

Programmable controllers TMM® xxxx – 3 car – boat for brushless sensorless motors (Ver. 2.2x)

Controllers TMM® xxxx - 3 car - boat are outstanding programmable controllers for brushless sensorless motors (BLCD motors). They are manufactured with the use of surface mounting from high-end components and are controlled by a very powerful processor. Controllers are ready for immediate use, no programming necessary. However, if you wish to set some parameters you may do so through a very simple process. These parameters are then saved permanently. The revolution regulation is extremely fine - 1024 steps all the way to the full throttle. The Mega BEC circuit (applies to versions with BEC) is also extremely powerful. The power components of the controller together with thick aluminum cooling plates are placed only on one side of controller for better heat removal (that means no inner boards with power components).

Thanks to the high-tech TMM® technology of MGM compro controllers feature number of outstanding properties which considerably eliminate the possibility of unwanted damage or destroy of motor, the batteries and the controller itself. Controllers also ensure the maximal efficiency with different kinds of motors.

Maximum attention is paid to development which is in continuous progress. To make our newest knowledge available to our customers the upgrade of SW is free (only shipping costs are charged).

The quality of products is under constant supervision in manufacture. Every controller goes through numerous tests. The final test of each controller is done under the controller's full load.

Protective and safety mechanisms of TMM® controllers:

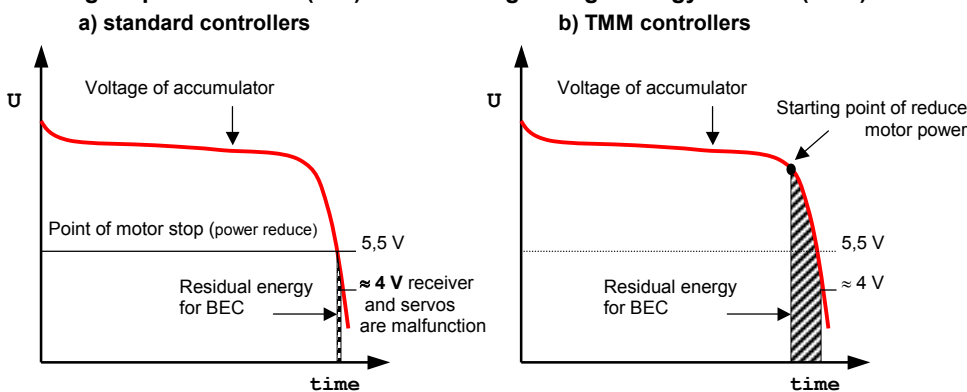
Accumulators are protected in three ways. Firstly, due to the use of automatic current fuse (ACF) the current overload of accumulators (and their possible damage) even at crisis points can be avoided. Secondly, the used system of intelligent power reduce (IPR) always ensures through measurements of number of cells, voltage, currents, accumulator condition and calculations an optimal point of starting continuous reduction of motor performance (it is applied when accumulators become heavily discharged) so that accumulator cells do not get extremely discharged. This, not mentioning other advantages, reduces the possibility of reversal of poles of lower cells.

This system at the same time **enables retaining defined energy for BEC (perfect RPC)** in controllers that have BEC which is of great significance for flying models (a crash due to running out of energy for receiver and servos can be avoided) Thirdly, it is the automatic current reduce (ACR) due to which a drop in voltage for BEC under extremely big current load (for every given controller) while motor starts does not occur.

The controllers efficiently **mask interference and drop-outs** up to 1,5 sec. When long-lasting drop-outs or interference occur the controller slowly reduces motor revolutions. After the signal is resumed the controller continuously gets to the requested power. Without the proper signal from the transmitter (e.g. transmitter is turned off), the motor neither jerks nor runs but is at standstill.

Thermal fuse of the controller is set to 90°C when performance is reduced to ca 60% After switching on, the temperature above 70°C is monitored; if the temperature is higher the controller does not start. New start is possible only after the controller temperature falls. Take notice that the controller warms up not only due to losses on switching transistor but also due to loss on BEC.

Intelligent power reduce (IPR) and retaining enough energy for BEC (RPC)



The controller's behavior at the point of exhausted batteries (or closely before that) is very significant from both the controlling point of view and economical use of remaining energy point of view.

