

**High reliability, low cost, compatible design**

## MR1107/MR1108



Alternative

### Switec Products

X25.166, X25.168, X25.288, X25.569,  
X25.589, X25.689

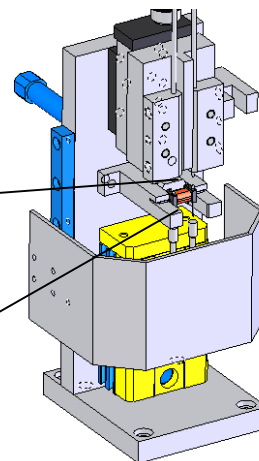
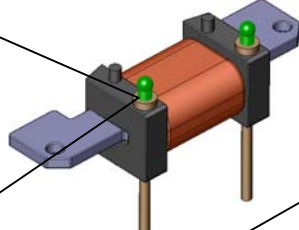
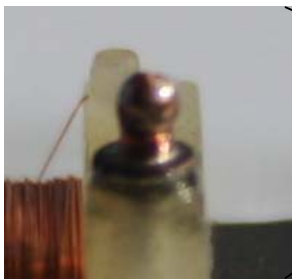
### VID Products

VID29-02, VID29-03, VID29-05,  
VID29-06

Housing and gear made from anti-aging material are used in manufacturing MR 1107/1108 stepper motor. Therefore, the motors can stand long-time temperature change, oil and erosion. Meanwhile, there won't be gear or housing breaking. Optimization design of the motor makes less parts and compact construction possible. All our parts are manufactured by Japanese plants, which ensures the stability and reliability of the products.

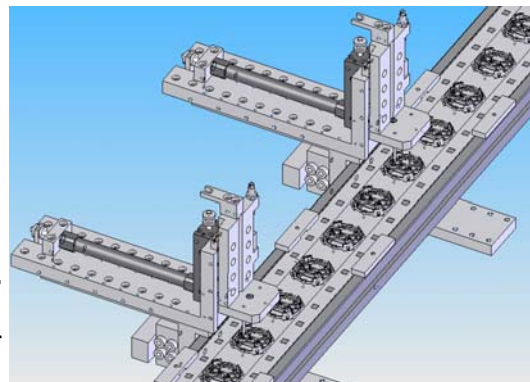
### Advanced manufacturing techniques

Auto winding equipment customized according to MCR's requirements are used in winding inside MR1107/1108 stepper motor. We apply special spark arc welding technique to do winding jointing. Such kind of welding can totally eliminate the problem of pollution and weld defect. All the parts should pass special aging treatment to ensure long-time precision and stability of the parts.



### Auto-assembly technology

MCR's unique auto assembly line adopted in the process of assembling MR1107/1108 stepper motor can guarantee the complete coherence of manufacturing and testing. In addition, this kind of assembling can prevent the precise transmission of gears from being polluted by dust or other infectant. The application of auto assembly line can greatly enhance the production efficiency of the micro motor as well as reduce the cost.



Auto assembly line and manipulator

MR1107/MR1108

## Description

The Miniature Stepper Motor MR11xx series was developed primarily as an indicator drive for dashboard instrumentation and other indicator equipment. The motor can operate directly from a numerical driving signal to move and position a pointer to visualize any parameter required. The miniature stepper motor consists of a motor and gear train with a reduction ratio of 1/180. It is produced with the advanced technologies in precision parts and micro drive of MCR MOTOR. These technologies assure a high quality product. The motor is simple in construction without concessions to stability or longevity.

