

# Digital Stepper Drive 2DM 442 Manual



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Precision Bearing House

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

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## **1. Overview**

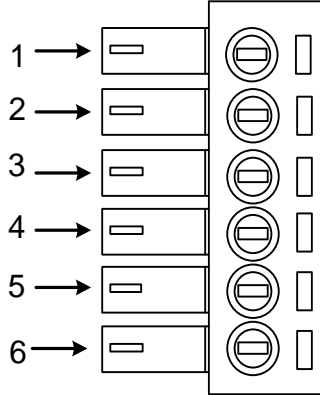
The 2DM442 is a two phase digital stepper driver based on ARM. Its Micro step resolutions and output current are programmable. And it has advanced control algorithm, which can brings a unique level of system smoothness, provides optimum torque and mid-range instability. The control algorithm of Multi-Stepping 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 motor self-test and 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 2DM442 to be an ideal solution for applications.

## 2. Features

- ◆ Parameter auto-setup and motor self-test
- ◆ 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

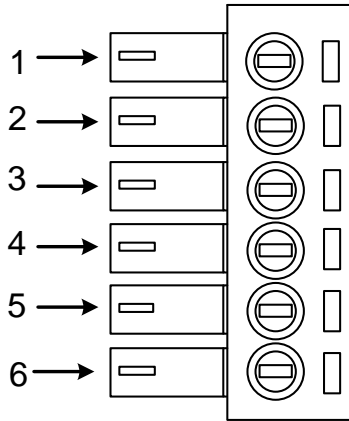
### 3. Ports Introduction

#### 3.1 Control Signal Input Ports



| Port | Symbol | Name              | Remark                       |
|------|--------|-------------------|------------------------------|
| 1    | ENA-   | Pulse signal +    | Compatible with<br>5V or 24V |
| 2    | ENA+   | Pulse signal -    |                              |
| 3    | DIR-   | Direction signal+ | Compatible with<br>5V or 24V |
| 4    | DIR+   | Direction signal- |                              |
| 5    | PLS-   | Enable signal +   | Compatible with<br>5V or 24V |
| 6    | PLS+   | Enable signal-    |                              |

### 3.2 Power Interface Ports



|   |                                 |     |               |               |
|---|---------------------------------|-----|---------------|---------------|
| 1 | Motor Phase<br>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<br>Ports            | VCC | Input Power + | DC24V-48V     |
| 6 |                                 | GND | Input Power-  |               |

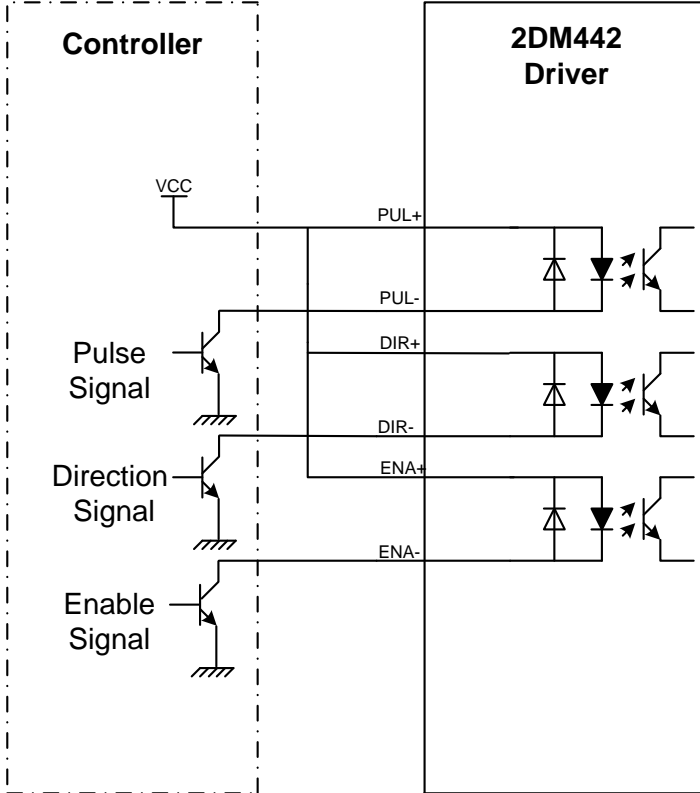
## 4. Technological Index

|                               |                          |                                         |
|-------------------------------|--------------------------|-----------------------------------------|
| Input Voltage                 |                          | DC24V-48V                               |
| Pulse Frequency max           |                          | 200K                                    |
| Communication rate            |                          | 57.6Kbps                                |
| Over voltage value            |                          | 60V                                     |
| Overall Dimensions (mm)       |                          | 118×75.5×34                             |
| Weight                        |                          | Approximate 260g                        |
| Environment<br>Specifications | Environment              | Avoid dust, oil fog and corrosive gases |
|                               | Operating<br>Temperature | +70°C Max                               |
|                               | Storage<br>Temperature   | -20°C~+80°C                             |
|                               | Humidity                 | 40~90%RH                                |
|                               | Cooling<br>method        | Natural cooling or forced air cooling   |