When switching (reducing power) the motor off at solid boundary (a) there is only very little energy remaining for BEC, particularly for 8 or more cells in battery pack. The better accumulators are used the less energy (time) is left to land (standard ESC).

Comparing to this, TMM (b) ensures the remaining energy to be big enough; it is also possible to modify its size in some types (bigger for gliders). This energy is certainly insignificant as long as duration of running the motor is concerned, but it is very significant for feeding BEC.

Operating data

Temperature of the environment:	0°C to 40°C	Number of regulation steps:	1024 / full throttle
Motor controlling:	PWM 8 kHz	Max. rpm for 2 poles motor:	150 000 rpm
Control signal:	positive pulses 1,5 ± 0,5 ms, period 10 ÷ 30 ms		
User set parameters	brake on – off / NiCd, NiMH or Li-Ion, Li-Pol batteries / min and max throttle positions		
Automatically set parameters	number and quality of cells, controlling signal from transmitter, motor timing		
MEGA BEC:	5V / max. 4,0 A (power losses 5W continuous, 10W / 40 sec., 15W / 5 sec., max. 20W, see graph)		
Suitable for motors:	Mega AC, Model Motors, MP JET, PJS, Überall model, Hacker, Kontronik, LRK, Plettenberg, etc.		

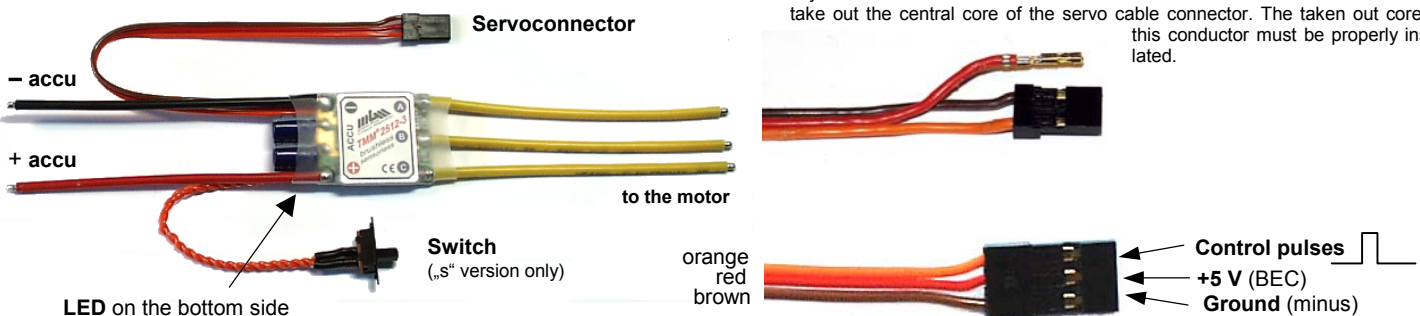
TMM®	1210-3	1810-3L	2512-3	4012-3	6012-3	8012-3
Dimensions (with external capacitor) [mm]:	25×22×6	40×26×6	44×26×6	55×32×6	67×30×12	67×30×12
No. of feeding NiCd/NiMH cells:	6 – 10	4 – 10	6 – 12	6 – 12	6 – 12	6 – 12
No. of feeding Li-Ion / Li-Pol cells	2 – 3	2 – 3	2 – 4	2 – 4	2 – 4	2 – 4
Model:	BEC	BEC	BEC	BEC	BEC	BEC
Max. current (for full throttle):	12 A	18 A	25 A	40 A	60 A	80 A
Max. current for 5 sec.:	15 A	23 A	30 A	50 A	70 A	100 A
On-state switch resistance at 25 °C:	2×6,3 mΩ	2×4,0 mΩ	2×3,9 mΩ	2×1,3 mΩ	2×1,0 mΩ	2×0,7 mΩ
Power conductors length/cross-section:	0,5 mm ²	1,0 mm ²	1,5 mm ²	2,5 mm ²	2,5 mm ²	2,5 mm ²
JR gold connector, cables:	0,15 mm ²	0,25 mm ²	0,25 mm ²	0,25 mm ²	0,25 mm ²	0,25 mm ²
Weight incl. all conductors ("s" version):	9 (11) g	17 (19) g	20 (22) g	31 (33) g	49 (52) g	49 (52) g
Weight without power conductors ("s" ver.):	6 (8) g	10 (12) g	10 (12) g	17 (19) g	35 (38) g	35 (38) g

The appearance and operating data may be changed without prior notice

Note:

(for BEC versions only !)

