

User's Manual

For

DM2282T

Fully Digital Stepper Drive



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1. Introduction, Features and Applications

Introduction

The DM2282T is a fully digital stepper drive developed with advanced DSP control algorithm based on the latest motion control technology. It has achieved a unique level of system smoothness, providing optimal torque and nulls mid-range instability. Its motor auto-identification and parameter auto-configuration feature offers quick setup to optimal modes with different motors. Compared with traditional analog drives, DM2282T can drive a stepper motor at much lower noise, lower heating, and smoother movement. Its unique features make DM2282T an ideal choice for high requirement applications.

Features

- Anti-Resonance provides optimal torque and nulls mid-range instability
- Motor auto-identification and parameter auto-configuration technology, offers optimal responses with different motors
- Multi-Stepping allows a low resolution step input to produce a higher microstep output, thus offers smoother motor movement
- Microstep resolutions programmable, from full-step to 25600. It can also be set via DIP switches.
- Soft-start with no “jump” when powered on
- Supply voltage up to 240 VAC
- Output current programmable, from 0.5A to 8.2A. It can also be set via DIP switches.
- Pulse input frequency up to 200 KHz, TTL compatible and optically isolated input
- Automatic idle-current reduction
- Suitable for 2-phase and 4-phase motors
- Support PUL/DIR and CW/CCW modes
- Over-voltage, Under-voltage, over-current, phase-error protections

Applications

Suitable for a wide range of stepping motors, size from NEMA34 to 51. It can be used in various kinds of machines, such as X-Y tables, engraving machines, labeling machines, laser cutters, pick-place devices, and so on. Particularly adapt to the applications desired with low noise, low heating, high speed and high precision.

2. Specifications

Electrical Specifications (T_j = 25°C/77°F)

Parameters	DM2282T			
	Min	Typical	Max	Unit
Output Peak Current	0.5	-	8.2	A
Input Voltage	180	220	240	VAC
Logic Signal Current	7	10	16	mA
Pulse input frequency	0	-	200	kHz
Pulse Width	2.5	-	-	μS
Isolation resistance	500			MΩ

Operating Environment and other Specifications

Cooling	Natural Cooling or Forced cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0°C – 50°C
	Humidity	40%RH – 90%RH
	Operating Temperature	45°C Max
	Vibration	10-55Hz/0.15mm
Storage Temperature	-20°C – 65°C	
Weight	Approx. 1.3Kg(45.86oz)	

Mechanical Specifications (unit: mm [1inch=25.4mm])

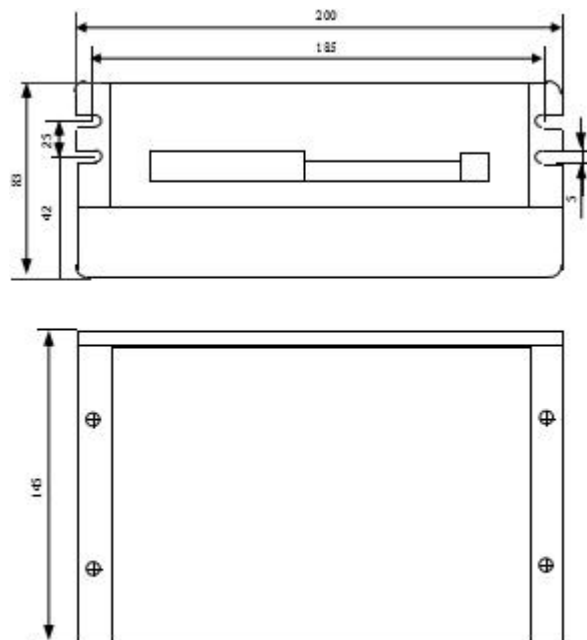


Figure 1: Mechanical specifications

***Recommend use side mounting for better heat dissipation**

Elimination of Heat

- Drive's reliable working temperature should be <math><45^{\circ}\text{C}</math>(113 °F), and motor working temperature should be <math><80^{\circ}\text{C}</math>(176°F);
- It is recommended to use automatic idle-current mode, namely current automatically reduce to 50% when motor stops, so as to reduce drive heating and motor heating;
- It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3. Pin Assignment and Description

The DM2282T has two connectors, connector P1 for control signals connections, and connector P2 for power and motor connections. The following tables are brief descriptions of the two connectors. More detailed descriptions of the pins and related issues are presented in section 4, 5, 9.

