MANUAL

3-phase Transistor Servo-Drive

TVD6-200bl, TVD6.2-400-bl

for brushless DC Motors
with Rotor Position Encoder

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Version
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Contens

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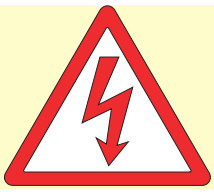
Electronic equipment is not fault proof. This fact should be borne in mind for all possible operating conditions.

Atention High voltage



TVD6bl AC 250V~, DC 420V=
TVD6.2bl AC 400V~, DC 800V=

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.
TVD6 devices are power electric parts used for regulating energy flow for power plants. Protection rating IP00.

Standards and guidelines

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

- EU Guidelines 89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG
  EN60204, EN50178, EN60439-1, EN60146, EN61800-3
- IEC/UL IEC364, IEC 664, UL508C, UL840
- VDE Regulations VDE100, VDE110, VDE160
- TÜV Regulations
- Trade body guidelines: VGB4

The user must ensure that in the event of :

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

the axis will be safely de-activated.
It must also be ensured that the machine or equipment are fitted with device in - dependent monitoring and safety features.

Setting adjustments

- should only be carried out by suitably trained personnel
- should only be carried out in accordance with health and safety guidelines

Assembly

- should only be carried out when all voltages have been removed.

QS

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

CE

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

General Information

The transistor 3-phase current servo amplifier **SERVO-TVD6 and TVD6.2** in combination with the brushless dc motor (synchro servo motor, CE 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, therefore, the bl-motors always have the protection rating IP 65.
From the electrical view, the brushless dc 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, i.e., the current is proportional to the torque and the voltage is proportional to the speed. Current and voltage are precisely measured, thus 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, a tacho control is always used. The speed actual value is generated in the encoder unit (rotor position encoder plus brushless tacho).
The difference of the command value and the actual value is amplified in the speed control loop circuit (P-I-controller) of the servo drive. This results in the current command value, which is transferred to the three phase-current controllers by means of the rotor position signal. In the course of this the 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, ac, or bl-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.

Information:

For motors	with incremental encoder	TVD3-2-xx-IN
	with resolver	TVD3-2-xx-RS
	with bl-tacho	TVD3-2-xx-bl
For low-voltage applications		TVD3-230-xx-bl TVD3-230-xx-IN TVD3-230-xx-RS
For high power		TVD6-2 -bl,IN,RS 200V/400V up to 25/40A
For digital servo controllers		DS400 200V/400V up to 50/100A

Applications

Machines and installations for all types with a drive power of
4 kW using TVD6-200bl
8 kW using TVD6.2-400bl,
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

For speed or torque control or combined speed/torque control incorporated wit - hin or independent of position control loops.
Drives with constant speed as in conveyors, spindle drives, pumps, transversal or longitudinal pitch drives.
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:

BI-drives where braking operations are predominant, e.g. when dece - leration is mainly required:

- winding machines, lifts, great centrifugal masses

The braking energy is annihilated in the ballast circuitry or fed into the mains through the use of an external dc bus converter.
Energy compensation is possible for drives with several axes.

Motor features

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

Features

Build

- switch cabinet mounting or 6HE plug-in device
  according to the VDE, DIN and EU regulations
- standard analog control electronics
- power electronics for 10A, 16A, and 25A
- wide-band chopper power supply unit for the auxiliary voltages
- power section on the rear panel

Galvanic isolation between

- the power section and the housing
- the power section and the control electronics
- the control electronics and the logic inputs

The distance of air gaps and leakage paths adhere to the VDE standards.

Components

- fully insulated six-pack IGBT power semiconductors, comfortably over-dimensioned
- only components customary in trade and industrially standardised are used
- high-quality bases for the IC with external connections
- LED displays
- 16-position binary switches for the P-I adjustment of the speed controller
- precision potentiometers for fine adjustments
- plug-in jumpers for the system set-up

Characteristics

* TVD6-200bl: connection directly to the mains 230V~
* TVD6.2-400bl: connection directly to the mains 400V~
* electronic limitation of the switch-on current
* 2 differential command value inputs
* start-up and braking ramp for the 2nd command value
* speed and torque control
* static and dynamic current limiting
* current command value output
* measurement points for current and speed
* optically de-coupled logic inputs and outputs
* logic for enable and the output stage switch
* switch-off of the integral function
* emergency stop
* braking in case of a mains failure
* temperature watchdog for the motor and the device
* solderless parameter adjustment
* 10-pin test point connector

Technical Data

Power connection TVD6-200bl:
directly to the mains 1 x 230V~ + 10%
using an auto-transformer 3 x 230V~ + 10%

Specification				
Servo amplifier TVD6-200		**10**	**16**	**25**
Output voltage	V~eff.	200	200	200
Stationary current output - continuous	A=	10	16	25
- peak	A=	20	32	40
Max. el. power	kW	2	3.2	5
Integrated quick ZW fuses	A	20	20	20
Dimensions: - compact device	wxhxd	see dimension sheet		
- plug-in unit	wxh	16TE/6HE	16TE/6HE	24TE/6HE
Cooling at 60% duty cycle		self	self	external
at 100% duty cycle		external	external	external

Power connection TVD6.2-400bl:
directly to the mains 1 x 400V~
3 x 400V~

max. 460V~

Option: for voltages < 300V~ >> please inquire

Specification:					
Servo amplifier TVD6.2-400-		**5**	**10**	**16**	**25**
Output voltage	V~eff.	400	400	400	400
Stationary current output - continuous	A=	5	10	16	25
- peak	A=	10	20	32	40
Max. el. power	kW	2	4	6,4	10
Integrated quick ZW fuses	A	20	20	20	20
Dimensions - plug-in unit w xh	6HE	16TE	16TE	16TE	24TE
Cooling at 60% duty cycle		external	external	external	external
at 100% duty cycle		external	external	external	external
Switch cabinet plug-in module	wxhxt	see dimension sheets			

Technical Data

Common specification

Protection rating	IP 00
Format	VDE 0100 group C, VDE 0160
Humidity rating	class F acc. to DIN 40040
Site of installation	< 1000m above sea level
Operating temperature range using external fans)	0 to 45°C (0 to 35°C when
Extended operating temp. range	up to 60°C reduced by 2%/°C
Storage temperature range	-30°C to +80°C
Speed control loop circuit	
control precision without act.value error	± 0.1%
control range	>1: 1000
Command value inputs	± 10V=
Logic inputs	+10 to +30V=
Logic inputs	>+14V, 6mA

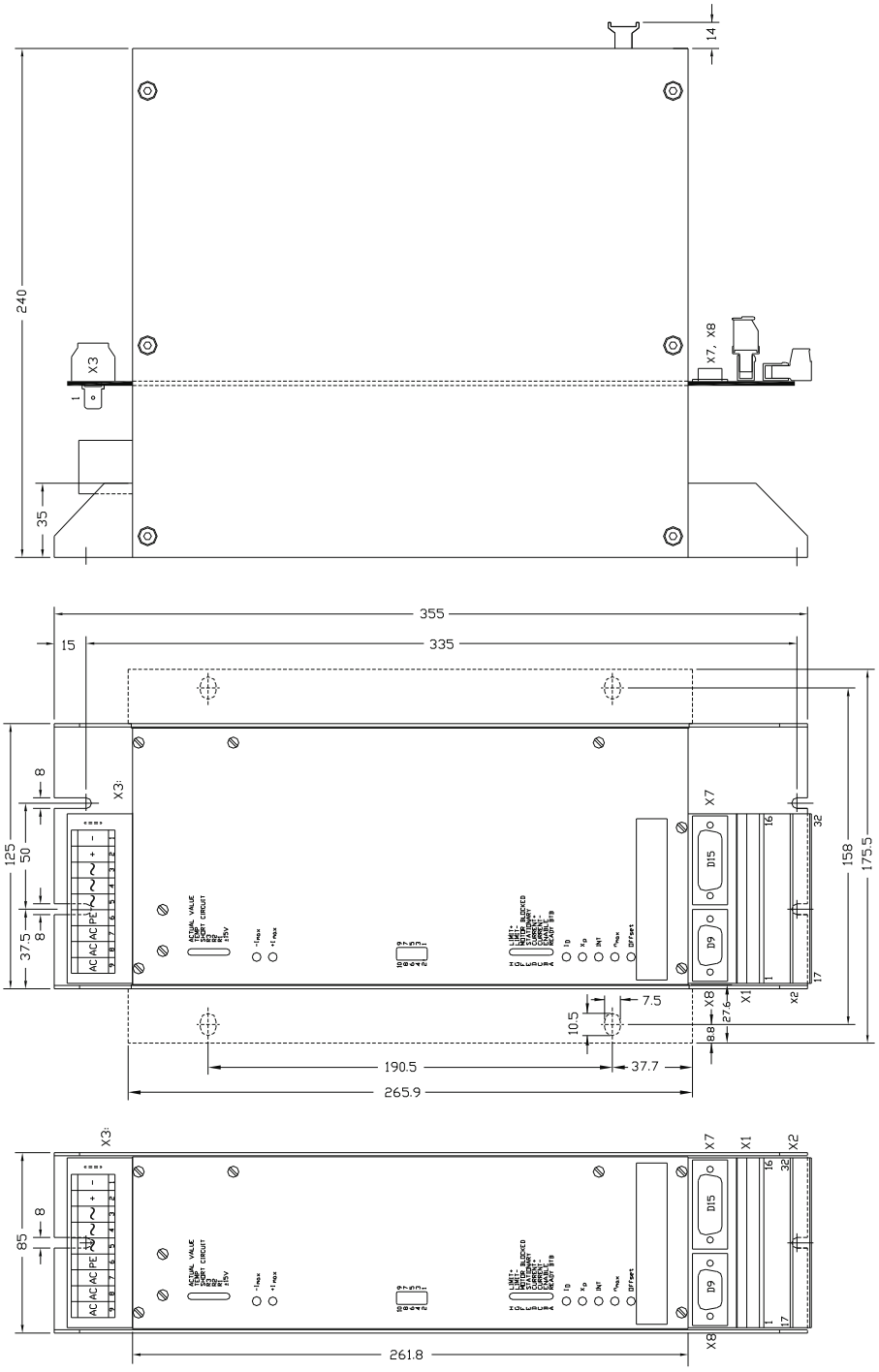
Note:

Necessary information to be indicated when ordering TVD6-200bl:

Check the switch-on time	>>>	external fan for 100% duty cycle
Multiple 16A axes on one rack	>>>	use an external fan
Precise torque control circuit	>>>	current controller as P-I loop
Large centrifugal mass	>>>	external ballast resistance>27 Ω

Necessary information to be indicated when ordering TVD6-400bl:

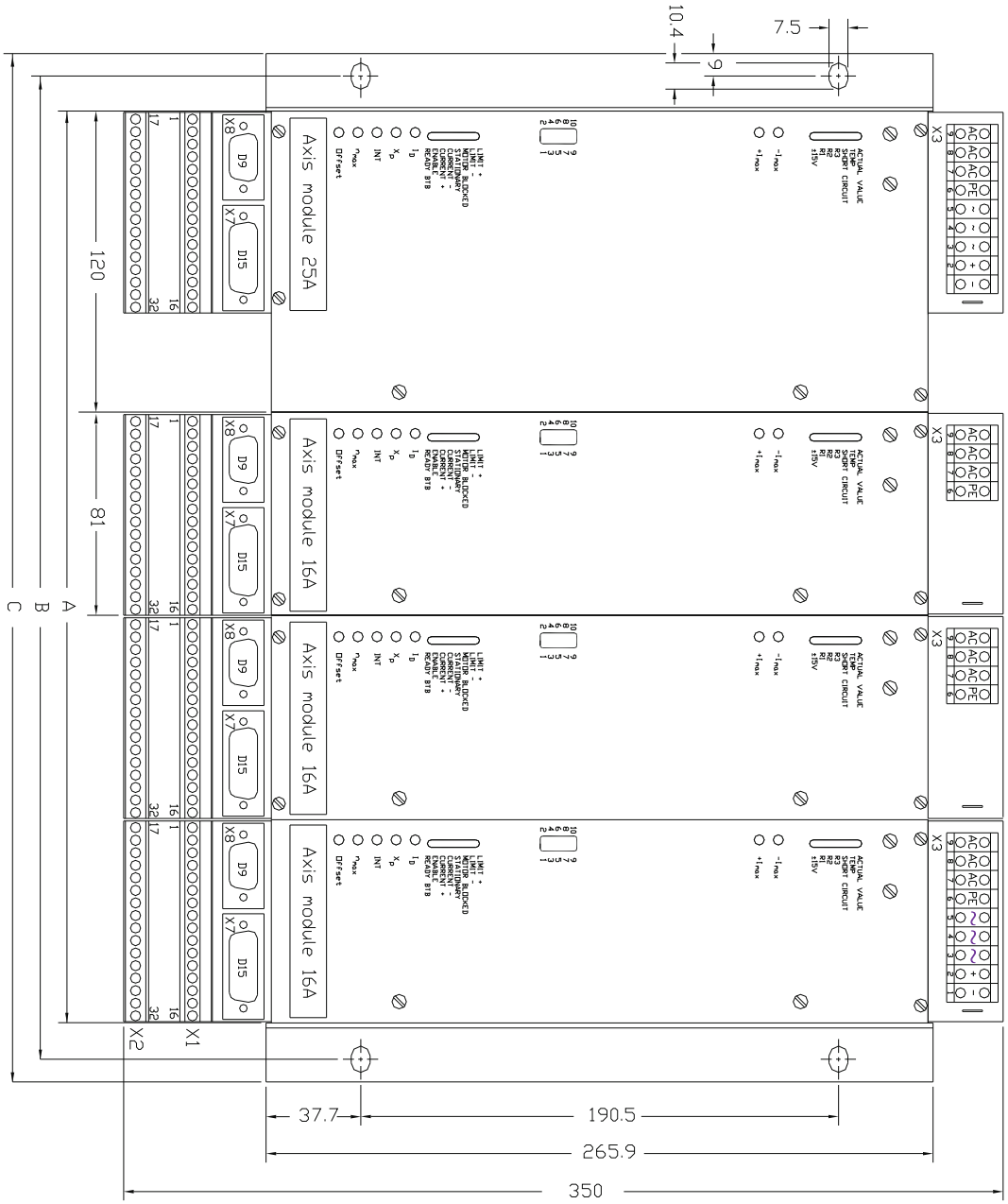
Check the switch-on time	>>>	external fan for 100% duty cycle
Multiple axes with >=10A on one rack	>>>	use an external fan
Precise torque control circuit	>>>	current controller as P-I loop
Large centrifugal mass	>>>	external ballast resistance
Input voltages		



