >150°C | X2:26 | — | no |
| | heat sink > 75°C | X2:26 | — | no |
| | heat sink 80°C | X2:26 | LED 2G | yes |
| Warning | motor, heat sink too hot | X2:19 | — | no |
| Reference earth | GND | X2:23 | | |

memory reset:

- Enable Off-On Jumper S6 plugged (*default setup*)
- Mains Off-On Jumper S6 unplugged



3 Electrical Installation

Control Connections

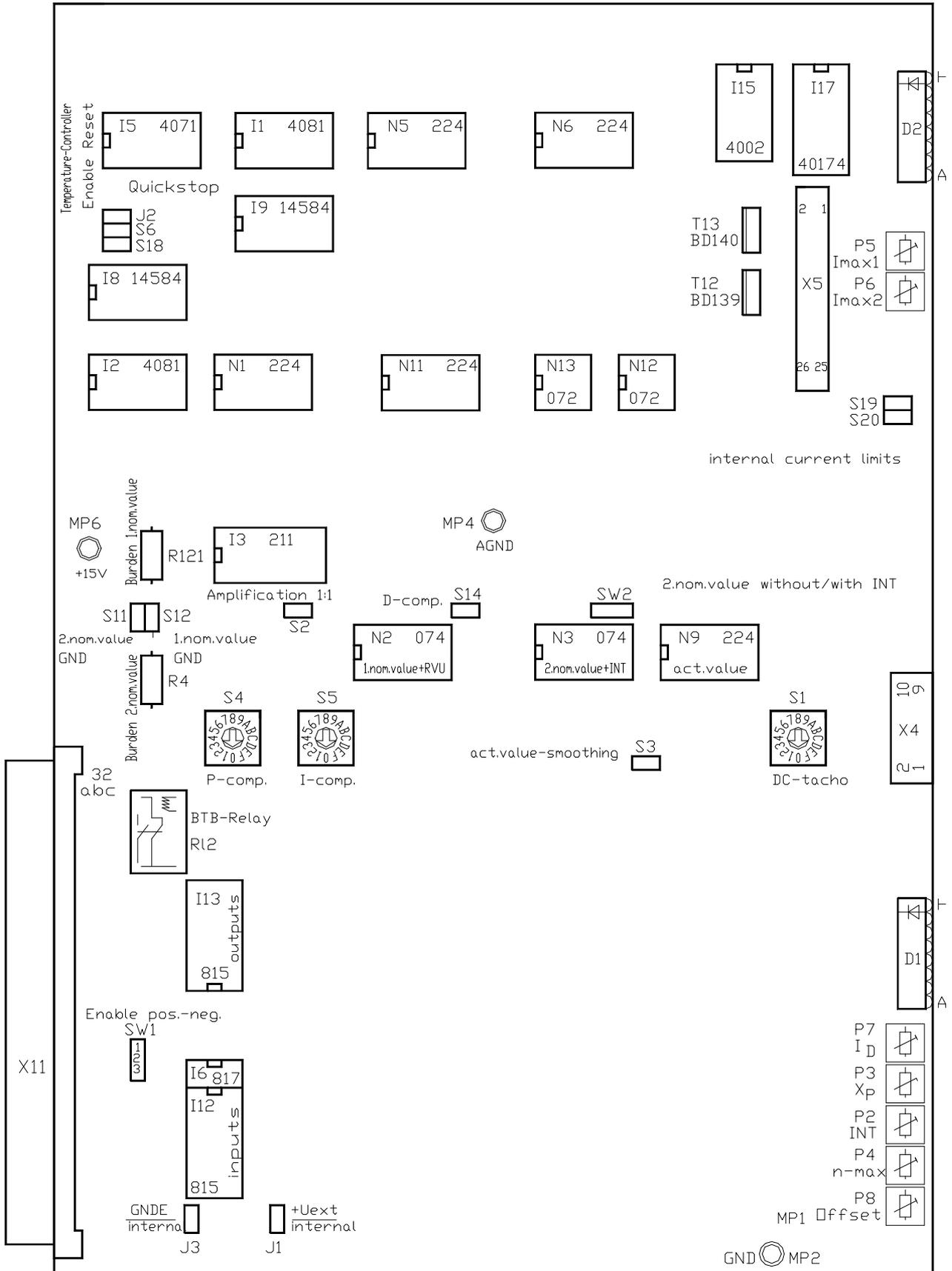
| Function | Clamp-Number | Pin-Number (internal) |
|--|--------------|---------------------------|
| + 15 Volt (for enable) | X1: 1 | X11: 32c |
| Enable-Input (+10 ... +30 Volt) | X1: 2 | X11: 30c |
| + 10 Volt (for nominal value) | X1: 3 | X11: 28c |
| Nominal value 1 - input +(Signal) | X1: 4 | X11:26c |
| - 10 Volt (for nominal value) | X1: 5 | X11: 24c |
| DC-tacho - input (Signal) | X1: 6 | X11: 22c |
| DC-tacho - input (AGND) | X1: 7 | X11: 20c |
| Nominal value 1 - input -(AGND) | X1: 8 | X11: 18c |
| External current limit I ₁ | X1: 9 | X11: 16c |
| External current limitI ₂ | X1: 10 | X11: 14c |
| External GNDE | X1: 11 | X11: 12c |
| -15V (ext. electronic) | X1: 12 | X11: 10c |
| Device ground GND | X1: 13 | X11: 8c |
| Buffer error | X1: 14 | X11: 6c |
| Amplification 1:1 | X1: 15 | X11: 4c |
| Limit switch - | X1: 16 | X11: 2c |
| Nominal value 2 - input +(Signal) | X2: 17 | X11: 32a |
| Signal Overload | X2: 18 | X11: 30a |
| Signal temperature or tachometer error | X2: 19 | X11: 28a |
| Current (list) | X2: 20 | X11:26a |
| Ready for operation | X2: 21 | X11: 24a |
| Ready for operation | X2: 22 | X11: 22a |
| Device ground GND (Earth) | X2: 23 | X11: 20a |
| Analogue-device ground(AGND) | X2: 24 | X11: 18a |
| Signal standstill | X2: 25 | X11: 16a |
| Overtemperature | X2: 26 | X11: 14a |
| external voltage UEXT | X2: 27 | X11: 12a |
| Nominal value 2 input -(AGND) | X2: 28 | X11: 10a |
| Current nominal value | X2: 29 | X11: 8a |
| +15V (external electronic) | X2: 30 | X11: 6a |
| Integral component interlock | X2: 31 | X11: 4a |
| Limit switch + | X2: 32 | X11: 2a |

