

Adtech (Shenzhen) Technology Co., Ltd.

## Q2BYG403MD Driver

### User's Manual



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**Chapter I. Safety Notice**

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To avoid personal injury and property damage, please read the following safety information carefully before testing and using the Driver. Please strictly follow the safety measures below:

- Please read the User's Manual carefully, and follow the safety rules strictly.
- If the input voltage of Q2BYG403MD is higher than 36V, please check whether voltage of the Driver terminal is in safe range with a multimeter after the power is cut off, and then connect the wire or check, or else it may cause electric shock.
- Do not connect the wires or insert/remove the terminal when the Driver and motor are working, or else it may cause electric shock.
- Do not open the shell of the Driver after the power supply is connected or when the Driver is running, or else it may cause electric shock.
- To avoid personal injury or property damage, please ask qualified personnel to operate the Driver.
- Please follow the technical specification and electrical installation standard during the installation. The Driver must be grounded properly, and the cross-sectional area of the grounding cable should be at least 1.25mm<sup>2</sup>.
- Do not put any object in the Driver, or else it may damage the Driver.
- If the Driver has any failure, please send it to the maintenance center. Disassembling the Driver without authorization or improper operation may damage the Driver. It will violate the warranty if the user opens the Driver shell without authorization.
- To dispose of the Driver, please follow local regulations on industrial waste disposal to avoid environment pollution.

※ Statement:

- ✧ If this Driver is applied to the machinery and equipment directly related to personal safety (nuclear power control, medical equipment, truck, train, aircraft, entertainment and security equipment), it is required to install protection equipment to avoid personal injury.
- ✧ Electronic equipment isn't permanently reliable. The equipment must have sufficient safety measure, in order to protect the safety of personnel and equipment in case of Driver failure. The customer shall assume the losses due to machine failure or

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misoperation if the Driver is installed or used by the customer.

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## **Chapter II. Product Overview**

### **2.1 Introduction**

Q2BYG403MD is a two-phase digital hybrid step motor Driver basing on AC servo control. It is a new generation digital step motor Driver that integrates advanced DSP control chip and unique control circuit. This design can increase the integrity significantly, and reduce the size and weight. The advanced current control algorithm is used to make it have excellent performance, low vibration, low noise, less heat radiation and high speed large torque output. Integrate undervoltage, overvoltage and overcurrent protection, and the reliability is further improved. In addition, this product also integrates RS-232 serial port communication. Through PC installed with Driver software, the user can set the parameters and test, which simplifies the production and test process.

### **2.2 Features**

- Allow driving 4, 6, 8 wires two-phase step motor
- Ultra low vibration noise
- Internal software uses micro-segmentation technology, which can obtain high segmentation effect in low speed low segmentation
- Integrate EMF compensation function, and the torque is constant when the speed is increased
- Parameter self-tuning
- Current setting is convenient, and allow selecting freely between 1.2A and 4.2A
- High precision segmentation, 1~256 optional
- Pulse response frequency is up to 200KHz
- Serial port communication, parameter is real-time adjustable, meeting high performance requirement
- In still state, the current decreases by half automatically, and the maximum driving current is 4.2A/phase
- Integrate protection for undervoltage, overvoltage, short circuit, etc.

### **2.3 Application**

The Driver is suitable for a variety of small and medium sized automation equipment and instruments, such as: dispenser, marking machine, cutting machine, engraving machine, labeling machine, plotter, automatic assembly equipment, numerical control machine tool, etc. The application is especially good in the equipment that users expect low

vibration, low noise and high-speed.

## Chapter III. Product Parameters and Installation

### 3.1 Parameters

**Table 1: Electrical Parameters Table**

Parameter	Description
Input voltage	Single power supply 24V~40VDC
Overvoltage protection point	45VDC
Undervoltage protection point	18VDC
Phase current (A)	1.2, 1.6, 2.0, 2.4, 2.8, 3.0, 3.6, 4.2
Subdivisions	1, 2, 4, 8, 16, 32, 64, 128, 256, 5, 10, 25, 50, 100, 200
Control mode	Pulse + direction
Type of protection circuit	Undervoltage, overvoltage and overcurrent protection

**Table 2: Operation Environment and Parameters Table**

Cooling mode		Natural air cooling
Operation environment	Occasion	Avoid oil mist, metal powder and corrosive gas
	Environment humidity	30%~90%
	Environment temperature	0℃~50℃
	Vibration	5.9m/s <sup>2</sup> max
Weight		250g
Size		118×5×34mm

