China Headquarters
Address: 3/F, Block 2, Nanyou Tianan Industrial Park, Nanshan District Shenzhen, China
Website: http://www.leadshine.com

Sales Hot Line:
Tel: 86-755-2640-9254 (for Europe region)
86-755-2641-7674 (for Asia, Australia, Africa region)
86-755-2641-7684 (for America region)
Fax: 86-755-2640-2718
Email: sales@leadshine.com

Technical Support:
Tel: 86-755-2641-8447 and 86-755-2647-1129
Fax: 86-755-2640-2718
Email: tech@leadshine.com and vic@leadshine.com

Leadshine America, Inc
Address: 25 Mauchly, Suite 318, Irvine, CA 92618, USA
Tel: 1-949-608-7270
Fax: 1-949-608-7298
Website: http://www.leadshineUSA.com
Email: usa_sales@leadshine.com and cli@leadshine.com

Leadshine Hong Kong
Address: Rm 3, 9/F, Block E, Wah Lok Industrial Center,31-41 Shan Mei St., Fo Tan, Shatin, Hong Kong
Tel: 852-2952-9114
Fax: 852-2952-9395
Email: hk_sales@leadshine.com

Note: Product appearance and technical parameters are subject to change without notice.

Leadshine

Leading Technology *Shining Value*

Stepper Systems

Smooth Movement, Extra Low Noise & Heating

Company Overview

Founded in 1997, Leadshine Motion Technology Ltd. specializes in developing, manufacturing, and distributing high-quality cost-effective motion control products. Its products include motion controllers, stepper motors and drives, integrated steppers, easy servo motors and drives, integrated easy servos, servo motors and drives, integrated servos and power supplies. Leadshine serves various industrial and OEM customers in Asia, Europe, North/South America, Africa and Australia.

Leadshine is one of the **LARGEST** manufacturers of motion control products around the world. Led by an MIT PhD graduate, Leadshine's R&D team of 100 talented engineers is capable of designing high-quality motion control products based on the latest technologies. Leadsine's manufacturing facilities are ISO-9001 certified and professionally staffed.

Leadshine is committed to provide its customers with world-class motion control products at highly competitive prices. "LEADING technology and SHINING value" is always what Leadshine intends to offer to its customers.

R&D

Leadshine is proud of its talented research & development team, which is one of the best in the motion control industry. We are capable of designing world-class products which can meet high requirements of our customers. Many innovative designs and products from Leadshine have been awarded for patents by Chinese government.

Product Quality

Leadshine has been awarded the ISO 9001 registration for quality management practices since September 2004. The certification is a testimony of Leadshine's commitment to provide its customers with high quality products and services.

Technical Support

Staffed with a highly professional and experienced technical support team, Leadshine can help its customers to increase productivity, reduce design & selection risks, and minimize the product development time. We are able to support our customers through email, telephone, field support, product studying conference, and some other approaches.

You can contact Leadshine technical support by phone at 86-755-2641-8447, by fax at 86-755-2640-2718, or by email at tech@leadshine.com.

World-class Products at Highly Competitive Prices

Currently, Leadshine offers three main series of 2-phase microstepping drives, the digital EM series, DM series and analog M series. The high performance DM drives are based on powerful 32-bit DSP control technology. Their features include super-low stepper noise, anti-resonance, low-speed ripple smoothing, and low motor heating. The EM series drives are leadshine's highest performance discrete stepper drives. They adopt even more innovative technologies than the DM series, thus have more features, such as sensorless stall detection, drive configuration protection, etc. The low-cost M drives employ precise analog current control and are characterized by extra high-speed torque, relatively low stepper noise, and low motor heating. Leadshine also supplies 3-phase digital and analog stepper drives.

Discrete Stepper Drives

Selection Guide ---- 2
EM Series Digital Stepper Drives ---- 4
EM402 ---- 4
EM503 ---- 4
EM705 ---- 4
EM806 ---- 4
DM Series Digital Stepper Drives ---- 12
DM422C ---- 12
DM556 ---- 12
DM870 ---- 12
DM1182 ---- 12
DM2282 ---- 12
3DM683 ---- 12
DM805-AI ---- 12
MX Series Multi-axis Stepper Drives ---- 19
MX3660 ---- 19

Leadshine offers 2-phase and 3-phase stepper motors from NEMA frame size 14 to 51. Made of high quality cold roll sheet copper and anti-high temperature permanent magnet, Leadshine's stepper motors are highly reliable and generate low motor heating. Because of their nice internal damping characteristics, those stepper motors can run very smoothly and have no obvious resonance area within the whole speed ranges.

Stepper Motors

Selection Guide ---- 22
2-phase Stepper Motors
35 / 39 HSxx Series ---- 24
42HSxx Series ---- 25
57HSxx Series ---- 26
86HSxx Series ---- 27
110HSxx Series ---- 28
130HSxx Series ---- 29
3-phase Stepper Motors
573Sxx Series ---- 30
863Sxx Series ---- 31
Speed-Torque Curves ---- 32

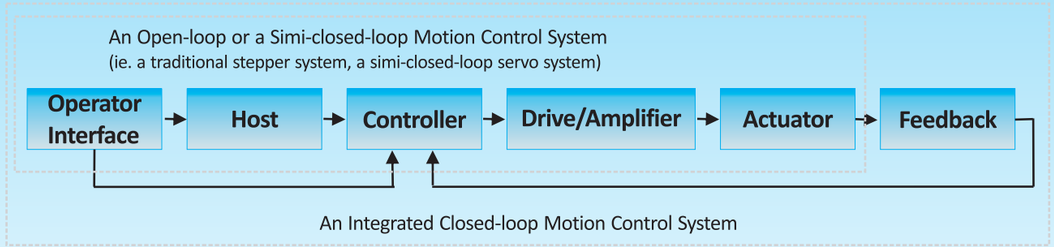
Leadshine's iST series integrated stepper systems are one of the most compact stepper drive and motor package on the market. An iST integrated stepper has a stepper motor integrated with an advanced DSP based stepper drive. At very compact size and with all components integrated, the iST series steppers can save mounting space, and motor wiring time, reduce interference, and lower cable and labor cost.

Integrated Steppers

Selection Guide ---- 34
iST Series ---- 34
iST17 ---- 34
iST23 ---- 34
iST24 ---- 34

Basic Components of Motion Control System

Many different components are used in a variety of combinations to create a modern motion control system. Usually, the system will be comprised of the following basic elements: controller, drive/amplifier, actuator. And for a more integrated motion control system will be comprised of feedback, operator interface and host, besides elements mentioned above. A simplified block diagram of a motion control system would appear as shown below.



*** Operator Interface and Host**

Operator interface and host are/is present to input control logic, modify programs, or provide real time operations, such as system shut down or schedule changes.

*** Controller**

The controller acts as brain of the system by taking the desired target positions and motion profiles and creating the trajectories for the motors to follow. It will include a means of entering a set of instructions or code into its memory which are then translated into a series of electrical pulses or analog signals and output to a drive for controlling some type of actuator.

*** Drive/Amplifier**

The drive/amplifier receives the signals from the controller and generate the current required to drive or turn the actuator.

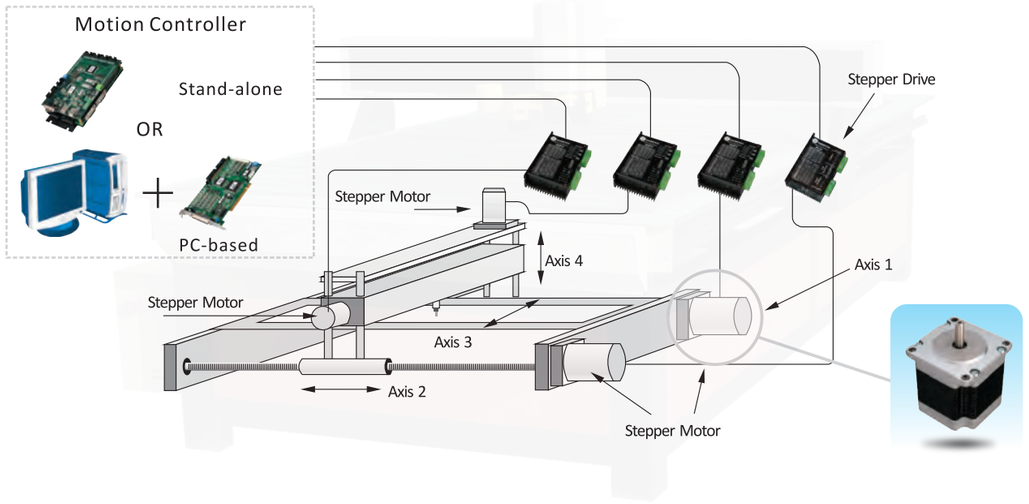
*** Actuator**

The actuator provides the actual physical motion and will be closely coupled to the design characteristics of the drive. The drive/actuator set may be any one of several different design classifications. Typically, but by no means always, they will the form of an electronic drive and an electric motor. Other common means of motion are pneumatic or hydraulic actuators.

*** Feedback Device**

There are a wide variety of feedback devices that are commonly used in motion control systems today which provide information on linear or rotary motion, such as optical encoders, magnetic encoders and resolvers.

A Typical Stepper System



Selection Guide ---------- 2
EM Series Advanced Digital Drives ------- 4
DM Series Digital Stepper Drives -------- 12
MX Series Multi-axis Stepper Drives ----- 19

Stepper Drives

Selection Guide for Stepper Drives

A stepper motor requires an electrical sequencer and it is called a stepper drive. The stepper drive is one of the key components in a stepper system. When you select a stepper drive for the special application, you can follow the following steps. Firstly, you should choose the drive type and determine the drive operating mode. Secondly, choose right supply voltage and output current according with the application and the motor. In the end, you should consider whether the acceptable control signals of the drive are right for those of your motion controller or not. Of course, the price of the chose drive should be acceptable too.

Drive Types

The output torque and power from a stepper motor are determined by the operating current, motor size, motor heat sinking, motor winding, and the type of the drive used. You can get much different performances from a given motor by choosing different type stepper drives.

There are some commonly-used drive types, such as unipolar constant voltage drive, unipolar L/nR constant voltage drive, unipolar timed bi-level drive, unipolar constant current drive, unipolar constant current drive and bipolar constant current microstepper drive.The highest output power and motor utilization for a given motor is achieved with the bipolar constant current drive. DC-losses is kept at a minimum due to maximum utilization of the copper in the winding and no power losses from leakage inductance and snubbing circuits since every winding only consists of one part.

Bipolar constant current microstepper drive is an improved version of the basic full- and half-step bipolar constant-current drive. Here, the winding currents form a sine/cosine pair. This greatly improves low frequency performances by eliminating overshot movements, ringing, and resonances. Performances at medium and high-stepper rates are close to those of full- and half-step. This drive uses the same power stage as the bipolar constant-current drive, but extra electronics for setting the sine/cosine current levels are used. Microstepper can also increase resolution and step accuracy of the stepper systems.

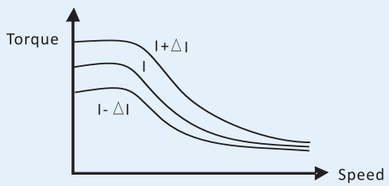
Supply Voltage and Output Current

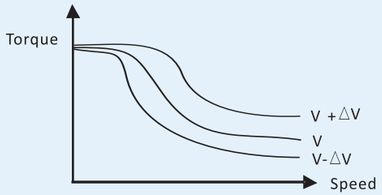
Although both regulated and unregulated power supplies can be used to power the drives, unregulated power supplies are preferred due to their ability to withstand current surge. The power supply voltage must be within the drive's allowable operating voltage range. Beyond that, the choice of voltage is dependent on the application and the motor used.

Higher supply voltage can increase motor torque at higher speeds, being helpful for avoiding losing steps. However, higher voltage may cause bigger motor vibration at lower speed, and may also cause over-voltage protection or even drive damage. Therefore, it is suggested to choose only a sufficiently high supply voltage for intended application, and use power supplies with theoretical output voltage of at least 10% below drive's maximum input voltage, leaving room for power fluctuation and back-EMF.

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

Leadshine's stepper drives cover a broad operating voltage range, from 18 to 312VDC or 18 to 220VAC. And most of Leadshine's stepper drives have over-voltage and over-current protection functions. All of Leadshine's stepper drives use DIP switches to set motor's operating current, and all of them have automatic idle-current reduction function.

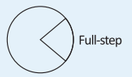




Drive Modes

The most common drive modes are full-step, half-step and microstepping.

FULL-STEP MODE: This is the basic stepper driving mode, it offers the simplest control electronics and it is recommended for high and medium frequency operation. At these frequencies, the inertia of the motor and the load smooth out the torque, resulting in less vibration and noise compared to low-speed operation.



1step (1.8° for 2-phase)

HALF-STEP MODE: Half-step gives smoother movement at low step rates compared to full-step and can be used to lower resonances at low speeds. Half-step doubles the system resolution. Observe that for most stepper motors, the step accuracy specification only is valid for 2-phase-on positions. The accuracy is lower and the stop-position hysteresis is larger for 1-phase-on positions.

1step (0.9° for 2-phase)

Microstepping: The smoothest movement at low frequencies can be achieved with microstepping. If resonance-free movement at low step rates is important, the microstepping drive is the best choice. Microstepping can also be used to increase stop position accuracy beyond the normal motor limits.

Leadshine's stepper drives cover all drive modes. Both our digital stepper drives and analog stepper drives can operate in full-step, half-step and microstepping modes.

1step (1.8° / n for 2-phase)

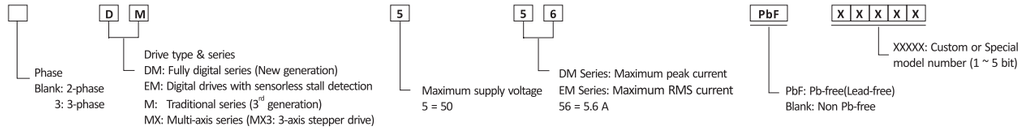
EM SERIES
DM SERIES
MX SERIES

Leadshine Stepper Drives

Since releasing its first stepper drive in 1997, Leadshine has been designing stepper drives to satisfy the requirements of its customers. Today, Leadshine is one of the **LARGEST** stepper drive manufacturers in the world. Every year, over **900,000** Leadshine stepper drives are implemented in thousands of applications around the world. The applications include CNC routers, laser machines, electronic equipment, medical equipment, packaging machines, textile equipment, pick-and-place devices, etc.

Currently, Leadshine offers three main series of 2-phase microstepping drives, the digital EM series, DM series and analog M series. The high performance DM drives are based on powerful 32-bit DSP control technology. Their features include super-low stepper noise, anti-resonance, low-speed ripple smoothing, and low motor heating. The EM series drives are leadshine's highest performance discrete stepper drives. They adopt more innovative technologies than the DM series, thus have more features, such as sensorless stall detection, user password protection, etc. The low-cost M drives employ precise analog current control and are characterized by excellent high-speed torque, relatively low stepper noise, and low motor heating. Leadshine also supplies 3-phase digital and analog stepper drives.

Part Number



Selection Table

Phase	Series	Model	Output Current (A)	Operating Voltage (V)	Microstep Resolution	Driving Motors (NEMA Size)	Weight (kg)	Size (mm)	Control Signals	
									PUL/DIR; CW/CCW	Single-ended; Differential
2	EM	EM402	0.3 - 2.2	DC(20-40)	1-512	14, 17, 23	0.12	86*55*20	PUL/DIR;	Single-ended; Differential
		EM503	0.5 - 4.5	DC(20-50)	1-512	14, 17, 23	0.2	116*69*26.5	PUL/DIR; CW/CCW	Single-ended; Differential
		EM705	0.5 - 7.8	DC(20-75)	1-512	17, 23, 34	0.29	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		EM806	0.5 - 8.4	DC(24-80)	1-512	17, 23, 34	0.58	151*97*48	PUL/DIR;	Single-ended; Differential
	DM	DM422C*	0.3 - 2.2	DC(18-40)	1-512	14, 17, 23	0.115	86*55*20	PUL/DIR; CW/CCW	Single-ended;
		DM556*	0.5 - 5.6	DC(18-50)	1-512	14, 17, 23	0.28	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		DM870*	0.5 - 7.0	DC(18-80)	1-512	17, 23, 34	0.28	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		DM1182	0.5-8.2	AC(80-150)	1-512	34, 42	1.3	202*167*63	PUL/DIR; CW/CCW	Single-ended; Differential
		DM2282	0.5-8.2	AC(80-220)	1-512	34, 42	1.3	202*167*63	PUL/DIR; CW/CCW	Single-ended; Differential
		DM805-AI **	0.5-7.0	DC(18-80)	1-512	17, 23, 34	0.28	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
	M	M542	1.0-4.2	DC(20-50)	2-128, 5-125	14, 17, 23	0.28	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		M550	1.2 - 5.0	DC(20-50)	2-256, 5-200	14, 17, 23	0.28	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		M760*	1.45 - 6.0	DC(20-75)	2-256, 5-200	17, 23, 34	0.57	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
		M860*	2.4 - 7.2	DC(24-80)	2-256, 5-200	17, 23, 34	0.57	151*97*48	PUL/DIR; CW/CCW	Single-ended; Differential
		M880A*	2.8 - 7.8	DC(24-80)	2-256, 5-200	17, 23, 34	0.57	151*97*48	PUL/DIR; CW/CCW	Single-ended; Differential
		MA860*	2.4 - 7.2	AC(18-58)	2-256, 5-200	17, 23, 34	0.58	151*97*48	PUL/DIR; CW/CCW	Single-ended; Differential
		MA860H	2.4 - 7.2	AC(24-80)	2-256, 5-200	34, 42	0.65	151*97*52	PUL/DIR; CW/CCW	Single-ended; Differential
3	DM	3DM683	0.5 - 8.3	DC(18-60)	200-51200s/r	17, 23, 34	0.30	118*75.5*34	PUL/DIR; CW/CCW	Single-ended; Differential
2	DM	MX3660	1.4 - 6.0	DC(20-60)	2-64	17, 23, 34	0.68	168*77.5*37	PUL/DIR;	Single-ended;

Operating Environment for Leadshine's Standard Drives

Cooling	Natural cooling or forced cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0 to +50 °C
	Humidity	40-90% RH
	Vibration	5.9m/s² MAX
Storage Temperature		-20 to 125 °C

Tips

1. Operating temperature of Leadshine standard drives should below 70°C (158°F); and motor working temperature should below 80°C (176°F). Use automatic idle-current function to reduce drive and motor heating when a motor stops. Use forced cooling to cool the system if necessary.

