

**Technical documentation**

**LE12-140**

231518  
as of Version 1.3

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# 1 Technical data

## 1.1 General

The stepping motor output stage LE12-140 was developed for 2-phase stepping motors. This fulfilled many practical requirements and thereby gave rise to a power output stage which is suitable for many different applications.

The features of this power output stage are:

- Constant current control in chopper operation
- Current adjustment with rotary switch
- Protection against overvoltage and undervoltage (motor power supply)
- Standby and fault display via LED
- Rotational direction reversal
- Temperature monitoring
- Current reduction at standstill
- Switchover to different stepping resolutions (200/400/500/800/1000/1600 steps per revolution)
- Rotation monitoring (switchable)
- Inputs high-active or low-active\*
- Reset, zero or boost function via selector input
- Standby output invertible\*

The input circuit is of a variable design so that this output stage can be used for as many applications as possible. A basic distinction is made between 2 variants:

- classic assignment of the VG strip (LE12-140)
- modern, opto-decoupled assignment (LE12-140-MO).

Rotation monitoring is realized in the case of both assignment variants.

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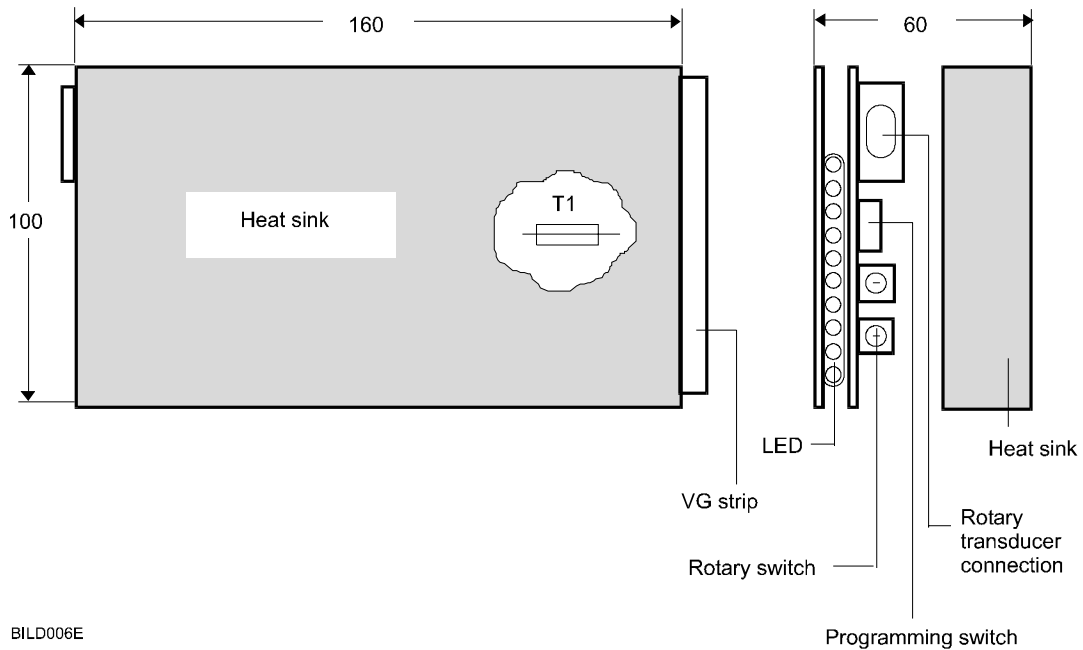
\* only with the standard version (without optocoupler) LE12-140

## 1.2 Technical data

<b>Operating voltage</b>	50V - 140VDC
<b>Limit values min/max</b>	45V / 160VDC
Operating voltage 50-90V <b>Electrolytic charging capacitor</b>	6800µF / 100V
Operating voltage 90-150V <b>Electrolytic charging capacitor</b>	4700µF/160V
<b>Residual ripple</b>	<10%
<b>Max. power consumption</b>	250VA
<b>Phase current</b>	adjustable : 1.0A - 12.0A
<b>Automatic current reduction</b>	adjustable: $I_N / I_N \times 0.75 / I_N \times 0.5 / I_N \times 0.25$
<b>Boost function</b>	$I_N \times 1.2$ (max. 12A)
<b>F<sub>max</sub></b>	75kHz
<b>Pulse width</b>	≥ 5µs
<b>Rise time</b>	≤ 1µs (10..90%)
<b>Fall time</b>	≤ 1µs (10..90%)
<b>Active switching edge pulse</b>	high → low or low → high
<b>Operating temperature</b>	0°C to 40°C (with max. phase current of 3A)
<b>Storage temperature</b>	0°C to 70°C

	<b>LE12-140</b>	<b>LE12-140-MO</b>
<b>Input signal level</b>	5V (24V as option)	5V (24V as option)
<b>Input signal current</b>	typ. 1mA	typ. 15mA
<b>Relay contact output</b>	max. 200VDC / 0.5A	max. 200VDC / 0.5A
<b>Transistor output</b>	max. 60VDC / 0.5A	max. 60VDC / 0.5A

## 1.3 External dimensions



Weight	:	approx. 700g
VG strip:	:	DIN 41612
Fuse T1	:	6.3AM / 250V

## 1.4 Ventilation

The power output stage LE12-140 or LE12-140-MO can be operated with a max. phase current of 3A and a maximum operating temperature of 40°C without external ventilation.

