Operator Manual

2-Phase Stepping Motor Drive

SMC61

Rev.: 17.05.2004 Subject to change without notice

Product features

For all 2-phase stepping motors, primarily up to 90th motor size

8-wire technology, windings switched parallel or in series

Powerful drive: bipolar chopper, low noise and losses

Only one power supply necessary

Motor current adjustment with HEX-switch

Steps/revolution:
standard: 200, 400, 800, 1600, 500, 1000
optional: 400, 500, 1000, 2000

Optimized torque ripple between steps

Step frequency up to 150 kHz

Switchable automatic current reduction

LED-indicators for supply voltage, over current, over temperature, over voltage(ballast), and zero phase

Automatic fan control (optional)

Protected against over temperature, excessively high motor current and power supply voltage surges (integrated active ballast circuit)

Inputs: PULSE, DIRECTION, GATE, OFF, RESET, FAST (Opto coupler)

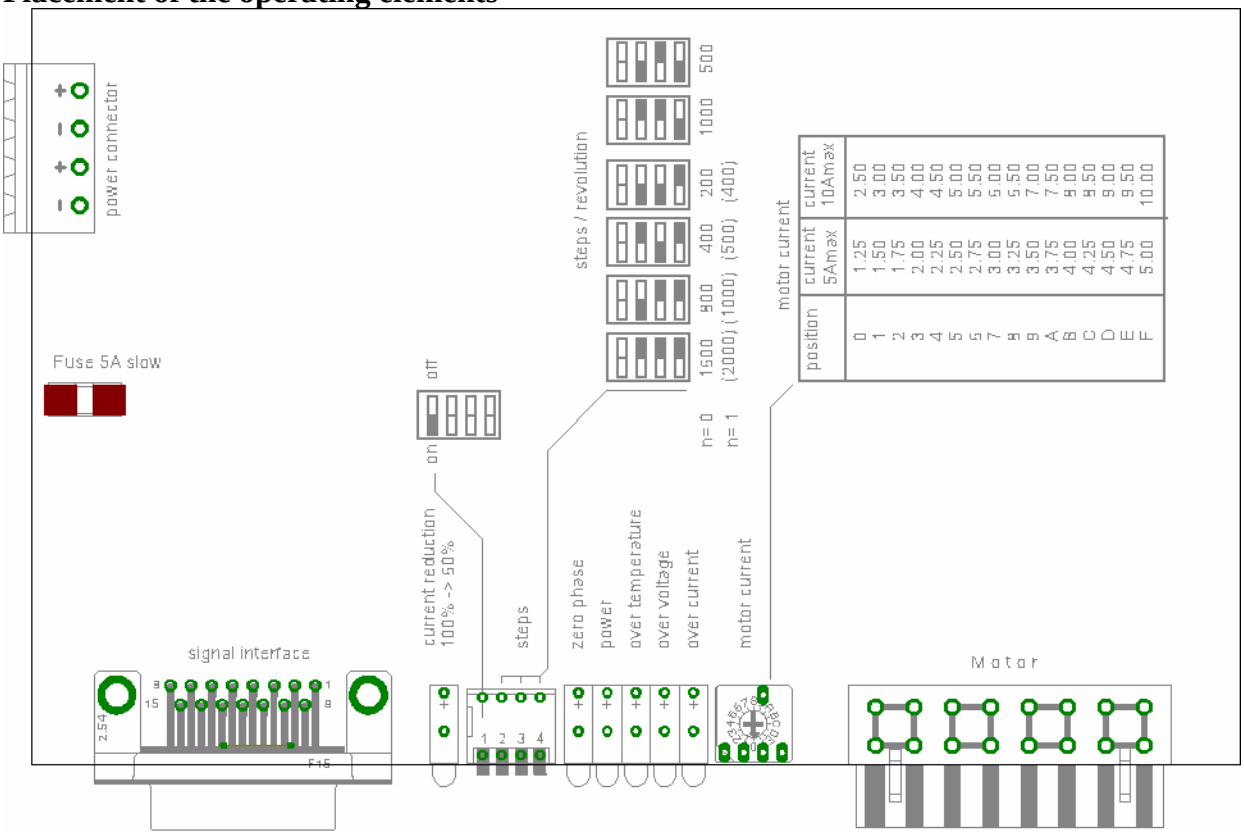
Outputs: READY, ZEROPHASE(Reference point) (Opto coupler)

