

EcoController GEL 8110/8115  
- Positioning/Circular Interpolation



09/98

# Design, construction

## Design

The GEL 8110 / 15 EcoController is designed for both single and double axis control. Up to 6 axes can be controlled via the CAN bus. The controller is suitable for controlling all AC/DC motors and hydraulic drives. The controller offers a fast and economical solution to both simple and complex automation tasks.

The EcoController is designed for installation in a switchgear cabinet. It can be operated individually or cross-linked. At the core of the EcoController hardware is a fast 16-bit microprocessor and a powerful peripheral ASIC developed especially for the demands of motion automation. The housing is constructed of sheet metal (Zincor).

## Inputs / Outputs

In the basic version, the controller has

- digital inputs (terminal strip G, J)
- digital outputs (terminal strip H, K) and
- combined inputs / outputs (terminal strip F)

Each output can drive a current of 300 mA. Groups of 8 outputs each can carry a current of 600 mA together and simultaneously.

Available as options are:

- 48 digital inputs (connectors E2, E3) and
- 48 digital outputs (connectors A2, A3)

All digital outputs operate with 24 V levels common in industry. All digital outputs are short-circuit proof and protected against polarity reversal. One can choose between displaying the input status of 24 inputs or the output status of 24 outputs via 24 (programmable) LEDs.

## Actual value acquisition

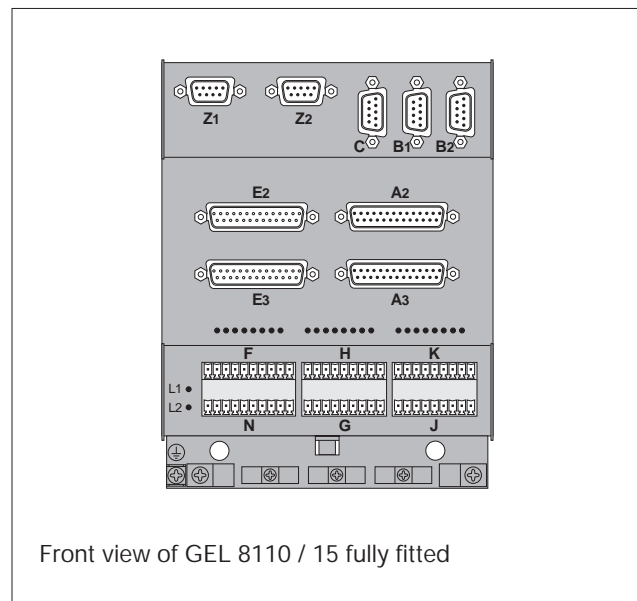
There are various encoder inputs available to record the actual values of rotation, distance, or angle

- up to two counting inputs for 5 V or 24 V incremental encoders
- up to two serial SSI inputs for absolute encoders in gray code (13 bits/25 bits)
- CAN bus
- and all combinations of the aforementioned actual value acquisitions

## Communications interfaces

The controllers can easily be cross-linked with the aid of two shunt-connected, 9-pin D-subminiature connectors. Available are:

- two RS 485 and one RS 422/485 communications interfaces independent of one another (connector B1, B2)
- PROFIBUS DP (connector P) not shown in front view, explained in the section PROFIBUS DP
- one RS 232 interface and the CAN bus (connector C)
- InterBus-S (connector I)



Front view of GEL 8110 / 15 fully fitted

## Field bus

The input and output of process data (nominal/actual values) and all control signals, as well as parametering can also be carried out via the PROFIBUS or InterBus-S, which considerably reduces materials and wiring costs in comparison to conventional parallel communication.

The PROFIBUS module is an intelligent interface RS 485 (1 line pair) that can transfer data in accordance with DIN E 19245 part 3 (PROFIBUS DP). The maximum transfer rate is 1.5 MBaud. An InterBus-S module according to DIN E 19258 (2 line pairs) with the same functions may be used alternatively. Connectors A2 and A3 are replaced by two 9-pin P connectors or I connectors.

# Programming, operation



## Programming

A controller programme always is comprised of one or more sentences that can easily be modified, duplicated or expanded. The sentence structure is set down by the users themselves and can therefore be adapted to all the various requirements. Inputting the sentences is carried out via the GEL 8810 operator terminal.

Still more convenient is using the BB 8100 „Operating + Observing“ PC programme to edit, store and load the sentences into the controllers or to read them out from the controllers. Of course the controllers can also be configured via this programme. At the same time, input masks of the BB 8100 nominal value editor also automatically adapt themselves to the selected sentence structures.

The „Operating + Observing“ PC programme also allows you to carry out communication with an individually operated controller or with a complex controller network. An automatic backup function reads the data and configurations of all the controllers that are cross-linked and independently generates the files necessary for system management. The option of saving data onto storage media allows for a better overview of the diverse controller files. A flexible printer driver assists in documenting the site data.

