MESA
SERVO-DRIVES & MOTION CONTROL

Product Date
September 2008

MSD4 Hardware Manual

MESANOR

RECEIVING AND HANDLING

Upon delivery of the equipment, inspect the shipping containers and contents for indications of damages incurred 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
- 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

Waste Disposal: According to the EC-Directive 2002/06 all drive are provided with the opposite icon. That means that the drives cannot be put to the general rubbish or garbage.

Manual Article Code: 74.02495

Table of Contents

1. Basic types of the MSD4 series – Power ranges

Name of the Series	Characteristics
M - Mesanor	Fieldbus: CANopen
S - Servoamplifier	PC interface
D - Digital	Analog input
4	High dynamic and great bandwidth
	Efficient power stage
	Fast current loop
	Extensive protection measurements
	Limit switches and stop-input
	Integrated motor brake control

Type	I_{max} [A]	I_{Rated} [A]	U_{Rated} [VDC]	U_{min} [VDC]	U_{max} [VDC]	Fan	Inductance L_{min} [mH] *	Ballast system
MSD4 3004	8	4	230	90	260	internal	3,9 / 2,0	internal
MSD4 3006	12	6	230	90	260	internal	2,6 / 1,3	internal
MSD4 3008	16	8	230	90	260	internal	2,0 / 1,0	internal
MSD4 3010	20	10	230	90	260	internal	1,6 / 0,8	internal
MSD4 3012	24	12	230	90	260	internal	1,3 / 0,7	internal
MSD4 3015	30	15	230	90	260	internal	1,0 / 0,5	internal
MSD4 3020	40	20	230	90	260	internal	0,8 / 0,4	internal
MSD4 5004	8	4	400	180	440	internal	6,5 / 3,3	internal
MSD4 5006	12	6	400	180	440	internal	4,4 / 2,2	internal
MSD4 5008	16	8	400	180	440	internal	3,3 / 1,6	internal
MSD4 5010	20	10	400	180	440	internal	2,6 / 1,3	internal

* Minimal motor inductance on nominal voltage: first value valid for 8 kHz PWM, second value for 16 kHz PWM

1.1. Type code

MSD4 MC 3010 E xxx

MESANOR
CANopen (C)
PROFIBUS (P)
Indexer (I)
Analog (A)

DC Bus voltage 320 V (30)
560 V (50)
680 V (70)
Battery devices 24..65 V (06)
36..125 V (12)

Option / Motor type
Encoder (E)
Resolver (R)
DC-Tacho (T)
BEMF (U)

Nominal current in A (10)

Other power ranges and options on request.

2. Common facts

The devices of the MSD4 series are digital servo amplifiers for using with brushed and brushless direct current motors (BLDC-Motors). Brushed motors with BEMF can be used with the variants 016 or 018.
Servo amplifiers named 30xx und 50xx are capable to be connected directly to mains power. They contain all necessary components – Rectifiers, braking circuits, inrush current limitation and line filters.

The following operation modes are available:

- **Torque control:** This operation mode allows a dynamic and precise torque control between the +/- maximum torque.
- **Speed control:** This operation mode allows a dynamic and precise speed control between the +/- maximum speed.
- **Position control:** This operation mode allows a dynamic and precise position control between the +/- maximum position. The control device delivers only the target position in this operation mode.
- **Interpolated position control:** This operation mode allows a dynamic and precise position control. The control equipment controls the entire motor movement by giving synchronous position set values. This operation mode is only available in the CAN version of the MSD4 series.
- **Position control via stored sequences:** Servo amplifiers of the MSD4 series are able to store 32 Positioning- and Homing sequences. The sequences can be started by their sequence numbers.
- **Speed and torque control via analog input (Stand alone):** These operation modes allow the using of the internal analog input for set value generation. There are speed and torque set values available.
- **RS 232 Mode:** The PC interface is mainly for diagnosis, parametrising and test purposes. Special features of the user interface like the “control panel”, the oscilloscope and “XY-writer” supporting the user during the bring-in-to-use and optimization procedure.

3. Technical data of the MSD4 series

3.1. Technical data

Power supply	06xx	12xx	30xx	50xx
AC supply voltage	48 V AC *	90 V AC *	230 V AC	400 V AC
DC supply voltage / Internal bus voltage	65 V DC	125 V DC	320 V DC	560 V DC
Output voltage U_A	60 V	120 V	290 V	520 V
Ballast voltage	80V / - *	148 V / - *	392...400 V	658...670 V
Over voltage	86 V	160 V	420 V	700 V
Under voltage	17 V	36 V	90 V DC	180 V DC

* Rectifiers and ballast circuits are optional in battery (Variant 018) devices

Power stage	IGBT-Technology in mains supply devices MOSFET-Technology in battery devices
PWM frequency	8 or 16 kHz
The power stage is protected against	Over current, Winding-leakage, Over voltage, Earth-leakage, Over temperature

Digital current loop

Controller type	PI
Set value via	Field bus (16 bit) ±10 V Analog input (12 bit) PC interface
Current limitation 1	$I_{max.}$, Maximum current
Current limitation 2	I_{rms} , Rated current
Parametrizing via	Field bus or PC interface
Sample time	62,5 µs

Digital speed loop

Controller type	PIDFF
Set value via	Field bus (16 bit) ±10 V Analog input (12 bit) PC interface
Feedback via	Encoder 250 ... 5000 ppr Tacho, BEMF (only for DC motors)
Parametrizing via	Field bus or PC interface
Sample time	250 µs

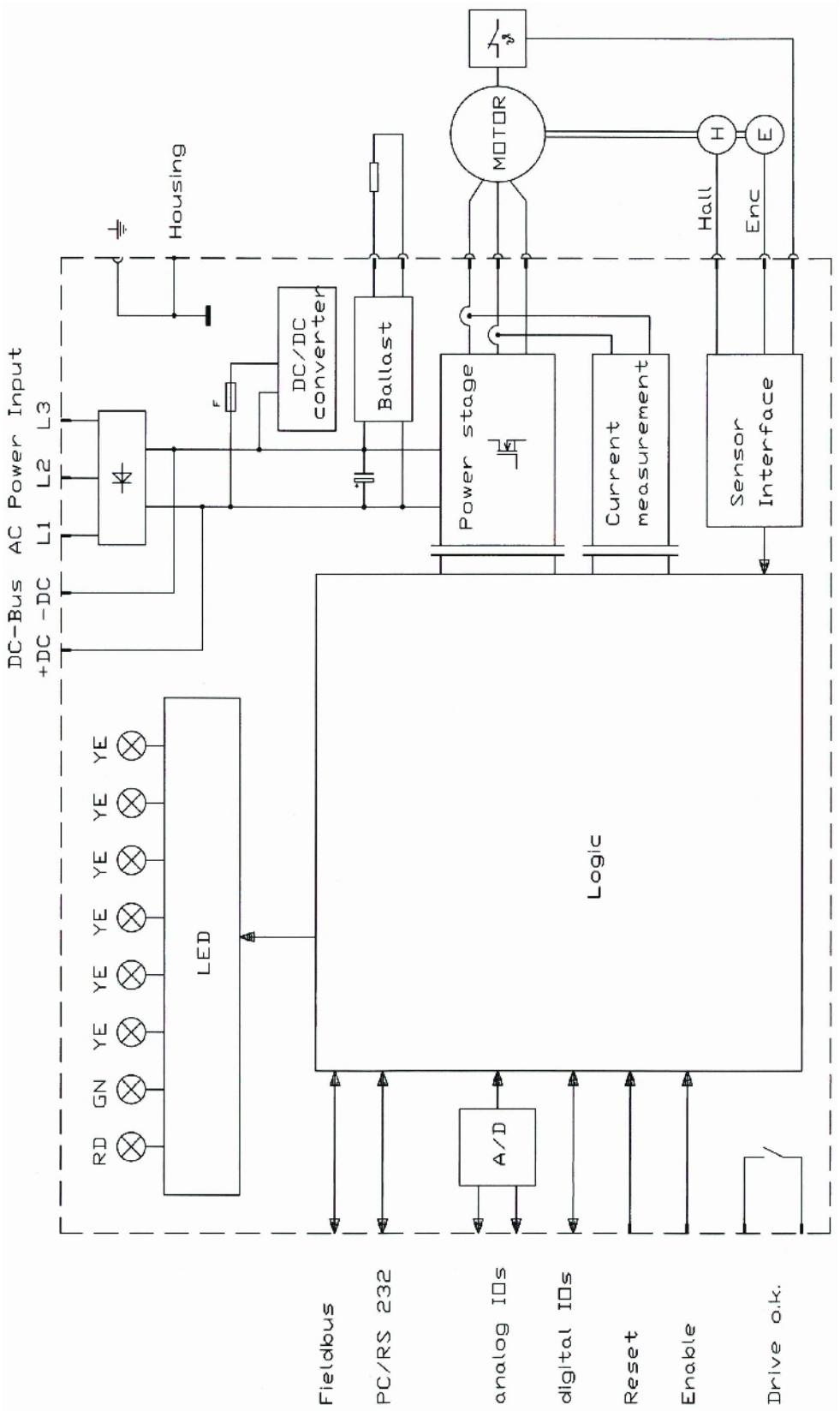
Digital position control

Controller type	PFF
Set value via	Field bus (32 bit) PC interface
Feedback via	Encoder 250 ... 5000 ppr
Parametrizing via	Field bus or PC interface
Sample time	250 µs

CAN - Interface	
Protocol	CANopen / DSP 402
Service channel	SDO, Asynchronous data transfer (Parametrizing)
Process channel	PDO, Synchronous data transfer (Process data in real time)
Baud rate	max. 1 MBit/s
Parametrizing via	Field bus or PC interface
Parameter storage	EEPROM (non volatile)
Common protection measurements	
I²t current limitation	Deactivation of the power stage / limitation of the output current
Motor over temperature	Deactivation of the power stage
Feedback error	Deactivation of the power stage
EEPROM-error	Deactivation of the power stage
Field bus error	Deactivation of the power stage
Processor error	Deactivation of the power stage
Specifications	
Operation temperature	0 ... 45 °C (Derating 2%/K 45-55 °C)
Storage temperature	-10 ... 60 °C
Protection class	IP 20
Cooling	Convection with integrated temperature controlled fan
Humidity	max. 65 % relative humidity
Isolation	C conform with EN50178
Mounting orientation	Vertical
“Ready” Signal	Relais contact 50 V / 10 mA
Control of the motor brake	Smart-Switch 24 V DC / 1,5 A
Digital In- and Outputs (+24 V DC)	1 fast input 2 limit switch inputs (+/-) 1 homing switch input 1 stop input 2 programmable In- / Outputs 8 programmable In- / Outputs (optional)
Analog input	2 differential analog inputs max. ±10 V (correlated to the housing / PE)
Motor types	brushless DC Motors brushed DC Motors
Operation modes	Position-, Speed- and Torque control
Parametrizing and diagnosis via	Field bus or PC interface
Set values and Feedback via	Field bus

4. Functional principle and basic functions

4.1. Block diagram



4.1.1. State machine

The internal control of a MSD4 servo amplifier takes place in precisely defined states. Also the transitions between the states are precisely defined. This functionality is implemented as a state-machine.
After power-up the servo amplifiers is situated in a defined state. Every appearing event switches the state-machine in a defined way into a defined state.
A detailed functional description of the state-machine can be found in the communication profile manual of the particular field bus type. The section “Device Control” is entirely concerned with this theme. The main states of the servo amplifier are “Operation Enabled” and “Switched On”. The switching between these both states will be controlled by the “Software-Enable” signal.

4.1.2. Operation modes

Depending on the function, the servo amplifier should provide, the correct operation mode has to be chosen. Changes of the operation mode are generally possible in every operation mode, if the state-machine is not in the “Operation Enabled” state.

The following steps are necessary to change the current operation modes:

1. Switch off the “Software-Enable” signal (State-machine leaves “Operation Enabled” state)
2. Change to the desired operation mode – check the right setting
3. Switch on the “Software-Enable” signal (State-machine goes into “Operation Enabled” state)

The following operation modes are selectable:

- **Simple speed control**

  The servo amplifier operates as speed controller and the speed actual value follows the speed set value, given by the communication interface.

