MANUAL

Digital Battery-Motor-Controller
BAMOCAR-D3
for
EC Servo Motors
AC Induction Motors
DC-Servo Motors

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Contens

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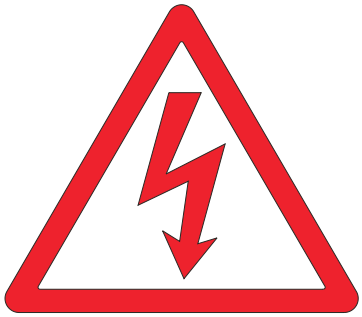
Basic Information

free

Electronic devices are never fail-safe.

Caution: high voltage DC 900V=.

Electric shock hazard!
Danger to personnel!
DC-bus discharge - time >4min



This manual must be carefully read and understood by the professional prior to installation or start-up.
Consult the manufacturer or the dealer if anything is unclear.
Faulty installation can lead to destruction of the devices.

The BAMOCAR-D series devices are electrical resources (eb) for power electronics regulating electric currents.
They are designed to control ec synchronous motors (blushless dc motors, bldc) in industrial applications.
IP65 protection standard
Only connect to battery.

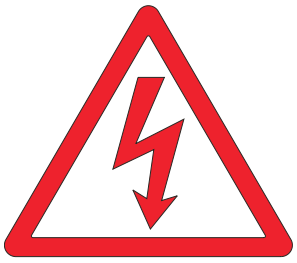
Regulations and guidelines:
Mount and connect the devices and their appropriate components in compliance with technical regulations locally applicable and required by law:

EG guidelines	2004/108/EG, 2006/95/EG, 2006/42/EG
-	EN60204-1, EN292, EN50178, EN60439-1, EN61800-3, ECE-R100
	ISO 6469, ISO 26262, ISO 16750, ISO 20653, ISO 12100
IEC/UL	IEC 61508, IEC 364, ICE 664, UL508c, UL840
Deregulations	VDE 100, VDE 110, VDE 160 and
TÜV regulations	

Trade association regulations,.VGB4
Stvzo §§20/21

Control and power connections can be live even though the drive is inoperative.

The dc-bus discharge time is more than 4 minutes. Measure the voltage prior to dismounting

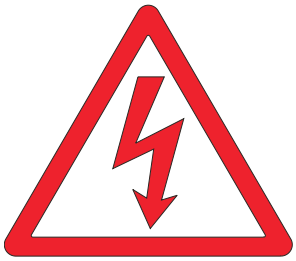


The user has to ensure :
That the drive will be led to a safe operating condition,
after an equipment failure
-due to malfunction of controlling or regulating unit

Machines, equipments and vehicles are to be further provided with equipment independent monitoring and safety devices.
Un-earthed systems (for ex. vehicles) must be protected
with an insulation monitor.
No danger shall arise for humans and property .

Assembly
-only in non-energized condition
-by trained personnel.

Installation work
- non-energized condition
-only by trained electrical personnel.



Safety regulations
Observe safety-regulations

Setting up
Setting up and programming
- to be done by trained personnel with knowledge and in electronic drives and software.
-observe programming instructions.

Safety regulations
Observe safety regulations.
Installation :
In case of nstallation in machines, equipments and vehicles, commissioning the equipment for the intended purpose is prohibited , until it has been ascertained , that the machines, equipments or vehicles comply with the EC guidelines for machines 2006/ 42/ EG, the EMC guidelines 2004/ 108/ EG and ECE-R100.

The EG- guideline 2004/ 108/ EG with emc regulations EN61000-2 and EN61000-4 pertaining to installation and test conditions mentioned in chapter emc instructions are complied with.
A manufacturer's clarification can be requested for.
Compliance of limiting values , laid down by the emc legislations , is the sole responsibility of vehicle manufacturers, equipments or machines.

Quality assurance equipment serial numbers , along with date of testing are archived by the manufacturer for 10 years. Test protocols can be requested for.

Safety symbolsttention :

Warning :
high voltage

Danger to life

important

General

The digital ac-dc servo drive BOMOCAR D3, together with a motor forms a 4 quadrant drive unit. Driving and braking with energy recuperation in both directions.based on the installed parameter set , the drive is suitable for ec synchronous motors, ac asynchronous motors or dc motors. Drive concepts are characterized by various advantages and disadvantages.
The ec drive (synchronous motor) has the highest efficiency and maximum performance per weight and volume ratio . It is maintenance free and has high control dynamics. The disadvantage is the complicated regulation in weak field region and the brake torque in case of motor short circuit.
The ec synchronous motor (brushless dc motor) is , in its electrical construction, a synchronous motor with permanent magnet rotor and rotary current stator. Physical features resemble to that of dc motors , i.e., current is proportional to torque and voltage is proportional to rpm.
Rpm will be stably controlled till current limit (max. torque). On overload the rpm sinks with constant current. rectangular rpm – torque – characteristics.
Current, rpm and position are measured exactly. the rotary field frequency is non variable, but sets itself automatically.
motor voltages and motor currents are sinusoidal.
The ac drive (asynchronous motor) has the highest rpm, through its simpler field weakening and does not generate braking torque on short circuit. Disadvantage is its size and low efficiency. Rotary field frequency is variable on consideration of motor specific parameters. (field oriented regulation). Motor currents and motor voltages are sinusoidal. In case of 3 phase alternating current , motor rotation does not take place, when the rotary field is shut down or a fault in the output stage exists . Heat loss arises predominantly in the motor stator.
DC- drive (dc motor) has the best synchronization and a high regulation region. Emergency stop can be achieved by directly switching off the battery supply. Disadvantages are the carbon brushes and heat development in the armature. The drive can rotate at high speeds in case of a fault in the output stage.
Current is proportional to the torque and voltage is proportional to rpm. current , rpm and position are exactly measured . Rpm is stably regulated till the current limit (max. torque)
On overload, the rpm sinks with constant current. rectangular rpm-torque characteristics. Field weakening is possible in case of separately excited motors.
BOMOCAR D3 can be used as a position controller, torque- or rpm drive . The actual value of speed is generated from the sensor unit (resolver or other) or generated internally (sensor less). Higher regulation requirement and control dynamics require a sensor system.

Attention

In case of dc fed dc-, ac- or bl servo drives , energy feedback in the DC- link during braking operation has to be monitored.
External ballast circuitry

Information

Battery – motor regulator (analog and digital)
Battery .:
Compact equipments

For smaller requirement	>>>UNITEK series BAMO -A2/ - A3	10 to 40A
	>> UNITEK series BAMOBIL A2/ D2/D3	50 to 450A
Thyristor regulator and servo drive (analog and digital)		
Thyristor regulator	>>> UNITEK series CLASSIC	15 to 2000A
Servo drives DC	>>> UNITEK series SERVO DC	5 to 75A
Servo drives AC/DC	>>>UNITEK series SEVO AC	3 to 75A
	>> UNITEK series DS	3 to 50A

Application in

Machines, equipments, vehicles of all types up to drive capacity of 140 kw especially as 4q-servo drives

-in case of highly dynamic acceleration and braking processes.
-in case of large control areas
-in case of high efficiency
-in case of small motor dimensions
-in case of constant , silent operation for
rpm control, torque control or combined torque- rpm control with or without superimposed position control.
Constant speed drives for conveyor operation, spindle drives, pumps , longitudinal and transverse drives.
Drives for synchronized operation of multiple motors.

Used in:
Battery operated vehicles like electric vehicles, electric boats, lift – trucks, transport systems as well as battery operated machines and equipments like automatic mounting metal processing machines, x- y tables, grocery machines, robots and handling systems, stacker cranes and stone processing machines and in many battery operated applications.

The motors and controllers are constructed with IP 65 protection ,
-compact ,
-for harsh conditions,
-for high dynamic overload,
- maintenance free.

Observe :
Braking energy would be fed back in to the battery.
The battery must be able to absorb the braking energy.

In case of unearthed systems (vehicles, it – networks) , the insulation between the parts which come in contact and HV-voltages should be monitored by an independent insulation monitoring watch dog.

Feature

Construction :

Compact equipment
Acc. to VDE-DIN-EG- standards.
IP 65 protection against accidental contact with power connections.

Power electronics for (S1 operation) 125 A, 200 A,(peak 250A, 400A)
Input power range nom. 12 to 700 V =
Liquid cooling (special construction air cooling)
Unified digital controller electronics)
Independent 12/ 24V DC chopper power unit for auxiliary power.

Galvanic isolation
-Galvanic isolation between power connector, motor connector and all other control connectors
-Galvanic isolation between auxiliary voltage and all other voltages.
-Housing and radiator assembly are galvanically isolated from all electric parts.
-The air and creepage distances comply with VDE.
- No internal insulation monitor. Y2 capacitors to housing.

The following are used:
IGBT – power semi conductor
- Generously dimensioned.
- Only commercially available parts in industry standard.
- SMD –mounting
- 7 segment led indicators (option)

Features

* Battery connection 12 v = to 700 volts = (dc supply, observe limitations)
* Independent auxiliary supply 24 v = or 12 v =
* Digital interfaces RS 232, can- bus (additional option)
* 2 analog inputs, programmable differential inputs
* 4 digital in- out puts, programmable, optically isolated
* Reference value ramps linear, non linear (s – function)
* Release and limit -switch logic.
* BTB – operation ready, solid state relay contact.
* Position , rpm and torque control
* Resolver or encoder – incremental encoder TTL , SINCOS 1Vss,
* Rotor positon + bl tacho.
* Encoder output or 2. encoder input.
* Static and dynamic current limit
* Unified full digital regulator unit
* Safety shutdown in case of over voltage, under voltage and over temperature from motor.
* Self protected short circuit proof power part. processor independent hardware -shut down in case of short circuit, earth fault , over voltage and over temperature of amplifier.

Technical Data

Device for EC/AC-motors

Power supply voltage	12V= to 700V=
Auxiliary supply	12V= or (24V=) ± 10% / 4a (2a) Ripple voltage <10%, self-resttable fuse

Data BAMOCAR-D3-400- (700)-	dim.		125/250	200/400	125/250	200/400
Rated supply voltage	V=		24 bis max .400		24 bis max .700	
Rated output voltage	V~eff		to 3x260		to 3x450	
Continue current rms	A_{eff}		125	200	125	200
Peak current	A_{io}		250	400	250	400
Dissipation max.	kW		2	3	2.6	4
Clock frequency	kHz		8-24		8-16	
Level Over voltage	V=		440		800	
External fusing	A		160	250	160	250
Weight	kg		5.8	6,8	5.8	6.8
Dimension HxWxD	mm		403x250x145			
Size			2	2	2	2

Device for DC-Motors

Power supply voltage	12V= to 400V=
Auxiliary supply	12V= or (24V=) ± 10% / 4a (2a) Ripple voltage <10%, self-resttable fuse

Data BAMOCAR-D2-	dim.		125/250	200/400		
Rated supply voltage	V=	24 bis max. 400				
Rated output voltage	V=	20 to 360				
Continue current rms	A=		125	200		
Peak current	A_{io}		250	400		
Dissipation max.	kW		2	3		
Clock frequency	kHz	8-16				
Level Over voltage	V=	programable to max 440v				
External fusing	A		160	250		
Weight	kg		5.8	6,8		
Dimension HxWxD	mm	403x250x145				
Size			2	2		

Technical Data

Input / Outpu	v	A	Funktion	Connector
Analog Input	± 10	0.005	Differential input	x1
Digital input ON OFF	10-30 <6	0.010 0	Logic io (opto)	x1
Digital output	+24	1	Transitor-output open emitter (opto)	x1
Resolver input			Differential input	x7
Encoder input	>3.6v		Opto	x7
Encoder output	>4.7v		Opto	x8
CAN-interface			Logik io (opto)	x9
RS232-interface			Logik io	x10

Ambient conditions	
Enclosure protection	IP65
Norms	EN 60204, ISO 16750
Ambient temperature	-10 to +45°C
Maximum ambient temperature	-30 to +65 ab +45°C to +65°C with power derating 2%/°C
Storage temperature	-30°c to +80°c
Humidity in operation	Klasse F rel. humidity <85% ,**no condensation !**
Site altitude	≤ 1000m ü.nn 100%, >1000m with power derating 2%/100m
Cooling	liquid cooler max 65°c , 12 l/min , precher max 1,3 bar
Mounting position	equal

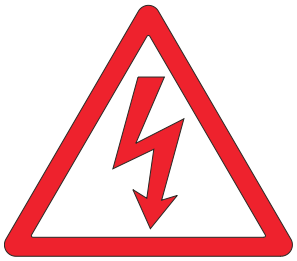
Program	Type	Software-version	
BAMOCAR-D3(D2)-xx-rs	resolver		
BAMOCAR-D3-(D2)xx-in	encoder-ttl		
BAMOCAR-D3-(D2)xx-sc	encoder-sincos 1vss		
BAMOCAR-D3-(D2)xx-bl	rotorlage+bl-tacho		
BAMOCAR xx-DC	dc-tacho, armature voltage		

Note:
Power supply cables between the BAMOCAR 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 equipment for mechanical damage
Install only defect-free equipments
Assembly only in non-energized condition

Disconnect the positive and negative terminals of the battery, disconnect DC supply.
Assembly only by trained personnel



The installation position is discretionary in case of equipments with liquid cooling.
In case of very low heat dissipation, the equipment is shut down by its thermal monitoring system.
Equipment fitment holes to be obtained from dimension drawing or drill plan not to be traced out from the equipment itself.

