Controller TMM® 18 extra, TMM® 35 extra, TMM® 50 extra (/ „hydro" version)

Operating data: *The appearance and operating data may be changed without prior notice.*

No. of feeding NiCd/NiMH cells:	6 up to 12
Dimensions:	32 × 26 × 6 mm
Temperature of the environment:	0°C to 40°C
Motor controlling:	PWM 2 kHz
Control signal:	positive pulses 1,5 ± 0,5 ms, period 10 ÷ 30 ms

	TMM 18 extra	TMM 35 extra	TMM 50 extra
Max. current:	18 A	35 A	50 A
Nominal load (electric motor):	3 up to 18 A	5 up to 35 A	8 up to 50 A
On-state switch resistance at 25 °C:	0,005 Ω	0,0025 Ω	0,0018 Ω
Power conductors: (90 mm):	1 mm^2	2,5 mm^2	2,5 mm^2
JR connector, cables:	0,15 mm^2	0,25 mm^2	0,25 mm^2
Weight incl. all conductors	15 g	21 g	22 g
Weight without power conductors:	8 g	10 g	11 g

Notice.: weight of the „hydro" version is 1 g higher

BEC (TMM 18 extra): **5V / 2,0 A peak, continuous max. ≈ 0,5 A at 8V (≈ 1,5 W) !!!**
BEC+ (TMM 35 / 50 extra): **5V / 3,0 A peak, continuous max. ≈ 0,8 A at 8V (≈ 2,5 W) !!!**

Table of BEC continuous current

Number of cells	U aku	difference Uaku-Ubec	continous current	loss of BEC	continous current	loss of BEC+
	[V]	[V]	[mA]	[W]	[mA]	[W]
6	7,2	2,2	**682**	1,5	**1 136**	2,5
7	8,4	3,4	**441**	1,5	**735**	2,5
8	9,6	4,6	**326**	1,5	**543**	2,5
9	10,8	5,8	**259**	1,5	**431**	2,5
10	12,0	7,0	**214**	1,5	**357**	2,5
11	13,2	8,2	**183**	1,5	**305**	2,5
12	14,4	9,4	**160**	1,5	**266**	2,5

Programmable brake: **ON / OFF**
Automatically programmed parameters: parameters of control signal, min and max position of the throttle stick, number and quality of cells, automatic current fuse of the motor

Controllers of the range TMM® xx extra are high-end crystal controlled controllers made predominantly or completely with the use of surface mounting. All parameters are automatically set (**APS**) (except for setting the brake yes/no) and the controller adapts itself optimally to your set, motor and accumulators. This setting of paramaters and features is preserved until the controller I switched off or the accumulators are disconnected.

Moreover, thanks to the possibilities of hi-tech TMM® technology of MGM compro company, many protective and optimizing methods which significantly reduce the chances of unwanted destroying or damaging the motor and accumulators as well as the controller itself were applied.

The motor is perfectly protected from damage caused by excessive current at crisis points (e.g. locking the motor under full load) by the automatic current fuse (**ACF**). In case of exceeding automatically set current limits the motor according to the nature and intensity of the overload becomes switched off either immediately or 1 or more sec later. Also more powerful types of controllers in combination with less powerful motors can be operated without any problems, all protective mechanisms being preserved; controller fuses protect the motor in crisis situations (for example motor range 400 and 50A controller). After the fuse is switched off you may resume operation after moving the throttle stick to zero position.

Accumulators are protected in three ways. Firstly, due to the use of ACF the current overload of accumulators (and possible damage) at crisis points can be avoided. Secondly, the used system of intelligent power reduce (**IPR**) ensures through measurements of number of cells, voltage, currents, accumulator condition and calculations always an optimal point of starting continuous reduction of motor performance (it starts to be efficient when accumulator becomes heavily discharged) so that accumulator cells do not get extremely discharged which significantly reduces the possibility of reversal of poles of lower cells. This at the same time **enables retaining defined energy for BEC** (perfect **RPC**) which is of great significance e.g. for gliders, helicopters etc. (a crash due to running out of energy for receiver can be avoided) and ships (you will be able to reach the shore and will not have to stay in the middle of the pond) (see "Unique properties of TMM® - more information"). 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.

Controllers work with high switching frequency of the motor (PWM 2kHz), which is an advantage. The current ripple is reduced, possible interference is lessened, motor commutator is not wear out so much (it's service life is longer) and also the efficiency is higher. All TMM controllers use the "synchronous rectification" system: the clamping schottky diode is replaced by suitably controlled FET transistor. Among the benefits of this system is a significant reduction of power loss of the controller and significant reduction of warming up as well as increased efficiency.

