

TMM® 4016-3ph controllers for brushless sensorless motors (V 2. x)

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

No. of feeding NiCd/NiMH cells:	7 up to 16
Dimensions:	62 × 30 × 12 mm
Temperature of the environment:	0°C to 40°C
Control signal:	positive pulses 1,5 ± 0,5 ms, period 10 ÷ 30 ms
Motor controlling:	PWM 8 kHz
Max. current:	40 A
On-state switch resistance at 25 °C:	2×0,0025 Ω
Power conductors: (90 mm):	2,5 mm ²
Weight incl. all conductors:	31 g
Weight without power conductors:	45 g

BEC+ (7 to 12 cells ONLY !) :5V / 3,0 A peak, continuous max. ≈ 0,8 A at 8V (≈ 2,5 W) !!!

Programmable brake: ON / OFF

Automatically programmed parameters: parameters of control signal, min and full throttle, number of cells

Instructions for use:

The controller is meant for a **stepless control of brushless sensorless electric motor revolutions in aircrafts** controlled by proportional remote control sets with positive control pulses and a pulse period from ≈10 up to 30 ms. The controllers feature "soft start" and therefore are suitable even for motors equipped with gearbox. They are designed for brushless sensorless motors such as Plettenberg, Mega AC, Kontronik, Hacker and others. It also may be used with sensor motors – sensors will stay disconnected.



It is equipped with a BEC circuit supplying the receiver and servos with the voltage of +5 V and peak current of 3A. **BEC is not for use above 12 cells !** 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 $P = (U_{aku} - 5V) \times \text{servos current consumption} > 2,5 \text{ W}$], you might damage this circuit. In the table is shown continuous current of the BEC for various number of cells. If you need (or must) 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. Possible switch failure nowise affects its functioning. **Turning off the switch activates controller.** Do not switch the controller on and off by connecting it to accu. If the motor is running do not disconnect it from accu. It is recommended to solder cables for the electric motor (yellow conductors marked "A", "B", "C") directly to the motor itself or furnish them with a suitable connector (G3,5 Schulze or G4). Make sure that they cannot shortcut themselves or the feeding conductors or even the controller. If you need the motor to run in an opposite direction, swap any two motor phases. Opposite piece of the connector, which is on your accumulators, should be soldered to the leading-in conductors to the accumulator (red and black) – only golden plated G3,5 or G4 are recommended – **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. Servocable should be inserted in receiver to "gas channel". If the controller's BEC is used, the receiver may not be fed from any other source.

As soon as, during the operation, the accumulator voltage drops the controller starts to reduce motor revolutions so that the minimum energy for reliable operation of BEC is retained (0,7 x number of cells or ca 5,3 V). Towards to lower performance the controller reacts to steering, towards to higher performance the steering is ineffective.

It is recommended to adjust max. difference between minimum and maximum throttle position, the regulation will be smoother.

The controller masks interference and drop-outs up to 1,5 sec., then the motor becomes switched off slowly.

If the motor becomes blocked the current fuse cuts off. The operation is resumed after dropping the throttle to zero. In case of exceeding the temperature of ca 90°C the motor performance is reduced to ca 40% of PWM, the model may land and is allowed to take off again only after the controller temperature falls under ca 70°C. Notice: the controller does not warm up only due to the loss on the switching transistor but also the loss on the BEC circuit. It is necessary to cool the controller properly. One is warned of overloading or overheating by motor beeping.

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!

Table of BEC continuous current

Number of cells	U _{aku}	difference	continous	loss of
	[V]	U _{aku} -U _{bec} [V]	current [mA]	BEC [W]
7	8,4	3,4	735	2,5
8	9,6	4,6	543	2,5
9	10,8	5,8	431	2,5
10	12,0	7,0	357	2,5
11	13,2	8,2	305	2,5
12	14,4	9,4	266	2,5
13 až 16	NO FOR USE !			

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13 až 16	NO FOR USE !			

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.



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.)

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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 messages:

(you must switch off / on controller for correction)

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 overheated controller



Development, manufacture and servis:

Ing. G. Dvorský, MGM compro,
Sv. Čecha 593, 760 01 Zlín, Czech Republic

Tel. +420 57 7001350, fax:+420 57 7001348

E-mail: mgm@mgm-compro.cz


Info: www.mgm-compro.com

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