Connector P1 Configurations

Pin Function	Details
DIR-	<p><u>DIR signal</u>: In single-pulse mode, this signal has low/high voltage levels, representing two directions of motor rotation; in CW/CCW mode (software configurable), this signal is counter-clock (CCW) pulse, active both at high level and low level. For reliable motion response, DIR signal should be ahead of PUL signal by 5μs at least. 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction.</p> <p>Series connect resistors for current-limiting when +12V or +24V used. The same as DIR and ENA signal.</p>
DIR+	
PUL-	<p><u>Pulse signal</u>: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active ; in CW/CCW mode (software configurable), this input represents clockwise(CW) pulse, active both at high level and low level. 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. For reliable response, pulse width should be longer than 2.5μs.</p>
PUL+	
ENA-	<p><u>Enable signal</u>: This signal is used for enabling/disabling the driver. High level (NPN control signal, PNP and differential control signals are on the contrary, namely low level for enabling.) for enabling the driver and low level for disabling the driver. Usually left UNCONNECTED (ENABLED).</p>
ENA+	
FAULT+	<p><u>Fault Signal</u>: OC output signal, active when one of the following protection is activated: over-voltage, over current, low voltage, phase error and over-temperature. This port can sink or source 20mA current at 24V. In default, the resistance between FAULT+ and FAULT- is high impedance in normal operation and become low when DM2282T goes into error.</p>
FAULT-	

Connector P2 Configurations

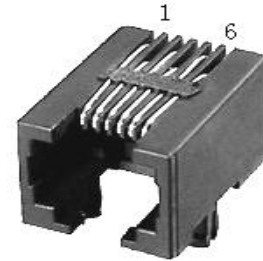
Pin Function	Details
PE	Recommend connect this port to the ground for better safety.
L	Power supply inputs. If AC input, recommend use isolation transformers with theoretical output voltage of 180~240VAC.
N	
A+	Motor Phase A
A-	
B+	Motor Phase B
B-	

RS232 Communication Port

The RS232 communication port is used to configure the DM2282T's peak current, microstep, active level, current loop parameters and anti-resonance parameters.

RS232 Communication Port – RJ11

Pin	Name	I/O	Description
1	NC	-	Not connected.
2	+5V	O	+5V power output.
3	TxD	O	RS232 transmit.
4	GND	GND	Ground.
5	RxD	I	RS232 receive.
6	NC	-	Not connected.



4. Control Signal Connector (P1) Interface

The DM2282T can accept differential and single-ended inputs (including open-collector and PNP output). The DM2282T has 3 optically isolated logic inputs which are located on connector P1 to accept line drive control signals. These inputs are isolated to minimize or eliminate electrical noises coupled onto the drive control signals. Recommend use line drive control signals to increase noise immunity of the drive in interference environments. In the following figures, connections to open-collector and PNP signals are illustrated.

