MESA
SERVO-DRIVES & MOTION CONTROL

Product Data
January 2007

Hardware Manual

MESANOR

BME *xxxx* Basic Motion Element

BDE *xxxx* Basic Drive Element

RECEIVING AND HANDLING

Upon delivery of the equipment, inspect the shipping containers and contents for indications of damages in curried in transit. If any of the items specified in the bill of lading are damaged, or the quantity is incorrect, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

Claims for loss or damage in shipment must not be deducted from your invoice, nor should payment be withheld pending adjustment of any such claims.

Store the equipment in a clean , dry area. It is advisable to leave the equipment in its shipping container until ready fore use. Each amplifier is checked carefully before shipment. However, upon receipt, the user should make sure that the amplifier corresponds to or is properly rated in terms of rated voltage and current for the type of motor which is to be driven. The descriptive label affixed to the amplifier specifies electrical ratings.

Safety and application information

According to the enclosure the Amplifiers Motors and Power supplies may have live, uninsulated or rotating parts or hot surfaces during operation.
The inadmissible removing of the required cover, in proper application, wrong installation or operation may lead to personal or material damages.
For further information please refer to the manual.
Only qualified personal are permitted to install or operate the equipment.
IEC 364, CENELEC HD 384, DIN VDE 0100,0105,0110 and national regulations must be observed
According to these general safety information a qualified person is someone who is familiar with installation, assembly, commissioning and operation of the equipment. These person must have the appropriate qualifications.

Never plug in or unplug any connectors on the amplifier or open the amplifier when power is applied. A time of discharge of 3 minutes must be considered

Key Features

- Compact design
- Easy installation
- DC-Supply 24-48 V DC
- DC-Bus coupling
- Optional analogous input
- Encoder sensor
- Direct brake control with smart switch (via Fieldbus)

Application

- All pick and place equipments
- Single and multi axis machinery
- Test equipments
- Feeding systems
- Wrapping machinery
- Robotics
- Textile machinery
- Spotlight-trace control systems
- Food machinery
- Medical equipments

YOUR ADVANTAGE

- *Wide range of applications*
- *Easy matching and setup*
- *High reliability*
- *Firmware update via RS 232*

SN : 74.02153

MESA
SERVO-DRIVES & MOTION CONTROL

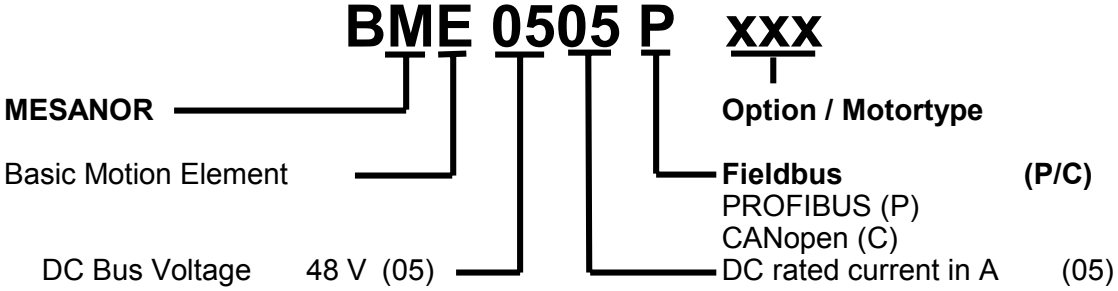
Contents

1 Basis Models BME / BDE – Power range

Family name	**Overview**
B-Basic	PROFIBUS- or CAN-Bus interface or analog input
M-Motion	RS 232
E-Element	High dynamic, high bandwidth High efficiency power stage
	Fast current controller Full protection mode Limit switch and stop input Motor brake control with smart switch

Type	**I_{max} (A)**	**I_N (A)**	**V_{rated} (V DC)**	**V_{min} (V DC)**	**V_{max} (V DC)**	**Pmax (W) (48/60V)**	**Internal Capacitor DC Power supply**
BME 050**5**	10	5	48	10	60	480	820 µF
BME 05**10**	20	10	48	10	60	960	1640 µF
BME 060**5**	10	5	65	10	80	600	470µF
BME 06**10**	20	10	65	10	80	1200	940 µF

Other voltage and current ratings on request
Type label indication



Other power range and options on special request.

Type	**I_{max} (A)**	**I_N (A)**	**V_{rated} (V DC)**	**V_{min} (V DC)**	**V_{max} (V DC)**	**Pmax (W) (48/60V)**	**Internal Capacitor DC Power supply**
BDE 050**5**	10	5	48	10	60	480	820 µF
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BDE 060**5**	10	5	65	10	80	960	470µF
BDE 06**10**	20	10	65	10	80	1200	940 µF

L_{min} –BDE in Chapter BDE

2 General

The BME is an integrated electronic motor with fieldbus interface for a wide range of applications. The BME includes the advantage of intelligent servo drive and a de central compact actuator. The principle allows a dramatic reduction of wiring and a high flexibility of application. The BDE is a Servo drive which allows you to use motors dislocated from the electronic.

The following operation modes are available :

- *Torque mode*

This mode allows a high dynamic and precise torque control between +/- maximum Torque.

- *Speed mode*

This mode allows a high dynamic and precise speed control between +/- maximum Speed.

- *Profile Position Mode*

This mode allows a high dynamic and precise position control until the +/- maximum position value.

- *Interpolated Position Mode*

This mode is only available in CAN-version

- *Sequence Position Mode*

32 position sequences are available including homing / reference.

- *Stand alone Speed or Torque mode*

This mode allows the speed or torque control via analog input

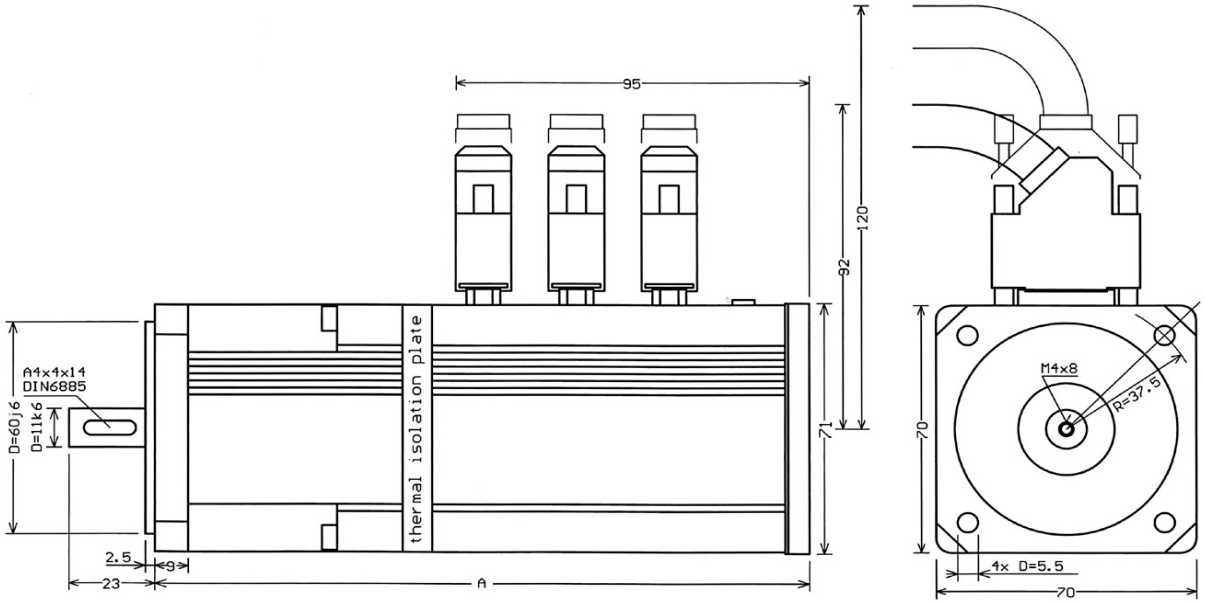
- *RS 232 Mode*

The RS 232 is a diagnose interface to set-up, adjust and test the BME/BDE. The built in help functions like RS 232 control panel, digital scope and other features allow a fast set-up and a short completion times for a wide range of applications.

3 Technical Specifications BME

3.1 Mechanical and Motor Data

Basic Motor		**071**	**072**	**073**	**074**
Flange size	mm	□70	□70	□70	□70
Max. torque	Nm	0,88	2,0	2,5	3
Rated torque	Nm	0,44	1,0	1,2	1,5
Max. speed (48VDC)	rpm	3000	3000	3000	3000
Length A – without brake	mm	170	190	210	230
Length A – with brake	mm	200	220	240	260
Weight without brake	g	1600	2000	2400	2900
Weight with brake	g	1900	2300	2700	3500
Winding insulation		Class F	Class F	Class F	Class F
Radial load Fr	N	216	245	275	314
Axial load Fa	N	98	98	98	98
Cooling with aluminium plate 10 mm thick upright position	mm	300 x 300	300 x 300	400 x 400	400 x 400
Motor brake (24 V DC)		optional	optional	optional	optional



3.2 Power stage

	05	06	
DC Power supply	24-48 V DC	24-65 V DC	External Fuse
Over voltage	69 V DC	88 V DC	Programmable
Under voltage	10 V DC	10 V DC	Programmable
Over temperature	75 grd C	75 grd C	Programmable (ϑ_{max} = 85 grd C)
Winding over temperature	85 grd C	85 grd C	Programmable (ϑ_{max} = 135 grd C)

