

# MANUAL

## Digital 3-phase Servo-Drive

DS2420, DS4820

for EC/AC servo motors

- Battery connection -

DS 2420, DS 4820



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### Part 2 Software manual

### Part 3 Commissioning instruction

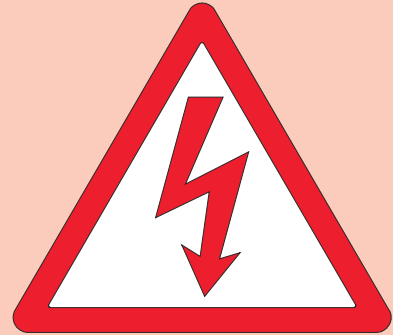
### Part 4 Software reference

### Part 5 CAN-BUS reference

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 off 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/EEG, 84/528/EEG, 86/663/EEG, 72/23/EEG

EN60204, EN50178, EN60439-1, EN60146, EN61800-3

IEC/UL                              IEC364, IEC 664, UL508C, UL840

VDE Regulations                VDE100, VDE110, VDE160

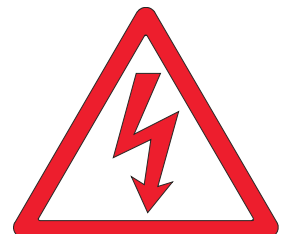
TÜV Regulations

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.

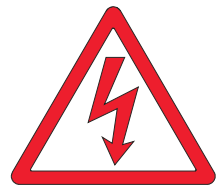


**Assembly**

- 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/EEG and the EMC guideline 89/336/EEG. Under the installation and test conditions of chapter 'EMC advice' the device adheres to the following: guideline EU89/336/EEG, 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 DS2420 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	> series DS200, DS400
Analog three-phase servo-amplifiers	> series TVD3, TVD6, AS
Analog dc servo-amplifiers	> series TV3, TV6, TVQ6
Thyristor current converters 1Q, 4Q, servo	> series Classic, 200W to 800kW
DC and ac servo-amplifiers for battery operation analog and digital	> series BAMO A2, A3, D3 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, Residualripple <10%, regenerating fuse

Specification	Dim.	DS2420	DS4820	DS2420-DC	DS4820-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 <sub>eff</sub>	20			
Max. Peak current	A <sub>Io</sub>	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 OFF	10-30 0 <6	0.010 0	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	



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

<b>Programming</b>	<b>Version</b>	<b>Software version</b>	<b>Extension</b>
DS-4xx-x	RESO- 12bit	DRIVE_DS2.	
DS-4xx-x	RESO- 12/16bit		
DS-4xx-x	Encoder		-IN
DS-4xx-x	Sine encoder		-RS

Free

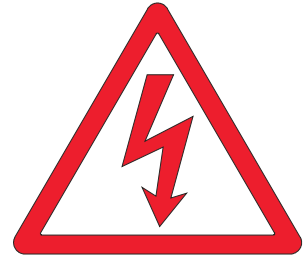


## Important instruction

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.



s  
d  
s

## 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.

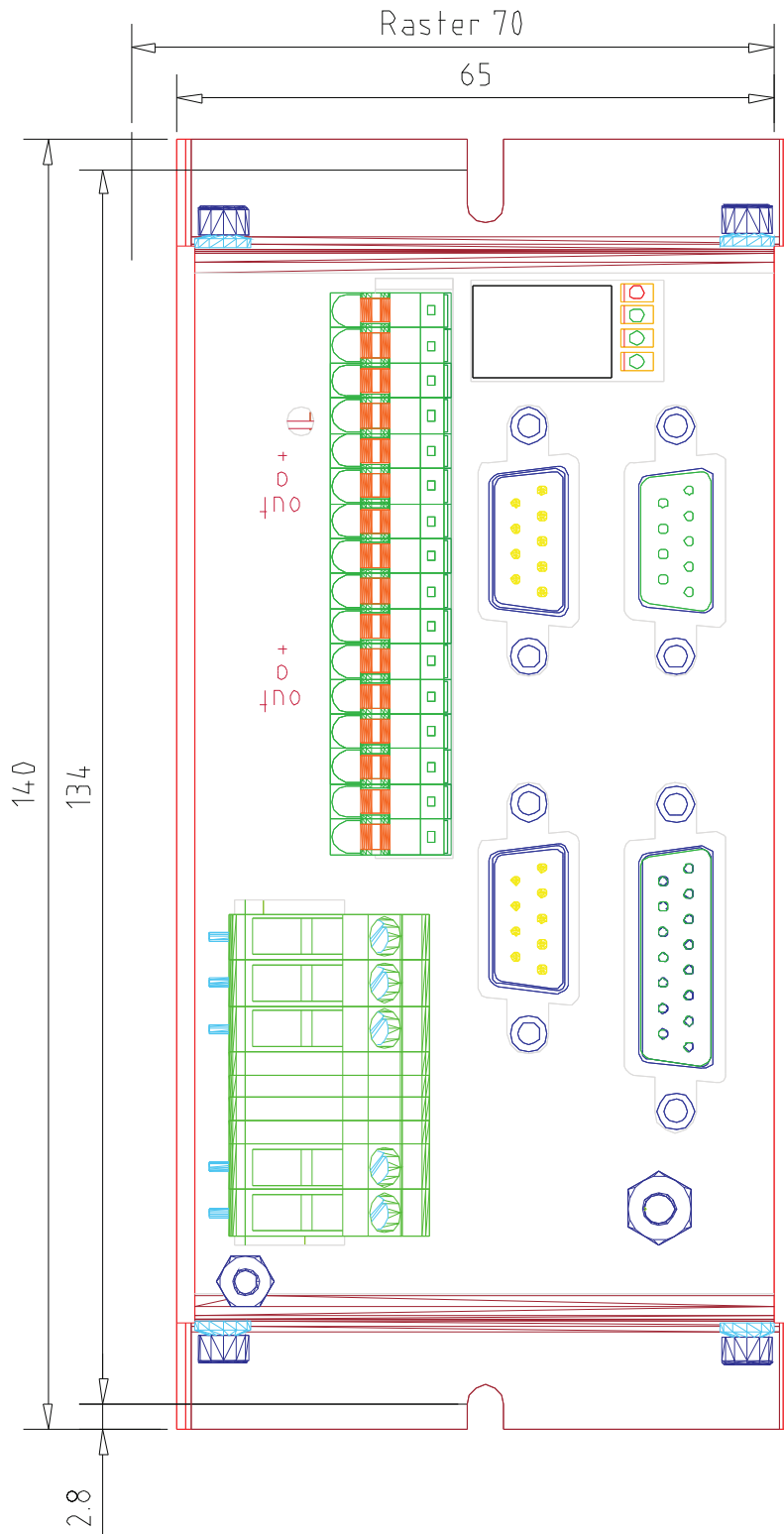
Use vibration-proof screw connections.

Ensure that the switch cabinet ventilation is sufficient.

If the ambient temperature is too high ( $>30^{\circ}\text{C}$ ) an air conditioning unit has to be installed.

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





**Dimensions**

**Size 1**

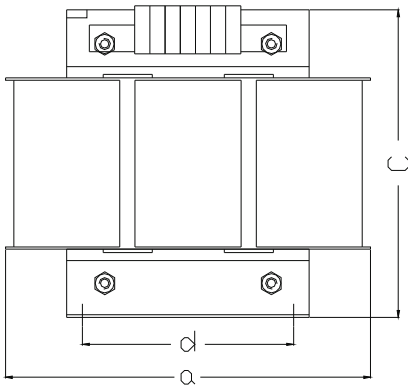
DS2420 to DS4820

Mounting depth

Fixing screws:

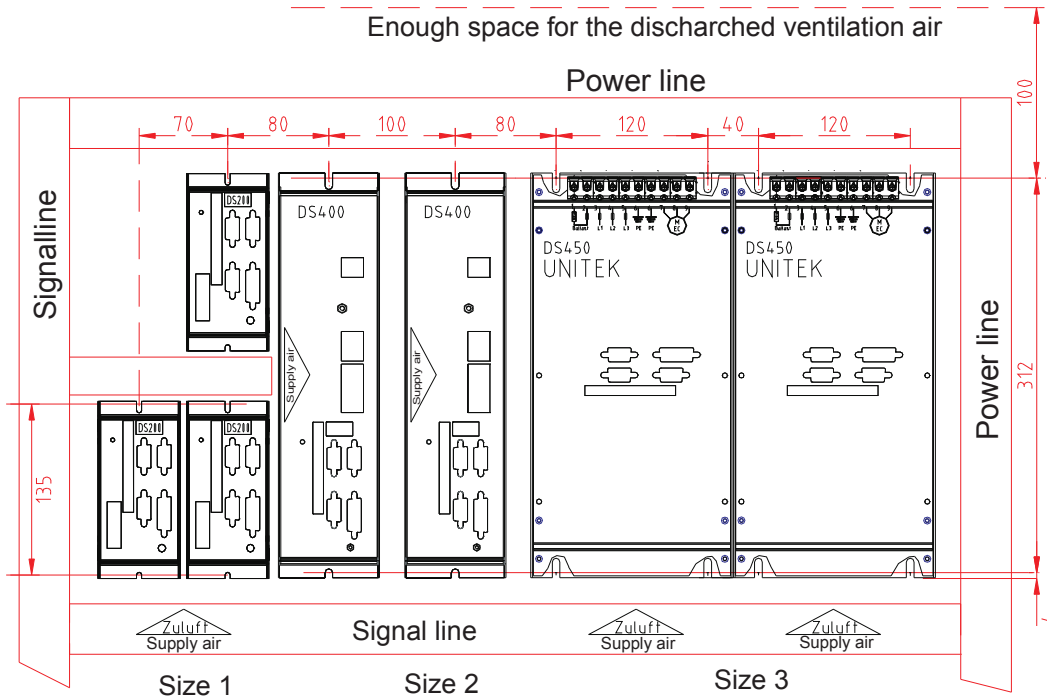
without connector 190mm  
 with connector max. 250mm  
 M4x10 (DIN912 recommended)

**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

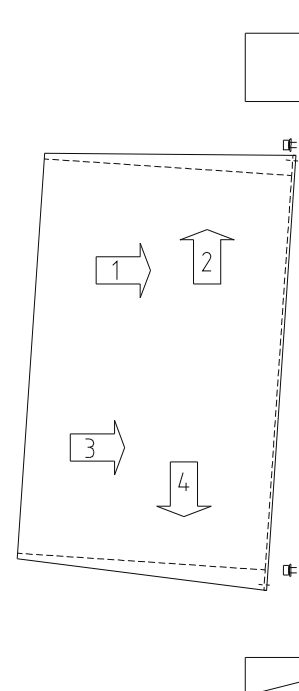


In order to achieve good EMC values, it is recommended to use bright, unpainted mounting plates. The bright surface of the device's rear panel ensure a good surface-to-surface contact.

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  
DIN912 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.



# 5 Eleectrical Installation

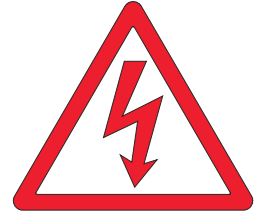
## Important note:

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!**

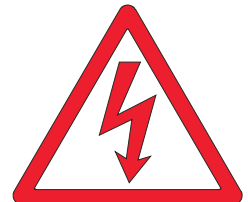
Ensure that the device is safely disconnected from the power supply

- place the shorting plug
- affix warning signs

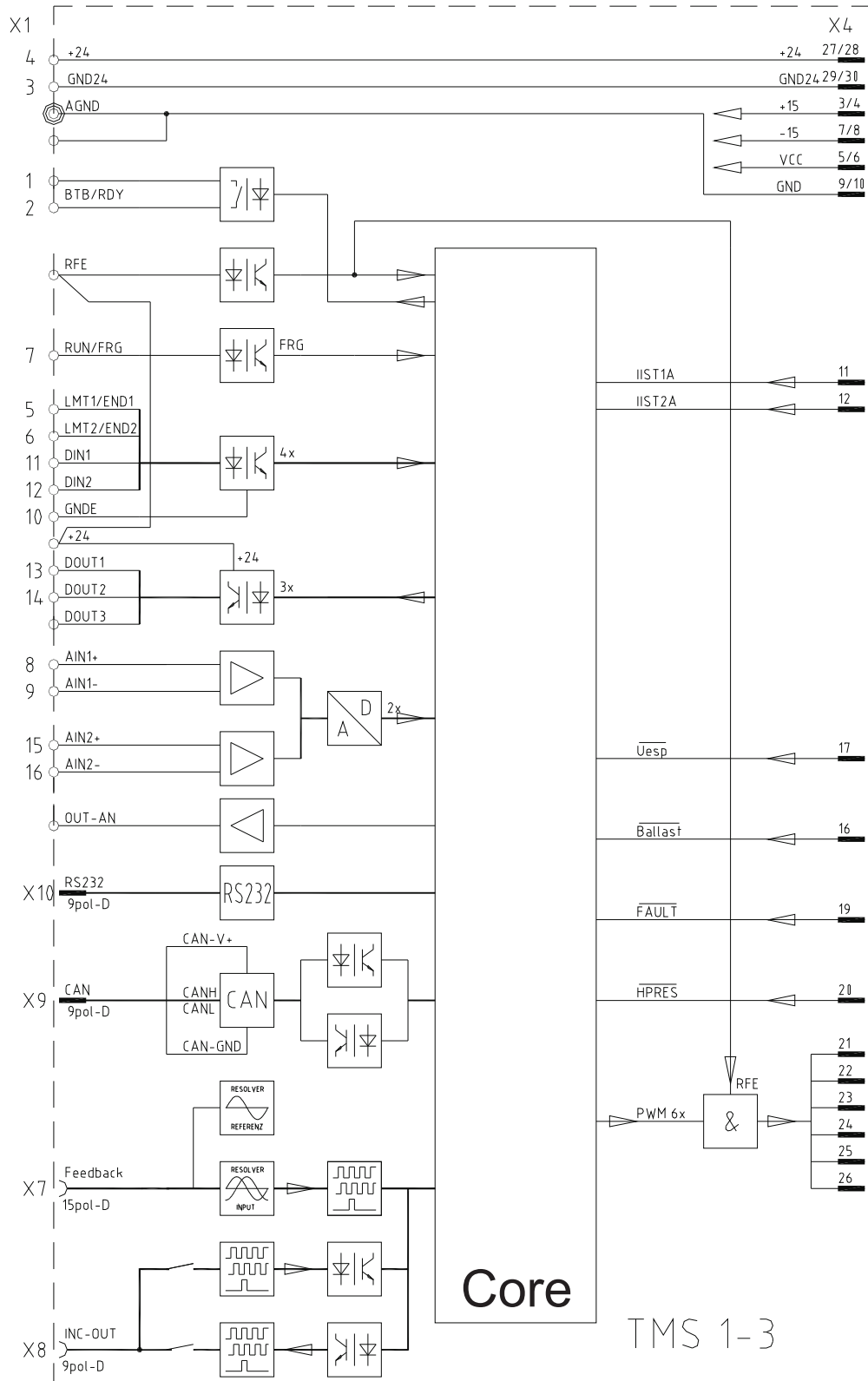
The installation should only be carried out by suitably trained personnel for electrical engineering.

- 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.

