BAMO A3

MANUAL

Battery- Motor-Controller

BAMO A3-x-25-40A

for AC-Synchro-Servo-Motors

brushless DC-motors

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Version
0305-2

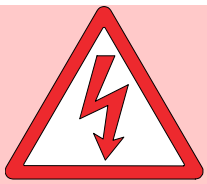
Contens

Contens

Electronic devices always involve the risk of failure.

Caution Direct Voltage

DC 60V



This manual has to be read carefully and must be understood by experts before installing or starting the device.
If there are any doubts call your trader or the manufacturer.

The BAMO series is designed to regulate electrical currents;
protection standard IP00.
Connection only to a battery or galvanic isolated direct voltage.

Standards and Guidelines:

The device and it's associated components can only be installed and switched on where the local laws and technical standards have been strictly adhered to:

EU-Guidelines	89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG
	EN60204, EN50178, EN60439-1, EN60146, EN61800-3
- IEC/UL	IEC364, IEC 664, UL508C, UL840
- VDE-regulations	VDE100, VDE110, VDE160
- TÜV-regulations	
- Regulations of Professional and Occupational bodies:	VGB4

The user has to assure that:
after
- a failure of the device
- an incorrect handling
- a failure of the control unit etc.

the drive is brought to a secure operating condition.
Machines and installations are to be provided with supervisory and safety equipment, that is independent of the device.

Adjustment
- only by qualified personnel
- adher to safety regulations

Installation work
- only when disconnected from all power lines.

QS
The devices are archived by the manufacturer with serial number and their test specifications.
CE
The EU-guide line 89/336/EWG with the Regulations EN61000-2 and EN61000-4 are observed.

General Information

The battery motor controller BAMO-A3x-xx forms together with the low voltage AC-synchro-servo-motor a propulsion unit distingushed by its high control range.
With a brushless DC-motor the current is proportional to the torque and the voltage is proportional to the speed.
Current and voltage are measured precisely.
The analogue circuits of the servo driveare simply constructed.
The speed actual value is generated from armature voltage or from the DC-tachogenerator.
The speed and the current controller are disigned as P-I-controller.
The brake energy is refeeded to the battery.

Application

for all kinds of machines or vehicles up to 2.4kW battery feeded drive power especially for
- a great controller range
- a high efficiency
- small motor dimensions
- a even and smooth travel

for speed or torque regulation or
combined speed-torque regulation with or without superposed position controller.

For use in

battery powered vehicles like cleaning machines, el. boats,
fork-lift trucks, transport systems,
Solar- or wind powered installations,
and many other battery powered machines and installations

Construction:

Cubicle-mount unit in IP23 according to the VDE- DIN- and EU- regulations.
Standard analogue regulation electronics.
Power electronics with IGBT-power semiconductors,generous dimensioning.

Characteristics:

* Battery supply or galvanicisolated direct voltage
* Differential command value inputs
* Speed and torque regulation
* Static and dynamic current limit
* Current command value output
* Enable logic, quick stop
* Mains failure braking
* Temperature control for motor and device

Technische Data

Power connection

power supply
battery voltage 12 up to 36, or 36 up to 60V =
direkt voltage bus (galvanicisolated) 12 up to 36, or 36 up to 60V =
auxiliary voltage connection 24V=

output voltage sine current max. 3x25V~ or 3x50V~
block current max. 3x25V~ or 3x50V~

Spezifications			
Device BAMO A3-xx-		**25**	**40**
Output current contin.	A=	25	40
Peek 5s	A=	50	80
El. power max.	W	1250	2400
Fuses quick internal	AF	25	40
Cooling	60%	convect	fan
	100%	fan	fan
Dimensions compact device BxHxT		see chapter 'mechanical Installation'	

Common specifications

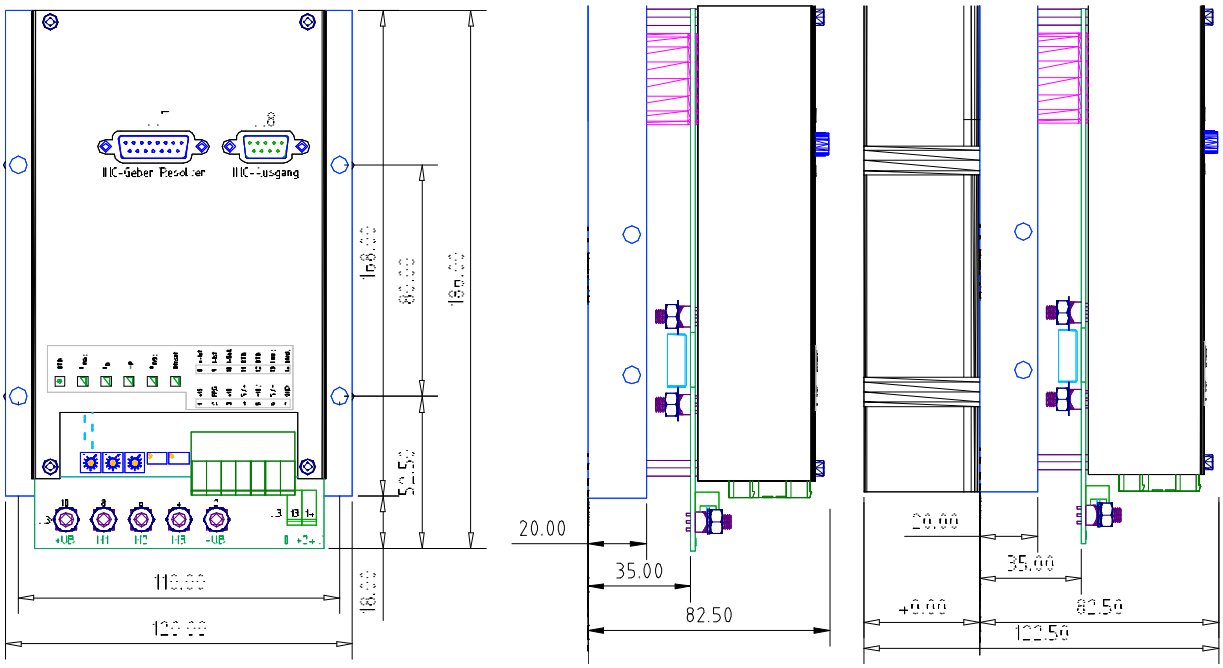
protection standard IP 23
device layout VDE 0100 group C
VDE 0160
humidity stress Klasse F nach DIN 40040
set up hight < 1000m über NN
operating range 0 ... 45°C
extended operating range bis 60°C red. 2%/ °C
bearing range -30°C bis + 80°C
speed controller
control accuracy no act.value error ± 0.5%
control range 1: 1000
temeperature observation 80°C

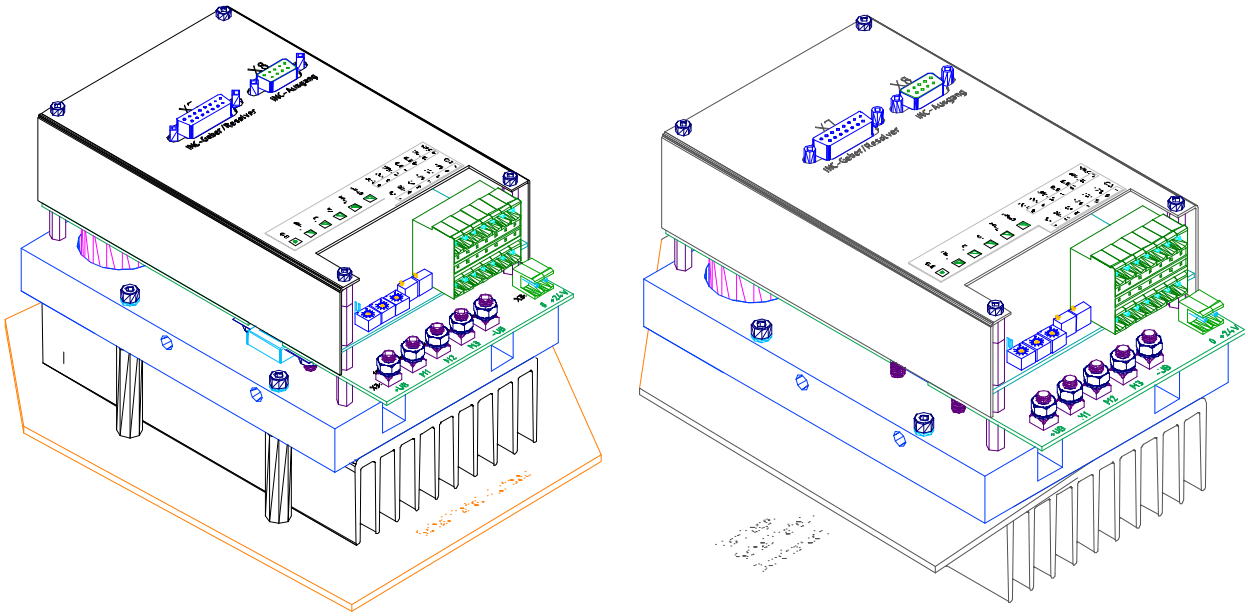
Versions		
Version	encoder signals	control range
BAMO A3-R	only rotor position	1:50
BAMO A3-bl	bl-tacho + rotor position	1:1000
BAMO A3-RS	Resolver	1:1000
BAMO A3-IN	incremental encoder	1:500