### System requirements for the BB 8100 PC programme

- 80386 PC or higher (MS-DOS 3.30 or higher)
- 3.5" floppy disk drive and hard disk
- RS 232 interface

If you are cross-linking several controllers, your PC requires an RS 485 interface. If your PC does not have such an interface, then we can offer you the following solutions:

- GEL 89010 V 24 / RS 485 converter incl. power supply unit
- GEL 89011 V 24 / RS 485 converter with electrical signal isolation incl. power supply unit, GEL 8810 operator terminal

## GEL 8810 operator terminal

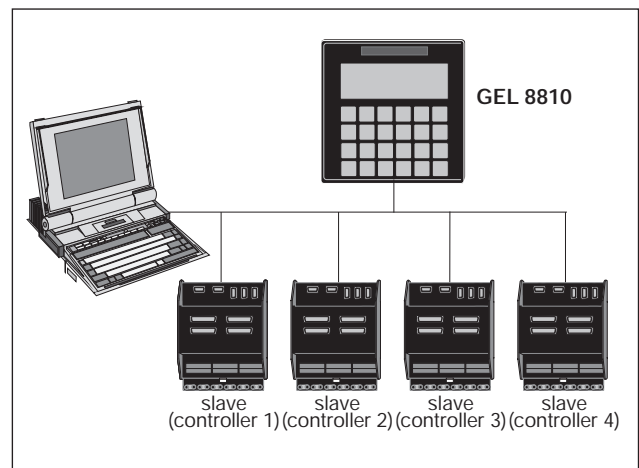
The GEL 8810 operator terminal with its front dimensions of 160 mm x 160 mm is designed for operating and observing in close proximity to the controller. The 18 mm x 18 mm quick stroke keys can be labelled with user-specific insertion strips.

The high-illumination, high-contrast display has an alphanumeric LCD dot matrix display ( 4 x 20 characters, 8 mm high) with LED background lighting. The self-explanatory display text (bilingual) uses menus to guide the user through the programming of functions and operating values. In addition, there are also convenient editing features such as:

- inserting sentences
- copying sentences, even beyond programme limits
- deleting sentences, programmes, units and the entire memory
- scrolling through memory contents, etc.

With the EcoControllers machine parameters and nominal value programmes can be edited or actual and nominal values can be visualized.

The selection of and communication with up to 31 EcoControllers is carried out via the RS 485 interface.



Further information about the GEL 8810 operator terminal is available on a separate data sheet.

# General information

## Nominal values

The **sentence-oriented programming** allows for programme processes to be entered quickly and simply. For this purpose, users have available to them 6416 nominal value storage locations that can be divided up into 99 programmes with up to 999 sentences per programme. A sentence can consist of the following nominal values:

- position / length
- quantity
- machinery functions
- speed
- autostarting time

## Programme process control

In order to make **programme structuring flexible**, 4 commands can be preset in the sentence in place of position values:

- CALL Pr. - subroutine call
- Jump Pr. - programme branch
- JMP Sentence - sentence in the programme
- IF E/A - branch depending on a signal

## Drive control

The control of variable speed drives is carried out via up to 2 analogue outputs with a voltage spread of 0 to + 10 V and 0 to ± 10 V and a resolution of 1.22 mV. In addition, the following signals are transmitted:

- forwards / backwards
- release controller inhibit
- release brake

For the control of e.g. pole-changing motors, there are 2 x 4 range signals available with the following controlling functions:

- slow run/fast run
- forwards / backwards

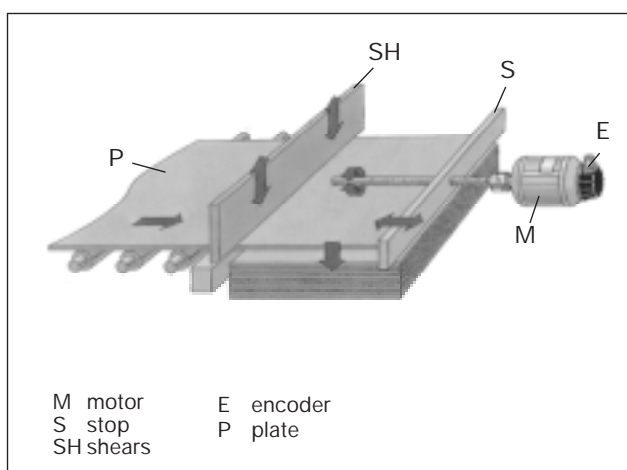
The CAN bus interface controls our Series ND 31 servo-converter. All controlled variables for up to 8 axes are transmitted via the bus. Wiring thus becomes easier (encoder and analogue outputs are not connected).

