

Controllers TMM<sup>®</sup> xxxx - 3 profi line 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, except types 7524-3 and 6032-3).

Thanks to the high-tech TMM<sup>®</sup> 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<sup>®</sup> controllers:**

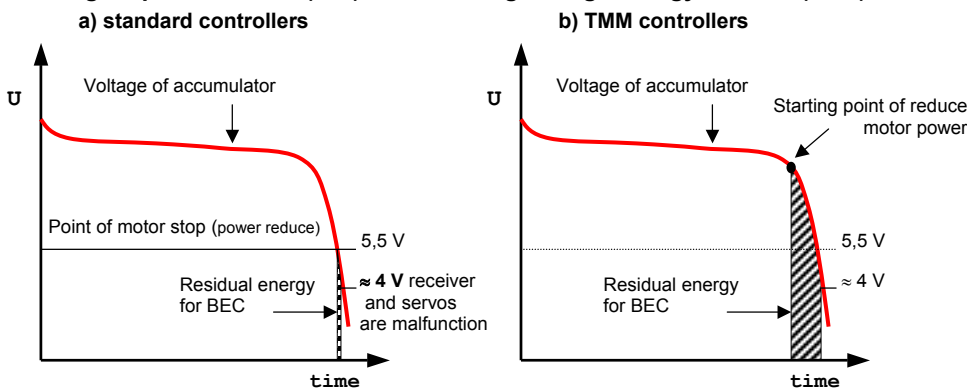
**Accumulators are protected** in three ways. Firstly, due to the use of automatic current fuse (ACF) the current overload of accumulators (and their possible damage) even at crisis points can be avoided. Secondly, the used system of intelligent power reduce (IPR) always ensures through measurements 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 accu pack. The better accumulators are used the less energy (time) is left to land (standard ESC).

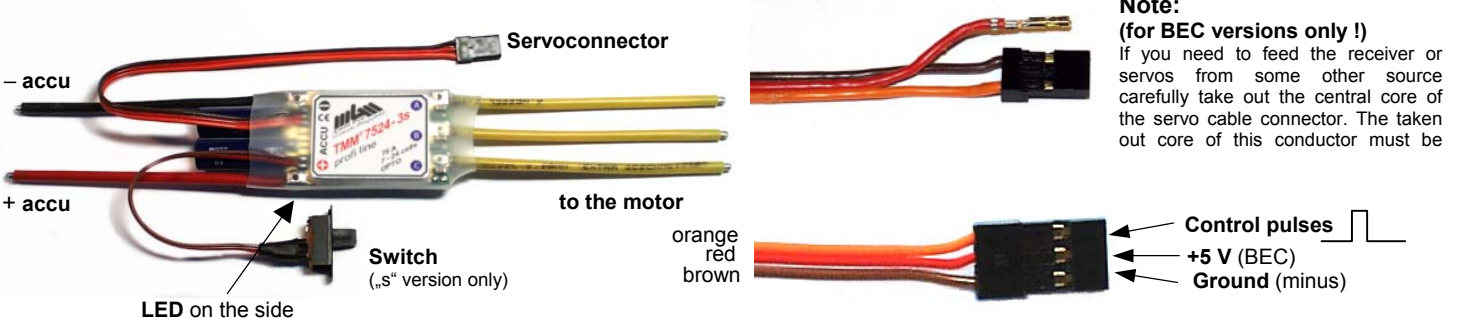
Comparing to this, TMM (b) ensures the remaining energy to be big enough; it is also possible to modify its size in some types (bigger for gliders). This energy is certainly insignificant as long as duration of running the motor is concerned, but it is very significant for feeding BEC.

