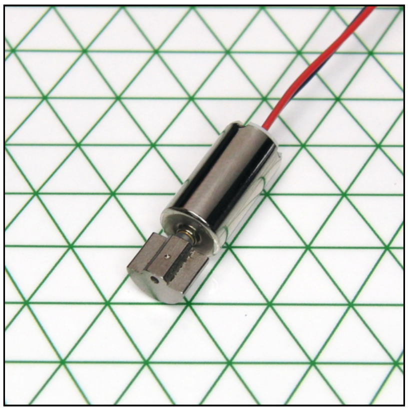


6mm Vibration Motor - 12mm Type
Shown on 6mm Isometric Grid

PRECISION MICRODRIVES™

Product Data Sheet
Precision Haptic™
6mm Vibration Motor - 12mm Type

Model: 306-109

Ordering Information

The model number 306-109 fully defines the model, variant and additional features of the product. Please quote this number when ordering.
For stocked types, testing and evaluation samples can be ordered directly through our online store.

Datasheet Versions

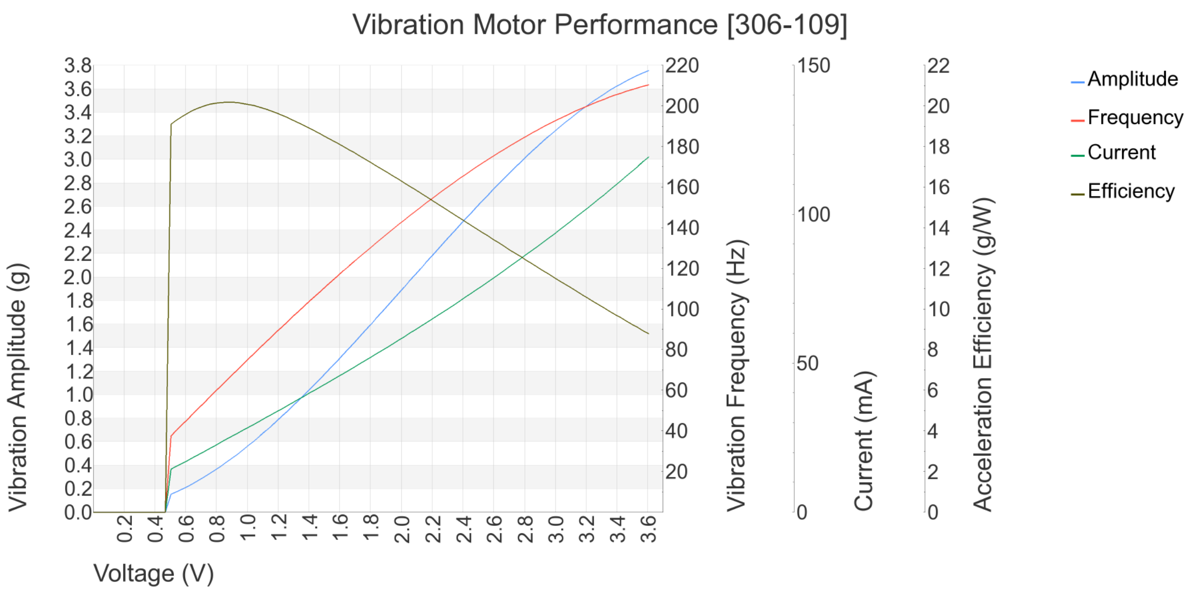
It is our intention to provide our customers with the best information available to ensure the successful integration between our products and your application. Therefore, our publications will be updated and enhanced as improvements to the data and product updates are introduced.
To obtain the most up-to-date version of this datasheet, please visit our website at:
www.precisionmicrodrives.com
The version number of this datasheet can be found on the bottom left hand corner of any page of the datasheet and is referenced with an ascending R-number (e.g. R002 is newer than R001). Please contact us if you require a copy of the engineering change notice between revisions.

If you have any questions, suggestions or comments regarding this publication or need technical assistance, please contact us via email at:
enquiries@precisionmicrodrives.com or call us on +44 (0) 1932 252 482

Key Features

Body Diameter:	6 mm [+/- 0.1]
Body Length:	12.2 mm [+/- 0.2]
Counterweight Radius:	2.9 mm [+/- 0.1]
Counterweight Length:	4.5 mm [+/- 0.1]
Rated Operating Voltage:	3 V
Rated Vibration Speed:	12,000 rpm [+/- 2,400]
Typical Rated Operating Current:	85 mA
Typical Normalised Amplitude:	3.5 G

Typical Vibration Motor Performance Characteristics



Understanding Precision Microdrives Specification and Production Stages

Precision Microdrives Specification Stages

Precision Microdrives is run on processes and we guide all customers through sets of predefined specification stages as they move from prototype to production. These are designed to allow the flexibility to iterate designs with the eventual certainty required for production parts.