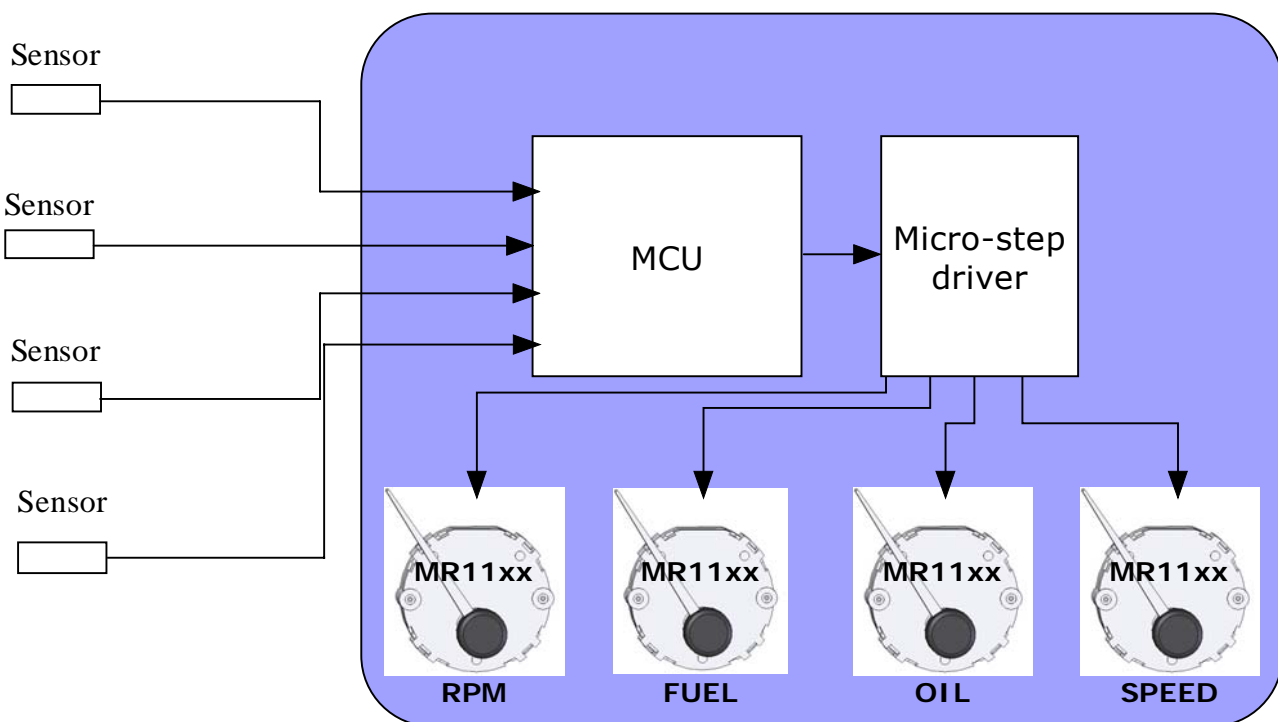
Full steps can be carried out up to 600Hz resulting in a 600°/s angular speed. Such characteristics allow a large dynamic range for indicator applications.

As a result of advanced coil welding technology and automatic dust-free assembly production, MR11xx series motor has high reliability during the temperature range of -40°C–105°C. So malfunction caused by weld defect or open circuit will not appear. Positioning assembly of the gear makes the motor stop vibrating when the pointer returns to zero.

## Applications

- Vehicle, shipping dashboard
- Industrial instrumentation
- Laser reflector

## Typical Application

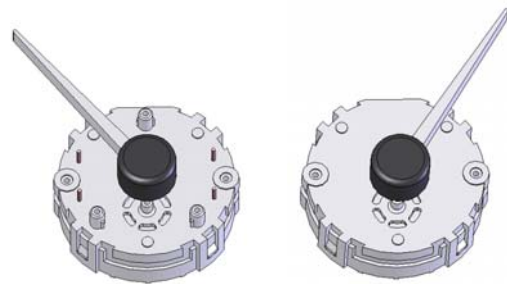


## Features

1/12° resolution per step  
 Low current consumption: <20mA  
 Small dimensions:  $\Phi 30 \times 9.6$  mm  
 Can be directly driven by MCU  
 Large temperature range: -40°C-105°C  
 High speed: 600°/s  
 Qualified for automotive applications

## Motor Type

PCB front installation: MR1108  
 PCB rear installation: MR1107



MR1107

MR1108

## Absolute Maximum Ratings

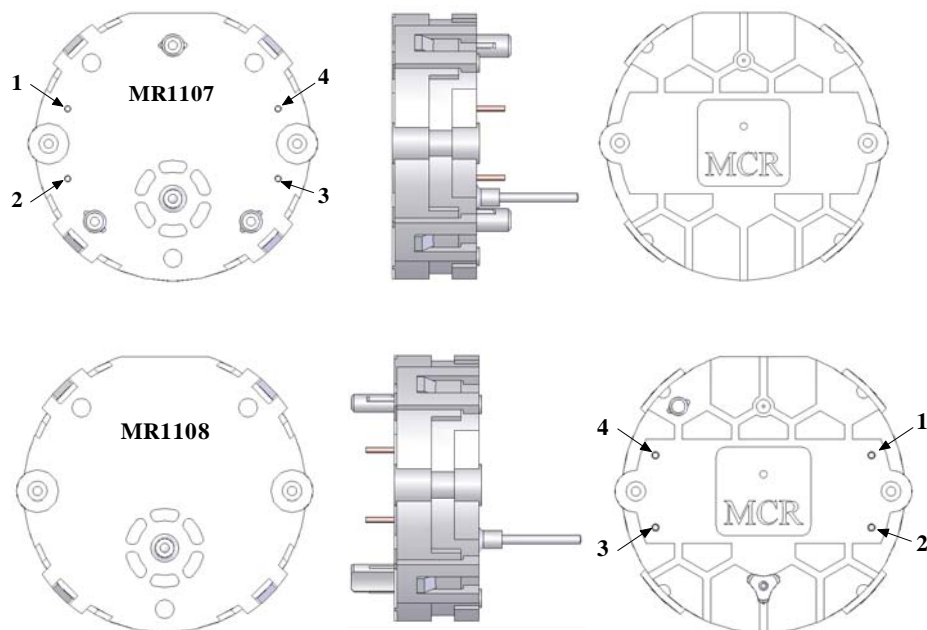
Parameter	Symbol	Conditions
Driving voltage	U <sub>b</sub>	10V
ESD tolerance(MIL883)	UESD	10,000V
EMI tolerance (1kHz,AM80%,100kHz-2GHz)	E	80V/m
Storage temperature	T <sub>stg</sub>	95°C
Solder temperature (10sec)	T <sub>s</sub>	260°C

