

# M A N U A L

## **Digitale three-phase Servo Amplifier DS-400.2 for EC/AC-Servo Motors**



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## 2 Basic information

### 2.1 History

Version	Modification	Date
04/2013 - V04	new English version	13.06.2013
04/2013 - V05	drawing news, fault list	Nov 2013
04/2019 - V01	CAN BUS data / Inrush Limiter updated	April 2019

### 2.2 Further UNITEK products

Digital servo-amplifiers for small power values	>>>	UNITEK	DS205, DS403, DPCxx
Analog three-phase servo-amplifiers TVD3, TVD6, AS	>>>	UNITEK	Series
Analog dc servo-amplifiers TV3, TV6, TVQ6	>>>	UNITEK	Series
Thyristor current converters 1Q, 4Q, Servo	>>>	UNITEK	Series Classic 200W to 800kW
DC and ac servo-amplifiers for battery operation A2, A3, D3			Series BAMO
Analog and digital			Series BAMOBIL Series BAMOCAR

### 2.3 Engineering instructions (MANUAL)

1.	MANUAL	DS xxx	Hardware
2.	MANUAL	NDrive2	Software
3.	MANUAL	DS, DPC	Commissioning - Troubleshooting

**Use all three MANUALs for the engineering, the installation, and the commissioning!**

CD (UNITEK-DOKU-SOFT) supplied with the delivery of the units.

Online: [www.unitek-online.eu](http://www.unitek-online.eu)




The hardware MANUAL comprises warning and safety advices, explanations of standards, mechanical and electrical installation advices.

The MANUAL must be available for all persons who are concerned with the unit.

## 2.4 Validity

Hardware state:	
Firmware state:	

## 2.5 Designations and symbols

<b>Unit</b>	DS xxx (BDM)
<b>User:</b>	Manufacturers or operators of machines or installations in the industrial sector (B2B, secondary environment)
<b>Manufacturer:</b>	UNITEK Industrie Elektronik GmbH
<b>Dealer:</b>	
	<b>Caution - Danger to life!</b> <b>High voltage</b>
	<b>Warning!</b> <b>Important</b>
	<b>Dangerous electric fields</b>

## 2.6 Scope of delivery

Divece DS405-x, DS412-x or DS420-x  
documentation DS400, NDrive, CD Unitek-Docu-Soft  
Connector plug Phönix 10pin. and 11pin.  
D-connector X7 15pin., X8 9pin  
In the shipping container

### Not in the delivery

D-connectorr X9, X10 9pin.

## 2.7 General product information

The digital 3-phase current servo amplifiers DS/DPC xxx as component (BDM) in combination with the synchronous servo motor (EC motor) or the asynchronous servo motor (ac motor) provide a drive solution (PDS) free of maintenance and with a wide dynamic control range.

The drive displays the well-known good control characteristics of dc drives without the disadvantages of the carbon brushes' wear and the commutation limits.

For synchronous motors the generated heat in the motor only occurs in the stator, the rotor remains cold. The motors can easily be cooled via the surface (efficiency up to 96%).

The physical characteristics correspond to those of dc motors, i.e., the current is proportional to the torque and the voltage is proportional to the speed. The speed is steadily controlled up to the current limit (max. torque. In case of an overload the speed drops and the current remains constant.

The speed/torque characteristic is rectangular.

Current, speed, and position are precisely measured. The field frequency is not controllable, it is automatically adjusted.

The rotor moment of inertia is notably smaller and the limiting performance is higher which results in up to 5 times higher acceleration values.

Asynchronous servo motors are less expensive and do not require solenoids in the rotor.

The control characteristics are very good due to the space-vector control, the performance and the efficiency are lower. Due to the heated rotor it is necessary to use a motor fan for large control ranges.

The EC and ac motors have the protection rating IP65.

The motor voltages and the motor currents are sinusoidal. A maximum motor efficiency is achieved by means of a compensating current control.

DS/DPCxx drives can be used as single-axis position amplifiers or torque or speed amplifiers.

The position and speed actual value is generated in the encoder unit (resolver, incremental, or SIN/COS encoder). The encoder pulses are emitted from the amplifier for a superordinate PLC/CNC control.

The control circuits of current, speed, and position are PID controllers which are easy to program. They can be programmed by means of the PC Software NDrive2.

The communication with superordinate controls is effected by means of BUS systems (standard CAN-BUS, RS232) or by analogue interfaces.

### **Note:**

For dc, ac, or EC servo amplifiers which are supplied by a bus circuit, it must be checked that the energy is fed back into the bus during brake operation (lift drives, winding machines, great centrifugal masses).

An internal or possibly external ballast resistor is necessary.

## 2.8 Application/build/features

Application in machines and installations for all types of industrial use with a drive power of 13.5 kW under hard application conditions especially as 4Q-servo-drive

- highly dynamic acceleration and braking cycles
- a wide control range
- a high efficiency
- small motor dimensions
- a uniform, accurate and smooth running

For speed or torque control or combined speed/torque control incorporated within or independent of position control loops.

### Suitable for:

Machines and installations

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

### Build:

- Robust units for switch cabinet mounting, steel housing, according to the VDE, DIN and EC regulations, protection rating IP20, VGB4
- Standard digital control electronics
- Power electronics of 5 and 20 A (S1 operation)
- Power input voltage 30V~ to 480 V~ (40 V= to 500 V=)
- Independent 24 V chopper power supply unit for the internal auxiliary voltages

### Galvanic isolation

- between the housing and all electric parts
- between the auxiliary voltage connection and the power section and the control electronics
- between the power section and the control electronics
- between the control electronics and the logic inputs/logic outputs

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

### Components used:

- completely isolated IGBT power semi-conductors, comfortably over-dimensioned
- only components customary in trade and industrially standardised are used
- SMD equipment
- LED displays , 7-segment displays

### Features:

- ✓ EMC protected steel housing
- ✓ Shock and vibration-proof build
- ✓ Direct mains connection 230 V~ to 480 V~
- ✓ Independent auxiliary voltage connection 24 V=
- ✓ Digital interfaces RS232, CAN-BUS (further option)
- ✓ Analog inputs, programmable differential inputs
- ✓ Digital inputs/outputs, programmable, optically de-coupled
- ✓ Output for brake 24 V/3 A with load watchdog
- ✓ logic for enable and the output stage switch, emergency stop function, safety
- ✓ BTB ready for operation, solid state relay
- ✓ Position, speed and torque control
- ✓ Encoder systems: resolver, TTL incremental encoder, SINCOS 1Vss, rotor position
- ✓ Encoder output
- ✓ Static and dynamic current limiting
- ✓ Uniform, completely digital control unit
- ✓ Intrinsically safe and short-circuit proof power section (EN50178)
- ✓ Anti-interference choke in the bus circuit
- ✓ Integrated ballast circuitry
- ✓ DC power bus
- ✓ Processor-independent hardware switch-off in case of short-circuits, circuits to earth, over-voltage, under-voltage, and over-temperature of the amplifier or the motor



## 2.9 Safety regulations

Electronic equipment is not fault proof!

### Caution - High voltage

**> 900V AC/DC ~/=**

**Shock hazard! / Danger to life!**

**Discharge time of the bus circuit > 4 min!**



Before installation or commissioning begins, this manual must be thoroughly read and understood by the skilled technical staff involved. It must be ensured that the documentation (manuals) and thus, the knowledge of the unit and especially the safety advices must be available for all persons who are concerned with the unit

If any uncertainty arises or if any function is not or not sufficiently described in the documentation, the manufacturer or dealer should be contacted.

Any incorrect installation/connection may damage the device!

Any incorrect programming may cause dangerous movements!

#### Intended applications:

The devices of the DSxx series are power electric parts used for regulating energy flow.

They are designed as components (BDM) to control EC synchronous motors and ac asynchronous motors in stationary machines or installations for industrial applications.

For applications in residential areas additional EMC measures are necessary.

Any other type of application must be approved by the manufacturer.

The user must draw up a hazard analysis for his end product.

Protection rating IP20 for stationary switch cabinet mounting.

**Power supply connection only to an earthed three-phase current system!**

**Protective conductor PE must be firmly connected!**

**Operation only allowed when the switch cabinet is closed or locked!**

**The control and power connections may be voltage-carrying without the axis operating!**

**The discharge time of the bus circuit is superior to 4 min!**

**Measure the voltage before any disassembly!**



The user must draw up a hazard analysis for his machine, vehicle, or installation.

**The user must ensure that in the event of:**

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

the axis will be safely de-activated.



It must also be ensured that the machines, equipment, or vehicles are fitted with device independent monitoring and safety features.

The user must take appropriate measures so that man as well as property are not exposed to danger due to incorrect or improper movements at any time!

During operation the switch cabinet must be closed and the safety systems must be enabled.

When the switch cabinet is open and/or the safety systems are de-activated, it must be ensured by the operator that only skilled and suitably trained personnel has access to the units.



**Assembly**

- should only be carried out when all voltages have been removed and the units are secured
- should only be carried out by suitably trained personnel

**Installation**

- should only be carried out when all voltages have been removed and the units are secured
- should only be carried out by suitably trained personnel for electricians
- should only be carried out in accordance with health and safety guidelines

**Adjustments and programming**

- should only be carried out by suitably trained personnel with knowledge in electronic drives and their software
- should only be carried out in accordance with the programming advice
- should only be carried out in accordance with health and safety guidelines

### 2.10 Commissioning

The servo amplifiers DS4xx (BDM) are components of the electronic drive technology. They are functional only in connection with an electrical consumer (e.g. a motor). Their use is limited for industrial, commercial applications.

When mounting the units into machines and installations the proper operation of the units may not be started until it is ensured that the machine, the installation, or the vehicle comply with the regulations of the EC machinery directive 2006/42/EG and the EMC guideline 2004/108/EG.

On the installation and test conditions described in the chapter 'EMV advices' it is adhered to the EC guideline 2004/108/EG including the EMC standards EN61000-2 and EN61000-4.

For applications in residential areas additional EMC measures are necessary.

A manufacturer's declaration can be requested.

The manufacturer of the machine or installation is responsible for observing the threshold values demanded by the EMC laws.

## 2.11 Safety advices

### Machinery directive

The manufacturer of the machine or installation must draw up a hazard analysis for his product. He must make sure that any unpredictable movements do not cause damage neither to persons nor to property.

### Skilled personnel

#### Hardware

The skilled qualified personnel must feature a training and instruction for an assignment in the field of electronic drive engineering. They must have knowledge of the standards and accident prevention regulations for drive engineering applications and they must be familiar with this field of activity. Eventually occurring dangerous situations are realized.

The local regulations (IEC, VDE, VGB) are known to the qualified personnel and they are observed during the works.

#### Software

The skilled qualified personnel for handling the software must be trained to safely program the units in the machines and installations. Incorrect parameter settings may cause improper and impermissible movements. Any parameter settings have to be checked for faulty operation. Acceptance tests must be thoroughly carried out according the four-eyes principle

### Working environment

Incorrect handling of the units may cause damage to persons or property.

When operating the units the switch cabinet must be closed and the safety systems must be enabled! Exceptions to this are the first commissioning or if switch cabinet repair works have to be carried out by the skilled qualified personnel.

Any unit covers must not be removed!

Disconnect the power supply prior to any works on electric connections and safeguard the switch cabinet against switching-on.

Any voltages and residual voltages (buffer circuit) must be measured prior to any works on the unit. Max. permissible voltage <42 V.

High temperatures > 70°C may arise.

The working environment may be dangerous for persons having electronic medical aids or appliances (e.g. cardiac pacemakers). Sufficient distance to these electrical parts must be observed.

### Exposure

During transport and storage the prescribed and specified climatic conditions must be adhered to. The units must not be mechanically damaged. Warped and bent housing parts may influence or damage the isolation distances. Damaged units must never be installed!

The units comprise parts which may be damaged by electrostatic discharge. The general recommendations for handling electrostatic devices must be observed. Special attention should be paid to strongly isolating plastic films and synthetic fiber.

For the operation it must be ensured that the environmental conditions in the switch cabinet are adhered to. This applies in particular to the impermissible condensation on the units.

## 2.12 Intended applications

The devices are designed as components (BDM) to control EC synchronous motors and ac asynchronous motors in stationary machines or installations.

Any other type of application must be approved by the manufacturer.

Protection rating IP20.

It is only allowed to install the units in stationary switch cabinets or machine frames which are similar to switch cabinets. Industrial site of operation only.

For applications in residential areas additional EMC measures are necessary.

The user must draw up a hazard analysis for his end product.

Power supply connection only to the earthed TN three-phase current system with a maximum three-phase voltage of 480V~ (max. 280 V~, phase - N (PE)). For any other types of power supply (IT, TT power supply) matching transformers have to be installed.

Voltage peaks must not exceed 1000 V between the phase conductors and they must not exceed 2000 V between the phase conductors and the housing.

The capacities between the clocked power modules (converter, motor, filter) result in high leakage currents. It is necessary to provide a safe and screwed earthing on the switch cabinet and the motor. Protective earth conductors must comply with the standards EN 50178, EN61800-5-1, and IEC 364.

Bad protective earth conductors are highly hazardous for health and life.

Protective parts for earth leakage (earth leakage circuit breakers) must be ac/dc sensitive and designed and rated according to the standards EN 50178.

For emergency battery connection it must be borne in mind that the battery voltages are at power supply voltage. All safety regulations regarding direct power supply connections must be observed (protection against accidental contact with exposed parts, short-circuit protection, etc.).

The control connections of the unit (terminals X1, pins X7, X8, X9, X10) adhere to the 'safe electrical isolation SELV' according to the standard EN 61800-5-1. The user must ensure that the complete control wiring complies with the standards.

It must be paid attention to the equipotential bonding for components which are connected to the unit and which do not have isolated inputs and outputs (equalizing connection GND). The equalizing currents may destroy components and parts.

When measuring the isolation the units must be disconnected or the power connections must be bridged together and the control connections must be bridged together. Non-observance will cause damage to the semi-conductors in the unit.

Repeating circuits to earth and short circuits the values of which are all below the response threshold for short circuits may cause damage to the output stages (conditionally short-circuit proof acc. to standard EN 50178, EN61800-5-1).

