M A N U A L

Digital battery - motor controller
BAMOBIL-D3-IM
for EC servo motor

UNITEK
Industrie Elektronik
G m b H

Edition / Version

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Table of Contents

1. Basic - Information

1.1 Other products

Digital servo amplifiers for lower power	>>>	UniTek	DS205, DS403
Analogue three-phase servo amplifiers TVD3, TVD6, AS	>>>	UniTek	Series
Analogue DC servo amplifiers TV3, TV6, TVQ-6	>>>	UniTek	Series
Thyristor converter 1Q, 4Q, Servo	>>>	UniTek	Classic series 200W up to 800 kW
Analogue and digital			BAMOBIL series BAMOCAR series

1.2 Project planning instructions (MANUAL)

1.   MANUAL   BAMOBIL-D3-IM   Hardware
2.   MANUAL   NDrive   Software

Use all MANUALs for project planning, installation and commissioning!

Online at Download: www.unitek.eu

The hardware MANUAL contains warnings and safety instructions, explanations of standards, mechanical and electrical installation instructions.

The MANUAL must be made accessible to all persons working with the unit.

1.3   Designations and symbols used

Device	BAMOBIL D3-IM
User	Vehicle, machine and plant manufacturers or Operators in the industrial sector (B2B, second environment)
Manufacturer:	UniTek Industry Electronics Ltd.
Traders:	
	Danger to life! **High voltage**
	Warning. **Important**
	Dangerous electric fields

Scope of delivery:
Device BAMOBIL D3-IM

Not included in the scope of delivery:
Accessories Connectors and cable glands.

Plug 35pol Type: Tyco 776164-1
Plug 14pin Type: Tyco 776273-1
Cable gland M25x1.5

1.4 General product information

The digital three-phase servo amplifier **BAMOBIL** forms a 4-quadrant drive unit together with the motor. Driving and braking with energy feedback in both directions of rotation.
Depending on the installed parameter set, the amplifier is suitable for EC synchronous motors, AC asynchronous motors or DC DC motors.

The drive concepts are characterised by different advantages and disadvantages.

The **EC drive** (synchronous motor) has the highest efficiency and the highest power per weight and volume. It is maintenance-free and has high control dynamics. The disadvantage is the field-weakening range, which is difficult to control, and the high braking torque in the event of a motor short-circuit.
The EC synchronous motor (brushless DC motor) is a synchronous motor with a permanent magnet rotor and three-phase stator in its electrical design.
The physical properties correspond to those of the DC motor,
i.e. the current is proportional to the torque and the voltage is proportional to the speed. The speed is controlled stably up to the current limit (max. torque). In case of overload, the speed decreases at constant current.
Rectangular speed-torque characteristic.
current, speed and position (position) are measured exactly. The rotating field frequency is not a controlled variable, it adjusts itself automatically.
The motor voltages and motor currents are sinusoidal.

The **AC drive** (asynchronous motor) has the highest speed range due to the simple field weakening and it does not generate a braking torque in the event of a motor short circuit. The disadvantage is the size and the poorer efficiency. The controlled variable is the rotating field frequency, taking into account the motor-specific parameters. (The motor voltages and motor currents are sinusoidal and the controller must supply the active current and the magnetising current.
With both three-phase systems, no motor movement takes place if the rotating field is switched off or there is power stage damage. The heat loss occurs mainly in the motor stator.

The **DC drive** (direct current motor) has the best synchronisation and a high control range. Emergency operation can be achieved by directly connecting the battery voltage. Disadvantages are the carbon brushes and the heat generation in the armature. The drive can rotate at high speed in the event of a power stage failure.
The current is proportional to the torque and the voltage is proportional to the speed. Current, speed and position (attitude) are measured exactly. The speed is controlled stably up to the current limit (max. torque). In case of overload, the speed decreases at constant current. Rectangular speed-torque characteristic curve.
Field weakening is possible with externally excited motors.

BAMOBIL D3-IM can be used as a position controller, torque or speed amplifier.
The actual speed value is generated from the encoder unit (resolver or other) or internally (sensorless).
A large control range and high control dynamics require an encoder system.

1.5 Application/use/design/property

Vehicles, machines and plants in industrial use of all kinds up to a drive power of 18 KW, especially as 4Q servo drives.
- during highly dynamic acceleration and braking processes
- for large control ranges
- at high efficiency
- for small motor dimensions
- with even, smooth running

for speed control, torque control or combined speed-torque control with or without superimposed position control.
Constant drives for conveyor drives, spindle drives, pumps, transverse and longitudinal divider drives, multi-motor synchronous drives.
Synchro servo drives are more compact than other electric drives.

Use in:

Battery-powered vehicles such as electric vehicles, electric boats, forklifts, transport systems, as well as in battery-powered machinery and equipment such as automatic assembly machines, metalworking machines, X-Y tables, food processing machines, robots and handling systems, rack conveyor vehicles, stone processing machines and in many other battery-powered applications in industrial environments.

The EC/AC motors are
- Designed in protection class IP 65
- compact
- for rough environment
- for high dynamic overload
- maintenance-free

Note:

bl drives in predominantly braking operation.
For example:
Unwinder, hoists, large flywheel masses

The braking energy is fed back into the battery. In DC grids, the grid must absorb the braking energy without the voltage rising above the permissible value.
If this is not ensured, a ballast circuit must be used.
Attention: Pay special attention when operating on laboratory power supplies

For unearthed systems (vehicles, IT networks)

the insulation between the touchable parts and HV voltages must be monitored with an independent insulation monitor. Static charging voltages (ESD) between different potentials and against earth are not permitted!

1.6 Structure

Compact unit in accordance with VDE, DIN and EC directives.
Splash-proof housing IP65
Uniform digital control electronics.
Power electronics for 100 A to 450 A
Independent 12 V= to 24 V= chopper power supply for the auxiliary voltages.
Power input range nom. 12 to 120 V=.
Auxiliary cooler for air or water cooling.

Galvanic separation between
- Housing to all electrical parts
- Auxiliary voltage connection to power section and control electronics
- Power section to control electronics
- Logic input outputs to control electronics
The clearances and creepage distances comply with EU standards.

To be used:
- FET power semiconductor
- generously dimensioned
- Only commercially available industrial-standard components
- SMD placement
- 7 segment light emitting diode displays

Properties:
- Battery or DC connection 12 V= to 120 V=
- Independent auxiliary voltage connection 12 V= to 24 V=
- Digital interfaces RS232, CAN-BUS (further options)
- 2 analogue inputs, programmable differential inputs
- 4 digital inputs/outputs, programmable, opto-decoupled
- Setpoint ramps linear, non-linear (S function)
- Enable and limit switch logic
- BTB-ready, solid state relay contact
- STO / Safe Tork Off
- Position, speed and torque control
- Resolver or encoder- Incremental encoder TTL, SINCOS 1Vss, rotor position +bl Tacho
- Static and dynamic current limit
- Uniform fully digital control unit
- Protective shutdown in case of overvoltage, undervoltage and overtemperature of the motor
- Intrinsically safe short-circuit proof power unit
- Processor-independent hardware shutdown in case of short circuit, earth fault, overvoltage and overtemperature at the output stage.

1.7 Safety regulations

<u>Electronic devices are fundamentally not fail-safe!</u>

Attention high voltage

DC 200 V =
Danger of shock!
Danger to life!
DC link discharge time >4 min.

This MANUAL must be carefully read and understood by qualified personnel before installation or commissioning. The knowledge and understanding of the appliance and in particular of the safety instructions must be available to all persons involved in its use.

In the event of any ambiguities, or if other functions are not described in the documentation or are not described in sufficient detail, the manufacturer or dealer should be contacted.

Incorrect installation can lead to the destruction of the units!

Incorrect programming can trigger dangerous movements!

Intended uses:

The devices of the **BAMOBIL x** series are electrical equipment (EB) of the power electronics for the control of the energy flow.

They are intended as components for controlling EC synchronous motors, AC asynchronous motors or DC direct current motors in vehicles, machinery or plants, in industrial use.

Additional EMC measures are necessary for use in residential areas.

Connection to batteries only.

Deviating applications require the approval of the manufacturer.

The user must prepare a hazard analysis of his end product.

Protection class IP65

 Energy recovery during braking operation

Attention: Pay special attention when operating on laboratory power supplies or DC networks

Operation only permitted with the unit closed!
Control and power connections can lead to voltages without the drive operating!
DC link discharge time is greater than 4 minutes!
Measure voltage before disassembly.

The user must prepare a hazard analysis for his machine, vehicle or plant.

The user must ensure:

- that after a failure of the unit
- in the event of incorrect operation,
- in case of failure of the regulation and control unit, etc.

the drive is guided into a safe operating state.

Vehicles, machines and plants must also be equipped with monitoring and safety devices that are independent of the equipment. Suitable measures must be taken to ensure that inadmissible movements do not cause danger to people and property!

During operation, the unit must be closed and the protection systems must be active.
With the unit open and/or protection systems deactivated, the user must ensure that only qualified personnel have access to the units.

Assembly work
- Only in the secured de-energised state
- Only by trained personnel

Installation work
- Only in the secured de-energised state
- Only by trained electrical specialists
- Observe safety regulations

Setting and programming work
- only by qualified personnel with knowledge in
- electronic drives and
- Software
- Observe programming instructions
- Observe safety regulations

1.8 Commissioning

The battery servo amplifiers BAMOBIL-D3-xx are components of the electronic drive technology. They are only functional in connection with an electrical consumer (e.g. motor). Their use is limited to industrial, commercial applications.

In the case of installation in vehicles, machines and systems, the start of the intended operation of the device is prohibited until it has been determined that the machine, the system or the vehicle complies with the provisions of the EC Machinery Directive 2006/42/E, the EMC Directive 2004/108/EC.

The EC Directive 2004/108/EC with the EMC standards EN61000-2 and EN61000-4 is complied with under the installation and test conditions specified in the chapter EMC notes.

When used in residential areas, additional EMC measures are necessary.

A manufacturer's declaration can be requested.

Compliance with the limit values required by EMC legislation is the responsibility of the manufacturer of the system or machine.

1.9 Details of the safety instructions

Machinery Directive

The machine or system manufacturer must prepare a hazard analysis for his product. He must ensure that no unforeseeable movements can lead to personal injury or damage to property.

Qualified personnelHardware

Qualified personnel are characterised by education and training for the use of electronic drive technology. They know the standards and accident prevention regulations for drive technology and can assess the application. Possible dangers are recognised.

The local regulations (IEC, VDE, VGB) are known to the qualified personnel and are taken into account during the work.

Software

Qualified personnel for the software must be trained for the safe programming of the devices in the machines and systems. Incorrect parameterisation can lead to unauthorised movements. The parameter settings must be checked against incorrect operation. Careful acceptance tests must be carried out according to the 4 eyes principle.

Working environment

Incorrect handling of the units can lead to damage to property or personal injury.

Operation of the units only when the control cabinet is closed or secured!

Exceptions are only permitted during initial commissioning or control cabinet repairs by qualified personnel.

Unit covers must not be removed.

Work on electrical connections only in a voltage-free control cabinet that is protected against switching on.The

voltages and residual voltages (DC link) must be measured before working on the unit. Maximum permissible voltage < 42 V.

High temperatures > 70 °C

may occur.

The working environments may be dangerous for wearers of electronic medical aids (e.g. pacemakers). A sufficient distance to these electrical parts must be maintained.

Stress

During transport and storage, the prescribed climatic conditions must be observed.

The units must not show any mechanical damage. Bent housing parts can damage the insulating sections. Never install damaged units!

The units contain components that can be damaged by electrostatic discharges. The general recommendations for handling ESDS components must be observed. Special attention must be paid to highly insulating plastic foils and synthetic fibres.

For operation, it must be ensured that the environmental conditions in the control cabinet are complied with. This applies in particular to the non-permitted condensation of the units.

1.10 Intended use

The devices are intended as components for controlling EC synchronous motors, AC asynchronous motors or DC direct current motors in vehicles, machines or systems. Other applications require the approval of the manufacturer. The device protection class is IP65.

The place of use is the industrial environment. When used in residential areas, additional EMC measures are necessary.

