

EM503 2-phase Digital Stepper Drive

20-50V, 0.21-3A, Sensorless Stall Detection, Pre-Matching Motor



- **Sensorless stall detection** eliminates cost of feedback devices and time of cable connection
- **Super-low** motor noise offers excellent quietness
- **User password 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
- Options to set output current and microstep resolutions via DIP switch or software
- Command input of PUL/DIR or CW/CCW, Microstep from 1 to 512
- Automatic idle-current reduction and reduction rate is software configurable
- Over-current, over-voltage, short-circuit protections besides sensorless stall detection
- Fault out prevents damages to your machines or the materials

Descriptions

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 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 or 3-phase stepper motors from NEMA8 to NEMA42.

Applications

EM503 stepper drives are suitable for driving a wide range of 2-phase stepper motors, from NEMA frame size 14 to 23. Typical applications include CNC routers, laser cutters, laser markers, medical equipments, X-Y tables, measurement equipments, etc.

Specifications

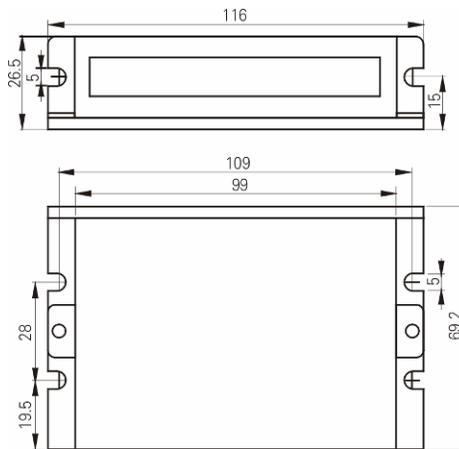
Electrical Specifications

Parameter	Min	Typical	Max	Unit
Input Voltage	20	36	50	VDC
Pulse Input Frequency	0	-	200	kHz
Logic Signal Current	7	10	16	mA
Isolation Resistance	500	-	-	MΩ

Operating Environment

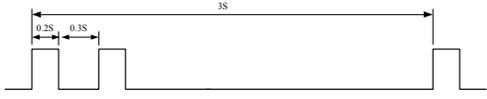
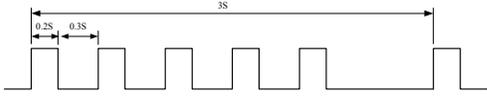
Cooling	Natural Cooling or Forced cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Storage Temperature	-20°C – 65°C (-4°F – 149°F)
	Ambient Temperature	0°C – 50°C (32°F – 122°F)
	Humidity	40%RH – 90%RH
	Operating Temperature (Heat Sink)	70°C (158°F) Max
	Vibration	10-55Hz, 0.15mm/s
Storage Temperature	-20°C – 65°C (-4°F – 149°F)	
Weight	209 g (7.37 oz)	

Mechanical Specifications



Protection Indications

The green indicator turns on when power-up. When drive protection is activated, the red LED blinks periodicity to indicate the error type

Priority	Time(s) of Blink	Sequence wave of RED LED	Description
1st	1		Over-current protection
2nd	2		Over-voltage protection
3rd	5		Motor Stall Protection

Connectors and Pin Assignment

The EM503 has two connectors, connector for control signals connections, and connector for power and motor connections.

Control Signal Connector			
Pin	Name	I/O	Description
1	PUL+	I	<u>Pulse signal</u> : In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active (software configurable, see EM drives software operational manual for more detail); In double pulse mode (software configurable), this input represents clockwise (CW) pulse, active both at high level and low level. 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. For reliable response, pulse width should be longer than 10 μ s. Series connect resistors for current-limiting when +12V or +24V used. The same as DIR and ENA signal.
2	PUL-	I	
3	DIR+	I	<u>Direction Signal</u> : In single-pulse mode, this signal has low/high voltage levels, representing two directions of motor rotation. In double-pulse mode (software configurable), this signal is counter-clock (CCW) pulse, active both at high level and low level. For reliable motion response, DIR signal should be ahead of PUL signal by 5 μ s at least. 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction. The direction signal's polarity is software configurable.
4	DIR-	I	
5	ENA+	I	<u>Enable signal</u> : This signal is used for enabling/disabling the driver. In default, high level (NPN control signal) for enabling the driver and low level for disabling the driver. Usually left UNCONNECTED (ENABLED) . Please note that PNP and Differential control signals are on the contrary, namely Low level for enabling. The active level of ENA signal is software configurable.
6	ENA-	I	
7	FLT+	O	<u>Fault Signal</u> : OC output signal, active when one of the following protection is activated: over-voltage, over current, short circuit and stall-error. This port can sink or source 20mA current at 24V. In default, the resistance between FLT+ and FLT- is low impedance in normal operation and become high when EM503 goes into error. The active level of fault signal is software configurable. See EM drives software operational manual for more detail.
8	FLT-	O	

