TVD3-2-IN

MANUAL

3-phase Servo-Drive

TVD3.2-xx-IN

for ac synchro servo motors

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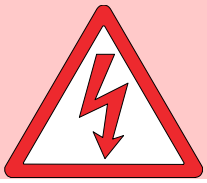
Electronic equipment is not fault proof. This fact should be borne in mind for all possible operating conditions.

ATTENTION - High voltage
AC 140V~, DC 220V=



Before installation or commissioning begins, this manual must be thoroughly read and understood by the technical staff involved.
If any uncertainty arises, the manufacturer or dealer should be contacted.
TVD3.2 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 independent 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

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

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

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

General information

The transistor 3-phase current servo amplifier **SERVO-TVD3.2** in combination with the brushless dc motor (ac synchro servo motor, EC motor) provide a drive solution free of maintenance and with a wide dynamic control range.
The drive displays the well-known good control characteristics of dc drives without the disadvantages of the carbon brushes' wear and the commutation limits.
The rotor moment of inertia is notably lower and the limit power is greater than with equally constructed dc motors. This results in up to 5 times higher acceleration values.
The generated heat in the motor only occurs in the stator (cold shaft).
The motors always have the protection rating IP 65.
From the electrical view, the ac synchro motor is a synchro motor with a permanent magnet rotor and a three-phase current stator.
The physical characteristics correspond to those of dc motors, that is, the current is proportional to the torque and the voltage is proportional to the speed.
Current and voltage are precisely measured. The analog circuits are simply constructed.
The speed actual value is generated in the incremental encoder with rotor position traces.
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 and ac synchro servo amplifiers which are supplied by a dc bus, it must be checked that the energy is fed back into the bus during brake operation (winding machines, lifts, great centrifugal masses).
The ballast circuitry is rated for 3% duty cycle. An extended operating time can be achieved by additional external resistors. (Option)

Information:

Further servo amplifiers for dc servo motors

For low power applications	UNITEK TV6.2
	UNITEK TV3.2
For high power applications	UNITEK Classic Q2, Q6, up to 250V, 15-60A
	UNITEK TVQ6.2

Amplifiers for dc shunt-wound motors

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

Three-phase servo amplifiers for ac synchro servo motors

For low power applications	UNITEK SERVO TVD3-2 -xx-bl, IN, RS,
	24-150V, 5-10AF
or medium power applications	UNITEK SERVO TVD6-2 -bl, N, RS,
	200V/400V, 5-25/40A
For high voltage applications	UNITEK AS 250bl, AS 450RS
	UNITEK DS 400
For battery operation	UNITEK series BAMO

Applications

Machines and installations for all types with a drive power of up to 0.8kW.
Especially as 4Q-servo-drive for feed axes where the following is required:
- high dynamic acceleration and braking cycles
- a wide control range
- high efficiency
- small motor dimensions
- highly repeatable, accurate and quiet moves
- 'cold shaft'

For speed or torque control or combined speed/torque control incorporated within or independent of position control loops.
Drives with constant speed as in conveyors, spindle drives, pumps, transversal or longitudinal pitch drives.
AC synchro-servo-drives are more compact than other electric drives.

Particularly suitable for:

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

Note

Use bl-drives where braking operations are predominant,
e.g. when deceleration is mainly required:
- winding machines, lifts, great centrifugal masses

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

Motor features

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

Build

- Switch cabinet mounting or 3HE plug-in device
  according to the VDE, DIN and EU regulations
- Standard analog control electronics
- Power electronics for 5A and 10A
- No galvanic isolation between the power connection and device

  ground (GND)
  GND = -UB = PE - housing

Components

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

Characteristics

* Connection using an isolating transformer nom. 115V~ (max. 140V~)
* Differential command value input
* Speed and torque control
* Static and dynamic current limiting
* Current command value output
* Measurement points for current and speed
* Enable logic
* Emergency stop
* Braking in case of a mains failure
* Temperature watchdog for the motor and the device
* Incremental encoder output

Technical Data

Power connection

- Compact device
  - with transformer — nominal 115V~ (max. 140V~), 24V~/=
  - with transformer + rectifier — nominal 180V= (max. 200V=), 24V~/=
- For a multiple axes mounting with mains module
  - transformer — 1x or 3x 115V~ (max.140V) + 1x 24V~/=
- Output voltage — max. 3x110~

Specification				
Device TVD3.2-115			**5**	**10**
Stationary current output	- continuous	A=	5	10
	- peak	A=	10	20
Max. el. power		W	450	900
Integrated quick ZW fuses		AF	12.5 … 16	16
Dimensions:	- compact device	w x h x d	see 'Dimensions'	
	- plug-in device	w x h	12TE/3HE	12TE/3HE
Cooling at	60% d.cyc.		self	self
	100% d.cyc.		self	fan

Mains module TVD3-N 100-30

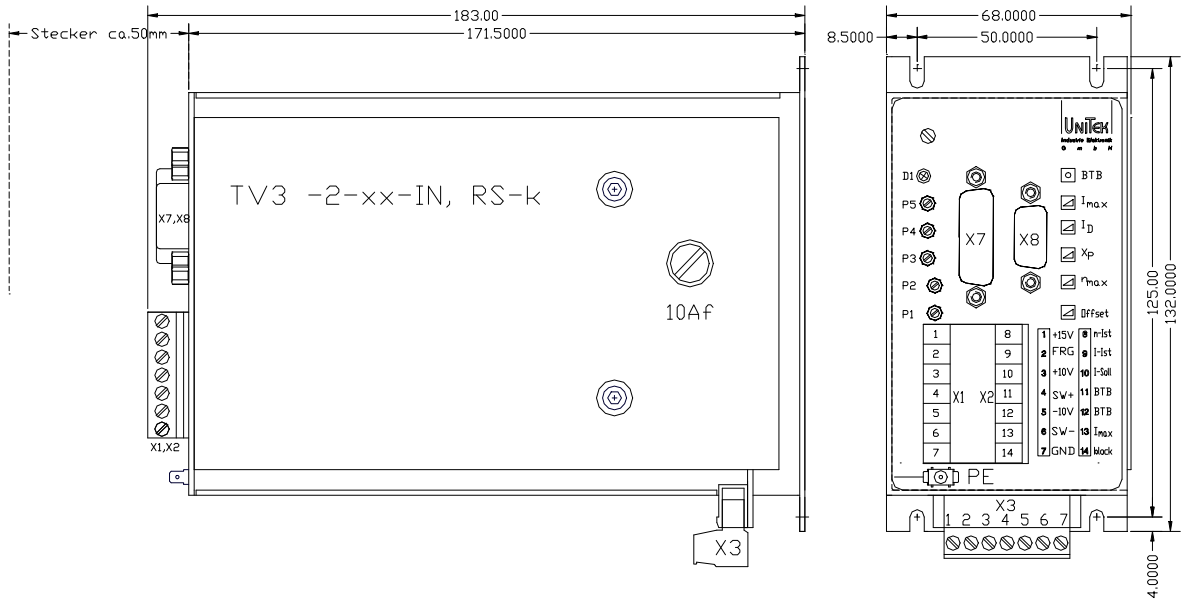
Power supply	V~		1x or 3x 115V~ + 1x 24V~
Output voltage	V=	max.	200
Output current	A=	max.	30
Regen circuit with	V=		220
Ballast power	W	100%	50
	WS		6000

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	0 ... 45°C
Extended operating temp. range	up to 60°C reduced by 2%/°C
Storage temperature range	-30°C to + 80°C
Speed control loop circuit	
- control precision without actual value error	± 0.5%
- control range	1: 1000
Incremental pulses	A/A, B/B, N/N 5V

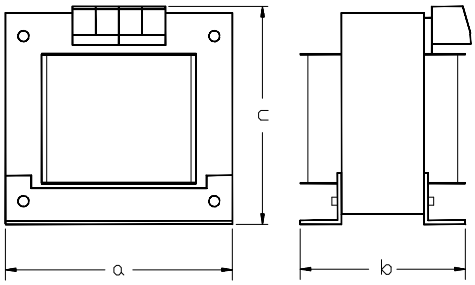
Caution: The maximum connection voltages 140V~, 200V= **must not** be exceeded even for short times.
The regen circuit may be destroyed.

