# User's Manual

**For**

# DM1182

## High Voltage Fully Digital Stepping Driver

Version 1.0



Attention: Please read this manual carefully before using the driver!


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# 1. Introduction, Features and Applications

## Introduction

The DM1182 is a high voltage, versatility fully digital stepping driver based on a DSP with advanced control algorithm. The DM1182 is the next generation of digital stepping motor controls. It brings a unique level of system smoothness, providing optimum torque and nulls mid-range instability. Motor auto-identification and parameter auto-configuration technology offers optimum responses with different motors and easy-to-use. The driven motors can run with much smaller noise, lower heating, smoother movement than most of the drivers in the markets. Its unique features make the DM1182 an ideal solution for applications that require low-speed smoothness.

## Features

- Anti-Resonance, provides optimum torque and nulls mid-range instability
- Motor auto-identification and parameter auto-configuration technology, offers optimum responses with different motors
- Multi-Stepping allows a low resolution step input to produce a higher microstep output for smooth system performance
- Microstep resolutions programmable, from full-step to 102,400 steps/rev
- Soft-start during initial power-up
- Supply voltage up to +150 VAC
- Output current programmable, from 0.5A to 8.2A
- Pulse input frequency up to 200 KHz
- TTL compatible and optically isolated input
- Automatic idle-current reduction (Reduction rate can be software configured)
- Suitable for 2-phase and 4-phase motors
- Support PUL/DIR and CW/CCW modes
- Over-voltage, Under-voltage, over-current, phase-error protections

## Applications

Suitable for a wide range of stepping motors, from NEMA size 34 to 51. It can be used in various kinds of machines, such as laser cutters, laser markers, high precision X-Y tables, labeling machines, and so on. Its unique features make the DM1182 an ideal solution for applications that require both low-speed smoothness and high speed performances.





# 2. Specifications

## Electrical Specifications ($T_j$ = 25℃/77℉)

| Parameters | DM1182 | | | |
|---|---|---|---|---|
| | Min | Typical | Max | Unit |
| Output current | 0.5 | - | 8.2 (5.9 RMS) | A |
| Supply voltage | 80(113) | 110(155) | 150(212) | VAC(VDC) |
| Logic signal current | 7 | 10 | 20 | mA |
| Pulse input frequency | 0 | - | 200 | kHz |
| Isolation resistance | 500 | | | MΩ |

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

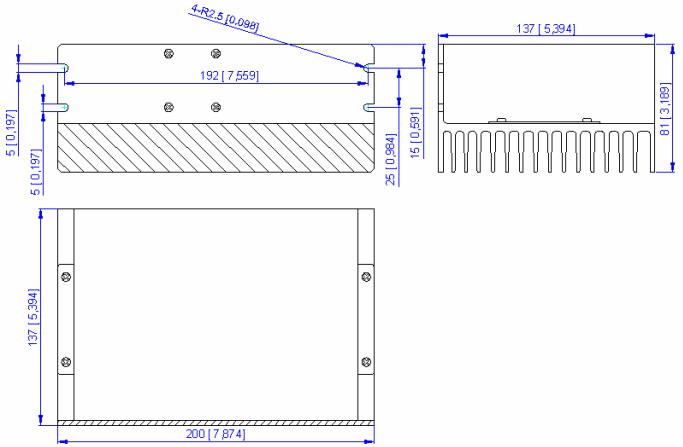



Figure 1: Mechanical specifications

## Elimination of Heat

- Driver's reliable working temperature should be <70℃(158℉), and motor working temperature should be <80℃(176℉);
- It is recommended to use automatic idle-current mode, namely current automatically reduce to 60% when motor stops, so as to reduce driver heating and motor heating;
- Use forced cooling method to cool the system if necessary.

### Operating Environment and other Specifications

| | | |
|---|---|---|
| Cooling | Natural Cooling or Forced cooling | |
| Operating Environment | Environment | Avoid dust, oil fog and corrosive gases |
| | Ambient Temperature | 0℃ — 50℃ (32℉ — 122℉) |
| | Humidity | 40%RH — 90%RH |
| | Operating Temperature | 70℃ (158℉) Max |
| | Vibration | 5.9m/s$^2$ Max |
| Storage Temperature | -20℃ — 65℃ (-4℉ — 149℉) | |
| Weight | Approx. 1000g (35oz) | |

## 3. Pin Assignment and Description

The DM1182 can accept differential and single-ended input signals (including open-collector and PNP output). The DM1182 has two connectors, connector P1 for control signals connections, and connector P2 for power and motor connections. The following tables are brief descriptions of the two connectors. More detailed descriptions of the pins and related issues are presented in section 4, 5, 9.