Power and Motor Connector			
Pin	Name	I/O	Description
1	A+	O	Motor Phase A+
2	A-	O	Motor Phase A-
3	B+	O	Motor Phase B+
4	B-	O	Motor Phase B-
5	+Vdc	I	Power Supply Input (Positive), 20-45VDC recommended, leaving rooms for voltage fluctuation and back-EMF.
6	GND	GND	Power Ground (Negative)

RS232 Communication Port

It is used to configure the peak current, microstep, active level, current loop parameters and anti-resonance parameters. See EM driver's software operational manual for more information.

RS232 Communication Port			
Pin	Name	I/O	Description
1	NC	-	Not connected.
2	+5V	O	+5V power only for STU (Simple Tuning Unit).
3	TxD	O	RS232 transmit.
4	GND	GND	Ground.
5	RxD	I	RS232 receive.
6	NC	-	Not connected.

DIP Switch Settings

Dynamic Current

Peak	RMS	SW1	SW2	SW3
Default	Default	on	on	on
1.46A	1.04A	of	on	on
1.91A	1.36A	on	off	on
2.37A	1.69A	off	off	on
2.84A	2.03A	on	on	off
3.31A	2.36A	of	on	off
3.76A	2.69A	on	off	off
4.20A	3.00A	off	off	off

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

Idle-Current

SW3 determines whether the idle current is reduced automatic or remains the same as the dynamic current setting.

	ON	OFF
SW4	The motor idle current reduces automatically when there is no pulse applied to EM503.	The motor idle current is the same as the dynamic current when there is no pulse applied to EM503.

Auto-Configuration

Switch SW4 two times in two seconds to auto-configure the drive's current loop parameter. That is, OFF-ON-OFF or ON-OFF-ON. During Auto-configuration, motor parameters are identified and the EM drive's current loop parameters are calculated automatically. The motor shaft will vibrate a little during the process of Auto-configuration which takes about 1 to 3 seconds.

Microstep Resolution

Steps/Revolution	SW5	SW6	SW7	SW8
Software Configured (Default 200)	on	on	on	on
400	off	on	on	on
800	on	off	on	on
1600	off	off	on	on
3200	on	on	off	on
6400	off	on	off	on
12800	on	off	off	on
25600	off	off	off	on
1000	on	on	on	off
2000	off	on	on	off
4000	on	off	on	off
5000	off	off	on	off
8000	on	on	off	off
10000	off	on	off	off
20000	on	off	off	off
25000	off	off	off	off

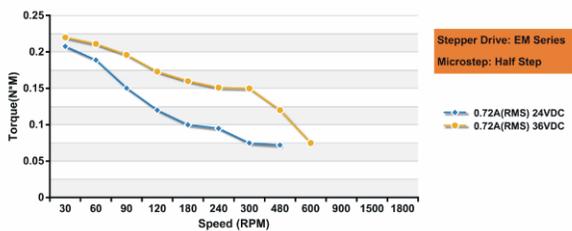
Motor Selection and Pre-matching Leadshine Motor

There is a rotation switch used for the motor selection.

