GEORGII KOBOLD
GmbH & Co. KG

KDV

Digital Servo Amplifier
for Direct Mains Connection

KDV 2/400 to KDV 20/400

Connection and Commissioning

Operating Instructions 221072E, V 7.5a 08/05

These operating instructions apply to

- KDV servo amplifiers, compact design, KDV 2/400 to KDV 20/400 with built-in power supply unit for AC power connection
- Operation via personal computer with SPP Windows software
- Access to device functions via communication interfaces
- Accessories

These operating instructions are applicable together with

- Operating Instructions 221071E (Functions and Parameters)
- Operating Instructions 221102E (SPP Windows Command and Commissioning Software)

and other operating instructions according to the equipment.

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Versions of the Document

2000-08-28	V 5.5, MH	for KDV Firmware V 5.5, hardware version G Remarks concerning system accuracy with resolver (p. 24); impulse current resistance against mains off/on (p. 29); voltage ripple of analog outputs Ist1, Ist2 (p. 51); line choke for higher currents (p. 70); references to SPP Windows; references to ready-assembled cables; document styles
2004-02-02	V 7.5, KS/MH	for KDV firmware V 7.5, hardware version I Motor position sensor Sincos (Hiperface) and EnDat including the corresponding connections added; description of fieldbus interfaces and section “Drivers, DLL Libraries, and Program Examples” completed; external shunt resistor 021060010 added.
2005-08-04	V 7.5a, KS/MH	prepared for OEM; minor corrections

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These operating instructions have been prepared with care. However, GEORGII KOBOLD GmbH & Co. KG can accept no liability for any errors in these operating instructions or possible consequences. Neither can any liability be accepted for direct or indirect damage resulting from abuse of the device.

The relevant regulations concerning safety technology and electromagnetic compatibility must be complied with when using the device.

Subject to alteration.

Contents

Appendix

Figures

1 Preliminary Remarks

1.1 About this Description

These Operating Instructions 221072E explain the connection and commissioning of KDV servo drives with built-in power supply unit for direct connection to 3 × 400 V AC.

They are applicable together with

- Operating Instructions 221071E
  - Functions and Parameters (included in the scope of delivery of the KDV servo amplifier)
- Operating Instructions 221102E
  - SPP Windows Command and Commissioning Software (supplied with command and commissioning software SPP Windows)
- Operating Instructions 221117E
  - Part Program (running motion sequences independent of a higher-level controller; included in the scope of delivery of the KDV servo amplifier)

as well as, according to the equipment,

- Operating Instructions 221074E
  - Communication Functions/Interbus (access to device functions via communication interfaces COM1 and/or Interbus; supplied with the optional Interbus interface)
- Operating Instructions 221086E
  - CANopen Interface (supplied with the optional CANopen interface)

For the commissioning of the functions described in these operating instructions, a PC with command and commissioning software SPP Windows is required. Please, make sure that this requirement is met and the above-mentioned operating instructions are available.

1.2 KDV Servo Drive Packages

KDV servo drive packages consist of

- an AC servo motor with integrated resolver, Sincos (Hiperface) encoder, high-resolution incremental encoder, or EnDat encoder as motor position sensor and
- a digital servo amplifier with built-in power supply unit.

These operating instructions describe

- the servo amplifiers,
- the connection,
- the accessories, and
- the commissioning.

The series described here includes

- amplifiers for 5 different currents (2 A_{rms} to 20 A_{rms}) with different equipment (options).

2 Safety Instructions

2.1 Type of Instructions

The warnings, instructions and hints in the margin must be observed under any circumstances:

- **Danger** to health and life due to electrical shock or motion of the drive. When disconnecting the device from the mains, wait for at least 2 minutes until the DC-bus capacitors have discharged before carrying out the measure described.

- **Caution**: Noncompliance violates the safety regulations or statutory provisions and can lead to personal injury or material damage.

EMC

- The CE marking requires compliance with the **EMC limits** according to EN 55011, A and B (emission) and EN 50082-1 and -2 (immunity). The instructions marked with this symbol must be observed by all means. Otherwise, the facility in which the amplifier is operated has to be checked for compliance with the EMC limits at the customer's own responsibility.

- **Check**: Prior to commissioning and in case of failures or problems, check these items first.

- **Tip**, useful hint.

2.2 Qualified Personnel

The servo amplifiers work with dangerous voltages. Contact with voltage-carrying parts can damage your health seriously.

Therefore, only trained, qualified personnel with knowledge in the fields of

- automation systems,
- handling of dangerous voltages,

EMC

- standards and regulations such as
  - EMC Directive (89/336 EEC),
  - Low Voltage Directive (73/23 EEC),
  - Machine Directive (89/392 EEC),
  - VDE regulations (such as DIN VDE 0100, DIN VDE 0113 <EN 60204>, DIN VDE 0160 <EN 50178>),
  - safety rules

may

- install,
- commission,

- maintain, and
- service

these devices.

They have to read these operating instructions carefully in advance and to observe the safety instructions permanently while working.

2.3 Use for the Intended Purpose

The servo amplifiers have been developed, manufactured, tested, and documented in accordance with the relevant standards. If used for the intended purpose, the devices do not cause any danger to persons or property. Use for the intended purpose requires that the device should be used only in the manner described here, and that the safety regulations mentioned should be adhered to.

When using the devices, use for the intended purpose includes compliance with the relevant regulations with respect to safety (machinery directive) and electromagnetic compatibility (EMC directive).

At the end of its service life, dispose of the device according to the regulations to be applied then.

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2.4 Protective Earthing

Due to the leakage currents of the built-in RFI filter, the protective earth conductor, in accordance with DIN VDE 0160, must

- either be routed double or
- have a cable cross-section of at least 10 mm^2 Cu.

Operation via earth-leakage circuit breaker is not possible

- due to the leakage currents of the RFI filter and
- since in case of an earth leakage a part of the direct current flows in the protective earth conductor.

2.5 Hazard Warnings

Due to their design and connection system, the servo amplifiers may be operated

- only in a closed housing (control cabinet),
- only with a fixed mains connection.

Do not insert objects (screwdrivers, wires etc.) through the ventilation holes into the inside of the device.

Before connecting or disconnecting a connector

- switch off the mains voltage.

The charging capacitor of the power supply unit maintains the voltage after switch-off. Before working at the device

- wait for at least 2 minutes after having switched off.

Electronic devices are generally not fail-safe. The user has to make sure that

- the drive is switched to a safe state in case of a break-down of the device.

2.6 CE Marking

The KDV servo amplifiers meet the requirements of

- EMC Directive (89/336 EEC) and
- Low Voltage Directive (73/23 EEC).

Thus, they conform to the current EU regulations and have a CE marking. The CE marking is only valid if

- all installation and connection instructions have been observed exactly and
- the requirements marked with the EMC symbol have been met.

If this is not possible, you must have checked the facility in which the amplifiers are operated for compliance with the EMC limits on your own responsibility.

2.7 Preconditions for Commissioning

In addition to the low voltage and EMC directives applicable to the servo amplifier, the machine directive 89/392 EEC applies, as well. Due to that, it is also applicable to the final product, the machine in which the servo amplifier is operated. That means it must be fulfilled by the machine manufacturer.

Commissioning is prohibited until the requirements of the machine directive have been met.

3 Description of the Device

3.1 Type Code

The type code clearly identifies amplifiers equipped in a certain way. It is also applicable to device variants not described in these operating instructions.

Example ⇨ KDV 8/400 A1-R1/G1/L1/F1/Sx

⇩

8

Continuous output current

2	output current 2 A_{eff}	12	output current 12 A_{eff}
4	output current 4 A_{eff}	20	output current 20 A_{eff}
8	output current 8 A_{eff}		

400

Mains connection and DC-bus voltage

000	no mains connection, supply via DC-bus from other device (in preparation)
400	mains connection 400 V 3-phase, corresponds to 560 V DC-bus voltage

A1

Digital inputs/outputs

A1	16 inputs, 8 outputs (24 V) (standard)
AK	customer-specific

R1

Motor position sensor

R1	resolver (standard)
R2	sincos encoder (available for Motor KSY 3... or larger, single or multi-turn)
R3	high-resolution incremental encoder Heidenhain
R4	EnDat encoder (single or multi-turn)
RK	customer-specific

G1

Output encoder signals (encoder emulation)

G1	incremental encoder output 5 V, push-pull signals RS 422
G2	incremental encoder output 24 V
GK	customer-specific

L1

Input encoder signals
for axis coupling (synchronization, el. gearing), external position encoder or pilot frequency;
incremental encoder signals (pulse/direction signals on request)

L1	signal level 5 V, push-pull signals RS 422
L2	signal level 24 V
LK	customer-specific

F1

Fieldbus connection

F1	Interbus (local bus) according to DRIVECOM profile 22
F2	CANopen (CAN according to CANopen standards and DRIVECOM profile 22)
F3	Interbus (optical fibre local bus) according to DRIVECOM profile 22
F5	Profibus-DP (in preparation)

Sx

Special equipment (customization)
Number = mechanical special equipment
Letter = electrical special equipment

For further details on the equipment, please see section 3.4 (page 21).

3.2 Technical Specifications

3.2.1 Electrical Specifications

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Mains input					
Rated supply voltage	3 × 400 V AC ±10%, 50 .. 60 Hz				
Rated DC-bus voltage	560 V DC				
Measuring range DC-bus voltage	approx. 60 V .. 800 V DC				
Switch-in threshold DC-bus	≥ 480 V DC				
Shutdown threshold overvoltage	750 V DC				
Shutdown threshold undervoltage	380 V DC (power circuit enabled) 480 V DC (power circuit disabled)				
Maximum mains inrush peak current	8 A			17 A	
Motor output	earth-fault proof, short-circuit proof				
Maximum continuous current (rms)	2 A	4 A	8 A	12 A	20 A
Max. peak current for 2 s (crest value)	5.5 A	11 A	22 A	34 A	56 A
Power dissipation under rated conditions	60 W	100 W	160 W	140 W	200 W
Switching frequency of power circuit	16 kHz			8 kHz	
Shunt circuit	overload-proof, short-circuit proof				
Max. continuous braking power (internal)	50 W			100 W	
Max. continuous braking power (external)	600 W			1.5 KW	
Internal fuse shunt circuit	soldered fuse at the resistor			8 A T	
Pulse braking power, 2% switch-on duration, 2 s	1.2 kW			2.5 kW	
Switch-in threshold shunt resistor	670 V DC				
Shutdown threshold shunt resistor	630 V DC				
Usable shunt resistor (external)	62 .. 220 Ω	62 .. 120 Ω	62 .. 70 Ω	30 .. 42 Ω	30 .. 33 Ω
Control supply	protected against polarity reversal				
Control supply voltage	24 V DC ±20%				
Maximum interruption time	10 ms without amplifier reset				
Current consumption at 24V (without fan and brake)	560 mA .. 780 mA ±10% depending on motor position sensor				
Fan starting current (for approx. 2 s)	+200 mA			+260 mA	
Fan current consumption (switched on)	+100 mA			+180 mA	
Additional current consumption due to modular equipment	up to 70 mA ±10% (plus position sensor power supply for option Lx)				

3.2.2 Line-Side Fuses, Cable Cross-Sections and Lengths

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Line-side fuses mains (3 pieces)	6 A T	10 A T	16 A T	20 A T	25 A T
Line-side fuse control supply	2 A T plus current for brake (if connected)				
Mains supply cable	shield not required				
Minimum cable cross-section	1.5 mm^2	1.5 mm^2	1.5 mm^2	2.5 mm^2	4.0 mm^2
Motor supply cable	shielded				
Minimum cable cross-section	1.5 mm^2	1.5 mm^2	1.5 mm^2	2.5 mm^2	4.0 mm^2
Maximum length without motor choke	5 m				
Maximum length with motor choke	50 m				
Connection external shunt resistor	shielded				
Cable cross-section	1.5 mm^2			2.5 mm^2	
Connection cable encoder	shielded, twisted-pair				
Cable cross-section resolver	0.25 mm^2				
Cable cross-section others	depending on the encoder type				

Cables available from Georgii Kobold are described in detail in section 6 (page 66ff).

3.2.3 Mounting, Dimensions, and Weight

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Mounting method	in control cabinet only, vertical wall mounting				
Min. mounting spacing above/below	80 mm				
Min. mounting spacing right/left	0 mm				
Width	84 mm			130 mm	
Height (without mounting straps)	320 mm			320 mm	
Height (with mounting straps)	360 mm			360 mm	
Depth without connectors	290 mm			290 mm	
Weight	6.8 kg			11.4 kg	

Figure 1 shows the mounting dimensions of amplifiers KDV 2/400 to KDV 8/400, fig. 2 shows the mounting dimensions of amplifiers KDV 12/400 and KDV 20/400.

