Operating Manual

33718 BRUSHLESS CONTROL +T 18 BEC JR
33718.SC BRUSHLESS CONTROL +T 18 BEC SC
33718.SH BRUSHLESS CONTROL +T 18 BEC SH
33735 BRUSHLESS CONTROL +T 35 G 3,5
33735.G2 BRUSHLESS CONTROL +T 35 G2
33745 BRUSHLESS CONTROL +T 45 G3,5
33745.G2 BRUSHLESS CONTROL +T 45 G 2
33760 BRUSHLESS CONTROL +T 60 G 3,5
33770 BRUSHLESS CONTROL +T 70 G 3,5
33770.D35 BRUSHLESS CONTROL +T 70 D3,5 XT-60
33851 BRUSHLESS CONTROL HV +T 160 G6

SUMMARY:

Manual V1.4
Revision: November 2013

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33735 BRUSHLESS CONTROL +T 35 G 3,5
33735.G2 BRUSHLESS CONTROL +T 35 G2

33745 BRUSHLESS CONTROL +T 45 G3,5
33745.G2 BRUSHLESS CONTROL +T 45 G 2

33760 BRUSHLESS CONTROL +T 60 G 3,5

33770 BRUSHLESS CONTROL +T 70 G 3,5
33770.D35 BRUSHLESS CONTROL +T 70 D3,5 XT-60

S3031 BRUSHLESS CONTROL +T 60,Opto, D 3,5
S3040 BRUSHLESS CONTROL +T 60, HV, D 3,5

S3041 BRUSHLESS CONTROL +T 80, HV, D 3,5
S3042 BRUSHLESS CONTROL +T 80,Opto, D 3,5

S3036 BRUSHLESS CONTROL +T 100, HV, G 6
S3037 BRUSHLESS CONTROL +T 100, Opto, G 6

S3038 BRUSHLESS CONTROL +T 120, HV,G 6
S3032 BRUSHLESS CONTROL +T 100,Opto, G 6

S3033 BRUSHLESS CONTROL HV +T 160, Opto G6
S3039 BRUSHLESS CONTROL HV +T 160, G6

THANK YOU

Congratulations for buying this state of the art brushless speed controller. It is adapted for use with high efficient and powerful brushless motors.

1. INTENDED USAGE

The BRUSHLESS CONTROL +T controls the rotational speed of a brushless electric motor connected to it. Precise information regarding your speed controller and suitable motors can be found under Point 11 in the Specification. The BRUSHLESS CONTROL +T is designed exclusively for use in radio-controlled models powered by dry or rechargeable batteries; no other type of use is permitted. Using the controller incorrectly, or for any purpose other than that described, invalidates our guarantee. In such cases we accept no liability. The unit also features a telemetry function, although this is only available in conjunction with a Graupner/SJ HoTT 2.4 system.

If you do not have the Graupner/SJ HoTT 2.4 radio system the telemetry function will not work.

Please read through this entire manual before you attempt the installation and usage of your BRUSHLESS CONTROL +T!

These operating instructions are part of this product. They contains important notes to the operation and handling. Please take this into consideration when you pass on the product to third parties. Neglect of the operating instructions and the safety instructions lead to expiring the warranty.

Graupner/SJ constantly work on the advancement of all remote control systems; changes of the scope of delivery in form, technology and equipment we must reserve ourselves therefore. Please have understanding for the fact that from data and illustrations of this operating instructions no requirements can be derived.

Please keep these instructions for further reference!

BRUSHLESS CONTROL +T features

1. Fully proportional forward with on/off brake and reverse
2. Smooth throttle response
3. Perfect compatible with both inrunner and outrunner motors without setting.
4. Motor rotation direction can be set.
5. Li-Po, NiCd and NiMH battery compatible
6. Selectable model type (Air, Heli, Boat, Car))
7. Brake programmable
8. Governormode ON / OFF with Governor Speed (only heli)
9. Oneway or twoway (Boat and car)
10. Automatically sets low-voltage cutoff based on input voltage
11. 32 kHz switching frequency
12. Thermal cutoff
13. Auto store on the stick Position

2. AVAILABLE TELEMETRY INFORMATION:

Telemetry screen:
- Battery voltage, minimum voltage
- ESC temperature, minimum ESC temperature
- Current, maximum current (except 33718, 33718.SC, 33718.SH)
- BEC voltage, minimum BEC voltage
- RPM, average RPM
- Used capacity (except 33718, 33718.SC, 33718.SH)

Programmable warning thresholds for battery voltage, BEC voltage, current consumption, capacity and ESC temperature (Power consumption and capacity not in 33718, 33718.SC, 33718.SH)

The user can exploit the update facility to maintain the BRUSHLESS CONTROL +T series speed controller constantly at the latest state of development, and to add expanded functions in future. Firmware updates are carried out via the receiver connecting lead in conjunction with the separately available USB interface, Order No. 7168.6, and the interface lead, Order No. 7168.S. Additional items required are two Y-leads, Order

No. 3936.11 and a receiver battery.
The program required - “Firmware Upgrade gr_studio” - and the update files can be found in the Download area for the appropriate product at our website www.graupner.de, where they can be downloaded at no charge.
There you will also find comprehensive instructions for connecting the BRUSHLESS CONTROL +T prior to updating, and the exact update procedure.

3. SYMBOLS AND THEIR MEANINGS:

	**ATTENTION!** This symbol alerts you to the following notes, which users ***must observe***. Ignoring or neglecting any point in these notes may have an adverse effect on the reliable operation of the device, and the operator’s personal safety.
	**WARNING!** This symbol alerts you to the following notes, with which users ***must comply***. Ignoring or neglecting any point in these notes may have an adverse effect on the reliable operation of the device, and the operator’s personal safety.
	This symbol highlights information that should be considered by the user to ensure safe operation of the unit.
	This symbol alerts you to notes concerning the proper care of the charger, which users should always observe in order to ensure that the device has an extended useful life.

