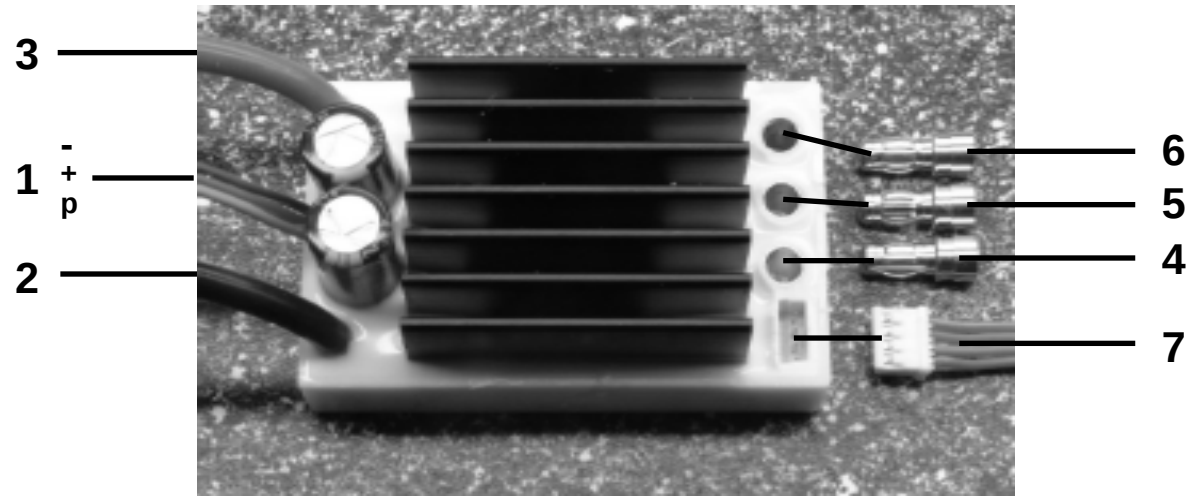
U-Force50 & U-Force75



Key to illustration:

1 Receiver Cable, 3-pin.
- = negative (black or brown),
+ = positive (red),
p = pulse (white or orange)

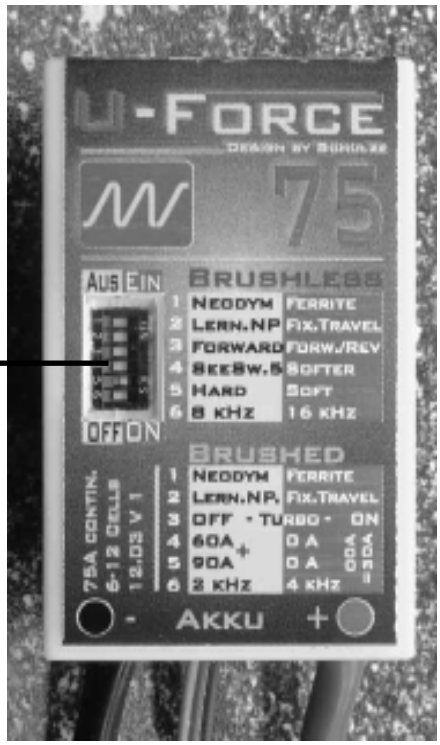
7 RS232 connector. „prog-adapt-uni“ for extra charge

Brushless motor:

2	Battery connection **-**,	neg,	black
3	Battery connection **+**,	pos,	red
4	Motor connection **A**,	phase 1	(blue)
5	Motor connection **B**,	phase 2	(yellow)
6	Motor connection **C**,	phase 3	(red)

Brushed motor:

2	Battery connection **-**,	neg.	black
3	Battery connection **+**,	pos.	red
	and motor connection	pos.	(red)
4, 5, 6	Motor connection	neg.	(blue, 1,5 mm² each)



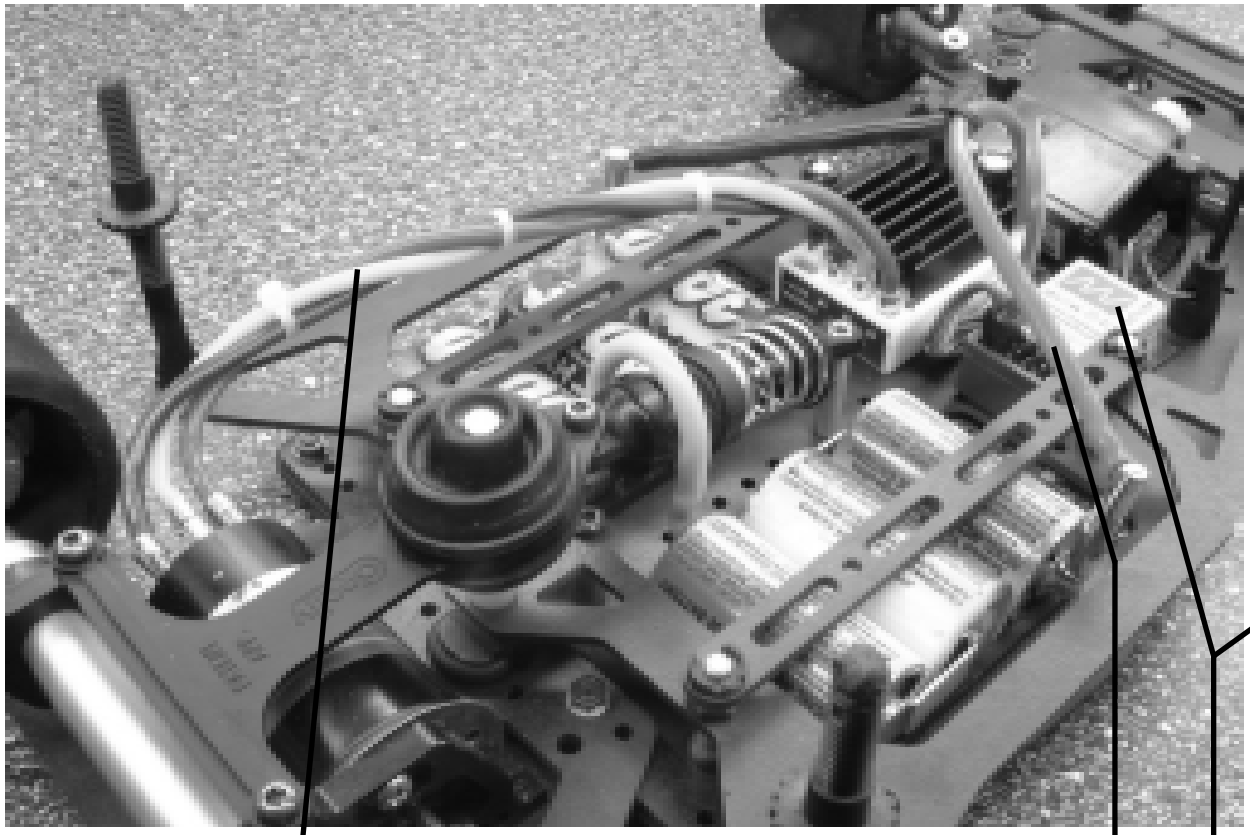
DIL-switch

Hints:

Condition as shipped: 3 * pp35 motor plugs enclosed (--> put in the sockets of the controller <--), but no RS232 serial interface cable (prog-adapt-uni).

When soldering cables to the controller use only electronic grade rosin-cored solder. Using a separate liquid or paste flux will wreck the connectors, as these materials are corrosive! No warranty!

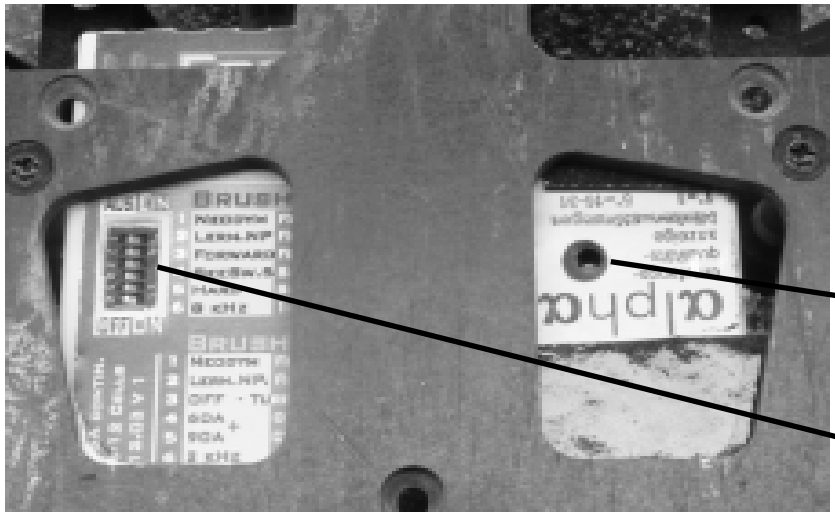
Installation and connection sample: 3-phase brushless motor in the RC10



Common hints for both types of motors:

Twist together motor- and battery cables. Keep battery cables away from the receiver.

