MotorPot Manual v1.0

Introduction

MotorPot is an automated high torque step motor driver that can work in a standalone mode or being controlled externally. It has a screen but you won't find any buttons on it. This is done for the simplification of the operation which is managed by simple MIDI commands such as Note On/Off and CC values. Every command that's received is displayed on the screen and it scrolls down the way you always see the history of those.
MotorPot can be controlled by MIDI via USB MIDI Class Compliant, MIDI input (TRS-A or TRS-B selectable) and via CV/Gate for certain parameters. The incoming data over TRS MIDI is transferred to USB out too. This allows to record all incoming messages into DAW from external MIDI controllers without reconfiguration.

Step motors are very precise in the positioning, however, keep in mind there is no position feedback from them, i.e. they don't know the actual position and can only rely on counting steps during operation. This results in two limitations. You need to set the 0-point at start if position is not a zero. If the load on the motor is heavy and exceeds stepper power (say you control a tough rotary switch) it may skip a step. On a positive note it brings many advantages, as step motors are more powerful than servos or automated potentiometers. You're also able to control multi-turn pots or other custom actuators with very high precision. It's very flexible.

Unlike other Eurorack modules, MotorPot may require external power to operate. Very often 5V rail is limited in Eurorack PSUs. Given that stepper motor consumption can approach 2A at peak loads, it's recommended to use a dedicated 12V PSU connected to the back of the unit. Other logic such as a microcontroller kept powered from Eurorack or USB input depends on the controller pin configuration (refer to the assembly guide).

MotorPot has several operational modes which are saved in its non-volatile memory together with other parameters. MotorPot firmware is open source under BSD 3-Clause License making the contributions easy and welcomed for the community. Additional functionality can be added and merged into the existing repository.

Deftaudio, 2023

Operation modes

There are several operational modes for the MotorPot controller. Some of them require initial programming of settings, which are later stored in its memory.

Mode	**MIDI note # to enable**	**Description**
Follow MIDI mode	C-1	This is the basic operation mode where stepper is following CC1 parameter changes or moves between 10 programmable presets. Speed and acceleration can be controlled.
Rotation mode	D-1	In this mode the stepper is constantly rotating clockwise or counterclockwise. A speed can be controlled in real time.
Bounce mode	E-1	This mode is for constant moving between two positions. Useful to simulate LFO for the external control. Speed and acceleration can be controlled.
Disable stepper output	A-1	Available for all operational modes this command disables stepper power. By default when the stepper stops it locks the position and continues taking a power. This command allows you to release the power and freely move the stepper by hand if needed.
Programming mode	B-1	This is the programming mode to set various parameters which is explained in detail later.

Programming mode

If you soldered a DIY kit or received an assembled unit, the first step is to program it to set the basic settings. Programming mode is used for this purpose. It’s important to note that you can interrupt programming by switching to one of the basic modes at any given time without overwriting new parameters.

Following parameters available for programming:

Parameter	**Corresponding mode**
Zero position	Follow MIDI mode
10 position presets	Follow MIDI mode
Max position	Follow MIDI mode

Start for Bounce range	Bounce mode
End for Bounce range	Bounce mode
Current Motor speed	Rotation and Bounce modes
Current Motor acceleration	All modes

Programming steps:

- First enter the programming mode by pressing the **B-1** key on the external MIDI keyboard connected to the TRS MIDI input or from a computer connected over USB.
- Set the Zero position by using Pitch Bend up or down causing the stepper to move. Once in position press **C-2** key.
- Now set the Max position by using Pitch Band again and pressing **C-3** key.
- You can set 10 more presets by moving to position and pressing any of **C#-2** - **B-2** keys.
- Finally, repeat the operation for setting up the Bounce range, which are assigned to **C-4** (bounce start) and **C-5** (bounce end).
- Once you finish assigning parameters, press **B-1** to exit from programming mode and save the settings.

Notes:

- It's important to set the Zero and Max position before operating the unit. Those are used to scale CC1 control in Follow MIDI mode. Other parameters are optional.
- You need to set the Zero position at every start otherwise the position, where you left MotorPot before turning it off, will be used as zero. This is not required for Rotation mode though.
- All preset positions are relative to the Zero position and don't require modifications at the start.

Follow MIDI mode

This is the most common operation mode of MotorPot which you can control by CC value, presets (zero, max, 10 presets) or CV/Gate.

Supported commands:

Command	**Description**
MIDI CC#1	Moves stepper following CC position. It scales between the Zero and Max range that were defined at programming. It can also be a multi-turn.
MIDI CC#2	Acceleration speed, i.e. how quickly stepper gets to the maximum speed while changing between presets

MIDI Note C-2	Move to Zero position
MIDI Note C#-2 - B-2	Move to Presets 1-10
MIDI Note C-3	Move to Max position
MIDI Note C-4	Move to Start of bounce range
MIDI Note C-5	Move to End of bounce range
CV input	Similar to CC#1 follows the CV level
Gate	Used as a trigger to start moving

Rotation mode

Rotation mode is the simple mode of operation where you can control direction and speed of the constant stepper rotation.

Command	**Description**
MIDI CC#2	Acceleration speed, i.e. how quickly stepper reacts to a speed change
MIDI CC#3	Rotation speed and direction: ● 64 is 0 speed, no move ● 127 is max speed clockwise ● 0 is max speed counterclockwise
MIDI Pitch Band	An extra speed adder to the existing rotation speed. Pitch Bend up adds a value, while Pitch Bend down subtracts it. The aggregated speed never exceeds the maximum speed set for the motor.
CV input	Similar to CC#3 sets the rotation speed
Gate	Used as a trigger to set the value

Bounce mode

In this mode MotorMot automatically moves between Start and End of the bounce range position which is identified during the programming. It's an efficient way to simulate an LFO control for external potentiometer or other attached hardware.

Command	**Description**
MIDI CC#2	Acceleration speed, i.e. how quickly stepper accelerates when reached the end of the range
MIDI CC#3	Rotation speed and direction: ● 0 is 0 speed, no move ● 127 is max speed
CV input	Similar to CC#3 sets the bouncing speed
Gate	Used as a trigger to set the value