4. WARNINGS:

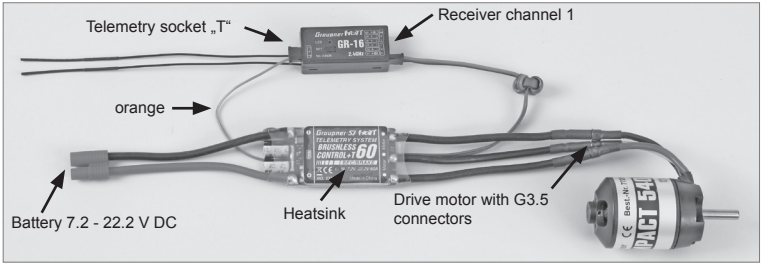
	This product isn‘t designed for use by children under the age of 14, it isn‘t a toy!
	The controller‘s CE certificate doesn‘t unbind users from their obligation to use ultimate caution.
	Should the motor refuse to start up, or after a crash, then you should immediately set the transmitter‘s control stick to the OFF position to avoid any overload to the controller. Check once again that the motor connections are correct. It may be necessary to shorten the leads, and / or set a throttle pick-up delay, in order to prevent timing errors.
	Use only motors delivered by GM-Racing or Graupner/SJ which are designed for the intended range of voltages!
	Use only high performance batteries by Graupner/SJ or GM-Racing. Using batteries with an increased internal resistance may lead to the destruction of the controller! Do never use a power supply!
	Never leave your model unattended when a battery is connected. In case of a deficiency this may cause an outbreak of fire on the model or its environment.
	Neither the controller nor any other electronic components should ever come in touch with water. Protect the controller against dust, dirt, humidity, vibrations, or other dangerous elements.
	Never run the motor on a separate battery. This will destroy the controller or the motor, and leads to the loss of our warranty.

	Never mix up polarities. Use plug systems which offer protection against wrong polarity. Avoid short-circuiting and blocking the motors.
	All cables and connectors should have good insulation. Short-circuits may lead to the destruction of your motor.
	Graupner/SJ-controllers are designed for use in battery-driven, radio-controlled models only; any other use is not permissible. Using this device on a passenger-carrying model is forbidden!
	Motors, gears or gearboxes, and propellers are dangerous objects. Never keep next to or in front of the danger area of the drive!
	Technical defects or failures of mechanical or electronic parts may lead to an unexpected start-up of the motor, with parts of it flying off, maybe causing severe injuries.
	Always check the service range of transmission of your model first thing while it‘s still on the ground (hold the model tightly!). Try again with motor on and also with fast changes of the throttle stick.
	Don‘t make any changes on the structure and design of your controller unless they are described in the manual.
	Only those components and accessory parts which have been recommended by us may be used. Use only genuine and matching Graupner/SJ connectors and accessory parts.
	Make sure whenever you start connecting and operating the controller, that your transmitter isswitched on, and has the throttle set to position “STOP”.
	Limited warranty: Graupner Ltd cannot survey the proper application of the mounting and using regulations, nor the working methods and conditions during the installation, use, operation, and servicing of the controller. Therefore Graupner Ltd cannot take on any liability for any loss, damage, or costs resulting from an incorrect use or operation of the product, or connected in any way with incorrect use or operation.

5. CONNECTING THE SPEED CONTROLLER BRUSHLESS CONTROL +T 18 -70:

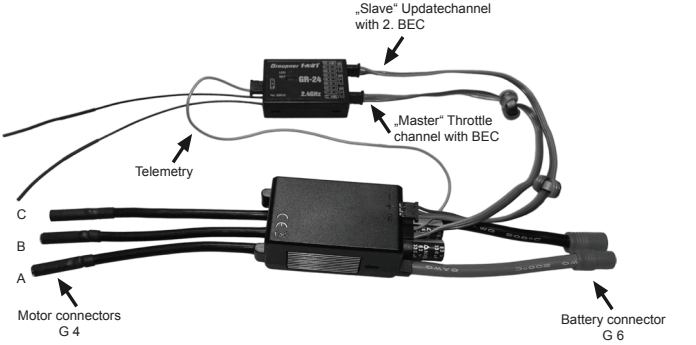
Battery leads may be supplied with different connector systems. You can avoid this problem by always using Graupner/SJ batteries fitted with matching connectors. The maximum length of the flight battery leads is 20 cm.

The motor is connected to the speed control of the three black cord. The cables are equipped with jacks. Therefore, should be attached to the engine the right plug. The motor cable can alternatively be soldered directly.



5.1 CONNECTING THE SPEED CONTROLLER BRUSHLESS CONTROL HV+T 160 G6:

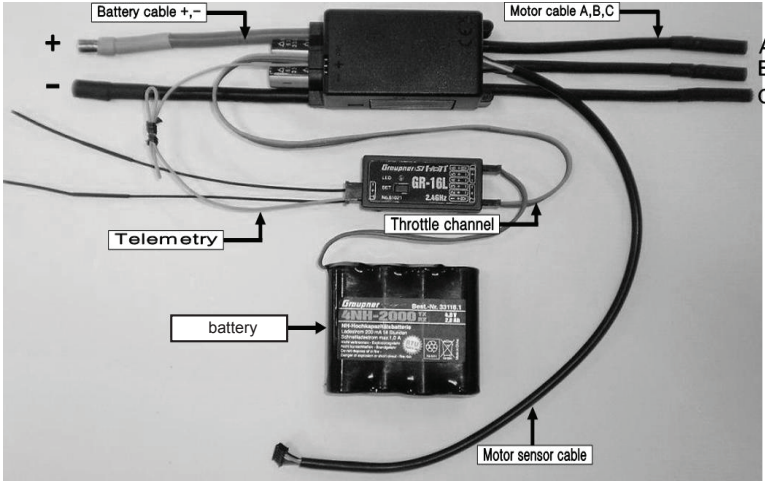
The speed controller provides stable voltage supply to the receiver with BEC continuous current rating of 5A and peak power load of 15 A. In order to achieve the optimum power, the speed controller is equipped with 2 BEC connectors. The „master“ connection must be connected to the throttle channel of the receiver. The „slave“ connection is the second BEC power supply and comes with a free channel of the receiver, use this best each of the outer terminals (Bat. port), or a flybarless system, etc. connected. The „slave“ connection is also to be used for the update cable. To update, you proceed as described in Chapter 11 before, but differing use the „slave“ connection.



When using a motor with sensor, connections must be made with the correct polarity:
speed controller A = motor A, speed controller B = motor B, speed controller C = motor C

5.1.1 CONNECTING THE SPEED CONTROLLER BRUSHLESS CONTROL HV+T 60 - 160, OPTO :

The speed controller feature an optocoupler to the signal input side (gas passage). That means the connected receiver requires a separate power supply because no BEC is present in the system, ie the controller supplies no voltage to the receiver. (see illustration)



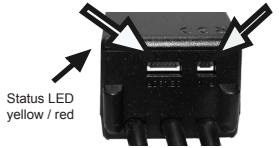
When selecting the receiver battery, note that you need to have adequate battery capacity for all servos to provide sufficient power. Pay attention also to a corresponding cross -section of the battery connection cable so under high load the voltage can not collapse.
Especially when using a large number of servos it is recommended to connect the power supply to the receiver via two entrances. Here you have the two outer ports, which are marked on the receiver with a ‚B'.
If you connect a separate battery pack to each battery terminal, make absolutely sure that the batteries have the same rated voltage and capacity. Do not connect different types of batteries or batteries with highly different charging states, because this may lead to short-circuit-like effects.
Use in such cases, for safety reasons, voltage stabilizers like the PRX-5A-receiver power supplies (No. 4136) between the battery and receiver.

