MotionController

GEL 823x

Axis control with PLC functionality in accordance with IEC 61131–3

LENORD +BAUER
... automates motion.

Device manual

D-02G-8230-2 (1.1)

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1 About this document

1.1 General

The device manual is part of the product and contains the information necessary for installation and for safe operation.

Information on the operation of the device, the system parameters that can be programmed for configuration of the MotionController and the axes controlled, on the PC parameter editor supplied and on the proprietary serial LB2 protocol is contained in the reference manual that is included on the installation CD in electronic form as a PDF file.

Descriptions of any pre-installed PLC program and of the library functions for writing custom programs are not covered here; the comments in the individual function blocks contain appropriate instructions on how to use them.

Please note the following:

- ▶ Carefully read the documents provided prior to the installation and usage of the device.
- ▶ Keep the documentation for the service life of the product.
- ▶ Ensure the necessary documentation is available to the personnel at all times.
- ▶ Pass the documentation on to the subsequent owner or user of the product.
- ▶ Add all supplements provided by the manufacturer of the device.
- ▶ Read and follow the information in the documentation to prevent damage to the product and malfunctions.

Scope

This manual is applicable to the standard version of the MotionControllers
– GEL 8230
– GEL 8231
– GEL 8232

This includes all types that are n o t marked with a **Y** after the product number in the type code.

A product marked with a Y is a customer-specific version with customised features and/or modified technical specifications. Depending on the customer-specific modification, further documents or other documents may be applicable.

1.2 Target group

The device manual is aimed at operating companies, machine manufacturers and qualified specialist staff.

Personnel must have adequate knowledge on how to handle components that are susceptible to electrostatic. They must also be familiar with and follow national health and safety regulations.

The operating company must ensure that the safety instructions in this manual are followed and that all individuals tasked with working on the MotionController have read and understood the manual.

1.3 Symbols, marks, notes

The following symbols, marks and notes are used in this document so that you can recognise specific information more quickly:

⚠CAUTION	Dangerous situation: There is a risk of injury on failure to follow the instructions!
NOTICE	Instructions on preventing damage
ℹ	Important information for improved understanding, on operation or optimisation of the work processes
▶	Work step to be undertaken
→ page 6	Page reference to another part of this manual

2 Safety

2.1 Safety instructions

⚠CAUTION

The operating software for the MotionController permits **on-line changes** to system parameters during **operation** to make it easier to set up the plant and to make service visits easier.

It is imperative on the utilisation of this feature that it is ensured no dangerous situations can arise for individuals in the area of the plant or for the plant itself by

- Consciously and carefully checking prior to transmission every parameter to be modified for correct application and for the possible effect (above all on changing pitch rates)
- Ensuring adequate protective measures as well as limit switches and emergency stop buttons are provided.

NOTICE

- ▶ Do not disconnect any connectors or any screen connection with the device switched on to avoid the occurrence of uncontrolled states.
- ▶ Prior to updating the operating system (→ page 24), switch off the power circuits for the drives controlled by the MotionController.

2.2 Designated use

The MotionController is only intended to be used for controlling and regulating drives in the industrial sector.

On operation in residential, business and commercial sectors compliance with the requirements on electromagnetic emissions in accordance EN 61000-6-3 is to be ensured with additional external screening and filtering measures.

The PLC functionality makes it possible to execute customer control programs or control programs supplied using the function implemented in the operating system for controlling drives.

The display and the keyboard make it possible, with appropriate programming, to use the MotionController as an operator terminal for controlling operating states.

The devices are configured using system parameters. This action is undertaken either on the device itself, via the PC editor software BB2100K supplied or via a loaded PLC program.

The data and information given in this manual are to be followed.

3 Product identification

3.1 Scope of supply

- MotionController GEL 8220/8231/8232
- Fastening set with 6 nuts, spring washers and washers as well as 2 earthing terminals (order no. BG 4623)
- Mating connector set (order no. GEL 89042
- Cable clip set (order no. BG 4622)
- Installation CD with the following content (can vary):
  - Operating system file in the latest version (for download to the MotionController), electronic documentation (PDF) and configuration files
  - Update software LingiMon (→ page 24)
  - CoDeSys (PLC programming environment)
    - ❍ Setup
    - ❍ Libraries
    - ❍ Documentation (PDF files in various languages)
  - Acrobat Reader for reading the PDF files supplied (self-extracting installation program)

  The CD has an autorun program that provides information and various possible options in a dialog box after the insertion of the CD, provided the autorun function is activated on the PC. If the CD does not start automatically, you can start the installation manually by running the program *start.exe* in the root folder on the CD.
- Optional: Cable terminals for horizontal cable outlet (without separate attachment frame)

3.2 Rating plate

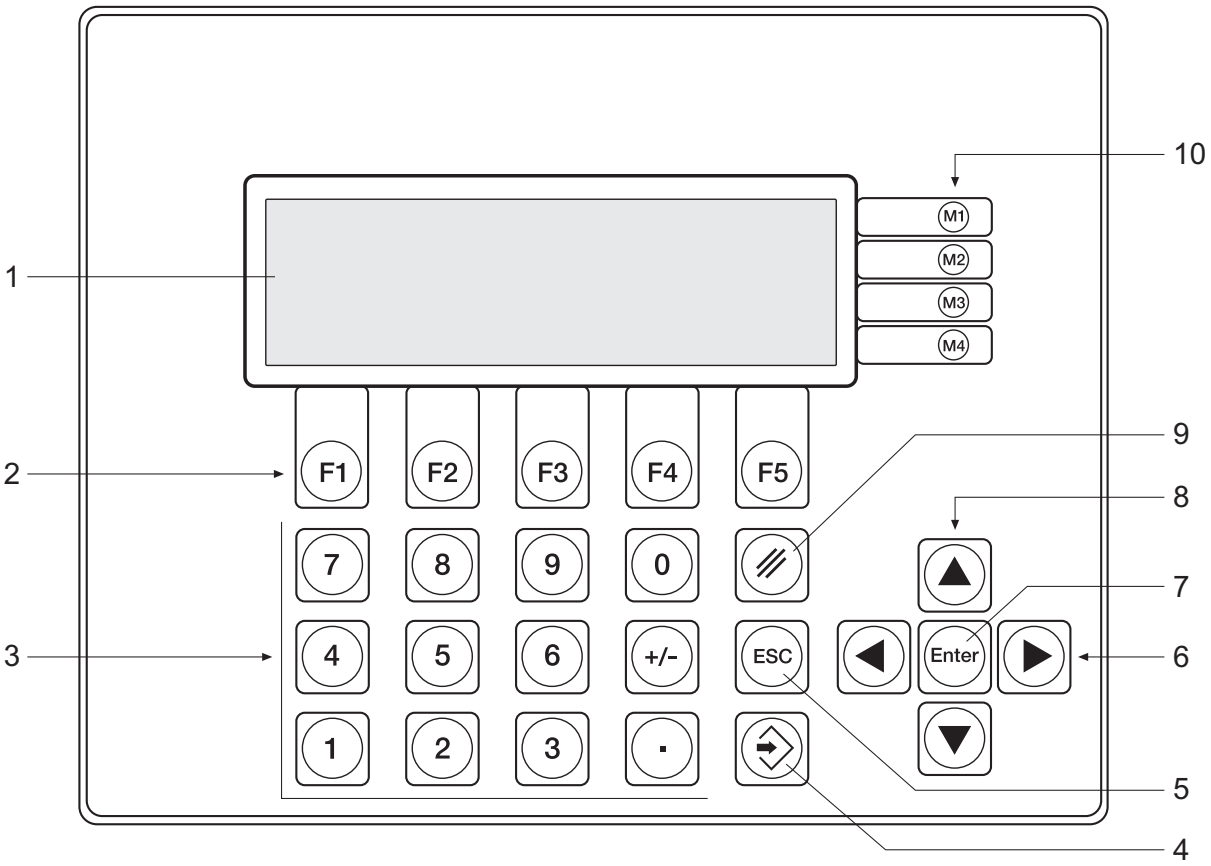
The rating plate is bonded to the side on the connection frame.