Start conditions	Start	Stop
Amplifier in speed control mode Amplifier disabled	Speed set value “0” Enable Amplifier Give a speed set value	Speed set value “0” Disable Amplifier

- **Simple current control**

  The servo amplifier operates as current controller and the current actual value follows the current set value, given by the communication interface.

Start conditions	Start	Stop
Amplifier in current control mode Amplifier disabled	Current set value “0” Enable Amplifier Give a current set value	Current set value “0” Disable Amplifier

- **Homing mode**

Start conditions	Start	Stop
Amplifier in position control mode Sequence chosen Amplifier enabled	Set the start-bit in control word Reset the start-bit in control word after sequence start	Stops automatically after sequence

- **Sequential position control**

The servo amplifier operates as position controller and the position actual value follows the position set value, given by the communication interface. The position control normally takes place as sequence. That means there will be given only the target position as set value. The movement itself will be calculated by the servo amplifier and can be additionally influenced by the parameters speed, acceleration and deceleration. Servo amplifiers with CAN interface are able to proceed movement profiles, which calculated by an external control devices. In this case the control device sends interpolated trajectory data to the servo amplifier in close succession.

Start conditions	Start	Stop
Amplifier in position control mode Sequence chosen Amplifier enabled	Toggle the start-bit in control word	Stops automatically after sequence

- **Speed control via analog input**

The servo amplifier operates as speed controller and the speed actual value follows the speed set value, given by the analog interface.

Start conditions	Start	Stop
Amplifier disabled („Hardware-Enable“ off)	Hardware-Enable on Give a speed set value	Disable Amplifier

- **Current control via analog input**

The servo amplifier operates as current controller and the current actual value follows the current set value, given by the analog interface.

Start conditions	Start	Stop
Amplifier disabled („Hardware-Enable“ off)	Hardware-Enable on Give a current set value	Disable Amplifier

4.1.3. Set value demand for speed, current and position

Set values can be given via field bus, via PC interface (RS 232) and via analog input. There can be given only set values for speed and torque on using the analog interface.

4.1.3.1. Speed settings

The parameter “Mechanical speed limit” will be normally delivered from the motor database. This setting is a limit for all given speed set values. The compliance with this parameter will be observed by the servo amplifier automatically in all operation modes.

The speed actual value will be detected by the chosen feedback device.

4.1.4. Control priority

The control priority determines the behaviour of the servo amplifier after activation of the “Hardware-Enable” signal. If the parameter is set to “Stand-Alone” the state-machine will be switched automatically into the “Operation Enabled” state. If the parameter is set to “Feldbus Master PLC” the state-machine can be switched by the control device or by the user interface.

4.1.5. Error-RESET

If the servo amplifier is situated in an error state, a RESET can be proceeded via field bus or PC interface. There is also a hidden button at the front plate, which also provides the reset function. This button is only active if the servo amplifier works in stand-alone mode. The RESET procedure will only be successful, if the error cause is not still active.

4.1.6. Power-On RESET

A switch “off” and “on” of the supply voltage will also reset all servo amplifier errors. On using a separate +24 V auxiliary voltage, both power supplies (main power and auxiliary power) have to be switched “off” and “on”. The RESET procedure will only be successful, if the error cause is not still active.

4.2. In- and Outputs

4.2.1. Digital In- and Outputs

The servo amplifiers of the MSD4 series containing a couple of digital in- and outputs. There are two kinds of in- and outputs. The first type is the determined type, because it has a determined function (like Limit switch, Homing switch or Stop). The other type is the general type. The function of the general digital in- and outputs is user-defined and can be used mainly for the extension of the machine functionality.

4.2.2. Analog inputs

There are two symmetric +/-10 V analog inputs. The analog input ANIN1 is normally configured as set value input for speed or torque. The analog input ANIN2 is user-defined and can be used for measurement data logging for the control device.

4.2.3. Actual value acquisition

4.2.3.1. Encoder

Encoder devices deliver position- and speed information to the servo amplifier. The servo amplifiers of the MSD4 series support encoders which are conform with the RS485 specification (A, A/,...). The encoder resolution can be set between 250 and 5000 ppr by the user interface software. The maximum input frequency of the encoder inputs is 700 kHz (about 17000 rpm maximum speed with a 2048 ppr encoder device).
Using of brushless DC motors needs additional HALL signals for the commutation information.

4.2.3.2. Hall feedback

The HALL feedback delivers the commutation information for brushless DC motors. Servo amplifiers of the MSD4 series support HALL signals with TTL level or with open collector outputs. The mounting of the HALL sensors should be 60° or 120° and can be set by the user interface software.

Attention! The power consumption of the 5V supply for encoder device and HALL sensors must not exceed 210 mA.

4.2.3.3. DC-Tacho

On using a brushed DC motor the actual value acquisition can be implemented with an encoder or preferably with a DC tacho generator. The tacho scaling setup has to be proceed by the user interface software. An additional resistor between TJ- (X1 Pin 6) and TJ+ (X1 Pin 18) is necessary for the tacho voltage adaptation. The value of this resistor can be taken from the following table or from the MESABO software.

Tacho voltage at N_{max}	Resistor value
< 12,0 V	open
12,0 V...17,9 V	180 kΩ 1% 0,25W
18,0 V...25,9 V	75 kΩ 1% 0,25W
26,0 V ... 37,9 V	43 kΩ 1% 0,25W
38,0 V ... 51,9 V	27 kΩ 1% 0,25W
52,0 V ... 73,9 V	18 kΩ 1% 0,25W
74,0 V ... 80,0 V	12 kΩ 1% 0,25W

Attention! The maximum voltage at the tacho input of the MSD4 must not exceed 80V for long times. Too high tacho voltages will damage the servo amplifier. Missing resistors or wrong resistor values will cause false measurement values

4.2.3.4. Armature voltage control with IxR compensation (opt. Var. 016 / 018)

On using brushed DC motors the armature voltage control allows a reasonable speed control. The speed information will be derived from the back electromotive force in this case. The IxR compensation counterbalances the voltage loss in the winding and wiring of the motor.

The armature voltage control with IxR compensation is only available with the variants 016 and 018 for brushed DC motors.

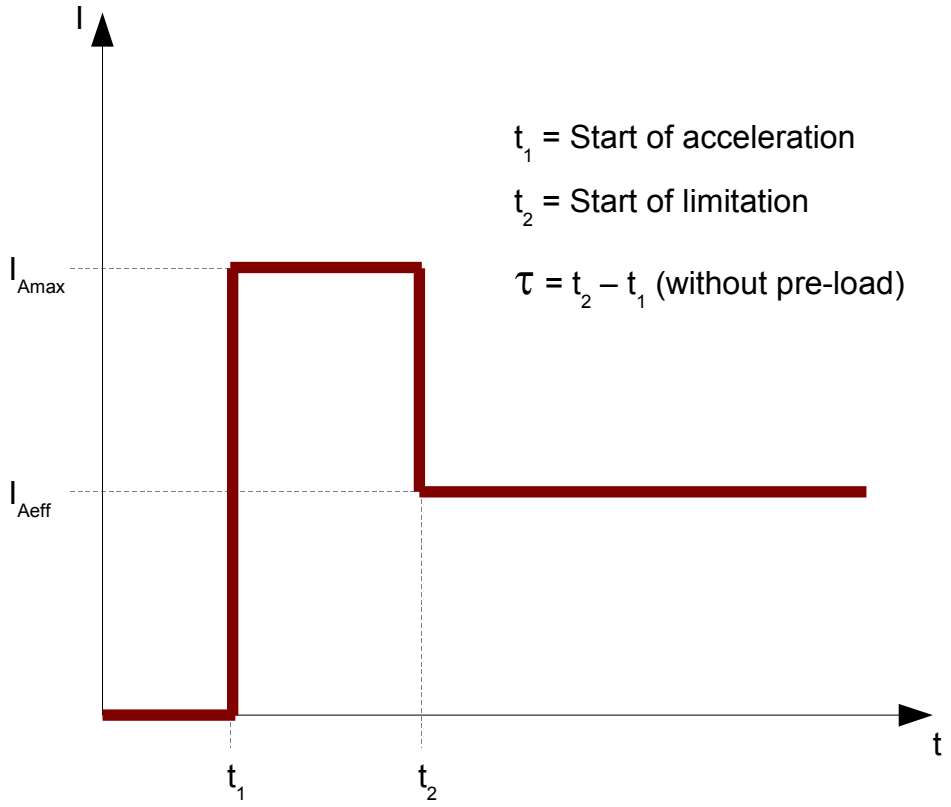
4.2.3.5. Current measurement

The motor current will be measured with resistors in the motor circuit. The signals will be rehashed and transferred by opto-isolated operational amplifiers.

4.2.3.5.1. I_{Amax} Maximum current setting

Servo amplifiers of the MSD4 series are able to deliver the double of their nominal current for a short time. This feature enables short acceleration and deceleration times. The current value of the type label means the nominal current (50% of the maximum current). The maximum output current can be set between 10...100 % I_{max}.

4.2.3.5.2. I_{Arms} (I^2t)-Function



The I²t function emulates the effective value of the motor current independently on the real curve shape. The effective value limitation will be set by the user interface software between 10...50 % I_{max}. The actual effective current depends on the pre-load, the parametrized peak current and the maximum current.

4.2.4. “Ready”-Output

“Ready” Output (Relais contact):

- **Closed:** Servo amplifier is ready for operation (no error)
- **Open:** Servo amplifier is not ready for operation (If there are errors, during start-up phase or if there is no supply voltage.)

4.2.5. Hardware-Enable

Connecting +24 V DC to the “Hardware-Enable” input activates the power stage if the servo amplifier operates in “Stand-Alone” mode. The servo amplifiers begins immediately to work in the actual operation mode.

Attention! The motor might move directly after switching on the “Hardware-Enable” signal.

Switching off the “Hardware-Enable” signal deactivates the power stage.

Attention! The motor will be decelerated only by friction in this case. In field bus mode or on using the user interface software the “Hardware-Enable” signal has to be activated. The motor can not be moved otherwise.

The “Hardware-Enable” signal controls an eventually existing motor brake at the same time.

4.2.6. Machine Switches

4.2.6.1. Stop-Input

The Stop function will be deactivated by connecting +24 V DC to the stop input. An open input or 0V at the stop input stops the motor movement immediately with maximum current. The function works independently on the actual moving direction. The internal current set value will be set to “0” if the servo amplifier works in the current controller mode – the motor will be decelerated by friction in this case.

If the servo amplifier is currently in a homing procedure a procedure error will be generated.

The behaviour of the servo amplifier for an occurring stop event depends on the actual operation mode:

- **Current control mode:** The parametrized current set value becomes active again.
- **Speed control mode:** The servo amplifier starts the movement with the parametrized speed again.
- **Position control mode:** The interrupted sequence can be restarted by setting the start command again (bit in control word)
- **Homing mode:** After RESET of the procedure error the homing procedure can be restarted.

4.2.6.2. Hardware-Limit Switch

To enable the corresponding moving direction the related limit switch input has to be connected to +24 V DC.

An open input or 0V at the limit switch input prevents every movement in the locked direction. The internal current set value will be set to “0” if the servo amplifier works in the current controller mode – the motor will be decelerated by friction in this case. The servo amplifier can only be moved in the opposite direction. If a limit switch will be reached during a running homing procedure a procedure error will occur.

The behaviour of the servo amplifier for an occurring hardware-limit-switch event depends on the actual operation mode:

- **Current control mode:** The parametrized current set value becomes active again.
- **Speed control mode:** The servo amplifier has to be moved in the opposite direction firstly. The software contains a lock function, which prevents each movement in the locked direction (Overrun of the limit switch).
- **Position control mode:** The interrupted sequence can be restarted by setting the start command again (bit in control word)
- **Homing mode:** After RESET of the procedure error the homing procedure can be restarted.

4.2.6.3. Homing Switch

In position controller mode this input can be used for the homing procedures. Detailed information about homing are contained in the PC user interface software (MESABO) manual.