Free

Dimensions BAMO A3-x-25/40A

Building cooling block coolig block + head sink





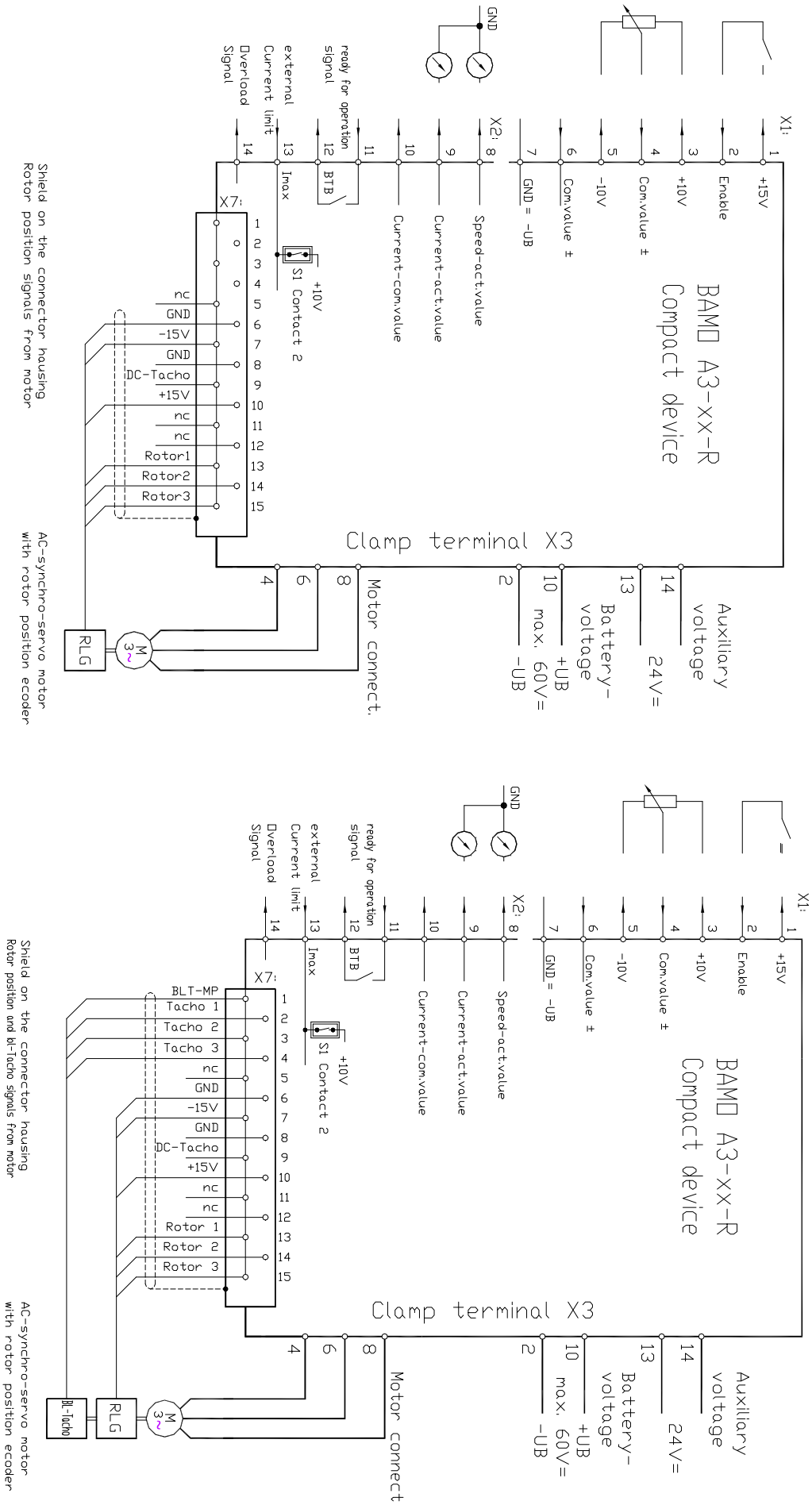
Screw: M5x70
Bolt: 10x40

Screw: M5x30

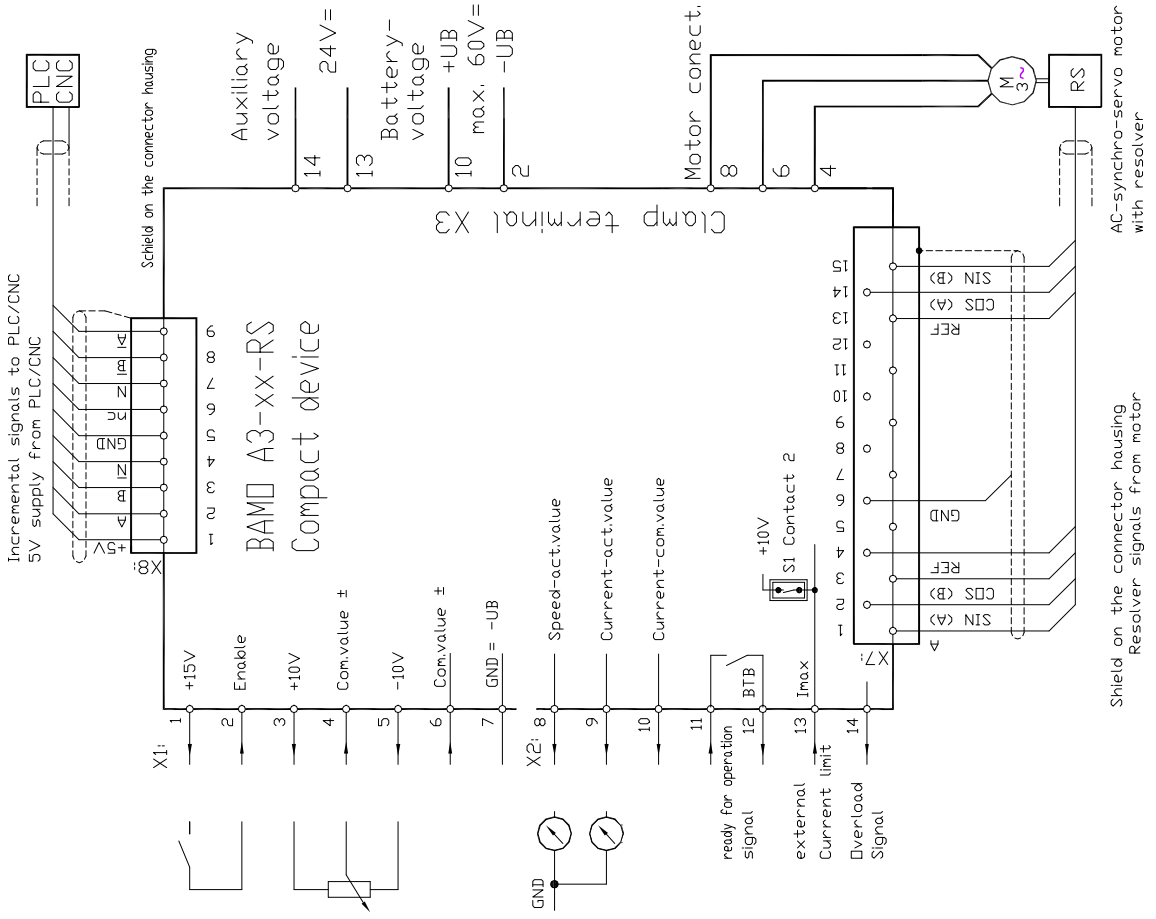
Attention:

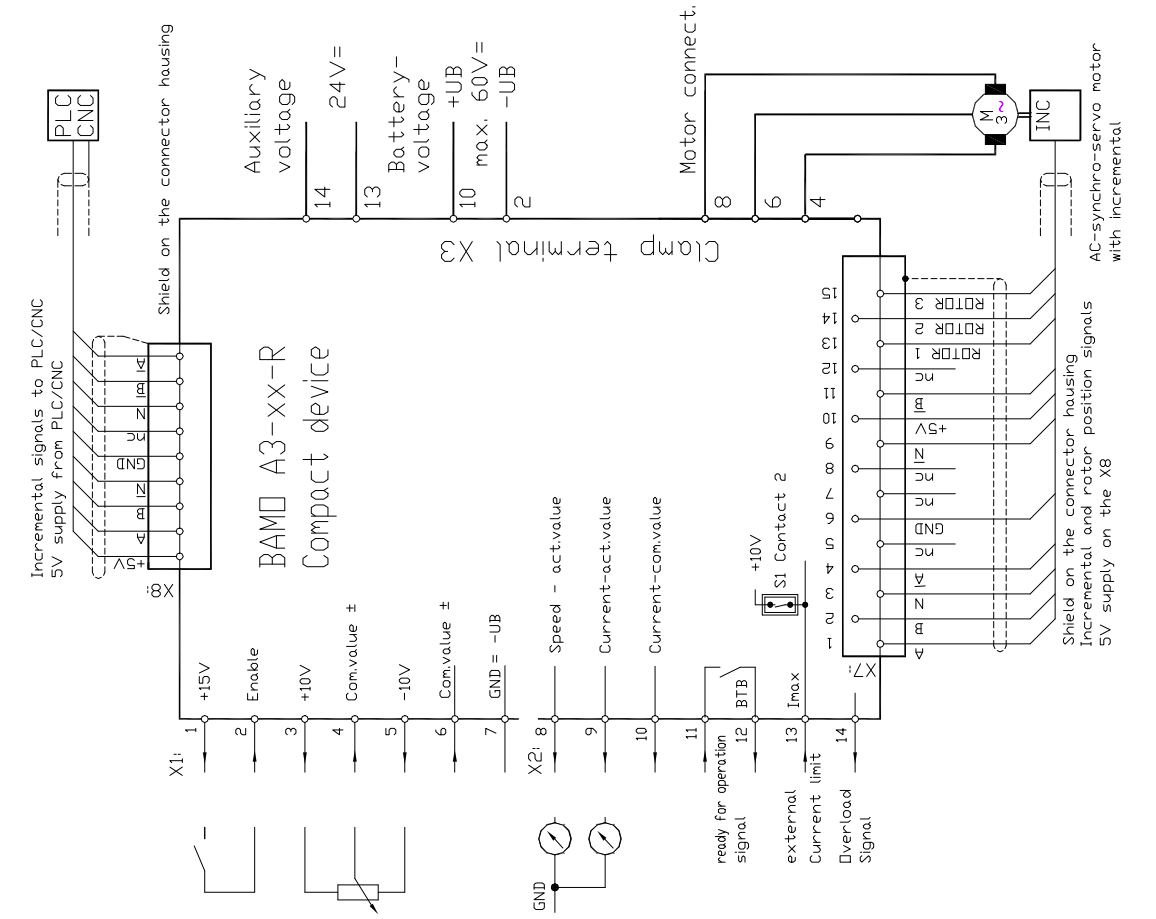
D-connector X7 and X8 >>> only for version Incremental encoder and Resolver

Connection-Overview R, bl



Connection-Overview IN, RS

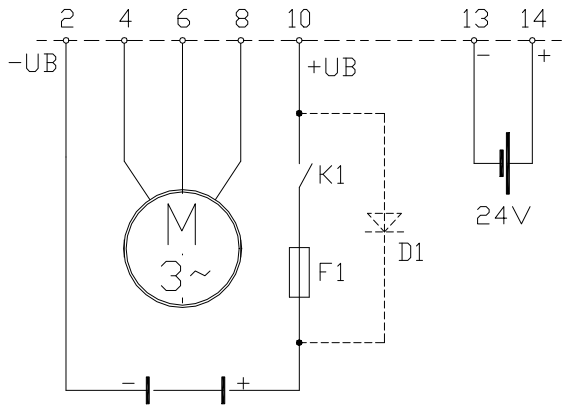




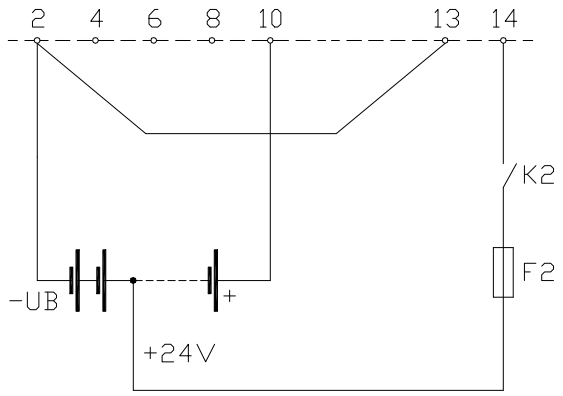
Caution:

The connection advices concerning the individual attachment of the connections to the plug numbers or terminals are binding.
All further advices to this are not binding.
The input and output lines can be altered or completed in consideration of the electrical regulations.