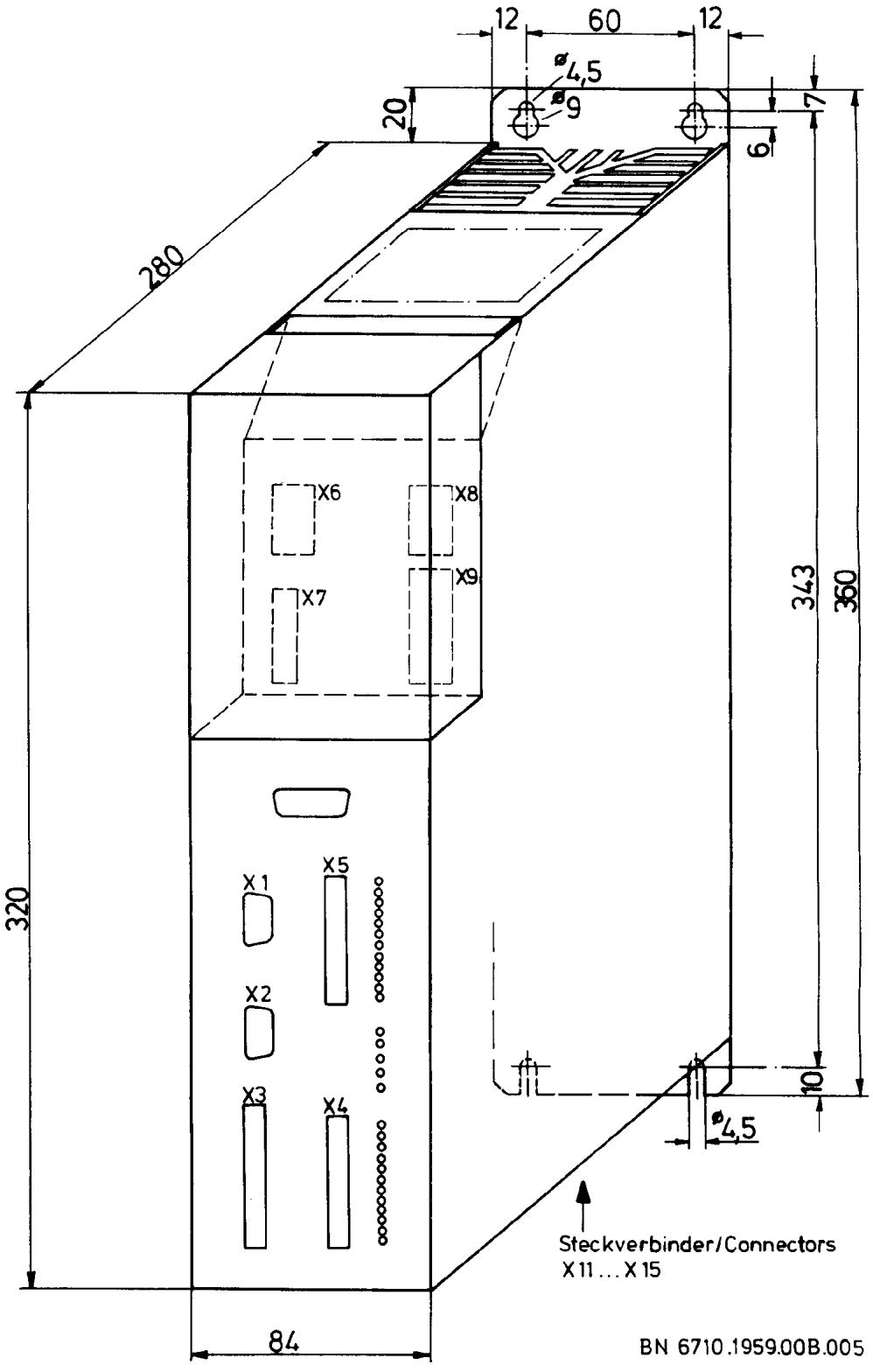


Figure 1: Mounting Dimensions, Location of Connectors KDV 2/400 to KDV 8/400

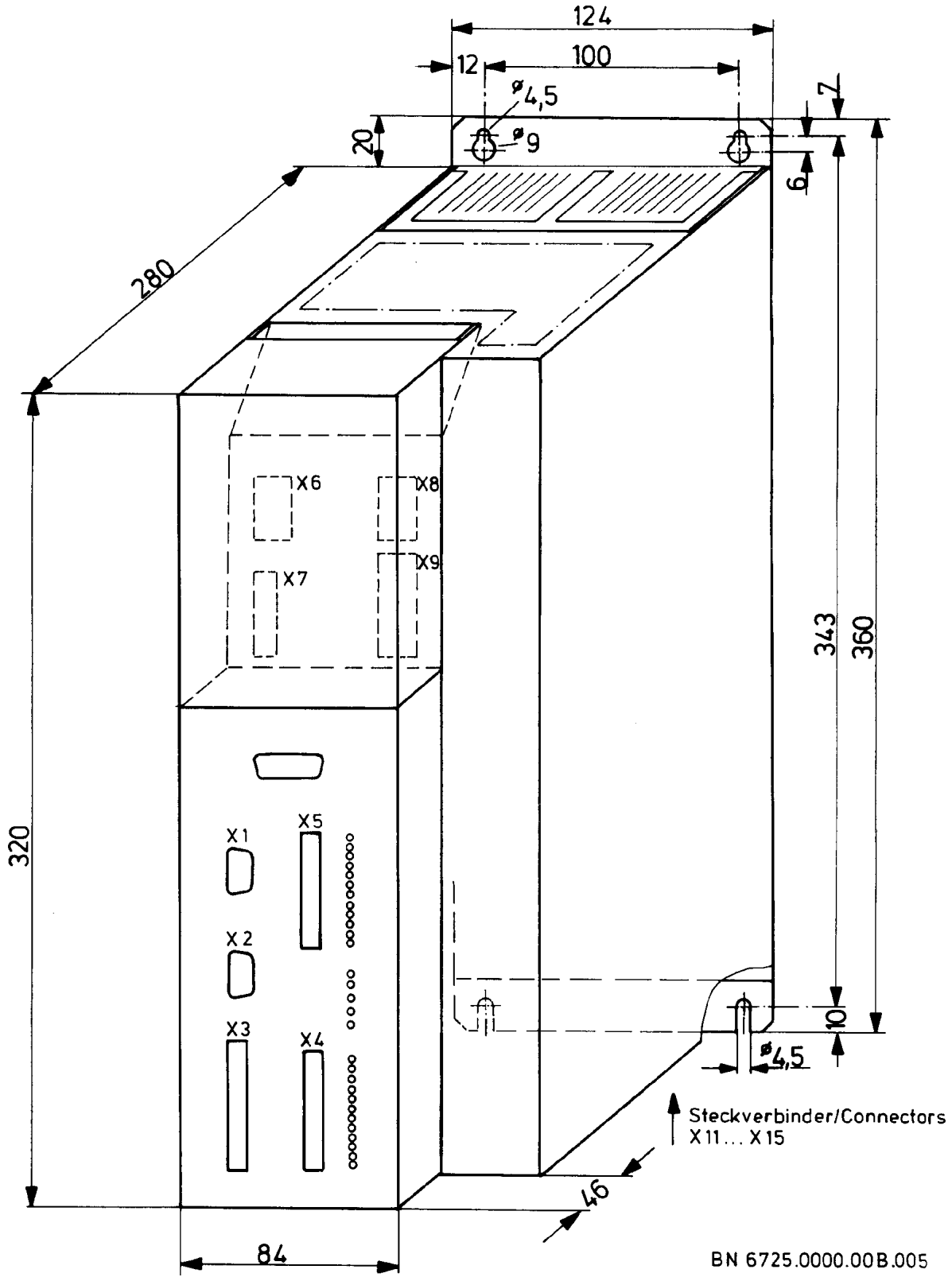


Figure 2: Mounting Dimensions, Location of Connectors KDV 12/400, KDV 20/400

3.2.4 Environmental Conditions

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Degree of protection	IP20 according to EN 60529				
Protection class	I according to VDE 0106				
Degree of pollution	2 according to EN 50178				
Overvoltage category	III according to EN 50178				
Mounting height (without current derating)	≤ 1000 m above sea level				
Mounting height (with current derating)	≤ 2000 m above sea level (–1.5% per 100 m above 1000 m)				
Climatic category acc. to DIN EN 50178	operation: 3K3 / storage: 1K4 / transport: 2K3				
Permissible ambient temperature	+5 .. +40 °C /	–25 .. +55 °C /		–25 .. +70 °C	
Permissible relative humidity	5 .. 85% /	5 .. 95% /		5 .. 95%	

3.2.5 Analog and Digital Inputs and Outputs, Interfaces

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Analog I/O					
Auxiliary voltage outputs	+15 V and –15 V, ±10%				
Load capability of auxiliary voltages	10 mA each (via PTC 125 Ω), short-circuit proof				
Analog inputs	1 differential input, freely configurable				
– assignment	“setpoint speed” (default setting)				
– voltage range	±10 V				
– input resistance	20 kΩ				
– resolution	12 Bit				
Analog outputs	2, freely configurable, short-circuit proof				
– assignment	“speed”, “current” (default setting)				
– voltage range	±5 V				
– resolution	10 Bit				
Digital I/O	opto-isolated, switching towards positive (PLC-compatible)				
Voltage supply	from outside, 24 V DC at “+24 V I/O”, “0 V I/O” (18 .. 32 V DC)				
Digital inputs	16, freely configurable				
– assignment	depending on the option, for an exemplary assignment see section 4.3 (page) 30				
– voltage level	0 .. 5 V for “0” (“low”) / 12 .. 30 V for “1” (“high”)				
– input current at 24 V	5 mA				
Digital outputs	8 freely configurable, 1 assigned				
– assignment	depending on the option, for an exemplary assignment see section 4.3 (page) 30				
– permissible load current	max. 40 mA				
– output resistance	125 Ω (PTC)				

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Relay output "Ready"	potential-free ("BTB/Ready")				
Permissible switching voltage	36 V AC/DC				
Permissible load current	1 A				
Relay output "Brake"	not short-circuit proof				
Output voltage	from control supply voltage "+24 V" and "–24 V"				
Permissible load current	2 A				
Interfaces					
Motor position sensor	resolver (standard), Sincos (Hiperface) encoder, high-resolution incremental encoder, or EnDat encoder (options)				
Encoder signals I/O (option)	5 V push-pull signals (RS 422) or 24 V (single-ended)				
Serial interfaces	COM1 (RS 232C), COM2 (RS 232C or RS 485), not galvanically isolated, max. 9600 Baud				
Fieldbus (option)	Interbus (local bus, optical fiber local bus) CANopen according to DRIVECOM profile 22, Profibus-DP (in preparation)				

3.2.6 Control and Operating Modes

Servo Amplifier	KDV 2/400	KDV 4/400	KDV 8/400	KDV 12/400	KDV 20/400
Cycle time current control loop	62.5 µs				
Cycle time speed control loop	62.5 µs				
Cycle time position control loop	1 ms				
Operating modes					
– command mode	with torque, speed, or position control				
– program mode	with positioning control, 500 blocks				
– 2-axis synchronization	electronic gearing, flying shear				
Ramp functions	linear, $\sin^2$				

3.3 Design

3.3.1 General Information

The KDV servo amplifiers are manufactured in a compact design for being screwed on a mounting plate. They have a metal housing. Figure 1 (page 16) shows the mounting dimension of amplifiers KDV 2/400 to KDV 8/400, figure 2 (page 17) shows the mounting dimensions of amplifiers KDV 12/400 and KDV 20/400.

All connections are located in the terminal compartment (at the top of the front side behind a cover), on the bottom side and on the front panel. LEDs for indicating the operating states are located on the front panel.

The KDV servo amplifiers have one (KDV 2/400 to KDV 8/400) or two (KDV 12/400 and KDV 20/400) built-in fans which are supplied internally with

the control voltage supplied from outside. The fans do not run continuously but are switched on depending on the temperature. Additionally, they will be switched on for approx. 1 minute after the shunt circuit has been activated.

The amplifier is fixed in the housing. Slots for the modules described below are provided.

3.3.2 LEDs

On the front panel of the amplifier, there are five LEDs displaying certain operating states as well as 24 LEDs for displaying the states of the digital I/O I 1.0 to I 2.7 and O 1.0 to O 2.3.

The LEDs have the following meanings:

Description	Color	Display
U_{Steuer}	green	Lit when the control supply voltage +24 V is applied via connector X7.
Störung	red	Lit or flashing when the servo amplifier indicates a fault. The fault is stored (state “fault”), the cause of the fault can be read out in the PC as “fault code” (see Operating Instructions 221071 “Functions and Parameters”) Continuous illumination indicates a drive fault, flashing indicates a programming or parameterization error.
Bereit	green	Lit when the power circuit is ready (state “operation enabled” **and** the bus voltage is in the permissible range, see p. 49). Flashing in all other cases.
Überlast	yellow	Lit when switched from peak current to continuous current in the event of an overload.
Ballast	yellow	Lit when the shunt circuit is switched on to receive the energy returned when the motor is braked.
I 1.0 to I 2.7	red	Lit when +24 V are applied at the corresponding digital output.
O 1.0 to O 2.3	red	Lit when the digital output is set, no matter whether or not a consumer is connected.

3.3.3 Operating Modes

The KDV servo amplifier permits the following operating modes:

- Command mode
  - with torque, speed, or position control

    for direct control of axis motions via single commands of a higher-level controller (PLC, PC)
  - electronic gearing

    the axis follows an externally specified position

– homing mode

establishes a reference between actual axis position value and coordinate system of the machine

- Program mode with positioning control, 500 blocks

  For running special programs, so-called part programs, on the KDV servo amplifier. With these part programs, motion sequences can be executed independent of a higher-level controller.

- Operating mode flying shear

  Special application with synchronization of two axes. For a periodical positioning process during which the slave axis (= flying shear) is temporarily synchronized with the master axis. The slave axis receives position and speed settings of the master axis via an encoder input (option Lx). In practical operation, the master axis typically ensures a continuous material flow and a tool actuated by the slave axis processes the material during the synchronous periods of time (e. g. sawing, cutting, printing).

The desired operating mode can be selected via one of the communication interfaces (variable access) or by means of appropriate programming in the part program.

For further information on the different operating modes and the application of them, please see Operating Instructions 221071 “Functions and Parameters”.

3.4 Modular Equipment

This section describes the various options of the KDV servo drives. It is based on the type code in section 3.1 (page 13).

The current consumption from the control voltage supply of the servo amplifiers depends on the modular equipment (Rx, Gx, Lx, and Fx). Details on the current consumption can be found in the corresponding sections.

The connector assignment is described in section 4 (page 28ff), the connection directions can be found in section 5 (page 55ff).

3.4.1 Mains Connection and DC-Bus Voltage

The following options for mains connection are available:

- without mains connection, supply via DC-bus from another device (up to 560 V): on request.
- Mains connection 400 V 3-phase, corresponds to 560 V in the DC-bus (other voltages on request): KDV ../400.

The power supply unit is installed by Georgii Kobold, refitting by the customer is not possible.

Connector X6 for mains connection is described in section 4.1 (page 28). For connecting the amplifier to the mains see section 5.5 (page 58).

3.4.2 Motor Position Sensor (Options Rx)

KDV servo amplifiers support servo motors with four types of position sensors:

- R1: resolver (standard),
- R2: Sincos (Hiperface) encoder (single- or multi-turn),
- R3: high-resolution incremental encoder, and
- R4: EnDat encoder (single- or multi-turn).

The servo drive is adjusted to the used encoder via a module installed in the KDV servo amplifier ex works. Therefore, the type of motor position sensor must be specified when ordering the motor as well as when ordering the servo amplifier.

The position is determined in the position sensor

- within one revolution with resolver, Sincos (Hiperface) encoder (single-turn), high-resolution incremental encoder and EnDat encoder (single-turn).

  For multiple revolutions, it is listed in a software counter in the KDV servo amplifier. That means: for positioning modes, the home position has to be determined after each switch-off and switch-on of the control supply voltage in order to determine the absolute position of the axis.

- for 4096 revolutions with Sincos (Hiperface) and EnDat encoder (multi-turn):

  The position is read out from the encoder after each switch-off and switch-on of the control supply voltage so that going to home position is not required.

Resolvers are used as standard (option R1). The resolver input is dimensioned for the standard servo drive-type single pole-pair resolvers with a transformation ratio of 1 : 0.5.

The excitation voltage is 7 V_{rms} (short-circuit proof) at an excitation frequency of 8 kHz.

Sincos (Hiperface) encoders, high-resolution incremental encoders, and EnDat encoders are intended for applications in which at least one of the following criteria must be met:

- high accuracy
- low speed ripple
- absolute position sensing (Sincos (Hiperface) or EnDat in multi-turn design)

Two types of **Sincos (Hiperface) encoders** and **EnDat encoders** are available:

- Single-turn design: similar to the resolver, the position is sensed within one revolution of the encoder.
- Multi-turn design: the position is sensed for 4096 revolutions in the encoder.

  Note: The travel distance of multi-turn-type Sincos (Hiperface) and EnDat encoders must not exceed 4096 revolutions of the motor. Thus, endless axes cannot be realized with multi-turn-type encoders. With the resolution per revolution the entire positioning range results in 4096 · 65536 = 268,435,456 (= 2^{28}) steps.

The **high-resolution incremental encoder** passes a reference signal once per revolution.

Before passing the reference signal for the first time, the position information of the rotor is determined using a second track (Z1 track). Until that, the position information is still inaccurate (see footnote of the following table).

Once the reference signal has been passed, the position is determined using the incremental signals and the position information reaches the high accuracy stated in the following table.

Motor Position Sensor System		**Resolver (R1)**	**Sincos (Hiperface) Encoder (R2)**		**High-Resolution Incremental Encoder (R3)**	**EnDat Encoder (R4)**	
			single-turn	multi-turn		single-turn	multi-turn
Measuring principle		magnetic	optic		optic	optic	
Max. operating speed[1]		10,000 r.p.m	12,000 r.p.m.		9,000 r.p.m.	15,000 r.p.m.	12,000 r.p.m.
Revolutions measured, absolute		1	1	4096	1	1	4096
Resolution (software)	angle	20"					
	steps/revolution	65536					
System accuracy	angle	±15' [2]	±60"		±80" [3]	±60" (512) ±20" (2048)	
	steps	±45	±3		±4	±3 or ±1	
Resolution output encoder signals (option Gx); steps/revolution per track		50 to 1024	According to the resolution of the motor position sensor 512 or 2048				
Zero pulse output encoder signals (option Gx)		yes	no		yes	no	
Endless axes possible		yes	yes	no	yes	yes	no
Current consumption of the amplifier[4]		560 mA ±10%	770 mA ±10%		740 mA ±10%	740 mA ±10%	

1 Higher speeds on request
2 Prerequisite: resolver has an accuracy of at least ±10'.
3 Before having passed the reference signal for the first time, the position accuracy is ±5°. After the first revolution of the rotor, at the latest, the stated accuracy will be reached.
4 From the control voltage supply, at full load, without connected consumers and other options. The current consumption can be considerably lower (e. g. when the power circuit is disabled). Also see the table in section 3.2.1 (page 14).

Motor position sensor connector X11 is described in sections 4.5 (resolver), 4.6 (Sincos (Hiperface) encoder), 4.7 (high-resolution incremental encoder), and 4.6 (EnDat encoder) from page 33 on. For connecting a motor position sensor, see section 5.13 (page 63ff).

3.4.3 Output Encoder Signals (Options Gx)

Encoder signals (actually incremental encoder signals) are either generated by the KDV servo amplifier (“output encoder signals”, option G1 or G2) or can be processed with it (“input encoder signals”, option L1 or L2).

Via output encoder signals, the position of the driven axes can be transmitted to other controllers or coupled axes in the form of incremental encoder signals (incremental encoder simulation).

Output encoder signals can be realized as follows:

- G0: not connected (standard),
- G1: incremental encoder output 5 V, push-pull signals RS 422,
- G2: incremental encoder output 24 V.

The resolution of the encoder signals and the function of the index pulse depend on the motor position sensor used (option Rx, see section 3.4.2, page 22):

- Resolver (R1) as motor position sensor:
  - The resolution of the encoder signals can be set between 50 and 1024 pulses per revolution by means of the machine data.
  - The index pulse is given once per motor revolution; the position of the index pulse can be shifted by means of the machine data.
  - The position sensed by the resolver serves as setpoint for a software control loop, the regulated quantity is the frequency of the encoder signals. At low values, feedforward via speed leads to additional short pulses at output encoder signals. These pulses will be corrected automatically with inverted pulses by the software control.
- Sincos (Hiperface) encoder (R2) or EnDat encoder (R4) as motor position sensor:
  - Depending on the resolution of the motor position sensor, the resolution of the encoder signals is 512 or 2048 pulses per revolution.
  - The index pulse is not given.
- High-resolution incremental encoder (R3) as motor position sensor:
  - Depending on the resolution of the motor position sensor, the resolution of the encoder signals is 512 or 2048 pulses per revolution.
  - The index pulse is given once per motor revolution.

Output encoder signals is designed as a module. It can be installed by Georgii Kobold only, subsequent installation on site is not possible.

The current consumption from the control voltage supply of the amplifier increases by approximately 20 mA when equipped with option G1 or G2.

Connector X13 for output encoder signals is described in sections 4.11 and 4.12 (page 39ff). For connecting the encoder signals, see section 5.14 (page 64).

3.4.4 Input Encoder Signals (Options Lx)

Encoder signals (actually incremental encoder signals) are either generated by the KDV servo amplifier (“output encoder signals”, option G1 or G2) or can be processed with it (“input encoder signals”, option L1 or L2).

