MANUAL

3-Phase-Servo-Drive
TVD3.2-xx-RS
for AC-Synchro-Servomotors
with
Resolver
Electronic devices always involve the risk of failure.

Caution High Voltage

AC 140V~, DC 220V=

This manual has to be read carefully and must be understood by experts before installing or starting the device. If there are any doubts call your trader or the manufacturer.

The TVD3-2 series is designed to regulate electrical currents; protection standard IP00.

Standards and Guidelines:
The device and its associated components can only be installed and switched on where the local laws and technical standards have been strictly adhered to:
EU-Guidelines 89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG
EN60204, EN50178, EN60439-1, EN60146, EN61800-3
- IEC/UL IEC364, IEC 664, UL508C, UL840
- VDE-regulations VDE100, VDE110, VDE160
- TÜV-regulations
- Regulations of Professional and Occupational bodies: VGB4

The user has to assure that:
after
- a failure of the device
- an incorrect handling
- a failure of the control unit etc.
the drive is brought to a secure operating condition.

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

Adjustment
- only by qualified personnel
- adhere to safety regulations

Installation work
- only when disconnected from all power lines.

QS
The devices are archived by the manufacturer with serial number and their test specifications.
CE
The EU-guide line 89/336/EWG with the EMV-Regulations EN61000-2 and EN61000-4 are observed.
General Information

The transistor 3-phase current servo amplifier SERVO-TVD3.2 forms together with the brushless direct current motor (synchro-servo (EC-) motor) a propulsion unit distinguished by its rear-zero maintenance and by its high dynamic control range.

The drive displays the wellknown good regulation characteristics of the direct current drives without the disadvantages of the carbon brush wear and of the communication limits.

The rotor inertia is notably lower and the power envelope is greater than with equally constructed DC-motors. The result are up to 5 times higher acceleration values.

The generated heat in the motor occurs in the stator (cold shaft).

The motors are always designed to the protection standard IP 65.

The brushless direct current motor is electrically a synchro-motor with a permanent magnet rotor and 3-phase stator.

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

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

The speed actual value is generated from the sensor unit (resolver).

In the speed controller (P-I-controller) of the servo-drive is the difference of nominal value and actual value amplified. The result is the current nominal value, which is transferred by the rotor position signal onto the three phase current controllers such that the stator magnetic field leads 90° electrically the rotor magnetic field.

This field frequency is not a controlled variable, it adjusts itself automatically. The motor currents are keystone formed.

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

(winding machines, lifts, great centrifugal masses )

The ballast circuit is set for 3% duty cycle, an extended operational time can be achieved by adding external resistors. (Option)

Information:

For Motors with rotor position encoder UNITEK Serie TVD3-2-xx-bl
incremental encoder UNITEK Serie TVD3-2-xx-RS

For higher power >>> UNITEK Serie TVD6-2-bl,IN,RS
200V/400V up to 25/40A

For high power >>> UNITEK Serie MODULA-MB,Mi,MS
400V up to 100/200A
Application

for all kinds of machines up to 0.8KW drive power especially as 4Q-servo-drive in travel axes with

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

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

Drives with constant speed as in conveyors, lead screw

AC-Syncho-Servo-Drives are more compact than other electric drives.

For use in

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

Notice

when deceleration is mainly required.

for example:

- winding machines, lifts, great centrifugal masses

the braking energy will be annihilated in the ballast circuit or re-fed to the mains using an external dc-bus converter.

In drives with several axes is an equalization of energy possible.

The motors are

- designed to protection standard IP 65
- compact
- suitable in rough surroundings
- suitable with high dynamic overload
- service-free
Construction:
Cubicle-mount or 3HE-plug-in unit
According to the VDE- DIN- and EU- regulations.
Standard analogue regulation electronics.
Power electronics for 5A and 10A.
No galvanic isolation between
Power section and device-zero (GND)
GND = -UB = PE -case

There are used:
- Fully isolated six-pack IGBT-power semiconductors, generous dimensioning.
- Only industrial standard components are used
- SMD - basic insertion
- LED displays
- 4 digit binary switches for system setup
- Precision potentiometers for fine adjustment

Characteristics:
* Power supply isolation transformer nom. 115V~ (max. 140V~)
* Differential nominal value inputs
* Speed and torque regulation
* Static and dynamic current limit
* Current nominal value output
* Test connectors for current and speed
* Enable logic
* Quick stop
* Mains failure braking
* Temperature control for motor and device
* Incremental encoder reproduction
1 Basic Information