Power connections X3

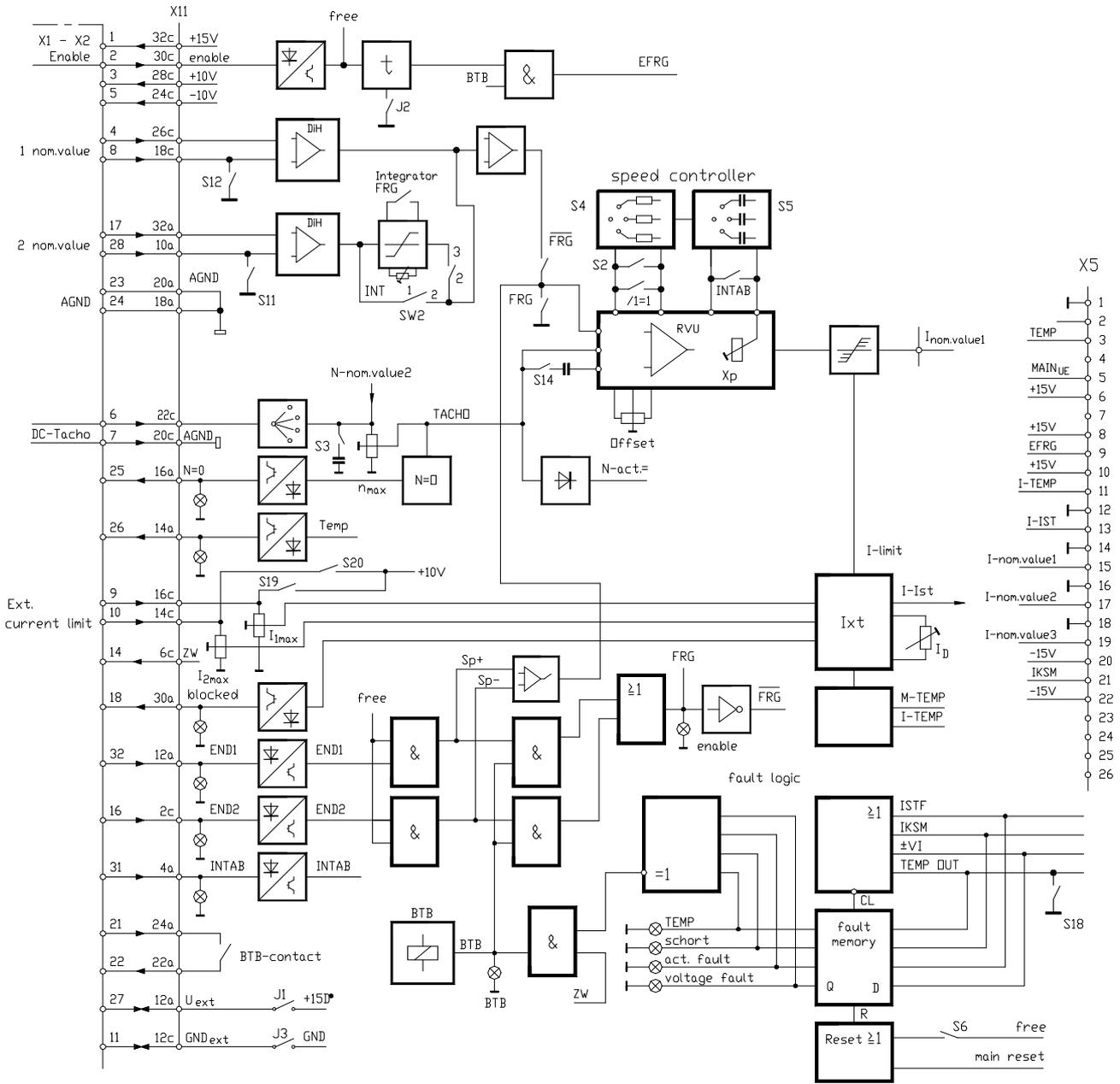
| Function | Clamp-Number | Pin-Number |
|---------------------------|--------------|----------------|
| External ballast resistor | X3:1 | X31: 18,20 abc |
| DC Buffer | X3:2 | X31: 14,16 abc |
| Mains L1 230V~ | X3:3 | X31: 10,12 abc |
| Mains L2 230V~ | X3:4 | X31: 6,8 abc |
| Mains L3 230V~ | X3:5 | X31: 2,4 abc |
| Earth PE | X3:6 | |
| Motor 1 | X3:7 | X31: 22,24 abe |
| Motor 2 | X3:8 | X31:26,28 abe |