Input encoder signals can be used for axis coupling (synchronization, electronic gearing), the connection of an external position sensor, or pilot frequency setting. The encoder signals can be processed either as incremental encoder or as pulse/direction signals. The maximally permissible signal frequency is 200 kHz, higher frequencies only after consultation with Georgii Kobold. The minimal signal frequency that can be processed by the software is 250 Hz.

Input encoder signals can be realized as follows:

- L0: not connected (standard),
- L1: signal level 5 V, push-pull signals RS 422,
- L2: signal level 24 V.

Both variants (L1 and L2) support all above-mentions functions.

Input encoder signals is designed as a module. It can be installed by Georgii Kobold only, subsequent installation on site is not possible.

The current consumption from the control voltage supply of the amplifier increases by the current for the external position sensor if supplied via input encoder signals.

Connector X12 for input encoder signals is described in sections 4.9 and 4.10 (page 37ff). For connecting the encoder signals, see section 5.14 (page 64).

3.4.5 Fieldbus (Options Fx)

The following fieldbus interfaces are available:

- F0: none (standard),
- F1: Interbus (local bus) according to DRIVECOM profile 22,
- F2: CANopen (CAN according to the CANopen standards and with DRIVECOM profile 22),
- F3: Interbus (optical fiber local bus) according to DRIVECOM profile 22

All parameters of the KDV servo drives can be accessed via the fieldbus interface. Due to the fact that the software of the KDV servo drives has been developed for use with a fieldbus from the beginning, all interfaces access the same parameters, serial interfaces included.

KDV servo amplifiers equipped with a fieldbus interface have two connectors X14 and X15 as well as LEDs on their bottom side.

The fieldbus interface is designed as a module. It can be installed by Georgii Kobold only, subsequent installation on site is not possible.

The current consumption from the control voltage supply of the amplifier increases by approximately 40 mA for one of options Fx.

4 Assignment of Connectors

This section describes the assignment of the connectors. The connection instructions can be found in section 5 (page 55ff). For information on the equipment, see section 3.4 (page 21ff).

Connectors X6 to X9 are located in the terminal compartment. Section 5.1 (page 55) describes how to open the terminal compartment to get access to these connectors.

The connector assignments on the bottom side may vary depending on the equipment of the device. For example, connector X11 for the motor position sensor can be designed for a resolver (option R1), a Sincos (Hiperface) encoder (option R2), a high-resolution incremental encoder (option R3), or an EnDat encoder (option R4). Therefore, the designation of the connector (e. g. X11) is supplemented in these operating instructions by the designation of the option (e. g. X11/R1) to which the specified assignment applies.

4.1 Mains Connection (X6)

4-pin Combicon connector X6 (RM 7.62) in the terminal compartment:

Pin	Designation	Assignment
L1	L1	mains phase 1
L2	L2	mains phase 2
L3	L3	mains phase 3
PE	PE	mains protective earth conductor

To limit the inrush current, the DC-bus is charged via the shunt resistor (internal or external, see next section). After exceeding the threshold value of 480 V DC, the current limitation will be switched off with a delay of 1 s using a power relay.

If the shunt resistor fails or has not been connected because

- the jumper for the internal shunt resistor has not been set,
- the external shunt resistor is missing, or
- the internal overload fuse has blown,

the DC-bus cannot be charged (LED “Bereit/Ready” flashes even if the power circuit is enabled, however, a fault is not reported). In this case, establish the connection to the internal or external shunt resistor or contact Georgii Kobold for an exchange of the internal overload fuse.

When the mains is switched off, the current limiting circuit is activated as soon as the DC-bus voltage is below the threshold value. The time required for that depends on the power circuit state:

Power Circuit	Motor	Discharge Time
off	standing	approx. 5 s
on	standing	approx. 0.6 s
on	rotating	approx. 0.4 s

If these times are observed, the mains can be switched off and on arbitrarily. In rare cases, a non-observance of these times may lead to a damage at the rectifier.

Relay contact “BTB/Ready” can be used for checking whether or not the DC-bus voltage has fallen below the threshold value: if this contact is open, the current limiting circuit is activated.

For connecting the amplifier to the mains, see section 5.5 (page 58). The recommended line-side fuses and cable cross-sections are listed in the table in section 3.2.2 (page 15).

4.2 Motor (X8)

3-pin Combicon connector X8 (RM 7.62) in the terminal compartment:

Pin	Designation	Belegung
U	Motor U	motor connection U
V	Motor V	motor connection V
W	Motor W	motor connection W
PE bolt M6 in the terminal compartment		PE of the motor supply cable
Strain relief		connect the cable shield using the strain relief

The motor connector is earth-fault and short-circuit proof.

Only the AC servo motors with permanent magnets in the rotor (synchronous servo motors) supplied by Georgii Kobold can be connected. Other motors can only be used after consultation with Georgii Kobold. The adaptation of the control to other motors can only be carried out by Georgii Kobold at extra charge.

For connecting the motor to the amplifier see section 5.6 (page 59). Recommended cable cross-sections are listed in the table in section 3.2.2 (page 15).

4.3 Control Supply Voltage, Brake, Motor Temperature Sensor (X7)

6-pin Combicon connector X7 (RM 5) in the terminal compartment:

Pin	Designation		Assignment
1	24 V	+	Control supply voltage +24 V DC
2		–	Control supply voltage 0 V
3	Brake	+	Brake control +24 V DC (O 3.0) [1] (from control supply voltage via contact in KDV)
4		–	Brake control 0 V
5	Motor temp.		Motor temperature sensor [2]
6			

[1] The drive-specific assignment “Brake control” can be switched on and off for this output by means of the machine data. When the drive-specific assignment is switched off, this output can be used freely as output O 3.0.

[2] For option R1 (resolver), this input is connected in parallel internally with the corresponding pins at connector X11/R1.

Figure 3 shows the internal circuitry of connector X7 together with an example of a connection.

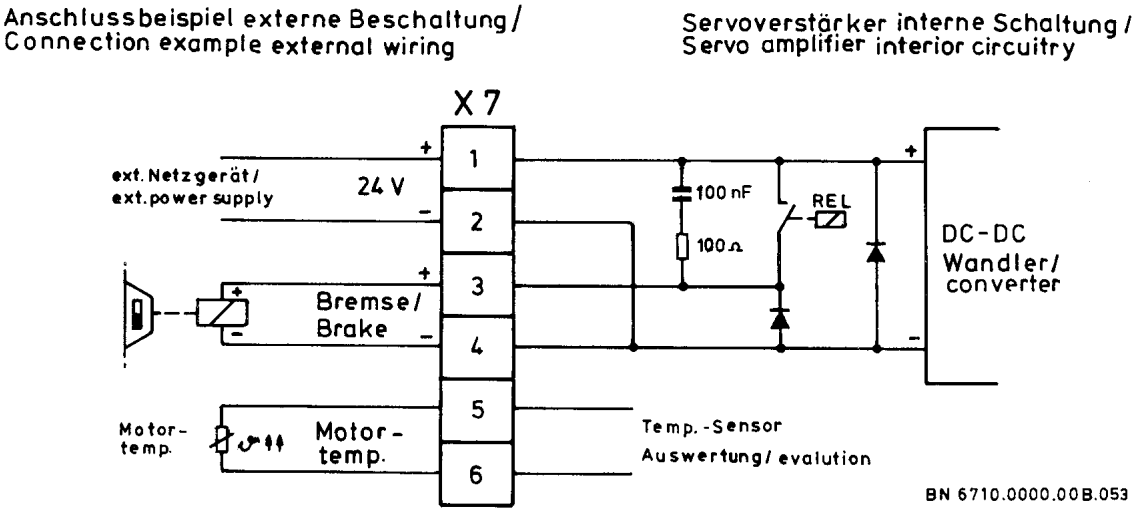


Figure 3: X7, Connection Example and Internal Circuitry

4.3.1 Control Supply Voltage

The control supply voltage of +24 V DC powers the electronics and, if installed, the fan(s) of the KDV servo amplifiers; inside the amplifier, it is converted into voltages of +5 V, +15 V and –15 V via DC/DC converters. The control supply voltage is potential-free towards the amplifier.

For connecting the control supply voltage, see section 5.8 (page 60).

4.3.2 Brake

A brake can be actuated with +24 V from the control supply voltage via relay contact “Bremse/Brake”. The following applies:

- +24 V (control supply voltage is supplied via contact):
  - brake released (actively released by +24 V),
- open contact (control supply voltage is not supplied):
  - brake activated.

This output is actuated automatically by the KDV servo drive. The machine data (“release brake selection code”) can be used for setting the states in which the brake is released (e.g. whenever there is no fault or only in state “operation enabled”).

Actuating the brake via output “Bremse/Brake” does not correspond to the safety requirements of the machine directive.

If the motor has to be braked for safety reasons or in case of an emergency stop, the safety requirements of the machine directive must be observed under all circumstances.

For connecting a brake see section 5.9 (page 61).

4.3.3 Motor Temperature Sensor

As temperature sensors,

- a thermo switch opening in the event of overheating or
- a PTC resistor increasing its value to more than 2 kΩ in the event of overheating

can be used.

If the motor does not have a temperature sensor, the pins must be jumpered at one of the connectors. Otherwise, the amplifier would constantly report a “motor overtemperature” fault.

The motor temperature sensor is connected via Combicon connector X7 or the input of the motor position sensor X11. The connection is described in section 5.10 (page 61).

4.4 Shunt Resistor and DC-Bus (X9)

5-pin Combicon connector X9 (RM 7.62) in the terminal compartment:

Pin	Designation	Assignment
5	R_{ext}	Either connect external shunt resistor between R_{ext} and +R or install jumper from R_{int} to +R. (Manufacturer default: with jumper installed)
4	R_{int}	
3	+R	
2	$+U_B$	Positive connection of the bus voltage from the power supply unit
1	$-U_B$	Negative connection of the bus voltage from the power supply unit

4.4.1 Shunt Resistor

The servo amplifier is equipped with a shunt resistor that takes up energy returned by the motor.

The shunt resistor (internal or external) is protected against overload by hard- and software:

- Under normal conditions, a software monitoring protects the shunt resistor against overheating (the amplifier signals fault “overtemperature shunt resistor”).
- In case of a failure of the control system, the internal overload fuse protects the shunt resistor from overheating.

  Attention: If the overload fuse has blown, the DC-bus cannot be charged again after the next switch-on, see preceding section.

The output for the shunt resistor is short-circuit proof. In case of a short-circuit,

- shunt circuit and power circuit are switched off and
- the amplifier signals fault “overvoltage in the shunt circuit”.

In case of an earth fault at pin +R, the internal overload fuse-link blows, see above.

Operation of the device as brake regulator in which the motor mainly has to work against an external torque in braking operation requires an external shunt resistor dimensioned for the appropriate power, e. g. shunt resistor 021058010 (for KDV 2/400 to KDV 20/400) or 021060010 (only for KDV 12/400 and KDV 20/400) described in the accessories, see section 6.8 (page 74). The internal resistor is not sufficient for that.

In most cases, an external shunt resistor will be required for the servo amplifiers KDV 8/400 to KDV 20/400 in normal operation, as well, due to the high current.

The resistor value for the external shunt resistor can be taken from the table in section 3.2.1 (page 14). The load capability must be dimensioned according to the required braking power.

For connecting an external shunt resistor, the jumper for the internal resistor has to be removed. For further details, see section 5.11 (page 62).

4.4.2 DC-Bus

Additional KDV amplifiers without power supply unit can be supplied by the DC-bus voltage of the power supply unit.

4.5 Input Resolver, Option R1 (X11/R1)

9-pin SUB-D female connector X11 on the bottom side, assignment for devices equipped with option R1:

Pin	Assignment
1	0 Volt (connect in special cases, only)
2	0 Volt for motor temperature sensor, connected in parallel internally with the corresponding pin at Combicon connector X7
3	Sine – (S2)
4	Cosine + (S3)
5	Excitation + (R2)
6	Motor temperature sensor, connected in parallel internally with the corresponding pin at Combicon connector X7
7	Sine + (S4)
8	Cosine – (S1)
9	Excitation – (R1)
Housing	Connect cable shield via the SUB-D housing

The resolver input is designed for the standard servo drive-type single pole-pair resolvers with a transformation ratio of 1 : 0.5.

The motors with resolver supplied by Georgii Kobold are equipped with matching resolvers. Other resolvers can only be installed after consultation with Georgii Kobold. The adaptation of the control to other resolver signals can only be carried out by Georgii Kobold at extra charge.

For the differences between the types of motor position sensors (option Rx), please see section 3.4.2 (page 22). For connecting the resolver, see sections 5.13 and 5.13.1 (page 63).

If the motor does not have a temperature sensor, the pins must be jumpered at one of the connectors. Otherwise, the amplifier would constantly report a “motor overtemperature” fault. For connecting a motor temperature sensor, please see section 5.10 (page 61).

4.6 Input Sincos (Hiperface) Encoder, Option R2 (X11/R2)

9-pin SUB-D female connector X11 on the bottom side, assignment for devices equipped with option R2:

Pin	Assignment
1	–485
2	+8 V
3	Motor temperature sensor, connected in parallel internally with the corresponding pin at Combicon connector X7[1]
4	SIN
5	COS
6	+485
7	GND[1]
8	REFSIN
9	REFCOS
Housing	Connect cable shield via the SUB-D housing

[1] With Sincos (Hiperface) encoders, the motor temperature sensor should preferably be connected at Combicon connector X7.

The Sincos (Hiperface) encoder input is designed for Sincos (Hiperface) encoders produced by Stegmann. Motors with built-in Sincos (Hiperface) encoders are available from Georgii Kobold.

For the differences between the types of motor position sensors (option Rx), please see section 3.4.2 (page 22).

For connecting the Sincos (Hiperface) encoder see sections 5.13 and 5.13.2 (page 63).

If the motor does not have a temperature sensor, the pins must be jumpered at one of the connectors. Otherwise, the amplifier would constantly report a “motor overtemperature” fault.

For connecting the motor temperature sensor via pins 3 and 7, an additional shield of the cables to the motor temperature sensor is absolutely required so that sensitive analog signals SIN, REFSIN, COS and REFCOS are not affected by interferences. For connecting the motor temperature sensor, please see section 5.10 (page 61).

4.7 Input High-Resolution Incremental Encoder, Option R3 (X11/R3)

15-pin SUB-D female connector X11on the bottom side, assignment for devices equipped with option R3:

Pin	Assignment	
1	R+	reference signal
2	R–	
3	D+	Z1 track
4	D–	
5	–	
6	B+	incremental signals
7	B–	
8	C+	Z1 track
9	C–	
10	+5 V	supply voltage for incremental encoder
11	A+	incremental signals
12	A–	
13	+5 V	input measuring lead for regulating the supply voltage for the incremental encoder
14	0 V	
15	0 V	for supply voltage incremental encoder
Housing	Connect cable shield via the SUB-D housing	

The high-resolution incremental encoder input is designed for incremental encoder ERN 1185 or ERN 1387 produced by Heidenhain. Motors with built-in high-resolution incremental encoder are available from Georgii Kobold.

To keep the supply voltage of the encoder at constant 5 V, it is fed back to the amplifier via the measuring lead and the output voltage is re-adjusted in the range between 5 V and 8 V.

For the differences between the types of motor position sensors (option Rx), please see section 3.4.2 (page 22).

For connecting a high-resolution incremental encoder see sections 5.13 (page 63) and 5.13.3 (page 64).

With option R3, the motor temperature sensor must be connected to Combicon connector X7, see section 5.10 (page 61).

4.8 Input EnDat Encoder, Option R4 (X11/R4)

15-pin SUB-D female connector X11 on the bottom side, assignment for devices equipped with option R4:

Pin	Assignment	
1	–	
2	–	
3	$\overline{\text{CLOCK}}$	digital-serial cycle
4	CLOCK	
5	–	
6	B+	incremental signals
7	B–	
8	DATA	digital-serial data
9	$\overline{\text{DATA}}$	
10	+5 V	supply voltage for EnDat encoder
11	A+	incremental signals
12	A–	
13	+5 V	input measuring lead for regulating the supply voltage for the EnDat encoder
14	0 V	
15	0 V	for supply voltage EnDat encoder
Housing	Connect cable shield via the SUB-D housing	

The EnDat encoder input is designed for EnDat encoder EQN 1325 or ECN 1313 produced by Heidenhain. Motors with built-in EnDat encoder are available from Georgii Kobold.

To keep the supply voltage of the encoder at constant 5 V, it is fed back to the amplifier via the measuring lead and the output voltage is re-adjusted in the range between 5 V and 8 V.

For the differences between the types of motor position sensors (option Rx), please see section 3.4.2 (page 22).

For connecting an EnDat encoder see sections 5.13 (page 63) and 5.13.4 (page 64).

With option R4, the motor temperature sensor must be connected to Combicon connector X7, see section 5.10 (page 61).