Compact housing, metal

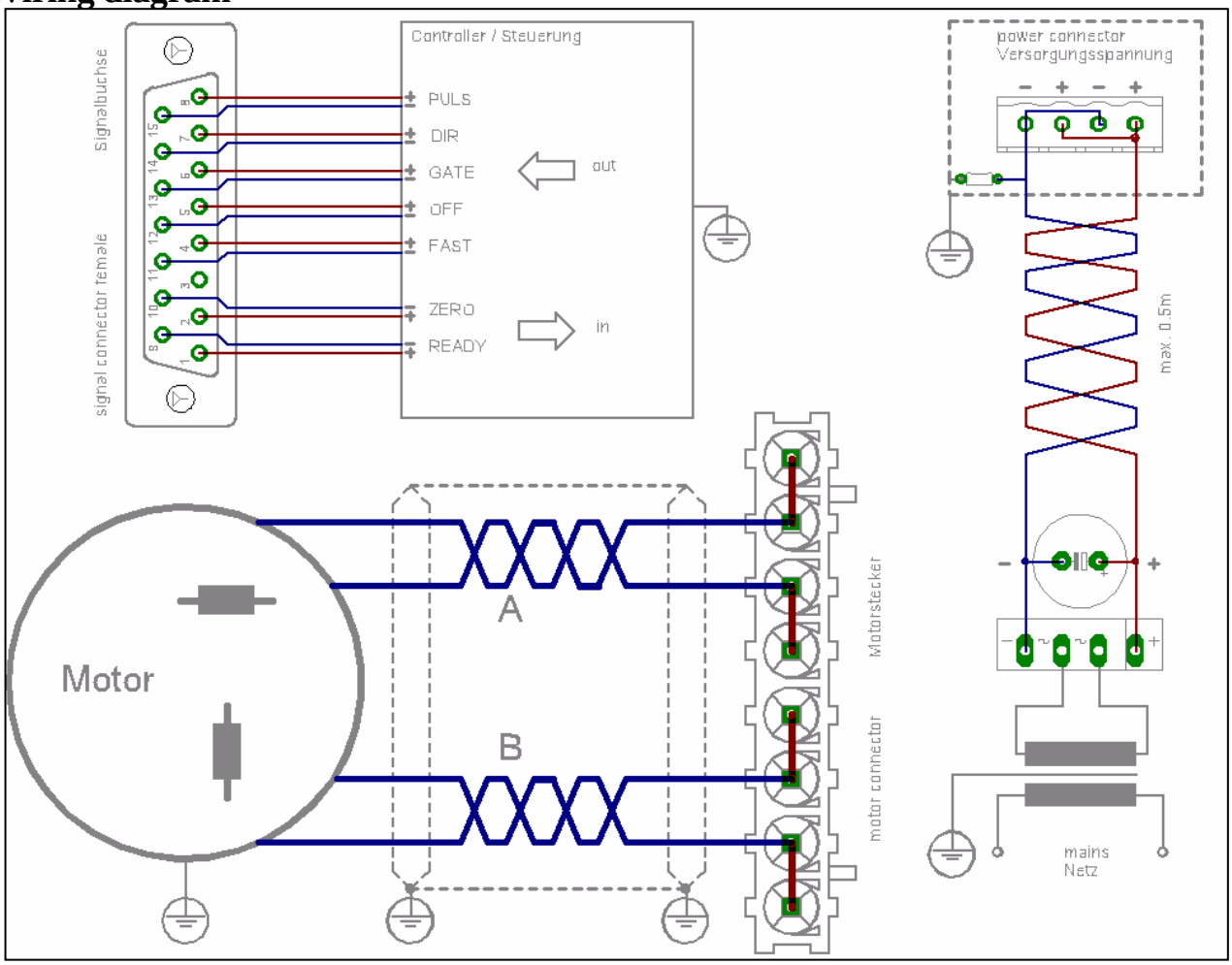
Variants/Order-key

SMC61-1	80 V, 5 A
SMC61-1L	80 V,10 A, with fan
SMC61-2	130 V, 5 A
SMC61-2L	130 V,10 A, with fan
-5	5 V signal interface
-24	24 V signal interface

Placement of the operating elements



Wiring diagram



Signal description

PULS:
A step is executed with each positive signal edge. The power drive exclusively reacts on signal edges. In case of an active current reduction (switch „current reduction“ on) and pulse pauses greater than approx. 100ms, the motor current is reduced to approx. 60% of the set value.

The current reduction is not active if the pulse signal stays on active.