Compact device dimensions

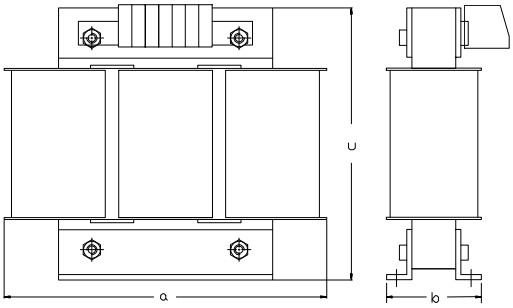


Transformer and choke dimensions

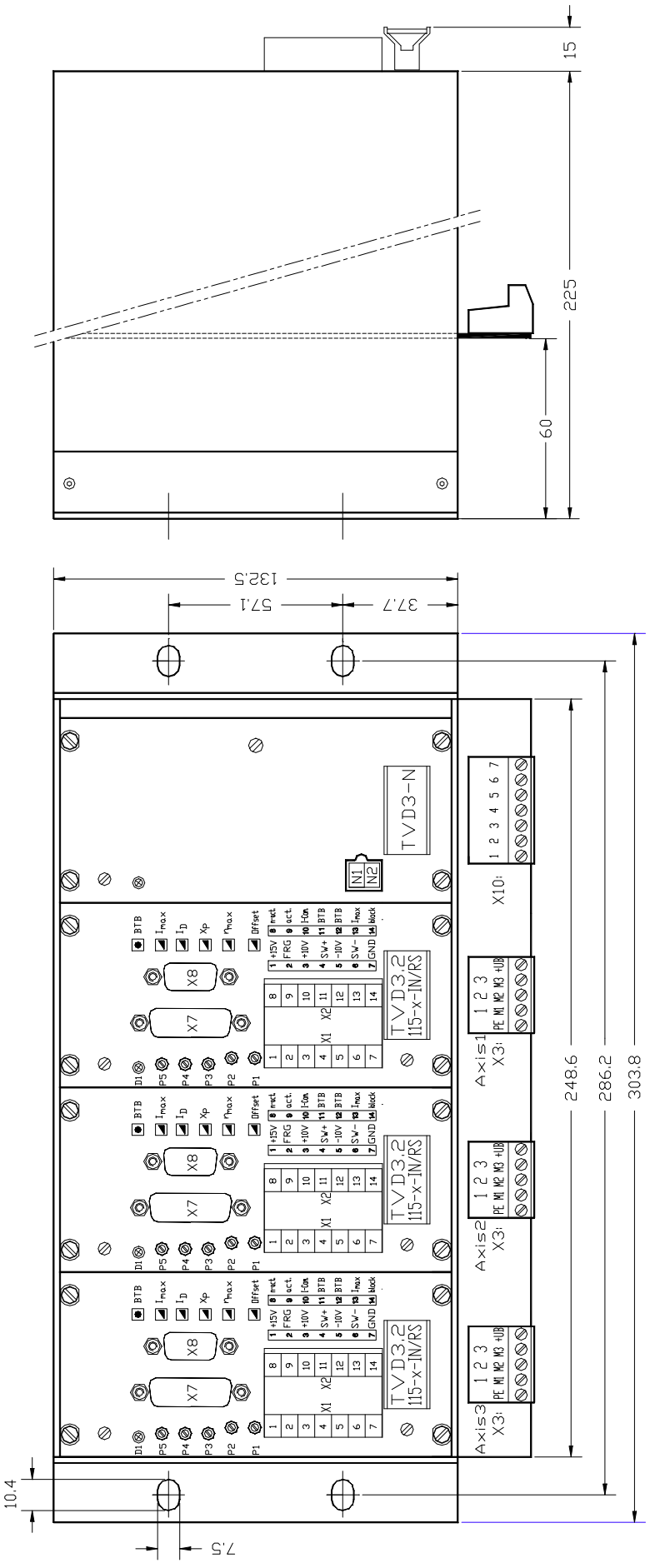
Transformer			
Transformer Type	**Transformer Power VA**	**Dimensions a/b/c mm**	**Weight kg**
TE 8/2	100	85x 89x 82	2.0
TE 12/1	250	120x101x115	4.3
TE 12/3	400	120x133x115	6.8
TE 15/1	500	108x132x122	8.2
TE 15/3	800	150x150x132	13.5
TE 74/2	1300	175x140x160	15.4
TE 74/3	1600	175x150x160	18.5



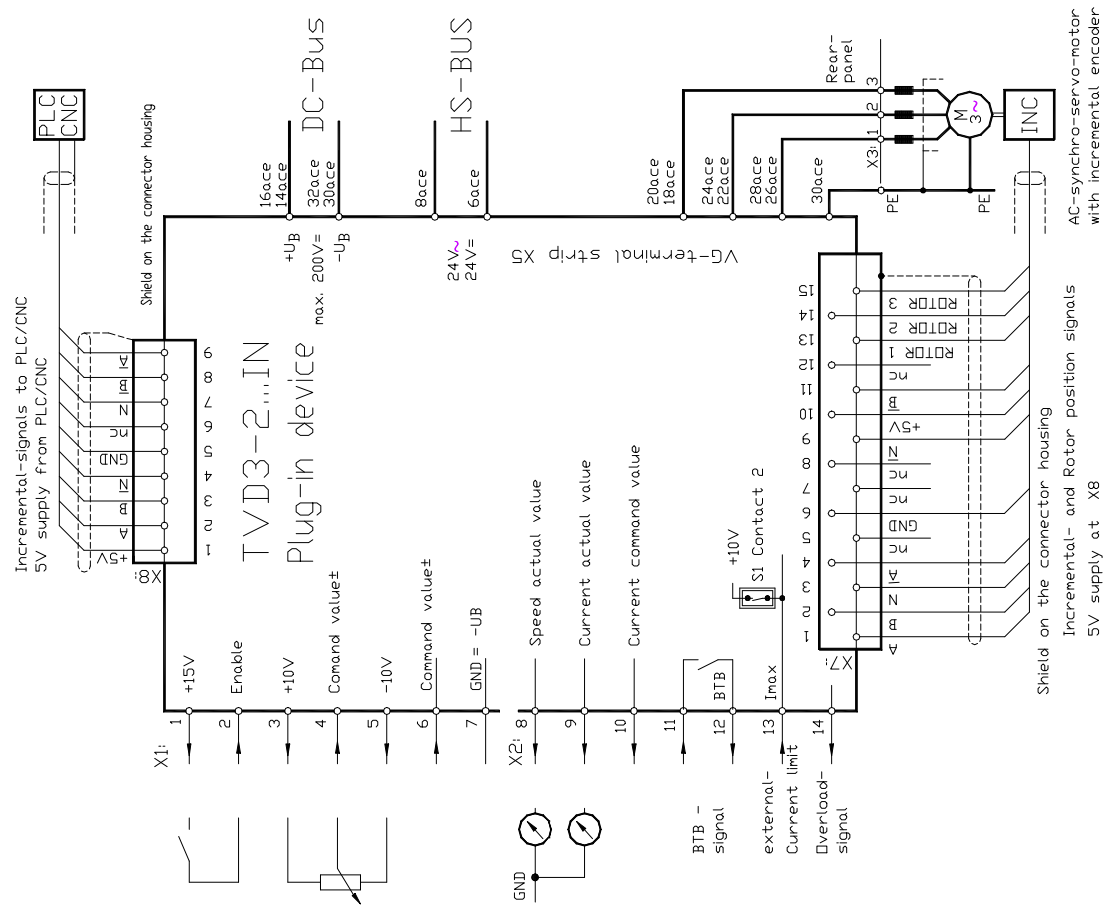
Choke				
Type	**Current A**	**Inductance mH**	**Dimensions a/b/c mm**	**Weight kg**
MDD 1,3a	-2.5	3.5	80x 48x90	1.1
MDD 1,6a	-5	1.9	95x54x108	1.3
MDD 1,6b	-10	1.0	95x 58x108	1.4

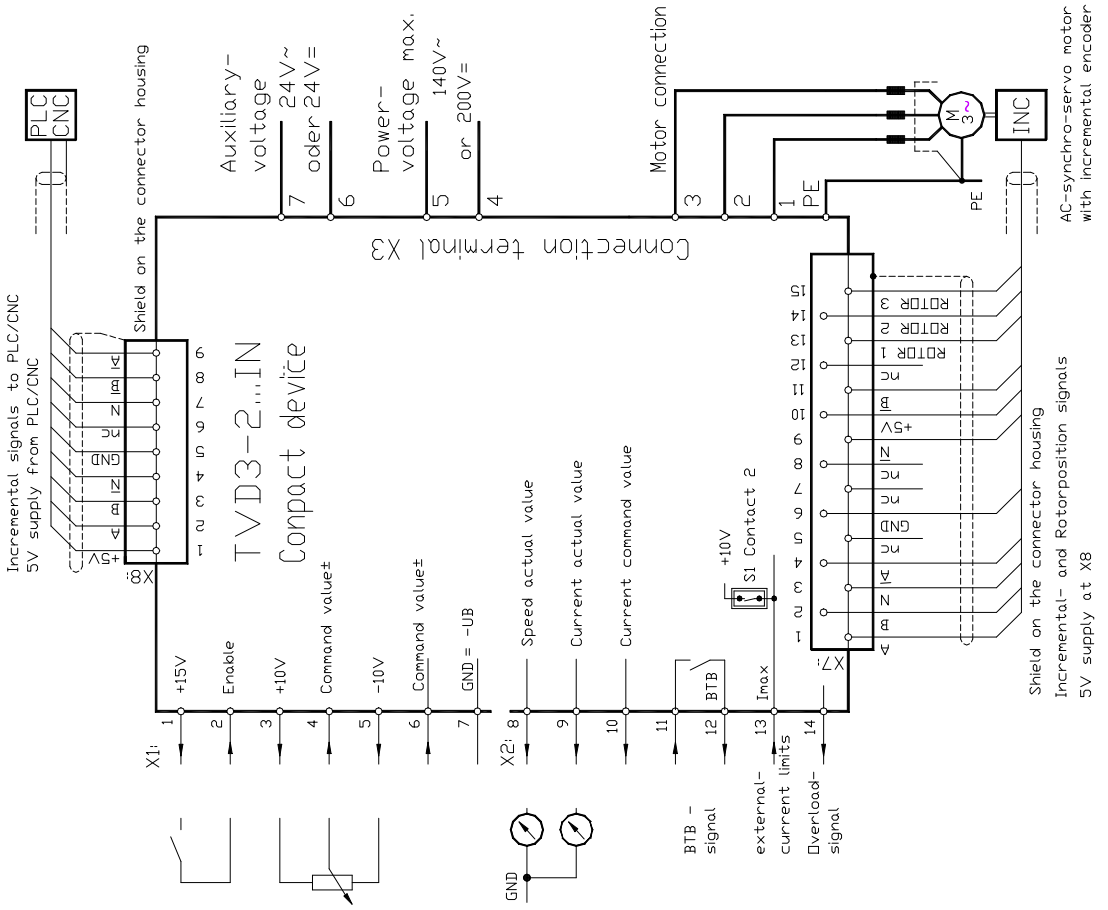


Dimensions of a multiple axes combination



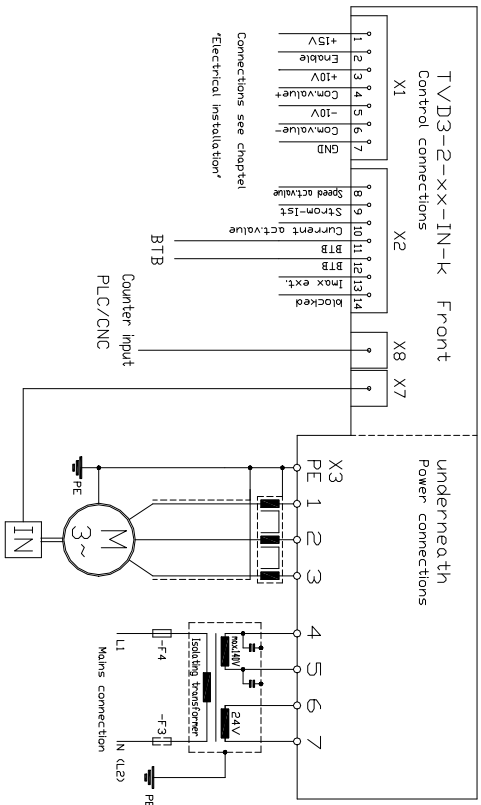
Free


PLC CNC
Incremental-signals to PLC/CNC
5V supply from PLC/CNC
Shield on the connector housing
TVD3-2...IN
Plug-in device
16ace 14ace
32ace 30ace
DC-Bus
+UB
-UB
max. 200V=
8ace
6ace
HS-BUS
24V~
24V=
VG-terminal strip X5
20ace 18ace
24ace 22ace
28ace 26ace
30ace
Rear-panel
X3:
PE
M 3~
INC
AC-synchro-servo-motor
with incremental encoder
X8:
+5V
A
B
N
GND
nc
nc
nc
X1:
+15V
Enable
+10V
Comand value±
-10V
Command value±
GND = -UB
X2:
Speed actual value
Current actual value
Current command value
BTB
Imax
+10V
S1 Contact 2
X7:
ROTOR 1
ROTOR 2
ROTOR 3
+5V
GND
BTB - signal
external- Current limit
Overload- signal
GND
Shield on the connector housing
Incremental- and Rotor position signals
5V supply at X8