Diameters: Use 2,5 mm² (13 gauge) for ***u-force50***, 4,0 mm² (11 gauge) for ***u-force75***.

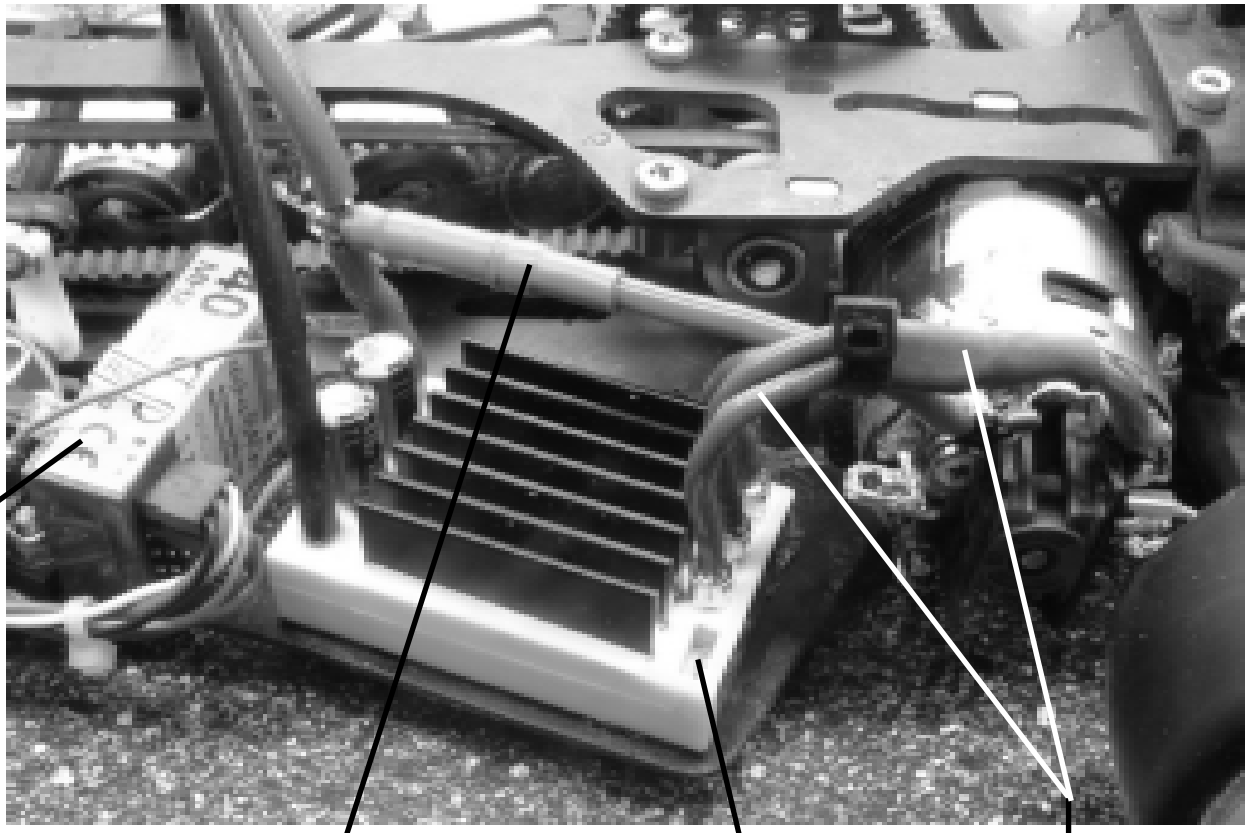


Keep the receiver & aerial 3 cm (>1") away from motor and speed controller. Mount receiver on its narrow side.

Reception quality LED of alpha-receiver

DIP-switch should be accessible from the bottom of the car.

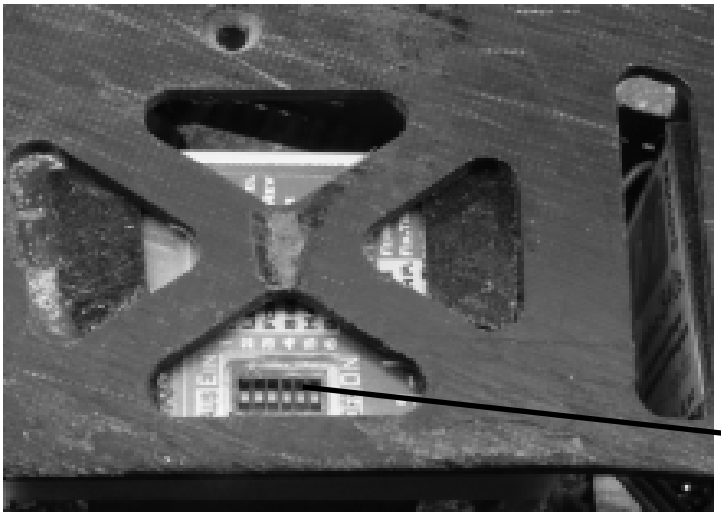
Installation and connection sample: Brushed motor in the SST2000



Please mount a plug (male connector) at the motor wire if a brushless motor shall be used later.

Keep computer port accessible.

Mount motor plugs separate and connect it after 3-4 cm



DIP-switch should be accessible from the bottom of the car.

Dear customer,

The *u-force* you have purchased is a micro-computer controlled speed controller for electric motors which was developed and manufactured entirely in Germany.

All *u-force* controllers are the most universal high-performance speed controllers available; they are designed for use in **RC model cars**.

All *u-force* controllers can be operated with both brushed and 3-phase brushless motors.
(Note: the ***u-force*** detects the motor type automatically from the arrangement of the motor connections.)

The EDS (Easy Direct Setup) of the ***u-force*** by means of **DIL switches** provides an ultra-simple method of configuring the unit to nearly any radio control system. The switches also allow a selected parameter set of the ***u-force*** to be modified.

The RCS (Remote Controlled Setup) of the ***u-force*** exploits a **serial interface** to a computer, and provides a means of accessing all the unit's comprehensive parameters; this is important for competition use.

Contents

1 Warning notes, cautions

Electric motors and moving parts are dangerous and require proper care for safe operation. Keep well clear of the moving/rotating at all times when the battery pack is connected.

Technical defects of an electrical or mechanical nature may result in unintended motor runs; loose parts may cause serious personal injuriy and/or property damage.

The CE-certificate on the speed controller does not absolve you from taking proper care when handling the system!

Speed controllers and soft-switches are exclusively for use in RC models. Their use in man-carrying aircraft is prohibited.

Speed controllers and softswitches are not protected against reverse polarity (+ terminal and - terminal reversed). Connecting the **battery pack** to the **motor leads** of the controller or soft-switch will almost certainly cause irreparable damage. No warranty!

Electronic equipment is sensitive to humidity. Even splashproofing by means of encapsulation does not represent permanent protection against penetrating damp. If the unit gets wet, it should at least be dried out carefully.

Ensure that all connectors are absolutely clean at all times, and that the gold plating is not damaged. Connector contacts must be a bright gold colour, and must not exhibit any discoloration or deposit (flux, dirt, liquid, e.t.c.). Examine the inside of sockets carefully; bunched-contact plugs must also be cleaned between the core and the contact leaves! Ensure that the plug contacts still have a strong spring force. Carry out regular maintenance! High-resistance connectors, like connecting leads of excessive length, may cause defective commutation which can destroy the ***u-force*** due to dangerous voltage spikes and peak currents.

Do not use speed controllers in conjunction with a power supply connected to the mains. Energy reversal can occur when the motor slows down and stops, and this may damage the power supply or cause an over-voltage condition which could damage the controller.

Never disconnect the flight pack while the motor is running, as this could cause damage on a speed controller.

On no account connect a separate receiver battery or an electronic battery switch (two receiver batteries), as this may cause damage to the speed controller and could cause current to flow from the receiver battery to the motor.

If you want to use a separate receiver battery cut through the + wire in the receiver cable, or pull it out of the connector if possible. However, for greater protection against motor-inducted interference it is always better to use a speed controller with an opto-coupler.

Protect the ***u-force***. from mechanical loads and excessive vibration, dirt and contamination.

Keep the cables to the battery and to the motor as short as possible (20 cm resp. 12 cm max. - read Section 2 and 6).