4.3. Temperature sensors

The servo amplifier contains a temperature sensors for the temperature monitoring of the power electronics. Additionally a temperature sensor for the temperature monitoring of motor winding can be connected. There can be set a maximum temperature and a time constant (0...16 s) for each temperature sensor separately. If the detected temperature exceeds the parametrized limit longer than the time constant, an over temperature error will be generated by the servo amplifier.

4.3.1. Motor temperature sensor

The evaluation circuit supports the following NTC resistor: R = 220k (10%). If there is a different type built in the motor, the user interface software displays wrong values.

Recommended types:

EPCOS 220k NTC d=5,5mm (No.: B57164K0224+000)

EPCOS 220k NTC d=3,5mm (No.: B57891M0224+000)

Commonly the temperature display at the user interface software supports arbitrary temperature sensors (NTC, PTC, Temperature switches). There are some temperature curves in the contained database. If you need other temperature curves, do not hesitate to ask our support department.

4.4. General digital in- and outputs

Optionally the MSD4 contains eight additional digital in- and outputs. Normally they work as 24V inputs but they can be programmed separately as 24V outputs by the user interface software.

The in- and outputs can be used as general in- and outputs by the superior control device.

4.5. Control- and Diagnosis Interface

4.5.1. Parameters

The MSD4 parameters will be stored in non-volatile EEPROM memory. During the boot-up phase the parameters will be loaded into the RAM area and be activated. The parameters can be changed and activated by the communication interface, if all other conditions are fulfilled. The changeability of a parameter depends additionally on state of the “Software-Control”, the “Software-Enable” signals and on the access type of the parameter (ro/rw). Changed parameters have to be stored into the EEPROM before power off if they should not get lost.

4.5.2. Monitor Outputs

The monitor outputs support the user during the bring-in-to-use procedure. Two internal signals can be brought out as analog signal and recorded with an oscilloscope or a XY writer.
Normally the monitor outputs are configured to show the signals „Actual speed“ and „Actual current“. The configuration of the monitor outputs is described in the software manual.

5. Configuration of the Servo Amplifier

The parametrizing of the servo amplifier should be made with the contained PC user interface software MESABO. Use the most actual version of the MESABO software each time. The MESABO software manual contains all necessary information for configuration and optimization of the servo amplifier.

The servo amplifier starts every time in this operation mode, which is stored in the EEPROM. To start the servo amplifier directly in the desired operation mode, it is recommended to store this mode into the EEPROM after the configuration of the servo amplifier was finished.

If the user interface software detects a servo amplifier for the first time, a parameter file with the “org” extension will be created automatically in the “devices” directory. It contains the delivery parameters of this particular servo amplifier.

Attention! The PC interface is only for parametrizing and diagnosis. Parameter changes influences the behaviour of the servo amplifier immediately. Wrong settings cause unpredictable behaviour or even damages and injuries.

5.1. Basic configuration – First Steps

- Wiring the servo amplifier corresponding to the local conditions
- Deactivate the “Hardware-Enable” signal
- Install the user interface software MESABO
- Connect PC and servo amplifier
- Connect the power supply (pay attention to the grounding!)
- Wait until the green “OK” LED lights
- Start the PC user interface software MESABO

The MSD4 will be controlled by the field bus interface after the start-up. The user has to taken the “Software-Control” before the parameter setting is possible.

Attention! Taking the “Software Control” interrupts immediately all field bus operations. Even running operations will be interrupted.

During the start-up the following operations will be proceeded:

- Initializing the DSP
- Loading the parameters from EEPROM into the RAM area
- Initializing the control loops
- Initializing and activating the communication interfaces (Field bus / PC interface)
- Checking the servo amplifier state and the input signals
- Setting up the outputs, the monitor signals and the LEDs
- Initializing the state machine

The start-up procedure takes several seconds – the servo amplifier is not operational during this time.

6. Power supply

The mains voltage has to be adapted by a transformer to the input voltage of the servo module on demand. An auto-transformer can be used.

6.1. Mains transformer

It is possible to use transformers with electrically isolated windings and auto-transformers for the mains adaptation. The transformers have to be conform with the VDE 0550 standard. On using three-phases transformers it is necessary to use star connection with earthed star point at the secondary side.

The internal mains filter causes a high leakage current (in worst case up to 14 mA). An eventually built-in earth leakage circuit breaker may interrupt the power circuit. The servo amplifier has to be fix installed. An interruption of the earth circuit (Housing / PE / GND) is not allowed.

6.2. Ballast circuit

During motor deceleration the kinetically energy of the motor will be transformed into electrically energy. In this case high voltages can accrue by induction. These voltage can cause an over voltage error in the servo amplifier. The servo amplifiers of the MSD4 series contain a complete ballast system with internal ballast resistor to prevent this. If the application causes higher braking energies an external (more powerful) resistor can be connected between X22 Pin 2 and 3.

Attention! The connection between X22 Pin 1 and 2 has to be rejected if an external ballast resistor will be connected.

Type	Internal Resistor	Max. continuous load	External Resistor	Max. continuous load
MSD4 30xx	22 Ohm	30 W	22 Ohm	200 W*
MSD4 50xx	39 Ohm	30 W	39 Ohm	200 W*

* higher continuous powers with external ballast resistor on demand

External ballast resistors should have a minimum load of 375 W.

The continuous ballast load will be electronically limited. It is about 30 W for internal ballast resistor and about 200 W for the external ballast resistor. If these limits will be exceeded during operation an over voltage error occurs.

- The wiring of the external ballast resistor has to be shielded if it is longer than 0,5 m.
- If the ballast resistor will be mounted outside of the cabinet, it has to be covered with perforated sheet metal to prevent emissions and accidental contact.
- The ballast resistor has to be protected against accidental contact in any case, because it gets very hot during normal operation.

Attention! The connector X22 and the ballast resistor have high voltage!

6.3. +24 V DC Auxiliary Voltage (Electronic supply)

The +24 V auxiliary voltage supplies the electronic of the servo amplifier if the power voltage is off. The purpose is to store and to detect the actual position if the power voltage is inactive. The auxiliary voltage controls also the motor brake.

The entire power consumption can be parted into the power consumption of the MSD4 electronics and into the power consumption of the motor brake:

- The power consumption of the MSD4 electronics is max. 0,8 A (24V DC ±20 %).
- The power consumption of the motor brake depends on the used model and has to be lower or equal to 1,5 A. The tolerance of the auxiliary voltage depends on the motor brake in this case.

6.4. Control of the motor brake

The servo amplifiers of the MSD4 series contain a semiconductor switch (+24V) for the motor brake control. The supply of the motor brake will be ensured by the +24V auxiliary voltage (connector X24 at the front panel). The internal voltage loss is lower than 0,5V.

The semiconductor switch is electronically protected.

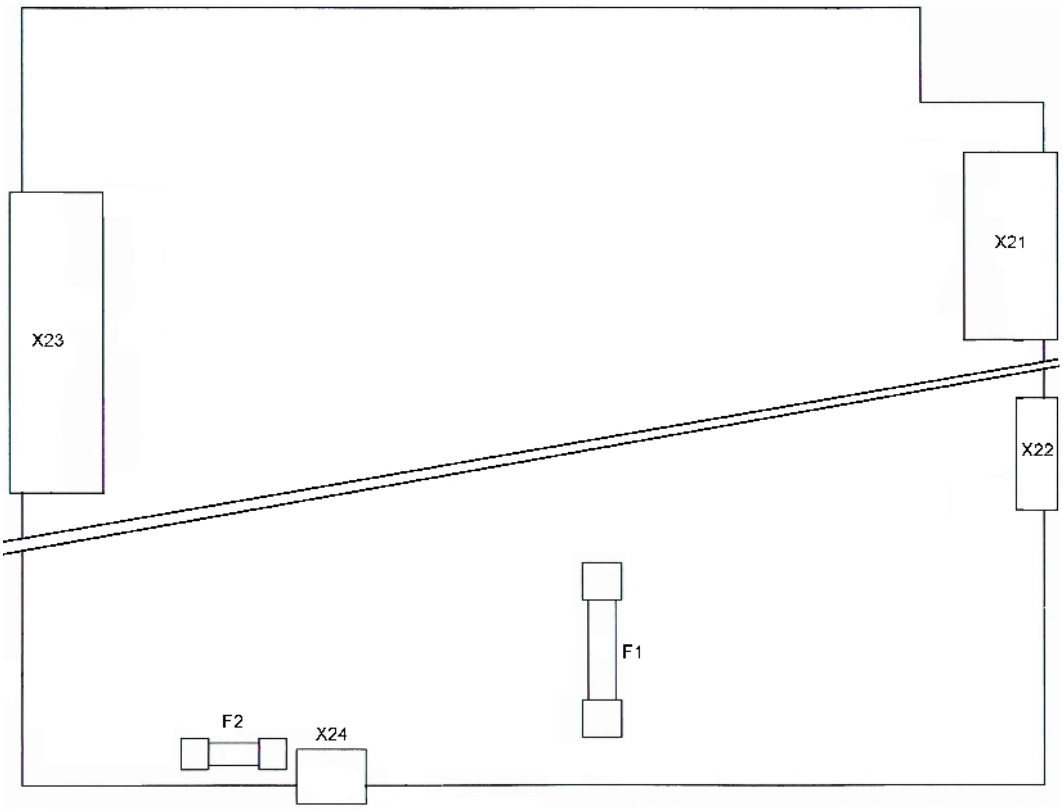
The motor brake can be controlled by the field bus or together with the “Software-Enable” signal. Normally it will be controlled by the field bus. If the user takes the “Software-Control” in the user interface software or in the “Stand-Alone” mode, the motor brake will be controlled automatically with the “Hardware-Enable” signal.

Attention! The power consumption of the motor brake must not exceed 1,5 A.

6.5. Fuses

Pos.	MSD4..	Size	Current / Voltage	Function / Notice
F1	06xx	5 x 20	4,0 A MT / 250 V AC	DC/DC-Converter - This fuse has to be changed only by our service department
	12xx	6,3 x 32	1,6 A F / 500 V DC	
	30xx	6,3 x 32	1,6 A F / 500 V DC	
	50xx	6,3 x 32	1,6 A FF / 1000 V DC	
F2	xxxx	5 x 20	2,0 A MT / 250 V AC	+24 V auxiliary voltage for motor brake and electronics
Power stage (external fuse) - has to be installed by the user				
F	xxxx		16 A T / 400 V AC	external fuse

The fuses are accessible after rejecting the front cover! Fuse F1 (special type) has to be changed only in the factory after checking the DC/DC converter.



MSD4 - Power board

Attention! The connectors at the servo amplifier must not connected or disconnected under load. Wait about 3 minutes after switching off the power supplies for the discharging of the capacitors!

7. Standard settings

The following table shows the standard settings of the most important parameters. For special applications or modifications other settings are possible. Ask our service department for detailed information.

Name	Function	Default	Notice
Communication			
RS 232	PC Communication	Baudrate 19200	automatically
Power stage			
Power stage temperature	Protection of the electronics	75 °C	Or lower
Temperature sensor (power stage)	Protection of the electronics	NTC	PTC
Motor			
Motor temperature	Protection of the motor	95 °C	max. 135 °C
Temperature sensor (motor)	Protection of the motor	NTC	PTC
Operation mode			
Mode	Controller type	Speed controller	Position / Current controller
Current loop			
Current loop	P-Gain	4500	
	I-Gain	500	
Imax	Max. output current	100 % (Imax)	20...100 % (Imax)
Irms	Output current	50 % (Imax)	20...50 % (Imax)
Irms-Limitation	Protection of the electronics	Limitation	Interruption
Speed loop			
Mode	Controller type	PIDFF-Mode	P-Mode
P	P-Gain	15000	
I	I-Gain	100	
D	D-Gain	0	
FF	Feed Forward Gain	0	
Max. speed	Speed limitation	14.000 rpm	500...14.000 rpm
Feedback resolution	Resolution of the position detection	2048 ppr	In several steps from 250 to 5000 ppr
Position loop			
Mode	Controller type	PFF	
P	P-Gain	125	
FF	FeedForward Gain	0	

CAN-Bus-Interface			
Configuration	Baudrate	1 MBaud	0,8 MBaud
	NODE Address	125	
Attention! A changed field bus address will be only valid after Power-On RESET.			