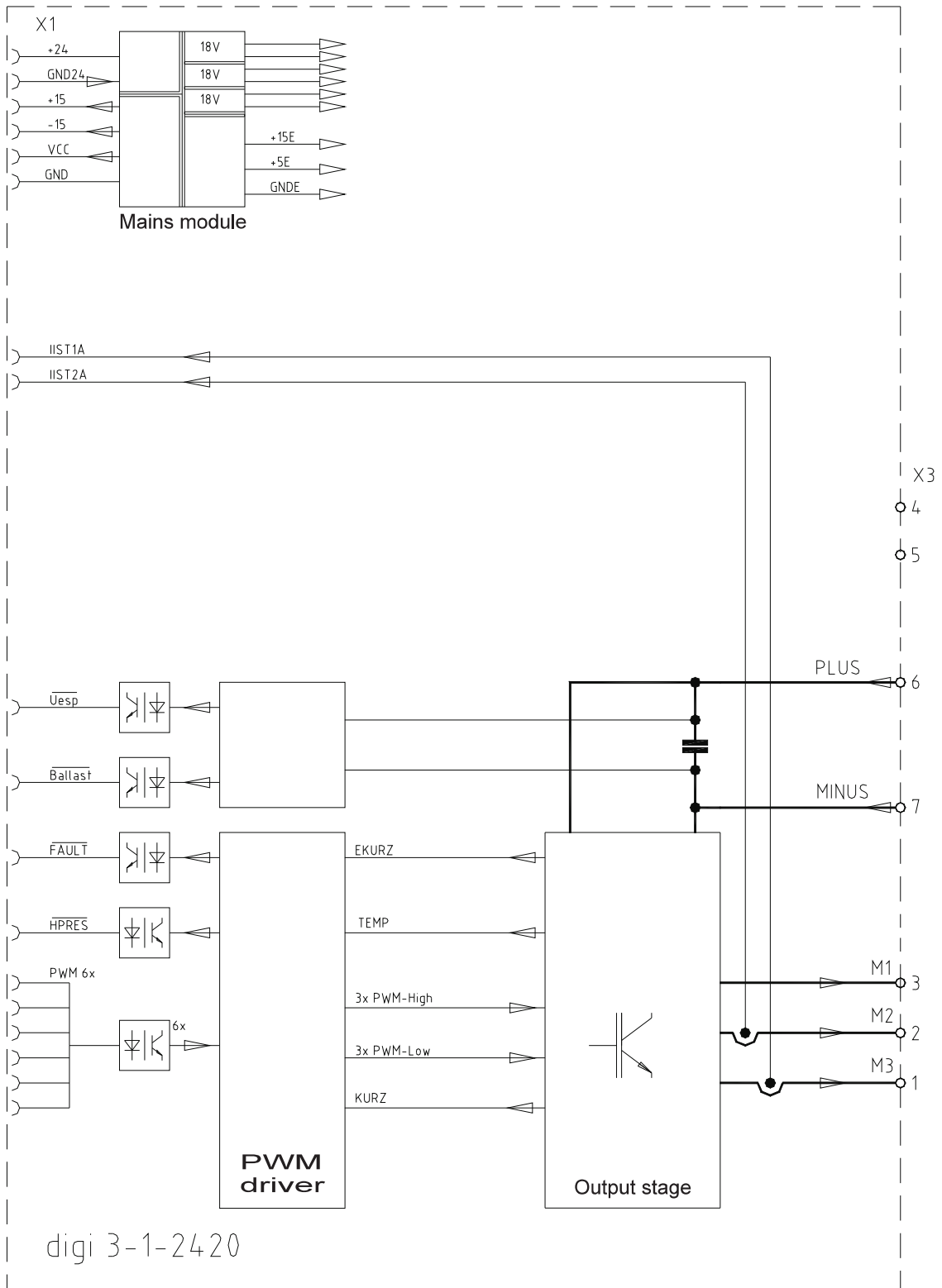


# 5 Eleectrical Installation

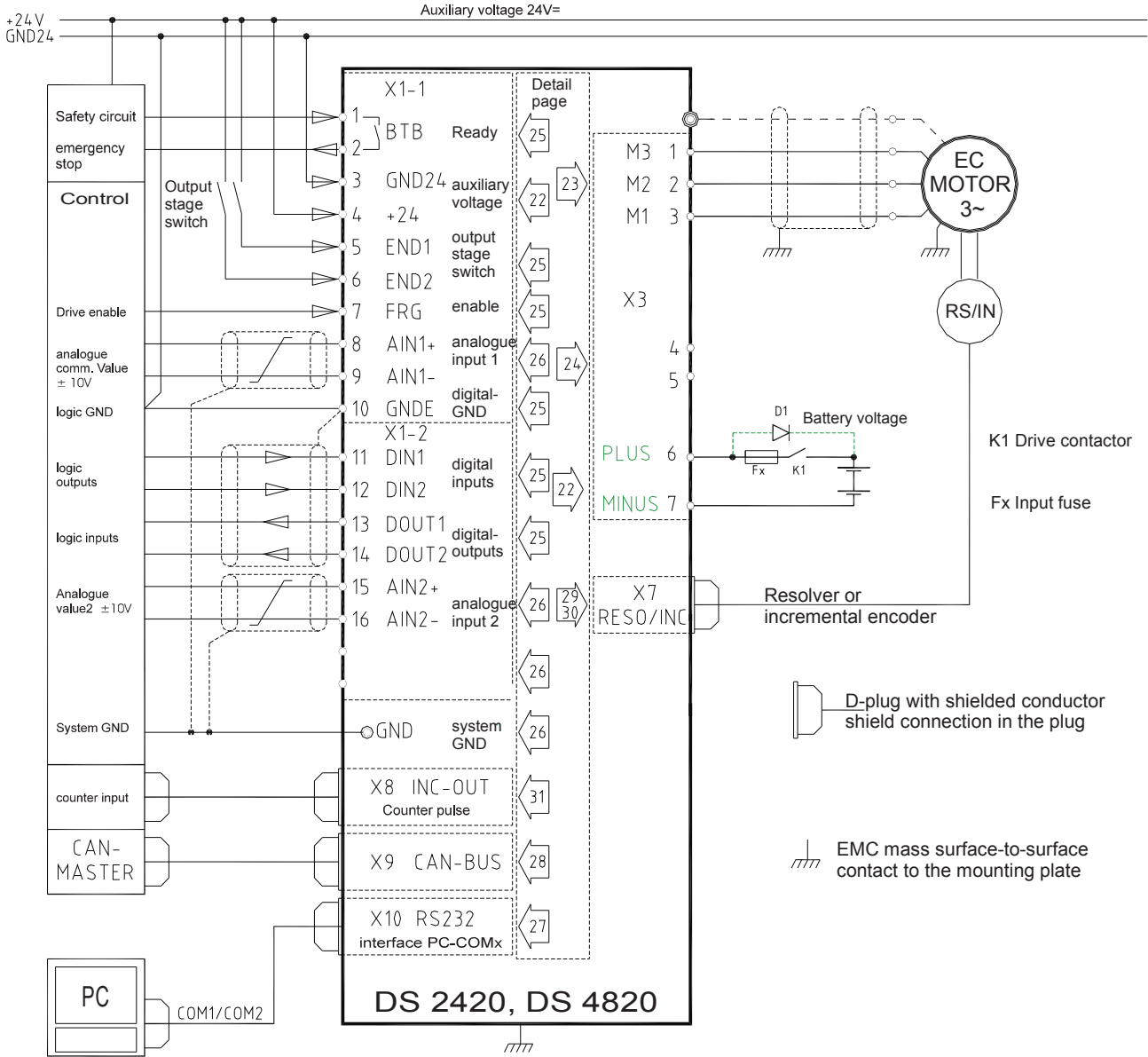




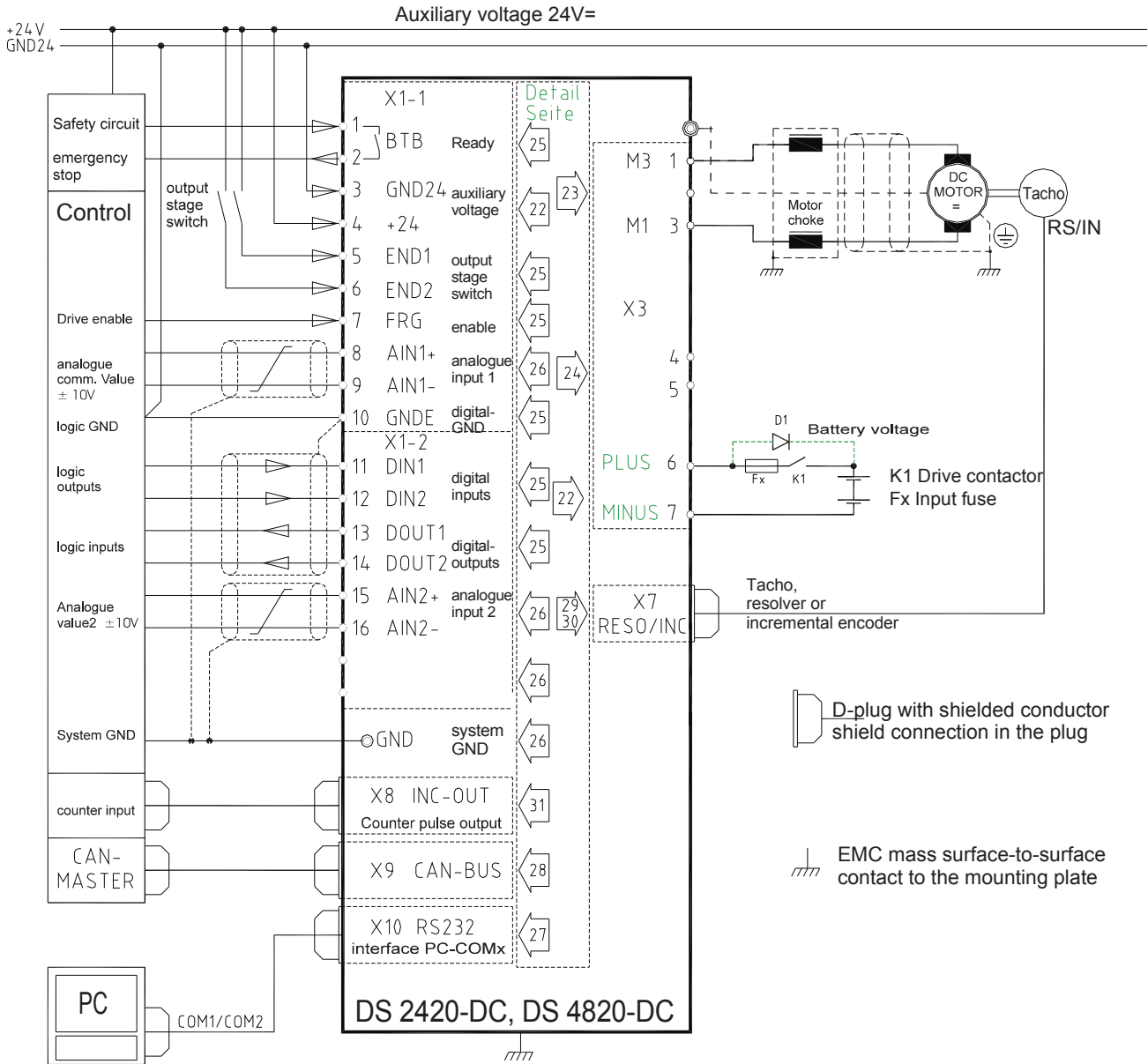
# 5 Elelectrical Installation



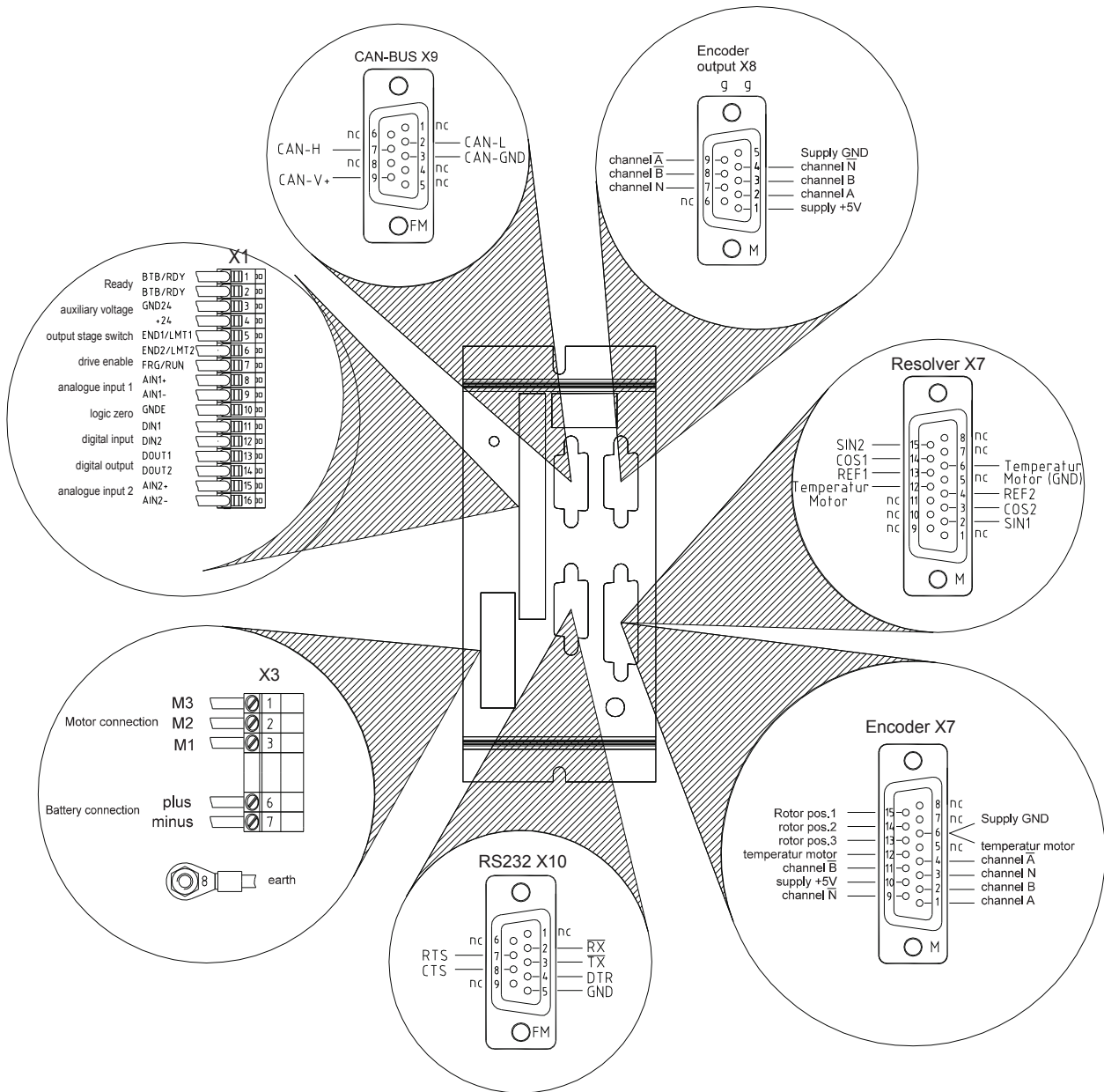
# 5 Eleectrical Installation



# 5 Eleectrical Installation



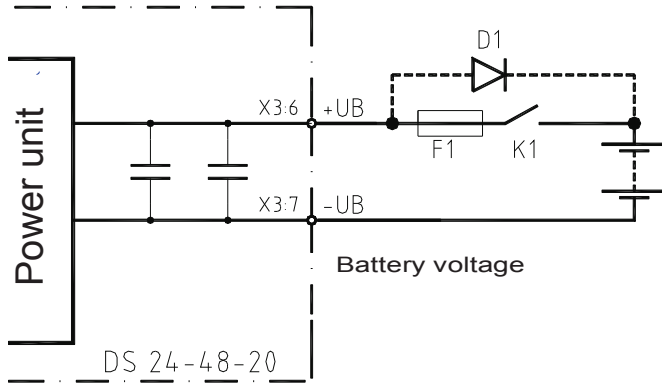
# 5 Eleectrical Installation



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

# 5 Eleectrical Installation

## 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.



Battery connection

Type	Battery connection	Connection cross - section mm <sup>2</sup> AWG		Fuse AT	Drive contactor size
2420	positive-X3:6 negative-X3:7	2.5	14	30	
4810		1.5	16	20	
4820		2.5	14	30	