**Operating data**

**Temperature of the environment:** 0°C to 40°C  
**Motor controlling:** PWM 8 kHz  
**Number of regulation steps:** 1024 / full throttle  
**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 <sup>®</sup> 6012-3	8012-3	6016-3	8016-3	5024	7524	4032	6032
<b>Dimensions (with external capacitor) [mm]:</b>	67×30×12	67×30×12	70×30×12	70×30×12	79×30×12	79×30×15	79×30×12	79×30×15
<b>No. of feeding NiCd/NiMH cells:</b>	6 to 12	6 to 12	7 to 16	7 to 16	7 to 24	7 to 24	7 to 32	7 to 32
<b>No. of feeding Li-Ion / Li-Pol cells:</b>	2 to 4	2 to 4	3 to 5	3 to 5	3 to 8	3 to 8	3 to 10	3 to 10
<b>Model:</b>	BEC	BEC	OPTO	OPTO	OPTO	OPTO	OPTO	OPTO
<b>Max. current (for full throttle):</b>	60 A	80 A	60 A	80 A	50 A	75 A	40 A	60 A
<b>Max. current for 5 sec.:</b>	70 A	100 A	70 A	100 A	60 A	90 A	50 A	70 A
<b>On-state switch resistance at 25 °C:</b>	2×1,0 mΩ	2×0,7 mΩ	2×1,0 mΩ	2×0,7 mΩ	2×1,3 mΩ	2×0,8 mΩ	2×1,5 mΩ	2×1,0 mΩ
<b>Power conductors (90 mm):</b>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>	2,5 mm <sup>2</sup>
<b>JR gold connector, cables:</b>	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>	0,15 mm <sup>2</sup>	0,15 mm <sup>2</sup>	0,15 mm <sup>2</sup>	0,15 mm <sup>2</sup>	0,15 mm <sup>2</sup>	0,15 mm <sup>2</sup>
<b>Weight incl. all conductors ("s" version):</b>	52 g	52 g	52 g	52 g	54 g	62 g	54 g	62 g
<b>Weight without power conductors ("s" ver.):</b>	38 g	38 g	38 g	38 g	40 g	48 g	40 g	48 g
<b>Thickness:</b>	12 mm	12 mm	12 mm	12 mm	12 mm	15 mm	12 mm	15 mm

The appearance and operating data may be changed without prior notice



properly insulated.

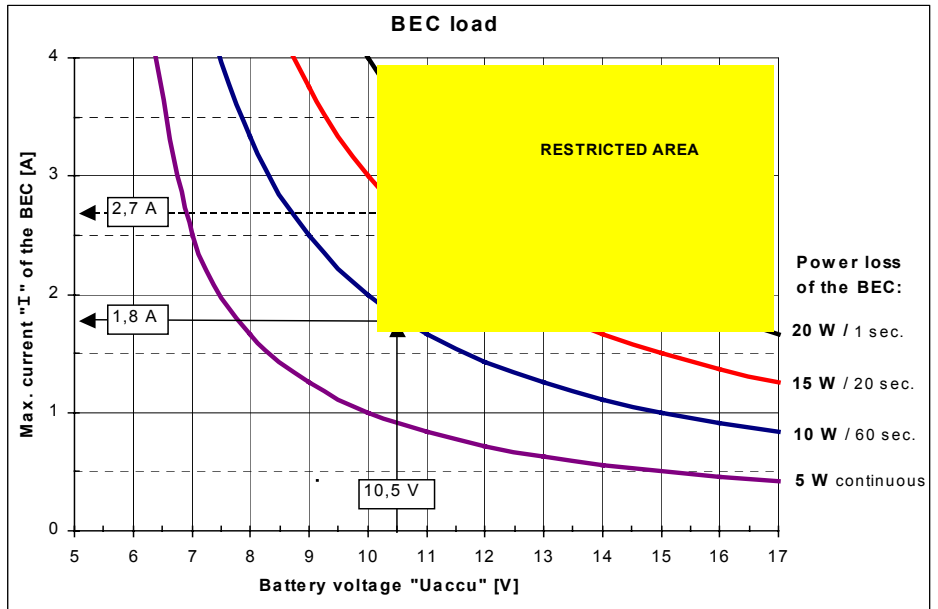
**MEGA BEC:** controllers up to 12 cells are equipped with BEC. The BEC can hold peak currents up to 4A and loss power loads which are significantly big but has its limits. It may not exceed 20W. It is possible to determine for example current which may be drawn from BEC under given load and voltage and also find out for how long from the graph. The power losses of the BEC warm the controller up. It is necessary to remove the generated heat by airflow. If the BEC is loaded with the power loss >5W pauses for cooling are necessary so that the average power loss is ≤ 5W.

**Power loss of BEC:**  $(U_{accu} - 5V) \times \text{current } I$

**Example:** (see graph) if voltage of batteries is 10,5V it is possible to draw current of 1,8A continuously for 60 sec. when the power loss of BEC is 10W. If the load would only take 20 sec. the power loss may be 15W and it is possible to draw current up to 2,7A.

