Manual

Bamobil D3.2

Digital Battery Drive
for EC Servo Motors

| UniTek | Industrie Elektronik |
| | G m b H |

Version 0808-2-V3

BAMOBIL D3.2

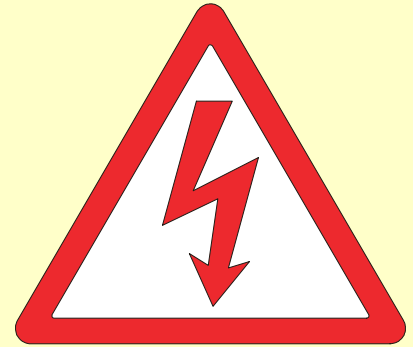Contents

Part 1   Manual BAMOBIL D3.2

Free

Safety advice

Safety advice - Standards and guidelines

Caution: High voltage DC 900V=.

Electric shock hazard!
Danger to life!
DC-BUS discharge - time >4min

Electronic equipment is not fault proof. This fact should be borne in mind for all possible operating conditions.
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/connection may damage the device.

BAMOBIL devices are power electric parts used for regulating energy flow.
They are designed to control EC synchronous motors (brushless dc motors) for industrial applications.

Protection rating IP40.
Connection **only** to batteries.

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	EC364, IEC 664, UL508C, UL840
VDE Regulations	VDE100, VDE110, VDE160
TÜV Regulations	
Trade body guidelines	VGB4

Control and power connections can be live even though the drive is inoperative.
The dc bus discharge time is superior to 4min.
Measure the voltage prior to any disassembly!
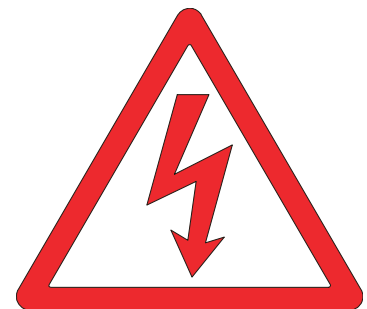
1 Basic - Information

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
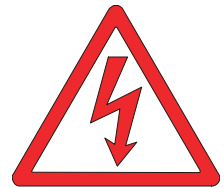
Installation

- 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.
The manufacturer of the machine or the installation is responsible for the observance of the threshold values prescribed in the EMC regulations.

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

Safety symbols . . . . **Important**

Caution - Danger to life   **Attention**

High voltage   **Warning**

BAMOBIL D3.2

General Information

The digital 3-phase current servo amplifier **BAMOBIL D3** 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 bl-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 BAMOBIL drives can be used as position control or torque or speed amplifier.
The speed actual value is generated in the encoder unit (resolver or others).

Note:

For dc, ac, or bl-servo amplifiers which are supplied by a dc mains, it must be checked that the energy is fed back into the bus during brake operation (external ballast circuitry).

Information:

Battery drive (analogue and digital)
Compact devices

For low power applications	UNITEK series BAMO-A2/-A3	10 to 40A
	UNITEK series BAMOBIL A2/D2	50 to 200A

Thyristor controllers and servo-drives (analogue and digital)

Thyristor controller	UNITEK series Classic	15 to
2000AServo-drive dc	UNITEK series Servo DC	5 to 75A

Servo-drive ac/EC	UNITEK series Servo AC	3 to 75A
	UNITEK series DS	3 to 50A

1 Basic - Information

Applications

Machines and installations for all types with a drive power of 7.5kW 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:

battery-driven vehicles such as electric vehicles and boats, forklifts, transportation systems as well as battery-supplied machines and installations such as assembly machines, metal working machines, food processing machines, robots and handling systems, conveyors, stone working machines, and for many other battery-supplied applications.

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

The braking energy is fed to the battery.
For dc mains the braking energy must be absorbed in the mains without the voltage exceeding the permissible value. If this cannot be guaranteed, a ballast circuitry must be used.

Caution:
The internal regenerative resistors have only a small continuous rating. Calculate the retarding power and use external regenerative circuit discharge resistors if necessary or of design safety. Calculation of regenerative power. See page 24.

BAMOBIL D3.2

Build

- compact devices according to the VDE, DIN and EU regulations, protection rating IP40
- for <60V no protection of the connections against contact
- splash-proof housing IP53 (option)
- standard analogue control electronics
- power electronics for 50A, 80A, 100A, 120A, 150A, 250A, 350A, and 450A
- independent 24V chopper power supply unit for the auxiliary voltages
- nominal power input range of 12 to 48V dc, (12 to 120V dc)
- additional cooling unit for air or water cooling

Galvanic isolation

- the negative battery voltage is connected with the device GND
- the housing and the heat sink are galvanically isolated from all electric parts
- 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
- 7-segment LED displays

Characteristics

* battery-powered or dc connection 24V= to 48V (24V= to 120V=)
* independent auxiliary voltage connection 24V=
* digital interfaces RS232, CAN BUS (further option)
* 2 analogue inputs, programmable differential inputs
* 4 digital inputs/outputs, programmable, optically de-coupled
* linear command value ramp, non-linear (s-function)
* logic for enable and the output stage switch
* BTB ready for operation, solid state relay contact
* position, speed and torque control
* resolver or incremental encoder TTL, SINCOS 1 Vss, rotor position + bl tacho
* encoder output or 2 encoder input
* static and dynamic current limiting
* uniform, completely digital control unit
* Protective switch-off from the motor in case of over-voltage, under-voltage, or over-temperature
* intrinsically safe and short-circuit proof power section
* processor-independent hardware switch-off in case of short-circuits, circuits to earth, over-voltage and over-temperature of the amplifier

1 Basic - Information

Technical Data
For battery voltages up to 48V=

Power supply connection	24V= bis 48 V= Please indicate battery voltage on order!
Auxiliary voltage connection	24V= ±10% / 2A Residual ripple <10%, regenerating fuse

Specifikation BAMOBIL-D3.2-62-	Dim.	80	120	250	350	450
Supply voltage	V=	24 to 48				
Max. output voltage	V~eff	3x14 to 3x33				
Continuous current	A	40	60	125	175	225
Peak current max.	A	80	120	250	350	450
Max. Power loss	W	200	300	600	900	1200
Pulse frequency	kHz	8				
Over voltage switching threshold	V=	programmable up to max. 68V				
Input fuse	A	80	160	250	250	500A
Weight	kg	5.5	5.8	6.8	6.8	6.8
Dimensions hxwxd	mm	244x194x90				
Unit size		2	2	2	2	2

For battery voltages up to 120V=

Power supply connection	24V= bis 120V= Batteriespannung bei Bestellung angeben!
Auxiliary voltage connection	24V= ±10% / 2A Residual ripple <10%, regenerating fuse

Specification BAMOBIL-D3.2-160-	Dim.	50	100	150		
Supply voltage	V=	24 to 120				
Max. output voltage	V~eff	3x14 to 3x78				
Continuous current	A	25	50	75		
Max. peak current	A	50	100	150		
Max. Power loss	W	200	300	600		
Pulse frequency	kHz	8				
Over voltage Switching threshold	V=	programmable to max. 160V				
Input fuse	A	80	160	250		
Weight	kg	5.5	5.8	6.8		
Dimensions h x w x d	mm	244x194x90				
Unit size		2	2	2		

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Control signals		V	A	Function	Connector
Analogue input		± 10	0.005	Differential input	X1
Digital input	ON OFF	10-30 <6	0.010 0	Logic IO	X1
Digital output		+24	1	Transitor output open emitter	X1
Resolver, TTL, SINCOS				Differential input	X7
2. Encoder input		>3.6V		Opttically decoupled	X7
Encoder output		>4.7V		Opttically decoupled	X8
CAN-interface				Logic IO	X9
RS232-interface				logicIO	X10

Specification	
Protection rating	IP00 (IP20, VGB4 bei > 60V) (IPx3 Option)
Standards	EN60204,
Operating temperature range	-10 bis +45C
Extended operating temperature range	+45C bis +60C performance reduced by 2%/C
Storage temperature	-30C bis +80C
Humidityrating	Klasse F rel. humidity <85% ,**no condensation !**!
Site of installation	≤ 1000m a.m.s.l. 100%, >1000m with power derating 2%/100m
Ventilation	Internal fan in case of additional cooling unit
Mounting position	Vertical, performance reduced by 20% when mounted horizontally

Programming	Version	Software version	
BAMOBIL-xx-RS	Resolver	BAMOBIL-RS	
BAMOBIL-xx-IN	Encoder-TTL	BAMOBIL-IN	
BAMOBIL-xx-SC	Encoder SINCOS 1Vss	BAMOBIL-SC	
BAMOBIL-xx-BL	Rotor posiotin+bl tacho	BAMOBIL-BL	

Note:

Power supply cables between the BAMOBIL and the battery must be as short as possible.
Long cables cause dynamic voltage drops due to the line impedance and as a consequence the service life of the installed ELKOs would be reduced.

Important instruction

Check the device for mechanical damage. Only perfect devices can be mounted.

Disconnect the power supply prior to any assembly.

Disconnect the positive battery pole.
The device must only mounted by suitably trained personnel.

The mounting position of the devices with ground plate and those with additional cooling unit (air by means of fan, liquid) is arbitrary.

Devices with an additional cooling unit without a fan must be mounted vertically.

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

Ensure that the ventilation is sufficient and that there is enough space for the discharged ventilation air (min. 100mm). If the heat is not dissipated sufficiently the device switches off via its temperature watchdog.

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.

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.

The power supply lines (battery line and motor line) must be routed separately from each other. Observe the min. line cross-section.

Unshielded cable heads must be kept short.