If the stated maximum values are exceeded, external ventilation is absolutely essential to dissipate the power loss.

The power output stage is switched off if the heat sink temperature exceeds 80°C.

**Please note:**



**Ensure that the air can circulate unhindered.**

## 2 Control inputs

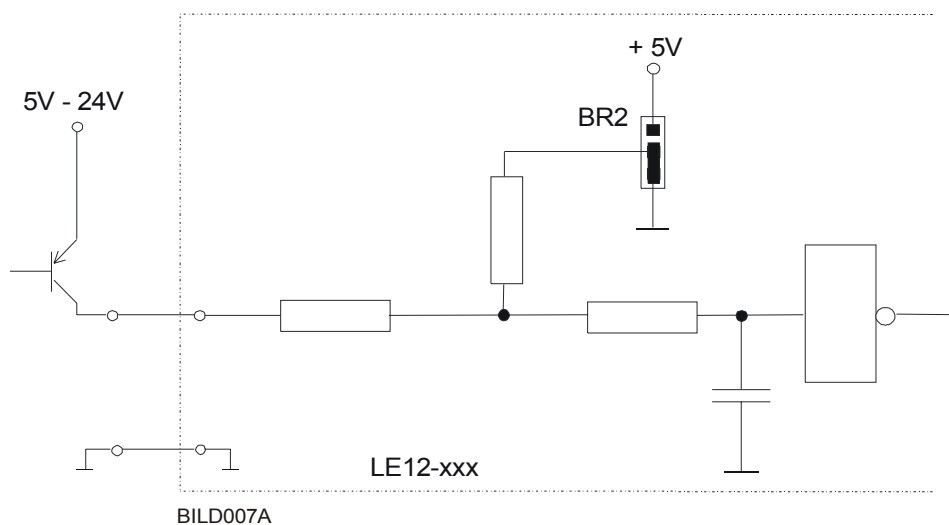
The circuit of the control inputs differs depending on the variant (with or without optocoupler).

### 2.1 LE12-140

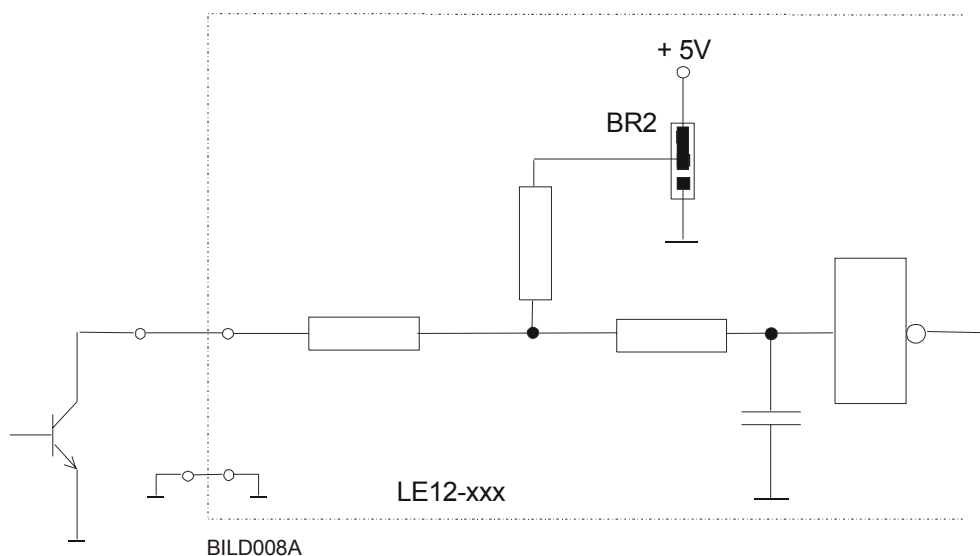
In the case of the LE12-140 which is not equipped with optocouplers, it is possible to choose between inputs low-active or high-active. This is determined via the jumper (BR2) on the printed circuit board (also see [Jumper assignment](#)).

For the standard setting, refer to Section [Jumper assignment](#).