## Machine parameters (selection)

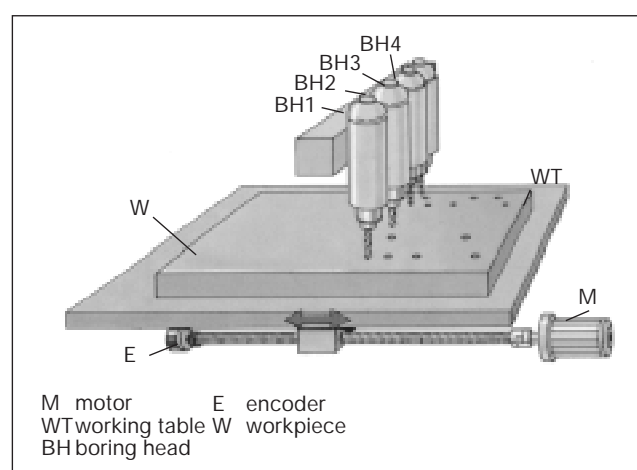
- power failure protection
- choice of encoder inputs (incremental / absolute)
- multipliers for nominal value, display, and nominal speed value
- zero-point adaption for absolute encoders
- correction value (e.g. for saw blade width)
- absolute / relative measure system / 2 reference measures
- residual value settlement
- control parameters (speed, acceleration / braking / jerk time)
- circular table positioning
- passwords for nominal values and machine parameters

## Special functions

- linear path control
- change as desired between absolute / relative measure system during inputting of nominal values
- continuous sentence processing
- parking position
- range signals
- software limit switch
- trailing error control



▲ *Example for application*  
*Stop positioning of plate shears*

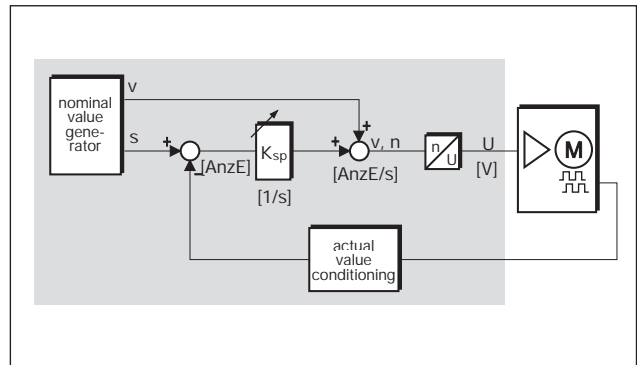


▲ *Example for application*  
*Positioning of a working table with additional signal output (machinery functions) for the control of 4 drills.*

# General information

## Control principle GEL 8110/8115

With the control principle used, a new, calculated nominal position value is cyclically specified for the drive and the resulting difference between actual and nominal values is evaluated by a programmable factor that is responsible for the control dynamics. In order to minimize the contouring distance, a calculated value for the speed is additionally added up (r.p.m. precontrol). Thus one has a very effective and individually adaptable control for the drives.



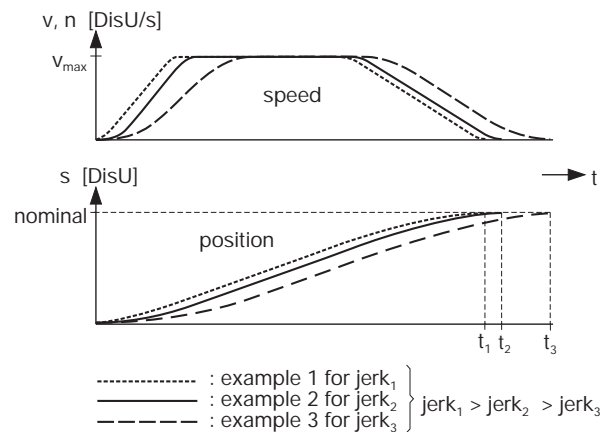
## Acceleration and braking curve

The acceleration and braking curve for the drive is separately set down for each axis over the parameters to be specified:

- maximum and operating speed
- acceleration and braking in both forward and backward directions
- jerk (time)