## 5. Connections to Control Signal

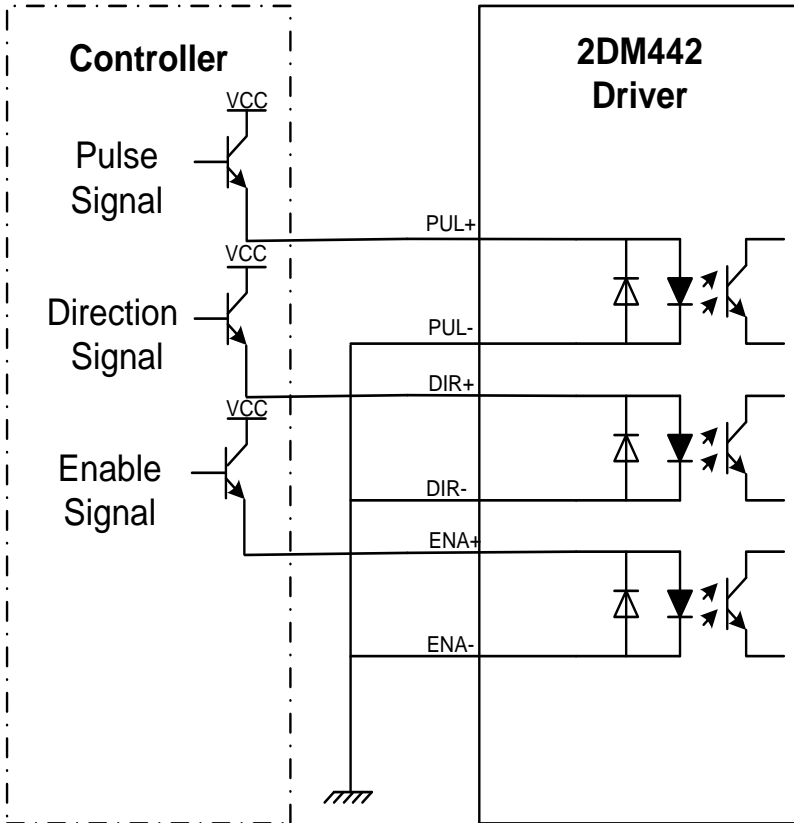
### 5.1 Connections to Common Anode



**Remark:**

VCC is compatible with 5V or 24V;

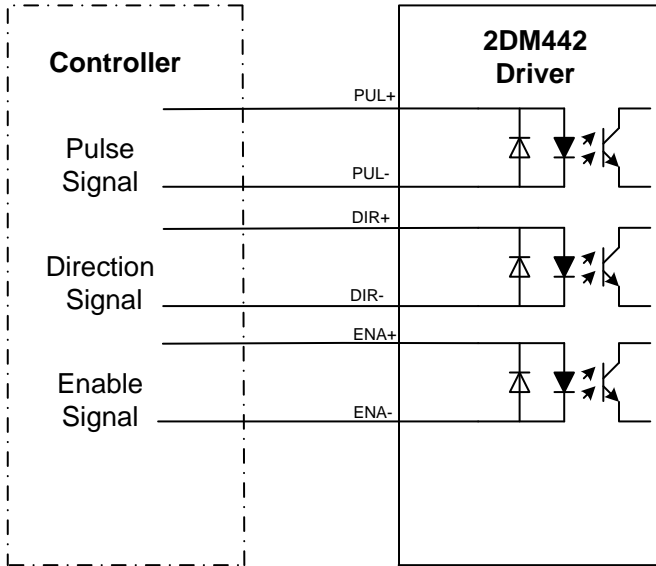
### 5.2 Connections to Common Cathode



**Remark:**

VCC is compatible with 5V or 24V;

