• Start executing program by pressing the button “Start” or input signal “Start” (connect “Start” and “GND”);
• Start searching for a limit switch (zero position) by pressing the “Home” button or input signal “Start” (connect “Home” and “GND”);
• Turn to the other operation mode: manual or simple driver mode (see section 6 and table 3).

**Program executing mode** – blink red color LED indicator.

The R272-1.5 controller turns to the program executing mode and start motion algorithm from the standby mode in case of:
- “Start” button pressed or input activated (connect “Start” and “GND”);
- Arrival the control command «ST1»;

The R272-1.5 controller turns back from program executing to the standby mode in case of:
- Executing program completed;
- Arrival the control command «ST1»;
- “Reset” button pressed or input activated (connect “Reset” and “GND”).

The commands of the sequence (operation algorithm) are executed one by one, as they were recorder to the controller. The controller commutates motor windings according to the executing commands. At the same time R272-1.5 controls the inputs state for “BX1”, “BX2”, “EN”, “Reverse”, “0”.

Active “EN” signal suspends and inactive signal resumes the program executing. Active “Reverse” signal changes motion direction (by the front edge). “BX1”, “BX2” and “0” signals are handed according to the current executing command.

**Waiting for an external signal submode** – red color LED indicator.

The R272-1.5 controller turns to this submode during program executing, as per the command “WH” or “WL” – waiting for an external signal. The controller suspends program executing till receiving active signal to input BX1 or BX2. As the signal arrives to BX1 or BX2 (as per the command) the controller resumes program executing.

**Commands loading to the controllers memory** – orange color LED indicator.

The R272-1.5 controller turns to this mode from the standby mode as receives the command “LD1”. In the commands loading mode the controller accepts the executing commands only (table 6). After arriving the command “ED” the controller record all received executing commands to the memory and turns to the standby mode.

**Reading commands from the controller** – orange color LED indicator.

The sequence of executing commands from the controller memory transfers to the computer as the controller receives the command “RD1”. After the commands transferred the controller turns back to the standby mode.

**Temporary stop mode** – orange color LED indicator.

The R272-1.5 controller turns to this submode during program executing as receives the signal «EN» (contact «EN» and «GND»). The controller suspends program executing while the signal is active. As the signal turns to inactive the controller resumes the program executing.

**Executing program error** – blink orange color LED indicator.

The R272-1.5 controller turns to this submode during program executing in case of wrong command in the sequence. The exit of this mode as “Reset” button pressed or input activated (connect “Reset” and “GND”). The executing program should be recorded again to the controller memory.

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**PROGRAMMABLE STEP MOTOR CONTROLLER R272-1.5**

Manual

R272.15.003

2015
1. Product designation
Programmable step motor controller R272-1.5 is designed to operate with stepper motor with maximum current per phase up to 1.6 Amp. There are three control modes provided: programmable, manual or simple driver.

2. Functions and possibilities
- Recording the operation algorithm from a computer to EEPROM of the unit as a sequence of ASCII commands.
- Reading the saved algorithm from the EEPROM to a computer.
- In the programmable mode: control the stepper motor as per the program, saved in the unit’s memory: Speed, acceleration/deceleration, displacement, direction of the stepper motor are set as a sequence of execution commands and is storage in the nonvolatile memory of the unit.
- In the simple driver mode: the unit receives logic signals “PULS” and “DIR” – 0VDC low level and 8-24VDC high level.
- In the manual mode: the unit receives analog signal “Speed” (voltage signal 0-5VDC, internal or external potentiometer) and digital signals “Reverse” and “Enable”.
- For synchronized operation of several R272-1.5 units and other devices there are 3 digital inputs and one output relay are provided. These inputs and output relay are used in the programmable mode.
- The unit can operate and be controlled by a computer or in a standalone mode.
- There is zero positioning function provided: start zero search by a command or by a signal on the digital input. Stop zero searching movement as input signal is received. The function provides homing by an individual input.
- The unit stops motor motion as receives a signal on an “Enable” input.
- The unit changes rotation direction as receives a signal on a “Reverse” input (in the manual and programmable modes).
- The microstepping can be changed on-fly in the manual and programmable modes.