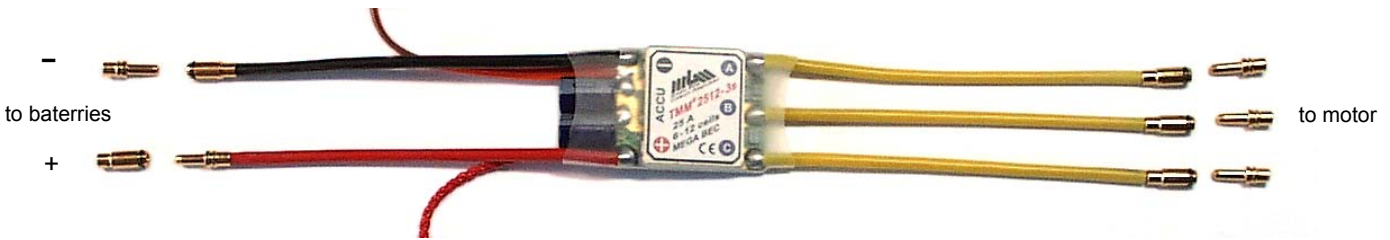
**When exceeding the maximal limits of current or power losses, BEC may be destroyed and the model may be uncontrollable !**

Please, notice that servos loaded with the control surfaces (rudder, ailerons etc.) in the air draw many times more current than when you move them on the ground !



**Instructions for use:**

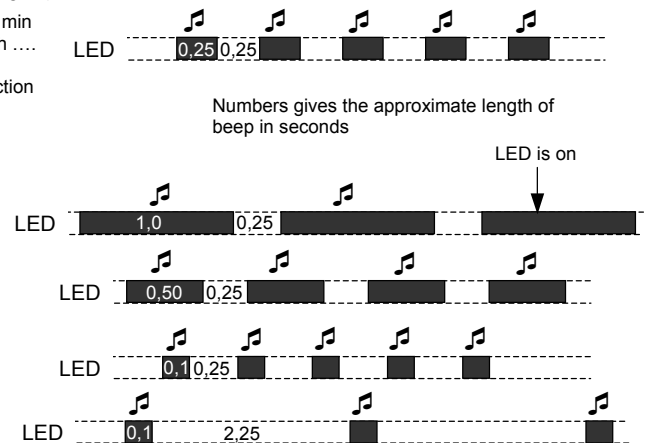
- Opposite piece of the connector, which is on your accumulators, should be soldered to the leading-in conductors to the accumulator. Use only quality golden plated kinds. We recommend the MP JET 1.8mm, 2.5mm or 3.5mm depending on the type of controller and current; or Schulze 3.5mm connectors (they are not interchangeable); or golden plated connectors Ø 4 or 2mm. The MP JET connectors have considerable smaller contact resistance. We recommend to put socket on the "-" wire (black wire) of the controller and the plug on the "+" wire (red wire).
- Use power conductors as short as possible – it is better for minimum weight and for minimum interference. Receiver and antenna should be placed as far as possible from the controller, the batteries and power leads.
- **NOTICE, reversal of poles on wires to the batteries will destroy the controller !**



- The leads to the motor (yellow wires marked "A", "B", "C") should be soldered directly to the motor or it is also possible to use the connectors mentioned above. If you decide to use connectors, this time solder sockets to the controller leads ! **Short cut of these wires together (when batteries are connected) or short cut of these wires to the feeding voltage results in damage or destroy of the controller !**
- After the connectors are soldered it is necessary to isolate them, for example with heat shrinking sleeve ! (the connectors on pictures are without isolation sleeve for better clearness)
- If you need the motor to run in an opposite direction, swap any two motor phases.
- **It is necessary to cool the controller in operation with flowing air. Do not prevent the cooling air to get to the controller (eg. by packing it in foam).**
- The controller informs of overload and overheating acoustically (motor beeping) and also through LED.
- The switch of the controller is connected in such way that even if it gets damaged the BEC will be still functioning.
- **The controller is switched on by TURNING OFF the switch** (applies to "s" version with switch) or by connecting batteries (applies to versions without switch).
- **Do not switch off or disconnect the controller from batteries when motor runs or when it is still turning – that may lead to damage or destroyed of controller !!!**

**Error messages** (the controller must be switched off to correct error, then switched on again):

- throttle stick was moved the opposite way then it is supposed to (the thrtholle stick was not in the min or max position at the beginning, and after beep it was moved to the max or min position to which .... the throttle was closer and not the other (correct way)
- low size of deflection of the throttle stick on the transmitter – you must shorten the size of deflection on transmitter
- overstep max. throttle position 0,5 and 2,5 ms – you must shorten the size of deflection
- switching on the controller with turned off transmitter
- starting an overheated controller
- overheating of controller during operation (only LED blinks, motor does not beep, ..... the power is reduced to 60%)
- more or less cells than specified .....
- current overload (resumes operation after dropping throttle to zero, it is not necessary to switch ..... the controller off in this case)
- signal drop out for long time .....