If you need to feed the receiver or servos from some other source carefully take out the central core of the servo cable connector. The taken out core of this conductor must be properly insulated.



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! It is necessary to programm the controller first !

PROGRAMMING and operation:

All programming is done through transmitter and receiver with which the controller will run. After programming the data will be saved (until possible next programming) and the controller must be switched off. After switching it on again it is ready to fly. If after switching on, the throttle stick is not in the **neutral** position the controller waits for it to get there (safety precaution) – if the throttle is in its **neutral** position you may take off immediately.

Description of parameters in the programming mode:

Parameter A – mode choice: “CAR” mode for cars, “BOAT” mode for boats

CAR mode: If the car is at standstill, then by moving the throttle from neutral the car will go backward or forwards. If the car is moving then by moving the throttle backwards the car will brake. The brake is proportional, that means the further the throttle is from neutral the more intensive the brake is. The intensity of braking in the max throttle position may be set in parameter “B”. When braking the car will stop, and not start moving backwards until you move the throttle to neutral and then again backwards.

BOAT mode: in this mode the parameter „B“ sets the speed in which the motor revolutions are reduced from maximum to the full stop. The direction of motor revolutions is reversed immediately upon moving the throttle the opposite way. The speed of slowing down and starting up is set in parameters „B“ and „C“.

Parameter B – brake:

CAR mode: enables to set 5 grades of intensity of proportional brake in the max throttle position. Set according to your needs.

– **deceleration:** **BOAT mode:** enables to set the speed of deceleration in 5 grades, Set according to your needs.

Parameter C – acceleration: enables to set acceleration (acceleration speed of motor) in 5 steps. Set according to your needs.

Parameter D – timing:

here you may choose (and experiment with) 5 different timings. The sixth possibility is automatic timing which is strongly recommended because it ensures optimal setting and maximal efficiency. While using the definite values of timing and higher timing you may rise the motor revolution or the twisting moment a bit but always at the expense of lowering the efficiency. If you wish to have higher revolutions it is better to use different motor or more cells because lower efficiency cannot be made up for. High value of timing may in unsuitable combination with some motors damage the controller!

Motor with high inductance: setup timing 5° or 10°, automatic timing cannot be optimal.

Parameter E – controller behavior when batteries are getting low: This parameter sets the controller's behavior at the moment when the voltage on the discharging curve of batteries gets to the point when the controller starts to preserve the remaining energy for the BEC. You may set continuous motor revolutions reduction or an immediate cut off (with the possibility of start when you lower the throttle to neutral). This depends on pilot's customs. Both behaviors are quite alike regarding the residual energy.

Race mode: In race mode, the motor will be stopped when the voltage of batteries drops below 5V, number of cells, their condition or current is not taken into consideration. After throttling down to neutral, the operation may be resumed. This mode is quite harsh on accumulators, particularly for those with more cells !!! Current fuse is disabled (that means it does not check maximal current !!!), the thermal fuse is set to 105°C. Warranty does not apply to a possible damage of controller when operating under this mode.

Parameter F – battery:

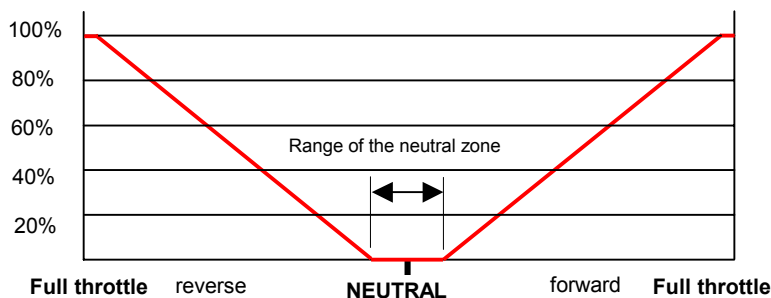
choice of the battery type, NiCd, NiMH or Li-Ion, Li-Pol

Parameter G – range of the neutral zone:

There exists a zone evaluated by the controller as „the neutral“. Here the motor is not fed, the brakes are or are not applied automatically, in case of an overcharge normal operating mode is resumed. This parameter may be changed according to your needs and requirements in the extent of ca 3 up to 20% of the full deflection of the throttle stick. The zone which is too narrow may be not evaluated reliably and the one which is too wide narrows the zone of stepless control.