Notice:
- **connection and operation advices**
- **local technical regulations**
- **EU-machine regulation 89/392/EWG, 84/528/EWG, 86/663/EWG**
- **CE-advice, EMC**



Connection auxiliary voltage
at same -UB



Connection lines				
Dimensioning at			**25A**	**40A**
Battery connection	cross section minimum line fuse blow-out fuse automatic circuit braker	mm² AF A	2.5 35 35	4 50 50
Motor line	cross section minimum	mm²	2.5	4
Auxiliary Voltage Thermo Sensor, Brake	cross section minimum	mm²		

Caution :
with longer lines >>> use a one step strengther cross section!

The connecting advices are for general information and without obligation

Notice:

- Connecting- and operating instructions
- Local regulations
- EU-machine regulation
- VDE and TÜV - regulations

pin-No. terminal block
X1: 1 up to X1:7 and X2 : 8 up to X2 : 14

Signal lines

Shielded and seperated from power lines.
command values paired twisted and shielded.

Logical connections

Relay with gold contacts or reed relays. Contact current 6mA.

Enable -internal logical voltage

- internal logical voltage	X1:1	+15V/10mA
- contact chain between	X1:1 and	X1:2

Enable -external logical voltage

- enable voltage +10...+30V	X1:2
- GND	X1:7

Switch on enable

- command value and speed controller are enabled immediately.

Switch off enable

- quick stop
- command value >>> is switched internally immediately to 0
- after 2 seconds >>> speed controller is locked.

Mains failure braking

braking function
command value is set to 0V in case of mains failure
maximum braking time 150ms

generatoric refeed to the buffer circuit

command value-speed

voltage source for command values ±10V,10mA

+10V	X1:3
-10V	X1:5
GND	X1:7

command value input

- command value input maximum ± 10V=
-differential input
- input resistance 50 kΩ
- relay contacts: gold- or reed contacts

Caution
command value lines paired twisted and shielded. Screen connection one-sided.

Connection :

command value voltage with internal supply

command value	X1:4 (signal)
	X1:7 (GND)
bridge	X1:6 — X1:7

External command value voltage SPS/CNC

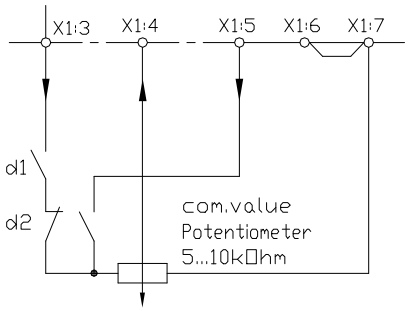
command value	X1:4 (signal)
	X1:6 (GND)

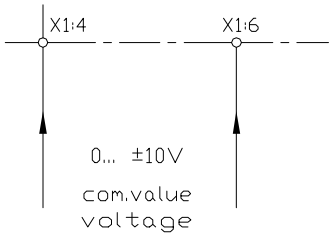
External command value current SPS/CNC

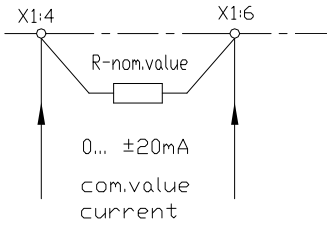
Resistance for command value current 0.. ± 20mA >>> R-command = 500Ω

command value current	X1:4 (signal)
	X1:6 (GND)

int. supply **CNC/SPS** **com.value current**







Caution:
do not use a command value current between 4 and 20mA

External current limitation

voltage source for external current limit

+10V/10mA	X1:13
GND	X1:7

Range

0...+ 5V	>>>	0 up to 100% device command current
0...+10V	>>>	0 up to 200% device command current
internal overcurrent control	>>>	max. 5s

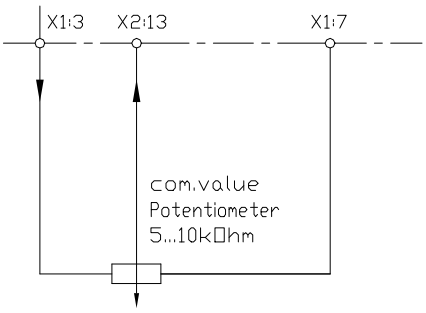
Current limit- input

maximum input voltage +10V
input resistance 10 kΩ
internal attenuation with potentiometer I_{max1}
relay contacts: gold- or reed contacts
switch S1, contact 2 = OFF

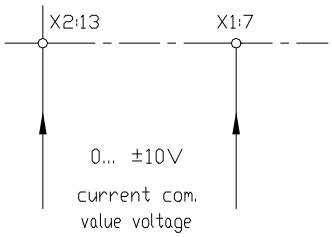
Connection

current limit	X2:13	(signal)
	X1:7	(GND)

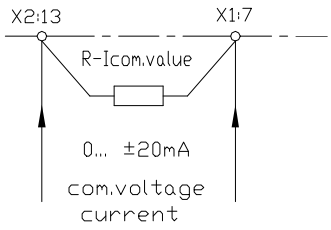
int.supply



CNC/SPS



com.value current



Caution:
in case of internal current limit adjustment

switch S1 >>> contact 2= ON

Encoder Connection BAMO A3-xx-R and BAMO A3-xx-bl

Connector X7

- D-connector15 pins
- case metallized plastic
- shielding on case

Cable

up to 10m	12x 0.14	shielded
> 10m	12x 0.25	shielded

Caution:

with BAMO **A3-xx-R** the tachometer connections pin 1 to 4 are omitted

Pin configuration

function	**colour**	**Pin-No.**
BL-tacho-Mp	grey	1
BL-tacho phase 1	yellow	2
BL-tacho phase 2	black	3
BL-tacho phase 3	white	4
GND	blue	6
+15V	violet	10
thermo sensor	pink	6
thermo sensor	orange	12
rotor position 1	brown	13
rotor position 2	green	14
rotor position 3	red	15
additional coating with DC-tacho		
-15V	grey	7
DC-tacho signal	yellow	9
DC-tacho GND	black	8

(BL-tacho connections are omitted - pin 1 to 4)

pin 6 is double coated.
motors without thermo sensor >>> bridge pin 6 and pin 12

Caution:
notice motorspecific connection sheets. (appendix A)

Encoder connection incremental encoder BAMO A3-xx-IN

Connector X7

- D-connector15 pins
- case metallized plastic
- shielding on case

Cable

supply 2x 0.5 plus <N>signal 12x 0.14 shielded

Pin configuration

function		colour		pin-No
channel	A	grey		1
channel	B	yellow		2
channel	N(Z)	black		3
channel	/A	white		4
channel	/N(/Z)	pink		9
channel	/B	green/white		11
GND		blue	0.5	6
+5V ±0.2V 150mA		violet	0.5	10
thermo sensor		red/white		6
thermo sensor		orange		12
rotor position 1		brown		13
rotor position 2		green		14
rotor position 3		red		15

pin 6 is double coated.
motors without thermo sensor >>> bridge pin 6 and pin 12

Caution:

notice motorspecific connection sheets. (appendix B)

Connector X8 (option)

- D-connector 9 pins
- case metallized plastic
- shielding on case

function		colour	pin-No	
channel	A	grey	2	
channel	B	yellow	3	
channel	N(Z)	black	7	
channel	/A	white	9	
channel	/B	green/white	8	
channel	/N(/Z)	pink	4	
incrmental encoder supply				
+5/150mA		violet 0.5 1	1	connect allways
GND		blue 0.5	5	+5V and GND!!

Cable: supply 2x 0.5 plus signal 6x 0.14 shielded

Encoder connection Resolver BAMO A3-xx-RS

Connector X7

- D-connector15 pins
- case metallized plastic
- shielding on case

Kabel: Resolverline

3x(2x 0.25 drillt and shielded) plus 2x 0.25 <N>plus outside shielding

Pin cofiguration

Function		**colour**	**pin-No**
reference	A(R1)	white	13
reference	B(R2)	brown	4
sine	A(S1)	yellow	2
sine	B(S3)	green	15
cosinel	A(S2)	pink	14
cosinel	B(S4)	grey	3
thermo sensor			6
thermo sensor			12

pin 6 is double coated.
motors without thermo sensor >>> bridge pin 6 and pin 12

Caution:
notice motorspecific connection sheets. (appendix C)

Incremental encoder output

Connector X8 (option)

- D-connector 9 pins
- case metallized plastic
- shielding on case

Cable: shielded, until 10m 8x 0.14 over 10m 8x 0.25

Pin configuration

function		**colour**	**pin-No**
channel	A	grey	2
channel	B	yellow	3
channel	N(Z)	black	7
channel	/A	white	9
channel	/B	green/white	8
channel	/N(/Z)	pink	4
channel	/B	green/white	8
+5/50mA		violet 0.5 1	1
GND		blue 0.5	5

Ready for operation indication BTB

Relay RL1

signal contact X2:12 - X2:13
contact values max. 48V, 0.5A

The ready for operation signal (BTB) shows the CNC/SPS that the drive is ready for operation.
Switch BTB- signals of several axes in one row.

delay after switching on mains >>> max. 1s

Indication

ready for operation	LED green bright	contact closed
not ready f. operation	LED glims green	contact open
error	LED red bright	contact open

BTB turns off with

overtemperature	controller, motor	not stored
overvoltage		stored
short-circuit, line-to-earth-fault		stored
voltage error		not stored
intermediate circuit error		not stored

To reset store switch off/on enable

Caution:

Use BTB-contact always with CNC/SPS - control or with emergency-stop circuit !
Self-starting possible!
fault memory
-is not effective with all faults !

