



**SMART MOTOR DEVICES**

<http://www.smd.ee>

**DC brush motor controller**

**BMD-40DIN**

*manual*

**BMD.40.DIN.002**

**2019**



## 1. Product designation

Controller BMD-40DIN is electronic device to operate and control DC brush motors with maximum voltage 24VDC and power under 960W. The controller is designed to control speed, direction, smooth start and stop of brush motors. BMD-40DIN provides the function of precise adjustable motor overcurrent protection.

## 2. Technical characteristics

Power supply: 12...24VDC, stabilized;

Max. operation motor current: 40A;

Maximum voltage across a motor:  $0.99 \cdot U_{sup}$ ;

Minimum non-zero voltage across a motor:  $0.01 \cdot U_{sup}$ ;

Overcurrent protection:

- hardware short-circuit protection - 100A, 15  $\mu$ s;
- motor phase current limit – set by customer, limitation range 1.0 – 40 A, actuation time – 5 sec. Refer to the section 5 for instruction on motor overcurrent protection setting.

Protection of an actuating mechanism:

- emergency stop (HARD\_STOP) - the motor stops immediately in case the protection circuit is broken.

Thermal protection:

- output stage temperature rise;
- brake circuit temperature rise.

Speed regulation:

- analog voltage signal: 0...5VDC;
- external potentiometer 2.2 kOhm;
- built-in potentiometer.

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

- type - clean contact;
- max. closed contact resistance: 4.7 kOhm;
- max. current: 0,5 mA.

Environmental conditions:

- Ambient environment: non- corrosive, non-explosive,
- Humidity: 90% RH or less upon condition +25°C
- Condensation and freezing: none
- Pressure: 650...800 mm of mercury.
- Ambient Temperature: 0...+50°C

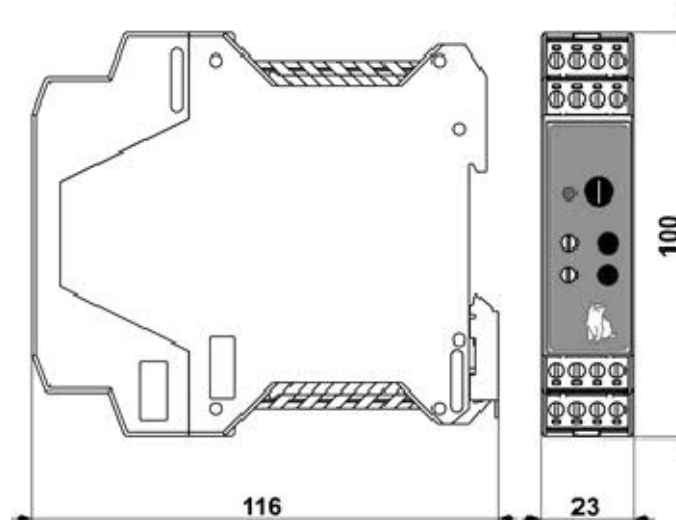


Fig.1 Dimensions of BMD-40DIN



### 3. Construction and control elements

BMD-40DIN 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" and "REVERSE" buttons;
- Internal preset potentiometers to adjust motor speed "SPEED", acceleration/deceleration "a" and motor current limit "I".
- 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 potentiometer "a" is provided. To change the direction input and button "DIR" are intended. To start or stop motion button and input "START/STOP" are intended. Adjustment of a threshold of operation of protection 1 ... 40A is carried out by a potentiometer of "CURRENT ADJUST" and terminal «Vref ».

### 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 voltage. 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.

**IMPORTANT:** due to high current it is strongly recommended to place a power supply in direct proximity to the controller BMD-40DIN. It is obligatory to use wire cross-section  $3 \text{ mm}^2$  (AWG-8). The power supply must be able to provide the current 20% higher than a maximum possible current consumption while in operation. Recommended wire length: no longer than 100 cm for current up to 10A; no longer than 50 cm for current from 10A to 20A, no longer than 25 cm for current 20A to 40A.

The connection scheme is shown on figure 2.