- Inputs high active => PNP control



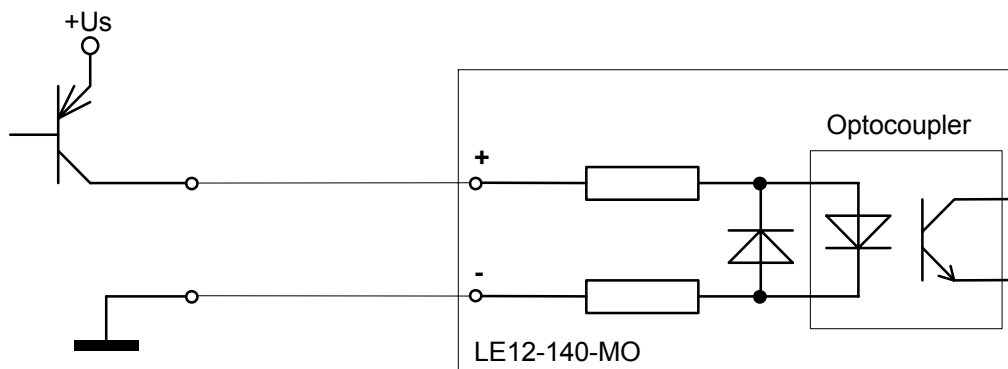
- Inputs low active => NPN control



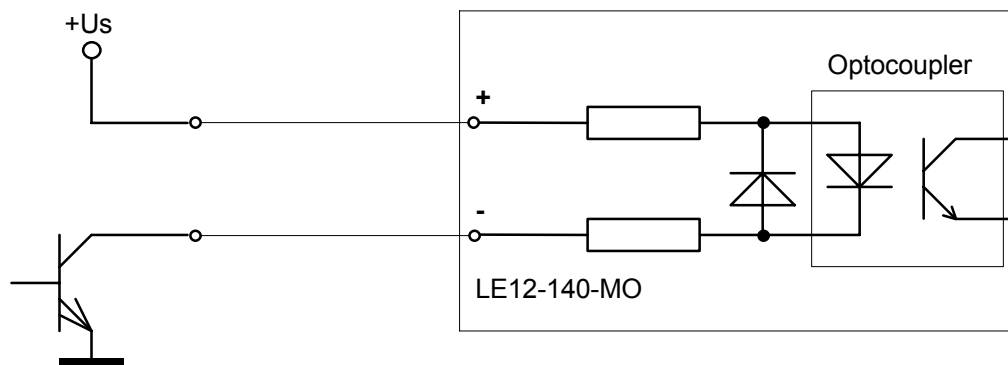
## 2.2 LE12-140-MO

The control inputs of the power output stage LE12-140-MO have optocouplers.

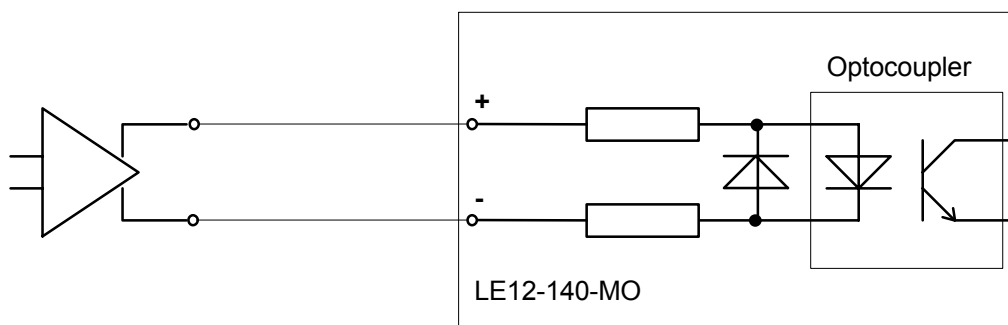
### 2.2.1 PNP control



### 2.2.2 NPN control



### 2.2.3 Push-pull control

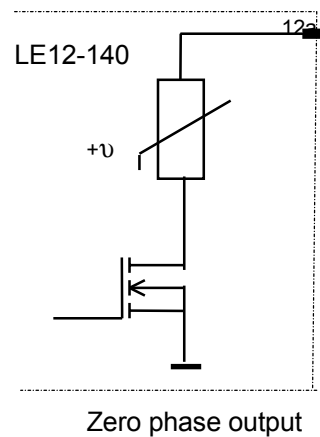
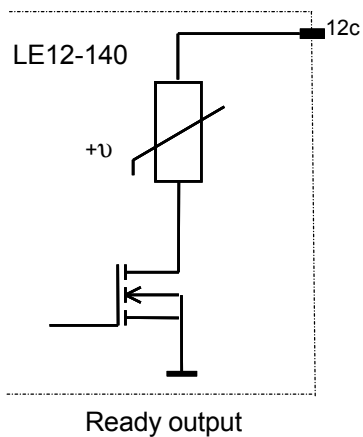




## 3 Output circuit

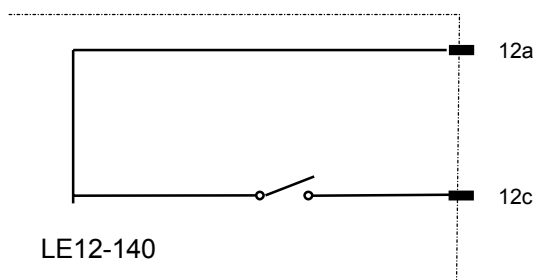
With regard to the output circuit, this power output stage offers two possibilities - transistor output and relay contact output. Different specifications exist for the two variants (see Section [Technical data](#)). The circuit is provided as a transistor output in the basic setting. If you require a relay contact output, the setting is made by the manufacturer on delivery.