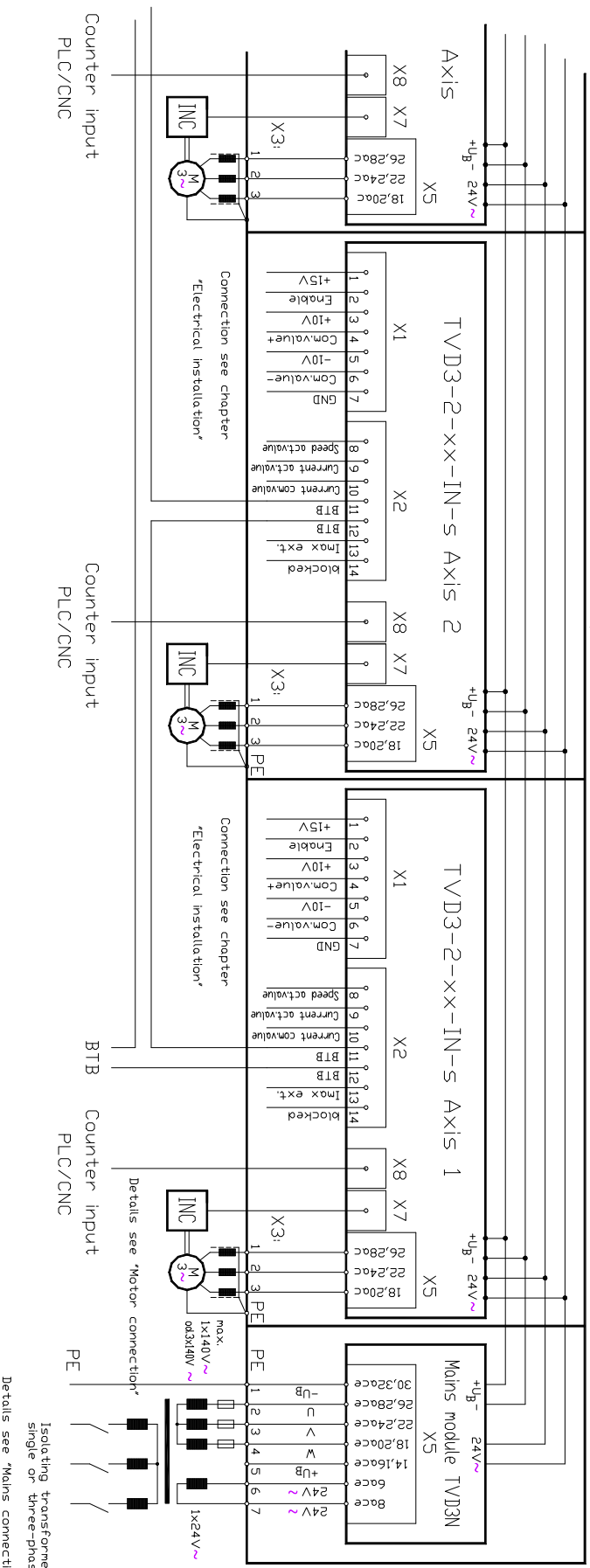

PLC CNC
Incremental signals to PLC/CNC
5V supply from PLC/CNC
Shield on the connector housing
TVD3-2...IN
Compact device
Auxiliary-voltage 24V~ oder 24V=
Power-voltage max. 140V~ or 200V=
Connection terminal X3
Motor connection
7
6
5
4
3
2
1
PE
M 3~
INC
AC-synchro-servo motor
with incremental encoder
X8:
+5V
A
B
N
GND
nc
nc
nc
X1:
+15V
Enable
+10V
Command value±
-10V
Command value±
GND = -UB
X2:
Speed actual value
Current actual value
Current command value
BTB
Imax
+10V
S1 Contact 2
X7:
ROTOR 1
ROTOR 2
ROTOR 3
+5V
GND
BTB - signal
external- current limits
Overload- signal
GND
Shield on the connector housing
Incremental- and Rotorposition signals
5V supply at X8

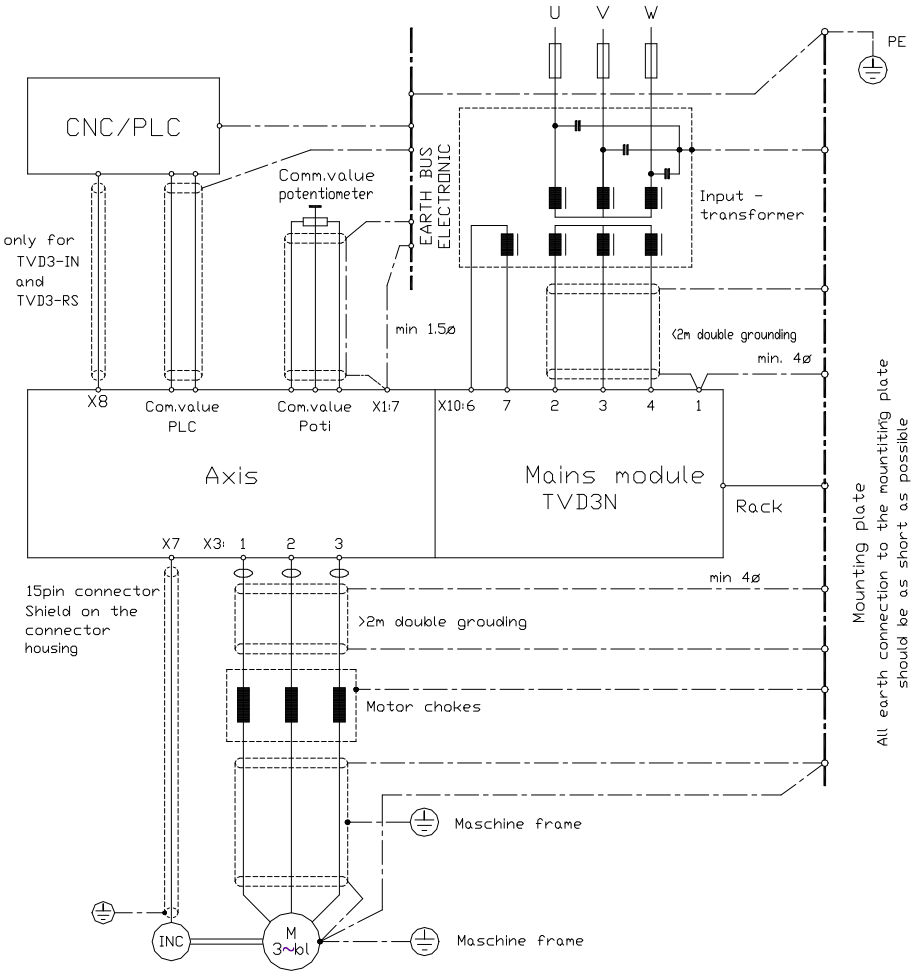
Connections Diagram

Compact device



Multiple axes combination





EMC Advice

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

- The device, the transformer, motor chokes and power line filter are conductively mounted on a 500x500x2 mm mounting plate.
- The mounting plate must be connected to ground using a 10mm² wire.
- The motor housing must be connected to ground using a 10mm² wire.
- The device ground X1:7 must be connected to the mounting plate using a 2.5mm² wire.
- X10:1(-U) must be connected to the mounting plate using a 4mm² wire, l = 50mm.
- The rack ground screw must be connected to the mounting plate using a 4mm² wire, l = 50mm.

Single-phase connection:

Transformer with filter type : TE8/2 F to TE17/3 F

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

Three-phase connection:

Transformer with filter type : DT3/50 F to DT4/75 F

Motor connection:

Motor conductor choke type: 5A= MD66-5 10A= MD78-10

Motor conductor l = 1.5m, 4-core, shielded.