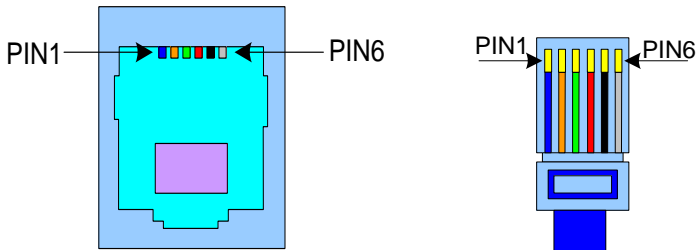
### 5.3 Connections to Differential Signal



**Remark:**

VCC is compatible with 5V or 24V;

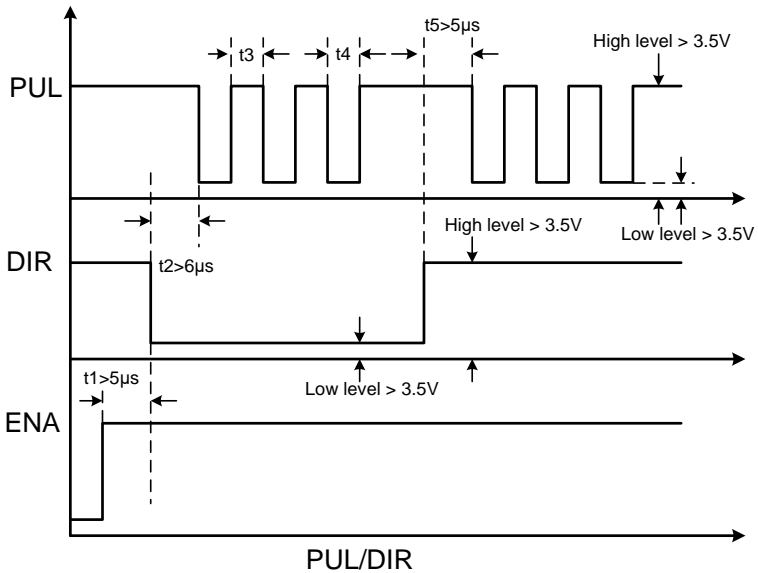
### 5.4 Connections to 232 Serial Communication Interface



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

### 5.5 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:**

- a. t1: ENA must be ahead of DIR by at least  $5\mu$  s. Usually, ENA+ and ENA- are NC (not connected).
- b. t2: DIR must be ahead of PUL active edge by  $6\mu$  s to ensure correct direction;
- c. t3: Pulse width not less than  $2.5\mu$  s;
- d. t4: Low level width not less than  $2.5\mu$  s.

## 6. DIP Switch Setting

### 6.1 Introduction Of SW-2

#### 6.1.1 Current Setting

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

| Dial switch<br>Current |        | SW1 | SW2 | SW3 |
|------------------------|--------|-----|-----|-----|
|                        |        |     |     |     |
| 1. 0A                  | 0. 71A | 1   | 1   | 1   |
| 1. 46A                 | 1. 04A | 0   | 1   | 1   |
| 1. 91A                 | 1. 36A | 1   | 0   | 1   |
| 2. 37A                 | 1. 69A | 0   | 0   | 1   |
| 2. 84A                 | 2. 03A | 1   | 1   | 0   |
| 3. 31A                 | 2. 36A | 0   | 1   | 0   |
| 3. 76A                 | 2. 69A | 1   | 0   | 0   |
| 4. 2A                  | 3. 0A  | 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 the micro steps can be also setting through the HISU. The details can be seen in the tenth sections.

SW-2 micro steps setting is in the following table

| Dial witch<br>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   |

## 6.2 Introduction Of SW-1

The SW-1 switch is mainly a number of auxiliary functions, the auxiliary functions of the first three switch are respectively motor self detection, pulse counting mode and single pulse selection; Fourth and fifth are set for the smoothing coefficient, and the last one is reserved.

SW-1 switches auxiliary functions are shown in the following table

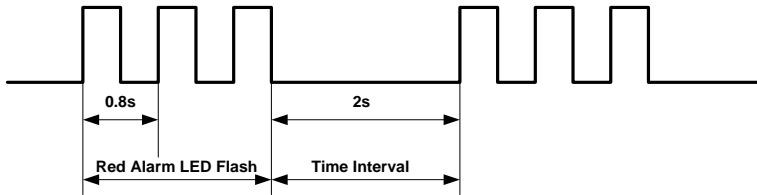
| Selection<br>DIP Switch | 0         | 1         |
|-------------------------|-----------|-----------|
| SW1                     | Run       | Self Test |
| SW2                     | Pulls&Dir | CW/CCW    |
| SW3                     | Up Edge   | Down Edge |

