



MD2-420

Digital Stepper Drive

Manual



Mach Motion Products, Inc.

360.601.0666

info@machmo.com

7509 South 5th Street, Suite 110

Ridgefield WA, 98642

Thanks for selecting our stepper motor driver. We hope that the superior performance, outstanding quality, excellent cost performance of our product can help you accomplish your motion control project.

The content in this manual has been carefully prepared and is believed to be accurate, but no responsibility is assumed for inaccuracies.

Version	Editor	Verifier
V1.0	R&D	R&D

Contents

Contents.....	- 3 -
1. Overview.....	- 4 -
2. Features.....	- 5 -
3. Ports Introduction.....	- 6 -
3.1 Control Signal Input Ports.....	- 6 -
3.2 Power Interface Ports.....	- 7 -
4. Technological Index.....	- 8 -
5. Connections to Control Signal.....	- 9 -
5.1 Connections to Common Anode.....	- 9 -
5.2 Connections to Differential Signal.....	- 10 -
5.3 Connections to 232 Serial Communication Interface.....	- 11 -
5.4 Sequence Chart of Control Signals.....	- 11 -
6. DIP Switch Setting.....	- 13 -
6.1 Introduction Of SW.....	- 13 -
6.1.1 Current Setting.....	- 13 -
6.1.2 Standstill current Setting.....	- 13 -
6.1.3 Micro steps Setting.....	- 14 -
7. Faults alarm and LED flicker frequency.....	- 15 -
8. Appearance and Installation Dimensions.....	- 16 -
9. Typical Connection.....	- 17 -
10. Parameter Setting.....	- 18 -
11. Processing Methods to Common Problems and Faults.....	- 23 -
11.1 Power on power light off.....	- 23 -
11.2 Power on red alarm light on.....	- 23 -
11.3 After input pulse signal but the motor not running.....	- 23 -

1. Overview

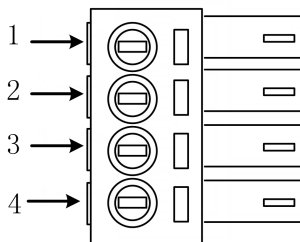
The MD2-420 is a two phase digital stepper driver based on ARM. Its Micro step resolutions and output current are programmable. And it has advanced control algorithm, which can bring a unique level of system smoothness, provides optimum torque and mid-range instability. The control algorithm of Multi-Stepping can make stepper motor has smooth system performance. The control algorithm of torque compensation can improve the torque of motor in the high speed. The control algorithm of parameter auto-setup technology offers optimum responses with different motors and easy-to-use. The control algorithm of smoothness can enhance the acceleration and deceleration of motor. Its unique features make the MD2-420 to be an ideal solution for applications.

2. Features

- ◆ Parameter auto-setup
- ◆ Multi-Stepping inside, Small noise, low heating, smooth movement
- ◆ Torque compensation in high speed
- ◆ Variable current control technology, High current efficiency
- ◆ Accelerate and decelerate control inside, Great improvement in smoothness of starting or stopping the motor
- ◆ Support PUL/DIR and CW/CCW modes
- ◆ Storage the position of motor
- ◆ Optically isolated input and compatible with 5V or 24V
- ◆ User-defined micro steps
- ◆ Micro-step resolutions and Output current programmable
- ◆ Over current and over voltage protection
- ◆ Automatic detection, flexible selection of pulse edge count mode;
- ◆ Green light means running while red light means protection or off line

3. Ports Introduction

3.1 Control Signal Input Ports



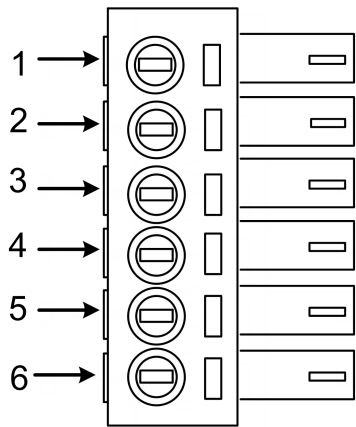
3.1.1 Common anode control signal connection

Port	Symbol	Name	Remark
1	ENA-	Enable signal-	Compatible with 5V or 24V
2	OPT+	Common+	
3	DIR-	Direction signal-	Compatible with 5V or 24V
4	PLS-	Pulse signal -	

3.1.1 Connections to Differential Signal

Port	Symbol	Name	Remark
1	DIR-	Direction signal -	Compatible with 5V or 24V
2	DIR+	Direction signal +	
3	PUS-	Pulse signal-	Compatible with 5V or 24V
4	PLS+	Pulse signal +	