### **Impermissible applications**

- in life-sustaining medical devices or machines
- across unearthed or asymmetrical power supplies
- on ships

- in explosive environments
- in environments with acrid fumes

## 2.13 Regulations and guidelines

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

EU Guidelines	2004/108/EG, 2006/95/EG, 2006/42/EG, 2002/96/EG
EU Standards	EN60204-1, EN292, EN 50178, EN60439-1, EN61800-3, ECE-R100
International standards	ISO 6469, ISO 26262, ISO 16750, ISO 20653, ISO 12100
IEC/UL Regulations	IEC 61508, IEC364, IEC 664, UL508C, UL840
VDE Regulations and TÜV Regulations	VDE 100, VDE 110, VDE 160
Regulations of the statutory accident insurance and prevention institution	VGB4

### EU standards and regulations observed for the components of the unit

Standard	Description	Version
EN 60146-1,-2	Semiconductor converters	2010
EN 61800-1,-2,-3	Speed-variable electrical drives	2010
EN 61800-5-1	Electric power drive systems - safety	2010
EN 60664-1	Isolation coordinates - low voltage	2012
EN 61010	Safety regulations - control units	2011
EN 61508-5	Functional safety of electric, electronic systems	2011
EN 60068-1,-2	Environmental influences	2011
ISO 20653	Type of protection of the electrical equipment of vehicles	
ECE-R100	Conditions for battery-driven electric vehicles	
UL 508 C	UL Regulations - converter	2002
UL 840	UL Regulation - clearance and creepage distances	2005

### EU standards and regulations which must be observed by the user

Standard	Description	Version
EN 60204	Safety and electrical equipment of machines	2011
EN 50178	Equipment of power plants	1998
EN 61800-3	Speed-variable electric drives - EMC	2010
EN 60439	Low voltage switching device combinations	2011
EN 1175-1	Safety of electric industrial trucks	2011
ISO 6469	Electric road vehicles	2009
ISO 26262	Functional safety of electric road vehicles	2011
ISO 16750	Elektrical components - vehicles	2010
ISO 12100	Safety of machines	2011
ISO 13849	Safety of machines and controls	2011
IEC 364	Protection against electric shocks	2010
IEC 664	Isolation coordinates - low voltage	2011

### 2.14 Risks

The manufacturer aims to keep the remaining risks emanating from the unit as low as possible by means of constructive, electrical, and software measures.

In the field of drive engineering the following known remaining risks must be considered regarding the risks arising from machines, vehicles, and installations.



#### Impermissible movements

caused by:

- failure of safety watchdogs or switched-off safety watchdogs during commissioning or repair works
- software errors in upstream controls, errors in bus systems
- non-monitored hardware and software errors in actuating elements and connecting cables
- inverted sense of control
- faults during the parameter setting and wiring
- limited response time of the control features. Ramps, limits
- operations not permitted in the specifications
- electromagnetic interferences
- electrostatic interferences, lightning strikes
- failure of components
- failure in the brakes

#### Dangerous temperatures

caused by:

- faults during the installation
- faulty connections, bad contacts, aging
- faults in the electric safety system, incorrect types of fuses
- operations not permitted in the specifications
- negative climatic conditions, lightning strikes
- failure of components

#### Dangerous voltages

caused by:

- faulty earthing of the unit or motor
- faulty connections, bad contacts, aging
- faulty potential isolation, failure of components
- conductive contamination, condensation

#### Dangerous fields

The units, the inductive and capacitive accessories as well as the power wiring can generate strong electric and electromagnetic fields. These fields may be dangerous for persons having electronic medical aids or appliances (e.g. cardiac pacemakers). Sufficient distance to these electrical parts must be observed.



The switch cabinet must be labeled accordingly.

### 2.15 Technical data

Power supply connection DVC	up to 1 kW up to 18 kW	1/3 x 30 V~ to 480 V~ 3 x 30 V~ to 480 V~	+10 % 50/60 Hz +10 % 50/60 Hz
Auxiliary voltage connection EVL	24 V= ±10 % / 2A residual ripple < 10 % regenerating fuse		

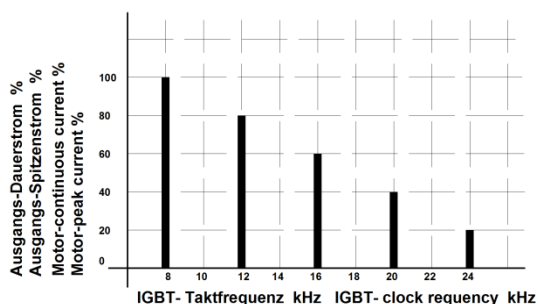
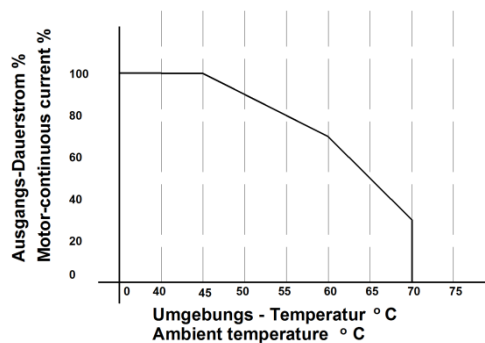
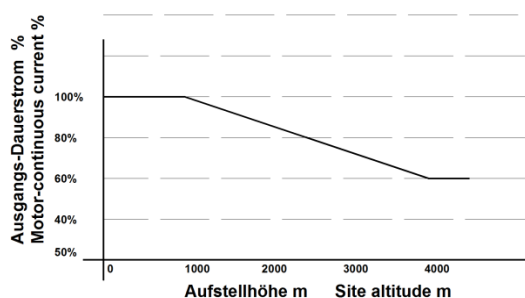
Data	Unit	DS-405.2	DS-412.2	DS-420.2
Supply voltage - rated value	V~	3x400 (480)		
Max. output voltage - rated value	V~eff	3x390( 470)		
Bus circuit voltage	V=	560 (675)		
Max. connection power S1	kVA	3.4	8.2	14
Max. power output S1	kW	3	7.5	13.5
Permanent current	Aeff	5	12	20
Max. peak current	Alo	10	24	40
Max. power loss	W	80	150	250
Clock frequency	kHz	8		
Ballast switch-on voltage	V=	750 ± 10		
Over-voltage switching threshold	V=	860 ± 10		
Min. external ballast resistance	Ω	8	51	40
Input fuse	A	10	20	40
Switch-off integral	A²s	150	200	300
Weight	kg	3	3	3
Dimensions h x w x d	mm	320x85x190		
Installation pattern	mm	100		
Size		2	2	2

Control signals		V	A	Funktion
Analog inputs		± 10	0.005	differential input
Digital inputs	ON	10-30	0.010	optically decoupled
	OFF	<6	---	
Digital outputs		+24	0.03	optically decoupled
Resolver				differential input
Encoder input		>3.6V		optically decoupled
Encoder output		>4.7		optically decoupled
CAN interface				optically decoupled
RS232 interface				115200 (or 9600) Baud



Ambiant conditions	
Protection rating	IP20, VGB4
Standards	EN60204, EN61800, IEC60146
Protection rating	Power protection class I (with PE firmly connected) Electronics protection class III (protection - low voltage)
Over-voltage	Class 2 (EN61800-5-1)
Operating temperature range	0 to +45°C
Extended operating temperature range	from +45°C to +60°C performance reduced by 2 %/°C
Storage and transport	-30°C to +80°C EN60721
Site of installation	≤ 1000m above sea level 100 %, >1000m performance reduced by 1.5 % / 100 m
Cooling	Internal ventilator
Mounting position	vertical, performance reduced by 20 % when mounted horizontally
Contamination	Contamination degree 2 acc. to EN61800-5-1
Oscillation	10 Hz to 58 Hz amplitude 0.075 mm (IEC 60068-2-3) 58 Hz to 200 Hz 1g
Shock	15 g for 11ms
Environmental conditions	<b>Not permissible:</b> condensation (dew), ice formation, oil mist, salt spray, water
Humidity range	class 3K3 humidity < 85 % <b>no condensation allowed!</b>

## Stromreduktion Umgebung



DS4/Strom-reduktion-Höhe-2  
DS4/Strom-reduktion-Umgebung-Temperatur-2  
DS4/Strom-reduktion-IGBT-Taktfrequenz

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## 3 Mechanical Installation

### 3.1 Important advices

Pay attention to the ESD advices.

Blank mounting surface, no lacquer (EMC surface-to-surface contact)

The unit must be safely protected in the switch cabinet against mist and water and the intrusion of metallic dust.

Check the device for mechanical damage.

Only devices in perfect working order can be mounted.

#### **Disconnect the power supply prior to any assembly.**

For installations connected to an electric power supply install the shorting plug and affix the warning signs.

The device must only be mounted by suitably trained personnel.



Vertical mounting position.

Please note that there will be a performance reduction when the devices are mounted horizontally.

Ensure that there is enough space for the discharged ventilation air (min. 100mm).

Any bore hole dimensions for the fixation of the device must be taken from the dimension diagrams or from the drilling plan, not from the device.

Drill the mounting bore holes into the mounting plate.

Insert the device and fasten the screws.

#### **Note: Protect the device against intrusion of foreign particles (bore chips, screws, etc.)!**

The filter and the choke have to be mounted near to the device

The line shields and the mounting plate must have surface-to-surface contact.

Unshielded cable heads must be kept as short as possible.

Braking resistors may become very hot (200°C).

Install the resistors such that neither persons will be injured (burns) nor damage will occur due to the heat.



Use vibration-proof screw connections.

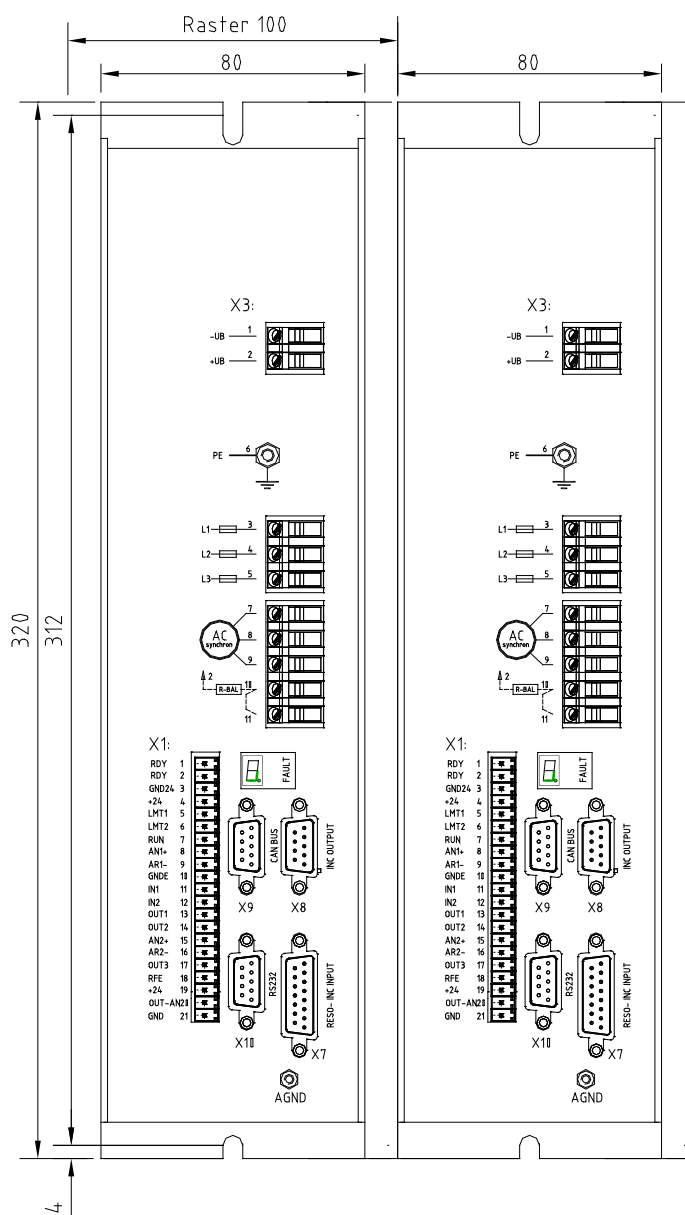
Inside temperature of the switch cabinet: **max. 45°C**

For internal mounting ensure that the switch cabinet ventilation is sufficient.

Use an air conditioning unit if the room temperatures are too high (>30°C).

#### **Note: The operation of bedewed devices is not permissible.**

## 3.2 Dimensions DS 405 – DS 420

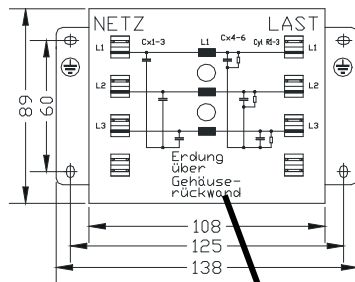


DS/DS-400-2-publi

Size 2:	DS405.xx bis DS420.xx
Mounting depth:	without connector 190 mm with connector max. 250 mm
Fixing screws:	M5x10 (recommended DIN 912)

## 3.3 Dimensions - accessories

### EMV-Filter

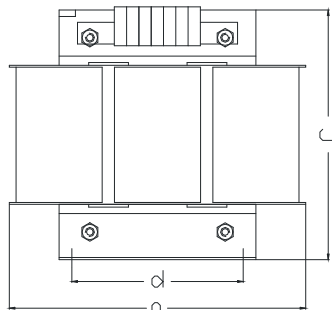


DS/DS-400-Filter1 Grounding on case back

Type	Voltage	Current	Dimensions	Weight
	V~	A~	HxBxT mm	kg
F250-V-B90-16	1x250	1x16	45x90x40	0,4
F400-V-B108-16	3x480	3x16	90x140x55	0,8
F400V-B150-25	3x480	4x25	130x180x80	2,4

Filters at high EMC requirements.  
In residential and commercial areas or unknown locations.  
Mount filter directly on the device.  
Bus filter and input filter capacitors  
are installed in the device.

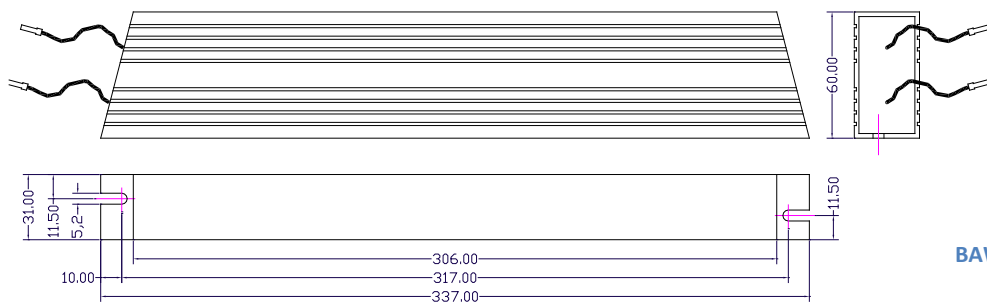
### Moto choke



DS/DS-400-Drossel

Type	Voltage	Induction	Dimension	Weight
	A	mH	HxBxT mm	kg
MDD 1.6a-5	5	1.9	95x54x108	
MDD 1.6b-10	10	1	95x58x108	
MDD 2b-20	20	0.8	128x80x140	

Motor choke only for cable - shield capacitances > 5 nF.  
Cable length approx. 25 m.