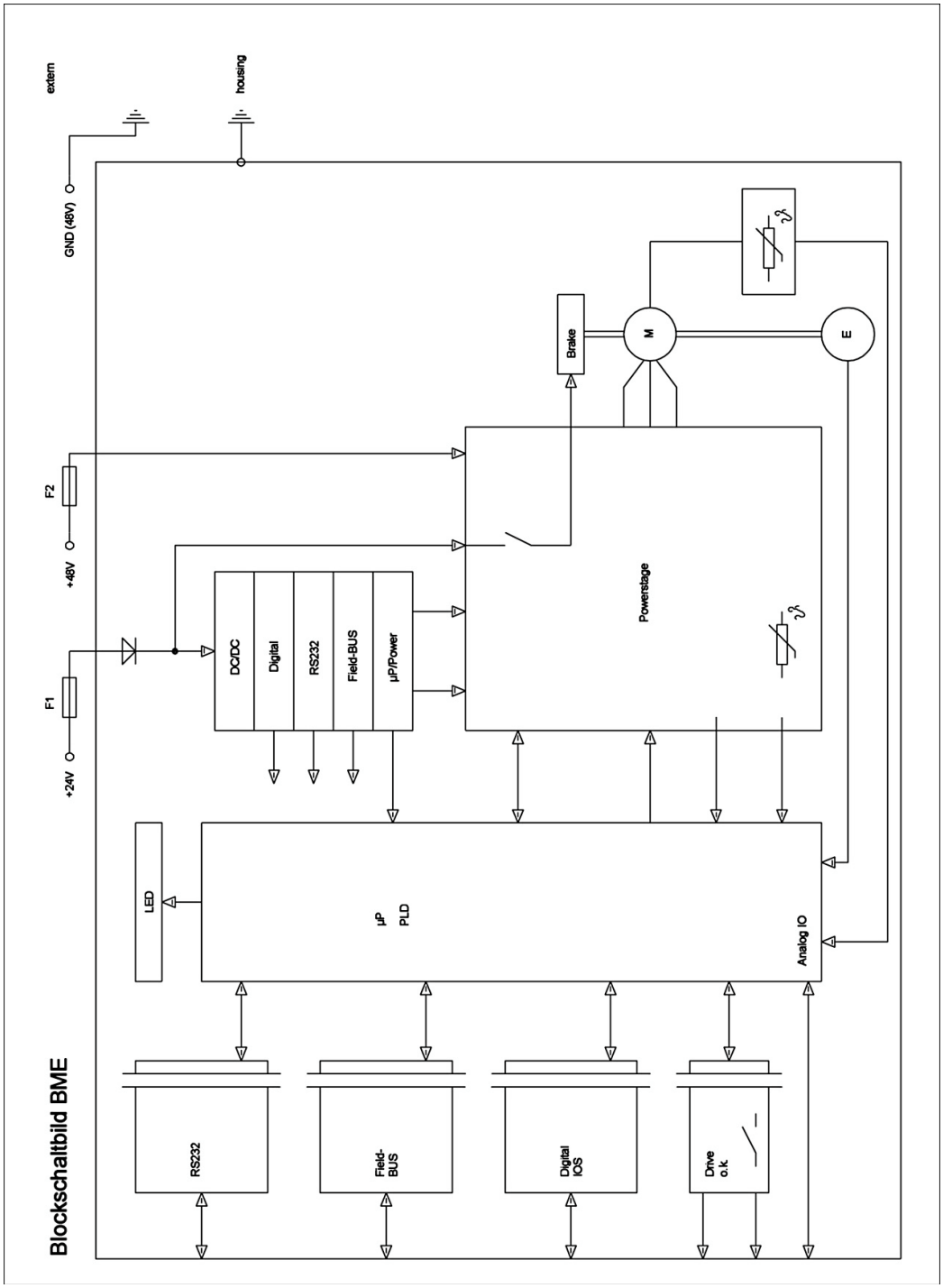
Powerstage	Power - MOS Transistor
PWM Chopper frequency	16 kHz
Powerstage protection	Over current, motor short circuit Over voltage, short to ground Power stage over temperature
Current controller - digital	Parameter setup via RS 232
Controller type	PI
Current limit1	$I_{max.}$, Max. current
Current limit2	I_{rms}, RMS / rated current
Time constant	0,1.....5s ; programmable
Sample time	62,5 µs
Speed mode - digital	
Controller type	PIDFF
Set value	PROFIBUS / CAN-Bus (16 bit) / +/- 10 V
Speed sensor	Encoder
Parameter setup	Fieldbus or RS 232
Sample time	250 µs
Position controller - digital	
Controller type	PD
Set value	PROFIBUS / CAN-Bus (32 bit)
Position feedback BME	Encoder 2048 ppr
BDE	Encoder 250.....5000 ppr
Sample time	250 µs
PROFIBUS Interface	
Protocol	PROFIBUS DP V0
Service channel	PKW parameter channel (MSO)
Process channel	PZD (MSO)
Baudrates	9,6K – 12M Bit/s
Setup interface	RS 232 or PROFIBUS

CAN - Interface

Protocol / Baudrate	CANopen / DSP 402 / 1 MBit
Service channel	SDO, transfer of data without real time demand (setup)
Process channel	PDO, dynamic transfer of real time data
Setup Interface	RS 232 - PC setup software (MSD2BO) CANopen
Parameter saving	EEPROM non volatile
General protection	
I rms limiting	I_{eff}-Disable drive or I_A-Limitation
Motor over temperature ϑ_M	Disable drive
Sensor Error	Disable drive
EEPROM-Error	Disable drive
Fieldbus-Error	Disable drive
Processor Error	Disable drive
General	
Operating temperature	0....45 grd C (Derating 2%/K 45-55 grd C)
Storage temperature	-10 to +60 grd C
Protection class	IP 40 up to IP 65
Cooling	Air convection and external Fan
Humidity	65 % max. relative Humidity max.
Isolation	C corresponding VDE 0110
Mounting Position	Any position
Drive healthy signal	Dry relay contact 50 V, 10 mA
Motor brake control	Smart switch 24 V DC, 1 A
Digital I/Os (+24V DC)	3 Inputs 2 Outputs 1 Fast Input (Interrupt) – Optional 2 Limit switch (+/-) 1 Home input 1 Fast stop
Analog Input	Differential Input max. +/-10 V
Reference	Power GND
Motor type	Brushless DC motor
Operation modes	Position / Speed / Torque
Parameter setting and diagnosis via	Fieldbus RS 232
Transfer of reference and monitor values via	Fieldbus

4 Principle of Operation and Basic Functions

4.1 Block diagram



4.2 Inputs and Outputs

The BME/BDE has a number of digital inputs and outputs which are used to fulfil the desired functionality of the machine. There are 2 categories of inputs and outputs: „dedicated type“ with fix functions like limit switch, reference, stop and „general type“ which can user defined .

4.3 State Machine

When the drive is powered on it goes in a defined state. Every further event is switching the state machine in a well defined manner into the corresponding state.

For the detailed description of the state machine see device control section of the corresponding fieldbus communication profile manual.
The basic operations of the drive described in this manual are realised in the „Operation Enabled“ and „Switched On“ states. The transfer between these 2 states are realised by the „Enable“/ „Disable“ operations.

4.4 Parameters

The BME/BDE parameters are stored in the non-volatile memory (EEPROM). In the start-up phase the parameters are loaded from the EEPROM into the RAM memory and activated. Now the parameter in the RAM memory can be changed by the communication interfaces in the defined conditions (drive enable/disable, parameter type read/write or read only) and they are automatically activated. The new parameters have to be saved into the EEPROM before power off (auxiliary supply), otherwise they are lost.

4.5 Functions and Operation Modes

The functionality of the BME/BDE can be achieved using the desired operation modes. The changing of the operation mode can be made generally in every operation mode except „Operation Enabled“ mode.
In order to change the operation mode, the following operations are to be realised:

- Disable the drive (get out from „Operation Enabled“ mode);
- Change into the desired operation mode and check if the operation mode has changed;
- Enable the drive (put into „Operation Enabled“ mode).

The following operation modes are available :

- Speed drive via the communication interfaces;

The drive is working in speed mode and actual speed is following the reference speed transmitted by the communication interface.

Start conditions	Start	Stop
Speed reference operation mode Drive disabled	Set speed reference to zero Enable drive Set reference speed via the communication interface	Set speed reference to zero Disable drive

- Jogging operation via the communication interfaces

The drive is moving with the programmed jogging speed in the specified direction. After setting the jogging speed the operation can be started as below:

Start conditions	Start	Stop
Drive enabled Profile position operation mode	Set start bit in the Control Word depending on the desired direction	Reset start bit in the Control Word

- Profile position operation mode via the communication interfaces

Start conditions	Start	Stop
Drive enabled Profile position operation mode Sequence selected	Toggle start bit in the Control Word	The move stops automatically when it is finished.

- Homing mode via the communication interfaces

Start conditions	Start	Stop
Drive enabled Profile position operation mode Sequence selected	Set start bit in the Control Word Reset the start bit after the homing is started	The homing procedure stops automatically when the programmed function is finished

4.6 Encoder

The resolution of the build in encoder (BME) is 2048 ppr. An external encoder must have a resolution between 250....5000 ppr.

4.7 Speed Adjustment

The motor speed can be adjusted by software via communication interface. The actual speed is measured by the encoder.

4.8 Hardware Limit Switch

Connecting of +24 V DC to the terminals for negative and positive direction deactivate the related limit switch and will enable the corresponding direction. If the limit switch is active the corresponding direction will be disabled. The status is indicated in the MSD2BO.

The drive can be moved out in the opposite direction. If the drive was in a homing procedure than it stops with a procedure error.
If the switch is deactivated the drives behaviour is depending on the actual operation mode:
-Speed mode: the drive restarts the move with the same speed.
-Profile position mode: the started move can be continued by a new start sequence command.
-Homing mode: after reset the procedure error is, the homing procedure can be restarted.

4.9 Fast Stop

Connecting of +24 DC V to the terminal the FAST- stop function is disabled. 0V or open input will stop the motor with I_{Amax} current independent of the moving direction.

If the drive is in a homing procedure, than it stops with a procedure error.
If the switch is deactivated the drives behaviour is depending on the actual operation mode:
-Speed mode: the drive restarts the move with the same speed.
-Profile position mode: the started move can be continued by a new start sequence command.
-Homing mode: after the procedure error is reset, the homing procedure can be restarted.