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

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

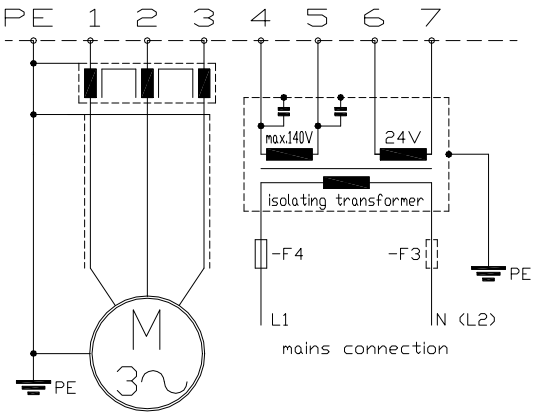
Note:
- connection and operating instructions
- local regulations
- EU guideline 89/392/EWG
- VDE and TÜV regulations and Trade body guidelines
- CE and EMC advice

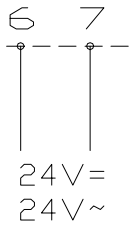
Connection with an isolating transformer
Note:
- The relay contacts must be rated according to the transformer switch-on current.
- Slow fuses must be installed at the input of the transformer
- The fuses must be rated according to the transformer current
- Quick fuses must be used at the output of the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

Isolating transformer
Rated transformer power [VA]= 1.42 x 115 x IM x GLF x nF
IM = Sum of the motor currents (effective)
GLF = simultaneity factor
nF = speed ratio factor

GLF =		**nF =**
1	with 1 motor	effective speed
0.5 ... 0.7	with 2 motors	maximum speed
0.4 ... 0.6	with > 2 motors	

Connection compact device X3





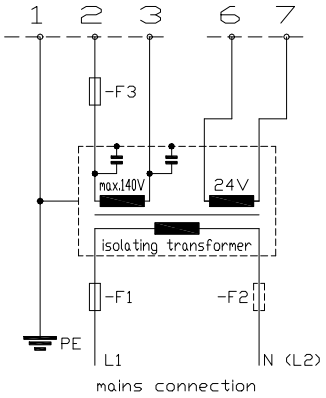
Warning:
Do not earth 24V~
Short-circuit to -UB

Auxiliary voltage connection terminal X3:6, X3:7
- from an external 24V source
- from the isolating transformer

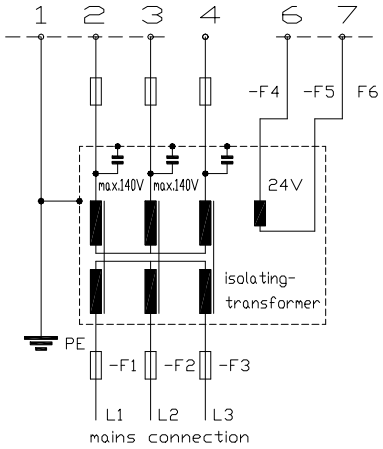
Warning: The maximum voltage 140V~ must not be exceeded!

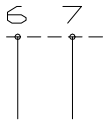
Connection to the mains module X10

Alternating voltage
1x 115V + 24V



Three-phase voltage
3x115V +24V





Auxiliary voltage connection
terminal X3:6, X3:7
- from an external 24V source
- from the isolating transformer

Warning:
Do not earth 24V~
Short-circuit to -UB

Connecting cable			
Dimensioning	**5A**	**10A**	**Mains module max. 30A**
Conductor cross-section mm²	0.5	0.75	2.5
Fuses - safety fuse AF	10	16	30
- automatic cut-out A	10	16	30

Motor power connection

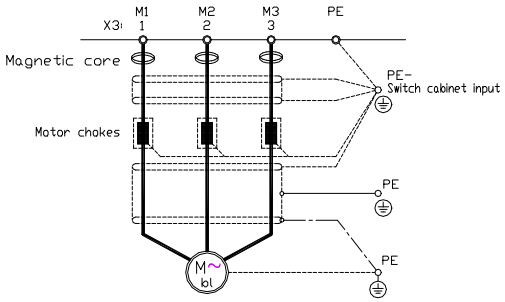
Cable no.	PE	M1	M2	M3
Connection	PE bolt	X3:1	X3:2	X3:3
Motor cable for	5A	10A	thermal	brake
Cross-section	0.75	1.5	0.5	0.5

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

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

Magnetic cores
- against HF failures

Motor chokes
- against LF failures
- against high leakage currents
- for motor efficiency
- for motor life



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

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

Connection no. terminal connector
X1:1 to X1:7 and X2:8 to X2:14

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

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

Drive enable - internal logic voltage

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

Drive enable - external logic voltage

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

Drive enabled
- command value and speed control loop circuit are immediately active

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

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

Feed-back to the bus circuit

Speed command value

Voltage source for command values ±10V, 10mA

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

Command value inputs

- command value voltage max. ±10V=
- differential input
- input resistance 50 kΩ
- relay contacts: use gold or reed contacts

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

Connections

Command value with an internal voltage source

Command value	X1:4 (signal)
	X1:7 (GND)
Bridge	X1:6 — X1:7

Command value from an external PLC/CNC voltage

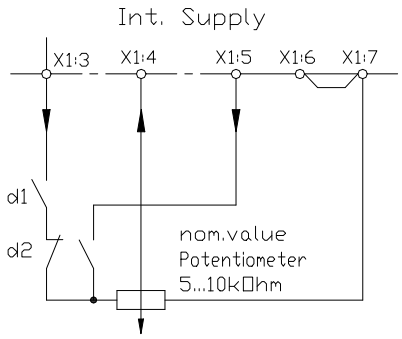
Command value	X1:4 (signal)
	X1:6 (GND)

Command value current from an external PLC/CNC

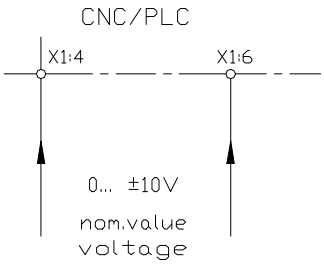
Resistor for a current command value of 0 to ±20mA >>>>> Rcom. = 500Ω

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

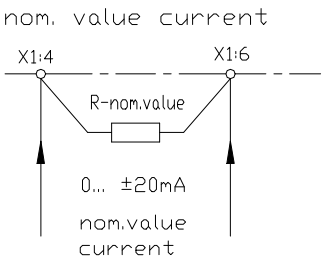
Internal supply



CNC/PLC



Current command value



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

External current limiting

Voltage source for an external current limit

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

Range

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

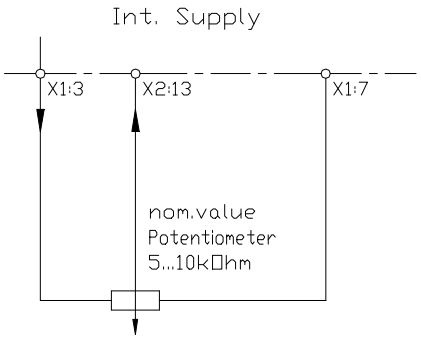
Current limit input

Max. input voltage +10V
Input resistance 10 kΩ
Internal attenuation with potentiometer Imax1
Relay contacts: use gold or reed contacts
Switch S1, contact 2 = OFF

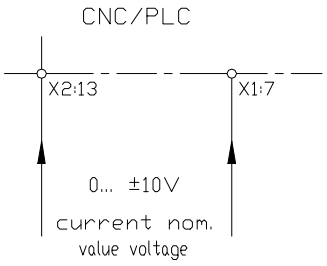
Connections

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

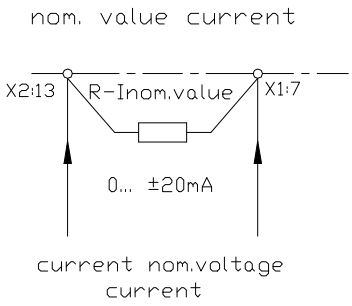
Internal source



CNC/PLC



Current command value



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

Actual value connection

Connector X7

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

Cable: supply 2 x 0.5 + signal 12 x 0.14 shielded

Connections

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

Pin no. 6 is double-coated.
For motors without thermal sensor >> bridge between pin no. 6 and 12

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

Connector X8

- 9-pin D-connector
- metallized plastic housing
- shield connected to the housing
- Cable: supply 2 x 0.5 + signal 6 x 0.14 shielded

Connections

Function	Colour (recommended)	Pin no.	
Channel A	grey	2	
Channel B	yellow	3	
Channel N(Z)	black	7	
Channel /A	white	9	
Channel /B	green/white	8	
Channel /N(/Z)	pink	4	
Incremental encoder supply			
+5/150mA	violet 0.5	1	**Always connect**
GND	blue 0.5	5	**+5V and GND!!!**

Cable: supply 2 x 0.5 + signal 6 x 0.14 shielded

Drive ready - BTB signal

Relay RL1

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

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

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

Display

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

BTB contact drops in case of

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

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

Attention:

In any case the BTB contact (drive ready) must always be used with the CNC/PLC or wired into the emergency stop circuit.
It is possible that the drive initiates motion without being instructed to do so.

Fault memory
Fault saving is not effective for all errors!

Signal blocked		
Current demand	**normal**	**overload**
output X2:14	>+10V	<+2V

Analog parameter measurement outputs		
Function	**Motor current**	**Speed**
Connector	X2:9 - X1:7	X2:8 - X1:7
Measured value	2.5V = Type current 5.0V = peak current unipolar positive	tacho voltage input of the divider bipolar
Output resistance	1 kΩ	4.7 kΩ

Control connections

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

Power connections - compact device

Function	Terminal no.
Motor 1	X3: 1
Motor 2	X3: 2
Motor 3	X3: 3
Power	X3: 4
Voltage	X3: 5
Auxiliary voltage	X3: 6, X3: 7

Power connections - plug-in unit

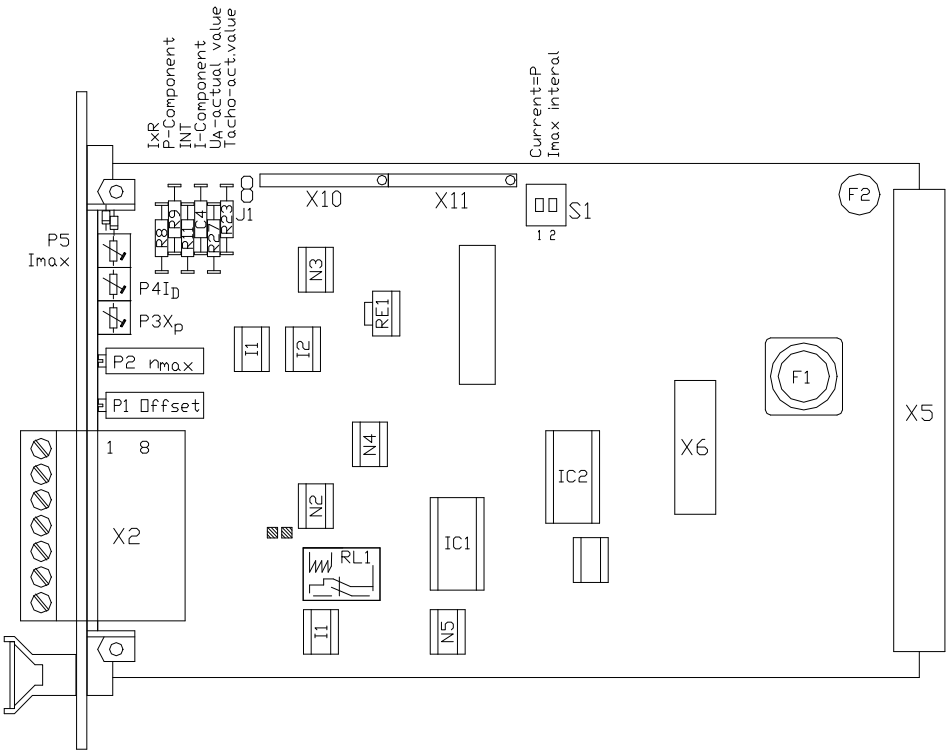
Function	Plug-in connector	Terminal no.
Bus circuit - (UB-)	X5: 30, 32 ace	
Motor 1	X5: 26, 28 acc	X3: 1
Motor 2	X5: 22, 24 ace	X3: 2
Motor 3	X5: 18, 20 ace	X3: 3
Bus circuit + (UB+)	X5: 14, 16 ace	
24V~	X5: 8 ace	
24V~	X5: 6 ace	