## Electrical Parameter

T<sub>amb</sub>=25°C and U<sub>b</sub>=5V, unless otherwise specified

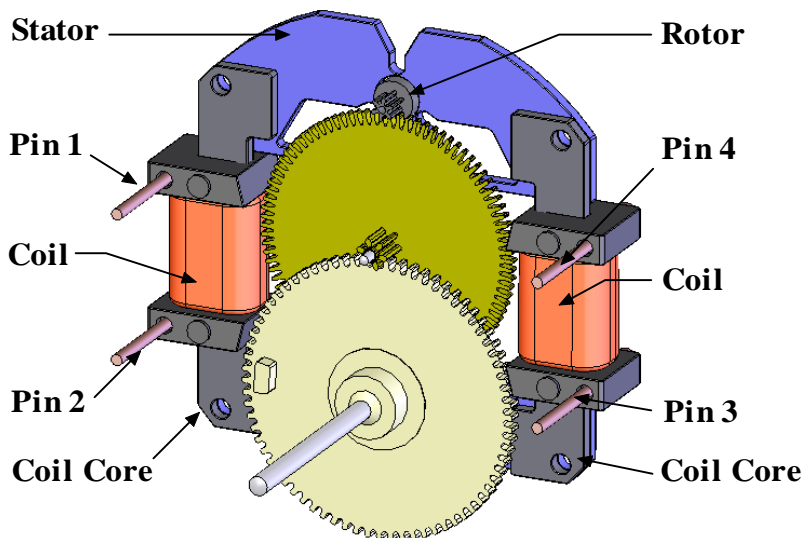
Parameter	Symbol	Test Conditions	Min.	Type	Max.	Units
Operating temperature	T <sub>a</sub>		-40		105	°C
Coil resistance	R <sub>b</sub>		280	290	310	Ω
Operating current	i <sub>m</sub>	@fz=200Hz		15		mA
Magnetic saturation voltage	U <sub>bs</sub>			9		V
Start-Stop Frequency	f <sub>ss</sub>	@JL=0.2*10 <sup>-6</sup> kgm <sup>2</sup>	200			Hz
Maximum driving frequency	f <sub>m</sub>	@JL=0.2*10 <sup>-6</sup> kgm <sup>2</sup>	600			Hz
Dynamic torque	M <sub>200</sub>	@fz=200Hz	1.2	1.4		mNm
	M <sub>400</sub>	@fz=400Hz		0.9		mNm
Static torque	M <sub>s</sub>	U <sub>b</sub> =5V	3.5	4.0		mNm
Gear play				0.5	1	Degree
Forces allowed on the pointer shaft:						
Axial push on force	F <sub>A</sub>				150	N
Perpendicular force	F <sub>Q</sub>				12	N
Imposed acceleration	a <sub>p</sub>				1000	rad/s <sup>2</sup>
Noise level	SPL			40	50	dBA
Angle of rotation of motor with internal stop	fl				315	Degree

Note: f<sub>a</sub> -- axial force on the pointer shaft    JL -- inertia of the load



## Operation Principle

MR11xx series motor is a two-phase magnet stepper motor. A partial step of the rotor is an angular rotation of  $60^\circ$ . The motor has a gearbox with a reduction ratio of 1:180 to reduce speed and give a  $1/3^\circ$  resolution on the output pointer.



**Full step** means that the rotor makes a  $180^\circ$  rotation ( $1^\circ$  for the output pointer). Operation frequency of the motor refers to how many full steps the rotor makes per second (how many degrees the pointer rotates per second). MR11xx series motor can operate at 600Hz or more.