3. Technical characteristic

![Table 1](image)

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of controlled stepper motors</th>
<th>Maximum output current per phase, A</th>
<th>Minimum output current per phase, A</th>
<th>Microstepping modes</th>
<th>Pulses frequency in programmable and manual modes, Hz</th>
<th>Voltage input, VDC</th>
<th>Dimensions, mm more</th>
<th>Digital inputs EN, Reverse, BX1, BX2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common characteristic:</td>
<td>1</td>
<td>1.6</td>
<td>0.16</td>
<td>1/2, 1/4, 1/8, 1/16</td>
<td>1 - 10000</td>
<td>10 – 30</td>
<td>117x83x23</td>
<td>Contact to GND</td>
</tr>
<tr>
<td>High level voltage, VDC:</td>
<td>4-24</td>
<td>(Please, connect current-limiting resistance when use high level voltage more, than 5VDC: 1 KOhm for 12VDC, 2 KOhm for 24VDC).</td>
<td>Low level voltage, VDC:</td>
<td>0-1</td>
<td>Input resistance, KOhm no less</td>
<td>3.0</td>
<td>Inputs DIR, STEP (simple driver mode):</td>
<td></td>
</tr>
<tr>
<td>Voltage, VDC</td>
<td>- baud</td>
<td>9600</td>
<td>- parity</td>
<td>even</td>
<td>- stop bit</td>
<td>1</td>
<td>Additional output &lt;5VDC&gt;:</td>
<td></td>
</tr>
<tr>
<td>Maximum load current, mAmp</td>
<td>5</td>
<td>Maximum output current per phase, Amp</td>
<td>1.6</td>
<td>Microstepping modes</td>
<td>1/2, 1/4, 1/8, 1/16</td>
<td>Pulses frequency in programmable and manual modes, Hz</td>
<td>1 - 10000</td>
<td>Voltage input, VDC</td>
</tr>
<tr>
<td>Resistance, Ohm</td>
<td>27</td>
<td>Continuous movement, till signal to input “0” (zero limit switch)</td>
<td>- if this command is received when the motor is stopped, continuous motion will begin till signal to input “0”; - if this command is received while driving from this moment the motor will start continuous movement with the current speed till signal to input “0”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse: min 1ms – max 1000000ms</td>
<td>SPddd</td>
<td>Pause for d/dddd ms, max = 100000000</td>
<td>After receiving this command the motor will stop and wait for dddd ms and then will continue to execute the remaining steps. If in pause time the commands MV, MVddd, WH, ML, HM a received, they are executed immediately and previous command is considered complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indefinite pause, wait for a signal to input IN1</td>
<td>LL</td>
<td>Set label for cycle operation</td>
<td>Set label for cycle operation – for program in buffer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeat from label ddddd times, max = 255. Set 2 commands SPddd to create endless cycle</td>
<td>JPddd</td>
<td>Repeat from label dddd times, max = 255. Set 2 commands JPddd to create endless cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indefinite pause, wait for a signal to input IN1</td>
<td>WL</td>
<td>Indefinite pause, wait for a signal to input IN1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indefinite pause, wait for a signal to input IN2</td>
<td>WH</td>
<td>Indefinite pause, wait for a signal to input IN2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command data error (check command data – integer, in allowed range, see table 6)</td>
<td>Table 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Programmable mode - submodes
The R272-1.5 controller goes in one of the submodes:
- **Standby mode** – green color LED indicator.

The R272-1.5 controller goes to the standby mode in one of the next cases:
- After program executing completed;
- After program executing was stopped by command «ST1»;
- After power on (if microswitches SW1=On and SW2=On);
- After “Reset” button or input activated (if microswitches SW1=On and SW2=On).