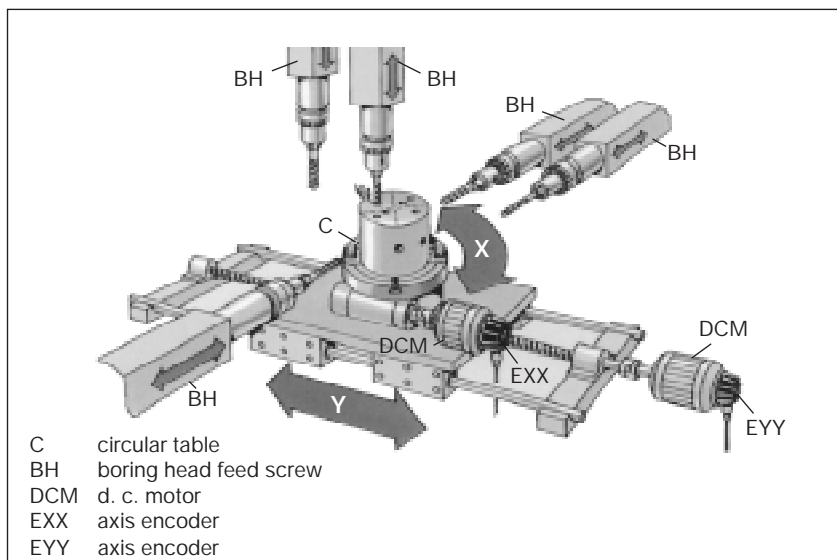
The jerk is the size by which the acceleration changes, i.e. a measure for the steepness of acceleration and braking. By prescribing these values for the specific plant, the commissioning of the device and the optimization of the control response are considerably simplified. The positioning characteristic for the drive (e.g. soft start) is set down simply by the suitable selection of the jerk parameter (see diagram „jerk-dependent positioning curves“).

## Jerk-dependent positioning curves



### ▲ legend

- v : speed
- n : r.p.m.
- $v_{max}$  : maximum speed programmed
- s : path
- nominal : nominal position prescribed in one sentence
- t : time (s)
- DisU : display units
- $K_{sp}$  : control factor (dynamics)



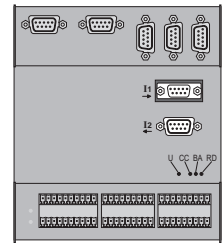
▲ Example for application: automatic drilling center

# Technical Data

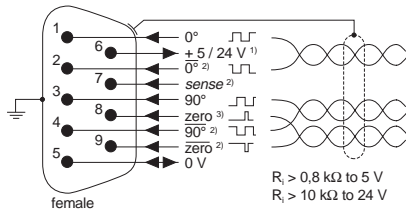
<b>Supply voltage</b>	
input	18 ... 30 V DC or 15 ... 23 V AC
current consumption	approx. 300 mA
output	$U_B - 1V$
load current	approx. 400 mA
<b>Counting inputs</b>	
logic level	24 V low: 0 ... +5 V high: +15 ... +30 V
	5 V low: 0 ... +0,8 V high: + 2.5 ... +5 V
input resistance	24 V > 2.5 k $\Omega$
	5 V > 3 k $\Omega$
input frequency	$\leq 200$ kHz
pulse width of zero signal	2.5 $\mu$ s
encoder supply	24 V approx. $U_B - 1.5 V$ (max. 26 V)
	5 V 5 V $\pm$ 5% stabilized with sense line
<b>SSI inputs</b>	
data, cycle	as per specification RS 422
cycle frequency	approx. 375 kHz
encoder supply	approx. $U_B - 1.5 V$
<b>Logic input</b>	
level	low: 0 ... +5 V high: +15 ... +30 V
input resistance	> 10 k $\Omega$
<b>Logic output (terminal strip)</b>	
$I_{max}$	300 mA, 8 outputs together max. 600 mA, sustained short circuit-proof
reaction time at overload	$\geq 1\mu$ s
voltage supply	external 8 ... 30 V DC
<b>Analogue outputs</b>	
voltage range	-10 V ... 0 ... 10 V
resolution	1.22 mV (14-bit-D/A-converter)
$I_{max}$	6 mA, sustained short circuit-proof
max. offset error	$\pm 0.7$ mV referring to 23 °C
offset-temperature coefficient	typ. 0.20 mV / 10 K, max. 1.00 mV / 10K
<b>Digital inputs (optional, 25-pole D-subminiature plug)</b>	
inputs	2 x 24
level	low: 0 ... +5 V high: +15 ... +30 V
input resistance	> 10 k $\Omega$

<b>Digital outputs (optional, 25-pole D-subminiature plug)</b>	
outputs	2 x 24
$I_{max}$	20 mA, in case of internal supply: all 48 outputs together 200 mA
supply voltage	approx. $U_B - 1.5 V$ (internal) 8 ... 30 V DC (external)
<b>Serial interfaces</b>	
	3
Ser1	RS 485 or RS 232 C, electrically isolated via optocoupler
Ser2	RS 422
Ser 3	RS 485 electrically isolated via optocoupler
<b>Count range</b>	$\pm 2^{31}$
<b>Control scanning time</b>	typ. 1 ms per axis
<b>Nominal value storage location</b>	6416
<b>Climatic applicability class</b>	
	KWF (acc. to DIN 40040)
relative humidity of air	up to 95 %, no condensing
operating temperature range	0 °C ... 50 °C
storage temperature range	-20 °C ... +80 °C
<b>EMC (observance of assembly instructions is mandatory)</b>	
electromagnetic emissions	acc. to EN 50081-1
electromagnetic immunity	acc. to EN 50082-2
The GEL 8110/15 is in strict conformity with Directive EMC 89/336/EEC of the European Union and is therefore certified by the CE mark.	
<b>Display</b>	
standard	2 LEDs
option (only for data inputs/outputs)	24 LEDs, signaling the switch position of inputs and outputs
<b>Housing</b>	
material	sheet metal (Zincor) powder-lacquered black
fixture	snap-on mounting on top hat rail as per DIN EN 50022-35 or simple fastening with screws
<b>Protection class</b>	IP 20