BAWID-300-996

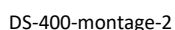
Regenerative discharge resistor in IP65  
protection standard aluminium housing

Weight 1.1 kg  
mounting screws M5x12

### Caution:

The ballast resistor can get as hot as 200°C. Protect  
the resistor against accidental touch when installing it.  
Do not place any heat-sensitive components  
directly at the resistor or in the hot airflow.  
Mount resistor outside



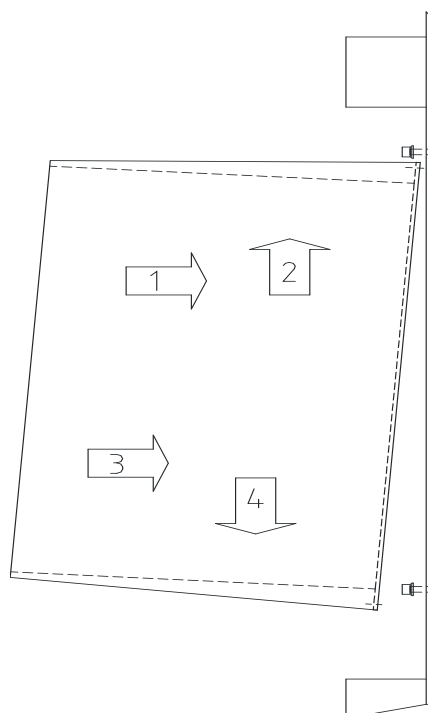


**Supply air temperature 0 to max. 45°C**

The signal lines and the power supply lines must be routed in separate trunkings with rectangular crossings (spatial separation of the disturbance coupling).

## Installation instruction

Fasten the screws.



## 4 Electrical installation

### 4.1 Important advice

The order of the connections to the connector or terminal numbers is obligatory.

All further advice is non-obligatory.

The input and output conductors may be altered or supplemented in accordance with the electrical standards and guidelines.

Adhere to:

- connection and operating instructions
- local regulations
- EU EG regulations such as the 2006/42/EG machine directive
- VDE and TÜV regulations and Trade body guidelines



### **Electrical installation should only be carried out when all voltages have been removed!**

Ensure that the device is safely disconnected from the power supply

- place the short-circuit bracket
- affix warning signs

The installation should only be carried out by suitably trained personnel for electrical engineering.

Compare the connection data with those indicated on the type plate.

Ensure that the correct fuses have been provided for the power supply, the auxiliary voltage, and the external ballast resistors.

**Use a pre-charging circuit (UNITEK Inrush limiter).**



Power supply conductors and control lines must be routed separately from each other.

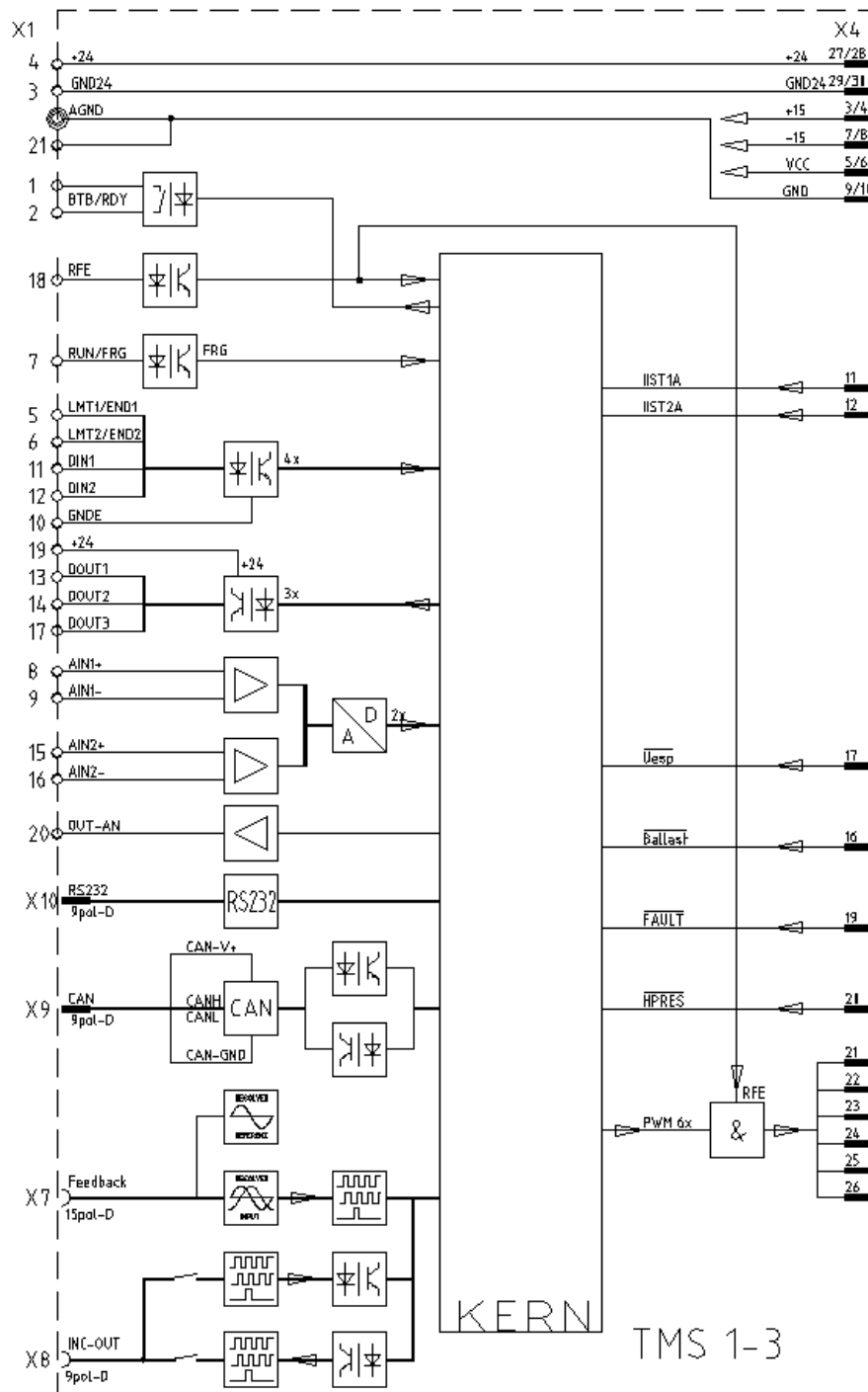
Connection shields and grounding must be carried out in compliance with the EMC guidelines.

Use the correct line cross-sections.

**Note: Always connect the BTB contact into the safety circuit!**

**Note: The PE connection must comply with the standard EN61800-5-1.  
Operation without a PE-connection is not allowed!**