In the standby mode the R272-1.5 controller wait for one of the next event:
- Arrival one of the control commands from a computer (table 5, accepted commands are «LD1», «RD1», «ST1»);
<table>
<thead>
<tr>
<th>№</th>
<th>Command</th>
<th>Standalone mode</th>
<th>«Direct control»</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>BG</td>
<td>Begin - start a new algorithm, the previous sequence is cleared.</td>
<td>Begin - start a new algorithm in the buffer, the previous sequence is cleared.</td>
</tr>
<tr>
<td>9</td>
<td>EN</td>
<td>Set “enable” – turn on the motor.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>DS</td>
<td>Set “disable” – turn off the motor.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>DL</td>
<td>Forward motion - if the motor is stopped, the start of the motion will be in this direction; if this command was received while driving, the remaining steps are processed in the direction according this command.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>DR</td>
<td>Backward motion - if the motor is stopped, the start of the motion will be in this direction; if this command was received while driving, the remaining steps are processed in the direction according this command.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>RS</td>
<td>Reverse - if the motor is stopped, the start of the motion will be carried out in the opposite direction; if this command was received while driving, the remaining steps are processed in the opposite direction.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>AL(-)ddd</td>
<td>Acceleration ddd: min = -1000, max = 1000</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SDddd (1 to 10000)</td>
<td>Speed ddd</td>
<td>- if the motor is stopped the start of the motion will be carried out with this speed; if acceleration is used this command sets the final speed; if there is no acceleration this speed will be used as start speed; if this command was received while driving, the remaining steps are processed with this speed.</td>
</tr>
<tr>
<td>16</td>
<td>SSddd (1 to 2000)</td>
<td>Start speed: This command is used only for starting motion and only when acceleration is used (AL≠0)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>SF</td>
<td>Turn the relay on</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>CF</td>
<td>Turn the relay off</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>MV</td>
<td>Continuous movement - if the motor is stopped, this command starts perpetual motion; if this command was received while driving, continuous motion with current speed begins.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>MVddd (1 to 1000000)</td>
<td>Movement on number of steps (run 1µd = 10000000µd) - if this command was received when the motor is stopped, the motor will make ddd steps and stop; if this command was received while driving, the motor will make ddd steps and stop, previous command will be considered complete.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>MH</td>
<td>Indefinite movement, till signal to input IN2 - if this command is received when the motor is stopped, continuous motion will begin till signal to input IN2; if this command is received while driving, from this moment the motor will start continuous movement with the current speed till signal to input IN2</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>ML</td>
<td>Indefinite movement, till signal to input IN1 - if this command is received when the motor is stopped, continuous motion will begin till signal to input IN1; if this command is received while driving, from this moment the motor will start continuous movement with the current speed till signal to input IN1</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental Conditions:**
- Ambient Temperature: -25…+50°C
- Humidity: 90% RH or less upon condition +25°C
- Condensation and freezing: none
- Pressure: 650…800 mm of mercury

**Dimensions:**
-R272-1.5 is designed as a circuit plate with electronics elements, installed on a heatsink plate and covered with a metal case. Besides electronic components, there are indicating and control elements, connection terminals and connectors on the board:
- terminal screws for power supply, stepmotor windings and control circuit connection;
- USB plug for a computer connection;
- control buttons “Reset”, “Homing”, “Start”;

![Diagram of R272-1.5](img1)

![Diagram of R272-1.5](img2)
internal preset potentiometer «V» to adjust speed in the manual mode;
connector "" for an external potentiometer connection to control motor speed in the manual mode;
LED for indication of the controller status;
switches SW1 – SW2 to set the operation mode;
switches SW3 – SW5 to set the microstepping mode;
internal potentiometer to adjust output current.

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.

Assembly and connection order
1. Connect the R272-1.5 controller with stepper motor, switches and electric DC power supplier according to one of schemes shown on images 3-6.
2. Connect if necessary the R272-1.5 controller to a computer by an interface USB cable (included to the set).