4.10 Enable

When connecting +24 V DC to the corresponding PIN the BME/BDE will be enabled and work in the dedicated mode. When disabling the BME/BDE the power stage is disabled and the motor will stop without torque.

4.11 Drive Ready

Drive ready output (dry contact):
-Closed: indicates that the drive has no error and is ready to operate;
-Opened: indicates that the drive has an error (or is in the power on phase / powerless) and is not ready to operate.

4.12 Operating Mode

The operating mode will be selected by fieldbus ,Stand alone or RS 232 (Drive must be disabled).

4.13 Temperature Sensors

The BME/BDE includes two temperature sensors. Sensor one is for the electronic part and sensor two is for the motor winding. The temperature limit can be adjusted by software and also the time constant can be adjusted between 0...16 s . The over temperature error will only generated if the over temperature remains longer as the adjusted time constant. The Motor temperature sensor for BDE must be external connected.

4.14 Software Reset

In case of an error a reset have to be made via Fieldbus or MSD2BO.

4.15 Power On-Reset

The power off/ on of the auxiliary supply (+24V) resets all errors .

4.16 Demand Set Value –Torque –Speed-Position

All demand set values transmitted via fieldbus, analog input or RS 232.

4.17 Reference Input

In position mode the reference input is used for the homing procedure.

5 Controller Set-up

The setup can be made by software via RS 232, please use the actual version of the MSD2BO Software. The MSD2BO Software manual will provide you with all necessary information for set-up and tuning.

The BME/BDE is always starting in the last saved operation mode. In order to have a quick and simple start of the BME/BDE with the needed functionality, it is recommended to save the appropriate operation mode, before disconnecting the BME/BDE.
During the first communication the MSD2BO will automatically store a parameter file in the "device" directory.

Attention !

The RS 232 interface is only for set-up and diagnoses purpose. Parameter changes will have direct influence to the process. Wrong parameters can cause unintentional behaviour or damage.
When capturing software control with the MSD2BO software the control by the fieldbus is stopped immediately – any running operation is interrupted!

5.1 Basic Set-up - first steps

Wire up the BME/BDE according to the test circuit
Disable the drive (hardware)
Install the MSD2BO program on your PC
Connect the RS 232 on the PC and BME/BDE
Connect the BME/BDE with the 24 V DC Auxiliaiy supply (+24V)
Connect the 24 - 48 V DC power supply
Wait until the LED 2 will light green
Start the MSD2BO - Program

The BME/BME is in fieldbus mode. To change parameters or use the RS 232 control panel you should take over the software control ("Capture software control").

In the start-up phase of the BME/BDE the following operation are executed:

- DSP initialisation;
- Loading the drive parameters from the non-volatile memory (EEPROM);
- Initialising of the control loops;
- Initialising and activating of the communication interfaces (Fieldbus and RS 232);
- Checking of the drive status and input signals;
- Setting of the outputs, monitor signals and LED's;
- Setting the state machine into initial state;

6 Power Supply

6.1 Wiring Recommendations

- It is important that the BME/BDE is properly earthed. If the BME/BDE is not earthed then if an earth fault occurs in the motor circuit, the output of the amplifier will be destroyed.
- Each BME/BDE must be wired separately (cables should be shielded).
- Power cables must be shielded to fulfil the EMC requirements
- Control and Fieldbus circuits should be individually shielded.

The main voltage (230/440 VAC) must be matched by an transformer or electronic power supply to 24-48 V DC. The capacity of the power supply must consider the high peak current of the BME/BDE.

The power supply for multiple axis systems must consider the high peak current of each axis. The minimum external capacity should be 2000 µF per axis. For high dynamic results the capacitor should have a value of : Imax (A) X 1000 µF.

Take care, a wrong polarity will damage the drive !
Use any time an external fuse or a current limited power supply!

The supply voltages are internally isolated to each other, the machine signals and the housing.
Don't use the same voltage supply for DC BUS and Auxiliaiy supply (+24V), because of the regenerative power of the BME/BDE. The DC bus voltage can increase until the over voltage error switches off the drive at 69 V DC. The braking power (regenerative) must be absorbed by the power supply. To prevent such problems use a ballast module like MESA type OS 14.

6.2 +24 V DC Electronic Supply Voltage

The auxiliary supply (+24V DC) is needed for the electronic and motor brake (option). It allows to keep the position during power off (+48V power supply).
The power consumption is around 6 W (0,3 A/24V DC), the tolerance should be less then +/-25%. The power consumption with brake is max. 1,5 A, the auxiliary supply voltage tolerance for brake operation depends from the brake type.

6.3 Motor Brake Control (Option)

The BME/BDE is equipped with a smart switch for brake control (+24V DC), supplied by the auxiliary supply (+24V). The brake will be controlled via fieldbus. A control by RS 232 is not possible. The smart switch is electronically protected.

6.4 Fuse

The user has the obligation to protect the BME/BDE with external fuses against hazardous situations.
Fuse F1 protects the electronic and brake circuit, fuse F2 the power circuit.

7 Default Settings

The following table shows the default setting . For special applications / modifications the settings are different. For more information pls. ask the service department.

Name	Function	Default	Remark
Communication			
RS 232	PC communication	Baud rate 19200	automatic
Power stage			
DC Power supply	Limit of Power Voltage	Max. 69 V DC	Lower values possible
		Min. 9 V DC	Higher values possible
Motor temperature	Motor protection	95 grd C	Lower values possible
Motor sensor type	Motor protection	NTC	PTC – not used
Drive temperature	Electronic protection	75 grd C	Lower values possible
Drive sensor type	Electronic protection	NTC	PTC – not used
Operating mode			
Mode	Controller mode	Speed	Torque/Position
Current loop			
Current controller	P-Gain	4500	Optimised
	I-Gain	500	Optimised
Imax	Max. Output current	100 % =Imax	20-100%(Imax)
Irms	Rated current	50 % =Imax	20-50% (Imax)
Irms-Limitation	Irms-protection mode	Limitation	fusing
Speed loop			
Mode	Controller mode	PIDFF-Mode	P-Mode
P	P-Gain	15000	
I	I-Gain	100	
D	D-Gain	0	
FF	Feed-Forward-Gain	0	
Max. Speed	Limitation of max. Speed	14.000 rpm	500-14.000 rpm
Sensor resolution	Resolution of Pos. Sensor	2048 ppr	BDE variable
	BME Fix		
Position loop			
	Controller mode	PFF	
P	P-Gain	125	
FF	Feed-Forward-Gain	0	
PROFIBUS –Interface			
	MESA BME GSD		Load file from CD
PROFIBUS Address	125		
CAN-Bus-Interface			
Bus speed	Baud rate	1 MBd	0,8 MBd
CAN-Cycle	Cycle time	2 ms	1-20 ms
	only valid after	Power off/on	
Attention!	Never change without	further Information's	Attention!

8 Commissioning-Terminal Description

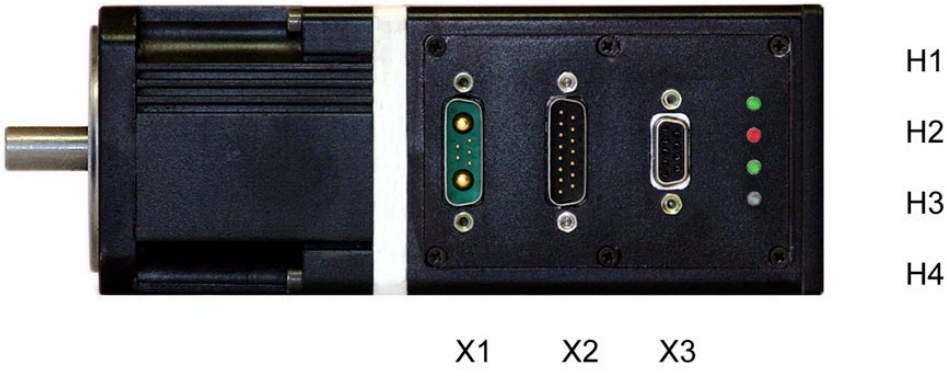
Attention!

Before applying any voltage, make sure that the BME/BDE (housing) is straight and correctly connected to ground / earth :

CHECK BEFORE POWER ON !

- Earthing according to the norm
- Supply voltage
- Wiring
- Special adjustments
- Rated and max. current for the application
- All external switches in right position
- Whether the BME is mechanically fixed, motor shaft is free and not yet connected with the machine! If this is not possible, maximal current must be reduced to 25 %.
- Then the BME is disabled by the enable input.

Make sure enable BME/BDE after power on !



Never plug in or unplug any connectors on the BME/BDE or open it when power is applied. The time of discharge of 3 minutes must be considered !