8. Bring-in-to-use

Attention! Check the earth circuit of the housing before connecting the servo amplifier to any voltage (Servo amplifier and motor and PE).

Check before switch-on...

- The correctness of the earth connection!
- The correctness of the wiring!
- The conformity of the transformer output voltage / mains voltage and the nominal voltage of the servo amplifier!
- The conformity of the servo amplifier current settings (maximum and rated current) and the nominal current values of the motor!
- The correctness of the application settings!
- The correctness of the settings and wiring of all external switches!
- The movability of the motor axis! (Separate the motor axis from the machine if possible! Limit the maximum current down to uncritical values (i.e. 20%) in all other cases.)
- The deactivation of the “Hardware-Enable” signal!

Attention! The connectors at the servo amplifier must not connected or disconnected under load. Wait about 3 minutes after switching off the power supplies for the discharging of the capacitors!

The power supply can be switched on if all these tests were successfully finished. The user should perform a same-time measurement of the intermediate circuit voltage.
If the “Ballast-On” LED lights, check again the power supply output voltage and/or the ballast threshold.
If the „OK“-LED lights, the servo amplifier is ready for operation.

Attention! The „Hardware-Enable“ signal must only be activated after connecting the power voltage.

9. Description of the Connectors

9.1. MSD4 Connectors

Name	Function	Pos.	Type	Notice
X 1	Motor sensor	top	D-Sub female 25 Pins	Slide lock
X 2	Control signals	top	D-Sub male 25 Pins	Slide lock
X 3	RS 232 alternativ USB	front	D-Sub male 9 Pins USB-B female	Service
X 4	Machine signals	front	Plug RM 3,5 10 Pins	Screw lock
X 5	Digital I/Os	front	Plug RM 3,5 10 Pins	optional
X 6	CAN (1)	bottom	D-Sub female 9 Pins	Slide lock
X 7	CAN (2)	bottom	D-Sub male 9 Pins	Slide lock
X21	Supply	bottom	Plug RM 7,6 mm 5 Pins	Power Combicon
X22	Ballast	bottom	Socket RM 7,6 mm 3 Pins	Combicon
X23	Motor	top	Socket RM 7,6 mm 8 Pins	Combicon (optional Power Combicon)
X24	Aux. +24 V	front	Plug RM 3,5 mm 2 Pins	Screw lock

9.2. X1 Motor Sensor

D-SUB 25 pins female

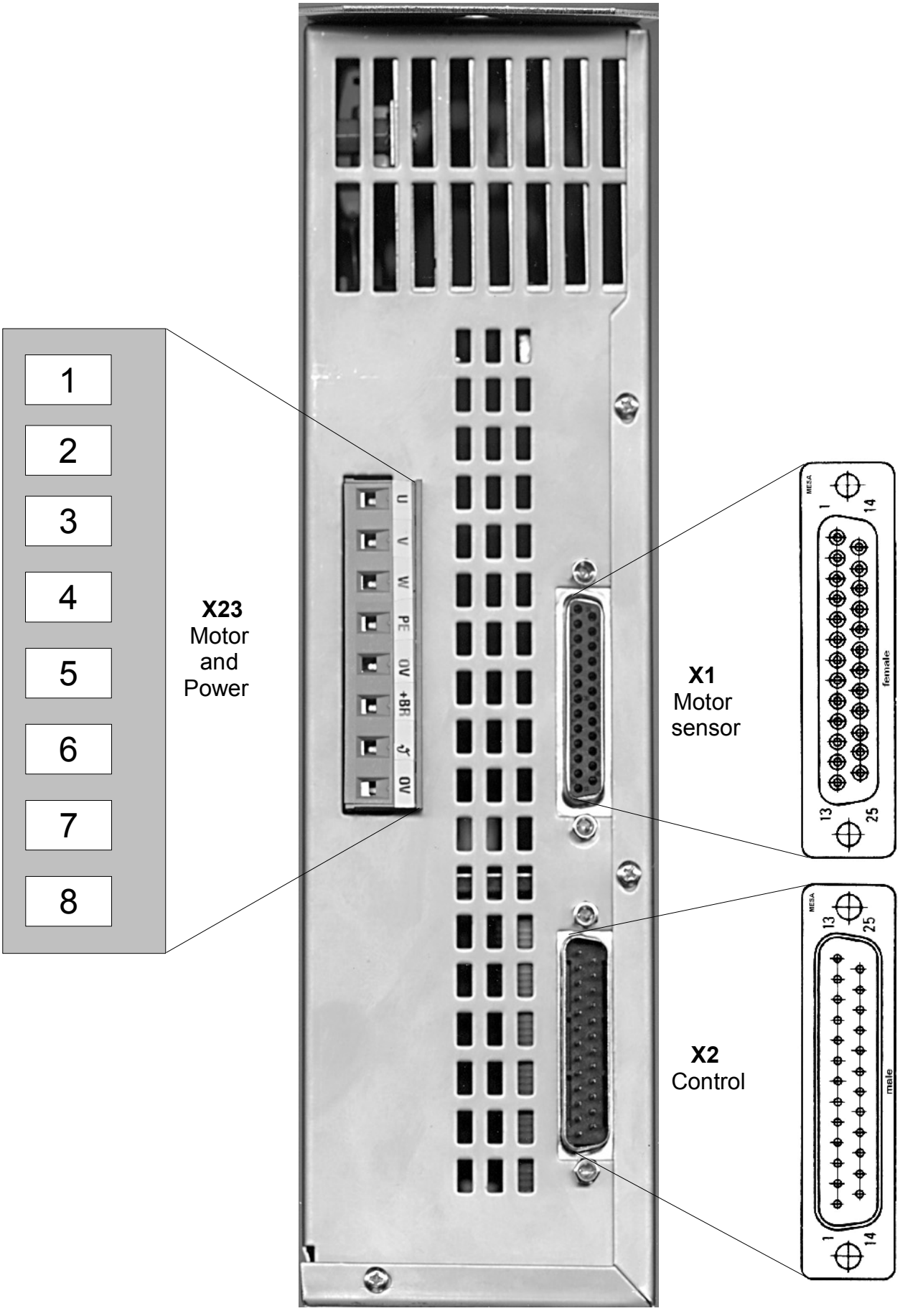
Pin	Name	Function	Notices
1	Z	Input	Encoder Index Z (RS422)
2	A	Input	Encoder A (RS422)
3	B	Input	Encoder B (RS422)
4	GND		Ground
5	+Ub	Output	+5 V Encoder / HALL supply max. 210 mA (Pin 5 und 7)
6	TJ-	Input	Tacho adaptation negative
7	+Ub	Output	+5 V Encoder / HALL supply max. 210 mA (Pin 5 und 7)
8	H1	Input	HALL 1
9	+24V	Output	+24 V Auxiliary voltage max. 20 mA
10	R1	Output	Resolver supply 1 *
11	T-	Analog Input	DC Tacho negative potential
12	COS+	Input	Resolver cosinus positive *
13	COS-	Input	Resolver cosinus negative *
14	/Z	Input	Encoder Index /Z (RS422)
15	/A	Input	Encoder /A (RS422)
16	/B	Input	Encoder /B (RS422)
17	GND		Ground
18	TJ+	Input	Tacho adaptation positive
19	H3	Input	HALL 3
20	H2	Input	HALL 2
21	R2	Output	Resolver supply 2 *
22	MT1	Input	Motor temperatur sensor
23	T+	Analog Input	DC Tacho positive potential
24	SIN+	Input	Resolver sinus positive *
25	SIN-	Input	Resolver sinus negative *

* The resolver interface is not available in the moment

9.3. X2 Control signals

D-SUB 25 pins male

Pin	Name	Function	Notice
1	MON1	Analog output	programmable, normally current monitor +/- 4,36 V
2	IO2	In / Output	programmable digital in/output 24V (also X4 Pin 2)
3	MON2	Analog output	programmable, normally speed monitor +/- 4,36 V
4	/Z	Output	Encoderindex /Z (RS422)
5	Z	Output	Encoderindex Z (RS422)
6	/A	Output	Encoder /A (RS422)
7	A	Output	Encoder A (RS422)
8	/B	Output	Encoder /B (RS422)
9	B	Output	Encoder B (RS422)
10	IO1	In / Output	programmable digital in/output 24 V (also X4 Pin 7)
11	GND		Ground
12	PAR	Input	Parameter switching (optional)
13	ERESET	Logic input	Error-RESET +24V / 0V
14	-		
15	AGND		Ground / Analog part
16	ANIN1-	Analog input	programmable, negative input (+/-10V differential)
17	ANIN1+	Analog input	programmable, positive input (+/- 10 V differential)
18	BE1	Output	Amplifier ready, dry contact
19	BE2	Output	Amplifier ready, dry contact
20	Freigabe	Logic input	Amplifier enabled +24V (also X4 Pin 8)
21	+24V	Output	+24 V Auxiliary voltage max. 20 mA
22	-		
23	ANIN2+	Analog input	programmable, positive input (+/- 10 V differential)
24	ANIN2-	Analog input	programmable, negative input (+/-10V differential)
25	GND		Ground


1
2
3
4
5
6
7
8
X23
Motor
and
Power
U
V
W
PE
0V
+BR
0V
X1
Motor
sensor
MESA
1
14
13
25
female
X2
Control
MESA
13
25
1
14
male

9.4. X3 RS232

D-SUB 9 pins male

Pin	Name	Function	Notice
1		n.c.	
2	RX	Data input	RS232 receive data
3	TX	Data output	RS232 send data
4		n.c.	
5	GND	Ground	Reference ground
6		n.c.	
7		n.c.	
8		n.c.	
9		n.c.	

The MSD4 is alternatively available with USB interface (USB-B plug).

9.5. X4 Digital In and Outputs

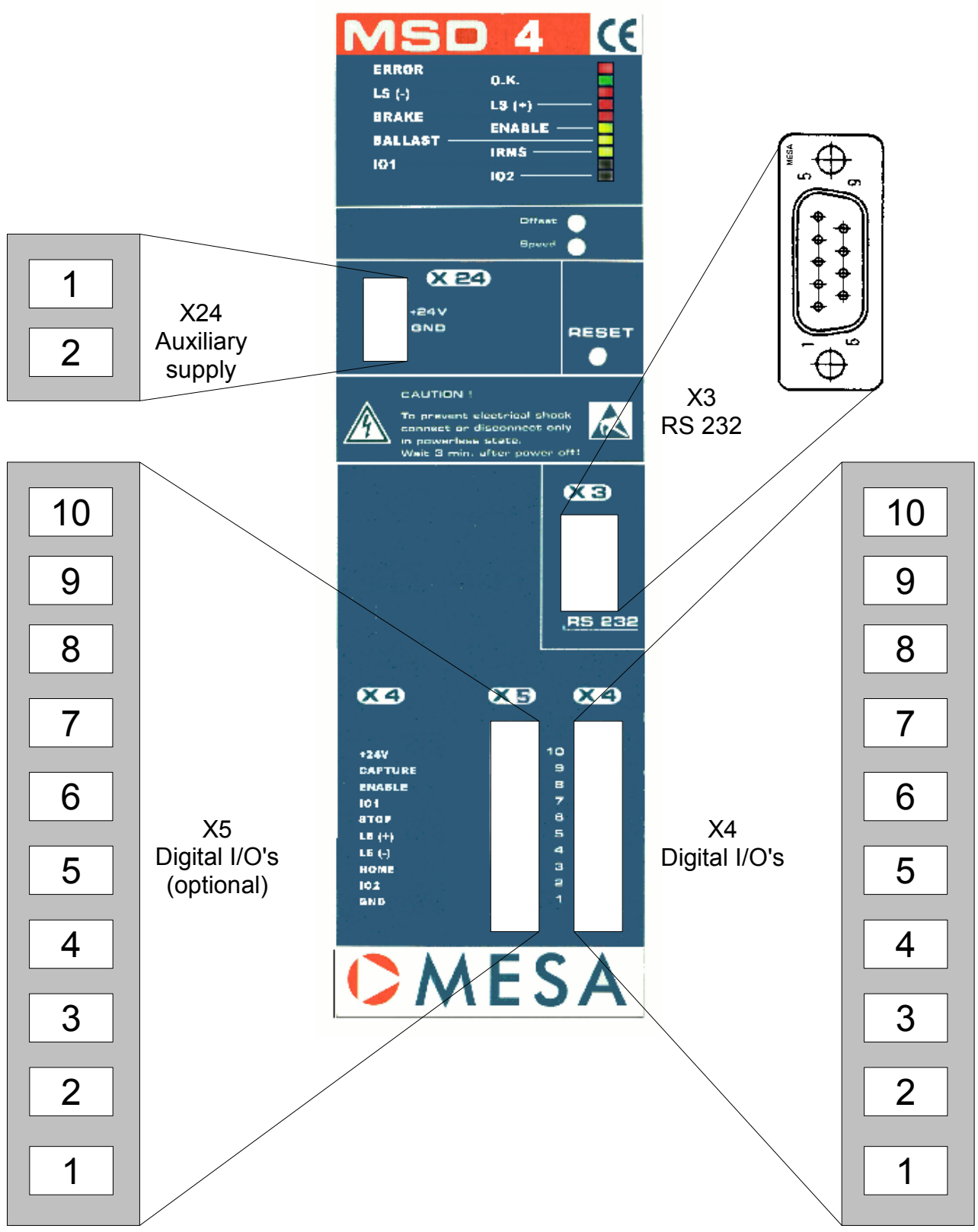
10 pin multi-pin connector / 3,5 mm grid dimension