Never leave the drive battery connected when ...
... the model is not in use and/or
... the battery pack is being charged.

Speed controllers can only function properly if they are in full working condition. The protective and monitoring circuits can also only work if the speed controller is in good operating condition.

In the case of motor failure (e.g.short circuits in the windings) the over-temperature sensor in the controllers may react too slowly to prevent damage. Switch the motor off immediately to prevent permanent damage to the speed controller.

If a transistor fails in the throttle stage, neither a "stop" signal from the transmitter nor the temperature monitor nor the current limiter will be able to throttle back or stop the motor.

Note: Please remember that the monitoring circuits are unable to detect every abnormal operating condition, such as a short between the motor cables. Note also that a stalled motor will only trip the current limiter if the motor's stall current is well above the controller's peak current. For example, if you are using an 80 A controller in conjunction with a 20 A motor, the current monitor will not detect an excessive current even when the motor is stalled.

2 Ensuring safe, trouble-free operation

Use only compatible connectors. A 2 mm pin cannot provide reliable contact in a 2.5 mm socket. The same applies with 2mm gold-contact pins and 2 mm tin-plated sockets.

Please also remember that ...

... the wiring of your RC-components must be checked regularly for loose wires, oxidation, or damaged insulation, especially when using a BEC system.

... Schottky diodes are essential in brushed multi-motor configurations by smoothing out the current flow and can be used to reduce controller temperature when run under part-load conditions. These diodes must be soldered directly across the terminals of each motor. The cathode (ring on diode-body) must be connected to the positive terminal of the motor.

... your brushed motor is suppressed by at least two, better: three, ceramic capacitors of 10 to 100nF / 63 to 100V. Extra suppression can also be achieved using filters with coils.

... your receiver and the aerial must be at least 3 cm (>1") away from motor, speed controller and high-current cables. For example, the magnetic fields around the high-current cables can cause interference to the receiver.

... all high-current cables must be as short as possible. Maximum length between flight pack and speed controller have <u>never exceed</u> 20 cm (7"), between speed controller and motor <u>should not</u> exceed 12 cm (4").

... all high-current cables longer than 5 cm (2") must be twisted together. This applies in particular to the motor power cables, which are very powerful sources of radiated interference.

... in rc-cars the aerial must never be fitted in a tube which is pushed into a metal holder. If you do not use a short aerial, make some windings close to the receiver.

... in model aircraft: half of the receiver aerial's length should be routed along the fuselage, the other half should be allowed to trail freely (take care not to tread on it). Do <u>not</u> attach the end of the aerial to the fin!

... in model boats: half of the receiver aerial's length should be deployed inside the hull above the waterline, the other half should be threaded into a small tube mounted upright.

Every time you intend to use the power system - before you turn on the receiver - make sure that ...

... no one else is using the same frequency (identical channel number).

... your transmitter is switched on and the throttle stick is (as a rule) in the STOP position.

Carry out a range check before each use. Ask an assistand to hold the model and set the throttle stick to the half throttle position. Collapse the transmitter aerial. Walk away from the model to the distance stated by the RC system manufacturer (this might be a distance of about 50-60 m = 200'). Make sure that you still have full control of the system at this range.

As a general rule: receiver interference is more likely to occur when using a controller with BEC system, as these units do not feature an optocoupler with its optical link.

When Ni-Cd batteries approach the end of their charge, voltage falls drastically and quickly. The ***u-force*** detects this and reduces power to the motor automatically. This should leave sufficient energy to bring your model back home. However, if you use a small number of cells of high internal resistance and operate at high motor currents, the controller may reduce power before the pack is discharged. You can eliminate this problem by using low resistance straps to connect the cells, or use the direct cell-to-cell soldering technique (“sticks”) and short, heavy-gauge wire if you assemble your own batteries.

Your receiver also benefits from the stability of the voltage supplied from the battery. If the BEC voltage is stable, the receiver is less liable to suffer interference.

The CE symbol is your guarantee that the unit meets all the relevant interference emission and rejection regulations when it is in use.

If you encounter problems operating the ***u-force*** controller, please note that many problems are due to an unsuitable combination of receiving system components, or an inadequate installation in the model.

3 Intended applications

***u-force*50:** Especially made to use in cars and boats because of its splash water protection (do NOT use under water). Works from 6 ... 12 Nickel cells (or also on 2 ... 4 Lithium cells after modification of the cut off voltage by the help of RCS configuration). BEC 5 V / 3,0 A.

***u-force*75:** similar to the **u-force50**, but for higher motor curents or lower losses at identical motor current.

Highlights common to all units:

Better than 250-step resolution over the whole control range for extremely fine speed control.

Controllers work reliably right down to the last scrap of energy in the battery pack.

"Auto-arm" function and "power on reset".

Selectable 2, 4 or 8 kHz switching frequency in BrushedMotorMode resp. 8, 16 or 32 kHz in BrushlessMotorMode. (EDS:2+4/8+16kHz)

EDS (Easy Direct Setup). No pots! If the system is activated, the characteristic configuration is made on the basis of the DIL switching position. Furthermore the ***u-force*** can learn automatically the neutral point of the used transmitter with each start-up.

During the configuration process the motor acts as a loudspeaker to give you audible confirmation of the procedure.

„qpi" quick **p**lug **i**n system. The ***u-force*** features integral high-current sockets (pp35) for the motor wires.

4 Monitor displays

The *u-force* is not fitted with LEDs to indicate its operating status.

However, when the ***u-force*** is connected to the battery and the transmitter stick is on "neutral" or "light brake" position, a beep from the motor shows "armed".

5 Protective circuits

Note: the monitor circuits are effective, but they cannot detect every possible operating condition.

5.1 Temperature monitor

The temperature monitor switches off the motor. You can reset the unit using the "auto-arm" function (throttle stick to stop for about 2 sec.)

If the motor windings are shortcircuited the temperature monitor reacts too slowly to prevent damage. Switch the motor off immediately to avoid permanent damage to the ***u-force***.

5.2 Voltage monitor

As soon as the voltage of the drive battery falls back to the 5V threshold the motor is throttled back.

If the situation continues which caused the controller to throttle back to less than 10% pulse width for more than a short time, the unit switches the motor off.

Of course, you can re-start the motor again briefly by moving the throttle stick back to "stop" for about 2 seconds to re-arm the system. The speed controller - and your model - remain fully controllable until the last drop of usable energy is exhausted.
We can not predict how long you can still control your model with the residual battery charge as this depends on many parameters such as the number of cells in the pack, the cell type, actual motor current and the way you control your model. If the voltage monitor trips, i.e. the motor starts to throttle back without your intervention, you should stop the motor at once with the throttle stick in any case so that you have the maximum possible reserve of power.

Caution: overloading the BEC system usually occurs due to excessive servo current drain caused by too many servos and/or stiff linkages. This situation is out of control, as it can cause the BEC-generated voltage for the receiver to collapse. If the voltage recovers, the ***u-force*** then automatically re-configures itself if it is in the „learning neutral position" mode. However, it will then adopt the wrong parameters, based on whatever position the transmitter's throttle stick happens to be in.

5.3 Current monitor

Our ***u-force*** controllers feature a current monitor circuit which trips when the current rises above the specified maximum value. If the motor is stalled, the motor is throttled back. This means, that a motor which draws an excessive current will never reach full-throttle, and the current may stay below the specified maximum value. At present only the maximum current is used as ref. for the maximum value in brushless mode; with brushed motors the set current is the reference.

5.4 Receiver signal monitor

If the receiver signal fails, or the signal is longer or shorter than the usual range of values, the ***u-force*** controller reverts 300ms to hold mode before switching to disarmed mode.

5.5 Reverse polarity protection

Die *u-force* are not protected against reversed polarity! Wrong polarity damages the controller.

5.6 Watchdog:

If this circuit is tripped the ***u-force*** stops working briefly and then reverts to normal operation.

6 Installation, connections

6.1 Installation (mechanically) in the chassis

High-adhesion Velcro (hook-and-loop) tape is the ideal method of installing the controller in the chassis, as it provides good access to the DIL switches for configuring the unit. If you prefer to use the computer-based configuration process, a piece of double-sided foam tape (servo tape) can be used as an alternative. Do not pack the ***u-force*** in foam as this may lead to a heat buildt-up in the controller.

6.2 Receiver connection

The *u-force* receives its throttle and brake signals via this receiver socket, and at the same time the ***u-force*** supplies the operating voltage to the receiver and the steering servo which is usually connected to channel 1.

Check regularly that the receiver cable is undamaged and firmly seated at the ***u-force***.