Control Connector X4 (front panel)

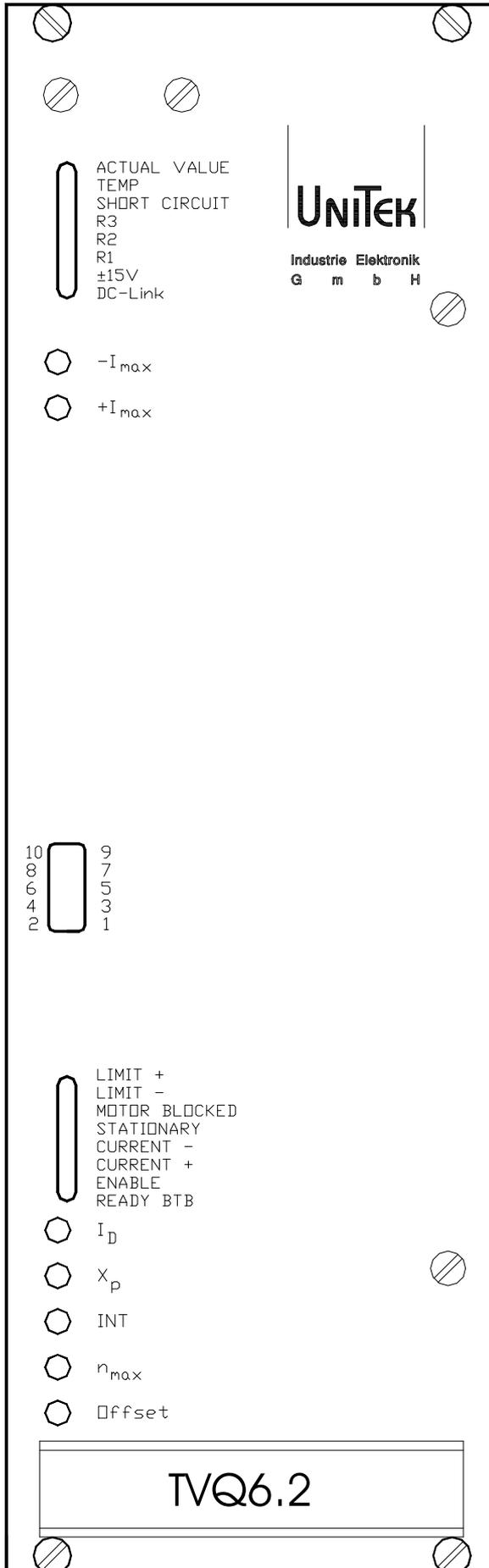
| Function | Pin-Number |
|---|------------|
| 1st speed nominal value behind differential amplifier | X4: 1 |
| 2nd speed nominal value behind differential amplifier or integrator | X4: 2 |
| Current nominal value | X4: 3 |
| + 10 Volt | X4: 4 |
| - 10 Volt | X4: 5 |
| Current actual value | X4: 6 |
| Speed actual value (behind attenuator) | X4: 7 |
| Enable | X4: 8 |
| Device ground GND | X4: 9, 10 |