Pin	Name	Function	Notice
1	GND		Ground
2	IO2	In / Output	Programmable digital in/output 24 V (also X2 Pin 2)
3	/REF	Input	0V or open: reference switch active
4	/E-	Input	0V or open: negative limit switch active
5	/E+	Input	0V or open: positive limit switch active
6	/STOP	Input	0V or open: stop active
7	IO1	In / Output	Programmable digital in/output 24 V (also X2 P. 10)
8	Enable	Input	Amplifier enabled +24 V (also X2 Pin 20)
9	/Capture	Input	0V or open: Capture active
10	+24V	In / Output	If output: Imax = 20 mA

9.6. X5 Digital In and Outputs (optional)

10 pin multi-pin connector / 3,5 mm grid dimension

Pin	Name	Function	Notice
1	GND		Ground
2	GIO0	In / Output	Programmable digital in/output 24 V
3	GIO1	In / Output	Programmable digital in/output 24 V
4	GIO2	In / Output	Programmable digital in/output 24 V
5	GIO3	In / Output	Programmable digital in/output 24 V
6	GIO4	In / Output	Programmable digital in/output 24 V
7	GIO5	In / Output	Programmable digital in/output 24 V
8	GIO6	In / Output	Programmable digital in/output 24 V
9	GIO7	In / Output	Programmable digital in/output 24 V
10	+24V	In / Output	If output: Imax = 20 mA


MSD 4
ERROR
LS (-)
BRAKE
BALLAST
IO1
O.K.
LS (+)
ENABLE
IRMS
IO2
Offset
Speed
X 24
+24V
GND
RESET
CAUTION !
RS 232
X3
X4
X5
+24V
CAPTURE
ENABLE
IO1
STOP
LS (+)
LS (-)
HOME
IO2
GND
1
2
X24
Auxiliary
supply
X3
RS 232
10
9
8
7
6
5
4
3
2
1
X5
Digital I/O's
(optional)
X4
Digital I/O's
MESA

9.7. X6 / X7 CAN Bus

D-SUB 9 pins female (X6) / D-SUB 9 pins male (X7)

Pin	Name	Function	Notice
1	-		
2	CAN_L	CAN Low	
3	CGND	CAN GND	
4	-		
5	Shield		
6	0GND	ext. CAN supply -	Not used
7	CAN_H	CAN High	
8	-		
9	+Ucan	ext. CAN supply +	Not used

9.8. X21 Power Supply

Power Combicon 5 pin connector

Pin	Name	Function	Notice
4	+DC	DC In / Output	DC-BUS (Rectifier, optional: intermediate voltage circuit)
5	-DC	DC In / Output	DC-BUS (Rectifier, optional: intermediate voltage circuit)
6	L1	AC Input	Power supply phase 1 **Mind the nominal value!**
7	L2	AC Input	Power supply phase 2 **Mind the nominal value!**
8	L3	AC Input	Power supply phase 3 **Mind the nominal value!**

9.9. X22 Ballast

Combicon 3 pin connector

Pin	Name	Function	Notice
1	Int	Ballast	internal ballast resistor (link between Pin 1 and 2)
2	RB	Ballast	common contact (ballast resistor)
3	Ext	Ballast	external ballast resistor (between Pin 2 and 3)

9.10. X23 Motor Connector

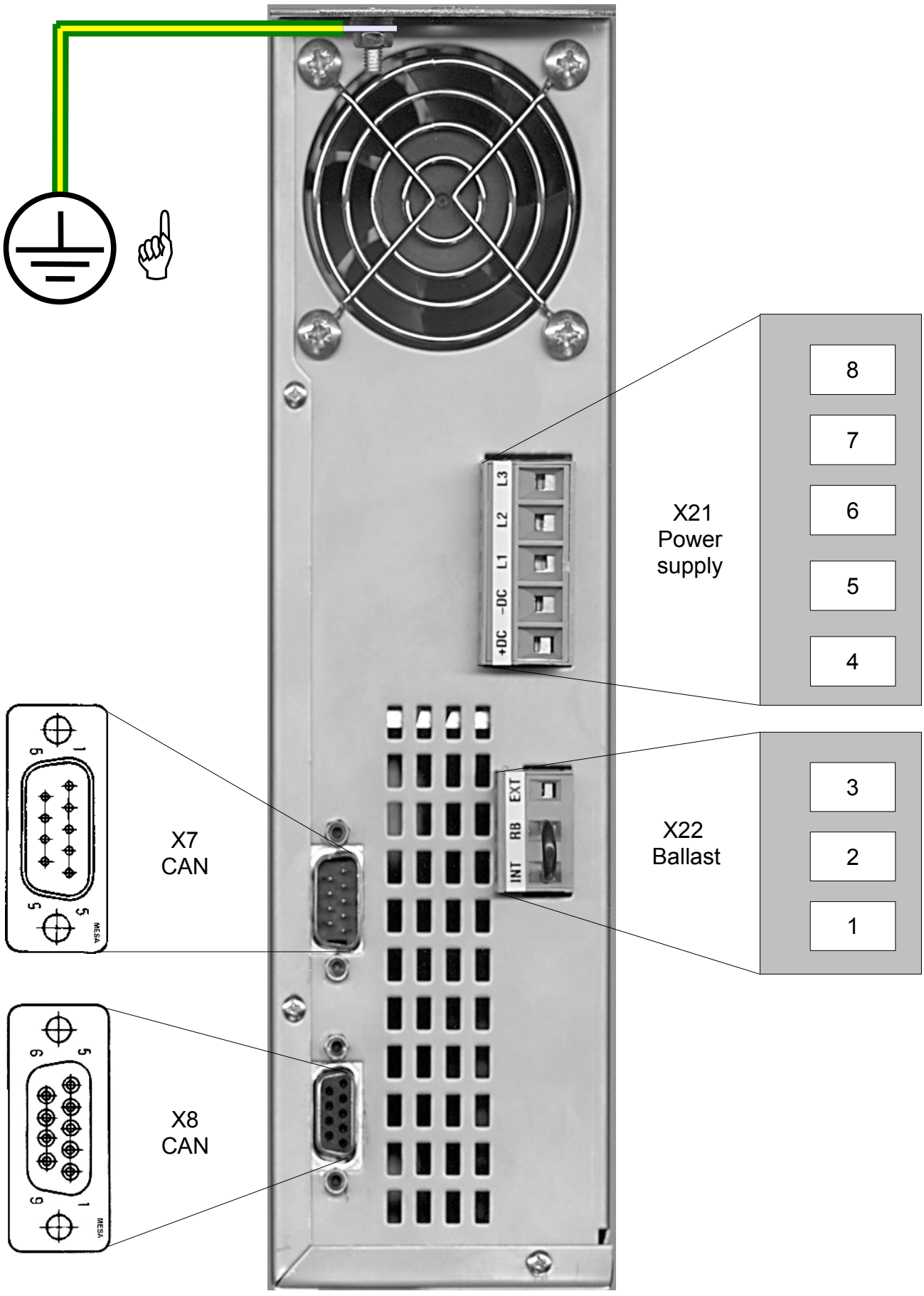
Combicon (optional Power Combicon) 8 pin connector

Pin	Name	Function	BLDC Motor	DC Motor
1	U	Motor phase	Phase U	A1 (positive pole)
2	V	Motor phase	Phase V	A2 (negative pole)
3	W	Motor phase	Phase W	
4	PE	Motor earth	Equipotential bonding between motor and servo amplifier	
5	0V	Motor brake-	Motor: brake- (GND)	
6	+Br	Motor brake+	Motor: brake+ (+24V)	
7	ϑ	Motor temperature	Motor: Temperature sensor	
8	0V	Motor temperature	Motor: Temperature sensor (GND)	

9.11. X24 Auxiliary Voltage +24 V

2 pin multi-pin connector / 3,5 mm grid dimension

Pin	Name	Function	Notice
1	+24 V	Input	External +24V input for motor brake and electronic supply
2	GND	Input	Ground (internally connected with PE potential)


8
7
6
5
4
X21
Power
supply
L3
L2
L1
-DC
+DC
3
2
1
X22
Ballast
EXT
RB
INT
X7
CAN
X8
CAN

10. Earthing and Installation according to EMC Norms

10.1. General Indications

It is important that the installation of the servo amplifiers of the MSD4 series is made according to the electrical safety regulations and by qualified personnel which is familiar with installation, assembly, commissioning and operation of the equipment. National and local regulations have to be be respected.

Please follow strictly the further instructions, they are important to assure the correct operation of the MSD4 and so far of the complete machine.

The electromagnetic compatibility of the drive system depends - besides of the MSD4 servo amplifier - on the following conditions:

- Total cable length and the total capacity to ground.
- Low-impedance earthing of all components, power supply and control device.
- Shielded cables and housings or a completely shielded control cabinet.
- Mind the cable routing – Keep distance between power, control and mains cables.

10.2. General Rules

- The following regulations have to be respected:
- Installation of the device(s) 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.
- The electromagnetic compatibility complies with the generic standards EN 61000-6-3, EN 61000-6-4.

10.3. Control Cabinet

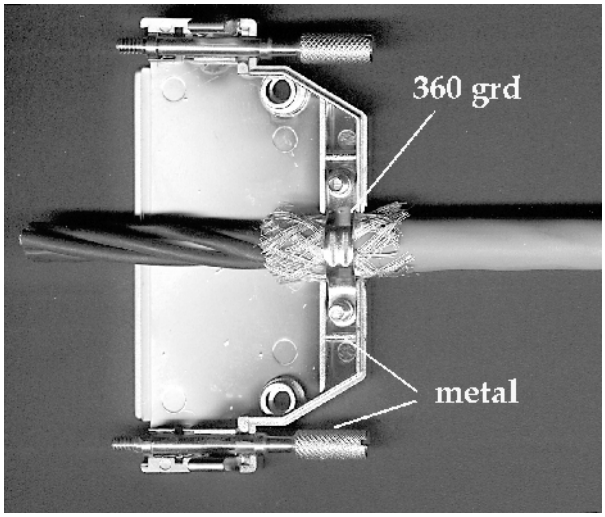
- The control cabinet must be equipped with a metal mounting panel with PE edge.
- The mounting panel in the control cabinet is the reference station (GND) for all signals, it is connected in a conductive way with the PE edge and the cabinet housing.
- The control cabinet with the mounting panel and 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.
- Shield connections must not be interrupted.
- All cable connections have to be executed as short as possible.
- 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.

- Use external filters or connectors with built-in filters for the external control connections on demand.
- Use additional chokes directly at the output pins of the servo amplifier in the motor phases U, V and W on demand. The cores of the chokes have to be mounted in the cabinet and have to be earthed. Additionally filter capacitors should only be used after request.
- Use additional mains filters with high damping factor on demand.

For additionally information ask your distribution partner!

10.4. D-SUB Cable shielding



- Use only metallic D-Sub housings or housings made of metal-coated plastics
- Use only shielded cables
- Contact the shield completely around the cable
- Use only twisted pair cables with common shield for the digital I/O's
- Do not lay power and control cables in a parallel way
- Care for low-impedance earth connections

11. Wiring

11.1. Cable cross sectional areas

Minimum cross sectional area for power cabling

Cable cross sectional area	Allowed R.M.S. current
1,0 mm^2	10 A
1,5 mm^2	15 A
2,5 mm^2	20 A

11.2. Motor cable

The maximum length of the motor cable depends on the used cable type, the motor type and the servo amplifier. For detailed information ask our support department.

Attention! The motor cable has to be shielded and the shield has to be contacted at both sides in a large area.

11.3. Control cables

- Control cables, especially if they are leaving the cabinet have to be shielded or equipped with additional filters. The shield has to be connected to the amplifier and to the mounting plate. The shield of the control cable X2 has to be connected to metallic plug housing.
- Unshielded control cables should be avoided. The distance to the power cables (X21, X22, X23) must be greater than 5 cm.
- The wiring of the encoder has to be made strictly as a shielded twisted pair cable.

11.4. MSD4 CAN Bus Wiring

11.4.1. General

There are two ways for connecting the CAN Bus:

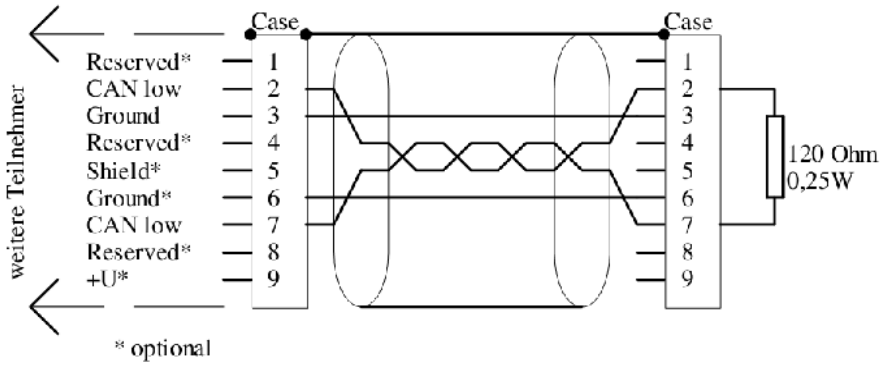
We suggest to use dedicated CAN Bus cable and metallic shielded plugs for best results and high reliability. The shield must be connected on both ends of the cable in every case.

Field bus cables have to be carried out in shielded twisted pair version and should be dislocated from power cables. The cable must be terminated with an 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.

11.4.2. Standard Version

Cable with two twisted pairs and common shield. We suggest an equipotential bonding to minimize circulating currents in the shield.

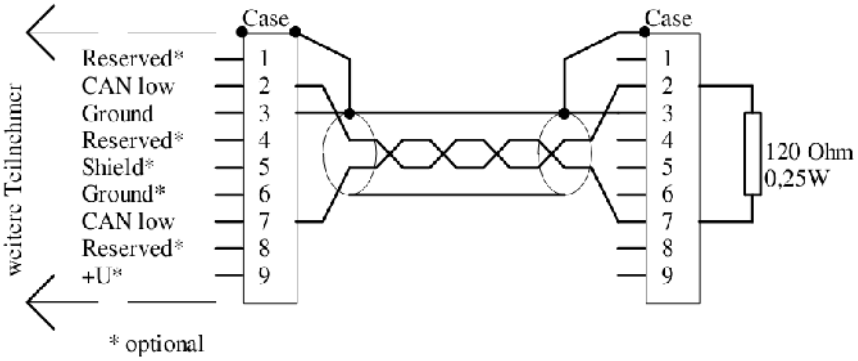


Cable type – order example

	Flexible wiring	Non flexible wiring
Label	Lütze Superflex Bus © PUR 2x2x0,25mm²	Lapp 2x2x0,22mm²
Outside diameter	5,9mm	5,9mm
Ordering number	104220	2170261

11.4.3. Simplified Version

Cable with one twisted pair and common shield. This version should only be used if the distances between the servo amplifiers are short and if the equipotential bonding is perfect.

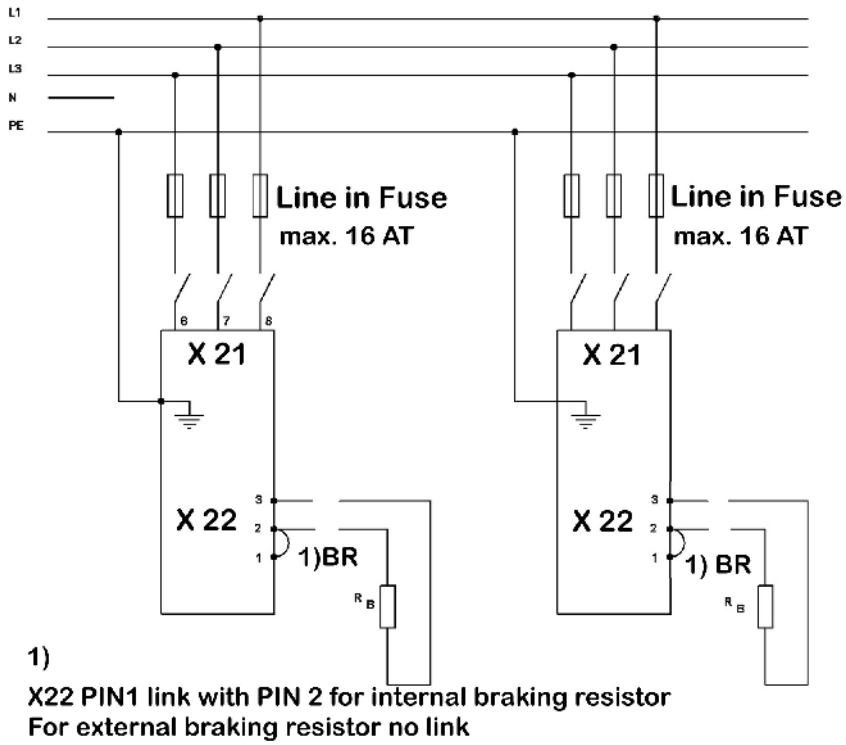


Cable type - order example

	Flexible wiring	Non flexible wiring
Label	Lütze Superflex Bus © PUR 1x2x0,25mm²	Lapp UNITRONIC BUS CAN1x2x0,22mm²
Outside diameter	6,0mm	5,7mm
Ordering number	104202	2170272
Label	Lapp UNITRONIC BUS-FD P CAN1x2x0,25mm²	
Outside diameter	6,4mm	
Ordering number	2170260	

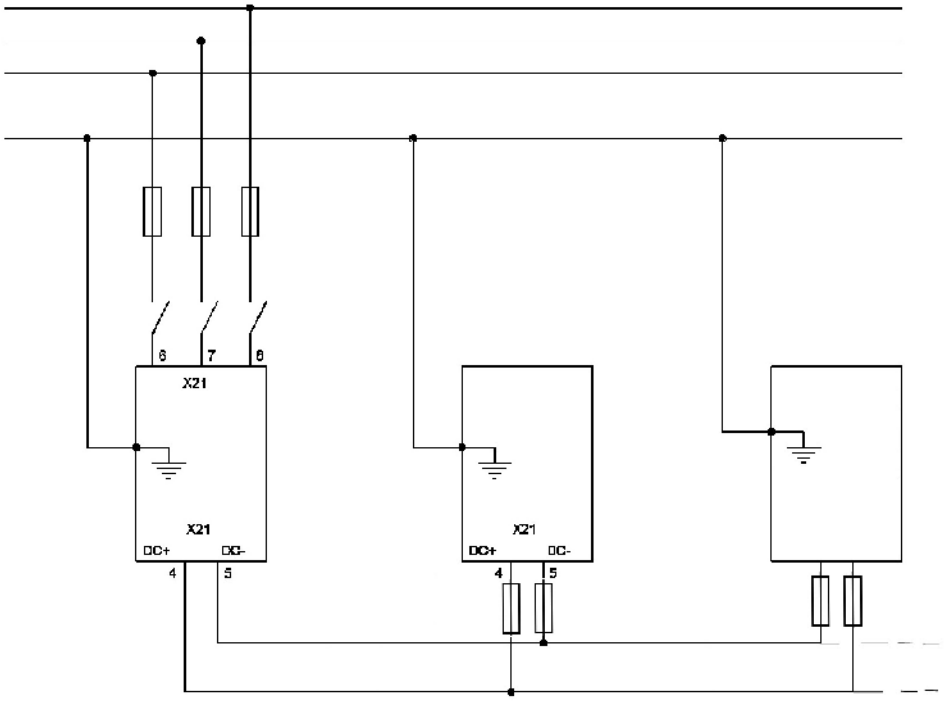
12. Connecting

12.1. Connection to Mains Power



1)
X22 PIN1 link with PIN 2 for internal braking resistor
For external braking resistor no link

12.2. DC Bus Coupling



The DC bus coupling has the following advantages in multi-axis systems:

- Higher DC bus capacity - especially on single-phase power supply
- Simple wiring
- The entire ballast power is available for each axis

Please pay attention to the following facts:

Use the DC bus coupling only for devices with the same nominal voltage.

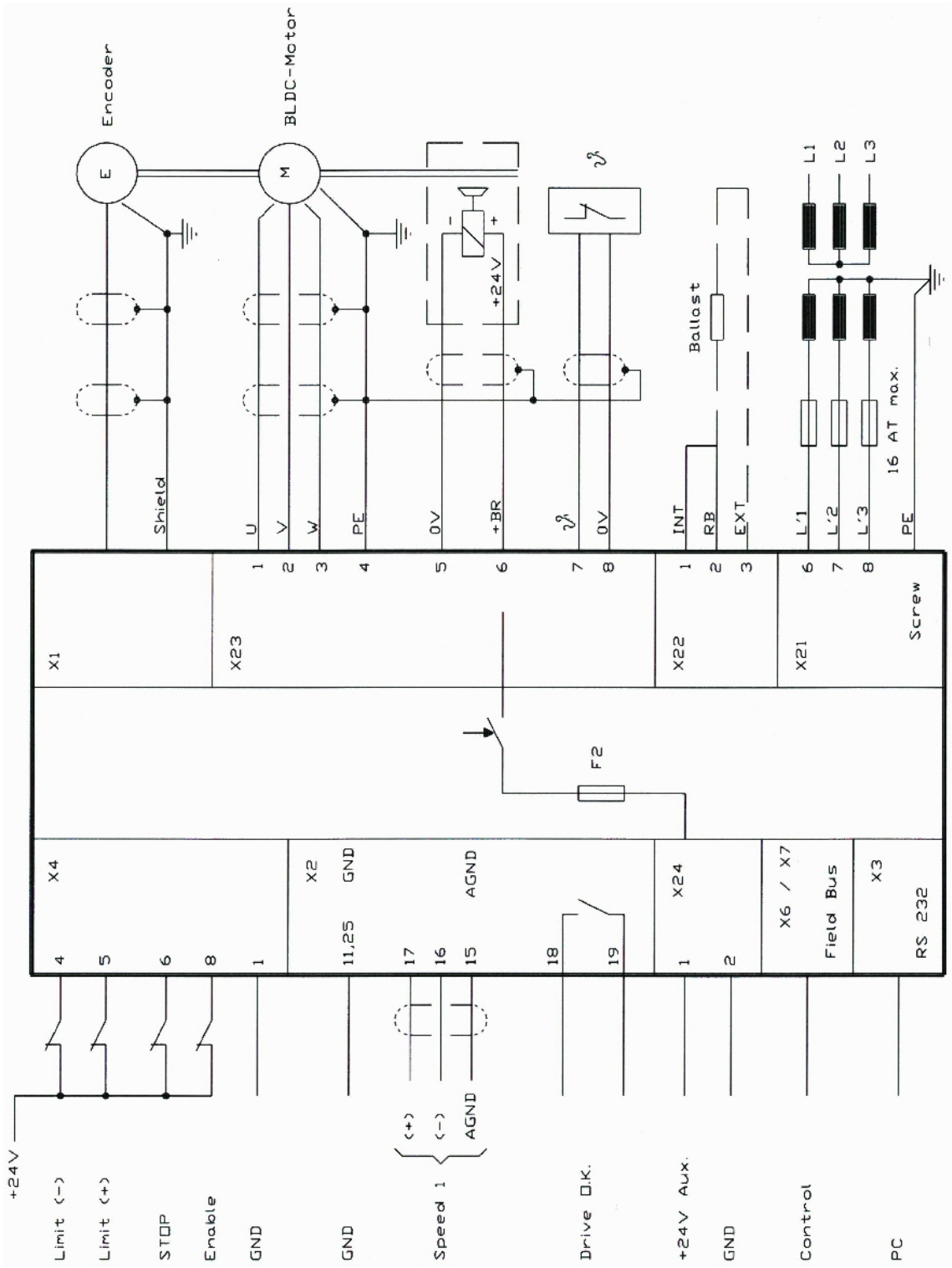
The entire nominal current of all axis has to be lower than 18 A. There is a maximum of 4 axis without an additional DC fuse.