Eart connection across the earthing point

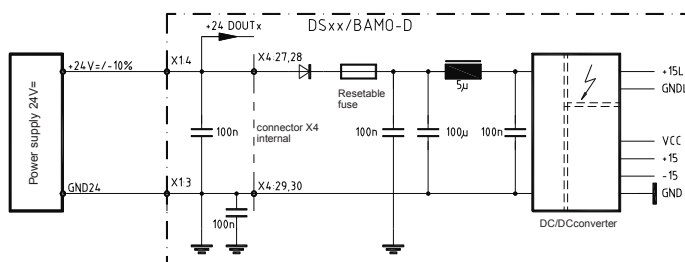
### Auxiliary voltage connection

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

GND24X1:3

Residual ripple      10%

Switch-on current      2A

Nominal current      0.8A

Mains module: negative connection across earth.

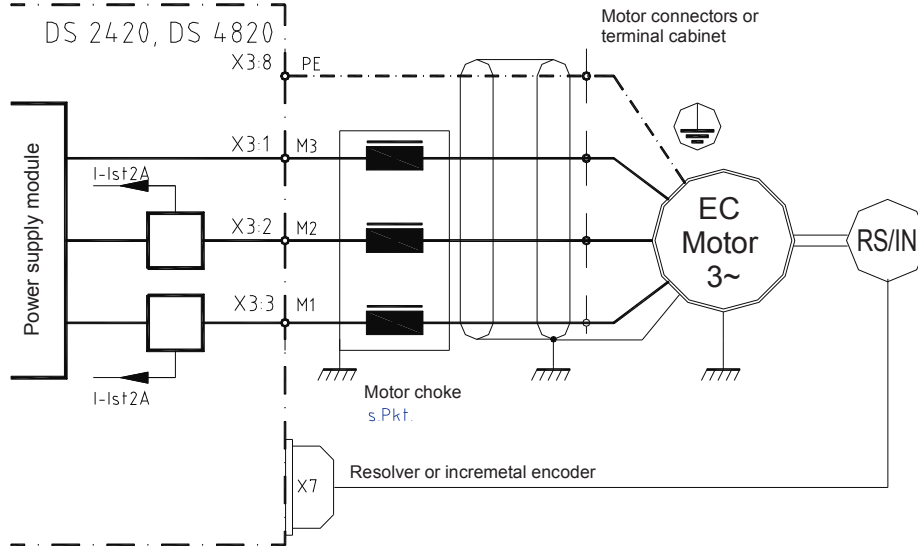
# 5 Eleectrical Installation

## 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 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 <sup>2</sup>	2,5	2,5
AWG	14	14

### Motor cable

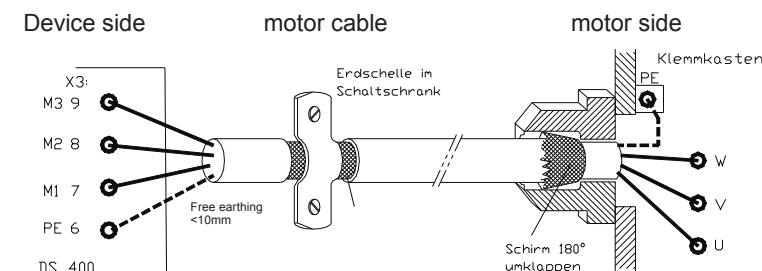
3-core + protective earth conductor, single-shielded for 600V~, 1000V=  
 shield capacity = 150pF/m  
 min. cross-section see below table