4.9 Input Encoder Signals 5 V, Option L1 (X12/L1)

15-pin SUB-D female connector X12 at the bottom side, assignment for devices equipped with option L1:

Pin	Assignment
1	–
2	–
3	–
4	–
5	+5 V output power supply for external position sensor
6	Ua1+ (channel A +)
7	Ua2+ (channel B +)
8	Ua0+ (index pulse +)
9	–
10	–
11	–
12	0 V reference voltage for encoder signals and for power supply for external position sensor
13	Ua1– (channel A –)
14	Ua2– (channel B –)
15	Ua0– (index pulse –)
Housg.	Connect cable shield via the SUB-D housing

Input X12/L1 is equipped with an internal RS-422 compatible line receiver for 5 V push-pull signals. With it, the KDV servo amplifier can process encoder signals.

An incremental encoder can be supplied with current via pin 5 and 12. The maximally permissible current consumption is 200 mA. Attention: This 5 V output is not short-circuit proof.

For connecting the encoder signals, see section 5.14 (page 64). Details on input encoder signals can be found in section 3.4.4 (page 26).

4.10 Input Encoder Signals 24 V, Option L2 (X12/L2)

15-pin SUB-D female connector X12 on the bottom side, assignment for devices equipped with option L2:

Pin	Assignment
1	0 V — reference voltage for encoder signals and for input power supply for external position sensor (internally connected to pin 12 or pin 5)
2	+24 V
3	–
4	–
5	+24 V output power supply for external position encoder (the voltage supplied via pin 2)
6	Ua1 (channel A)
7	Ua2 (channel B)
8	Ua0 (index pulse)
9	–
10	–
11	–
12	0 V output power supply for external position sensor
13	–
14	–
15	–
Housing	Connect cable shield via the SUB-D housing

Input X12/L2 is equipped with an internal line receiver for single-ended 24 V signals. With it, the KDV servo amplifier can process encoder signals.

An incremental encoder must be supplied with externally provided 24 V DC. As this voltage is connected to pins 1 and 2 for reference, the incremental encoder can be supplied via these pins.

For connecting the encoder signals, see section 5.14 (page 64). Details on input encoder signals can be found in section 3.4.4 (page 26).

4.11 Output Encoder Signals 5 V, Option G1 (X13/G1)

15-pin SUB-D male connector X13 on the bottom side, assignment for devices equipped with option G1:

Pin	Assignment
1	–
2	–
3	–
4	–
5	–
6	Ua1+ (channel A +)
7	Ua2+ (channel B +)
8	Ua0+ (index pulse +)
9	–
10	–
11	–
12	0 V reference voltage for encoder signals
13	Ua1– (channel A –)
14	Ua2– (channel B –)
15	Ua0– (index pulse –)
Housing	Connect cable shield via the SUB-D housing

Output X13/G1 is equipped with an internal RS-422 compatible line receiver for 5 V push-pull signals. With it, the KDV servo amplifier can output encoder signals.

For connecting the encoder signals, see section 5.14 (page 64).

The output data of the encoder signals (number of pulses per revolution, index pulse function) depend on the motor position sensor used (option Rx). Please refer to section 3.4.3 (page 24).

4.12 Output Encoder Signals 24 V, Option G2 (X13/G2)

15-pin SUB-D connector X13 on the bottom side (available for devices with option G2):

Pin	Assignment
1	–
2	–
3	–
4	–
5	+24 V input power supply for output encoder signals
6	Ua1 (channel A)
7	Ua2 (channel B)
8	Ua0 (index pulse)
9	–
10	–
11	–
12	0 V reference voltage for encoder signals and for power supply pin 5
13	–
14	–
15	–
Housing	Connect cable shield via the SUB-D housing

Output X13/G2 is equipped with an internal line receiver for single-ended 24 V signals. With it, the KDV servo amplifier can output encoder signals.

The output is short-circuit proof.

For connecting the encoder signals, see section 5.14 (page 64).

The output data of the encoder signals (number of pulses per revolution, index pulse function) depend on the motor position sensor used (option Rx). Please refer to section 3.4.3 (page 24).

4.13 Interbus, Option F1 and F3 (X14/F1, X15/F1)

The Interbus interface is an optional interface. It can be designed as local bus (option F1) or as optical fiber local bus (option F3).

These operating instructions describe option F1 (local bus), only. For further information on option F3 (optical fiber local bus) see Operating Instructions 221074 “Communication Functions”.

The assignment of the two 15-pin SUB-D connectors X14/F1 and X15/F1 corresponds to the local bus specification of Phoenix Contact. A connection with further Interbus participants has to be carried out by means of local bus cables

according to the specifications of the Interbus installation manual IBS SYS INST UM.

X14/F1 Interbus In: 15-pin SUB-D male connector on the bottom side

Pin	Assignment
1	Uv (+9 V)
2	Uv (+9 V)
3	–
4	–
5	SLI1
6	CKI1
7	CRI1
8	DI1
9	GND
10	GND
11	/ResIn
12	SLO1
13	CKO1
14	CRO1
15	DO1
Housing	Connect cable shield via the SUB-D housing

X15/F1 Interbus-Out: 15-pin SUB-D female connector at the bottom side

Pin	Assignment
1	Uv (+9 V)
2	Uv (+9 V)
3	+5 V
4	RBST
5	SLI2
6	CKI2
7	CRI2
8	DI2
9	GND
10	GND
11	/LBRes
12	SLO2
13	CKO2
14	CRO2
15	DO2
Housing	Connect cable shield via the SUB-D housing

LEDs

Two LEDs are located on the bottom side of the KDV servo amplifiers. They display the state of the Interbus interface (option F1):

- green with designation “TR” is lit when parameter data are transmitted
- green with designation “+5V” is lit when the internal +5 are available

Coding Switches

do not exist for the Interbus interface.

4.14 CANopen, Option F2 (X14/F2, X15/F2)

The CANopen interface is installed in the KDV servo amplifiers as a module (option F2). It consists of two 9-pin SUB-D connectors located on the bottom side of the device.

Connection:

X15/F2 CAN IN: 9-pin SUB-D male connector at the top side
X14/F2 CAN OUT: 9-pin SUB-D female connector at the top side

Pin	Signal	Assignment
1	–	–
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN ground
4	–	–
5	CAN_SHLD	Shield connection for special applications (use only after consultation with Georgii Kobold)
6	CAN_GND	CAN ground (optional 2nd connection)
7	CAN_H	CAN_H bus line (dominant high)
8	–	–
9	–	–
Housg.	Shield	Connect cable shield via the SUB-D housing . Use metallized connector housings and install the cable shield over a large surface. After having plugged the connector housing on X15, X14, screw the connector housing onto the male or female SUB-D connector.

The two 9-pin SUB-D connectors are assigned according to CANopen CiA DR 303-1 (Cabling and Connector Pin Assignment). The signals correspond to standard ISO 11898. The bus connection is galvanically isolated from the CAN controller by means of optocouplers.

With the CAN IN and CAN OUT connectors, the device can be connected to the bus without T connectors and stub lines.

Bus Lines

Max. permissible bus lengths (total of all bus lengths):

Transmission rate kBit/s	1000	800	500	250	125	50	20	10
Max. bus length m	40	40	100	250	500	1000	1000	1000

Cables corresponding to the following specifications must be used:

- shielded
- twisted pair (CAN_L and CAN_H twisted with one another)
- wave impedance 120 Ω

- line resistance max. 80 Ω/km (at a length of 15 m) to max. 25 Ω/km (at a length of 1000 m)
- cable cross-section of at least 0.25 mm^2 (at a length of 15 m) to at least 0.75 mm^2 (at a length of 1000 m)

Coding Switches

- Coding switches S1, S2 for setting the Node-ID

  Setting of the Node-ID of the CANopen participant:

  These are 4 bit coding switches by means of which the Node-ID can be set in hexadecimal format.

  – S1 for the higher-valued 4 bits (S1 is located near the front panel)

  – S2 for the lower-valued 4 bits

  Permissible setting range 01 .. $7F_{hex}$

  Setting range 81_{hex} .. FF_{hex} is mapped on Node-ID 01_{hex} .. $7F_{hex}$. Settings 0_{hex} and 80_{hex} are not permissible; for these settings, Node-ID 1_{hex} has to be selected.

  The setting of these switches is read in

  – when the control supply voltage of the servo amplifier is switched on

  – NMT service Reset_Communication

  – NMT service Reset_Node

  The COB-ID assignment depends on the set Node-ID.

  A Node-ID may be given only once in the network.

- Coding switch S3 for setting the transmission rate

Switch position	0/8	1/9	2/A	3/B	4/C	5/D	6/E	7/F
Transmission rate kBit/s	10	20	50	125	250	500	800	1000

  The setting of these switches is read in

  – when the control supply voltage of the servo amplifier is switched on

  – NMT service Reset_Communication

  – NMT service Reset_Node

  All bus participants must be set to the same transmission rate.

LEDs

The state LEDs LD1 (red) and LD2 (green) of the CANopen module are located on the top side of Georgii Kobold amplifiers with CANopen interface.

These LEDs display the states of the CANopen interface (communication).

LD1 (green) displays the state in the NMT node state diagram:

- flashing approx. 2 Hz: pre-operational
- permanently on: operational

LD2 (red) displays the state of the send and receive monitoring of the CAN controller of the KDV servo amplifier:

- off: OK (CAN term: error active)
- flashing 0.5 Hz: warning (CAN term: error passive)

  sending or receiving faults have occurred frequently, device and bus run on
- on: fault (CAN term: bus off)

  sending or receiving faults have occurred too many times, device separated from the bus

For detailed information on option F2, CANopen interface, see Operating Instructions 221086 “CANopen Interface”.

4.15 Serial Interface COM1 for PC (X1)

9-pin SUB-D female connector X1 on the front panel:

Pin	Belegung
1	–
2	TxD (send data), RS 232C level
3	RxD (receive data), RS 232C level
4	–
5	GND
6	–
7	–
8	–
9	–
Housing	Connect cable shield via the SUB-D housing

A suitable cable, 3 m long, for connecting the serial interface to a PC is included in the scope of delivery of SPP Windows.

For connecting a PC, see section 5.16 (page 65).

4.16 Serial Interface COM2 (X2)

9-pin SUB-D female connector X2 on the front panel:

Pin	Assignment RS 232C	Assignment RS 485
1	–	–
2	TxD (send data)	do not use
3	RxD (receive data)	ADATA (+)
4	–	–
5	GND	GND
6	–	– [1]
7	–	–
8	do not use	BDATA (–)
9	–	–
Housing	Connect cable shield via the SUB-D housing	

[1] optional: +5 V

The standard assignment of this interface corresponds to RS 232C levels. If stated in the order, it can alternatively be equipped with drivers for RS 485 levels by Georgii Kobold. On request, pin 6 can be assigned with +5 V on request in order to supply external communication electronics.

4.17 Control Signals (X3)

13-pin Combicon connector X3 (RM 3.81) on the front panel:

Pin	Designation	Assignment
13	+24 V I/O	+24 V input supply digital I/O
12	0 V I/O	0 V supply digital I/O
11	Freigabe/Enable	digital input “Enable” (I 3.0) [1]
10	Störung/Fault	digital output “Fault”
9	BTB/Ready	potential-free relay contact (output) “Ready”
8	BTB/Ready	
7	+15 V	output auxiliary voltage +15 V
6	–15 V	output auxiliary voltage –15 V
5	Soll+	analog input setpoint+
4	Soll –	analog input setpoint –
3	Ist1	analog output actual value 1
2	Ist2	analog output actual value 2
1	0 V	0 V for actual value 1 and 2, also shield for setpoint cable

[1] Drive-specific functions and signals can be assigned to the individual inputs and outputs by means of machine data “Digital inputs signal” and “Digital outputs signal”. Alternatively, inputs as well as outputs can be used freely.

If input “Enable” does not act on a drive-specific function, it can be used freely as I 3.0.

The digital inputs and outputs of connectors X3, X4, and X5

- are opto-isolated and
- switch towards positive (PLC-compatible).

Plus is the externally supplied voltage “+24 V I/O” at X3, see section 4.17.1 (page 48).

For detailed information on the digital I/O see section 4.18 (page 51).

The analog I/O can be used for the definition of a setpoint or for the output of actual values as analog voltages. The inputs and outputs can be configured via the machine data.

Figure 4 shows the internal circuitry of connector X3 together with an example of a connection.

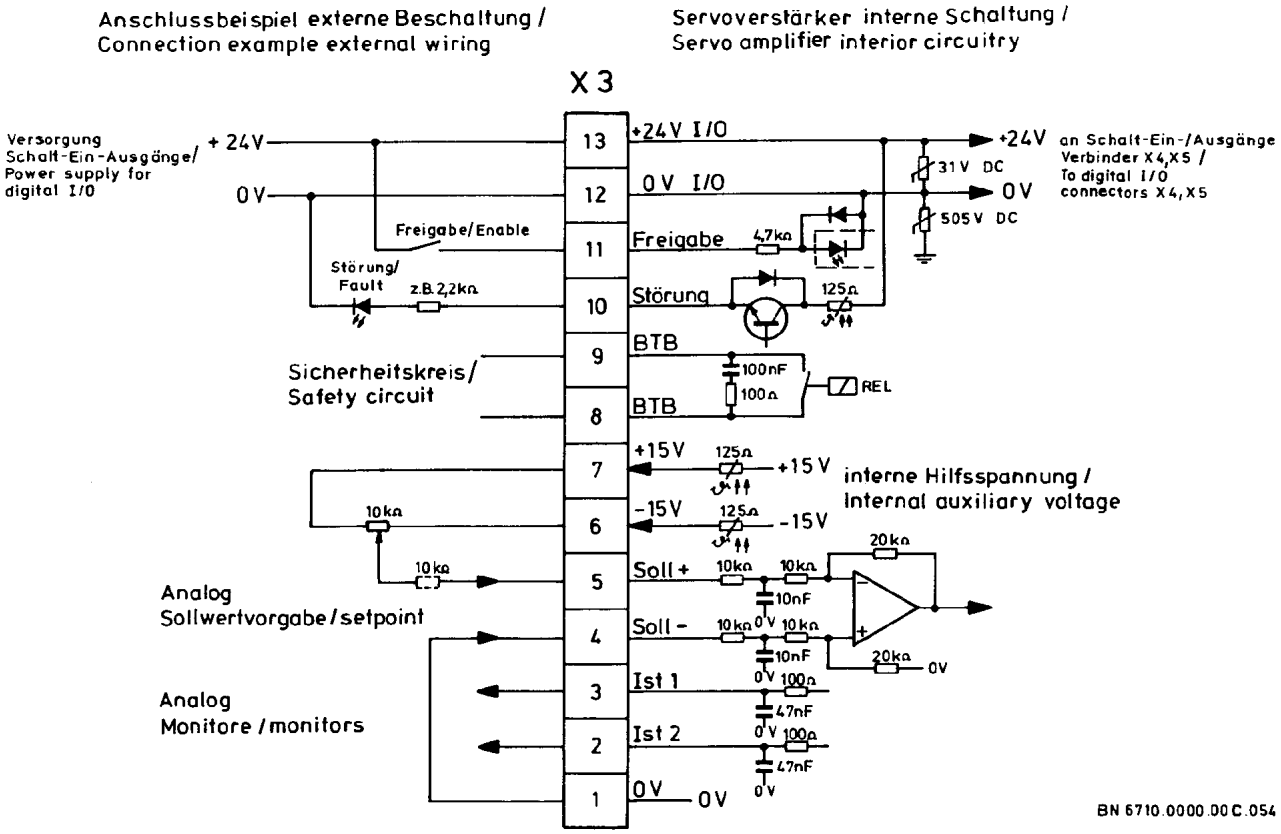


Figure 4: X3, Connection Example and Internal Circuitry

Section 3.2.5 (page 18) includes general information on the technical data of the inputs and outputs.

4.17.1 24 V Supply of Digital Inputs and Outputs

Through pins “+24 V I/O” and “0 V I/O”, the supply voltage (+18 V DC to +32 V DC, preferably +24 V DC) for the digital inputs and outputs and the connected consumers is applied from outside. This power supply may be

- an independent power supply or
- the power supply for the control supply voltage at X7.

  (Since in this case the 0 V of the control supply voltage are connected to the 0 V of the digital inputs and outputs, the opto-isolation of the digital inputs and outputs becomes ineffective).

When dimensioning the corresponding power supplies take into account the current consumption of the consumers connected to the digital inputs and outputs.

4.17.2 Digital Input “Frei/Enable”

At digital input “Frei/Enable”, the logic level for

- “1” leads to: “enabled”
- “0”: leads to “disabled”

The meaning of “enabled” (e. g. ready to accept a setpoint or start part program) and “disabled” can be set via the machine data (“Action enable inactive/active”).

Disabling via digital input “Frei/Enable” does not meet the safety requirements of the machine directive. If an emergency stop or safety shutdown is required, the safety requirements of the machine directive must be observed under any circumstances.

If input “Frei/Enable” is set to “no action/no action” via parameter “Action enable inactive / active”, this input can be used freely as I 3.0.

4.17.3 Digital Output “Störung/Fault”

The following applies to digital output “Störung/Fault”:

- when the servo amplifier works properly, the output is set to “0"
- in case of a fault, the output switches to “1”. At the same time, the fault is reported via LED “Störung/Fault”. The fault is stored (status “Fault”) and the cause of the fault can be read out in the PC as “Fault code”.

