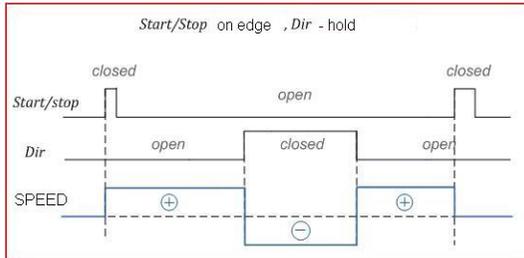


6. The motor direction depends on the motor wiring. Motor rotation direction can be changed by signal DIR. Signals is activated as per the front edge of the signal. The acceleration and reverse deceleration are applied according "ACCEL" and "BRAKE" potentiometers position. Please, refer to the section 5.4 and 5.5.

7. If the jumper J1 is established at the stopped motor, then windings of the engine are closed on themselves. If the jumper of J1 isn't established, then windings of the engine are in Z state.

Example of work of entrance signals of "START/STOP" and "DIR" for the standard version of the block.



In case of origin of an overcurrent condition of the engine (current 30A more than 1 msec) the unit passes into emergency operation with switch-off of the engine. The LED of indication of the mode passes into the switching mode with the period of 200 msec. The output from the mode is carried out by removal and restoration of a supply of the device. The potentiometer of "CURRENT ADJUST" is also used for protection on current. With its help the most permissible current for each specific engine controlled by the unit is set. (see Table 1). Exceeding of value of this current during more than 4 sec. will lead to transition to emergency operation.

Table 1. Dependence of the most admissible current given on the motor on tension at the exit of a potentiometer of "CURRENT ADJUST".

U, mB	I, mA	U, mB	I, mA	U, mB	I, mA
0	200	2400	2000	4400	10000
350	300	2700	2500	4500	11000
600	400	3300	4000	4600	12000
900	500	3500	5000	4700	13000
1300	750	3800	6000	4800	14100
1600	1000	3950	7000	4900	15100
1800	1200	4100	8000	5000	16100
2100	1500	4300	9050		

6. Delivery in complete sets

The brush motor controller BMD
Manual BMD.24.004

1 pcs.
1 pcs.

7. Warranty

Any repair or modifications are performed by the manufacturer or an authorized company.

The manufacturer guarantees the failure-free operation of the controller for 12 months since date of sale when the operation conditions are satisfied – section 2.

The manufacturer sales department address: Smart Motor Devices OÜ,
Tallinn Science Park Tehnopol, Mäealuse st. 4, Tallinn 12618, Estonia,
Phone: + 372 6559914,
e-mail: sale@smd.ee
url: <http://www.smd.ee>



SMART MOTOR DEVICES
<http://www.stepmotor.biz>

DC BRUSH MOTOR CONTROLLER BMD

Manual
BMD.24.005

2016

1. Product designation

Controller BMD is electronic device to operate and control DC brush motors with maximum voltage 24VDC and power under 400W. Controller is designed to control speed, direction, smooth start and stop of brush motors.

2. Technical characteristic

Power voltage V_{sup} : 12 – 24VDC

Max. operation motor current: 16A

Overcurrent protection: 0.2 ... 16A within 4 seconds

Max. output voltage (to the motor): $0,98 * V_{sup}$

Min. output voltage (to the turned on motor): $0,05 * V_{sup}$

Min. acceleration and deceleration setting: $(V_{sup} / 8)$ V/sec

Max. acceleration and deceleration setting: $(3V_{sup})$ V/sec:

- voltage: 0 – 5V

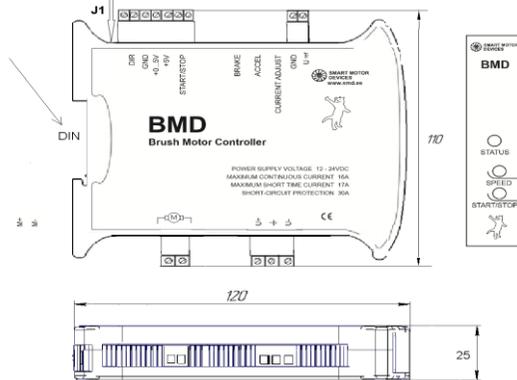
- resistance: 2.2 k Ω

Input signals "DIRECTION" and "START/STOP" parameters:

- max. closed contact resistance of breaker contact: 2 k Ω

- max. current: 0,5 mA

Overall dimensions: 120x110x25 mm



Dimensions and control elements

Environmental Conditions:

Ambient Temperature: -25...+50°C

Humidity: 90% RH or less upon condition +25°C

Condensation and freezing: none

3. Construction and control elements

BMD is designed as circuit plate with electronics elements, installed on a plate and covered with a metal case.