### Connector P1 Configurations

| Pin Function | Details |
|---|---|
| **PUL+** | Pulse signal: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active (software configurable); 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. In double pulse mode (pulse/pulse) , this input represents clockwise (CW) pulse，active both at high level and low level (software configurable). For reliable response, pulse width should be longer than 2.5μs. Series connect resistors for current-limiting when +12V or +24V used. The same as DIR and ENA signals. |
| **PUL-** | |
| **DIR+** | DIR signal: 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 (software configurable). For reliable motion response, DIR signal should be ahead of PUL signal by 5μs at least. 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction. |
| **DIR-** | |





| | |
|---|---|
| **ENA+** | Enable signal: This signal is used for enabling/disabling the driver. High level (NPN control signal, PNP and Differential control signals are on the contrary, namely Low level for enabling.) for enabling the driver and low level for disabling the driver. Usually left **UNCONNECTED (ENABLED)**. When use it, the ENA signal should ahead the PUL signal at least 100ms due to of soft-start feature of the DM1182. |
| **ENA-** | |
| **FAULT+** | Fault Signal: Open collector fault output. High impedance between FAULT+ and FAULT- during normal operation and low impedance when over-voltage, under-voltage, over-current and phase error protection. MAX: 30VDC, 20mA. |
| **FAULT-** | |

### Selecting Active Pulse Edge and Control Signal Mode

The DM1182 supports PUL/DIR and CW/CCW modes and pulse actives at rising or falling edge. Default setting is PUL/DIR mode and rising edge active (NPN, and PNP control signal is on the contrary).

### Connector P2 Configurations

| Pin Function | Details |
|---|---|
| PE | Recommend connect this port to the ground for better safety. |
| AC | AC power supply inputs. If AC input, recommend use isolation transformers with theoretical output voltage of 80~150VAC. DC input range is 113~212VDC |
| AC | |
| A+, A- | Motor Phase A |
| B+, B- | Motor Phase B |

## 4. Control Signal Connector (P1) Interface

The DM1182 can accept differential and single-ended inputs (including open-collector and PNP output). The DM1182 has 3 optically isolated logic inputs which are located on connector P1 to accept line driver control signals. These inputs are isolated to minimize or eliminate electrical noises coupled onto the drive control signals. Recommend use line driver control signals to increase noise immunity of the driver in interference environments. In the following figures, connections to

open-collector and PNP signals are illustrated.

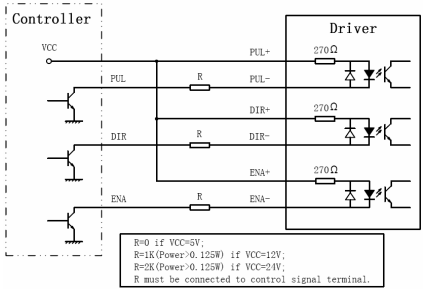



Figure 2: Connections to open-collector signal (common-anode)

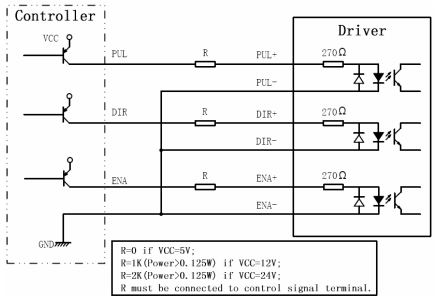



Figure 3: Connection to PNP signal (common-cathode)

# 5. Connecting the Motor

The DM1182 can drive any 2-pahse and 4-pahse hybrid stepping motors.

## Connections to 4-lead Motors

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

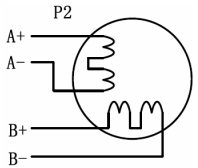



Figure 4: 4-lead Motor Connections





## Connections to 6-lead Motors

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

### Half Coil Configurations

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

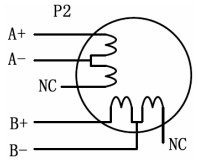



Figure 5: 6-lead motor half coil (higher speed) connections

### Full Coil Configurations

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

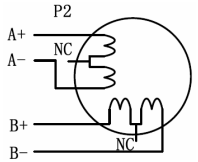



Figure 6: 6-lead motor full coil (higher torque) connections

## Connections to 8-lead Motors

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

### Series Connections

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to

degrade at higher speeds. In series mode, the motors should also be run at only 70% of their rated current to prevent over heating.

