

4-Q PWM Servo – 09 / 18 A

For Brush-Commutated DC Motors up to 1260 W

DA4709 / DA4718


- 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
- Wide range supply voltage between +11 and +70 VDC for different kinds of DC-power supplies
- Protected against over temperature and over current
- MOSFet-technology, efficiency 95%
- Continuous current up to 09 / 18 A (model dependent)

Basic drive description: The DA4709/DA4718 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 DA4709/DA4718 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 DA4709/DA4718, 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 DA4709/DA4718 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 /Error output. (Refer chapter 7.2)
Nominal Current	9 / 18 A (model dependent)
Peak Current	18 / 36 A (model dependent)
Maximum Power (only achievable with additional heatsink & proper mounting, see accessories.)	630 / 1260 W (model dependent)
Switching Frequency	50 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 (AWG14). 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.
Signal terminals	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>	Active High TTL, +24 VDC; Resistance = 4,7 kOhm
<i>Ramp</i>	Active High TTL, +24 VDC; Resistance = 4,7 kOhm
<i>I max</i>	Analog 0 – +10 VDC ; Resistance > 100 kOhm
<i>Set value</i>	Analog -10 – +10 VDC ; Resistance = 20 kOhm
<i>Tacho</i>	Analog -50 – +50 VDC ; Resistance = 50 kOhm

2.5 Outputs

Auxiliary Voltage Output +5V	+5 V / 50 mA
Auxiliary Voltage Output +10V	+10 V / 20 mA
Auxiliary Voltage Output -10V	-10 V / 20 mA
<i>/Error</i>	Open Collector / Push Pull / TTL / +24 VDC; Resistance = 50 Ohm
<i>Monitor I</i>	Analog 0 – +10 VDC ; Resistance = 200 Ohm; max. 20 mA
<i>Monitor n</i>	Analog 0 – +10 VDC ; Resistance = 200 Ohm; max. 20 mA

