

2-Q PWM Servo – 06 / 16 / 24 A For Brushless-Commutated DC Motors up to 1680 W

EA2708 / EA2716 / EA2724



- Servo amplifier in a small size, rugged aluminium housing in (bookshelf form)
- Different methods of mounting for fast installation
- Tool free connections for power terminations
- Inputs and outputs via RJ45-CAT5 plug
- Operation mode with simple DIP switch setting
- User adjustable current limit and ramp function
- Wide range supply voltage between +11 and +70 VDC for different kinds of power supplies
- Protected against overtemperature and over-current
- MOSFet-technology, efficiency 95%
- Continuous current up to 09 / 16 / 24 A (model dependent)

Basic drive description: The EA2708 / EA2716 / EA2724 servo amplifiers are designed to drive DC brushless 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. The drives are protected against short circuits, under voltage, over temperature, and over current. It has multiple possibilities of operation and serves as a reliable choice for your motion control needs.

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1. Safety & Installation



The EA2708 / EA2716 / EA2724 requires installation by qualified personal whom must pay attention to 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 disconnected from the load. Improper wiring could cause a “motor run away” condition, and cause severe injury or damage to the machine.



Before starting installation of the EA2708 / EA2716 / EA2724, be sure that main power is disconnected. After powering the drive it should not be touched by hand or risk shock.



Be 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 recommended connecting a capacitor in parallel close to power input, with 1000 μ F per each ampere output current.



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



The EA2708 / EA2716 / EA2724 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.
Auxiliary Voltage Input	+5 to +30 VDC Supply voltage for the /Still out output. (Refer chapter 7.2)
Nominal Current	08 / 16 / 24 A (model dependent)
Maximum Power (only achievable with additional heatsink & proper mounting, see accessories.)	560 / 1120 / 1680 W
Switching Frequency	20 kHz
Efficiency	95 %
Induction Specification & caution for low inductance motors	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 connector	The diameter must be suited for the connecting wires of the current load. The recommendation is 1,5 mm ² (AWG16), the minimum is 0,13 mm ² (AWG28). Maximum wire diameter with respect to the plug contact is 2,5 mm ² . Strip the wire insulation of the cables on a length of 10mm. For stranded wire, use end sleeves with the corresponding length. Wire ends have to be inserted into the contact, until they reach the stop.
Signals	For the cabling of the RJ45 plugs, we recommended shielded CAT5 cables. The cables are available in different colours and lengths in the system accessories.

2.2 Mechanical Data

Mechanical Dimensions L x W x H	120 x 85 x 27.5 mm
Weight	220 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>	TTL, +24 VDC; Resistance = 4,7 kOhm
<i>Fwd/Rev</i>	TTL, +24 VDC; Resistance = 4,7 kOhm
<i>Brake</i>	TTL, +24 VDC; Resistance = 4,7 kOhm
<i>Hall A, B, C</i>	TTL, +6 VDC; Resistance = 22 kOhm
<i>Speed</i>	Analog 0 – +5 VDC ; Resistance = 100 kOhm
<i>I_{max}</i>	Analog 0 – +10 VDC ; Resistance = 100 kOhm
<i>I-Pot HI; I-Pot; I-Pot LO</i>	100 kOhm potentiometer

2.5 Outputs

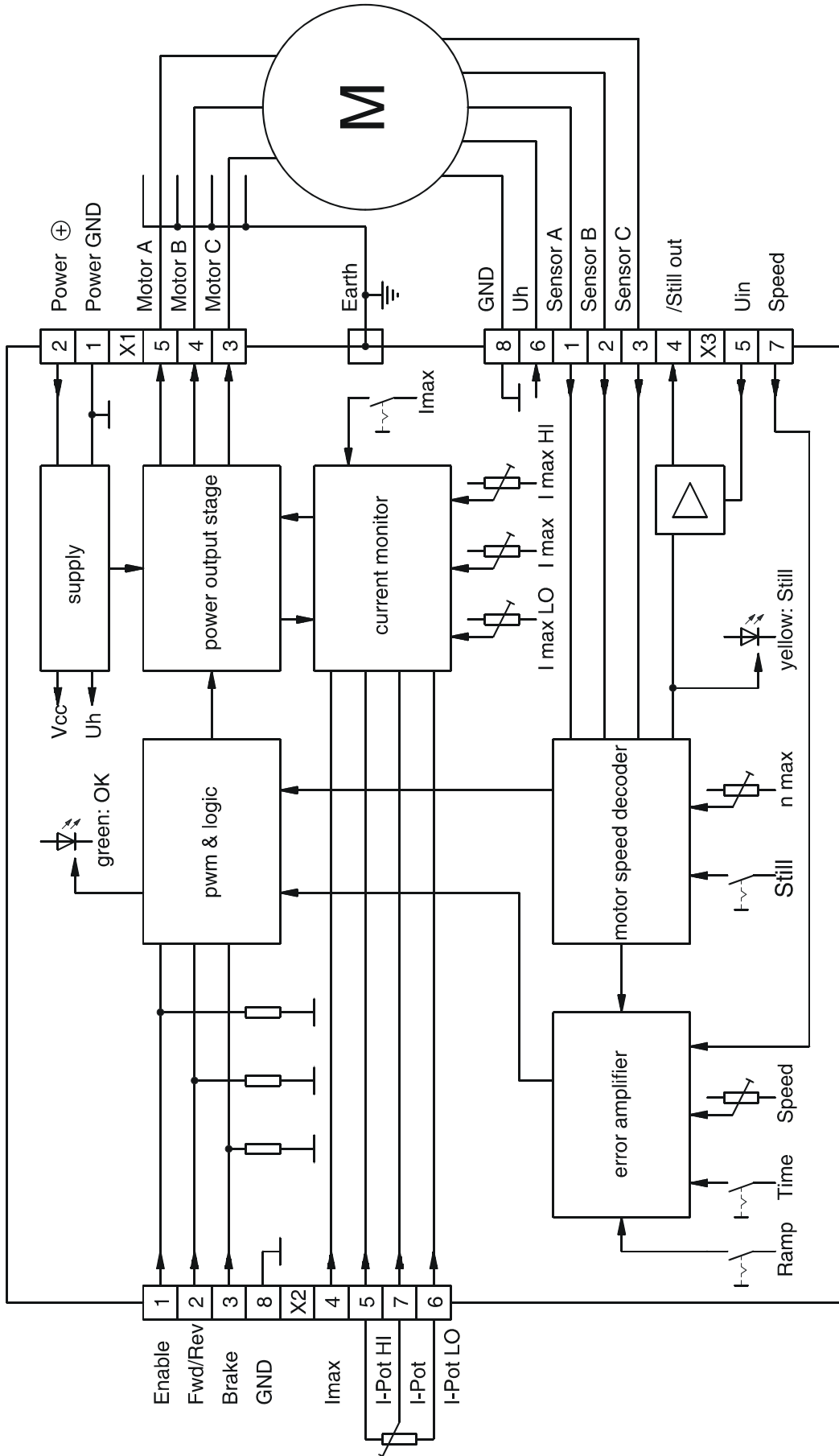
Auxiliary Voltage Outputs <i>Uh</i>	+6 V / 20 mA
<i>/Still out</i>	Open Collector / Push Pull / TTL / +24 VDC; Resistance = 50 Ohm