**SECURITY WARNING:**

Always disconnect the accumulators when not operating the model !!! Small current consumption occurs even when controller is switched off. Do not leave model with connected accumulators unattended ! Do not charge batteries when connected to the controller ! If the controller is connected to batteries do not stay in the reach of the propeller even when the controller is switched off ! Please notice that running motor with propeller is very dangerous !

The controllers are initially set into a default mode called the „BASIC“ mode (I). That means it is not necessary to do any other programming, the user may start flying immediately (this is similar as with the SMM or TMM extra range controllers). Upon each controller switch on, user sets the brake on or off by the throttle stick position. The throttle min and max position are automatically set while setting the brake. Disadvantage of this simple mode is the necessity of repeating this procedure after each switch on of the controller. Some parameters are automatically set by the controller itself and to set other parameters the user may decide to keep the default setting or may set those through additional programming.

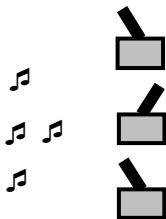
Those who would not be satisfied with the simple mode may choose from two other programming modes. The easier one of those is the „EASY“ mode in which a brake is set on or off through simple procedure using only throttle stick. Simultaneously, the min and max throttle position is determined by the controller itself. Both, the brake setting and the throttle min and max position are stored in controllers memory even after switch off. Some parameters e.g. Number of cells, their quality are determined by the controller and others are set according to the default setting.

If you wish to set other parameters you may use the „FULL“ programming mode which allows you to change some features of the controller. Therefore we recommend this programming mode for only experienced modelers who know what they are changing. For more information see „Programming“ (II). There is always a possibility to simply get to the default setting or the BASIC mode.


### (I) Operation in the BASIC mode:

#### Starting with the brake in Basic mode:

1. switch the transmitter on
2. throttle down (min. throttle)
3. turn the controller on
4. 1 × BEEP
5. full throttle (max. throttle)
6. 2 × BEEP
7. throttle down (min. throttle)
8. 1 × BEEP
9. you may start

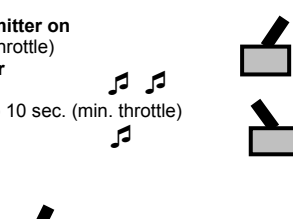



#### NOTE :

If in the starting position  of the throttle stick (min position), 2 × BEEP can be heard, change the norm of deflection of the throttle stick on the transmitter.

#### Starting without the brake in the basic mode:

1. switch the transmitter on
2. full throttle (max. throttle)
3. zapnout regulátor
4. 2 × BEEP
5. throttle down up to 10 sec. (min. throttle)
6. 1 × BEEP
7. you may start



If in the starting position  of the throttle stick (max position), 1 × BEEP can be heard, change the norm of deflection of the throttle stick on the transmitter.

### (II) 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 min position the controller waits for it to get there (safety precaution) – if the throttle is in its min position you may take off immediately – except for the BASIC mode.

#### Description of parameters in the “FULL” programming mode:

**Parameter A – mode choice:** enables to set “Basic” mode option or user set parameters option

**Parameter B – brake:** enables to set the brake off and the strength of brake (intensity of braking) in 5 steps. 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** (for example AXI 4120): 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 BEC. You may set continuous motor revolutions reduction or an immediate cut off (with the possibility of start when you lower the throttle to zero). 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 zero, 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

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

Move the throttle to ½ throttle, green LED will be switched off 2x (twice) and motor beeps 2x. Move throttle back to min position, green LED will be switched off once and motor beeps once. Repeat this procedure (1/2 throttle – min throttle) as many times as is the number of parameter (according to the table) you wish to set. **For example:** for setting the **number 3** in parameter D (that is timing 10°) repeat the whole procedure (1/2 throttle – min throttle) **3x** (you certainly have to be in parameter D).