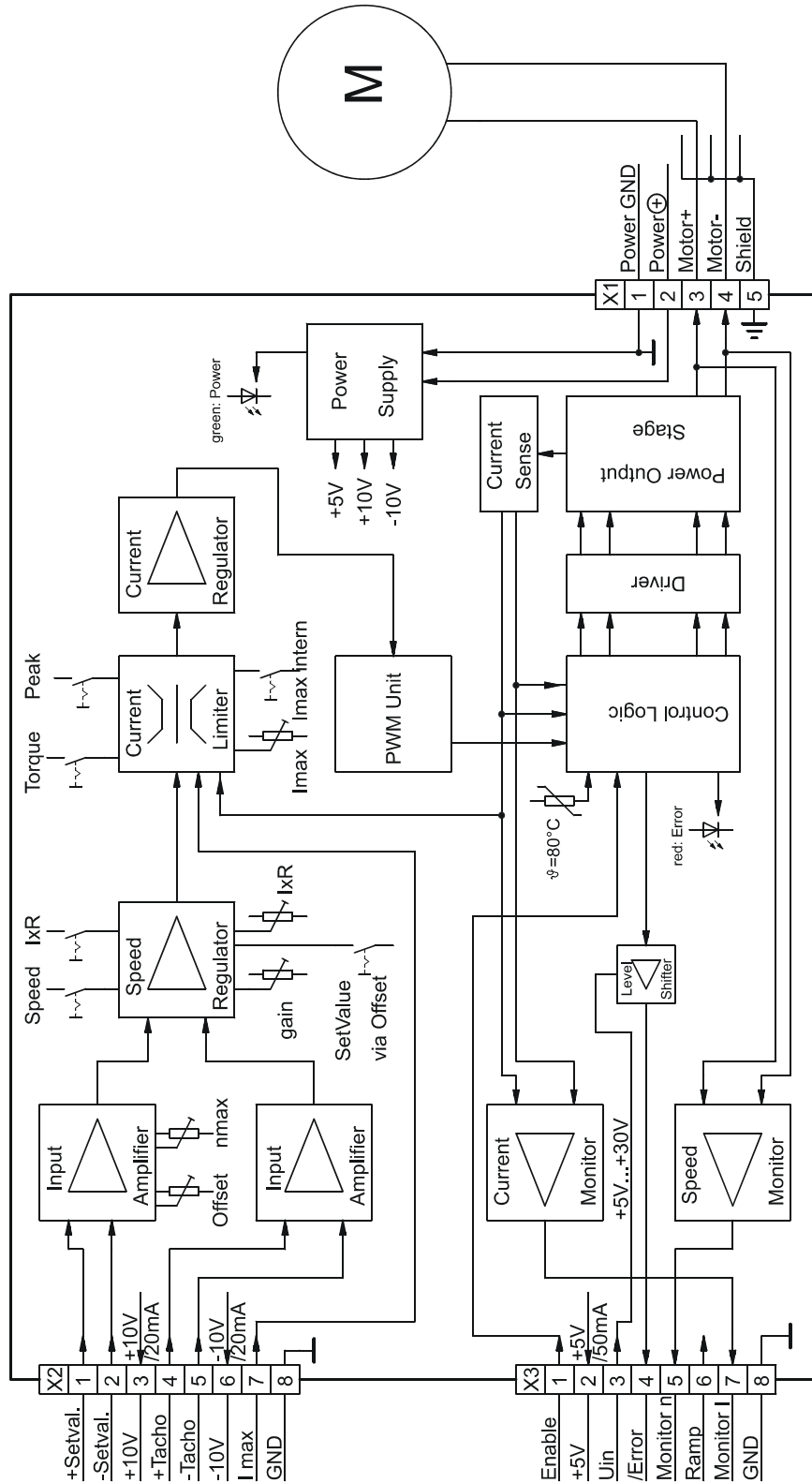
2.6 Control LEDs

<i>Power</i>	LED green Note: The LED is lit when the operating voltage is present and the undervoltage protection circuit has not been initiated.
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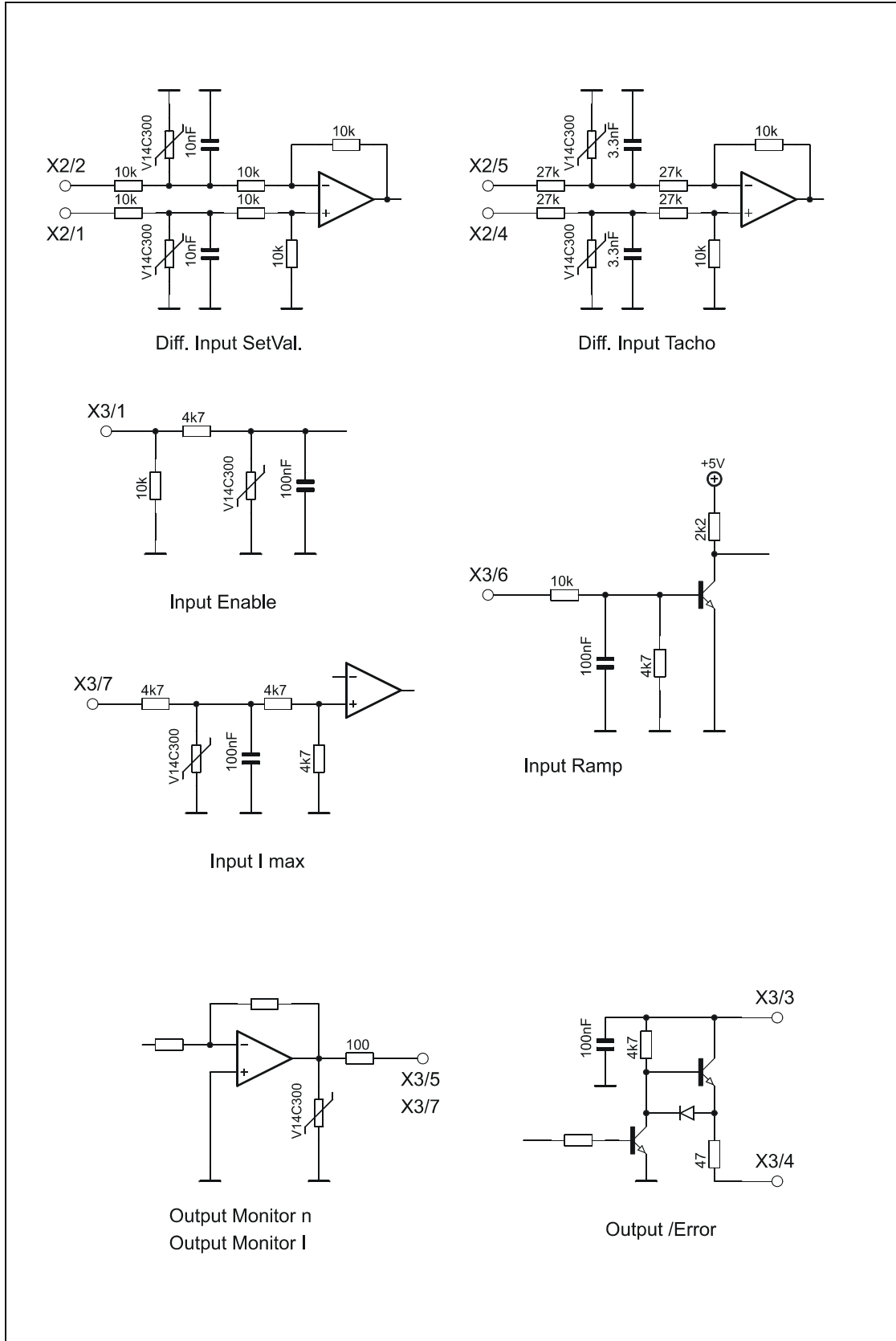
<i>Error</i>	LED red The lamp is lit at overtemperature. It disables only after reset the Enable input. If the error condition persists (i.e. temperature still too high), this is immediately visible by the red LED.
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3. Drive Overview

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.

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*, *+Set val.*, *-Set val.*; *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*, *Ramp*, */Error*)

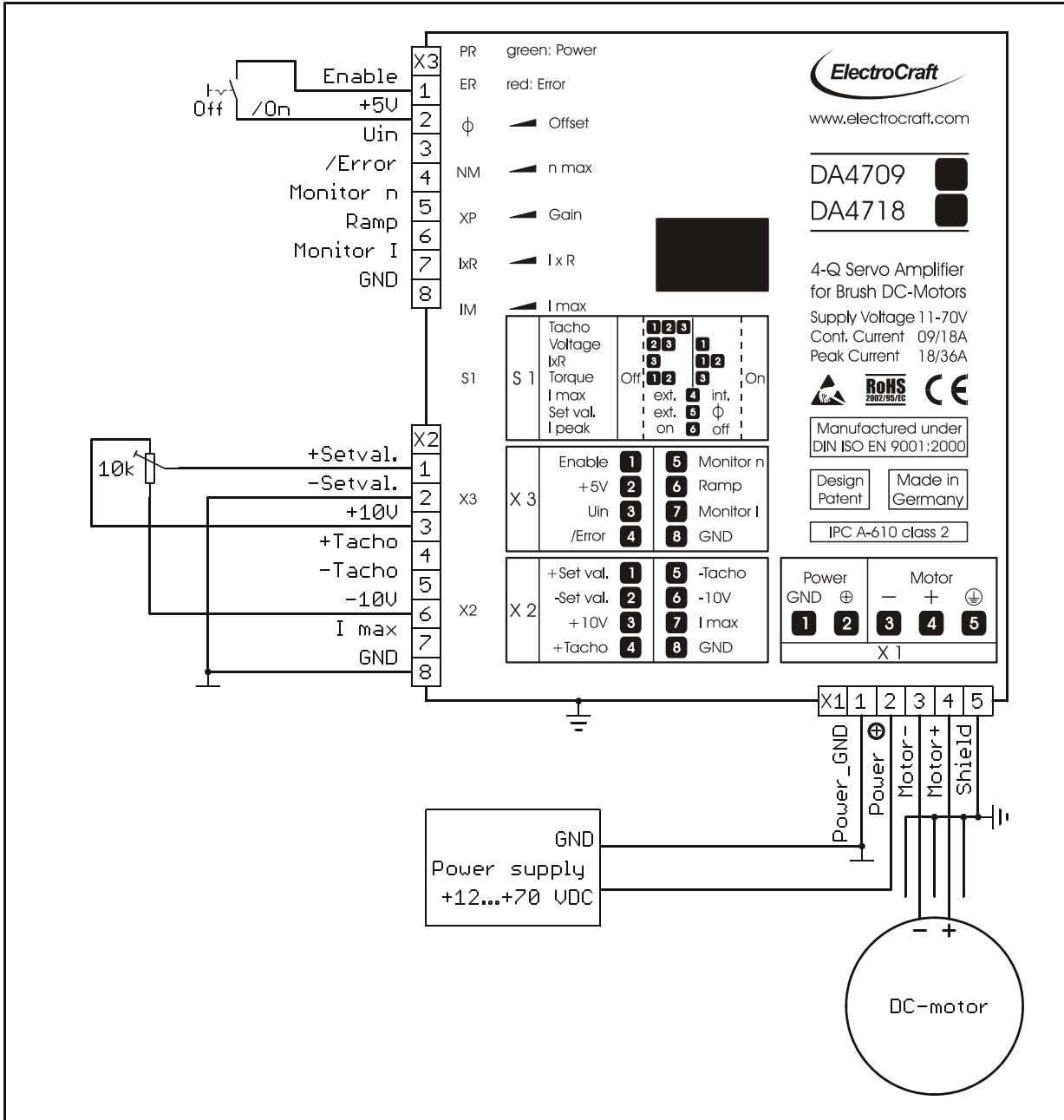
- No shielding required.