8mm cable lugs

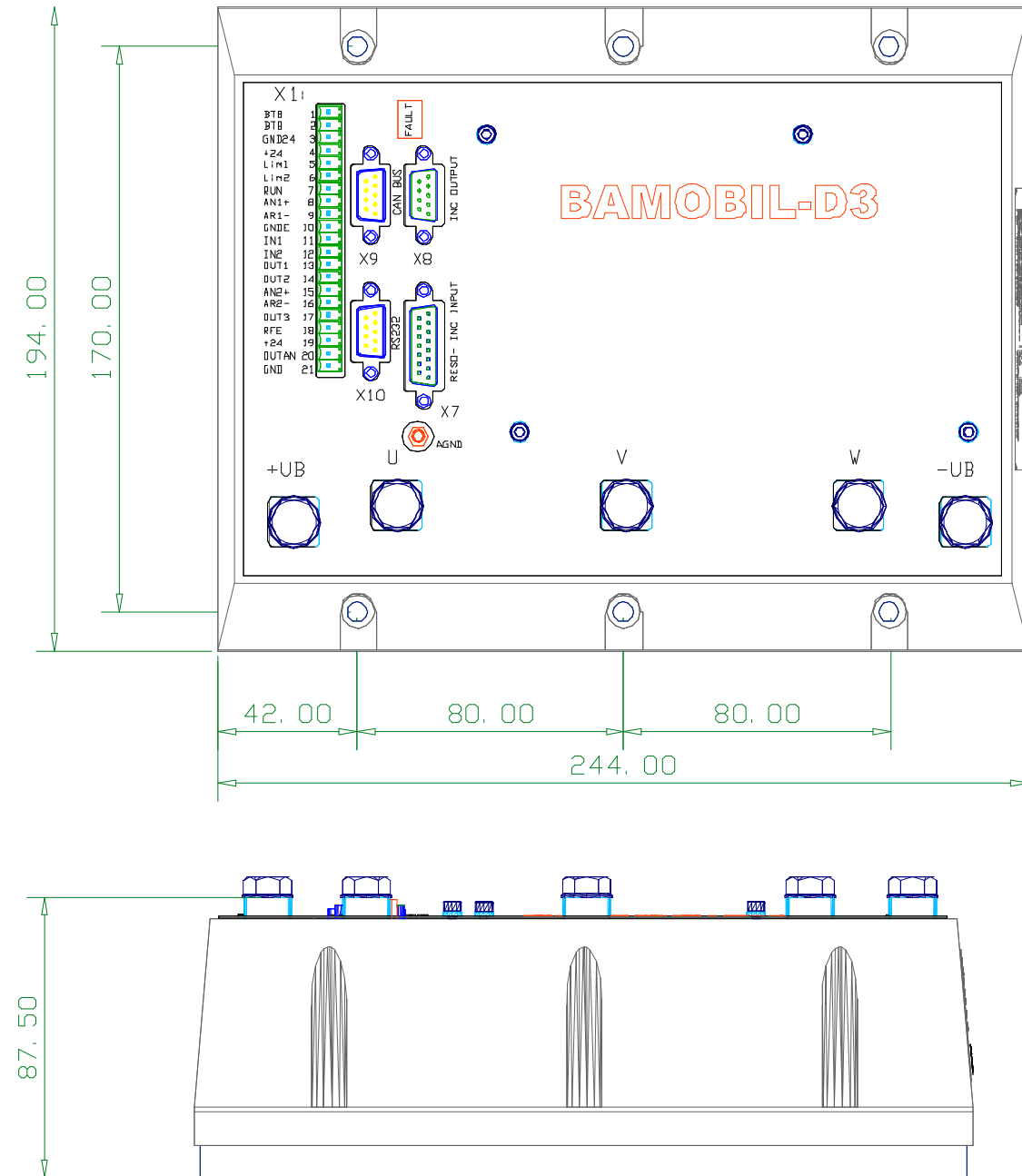Use vibration-proof screw connections.

Note:

Concerning the power supply connection and the auxiliary voltage connection of the battery please check:

negative power supply voltage = negative auxiliary voltage

The internal connection is destroyed in case of a reverse polarity of the auxiliary voltage.

BAMOBIL D3.2
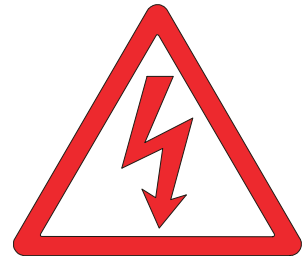
Dimensions - BAMOBIL

Mounting depth without connector: BAMOBIL up to 120A = 85mm
BAMOBIL ³150A = 95mm
Fixing screws: BAMOBIL up to 120A = M5x20
BAMOBIL ³150A = M5x30

If the mounting plate (without the additional cooling unit) is mounted onto the rear panel of the switch cabinet (4mm bright steel), the cooling capacity of the plate corresponds to:
- a continuous current of 35A (S1 duty) when the plate is 10mm thick
- a continuous current of 50A when the plate is 20mm thick
For currents superior to 50Aeff. (for intermittent duty S2, S3) it is necessary to provide an additional cooling unit (air or liquid) or a heat dissipating mounting plate.

Connecting screws M8x16
max. permissible torque = 12Nm
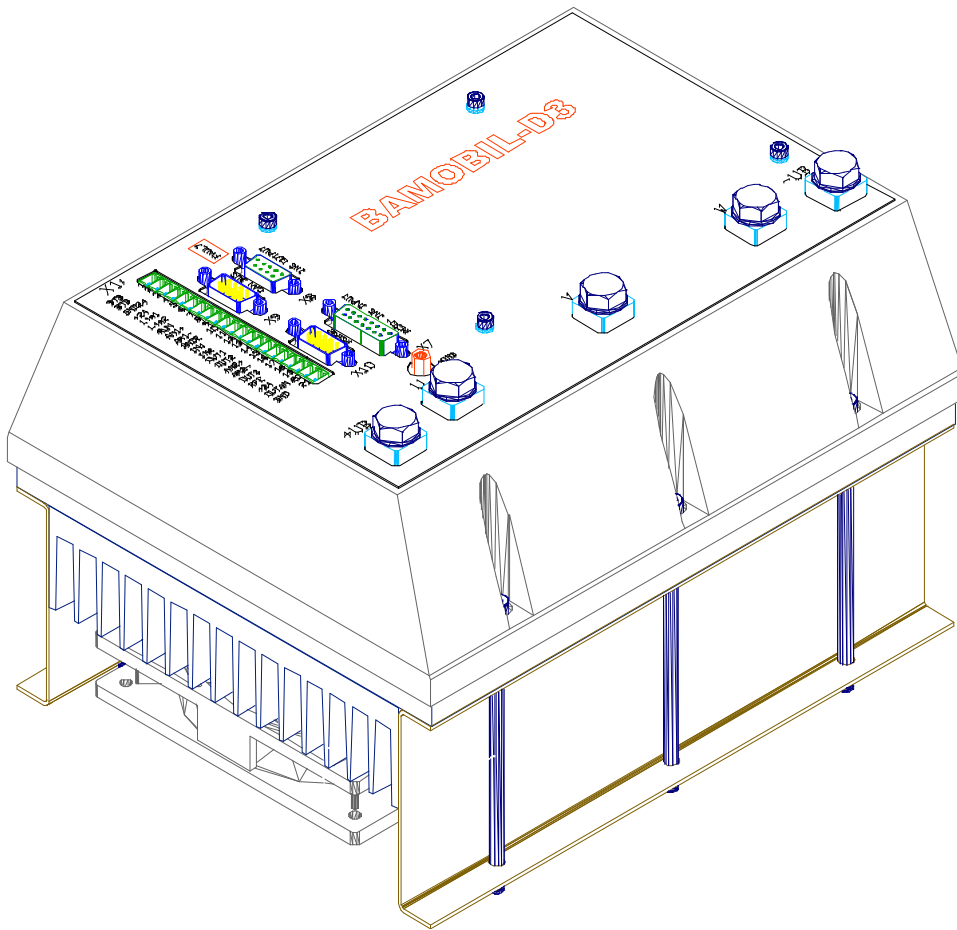
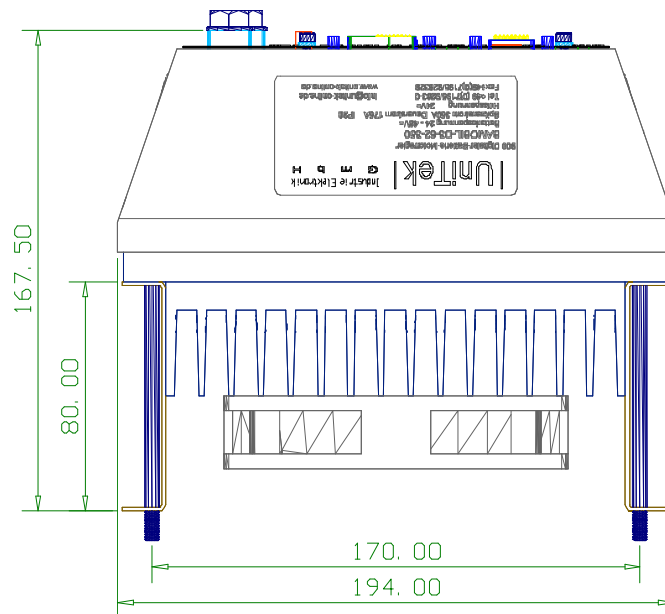# 2 Mechanical Installation

Dimensions Control tpanel
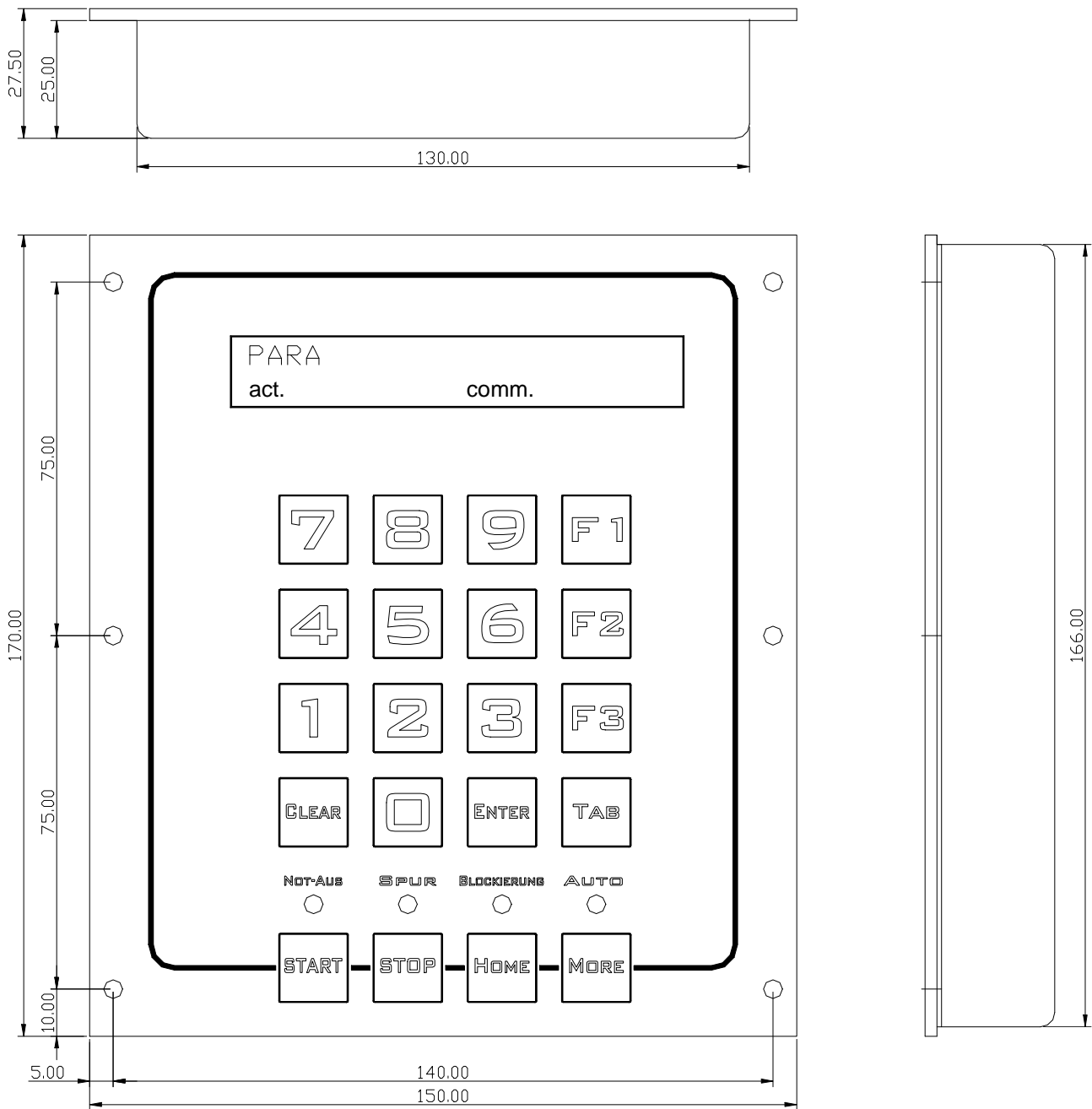
The control panel is connected with the control unit via the CAN BUS.