**The programming of each parameter will be finished** when you move the throttle from min position to the full throttle – green LED will be turned off 3x and motor will beep 3x, then move the throttle back to min 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 be always switched off first !

**If you do not wish to change some parameter** (you wish to preserve its last value) you directly set full throttle when programming it (no ½ throttle – minimum procedure, but directly ENTER). The parameter value stays as it was before and the controller will get to the next parameter programming.

**The programming itself:****3) Turn the transmitter on with throttle stick in max position !**

2) **Turn on the controller.** After 10 seconds (++) the controller will beep 3 x and LED will blink and stay turned on. Now you have 3 seconds to move the throttle back to zero. 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 zero in this time limit the motor will beep 1x and the green LED will be turned off 1x. Now you are in the programming mode and may start to program parameters according to the procedure described above.

(++) **If before this programming the BASIC mode was set, the motor will beep 2x after switching on the controller, do not take care of this, wait for 3 beeps.**

**3) Parameter A – mode choice: EASY mode / BASIC mode / Full mode****I) you do not wish to program and you wish to use the initial setting, brake on:**

Move the throttle to ½ throttle position, green LED will be turned off 2x and the motor will be beep 2x. Move throttle back to min position, green LED turned of 1x and motor will beep 1x. This choice will be confirmed by moving the throttle from min to full position – green LED will be turned off 3x and motor will beep 3x. then move back to min position and LED will be turned off 1x and motor will beep 1x. The default setting is set and min and max positions of throttle are saved, Now you may start flying, the controller is in normal operating mode, when you throttle up the motor will start running..

**II) You do not wish to program and would like to use the default setting, brake off:**

Move the throttle to ½ throttle position, green LED will be turned off 2x and the motor will be beep 2x. Move throttle back to min position, green LED turned of 1x and motor will beep 1x. Repeat this procedure once more (as if you were setting **value 2** of this parameter) This choice will be confirmed by moving the throttle from min to full position – green LED will be turned off 3x and motor will beep 3x. then move back to min position and LED will be turned off 1x and motor will beep 1x. The default setting is set and min and max positions of throttle are saved, Now you may start flying, the controller is in normal operating mode, when you throttle up the motor will start running.

**III) You wish to set the min and max throttle positions and brake upon each switch on – also this is how the controller is set from manufacturer (so called BASIC mode):**

Move the throttle to ½ throttle position, green LED will be turned off 2x and the motor will be beep 2x. Move throttle back to min position, green LED turned of 1x and motor will beep 1x. Repeat this procedure two more times (as if you were setting **value 3** in this parameter) This choice will be confirmed by moving the throttle from min to full position – green LED will be turned off 3x and motor will beep 3x. then move back to min position and LED will be turned off 1x and motor will beep 1x. The default setting is set. After switching off and switching on you may start flying. If you wish to change some other parameters of controller, it is possible to do so also in this mode – do not switch the controller off and continue programming of other parameters as if in full mode. After finishing you must always turn the controller off! Parameters(except for brake and min and full throttle positions) are saved permanently.

**IV) You wish to program and set the controller according to your criteria:**

Move the throttle directly to full throttle as if you wanted to skip the parameter. Green LED will blink 3x and motor will beep. Move the throttle back to min position, green LED will be turned off once and motor will beep. Now you may set parameter B.

**4) parameter B – brake:**

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 accu 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. By sequence „ENTER“ (set full throttle – back to min. throttle) you terminate programming.

**9) Turn of controller !**

**Notice:** If you do not wish to change some parameter, move directly to full throttle when programming it (no ½ throttle –minimum 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	1	2	3	4	5	6	7	8	9	10
A	Mode choice	„FULL“ mode	„EASY“ mode, brake on	„EASY“ mode, brake off	„BASIC mode“							
B	Brake	next parameter	Brake off	light	<b>medium</b>	high	hard	very hard				
C	Acceleration (from 0 to 100%)	next parameter	160 ms	<b>290 ms</b>	410 ms	660 ms	1300 ms					
D	Timing	next parameter	<b>automatic</b>	5°	10°	15°	20°	25°				
E	Behavior when accu voltage going down	next parameter	<b>Slow reduce rpm</b>	Motor cut off	RACE MODE							
F	Battery type	End of programming	<b>NiCd, NiMh</b>	Li-Ion, Li-Pol 2 cells	Li-xxx 3 cells	Li-xxx 4 cells	Li-xxx 5 cells	Li-xxx 6 cells	Li-xxx 7 cells	Li-xxx 8 cells	Li-xxx 9 cells	Li-xxx 10 cells