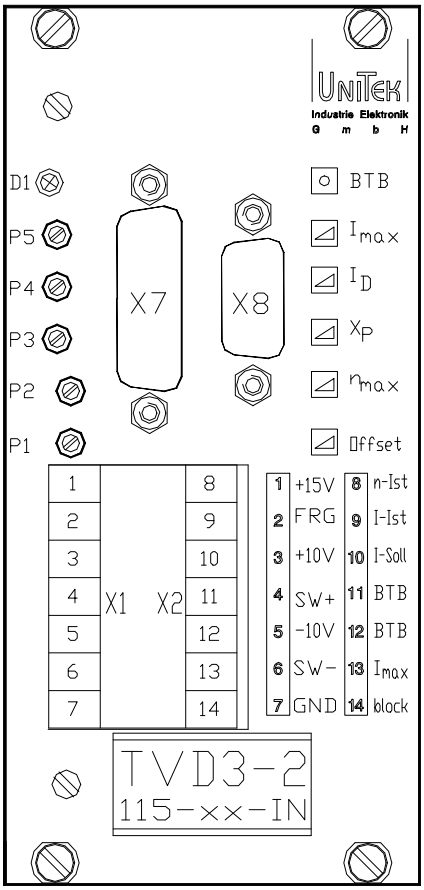
Mains module - plug-in unit

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

Encoder connections (see page 19)

Components overview





Display

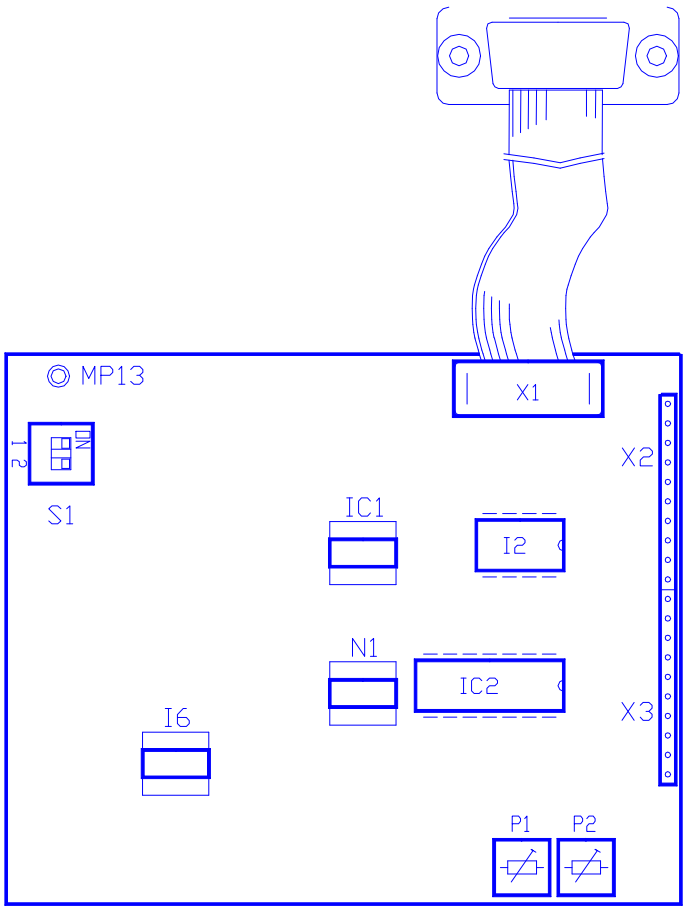
	D1 green	BTB
	D2 red	fault

Potentiometer

P5	I_{max}
P4	I_D
P3	X_P
P2	n_{max}
P1	offset

Connector

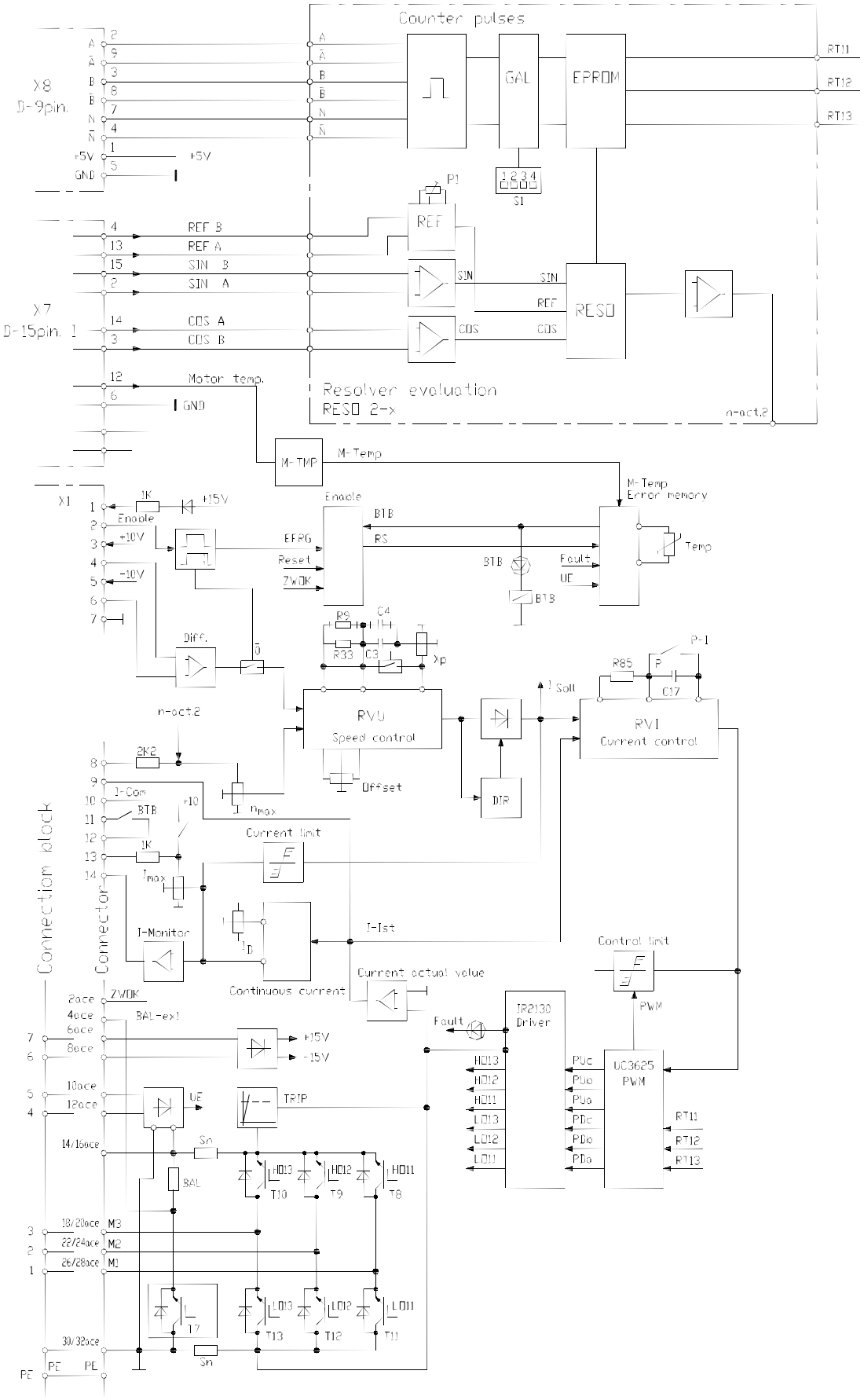
X7	encoderinput
X8	inc. output
X1:1	+15V
X1:2	enable
X1:3	+10V
X1:4	com. value +(-)
X1:5	-10V
X1:6	com. value - (+)
X1:7	GND
X2:8	n-act. value
X2:9	I-act. value
X2:10	I-com. value
X2:11-12	BTB- contact
X2:13	ext.current limit
X2:14	blocked



Adjustment range with potentiometer n_{max} at a command value of 10V					
Pulse encoder on the motor Pulses	Switch position S1-1 On OFF / S1-2 ON OFF	Multiplication factor **x**	Adjustment range n_{max} poti- position kHz left	right	Frequency
1024		4	950	1700	64 ... 116
1024		2	1900	3400	64 ... 116
1024		1	3800	7000	64 ... 116
2048		2	950	1700	64 ... 116
2048		1	1900	3500	64 ... 116

Examples:						
Example No.:	**Encoder pulse**	**Speed 1/min**	**Switch position S1-1**	**S1-2**	**Factor x**	**Frequency kHz**
1	1024	1200	OFF	OFF	4	81,92
2	1024	2000	OFF	ON	2	68,26
3	1024	3000	OFF	ON	2	102,4
4	2048	3000	ON	OFF	1	102,4

Circuit Diagram



Adjustments

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

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

LED display

BTB	green	LED 1
fault	red	LED 2

Signal outputs		
Function	**Designation**	**Terminal no.**
Speed	n-actual value	X2:8
Current	I-actual value	X2:9
Current command value	I-command value	X2:10
Blocked	>10V/6mA	X2:14
BTB -contact	BTB/fault	X2:11, X2:12

Adjustment advice

Adjustments

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

Pre-settings

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

Optimisation

Actual value adjustment	n_{max} adjustment
Current control	switch S1, contact 1 (stand. set-up > ON)
Current limits	I_{max}, I_D-adjustment
Speed control	X_P-adjustment, variable components
Zero point	offset adjustment
Path-/position control	in the CNC/PLC

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

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

Command value		
Function	**max.**	**Connector**
Input Signal	±10V=	X1:4
Input GND		X1:6

The signal and the GND connection can be swapped.