Assembly

Dimensions - Additional cooling unit for control panel mounting

Mounting depth
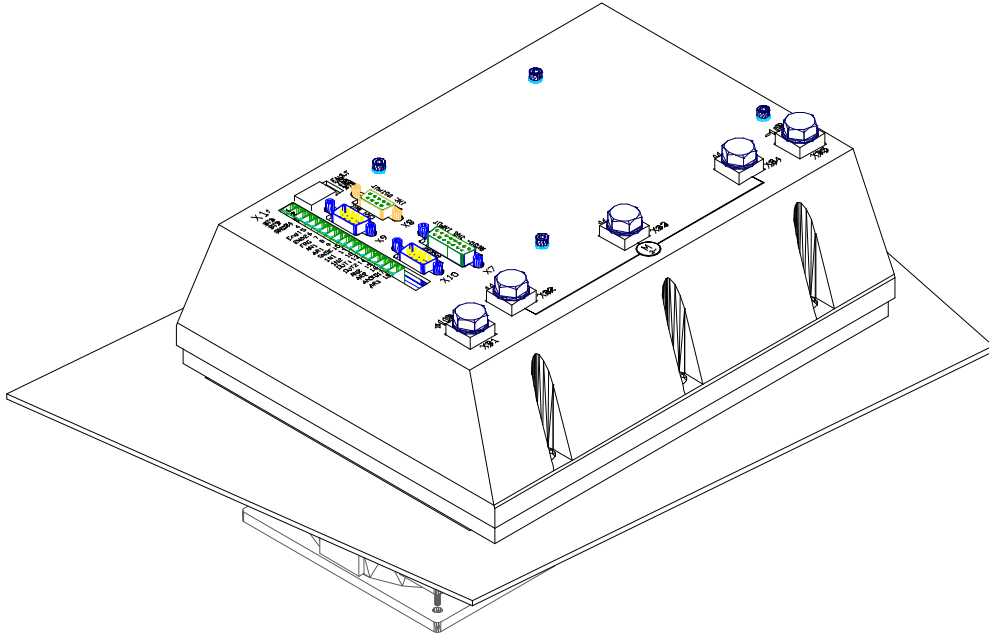without
connector:

167.50

80.00

170.00

194.00

Fixing bore hole dimensions: see basis device

Fixing screws M5x110mm

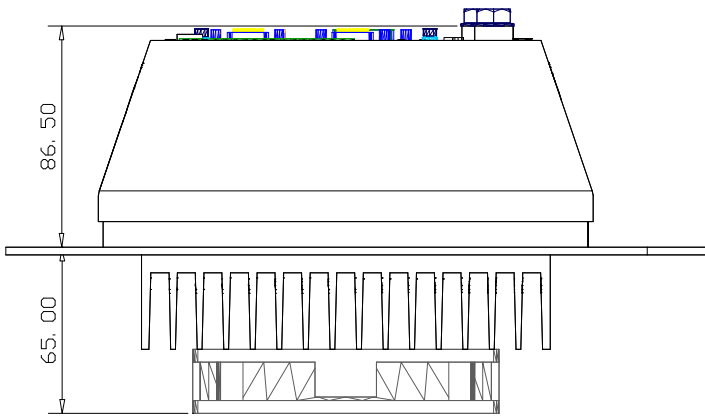Vertical mounting position,
performance reduced by 20% if the mounting position is horizontal
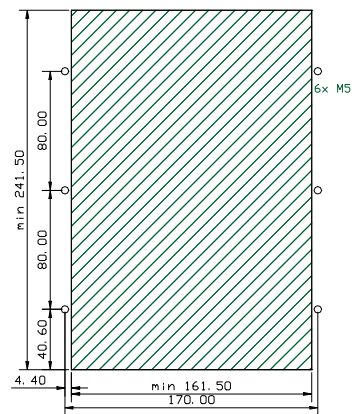
Dimensions - Additional cooling unit to be inserted

Mounting depth without connector

86. 50

65. 00

Enough space for the ventilation air must be provided

min 241. 50

80. 00

80. 00

40. 60

4. 40

6x M5

min 161. 50

170. 00

Control panel break through
Fixing screws M5x30mm

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Free

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3 Electrical Installation

Power connections

Attention:

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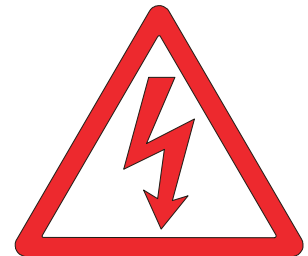
Adhere to:
- connection and operating instructions
- local regulations
- EU guideline 89/392/EWG
- VDE and TÜV regulations and Trade body guidelines

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 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 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.

Warning:
Bad or insufficiently rated cable connections between the battery and the device may cause damage to the device! (Brake energy)

Warning:
Power supply cables between the BAMOBIL and the battery must be as short as possible.
Long cables cause dynamic voltage drops due to the line impedance and as a consequence the service life of the installed ELKOs would be reduced.
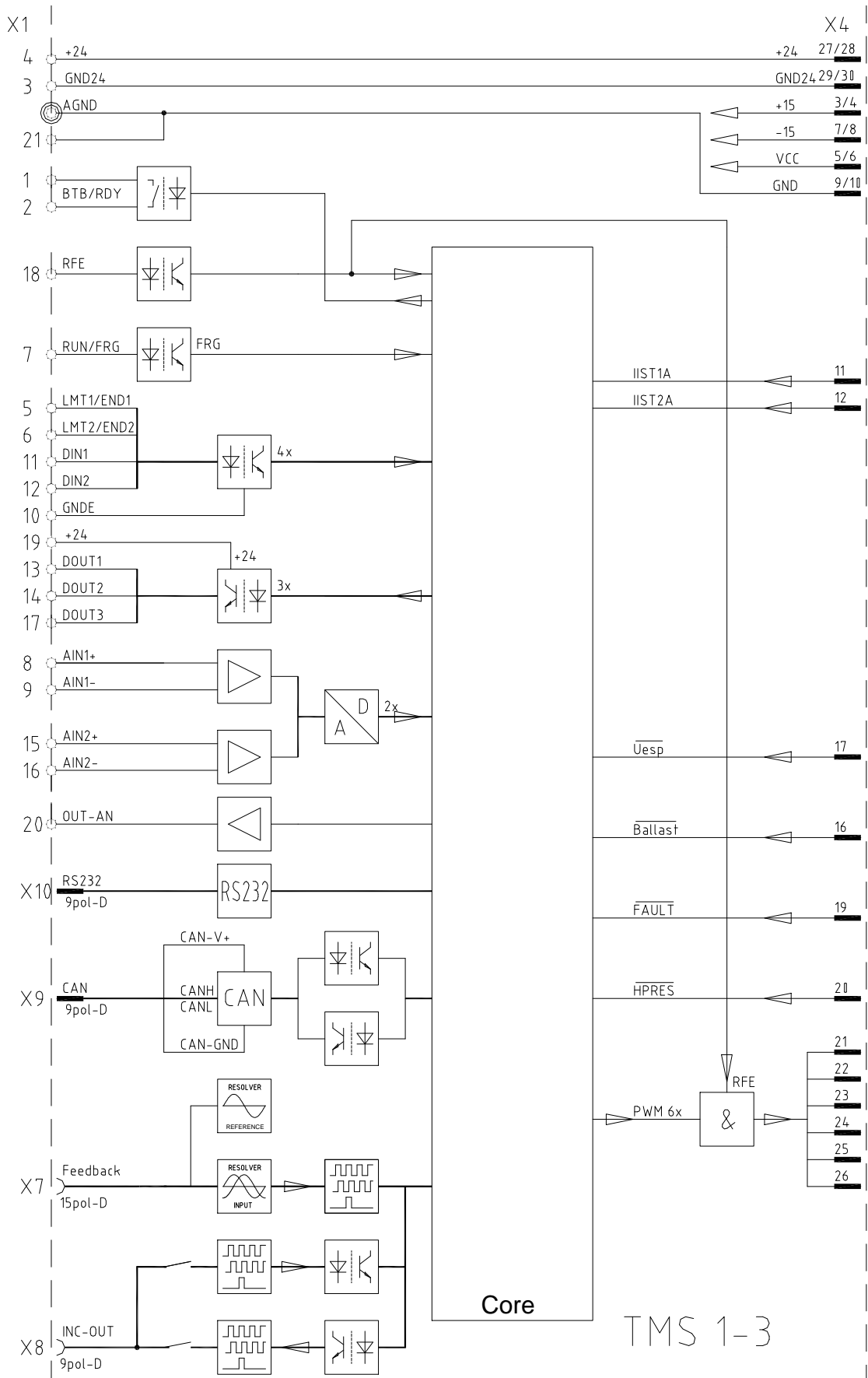
Warning:
Concerning the power supply connection and the auxiliary voltage connection of the battery please check:
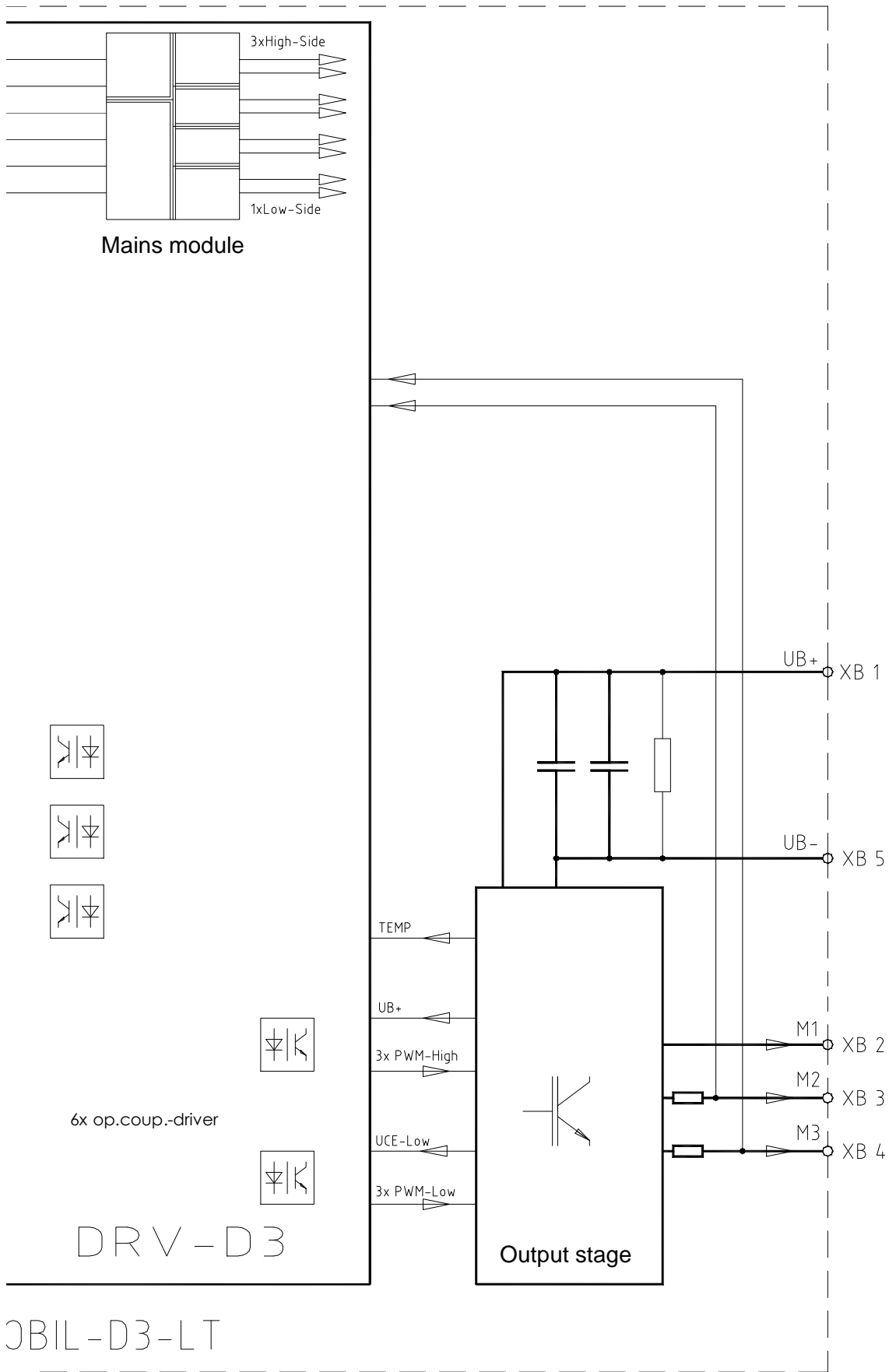
negative power supply voltage = negative auxiliary voltage

