

## 4-Q Linear Servo – 03 A

For Brush-Commutated DC Motors up to 75 W

### SCA-LE-30-03



- Servo amplifier in a rugged aluminium housing
- Different methods of mounting for fast installation
- Inputs and outputs via screw terminals
- Operation mode setting with jumpers
- User adjustable current limit
- Wide range supply voltage between +11 and +30 VDC for different kinds of DC-power supplies
- Protected against overtemperature and over-current
- Linear amplifier
- Continuous current up to 6 A

Basic drive description: The SCA-LE-30-03 servo amplifiers are designed to drive DC brush type motors. They require a single DC power supply for operation. The drives are to be used with a single motor. They have the functionality to operate as an independent speed control or high performance servo. The drives are protected against short circuits, under voltage, over temperature, and over current. It has multiple modes of operation and serves as a reliable choice for your motion control needs.

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## Used Symbols



Indicates a warning or caution concerning operations that may lead to death or injury to persons, or damage to property if not performed correctly. In order to use the drive safely, always pay attention to these warnings.



Indicates a clarification of an operation, or contains additional explanations, or operational requirements for a procedure. Reading these notes is much recommended.

## 1. Safety & Installation



The SCA-LE-30-03 requires installation by qualified personal which must pay attention to significant safety and other regulatory standards. They should be thoroughly familiar with the entire system before beginning installation.



Before final operation of machine be sure to test hookup with motor but disconnected from the load. Improper wiring could cause a “motor run away” condition, and cause serious injury or damage to the machine and persona



Before starting installation of the SCA-LE-30-03, be sure that main power is disconnected. After powering the drive it should not be touched by hand or risk shock.



Take care that in case of regeneration or in brake operation the energy recovery must be buffered by the power supply and / or a braking module. Ensure with electronically stabilized power supplies that protection circuit isn't react.

Don't switch off the power supply while the motor is turning, in this case the drive could be destroyed by regeneration.

We recommend connecting a capacitor of 1000  $\mu$ F per each ampere output current close to power input, in parallel.



Do not repair or open drives enclosure. Result would result in personal injury and would void all warranties.



The SCA-LE-30-03 comply with the European directive EN 61800-3 (1996). The followings points must followed:

- A metal mounting plate with correct grounding is mandatory.
- For installation purposes, tooth lock washers have to be used.
- For most wiring schemes, only shielded cables are admissible, to suppress interference with other devices. Damaged items have to be replaced.
- Provide for a large contact area between shields and mounting plate.
- The motor has to be grounded in the prescribed manner.
- The drive is an Electrostatic Sensitive Device (ESD). Electrostatic discharge needs to be avoided.



### NOTE:

Certain applications may involve special requirements. Consult Factory!

## 2. Specifications:

### 2.1 Electrical Data

Power Supply Voltage	+11 to +30 VDC (Residual ripple <5 %) (The lower limit is monitored by integrated undervoltage trip) <b>WARNING: Do not exceed 70V. Overvoltage will damage the drive.</b>
Nominal Current	3 A
Maximum Power (only achievable with additional heatsink & proper mounting, see accessories.)	75 W
Specification & caution for voltage drop	Through the linear output stage the voltage drop over the drive is depending of the current and the resistance of the motor. The highest voltage drop is caused by a blocked motor. If an overheating situation occurs in regular intervals contact factory service for details.
Power terminals	The diameter must be suited for the current load. The recommendation for the drive is 1,5 mm <sup>2</sup> (AWG16), the min. is 0,14 mm <sup>2</sup> (AWG26) and the max. is 1,5 mm <sup>2</sup> (AWG16). Strip the wire insulation of the cables on a length of maximal 7 mm. For stranded wire, use end sleeves with the corresponding length.
Signal terminals	The recommendation is 0,5 mm <sup>2</sup> (AWG21), the min. is 0,14 mm <sup>2</sup> (AWG26) and the max. is 1,5 mm <sup>2</sup> (AWG16). Strip the wire insulation of the cables on a length of maximal 7 mm. For stranded wire, use end sleeves with the corresponding length.

## 2.2 Mechanical Data

Mechanical Dimensions L x W x H	121 x 100 x 40 mm
Weight	380 g
Mounting	M3 screws or Din Rail Mounting

## 2.3 Ambient Conditions

Operation Temperature	-10 to +45 °C
Storage Temperature	-40 to +85 °C
Humidity (Non Condensing)	20 % to 80 % RH
Overtemperature Protection	+80 °C

## 2.4 Digital and Analog Inputs

<i>Enable</i>	8...+30 VDC; Resistance = 5 kOhm
<i>Encoder A, /A, B, /B, I, /I</i>	TTL, +5 to +30 VDC; Resistance > 10 kOhm; max. 600 kHz
<i>-Set value, +Set value</i>	Analog -10 – +10 VDC ; Resistance = 20 kOhm
<i>-Tacho, +Tacho</i>	Analog -50 – +50 VDC ; Resistance = 50 kOhm
<i>24V Opt. In</i>	+24 VDC; Resistance = 4,7 kOhm

## 2.5 Outputs

Auxiliary Voltage Output <i>+Reference</i>	+3,9 VDC / 20 mA
Auxiliary Voltage Output <i>-Reference</i>	-3,9 VDC / 20 mA
Auxiliary Voltage Output <i>Enable +V</i>	4,7 kOhm to +VCC
Auxiliary Voltage Output <i>+5V</i>	+5 VDC / 100 mA
<i>Error out</i>	Open Collector / +30 VDC; max. 20 mA
<i>-Tacho out, +Tacho out</i>	Analog -3,9 – +3,9 VDC ; max. 20 mA; Resistance = 100 Ohm

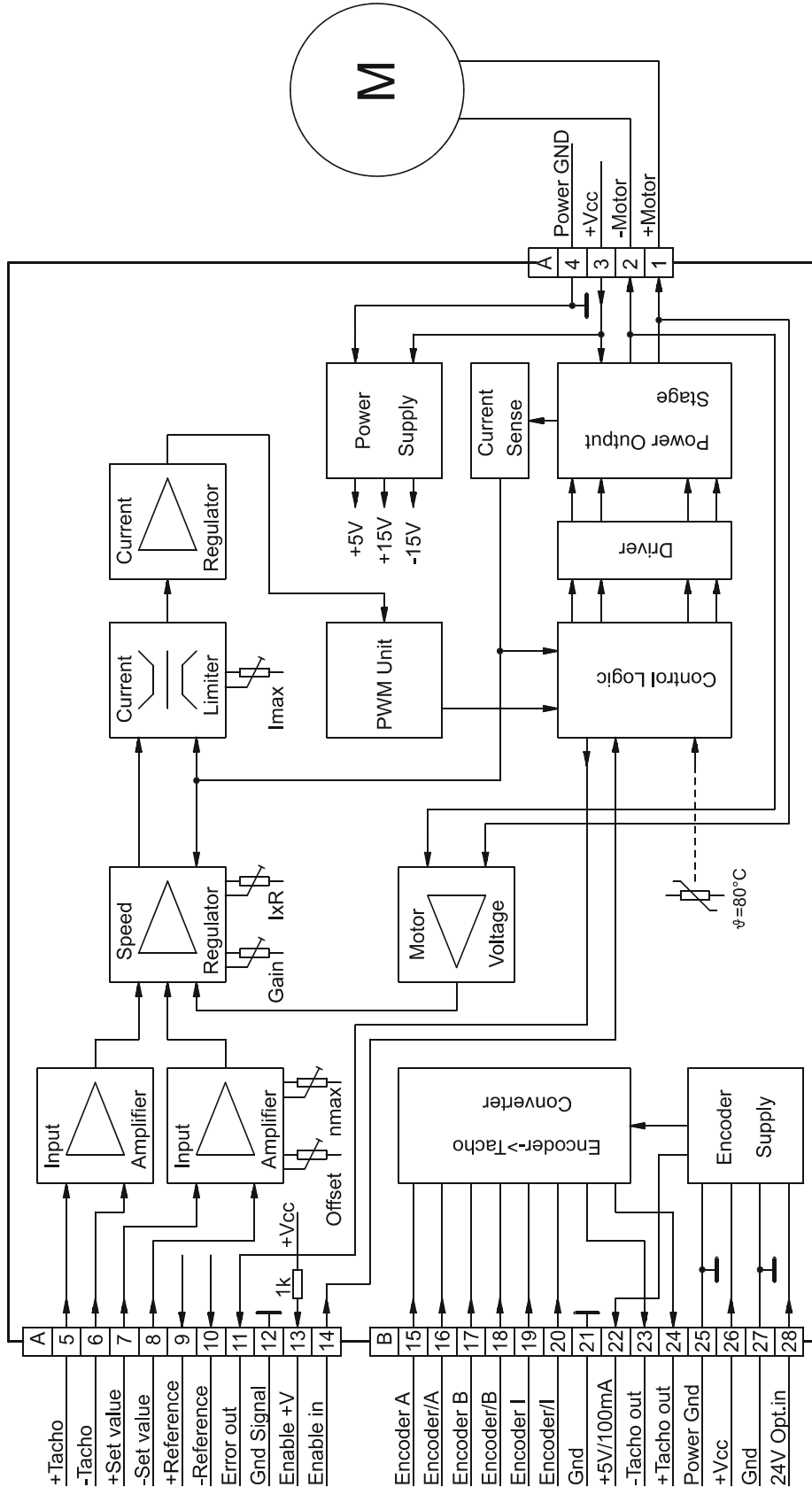
## 2.6 Control LEDs

<i>OK</i>	LED green The LED is lit when the drive is ready to work.
<i>Fault</i>	LED red

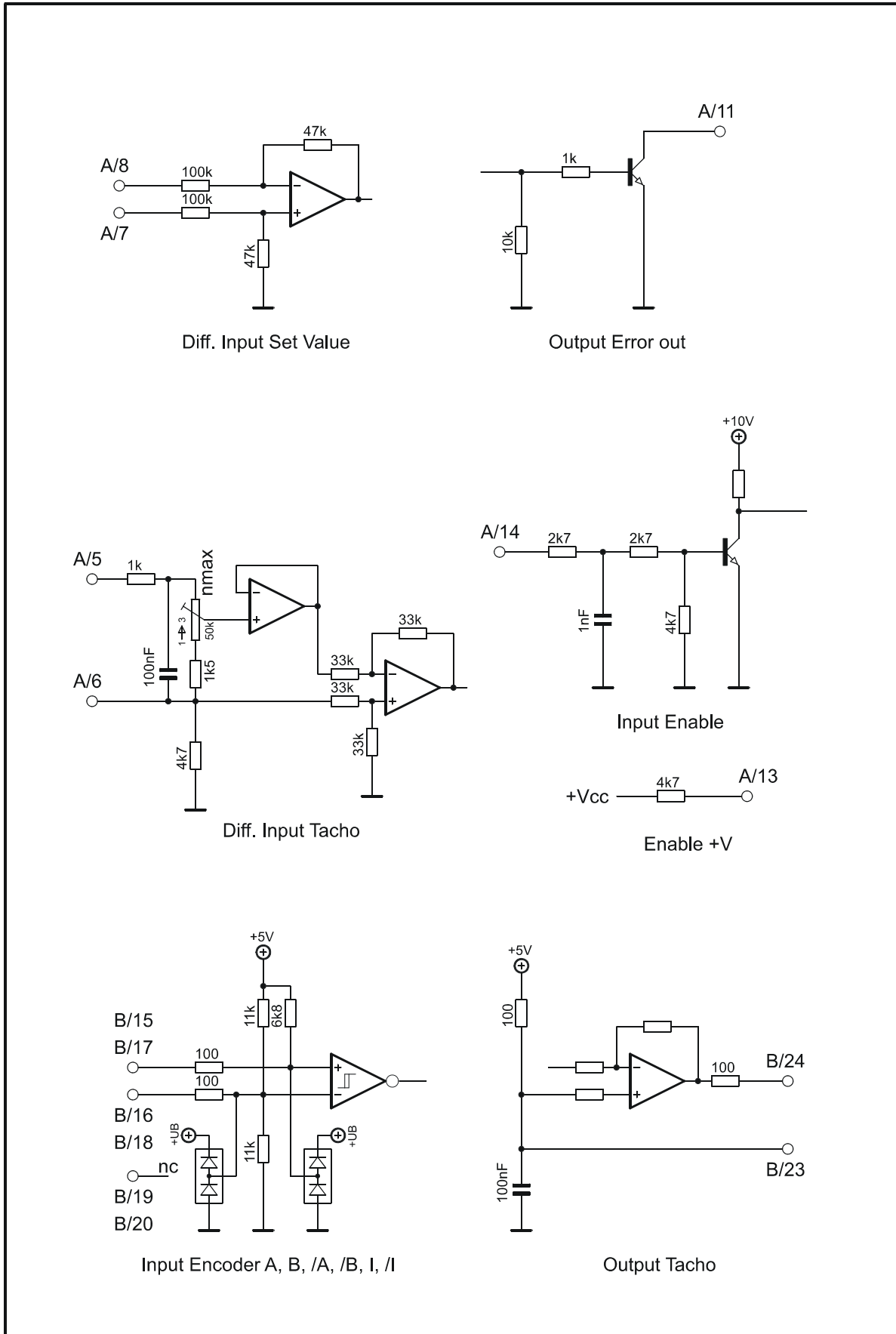
The lamp is lit if the overtemperature, the undervoltage, the overvoltage or the overcurrent protection circuit have been initiated.

### 3. Drive Overview

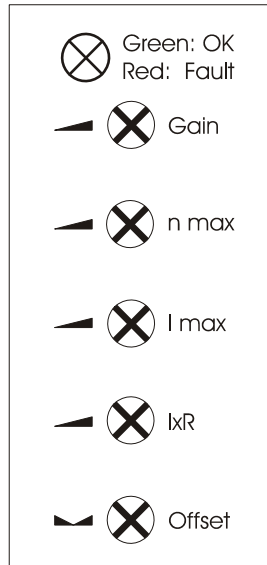
#### 3.1 Block Diagram



### 3.2 Input & Output Schematics



### 3.3 Control Elements



### 3.4 Operation Modes

#### Encoder Mode

At encoder mode feedback information is coming from the encoder signals. The encoder is mounted at the motor. The speed regulation has got a high performance at each load condition and qualified for each application to control exactly the speed of a system especially for low speed application. The maximum achievable speed in this mode is limited through the encoder input frequency.

Remark:



The modes below are possible with the drive but not advisable. Use in this case the SCA-LS-30-03. The descriptions and wiring examples for these modes are all described in the manual of the SCA-LS-30-03.

#### Voltage Mode

In the voltage mode the drive is watching the output voltage as a feedback voltage. The drive can not regulate the speed exactly if the motor is loaded with a higher load. This mode is used e.g. in conveyors with nearly constant load to control the speed.



### **Tacho Mode**

In the tacho mode the feedback information is coming as a voltage signal from a tacho mounted at the motor. The speed regulation is very good at each load condition and qualified for each application to control exactly the speed of a system.

### **IxR Mode**

The IxR mode is a voltage mode with an additional factor to correct the speed under changing the load. The factor which is adjusted with the IxR potentiometer is only an approximate value. The speed regulation is good but not stable for all load conditions. It is a compromise between voltage mode and tacho mode.

### **Torque Mode**

In the torque mode the drive does only control the current in the motor. This control loop is very fast but the speed is moving with the load due to the constant current. This mode is used in application with force control or as a fast power amplifier for position systems.

## 4. Wiring

According to the safety directives, a correct cable selection is mandatory. Regular inspection is advisable. Damaged, burned or kinked items have immediately to be exchanged.

### Power (+Vcc - Power GND)

- Normally no shielding required.
- When connecting several amplifiers to the same supply pack, use star point wiring.

### Motor Wiring (> 30 cm)

- Only shielded cables are recommended.
- Connect the shield to the ground lug of the servo amplifier.
- A separate cable has to be used.
- Choke modules are useful to reduce PWM-pulses.

### Connection to encoder (> 30 cm)

- Only shielded cables are recommended.
- Connect the shield to the controller.
- A separate cable has to be used.

### Analog Signals (+Set value, -Set value, +Tacho, -Tacho, +Tacho out, -Tacho out)

- In most cases no shielding required. This may be different for low level signals or in an environment with strong magnetic interference.
- Connect the shield on either end of the cable. For 50/60 Hz interference, remove the shield on one side.

### Digital Signals (Enable In, Error out,)

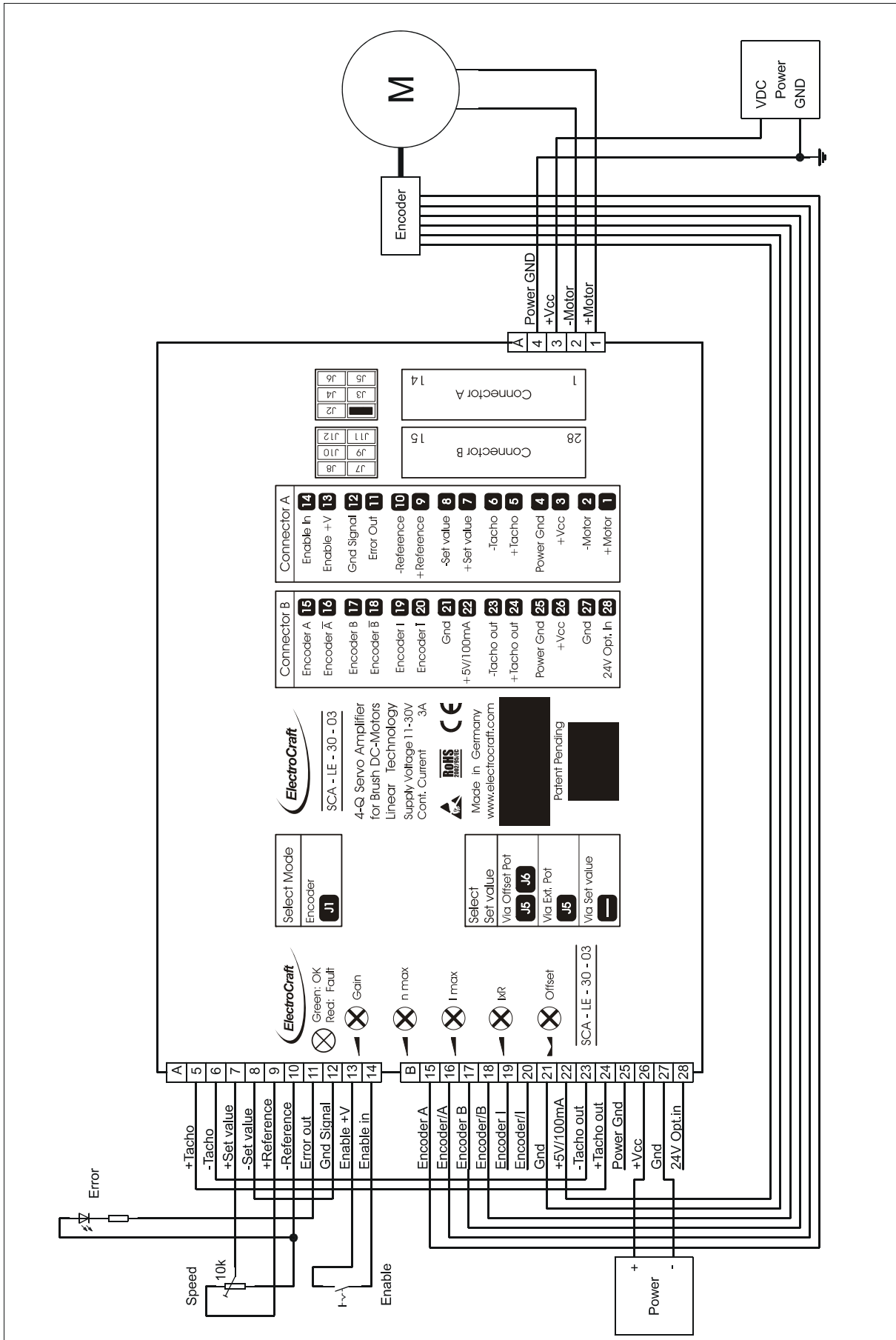
- No shielding required.

To verify a trouble-free operation and the conformity to CE regulation, it makes only sense to test the system as a whole, with all components installed (motor, amplifier, supply pack, EMC filters cables etc.).



Note: To improve the noise immunity, always connect unused logical inputs to a fix potential.

### 4.1 Wiring Example I – Encoder Mode



### 4.1.1 Setting of the Jumpers

Mode	Set Value via		
Encoder Control 1,5 kHz	Offset - potentiometer	external potentiometer	external voltage



Note: Advanced information's about the jumpers refer chapter 5.3.

### 4.2.2. Adjustment procedure for *Encoder* mode

1. Presetting of the jumpers J7 –J12 refer chapter 5.3.
2. Potentiometer pre setting refer chapter 5.2.
3. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum speed is reached with unloaded motor.
4. Adjust the current limiter to a value requested by you with the *I max* potentiometer. It is of major importance that this value is lower than the maximum admissible constant current (see motor data sheet). To measure the motor current use a current probe in one of the motor cables with an oscilloscope or a multimeter, or the *Monitor I* output.
5. Slowly raise the value of the *Gain* potentiometer. If the motor begins to work unsteadily, to vibrate or to cause excessive noise, carefully lower the gain factor again, until the instability symptoms have disappeared for all load selections
6. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.



**WARNING:**

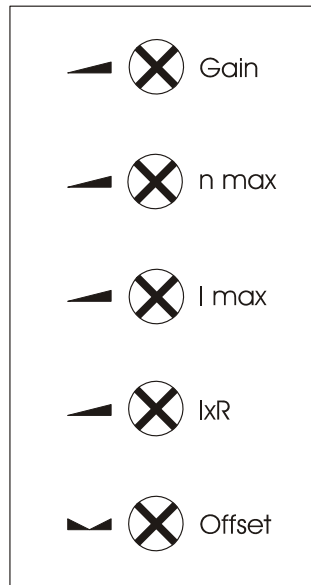
Correct connection of the encoder and *Tacho out* to *Tacho* is crucial. Otherwise the motor operates at maximum speed without any control.

## 5. Explanation of Terminals, Dip Switches, & Potentiometers

### 5.1 Terminals

Terminal	Label	Description	
XA	Connector		
	Enable In	14	Pin 14 input <i>Enable In</i> .
	Enable +V	13	Pin 13 voltage output <i>Enable +V</i> .
	Gnd Signal	12	Pin 12 signal GND.
	Error Out	11	Pin 11 output signal <i>Error out</i> .
	-Reference	10	Pin 10 voltage output -3,9 VDC.
	+Reference	9	Pin 9 voltage output +3,9 VDC.
	-Set value	8	Pin 7 & 8 input set value.
	+Set value	7	Pin 7 & 8 input set value.
	-Tacho	6	Pin 5 & 6 input tacho.
	+Tacho	5	Pin 5 & 6 input tacho.
	Power Gnd	4	Pin 3 & 4 connect to power supply.
	+Vcc	3	Pin 3 & 4 connect to power supply.
	-Motor	2	Pin 1 & 2 connect to motor.
+Motor	1	Pin 1 & 2 connect to motor.	
	Connector B		
	Encoder A	15	Pin 15 & 16 input encoder A, /A.
	Encoder $\bar{A}$	16	Pin 15 & 16 input encoder A, /A.
	Encoder B	17	Pin 17 & 18 input encoder B, /B.
	Encoder $\bar{B}$	18	Pin 17 & 18 input encoder B, /B.
	Encoder I	19	Pin 19 & 20 input encoder I, /I.
	Encoder $\bar{I}$	20	Pin 19 & 20 input encoder I, /I.
	Gnd	21	Pin 21 GND.
	+5V/100mA	22	Pin 22 voltage output +5 VDC.
	-Tacho out	23	Pin 23 & 24 output tacho.
	+Tacho out	24	Pin 23 & 24 output tacho.
	Power Gnd	25	Pin 25 & 26 connect to power supply.
	+Vcc	26	Pin 25 & 26 connect to power supply.
	Gnd	27	Pin 27 GND.
	24V Opt. In	28	Pin 28 voltage input <i>24V Opt. In</i> .

## 5.2 Potentiometers

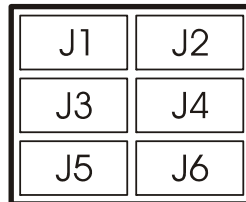
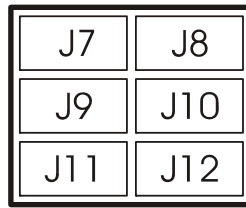


Potentiometer	Function	Turning to the Left (ccw)	Turning to the Right (cw)
<i>Gain</i>	Gain	Factor lowered	Factor raised
<i>n max</i>	Definition of max. number of revolutions	Value is decreased	Value is increased
<i>I max</i>	Set value for max. current	Upper limit lowered	Upper limit raised
<i>IxR</i>	IxR offset compensation	Low compensation	High compensation
<i>Offset</i>	Zero Offset (motor stands still)	Motor rotates counterclockwise	Clockwise rotation

### Potentiometer setting for start up:

<i>Gain</i>	<i>n max</i>	<i>I max</i>	<i>IxR</i>	<i>Offset</i>
Left stop	Middle	Middle	Left stop	Middle

### 5.3 Jumpers



J7	J8	J9	J10	J11	J12	Max. Encoder Input Frequency
Open	Set	Open	Open	Open	Open	600 kHz
Set	Set	Open	Open	Open	Open	300 kHz
Open	Open	Open	Open	Open	Open	150 kHz
Set	Open	Open	Open	Open	Set	75 kHz
Open	Set	Set	Open	Open	Set	60 kHz
Set	Set	Set	Set	Open	Set	30 kHz
Open	Open	Set	Open	Open	Set	15 kHz
Set	Open	Set	Set	Open	Set	7,5 kHz
Set	Set	Set	Open	Set	Set	6 kHz
Set	Open	Set	Open	Set	Set	1,5 kHz

Refer chapter 7.1.

$$\text{max. input frequency} = \frac{n \text{ max} \cdot \text{encoder resolution}}{60}$$

Remark:



J12 is responsible for the filtering of the output signal. If it is set, the quality of the *Tacho out* signal is improved but the dynamic behaviour is reduced due to the lowpass response.

J1	J2	J3	J4	Function Mode
Set	Set	Open	Open	Speed Control by Voltage
Set	Set	Open	Set	Speed Control by IxR
Open	Open	Set	Open	Torque Control
Set	Open	Open	Open	Speed Control by Tacho

J5	J6	Methods of entering the set value (refer chapter 7.3)
Open	Open	External selection using a voltage (0 to 10 VDC) between XA/7 and XA/8.
Set	Open	External potentiometer is used (0 to 4 VDC).
Set	Set	The internal <i>Offset</i> potentiometer is used.

 Remark:  
Do not connect *-Set value* and *+Set value* in this case.



## 6. Glossary

### **Offset**

There are two distinct functions for the *Offset*-Potentiometer:

1. Levelling the position at which the motor stands still.
2. Selection of the Set Value. This task requires setting jumper J5 and J6. In any mode, this feature is available and offers the possibility of a quick functional test.

It is advisable to begin the subsequent levelling procedure with an idle run of the motor. However you cannot expect this calibration to be stable in the long term, because the motor as well as the controller are always subject to thermal influences.

### ***n max***

Use this potentiometer to adapt the desired maximum speed to the amplitude of the present set value.

Take care not to exceed meaningful limits. An exaggerated value may entail problems for the control of the servo amplifier, making it impossible e.g. to line-up the system in speed control operation under load.

### **Gain**

The dynamical behaviour of the servo amplifier must be compatible to the particular connected motor. The adjusting procedure is performed using the *Gain* potentiometer. A bad adaptation (i.e. if the *Gain* value has been selected too high) can be easily recognized by excessive motor vibration or noise. Consequential mechanical damages cannot be excluded, furthermore an overtemperature situation may arise, due to high currents inside the motor.

When setting the *Gain* value during a stop, the result most probably will have to be accommodated one more time, because the dynamical reaction of the motor at a higher speed will not be sufficient.

Always remember that this potentiometer does not only act on the gain itself, but also on the frequency of the entire control loop.

### ***I max***

The following action requires the motor to be operated with maximum load. The motor current may be measured e.g. using current probe with effective value display, or by means of an ammeter located in the motor line.

*I max* decides on the maximum possible motor current.

The following limits have to be observed:

- Left stop: 5 % of rated current of 3 A
- Right stop: 100 % of rated current + (0 – +10 %)

Note:



Do not overheat the motor. For this reason, the *I max* limit should always be selected lower than the maximum admissible constant current.

### ***Encoder mode***

This is a closed loop speed mode that receives the speed information from the encoder. The advantage of a better speed regulation is given especially at lower speed. The encoder input is proper for encoder with differential or without differential outputs. Connect only the existing signals of the encoder.

### ***IxR***

This potentiometer is helpful to stabilize the speed in a certain range after a change of the load. First detect the number of revolutions at the lower level, then raise the load and adapt the speed using the *IxR* potentiometer.

An optimum precision of the compensation however is not realistic, because the behaviour of the motor after a load change is only predictable in a certain tolerance.

If the motor current during the alignment procedure starts to oscillate, these disturbances may be suppressed using the *Gain* potentiometer.

### ***IxR Mode***

The *IxR* mode is a voltage mode with an additional factor to correct the speed under changing the load. The speed regulation is good but not stable for all load conditions.

### ***Tacho Mode***

In the tacho mode the feedback information is coming as a voltage signal from a tacho mounted at the motor.

### ***Torque mode***

In this mode the driver controls only the current into the motor. The speed of the motor depends on the load because only the output force of the motor is regulated.

### ***Voltage Mode***

In the voltage mode the drive is watching the output voltage as a feedback voltage.

### ***Brushed motor***

In brush type motors, commutation is done electromechanically via the brushes and commutator.

### ***Commutation***

Is a term which refers to the action of steering currents or voltages to the proper motor phases so as to produce optimum motor torque. In brush type motors, commutation is done electromechanically via the brushes and commutator. In brushless motors, commutation is done by the switching electronics using rotor position information obtained by Hall sensors.

### ***Analog Position Mode***

The analog position mode is using a voltage feedback generated by a potentiometer which is mounted e.g. on the motor axis.

### ***Back EMF***

The voltage generated when a permanent magnet motor is rotated. This voltage is proportional to motor speed and is present regardless of whether the motor winding(s) are energized or de-energized.

### ***Brushless motor***

A Class of motors that operate using electronic commutation of phase currents, rather than electromechanical (brush-type) commutation. Brushless motors typically have a permanent magnet rotor and a wound stator.

### ***Closed loop***

This is broadly applied term, relating to any system in which the output is measured and compared to the input. The output is then adjusted to reach the desired condition. In motion control, the term typically describes a system utilizing a velocity and/or position transducer to generate correction signals in relation to desired parameters.

### ***Cogging***

A term used to describe non-uniform angular velocity. Cogging appears as jerkiness, especially at low speeds.

### ***Continuous rated current***

The maximum allowable continuous current a motor can handle without exceeding the motor temperature limits

### ***Continuous stall torque***

Is the amount of torque at zero speed, which a motor can continuously deliver without exceeding its thermal rating. To determined by applying DC current through two windings with locked rotor, while monitoring temperature. It's specified with motor windings at maximum rated temperature and 25 °C ambient temperature, motor mounted to a heat sink. Refer to individual specs for heat sink size.

### ***Controller***

A term describing a functional block containing an amplifier, power supplies, and possibly position-control electronics for operating a servomotor or step motor.

### ***Demag current***

The current level at which the motor magnets will start to be demagnetized. This is an irreversible effect, which will alter the motor characteristics and degrade performance.

### ***Drive***

It's an electronic device that controls torque, speed and/or position of an AC or brushless motor. Typically a feedback device is mounted in or on the motor for closed-loop control of velocity and position.

### ***Driver***

Is the electronics which convert step and direction inputs to high power currents and voltages to drive a step motor. The step motor driver is analogous to the servomotor amplifier's logic.

### ***Encoder***

Is a feedback device which converts mechanical motion into electronic signals. The most commonly used, rotary encoders, output digital pulses corresponding to incremental angular motion. For example, a 1000-line encoder produces 1000 pulses every mechanical revolution. The encoder consists of a glass or metal wheel with alternating transparent and opaque stripes, detected by optical sensors to produce the digital outputs.

### ***Efficiency***

The ratio of power output to power input.

### ***Feedback***

It is a signal which is transferred from the output back to the input for use in a closed loop system.

### ***Four quadrants***

Refers to a motion system which can operate in all four quadrants; i.e., velocity in either direction and torque in either direction. This means that the motor can accelerate, run, and decelerate in either direction.

### ***Inductance***

The electrical equivalent to mechanical inertia; that is, the property of a circuit, which has a tendency to resist current flow when no current is flowing, and when current is flowing has a tendency to maintain that current flow.

### ***NTC - Negative Temperature Coefficient***

A negative temperature coefficient thermistor is used to detect and protect a motor winding from exceeding its maximum temperature rating it is also used in a servo amplifier. Resistance of the device decreases with an increase in temperature.

### ***Open-loop***

A system in which there is no feedback. Motor motion is expected to faithfully follow the input command. Stepping motor systems are an example of open-loop control.

### ***Pulse Width Modulation (PWM)***

1. A PWM controller (amplifier) switches DC supply voltage on and off at fixed frequencies. The length of the on/off interval or voltage waveform is variable.
2. Pulse width modulation (PWM), describes a switch-mode (as opposed to linear) control technique used in amplifiers and drivers to control motor voltage and current. PWM offers greatly improved efficiency compared to linear techniques.

### ***Ramp***

The ramp time defines the increasing time to reach the scheduled value. The ramp is active after the drive is enabled, also after changing the *Set value*.

### ***Regeneration***

The action during motor braking, in which the motor acts as a generator and takes kinetic energy from the load, converts it to electrical energy, and returns it to the amplifier.

### ***Resonance***

Oscillatory behaviour caused by mechanical limitations.

### ***Ringing***

Is an oscillation of a system following a sudden change in state.

### ***Speed***

Describes the linear or rotational velocity of a motor or other object in motion.

### ***Tachometer***

A small generator normally used as a rotational speed sensing device. The tachometer feeds its signal to a control which adjusts its output to the motor accordingly (called "closed loop feedback" control).

### ***Thermal protection***

A thermal sensing device mounted to the motor to protect it from overheating. This is accomplished by disconnecting the motor phases from the drive in an over temperature condition.

### ***Torque***

Is a measure of angular force which produces rotational motion. This force is defined by a linear force multiplied by a radius; e.g. lb-in or Nm. Torque is an important parameter of any motion control system.

### ***Two Quadrants***

Refers to a motion system which can operate in two quadrants by changing the direction of the motor speed ore in one quadrant with active accelerate and decelerate.

### ***Watt***

One horsepower equals 746 watts.

## 7. Description of Inputs and Outputs

### 7.1 Digital Inputs

#### **Enable In: Activating or Disabling the Output Stage**

If the *Enable In* input is at GND potential or not wired at all, the output stage remains in the locked state. The motor stands still or slow down without brake. To reactivate the output stage, a voltage signal  $>8\text{ V}$  to the *Enable In* input XA/14 is necessary.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +30 VDC
Input Impedance	5 kOhm to GND
<i>Enable</i> activated	$>8\text{ VDC}$
<i>Enable</i> disabled	open or connected to GND

Note:



The voltage output *Enable +V* can be used as source for the *Enable In* input.

#### **Encoder A, /A, B, B, I, /I: Encoder Feedback of the Motor**

The encoder inputs XB/15 to XB/20 are connected to the incremental encoder outputs of the motor. The supply voltage is given by the +5V output at XB/22 to GND. The drive needs the signals to control the speed.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +24 VDC
Input Impedance	5 kOhm
Input Frequency	max. 600 kHz
Permanent Input Protection	-5 to +30 VDC
High level at +5 V	$>3\text{ VDC}$
Low level at +5 V	$<1,7\text{ VDC}$
High level at +24 V	$>13\text{ VDC}$
Low level at +24 V	$<5,5\text{ VDC}$



Two channels (A and B) are required for the working, a third channel (I) can be connected but it is not needed. The drive can work with single ended signals, with differential signals or with line drivers corresponding to the RS422 standard.

Note:



It is possible to operate the drive with a 24 V encoder. For this the *24V Opt. In* input XB/28 has to be connected to a 24 VDC power supply. In this case an additional connection to the pin +VCC XB/26 is not necessary.



WARNING:

Correct connection of the encoder is crucial. Otherwise the motor operates at maximum speed without any control.

## 7.2 Digital Outputs

### **Error Out: Monitoring Output**

Whenever a system failure occurs (i.e. overtemperature), the *Error Out* output responds (LO position), and the green LED on the front panel is switch to red. The drive output stage is switched off and will be switch on after the failure is drop.

The output is an open-collector output and via an external pull-up resistor adaptable to the most industrial logics, up to +30 V.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	min. 0.4 V at LO – max. 30 V at HI
Output Impedance	>100 Ohm at LO
Permanent Output Current	20 mA max.

Note:



The logical state of this output is clearly visible by the green/red *OK/Fault* LED on the front panel.

### 7.3 Analog Inputs

#### +Set value –Set value: Inputs for Set Value

An external +10/-10 V analog signal for speed or for current is entered using +Set value and –Set value inputs. If the effective voltage is 0V, the motor stops. If the effective voltage is positive, the motor moves in one direction. If the input is negative, the motor consequently will be move in the opposite direction.

These inputs are given in form of a differential amplifier, so each of them can be related to ground. This offers the possibility to preset the level control in only one direction.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	-10 V to +10 V
Input Impedance	100 kOhm
Permanent Input Protection	-15 V to +15 V

Remark:



To use the internal *Offset* potentiometer as *Set value* source set jumper J5 and jumper J6. Refer chapter 5.3.

As an alternative, the set value can be entered using an external potentiometer (10 kOhm). For this purpose, set jumper J5, connect the slide resistance to +Set value, the left stop to -Reference and the right stop to +Reference. In this case do not connect the -Set value input.

The admissible range for the set value is limited by the programmed *n max* speed value. In this case, the desired maximum speed can be selected according to the maximum input voltage. If the motor does not stop at input voltage = 0 V, fine tuning has to be performed using *Offset* potentiometer.

**+Tacho –Tacho: Analog Tachometer Feed Back**

The *+Tacho* and *–Tacho* inputs are transmit an analog set value for the number of revolutions from a tachometer coupled to the motor, back to the servo amplifier. This feature improves the accuracy of speed control, stable even in cases of a large load change. The input is given in form of a differential amplifier.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	-50 V to +50 V
Input Impedance	50 kOhm
Input Protection	up to -60 V to +60 V

WARNING:



Correct polarity is crucial. Otherwise the motor operates at maximum speed without any control. The value of the input protection depends on the setting of *n max* potentiometer.

**7.4 Analog Outputs**

**+Tacho out –Tacho out: Analog Encoder Output for Tachometer Feed Back**

The *+Tacho out* XB/23 and *–Tacho out* XB/24 outputs are transmit an analog set value for the number of revolutions generated by a frequency to voltage converter from the digital encoder signals. These output has to connected to the *+Tacho* XA/5 and *–Tacho* XA/6 inputs of the drive.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	-3,9 V to +3,9 V
Output Impedance	100 Ohm
Permanent Output Current	20 mA max.

WARNING:



Correct polarity is crucial. Otherwise the motor operates at maximum speed without any control.

## 8. Basic Troubleshooting

The servo amplifier has included some different protective functions. Under voltage and over temperature are monitored and shown with the LED's at the front side.



### **Important:**

The motor starts after the failure is eliminated.

### ***Motor oscillates***

- The gain of the servo amplifier is too high. Reduce the gain pot or in IxR mode the the IxR pot.

### ***Motor runaway***

- The feedback loop is open. Check wiring.
- The polarity of the motor or of the tacho is permuted.
- Check the encoder wiring.
- No load at torque mode.
- Reduce the maximal speed with pot n max.

### ***Motor noise***

- Reduce gain with gain pot.
- Use additional choke in the motor

### ***Motor has no torque***

- Increase the admissible current with I max pot.

### ***Motor drifts at standstill***

- Adjust the offset with the offset pot.
- The input value for the set value isn't stable.

### ***Motor is going hot at standstill***

- Is the motor blocked?

### ***Motor speed too low***

- Increase the range with pot n max.
- Increase the admissible current with I max pot.
- Supply voltage too low.

***No motion even though enable is on***

- Check power supply and the wiring.
- Overheating protection is active.

***Overtemperature***

- Use an additional heatsink (see accessories).
- Reset the amplifier.

Note:



Beware that the maximal working temperature of 80°C in the driver is not reached; otherwise the drive will be switched off.

## **9. Accessories & Options**

- Mounting adaptor for Din rail ASX-RM-01-01
- Choke modules IA2100 (with 2 x 50 µH)  
and IA2101 (with 2 x 100 µH)
- Braking module ASO-BM-70-30.

## 10. Warranties & Disclaimers

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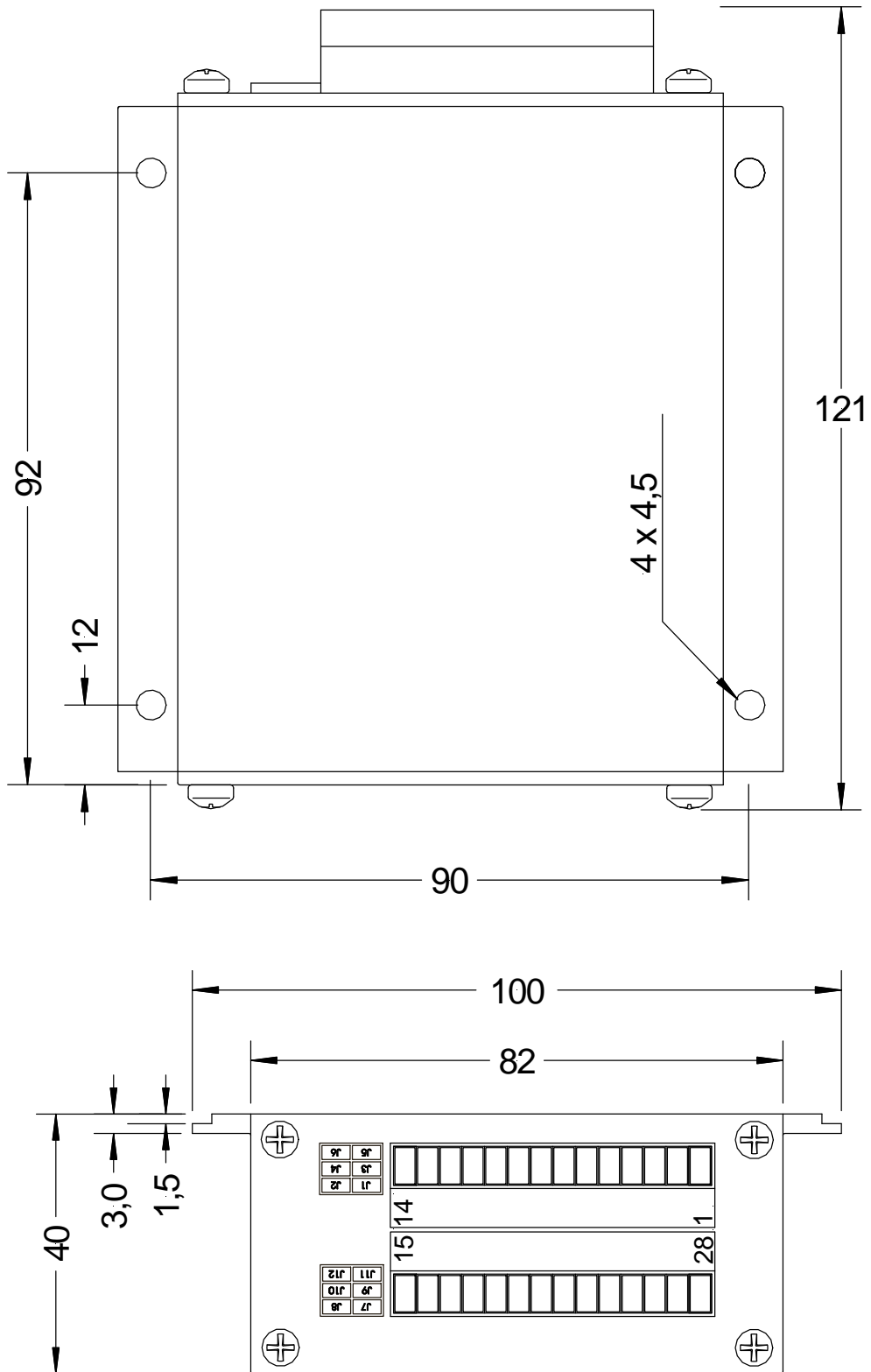
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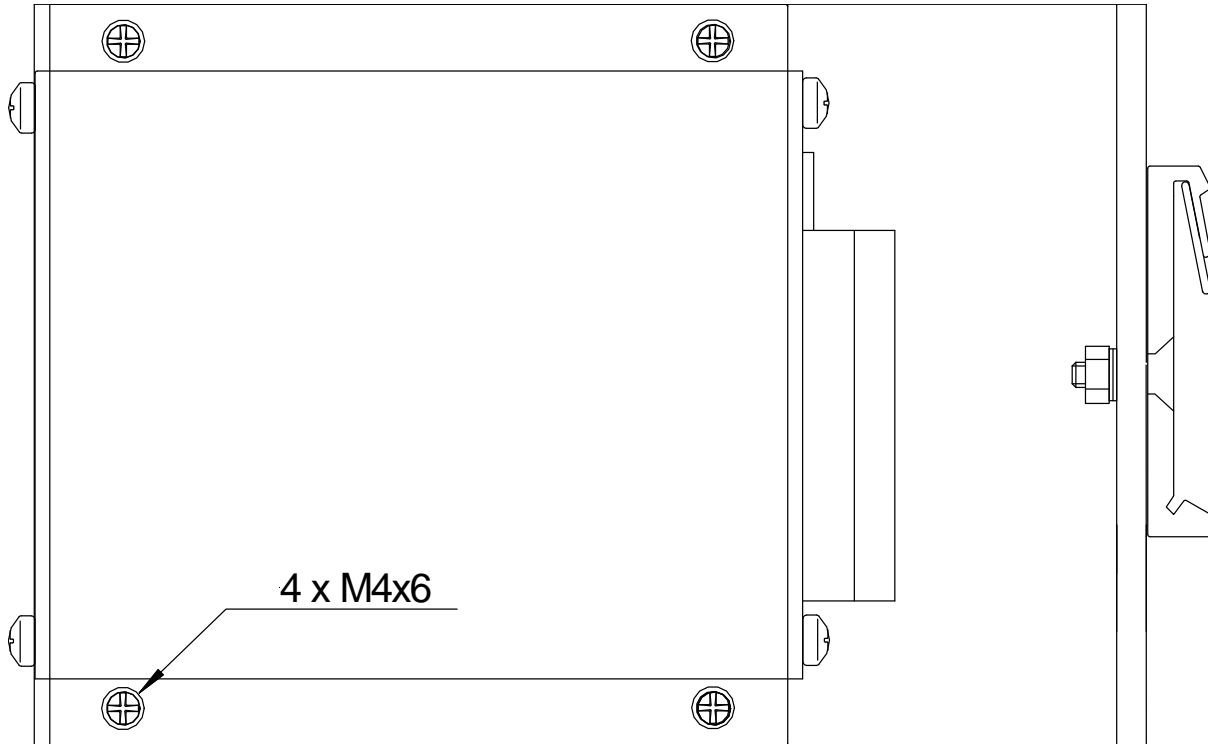
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## 11. Dimensions



All dimensions in mm.

## 12. Mounting Din rail adapter



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