### 3.1 Transistor output



- standard setting by LE12-140

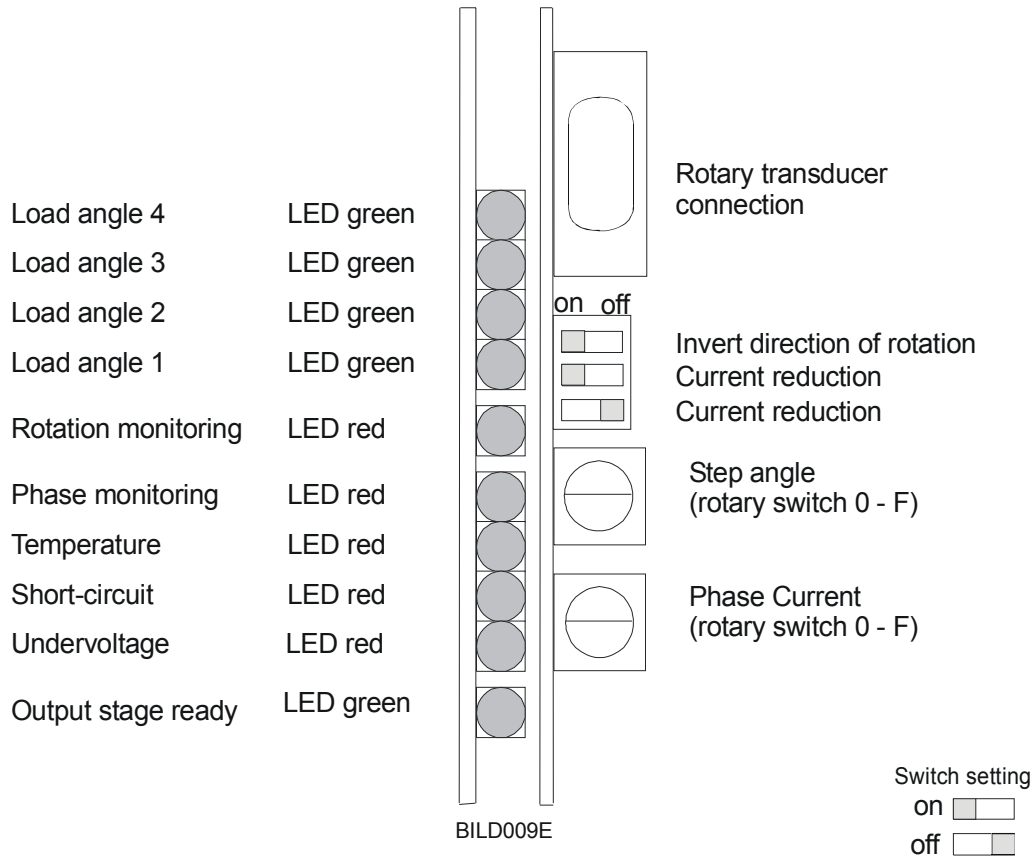
### 3.2 Relay contact output (option)



- standard setting by LE12-140-MO

# 4 Displays and programming switches

## 4.1 Overview



**Important:**



**If it is necessary to change the direction of rotation, this must be done only by means of the switch on the output stage and not by rewiring a motor winding.**

## 4.2 Descriptions

### Display, load angle:

An assessment of the dynamic state of the drive can be made with the LEDs "Load angle 1-4". If low requirements are placed on the drive system, only the LEDs "Load angle 1" and "Load angle 2" light up when the motor is running. If the LEDs "Load angle 1-3" light up simultaneously, the drive is at the limit of its possibilities.

### Display, rotation monitoring:

The red LED "Rotation monitoring" displays the following:

- If the LED "Rotation monitoring" continuously lights up together with the LEDs "Load angle 2 and 4", the rotation monitoring module signals that the maximum permissible load angle has been exceeded.
- If only the red LED "Rotation monitoring" lights up continuously, the output stage is in the reset state.
- If the red LED "Rotation monitoring" lights up with the green LEDs "Load angle 1-4" with a continuous light, the rotation monitoring facility is not active.

### Display, phase monitoring / temperature / short-circuit / undervoltage:

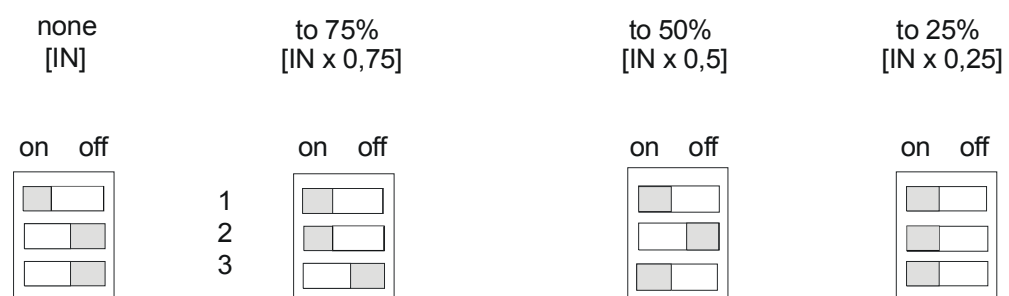
These LEDs display faults and errors which have occurred. This greatly simplifies diagnosis if the power output stage is not functioning (also see Section [Diagnosis](#)).

### Programming switch:

The rotation direction can be inverted and the value for the current reduction can be set at the programming switch.

The following possibilities exist for the current reduction (rotation direction set to inverting as an example):

#### Current reduction



Standard setting

BILD010E

## 5 Rotation monitoring

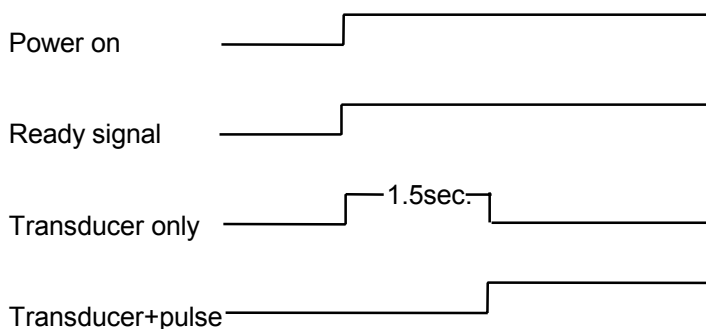
The rotation monitoring can be activated via the jumper BR6. When the rotation monitoring is active, a rotary transducer with 50 increments per motor revolution must be connected to the plug-in connector "rotary transducer connection" (see Section 6 "Connector assignment" for connector assignment).

A supply voltage of +5V with up to 100 mA is available for the rotary transducer. The rotary transducer output signals channel A and B are square-wave signals phase-displaced by 90°. They must be executed as a 5V push-pull signal (RS422 convention).

The following must be taken into account when using rotation monitoring:

1. The motor wiring and transducer connection must be connected in accordance with the relevant documentation. If it is necessary to change the direction of rotation, this must be done only by means of the switch on the output stage and not by rewiring a motor winding.
2. Rotation monitoring is in a special monitoring mode for approximately 1.5 sec. during the switch-on phase. During this time only the transducer pulses are processed and no control pulses must be supplied to the output stage. This permits realization of a settling phase for the drive in the case of vertical drives with a holding brake. This in turn means that the rotation monitoring function observes any inadmissible "fall-through" of the drive (max. one motor revolution) and disables the ready signal again in the event of a fault.

### Normal characteristic



# 6 Connector assignment

## 6.1 VG strip

The VG strip at the power output stages LE12-140 and LE12-140-MO conforms to DIN 41612.

### 6.1.1 LE12-140

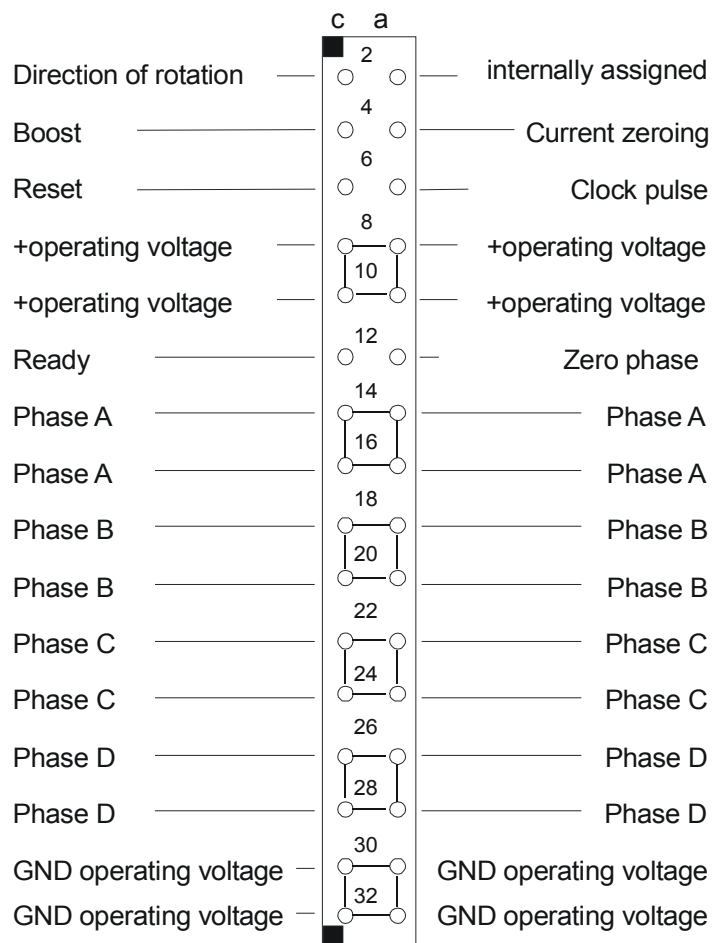


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## 6.1.2 LE12-140-MO

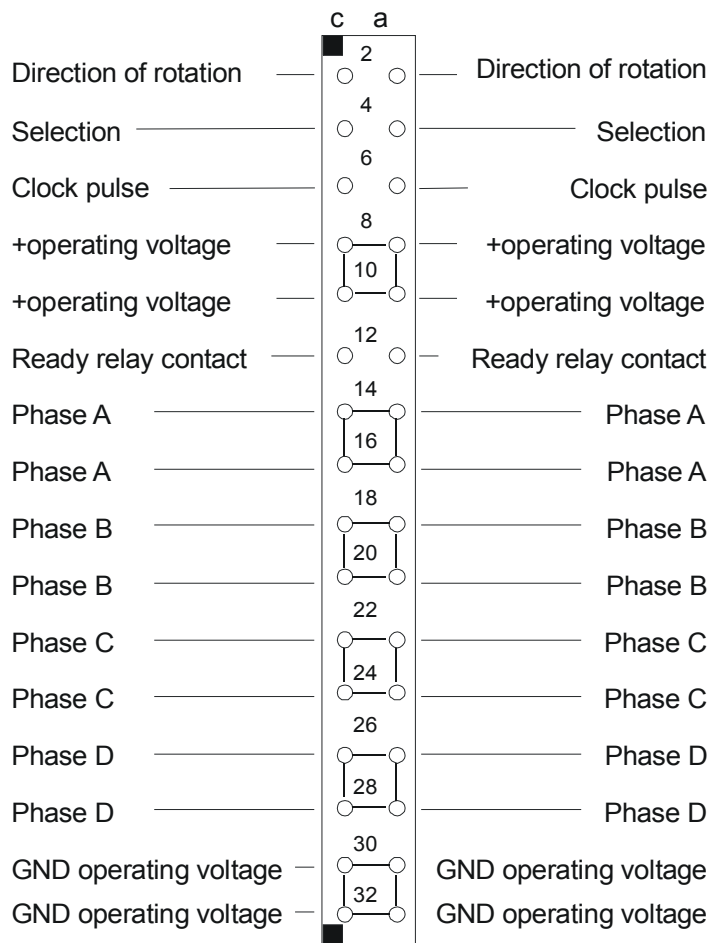
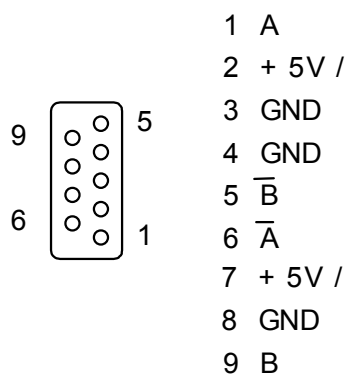