5.2 SIDE CONNECTIONS OF THE SPEED CONTROLLER BRUSHLESS CONTROL HV+T 160 G6:

„Slave“ Up-datechannel with 2. BEC

Battery connector side

Sensor connector **Fan connector**



Motor connectors side

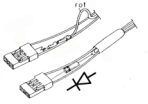
6. INSTALLING THE CONTROLLER IN THE MODEL, FIRST USE, SETTING THE THROTTLE STICK POSITIONS ON THE ESC, AND ACTIVATING / DISABLING THE BRAKE:

Mount the speed controller in the model so that it is isolated from vibration and shock and make sure the heatsink is free for best cooling. Make sure that there is sufficient cooling of the motor and speed controller by directing adequate cooling air from the outside airflow.

- Make sure all the cable leads are properly connected.
- Turn the transmitter on and check the servo travel of the throttle channel which should be ±100% or, with Multiplex R/C systems, ±80%. Robbe/Futaba systems need reversing (REVERSE) the throttle arm travel! With Graupner/JR/SJ systems, the latter should be set to “NORMAL”.

WARNING: the BEC voltage of the speed controller is adjustable from 5 to 8 V. The factory setting is 5.6 V and works for all receiver and servos. A voltage above 5.6 V may only be programmed when the receiver and all connected servos are suitable for this voltage, eg. high-voltage servos! **Risk of fire!**

Warning: If you do not want to use the BEC supply from the controller and instead use a separate battery, you have to remove and isolate the red wire (+) of the BEC plug as shown in the sketch. This will prevent a backflow into the controller, which could destroy the controller. If you want to connect a battery to the BEC system, a diode (e.g. Schottky diode 91505) needs to be soldered into the BECs red wire, so that the current can only flow from the BEC to the receiver.



Calibrating the transmitter travels for full-throttle and motor off:

1. Switch the transmitter on (“ON”), then move the throttle stick to the “full-throttle” position and hold it there.
2. Connect the dry / rechargeable battery to the speed controller with correct polarity. When all the leads are correctly inserted, the motor emits a brief beep to confirm that the power supply is connected.
3. After about ten seconds you hear a brief melody (di-da-di), and both LEDs (red and yellow) flash to indicate that the speed controller has detected the full-throttle position.

4. Move the throttle stick to the motor OFF position (back towards you) within four seconds: the motor emits a brief beep (di-da), and both LEDs flash. Hold the throttle stick in that position until you hear a brief melody - only the yellow LED lights up - to indicate that the speed controller has detected and stored the motor OFF position.
5. Full-throttle and motor OFF are now programmed; disconnect the power supply from the speed controller in order to store the settings.

Calibrating the transmitter travels for full-throttle - neutral - brake (or reverse):

1. Switch the transmitter on (“ON”), then move the throttle stick to the “full-throttle” position and hold it there.

2. Connect the dry / rechargeable battery to the speed controller with correct polarity. When all the leads are correctly inserted, the motor emits a brief beep to indicate that the power supply is connected.
3. After about ten seconds you hear a brief melody (di-da-di), and both LEDs (red and yellow) flash to indicate that the speed controller has detected the full-throttle position.
4. Move the throttle stick to the neutral position (e.g. centre) within four seconds. The motor emits a brief beep (di-da), and the yellow LED flashes to indicate that the speed controller has detected the neutral position.

5. Move the throttle stick to the bottom position (back towards you) within six seconds. The motor emits a brief beep (di-da), and both LEDs flash. Hold the throttle stick in that position until you hear a brief melody - only the yellow LED lights up - to indicate that the speed controller has detected the motor OFF position.

6. Full-throttle - neutral - brake - reverse are now programmed; disconnect the power supply from the speed controller in order to store the settings.

Note: the 'reverse' function is only available in 'Boat' and 'Car' mode, and must be activated separately at the transmitter when calibration is complete. For more information please refer to the section entitled 'Settings'.

LED status during operation:

Function	yellow LED	red LED
Neutral	on	off
Full throttle	off	on
Full brake	on	on
reverse	off	off

The error messages are retained until the speed controller is disconnected from the battery. The exception is message No. 2, which disappears as soon as the speed controller picks up a valid signal again.

Errors:

Nr.	LED	Error
1	Yellow LED flashes 1 x	Throttle stick not at neutral or reverse position, check programming if necessary
2	Red LED flashes 1 x	no signal
3	Red LED flashes 2 x	Battery voltage too low
4	Red LED flashes 3 x	Temperature of speed controller too high
5	Red LED flashes 4 x	Current too high

7. SETTINGS - PROGRAMMING:

The BRUSHLESS CONTROL +T series of speed controllers can be programmed either directly using the transmitter, or via the telemetry settings if you are using a Graupner/SJ HoTT RC system.

7.1 Settings in programming mode (without HoTT radio control system)

1. Start by programming the speed controller as described under "Calibrating the transmitter travels", working through as far as Point 4 or 5.
2. Move the stick to the full-throttle position again, and hold it there for at least six seconds: the speed controller now beeps five times to indicate that it is in programming mode.
3. The mode (1 - 5) is indicated by the yellow LED, the parameters by the red LED. The LEDs flash to indicate the settings, e.g. 2 x flashes of the yellow LED equates to mode 2 (direction of rotation), 1 x flash of the red LED equates to normal (direction of rotation).
4. To set the mode, move the throttle stick to the Stop / Reverse position (throttle stick right back), then return it to the "full-throttle" position to switch to the next mode. The switch is confirmed by 2 x beeps.
5. When you are in the desired mode, move the throttle stick to the Stop / Reverse position for two seconds: you can now program the parameters.
6. The red and yellow LEDs flash simultaneously, according to the set parameter.
7. You can now program the parameter by alternating between "full-throttle" and Stop / Reverse; advancing the throttle increases the value by one.
8. When you reach the desired value, store the setting by holding the throttle stick at the full-throttle position for at least two seconds. The speed controller beeps 3 x as an audible confirmation.
9. Repeat the procedure for all the remaining parameters which you wish to program, starting in each case at Point 3.

10. When everything is programmed to your satisfaction, store the settings by disconnecting the power supply from the speed controller.

***Note:** the settings in mode 3 vary according to the model type (mode 4). It is therefore essential to program the model type first!*

Yellow LED	Mode	Red LED										
		1	2	3	4	5	6	7	8	9	10	11
1	Battery type	LiPo	NiMH									
2	Rotation	normal	reverse									
3	Auto brake (fixed wing models) in%	0	10	20	30	40	50	60	70	80	90	100
	Governor (helicopter)	off	on									
	Reverse function (boat/car)	one-way	twoway									
4	Motortype	Sen-sorless	Sensor									
5	Model type	plane	heli	boat	car							
6	factory reset	no	yes									

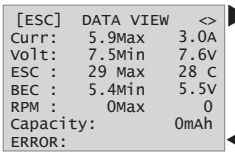
7.2 Settings in programming mode (with HoTT radio control system)

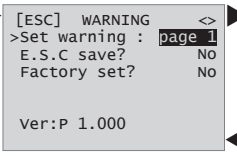
The method of operating the HoTT transmitter. For more information please read the section entitled "Telemetry" in the operating instructions supplied with your radio control system. Programming is carried out in the transmitter's "Telemetry" menu under the menu point "SETUP / DISPLAYS". The sensor displays come next in sequence after the transmitter - receiver displays, i.e. the "ESC DATA VIEW" display follows the last display of the RC system's servo test (RX SERVO TEST). ***Please note the following:*** the menus can only be selected if the receiver is switched on! When you switch the receiver on, it may take a few seconds for the display to become active - i.e. before you can select it.
There might be a slight delay in the screen's response to inputs, as all settings are transferred directly to the receiver / speed controller by wireless means.

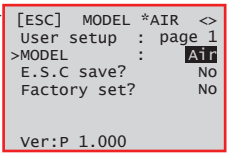
If your HoTT transmitter does not feature speech output, then programming is carried out using either a SMART-BOX or internal telemetry, if retro-fitted to an mc-19 / 22 /24 or mx-24 HoTT. Please refer to the operating instructions supplied with your SMART-BOX or radio control system for more information.
A future update of the SMART-BOX will make it possible to program the speed controller directly and quickly using the SMART-BOX itself.

The labeling of the arrows of the following displays corresponds to the keys on top of the SMART-BOX. This assignment is different depending on the remote control system:

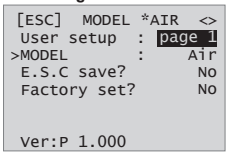
SMART-BOX	**mx-12/16/20/32 HoTT**	**mc-19/mc-22/mc-24/mx-24 HoTT**
ENTER	▶	ENTER
ESC	◀	CLEAR
INC	*scroll:* ▼ *value:* ▲	*scroll:* push Rotary + ↻ *value:* Rotary ↻
DEC	*scroll:* ▲ *value:* ▼	*scroll:* push Rotary + ↺ *value:* Rotary ↺
INC+DEC	SET	push Rotary

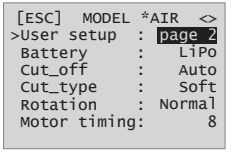


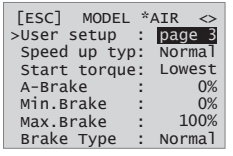


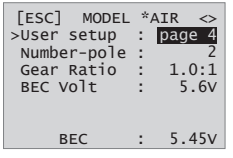


Fixed wing model:

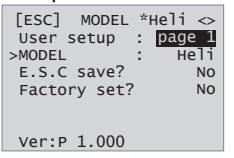


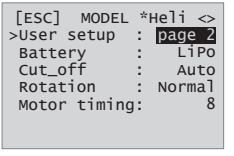


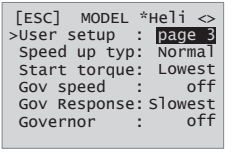


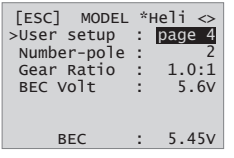


Helicopter:

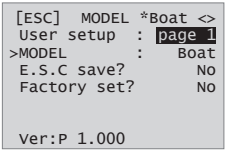


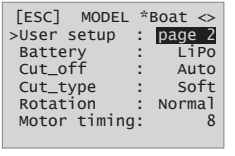


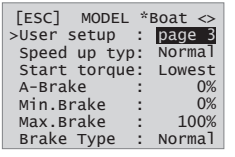


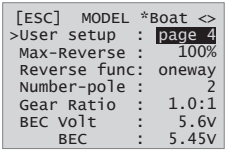


Boat:



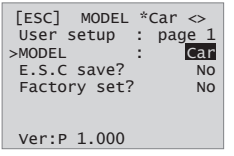


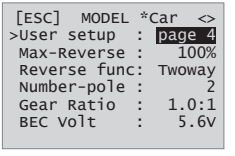


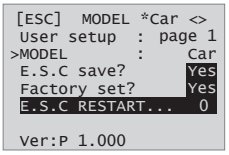


Car:

These settings are similar to the “Boat” model type, with the exception of the reverse (two-way) function, which is activated by default.







To store the settings in the speed controller, use the INC (▲) or DEC (▼) button to return to the “page 1 - ESC MODEL” screen display, and select the “”E.S.C. save” menu point. Simultaneously pressing the INC and DEC buttons (**SET**) highlights the parameter (black background). Press the INC button (▲) to move to YES, and then store the selected setting by simultaneously pressing the INC and DEC buttons (**SET**). An additional line “E.S.C. RESTART” now appears on the screen, and counts down starting at 3. The settings are permanently stored when the count reaches 0; “E.S.C. RESTART” disappears again to confirm this. If you do not wish to save the changes, select NO.

Note: the motor will not start if you alter settings but do not store them. This is an additional safety function to ensure that you do not overlook the ‘saving’ procedure.