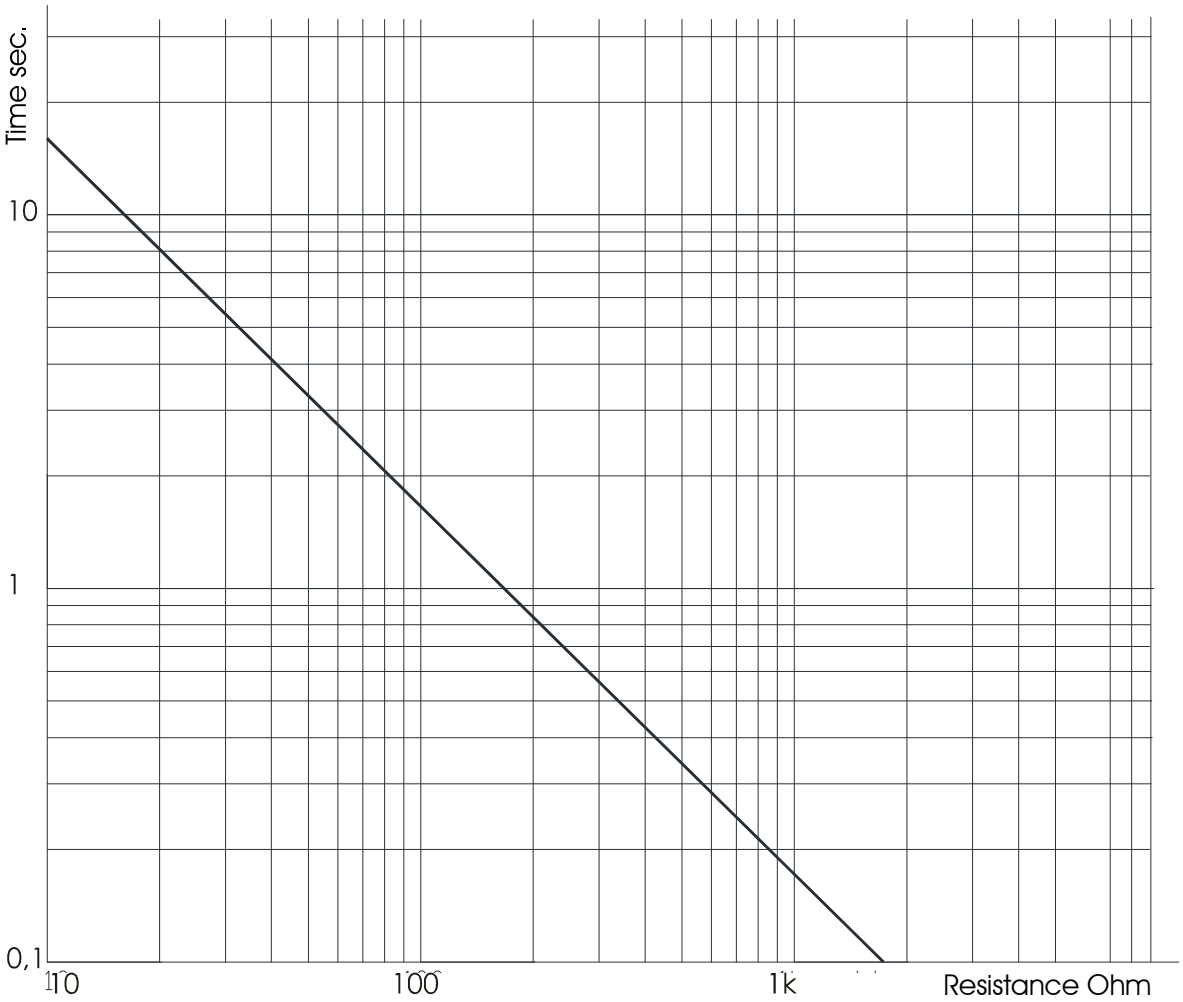
Command value as current signal

Command value from an external current source 0 to ± 20mA
External load resistance for the command value 0 to max. ±10V
Command value resistance R-com[Ω] = com. value voltage/com. value current (max. 500Ω)

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

Command value integrator

Linear integrator
Time adjustment with resistor R11 (INT)

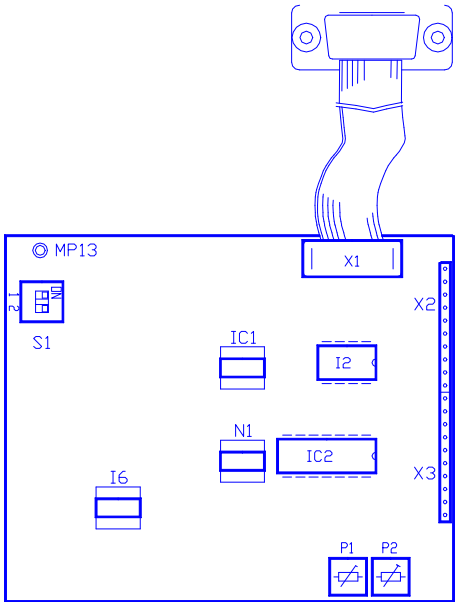


Free

Speed actual value from the incremental encoder

Evaluation electronics subprint FU 1-x

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



Connection test

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

Rotor position encoder

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

Tacho signal X2:8

uniform speed-proportional voltage, no saw-tooth voltage

Pre-settings - with switch S1

Adjustment range of poti n **at a command value of 10V**						
Pulse encoder on the motor Pulses	Switch position **S1-1** ON OFF	**S1-2** ON OFF	**Multiplication factor x**	**Adjustment range n_{max} poti position kHz left**	**right**	**Frequency**
1024			4	950	1700	64 ... 116
1024			2	1900	3400	64 ... 116
1024			1	3800	7000	64 ... 116
2048			2	950	1700	64 ... 116
2048			1	1900	3500	64 ... 116

Fine adjustment with potentiometer n_{max} (P2)

Command value from the potentiometer:

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

Command value from a CNC/PLC:

- with a 0.8V command value: adjust the speed to10% of the maximum required

Direction chang

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

Current limiting

Peak current	range 0 to 200% rated current max. reset time 5sec.	Poti Imax (P5)
Continuous current	range 5 to 100% rated current	Poti ID (P4)

Internally resetting current limits

Current limit	Function	Limit
Overload	Time	Continuonus current
Signal to X2:14	blocked	

The lowest current limit is effective!

Peak current

Internal current limit (standard set-up)		
Adjustment	**Switch**	**Poti**
Imax	S1, contact 2=ON	Imax1 (P5)

External current limit			
Adjustment	**Input**	**Switch**	**Poti**
Imax	X1:9 0 to +10V	S1, contact 2=OFF	Imax1 (P5)

The external current limiting voltage can internally be reduced by means of the potentiometer Imax.

Continuous current

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

Measuring adjusted values:

- Do not connect motor
- Set the command value and enable >>>>> switch off/on

Measured current command value X2:10 (5V = rated current)

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

Current actual values

Measured current actual value X2:9 Imax = 0 to +5V
ID = 0.12 to +2.5V

Attention:

for an exact torque control:

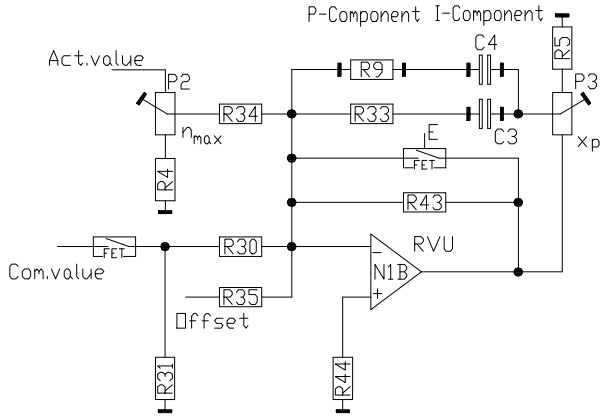
- a PI-current control switching is necessary
- the device is adjusted to P-control in the factory
- change from P- to PI-control in the current control loop
- switch S1, contact 1 = OFF

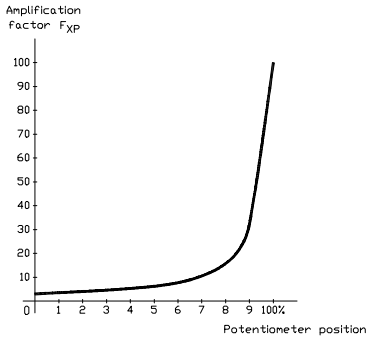
Speed control loop circuit

- variable components R9, C4
- amplification potentiometer P3 (Xp)
- Take over the adjusted values when the device is exchanged

Standard set-up

- fixed R, C values: 220kΩ, 22nF
- amplification potentiometer Xp to 50%
- suits the majority of drives





Adjustment without measurement equipment

Connect the motor,

command value	= 0
Xp	= 50%
R, C	= basic values

Enable the drive,

- Turn the potentiometer XP clockwise until the axis begins to oscillate
- Turn the potentiometer XP anti-clockwise until the oscillations disappear
- Turn the potentiometer XP another 2 clicks anti-clockwise

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

Attention:

Drive connected to CNC/PLC controllers
For the maximum speed output from the controller,
adjust the speed command value to between 8V and 9V by means of the potentiometer nmax.