2.6 Control LEDs

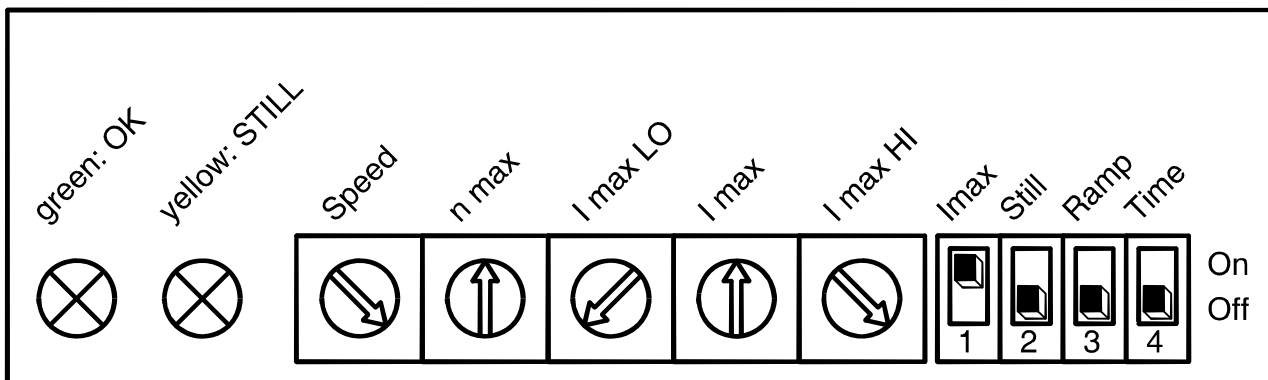
<i>OK</i>	LED green Note: The LED is lit when the operating voltage is present, overtemperature and the undervoltage protection circuit has not been initiated.
<i>Still</i>	LED yellow

The lamp is lit at low speed. The value of the speed is defined by setting of switch S1/4.

3. Block Diagram



3.1 Control Elements



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 (*Power* ⊕ - *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 hall and encoder (> 30 cm)

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

Analog Signals (*I max*, *Speed*; *I-Pot HI*; *I-Pot LO*; *I-Pot*)

- 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.

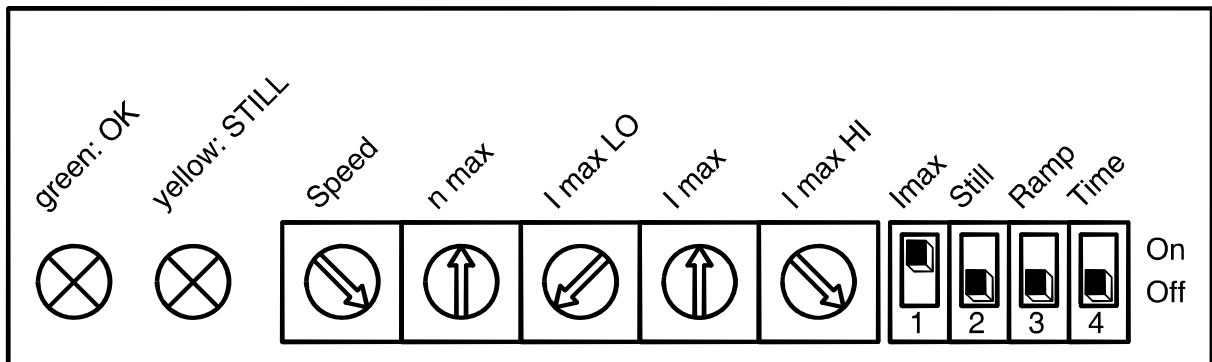
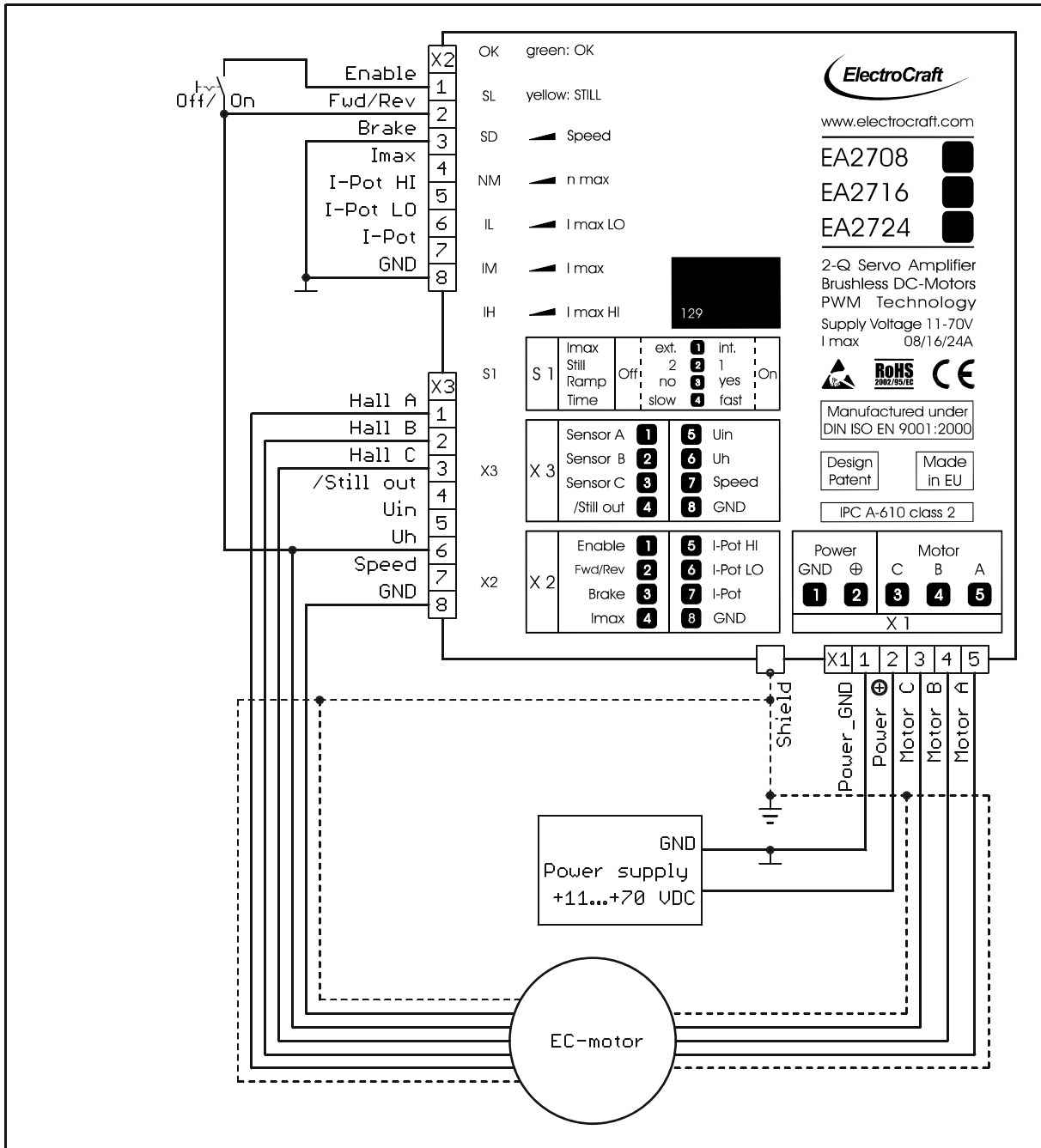
Digital Signals (*Enable*; *Fwd/Rev*; *Brake*; */Still out*)

- 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 resistance to the noise immunity, always connect unused logical inputs to a fix potential (*GND* or *+5V*). Do not connect the CAT5 connectors to any network.