Base	Sampling	Pre-Production	Production	EOL
Used for factory downselection Typically 0 units	Used for validating prototypes Typically ~ 10 units	Used for validating initial production Typically ~ 1k units	Used for validating mass production Typically >5k+ units	Used as basis for product replacement 'Base' spec Typically 0 units

Precision Microdrives Capabilities and Competences

Precision Motor Testing and Motor Testing Services

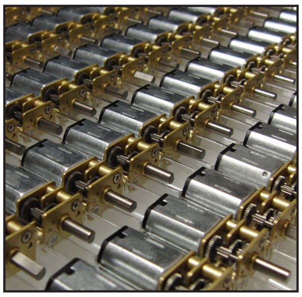
When we started PMD there were no commercial testing machines available, so we built our own. Ever since we've continued to develop new motor testing machines & procedures each year. Fast forward to today and we now have the most extensive testing facilities in the world for sub 40mm diameter motors, gear motors and vibration motors. These are used to validate motors through specification stages and during manufacturing. We also test motors as a service, provide easy to read reports and assist customers with their interpretation.

Motor Customisation, Design, and Manufacturing

To be useful motors need to be integrated with other parts, such as housings or couplings . We routinely develop and produce complete assemblies, from motors with customised leads or connectors to complete electromechanical mechanisms and integrated control electronics. We will support and guide you through the specification stages from prototype to signing-off for mass production.

Competent and Dependable Supply Chains for Production

Most of the worlds miniature motors are made in Asia, and you need engineers on the factory floor who can maintain the Western values of "doing things right" whilst supporting the Asian values of "getting things done". As a customer you are supported by expert eyes, right at the heart of the manufacturing process where it is needed: On the ground in the UK, Hong Kong, and China.



Quality Engineers on the Ground and Local Engineering Teams

The nature of our business is to confidently produce and supply motors 'On time & To spec'. Our customers benefit from our certified ISO 9001 quality systems, reliable motor production infrastructure, and experience. We have a core competence in helping customers design out over-specified and expensive European drives, with more cost-effective, adequately specified, and verified Asian alternatives.

Physical Specification

PARAMETER	CONDITIONS	SPECIFICATION
Body Diameter	Max body diameter or max face dimension where non-circular	6 mm [+/- 0.1]
Body Length	Excl. shafts, leads and terminals	12.2 mm [+/- 0.2]
Unit Weight		2.7 g
No. of Output Shafts		1
Counterweight Radius	Radius from shaft for non-cylindrical weights	2.9 mm [+/- 0.1]
Counterweight Length		4.5 mm [+/- 0.1]

Construction Specification

PARAMETER	CONDITIONS	SPECIFICATION
Motor Construction		Coreless
Commutation		Precious Metal Brush
No. of Poles		3
Bearing Type		Sintered Bronze

Leads & Connectors Specification

PARAMETER	CONDITIONS	SPECIFICATION
Lead Length	Lead lengths defined as total length or between motor and connector	45 mm [+/- 2]
Lead Strip Length		2 mm [+/- 0.5]
Lead Wire Gauge		32 AWG
Lead Configuration		Straight

Operational Specification

PARAMETER	CONDITIONS	SPECIFICATION
Rated Operating Voltage		3 V
Rated Vibration Speed	At rated voltage using the inertial test load	12,000 rpm [+/- 2,400]
Max. Rated Operating Current	At rated voltage using the inertial test load	100 mA
Rated Inertial Test Load	Mass of standard test sled	100 g
Min. Vibration Amplitude	Peak-to-peak value at rated voltage using the inertial test load	2.4 G
Max. Start Voltage	With the inertial test load	1 V
Max. Operating Voltage		3.6 V
Max. Start Current	At rated voltage	190 mA
Min. Insulation Resistance	At 50V DC between motor terminal and case	1 MOhm

Important: The characteristics of the motor is the typical operating parameters of the product. The data herein offers design guidance information only and supplied batches are validated for conformity against the specifications on the previous page.