Standard set-up

Before commissioning check the following connections
Nominal power supply 115V~/180V=, maximum 140V~/200V=

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

Compact device

- Power supply	compact	terminals X3:4, X3:5,
- Auxiliary voltage	compact	terminals X3:6, X3:7
- Motor connection	compact	terminals X3:1, X3:2, X3:3

Multiple axes combination

- Power supply	mains module	terminals X10:2, X10:3, X10:4
- Motor connection	axis	terminals X3:1, X3:2, X3:3
- Protection earth		earth screw on the housing
- Motor-earth connection		earth screw on the housing

Always observe the connection advice

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

Power connections

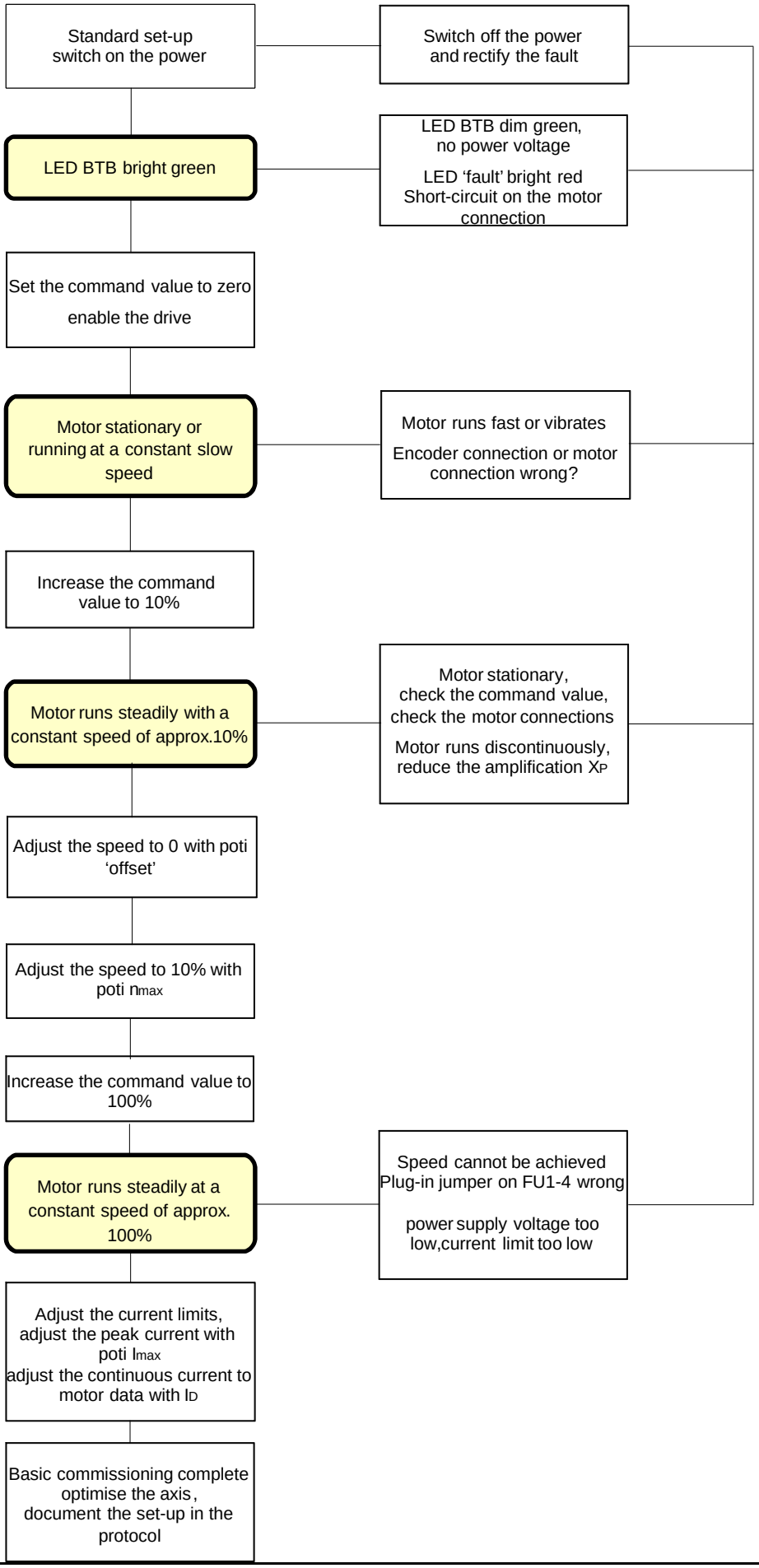
- Protection earth	PE bolt
- Mains	1x or 3x 115V~
- Motor	3xmotor conductors + protect. conductor + shield
- Encoder connection	observe the motor-specific connection data sheets

Control connections

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

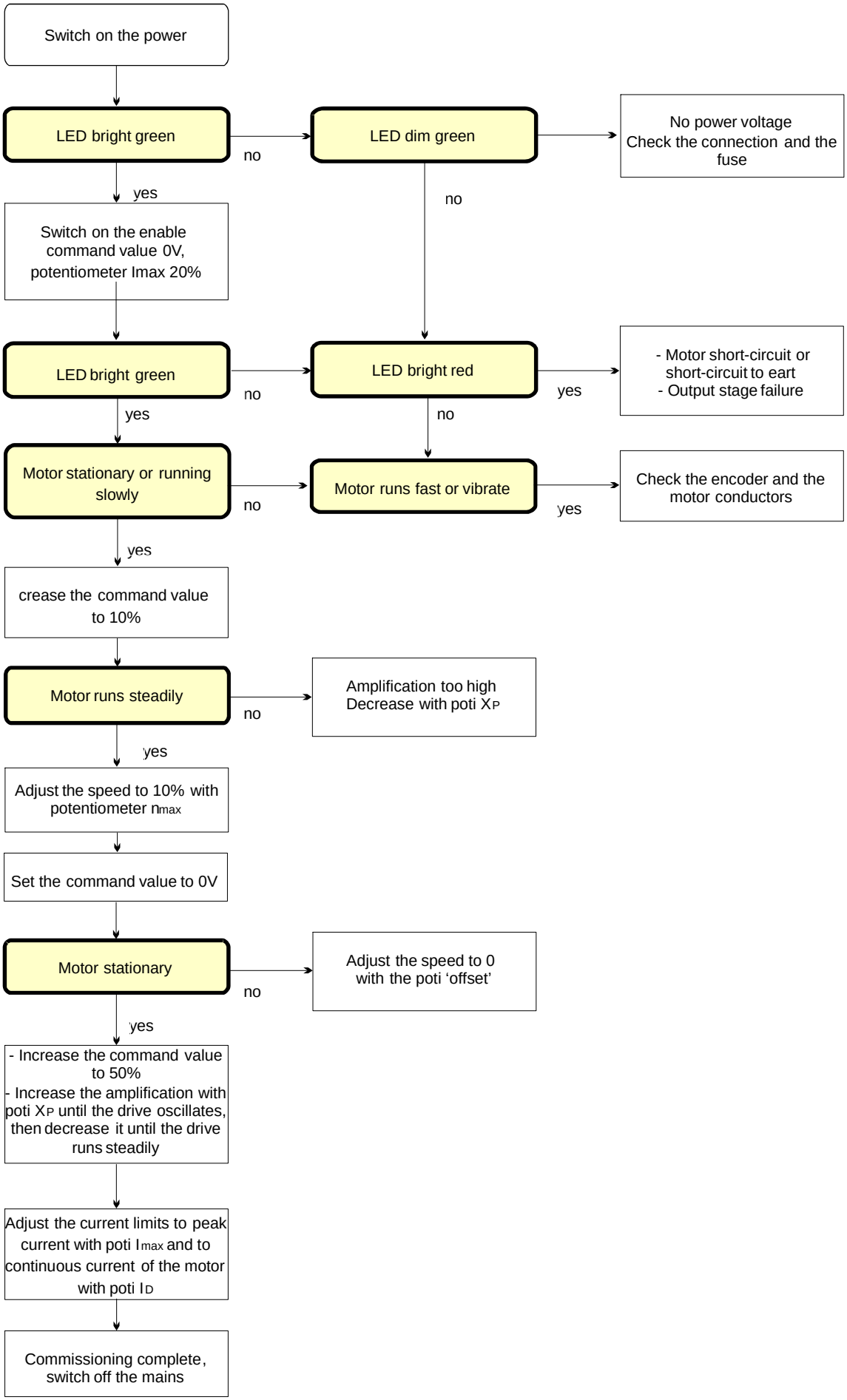
Standard set-up for the first commissioning