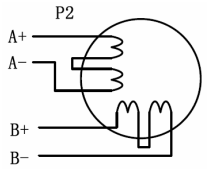



Figure 7: 8-lead motor series connections

**Parallel Connections**

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

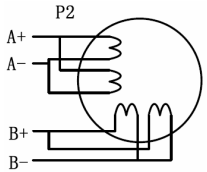



Figure 8: 8-lead motor parallel connections

**NEVER** disconnect or connect the motor while the power source is energized.

## 6. Power Supply Selection

The DM1182 can match large and medium size stepping motors (from NEMA size 34 to 51) made by Leadshine or other motor manufactures around the world. To achieve good driving performances, it is important to select supply voltage and output current properly. Generally speaking, supply voltage determines the high speed performance of the motor, while output current determines the output torque of the driven motor (particularly at lower speed).

**Attention:** For safety and to improve reliability, it is recommended to use isolation transformer instead of directly use network source to supply the DM1182. Recommend use isolation transformers with theoretical output voltage of 80～150VAC or 113～212VDC, leaving room for power fluctuation and back-EMF. And the power of the isolation transformer should larger than 500 watts.





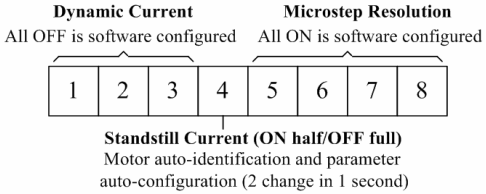
**Selecting Supply Voltage**

The DM1182 can actually operate within 80～150VAC or 113～212VDC, including power input fluctuation and back EMF voltage generated by motor coils during motor shaft deceleration. Higher supply voltage can increase motor torque at higher speeds, thus helpful for avoiding losing steps. However, higher voltage may cause bigger motor vibration at lower speed, and it may also cause over-voltage protection or even driver damage. Therefore, it is suggested to choose only sufficiently high supply voltage for intended applications, and it is suggested to use power supplies with theoretical output voltage of 80～130VAC or 113～183VDC, leaving room for power fluctuation and back-EMF. If the motion speed requirement is low, it's better to use lower supply voltage to decrease noise, heating and improve reliability.

## 7. Selecting Microstep Resolution and Driver Output Current

Microstep resolutions and output current are programmable, the former can be set from full-step to 102,400 steps/rev and the latter can be set from 0.5A to 8.2A.

However, when it's not in software configured mode, this drive uses an 8-bit DIP switch to set microstep resolution, and motor operating current, as shown below:




**Microstep Resolution Selection**

When it's not in software configured mode, microstep resolution is set by SW5, 6, 7, 8 of the DIP switch as shown in the following table:

| Microstep | Steps/rev.(for 1.8°motor) | SW5 | SW6 | SW7 | SW8 |
|---|---|---|---|---|---|
| 1 to 512 | Default/Software configured | ON | ON | ON | ON |
| 2 | 400 | OFF | ON | ON | ON |
| 4 | 800 | ON | OFF | ON | ON |
| 8 | 1600 | OFF | OFF | ON | ON |
| 16 | 3200 | ON | ON | OFF | ON |

| | | | | | |
|---|---|---|---|---|---|
| **32** | **6400** | OFF | ON | OFF | ON |
| **64** | **12800** | ON | OFF | OFF | ON |
| **128** | **25600** | OFF | OFF | OFF | ON |
| **5** | **1000** | ON | ON | ON | OFF |
| **10** | **2000** | OFF | ON | ON | OFF |
| **20** | **4000** | ON | OFF | ON | OFF |
| **25** | **5000** | OFF | OFF | ON | OFF |
| **40** | **8000** | ON | ON | OFF | OFF |
| **50** | **10000** | OFF | ON | OFF | OFF |
| **100** | **20000** | ON | OFF | OFF | OFF |
| **125** | **25000** | OFF | OFF | OFF | OFF |

## Current Settings

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

When it's not in software configured mode, the first three bits (SW1, 2, 3) of the DIP switch are used to set the dynamic current. Select a setting closest to your motor's required current.

**Soft-start**

When power-up or reset by the ENA signal, the DM1182 slowly increases the motor coil current until it reaches to the setting value, eliminating the sudden motor move. or 'jump". It requires about 100ms to setup the current and the controller should send pulse to the DM1182 at least 100ms later. Otherwise the motor would lose step or be stalled.