# Pin layouts



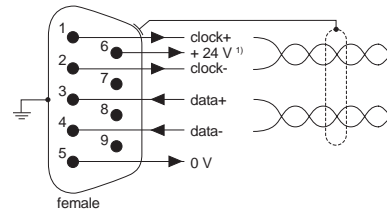
## Connectors Z1, Z2 (counting input for incremental encoders)



- <sup>1)</sup> change with DIP switch (same voltage value as at N4, 26 V max.)
- <sup>2)</sup> do not connect if not used
- <sup>3)</sup> alternative: sensor signal for *reference fine* function; if you use different voltage levels for the encoder (5 V) and the sensor (24 V) adjust with DIP switch accordingly

E281047Z

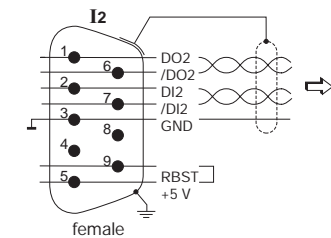
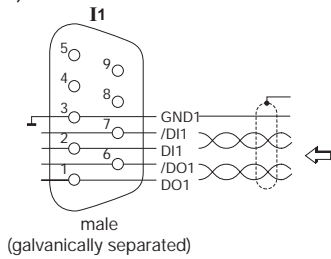
## Connectors Z1, Z2 (actual value input for an absolute SSI encoder)



- <sup>1)</sup> change with DIP switch (same voltage value as at N4, 26 V max.)

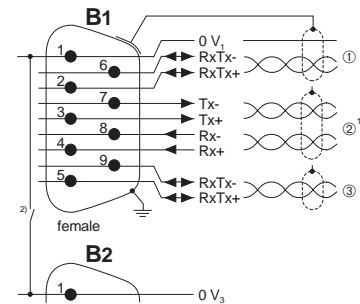
E281047S

## Connectors I (InterBus-S)



E281047I

## Connectors B1, B2 (serial interfaces)

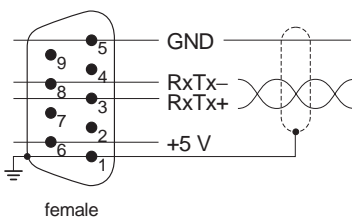


- ① Ser1: RS 485 with galvanical separation(PC etc.)
- ② Ser2: RS 422/485 (daisy chaining EcoController)
- ③ Ser3: RS 485 with galvanical separation (operator terminal GEL 8810)

- <sup>1)</sup> switch on von RS 422 auf RS 485 mittels DIP switch
- <sup>2)</sup> close DIP switch if several EcoControllers form a cascade arrangement

E281047B

## Connectors P (two PROFIBUS ports connected in parallel)

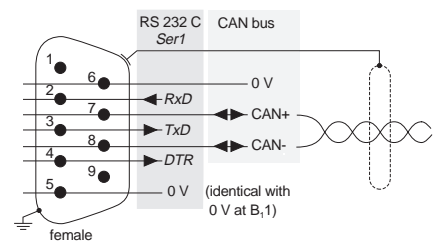


### Important!

The bus terminator GEL 89030 which is included in the scope of supply must absolutely be plugged into connector P.