Example:

1 Type (order) code
2 Serial number
3 Nominal operating voltage

3.3 Parts named

3.3.1 Front panel

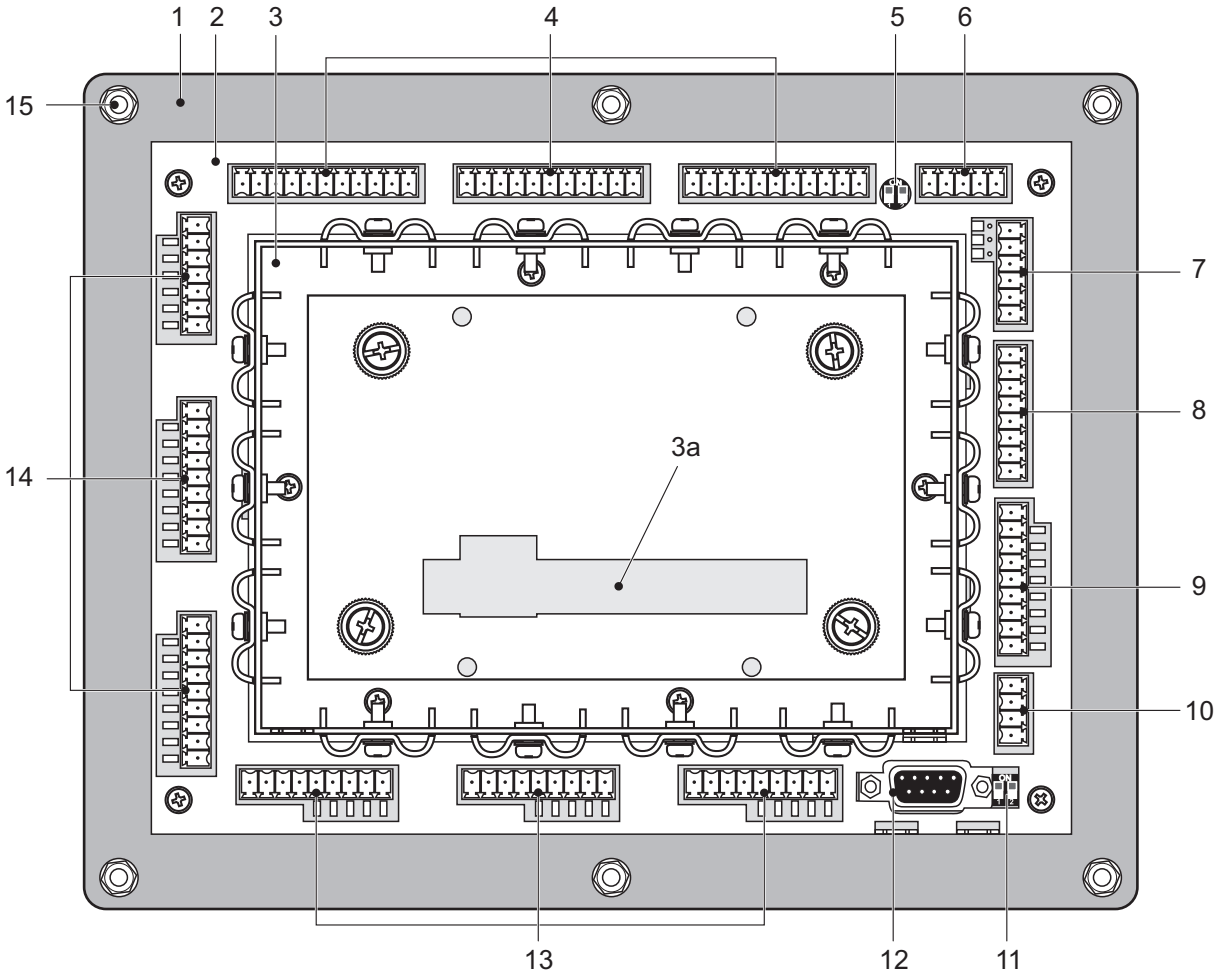


1 Display
2 Function keys (assignment dependent on the current window)
3 Numerical keys (value entry)
4 Enter key: Confirm entry, select/open entry marked (identical to *7*)
5 Escape key: Cancel entry/function; return to next menu level up
6 Navigation and selection keys (select property of a system parameter)
7 as for *4*
8 Scroll keys (move up/down by one line the window in the overall list that can be displayed)
9 Delete key: Delete value entry
10 Menu keys (assignment dependent on the actual window, row orientated)

3.3.2 Display

The function of the display is dependent on the MotionController operating system and any software expansions loaded. There is a corresponding description in the reference manual.

3.3.3 Rear side

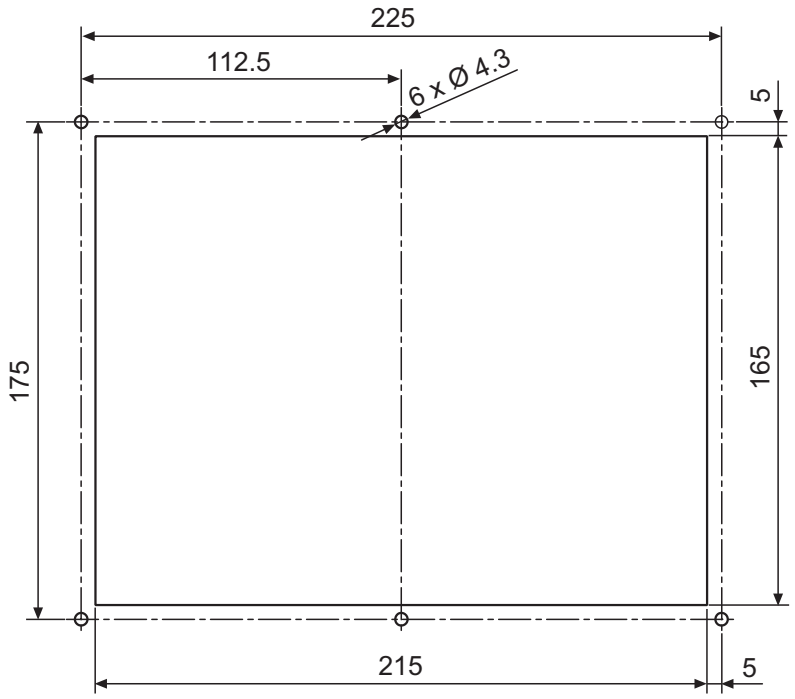


1 Front panel
2 Connection frame
3 Cover with attachment frame mounted (cable clips for vertical cable outlet) and cut-out for optional field bus module (*3a*)
4 Encoder connections (terminal strips Z1–3)
5 DIP switch for CAN bus termination
6 CAN bus connection (terminal strip C2)
7 Connection analogue inputs U/I (terminal strip E6)
8 Connection analogue inputs PT100 (terminal strip E5; not GEL 8230)
9 Connection digital inputs and LED status indicators (terminal strip E4; not GEL 8230)
10 Connection power supply (terminal strip V)
11 DIP switch for terminating RS 422/485
12 Connection serial interfaces RS 232/422/485 (connector C1)
13 Connection digital and analogue outputs and LED status indicators (terminal strips A1–3)
14 Connection digital inputs and LED status indicators (terminal strip E1–3)
15 Studs for control panel mounting

4 Assembly

4.1 Installation

Control panel cut-out



(dimensions stated in mm)

- ▶ Make the necessary control panel cut-out and fastening bores in the required position in the switch cabinet.
- ▶ Insert the device in the control panel.
- ▶ Fasten the device using 6 nuts M4, spring washers and washers.
- ▶ Make the electrical connections taking into account the information in section 5.
- ▶ Fit the cover and fasten the 4 knurled screws.
- ▶ Fix the cable to the connection frame and to the cover itself with the aid of the clamps.

4.2 Removal

- ▶ For brief removal of the MotionController undo the four knurled screws in the cover (are captive in the cover) and disconnect all connectors.

  ⓘ After refitting the cover first press on the knurled screws and then tighten them.
- ▶ Remove the 6 nuts on the M4 studs on the MotionController and remove the device.

4.3 Module installation

The MotionController can be upgraded at a later date with a function module (field bus). The installation, the connections and other information on the module are described in a separate document (also on the CD supplied in electronic form).

Ensure that all pins on the module edge connectors are sitting correctly in the related housing connector.

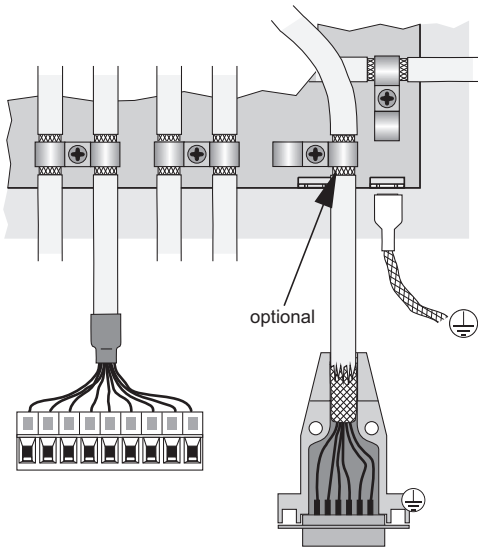
Communication with the extension modules is via a PLC program using CoDeSys function blocks provided. The basic configuration is undertaken using various system parameters (→ reference manual).