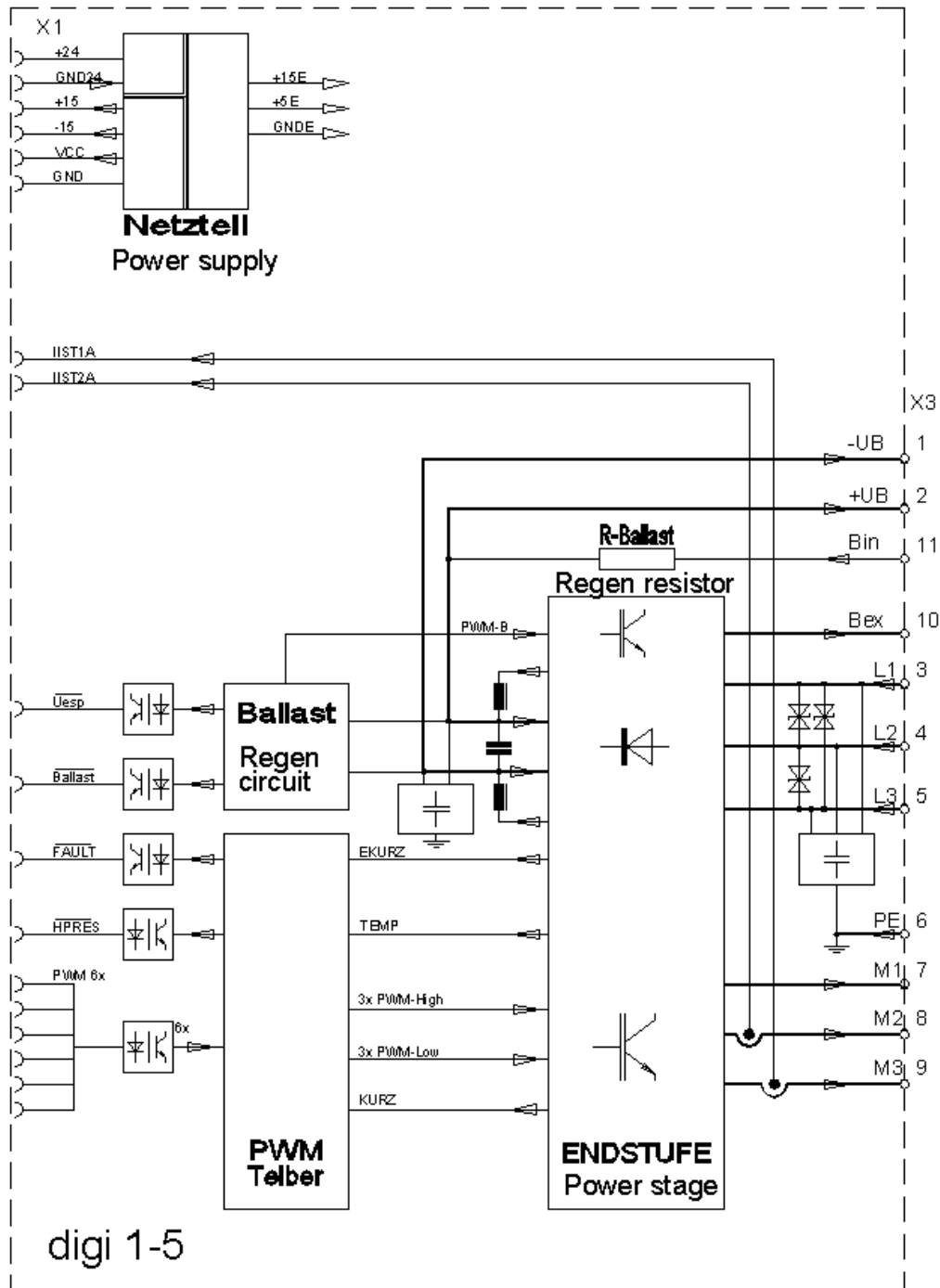
## 4.2 Circuit diagram



DS-400-blockbild-2-tms



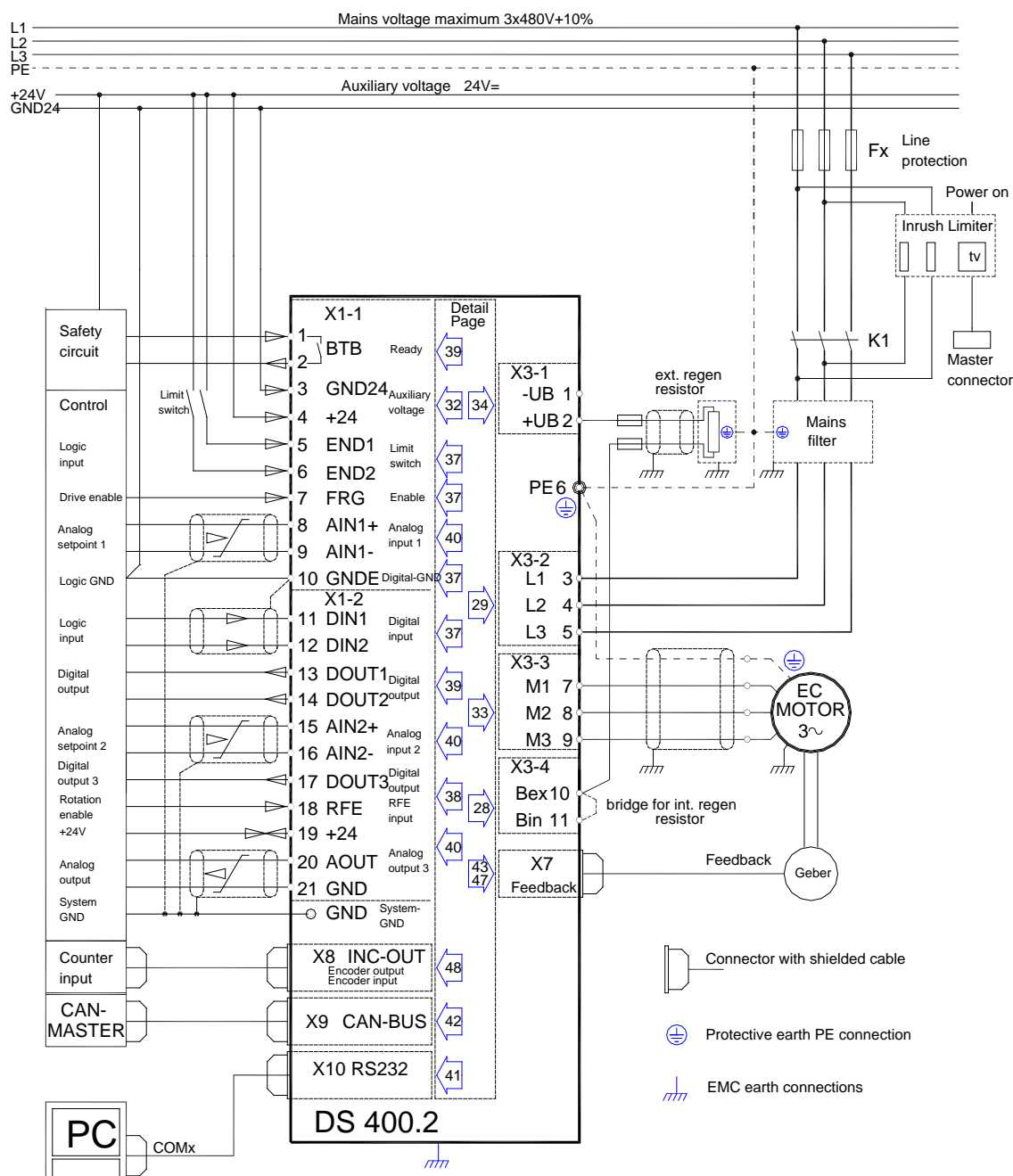
## Circuit diagram



DS-400-blockbild-digi-1-5

## 4.3 Connection diagram

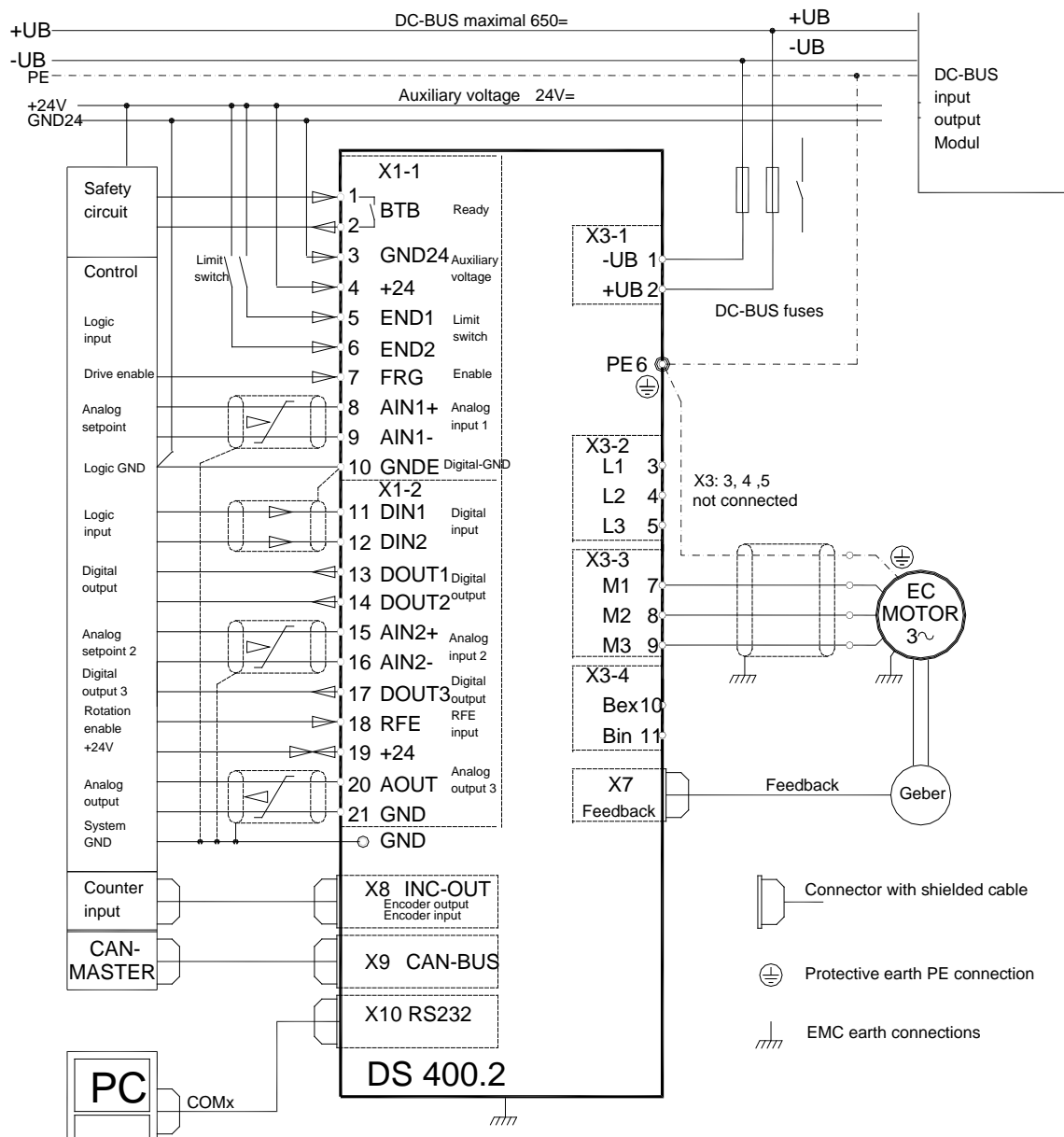
### Connections DS405.2, DS412.2, DS420.2



Zeichnungen- DS4 / E-DS-400-anschlussplan3-1

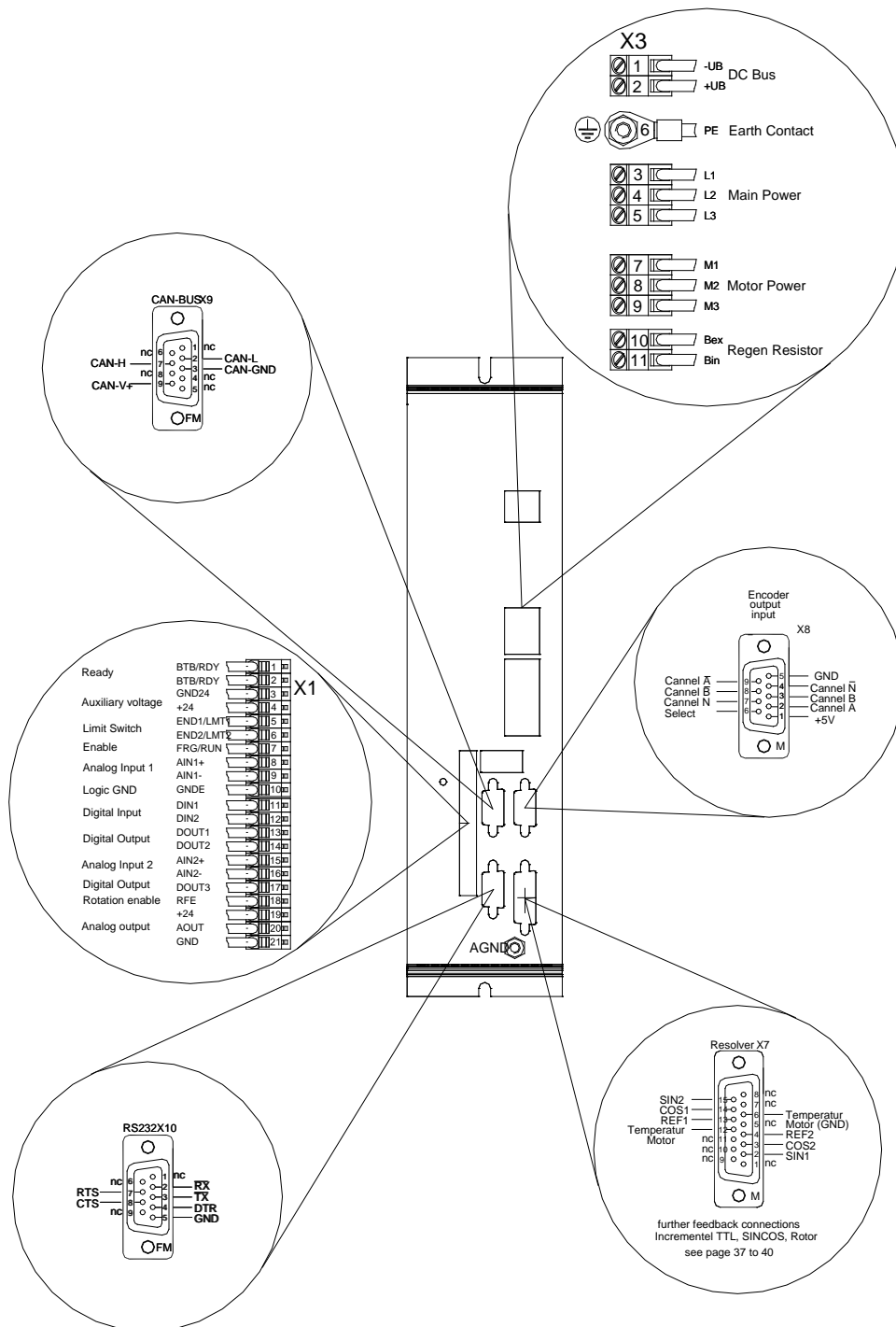
## 4.4 Connections DS405.2, DS412.2, DS420.2

For DC BUS with energy input and recovery module

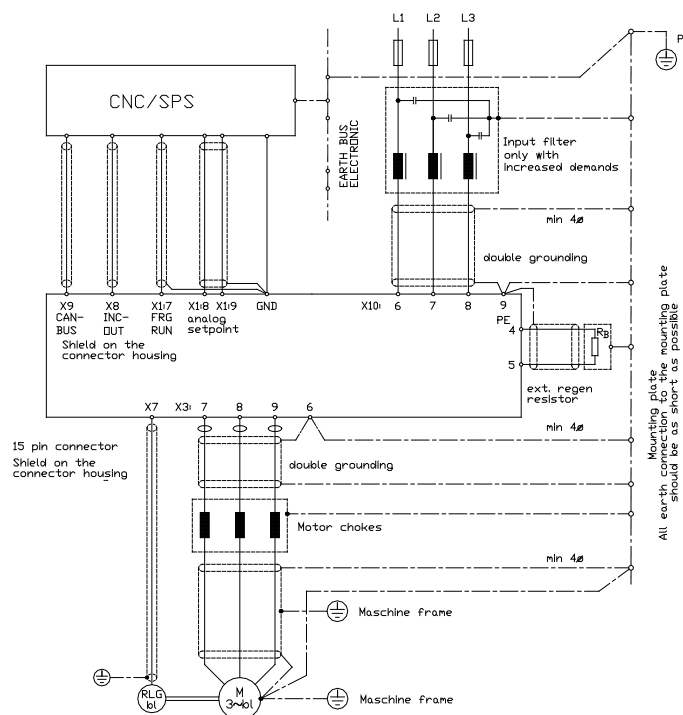


E-DS-400-anschpl-MoAC-DCBus-2

## 4.5 Connectors DS405.2/DS412.2/DS420.2



## 4.6 EMC



The devices adhere to the EU guidelines 2004/108/EC and the technical standard EN 61800-3 provided that the following conditions are observed:

### Mounting:

The device is conductively mounted on a 500x500x5 mm bright mounting plate.

The mounting plate must be connected to PE using a 10 mm<sup>2</sup> wire.

The motor housing must be connected to PE using a 10 mm<sup>2</sup> wire.

The device ground X-AGND must be connected to the mounting plate using a 2.5 mm<sup>2</sup> wire.

The device PE screw X:3:6 must be connected to the mounting plate using a 4 mm<sup>2</sup> line.

### Connection of the control conductors:

All control conductors must be shielded. Analogue signal lines must be twisted and shielded.

### Three-phase mains connection:

3 x 400 V~ with protective earth conductor

### Motor connection:

Motor lines must be shielded and must have surface-to-surface contact with the earth.

After having been mounted in machines and installations the operation of the device must not be started until the machine or the installation has been approved of the regulations of the EC machine guideline 2006/42/EC and the EMC guideline 2004/108/EC, for vehicles ECE-R83 and ECE-R100. A manufacturer's declaration can be asked for.

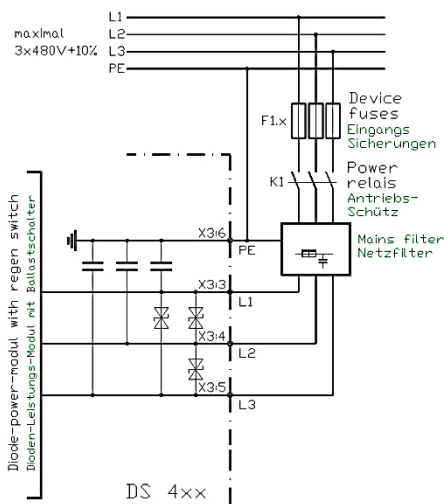


## 4.7 Mains connection

Connection to earthed three-phase power supply system (TN-C mains supply).  
Asymmetrically earthed supply systems must be connected via an isolating transformer!



### Connection to the T-NC mains



DS400-Netzanschluss-T-NC

The max. supply voltage of 528 V~ must not be exceeded at any time (not even for short intervals)!

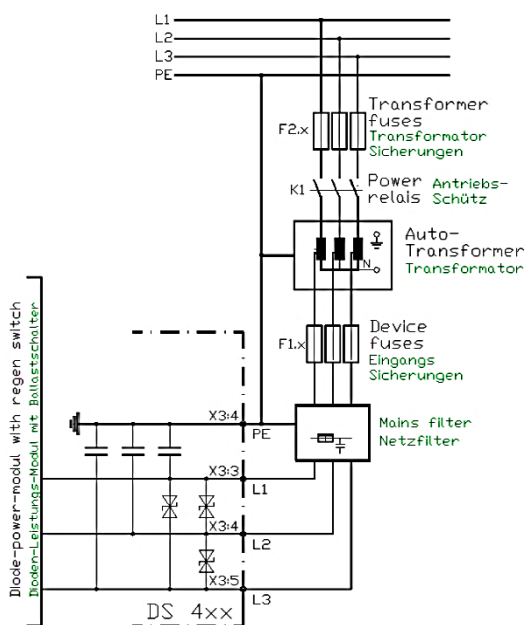
**Danger of damage!**

**F1 = device protection**  
safety fuses FF, F, or semi-conductor automatic fuses

Install an additional power line filter for high EMC requirements.

Bus filter and input capacitors are installed.  
Leakage current > 60 mA

### Connection to the T-NC mains using an auto-transformer



DS400-Netzanschluss-T-NC-Trafo

**If the supply voltage is < 30 V the output stage is electronically de-activated.**

The max. secondary voltage of the transformer of 528 V~ must not be exceeded at any time (not even for short intervals)!

**Danger of damage!!**

Slow-acting transformer fuses

**F1 = device protection:**  
safety fuses FF, F, or semi-conductor automatic fuses

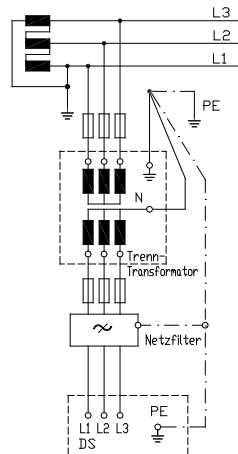
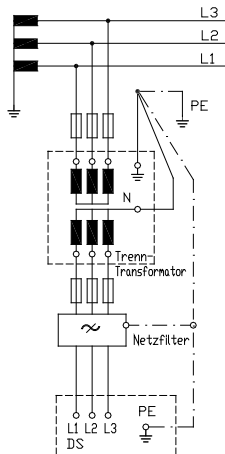
Install an additional over-voltage protective device for protecting against switching surges of the transformer.

Install an additional power line filter for high EMC requirements.  
Bus filter and input capacitors are installed.  
Leakage current > 60 mA.

