



**Key to illustration:**

- 1 Receiver cable, 3-pin:
  - = negative . . . . . black or brown
  - + = positive . . . . . red
  - p = pulse . . . . . white or orange
- 2 Battery connection neg (-) . black
- 3 Battery connectin pos. (+) . red
- 4 Motor connection a . . . . . red . . . . . blue, black
- 5 Motor connection b . . . . . white, yellow . . . . . white, yellow
- 6 Motor connection c . . . . . blue, black . . . . . red

**Reverse use:**

**Please note the following guidelines, which apply when you are connecting the motor and reversing its direction of rotation:**

- 1) The controller can be used with sensorless and sensor-controlled motors. If your motor is sensor-controlled, the 5-pin connector is not used.
- 2) The three motor cables can be connected in any order.
- 3) To reverse the direction of rotation you have to swap over two of the three motor cables; we recommend that you swap the two outer wires.

Unfortunately the colour coding of the motor windings may not apply consistently to the sensor-controlled and sensorless types.

**Note:** for right-hand rotation, Plettenberg motors should be connected as the colour code shows. Mostly **futures** should be connected with the cooling plate facing the outside of the fuselage.

## Dear customer,

**Congratulations** on your choice of a **future** speed controller, which is a micro-computer controlled unit developed and manufactured entirely in Germany, designed for brushless and sensorless 3-phase rotary current motors.

All models of the **future** are amongst the world's smallest, lightest and most capable speed controllers.

**future** controllers have the most intelligent, comprehensive software, which means that this speed controller (or governor) is capable of operating virtually any brushless motor currently on the market with optimum efficiency.

The **ips** (intelligent programming system) which is a standard feature of the -bo/ -Ko/ -be versions of the **future**, makes it as simple as possible to configure the controller to match any radio control system.

The transmitter stick travel settings of the special types (future -H) are pre-set and fixed.

The **integral motor connector system** is a feature of all **future** controllers up from 35A nominal current, and makes it possible to remove the unit for servicing, or for fitting in another model, simply by unplugging the cables - no soldering is required.

This operating instruction is only valid for types from software version 30 and higher (non volatile setting of motor mode and operating mode).

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# 1 Warning notes, cautions

**Electric** motors fitted with propellers are dangerous and require proper care for safe operation. Keep well clear of the propeller 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 injury 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 are exclusively for use in RC models. Their use in man-carrying aircraft is prohibited.

**Speed** controllers are not protected against reverse polarity (+ terminal and - terminal reversed). Connecting the **battery pack** to the **motor leads** of the controller will almost certainly cause irreparable damage.

**Electronic** equipment is sensitive to humidity. Speed controllers which have got wet may not function properly even after thorough drying. You should send them back to us for cleaning and testing.

**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.

**Please** take care when switching off the receiver battery: depending on the receiver you are using, it may send an incorrect throttle signal to the **future** at this moment, which could then cause the motor to burst into life unexpectedly.

If you are using a **future** with BEC system:  
**a) 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.

**b) 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-induced interference it is always better to use a speed controller with an opto-coupler.

**Protect** the speed controller from mechanical loads, vibration, dirt and contamination.

**Keep** the cables to the motor as short as possible (max. length = 10 cm / 4").

**Do** not exceed the maximum stated length of cable between battery and **future** (max. length: 20 cm / 7...8"). The wiring inside the battery pack must also be as short as possible. Use in-line soldered "stick" packs. For the same reason, use a clamp-type amperemeter, not a series meter with shunt resistor.

**Never** leave the flight battery connected when ...

... the model is not in use and/or

... the battery pack is being charged.

**Although** some speed controllers feature a separate On/Off switch, this does not isolate it completely from the battery.

**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.

**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.

... 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 should not exceed 20 cm (7"), between speed controller and motor: 10 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 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 not 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 (exceptions see Section 9).

**Carry** out a range check before each flight. Ask an assistant to hold the model aircraft 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 opto-coupler with its optical link.

**When** Ni-Cd batteries approach the end of their charge, voltage falls drastically and quickly. The **future** detects this and reduces power to the motor automatically. This should leave sufficient energy to bring your model safely 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 by a BEC system. 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 **future** 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

#### Highlights common to all units:

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

“**Auto-arm**” function and “power on reset”

“**ips 30**” (intelligent programming system) with no pots! The speed controller automatically configures itself every time to the stick travel when you switch your receiver on respectively you connect your battery pack. The brake can also be disabled in the same way if required.

“ips” also includes a special setup variant for geared motor systems. Fixed stick travel between braking point and full-throttle point, softstart for throttle and brake. It is normally essential to apply full-throttle at the start of the flight. This variant only learns one stick position (brake point) when in use. Fine-tuning the system to match the transmitter’s stick travel is still possible, but must be done by adjusting the travel at the transmitter.

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

All **future** types with shpa include a timing and/or pulse frequency adjustment facility, which enables you to make adjustments without additional cables or push-buttons. This feature allows us to cater more accurately for the different magnetic field geometries and flux concepts employed by the various motor manufacturers. This function also lets you offset the maximum efficiency point to suit your particular application.

**Use with Tango/Samba motors:** set the pulse frequency of your **future** to 38 kHz. You may find that your power system operates at higher efficiency set to 19 kHz, but this is below the pulse frequency which the manufacturer approves for these motors (to avoid invalidating the warranty).

#### **Niedervolt-Typen:**

**future-45bo:** This controller is primarily designed for use in electric gliders or all purposes with non excessive half throttle use. 6 to 17 Ni-Cd / Ni-MH cells.

**future-45be:** Identical to the **future-45bo**, but with the addition of a BEC system. That’s why can be used with 6 - 12 cells.

**future-45Ko:** The controller for longer duration half throttle as used in sport models, aerobatic models or ducted fan models. Batt. range 6 - 17 cells; finned heat-sink.

**future-45He/Ho:** Steller für Hubschrauber mit langdauerndem Start-Sanftlauf. Regler- oder Stellerbetrieb möglich. 6-10 Ni-Cd/Ni-MH Zellen in der ...**He** Version, bei ...**Ho** bis 17 Zellen; Rippenkühlkörper; feste Knüppelpositionen für Leerlauf und Vollgas.

**future-58bo:** This version can be used with 7 to 17 Ni-Cd cells in any model where the capacity of the 45A version is marginal, and where the 90A type would represent a sledgehammer to crack a nut. With its improved efficiency it is also a good choice in models where cooling can be problematic. The intended applications therefore include small hotliners and small ducted-fan models.