The programmable parameters vary according to the selected model type:

A. Fixed wing models

Parameter	Display-Page	Description	Setup
User setup	Page 1	User setup: Model type, save settings	**Air: Fixed wing model** Heli: Helicopter Boat Car
Battery	Page 2	Battery type	LiPo, NiMH *Factory setting: LiPo*
Cut_off		Cutoff voltage (drive battery)	Auto, 6.0 - 32.0 V *Factory setting: auto*
Cut_type		Cutoff type	soft, hard, *Factory setting: soft*
Rotation		Direction of rotating	normal, reverse, *Factory setting: normal*
Motor timing		Motor timing	0 - 25, *Factory setting: 8*
Speed up type	Page 3	Acceleration	lowest, low, normal, high, highest, *Factory setting: normal*
Start torque		Start torque	lowest, low, normal, high, highest, *Factory setting: lowest*
A-Brake		Automatic brake	0 - 70 %, *Factory setting: 0%*
Min-Brake		Minimum brake	0 - 50 %, *Factory setting: 0%*
Max-Brake		Maximum brake	50 - 100 %, *Factory setting: 100%*
Brake Type		Brake response	softest, soft, normal, hard, *Factory setting: normal*
Number pole	Page 4	Number of motor poles (important for the correct speed display)	2 - 36, *Factory setting: 2*
Gear ratio		Gear ratio (important for the correct RPM display)	1.0:1 - 25.0:1, *Factory setting: 1.0:1*
BEC Volt		BEC voltage	5.0 - 8.0 V, *Factory setting: 5.6 V*

B. Helicopter

Parameter	Display-page	Description	Setup
User setup	Page 1	User setup: Model type, save settings	Air: Fixed wing model **Heli: Helicopter** Boat Car
Battery	Page 2	Battery type	LiPo, NiMH *Factory setting: LiPo*
Cut_off		Cutoff voltage (drive battery)	Auto, 6.0 - 32.0 V *Factory setting: auto*
Rotation		Direction of rotating	normal, reverse, *Factory setting: normal*
Motor timing		Motor timing	0 - 25, *Factory setting: 8*
Speed up type	Page 3	Acceleration	lowest, low, normal, high, highest, *Factory setting: normal*
Start torque		Start torque	lowest, low, normal, high, highest, *Factory setting: lowest*
Gov speed		Governor speed (see below)	on/off, *Factory setting: off*
Gov response		Governor response	slowest (8 ms), slow (6 ms), normal (4 ms), fast (2 ms), fastest (1 ms), *Factory setting: slowest*
Governor		Governor mode	on/off, *Factory setting: off*
Number pole	Page 4	Number of motor poles (important for the correct speed display)	2 - 36, *Factory setting: 2*
Gear ratio		Gear ratio (important for the correct RPM display)	1.0:1 - 25.0:1, *Factory setting: 1.0:1*
BEC Volt		BEC voltage	5.0 - 8.0 V, *Factory setting: 5.6 V*

Governor-Drehzahl (Gov speed): Governor Speed is a further development of the familiar Governor mode. In this case the motor speed is stored according to the throttle stick position - but regardless of the battery in use (cell-count, quality). This means that the controller regulates rotational speed according to the load on the motor, regardless of the state of the battery, i.e. whether it is fully charged or almost flat, or whether - for example - you are using a 4S or 5S battery.

- Governor mode must first be activated (Governor ON).
- Switch Governor Speed on (ON) - don't forget to store the setting on page 1, otherwise the motor will not run.
- Advance the throttle until the desired rotational speed is reached. We recommend a value of 70 - 80%, to ensure that there is a reserve available for the regulatory process. If the motor runs stably at this speed, the yellow LED on the speed controller flashes briefly to indicate that the rotational speed is now stored.
- To store the value permanently in the speed controller, land the helicopter and leave the throttle stick at the motor OFF position for at least three seconds. The programming was successful if the Governor Speed display returns to off (OFF).

Note:

- *If you intend to use different batteries, it is important to test-fly the Governor Speed using the "smallest" battery; i.e. if you plan to use 4S and 5S batteries, the setting must be established using the 4S battery.*
- *Gaslimitter must be fully open! Before programming, please perform a factory reset!*

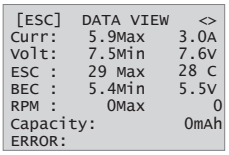
C. Boats

Parameter	Display-page	Description	Setup
User setup	Page 1	User setup: Model type, save settings	Air: Fixed wing model Heli: Helicopter **Boat** Car
Battery	Page 2	Battery type	LiPo, NiMH *Factory setting: LiPo*
Cut_off		Cutoff voltage (drive battery)	Auto, 6.0 - 32.0 V *Factory setting: auto*
Cut_type		Cutoff type	soft, hard, *Factory setting: soft*
Rotation		Direction of rotating	normal, reverse, *Factory setting: normal*
Motor timing		Motor timing	0 - 25, *Factory setting: 8*
Speed up type	Page 3	Acceleration	lowest, low, normal, high, highest, *Factory setting: normal*
Start torque		Start torque	lowest, low, normal, high, highest, *Factory setting: lowest*
A-Brake		Automatic brake	0 - 70 %, *Factory setting: 0%*
Min-Brake		Minimum brake	0 - 50 %, *Factory setting: 0%*
Max-Brake		Maximum brake	50 - 100 %, *Factory setting: 100%*
Brake Type		Brake response	softest, soft, normal, hard, *Factory setting: normal*
Max-Reverse	Page 4	Maximum reverse	20 - 100 %, *Factory setting: 100%*
Reverse func.		Reverse function	oneway, twoway, *Factory setting: oneway*
Number pole		Number of motor poles (important for the correct speed display)	2 - 36, *Factory setting: 2*
Gear ratio		Gear ratio (important for the correct RPM display)	1.0:1 - 25.0:1, *Factory setting: 1.0:1*
BEC Volt		BEC voltage	5.0 - 8.0 V, *Factory setting: 5.6 V*

D. Car models

Parameter	Display-Page	Description	Setup
User setup	Page 1	User setup: Model type, save settings	Air: Fixed wing models Heli: Helikocter Boat **Car**
Battery	Page 2	Battery type	LiPo, NiMH *Factory setting: LiPo*
Cut_off		Cutoff voltage (drive battery)	Auto, 6.0 - 32.0 V *Factory setting: auto*
Cut_type		Cutoff type	soft, hard, *Factory setting: soft*
Rotation		Direction of rotation	normal, reverse, *Factory setting: normal*
Motor timing		Motor timing	0 - 25, *Factory setting: 8*
Speed up type	Page 3	Acceleration	lowest, low, normal, high, highest, *Factory setting: normal*
Start torque		Start torque	lowest, low, normal, high, highest, *Factory setting: lowest*
A-Brake		Automatic brake	0 - 70 %, *Factory setting: 0%*
Min-Brake		Minimum brake	0 - 50 %, *Factory setting: 0%*
Max-Brake		Maximum brake	50 - 100 %, *Factory setting: 100%*
Brake Type		Brake response	softest, soft, normal, hard, *Factory setting: normal*
Max-Reverse	Page 4	Maximum reverse	20 - 100 %, *Factory setting: 100%*
Reverse func.		Reverse function	oneway, twoway, *Factory setting: twoway*
Number pole		Number of motor poles (important for the correct speed display)	2 - 36, *Factory setting: 2*
Gear ratio		Gear ratio (important for the correct RPM display)	1.0:1 - 25.0:1, *Factory setting: 1.0:1*
BEC Volt		BEC voltage	5.0 - 8.0 V, *Factory setting: 5.6 V*