**Note: For power supply systems without a PE conductor please note that the connection must be made via an isolating transformer.**



## Connection to the TT mains



Separating transformer

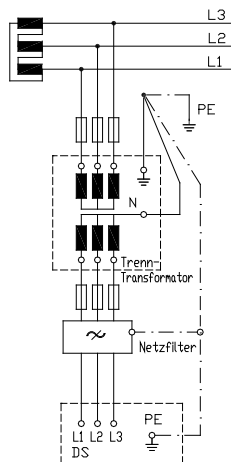
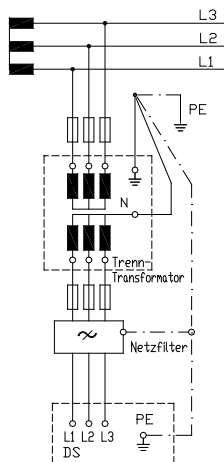
Power line filter

## TT-mains

Asymmetric three or four conductor three-phase mains with direct earthing.

Device PE via a ground connection

## Connection to the IT mains



Separating transformer

Power line filter

## IT-mains

Asymmetric three or four conductor three-phase mains without direct earthing.

Device PE via a ground connection.

## Connection data

Typ	AC connection 1x30V -10% to 1x480V +10% 50/60Hz	Three-phase current connection 3x30V -10% to 3x480V +10% 50/60Hz	min. connecting cross-section mm <sup>2</sup> AWG		Fuse	Drive contactor size	Power line filter type
405	L1=X3:3, N=X3:4	L1=X3:3, L2=X3:4, L3=X3:5	1	18	10 AFF	DL00	F250V-B90-16 F400V-B108-16
412	L1=X3:3, N=X3:4	L1=X3:3, L2=X3:4, L3=X3:5	1.5	16	20 AFF	DL0	
420	not possible	L1=X3:3, L2=X3:4, L3=X3:5	2.5	14	10 AFF	DL0	F400V-B150-25
PE-connection to X3:9 <b>(Any operation without a PE connection is not allowed!)</b>							

## 4.8 Pre-charging

### Inrush current

With the first switching-on the inrush current is internally limited to a 10-fold rated current value (approx. 2 ms) by means of a NTC resistor.

The effect persists when between switching off and switching on again a waiting time interval of 180s is adhered to. The NTC resistor is placed in the cooling air flow of the device ventilator.

**Note:** Always check the switching capacity K1

### Fast switching off/on

If the switch off-on sequence is fast the inrush current may rise to a 30-fold higher value (1ms)

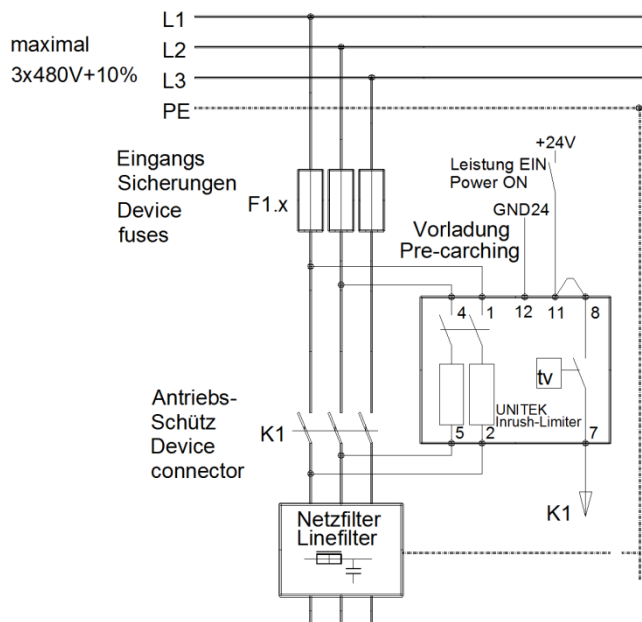
### Attention:

The drive contactor K1 and the input rectifier may be damaged.

## A pre-charging unit must be installed.

### Pre-charging with inrush limiter

The charging current is limited to < 10 A by means of the UNITEK Inrush Limiter. The power contactor K1 is switched on after a delay time.



### Attention:

The drive contactor must not be switched under load.

Switching on-off only when the enable is blocked.

No voltage applying across FRG/RUN (X1:7).



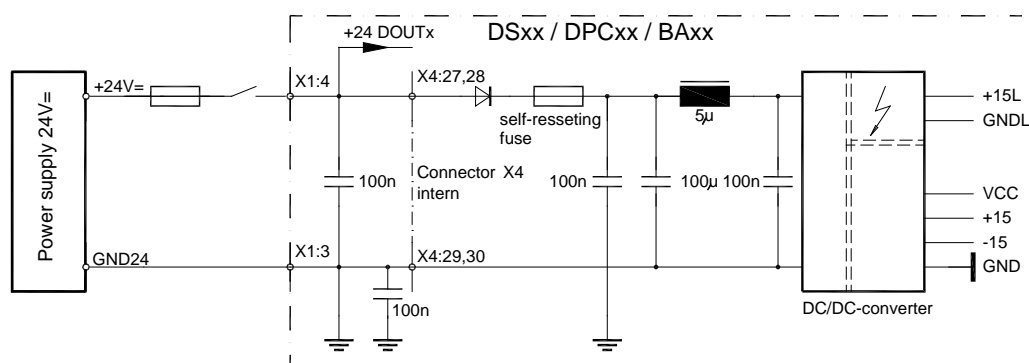
## 4.9 Auxiliary voltage connection

Mains potential-free auxiliary dc voltage

24 V =  $\pm 10\%$  / 2 A

The auxiliary voltage

- is galvanically connected with the logic voltage
- is galvanically isolated from all internal supply voltages of the device
- has internal regenerating fuses
- has an EMC filter



DS-BAx-DPC/E-DS-400-Hilfsspannung

External fuse only for line protection.

Input voltage	24 V DC X1:4
	GND24 X1:3
Residual ripple	10 %
Inrush current	2 A
Nominal current	0.8 A

### Attention:



In addition to the internal supply current (0.8 A) the sum of the output currents (DOUT) must be provided by the mains module 24 V.

If the auxiliary voltage is inferior to 20 V - even in case of short-time voltage drop-outs - the internal mains module is switched off.

Any data of the RAM are deleted!

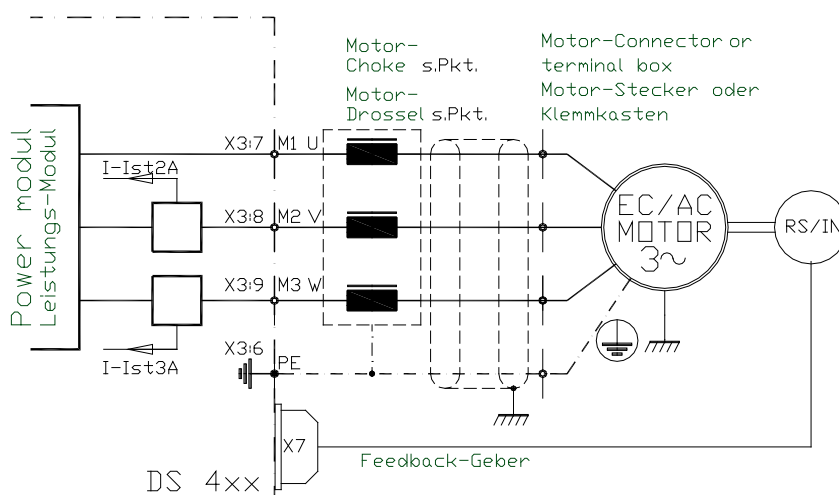
The speed and the position command values are set to zero and any calibrated data are deleted.

The LED signal for the state "OK" is dark.

## 4.10 Motor connection

Only electronically commutating synchronous motors (brushless dc motors, EC motors, AC motors) must be used.

These motors must be approved of by the manufacturer prior to any use.

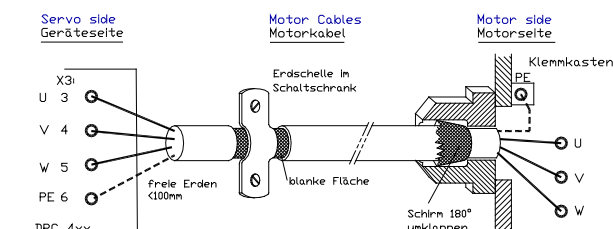


DS400 / DS-400-Motor-3

Cable	PE	M1	M2	M3	Motor cable
Connecting terminal	X3:6	X3:7	X3:8	X3:9	
Only one correct connecting sequence is possible!!!					3-core + protective earth, single-shielded for 600 V~, 1000 V=, shield capacity = 150 pF/m min. cross-section see below table

Type DS	405	412	420	Motor choke
Cross-section mm <sup>2</sup>	1.5	2.5	4	
AWG	16	14	10	

**Attention:** Any motor cable cores which are not used must be connected to earth. Dangerous voltages due to capacitive coupling of the clocked motor cores.



### Connection of the shield

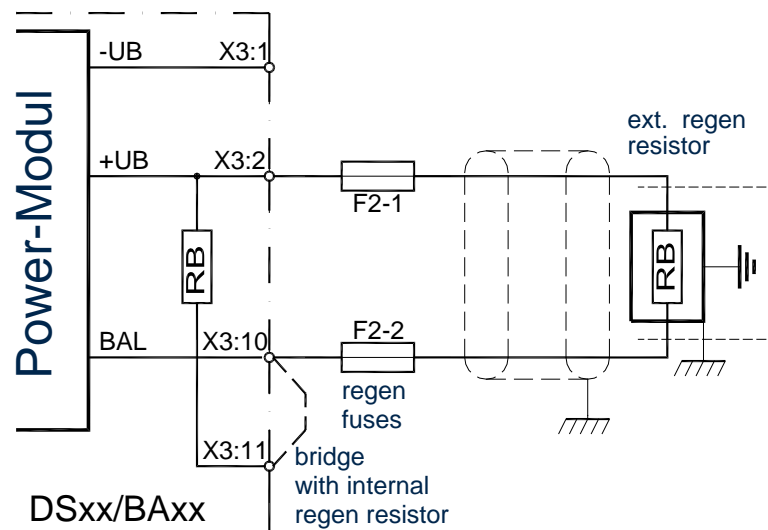
Surface-to-surface connection to the switch cabinet input. Surface-to-surface connection as short as possible to the motor side

DS-400-emv-motor

**Use multiple shield earthing for long motor cables.**



## 4.11 Ballast circuit DS405 / DS412 / DS420



DS-BAx-DPC / E-DS-400-ballast-3

The energy arising during the braking operation is fed back into the dc bus circuit. The bus circuit Elkos can store only little energy.

Any surplus of energy is transformed into heat in the ballast resistor.

The internal ballast resistance is rated for drives without centrifugal mass.

Always use external resistors for centrifugal masses or in case of uncertainties concerning the rating.

Type DS		405	412	420
Installed resistor	Ohm	80	51	42
Continuous power	W	50		100
Pulse power 1s	kW	1		2.5
External resistor min.	Ohm	80	51	40
Fuse F2	AF	10	16	25

### Note:

#### For DS420:

Observe the motor centrifugal mass (rotor moment of inertia).

The power of the internal ballast resistance is only 100 W.

Install an external ballast resistor.

**Caution:** Ballast resistors may become very hot!

## 4.12 Ballast – dimensioning

External ballast resistance

Dimensioning

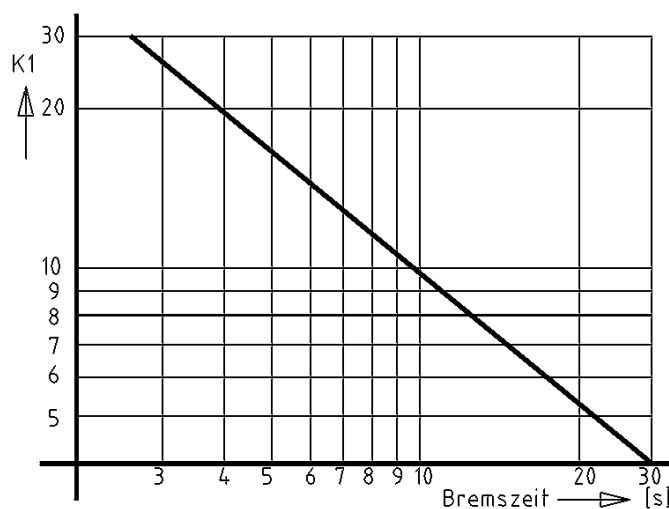
Maximum value of the braking power

Ballast resistance power

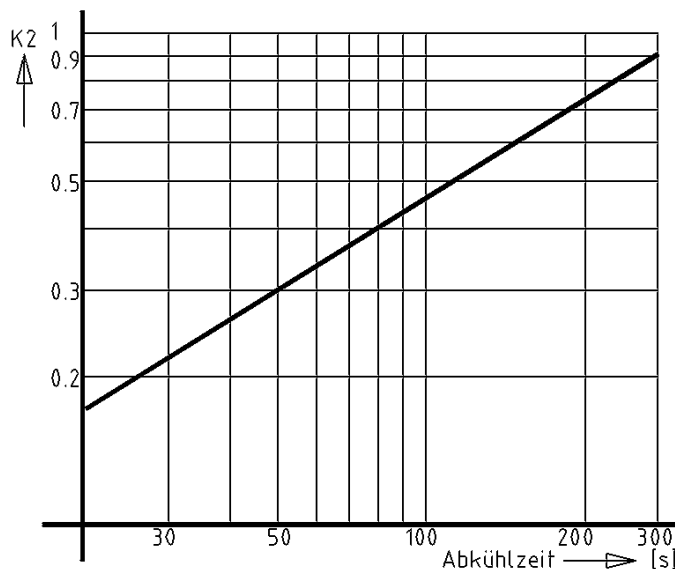
$$P_{\text{Ballast}} [\text{W}] = \frac{P_{\text{max}}}{K1 \times K2}$$

$$P_{\text{max}} [\text{W}] = \frac{J_g \times \Delta n \times n}{91 \times t_B}$$

$J_g$	=	Motor torque and reduced load	$\text{kgm}^2$
$n$	=	max. Speed	$[\text{min}^{-1}]$
$\Delta n$	=	Speed difference	$[\text{min}^{-1}]$
$t_B$	=	Braking time	$[\text{s}]$



Braking time



Cooling time

### Warning:

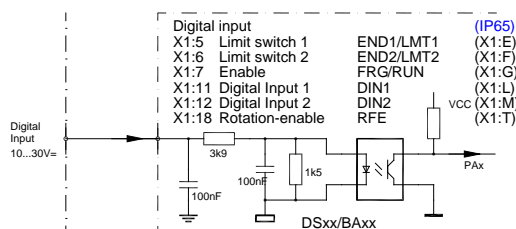
The ballast resistor may be up to 200 ° C hot. Resistance shockproof mount. Do not place any heat-sensitive parts directly to the resistance or heat air flow. Note enclosure temperature rise, resistance mounted outside as possible.