4 Device Overview



Block Diagram



Indication LED 2x

- H Actual value error
- G Temperature- error
- F Short detection
- E Rotor position 3
- D Rotor position 2
- C Rotor position 1
- B Voltage- error
- A Buffer error

Trimmer

- Current limit I_{max} -
- Current limit I_{max} +

Control Conector X4

- 1 nom.value 1 behind diff.-amplifier
- 2 nom.value 2 behind Integrator
- 3 Current - nominal value
- 4 +10V
- 5 -10V
- 6 Current - actual value
- 7 Speed - actual value
- 8 Enable
- 9 not coated
- 10 device ground GND

Indication LED 1x

- Limit switch +
- Limit switch -
- Overload - blocked
- Standstill
- Current direction -
- Current direction+
- Enable
- Ready for operation

Trimmer

- I_D steady current limit
- X_p Amplification
- INT Integration time
- n_{max} Speed
- Offset Zero point

4 Device Overview

Adjustment functions

| Function | Poti | Switch | Jumper | Component |
|-----------------------------------|--------|--------|-----------|------------|
| Actual value balancing - DC-Tacho | | S9 | | switch S9 |
| | nmax | | | trimmer P4 |
| Internal current limit | | | S19, S20 | |
| | Imax1 | | S19 | trimmer P5 |
| | Imax2 | | S20 | trimmer P6 |
| External current limit | | | | trimmer P5 |
| | Imax1 | | | trimmer P6 |
| | Imax2 | | | trimmer P7 |
| Steady current | ID | | | trimmer P7 |
| Integrator | | | SW2 (2-3) | trimmer P2 |
| Amplification P-Component | | S4 | | switch S4 |
| | Xp | | | trimmer P3 |
| Amplification I-Component | | S5 | | switch S5 |
| Zero point adjustment | Offset | | | trimmer P8 |

Jumper

| Function | plugged | unplugged | Jumper-Number |
|---|---------|------------------------------|---------------|
| 1st nominal value input (zero referenced) | | differential input | S 12 |
| 2nd nominal value input (zero referenced) | | differential input | S 11 |
| Ramps 2nd nominal value on=2-3, | | 2-3,off=1-2 plugged | SW2 2-3/1-2 |
| Actual value differentiation | | no differentiation | S 14 |
| Actual value smoothing | | no smoothing | S 3 |
| Internal current limit 2 | | external current limit 2 | S 19 |
| Internal current limit 1 | | external current limit 1 | S 20 |
| Amplification 1=1 | | Amplification >1000 | S 2 |
| ext. +UL = int. +15V | | ext-int separated | J 1 |
| ext GND = int. GND | | ext-int separated | J 3 |
| Quick stop (delayed controller interlock) | | free running down | J 2 |
| Enable - reset | | mains-reset | S 6 |
| Enable positive=2-3 | | 2-3,negative=1-2 plugged | SW1 2-3/1-2 |
| Temperature controller | | temperature circuit breaking | S 18 |

