SMART MOTOR DEVICES

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**STEP MOTOR DRIVER
SMD-4.2DIN ver.2**

manual
SMDDIN.42.V2.001

2020

1. Product designation

Step motor controller SMD-4.2DIN ver.2 is an electronic device designed to operate with 2 or 4-phase stepper motor with maximum current per phase up to 4.2 Amp.

2. Functions and possibilities

- Pulse position control with standard logic low level voltage signals 0…1VDC and high level voltage signals 4…5VDC (up to 24VDC on condition that additional current limiting resistances are used) «STEP», «DIR» and «ENABLE» is provided;
- Analog speed control is provided: using internal or external potentiometers or analog voltage signal 0..5VDC;
- Analog position control (motor shaft rotation angle) is provided: using internal or external potentiometers or analog voltage signal 0..5VDC;
- Automatic source voltage control – if the power supply falls outside the allowance range (less than 20VDC or more than 51VDC) when the driver is switched on or within 2 seconds during operation, the driver turns off motor phases, outputs the alarm and indicate the alarm code by LED flashing;
- All operation settings are done via USB connection through software at a computer;
- The driver is equipped with an internal brake resistor. External brake resistor can be connected as well if needed;
- Control of a known state of the driver and output of the relevant signal FAULT;
- Alarm sound, indication of a code of the alarm by the LED at the front panel and inversion of FAULT output signal are provided.

3. Technical characteristic

Table 1.

Common characteristics:	
Maximum output current per phase, Amp	4.2
Minimum output current per phase, Amp	0.1
Microstepping	In the current control mode: 1/1, 1/2, 1/4, 1/8, 1/16 In the voltage control mode additionally: 1/32, 1/64, 1/128
Power supply, VDC (stabilized)	12…48
Maximum overall dimensions, mm	116x100x23
Inputs STEP, DIR, ENABLE	
High voltage level, VDC	4…24 (24VDC on condition of using additional current limiting resistors)
Low voltage level, VDC	0…1
Input STEP resistance, kOhm, no less	3
Inputs DIR and ENABLE resistance, kOhm, no less	1
Input current of control input STEP, mA	1,4…4
Input current of control inputs DIR и ENABLE, mA	4…12
Output «FAULT» parameters	
Signal type	Opto-coupler output
Maximum voltage, VDC	48
Maximum load current, mA	50
Resistance at close contact, Ohm, no more	100

Environmental Conditions:
Ambient Temperature: 0…+40°C
Humidity: 90% RH or less upon condition +25°C
Condensation and freezing: none
Pressure: 650…800 mm of mercury

4. Construction

The controller SMD-4.2DIN ver.2 is designed as a circuit plate with electronics components, indication and control elements, terminals and connectors. The plastic case of the driver is designed to be mounted on a DIN rail. The heatsink is installed inside the case on the circuit plate. There are graphical symbols of the control elements and the terminals assignment on the front plate of the controller.

Besides the control elements at the driver frame there are:
- connector A for a stepper motor phases connection (fig. 1);
- connector B for a power supply and external braking resistor connection (fig.1);
- connector C for connection of control signals STEP, DIR, ENABLE (fig.1);
- connector D for connection of an external potentiometer or source of analog signal 0…+5VDC – to analog speed or position control, and for connection of the output signal FAULT (fig.1);
- internal potentiometer SPEED for analog speed or position control (fig.1);
- bicolour LED for indication of control modes and alarm codes;
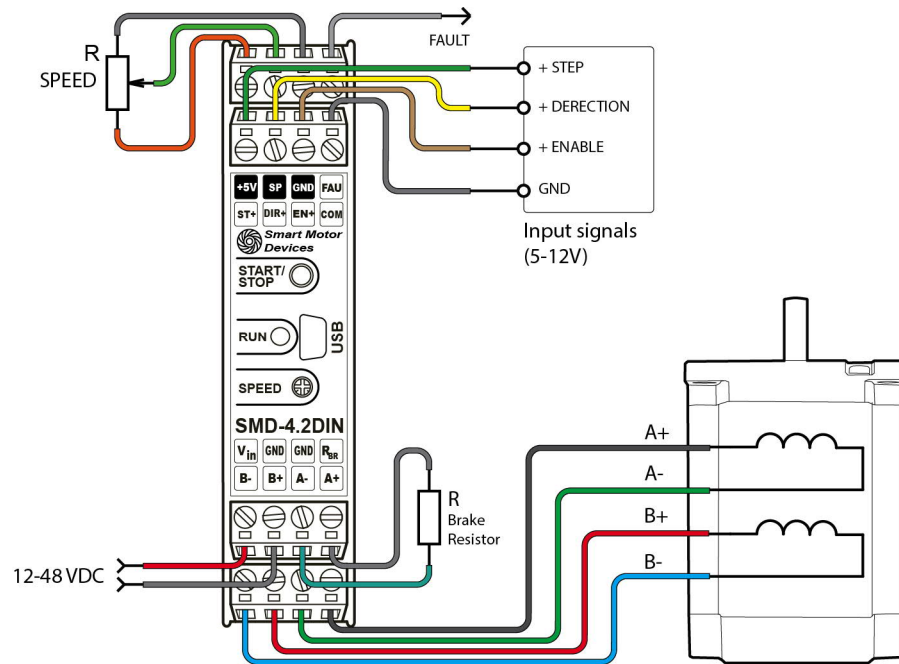- Button START/STOP;
- USB input – for connection to a PC.