The user must prepare a hazard analysis of his end product.

Only approved for connection to a battery with battery-side charging current limitation.
Use insulation monitors for voltages >60 V.

The user must ensure that the standards are complied with throughout the control wiring.

In the case of components connected to the unit without potential-separated inputs/outputs, attention must be paid to the potential equalisation (equalisation connection GND). The equalising currents can destroy components.

For insulation measurements in the application, the units must be disconnected or the power connections to each other and the control connections to each other must be bridged.

Non-observance can destroy semiconductors in the unit.

Repetitive earth and short circuits below the short-circuit response threshold can damage the output stages (conditionally short-circuit proof according to EN50178).

Inadmissible applications
- Life-sustaining medical devices or machines
- on DC networks without overvoltage protection circuits
- in potentially explosive environments
- in environments with corrosive vapours

1.11 Regulations and guidelines

The units and the associated components must be
installed and connected in accordance with the local legal
and technical regulations:

EC Directive	2004/108/EC, 2006/95/EC, 2006/42/EC, 2002/96/EC
EC standards	EN 60204-1, EN 292, EN 50178, EN 60439-1, EN 61800-3, ECE-R100
Internal. Standards	ISO 6469, ISO 26262, ISO 16750, ISO 20653, ISO 12100
IEC/UL	IEC 61508, IEC 364, IEC 664, UL508C, UL840
VDE regulations and TÜV regulations	VDE 100, VDE 110, VDE 160
Regulations of the employers' liability insurance association	VGB4

EU standards and regulations taken into account in the appliance

Standard	Explanation	Output
EN 60146-1,-2	Semiconductor power converter	2010
EN 61800-1,-2,-3	Variable speed electric drives	2010
EN 61010	Safety regulations for control devices	2011
EN 60664-1	Insulation coordinates low voltage	2012
EN 61800-5-1	Electric power drive systems	2010
EN 61508-5	Functional safety of electrical, electronic systems	2011
EN 60068-1,-2	Environmental influences	2011
ISO 20653	Protection class of electrical equipment of vehicles	
ECE-R100	Conditions battery-powered electric vehicles	
UL 508 C	UL regulation power converter	2002
UL 840	UL Regulation Air and Creepage Distances	2005

EU standards and regulations to be observed by the user

Standard	Explanation	Output
EN 60204	Safety and electrical equipment of machines	2011
EN 50178	Equipment of power installations	1998
EN 61800-3	Variable speed electric drives -EMV	2010
EN 60439	Low-voltage switchgear and controlgear assemblies	2011
EN 1175-1	Safety of electric industrial trucks	2011
ISO 6469	Electric road vehicles	2009
ISO 26262	Functional safety of electric road vehicles	2011
ISO 16750	Electrical components Vehicles	2010
ISO 12100	Safety of machinery	2011
ISO 13849	Safety of machines and controls	2011
IEC 364	Protection against electric shock	2010
IEC 664	Insulation coordinates low voltage	2011

1.12 Risks

The manufacturer endeavours to reduce the residual risks emanating from the device as far as possible by means of design, electrical and software measures.

The following known residual risks from drive technology must be taken into account in the risk assessment of machines, vehicles and systems.

Impermissible movements
caused by:
- the failure of safety monitoring systems or switched off
  Safety monitoring during commissioning or repair
- Software errors in upstream controls, errors in bus systems
- Unmonitored hardware and software errors in the actuators and connecting cables
- Inverted sense of the rules
- Error in parameterisation and wiring
- Limited reaction time of the control properties.
- Operation outside the specifications
- Electromagnetic interference
- Electrostatic disturbances, lightning strike
- Component failure
- Fault in the brakes

Dangerous temperatures
caused by:
- Error during installation
- Defects at connections, bad contacts, ageing
- Error in electrical fuse protection, wrong fuse types
- Operation outside the specifications
- Weather influences, lightning strike
- Component failure

Dangerous tensions
caused by:
- Faulty earthing of unit or motor
- Defects at connections, bad contacts, ageing
- Potential separation fault, ESD, component failure
- Conductive pollution, condensation

Dangerous fields
The units, the inductive and capacitive accessories, and the power cabling can generate strong electrical and electromagnetic fields.
produce fields. These can be dangerous for wearers of electronic medical aids (e.g. pacemakers). A sufficient distance to these electrical parts must be maintained.

1.13 Technical data

Version for battery voltage up to 48 V=

Power voltage connection	12 V= to 48 V= Specify battery voltage when ordering!	
Auxiliary voltage connection	12 V= to 24 V ± 10 % / 2A	Ripple < 10 % Self-healing fuse

Data BAMOBIL D3-IM-62-	Dim		120	250	450	
Supply voltage	V=		12 to 48			
Output voltage max.	V~eff		3 x 7 to 3 x 33			
Continuous current	A_{eff}		60	125	225	
Peak current max.	A_{lo}		120	250	450	
Power loss max.	W		300	600	1200	
Clock frequency	kHz		Programmable 4-16			
Overvoltage switching threshold	V=		Programmable up to max. 72 V			
Input fuse	A		160	250	350	
DC link capacity	µF		28200			
Weight	Kg		6.8			
Dimensions HxWxD	mm		280 x 200 x 90			

Version for battery voltage up to 120V=

Power voltage connection	12 V= to 120 V= Specify battery voltage when ordering!	
Auxiliary voltage connection	12 V=to 24 V ± 10 % / 2A	Ripple <10 % Self-healing fuse

Data BAMOBIL D3-IM-160-	Dim		100	200	300	
Supply voltage	V=		12 to 120			
Output voltage max.	V~eff		3 x 7 to 3 x 78			
Continuous current	A_{eff}		50	100	150	
Peak current max.	A_{lo}		100	200	300	
Power loss max.	W		300	600	1200	
Clock frequency	kHz		Programmable 4-16			
Overvoltage switching threshold	V=		Programmable up to max. 160 V			
Input fuse	A		160	250	350	
DC link capacity	µF		9000			
Weight	Kg		6.8			
Dimensions HxWxD	mm		280 x 200 x 90			

Control signals		V	A	Function	Connection
Analogue inputs		± 10	0.005	Differential input	X1
Digital inputs	ONE	10-30	0.0100	Logic IO	X1
STO	OFF	<6			
Digital outputs		+24	1	Transistor - Output Open Emitter	X1
Analogue output		± 10		Operational amplifier	X1
Resolver, TTL, SINCOS				Differential input	X7
CAN interface				Logic IO	X9
RS232 interface				Logic IO	X10

Environmental conditions	
Protection class	IP65
Standards	EN60204, EN61800, IEC60146
Operating temperature range	-30 to +65°C
Extended operating temp. range	+65 °C to +80 °C Power reduction 2 % / °C
Storage, transport	-30 °C to +80 °C; EN60721
Installation height	≤ 1000 m a.s.l. 100 %, >1000 m Power reduction 2 % / 100m
Cooling	With additional cooler
Mounting position	any
Pollution	Pollution degree 2 according to EN 61800-5-1
Vibration	10 Hz to 58 Hz Ampl. 0.075mm (IEC60068-2-3) 58 Hz to 200 Hz 1 g
Shock	15 g for 11 ms
Environmental conditions	not permissible: oil fog, salt fog, water
Humidity	Class F Humidity <85 %, **no internal condensation!**

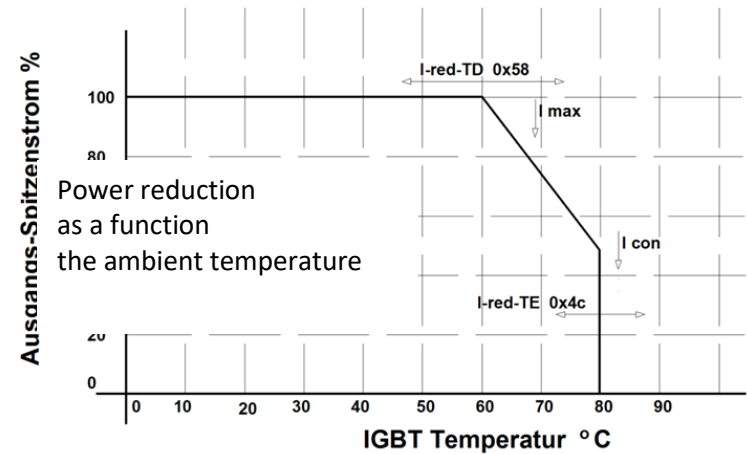Power connection cable from BAMOBIL to battery as short as possible.
Longer cables lead to dynamic voltage drops due to the cable impedance. These stress the built-in electrolytic capacitors and shorten the service life.
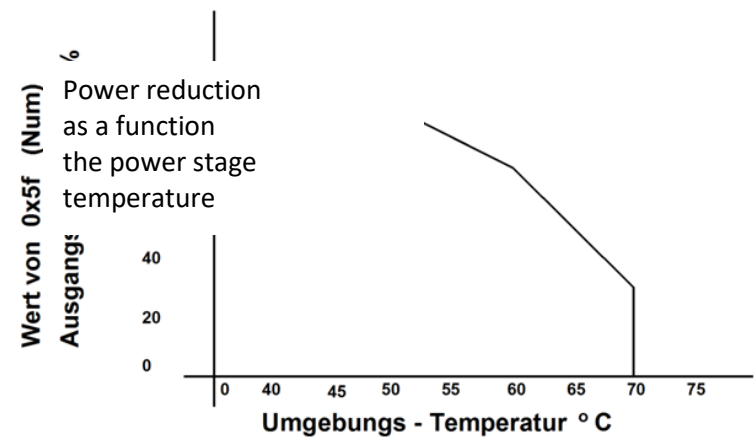
Reduction of current and power

Power reduction
as a function
the installation height

Zchn-DS4-Current-Reduction-Height-2

Power reduction
as a function
the ambient temperature

I-red-TD 0x58

I max

I con

I-red-TE 0x4c

Zchn-DS4-Current-Reduction-Environment-Temperature-2

Power reduction
as a function
the power stage
temperature

Zchn-DS-4 Current Reduction IGBT Temperature

Basic - Information

Losses with version -62 (power voltage 12 to 48 V)

Power amplifier losses

Ieff = RMS value of current demand at maximum load cycle

R-FET = Maximum on-resistance at FET bridge branch

Cooling capacity base plate 10mm with aluminium housing = 1.7°

C/Watt Internal limit temperature 85 C°

Power loss = 2*R-FET * Ieff^2

Example 1: Unit BAMOBIL D3-IM- 62-250 R-FET = 1.2 mΩ Ieff approx. 80 A	Example 2: Unit BAMOBIL D3-IM- 62-250 R-FET = 1.2 mΩ Ieff approx. 120 A
Power loss: $0.0024 *80^2 = 15$ watts Heating: 1.7*15 = 25.5 C° Final temperature at 35° C ambient = 60.5 C ° **No** additional cooling surface is necessary.	Power loss: $0.0024 *120^2 = 34.6$ watts Heating: 1.7*34.6 = 58.8 C° Final temperature at 60° C ambient = 118.8 C ° **An** additional cooling surface is necessary. Additional air cooler or additional liquid cooler

Losses with version -160 (power voltage 12 to 120 V)

Power amplifier losses

Ieff = RMS value of the current demand at maximum load cycle

R-FET = Maximum on-resistance at the field-effect transistor bridge branch

Cooling capacity base plate 10mm with aluminium housing = 1.7 C/Watt°

Internal limit temperature 85 C°

Power loss = 2*R-FET * Ieff ^{2}

Example 1: Unit BAMOBIL D3-IM- 60-200 R-FET = 4 mΩ Ieff approx. 80 A (selected)	Example 2: Unit BAMOBIL D3-IM-160-200 R-FET = 4 mΩ Ieff approx. 120 A (selected)
Power loss: $0.004 *80^2 = 25.6$ watts Heating: 1.7*25.6 = 30.7° C Final temperature at 35° C ambient = 65.7 C ° **No** additional cooling surface is necessary	Power loss: $0.004 *100^2 = 40$ Watt Heating: 1.7*40 = 68° C Final temperature at 60 °C ambient = 128 C ° **An** additional cooling surface is necessary. Additional air cooler or additional liquid cooler

Forward resistance FET branch

BAMOBIL	62-80	62-120	62-250	62-450	160-100	160-200	160-300
R-FET mΩ	3.5	1,2	1,2	1,2	4	4	4

Cooling capacity auxiliary cooler

Radiator design	Thermal resistance	Weight
Air cooler (natural convection)	0.4° /W	2.0 kg
Air cooler (fan)	0.07° /W	2,5 kg
Liquid cooler	0.012° /W (2 l/min, 0.8 psi)	1,2 kg

2   Mechanical installation

2.1   Important notes

Check the unit for mechanical damage.
Only install faultless units.

