# MANUAL

## Digital 3-phase Servo-Drive

## DS 2420, DS 4820

for EC/AC servo motors

- Battery connection -


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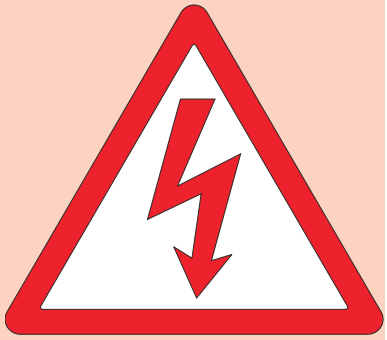
Content

**Content**Hardware manual

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

## ATTENTION - DC voltage

DC 60V=
Discharge time of the bus circuit >4 min!



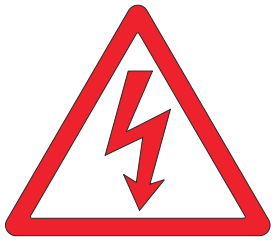
Before installation or commissioning begins, this manual must be thoroughly read and understood by the technical staff involved.
If any uncertainty arises, the manufacturer or dealer should be contacted.
Any incorrect installation or assembly may damage or destroy the units.

DS xx devices are power electric parts used for regulating energy flows. They are designed for the control of EC synchronous motors (brushless dc motors, BLDC) for industrial applications and they are part of an electric drive (PDS).
Protection rating IP20 for switch cabinet mounting.
Connection only to an earthed ac or three-phase power supply.

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

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

The 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!

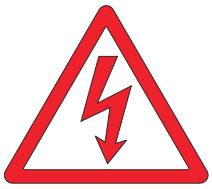


**The user must ensure that in the event of:**
- device failure
- incorrect operation
- loss of regulation or control

the axis will be safely de-activated.
It must also be ensured that the machine or equipment are fitted with device independent monitoring and safety features.
Man as well as property must not be exposed to danger at any time.

**Assembly**
- should only be carried out when all voltages have been removed.
- should only be carried out by suitably trained personnel.

**Installation**



- should only be carried out when all voltages have been removed.
- should only be carried out by suitably trained personnel
- should only be carried out in accordance with health and safety guidelines

**Setting adjustments/programming**

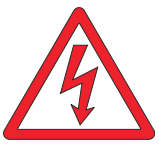
- should only be carried out by suitably trained personnel with knowledge in electronic drives and their software
- should only be carried out in accordance with the programming advice
- should only be carried out in accordance with health and safety guidelines

**CE**
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 89/392/EWG and the EMC guideline 89/336/EWG.
Under the installation and test conditions of chapter ‘EMC advice’ the device adheres to the following: guideline EU 89/336/EWG, EMC standards EN61000-2 and EN61000-4.
A manufacturer’s declaration can be asked for.

**QS**
Test results are archived with the device serial number by the manufacturer for a period of 5 years. Test protocols can be asked for.

**Safety symbols**

Caution - Danger to life
High voltage



Attention
Warning
Important

**General information**

The digital 3-phase current servo amplifier **DS xx** in combination with the brushless dc motor (synchro servo motor, CE motor) provide a drive solution free of maintenance and with a wide dynamic control range. The drive displays the well-known good control characteristics of dc drives without the disadvantages of the carbon brushes' wear and the commutation limits. The rotor moment of inertia is notably lower and the threshold power is greater than with equally constructed dc motors. This results in up to 5 times higher acceleration values. Compared to asynchronous motors with frequency converters the stability, the control range and the efficiency of the drive are considerably improved. The generated heat in the motor only occurs in the stator, therefore, the EC motors always have the protection rating IP 65.

From the electrical view, the brushless dc motor is a synchro motor with a permanent magnet rotor and a three-phase current stator.

The physical characteristics correspond to those of dc motors, i.e., the current is proportional to the torque and the voltage is proportional to the speed. 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 motor voltages and the motor currents are sinusoidal. A maximum motor efficiency is achieved by means of a compensating current control.

The DS 2420 drives can be used as single-axis position amplifier or torque or speed amplifier.

The position and speed actual value is generated in the encoder unit (resolver or incremental 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 a PC or a programming box. The communication with superordinate controls is effected by means of BUS systems (standard CAN-BUS, RS232) or by analogue interfaces.

**Note:**

The energy is fed back into the battery during brake operation.

No ballast (regen) circuit.

For any operation via a mains supply circuit (without battery) a separate ballast circuit or a voltage watchdog must be installed.

**Information:**

| | |
|---|---|
| Digital servo-amplifiers | > UNITEK series DS200, DS400 |
| Analog three-phase servo-amplifiers | > UNITEK series TVD3, TVD6, AS |
| Analog dc servo-amplifiers | > UNITEK series TV3, TV6, TVQ6 |
| Thyristor current converters 1Q, 4Q, servo | > UNITEK series *Classic*, 200W to 800kW |
| DC and ac servo-amplifiers for battery operation analog and digital | > UNITEK series BAMO A2, A3, D3<br>series BAMOBIL |

## Applications

Battery-driven machines and installations for all types with a drive power of 1kW especially as 4Q-servo-drive for
- 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.
Drives with constant speed as in conveyors, spindle drives, pumps, transversal or longitudinal pitch drives.
Synchronous multiple motor drives.
Synchro-servo-drives are more compact than other electric drives.

## Particularly suitable for:

component equipment 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.

## Motor features

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

**Note**

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

The braking energy is fed to the battery.
For any operation via a mains supply circuit (without battery) a separate ballast circuit or a voltage watchdog must be installed.

## Build

- devices for switch cabinet mounting, steel housing, according to the VDE, DIN and EC regulations, protection rating IP20, VGB4
- standard digital control electronics
- power electronics for 20A (S1 operation)
- battery power input voltage 24V= or 48V=
- independent 24V chopper power supply unit for the 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
- the distance of air gaps and leakage paths adhere to the VDE standards

## Components

- FET power semi-conductors, comfortably over-dimensioned
- only components customary in trade and industrially standardised are used
- SMD equipment
- LED displays

### Characteristics

* EMC protected steel housing
* battery connection 24V= or 48V=
* independent auxiliary voltage connection 24V=
* digital interfaces RS232, CAN-BUS (further option)
* analogue inputs, programmable differential inputs
* digital inputs/outputs, programmable, optically de-coupled
* logic for enable and the output stage switch
* BTB ready for operation, relay contact
* position, speed and torque control
* resolver or incremental encoder (sine encoder option)
* encoder output
* static and dynamic current limiting
* uniform, completely digital control unit
* intrinsically safe and short-circuit proof power section
* 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

| | |
|---|---|
| Power supply connection | Battery 24V= ; Battery 48V= |
| Auxiliary voltage connection | 24V= ± 10% / 2A, Residual ripple <10%,regenerating fuse |

| **Specification** | Dim. | DS2420 | DS 4820 | DS2420-DC | DS 4820-DC |
|---|---|---|---|---|---|
| Supply voltage nominal value | V~ | 24 | 48 | 24 | 48 |
| Max.output voltage, Max.nominal value | V~eff | 3x14 | 3x32 | 22 | 45 |
| Power input S1 max. | VA | 700 | 1400 | 700 | 1400 |
| Power output S1 max. | W | 500 | 1000 | 500 | 1000 |
| Continuous current | $A_{eff}$ | 20 | | | |
| Max. Peak current | $A_{lo}$ | 40 | | | |
| Max. Power loss | W | 60 | 65 | 60 | 65 |
| Pulse frequency | kHz | 8 | | | |
| Over-voltage switching treshold | V= | 38 | 66 | 38 | 66 |
| under-voltage switching treshold | V= | 18 | 32 | 18 | 32 |
| Input fuse | A | 30 | | | |
| Weight | kg | 1.2 | | | |
| dimensions h x w x d | mm | 140x70x190 | | | |
| Unit size | | 1 | | | |

| **Control signals** | V | A | Function | Connector |
|---|---|---|---|---|
| Analog inputs | ± 10 | 0.005 | Differential input | X1 |
| Digital inputs ON<br>OFF | 10-30<br><6 | 0.0100 | Optically decoupled | X1 |
| Digital output | +24 | 0.03 | Optically decoupled | X1 |
| Resolver | | | Differential input | X7 |
| Encoder input | >3.6V | | Optically decoupled | X7 |
| Encoder output | >4.7 | | Optically decoupled | X8 |
| CAN interface | | | Optically decoupled | X9 |
| RS232 interface | | | 9600 baud | X10 |
| | | | | |

| **Specification** | |
|---|---|
| Protection rating | IP20, VGB4 |
| standards | EN60204, |
| Operating temperature range | 0 to +45°C |
| Extended operating temperature range | +45°C to +60°C<br>performace reduced by 2%/°C |
| Storage temperature | -30°C bis +80°C |
| Humidity rating | Class F humidity <85%,<br>**no condensation allowed !** |
| Site of installation | ≤ 1000m above sea level 100%,<br>>1000m performace reduced by 2%/100m |
| Ventilation | Internal fans |
| Mounting position | Vertical; performace reduced by 20% when mounted horizontally |

| **Programming** | **Version** | **Software version** | **Extension** |
|---|---|---|---|
| DS-4xx-x | RESO- 12bit | DRIVE_DS 2. | |
| DS-4xx-x | RESO-<br>12/16bit | | |
| DS-4xx-x | Encoder | | -IN |
| DS-4xx-x | Sine encoder | | -RS |

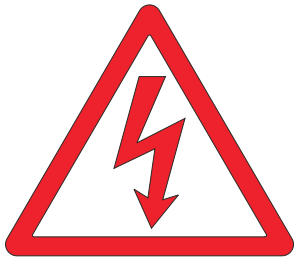
Free

## Important instruction

Blank mounting surface, no lacquer (EMC surface-to-surface contact)
Check the device for mechanical damage. Only perfect devices can be mounted.