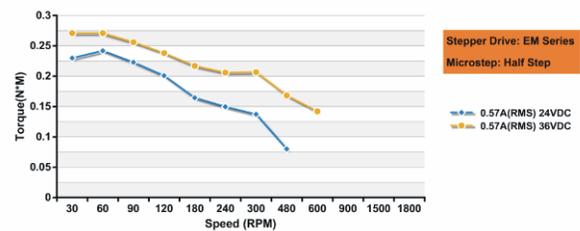
Matching Motor	Connection	Code	Description
39HS02	-	0	Select pre-matching Leadshine stepper motor. EM503 has been tuned for these motors.
42HS03	Parallel	1	
57HS09	Parallel	2	
57HS13	Parallel	3	
57HS22	Parallel -	4	
86HS35	Parallel	5	
42HS03	Serial	6	
57HS04	Serial	7	
57HS09	Serial	8	
86HS13	Serial	9	
86HS22	Serial	A	
86HS35	Serial	B	
Custom1	-	C	Select non-Leadshine motor. EM503 needs tuning either by Auto-configuration or the PC software. There are up to four custom positions for customer selection.
Custom2	-	D	
Custom3	-	E	
Custom4	-	F	

Speed Torque Curve for Pre-matching Leadshine Motor

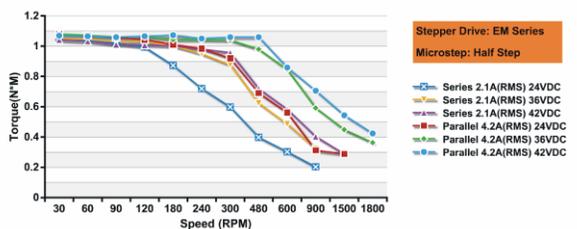
Stepper Motor: 39HS02



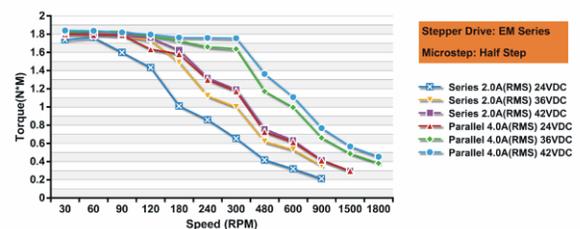
Stepper Motor: 42HS02



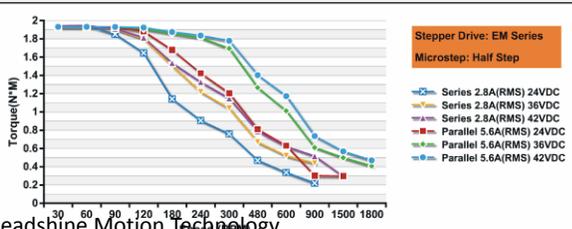
Stepper Motor: 57HS09



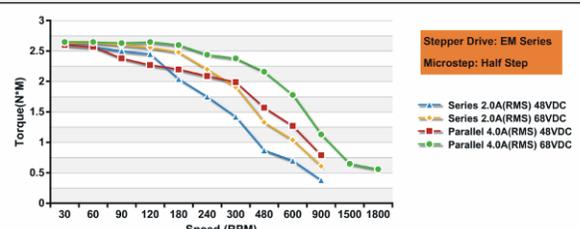
Stepper Motor: 57HS13



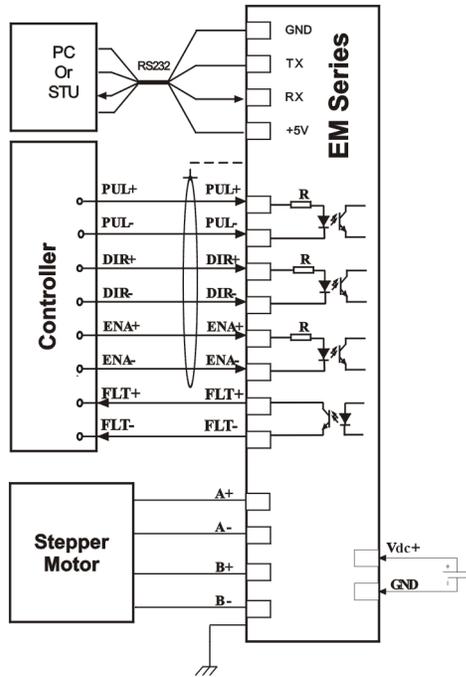
Stepper Motor: 57HS22



Stepper Motor: 86HS35



Typical Connections

Differential Control Signal

NPN Control Signal