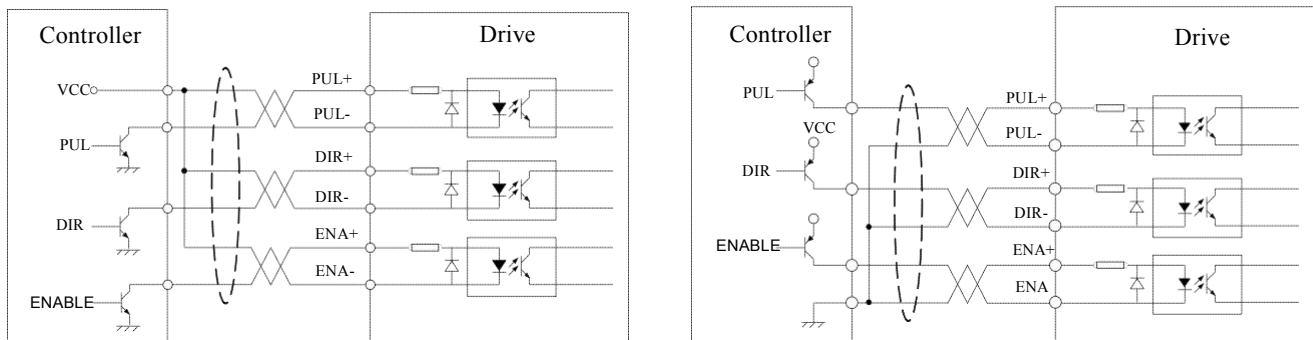


Figure 3: Connections to open-collector signal (common-anode)

Figure 4: Connection to PNP signal (common-cathode)

5. Connecting the Motor

The DM2282T can drive any 2-phase and 4-phase hybrid stepping motors.

Connections to 4-lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance. In setting the drive output current, multiply the specified phase current by 1.4 to determine the peak output current.

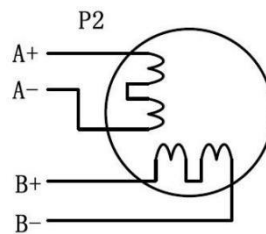


Figure 5: 4-lead Motor Connections

Connections to 6-lead Motors

Like 8 lead stepping motors, 6 lead motors have two configurations available for high speed or high torque operation. The higher speed configuration, or half coil, is so described because it uses one half of the motor's inductor windings. The higher torque configuration, or full coil, uses the full windings of the phases.

Half Coil Configurations

As previously stated, the half coil configuration uses 50% of the motor phase windings. This gives lower inductance, hence, lower torque output. Like the parallel connection of 8 lead motor, the torque output will be more stable at higher speeds. This configuration is also referred to as half chopper. In setting the drive output current multiply the specified per phase (or unipolar) current rating by 1.4 to determine the peak output current.

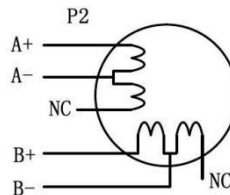


Figure 6: 6-lead motor half coil (higher speed) connections

Full Coil Configurations

The full coil configuration on a six lead motor should be used in applications where higher torque at lower speeds is desired. This configuration is also referred to as full copper. In full coil mode, the motors should be run at only 70% of their rated current to prevent over heating.

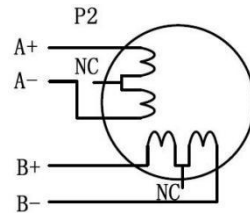


Figure 7: 6-lead motor full coil (higher torque) connections

Connections to 8-lead Motors

8 lead motors offer a high degree of flexibility to the system designer in that they may be connected in series or parallel, thus satisfying a wide range of applications.

Series Connections

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to degrade at higher speeds. In series mode, the motors should also be run at only 70% of their rated current to prevent over heating.

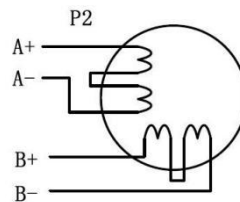


Figure 8: 8-lead motor series connections

Parallel Connections

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. But because of the lower inductance, there will be higher torque at higher speeds. Multiply the per phase (or unipolar) current rating by 1.96, or the bipolar current rating by 1.4, to determine the peak output current.