4.17.4 Relay Contact “BTB/Ready”

The readiness of the KDV servo amplifiers is reported by a potential-free relay contact via the two connections “BTB/Ready”.

The following applies to this output:

- If the servo amplifier is **not** in state “fault” **and** the DC-bus is within the permissible voltage range (above the shutdown threshold undervoltage and below the shutdown threshold overvoltage), the relay contact is **closed**.
- In all other cases (if the servo amplifier is in state “fault” **or** if the DC-bus is outside the permissible voltage range), the relay contact is **open**.

The values for the shutdown thresholds can be found in the table in section 3.2.1 (page 14), information on the load capability of this relay contact are listed in the table in section 3.2.5 (page 18).

4.17.5 Auxiliary Voltage Outputs +15 V, –15 V

The two auxiliary voltage outputs primarily serve for connecting an external setpoint potentiometer (10 kΩ). Please note that the setpoint input can handle only ±10 V. With an additional 10 kΩ resistor in the wiper circuit (drawn dash-lined in fig. 4), the full potentiometer control range can be used.

For loading the auxiliary voltages, the voltage drop at the PTCs (125 Ω) has to be considered; for maximum loading (10 mA), the voltage drop is approximately 1.25 V.

4.17.6 Analog Input Setpoint

The setpoint input with the connections Soll+ and Soll1– lead to a differential amplifier.

The input voltage range is ±10 V at 20 kΩ.

Machine data “Setpoint sources” can be used for selecting the function the setpoint input acts on:

- target velocity
- torque setpoint
- current limitation (Max-current-amount)

For connecting the setpoint source, see section 5.15 (page 64).

Information on selecting the desired setpoint source is contained in Operating Instructions 221071 “Functions and Parameters”, section “Machine Data Set-point Sources”. Options for scaling the values with a factor and for shifting zero with an offset are described there, as well.

4.17.7 Analog Outputs Actual1, Actual2

Actual values such as speed or current can be output as analog currents via outputs Ist1 and Ist2. Which signal is given at which output can be set with the machine data; for further details see Operating Instructions 221071 “Functions and Parameters”.

Connection “0 V” at SUB-D female connector X3 is the related zero point.

Technical specifications of the analog outputs:

Analog Output	Ist1	Ist2
Signal und scaling (delivery state)	actual speed 5 V = 8,200 r.p.m.	actual current 1.48 V = max. cont. current of the amplifier
Output voltage range	±5 V	
Resolution	1,248 steps, corresponding to 8 mV per step	
Output resistance R_A	100 Ω	
Band width	0.5 kHz	1 kHz
Voltage ripple	±5 mV, 8 kHz	±40 mV, 8 kHz

4.18 Digital Inputs and Outputs (X4, X5)

12-pin Combicon connector X4 (RM 3.81) on the front panel:

Pin	Designation	Assignment	Delivery State (Standard) [1]
1	I 1.0	digital input I 1.0	Clear fault
2	I 1.1	digital input I 1.1	Pre-pulse
3	I 1.2	digital input I 1.2	for free use
4	I 1.3	digital input I 1.3	for free use
5	I 1.4	digital input I 1.4	Enable saw
6	I 1.5	digital input I 1.5	Start running back
7	I 1.6	digital input I 1.6	Measure position
8	I 1.7	digital input I 1.7	for free use
9	O 1.0	digital output O 1.0	Overload
10	O 1.1	digital output O 1.1	Setpoint reached
11	O 1.2	digital output O1.2	Position monitoring
12	O 1.3	digital output O 1.3	Synchronized/Apply saw

[1] Drive-specific functions and signals can be assigned to the individual inputs and outputs by means of machine data “Digital inputs signal” and “Digital outputs signal”. Alternatively, inputs as well as outputs can be used freely.

12-pin Combicon connector X5 (RM 3.81) on the front panel:

Pin	Designation	Assignment[1]
1	I 2.0	digital input I 2.0
2	I 2.1	digital input I 2.1
3	I 2.2	digital input I 2.2
4	I 2.3	digital input I 2.3
5	I 2.4	digital input I 2.4
6	I 2.5	digital input I 2.5
7	I 2.6	digital input I 2.6
8	I 2.7	digital input I 2.7
9	O 2.0	digital output O 2.0
10	O 2.1	digital output O 2.1
11	O 2.2	digital output O 2.2
12	O 2.3	digital output O 2.3

[1] Drive-specific functions and signals can be assigned to the individual inputs and outputs by means of machine data “Digital inputs signal” and “Digital outputs signal”. Alternatively, inputs as well as outputs can be used freely.

Via digital inputs and outputs, the servo amplifier communicates with

- sensors in the machine (e. g. switches),
- actuators in the machine (e. g. relays),
- other controllers.

The digital inputs and outputs of connectors X3, X4, and X5

- are opto-isolated and
- switch towards positive (PLC-compatible).

  Plus is the externally supplied voltage “+24 V I/O” at X3, see section 4.17.1 (page 48).

The outputs are channeled via PTC resistors and thus short-circuit proof.

The logic levels are listed in the table in section 3.2.5 (page 18).

The delay times are

- 3 ms (typical) at the inputs,
- 1 ms (maximum) at inputs O1.0, O1.1, and O1.3,
- 3 ms (typical), sporadically up to 10 ms at output O1.2 and A2x.

If an output operates a miniature relay, the relay has to be

- connected with the 0 V of the control supply (“0 V I/O” at X3, see section 4.17.1, page 48) or

- shunted by a diode.

Figure 5 shows the internal circuitry of connectors X4 and X5 together with an example of a connection.

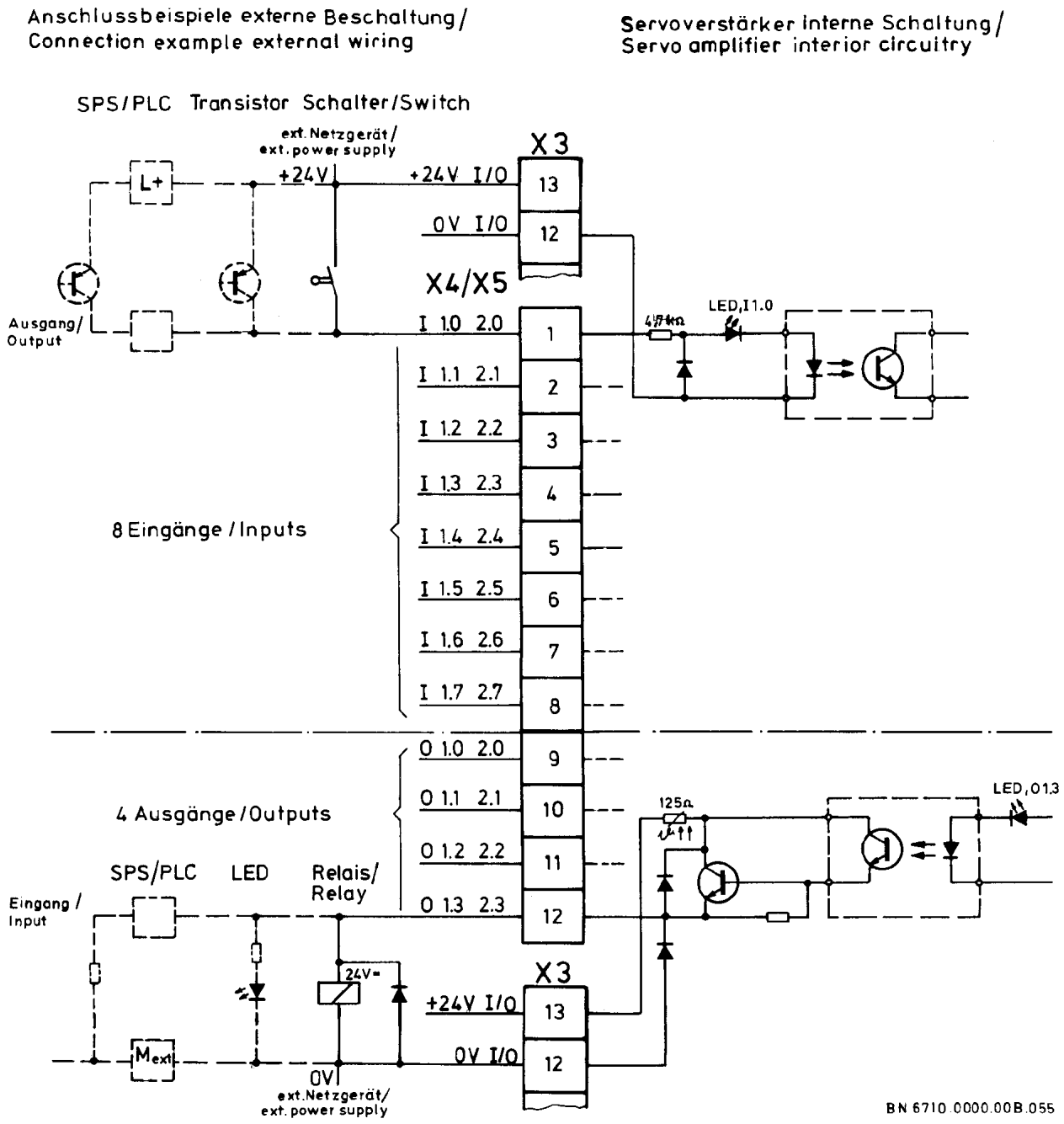


Figure 5: X4 and X5, Connection Example and Internal Circuitry

Section 3.2.5 (page 18) includes general information on the technical specifications of the inputs and outputs.

4.18.1 Digital Inputs I 1.0 to I 2.7

These inputs can be used freely. They can be queried by the part program or a higher-level controller via the communication interfaces.

Via the machine data, the inputs can be configured individually in a way that a drive-specific assignment is activated (e. g. “Limit switch +”). They then have a drive-specific function and cannot be used freely any longer.

The use of digital inputs for stopping the drive (e. g. as “limit switch”) does not meet the safety requirements of the machine directive. If an emergency stop or safety shutdown is required, the safety requirements of the machine directive must be observed under all circumstances.

4.18.2 Digital Outputs O 1.0 to O 1.3 and O 2.0 to O 2.3

These outputs can be used freely. They can be set or reset by the part program or a higher-level controller via the communication interfaces.

Via the machine data, the outputs can be configured individually in a way that a drive-specific assignment is activated (e. g. “Overload”). They then have a drive-specific function and cannot be used freely any longer.

If a brake shall be actuated via this output, the internal relay contact “Brake” has to be used.

5 Installation and Connection Instructions

This section deals with the installation of the servo amplifier in a control cabinet and the establishment of the electrical connections. Section 7 (page 77ff) describes how to proceed with the installation, information on the various connectors can be found in section 4 (page 28ff).

EMC

The values according to EN 55011, A and B (emission), and EN 50082-1 and -2 (immunity) are kept within the EMC limits if the KDV drive package is connected according to the instructions given herein. Only in this case, the CE marking is valid.

If the connection instructions are not observed, the facility in which the amplifier is operated has to be checked for compliance with the EMC limits at the customer's own responsibility.

The connectors must not be plugged or unplugged while under voltage. The current rush might destroy the contacts of the connector. The connectors are intended for fixed connection, only.

Figure 6 shows the connection instructions for connectors X6 to X9.

5.1 How to Open the Terminal Compartment

Proceed as follows to get to the terminal compartment:

- If the servo amplifier is already connected: disconnect the device from the mains and switch off the control supply voltage.
- Remove the cover of the terminal compartment after having loosened 2 screws on the upper side.

5.2 Installation in the Control Cabinet

Mounting in the control cabinet:

- At the top of the rear side, there are two straps with an opening for hooking into two M 4 bolts.
- At the bottom of the rear side, there is another strap with two slots for additional fixing, see figure 1 (page 16) and figure 2 (page 17).

For mounting on a bare metal mounting plate, see section 5.3.

To ensure that the air can flow through housing and heat sink, leave a clearance of

- at least 80 mm above and below the devices.

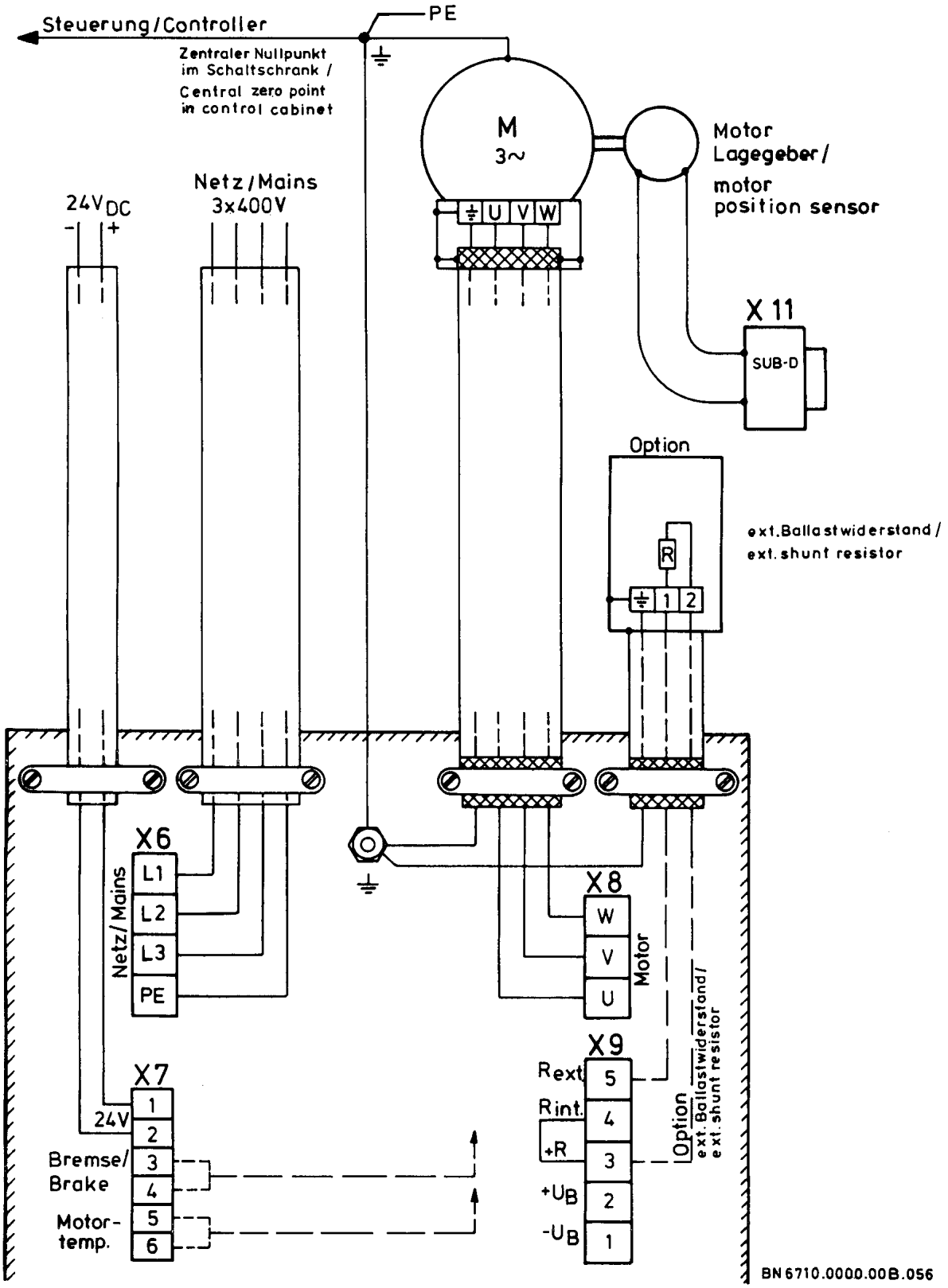


Figure 6: X6 to X9, Connection Directions

Several of those devices can be installed directly next to each other (without lateral gaps between the devices). Some millimeters of space facilitate installation and subsequent disassembly and assembly of individual devices.

If required, the mounting can be effected in a way that the heat sink protrudes from the control cabinet

- so that the heat loss does not heat up the control cabinet.

Suitable mounting accessories for KDV servo amplifiers KDV 2/400 to KDV 8/400 are described in section 6.2 (page 66). For the KDV servo amplifiers KDV 12/400 and KDV 20/400, corresponding accessories are being prepared.

5.3 Installation on a Mounting Plate

For the installation of the amplifier on a mounting plate, screw the amplifier

EMC

- with its bare metal housing
- onto a bare metal (e. g. zinc-plated) mounting plate.

For that, the mounting plate has to be

- earthed and therefore be
- connected to the central zero point of the control cabinet via the potential equalization cable.

5.4 Potential Equalization Cables

Potential equalization cables originate in the central zero point of the control cabinet (see figure 6, page 56). They

- connect different zero points with one another at low resistance and
- reduce equalizing currents on the cable shield.

Thus, they prevent electrical interferences.

The central zero point of the control cabinet is connected to the PE (protective earth) conductor. This connection avoids an endangering of operating and maintenance personnel in case of electrical faults.

Due to leakage currents of the built-in RFI filter, the potential equalization cable from amplifier to central zero point must (like the cable of the protective earth conductor) in accordance with EN 50178

- either be routed double (at PE bolt and mains connector) or
- have a cable cross-section of at least 10 mm^2 Cu (connect to PE bolt).