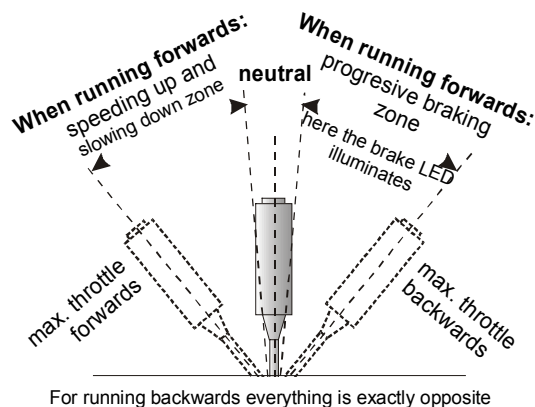
Parameter H – automatic correction of the neutral after each switching-on:

If this parameter is not switched on, the position of the neutral is evaluated exactly according to the setup within the scope of basic programming. If this parameter is switched on, the correction to the throttle stick's current neutral position is carried out after each controller switch-on. It can be used in such cases as are those when you easily (and unintentionally) move the trim thus changing the center of the neutral. There is no need to carry out the basic programming again - upon the following switch-on of the controller the position of the neutral is set automatically. When switching the controller on, pay heed to the following - the transmitter must already be switched on and the throttle stick moved to the neutral position.



Note:

Set on your transmitter the biggest possible size of deflections, the control will be finer. If you do not wish to use a full performance of the motor (in some direction), reduce the size of deflections (only after programming !!) on your transmitter; as a result, max. motor revolutions will be not achieved even if the throttle stick is moved into a full deflection position.



WARNING : You risk destroying the controller for:

- connecting more battery cells to the controller than the max. number specified in the technical data
- reversing connections to the accumulator
- shortcutting of wires to motor when batteries are connected
- changing motor and accumulator outlets
- overloading of the BEC with bigger currents or bigger power loss than is specified in technical data
- water in the controller (except for „hydro“ versions“)
- metal objects in the controller (screwdrivers, wires, etc.)
- disconnecting the controller from batteries or turning off the controller while motor is running (or still turning)

How to program the desired “value” in parameter you are setting (basic procedure in each parameter):

Move the throttle to the max throttle backwards position, green LED will be switched off 2x (twice) and motor beeps 2x. Move throttle back to neutral position, green LED will be switched off once and motor beeps once. Repeat this procedure (max throttle backwards position – neutral) as many times as is the number of parameter (according to the table) you wish to set. **For example:** for setting the **number 4** in parameter D (that is timing 15°) repeat the whole procedure (max throttle backwards position – neutral) **4x** (you certainly have to be in parameter D).

The programming of each parameter will be finished when you move the throttle from neutral position to the max throttle forward position – green LED will be turned off 3x and motor will beep 3x, then move the throttle back to neutral position, Green LED will be turned off 1x and motor will beep once – the parameter is programmed to the value you have chosen and saved (**this sequence is marked as “ENTER”**). This also automatically gets you to next parameter. After the last programmed parameter the controller must to be always switched off first!

If you do not wish to change some parameter (you wish to preserve its last value) you directly set max. throttle forward position when programming it (no max throttle backwards position – neutral, but directly ENTER). The parameter value stay as it was before and the controller will get to the next parameter programming.

The programming itself:**1) Turn the transmitter on with throttle stick in max. throttle forwards position !**

2) Turn on the controller. After 10seconds the controller will beep 3 x and LED will blink and stay turned on. Now you have 3 seconds to move the throttle to max throttle backwards position (full brake). If in this time limit you do not put the throttle in min position the programming process will end and the controller will be turned off. **Its next operation is possible after switching off and then turning on by switch (disconnecting and connecting of batteries).** If you put the throttle to full brake in this time limit, the motor will beep 1x and the green LED will be turned off 1x. Move throttle to neutral position, motor will beep 2x and the green LED will be turned off 2x. Now you are in the programming mode and may start to program parameters according to the procedure described above.