## 3.2 Port description

### (1) Description of control signal interfaces

Signal	Function	Description
DR+	Direction control signal	High/low voltage level state; requirement: low voltage level 0~0.5V, high voltage level 4~5V, corresponding to two directions of the motor The initial running direction of the motor depends on the wiring of the motor, and it can be changed by interchanging any phase.
DR-		
PU+	Pulse control signal	Rising edge is valid; every time the pulse signal rises from low to high, the motor runs one step; requirement: low voltage level 0~0.5V, high voltage level 4~5V, pulse width $\geq 1.5\mu s$
PU-		
EN+	Enable control signal	Used to enable/release motor; EN+ is connected to +5V, EN- is grounded, the Driver will cut off the current of the motor and enter the free state; at this moment, the temperature rise and heating of the Driver and the motor will reduce. If this function isn't used, make the signal terminal float.
EN-		

### (2) Motor and power interfaces

Signal	Name	Description
DC-	DC power grounding	Power supply grounding terminal
DC+	DC power positive terminal	Positive terminal of the power supply, single phase DC power supply might be any value between 24V and 45VDC, and the recommended value is 36VDC.
B-	B phase winding	Motor B phase winding coil
B+		
A-	A phase winding	Motor A phase winding coil
A+		





### (3) RS-232 communication interface

Allow connecting to PC serial port through dedicated cable, modify and save parameters, and monitor the running status through dedicated upper computer commissioning software.

PIN No.	Name	Symbol	Application
1	5V power supply positive terminal	+5V	The internal power supply of the Driver is +5V, and is reserved for external debugger
2	SCI transmitter terminal	TXD	Serial data transmitter terminal
3	SCI receiver terminal	RXD	Serial data receiver terminal
4		NC	Reserved
5	5V power supply grounding	GND	Power point

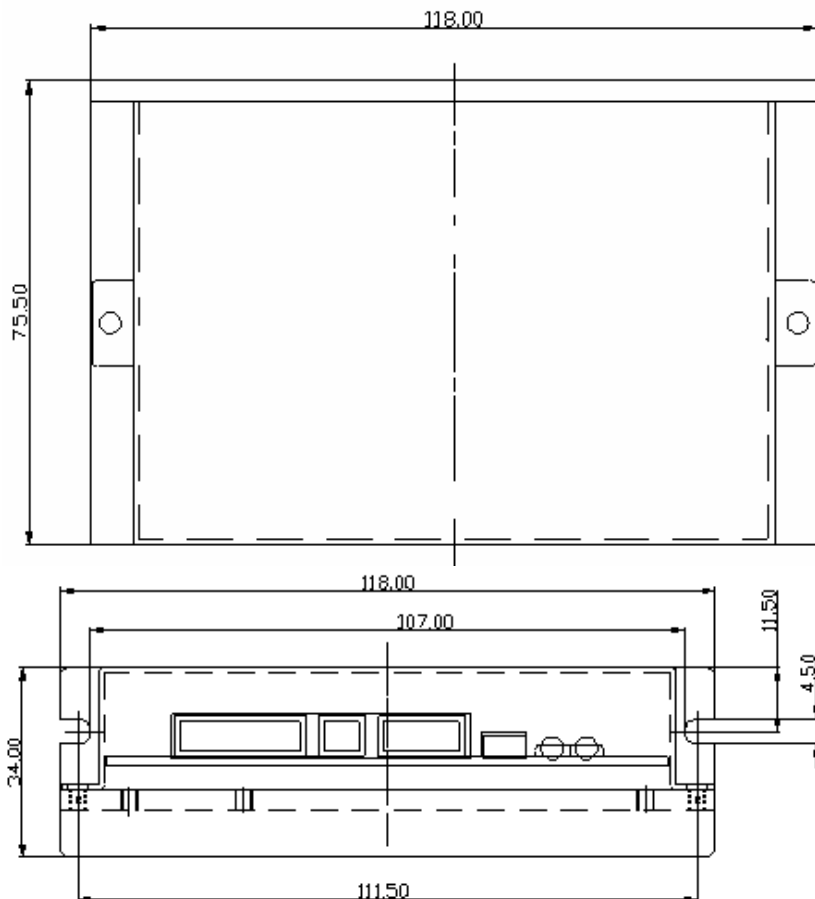
### (4) Driver status indicator

The green LED is power indicator. When the power supply of the Driver is connected, this indicator is constantly on; when the power supply is cut off, the indicator is off. The red LED is failure indicator. If there is any failure, this indicator flashes repeatedly in a period of two seconds. Please see the table below for the details of failure.