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

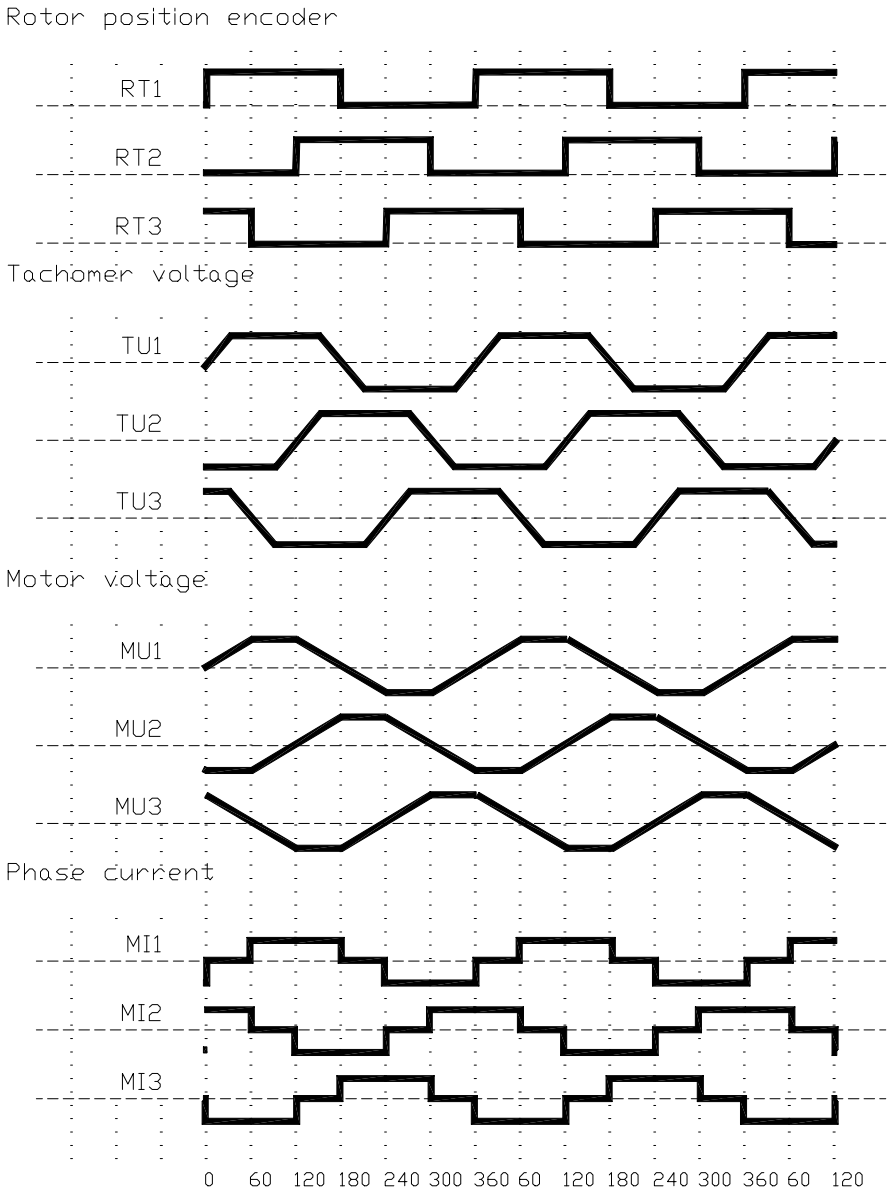

Standard set-up
switch on the power
Switch off the power
and rectify the fault
LED BTB bright green
LED BTB dim green,
no power voltage
LED 'fault' bright red
Short-circuit on the motor
connection
Set the command value to zero
enable the drive
Motor stationary or
running at a constant slow
speed
Motor runs fast or vibrates
Encoder connection or motor
connection wrong?
Increase the command
value to 10%
Motor runs steadily with a
constant speed of approx.10%
Motor stationary,
check the command value,
check the motor connections
Motor runs discontinuously,
reduce the amplification XP
Adjust the speed to 0 with poti
'offset'
Adjust the speed to 10% with
poti nmax
Increase the command value to
100%
Motor runs steadily at a
constant speed of approx.
100%
Speed cannot be achieved
Plug-in jumper on FU1-4 wrong
power supply voltage too
low,current limit too low
Adjust the current limits,
adjust the peak current with
poti Imax
adjust the continuous current to
motor data with ID
Basic commissioning complete
optimise the axis,
document the set-up in the
protocol

Faults

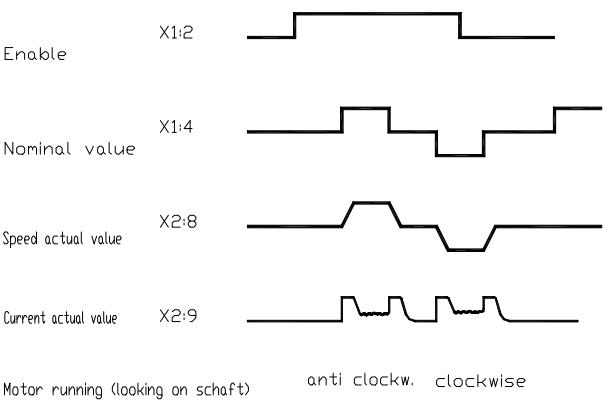
Fault	Causes
LED dim green	- no power connection - Power voltage too small - no temperature connection of the encoder cable
LED 'fault' bright red	- Short-circuit on the motor connection - Final stage fault - Over-voltage
Motor stationary, no torque	- no enable, current limit Imax at left full scale - Motor connection interrupted
Motor stands in one position, runs jerky or oscillates in one position	- Encoder or motor connection cable cores mixed up or interrupted
Motor speeds up	- Motor or IN-rotor position cores leading or lagging by 120° in the rotating field
Motor runs unsteadily	- Incremental encoder connection cores mixed up or interrupted - Amplification Xp too high - Command value failures
Amplifier switches to failure, LED bright red	- Over-temperature, phase short-circuit or short-circuit to earth, BTB fault, - Output stage failure
Speed cannot be adjusted with poti n_{max}	- Switch S1 on the evaluation electronics FU1-x wrong
Mains module switches to failure during braking	- Braking energy too high
Mains module switches immediately to failure when being switched on	- Under-voltage - Over-voltage


Switch on the power
LED bright green
no
LED dim green
No power voltage
Check the connection and the fuse
yes
no
Switch on the enable command value 0V, potentiometer Imax 20%
LED bright green
no
LED bright red
yes
- Motor short-circuit or short-circuit to eart
- Output stage failure
yes
no
Motor stationary or running slowly
no
Motor runs fast or vibrate
yes
Check the encoder and the motor conductors
yes
crease the command value to 10%
Motor runs steadily
no
Amplification too high
Decrease with poti XP
yes
Adjust the speed to 10% with potentiometer nmax
Set the command value to 0V
Motor stationary
no
Adjust the speed to 0 with the poti 'offset'
yes
- Increase the command value to 50%
- Increase the amplification with poti XP until the drive oscillates, then decrease it until the drive runs steadily
Adjust the current limits to peak current with poti Imax and to continuous current of the motor with poti ID
Commissioning complete, switch off the mains

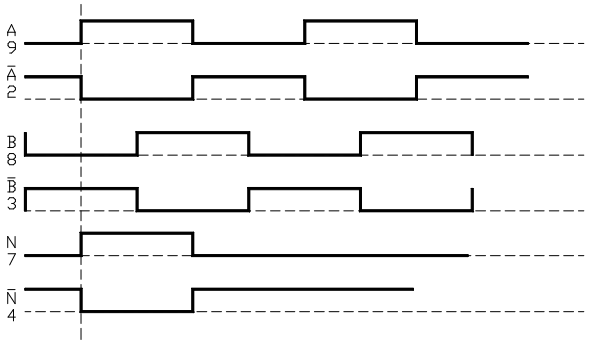
Functional diagram bl/ec motor amplifier



TVD3 - Signal scheme



Incremental outputs
D-cvonnector X8
GND = X8:5
+5V = X8:1



Customer . . . . . **Machine no.** . . . . . .

Device . . . . . **Serial no.** . . . . . .

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

Inputs

Enable	Contact ?	Voltage [V=]	. . . . .
Command value 1	Type	Voltage [V=]	. . . . .
Current com. value I_{max1}	external	Voltage [V=]	. . . . .

Actual value settings - evaluation

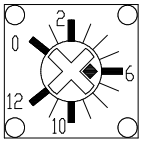
DC tacho	R23	Value	[kΩ] . . . . .
bl-Tacho	Network RN1, RN2	Value	[kΩ] . . . . .
IN-Evaluation	Switch S1-1, S1-2	Position	. . . . .
RS-Evaluation	Switch RS-S1 ON/OFF	Position	. . . . .

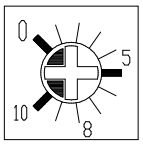
Speed control loop settings

Variable components

P-Component	R9	Value	. . . . .
I-Component	C4	Value	. . . . .

Potentiometer settings





Speed	n_{max}	P2	Position	. . . . .
Pea Current	I_{max}	P5	Position	. . . . .
Continuous current	I_D	P4	Position	. . . . .
Amplification	X_P	P3	Position	. . . . .
Offset	Offset	P1	Position	. . . . .

Current controller settings P/PI Switch S1, contact 1 ON/OFF

Measured data

Motor voltage	max.	
Motor current	peak	continuous . . . . .

Motor Data

Manufacturer . . . . . Type . . . . . .

Serial number . . . . . .

Encoder type . . . . . IMP . . . . . Voltage . . . . . .

Motor voltage . . . . . Motor current . . . . . .

Guarantee

UNITEK guarantees that the device is free from material and production defects. Test results are recorded and archived with the serial number.
The guarantee time begins from the time the device is shipped, and lasts one year. Unitek undertakes no guarantee for devices which have been modified for special applications.

During the warranty period, UNITEK will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. UNITEK specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by UNITEK.
For products returned to UNITEK for warranty service, the Buyer shall prepay shipping charges to UNITEK and UNITEK shall pay shipping charges to return the product to the Buyer.
However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to UNITEK from another country.
The foregoing warranty shall not apply to defects resulting from:

* improper or inadequate repairs effected by the Buyer or a third party,
* non-observance of the manual which is included in all consignments,
* non-observance of the electrical standards and regulations
* improper maintenance
* acts of nature

All further claims on transformation, diminution, and replacement of any kind of damage, especially damage, which does not affect the UNITEK device, cannot be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed.
This limitation does not affect the product liability laws as applied in the place of manufacture (i. e. Germany).

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All connection circuitry described is meant for general information purposes and is not mandatory.
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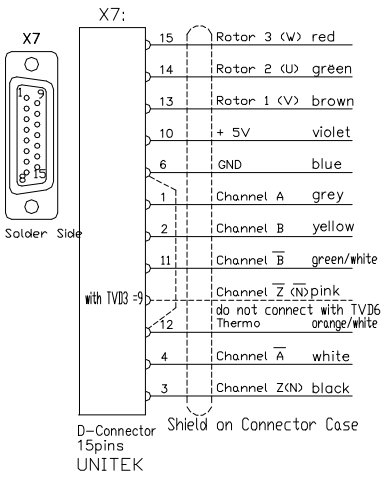
Encoder Connection for AC-Synchro-Servo-Motors with Incremental Encoder

UNITEK-Motor Connection

TVD3 X3	TVD6 X3	AS/DS X10	DS400 X10
3	7	M1	9
2	8	M2	8
1	9	M3	7

UNITEK- Electronic Connection



without Terma Bridge X7:12 and X7:6

with TVD6 do not connect X7:9

MOTOR	EMOD EC-Motors	BAUMÜLLER-Motors DSM 115	STÖBER EC-Motors	PAPST-Motors
Terminal Box	W 1, V 3, U 2, BR, TEMP	W 3 blue, V 1 black, U 2 red, BR, TEMP	W red, V black, U green, BR, TEMP	Power Connection 5 4 6 3 2 1 Encoder Connection
MOTOR-Connector	EMOD-EC-Motor with Encoder OIH48-TS...N510-5V	Sensor-Line: green L, yellow K, brown M, blue GND, red U_B, white □, grey B, pink A	with Encoder OIH48-TS...N510-5V	with Encoder 500 Inc.
	1 2 3 4 5 6 7 8 9 10 11 12 Connector	M L K U_B GND B A □ T T: Rotor Position-signals, Supply-Voltages, Pülses, Motor-Temperature-Sensor; Connector	1 2 3 4 5 6 7 8 9 10 11 12 Connector	11 8 10/5 6 9 2 3 1 7 Connector
Encoder Line shielded	10 x 0.14	8 x 0,14 +2 x 0,5	10 x 0,14 +2 x 0,5	10 x 0,14 +2 x 0,5
Encoder Connector Looking on Solder Side				

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