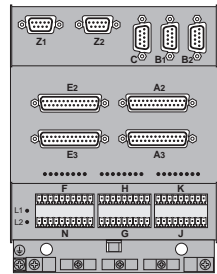
E281047P

## Connector C (serial interfaces RS 232 C and CAN-Bus)

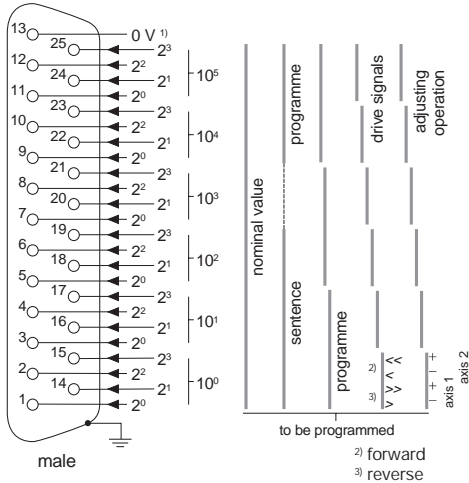


E281047C

# Pin layouts



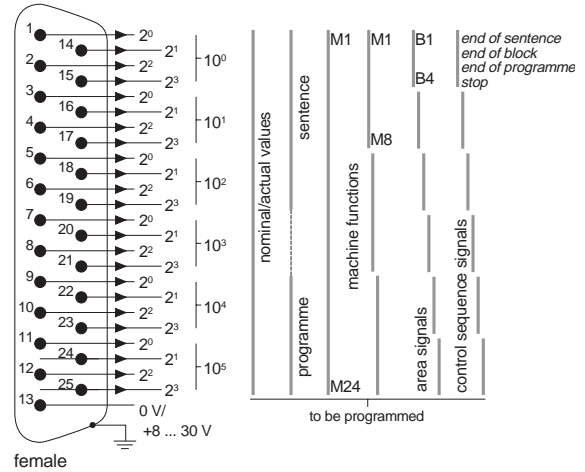
## Connectors E2, E3 (data input)



<sup>1)</sup> upon request this can also be supplied with positive voltage (same as data output A2/A3: externally or internally U, see terminal strip N)

E281047E

## Connectors A2, A3 (data output)



E281047A

## Terminal strip F (data input or output)

### data input E1

1	←	0 V	
2	←	forward	min
3	←	forward	max
4	←	reverse	min
5	←	reverse	max
6	←	forward	min
7	←	forward	max
8	←	reverse	min
9	←	reverse	max
10	←	+ 8 ... 30 VDC	

### and /or data output A1

1	←	0 V	
2	→	M1	B1
3	→	M2	B2
4	→	M3	B3
5	→	M4	B4
6	→	M5	B1
7	→	M6	B2
8	→	M7	B3
9	→	M8	B4
10	←	+ 8 ... 30 VDC	

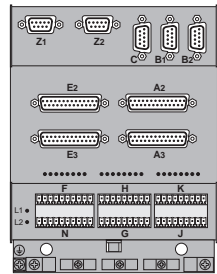
E281025 F

## Terminal strip N (voltage supply)

1	←	~	voltage supply 15 ... 23 V AC or + 18 .. 30 V DC
2	←	~/+	
3	←	-	
4	→	+	voltage output for supplying signal encoders ≈U <sub>s</sub> -1 V, max. 400 mA
5	←	-	
6	←	-	analogue output
7	←	0 V (axis 1)	
8	←	0 V (axis 2)	
9	→	± 10 V (axis 1)	
10	→	± 10 V (axis 2)	

E281025N

# Pin layouts



## Terminal strip, K-axis 1 (control outputs)

1	→	<i>/malfunction</i>
2	→	<i>no function</i>
3	→	<i>forward</i>
4	→	<i>reverse</i>
5	→	<i>drive enable</i>
6	→	<i>release brake</i>
7	→	<i>reference reached</i>
8	→	<i>actual = nominal</i>
9	←	<i>+8 ... 30 V DC</i>

external supply

J	
9	— 0 V *)

E281025K

## Terminal strip, J-axis 1 (control inputs)

1	←	<i>start</i>
2	←	<i>/stop</i>
3	←	<i>reset</i>
4	←	<i>search reference</i>
5	←	<i>reversing switch</i>
6	←	<i>coarse reference</i>
7	←	<i>reference 2/1</i>
8	←	<i>zero delta_s</i>
9	←	<i>0 V *)</i>

external supply

E281025J

## Terminal strip, H-axis 2 (control outputs)

1	→	<i>no function</i>
2	→	<i>no function</i>
3	→	<i>forward</i>
4	→	<i>reverse</i>
5	→	<i>drive enable</i>
6	→	<i>release brake</i>
7	→	<i>reference reached</i>
8	→	<i>actual = nominal</i>
9	←	<i>+8 ... 30 V DC</i>

external supply

G	
9	— 0 V *)