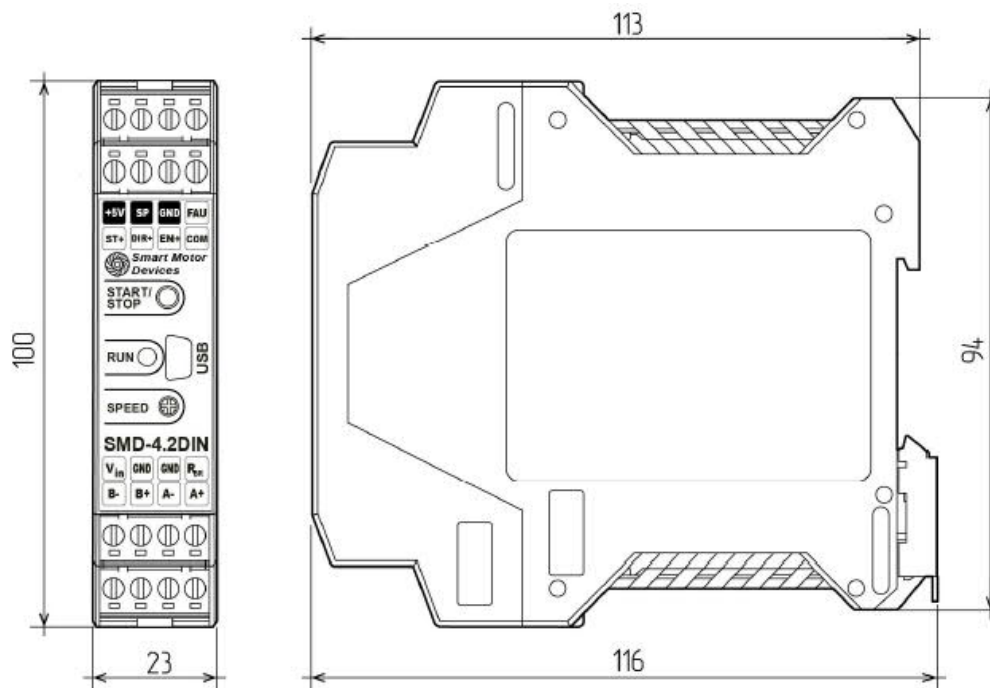Fig. 1. Terminals of the stepmotor driver SMD-4.2DIN ver.2

Fig. 2. The frame of the stepmotor driver SMD-4.2DIN ver.2

5. Connection

Please follow this manual carefully for connection and assembly.
Please, connect wires only 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.
Connection examples are shown on figures 3-7. Possible connection schemes for motors are given below in the table 2.

Connection examples for control inputs and outputs of the driver:
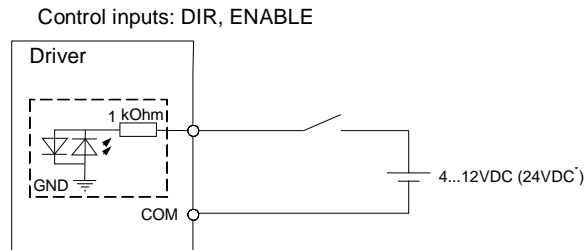
Control inputs: DIR, ENABLE

Fig.3. Connection of the input signals (4...12VDC) to an external controller.