## Disconnect the power supply prior to any assembly.

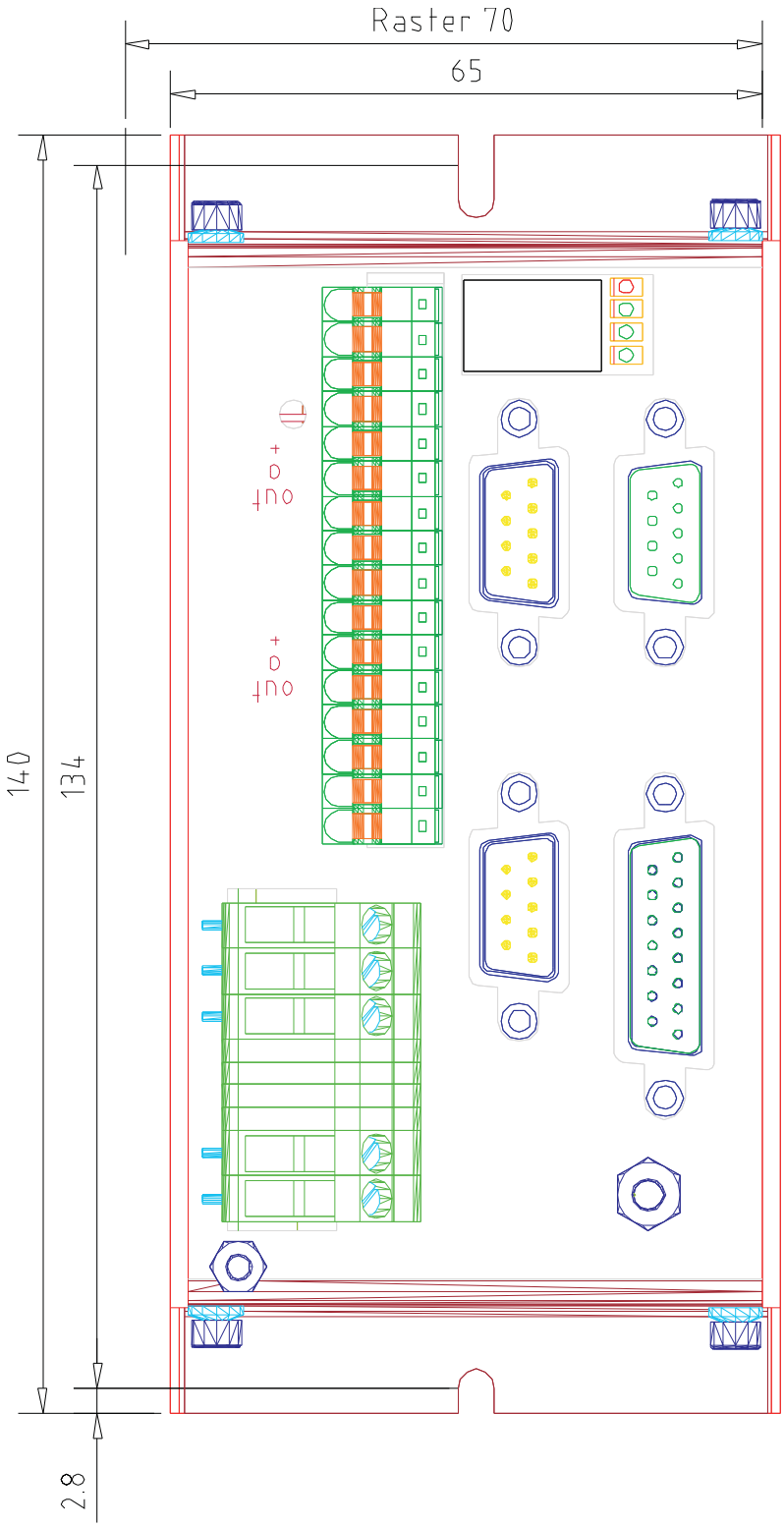
For installations connected to an electric power supply install the horting plug and affix the warning signs.
The device must only mounted by suitably trained personnel.



## Vertical mounting position.

Please note that there will be a performance reduction when the evices are mounted horizontally (10%).
Ensure that the ventilation is sufficient and that there is enough pace 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 (M4) into the mounting plate. Turn-in the screws to 4mm.
Insert the device and fasten the screws.
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.
Use vibration-proof screw connections.
Ensure that the switch cabinet ventilation is sufficient.
If the ambient temperature is too high (>30°C) an air conditioning unit has to be installed.

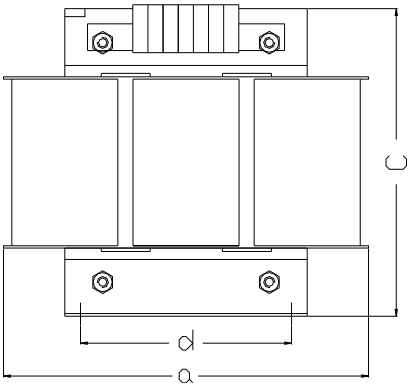
**Note**: The operation of bedewed devices is not permissible.




**Dimensions**
**Size 1**
DS 2420 to DS 4820

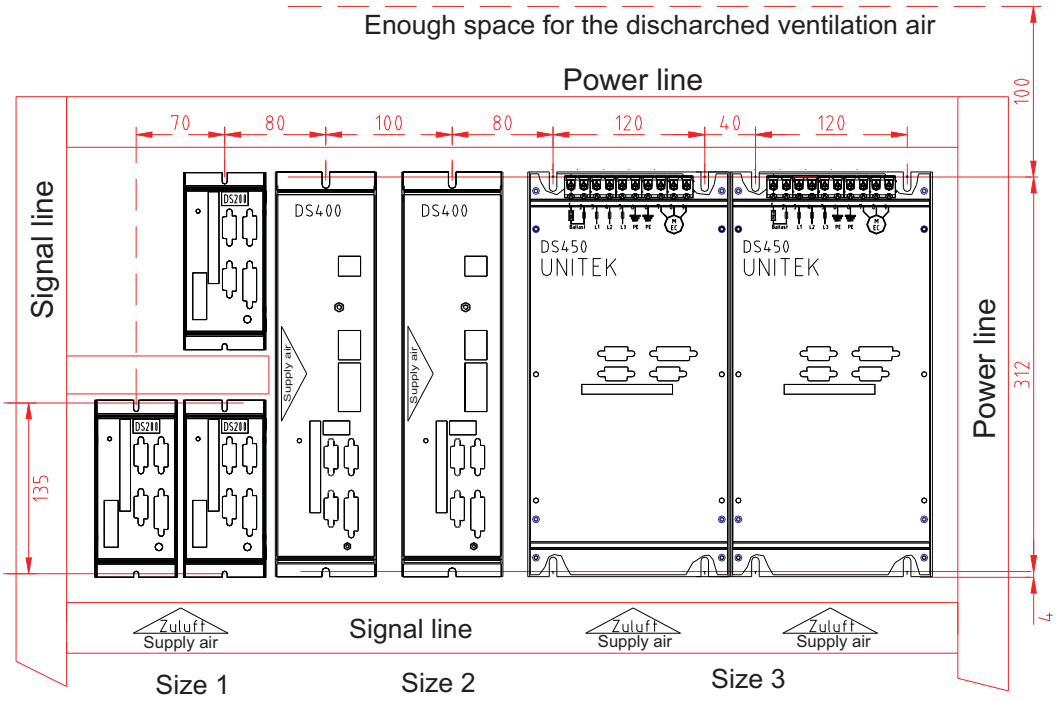
| | |
|---|---|
| Mounting depth | without connector 190 mm |
| | with connector max. 250mm |
| Fixing screws: | M4 x 10 (DIN 912 recommended) |

## Dimensions - Motor choke



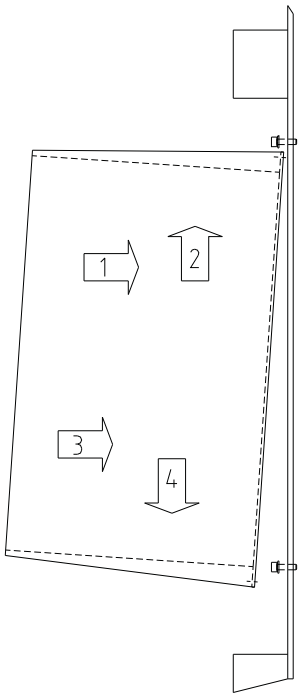

| Type | Current | Induct. | Dimensions | w. |
|---|---|---|---|---|
| | A | mH | H x w x d mm | kg |
| MDD 1.6b-10 | 10 | 1 | 95x58x108 | 1.4 |
| MDD 2b-20 | 20 | 0.8 | 128x80x140 | 2.6 |
| | | | | |

Motor choke only with a cable shield capacity of >5nF.
Cable length: approx. 25m

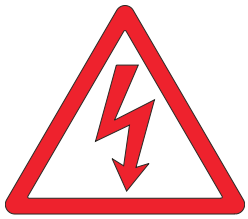



In order to achieve good EMC values, it is recommended to use bright, unpainted mounting plates. The bright surface of the device's rear panel ensure a good surface-to-surface contact.
The signal lines and the power supply lines must be routed in separate trunkings with rectangular crossings (spatial separation of the disturbance coupling).

**Mounting instruction**
Recommended fixing screw
DIN 912 M4x12 with safety washer
Bore threaded M4 holes at a right angle distance of 312mm.
Drilling template included.
Turn in the M4x12 screws.
Distance to the rear panel of the switch cabinet approx. 4mm
Position the upper edge of the device (1) and push it up against the stop (2). Then push the lower part of the device against the switch cabinet's rear panel (3) and lower it (4).
Fasten the screws.



**Important note:**
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.



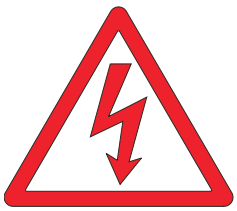
**Adhere to:**
**- connection and operating instructions**
**- local regulations**
**- EU guideline 89/392/EWG**
**- VDE and TÜV regulations and Trade body guidelines**

**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 shorting plug
- 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 and the auxiliary voltage.
- 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.



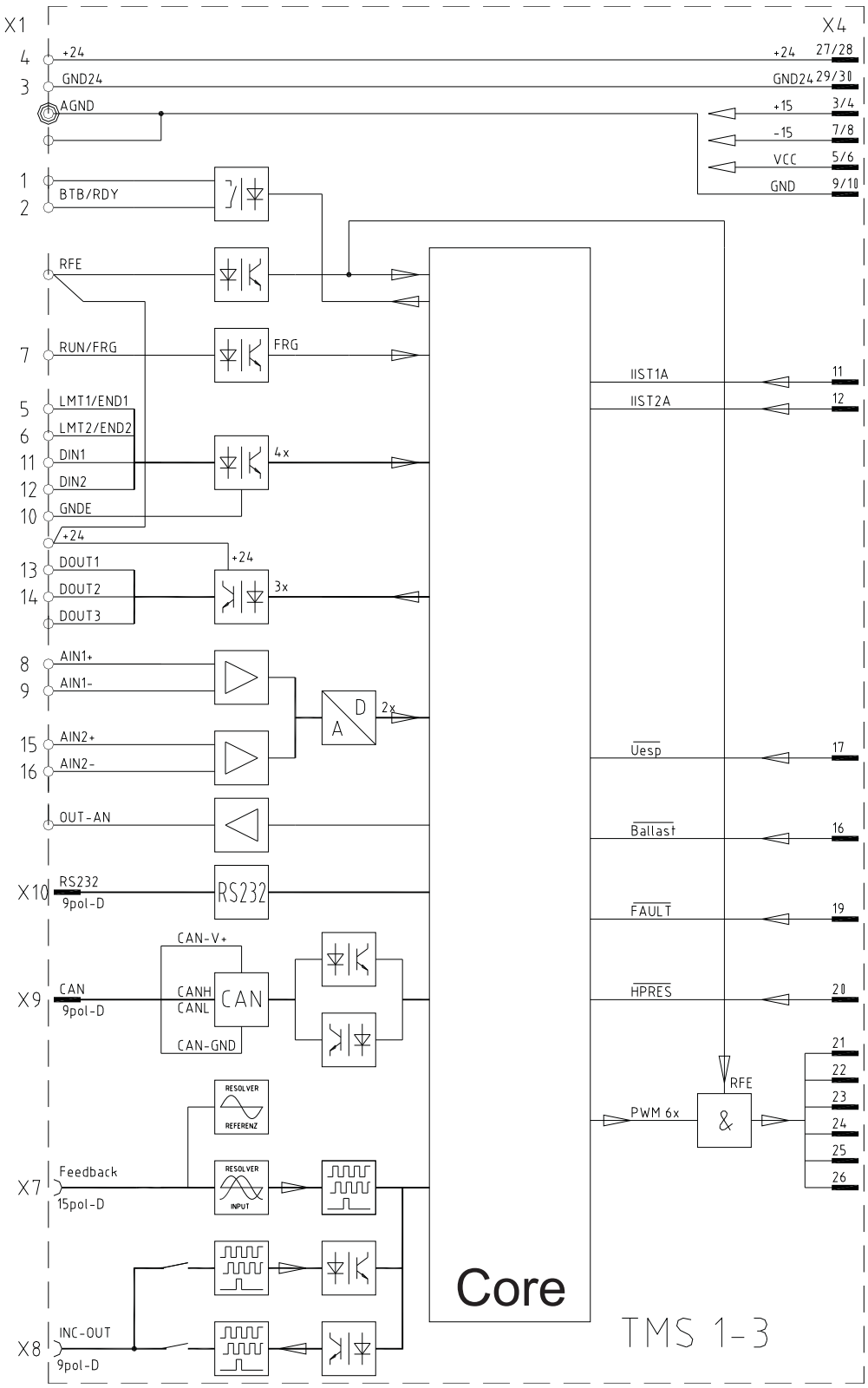
**Type plate** (example)