On no account connect a separate receiver battery, as this may cause damage to the speed controller.

If you want to use a separate receiver battery cut through the + wire in the receiver cable, or pull it out of the connector if possible.

6.3 Length of connecting cables

The cables to the drive battery and - in particular to the motor - should be kept as short as possible. Long cables tend to act as aerials and radiate interference; they also add unnecessary weight.
Especially with brushless motors it is essential to ensure that the total cable length between battery and ***u-force*** is no longer than 2 x 20 cm = 40 cm. Example of a saddle-pack: 12 cm "- battery" lead (black) plus 8 cm between the saddle-pack plus 20 cm "+ battery" lead (red): this is already excessive, because the 4 bridges between the individual cells add an extra 6 cm. The long cables cause an increase in cable inductivity, and this overloads the **blocking capacitors**; the capacitors fail and are then unable to protect the speed controller.

For this reason in-line battery packs are preferable.

There are no technical reasons limiting the cable length to the motor, but in fact the leads should not be longer than 2 x 12 cm because of increased radiated interference.

6.4 Power-connection battery <--> *u-force*:

It is essential to use **polarized** gold-plated-contact connectors - fitting any other type of connector invalidates the warranty.

Ein verpolter Anschluss an den Akku führt oft nicht nur zu einem irreparablen ***u-force***, sondern kann auch zu einem defektem Empfänger und einem defektem Servo.

Connectors which do not have a polarised insulator can be made safe (i.e. polarised) by soldering the ***u-force***'s positive battery wire to a socket, and the ***u-force***'s negative wire to a plug.

We recommend that you choose your connectors from our selection in Section 7.

Caution: the actual method of connecting the battery and motor to the ***u-force*** varies according to the motor type in use. Please be sure to read Chapter 6.5.

6.5 Power-connection *u-force* <--> motor

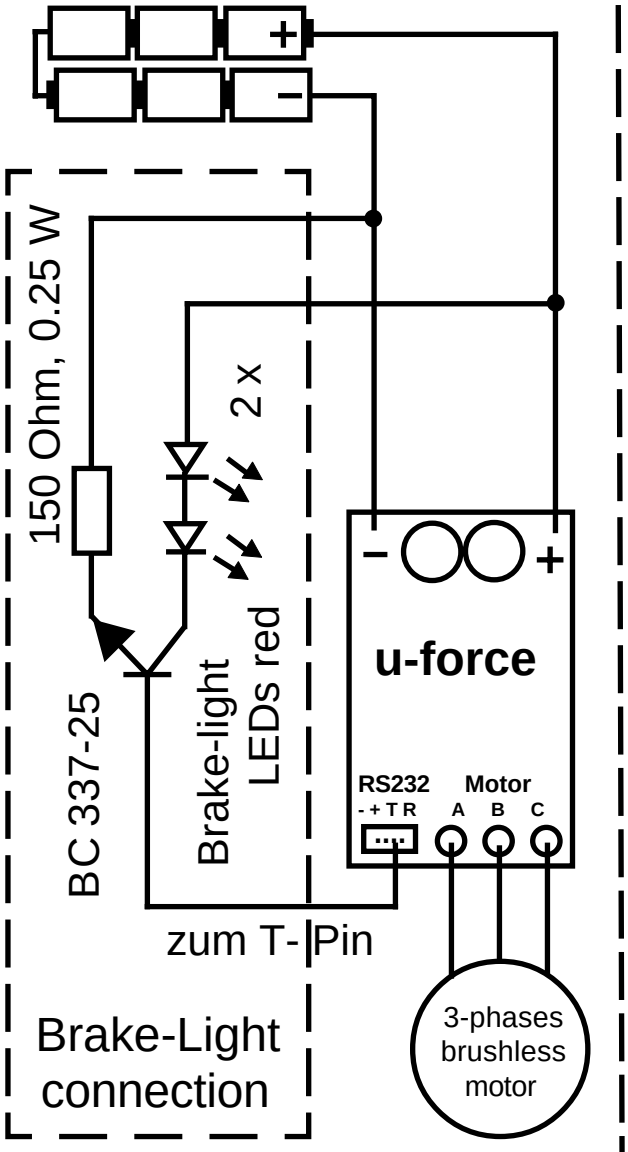
The requirements for connecting the controller to the motor vary according to the motor type. The correct arrangement must be observed to ensure that the *u-force* is able to detect the motor type automatically every time, and operate it reliably.

6.5.1 Brushless motor

Extend the 3 motor leads using multi-core flex so that they reach the motor connections of the ***u-force*** by the shortest route.

Solder the cables to the 3 motor plugs, observing the notes regarding soldering (Chapter 7), and connect these to the motor sockets.

If the motor runs in the wrong direction, swap over any two motor leads in the sockets.



6.5.2 Brushed motor

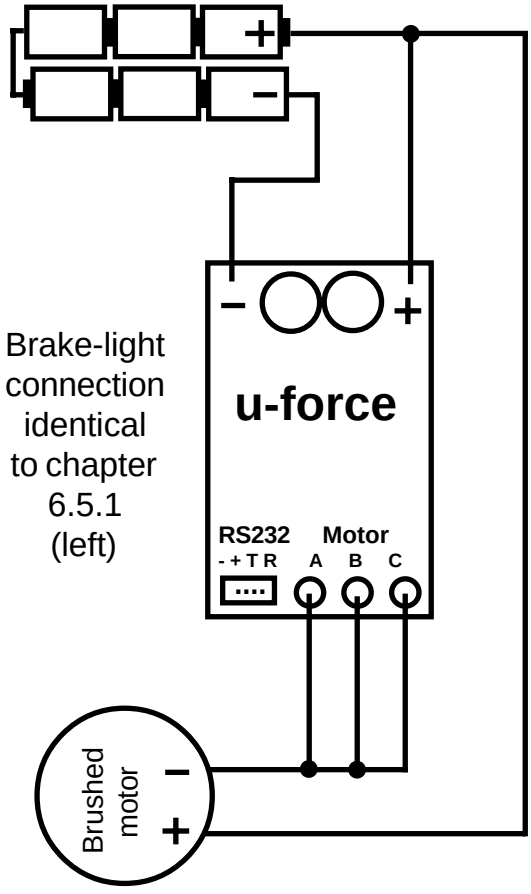
Connect the 3 motor plugs to the 3 motor sockets (as supplied).

Solder all three plugs together using short pieces of multi-core flex.

Connect the “negative” terminal of the brushed motor to the central one of the three bridged motor connections on the ***u-force*** using a (blue) cable.

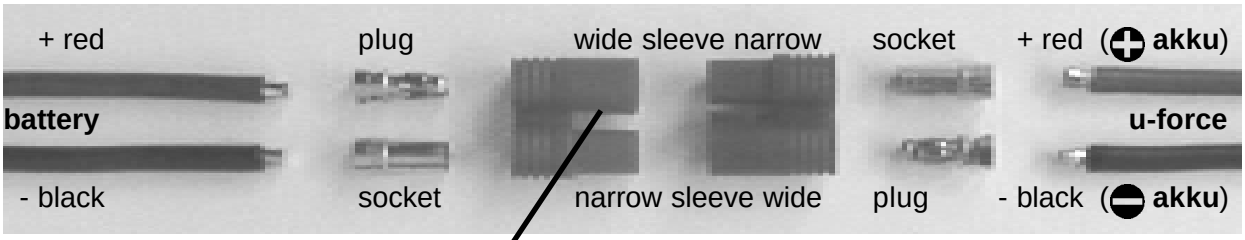
Connect the “positive” terminal of the brushed motor directly to the “+ battery” socket on the ***u-force*** using a (red) cable.

Note: do not replace the red positive cable attached to the battery connection on the ***u-force*** by a thinner wire. The brake currents flow through this cable in addition to the operating voltage for the ***u-force***.



7 Connector systems and its mounting

7.1 3.5 mm gold-contact connector system (pp35); max. load > 80A



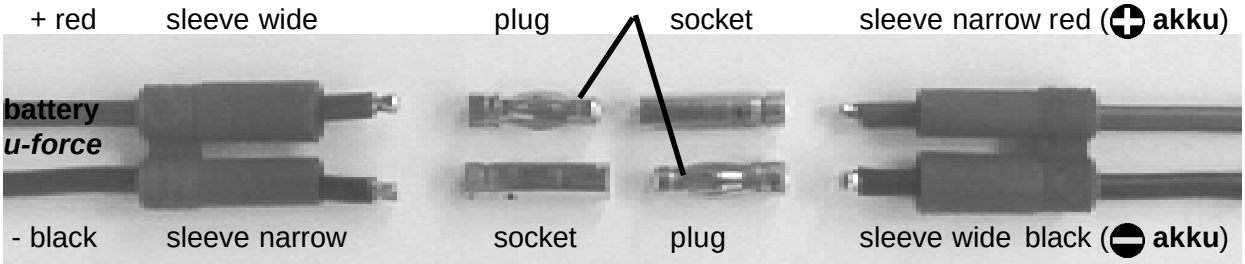
Caution: remove locating lug from battery cable. Do not remove lug from any cables attached to controllers or charge leads!