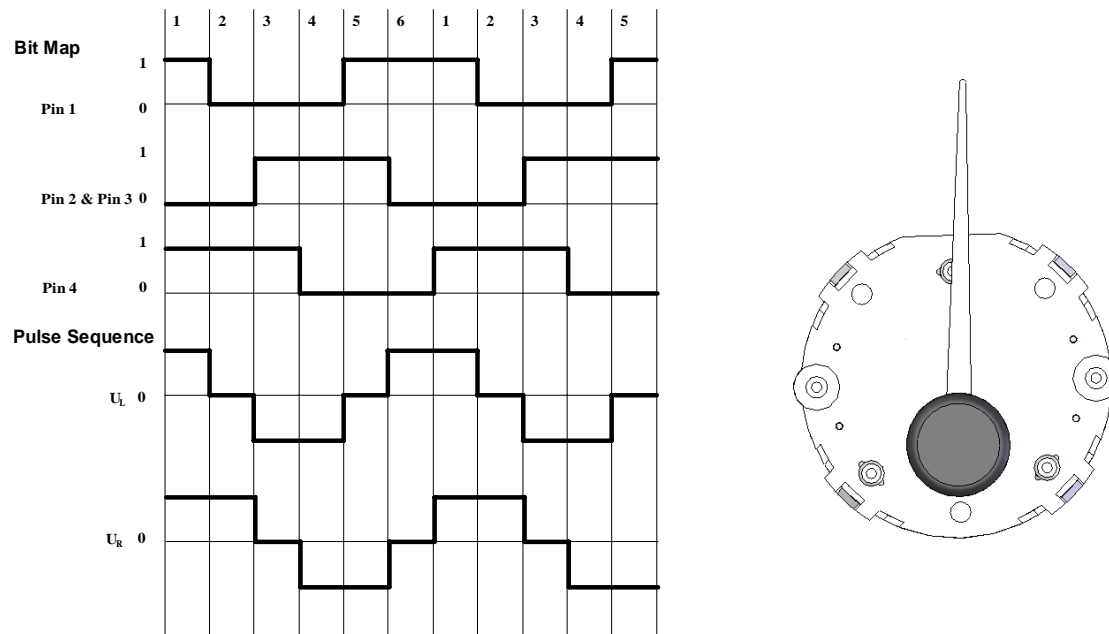
**Half step** means that the rotor makes a  $60^\circ$  rotation ( $1/3^\circ$  for the output pointer). Three output ports (maximum current 20mA required) of the SCM are enough to drive the motor at half-step value efficiently. The pointer shaft operates at  $1/3^\circ$  in the half-step mode.

**Loss of step** Usually, loss of step is caused by an over-high operation frequency or the rapid change of the frequency. As is normally the case for stepper motors, the clock frequency of the drive determines the rotational speed of the motor. Up to the start-stop frequency, a reverse rotation and a sudden startup is possible without loss of step. Motor rotation and the pulse are synchronous. The dynamic behavior of the motor (start-stop frequency) is influenced by the inertia of the load. The start-stop frequency of MR11xx series Motor loaded with an inertial mass of 200gmm<sup>2</sup> is approximately 200Hz.