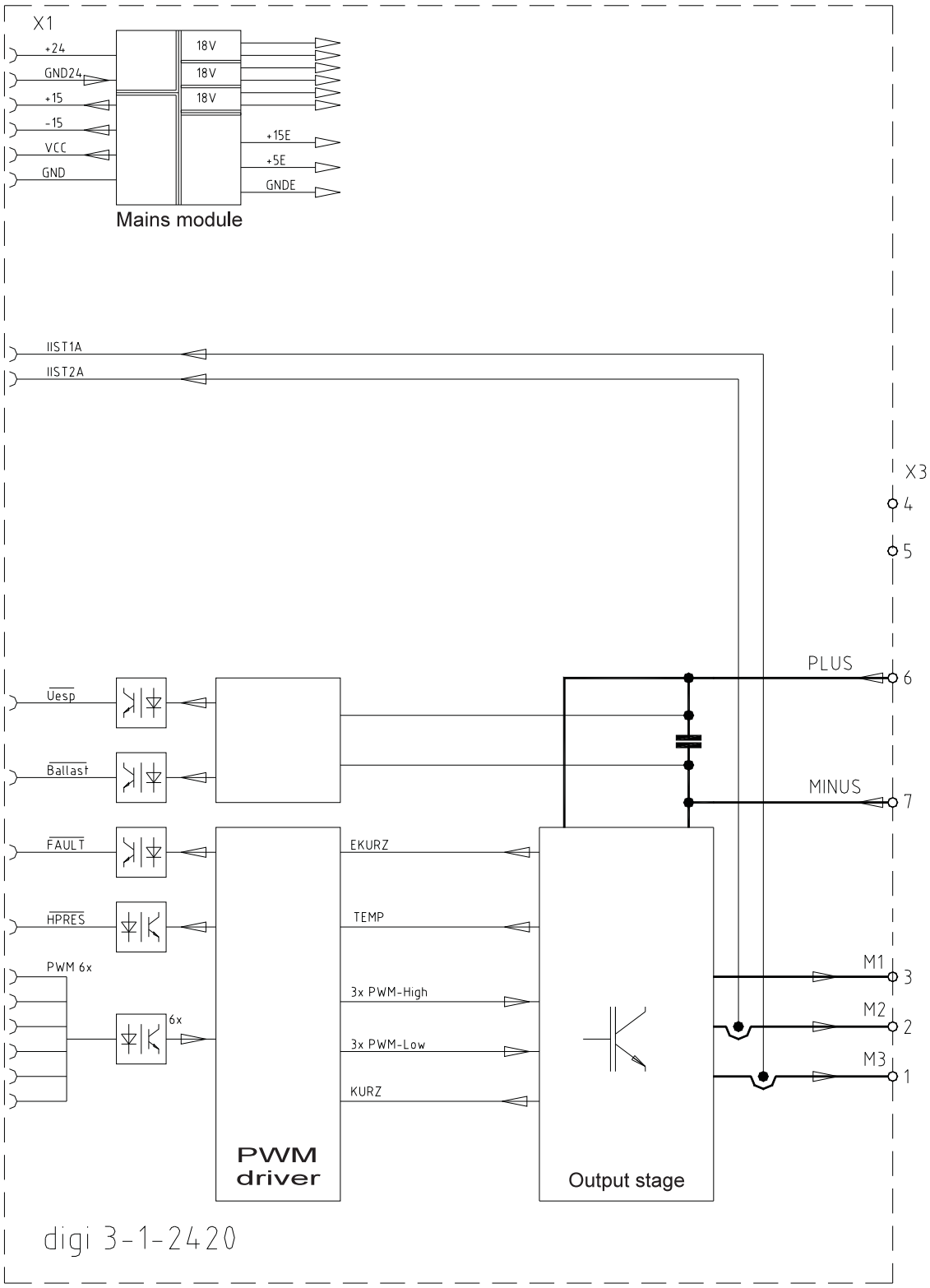
UniTek Industrie Elektronik G m b H

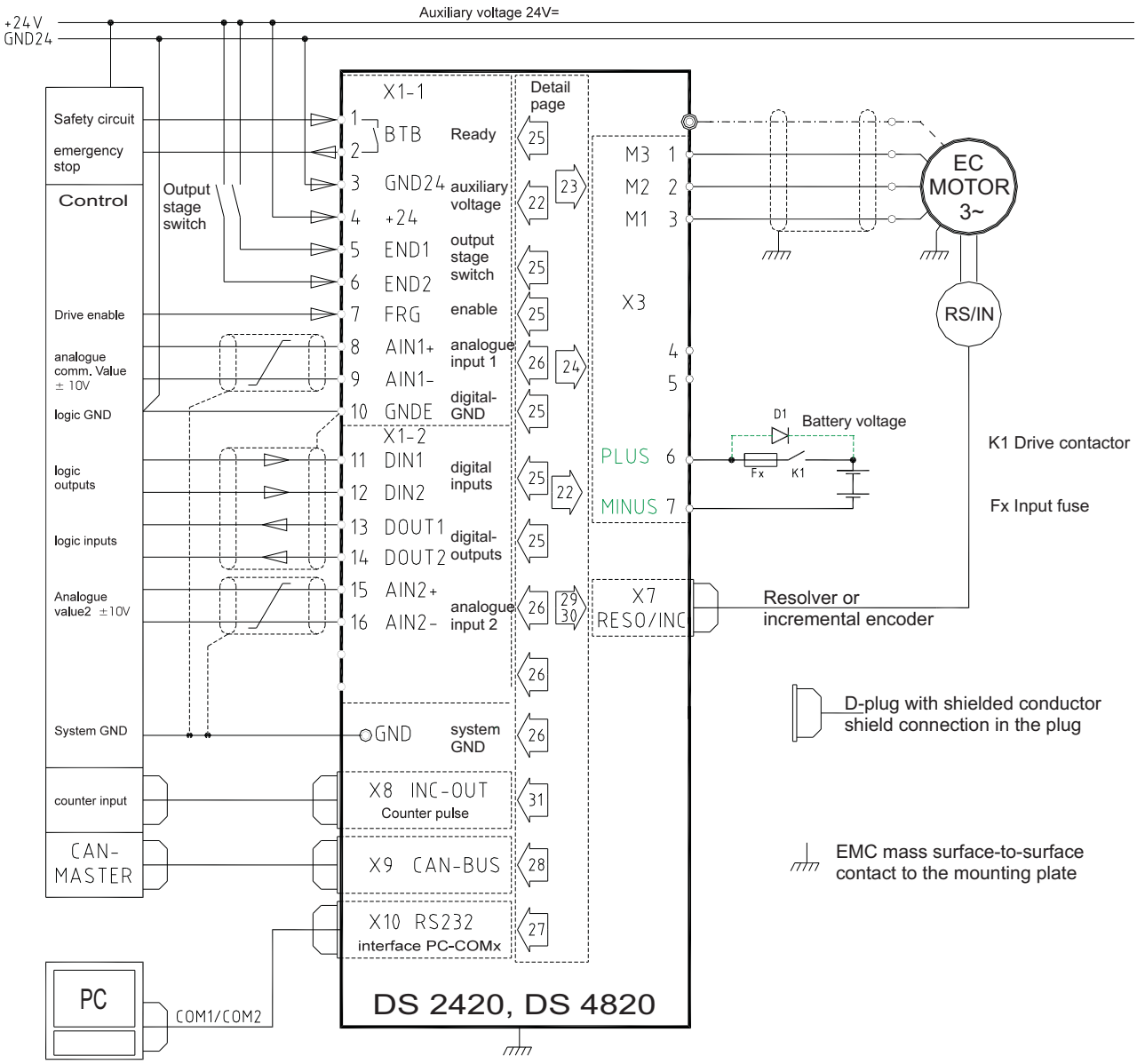
726 3-phase Servo drive
DS 412-RS
Power supply 3 1( x)30V~ to 480V~
Rated current 12A eff IP20
Auxiliary voltage 24V=
Tel. +49 (0)7195/9283-0 Info@unitek-online.de
Fax +49(0)7195/928329 www.unitek-online.de

Serial no. 044444

Circuit diagram




X1
+24
GND24
+15
-15
VCC
GND
18V
18V
18V
+15E
+5E
GNDE
Mains module
IIST1A
IIST2A
X3
4
5
PLUS
6
MINUS
7
Uesp
Ballast
FAULT
HPRES
PWM 6x
6x
EKURZ
TEMP
3x PWM-High
3x PWM-Low
KURZ
M1
3
M2
2
M3
1
PWM driver
Output stage
digi 3-1-2420