Typical Performance Characteristics

PARAMETER	CONDITIONS	SPECIFICATION
Typical Rated Power Consumption	At rated voltage and load	255 mW
Typical Rated Operating Current	At rated voltage using the inertial test load	85 mA
Typical Vibration Amplitude	Peak-to-peak value at rated voltage using the inertial test load	3.5 G
Typical Start Current	At rated voltage	180 mA
Typical Vibration Efficiency	At rated voltage using the inertial test load	13.7 G/W
Typical Normalised Amplitude	Peak-to-peak vibration amplitude normalised by the inertial test load at rated voltage	3.5 G
Typical Start Voltage	With the inertial test load	0.5 V
Typical Terminal Resistance		16 Ohm
Typical Terminal Inductance		75 uH

Typical Haptic Characteristics

PARAMETER	CONDITIONS	SPECIFICATION
Typical Lag Time	At rated voltage using the inertial test load	14 ms
Typical Rise Time	At rated voltage using the inertial test load	42 ms
Typical Stop Time	At rated voltage using the inertial test load	104 ms
Typical Active Brake Time	Time taken from steady-state to 0.04 G under inverse polarity at max. voltage	27 ms

Typical Durability Characteristics

PARAMETER	CONDITIONS	SPECIFICATION
Typical Min. Counterweight Pullout		9.8 N
Mean Time to Failure		216 hours

Environmental Characteristics

PARAMETER	CONDITIONS	SPECIFICATION
Min. Operating Temp.		-20 Deg.C
Max. Operating Temp.		60 Deg.C
Min. Storage Temp.		-40 Deg.C
Max. Storage Temp.		80 Deg.C

Typical Packing Conditions

PARAMETER	CONDITIONS	SPECIFICATION
Carton Type		Boxed trays

Haptic Characteristics

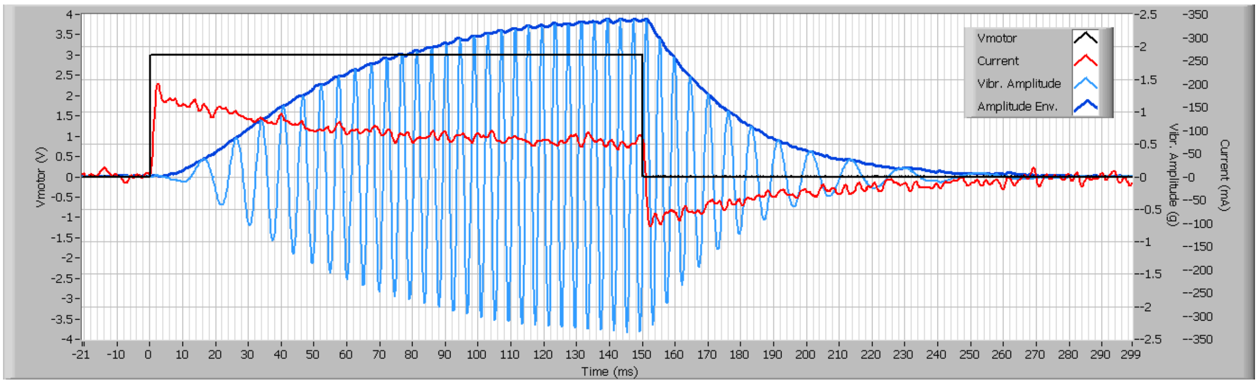
This section presents information regarding the performance of the motor for haptic feedback applications. The tests performed are equivalent to Immersion's TS2000 Actuator Performance Test for certified actuators.

Step Response applies the motor's rated voltage for set time - operating current, vibration amplitude are measured. The haptic parameters are calculated from the results. The negative current is a result of back EMF from the motor.

Overdrive Step Response is similar, but includes a period of overdrive (using the motor's maximum voltage instead of rated voltage) before falling to the rated voltage once vibration amplitude reaches 90% of rated amplitude. Concludes with active brake period where the maximum voltage is applied with reversed polarity until the vibration amplitude is less than 0.04 G.