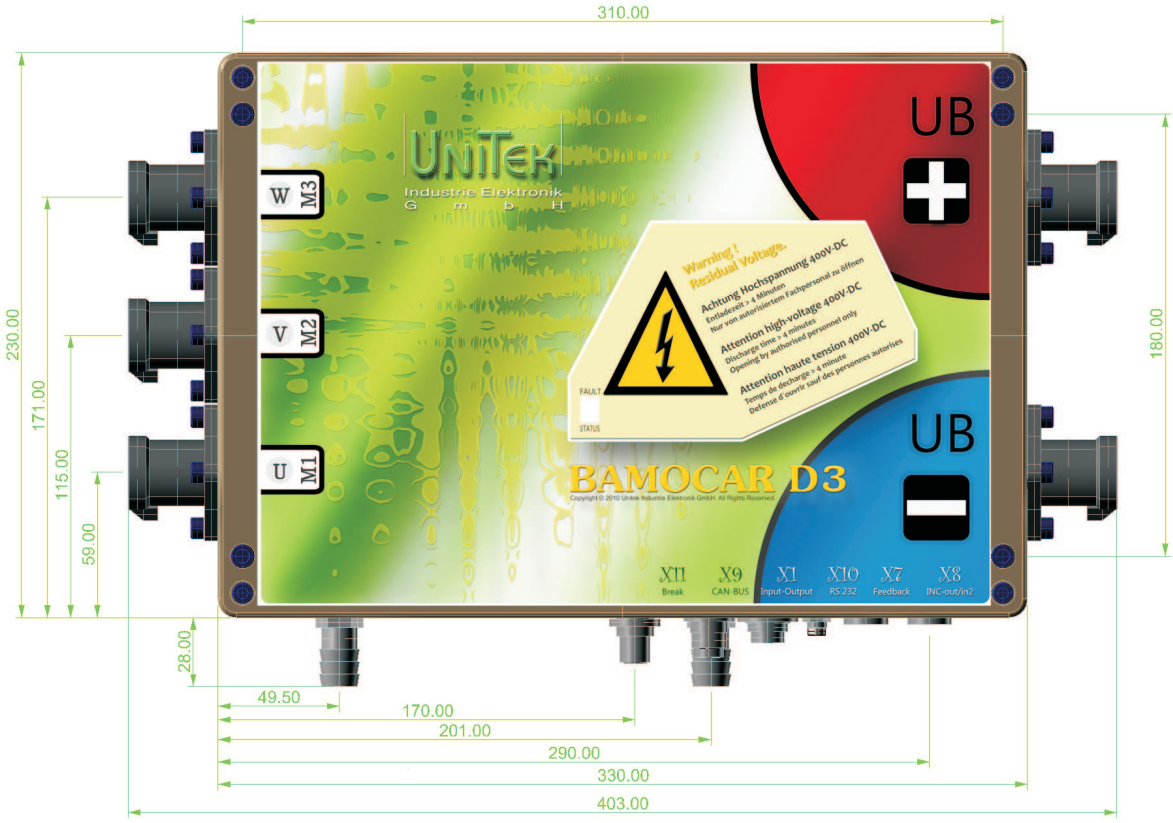
Filter and choke to be mounted close to the equipment.
Connect cable screens with mounting area so as to have surface contact.

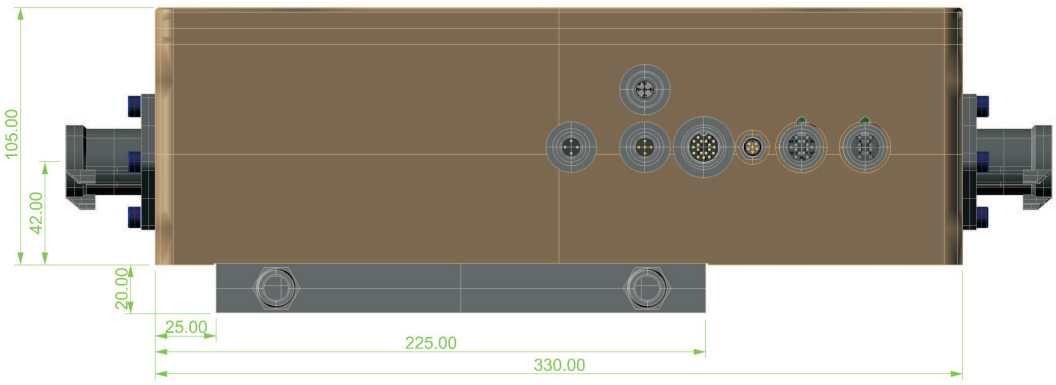
Lay power cables (battery and motor cables) well separated from signal cables observe minimum cable cross –section.

Unscreened cable ends to be as short as possible.

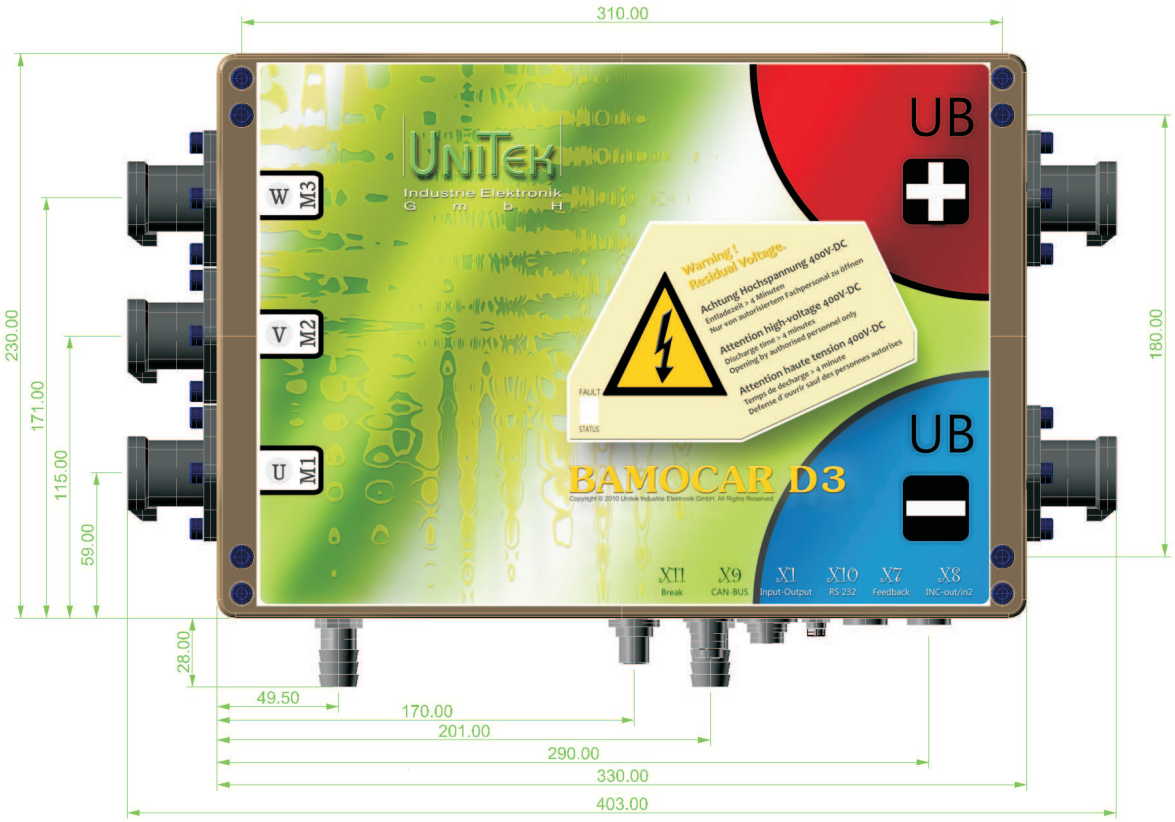
Secure earth connection from housing to ground plane
(vehicle ground, control panel –earth)
Use vibration resistant screw joints.

Dimensions





Screw for hex key BAMOCAR

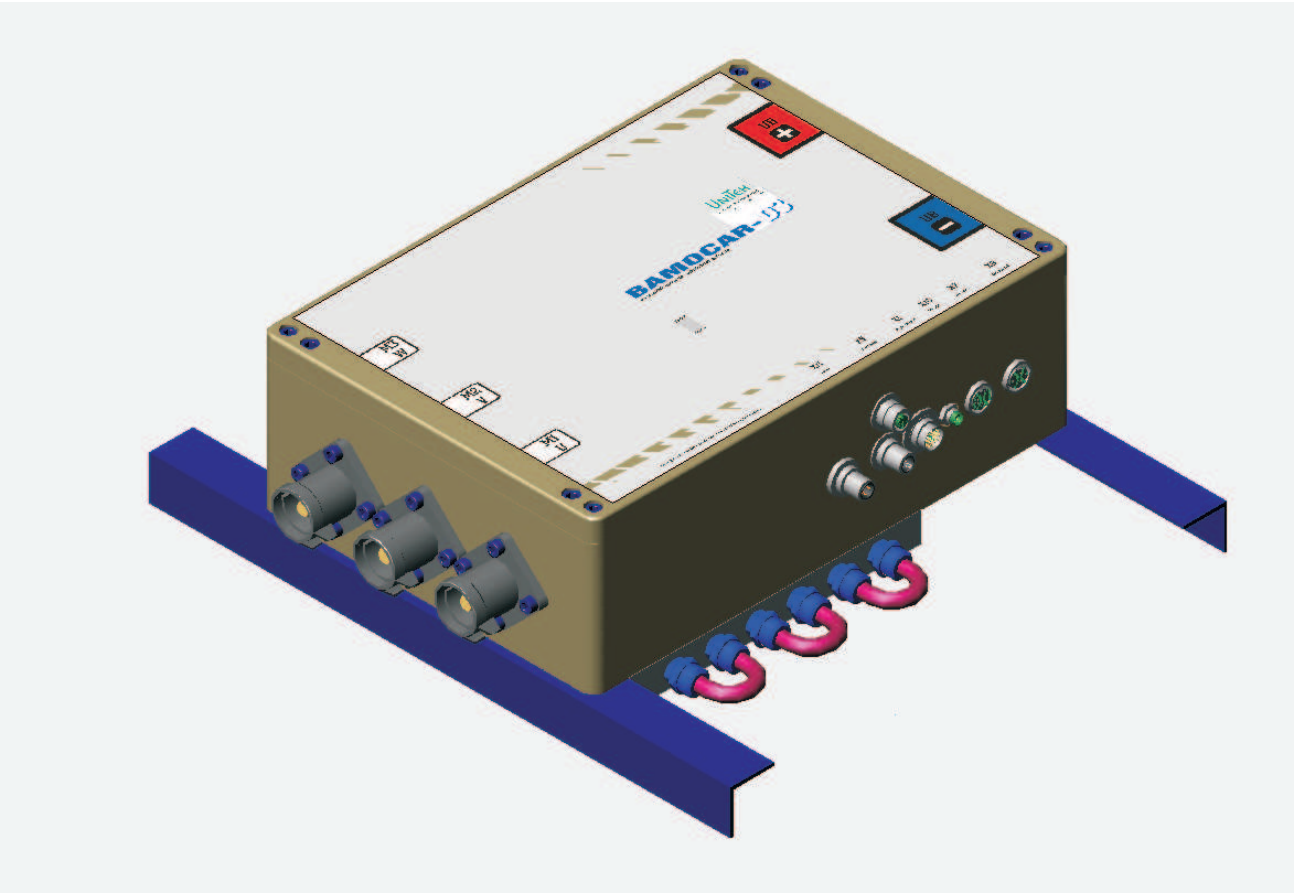


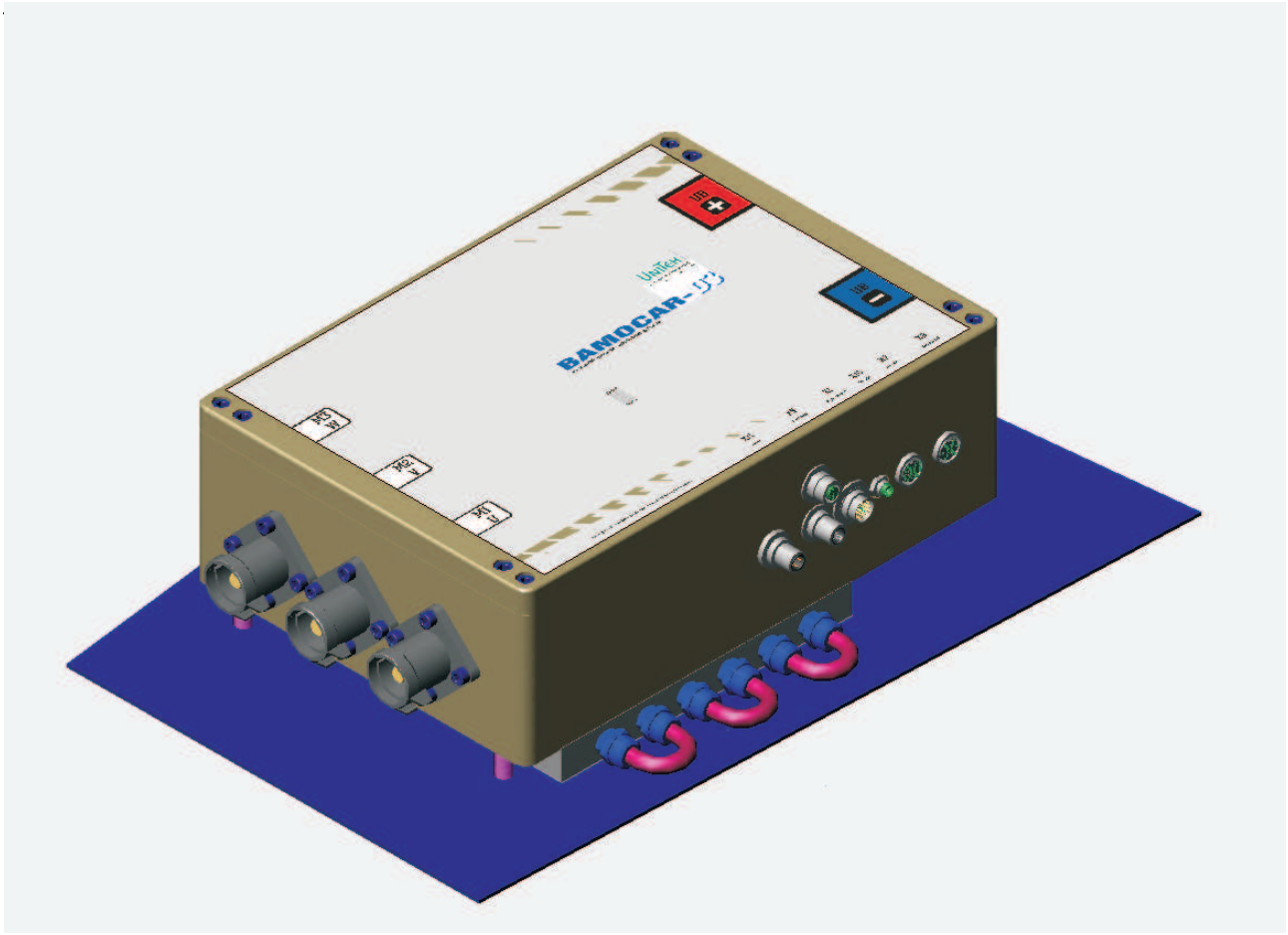
Liquid cooler

Connection

hose connection	metall 13mm
inlet temperature	50° grad c
flow max	12l/min
pressure max	1,3 bar

Assembly





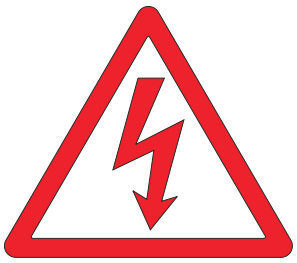
Important instructions

The connection instructions are classified according to the connector numbers respectively and are mandatory.