Manufacturer's information: the **pp35** plug is very short, and this presents the danger that the contact spring could lose its resilience (spring force) due to excessive heat build-up during the soldering process. You can side-step the problem by keeping the temperature below 200°C as follows: either remove the contact carefully before soldering, or simply push the plug into a piece of wet fine-grain sponge for soldering, or plug it in a 3.5 mm hole of a copper-block.

Fit the connectors in the order shown above; the contacts are pressed in as follows:
a. Place plastic sleeve vertically on table, grip end up.
b. Push contact down into sleeve.
c. Place 2.5mm wide screwdriver blade on top of cable solder joint inside sleeve.
d. Tap screwdriver to press contact into sleeve until latch engages.

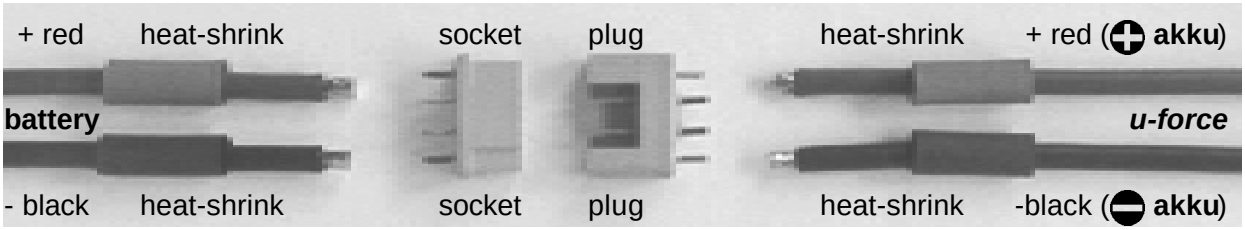
7.2 4mm(CT4), 2mm(CT2) gold-contact connectors (rating CT4=80A; CT2=30A)

Distinguishing marks for suited plugs: „MC" or „S" contact spring embossment.



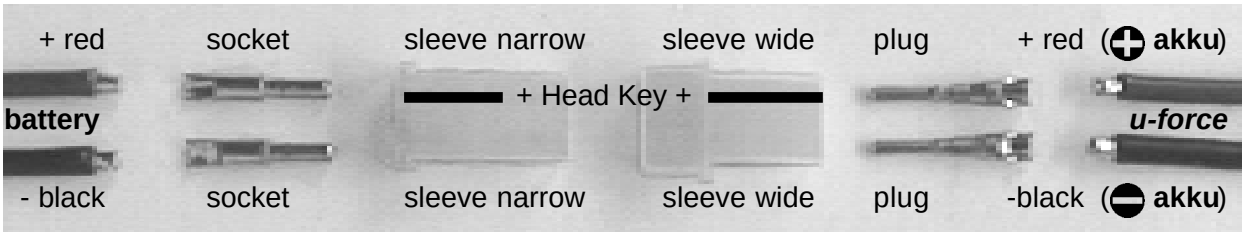
Fit the connectors in the order shown above; the contacts are pressed in as follows:
a. Rest plastic sleeve on vice jaws with cables hanging down.
b. Close vice jaws until cables are just free to move.
c. Fit plug into socket and tap into sleeve until latch engages.
d. Fit socket onto plug and tap into sleeve until latch engages.

7.3 MPX gold-contact connector system (green or red); max. load ~30A



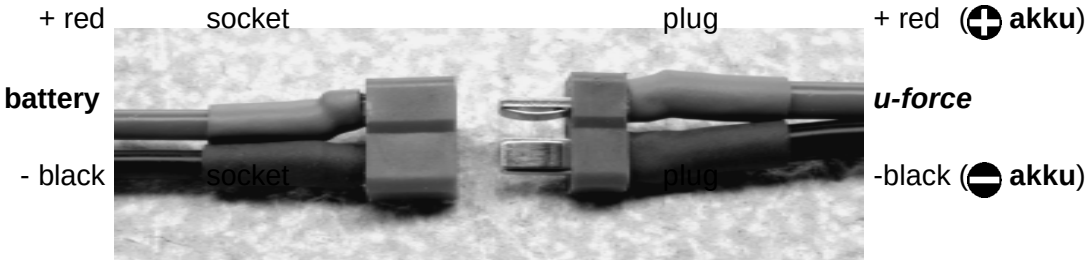
Fit the connectors in the order shown above; the contacts are soldered as follows:
a. To center the contacts fit plug and socket together before soldering.
b. Tin all 6 exposed solder terminals of plug or socket.
c. Fit cable end into triangle of contacts, solder to all three solder terminals.
d. Position heat-shrink sleeve and shrink over joint.

7.4 2,0 / 2,5 mm gold-contact connector system; max. load ~30A



Fit the connectors in the order shown above; the contacts are pressed in as follows:
a. Place plastic sleeve vertically on table, grip end up.
b. Push contact down into sleeve.
c. Place 2.5mm wide screwdriver blade on top of cable solder joint inside sleeve.
d. Tap screwdriver to press contact into sleeve until latch engages.

7.5 Deans connector system; rating up to 50 A



8 Using the controller for the first time

8.1 Symbols and terminology

Throttle stick or trigger: refers to the same function: the trigger on a steering wheel transmitter, or the throttle stick on a conventional transmitter.

Neutral position (self neutralising stick)
Idle position (position where the motor runs or stopps unbraked)

Brake position (or idle position in boat mode)
Position of the throttle stick where the motor stops (braked or unbraked).

Zwischenposition:
Zur Konfigurierung in den Bootsbetrieb; auch: Halbgas bei Fahrbetrieb

Full-throttle position
100% voltage passed to the motor.

Wait (0.5 seconds)

Audible indicators:
These indicators are only audible when a motor is attached, as the motor itself acts as the loudspeaker.

Single beep (or duotone beep in boat mode)

Double beep, triple beep

8.2 EDS: The direct programming sysytem using DIL-switches for configuring the *u-force* to suit your application

We recommend that you program your transmitter using the following basic settings:
a) Set servo travel at the transmitter to +/- 100%. Trim neutral (centre position). If you encounter problems with a Multiplex transmitter, set the servo centre to 1.5 ms (i.e. -22% centre).
b) Opening the throttle must generate a longer pulse than the pulse width at neutral; operating the brake must produce a shorter pulse. If this is not the case you will find that the ***u-force*** runs forward when brake is applied, and brakes when the throttle is opened. You can correct this by operating the servo reverse switch for the throttle channel at the transmitter.

A single beep usually indicates that the ***u-force*** is armed. This means that moving the throttle stick will cause the motor to run.

In the default state of the ***u-force*** (as supplied) EDS is active.

If you have used a PC has to control the ***u-force***, you can **switch the controller back to DIL switch operation** as follows:
a) Disconnect the ***u-force*** from the drive battery,
b) Set all the DIL switches to ON,
c) Connect the drive battery,
d) Wait 5 seconds - the ***u-force*** has now switched to EDS configuration.
e) Disconnect the drive battery from the ***u-force***,
f) Set the DIL switches as required,
g) Re-connect the drive battery - the controller interrogates the switch settings.

8.2.1 DIL-switch #1 Select motor type

OFF=Neodym / Ferrit=ON

DIL switch 1 configures the ***u-force*** for use with a motor with neodymium magnets, or a motor with ferrite magnets.

Reason for the distinction: to obtain comparable running and braking characteristics with a motor fitted with the weaker ferrite magnets the soft-start for throttle and brake must be faster than for neodymium motors.

8.2.2 DIL-switch #2 Select stick travel

OFF=learning NP only / fixed travel=ON

DIL switch 2 configures the ***u-force*** to learn the neutral point of the transmitter when you connect the drive battery, or to use fixed (previously learned) stick positions and travels.

8.2.2.1 DIL switch OFF: the neutral point of the transmitter is learned every time the *u-force* is switched on (switch transmitter on beforehand).

a) If the neutral point is higher than 1.36 ms, then the ***u-force*** works in Car mode, and the end-points are set to a fixed scale: neutral point + 0.3 ms for full throttle, neutral point - 0.3 for full brake.

aa) The ***u-force*** confirms Car mode with a single beep **[*]**.

b) If the neutral point is lower than 1.36 ms, then the ***u-force*** works in Boat mode. In this mode the brake is disabled, and the full-throttle point is set to neutral point + 0.6 ms.

bb) The ***u-force*** confirms Boat mode with a two-tone beep **[*]**.

[*] i.e. it is armed and ready to use.

8.2.2.2 DIL switch ON: the controller uses the previously programmed stick positions for neutral, full throttle and full brake (by ***u-soft***) **or the values learned in a previous configuration procedure (below).**

Learning procedure: A must for **Futaba HRS** receivers (u-force **V3** ...). Learning is **not required** in RCS mode. Also eliminated in EDS mode if all 6 DIL switches are set to ON before the controller is switched on.

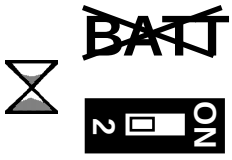
8.2.2.2.1 Forcing stick travel learn mode:
In EDS mode it is possible to force the ***u-force*** to learn the settings by briefly setting the unit to “Learn neutral point” mode, i.e.

a) Disconnect drive battery,

b) wait for 10 seconds,

c) set DIL-switch # 2 to OFF position,

d) connect drive battery.
- the ***u-force*** is now configured to **„learning NP“** .



8.2.2.2.2 Learning stick positions and stick travel:

e) Disconnect drive battery again,

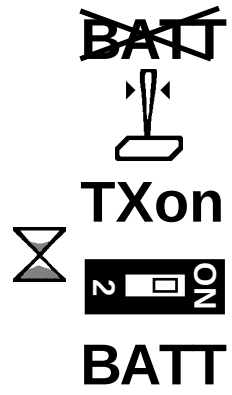
f) move transmitter stick to „neutral“ position

g) switch transmitter on,

h) wait for 10 seconds,

i) set DIL-switch #2 to ON position,

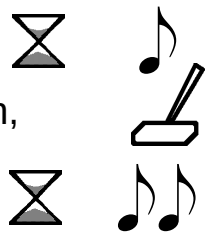
j) Connect drive battery again,



k) wait 2 seconds, the neutral point of the stick is learned, the ***u-force*** confirms with one beep,

l) move transmitter stick <u>quickly</u> to full <u>THROTTLE</u> position,

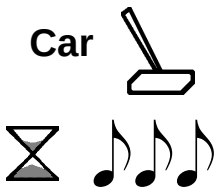
m) wait 2 seconds, the full throttle point of the stick is learned, the ***u-force*** confirms with two beeps,



8.2.2.2.2.1 Car-mode with proportional brake:

n1) move transmitter stick <u>quickly</u> to full <u>BRAKE</u> position,

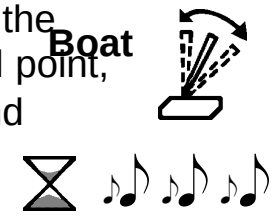
o1) wait 2 seconds, the full brake point of the stick is learned, the ***u-force*** confirms with three beeps,



8.2.2.2.2.2 Boat mode without brake:

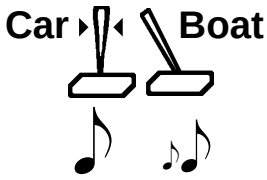
n2) move transmitter stick <u>quickly</u> to a position between the last learned full throttle point and the first learned neutral point,

o2) wait 2 seconds, the ***u-force*** shifts into boat mode and confirms with three duo-tone beeps.



8.2.2.2.3 put *u-force* into operation:

p) move transmitter stick to „neutral“ position,
u-force confirms with one beep in car-mode resp. one duotone beep in boat mode
(i.e. ***u-force*** arms and is ready to use),



q) Moving the transmitter stick towards full throttle starts the motor running

8.2.3 DIL-switch #3 Enable reverse / turbo start

The effect of this DIL switch varies according to the motor connected to the controller.

8.2.3.1 brushless motor

OFF=forward only / forward and reverse=ON

DIL switch 3 configures the ***u-force*** to allow the motor to run forward only or forward and reverse.

DIL switch OFF: the motor has no reverse “gear”.

DIL switch ON: Reverse can be activated in the following manner:

Holding the transmitter stick at ¾ brake or more **(neutral position - 0.225 ms)** for about 1.2 seconds activates reverse with slow acceleration.

As soon as the motor is running in reverse, the full brake range becomes available to provide proportional reverse speed.

As soon as the transmitter stick is moved beyond the neutral point into the forward range again, the motor is braked strongly, then accelerated in the forward direction.

8.2.3.2 brushed motor - forward only

OFF = turbo off / turbo on = ON

DIL switch 3 configures the ***u-force*** to enable turbo-start.

DIL switch OFF: turbo-start is disabled.

DIL switch ON: turbo-start is possible.

Holding the transmitter stick at **neutral** or a brake setting for about 3 seconds reduces the full-throttle point to half normal stick travel. This means that full current is fed to the motor when the throttle stick reaches half travel; this is ideal for drivers with slow throttle fingers in mass-start races.

Starting from the “half-throttle setting” described above, the effective full-throttle point then shifts “upward” until full stick travel is available for controlling the motor.

Moving the throttle stick to the neutral point or beyond it into the brake range also has the effect of switching to full stick travel.

8.2.4 DIL-switch #4 & #5 Timing / Current limiter

The effect of DIL switches 4 and 5 varies according to the motor type connected:

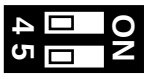
8.2.4.1 Brushless motor: timing adjustment

These 2 DIL switches can be used to implement 4 different timing settings. These alter the motor characteristics within certain limits.

The general rule is: the harder the timing, the higher the current at which maximum efficiency occurs. However, optimum timing also varies according to the design of the motor. For this reason we state recommended timings for each motor type.

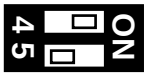
The numbers stated below refer to the positions of the DIL switches stated above:

Timing 1: Hard timing
DIL-switch #4= 0 „not softer“
DIL-switch # 5=0 „hard“



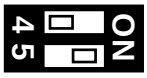
- Maximum efficiency at highest power and rotational speed
- Optimum for all Ikarus, Köhler, LRK, Plettenberg motors and all other motors when maximum rotational speed is needed

Timing 2: medium timing
DIL-switch # 4=1 „softer“
DIL-switch # 5=0 „hard“



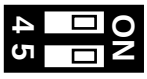
- Motor efficiency is set to medium motor currents
(e.g. runtime problems on Ikarus, Köhler, LRK, Plettenberg motors)
- Recommended when changing from a Kontronik to a Schulze speed controller with a given motor. The rotational speeds coincide more closely with the manufacturers' stated figures
- Optimum for all Aveox and Kontronik KBM motors in FAI operation.

Timing 3: soft timing
DIL-switch # 4=0 „not softer“
DIL-switch # 5=1 „soft“



- Motor efficiency is set to lower motor currents (e.g. for long duration flights with helicopters)
- Recommended when changing from a Lehner to a Schulze speed controller with a given motor. The rotational speeds coincide more closely with the manufacturers' stated figures
- Optimum for Astro, Aveox, Bittner, Hacker, Kontronik and Lehner motors
- Not for Ikarus, LRK and Plettenberg motors

Timing 4: super soft timing
DIL-switch # 4 = 1 „softer“
DIL-switch # 5 = 1 „soft“



- Motor efficiency is set to very low motor currents
- Use when having problems with runtime and/or too much current on very sharp Lehner and Hacker motors at relatively low currents
- For lowest idle current on Hacker, Kontronik BL/Fun-series and Lehner motors (e. g. duration contest)
- Not for Astro, Aveox, Bittner, Ikarus, Köhler, LRK and Plettenberg motors

8.2.4 DIL-switch #4 & #5 Timing / Current limiter cont.

The effect of DIL switches 4 and 5 varies according to the motor type connected:

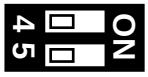
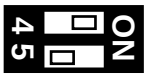
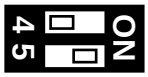
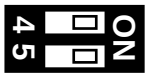
8.2.4.2 Brushed motor: current limiter

These 2 DIL switches can be used to implement 4 different current limiting values.

If the selected maximum current is exceeded permanently, or during the acceleration phase, the ***u-force*** reduces the current to the set maximum value.

The result is that the car accelerates more smoothly and maintains its grip on slippery surfaces.

The numbers stated below refer to the positions of the DIL switches stated above:

			u-force75	**u-force50**
Maximum current:	DIL-switch # 4 = 0		60 A	40 A
	DIL-switch # 5 = 0		90 A	60 A
	Sum =		**150 A**	**100 A**
Large current:	DIL-switch # 4 = 1		00 A	00 A
	DIL-switch # 5 = 0		90 A	60 A
	Sum =		**90 A**	**60 A**
Medium current:	DIL-switch # 4 = 0		60 A	40 A
	DIL-switch # 5 = 1		00 A	00 A
	Sum =		**60 A**	**40 A**
Small current:	DIL-switch # 4 = 1		00 A	00 A
	DIL-switch # 5 = 1		00 A	00 A
	Minimum current:		**30 A**	**30 A**

Hint: When the DIL switches are off, maximum current is supplied;
DIL switch = ON means: current reduction active.

8.2.6 DIL-Schalter #6 Switching frequency at part throttle

DIL switch 6 configures the ***u-force*** for the switching frequency to be used in the part-throttle range.

The general rule for selecting the switching frequency is as follows: the lower the inductivity of the motor, the higher the switching frequency should be. A higher switching frequency reduces any current irregularity in the part-throttle range, but at the cost of increased eddy current losses in the motor and switching losses in the controller. The simplest solution is to try out different switching frequencies and select the one at which the motor and the ***u-force*** stay coolest.

For more information on this matter please visit our web site and read the section “Important tips”.

8.2.6.1 brushless motor

OFF = 8 kHz / 16 kHz = ON

Each DIL-switch position is interrogated directly after the drive battery is connected.

8.2.6.1.1 Use 8 kHz part throttle switching frequency

a) set DIL-switch # 6 to OFF position (= 8 kHz)
b) switch transmitter ON

c) connect the ***u-force*** to the drive battery ***u-force*** piepst: ♪♪♪♪♪ ♪ bzw. ♪♪

8.2.6.1.2 Use 16 kHz part throttle switching frequency

a) set DIL-switch # 6 to ON position (= 16 kHz)
b) switch transmitter ON

c) connect the ***u-force*** to the drive battery ***u-force*** piepst: ♪♪♪♪♪ ♪ bzw. ♪♪

8.2.6.2 brushed motor

OFF = 2 kHz / 4 kHz = ON

Each DIL-switch position is interrogated directly after the drive battery is connected.

8.2.6.1.1 Use 2 kHz part throttle switching frequency

a) set DIL-switch # 6 to OFF position (= 2 kHz)
b) switch transmitter ON

c) connect the ***u-force*** to the drive battery ***u-force*** piepst: ♪♪♪♪♪ ♪ bzw. ♪♪

8.2.6.1.2 Use 4 kHz part throttle switching frequency

a) set DIL-switch # 6 to ON position (= 4 kHz)
b) switch transmitter ON

c) connect the ***u-force*** to the drive battery ***u-force*** piepst: ♪♪♪♪♪ ♪ bzw. ♪♪

8.3 RCS, the computer-based programming system

in comjunction with a PC or laptop and the *u-soft* program.

We recommend that you program your transmitter using the following basic settings:

a) Set servo travel at the transmitter to +/- 100%. Trim neutral (centre position).

b) Opening the throttle must generate a longer pulse than the pulse width at neutral; operating the brake must produce a shorter pulse. If this is not the case you will find that the ***u-force*** runs forward when brake is applied, and brakes when the throttle is opened. You can correct this by operating the servo reverse switch for the throttle channel at the transmitter.

A single beep usually indicates that the ***u-force*** is armed. This means that moving the throttle stick will cause the motor to run.

In the default state of the ***u-force*** (as supplied) EDS is active, i.e. direct programming using the DIL switches.

If you wish to control the ***u-force*** from your PC or laptop, **RCS can be activated in the following manner:**

a) Disconnect the ***u-force*** from the drive battery,
b) **Set all DIL switches to OFF** <-- absolutely essential!
c) Load the ***u-soft*** program on the PC,
d) Connect the ***u-force*** to the PC,
e) Connect the drive battery to the ***u-force***,
f) Press the PC function key for "**deactivate DIL-switches (RCS on)**" **-> u-force**".
- The ***u-force*** now responds to the PC.
g) The parameters stored in the ***u-force*** can be loaded into the PC using "**read parameters from u-force -> u-soft**", and …
h) … modified using "**show / change parameters in u-soft**",
i) The parameters modified on the PC can be transferred to the ***u-force*** and stored there using "**transfer parameters from u-soft -> u-force**".

If you wish to activate the DIL switch settings again, you have two alternatives: use the procedure described in Chapter 8.2, or - if the ***u-force*** is still connected to the PC - use the following method:
j) Press the PC function key for "**activate DIL-switches (RCS off) -> u-force**".
The DIL switch settings "Switches 1…6 OFF" now apply.

Special feature:

The ***u-force*** stores two "parameter sets" which influence its characteristics:
a) the DIL switch settings and **b)** the RCS parameters.

If EDS is used, the RCS parameter set remains stored in the ***u-force***, but is not activated.

This "background" parameter set can even be modified using the ***u-soft*** program, but it is only used by the ***u-force*** if it is activated as described above.

8.3.1 Range of adjustments available using PC/lap-top

<ESC> brake - one step back - quit *u-uoft*

<F1> open help menue - always states the current ***u-soft*** version.

--- Loading parameter sets into *u-soft* ---

<F2> load standard parameters -> u-soft
- loads a standard factory default parameter set into ***u-soft***

<F3> load parameters from file -> u-soft
- loads a parameter set established at a previous time and stored on the hard disk into ***u-soft***

<F4> read DIL-switch from u-force -> u-soft
- Loads the parameters set on the ***u-force*** DIL switches into ***u-soft***.
a) If the ***u-force*** is currently using RCS, then the data set necessarily associated with this type of configuration (DIL switch settings "1…6 = OFF") is read in.
b) If the ***u-force*** is currently using EDS, the parameters associated with the DIL switch settings are read in.

<F5> read parameters from u-force -> u-soft
- Loads the parameter set stored in the ***u-force*** into ***u-soft***.
a) If the ***u-force*** is currently using RCS, the parameter set currently used by the ***u-force*** is read in.
b) If the ***u-force*** is currently using EDS, the parameter set valid for RCS, but not active, is read in.

--- Modifying parameter sets in *u-soft* ---

<F6> show / change parameters in u-soft
- Displays / modifies the parameters stored in ***u-soft***. This can be:
a) on the one hand the parameter set last used by ***u-soft***, and automatically loaded, or one of the following, depending on the previous loading process (F2 … F5):
b) the standard parameter set,
c) the parameter set stored in a file on the PC,
d) the parameter set according to the DIL switches of the ***u-force***, or
e) the RCS parameter set stored in the ***u-force***.

--- Storing parameter sets and/or functions ---

<F7> save parameters from u-soft -> file
- writes the current parameter set from the ***u-soft*** to the hard disk.

<F8> transfer parameters from u-soft -> u-force
- copies the parameter set from ***u-soft*** into the ***u-force***.
a) If the ***u-force*** is currently using RCS, these parameters immediately become active when you disconnect the cable connection to the PC.
b) If the ***u-force*** is currently using EDS, the parameters can be written back for later use by RCS. Note that re-writing does NOT automatically activate the parameters, since RCS does not carry out any change-over process.

---selectively activating parameters in the *u-force* ---

<F9> enable DIL-switch (RCS off) -> u-force
- EDS is activated, RCS is disabled.
i.e. the functions of the ***u-force*** are dictated by the DIL switch settings.

<F10> disable DIL-switch (RCS on) -> u-force

- EDS is disabled, RCS is activated.

i.e. the functions of the ***u-force*** are dictated by the RCS parameter set transferred via the PC.

<F11> 'learn neutral point, calculate stick travel' -> u-force

- only in RCS mode; corresponds to DIP switch #2 = OFF in EDS mode.

<F12> 'use stick positions of RCS parameter block' -> u-force

- ***u-force*** uses the stick positions configured in the RCS parameter set.
- corresponds to the positions learned in EDS mode when DIP switch #2 = ON.