## Drive and Controlling Circuit

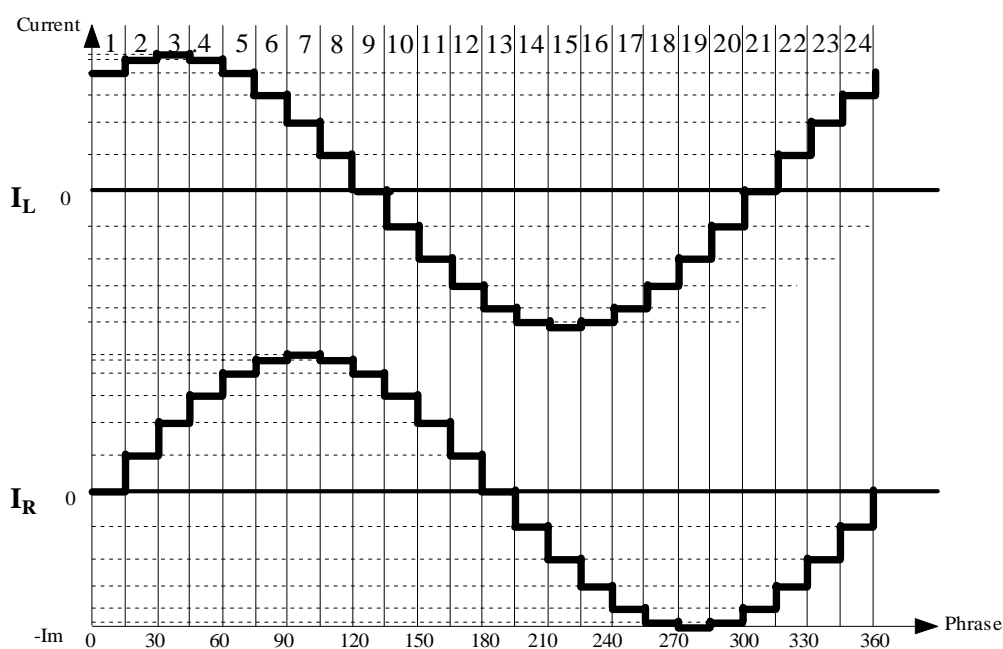
### Half-stepping Mode of Operation

MR11xx series micro stepper motor can be driven by standard logic level. The sequence below is stepwise driving mode. The sequence direction of the bit map determines the rotating direction of the motor. Under such mode, a partial step is an angular rotation of  $1/3^\circ$  of the pointer or  $60^\circ$  on the rotor shaft.