## 5 Control connection

### 5.1 Digital input

#### 6 Opto-input



DS-BAx-DPC/E-DS-400-digi-in-2

Input voltage		
H-level (On)		+10 bis +30 V
L-level (Off)		<+6 V
Input current	Max.	7,5 mA
Ratet voltage / cure		24 V/6 mA
Reference ground	GNDE	(X1:10)

The enable input (FRG/RUN) and the input for the rotating field enable (RFE) are fixed, they cannot be programmed.

Without the enable FRG/RUN the servo-drive is electronically disabled (no PWM pulses).

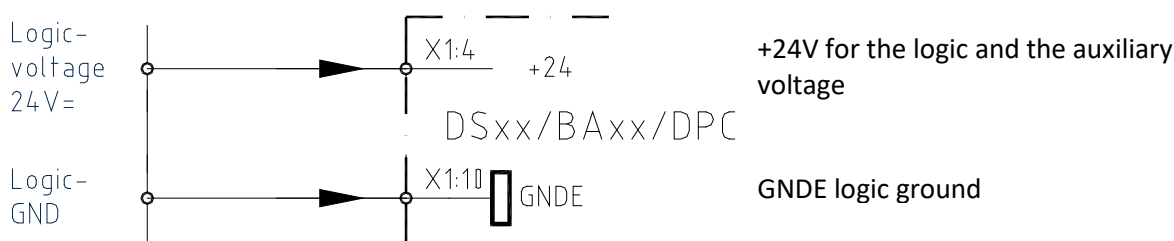
Without the rotating field enable RFE the rotating field of the output stage is additionally electronically disabled (2<sup>nd</sup> disable channel). The drive is free of torque (no holding torque).

The remaining four digital inputs can be programmed.

The inputs LMT1 (X1:5) and LMT2 (X1:6) are preferably to be used as inputs of the output stage switch.

Input	Connection	Function	State	
FRG/RUN	X1:7	Enable	fixed	
RFE	X1:18	Rotating field enable	fixed	
END1/LMT1	X1:5	Output stage switch 1/Digital input	programmable	
END2/LMT2	X1:6	Output stage switch 2/Digital input	programmable	
DIN1	X1:11	Digital input 1	programmable	
DIN2	X1:12	Digital input 2	programmable	

#### External voltage supply for the inputs and outputs



DS-BAx-DPC/E-DS-400-Logi

## 5.2 Safety input RFE (rotating field enable) Stopp-Class 0

### Warning!

If the input of the enable or of the rotating field enable are switched off, the drive is free of torque. The drive could move if there is no mechanical brake or block provided.

The motor conductors are not dead. Only the rotating field is disabled. Prior to any work or maintenance on the motor or servo-drive, the servo-drive must be completely disconnected from the mains power supply.



### Operation with RFE input

Two-channel disable of the enable via a safety switching device.

Enable input FRG/RUN + rotating field enable input RFE

### Switching on

Contacts of the safety device closed.

Enable FRG/RUN 0.5s after RFE

### Safety switch-off

Contacts of the safety device open:

There is no FRG/RUN signal in the 1<sup>st</sup> disable channel to disable the PWM pulses in the processor,

There is no RFE signal in the 2<sup>nd</sup> disable channel to disable the PWM pulses at the output of the processor.

### Restart

Release the safety switching device.

Contacts of the safety device closed.

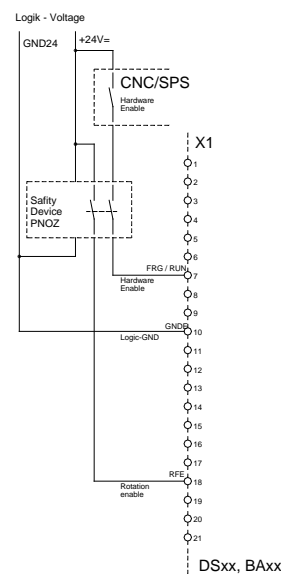
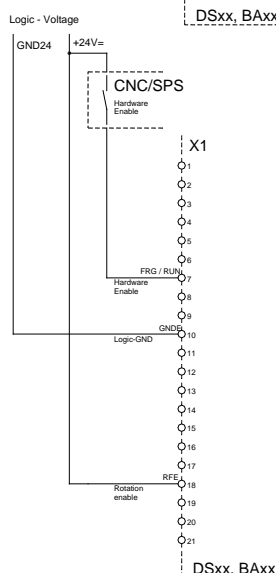
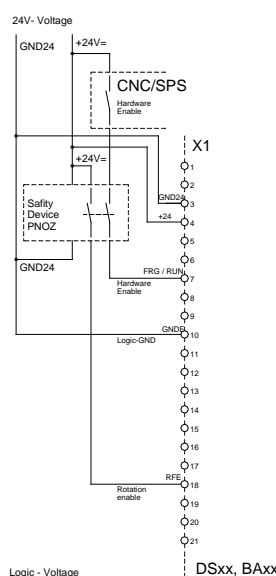
The motor can only move after a second disable FRG/RUN (after the rotating field enable RFE).

### Operation without RFE input

The input RFE must be bridged with the logic voltage.

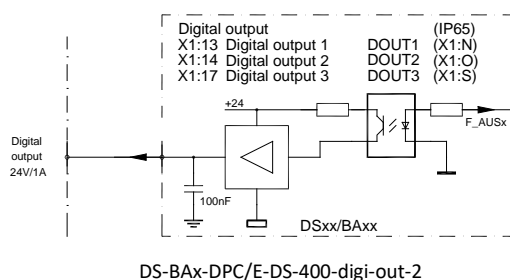
If the logic voltage corresponds to the supply voltage, the RFE input is bridged with +24V.

Enable FRG/RUN at least 0.5s after the RFE signal.



DS-BAXDPC/E-DS-400-REF-1-1/1-2/1-3

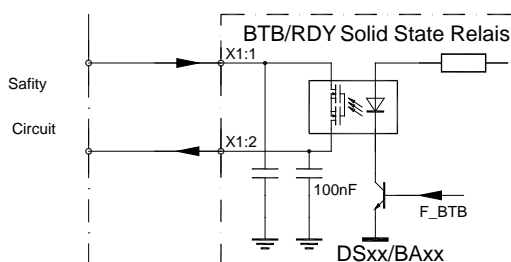
## 5.3 Digital outputs (open emitter)



Output voltage		
ON level	max.	+24 V=
OFF level		<1 V=
Output current	nom	1 A
Output current	max.	2 A
Reference voltage	+24	(X1:4)
Reference ground	GNDE	(X1:10)

The logic outputs 1 to 3 are rated for 24 V and 1A (short-time: 2 A).

## Signal contact "Ready BTB/RDY" (Solid state relay)/ Ready BTB / RDY



Contact for	max. 48 V/0.5 A
	(not short-circuit proof)
Capacitive load	max. 1 myF
Contact resistance	max. 2 Ohm

The contact is closed when the device is ready for operation.

State signal via seven-segment LED display.

In case of failures the contact is open.

**Always install the BTB/RDY contact in the safety circuit!**

**Protect the BTB/RDY signal path by means of 0.5A!**



DS-BAx-DPC/E-DS-400-BTB-3

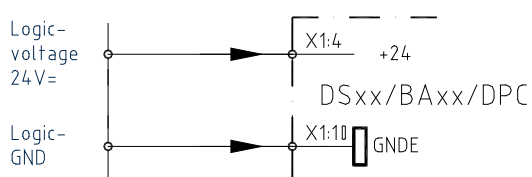
## Ready for operation opens (red LED, open relay contact)

in case of error messages

in case of under-voltage of the auxiliary voltage (<20 V)

The message "under-voltage in the bus circuit" can be programmed. (Manual NDrive)

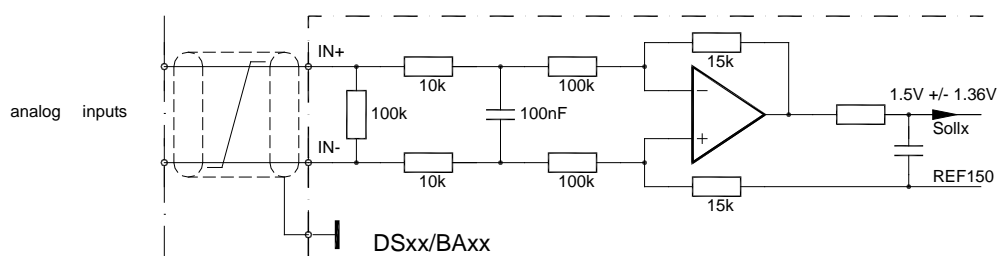
Output	Connection	Function	State	Parameter
BTB/RDY	X1:1, X1:2	ready	fixed/relay	
DOUT1	X1:13	Digital output 1	programmable	
DOUT2	X1:14	Digital output 2	programmable	
DOUT3	X1:17	Digital output 3	programmable	
DOUT4	Xx:Xx	Digital output 4	programmable	



+ 24 V for logic and auxiliary voltage  
Observe the total current of all outputs

GNDE logic ground

DS-BAx-DPC/DS-400-Igoiksp

Analoge Eingang  $\pm 10$  V

DSx-BAx-DPC/E-DS-400-Ana-1-2

Input	Connection	Basic function	Voltage	State	Parameter
AIN1+, AIN1-	X1:8, X1:9	Speed command value	+/- 10 V	prog.	
AIN2+, AIN2-	X1:15, X1:16	Current limit	+/- 10 V	prog.	

## Features

Differential input	AIN1+ / AIN1-	AIN2+ / AIN2-	
Input resistance	70 k		
Threshold voltage	$\pm 12$ V		
Resolution	11Bit + sign		

The direction of rotation of the motor can either be changed by swapping the  $\pm$  connections at the differential input, or by means of a logic input or by programming.

The analog inputs can be assigned to different functions.

With a digital command value (RS232, x-bus) the analog input AIN1 can be programmed as external analog speed limit and the analog input AIN2 can be programmed as external analog current limit.

## Analog output +/- 10V

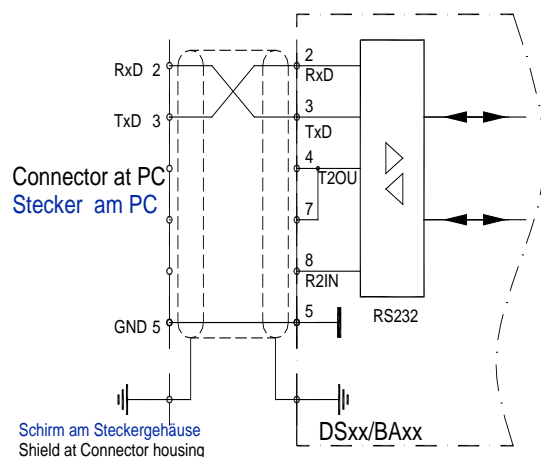
Output	Connection	Function	Voltage	State	Parameter
AOUT1	X2:20	measurement	$\pm 10$ V	prog.	
GND	X2:21	Signal zero	0 V	fixed	

The analog input can be assigned to different functions.



## 5.4 Serial interface RS 232

Via the serial pc interface RS232 the device is programmed and operated during commissioning. There is a software description in the Manual DS NDrive.



The interface is galvanically connected with the device zero (GND/AGND).

DS-BAx-DPC/E-DS-400-rs232-2

The controller (D connector X10) and the serial interface (COMx) of the pc must only be connected using a null modem cable.

Do not use a null modem link cable!

Install the cable only after disconnecting the device from the mains.

The interface is hard-coded to **115200 Baud**.

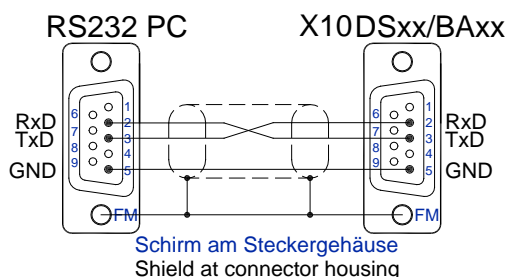
Null modem connecting cable

View to the soldered side,

Shield on the housing,

Max. cable length 10m

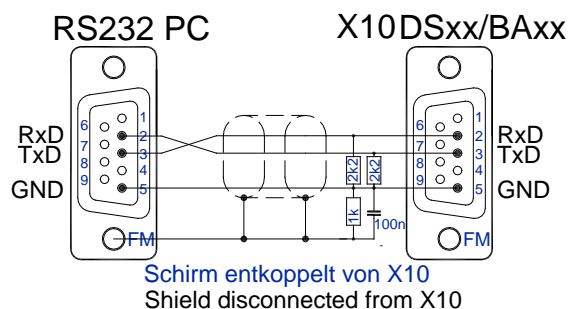
E-DS-400-RS232-Verb-1



FM = socket

A line filter should be installed in case of strong interferences at the interface.

Notebooks with a USB-RS232 converter are usually susceptible to interference.



E-DS-400-RS232-FI-1

## 5.5 CAN-BUS

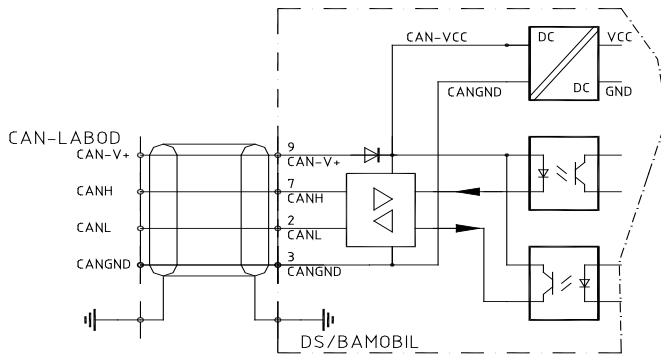
The CAN-BUS is a digital connection to the CNC control.

Optimum conditions are achieved with CNC controls and CAN components of LABOD electronic or CAN Open.

Programming and operation by means of the control panel via the CAN-BUS.

Interface complies with the standard ISO 11898.

Adjustment and programming see Manual DS-CAN.



The BUS interface is galvanically isolated from the internal device voltage.

The voltage is supplied via an internal isolated DC-DC converter.

CAN-V +9 to 15 V=

CAN-Bus isoliert /

CAN-GND auf gemeinsames Potential bringen.

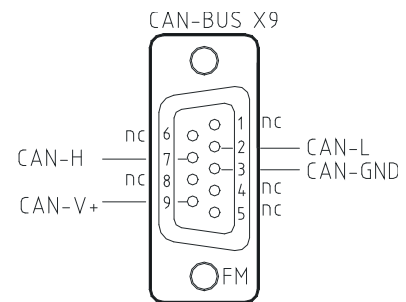
### CAN BUS cable

Use a shielded bus conductor with a low shielding capacity.