Axis 1	Axis 2	Axis 3	Axis 4	Entire I_{rms} (A)
MSD4 xx10	MSD4 xx06	----------	----------	16
MSD4 xx08	MSD4 xx04	MSD4 xx04	----------	16
MSD4 xx06	MSD4 xx04	MSD4 xx04	MSD4 xx04	18

Attention! The DC bus connectors and the fuse sockets have high voltage!

12.3. Wiring Scheme for BLDC-Motor

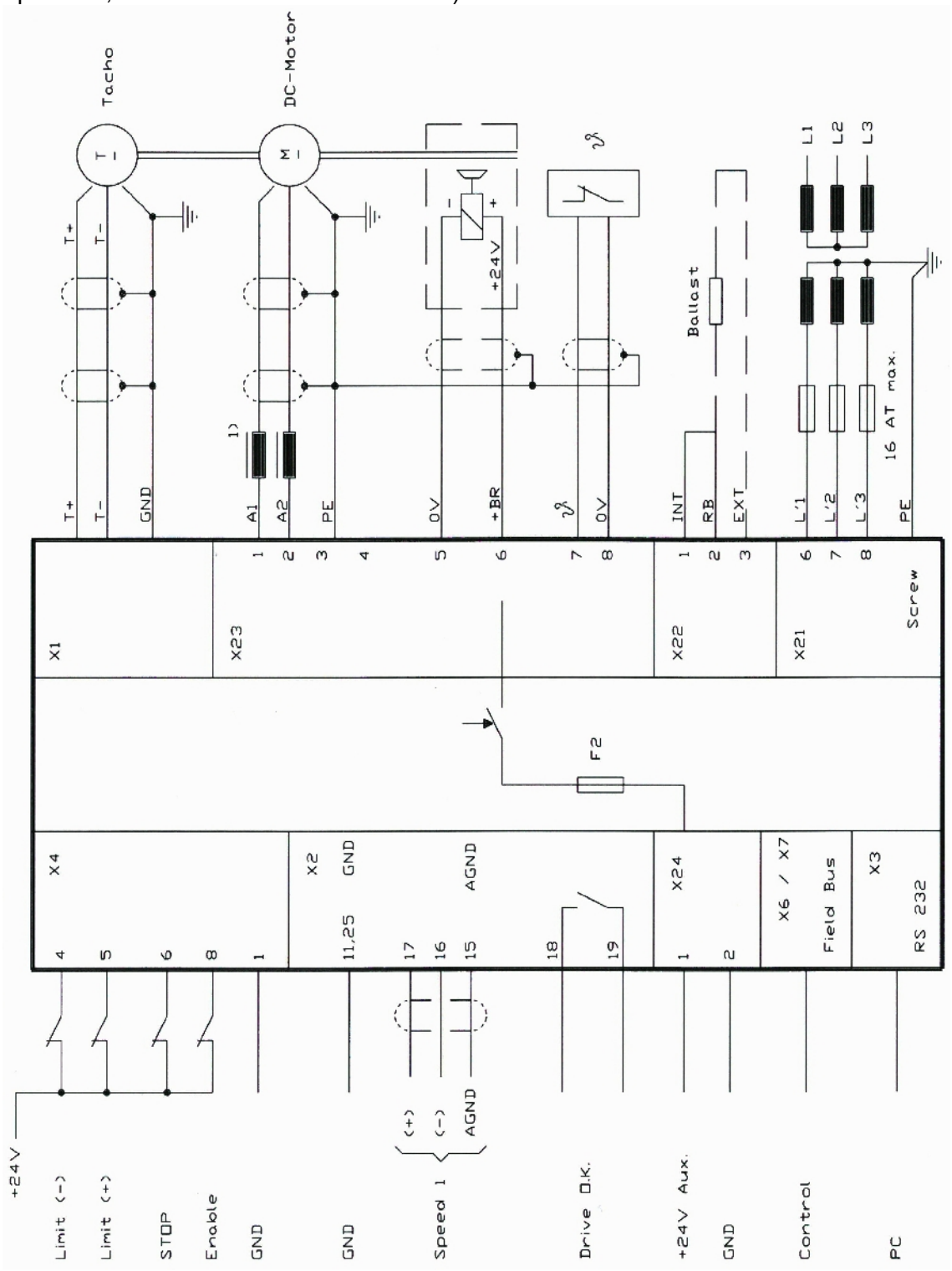
(Principle view)



Attention! Use the eventually provided wiring sheet and the adjustment notes every time.

12.4. Wiring Scheme for DC Motor

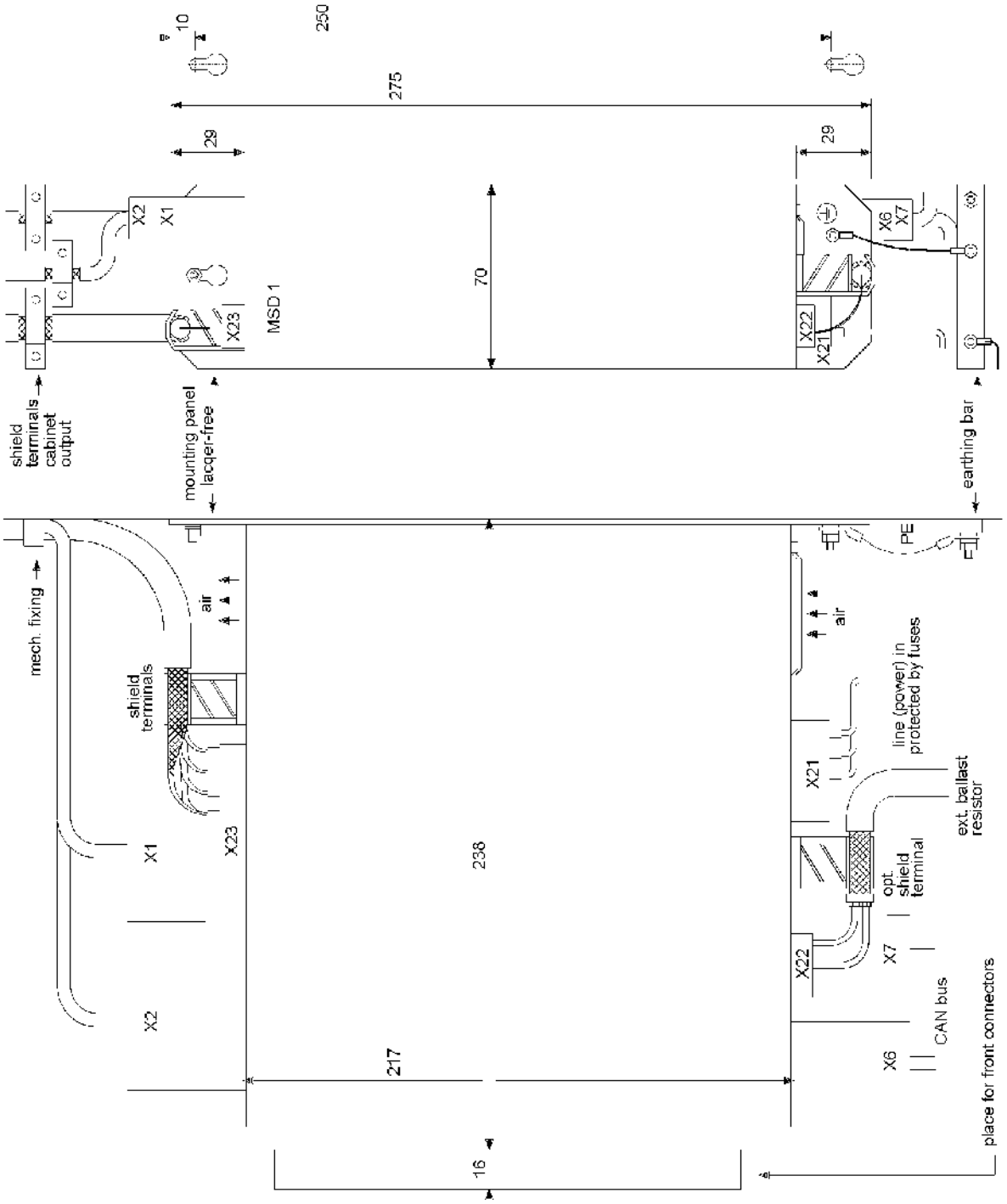
(Principle view, see also Variants 016 and 018)



Attention! Use the eventually provided wiring sheet and the adjustment notes every time and mind the minimum inductance Lmin [(1)].