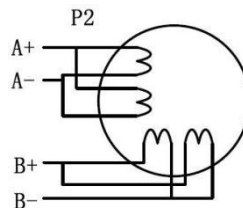


Figure 9: 8-lead motor parallel connections

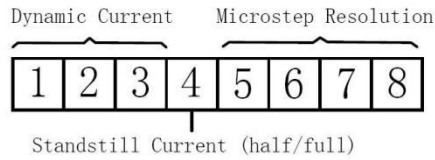
6. Power Supply Selection

The power supply voltage can work normally between the voltage range specified by the driver. The DM2282T is directly powered by AC. It is recommended that the user use the highest voltage lower than the driver's specified voltage to avoid the grid fluctuation exceeding the driver voltage operating range.

To reduce costs, two or three drivers can share a single power supply, but the power of power supply should be large enough.

7. Selecting Microstep Resolution and Drive Output Current

This drive uses an 8-bit DIP switch to set microstep resolution, and motor operating current, as shown below:



Microstep Resolution Selection

Microstep resolution is set by SW5, 6, 7, 8 of the DIP switch as shown in the following table:

Microstep	Steps/rev.(for 1.8°motor)	SW5	SW6	SW7	SW8
	Default	ON	ON	ON	ON
2	400	OFF	ON	ON	ON
4	800	ON	OFF	ON	ON
8	1600	OFF	OFF	ON	ON
16	3200	ON	ON	OFF	ON
32	6400	OFF	ON	OFF	ON
64	12800	ON	OFF	OFF	ON
128	25600	OFF	OFF	OFF	ON
5	1000	ON	ON	ON	OFF
10	2000	OFF	ON	ON	OFF
20	4000	ON	OFF	ON	OFF
25	5000	OFF	OFF	ON	OFF
40	8000	ON	ON	OFF	OFF
50	10000	OFF	ON	OFF	OFF
100	20000	ON	OFF	OFF	OFF
125	25000	OFF	OFF	OFF	OFF

Current Settings

For a given motor, higher drive current will make the motor to output more torque, but at the same time causes more heating in the motor and drive. Therefore, output current is generally set to be such that the motor will not overheat for long time operation. Since parallel and serial connections of motor coils will significantly change resulting inductance and resistance, it is therefore important to set drive output current depending on motor phase current, motor leads and connection methods. Phase current rating supplied by motor manufacturer is important in selecting drive current, however the selection also depends on leads and connections.

The first three bits (SW1, 2, 3) of the DIP switch are used to set the dynamic current. Select a setting closest to your motor's required current.

Dynamic Current Setting

Peak Current	RMS Current	SW1	SW2	SW3
Default	Default	OFF	OFF	OFF
2.2A	1.6A	ON	OFF	OFF
3.2A	2.3A	OFF	ON	OFF
4.2A	3.2A	ON	ON	OFF
5.2A	3.7A	OFF	OFF	ON
6.3A	4.4A	ON	OFF	ON
7.2A	5.2A	OFF	ON	ON
8.2A	5.9A	ON	ON	ON

Notes: Due to motor inductance, the actual current in the coil may be smaller than the dynamic current setting, particularly under high speed condition.

Standstill Current Setting

SW4 is used for this purpose. OFF meaning that the standstill current is set to be half of the selected dynamic current, and ON meaning that standstill current is set to be the same as the selected dynamic current.

The current automatically reduced to 50% of the selected dynamic current one second after the last pulse.

Motor auto-identification and parameter auto-configuration

The drive will operate the function of motor auto-identification and parameter auto-configuration when power on, and calculate the optimal parameter using for current control after this processing,, then the stepper motor can output optimal torque.

8. Wiring Notes

- In order to improve anti-interference performance of the drive, it is recommended to use twisted pair shield cable.
- To prevent noise incurred in PUL/DIR signal, pulse/direction signal wires and motor wires should not be tied up together. It is better to separate them by at least 10 cm, otherwise the disturbing signals generated by motor will easily disturb pulse direction signals, causing motor position error, system instability and other failures.
- If a power supply serves several drives, separately connecting the drives is recommended instead of daisy-chaining.
- It is prohibited to pull and plug connector P2 while the drive is powered ON, because there is high current flowing through motor coils (even when motor is at standstill). Pulling or plugging connector P2 with power on will cause extremely high back-EMF voltage surge, which may damage the drive.