The smooth coefficients of the SW-1 switches are shown in the following table

| Smoothness | SW4 | SW5 |
|------------|-----|-----|
| 0          | 0   | 0   |
| 1          | 0   | 1   |
| 2          | 1   | 0   |
| 3          | 1   | 1   |

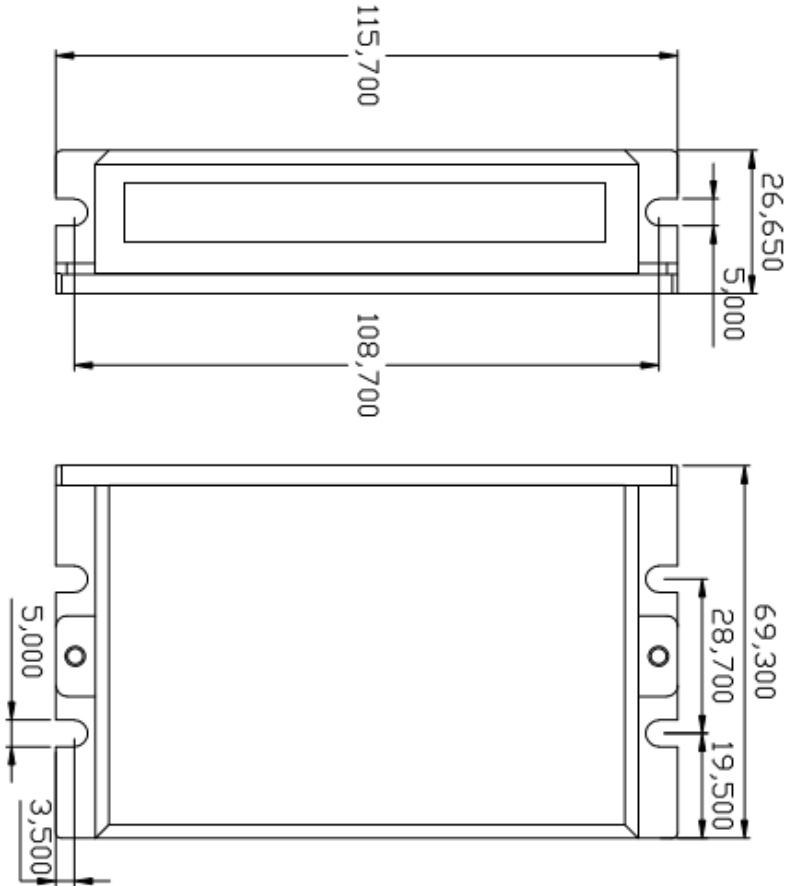


## 7. Faults alarm and LED flicker frequency



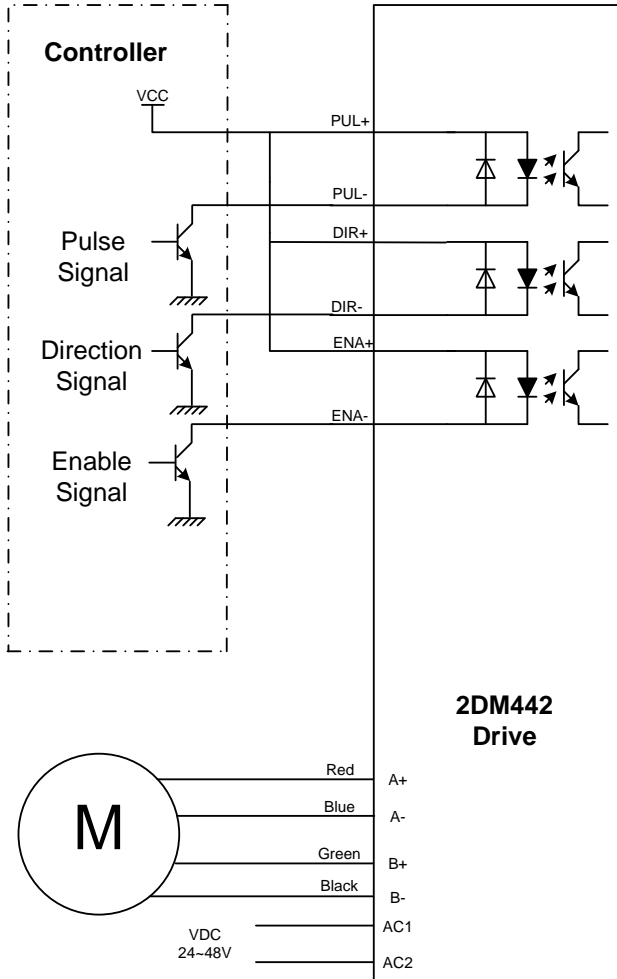
| Flicker Frequency | Description to the Faults                                                   |
|-------------------|-----------------------------------------------------------------------------|
| 1                 | Error occurs when the motor coil current exceeds the drive's current limit. |
| 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 2DM442.