Signal plus GND.

D-connector with a metal or metallized housing.

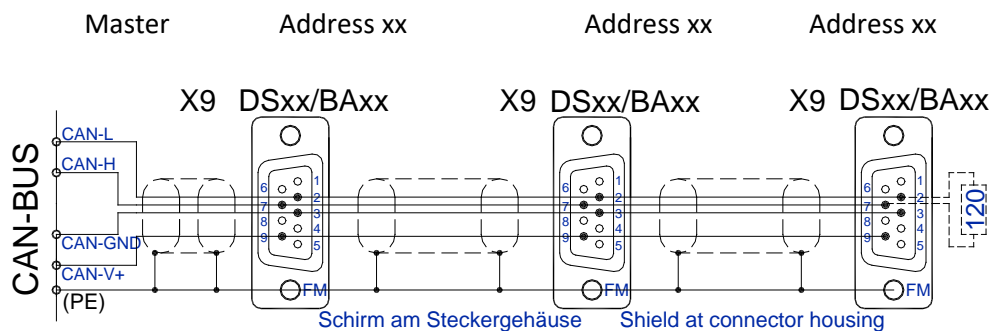
LiYCY 4x0.25+shield.



Designation	Connector no.	Cable colour
CAN-V+	9	brown
CAN-GND	3	white
CAN-H	7	green
CAN-L	2	yellow

FM=jack

### CAN BUS connection with several devices

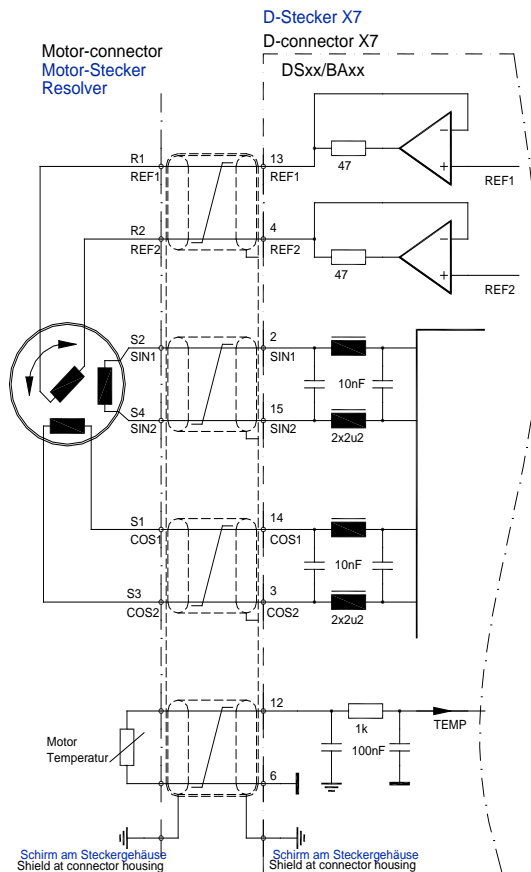


DS-BAx-DPC / E-DS-400-CAN-3x3

Terminating resistor at the end of the bus line > 120 Ohm between CAN-H and CAN-L

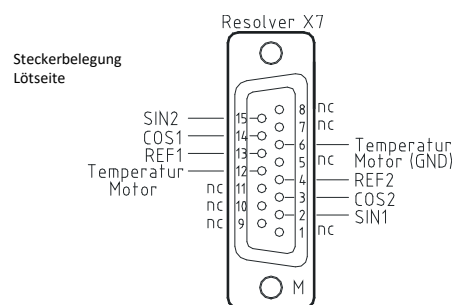
## 5.6 Resolver connection

Only for version RS



DSx-BAx-DPC/E-DS-400-Reso-anschluss-3

The resolver is an absolute measuring system for a motor revolution. It is robust and not impaired by high motor temperatures. Its build corresponds to a revolving transformer. The rotor is supplied by the reference (10kHz). The stator supplies the sine and cosine signals modulated by the rotational frequency. The amplitudes of these signals are analyzed and digitalized in the servo-drive. The resolution is automatically and optimally adjusted to 10, 12, or 14 bit. The max. possible speed is 50 000 (10bit). The digitalized signals are used for the polar wheel angle, the position and speed control, and the incremental output.



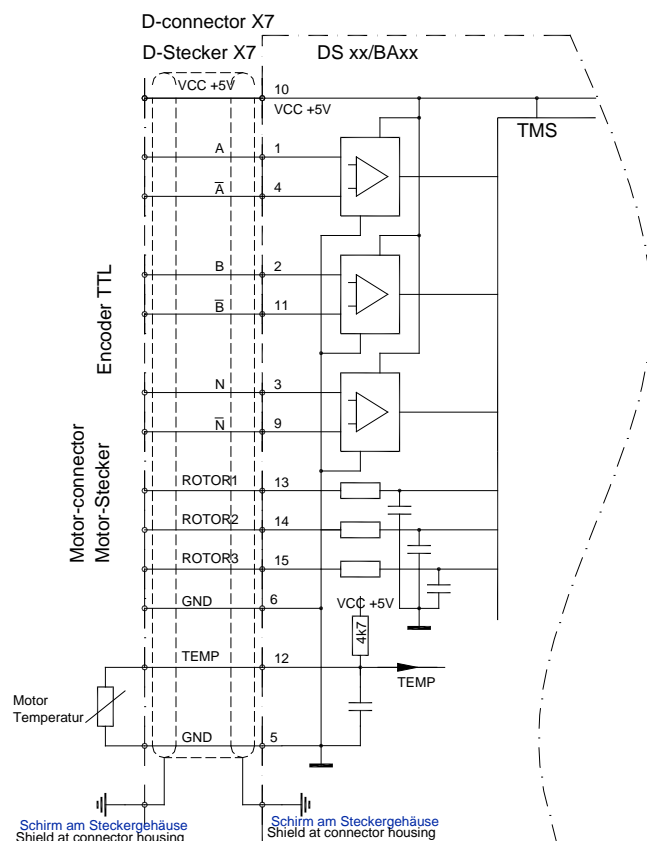
DS/BAx/DPC - DS-400-stecker-reso

Use only motors with a 2-,4-,6-, or 8-pole resolver which have been approved by the manufacturer. Observe the motor specific connection data sheet (RS)!

Connector	X7	15-pole D-connector
Connecting cable	4 x 2 cores, twisted in pairs and shielded, additional overall shield. For link chains use appropriate cables!	
cable length	for >25m only use high-quality resolver cables with adequate shielding properties.	
Shield connection	across connector X7	combine all shields and connect them to the housing
	across the motor connector	connect the overall shield tot he connector housing
Setting parameters	see Software-Manual DS	

## 5.7 Encoder TTL connection

Only for Version IN



DSx-BAx-DPC/E-DS-400-Enco-TTL-Anschluss-400

ITTL Incremental encoder (Encoder) with 2 counter tracks and 1 zero track plus 3 rotor position tracks. Counter tracks with or without push-pull output.

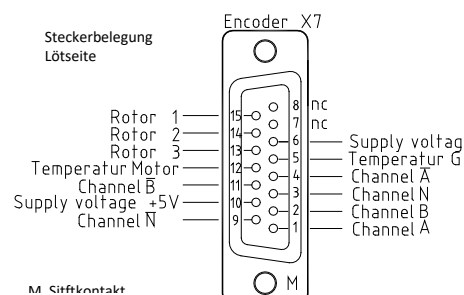
Without a push-pull pulse a connecting adapter must be used.

The counter input corresponds to RS485.

Max. counting frequency 500kHz.

The incremental encoder is galvanically connected with the device zero (GND).

Supply voltage 5V is provided by the servo.

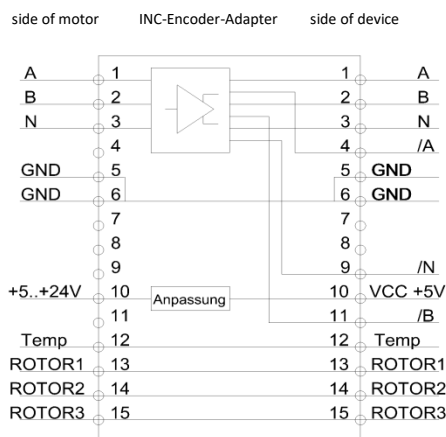


DS/BAx/DPC - DS-400-stecker-encoin

Use only motors with TTL incremental encoders and rotor position tracks which have been approved by the manufacturer. Observe the motor specific connection data sheet (IN)!

Connector	X7	15 pole D-connector
Connecting cable	10 signal conductors, shielded	min. cross-section 0,14 mm
	2 supply lines	min. cross-section 0,5 mm
	For link chains use appropriate cables!	
Cable length	for >25m the cross-section for the cable used must be increased by one grade	
Shield connection	across the connector X7	connect the shield to the connector housing
	across the motor connector	connect the shield to the connector housing
Setting parameter	see Software-Manual DS	

## Adapter for INC- encoder with A,B,N channel without push-pull signals



The device input for the incremental counter signals requires the push-pull counter pulses for a reliable detection.

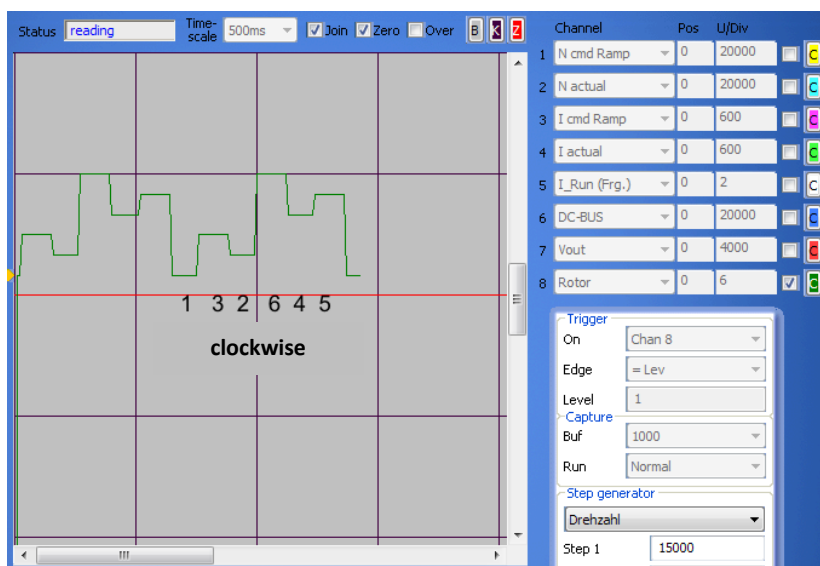
Encoders without push-pull signals (e.g. position encoders) with different supply voltages are used for many simple applications. For these applications the INC adapter must be installed.

The adapter converts the counter signals A, B, N to he push-pull signals A, /A, B, /B, N, /N.

For supply voltages which differ from 5V the voltage must be specified on order and externally be connected.

## Checking the correct connection

Rotor sequence



The correct sequence of the rotor signals with a motor turning clockwise is 1,3,2,6,4,5.

If the sequence of numbers is different the encoder connection of the rotor position signals Rotor1, Rotor2, Rotor3 (U,V,W) is not correct.

Use the connection diagram!

## Numerical value

Turn motor clockwise for one revolution without enable.

One motor revolution corresponds to a position value of Num65536. In case of different results the input of Feedback Inc-Mot (0xa6) is incorrect.

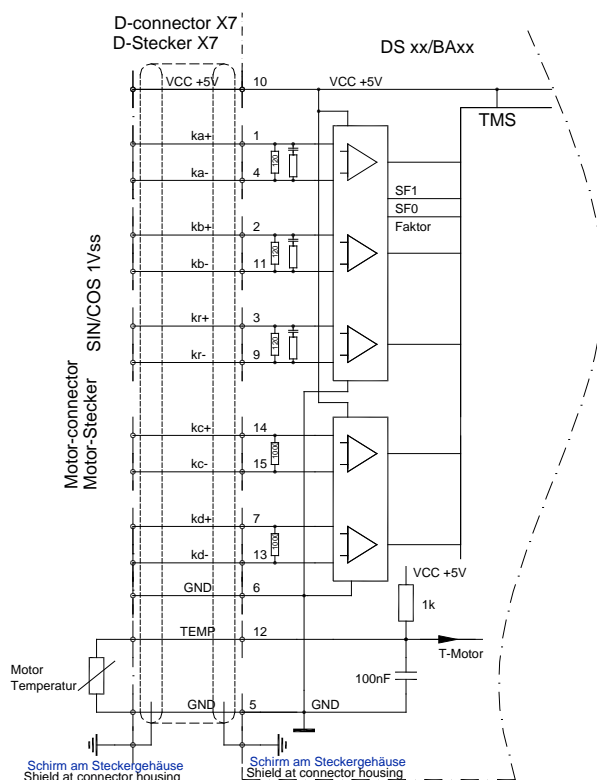
## Zero angle

Motor turning clockwise and anti-clockwise at 10%-100% speed.

The value of zero-capture must remain constant.

## 5.8 SIN COS 1Vss CONNECTION

Only for version SC

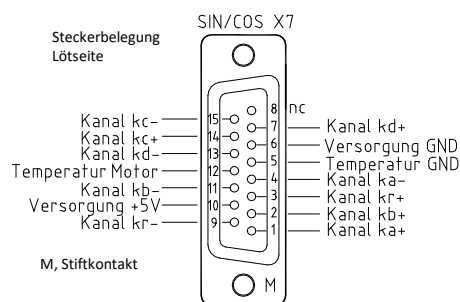


Incremental encoder with 2 analog sinusoidal counter tracks and 1 zero track plus 2 commutating tracks. Differential inputs 1Vss.

Max. counting frequency 500 kHz

The incremental encoder is galvanically connected with device zero (GND). Supply voltage 5 V, provided by the servo.

The resolution is automatically adjusted to an optimum.



