

4–Q PWM Servo – 10 A

For Brush-Commutated DC Motors up to 700 W

SCA-SS-70-10



- 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 +70 VDC for different kinds of DC-power supplies
- Protected against overtemperature and over-current
- MOSFet-technology, efficiency 95%
- Continuous current up to 10 A

Basic drive description: The SCA-SS-70-10 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-SS-70-10 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-SS-70-10, 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 μ 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-SS-70-10 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 +70 VDC (Residual ripple <5 %) (The lower limit is monitored by integrated undervoltage trip) WARNING: Do not exceed 70V. Overvoltage will damage the drive.
Nominal Current	10 A
Peak Current	20 A
Maximum Power (only achievable with additional heatsink & proper mounting, see accessories.)	700 W
Switching Frequency	49 kHz
Efficiency	95 %
Induction Specification & caution for low inductance motors	Integrated choke 370 µH Optional choke modules are often an economical solution for low inductance or other motors, 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 ² (AWG16). Maximum wire diameter with respect to the terminal is 2,5 mm ² (AWG14) or 1,5 mm ² (AWG16) for stranded wires. Strip the wire insulation of the cables on a length of maximal 8 mm. For stranded wire, use end sleeves with the corresponding length.
Signal terminals	The recommendation is 0,5 mm ² (AWG21), the min. is 0,14 mm ² (AWG26) and the max. is 1,5 mm ² (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	180 x 100 x 40 mm
Weight	740 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 = 4,7 kOhm
<i>Encoder A, B</i>	TTL, +5 VDC; Resistance = 1 kOhm; max. 100 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

2.5 Outputs

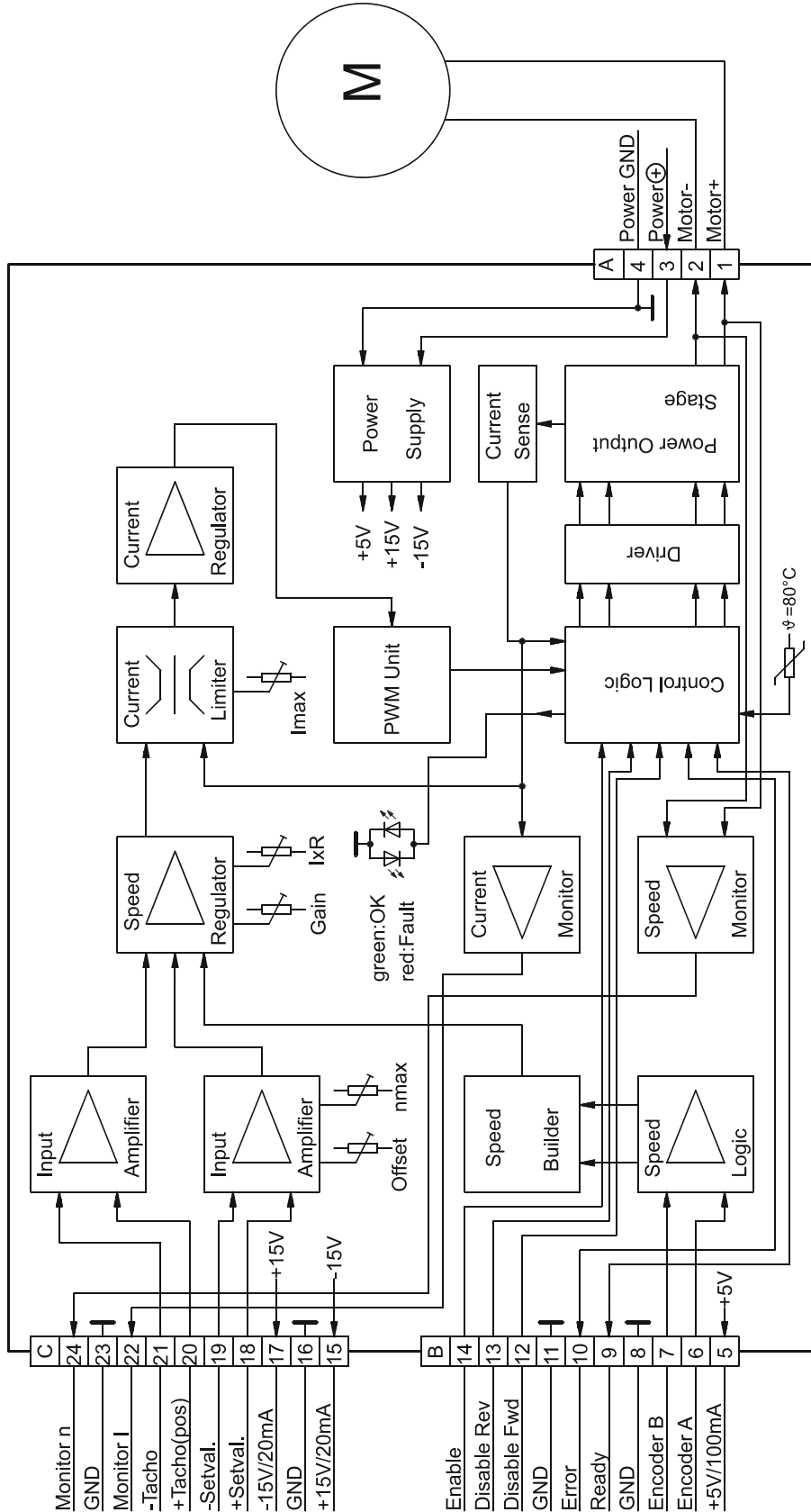
Auxiliary Voltage Outputs +5V	+5 VDC / 100 mA
Auxiliary Voltage Output +15V	+15 VDC / 20 mA
Auxiliary Voltage Output -15V	-15 VDC / 20 mA
<i>Ready</i>	Open Collector / +30 VDC; max. 20 mA
<i>Error</i>	Open Collector / +30 VDC; max. 20 mA
<i>Monitor I</i>	Analog 0 – +10 VDC with = 0,5 V / A Resistance = 10 kOhm
<i>Monitor n</i>	Analog 0 – +10 VDC ; Resistance = 10 kOhm