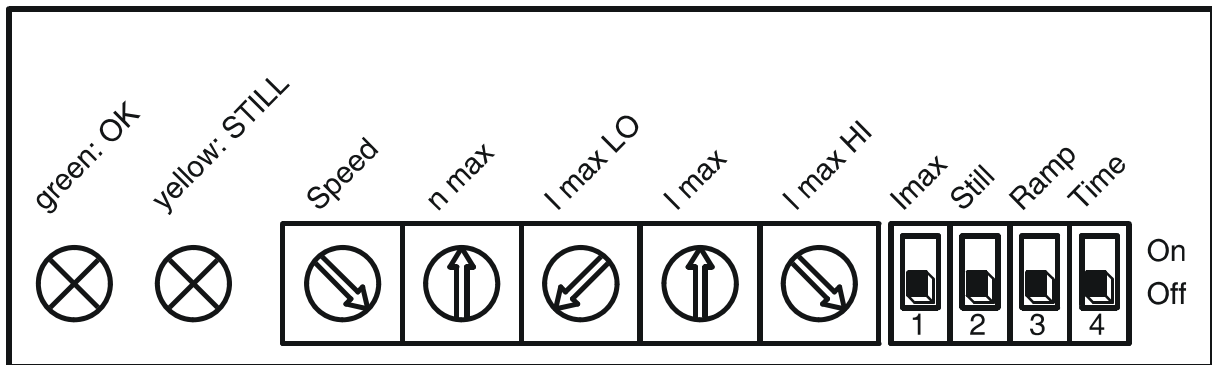
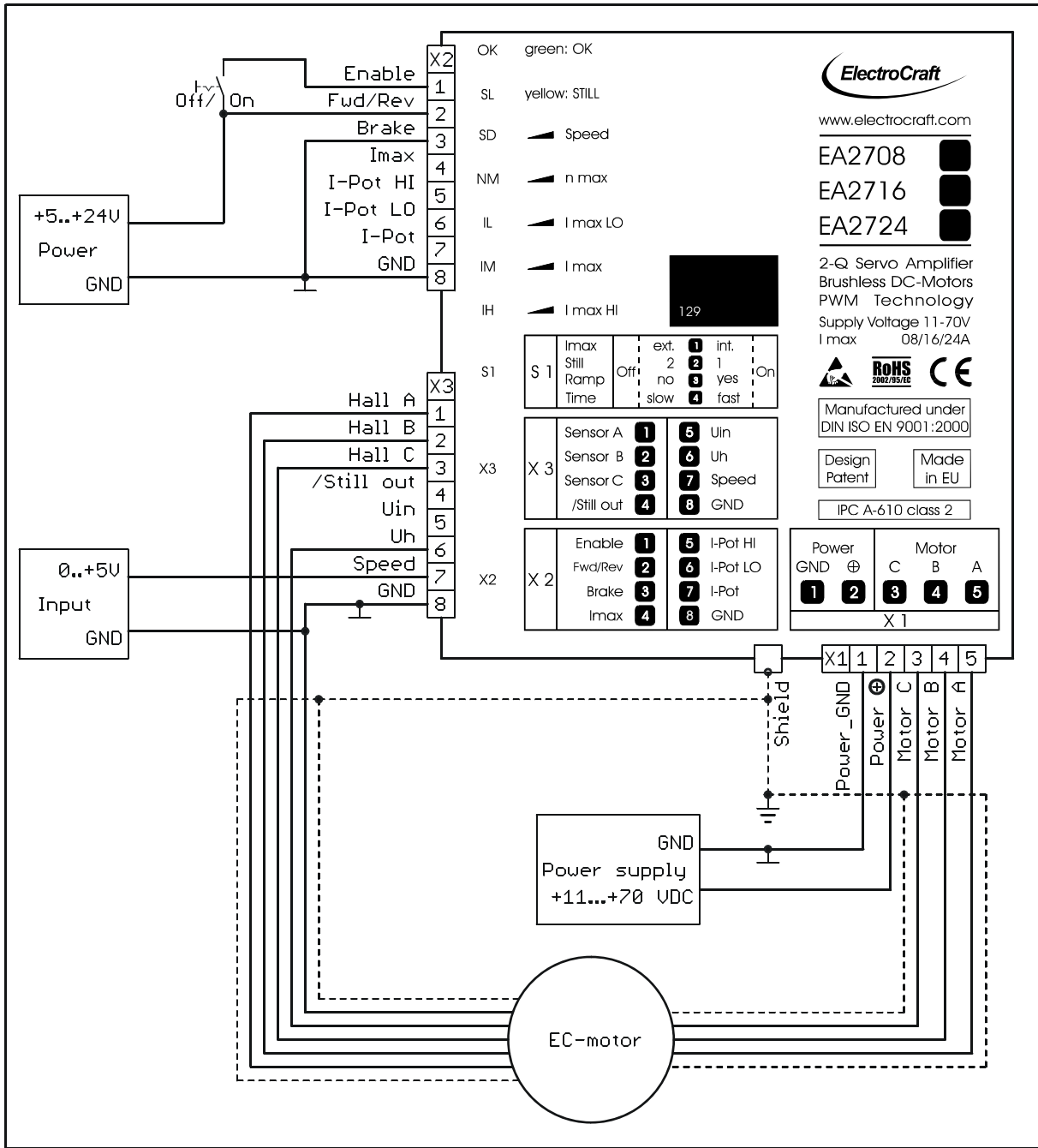
4.1 Wiring Example I



4.1.1 Adjustment procedure for Wiring Example I

1. Set the internal *Speed* potentiometer to right (maximum speed).
2. Turn the potentiometer *n max*, until the desired maximum speed is reached.
3. If the current limiters *I max LO* and *I max HI* are not used set *I max LO* to left and *I max HI* to right (refer chapter 5.2).
4. Adjust with the *I max* potentiometer the maximum motor current to a value requested by you. 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 a oscilloscope or a multimeter.