+24V
GND24
Auxiliary voltage 24V=
Safety circuit
emergency stop
Control
Output stage switch
Drive enable
analogue comm. Value ± 10V
logic GND
logic outputs
logic inputs
Analogue value2 ±10V
System GND
counter input
CAN-MASTER
PC
COM1/COM2
X1-1
1 2 BTB Ready
3 GND24 auxiliary voltage
4 +24
5 END1 output stage switch
6 END2
7 FRG enable
8 AIN1+ analogue input 1
9 AIN1-
10 GNDE digital-GND
X1-2
11 DIN1 digital inputs
12 DIN2
13 DOUT1 digital-outputs
14 DOUT2
15 AIN2+ analogue input 2
16 AIN2-
GND system GND
X8 INC-OUT Counter pulse
X9 CAN-BUS
X10 RS232 interface PC-COMx
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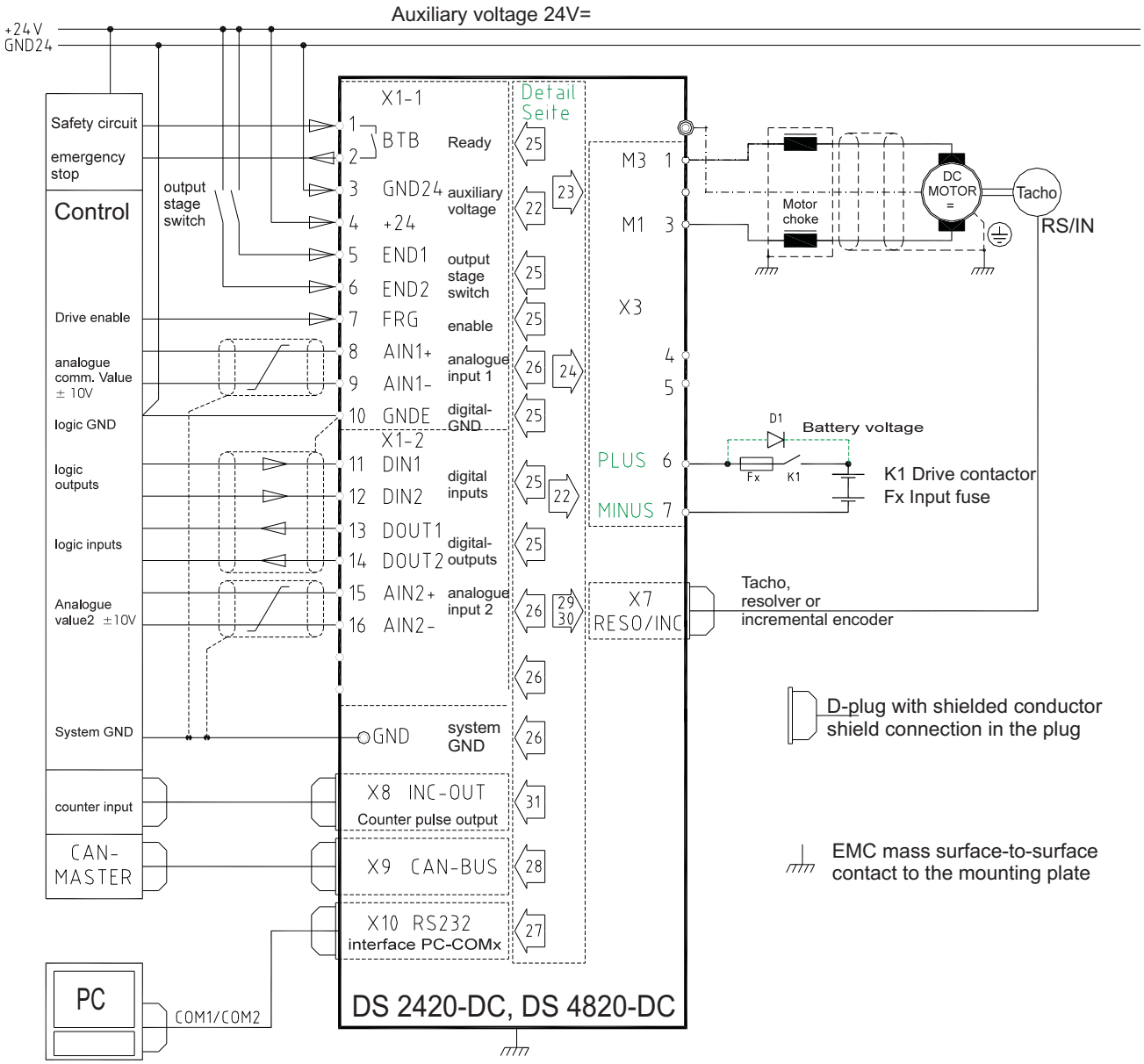
M2 2
M1 3
X3
4
5
PLUS 6
MINUS 7
X7 RESO/INC
EC MOTOR 3~
RS/IN
D1
Battery voltage
Fx
K1
K1 Drive contactor
Fx Input fuse
Resolver or incremental encoder
D-plug with shielded conductor shield connection in the plug
EMC mass surface-to-surface contact to the mounting plate


Auxiliary voltage 24V=
+24 V
GND24
Safety circuit
emergency stop
Control
output stage switch
Drive enable
analogue comm. Value ± 10V
logic GND
logic outputs
logic inputs
Analogue value2 ±10V
System GND
counter input
CAN-MASTER
PC
COM1/COM2
X1-1
1 BTB Ready
2
3 GND24 auxiliary voltage
4 +24
5 END1 output stage switch
6 END2
7 FRG enable
8 AIN1+ analogue input 1
9 AIN1-
10 GNDE digital-GND
X1-2
11 DIN1 digital inputs
12 DIN2
13 DOUT1 digital-outputs
14 DOUT2
15 AIN2+ analogue input 2
16 AIN2-
GND system GND
X8 INC-OUT
Counter pulse output
X9 CAN-BUS
X10 RS232
interface PC-COMx
DS 2420-DC, DS 4820-DC
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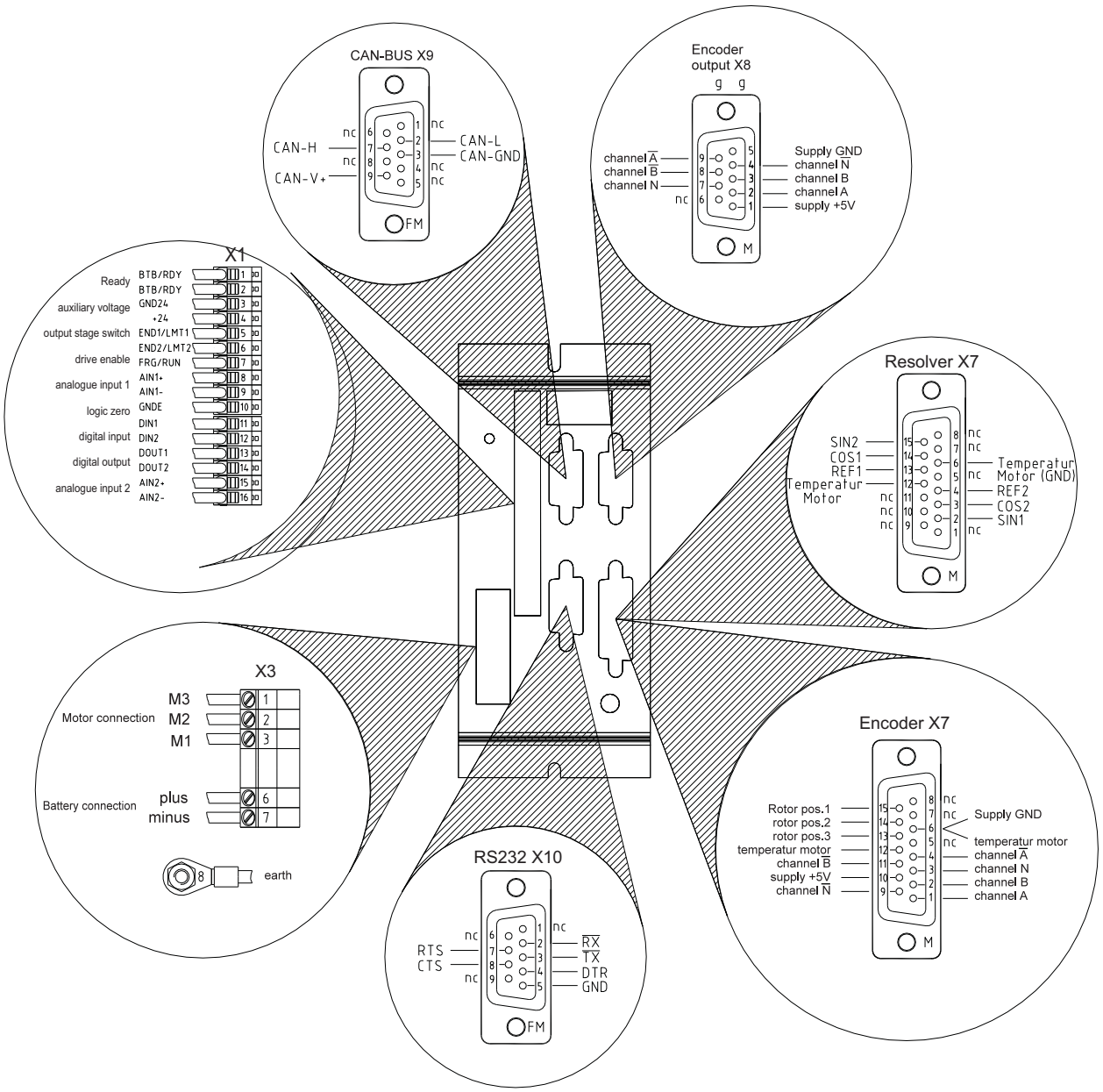
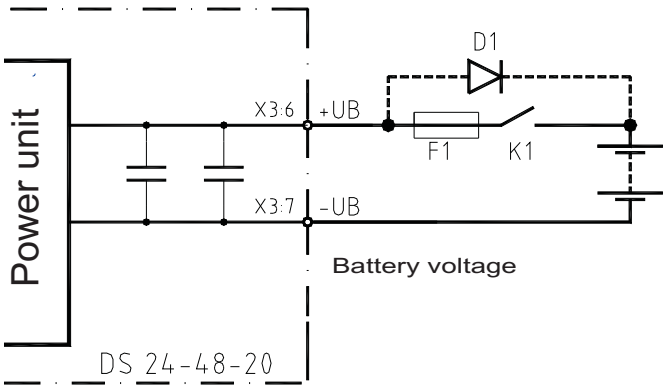
29
30
26
26
31
28
27
M3 1
M1 3
X3
4
5
PLUS 6
MINUS 7
X7
RESO/INC
Motor choke
DC MOTOR
=
Tacho
RS/IN
D1
Battery voltage
Fx
K1
K1 Drive contactor
Fx Input fuse
Tacho, resolver or incremental encoder
D-plug with shielded conductor shield connection in the plug
EMC mass surface-to-surface contact to the mounting plate




Connector on the solder side
M = connector
FM = input jack

## Battery connection




**Warning**
The max. supply voltage must not be exceeded at any time (not even for short intervals)!
Danger of damage!
F1 = safety fuses

Feedback diode D1
more safety
during braking operation with open contact K1 or defective fuse.