**Dynamic current setting**

| Peak Current | RMS Current | SW1 | SW2 | SW3 |
|---|---|---|---|---|
| **Default/Software configured (0.5 to 8.2A)** | | **OFF** | **OFF** | **OFF** |
| **2.2A** | **1.6A** | ON | OFF | OFF |
| **3.2A** | **2.3A** | OFF | ON | OFF |
| **4.2A** | **3.2A** | ON | ON | OFF |
| **5.2A** | **3.7A** | OFF | OFF | ON |
| **6.3A** | **4.4A** | ON | OFF | ON |
| **7.2A** | **5.2A** | OFF | ON | ON |
| **8.2A** | **5.9A** | ON | ON | ON |

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

**Standstill current setting**

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

By default, the current automatically reduced to 60% of the selected dynamic current two second after the last pulse. Theoretically, this will reduce motor heating to 36% (due to $P=I^2*R$) of the original value. **Reduction rate and idle time can be configured in the PC software ProTuner**.

# 8. Wiring Notes

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

damage the driver.

## 9. Typical Connection

A complete stepping system should include stepping motor, stepping driver, power supply and controller (pulse generator). A typical connection is shown as figure 9.

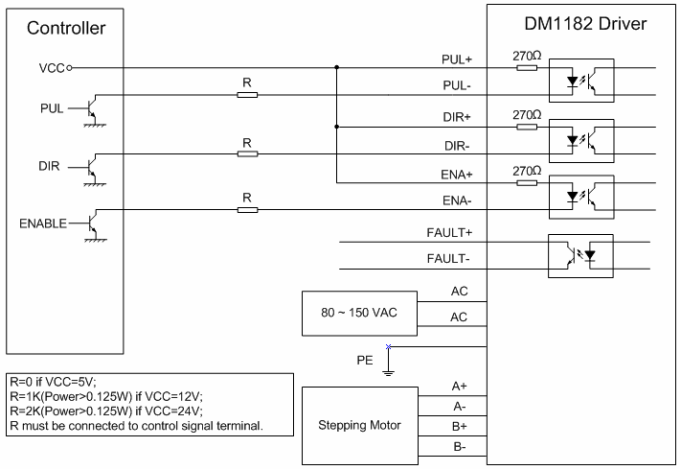



Figure 9: Typical connection

## 10. Sequence Chart of Control Signals

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:

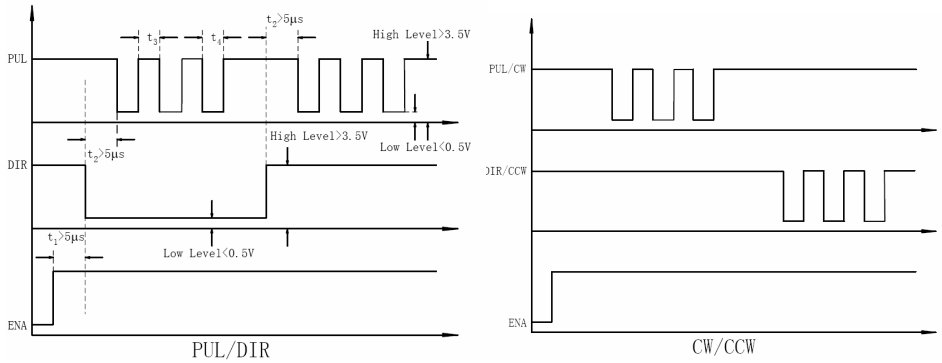



Figure 10: Sequence chart of control signals





**Remark:**

a) t1: ENA must be ahead of DIR by at least 100ms due to soft-start feature of DM1182. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.
b) t2: DIR must be ahead of PUL active edge by 5μs to ensure correct direction;
c) t3: Pulse width not less than 2.5μs;
d) t4: Low level width not less than 2.5μs.

## 11. Protection Functions

To improve reliability, the driver incorporates some built-in protection functions. The DM1182 uses one RED LED to indicate what protection has been activated. The periodic time of RED is 3 s (seconds), and how many times the RED turns on indicates what protection has been activated. Because only one protection can be displayed by RED LED, so the driver will decide what error to display according to their priorities. See the following **Protection Indications** table for displaying priorities.

**Over-current Protection**

Over-current protection will be activated when continuous current exceeds the limits or in case of short circuit between motor coils or between motor coil and ground, and RED LED will turn on once within each periodic time (3 s).

**Over-voltage Protection**

When power supply voltage exceeds 200±1 VAC, protection will be activated and RED LED will turn on twice within each periodic time (3 s).

**Under-voltage Protection**

When power supply voltage under 63±1 VAC, protection will be activated and RED LED will turn on thrice within each periodic time (3 s).