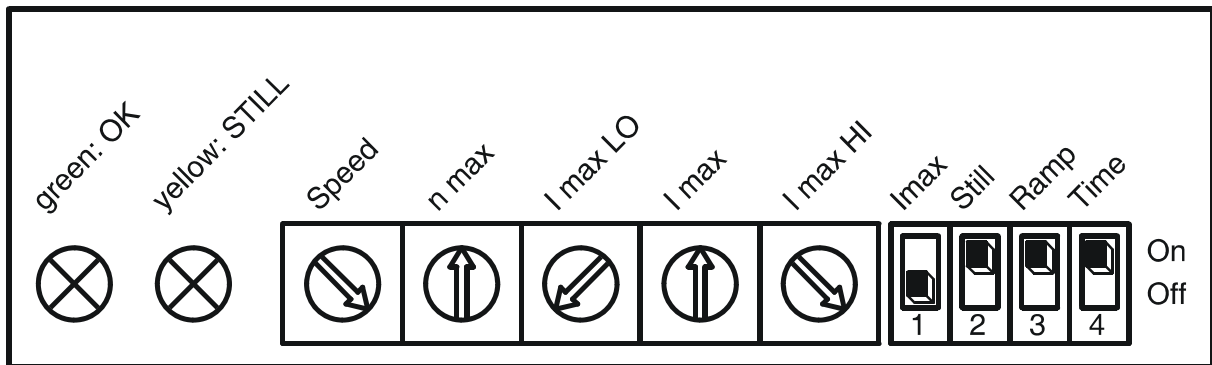
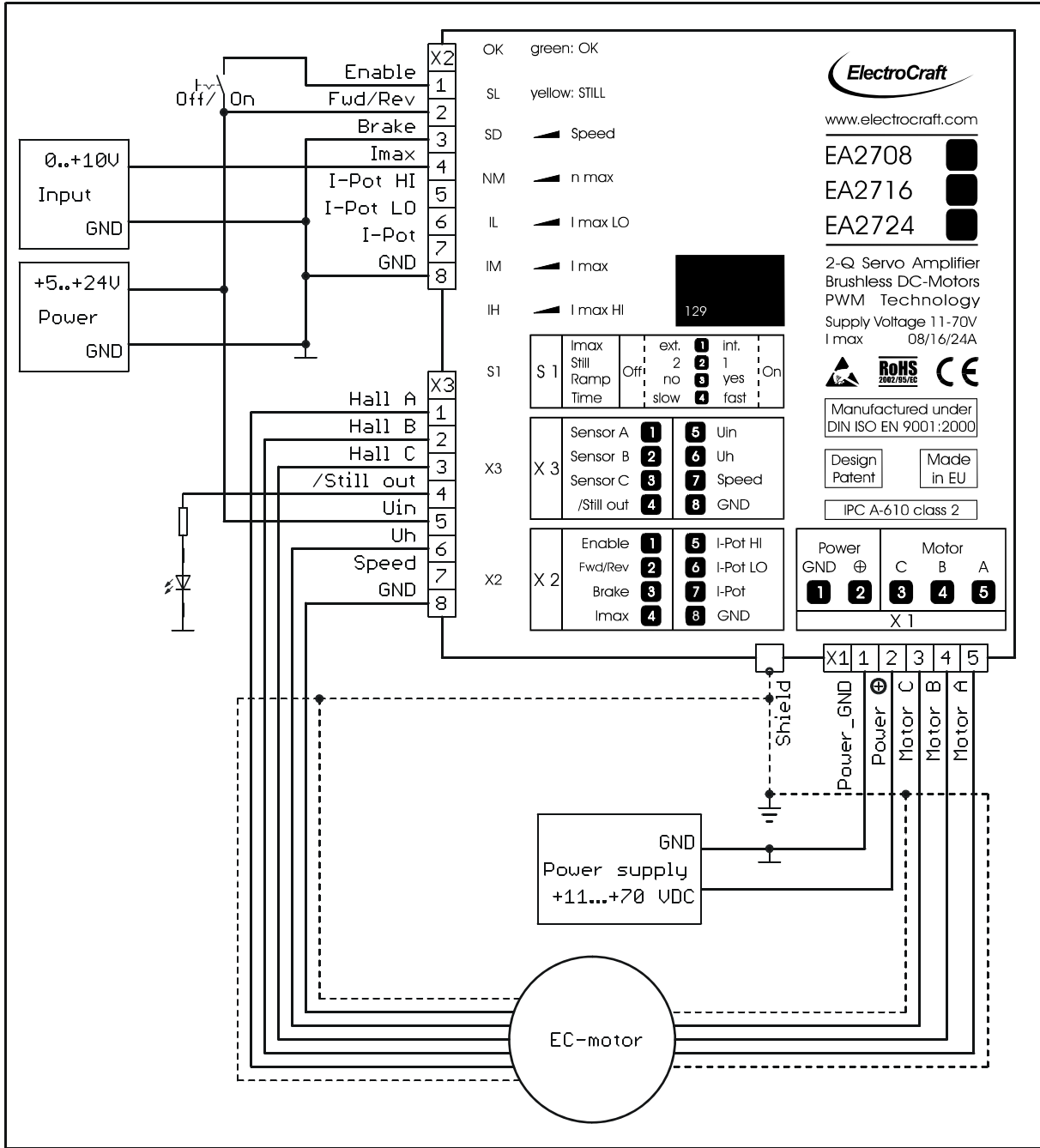
4.2 Wiring Example II



4.2.1 Adjustment procedure for Wiring Example II

1. Set the internal *Speed* potentiometer to left (minimum).
2. Chose the maximum speed (e.g. 5V) to the *Speed* input.
3. Turn the potentiometer *n max*, until the desired maximum speed is reached.
4. If the current limiters *I max LO* and *I max HI* are not used set *I max LO* to left and *I max HI* to right (refer chapter 5.2).
5. Adjust with the *I max* potentiometer the maximum motor current to a value requested by you. 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 a oscilloscope or a multimeter.

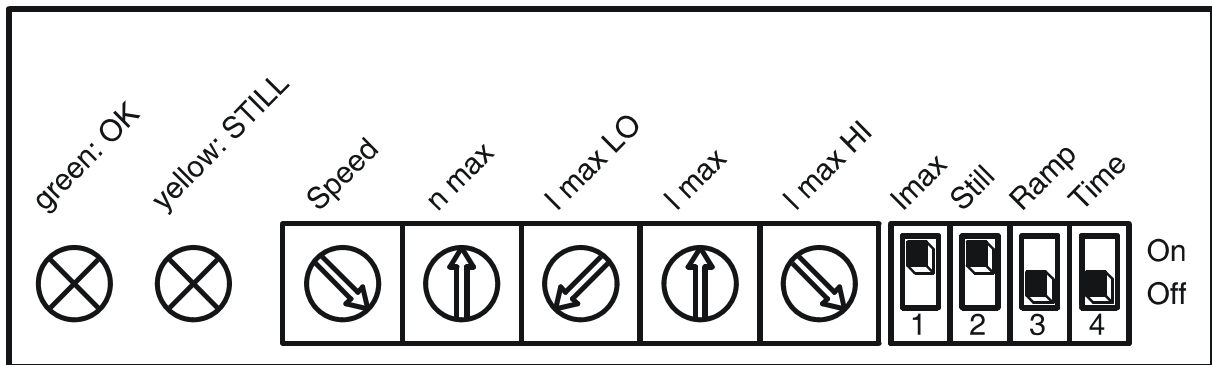
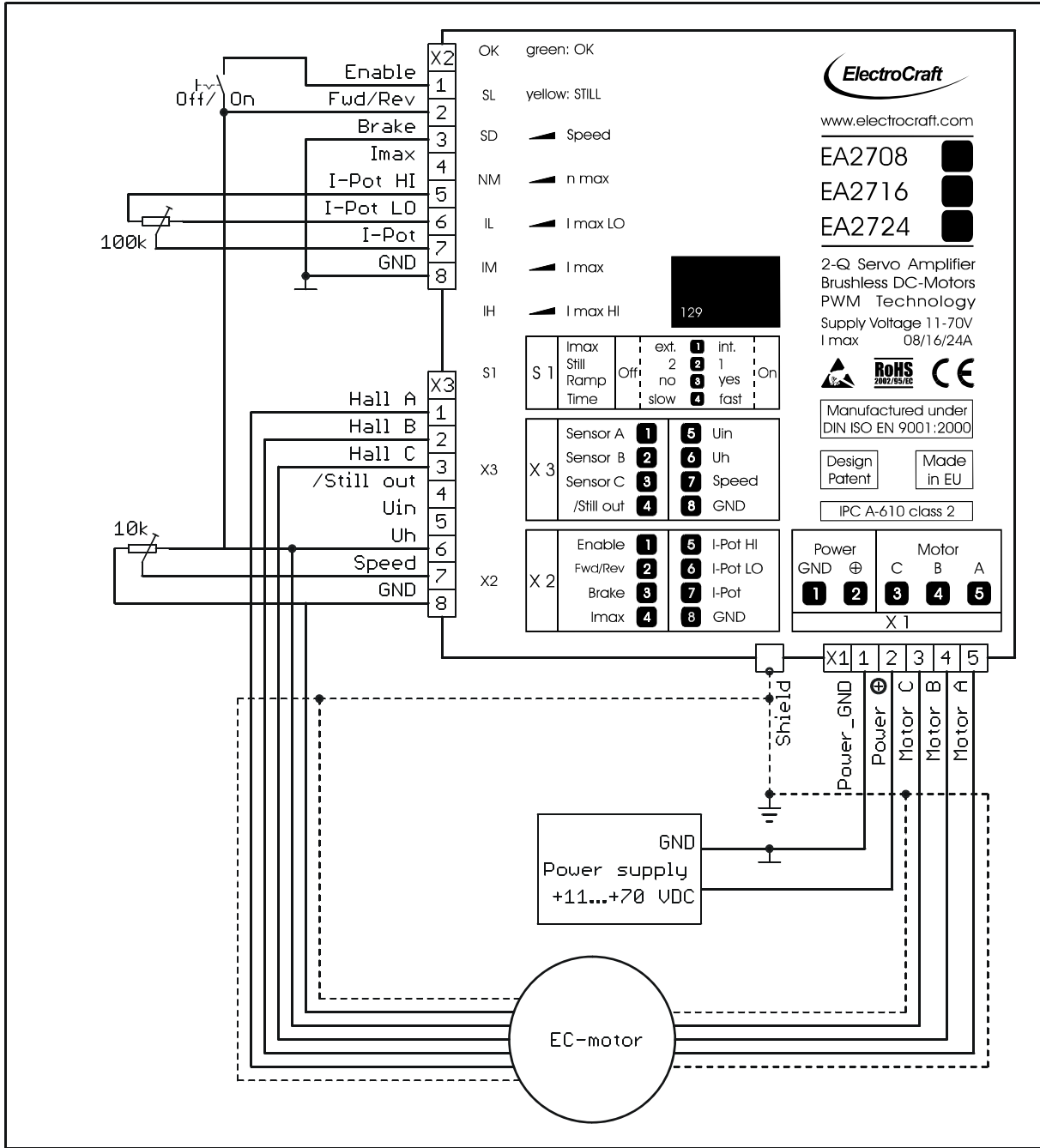
4.3 Wiring Example III