5 Connections

5.1 Information on wiring

To improve the electromagnetic environment (EMC) please follow the following installation instructions:

- Correctly earth device: Short connections via cable lug contacts (6.3 mm) housing/cover → switch cabinet (wall) as well as between housing/cover (use low inductance earth strap or flat conductor)
- Earth connector cable at the device: Strip insulation from cable screen at a suitable point and clamp under a cable clip on the cover (see figure)
- Use metal D-Sub mating connector and clamp the cable screen cleanly between the halves of the connector
- Tighten fastening screws for the D-Sub mating connector to ensure a reliable earth contact (however it is recommended to additionally earth this cable as show in the figure)



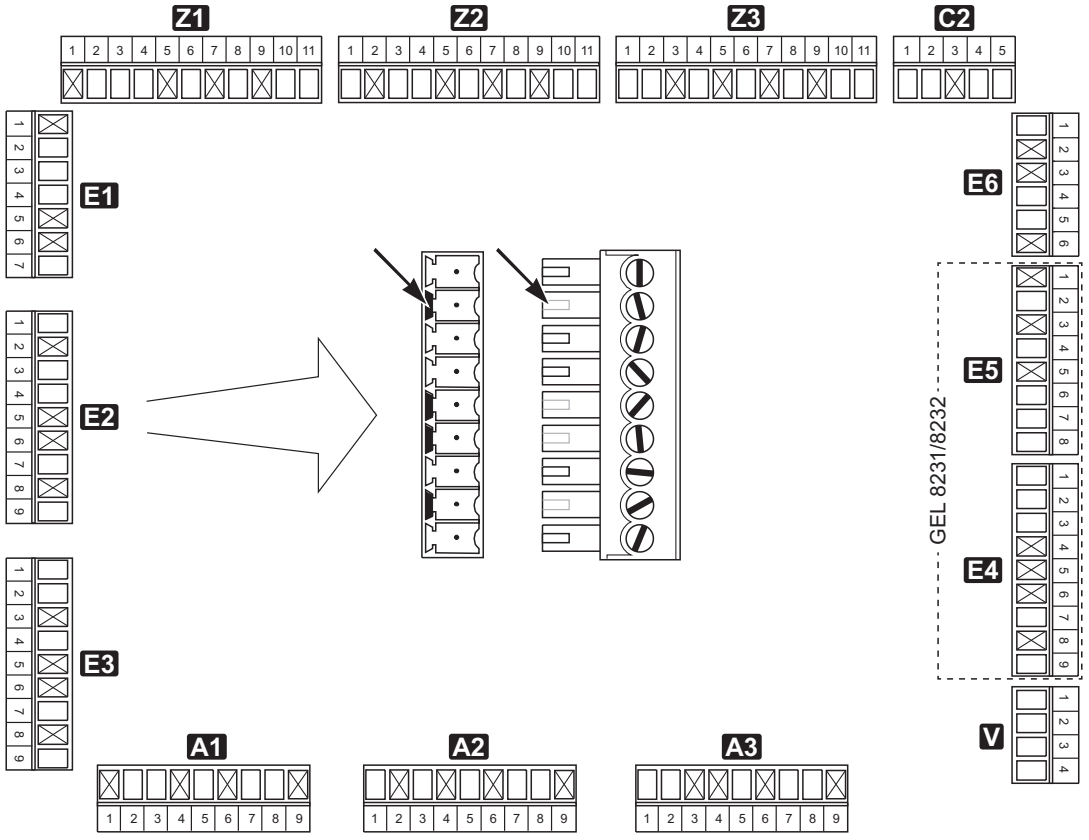
- For good electrical contact and mechanical restraint of the cable in the terminals as well as for reliable isolation, fit the cable cores used with insulated ferrules in accordance with DIN 46228 Part 4 that are permanently connected to the cores with the aid of a special crimping tool. If two or more thinner cables are to be connected to a terminal, the usage of twin ferrules is advantageous. The maximum connection cross-section is 1.5 mm² (incl. bush).

  To tighten the terminal screws (M2) use a screwdriver with a 0.4×2.5 mm blade.
- Keep all unscreened cables as short as possible
- Attach screens at both ends of cables using a connection with as large a surface area as possible
- Ensure that external protection measures against surges have been implemented (EN 61000-4-5).
- In case of inductive loads (relays, contactors) on the digital outputs, provide suppression measures (free-wheeling diode or RC element in parallel and in the immediate vicinity of the coil)
- Lay signal cables and control cables physically separate from power cables
- If there are potential differences between the earth connections for the machine and electronics, or if such differences occur, ensure by means of appropriate measures

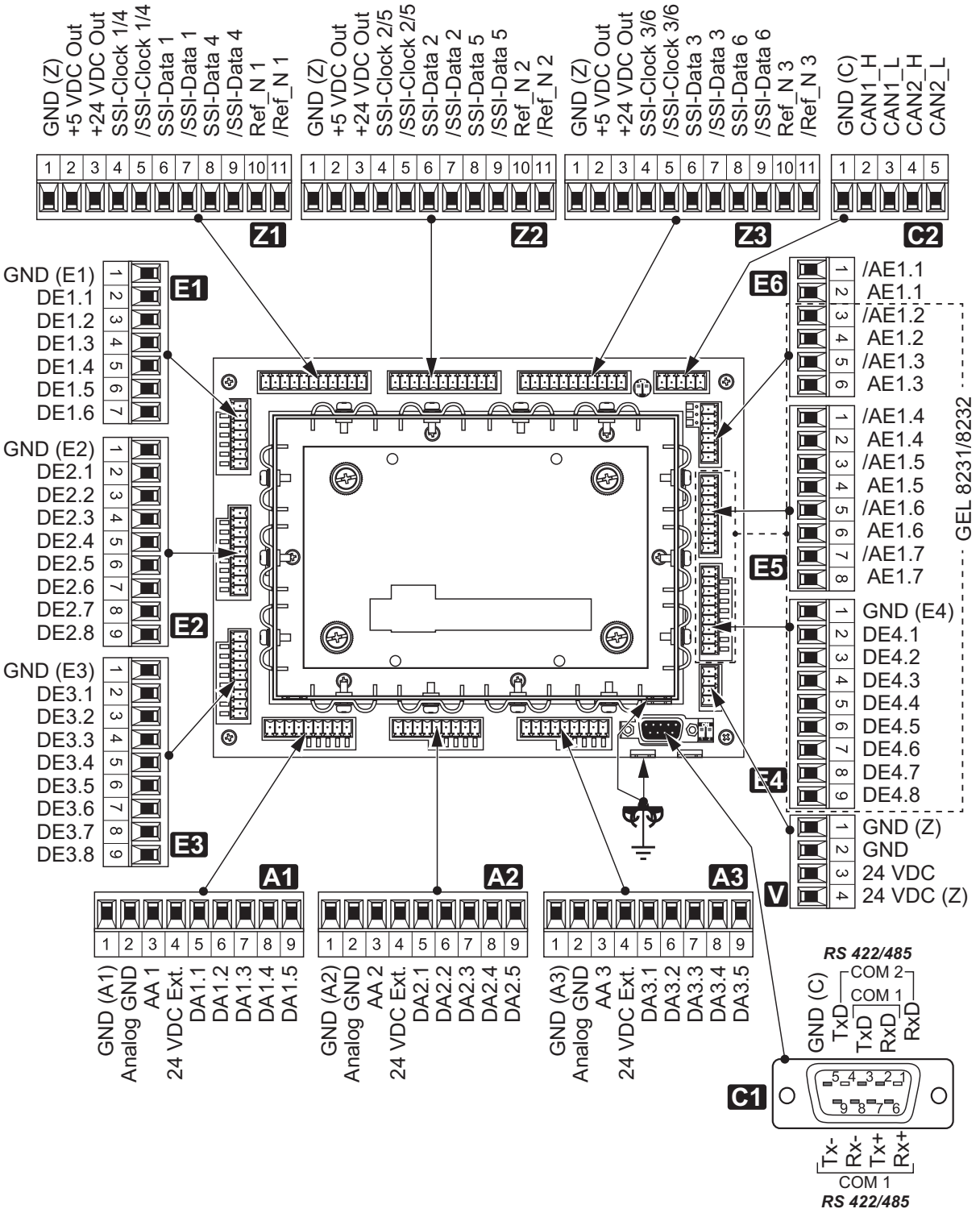
that no equalising currents can flow via the cable screen; (e.g. lay an equipotential bonding cable with a large cross-section or use cables with a separate double screen with each screen connected at only one end.)

NOTICE Do not disconnect any connectors or any screen connection while the device is switched on.