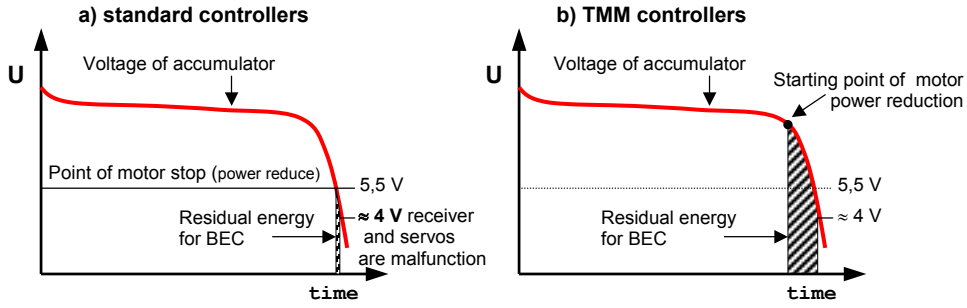
The controllers **mask interference and drop-outs** to a large extent up to 1,5 sec. When there occur long-lasting drop-outs the controller switches the motor off. Without the proper signal from the transmitter (e.g. transmitter is turned off), the motor neither jerks nor runs but is at standstill.

Thermal fuse of the controller ,and even for the motor (applies for some types) 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.

The controller´s switch is connected in a safe way so that possible damage to the switch has no negative effect on the BEC operation.

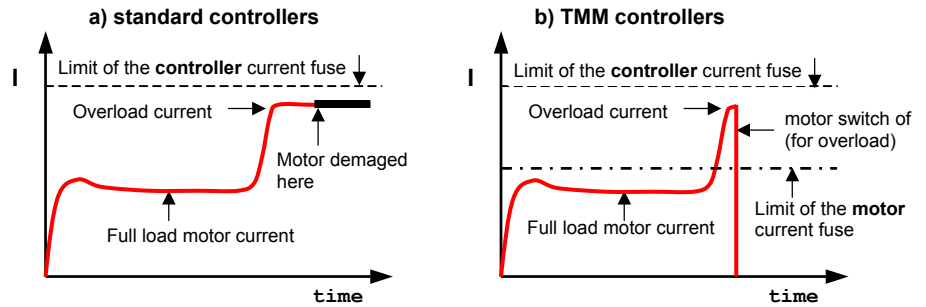
Basic Advantages of TMM controllers shown in graphs:

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



When switching (reducing) the motor off at solid boundary there is only very little energy remaining for BEC. The better accumulators you have the less energy (time) is left to land (standard accumulators). Comparing to this, TMM ensures the remaining energy to be big enough; it is also possible to modify its size in some types (greater 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.

Automatic current fuse (ACF)



In case the current of the motor when overloaded does not exceed the limit of the current fuse of the controller, the fuse does not switch off and the motor is very likely to burn down or to be seriously damaged (standard controllers). When using TMM the motor (possibly also accumulator) is saved due to ACF.

Instructions for use:

The controller is meant for a stepless control of electric motor revolutions in aircrafts (may be alo used in ships) controlled by proportional remote control sets with positive control pulses and a pulse period from ≈10 up to 30 ms. It is equipped with a BEC circuit supplying the receiver and servos with the voltage of +5 V and peak current of 2 A (resp. 3 A). In case of overloading this circuit there occurs a drop in voltage for the receiver and servos. For a long time overload (lasting in seconds) [e.g. power dissipation P = (Uaku - 5V) × servos current consumption > 1,5 W, resp. 2,5W], you might damage this circuit. In the table is shown continuous current of the BEC for various number of cells. If you need higher levels of current from the BEC circuit than are those the controller is able to supply (or in any other case when you need to feed the receiver or servos from some other source) carefully take out the central core of the servo cable connector (+5V) (see Fig.). The taken out core of this conductor must be properly insulated. The receiver and servos must be then fed from some other source.

Possible switch failure (for "s" version) nowise affects its functioning. **Turning off the switch activates controller**. Some types are also made as the so-called **„hydro" versions** ensuring the controllers resistance to water. After being in contact with water, water needs to be blown out of the controller and then it may resume operation. Brake is fully functional even in "hydro" versions.