Connection schemes
The connection example in the programmable mode is on the image 3, in the simple driver mode – image 4, in the manual mode – image 5. The switch connection example is on the image 6.

Programmable mode – connection example

In the simple control panel window (img 10) check the box 1, (coordinate 1 – img.14).

If the program is in the simple control mode (image 10) - input motor operation parameters (steps number, speed, acceleration, direction) and press the button “write” to record parameters to the controller and press the button “start” to start motion according to the recorded command sequence. Or press the button “Write and start” to record new parameters and start motion at the moment.

If the program is in the programming control mode (image 11) add to the command list:
1) «Start loading to the coordinate 1»
2) Add commands to assemble the operation algorithm.
3) «End loading».
4) Press the button «send» under the command list.

Commands list and description are in the section 7. “Commands”, and in the SMC_Program manual.

After the commands sequence (operation algorithm) is recorded into the controller there are two possibilities: to continue control by the SMC_Program or to use the controller in standalone mode. To start program executing in the standalone mode press the “Start” button or contact “Start” and “GND” at the controller frame.

Saving execute program with other terminal program with RS-232 communication function
Set the port number (check in the windows device manager, image 9), set port parameters according to the table 1. Input required commands sequence using the ASCII codes (table 5, 6; section 7).

7. Commands

Commands in the programmable mode should be byte-serial (character-serial) transferred. Every command should be completed with the ending character “*”. The ending character “\" instead of “*” cancels previous bytes transfer (whole string). There is the commands list in the table 5 and 6. Commands can be loaded to the memory of controller and then controller works in standalone mode or commands can be executed in real-time mode (“direct control”). The R272-1.5 controller receives and checks each command after receiving the ending character “*”. Controller sends to the communication port a reply after receiving every command (successful or error command). All possible controller replies are presented in the table 7.

<table>
<thead>
<tr>
<th>№</th>
<th>Command</th>
<th>Standalone mode</th>
<th>«Direct control»</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LD (or LD1)</td>
<td>Start loading to the controller – after the command controller is in the loading mode.</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>RD</td>
<td>Read the command sequence from the controller memory</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ST</td>
<td>Start if the controller in the programmable standby mode, stop if the commands sequence is executing.</td>
<td>Start or stop commands sequence executing.</td>
</tr>
<tr>
<td>4</td>
<td>LB</td>
<td>Start loading to the operational buffer. If this command is received while driving, the motor is stopped and turned off.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>RB</td>
<td>Read the command sequence from the operational buffer. If this command is received while driving, the motor is stopped and turned off.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SBddd</td>
<td>Start the commands sequence of the operational buffer executing, ddd – sets how many times the program from the operational buffer should be executed (from 1 to 255). If it is necessary to stop program executing use ST command.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>ED</td>
<td>Complete executing commands sequence. After accepting this command the controller records all transferred commands into the memory and turns to the standby mode.</td>
<td>Complete executing commands sequence. After accepting this command the controller record all commands to operational buffer and turns to the standby mode</td>
</tr>
</tbody>
</table>
The availability and the number of new port can be checked in windows device manager (Windows XP: On the desktop right-click on My Computer and click Properties or open the Control Panel and double-click the System icon. In the System Properties window click the Hardware tab. In the Hardware tab click the Device Manager button) – image 9. This COM-port should be used for communication with R272-1.5 controller. The port properties should be set in a terminal program according to the table 1. As a terminal program SMC_Program or some other software can be used (software should provide RS-232 ASCII communication). The program is available and supplied with the R272-1.5 controller.

**Saving execute program with SMC_Program**

The program should be copied to the hard drive of the computer. Unpack the program pack. SMC_Program doesn’t require registration and installation. The write/read operations should be allowed in the program folder (carefully check for windows vista and windows 7).

It is necessary to set port properties in SMC_Program. Menu “Port settings” > «Choose port» (image 12) chose the connected port number and press “Ok” (image 13).
Motor connection

The R272-1.5 controller provides operation with 2 or 4-phase stepper motors, 4, 6 or 8 wires. Winding connection examples are in the table 2. Connect step motor wires to A, A*, B and B* terminals of R272-1.5.