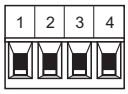
5.2 Connector coding



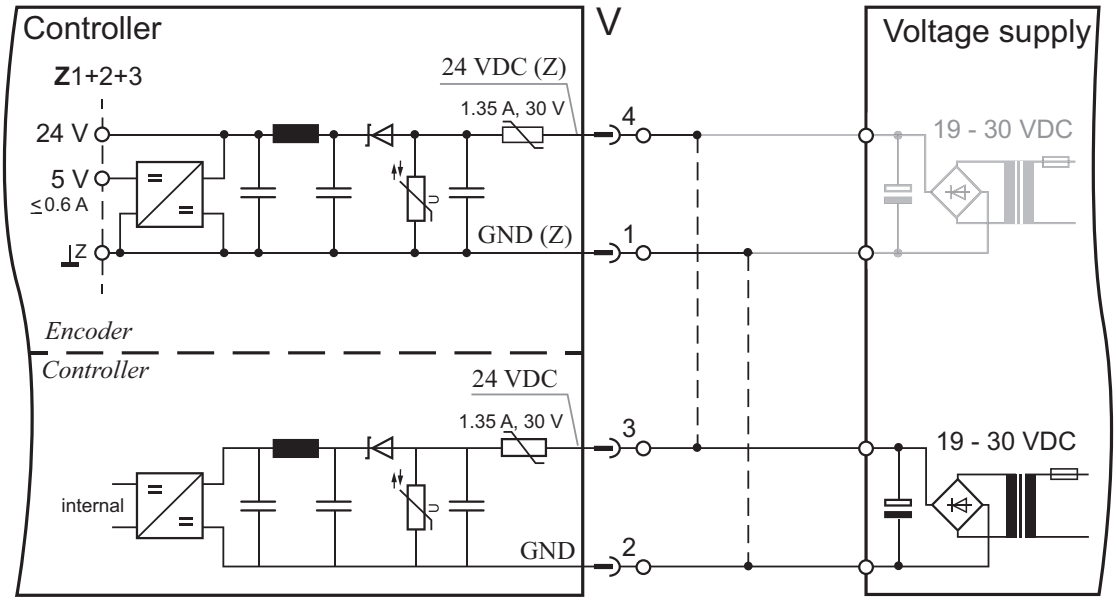
5.3 Overview


GND (Z)
+5 VDC Out
+24 VDC Out
SSI-Clock 1/4
/SSI-Clock 1/4
SSI-Data 1
/SSI-Data 1
SSI-Data 4
/SSI-Data 4
Ref_N 1
/Ref_N 1
Z1
GND (Z)
+5 VDC Out
+24 VDC Out
SSI-Clock 2/5
/SSI-Clock 2/5
SSI-Data 2
/SSI-Data 2
SSI-Data 5
/SSI-Data 5
Ref_N 2
/Ref_N 2
Z2
GND (Z)
+5 VDC Out
+24 VDC Out
SSI-Clock 3/6
/SSI-Clock 3/6
SSI-Data 3
/SSI-Data 3
SSI-Data 6
/SSI-Data 6
Ref_N 3
/Ref_N 3
Z3
GND (C)
CAN1_H
CAN1_L
CAN2_H
CAN2_L
C2
GND (E1)
DE1.1
DE1.2
DE1.3
DE1.4
DE1.5
DE1.6
E1
GND (E2)
DE2.1
DE2.2
DE2.3
DE2.4
DE2.5
DE2.6
DE2.7
DE2.8
E2
GND (E3)
DE3.1
DE3.2
DE3.3
DE3.4
DE3.5
DE3.6
DE3.7
DE3.8
E3
/AE1.1
AE1.1
/AE1.2
AE1.2
/AE1.3
AE1.3
E6
/AE1.4
AE1.4
/AE1.5
AE1.5
/AE1.6
AE1.6
/AE1.7
AE1.7
E5
GND (E4)
DE4.1
DE4.2
DE4.3
DE4.4
DE4.5
DE4.6
DE4.7
DE4.8
E4
GEL 8231/8232
GND (Z)
GND
24 VDC
24 VDC (Z)
V
A1
GND (A1)
Analog GND
AA 1
24 VDC Ext.
DA1.1
DA1.2
DA1.3
DA1.4
DA1.5
A2
GND (A2)
Analog GND
AA 2
24 VDC Ext.
DA2.1
DA2.2
DA2.3
DA2.4
DA2.5
A3
GND (A3)
Analog GND
AA 3
24 VDC Ext.
DA3.1
DA3.2
DA3.3
DA3.4
DA3.5
RS 422/485
GND (C)
TxD
RxD
COM 2
COM 1
TxD
RxD
C1
Tx-
Rx-
Tx+
Rx+
COM 1
RS 422/485

5.4 Power supply V

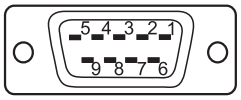


Both the power for the internal circuits in the MotionController (U_B) and the power for the supply of encoders connected (U_Z) is provided at terminal strip V.



If only a single power source is used to supply the controller and encoders, the related terminals 3 and 4 as well as 1 and 2 must be connected together as shown dotted in the figure.

5.5 Serial interfaces C1



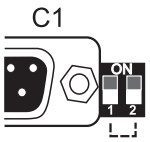
Two independent serial interfaces are available on connector C1: COM 1 and COM 2.

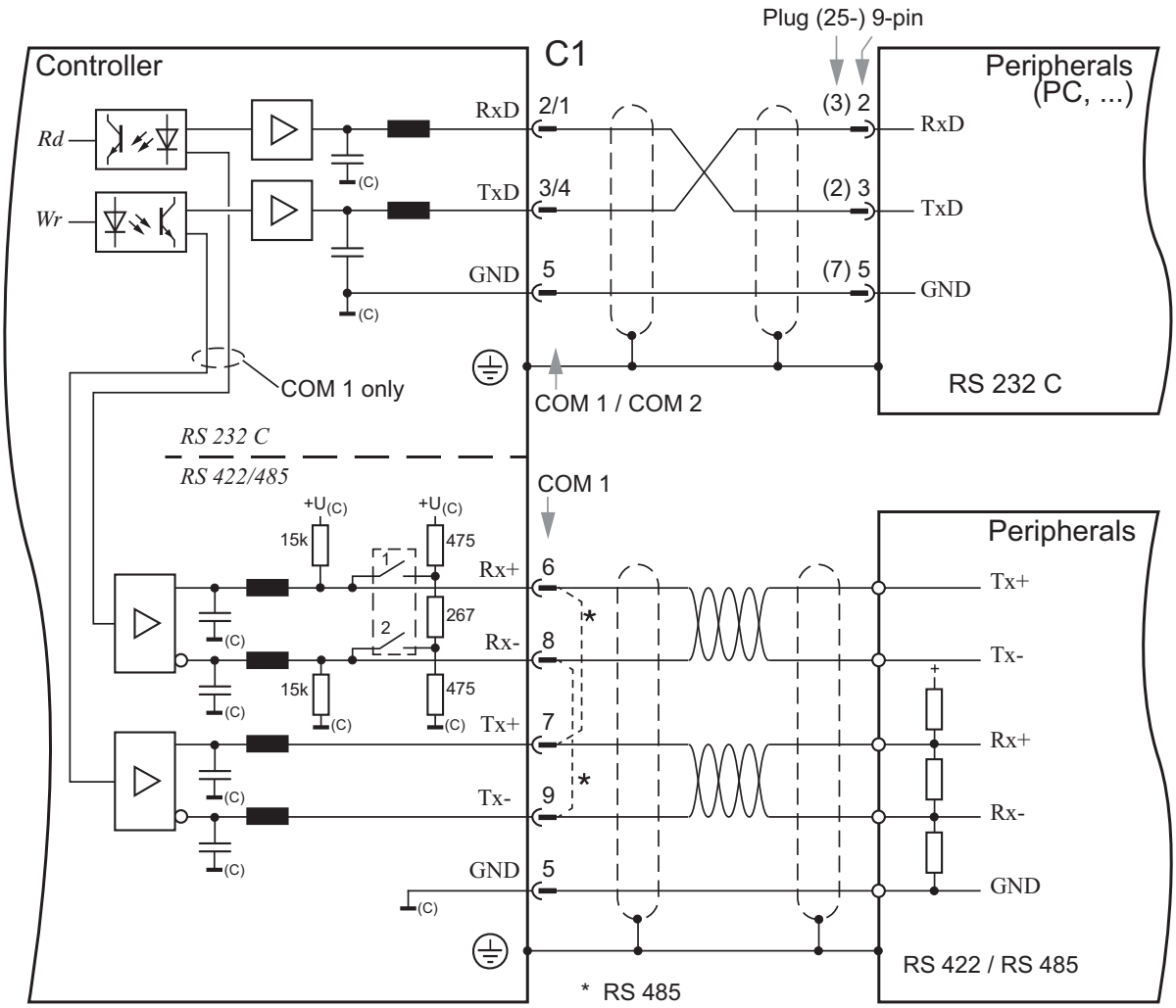
COM 2 is designed as pure RS 232 C.