Mounting only in de-energised state.
Disconnect the positive and negative battery terminals,
disconnect the DC mains.
Assembly only by trained specialist personnel.

The installation position is arbitrary for units with base plate and
for units with additional cooler (air with fan, liquid).

For units with additional cooler without fan, vertical installation
position. In the case of horizontal installation, note the reduction
in output.
Ensure that there is free space for exhaust air (min. 100 mm).
Ensure sufficient ventilation.
If the heat dissipation is too low, the unit switches off via its
thermal monitoring.

Take the unit mounting holes from the dimensional drawing or from the drilling plan.
Do not mark off the unit.

Mount the filter and choke spatially close to the unit.

Contact the cable shields with the mounting surface.
Lay the power cables (battery and motor cables) separately from the signal cables.
Observe the minimum cable cross-section.

Safe earth connection from the enclosure to the earth level (vehicle earth, control cabinet earth)

Shieldless cable ends as short as possible.

Cable lug 10 mm

Use vibration-proof screw connections.

2.2 Dimension drawings BAMOBIL-D3-IM

Bamobil-D3-IM-mass-image-side

Depth with plug and cable 150 mm
Heat sink up to 300 A = 10 mm, >300 A = 20 mm
Thermal resistance 1.7 °K/W

Mounting screws: BAMOBIL D3-IM: M4x20
Screws for power connections: Allen key M10x16 / max. tightening torque 15 Nm

The cooling capacity of the base plate (without additional cooler) mounted on the control cabinet rear panel (4mm steel bright) at 45 °C ambient temperature.
Continuous current: BAMOBIL D3-63 of 60 Aeff (S1 operation)
               BAMOBIL D3-160 of 45 Aeff (S1 operation)
For larger currents (for intermittent operation S2, S3), an additional cooler (air or liquid) or a heat-dissipating mounting surface is necessary.

Cable glands M25x1.5 and Tyco plug are not included in the scope of delivery

2.3 Additional cooler option / on request (minimum quantities)

Liquid cooler

Thermal resistance	0.012 0K/W
Weight	1,2 kg
Coolant connection	¼ Zoll

Air cooler

Thermal restance	0,4 ^{0}K/W
Weight	2 kg

Air cooler with fan

Thermal resistance	0,07 ^{0}K/W
Weight	2,5 kg
Fan connection	24 V DC

3 Electrical installations

3.1 Important notes

The connection instructions are <u>binding in </u>their assignment of the connections to the plug numbers or terminal numbers!

All further information on this is non-binding. The input and output lines can be changed and supplemented taking into account the electrical regulations and guidelines.

The regulations to be observed are
- Connection and operating instructions
- Local regulations
- EC regulations such as EC Machinery Directive 2006/42/EC
- Vehicle regulations ECE-R100, ISO 6469, ISO 26262
- VDE, TÜV and Employer's Liability Insurance Association regulations

Electrical installation only in de-energised state.
Ensure secure activation.
- Insert shorting bar
- Put up warning signs
Installation only by electrotechnically trained personnel

Compare the connection values with the nameplate data.
Ensure correct fusing of the auxiliary voltage supply.
Lay power cables and control cables spatially separated.
Carry out shield connections and earthing measures in accordance with EMC directives.
Use the correct cable cross-sections.

Use external insulation monitors!

Attention: Poor or undersized cable connections between the battery and the unit can damage the unit! (Braking energy)

Attention: Power connection cable from BAMOBIL to battery as short as possible.
Longer cables lead to dynamic voltage drops due to the cable impedance. These stress the built-in electrolytic capacitors and shorten the service life.

<u>Static charge voltages ESD:</u>
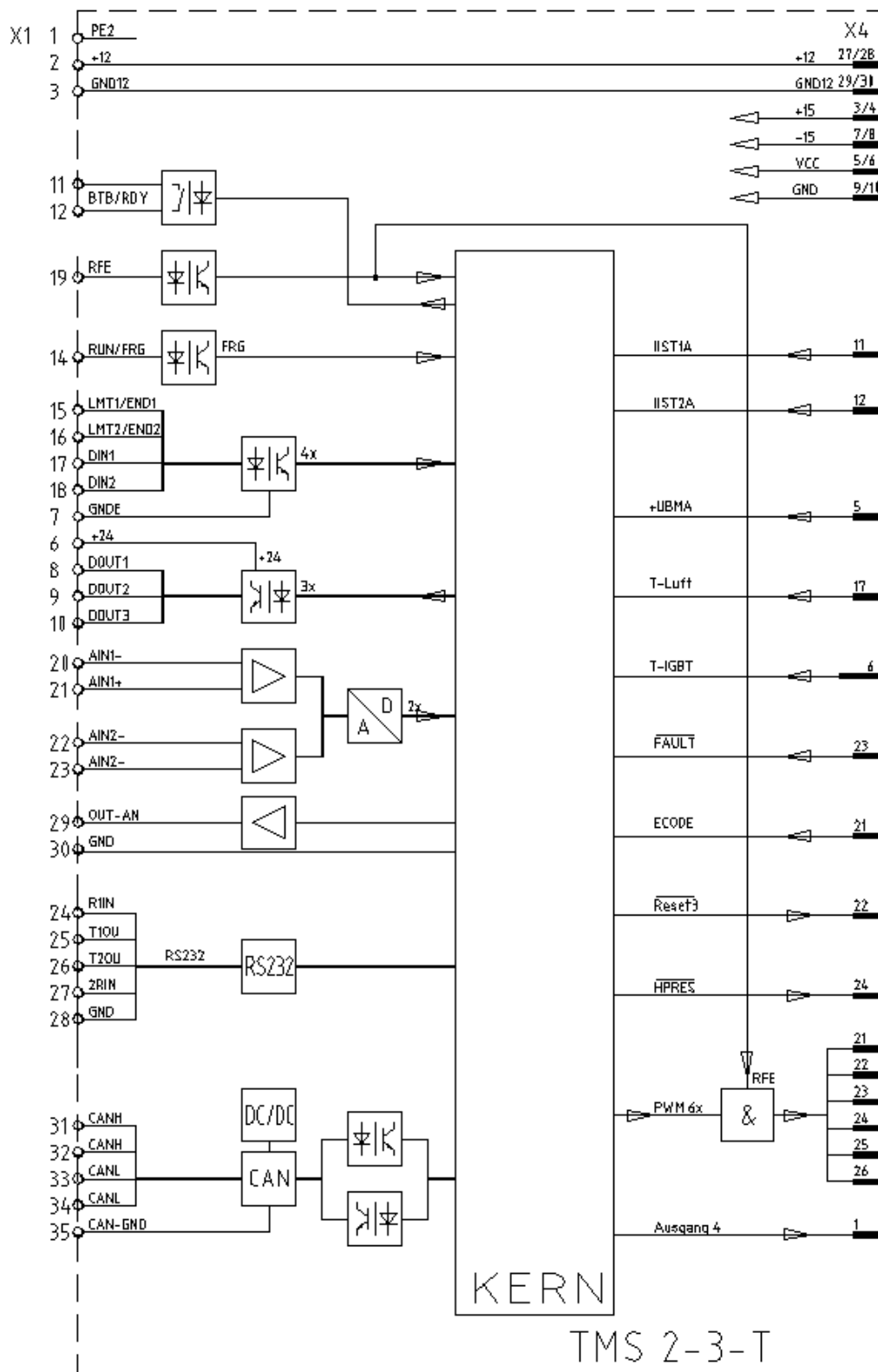No ESD voltages may build up between the potentials and against earth.
Use appropriate protective measures!
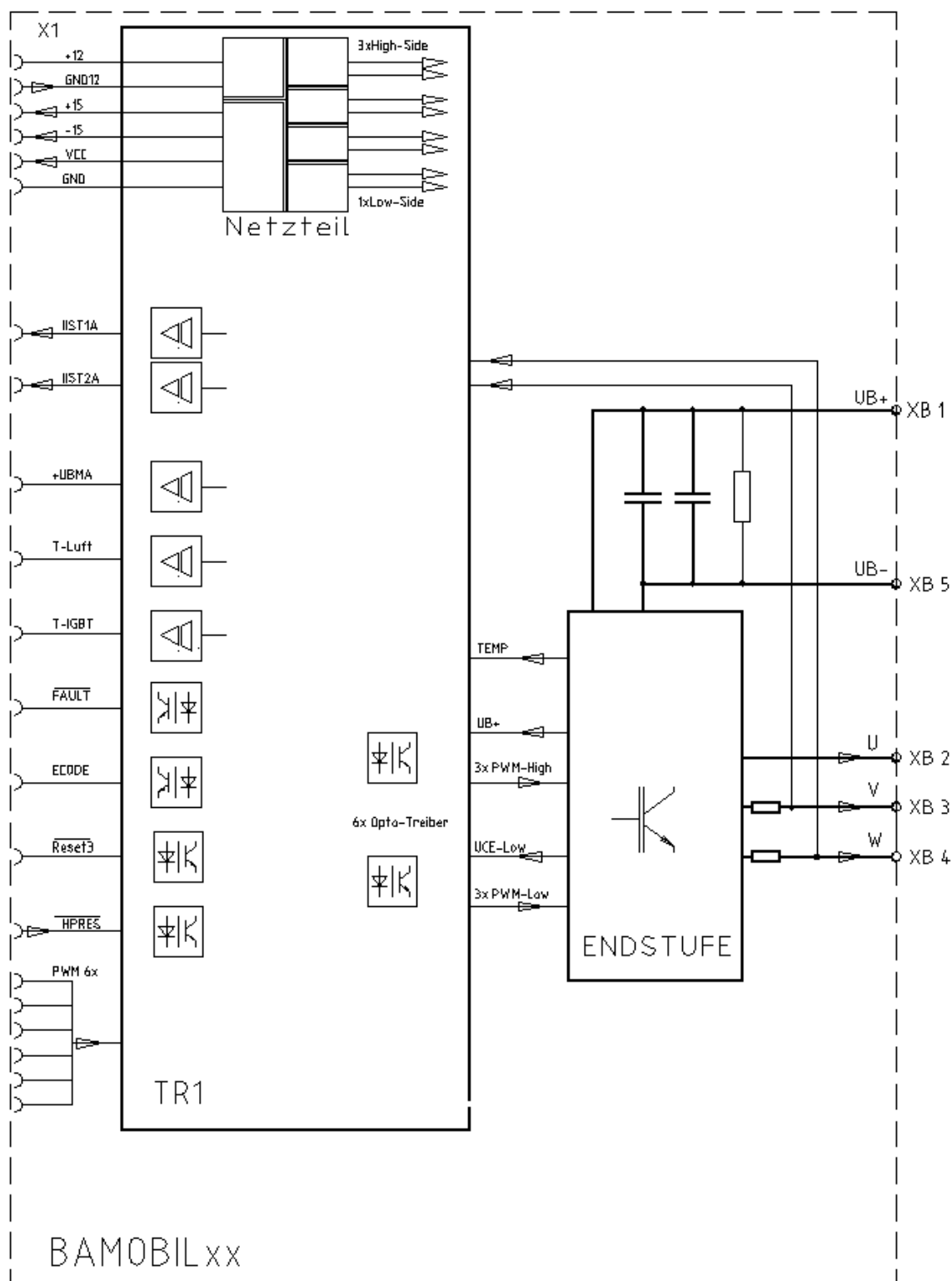
Use contact protection for voltage > 60 V.