### Motor choke

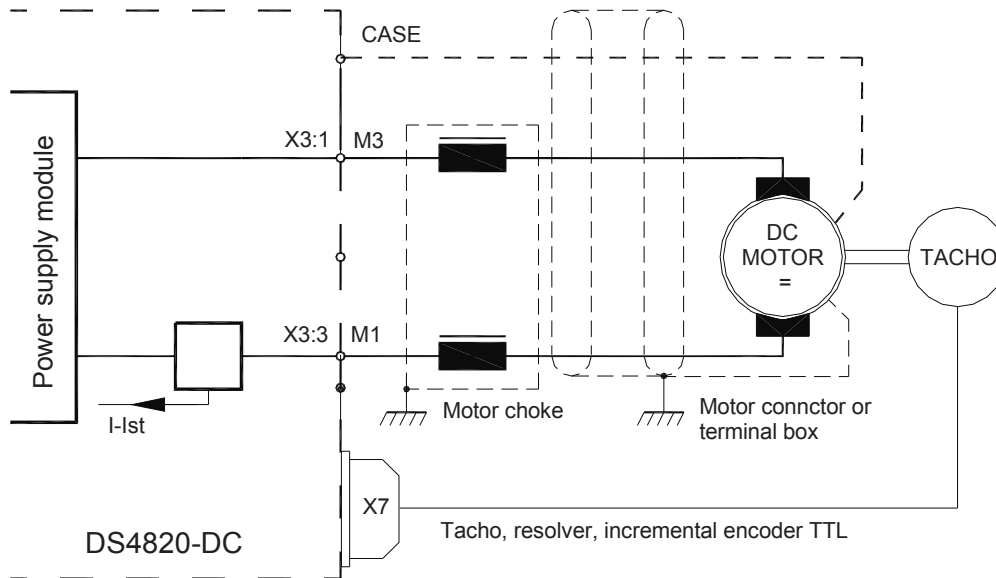
Only necessary for a shield capacity of >5nF. Approx. 25m motor cable

### 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

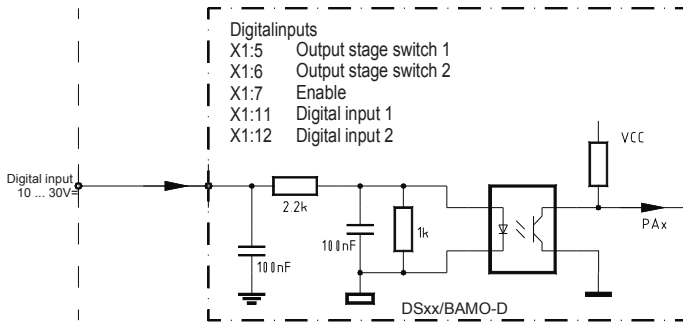
Choke with ferrous motors use forever ! Type 2EI 84-25

### 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.

# 5 Eleectrical Installation

## Digital inputs



### Opto input

Input voltage

Level ON

+10 to +30V

Level OFF

0 to +6V

Input current

max. 14mA

Nom. voltage/nom. current

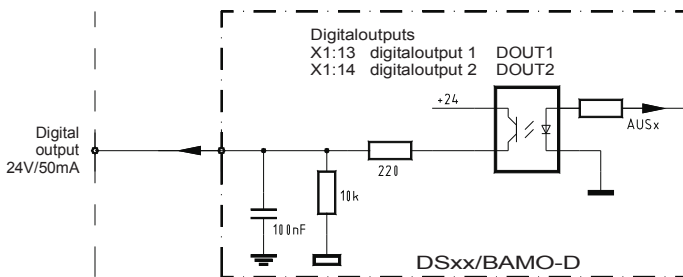
+24V/10mA

Ground reference

GNDE (X1:10)

Input	Connection	Function	State1	State2	Parameter
FRG/RUN	X1:7	Enable	fixed	fixed	DS-Drive-2 inputs & outputs
END1/LMT1	X1:5	Output stage switch1	fixed	programmable	
END2/LMT2	X1:6	Output stage switch2	fixed	programmable	
DIN1	X1:11	Digital input1		programmable	
DIN2	X1:12	Digital input2		programmable	

## Digital outputs



### Open emitter output

Output voltage

max. 24V=

Level ON

Level OFF

<1V=

Output current

max. 30mA

Output resistance

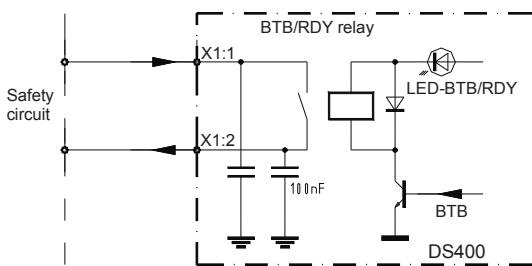
220W

Reference voltage

+24 (X1:4)

Ground reference

GNDE (X1:10)



### Relay contact

### BTB/RDY

Contact for

48V/1A

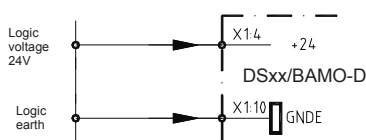
The contact is closed when the device is ready.

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

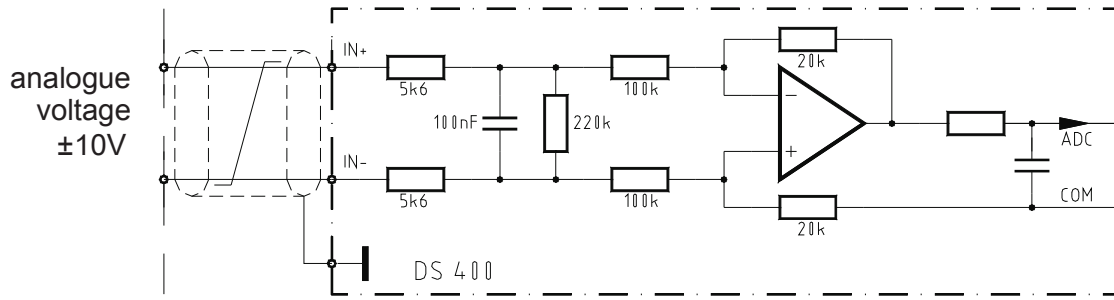
+24V for the logic and the auxiliary voltage

GNDE logic ground



# 5 Eleectrical Installation

## Analog inputs $\pm 10V$



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

## Features

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

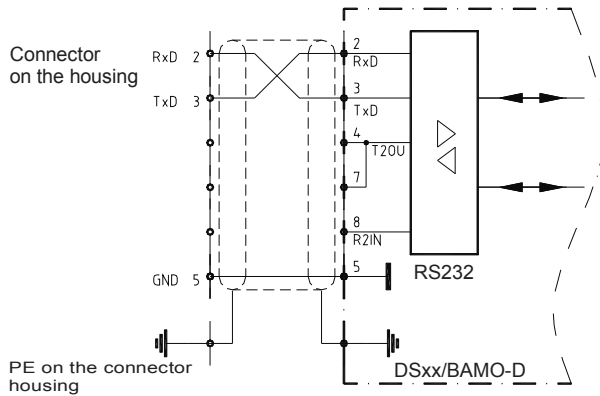
The direction of rotation of the motor can either be changed by swapping the  $\pm$  connections at the differential input or by changing the signs via the parameter scale.

# 5 Eleectrical Installation

## 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.

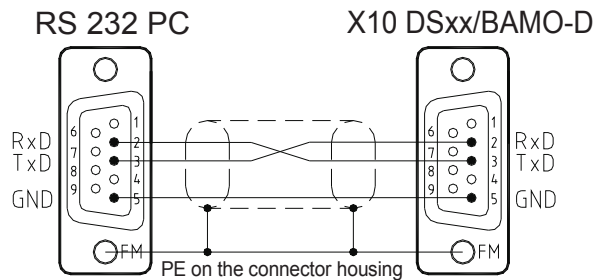
Do not use a null modem link cable!

Install the cable only after disconnecting the device from themains.

The interface is hard-coded to 115200Baud.

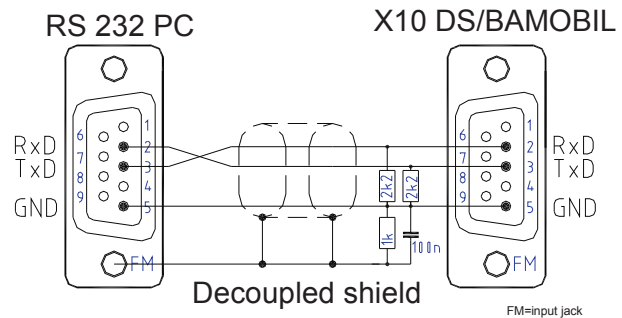
### Null modem connecting cable

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



In case of strong interferences at the interface a line filter should be installed.