13. Mechanical Dimensions

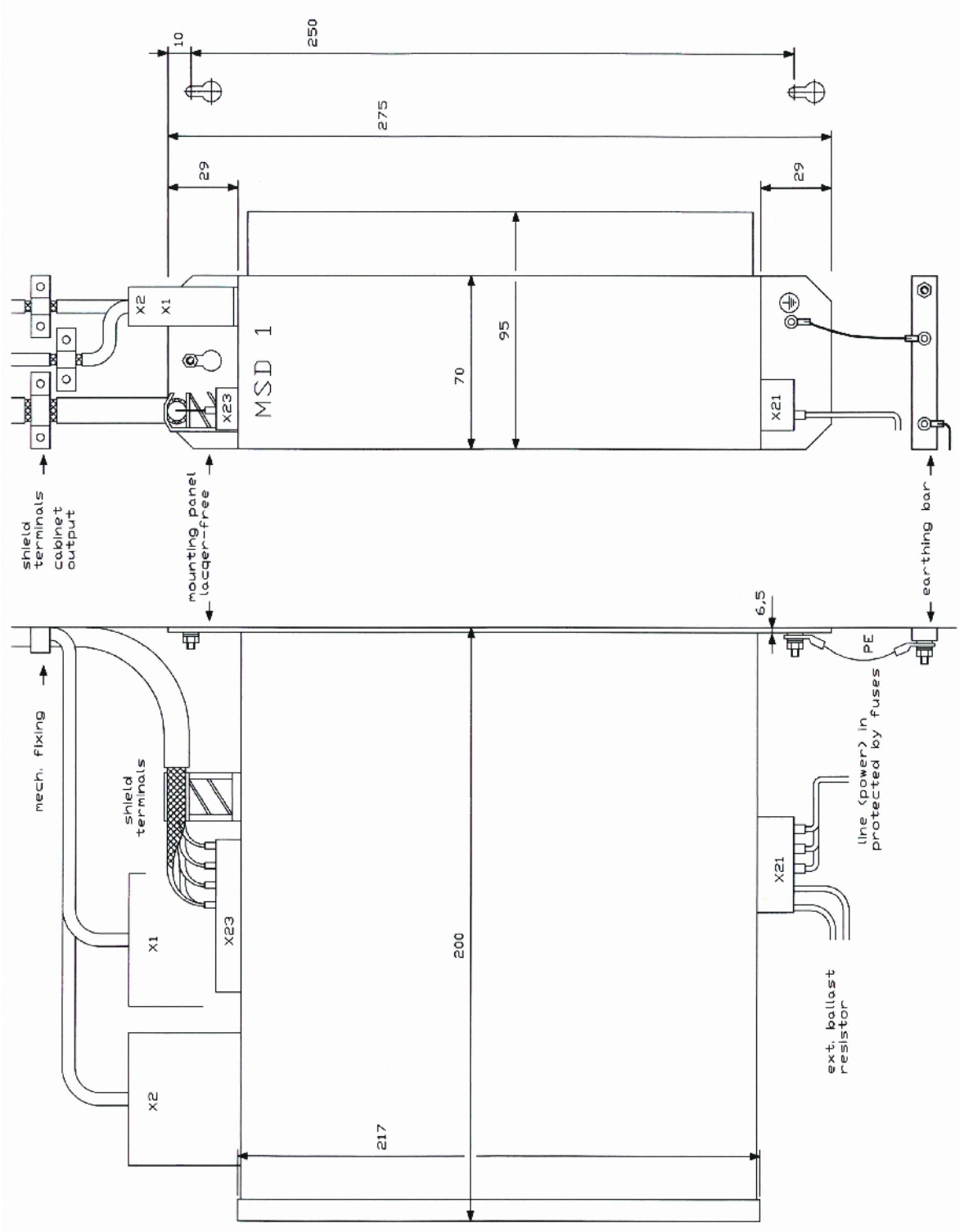
13.1. Standard Housing



Attention! The user has to take care for equipotential bonding between the different machine parts (Control device – Servo amplifier – Motor). If there are doubts about the activity, an additionally measurement must made for certification.

13.2. Short Housing (optional)

The short housing contains neither a ballast resistor nor a fan. Normally an external ballast resistor is necessary. The cooling takes place via the mounting plate or via an side-mounted heatsink. Under circumstances an external fan is necessary.



Attention! The user has to take care for equipotential bonding between the different machine parts (Control device – Servo amplifier – Motor). If there are doubts about the activity, an additionally measurement must made for certification.

14. Known problems and limitations

There are some known problems and limitations concerning the functionality of the servo amplifier.

Please remind the further limitations to prevent an unpredictable behaviour of the servo amplifier.

The problems and limitations could be solved by updates of the firmware or user interface software in the mean time. For additionally information ask our service department!

Operation notes:

- Set the parameter “Maximum position following error” to a defined value to garant a reliable function of the safety mechanisms.
- During the CANopen operation mode “Interpolated position mode” all device control options are internally set to “Switch off PWM“.

15. Troubleshooting

15.1. LED Display

LED	Meaning	Color	Notice
Error	Summary error message	red	Amplifier not ready
OK	Amplifier ready	green	Amplifier ready, „Enable“ possible
LS(-)	Limit switch active	yellow	Negative moving directory locked
LS(+)	Limit switch active	yellow	Positive moving directory locked
Brake	Motor brake	yellow	Motor brake supplied with current
Enable	Enabled	yellow	Amplifier enabled
Ballast	Ballast system active	yellow	Motor will be decelerated
IRMS	I2t limit reached	yellow	Output current limitation ($I_A$eff)

15.2. Error Finding

Use the PC user interface software MESABO for setup and diagnosis of the servo amplifier. Do not try to use servo amplifiers with damages or servo amplifiers with open housings or wrong wirings.

Categories	Symptoms	Measurements
General	Mechanical damage	Change the amplifier
	MSD4 gets too hot	Check the parameter settings Check the mounting situation
Power supply	Fuses defective	Check wiring and power supply Limit the maximum current
Servo motor	Noises	Check the parameter settings Change the motor
	Axis does not move	Change the amplifier / motor
Motor brake	Motor brake not lifted	Check the +24V auxiliary voltage Lift the brake
Power stage	Under voltage	Check the power supplies Check for 3 phase supply
	Over voltage	Ballast power too high Use an external ballast resistor
Current loop	Over current	Check the PI parameter settings Set the parameters to default values
Speed loop	Speed too low	Check the Nmax parameter settings Check the PI parameter settings Set the parameters to default values Check the power voltage
Position loop	Target position overrun	Check the Nmax parameter settings Check the Imax parameter settings
Field bus	No communication	Check the wiring Check the parameter settings
PC interface	No communication	Check the availability of the COM port Check the baudrate setting Read the software manual Close all programs which are using COM ports.

15.3. Errors

Error	Possible reasons
Under voltage error Intermediate circuit voltage too low or absent.	Loss of supply voltage during acceleration / Defective fuse
Over voltage error Intermediate circuit voltage too high.	Braking energy too high / Mains over voltage / Supply voltage too high
Over current error Output current of the power stage too high.	Short circuit in the motor winding or wiring / wrong current loop settings or defective power stage
Ballast error Ballast current higher than the limit.	With external ballast: short circuit in the ballast wiring / ballast resistor too low
Feedback error HALL- or encoder signals not correctly detected or absent.	Wiring error in the feedback device / Hardware error / Shield not connected
I2t error R.M.S. current higher than the limit.	Acceleration time with maximum current too long / Motor axis blocked
Following error Position deviation is higher than the limit.	Load at the motor axis too high / Wrong parameter settings
EEPROM error Reading from or writing to the EEPROM failed. (possible state after firmware update)	EEPROM hardware error
Field bus communication error Communication via field bus failed.	Wrong field bus parameter setting / Wiring error
Procedure error Internal procedure was terminated with an error.	i.e. Homing timeout
Over temperature amplifier Temperature of the electronics is higher than the limit.	R.M.S. current too high / Bad cooling
Over temperature motor Temperature of the motor is higher than the limit.	R.M.S. current too high / Bad cooling

If there occurs an error the internal state machine goes via the “Fault Reaction Active” state into the “Fault” state (see field bus manual).

Error states will be stored until the next RESET or power-off. Additionally the summary error bit in the state register will be set. The detailed error information is readable via the communication interfaces. It is only possible to reset the error state of the servo amplifier if the error condition is not still active.

The following steps have to be done in error case:

- Detect the error cause (i.e. With the user interface software)
- Fix the error cause (i.e. Change a parameter)
- Run the RESET function
- Check if the amplifier is ready again

After a successful RESET procedure the servo amplifier state machine stays in the state “Switch On Disabled”.

Several error messages can be disabled (masked) for test purposes:

- **Following error:** If this error will be masked, the drive moves on, even if the “Maximum position following error” will be exceeded. The masking of this error makes sense during the optimization of the servo amplifier.
- **Power stage under voltage error:** If this error occurs, the MSD4 will not become operational, neither a “ready” message will be shown. The masking of this error will not be supported by the MSD4 this time.

Several error states become active not until an internal programmable timer runs out. As long as the timer runs a warning will be presented. The control device can react to prevent the error state in this case.

- **Over temperature electronics:** The over temperature error will be activated if the error condition is active longer than parametrized time.
- **Over temperature motor:** The over temperature error will be activated if the error condition is active longer than parametrized time.

16. Variants and Modifications

Devices with variant numbers are devices with functions not according to the standard functions. They are mostly available for different classes.

Devices with customer-specific modifications are additionally available.

16.1. Variant 016 (MSD4 for DC Motor)

- Using with brushed motors
- Additionally available armature voltage feedback with IxR compensation
- Rectifier and ballast circuit are contained (usable for AC and DC supply, if recovery is not wanted).

Attention! Using of brushless motors is not possible with this variant.

16.2. Variant 018 (MSD4 for DC Motor and battery operation)

Type	I_{max} [A]	I_{Rated} [A]	U_{Rated} [VDC]	U_{min} [VDC]	U_{max} [VDC]	Fan	Inductance L_{min} [mH] *	Ballast system
MSD4 0610	20	10	24...65	17	75	internal	0,3 / 0,15	Var.018: no
MSD4 0615	30	15	24...65	17	75	internal	0,2 / 0,1	Var.018: no
MSD4 1215	30	15	36..125	36	140	internal	0,4 / 0,2	Var.018: no

* Minimal motor inductance on nominal voltage: first value valid for 8 kHz PWM, second value for 16 kHz PWM

- Using with brushed motors
- Additionally available armature voltage feedback with IxR compensation
- Rectifier and ballast circuit are not included because of the battery operation and of the ballast voltage for battery recovery.

Attention! Using of brushless motors is not possible with this variant.

If the device will be powered by a power supply which is not able to tolerate the voltage rising during the deceleration the variant 016 (with rectifier and ballast circuit) has to be used. The power supply has to be connected to the pins L1 (X21 Pin 6, positive pole) and -DC (X21 Pin 4, negative pole).

17. Additional information

Software manual CAN-Bus

Software manual MESABO (user interface software)

17.1. Optional connector sets

For the cable manufacturing (contains all plugs beside X3 and X5):

Connector set MSD4 (MESA article code: 92.02052)

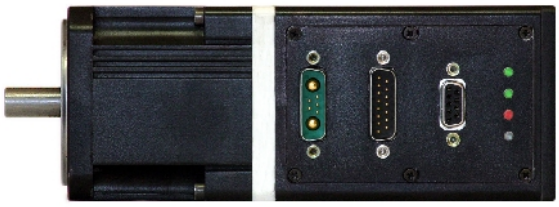
Other connector sets on demand!

18. Other products

The following digital servo amplifiers are available for supply voltages from 24 to 65 VDC.
They are available with CANopen or PROFIBUS communication interface.

18.1. BME: Basic Motion Element

(BLDC Motor with integrated servo electronics)



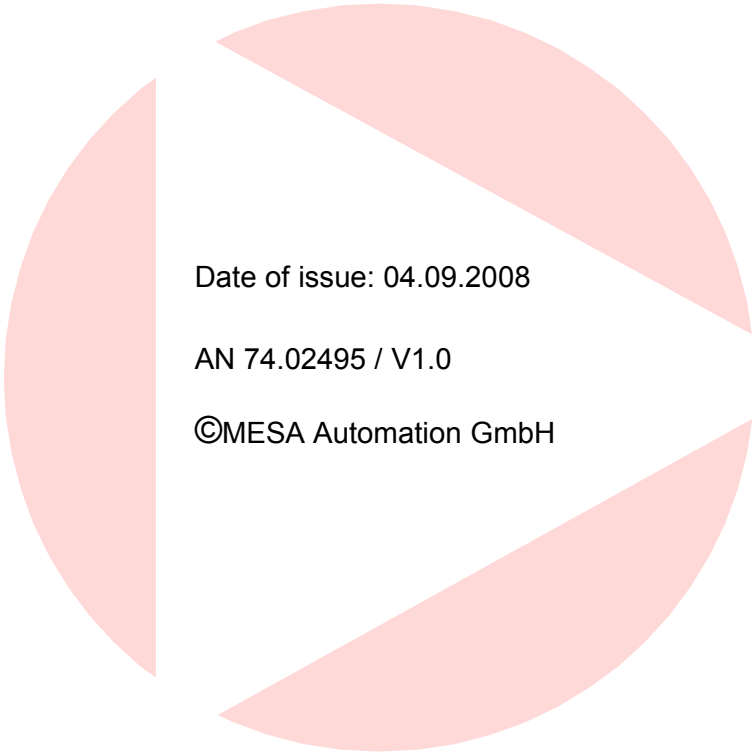
18.2. BDE: Basic Drive Element

(small servo amplifier, same electronics as BME)

18.3. BDE: High Current Device

(BDE High current version, 48 V / 120 A_{max} or 65 V / 100 A_{max})

19. Place for your notices:



Date of issue: 04.09.2008

AN 74.02495 / V1.0

© MESA AUTOMATION GmbH

INFRANOR GROUP - www.infranor.com

12045 Berlin

Maybachufer 48-51

Phone: +49 (0)30 6139080 Fax: +49 (0)30 6231766

http://www.mesa-berlin.de e-mail: service@mesa-berlin.de