

f21 speed controller series

not recommended in addition with SIMPROP System 90 transmitters



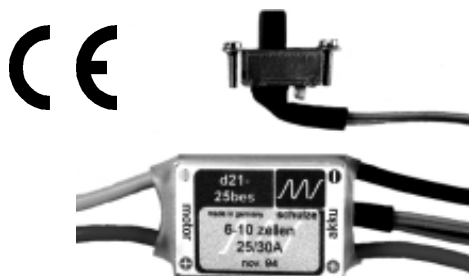
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user manual

issue 25.3.96, page 1 of 3

Chaper Content	Page
1 CE-Certification	1
2 Safety Precautions	1
3 General Warnings	1
4 Range of Applications	2
5 Features	2
6 Monitoring and Safety Circuits	2
7 Remarks to the Slide Switch	2
8 Adjustment	3
9 Control	3
10 Warranty	3
11 Installation Instructions	3
12 Technical Data	3



1) 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 these norms:

EMI-emissions: EN 50 081-1:1992

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

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 and operating at 75% power settings, close to the maximum allowed currents. Testing at full power and/or using resistors instead of motors will not create maximum emission levels.

Further testing is done to ensure adequate EMI-resistance against emissions from other devices. The HF signals used for these tests are similar to those produced by mobile telephones or RC transmitters.

Again, our products are tested under realistic conditions for the most dangerous situation: Exposed to the field of a powerful Tx, the motor must not start while working on the model.

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

2) Safety Precautions:

Make sure that:

... your motor is suppressed by at least two, better: three, ceramic capacitors of 10 ... 100nF / 63 ... 100V.

Extra suppression can also be achieved using filters with coils.

... your receiver and its antenna are at least 3cm away from the motor, the speed controller and the high current cables.

... all high current cables are as short as possible. Maximum length between flight pack and speed controller: 20cm, between speed controller and motor: 12cm.

... all high current cables longer than 5cm are twisted, especially the motor cables.

... half of the receiver antenna is routed along the fuselage (in a boat above the waterline!) with the other half outside in a vertical position. On an aircraft model half part of the antenna may hang down freely, but be careful not to step on it!

3) General Warnings:

Electric motors with propellers are dangerous objects which require due care for safe operation. Keep away from the danger zones when the battery-pack is connected.

The CE-Certificate on the speed controller is not a permit for careless handling!

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

Every time you use your propulsion system - before turning on the Rx -, make sure that:

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

b) your transmitter is turned on and the throttle stick is in STOP position.

Also to be considered:

c) Electronic equipment is sensitive to humidity. Speed controllers which have got wet may not function properly even after thorough drying.

d) Protect the speed controller against mechanical loads.

e) The **f21** are not protected against reverse polarity (+ pole changed with -pole) and connection of your **battery pack** to the **motor leads** of the controller will almost certainly cause irreparable damage.

f) Use only compatible connectors. A 2mm pin in a 2.5mm socket will not provide reliable contact. The same applies for 2mm gold pins in 2mm tin sockets.

g) Regularly check the wiring of your RC-components for loose wires, oxidation, or damaged insulation, especially when using BEC.

h) The **f21** are exclusively designed for RC-models. Their use in man carrying aircraft is prohibited.

i) Never disconnect your flight pack while the motor is still running. The speed controller may suffer damage.

j) Never leave your flight pack connected while the model is not in use. Never charge it while connected to the speed controller.

k) Ensure that your electric motor is properly suppressed.

l) Check receiver performance via range tests (Tx-antenna retracted, motor running in mid range). Speed controllers with BEC are generally more sensitive to electromagnetic noise than those with opto-couplers.



m) Usage in RC-Helicopters: Always disconnect the flight pack before turning off the Rx. The still running gyro may provide sufficient voltage and create unwanted signals to cause uncontrolled motor runs.

n) Warning: The f21 content monitoring circuits. Their effectiveness depends on a fully functional speed controller. In case of a short within the throttle transistor, neither the Stop signal from the Tx nor the current limitation nor the temperature monitoring circuits can stop the motor.

o) Note: Be reminded that the monitoring circuits can not detect every abnormal condition. For example: Short circuits between motor wires or operations above the nominal controller current limit. As the maximum current of a cold f21 far exceeds the initial motor current, a permanent current close to the peak value can not be detected in speed controllers without decreasing current limitation (as f21). Current reduction due to a blocked air screw will only occur if the motor current far exceeds the current limit value of the speed controller, i.e.: A stall current of only 20A would not be considered abnormal by an 80A controller.

p) Limits of Liability: As we can not control and ensure the proper usage of our products, Schulze Electronic GmbH can not be held liable for losses, damage or costs due to improper usage or during incidents caused by the operation of radio-controlled models.