The internal connection is destroyed in case of a reverse polarity of the auxiliary voltage.

BAMOBIL D3.2

X1			X4	
4	+24		+24	27/28
3	GND24		GND24	29/30
	AGND		+15	3/4
21			−15	7/8
			VCC	5/6
			GND	9/10
1	BTB/RDY			
2				
18	RFE			
7	RUN/FRG FRG		IIST1A	11
			IIST2A	12
5	LMT1/END1			
6	LMT2/END2			
11	DIN1	4x		
12	DIN2			
10	GNDE			
19	+24			
13	DOUT1 +24			
14	DOUT2 3x			
17	DOUT3			
8	AIN1+			
9	AIN1−			
		A D 2x		
15	AIN2+		Uesp	17
16	AIN2−			
20	OUT−AN		Ballast	16
X10	RS232 9pol-D	RS232	FAULT	19
	CAN-V+			
X9	CAN 9pol-D CANH CANL CAN CAN-GND		HPRES	20
				21
	RESOLVER REFERENCE		RFE	22
X7	Feedback 15pol-D RESOLVER INPUT	PWM 6x &		23
				24
				25
X8	INC−OUT 9pol-D			26

Core

TMS 1-3

3xHigh-Side

1xLow-Side

Mains module

UB+   XB 1

UB-   XB 5

TEMP

UB+

3x PWM-High

6x op.coup.-driver

UCE-Low

3x PWM-Low

M1   XB 2

M2   XB 3

M3   XB 4

D R V – D 3

Output stage

OBIL–D3–LT

BAMOBIL D3.2

Auxiliary voltage 24V=

+24V
GND24

Control

Label		
Safety circuit emergency stop		
Drive enable		
Analogue com.value ±10V		
Logic GND		
Logic output		
Logic input		
Analogue value 2 ±10V		
Digital output Rotating field enable		
+24V		
Analogue value 3 ±10V		
System-GND		

output stage switch

X1-1
1 BTB   ready   27
2
3 GND24 auxiliary voltage   23
4 +24
5 END1   output stage switch   25
6 END2   25   23
7 FRG   enable   25
8 AIN1+ analogue input 1   28
9 AIN1-
10 GNDE   digital GND   27
X1-2
11 DIN1   digital inputs   25
12 DIN2
13 DOUT1 digital outputs   27
14 DOUT2   24
15 AIN2+ analogue input 2   28
16 AIN2-
17 DOUT3 digital output   27
18 RFE   rotating field enable
19 +24
20 AOUT   digital output   28   31
21 GND   Analogue-GND   34
   AGND   System-GND

Detail page

XB:1 +UB

-UB XB:5

F1

D1 braking current diode

Battery voltage

M1 XB:2
M2 XB:3
M3 XB:4

EC Motor 3~

X7 Encoder

Feedback Encoder

Encoder

Counter input	X8 INC-OUT counter pulse output counter pulse input 37
CAN-MASTER	X9 CAN-BUS 30
	X10 RS232 Interface PC-COMx 29

BAMOBIL-D3.2

PC   COM1/COM2

D-plug with shielded conductor
shield connection in the plug

EMC mass surface-to-surface contact to the mounting plate
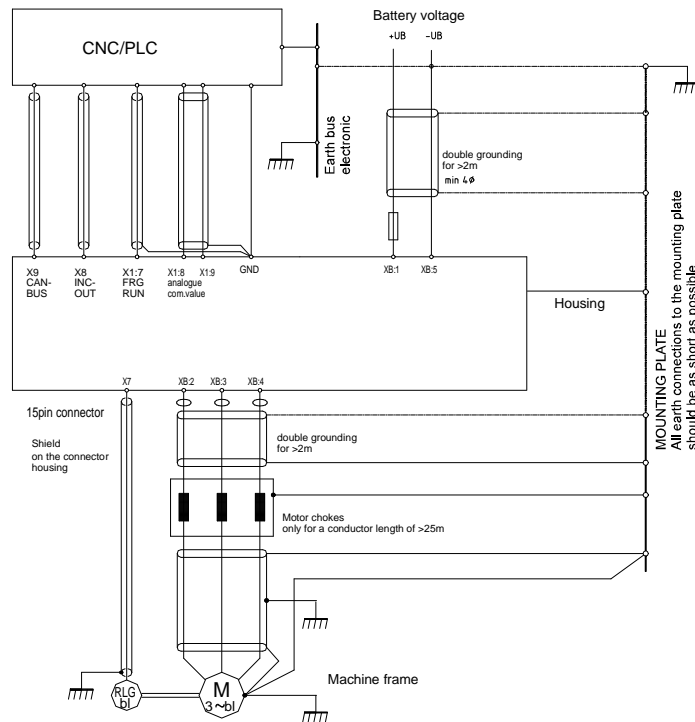
EMC Advice

The devices adhere to the EU guidelines 89/336/EWG and the technical standards EN 61000-2 and 61000-4 provided that the following conditions are observed:

- The device is conductively mounted on a 500x500x5 mm bright
  aluminium mounting plate-
  The mounting plate must be connected to -U using a 10mm² wire.
- The motor housing must be connected to -U using a 10mm² wire.
- The device ground X-AGND must be connected to the mounting plate
  using a 1.5mm² wire.
- The housing must be connected to the mounting

Connection of the control conductors:

All control conductors must be shielded. Analogue signal lines must be twisted and shielded. The shield must have surface-to-surface contact with the mounting plate.

Battery connection:
  48V dc voltage

Motor connection:
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.

A manufacturer's declaration can be asked for.

BAMOBIL D3.2

CAN-BUS X9

nc — 6
CAN-H — nc — 7
— nc — 8
CAN-V+ — 9

1 — nc
2 — CAN-L
3 — CAN-GND
4 — nc
5 — nc

FM

Encoder output input X8

Channel Ā — 9
Channel B — 8
Channel N — 7
Select IN — 6

5 — Supply GND
4 — Channel N
3 — Channel B
2 — Channel A
1 — Supply +5V

X1

Ready	BTB/RDY	1
	BTB/RDY	2
Auxiliary voltage	GND24	3
	+24	4
Output stage switch	END1/LMT1	5
	END2/LMT2	6
Drive enable	FRG/RUN	7
	AIN1+	8
Analogue input 1	AIN1-	9
Logic - zero	GNDE	10
	DIN1	11
Digital input	DIN2	12
	DOUT1	13
Digital output	DOUT2	14
	AIN2+	15
Analogue input	AIN2-	16
Digital output	DOUT3	17
Rotating field enable	RFE	18
	+24	19
Analogue output	AOUT	20
Analogue - zero	GND	

Resolver X7

SIN2 — 15
COS1 — 14
REF1 — 13
Temperatur — 12
Motor — 11
nc — 10
nc — 9

8 — nc
7 — nc
6 — nc
5 — Temperatur Motor (GND)
4 — REF2
3 — COS2
2 — SIN1
1 — nc

M

Additional encoder connections
feedback, incremental, SINCOS, rotor
see page 37 to 48

AGND

RS232 X10

nc — 6
RTS — 7
CTS — 8
nc — 9

1 — nc
2 — RX
3 — TX
4 — DTR
5 — GND

FM

Connection to the battery
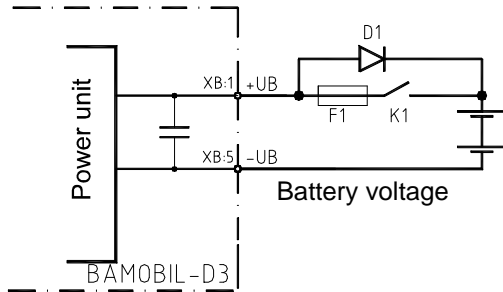
Warning

The max. supply voltage U +30% (62V=) must not be exceeded at any time
(not even for short intervals)!
Danger of damage!

F1 = safety fuses

The power supply connection has no protection against reverse polarity.

If the polarity of the connection is wrong, the device will be destroyed!

Type	Battery connection bolt 24.48 V= bolt M8x16	Connection cross-section mm2 AWG		Fuse A
-50, 80	torque <12Nm	16	4	80 160 250 350 500
-100 -150	XB1 (+UB=)	35	2	
-250	XB5 (-UB=)	70	00	
-350		95	0000	
-450		185	350	

Battery connecting line <2m. For conductor lengths from 2 to 10m more powerful. Use an additional capacity for conductor lengths superior to 10m!

Auxiliary voltage connection

Mains potential-free auxiliary dc voltage   24V= ±10%/2A
The auxiliary voltage
- is galvanically connected with the logic voltage
- has internal regenerating fuses
- has an EMC filter

External fuse only for line protection

Input voltage   24V dc   X1:4
                       GND24   X1:3
Residual ripple   10%
Switch-on current   2A
Nominal current   0.8A
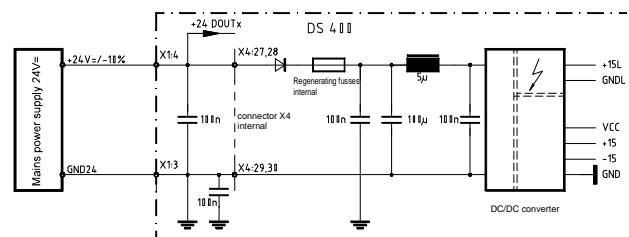
Note: In addition to the internal supply current (0.8A) the sum of the output currents (DOUT) must be provided by the mains module 24V.