LED- Indications

| Function | designation | LED-Number |
|----------------------------|---------------|---------------|
| Control electronics | | |
| Limit switch + | LIMIT+ | LED H |
| Limit switch - | LIMIT- | LED G |
| Blocked | MOTOR BLOCKED | LED F |
| Standstill | STATIONARY | LED E |
| Speed controller output - | CURRENT- | LED D |
| Speed controller output + | CURRENT+ | LED C |
| Enable nominal value | ENABLE | LED B |
| Ready for operation | READY BTB | LED A |
| Power section | | |
| Actual value error | stored | ACTUAL VALUE |
| Temperature | choosable | TEMP |
| Short detection | stored | SHORT CIRCUIT |
| Rotorage R3 | no function | R3 |
| Rotorage R2 | no function | R2 |
| Rotorage R1 | no function | R1 |
| Voltage error | stored | ±15 |
| Buffer error | not stored | DC-LINK |
| | | LED D2x |
| | | LED H |
| | | LED G |
| | | LED F |
| | | LED E |
| | | LED D |
| | | LED C |
| | | LED B |
| | | LED A |

Adjustment Advice

adjustments

- only by qualified personnel
- adhered to safety regulations
- notice adjusting sequence

Presettings

| | | | |
|------------------------|----|---------|---------------------|
| Actual value | >> | Jumper, | networks |
| Nominal value inputs | >> | Jumper, | differential inputs |
| logical inputs/outputs | >> | Jumper, | int/ext. supply |
| P-I parameter switch | >> | Jumper, | switches |

Optimization

| | |
|-------------------------------|--|
| Actual value balancing | n_{max} adjustment |
| Current controller | adjusted by manufacturer (P- or PI-controller) |
| Current limits | I_{max} , I_D -adjustment |
| Speed controller | P-I-Switch, X_P -Adjustment |
| Slope limitation | INT-Adjustment (only nom. value 2) |
| Zero point | Offset-Adjustment |
| Path- and position controller | in CNC/SPS - Control |

Caution:

control systems have to be optimized from inside to outside.

sequence: current controller >> torque controller >> position controller (CNC/SPS)

Measuring values

Control connector X4

Measuring values

| | max. value | measuring point |
|---------------------------------------|------------|-----------------|
| Nom.value 1 after input amplifier | $\pm 10V$ | X4:1 |
| Nom.value 2 after input amplifier | $\pm 10V$ | X4:2 |
| Current nom. value (speed controller) | $\pm 10V$ | X4:3 |
| Current actual value unipolar | +5V | X4:6 |
| torque actual value after divider | $\pm 5V$ | X4:7 |

5 Adjustment

Nominal Value

| Function | | nom.value 1 | nom.value 2 |
|--------------------------------|--------|---------------|---------------|
| Input amplification | fix | 1 | 1 |
| Input voltage | max. | ± 10V= | ± 10V= |
| Differential input | Jumper | S12 unplugged | S11 unplugged |
| Input in relation to GND | Jumper | S12 plugged | S11 plugged |
| Input Signal | | X1:4 | X2:17 |
| Input GND | | X1:8 | X2:28 |
| Measuring on control connector | | X4:1 | X4:2 |
| Measuring value | max. | ±10V= | ±10V= |
| Integrator function | | not available | Jumper SW2 |

Input in relation to GND

with nominal value trimmer
with internal supply voltage
Jumper S11, S12 plugged
Notice GND-connection

Differential input

with nominal value of SPS/CNC
foreign external voltage
Jumper S11, S12 unplugged
Signal- and GND-connection exchangeable
Default Setup

Both nominal values connected:

- 1st and 2nd nominal value are added internally
- notice signs
- sum of nominal values not over ±10Volt.

Only with 2nd nominal value

-acceleration and deceleration-ramp linear integrator

| Nom. value 2 | Jumper | trimmer | range |
|---------------------|---------------------|--------------------|-------|
| without Integrator | SW2 Pos. 1-2 | — | — |
| with Integrator | SW2 Pos. 2-3INT(P2) | 0.1 up to 4.5 sec. | |
| Without nom. value2 | SW2 offen | — | — |

Nominal Value Current

nominal value from external source 0 up to ±20mA
internal compliance resistors for 0 up to max. ±10V

Nom. value 1 resistor R121

Nom. value 2 resistor R4

resistance [Ω] = nominal value voltage / nominal value current (max. 500Ω)

Caution:

Do not use nominal value current from 4 up to 20mA

Actual Value

Als Drehzahl-Istwert nur Gleichstromtachogeneratoren verwenden

Use only DC-Tachodynamos to acquire the speed actual value

Option: Incremental encoder with IN-evaluation

Coarse Adjustment

Switch S9

Adjustment Tacho - coarse balancing

| Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 up to F | trimmer-position |
|------------|----------|------------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------|------------------------|
| Tachometer | | | | | | | | | | | |
| Voltage | ∞ | 67 100 205 | 40 70 145 | 32 50 97 | 25 40 85 | 23 35 70 | 20 30 65 | 18 25 55 | 14 18 35 | 12V | min. middle max. |