The other potential equalization cables must have a cross-section of at least 2.5 mm^2, or, if possible, 4 mm^2.

It is true: Drives can be run without potential equalization cables, without shielded cables and without compliance with safety regulations. However, this

- is contradictory to elementary safety requirements,
- violates statutory regulations,
- endangers the safety of persons,
- endangers the operational safety of the system,
- may lead to disturbances in the devices caused by other parts of the system,
- may lead to disturbances in other parts of the system caused by the devices.

5.5 Mains Connection

The mains is connected directly at the servo amplifier via Combicon connector X6 in the terminal compartment (see figure 6, page 56).

The cable to the servo amplifier must have

- a sufficient cross-section and
- a fixed connection (also applies to transformers, if installed).

Shield is not required.

The recommended line-side fuse and cable cross-sections are listed in the table in section 3.2.2 (page 15).

The mains connector must not be plugged or unplugged while under voltage. The current rush might destroy the contacts of the connector. The connectors are intended for fixed connection, only.

EMC The EMC limits for power supply systems in an industrial environment according to

- EN 55011, A (emission)
- EN 50082-1 (immunity)

are complied with without additional measures for mains connection.

The limits according to above standards are not exceeded with the filters installed in the servo amplifier if all connections are made in accordance with section 5.

For compliance with the stricter EMC limits for power supply systems in a residential, commercial and light industry environment according to

- EN 55011, A (emission)
- EN 50082-1 (immunity),

an additional line choke (triple choke) is required in the mains cable. To this line choke applies:

- a line choke according to section 6.4 (page 69) must be used
- the line choke has to be mounted near the servo amplifier
- the connecting cable between line choke and servo amplifier must not be longer than 1 m, shield is not required.

For compliance with these stricter limits, the additional use of the line choke is sufficient if all connections are carried out in accordance with section 5.

5.6 Motor Connection (Power)

The motor is connected at Combicon connector X8 in the terminal compartment by means of a 4-core (see figure 6, page 56):

- Connect the shield as described in the following section.
- Connect the machine earth to the central zero point of the control cabinet using a potential equalization cable with a cross-section of 10 mm^2.
- Connect the PE of the motor supply cable with the PE bolt in the terminal compartment
- Use the motor supply cable specified in the accessories, for further details see section 6.5 (page 70). The cable cross-section must be in accordance with the mains connection cable, for that, please refer to the table in section 3.2.2 (page 15).

The motor connector must not be plugged or unplugged while under voltage. The current rush might destroy the contacts of the connector. The connectors are intended for fixed connection, only.

The capacitive load caused by the motor supply cable is an additional load for the amplifier. This load is reduced by means of a choke.

For motor supply cable lengths of more than 5 m, a motor choke (triple choke) must be installed in the motor supply cable. For that, the following applies:

- A motor choke according to section 6.6 (page 71) must be used.
- The motor choke must be mounted near the servo amplifier.
- The connecting cable between motor choke and servo amplifier must not be longer than 1 m and must also be shielded.
- The shield must be connected according to section 5.7.

Note the maximum cable lengths in section 3.2.2 (page 15).

Under full load, the motor choke can reach an operating temperature of more than 100 °C. For an adequate heat dissipation, it must be screwed on a metal plate.

The 3 motor phases must be connected with the correct assignments, otherwise

- the motor blocks,
- the motor runs unsmoothly,
- the motor runs with a lower torque, or
- the motor runs uncontrolled at full speed.

This does not damage motor or amplifier but may endanger machine and commissioning personnel.

5.7 Shield Connection Motor Supply Cable

EMC

A cable clamp for the shielded motor supply cable is provided on the amplifier.

- Use this to establish a large-area connection between shield and housing by folding back the strands of the shield over the cable insulation and securing the strands using the cable clamp.
- Establish a large-area connection between shield and earth at the motor in a suitable manner.
- At that, avoid earthing the shield using twirled strands (pigtails) of the shield braiding at all places.

The shields of the motor supply cable must not be interrupted. If you have to install contactors, switches, or chokes in the motor supply cable,

- install them in a metal housing and
- connect a large area of the shield via the cable clamp, as described above.

The motor chokes supplied by Georgii Kobold are mounted in suitable housings and equipped with cable clamps.

5.8 Connection of Control Supply Voltage +24 V

The control supply voltage +24 V DC is connected at Combicon connector X7 in the terminal compartment (see figure 6, page 56).

The control supply voltage connector must not be plugged or unplugged while under voltage. The current rush might destroy the contacts of the connector. The connectors are intended for fixed connection, only.

For fault-free operation, the control supply voltage must meet the requirements specified in the “Technical Specifications” (see section 3.2, page 14). The control supply voltage should always be checked at maximum load. Please, remember that the load can change during operation, e. g. when the power circuit is enabled.

Information on the assignment of Combicon connector X7 and the control supply voltage can be found in sections 4.3 and 4.3.1 (page 30ff).

5.9 Connection of a Brake

A brake can be connected at Combicon connector X7. The internal relay contact connects +24 V DC from the control supply voltage to this output.

If the leads to the brake are routed in the motor supply cable or the encoder connection cable, these leads must have a shield of their own. Connect the shield at the KDV servo amplifier side, only.

For information on the assignment of Combicon connector X7 and the control supply voltage see sections 4.3 and 4.3.1 (page 30ff).

5.10 Connection of the Motor Temperature Sensor

The motor temperature sensor is connected

- usually at connector X11/R1 of the motor position sensor with option R1 (resolver) and R2 (Sincos (Hiperface) encoder). It can also be connected at Combicon connector X7; the corresponding pins of the two connectors are internally connected in parallel.
- at Combicon connector X7 with options R3 (high-resolution incremental encoder) and R4 (EnDat encoder).

If the leads to the motor temperature sensor are routed within the motor supply cable or the encoder connection cable, these leads must have a shield of their own. Connect the shield at the KDV amplifier side, only.

As temperature sensors can be used

- a thermo switch opening in the event of overheating or
- a PTC resistor increasing its value to more than 2 kΩ in the event of overheating.

If the motor does not have a temperature sensor, the pins have to be jumpered at one of the connectors. Otherwise, the amplifier would constantly signal a “motor overtemperature” fault.

When connecting a motor temperature sensor, you must ensure that it is not rendered ineffective by a jumper at the pins connected in parallel internally at the second connector (options R1 and R2).

Information on the assignment of Combicon connector X7 and the connection “motor temperature sensor” can be found in sections 4.3 and 4.3.3 (page 30ff).

5.11 External Shunt Resistor

If you would like to connect an external shunt resistor to Combicon connector X9 instead of an internal one,

- remove the jumper between R_{int} and +R,
- connect the external resistor to connections R_{ext} and +R,
- connect the PE of the shunt resistor cable to the corresponding PE bolt in the terminal compartment (see figure 6, page 56).

The external shunt resistor must be installed in an earthed metal housing

EMC

- in order to avoid emissions and
- as a protection against contact with live parts and the hot resistor.

Use e. g. shunt resistor 021058010 or 021060010 described in the accessories, see section 6.8 (page 74).

TIP

The external shunt resistor becomes very hot during operation. Therefore, it should be mounted outside the control cabinet. Pay attention to the degree of protection of the resistor!

Recommended cross-sections for the shunt resistor cables are listed in the table in section 3.2.2 (page 15).

A cable clamp for the shielded cable is provided on the amplifier.

- Use this to establish a large-area connection between shield and housing by folding back the strands of the shield over the cable insulation and securing the strands using the cable clamp.
- Establish the shield in the same way at the shunt resistor, as well.

?

Please note that the machine data have to be adapted when using an external shunt resistor. Detailed information can be found in Operating Instructions 221071 “Functions and Parameters”.

5.12 Shield Connection SUB-D Connectors

EMC

These explanations for shield and shield connection apply to the following sections.

Use only shielded cables.

The housings of the SUB-D connectors are metallized. There, a low-resistance connection between shield and housing is made via the strain relief.

With that, you achieve the necessary large-area earth connection for the shield and avoid earthing the shield using twirled strands (pigtails) of the shield braiding.

5.13 Connection of a Motor Position Sensor

The cable to the motor position sensor (options Rx) must be

- laid separately from the motor supply cable and
- connected exactly according to the instructions, otherwise
  - the motor blocks,
  - the motor runs unsmoothly,
  - the motor runs with a lower torque,
  - the motor runs uncontrolled at full speed, or
  - the servo amplifier reports a fault.

This does not damage motor or amplifier but may endanger machine and commissioning personnel.

When connecting the shield, please observe the following:

- Connect the shield of the encoder connection cable at the amplifier side, only, via the SUB-D housings.

  Thus, you achieve the necessary large-area earth connection of the shield and avoid earthing the shield using twirled strands (pigtails) of the shield braiding.
- Do not connect the shield at the motor end of the cable.

5.13.1 Connection of the Resolver

For connecting the resolver (option R1) to the corresponding connector X11/R1 use

- a shielded cable with twisted-pair leads for sine, cosine, and excitation,

  e. g. encoder connection cable 535254 specified in the accessories, for further details see section 6.7 (page 73).

5.13.2 Connection of the Sincos (Hiperface) Encoder

For connecting the Sincos (Hiperface) encoder (option R2) to the corresponding connector X11/R2 use

- a shielded cable with twisted-pair leads for the signals SIN/REFSIN, COS/REFCOS, and –485/+485,

  e. g. encoder connection cable 535270 specified in the accessories, for further details see section 6.7 (page 73).

5.13.3 Connection of the High-Resolution Incremental Encoder

For connecting the high-resolution incremental encoder (option R3) to the corresponding connector X11/R3 use

- a shielded cable with twisted-pair leads for the signals A+/A– and B+/B–.

  Also recommended are twisted-pair leads for the signals C+/C–, D+/D–, and R+/R–, e. g. encoder connection cable 535265 specified in the accessories, for further details see section 6.7 (page 73).

5.13.4 Connection of the EnDat Encoder

For connecting the EnDat encoder (option R4) to the corresponding connector X11/R4 use

- a shielded cable with twisted-pair leads for the signals A+/A–, B+/B–, CLOCK/$\overline{\text{CLOCK}}$, DATA/$\overline{\text{DATA}}$

  e. g. encoder connection cable 535265 specified in the accessories, for further details see section 6.7 (page 73).

5.14 Connection of Encoder Signals

When connecting incremental encoder signals to the corresponding connector X12 or X13 at the bottom side of the device, please observe:

- for the 5 Volt version (options G1, L1), choose twisted pairs for each channel
- use a shielded cable (e. g. encoder connection cable 535254 specified in the accessories, for further details see section 6.7, page 73ff)
- connect the shield at the amplifier to the earthed amplifier housing using the metallized SUB-D housing
- earth the shield additionally at the controller, follow the recommendations of the manufacturer of the controller regarding earthing and shield connection

Information on options Gx and Lx for encoder signals can be found in sections 3.4.3 and 3.4.4 (page 24ff). For details on the assignment of Combicon connectors X12 and X13 see sections 4.9 to 4.12 (page 37 ff).

5.15 Setpoint Connection

EMC When connecting setpoint sources to pins Soll+ and Soll– of Combicon connector X3, ensure proper earthing and shielding in order to avoid interferences at the amplifier input and the setpoint source.

Essential measure: shielding of the setpoint cable.

- Earth the shield at the setpoint source.

In particularly critical cases

- connect the shield at the amplifier side with the 0 V terminal (pin 1) of X3,
- install a potential equalization cable with a cross-section of at least 2.5 mm^2 in parallel with the setpoint cable in order to avoid sheath currents on the shield or
- establish only a high-frequency connection of the shield at the amplifier side using a low-induction capacitor (e. g. 10 nF, 400 V).

Always use the differential input to prevent zero loops, that is the coupling of interferences via input 0 V.

- Apply the setpoint at the Soll+ input.
- Connect input Soll– respectively with the neutral conductor as near as possible to the setpoint source.

Details on the assignment of Combicon connector X3 and the setpoint inputs can be found in sections 4.17 and 4.17.6 (page 47 ff).

5.16 PC Connection

A PC (personal computer) with command and commissioning software SPP Windows is required for commissioning the KDV servo amplifiers. For that, a serial interface of the PC has to be connected to the serial interface COM1 (connector X1) of the KDV servo amplifier.

For the connection between PC and COM1 of the KDV servo amplifier, a standard serial cable can be used in which the connectors with the same pin numbers are connected respectively. A suitable cable, 3 m long, for connecting the serial interface to a PC is included in the scope of delivery of the SPP Windows software.

For details on the assignment of interface COM1 (X1), see section 4.15 (page 45).

6 Accessories

6.1 Available Accessories and Order Numbers

Accessories	Order Number
Mounting set for KDV 2/400 to KDV 8/400 (for mounting with heat sink outside the control cabinet)	086230
Mounting set for KDV 12/400 and KDV 20/400 (for mounting with heat sink outside the control cabinet)	on request
Connector set for KDV servo amplifiers, standard version	099084010Z
Line choke (triple choke with terminals and housing, IP20)	038098010Z
Motor supply cable (power), up to 12 A, 4 cores, shield	535246*
Motor supply cable (power), up to 12 A, 4 cores, shield + 2 cores, shield	535262*
Motor supply cable (power), up to 16 A, 4 cores, shield	535271*
Motor supply cable (power), up to 16 A, 4 cores, shield + 2 cores, shield	535269*
Motor supply cable (power), up to 20 A, 4 cores, shield	535273*
Motor supply cable (power), up to 20 A, 4 cores, shield + 2 cores, shield	535276*
Motor choke (triple choke with terminals, shield connection clamps, and housing)	038097010Z
Encoder connection cable for resolver and incremental encoder signals, 8 cores, twisted-pair, shield	535254*
Encoder connection cable for Sincos (Hiperface) encoder, 8 cores, twisted-pair + 2 cores, shield	535270*
Encoder connection cable for high-res. incremental encoder and EnDat encoder, 8 cores, twisted-pair, shield + 8 cores, shield	535265*
External shunt resistor 68 Ω, 600 W (in housing, IP20) for KDV 2/400 –KDV 20/400	021058010
External shunt resistor, 33 Ω, 1000 W (in housing, IP20), only for KDV 12/400/ KDV 20/400	021060010
Command and commissioning software SPP Windows for PC with Windows 95/98/NT 4.0/2000/XP	290 007 Z
Drivers, DLL libraries, and example programs for PC with Windows 95/98/NT 4.0/2000/XP	on request

* also available as ready-assembled cables

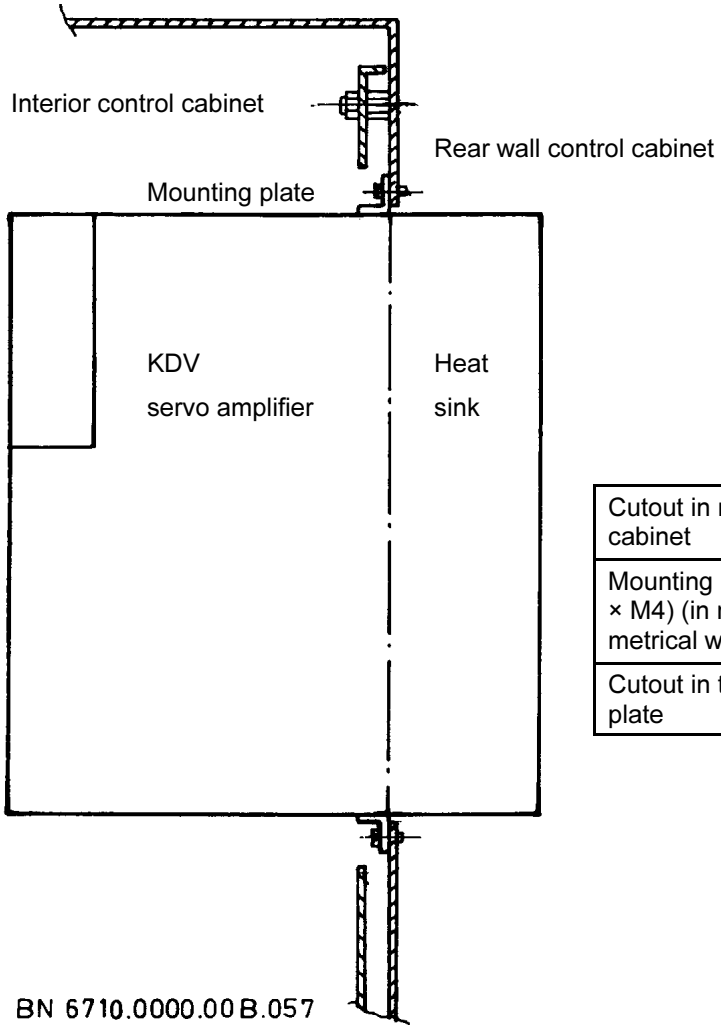
6.2 Mounting Set 086230

With mounting set 086230, the KDV servo amplifiers KDV 2/400 to KDV 8/400 can be mounted in a way that the heat sink is located outside the control cabinet so that the heat loss of the KDV servo amplifier does not heat up the control cabinet. For that, holes must be provided in the rear wall of the control cabinet and in the mounting plate.

If mounting set 086230 is ordered together with the KDV servo amplifier, it is installed at the servo amplifier by the manufacturer.