3) Parameter A – mode choice: DEFAULT – CAR – BOAT**I) You wish to set default parameters:**

Move the throttle directly to max throttle forwards position, green LED will be turned off 3x and the motor will be beep 3x. Move throttle back to neutral position, green LED turned off 1x and motor will beep 1x. **It is set default parameters, controller switch off.**

II) You wish to set CAR mode:

Move the throttle to max throttle backwards position (full brake) position, green LED will be turned off 2x and the motor will be beep 2x. Move throttle back to neutral position, green LED turned of 1x and motor will beep 1x. This choice will be confirmed by moving the throttle from neutral to max throttle forwards position – green LED will be turned off 3x and motor will beep 3x. Then move back to neutral position and LED will be turned off 1x and motor will beep 1x. It is set CAR mode and you may go to set next parameters.

III) You wish to set BOAT mode:

Move the throttle to max throttle backwards position (full brake) position, green LED will be turned off 2x and the motor will be beep 2x. Move throttle back to neutral position, green LED turned of 1x and motor will beep 1x. **This sequence make two times (you must set number “2”)**. This choice will be confirmed by moving the throttle from neutral to max throttle forwards position – green LED will be turned off 3x and motor will beep 3x. Then move back to neutral position and LED will be turned off 1x and motor will beep 1x. It is set BOAT mode and you may go to set next parameters.

4) parameter B – brake / deceleration:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

5) parameter C – acceleration:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

6) parameter D - timing:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

7) parameter E - behavior when battery are getting low:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

8) parameter F - battery:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

9) parameter G - range of the neutral zone:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value and move to next parameter

10) parameter H - automatic correction of the neutral after each switching-on:

set according to the “How to program the desired “value” in parameter you are setting” (see above) set the desired value. By sequence „ENTER“ (set full throttle forward – back to neutral) you terminate programming.

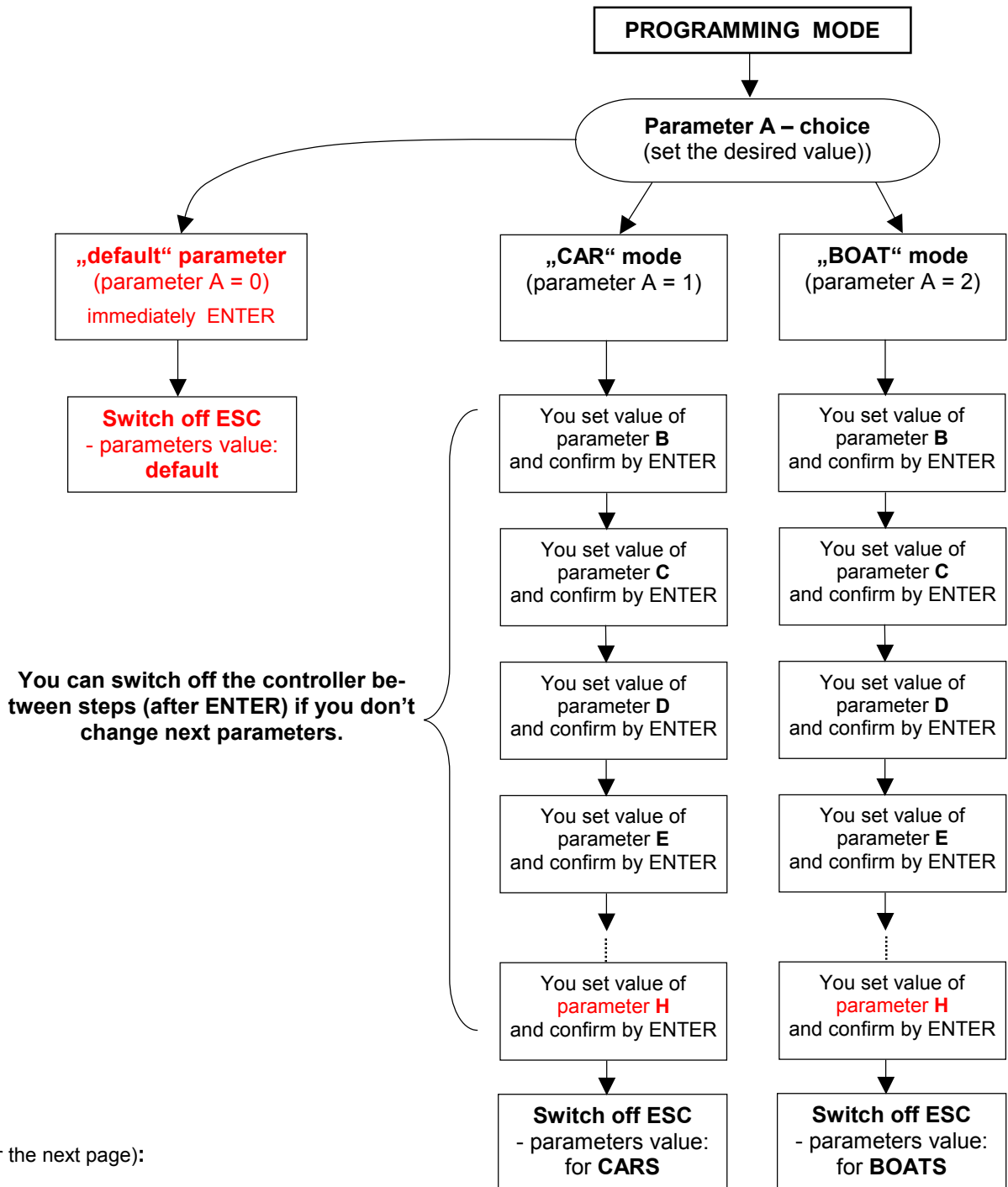
11) Turn of controller !