#### **High voltage types:**

**future-35bo:** The controller for high cell numbers, for example as used in ducted-fan models. Battery range 16 - 30 cells; finned heat-sink.

**future-35Ho:** Controller for helicopters with long duration initial softstart. 16-30 Ni-Cd / Ni-MH cells; cooling ribs; fixed stick positions for neutral and full throttle. Normal speed controller and constant rpm use. Autorotation use.

**future-55bo:** The high-current controller for high cell count. Batt. range 16...30 cells; finned heat-sink.

## 4 Protective circuits

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

### 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 short-circuited the temperature monitor reacts too slowly to prevent damage. Switch the motor off immediately to avoid permanent damage to the speed controller.

### 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 which caused the controller to throttle back continues 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.

If you use a *future* with opto-coupler you retain full control of the model until the receiver battery is flat;

if you use a *future* with BEC system the power system and the model remain fully controllable until the last usable energy in the flight pack 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. The only solution is for you to time the period yourself with the model on the ground. 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.

### Current monitor:

Our *future* 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. If *future* is some seconds in current limiting mode, it will disarm itself (switching off the motor).

### Maximum speed monitor:

If maximum rotational speed of the motor will exceed, *future* throttles down. In this state do not use longer then 1 second.

*future bo or ko types* cut off instantly.

**Because of this:** Do not run motor without airscrew.

### Minimum speed monitor:

To ensure that the controller detects the rotor position reliably, this series of *future* types sets a defined minimum rotational speed. If the rotor speed falls below this value continuously, the controller switches the motor off. You can over-ride the reset with the "auto-arm" function (throttle stick to stop for about 2 sec). This protective function can cause the motor to be reluctant to start up if its torque limit is exceeded. If you are using one of the ...bo types with V03 software the only time you may notice this is when you first start the motor after changing the battery. In this case a propeller one step smaller in diameter must be used. If this should happen, check that the maximum permissible motor current is not exceeded.

### Receiver signal monitor:

If the receiver signal fails, or the signal is longer or shorter than the usual range of values, the smart controller reverts to hold mode for about 300 milliseconds before switching to disarmed mode.

This warning function enables you to eliminate receiver interference before you actually lose your model, perhaps by modifying the installation or changing the radio control components

### Reverse polarity protection:



These speed controllers are not protected against reversed polarity!

### Watchdog:

If this circuit is tripped the speed controller stops working briefly and then reverts to normal operation.

## 5 Monitor displays

The **future** is fitted with LEDs to indicate its operating status „disarmed“, „neutral“ or „brake enabled“.

**However**, when the unit is being configured the set stick end-points are (in dependence

of the used **future**-type or ips-mode) confirmed by a beep from the motor or a barely perceptible "blip" in full-throttle position when normal using with activated brake.

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## 6 Installation, connections

### Installing in the fuselage:

**Velcro** (hoop and loop) tape is the ideal method of mounting the controller in the fuselage. Do not pack the **future** in foam as this may lead to a heat build-up in the controller.

### Receiver connection:

**Connect** the receiver cable attached to the **future** to the receiver servo output corresponding to the throttle stick on the transmitter (or a switch if that is your preference).

The **future** receives its control signal via this receiver socket.

If you use a **future** with BEC system and one receiver cable, power is supplied to the receiver via the same cable. If the **future** has two receiver cables, please connect the two-core cable to the receiver socket to which the receiver battery would normally be connected, or to any other vacant receiver socket.

**Check** regularly especially in this case that the receiver cable is undamaged and firmly seated at the **future**.

**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.

### Length of connecting cables:

#### Power-connection battery <--> future:

Do not exceed the maximum stated length of cable between battery and **future** (max. length: 20 cm / 7...8"), otherwise the speed controller may be damaged. This rule still applies even if your power system features a retractable (folding) motor, or your model necessarily includes a long battery cable!!! Battery packs which are assembled in a zig-zag pattern also produce "long cable" effects; use in-



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

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

We recommend that you choose your connectors from our selection in Section 8 - fitting any other type of connector invalidates the warranty.

### Power-connection future <--> motor:

The cables to the motor should be kept as short as possible to avoid interferences to your receiver. Long cables tend to act as aerials and radiate interference; they also add unnecessary weight (see also section 2).

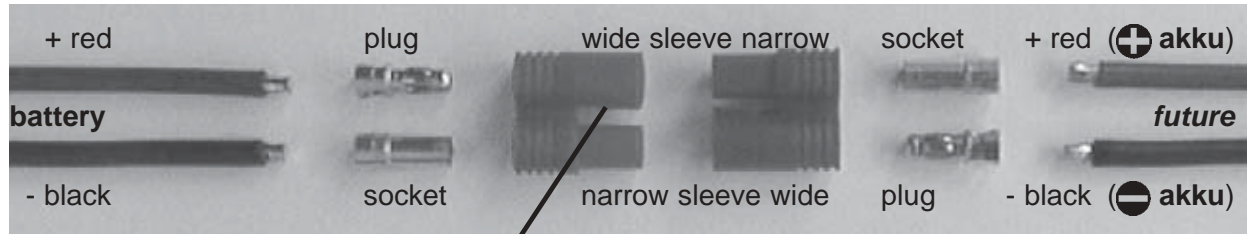
**Cut** down the existing motor cables to a length of no more than 10 cm. Do not extend the motor cables except in exceptional cases; although this generally does not harm to the **future** itself.

**Locate** the cables with the pp35 plugs supplied with the controller (plugged into the **future**), and solder them to the motor cables. See separate sheet (page 1) for details of cable configuration.

**Avoid** pulling on the motor cables; we recommend that you secure the three motor plugs with glass-reinforced tape to prevent them being pulled out.

## 7 Connector systems and mounting instructions

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



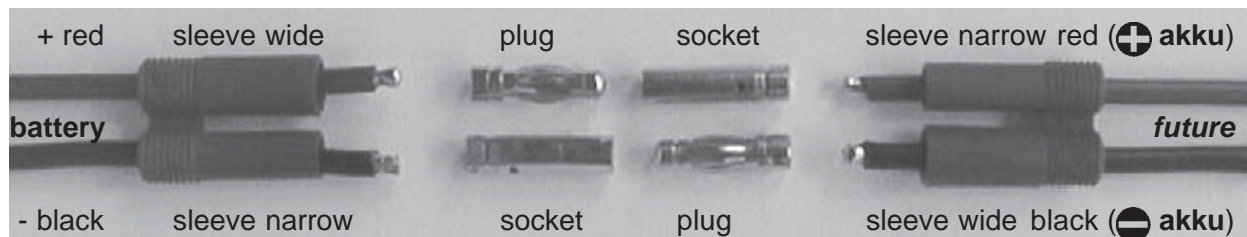
**Caution:** remove locating lug from battery cable. Do not remove lug from any cables attached to controllers or charge leads!