Technical Data

Power supply

<table>
<thead>
<tr>
<th>Power supply compact device</th>
<th>nominal 115V~/ (max. 140V), 24V~/=</th>
<th>nominal 180V= (max. 200V), 24V~/=</th>
</tr>
</thead>
<tbody>
<tr>
<td>with transformer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with transformer + rectifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with multi-axes mounting</td>
<td>1x or 3x 115V~/ (max. 140V)</td>
<td></td>
</tr>
<tr>
<td>with mains module</td>
<td>plus 1x 24V~/=</td>
<td></td>
</tr>
</tbody>
</table>

output voltage max. 3x110~

Specifications

<table>
<thead>
<tr>
<th>device TVD3.2-115</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>output standstill current</td>
<td>A= 5</td>
<td>10</td>
</tr>
<tr>
<td>duration</td>
<td>A= 10</td>
<td>20</td>
</tr>
<tr>
<td>peak</td>
<td>W 450</td>
<td>900</td>
</tr>
<tr>
<td>el. power max.</td>
<td>AF 12.5-16</td>
<td>12.5-16</td>
</tr>
<tr>
<td>ZW-fuses quick</td>
<td>convect</td>
<td>convect</td>
</tr>
<tr>
<td>mounted</td>
<td>BxH 12TE/3HE</td>
<td></td>
</tr>
<tr>
<td>dimensions</td>
<td>12TE/3HE</td>
<td></td>
</tr>
<tr>
<td>plug-in device</td>
<td>convect</td>
<td>convect</td>
</tr>
<tr>
<td>compact device</td>
<td>BxHxT</td>
<td>see dimensions</td>
</tr>
<tr>
<td>cooling</td>
<td>60% ED</td>
<td></td>
</tr>
<tr>
<td>with 100% ED</td>
<td>convect</td>
<td>fan</td>
</tr>
</tbody>
</table>

Power supply unit module TV3-N 100-30

<table>
<thead>
<tr>
<th>power supply</th>
<th>V~ 1x or 3x 115V~/plus 1x24V~/=</th>
</tr>
</thead>
<tbody>
<tr>
<td>output voltage</td>
<td>V= max. 200</td>
</tr>
<tr>
<td>output current</td>
<td>A= max. 30</td>
</tr>
<tr>
<td>ballast circuitry with</td>
<td>V= 220</td>
</tr>
<tr>
<td>ballast power</td>
<td>W 100% 50</td>
</tr>
<tr>
<td>WS</td>
<td>6000</td>
</tr>
</tbody>
</table>

Common specifications

<table>
<thead>
<tr>
<th>protection standard</th>
<th>IP 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>device layout</td>
<td>VDE 0100 group C, VDE 0160</td>
</tr>
<tr>
<td>humidity stress</td>
<td>class F after DIN 40040</td>
</tr>
<tr>
<td>set up hight</td>
<td>&lt; 1000m over NN</td>
</tr>
<tr>
<td>operating range</td>
<td>0 ... 45°C</td>
</tr>
<tr>
<td>extended operating range</td>
<td>up to 60°C red. 2%/°C</td>
</tr>
<tr>
<td>bearing range</td>
<td>-30°C up to + 80°C</td>
</tr>
<tr>
<td>speed controller</td>
<td></td>
</tr>
<tr>
<td>control accuracy</td>
<td>no actual value error ± 0.5%</td>
</tr>
</tbody>
</table>

Caution: The maximum voltage 140V~, 200V= must not be exceeded even for short times. Ballast circuit may be destroyed.
## Dimensions compact device

<table>
<thead>
<tr>
<th>Trafo- Type</th>
<th>Trafo- power VA</th>
<th>Dimensions a /b /c mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE 8/2</td>
<td>100</td>
<td>85x 89x 82</td>
<td>2.0</td>
</tr>
<tr>
<td>TE 12/1</td>
<td>250</td>
<td>120x101x115</td>
<td>4.3</td>
</tr>
<tr>
<td>TE12/3 6.8</td>
<td>400</td>
<td>120x133x115</td>
<td></td>
</tr>
<tr>
<td>TE 15/1</td>
<td>500</td>
<td>108x132x122</td>
<td>8.2</td>
</tr>
</tbody>
</table>

## Dimensions transformers, chokes

<table>
<thead>
<tr>
<th>Choke-type</th>
<th>rated Current A</th>
<th>Induct. mH</th>
<th>Dimensions a /b /c mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDD 1.3a</td>
<td>-2.5</td>
<td>3.5</td>
<td>80x 48x 90</td>
<td>1.1</td>
</tr>
<tr>
<td>MDD 1.6a</td>
<td>-5</td>
<td>1.9</td>
<td>95x 54x108</td>
<td>1.3</td>
</tr>
<tr>
<td>MDD 1.6b</td>
<td>-10</td>
<td>1.0</td>
<td>95x 58x108</td>
<td>1.4</td>
</tr>
</tbody>
</table>
2 Mechanical Installation

Dimensions multi-axes combination
Transistor-Servo-Drive TVD3.2 -xx- RS
3 Electrical Installation

Connection Overview
EMC-Advice

The standards EN 50081-2 and prEN 50082-2 will be observed under the following conditions:

device, mains choke and filter capacitor conductive fixed on a 500x500x2 mm mounting board.
mounting board connected to gnd with a 10mm² wire.
device ground X1:7 connected to mounting board with a 2,5mm² wire.
X10:1(-U) connected to mounting board with a 50mm long 4mm² wire
Rack-gnd-screw connected to mounting board with a 50mm long 4mm² wire.