2. To improve anti-interference performance of the system, use twisted pair shielded cable for control signals and correctly ground the system. To prevent noise coupling on pulse/direction signals, pulse/direction signal wires, motor wires and power wires should not be tied up together. Separate them by at least 10 centimeters (4 inches) to avoid disturbing signals generated by a stepper motor, which can easily disturb pulse and direction signals and cause motor position error, system instability and other failures.

3. Don't pull and plug motor or power wires while a stepper drive is powered ON, because there is high current flowing through motor coils (even stopped). Doing that would result in extremely high voltage surge, and could damage the drive.

4. If a power supply serves multiple drives, separately connecting the drives (each in a star arrangements) is recommended instead of daisy-chain arrangement.

* This model is UL approved.
** Command sources include step/direction, analog(0-5V).

EM Series Digital Stepper Drives

Sensorless stall detection and Extra-low motor noise

Innovative Technologies

- Sensorless Stall Detection
- Extra-low Motor Noise
- Drive Configuration Protection
- Anti-Resonance Technology
- Low-speed Ripple Smoothing
- Multi-stepping Technology
- Soft Start Technology
- Self-test and Auto-configuration

Specifications

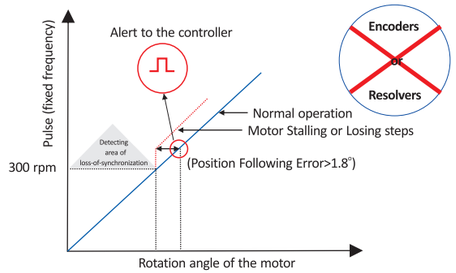
Type	Model	Voltage	RMS Cur.	Matching Motors
DC Input	EM402	20-40 VDC	0.07-1.6A	NEMA8 to 23
	EM503	20-50 VDC	0.21-3.2A	NEMA14 to 23
	EM705	20-75 VDC	0.35-5.5A	NEMA17 to 34
	EM806	24-80 VDC	0.35-6.0A	NEMA23 to 34
AC Input	EM1206H*	80-150 VAC	0.35-6.0A	NEMA34 to 42
	EM2306H*	80-230 VAC	0.35-6.0A	NEMA34 to 51

● Over voltage, over current, short-circuit protections and fault out.
*Available time: to be determined.

Innovative Technologies

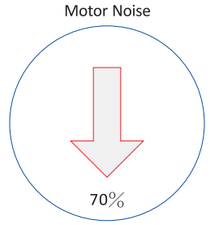
1 Sensorless Stall Detection

By detecting motor voltage, current, and back-emf signal, EM series drives can detect loss-of-synchronization of stepper motors without encoders. The sensorless stall detection eliminates cost of feedback devices and time of cable connection.



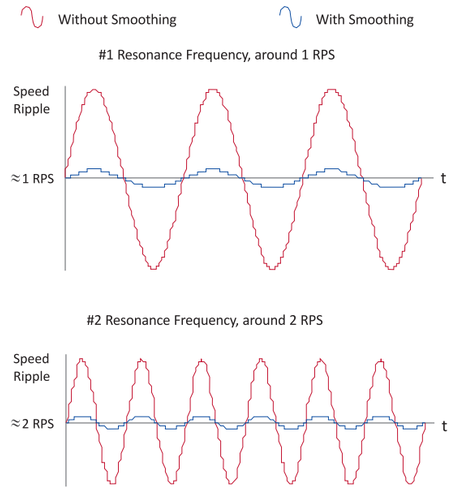
2 Extra-low Motor Noise

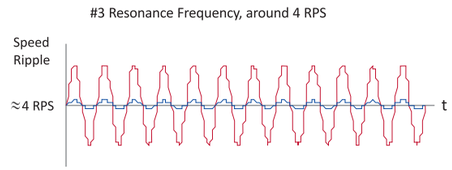
Precision current control technology and multi-stepping technology can reduce about 70% motor noise, making the EM series to be an ideal solution for the applications require extra-low motor noise.



3 Low-speed Ripple Smoothing

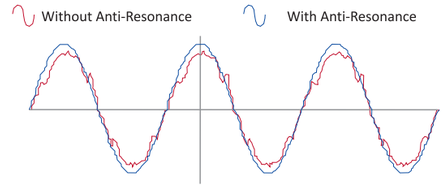
Electronic damping for 3 major resonance frequencies for stepper motors at low speed range, eliminating undesirable motor speed oscillation and delivering unique level of smoothness.





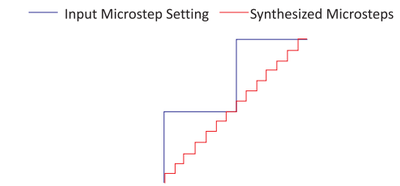
4 Anti-Resonance at Mid-range

Most stepper systems resonate at mid-range speed between 10 to 18 rps. EM stepper drives can calculate natural frequency of the stepper system and apply damping in control algorithm for anti-resonance, Providing optimizing torque and nulling mid-range instability.



5 Multi-stepping Technology

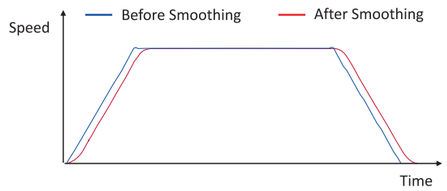
Multi-stepping allows a low resolution input to produce a higher microstep output for smoother system performance. This function can improve smoothness of the stepper systems without upgrading your motion controllers.



Innovative Technologies

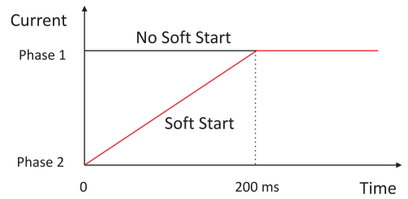
6 Command Signal Smoothing

Command signal smoothing can soften the effect of sudden changes in velocity and direction, thus delivering smoother performance and improving system lifetime.



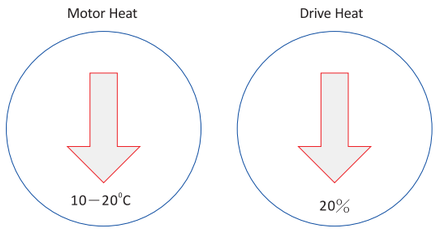
7 Soft Start Technology

On power up of a stepper motor, soft start technology allows a stepper motor gradually applying the shaft torque to the load and avoid "starting shock" to the machine. This function is implemented through software, so no additional hardware needed.



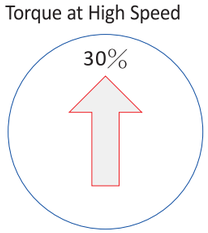
8 Lower Heating Technology

Due to DSP precision current control algorithm, motor heat is 10— 20 °C lower compare to a traditional stepper drive. Longer motor lifetime can be achieved, reducing maintenance cost. Drive heat is also 20% lower, offering higher drive stability and energy efficiency.



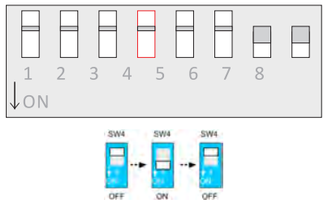
9 Torque Improvement

Torque improvement increases torque up to 30% at high speed, therefore they can drive a normal stepper motor to 3000 RPM or even higher, and significantly increase production efficiency.



10 Self-test and Auto-configuration

Motor-self-test and parameter-auto-configuration technology offers optimum performance for different motors. It is easier for users to configure different axes or build different machines.



Turn SW4 2 times switch in 1 second .

11 Drive Configuration Protection

Drive configuration protection allows you to prevent others from copying your stepper drive configuration.

Features

- **Sensorless stall detection** eliminates cost of feedback devices and time of cable connection
- **Extra-low motor noise** offers excellent quietness
- **Drive Configuration protection** prevents others from copying your drive configurations
- **Anti-Resonance** optimizes torque and nulls mid-range instability
- **Self-test and Auto-configuration** technology offers optimum performance for different motors
- **Multi-stepping** allows a low resolution input to produce a higher microstep output for smoother system performance
- Built-in controller for simple test, easier to test the drive or system
- Options to set output current and microstep resolutions via DIP switch or software
- Command input of step&direction and CW/CCW pulse*
- Over-current, over-voltage, short-circuit protections besides sensorless stall detection
- **Fault out** prevents damages to your machines or the materials

Introduction

By implementing the latest motion control technologies, Leadshine's EM series DSP-based stepper drives deliver excellent performance not available before. Unique features of sensorless stall detection, extra smoothness and excellent high speed performance make the EM stepper drives deliver servo-like performance at the cost of stepper drives. They are capable of delivering high performance without damages to your machines or the materials. Leadshine EM series stepper drives are able to drive 2-phase stepper motors from NEMA8 to NEMA51.

Part Number

3	—	EM	—	80	—	6	—	H
Phase		**Series**		**Max Input**		**Max RMS Current**		**Power Input Type**
Blank: 2-phase 3: 3-phase		EM: EM series		40: 40 V 80: 80 V ...		2: 1.5 A 6: 6.0 A ...		Blank: DC H: AC and DC

Electrical Specifications

Parameters / Model	Input Voltage (VDC)			RMS Current (A)		
	Min	Typical	Max	Min	Typical	Max
EM402	+20	+24	+40	0.07	-	2.0
EM503	+20	+24	+50	0.21	-	3.2
EM705	+20	+48	+75	0.35	-	5.5
EM806	+24	+68	+80	0.35	-	6.0
EM1206H	80VAC/112VDC	120VAC/170VDC	150VAC/212VDC	0.35	-	6.0
EM2306H	80VAC/112VDC	230VAC/325VDC	240VAC/339VDC	0.35	-	6.0

Parameters / Model	Pulse Input Frequency (kHz)			Logic Signal Current (mA)			Isolation Resistance (MΩ)		
	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
EM Series	0	-	500	7	10	16	500	-	-

* The EM402 and E806 only support step&direction command.

Applications

Leadshine EM stepper drives are suitable for driving a wide range of stepper motors, from NEMA frame size 8 to 51. Typical applications includ CNC routers, laser cutters, laser markers, medical equipments, X-Y tables, measurement equipments, etc.

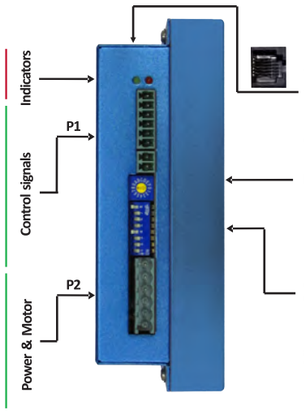
Pin Assignment

There are two connector types for an EM stepper drive. Connector type P1 (See figure below.) is for control signal connections, and connector type P2 is for power and motor connections. The RS232 communication port is for parameter configurations via computer. See brief descriptions for these connectors and interface below.

Red LED: Error Alarm
Green LED: Power Indicator

Pin1 PUL+ Pulse Input(+)
Pin2 PUL- Pulse Input(-)
Pin3 DIR+ Direction Input(+)
Pin4 DIR- Direction Input(-)
Pin5 ENA+ Enable Input(+)
Pin6 ENA- Enable Input(-)
Pin7 FLT+ Fault Out(+)
Pin8 FLT- Fault Out(-)

Pin1 GND Power Ground / AC
Pin2 +Vdc Power Input / AC
Pin3 A+ Phase A+
Pin4 A- Phase A-
Pin5 B+ Phase B+
Pin6 B- Phase B-



Pin6 NC Not connected
Pin5 RXD RS232 receive.
Pin4 GND Signal ground.
Pin3 TXD RS232 transmit.
Pin2 +5V Power for STU-EM only
Pin1 NC

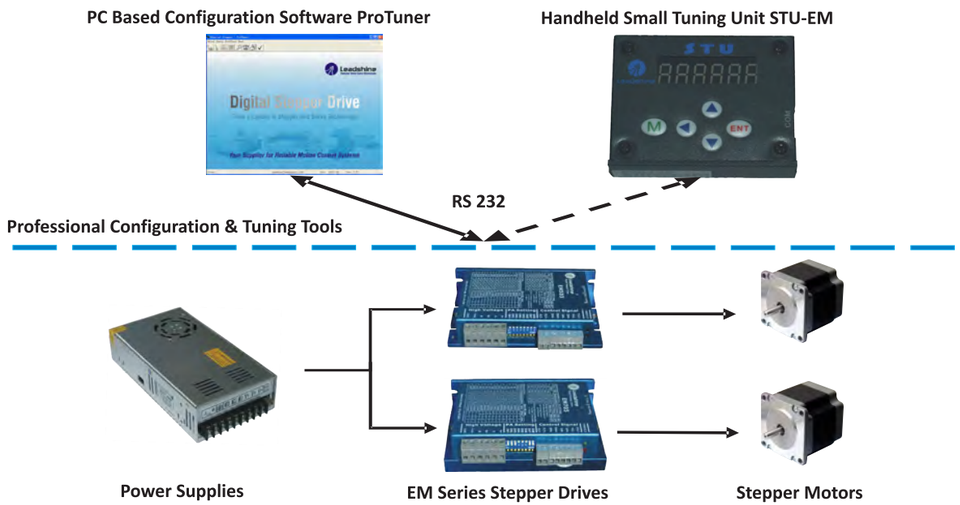
When configuring an EM series stepper drive through DIP switches, use SW1,2,3 to set output current, and SW5,6,7 to set mmicrostep resolutions. SW4 is for standstill current setting and motor self-test & auto-configuration function (Turn SW4 2 times switch in 1 second.). SW8 is for active edge setting of pulse signals.

Tips:

1. Users are suggested to use motor **self-test and auto-configuration** function when powering up the system (with the motor) for the first time, or replacing a new motor.
2. To operate at current and microstep settings configured by software or STU, DIP switch must set to default mode.
3. Only software **ProTuner** can be used to configure anti-resonance parameter settings.
4. How many times the RED light blinks on in a periodic time indicates what protection has been activated. See manuals for detail.

PC Based and Handheld Configuration/Tuning Tools

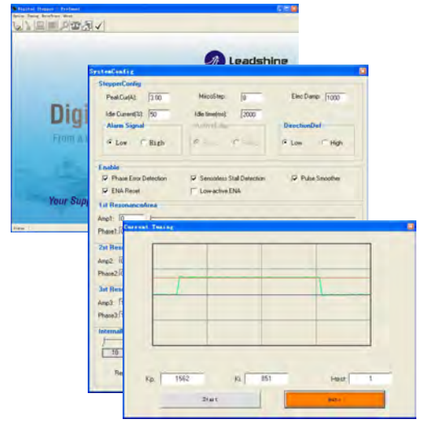
For most of applications, configurations set by self-test and auto-configuration function should be good enough to meet the application requirements. However, a user can also configure the advanced features such as anti-resonance and advanced current loop tuning through software or STU-EM, a simple device specially designed for easy tuning.



ProTuner (Windows Based Setup Software)

- User password setting
- Upload and Download parameter settings
- PI parameter settings for current loop
- Microstep resolution and output current setting
- Electronic damping coefficient setting
- Anti-resonance parameter settings for 3 resonance areas
- DIR and FLT logic level setting
- Enable and disable sensorless stall detection, ENA reset function and command signal smoothing
- Parameter settings for self motion test
- Save, open, upload and download a configuration file
- Read the latest 10 failure events and clear these events

* 1 PC RS232 interface is necessary.
** Leadshine offers special cable for communication between ProTuner and the drive.