Alarm No.	Flashing times	LED status	Description
1	1		Open circuit failure
2	2		Undervoltage
3	3		Overvoltage
4	4		Overcurrent and short circuit failure

### 3.3 Installation and wiring diagram

#### 3.3.1 Machine installation size (mm)

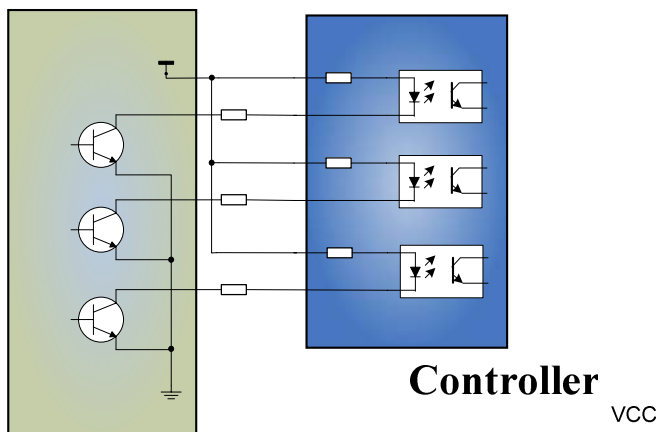


#### 3.3.2 Connecting control wires

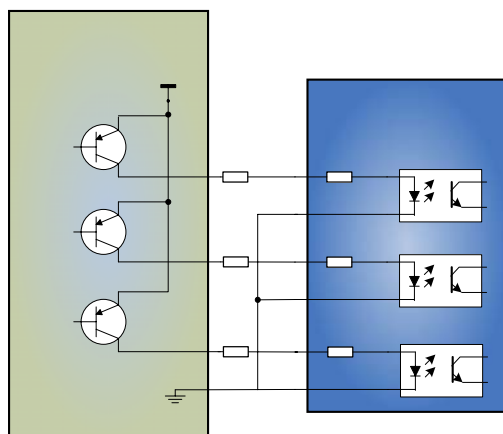
This Driver adopts differential interface circuit, builds in high-speed optocoupler, the receiving frequency is higher than similar products, interface is highly compatible, and anti-jamming capacity is strong (especially differential output mode), and is applicable to NPN open-collector output, PNP type output and differential mode output. The connector circuit is shown below:



- (1) **Common anode wiring:** when VCC is connected to +5V, R is short connected; when VCC is connected to +12V, R is 1K $\Omega$ ; when VCC is connected to +24V, R is 2K $\Omega$ ;

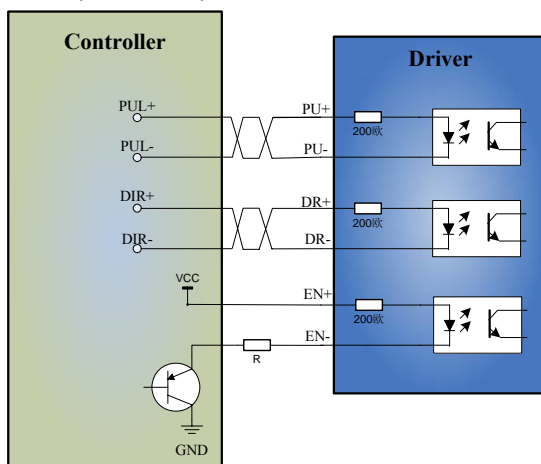


- (2) **Common cathode wiring:** when VCC is connected to +5V, R is short connected; when VCC is connected to +12V, R is 1K $\Omega$ ; when VCC is connected to +24V, R is 2K $\Omega$ ;



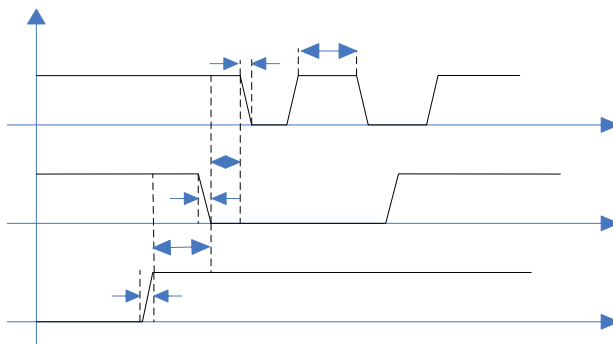
- (3) **Differential wiring:** when VCC is connected to +5V, R is short connected; when VCC is connected to +12V, R is 1K $\Omega$ ; when VCC is connected to +24V, R is 2K $\Omega$ ;

connected to +24V, R is 2K $\Omega$ ;