4) Range of Applications:

All f21 speed controllers are specially designed for small models.

They contains a 5V BEC system. There is no need for a receiver battery.

There are two types with brake for the use in models with folding props and one type without brake for the use in helicopters and acrobatic models.

f21-15be: 15A / 20A, 6-12 cells

to be used with one SPEED 400 motor with 6-7 cells, a gear driving SPEED 400 motor up to 10 cells or SOLAR 600 BB 7,2V.

f21-25bes: 25A / 30A, 6-12 cells

to be used with SPEED 600 with 6-7 cells (E-UHU) or 2 times SPEED 400 with 6 cells.

f21-28Hes: 28A / 40A, 6-10 cells, controller without brake.

to be used in ECO, Whisper or EP-Concept helicopters.

5) Features:

Power-On Reset:

f21 controllers include a power on reset circuit.

Motor will not run while connecting the power battery pack, **if Tx throttle stick is at STOP position.**

Soft Start Circuit:

f21 controllers include a soft start circuit. You can activate f21 controllers from a switch instead of the normal throttle stick.

BEC:

For those who want to save the weight of a separate receiver battery, these controllers are equipped with a 1 Amp BEC system capable of providing power for as a rule 2 servos.

LED Monitor:

LED helps to adjust and to indicate power.

Switching Frequency:

Switching frequency of 1.1 kHz is optimised for low power loss and high efficiency.

EMF-brake (not f21-28Ho):

The brake is activated automatically when f21 is set to the STOP position.

Brake is recommended when using folding props.

Shottky Diode (f21-28Ho only):

By means of the shottky diode, f21-28Ho works with highest efficiency using half throttle.

Transistors:

Power mosfets of the latest technology are used for throttle and brake circuit.

Housing:

f21 controllers are suited in clear high temperature heat shrink tube.

Cables:

All controllers are sold with highly flexible cables.

6) Monitoring and Safety Circuits:

Current monitoring: Current monitoring will limit the current in case of a stalled motor. Motors with current consumptions above the specified current limit will not reach Full Power. The throttle indicator LED will remain at half intensity.

Temperature monitoring: Temperature monitoring will stop the motor. **caution: if f21 has cooled down, it will switch the motor on again by itself if you have not moved the throttle stick into stop position!**

Note: In case there is a short circuit between the motor windings or motor cables, the monitoring circuits may not act fast enough. Immediately turn off the motor to avoid permanent damage to the speed controller.

Low-voltage monitoring: This feature will automatically reduce motor power when the battery voltage has dropped to 5.5V. Below 5.5V the motor is turned off. You have to verify (model on the ground) how much longer you can move the controls because there are many parameters which effect this time: number and type of cells, number and type of servos, motor current and steering habits. It is recommended to turn off the motor as soon as the low-voltage monitoring circuit starts to reduce power.

7) Remarks to the Slide-Switch:

The slide switch at the f21-28Hes has three positions: Off, Half-On, On. In the Half-On position (middle position), only the 5V BEC system is active. In this switch position you can check pitch positions, without turning on the motor.

Only in the On position you can switch on the motor.

Please mount the switch by velcro tape or double-sided adhesive tape at the helicopter fuselage or use the holes in the printed circuit board of the switch.

The slide switch of the ...bes types has only 2 switch positions: On, Off.

Consider, that in the On position of the switch the motor starts immediately, if you have not put the transmitter stick in the STOP position.



8) Adjustment:

8.1) Tx-Adjustments for Helicopters:

Steps to be followed before adjusting the **f21** as described in next chapter.