Indication blocked		
current demand	normal	overload
output X2:14	>+12V	<+2V

Analogue measuring outputs		
function	**motor current indication**	**speed- indication**
connection	X2:9 - X1:7	X2:8 - X1:7
measuring value	2.5V = rated current 5.0V = peak current unipolar positive	tacho voltage before divider bipolar
output resistance	1 kΩ	4.7 kΩ

Control Connections

Function	Clamp-number
+ 15 Volt (for enable)	X1: 1
Enable - Input (+10... +30Volt)	X1: 2
+ 10 Volt (for com.value)	X1: 3
com.value + Input	X1: 4
- 10 Volt (for com.value)	X1: 5
com.value - Input	X1: 6
GND	X1: 7
Speed-Act.value-Output	X2: 8
Current-Act.value-Output	X2: 9
Current-com.value-Output	X2: 10
BTB Contact	X2: 11
BTB Contact	X2: 12
External Current Limit-Input	X2: 13
Blocked-Output	X1: 14

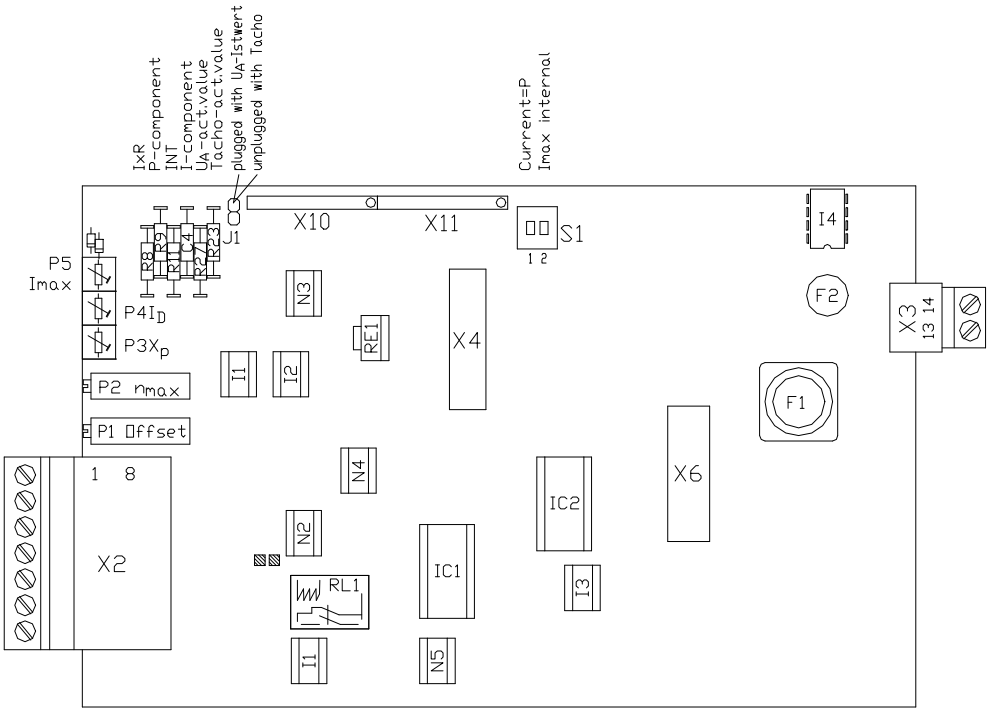
Power Connections

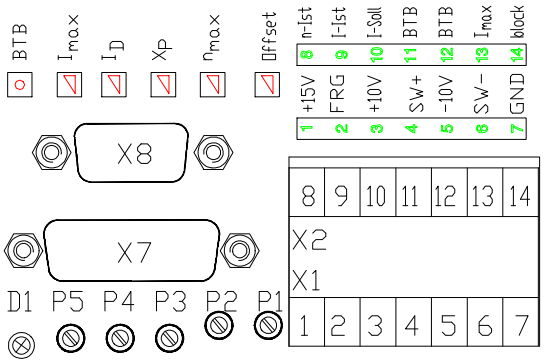
Function	bolt-number
Battery Minus	X3: 2
Motor 1	X3: 4
not coated	X3: 6
Motor 2	X3: 8
Battery Plus	X3:10
Auxiliary	X4:13
Voltage	X4:14