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

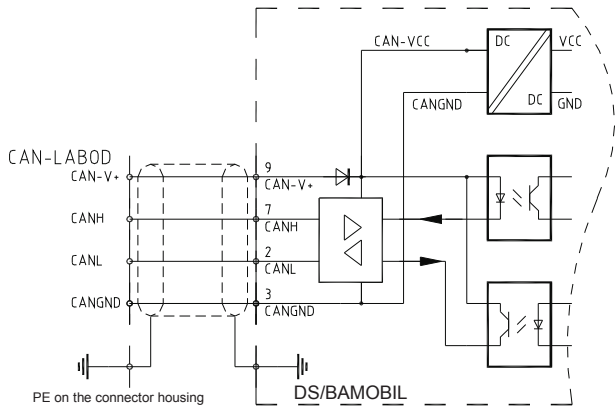


# 5 Eleectrical Installation

## CAN-BUS

The CAN-BUS is adigital connection totheCNC control.  
 Optimum conditions are achieved with LABOD CNC controls.  
 Programming and operation by means ofthe control panel via the CAN-BUS.  
 Interface complies with the standard ISO11898.

Adjustment and programming see Manual DS-CAN.



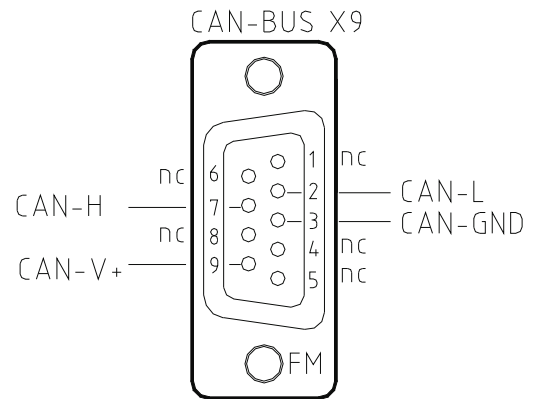
The interface is galvanically isolated from the device.  
 The voltage is supplied via the bus cable.  
 CAN-V+ 9 to 15V=

Option:  
 potentially isolated internal voltage supply

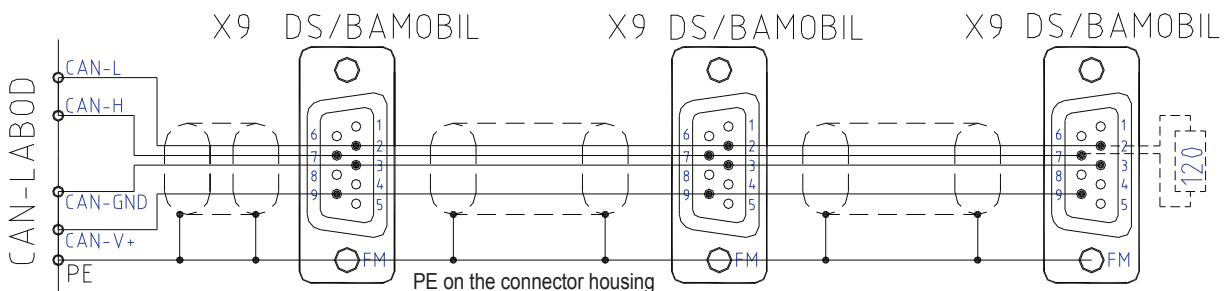
## CAN-BUS cable

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

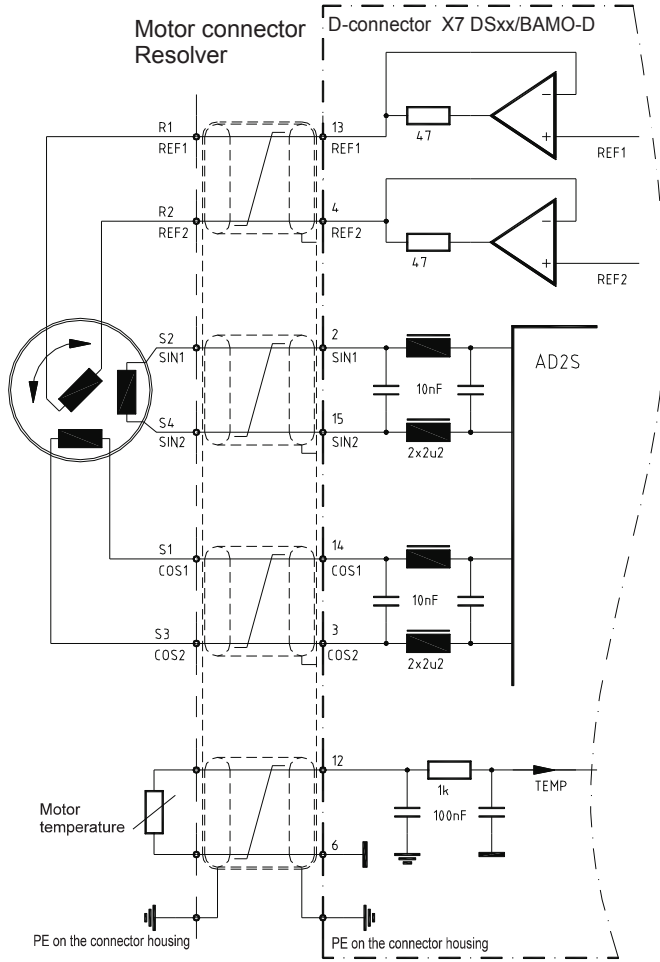


FM=input jack



# 5 Eleectrical Installation

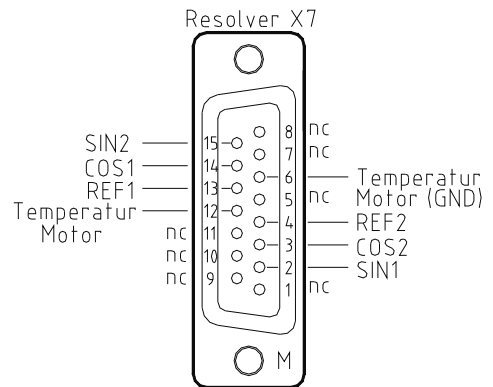
**Resolver connection**  
only for DS 2420, DS 4820-RS  
**Connector X7**



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. The absolute accuracy is approx.  $\pm 10$  arcmin.

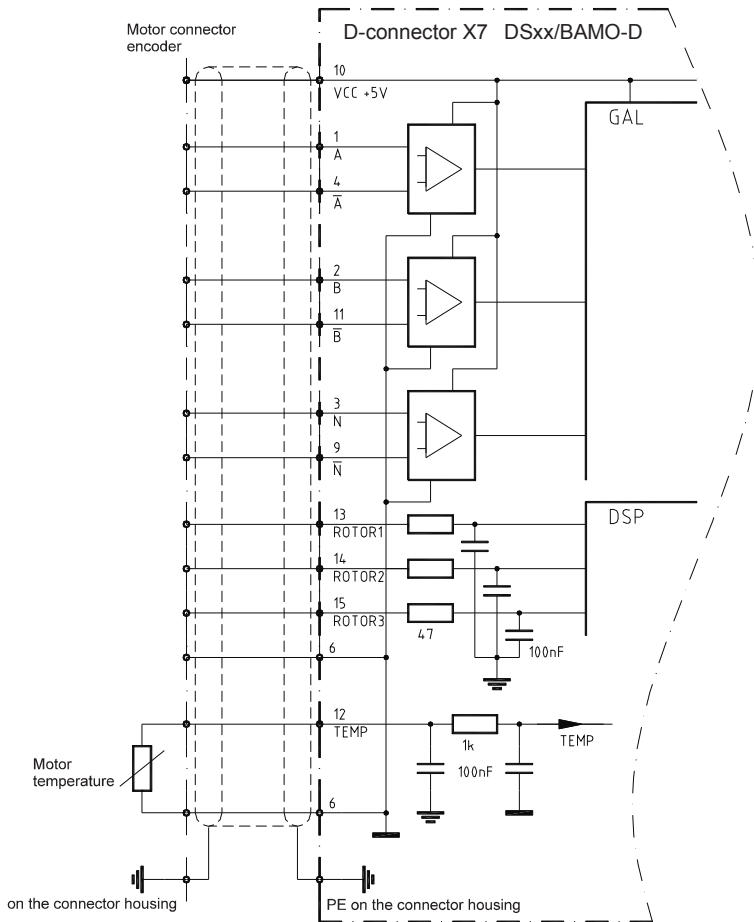
Use only motors with a 2-, 4-, or 6-pole resolver which have been approved (AppendixA).  
Observe the motor specific connection data sheet!