Fine Adjustment

With trimmer n_{\max} (P4)

with nominal value from potentiometer:

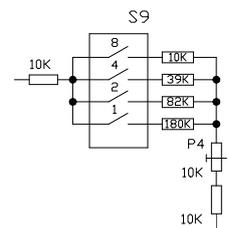
with 1V nominal value adjust to 10% maximum speed

with 10V nominal value fine adjust to 100% .

with nominal value from CNC/SPS:

with 0,8V nominal value adjust to 10% maximum speed

with 8V nominal value fine adjust to 100%



5 Adjustment

Current limitation

| | | |
|----------------|--|------------|
| Peek current | Range: 0 up to 200% rated current reset time maximum 5 sec. | Poti P5/P6 |
| Steady current | Range: 5 up to 100% rated current | Poti P7 |

Internal resetting current limits

| Current Limit | Function | Limit |
|---------------|-------------|-------------------|
| Overload | time | Steady current |
| Heat Sink | temperature | 50% rated current |
| Motor | temperature | 50% rated current |

The lowest current limit is active!

Peek current

internal current limit (Default Setup)

| Adjustment | Jumper | Trimmer |
|------------|-------------|-----------------|
| I_{max1} | S19 plugged | I_{max1} (P5) |
| I_{max2} | S20 plugged | I_{max2} (P6) |

external current limit

| Adjustment Input | Jumper | Trimmer |
|---------------------------|---------------|-----------------|
| I_{max1} X1:9 0...+10V | 19 unplugged | I_{max1} (P5) |
| I_{max2} X1:10 0...+10V | S20 unplugged | I_{max2} (P6) |

The external current limit can be internally reduced with the I_{max} -trimmer.

Steady current

motor protection adjustment for both torque directions to motor rated current with trimmer I_D (P6).

Measuring adjusted values:

- don't connect Motor
- predetermine nominal value and turn on/off enable

measuring value at connector X4:3 (5V=rated current)

| Nominal value | measuring value I_{max} (2 sec.) | measuring value I_D |
|---------------|------------------------------------|-----------------------|
| +5V | 0 up to max. 10V | 0.25 up to max. 5V |
| - 5V | 0 up to max. 10V | 0.25 up to max. 5V |

Current-actual values

measuring value at connector X4:6 >> $I_{max} = 0$ up to +5V, $I_D = 0.12$ up to +2.5V

Caution:

for exact torque regulation:

- Changing the current controller from P- to PI-regulation by the manufacturer
- specify when ordering