4.3.1 Adjustment procedure for Wiring Example III

1. Set the internal *Speed* potentiometer to right (maximum speed).
2. Turn the potentiometer *n max*, until the desired maximum speed is reached.
3. If the current limiters *I max LO* and *I max HI* are not used set *I max LO* to left and *I max HI* to right (refer chapter 5.2).
4. Adjust with an external voltage to the *I max* input the maximum motor current to a value requested by you. 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 a oscilloscope or a multimeter.
5. To check the LED at the */Still out* output reduce the motor speed with the *Speed* pot till the LED is lit, at the same time the internal yellow LED *Still* is activated.

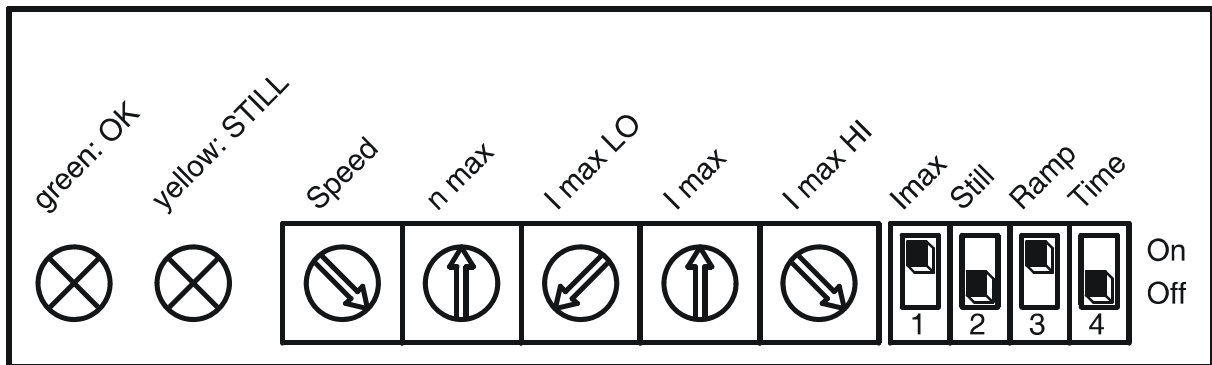
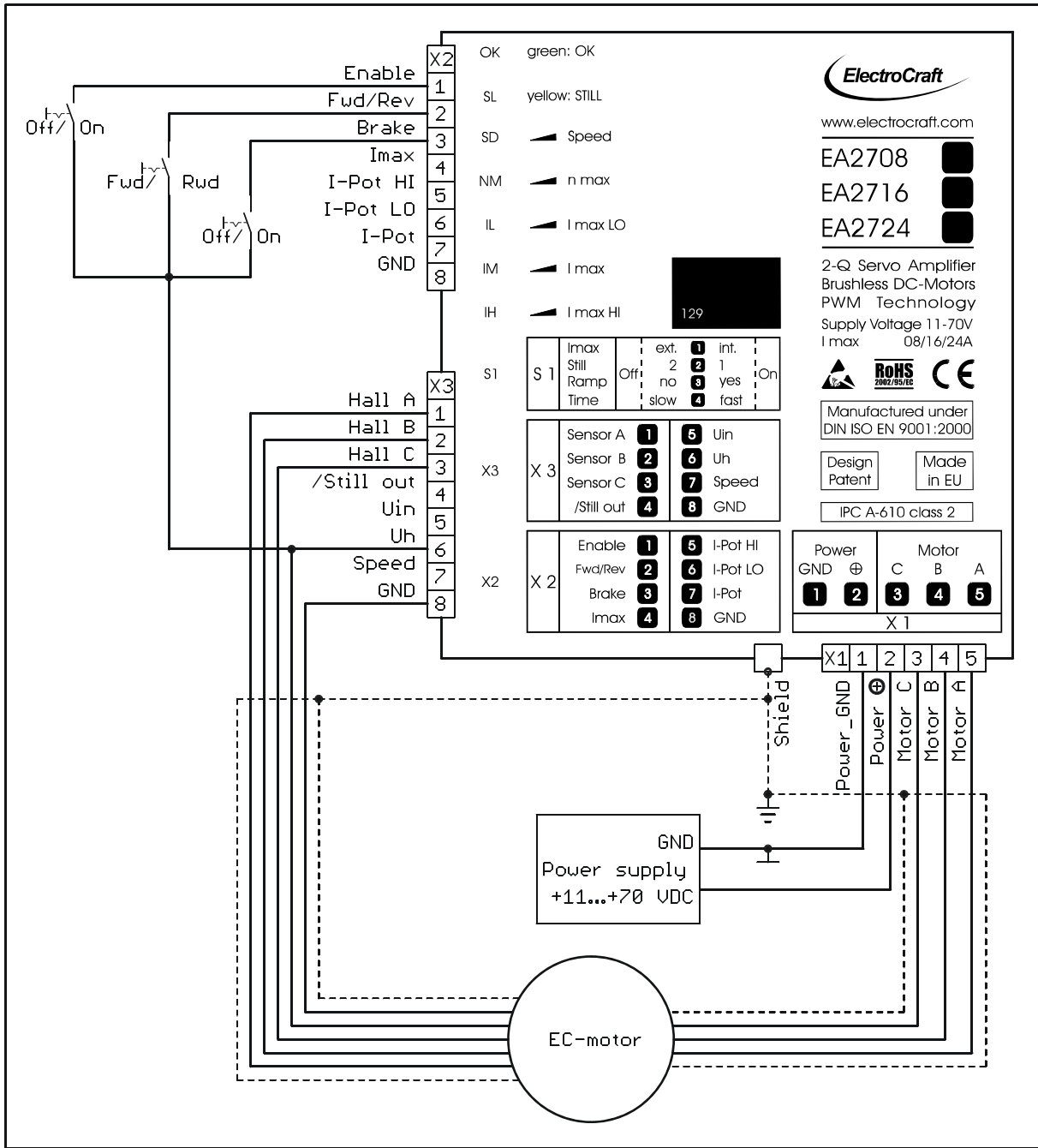
4.4 Wiring Example IV



4.4.1 Adjustment procedure for Wiring Example IV

1. Set the internal *Speed* potentiometer to left (minimum).
2. Chose the maximum speed to the *Speed* input with the external potentiometer.
3. Turn the potentiometer *n max*, until the desired maximum speed is reached.
4. If the current limiters *I max LO* and *I max HI* are not used set *I max LO* to left and *I max HI* to right (refer chapter 5.2).
5. Adjust with the external *I max* potentiometer the maximum motor current to a value requested by you. 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 a oscilloscope or a multimeter.