Besides electronic components, there are indicating and control elements and connection terminals on the board:

- terminal screws for power supply, motor windings and control circuit connection;
- "START/STOP" button;
- Internal preset potentiometers to adjust speed "SPEED", acceleration "ACCEL" and reversing deceleration "BRAKE";
- LED for indication of the controller status.

To adjust motor speed internal potentiometer "SPEED" and analog input "(0..5)V" are provided. To adjust acceleration and reversing deceleration internal potentiometers "ACCEL" and "BRAKE" are provided. To change the direction input "DIR" is intended. To start or stop motion button and input "START/STOP" are intended. Adjustment of a threshold of operation of protection 0,2 ... 16A is carried out by a potentiometer of "CURRENT ADJUST".

4. Principle of work

Regulation of speed and the direction of rotation of the engine is carried out by change of size and polarity of tension feeding windings. This change is provided with turning on of the engine in the bridge scheme on the transistor keys operated by the PWM. The PWM-generator is executed on the microcontroller. Except the PWM-regulator the microcontroller carries out functions of measurement of values of the operating entrances, provisions of regulators, calculation of speed, acceleration and braking according to the built-in program.

5. Assembly and connection.

Please, learn this manual carefully before connection and assembly.

Please, wire just when power is off. Do not attempt to change wiring while the power is ON.

Please, provide a reliable contact in connection terminals. During wiring, please, observe the polarity and wire management.

1) Make sure the power supply is turned off. Please, wire just when power is off.

2) Please, choose the speed adjusting method:

- Internal potentiometer - additional connection doesn't required.
- External potentiometer – connect potentiometer to the "SPEED" contacts "(0...5)V" and "+5V". The internal potentiometer "SPEED" should be turned to the end left position.
- Analog signal 0-5VDC – connect the source of analog signal 0-5VDC to the "SPEED" contacts: "-" to the "GND" contact and "+" to the "(0...5)V" contact. The motor speed is proportional to the signal voltage.

3) If needed, connect control elements to the "START/STOP" and "DIR" contacts. These inputs are clean contact. Signals are activated as per the front edge of the signal.

4) Connect brush motor to contacts  of the controller. The motor rotation direction depends on the polarity of motor wiring.

5) Connect power supply to contacts "+" – to "U+", "-" to "U-". $\frac{1}{2}$ - is the electric ground. At the maximum speed adjusting 0.98 of power supply voltage will be applied to the motor.

6) Turn on the power supply.

6. Motor Control

The LED color is non-blinking green then the power supply is ON and the BMD controller is ready to operate.

1. To start the motor rotation press "START/STOP" button or activate "START/STOP" signal (clean contact). The LED indicator is blinking when the motor is running.

2. To stop the motor press "START/STOP" button or activate "START/STOP" signal (clean contact) when the motor is running.

3. The motor speed depends on speed adjusting signal.

- Internal potentiometer - additional connection doesn't required. The minimum speed corresponds to the left position of the potentiometer "SPEED". The maximum speed corresponds to the right position of the potentiometer "SPEED".

- External potentiometer – should be connected according to the section 4.2. The internal potentiometer "SPEED" should be turned to the end left position. The minimum resistance of the potentiometer corresponds to the maximum motor speed. Increasing resistance leads to reducing motor speed. We recommend to use 10KOhm potentiometer.

- Analog signal 0-5VDC – the signal source should be connected according to the section 4.2

The motor voltage is $0,05 * V_{sup}$ (5% of supply voltage) at the minimum speed. The motor can completely stop at the minimum speed if the motor model doesn't accept the voltage. The motor voltage is $0,98 * V_{sup}$ (98% of supply voltage) at the maximum speed.

4. The motor acceleration depends on the "ACCEL" potentiometer position. The maximum acceleration (minimum acceleration time) corresponds to the end left position - $(3V_{sup})$ V/sec. The minimum acceleration (maximum acceleration time) corresponds to the end right position - $(3V_{sup}/8)$ V/sec. Note: When motor starts in short period after it was stopped, motor start speed depends on "BRAKE" potentiometer position and time period since it was stopped.

5. The motor reversing deceleration depends on the "BRAKE" potentiometer position. The maximum deceleration (minimum deceleration time) corresponds to the end left position - $(3V_{sup})$ V/sec. The minimum acceleration (maximum acceleration time) corresponds to the end right position - $(3V_{sup}/8)$ V/sec.