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.

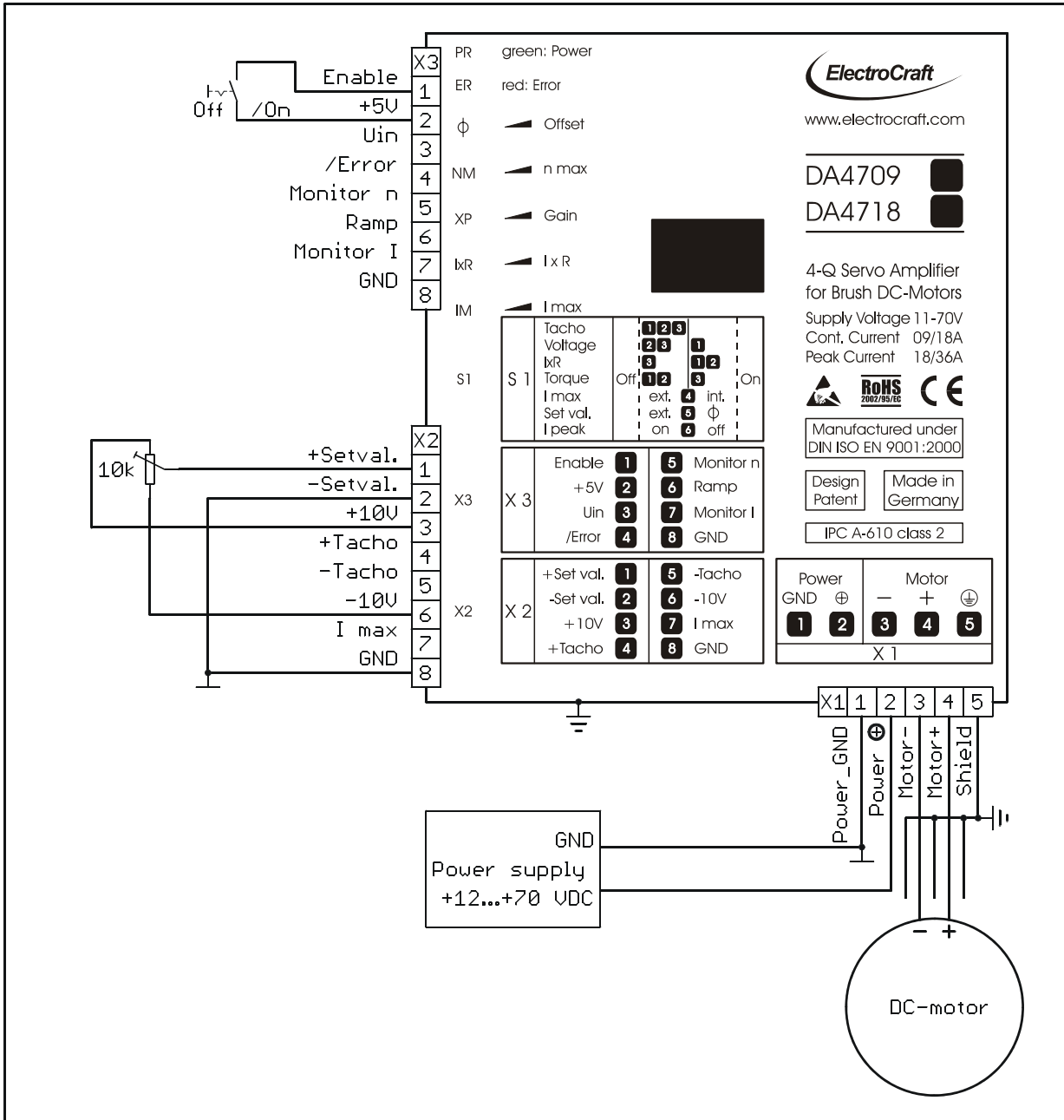
4.1 Wiring Example I – Voltage Mode



4.1.1 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.