3.2 Power Interface Ports



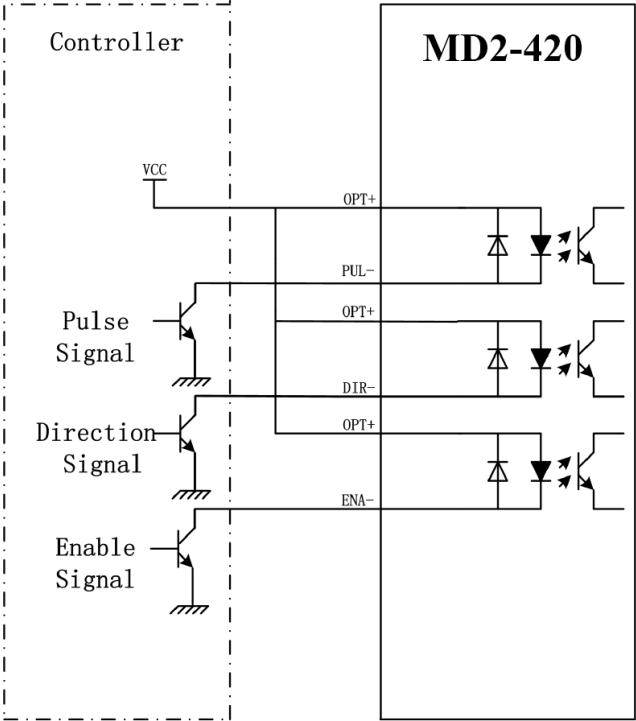
1	Motor Phase Wire Input Ports	B-	Phase B-	Motor Phase A
2		B+	Phase B+	
3		A-	Phase A-	Motor Phase B
4		A+	Phase A+	
5	Power Input Ports	VCC	Input Power +	DC24V-36V
6		GND	Input Power-	

4. Technological Index

Input Voltage		DC24V-36V
Pulse Frequency max		200K
Communication rate		57.6Kbps
Over voltage value		50V
Overall Dimensions (mm)		118× 75.5× 34
Weight		Approximate 160g
Environment Specifications	Environment	Avoid dust, oil fog and corrosive gases
	Operating Temperature	+70°C Max
	Storage Temperature	-20°C~+80°C
	Humidity	40~90%RH
	Cooling method	Natural cooling or forced air cooling

5. Connections to Control Signal

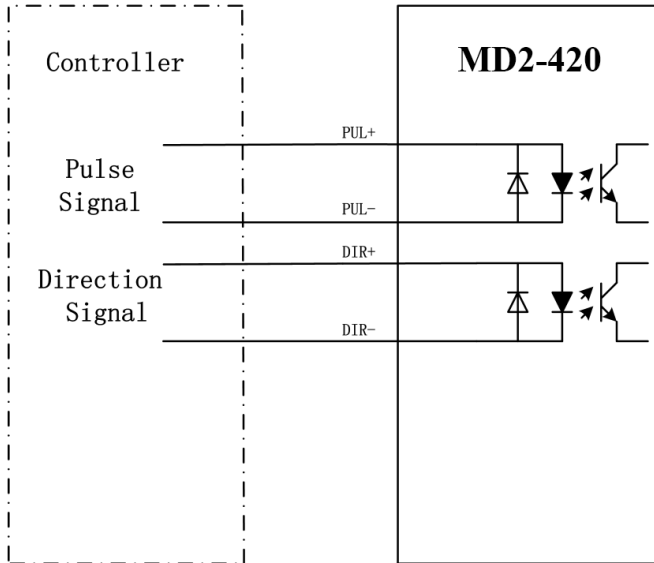
5.1 Connections to Common Anode



Remark:

VCC is compatible with 5V or 24V;

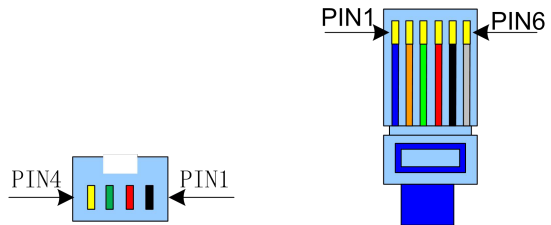
5.2 Connections to Differential Signal



Remark:

VCC is compatible with 5V or 24V;