Use precharge circuit (e.g. manufacturer's inrush limiter).
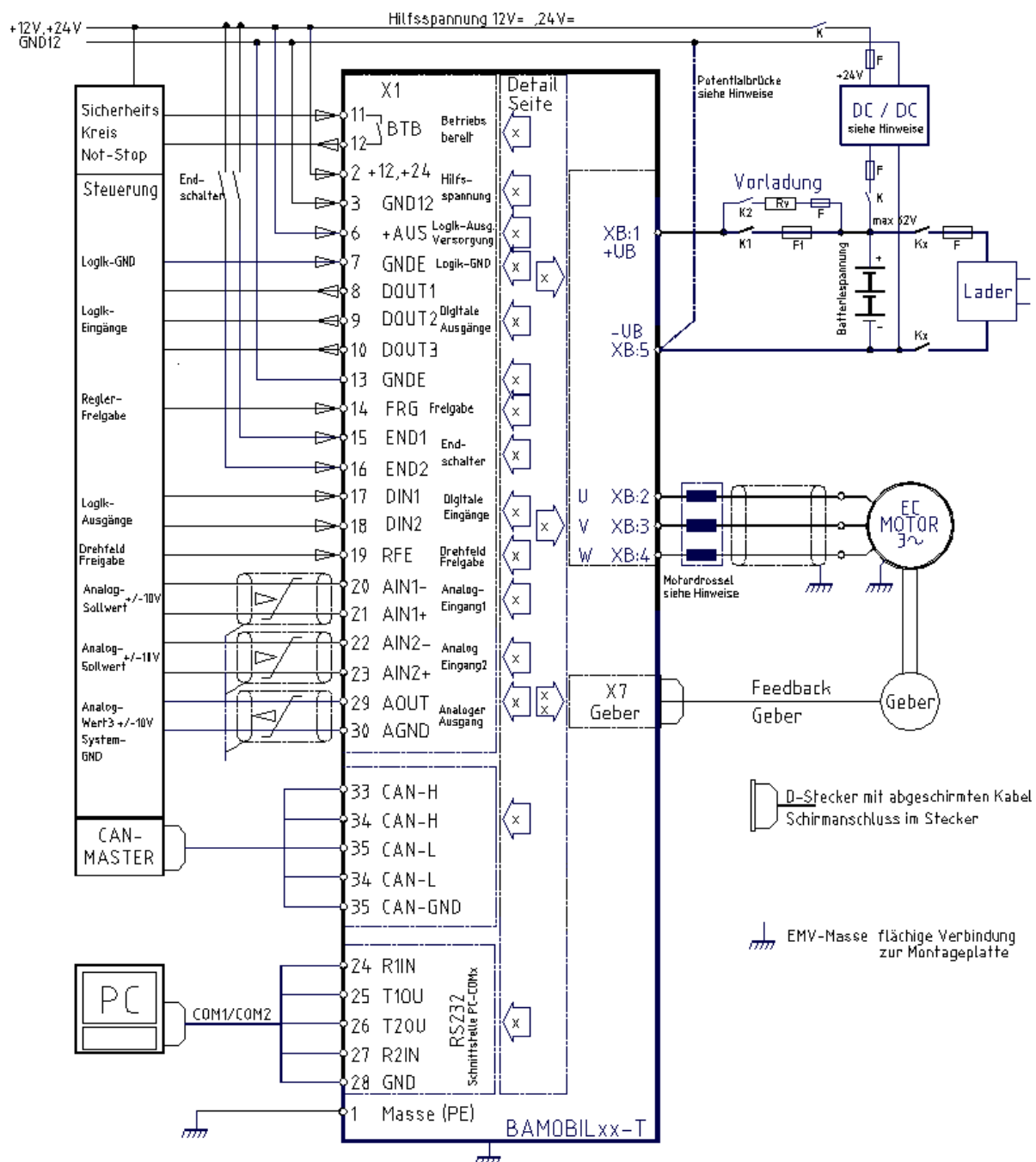
3.2 Block diagrams

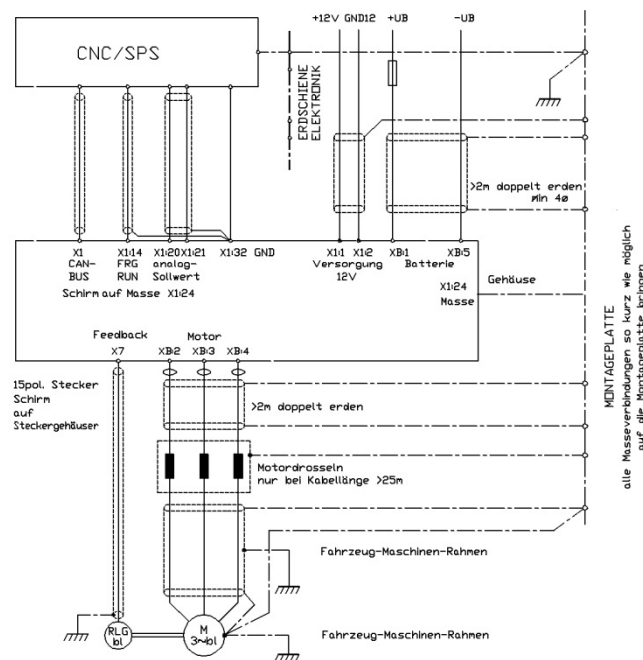**Drawing page 1 of 2** Bamobilxx-blockscreen-TMS-3

Drawing page 2 of 2 Bamobilxx-blockscreen-TR2-

3.3 Connection overview

bamobilxx-Tyco-D3-2-connection-plan-4

3.4 EMC

Bamobil65-emv-1

The units comply with EC Directive 2004/108/EC in the EN 61800-3 standards under the following installation and test conditions.

Assembly:
Unit conductively mounted on bare mounting plate aluminium 500x500x5 mm.
Mounting plate connected to -UB via 10 mm².
Motor housing connected to -UB via 10 mm².
Device pull X-AGND connected to mounting plate via 1.5 mm².
Housing connected to mounting plate (ground).

Control connections:
Signal lines shielded, analogue signal lines twisted and shielded.
Shield flat contact on mounting plate (ground).

Battery connection:
48 V DC voltage

Connection motor:
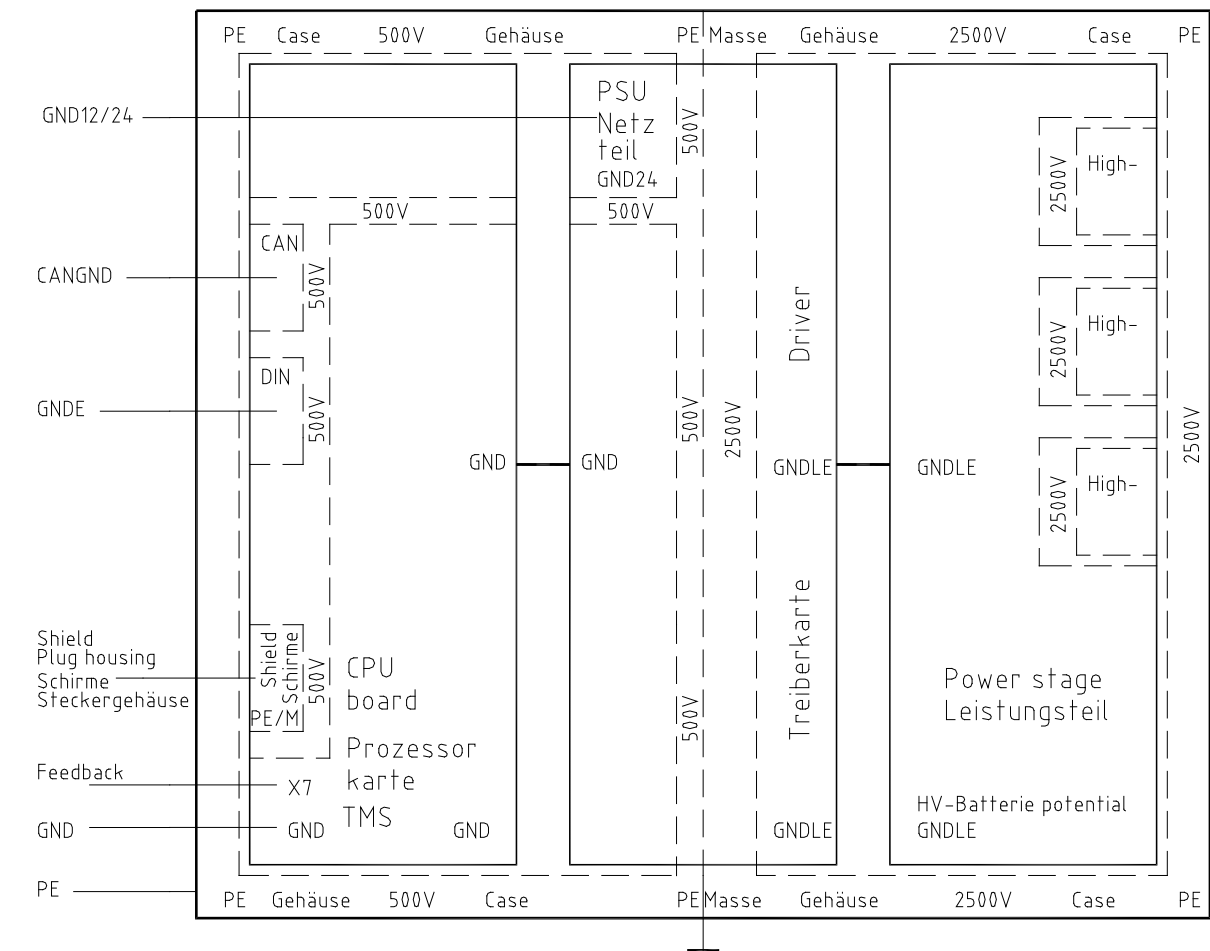Motor cable shielded, flat contact on mounting plate (earth).
Shielded encoder cable

In the case of installation in vehicles, machines and systems, the start of the intended operation of the device is prohibited until it has been established that the vehicle, machine or system complies with the provisions of the EC Machinery Directive 2006/42/EC and the EMC Directive 2004/108/EC. For vehicles ECE-R83, ECE-R100.
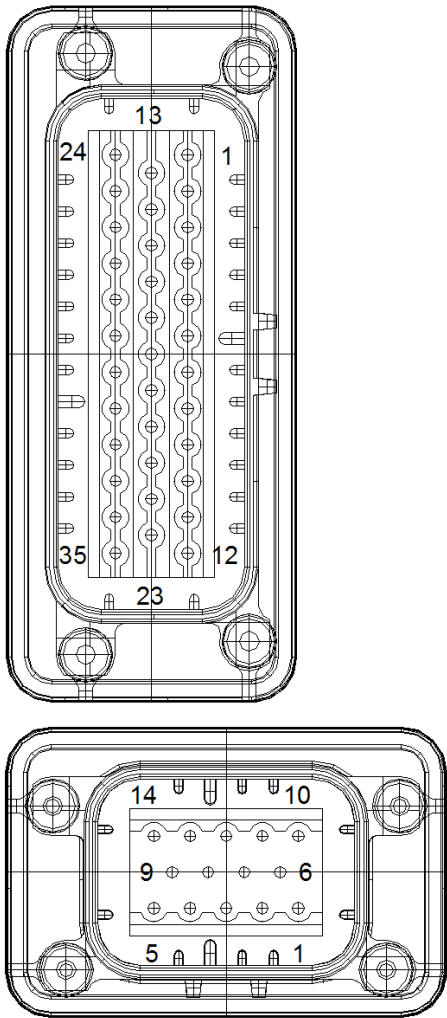A manufacturer's declaration can be requested.