8.1 LED Display

Name	Colour	Indication	Remark
LED 1	Green	DC power supply ok	Powerstage supply
LED 2	Green / Red	Drive ready / Error	Green ready / red error
LED 3	Green	Power stage enabled	Brake open [1)]
LED 4	Green	Bus communication	Also during boot procedure

1) If BME or the external motor is equipped with a stall brake, take care of the brake delay time

8.2 Terminal description BME

Name	Function	Type	Remark
X 1	Power supply	DSUB-2P-5S (male)	
X 2	Control signals	DSUB-15 (male)	
X 3	Fieldbus	DSUB-9 (female)	

8.3 Power Supply X1

DSUB-2P-5S (male)

Pin	Signal	Function	Remark
A1	Ucc+	DC power supply	external fusing
A2	Ucc-		external grounding at the power supply
1	U_H+	auxiliary supply	external fusing
2	U_H-	(18...30 VDC / 6 W)	external grounding at the power supply
3	ENABLE	Enable the Drive	Input; active high +24V DC / 5mA; passive low 0V or open
4	READY1	Drive is Ready	Output; active closed loop; passive open
5	READY2		dry contact (50V/10mA)

8.4 External Fuse

Fuse	F1 without motor brake	F1 with motor brake	F2
Irms = 5 A	1 A F	1,6 A F	6,3 A MT
Irms = 10 A	1 A F	1,6 A F	10 A MT

8.5 Control Signals X2

DSUB-15 (male)
Galvanic isolated Inputs and Outputs

Pin	Signal	Function	Remark
1	REF	Reference Switch	active low 0V or open; passive high +24V / 5mA
2	LIMIT+	Limit Switch pos	active low 0V or open; passive high +24V / 5mA
3	LIMIT-	Limit Switch neg	active low 0V or open; passive high +24V / 5mA
4	STOP	Rapid Stop	active low 0V or open; passive high +24V / 5mA
5	IN+	Analog input (differential)	+/-10V (25Kohm Input resistance) for speed reference or general use
6	IN-		
7	IN1	Digital input[1)]	active low 0V or open; passive high +24V / 5mA
8	IN3	Digital input [1)]	active low 0V or open; passive high +24V / 5mA
9	IN2	Digital input[1)]	active low 0V or open; passive high +24V / 5mA
10	OUT2	Digital output[1)]	active low closed collector to COMMON; passive open collector (+24V / 5mA)
11	OUT1	Digital output[1)]	active low closed collector to COMMON; passive open collector (+24V / 5mA)
12	COMMON	common potential	for digital IOs
13	RS232-TX	TxD	RS232 transmit line 19200 Baud
14	RS232-RX	RxD	RS232 receive line 19200 Baud
15	RS232-GND	common potential	for RS232

1) for general use

Logic	Input level active	Input level passive	Example
Active low	< 6 V or open	> 14 .....28V	Limit switch, home, Stop
Active high	> 14 V	< 6 V or open	Enable,
Input current (24 V)	max 5mA		

8.6 PROFIBUS X3

DSUB-9 (female)

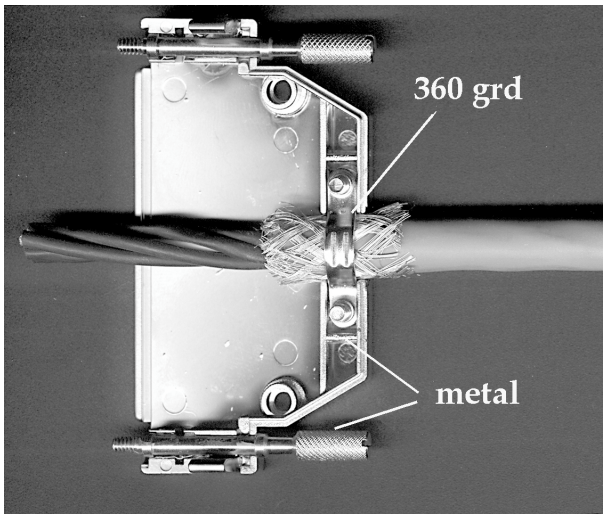
PIN	Name	Description	Remark
1	Shield		
2	-		
	RxD/TxD-P	Receive / Transmit data –plus, B-line	(red)
4	RTS	direction control signal	
5	DGND	Data ground	(reference potential to VP)
6	VP	Power supply plus,	(P5V)
7	-		
8	RxD/TxD-N	Receive / Transmit data –N, A-line	(green)
9	-		

8.7 CAN-Bus X3

DSUB-9 (male)

Pin	Signal	Function	Remark
1	-		
2	CAN_L	CAN line low	
3	CGND	CAN Ground	
4	-		
5	Shield		
6	0GND	external supply	not used
7	CAN_H	CAN line high	
8	-		
9	+Ucan	external supply	not used

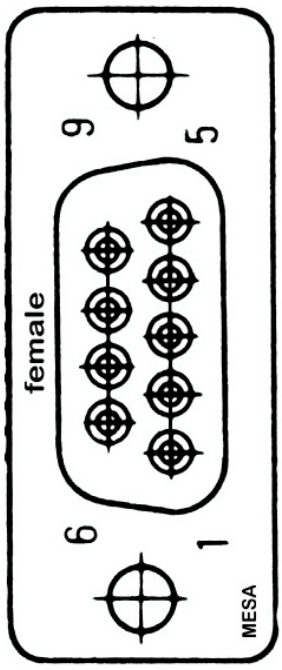
8.8 Principle Connectors Shield Connection



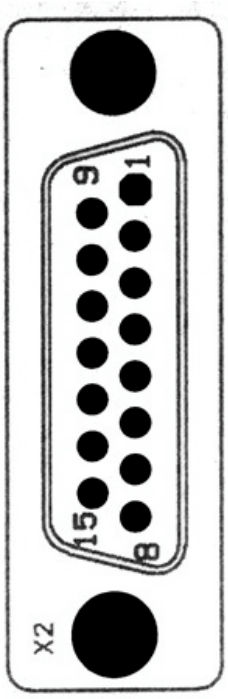
- Use only metal or metal plated housing
- Use only shielded cables
- 360 grd shield connection
- For logic I/O´s use only twisted paired cables with common shield
- Never run signal and power cables in parallel
- Use low impedance earth connection

8.9 D-Sub-Pinning

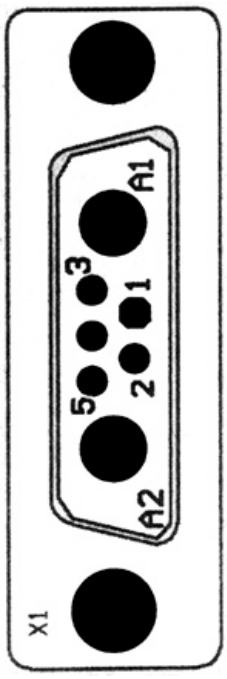
9 Pole female



15 Pole male



2 + 5 Pole male



8.10 RS232 Connector

Serial connection to PC and machine signals to BME via X2 (like a T-connector)

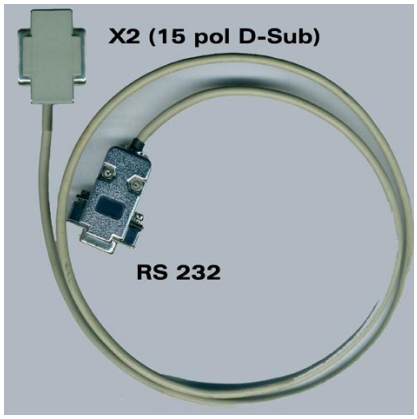
8.11 Construction

DSUB15 (female) to BME X2	DSUB15 (male) to machine	DSUB9 (female) to PC	DSUB9 (male) via non-modem cable	Remark
Pin	**Pin**	**Pin**	**Pin**	**Signal name**
1	1			REF
2	2			LIMIT+
3	3			LIMIT-
4	4			STOP
5	5			IN+
6	6			IN-
7	7			IN 1
8	8			IN 3
9	9			IN 2
10	10			OUT 2
11	11			OUT 1
12	12			COMMON
13		2	3	TX
14		3	2	RX
15		5	5	GND1

8.12 Non-modem Cable (typical)

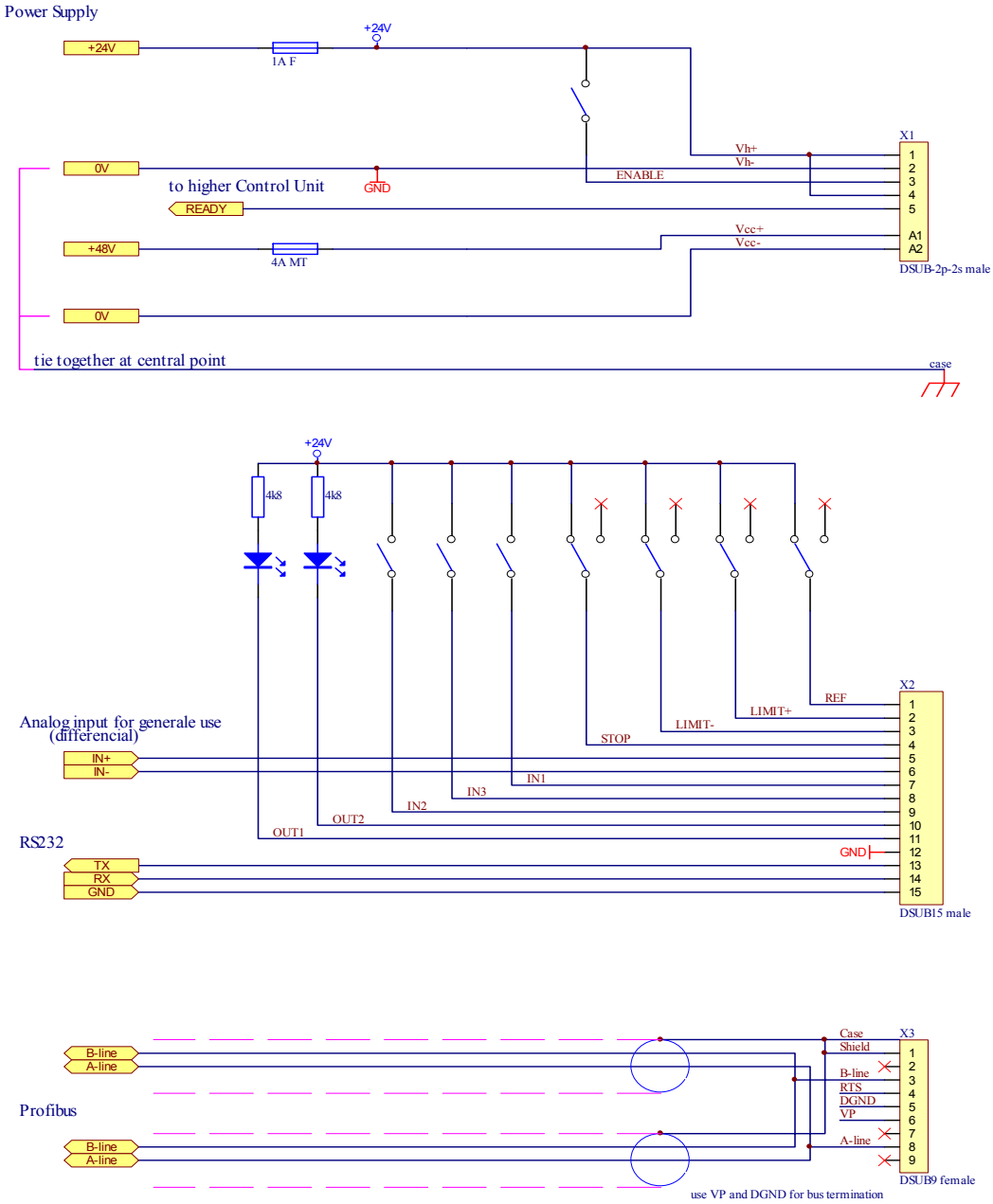
DSUB9 (female)		Cable 1x2 shielded	DSUB9 (female)	
Pin	**Signal**		**Pin**	**Signal**
3	TX		2	RX
2	RX		3	TX
5	GND	Shield	5	GND