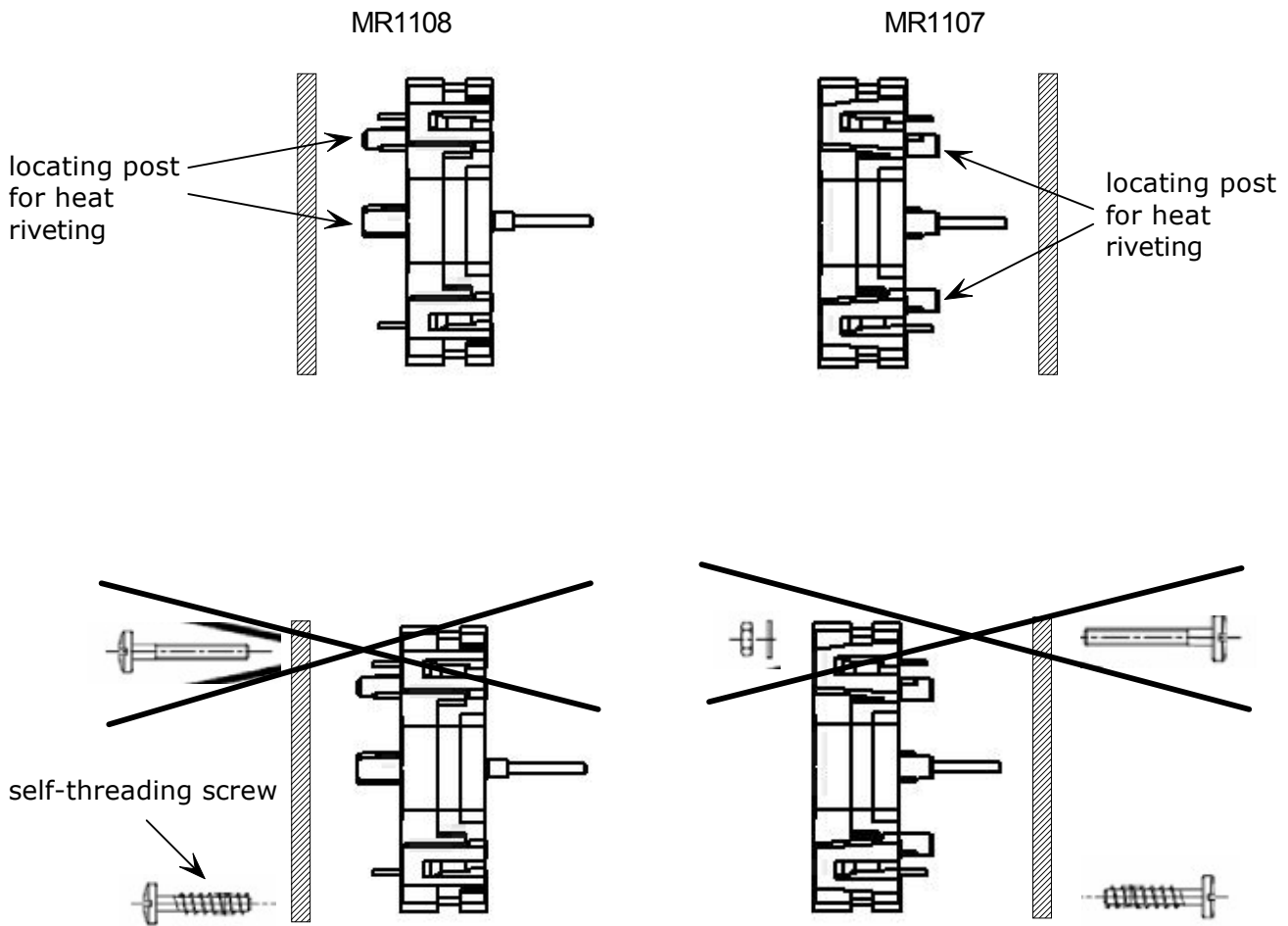
### Microstepping Mode of Operation

In order to lower noise and vibration as well as to make a continuous smooth movement of a pointer, microstepping mode of operation is frequently used to make the rotor rotate more equably. Twenty-four subdivided steps can help to produce fluent rotating of the motor, thus be widely adopted. By such subdivision drive, a microstep of the rotor is an angular rotation of  $1/12^\circ$  of the pointer or  $15^\circ$  on the rotor shaft. The angle is small enough that people cannot detect with eyes.



## Installation

The installation method of MR11xx series micro stepper motor:

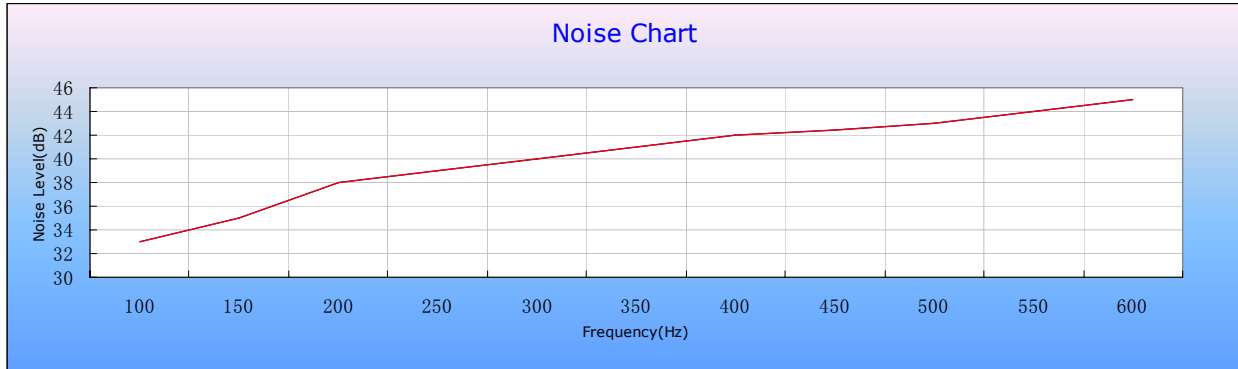


Generally, heat riveting is suggested to rivet locating post on the PCB board. For special situation, self-threading screws can also be used to fix the locating post. Motor R1107/MR1108 had better to adopt self-threading screw with a diameter of 1.4mm.

## Acoustic Measurements

Acoustic test of the stepper motor is taken inside a soundproof box (background noise less than 30dB). Decibelmeter TES1357 is placed 40mm above the output shaft of the motor to measure the noise. Standard driving tester is used to measure the noise of the motor at the speed of 10~60 Hz, by a driving mode of 24 micro-step and a driving voltage of 5V. The noise of MR1107/MR1108 Stepper Motor will be larger when speed increases.

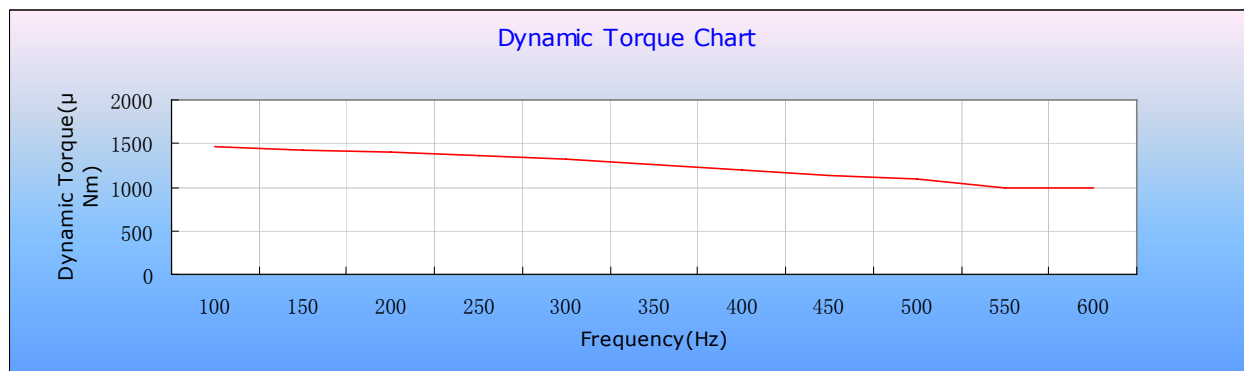
In the process of mass production, we pick samples to take this acoustic measurement.