**Manufacturer's information:** the **pp35** plug is very short, and this presents the danger that the spring contact could lose its resilience 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 2.5 mm wide screwdriver blade on top of cable solder joint inside sleeve.
- d. Tap screwdriver to press contact into sleeve until latch engages.

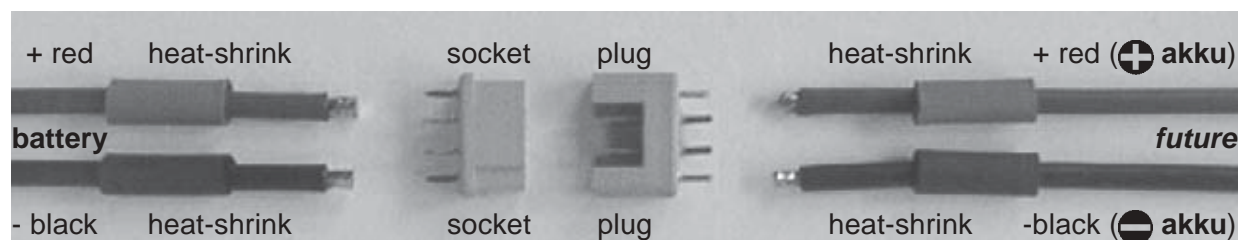
### 7.2 4 mm gold-contact connector system (CT 4, also CT 2); max. load > 80A



**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.

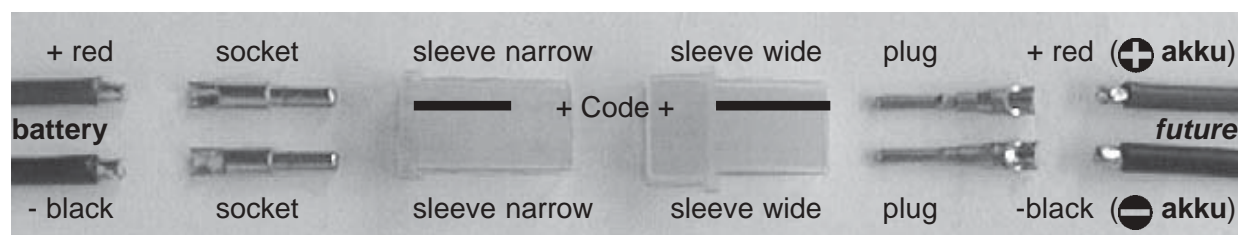
### 7.3 MPX gold-contact connector system (green or red); max. load ~30A



**Fit** the connectors in the order shown above; the contacts are soldered as follows:

- To center the contacts fit plug and socket together before soldering.
- Tin all 6 exposed contacts of plug or socket.
- Fit cable end into triangle of contacts, solder to all three contacts.
- 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:

- Place plastic sleeve vertically on table, grip end up.
- Push contact down into sleeve.
- Place 2.5mm wide screwdriver blade on top of cable solder joint inside sleeve.
- Tap screwdriver to press contact into sleeve until latch engages.

### 7.5 Suitable servos for BEC operation (selection)

DYMOND	D 60
FUTABA	5102
GRAUPNER	C261, C341, C351, C3041, C3321
MEGATECH	MTC FX200
ROBBE	FS40 #8433
VOLZ	Microstar, Wingstar, Zip

## 8 Initial use

### 8.1 ips, the intelligent programming system

for configuring the *future* to suit your application

**In general terms: in its standard form (mode 1 = default mode) the *future* works with all motors known to us, i.e. without you having to make any adjustments to it!**

If you have a transmitter with adjustable servo travel we recommend that you set throttle-servo to normal full travel, i.e. +/- 100%. Adjust Multiplex servo center pulse width to 1.5 ms (= -22% center **or use UNI-Mode**).

The **ips30** consists of three components:

- a) Configuring the controller's Operating Mode (i.e. the application) and
- b) configuring the controller's Motor Mode (i.e. the motor to be used) and
- c) matching the controller automatically to the transmitter's stick travel.

**Points a) and b)** are explained in the following pages. Point **c)** includes two different procedures, one of which (**c1**) is also explained on the following pages:

The procedure for matching the controller to the stick travel is basically the same as before, when using the controller for the first time, and is fully automatic in operation:

- c1)** For normal applications use the standard procedure: **1.** Transmitter to Stop, **2.** Switch on receiver, **3.** Connect flight pack / drive battery (future confirms "motor mode" with 1...6 beeps, waits 2 seconds, confirms "operating mode" with 1...4 two-tone beeps, then learns the Stop position, confirms this with a single beep and arms itself), **4.** Hold model in launch / start position, **5.** Apply full-throttle (future learns full-throttle point, confirms with brief drop in motor speed), **6.** Launch / start model.

**This** process configures both the brake point and the full-throttle point, so that full stick travel is always available, giving fine control of motor speed.

- c2)** If the brief drop in motor speed at full-throttle (confirming the learned full-throttle position) is disturbing or annoying, or if you don't wish to apply full-throttle at launch, use this alternative procedure: set the throttle stick to full-throttle before you switch on the receiving system and connect the flight pack / drive battery. The **future** beeps for motor mode, emits two-tone beeps for operating mode, then confirms "full throttle position learned" with a double beep. Now move the transmitter stick to Stop, and the future emits a single beep (i.e. brake position learned, future armed). You can now start or launch the model using any throttle position.

**The** helicopter programs do not provide a means for the user to configure the stick travels, i.e. both the idle and full-throttle positions are fixed.

If you want to exploit full transmitter stick travel to vary the rotational speed of your helicopter, we recommend that you reduce the servo travel slightly at the transmitter. Caution: reducing it too far will prevent you obtaining full throttle and/or the Stop position (controller will not be armed).

If your **future** beeps twice (double beep = full throttle position) when the transmitter stick is at the brake position, you must reverse the throttle channel using your transmitter's servo reverse function. If you neglect to do this, the **future** will be armed (single beep) at the transmitter's full-throttle setting, and run at full-throttle at the stop setting, which is not recommended!

**The** next pages includes instructions on operating your speed controller. There you will discover that the **future** emits a certain number of beeps when you connect the power battery; the number of beeps varies according to the set modes. This is how the **future** tells you the part-load switching frequency and timing and the Operating Mode which are currently set on your particular controller. The range of adjustment facilities varies according to controller type (wing aircraft or helicopter), and they are described in full in the section covering the use of the controller.