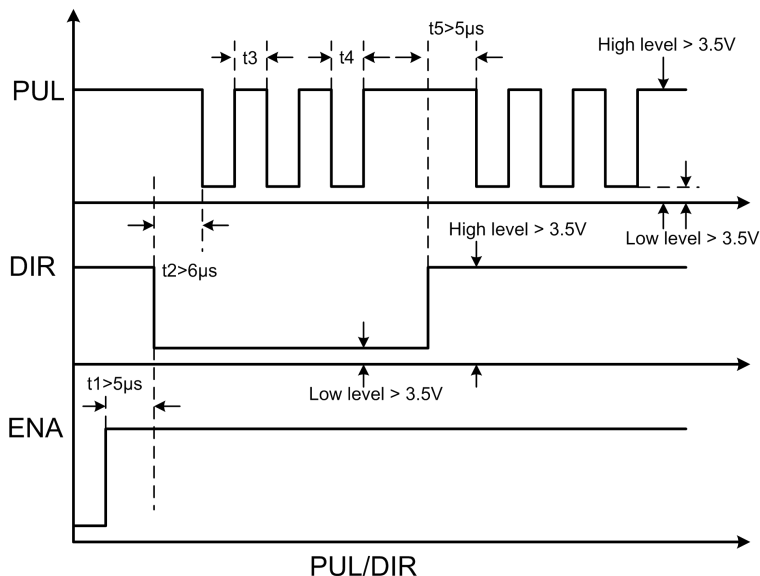
5.3 Connections to 232 Serial Communication Interface



Crystal Head foot	Definition	Remark
1	TXD	Transmit Data
2	RXD	Receive Data
4	+5V	Power Supply to HISU
6	GND	Power Ground

5.4 Sequence Chart of Control Signals

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:



Remark:

- t_1 : ENA must be ahead of DIR by at least $5\mu s$. Usually, ENA+ and ENA- are NC (not connected).
- t_2 : DIR must be ahead of PUL active edge by $6\mu s$ to ensure correct direction;
- t_3 : Pulse width not less than $2.5\mu s$;
- t_4 : Low level width not less than $2.5\mu s$.

6. DIP Switch Setting

6.1 Introduction Of SW

6.1.1 Current Setting

The SW-2 current setting is in the following table.

<div> <div>Dial switch</div> <div>Current</div> </div>		SW	SW2	SW3
Peak	RMS			
0. 9A	0. 64A	1	1	1
1. 20A	0. 85A	0	1	1
1. 50A	1. 06A	1	0	1
1. 80A	1. 27A	0	0	1
2. 10A	1. 49A	1	1	0
2. 40A	1. 70A	0	1	0
2. 70A	1. 91A	1	0	0
3. 0A	2. 12A	0	0	0

6.1.2 Standstill current Setting

SW4 is used for setting the standstill current , “off” means the standstill current is set to be half of the selected dynamic current or other current, which can be set by the HISU, the details can be seen in the tenth sections. While “on” means the standstill current is set to be the same as the selected dynamic current.

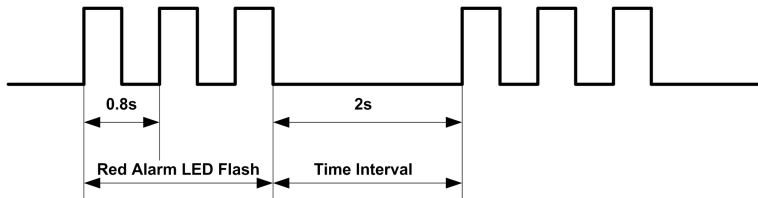
6.1.3 Micro steps Setting

The micro steps setting is in the following table. And it can be also setting through the HISU. The details can be seen in the tenth sections.

SW micro steps setting is in the following table

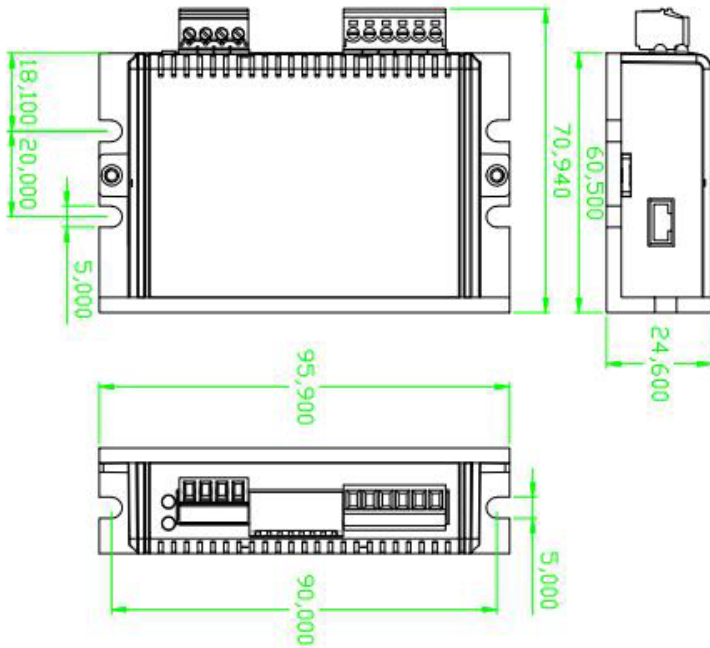
Dial switch Micro steps	SW5	SW6	SW7	SW8
400	0	1	1	1
800	1	0	1	1
1600	0	0	1	1
3200	1	1	0	1
6400	0	1	0	1
12800	1	0	0	1
25600	0	0	0	1
1000	1	1	1	0
2000	0	1	1	0
4000	1	0	1	0
5000	0	0	1	0
8000	1	1	0	0
10000	0	1	0	0
20000	1	0	0	0
25000	0	0	0	0