Potential separation

Bamobil-D3-IM-potential-1

3.5 Connector overview

Connector X1 Control inputs/outputs

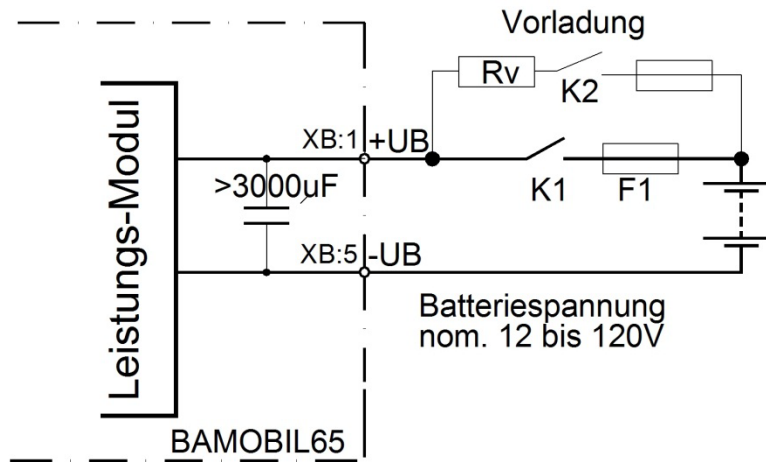|		
1	PE2	
2.	+24V	Auxiliary voltage +
3	GND24	Auxiliary voltage
04		
nc5 nc6	+ OFF	Supply
Outputs7	GNDE	GNDE
Outputs8	DOUT1	Digi
output19DOUT2	Digi-output210DOUT3	
Digi output311	BTB	Ready for
operation12BTB		Ready for
operation13GNDE		GNDE
Inputs14 FRG		Enable15END1
Limit switch116END2		Limit
switch217DIN1		Digi
input118DIN2		
Digi input219	RFE	Rotor
enable20AR1		Analogue
input 1-21AIN1	Analogue input	
1+22AR2	Analogue input 2-	
23AIN2	Analogue input 2+ RS23224R1IN	
RS23225T1OU		
RS23226T2OU		RS232
27R2IN	RS232	
28	GND	Analogue GND
Analogue output 29DAC1		Analogue
output		
30GND		Analogue
GNDCAN-BUS		
31 ,32	CAN	
H33 ,34CAN	L35CAN-GND	

Plug 35pol: Tyco 776164-1
Plug 14pin: Tyco 776273-1

Connector X7
Encoder connector
Resolver12SIN13
COS24REF15
6Temp
GND7
8
910 11Temp
Signal12REF213COS1
14SIN2

Connector X7Transmitter
connector
INC-TTL1 Channel
A2Channel
B3Channel
N4Channel
/A5
GND6 GND
Temp7
8 Channel /N
9 +5
VCC10Channel/B11Temp
Signal
12Rotor position113Rotor
position214Rotor
position3

Connector
X7Master connector
SINCOS1
ka+2
kb+3
kr+4
ka-5
GND6 GND Temp
7
kd+8kr--9+5
VCC10 kb-11Temp-
Signal12kd-13kc+14kc-

3.6 Battery connection

BAC65-T-Battery-1

Use precharging circuit.

When K1 is switched on directly, the charging current can be as high as 5kA.

DC link min. 6000 µF

Series resistor
RV approx. 10 Ohm 10 W
Charging current via K2 < 16 A
Charging time max. 0.5 sec.

Switching delay of K1 with time relay (2 seconds after K2) or with
DC link monitoring

Attention:
The main contactor (K1) may only be operated when the BAMOBIL
(enable X1:7 FRG = 0 V) must be switched!

Switch-on sequence: Auxiliary voltage on, (setpoint 0),
minimum 5 sec. later Power voltage on,
minimum 2 sec. later Enable on.

Switch-off sequence: (setpoint 0), enable off,
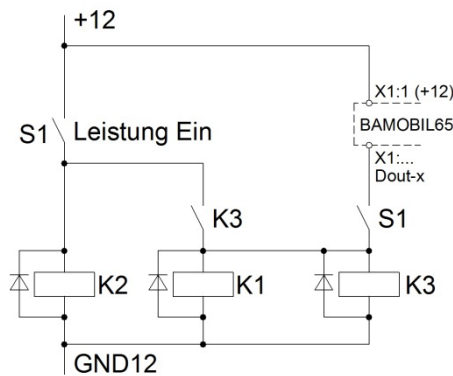minimum 2 sec. later power voltage off,
auxiliary voltage off.

Always insert BTB/RDY contact in the safety circuit!
In the event of a fault, the battery connection must be disconnected
from the battery (open K1).
Fire hazard due to internal electric arc!

Principle circuit precharge

BAC65-5-Subpoena-1

Programming example:
The output Dout1 switches the relay K3 when the DC link voltage (DC-BUS)
(I_o/u voltage) is greater than variable 1.

Hint:
Parameter DC-BUS min to battery minimum voltage
(approved discharge voltage).
(100 % corresponds to 48 V)

Attention

**Do not exceed the maximum connection voltage (72 V=, 160
V=) even for a short time.**
P r e s s u r e t h e f a h r!!!
F1 = Fuse

The power connection has no reverse polarity protection

The unit can be destroyed if the polarity is reversed!

Type	Battery connection bolt 12 to 120V V= Screw M10x16	Connection Cross-section		Fuse A		
	Tightening torque <12 Nm XB1 (+UB=) XB5 (-UB=)					
-100,120		16	4	160		
-200,250		25	4	250		
-300		50	1	350		
-450		70	2/0	450		
Battery connection < 2 m. 2 to 10 m connection stronger. **Use additional capacity from 10 m!**						

3.7   Auxiliary voltage connection
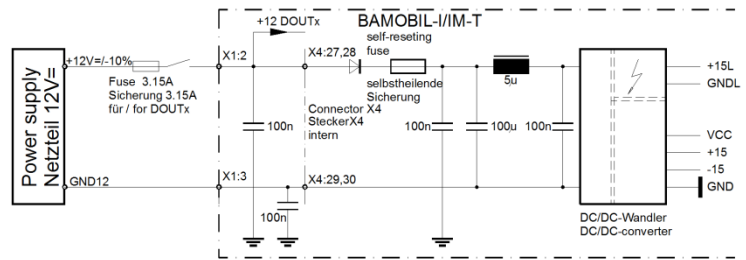
Mains-potential-free auxiliary DC voltage
12 V= to 24 V= +/- 10 % / 2A
The auxiliary voltage is galvanically
Separate from all other voltages
- Internal self-healing fuse
- EMC filter
- External fuse for line protection only

Input voltage	12 V to 24 V=	
	DC X1:4	
Ripple1	GND24 X1:3	
Inrush current	10 %	
Nominal current	2 A	
	0.8 A	

BAC-I-T auxiliary voltage-1

Hint: Connect auxiliary voltage only to stable 12 V to 24 V voltage source (battery or power supply unit).

Attention: In addition to the internal supply current (0.8 A), the sum current of the outputs (DOUT) must be supplied by the 12V power supply unit.

Attention: If the auxiliary voltage is less than 10 V, including brief voltage interruptions, the internal power supply unit switches off. Data in the RAM memory is deleted. Speed and position setpoints are set to 0, calibration data is lost. **Message OK in the status is dark.**
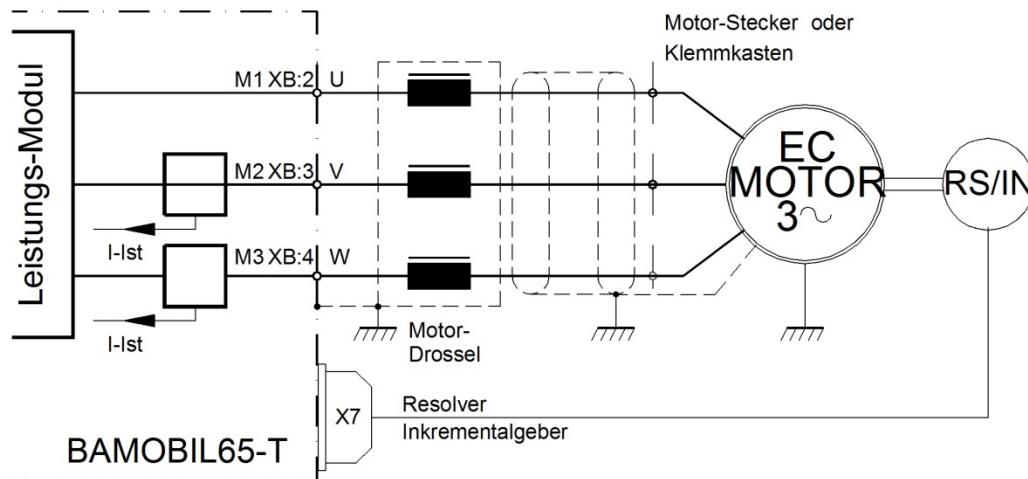
Attention: Firmware update only with the Power voltage.

Auxiliary voltage and / or power voltage only switch when BAMOBIL is locked.
Enable - Input X 1:14 = Zero

3.8 Motor power connection

Only use electronically commutated synchronous motors (brushless DC motors, EC motors) with resolver or incremental encoder approved by the manufacturer.

BAC-65-5-Motor-1

Follow-up

Cable designation	M1	M2	M3	**Motor cable**
Motor phase	U	V	W	Shielded for 200 V=
Connection bolt	XB:2	XB:3	XB:4	Shield capacitance 150 pF/m
				Minimum cross-section s. Table
Only one correct connection sequence possible!				

Minimum cable cross-section

Type BAMOBIL D3-IM			-100	-120	-200	-250	-300	-450
Cross section mm²			6	10	25	35	50	70
AWG			10	6	4	2	1	2/0

Attention:
Connect unused motor cable cores to ground.
Dangerous voltages due to capacitive coupling
from the clocked motor wires.

Motor choke
Only necessary from a shield capacity of < 5 nF. / approx. 25 m motor cable.
Ferrite rings
In case of HF interference coupling on sensor systems, slide ferrite rings over the motor cable.
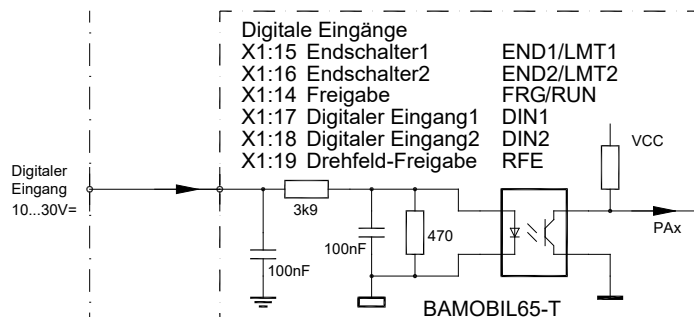**Shield connection**
Flat connection with the cable gland on the BAMOBIL D3xx
Flat or shortest possible connection on the motor side.

3.9 Control ports

Digital inputs / 6 optocoupler inputs

BAC65-5-DIN-1

Input voltage		
ON level		+10 to +30 V
OFF level		<+6 V
Input current	Max.	7.5 mA
Nominal voltage/current		+24 V / 6mA
Reference mass	GNDE	(X1:7)

The enable input (FRG/RUN) and the input for rotating field enable (RFE) are permanently assigned and cannot be programmed.
Without enable (FRG/RUN = 0) the servo is electronically locked (no PWM pulses).
Without rotating field release RFE, the rotating field of the output stage is also electronically blocked (second blocking channel).
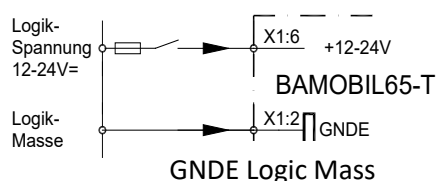The drive is currently free (no holding torque).

The other 4 digital inputs are freely programmable.
The inputs LMT1 (X1:5) and LMT2 (X1:6) are preferably to be used as limit switch inputs.

Entrance	Connection	Function	Status	Parameter
FRG/RUN	X1:14	Release/Nable	fixed	
RFE	X1:19	Rotary field/nable	fixed	
END1/LMT1	X1:15	Limit switch1/Dig. input	programmable	
END2/LMT2	X1:16	Limit switch2/Dig. input		
DIN1	X1:17	Digital input1		
DIN2	X1:18	Digital input2		

External power supply for inputs and outputs

BAC65-5-Logikspannung-1

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

3.10 Safety input RFE

Attention:
When the input of the enable or the rotating field enable is switched off, the drive is torque-free. Without a mechanical brake or lock, the drive can fall through or move.
The motor cables are not voltage-free. Only the rotating field is blocked. When working on the motor or servo, the servo amplifier must be disconnected from the mains.