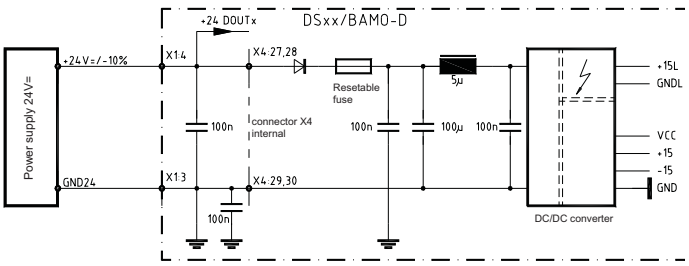
| Type | Battery connection | Connection cross - section mm² | AWG | Fuse AT | Drive contactor size |
|---|---|---|---|---|---|
| 2420 | positive - X3:6<br>negative - X3:7 | 2.5 | 14 | 30 | |
| 4810 | | 1.5 | 16 | 20 | |
| 4820 | | 2.5 | 14 | 30 | |
| Eart connection across the earthing point | | | | | |

### Auxiliary voltage connection

Mains potential-free auxiliary dc voltage 24V= ±10%/2A
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

External fuse only for line protection.

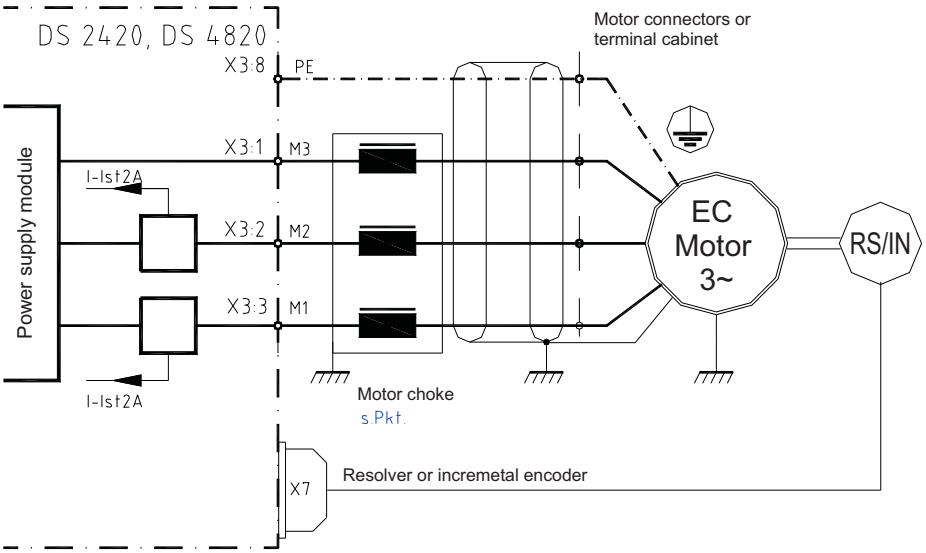



| | |
|---|---|
| Input voltage | 24V dc X1:4<br>GND24 X1:3 |
| Residual ripple | 10% |
| Switch-on current | 2A |
| Nominal current | 0.8A |

Mains module: negative connection across earth.

**Motor power connection**

Only electronically commutating synchronous motors (brushless dc motors, EC motors) with resolver or incremental encoder must be used. These motors must be approved of by UNITEK prior to any use.
See appendix A
(Motor specific connection and parameter standards and guidelines).



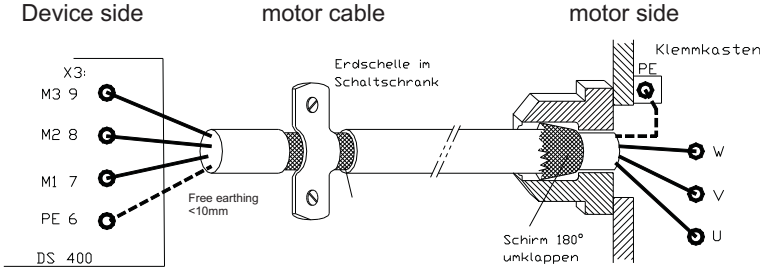

| Cable | **PE** | **M1** | **M2** | **M3** |
|---|---|---|---|---|
| Connect. terminal | X3:6 | X3:3 | X3:2 | X3:1 |
| Only one correct connecting sequence is possible! | | | | |

| Type DS | **2420** | **4820** |
|---|---|---|
| Querschnitt $mm^2$ | 2,5 | 2,5 |
| AWG | 14 | 14 |

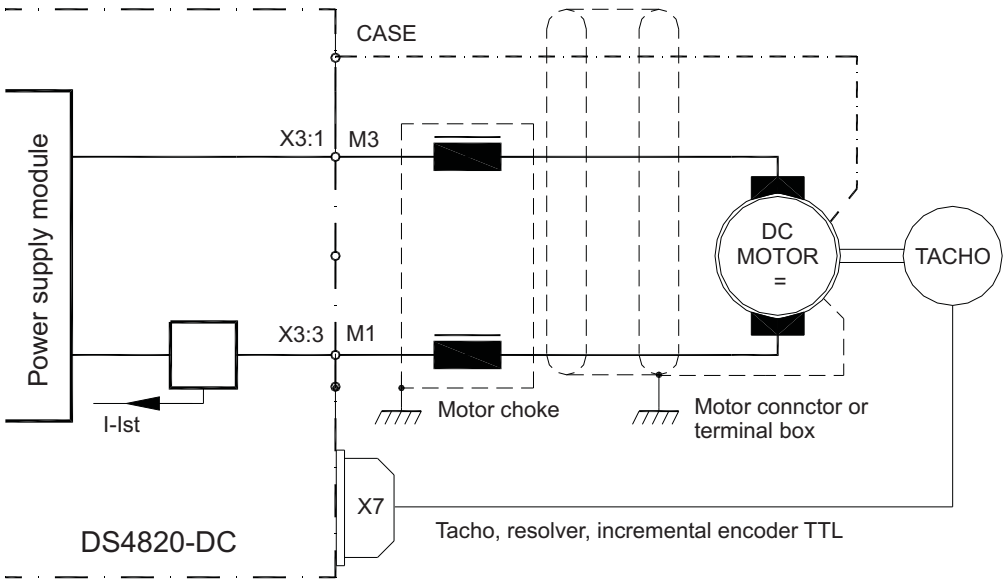
**Motor cable**
3-core + protective earth conductor, single-shielded for 600V~, 1000V=
shield capacity = 150pF/m
min. cross-section see below table

**Motor choke**
Only necessary for a shield capacity of >5nF. Approx. 25m motor cable

**Connection of the shield**
Surface-to-surface connection to the switch cabinet input.
Surface-to-surface connection or connection as short as possible to the motor side.



## Motor power connection




## Motor cable

2-core + protective earth conductor
single-shielded for 600V~, 1000V=
shield capacity = 150pF/m

**min. Cross-section** 2.5mm AWG14

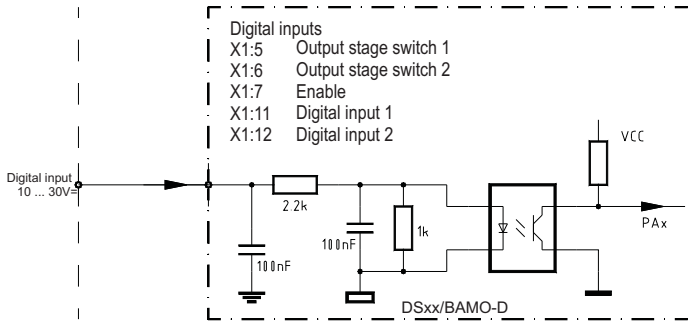
## Motor choke

Choke with ferrous motors use forever ! Type 2EI 84-25

## Connection of the shield

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

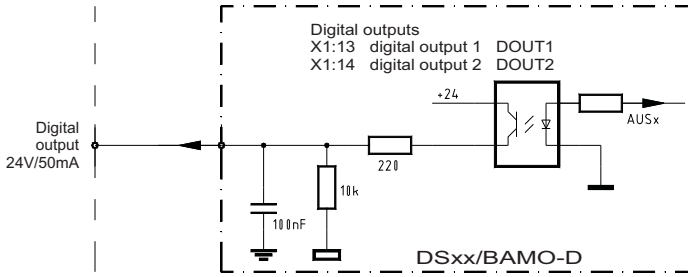
## Digital inputs




| Opto input | |
|---|---|
| Input voltage | |
| Level ON | +10 to+30V |
| Level OFF | 0 to +6V |
| Input current | max. 14mA |
| Nom.voltage/nom.current | +24V/10mA |
| Ground reference | GNDE (X1:10) |

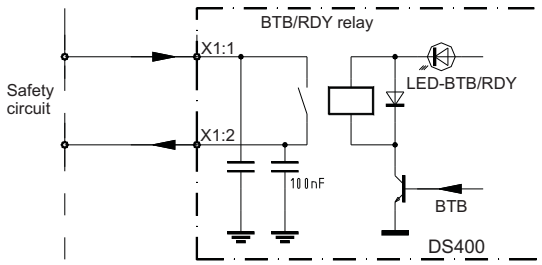
| Input | Connection | Function | State 1 | State 2 | Parameter |
|---|---|---|---|---|---|
| FRG/RUN | X1:7 | Enable | fixed | fixed | DS-Drive-2 inputs & outputs |
| END1/LMT1 | X1:5 | Output stage switch 1 | fixed | programable | |
| END2/LMT2 | X1:6 | Output stage switch 2 | fixed | programable | |
| DIN 1 | X1:11 | Digital input 1 | programable | | |
| DIN 2 | X1:12 | Digital input 2 | programable | | |

## Digital outputs




### Open emitter output

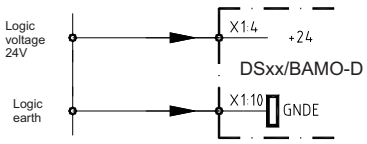
| | |
|---|---|
| Output voltage | |
| Level ON | max. 24V= |
| Level OFF | <1V= |
| Output current | max. 30mA |
| Output resistance | 220W |
| Reference voltage | +24 (X1:4) |
| Ground reference | GNDE (X1:10) |




### Relay contact BTB/RDY

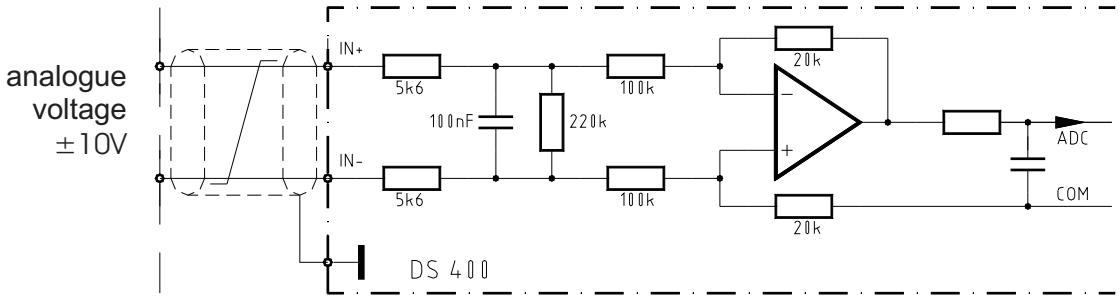
Contact for 48V/1A
The contact is closed when the device is ready.
Indication by a green LED on the front panel.
In case of an error the contact is open.