**Once** the **future** is configured, the "Operating Modes" and the "Motor Modes" are stored in the unit until you change them again, i.e. they are not lost when you disconnect the battery.

## 8.2 Symbols and terminology

**Stick:** The throttle stick on the transmitter



**Neutral position** (self neutralising stick)

Idle position (position where the motor just barely runs) or stop position (brake).

**Brake position or idle position**

Position of the throttle stick where the motor stops or just barely runs.



**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**



**Double beep**



**Duotone**



**Momentary interruption in running** (inverse beep)













## 8.3 Notes on changing motor timing and switching frequency

**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. Within certain limits, it is also possible to adjust the motor to suit a particular aircraft propeller or boat propeller by modifying the timing.

**When** selecting the switching frequency the general rule is this: the lower the motor's inductivity, the higher the switching frequency should be. Increasing the switching frequency reduces non-linearity in the current flow in part-load mode, but at the same time causes a rise in eddy current losses in the motor and switching losses in the controller. The simplest method is to try out different switching frequencies, and select the one at which the motor and the **future** heat up the least.


























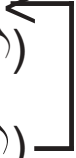
**Mode 1** is the standard mode. As a rule **future** is shipped in this mode.

### 8.4.1 Operating the *future -bo/ -Ko/ -be* from v30

- a Receiver off (flight battery disconnected)
- b Set throttle stick to brake position 
- c Switch transmitter on **TXon**
- d Switch receiver on (connect flight battery) **RXon**
- e *future* shows Motor Mode with single tone beep(s) 
- f waits 2 seconds 
- g *future* shows Operating Mode with duotone beep(s) 
- h waits 2 seconds, learns and confirms brake position with a single tone beep and is now armed! 
- i Hold model in launch position, keep clear of danger area around propeller! 
- j Move throttle quickly to full-throttle position and ...   
... leave it there for about 1/2 second. Motor is already running - as with a conventional speed controller 
- k *future* confirms full-throttle position by interrupting the motor run very briefly - a barely perceptible "blip" 
- l The *future* is completely configured and the model can be flown 

**Also** see „Configuration of the Operating Mode“ in chapter 8.4.1.1 and of the „Motor Mode“ chapter 8.4.1.2 resp. 8.4.1.3

## 8.4.1.1 Configuration of the Operating Mode *future -bo/-be/-Ko*, from v30

- |   |   |  |
|---|---|--|
|   |   | TXon   |
| a | Switch transmitter on   |  |
| b | Switch receiver on ( <i>future</i> with opto coupler)   | RXon   |
| c | Set transmitter stick to full throttle position (> 1,67 ms)   |   |
| d | Connect Drive-/Flight battery   | BATTon   |
| e | <i>future</i> confirms with <u>Motor Mode-</u> ,<br>old <u>Operating Mode-</u> and „full throttle learned-“beep(s)                                  | <br><br>     |
| f | Wait for duotone beep (10 s)  |    |
| g | Move throttle stick to stop position (< 1,40 ms) within 1.5 seconds   |   |
| h | Wait for duotone beep (1.5 s)   |    |
| i | Move throttle stick to half throttle position (1,41 ... 1,67 ms) within 1.5 seconds   |    |
| j | Wait for duotone beeps<br>This beep means: " <b>Caution, count signals</b> " (i.e. with your fingers)   |    |
| k | Wait for 2 sec, after that first double beep sounds ( <b>1, brake enabled</b> )<br>To select mode 1: after that instantly go to <b>o</b>            |    |
| l | Wait for 2 sec, after that second double beep sounds ( <b>2, brake disabled</b> )<br>To select mode 2: after that instantly go to <b>o</b>          |    |
| m | Wait for 2 sec, after that third double beep sounds ( <b>3,belt drive, brake enabled</b> )<br>To select mode 3: after that instantly go to <b>o</b> |    |
| n | Wait for 2 sec, after that fourth double beep sounds ( <b>4, belt drive, no brake</b> )<br>To select mode 4: after that instantly go to <b>o</b>    |    |
| o | Move throttle stick to stop position instantly (within 1.5 seconds)   |   |
| p | <i>future</i> waits 2 seconds, then repeats the stored "Motor Mode"   |    |
| q | <i>future</i> waits 2 seconds, then repeats the stored "Operating Mode"<br>and continues with <b>p</b> until the flight battery is disconnected.    |  <br> |

**Note:** If the number of the maximum possible Operating Modes (4) is exceeded, the mode change is invalid. This means: if you wait longer than 2 seconds after the four double beeps, or if you fail to observe the time sequence described above, the Operating Mode change is invalid.

The old Operating Mode is still valid.

### 8.4.1.2 Motor Modes of *future -bo/ -be/ -Ko* from v30

**Motor Mode 1:** Hard timing, **9.6 kHz**, 1 beep (♪)

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

**Motor Mode 2:** Soft timing, **9.6 kHz**, 2 beeps (♪♪)

- 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 all Astro, Aveox, Hacker, Kontronik and Lehner motors
- Not for Köhler, Ikarus, LRK and Plettenberg motors

**Motor Mode 3:** Hard timing, **19 kHz**, 3 beeps (♪♪♪)

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

**Motor Mode 4:** Soft timing, **19 kHz**, 4 beeps (♪♪♪♪)

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



































**Motor Mode 5:** Hard timing, **38 kHz**, 5 beeps (♪♪♪♪♪)

- Maximum efficiency at highest power and rotational speed
- Optimum for all Tango and Samba motors when maximum rotational speed is needed

**Motor Mode 6:** Soft timing, **38 kHz**, 6 beeps (♪♪♪♪♪♪)

- Motor efficiency is set to lower motor currents
- Recommended when changing from a Kontronik to a Schulze speed controller with a given motor
- With Hacker, Kontronik and Lehner motors the rotational speeds coincide more closely with the manufacturers' stated figures
- Optimum for all Hacker, Kontronik (BL and Fun) and Lehner motors with very low winds (fewer than 7 turns)
- Optimum for all Tango and Samba motors when long motor run times are required
- Not for Ikarus, Köhler, LRK and Plettenberg motors











### 8.4.1.3 Configuration of the Motor Mode *future -bo/-be/-Ko*, from v30

- |              |   |  |
|--------------|---|--|
|              |   | <b>TXon</b>  |
| <b>a</b>     | Switch transmitter on   |  |
| <b>b</b>     | Switch receiver on ( <i>future</i> with opto coupler)   | <b>RXon</b>  |
| <b>c</b>     | Set transmitter stick to full throttle position (> 1,67 ms)   |   |
| <b>d</b>     | Connect Drive-/Flight battery   | <b>BATTon</b>  |
| <b>e</b>     | <i>future</i> confirms with <u>Motor Mode-</u> ,  |   |
|              | old <u>Operating Mode-</u> and „full throttle learned-“beep(s)   (   ..  )   |  |
| <b>f</b>     | Wait for duotone beep (10 s)  |    |
| <b>g</b>     | Move throttle stick to stop position (< 1,40 ms) within 1.5 seconds   |   |
| <b>h</b>     | Wait for duotone beep (1.5 s)   |    |
| <b>i</b>     | Move throttle stick to full throttle position (> 1,67 ms) within 1.5 seconds  |    |
| <b>j</b>     | Wait for duotone beeps<br>This beep means: " <b>Caution, count signals</b> " (i.e. with your fingers)   |    |
| <b>k</b>     | Wait for 2 sec, after that first single beep sounds ( <b>Motor Mode 1</b> )<br>To select mode 1: after that instantly go to <b>q</b>  |    |
| <b>l</b>     | Wait for 2 sec, after that second single beep sounds ( <b>Motor Mode 2</b> )<br>To select mode 2: after that instantly go to <b>q</b>   |    |
| <b>m</b>     | Wait for 2 sec, after that third single beep sounds ( <b>Motor Mode 3</b> )<br>To select mode 3: after that instantly go to <b>q</b>  |    |
| <b>n,o,p</b> | etc. up to <b>Motor Mode 4 ... 6</b><br>To select Motor Mode 4, 5 or 6 instantly go to <b>q</b>   |  .....   |
| <b>q</b>     | Move throttle stick to stop position instantly (within 1.5 seconds)   |   |
| <b>r</b>     | <i>future</i> waits 2 seconds, then repeats the stored "Motor Mode"   |   (  ..  ) |
| <b>s</b>     | <i>future</i> waits 2 seconds, then repeats the stored "Operating Mode" and continues with <b>r</b> until the flight battery is disconnected.   |   (  ..  ) |

**Note:** If the number of the maximum possible Motor Modes (6) is exceeded, the mode change is invalid. This means: if you wait longer than 2 seconds after the six single beeps, or if you fail to observe the time sequence described above, the Motor Mode change is invalid.
























The old Motor Mode is still valid.

## 8.4.2 Operating the *future -Ho/ -He* from v30

- a Receiver off (flight battery disconnected)
  - b Set throttle stick to „minimum pitch“ position 
  - (c) **Only in speed governor mode (low- or high rpm):**  
Set switch resp. slider to „motor stop“ position 
  - d Switch transmitter on **TXon**
  - e Switch receiver on (connect flight battery) **RXon**
  - f **future** shows Motor Mode with single tone beep(s) 
  - g waits 2 seconds 
  - h **future** shows Operating Mode with duotone beep(s) 
  - i waits 2 seconds, confirms idle position with a single tone beep and is now armed! 
  - j Place model in launch position, keep clear of danger area around rotor blades etc.! 
  - (k) **Only in speed governor mode (low- or high rpm):**  
Set switch resp. move slider quickly in direction ‘hoover throttle’ up to the desired rotational speed. 
  - l Move pitch lever in direction „hoovering“, the helicopter can be flown 
- 

**Also** see „Configuration of the Operating Mode“ in chapter 8.4.2.1 and of the „Motor Mode“ chapter 8.4.2.2 bzw 8.4.2.3

## 8.4.2.1 Configuration of the Operating Mode bei *future* -Ho/ -He, ab v30

- |   |  |  |   |
|---|--|--|---|
| a | Switch transmitter on  |  | TXon  |
| b | Switch receiver on ( <i>future</i> with opto coupler)  |  | RXon  |
| c | Set transmitter stick to full throttle position (> 1,67 ms)  |  |    |
| d | Connect Drive-/Flight battery  |  | BATTon  |
| e | <i>future</i> confirms with <u>Motor Mode-</u> and old <u>Operating Mode-</u> beep(s)  |    |   |
| f | Wait for duotone beep (10 s)   |   |    |
| g | Move throttle stick to stop position (< 1,15 ms) within 1.5 seconds  |  |    |
| h | Wait for duotone beep (1.5 s)  |   |    |
| i | Move throttle stick to half throttle position (1,16 ... 1,67 ms) within 1.5 seconds  |  |   |
| j | Wait for duotone beeps<br>This beep means: " <b>Caution, count signals</b> " (i.e. with your fingers)                                  |   |  |
| k | Wait for 2 sec, after that first double beep sounds ( <b>1, normal controller</b> )<br>To select mode 1: after that instantly go to n  |   |  |
| l | Wait for 2 sec, after that second double beep sounds ( <b>2, low rpm governor</b> )<br>To select mode 2: after that instantly go to n  |   |  |
| m | Wait for 2 sec, after that third double beep sounds ( <b>3, high rpm governor</b> )<br>To select mode 3: after that instantly go to n  |   |  |
| n | Move throttle stick to stop position instantly (within 1.5 seconds)  |  |  |
| o | <i>future</i> waits 2 seconds, then repeats the stored "Motor Mode"  |   |  |
| p | <i>future</i> waits 2 seconds, then repeats the stored "Operating Mode" and continues with o until the flight battery is disconnected. |   |  |

**Note:** If the number of the maximum possible Operating Modes (3) is exceeded, the mode change is invalid. This means: if you wait longer than 2 seconds after the four double beeps, or if you fail to observe the time sequence described above, the Operating Mode change is invalid. The old Operating Mode is still valid.

## 8.4.2.2 Motor Modes of *future -Ho/ -He* from v30

**Motor Mode 1:** Hard timing, **9.6 kHz**, 1 beep (♪)

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

**Motor Mode 2:** Soft timing, **9.6 kHz**, 2 beeps (♪♪)

- 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 all Astro, Aveox, Hacker, Kontronik and Lehner motors
- Not for Köhler, Ikarus, LRK and Plettenberg motors

**Motor Mode 3:** Hard timing, **19 kHz**, 3 beeps (♪♪♪)

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

**Motor Mode 4:** Soft timing, **19 kHz**, 4 beeps (♪♪♪♪)

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




























**Motor Mode 5:** Hard timing, **38 kHz**, 5 beeps (♪♪♪♪♪)

- Maximum efficiency at highest power and rotational speed
- Optimum for all Tango and Samba motors when maximum rotational speed is needed

**Motor Mode 6:** Soft timing, **38 kHz**, 6 beeps (♪♪♪♪♪♪)

- Motor efficiency is set to lower motor currents
- Recommended when changing from a Kontronik to a Schulze speed controller with a given motor
- With Hacker, Kontronik and Lehner motors the rotational speeds coincide more closely with the manufacturers' stated figures
- Optimum for all Hacker, Kontronik (BL and Fun) and Lehner motors with very low winds (fewer than 7 turns)
- Optimum for all Tango and Samba motors when long motor run times are required
- Not for Ikarus, Köhler, LRK and Plettenberg motors

### 8.4.2.3 Configuration of the Motor Mode future -Ho/ -He, from v30

- |       |  |   |   |
|-------|--|---|---|
| a     | Switch transmitter on  |   | TXon  |
| b     | Switch receiver on ( <i>future</i> with opto coupler)  |   | RXon  |
| c     | Set transmitter stick to full throttle position (> 1,67 ms)  |   |    |
| d     | Connect Drive-/Flight battery  |   | BATTon  |
| e     | <i>future</i> confirms with <u>Motor Mode-</u> ,<br>old <u>Operating Mode-</u> and „full throttle learned-“beep(s)                               |     |    |
| f     | Wait for duotone beep (10 s)   |    |    |
| g     | Move throttle stick to stop position (< 1,40 ms) within 1.5 seconds  |   |    |
| h     | Wait for duotone beep (1.5 s)  |    |    |
| i     | Move throttle stick to full throttle position (> 1,67 ms) within 1.5 seconds   |   |   |
| j     | Wait for duotone beeps<br>This beep means: " <b>Caution, count signals</b> " (i.e. with your fingers)  |    |  |
| k     | Wait for 2 sec, after that first single beep sounds ( <b>Motor Mode 1</b> )<br>To select mode 1: after that instantly go to <b>q</b>             |    |  |
| l     | Wait for 2 sec, after that second single beep sounds ( <b>Motor Mode 2</b> )<br>To select mode 2: after that instantly go to <b>q</b>            |    |  |
| m     | Wait for 2 sec, after that third single beep sounds ( <b>Motor Mode 3</b> )<br>To select mode 3: after that instantly go to <b>q</b>             |    |  |
| n,o,p | etc. up to <b>Motor Mode 4 ... 6</b><br>To select Motor Mode 4, 5 or 6 instantly go to <b>q</b>  |    |  |
| q     | Move throttle stick to stop position instantly (within 1.5 seconds)  |   |  |
| r     | <i>future</i> waits 2 seconds, then repeats the stored "Motor Mode"  |    |  |
| s     | <i>future</i> waits 2 seconds, then repeats the stored "Operating Mode"<br>and continues with <b>r</b> until the flight battery is disconnected. |    |  |

**Note:** If the number of the maximum possible Motor Modes (6) is exceeded, the mode change is invalid. This means: if you wait longer than 2 seconds after the six single beeps, or if you fail to observe the time sequence described above, the Motor Mode change is invalid. The old Motor Mode is still valid.

## 9 Tips & Common

### 9.1 Rotational speeds

**future** speed governors and controllers generally produce higher rotational speeds than Kontronik controllers. In order to maintain the same load on the motor, this requires a change to a motor pinion around 8% smaller (i.e. around 1 - 2 teeth) when you switch to the **future**, otherwise you will overload the motor.

This applies not to Plettenberg or Köhler motors. Depending on the construction of the motor they will run about 2% faster only.

### 9.2 Start-up problems, controller / governor faults

We have now established that the usual cause of unreliable motor start-up problems is poor contact in the connectors.

Inadequate contact can result in faults due to excessive voltage, especially when the high-voltage versions of the **future** are used, because the high resistance of the connectors prevents the voltage being passed back into the battery at mid-range settings, and especially during braking. Examples of poor practice:

- Solder between the contact segments of the plug
  - Remedy: solder on a brand-new plug.
- Resin (electronic solder flux) under the contact segments of the plug
  - Remedy: remove flux residues with meths or contact cleaner.
- Over-long leads between battery and **future**
  - Remedy: shorten to permissible length (chapter 6).
- Lack of spring pressure in the contact segments
  - Remedy: solder on brand-new plugs, and be sure to cool the segments when soldering.
- Poor-quality connectors. Oxidised sockets (black inside), discoloured gold plating (greenish or grey).
  - Remedy: use high-quality plugs and sockets from a brand-name manufacturer
  - Remedy: don't use cheap goods from the Far East
  - Remedy: contact segments should be made of copper-beryllium - no mild steel contacts!

### 9.3 Overheating motors

If you are using a Graupner Carbon 70, Hacker, Kontronik BL or Simprop motor, never shorten the winding wires which project from the motor. The strands are coated with high-temperature lacquer, and it is impossible to solder through this material. To obtain a sound soldered joint you must mechanically remove the lacquer coating all round each individual strand. Any strands which are not soldered or fractured cause an increase in current flow through each remaining wire, and this in turn causes a lower efficiency and increase in motor temperature.

### 9.4 Interferences

We recognized some interference in combination with certain types of motors. These interferences occurs in combinations with different manufacturers of controllers.

## 9.5 Multi-motor operation

In general terms we do not recommend operating multiple motors with a **future**.

From some of our customers we have heard that this certainly works with some (but not all) Aveox, Hacker and Lehner motors, provided that the currents do not exceed the permissible maximum values for the speed controller concerned. However, we cannot guarantee that both motors will rotate over the full load range.

It is never permissible to run more than one Plettenberg motor connected to a single **future**: you must use a separate **future** for each motor. However, you can certainly power both controllers from a single drive battery - short cables and inline (end to end) soldered batteries required!

## 9.6 Helicopter use

### 9.6.1 Common to helicopter use

- **Fixed stick positions:** idle (off)=1,1 ms, full throttle=1,9 ms
- **slow initial startup** up to 10 seconds

### 9.6.2 Speed ranges, showed for 4-pole motors

<b>Low rpm:</b> Slider at 1,15 ms =	3966 rpm;	at 1,9 ms = 28935 rpm
<b>High rpm:</b> Slider at 1,15 ms =	7931 rpm;	at 1,9 ms = 57870 rpm

### 9.6.3 Under voltage

As soon as the voltage of the drive battery is not high enough the motor is throttled back first. Later **future** is switched off.

### 9.6.4 Pre set rotor speed

To provide finer control of the pre-set rotor speed, set up the slider channel on the transmitter so that the full-throttle end-point correspondends to the maximum rotor speed you ever need (e. g. for aerobatics). You can achieve this by reducing servo travel, and/or adjusting the neutral point if necessary. It is usual to use a 3-position toggle switch (motor off / hover / cruise) if you wish to use fixed rotational speeds.

The reduced servo travel normally does not affect initialisation of the **high rpm** mode.

### 9.6.5 Unknown pole count of the motor

To find out the **low rpm** or **high rpm** “stick operating mode” do as follows: Start in **low rpm** mode. If the maximum rotor speed is good for cruise, you found the right mode. Otherwise use **high rpm** “stick operating mode”.

### 9.6.6 Auto rotation:

If the slider channel is moved back to minimum speed by a mixer (not to the “motor stopped” position, but to about 1.18 ms (Graupner=-80%)), the integral soft-start designed for manual speed changes is reduced to the point where an

auto-rotation can be interrupted quickly by suddenly (autorotation switch, no soft start) opening the throttle again. If you preselect the “motor stopped” position (less than 1.1 ms) for autorotation, it will be nearly impossible to interrupt autorotation by means of the 10 second soft start.

**9.6.7 Note:** Fixed stick positions means: idle (off) = 1.1 ms, full throttle = 1.9 ms. If you are using a Graupner RC system this equates to +/- 100% stick travel. If you find that you cannot arm the controller reliably, the solution is to increase servo travel to about 105%...110%.

In speed regulator mode the full throttle setting on a slider should be different - according to the maximum rotational speed you require - and must not be necessarily 100%.

**Important:** If you are using the *future* as a normal speed controller in your helicopter, you must connect the future's servo cable to the receiver output which produces the throttle curve set on the transmitter when you operate the collective pitch control.

If you are using the *future* as a speed regulator (governor), you must not connect the controller to the receiver channel which produces the throttle curve. Instead connect it to a channel which is controlled directly by a slider or rotary control on the transmitter, i.e. a channel not affected every time by the collective pitch control. If you ignore this, motor speed will change every time you give a collective pitch command.

#### **9.6.8 Helicopter motors (efficiency / temperature)**

For helicopter applications the motor's maximum efficiency should be around 15 A, and not at the maximum currents which can occur briefly in aerobatics.

#### **9.6.9 Rotational speed fluctuations in governor mode**

- The first step is to test the *future* in standard speed controller mode (not speed regulator mode). Test it if the air is not smooth. If tail oscillation occur, the gyro is incorrectly set up, and/or the tail rotor servo is too slow, and/or the tail rotor control mechanism and/or the helicopter chassis is not rigid enough. There must be absolutely no play in the sliding sleeve linkage, the blades, the ball-races in the sleeve and in the tail rotor blades.

- If the transmission includes a belt drive, especially in the main rotor system, the belt must be adequately tensioned.

- Receiver interference may affect the nominal rotor speed, and cause fluctuations in rotational speed. In “normal controller” mode this interference is not usually detectable. Please use a schulze-alpha or a PCM-receiver.

- Please mount the gyro on the tailboom, not in or on the chassis.

## 10 Legal matters

### 10.1 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 occurred etc. A note saying "doesn't work" does not help us much, and it may lead to wasted time in troubleshooting. 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!). When a brushless controller has a need to repair it is often necessary to send it to us together with the battery pack, the motor and the airscrew. The warranty does also not cover those controllers which are not used with those connectors (of the fitting current) shown in our operating instructions and/or those connectors which can not serve the reliable function e.g. by dirt.

#### 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).

### 10.2 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.

### 10.3 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:

<b>EMI-emissions:</b>	<b>EN 50 081-1:1992</b>
<b>EMI-resistance:</b>	<b>EN 50 082-1:1992 or EN 50 082-2:1995</b>

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.

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

### 10.4 Connection to Tango and Samba motors

We do not recommend that you operate these motors with **future** controllers, as this may invalidate the warrantee. **However**, in technical terms there is no problem, provided that you set the appropriate frequency.

# 11 Specifications

## Key to the product summary on the next page (in Chapter 12).

**Weight:** Excluding - including cables

**Current rating:** Nominal current / maximum current:

The excess current level lies above the maximum current value for each unit.

The nominal current value is the continuous current at full throttle at which the **future** can be operated when connected to a 2 Ah battery (1 Ah for -18be, -25be, -20He; 1250 mAh - 80Fo).

**Throttle, brake:** Internal resistance of the MOSFETs, based on data sheet values (25°C / 10 V gate voltage). At 125°C the resistance is about 40% higher. For this reason you should always provide an effective flow of cooling air over the **future** to prevent it getting too hot.

**Pulse times:**

General: Allowed range: 0.8 ms ... 2.5 ms, cycle time: 10 ... 30 ms.

Gearbox-mode: Brake point <1.35 ms, fixed travel brake point <-> full throttle: ~0.6 ms.

**future**\_\_\_Fo: Fixed brake point = 1.2 ms, fixed full throttle point = 1.8 ms.

**Rotational speed:** the rotational speed stated above is the limit value for a 4-pole motor (...P4). The following multiplication factors apply: P2= \*2; P4= \*1; P6= \*0.67; P8= \*0.5; P10= \*0.4. The speed limiter provides some level of protection against the armature magnets of HP 220 motors flying off. Note: this speed limit is too high for the "washing machine" motor types.

**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 continuous current is much lower and is determined by the maximum power dissipation of the voltage regulator used in the unit ( $V_{\text{loss}} = V_{\text{battery}} - 5 \text{ V}$  BEC-voltage).

**Pay attention** when connecting micro-servos: the current consumption is mostly 2...3 times higher than the current of the Graupner C341 servo! The BEC System can be overloaded by temperature when using more than 8 cells and more than 3 servos!

**Maximum permissible dissipated power:** approx. 2 W with **future**-18 ...-25 (400 mA continuous current at 10 V). Approx. 3.6 W (400 mA continuous current at 14 V) with the other **future** types with BEC (-45be, -45He).

**Pulse frequency:** see "set operating modes" of every type group.

**Soft-start:** the soft-start feature on throttle and brake is not the same for the standard versions and special versions (boat, car, helicopter, pylonracer or FAI-sailplane); it is matched to the requirements of each application.

**Temperature:** Overtemperature threshold approximately 110°C.

**Note:** If you have been using a sensor-controlled speed controller, you may find that now your motor's maximum speed is different when you use the **future**. The timing of sensor-equipped motors is set for a particular rotational speed and a particular load (similar to the advance setting of an internal combustion engine's timing), but the **future** automatically optimises the timing (within the pre-setted timing) for maximum efficiency under all load conditions. **This** means that the timing does not depend on the position of the speed sensors as dictated by the mechanical design, nor on the accuracy with which they are installed. **The** net result is that you may find that the maximum rotational speed of your motor is higher - combined with higher current; or lower - combined with lower current.