With mounting set 086230, mounting can be carried out in two different ways which are described in the following as “standard mounting” and “special mounting”.

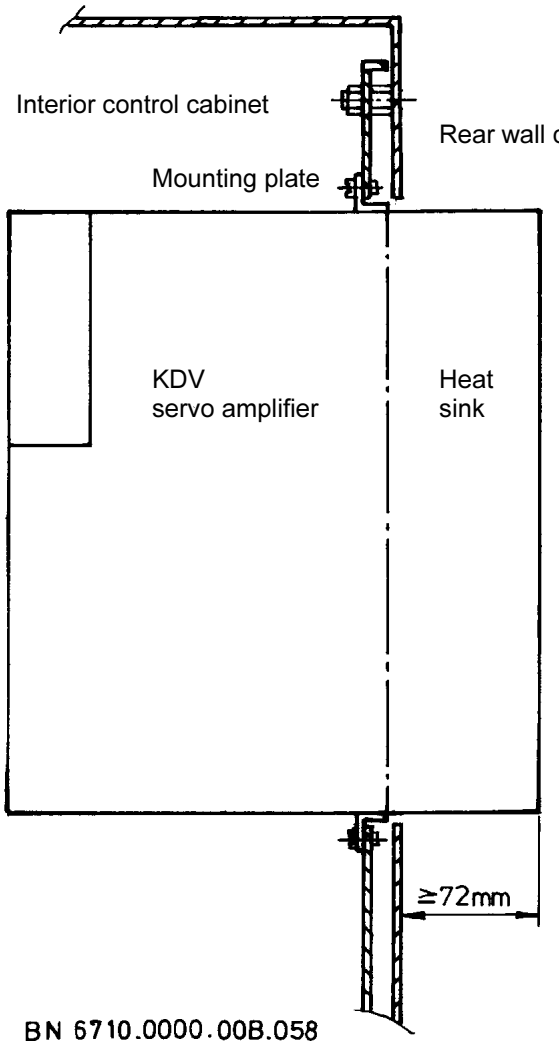
6.2.1 Standard Mounting on the Rear Wall of the Control Cabinet



Cutout in rear wall control cabinet	322 × 85 mm
Mounting hole distance (4 × M4) (in rear wall, symmetrical with the cutout)	346 × 60 mm
Cutout in the mounting plate	370 × 90 mm

Figure 7: Mounting Set 086230, Side View Standard Mounting

6.2.2 Special Mounting on Mounting Plate



Cutout in rear wall control cabinet	322 × 85 mm
Cutout in mounting plate	330 × 90 mm
Mounting hole distance (4 × M4) (in mounting plate, symmetrical with the cut-out)	346 × 60 mm

Figure 8: Mounting Set 086230, Side View Special Mounting

TIP For this special mounting, the two mounting brackets at the top and at the bottom of the KDV servo amplifier must be turned by 180° (compared to standard mounting) before the device can be mounted.

6.2.3 General Notes for Both Mounting Types

TIP For mounting, also see section 5.2 (page 55) as well as the mounting dimension on page 16.

Take appropriate action against dirt and humidity. Seal the slots between the opening in the rear wall of the control cabinet and the housing of the KDV servo amplifier.

6.3 Connector Set 099084010Z

Connector set 099084010Z contains the matching counterparts for all connectors of the standard KDV servo amplifiers, except for serial interfaces X1, X2. For the scope of the standard version see section 3.1 (page 13).

Connector sets are also available for other connectors. We also offer ready-assembled cables. If required, please contact Georgii Kobold.

6.4 Line Choke 038098010Z

A line choke (triple choke) is required for compliance with the stricter EMC limits in a residential, commercial and light industry environment (see section 5.5, page 58). This is line choke 038098010Z which is supplied ready for installation and connection in a sheet metal housing (IP20) with terminals.

Figure 9 shows the mounting dimensions, the connection and the designation of the terminals.

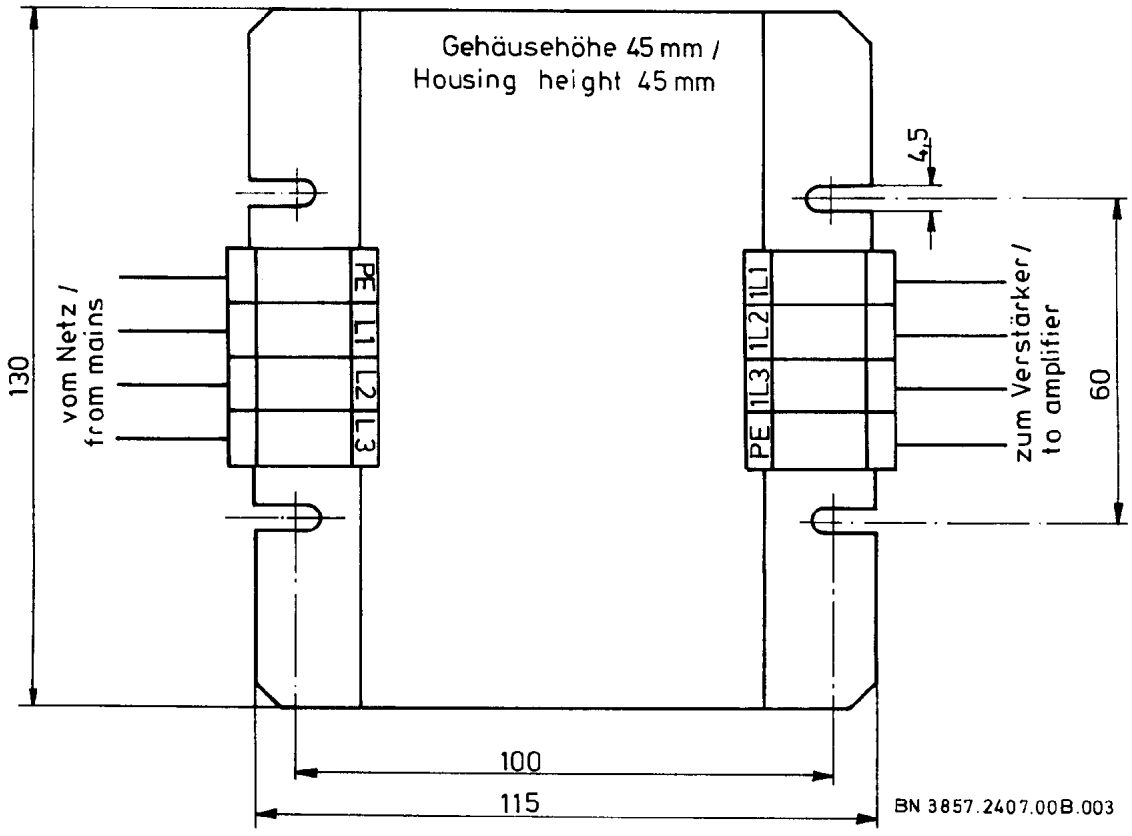


Figure 9: Line Choke

Technical Specifications:

Line Choke (Triple Choke)	**038098010Z**
Permissible current (crest value)	12 A
Inductance	3 × 0.9 mH
Design	3 single chokes in sheet metal housing, with terminals
Degree of protection	IP20
Dimensions (with straps and terminals)	125 × 130 × 45 mm (H × W × D)

For higher currents, line choke is available. If required, please contact Georgii Kobold.

6.5 Motor Supply Cables 535246, 535262, 535271, 535269, 535273, and 535276

As explained in section 5.6 (page 59), the motor must be connected with a shielded cable. Characteristics of the Georgii Kobold motor supply cables:

- 4-core, shielded (535246, 535271, 535273),
  - additionally 2-core, shielded (535262, 535269, 535276),
- cross-section
  - 1.5 mm^2 (535246, 535262),
  - 2.5 mm^2 (535271, 535269),
  - 4.0 mm^2 (535273, 535276),
- suitable as trailing cable.

The two additional cores of cables 535262, 535269, and 535276 can be used e.g. for connecting a brake (see section 4.3.2, page 31) or a motor temperature sensor (see section 4.3.3, page 31).

Technical Specifications:

Motor Supply Cable	**535246**	**535271**	**535273**	**535262**	**535269**	**535276**
Structure	4 cores, stranded with optimized length of twist			6 cores, stranded with optimized length of twist		
	1.5 mm^2	2.5 mm^2	4.0 mm^2	1.5 mm^2	2.5 mm^2	4.0 mm^2
Color coding	GN/YE, 3 × BK (1, 2, 3)			GN/YE, 3 × BK (U, VV, WWW); 2 × BK (BR1, BR2)		
Element shield	–			coverage approx. 90%		
Total shield	coverage approx. 85%					
Outer sheath	Polyurethane orange, low-adhesion, 11YM1 acc. to DIN VDE 0250 part 818, imprint black					
Outer diameter (approx)	9.4 mm	9.6 mm	13.5 mm	11.6 mm	12.5 mm	14.9 mm
Operating temperature	–50 to +90 °C (fixed installation) –30 to +80 °C (trailing use)					
Min. bending radius for single bending, fixed installation	47 mm	48 mm	67.5 mm	58 mm	62.5 mm	74.5 mm
Min. bending radius (cont. altern. bending, trailing use)	70.5 mm	72 mm	101.2 mm	87 mm	93.8 mm	111.7 mm

We also offer ready-assembled cables. If required, please contact Georgii Kobold.

6.6 Motor Choke 038097010Z

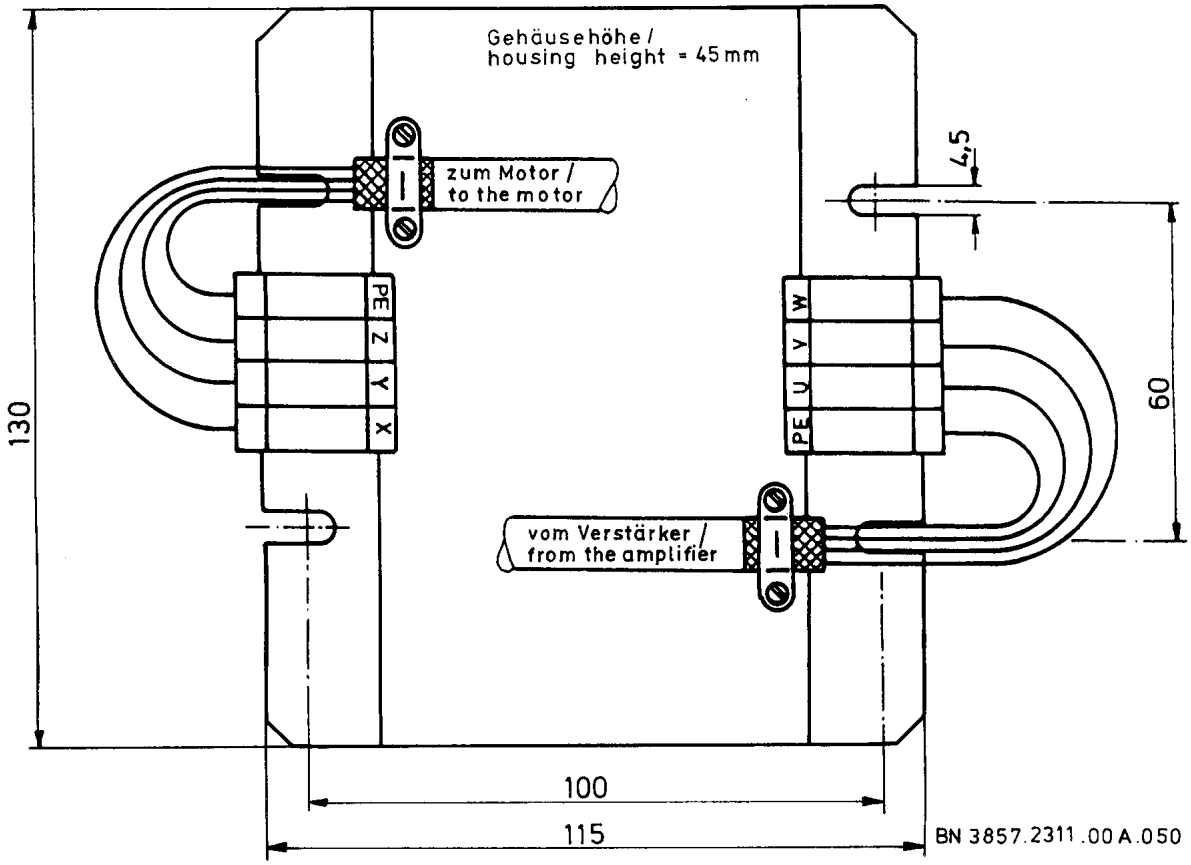
According to section 5.6 (page 59), a motor choke (triple choke) is required depending on the cable length. This is motor choke 038097010Z which is supplied ready for installation and connection in a zinc-plated sheet metal housing (IP20) with terminals and shield connection clamps.

Under full load, the motor choke can reach an operating temperature of more than 100° C. For an adequate heat dissipation, it must be screwed on a metal plate.

Figure 10 shows the mounting dimensions, the connection (note the connection of the shield), and the marking of the terminals.

Technical Specifications:

Motor Choke (Triple Choke)	038097010Z
Permissible current (crest value)	12 A
Inductance	3 × 0.9 mH
Design	3 single chokes in sheet metal housing, with terminals and shield connection clamps
Degree of protection	IP20
Dimensions (with straps and terminals)	125 × 130 × 45 mm (H × W × D)



Internal Choke	Input	Output
1	U	X
2	V	Y
3	W	Z

The pins PE are connected to each other and to the housing.

Figure 10: Motor Choke

6.7 Encoder Connection Cables 535254, 535270, and 535265

Encoder connection cable 535254 is suitable for connecting resolver and incremental encoder signals to X12/X13 (“input encoder signals”, “output encoder signals”). For connecting the Sincos (Hiperface) encoder, 535270 should be used. Encoder connection cable 535265 is suitable for connecting the high-resolution incremental encoder Heidenhain ERN 1185 or ERN 1387 and the EnDat encoder. Characteristics of the encoder connection cables 535254, 535270 and 535265 by Georgii Kobold:

- 8-core, twisted-pair, shielded (535254)
  - additionally 2-core (535270)
  - additionally 8-core, 4 of them with extra shield (535265),
- suitable as trailing cable

Technical Specifications:

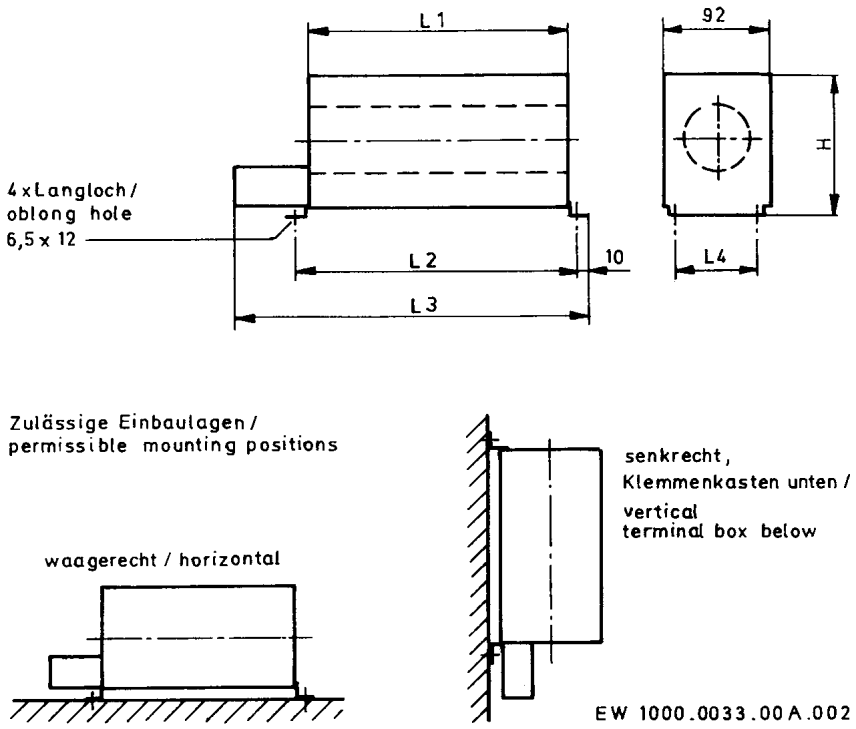
Encoder Connection Cable	535254	535270	535265
Structure	4 pairs of cores: 4 × 2 × 0.25 mm^2	4 pairs of cores and 2 single cores: 4 × 2 × 0.25 + 2 × 0.5 mm^2	4 pairs of cores and 8 single cores: 4 × 2 × 0.14 + 4 × 0.14 + 4 × 0.5 mm^2
Color coding	RD-BU, GY-PK, GN-YE, WH-BN	GN-BN, GY-PK, BU-VT, RD-BK, WH, BN	RD-BK, GY-PK, YE-VT, BN-GN; BU/BK, GN/BK, RD/BK, YE/BK; WH, BU, WH/GN, BN/GN
Conductor	Cu braiding, stranded according to DIN VDE 0295, class 6, or IEC 228, class 6		Cu, tin-coated
Total shield	coverage approx. 85%		CuSn 216 × 0.10 mm, braiding, coverage approx. 85%
Outer sheath	Polyurethane		
Outer diameter (approx.)	8.1 mm	8.5 mm	8.0 mm
Operating temperature – fixed installation – trailing use	 –50 to +90 °C –30 to +80 °C	 –50 to +90 °C –30 to +80 °C	 –40 to +80 °C –10 to +80 °C
Min. bending radius for single bending, fixed installation (approx.)	40.5 mm	42.5 mm	40 mm
Min. bending radius for cont. altern. bending, trailing use (approx.)	60.8 mm	63.8 mm	100 mm

We also offer ready-assembled cables. If required, please contact Georgii Kobold.