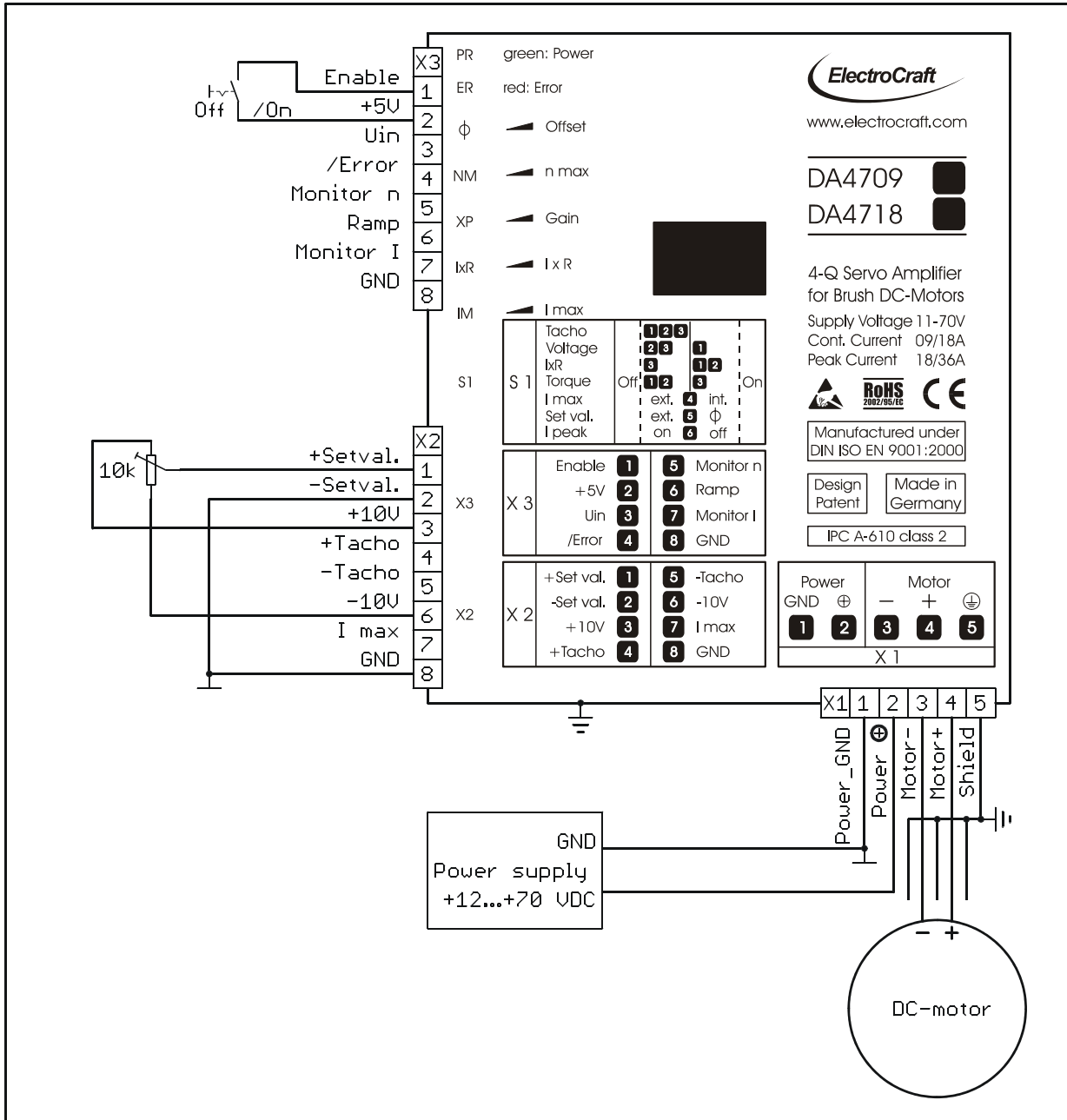
4.2 Wiring Example II – IxR Comp Mode



4.2.1 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.