| Output | Connections | Function | State | Parameter |
|---|---|---|---|---|
| BTB/RDY | X1:1, X1:2 | ready | fixed /relay | |
| DOUT1 | X1:13 | Digital output 1 | programmable | DS-DRIVE-2 Inputs&Outputs |
| DOUT2 | X1:14 | Digital output 21 | programmabler | |




External power supply for the inputs and outputs
+24V for the logic and the auxiliary voltage
GNDE logic ground

## Analog inputs ±10V




| Input | Connection | Basic function | Voltage | State | Parameter |
|---|---|---|---|---|---|
| AIN1+,AIN1- | X1:8, X1:9 | Speed command value | ±10V | programmable | DS-DRIVE-2 Analog inputs |
| AIN2+,AIN2- | X1:15, X1:16 | Current limit | ±10V | programmable | |

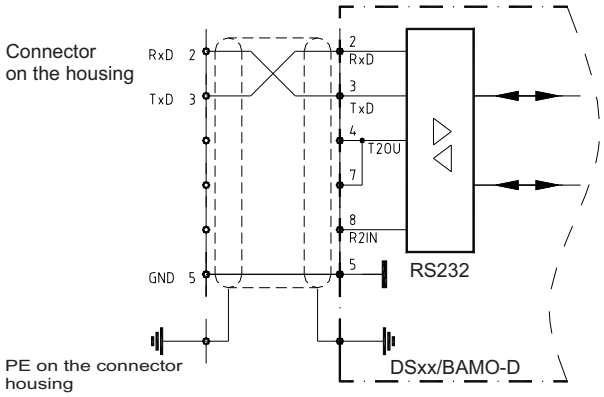
## Features

| **Differential input** | AIN1+/AIN1- | AIN2+/AIN2- | |
|---|---|---|---|
| Input resistance | 70k | | |
| Threshold voltage | ±12V | | |
| Resolution | 11Bit + sign | | |
| Parameter scale | | | |
| Parameter assignment | | | |
| | | | |

The direction of rotation of the motor can either be changed by swapping the ± connections at the differential input or by changing the signs via the parameter scale.

**RS 232**
DSxx is programmed and operated during commissioning via the serial pc interface RS232.
There is a software description in the Manual DS.

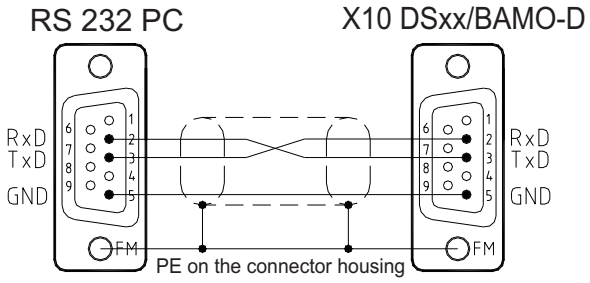
**Connector X10**



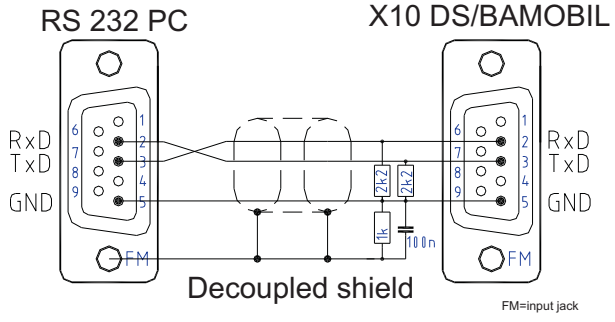

The serial interface is galvanically connected with the device zero (GND).

The DSxx (D connector X10) and the serial interface (COM1/COM2) 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 115200Baud.

Null modem connecting cable
View to the soldered side,
Shield on the housing,
Max. cable length 5m

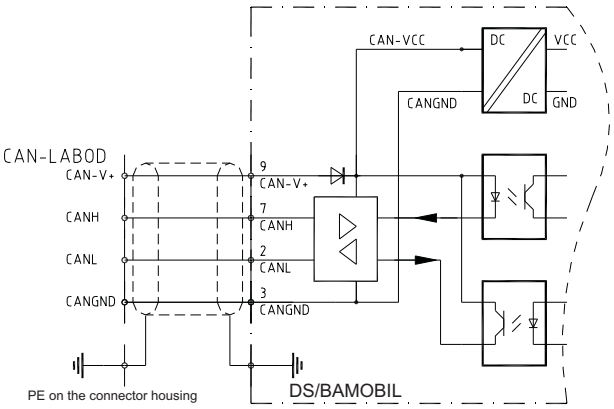



Bei starken Störungen auf der Schnittstelle sollte ein Leitungsfilter eingesetzt werden.
Laptop mit USB-RS232 Konverter sind meist störempfindlich.



CAN-BUS
The CAN-BUS is a digital connection to the CNC control.
Optimum conditions are achieved with LABOD CNC controls.
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.

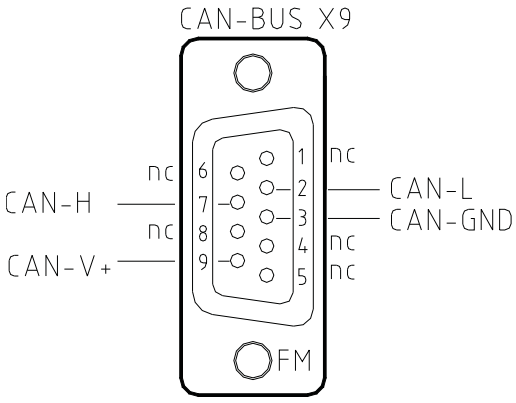



The interface is galvanically isolated from the device.
The voltage is supplied via the bus cable.
CAN-V+ 9 to 15V=

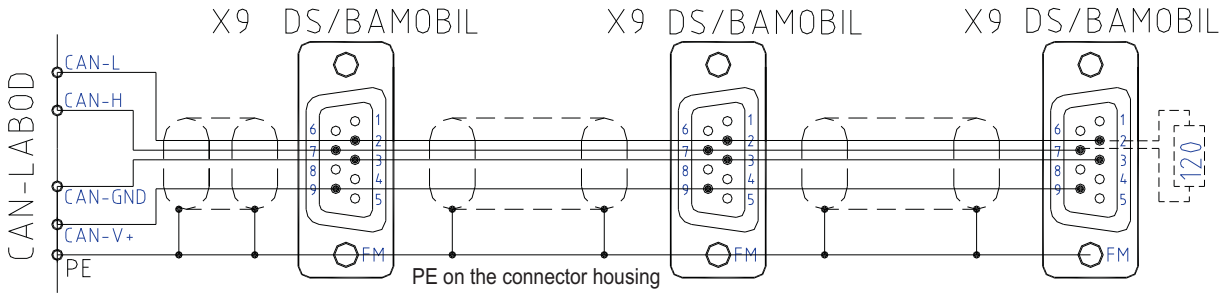
Option:
potentially isolated internal voltage supply

**CAN-BUS cable**
Use a shielded bus conductor with a low shielding capacity.
Signal + supply.
D-connector with a metal or metallized housing.
Recommended cable colours LiYCY 4x0.25+shield.

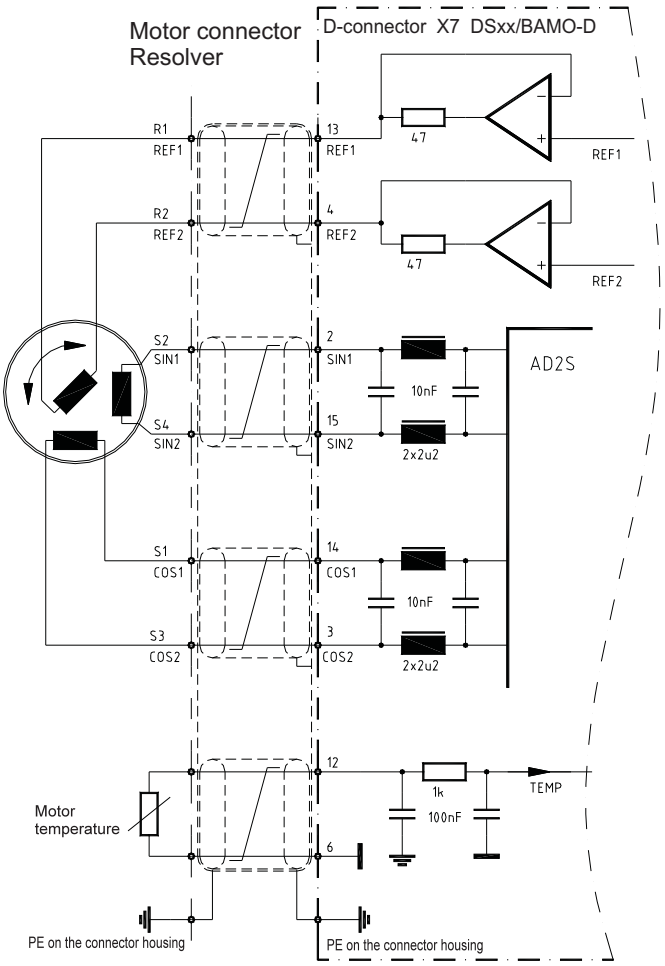
| Designation | Connector no. | Cable colour | Cable no. |
|---|---|---|---|
| CAN-V+ | 9 | brown | 1 |
| CAN-GND | 3 | white | 4 |
| CAN-H | 7 | green | 3 |
| CAN-L | 2 | yellow | 2 |