T-Adapter

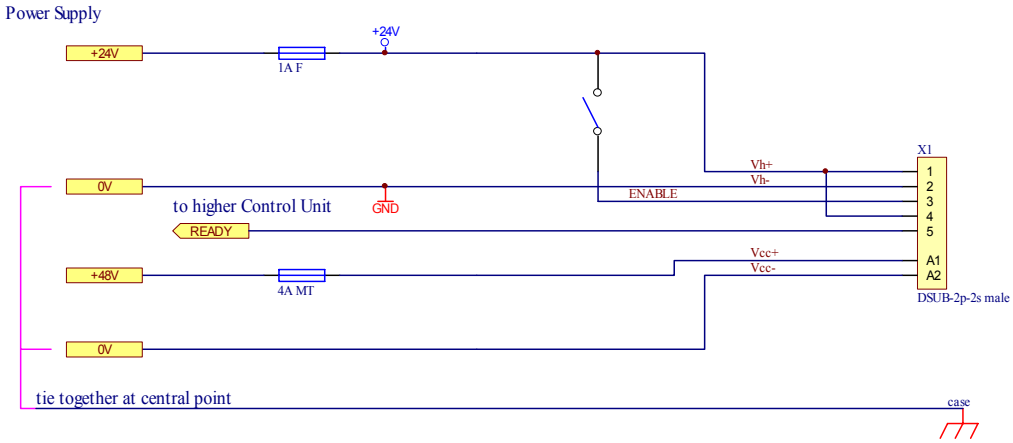


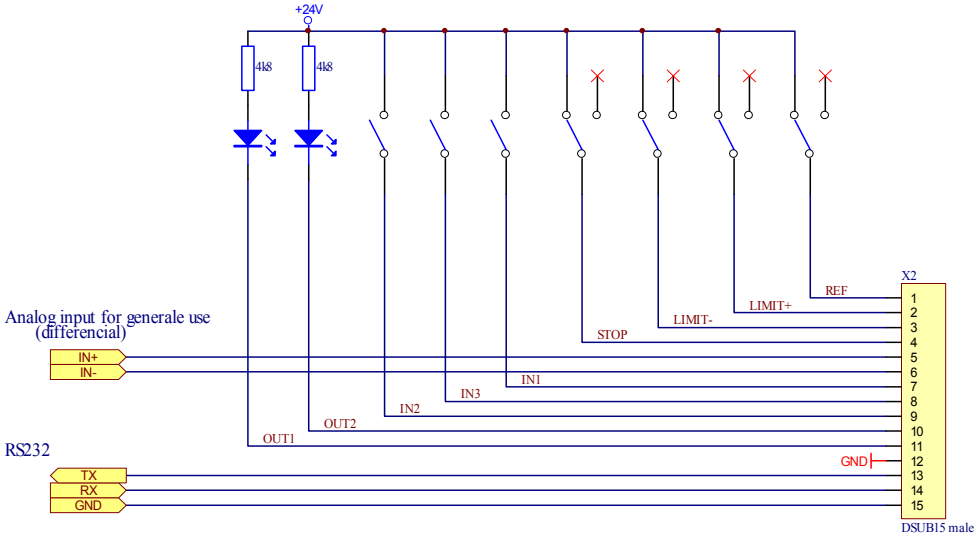
Non-Modem-Cable

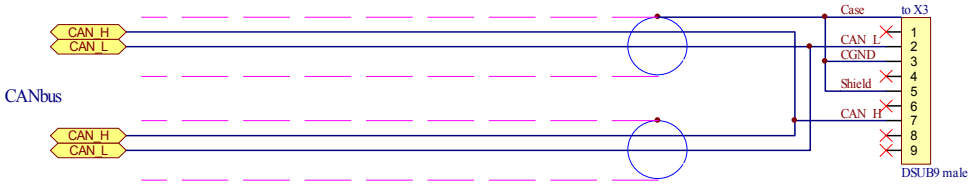
8.13 BME Test Circuit Profibus



8.14 BME Test Circuit CAN Bus







9 Earthing and Installation according to EMC Norms

9.1 General Indications

It is important that the installation of the BME/BDE is made according to the electrical safety regulations and by a qualified person who is familiar with installation, assembly, commissioning and operation of the equipment. National and local regulations must be respected.
Please follow strictly the following instructions, it is important to assure the correct operation of the BME/BDE and so far of the complete machine.

The electromagnetic compatibility of the drive system depends - besides of the BME/BDE module - on the following conditions:
Total cable length - total capacity to ground.
Low impedance Earthing of all components, Power supply and Control.
Shielded cables and housings or shielded the complete control cabinet.
Line tracing - distance between power, control and mains cables.

9.2 General Rules

The following regulations have to be respected:
Installation of the devices in a closed metal control cabinet or machine
Use the same ground potential for all components (motor, drive, control) by central earthing, please check it by measuring on commissioning.
Contact the service for more information about the filter mode.
In case of connection of the drive system with the general power supply system (or devices that do not correspond to EN 50082-2 regulations), an additional (common) mains filter is necessary.

9.3 Control Cabinet

- The control cabinet must be equipped with a metal mounting panel with PE edge.
- The mounting panel in the control cabinet is the reference station (GND) for all signals, it is connected in a conductive way with the PE edge and the cabinet housing.
- The control cabinet with the mounting panel and the machine must be earthed and connected (for example with short ground copper strips).
- The shields of all cables leaving the control cabinet must be connected 360° on the mounting panel, no matter if they are earthed otherwise.
- Outside of the control cabinet the cables should be led directly to the metal parts, as large distance increases the unwanted emission. For special demands metal cable channels can be used.
- If cables are led via additional terminals or switches, it is important to assure sufficient distance between motor cable, mains cable and control cable. Due to the fact that the cables are not shielded on this position, especially emissions of the motor cables may have effects on other cables. The cables must be shielded directly before and after the interruption on the mounting panel. This kind of interruptions should be avoided. If this is not possible, special shields (housing) can be mounted according to producer's advice.

9.4 Housing

- The BME/BDE housing has to be connected via GN/YE cable with the PE edge in the control cabinet.
- In addition to the shield earthing you have to screw the housing of the BME/BDE in a conductive way on the mounting panel of the control cabinet.

9.5 Power Cable

- The power cable should be as short as possible. It should be led directly on the metal parts of the machine or in metal cable channels.
- The earth wire (GN/YE) is connected with the BME/BDE and machine .

9.6 Estimation of needed Wire range

The voltage drop on power cable should be less then 10 % of the nominal supply voltage.
The following tables are based on this .

Necessary Wire range

Cable lenghts	Total of I_{max} (all drives together)					
	10 A	20 A	30 A	40 A	50 A	60 A
6 m	0,5 mm^2	1,0 mm^2	1,5 mm^2		2,5 mm^2	
8 m	0,75 mm^2			2,5 mm^2		4 mm^2
10 m		1,5 mm^2	2,5 mm^2		4 mm^2	
12 m	1,0 mm^2			4 mm^2		6 mm^2
15 m		2,5 mm^2	4 mm^2		6 mm^2	
20 m	1,5 mm^2	4 mm^2	6 mm^2	6 mm^2	10 mm^2	10 mm^2
30 m	2,5 mm^2			10 mm^2		16 mm^2
40 m	4 mm^2	6 mm^2	10 mm^2		16 mm^2	

Possible Cable Length

Wire range	Total of I_{max} (all drives together)					
	10 A	20 A	30 A	40 A	50 A	60 A
0,5 mm^2	6 m					
0,75 mm^2	9 m					
1,0 mm^2	12 m	6 m				
1,5 mm^2	18 m	9 m	6 m			
2,5 mm^2	30 m	15 m	10 m	8 m	6 m	
4 mm^2	48 m	24 m	16 m	12 m	10 m	8 m
6 mm^2		38 m	25 m	19 m	15 m	13 m
10 mm^2			40 m	30 m	24 m	20 m
16 mm^2				48 m	38 m	32 m

If the truly duty cycle is know the wire range may be lower then in the above table.