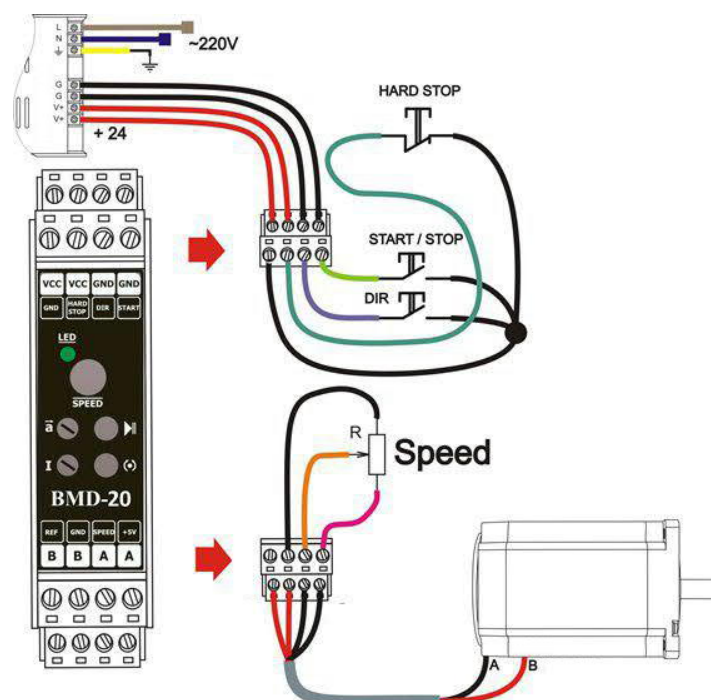


Fig.2. BMD-40DIN connection scheme (example of speed control by external potentiometer.)



- 1) Make sure the power supply is turned off. Please, wire just when power is off.
- 2) Connect the motor to the controller terminals A and B.
- 3) Connect the control elements to the controller according to chosen 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.
- 4) If needed, connect control elements to the “START/STOP” and “DIR” contacts. These inputs are clean contact.
- 5) Connect power supply to the controller contacts: “+” of the power supply to the terminal “U+”, “-“ of the power supply to the terminal “U-“. - is the electric ground. Wire cross-section should be suitable to the motor current consumption. We recommend using wire cross-section 3 mm<sup>2</sup> (AWG-8). Ground the power supply unit.
- 6) Set speed and acceleration regulators to the end CCW position, which correspond to their minimum values.
- 7) Using the potentiometer «CURRENT ADJUST», set the maximum motor current. Adjust the «CURRENT ADJUST» potentiometer and control the set current limit by a voltmeter, connected to «GND» and «Vref » terminals (fig.3). The motor current limitation can be calculated as:  
$$I_{lim} = 1.0 + 39.9 \times (V_{ref}/3.3)$$

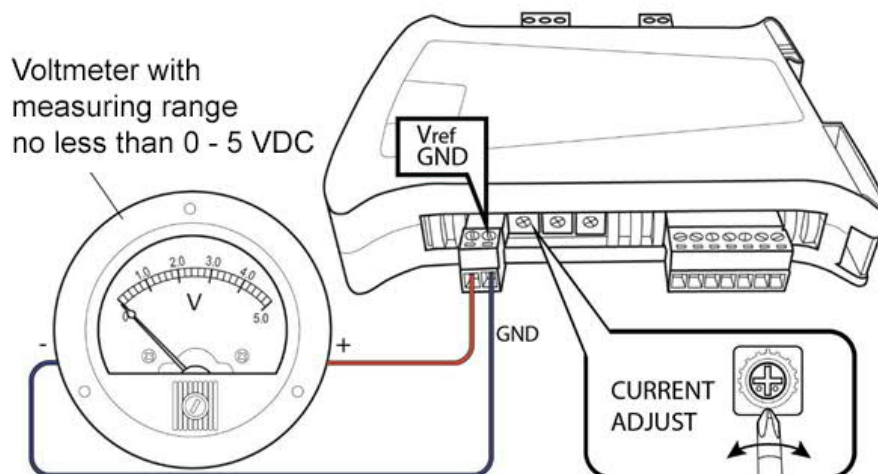


Fig. 3. Connection of a voltmeter for setting of a motor maximum current limit.