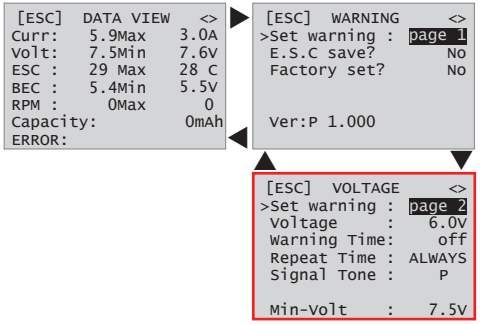
8. ESC DATA VIEW



The ESC DATA VIEW display shows the telemetry data of the BRUSHLESS CONTROL +T. This is not a “live display”, and is suppressed when the model is actually operating. Use the graphic screen for this - see section 10.

Parameter	Description	Setup
Curr(ent)	The actual current drain of the connected motor, maximum current drain since switching on (Max)	-
Volt	Current voltage of the connected battery, minimum voltage since the start (Min)	-
ESC	Current temperature of the ESC in °C, maximum temperature since the start (Max)	-
BEC	Current BEC voltage, minimum voltage since the start (Min)	-
RPM (MAX)	Maximum RPM of the connected motor since the start	-
RPM (Avg)	Average RPM of the connected motor since the start	-
Capacity	Used capacity of the connected battery since the start	-
Error	OC: Overcurrent, T: Overheat, V: Low-Tension, R: No receiver signal	-

9. SETUP STRUCTURE - PROGRAMMING WARNING THRESHOLDS:



If you wish to carry out an adjustment, you must use the INC or DEC buttons (▲ or ▼) above the screen to select the desired parameter (e.g. page 2) by moving the arrow cursor (INC or ▲ moves the cursor down, DEC oder ▼ moves it up). Simultaneously pressing the INC and DEC (**SET**) buttons switches the parameter to be adjusted to inverse video (white on black); this indicates that it can be programmed: pressing the INC (▲) button at this point increases the value, pressing the DEC (▼) button reduces the value. When the adjustment is complete, save the selected setting by pressing the INC and DEC (**SET**) buttons simultaneously; the dark background now disappears in order to confi rm this action.

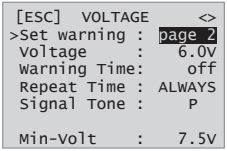
Display (Set Warning): shows the various „display pages“ with the possible adjustable parameters and the associated adjustable warning thresholds (page 1, page 2, etc.). To switch between pages, press the INC or DEC key (▲ or ▼).

Parameter	Display-Page	Description	Setup
Set Warning	Page 1 – page 6	Parameter Display	Page 1 – page 6
Voltage	Page 2	Minimum voltage in Volt	5.5 to 25 V
Temperature	Page 3	Maximum ESC temperature in °C	0 to 99° C
Max. Current	Page 4	Maximum current of the connected motor in A	25 to 200 A
Minimum RPM	Page 5	Minimum RPM of the connected motor in RPM	10 to 200.000 RPM
Capacity	Page 6	Maximum capacity	10 - 60000 mAh
Warning Time	Page 2 – page 6	Warning time	OFF, 5, 10, 15, 20, 25, 30 sec.
Repeat Time	Page 2 – page 6	Repeat time	always, 1, 2, 3, 4, 5 minutes, one time
Signal Tone	Page 2 – page 6	Sinal tone (voice output)	
E.S.C save	Page 1	Saves the settings in the speed controller	YES / NO
Factory Set	Page 1	Reset to factory setting	YES / NO

The following parameters can be set separately for all displays:
Warning Time: sets whether and how long the warning signal is activated when reaching a certain value for each display screen - OFF deactivates the warning.
Repeat Time: sets how often the warning signal is activated when reaching a certain value for each display screen.
Signal Tone: sets the signal tone melody. The warning sounds are combined with the warnings on the display and the voice output. Therefore, they may not be changed.
When a warning is activated, the corresponding message (e.g. VOLTAGE) is shown inverted in the first row of the associated display and the signal tone respectively voice output sounds.
If you wish to carry out an adjustment (page 2 to 6) you must use the INC (▲) or DEC (▼) buttons above the screen to select „page 1 - ESC WARNING“ and choose „E.S.C save“. Simultaneously pressing the INC and DEC buttons (**SET**) switches the parameter to be adjusted to inverse video (white on black); this indicates that it can be programmed: pressing the INC (▲) button at this point increases the value to YES. When the adjustment is complete, save the selected setting by pressing the INC and DEC buttons (**SET**) simultaneously; the dark background now disappears in order to confirm this action. If you do not want to save the adjustments, select NO.

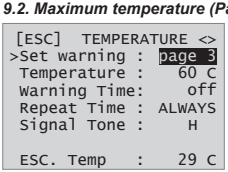
WARNING: Do not carry out any programming work on the sensors while the model is fl ying, otherwise there is a real risk that your model will fl y out of control while you are not concentrating on it!
If your model is fi tted with two or more receivers, it is absolutely essential that you do not carry out programming work during a fl ight, as this can alter the settings in the receivers to which no telemetry equipment is connected; in the worst case this could result in the model crashing.
For this reason always carry out programming on the ground, and check that only the receiver with conneted sensors is powered on.