7. Faults alarm and LED flicker frequency



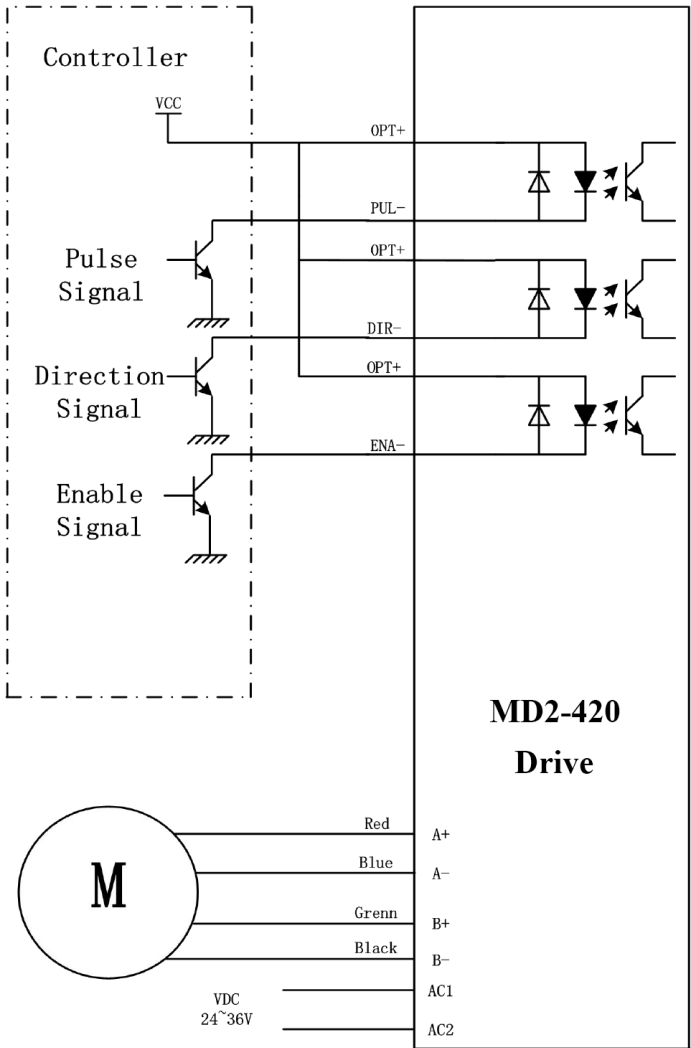
Flicker Frequency	Description to the Faults
1	Error occurs when the motor coil current exceeds the drive's current limit.
2	Voltage reference error in the drive
3	Parameters upload error in the drive
4	Error occurs when the input voltage exceeds the drive's voltage limit.

8. Appearance and Installation Dimensions



9. Typical Connection

Here is the typical connection of MD2-420.



10. Parameter Setting

The parameter setting method of MD2-420 drive is to use a HISU adjuster through the 232 serial communication ports, only in this way we can set the parameters we want. There are a set of best default parameters to the corresponding motor which are carefully adjusted by our engineers, users only need refer to the following table, specific condition and set the correct parameters.