4.5 Wiring Example V



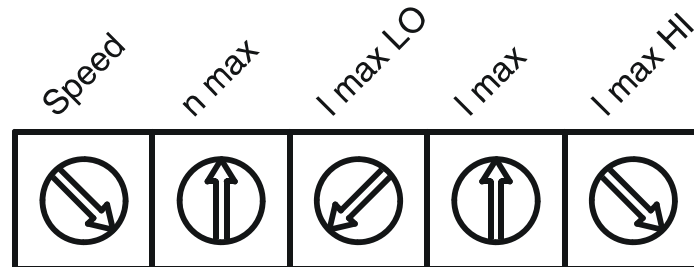
Note: In case of using the switches *Fwd/Rev* or *Brake* refer chapter 7.1.

5. Explanation of Terminals, Dip Switches, & Potentiometers

5.1 Terminals

Terminal	Label	Description																				
S1	<table border="1"> <tr> <td rowspan="4">S 1</td> <td>Imax</td> <td>ext.</td> <td>1</td> <td>int.</td> <td rowspan="4">On</td> </tr> <tr> <td>Still</td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td>Ramp</td> <td>Off</td> <td>3</td> <td>yes</td> </tr> <tr> <td>Time</td> <td>slow</td> <td>4</td> <td>fast</td> </tr> </table>	S 1	Imax	ext.	1	int.	On	Still	2	2	1	Ramp	Off	3	yes	Time	slow	4	fast	<p>S1-1 select <i>Imax</i> extern or intern.</p> <p>S1-2 change the <i>Still</i> level.</p> <p>S1-3 select the <i>Ramp</i> off or on.</p> <p>S1-4 select the time of the <i>Ramp</i>.</p>		
S 1	Imax		ext.	1	int.	On																
	Still		2	2	1																	
	Ramp		Off	3	yes																	
	Time	slow	4	fast																		
X1	<table border="1"> <tr> <td colspan="2">Power</td> <td colspan="3">Motor</td> </tr> <tr> <td>GND</td> <td>⊕</td> <td>C</td> <td>B</td> <td>A</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td colspan="5" style="text-align: center;">X 1</td> </tr> </table>	Power		Motor			GND	⊕	C	B	A	1	2	3	4	5	X 1					<p>Pin 1 & 2 connect to power supply.</p> <p>Pin 3 & 4 & 5 connect to motor.</p>
Power		Motor																				
GND	⊕	C	B	A																		
1	2	3	4	5																		
X 1																						
X2	<table border="1"> <tr> <td rowspan="4">X 2</td> <td>Enable</td> <td>1</td> <td>5</td> <td>I-Pot HI</td> </tr> <tr> <td>Fwd/Rev</td> <td>2</td> <td>6</td> <td>I-Pot LO</td> </tr> <tr> <td>Brake</td> <td>3</td> <td>7</td> <td>I-Pot</td> </tr> <tr> <td>Imax</td> <td>4</td> <td>8</td> <td>GND</td> </tr> </table>	X 2	Enable	1	5	I-Pot HI	Fwd/Rev	2	6	I-Pot LO	Brake	3	7	I-Pot	Imax	4	8	GND	<p>Pin 1 input <i>Enable</i>.</p> <p>Pin 2 input direction <i>Fwd/Rev</i>.</p> <p>Pin 3 input <i>Brake</i>.</p> <p>Pin 4 input <i>Imax</i> extern.</p> <p>Pin 5 input external <i>Imax</i> pot.</p> <p>Pin 8 GND.</p>			
X 2	Enable		1	5	I-Pot HI																	
	Fwd/Rev		2	6	I-Pot LO																	
	Brake		3	7	I-Pot																	
	Imax	4	8	GND																		
X3	<table border="1"> <tr> <td rowspan="4">X 3</td> <td>Sensor A</td> <td>1</td> <td>5</td> <td>Uin</td> </tr> <tr> <td>Sensor B</td> <td>2</td> <td>6</td> <td>Uh</td> </tr> <tr> <td>Sensor C</td> <td>3</td> <td>7</td> <td>Speed</td> </tr> <tr> <td>/Still out</td> <td>4</td> <td>8</td> <td>GND</td> </tr> </table>	X 3	Sensor A	1	5	Uin	Sensor B	2	6	Uh	Sensor C	3	7	Speed	/Still out	4	8	GND	<p>Pin 1 & 2 & 3 input for hall signals.</p> <p>Pin 4 output signal <i>/Still out</i>.</p> <p>Pin 5 voltage input for <i>/Still out</i>.</p> <p>Pin 6 voltage output +6 VDC.</p> <p>Pin 7 input <i>Speed</i> extern.</p> <p>Pin 8 GND.</p>			
X 3	Sensor A		1	5	Uin																	
	Sensor B		2	6	Uh																	
	Sensor C		3	7	Speed																	
	/Still out	4	8	GND																		

5.2 Potentiometers



Potentiometer	Function	Turning to the Left (ccw)	Turning to the Right (cw)
<i>Speed</i>	Set the motor speed	Decrease motor speed	Increase motor speed
<i>n max</i>	Definition of max. number of revolutions	Value is decreased	Value is increased
<i>I max LO</i>	Adjust lower <i>I max</i> level	Decline the lower limit	Raise the lower limit
<i>I max</i>	Set value for max. current	Reduce the current	Increase the current
<i>I max HI</i>	Adjust upper <i>I max</i> level	Upper limit is lowered	Upper limit is raised

I max, I max LO, I max HI

The *I max* potentiometer is normally set to the maximum possible motor current. With the potentiometers *I max LO* and *I max HI* it is possible to shift the adjustment range of the *I max* potentiometer. The tuning area of *I max LO* is from 10% to 90% and of *I max HI* from 10% to 100% of the maximum continuous current of the drive.

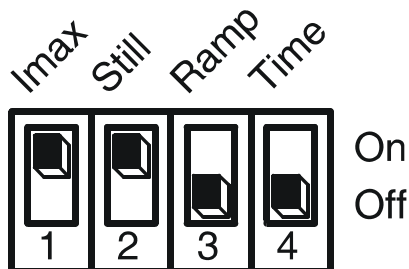
If now needed that the range of the *I max* potentiometer is limited (8 A drive version), e.g. from 4 A to 8 A, set *I max LO* about to the centre (ca. 4 A) and *I max HI* to the right stop (ca. 8 A). The range of the *I max* potentiometer is now reduced to wanted area.

This is possible with the internal also with the external *I max* potentiometer.

Remark:

Do not adjust the potentiometer *I max LO* higher than *I max HI* and *I max HI* lower than *I max LO*. *I max* can't be set if there is a overlapping of these areas.

5.3 Dip switches



S1-1	<i>Imax</i>	Methods of entering the set value for the current reduction
Off:	<i>Imax</i> extern	External selection using a voltage between X2/4 and X2/8 or a external potentiometer at X2/5, X2/6, X2/7.
On:	<i>Imax</i> intern	The internal <i>Imax</i> potentiometer is used.
S1-2	<i>Still</i>	Selecting the speed for the Still function
Off:	<i>Still</i> 2	A speed lower than 1000 rpm will activate the output.
On:	<i>Still</i> 1	A speed lower than 100 rpm will activate the output.
S1-3	<i>Ramp</i>	Ramp function
Off:	<i>Ramp</i> Off	The feature is disabled.
On:	<i>Ramp</i> On	The output signal is increasing in that time which is defined by the <i>Time</i> switch.
S1-4	<i>Time</i>	Setting the Ramp time
Off:	<i>Time</i> slow	The time of the ramp is set approximately to 4 sec.
On:	<i>Time</i> fast	The time of the ramp is set approximately to 1 sec.