*It is possible to use the voltage 24VDC as a high level signals for inputs DIR and ENABLE on condition of using additional current limiting resistors 1kOhm.
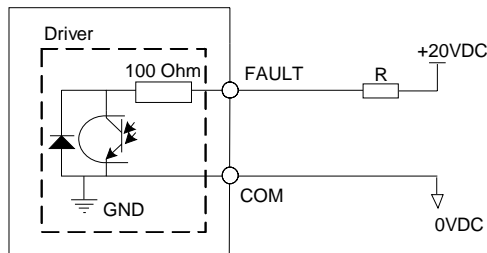

Fig.4. An example of output signal FAULT connection. Signal type – opto-coupler output. Max. voltage: 48VDC, max. current: 50 mA
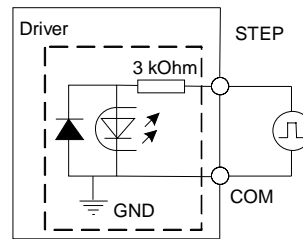

Fig.5. An example of input STEP connection, high level voltage signal 4…12VDC (24VDC*). It is possible to use the voltage 24VDC as a high level signals for input STEP on condition of using additional current limiting resistors 3kOhm.
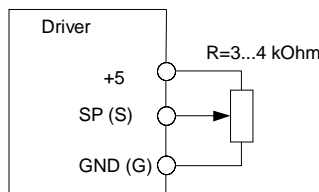

Fig.6. Analog speed control or analog position control with the use of an external potentiometer
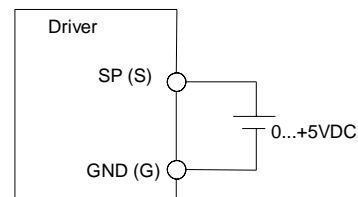

Fig.7. Analog speed control or analog position control with the use of an analog voltage signal 0…5VDC source.

Connection of an external braking resistor

Braking (regenerative) resistor is meant to be used to absorb and dissipate energy, which appears due to deceleration or forced rotation of the motor (as an example, during deceleration of a high inertia load). The driver is equipped with an internal regenerative resistor for 5W. The power of the resistor is suitable for normal operation of a stepper motor SM8680.

In case of forced motor rotation at a speed below 120rpm (10 seconds average value at the desired interval from 0 to infinite), using of an external regenerative resistor is not necessary.

In case of forced motor rotation at a speed 120...240 rpm (10 seconds average value at the desired interval from 0 to infinite), it is necessary to connect an external brake regenerative resistor R=5 Ohm P=100W. The load resistor should be connected to the screw terminals «GND» and «RES BRAKE» (fig.1).
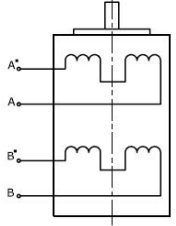
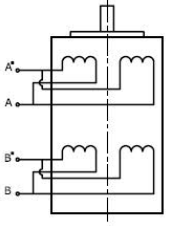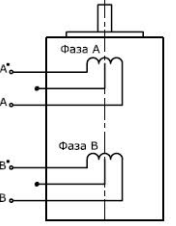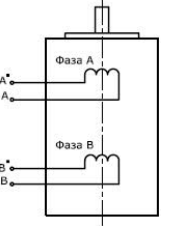Long duration forced motor rotation at average velocity more than 240 rpm (10 seconds average value at the desired interval from 0 to infinite) is forbidden.

Connection of a stepper motor

The driver provides operation with 2 or 4-phase stepper motors, 4, 6 or 8 wires. Winding connection examples are in the table 2. Connect stepper motor wires to A+, A-, B+ and B- terminals of the driver according to the table 2.

Table 2.

Scheme 1	Scheme 2	Scheme 3	Scheme 4

8 wires stepmotor connection (4 phases):
       Scheme 1 – serial connection;
       Scheme 2 – parallel connection.
6 wires stepmotor connection (2 phases with midpoint taps):
       Scheme 3;
4 wires stepmotor connection (2 phases without midpoint taps):
       Scheme 4.

Connection and assembling

Assembling order is as below:
1. Connect the driver to a stepper motor and power supply unit according the given schemes and recommendations;
2. If necessary, connect an external regenerative resistor.