2.6 Control LEDs

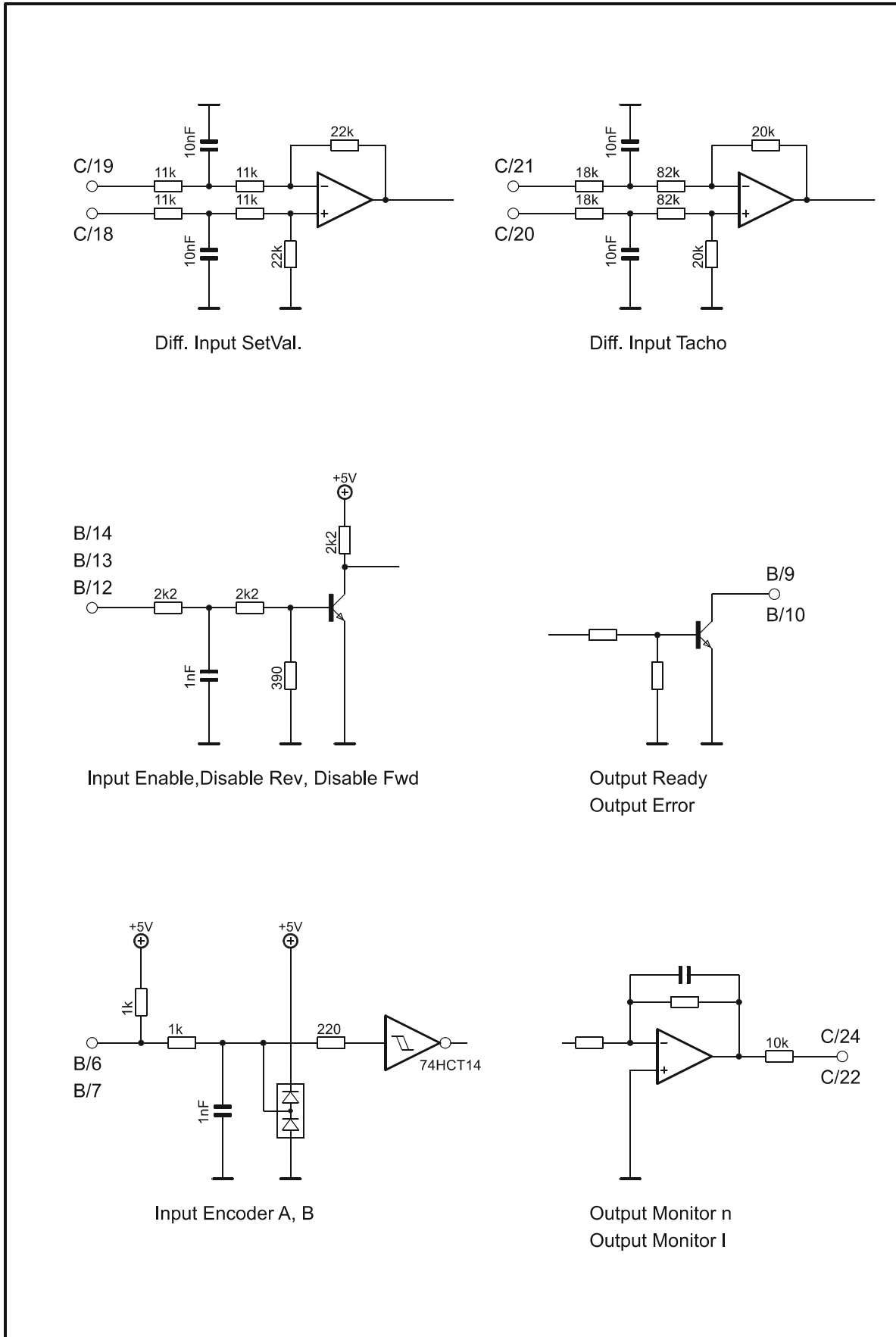
<i>OK</i>	LED green The LED is lit when the drive is ready to work.
<i>Fault</i>	LED red The lamp is lit if the overtemperature, the undervoltage, the overvoltage or the overcurrent protection circuit have been initiated.

3. Drive Overview

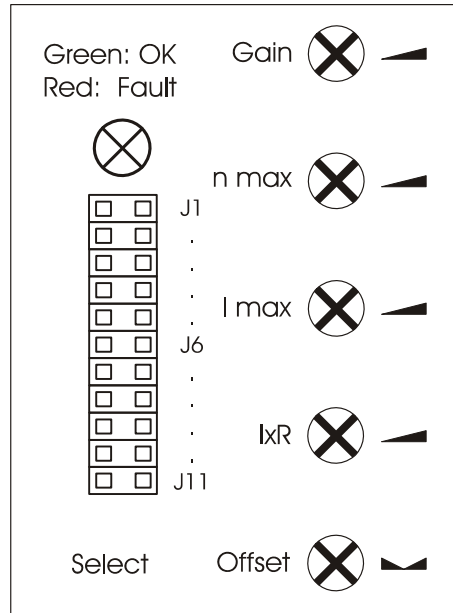
3.1 Block Diagram



3.2 Input & Output Schematics



3.3 Control Elements



3.4 Operation Modes

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.

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.

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. This mode can be used to control the movement or the position of a flap, a wheel or a linear actuator. The range of the movement depends of working range of the feedback system.

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 ($\oplus V_{cc}$ - *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, Monitor I, Monitor n, +Tacho, -Tacho*)

- 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, Ready, Error, Disable Rev, Disable Fwd*)

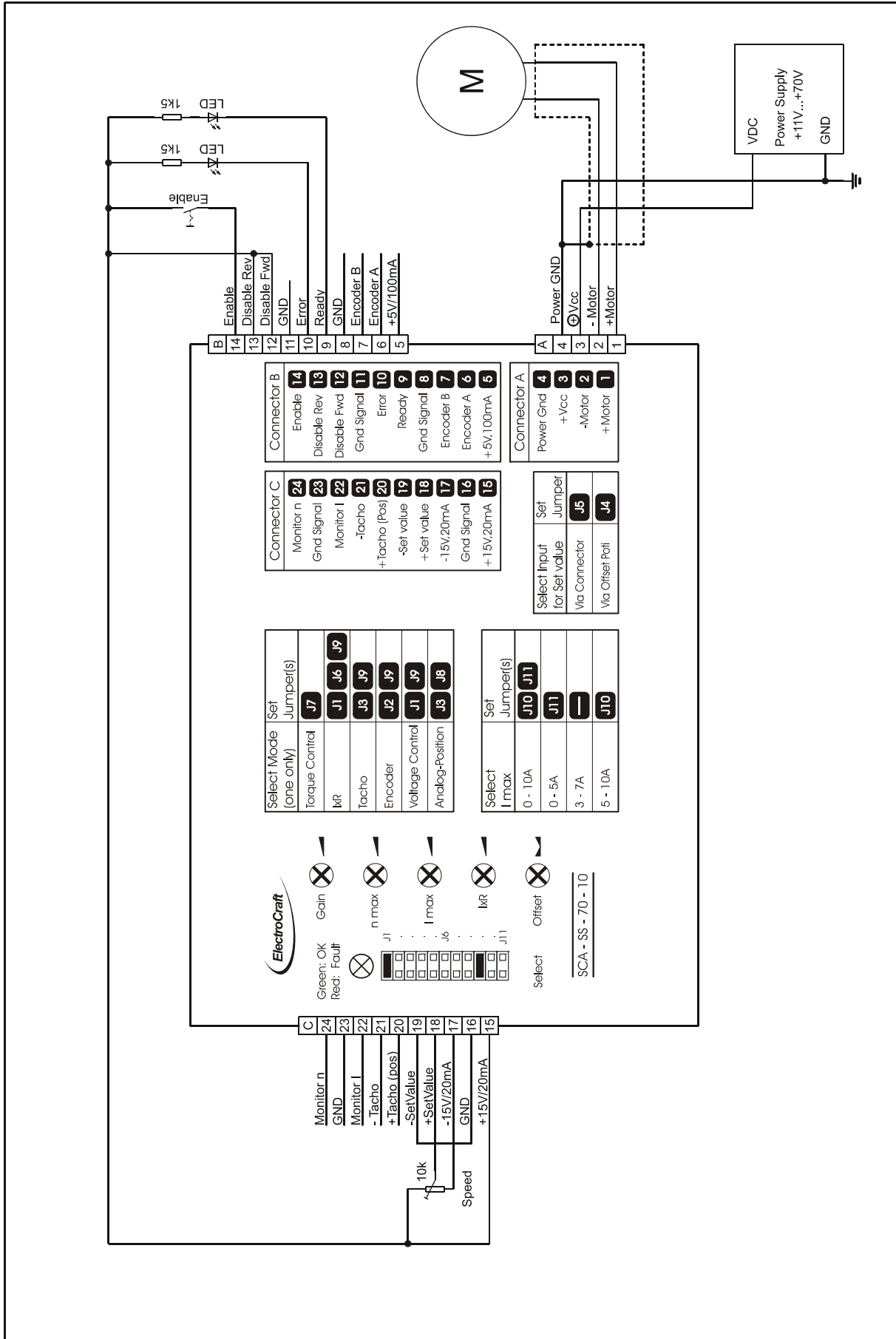
- No shielding required.