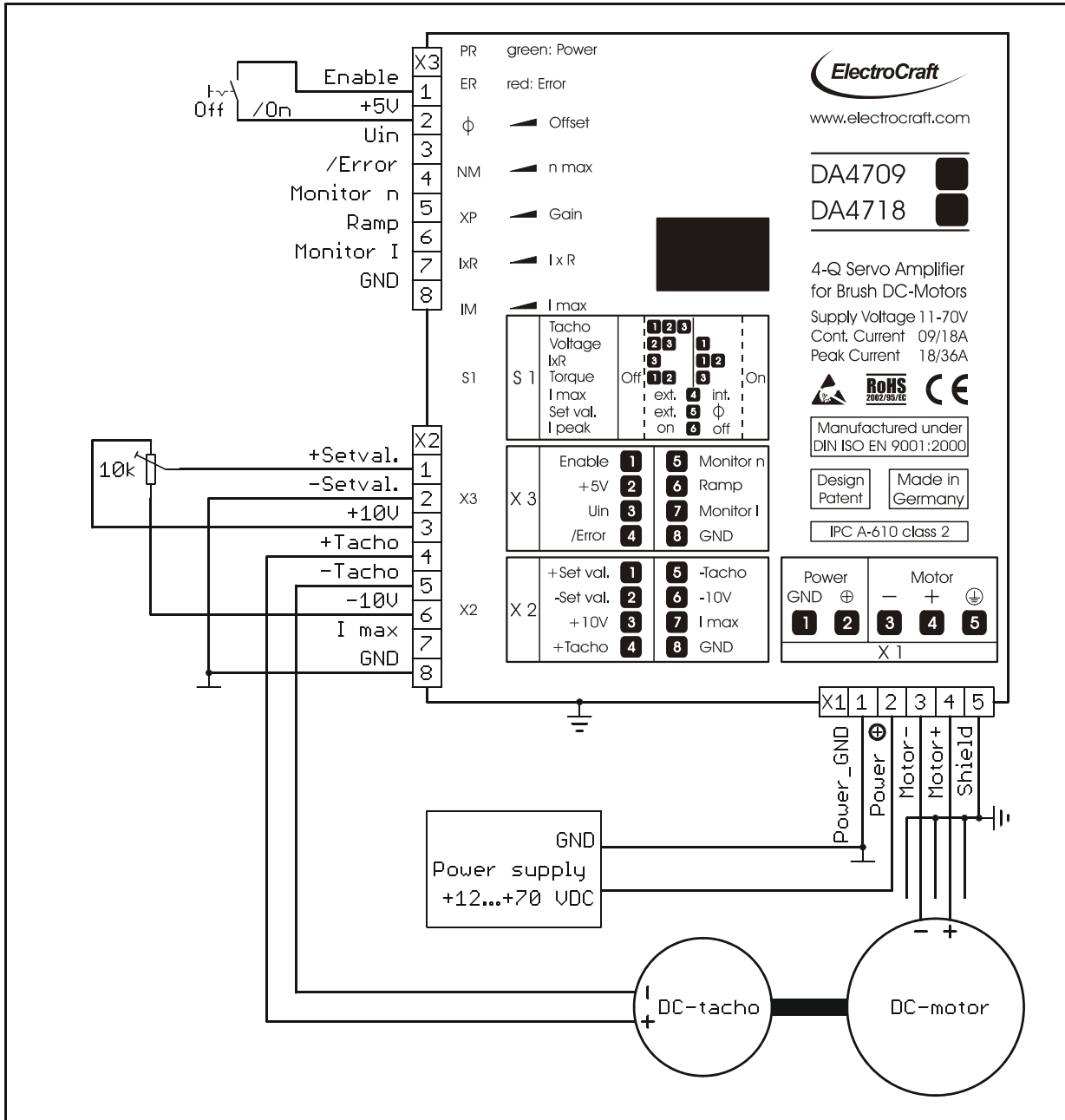
4.3 Wiring Example III – Torque Mode



4.3.1 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. To optimize the response time, 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.

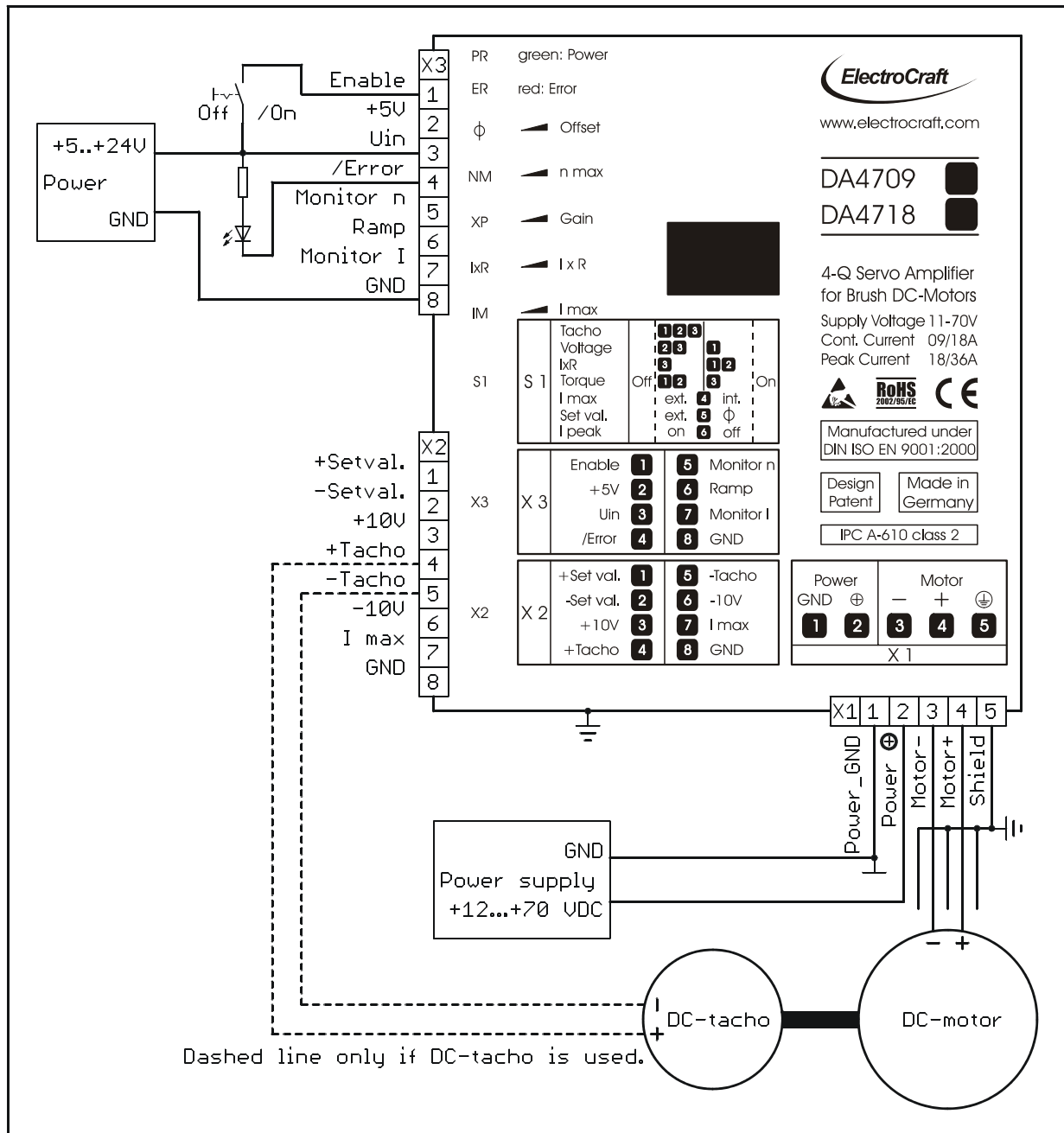
4.4 Wiring Example IV – Tacho Mode



4.4.1 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.