Also other factors may be considered for choosing the right wire range like :

- Fusing situation
- Ambient temperature
- Kind of installation

Diagram 1: Max. current in A for 4,8 V total voltage drop

Cable length (m)

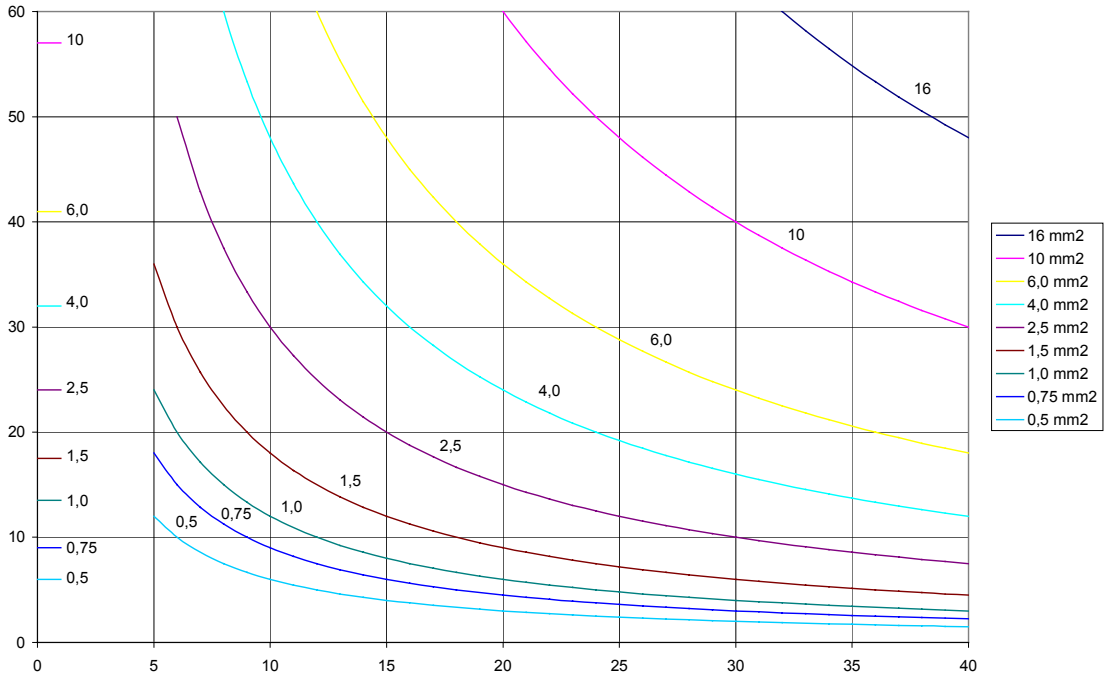
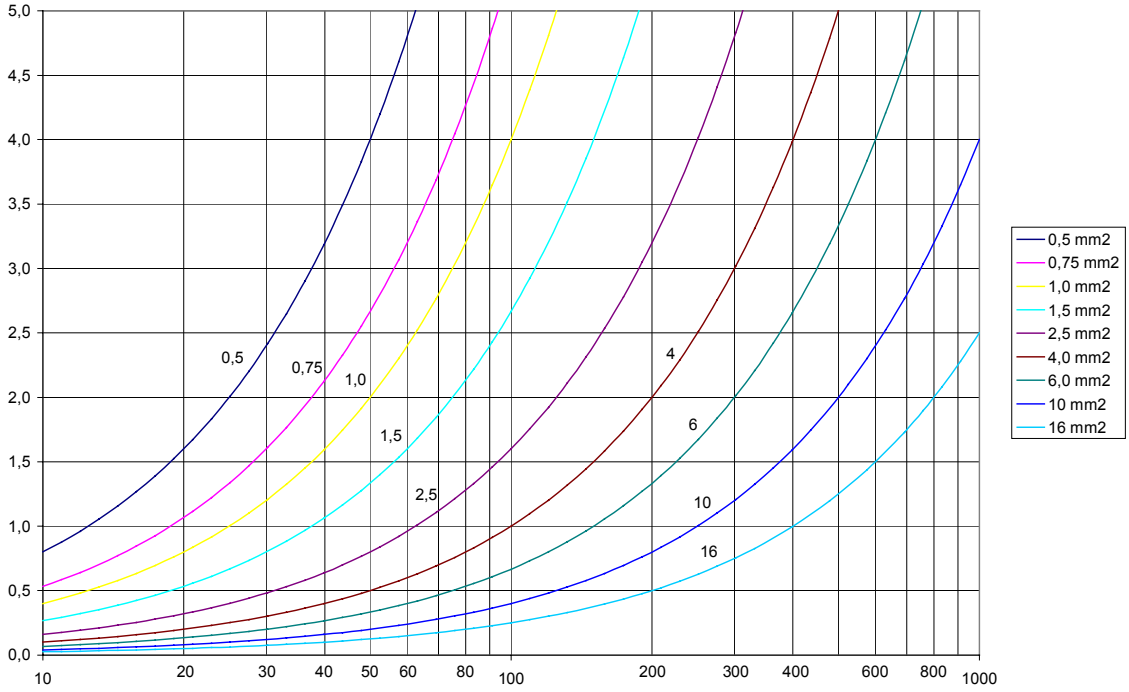
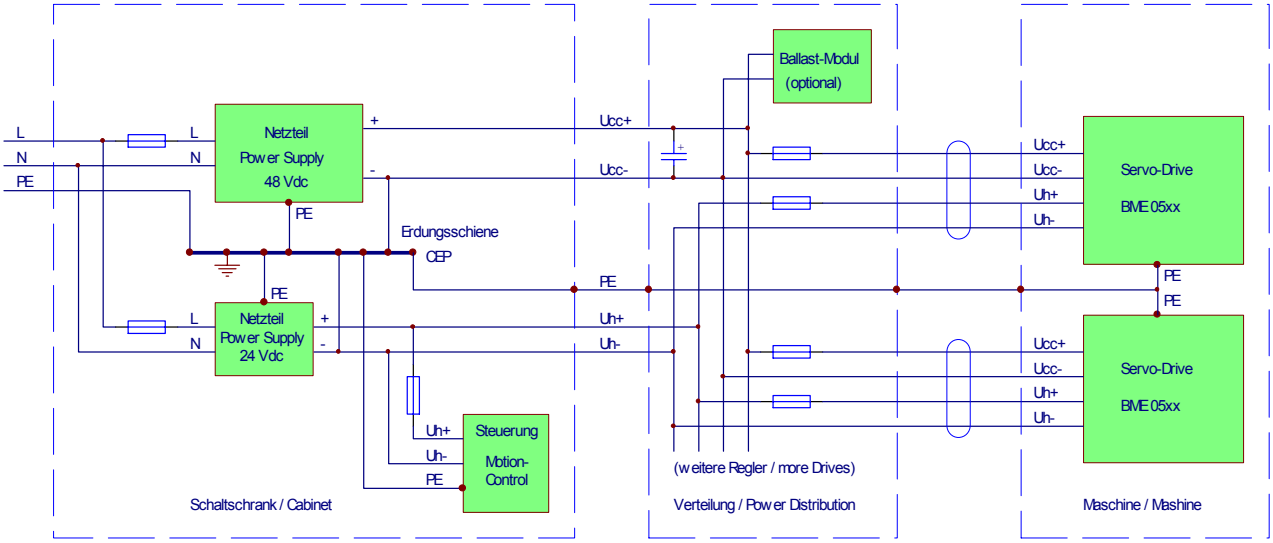


Diagram 2: total voltage drop

Cable length (m) X Max. Current (A)



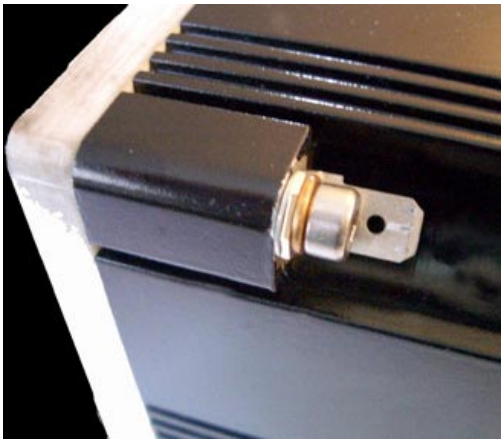
9.7 *Principle Wiring Diagram*



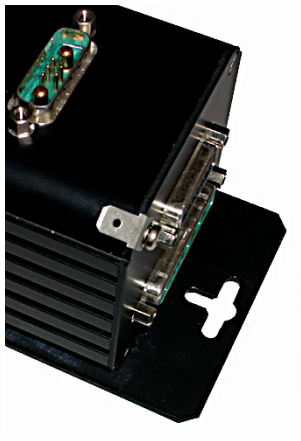
Hints:

- Power supply must be grounded directly on the power supply and only there (central)
- Sufficient +24 V Auxiliaiy supply (+24V)
- U_{CC} increase during braking, qualified power supply with braking system
- Fusing of the BME/BDE see this Manual
- Fusing according to the local / suppliers norm
- Power cable short as possible

PE-Contact BME



PE-Contact BDE



9.8 Control Cables

- Control cables, especially those leaving the control cabinet, must be shielded or equipped with an inter-filter (contact the producer). The shield has to be fixed on the BME/BDE and on the mounting panel in the control cabinet. The shield of the control cable has to be connected with the metal connector housing.
- Unshielded control cables should be avoided, also short connections should be twisted and shielded pairs.

9.9 BME/BDE CAN Bus Wiring

9.9.1 General

There are to ways for connecting the can bus.

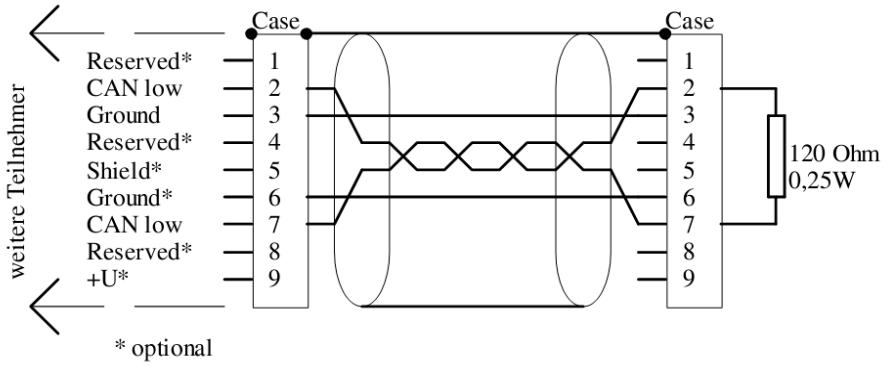
We suggest to use dedicated CAN Bus cable and metallic shielded plugs for best results and high reliability. Any way the shield must be connected on both ends of the cable.
Field bus cable are carry out in twisted pair shield version and should be dislocated from Power cables.
The cable must be terminated with a 120 Ohm 0,25W resistor on both ends.
Stubs are only allowed up to 30 cm.

Attention !
Read also carefully the control builders manual for specific information.