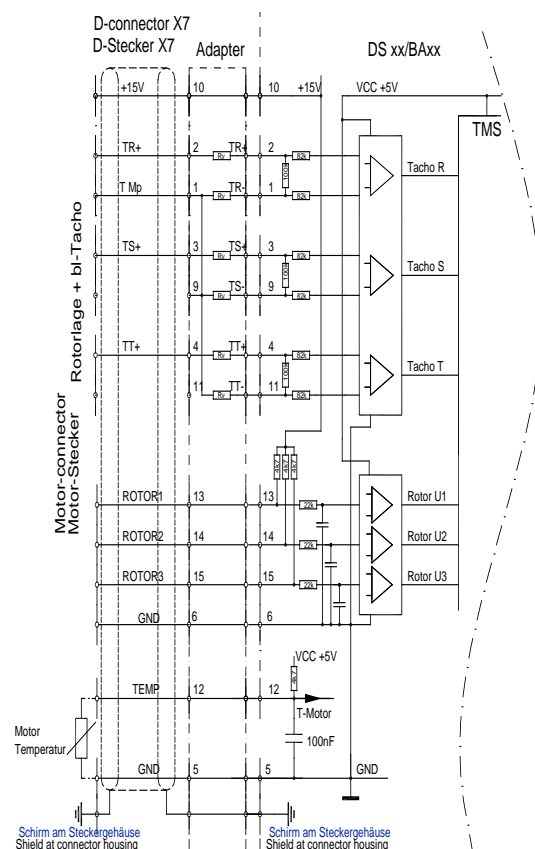
DS/BAx/DPC – DS-400-stecker-sincos

DS-BAx-DPC/E-DS-400-SINCOS-Anschluss-3

Use only motors with SIN/COS encoders (SC) which have been approved by the manufacturer. Observe the motor specific connection data sheet (SC)!		
Connector	X7 15-pole D-connector	
Connecting cable	4x signal conductors, twisted and shielded	min. cross-section 0.14 mm
	2x signal conductors, shielded	min. cross-section 0.14 mm
	4x supply lines, temp	min. cross-section 0.5 mm
Cable type	(4x(2x0,14)+(4x0,14)C+4x0,5)C For link chains use appropriate cables!	
Cable length	for >25m the cross-section of the cable used must be increased by one grade	
Shield connection	across connector X7	connect the shield to the connector housing
	across the motor connector	connect the shield to the connector housing
Setting parameter	see software Manual DS	

## 5.9 Rotor position encoder – connection via a bl-tacho

Only for version bl

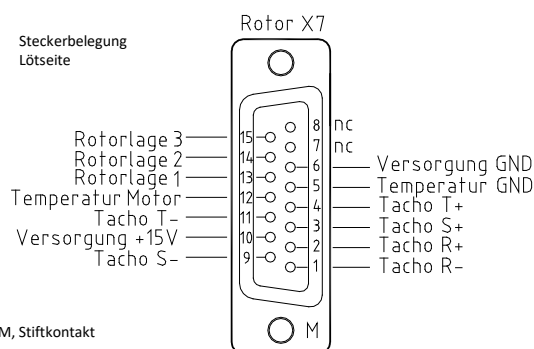


3 rotor position encoder signals (Hall sensors) for the commutation; with or without a brushless tacho.

The rotor position encoder is galvanically connected with the device zero (GND). The voltage of 15 V is supplied by the servo-drive.

Provide an adapter in case the tacho voltage at rated speed is superior to 10 V~.

For lower tacho voltages connect X7: pin 1, 9, and 11. Connect the tacho center point to X7:1



DS-400-stecker-rotor

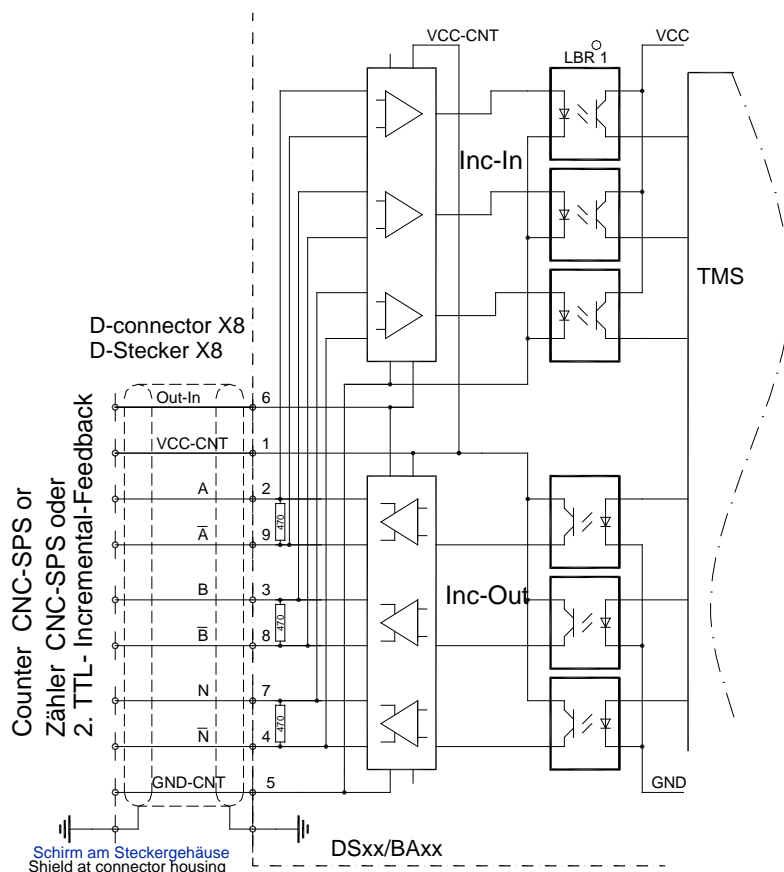
DS-BAX-DPC/E-DS400-X7-Roto

Use only motors with rotor position encoders (bl) which have been approved by the manufacturer. Observe the motor specific connection data sheet (bl)!		
Connector	X7 15-pole D-connector	
Connecting cable	12x signal conductors, supply lines, temp.	
	min. cross-section 0.25mm	
	For link chains use appropriate cables!	
Cable length	for >25 m the cross-section of the cable used must be increased by one grade	
Shield connection	across connector X7	connect the shield to the connector housing
	across the motor connector	connect the shield to the connector housing
Setting parameter	see software Manual DSNDrive	

## 5.10 X8 TTL-Encoder output or input (2)

The D-connector X8 is connected as input or output (default).

Output X8 Pin 6 not connected or bridged with GND  
Input X8 Pin 6 bridged with +5 V (X8:1)



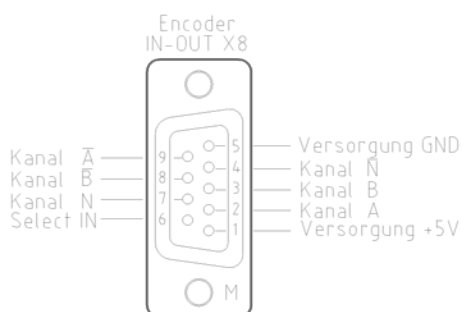
DSx-BAX-DPC/ E-DS-400-Enco-In-Out-TTL-Ansch3

9 pol D-connector (M,pins)

Connector assignment  
solder side

**Note:**  
**X8 as input**

Connect X8:6 (select IN) with  
X8:1 (+5 V) in the D-connector.



DS-BAX-DPC/DS-400-Stecker-encoout



## 5.11 X8 as TTL Encoder output

The encoder signals supplied by the motor (feedback) are available at the output of the D-connector X8 TTL encoder signals for the CNC control.

The encoder output is internally isolated.

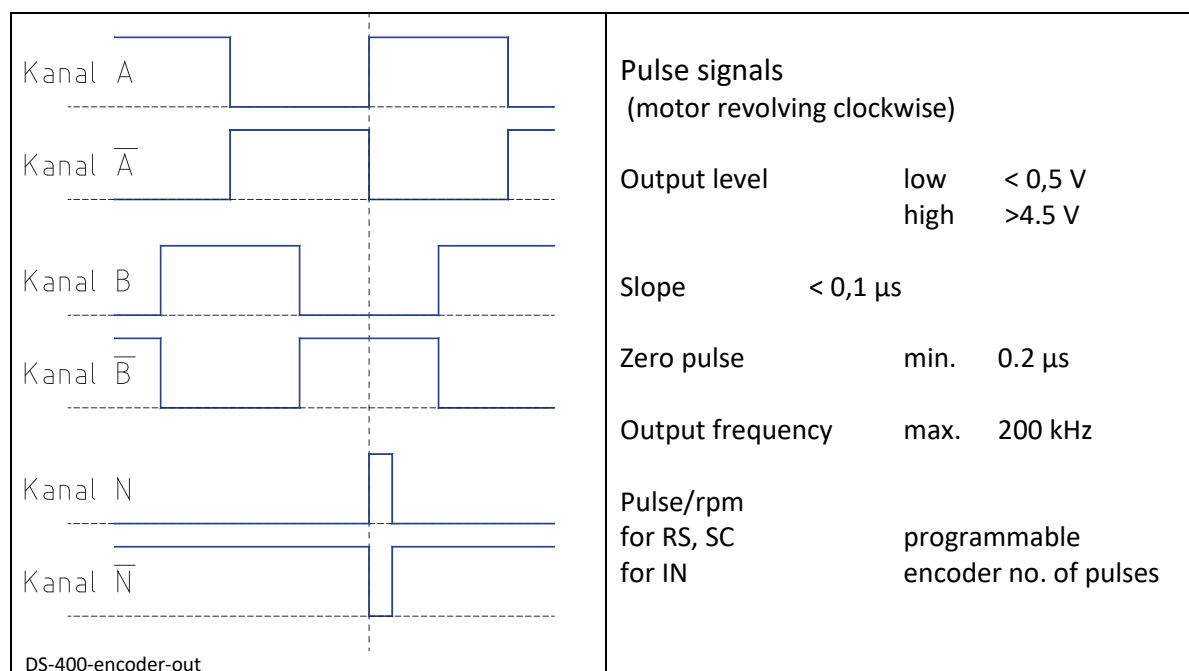
The voltage is supplied via the encoder line from the CNC/PLC control.

Voltage supply +5 V  $\pm 0.2$  V.

The output signal corresponds to RS485.

Option: Internal supply from the servo-drive (LBR1 + LBR2)

For RS and SC the resolution can be programmed. (Parameter 0 x a4, Bit1),  
for IN it corresponds to the encoder no. of pulses



## X8 as TTL encoder input

**Note:** X8 pin 6 (select IN) must be bridged with X8 pin 1 (+5V)!

The encoder input is internally isolated.

The voltage is supplied via the encoder line.

Option: Internal supply from the servo-drive

The input signal correspond to RS485.

Input frequency max. 200 kHz

Option: Internal supply from the servo-drive (LBR1 + LBR2)

The encoder input can be programmed for different functions;  
see software Manual DS-NDrive

## 5.12 Display

The state **"normal"** is signalled by a bright green seven-segment display + decimal point (display of the state).

The state **"fault"** is signalled by a bright red fault LED and the seven-segment display indicates the error no.

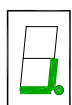
The state **"warning"** is signalled by the flashing red fault LED and the seven-segment display indicates alternately the state and the warning no.

### Display of the servo-drive state

Display	Point/segment	State	State of NDrive
	flashing	Processor active	
	dark	Auxiliary voltage missing or inherent hardware failure	
	flashing	Starting state after reset (auxil. voltage 24V off-on). The first enable stops the flashing display.	OK = 0
	bright	Drive enable	OK = 1, ENA = 1
	dark	Drive disabled (not enabled)	OK = 1, ENA = 0
	bright	Speed zero (standstill signal)	N0 = 1
	bright	Drive revolves clockwise, N currently positive	N0 = 0
	bright	Drive revolves anti-clockwise, N currently negative	N0 = 0
	flashing	Motor current reduced to continuous current $I_{cns}$	$I_{cns} = 1$
	bright	Motor current at max. current limit $I_{max}$	$I_{cns} = 0$
	dark	Normal operation; Motor current within the current limits	$I_{cns} = 0$
	bright for 0.1 s	A new command (value) was received from the BUS or RS232.	

Zeichnung\_NDrive2\_Bilder/7Segment.....

Beispiel: Motor clockwise




Point flashes = active processor  
 Bottom segment = drive enabled  
 Right segment = motor turns clockwise

### 5.13 Error display on the servo

The red LED "fault" is bright and the fault no. is indicated by the green seven-segment display.

#### List of faults/errors

Display controller	Fault display on the NDrive	Meaning
0	BADPARAS	Damaged parameter
1*	POWER FAULT	Output stage error
2	RFE FAULT	Safety bus fault
3	BUS TIMEOUT	Transmission fault BUS
4	FEEDBACK	Encoder signal faulty
5	POWERVOLTAGE	No power supply voltage
6	MOTORTEMP	Motor temperature too high
7*	DEVICETEMP	Device temperature too high
8	OVERVOLTAGE	Overvoltage $>1.8 \times U_N$
9	I_PEAK	Over-current 300 %
A	RACEAWAY	Drive races (without command value, wrong direction)
B	USER	User - choice of error
C	12R	Overload
D	RESERVE	
E	CPU-ERROR	Software error
F (device-dependent)	BALLAST	Ballast circuit overloaded
Decimal point flashing	Processing unit active	
Decimal point dark	Auxiliary voltage missing or inherent hardware failure	

	Fault	Beispiel:	POWERVOLTAGE (Power voltage missing)
		FAULT LED rot	
		Fault no. 5	

\* DEVICETEMP

For the DS405, 412, 420 the IGBT over-temperature is signaled as fault 1 POWER FAULT (output stage fault).


**Note:** When applying the 24V auxiliary voltage with the enable closed (FRG/RUN X1:7 active) the red LED signals an error. There is no fault signal displayed in the 7-segment display.

## 5.14 Warning signals

The state "warning" is signalled by the flashing red fault LED and the seven-segment display indicates alternately the state and the warning no.

## List of warning signals

Display Controller	Warning signals on the NDrive	Meaning	ID-Address
			0x8f
0	WARNING_0	Device detection inconsistent	Bit 16
1	ILLEGAL STATUS	RUN Signal	Bit 17
2	WARNING_2	RFE Signal inactiv	Bit 18
3			Bit 19
4			Bit 20
5	POWERVOLTAGE	Power voltage too small or missing	Bit 21
6	MOTORTEMP		Bit 22
7	DEVICETEMP		Bit 23
8	OVERVOLTAGE		Bit 24
9	I_PEAK		Bit 25
A			Bit 26
B			Bit 27
C	I2R	Overload >87 %	Bit 28
D			Bit 29
E			Bit 30
F(device-ependent)	BALLAST	Ballast circuit >87 % overloaded	Bit 31

	<b>Fault</b>	<b>Example:</b> flashing red, The display swaps between the state and the warning no., Warning no. 5
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## 6 Warranty

### 6.1 Warranty

**UNITEK** warrants that the device is free from material and production defects. Test results are recorded and archived with the serial number.

The warranty time begins from the time the device is shipped, and lasts two years.

**UNITEK** undertakes no warranties for devices which have been modified for special applications.

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

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

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

The foregoing warranty shall not apply to defects resulting from:

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

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

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