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 – Voltage Mode



4.1.1 Setting of the Jumpers

Mode	Current				Set Value via	
	Voltage Control	0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot

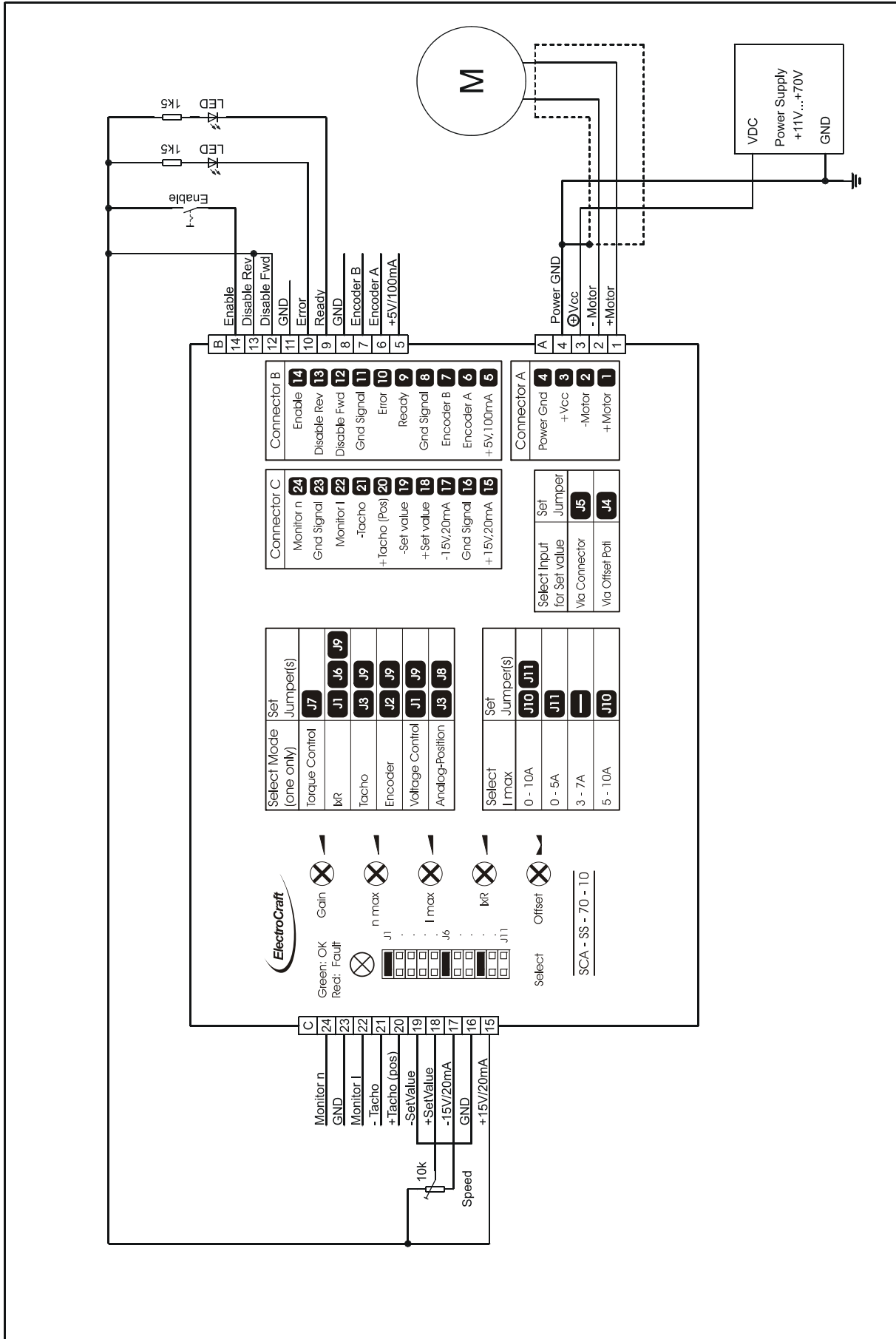


Note: Advanced information's about the jumpers refer chapter 5.3.

4.1.2 Adjustment procedure for Voltage mode

1. Potentiometer pre setting refer chapter 5.2.
2. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum speed is reached with unloaded motor.
3. 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.
4. 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
5. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.

4.2 Wiring Example II – IxR Comp Mode



4.2.1 Setting of the Jumpers

Mode	Current				Set Value via	
IxR Control	0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot	Connector
J1 J6 J11	J1 J6 J11	J1 J6 J11	J1 J6 J11	J1 J6 J11	J1 J6 J11	J1 J6 J11

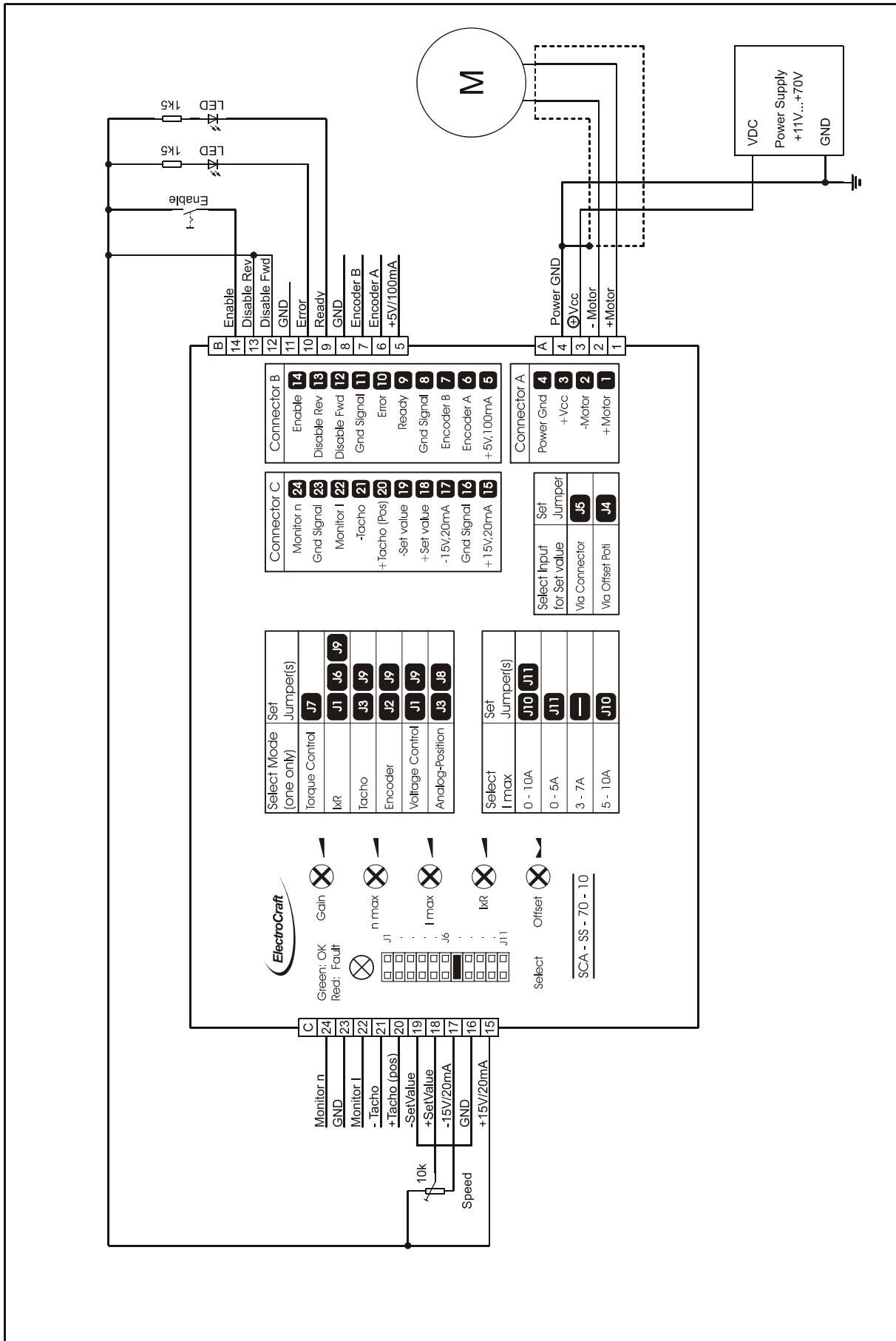


Note: Advanced information's about the jumpers refer chapter 5.3.

4.2.2 Adjustment procedure for IxR mode

1. Potentiometer pre setting refer chapter 5.2.
2. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum speed is reached with unloaded motor.
3. 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.
4. 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
5. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.
6. Slowly increase *IxR* value. The gain must be sufficient, that even for a higher motor load, the number of revolutions does not significantly decrease.

4.3 Wiring Example III – Torque Mode



4.3.1 Setting of the Jumpers

Mode	Current				Set Value via																																																																																																																																																																																																																								
	Torque Control	0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot	Connector																																																																																																																																																																																																																						
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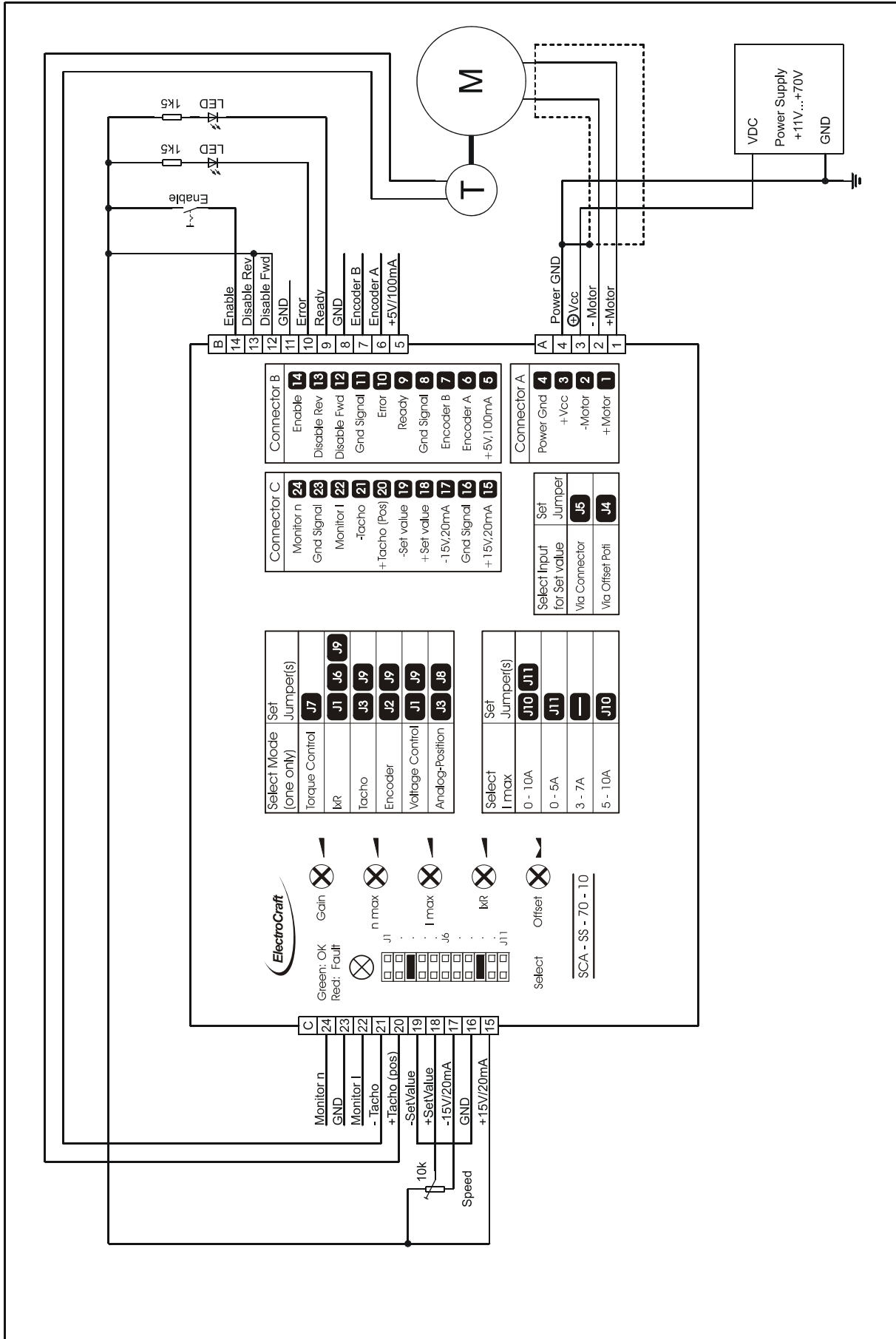


Note: Advanced information's about the jumpers refer chapter 5.3.

4.3.2 Adjustment procedure for *Torque* mode

1. Potentiometer pre setting refer chapter 5.2.
2. 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.
3. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum current is reached.
4. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.

4.4 Wiring Example IV – Tacho Mode



4.4.1 Setting of the Jumpers

Mode	Current				Set Value via	
	0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot	Connector
Tacho Control						
J1	J1	J1	J1	J1	J1	J1
.
.
J6	J6	J6	J6	J6	J6	J6
.
.
J11	J11	J11	J11	J11	J11	J11
.
.



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

4.4.2. Adjustment procedure for *Tacho* mode

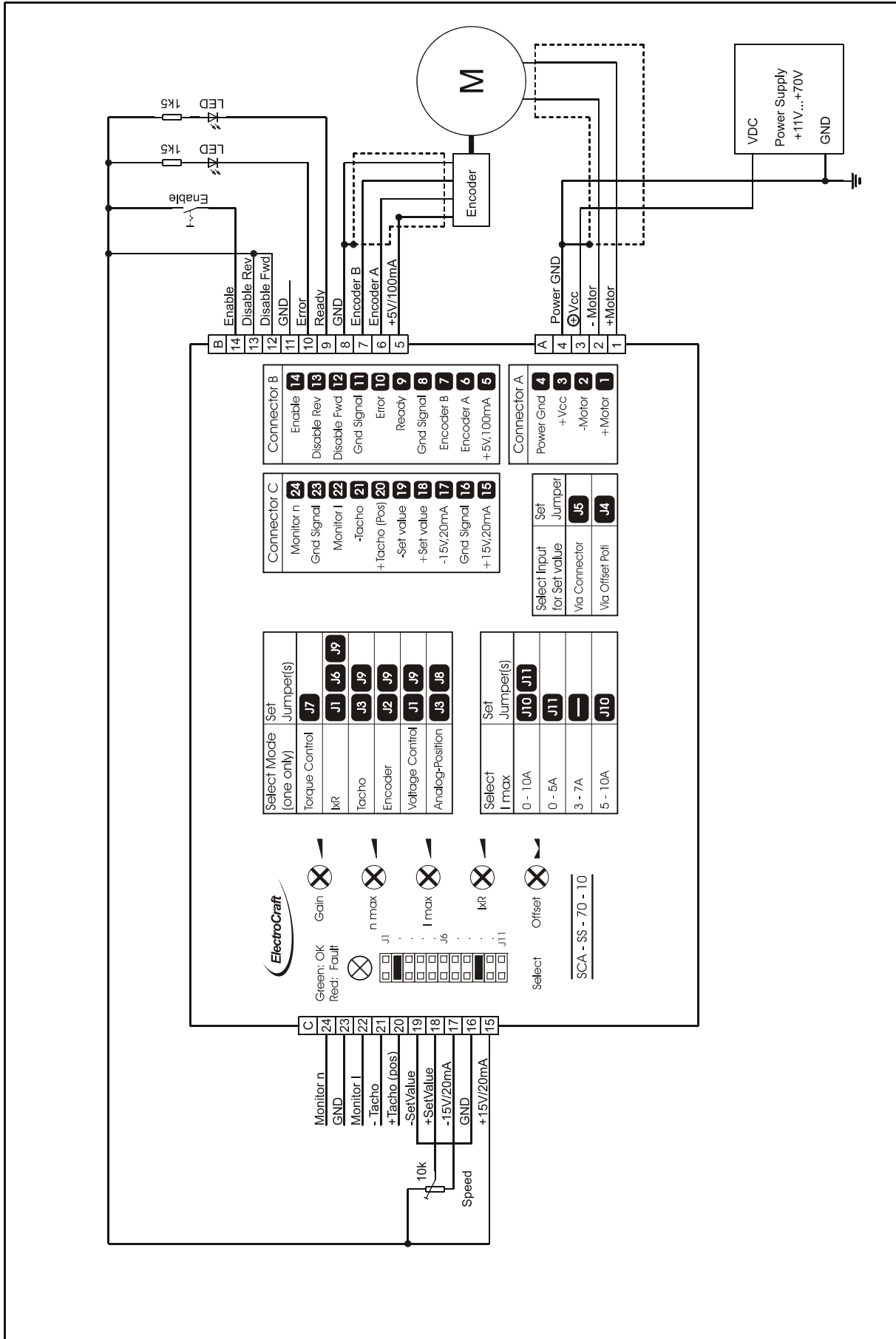
1. Potentiometer pre setting refer chapter 5.2.
2. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum speed is reached with unloaded motor.
3. Adjust the current limiter to a value requested by you with the *I max* potentiometer. It is of major importance 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.
4. 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
5. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.



WARNING:

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

4.5 Wiring Example V – Encoder Mode



4.5.1 Setting of the Jumpers

Encoder Control	Current				Set Value via	
	0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot	Connector
<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1	<input type="checkbox"/> <input type="checkbox"/> J1
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Note: Advanced information's about the jumpers refer chapter 5.3.

4.5.2. Adjustment procedure for *Encoder* mode

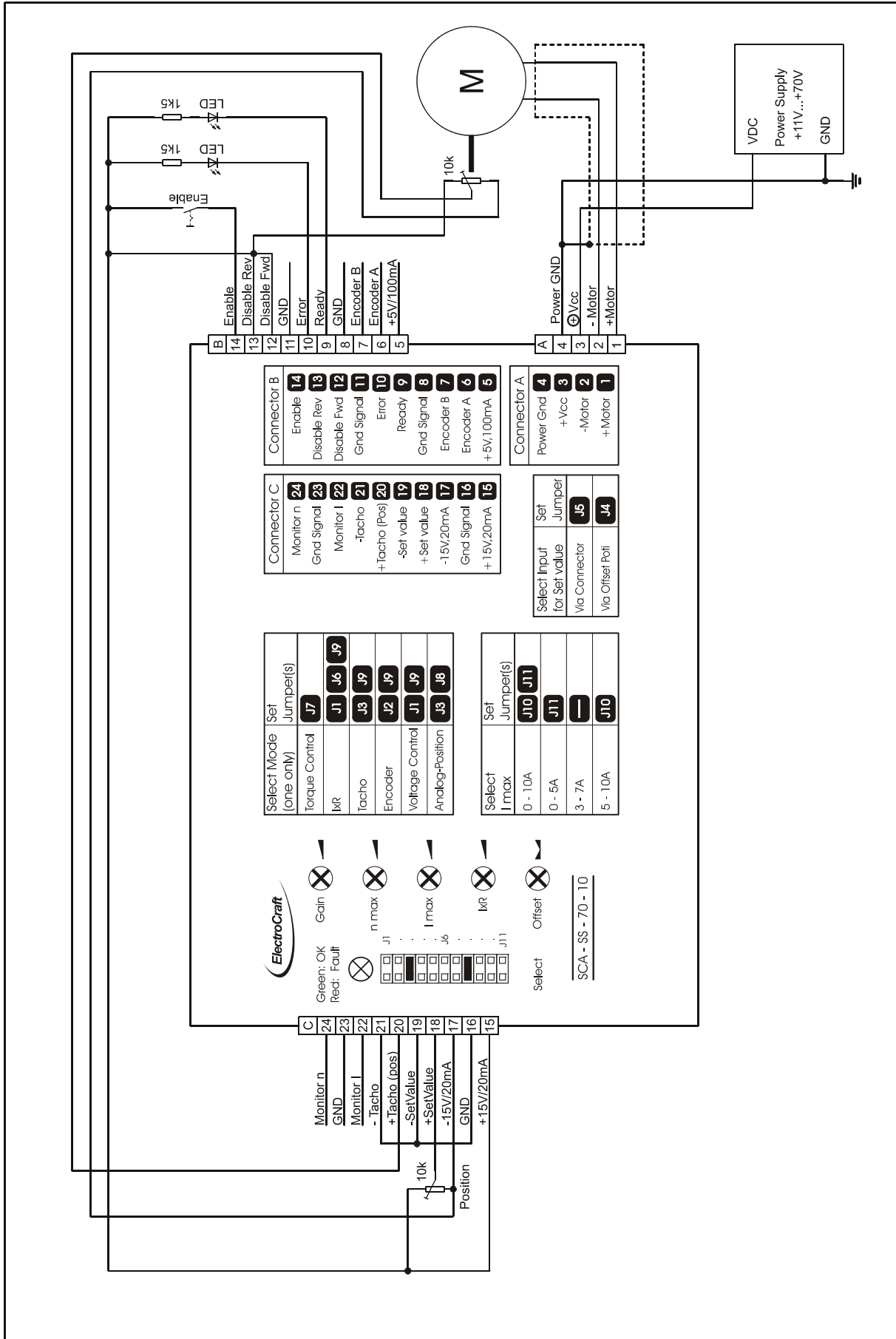
1. Potentiometer pre setting refer chapter 5.2.
2. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired maximum speed is reached with unloaded motor.
3. Adjust the current limiter to a value requested by you with the *I max* potentiometer. It is of major importance 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.
4. 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
5. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.



WARNING:

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

4.6 Wiring Example VI – Analog Position Mode



4.6.1 Setting of the Jumpers

Mode		Current				Set Value via	
Analog Position		0 – 10 A	0 – 5 A	3 – 7 A	5 – 10 A	Offset - pot	Connector
	J1						
	.						
	.						
	.						
	.						
	J6						
	.						
	.						
	.						
	J6						
	.						
	.						
	.						
	J11						
	.						
	.						
	J11						



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

4.6.2 Adjustment procedure for *Analog Position* mode

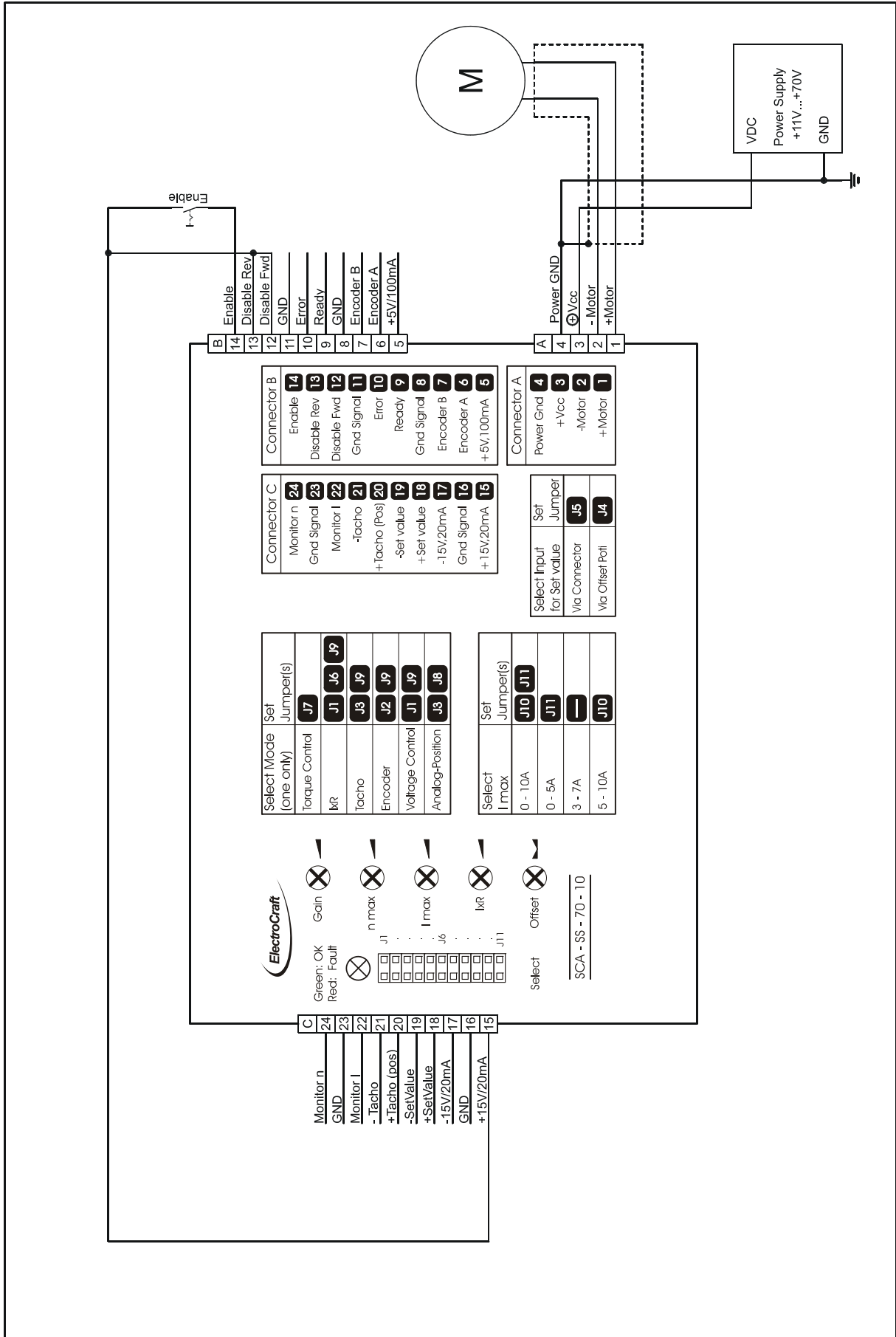
1. Potentiometer pre setting refer chapter 5.2.
2. Choose the maximum set value (e.g. 10 V). Turn the potentiometer *n max*, until the desired moving angle is reached with unloaded motor.
3. Adjust the current limiter to a value requested by you with the *I max* potentiometer. It is of major importance 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.
4. 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
5. Set the set value to zero and adjust the *Offset* potentiometer, to the standstill of the motor.

Note:

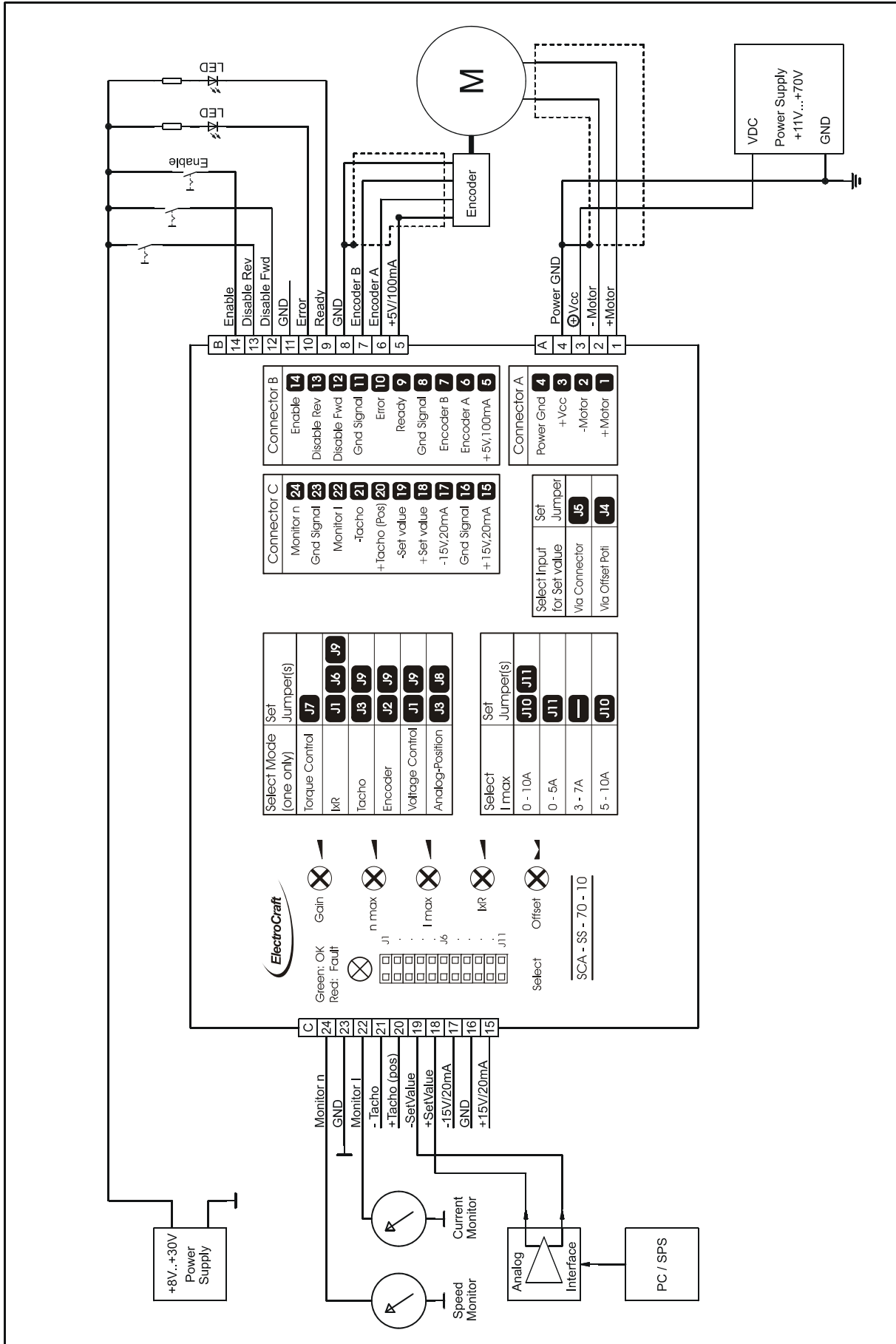


The inputs *Disable Rev* and *Disable Fwd* can be used as limit switches to protect the feedback system.

4.7 Wiring Example VII – Minimal Mode



4.8 Wiring Example VIII

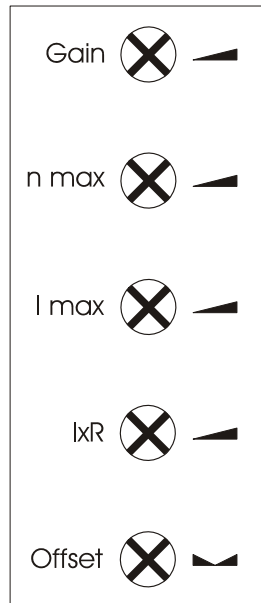


5. Explanation of Terminals, Dip Switches, & Potentiometers

5.1 Terminals

Terminal	Label	Description	
XA	Connector A		
	Power Gnd	4	
	+Vcc	3	
	-Motor	2	
	+Motor	1	
		Pin 1 & 2 connect to power supply. Pin 3 & 4 connect to motor.	
XB	Connector B		
	Enable	14	
	Disable Rev	13	
	Disable Fwd	12	
	Gnd Signal	11	
	Error	10	
	Ready	9	
	Gnd Signal	8	
	Encoder B	7	
	Encoder A	6	
	+5V,100mA	5	
			Pin 5 voltage output +5 VDC. Pin 6 & 7 input encoder feedback. Pin 8 signal GND. Pin 9 output signal Ready. Pin 10 output signal Error. Pin 11 signal GND. Pin 12 input for Disable Fwd. Pin 13 input for Disable Rev. Pin 14 input <i>Enable</i> .
	XC	Connector C	
		Monitor n	24
Gnd Signal		23	
Monitor I		22	
-Tacho		21	
+Tacho (Pos)		20	
-Set value		19	
+Set value		18	
-15V,20mA		17	
Gnd Signal		16	
+15V,20mA		15	
		Pin 15 voltage output +15 VDC. Pin 16 signal GND. Pin 17 voltage output -15 VDC. Pin 18 & 19 input set value. Pin 20 & 21 input tacho. Pin 22 voltage output for current. Pin 23 signal GND. Pin 24 voltage output speed monitor.	

5.2 Potentiometers

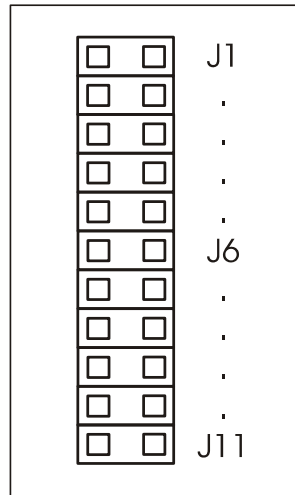


Potentiometer	Function	Turning to the Left (ccw)	Turning to the Right (cw)
<i>Gain</i>	Gain	Factor lowered	Factor raised
<i>n max</i>	Definition of max. number of revolutions	Value is decreased	Value is increased
<i>I max</i>	Set value for max. current	Upper limit lowered	Upper limit raised
<i>IxR</i>	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



J1	J2	J3	J6	J7	J8	J9	Function Mode
Set	Open	Open	Open	Open	Open	Set	Speed Control by Voltage
Set	Open	Open	Set	Open	Open	Set	Speed Control by IxR
Open	Open	Open	Open	Set	Open	Open	Torque Control
Open	Open	Set	Open	Open	Open	Set	Speed Control by Tacho
Open	Set	Open	Open	Open	Open	Set	Speed Control by Encoder
Open	Open	Set	Open	Open	Set	Open	Analog Position

J10	J11	Select range of the Current
Open	Open	Current range is from 3 A to 7 A.
Open	Set	Current range is from 0 A to 5 A.
Set	Open	Current range is from 5 A to 10 A.
Set	Set	Current range is from 0 A to 10 A.

J4	J5	Methods of entering the set value
Open	Set	External selection using a voltage between XC/18 and XC/19.
Set	Open	The internal <i>Offset</i> potentiometer is used.

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 J4 and opening jumper J5. 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_{xR}

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 *I_{xR}* 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.

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: 3 % of rated current of 10 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.

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.

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.

I_{xR} Mode

The *I_{xR}* 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.

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: Activating or Disabling the Output Stage

If the *Enable* 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 V to the *Enable* input XB/14 is necessary.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +30 VDC
Input Impedance	4.5 kOhm to GND
<i>Enable</i> activated	>8 VDC
<i>Enable</i> disabled	open or connected to GND

Disable Fwd: Activating or Disabling one Direction of Rotation

If the *Disable Fwd* input is at GND potential or not wired at all, the motor works only in one direction e.g. clockwise. To activate this direction, a voltage signal >8 V to the *Enable* input XB/12 is necessary.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +30 VDC
Input Impedance	4.5 kOhm to GND
Direction activated	>8 VDC
Direction disabled	open or connected to GND

Disable Rev: Activating or Disabling one Direction of Rotation

If the *Disable Fwd* input is at GND potential or not wired at all, the motor works only in one direction e.g. counter clockwise. To activate this direction, a voltage signal >8 V to the *Enable* input XB/13 is necessary.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +30 VDC
Input Impedance	4.5 kOhm to GND
Direction activated	>8 VDC
Direction disabled	open or connected to GND

Encoder A / B: Encoder Feedback of the Motor

The encoder inputs XB/7 and XB/8 are connected to the encoder output of the motor. The supply voltage is given by the +5V output at XB/6 to GND. The drive needs the signals control the speed.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +5 VDC
Input Impedance	1 kOhm to +5V
Input Frequency	max. 100 kHz
Permanent Input Protection	-5 to +10 VDC
High level	>2,4 VDC
Low level	<1 VDC



WARNING:

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

7.2 Digital Outputs

Error: Monitoring Output

Whenever a system failure occurs (i.e. overtemperature), the *Error* output responds (LO position), and the green LED on the front panel is switch to red. The drive output stage is switched off and the error will not reset until the user resets the drive by switching the enable input. If the error occurs again the problem still exists.

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.

Ready: Monitoring Output

The *Ready* output is set if there no errors occurs in the drive (LO position). On error the output is opened and will not reset until the user resets the drive by switching the enable input. This output is a mirror image of the *Error* output.

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 Values

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	20 kOhm
Permanent Input Protection	-30 V to +30 V

Remark:



To use the internal *Offset* potentiometer as *Set value* source set jumper J4 and open jumper J5.

As an alternative, the set value can be entered using an external potentiometer (10 kOhm). For this purpose, connect the slide resistance to +Set value, the left stop to -15V and the right stop to +15V. This procedure requires the -Set value input to be bridged to GND.

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 –Tacho inputs 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 without ground connection.

Additional information about the schematic refer chapter 3.2.

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



WARNING:

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

7.4 Analog Outputs

Monitor n: Motor Speed Output

This feature shows the motor speed as a voltage signal. After adjusting the *n max* potentiometer at maximum *Set value* (refer chapters 4.x.2) the output goes to 10 V if the maximum speed is reached.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	-10 V to +10 V
Output Impedance	10 kOhm
Permanent Output Current	100 µA max., source and sink

Monitor I: Motor Current Output

Monitor I delivers a result representing the actual value of the peak motor current. The proportionality factor is fixed to 0.5V per 1A motor current.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	-10 V to +10 V
Output Impedance	10 kOhm
Permanent Output Current	100 µA max., source and sink

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 only by resetting the *Enable*. Before resetting an error by resetting the *Enable* make sure that the cause of 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

- Use an additional choke in series with the motor (see accessories).

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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Customer service at +44 (0) 127 050 8800

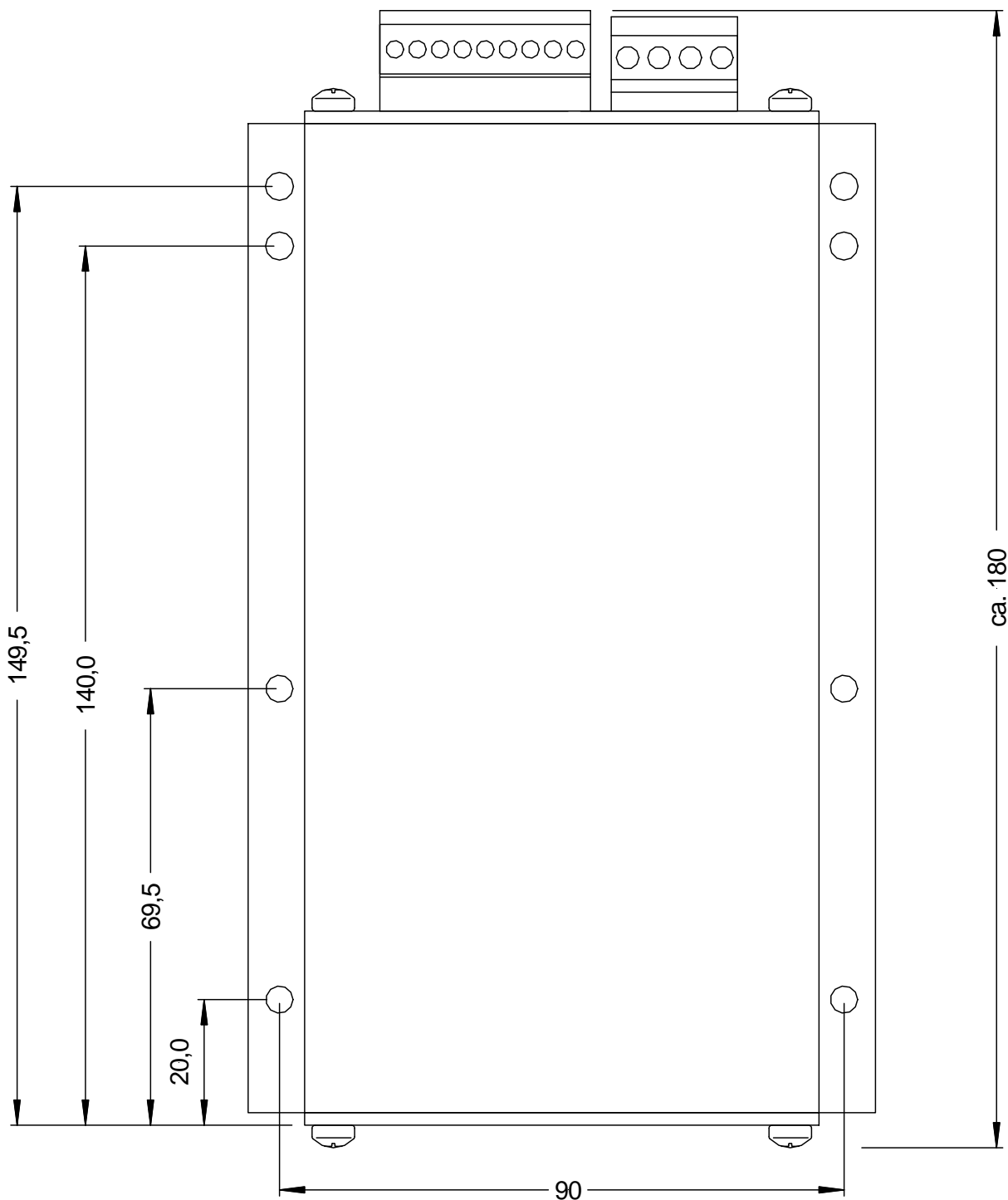
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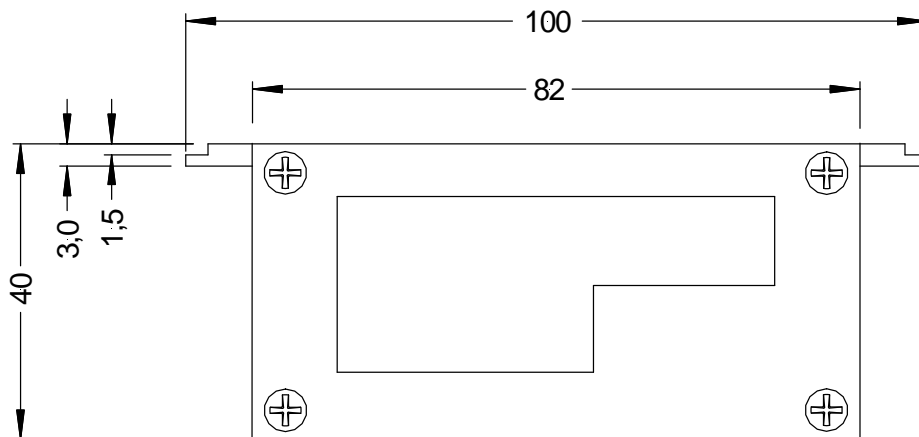
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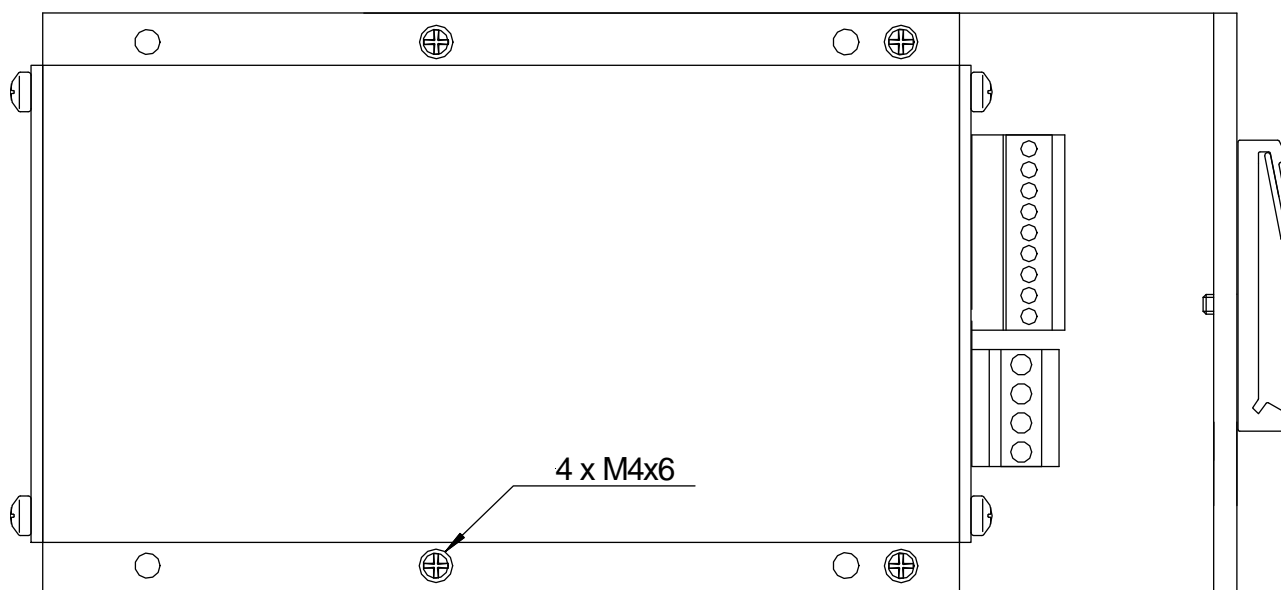
11. Dimensions





All dimensions in mm.

12. Mounting Din rail adapter



SCA-SS-70-10_E09 Subject to change without prior notice.