4.5 Wiring Example V



Setting of S1:

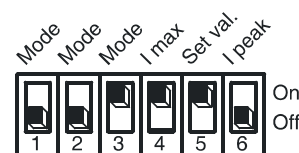
Voltage Mode:



IxR Comp Mode



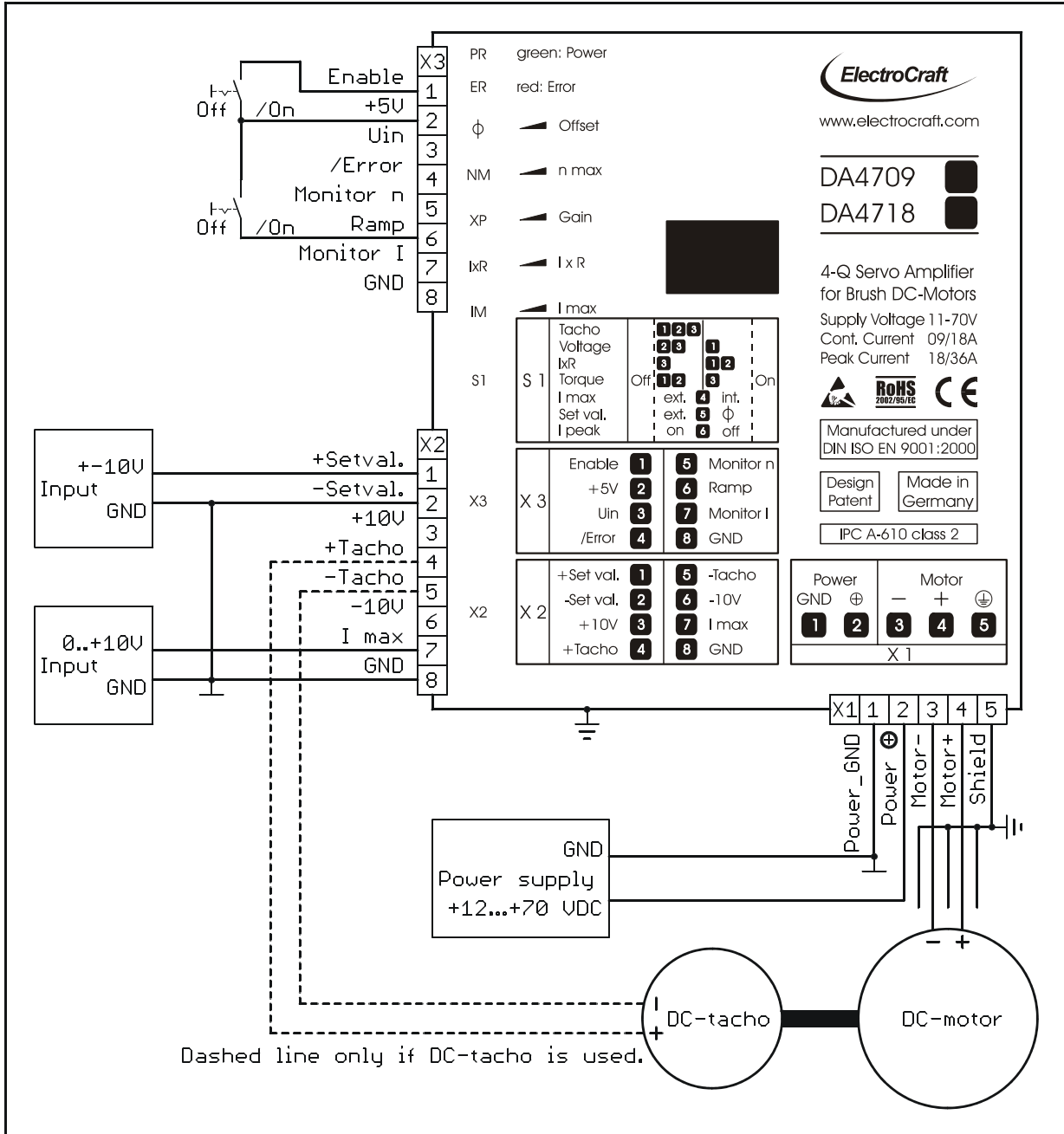
Torque Mode



Tacho Mode

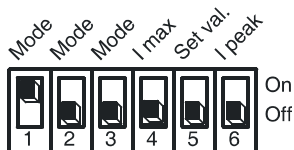


4.6 Wiring Example VI



Setting of S1:

Voltage Mode:



IxR Comp Mode



Torque Mode



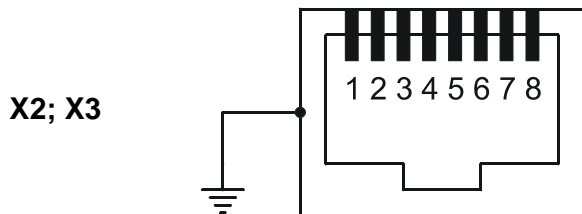
Tacho Mode



5. Explanation of Terminals, Dip Switches, & Potentiometers

5.1 Terminals

Terminal	Label	Description
S1		<p>S1-1; S1-2; S1-3 select mode.</p> <p>S1-4 select set value for <i>I max</i>.</p> <p>S1-5 change set value to <i>Offset-pot</i>.</p> <p>S1-6 select <i>I peak</i> on or off.</p>
X1		<p>Pin 1 & 2 connect to power supply.</p> <p>Pin 3 & 4 connect to motor.</p> <p>Pin 5 shield for the motor cable.</p>
X2		<p>Pin 1 & 2 input set value.</p> <p>Pin 4 & 5 input tacho feedback.</p> <p>Pin 3 & 6 voltage output +-10 VDC.</p> <p>Pin 7 input <i>I max</i> extern.</p> <p>Pin 8 GND.</p>
X3		<p>Pin 1 input Enable.</p> <p>Pin 2 voltage output +5 VDC.</p> <p>Pin 3 voltage input for <i>/Error</i>.</p> <p>Pin 4 output signal <i>/Error</i>.</p> <p>Pin 5 voltage output speed monitor.</p> <p>Pin 6 input <i>Ramp</i>.</p> <p>Pin 7 voltage output for current.</p> <p>Pin 8 GND.</p>



Pinning of CAT5 connectors.