COM 1 can be used either as RS 232 C or as RS 422/485.

The serial interfaces have the same earth potential as the CAN buses (connector C2).

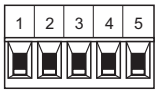
In the case of RS 422/485 the internal termination resistors must be enabled on the first and last device on the bus using the DIP switch beside the connector: both switches in the ON position. The resulting termination resistance is approx. 125 Ω





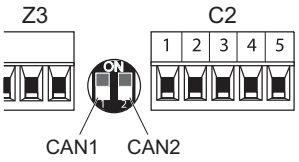
On the usage of RS 485, the connections 6 and 7 as well as 8 and 9 must be connected using solder jumpers (shown dotted in the figure).

5.6 CAN bus C2

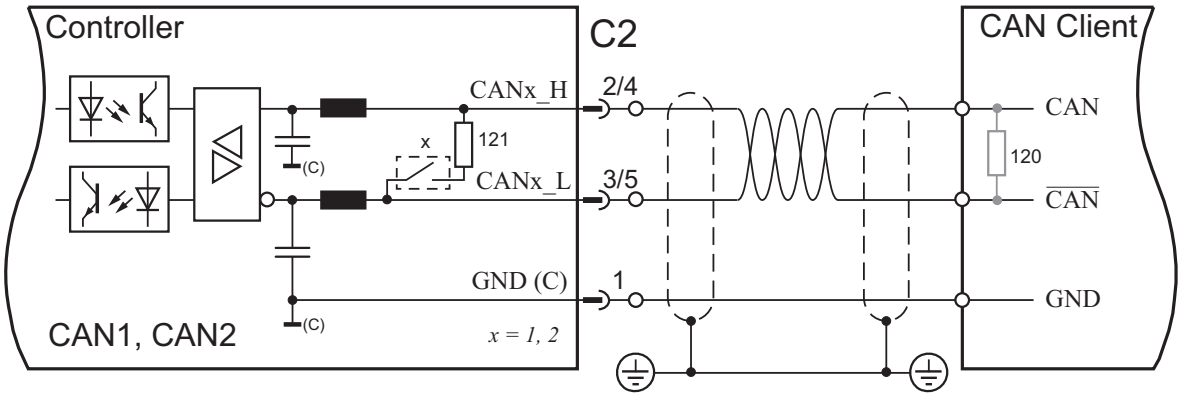


Two CAN bus interfaces are available on terminal strip C2: CAN1 and CAN2.

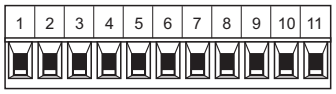
The internal termination resistor for the specific CAN bus must be enabled on the first and last device on the bus using the DIP switch beside the connector: Switch in ON position. The terminating resistance is approx. 120 Ω



The CAN buses have the same earth potential as the other serial interfaces (connector C1).



5.7 Encoder inputs Z1–3

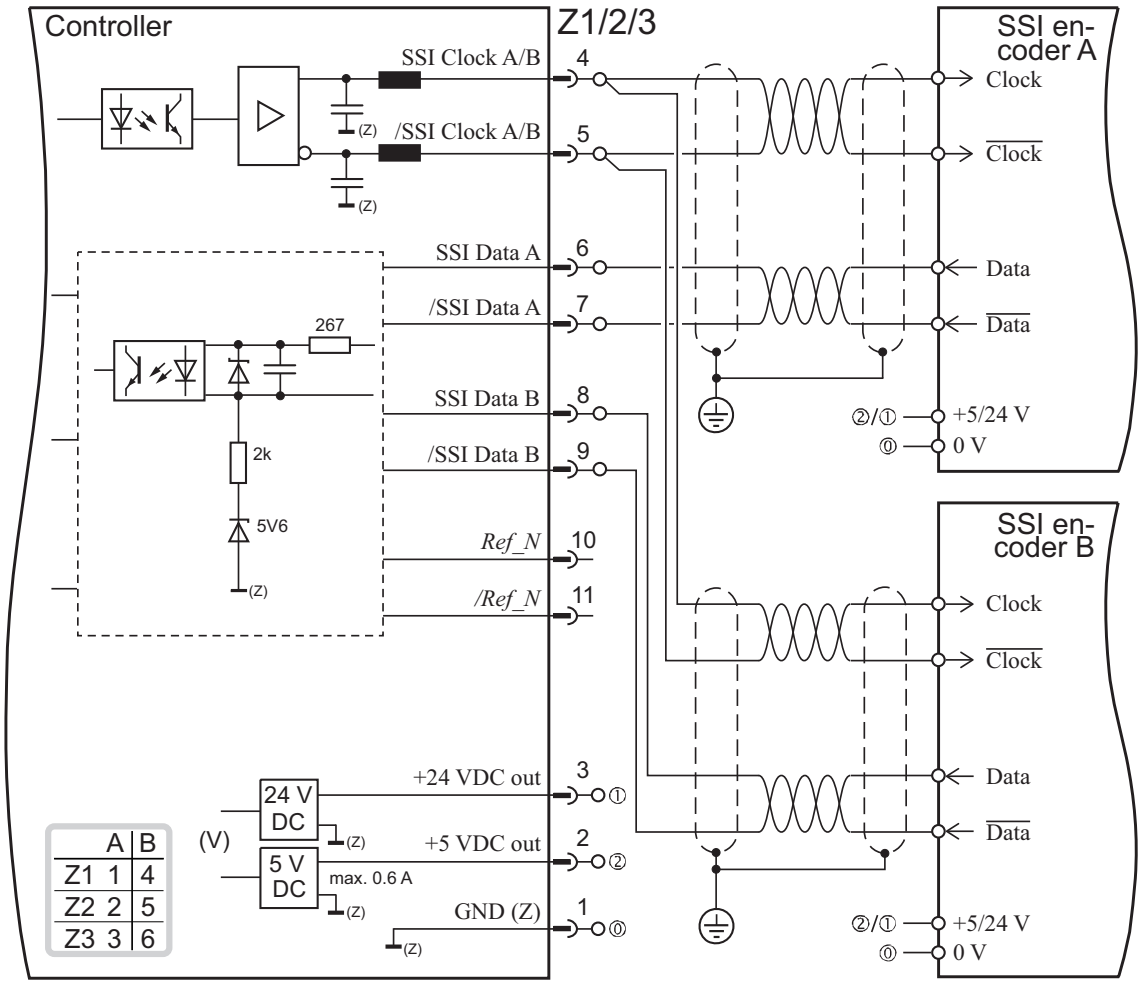


2 SSI encoders can be connected to each of the terminal strips Z1 to Z3 .

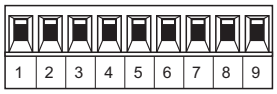
5 V and 24 V are output there as the operating voltage for the encoders (provided at terminal strip V). The maximum currents are

- At 24 V: 300 mA per encoder
- At 5 V: 200 mA per encoder, in total 0.6 A

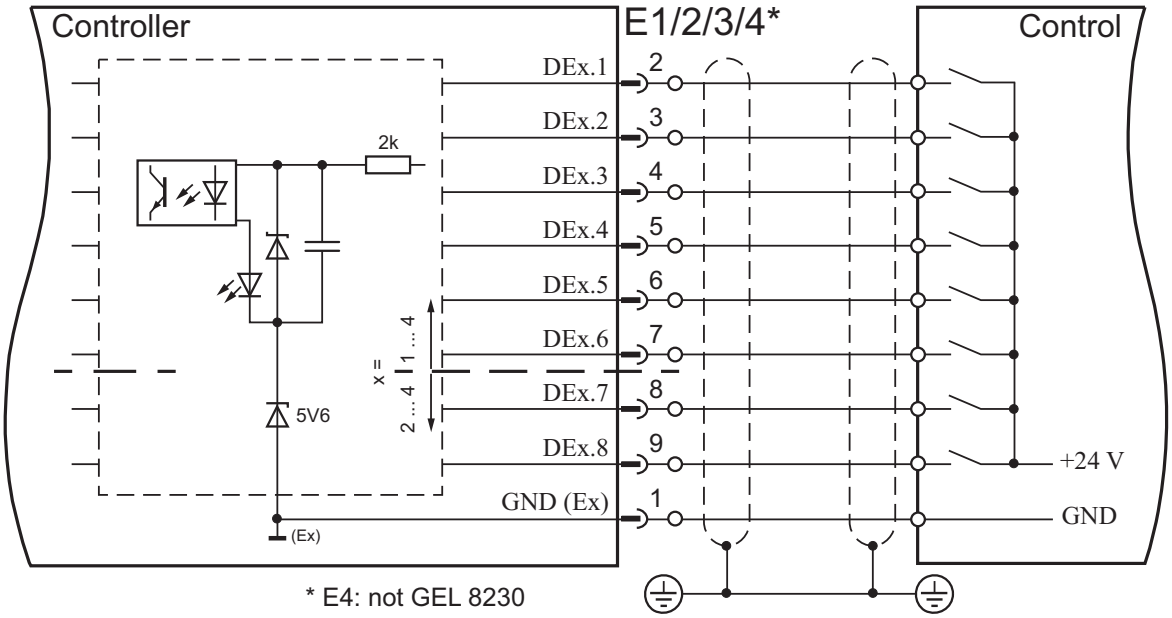
All encoder inputs have the same earth potential.