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Microswitch</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Simple driver</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Manual</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Table 2

1. Make sure the power supply is turned off.
2. Choose the suitable operation mode and set microswitches SW1 and SW2 according to the table 3.
3. Choose suitable microstepping mode and set microswitches SW3 – SW5 according to the table 4. The new microstepping in the simple driver mode is applied after RESET (by button or input signal).
4. Make wiring according to the section 5 “Assembly and connection”.
5. Set suitable for the stepper motor current per phase. Please, use the potentiometer “Current” on the board of the controller. Adjust current according image 7. The output current, set by the potentiometer, should be set according to the motor’s description. Low current leads to a weak torque of the motor, high current leads to the motor heating and can damage the motor.

Table 3

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>SW1</th>
<th>SW2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Simple driver</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Manual</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Table 4

6. Before starting

1. Make sure the power supply is turned off.
2. Choose the suitable operation mode and set microswitches SW1 and SW2 according to the table 3.
3. Choose suitable microstepping mode and set microswitches SW3 – SW5 according to the table 4. The new microstepping in the simple driver mode is applied after RESET (by button or input signal).
4. Make wiring according to the section 5 “Assembly and connection”.
5. Set suitable for the stepper motor current per phase. Please, use the potentiometer “Current” on the board of the controller. Adjust current according image 7. The output current, set by the potentiometer, should be set according to the motor’s description. Low current leads to a weak torque of the motor, high current leads to the motor heating and can damage the motor.

6. If necessary, connect the R272-1.5 controller to a computer by the USB cable, which is supplied with the unit.
7. Check wiring once again and turn on the power supply.
8. If the operation mode should be changed after power on, set SW1 and SW2 according to the table 3 and RESET the controller (by button or input signal).
9. To control the stepper motor:

   - **In the simple driver mode** (connection example on the image 4) set the required sequence of logic signals “STEP” and “DIR” according to the scheme below (image 8).

   One step (or microstep) executes as the front edge of the voltage pulse on the “STEP” input. Direction switches by changing voltage level on the “DIR” input. The motor can be stopped by the active signal on the “EN” input (clean contact of EN and GND).

   - **In the manual mode** (connection example on the image 5) close contacts “start” and “GND” to run the motor, adjust speed by the potentiometer or analog signal 0-5VDC. The motor speed is changed by the internal potentiometer “SPEED” when jumper “\\[Image 143x370 to 208x458]” is closed. To connect external potentiometer set the minimum speed by internal potentiometer, remove jumper “\\[Image 143x370 to 208x458]” and connect on this place external potentiometer 10 KOhm. To adjust speed by the analog signal set the minimum speed by internal potentiometer, remove jumper “\\[Image 143x370 to 208x458]” and connect on this place contacts of analog signal source (“0V” at the cover side, “+V” at the heatsink bottom side). In the manual mode information of current speed of the motor is available via communication interface as the ASCII string. To change direction set signal to the “REVERSE” input – contact “REVERSE” and logic “GND”. Direction changes as the front edge of the signal.

   - **In the programmable mode** to control via a computer the USB cable connection should be provided. For a standalone operation the executing program should be saved via USB (virtual RS-232), after that the USB cable can be disconnected. For virtual RS-232 communication the special driver USB-RS-232 should be installed to the computer. Please, download the package with the driver and SMC-Program from our web-site http://www.stepmotor.biz/program/smc_program.rar. Save on a computer hard drive, unpack the archive and launch the installation file CP210x_VCP_Win2K_XP_S2K3.exe (it is located in folder “smc_program\driver-usb-com\CP210x_VCP_Windows” of the downloaded package). Please, follow the instructions during the installation progress. As a result when the controller is connected to the PC, the additional program COM-port appears (CP2102 USB to UART Bridge Controller).