- Connector** X7 15-pole D-connector
- Connecting cable** 4 x 2 cores, twisted in pairs and shielded, additional overall shield.  
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 the connector housing
- Setting parameters** see software Manual DS



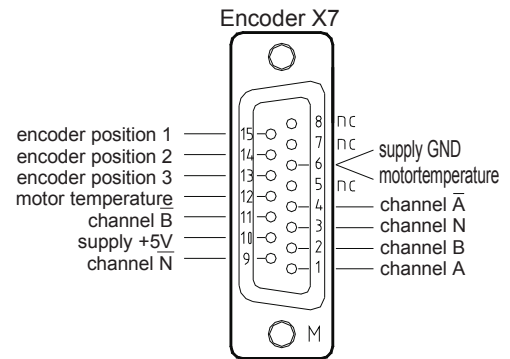
# 5 Eleectrical Installation

## Encoder connection only for DS2420, DS4820-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 (AppendixA).

Observe the motor specific connection data sheet!

**Connector** X7 15-pole D-connector

**Connecting cable** 10 signal conductors, shielded, min. cross-section 0.14mm  
2 supply lines, min. cross-section 0.5mm

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

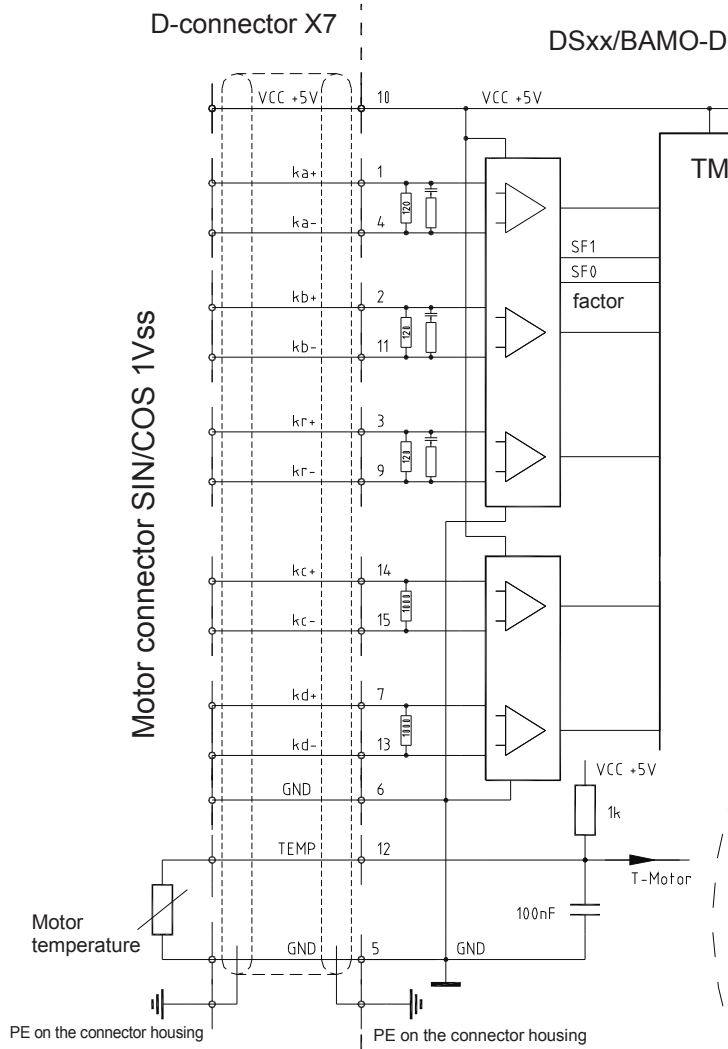
**Setting parameter** across the motor connector-connect the shieldconnector housing  
see software Manual DS

# 5 Eleectrical Installation

SIN/COS 1Vss

## SIN / COS Connection

only for DS xx-SC

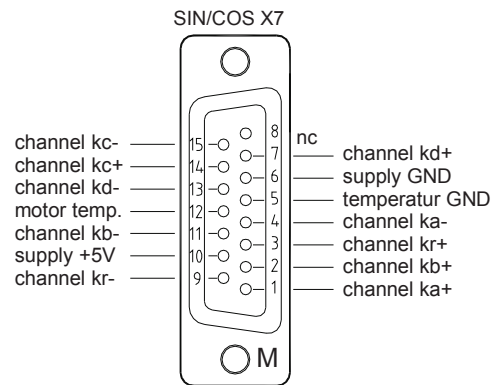


Incremental encoder with 2 analog sinusoidal counter tracks and 1 zero track plus 2 commutating tracks.  
Differential inputs 1Vss

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 (AppendixA). Observe the motor specific connection data sheet (SC)!

**Connector** X7 15-pole D-connector  
**Connecting cable** 4 signal conductors, twisted and shielded,  
 2 signal conductors, shielded,  
 4 supply lines, temp.,  
**Cable type** (4x(2x0.14)+(4x0.14)C+4x0.5)C

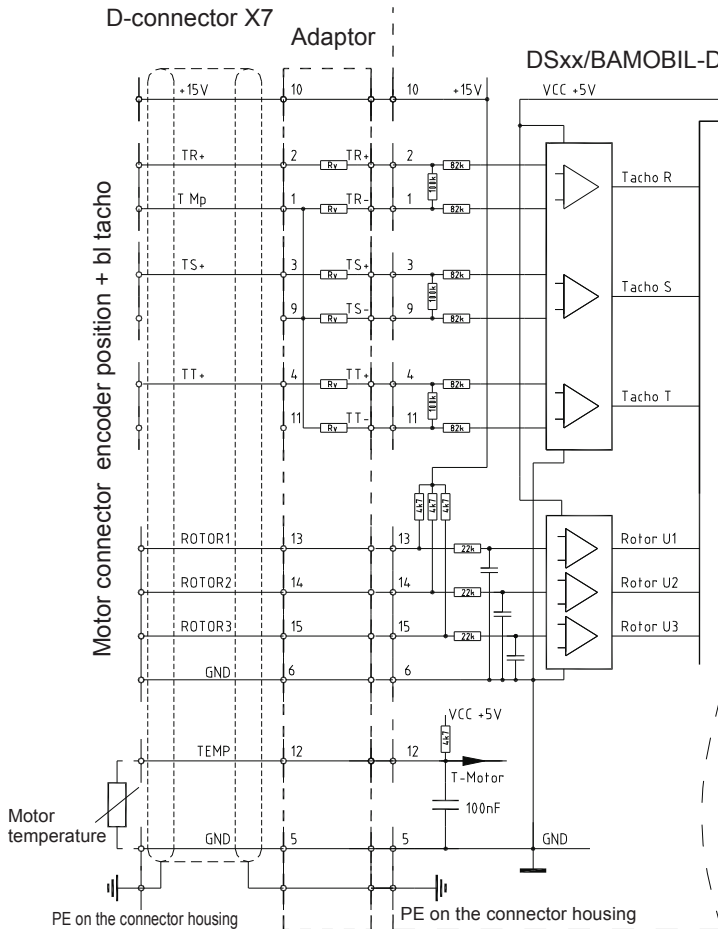
min. cross-section 0.14mm  
 min. cross-section 0.14mm  
 min. cross-section 0.5mm

**Cable length** For link chains use appropriate cables!  
 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

# 5 Eleectrical Installation

## Rotor position encoder Connection via a bl-tacho



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

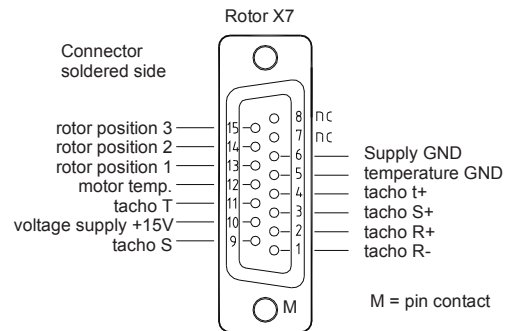
The rotor position encoder is galvanically connected with the device zero (GND).

The voltage of 15V is supplied by the servo drive.

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

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 and rotor encoders. Note motor specific connection sheet!

**Connecting plug**  
**Connecting lead**

**X7 15-pole D-connector**  
**12 signal wires, shielded minimum cross section 0,25mm**

Use only suitable cables in a power carrier chain  
the next step up for a section of >25m.