## 6. Motor Control

1. Choose the method of speed regulation: internal or external potentiometer or analog voltage signal 0-5VDC.
2. Connect the motor, power supply and control elements to the controller according section 5.
3. Turn on the power supply. The controller is ready for operation. LED at the front panel of the controller should solid light. Adjust the motor current limit (see the section 5).
4. Start the motor by button or input signal «START/STOP». The LED should start blinking (period 1 sec).
5. Adjust the motion parameters by using of a speed regulator, acceleration potentiometer and direction input or button.

In case of short-circuit of motor phases or overcurrent 100A for 15  $\mu$ s, the controller turns to an emergency mode, deenergizes the motor and indicates the alarm by LED blinking.



In case of motor current exceeds the set limit for 5 sec, the controller also turns to an emergency mode, red LED is blinking.

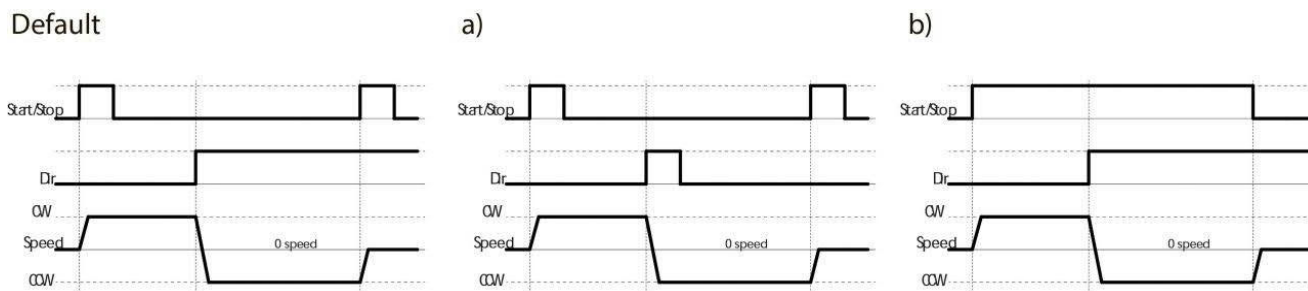
To reset the emergency mode, reset the power supply of the controller.

## 7. Input signals logic

As a default the controller is supplied with standard signal logic: input START/STOP is handled as per the front edge of the signal, input DIR is handled as per the signal level.

On a request the signals logic can be changed by supplier to the next:

- a. «START/STOP» and «DIR» - as per the front edge of the signal;
- b. «START/STOP» and «DIR» - as per the signal level.



Changing the signals logic is done in the supplier's office only.

## 8. Alarms indication

LED on the front panel of the controller indicates the controller operation status. In case of normal operation the indicator is green. Green indicator blinks during motor operation (approx. 1 time per second). In case if errors occur, the LED indicates the code of an error. The number of red blinks represents the alarm code (refer to the table below).

LED errors indication

Alarm code	Alarm	Alarm code	Alarm
0	Normal operation	4	Internal power switches overheating
1	Input voltage range exceeded	5	Wrong motor connection or emergency stop (HARD_STOP)
2	Short circuit in a motor phase	6	Testing version of firmware
3	Internal brake circuit overheating		

## 9. Delivery in complete sets

DC brush motor controller BMD-40DIN	1 pcs
Manual BMD.40.DIN.002	1 pcs

## 10. 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.

The manufacturer sales department address:  
 Smart Motor Devices OÜ,  
 Tallinn Science Park Tehnopol, Akadeemia tee 21/6, 12618, Tallinn, Estonia,  
 Phone: + 372 6559914,  
 e-mail: [mail@smd.ee](mailto:mail@smd.ee)  
 url: <http://smd.ee>

Date of sale:

Last modified: 20.05.2022