DIR: **(Direction)**
The direction signal defines the sense of motor rotation. The logic assignment can be inverted by swapping the wires of one motor phase.

GATE:
The power drive ignore all input pulses if the input GATE is activated. With this function it is possible to operate multiple power drives from one pulse source.

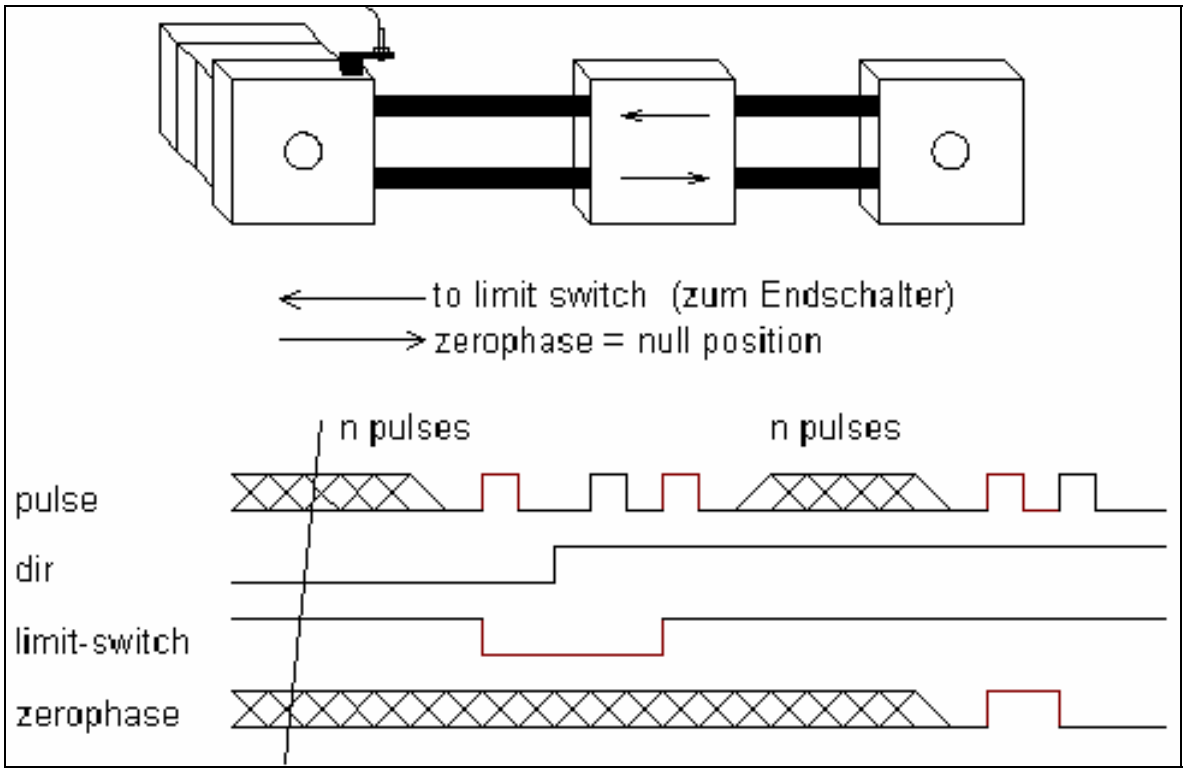
OFF/RESET:
When active, the motor current is switched to zero. The motor shaft can now easily be rotated manually.

OFF/RESET:
Change from error condition to operating condition. Independent of the current motor position, the motor switches to ZERO position.

While the RESET signal is active, the motor current is switched to zero and the motor is without torque.

READY:
This output is switched when the drive is functional. The following faults switch the output to high impedance: low voltage, over current/temperature
This condition is hold until „RESET-Signal“ is active or the power drive is switched off and on again.
The power drive senses READY approx. 200ms after power supply is stable.

ZEROPHASE: (Reference point)



ZERO phase or ZERO position can be used as an exact reference point. Following is a procedure to handle with ZERO points.
First move carefully to the limit switch, reverse the direction and move until ZERO phase is active. Be sure, the ZERO phase don't coincides with the limit switch hysteresis and perhaps adjust the limit switch position.
Depending on the pulses/revolution the ZERO phase becomes active after n pulses under the condition the direction doesn't change

steps/rev.:	ZEROPHASE after n pulses
200	4
400	8
800	16
1600	32
500	10
1000	20

FAST:
Activating of this input switches to the halve resolution. So the result is the double motor speed.