Note: If the auxiliary voltage is inferior to 20V - 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.

BAMOBIL D3.2

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).
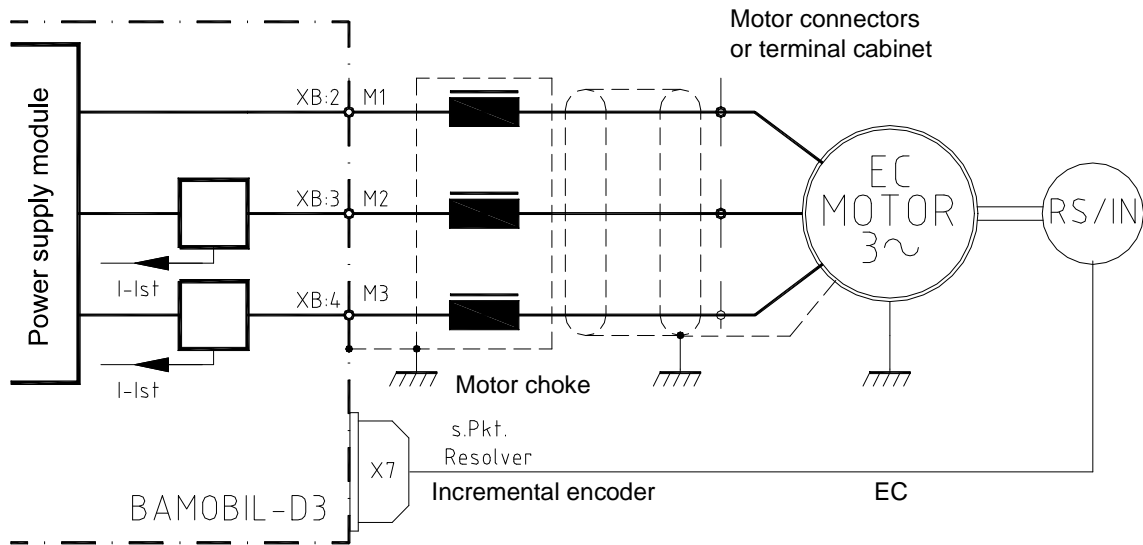
Sequence of connection

Cable		M1	M2	M3
Motor phases		U	V	W
Connecting bolt		XB:2	XB:3	XB:4
Only one correct connecting sequence is possible !				

Motor cable
3-core, single-shielded for 200V=,
shield capacity = 150pF/m,
min. Cross-section - see below table

Min. cable cross-section

BAMOBIL-D3-x	-50	-80	-100	-120	-150	-250	-350	-450
Cross-section mm²	4	6	6	10	16	25	70	95
AWG	10	10	10	6	4	2	000	0000

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

Magnetic rings
against HF failures of the sensor systems. Slide the rings onto the motor lines.

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.

Digital inputs


```
Digital inputs
X1:5   Output stage switch 1      END1/LMT1
X1:6   output stage switch  2     END2/LMT2
X1:7   enable                     FRG/RUN
X1:11  digital input 1            DIN1
X1:12  digital input 2            DIN2
X1:18  rotating field-enable      RFE
```

Digital input 10 to 30V=

3k9 · 100nF · 470 · 100nF · VCC · PAx

DSxx/BAMO-D

Opto-input

Input voltage		
H-level (ON)		+10V to +30V
L-level (Off)		0 to +6V
Input current	max.	7.5 mA
Nominal voltage/current		+24V/6mA
Referenc ground		GNDE (X1:10)
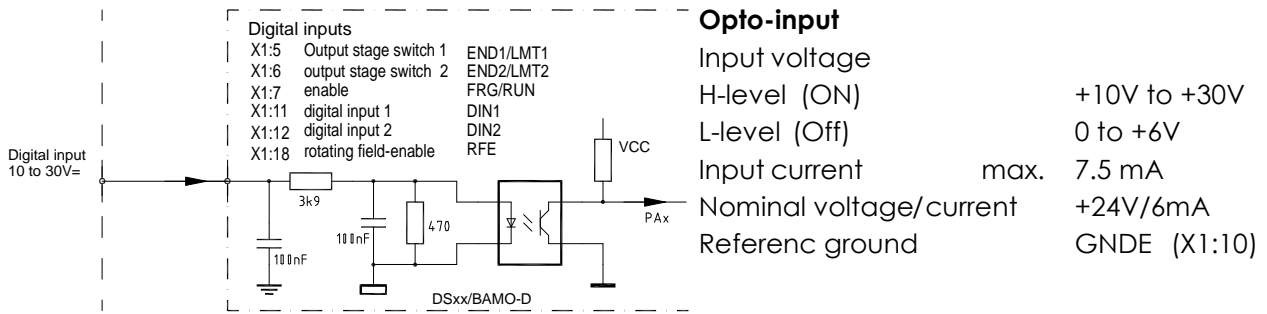
The enable input (FRG/RUN) and the input for the rotating field enable (RFE) are fixed, they cannot be programmed.

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 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	Parameter
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		
DIN1	X1:11	Digital input1		
DIN2	X1:12	Digital input2		

External power supply for the inputs and outputs

Logic voltage 24V=

Logic ground

X1:4 +24V

DS400

X1:10 GNDE

+24V for the logic and the auxiliary voltage
GNDE logic ground
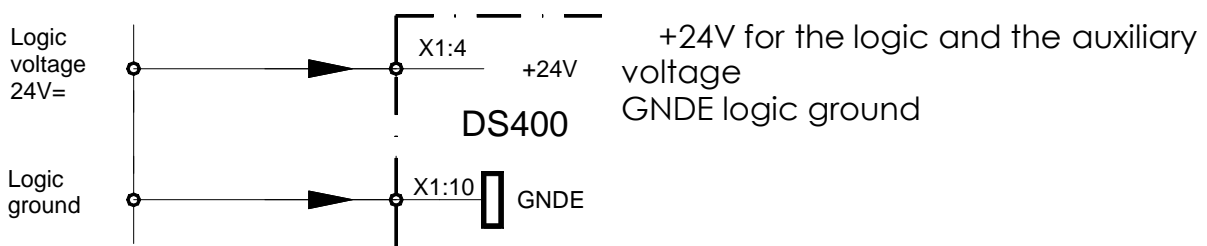
Warning!

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.
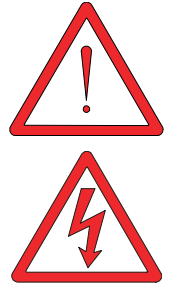
Operation with RFE input

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 disable channel to disable the PWM pulses in the processor,

- there is no RFE signal in the 2 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).

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.
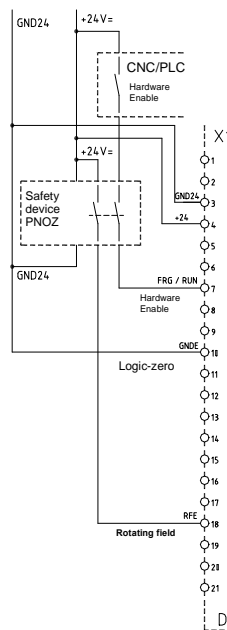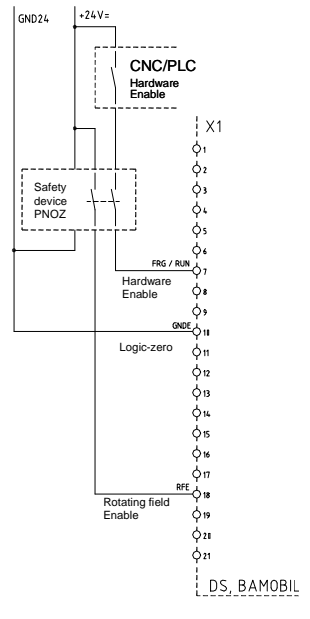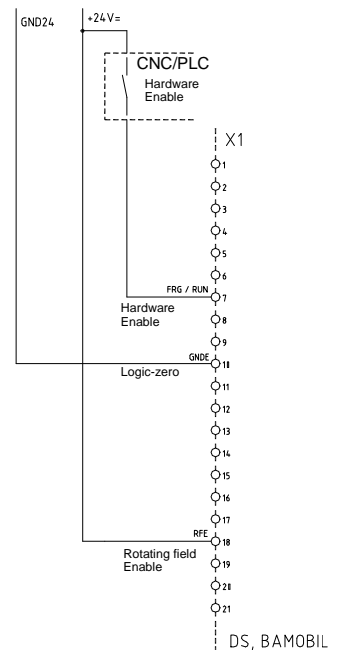
Digital logic outputs (open emitter)

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

Digital outputs:
X1:13 dig.output 1 DOUT1
X1:14 dig.output 2 DOUT2
X1:17 dig.output 3 DOUT3

Digital output 24V/1A

+24

100nF

DS/BAMOBIL
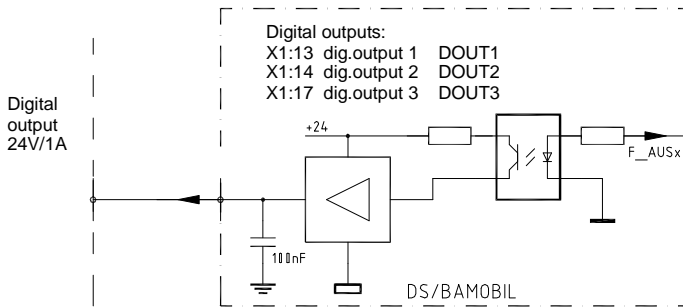
Output voltage		
On-level	max.	+24V
Off-level		<1V
Output current	nom.	1A
Output current	max.	2A
Voltage reference	+24V	(X1:4)
ground reference	GNDE	(X1:10)

It is possible to program an energy saving program (clocked output).

The logic output 4 (24V, 3A) at the power section is only available with certain **devices.**

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

BTB/RDY Solid State Relais

X1:1

X1:2

Safety circuit

100nF

F_BTB

DS/BAMOBIL
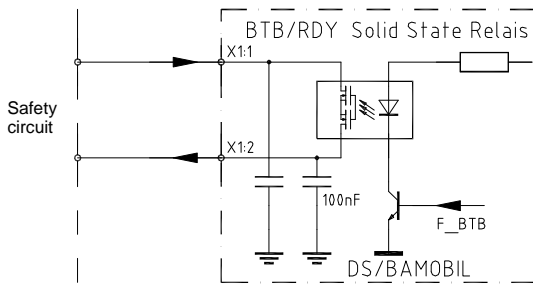
Contact for	max. 48V/0.2A
Capacitive load	max. 1myF
Contact resistance	max. 2 Ohm

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.