### 3.3.3 Control signal timing diagram

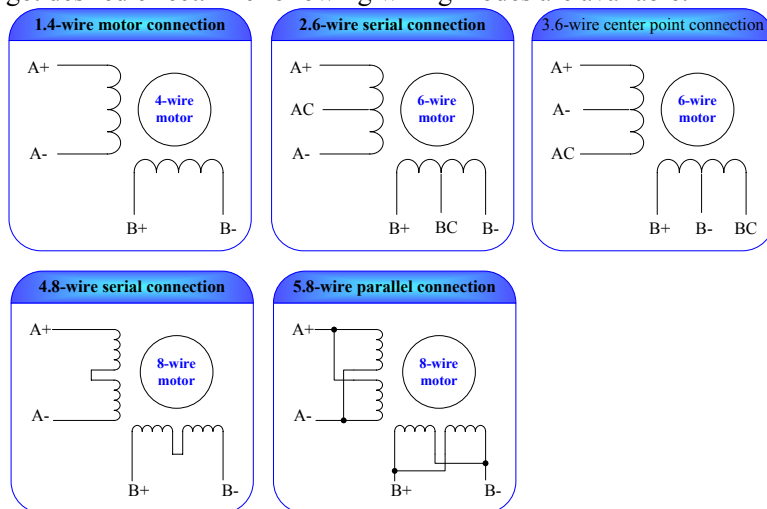
To avoid malfunction and deviation, PU, DR and EN signals should meet certain timing requirement, as shown below:



### 3.3.4 Motor connection

If the Driver and motor are connected in different modes, the motor running will have significantly different effect. Generally, the supply voltage of the Driver determines the high speed performance of motor running. The higher the voltage is, the larger the high speed torque is. Current value determines the output torque of the motor. The higher the current is, the larger the output torque is. However, if the supply voltage is high, the vibration during low speed running is also large; if the

current value is high, the heating of the Driver and motor will be serious. Therefore, the user needs to select appropriate connection accordingly to get desired effect. The following wiring modes are available.



**4-wire motor:** only one connection is available, and the current should be no higher than the rated current.

**6-wire motor:** serial and center tap connection are available. Serial mode has large torque at low speed, but it can't rotate fast as connected to center tap and the current should be set to 70% of the rated current; center tap mode has high speed performance and the current should be no higher than the rated current.

**8-wire motor:** serial and parallel mode are available. Serial mode has large torque at low speed and small torque at high speed, and the current should be set to 70% of the rated current; parallel mode has excellent performance at high speed, and the current should be set to 1.4 times of the rated current.



: When the motor is connected to the Driver, please make sure that the power supply has been turned off. Make sure that the motor leads not used can't contact other objects. When the Driver is electrified, do not disconnect the motor directly. Do not connect the motor lead to ground or power supply.

### 3.3.6 Wiring requirements:

(1) To prevent the Driver from interference, it is recommended to use shielded cable for signal control, and short connect the shielding layer and ground wire; unless otherwise specified, ground one end of the shielding cable that controls signal cable: ground the upper computer end of the shielded cable, and leave the Driver end of the shielded cable floating. In the same machine, only one point can be grounded; if the ground wire isn't true, it may cause serious interference, and the shielded layer isn't connected at this moment.

(2) Pulse and direction signal wires can't be bundled together, and keep at least 10cm clearance, or else the motor noise will interfere with the pulse and direction signal, cause inaccurate motor positioning, instable system and other faults.

(3) If one power supply is provided to several Drivers, it is required to connect them in parallel, rather than in chain.

(4) Do not insert or remove the strong current CN1 terminal of the Driver when the power is still on. The motor still has large current through the coil even when it is stopped, and inserting/removing CN1 terminal will cause instantaneous induced EMF and burn out the Driver.

(5) It is strictly prohibited to add tin to the lead head and connect to the terminal, or else the terminal may be damaged due to large contact resistance and overheating.

(6) The wire connector can't expose out of the terminal, to avoid damaging the Driver due to short circuit.