Actual value = Set value \times the corresponding dimension

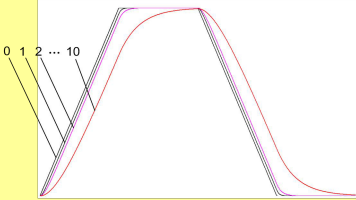
Mode	Definition	Range	Dimension	Drive Restart	Default Value
P1	Current loop Kp	0—4000	1	Y	1000
P2	Current loop Ki	0—1000	1	Y	100
P3	Damping coefficient	0—500	1	N	100
P4	Amplitude of first resonance point	0—100	1	N	0
P5	Phase of first resonance point	0—100	1	N	0
P6	Amplitude of second resonance point	0—100	1	N	0
P7	Phase of second resonance point	0—100	1	N	0
P8	Anti-resonance coefficient	0—500	1	N	120
P9	Anti-resonance coefficient	0—500	1	N	160

P10	Enable signal level	0—1	1	N	0
P11	Initial direction selection	0—1	1	N	1
P12	Reserved				
P13	Command Type	0—1	1	Y	1
P14	User-defined micro steps	4—1000	50	Y	0
P15	Time of standstill current	0—4000	1ms	N	1000
P16	Percentage of standstill current	0—100	1	Y	50
P17	Speed smoothness	0—10	1	Y	0
P18	Enable of position memory	0—1	1	Y	0
P19	User-defined resistance of motor	0—100	mh	Y	0
P20	User-defined inductance of motor	0—100	0.1Ohm	Y	0
P21	Result of position memory	0—128	1		0
P22	Reserved				
P23	Reserved				
P24	Current self-regulation	0—130	1	Y	100

There are total 24 parameter configurations, use the HISU to download the configured parameters to the drive, the detail descriptions to every parameter configuration are as follows:

Item	Description
Current loop Kp (P1) Current loop Ki (P2)	The P1 and P2 is used to set Kp and Ki of Current loop at the moment of power-on. When the motor is turning, the Kp and Ki is got by the Self-tuning algorithm.
Damping coefficient (P3)	This parameter is used to change the damping coefficient in case of the desired operating state is under resonance frequency. This parameter is useful in high speed.
Amp 1—2 (P4,P5,P6,P7) Phase 1—2	MD2-420 Driver provides robust anti-resonance control to stop the vibrations and maintain equilibrium. Amp1 and Phase1 is Phase adjustment for 1st and Amplitude adjustment for 1st resonance area respectively. Usually between 0.6rps and 1.2rps. Amp2 and Phase2 is Phase adjustment for 2nd and Amplitude adjustment for 2nd resonance area respectively. Usually between 1.2rps and 2.4rps.

Enable signal level (P10)	This parameter is set to control the Enable Input signal level. 0 means high, while 1 means low.
Initial direction selection (P11)	For the initial direction selection, 1 indicates that the initial direction is the counter clockwise, and the 0 indicates the initial direction is clockwise.
Command Type (P13)	This parameter is set to choice the PUL/DIR mode or CW/CCW mode. 0 means PUL/DIR mode, while means CW/CCW mode.
User-defined micro steps ((P14)	This parameter is set of user-defined micro steps. The actual micro steps = the set value \times 50. For example, if the parameter is 4, the micro steps is $4 \times 50 = 800$. But If this parameter is 0, which means micro steps is set by the outer DIP switches.
Time of standstill current (P15)	This parameter is set the time when the standstill current is set to be half of the selected dynamic current or other current.
Percentage of standstill current (P16)	This parameter is set the percentage of standstill current.

<p>Speed smoothness (P17)</p>	<p>This parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.</p> 
<p>Enable of position memory (P18)</p>	<p>This parameter is set to enable the function of position memory. 0 means disable, while 1 means enable. If set 1, the MD2-420 can remember the position of motor in the next time of power on.</p>
<p>User-defined inductance of motor (P19)</p>	<p>This parameter is set the inductance of motor. 0 means MD2-420 gets the inductance by control algorithm of Parameter auto-setup, while 1 means MD2-420 gets the inductance through user sets.</p>
<p>User-defined resistance of motor (P20)</p>	<p>This parameter is set the resistance of motor. 0 means MD2-420 gets the resistance by control algorithm of Parameter auto-setup, while 1 means MD2-420 gets the resistance through user sets.</p>
<p>Result of position memory (P21)</p>	<p>This parameter is set to control the smoothness of Display the result of position memory</p>

**Current
self-regulation
(P24)**

This parameter is the function of self-regulation current; set the parameter value of Pa, while the DIP set current is I, the actual current value:
 $I_{\text{get}} = I * P_a / 100.$

11. Processing Methods to Common Problems and Faults

11.1 Power on power light off

- No power input, please check the power supply circuit. The voltage is too low.

11.2 Power on red alarm light on

- Please check the motor is connected with the drive.
- The stepper digital drive is over voltage or under voltage. Please lower or increase the input voltage.

11.3 After input pulse signal but the motor not running

- Please check the input pulse signal wires are connected in reliable way.
- Please make sure the input pulse mode is corresponding with the real input mode.
- The Driver is disabled.