Operation with RFE input
Two-channel enabling lock via a safety switching device.
Enable input FRG/RUN plus
Rotary field enable input RFE

Switch on
Safety device Contacts closed
Release FRG/RUN 0.5 sec. after RFE switch on

Safety shutdown
Safety device contacts opened
No FRG/RUN signal blocks in the first blocking channel the PWM pulses in the processor.
No RFE-signal blocks the PWM pulses in
A second barrier channel after the
Processor.
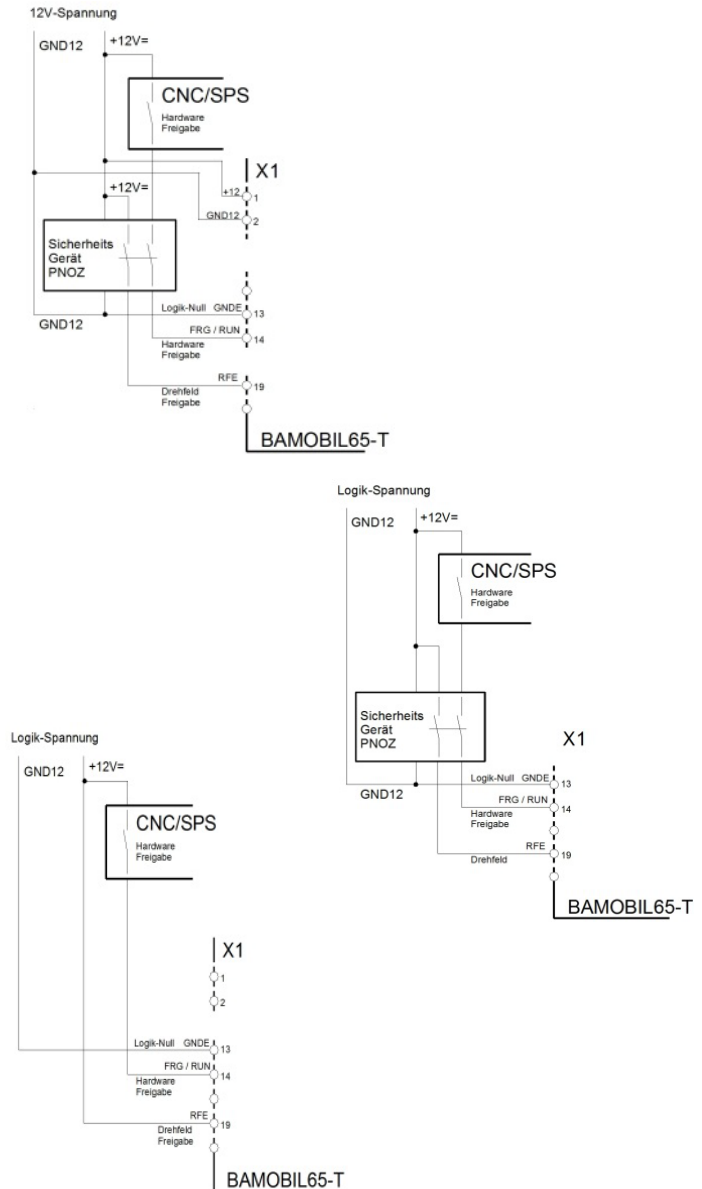
Switch on again
Unlock the safety device.
Safety device Contacts closed.
The motor can only move after FRG/RUN has been enabled again after the rotating field has been enabled.

Operation without RFE input
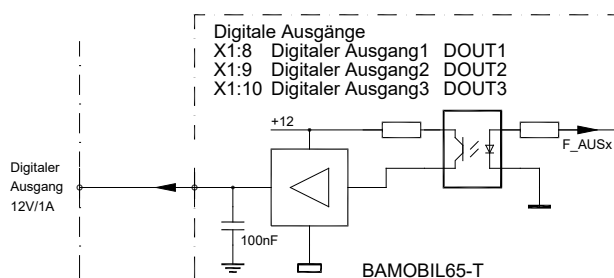The input RFE must be bridged with the logic voltage

If the logic voltage is equal to the supply voltage,
the RFE input is bridged with +24 V.
The release FRG/RUN at least 0.5 sec.
Switch on after the RFE signal.

BAC65-5-RFE-1-1 / BAC65-5-RFE-1-2 / BAC65-5-RFE-1-3

3.11 Digital outputs (0pen emitter)

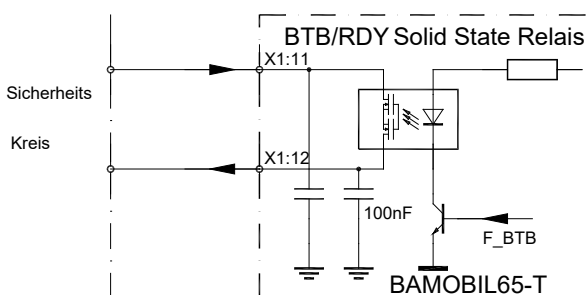Logic outputs 1 to 3 are designed for up to 24 V and 1 A. 2 A for a short time.

Digitale Ausgänge
X1:8 Digitaler Ausgang1 DOUT1
X1:9 Digitaler Ausgang2 DOUT2
X1:10 Digitaler Ausgang3 DOUT3

BAMOBIL65-T

Digitaler Ausgang 12V/1A

BAC65-5-DOUT-1

Output voltage		
ON level	max.	+ 24 V=
OFF level		< 1 V=
Output current	nom	1 A
Output current	max.	2 A
Reference voltage +OFF	+ 24	(X1:4)
Reference mass	GNDE	(X1:7)

An energy-saving programme can be programmed (clocked output).
Logic output 4 (24V, 3A) is only available with certain units on the power section.

3.12 Signalling contact Ready for operation (solid state relay) / Ready BTB / RDY

BTB/RDY Solid State Relais
X1:11
X1:12
100nF
F_BTB
BAMOBIL65-T

Sicherheits
Kreis

BAC65-5-BTB-1

Contact for max. 48 V / 0.2 A

Capacitive load max. 1 µF
Contact resistor max. 2 Ohm

The contact is closed with the
Device. Display with
Status 7segment LED
In the event of an error, the contact
open.

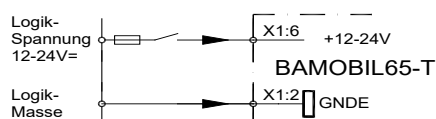**BTB/RDY contact always in the Insert safety circle!**

Ready for operation drops out (LED red, relay contact open)

For error messages
in case of undervoltage of the auxiliary voltage (< 10 V)
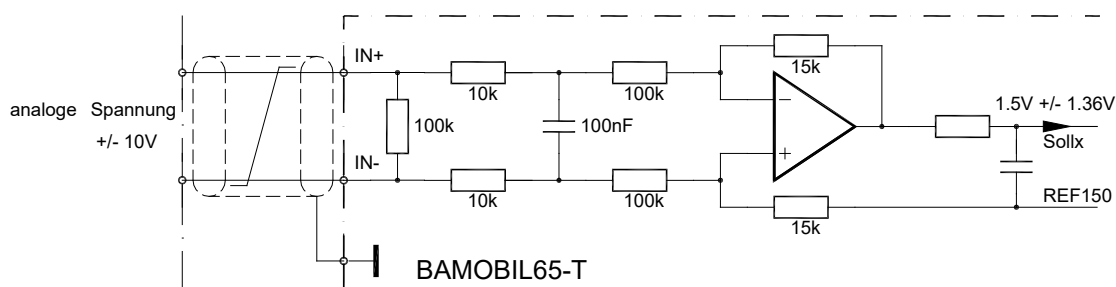The message undervoltage in the DC link can be programmed (see NDrive manual).

Output	Connection	Function	Status	Parameter
BTB/RDY	X1:11, X1:12	Ready for operation	Fixed / Relay	
DOUT1	X1:8	Digital output 1	Programmable	
DOUT2	X1:9	Digital output 2	Programmable	
DOUT3	X1:10	Digital output 3	Programmable	

Logik-Spannung 12-24V=
X1:6 +12-24V
BAMOBIL65-T
Logik-Masse
X1:2 GNDE

+ 12- 24 V for logic and auxiliary voltage

GNDE Logic Mass

3.13 Analogue input +/- 10 V

BAC-5-AIN-1

Entrance	Output	Basic function	Voltage	Status	Parameter
AIN1+, AIN1-	X1:20, X1:21	Speed setpoint	+/- 10 V	prog.	
AIN2+, AIN2-	X1:22, X1:23	Current limit	+/- 10 V	prog.	

Properties

Differential input	AIN1+ / AIN1-	AIN2+ / AIN2-	
Input resistance	70 kOhm		
Voltage limit	+/- 12 V		
Resolution	11 bit + sign		

The direction of motor rotation can be changed by swapping the +/- connections on the differential input, by a logic input or by programming.

The analogue inputs can be assigned to different functions.

Analogue input AIN1 can be used with a digital setpoint (RS232, x-BUS).
as an external analogue speed limit and the analogue input AIN 2 can be
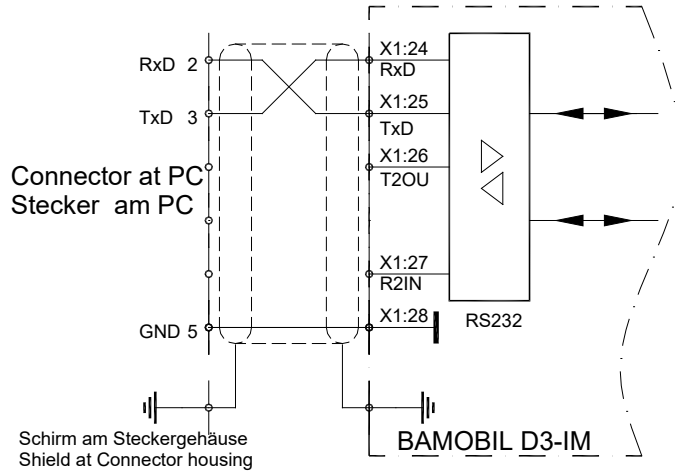can be programmed as an external analogue current limit.

3.14 Analogue output ±10 V

Entrance	Output	Basic function	Voltage	Status	Parameter
AOUT1	X1:31	Speed setpoint	+/- 10 V	prog.	
GND	X1:32	Signal zero	0 V	fixed	

The analogue output can be assigned to different functions.

3.15 Serial interface RS 232

The BAMOBIL-D3 amplifier is programmed and operated for commissioning via the serial PC interface RS232. The software is described in the DS NDrive software manual.

Attention:
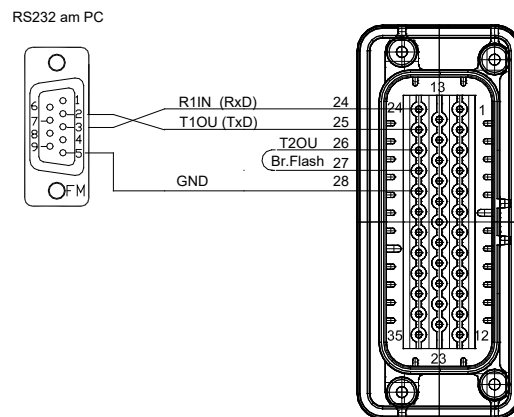The serial interface is galvanic with the Devices - Zero (GND / AGND) connected

BAC65-5-RS232-2

Connection between BAMOBIL-D3-IM and the serial interface (COMx) on the PC only with a shielded cable.

Only plug in the cable when it is de-energised.
The interface is set to 115200 baud,
can also be changed to 9600 baud with NDrive

Connecting cable
LiYCY 5x0.25+Shield

View of solder side
Screen on the housing
Cable length max. 10m

In the event of severe disruptions on the interface, a line filter should be used.
Laptop with USB RS232 converter
are usually sensitive to interference.