E281025H

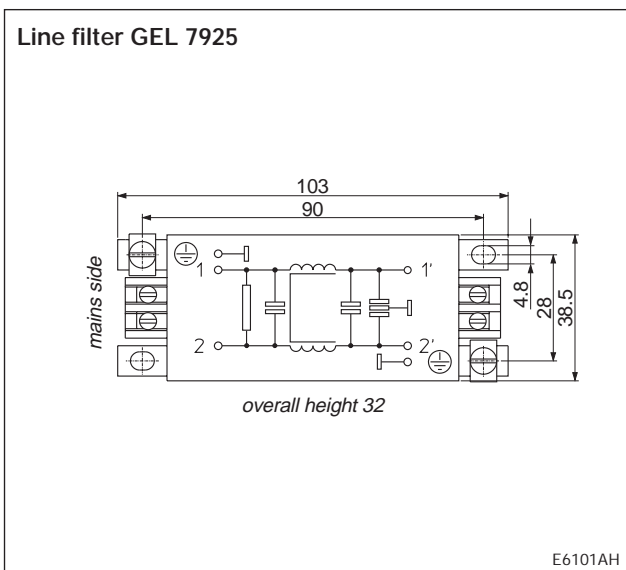
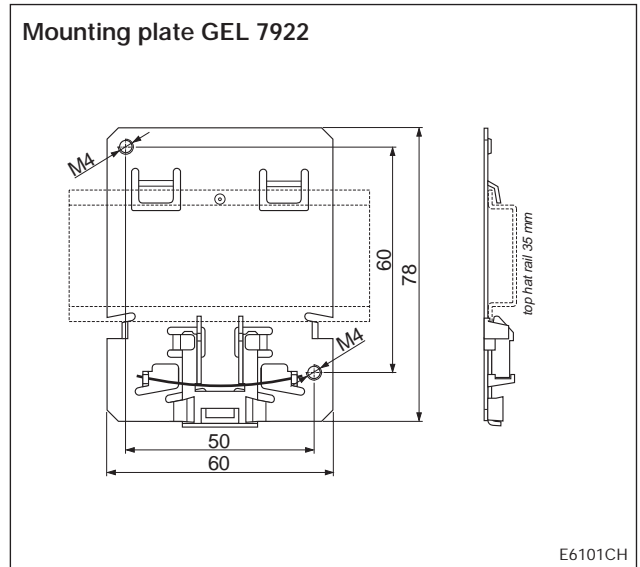
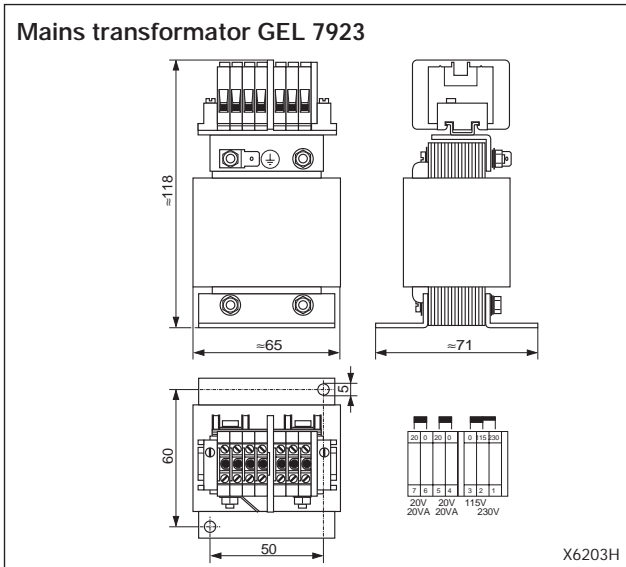
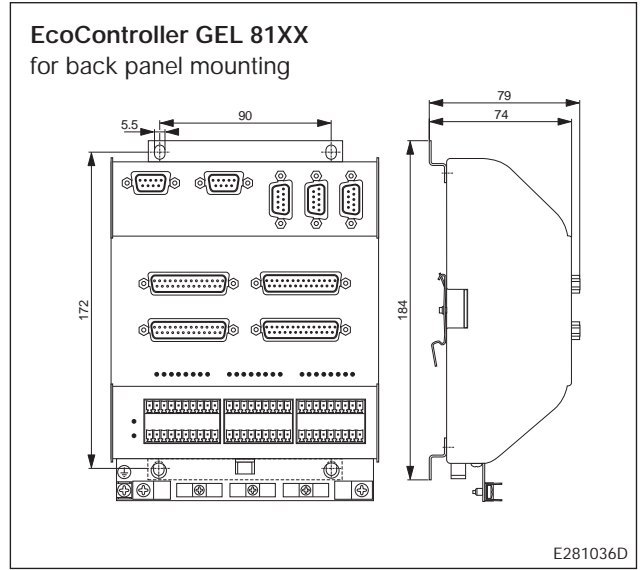
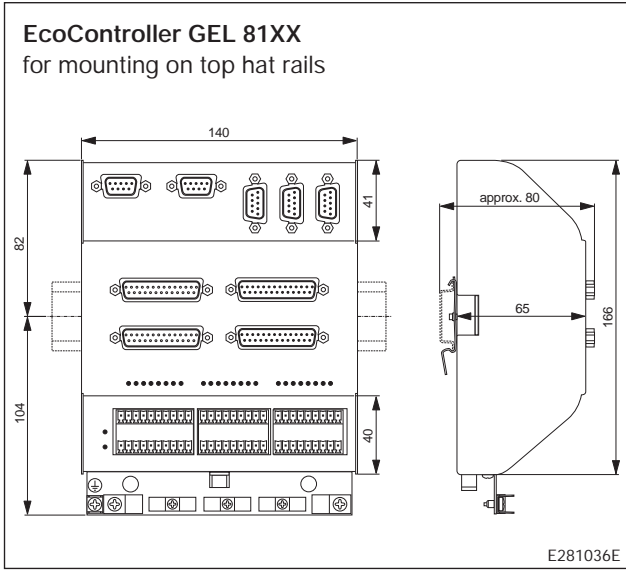
## Terminal strip, G-axis 2 (control inputs)