6. Controller parameters settings

It is needed to connect the controller SMD-4.2DIN ver.2 via USB to a computer with windows OS to set the necessary control parameters. For the purposes of the driver adjusting the special software is used.
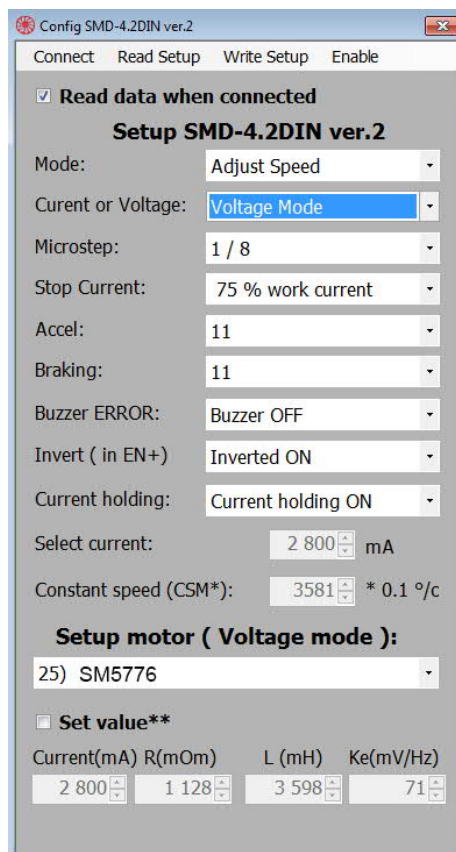
Fig.8 Software for motor control parameters setting

6.1. Setting of parameters

- Download the software from web site https://smd.ee/software.htm

- Connect the controller SMD-4.2DIN ver.2 to the computer using a USB cable. It is not necessary to connect the controller to a power supply unit – USB connection is enough for parameters setting.

- Check the COM port number from device manager of windows OS. This number should be in range from 1 to 9. If the number differs, change it to any number from 1 to 9 (device manager - > port properties - > additional - > COM port number).

- Launch the program "Config SMD-4.2DIN ver.2".

- If the tick box "Read data when connected" all actual parameters will be read from the controller and displayed at the program interface after connection. Clear the tick box if the control parameters were prepared in advance and if it is needed to write new prepared parameters to the controller.

- In the menu "Connect" choose the COM port – the connection with the controller will be established. The controller turns to the control setting mode.

- Adjust necessary motor control parameters (see the section 6.2).

- Write new settings to the controller – use menu "Write setup" - > "SMD-4.2DIN ver.2".

- Turn the controller to the operation mode – use menu "Enable".

6.2. Description of controller settings

- ***Mode*** – motor control mode
- ***Current or Voltage*** – phases commutation mode
- ***Microstep*** – microstepping mode
- ***Stop Current*** – holding current
- ***Accel*** – acceleration value
- **Accel** – deceleration value
- **Buzzer ERROR** – turn on / turn off of byzzer sound
- **Invert EN** – invertion of signal ENABLE (at the input EN+)
- **Holding current** – turn on / turn off holding current
- **Select current** – setting of current per phase for current commutation mode (if "Current or Voltage" is selected as "Current mode")
- **Constant speed (CSM*)** – setting of a constant speed value for control mode "Constant speed (CSM)"
- **Setup motor (Voltage mode)** – selection of a motor type for voltage commutation mode (if "Current or Voltage" is selected as "Voltage mode")
- Advanced settings for Voltage commutation mode (if "Current or Voltage" is selected as "Voltage mode") - see the section 6.3.

6.3. Advanced settings for Voltage commutation mode:

!!!   These settings must be done just by experienced users! Wrong parameters can cause incorrect operation or lead to damage of the motor and controller!

To set fine settings of the motor, tick the point "Set value**".
Set exact motor parameters at the corresponding fields.
Write new settings through menu "Write setup" - > "SMD-4.2DIN ver.2"

7. Operation order

1. Make sure the power supply is turned off.
2. Make assembly and connection according to the section 5.
3. Set controller operation parameters: motor control mode (current or voltage), operation current (for current control mode) or motor model (for voltage control mode), holding current, microstepping mode and other necessary parameters (please, refer to the section 6).