For a stationary hover an electric helicopter requires usually 75-85% of available power.

As trim travels or settings on the transmitter are often limited, it is recommended to offset the neutral position (hover position) by changing the throttle end point adjustments to 150% (Power-Off) and 50% (Full Power). This little trick will enable you to use the full trim range for the final set-up.

8.2) f21 Speed Controller Adjustments:

f21 is factory set-up to suit GRAUPNER mc-10/mc-20 systems.

The stop point can be adjusted if necessary by rotating the trim-pot on the **f21**.

The range direction and range widths between stop and full throttle is fixed. If you will adjust, please use *servo reverse* and *servo travel* facility in your transmitter.

Caution:

For safety, remove prop before adjusting **f21**.

9) Control:

You can control the state of the **f21** by observing light emitting diode (LED). The brightness of the LED is inverse proportional to the voltage (= rotations) of the motor. If **f21** is in overcurrent state, LED will not extinguish.

10) Warranty:

All **f21** have been examined carefully before the delivery under practice conditions with accumulators at the motor. If you should have reason for the complaint, please send the device back to us with a clear error description. The text "No 100% function" is not

enough! Test the **f21** carefully once more before returning it. If our tests show no problem with your device, you have to buy the costs of our testing. It is insignificant, whether the device will be send back within the time of warranty or later.

Hint: If you have a problem with a device of us, please send it directly back to us without previously soldering in it. So the results of repair are the fastest, the costs remain low and warranty errors are recognized without doubt. Then you can be sure too, that only original parts will be inserted (We have had to make already bad experiences with alleged service stations). Cause of previously done repair outside of our firm and/or by improper repair the costs of repair can not longer be estimated, a repair of such devices is possibly refused by us completely.

11) Installation Instructions:

Using others than reverse polarity protected connectors will void your warranty. Suitable for up to 35A are Gold 2mm (with limitations), Gold 2.5mm or the green MPX 6-pin systems. For higher currents 4mm systems like the Conzelmann CT4 may be used (available as accessory) but it is not necessary in combination with **f21** controllers, they are too heavy to.

Soldering instructions for **f21** cables:

f21 battery +: Red cable

f21 battery -: Black cable

f21 motor +: Red cable

f21 motor -: Black cable

Whenever possible the motor should be directly soldered to the motor cables (red and yellow of the f21). Keep the length of the cables short to reduce EMI emissions!

To change the direction of motor rotation simply swap the motor cables. Never reverse the battery cables!

Avoid excessive heat built-up by packing the **f21** in foam rubber. Fix it with Velcro!

12) Technical Data

	f21-15be	f21-25bes	f21-28Hes
Range of voltage [V]	7.2-14.4	7.2-14.4	7.2-12
Number of Ni-Cd cells	6 - 12	6 - 12	6 - 10
Nominal- / peak-current [A]*	15 / 20	25 / 30	28 / 40
Current self consumption	varies with voltage and throttle position, approx. 35mA		
Dimensions approx. [mm]	37x27x10	37x27x11	37x27x12
Weight without/with cables approx.[g]	20 / 26	21 / 28	22 / 32
Weight switch with its cable approx.[g]	4	4	4
Cable length motor/battery approx. [cm]	8 / 8	8 / 8	8 / 13
Cable cross section [mm ²]	1.5	1.5	1.5
Length receiver cable approx. [cm]	20 - 25	20 - 25	20 - 25
FET resistance throttle/brake [mΩ]**	8 / 16	5 / 16	5 / -
BEC approx. [V / A]	5 / 1	5 / 1	5 / 1.5
Under voltage recognition at approx. [V]	5.4	5.4	5.4
Switching frequency approx. [kHz]	1.1	1.1	1.1
Overheat limit approx. [°C]	110	110	110

[*] **f21** can operate at full throttle and nominal current for the length of a 1000mAh battery charge.

The value of the specified peak current corresponds approximately to the threshold point of the current limiting circuit, varying with temperature.

Peak current is higher when **f21** is cold and could be lower than the specified value when it is warm/hot.

[**] Data sheet values, varies with gate-voltage and temperature.

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issue 25.3.96, page 4 of 3