5.2 Potentiometers

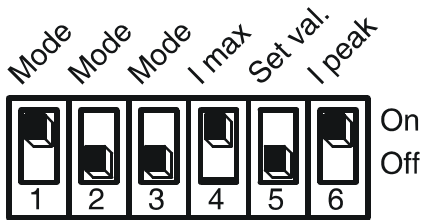


Potentiometer	Function	Turning to the Left (ccw)	Turning to the Right (cw)
<i>Offset</i>	Zero Offset (motor stands still)	Motor rotates counterclockwise	Clockwise rotation
<i>n max</i>	Definition of max. number of revolutions	Value is decreased	Value is increased
<i>Gain</i>	Gain	Factor lowered	Factor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

Potentiometer setting for start up:

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

5.3 Dip switches



S1-1	S1-2	S1-3	Function Mode
Off:	Off:	Off:	Speed Control by DC-tacho
On:	Off:	Off:	Speed Control by Voltage
On:	On:	Off:	IxR Compensation
Off:	Off:	On:	Torque Control

S1-4	<i>I max</i>	Methods of entering the current limit
Off:	<i>I max</i> extern	The current limit is entered using an external voltage to X2/7.
On:	<i>I max</i> intern	The limit is set using the internal potentiometer <i>I max</i> .

S1-5	<i>Set val.</i>	Methods of entering the set value
Off:	<i>Set val.</i> extern	External selection using a voltage between X2/1 and X2/2.
On:	<i>Set val.</i> intern	The internal <i>Offset</i> potentiometer is used.

S1-6	<i>I peak</i>	Pulsed Current
Off:	<i>I peak</i> On	The output delivers a pulsed current for a phase of 100 ms, corresponding to the double value of <i>I max</i> . If needed the pulsed current is activated again after 400 ms.
On:	<i>I peak</i> Off	The feature is disabled.

Setting	Voltage Mode:	IxR Mode	Torque Mode	Tacho Mode
<i>I</i> max intern Set value extern <i>I</i> peak off				
<i>I</i> max extern Set value extern <i>I</i> peak off				
<i>I</i> max intern Set value intern <i>I</i> peak on				
<i>I</i> max extern Set value intern <i>I</i> peak on				
<i>I</i> max intern Set value extern <i>I</i> peak on				
<i>I</i> max extern Set value extern <i>I</i> peak on				
<i>I</i> max intern Set value intern <i>I</i> peak off				
<i>I</i> max extern Set value intern <i>I</i> peak off				

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 the switch S1-5 (*Set val.*) to be in *On* position. 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.

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.

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 9 A, 18 A (model dependent)
- 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.

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*, for both directions. The function works in all modes. The ramp function is activated with input X3/Pin7.

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.

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.

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.

Ringling

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 $>3.5V$ 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.

Additional information about the schematic refer chapter 3.2.

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

Ramp:

To turn the Ramp function on/off use Plug X3, pin 2 to pin 6.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +24 V
Input Impedance	4.7 kOhm to GND
Permanent Input Protection	-0.6 V to +50 V
<i>Ramp</i> activated	>3.5 V
<i>Ramp</i> deactivated	<0.6 V, open or connected to GND
Ramp Time	5 sec



Note:

If not using the Ramp function jumper GND – pin 8 to Ramp Input.

7.2 Digital Outputs

/Error: Monitoring Output

Whenever a system failure occurs (i.e. overtemperature or over current), the */Error* output responds (LO position), and the red LED on the front panel is lit. 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 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 $R_i = 50 \text{ Ohm}$, when connecting the upper voltage signal to input U_{in} . With $U_{in} = +24 \text{ V}$, an SPS with photocoupler inputs can directly be controlled.
- C) Together with a bridge between the +5V output and U_{in} input, applicable as Push-Pull-output for a connection to TTL or CMOS-Logics without external upper voltage signal.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	$0.6 \text{ V} - (U_{in} - 0.6 \text{ V})$ with $U_{in} = +5 \text{ V to } +30 \text{ V}$
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 red *Error* LED on the front panel.

7.3 Analog Inputs

+Set val. –Set val.: Inputs for Set Values

An external +10/-10 V analog signal for speed or current are entered using +Set val. and –Set val. inputs. If the effective voltage is 0V, the motor stops. If the effective voltage is positive, there is also a positive voltage between *Motor+* and *Motor-* output. If the input is negative, the output consequently will be negative as well.

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

As an alternative, the set value can be entered using an external potentiometer (10 kOhm). For this purpose, connect the slide resistance to +Set val., the left stop to -10V and the right stop to +10V. This procedure requires that the -Set val. input to be bridged to GND (see also chapter 4.1).

The admissible range for the set value is limited by the programmed *max* speed value. In this case, the desired maximum speed can be selected according to the maximum input voltage.

Note:



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:

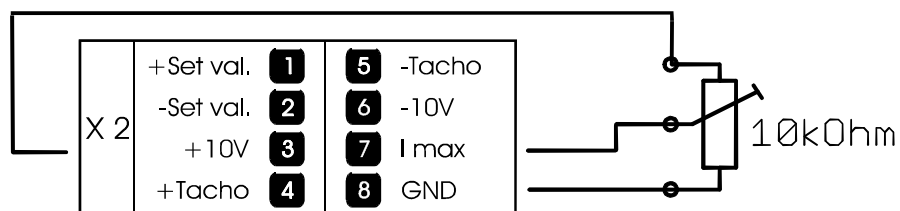
Correct polarity is crucial. Otherwise the motor operates at maximum speed without any control.

I max: Current limit

Normally the I max potentiometer is used to adjust the maximum current required for the motor. With this analog input it is possible to do that by an external signal from 0 to +10 VDC or with an external 10 kOhm potentiometer (see also chapter 4.6). For this purpose, connect the slide resistance to I max, the left stop to GND and the right stop to +10V.

Additional information about the schematic refer chapter 3.2.

Range of Input Voltage	0 to +10 VDC (.9A – 9A DA4709)/ (1.8A – 18A DA4718)
Input Impedance	100 kOhm
Permanent Input Protection	-30 V to +30 V



Note:

For this application set DIP switch S1-5 to Off position.

7.4 Analog Outputs

Monitor n: Motor Speed Output

This feature shows the motor voltage in form of a voltage signal together with the correct sign. The proportionality between signal and actual value is 0.1V per 1V.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	-10 V to +10 V
Output Impedance	100 Ohm
Permanent Output Current	20 mA max., source and sink

When measuring the speed with a known set value input voltage, this output can directly serve as speed display as long as the drive can work in a closed loop regulation.

Monitor I: Motor Current Output

Monitor I delivers a result (sign+value) representing the motor current. The proportionality factor is fixed to 1V (DA4709) / 0.5V (DA4718) per 1A motor current.

Additional information about the schematic refer chapter 3.2.

Range of Output Voltage	-10 V to +10 V
Output Impedance	100 Ohm
Permanent Output Current	20 mA 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.
- 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 MA0025
- Connecting module WA2509
- Choke modules IA2100 (with 2 x 50 μ H)
and IA2101 (with 2 x 100 μ H)
- Heatsink (No Fan) HA3008
- Heatsink (1 Fan) HA3018
- Heatsink (2 Fans) HA3028
- Shielded CAT5 Cables:

CA2005	Red	50 cm / 20"
CA2010	Red	100 cm / 39"
CA2020	Red	200 cm / 79"
CA2030	Red	300 cm / 118"
CA8005	Yellow	50 cm / 20"
CA8010	Yellow	100 cm / 39"
CA8020	Yellow	200 cm / 79"
CA8030	Yellow	300 cm / 118"
CA4005	Grey	50 cm / 20"
CA4010	Grey	100 cm / 39"
CA4020	Grey	200 cm / 79"
CA4030	Grey	300 cm / 118"
CA6005	Blue	50 cm / 20"
CA6010	Blue	100 cm / 39"
CA6020	Blue	200 cm / 79"
CA6030	Blue	300 cm / 118"

- Braking module ASO-BM-70-30.

10. Warranties & Disclaimers

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Email: info@electrocraft.com

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

Customer service at +44 (0) 127 050 8800

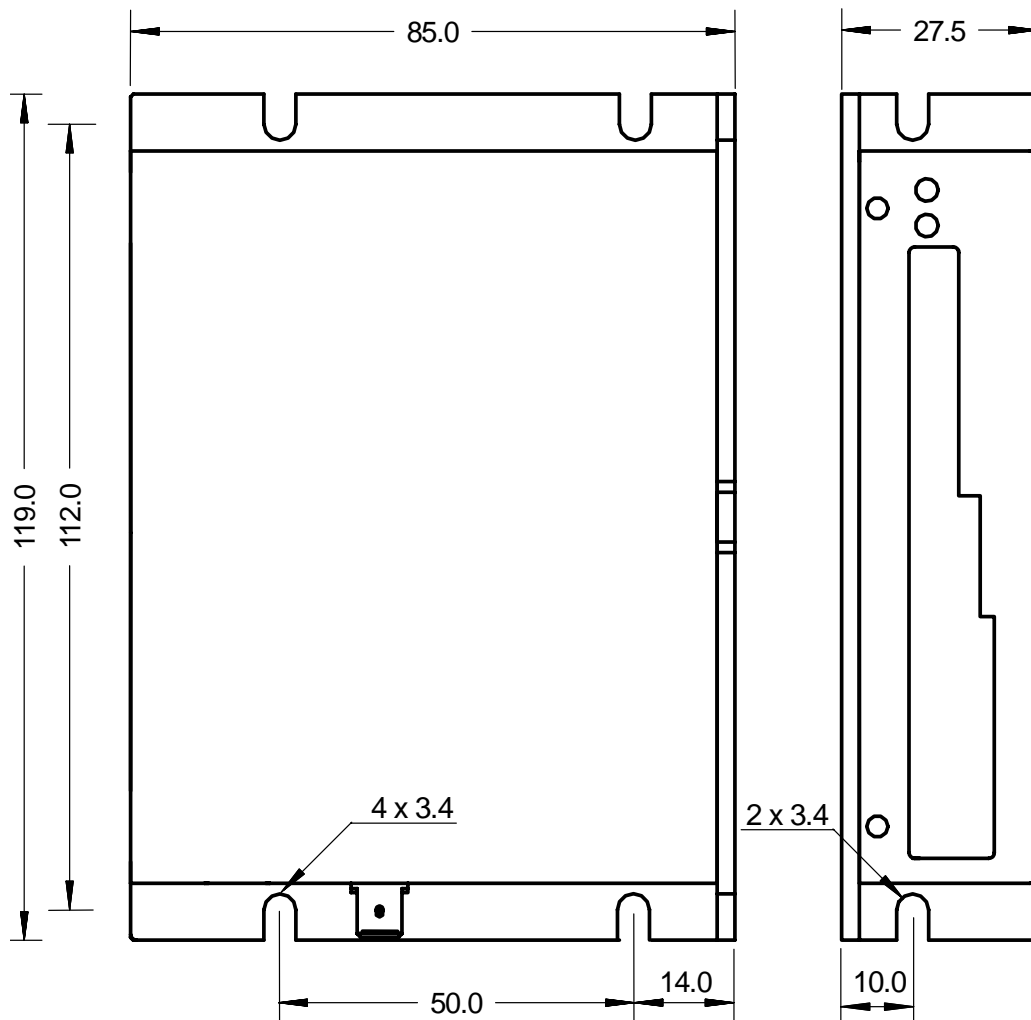
Email: EMEAsales@electrocraft.com

Customer Support, Germany

Customer service at +49 (0) 711 727205 0

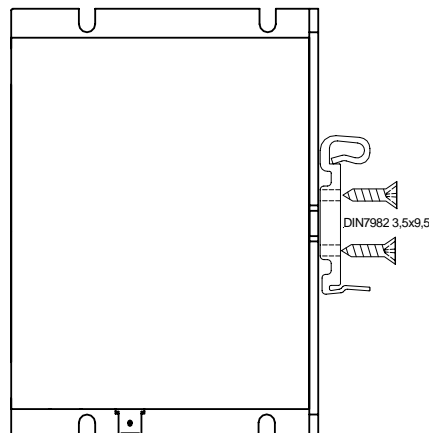
Email: info@electrocraft.de

11. Dimensions



All dimensions in mm.

12. Mounting Din rail adapter



DA47xx_E09 Subject to change without prior notice.