Stepper Motor Driver EM542S

1. Features:

- Anti-resonance for optimum torque, extra smooth movement, low motor heating and noise generation
- Supply voltage +20 to +50 VDC
- Eight settings for output current from 1.0 - 4.2 A via DIP switch, or 0.5 - 4.2 A via software (increase by 0.1 A)
- No-load current reduction to 50 % or 90 % selectable via SW4
- Auto-tuning for adaptation to a variety of NEMA 17, 23, 24 stepper motors
- Step and direction control (PUL/ DIR) or CW/ CCW (double pulse)
- Pulse input frequency up to 200 kHz (500 kHz optional)
- Configurable control command smoothing to reduce motor vibrations
- Microstep resolution: 16 setting 200 - 25,600 via DIP switch, or 200 - 51,200 via software (in steps of 200)
- Soft start without "jolt" when switching on
- Control signal inputs 5 V or 24 V optically decoupled
- Output signal for fault or brake
- Protection against overvoltage, overcurrent and contact faults in the motor wiring

2. Description:

The EM542S is a versatile fully digital driver for high voltage, based on a DSP controller with state-of-the-art control software. It brings a unique level of smoothness to the system, providing optimum torque and zero mid-range instability. Motor self-test parameters and auto-setup technology provide easy handling and better customization depending on the use of different motors. The driven motor can be operated in quieter operation, with less heating, with smoother movement than most comparable controllers. It is suitable for 2-phase and 4-phase hybrid stepper motors. Its unique features make the EM542S an ideal solution for applications that require high performance.

3. Applications:

The EM542S stepper motor driver is designed to operate 2-phase or 4-phase NEMA 17, 23 and 24 hybrid stepper motors. It can be used in many industries (CNC machines, electronics, medical, automation, packaging...) for applications such as CNC routers, milling machines, plasma, laser cutters, factory assembly lines, vending machines, etc. With its excellent performance, simple design and easy set-up, the EM542S is ideal for many applications with step and direction control.

4. Electrical Specification:

Parameters	Min.	Typ.	Max.	Unit
Output current	0,5	-	4,2 (3,0 eff.)	A
Input voltage	+20	+24 - +48	+50	VAC (VDC)
Logical signal current	7	10	16	mA
Input frequency	0	-	200	kHz
Minimum pulse width	2.5			µs
Minimum pulse width for direction change	5.0			µs
Isolation Resistance	500			MΩ

5. Further Specifications:

Parameters	Min.	Typ.	Max.
Micro steps	200		25600 (51200*)
Pulse / Direction (PUL / DIR)		X	
Double Puls (CW / CCW)		X	
NEMA Sizes	17		24
Motor Type Mecheltron	42BYGH-XXX		60BYGH-XXX
Weight		0.23 kg	

*via software
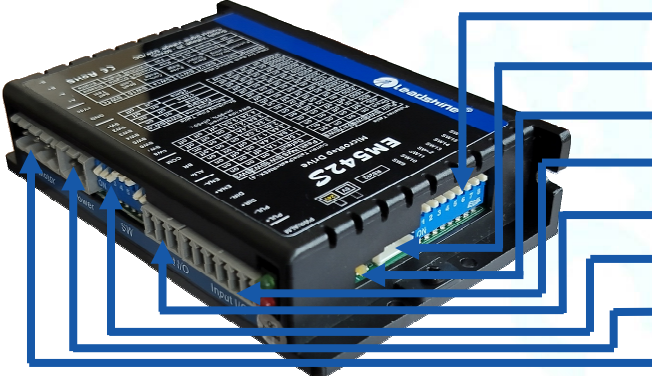
6. Environment:

Cooling	Natural or Forced cooling	
Operating Environment	Environment	Avoid dust, oil and corrosive gases
	Ambient temperature	0 °C - 40 °C
	Humidity	40 % RH to 90 % RH
	Operating temperature	max. 90 ℃
Storage Temperature	-20 °C to 65 °C	

7. Pin and DIP-Switch-Positions

S2: DIP Switch terminal
P5: RS232 programming connection
S3: Control signal voltage selector
P1: Control signal inputs
P2: Error and brake outputs
S1: DIP Switch terminal
P3: Power connection
P4: Motor connection

8. DIP Switch Settings:

Dynamic Current Settings (SW1-3) (S1)				
Peak Current	**RMS Current**	**SW 1**	**SW 2**	**SW 3**
1,00 A	0,70 A	On	On	On
1,50 A	1,10 A	Off	On	On
1,90 A	1,40 A	On	Off	On
2,40 A	1,70 A	Off	Off	On
2,80 A	2,00 A	On	On	Off
3,30 A	2,40 A	Off	On	Off
3,80 A	2,70 A	On	Off	Off
4,20 A	3,00 A	Off	Off	Off

Idle Current Setting (SW4) (S1)

SW4 of the EM542S is used to set the percentage of the output current when the motor is at a standstill. The no-load current percentage is set to 50% in the OFF position and 90% in the ON position. If the driven stepper motor is idle for 0.4 seconds (no movement), the output current of the EM542S is automatically reduced to the configured percentage

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Micro Step Resolution Setting (SW5-8) (S1)

Each EM542S has 16 micro step settings that can be configured via DIP switches SW5 to SW8. See the table below for details. When set to default, the micro step can be set via Leadshine ProTuner Software.

Micro Step	Steps/rev. (1,8°)	SW 5	SW 6	SW 7	SW 8
Default		On	On	On	On
1/2	400	Off	On	On	On
1/4	800	On	Off	On	On
1/8	1600	Off	Off	On	On
1/16	3200	On	On	Off	On
1/32	6400	Off	On	Off	On
1/64	12800	On	Off	Off	On
1/128	25600	Off	Off	Off	On
1/5	1000	On	On	On	Off
1/10	2000	Off	On	On	Off
1/20	4000	On	Off	On	Off
1/25	5000	Off	Off	On	Off
1/40	8000	On	On	Off	Off
1/50	10000	Off	On	Off	Off
1/100	20000	On	Off	Off	Off
1/125	25000	Off	Off	Off	Off

Smoothing-Filter Settings (SW9-10) (S2)

The EM542S offers an advanced function for optimizing control commands. The input pulse from the pulse generator (e.g. controller or PLC) is converted into an S-curve acceleration. This ensures smoother movement and enables a higher starting frequency, especially in demanding operating situations. The conversion is achieved by adding a filter time, which can be configured using switches SW9 and SW10. Details on the configuration can be found in the following table.
Attention: The value for the filter time must be set to the same value for each EM542S in multi-axis operation!

Filter Time	SW 9	SW 10
0 ms (disabled)	On	On
6 ms	Off	On
12 ms	On	Off
25 ms	Off	Off

No Auto-Tuning (SW 11) (S2)

The EM542S can configure itself to best suit the stepper motor being driven. This function may need to be deactivated for some applications or if a specially developed stepper motor is to be controlled. To do this, set the DIP switch SW11 to the ON position and the auto-tune function will be deactivated.

Alarm Output Setting (SW12) (S2)

The DIP switch SW12 is used to set the status of the alarm output (fault output). In the OFF position (factory setting), the resistance between ALM and COM is low in normal operation and increases when the driver switches to the error state. If SW12 is set to ON, the resistance is high in normal operation and decreases in the event of an error.

Activated Pulse Edge Setting (SW13) (S2)

OFF (factory setting): Pulse on rising edge.
ON: Pulse on falling edge.
This setting must match the pulse generator. If stepper motors lose steps, test a changeover of SW13.

Control modes Settings (SW14) (S2)

The DIP switch SW14 is used to configure the control mode. The factory setting is single pulse (PUL/DIR) control. By setting to **ON**, the control model is switched to double pulse control (CW/CCW).

Shaft lock settings (SW15) (S2)

Use DIP switch SW15 to set the shaft lock mode when EM542S is disabled (refer to the ENA+ and ENA- explanation of how to disable EM542S). Set the switch to OFF (default setting) to prevent the motor shaft from locking (free running) when the drive is deactivated. Set it to the **ON** position to block the motor shaft.
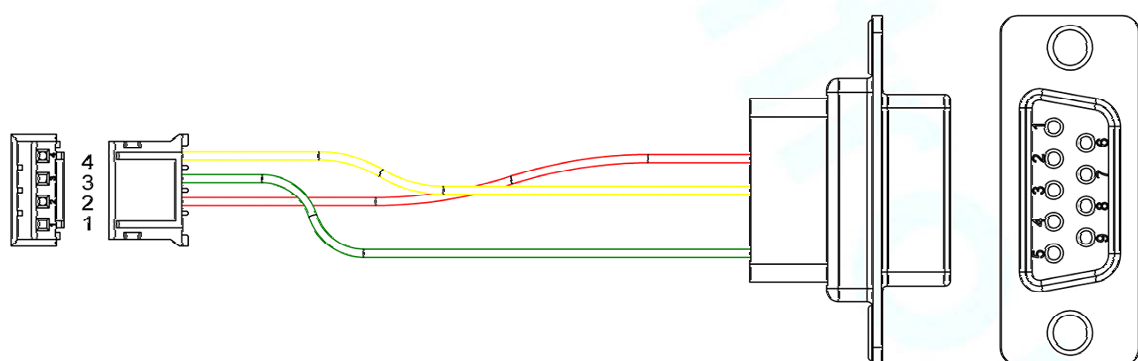
Self-Test Setting (SW16) (S2)

The EM542S is equipped with a self-test for testing and system diagnostics purposes. Each time SW16 is switched to the **ON** position, the frequency inverter automatically rotates the driven stepper motor back and forth for one turn in each direction. Set this switch to the **OFF** position for normal operation.
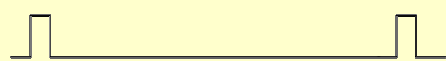
9.Pin Assignment:

Pin	I / O	Details
Control terminal connector (P1)		
PUL+	I	(1) Optically isolated, high level 4.5-5V or 24V (selectable via S3, factory setting 24V), low voltage 0-0.5V
PUL -	I	(2) Maximum 200 KHz input frequency
DIR +	I	(3) The width of the PUL signal is at least 2.5µs, the duty cycle is recommended at 50% (4) PUL/DIR or double pulse (CW/CCW); is set with DIP switch SW14 (5) The DIR signal must precede the PUL signal by at least 5 µs in PUL/DIR mode.
DIR -	I	(6) The activated edge of PUL and DIR is set with DIP switch SW13.
ENA +	I	(1) Optically isolated, differential. (2) Deactivation of the actuator by 4.5-5.0V or 24V (selectable via S3); activation of the actuator by 0-0.5V
ENA -	I	(3) The ENA signal must precede the DIR signal by at least 5µs in single pulse mode.
Fault and brake output connector (optional) (P2)		
ALM	O	(1) Maximum 30V/100mA output
BR	O	(2) Current sinking or current supplying (3) The resistor between ALM and COM- is low impedance by default (configurable via DIP switch SW12) and becomes high impedance when the driver goes into error state.
COM-	O	
Power Connector (P3)		
GND	I	Connect to the ground connection of the power supply unit.
+V DC	I	Connect to the positive connection of the power supply. Recommended 24-48V DC
Motor Connector (P4)		
A+	O	Motor A+ Connection
A-	O	Motor A- Connection
B+	O	Motor B+ Connection
B-	O	Motor B- Connection
RS232-Connection (P5)		

The EM542S has an RS232 interface for changing the drive parameters, but this is only used for setting the parameters (e.g. via a PC with ProTuner software) and not for controlling the device.

(schematisch)

JST-PH-04p-Connector-male		D-SUB9-Connector-female
Pin	Signal	Pin
4	RxD	3
3	GND	5
2	TxD	2
1	NC	-

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9. Protection indicator:

Prio.	Times flashing	Sequence of the red LED	Description
1.	always on		The drive was short-circuited or burned out
2.	1		The overcurrent protection is activated if the peak current exceeds the limit value.
3.	2		Overvoltage protection activated.

10. Mechanical Dimensions:

118
112
25,50
4,50
14
112
4 × Ø3,50
75,50
47,80
25,30
(Unit: mm)
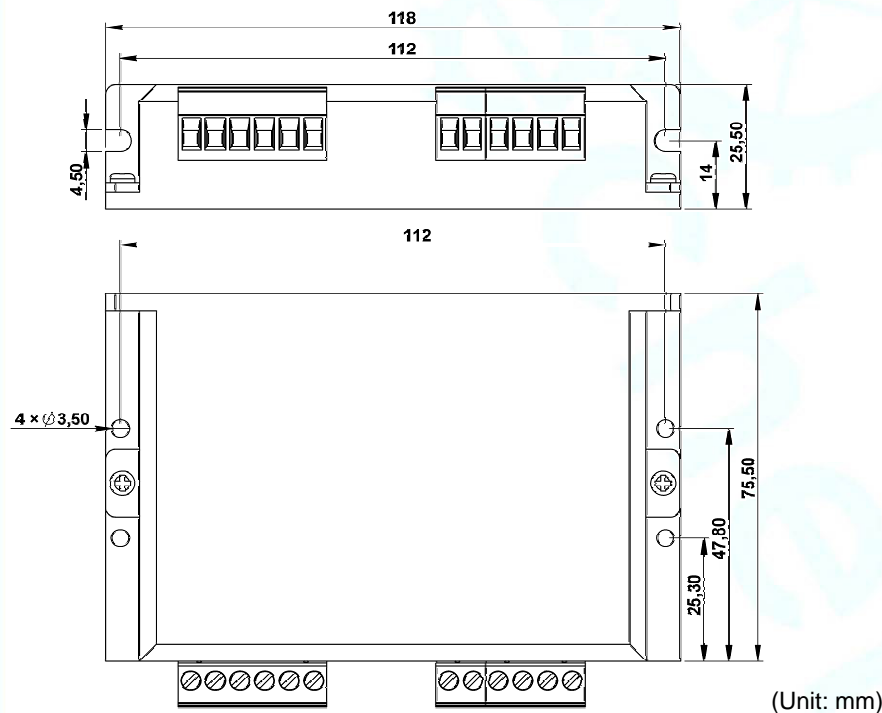
11. Wiring:

A complete system consists of stepper motor, stepper motor driver, power supply unit and controller (pulse generator). The EM542S can accept differential or unbalanced control signals (PUL/DIR and ENA) via the P1 connection. It is recommended to connect an EMI line filter between the power supply and the driver to increase the noise immunity of the driver in noisy environments.

Controller — Drive

Step — VCC
Direction — VCC
Enable — VCC

PUL+ 1
PUL- 2
DIR+ 3
DIR- 4
ENA+ 5
ENA- 6

Common-Anode

Controller — Drive

VCC
Step
Direction
Enable

PUL+ 1
PUL- 2
DIR+ 3
DIR- 4
ENA+ 5
ENA- 6

Common-Cathode