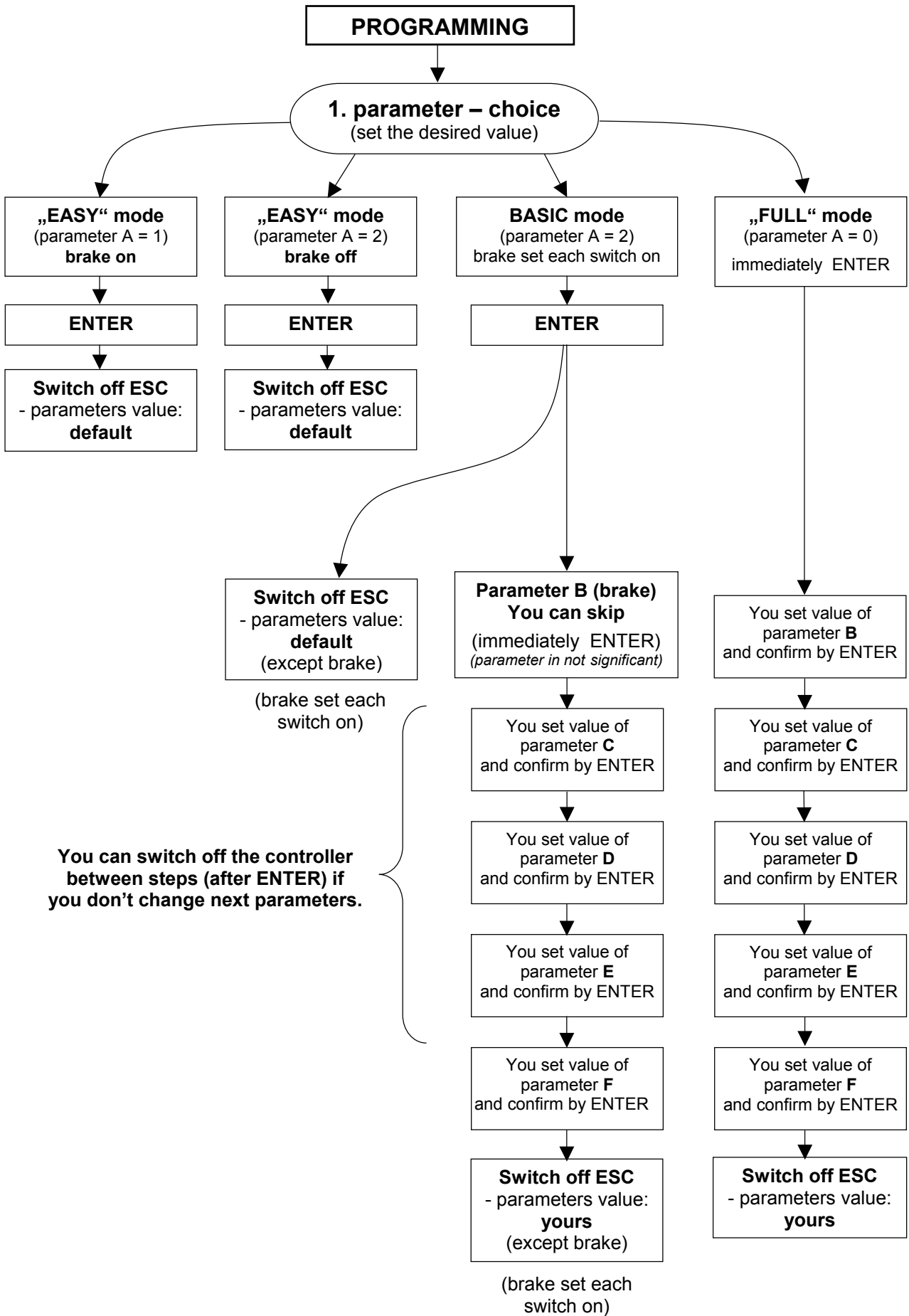
Notice: - Default setting **bold**

**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)

# PROGRAMMING TMM xxxx – 3, profi line



# PROGRAMMING MM xxxx – 3, profi line

## a) Easy programming modes

## b) Full programming mode