8.3.1.1 Modifiable parameters in RCS

ControllerType		***u-force50*** resp. ***u-force75***
Usage		car / boat
Neutral Position/Idle Position		0.8 ms ... 1.8 ms
FullThrottle Position		1.3 ms ... 2.5 ms
FullBrake Position		0.8 ms ... 1.5 ms
DeadStickTravel Forward		3 ... 255 µs
DeadStickTravel Reverse		3 ... 255 µs
InitialThrottle (Initial Percentage)		0 ... 50%
AutomaticBrake (Off / Initial Percentage)		0 ... 100%
SoftStartTime Throttle (time from 0 to 100% throttle)		66 ms ... 16.7 s
SoftStartTime Brake (time from Stop to FullBrake)		66 ms ... 16.7 s
Low voltage limit		5.3... 12 V
(3-Ph.)	PartThrottleSwitchingFrequency	8, 16, 32 kHz
(brush)	PartThrottleSwitchingFrequency	2, 4, 8 kHz
Parameters for brushless motors only		
(3-Ph.)	RotationalSpeedLimiter (RCS Param only)	5000...126000 U/min*****
(3-Ph.)	MotorTimingLevel	1, 2, 3, 4
(3-Ph.)	BrakeLevel to switch to ReverseGear	10 ... 95% of FullBrake
(3-Ph.)	DelayTime to switch to ReverseGear	66 ms ... 5 s
(3-Ph.)	SoftStartTime of ReverseGear (0 - 100%)	66 ms ... 16.7 s
(3-Ph.)	CurrentLimit (fixed)	67 A resp. 100 A
Parameters for brushed motors only		
(brush)	CurrentLimit	10...100 resp. 10...150 A
(brush)	TurboStart	possible / deactivated
(brush)	ReverseGear	not possible

Note: certain DIL switch settings have different effects depending on the type of motor connected, i.e. brushless or brushed. **Example**: if you modify the timing in brushless mode using the DIL switches (or the same RCS parameter set), then the same settings will affect current limiting if a brushed motor is connected.

Note: in ferrite motor mode the DIP switches in EDS alter the soft-start function for throttle and brake and the rotational speed limit (55,000 rpm*) simultaneously. If you wish to adjust the settings individually you must use RCS.

[*] Speed limit: this is the limit value for a 2-pole motor (…P2). The following division factor applies: P4 = /2; P6 = /3, P8 = /4; P10 = /5. Speed limiting is a guard against the armature magnets flying off, and must be adjusted to suit the motor type.

9 Legal matters

9.1 Warranty conditions

All schulze products are 100% dynamically tested by using a battery and a motor. We do not simulate tests.

If your unit develops a problem, please return it to **schulze** or to the importer. Include a description of the problem. Please be careful and precise, and list the battery voltage and capacity, motor type, conditions under which failure occured etc. A note saying “doesn't work” does not help us much, and it may lead to waisted time in trouble-shooting. Before returning the unit for repair, please test it “one more time” carefully. If we find that the controller is operating correctly, whether it is under warranty or not, we will make a charge for our lost time.

Warranty claims are processed according to our current General Conditions of Business, which are enclosed in our price list or our web page.

The warranty does not cover consequent damage or damage due to incompetent usage, such as: damage caused by moisture, by soldering cables using an acid-based flux (especially relating to speed controllers), or due to the use of non-polarised connectors. This means that you have to ship your controllers to us originally as used (particularly do not remove the plug system on the leads!).

Excluded from the guarantee are speed controllers fitted with connectors which are incapable of handling the current loads stated in the operating instructions, and/or connectors which provide poor electrical contact (e.g. through soiling) and therefore cannot function reliably.

One further note:

If a problem arises with a schulze device, send it straight back to us or our authorized representative (see catalogue); don’t attempt to repair it! This allows us to repair it as quickly as possible, as we can detect warranty defects without any doubt and thus keep costs low. You can also be certain that we will fit genuine replacement parts which are a perfect match to your device. (Very few hobby shops are equipped to analyze and repair surface-mount printed circuit boards.)

We reserve the right to refuse repair to units which have been modified or “improved” by unauthorized “experts”.

You also have the comfort of a properly repaired unit with a renewed warranty. The warranty period of repaired devices is applicable only to the repair. This period is shorter than the warranty period of a new product (See general conditions of business).

9.2 Liability limits / compensation

We at Schulze Elektronik GmbH are unable to monitor methods of installation and operation, and have no control over how you fit, use and maintain the devices we produce. For this reason we accept no liability for loss, damage or costs which arise from the incorrect or incompetent use of our products, or are connected with that use in any way.

In so far as the law allows, our obligation in respect of compensation, regardless of the legal grounds, is limited to the invoice value of that quantity of goods which was immediately involved in the event which caused the damage. This does not apply if legally binding regulations oblige us to accept unlimited liability in a particular case, or if deliberate or gross negligence can be proved on our part.

9.3 CE certification

The products described in this manual are manufactured in accordance with all specific and mandatory European CE guidelines:

EMI 89/336/EEC, 91/263/EEC and 92/31/EEC.

The products have been tested according to the following norms:

EMI-emissions:	**EN 50 081-1:1992**
EMI-resistance:	**EN 50 082-1:1992 or EN 50 082-2:1995**

The design and construction of our products comply with the requirements for safe operation.

EMI emissions were tested under realistic conditions, i.e. using suitable motors close to the maximum allowed currents. The use of resistors instead of motors do not create maximum emission levels.

Further testing is carried out to ensure adequate EMI resistance against emissions from other apparatus. The RF signals used for these tests are similar to those produced by mobile telephones and RC transmitters.

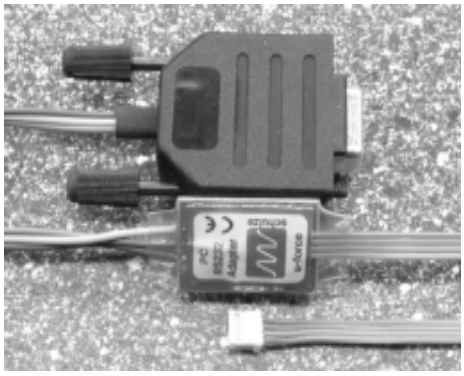
We wish to point out again that our products are tested under realistic conditions for the most dangerous scenario: exposed to the field of a powerful transmitter, the motor must not start while you are working on the model.

Hint: all ***slims*** must be insulated in heat shrinking tube.

Problems involving our products are most likely caused by unsuitable combinations of radio components or improper installations.

10 Accessories

If you wish to be able to configure every technical detail of the ***u-force***, you will need to connect the controller to a PC or laptop using the ***prog-adapt-uni*** cable. Using the ***u-soft*** program you can process the parameter sets stored on the hard disc and transfer them to the ***u-force***, and also read out the parameters stored in the ***u-force***, modify them and write them back into the controller again.



11 Specifications

Type	**Current.**	**Ni-Cd/Ni-MH**	**Size**	**Weight**	**Cable**	**Trottle**	**Brake**	**BEC**	**BEC**
unit	[A]	[cell count]	[mm]	[g]	[mm²]	[mΩ]	[mΩ]	[V / A]	[W]
brushless motor use									
***u-force*50**	50/67	6 - 12	52*32*23	46-52	2,5	2*1,4	2*1,4	5 / 3 peak	5
***u-force*75**	75/100	6 - 12	52*32*23	46-59	4,0	2*0,9	2*0,9	5 / 3 peak	5
brushed motor use									
***u-force*50**	100/200	6 - 12	52*32*23	46-52	2,5	0,45	0,45	5 / 3 peak	5
***u-force*75**	150/300	6 - 12	52*32*23	46-59	4,0	0,3	0,3	5 / 3 peak	5

Current rating: Nominal current / maximum current:

The excess current level lies above the maximum current value for each unit - if not otherwise limited by the current parameter setting.
The nominal current value is the continuous current at full throttle at which the future can be operated when connected to a 3,3 Ah battery without forced cooling. The nominal current value actually achieved may vary in either direction with different types of motor, rotational speeds and cell counts.
Note re. ***u-force*** in brushed motor mode: -> **no motor turn limit** with 6 cells.

Weight: **Excluding** - including cables

Throttle, brake: **Internal** resistance of the MOSFETs, based on data sheet values

Temperature: Overtemperature threshold approximately 110°C.

Additional parameters: see Chapter 8.3.1.1 “Modifiable parameters”

BEC: **The** stated peak current is dictated by the maximum current value of the 5V voltage regulator; it can only flow for less than 0.5 seconds, followed by a cooling-off period.
The stated continous current is much lower and is determined by the maximum power dissipation of the voltage regulator used in the unit.
Formula: P_{loss} = (V_{loss} = $V_{battery}$ - 5 V BEC-voltage) * servo current.

Essential in multi-motor configurations:

Brushless mode: multi-motor operation is NOT permissible.
Brushed mode: for multi-motor operation a Schottky diode must be soldered directly across each motor; the diode must be matched to the maximum current.The cathode (ring on diode-body) must be connected to the positive terminal of the motor.

Praktische BEC-Belastbarkeit mit BEC geeigneten Servos:

at 6-8 cells max. 6 servos, at 9 cells max. 5.7 servos,
at 10 cells max. 5 servos, at 11 cells max. 4 servos,
at 12 cells max. 3,6 servos.