**Cable length**  
**Shield connection**

a plug X7 contact shield with the plug housing  
at the motor plug contact shield with the plug housing

**Setting parameter**

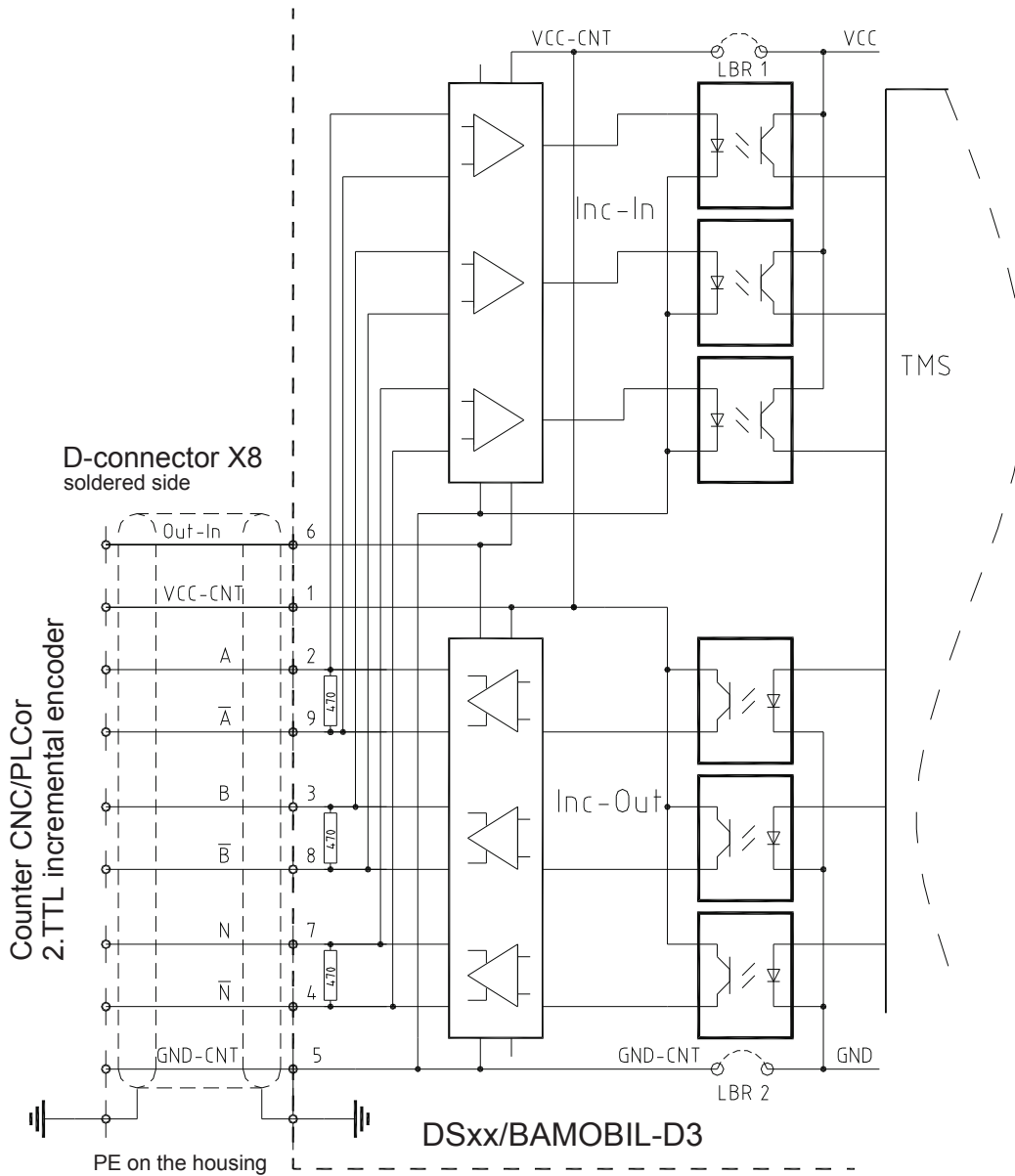
see software Manual DS NDrive

# 5 Eleectrical Installation

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

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

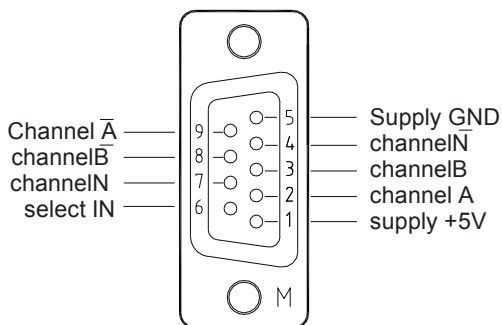
- Output X8 pin 6 not connected or bridge to GND
- Input X8 pin 6 bridge to +5V (X8:1)



Encoder IN-OUT X8

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



# 5 Eleectrical Installation

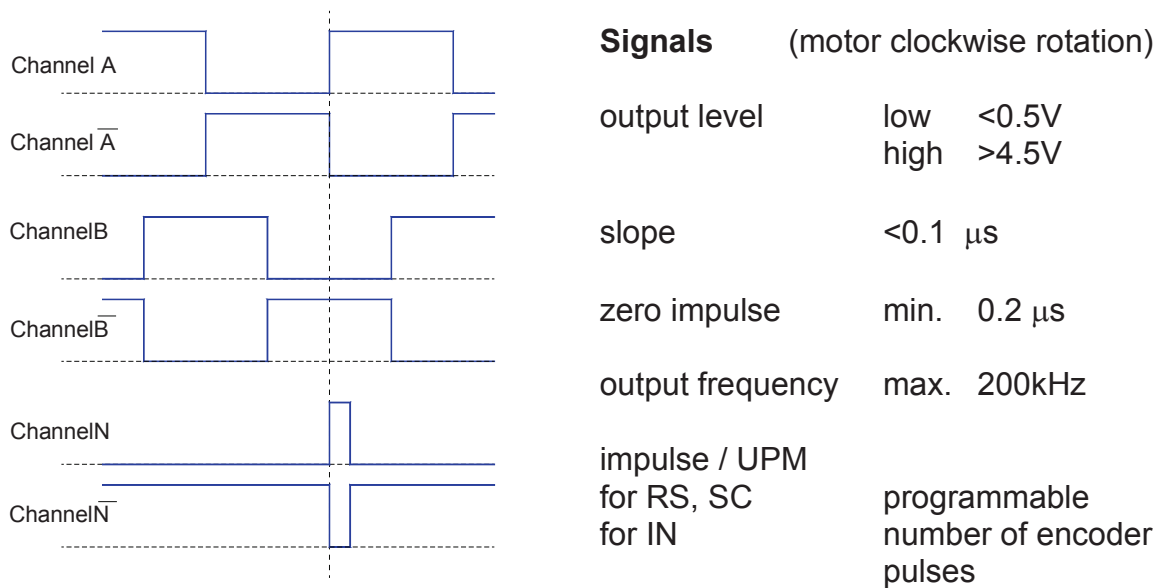
## X8 as TTL Encoder output

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  $\pm$ 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.



## X8as TTL Encoder input

**Attention:** X8 pin 6 (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.








# 5 Eleectrical Installation

## 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 dark	Processor active Auxiliary voltage missing or inherent hardware failure	
	flashing bright dark	Starting state after reset (auxil. voltage 24V off-on). The first enable stops the flashing display. Drive enabled Drive disabled (not enabled)	OK = 0 OK = 1, ENA = 1 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 bright dark	Motor current reduced to continuous current $I_{cns}$ Motor current at max. current limit $I_{max}$ Normal operation; Motor current within the current limits	$I_{cns} = 1$ $I_{cns} = 0$ $I_{cns} = 0$
	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

# 5 Eleectrical Installation

## 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.

### Errorlist

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:



FAULTLED  
Error no.5

red  
Power voltage (missing power voltage)

## Warnings

The warning messages are displayed in the window 'warnings'.

### Warningmessages

Warning display	Warningmessage ontheNDrive	Description	ID-address
			0x8f
0			Bit16
1			Bit17
2			Bit18
3			Bit19
4			Bit20
5	POWERVOLTAGE	Undervoltage, Power voltage missing	Bit21
6	MOTORTEMP	Motor temperature superior to 87%	Bit22
7	DEVICTEMP	Device temperature superior to 87%	Bit23
8	OVERVOLTAGE	Overvoltage >1.5xUN	Bit24
9	I_PEAK	Overcurrent 200%	Bit25
A			Bit26
B			Bit27
C	I2R	Overload >87%	Bit28
D			Bit29
E			Bit30
F	BALLAST	Overload Regen >87%	Bit31

### 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).



**Fault**

#### Example:

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



## Guarantee

**Stegmaier-Haupt** guarantees that the device is free from material and production defects. Test results are recorded and archived with the serial number.

The guarantee time begins from the time the device is shipped, and lasts one year. **Stegmaier-Haupt** undertakes no guarantee for devices which have been modified for special applications. During the warranty period, **Stegmaier-Haupt** will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. **Stegmaier-Haupt** 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 **Stegmaier-Haupt**.

For products returned to **Stegmaier-Haupt** for warranty service, the Buyer shall prepay shipping charges to **Stegmaier-Haupt** 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 **Stegmaier-Haupt** from an other 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 **Stegmaier-Haupt** device, can not be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed.

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