Speed controller switching

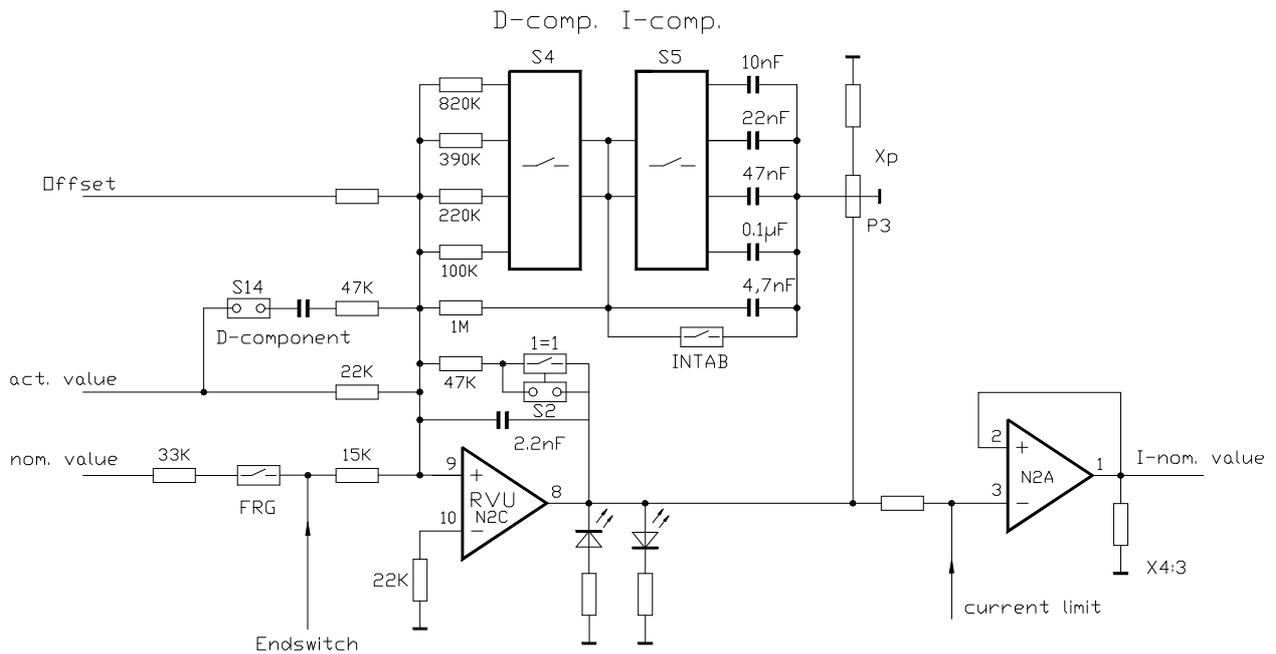
Adjustment with

- two 16-position binary switches S4, S5
- Amplification trimmer P3 (Xp)
- D-component with jumper S14
- in case of replacing the device > take over adjustment values

Default Setup

Binary switches S4 and S5 in position 4

- amplification trimmer Xp is set to 50%
- no D-component, Jumper S14 unplugged
- optimal for most drives.



Adjustment Proportional-component with binary switch S4

Switch S4

| Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------------|------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| Resistance kΩ | 1000 | 450 | 280 | 209 | 180 | 148 | 123 | 107 | 90 | 82 | 73 | 67 | 64 | 59 | 55 | 52 |

Adjustment Integral-component with binary switch S5

Switch S5

| Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-------------|------|------|------|------|------|------|-----|------|------|------|------|------|------|------|-----|------|
| Capacity µF | 0.01 | 0.02 | 0.03 | 0.04 | 0.08 | 0.09 | 0.1 | 0.11 | 0.11 | 0.12 | 0.13 | 0.14 | 0.18 | 0.19 | 0.2 | 0.21 |

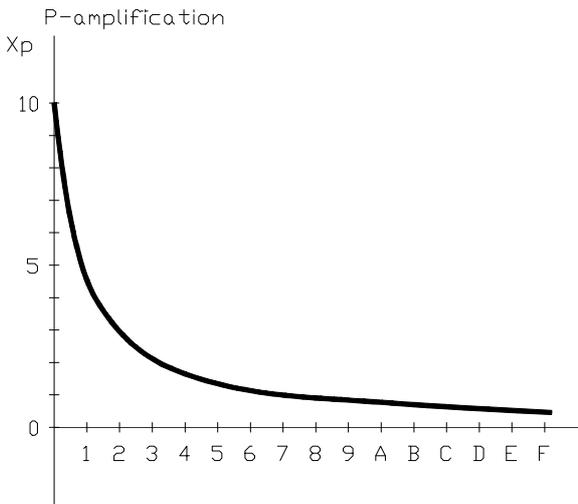
Caution:

With the input INTAB (X2:31) the I-component can be switched off.