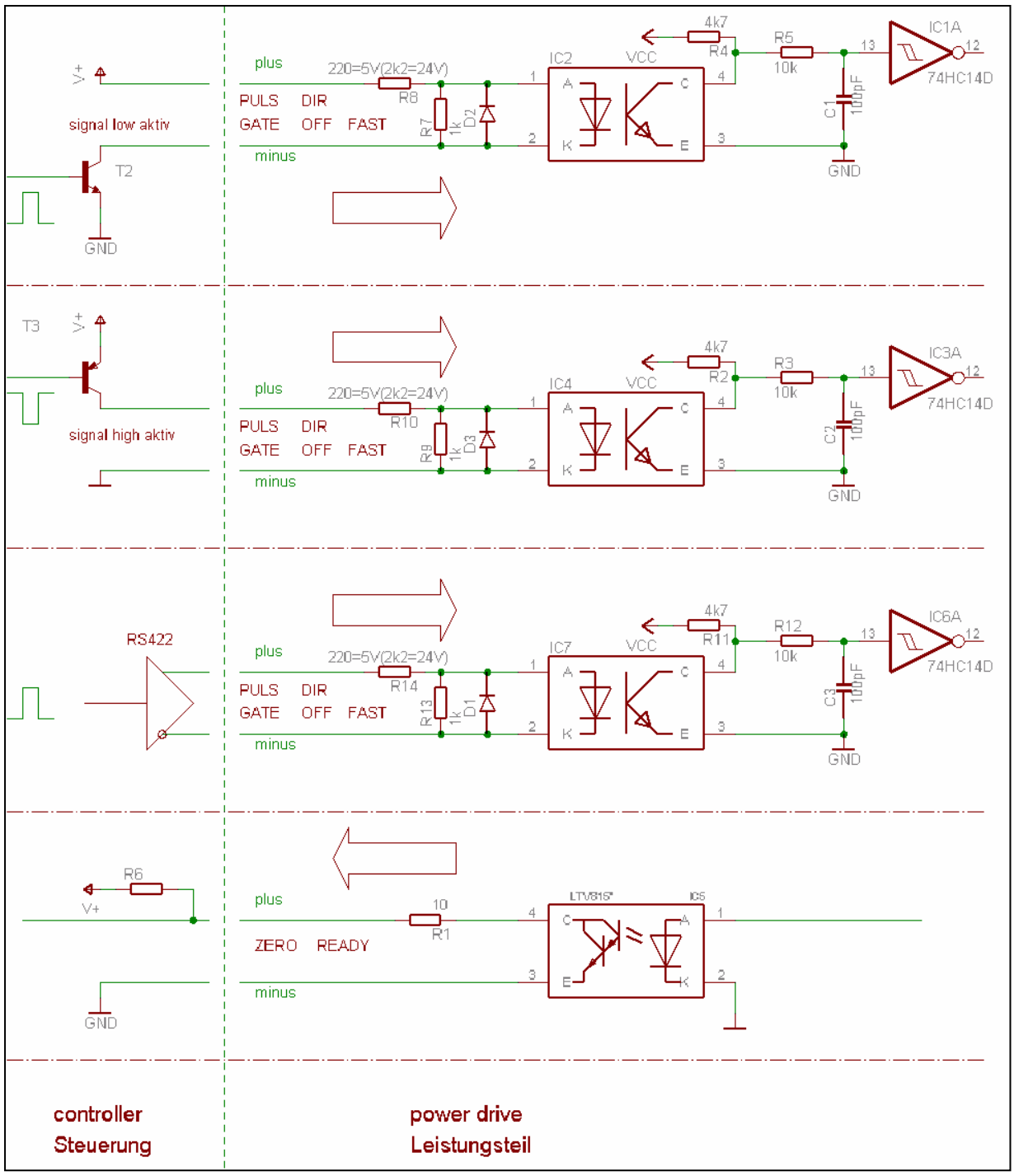
! It acts only at the 1600, 1000 and 400 steps/revolution.
! Switching only at even positions 2,4,6,...

Motor connections:
The motor connector is optimized to drive stepping motors wit 8 wires, two windings for each phase in parallel mode. This results in well dynamics at higher frequencies.

By swapping the wiring connection of one motor phase, e.g. phase A, the motor sense of rotation can be inverted to the logic assignment of the direction signal.

Under no circumstances motor wires must be disconnected during operation. Induction voltages can destroy the power drive. For this reason assure proper contact of the motor wires at the socket.