All further instructions hereto are non-binding.
The input and output lines can be modified and supplemented, under consideration of electrical regulations and guidelines

Regulations to be observed are
Connection and operational instruction
Local regulations
EC-regulations like ec machinery directive 2006/ 42/ EG-
EC-regulations for vehicles EC-R 100, ISO 6469, ISO 26262
VDE , TÜV and provisions of professional association.

Electrical installation only in non-energized condition.
Observe safe activation.
Insert shorting bar
Put up warning boards
Installation only by trained personnel in electronics



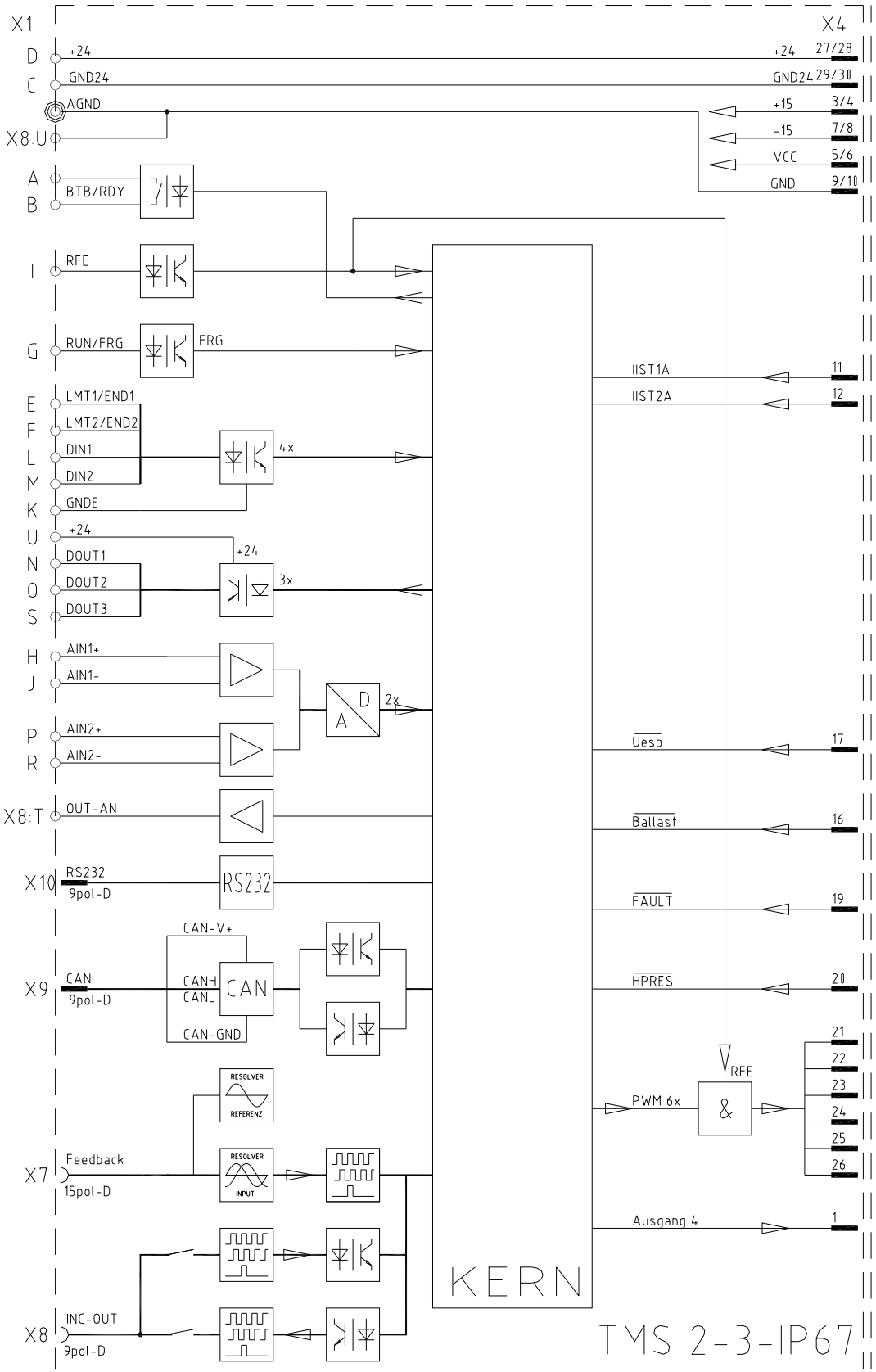
Compared connected load with type – identification plate details.
Observe correct input of power and auxiliary voltage.
Lay power cable and control cable spatially separated.
Follow emc-guidelines for screen connection and earthing procedures.
Use correct cable cross- section.

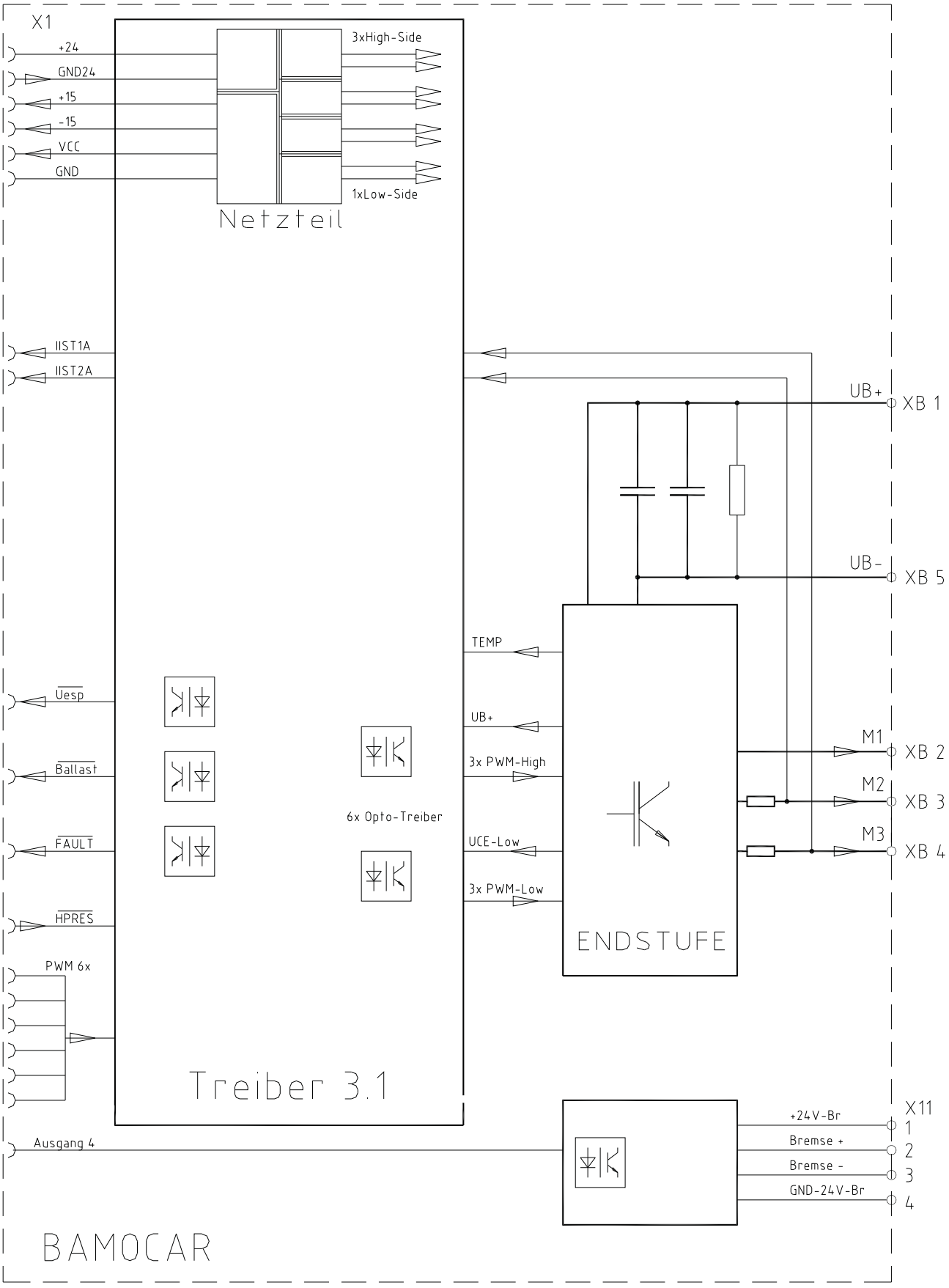
Use external insulation watch dog

Attention
Poor or under dimensioned cable connection between the battery and the equipment can lead to equipment damage.
(braking energy)

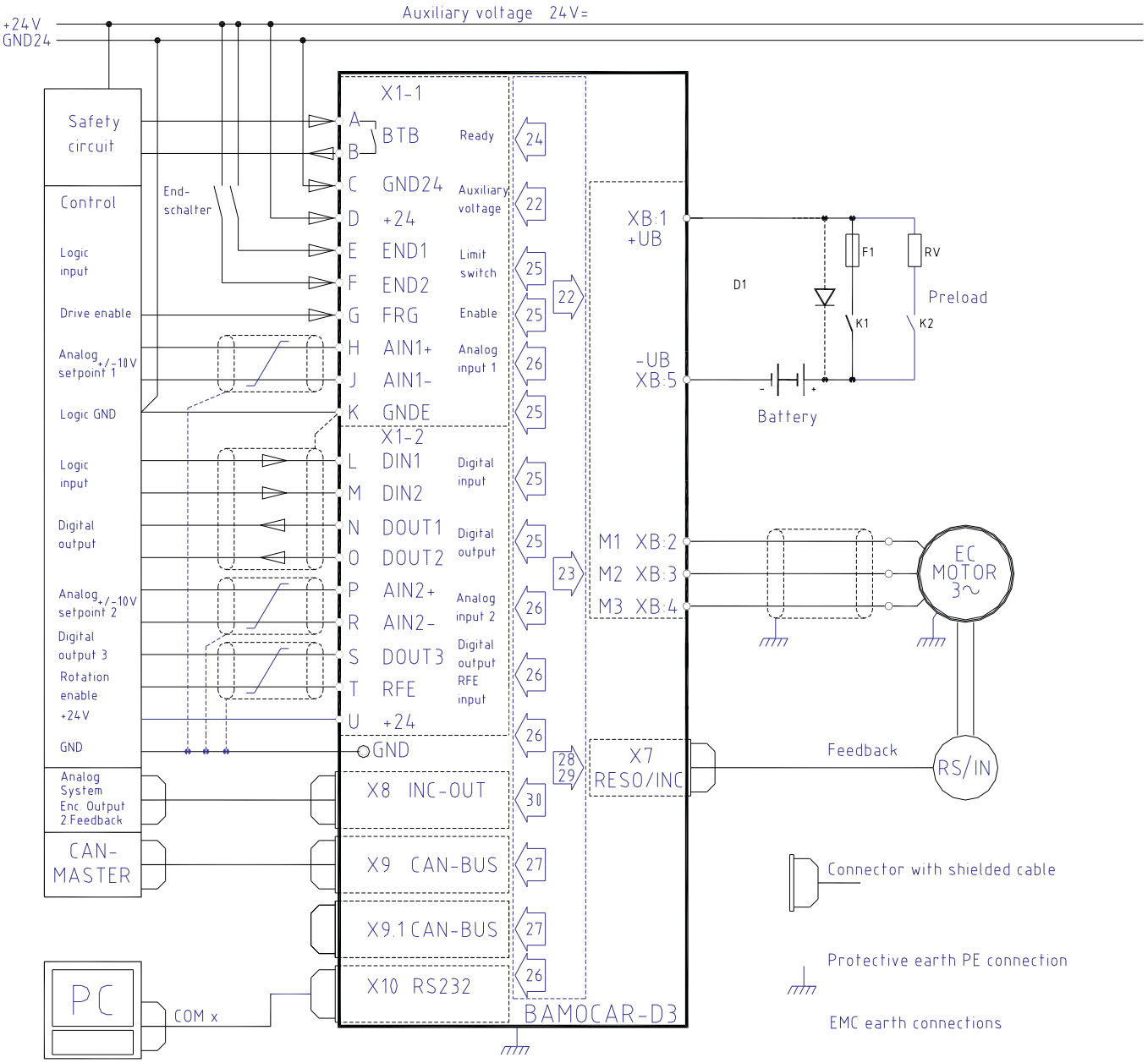
Attention : Power cables from fmc iii to batteries to be as short as possible. Long cables lead to dynamic voltage-drops due to their impedance.
These burden the installed capacitors and shorten the life span.

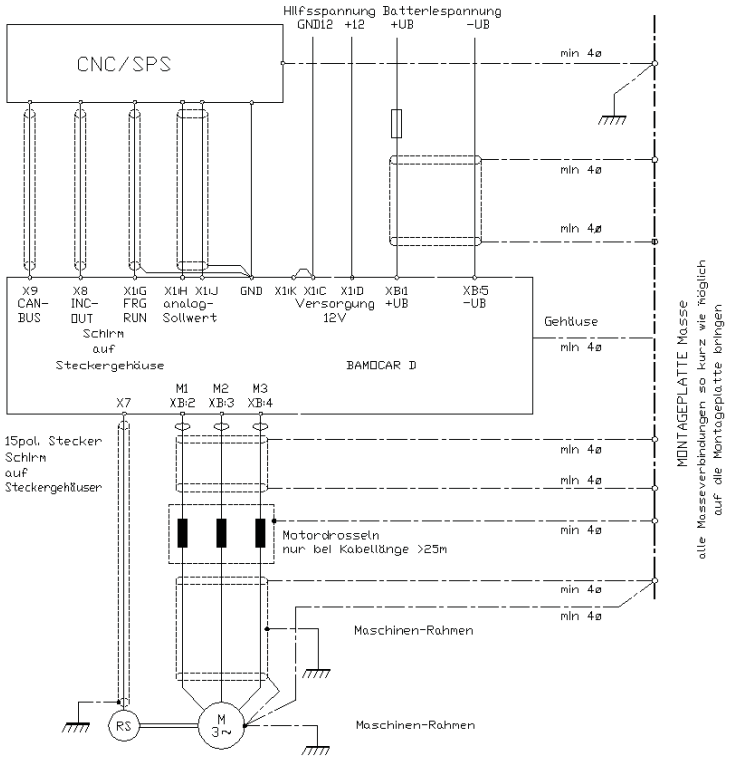
Block diagram




X1
+24
GND24
+15
-15
VCC
GND
3xHigh-Side
1xLow-Side
Netzteil
IIST1A
IIST2A
UB+
XB 1
UB-
XB 5
TEMP
UB+
3x PWM-High
UCE-Low
3x PWM-Low
M1
XB 2
M2
XB 3
M3
XB 4
ENDSTUFE
Uesp
Ballast
FAULT
HPRES
PWM 6x
6x Opto-Treiber
Treiber 3.1
Ausgang 4
+24V-Br
Bremse +
Bremse -
GND-24V-Br
X11
1
2
3
4
BAMOCAR

Connection diagram





Equipments comply with the EC- regulations 2004/ 108/ EG and standards EN 61800-3 according to the following installation and test conditions.

Mounting :
The equipment is conductingly mounted on a bare , aluminum plate with dimensions 500 x 500 x 5mm. mounting plate corresponds to ground plane
(vehicle ground , control panel ground)
Motor casing above 10 mm^2 connected to ground .
Equipment ground x- agnd above 1.5 mm^2 connected to the mounting plate
(ground) .
Housing connected with mounting plate (ground)

Control connections:
Signal wires are screened, analog signal wires are twisted and screened .
Screen: surface contact with the mounting plate (ground)

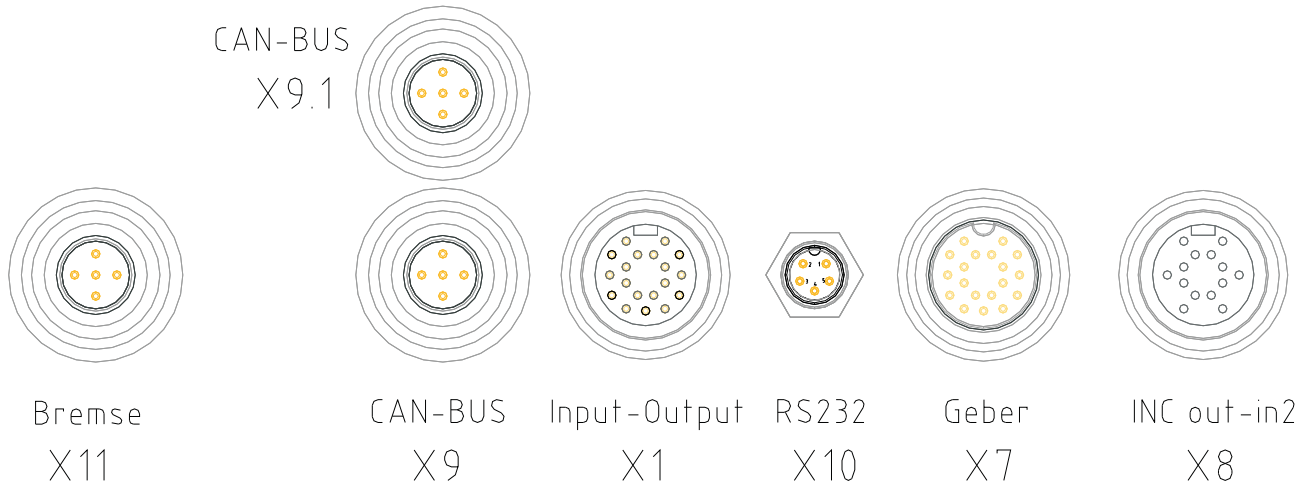
Battery connection:
360 V DC

Motor connection :
Motor cables are screened, and have surface contact with the mounting plate (ground)

In case of installation in machines and equipments , the commencement of operation of the equipment in accordance with the provisions is prohibited, till it is confirmed, that the machine or equipment complies with the ec – regulations 2006/ 42/ EG and the emc – regulations 2004/ 108/ eg,
in case of vehicles ECE-Rr83, ECE-R100.

A manufacturer's declaration can be requested for.

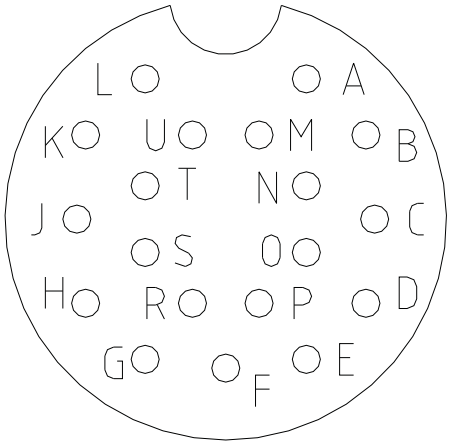
Connectors



Connector X1 IN / Output

a brown	BTB	BTB-Ready
b red	BTB	
c pink	GND	Auxiliary voltage 0
d yellow	+24	Auxiliary voltage+
e gree	END1/LMT1	Limit switch1
f blue	END2/LMT2	Limit switch2
g violett	FRG/RUN	Enable
h gray	AIN1+	Analog-Input1
j white	AIN1-	
k black	GNDE	Logik-GND
l br-green	DIN1	Digital-Input1
m br-yellow	DIN2	Digital-Input2
n ws-green	DOUT1	Digital-Output1
o red-blue	DOUT2	Digital-Output2
p wh-yellow	AIN2+	Analog-Input2
r wh-red	AIN2-	
s wh-gray	DOUT3	Digital-Output3
t wh-black	RFE	Rotation Enable
u ws-blue	+24v	Auxiliary voltage +

Connector Binder 99-5662-15-19

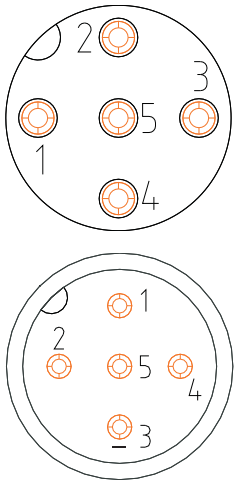


Connector X9, X9.1 CAN-BUS

1	PE
2	(Voltage in)
3	CAN GND
4	CAN Hh
5	CAN LI

Connector X9
Binder 99-0436-14-05

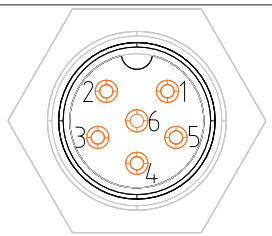
Connector X9.1
Binder 99-0437-14-05



Connector X 10 RS232

1 brown	r2in
2 white	txd
3 blue	t2ou
4 black	t2ou
5 gray	rxd
6 pink	gnd

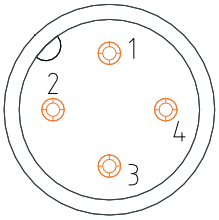
Connector Binder 79-3464-52-06



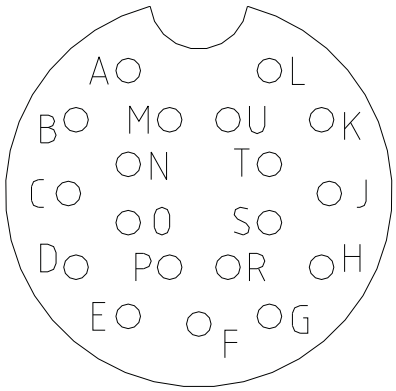
Connector X11 Brake

1	+24 v-br
2	Brake +
3	Brake -
4	GND-24V-Br

Connector Binder 99-0429-15-04



Feedback- connector X7

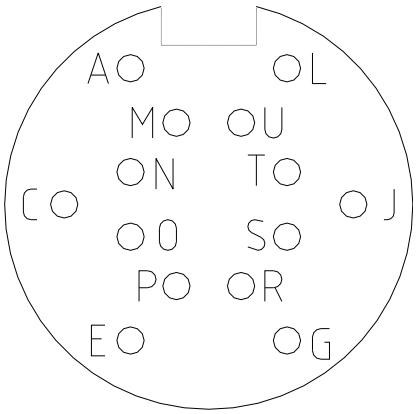


Connector Binder 99-5661-15-19

Connector X7 Resolver		Connector X7 ENC-TTL		Connector X7 SIN/COS		Connector X7 bl	
a		a	canal a	a	canal ka+	a	mp-tacho
b		b	canal /n	b	canal kr+	b	
c	sin1	c	canal b	c	canal kb+	c	tacho 1
d		d	voltage +5v	d	voltage +5v	d	voltage +15v
e	cos2	e	canal n	e	canal kr+	e	tacho 2
f		f	canal /b	f	canal kb-	f	
g	ref2	g	canal /a	g	canal ka-	g	tacho 3
h	temp signal	h	temp signal	h	temp signal	h	temp signal
j		j	temp gnd	j	temp gnd	j	temp gnd
k	ref1	k	rotor 3	k	canal kd-	k	rotor 3
l	temp gnd	l	gnd	l	voltage gnd	l	versorgung gnd
m	cos1	m	rotor2	m	canal kc+	m	rotor2
n		n		n	canal kd+	n	
o	sin2	o	rotor1	o	canal kc-	o	rotor 1
p		p				p	

Connector X8
Output / 2 Input ENC-TTL

a	voltage +5v
c	selekt in
e	canal a
g	canal n
j	canal b
l	canal /b
m	canal /n
n	canal /a
o	voltage GND
t	output dac1
u	GND dac1



Connector Binder 99-5651-15-14

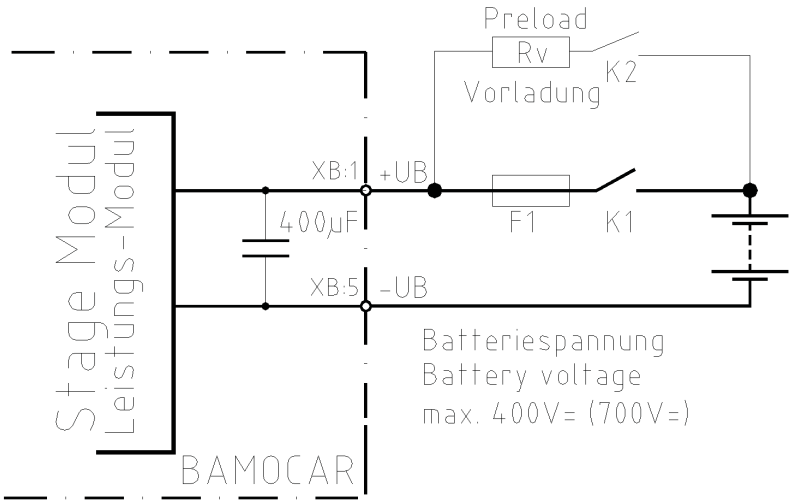
At all connectors: View the plug on solder-crimp side.

Power connectors 1000V / 400A

Connector socket plus	Pfisterer p1 (350 205-301 (-302))
Connector socket minus	Pfisterer p1 (350 205-301)
Motor connector socket	Pfisterer p1 (350 205-301)

Connector plug	plus	Pfisterer connector straight p1 (350205-002..) or connector angle p1 (350205-102)
Connector plug	minus	Pfisterer connector straight p1 (350205-001..) or connector angle p1 (350205-101)
Connector plugr	motor	Pfisterer connector straight p1 (350205-001) or connector angle p1 (350205-101)

Connection to the battery



Attention:

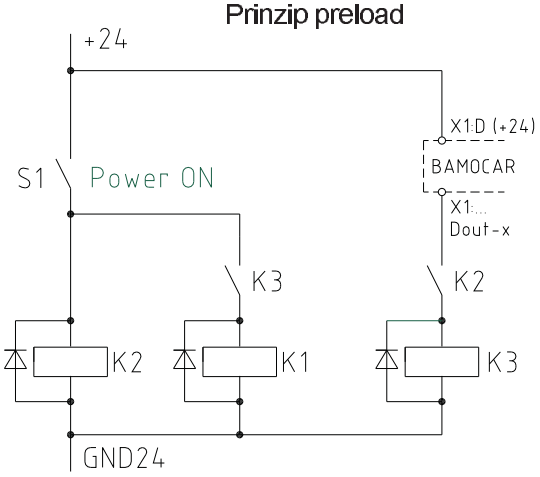
DC-Link
at 400V 800µF
at 700V 320µF

Resistor
Rv ca. 40 ohm 10w

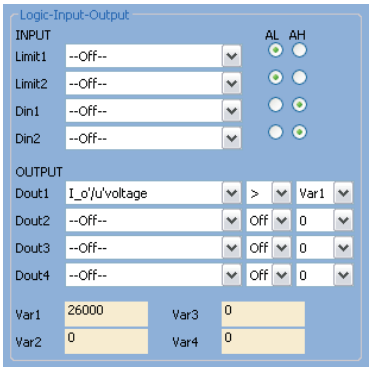
Inrush-current over k2
ca.10A

Enable (RUN) only at
switched main contactor K1

Prinzip preload



Programming example
Output dout1 switches the relay k3 when the dc link voltage (I_o/u voltage) is higher than the variable 1.



Warning

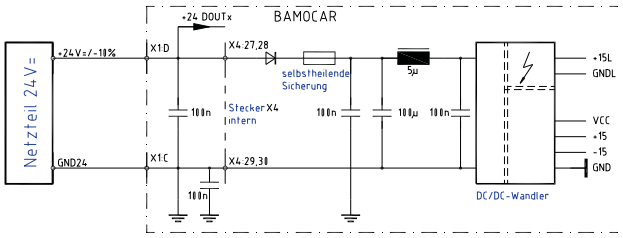
The max. supply voltage U. + 400 (700) must not be exceeded at any time (not even for short intervals)!
Danger of damage!
F1 = safety fuses

Connection has no protection against reverse polarity.
If the polarity of the connection is wrong, the device will be destroyed

Type		Connection cross-section mm2	AWG	Fuse A		
-125/250		25	2	160		
-200/400		35	1	250		
Battery connecting line <2m. For conductor lengths from 2 to 10m more powerful. Use an additional capacity for conductor lengths superior to 10m!!						