**Phase Error Protection**

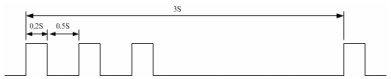
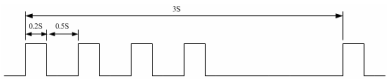
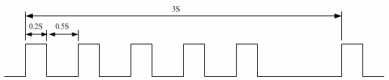
Motor power lines wrong & not connected will activate this protection. RED LED will turn on four times within each periodic time (3 s).

**Over temperature Protection**

Protection will be activated when driver temperature reaches to 75℃. RED LED will turn on five times within each periodic time (3 s).

**Attention:** When above protections are active, the motor shaft will be free or the LED will turn red. Reset the driver by repowering it to make it function properly after removing above problems. Since there is no protection against power leads ( + , - ) reversal, it is critical to make sure that power supply leads correctly connected to driver. Otherwise, the driver will be damaged instantly.

**Protection Indications**

| Priority | Time(s) of ON | Sequence wave of RED LED | Description |
|---|---|---|---|
| 1st | 1 |  | Over-current protection |
| 2nd | 2 |  | Over-voltage protection |
| 3rd | 3 |  | Under-voltage protection |
| 4th | 4 |  | Phase error protection |
| 5h | 5 |  | Over-temperature protection |

## 12. Frequently Asked Questions

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

Many of the problems that affect motion control systems can be traced to electrical noise, controller





software errors, or mistake in wiring.

### Problem Symptoms and Possible Causes

| Symptoms | Possible Problems |
|---|---|
| **Motor is not rotating** | No power |
| | Microstep resolution setting is wrong |
| | DIP switch current setting is wrong |
| | Fault condition exists |
| | The driver is disabled |
| **Motor rotates in the wrong direction** | Motor phases may be connected in reverse |
| **The driver in fault** | DIP switch current setting is wrong |
| | Something wrong with motor coil |
| **Erratic motor motion** | Control signal is too weak |
| | Control signal is interfered |
| | Wrong motor connection |
| | Something wrong with motor coil |
| | Current setting is too small, losing steps |
| **Motor stalls during acceleration** | Current setting is too small |
| | Motor is undersized for the application |
| | Acceleration is set too high |
| | Power supply voltage too low |
| **Excessive motor and driver heating** | Inadequate heat sinking / cooling |
| | Automatic current reduction function not being utilized |
| | Current is set too high |

# APPENDIX

## Twelve Month Limited Warranty

Leadshine Technology Co., Ltd. warrants its products against defects in materials and workmanship for a period of 12 months from shipment out of factory. During the warranty period, Leadshine will either, at its option, repair or replace products which proved to be defective.

## Exclusions

The above warranty does not extend to any product damaged by reasons of improper or inadequate handlings by customer, improper or inadequate customer wirings, unauthorized modification or misuse, or operation beyond the electrical specifications of the product and/or operation beyond environmental specifications for the product.

## Obtaining Warranty Service

To obtain warranty service, a returned material authorization number (RMA) must be obtained from customer service at e-mail: tech@leadshine.com before returning product for service. Customer shall prepay shipping charges for products returned to Leadshine for warranty service, and Leadshine shall pay for return of products to customer.

## Warranty Limitations

Leadshine makes no other warranty, either expressed or implied, with respect to the product. Leadshine specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. Some jurisdictions do not allow limitations on how long and implied warranty lasts, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the 12-month duration of this written warranty.

## Shipping Failed Product

If your product fail during the warranty period, e-mail customer service at tech@leadshine.com to obtain a returned material authorization number (RMA) before returning product for service. Please include a written description of the problem along with contact name and address. Send failed product to distributor in your area or: Leadshine Technology Co., Ltd. 3/F, Block 2, Nanyou Tianan Industrial Park, Nanshan Dist, Shenzhen, China. Also enclose information regarding the circumstances prior to product failure.





# Contact Us

**China Headquarters**

**Address:** 3/F, Block 2, Nanyou Tianan Industrial Park, Nanshan District Shenzhen, China

**Web:** http://www.leadshine.com

**Sales Hot Line:**

**Tel:** 86-755-2643 4369 (for All)

86-755-2641-7674 (for Asia, Australia, Africa areas)

86-755-2640-9254 (for Europe, America areas)

**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 U.S.A**

**Address:** 25 Mauchly, Suite 318 Irvine, California 92618

**Tel:** 1-949-608-7270

**Fax:** 1-949-608-7298

**Web:** http://www.leadshineUSA.com

**Email:** sales@leadshineUSA.com and support@leadshineUSA.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.