**For** this reason it may prove necessary to experiment with new propeller sizes when you make the switch to a sensorless controller or you simply use the timing adjustment features of this new **shpa** software.

## 12 Product overview

Type	Current	Ni-Cd	Size	Weight	Cable	Thrott.	Brake	Rot.Sp.	Version	Special features
unit	[A]	[cells]	[mm]	[g]	[mm <sup>2</sup> ]	[mΩ]	[mΩ]	[min <sup>-1</sup> ]		
<b>Common Airplane:</b>										
<i>future-18be</i>	18/24	6-10	50*25*10	16-21	1.5	6.5+7	6.5/3	63000	19i	15 FETs,BEC5V/1.5A
<i>future-25be</i>	25/33	6-10	50*25*12	18-23	1.5	4+4.7	4/3	63000	19i	15 FETs,BEC5V/1.5A
<i>future-45bo</i>	45/60	6-17	74*24*12	25-35	2.5	2.2*2	2.2/3	63000	<u>30a</u>	36 FETs, w.cool.plate
<i>future-45be</i>	45/60	6-12	74*24*17	32-42	2.5	2.2*2	2.2/3	63000	<u>30a</u>	BEC 5V / 3A " "
<i>future-45Ko</i>	45/60	6-17	74*24*14	28-38	2.5	2.2*2	2.2/3	63000	<u>30a</u>	36 FETs, w.cool.rips
<i>future-58bo</i>	58/77	7-17	74*24*12	25-35	2.5	1.4*2	1.4/3	63000	<u>30a</u>	36 FETs, w.cool.plate
<i>future-35bo</i>	35/45	16-30	81*24*14	28-38	2.5	4.0*2	4.0/3	63000	<u>30a</u>	36 FETs, w.cool.rips
<i>future-55bo</i>	55/70	16-30	81*24*19	37-50	2.5	2.0*2	2.0/3	63000	<u>30a</u>	72 FETs, w.cool.rips
<b>Contest (FAI-sailplane):</b>										
<i>future-88Fo</i>	88/130	7-17	74*24*14	27-44	4.0	0.7*2	0,7/3	120000	18b	36 FETs, w.cool.plate
<i>future-111Fo</i>	111/148	7-17	74*24*16	33-50	4.0	0.7*2	0.7/3	120000	18b	72 FETs, no cool. plate
<i>future-80Fo</i>	80/110	16-28	81*24*19	38-50	2.5	2.0*2	2.0/3	120000	18b	72 FETs, w.cool.rips
<i>future-102Fo</i>	102/136	16-24	81*24*19	37-57	4.0	0.8*2	0.8/3	120000	18b	72 FETs, w.cool.rips
<b>Pylon:</b>										
<i>future-70Po</i>	70/120	7-10	69*24*10	21-31	2.5	1.4*2	1.4/3	120000	18b	36 FETs, thin, leightw.
<i>future-88Po</i>	88/130	7-10	69*24*11	24-41	4.0	0.7*2	0.7/3	120000	18b	36 FETs, thin, leightw.
<b>Helicopter:</b>										
<i>future-18Le</i>	18/24	6-10	50*25*10	16-21	1,5	6,5+7	-	63000	18L	BEC5V/1,5A - <b>C261</b>
<i>future-18He</i>	18/24	6- 8	50*25*10	16-21	1,5	6,5+7	-	63000	18h	BEC5V/1,5A - <b>C261</b>
<i>future-20Le</i>	20/33	6-10	50*25*12	18-23	1,5	4+4.7	-	63000	18L	BEC,cool.plate
<i>future-20He</i>	20/33	6- 8	50*25*14	20-25	1.5	4+4.7	-	63000	18h	BEC,cool.rips - <b>C261</b>
<i>future-45Ho</i>	45/60	6-17	74*24*14	28-38	2.5	2.2*2	-	63000	<u>30f</u>	36 FETs, w.cool.rips
<i>future-45He</i>	45/60	6-10	74*24*17	32-44	2.5	2.2*2	-	63000	<u>30f</u>	BEC 5V/3A, w.cool.rips
<i>future-35Ho</i>	35/45	16-30	81*24*14	29-39	2.5	4.0*2	-	63000	<u>30f</u>	36 FETs, w.cool.rips
<b>Car:</b>										
<i>future-58Co</i>	58/77	6-10	69*24*18	36-46	2.5	1.4*2	1.4/3	63000	15e	36 FETs, w.cool.rips
<i>future-58Ce</i>	58/77	6-10	69*24*21	43-55	2.5	1.4*2	1.4/3	63000	15e	BEC 5.7V/3A, cool.rips
<i>future-88Co</i>	88/130	6-10	69*24*18	36-53	4,0	0,7*2	0,7/3	63000	15e	36 FETs, m.Rippen-Kk
<i>future-88Ce</i>	88/130	6-10	69*24*21	43-62	4,0	0,7*2	0,7/3	63000	15e	BEC 5,7V/3A, m.R.-Kk
<i>future-102Co</i>	102/136	16-24	81*24*31	56-73	4,0	0,8*2	0,8/3	63000	15e	72 FETs, m.Rippen-Kk
<b>Boat (Water):</b>										
<i>future-45Wo</i>	56/65	6-17	74*24*18	44-54	2.5	2.2*2	-	63000	16w	36 FETs, w.cool.tubes
<i>future-45We</i>	56/65	6-12	74*24*24	46-58	2.5	2.2*2	-	63000	16w	BEC 5V/3A,w.cool.tub.
<i>future-62Wo</i>	62/82	7-22	74*24*18	44-54	2.5	1.5*2	-	63000	16w	36 FETs, w.cool.tubes
<i>future-88Wo</i>	88/130	7-17	74*24*14	29-46	4.0	0.7*2	-	63000	16w	36 FETs, w.cool.plate
<i>future-105Wo</i>	105/130	7-17	74*24*18	41-58	4.0	0.7*2	-	63000	16w	36 FETs, w.cool.tubes
<i>future-157Wo</i>	157/209	7-17	74*24*16	33-50	4,0	0,3*2	-	63000	16w	72 FETs, w.cool.plate
<i>future-35Wo</i>	42/50	16-30	81*24*18	41-51	2.5	4.0*2	-	63000	16w	36 FETs, w.cool.tubes
<i>future-55Wo</i>	65/80	16-30	81*24*23	53-63	2.5	2.0*2	-	63000	16w	72 FETs, w.cool.tubes
<i>future-102Wo</i>	102/136	16-24	81*24*16	40-57	4,0	0,8*2	-	63000	16w	72 FETs, w.cool.plate