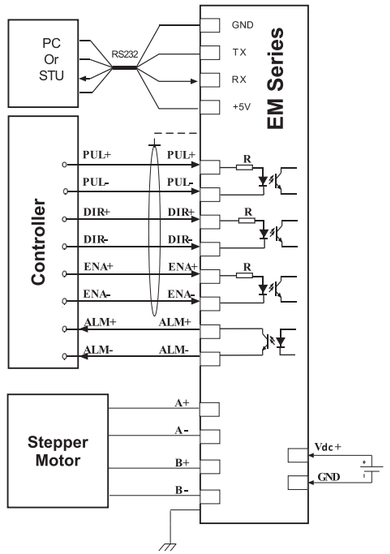


STU-EM (Handheld Configuration and Tuning Unit)

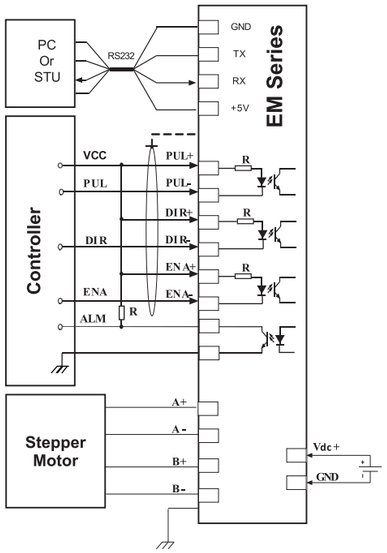
- Upload and Download parameter settings
- PI parameter settings for current loop
- Microstep resolution and output current setting
- Electronic damping coefficient setting
- DIR and FLT logic level setting
- Enable and disable sensorless stall detection, ENA reset function and command signal smoothing
- Parameter settings for self motion test
- Upload and download a configuration file

* Leadshine offers special cable for communication between the STU-EM and the drive.

Typical Connections



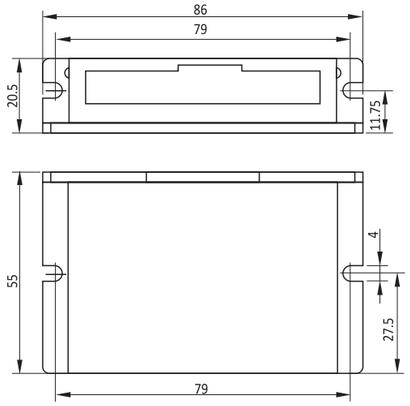
(a) Differential control signals



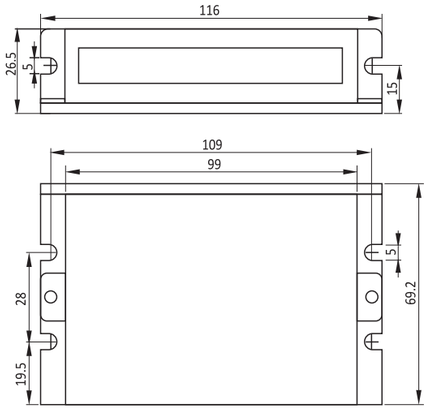
(b) Single-ended (NPN) control signals

Mechanical Specifications (Unit: mm 1 inch=25.4mm)

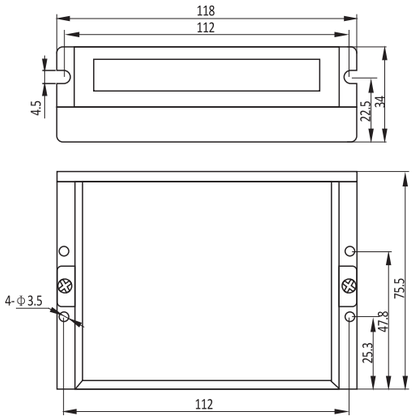
Units: mm 1 inch=25.4mm



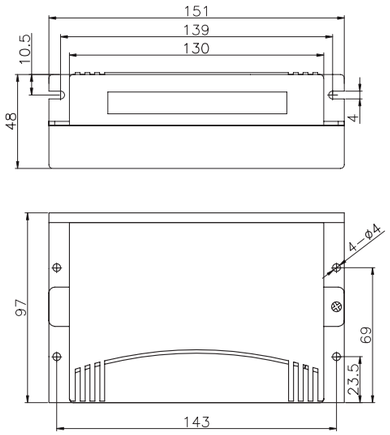
(a) Mechanical specifications of the EM402



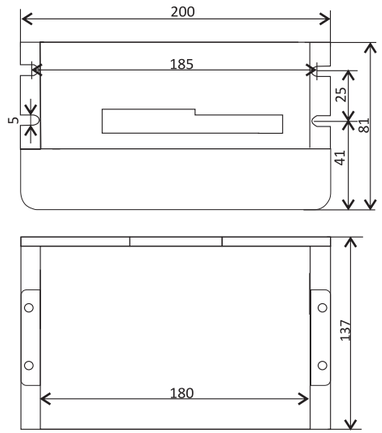
(b) Mechanical specifications of the EM503



(c) Mechanical specifications of the EM705



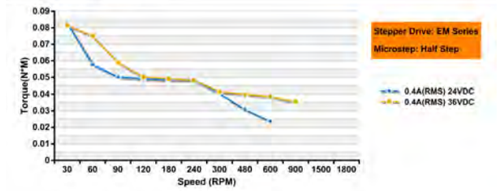
(d) Mechanical specifications of the EM806



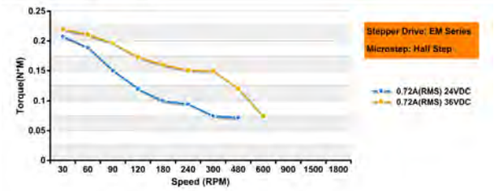
(e) Mechanical specifications of the EM1206H and EM2306H

Speed-Torque Curves of Pre-set Matching Motors*

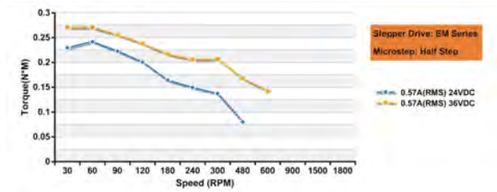
Stepper Motor: 35HS01 (NEMA14, Holding Torque: 0.1 Nm)



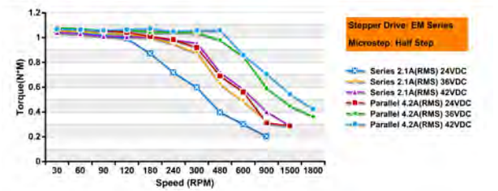
Stepper Motor: 39HS02 (NEMA16, Holding Torque: 0.2 Nm)



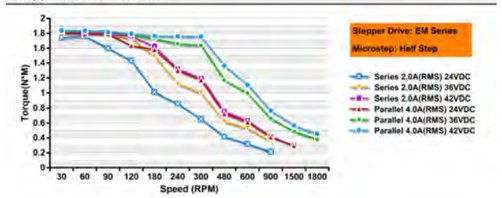
Stepper Motor: 42HS03 (NEMA17, Holding Torque: 0.3 Nm)



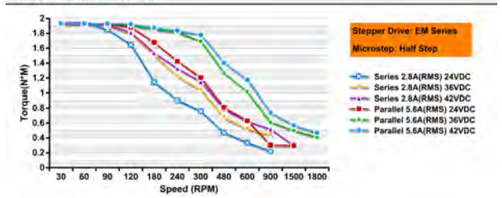
Stepper Motor: 57HS09 (NEMA23, Holding Torque: 0.9 Nm)



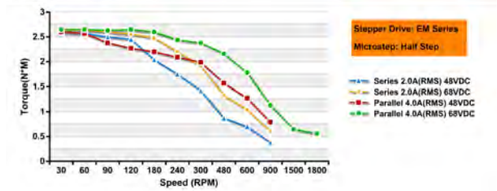
Stepper Motor: 57HS13 (NEMA23, Holding Torque: 1.3 Nm)



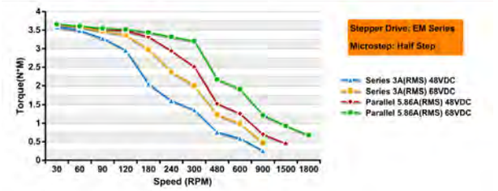
Stepper Motor: 57HS22 (NEMA23, Holding Torque: 2.0 Nm)



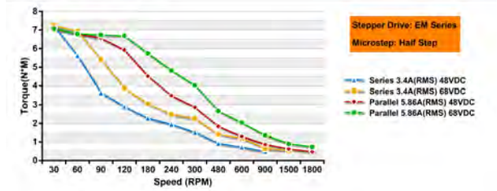
Stepper Motor: 86HS35 (NEMA34, Holding Torque: 3.5 Nm)



Stepper Motor: 86HS45 (NEMA34, Holding Torque: 4.5 Nm)



Stepper Motor: 86HS85 (NEMA34, Holding Torque: 8.5 Nm)



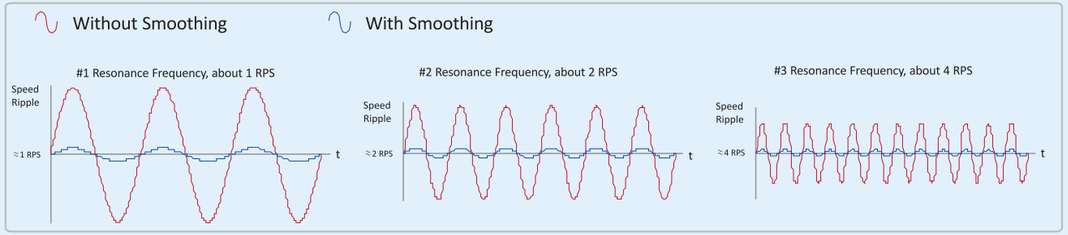
* Other curves will be released soon.

DM Series Digital Stepper Drives

Innovative Technologies

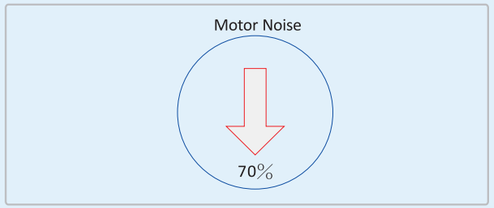
Low-speed Ripple Smoothing

Electronic damping for 3 major resonance frequencies for stepper motors at low speed range, eliminating undesirable motor speed oscillation and delivering unique level of smoothness.



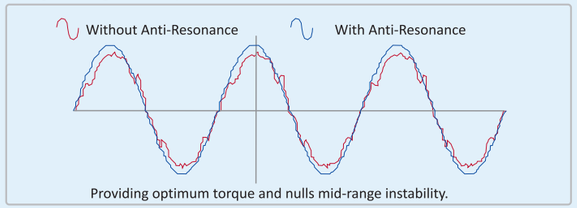
Extra-low Motor Noise

Precision current control technology and multi-stepping technology can reduce about 70% motor noise, making the DM series to be an ideal solution for the applications require extra low motor noise.



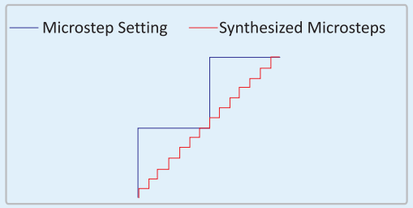
Anti-Resonance at Mid-range

Most stepper systems resonate at mid-range speed between 10 to 18 rps. The DM stepper drives can calculate natural frequency of the stepper system and apply damping in control algorithm for anti-resonance, Providing optimizing torque and nulling mid-range instability.



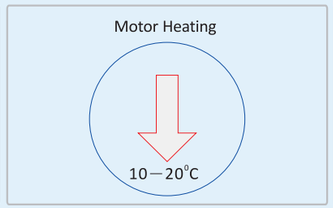
Multi-Stepping Technology

Multi-stepping allows a low resolution input to produce a higher microstep output for smoother system performance. This function can improve smoothness of the stepper systems without upgrading your motion controllers.



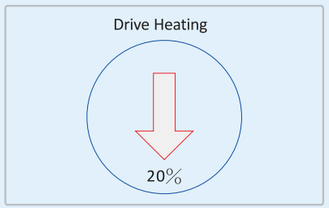
Lower Motor Heating

Due to DSP precision current control algorithm, motor heat is 10 - 20 °C lower compare to using a traditional stepper drive. Longer motor lifetime can be achieved, reducing maintenance cost.



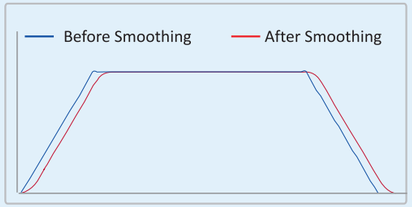
Lower Drive Heating

Drive heat is also 20% lower, offering higher drive stability and energy efficiency.



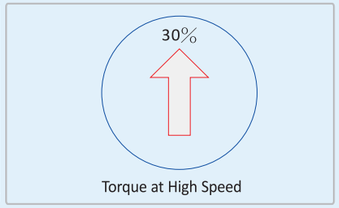
Command Signal Smoothing

Command signal smoothing can soften the effect of suddent changes in velocity and direction, thus delivering smoother performance and improving system liftime.



Torque Improving

Torque improvement increases torque up to 30% at high speed, therefore they can drive a normal stepper motor to 3000 RPM or even higher, and significantly increase production efficiency.



Self-test and Auto-config

Motor-self-test and parameter-auto-configuration technology offers optimum performance for different motors. It is easier for users to configure different axes or build different machines.

Features

- **Anti-Resonance** optimizes torque and nulls mid-range instability
- **Extra-low motor noise** offers excellent quietness
- **Self-test and Auto-configuration** technology offers optimum performance for different motors
- **Multi-stepping** allows a low resolution input to produce a higher microstep output for smoother system performance
- 2-phase and 3-phase stepper drives are available
- Options to set output current and microstep relolutions via DIP switch or software
- Command input of PUL/DIR and CW/CCW
- Over-current, over-voltage, short-circuit protections

Introduction

By implementing the latest motion control technologies, Leadshine's DM series DSP-based stepper drives deliver excellent performance not available before. Unique features of extra smoothness and excellent high speed performance make the DM stepper drives deliver servo-like performance at the cost of stepper drives. They are capable of delivering high performance without damages to your machines or the materials. Leadshine DM series stepper drives are able to drive 2-phase or 3-phase stepper motors from NEMA8 to NEMA42.

Applications

Leadshine DM stepper drives are suitable for driving a wide range of stepper motors, from NEMA frame size 8 to 42. Typical applications includ CNC routers, laser cutters, laser markers, medical equipments, X-Y tables, measurement equipments, etc.

Electrical Specifications

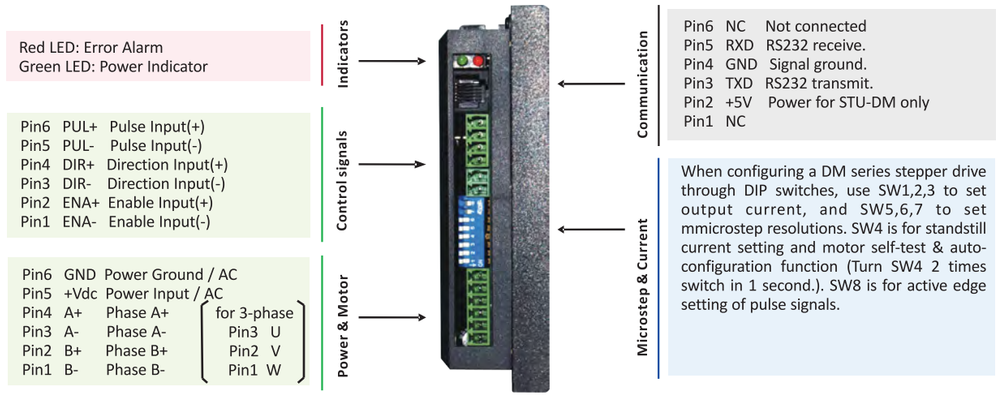
Parameters / Model	Input Voltage (VDC)			Output Current (A)		
	Min	Typical	Max	Min	Typical	Max
DM422C	+18	+24	+40	0.3	-	2.2
DM556	+18	+36	+50	0.5	-	5.6
DM870	+18	+60	+80	0.5	-	7.0
DM1182	80 (VAC)	120 (VAC)	150 (VAC)	0.5	-	8.2
DM2282	80 (VAC)	230 (VAC)	240 (VAC)	0.5	-	8.2
3DM683	+18	+48	+60	0.5	-	8.3
DM805-AI	+18	+60	+80	0.5	-	7.0

Parameters / Model	Pulse Input Frequency (kHz)			Logic Signal Current (mA)			Isolation Resistance (MΩ)		
	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
DM Series	0	-	300**	7	10	16	500	-	-

* This model is UL approved.
** Maximum pulse input frequency of the DM422C is 75 kHz.

Pin Assignment and Description

There are two connector types for a DM stepper drive. Connector type P1 (See figure below.) is for control signal connections, and connector type P2 is for power and motor connections. The RS232 communication port is for parameter configurations via computer. See brief descriptions for these connectors and interface below (Not including the DM805-AI, and see related contents in page 17 for more information about the DM805-AI.).

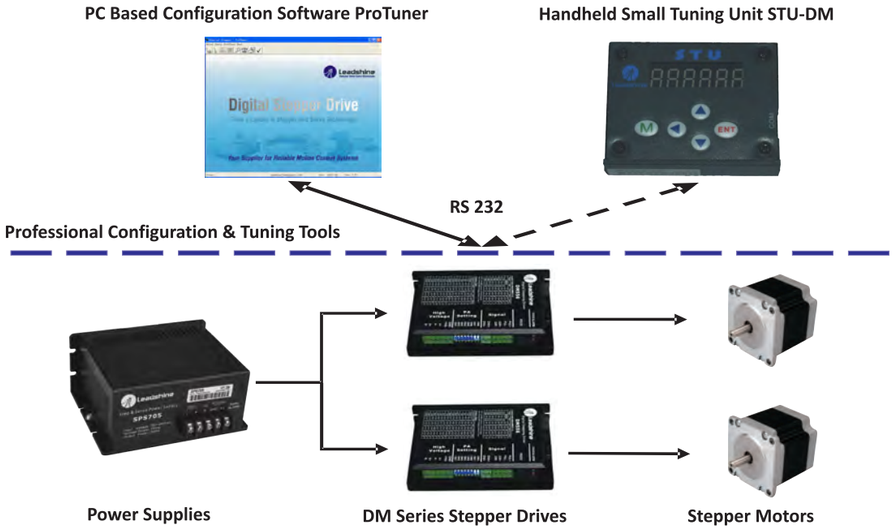


Tips:

1. Users are suggested to use motor **self-test and auto-configuration** function when powering up the system (with the motor) for the first time, or replacing a new motor.
2. To operate at current and microstep settings configured by software or STU, DIP switch must set to default mode.
3. Only software **ProTuner** can be used to configure anti-resonance parameter settings.
4. How many times the RED light blinks on in a periodic time indicates what protection has been activated. See manuals for detail.

PC Based and Handheld Configuration & Tuning Tools

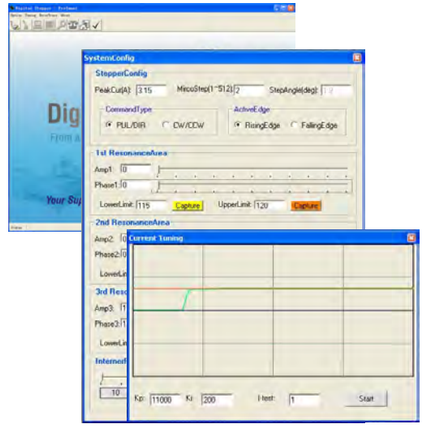
For most of applications, configurations set by self-test and auto-configuration function should be good enough to meet the application requirements. However, a user can also configure the advanced features such as anti-resonance and advanced current loop tuning through software or STU-DM, a simple device specially designed for easy tuning.



ProTuner (Windows Based Setup Software)

- Upload and Download parameter settings
- PI parameter settings for current loop
- Microstep resolution and output current settings
- Operation mode configuration :PUL/DIR, CW/CCW, analog*
- DIR logic level setting
- Active edge of pulse signal setting
- Electronic damping coefficient setting
- Anti-resonance parameter settings for 3 resonance area
- Parameter settings for self motion test or a simple application
- Read the latest 10 failure events and clear these events

* 1 PC RS232 interface is necessary.
** Leadshine offers special cable for communication between ProTuner and the drive.

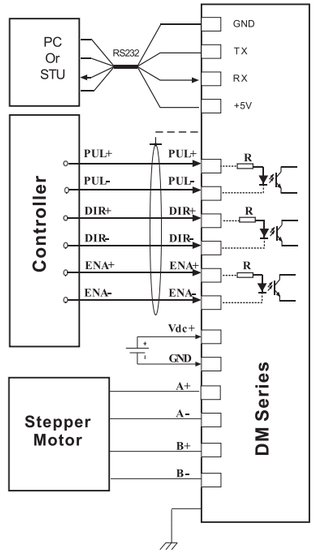


STU-DM (Handheld Configuration and Tuning Unit)

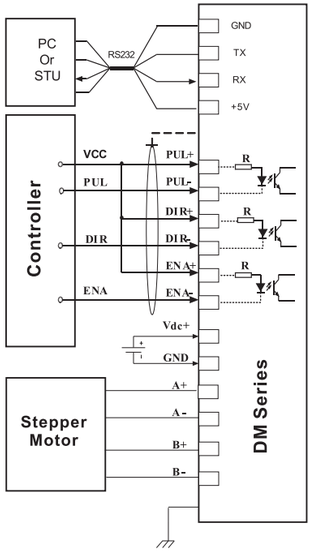
- Upload and Download parameter settings
- PI parameter settings for current loop
- Microstep resolution and output current settings
- Operation mode configuration :PUL/DIR, CW/CCW, analog*
- DIR logic level setting
- Active edge of pulse signal setting
- Parameter settings for self motion test or a simple application

* Leadshine offers special cable for communication between the STU-DM and the drive.

Typical Connections



(a) Differential control signals

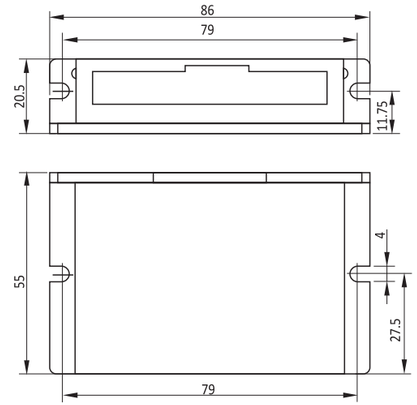


(b) Single-ended (NPN) control signals

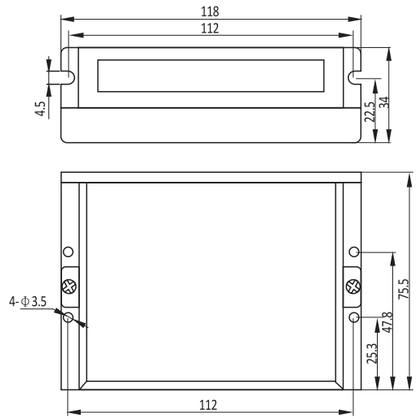
* Only DM805-AI support analog command for the moment.

Mechanical Specifications (Unit: mm 1 inch=25.4mm)

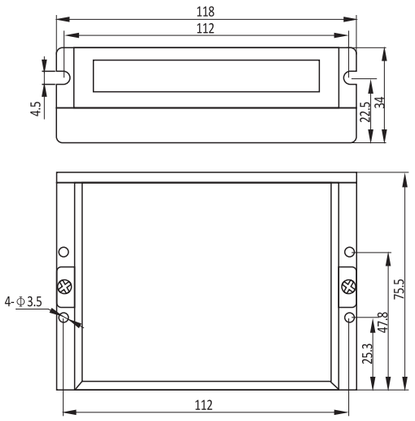
Units: mm 1 inch=25.4mm



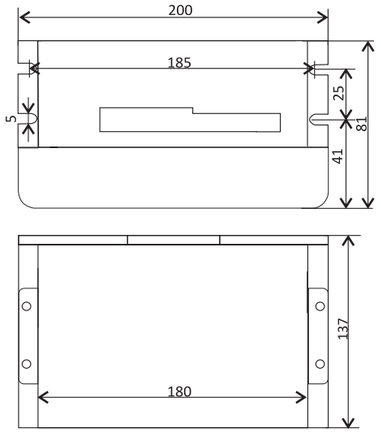
(a) Mechanical specifications of the DM422C



(b) Mechanical specifications of the DM556 and DM870



(c) Mechanical specifications of the 3DM683 and DM805-AI



(d) Mechanical specifications of the DM1182 and DM2282

DM805-AI

Introduction

The DM805-AI is a multi-function digital stepper drive and it belongs to DM series stepper drives. It has all the features that other DM drives have. The DM805-AI is distinguished from other DM series drives by it's operating modes. The DM805-AI can be operated in 4 different modes. They are 0-5V speed, low/high speed, external POT and pulse/direction modes.

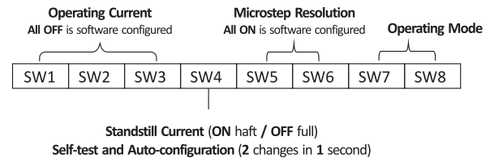
Three built-in potentiometers can be used to set the velocity, acceleration and deceleration. In 0-5V speed mode, the motor speed follows the analog 0-5V input. In Low/HIGH speed mode, the motor speed is selected by the digital input and adjusted by the high/low speed potentiometers. In pulse/direction mode, the DM805-AI acts as a traditional stepper drive. There is a 5V auxiliary output for customer use. The user can run the motor with the least configuration and connection, without buying a expensive motion controller.

Function Description

Function	Description
Microstep Setting	Microstep resolution is programmable. When not in software configured mode, microstep resolution is set by SW5, 6, 7, 8 of the DIP switch. In order to avoid losing steps, do not change the microstep resolution on the fly.
Current Setting	Output current is programmable. When not in software configured mode, operating current is set by SW1,2,3 of the DIP switch. Up to 8.2 A. Select a current setting closest to your motor's required current.
Automatic standstill current reduction;	SW4 is used for the automatic standstill current reduction, self-test and auto-configuration function. When the former active, the current will automatically reduced to 60% of the selected operating current 0.4 second after the last pulse. Theoretically, this will reduce motor heating to 36% (due to $P=I^2*R$) of the original value.
Self-test and auto-configuration	If the user changes the status/position of SW4 twice in 1 second, the drive will self-test the driving motor and auto-configuration control parameters, offering optimum performance with different motors.
Control Signals	The DM805-AI is a multi-function digital stepper drive. It can be operated in 0-5V speed, low/high speed, externalPOT and pulse/direction modes. There are 3 potentiometers, 4 digital inputs and 1 analog input can be configured to control the acceleration, speed, position and direction in different modes.
Motor Connector	A+, A- and B+, B- are for motor connections. Exchanging the connection of two wires for a coil to the drive will reverse default motion direction.
Power Connector	Recommended to use power supplies with output of 20 to 80 VDC, leaving room for power fluctuation and back-EMF.
Indicators	There are two LED indicators on the drive for power and alarm signals. When the Green LED is on means the drive is powered up, and when the Red LED is on means the drive is in fault status. When in fault status, the motor shaft will be free. Reset the drive by re-powering it to make it function properly after removing problem(s). See its manual for more information.

Parameter Settings

Microstep resolution, output current and operating mode are programmable. When not in software configured mode, the drive uses an 8-bit DIP switch to set microstep resolution, and motor operating current, as shown below:



Operating Current Setting

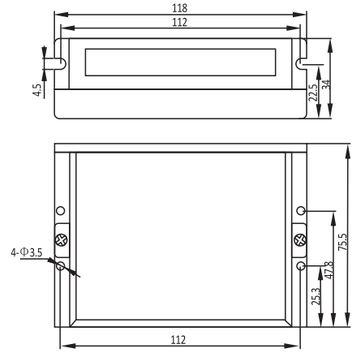
Peak Current	RMS Current	SW1	SW2	SW3
Default (software configured, 0.5-7.0 A)		off	off	off
2.6 A	1.8 A	on	off	off
3.4 A	2.4 A	off	on	off
4.0 A	2.8 A	on	on	off
4.8 A	3.4 A	off	off	on
5.4 A	3.8 A	on	off	on
6.1 A	4.3 A	off	on	on
7.0 A	5.0 A	on	on	on

Microstep Resolution Setting

Steps/rev.	SW5	SW6
Default (software configured, 1-512)	on	on
400	off	on
1600	on	off
12800	off	off

Mechanical Specifications

Units: mm 1 inch = 25.4mm



Applications

The DM805-AI is particularly suitable for the applications which need to adjust the velocity via the potentiometer or analog 0-5V command. Owing to high torque and extra-low motor noise at low speed, stepper solution based on the DM805-AI can be used to replace the brushless motor and gearbox solution, which is used in various kinds of machines, such as rotary heat exchange, conveyor belts, transport vehicle, offering longer life time and lower cost than the later.

Operating Mode Setting

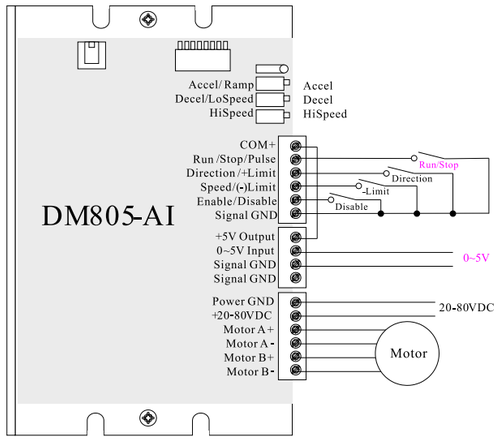
Operating Modes	SW7	SW8	Descriptions
0~5 V Speed	on	on	Speed controlled by the 0~5V, and direction controlled by the direction input.
Low/High Speed	off	on	Speed controlled by the preset low speed and high speed, and direction control by the direction input.
External POT	on	off	Both speed and direction are controlled by the 0~5V. 0~2.5 V, negative direction; 2.5~5V, positive direction.
Pulse/Direction	off	off	Speed and movement distance are controlled by the pulse, and direction controlled by the direction input.

Potentiometer Function in Different Operating Modes

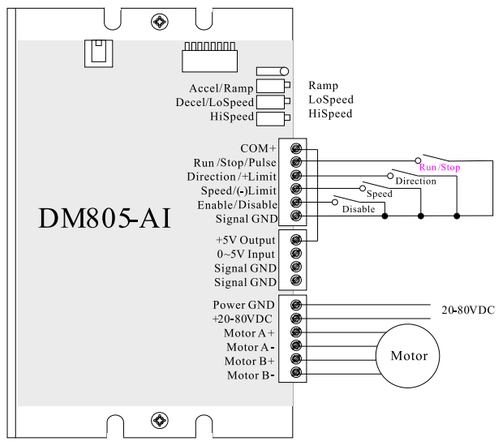
Potentiometers	0~5V Speed Mode	Low/High Speed Mode	External POT Mode	Pulse/Direction Mode
Accel / Ramp	Acceleration	Ramp	Acceleration	N/A
Decel / LoSpeed	Deceleration	Low Speed	Deceleration	N/A
HiSpeed	High Speed	High Speed	High Speed	N/A

Typical Connections

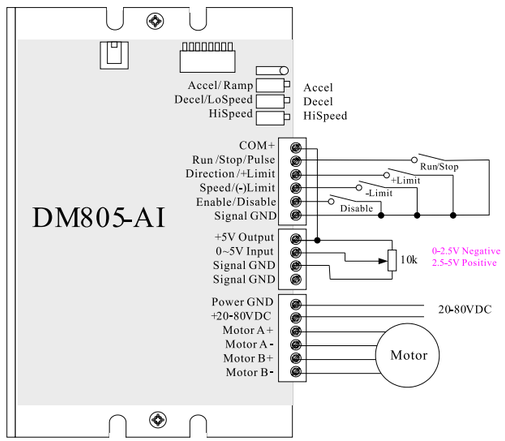
(a) 0~5 V Speed Mode



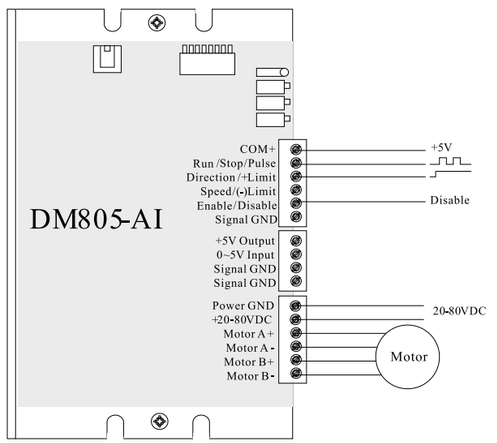
(b) Low/High Speed Mode



(c) External POT Mode



(d) Pulse/Direction Mode



Multi-Axis Stepper Drives

Features

- Multiple-axis digital stepper drives built on latest DSP technology
- Step & direction control
- VDC working voltage up to 60 VDC
- Output current up to 6.0A
- Anti-resonance for low and middle speed
- Built-in breakout boards and IO's
- DIP switches for micro step and output current configurations
- Easy to install and simple to implement
- Automatic idle current reduction to 50%
- Able to drive NEMA 17, 23, 24, and 34 stepper motors
- Direct connection to popular control systems like Mach3 and EMC

Introduction

Based on the latest DSP technology and adopting Leadshine's advanced control algorithms, Leadshine MX series was specially designed to allow easy and rapid implementation of multiple axis stepper solutions. With up to 60VDC working voltage and output current to 6.0A, Leadshine multi-axis stepper drives are capable of driving multiple 2-phase stepper motors in frame size 17, 23, 24, and 34. Leadshine multiple axis stepper drives can drive stepper systems at excellent low-to-high speed performance with high precision, extra low motor heating, smooth movement, and low motor noise. They are featured with anti-resonance, multi-stepping, digital smoothing, options of different configuration for each axis, automatic idle current reduction, and easy configurations of microstepping and output currents via DIP switches. Their integrated breakout board and built-in IO's offer easy implementation for many applications at very effect costs. The MX3660, a 3-axis stepper drive is available now, and 4-axis stepper drive will be available later.

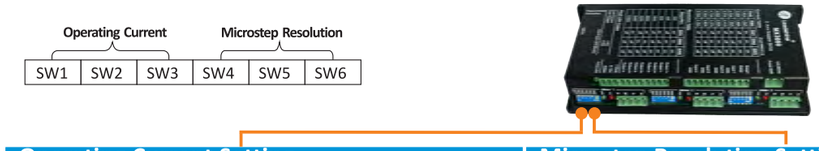
Applications

With integrated breakout boards and built-in IO's, Leadshine MX3660 3-axis stepper drives can be easily implemented as general purpose stepper drives to power 3 two-phase stepper motors in frame size 17, 23, 24, and 34. They are ideal solutions to many applications with 2-3 axis stepper systems such as CNC machinery, electronics, semiconductors, medical, packaging, lab automation, etc. They can be easily adopted in stepper control systems for machines like CNC routers/engravers, light-duty CNC mills, CNC lathes/cutters, laser cutters/markers/engravers, CNC welders, waterjet cutters, X-Y tables, CNC dispensing machines, medical equipments...

The unique design of MX3660 with DB25 connectors makes it fit seamlessly with many popular CNC control systems like Mach3 and EMC.

Parameter Settings

Via DIP switches of a MX3660, a user can easily set stepper motor current and resolution configurations. Each individual axis can be set with different configuration. For example, you can configure axis 1 with 1/16 micro step & 6.0A to drive a large NEMA 34 stepper motor, axis 2 with 1/10 micro step & 2.72A to drive a NEMA 23 stepper motor, and axis 3 with 1/8 micro step & 1.45A current to drive a NEMA 17 stepper motor.



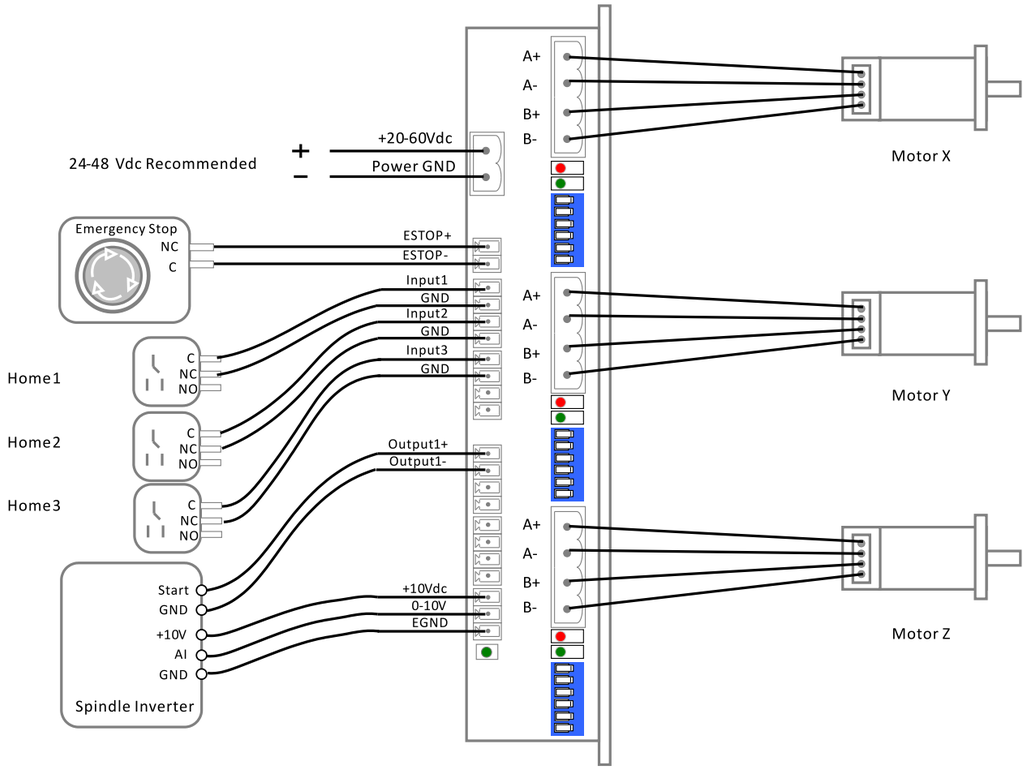
Operating Current Setting

Peak Current	RMS Current	SW1	SW2	SW3
1.45 A	1.04 A	on	on	on
2.08 A	1.48 A	off	on	on
2.72 A	1.94 A	on	off	on
3.37 A	2.41 A	off	off	on
4.05 A	2.89 A	on	on	off
4.72 A	3.37 A	off	on	off
5.35 A	3.82 A	on	off	off
6.00 A	4.29 A	off	off	off

Microstep Resolution Setting

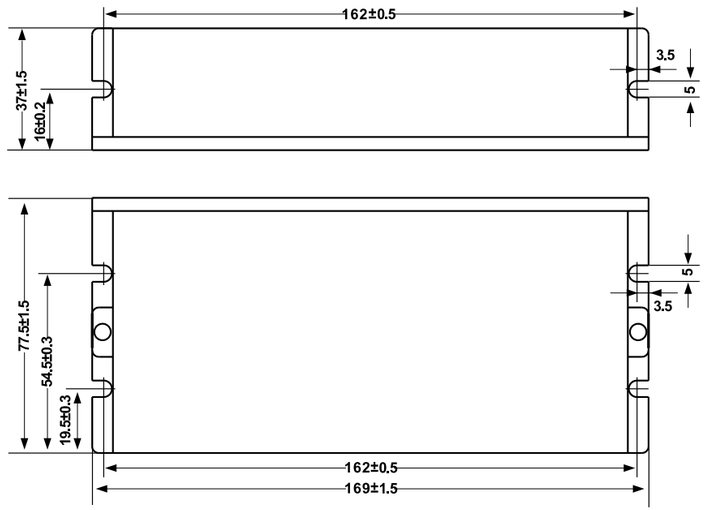
Steps / rev.	SW4	SW5	SW6
200	on	on	on
400	off	on	on
800	on	off	on
1600	off	off	on
2000	on	on	off
3200	off	on	off
6400	on	off	off
12800	off	off	off

Typical Connections



Mechanical Specifications

Units: mm 1 inch = 25.4mm



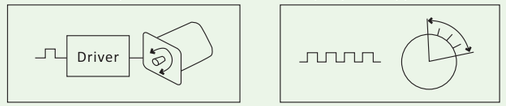
Selection Guide 22
2-phase Stepper Motors
35HSxx 24
39HSxx 24
42HSxx 25
57HSxx 26
86HSxx 27
110HSxx 28
130HSxx 29
3-phase Stepper Motors
573Sxx 30
863Sxx 31
Speed-Torque Curves of 2-phase Motors 32
Speed-Torque Curves of 3-phase Motors 33

Stepper Motors

Stepper Motor Basic

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in a proper sequence. The motor rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

A stepper motor can be a good choice whenever controlled movement is required. They can be used in applications where you need to control rotation angle, speed, position and synchronism. Because of the inherent advantages, stepper motors have found their places in many different applications, such as CNC routers, laser machines, and so on.



The length of rotation is directly related to the number of input pulses applied.

Stepper Motor Types

There are three basic stepper motor types. They are variable-reluctance, permanent-magnet and hybrid.

Variable-reluctance (VR)

This type of motor consists of a soft iron multi-toothed rotor and a wound stator. When the stator windings are energized with DC current the poles become magnetized. Rotation occurs when the rotor teeth are attracted to the energized stator poles.

Permanent Magnet (PM)

Often referred to as a "tin can" or "canstock" motor, the permanent magnet step motor is a low cost and low resolution type motor. PM motors as the name implies have permanent magnets added to the motor structure. The magnetized rotor poles provide an increased magnetic flux intensity and because of this the PM motor exhibits improved torque characteristics when compared with the VR type.

Hybrid (HB)

The hybrid stepper motor provides better performance with respect to step resolution, torque and speed. The hybrid stepper motor combines the best features of both the PM and VR type stepper motors. The rotor is multi-toothed like the VR motor and contains an axially magnetized concentric magnet around its shaft. This further increases the detent, holding and dynamic torque characteristics of the motor when compared with both the VR and PM types. Generally speaking, the hybrid motor may be the better choice along with reducing cost, for it offers better performance with respect to step resolution, torque and speed.

Normal Selection Steps

You can follow the following steps to choose a stepper motor.

1. Determining the Drive Mechanism Component

Determine the mechanism and required specifications. First, determine certain features of the design, such as mechanism, rough dimensions, distances moved, and positioning period.

2. Calculate the Required Resolution

Find the resolution the motor requires. From the required resolution, determine whether a motor only or a geared motor is to be used. The resolution and positioning accuracy of a stepper motor system is affected by several factors—the stepper angle, the selected drive mode (full-step, half-step or microstepper), and the gear rate.

3. Determine the Operating Pattern

Determine the operating pattern that fulfills the required specifications. Find the acceleration (deceleration) period and operating pulse speed in order to calculate the acceleration torque.

4. Calculate the Required Torque

Calculate the load torque and acceleration torque and find the required torque demanded by the motor.

5. Select the Motor

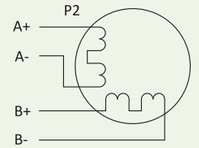
Make a provisional selection of a motor based on required torque. Determine the motor to be used from the speed-torque characteristics.

6. Check the Selected Motor

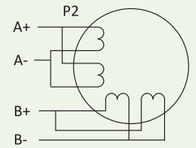
Confirm the acceleration/deceleration rate and inertia ratio.

Motor Connections

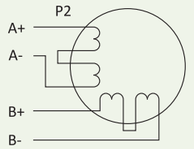
The M series drives can drive any 2-phase, 4-phase hybrid stepper motors, including 4-lead, 6-lead and 8-lead motors. Step angle of the motors can be 1.8 or 0.9 degree. For 6-lead and 8-lead stepper motors, different connections have different performance shown in the following figures.



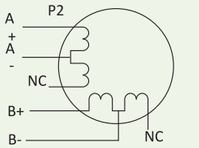
4-lead



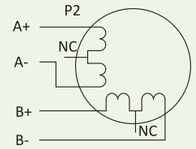
8-lead Parallel connection
Better high speed performance
due to smaller inductance



8-lead Series connection
Same low-speed performance as parallel
connection with smaller current



6-lead half-coil connection
Better high speed performance
due to smaller inductance



6-lead Series connection
Higher torque than half-coil at
low speed with the same current

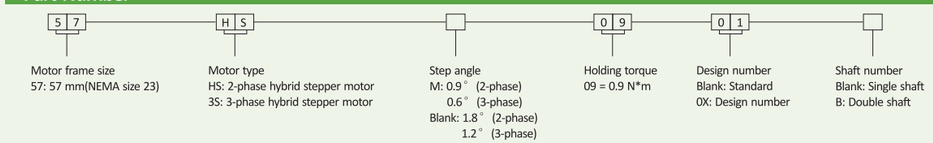
Leadshine's Stepper Motors

Leadshine offers 2-phase and 3-phase stepper motors from NEMA14 to NEMA51. Made of high quality cold roll sheet copper and anti-high temperature permanent magnet, these stepper motors are highly reliable and generate low motor heating. Because of their nice internal damping characteristics, those stepper motors can run very smoothly and have no obvious resonance area within the whole speed ranges.

Selection Table

Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	14	35HS01	1.8	4	-	0.4	0.07	26	0.15	EM402 / DM422C
	16	39HS02	1.8	4	-	0.6	0.22	34	0.2	EM402 / DM422C
	17	42HS02	1.8	4	-	0.4	0.22	40	0.24	EM402 / DM422C
		42HS03	1.8	8	Parallel	1.4	0.47	48	0.34	EM402 / DM422C
					Series	0.7	0.47			
					Unipolar	1.0	0.34			
	23	57HS04	1.8	6	Series	2.0	0.4	41	0.45	EM503 / DM556
					Unipolar	2.8	0.28			
		57HS09	1.8	8	Parallel	4.2	1.3	54	0.6	EM503 / DM556
					Series	2.1	1.3			
					Unipolar	2.8	0.9			
		57HS13	1.8	8	Parallel	4.0	1.8	76	1.0	EM503 / EM705 / DM556 / DM870
					Series	2.0	1.8			
					Unipolar	2.8	1.3			
		57HS22	1.8	8	Parallel	5.6	2.2	81	1.15	EM503 / EM705 / DM556 / DM870
					Series	2.8	2.2			
					Unipolar	4.0	1.5			
	34	86HS35	1.8	8	Parallel	4.0	3.5	65	1.7	EM705 / EM806 / DM870
					Series	2.0	3.5			
					Unipolar	2.8	2.5			
		86HS45	1.8	8	Parallel	6.0	4.5	80	2.3	EM806 / DM870 / DM1182
					Series	3.0	4.5			
					Unipolar	4.2	3.2			
		86HS85	1.8	8	Parallel	6.8	8.5	118	3.8	EM806 / DM870 / DM1182 / DM2282
					Series	3.4	8.5			
					Unipolar	4.9	6.0			
	42	110HS12	1.8	4	-	5.0	12	99	5.0	DM1182 / DM2282
		110HS20	1.8	4	-	6.5	20	150	8.4	DM1182 / DM2282
	51	130HS27	1.8	4	-	6.0	27	227	13	DM1182 / DM2282
		130HS45	1.8	4	-	7.0	45	283	19	DM1182 / DM2282
3	23	573S05	1.2	6	Delta	5.2	0.45	42	0.45	3DM683 / 3DM883
		573S09	1.2	6	Delta	3.5	0.9	50	0.75	3DM683 / 3DM883
		573S15	1.2	6	Delta	5.8	1.3	76	1.1	3DM683 / 3DM883
	34	863S22	1.2	6	Delta	5.0	2.3	71	1.7	3DM683 / 3DM883
		863S42	1.2	6	Delta	5.0	4.3	103	2.9	3DM683 / 3DM883
		863S68H	1.2	6	Delta	2.3	6.8	135	4.0	3DM683 / 3DM883

Part Number



Motor frame size
57: 57 mm(NEMA size 23)

Motor type
HS: 2-phase hybrid stepper motor
3S: 3-phase hybrid stepper motor

Step angle
M: 0.9° (2-phase)
0.6° (3-phase)
Blank: 1.8° (2-phase)
1.2° (3-phase)

Holding torque
09 = 0.9 N*m

Design number
Blank: Standard
0X: Design number

Shaft number
Blank: Single shaft
B: Double shaft

35HSxx/39HSxx Series

General Specifications

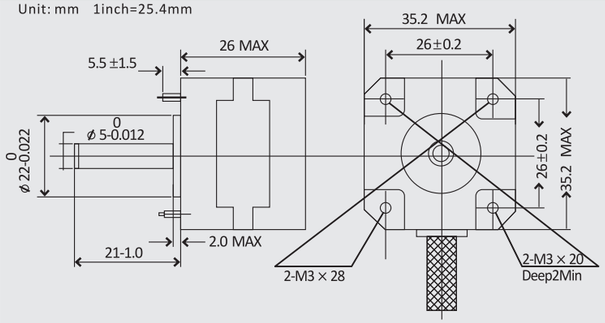
Angle Accuracy	±5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

Selection Table

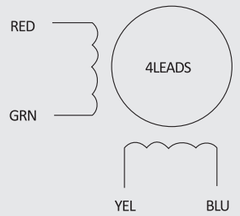
Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	14	35HS01	1.8	4	-	0.4	0.07	26	0.15	EM402 / DM422C
	16	39HS02	1.8	4	-	0.6	0.22	34	0.20	EM402 / DM422C

Mechanical Specifications

Unit: mm 1inch=25.4mm

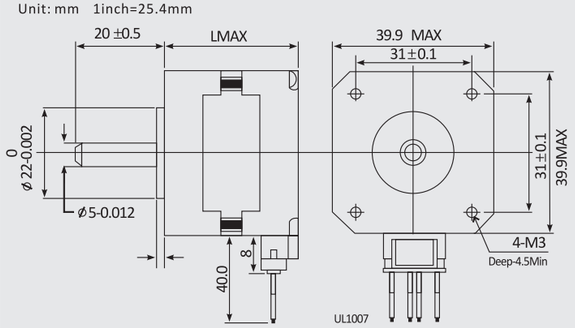


Wiring Diagram

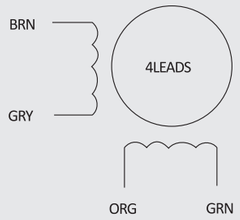


Mechanical Specifications

Unit: mm 1inch=25.4mm



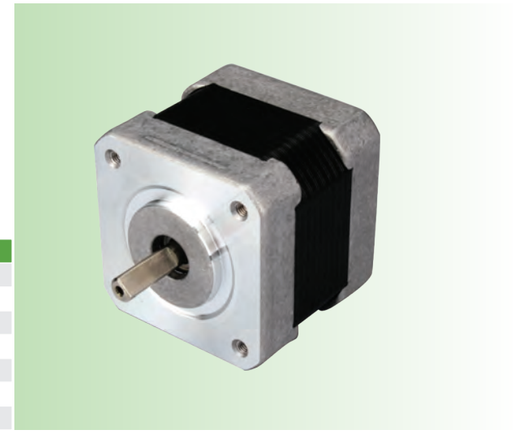
Wiring Diagram



Match Drives

Model	Match Drives
35HSxx / 39HSxx	EM402 / DM422C

42HSxx Series



General Specifications

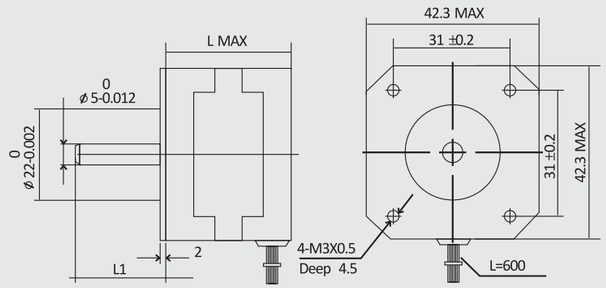
Angle Accuracy	±5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

Selection Table

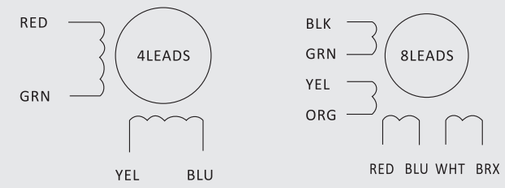
Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	17	42HS02	1.8	4	-	0.4	0.22	40	0.24	EM402 / DM422C
		42HS03	1.8	8	Parallel	1.4	0.47	48	0.34	EM402 / DM422C
					Series	0.7	0.47			
					Unipolar	1.0	0.34			

Mechanical Specifications

Unit: mm 1inch=25.4mm



Wiring Diagram



Match Drives

Model	Match Drives
42HSxx	EM402 / DM422C

57HSxx Series

General Specifications

Angle Accuracy	±5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

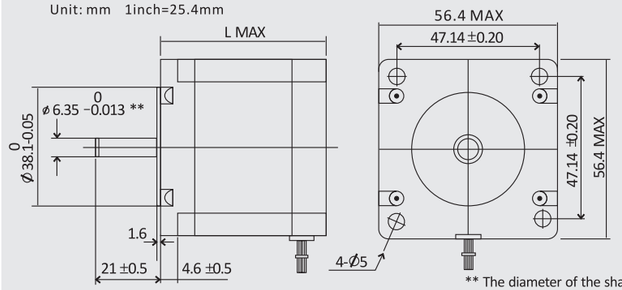
Selection Table

Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	23	57HS04	1.8	6	Series	2.0	0.4	41	0.45	EM503 / DM556
					Unipolar	2.8	0.28			
		57HS09	1.8	8	Parallel	4.2	1.3	54	0.6	EM503 / EM705 / DM556
					Series	2.1	1.3			
					Unipolar	2.8	0.9			
		57HS13	1.8	8	Parallel	4.0	1.8	76	1.0	EM503 / EM705 / DM556
					Series	2.0	1.8			
					Unipolar	2.8	1.3			
		57HS22*	1.8	8	Parallel	5.6	2.2	81	1.15	EM503 / EM705 / DM556
					Series	2.8	2.2			
					Unipolar	4.0	1.5			

* The diameter of the shaft of the 57HS22 is 8 mm, and those of the others are 6.35 mm.

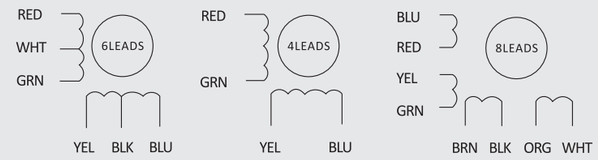
Mechanical Specifications

Unit: mm 1inch=25.4mm



** The diameter of the shaft of the 57HS22 is 8 mm, and those of the others are 6.35 mm.

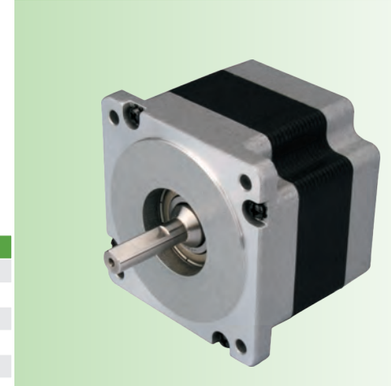
Wiring Diagram



Match Drives

Model	Match Drives	Model	Match Drives
57HS04	EM503 / EM705 / DM556	57HS13	EM503 / EM705 / DM556
57HS09		57HS22	

86HSxx Series



General Specifications

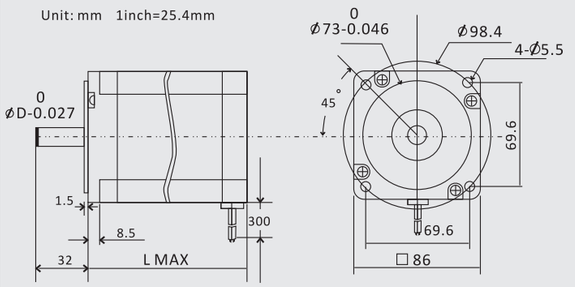
Angle Accuracy	±5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

Selection Table

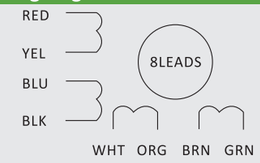
Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	34	86HS35	1.8	8	Parallel	4.0	3.5	65	1.7	EM705 / EM806 / DM870
					Series	2.0	3.5			
					Unipolar	2.8	2.5			
		86HS45	1.8	8	Parallel	6.0	4.5	80	2.3	EM705 / EM806 / DM870 / DM1182
					Series	3.0	4.5			
					Unipolar	4.2	3.2			
		86HS65	1.8	8	Parallel	6.1	6.5	96	2.3	EM806 / DM870 / DM1182 / DM2282
					Series	3.05	6.5			
					Unipolar	4.3	4.6			
		86HS85	1.8	8	Parallel	6.8	8.5	118	3.8	EM806 / DM870 / DM1182 / DM2282
					Series	3.4	8.5			
					Unipolar	4.9	6.0			
		86HS120	1.8	8	Parallel	6.0	12	156	5.3	EM806 / DM870 / DM1182 / DM2282
					Series	3.0	12			
					Unipolar	4.2	8.4			

Mechanical Specifications

Unit: mm 1inch=25.4mm

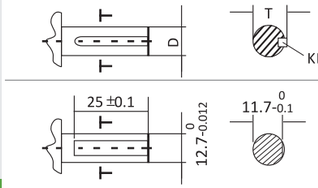


Wiring Diagram



Specifications of Motor Shafts

Model	T	KEY	D
86HS35	/	/	9.5
86HS45	/	/	12.7
86HS65, 86HS85	14.7	5*5*25	12.7
86HS120	17.875	5*5*25	15.875



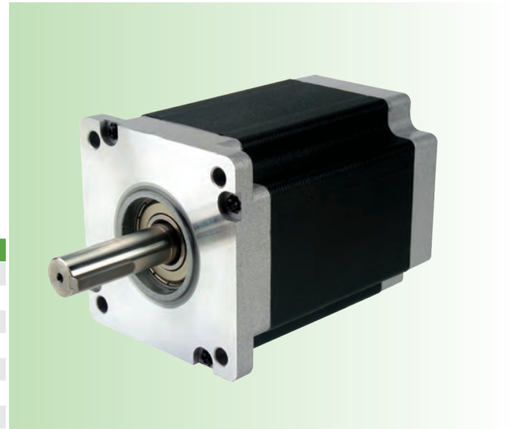
The Shaft of the 86HS45

* The shaft of the 86HS35 is round, no flat.

Match Drives

Model	Match Drives
86HS35	EM705 / EM806 / DM1182
86HS45 / 86HS65	
86HS85 / 86HS120	EM705 / EM806 / DM1182

110HSxx Series



General Specifications

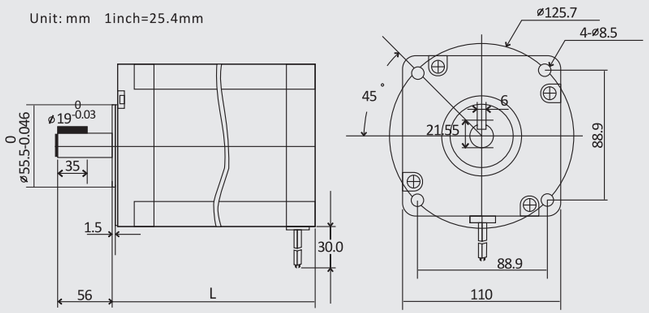
Angle Accuracy	± 5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

Selection Table

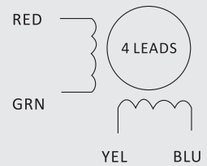
Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	42	110HS12	1.8	4	-	6.0	12	115	6.0	DM2282 / DM1182
		110HS20	1.8	4	-	6.0	20	150	8.4	DM2282 / DM1182
		110HS28	1.8	4	-	6.5	28	201	11.7	DM2282 / DM1182

Mechanical Specifications

Unit: mm 1inch=25.4mm



Wiring Diagram



Match Drives

Model	Match Drives
110HS12	DM2282 / DM1182
110HS20	
110HS28	

130HSxx Series

General Specifications

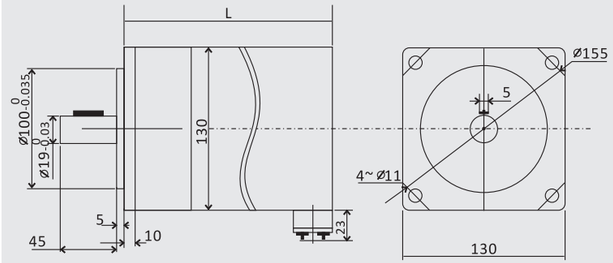
Angle Accuracy	± 5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

Selection Table

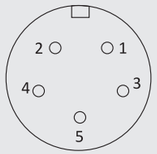
Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
2	51	130HS27	1.8	4	-	6.0	27	227	13	DM2282 / DM1182
		130HS33	1.8	4	-	6.0	33	227	13	DM2282 / DM1182
		130HS40	1.8	4	-	7.0	40	283	16	DM2282 / DM1182
		130HS45	1.8	4	-	7.0	45	283	19	DM2282 / DM1182

Mechanical Specifications

Unit: mm 1inch=25.4mm



Wiring Diagram



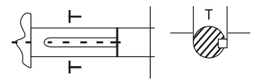
1	2	3	4	5
A+	A -	B+	B-	NC

Match Drives

Model	Match Drives
130HSxx	DM2282 / DM1182

Specifications of Motor Shafts

	T	KEY	D



T=21

KEY=5×5×30

573Sxx Series

General Specifications

Angle Accuracy	± 5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

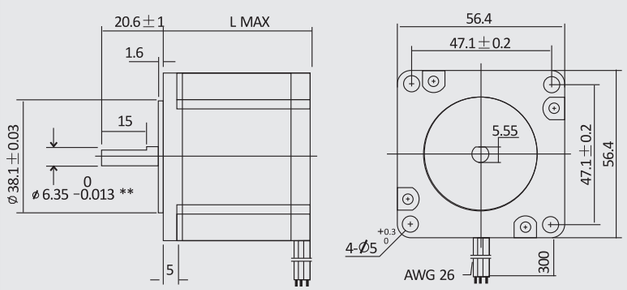
Selection Table

Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
3	23	573S05	1.2	6	Delta	5.2	0.45	42	0.45	3DM683 / 3DM883
		573S09	1.2	6	Delta	3.5	0.9	50	0.75	3DM683 / 3DM883
		573S15	1.2	6	Delta	5.8	1.3	76	1.1	3DM683 / 3DM883

* The diameter of the shaft of the 573S15 is 8 mm, and those of the others are 6.35 mm.

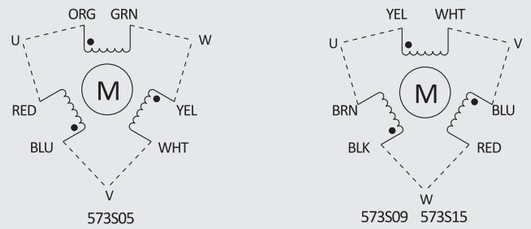
Mechanical Specifications

Unit: mm 1inch=25.4mm



** The diameter of the shaft of the 573S15 is 8 mm, and those of the others are 6.35 mm.

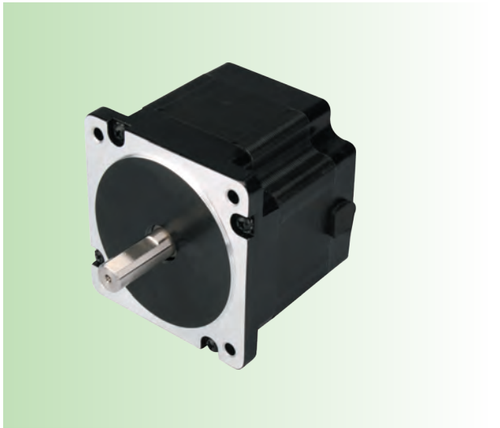
Wiring Diagram



Match Drives

Model	Match Drives
573S05	3DM683 / 3DM883
573S09	3DM683 / 3DM883
573S15	3DM683 / 3DM883

863Sxx Series



General Specifications

Angle Accuracy	± 5%(full step, no load)
Temperature Rise	80 ℃ Max
Ambient Temperature	-10 ℃ — +50 ℃
Insulation Resistance	100M Ω min. 500VDC
Dielectric Strength	500VAC for one minute
Shaft Radial Play	0.06 Max. (450g-load)
Shaft Axial Play	0.08 Max. (450g-load)

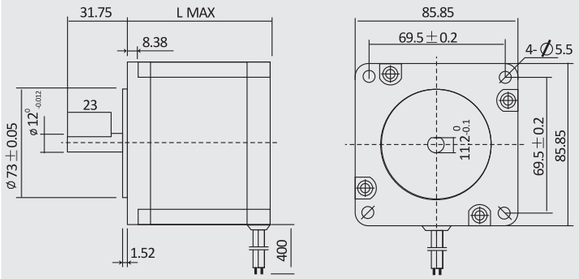
Selection Table

Phase	NEMA Size	Model	Step Angle (°)	# of Leads	Connection	Current/Phase (A)	Holding Torque (Nm)	Length L (mm)	Weight (kg)	Match Drives
3	23	863S22	1.2	6	Delta	5.0	2.3	71	1.7	3DM683 / 3DM883
		863S42	1.2	6	Delta	5.0	4.3	103	2.9	3DM683 / 3DM883
		863S68H	1.2	6	Delta	2.3	6.8	135	4.0	3DM683 / 3DM883

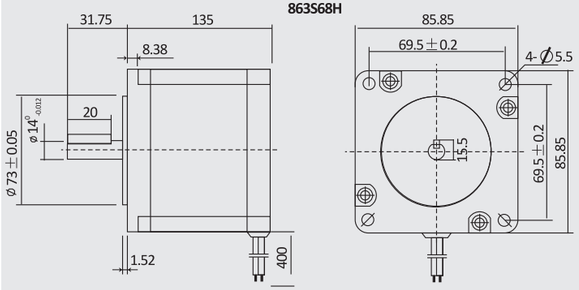
Mechanical Specifications

Unit: mm 1inch=25.4mm

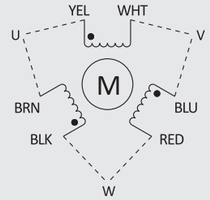
863S22, 863S42



863S68H

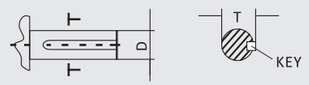


Wiring Diagram



Specifications of Motor Shafts

Model	T	KEY	D
863S68H	15.5	4*4*20	14

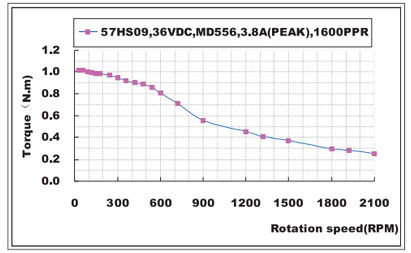


Match Drives

Model	Match Drives
863S22	3DM683 / 3DM883
863S42	3DM683 / 3DM883
863S68H	3DM683 / 3DM883

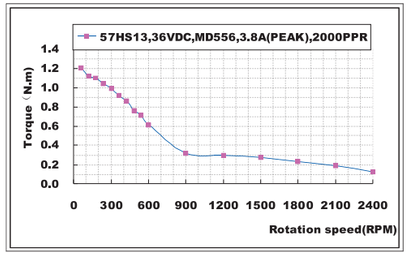
Speed-Torque Curves of 2-phase Stepper Motors

57HS09



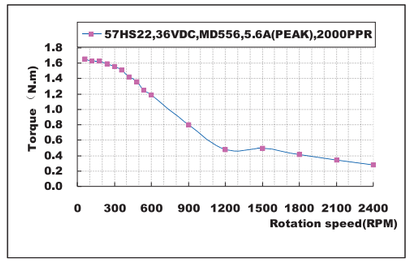
Stepper Motor: 57HS09 Output Current: 3.8 A(Peak)
Stepper Drive: MD556 Microstep: 1600 PPR
Input Voltage: 36 VDC Connection: Parallel

57HS13



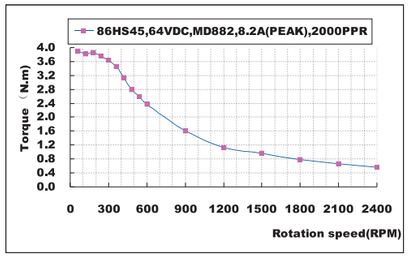
Stepper Motor: 57HS13 Output Current: 3.8 A(Peak)
Stepper Drive: MD556 Microstep: 2000 PPR
Input Voltage: 36 VDC Connection: Parallel

57HS22



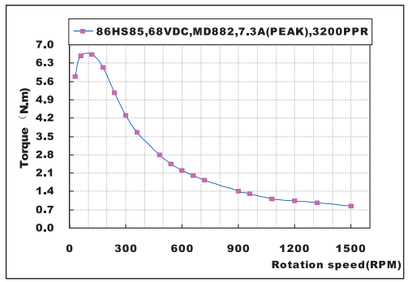
Stepper Motor: 57HS22 Output Current: 5.6 A(Peak)
Stepper Drive: MD556 Microstep: 2000 PPR
Input Voltage: 36 VDC Connection: Parallel

86HS45



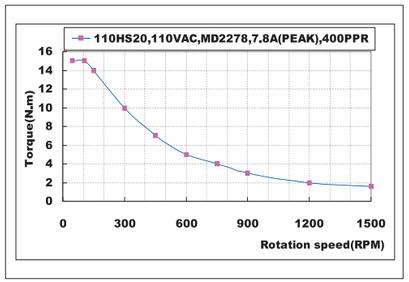
Stepper Motor: 86HS45 Output Current: 8.2 A(Peak)
Stepper Drive: MD882 Microstep: 2000 PPR
Input Voltage: 64 VDC Connection: Parallel

86HS85



Stepper Motor: 86HS85 Output Current: 7.3 A (Peak)
Stepper Drive: MD882 Microstep: 3200 PPR
Input Voltage: 68 VDC Connection: Parallel

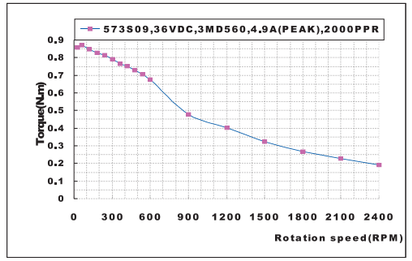
110HS20



Stepper Motor: 110HS20 Output Current: 7.8 A (Peak)
Stepper Drive: MD2278 Microstep: 400 PPR
Input Voltage: 110 VAC Connection: Parallel

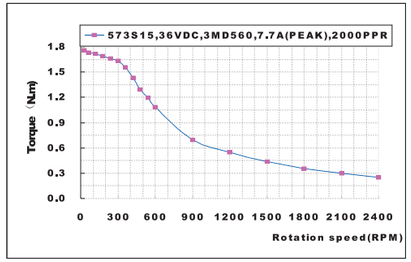
Speed-Torque Curves of 3-phase Stepper Motors

573S09



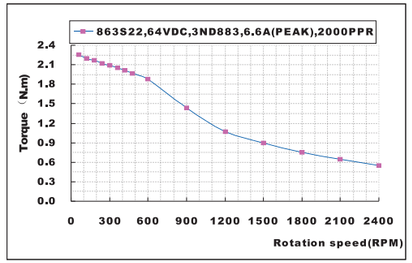
Stepper Motor: 573S09 Output Current: 4.9 A(Peak)
Stepper Drive: 3MD560 Microstep: 2000 PPR
Input Voltage: 36 VDC Connection: Delta

573S15



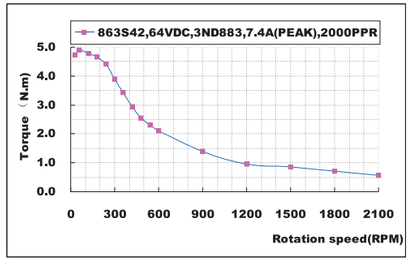
Stepper Motor: 573S15 Output Current: 7.7 A(Peak)
Stepper Drive: 3MD560 Microstep: 2000 PPR
Input Voltage: 36 VDC Connection: Delta

863S22



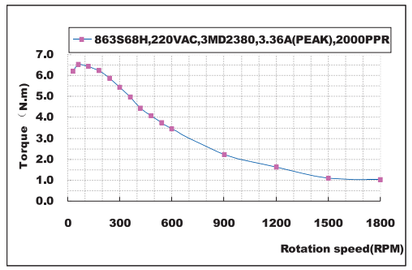
Stepper Motor: 863S22 Output Current: 6.6 A(Peak)
Stepper Drive: 3ND883 Microstep: 2000 PPR
Input Voltage: 64 VDC Connection: Delta

863S42



Stepper Motor: 863S42 Output Current: 7.4 A(Peak)
Stepper Drive: 3ND883 Microstep: 2000 PPR
Input Voltage: 64 VDC Connection: Delta

863S68H



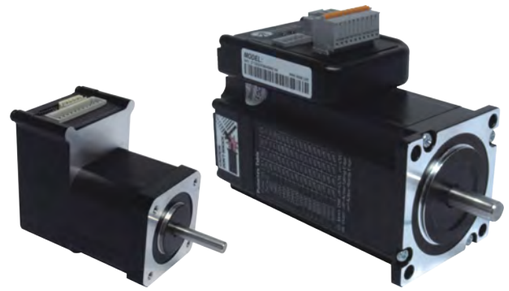
Stepper Motor: 863S68H Output Current: 3.36 A(Peak)
Stepper Drive: 3MD2380 Microstep: 2000 PPR
Input Voltage: 220 VAC Connection: Delta

Integrated Steppers

(Open-loop Stepper Systems)

Motor + Drive + Controller + Network

iST Series Integrated Steppers



Features

- **Highly Integrated,** Stepper motor + advanced DSP stepper drive
- **Extra-low** motor noise
- **Anti-Resonance** optimizes torque and nulls mid-range instability
- **Multi-stepping** allows a low resolution input to produce a higher microstep output for smoother system performance
- Options to set output current and microstep resolutions via DIP switch or software
- Command input of PUL/DIR and CW/CCW
- Over-current, over-voltage, short-circuit protections

Extra-low Motor Noise + **Lower Labor Cost** + **Lower Cable Cost** + **Save Mounting Space**

Introduction

Leadshine's iST series integrated steppers are one of the most compact stepper systems available on the market. An iST integrated stepper has a stepper motor and an advanced DSP stepper drive. At very compact size and with all components integrated, the iST series steppers can save mounting space, eliminate encoder connection and motor wiring time, reduce interference, and lower cable and labour cost. Owe to its advanced DSP stepper drive, the iST series integrated steppers offer high starting torque, high precision and smooth movement, and supe-low noise at low speed movement with no obvious resonance area. The drive takes step & direction commands, and is capable of outputting fault signals back to the master controller or external devices for complete system controls.

The iST series integrated steppers are suitable for applications require compact size, smooth movement, and extra low noise stepper systems, such as medical devices, dental mills, lab automation instruments, etc.

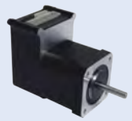
Part Number

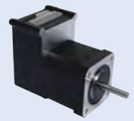
iST – □□ □□ – □ – □□□

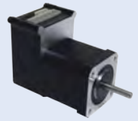
- **iST:** Integrated Stepper
- **Motor Frame Size:** 17: NEMA17 (42mm); 23: NEMA23 (57mm); 24: NEMA24 (60mm)
- **Holding Torque:** 03: 0.3 Nm; 10: 1.0 Nm; 30: 3.0 Nm; ...
- **Communication Type:** Blank: Step & Direction; R: RS485; C: CANopen
- **Custom or Special model number**

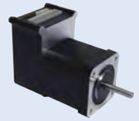
Overview

iST-17 (NEMA17)


iST-1703


iST-1704


iST-1705


iST-1706

iST-23 (NEMA23)


iST-2309


iST-2320

iST-24 (NEMA24)


iST-2412


iST-2418


iST-2424


iST-2430

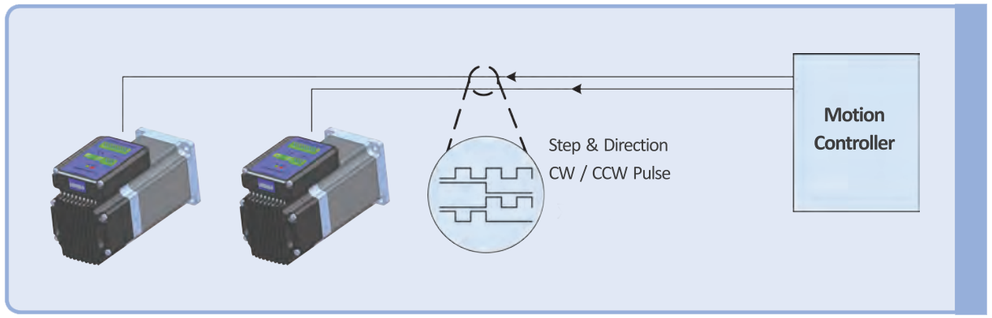
Specifications

Model		iST-17	iST-23	iST-24
Operating Voltage (VDC)		24	18 to 48	18 to 70
Holding Torque (Nm)		0.3, 0.4, 0.5 and 0.6	0.9 and 2.0	1.2, 1.8, 2.4 and 3.0
Operation Modes		Step & Direction, RS485 and CANopen		
Maximum Input Frequency (kHz)		500		
Protection Functions		Over-current, Over-voltage		
Inputs	Step & Direction	Step & Direction, Enable (differential)		
	RS485 / CANopen	4 digital inputs, 1 analog input (single-end)		
Outputs	Step & Direction	fault out (differential)		
	RS485 / CANopen	2 digital outputs (open collector)		
Storage Temperature		-20 ˚C to 80 ˚C		
Ambient Temperature		0 ˚C to 50 ˚C (Heat sink)		
Humidity		40%RH to 90%RH		

Please visit Leadshine's website at www.leadshine.com for the latest information about the iST series integrated steppers.

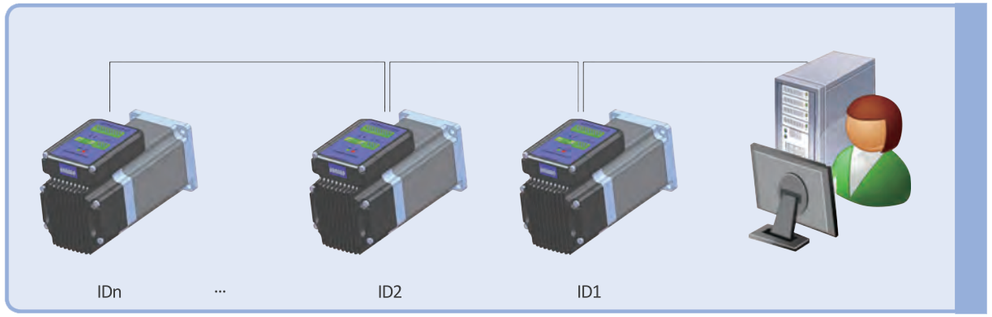
Operation Modes

1. Step & Direction



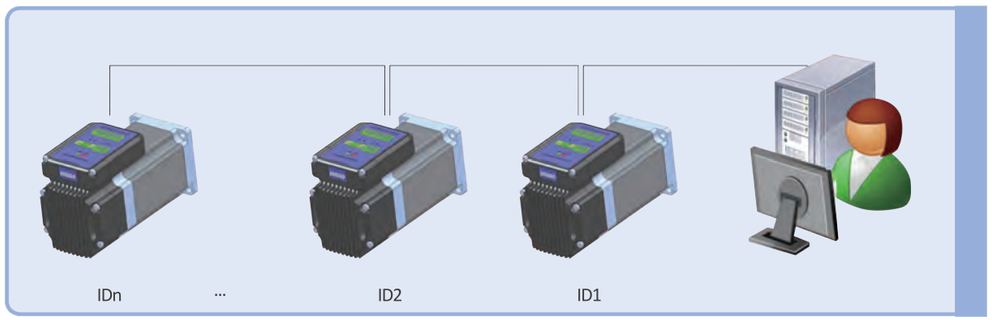
- Support step & direction and CW/CCW pulse commands
- Compatible with 5 to 24 V command signals

2. RS485



- One host up to 32 drives
- Can be used with either 2-wire (half-duplex) or 4-wire RS485 (full-duplex) implementation
- DLL is available for API function calling
- Easy to wire and build multi-axis systems

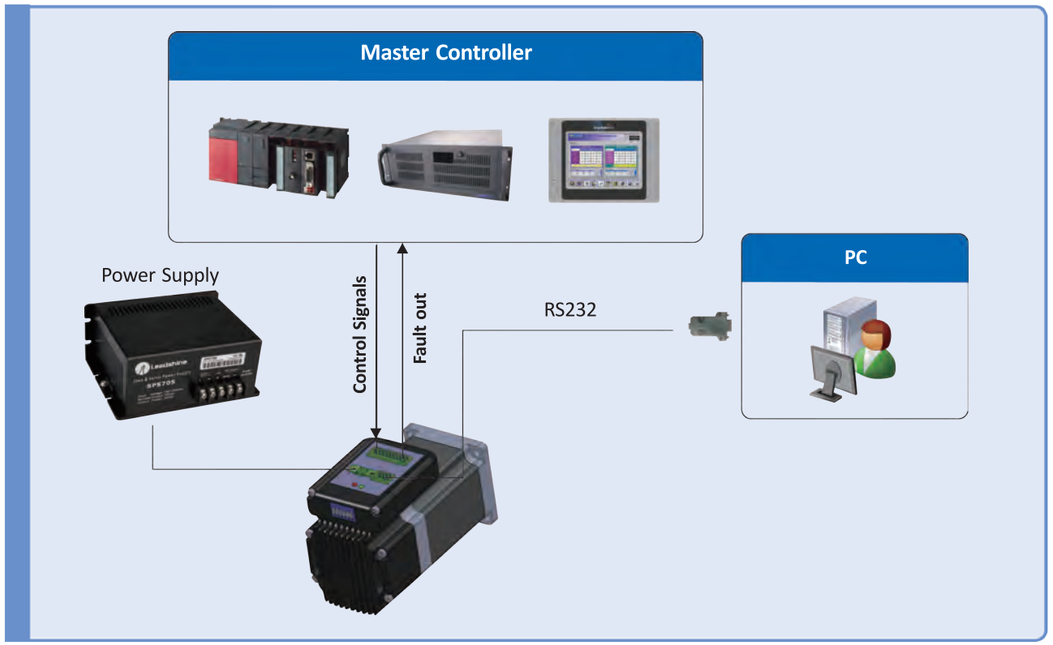
3. CANopen



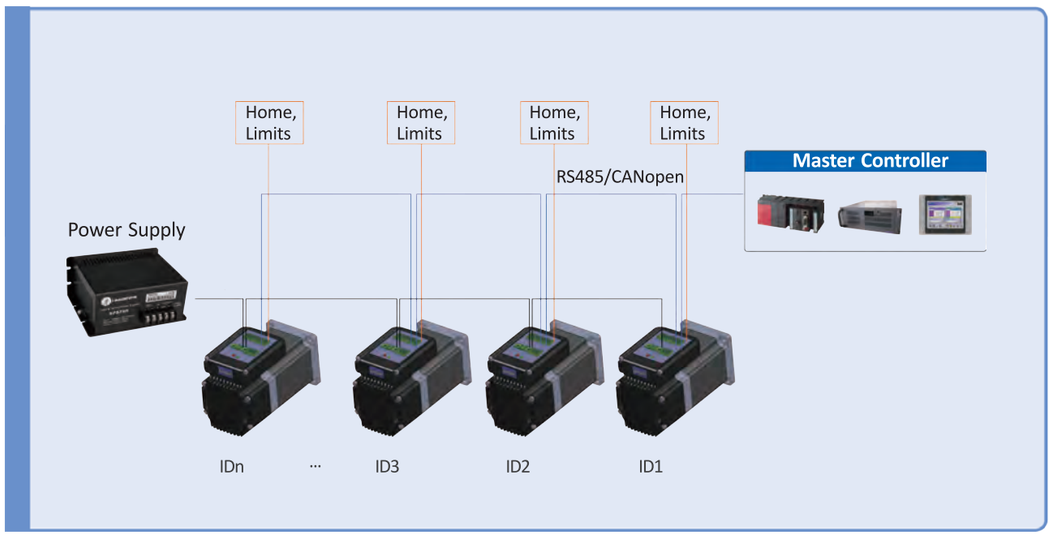
- One host up to 127 drives
- CANopen standards: CiA Standard 301 (DS301), CiA Standard 402 (DSP402)
- Up t 1 Mbit/sec speeds possible
- Easy to wire and build multi-axis systems