Connection one-phase:
  Trafo with filter type: TE8/2 F to TE17/3 F
  linelength between device and mains filter <100mm

Connection three-phase:
  Trafo with filter type: DT3/50 F to DT4/75 F
connection motor:
  motor-line chokes type: 5A = MD66-5 10A = MD78-10
  motor-line 1.5m long, 4wires shielded. Shield fixed to mounting plate on device side and to gnd on motor side.
connection control lines:
  all control lines shielded 1.5m. Shield fixed to gnd
Caution:
The connection advice concerning the individual attachments of the connections to the plug numbers or terminals are binding. All further advices to this are not binding. The input and output lines can be altered or completed in consideration of the electrical regulations.

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

Connection with isolation transformer

Notice:
- rate contactor contacts according to transformer inrush current.
- delay-action fuses before transformer
- fuse value according to transformer current
- quick fuses after transformer
- fuse value for each power supply unit max. 30AF

Isolation transformer

Transformer-nominal power [VA]= \( 1.42 \times 115 \times IM \times GLF \times nF \)

\[
\begin{align*}
IM & = \text{Sum of motor currents (effective)} \\
GLF & = \text{coincidence factor} \\
nF & = \text{speed ratio factor}
\end{align*}
\]

\[
GLF =
\begin{align*}
1 & \quad \text{with 1 motor} \\
0.5 - 0.7 & \quad \text{with 2 motors} \\
0.4 - 0.6 & \quad \text{with > 2 motors}
\end{align*}
\]

Connection compact device X3

Connection advice

Caution: The maximum voltage 140V~must not be exceeded!
3 Electrical Installation

Connection at power supply unit X10

alternating voltage 3-phase voltage
1x 115V + 24V 3x115V +24V

Power cord

<table>
<thead>
<tr>
<th>dimensioning</th>
<th>5A</th>
<th>10A</th>
<th>power supply max.30A</th>
</tr>
</thead>
<tbody>
<tr>
<td>line cross section mm²</td>
<td>0.5</td>
<td>0.75</td>
<td>2.5</td>
</tr>
<tr>
<td>fuse protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>blow-out fuse AF</td>
<td>10</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>automaton A</td>
<td>10</td>
<td>16</td>
<td>30</td>
</tr>
</tbody>
</table>

Motor-power connection

cable No.
PE PE-bolt M1 M2
connection PE-bolt X3:1 X3:3
motor cable with 5A 10A thermo break
cross section 0.75 1.5 0.5 0.5

Cable type
3x motor line + PE shielded
+ (if required: 2x thermo+2x break)

Shielding

- with earth clamp
- directly at switch cabinet entry
- and connect with motor.
- earth manifold with long lines.

Ferrite cores
- against HF-failures

Motor chokes
- against NF-failures
- against high discharge current
- for motor efficiency
- for motor operating life
The connecting advices are for general information and without obligation

Notice: - Connecting- and operating instructions
- Local regulations
- EU-machine regulation

pin-No. terminal block
X1: 1 up to X1:7 and X2: 8 up to X2: 14

Signal lines
Shielded and seperated from power lines.
Nominal values paired twisted and shielded.

Logical connections

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

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

Enable -external logical voltage
- enable voltage +10 ... +30V X1:2
- GND X1:7

Switch on enable
- nominal value and speed controller are enabled immediately.

Switch off enable
- quick stop
- nominal value >>> is switched internally immediately to 0
- after 2 seconds >>> speed controller is locked.

Mains failure- breaking

Breaking function
- switch nominal value in case of mains failure to 0V
- breaking time max. 150ms

generatoric rear feed into intermediate circuit
3 Electrical Installation

Nominal value-speed

voltage source for nominal values ±10V, 10mA

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

Nominal value input

- nominal value input maximum ±10V=
- differential input
- input resistance 50 kΩ
- relay contacts: gold- or reed contacts

Caution
nominal value lines paired twisted and shielded. Screen connection one-sided.

Connection:

Nominal value voltage with internal supply

nominal value X1:4 (signal)
X1:7 (GND)
bridge X1:6 — X1:7

External nominal value voltage SPS/CNC

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

External nominal value current SPS/CNC

Resistance for nominal value current 0 ... ± 20mA >>> R-nominal = 500Ω

nominal value current X1:4 (signal)
X1:6 (GND)

Caution:
do not use nominal value current between 4 and 20mA
External current limitation

voltage source for external current limit

+10V/10mA \hspace{1cm} X1:13
GND \hspace{1cm} X1:7

Range

0 ... + 5V \hspace{1cm} >>> \hspace{1cm} 0 up to 100% device nominal current
0 ... +10V \hspace{1cm} >>> \hspace{1cm} 0 up to 200% device nominal current
internal overcurrent control \hspace{1cm} >>> \hspace{1cm} max. 5sec.