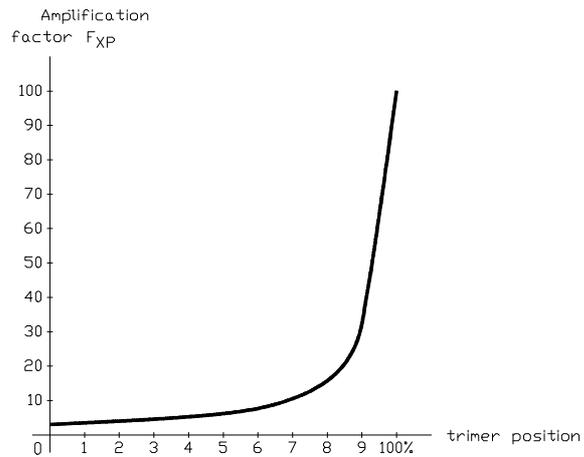
5 Adjustment

Proportional Amplification

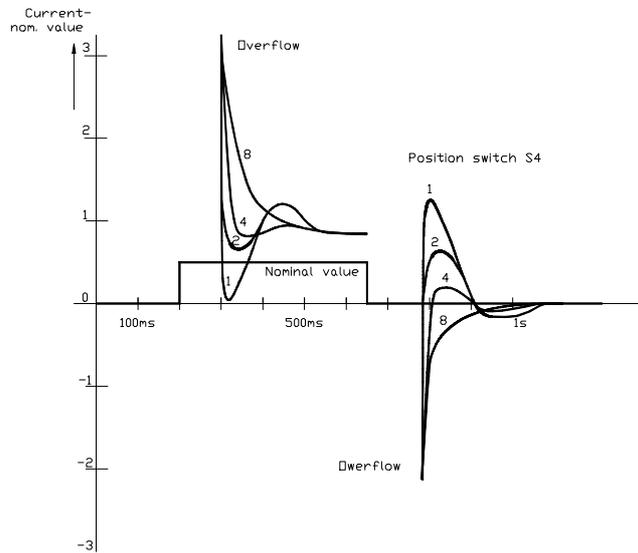
Function binary switch S4



Function Potentiometer Xp



Proportional amplification = $X_p \times F_{xp}$



Adjustment with oscilloscope

Adjust

- nom.value jump $\pm 0,5V$
- Input INTAB X2:31 activated

Measuring value

- nominal value
- reply of the controller
- current nominal value

Measuring point

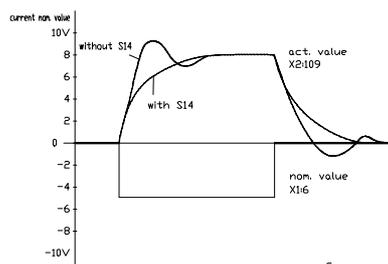
- X4:1
- X4:3

Effect D-component

- nominal value -differentiation
- jumper S14 plugged

Caution:

In case of position control (CNC/SPS)
Do **not** use D-component



Adjustment without measuring instruments

Connect Motor

Nominal Value = 0
 Xp = 50%
 Switch S4 = position 4
 Switch S5 = position 4

Enable drive,

Turn trimmer Xp clockwise until the drive oscillates.

if there is no oscillation

- turn switch S4 back to a lower value
- adjust to oscillation with trimmer Xp

- turn the potentiometer Xp anti-clockwise until the oscillation fades out,
- turn potentiometer Xp two more positions anti-clockwise.

Adjust switch S5 so, that the drive runs smoothly after about two oscillations when there was a nominal value jump off 50%.

Response of the drive:

Amplification too low
 long wave oscillation 1 ... 0.1Hz
 long overshoots
 overshoots target position

amplification too high
 short wave oscillation 30 ... 200Hz
 vibrates >during acceleration
 vibrates >during deceleration and
 in position

Caution:

Operation with CNC/SPS - Contols

- ad maximum speed >>speed nominal value between 8 and 9V.

Default Setup

Check connections before getting started!

- Mains connection clamps X3:3, X3:4, X3:5 **max. 230V~**
 - protective conductor PE-screw at case
 - Motor connection clamps X3:7, X3:8
 - Motor-earth-connection clamps X3:6
 - Option
 - external ballast resistor clamps X3:9 and X3:2
- Notice Connection Advice on Page 12.

Basic Connection - Power connections

Protective earthing

- Mains 1x or 3x 230V~
- Motor 2x Motorline + protective conductor + shielding

Basic Connection - Control connections

- Enable contact between X1:1 and X1:2
- Nominal Value signal X1:4, GND X1:8
- Limit Switch limit switch to X1:16 and X2:32
or bridge between X2:27 and X1:16, X2:32
- Tachometer Connection 2x Tacholine + shielding to X1:6, X1:7

Default setup for first getting started

- | | | | |
|---------------|----|--------------------------------|---------------------|
| Switch | S4 | P-amplification | Position 4 |
| Switch | S5 | I-component | Position 4 |
| Switch | S9 | tacho-attenuator | Position 4 |
| Potentiometer | | I _{max1} peek current | 10% |
| Potentiometer | | I _{max2} peek current | 10% |
| Potentiometer | | I _D steady current | 100% |
| Potentiometer | | X _p Amplification | 50% |
| Potentiometer | | INT integrator | anti-clockwise stop |
| Potentiometer | | n _{max} speed | anti-clockwise stop |

Jumper

unplugged

- S2, S14, S18
- SW1 Pos.1-2
- SW2 Pos.1-2

plugged

- J1, J2, J3, J4
- S3, S6, S11, S12, S19, S20
- SW1 Pos.2-3
- SW2 Pos.2-3

Guarantee

UNITEK guarantee 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.

Defects, defective goods.

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 the 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).

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