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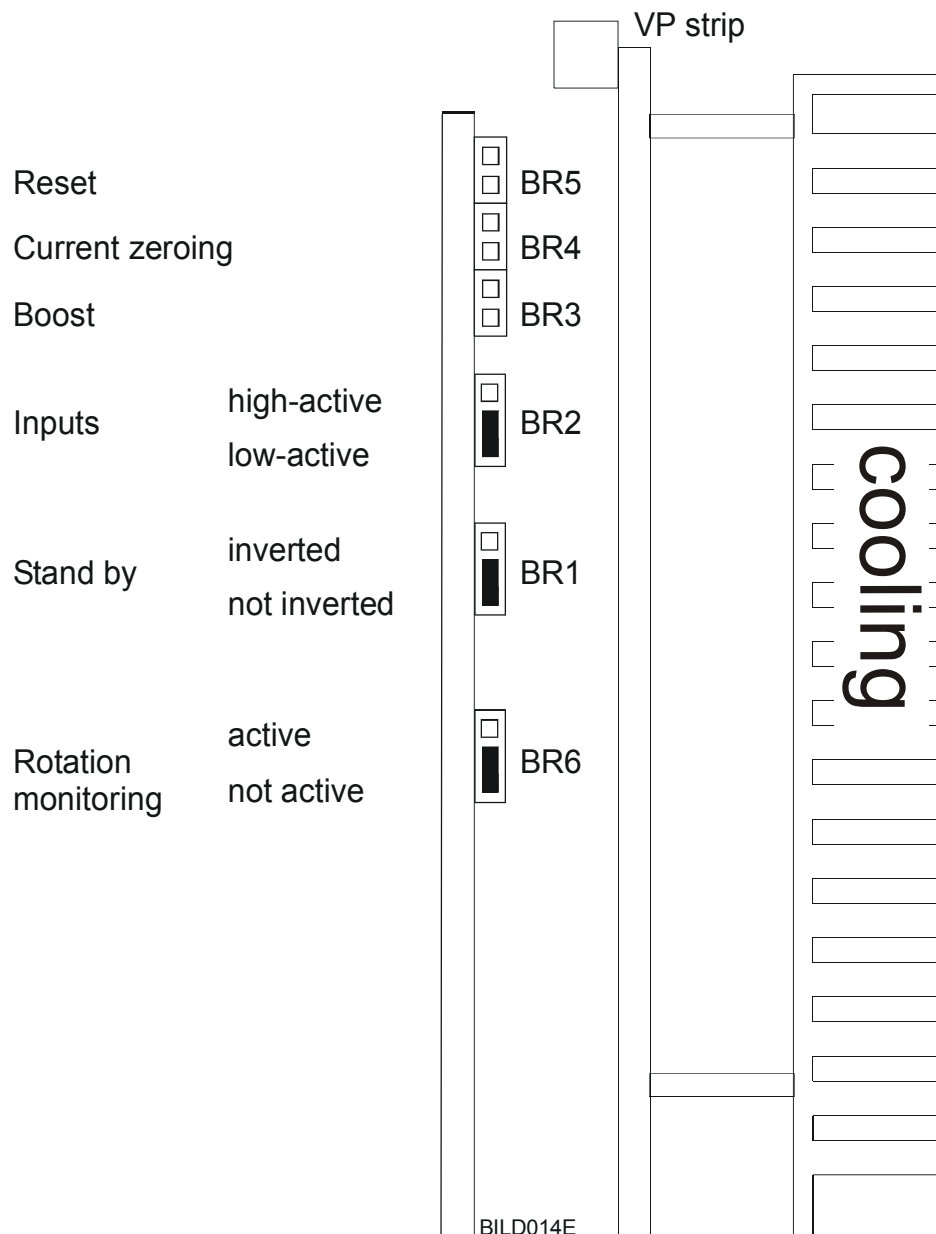
## 6.2 Rotary transducer