Current limit- input

maximum input voltage \hspace{1cm} +10V
input resistance \hspace{1cm} 10 kΩ
internal attenuation with potentiometer I
relay contacts: gold- or reed contacts
switch S1, contact 2 = OFF

Connection

current limit \hspace{1cm} X2:13 \hspace{1cm} (signal)
\hspace{1cm} X1:7 \hspace{1cm} (GND)

Caution:
in case of internal current limit adjustment

switch S1 \hspace{1cm} >>> \hspace{1cm} contact 2 = ON
3 Electrical Installation

Actual Value Connection - Resolver

Connector X7
- D-connector 15 pins
- case metallized plastic
- shielding on case

Cable
  - supply 2x0.5 plus signal 12x0.14 shielded

Anschlußbelegung

<table>
<thead>
<tr>
<th>function</th>
<th>colour</th>
<th>pin-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>reference</td>
<td>A(R1)</td>
<td>white</td>
</tr>
<tr>
<td>reference</td>
<td>B(R2)</td>
<td>brown</td>
</tr>
<tr>
<td>sine</td>
<td>A(S1)</td>
<td>yellow</td>
</tr>
<tr>
<td>sine</td>
<td>B(S3)</td>
<td>green</td>
</tr>
<tr>
<td>cosine</td>
<td>A(S2)</td>
<td>pink</td>
</tr>
<tr>
<td>cosine</td>
<td>B(S4)</td>
<td>grey</td>
</tr>
<tr>
<td>thermo sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thermo sensor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pin 6 is double coated.
motors without thermo sensor >>> bridge between pin 6 and 12

CAUTION:
Pay attention to motorspecific connection sheets. Appendix A

Incremental encoder output

Connector X8
- D-connector 9 pins
- case metallized plastic
- shielding on case

Cable: shielded, up to 10m 8x0.14, over 10m 8x0.25

Pin configuration

<table>
<thead>
<tr>
<th>function</th>
<th>colour</th>
<th>pin-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>channel A</td>
<td>grey</td>
<td>2</td>
</tr>
<tr>
<td>channel B</td>
<td>yellow</td>
<td>3</td>
</tr>
<tr>
<td>channel N(Z)</td>
<td>black</td>
<td>7</td>
</tr>
<tr>
<td>channel /A</td>
<td>white</td>
<td>9</td>
</tr>
<tr>
<td>channel /B</td>
<td>green/white</td>
<td>8</td>
</tr>
<tr>
<td>channel /N(/Z)</td>
<td>pink</td>
<td>4</td>
</tr>
<tr>
<td>+5/150mA</td>
<td>violet 0.5 1</td>
<td>1</td>
</tr>
<tr>
<td>GND</td>
<td>blue 0.5</td>
<td>5</td>
</tr>
</tbody>
</table>
Ready for operation signal BTB

Relay RL1

signal contact X2:12 - X2:13
contact values max. 48V, 0.5A

The ready for operation signal (BTB) shows the CNC/SPS that the drive is ready for operation. Switch BTB- signals of several axes in one row.

delay after switching on mains >>> max. 1sek.

Indication

<table>
<thead>
<tr>
<th>ready for operation</th>
<th>LED green bright</th>
<th>contact closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>not ready f. operation</td>
<td>LED glims green</td>
<td>contact open</td>
</tr>
<tr>
<td>error</td>
<td>LED red bright</td>
<td>contact open</td>
</tr>
</tbody>
</table>

BTB turns off with

- overtemperature controller, motor not stored
- overvoltage stored
- short-circuit, line-to-earth-fault stored
- voltage error not stored
- intermediate circuit error not stored

To reset store switch off/on enable

Caution:

Use BTB-contact always with CNC/SPS - control or with emergency-stop circuit!
Self-starting possible!
fault memory
-is not effective with all faults!

Signal blocked

<table>
<thead>
<tr>
<th>current demand</th>
<th>normal</th>
<th>overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>output X2:14</td>
<td>&gt;+12V</td>
<td>&lt;+2V</td>
</tr>
</tbody>
</table>

Analogue measuring outputs

<table>
<thead>
<tr>
<th>function</th>
<th>motor current indication</th>
<th>speed- indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>connection</td>
<td>X2:9 - X1:7</td>
<td>X2:8 - X1:7</td>
</tr>
<tr>
<td>measuring value</td>
<td>2.5V = rated current</td>
<td>tacho voltage</td>
</tr>
<tr>
<td></td>
<td>5.0V = peak current before divider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>unipolar positive bipolar</td>
<td></td>
</tr>
<tr>
<td>output- resistance</td>
<td>1 kΩ</td>
<td>4,7 kΩ</td>
</tr>
</tbody>
</table>
3 Electrical Installation

Control connections

Function | clamp No.
--- | ---
+ 15 Volt (for enable) | X1: 1
enable - input(+10..+30 Volt) | X1: 2
+ 10 Volt (for nominal value) | X1: 3
nominal value + input | X1: 4
- 10 Volt (for nominal value) | X1: 5
nominal value - input | X1: 6
GND | X1: 7
speed- actual value- output | X2: 8
current- actual value- output | X2: 9
current nominal 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 | clamp No.
motor 1 | X3: 1
motor 2 | X3: 2
motor 3 | X3: 3
power | X3: 4
voltage | X3: 5
auxiliary- | X3: 6
voltage | X3: 7