## 10. Parameter Setting

The parameter setting method of 2DM442 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 × the corresponding dimension**

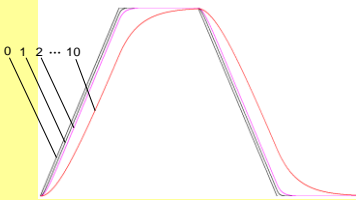
| Mode | Definition                          | Range  | Dimension | Drive Restart | Default Value |
|------|-------------------------------------|--------|-----------|---------------|---------------|
| P1   | Current loop Kp                     | 0—4000 | 1         | Y             | 1000          |
| 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—1000 | 1         | N             | 100           |
| P9   | Reserved                            |        |           |               |               |

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

There are total 22 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                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Current loop Kp (P1)</b></p> <p><b>Current loop Ki (P2)</b></p>     | <p>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.</p>                                                                                                                                                                                                                                                                           |
| <p><b>Damping coefficient (P3)</b></p>                                    | <p>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.</p>                                                                                                                                                                                                                                                                     |
| <p><b>Amp 1—2</b></p> <p><b>Phase 1—2</b></p> <p><b>(P4,P5,P6,P7)</b></p> | <p>2DM442 Driver provides robust anti-resonance control to stop the vibrations and maintain equilibrium.</p> <p><b>Amp1</b> and <b>Phase1</b> is Phase adjustment for 1st and Amplitude adjustment for 1st resonance area respectively. Usually between 0.6rps and 1.2rps.</p> <p><b>Amp2</b> and <b>Phase2</b> is Phase adjustment for 2nd and Amplitude adjustment for 2nd resonance area respectively. Usually between 1.2rps and 2.4rps.</p> |

|                                                             |                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Anti-resonance coefficient</b><br><br><b>(P8)</b>        | This parameter is used for reducing resonance. Usually between 3rps and 4rps.                                                                                                                                                                                             |
| <b>Enable signal level</b><br><br><b>(P10)</b>              | This parameter is set to control the Enable Input signal level. 0 means high, while 1 means low.                                                                                                                                                                          |
| <b>Initial direction selection</b><br><br><b>(P11)</b>      | For the initial direction selection, 1 indicates that the initial direction is the counter clockwise, and the 0 indicates the initial direction is clockwise.                                                                                                             |
| <b>User-defined micro steps</b><br><br><b>((P14)</b>        | 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. |
| <b>Time of standstill current</b><br><br><b>(P15)</b>       | This parameter is set the time when the standstill current is set to be half of the selected dynamic current or other current.                                                                                                                                            |
| <b>Percentage of standstill current</b><br><br><b>(P16)</b> | This parameter is set the percentage of standstill current.                                                                                                                                                                                                               |

|                                                                                              |                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Speed<br/>smoothness<br/>(P17)</b></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 style="text-align: center;"><b>Enable of<br/>position memory<br/>(P18)</b></p>            | <p>This parameter is set to enable the function of position memory. 0 means disable, while 1 means enable. If set 1, the 2DM442 can remember the position of motor in the next time of power on.</p>                                                                                 |
| <p style="text-align: center;"><b>User-defined<br/>inductance of<br/>motor<br/>(P19)</b></p> | <p>This parameter is set the inductance of motor. <b>0 means 2DM442 gets the inductance by control algorithm of Parameter auto-setup</b>, while 1 means 2DM442 gets the inductance through user sets.</p>                                                                            |
| <p style="text-align: center;"><b>User-defined<br/>resistance of<br/>motor<br/>(P20)</b></p> | <p>This parameter is set the resistance of motor. <b>0 means 2DM442 gets the resistance by control algorithm of Parameter auto-setup</b>, while 1 means 2DM442 gets the resistance through user sets.</p>                                                                            |
| <p style="text-align: center;"><b>Result of<br/>position memory<br/>(P21)</b></p>            | <p>This parameter is set to control the smoothness of Display the result of position memory</p>                                                                                                                                                                                      |



## **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.

#### **11.4 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.