Compact-device **10 and 16A** case

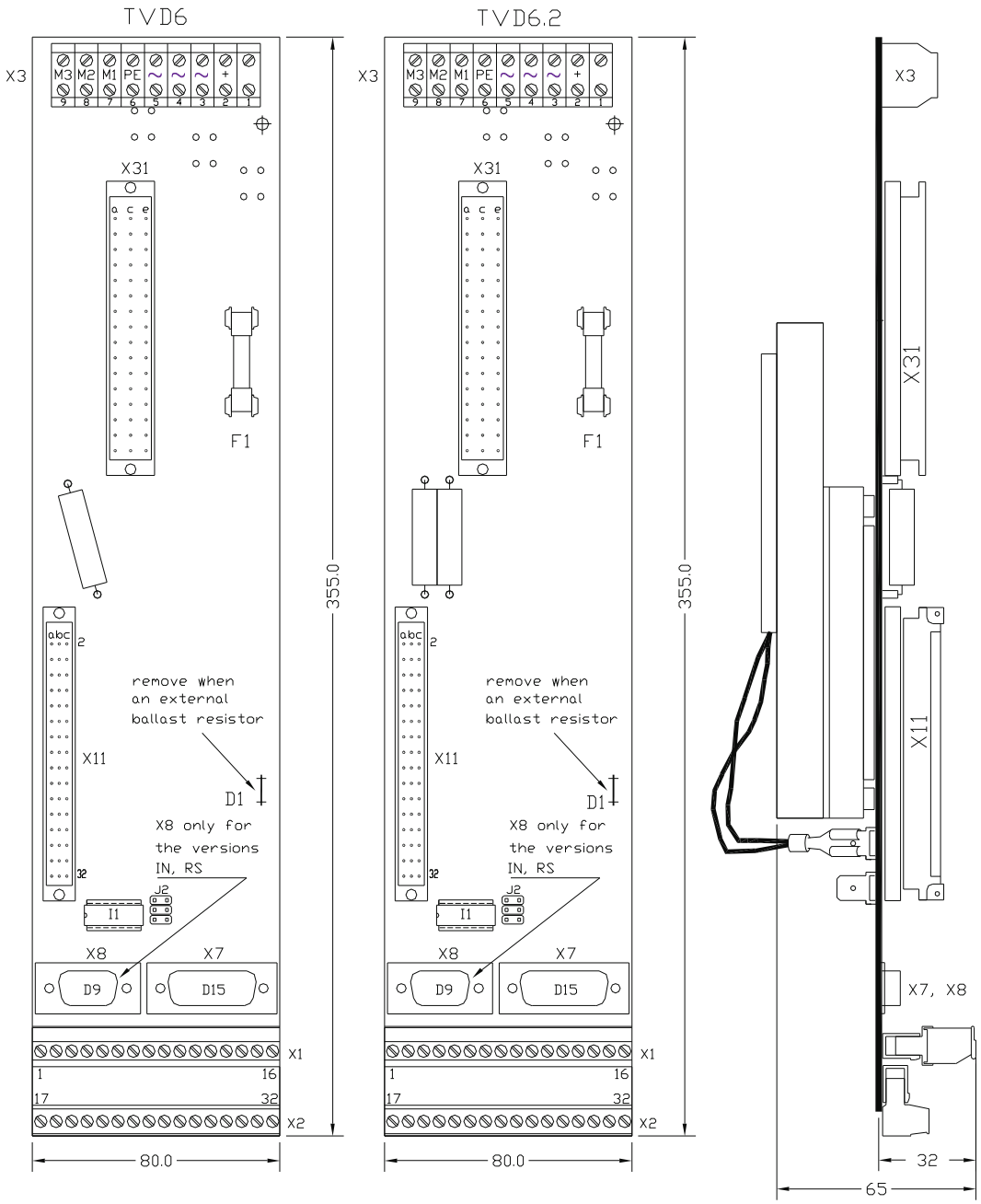
25A case or lateral angle bracket

Multiple - axes combination



Dimensions 6HE [mm]					
Dimensions of the modules	**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
Device frame					
E	for <= 16 A >>> 81.28 mm				
E	for 25A >>> 121.92 mm				
Mounting depth 255 mm					

For front mounting the lateral angle bracket is to be fixed on the front side, for wall mounting it is to be fixed on the rear side.



Rear panel of the mains module

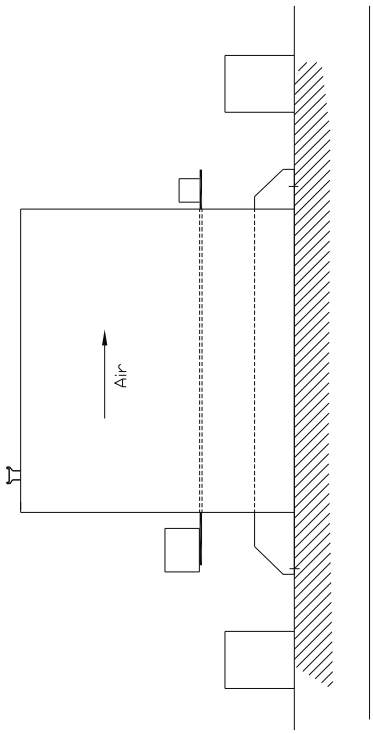
with the module insertion (without supporting frame)

Mains module adjustments
external ballast resistance bridge D1 open

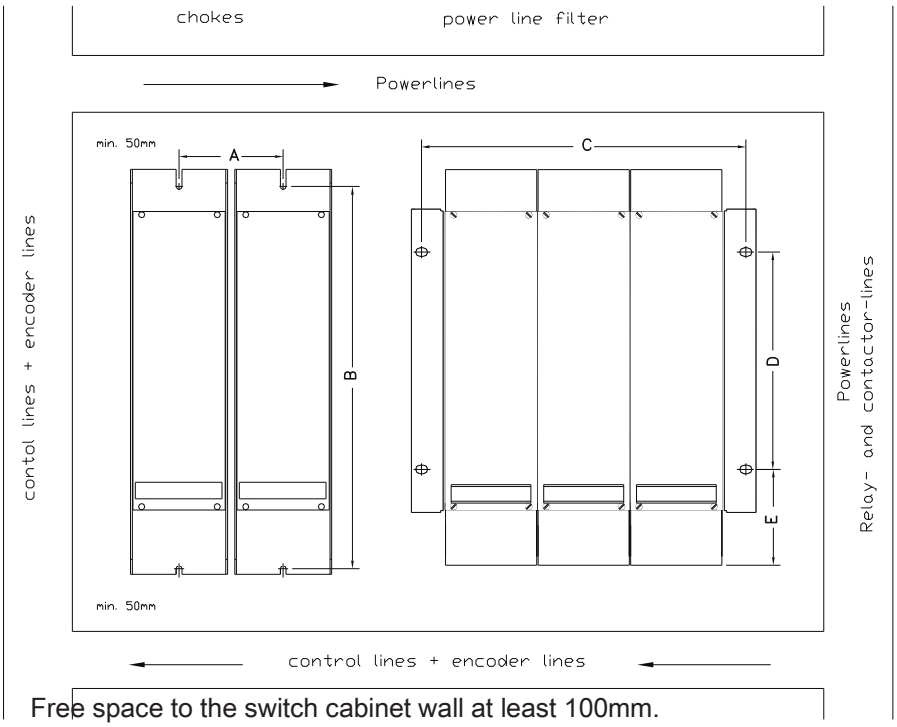
Supporting frame

Height units:	6HE
Splitting units:	10/16A = 16TE, 25A = 24TE
Mixed 6HE, 3HE (TVD3.2):	supporting frame on request

Mounting depth 255mm



Compact device 10/16A
Compact device 25A (w)



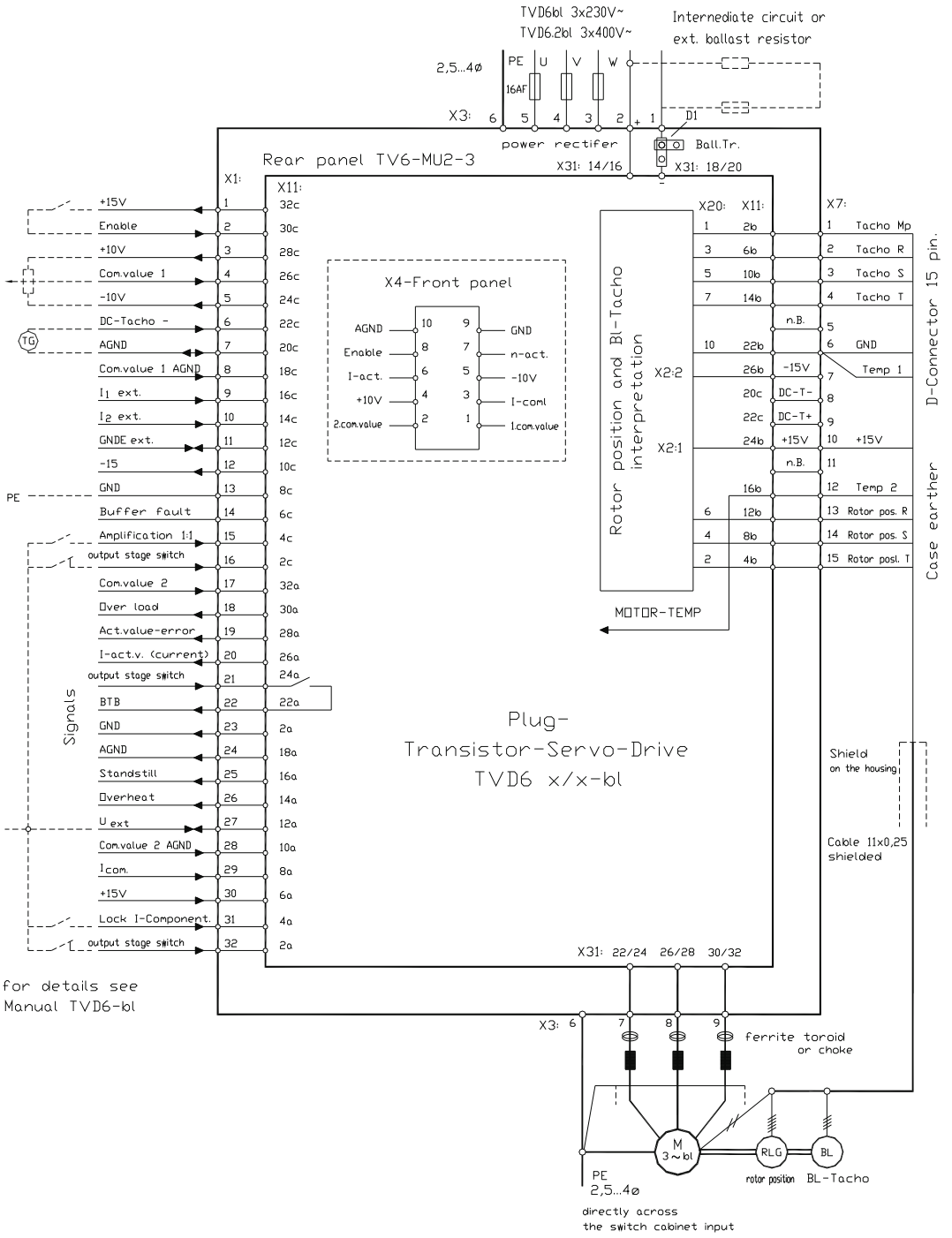
Compact device 25A (sw)
Multiplex axes combination

Free space to the switch cabinet wall at least 100mm.

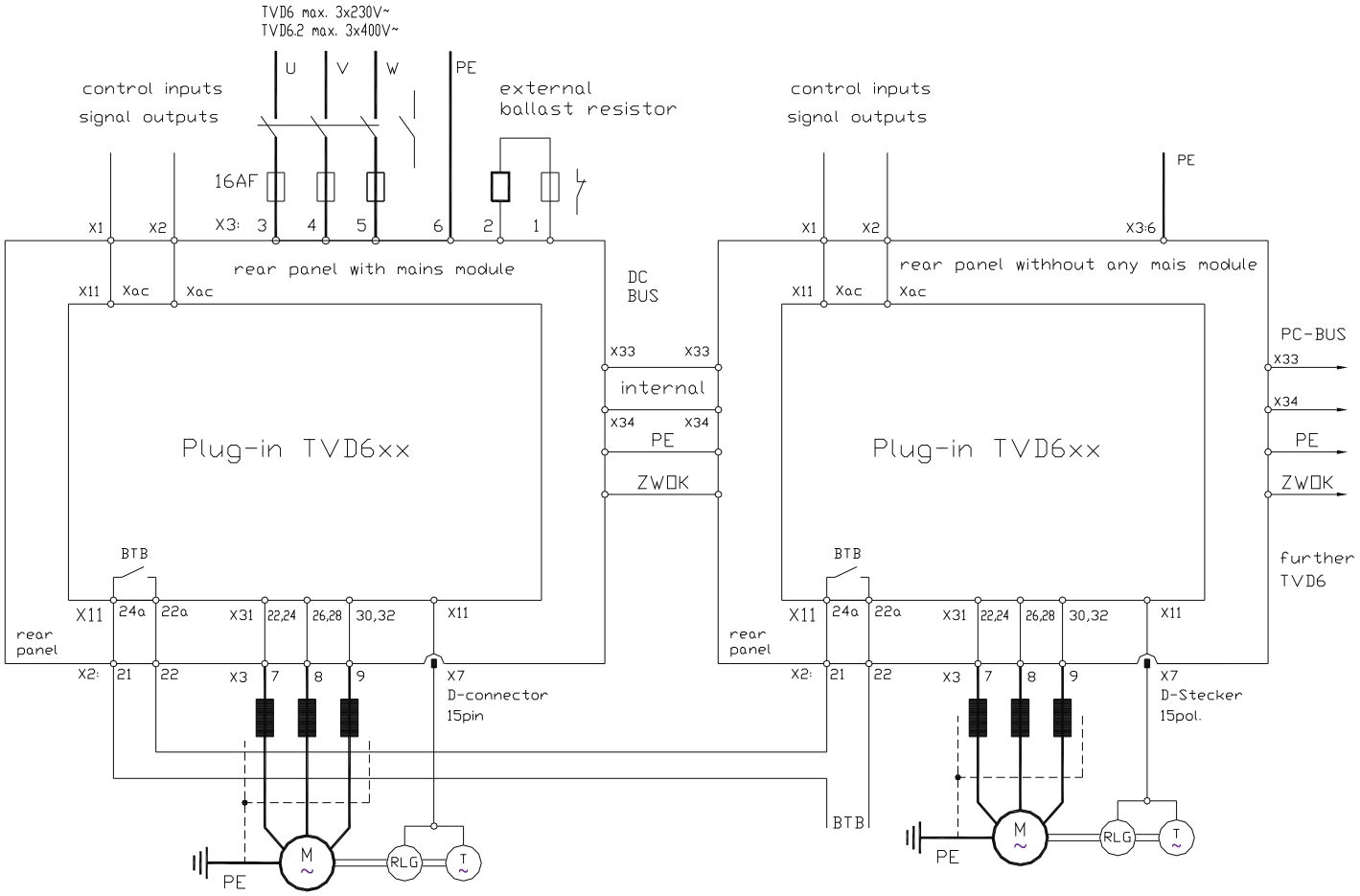
Bore hole dimensions of the compact devices [mm]						
Current	**A**	**B**	**C**	**D**	**E**	**Screw**
10, 16 case	95	335				M4
25-w case	135	335				M4
25-sw lat.angle bracket	180		158	190.5	55	M5

Bore hole dimensions of the multiple axes combinations [mm]					
Lateral angle bracket	**A**	**C**	**D**	**E**	**Screw**
Wall mouting	n x E+60	n x E+40	190,5	55	M5
Front mounting bei 19" systemen					
E for <=16A = 81.28 mm					
E for 25A = 121.92 mm					
n = No. of axis modules					

Power loss at max. power					
Device current	**Power loss** [W] **Amplifier**	**Mains module**	**Fuse**	**M-choke**	**Filter**
5A	70	20	xx	xx	xx
10A	90	20	xx	xx	xx
16A	125	30	xx	xx	xx
25A	180	43	xx	xx	xx



Choke					
Device current	**Power line filter**		**Motor choke**	**Motorchoke**	**Magnetic core**
	1ph	**3ph**	**TVD6-200**	**TVD6.2-400**	
5A	FE1-10	FE3-10	-	MDD 1,3a	EMI742 70107
10A	FE1-16	FE3-16	MD78-10	MDD 1,6a	EMI742 70107
16A	FE1-16	FE3-16	MD84-20	MDD 2 b	EMI742 70107
25A	—-	FE3-25	MD84-30	MDD 2,5b	EMI742 70107



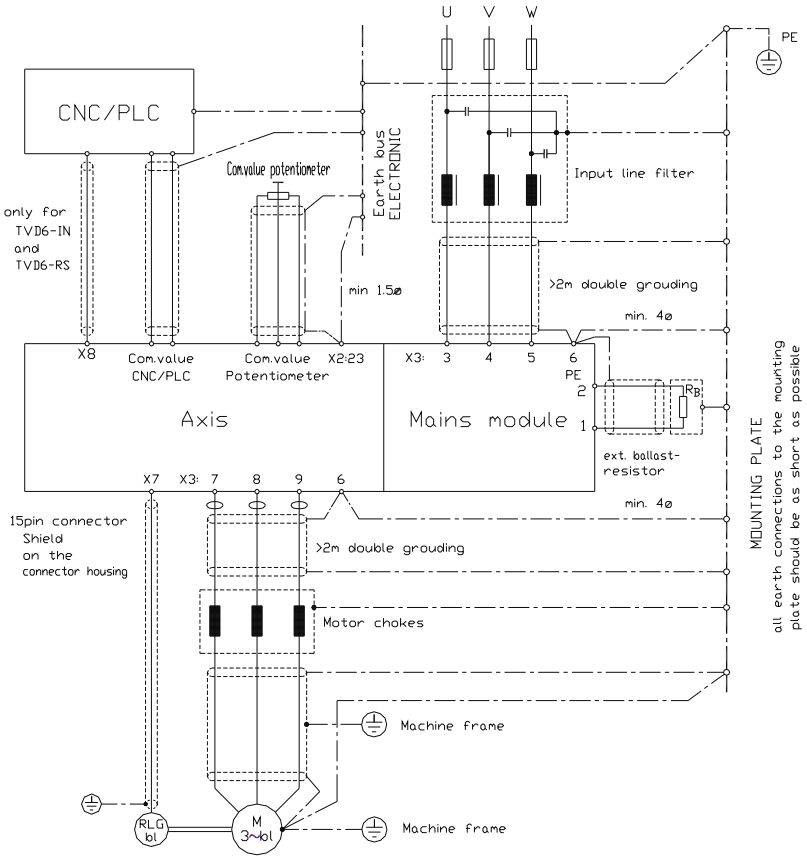
Compact device connection:

only left figure without internal connections

Multiple-axis combination:

one or multiple axis with a mains module plus one or multiple axis without any mains module;
optional position of the mains module

Connections



The devices adhere to the EU guidelines 89/336/EWG and the technical standards EN 610001-2 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 X1:13 must be connected to the mounting plate using a 2.5mm² wire.
- Device PE screw must be connected to the mounting plate using a 4mm² wire, l =50mm.

Single-phase connection:

Power line filter type : up to 16A = FE1-16

Conductor length between the device and the power line filter <100mm

Three-phase connection:

Power line filter type : up to 16A = FE3-16

up to 25A = FE3-25

Conductor between the transformer and the power line filter <500mm.

Conductor between the device and the power line filter <100mm.

Motor connection:

Types of motor lines chokes		
	TVD6-200bl	**TVD6.2-400bl**
5A	-	MDD 1.6b-10
10A	MD78-10	MDD 1.6b-10
16A	MD84-20	MDD 2 b-20
25A	MD84-30	MDD 2.5b-30

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:

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

Attention:
The order of the connections to the connector numbers or screw terminals is ob - ligatory. 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

Input filter:
rf. to the CE advice, page 16
Short conductor length to be used between the input filter and the device or a shielded conductor to be used.

FI switch:
- layout acc. to the DIN standard VDE 0664
- release current >200mA
- only in combination with further protection measures

TVD-200bl

Connection to the 230V~ mains
AC voltage connection 1 x 230V~, 50/60Hz
Compact device up to 10A
Multiple axes combination up to 20A
Three-phase voltage connection 3 x 230V~, 50/60Hz
for >10A the multiple axes rack 20A is required

TVD.2-400bl

Connection to the 400V~ mains (T-NC mains power supply system)
for asymmetrical or unearthed power supply systems the connection must only be effected via an isolating transformer
AC voltage connection 1 x 400V~, 50/60Hz
Compact device up to 10A
Multiple axes combination up to 20A
Three-phase voltage connection 3 x 400V~, 50/60Hz
for >10A the multiple axes rack 20A is required

Dimensioning	**10A**	**16A**	**25A**	**max. 30A**
Conductor cross-section mm²	0.75	1.5	2.5	2.5
Fuses - safety fuse Aff	10	16	25	30
- automatic cut-out	10	16	25	25
(release feature A, acc. to EN60898)				

Input fuses >>> semi-conductor fuses or semi-conductor automatic cut-outs

Connection with a transformer

- AC or three-phase voltage connection
- Auto-transformer or isolating transformer
  (additional over-voltage protection provided)
- One transformer for multiple devices

Note:

- The relay contacts must be rated according to the transformer switch-on current.
- Slow fuses must be installed at the input of the transformer
- The fuses must be rated according to the transformer current
- Quick fuses must be used at the output of the transformer
- The fuse value for each mains module is max. 30AF

Transformer power: examples	
TVD6-200bl	**TVD6.2-400bl**
Autotransformer Transformer rated power [VA]= 0.6 x 230 x IM x GLF x nF **Isolating transformer** Transformer rated power [VA]= 1.42 x 230 x IM x GLF x nF	**Autotransformer** Transformer rated power [VA]= 0.2 x 400 x IM x GLF x nF **Isolating transformer** Transformer rated power [VA]= 1.25 x 400 x IM x GLF x nF
IM = Sum of the motor currents (effective) GLF = simultaenity factor nF = speed ratio factor	

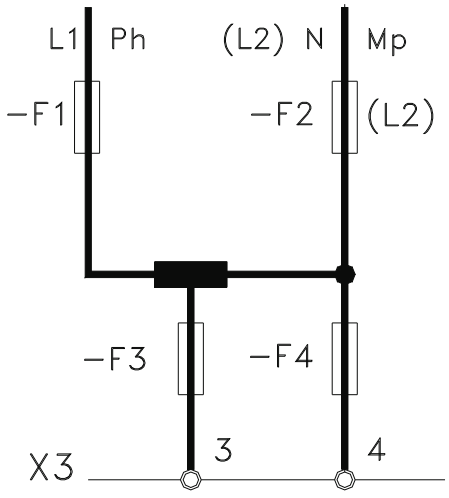
GLF =

1 with 1 motor
0.5 ... 0.7with 2 motors
0.4 ... 0.6with > 2 motors

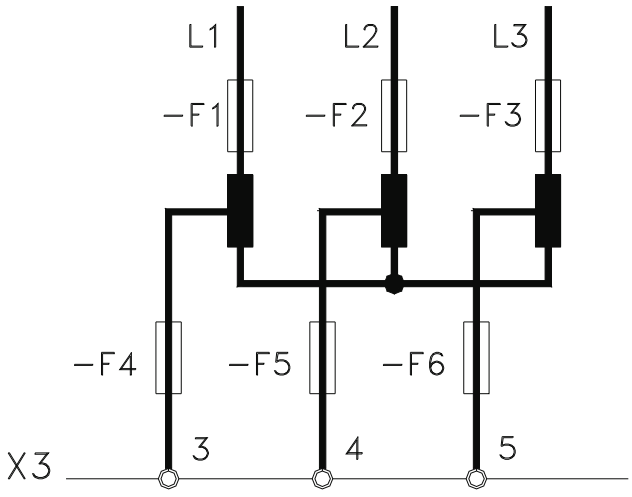
nF =

effective speed
maximum speed

ac voltage



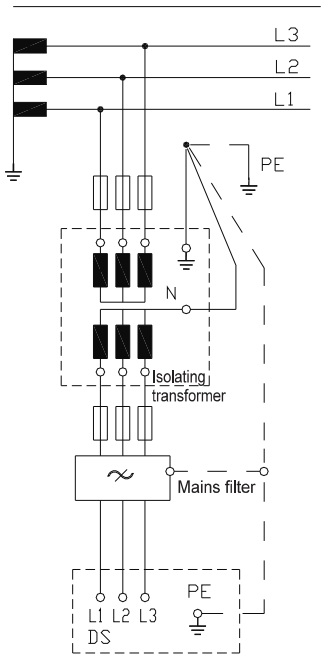
three-phase voltage

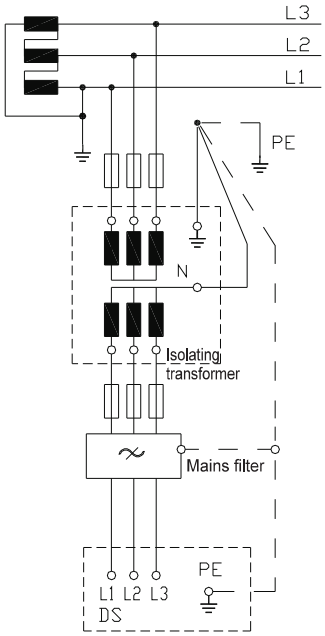


Note:

For power supply systems without protective conductors the connection must only be effected via an isolating transformer!!!

Connection to the TT mains



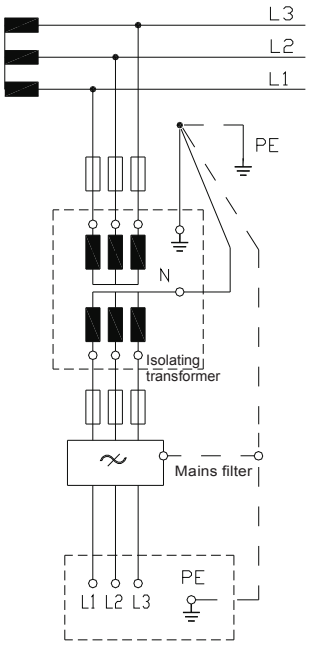


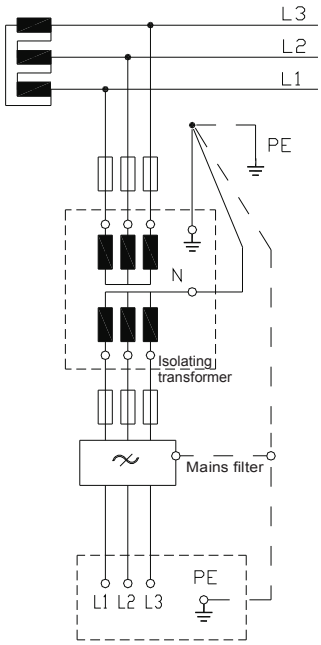
TT mains:

Symmetrical three or four con - ductor three-phase mains with direct earthing.

Device PE via the earthing con - nection.

Connection to the IT mains





IT mains:

Symmetrical three or four con - ductor three-phase mains wit - hout direct earthing.

Device PE via the earthing con - nection.

Attention:

If the TVD6-Servo is directly connected and the transformer primarily switched, it is neces - sary to connect an additional over-voltage protection device (e.g. TRABTECH).

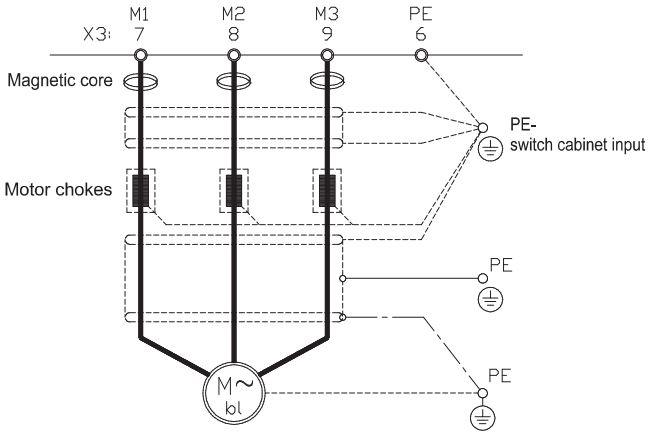
Motor power connection

Cable no.	PE	M1	M2	M3
Connection X3	X3:6	X3:7	X3:8	X3:9
Terminal X3:6 is internally connected to the PE connection bolt of the device				

Motor cable for	5A	10A	16A	25A	Thermo	Brake
Cross-section	0.75	1.5	1.5	2.5	0.75	0.75
Cable type	3 x shielded motor conductor + PE (+ if required: 2 x thermo + 2 x 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
- for motor life

External ballast resistance

Dimensioning:

Mean value of the braking power per axis

$$P_{Ballast}\ [W] = \frac{1 \times Jg \times n^2}{2} - \frac{Jg^2 \times a \times n}{M_M} \times f$$

Jg	= reduced motor and load moment	[kgm²]
n	= max. speed	[s^{-1}]
M_M	= max. motor torque	[Nm]
a	= delay time	[s^{-2}]
f	= repetition frequency of the braking	[s^{-1}]

Modify on the rear panel of the mains module:		
Remove soldered bridge D		
	TVD6-200bl	TVD6.2-400bl
External ballast resistor	smallest resistance value 22 Ω	smallest resistance value 40 Ω
Installed ballast resistor	20Ω/ 50W, for 3%d.cyc. = 1.5 kW	42Ω/ 50W, for 3%d.cyc. = 1.5 kW

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. of the terminal connectors
X1:1 to X1:16 and X2:17 to X2:32

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

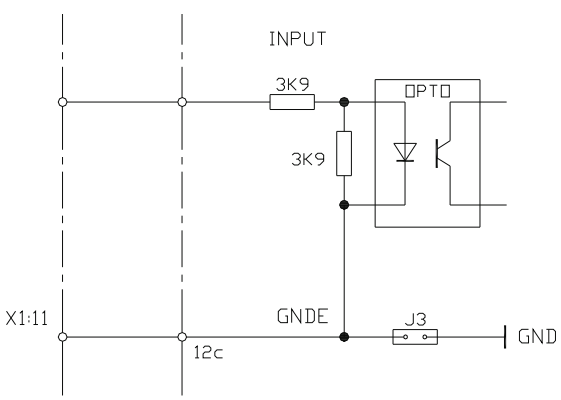
Logic connections
Relays with gold contacts or reed relays. Contact current 6mA.

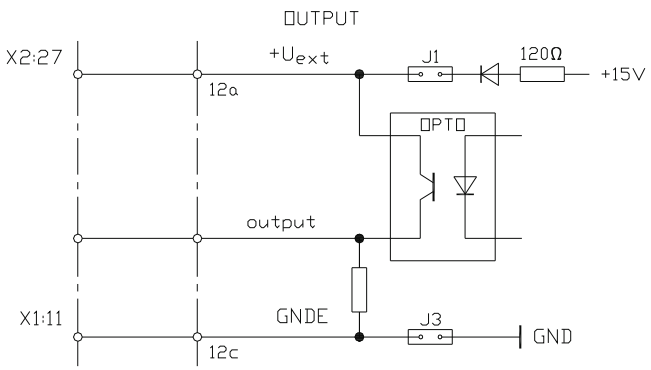
Internal logic voltage 15V=
- Potential connection
- for relay control
- Jumpers J1 and J3 plugged-in

External logic voltage
- Potential isolation
- for PLC or CNC
- UEXT +15V to 30V= across terminal X2:27
- GNDE across terminal X1:11

- Jumpers J1 and J3 **not** plugged-in
- residual ripple of the logic voltage <20%

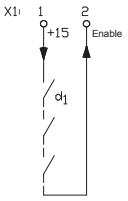
Basic set-up: Jumpers J1 and J3 are plugged-in.
Inputs and outputs via an optocoupler.





Drive enable >>> active with a positive voltage

- Jumper SW1 in position 2-3 (basic set-up)

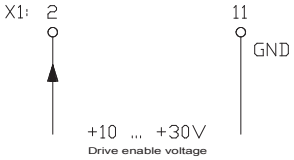


Drive enable - internal logic voltage

- 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

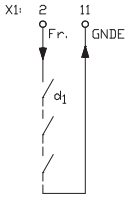


Drive enable >> active at zero

- Jumper SW1 in position 1-2 (US version)

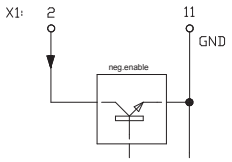
Drive enable - internal logic voltage

- logic zero X1:11
- contact circuit between X1:2 and X1:11



Drive enable - external logic voltage

- drive enable voltage 0V X1:2



Drive enabled

- command value and speed control loop circuit are immediately active
- LED D1B bright

Drive disabled

Jumper **J2** plugged-in (emergency stop) (basic set-up)
- command value internally immediately to 0 (braking)
- LED D1B dark
- after 5 seconds >>> speed controller de-activated

Jumper **J2** open (decelerates without braking)
- speed controller is immediately de-activated
- LED D1BB dark

Note:
Jumper SW1
Pos. 2-3 >>> Drive enable active at >+10V (basic set-up)
Pos. 1-2 >>> Drive enable active at zero
Jumper J2
plugged-in >>> emergency stop (basic set-up)
open >>> deceleration without braking

Control connections

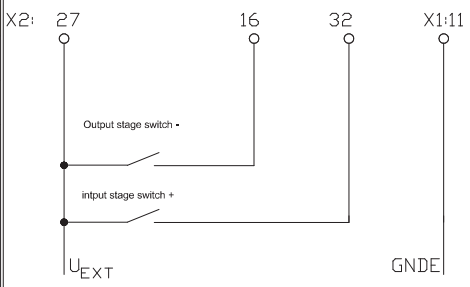
Output stage switch

Switch inputs

Drive enable for

- positive command value direction
  LED 1D >>> contact between X2:27 and X1:16
- negative command value direction
  LED 1H >>> contact between X2:27 and X2:32

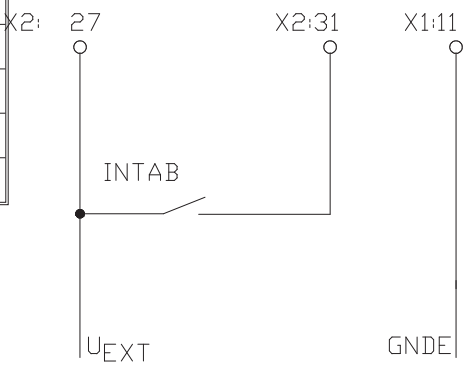
Output stage switch - function	
Contact	**Function**
closed	Enable > LED bright
open	direction disabled
> output stage switch is connected >>> contact open - drive brakes > reversal of the command value direction - the drive is disconnected from the output stage switch - output stage switch disconnected >>> contact closed	



Attention:

without output stage switch >> connection between X2:27, X2:32, and X1:16

Integral switch-off function	
Function - Relay contact	
Contatc	**Speed control loop**
open	P-I control
closed	P- control
Function - external logic voltage	
Voltage X2:31	**Speed control loop**
< 2V	P-I control



Note:

Please observe the optimisation advice

Braking in case of a mains failure
Braking function
- command value in case of a mains failure

Feed-back to the bus circuit

Speed command value

Voltage source for command values ±10V, 10mA

+10V X1:3
-10V X1:5
GND X1:8

with internal voltage source >> Jumper S11, S12 plugged-in

Command value inputs

- Command value voltage max. ±10V=
- Input resistance 50 k Ω
- Relay contacts: use gold or reed contacts

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

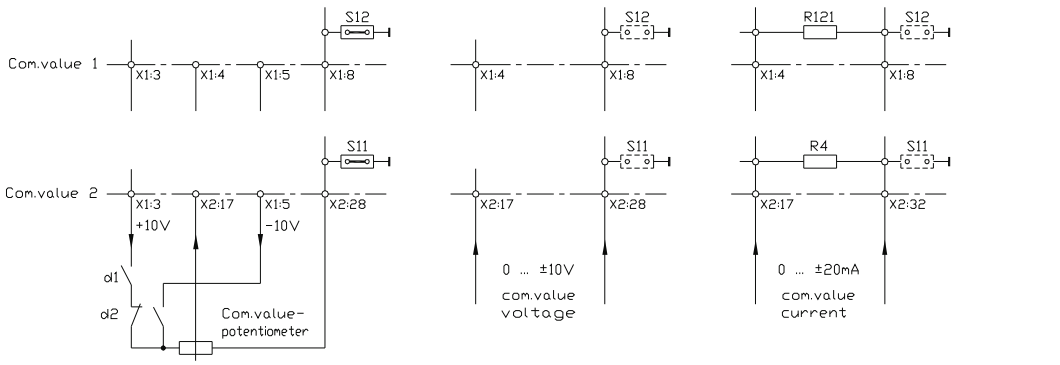
Connections				
Command value	**Connector**	**Jumper**	**Function**	**Measuring point**
Command value 1	X1:4 (signal)		directly	X4:1
	X1:8 (GND)			X4:10
Command value 2	X2:17 (signal)	SW2 1-2 SW2 2-3	directly ramp	X4:2 X4:2
	X2:28 (GND)			X4:10

Jumper positions				
	Function	**Jumper**	**Position**	**Basic set-up**
Command value 1	Differential input	S12	open	
	with internal voltage source	S12	plugged	***
Command value 2	Differential input	S11	open	
	with internal voltage source	S11	plugged	***
	with ramp (integrator)	SW2	Pos. 2-3	***
	without ramp	SW3	Pos. 1-2	
without command value 2		SW2	open	

Resistors for a current command value of 0 to ±20mA

Command value 1 R121 500 Ω
Command value 2 R4 500 Ω

Internal supply **CNC/PLC** **Current command value**



External current limiting

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

Control range

0 ... + 5V >>> 0 to 100% rated current of the device
0 ... +10V >>> 0 to 200% rated current of the device

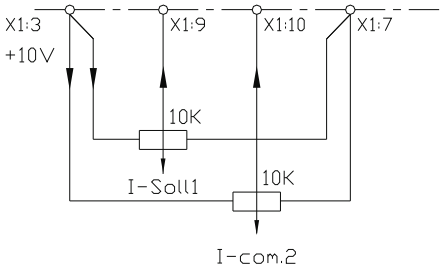
internal over-current watchdog >>> max. 5s

Inputs

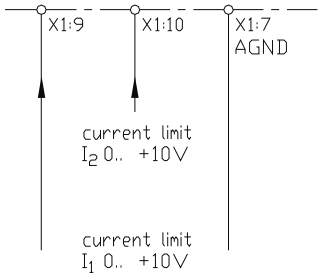
Maximum input voltage +10V
Input resistance 10 k Ω
Internal reduction using the potentiometers I_{max1} , I_{max2}
Relay contacts: gold or reed contacts

Connections			
Current limit	**Connector**	**Jumper**	**Measuring point**
positive	X1:9 (signal)	S19 open	X4:3
	X1:7 (GND)		X4:10
negative	X1:10 (signal)	S20 open	X4:3
	X1:7 (GND)		X4:10

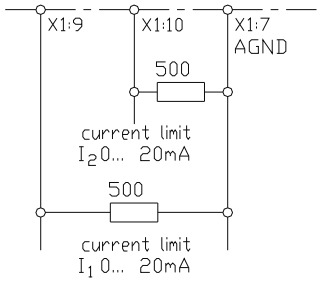
Internal supply value



CNC/PLC



Current command



Attention:

If the current limit is internally adjusted >>> Jumper S19, S20 plug - ged-in.

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

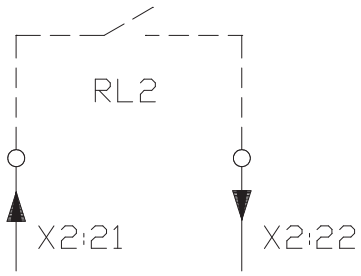
Connections		
Function	**Colour** (recommended)	**Pin no.**
bl-tacho mp	grey	1
bl-tacho phase 1	yellow	2
bl-tacho phase 2	black	3
bl-tacho phase 3	white	4
GND	blue	6
+15V	violet	10
Thermo sensor	pink	6
Thermo sensor	orange	12
Rotor position 1	brown	13
Rotor position 2	green	14
Rotor position 3	red	15
Additional connections 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 to 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 RL2

Signal contact X2:21 - X2:22
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 D1A bright	contact closed
Error	LED D1A dark	contact open
BTB contact drops in case of:		
Error	**BTB LED D1A**	**LED display**
Actual value error	dark	LED D2H bright
Over-temperature	dark	LED D2G bright
Short-circuit, short-circuit to earth	dark	LED D2F bright
Voltage error	dark	LED D2B bright
Bus error	dark	LED D2A bright

Attention:

In any case the BTB contact (drive ready) must always be used with the CNC/PLC!

Analog parameter measurement outputs		
Function	**Motor current**	**Speed**
Connector	X2:20 - X2:24	X1:6 - X1:7
Messwert	2.5V = type current	Tacho voltage
	5.0V = peak current	at the input of the divider
	unipolar positive	bipolar
output resistance	1 k Ω	4.7 k Ω

Output signals

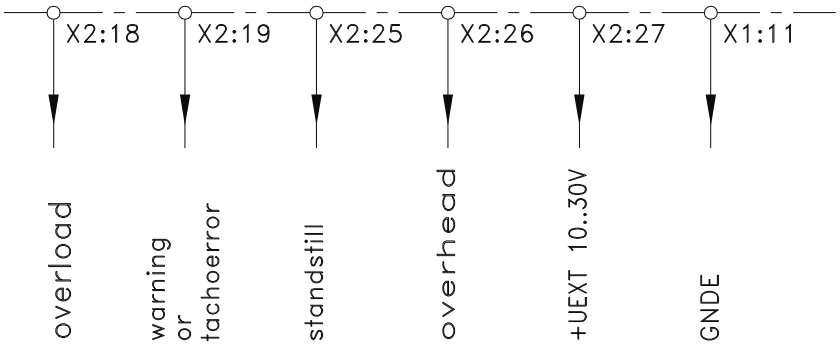
Logic outputs with optocoupler

- wire-break proof	output blocked in case of errors
- output voltage	10 to 30V=
- output current	5mA
- output resistance	1kΩ

Output signals				
Signal	**Function**	**Output**	**Display**	**saved**
Bus	mains module error	X1:14	LED2A	yes
Overload	disable	X2:18	LED 1F	no
Stationary	speed < 1%	X2:25	LED 1E	no
Over-temperature	motor >150°C	X2:26	-	no
	heat sink >75°C	X2:26	-	no
	heat sink >80°C	X2:26	LED 2G	yes
Pre-warning	motor, heat sink too hot	X2:19	-	no
Reference ground	GND	X2:23	-	-

Memory deletion

Drive enable	off/on	Jumper S6 plugged-in (basic set-up)
Mains	off/on	Jumper S6 off



Control connections X1, X2

Function	Terminal no.	Connector no.
	(internal)	
+ 15 Volt (for enable)	X1: 1	X11: 32c
Enable input(+10 to +30 Volt)	X1: 2	X11: 30c
+ 10 Volt (for command value)	X1: 3	X11: 28c
Command value 1 - input (signal)	X1: 4	X11: 26c
- 10 Volt (for command value)	X1: 5	X11: 24c
DC tacho input (signal)	X1: 6	X11: 22c
DC tacho input (AGND)	X1: 7	X11: 20c
Command value 1 - input (AGND)	X1: 8	X11: 18c
Current limit I1 external	X1: 9	X11: 16c
Current limit I2 external	X1: 10	X11: 14c
external GNDE	X1: 11	X11: 12c
-15V (external electronics)	X1: 12	X11: 10c
Device zero GND	X1: 13	X11: 8c
Bus error	X1: 14	X11: 6c
Amplification 1:1	X1: 15	X11: 4c
Output stage switch -	X1: 16	X11: 2c
Command value 2 - input (signal)	X2: 17	X11: 32a
Overload signal	X2: 18	X11: 30a
Temperature signal without tacho fault	X2: 19	X11: 28a
Current (I_{act})	X2: 20	X11: 26a
Drive ready BTB	X2: 21	X11: 24a
Drive ready BTB	X2: 22	X11: 22a
Device zero GND (ground)	X2: 23	X11: 20a
analog device zero (AGND)	X2: 24	X11: 18a
Stationary signal	X2: 25	X11: 16a
Over-temperature	X2: 26	X11: 14a
external voltage UEXT	X2: 27	X11: 12a
Command value 2 input (AGND)	X2: 28	X11: 10a
Current command value	X2: 29	X11: 8a
+15V (external electronics)	X2: 30	X11: 6a
Integral term disable	X2: 31	X11: 4a
Output stage switch +	X2: 32	X11: 2a

Power connections X3

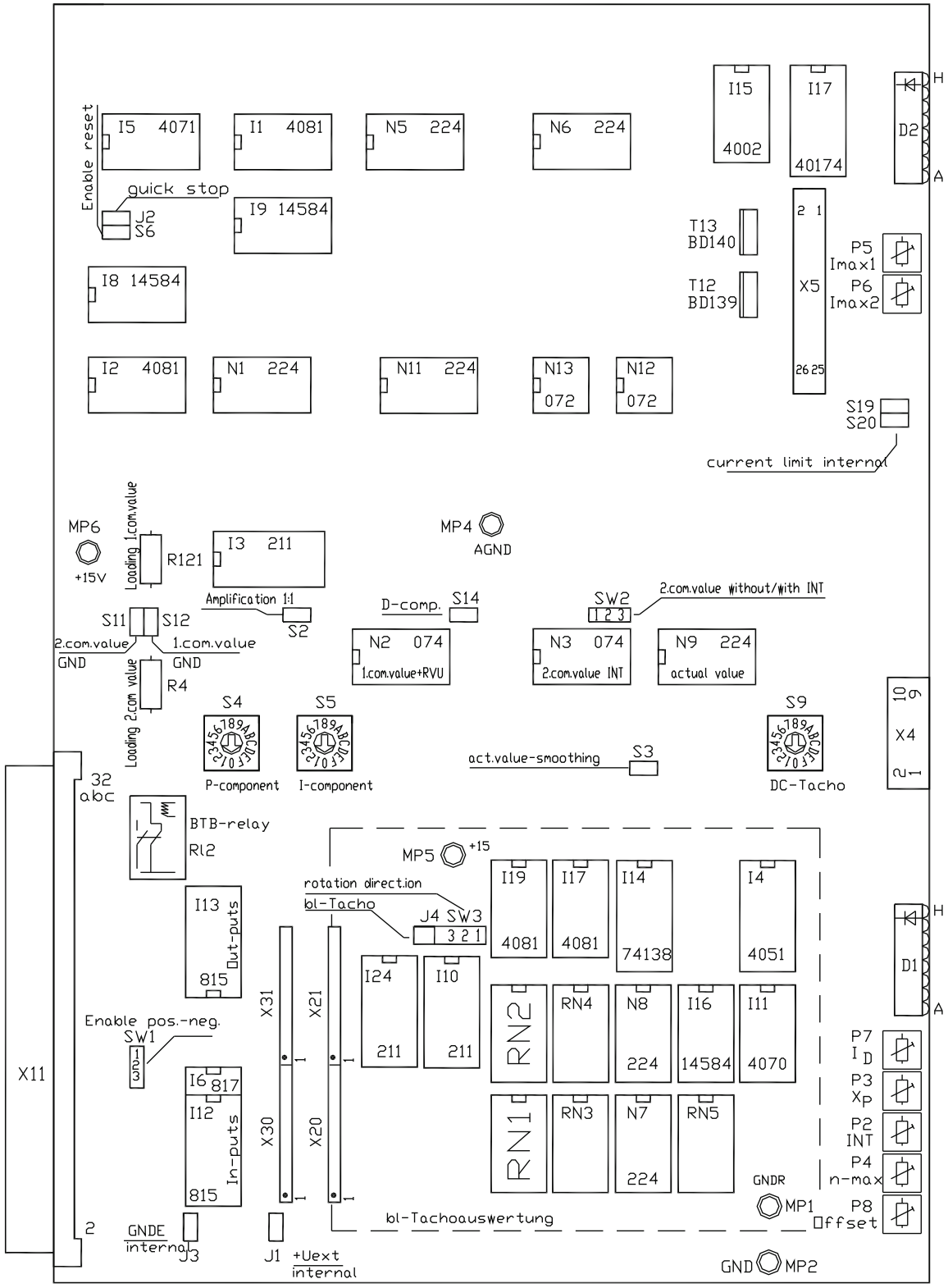
Function	Terminal no.	Connector no.
Bus external ballast resistor	X3: 1	X31: 18, 20 abc
Bus +	X3: 2	X31: 14, 16 abc
Mains L1 TVD6-200/230V~ TVD6.2-400/400V~	X3: 3	X31: 10, 12 abc
Mains L2 TVD6-200/230V~ TVD6.2-400/400V~	X3: 4	X31: 6, 8 abc
Mains L3 TVD6-200/230V~ TVD6.2-400/400V~	X3: 5	X31: 2, 4 abc
PE	X3: 6	
Motor 1	X3: 7	X31: 22, 24 abe
Motor 2	X3: 8	X31: 26, 28 abe
Motor 3	X3: 9	X31: 30, 32 abe

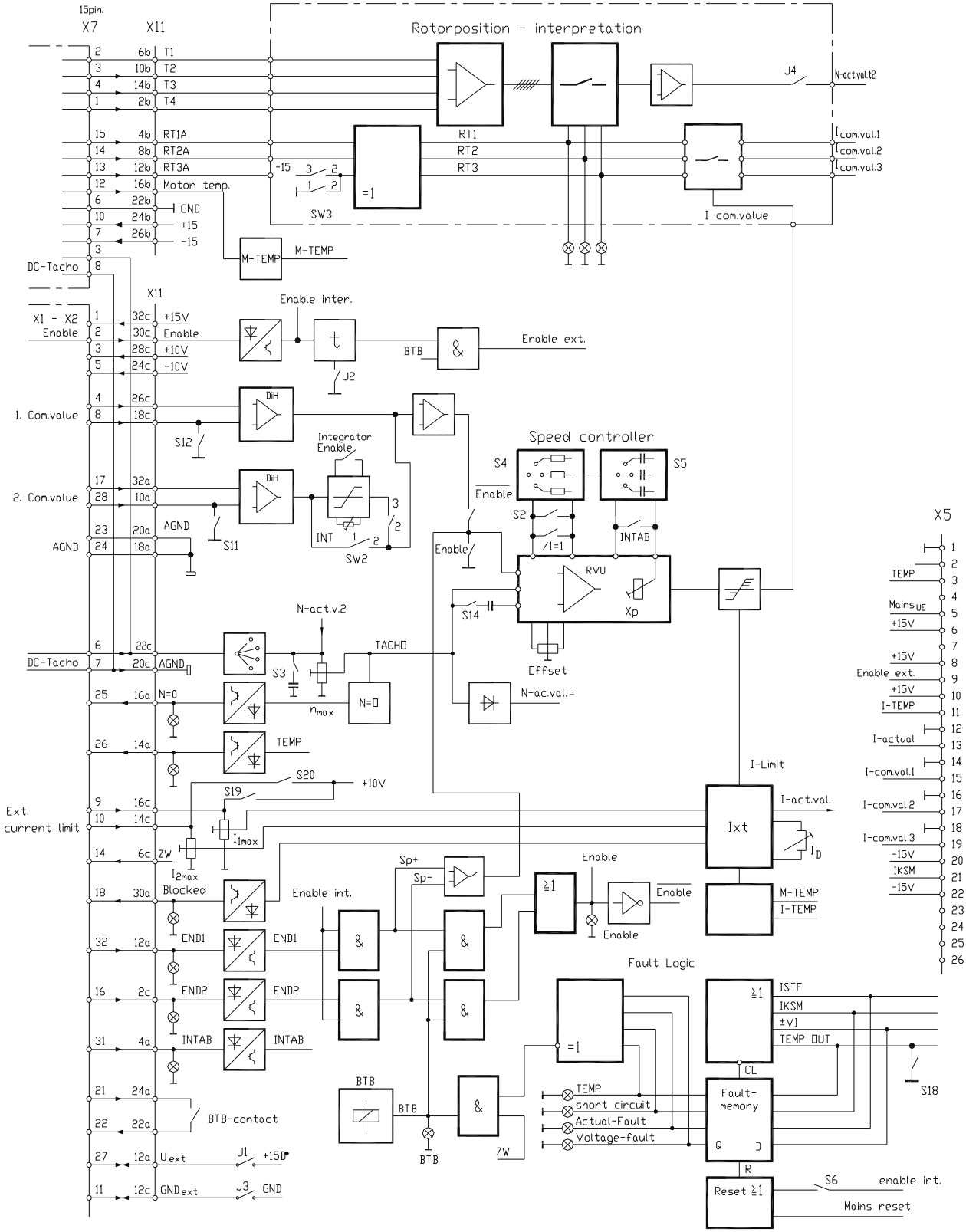
Encoder connector X7

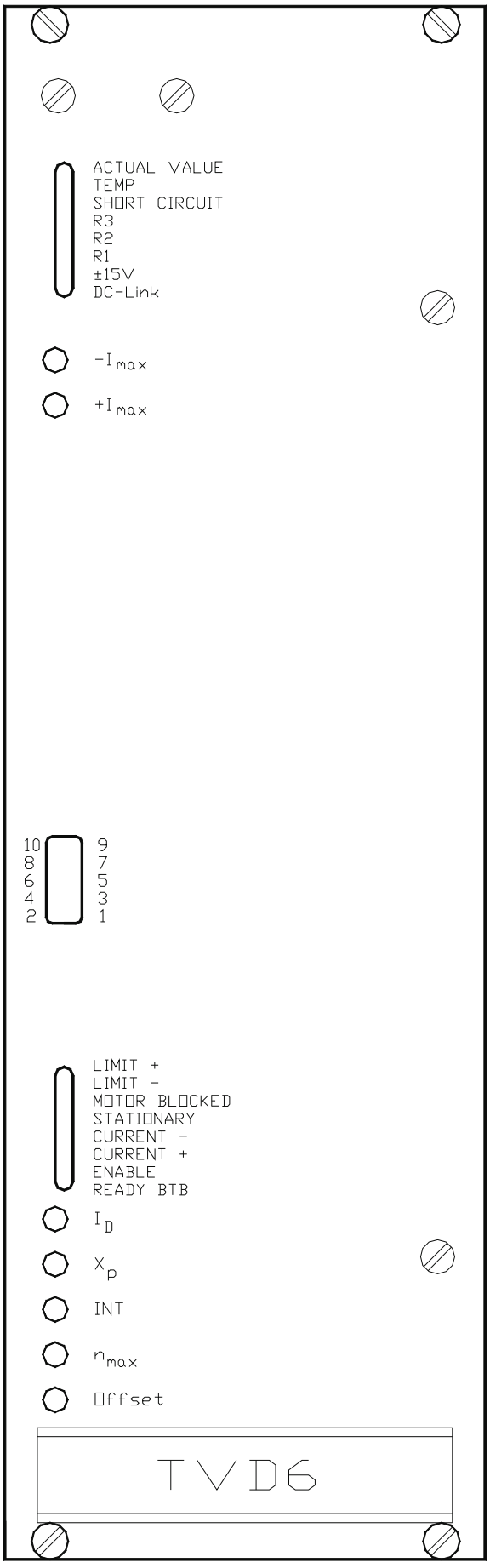
Function	D-connector no.	Connector no.
bl-tacho mp	X7: 1	X11: 2b
bl-tacho phase 1	X7: 2	X11: 6b
bl-tacho phase 2	X7: 3	X11: 10b
bl-tacho phase 3	X7: 4	X11: 14b
free	X7: 5	
GND	X7: 6	X11: 22b
-15V	X7: 7	X11: 26b
DC tacho -	X7: 8	X11: 20c
DC tacho +	X7: 9	X11: 22c
+15V	X7: 10	X11: 24b
free	X7: 11	
Temperature sensor	X7: 12	X11: 16b
Rotor position 1	X7: 13	X11: 12b
Rotor position 2	X7: 14	X11: 8b
Rotor position 3	X7: 15	X11: 4b

Test point connector, connection to the optional units X4

Function	Connector no.
1st n-command value at the output of the diff. amplifier	X4: 1
2nd n-command value at the output of the diff. amplifier or integrator	X4: 2
I-command value	X4: 3
+ 10 V	X4: 4
- 10 V	X4: 5
I-actual value	X4: 6
n-actual value (at the output of the divider)	X4: 7
Enable	X4: 8
Device ground GND	X4: 9, 10


I5 4071
I1 4081
N5 224
N6 224
I15 4002
I17 40174
D2
H
A
Enable reset
quick stop
J2
S6
I9 14584
T13 BD140
T12 BD139
2 1
X5
26 25
P5 Imax1
P6 Imax2
I8 14584
I2 4081
N1 224
N11 224
N13 072
N12 072
S19
S20
current limit internal
MP6
+15V
Loading 1.com.value
R121
I3 211
MP4
AGND
Amplification 1:1
S2
D-comp.
S14
SW2
1 2 3
2.com.value without/with INT
S11
S12
2.com.value
GND
1.com.value
GND
N2 074
1.com.value+RVU
N3 074
2.com.value INT
N9 224
actual value
Loading 2.com.value
R4
S4
S5
S9
P-component
I-component
DC-Tacho
act.value-smoothing
S3
10
9
X4
2
1
32
abc
BTB-relay
Rl2
MP5
+15
rotation direction
bl-Tacho
J4 SW3
3 2 1
I19 4081
I17 4081
I14 74138
I4 4051
I13
Out-puts
815
I24 211
I10 211
RN2
RN4
N8 224
I16 14584
I11 4070
D1
H
A
Enable pos.-neg.
SW1
X31
X21
X30
X20
X11
I6 817
I12
In-puts
815
RN1
RN3
N7 224
RN5
P7 I D
P3 Xp
P2 INT
P4 n-max
P8 Offset
GNDR
MP1
bl-Tachoauswertung
2
GNDE
internal
J3
J1
+Uext
internal
GND
MP2


15pin.
X7
X11
Rotorposition - interpretation
T1
T2
T3
T4
RT1A
RT2A
RT3A
Motor temp.
GND
+15
-15
RT1
RT2
RT3
J4
N-act.val.2
I com.val.1
I com.val.2
I com.val.3
I-com.value
SW3
M-TEMP
DC-Tacho
X1 - X2
Enable
+15V
Enable
+10V
-10V
Enable inter.
BTB
Enable ext.
J2
1. Com.value
2. Com.value
AGND
S12
S11
Integrator Enable
INT
SW2
Speed controller
S4
S5
S2
/1=1
INTAB
RVU
Xp
S14
Offset
N-act.v.2
TACHO
S3
nmax
N=0
N-ac.val.=
TEMP
S20
+10V
S19
Ext. current limit
I1max
I2max
ZW
Blocked
Enable int.
END1
END2
INTAB
Sp+
Sp-
Enable
I-Limit
Ixt
I-act.val.
ID
M-TEMP
I-TEMP
Fault Logic
ISTF
IKSM
±VI
TEMP OUT
CL
Fault-memory
Q
D
R
S18
TEMP
short circuit
Actual-Fault
Voltage-fault
BTB-contact
Uext
GNDext
J1
+15D
J3
GND
Reset ≥1
S6
enable int.
Mains reset
X5
TEMP
Mains UE
+15V
Enable ext.
I-TEMP
I-actual
I-com.val.1
I-com.val.2
I-com.val.3
-15V
IKSM



LED displays 2x

Actual value error
Temperature error
Short-circuit
Rotor position 3
Rotor position 2
Rotor position 1
Voltage error
Bus error

Adjustment potentiometers

Current limit I max -
Current limit I max +

Test point connector X4

1 1st command value at the output of the differential amplifier
2 2nd command value at the output of the integrator
3 Current command value
4 +10V
5 -10V
6 Current actual value
7 Speed actual value
8 Enable
9 free
10 Device zero GND

LED displays 1x

Output stage switch +
Output stage switch -
Overload - disabled
Stationary
Current direction -
Current direction +
Enable
Drive ready BTB

Adjustment potentiometers

I_D	Continuous current limit
X_P	Amplification
INT	Integrator time
n_{max}	Speed
Offset	zero point

Adjustments

Function	Component
Actual value adjustment bl-tacho	Poti P4 (n_{max})
Actual value adjustment, option dc tacho	Binary switch S9 + Poti P4
Internal current limit	Jumper S19, S20 Poti P5 (I_{max1}), S19 Poti P6 (I_{max2}), S20
External current limit	Poti P5 (I_{max1}) Poti P5 (I_{max2})
Continuous current	Poti P7 (I_D)
Integrator	Jumper SW2 (2-3) Poti P2 (INT)
Amplification P-term	Binary switch S4 Poti P3 (X_P)
Amplification I-term	Binary switch S5
Offset	Poti P8

Plug-in jumpers

Function	Jumper no.
1st command value input, ref. zero	S12
2nd command value input, ref. zero	S11
Ramps 2nd command value on/off	SW2 2-3/1-2
Actual value differentiation	S14
Actual value smoothing	S3
Current limit 2, internal	S19
Current limit 1, internal	S20
Amplification 1=1	S2
ext. +UL = int. +15V	J1
ext. GND = int. GND	J3
Emergency stop (delay - blocked control loop)	J2
Actual value bl-tacho	J4
Enable - reset	S6
Enable - pos./neg. logic	SW1 2-3/1-2

LED signals

Function		LED no.
Control electronics		**LED D1x**
Output stage switch +		LED H
Output stage switch -		LED G
Disabled		LED F
Stationary		LED E
Speed loop output -		LED D
Speed loop output +		LED C
Command value enable		LED B
Drive ready BTB		LED A
Power section		**LED D2x**
Actual value error	saved	LED H
Temperature	optional	LED G
Short-circuit	saved	LED F
Rotor position 3		LED E
Rotor position 2		LED D
Rotor position 1		LED C
Voltage error	saved	LED B
Bus error	not saved	LED A

Adjustments

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

Pre-setting

Actual value	>>>	jumper
Command value inputs >>>		jumper, differential input
logic inputs/outputs	>>>	jumper, internal/external supply
P-I parameter switch	>>>	jumper, switch

Optimisation

Current controller	adjusted in the factory (P or PI control loop)
Actual value adjustment	n_{max} adjustment
Current limits	I_{max}, I_D adjustment
Speed controller	P-I switch, Xp adjustment
Slope limiting device (integrator)	INT adjustment (only command value 2)
Zero point	Offset adjustment
Path/position controller	in the CNC\PLC control

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

Test points

Test point connector X4

Measurement	**max. value**	**Connector**
Command value 1 at the output of the input amplifier	±10V	X4:1
Command value 2 at the output of the input amplifier	±10V	X4:2
Current command value (control function speed controller) ±10V		X4:3
Current actual value, unipolar	±5V	X4:6
Speed actual value at the output of the divider	±5V	X4:7

Command Value

Function	Command value1	Command value2
Input amplification fixed	1	1
Input voltage max.	±10V=	±10V=
Differential input jumper	S12 open	S11 open
Input referred to GND jumper	S12 plugged-in	S11 plugged-in
Input signal	X1:4	X2:17
Input GND	X1:8	X2:28
Test point connector	X4:1	X4:2
Measured value max.	±10V=	±10V=
Integrator function	not existing	jumper SW2

Input referred to GND	Differential input
for a potentiometer command value	for a command value from the PLC/CNC
with internal voltage supply	external command value
Jumper S11, S12 plugged-in	Jumper S11, S12 open
Check the GND connection	The signal and GND connections can be swapped. (Basic set-up)

Both command values connected:

- The command values 1 and 2 are added internally.
- Check the signs.
- The sum of the command values must not be superior to ±10V.

Only with the command value 2 - acceleration and braking ramp - linear integrator			
Command value 2	**Jumper**	**Poti**	**Range**
without integrator	SW2 Pos. 1-2	—	—
with integrator	SW2 Pos. 2-3	INT(P2)	0.1 to 4.5 sec.
without command value 2	SW2 open	—	—

Command value current

Command value from an external current source 0 to ±20mA.
Internal load resistors for 0 to max. ±10V.

Command value 1 Resistor R121
Command value 2 Resistor R4

Resistance values [Ω] = command value voltage/command value current (max. 500 Ω)

Attention:
Do not use the command value current of 4 to 20mA.

Speed actual value

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

Actual value bl-tacho with rotor position encoder

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

LED signal sequence R1>R1+R2>R2>R2+R3>R3>R3+R1>R1>R1+R2 etc.

Tacho signal X4:7

>uniform speed-proportional voltage, no saw-tooth voltage

Pre-settings with the resistance network RN1, RN2

- Resistance value (Ohm) = tacho voltage x max. speed
- Basic set-up for 3000 min^{-1}
- for further max. speeds: pls indicate on order

Fine adjustment with potentiometer n_{max} (P4)

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 to10% of the maximum required

Sense of rotation (seen on the rear panel of the motor, DIN)			
Command value	**Sense of rotation**	**Jumper**	**Position**
positive	clockwise	SW3	Pos. 1-2
positive	anti-clockwise	SW3	**Pos. 2-3**

Option dc tacho for motors with dc tacho or rotor position encoder

- fine adjustment see ‘bl-tacho’

Switch S9											
Rough tach adjustment											
Stellung	0	1	2	3	4	5	6	7	8	9 bis F	n_{max}

Current limiting

Peak current	range 0 to 200% rated current maximum reset time 5sec.	Poti P5/P6
Continuous current	range 5 to 100% rated current	Poti P7

Internally resetting current limits		
Current limit	**Function**	**Limit**
Overload	Time	Continuous current
Heat sink	Temperature	50% rated current
Motor	Temperature	50% rated current
The lowest current limit is effective!		

Peak current

Internal current limit (Basic set-up)		
Adjustment	Jumper	Potentiometer
I_{max1}	S19 plugged-in	I_{max1} (P5)
I_{max2}	S20 plugged-in	I_{max2} (P6)

External current limit				
Adjustment	**Input**		**Jumper**	**Potentiometer**
I_{max1}	X1:9	0 to +10V	S19 open	I_{max1} (P5)
I_{max2}	X1:10	0 to +10V	S20 open	I_{max1} (P6)
The external current limiting voltage can be reduced internally 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 (P6)

Measuring adjusted values:

- Do not connect the motor
- Preset the command value and enable > switch on/off
- The value to be measured applies across the test point connector X4:3 (5V=rated current)

Command value	Measured value I (2 sec.)	Measured value I
+ 5V	0 to max.10V	0.25 to max. 5V
- 5V	0 to max.10V	0.25 to max. 5V

Current actual values

Measured value at the test point connector X4:6 >>> I_{max} = 0 to +5V

I_D = 0.12 to +2.5V

Note : for an exact torque control :

- the device is adjusted to from P- to PI-control in the factory
- please indicate on order

Speed control loop circuit

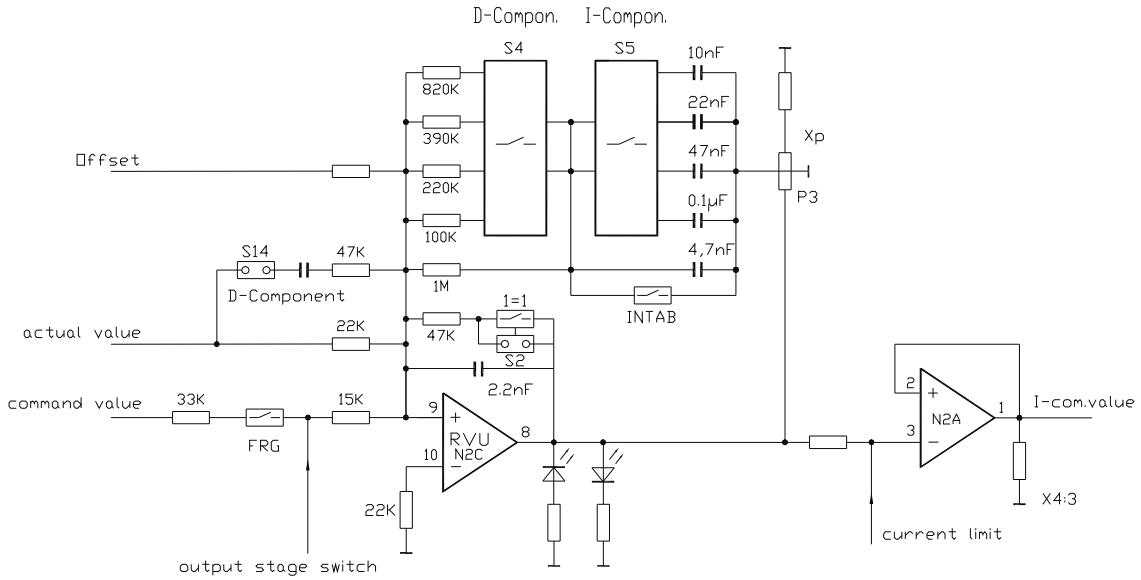
- two 16-position binary switches S4, S5
- amplification potentiometer P3 (X P)
- D-term with jumper S14

Take over the adjusted values when the device is exchanged.

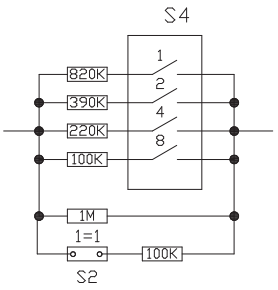
Basic set-up

- binary switches S4 and S5 in position 4
- amplification poti Xp to 50%

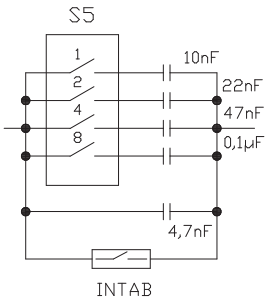
- no D-term, jumper S14 open
- suits the majority of drives



Adjustment of the proportional term by means of the binary switch S4								
Switch S4								
Position	0	1	2	3	4	5	6	7
R-Value kW	1000	450	280	209	180	148	123	107
Position	8	9	A	B	C	D	E	F
R-Value kW	90	82	73	67	64	59	55	52



Adjustment of the proportional term by means of the binary switch S5								
Switch S5								
Poition	0	1	2	3	4	5	6	7
C-Value µF	0,01	0,02	0,03	0,04	0,08	0,09	0,1	0,11
Position	8	9	A	B	C	D	E	F
C-Value µF	0,11	0,12	0,13	0,14	0,18	0,19	0,2	0,21

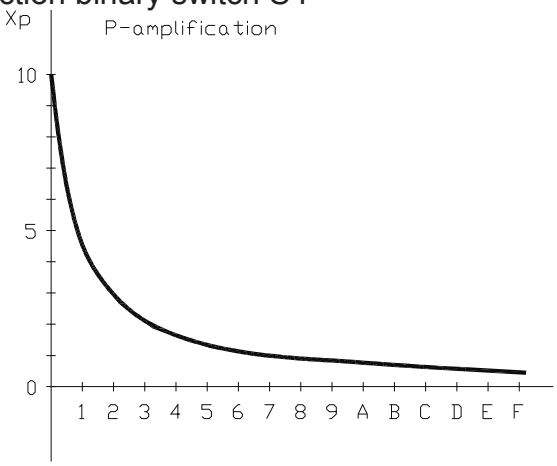


Note:

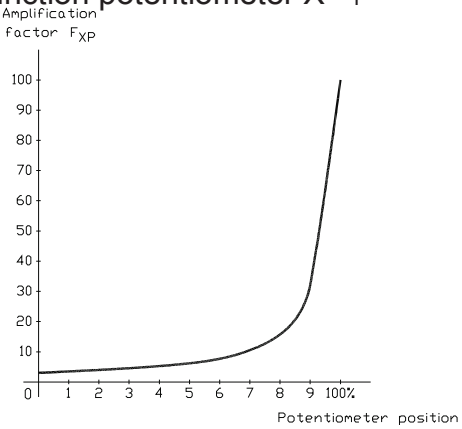
The integral term can be switched off through the use of the input INTAB (X2:31)

Proportional amplification

Function binary switch S4

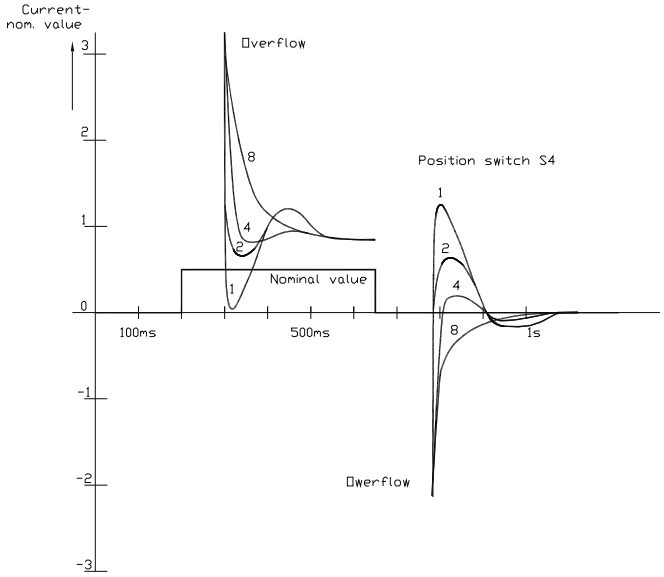


Function potentiometer X P



Proportional amplification = X P x FXP

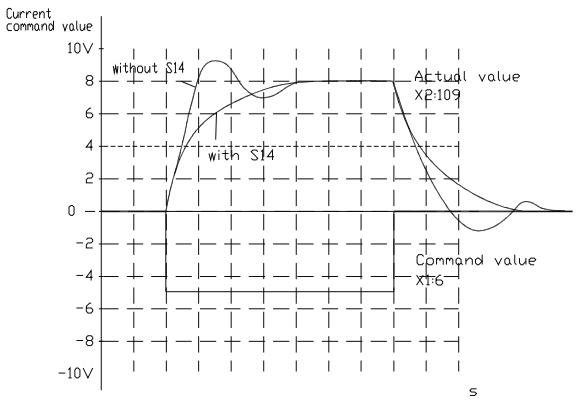
Adjustment by means of an oscilloscope



Adjustment
- Command value jump ±0.5V
- Input INTAB X2:31 activated

Measured value
Command value X4:1
Controller response
Current command valueX4:3

Effect D-term
- Actual value differentiation
- Jumper S14 plugged-in



Attention:
Do **not** use the D-term for the position control (CNC/PLC)!

Adjustment without measurement equipment

Connect the motor,
command value = 0
XP = 50%
switch S4 = position 4
switch S5 = position 4
enable the drive,
turn the potentiometer X P clockwise until the axis begins to oscilate.

If the axis does not oscillate
- reset the switch S4 to a lower value.
- Adjust by means of the potentiometer X P until the oscillations begin.
- Turn the potentiometer X P anticlockwise until the oscillation disappears.
- Turn poti X P back another 2 clicks.

Adjust the switch S5 in such a way, that when a command value jump of 50 % occurs, the drive runs smoothly after approx. two oscillations.

Drive behaviour:	
Amplification too low	**Amplification too high**
Large overshoots	vibrates > during acceleration
Overshoots destination position	vibrates >during braking and in position

Attention:
Drives connected to CNC\PLC controllers:
for the maximum speed output from the controller, adjust the speed command value to between 8 and 9V.

Standard set-up

Before commissioning check the following connections

- Nominal power supply	terminals no. X3:3, X3:4, X3:5 **max. 230V~ (TVD6-200)** **max. 460V~ (TVD6.2-400)**
- Protection earth	earthing screw on the housing
- Motor connection	terminals X3:7, X3:8, X3:9
- Motor earth connection	terminal X3:6
- Option	
- external ballast resistance	terminals no. X3:1 and X3:2
- Fuse type, fuse value	

(Please observe the connection advice, page 12)

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

Power connections

- Protective earth	
- Mains	1x or 3x 230V~ (for TVD6-200bl) 1x or 3x 400V~ (for TVD6.2-400bl)
- Motor	3 x motor conductors + protect. conductor + shield
- Encoder connection	observe the motor-specific connection data sheets

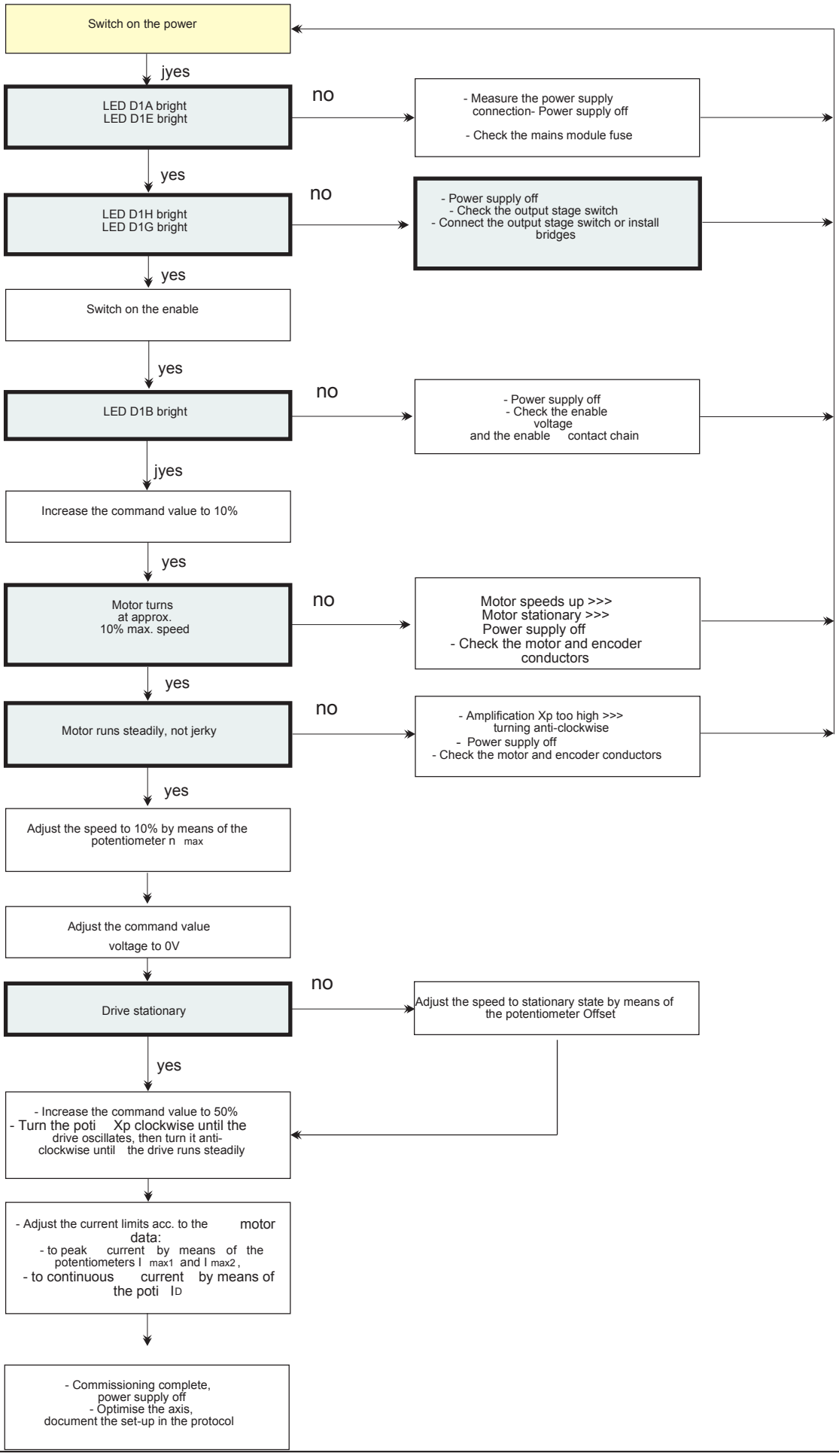
Control connections

- Enable	contact between X1:1 and X1:2
- Command value	signal X1:4, GND X1:8
- Output stage switch	output stage switch across X1:16 and X2:32 or bridge between X2:27 and X1:16, X2:32

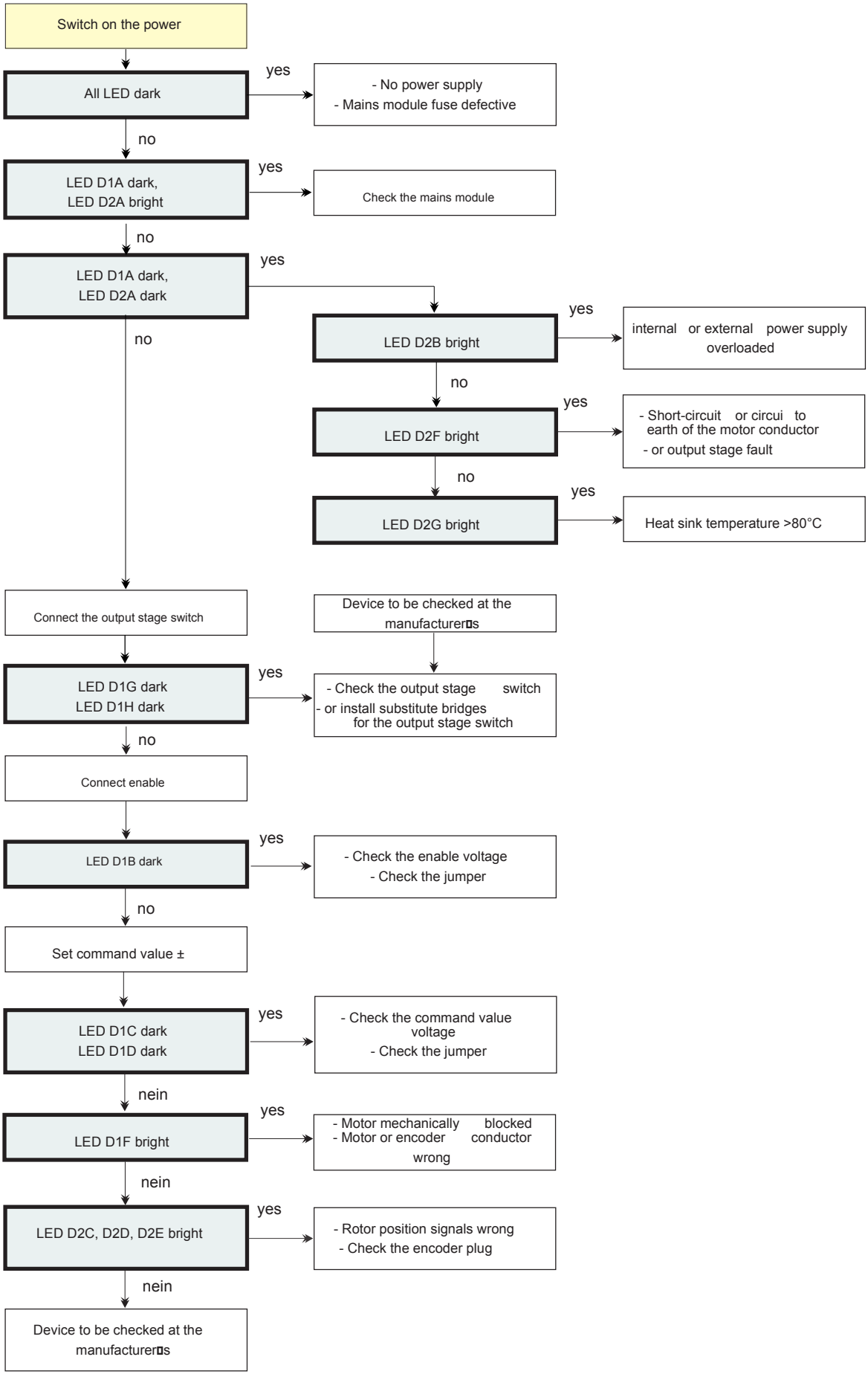
Basic set-up for the first commissioning

Switch	S4	P amplification	position 4
Switch	S5	I-term	position 4
Potentiometer	I_{max1}	peak current	10%
Potentiometer	I_{max2}	peak current	10%
Potentiometer	I_D	continuous current	100%
Potentiometer	X_P	amplification	50%
Potentiometer	INT	integrator	left full scale
Potentiometer	n_{max}	speed	left full scale

Jumper	**open**	**plugged-in**
	S2, S14	J1, J2, J3, J4 S3, S6, S11, S12, S19, S20
	SW1 pos. 1-2	SW1 pos. 2-3
	SW2 pos. 1-2	SW2 pos. 2-3


Switch on the power
jyes
LED D1A bright
LED D1E bright
no
- Measure the power supply connection- Power supply off
- Check the mains module fuse
yes
LED D1H bright
LED D1G bright
no
- Power supply off
- Check the output stage switch
- Connect the output stage switch or install bridges
yes
Switch on the enable
yes
LED D1B bright
no
- Power supply off
- Check the enable voltage
and the enable contact chain
jyes
Increase the command value to 10%
yes
Motor turns
at approx.
10% max. speed
no
Motor speeds up >>>
Motor stationary >>>
Power supply off
- Check the motor and encoder conductors
yes
Motor runs steadily, not jerky
no
- Amplification Xp too high >>> turning anti-clockwise
- Power supply off
- Check the motor and encoder conductors
yes
Adjust the speed to 10% by means of the potentiometer n max
Adjust the command value
voltage to 0V
Drive stationary
no
Adjust the speed to stationary state by means of the potentiometer Offset
yes
- Increase the command value to 50%
- Turn the poti Xp clockwise until the drive oscillates, then turn it anti-clockwise until the drive runs steadily
- Adjust the current limits acc. to the motor data:
- to peak current by means of the potentiometers I max1 and I max2 ,
- to continuous current by means of the poti ID
- Commissioning complete, power supply off
- Optimise the axis, document the set-up in the protocol