It is recommended to solder cables for the electric motor directly to the motor itself or furnish them with a suitable connector. Solder a suppression capacitor(s) to the motor unless the motor is already equipped with it by the manufacturer. Opposite piece of the connector, which is on your accumulators, should be soldered to the leading-in conductors to the accumulator - **be careful not to reverse poles!** Try to use power conductors as short as possible – it is better for minimum weight and for minimum interference. In case of possible interference you can solder capacitor 10 to 100 μF/25V (The best is „low ESR" type) on the conductors to the accumulator. Controller is encased in an alluminium box which is electrically insulated from electronic circuits and so nothing happens if the case touches anything under voltage (the box, however, must not short-circuit two different potentials).

The controller automatically determines number of cells and measures their internal resistance as well as it measures instantenous currents. On the basis of these measurements the relevant breaking voltage is set so that the accumulators might be made use of in an optimal manner and that minimal energy needed for reliable operation BEC is retained.

As soon as, during the operation, the accumulator voltage drops to the set limit the controller starts to reduce the motor performance so that the minimum energy for reliable operation of BEC is retained. The controller does not switch the motor suddenly and unexpectedly. Downwards to lower performance the controller responds to steering, upwards to higher performance any movement of the throttle stick is ineffective.

It is recommended to adjust max. difference between minimum and maximum throttle position, the regulation will be smoother. Controllers mask interference and drop-outs up to 1,5 sec, then slowly switch off the motor.

If the maximal controller current or the maximal motor current is exceeded and the time for which it is tolerated expires, the current fuse cuts the motor off. After moving the throttle stick to zero position, controller resumes operation. In the case of overheating (temperature above ca 90°C) the controller during operation, motor performance is reduced to ca 60% and the model may land and are allowed to take off again only after the controller temperature falls. Please notice, that the controller temperature rises not only because of the losses on switching transistors but also because of the loss on the BEC circuit. **If the controller is operated near crisis points, it is highly recommended to cool it.** Controllers are encased in an alluminium box which also serves as a cooler – do not wrap it in any materials which would prevent its cooling – do not prevent the cooling air to access the controller.

One is warned of overloads and overheating accoustically (motor beeping).

Starting with the brake:

1. switch the transmitter on
2. throttle back (min. throttle)
3. turn the controller on
4. 1 × BEEP 0,5 kHz
5. full throttle (max. throttle)
6. 2 × BEEP 0,5 kHz
7. throttle dropped (min. throttle)
8. 1 × BEEP 0,5 kHz
9. you may start

NOTE :
If in the starting position  of the throttle stick, 2 × BEEP 0,5 kHz can be heard, change the norm of deflection of the throttle stick on the transmitter.

Starting without the brake:

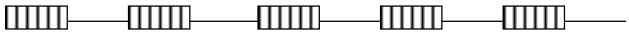
1. switch the transmitter on
2. full throttle (max. throttle)
3. turn the controller on
4. 2 × BEEP 0,5 kHz
5. throttle dropped (min. throttle)
6. 1 × BEEP 0,5 kHz
7. you may start

If in the starting position  of the throttle stick, 1 × BEEP 0,5 kHz can be heard, change the norm of deflection of the throttle stick on the transmitter.

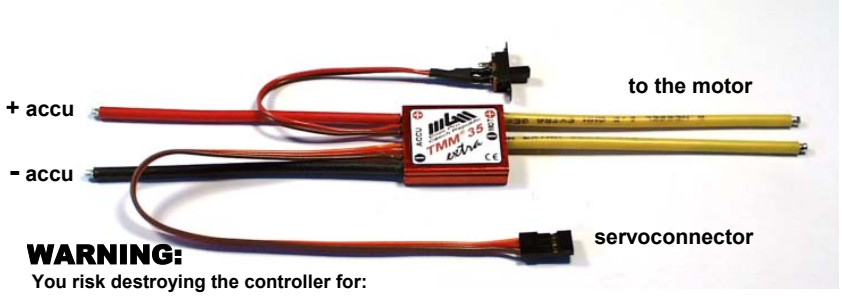
Error mesages:

(you must switch off / on controller for correctly operation)

BEEP 500 Hz



- low size of deflection of the throttle stick on the transmitter – you must enlarge the size of deflection
- overstep max. throttle position 0,5 and 2,5 ms – you must shorten the size of deflection
- switching on the controller with turn off the transmitter (for some receiver only)
- for moving the throttle stick to opposite (reverse) side
- for current overload (resumes operation after dropping throttle to zero)
- for starting the overhaet controller



WARNING:

You risk destroying the controller for:

- **connect more battery cells to the controller than the max. number specified in the technical data**
- **reverse connections to the accumulator**
- **change motor and accumulator outlets**
- **short-circuit the output wires with the accumulator connected**
- **current overload, power overload**
- **water in the controller, metal objects in the controller (screwdrivers, wires, etc.)**

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 contorller! 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!

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