9.1. Minimum Voltage (Page 2)



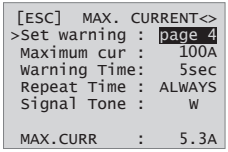
Minimum Voltage: Warning threshold for the minimum battery voltage, set between 5.5 and 25 V.
Factory setting: 6.0 V, Signal Tone: P
Warning OFF

9.2. Maximum temperature (Page 3)



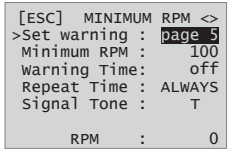
Maximum ESC Temperature: Warning threshold for the maximum ESC temperature, set between 0 and 99°C.
Factory setting: 60°C, Signal tone: H
Warning OFF

9.3. Maximum current (Page 4)



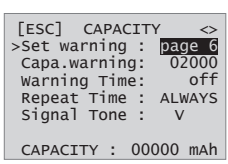
Maximum Current: Warning threshold for the maximum current of the drive motor, set between 25 and 200 A. ***Note:*** *the warning threshold should never be set to a higher value than the maximum permissible current for your speed controller type, as this would prevent sensible warnings being generated!*
Factory setting: depending on speed controller, Signal tone: W
Warning on

9.4. Minimum RPM (Page 5)



Minimum RPM: Warning threshold for the minimum RPM, set between 10 and 100.000 RPM.
Factory setting: 100 RPM, Signal tone: T
Warning OFF

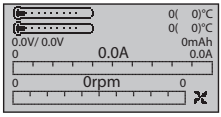
9.5. Capacity (Page 6)



CAPACITY: Warning threshold for the maximum capacity, set between 10 and 60000 mAh.
Factory setting: 2000 mAh, Signal tone: V
Warning OFF

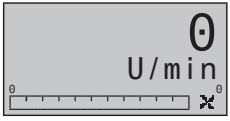
10. GRAPHIC DISPLAY OF TELEMETRY DATA

For information on displaying telemetry data please read the instructions supplied with your radio control system or SMART-BOX.



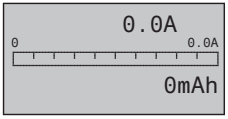
This screen displays the data generated by a BRUSHLESS CONTROL +T. Key, reading from top right:

Value	Explanation
V	Left-hand value: actual battery voltage
	Right-hand value: actual battery voltage in present power-on period
°C	Left-hand value: actual speed controller temperature
	Value in brackets: maximum controller temperature in present power-on period
mAh	Battery capacity consumed
A	Centre and bar display: actual current
	Right-hand value: maximum current in present power-on period
rpm	Centre an bar display: actual rotation speed of the motor connected to the ESC
	Right-hand value: maximum rotational speed in present power-on period



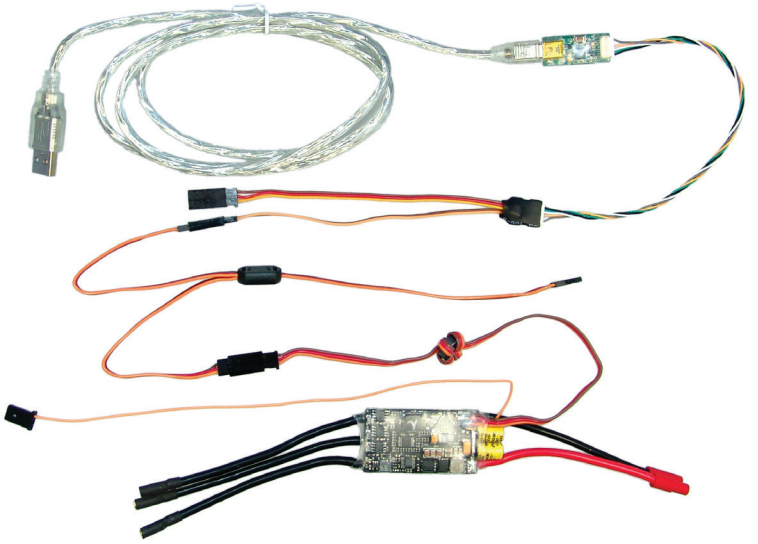
RPM display

This screen displays the current rotational speed of the motor connected to the brushless speed controller.



Current / consumption display

This screen displays the actual current consumption, the peak drain which has occurred in the present power-on period, and the capacity drawn from the battery connected to the brushless speed controller within the same period.



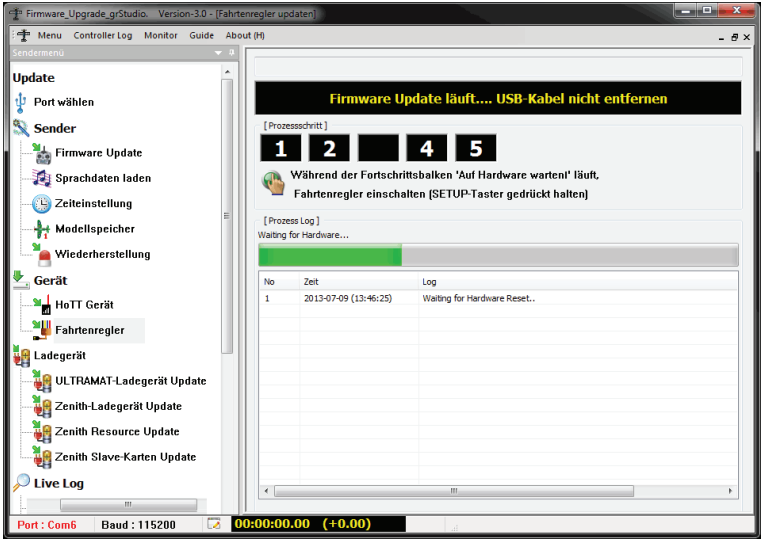
11.1. CONNECTING THE SPEED CONTROLLER PRIOR TO UPDATING

Accessories required:
- (1) USB interface for Graupner/GM-GENIUS, 7168.6
- (2) USB interface / HoTT sensor manager interface lead, 7168.S
- (3) GOLD 110 mm Y-lead, 3936.11

Once you have connected the adapter lead (2) to the USB interface (1), you must connect the Y-lead (3) to the two-pin plug attached to the adapter lead (2).

11.2. UPDATING THE SPEED CONTROLLER

For the update you need a Windows PC and the “Firmware Upgrade grStudio” software, which you can download from our website. Call up the product page for your controller, then click on the Downloads tab. You will find the file required under the PC Updatesoftware point; you will need to unpack the file after downloading it.



In the application call up the Speed controller point in the list on the left-hand side. A dialogue box now opens, offering the following choices: “Load automatically” and “Open file”.
If you wish to load the current firmware into the controller, select Load automatically. The application then attempts to download the current firmware via the Internet. Immediately after clicking on the button the bar starts to fill green from the left. Connect the speed controller power supply before the bar is completely filled: a further dialogue box now opens, in which you should click on the desired firmware, followed by the “Open file” button. The application now downloads the file, and loads it into the speed controller.
If you wish the controller to be loaded with special firmware to which you have access as a file, use “Open file”. Select the appropriate file in the dialogue box which now opens: the bar starts to fill green. Connect the speed controller power supply before the bar is full, and the application then transfers the firmware.