Connector, rotary transducer



# 7 Jumper assignment

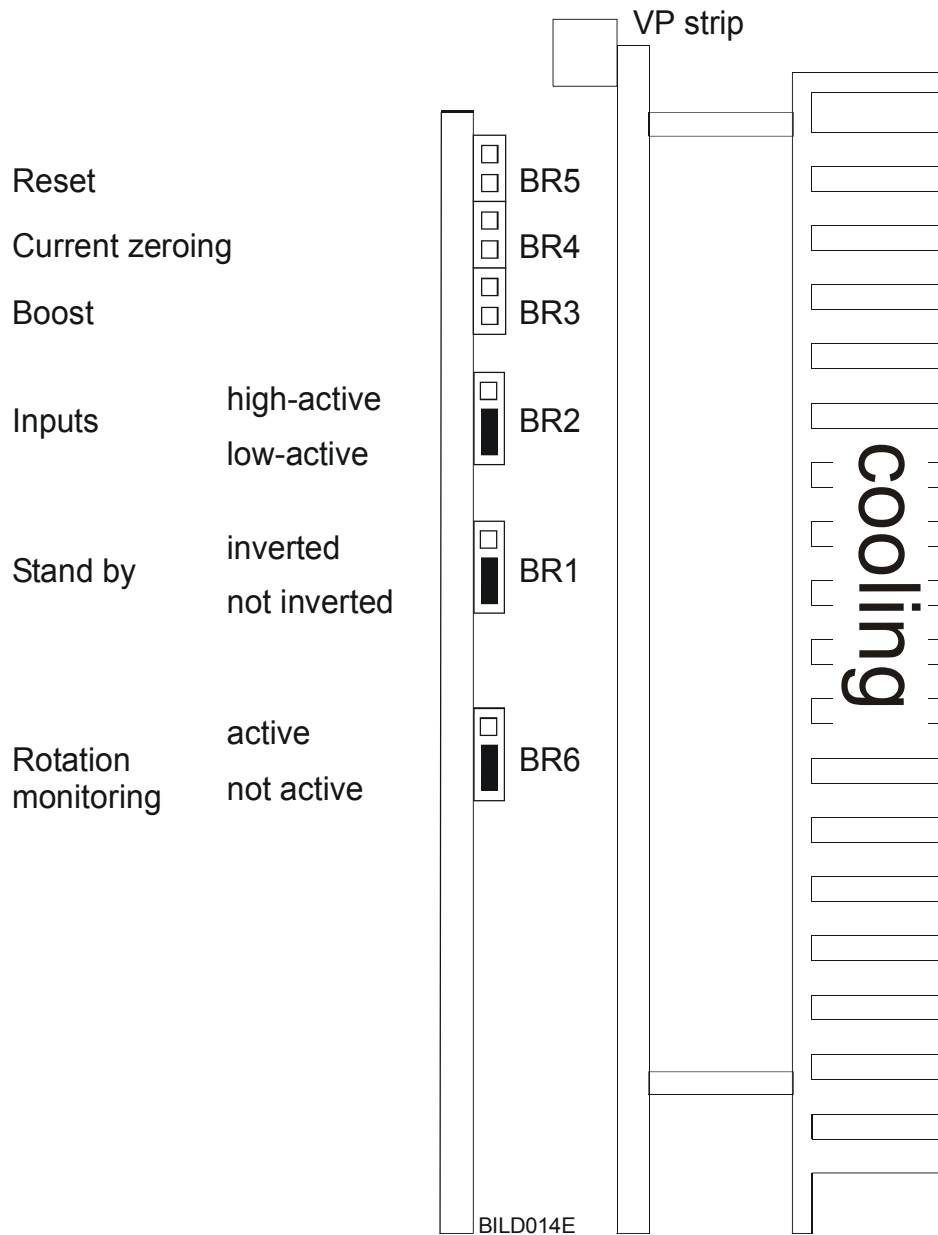
## 7.1 LE12-140



BR1 to BR5 without function.

Standard setting on delivery.

## 7.2 LE12-140-MO



Control BR3, BR4 and BR5 via the input "Selection" alternatively!

Standard setting on delivery.



## 8 Settings

The settings for the step angle and phase current are made via the rotary switch (0-F) which is accessible from the front (see Section 4 "Displays and programming switch").