Notice: If you do not wish to change some parameter, move directly to max throttle forwards position when programming it (no max throttle backwards position – neutral procedure). This will keep the last value and get you to programming of next parameter (**applies to all parameters except for the first one which has to be set !!!**)

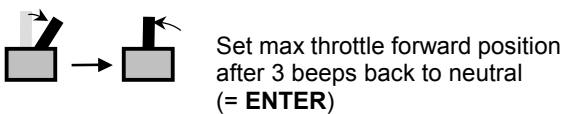
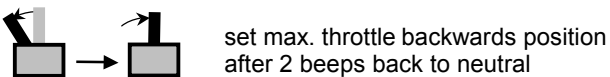
Parameter	Value of parameter →	0 (direct ENTER)	1	2	3	4	5	6	7	8
A	Mode choice	default, end of prog.	„CAR“ mode	„BOAT“ mode	-	-	-	-	-	-
B	Brake (car) Deceleration (boat)	next parameter	Light 0,13 sec.	Medium 0,26 sec.	High 0,39 sec.	Hard 0,65 sec.	Very hard 1,3 sec.	- 1,8 sec.	- 2,3 sec.	- 3,0 sec.
C	Acceleration (from 0 to 100%)	next parameter	0,13 sec.	0,26 sec.	0,39 sec.	0,65 sec.	1,3 sec.	1,8 sec.	2,3 sec.	3,0 sec.
D	Timing	next parameter	automatic	5°	10°	15°	20°	25°	-	-
E	Behavior when accu voltage going down	next parameter	Slow reduce rpm	Motor cut off	RACE MODE	-	-	-	-	-
F	Battery type	next parameter	NiCd, NiMH	Li-Ion, Li-Pol 2 cells	Li-xxx 3 cells	Li-xxx 4 cells	-	-	-	-
G	Range of the neutral zone	next parameter	3%	6%	9%	12%	15%	18%	21%	24%
H	Automatic correction of the neutral after	End of program- ming	NO	YES	-	-	-	-	-	-

Notice: Default setting is **bold**.

PROGRAMMING TMM xxxx – 3, CAR - BOAT



Legend (for the next page):



PROGRAMMING TMM xxxx – 3, CAR - BOAT

a) default parameters setup

b) „CAR / BOAT“ programming mode