Plug-in unit

Function | plug-in connector | clamp-No.
--- | --- | ---
intermediate circuit- (UB-) | X5: 30, 32 ace | X3: PE
motor 1 | X5: 26, 28 ace | X3: 1
motor 2 | X5: 22, 24 ace | X3: 2
motor 3 | X5: 18, 20 ace | X3: 3
intermediate circuit (UB+) | X5: 14, 16 ace |
24V~ | X5: 8 ace |
24V~ | X5: 6 ace |

Power supply unit

Function | plug-in connector | clamp-No.
--- | --- | ---
intermediate circuit- PE(UB-) | X5: 30, 32 ace | X10: 1
power U | X5: 26, 28 ace | X10: 2
power V | X5: 22, 24 ace | X10: 3
power W | X5: 18, 20 ace | X10: 4
intermediate circuit+ (UB+) | X5: 14, 16 ace | X10: 5
auxiliary- | X5: 8 ace | X10: 6
voltage | X5: 6 ace | X10: 7

Encoder connections
see page 19
Component overview

**Indication**
- D1 green: BTB
- D2 red: fault

**Poti**
- P5: I
- P4: I
- P3: X
- P2: n
- P1: offset

**Plug**
- X7: encoder-input
- X8: inc-output

**Connections**
- X1:1 +15V
- X1:2 enable
- X1:3 +10V
- X1:4 nom. value (+)
- X1:5 -10V
- X1:6 nom. value (-)
- X1:7 GND
- X2:8 n-act. value
- X2:9 I-act. value
- X2:10 I-nom. value
- X2:11-12 BTB-contact
- X2:13 current limit ext.
- X2:14 blocked
4 Device Overview

Resolver

gezeichnet Grund-Einstellung S1

Polzahlanpassung \( p = \frac{\text{Motorpolzahl}}{\text{Gerberpolzahl}} \)

\[
\begin{align*}
P &= 4 & P &= 3 & P &= 2 & P &= 1 \\
\text{An/Off} &= 
\end{align*}
\]

Auflösung

\[
\begin{align*}
16\text{bit} &= \text{on} & 14\text{bit} &= \text{on} & 12\text{bit} &= \text{on} & 10\text{bit} &= \text{on} \\
\text{on/off} &= \text{off} & \text{on/off} &= \text{off} & \text{on/off} &= \text{off} & \text{on/off} &= \text{off} \\
\end{align*}
\]

Einstellbereich-\( \max \) - Potentiometer

\[
\begin{align*}
3600 - 4900 & \quad 6000 - 9200 & \quad 7680 - 10600 & \quad 12000 - 12000 & \quad 2530 - 3700 \\
\text{Impulsausgabe} &= \text{on} & \text{on} & \text{on} & \text{on} & \text{on} \\
\text{on/off} &= \text{off} & \text{off} & \text{off} & \text{off} & \text{off} \\
\end{align*}
\]

Beispiel 1

5000 Upm
Motor 6pol., Resolver 2pol., Auflösung 16bit, Impulse 1024

Beispiel 2

3600 Upm
Motor 8pol., Resolver 2pol., Auflösung 16bit, Impulse 2048

TVD3.2-xx-RS

23
4 Device Overview

Adjustment functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>actual value adjustment bl-Tacho</td>
<td>Poti P2 (n)</td>
</tr>
<tr>
<td>actual value adjustment option DC-tacho</td>
<td>resistance R + poti P2 (n)</td>
</tr>
<tr>
<td>internal current limit</td>
<td>switch S1 &gt;&gt; contact 2=ON poti P5 (l)</td>
</tr>
<tr>
<td>external current limit</td>
<td>switch S1 &gt;&gt; contact 2=OFF poti P5 (l)</td>
</tr>
<tr>
<td>continous current</td>
<td>poti P4 (l)</td>
</tr>
<tr>
<td>amplification P-component</td>
<td>resistance R9 poti P3 (X)</td>
</tr>
<tr>
<td>amplification I-component</td>
<td>condensator C100</td>
</tr>
<tr>
<td>integrator</td>
<td>resistor R11</td>
</tr>
<tr>
<td>zero balance</td>
<td>poti P1 (offset)</td>
</tr>
</tbody>
</table>

Switch S1

<table>
<thead>
<tr>
<th>function</th>
<th>contact</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>current limit</td>
<td>2</td>
<td>internal</td>
<td>external</td>
</tr>
<tr>
<td>current amplification</td>
<td>1</td>
<td>P</td>
<td>P1</td>
</tr>
</tbody>
</table>