BTB opens (red LED, open relay contact)
in case of error messages
in case of under-voltage of the auxiliary voltage (<20V)
The message "under-voltage in the bus circuit" can be programmed
(see Manual NDrive)

Output	Connection	Function	State	Parameter
BTB/RDY	X1:1, X1:2	Ready	fixed /Relay	
DOUT1	X1:13	Digital output1	programmable	
DOUT2	X1:14	Digital output2	programmable	
DOUT3	X1:14	Digital output3	programmable	
DOUT4	Xx:xx	Digital output4	programmable	

Logic voltage 24V=

X1:4

+24V

DS400

Logic ground

X1:10
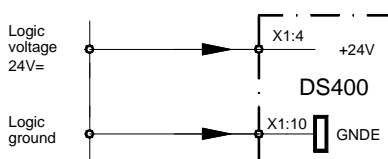
GNDE

+24V for the logic and the auxiliary voltage
Observe the sum of all output currents!

GNDE logic ground

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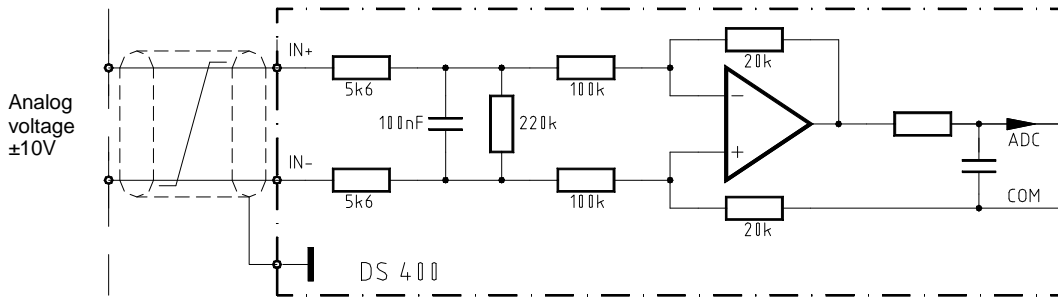
Input	Connection	Basic function	Voltage	State	Parameter
AIN1+, AIN1-	X1:8, X1:9	Speed command value	±10V	programmable	
AIN2+, AIN2-	X1:15, X1:16	Current limit	±10V	programmable	

Features

Differential input	AIN1-/AIN1-	AIN2+/AIN2-	
Input resistance	70k		
Threshold voltage	±12V		
Resolution	11bit + sign		

The direction of rotation of the motor can either be changed by swapping the ± 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 AIN1can be programmed as external analog speed limit
  - and the analog input AIN2 can be programmed as external analog current limit.

Input	Connection	Basic function	Voltage	State	Param.
AOUT1	X2:20	Speed actual value	±10V	programmable	
GND	X2:21	Signal zero	0V	fixed	

3 Electrical Installation

Interface

Serial interface RS 232

BAMOBIL-D3 is programmed and operated during commissioning via the serial pc interface RS232.
There is a software description in the Manual DS NDrive.
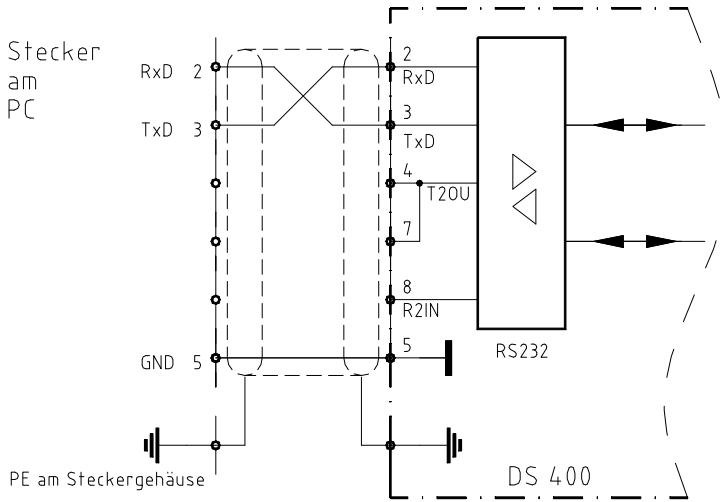
The serial interface is galvanically connected with the device zero (GND/AGND).
Null modem cable

The BAMOBIL-D3 (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 **115200Baud**.

Null modem connecting cable
View to the soldered side,
Shield on the housing,
Max. cable length 10m
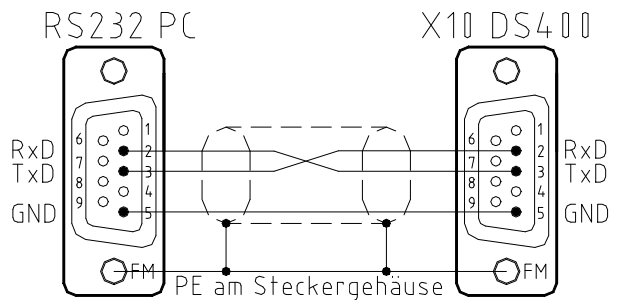
In case of strong interferences at the interface a line filter should be installed.

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

BAMOBIL D3.2
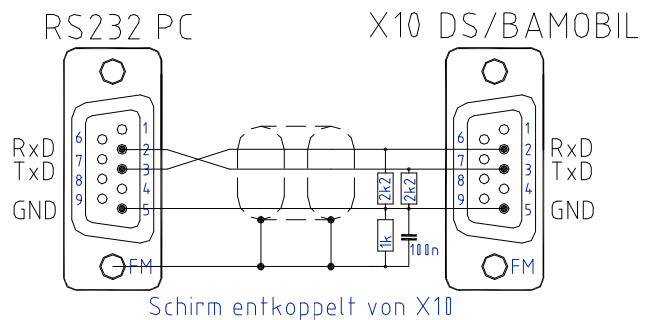
CAN-BUS

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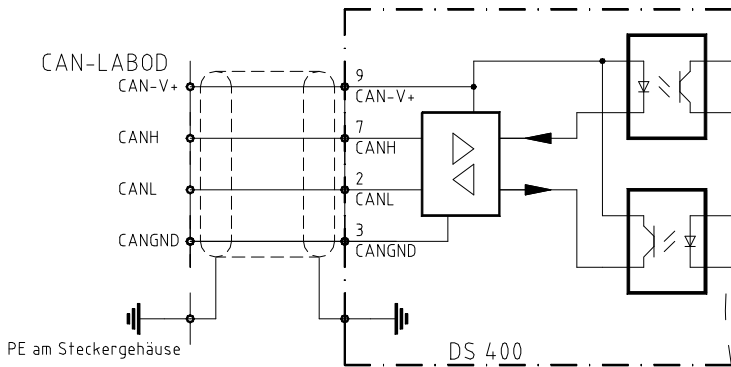
The BUS interface is galvanically isolated from the internal device voltage.

.

The voltage is supplied via an internal, isolated DC-DC converter or via the BUS cable. CAN-V+ 9 to 15V=

CAN-BUS cable

Use a shielded bus conductor with a low shielding capacity.
Signal plus GND (+supply).
D-connector with a metal or metallized housing. LiYCY 4x0.25+shield.
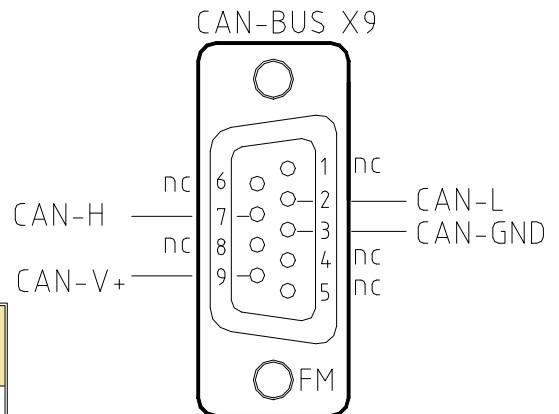
Designation	Connect. no	cable color	cable no.
CAN-V+	9	brown	1
CAN-GND	3	white	4 (PE)
CAN-H	7	green	3
CAN-L	2	yellow	2

CAN-BUS connection with several BAMOBIL-D3
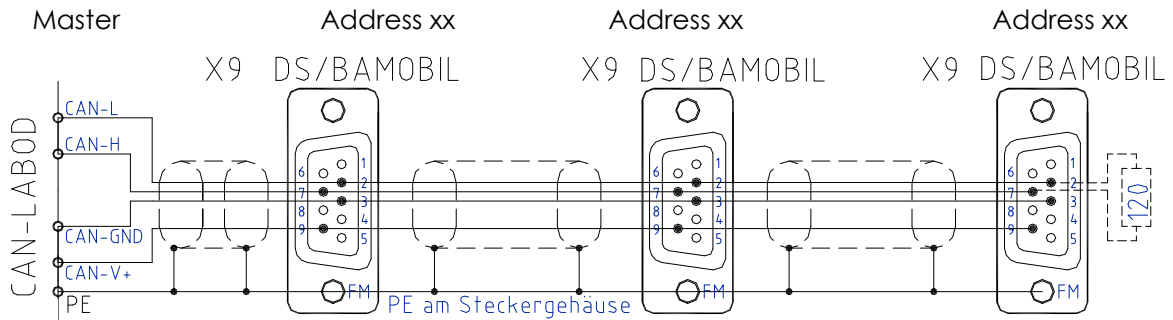
Terminating resistor at the end of the bus line > 120Ohm between the CAN-H and CAN-L

Resolver (vertical, right margin)

Resolver connection
only for BAMOBIL-D3-RS
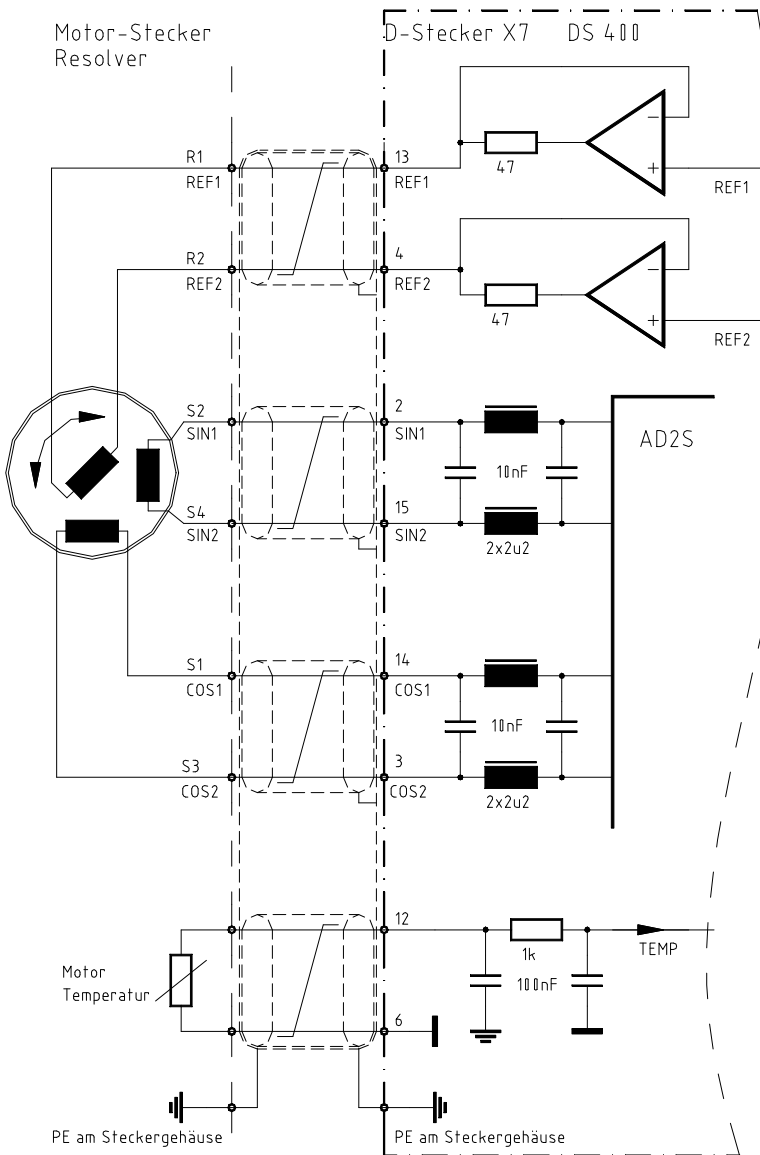
The resolver is an absolute measuring system for a motor revolution.
It is robust and not impaired by high motor temperatures.
Its build corresponds to a revolving transformer.
The rotor is supplied by the reference (10kHz).
The stator supplies the sine and cosine signals modulated by the rotational frequency.
The amplitudes of these signals are analyzed and digitalized in the servo-drive.
The resolution is automatically set to an optimum of 10, 12, or 14 bit.
The max. possible speed is 50000 (10bit).
The digitalized signals are used for the polar wheel angle, the position and speed control, and the incremental output.