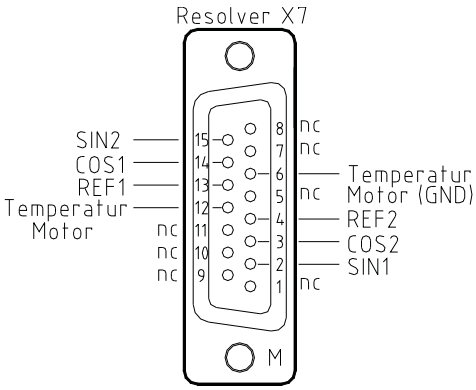

FM=input jack



**Resolver connection**
only for DS 2420, DS 4820-RS
**Connector X7**



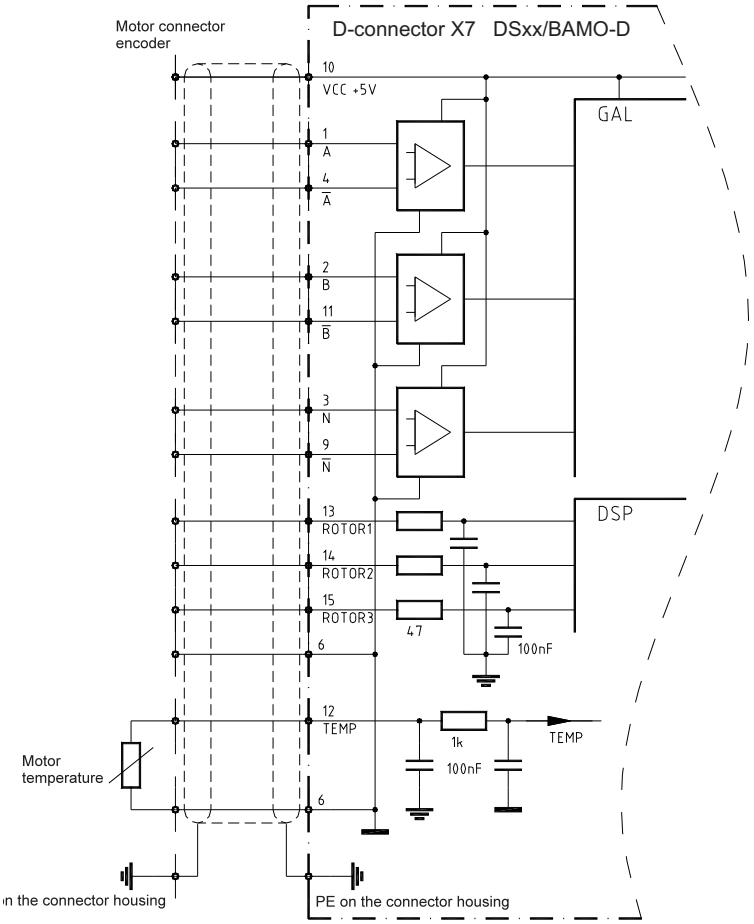

The resolver is an absolute measuring system for a motor revolution.
It is robust and not impaired by high motor temperatures.
Its build corresponds to a revolving transformer.
The rotor is supplied by the reference (10kHz).
The stator supplies the sine and cosine signals modulated by the rotational frequency.
The amplitudes of these signals are analyzed and digitalized in the servo-drive.
The resolution is adjusted to 12 bit (4096 inc/rpm).
The max. possible speed is 15600.
The digitalized signals are used for the polar wheel angle, the position and speed control, and the incremental output.
Die Absolutgenauigkeit ist ca. ±10 Winkelminuten.




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

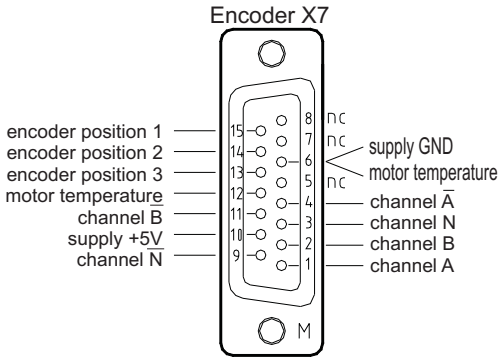
| | |
|---|---|
| **Connector** | X7 15-pole D-connector |
| **Connecting cable** | 4 x 2 cores, twisted in pairs and shielded, additional overall shield.<br>For link chains use appropriate cables! |
| **Cable length** | for >25m only use high-quality resolver cables with adequate shielding properties.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

**Encoder connection**
only for DS 2420, DS 4820-IN




Incremental encoder (encoder) with 2 counter tracks and 1 zero track plus 3 rotor position tracks. Counter tracks with push-pull output.
Max. counting frequency 500kHz.
The incremental encoder is galvanically connected with the device zero (GND).
Supply voltage 5V.

Steckerbelegung Lötseite




Use only motors with a Incremental (encoder) which have been approved by UNITEK (Appendix A).
Observe the motor specific connection data sheet!

| | |
|---|---|
| **Connector** | X7 15-pole D-connector |
| **Connecting cable** | 10 signal conductors, shielded, min. cross-section 0.14mm<br>2 supply lines, min. cross-section 0.5mm<br>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<br>across the motor connector-connect the shielconnector housing |
| **Setting parameter** | see software Manual DS |

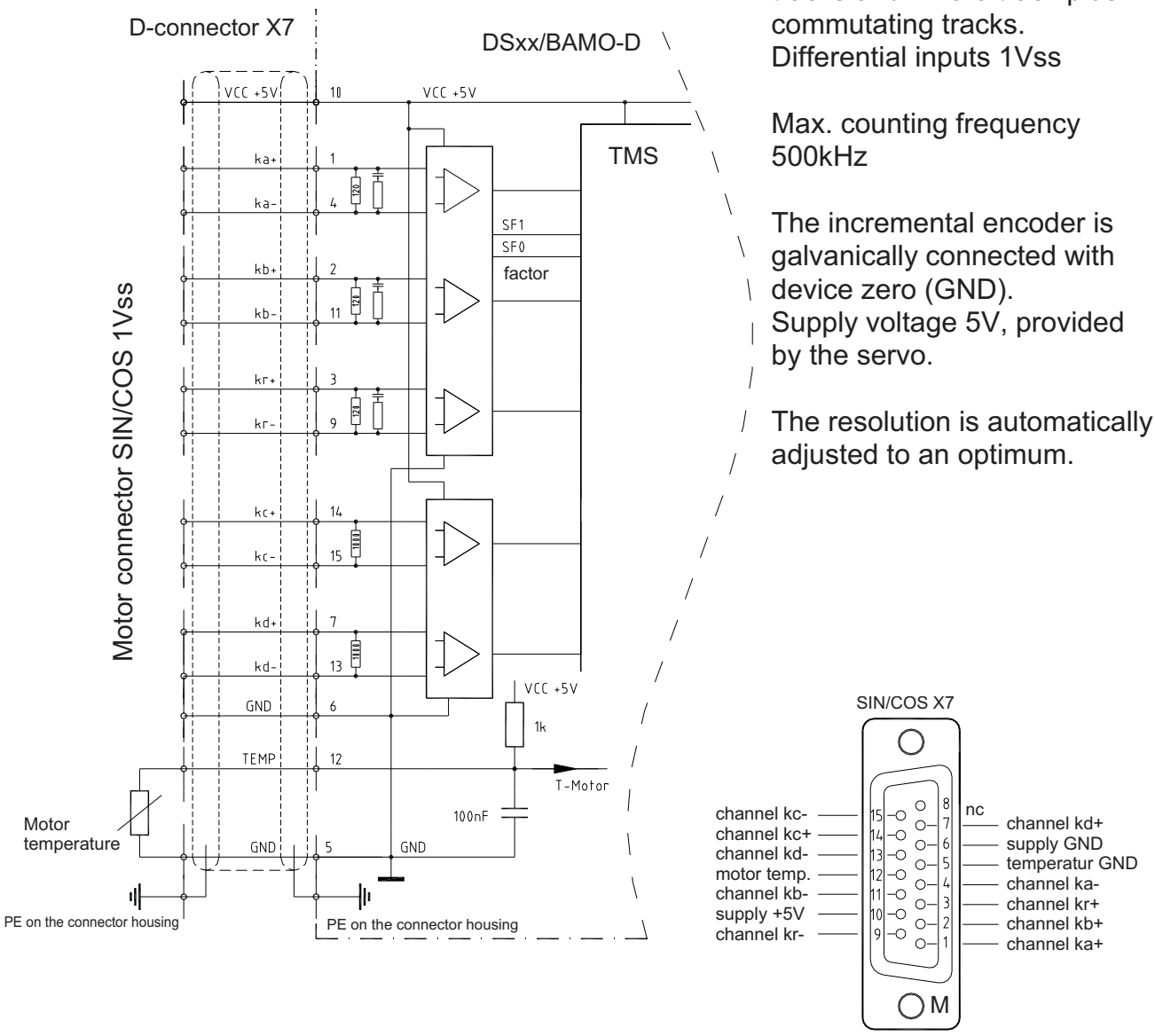
**SIN / COS Connection**
only for DS xx-SC

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

Max. counting frequency 500kHz

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

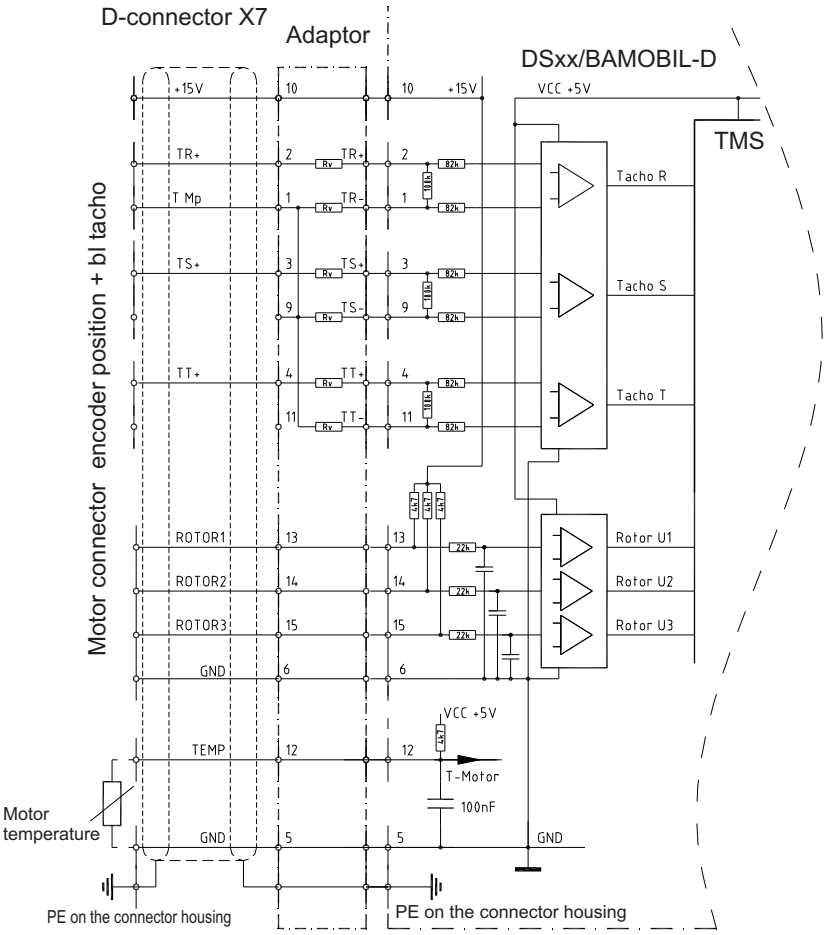
The resolution is automatically adjusted to an optimum.