## Torque Measurements

Torquemeter is used as a fictitious load of the stepper motor. The torquemeter is driven by the motor. The torque shown on the torquemeter is directly proportional to the angle of rotation. The max torque of the motor is the output torque. The torque of MR1107/MR1108 Stepper Motor goes up when the motor slows down.

In the process of mass production, we take a full test of torque measurement.

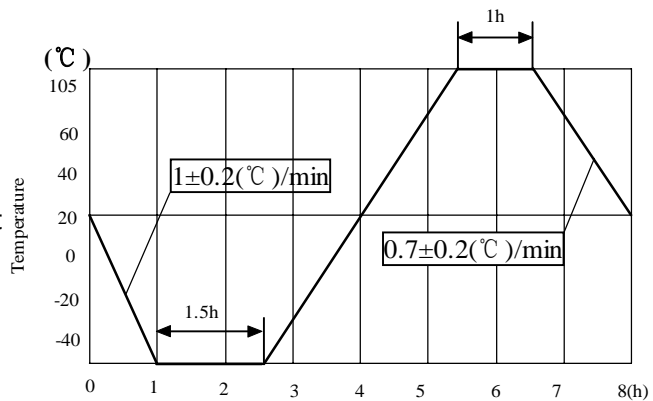


## Environment Tests(Reliability Test)

Environment testing is to test whether the motor could normally operate or be stored at long-term in various harsh environment. As soon as mass production starts, a certain proportion of MR11xx series Motor will be taken as samples for environment test. All these samples need to pass the test to prove the group of products up to standard, which determines shipment. During the test, standard testing pointer is fixed on the motor. No loss of step or stop indicates that the motor under test is qualified. The weight of the standard pointer is 2.5g. Rotation inertia of the pointer is

### Temperature Cycling

- Minimum temperature :  $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Maximum temperature :  $+105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Temperature cycling : refer to the graph on the right
- 50 cycles, 6 hours per cycle
- Motor running : 0-600Hz sweep operation
- Number of samples : 28pcs



### High Temperature Operating Test

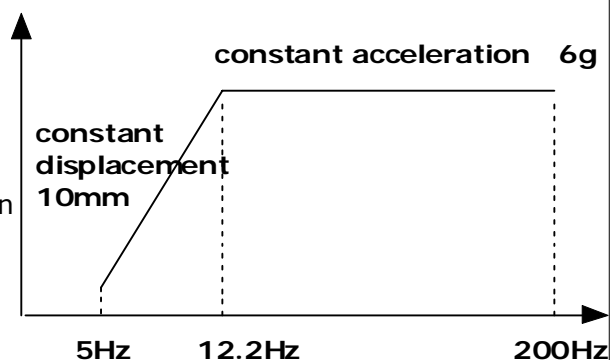
- Temperature :  $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Time : 500 hours
- Motor running : 0-600Hz sweep operation
- Number of samples : 28pcs

### Low Temperature Operating Test

- Temperature :  $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Test time : 500hours
- Motor running : 0-600Hz sweep operation
- Number of samples : 28pcs

### Vibration Test

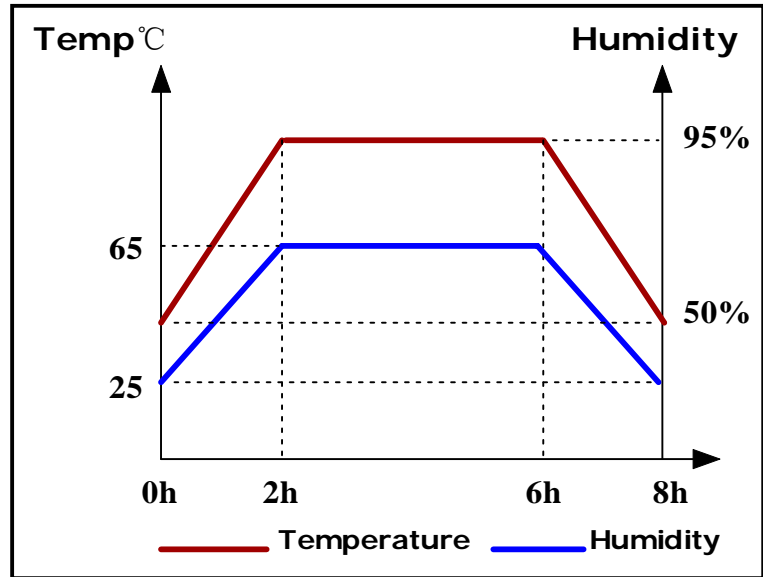
- Waveform : sine wave
- Frequency : 5-200Hz log frequency sweep
- Double frequency : 1 Oct/min
- Vibration direction : axial direction/radial direction
- Vibration time : 22 hours per direction
- Motor running : 0-600Hz sweep operation
- Number of samples : 28pcs