Connect.assignment
Soldered side
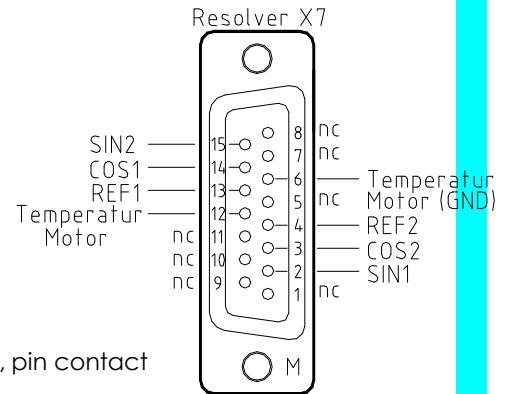
Use only motors with a 2-, 4-, 6-, or 8-pole resolver which have been approved by UNITEK (Appendix A). Observe the motor specific connection data sheet (RS)!

M, pin contact

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 con.   connect the overall shield to the connector housing

Setting parameters   see software Manual DS

Encoder TTL connection
only for BAMOBIL-D3-xx-SC

Motor-Stecker Encoder

D-Stecker X7   DS 400

10 VCC +5V
1 A
4 Ā
2 B
11 B̄
3 N
9 N̄
13 ROTOR1
14 ROTOR2
15 ROTOR3
47
100nF
GAL
DSP
12 TEMP
1k
TEMP
100nF
6
Motor Temperatur
PE am Steckergehäuse   PE am Steckergehäuse
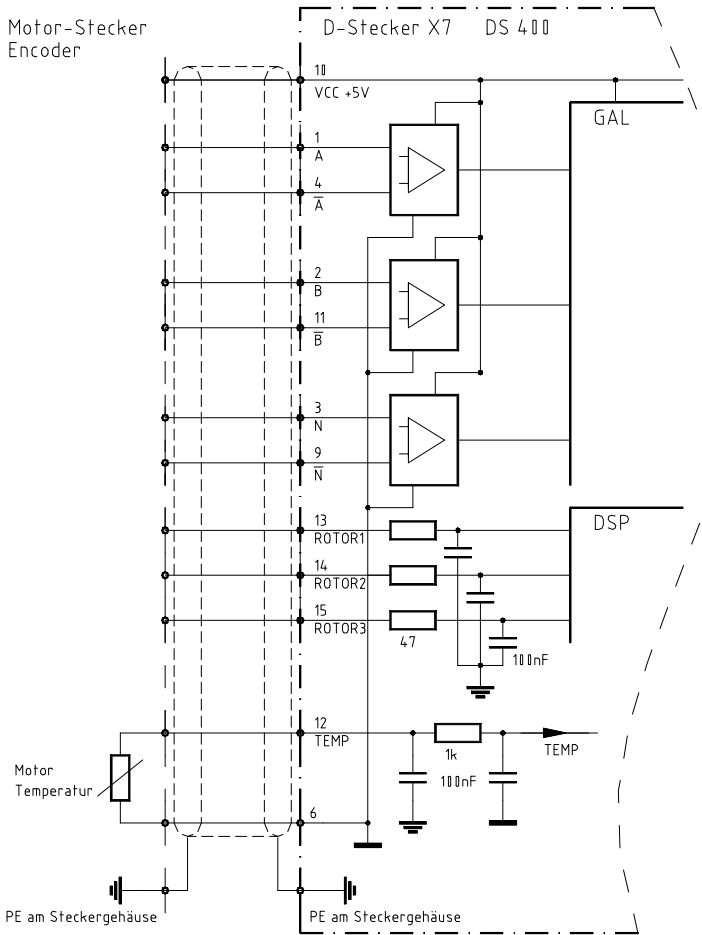
ITTL incremental encoder (encoder) with 2 counter tracks and 1 zero track plus 3 rotor position tracks. Counter tracks with or without push-pull output. (For single connection A, B, N do not connect the negative inputs.)

The counter input corresponds to RS485.
Max. counting frequency 500kHz.

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

The voltage of 5V is supplied by the servo-drive.

Connect. assignment
Solderer side

Encoder X7

Rotorlage 1 — 15
Rotorlage 2 — 14
Rotorlage 3 — 13
Temperatur Motor — 12
Kanal B̄ — 11
Versorgung +5V — 10
Kanal N̄ — 9

8 nc
7 nc
6 — Versorgung GND
5 — Temperatur GND
4 — Kanal Ā
3 — Kanal N
2 — Kanal B
1 — Kanal A
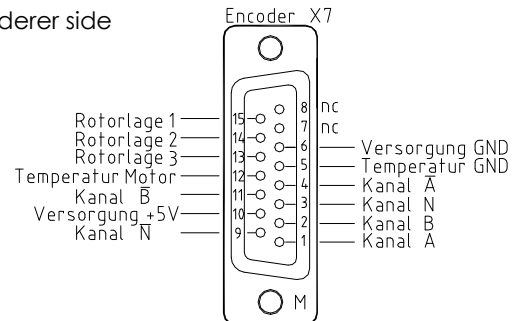
M, pin contact

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

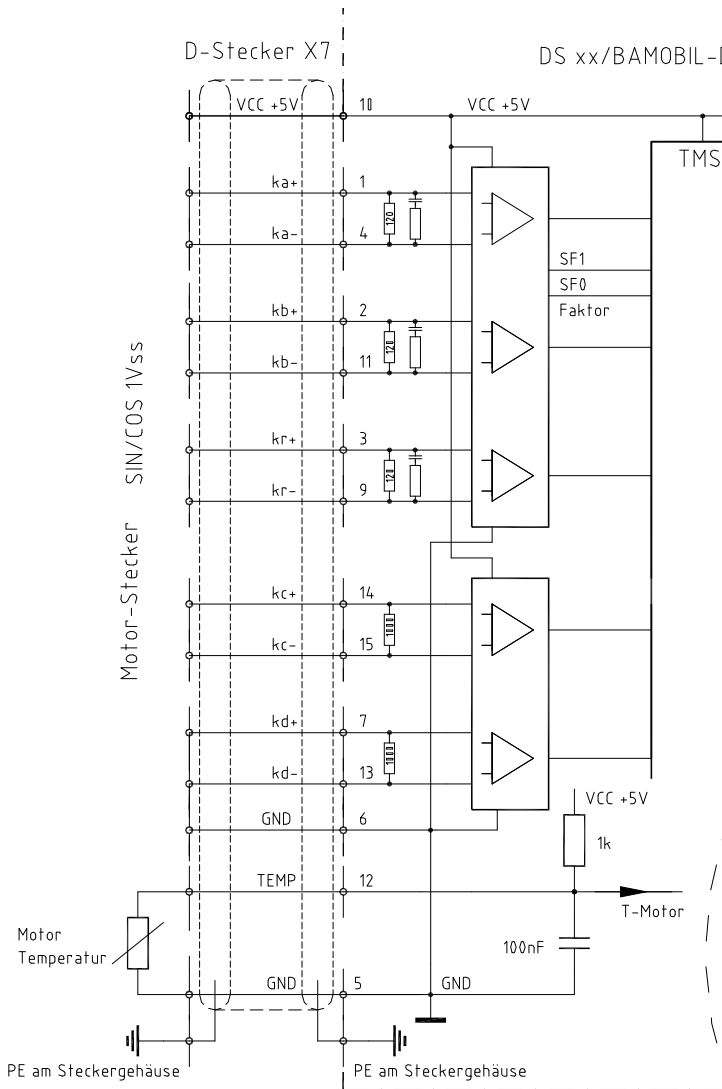|	
Connector X7	15-pole D-connector
Connecting cable	10 signal conductors, shielded, min. cross-section 0.14mm 2 supply lines, min. cross-section 0.5mm For link chains use appropriate cables!
Cable length	for >25m the cross-section of the cable used must be increased by one grade
Shield connection	across connector X7 - connect the shield to the connector housing across the motor connector - connect the shield to the connector housing
Setting parameter	see software Manual DS

SIN/COS 1Vss
only for BAMOBIL-D3-xx-SC

Incremental encoder (encoder) with 2 analog, sinusoidal counter tracks and 1 zero track plus 2 commutating tracks. Differential signals 1Vss
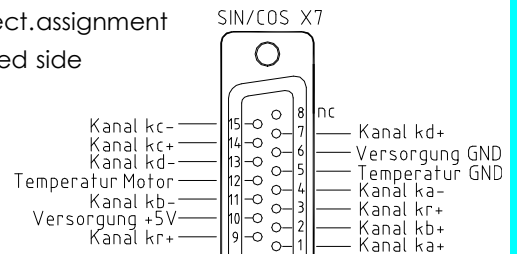
Max. counting frequency 500kHz.

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

The voltage of 5V is supplied by the servo-drive.

The resolution is automatically set to an optimum.

Connect.assignment
Soldered side

M, pin contact

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	(4 x (2 x 0.14) + (4 x 0.14)C + 4 x 0.5)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

BAMOBIL D3.2

Rotor position encoder - connection via a bl-tacho
only for BAMOBIL-D3-xx-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).

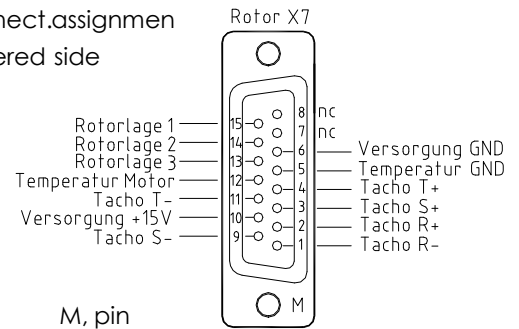The voltage of 15V is supplied by the servo-drive.