Typical System Configurations

1. Step & Direction

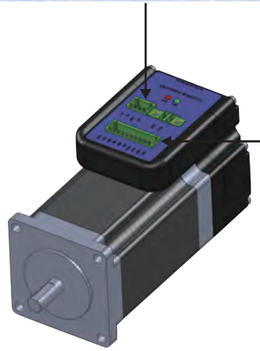


2. RS485 and CANopen



Pin Assignment

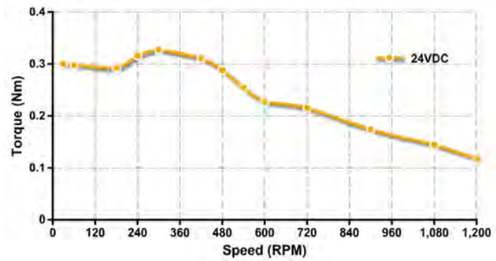
Model	Step&Direction	RS485	CANopen
iST-17	+5V TX GND RX GND	T+ T- R+ R- GND	CANH CANL CANH CANL GND
iST-23			
iST-24			



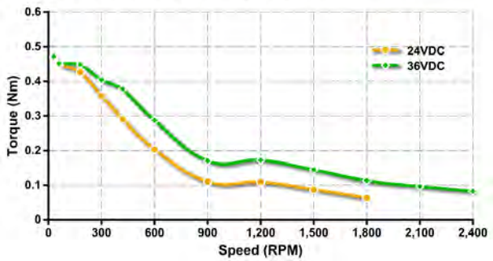
Model	Step&Direction	RS485/ CANopen
iST-17	PUL+ PUL- DIR+ DIR- ENA+ ENA- PEND+ PEND- ALM+ ALM- +VDC GND	IN1 IN2 IN3 IN4 OUT1 OUT2 VIN+ VIN- COM+ COM- +VDC GND
iST-23	PUL+ PUL- DIR+ DIR- ENA+ ENA- PEND+ PEND- ALM+ ALM-	IN1 IN2 IN3 IN4 OUT1 OUT2 VIN+ VIN- COM+ COM-
iST-24		

Speed-Torque Curves

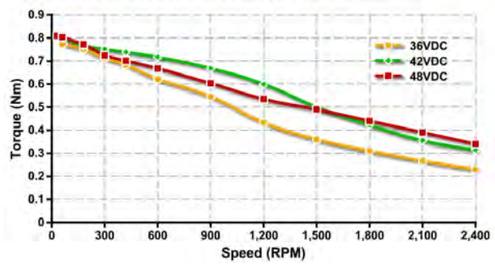
Model: iST-1703, Resolution:3200steps/rev., Peak Current: 1.4 A



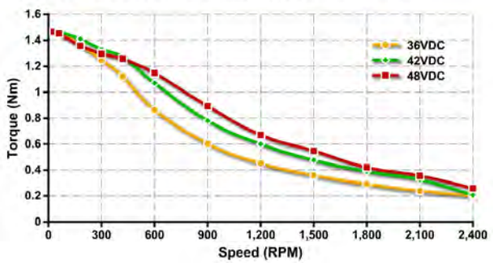
Model: iST-1706, Resolution:1600steps/rev., Current: Maximum



Model: iST-2309, Resolution: 1600steps/rev., Current: Maximum



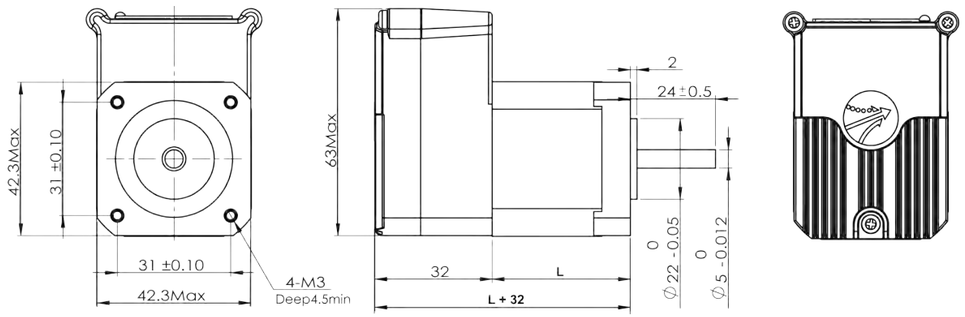
Model: iST-2320, Resolution:1600steps/rev., Current: Maximum



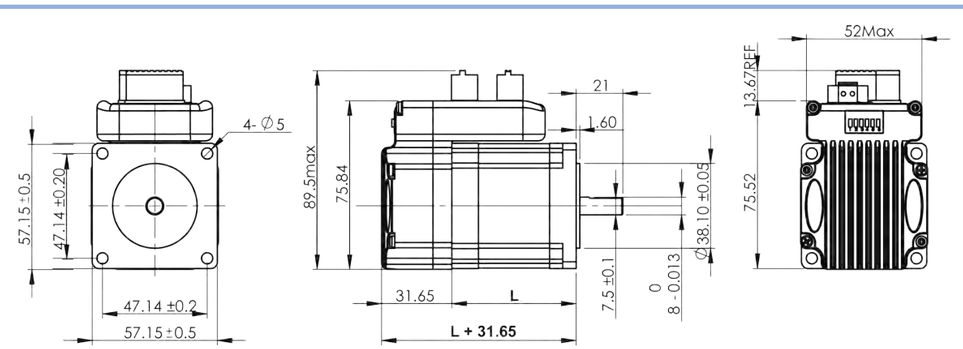
* Please contact Leadshine or visit www.leadshine.com for more speed-torque curves of other models.

Mechanical Specifications

iST-17



iST-23



Frame Size	Motor Body Length (mm)	Holding Torque (Nm)	Model
iST-17 (NEMA17)	L = 33	0.3	iST-1703-x
	L = 39	0.4	iST-1704-x
	L = 47	0.5	iST-1705-x
	L = 58	0.6	iST-1706-x
iST-23 (NEMA23)	L = 56	1.0	iST-2309-x
	L = 80	2.0	iST-2320-x
iST-24 (NEMA24)	L = 47	1.2	iST-2412-x
	L = 55	1.8	iST-2418-x
	L = 68	2.4	iST-2424-x
	L = 85	3.0	iST-2430-x

Companion Products

Stepper and Servo Power Supplies

SPS Series Unregulated Switching Mode Power Supplies

- Specifically designed to power stepper and servo drives
- High efficiency, compact size, light weight
- Input voltage 220VAC± 10% or 110VAC± 10% 50/60 Hz
- Short circuit, over-current, over-voltage and short-voltage protection

Electrical Specifications

Model	Output Voltage (V)	Output Current (A)	Input Voltage	Size (mm)	Weight (kg)
SPS407	42	7 (RMS)	220VAC±10%	132*104*60	0.638
SPS487	48	7 (RMS)			
SPS705	68	5 (RMS)			
SPS407-L	42	4.7 (RMS)	110VAC±10%	132*104*60	0.638
SPS487-L	48	4.0 (RMS)			
SPS705-L	68	3.0 (RMS)			

RPS Series Regulated Switching Mode Power Supplies

- Specifically designed to power stepper and servo drives
- High efficiency, compact size, light weight
- Input voltage 220VAC±10% or 110VAC± 10% 50/60 Hz
- Short circuit, over-current, over-voltage and short-voltage protection

Electrical Specifications

Model	Output Voltage (V)	Output Current (A)	Input Voltage	Size (mm)	Weight (kg)
RPS2410	24	10 (RMS)	220VAC±10% or 110VAC±10%	199*110*50	0.8
RPS369	36	9.7 (RMS)		215*113.6*50	0.88
RPS488	48	8.3 (RMS)		215*113.6*50	0.88
RPS608	60	8.5 (RMS)		261*102.4*65	1.13

PS Series Linear Power Supplies

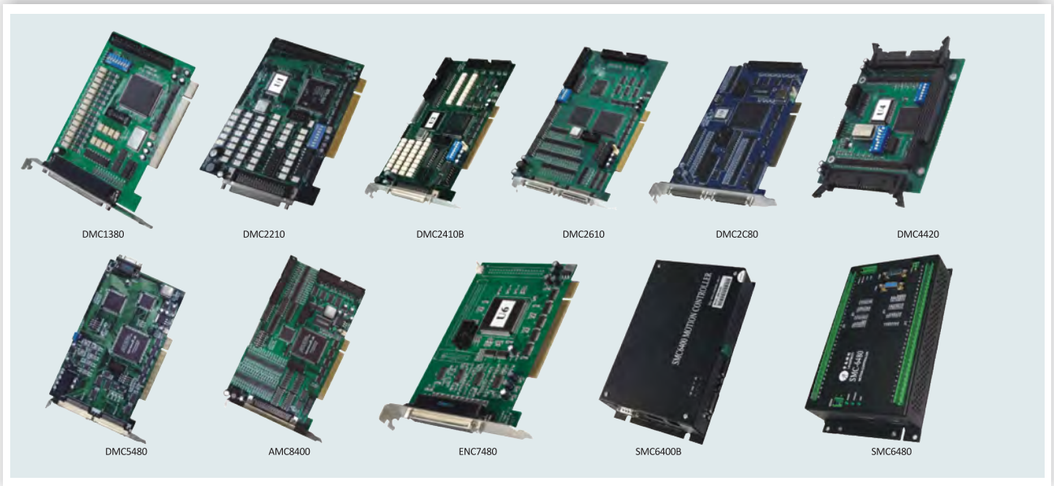
- Low cost and high reliability
- 3 main output plus 1 auxiliary output
- Short circuit and over-voltage protection
- Simple structure

Electrical Specifications

Model	Main DC Output	Auxiliary DC Output	Rated Power	Size (mm)	Weight (kg)
PS405-5	DC36V/5A	DC5V/1A	200	175*110*70	1.6
PS405-12	DC36V/5A	DC12V/1A	200		
PS408-5	DC36V/8A	DC5V/1A	300		
PS408-12	DC36V/8A	DC12V/1A	300		
PS804-5	DC68V/4A	DC5V/1A	300	175*110*70	2.0
PS804-12	DC68V/4A	DC12V/1A	300		
PS806-5	DC68V/6A	DC5V/1A	500	215*130*70	3.5
PS806-12	DC68V/6A	DC12V/1A	500		

Companion Products

Motion Controllers



Introduction

A variety of controllers handle motion control today. Depending on the application, a bus-based, stand-alone, or network motion controller may be needed. There are three popular data communication technologies or protocols, are ued in motion control: PC bus, such as peripheral component interconnect (PCI), fieldbus and Ethernet. Each has its place in industrial control .

PCI Bus.

PCI bus architecture offers the highest data transfer rate between peripheral devices and a PC — about 20 times greater than either Ethernet or fieldbus. There are several advantages to PC-based motion control including lower system cost, flexibility, continuous improvement of PC technology, easy to make an user-friendly software and ease of integration with other PC-based components, such as PC-based machine vision or data acquisition. A single platform can synchronize each of these pieces to one another, opening up new possibilities for automated inspection.

However, the PCI architecture offers only a bus-based approach. In applications where the motion controller has to handle functions independent of a PC or in cases where the machine doesn't have PC control, PCI architecture doesn't work. However, most fieldbus or Ethernet controllers can operate as stand-alone devices. Nevertheless, the trend toward integrating vision and motion system software can increase the use of the PC-based motion controllers among applications that need high-level precision.

Fieldbus.

Originally designed as a replacement for the 4-20mA analog control method, fieldbus is a generic term that covers many different industrial network protocols. Two of the most popular protocols are DeviceNet and Profibus. Generally, fieldbus protocols originate with specific programmable logic controller (PLC) manufacturers, and their performance and hardware interfaces differ. Software is a key component in the fieldbus standard, and such equipment often required custom software to make the systems work.

Ethernet.

Ethernet offers a variety of advantages for today's motion control needs. It's usually incorporated into a motion control system through a stand-alone controller connected to the PC or network using a standard Ethernet cable.

Using Ethernet TCP/IP can help eliminate the problems inherent with PCI architecture. Ethernet devices are stand-alone and outside the PC. And another important advantage of the Ethernet protocol is its inherent scalability.

Most supervisory control and data acquisition (SCADA) networks use TCP/IP over Ethernet as the network protocol and physical layer. If a motion controller must connect to a factory network through a network interface, Ethernet motion controller is a good choice.

Typical Controller Features

Controllers generate several types of motion profiles including point-to-point, linear/circular interpolation, and contouring.

Point-to-point motion is the most basic type of controlled motion. As the name implies, an axis is made to move from one position to another. Point-to-point motion is used in applications where complex trajectories are not important such as moving a slide to a certain position or indexing a conveyor belt.

Linear interpolation extends the point-to-point approach to include coordinated motion between two or more axes. Linear interpolation specifies a target destination in two or three dimensional space. Axes move in concert plotting a direct path to the specified destination.

Circular interpolation also involves coordination of multiple axes. Circular interpolation is a hardware feature of many controllers that creates smooth circular paths without chordal error by connecting several short linear moves or chords. The combination of circular and linear interpolation enables the creation of many complex trajectories.

Some paths, however, can not be defined using simple lines and arcs. Such complex paths require controllers that support contouring. Contouring can be used for special applications like complex CNC machining, earthquake simulation.

Leadshine's Motion Controllers

Since releasing its first motion controller in 1997, Leadshine has been developing new products to meet the needs of its customers in a wide range of industries. Today, thousands of Leadshine motion controllers are deployed around the world in hundreds of industries. These applications include PCB drilling and milling machines, coordinate measuring machines (CMM), laser welding machines, vision and photo composition automation, electronic manufacturing and assembly, measurement device, biotech sampling and handing, LCD manufacturing, robotics, electronic assembly and measurement equipment, AOI machines, screen printing machines, and so on.

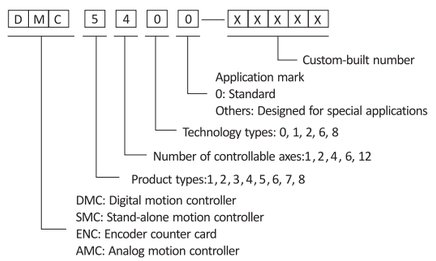
Leadshine is distinguished from others by providing motion controllers that are highly reliable, cost-effective, and easy-to-use. Leadshine's full line of motion controllers includes single and multi-axis, bus-based and stand-alone controllers. Available interface options for international markets include PCI bus, Ethernet, USB and RS232 for the moment. By using one ASIC microcomputer, Leadshine's controllers provide high speed performance and can handle many modes of motion such as point-to-point positioning, jogging, linear and circular interpolation, continuous interpolation and helix interpolation.

All of them are SMT processed with high reliability. They are suitable for stepping and digital servo control systems. Leadshine offers drivers, demo software, and documents to help the users to develop their own application software with G code or VB/VC/C++ Builder/LabVIEW in Window95/98/2000/NT/XP.

Selection Table (Visit www.leadshine.com for information about other motion controllers.)

Features \ Model	DMC1000B	DMC2410B	DMC5480	SMC6480	SMC3481	ENC7480
Number of Controllable Axes	4	4	4	4	4 (4 stepper drives Integrated)	4
Interfaces	PCI	PCI	PCI	Stand-alone, USB RS232, Ethernet	Stand-alone, CAN RS232	PCI
Pulse Output Frequency (Max)	1.2 MPPS	5 MPPS	8.0 MPPS	5.0 MPPS	1.0 MPPS	-
Encoder Input Frequency (Max)	-	4 MHz	6 MHz	-	-	6.5 MHz
Position Ranges	24-bit ± (8,388,608 pulses)	28-bit ± (134,217,728 pulses)	28-bit ± (134,217,728 pulses)	32-bit ± (2,147,483,648 pulses)	32-bit ± (2,147,483,648 pulses)	-
General purpose I/O	32 Inputs / 28 Outputs	20 Inputs / 20 Outputs	20 Inputs / 20 Outputs	32 Inputs / 24 Outputs	21 Inputs / 8 Outputs	32 Inputs / 32 Outputs
Linear Interpolation	2~4 axes	2~4 axes	2~4 axes	2~4 axes	2~4 axes	-
Circular Interpolation	Any 2 axes Software Interpolation	Any 2 axes High Speed Hardware Interpolation	Any 2 axes High Speed Hardware Interpolation	Any 2 axes High Speed Hardware Interpolation	Any 2 axes Software Interpolation	-
Continuous Interpolation	-	Yes	Yes	Yes	Yes	-
Acceleration and Deceleration	Equal	Equal or Unequal	Equal or Unequal	Equal or Unequal	Equal or Unequal	-
Encoder Counter	-	28-bit ± (134,217,728 pulses)	32-bit ± (2,147,483,647 pulses)	28-bit ± (134,217,728 pulses)	-	28-bit ± (134,217,728 pulses)
Manual Pulser Input	-	100 KHz (Max)	100 KHz (Max)	100 KHz (Max)	-	-
Index Signal Input	-	Yes	Yes	Yes	-	Yes

Part Number



Typical motion control system (1 axis)