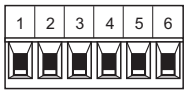
5.8 Digital inputs E1–4



The signal state on the 6 (E1) or 8 (E2 to E4) digital inputs is indicated by green light emitting diodes underneath the related terminal (on ≙ high).



5.9 Analogue inputs E6

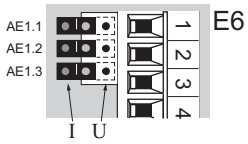


The analogue inputs can be set for the measurement of
– currents 0 – 20 mA or
– voltages 0 – 10 V.

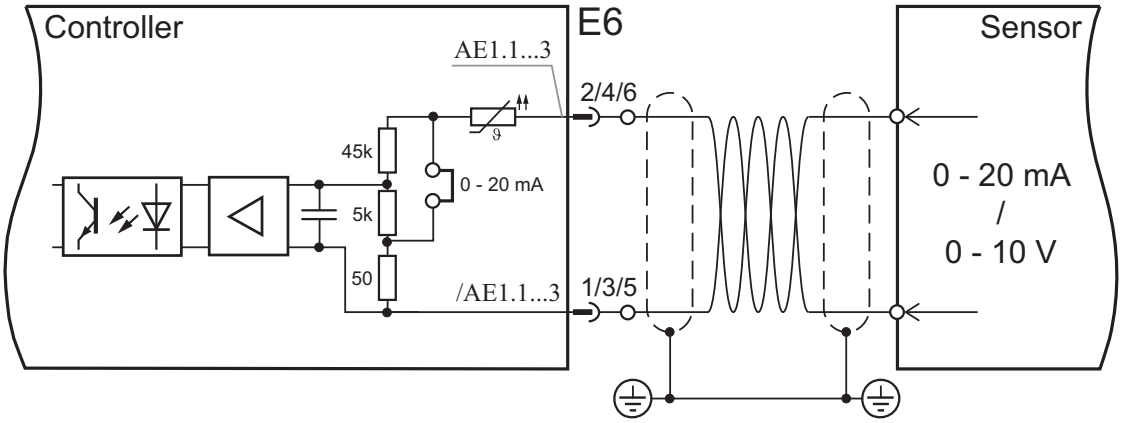
A jumper is provided for this purpose beside the terminal strip for each input (GEL 8230: 1 input AE1.1 only).

Standard configuration: Current measurement (I)

For voltage measurement (U) fit the related jumper. For this purpose the cover with the cable clips must be removed: Undo 4 knurled screws.

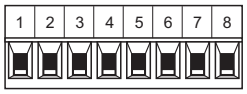


The measuring ranges are converted internally to a value range from 0…255 (1 byte).



To stabilise the differential input it is recommended to connect the earth for the external sensor supply to the analogue earth on the controller:
– terminal strip E5, terminals 1/3/5/7 or
– terminal strips A1–3, terminal 2

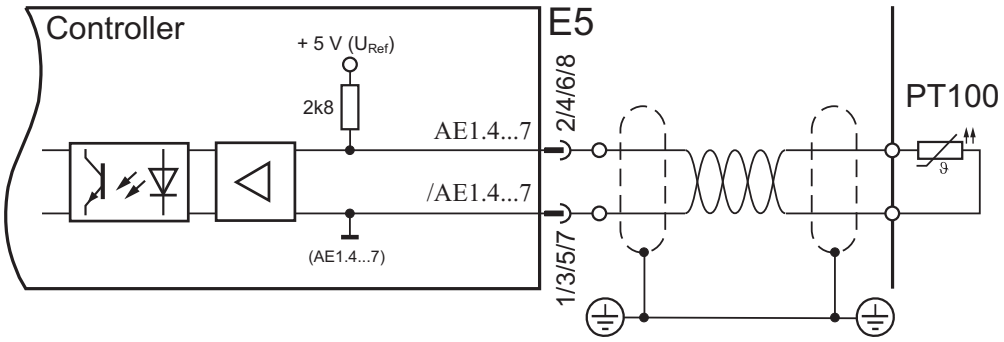
5.10 PT100 analogue inputs E5 (GEL 8231/8232 only)



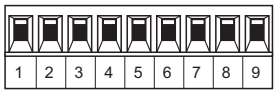
These 4 special analogue inputs are provided for temperature measurements using PT100 resistors in the range from -40 °C to +215 °C.

The measuring range is converted internally to a digital value range from 0 to 255 (1 byte).

The inputs 1/3/5/7 are connected together (earth).



5.11 Digital and analogue outputs A1–3

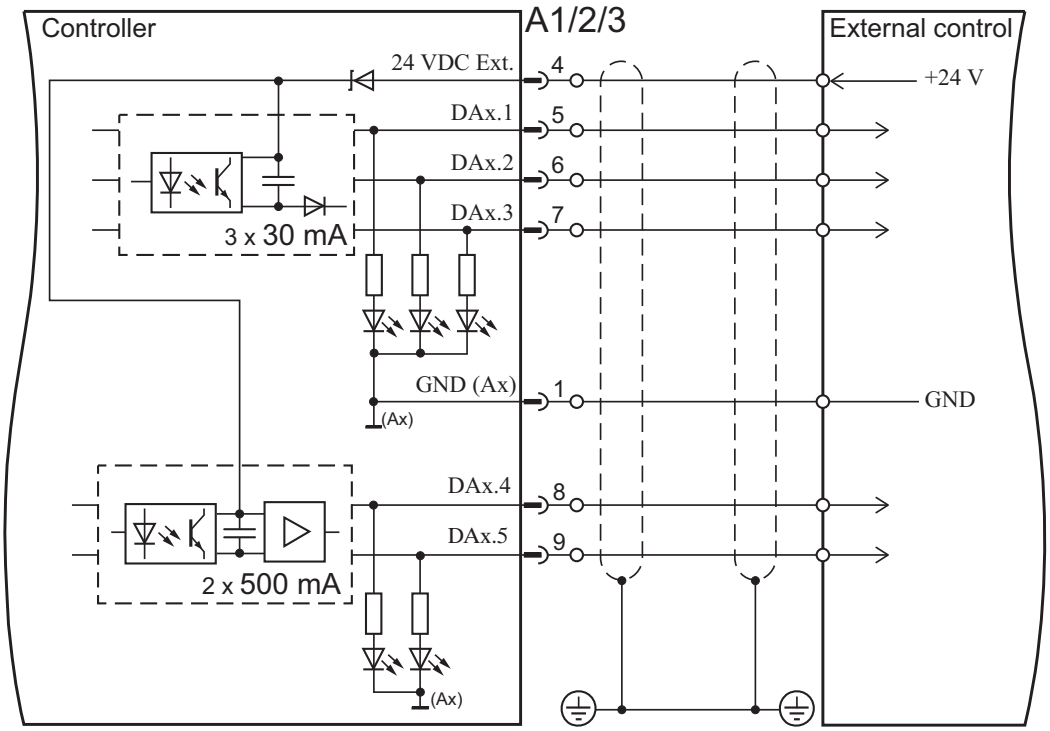


Each of the 3 output terminal strips A contains:
– 3 digital outputs 30 mA (terminals 5, 6, 7)
– 2 digital outputs 500 mA (terminals 8, 9)
– 1 analogue output for the axis control (terminals 2 + 3)

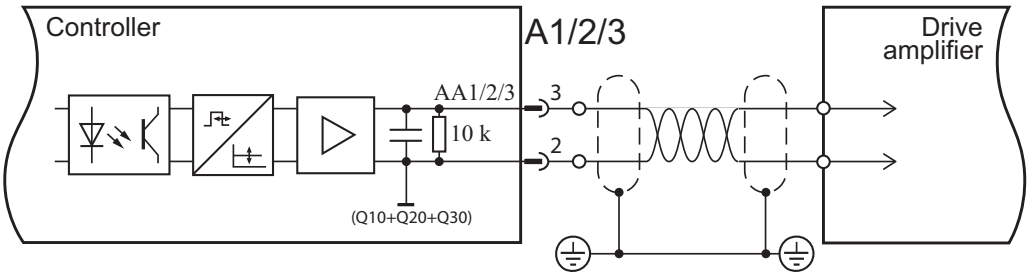
The digital outputs on a terminal strip each have a separate earth potential. The minus connections for the analogue outputs are connected together.

The signal state on the digital outputs is indicated by red light emitting diodes underneath the related terminal (on ≙ high).

Digital:



Analog:



6 Commissioning

6.1 MotionController

After switching on and a short initialisation process, specific changes can be made to the MotionController and the axes to be controlled using the system parameters described in the reference manual.

After setting all axis-related control parameters, the drives can be moved manually using the keyboard on the Controller.

6.2 Operating system update

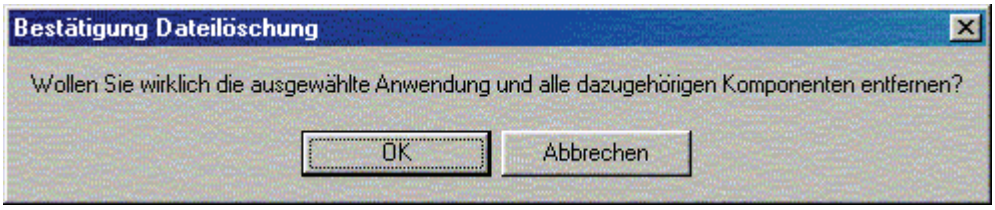
⚠CAUTION Prior to updating the operating system, switch off the power circuits for the drives controlled by the MotionController.

If new operating system software is to be installed on the MotionController (e.g. available on the Internet at www.lenord.de), use the tool provided for this purpose: `LingiMon`.

▶ To install LingiMon, start the program `LingiMonSetup.exe` on the CD or simply click the related menu command in the CD autorun program.

The application will now be installed in the usual manner for Windows (it is possible to change the folders to suit specific needs).

ⓘ If LingiMon has already been installed, the previous version will first be uninstalled by the installation routine:



Confirm uninstall
“Do you really want to remove the selected application and all its components?”

LingiMonSetup must then be started again for a new installation.

▶ After installation start the program either via the Windows Start menu or by using the left mouse button to double-click a binary file with the extension ‘.h86’ or ‘.b86’ in Windows-Explorer.

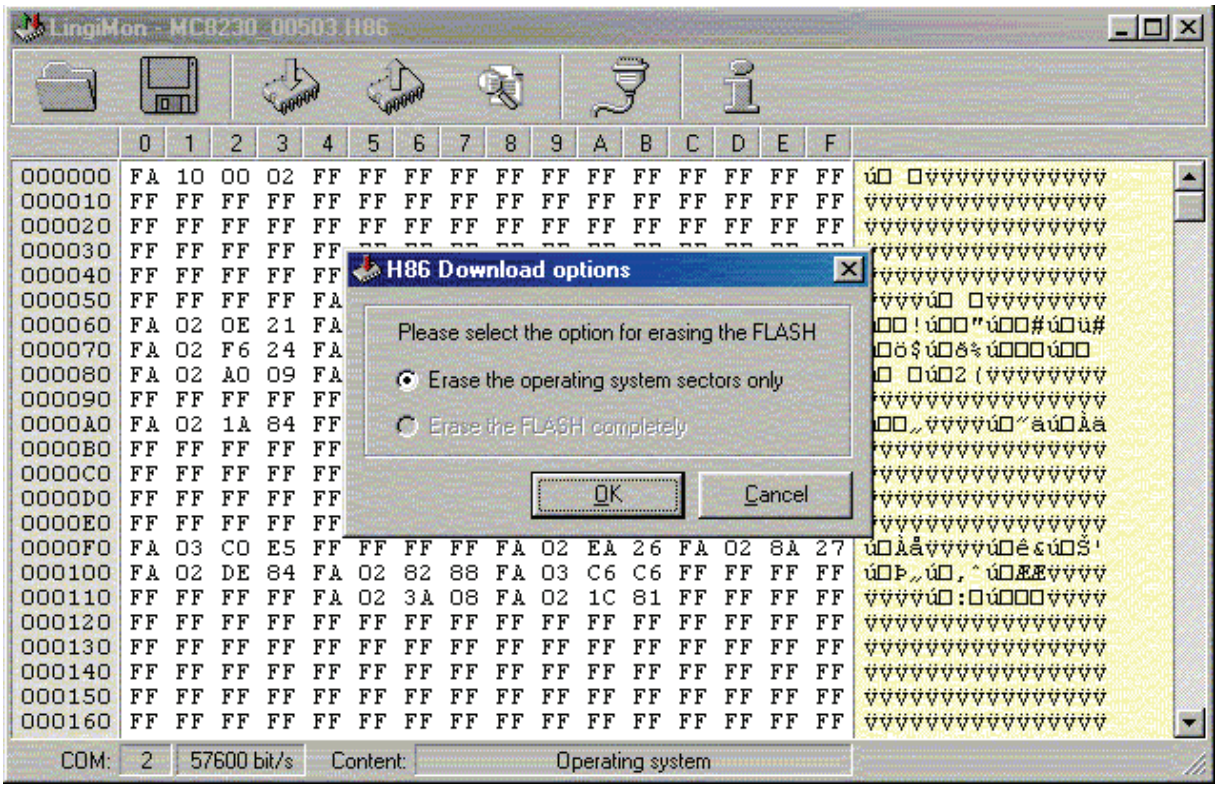
▶ Using a null modem cable establish a connection between the PC (RS 232 C: COM1/2) and the MotionController (connector C1).

▶ In the program select the COM port used (to be set via the connector icon).

ⓘ The transmission rate is set to 57,600 baud by default. If problems occur during the data transfer, first the transmission rate should be reduced in steps to the minimum value of 9,600 baud (to be set via the connector icon).

Other communication parameters: 8 data bits, even parity, 1 stop bit, no control

Starting LingiMon with selected binary file (.h86)

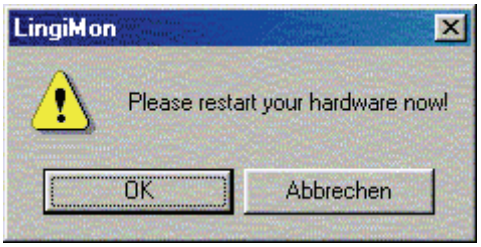


The status bar provides information on the COM port (COM 2) selected, the transmission rate (57600 Baud) as well as type of file loaded.

Prior to transmitting the data to the flash memory on the device, this memory is first cleared. In general it is sufficient to clear only the operating system area – as per the default in the program. Then any existing PLC program and the system parameter settings will be retained. The other option can be enabled in the Download options (click connector icon).

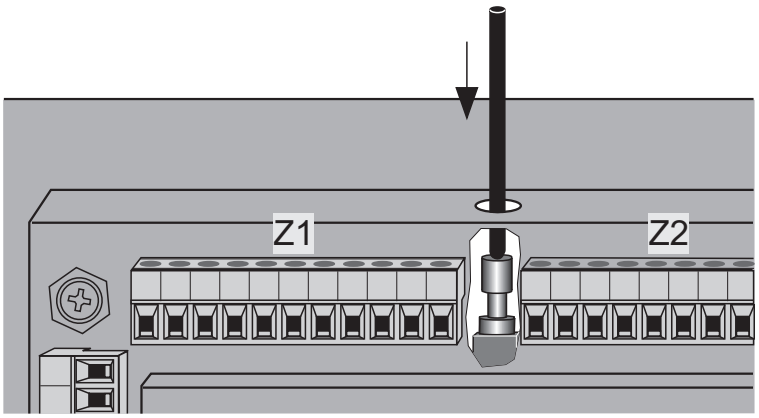
Do not switch to another application during the transmission of the data – the transmission window must remain active, progress can then be followed using the progress bar displayed. Otherwise Windows-specific errors can occur during the transmission process that will result in the MotionController ceasing to respond. In such a case repeat the transmission.

After confirming using OK, the program will prompt you to reset the device.



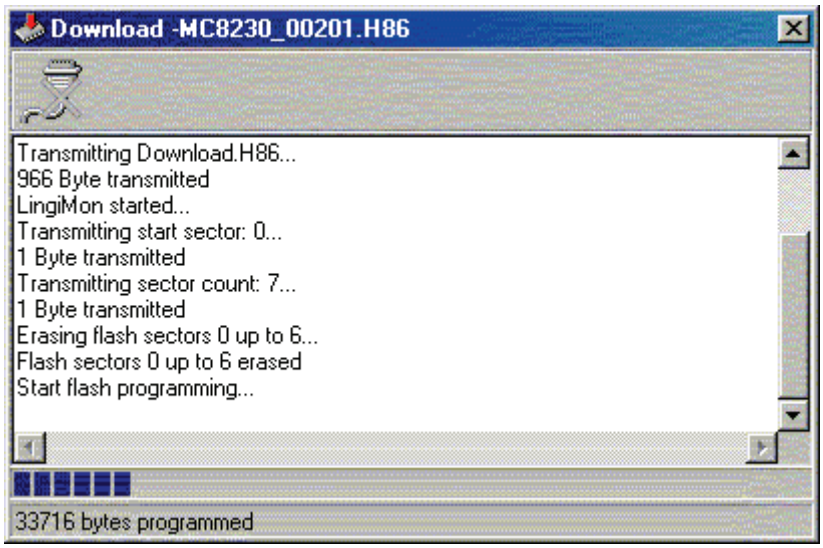
▶ Switch off the MotionController.

▶ Press the miniature button in the housing as per the following figure using a non-metallic object (e.g. match) and switch the device back on.



▶ Release the button again.
The MotionController is now ready for the download (only one or more lines can be seen on the display).

After confirming using OK the transmission process starts (approx. 250 Kbytes for “operating system”):

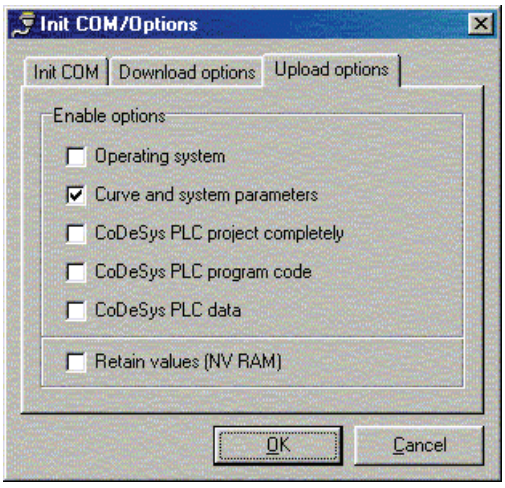


At the end of the (successful) transmission the MotionController switches to normal operation. If not, repeat the transmission process possibly with a reduced transmission rate.

The contents of the complete flash memory or only parts of the memory can also be uploaded i.e. read and saved in a file with the extension ‘.b86’. This file can be written back again at any time – as explained above (backup function). The name of the file is generated automatically by the option selected, but can be changed if necessary.

The memory area to be uploaded is defined using the Upload options (click connector icon).

Using the magnifying glass icon a comparison can be made between the data displayed and the data in the MotionController. A corresponding upload process is started for this purpose.



7 Technical data

7.1 Specifications

Electrical data	
Supply voltage V_S	19 to 30 V DC
Power consumption	1 A max. (depending on interface)
Interfaces	
Serial RS 232	2 (COM1/2), adjustable baud rate, for PC communication/programming; COM1: RS 232 C, COM2: RS 232 C or RS 422/485
CAN bus	2 x onboard (master / slave)
Field bus	1 extension slot for PROFIBUS DP, Inter-Bus-S or DeviceNet (others on request)
Inputs	
Counting inputs	6 × absolute SSI, power supply 24/5 V, 900/600 mA in total, clock frequency 125 kHz
Digital inputs (galvanically separated) • GEL 8230 • GEL 8231, GEL 8232	24 V, green LED status indicators 22 30
Analogue inputs (galvanically separated) • GEL 8230 • GEL 8231, GEL 8232	selectable alternatively 0 to 10 V or 0 to 20 mA 1 3
PT100 inputs (galvanically separated) • GEL 8230 • GEL 8231, GEL 8232	-40 °C to +215 °C – 4
Outputs (galvanically separated)	
Digital outputs	9 × 24 V, 30 mA 6 × 24 V, 500 mA red LED status indicators
Analogue outputs	3 × ±10 V, max. 10 mA, 2 mV resolution
PLC	
Memory	programme: 256 KB / data: 128 KB / data backup: 128 KB / NV RAM: 4 KB
Programming	according to IEC 61131-3, CoDeSys environment
Ambient data	
Protection class	front side: IP 65, rear side: IP 20
Operating temperature	-20 °C to +70 °C

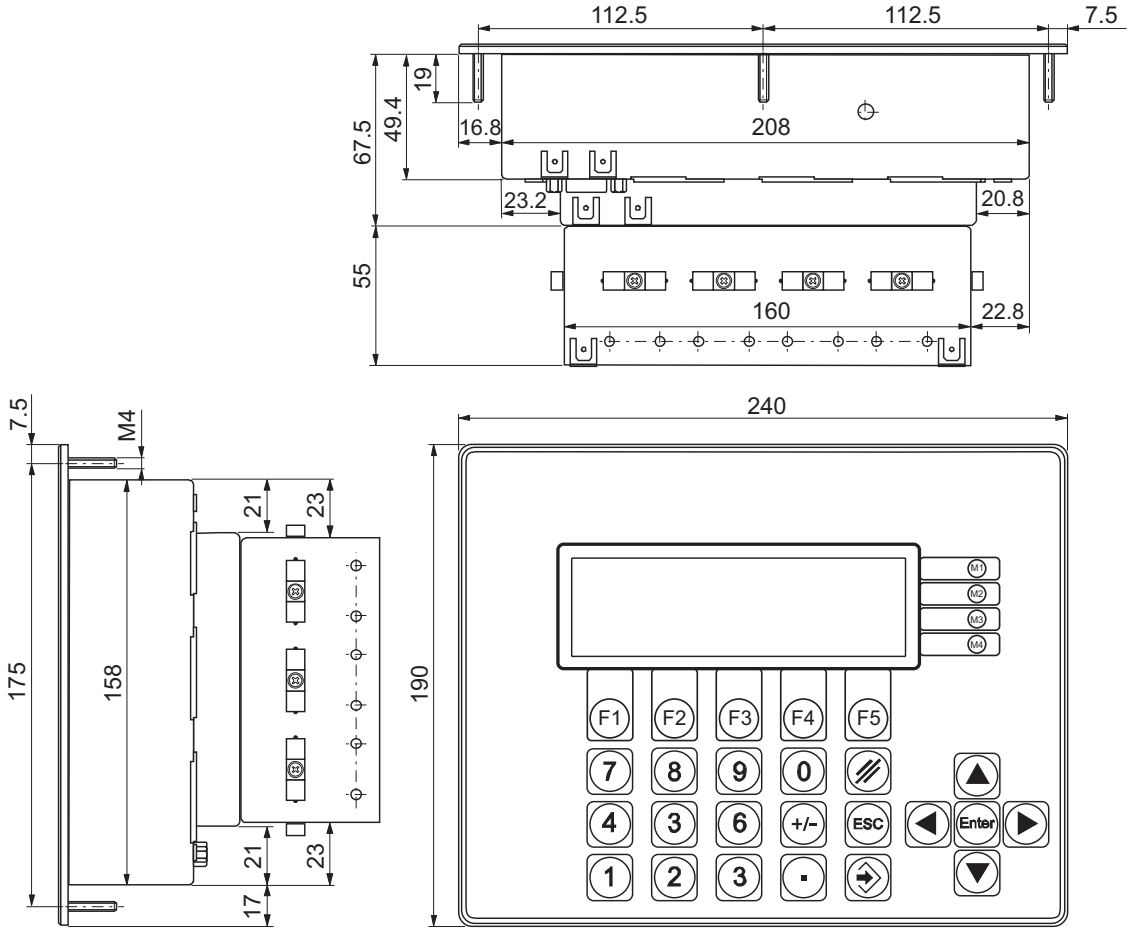
Ambient data	
Storage temperature • GEL 8230, GEL 8231 • GEL 8232	 -40 °C to +70 °C(1) -30 °C to +70 °C
Relative humidity of air	95 %, non-condensing
EMC	EN 61000-6-2 and 4(2)
Vibration resistance (IEC 60068, 2-6)	20 m/s^2, 9 to 50 Hz
Display	
Display	LCD 64×240 px with LED backlighting; visible area 133 × 39 mm
Housing	
Material	galvanized sheet steel
Front panel	edge-protected aluminium
Weight	approx.1.7 kg

(1) From serial number 1230 xxx xxx

(2) When using the device in residential areas or in commercial or industrial environments the requirements as to electromagnetic emission defined in EN 61000-6-3 can be complied with by applying additional shieldings and filters.

7.2 **Dimensional drawing** (Figures in mm)

Standard



With horizontal cable outlet (option)