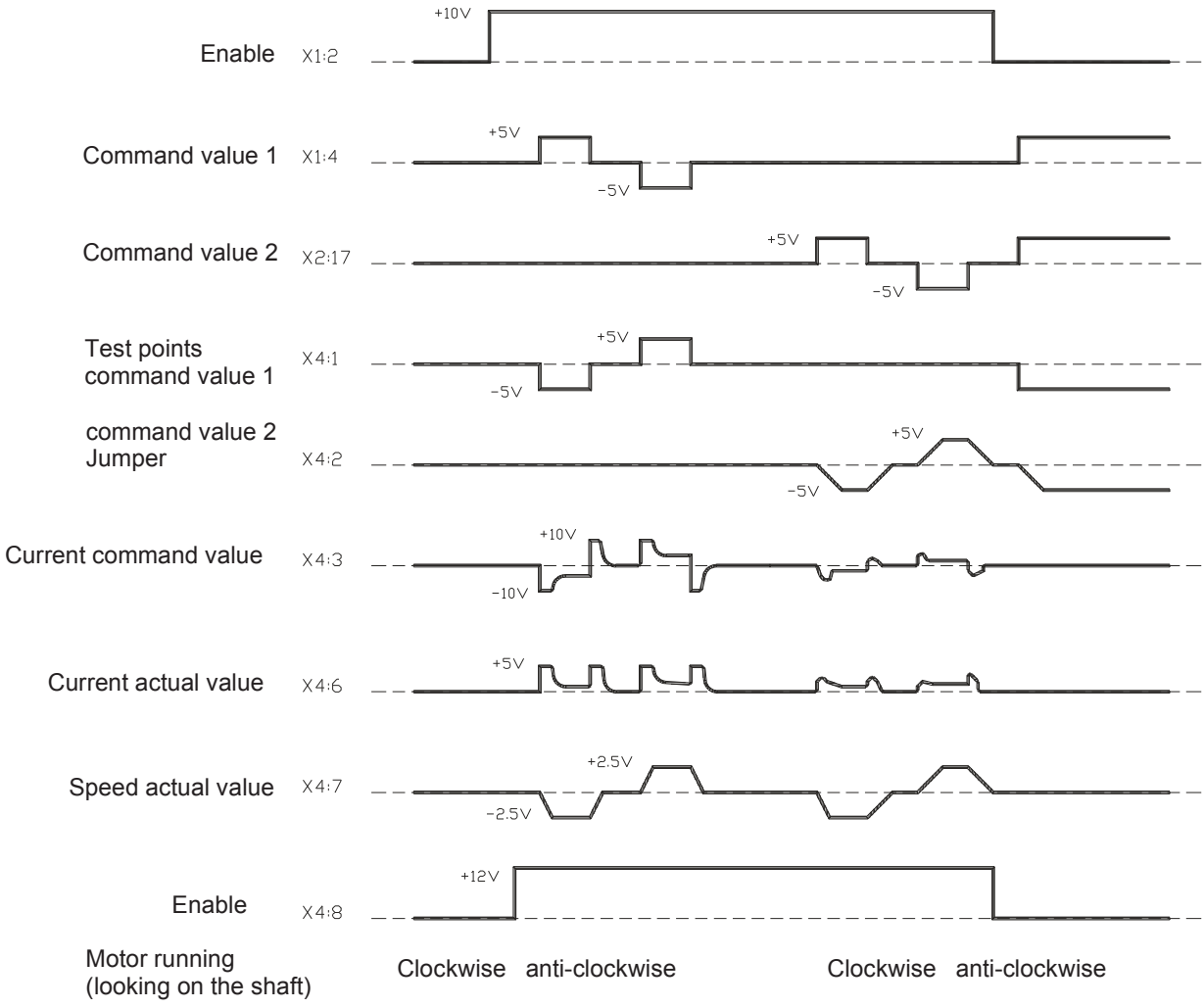
LED displays



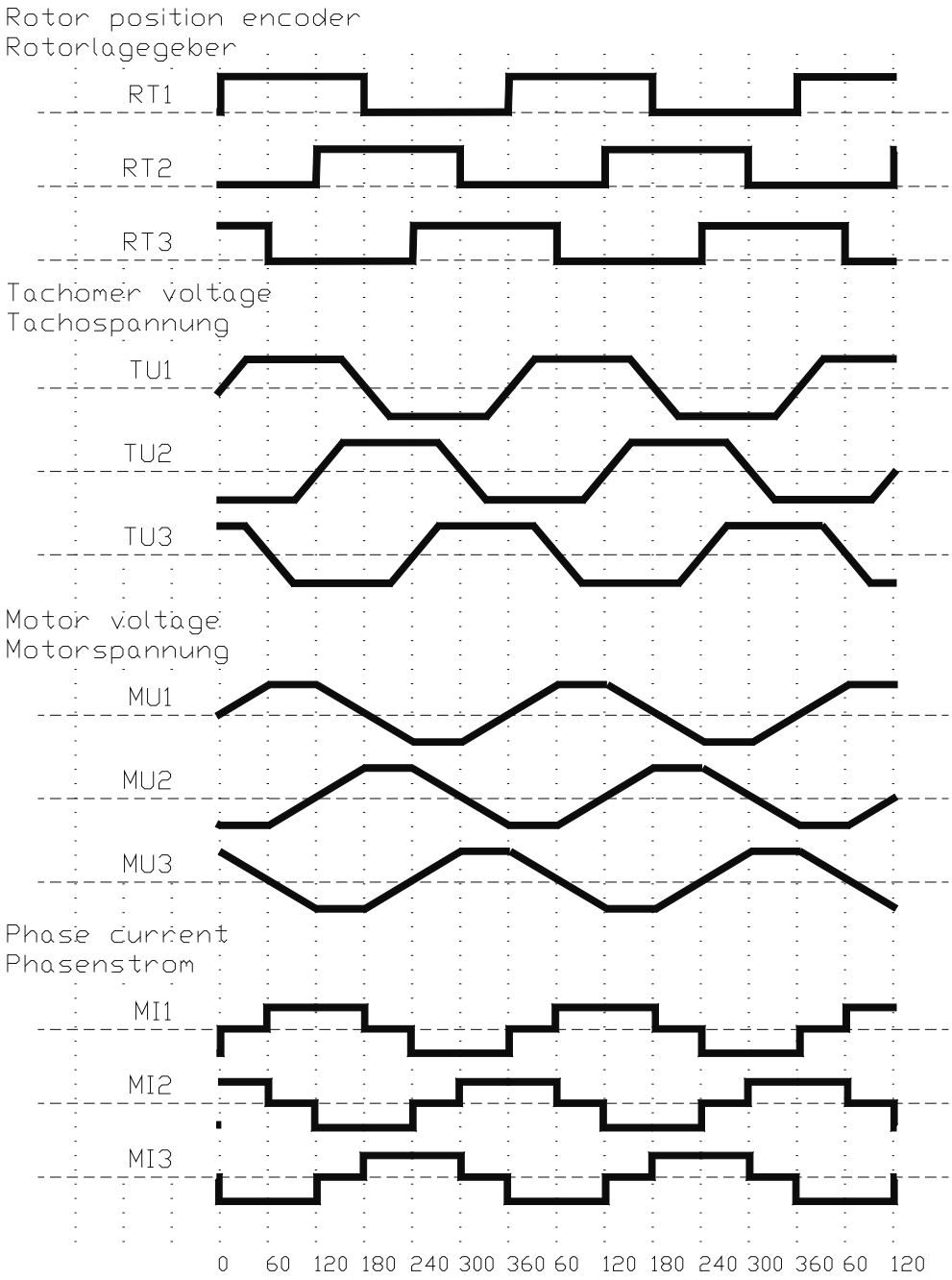
Fault diagnosis

Fault	Causes
Motor stands in one position, runs jerky or oscillates in one position	- Encoder or motor conductor cores mixed up or interrupted
Motor speeds up	- Motor or rotor position conductor cores leading or lagging by 120° in the rotating field
Motor runs unsteadily	- Tacho conductor cores mixed up or interrupted - Amplification too high - Command value faults
Mains module switches to failure during braking, LED D2A bright	- Braking energy too high
Mains module switches to failure when being switched on, LED D2A bright	- No connecting phase - or the power supply voltage is too low
Amplifier switches to failure	- Over-temperature - Phase short-circuit or short-circuit to earth - BTB fault - Output stage fault
Speed cannot be adjusted with poti n_{max}	- Resistance network RN1, RN2 wrong

Functional diagram - test point connector



Functional diagram bl/ec motor amplifier
Funktions-Diagramm bl/ec Motorverstärker



Customer . . . . . **Machine No.** . . . . . .

Device . . . . . **Serial No** . . . . . .

Supply voltage [V=,V~]. . . . . ..

Inputs

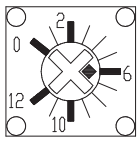
Enable	contact ?	voltage [V=]
Command value 1	type	voltage [V=]
Command value 2 additional	type	voltage [V=]
Current command value I_{max1}	external	voltage [V=]
Current command value I_{max2}	external	voltage [V=]

Speed controller settings

Actual value - rough adjustment
DC tacho S9 Position

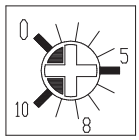
Switches

P-term	S4	Position
I-term	S5	Position



Potentiometers

Speed	n_{max}	P4	Position
Peak current	I_{max1}	P5	Position
Peak current	I_{max2}	P6	Position
Continuous current	I_D	P7	Position
Integrator	INT	P1	Position
Amplification	X_P	P3	Position
Offset	Offset	P8	Position



Jumper (Plug-in bridges) soldered jumpers

plugged-in no. . . . . .

open no. . . . . .

Adjustments - power section

Current control loop amplification

Resistances - current control loop (kΩ)

Measured data

Motor voltage max. [V~] 3x

Motor current peak [A~] 3x

Motor current continuous [A~] 3x

DC tacho voltage max. [V=]

Acceleration [V/ms]

Braking [V/ms]

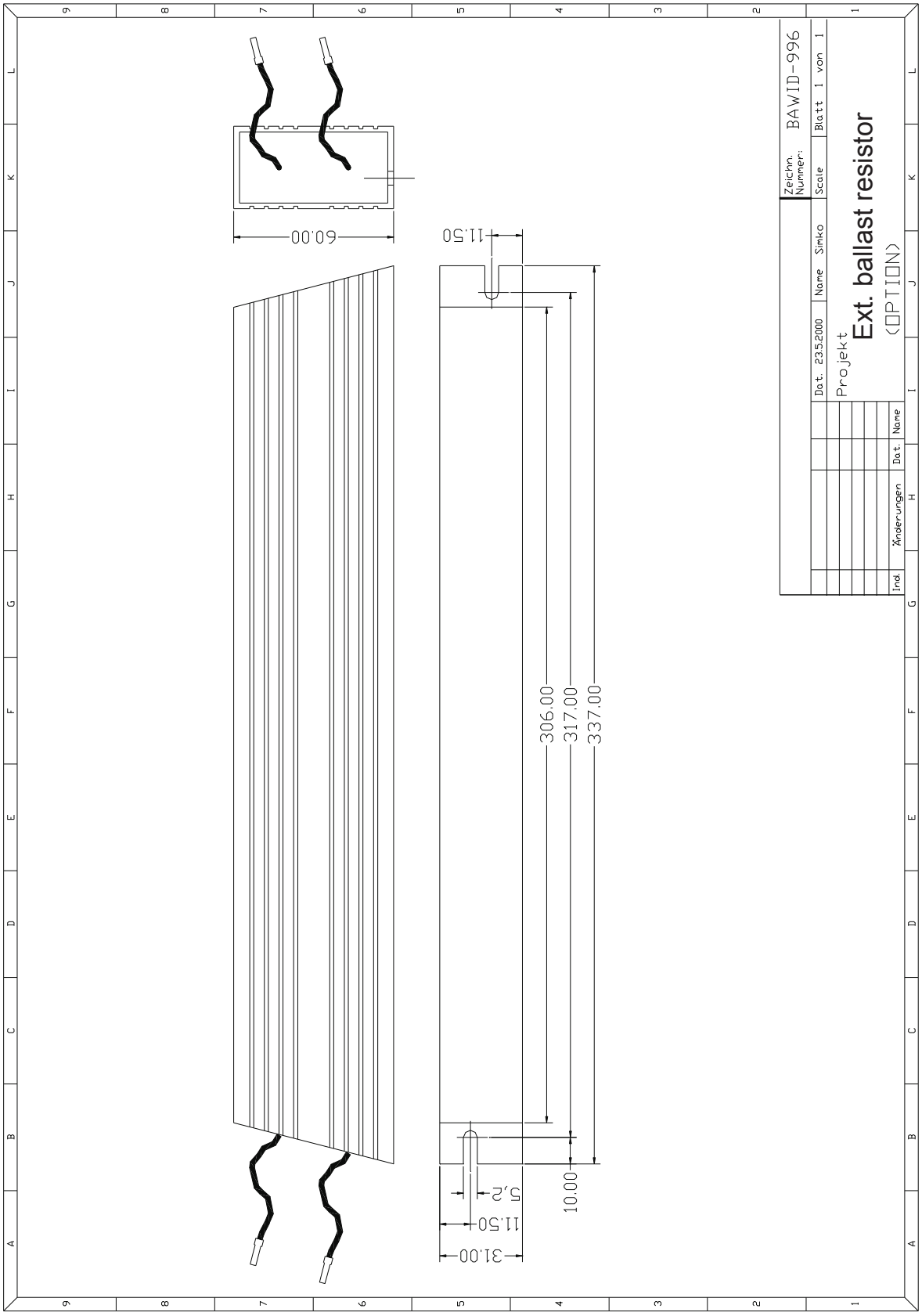
Motor Data

Manufacturer . . . . . .
. . .

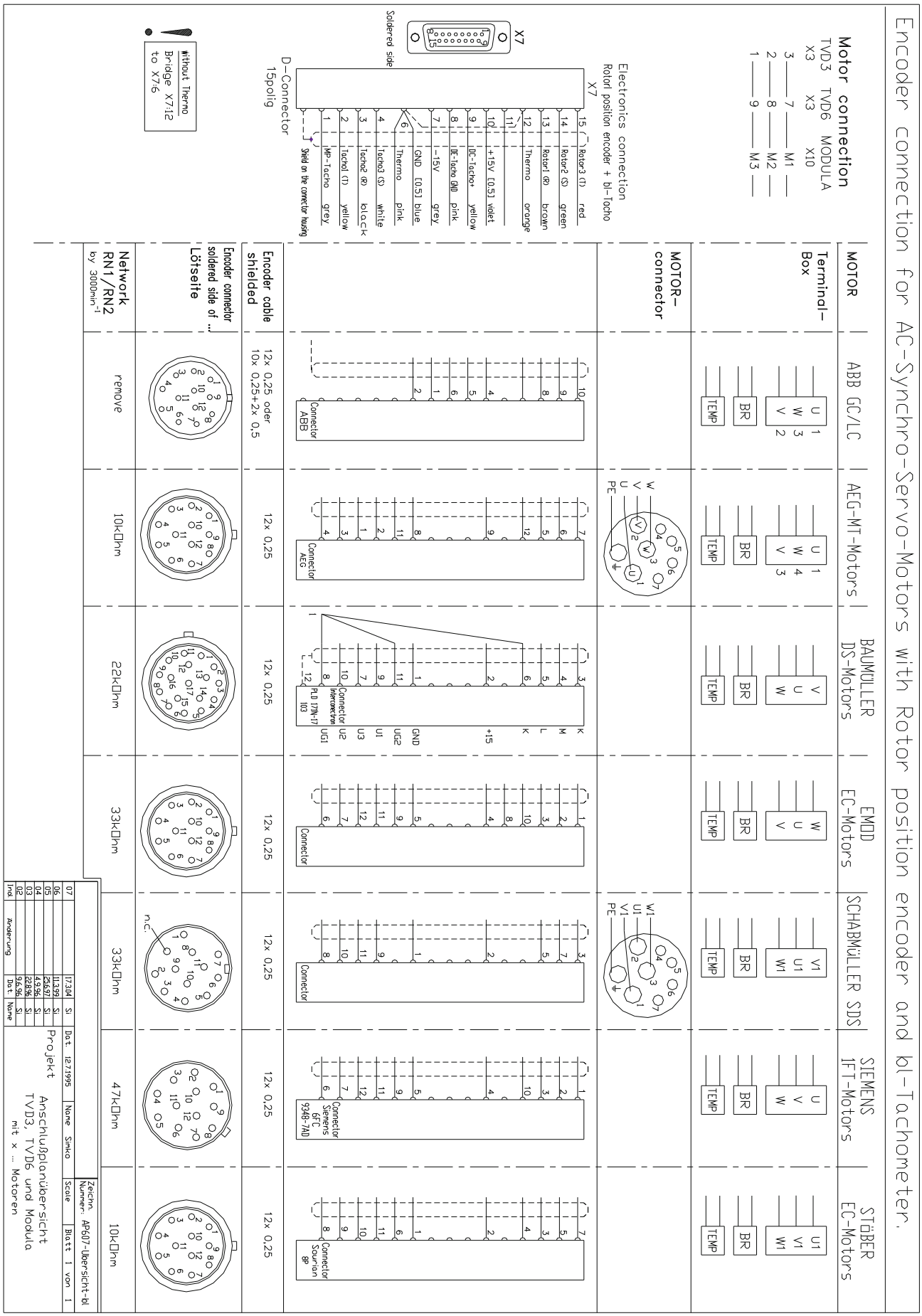
Type . . . . Serial number . . . . . .
. . . .

Motor voltage [V~] . . . . . Motor current [[A~] . . . . . .
. . . .

Brake [V] . . . . . Fan [V] . . . . . .
. . . .


60.00
11.50
306.00
317.00
337.00
10.00
5.72
11.50
31.00
Zeichn. Nummer: BAWID-996
Scale
Blatt 1 von 1
Name Simko
Dat. 2352000
Projekt
Ext. ballast resistor
(OPTION)
Ind.
Änderungen
Dat.
Name

Encoder connection



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