Encoder Connections

see page 14 to 16

Component Overview





Indications

D1	green	BTB
D2	red	fault

Poti

P5	Imax
P4	ID
P3	XP
P2	nmax
P1	Offset

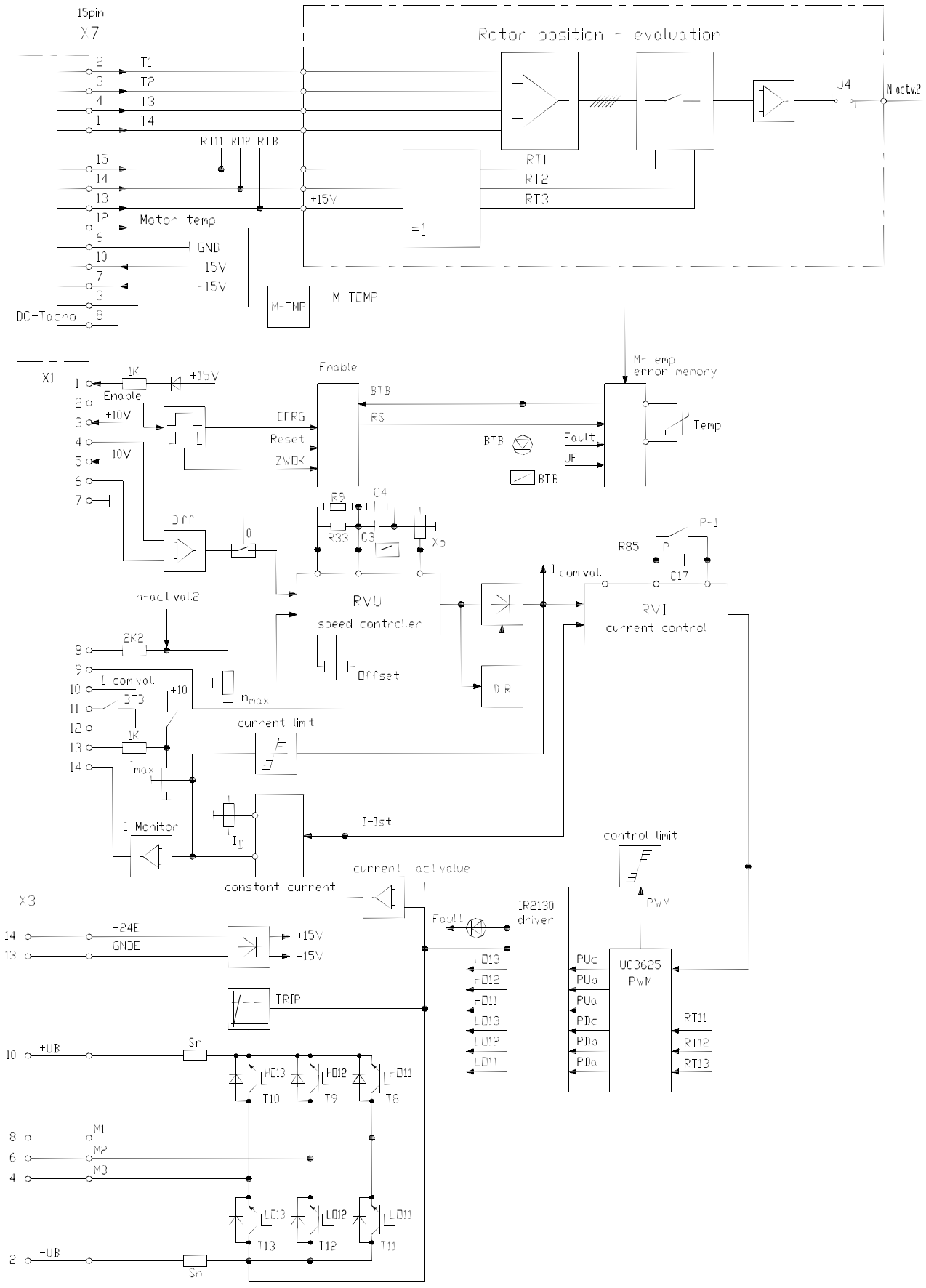
Connectors

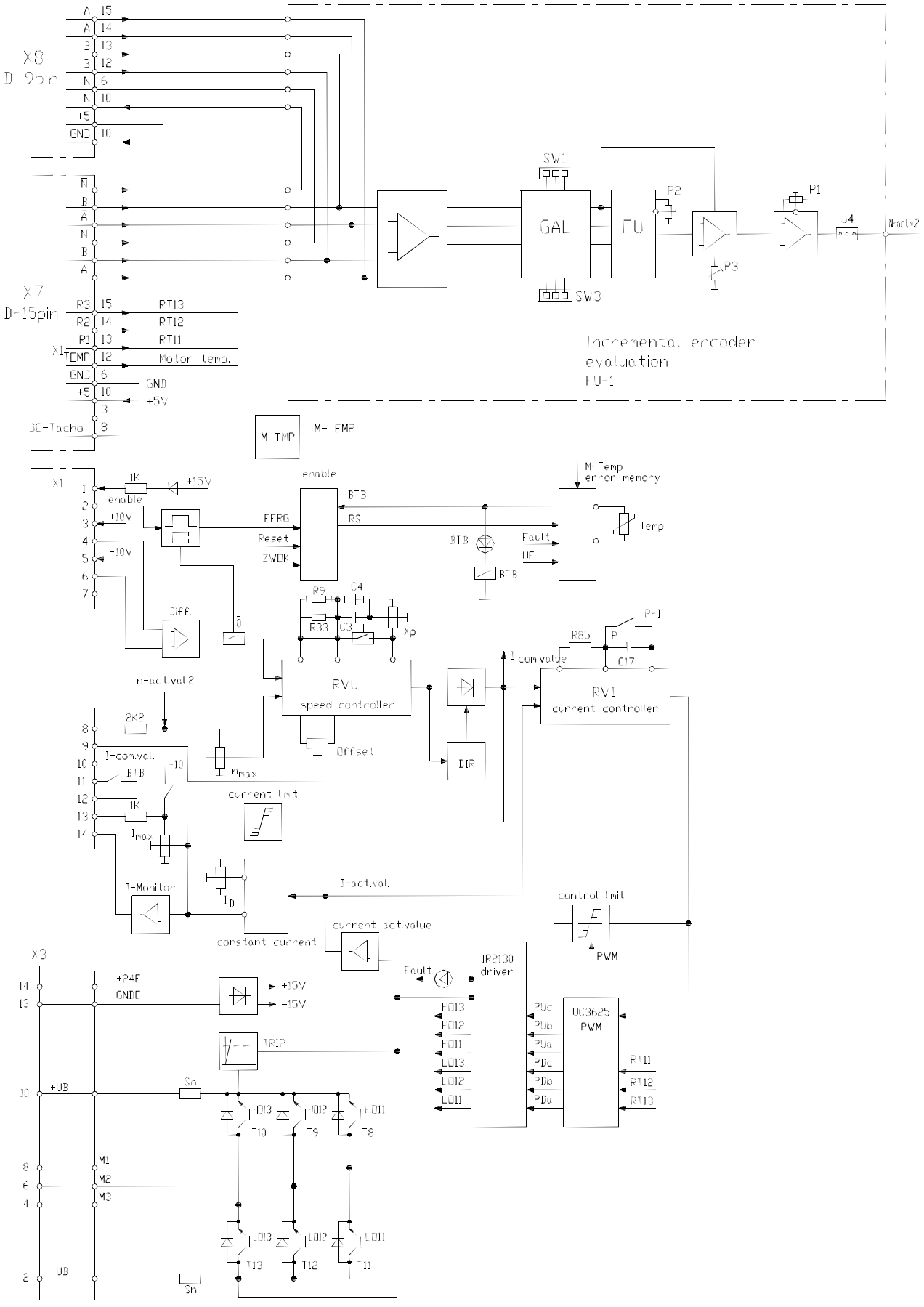
X7	Encoder-Input
X8	Inc-Output

Clamps

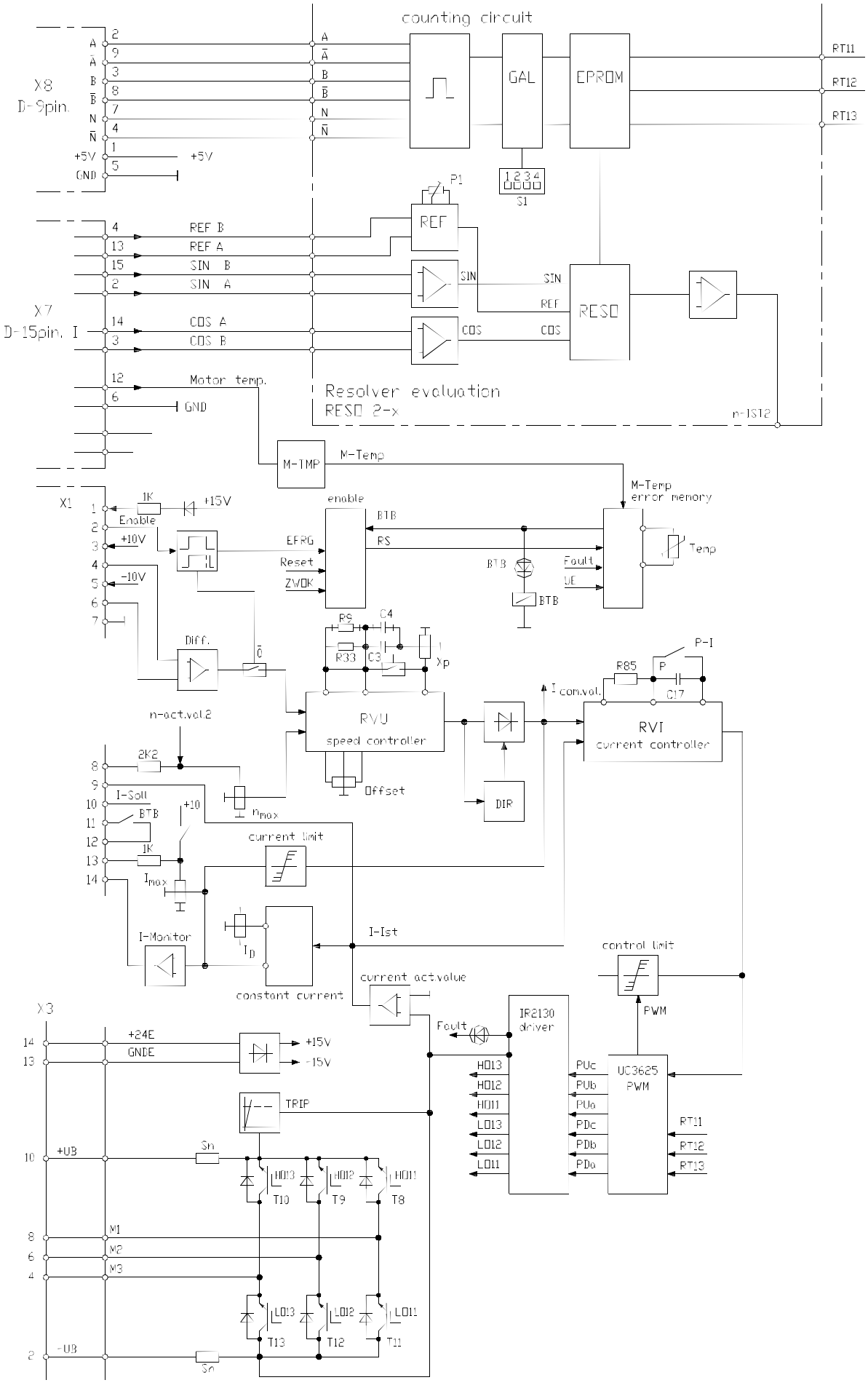
X1:1	+15V
X1:2	enable
X1:3	+10V
X1:4	com.value +(-)
X1:5	-10V
X1:6	com.value -(+)
X1:7	GND
X2:8	n-act.value
X2:9	I-act.value
X2:10	I-com.value
X2:11-12	BTB-contact
X2:13	current limit ext.
X2:14	blocked

Block Diagram R and bl




X8
D-9pin.
X7
D-15pin.
X1
A 15
Ā 14
B 13
B̄ 12
N 6
N̄ 10
+5
GND 10
R3 15 RT13
R2 14 RT12
R1 13 RT11
TEMP 12 Motor temp.
GND 6 GND
+5 10 +5V
3
DC-Tacho 8
SW1
SW3
GAL
FU
P1
P2
P3
J4
n-act.v.2
Incremental encoder
evaluation
FU-1
M-TMP
M-TEMP
M-Temp
error memory
Temp
Fault
UE
BTB
RS
enable
+15V
+10V
-10V
EFRG
Reset
ZWDK
Diff.
R32
C4
R33
C3
Xp
P-1
R85
P
C17
I-com.value
RVU
speed controller
RV1
current controller
Offset
DIR
n-act.val.2
2K2
I-com.val.
nmax
current limit
Imax
I-Monitor
ID
I-act.val.
constant current
current act.value
control limit
PWM
X3
+24E
GNDE
+15V
-15V
TRIP
+UB
-UB
Sh
M1
M2
M3
T10
T9
T8
T13
T12
T11
IR2130
driver
UC3625
PWM
HO13
HO12
HO11
LO13
LO12
LO11
PUc
PUb
PUa
PDc
PDb
PDa
RT11
RT12
RT13

Block Diagram RS



Adjustment Functions

Function	Component
Act.value balance	presetting + trimmer P2 (n_{max})
internal current limit	switch S1 >>> contact 2=ON trimmer P5 (I_{max})
external current limit	switch S1 >>> contact 2=OFF trimmer P5 (I_{max})
steady current	trimmer P4 (I_D)
Amplification P-component	resistor R9 trimmer P3 (X_P)
Amplification I-component	capacitor C100
Integrator	resistor R11
Null balance	trimmer P1 (Offset)

Switch S1			
Function	**contact**	**ON**	**OFF**
Current limit	2	internal	external
Current amplification	1	P	PI

LED-Indication		
BTB	green	LED 1
Error	red	LED 2

Signal outputs		
Function	**name**	**Clamp-number**
speed	n-act. value	X2:8
current	I-act. value	X2:9
current com.value	I-com. value	X2:10
blocked	>10V/6mA	X2:14
BTB - contakt	BTB/fault	X2:11, X2:12

Adjustment advice

adjustments
- only by qualified personnel
- adhered to safety regulations
- notice adjusting sequence

Presettings

actual value	>>>	tacho coarse adjustment R23
current limit internal/external	>>>	switch S1, contact 1
current regulator P- PI	>>>	switch S1, contact 2

Optimization

act. value adjustment	n_{max} adjustment
current regulator	switch S1 , contact 1 (default setup >> ON)
current limits	I_{max}, I_D-adjustment
speed regulator	X_P-adjustment, variable components
zero point	offset-adjustment
path-/position controller	in CNC\PLC

Caution:

control systems have to be optimized from inside to outside.
sequence: current controller >>>> speed controller >>>> position controller

Measuring values		
measuring value	**max. value**	**measuring**
command value	±10V	X1:4
speed actual value after divider	± 5V	X2:8
current act.value unipolar	+ 5V	X2:9
current com.value (regulation func.speed con.)	- 10V	X2:10

command value		
Function	**max. value**	**connection**
input signal	±10V=	X1:4
input GND		X1:6
Differential Input >>> signal- and GND-connection exchangeable External Supply >>> Bridge X1:6 and X1:7,GND connected to X1:7		

command value as current signal

com.value from external currnet source	0 bis ± 20mA
external burden resistor for com.value	0 bis max. ± 10V

com.value resistor R-Soll[Ω]=com.value voltage/com.value current(max.500Ω)