LED-indication

BTB: green LED 1
fault: red LED 2

signal outputs

<table>
<thead>
<tr>
<th>function</th>
<th>name</th>
<th>clamp No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>speed</td>
<td>n-actual value</td>
<td>X2:8</td>
</tr>
<tr>
<td>current</td>
<td>l-actual value</td>
<td>X2:9</td>
</tr>
<tr>
<td>current nominal value</td>
<td>l-nominal value</td>
<td>X2:10</td>
</tr>
<tr>
<td>blocked</td>
<td>+12V/10mA</td>
<td>X2:14</td>
</tr>
<tr>
<td>BTB -contact</td>
<td>BTB/fault</td>
<td>X2:11, X2:12</td>
</tr>
</tbody>
</table>
**Adjustment advice**

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

**Presets**

<table>
<thead>
<tr>
<th>actual value</th>
<th>switch RS-S1 on RESO2-x contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>current limit internal/external</td>
<td>switch S1, contact 2</td>
</tr>
<tr>
<td>current regulator P- PI</td>
<td>switch S1, contact 1</td>
</tr>
</tbody>
</table>

**Optimization**

<table>
<thead>
<tr>
<th>act. value adjustment</th>
<th>n. adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>current regulator</td>
<td>switch S1, contact 1 (basical setup &gt;&gt; ON)</td>
</tr>
<tr>
<td>current limits</td>
<td>I, I-adjustment</td>
</tr>
<tr>
<td>speed regulator</td>
<td>X-adjustment, variable components</td>
</tr>
<tr>
<td>zero point</td>
<td>offset-adjustment</td>
</tr>
<tr>
<td>path-/position controller</td>
<td>in CNC\SPS</td>
</tr>
</tbody>
</table>

**Caution:**

control systems have to be optimized from inside to outside.
sequence: current controller>> speed controller>> position controller

**Measuring values**

<table>
<thead>
<tr>
<th>measuring value</th>
<th>max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominal value</td>
<td>±10V</td>
</tr>
<tr>
<td>speed actual value after divider</td>
<td>± 5V</td>
</tr>
<tr>
<td>current act.value unipolar</td>
<td>+ 5V</td>
</tr>
<tr>
<td>current nom.value (regulation func.speed con.)</td>
<td>-10V</td>
</tr>
</tbody>
</table>

**Nominal value**

<table>
<thead>
<tr>
<th>function</th>
<th>max.</th>
<th>connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>input signal</td>
<td>±10V=</td>
<td>X1:4</td>
</tr>
<tr>
<td>input GND</td>
<td></td>
<td>X1:6</td>
</tr>
</tbody>
</table>

signal- and GND-connection exchangeable

**Nominal value as current signal**

| nom.value from external current source | 0 bis ± 20mA |
| external burden resistor for nom.value | 0 bis max. ±10V |

nom.value resistor R-Soll[Ω]=nom.value voltage/nom.value current(max.500Ω)
5 Adjustment

Speed - Actual Value

Resolver
evaluation electronics subprint
RESO2-4
Caution:
Use in any case the motor specific connection sheets.
(see appendix A)
Only one correct pin configuration.

Tachometer Signal X2:8
uniform speed proportional voltage, no sawtooth voltage

Presetting with resistor R19
with TVD3.2 xx RS
(see page 23)

Resolution: switch position RS-SW1
chose highest resolution (z.B. 3000 Upm=14bit,
R19=39kΩ)
(see page 23)

Fine adjustment
with Potentiometer n. (P2)

nominal value from Potentiometer:
with 1V nom. value adjust to 10% of maximum speed
with 10V nom. value fine adjust to 100% (max. speed).

nominal value from CNC\SPS:
with 0.8V nom. value adjust to 10% of maximum speed

Change direction of rotation
exchange nominal value connection X1:4, X1:6
Current limitation

peak current range 0 up to 200% nominal current reset time max. 5sec. poti Imax (P5)
steady current range 5 up to 100% nominal current poti ID (P4)

Internally resetting current limits

<table>
<thead>
<tr>
<th>current limit</th>
<th>function</th>
<th>limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>overload signal to X2:14</td>
<td>time blocked</td>
<td>continuous current</td>
</tr>
</tbody>
</table>

the smallest current limit is effective!

Peak current

internal current limit (basic setup)

<table>
<thead>
<tr>
<th>adjustment</th>
<th>switch</th>
<th>poti</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imax</td>
<td>S1, contact 2=ON</td>
<td>Imax1 (P5)</td>
</tr>
</tbody>
</table>

external current limit

<table>
<thead>
<tr>
<th>adjustment</th>
<th>input</th>
<th>switch</th>
<th>poti</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imax</td>
<td>X1:9 0 ... +10V</td>
<td>S1, contact2=OFF</td>
<td>Imax1 (P5)</td>
</tr>
</tbody>
</table>

the external current limit can internally be reduced with \( \frac{I}{B_6} \)-potentiometer.

Steady current

adjust motor protection for both torque directions on motor nominal current with potentiometer ID (P4).