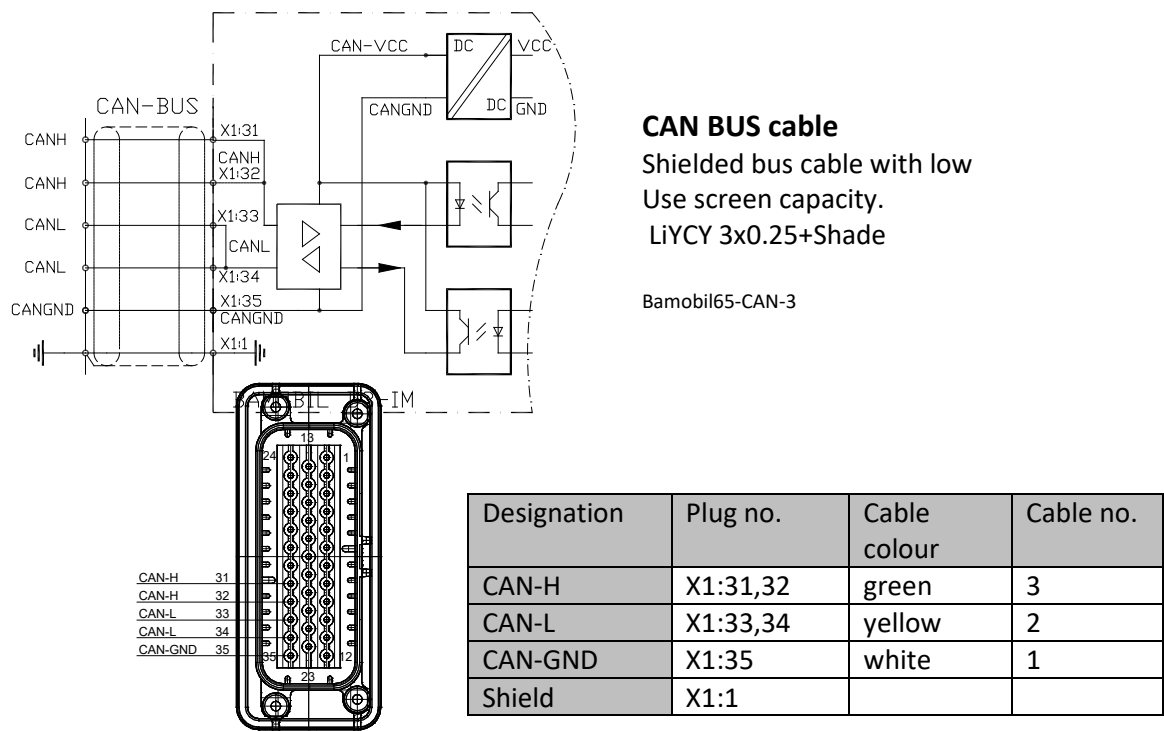 Bridge X1:26 to X1:2 only for firmware update (flash)
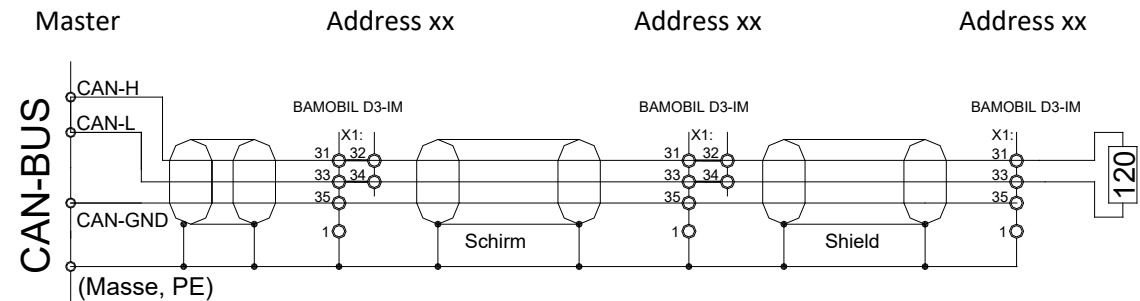
Bamobil65-stecker-RS232-tyco-35-2

3.16 CAN-BUS

The CAN-BUS is the digital connection to the CNC control.
Optimum conditions with CNC controls and CAN components from
Company LABOD electronic or CAN Open.
Programming and operation via control panel with CAN-BUS.
Interface according to ISO 11898.
For setting and programming, see DS-CAN manual.

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

Power is supplied via an internal isolated DC-DC converter

CAN BUS cable
Shielded bus cable with low
Use screen capacity.
 LiYCY 3x0.25+Shade

Bamobil65-CAN-3

Designation	Plug no.	Cable colour	Cable no.
CAN-H	X1:31,32	green	3
CAN-L	X1:33,34	yellow	2
CAN-GND	X1:35	white	1
Shield	X1:1		

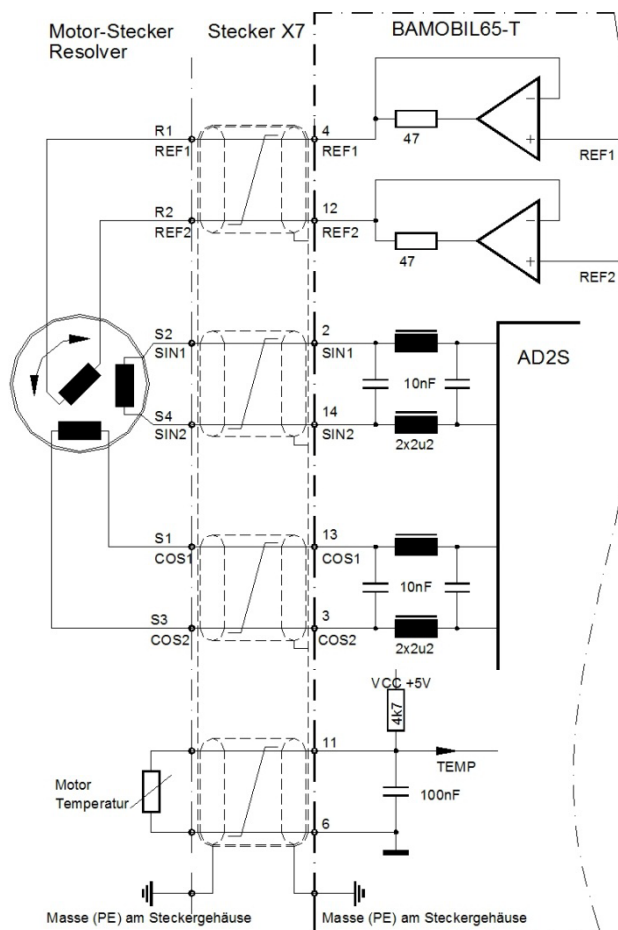## CAN-BUS connection with several BAMOBIL-D3-IM

Bamobil-D3-IM-CAN-3x-2

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

3.17 Resolver connection

Only with variant RS

The resolver is an absolute measuring system for one motor revolution.
It is robust and insensitive to high engine temperatures.
The design corresponds to a rotating transformer.
The rotor is driven by the reference (10 kHz) is fed.
The stator provides the sine and cosine signals modulated by the rotational frequency.
In the servo amplifier, the amplitudes of these signals are evaluated and digitised.
The resolution is automatically set to 10, 12 or 14 bits.
The maximum possible speed is 50 000 (10 bit).
The digitised signals are used for the pole wheel angle, the position control, the speed control and for the increment output.
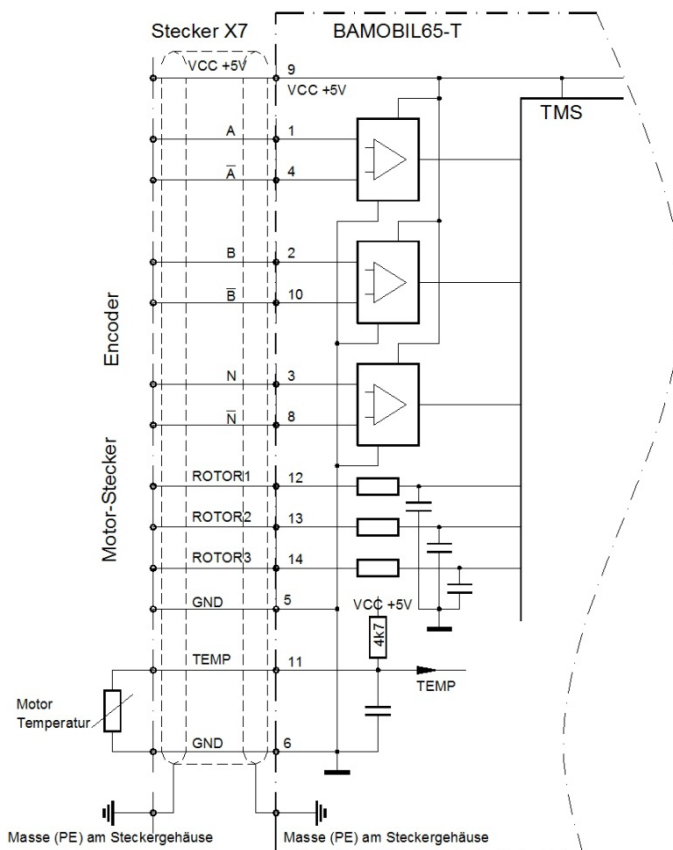
BA65-5-Reso-1

Only use a motor approved by the manufacturer with a 2, 4, 6 or 8-pole resolver.
Observe the motor-specific connection sheet (RS)!

Connector	X7	14-pin Tyco connector type
Connection cable	4x2 cores twisted in pairs and shielded, plus overall shield.	
	Use only suitable cable for drag chain.	
Cable length	>25 m only use high-quality resolver cables with improved shielding properties.	
Shield connection	at connector X7	Combine all shields and contact with the housing
	at the motor connector	contact the overall with the connector housing
For setting parameters	see software manuel NDrive	

3.18 Encoder TTL connection

Only with variant IN

BAC65-5-INC-1

ITTL incremental encoder (encoder) with 2 counting tracks and one zero track
plus 3 rotor position marks.
Counting tracks with or without push-pull output.

(With single connection A, B, N do not use the negated inputs).

Count input corresponds to RS485
Maximum counting frequency 500 kHz

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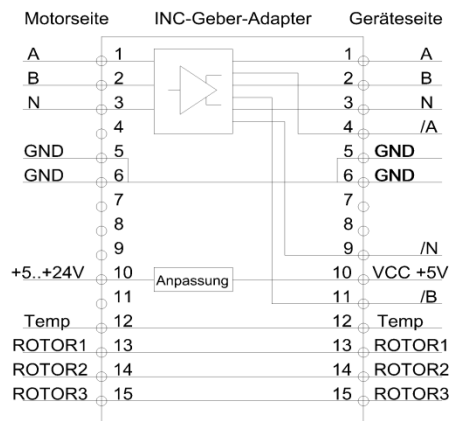connected to the device zero (GND).

The servo supplies 5 V.

Only use motors approved by the manufacturer with TTL incremental encoder and rotor position tracks. Observe motor-specific connection sheet (IN)!

Connector plug	X7	14-pin Tyco plug Type
Connection cable	10 signal wires shielded	Minimum cross section 0.14 mm
	2 supply cores	Minimum cross section 0.5 mm
	Use only suitable cable for drag chain.	
Cable length	for >25m cross-section one step larger.	
Shield connection	at connector X7	Contact the shield with the connector housing.
	on the motor plug	Contact the shield with the connector housing.
Setting parameters	see software manual NDrive	

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

The unit input for the incremental counting signals requires the push-pull counting pulses for reliable detection.