### 3.5 DIP switch setting

Q2BYG403MD step Driver uses 8-bit DIP switch to set the output current, subdivision precision, quiescent current and self-tuning of parameters. The front view of DIP switch is shown below:

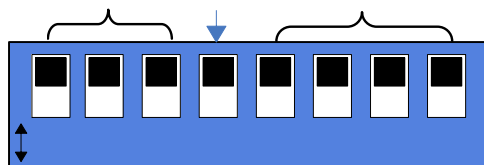


Fig. (2) Front View of DIP Switch

**(1) Current setting ( $I_{peak} = I_{rms} \times 1.4$ ):**

<b>Irms(A)</b>	<b>SW1</b>	<b>SW2</b>	<b>SW3</b>
1.2	OFF	OFF	OFF
1.6	ON	OFF	OFF
2.0	OFF	ON	OFF
2.4	ON	ON	OFF
2.8	OFF	OFF	ON
3.0	ON	OFF	ON
3.6	OFF	ON	ON
4.2	ON	ON	ON

**(2) Subdivision setting:**

<b>Subdivisions</b>	<b>SW5</b>	<b>SW6</b>	<b>SW7</b>	<b>SW8</b>
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
4	OFF	ON	OFF	OFF
8	ON	ON	OFF	OFF
16	OFF	OFF	ON	OFF
32	ON	OFF	ON	OFF
64	OFF	ON	ON	OFF
128	ON	ON	ON	OFF
256	OFF	OFF	OFF	ON
5	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
25	ON	ON	OFF	ON
50	OFF	OFF	ON	ON
100	ON	OFF	ON	ON
150	OFF	ON	ON	ON
200	ON	ON	ON	ON

**(3) Quiescent half current setting**

Set half/full current (SW4=OFF: half current; SW4=ON: full current). For self tuning setting of parameters, move the SW4 switch once in two seconds to realize the self tuning of motor parameter and Driver parameter.

## Chapter IV. FAQ

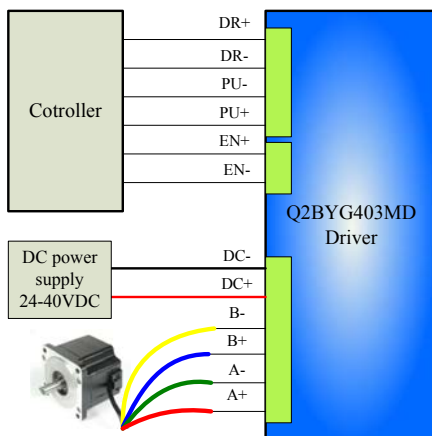
### 4.1 Motor selection

Q2BYG403MD is suitable for 4, 6, 8-wire two phase hybrid step motor. However, to make the motor have optimized running effect, it is usually required to select appropriate motor to match the Driver.

- (1) It is known from the torque-frequency characteristics of the step motor that the output torque decreases along with the increase of motor speed. Generally, at light load, the maximum working speed is below 15 rev/sec, and at heavy load, the maximum working speed is about 10 rev/sec. If the system has a higher requirement on speed, please select servo motor.
- (2) If step motor is selected, please select the model of appropriate torque according to the load.
- (3) During working, it is allowed to change the system transmission ratio through gear box and synchronous belt, and thus adjust the relationship between output torque and load speed.
- (4) Increase the supply voltage of the step motor to improve the working speed of the motor; increase the working current of the step motor to improve the torque of the motor; increase the subdivisions of the step motor to improve the precision of motor, and also improve the stability of the motor, and reduce vibration and noise.

### 4.2 Typical wiring

The control signal wiring of the controller and Driver can be one of the three wiring modes shown in 3.3.2. The power supply and motor wiring is shown below:



### 4.3 Troubleshooting

Failure	Possible reason	Solution
Power indicator is off	Power supply system has error	Check the power supply circuit
	Supply voltage is low	Increase the supply voltage
Alarm indicator is on	Motor wire isn't connected properly	Check the wiring
	Voltage is too high or too low	Check the power supply
	Current is too large	Check the power supply
Motor doesn't run	The power supply isn't connected	Check and connect the power supply
	Motor wiring error	Check the wiring
	Protection circuit works	Reconnect the power supply
	Enable signal is low	Disconnect EN signal
	Current setting is too low	Reset the current
	Subdivision is too small	Reset the subdivisions
	No pulse signal input	Adjust the pulse signal
Position is inaccurate	Subdivision has error	Reset the subdivisions
	Motor load is too high	Change the motor or increase the current
	Motor wire bad contact	Check and connect the wires properly
Motor rotation is wrong	Direction signal isn't connected properly	Interchange two wires in the winding of same phase
	Motor wire is disconnected	Check and connect properly
Motor acceleration stalled	Acceleration is too high	Reduce the acceleration
	Motor torque is too small	Select appropriate motor
	Maximum speed is too high	Reduce the maximum speed

#### ☺ Prompt

Dear customers:

Thanks for purchasing the step motor Driver of our company. We hope that the excellent performance, superior quality and high performance-price ratio of our products can accomplish your value. If there is any problem, please don't hesitate to contact us. Please call our hotline 0755-26099116 or E-mail us: [export@machine-controller.com](mailto:export@machine-controller.com)