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

For lower tacho voltages connect X7: pin 1, 9, and 11. Connect the tacho center point to X7:1.
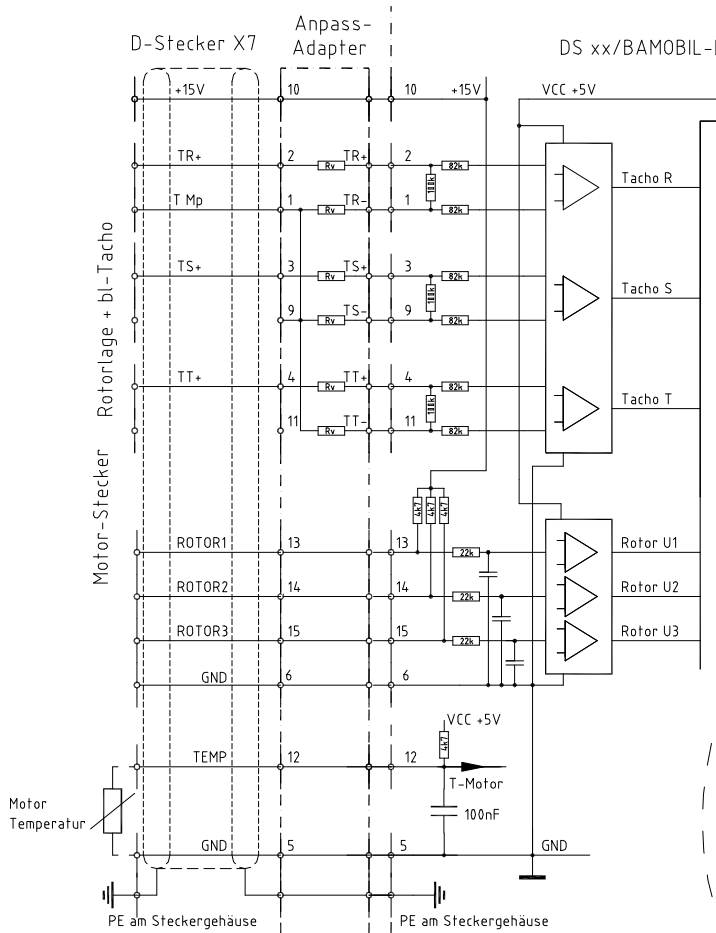
Use only motors with rotor

Connect.assignmen
Soldered side

M, pin

position encoders (bl) which have been approved by UNITEK (Appendix A). Observe the motor specific connection data sheet (bl)!

Connector X7	15-pole D-connector
Connecting cable	12 signal conductors, supply lines, temp., min. Cross-section 0.25mm
	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 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 bridged with GND
Input   X8 pin 6 bridged with +5V (X8:1)
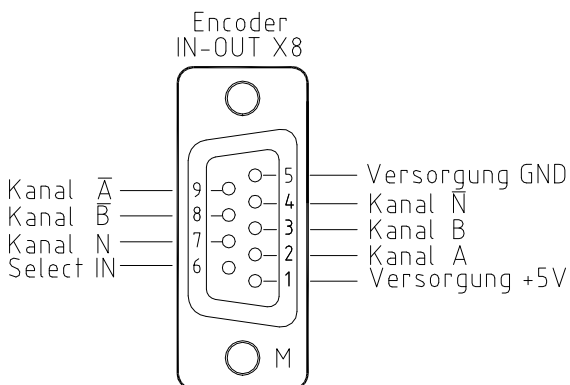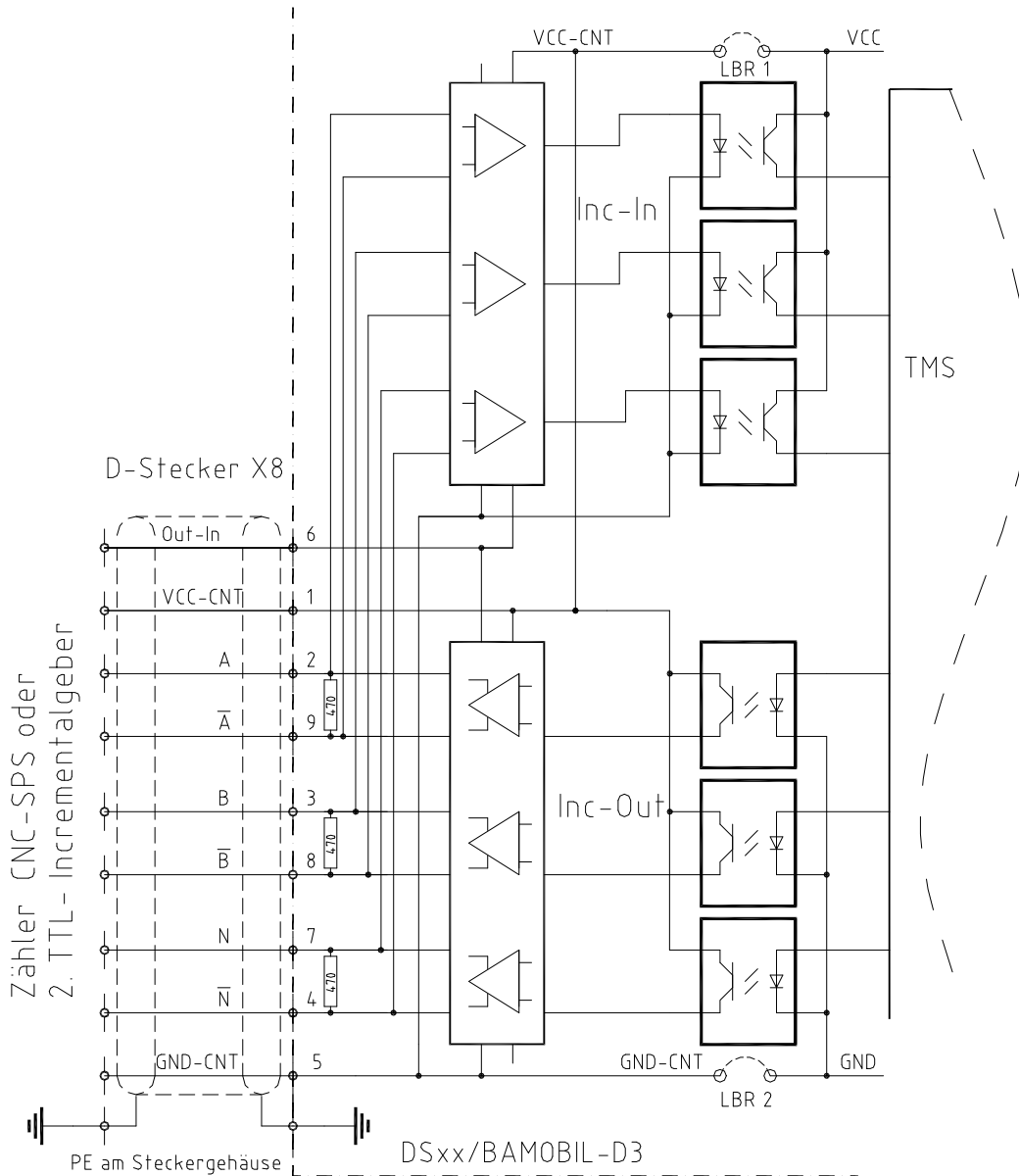
9-pole D-connector (M, pins)
connector assignment
soldered side

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

BAMOBIL D3.2

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 +5V ±0.2V.
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.
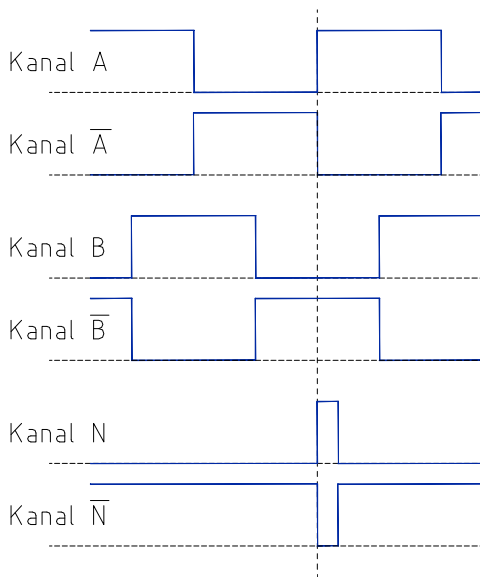
Pulse signals (motor revolving clockwise)

Output level	low <0.5V, high >4.5V
Slope	<0.1ms
Zero pulse	min. 0.2ms
Output frequency	max. 200kHz
Pulse/rpm- for RS, SC	programmable
- for IN	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. 200kHz

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

The encoder input can be programmed for different functions.

see software Manual DS-NDrive.

Displays - BAMOBIL D3

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 enabled	OK = 1 , ENA = 1
	dark	Drive disabled (not enabled)	OK = 1 , ENA = 0
	bright	Speed zero (standstil 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 Icns	Icns = 1
	bright	Motor current at max. current limit Imax	Icns = 0
	dark	Normal operation; Motor current within the current limits	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

BAMOBIL D3.2

Errordisplay - BAMOBIL D3

The red LED "fault" isbright and the falt u o. Isindicated bythe sevensegment -display.

List of errors.

Display at the BAMOBIL	Errordisplay with NDrive	Meaning
0	BADPARAS	Damaged parameter
1	POWER FAULT	Output stage error
2	RFE FAULT	Safety bus fault
3	BUS TIMEOUT	Transmision fault BUS
4	FEEDBACK	Encoder signal faulty
5	POWER VOLTAGE	Power voltage missing
6	MOTOR TEMP	Motor temperature too high
7	DEVICE TEMP	Device temperature too high
8	OVER VOLTAGE	Over voltage >1.8 x U_N
9	I_PEAK	Over current 300%
A	RACE AWAY	Drive races (withoutcommand value, wrong direction
B	USER	User - choice of error
C	RESERVE	
D	RESERVE	
E	CPU-ERROR	Software error
F	BALLAST	Ballast circuit overload
Decimal point flashes	Processing unit active	
Decima point dark	Auxiliaryvoltage missingor inherenthardware failure	

Example:

FAULT LED   red
Error no. 5   POWER VOLTAGE (power voltageis missing)

3 Electrical Installation

Warning signals - BAMOBIL D3

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 at the BAMOBIL	Warning signals with NDrive	Meaning
0	MOTOR TEMP	Motor temperature superior to 80%
1	DEVICE TEMP	Device temperature superior to 80%
2	I2t	I2t superior to the programmed value
3	BLOCK	Drive disabled
4		
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

Example:

Fault LED	flashes red
	The display swaps between state and warning no.
Warning no. 5	??

Guarantee

UNITEK 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. Unitek undertakes no guarantee 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).

UNITEK reserves the right to change any information included in this MANUAL.
All connection circuitry described is meant for general information purposes and is not mandatory.
The local legal regulations, and those of the Standards Authorities have to be adhered to. UNITEK does not assume any liability, expressively or inherently, for the information contained in this MANUAL, for the functioning of the device or its suitability for any specific application.