9. Typical Connection

A complete stepping system should include stepping motor, stepping drive, power supply and controller (pulse generator). A typical connection is shown as figure 10.

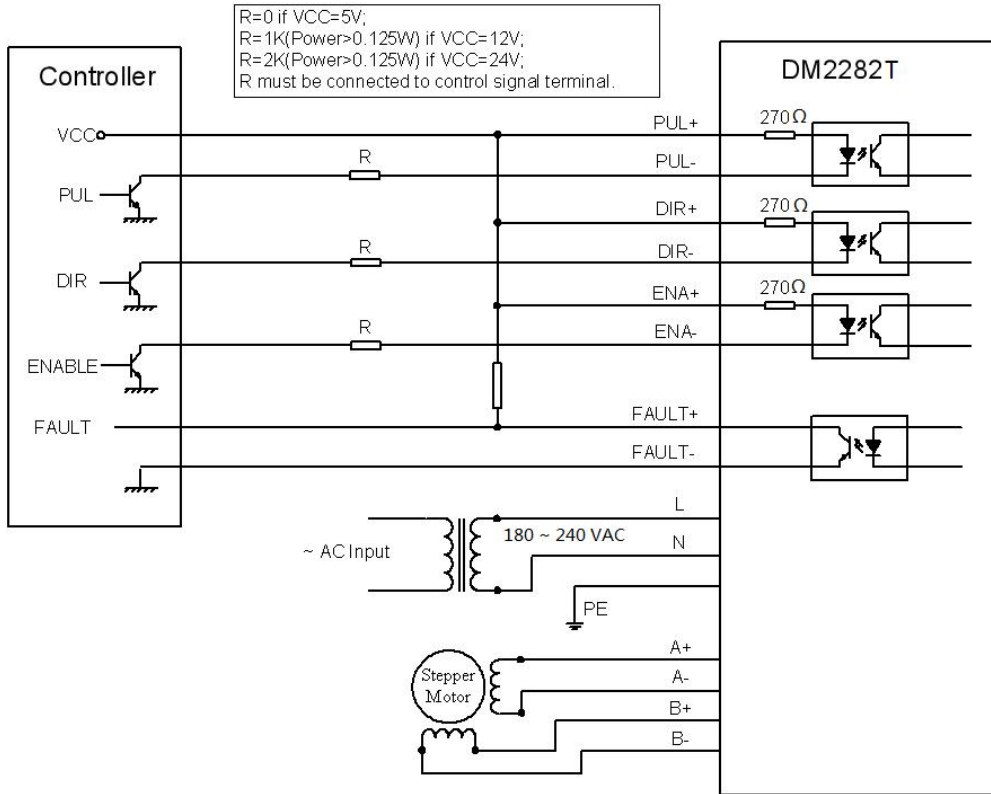


Figure 10: Typical connection

10. 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:

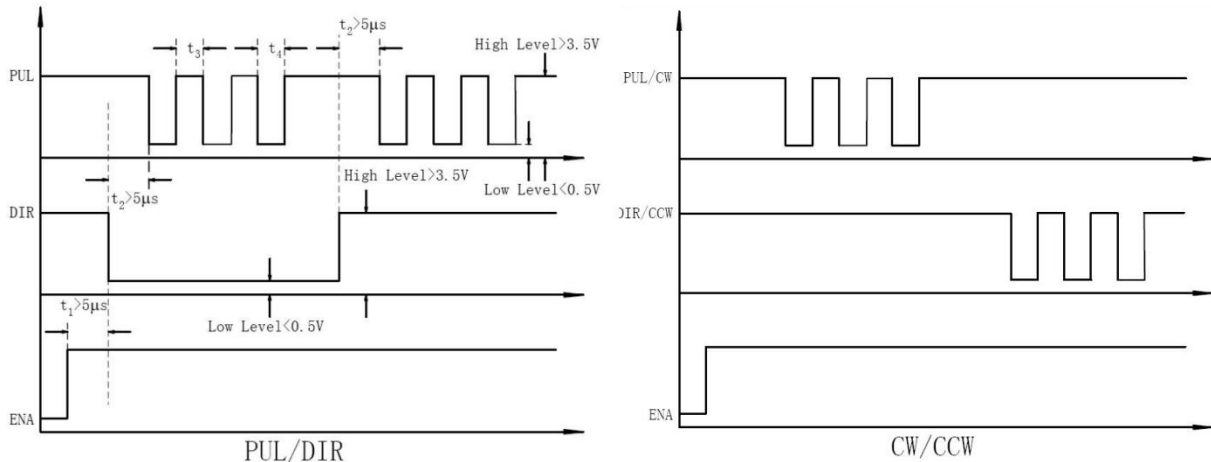


Figure 11: Sequence chart of control signals

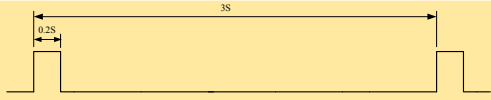
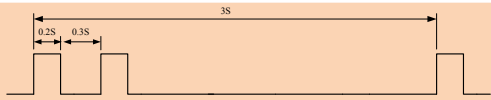
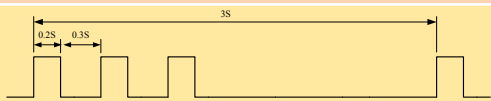
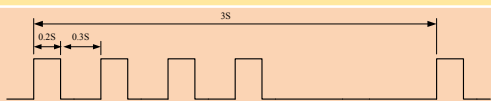
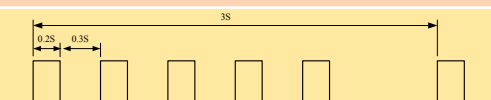
Remark :

- a)t1: ENA must be ahead of DIR by at least 5µs. Usually, ENA+ and ENA- are NC (not connected). See “Connector P1 Configurations” for more information.
- b)t2: DIR must be ahead of PUL effective edge by 5µs to ensure correct direction;

- c)t3: Pulse width not less than 2.5μs;
- d)t4: Low level width not less than 2.5μs.

11. Protection Functions

To improve reliability, the drive incorporates some built-in protections features.

Priority	Time(s) of Blink	Sequence wave of RED LED	Description
1st	1		Over-current Protection
2nd	2		Over-voltage Protection
3rd	3		Low-voltage Protection
4th	4		Phase Error Protection
5th	5		Over Temperature Protection

When above protections are active, the motor shaft will be free or the red LED blinks. Reset the drive by repowering it to make it function properly after removing above problems.

12. Frequently Asked Questions

In the event that your drive doesn't operate properly, the first step is to identify whether the problem is electrical or mechanical in nature. The next step is to isolate the system component that is causing the problem. As part of this process you may have to disconnect the individual components that make up your system and verify that they operate independently. It is important to document each step in the troubleshooting process. You may need this documentation to refer back to at a later date, and these details will greatly assist our Technical Support staff in determining the problem should you need assistance.

Many of the problems that affect motion control systems can be traced to electrical noise, controller software errors, or mistake in wiring.

Problem Symptoms and Possible Causes

Symptoms	Possible Problems
	No power
	Microstep resolution setting is wrong

	DIP switch current setting is wrong
	Fault condition exists
	The drive is disabled
	Motor phases may be connected in reverse
	DIP switch current setting is wrong
	Something wrong with motor coil
	Control signal is too weak
	Control signal is interfered
	Wrong motor connection
	Something wrong with motor coil
	Current setting is too small, losing steps
	Current setting is too small
	Motor is undersized for the application
	Acceleration is set too high
	Power supply voltage too low
	Inadequate heat sinking / cooling
	Automatic current reduction function not being utilized
	Current is set too high