6. Glossary

Speed

The function for the *Speed*-potentiometer is to adjust the motor speed. If the speed is set by the input X3/7 set the potentiometer to the left stop.

n max

Use this potentiometer to adapt the desired maximum speed to the amplitude of the present set value. For Example: if maximum of 5V is to be used for maximum Speed then send 5V and adjust that maximum with the *n max* potentiometer

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.

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 decide on the maximum possible motor current.

The following limits have to be observed:

- Left stop: 10 % of rated current of 08A, 16 A, 24 A (model dependent)
- Right stop: 100 % of rated current + (0 – +20 %)
- With the pots *I max LO* and *I max HI* is it possible to adjust the upper and the lower limits (refer chapter 5.2).

Note:

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

Ramp

The ramp function is activated if the switch S1/3 is set to On.

The ramp time defines the increasing time to reach the scheduled value defined by *n max*. The ramp is active after the drive is enabled, also after changing the *Speed*.

Still

This is function that shows a low speed operation of the motor.

Hall mode

This is a closed loop speed mode which is using the hall signals as a feedback input for the speed.

Brushless motor

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.

Commutation

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.

Hall sensor

A feedback device which is used in a brushless servo system to provide information for the amplifier to electronically commutate the motor. The device uses a magnetized wheel and hall effect sensors to generate the commutation signals.

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.

Closed loop

A 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 a 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

The amount of torque at zero speed, which a motor can continuously deliver without exceeding its thermal rating. Determined by applying DC current through two windings with rotor locked, while monitoring temperature. Specified with motor windings at maximum rated temperature, with motor in 25 °C ambient, 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

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

Driver

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.

Efficiency

The ratio of power output to power input.

Encoder

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.

Feedback

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

Four quadrant

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.

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.

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.

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 behavior caused by mechanical limitations.

Ringling

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

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. Torque is an important parameter of any motion control system.

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.

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 X2/1 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 >3.5V to the *Enable* input is necessary.

If the ramp function is applied as well, it will immediately be carried out after the activation of the connector.

Range of Input Voltage	0 to +24 VDC
Input Impedance	4.7 kOhm to GND
Permanent Input Protection	-0.6 to +50 VDC
<i>Enable</i> activated	>3.5 VDC
<i>Enable</i> disabled	<0.6 V, open or connected to GND

***Fwd/Rev*: Changing the Direction of the Rotation**

If the *Fwd/Rev* input X2/2 is at LO the motor turns in counter clockwise at HI he works in clockwise rotation.

Range of Input Voltage	0 to +24 VDC
Input Impedance	4.7 kOhm to GND
Permanent Input Protection	-0.6 to +50 VDC
<i>Fwd/Rev</i> CW-rotation	>3.5 VDC
<i>Fwd/Rev</i> CCW-rotation	<0.6 V, open or connected to GND

Note:

It is to avoid changing the direction on fly; otherwise the motor also the drive can be damaged. For changing the direction please follow this way:

- Enable auf LO till motor has stopped
- Change the *Fwd/Rev* level
- Enable auf HI, motor is working in the other direction

***Sensor A / B / C*: Hall Feedback of the Motor**

The *Sensor* input X3/1, X3/2 and X3/3 are connected to the hall signal of the motor. The supply voltage is given by the *Uh* output at X3/6 to GND. The drive needs the signals to do the commutation and control the speed.

Range of Input Voltage	0 to +6 VDC
Input Impedance	22 kOhm to <i>Uh</i>
Permanent Input Protection	-0.6 to +24 VDC
High level	>2,4 VDC
Low level	<1 VDC

Brake: Braking the Motor

If the *Brake* input X2/3 is at GND potential or not wired at all, the function is not activated. At HI the motor is braking suddenly by shorting the motor windings to GND, even if the *Enable* input is switched off.

Range of Input Voltage	0 to +24 VDC
Input Impedance	4.7 kOhm to GND
Permanent Input Protection	-0.6 to +50 VDC
<i>Brake</i> activated	>3.5 VDC
<i>Brake</i> disabled	<0.6 V, open or connected to GND

Note:

Don't exceed the maximum braking speed, otherwise the output stage could be destroyed.

The maximum allowed braking speed is limited by the maximum permitted short circuit current and the maximum allowed kinetic energy:

- $I \leq 30 \text{ A}$
- $W_k \leq 20 \text{ Ws}$



max. allowed braking speed limited by current
($I = 30 \text{ A}$)

By the motor data's it is possible to calculate the maximum braking speed:

$$n_{\max} = 30 \text{ A} \cdot k_n \cdot (R_{Ph-Ph} + 0.05 \Omega) \quad [\text{min}^{-1}]$$

$$k_n = \text{Speed Constant} [\text{min}^{-1} \text{V}^{-1}]$$

$$R_{Ph-Ph} = \text{Terminal Resistance Phase-Phase} [\Omega]$$

At a given moment of inertia the maximum braking speed is calculated as follows:



max. allowed braking speed limited by kinetic energy
($W_k = 20 \text{ Ws}$)

$$n_{\max} = \sqrt{\frac{365}{J_R + J_L}} \cdot 10\,000 \quad [\text{min}^{-1}]$$

$$J_R = \text{Rotor Inertia} [\text{gcm}^2]$$

$$J_L = \text{Load Inertia} [\text{gcm}^2]$$

7.2 Digital Outputs

/Still out: Low Speed Monitor

Whenever the motor is drop under a defined level the */Still out* output responds (LO position). The level is given by switch S1/2 and the adjusting of the potentiometer *n max*.

- Level 1: circa 100 rpm
- Level 2: circa 1000 rpm

The output is applicable in three different modes:

- A) As Open-Collector, LO active, TTL-compatible or up to +30 V industrial logic.
- B) As Push-Pull output with an output impedance = 50 Ohm, when connecting the upper voltage signal to input *Uin*. With *Uin* = +24 V, an SPS with photocoupler inputs can directly be controlled.
- C) Together with a bridge between the +5V output and *Verror* input, applicable as Push-Pull-output for a connection to TTL or CMOS-Logics without external upper voltage signal.

Range of Output Voltage	0.6 V – (<i>Uin</i> – 0.6 V) with <i>Uin</i> = +5 V to +30 V
Output Impedance	50 Ohm
Permanent Output Current	100 mA max., source and sink

Note:

The logical state of this output is clearly visible by the yellow *Still* LED on the front panel.

7.3 Analog Inputs

Speed: Set Value Input for Speed

An external analog signal for speed entered using +Speed input. If the voltage is 0V, the motor stops. If the voltage is positive (+0,6 V to +4,5 V) the drive is working in the regulation area. Over +4,5 V the motor is unregulated with a limited maximum speed through the *n max* potentiometer.

Range of Input Voltage	0 V to +5 V
Input Impedance	100 kOhm
Permanent Input Protection	-0,6 V to +30 V

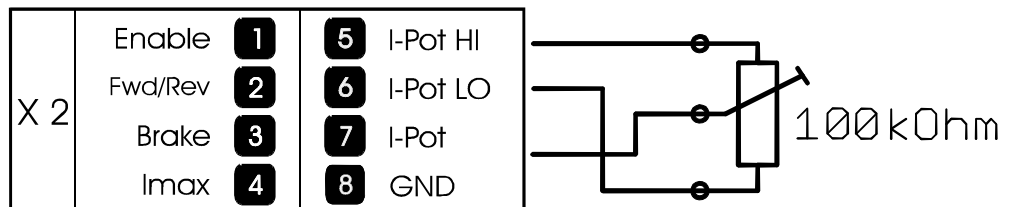
Remark:

To use the external Speed input set the internal Speed potentiometer to left stop.