9.9.2 Standard Version

Cable with two twisted pairs and commend shield

We suggest an equipotential bonding to minimise circulating currents in the shield.



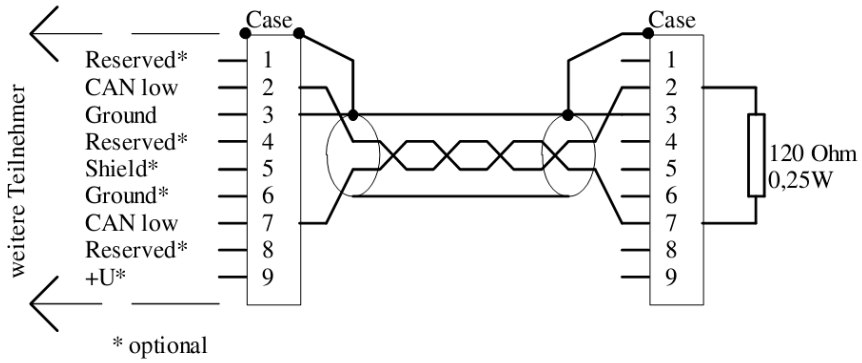
Cable type order example
for flexible type
Lütze Superflex Bus © PUR 2x2x0,25mm²; Outside diameter 5,9mm; Order number :104220

Non flexible type
Lapp 2x2x0,22mm²; Outside diameter 5,9mm; Order number 2170261

9.9.3 Simplified Version

Cable with one twisted pair and commend shield

This version is only useful and leads to reasonable results if the BME/BDE are grouped together and the equipotential bonding to minimise circulating currents in the shield is well made .



Cable type order example
for flexible type
Lütze Superflex Bus © PUR 1x2x0,25mm²; Outside diameter 6,0mm; Order number 104202
Lapp UNITRONIC BUS-FD P CAN1x2x0,25mm²; Outside diameter 6,4mm; Order number 2170260

Non flexible type
Lapp UNITRONIC BUS CAN1x2x0,22mm²; Outside diameter 5,7mm; Order number 2170272

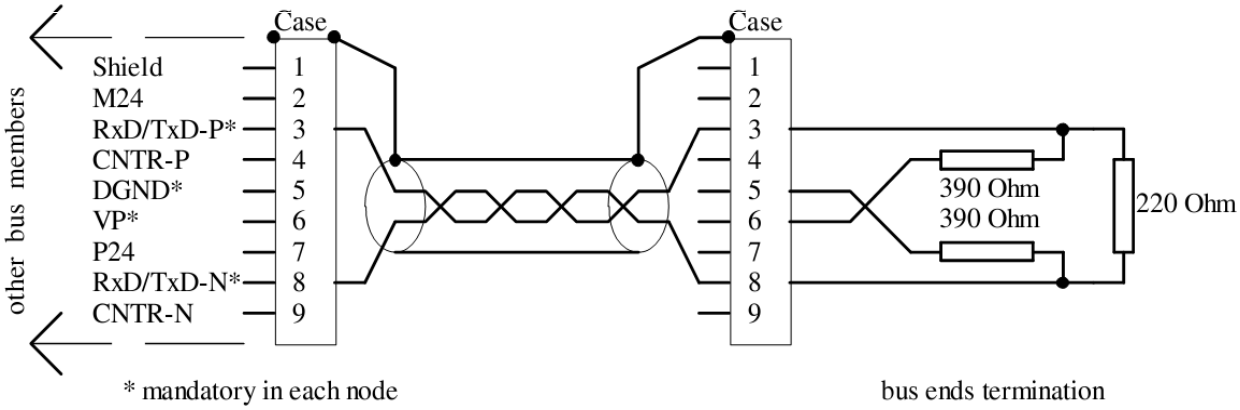
9.10 BME/BDE PROFIBUS Wiring

We suggest to use dedicated PROFIBUS cable (see IEC61158) and metallic shielded plugs for best results and high reliability. Any way the shield must be connected on both ends of the cable.
Field bus cable are carry out in twisted pair shield version and should be dislocated from Power cables.
Both ends of the whole bus must be terminated like shown below. Stubs are not allowed for data rates >1500kbits/s.

The PROFIBUS installation instructions must absolutely observe. The whole instruction can be find at www.profibus.com.

Attention !
Read also carefully the control builders manual for specific information.

We suggest an equipotential bonding to minimise circulating currents in the shield.



Cable type order example
for flexible type
Lapp 1x2x0,64mm; Outside diameter 8,0mm; Order number 2170222

Non flexible type
Lapp 1x2x0,64mm; Outside diameter 8,0mm; Order number 2170220

10 Known problems and limitations

There are some known problems and limitations in the functionality of the drive.

It is very important to take care to the next recommendations in order to avoid unexpected behaviour of the BME/BDE!

Problems and functional limitations

Function	Limitation	How to handle
Encoder resolution	Is set fix to 2048 ppr in BME corresponding to the factory mounted encoder	Do not change this parameter!
	BDE 250....5000 ppr	Set to encoder resolution
Control word 2 (ZSW2)	With out function	Do not use
Profile position mode: start conditions	There are 3 digital inputs which can be used as start conditions!	Use only these 3 inputs as start conditions.

Pls. ask for software and firmware update. We will provide you with the latest version.

11 Fault Finding- Quick Reference

Pls. use the RS 232 Interface for setup and diagnostic. Do not use mechanically damaged device or devices with uncompleted housing.

Symptom	**Cause**	**Remedy**
GENERAL		
	Mechanical damage	Change device
	BME/BDE is too hot	Check parameter
		Check mounting
Power supply	Fuse blows up	Check wiring / polarity
		Check power supply capacity
		Reduce Imax.
Motor Part	Noise	Check speed and current loop parameter
		Change device
	Shaft not free	Change device
Motor Brake	Brake is closed	OPEN brake
Power stage under voltage		Check power supply capacity
		Use additional capacitor
		Check wire diameter
Current loop	Over current	Check PI-parameter
		Set to default parameter
Speed loop	Speed too low	Check max speed
		Check PI-parameter
		Set to default parameter
		Check power voltage
Position loop	Position overshoot	Check max. speed
		Check max. current
Fieldbus	No communication	Check wiring
		Check parameters
RS 232		Check available COM-Port
		Check baud rate
		See also software manual

11.1 Hardware and Software Errors

Error	Description
Under voltage of the logic supply voltage (auxiliary supply)	Auxiliary supply (+24V)has a value which is under the minimum limit. Check the logic supply voltage value and current rating!
Output stage (motor) over current	The output current is higher than the limit. Possible causes: short circuit on the outputs, wrong current loop parameters or power stage failure.
HALL encoder error	HALL / encoder failure - change device

Error	Description
I2t error	The Irms current of the drive is higher than the programmed limit value. Possible causes: acceleration time with maximum current is too long or the shaft is locked.
Position following error	The following error of the positioning move is higher than the programmed limit value. Possible causes: too high load inertia on the motor shaft, wrong tuning of the control loops.
EEPROM error	The parameter reading or writing has produced an error. Possible causes: failure in the EEPROM circuit.
Bus communication error (PROFIBUS)	Failure in the communication on the bus system.
Procedure execution error	A procedure was started or ended with an error. For example: timeout in the homing procedure.
Power stage supply overvoltage	The power stage supply voltage is higher than the programmed limit value. Possible causes: braking energy is too high, Ucc voltage is increasing during braking
Power stage supply undervoltage	The power stage supply voltage is not connected or is lower than the programmed limit. Possible causes: breakdown of the voltage in the acceleration phase.
Drive overtemperature error	The electronic part temperature is higher than the programmed limit value.
Motor overtemperature error	The motor temperature is higher than the programmed limit value.

When an error is active the statemachine is passing through the „Fault Reaction Active“ state into the „Fault“ state (see also PROFIBUS_ShortDescription.pdf).

The errors are stored in the status registers and can be read by the communication interfaces. The errors are always memorised and can be reset. The error reset function is effective only if the case of the error is no longer existing.

If an error occurs, the following operation must be executed:
- Checking the cause of the error and remove the error
- Use reset and checking if the BME/BDE is ready;

If the reset operation succeeded, the statemachine is passing into the „Switch On Disabled“ state.

Some of the errors can be activated or deactivated (masked) for test purposes:

- Position following error: if this error is masked the drive is continuing the move even the following error is higher than the programmed maximum limit value. This masking possibility is useful during the testing and tuning process.
- Drive power stage supply under voltage error: if this error is masked (only a warning will be generated) the drive is ready even if the power stage supply is not connected. This masking possibility is useful when the control is connecting the power stage supply voltage only if the drive is error free.

Attention !

If the power stage voltage is lower then 10 V a short circuit error will not be detected and generated.

Some of the errors have a supplementary timer functions in the error checking, that means the error will be active only after a time that is longer than the programmed time constant. In this way the control has the possibility to take some actions in order to avoid the error, in the programmed time window.