### 8.1 Step angle

Step angle	200	400	800	1600*					500	1000
Switch setting	0	1	2	3*	4	5	6	7	8	9

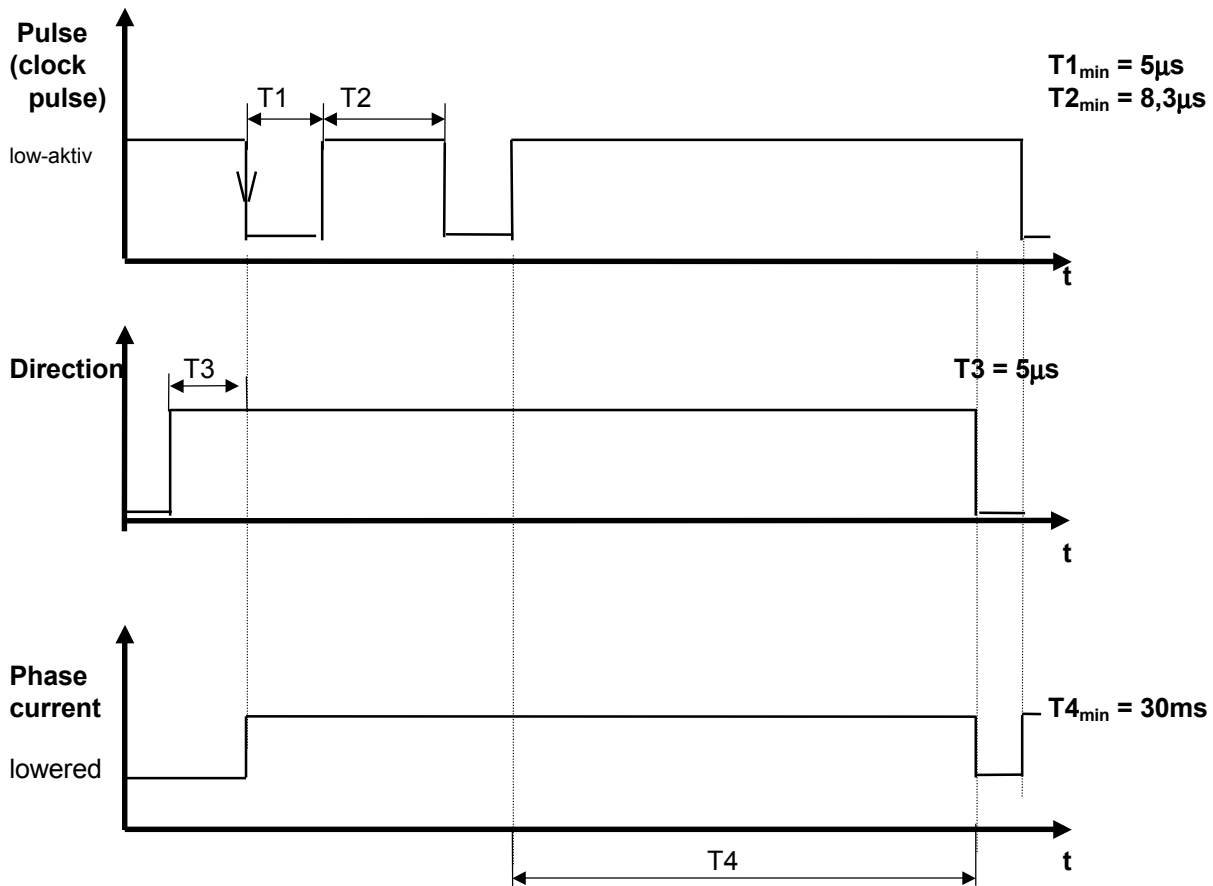
### 8.2 Phase current

Phase current(A)	1,0	1,7	2,5	3,2	4,0	4,6	5,4	6,1
Switch setting	0	1	2	3	4	5	6	7

Phase current(A)	6,8	7,5	8,3	9,0	9,7	10,4	11,3	12,0
Switch setting	8	9	A	B	C	D	E	F

\* Step angle 1600 incl. rotation monitoring is possible from version 02....

## 9 Signal allocation



### Switching edge definition:

Rise time	$\leq$	$1\mu s$ (10%..90%)
Fall time	$\leq$	$1\mu s$
Pulse width (T1)	$\geq$	$5\mu s$

## 10 Putting into operation

Please note:



The LE12-140 and LE12-140-MO boards may only be plugged in and removed when deenergized.

Procedure:

- Wiring in accordance with the stated assignments (see Section Connector assignment)
- Make the adjustments for the step angle and phase current and also for the rotation direction and current reduction
- Switch on the operating voltage
- Check the function



The following conditions must be observed if the output stage is used outside IEF subracks:

- the electrolytic charging capacitor must be chosen corresponding to the supply voltage.

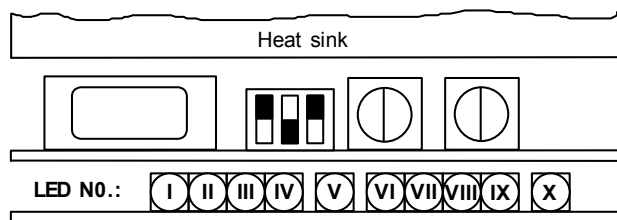
(See chapter Technical data)

- The distance between the electrolytic charging capacitor and the output stage should not exceed 0.5 m. The connecting cable between the output stage and the electrolytic capacitor should have an adequate cross-section ( min. 1.5mm<sup>2</sup> ) and should be twisted.

# 11 Diagnosis

The LEDs on the front of the power output stage (also see Section [Displays and programming switches](#)) show various states and errors or faults in the output stage. The displays can indicate various faults, making fault-finding and remedying faults easier.

The table below lists possible faults and possibilities for remedying them. Pay attention to the following assignments:



## Abbreviations:

E	=	LED is on
B	=	LED flashing
no entry	=	LED is off

LED No.										Possible cause	Possible remedies
I	II	III	IV	V	VI	VII	VIII	IX	X		
					E					- 1 or more phases are not connected	- Check wiring
						E				Heat sink temperature above 80°C: - Ambient temperature too high - External ventilation not functioning	- Reduce ambient temperature - Use external ventilation - Check external ventilation
							E			- Short-circuit in the cable, connector or motor - Short-circuit to ground - Supply voltage short	- Check cable, connector and motor - Remedy fault
								E		- Operating voltage is less than 50V	- Check supply voltage
E		E		E						- Rotary transducer not plugged in or is unplugged - Max. permissible load angle exceeded - Contouring error - No signals	- Plug in rotary transducer connector - Check rotary transducer connector and wiring
			E	B						- 5V supply at rotary transducer connector interrupted	- Check voltage, connector and cable
		E		B						- Motor plug was not plugged in during switching-on	- Switch off operating voltage and plug in motor plug
										- Operating voltage incorrectly connected or not connected at all - Output stage/fuse T1 faulty	- Check wiring  - Change fuse or output stage

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