I-Pot, I-Pot LO, I-Pot HI: Set Value Input for Current Limiting

An external analog signal for the current limiting entered using +I-Pot input. At 0 V input voltage the current is set to circa 10% of the defined driver current. With 10 V the driver will deliver the maximum current. To use this input set S1/1 to Off. The internal *I max* potentiometer are deactivated.

Range of Input Voltage	0 V to +10 V
Input Impedance	100 kOhm
Permanent Input Protection	-30 V to +30 V



Alternative it is possible to use external potentiometer with a value of 100 kOhm instead the internal *I max* potentiometer. Connect the tap to *I-Pot*, the left stop to *I-Pot LO* and the right stop to *I-Pot HI*. In this case the internal *I max LO* and *I max HI* potentiometer are working like description in chapter 5.2.

8. Basic Troubleshooting

Motor runaway

- The logic of the hall connection is permuted.
- Reduce the maximal speed with pot *n max*.
- Input frequency of feedback has been exceeded.

Motor noise

- Use additional choke in the motor

Motor has no torque

- Increase the admissible current with *I max* pot.

Motor drifts at standstill

- 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.
- Check the polarity of the motor windings and hall signals.
- Is the phasing (120° or 60°) of the hall correct?
- The polarity of the motor windings or hall signals is permuted.
- The feedback loop is open. Check wiring.

Over temperature

- 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 MA0025
- Connecting module WA2509
- Choke modules IA3100 (with 3 x 50 μ H)
and IA3101 (with 3 x 100 μ H)
- Heatsink (No Fan) HA3008
- Heatsink (1 Fan) HA3018
- Heatsink (2 Fans) HA3028
- Shielded CAT5 Cables:

CA2005	Red	5"
CA2010	Red	10"
CA2020	Red	20"
CA2030	Red	30"
CA8005	Yellow	5"
CA8010	Yellow	10"
CA8020	Yellow	20"
CA8030	Yellow	30"
CA4005	Grey	5"
CA4010	Grey	10"
CA4020	Grey	20"
CA4030	Grey	30"
CA6005	Blue	5"
CA6010	Blue	10"
CA6020	Blue	20"
CA6030	Blue	30"

- Braking module ASO-BM-70-30

10. Warranties & Disclaimers

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For Warranty, Repair, or Technical Assistance contact:

Customer Support, North America / USA & Canada

Motion Control Technologies: (800) 697-6715

Email: info@electrocraft.com

Customer Support, Europe (except Germany), Middle East, Africa, Australia, Central & South America

Customer service at +44 (0) 127 050 8800

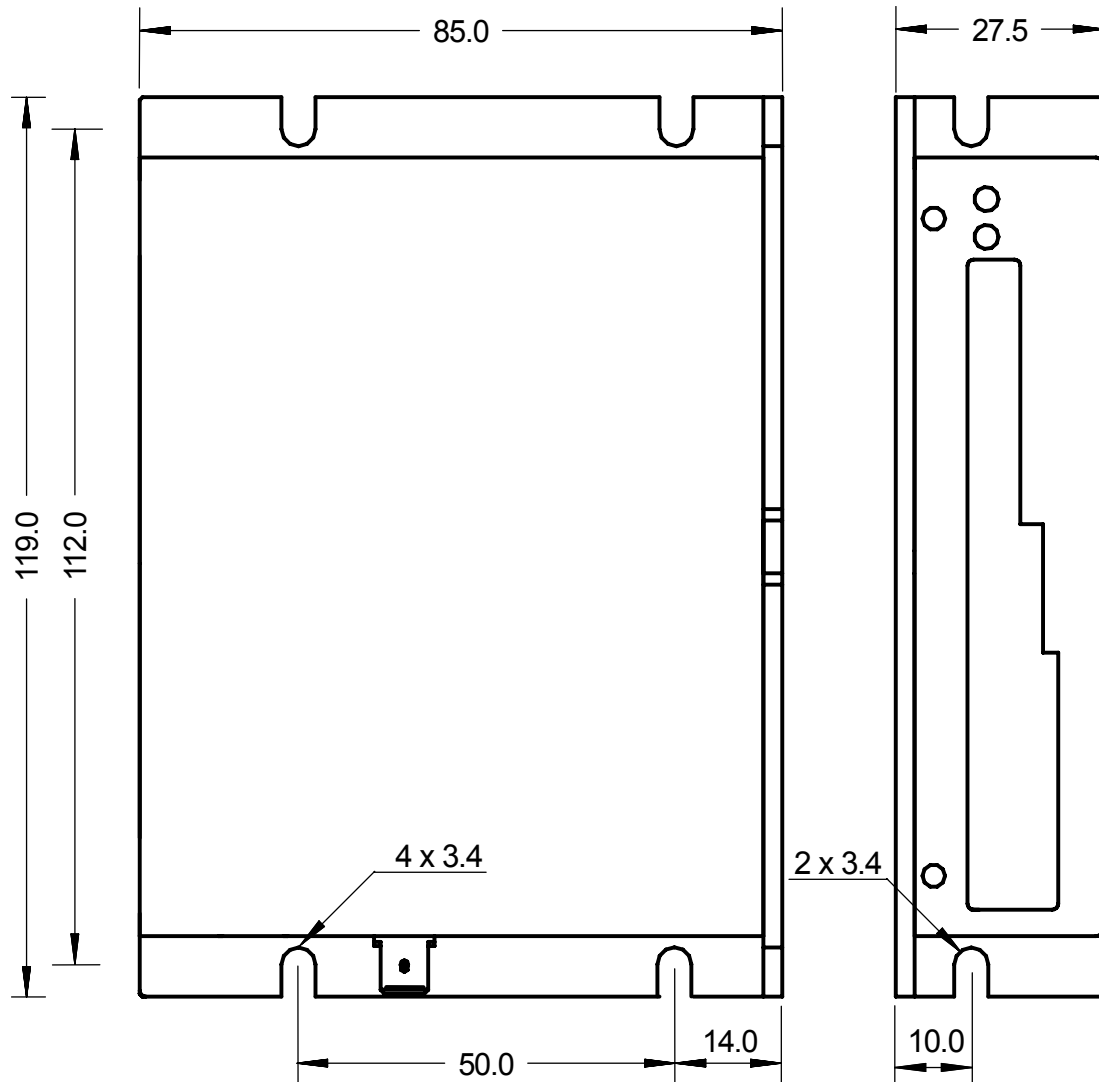
Email: EMEAsales@electrocraft.com

Customer Support, Germany

Customer service at +49 (0) 711 727205 0

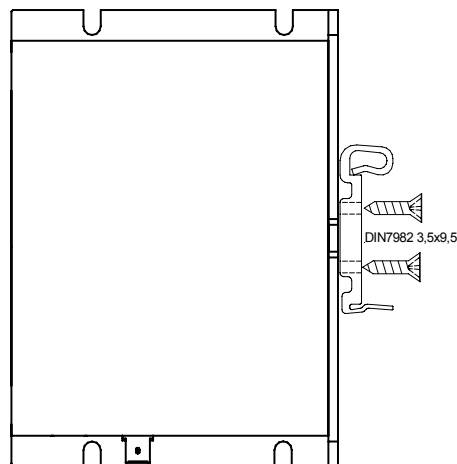
Email: info@electrocraft.de

11. Dimensions



All dimensions in mm.

12. Mounting Din rail adapter



EA27xx_L08 Subject to change without prior notice.