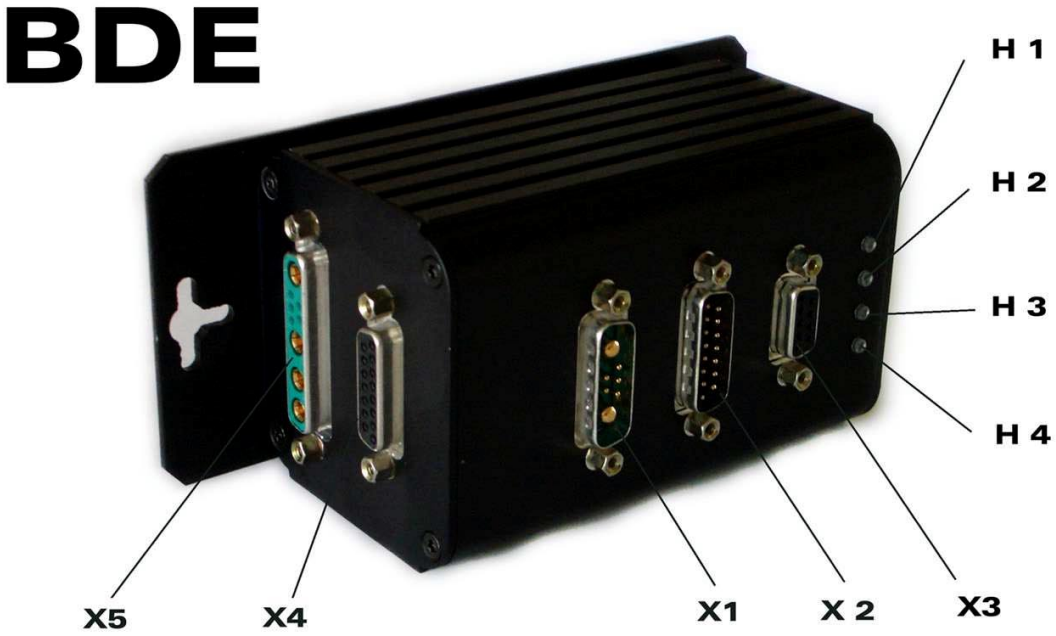
- Drive over temperature error: the error function is activated only after the programmed time expired;
- Motor over temperature error: the error function is activated only after the programmed time expired;

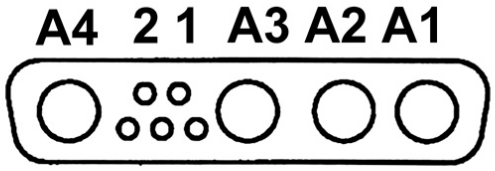
12 Additional Information

Software manual PROFIBUS
Software manual CAN-Bus
Software manual MSD2BO
MSD2BO (PC-Control software)

13 BDE - Basic Drive Element

The BDE contains the same electronic like the BME. The BDE is for driving brushless and brush servomotors with hall and encoder feedback.





9W4 Buchse / female

13.1 Motor Temperature probe

NTC 220k 10%
recommend types:
EPCOS 220k NTC d=5,5mm (No.: B57164K0224+000)
EPCOS 220k NTC d=3,5mm (No.: B57891M0224+000)

13.2 Motor Connections

13.2.1 DC Motor Servo with brushes

13.2.2 Motor Feedback X4

Connector DSUB15 female

Pin	Signal	Function	Remark
1	A	in	Encoder Track A
2	/A	in	Encoder Track A inverse
3	B	in	Encoder Track B
4	/B	in	Encoder Track B inverse
5	Z	in	Encoder Track Z
6	/Z	in	Encoder Track Z inverse
7	GND	-	Ground (Common)
8	+5V	out	Supply to encoder +5V max. 210mA
9	Hu	in	n.c.
10	Hv	in	connect to Ground
11	Hw	in	connect to Ground
12	Mt0	in	n.c.
13	Mt1	in	n.c.
14	GND	-	Ground (Common), also Pin 7
15	+5V	out	Supply to encoder +5V, also Pin 8

13.2.3 Motor Power X5

Connector DSUB9W4 female

Pin	Signal	Remark
A1	A1	For DC Brush Motor Armature + Pole
A2	.....	For DC Brush Motor n.c.
A3	A2	For DC Brush Motor Armature - Pole
A4	GND	Housing
1	Mt0	For DC Brush Motor n.c.
2	Mt1	For DC Brush Motor n.c.
3	Br+	Brake + Pole
4	-	n.c.
5	Br-	Brake - Pole

13.3 Brushless Servo Motor

13.3.1 Motor Feedback X4

Connector DSUB15 female

Pin	Signal	Function	Remark
1	A	in	Encoder Track A
2	/A	in	Encoder Track A neg
3	B	in	Encoder Track B
4	/B	in	Encoder Track B neg
5	Z	in	Encoder Track Z
6	/Z	in	Encoder Track Z neg
7	GND	-	Ground (Common)
8	+5V	out	Supply to encoder +5V max. 210mA
9	Hu	in	Commutation track U
10	Hv	in	Commutation track V
11	Hw	in	Commutation track W
12	Mt0	in	Motor temp sensor NTC
13	Mt1	in	Motor temp sensor NTC
14	GND	-	Ground (Common), also Pin 7
15	+5V	out	Supply to encoder +5V, also Pin 8

13.3.2 Motor Power X5

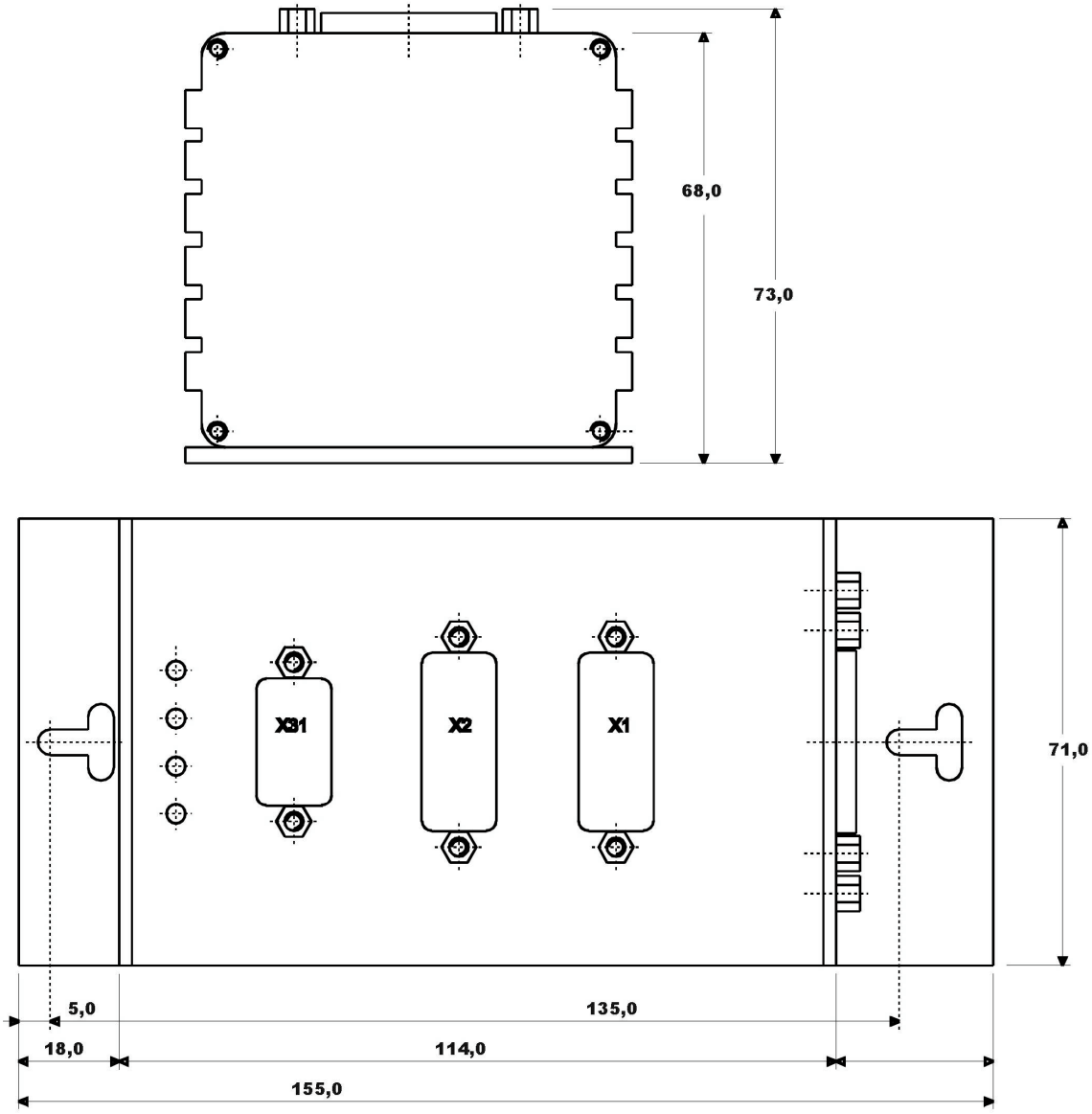
Connector DSUB9W4 female

Pin	Signal	Remark
A1	U	Motor phase U
A2	V	Motor phase V
A3	W	Motor phase W
A4	PE	Case
1	Mt0	Motor temp sensor (alternativ X4)
2	Mt1	Motor temp sensor (alternativ X4)
3	Br+	Brake + Pol
4	-	free
5	Br-	Brake - Pol

13.3.3 Minimal Motor Inductance

Type	L_{min} /mH	Remark		
BDE 050**5**	0,24			
BDE 05**10**	0,12			
BDE 060**5**	0,3			
BDE 06**10**	0,15			

13.4 Mechanics



13.5 Optional Connector Sets

For cable production by customer (contains all connectors for X1 to X5):
Connector Set for BDE PROFIBUS (MESA No.: 92.02270)
Connector Set for BDE CANbus (MESA No.: 92.02271)

13.6 Encoder

The default resolution of the encoder is 2048 ppr. Other values can set by software (MSD2BO). The BDE accepts encoder signals as RS485 level (A, /A,...) with maximal cable length up to 5 meters. In this case the frequency of encoder pulses be allowed up to 700kHz (this match with about 17000 rpm at an 2048 ppr encoder).

13.7 Hall Device

The hall device delivers the commutation signals for brushless DC motors. The BDE accepts hall signals as TTL- or open collector signals. The signal sequence should be 120 degree. Encoder supply (+5V) together with hall device supply (+5V) should not exceed 210 mA.

13.8 Motor Brake Control

Motors stall brake fix the shaft if the brake is without current. The shaft can free turn if the brake is supplied with 24VDC. The BDE can control the brake with the build in smart switch, therefore the brake has to be connected to connector X5, BR+ and BR.
The auxiliary supply (+24VDC) support also the brake. The max. current should be not exceed 800 mA. The smart switch is electronically protected, in case of overload the switch will be disabled – the output current drop to zero.

MESA
SERVO-DRIVES & MOTION CONTROL

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