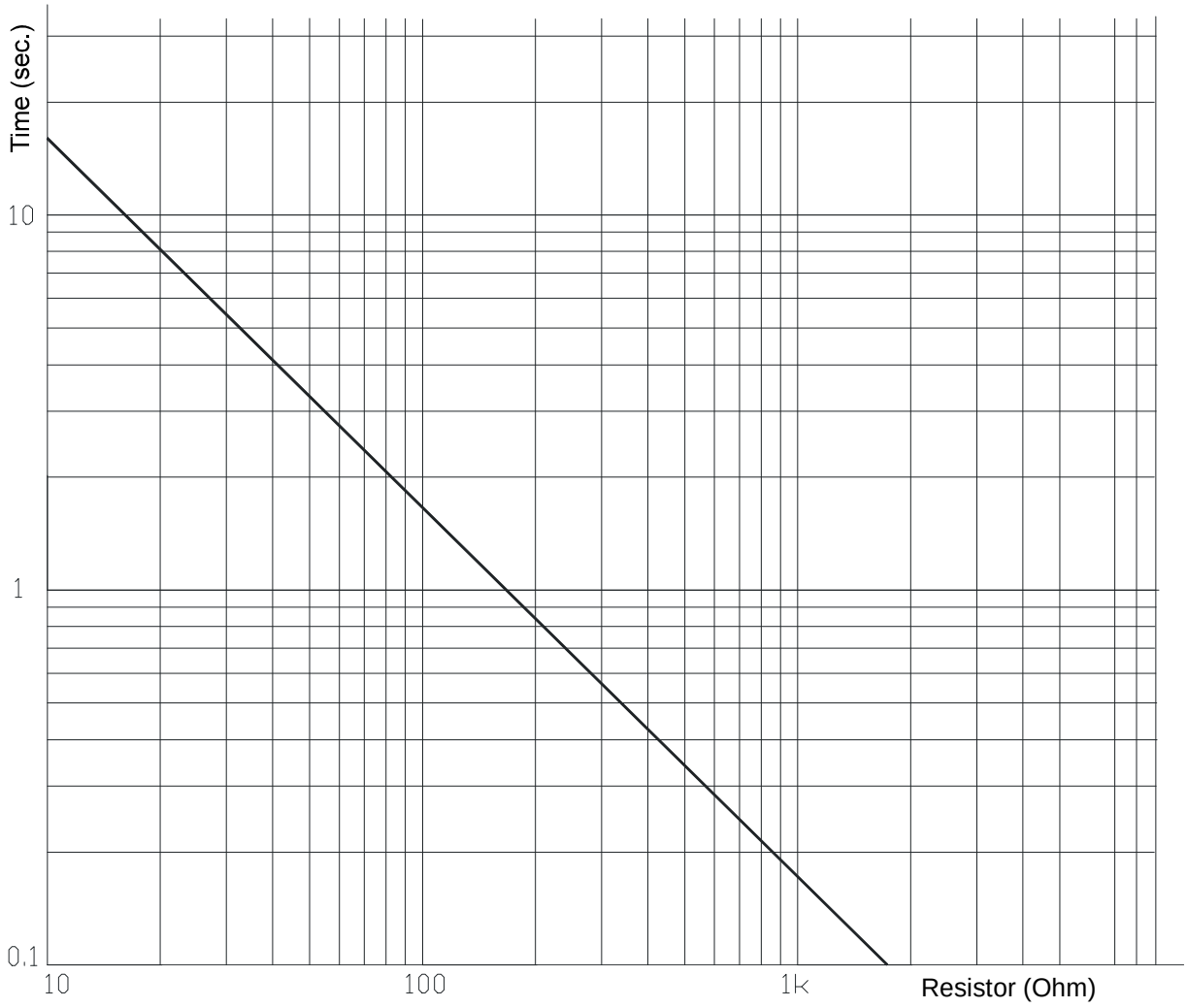
Caution !

Do not use a command value current 4 to 20mA.

Command value - Integrator

Linear - Integrator

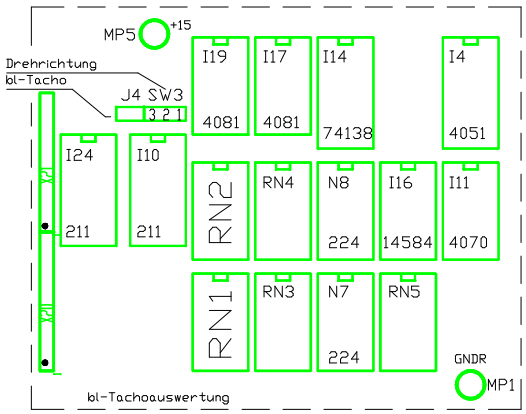
Time adjustment with resistor R11



Speed actual value from rotor position encoder Version BAMO A3-xx-R

internal actual value creation
no presetting
fine adjustment with trimmer n_{max} (P2).
rotor position and fine adjustment >>> see below

Speed actual value from BL-Tacho with rotor position encoder Version BAMO A3-xx-bl



Evaluation electronics subprint TVD-RLG-bl

Caution:
Use in any case motorspecific connection sheets.
(see appendix A)

Connection-Check

Motor running anti-clockwise (looking on motor backside according to DIN)
Only one correct pin configuration

Rotor position encoder

Signal sequence:
X7:15//X7:15+X7:14//X7:14//X7:14+X7:13//X7:13//X7:13+X7:14//

Caution : If all 3 rotor signals are >8V sind >>> encoder line is interrupted

Tachometer signal X2:8

uniform speed proportional voltage, no sawtooth voltage

Presetting

- with resistor networks RN1, RN2
- resistance [Ω] = tachometer voltage x max. speed
- default setup for 3000 min^{-1}

Fine adjustment

with trimmer n_{max} (P2)

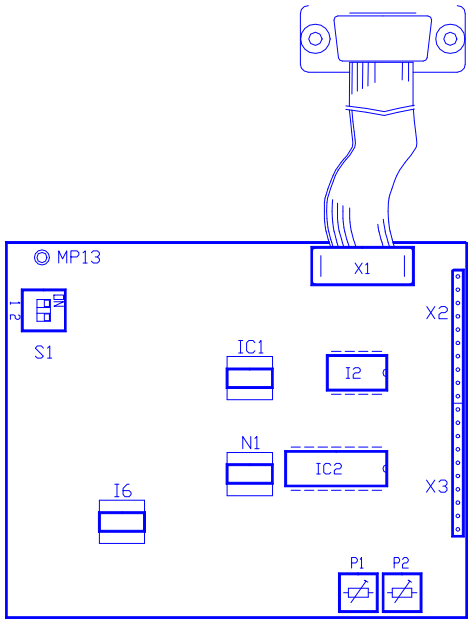
command value adjusted with trimmer:
with 1V com.value adjust to 10% of maximum speed
with 10V com.value fine adjust to100% (max. speed)

com. value from CNC\SPS:
with 0.8V com.value adjust to 10% of maximum speed

Change direction of rotation

exchange com. value connection X1:4, X1:6

Speed actual value from incremental encoder Version BAMO A3-xx-IN



Evaluation electronic subprint
FU 1-4

Caution:
Use in any case motorspecific connection sheets.
(see appendix B)

Connection-Check

Motor running anti-clockwise
(looking on motor backside according to DIN)
Only one correct pin configuration

Rotor position encoder

Signal sequence:
X7:15//X7:15+X7:14//X7:14//X7:14+x7:13//X7:13//X7:13+X7:15//

Tachometer signal X2:8
uniform speed proportional voltage, no sawtooth voltage

Adjustment range n_{max} trimmer at 10V command value

Pulser at motor pulses	switch position S1-1 on off	S1-2 on off	multiplication factor x	adjust. range1/min n_{max} trimmer stop kHz left	right	frequence
1024			4	950	1700	64 ... 116
1024			2	1900	3400	64 ... 116
1024			1	3800	7000	64 ... 116
2048			2	950	1700	64 ... 116
2048			1	1900	3500	64 ... 116

Caution:
- speed 950 and 1700 ... 1900 can only be adjusted by command value adaption!

Presetting- with jumper S1

Fine adjustment with trimmer n_{max} (P2)

command value adjusted with trimmer:
with 1V com. value adjust to 10% of maximum speed
with 10V com. value fine adjust to100% (max. speed)

com. value from CNC\SPS:
with 0.8V com.value adjust to 10% of maximum speed

Change direction of rotation

exchange com. value connection X1:4, X1:6

Speed-actual value
Version BAMO A3-xx-RS

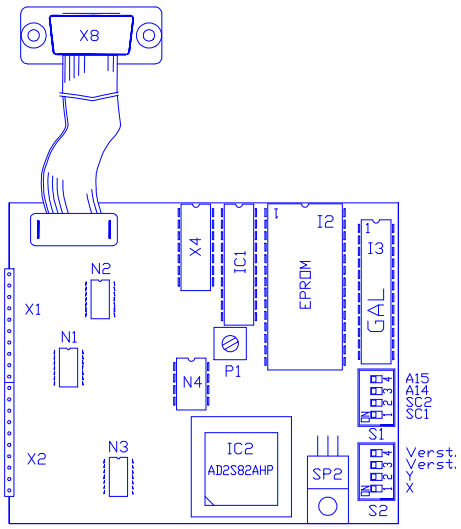
Resolver

Evaluation electronic subprint

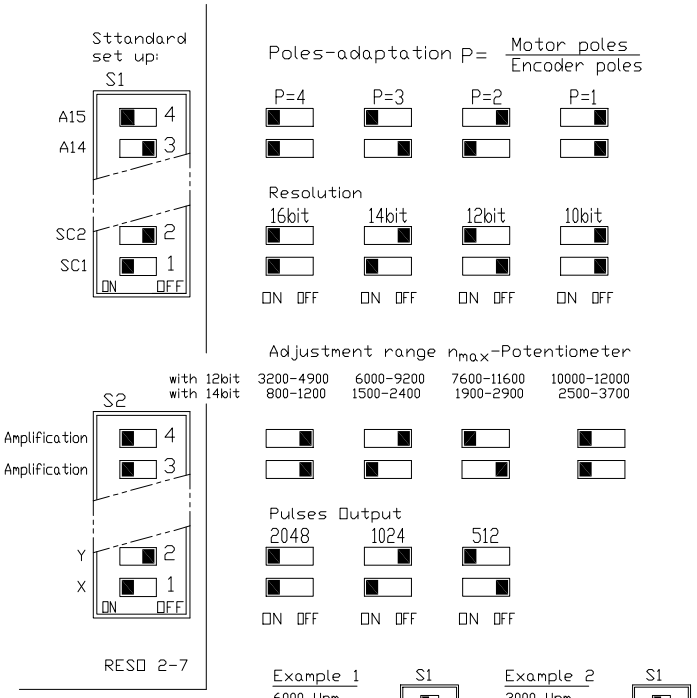
RESO2-4

Caution:
Use in any case motorspecific
connection sheets.
(see appendix C)

Presetting with resistor R19



Speed adjustment: >>>>>>>>



Resolution:

switch position RS-SW1
choose highest resolution
for example
3000Upm=14bit, R19=39kΩ

Fine adjustment with trimmer n_{max} (P2)

command value adjusted with trimmer:
with 1V com. value adjust to 10% of maximum speed
with 10V com. value fine adjust to100% (max. speed)

com. value from CNC\SPS:
with 0.8V com. value adjust to 10% of maximum speed

Change direction of rotation
exchange com. value connection X1:4, X1:6

Current limitation

peak current range 0 up to 200% command current poti I_{max} (P5)
reset time max. 5s
steady current range 5 up to 100% command current poti I_D (P4)

Internally resetting current limits		
current limit	**Function**	**limit**
overload	time	continous current
signal to an X2:14	Blocked	

The smallest current limit is effective!

Peak current				
	adjustment	**input**	**switch**	**Poti**
internal current limit (default setup)	I_{max}		S1, contact 2=ON	I_{max1} (P5)
External current limit	I_{max}	X1:9 0 ... +10V	S1, contat2=OFF	I_{max1} (P5)

The external current limit can internally be reduced with I_{max}- potentiometer.

Steady current

adjust motor protection for both torque directions on motor command current with potentiometer I_D (P4).

Measure adjustment values:

- do not connect motor
- predetermine command value and enable >>> switch off/on

measuring value current com. value X2:10 (5V= rated current)

command value	**measuring value I_{max}** (ca. 2s)	**measuring value I_D**
+5V	0 bis max.10V	0.25 bis max. 5V
- 5V	0 bis max.10V	0.25 bis max. 5V

Current actual values:

measuring value current actual value X2:9 I_{max} = 0 upto+5V
I_D = 0.12 up to+2.5V

Caution:
for exact torque control:

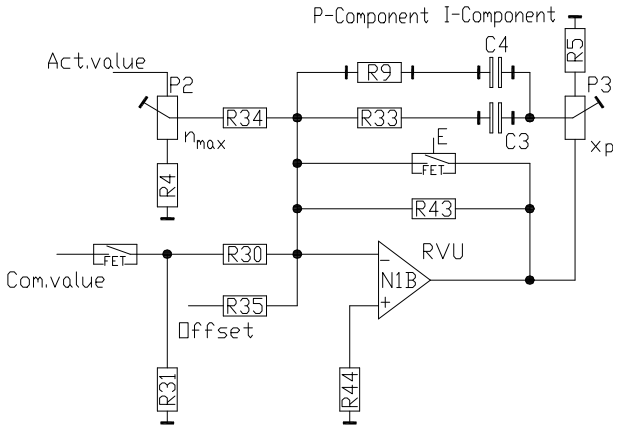
- PI-current control switching necessary
- manufacturers adjustment is P-control
- change from P- to PI-control in current controller
- switch S1, contact 1 = OFF

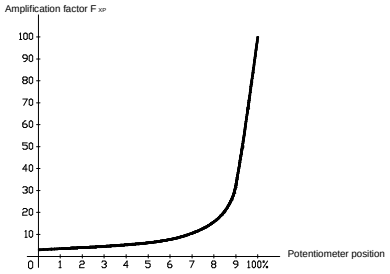
Speed Controller Switching

- variable components R9, C100
- amplification potentiometer P3 (X_P)
- in case of changing devices >>> take over adjustment values.

Default setup

- firm R,C - values 220kΩ , 22nF
- amplification potentiometer X_P to 50%
- optimal for most drives.





Adjustment without measuring instruments

connect motor

command value	= 0
X_P	= 50%
R,C	= basical values

enable drive

- turn potentiometer X_P clockwise until drive swings
- turn potentiometer X_P anticlockwise until the swinging is dying-out,
- turn X_P-potentiometer further 2 positions anticlockwise.

Drive behaviour:	
amplification too low	**amplification too high**
long oscillations 1... 0.1Hz	short oscillations 30 ... 200Hz
long overshoots	vibrates during acceleration
overruns target position	vibrates during braking and in position

Caution:
in case of operating with CNC\PLC
- in case of maximum speed
- adjust command value speed with Poti n_{max} from 8 up to 9V

Default setup

Check connections before getting started

Battery connection maximum 36 or 60V = +10%
notice type plate U_B 36V, U_B 60V, U_B 120V

Compact device

- Battery connection	max. 36 or 60V=	clamps	X3:1, X3:9,
- auxiliary voltage	24V=	clamps	X4:12, X4:13
- motor connection		clamps	X3:1, X3:2, X3:3

Notice connection advice.

Basic connections-power supply

- battery	2x power connection
- motor	2x motor connection

Basic connection-control connections

enable	contact between X1:1 and X1:2
command value	signal X1:4, GND X1:6 (differental input) with internal poti-supply bridge X1:6-X1:7
actual value	notice encoder connection sheet

Default setup for first getting started

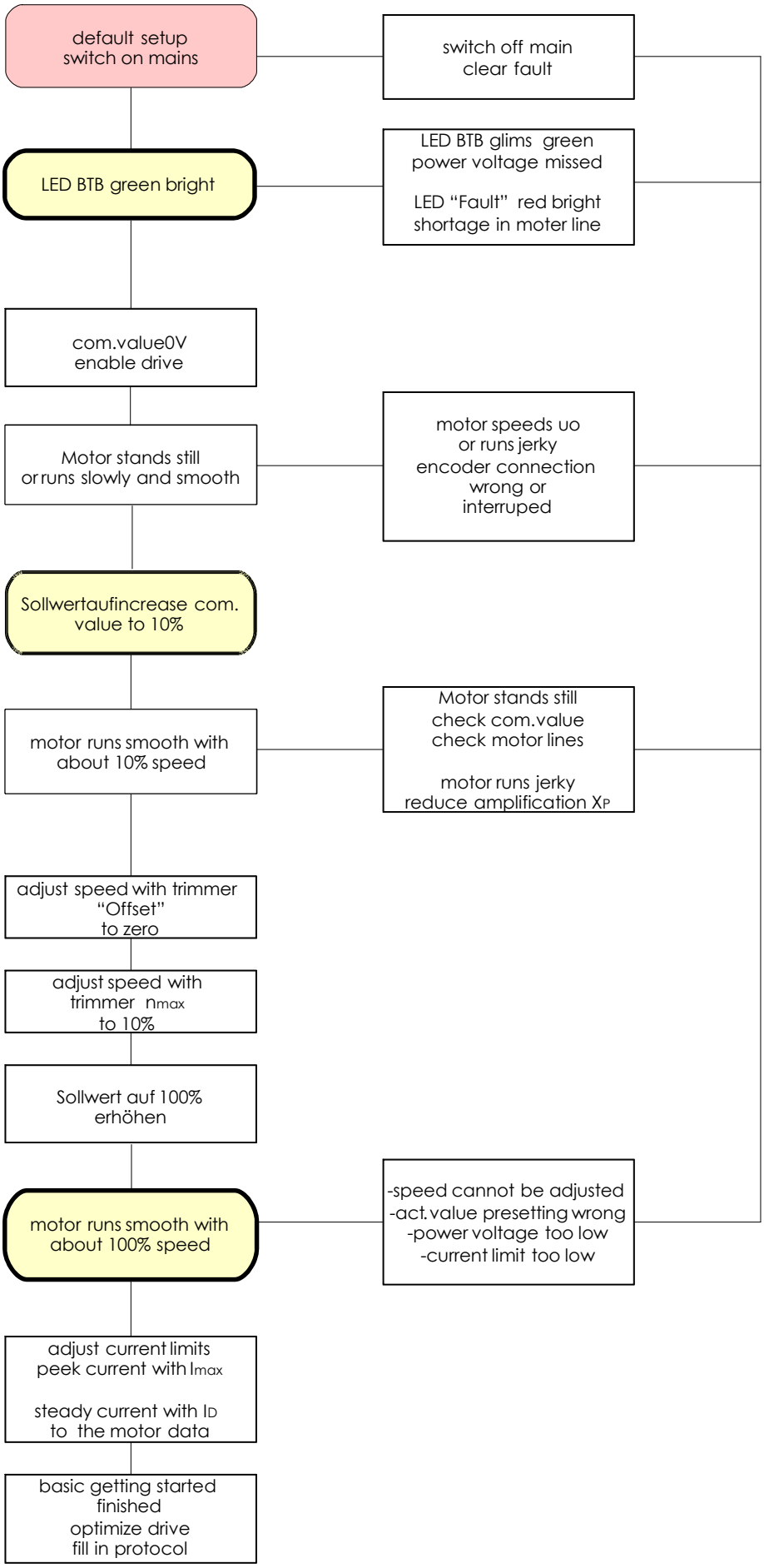
trimmer	I_{max1}	peek current	20%
trimmer	I_D	steady current	100
trimmer	X_P	amplification	50
trimmer	n_{max}	speed	anti-clockwise stop

Switch position version R, bl, RS

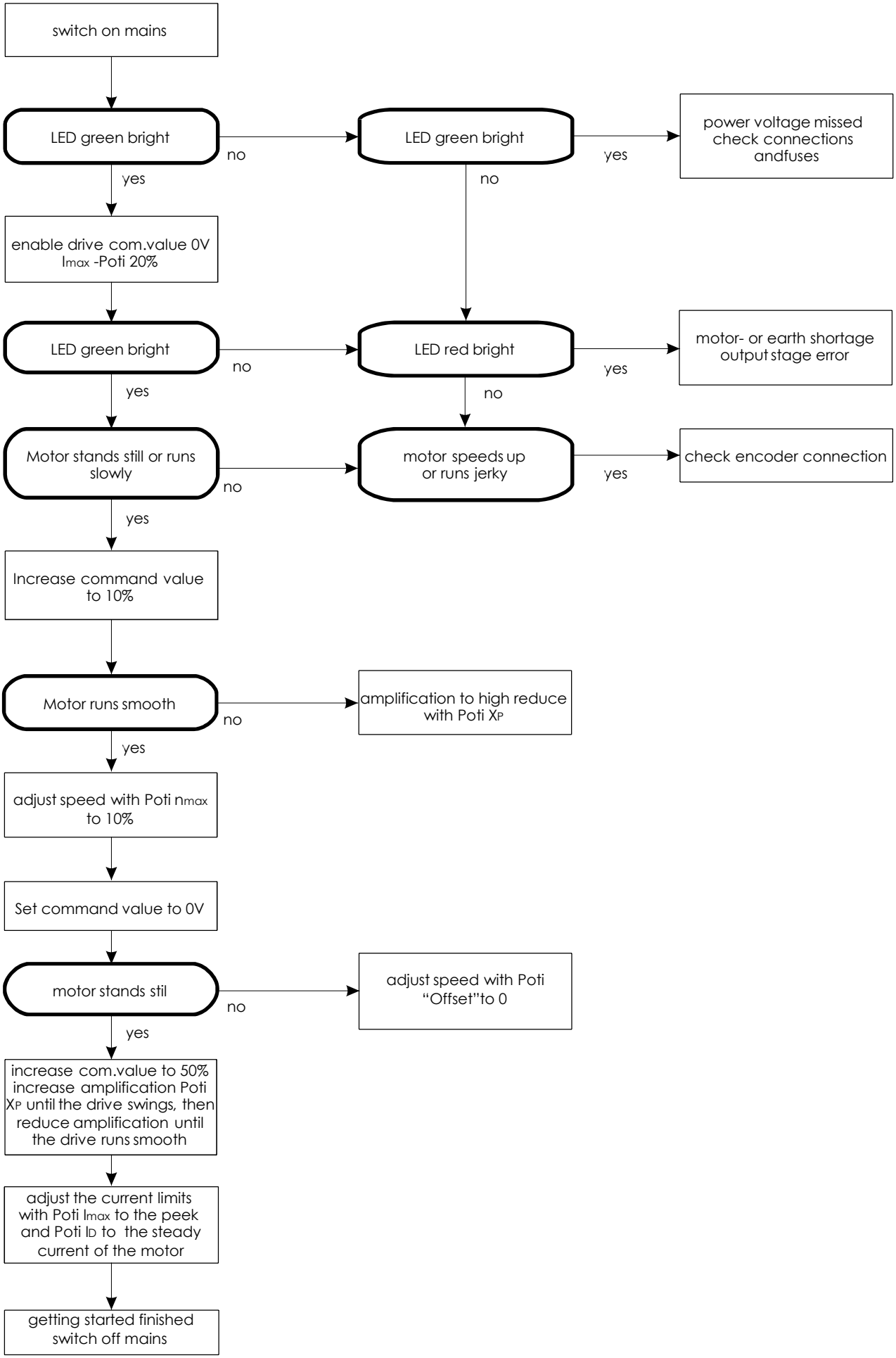
switch	S1	contact 1	= ON
		contact 2	= ON

Switch position version IN

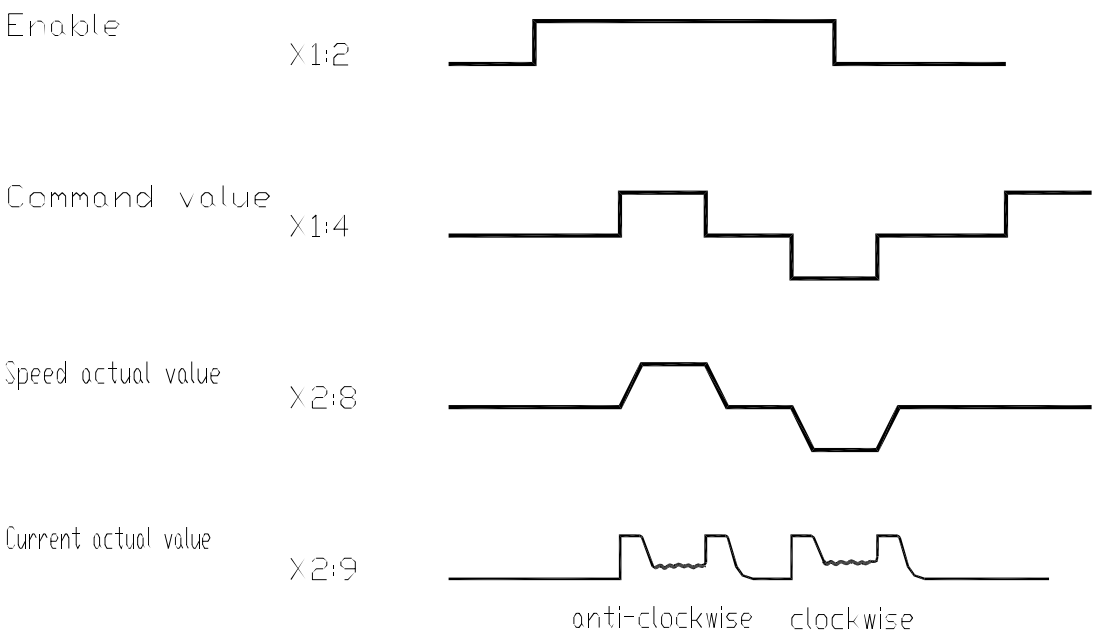
switch	S1	contact 1	= ON
		contact 2	= ON


default setup
switch on mains
switch off main
clear fault
LED BTB green bright
LED BTB glims green
power voltage missed
LED "Fault" red bright
shortage in moter line
com.value0V
enable drive
Motor stands still
or runs slowly and smooth
motor speeds uo
or runs jerky
encoder connection
wrong or
interruped
Sollwertaufincrease com.
value to 10%
motor runs smooth with
about 10% speed
Motor stands still
check com.value
check motor lines
motor runs jerky
reduce amplification XP
adjust speed with trimmer
"Offset"
to zero
adjust speed with
trimmer nmax
to 10%
Sollwert auf 100%
erhöhen
motor runs smooth with
about 100% speed
-speed cannot be adjusted
-act.value presetting wrong
-power voltage too low
-current limit too low
adjust current limits
peek current with Imax
steady current with ID
to the motor data
basic getting started
finished
optimize drive
fill in protocol

Faults	
Fault	**Causes**
LED bright red	Short in motor connection Output stage fault Overvoltage Motor contacts are missing or defective
Motor stands still no torque	Enable missed Current limit I_{max} anti-clockwise stop Motor connection interruped
Motor speeds up or runs jerky	Encoder connection wrong
Motor runs jerky	Amplification X_P too high. command value faults
Drive switches to fault LED red bright	Overtemperature, phase- or earth-short. BTB-fault Output stage fault
Speed can't be adjusted with poti n_{max}	actual value presetting on evaluation electronic wrong


switch on mains
LED green bright
no
LED green bright
yes
power voltage missed
check connections
andfuses
yes
no
enable drive com.value 0V
Imax -Poti 20%
LED green bright
no
LED red bright
yes
motor- or earth shortage
output stage error
yes
no
Motor stands still or runs
slowly
no
motor speeds up
or runs jerky
yes
check encoder connection
yes
Increase command value
to 10%
Motor runs smooth
no
amplification to high reduce
with Poti XP
yes
adjust speed with Poti nmax
to 10%
Set command value to 0V
motor stands stil
no
adjust speed with Poti
"Offset"to 0
yes
increase com.value to 50%
increase amplification Poti
XP until the drive swings, then
reduce amplification until
the drive runs smooth
adjust the current limits
with Poti Imax to the peek
and Poti ID to the steady
current of the motor
getting started finished
switch off mains

BAMO A3 - Signal scheme



Motor running (looking on the shaft)

Customer: . . . . . **Machine-No.** . . . . . .

Device: . . . . . **Series-No.** . . . . . .

BatteryVoltage [V=] . . . . . .

Inputs

Enable	Contact ?	Voltage [V=] . . . . .
command Value	Type	Voltage [V=] . . . . .
Current com.Value	I ext.	Voltage [V=] . . . . .

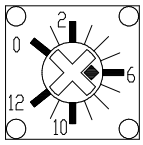
Setup- Actual Value- Evaluation

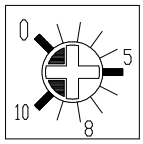
DC-Tacho	R23		Value	[kΩ] . . . . .
IN -Evaluation	Jumper SW1,1-2/2-3		Position	. . . . .
RS- Evaluation	Switch	RS-S1	ON/OFF	K1. . . . K2 . . . .

Setup- Speed Controller

Variable Bauelemente

P-Component		R9	Value	. . . . .
I-Component		C100	Value	. . . . .
PotiPositions				
Peek Current	I_{max}	P5	Position	. . . . .
Steady Current	I_D	P4	Position	. . . . .
Amplification	X_P	P3	Position	. . . . .
Speed	n_{max}	P2	Position	. . . . .
Offset	Offset	P1	Position	. . . . .





Setup-Current Controller **P/PI** **SwitchS1, Contact 1 ON/OFF**

Measuring Values

Motor Voltage	max.	
Motor Current	peek	steady . . . . .

Motor Data

Producer	. . . . .	Type	. . . . .
Series Number	. . . . .	Encoder Type.	. . . . .
IMP	. . . . .	Voltage	. . . . .
Motor Voltage	. . . . .	Motor Current	. . . . .
Brake	. . . . .	Fan	. . . . .

Guarantee

UNITEK products have a warranty against defects in material and workmanship for a period of one year from the date of shipment.
All values from the pre- and final quality control checks are archivied with the devices' serial numbers. UNITEK does not guarantee the suitability of the device for any specific application.
During the warranty period, UNITEK will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes.
UNITEK specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by UNITEK.
For products returned to UNITEK for warranty service, the Buyer shall prepay shipping charges to UNITEK and UNITEK shall pay shipping charges to return the product to the Buyer.
However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to UNITEK from another country.

The foregoing warranty shall not apply to defects resulting from:

* improper or inadequate repairs effected by the Buyer or a third party,
* non-observance of the manual which is included in the all consignments,
* non-observance of the electrical standards and regulations
* improper maintenance
* acts of nature

All further claims on transformation, diminution and replacement of any kind of damage, especially damage, which does not affect the UNITEK device, cannot be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed.
This limitation does not affect the product liability laws as applied in the place of manufacture (i. e. Germany).

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The local legal regulations, and those of the Standards Authorities have to be adhered to. UNITEK does not assume any liability, expressively or inherently, for the information contained in this MANUAL, for the functioning of the device or its suitability for any specific application.