Measure adjustment values:
- do not connect motor
- predetermine nominal value and enable >>> switch off/on measuring value current nominal value X2:10 (5V=nominal current)

<table>
<thead>
<tr>
<th>nominal value</th>
<th>measuring value Imax (ca. 2sec.) measuring value I</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V</td>
<td>0 up to max. 10V</td>
</tr>
<tr>
<td>-5V</td>
<td>0 up to max. 10V</td>
</tr>
</tbody>
</table>

Current actual values

measuring value current actual value X2:9 \( Imax = 0 \) up to +5V
ID \( = 0,12 \) up to +2,5V

Caution

for exact torque control:
- PI-current control switching necessary
- manufacturers adjustment is P-control
- change from P- to PI-control in current controller
- switch S1, contact 1 = OFF
5 Adjustment

Speed Controller Switching
- variable components R9, C100
- amplification potentiometer P3 (XP)
- in case of changing devices >>> take over adjustment values.

Basic setup
- firm R, C - values 220kΩ, 22nF
- amplification potentiometer X to 50%
- optimal for most drives.

Adjustment without measuring

instruments
connect motor,
  nominal value = 0
  Xp = 50%
  R, C = basical values

enable drive,
- turn potentiometer Xp clockwise until drive swings
- turn potentiometer Xp anticlockwise until the swinging is dying-out,
- turn Xp-potentiometer further 2 positions anticlockwise.

Drive behaviour:

<table>
<thead>
<tr>
<th>amplification too low</th>
<th>amplification too high</th>
</tr>
</thead>
<tbody>
<tr>
<td>long oscillations 1 ... 0.1Hz</td>
<td>short oscillations 30 ... 200Hz</td>
</tr>
<tr>
<td>long overshoots</td>
<td>vibrates during acceleration,</td>
</tr>
<tr>
<td>overruns target position</td>
<td>vibrates during braking and in position</td>
</tr>
</tbody>
</table>

Caution:
in case of operating with CNC\SPS
- in case of maximum speed
- adjust nominal value speed with Poti n_{max} from 8 up to 9V
Basic Setup

Check connections before getting started
power supply nominal 115V~/180V=, maximum 140V~/200V=

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

Compact device
- power supply compact clamps X3:4, X3:5,
- auxiliary voltage compact clamps X3:6, X3:7
- motor connection compact clamps X3:1, X3:3

Multi-axis combination
- power supply power supply unit clamps X10:2, X10:3, X10:4
- motor connection axis clamps X3:1, X3:3
- protection earth protection earth screw at case
- motor-earth connection protection earth screw at case

Mind connection advices.
Encoder connection X7 notice motor specific connection sheets (see appendix A)
INC-connection X8 encoder supply voltage +5V

Basic connections power connections
- protection earth PE-bolt
- mains 1x or 3x 115V~
- motor 3x motor lines + protective conductor + shield
- transmitter connection mind motor specific connection sheets

Basic connection control connections
enable contact between X1:1 and X1:2
nominal value signal X1:4, GND X1:6
in case of internal poti-supply bridge X1:6 - X1:7

Basic setup for first putting into operation
potentiometer \( I_{\text{max1}} \) peak current 20%
potentiometer \( I_D \) continuous current 100%

potentiometer \( X_P \) amplification 50%

potentiometer \( n_{\text{max}} \) speed anticlockwise

switch S1 contact 1 = ON
contact 2 = ON

On RESO 2-4
switch position RS-S1, jumper RS-SW1
## Faults

<table>
<thead>
<tr>
<th>Fault</th>
<th>Causes</th>
</tr>
</thead>
</table>
| LED glims green | mains, encoder or temperature sensor connection missed  
mains voltage too low |
| LED red bright | short in motor connection  
output stage fault  
overvoltage |
| motor stands still  
no torque | no enabling  
current limit Imax anti-clockwise stop  
motor connection interrupted |
| motor stands in  
position, runs  
jerky or swings  
in position | resolver or motor  
lines mixed up or interrupted  
switch position RESO S1-pos. 3 and 4 wrong  
(pole number adaption) |
| motor speeds up | motor- or resolver cores  
leading or lagging 120°  
in rotating field |
| motor runs unsteady | resolver cores  
mixed up or interupted  
amplification Xp too high  
nominal value failure |
| amplifier switches to failure  
LED red bright | overtemperature, phase- or line-to-earth fault. BTB-fault  
output stage fault. |
| speed is not adjustable with Poti n. | resistor R19 or S1 (resolution)  
on evaluation electronic  
RESO2-4 wrong |
| power supply unit switches to failure while braking | braking energy too high |
| power supply unit goes to failure while switching on | undervoltage  
overvoltage |
7 Fault Finding

switch on mains

LED green bright

YES

LED green glims

YES

check connections and fuses

NO

enable drive nominal value 0V
Imax - Poli 20%

NO

mains missed

LED red bright

YES

motor - or earth - short

output stage

NO

motor stands still or runs slowly

YES

check encoder and motor lines

NO

increase nom. value to 10%

NO

motor runs steady

amplication to high
decrease with Poli Xp

YES

adjust speed with Poli nmax
to 10%

NO

set nom. value to 0V

motor stands still

YES

adjust speed with poli “Offset” to 0

NO

Increase nom. value to 50%
increase amplification with
Poli Xp until the drive swings,
then decrease until the drive
runs smooth