1	←	<i>start</i>
2	←	<i>/stop</i>
3	←	<i>reset</i>
4	←	<i>search reference</i>
5	←	<i>reversing switch</i>
6	←	<i>coarse reference</i>
7	←	<i>reference 2/1</i>
8	←	<i>zero delta_s</i>
9	←	<i>0 V *)</i>

external supply

E281025G

# Dimensioned drawings



# Type code GEL 81 XX

81	XX	X	X	XX	X	X	0	description
								<b>CAN bus</b>
							0	not mounted
							1	CAN bus
							2	CAN bus, extended
								<b>data input/output</b>
							0	not mounted
							6	48 data outputs, 48 data inputs, 24 LEDs
							8	InterBus-S
							9	PROFIBUS
								<b>actual value inputs</b>
							0	not mounted
							A	incremental counter input 24 V
							B	incremental counter input 5 V
							S	absolute SSI encoder
								<b>analogue outputs</b>
							0	not mounted
							B	2 analogue output 0 ... ± 10 V, 14 Bit
								<b>control inputs/outputs</b>
							A	16 digital inputs, 16 digital outputs 300 mA, 8 combined digital inputs/outputs
								<b>controller type</b>
							10	positioning controller
							15	positioning with circular interpolation
							30	flying saw
							35	rotating cutter
							40	synchronization control
							50	coiling controller
							80	camshaft gear
							90	EcoPLC

## PC software

Operating and observing for

- GEL 8110/15/30/35/40

- GEL 8150

- GEL 8180

- GEL 8190 programming system for EcoPLC

- for MS-DOS

- for Windows 3.X

- for Windows 95/NT

BB 8110

BB 8150

BB 8180

PG 8011

PG 8012

PG 8032

cable from EcoController to EcoController

● transmitter/receiver

GEL 89016 SED

● receiver/receiver

GEL 89016 EED

cable from operator terminal GEL 8810 to EcoController

GEL 89019

connection cable RS 232C between PC and EcoController

GEL 89022

D-type subminiature adapter:

● 25-pole male to 9-pole female

GEL 89025

● 25-pole male to 25-pole female

GEL 89026

● 9-pole male to 9-pole female

GEL 89027

bus terminal connector (PROFIBUS)

GEL 89030

mounting plate for mains transformer

GEL 7922

mains transformer

GEL 7923

line filter with current-compensated chokes 250 V~

GEL 7925

## Accessories

converter (V24/RS485) incl. supply unit

converter (V24/RS485)

with galvanic signal separation

incl. supply unit

cable from converter to EcoController

GEL 89010

GEL 89011

GEL 89015

# Example

## Example 1:

### Positioning controller GEL 8110 A B S S 6 0

Positioning controller	<b>8110</b>
16 digital inputs (G, J)	
16 digital outputs 300 mA (H, K)	
8 combined digital inputs/outputs (F)	<b>A</b>
2 analogue outputs 0 ... ± 10 V	<b>B</b>
2 actual value input for absolute encoder with SSI interface	<b>S S</b>
96 data inputs/outputs (E2/3, A2/3)	
24 LEDs	<b>6</b>
no CAN bus	<b>0</b>

## Example 2:

### Synchronization control GEL 8140 A B A B 0 0

Synchronization control	<b>8140</b>
16 digital inputs (G, J)	
16 digital outputs 300 mA (H, K)	
8 combined digital inputs/outputs (F)	<b>A</b>
2 analogue outputs 0 ... ± 10 V	<b>B</b>
incremental counter input with 24 V and 5 V level	<b>A B</b>
no data input/output	<b>0</b>
no CAN bus	<b>0</b>

## Example 3:

### Camshaft gear GEL 8180 A 0 A 0 2 0

Camshaft gear	<b>8180</b>
16 digital inputs (G, J)	
16 digital outputs 300 mA (H, K)	
8 combined digital inputs/outputs (F)	<b>A</b>
no analogue output	<b>0</b>
incremental counter input with 24 V level	<b>A 0</b>
with 24 data outputs, 24 LEDs	<b>2</b>
no CAN bus	<b>0</b>