In many simple applications, encoders without push-pull signals (e.g. bearing encoders) are used with different supply voltages.
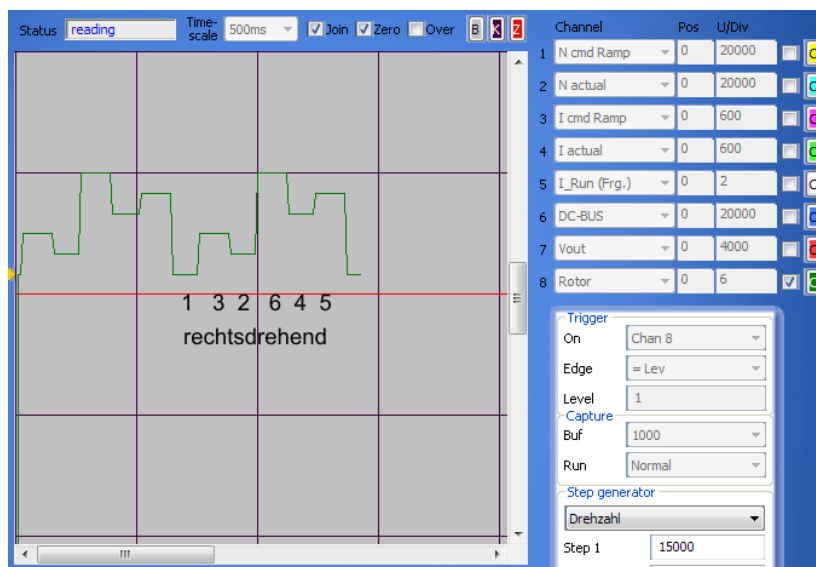
In these applications, the INC adapter must be used.

The adapter converts the counting signals A, B, N into the push-pull signals A, /A, B, /B, N, /N.

For supply voltages other than 5 V, the voltage must be specified in the order and connected externally.

Checking for correct connection

Rotor sequence

The correct sequence of rotor signals with clockwise rotating motor is 1, 3, 2, 6, 4, 5

With other number sequence the encoder connection of the rotor position signals Rotor1, Rotor2, Rotor3, (U, V, W) is wrong
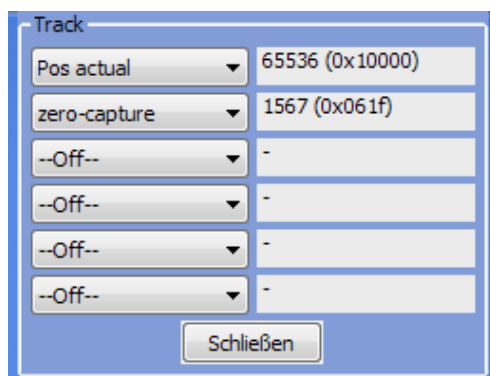
Use connection diagram!

Numerical value

Turn the motor one turn to the right without release
One motor revolution corresponds to one
Position value of Num 65536
If the result is different, the input of

Feedback Inc-Mot (0xa6) wrong

Zero angle
Motor rotating right and left with 10 % - 100 % speed.
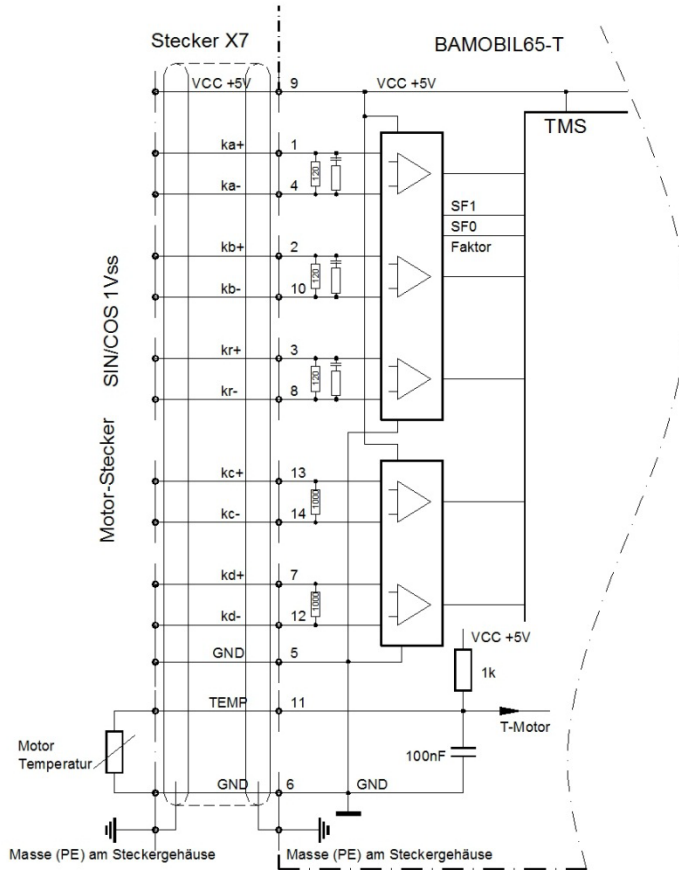The value of zero-capture must remain constant.

Encoder error
Error Feedback (4)
in case of missing or wrong rotor position signals.

3.19 SIN COS 1Vss connection

Only with variant SC

Incremental encoder
with 2 analogue sinusoidal
Counting lanes and one zero lane
plus 2 commutation tracks.
Differential signals 1Vpp

Maximum counting frequency 500 kHz

The incremental encoder is galvanically connected to the device zero (GND)
connected.
The servo supplies 5 V.

The dissolution is carried out automatically
set to optimum.

BAC65-5-SINCOS-1

Only use motors approved by the manufacturer with SIN / COS encoder (SC).
Observe motor-specific connection sheet (SC)!

|		
Connector plug	X7 14-pin Tyco plug Type	
Connection cable	4xsignal wires drill-shielded	Minimum cross section 0.14 mm
	2xsignal cores shielded	Minimum cross section 0.14 mm
	4xsupply cores, temp.	minimum cross-section 0.5 mm
Cable type	(4x(2x0,14)+(4x0,14)C+4x0,5)C	
	Use only suitable cable for drang chain.	
Cable length	for >25m cross-section one step larger.	
Shield connection	at connector X7	Contact the shield with the connector housing
	on the motor plug	Contact the shield with the connector housing.
Setting parameters	see software manual NDrive	

4   Status information

4.1   Status display on the servo

In the **"Normal"** state, the green 7-segment display plus decimal point lights up as an operating indicator (status display).

In the **"Error"** state, the red error LED lights up and the 7-segment display shows the error number.
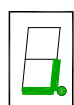
In the **"Warning"** state, the red error LED flashes and the 7-segment display alternates between the status and the warning number.

Status display on the servo

Display	Dot/ dash	State	Status at NDrive
	flashes dark	Processor active Auxiliary voltage missing or unit-internal hardware error	
	flashes lights up dark	Start status after reset (auxiliary voltage 24V off-on) The first release ends the flashing state Drive enabled Drive locked (not released)	OK = 0 OK = 1, ENA = 1 OK = 1, ENA = 0
	lights up	Speed equal to zero (standstill message)	N0 = 1
	lights up	Drive turns right, N currently positive	N0 = 0
	lights up	Drive turns left, N currently negative	N0 = 0
	flashes lights up dark	Motor current reduced to continuous current I_{cns} Motor current at maximum current limit I_{max} Normal operation, motor current within the current limit	I_{cns} = 1 I_{cns} = 0 I_{cns} = 0
	Lights up for 0.1 seconds	Left bar: — A new command (value) has been received from the BUS or RS232. Right bar: — Digital input changed	

NDrive:7segment 1-8

Example: Motor clockwise

Dot flashes	=	Processor active
Bottom line	=	Drive enabled
Right line	=	Motor turns right

4.2 Status information - Error

The red "FAULT" LED lights up and the green 7-segment display shows the error number.

Error list

Display at the BAMOBIL	Error display at NDrive	Meaning
0	BADPARAS	Parameter damaged
1	POWER FAULT	Power stage error
2	RFE ROT	Safety circuit faulty (only active with RUN)
3	BUS TIMEOUT	Transmission error BUS
4	FEEDBACK	Encoder signal faulty
5	POWERVOLTAGE	Power voltage missing
6	MOTORTEMP	Engine temperature too high
7	DEVICETEMP	Unit temperature too high
8	OVERVOLTAGE	Overvoltage >1.8 x UN
9	I_PEAK	Overcurrent 300 %
A	RACEAWAY	Spinning (without setpoint, wrong direction)
B	USER	User - Error selection
C	I2R	Overload
D	RESERVE	
E	ADC-INT	Current measurement error
F (device-dependent)	BALLAST	Ballast circuit overloaded
Decimal point flashes	Processor active	
Decimal point dark	Auxiliary voltage missing or unit-internal hardware error	

Indicator lights on the servo:

In case of an error, the red LED FAULT lights up and the error number is displayed.
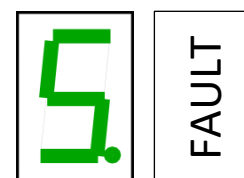The BTB contact is opened.
The software BTB message switches from 1 to 0.
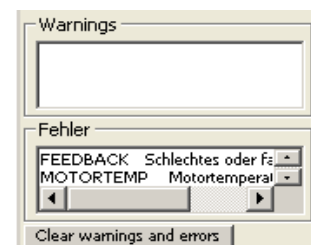The status message Rdy goes dark.

When switching off the release (Enable), the error message remains.

The error message is deleted.
When Cancel errors is switched on by a digital input or via CAN BUS.

Attention:
When applying the 24 V auxiliary voltage with closed enable (FRG/RUN X1:7 active)
the red LED indicates an error. There is no error indication in the 7-segment display.

4.3   Status information - Warnings

In the **"Warning"** state, the red error LED flashes and the 7-segment display alternately shows the operating status (LED dark) and the number of the warning (LED red).
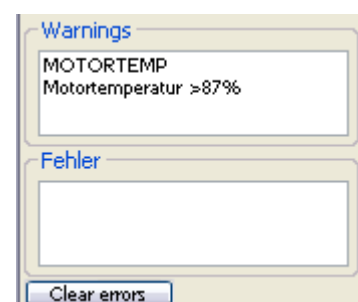
Warning messages

Display at the servo	Error display at NDrive	Meaning	ID address
			REGID - 0x8f
0	WARNING_0	Device detection inconsistent	Bit 16
1	ILLEGAL STATUS	RUN signal	Bit 17
2	WARNING_2	FE signal inactive	Bit 18
3			Bit 19
4			Bit 20
5	POWERVOLTAGE	Power voltage too low or missing	Bit 21
6	MOTORTEMP	Engine temperature > 87 %	Bit 22
7	DEVICETEMP	Unit temperature > 87 %	Bit 23
8	OVERVOLTAGE	Overvoltage > 1.5 x UN	Bit 24
9	I_PEAK	Overcurrent 200 %	Bit 25
A			Bit 26
B			Bit 27
C	I2R	Overload > 87 %	Bit 28
D			Bit 29
E			Bit 30
F (depending on unit)	BALLAST	Ballast circuit >87 % overloaded	Bit 31

Fault

Example:
Flashes red,
The display alternates between
Status and warning number /
Warning number 5

Warnings
MOTORTEMP
Motortemperatur >87%

Fehler

Clear errors

5   Measured values

5.1   DC link voltage

(from firmware 378)
DC link voltage (nom 48V)

BAMOBIL D3-62	DC link-Voltage	Parameter 0xeb	DC BUS - %
Maximum voltage	62 V	21961	134
Battery voltage	48 V	17000	103
Overvoltage message	72 V	25503	155
Charging voltage	56 V	19836	121
Without charging voltage	0 V	0	0
Standardisation	1	354,22	2,16
DC BUS 200%	92 V	32767	200

Parameter 0xeb = 354.22 x DC link voltage

DC link voltage (nom 96V)

BAMOBIL D3-120	DC link-Voltage	Parameter 0xeb	DC BUS - %
Maximum voltage	124 V	21961	134
Battery voltage	96 V	17000	103
Overvoltage message	144 V	25503	155
Charging voltage	112 V	19836	121
Without power voltage	0 V	0	0
Standardisation	1	177,11	1,08
DC BUS 200 %	185 V	32767	200

Parameter 0xeb = 177.11 x DC link voltage

5.2   Actual current value

BAMOBIL-D3	I 100 %	Calibration nominal current I-device			Peak current DC blocked	
Maximum value +/- 11Bit	mV	Num	Aeff	A=	Num	A=
x-100	700	560	50	60	800	100
x-120	840	670	60	84	970	120
x-200						
x-250	874	700	125	175	1010	250
x-300	610	490	175	245	710	350
x-450	785	630	225	315	910	450

The basic settings are protected in the parameter set.

Measured values

5.3   Power stage temperature

IGBT module temperature	Analogue voltage X4 Pin6	Parameter 0x4a
Maximum +80 °C	2,49 V	25819 (FW>3789