Auxiliary power connection
Mains independent Auxiliary dc voltage 12 V = up to 24 V = +/- 10 % / 4 up to 2 A

The Auxiliary voltage has
- galvanic connection to logic voltage
- internal self healing fuse
- emc filter
- external fuse only for line protection



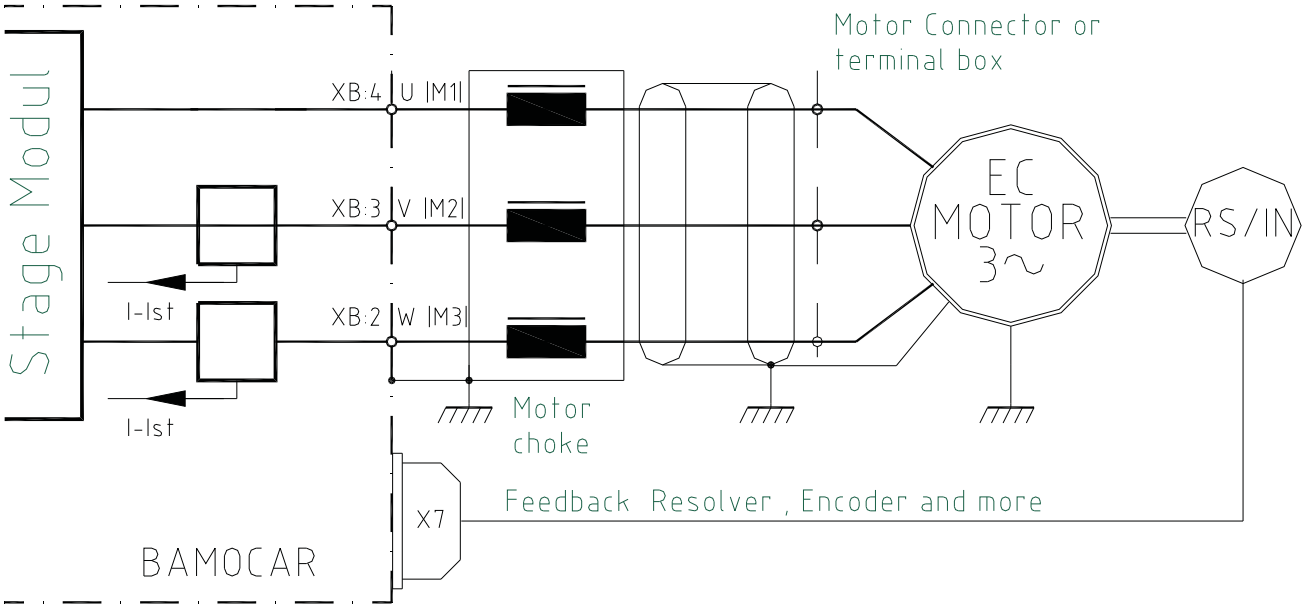
Input voltage 12...24 V DC X 1: 4
GND 24 X 1 :3
Ripple 10 %
Inrush current 4A
Rated current in case of 12 v 1.4 A
in case of 24 v 0.9 A

Attention : For internal power supply (1,4 A) , also the sum total currents of output (dout) has to be fed from the 12/24 V system.

Attention : In case of Auxiliary voltage less than 10 V, including during short time drop outs, the internal power supply system shuts down. Temporary data in ram memory are erased. Digital rpm and torque reference are reset to 0, fault indication 1 (hardware fault) .

Indication ok in status is off.

Motor – power connection
Use only UNITEK approved, electronically commutated synchronous motors (brushless dc motors, ec motors) with resolver or incremental encoder .
Refer Appendix A (motor specific connection and parameter guidelines)



Connection sequence

Cable indication		M1	M2	M3
Motor phase		U	V	W
Connector		xb:2	xb:3	xb:4
Correct wiring is essential !				

Motor cables,
3 wires + simply shielded protective earth conductor for 600V~, 1000V=, shield capacity 150pF/m.

Cable cross –section minimum.

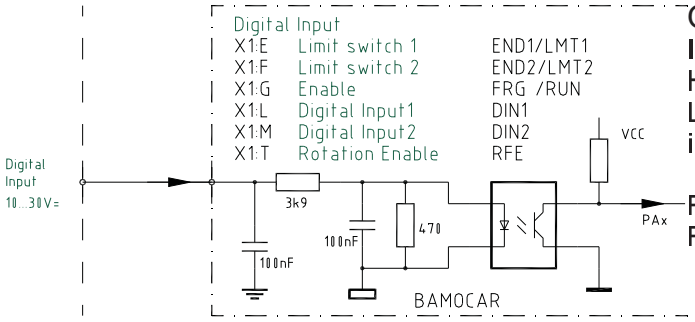
Type BAMOCAR -Dx	-125	-200		
Cable dim. mm^2	25	35		
Cable dim. AWG	2	1		

Motor choke.
Only required upwards of 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.

Shielded connection:
Surface connection at entry to control cabinet. Surface or as short as possible connection at the motor end.

Digital inputs



Opto-input		
Input voltage		
H-level	(ON)	+10 to +30V
L-level	(Off)	0 to +6V
input current		max. 14 mA
Ratet voltage/curen		+24V/10mA
Referenc ground		GNDE(X1:10)

The enable input- (FRG/RUN) and the input for rotary field release (RFE) are pre-fixed and cannot be programmed. Without FRG/RUN release , the servo is electronically blocked (no pwm pulses).

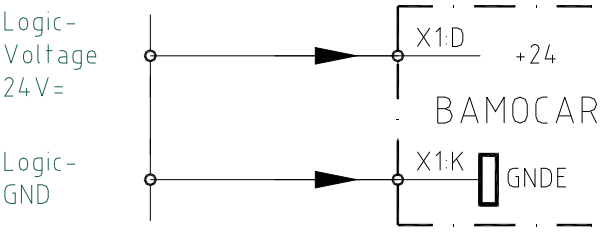
Without rotary field release RFE, the rotary field of the output stage is additionally blocked electronically. (second blocking channel). The drive is momentum free (no stop-moment).

The 4 additional digital inputs are freely programmable.

Inputs lmt 1 (x1: e) and lmt 2 (x1: f) are preferred and to be used as limit switch inputs .

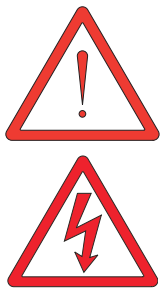
Input	Plug	Function	Status	
FRG/RUN	X1.7	Enable	fix	
RFE	X1:18	Rotation Enable	fix	
END1/LMT1	X1:5	Limit switch 1/Dig. Input	programmable	
END2/LMT2	X1:6	Limit switch 2/Dig. Input		
DIN1	X1:11	Digital Input 1		
DIN2	X1:12	Digital Input 2		

External power supply for inputs and outputs.



+24for	for the logic and the auxiliary voltage	
GNDE	Logic reference	

Safety – input RFE (rotary field – release)

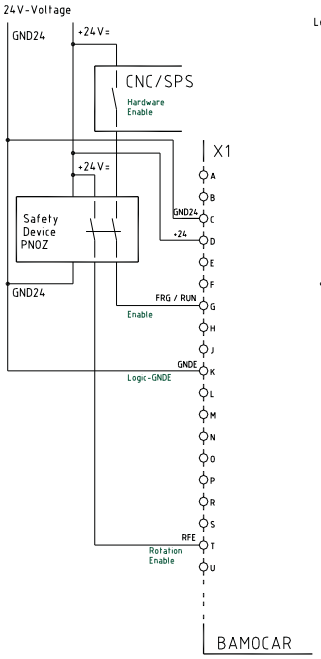


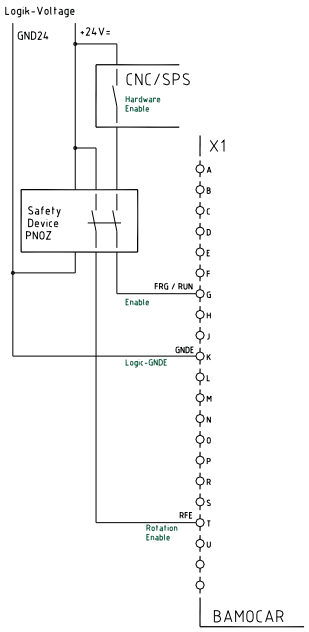
Attention : The drive is momentum-free , in case of disabled input release or rotary field release . If there are no mechanical brakes or blocks, the drive can stop or be in motion , the motor cables are not potential-free. Only the rotary field is blocked . The servo Amplifier has to be isolated from the mains to carry out work on the motor.

Operation with rfe input.
Two channel release – block by a safety device.
Enable - input FRG/RUN plus rotary field enable – input RFE

Switch on
Safety switch contacts closed
Enable FRG/RUN 0.5 seconds after RFE.

Safety shut-down.
Safety switch contacts open.
Absence of FRG/RUN signal -blocks the pwm pulses in the processor through the first blocking channel.
Absence of FRG signal blocks the pwm pulses after the processor through the second blocking channel .





Restarting :

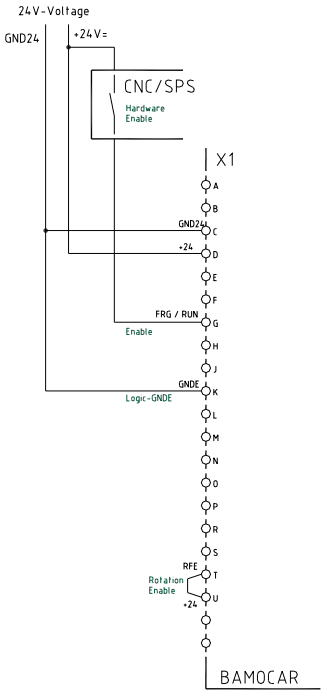
Reset safety switch
Safety switch contacts closed.
The motor can start rotating, only after a renewed rotary field enable, followed by enble FRG/RUN ,

Operation without RFE -input

Input RFE has to be bridged with the logic voltage.

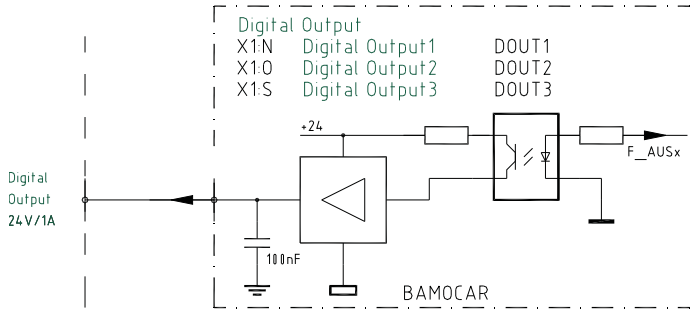
If the logic voltage and the supply voltage are the same, bridge the RFE input with +12V/ 24 V.

Enable FRG/RUN at lease 0.5 seconds after RFE –signal.



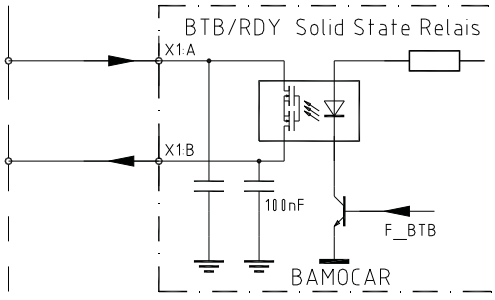
Digital logic- outputs (open- emitter)

Logic outputs 1 to 3 are for laid out for 12/ 24 V and 1 A . Short time 2 A.



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)

Attention : The auxiliary voltage is also the power supply for the logical outputs.
An energy saving program can be programmed. (clocked output).
Logic output 4 (brake 24 V, 3 A) is available at terminal X 11.



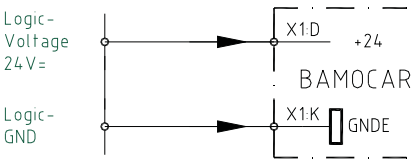
Contact for	max. 48V/0.2A
Capacitive load	max. 1myF
Contact resistance	max. 2 Ohm
external fuse	0.5Aff

The contact is closed when the device is r
eady for operation.
State signal via seven-segment LED

Signal operation ready (solid state relay) / ready BTB/RDY
Operation ready are off in case of fault indications, if Auxiliary voltage is low (<10 V)

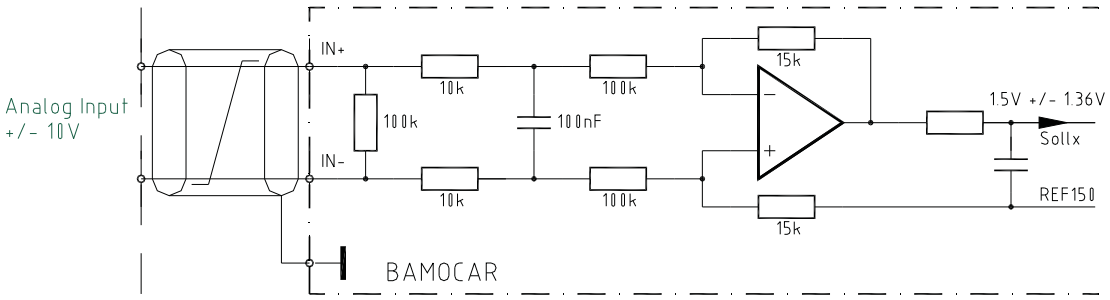
The function of indication „ under voltage in DC link ” can be programmed.
BTB with or without under voltage monitoring . (BTB-power)

Output	Plug	Funktion	Status	Parameter
BTB/RDY	x1:A, x1:b	Ready	fix /Relay	
DOUT 1	x1:n	Digital output 1	programmable	
DOUT 2	x1:o	Digital output 2	programmable	
DOUT 3	x1:s	Digital output 3	programmable	
DOUT 4	x11	Digital output 4	programmable	



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

Analog inputs +/- 10V



Inputs	Terminal	Basic function	Voltage	Status	Parameter
Ain1+,Ain1-	X1:h, X1:j	rpm – reference value	+/-10V	prog.	
Ain2+,Ain2-	X1:p, X1:r	current limit	+/-10V	prog.	

Characteristics

Differential input	Ain1+/Ain1-	Ain2+/Ain2-	
input impedance	70kOhm		
limit voltage	+/-12V		
resolution	11bit + sign		

The direction of rotation of the motor can be changed by reversing the +/- polarity at the differential input, by a logic- input or by programming .

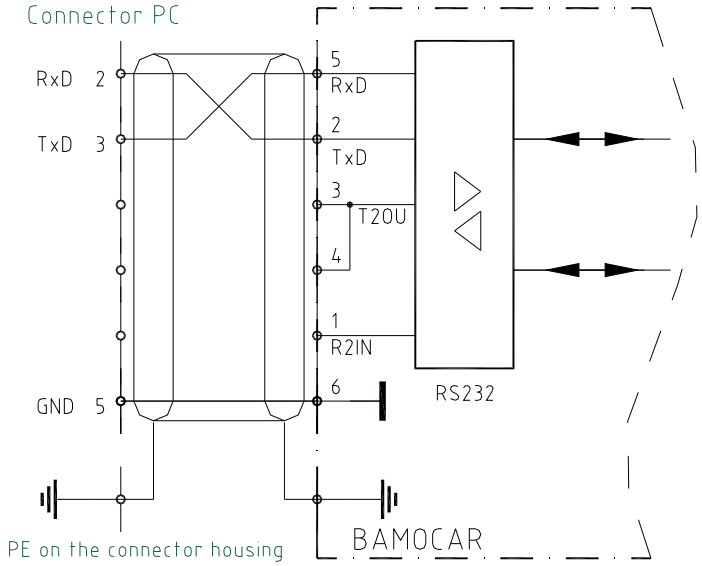
In case of digital reference value (RS 232, x bus), analog input Ain 1 can be programmed as external rpm limit and the Analog input Ain 2 can be programmed as external analog current limit.

Analog output +/- 10 V

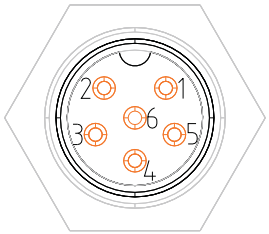
Output	Terminal	Basic function	Voltage	Status	Parameter
Aout1	x8:t	rpm- Actual value	+/-10v	prog.	
gnd	x8:u	signal-gnd	0v	fixed	

Serial interface RS232

The Amplifier BMOCAR-D3 is programmed and commissioned through the PC interface RS232 .

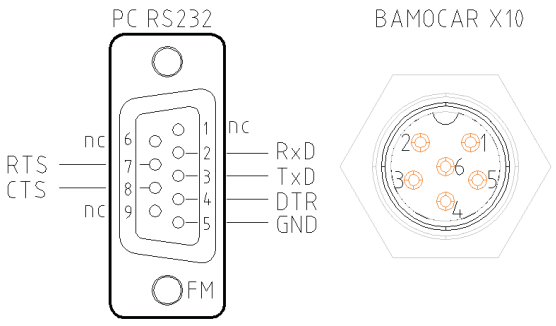


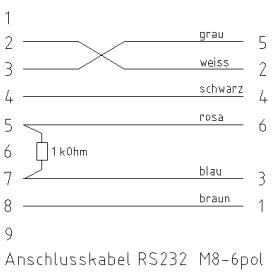
The serial interface is galvanically coupled with the device - zero (GND) .



The software is described in the software-manual DS NDrive.
Connection between the BAMOCAR-D3 (d-connector X10) and the serial interface only through a null modem-cable.
Do not use null modem-link cable!
Cable to be plugged in only in de-energized condition.
Select the interface baud rate in NDrive as **115200**.

Null modem cable
Pin assignment. Solder side.
Contact shield with the plug housing.
Cable length max. 10m



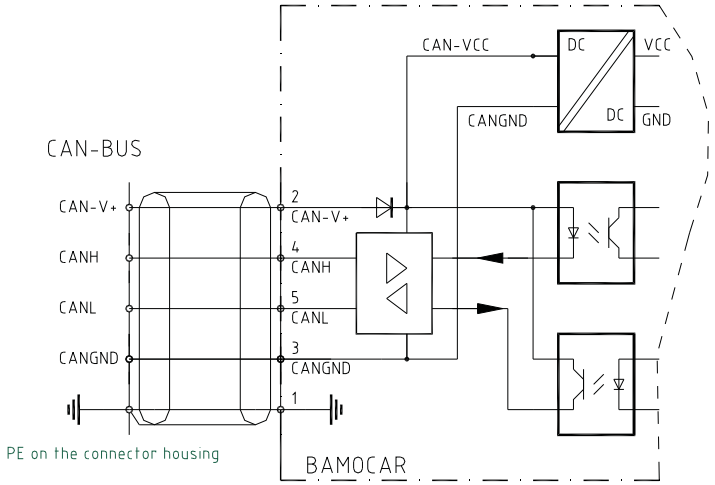


BAMOCAR
Connector X 10 RS232

1	R2in
2	Txd
3	T2ou
4	Dtr
5	Rxd

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

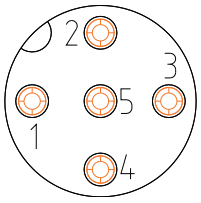


The CAN-BUS input is galvanically separated.
The power supply is from the intern DC/DC

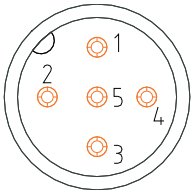
.

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	Connector no. X9, X9.1 CAN-BUS	Cable colour
Sield	1	green-white
CAN-v+	2	brown
CAN-gnd	3	white
CAN-h	4	green
CAN-I	5	yellow



x9.1 Female

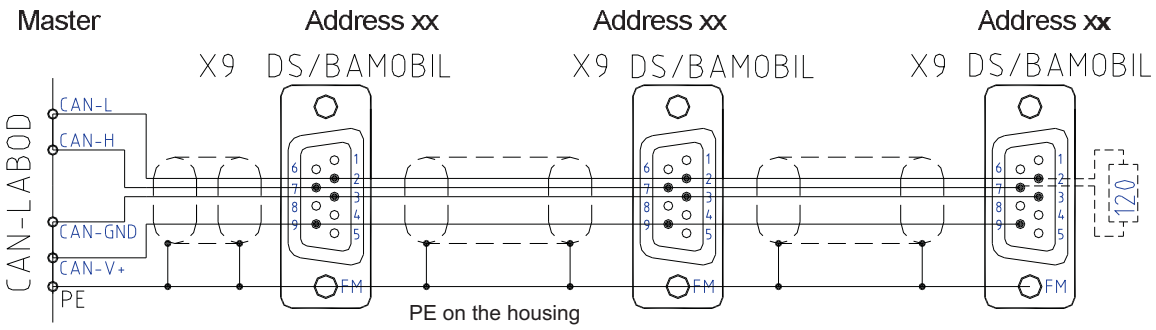


x9 Male

Pin assignment.
Solder side

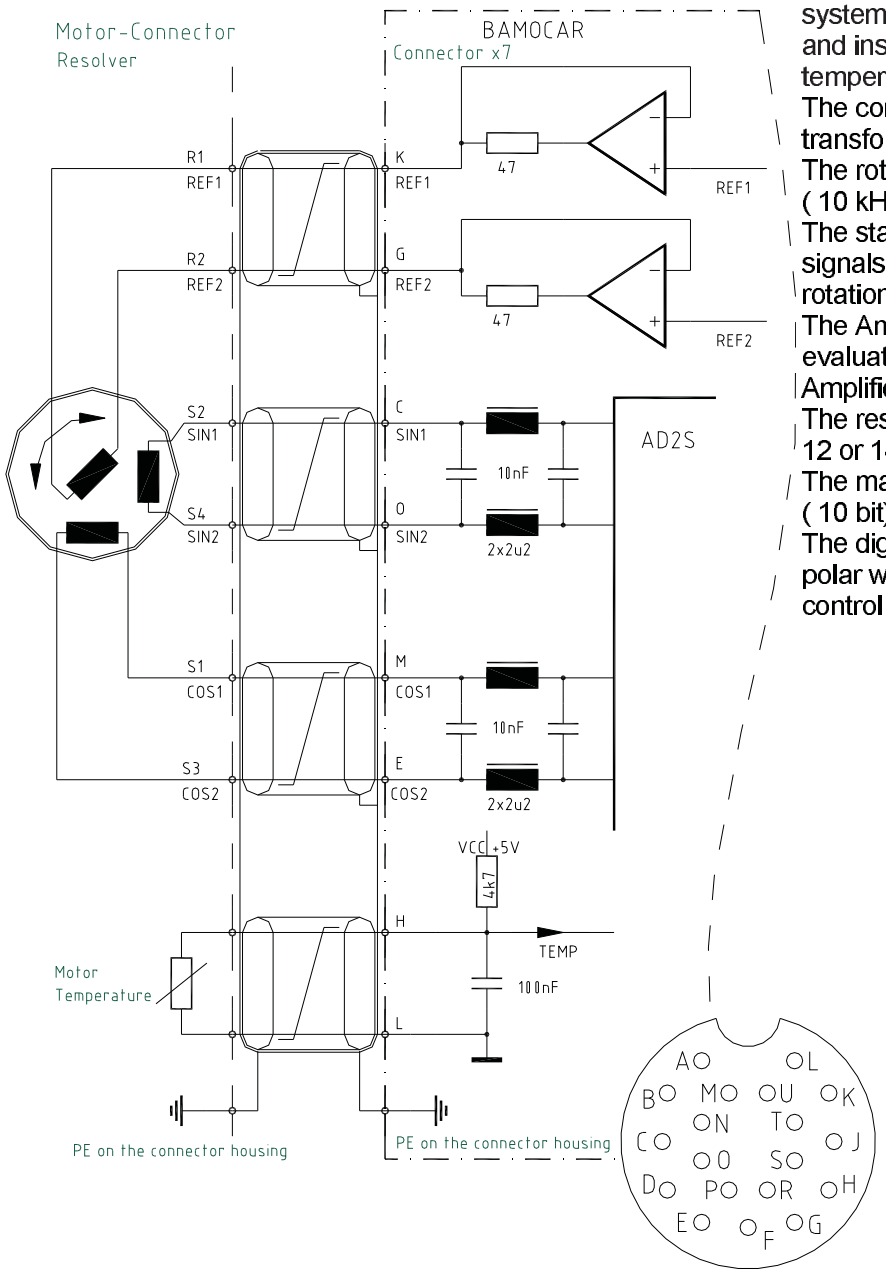
Terminating resistor at the end of the bus line > 120Ohm between the CAN-H and CAN-L

CAN-BUS connection with several BAMOCAR-D3



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

Resolver - connection.
Applicable only for BAMOCAR D3 xx-RS



The resolver is an absolute measuring system for motor rotation. It is robust and insensitive against high motor temperatures.
The construction is similar to a rotating transformer.
The rotor is fed from the reference (10 kHz)
The stator delivers the sine and cosine - signals , that are modulated from the rotational frequency .
The Amplitudes of these signals will be evaluated and digitized in the servo Amplifier.
The resolution will be optimally set to 10, 12 or 14 bits automatically.
The maximum possible rpm is 50000 (10 bit)
The digitized signals are used for the polar wheel Angle, position and speed control and for incremental outputs.

Connector X7
Resolver

A	
b	
c	sin1
d	
e	cos2
f	
g	ref2
h	temperature signal
j	
k	ref1
l	temperature gnd
m	cos1
n	
o	sin2
p	

Use only UNITEK approved motors (Appendix A)with 2, 4, 6 or 8 pole resolver
Follow motor specific connection chart (RS)

Connector x7 : 19 pole round connector

Connecting cable : 4 x 2 core twisted pair and screened, plus total shield.
In case of drag chain use only suitable cable.

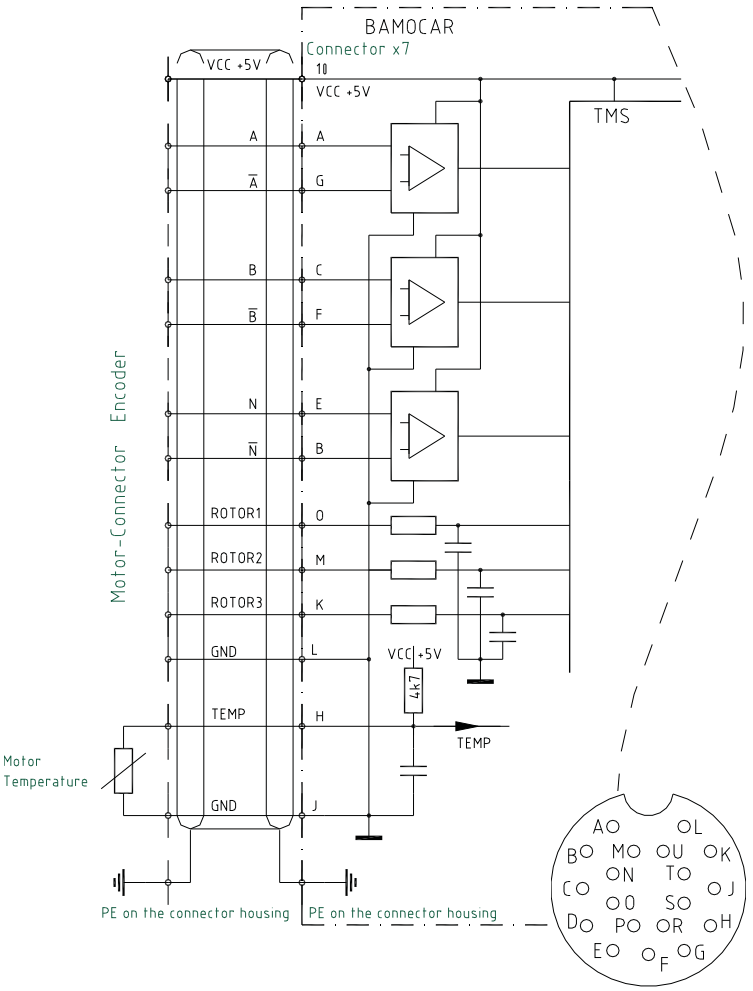
Cable length: In case of length > 25 m, use only high quality resolver cable with better screen properties .

Screen connection At connector x7, connect all screens together with the casing .
At the motor connector , connect the total shield with the connector housing.

Individual parameter refer software manual DS NDrive.

Encoder TTL Anschluß

only BAMOCAR-D3-IN



TTL encoder with 2 counter channels and one zero channel plus 3 rotor position channels . Counters with or without push-pull output.
In case of simple connection a, b, n , do not use the negated inputs.

Counter input complies with rs 485 maximum counter frequency 500 kHz.

The encoder is galvanically connected to the equipment earth (GND) .
Supply voltage is fed by the servo.

Connector X7
ENC-TTL

a	**canal a**
b	**canal /n**
c	**canal b**
d	**voltage +5v**
e	**canal n**
f	**canal /b**
g	**canal /a**
h	**temp signal**
j	**temp gnd**
k	**rotor 3**
l	**gnd**
m	**rotor2**
n	
o	**rotor1**
p	

To be used only with UNITEK approved motors (Appendix A) with ttl encoder and rotor position tracks.
observe motor specific connection chart (IN) .

Connector: X7 19 pole round connector

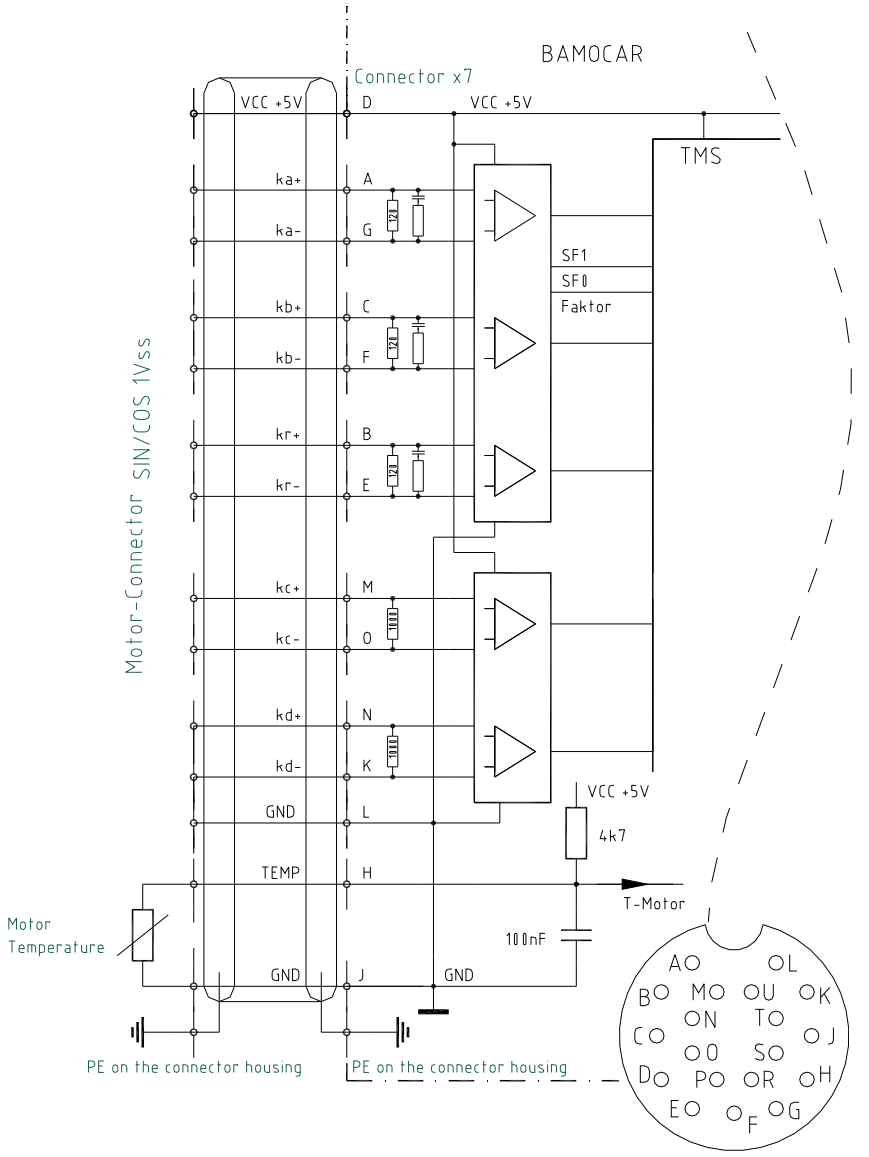
Connecting cable : 10 signal wires screened , minimum cross section 0.14mm
2 power supply wires , minimum cross section 0.5mm

In case of drag chain , use only suitable cables.
Cable length : one level more in case of cross section greater than 25m .

Screen connection : At connector X7, connect screen with connector casing

Individual parameter refer software manual DS NDrive.

SIN / COS 1Vss Anschluss
only BAMOCAR-D3-xx-SC



SIN COS 1Vss connection
only in case of
BAMOCAR-D3–xx-SC

Encoder with 2 analog sinusoidal counter track and a track zero plus two commutation tracks.
Differential signals 1 Vss signal difference
Maximum counter frequency 500 khz.
The encoder is galvanically connected to equipment ground (GND).
Servo feeds the supply voltage 5V

Optimum resolution will be automatically selected.

Connector X7
SIN/COS

a	canal ka+
b	canal kr+
c	canal kb+
d	voltage +5v
e	canal kr+
f	canal kb-
g	canal ka-
h	temp signal
j	temp gnd
k	canal kd-
l	voltage gnd
m	canal kc+
n	canal kd+
o	canal kc-

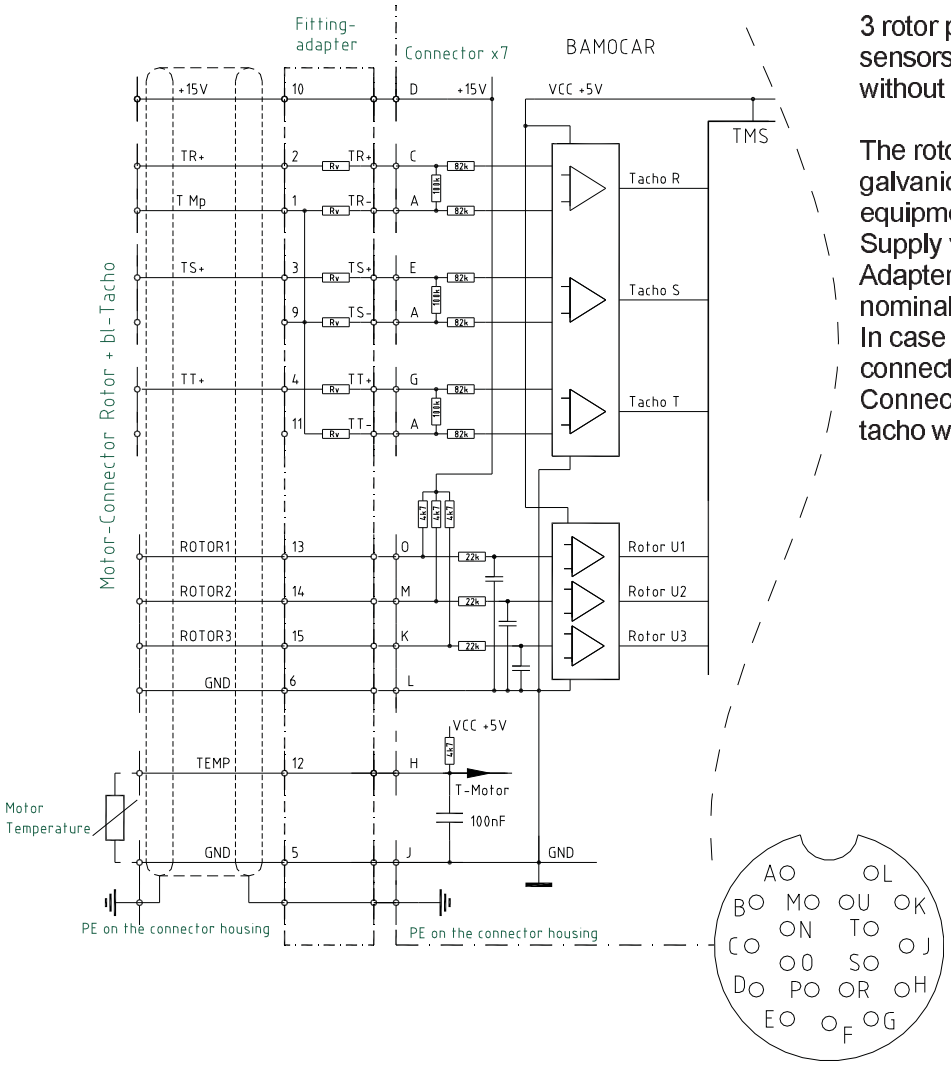
Use only UNITEK approved motors (Appendix A) with sin/ cos sensor (SC).
observe motor specific connection chart (SC)

Connection terminal X 7	19 pole round connector
Connecting cable	4 x core signal cable , drill –screened
	Minimum cross section 0.14mm
	2 core signal screened cable minimum cross section 0.14 mm
	4 core power supply cables, temperature minimum cross section 0.5 mm
Cable type :	(4x(2x0.14)+(4x0.14)c+4x0.5)c
	Use appropriate cable in case of drag chain.
Cable length	in case of length > 25m, cross section one step higher.
Screen connection	At connector X 7 connect screen with the connector
casing.	
	At motor connector connect screen with connector casing.

Individual parameter refer software manual DS NDrive.

Rotor sensor Anschluss with bl-tacho

only BAMOCAR-D3- xx-bl



Rotor position indicator connection with bl-tacho
only in case of
BAMOCAR-D3 xx-bl

3 rotor position sensor signals (hall sensors) for commutation. With or without brushless tacho generator.

The rotor position sensor is galvanically connected with the equipment ground (gnd).
Supply voltage 15 v is from servo. Adapter , when tacho voltage at nominal rpm is more than 10 volts .
In case of low tacho-voltages connect x7: pin 1,9 and 11.
Connect the centre point of the tacho with x7:1

Connector X7
bl

a	mp-tacho
b	
c	tacho 1
d	voltage +15v
e	tacho 2
f	
g	tacho 3
h	temp signal
j	temp gnd
k	rotor 3
l	versorgung gnd
m	rotor2
n	
o	rotor 1
p	

To be used only with motors approved by UNITEK (Appendix A) with rotor position sensor (bl).

Observe the motor-specific connection chart (bl).

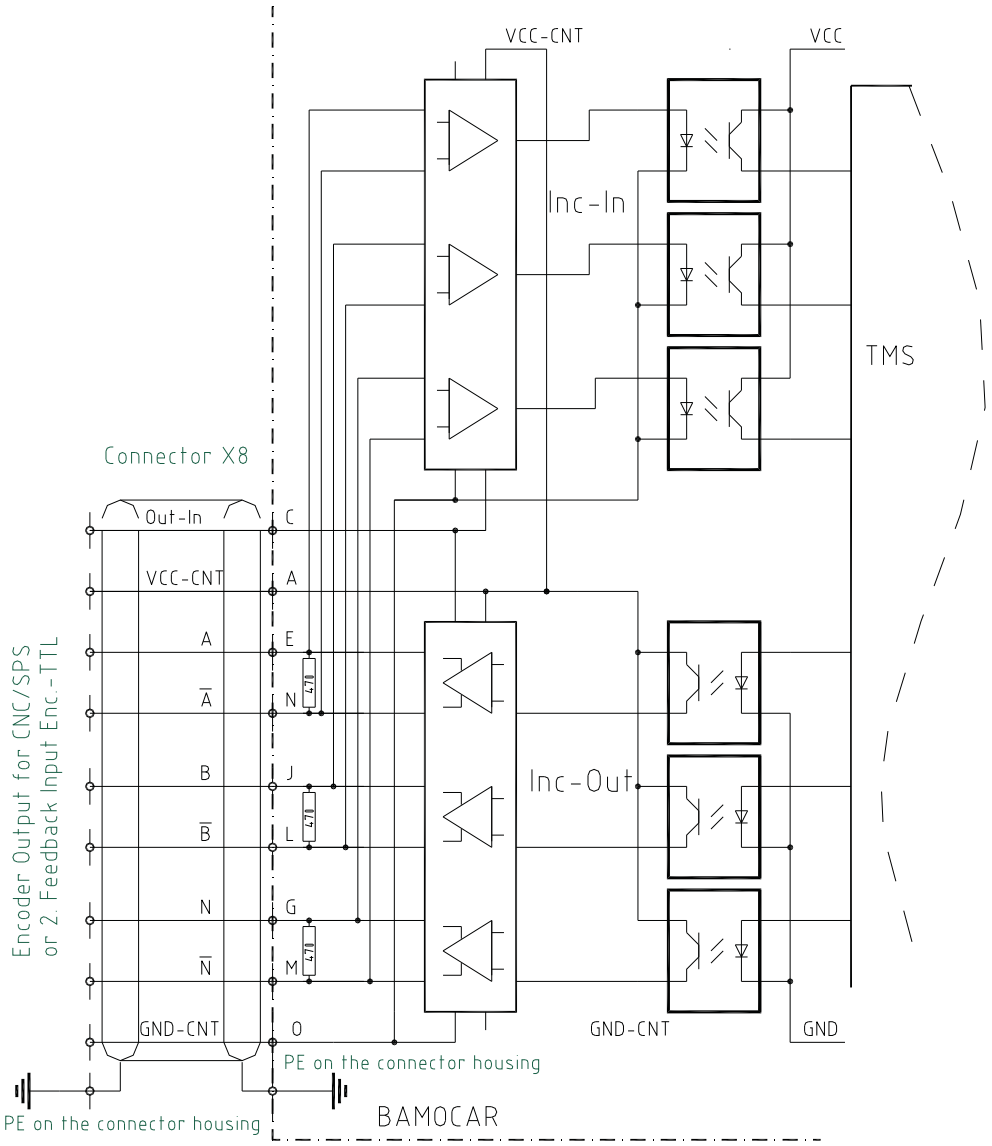
Terminal connector X7	19 pole round connector
Connecting cable	12 x signal cables , supply cables, temp Minimum cross-section 0.25 mm In case of pull chain use only suitable cable.
Cable length	In case of > 25 m diameter, one step more.
Screen connection	At connector x 7 , connect screen with the connector casing . Connect the screen with the connector casing at the motor connector end.

Individual parameters refer software manual DS NDrive.

X8 TTL- Encoder output or input (2)

The D- connector X8 will be operated as input or output(default).

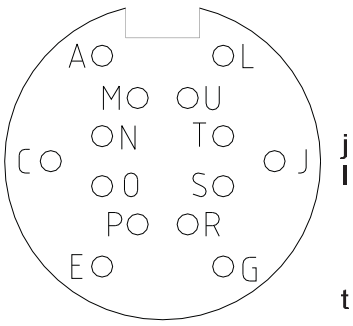
Output X8 pin c not used or connected with GND.
Input X8 pin c connected with + 5 v (x8: a)



Connector X8
Output / 2 Input
ENC-TTL

a	voltage +5v
c	selekt in
e	canal a
g	canal n
j	canal b
l	canal /b
m	canal /n
n	canal /a
o	voltage GND

output dac1



Attention X8 as input

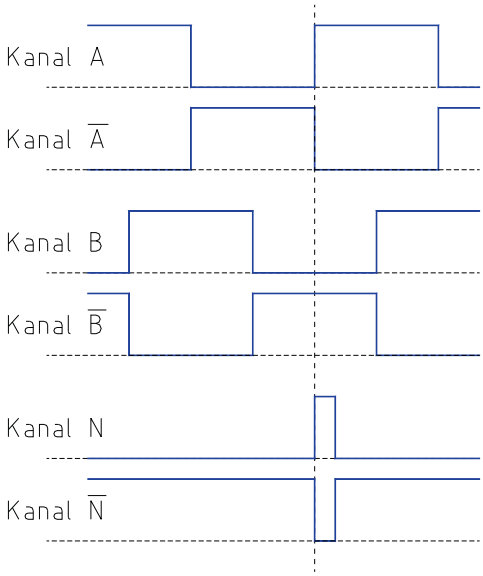
Connect x8: C (select in) with x8:A (+ 5 V) within the connector .

X8 as TTL-Encoder output
Sensor signals(feedback) from the motors will be given as ttl – encoder signals for cnc control at d connector X8.

Encoder output is potentially isolated .

Power is supplied through the senor cable from the cnc/ sps control.
Power supply + 5 V +/ - 0.2 Volts
Output signal complies with RS 485.

The resolution is programmable in case of rs and sc. (parameter 0xa4, bit 1), same as in case of in sensor – pulse rate.



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

Attention : X8 pin C (select in) must be connected to X8 pin A (+ 5V)!!

The encoder input is potentially isolated
power supply is done through the sensor cable.

Option : internal supply from servo input signals comply with RS 485

Maximum input frequency 200 kHz

Encoder input can be programmed for various functions.
Refer software description DS-NDrive.

Light indications on BAMOCAR-D3

In case of „ normal“ condition , the green 7 segment indicator and decimal points glow indicating operational condition (status- indication)

In case of „ fault“ the red led „ FAULT“ glows and the 7 segment indicator indicates the fault number.

In case of „ warning „ the red fault led blinks and the 7 segment display alternatively indicates the status and the warning number.

Status indication on servo

Display	Point/ segment	State	State of NDrive
	flashing dark	Processor active Auxiliary supply failure or internal fault in equipment	
	flashing bright dark	Start condition after reset (auxiliary voltage on/ off The first release ends the blinking condition Drive released Drive blocked (not released)	ok = 0 ok = 1 , ena = 1 ok = 1 , ena = 0
	bright	rpm = zero (indication- stand still condition)	n0 = 1
	bright	Drive rotates clock wise , n presently positive	n0 = 0
	bright	Drive rotates anti-clock wise , n presently negative	n0 = 0
	flashing bright dark	Motor current reduced to continuous current icns Motor current at current limit imax Normal operation . motor current within current limits	icns = 1 icns = 0 icns = 0
	bright for 0.1 secunds	A new command (value) has been received from BUS or RS232	

Example : Motor rotating clockwise

Point blinks = Processor active
Bottom line = Drive released
Right side line = Motor rotates clock – wise

Fault indication on BAMOCAR-D3

The red led“FAULT“ lights up and the fault number will be indicated by the green 7 segment display.

List of faults

Display at the BAMOCAR	Error message on the NDrive	Meaning	ID-address
			Ox8f
0	BADPARAS	Parameter error	bit 0
1	POWER FAULT	Output stage error	bit 1
2	RFE FAULT	Error in the safety circuit	bit 2
3	BUS TIMEOUT	Transfer error BUS	bit 3
4	FEEDBACK	Incorrect/faulty encoder signal	bit 4
5	POWERVOLTAGE	No power supply voltage	bit 5
6	MOTORTEMP	Motor temperature too high	bit 6
7	DEVICETEMP	Device temperature too high	bit 7
8	OVERVOLTAGE	Over voltage >1.8 x UN	bit 8
9	I_PEAK	Overcurrent 300%	bit 9
A	RACEAWAY	Racing (without command value, incorrect polarity)	bit 10
B	USER	User’s error choice	bit 11
C	RESERVE		bit 12
D	RESERVE		bit 13
E	CPU-ERROR	Software error	bit 14
F	BALLAST	Ballast circuitry overload	bit 15
Flashing decimal point		Active processor	
Dark decimal point		Missing auxiliary voltage or device hardware failure	

Example:

FAULT led red
Error-number 5 POWERVOLTAGE (power voltage is missing)

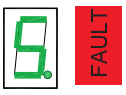
Fault –warning indications on BAMOCAR-D3

In case of „warning“, the red FAULT led blinks and the 7 segment display alternatively indicates the status and the warning number.

List warning messages

Display at the BAMOCAR	Error message on the NDrive	Meaning	ID-address
			0x8f
0			bit 16
1			bit 17
2			bit 18
3			bit 19
4			bit 20
5	POWERVOLTAGE	power voltage too low or not present	bit 21
6	MOTORTEMP	motor temperature > 87 %	bit 22
7	DEVICETEMP	equipment temperature > 87 %	bit 23
8	OVERVOLTAGE	over voltage > 1.5 x un	bit 24
9	I_PEAK	over current 200 %	bit 25
A			bit 26
B			bit 27
C	I2R	over load > 87 %	bit 28
D			bit 29
E			bit 30
F			bit 31

Example: red FAULT led flashes,
indication toggles between status and warning number.
warning number 5 POWERVOLTAGE



Measurement values

Firmware 400 onwards
DC link voltage (400V)

BOMOCAR D3-400	DC link voltage	Parameter 0xa5
maximum voltage	460V	25088
battery voltage	370V	20179
over voltage – shut down	440V	24000
charging voltage	340V	18543
without power voltage	0V	0
standardization	1	54,54

Parameter 0xa5 = 54,54 x DC link voltage

DC-link voltage (700V)

BOMOCAR D3-700	DC link voltage	Parameter 0xa5
maximum voltage	800V	29195
battery voltage	700V	19088
over voltage – shut down	750V	28462
charging voltage	680V	24813
without power voltage	0V	0
standardization	1	36,49

parameter 0xa5 = 36,49 x DC link voltage

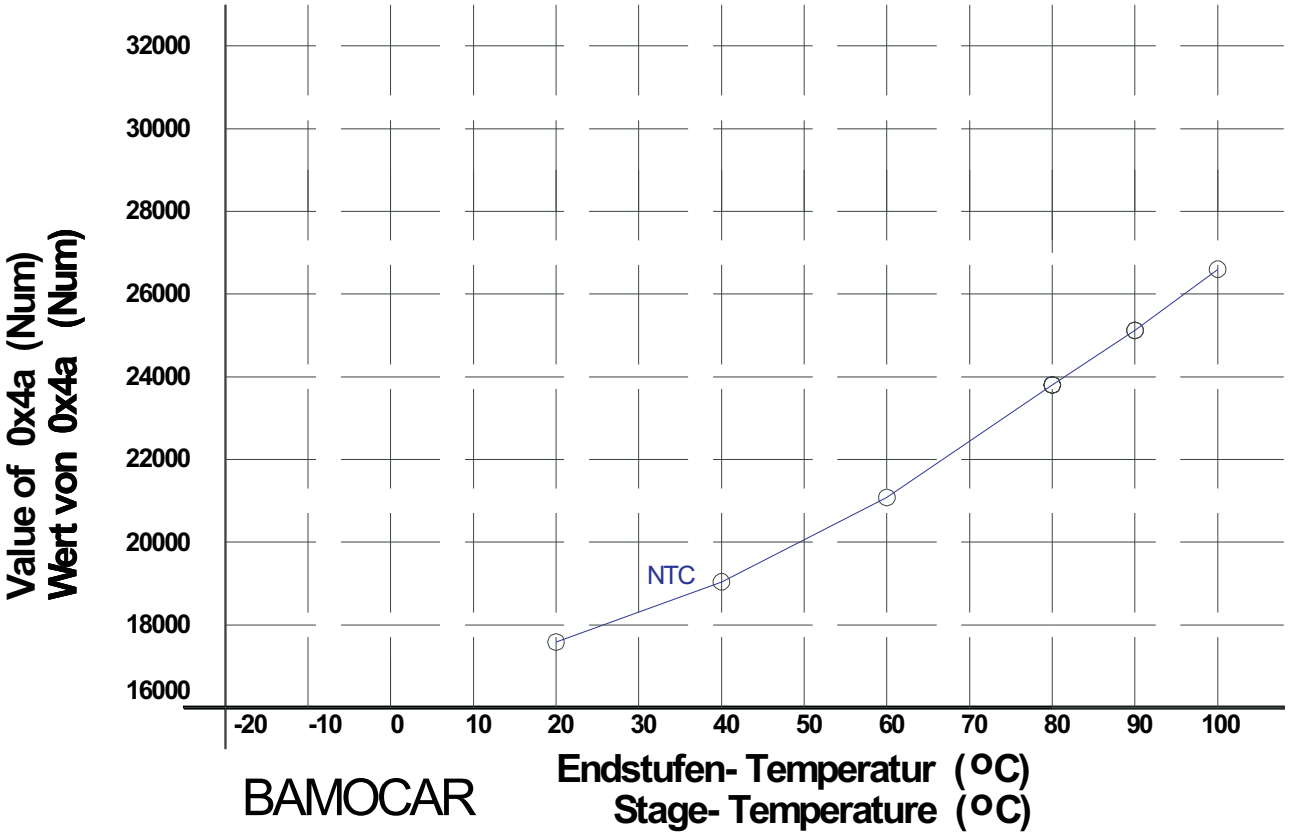
Current actual

BAMOCAR-D3	I-100%	Calibration rated current i-device			Peak current dc blocked	
maximum value +/- 11bit	mv	num	Aeff	Aa=	num	Aa=
400 (700) -250/150	520	420	150	210	608	300
400 (700) -400/250	785	700	250	350	910	450

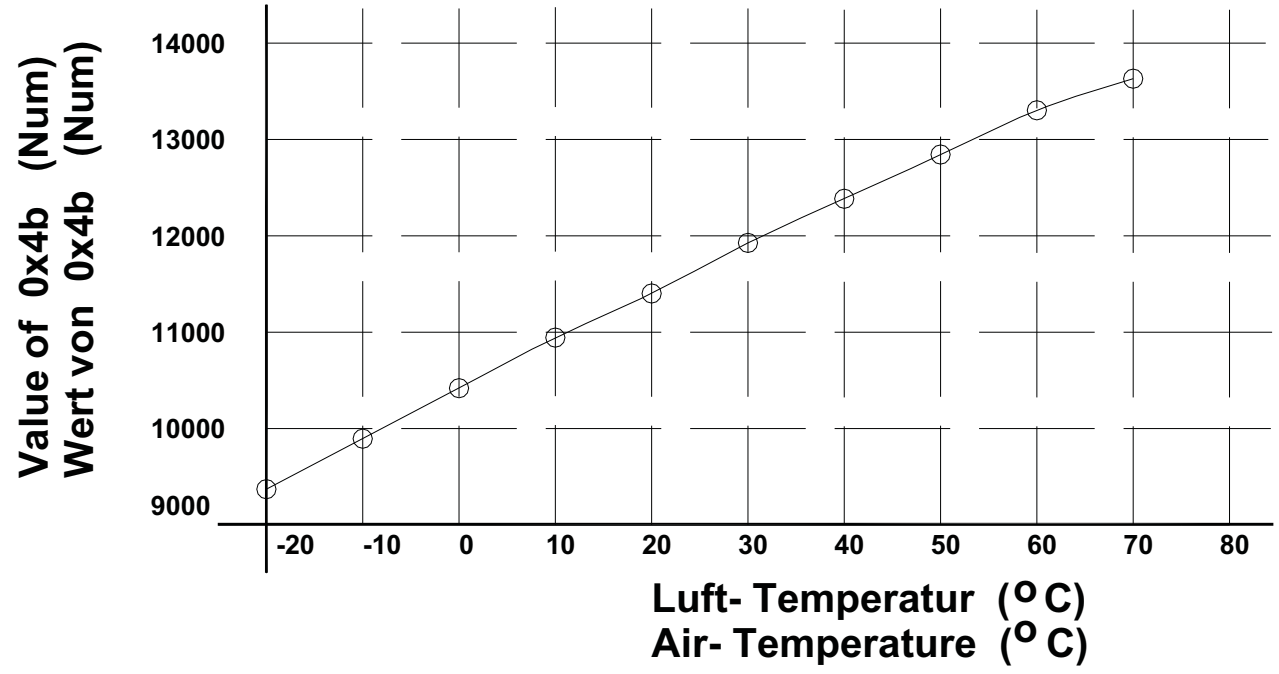
Basic reference values are stored in the parameter set.

Stage-temperature

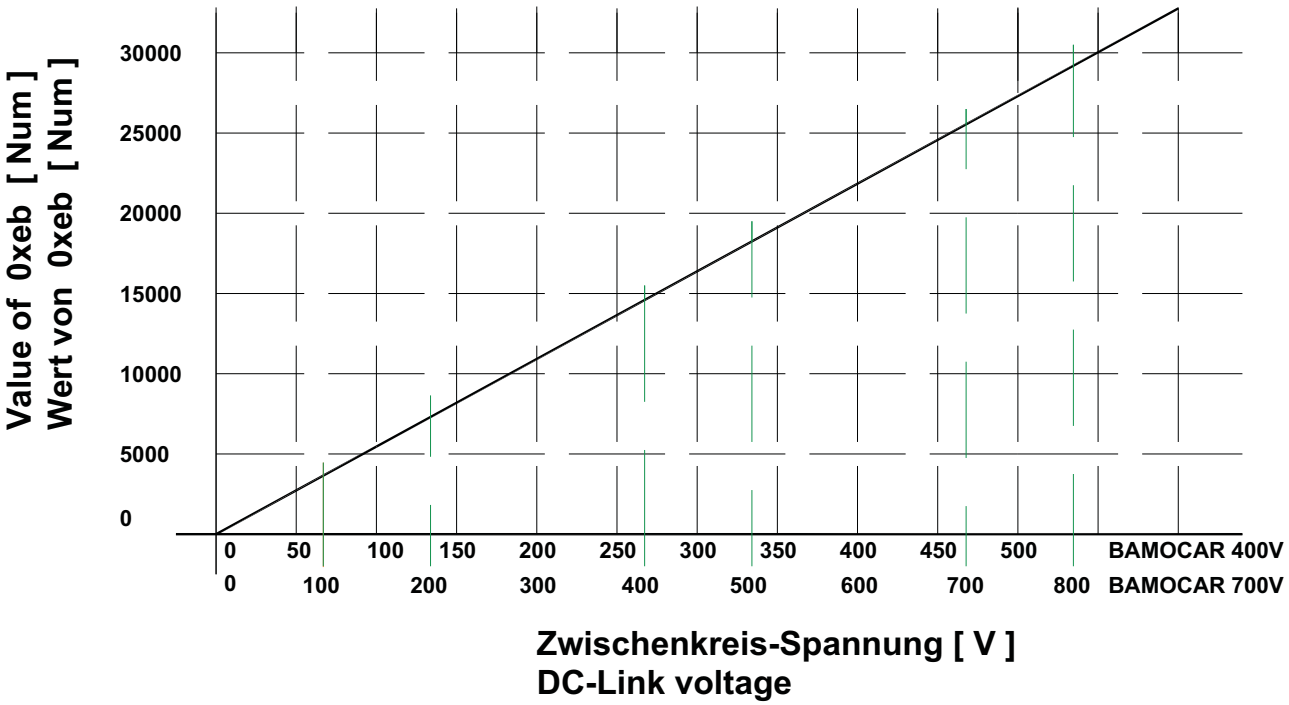
IGBT temperature	parameter 0x4a
maximal +83	24000 (FW>400)



Air-temperature



DC-Link voltage



Settings for BAMOCAR 400/400

DC-BUS max (0xa5H)	for max voltage	440V = 23670 = 72%
	for max voltage	400V = 21520 = 66%
DC-BUS min (0xa5L)	for undervoltage	320V = 17210 = 52%
	for undervoltage	270V = 14530 = 44%

Settings for BAMOCAR 700/400

DC-BUS max (0xa5H)	for max voltage	750V = 27367 = 83%
	for max voltage	700V = 25541 = 78%
DC-BUS min (0xa5L)	for undervoltage	600V = 20694= 63%
	for undervoltage	500V = 17245= 52%

Guarentee
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He guarantee period begins from the date of equipment delivery and extends up to two years.

UNITEK does not guarantee suitability of the equipment for any kind of special applications.

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