Use only motors with SIN/COS encoders (SC) which have been approved by UNITEK (Appendix A). Observe the motor specific connection data sheet (SC)!

| | | |
|---|---|---|
| **Connector** | X7 15-pole D-connector | |
| **Connecting cable** | 4 signal conductors, twisted and shielded, | min. cross-section 0.14mm |
| | 2 signal conductors, shielded, | min. cross-section 0.14mm |
| | 4 supply lines, temp., | min. cross-section 0.5mm |
| **Cable type** | (4x(2x0.14)+(4x0.14)C+4x0.5)C<br>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 | |

**Rotor position encoder**
Connection via a bl-tacho




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

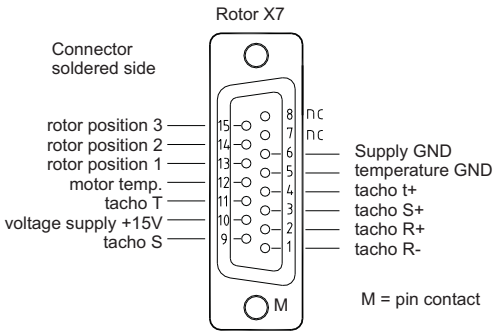
The rotor position encoder is galvanically connected with the device zero (GND).

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 voltage connect X7 : pin 1, 9 and 11.

Connect the tacho center point to X7:1.

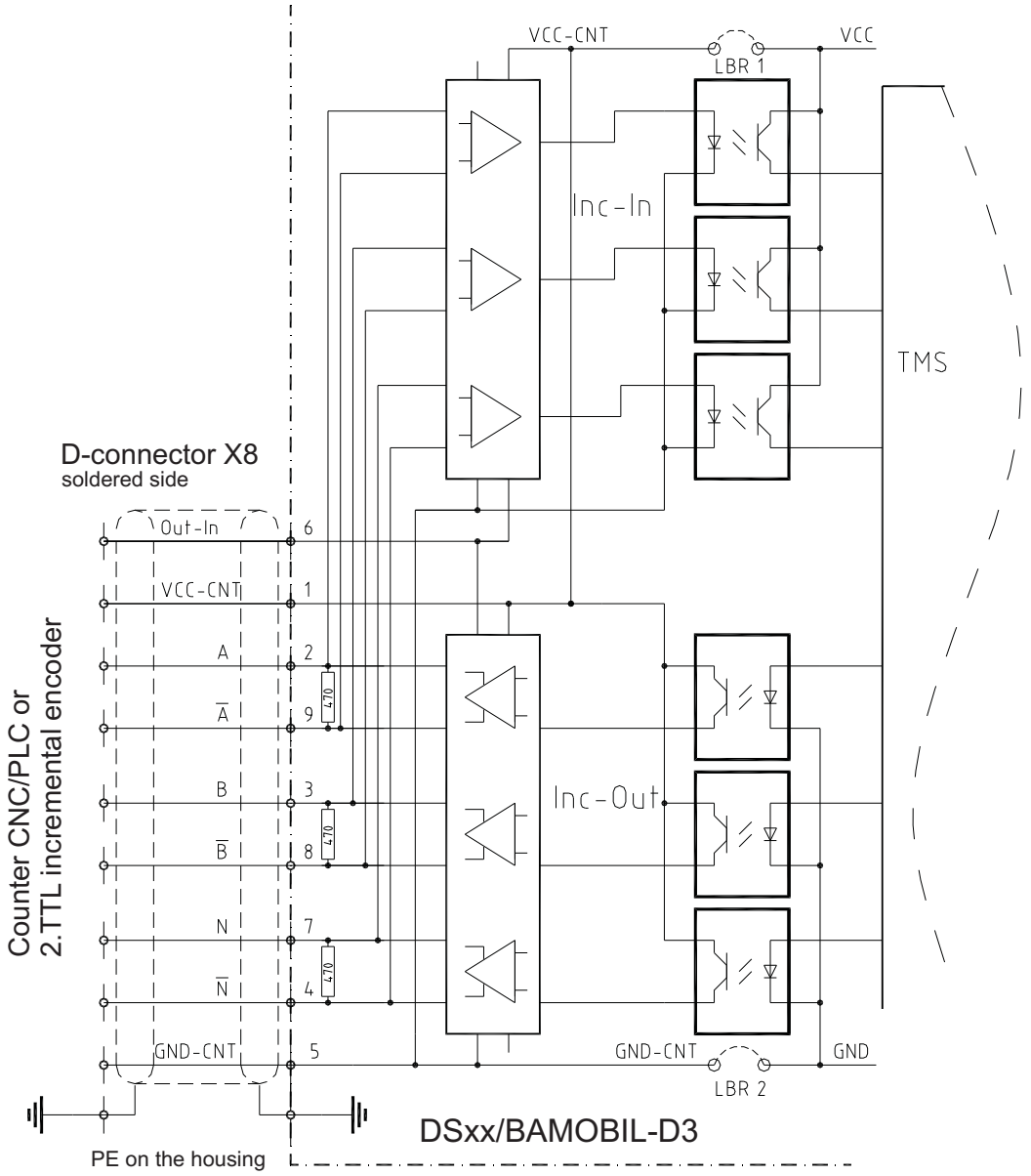


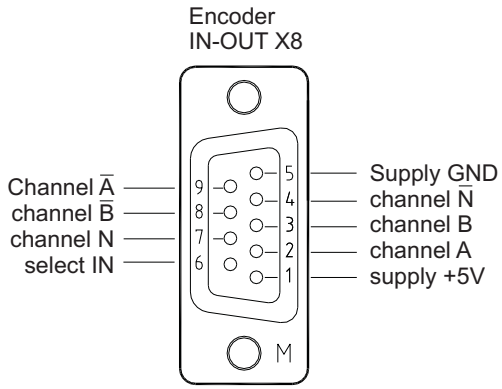

Only manufacturer-approved motors with incremental encoders an d rotor encoders. Note motor specific connection sheet!

| | |
|---|---|
| **Connecting plug** | **X7 15-pole D-connector** |
| **Connecting lead** | **12 signal wires, shielded minimum cross section 0,25 mm** |
| | Use only suitable cables in a power carrier chain |
| **Cable length** | the next step up for a section of >25 m. |
| **Shield connection** | a plug X7 contact shield with the plug housing |
| | at the motor plug contact shield with the plug housing |
| **Setting parameter** | see software Manual DS NDrive |

## 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 bridge toGND
Input X8 pin 6 bridge to +5V (X8:1)




9-pin D connector ( M, pins)

Connector assignment soldering side

**Attention: X8 as input**
X8:6 (Select IN) with X8:1 (+5V) connect with the D connector

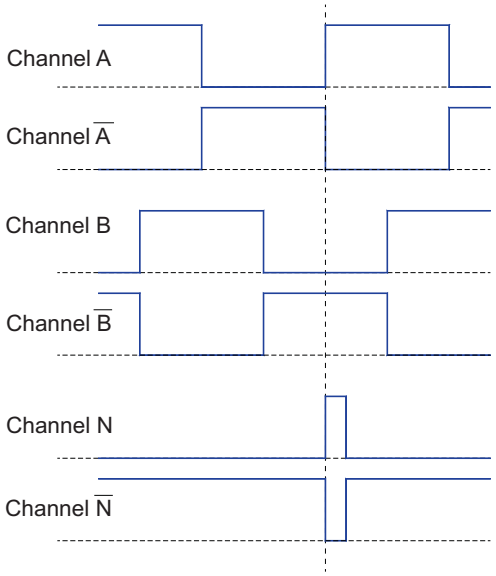
**X8 as TTL Encoder output**

The encoder signals supplied by the motor (feedback) are available at the output of the D-connector X8 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 +5V ±0.2V.
The output signal corresponds to RS485.

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

For RS and SC the resolution can be programmed (parameter 0xa4), Bit1).
For IN it is equal to the number of encoder pulses.




| **Signals** | (motor clockwise rotation) |
|---|---|
| output level | low < 0.5V<br>high > 4.5V |
| slope | < 0.1 µs |
| zero impulse | min. 0.2 µs |
| output frequency | max. 200 kHz |
| impulse / UPM<br>for RS, SC<br>for IN | <br>programmable<br>number of encoder pulses |

X8 as TTL Encoder input

**Attention:** X8 pin6 (select IN) and X8 pin1 (+5V) must be bridged!

The encoder input is internally isolated.
The voltage is supplied via the encoder line.
Option: Internal supply from the servo
The input signals correspond to RS485.
Input frequency: max. 200kHz

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

The encoder input can be programmed to fulfill different functions.

## LED displays on the Servo

The operating 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.

### Display of the servo-drive state

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

**Example:** Motor revolving clockwise

| | |
|---|---|
| Point flashes | = active processor |
| bottom segment | = drive enabled |
| right segment | = motor revolves clockwise |

### Error message on the Servo

In case of an error the red LED ‘fault’ lights up and the green 7-segment display indicates the error number.

### Error list

| Display on the Servo | Error message on the NDrive | Description |
|---|---|---|
| 0 | BADPARAS | Parameter error |
| 1 | POWER FAULT | Output stage error |
| 2 | RFE FAULT | Error in the safety circuit |
| 3 | BUS TIMEOUT | Transfer error BUS |
| 4 | FEEDBACK | Incorrect/faulty encoder signal |
| 5 | POWERVOLTAGE | No power supply voltage |
| 6 | MOTORTEMP | Motor temperature too high |
| 7 | DEVICETEMP | Device temperature too high |
| 8 | OVERVOLTAGE | Over voltage >1.8 x UN |
| 9 | I_PEAK | Overcurrent 300% |
| A | RACEAWAY | Racing (without command value, incorrect polarity) |
| B | USER | User’s error choice |
| C | RESERVE | |
| D | RESERVE | |
| E | CPU-ERROR | Software error |
| F | BALLAST | Ballast circuitry overload |
| | | |
| Flashing decimal point | Active processor | |
| Dark decimal point | Missing auxiliary voltage or device hardware failure | |

### Example:


FAULT LED red
Error no. 5 Power voltage (missing power voltage)

## Warnings

The warning messages are displayed in the window ‘warnings’.

### Warning messages

| Warning display | Warning message on the NDrive | Description | ID-address |
|---|---|---|---|
| | | | 0x8f |
| 0 | | | Bit 16 |
| 1 | | | Bit 17 |
| 2 | | | Bit 18 |
| 3 | | | Bit 19 |
| 4 | | | Bit 20 |
| 5 | POWERVOLTAGE | Undervoltage, Power voltage missing | Bit 21 |
| 6 | MOTORTEMP | Motor temperature superior to 87% | Bit 22 |
| 7 | DEVICTEMP | Device temperature superior to 87% | Bit 23 |
| 8 | OVERVOLTAGE | Overvoltage >1.5xUN | Bit 24 |
| 9 | I_PEAK | Overcurrent 200% | Bit 25 |
| A | | | Bit 26 |
| B | | | Bit 27 |
| C | I2R | Overload >87% | Bit 28 |
| D | | | Bit 29 |
| E | | | Bit 30 |
| F | BALLAST | Overload Regen > 87% | Bit 31 |
| | | | |
| | | | |
| | | | |

### LED displays on the servo

In case of a warning state the red LED changes (low-frequency) and the seven-segment display shows alternately the warning no. (red LED) and the operating state (LED dark).


**Example:**
The red fault LED flashes and the display shows alternately the warning number and the operating state.