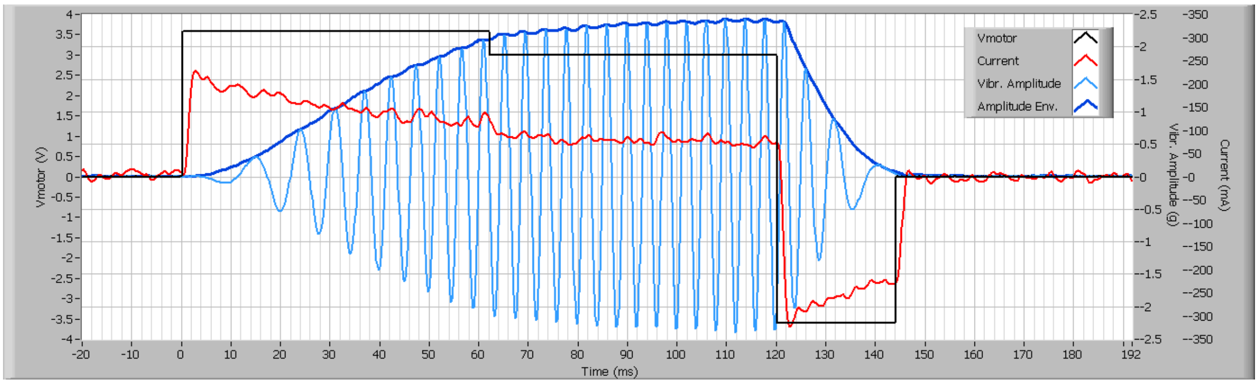
Step Response

PARAMETER	CONDITIONS	SPECIFICATION
Typical Rise Time to 50%	**Time to get to 50% of the rated amplitude at rated voltage**	**42 ms**
Typical Rise Time to 90%	**Time to get to 90% of the rated amplitude at rated voltage**	**92 ms**
Typical Stop Time	**Time to stop the motor when the voltage is removed**	**104 ms**



Overdrive Step Response

PARAMETER	CONDITIONS	SPECIFICATION
Typical Overdrive Rise Time to 50%	**Time to get to 50% of the rated amplitude at maximum voltage**	**33 ms**
Typical Overdrive Rise Time to 90%	**Time to get to 90% of the rated amplitude at maximum voltage**	**60 ms**
Typical Brake Time	**Time to stop the motor when the voltage is reversed to negative maximum voltage**	**25 ms**



Reliability Analysis

This section presents information regarding the longevity test performed on the motor. The Mean Time to Failure reported in this page should not be interpreted as a guaranteed lifetime. Please check our Application Notes for further information.

Our longevity test consists of powering the motors at their rated voltage for 2 seconds, then turning them off for 2 seconds. This cycle is repeated over the total test time.

The test is performed by our custom longevity machine which drives the motors and collects performance data. The test parameters and results can be seen below.

Test Parameters

- Motors tested: 48
- Test time: 720 hours
- Cycle period: 4 seconds
- Duty cycle: 50%
- Test voltage: 3.0 V
- Temperature: 33 °C

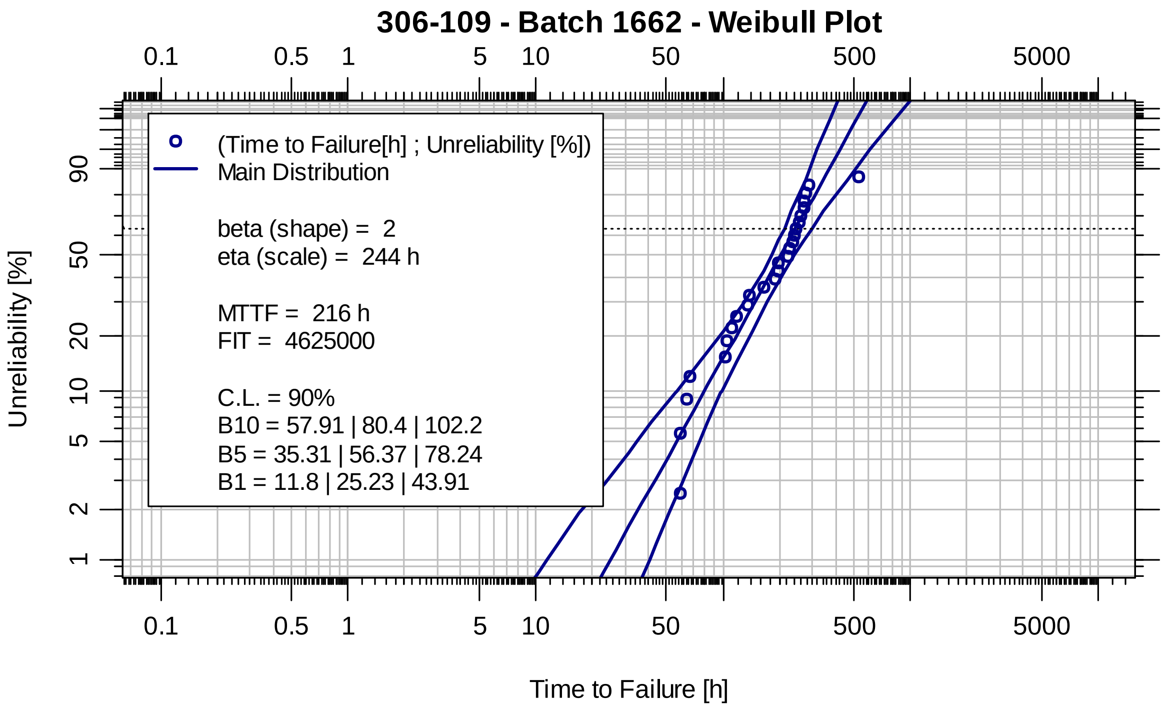
Formulas to derive the key reliability figures from a Weibull distribution:

$$MTTF = \eta * \Gamma\left(1 + \frac{1}{\beta}\right)$$

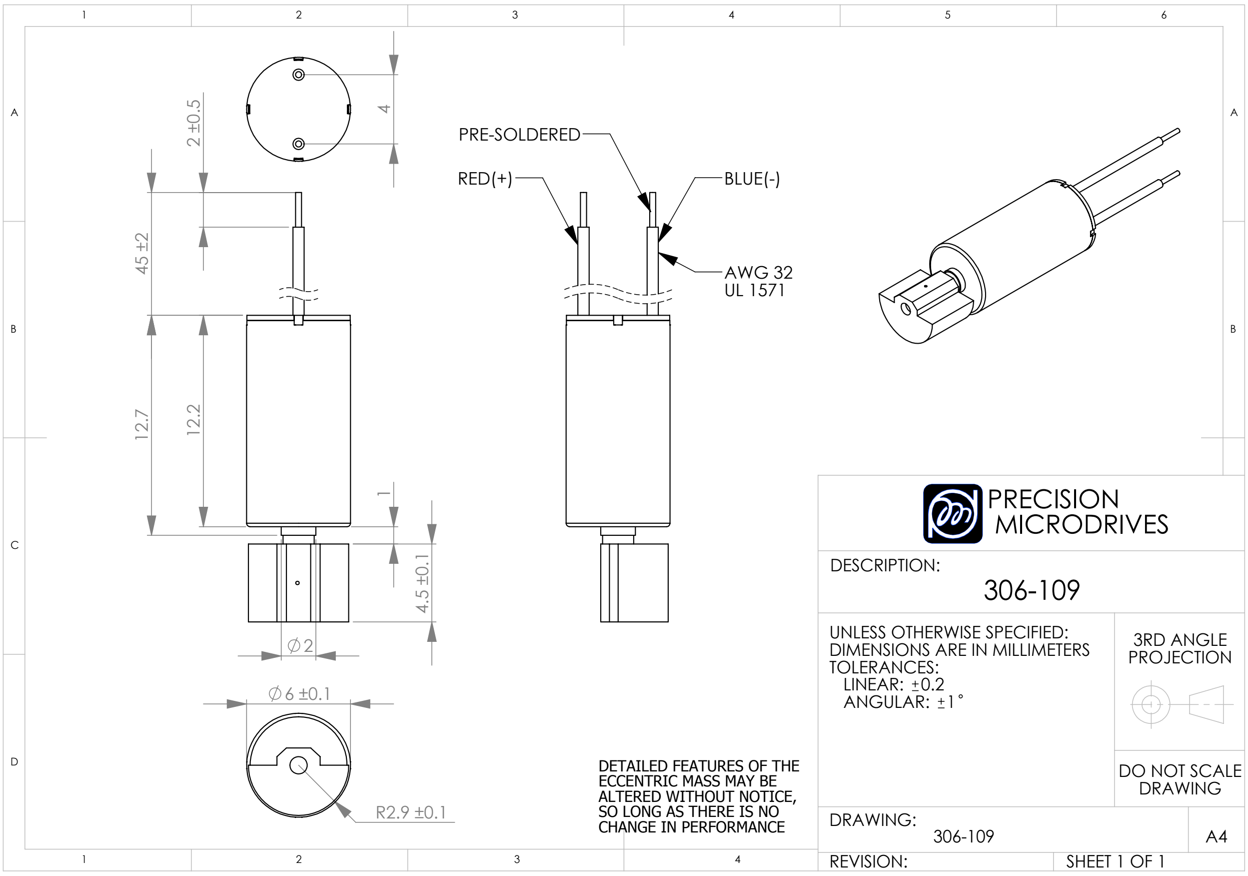
$$FIT = 10^9/MTTF$$

Test Result

The results for the longevity test are presented in a Weibull plot. From the fitting distribution it is possible to obtain an estimate of the Mean Time to Failure.



Product Dimensional Specification



Life Support Policy

PRECISION MICRODRIVES PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF PRECISION MICRODRIVES LIMITED.
As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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