6.8 External Shunt Resistor 021058010 or 021060010

According to section 4.4.1 (page 32), an external shunt resistor might be required under certain circumstances. For that, you can use the external shunt resistor 021058010 or 021060010 by Georgii Kobold which is supplied ready for installation and connection in a zinc-plated sheet metal housing (IP20) with terminals and shield connection clamps. The shield is connected via the metallic PG gland.

Figure 11 shows the mounting dimensions and the permissible mounting positions of the external shunt resistor.



Dimensions	L1	L2	L3	L4	H
021058010	400 mm	426 mm	486 mm	64 mm	120 mm
021060010	615 mm	630 mm	646 mm	80 mm	120 mm

Figure 11: External Shunt Resistor, Dimensions, and Permissible Mounting Positions

Technical Specifications:

External Shunt Resistor	021058010	021060010
Load capability	600 W	1000 W
Resistance	68 Ω	33 Ω
Design	in sheet metal housing, with terminals	
Degree of protection	IP20	
Dimensions (with straps and terminals) (H × W × D)	120 × 486 × 92 mm	120 × 646 × 92 mm

Please note that the machine data have to be adapted when using an external shunt resistor. Detailed information can be found in Operating Instructions 221071 “Functions and Parameters”.

6.9 Command and Commissioning Software SPP Windows

The command and commissioning software SPP Windows supports the following functions:

- Operating
  - selecting operating modes
  - switching on and off
  - displaying actual values
  - displaying and modifying setpoints
- Commissioning
  - by means of operating functions and integrated oscilloscope
- Generating, modifying, saving, and transmitting of
  - machine data
  - part programs
  - part program variables

The SPP Windows software runs on IBM-compatible personal computers under Windows 95/98/NT 4.0/2000/XP.

Further information can be found in Operating Instructions 221102 “Command and Commissioning Software SPP Windows”.

Command and commissioning software SPP Windows for personal computers is required for the commissioning of the KDV servo drives. The software may also be obtained from Georgii Kobold at a later date.

6.10 Drivers, DLL Libraries, and Example Programs

Drivers and DLL libraries are available for the development of own application programs under Windows 95/98/NT 4.0/2000/XP.

Included in the scope of delivery are example programs with documented source code which demonstrates the access to the functions of the KDV servo amplifier via serial interface COM1 of the amplifier and can be used as a basis for own developments.

Also included in the scope of delivery:

- modules for various programming languages (C, Basic, Pascal, others on request)
- libraries for access to the functions of the digital servo amplifiers as Win32-DLLs
- interface drivers for the connection via serial interface, fieldbus, TCP/IP (e. g. Ethernet), and DriveServer (OPC)

7 Commissioning

This section describes the commissioning step by step. Knowledge of the connection directions (section 5, page 55ff) is assumed!

7.1 How to Proceed for Commissioning

For the first commissioning, please proceed according to the steps described here in order to prevent damage to the devices or the driven machines and yet become acquainted with the device quickly.

In each case, the next step must not be carried out unless the previous one has been completed successfully.

Connections may only be established or disconnected when the devices are switched off.

For commissioning the servo amplifier, the motor should not be mounted at the machine yet but fixed properly otherwise. It is essential to ensure that possible commissioning faults, such as uncontrolled running of the motor at maximum speed or excessive acceleration, cannot lead to an endangering of persons or damages to property.

The following steps must be carried out:

- Check equipment, accessories, operating instructions
  - check the equipment of the device you wish to put into operation on the basis of sections 3.1 (page 13) and 3.4 (page 21).
  - gain an overview of the accessories to be used on the basis of section 6 (page 66).

Of these accessories, you require a PC with the command and commissioning software SPP Windows as commissioning aid. If you do not have this aid, you cannot carry out the commissioning.

  - check the operating instructions for completeness under consideration of the included equipment and accessories on the basis of section 1.1 (page 8).

- Learn the basics of mounting and connecting the device. For that, study at least the following sections of these operating instructions:
  - Safety Instructions (section 2, page 10),
  - Technical Specifications (section 3.2, page 14),
  - Design (section 3.3, page 19),
  - Assignment of the Connectors (section 4, page 28), and
  - Installation and Connection Directions (section 5, page 55).

- Learn the basics of the functions of the device. For information on that see 221072 “Functions and Parameters”.

Each of the following steps is dealt with in a separate section:

- Connecting the Control Supply Voltage, First Test
- Connecting the Motor Position Sensor (resolver, Sincos (Hiperface) encoder, high-resolution incremental encoder, EnDat encoder)
- Connecting Motor and Mains
- Setting the Machine Data
- Connecting Other Peripheral Devices
- Writing and Testing Part Programs

7.2 Connecting the Control Supply Voltage, First Test

Connect the control supply voltage +24 V DC at connector X7 and switch it on.

Check the state of the LEDs after an initialization phase of some seconds:

- LED „U_{Steuer}” must be lit (control supply voltage applied)
- LED “Störung/Fault” must be lit (motor position sensor not connected) .
- LED “Bereit/Ready” must be flashing (power circuit not ready yet).
- The two other LEDs must be off
- LED O 1.x and O 2.x may be lit or off (the corresponding digital output indicates a certain state)
- all other LEDs must be off.

For further information on the meaning of the individual LEDs, please refer to section 3.3.2 (page 20).

For further commissioning, you require a PC with the command and commissioning software SPP Windows as commissioning aid. Please refer to Operating Instructions 221102 “SPP Windows Command and Commissioning Software”. Connect the serial interface of the PC via the cable supplied with SPP Windows with connector X1 of the KDV servo amplifier.

Use the SPP Windows software to establish a connection to the servo amplifier and have the type of fault reported at the KDV servo amplifier displayed by the corresponding LED.

The connection is established automatically during the program start or via menu item “Communication/Connect”. A fault should be displayed in the device control and the fault window. The fault is described more detailed in the fault window and the status line.

As a motor position sensor has not been connected yet, it must either be an “encoder fault” or a “resolver fault”.

When the SPP Windows command and commissioning software is working together with the KDV servo amplifier, you can continue with the next steps of commissioning.

7.3 Connecting the Motor Position Sensor

Four types of motor position sensors can be used. First of all, check which version of the KDV servo amplifiers you are using:

- R1 for connecting a resolver,
- R2 for connecting a Sincos (Hiperface) encoder (single- or multi-turn),
- R3 for connecting a high-resolution incremental encoder,
- R4 for connecting an EnDat encoder (single- or multi-turn).

Then, check whether or not the motor position sensor installed in the motor matches using your documents or the nameplate. In case of a motor in special design, please ensure also that the signal assignment of the encoder connection cable matches the signal assignment of the encoder connector at the motor. If the equipment of the KDV servo amplifier or the signal assignment does not match the connected encoder, parts of the servo amplifier or the encoder may be destroyed.

When connecting, please proceed in the following order:

- switch off the control supply voltage
- connect the position sensor to connector X11 of the KDV servo amplifier (for information on the connection see section 5.13, page 63ff).

When you switch on the control supply voltage again, a fault should not be indicated (LED “Störung/Fault” is off, LED “Bereit/Ready” flashes). Should a fault still be indicated, first use the SPP Windows software to check what kind of fault it is. In case of an “encoder fault” or a “resolver fault”, check the connection.

Then, check the function of the encoder by

- turning the motor shaft manually
- checking the change of the “actual position” with the SPP Windows software.

The “actual position” has to increase or decrease (this depends on the direction of rotation) by approximately 65,000 (exactly: 65,535). Other values indicate that the wiring is faulty or that a conversion factor has already been stored in the KDV servo amplifier via machine data parameter “Position factor”.

To continue connecting, switch off the control supply voltage.

7.4 Connecting the Motor (Power)

Proceed as follows (for information on the connection of motor and motor choke see section 5.6, page 59):

- connect the motor supply cable to the motor (shield, PE, motor phases U, V, W),
- connect the machine earth to the central zero point of the control cabinet,
- lay the motor supply cable separate from the encoder connection cable.

For motor supply cables of a length of more than 5 m, a motor choke is required (see section 6.6, page 71).

- Install the motor choke near the amplifier and connect the motor supply cable (shield, PE, motor phases U, V, W).
- Connect shield and leads of the connection cable to the amplifier in the same way (shielded, max. 1 m long).

Connection to the amplifier:

- Connect the motor supply cable to Combicon connector X8 of the KDV servo amplifier (shield, PE, motor phases U, V, W). Pay attention to the correct assignment of the motor phases. Connect the cable shield to the cable clamp and the PE line to the PE bolt in the terminal compartment.

7.5 Connecting the Amplifier to the Mains

Connect the device to the central zero point of the control cabinet using a suitable potential equalization cable (see section 5.4, page 57).

Connect the amplifier to the mains as follows (for information on the connection see section 5.5, page 58):

For an installation of the device in a residential, commercial, and light industry environment, the following is required for compliance with the EMC limits:

- an additional line choke (see section 6.4, page 69).
  - Install this line choke near the amplifier and connect the supply cable to the inputs of the line choke.
  - Connect the connection cable to the amplifier at the outputs of the line choke.
  - Shield is not required.

Connection at the amplifier (Combicon connector X6):

- Connect the supply cable to Combicon connector X6 of the KDV servo amplifier (shielding is not required).

- Make sure that at Combicon connector X9 either the internal shunt resistor is activated by a jumper at $+R/R_{int}$ or that an external shunt resistor is connected to $+R/R_{ext}$.

7.6 Setting the Machine Data

For setting the machine data, follow the instructions of Operating Instructions 221071 “Functions and Parameters”.

7.7 Connecting Other Peripheral Devices

After the drive system has been put into operation in accordance with the above sections, further peripheral devices can be connected to the KDV servo amplifier.

When connecting further peripheral devices, ensure that the voltage supply of the control supply voltage is not overloaded and that 24 volts are still available for the basic device.

When connecting other peripheral devices, it is also important to make sure that the cables are shielded and that interferences at inputs and outputs are sufficiently suppressed so that there are no interferences in the drive system.

7.8 Writing and Testing Part Programs

Part programs should not be written and tested until all above-mentioned steps have been carried out. Part programs cannot run correctly unless the drive system is running in command mode and the machine data have been set correctly. Further information can be found in Operating Instructions 221117E “Part Program”.

Appendix

Appendix A EC Declaration of Conformity

GEORGII KOBOLD
GmbH & Co. KG

Total Quality

Form

Certificate of Conformity

Certificate of Conformity

In the sense of EC-Directives:

Here with we confirm, that the products

Product	GEORGII KOBOLD
Type	KDV X...
Series	Digital Servo-Amplifier KDV

corresponds to the EC directives, standards and regulations below and are designed for installation in a machine. According to EC directive „Machines", commissioning is prohibited until it has been ascertained that the machine in which the above product is installed meets the provisions of the EC directive.

The requirements of the EC directives, standards and regulations will only be met if the directions for installation and cabling given in the operating instructions are observed.

Operating instructions 221072E

The products are developed, constructed and produced in accordance to EC-Directives 89/336/EEC, amended by 91/263/ECC, 92/31/ECC, 93/68/ECC (EMC-Directive) and 72/23/ECC, amended by 93/68/ECC (Low Voltage Directive) of exclusive responsibility of

company **GEORGII KOBOLD** **GmbH & Co. KG**

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The signers are: Krychevskyy - application
Schramm - technical director

The following harmonized standards are used:

- [X] EN 55011:1991, Classes A and B, (DIN VDE 0875, Part 11)
- [X] DIN EN 50082-1:1994
- [X] DIN EN 50082-2:1995
- [X] DIN EN 50178:1994
- [ ]

A technical documentation is completely available.

An operation instruction for the machinery is available.

- [X] in the original version
- [ ] in the native language of the user .....

Doc.-No.:	Edition	made/changed: Krychevskyy	release/checked: Schramm	Page
Q8.2-4.52.	2	Date/Signum 27. Mai 2005	Date/Signum 27. Mai 2005	1 of 1

Appendix B Terms of Warranty

GEORGII KOBOLD GmbH & Co. KG warrants that the device is free of material and production defects. In quality assurance, measured values are recorded in the final inspection and testing.

The warranty period begins with delivery. It lasts for 12 months.

Delivery is based on the “General Terms of Delivery for Products and Services of the Electrical Industry” (green terms of ZVEI, German electrical and electronic manufacturers' association). In case of a defect as to quality the device is to be returned. It is repaired in the works of the manufacturer free of charge or replaced, at our discretion.

No other claims for damage which has not occurred in our device can be accepted. No claims for indirect damage resulting from a malfunction of or defect in our device may be put forward.

Appendix C Firmware Versions Relating to the Connection

This section summarizes notes on changes in the firmware with references to the corresponding sections in the text. The latest modifications are listed first.

If you have worked with a KDV servo amplifier with an older firmware, before and have obtained a new KDV servo amplifier with a new firmware, please observe all sections referring to changes between the two version numbers.

This appendix lists all firmware changes regarding the connection described in these operating instructions. For further firmware modifications, also see the respective appendices of the other operating instructions for KDV servo amplifiers.

Changes from V 7.2 on:

- Flying shear: digital output “synchronous point”
- Input “fast position measurement with stop”
- Output “reference existing”
- Status of “BTB contact” as “Betriebsbereit/Ready (BTB)” can be assigned to digital outputs

Changes from V 7.0 on:

- EnDat motor position sensors (EnDat 2.1) are supported (option R4).

Changes from V 6.0 on:

- DriveTerminal no longer supported (operation and commissioning via PC, only)

Changes from V 5.5 on:

- Earth-fault detection

Changes from V 5.4d on:

- Support for motors with more than 7000 r.p.m. speed

Changes from V 5.4 on:

- E 1.7 “Position spindle” for function “spindle positioning”

Changes from V 5.1 on:

- Drive-specific functions of digital outputs 1.x and 2.x can be configured freely

Changes from V 4.7 on:

- Support for additional high-resolution motor position sensor; also see Operating Instructions 221071E “Functions and Parameters”
- Support for devices with 12 A, 20 A

Changes from V 4.5 on:

- I 1.5 “Start reverse running”, O 1.3 “Waste” in operating mode “Flying Shear”

Changes from V 4.4 on:

- O 1.3 „Synchronized” in operating modes electronic gearing, flying shear

Changes from V 4.0 on:

- Support for Sincos (Hiperface) encoders (single- and multi-turn, option R2)

Changes from V 3.5 on:

- Analog input setpoint at X3 may also be used for current limiting; also see Operating Instructions 221071E “Functions and Parameters”.
  - Short description see section 4.17.6 (page 50) of these Operating Instructions
- Assignment of analog outputs Ist1, Ist2 at X3 can now be selected; also see Operating Instructions 221071E “Functions and Parameters”
  - Short description see section 4.17.7 (page 50) of these Operating Instructions

Changes from V 3.3b on:

- Monitoring for leaving target position implemented; also see Operating Instructions 221071E “Functions and Parameters”
  - section 4.18, table on page 51: O 1.2 at X4 assigned drive-specifically with function “Position monitoring”

Changes from V 3.2 on:

- Function for measuring position via input implemented; also see Operating Instructions 221071E “Functions and Parameters”
  - section 4.18, table on page 51: I 1.6 at X4 assigned drive-specifically with function “Measure position”.

Appendix D Hardware Versions

This section summarizes notes on changes in the hardware with references to the corresponding sections in the text. The latest modifications are listed first.

The character identifying the hardware version is stated on the nameplate behind the serial number (SN).

Changes in version I compared with G and H:

- Extended memory (256 kB Ram)

Changes in version G compared with F:

- Extended overvoltage protection in the DC-bus (against overvoltage due to frequent switch-on and switch-off within a short period of time)

Changes in version F compared with E and D:

- Short-circuit protection auxiliary voltage ±15 V (X3, pins 6, 7) via PTCs 125 Ω new.
  - Table of technical specifications (page 14) adapted accordingly.
  - Figure 4 to X3 (page 48), internal circuit pin 6, 7 changed.

Changes in version D compared with C, B, A:

- Additional PE terminal for mains connection (X6 extended), PE bolt M 6 instead of M 4.
  - Section 4.1 (page 28): PE terminal instead of bolt.
  - Section 4.2 (page 29): PE bolt M 6 instead of M 4.
  - Figure 6 (page 56): connecting instructions for PE changed.
  - Section 5.4 (page 57): PE bolt M 6 instead of M 4.
- Tolerance for mains connection voltage 3 × 400 V AC now ±10% (instead of +10%, min. mains connection voltage 3 × 230 V AC), shutdown threshold bus voltage 480/380 V instead of 60 V.
  - Table of technical specifications (page 14) adapted accordingly.
  - Section 4.17.4 (page 49) and section 3.3.2, table on page 20: Values shutdown threshold bus voltage adapted accordingly.