## Cycle Temperature and Humidity

- Temperature :  $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Humidity :  $85\pm 2\%$  RH
- Preserving time : 168 hours
- Condition : not rotate
- Number of samples : 28pcs



## Temperature Shock

- Minimum temperature :  $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Maximum temperature :  $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Residence time : twice per hour
- Conversion time : 30s
- Circulation : 100 times, 100 hours totally
- Condition : not rotate
- Number of samples : 28pcs

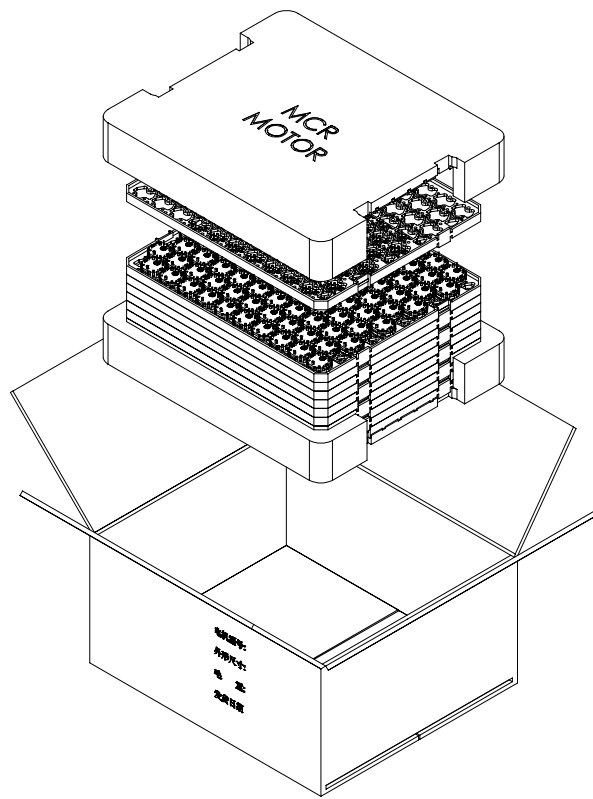
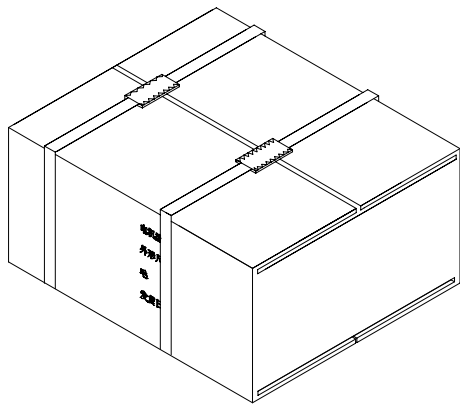
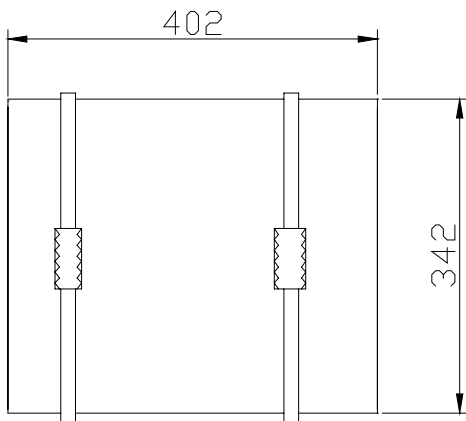
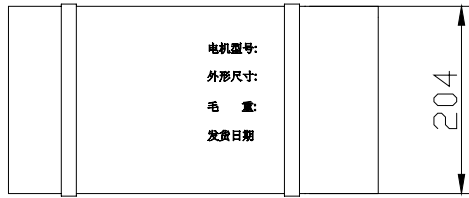
## Test Analyse and Report

Before environment test, torque and noise performance of sample motors should be measured. During the process of environment test, the samples are to be made sure whether they lose step. After environment, torque and acoustic measurements are taken to see the differences of the sample motor before and after the environment test. If the motor is found to lose step in the process of environment test, it is regarded as defective goods. If the sample motor is found to have a 20% torque decrease or 6dB noise increase after environment, it's also regarded as defective goods.

## Packing Instruction

Black plastic tray is used to pack the stepper motors. Every tray can hold 100pcs of motors.

Ten trays consist a carton, for a total of 1000pcs of motors.



MR1107/MR1108