Interface:



The signal interface is completely isolated by opto couplers. To have a wide flexibility, both inputs plus and minus of the opto couplers are available. So its easy to drive the signal interface with high-, low- or RS422 active signals.

Never operate a power drive prepared for 5V-signals with 24V signals, the opto couplers will be damaged

Steps per revolution
Select the steps/revolution with the DIP-switch.

! Only when power drive is off

Using a standard hybrid stepper motor with 50 magnetic poles result in following steps/revolution:

200, 400, 800, 1600, 500, 1000 oder
400, 500, 1000, 2000 optional

Performance of rotation smoothing:
☹ less than 400 ☺ more than 400

Behavior of resonance
The motor resonance can be reduced by increasing the steps/revolution. Following table will show the effect under the condition the resonance at full step will be 100%

steps/rev.:	behavior of resonance
200	100%
400	29%
800	8%

Motor current setting:
The motor current is set with the HEX switch. In the picture „placement of the operator elements“ on side 2 you can see the motor current according to the position of the HEX switch. The value represents the amplitude of the sinusoidal phase current. The total motor current is the sum Imotor= √(Ia²sin()+Ib²cos()).
In general only as much current should be set as actually is required for the application. Too high motor currents results in unnecessary losses in motor and drive.
At higher pulse rates the motor current reduces because of the motor inductance. (see diagrams from manufactures)

Automatic current reduction
In operating modes with pauses between movements it is useful to activate the current reduction. The motor current is reduced to approx. 60% of the set motor current. The losses in motor and drive are reduced as could be seen in following table:

current reduction	0%	auf 60%
losses	100%	36%
motor torque	100%	60%

! Current reduction reduces holding torque. Assure the resulting holding torque is acceptable for your application.

The current reduction is activated, if the pulse input is inactive for more then approx. 100ms.

The current reduction can be blocked if the pulse input remains in a static active level.

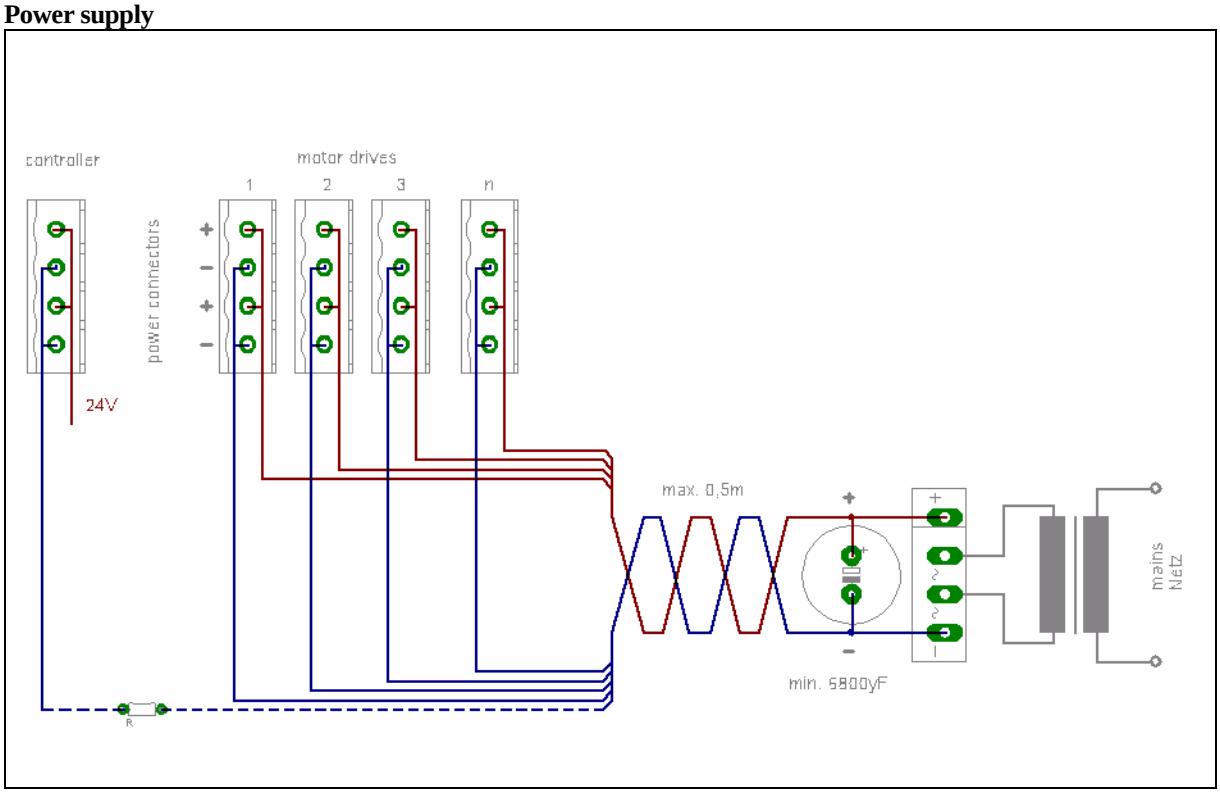
With the next pulse, the current reduction is disabled immediately. The time to full motor current depends on motor type, motor voltage and pulse width(if < 15ys)

the current reduction must be activated at motor currents over 7,5A

Temperature monitoring
The fan automatic (optional) is switched on if the heat sink temperature exceeds approx. 60°C. This should be interpreted as an over temperature warning. The condition is indicated with the LED „over temp.“. The power drive is disabled, if the heat sink temperature exceeds 70° Celsius.

Motor currents grater than 5A makes an additional cooling necessary.

Power supply



To reduce fault influences it is highly recommended to have separated power lines for each power drive. To avoid static charges when controller and power drive operates with different power supplies, it is a good praxis to insert a resistor of approx. 100kOhm between controller and power drive.

Power supply

It must be guaranteed that the power supply have an capacitor of at least 6800yF. An active internal ballast circuit eliminates short over voltages caused by generator operation occurring during fast deceleration. This condition is indicated with the over voltage LED that only be lit for a short period of time during this condition.

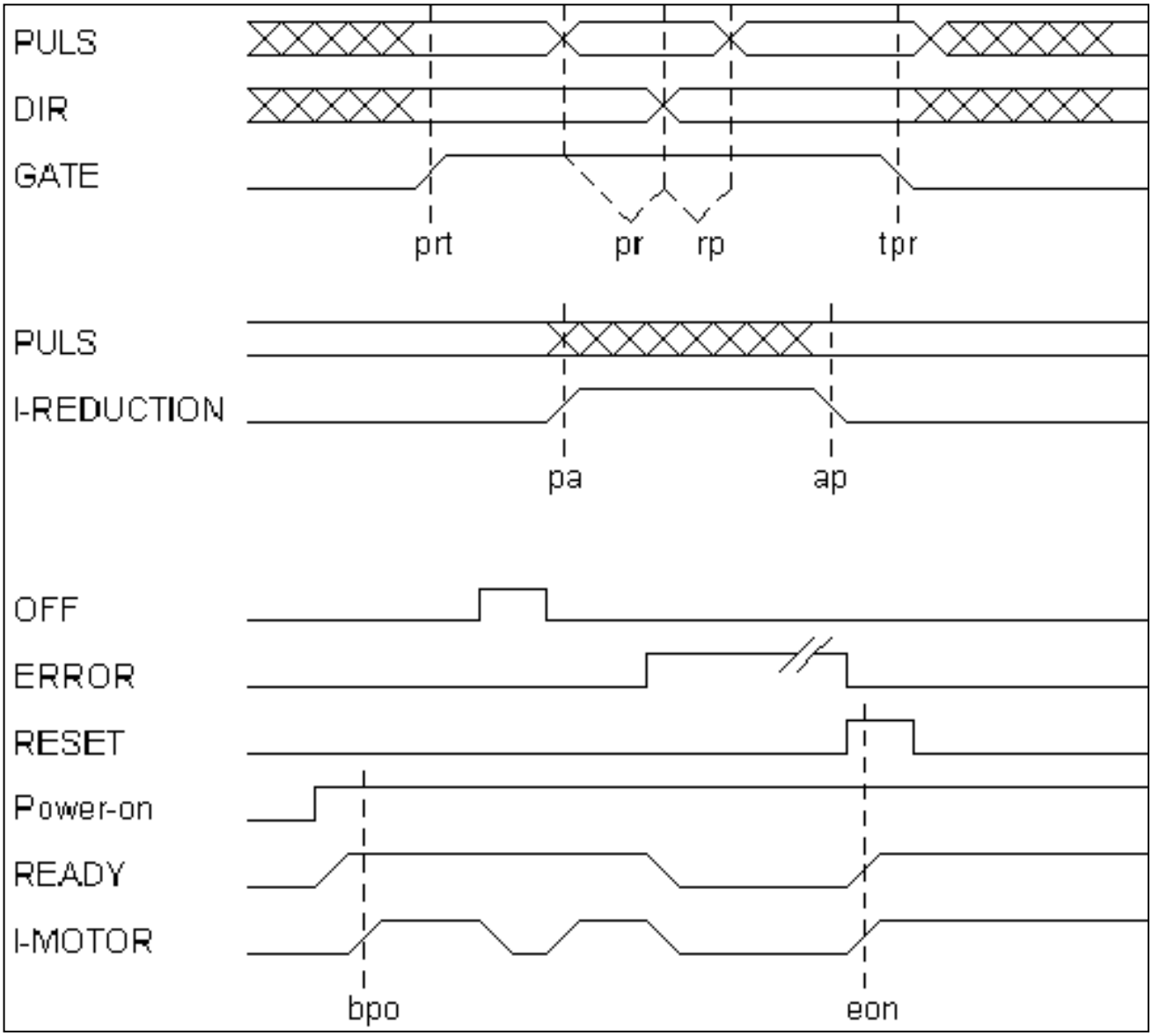
Too high motor voltages may damage the power drive.

Never connect live supply voltage wires to the terminals, because the sudden charge current of the internal electrolytic capacitors can destroy the internal fuses

! Check for correct polarity

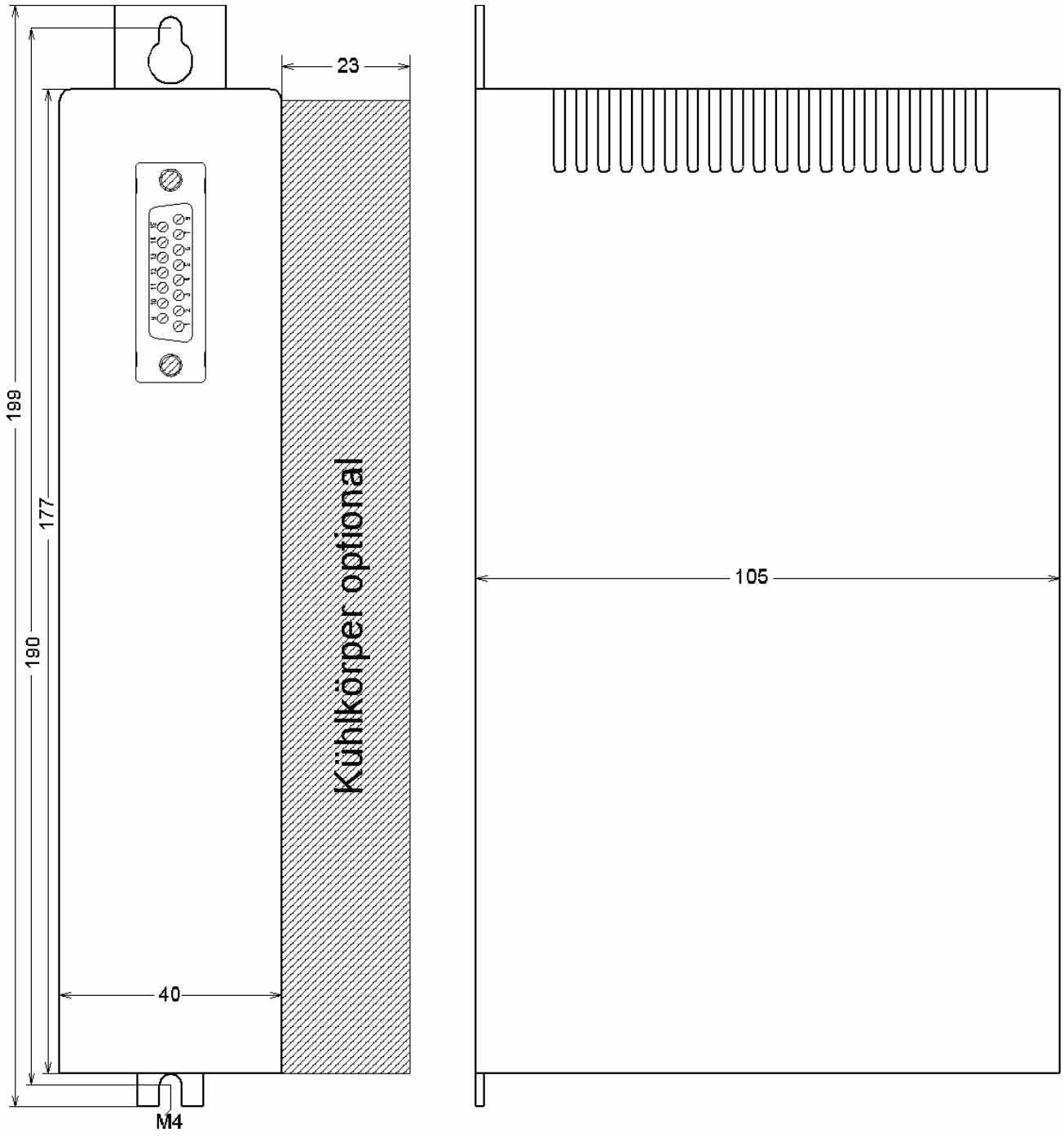
Timing

! Pulse slope	**max**	**2ys**
! Pulse width:	**min**	**5ys**
! ERROR:	**OFF-Signal in fault condition**	



prt:	> 5ys	gate active after pulse/direction
tpr:	> 10ms	pulse/direction active after gate
pr:	> 5ys	pulse bevore direction
rp :	> 5ys	pulse after direction
pa:	<150ms	I-reduction active after pulse
ap:	< 0,5ms	I-reduction deactive after pulse
bpo:	< 1s	ready after power-on
eon:	<100ms	ready after reset

Dimensions



Technical spezifications:

Power drive supply:	**285, 2810, 2135, 21310**
Absolute max. voltage:	85, 85, 135, 135V
Minimum voltage:	24, 24, 80, 80V
recommended voltage Un:	80, 80, 130, 130V
Voltage ripple:	< 2,0Vss
Input peak current at power on:	< 4,0A
Fusing:	5,0Amt
Power supply charge capacitor:	>6800yF
Power supply cable cross section:	0,75mm²
Distance to power supply capacitor	<0,3m

Motor connection:

Cable cross section:	<4A	>0,75mm²
	>4A	>1,00mm²
Cable length:		<10m

Signal input interface: (24V signal interface)
Pulse, Direction, Gate, Off, Fast

Input type:		Opto coupler
Input voltage:	low:	< 1V(6V)
	high	>3,5V(15V)
	nominal	5V(24V)
	max.	6V(28V)
Input resistance		ca.220(2k2)Ohm

Signal output interface:
Ready, Zerophase

Output type:	Opto coupler
Switching voltage:	<30V
Inner resistance:	<15 Ohm
Switching current:	< 50 mA
Load:	only ohmic

Temperature monitoring:

Automatic fan control active :	->ca. 60°
Switch off:	> ca. 70 °

Current reduction, active at frequencies lower than

Pulse width:	5ys	10ys	50ys	100ys
Current red.:	50Hz	30Hz	20Hz	15Hz

Ambient conditions:

Temperature:	40° max
UL94V-1 all components	
IP20	

Electromagnetic compatibility

Radio interference:	EN55011B
Static discharge:	4kV
Burst:	IEC-Level 4 / 2,5kHz

Trouble shooting:

Motor has no holding torque
-The motor voltage is below the minimum value
-Signal inputs “reset” or “off” are active
-The over temperature monitoring is still active
- A non-valid step resolution is selected

Motor has holding torque, but doesn’t execute steps
- The “GATE“ input is active
- The pulse level is too low (24V interface)

“TEMP“-LED is on immediately after power on
- The heat sink couldn’t cool down sufficiently

“Over curr.“-LED is on immediately after power on
- The power drive is damaged
- The motor winding has a short cut

Sudden “crackling“ noises in the motor
- Motor is operated at the minimum voltage limit
- The motor connection is bad

The motor doesn’t reach the set speed but starts
- The motor voltage is too low for the required speed
- The motor current was set too low
- The acceleration ramp was set too high
- Motor wires are too long or too small cross section
- Power supply is not powerful enough

The motor “loses“ steps and drifts
- The amplitudes of the control signals are too low
- Signal cable noise is too high (shielded cables?)
-The wiring concept is not optimal (system ground)
- The mechanical shaft coupling has play

Motor vibrates at pulse frequency and doesn’t start
- Start/Stop-frequency too high
- Motor windings are connected wrong or broken cable
- The motor current is set too low

The automatic current reduction doesn’t work
- The pulse input remains active after the last
- The current reduction is not enabled

The over voltage LED is often/permanently lit
- The supply voltage is too high

The motor is hot
Up to 85 ° Celsius should be no problem

Step angle too different
- Motor inductance is too high
- Motor current too less