12. SPECIFICATION:

	BRUSH-LESS CONTROL +T 18 #33718	BRUSH-LESS CONTROL +T 35 #33735	BRUSHLESS CONTROL +T 45 #33745	BRUSHLESS CONTROL +T 60 #33760	BRUSHLESS CONTROL +T 70 #33770	BRUSHLESS CONTROL HV+T 160 G6 #33851
Cell count (LiPo)	2 - 4	2 - 6	2 - 6	2 - 6	2 - 6	5 - 12
Operating voltage	5,5 - 15V DC	7,4 - 22,2V DC	6 - 25 V DC	6 - 25 V DC	6 - 25 V DC	18,5 - 44,4 V DC
Cont. current	18 A	35 A	45 A	60 A	70 A	160 A
PWM frequency	32 kHz	32 kHz	32 kHz	32 kHz	32 kHz	32 kHz
BEC cont. current	2 A	2 A	3 A	3 A	3 A	5 A
BEC max. current	3 A	3 A	10 A	10 A	10 A	15 A
BEC voltage	5,0...8,0 V*	5.0...8,0 V*	5.0...8.0 V*	5.0...8.0 V*	5.0...8.0 V*	5.0...8,0 V*
False start protection	ja	ja	yes	yes	yes	ja
Overtemp. protection	ja	ja	yes	yes	yes	ja
Low voltage cutoff	ja	ja	yes	yes	yes	ja
updatetable firmware	ja	ja	yes	yes	yes	ja
Dimensions (mm) Lenght without capacitor	38x23x8	54x26x10	55x30x10	55x30x10	55x30x10	87x36x28
Weight (with cable)	16 g	44 g	66 g	69 g	73 g	180 g

* Programmable using a Graupner/SJ HoTT radio control system or the Smart-Box (update to Smart-Box required; available in future)

EG DECLARATION OF CONFORMITY:

We hereby declare that the following product

BRUSHLESS CONTROL +T Order No. 33718, 33735, 33745, 33760, 33770, 33851

confirms with the essential protective requirements as laid down in the directive for harmonising the statuatory directives of the member states concerning electro-magnetic interference 2004/108/EC.

This product has been tested for electro-magnetic interference in accordance with the following norms:
EN 61000-6-1
EN 61000-6-3
This declaration was produced by
Graupner/SJ GmbH
Henriettenstr. 96
73230 Kirchheim/Teck

and is valid for the manufacturer / importer of the product

73230 Kirchheim/Teck, den 30.04.2013 Ralf Helbing
Managing director

Environmental Protection Notes

When this product comes to the end of its useful life, you must not dispose of it in the ordinary domestic waste. The correct method of disposal is to take it to your local collection point for recycling electrical and electronic equipment. The symbol shown here, which may be found on the product itself, in the operating instructions or on the packaging, indicates that this is the case.

Individual markings indicate which materials can be recycled and re-used. You can make an important contribution to the protection of our common environment by re-using the product, recycling the basic materials or recycling redundant equipment in other ways.
Remove batteries from your device and dispose of them at your local collection point for batteries.
In case of R/C models, you have to remove electronic parts like servos, receiver or speed controller from the product in question, and these parts must be disposed of with a corresponding collection point for electrical scrap.

If you don't know the location of your nearest disposal centre, please enquire at your local council office.

Wir gewähren auf dieses Erzeugnis eine / This product is / Sur ce produit nous accordons une

Garantie von warrantied for garantie de **24** **Monaten months mois**

Die Fa.Graupner/SJ GmbH, Henriettenstrasse 96, 73230 Kirchheim/Teck gewährt ab dem Kaufdatum auf dieses Produkt eine Garantie von 24 Monaten. Die Garantie gilt nur für die bereits beim Kauf des Produktes vorhandenen Material- oder Funktionsmängel. Schäden, die auf Abnützung, Überlastung, falsches Zubehör oder unsachgemäße Behandlung zurückzuführen sind, sind von der Garantie ausgeschlossen. Die gesetzlichen Rechte und Gewährleistunsansprüche des Verbrauchers werden durch diese Garantie nicht berührt. Bitte überprüfen Sie vor einer Reklamation oder Rücksendung das Produkt genau auf Mängel, da wir Ihnen bei Mängelfreiheit die entstandenen Unkosten in Rechnung stellen müssen.

Graupner/SJ GmbH, Henriettenstrasse 96, 73230 Kirchheim/Teck, Germany guarantees this product for a period of 24 months from date of purchase. The guarantee applies only to such material or operational defects witch are present at the time of purchase of the product. Damage due to wear, overloading, incompetent handling or the use of incorrect accessories is not covered by the guarantee. The user´s legal rights and claims under garantee are not affected by this guarantee. Please check the product carefully for defects before you are make a claim or send the item to us, since we are obliged to make a charge for our cost if the product is found to be free of faults.

La société Graupner/SJ GmbH, Henriettenstrasse 96, 73230 Kirchheim/Teck, Allemagne, accorde sur ce produit une garantie de 24 mois à partir de la date d´achat. La garantie prend effet uniquement sur les vices de fonction-nement et de matériel du produit acheté. Les dommages dûs à de l´usure, à de la surcharge, à de mauvais accessoires ou à d´une application inadaptée, sont exclus de la garantie. Cette garantie ne remet pas en cause les droits et prétentions légaux du consommateur. Avant toute réclamation et tout retour du produit, veuillez s.v.p. contrôler et noter exactement les défauts ou vices.

Servicestellen / Service / Service après-vente

Graupner-Zentralservice	Servicehotline
Graupner/SJ GmbH	☎ (+49) (0)7021/722-130
Henriettenstrasse 96	Montag - Donnerstag
D-73230 Kirchheim / Teck	7:30 -9:00 Uhr 9:15 -16:00 Uhr Freitag 9:00 - 13:00 Uhr

Die Adressen der Servicestellen außerhalb Deutschlands entnehmen Sie bitte unserer Webseite www.graupner.de.

For adresses of service points outside of germany please refer to www.graupner.de/en/.

Pour adresses des points de service situés en dehors de l'Allemagne s'il vous plaît se référer à www.graupner.de/fr/.

Garantie-Urkunde

Warranty certificate / Certificat de garantie

33718, 33735, 33745, 33760, 33770, 33851
BRUSHLESS CONTROL +T

Übergabedatum
Date of purchase/delivery
Date de remise

Name des Käufers
Owner´s name
Nom de l´acheteur

Straße, Wohnort
Complete adress
Adresse complète

Firmenstempel und Unterschrift des Einzelhändlers
Stamp and signature of dealer
Cachet et signature du vendeur

Notizen

Notizen

Graupner/SJ GmbH
Henriettenstraße 96
D-73230 Kirchheim/Teck
Germany
www.graupner.de

BRUSHLESS CONTROL +T / November 2013 - EN V1.4