NO

adjust the current limits with
Poli iMax to the peak current
and with Poli I D to the steady
current of the motor

NO

getting started finished
switch off mains
Signals

Transistor-Servo-Drive TVD3.2 - xx - RS

Resolver Signal

Motor voltage
Motorspannung

Motor current
Motorstrom

TVI3 - Signalplan
TVI3 - Signal scheme

Incremental outputs
D-Flug XB

Integriertes D-Signal D-Stecher XB

G18 = KG1
+5V = K91
8 Protocol

Customer: Machine-No.: 
Device: Series-No.: 
Mains Voltage [V=, V=] 

Inputs 
Enable Contact? Voltage [V=] 
Nominal Value 1 Type Voltage [V=] 
Current nom. value Imax1 external Voltage [V=] 

Setup Actual Value Evaluation 
DC-Tacho R23 Value [kΩ] 
bl-Tacho Network RN1, RN2 Value [kΩ] 
IN-Evaluation Jumper SW1, 1-2/2-3 Position 
RS-Evaluation Switch RS-1 ON/OFF Position 

Setup Speed Controller 
Variable Components 
P-Component R9 Value 
I-Component C100 Value 

Potentiometer Positions 
Speed nmax P2 Position 
Peak Current Imax P5 Position 
Steady Current ID P4 Position 
Amplification XP P3 Position 
Offset Offset P1 Position 

Setup Current Controller 
P/PI Switch S1, Contact 1 ON/OFF 

Measuring Values 
Motor Voltage max 
Motor Current peak steady 

Motor Data 
Producer Type 
Series Number 
Encoder-Type IMP Voltage 
Motor Voltage Motor Current
GUARANTEE

UNITEK products have a warranty against defects in material and workmanship for a period of one year from the date of shipment. All values from the pre- and final quality control checks are archived with the devices’ serial numbers. UNITEK does not guarantee the suitability of the device for any specific application.

During the warranty period, UNITEK will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. UNITEK specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by UNITEK.

For products returned to UNITEK for warranty service, the Buyer shall prepay shipping charges to UNITEK and UNITEK shall pay shipping charges to return the product to the Buyer.

However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to UNITEK from another country.

The foregoing warranty shall not apply to defects resulting from:

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

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

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# Encoder Connection for AC-Syncho-Servo-Motors with Resolver

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TVD3 TVD6 MODULA X3 X3 X10</td>
<td>Terminal box</td>
<td>W G V C U V</td>
<td>V 2 W 2 U 1</td>
<td>V 3 W 3 U</td>
<td>W V U</td>
<td>V 2 W 2 U 1</td>
<td>V 3 W 3 U</td>
</tr>
<tr>
<td>3 7 1 W1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 8 2 W2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 2 3 W3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## MOTOR—Connector

- **UNITEK—Electronic Connection Resolver**
- **CANNON E20-155-44-48**
- **Spartan BM-2-260 010**

### Encoder Cable Shielded

- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25

### Encoder Connector

- Connection diagram for TVD3, TVD6 and Modula with x... Motors

- **EPROM for TVD3**
  - RLTab 270
  - SINTAB

- **EPROM for TVD6/Modula**
  - RLTab 270
  - SINTAB

---

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Page 1

Connection diagram for TVD3, TVD6 and Modula with x... Motors
## Encoder Connection for AC-Synchro-Servo-Motors with Resolver

<table>
<thead>
<tr>
<th>UNITEK - Motor Connection</th>
<th>MOTOR</th>
<th>ASB - Motor with Resolver</th>
<th>Baumüller-Motor DSG 56L with Resolver</th>
<th>Motor SEM HR 142 G6</th>
<th>LENZE SRL 2-SRL 4 n-pos Resolver</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVD3 X3</td>
<td>Terminal box</td>
<td>U</td>
<td>V</td>
<td>W</td>
<td>U</td>
</tr>
<tr>
<td>TVD6 X3</td>
<td>BR</td>
<td>BR</td>
<td>BR</td>
<td>BR</td>
<td>BR</td>
</tr>
<tr>
<td>TVD6 X10</td>
<td>TEM</td>
<td>FOM</td>
<td>TEM</td>
<td>FOM</td>
<td>TEM</td>
</tr>
<tr>
<td>UNITEK - Electronic Connection Resolver</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7</td>
<td>U</td>
<td>V</td>
<td>BR</td>
<td>CANNON E20-105-44-48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>PE</td>
<td>BR+</td>
<td>Solution DGM-DM 2-6p 018</td>
<td></td>
</tr>
</tbody>
</table>

### Encoder Cable Shielded
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 3x2x0.25 + 2x0.25
- 2x0.25

### Encoder Connector looking on Solder Side

### EPROM for TVD3
- TVD3 RLTAB 270
- TVD6/Modula SINTAB

---

10 Drawings

15.4.99 TV-A739

Blatt 3

Connection diagrams TVD3, TVD6 and Modula with AC Motors