   Current control mode – during the motor control the target parameter is a maximum operation current given to a motor phase. If use this control mode, it is possible to connect any motor to the controller under the condition of a correct current setting (use the menu of the controller) in an available range 0.1 – 4.2A. The current motor control mode performs better torque and high rotation speed, but it is limited with a maximum microstepping division 1/16;

   Voltage control mode – performs smooth motion and provides microstepping division up to 1/128. However, rotation speed and torque are less in comparison with the current control mode. This control mode is only applicable to the exact list of motor models. The models list resides in the controller memory (please, refer to the section 6.3).

- **If used pulse position control mode (Step / Dir),** give a sequence of signals «STEP» (pulse), «DIR» (level) and «ENABLE». High level of the signals – 4..5VDC (24VDC*), low level - 0..1VDC.
One step (or microstep) executes as front edge of the voltage pulse at the «STEP» input. Direction switches by changing voltage level at the «DIR» input. The motion is enabled if the signal to «ENABLE» input is given. The signals oscillogram is shown on fig.9.
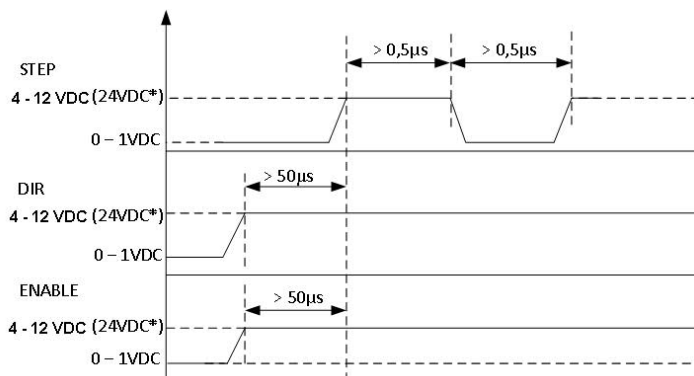

Fig.9. «STEP», «DIR» and «ENABLE» signals order and duration

**Please, connect additional current limiting resistance if use high level signal +24VDC instead of 5VDC: 3KOhm for STEP input, 1KOhm

for all the rest inputs.

- **If used constant speed control mode (Constant speed (CSM)) -** set the target speed value during controller setup (see section 6). To start or stop operation use the button START/STOP or input ENABLE.

- **If used analog speed control (Adjust Speed)** – control the motor velocity using the internal potentiometer SPEED, an external potentiometer (connected to inputs "+5", "SP" and "GND" - see figure 1) or source of analog signal 0 – 5VDC (connect according the scheme on the figure 7). The motor motion can be started and stopped by pressing the START/STOP button, or by signal at the ENABLE input. When use an external potentiometer, the internal potentiometer SPEED should be turned to the position "0".

- **If used analog position control (Adjust Angle)** – control the motor rotation angle using the internal potentiometer SPEED, an external potentiometer (connected to inputs "+5", "SP" and "GND" - see figure 1) or source of analog signal 0 – 5VDC (connect according the scheme on the figure 7). The motor motion can be started and stopped by pressing the START/STOP button, or by signal at the ENABLE input. When use an external potentiometer, the internal potentiometer SPEED should be turned to the position "0". In this operation mode microstepping below 1/16 is not applicable. Microstepping mode 1/16…1/128 should be used. In case of microstepping ratio 1/16 for a stepper motor with step angle 1.8° - the maximum rotation angle is 270°; in case of microstepping ratio 1/32 – 135°; 1/64 – 67,5°; 1/128 – 33,7°. The maximum momentary target speed is 600 steps/sec.

8. Errors detection

The output Fault is closed to GND (fig. 4) during normal operation. In case of alarm state the fault circuit is open. The reason of an alarm can be determined by the LED indication according the table 3.

The table of error codes of SMD-4.2DIN ver.2

Table 3.

LED flashes	LED color	Meaning
0	Green	Normal state – standby
1	Green	Normal state – operation in process
1	RED	Power supply of the driver is out of the permissible range
2	RED	Short circuit in motor phases
3	RED	The braking system is overheated
4	RED	The stepper motor control circuits is overheated
5	RED	Gate driver supply voltage is below the preset threshold
6	RED	The motor hard stop
7	RED	Driver settings error
8	RED	Setting read / write error
9	RED	Error of the ROM
10	RED	Testing firmware

9. Delivery in complete sets

Stepmotor driver SMD-4.2DIN ver.2   1 pcs
Manual SMDDIN.42.V2.001   1 pcs

9. 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:
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Phone: + 372 6559914,
e-mail: mail@smd.ee
url: https://smd.ee

Date of sale: