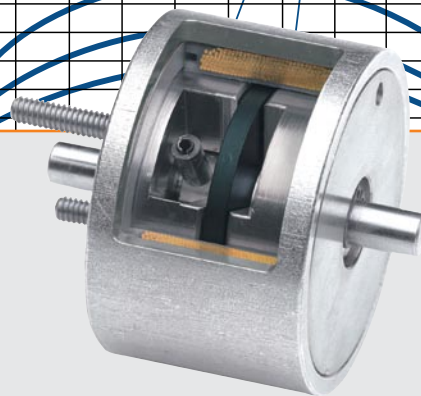
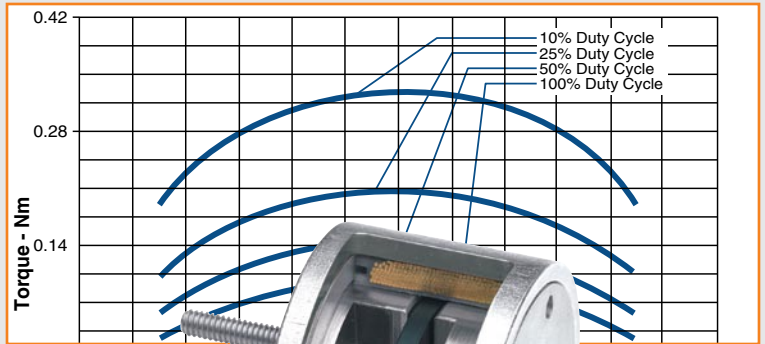


Ultimag[®] Rotary Actuators



WARNING: Exposed Magnet may affect pacemakers. In the event a product unit's magnet is exposed due to product disassembly, Pacemaker Wearers should distance themselves 3 metres from exposed magnet.

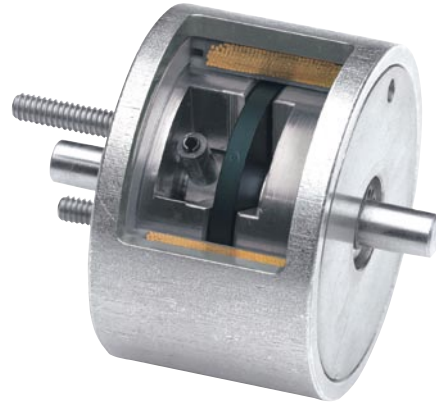


Ultimag® Rotary Actuators

ROTARY Ultimag®



- Speeds over 100 Hz
- Peak torque of over 1.5 Nm
- 100 million actuation life
- Three standard sizes

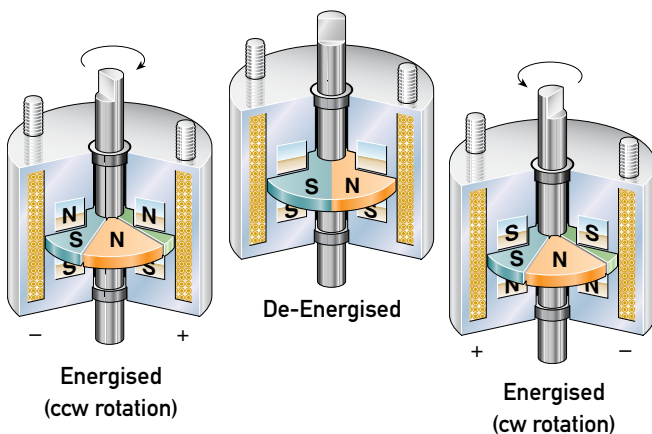


All catalogue products manufactured after April 1, 2006 are RoHS Compliant

Ultimag® Principle of Operation

Ultimag® operates on the simple principle of attraction and repulsion of opposite and like magnetic poles. The permanent magnetic armature has twice as many poles as the stator. In the de-energised state, the armature poles each share half a stator pole, causing the shaft to seek mid-stroke. When power is applied, the

stator poles are polarised. This attracts half and repels the other half of the armature poles, causing the shaft to rotate. When the voltage is reversed, the stator poles are polarised with the opposite pole. Consequently, the opposite poles of the armature are attracted and repelled, thus causing rotation in the opposite direction.



The Ultimag Series has been developed in response to application needs for higher speed and higher torque motion control components. We have found that many applications require a working stroke less than 360°, yet still employ motors with their associated complex and expensive controls and linkages. As a result, a powerful, extremely fast short stroke actuator has many design advantages for industrial, office automation, automotive and medical applications.

We have been designing and manufacturing world class, innovative motion control components for over 60 years. Our patented Ultimag series is the latest of our state-of-the-art developments in rotary actuation products.

Ultimag® Rotary Actuators

The Ultimag® Difference

Ultimag® offers a bidirectional, centre return function not found in rotary solenoids. The Ultimag is substantially faster than other solenoids, and can be operated in an on/off mode or proportionally, in both open loop and closed loop systems.

The Ultimag does not offer 360° of rotation which is definitive of motors. With this stroke limitation in mind, Ultimag provides an inexpensive alternative for limited stroke applications, particularly, when total cost of system control is included.

Ultimag actuators offer a 45° stroke. However, the design is capable of a maximum stroke of 160°. Gears, belts, pulley, etc., can be employed to amplify stroke. In all cases, an increase in stroke will cause a reduction in torque.

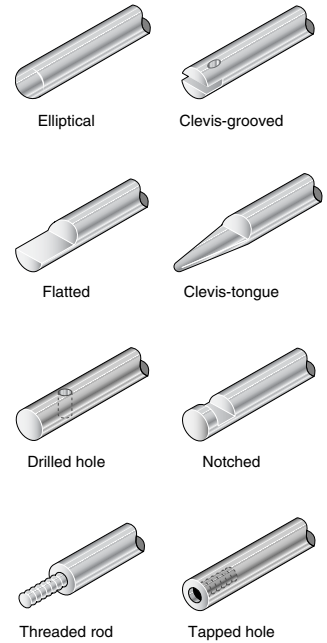
For shorter strokes, electronic or mechanical stops can be used. By having a unit tooled to perform a specific stroke less than 45°, more torque will be obtained.

When adding the Ultimag to your application, the shaft must be supported to avoid stress fractures to the magnet.

Temperature Limitation

The permanent magnet in the Ultimag is NdFeB. For applications running above 130°C, we do not recommend the Ultimag, since the NdFeB magnets irreversibly degrade after reaching a 150°C temperature.

Typical Examples of Custom Features



ROTARY Ultimag®

Ultimag Selection Overview

| Size | Package Dimensions (mm) | | Net Starting Torque (Nm) @ Specified Duty Cycle* | | | | Net Ending Torque (Nm) @ Specified Duty Cycle* | | | |
|------|-------------------------|--------|--|------|------|------|--|------|------|------|
| | Dia. | Length | 100% | 50% | 25% | 10% | 100% | 50% | 25% | 10% |
| 4EM | 41 | 26 | 0.10 | 0.14 | 0.20 | 0.33 | 0.02 | 0.06 | 0.10 | 0.19 |
| 5EM | 49 | 33 | 0.23 | 0.33 | 0.44 | 0.71 | 0.04 | 0.11 | 0.23 | 0.44 |
| 6EM | 59 | 41 | 0.57 | 0.68 | 1.13 | 1.58 | 0.28 | 0.43 | 0.57 | 0.83 |

*Note: Torque outputs degrade with elevated temperatures.

How to Use Ultimag Performance Charts

- Select one of the four columns which provides the appropriate duty cycle. (For example 50%.)
- Reading down this column provides a variety of performance and electrical data including maximum on time, watts, and amp turns.
- Following down the column further into the VDC ratings, select the voltage which most closely matches your supply voltage. (For example, 11.5 for a 12 VDC power supply.)
- Read across (to the left) to select the avg suffix to complete the part number when ordering. (In this example using our 5EM chart, 25 avg is required, thus to order, specify: 199173-025.)

Performance

| Maximum Duty Cycle* | 100% | 50% | 25% | 10% |
|---|----------|------|------|------|
| K_M (mNm/ $\sqrt{\text{watt}}$) | 76.3 | 84.6 | 57.4 | 48.3 |
| Maximum ON Time (sec) when pulsed continuously ¹ | ∞ | 40 | 15 | 4 |
| Maximum ON Time (sec) for single pulse ² | ∞ | 109 | 36 | 10 |
| Typical Energise Time (msec) ³ | 6.0 | 5.5 | 4.5 | 4.0 |
| Watts (@ 20°C) | 2.1 | 42 | 84 | 210 |
| Ampere Turns (@ 20°C) | 621 | 878 | 1242 | 1964 |

Coil Data

| avg (0XX) ⁴ | Resistance (@20°C) | # Turns ⁵ | VDC (Nom) | VDC (Nom) | VDC (Nom) | VDC (Nom) |
|------------------------|--------------------|----------------------|-----------|-----------|-----------|-----------|
| 23 | 1.05 | 128 | 4.7 | 6.6 | 9.4 | 14.8 |
| 24 | 2.24 | 213 | 6.9 | 9.7 | 13.7 | 21.7 |
| 25 | 3.16 | 240 | 8.1 | 11.5 | 16.3 | 25.8 |
| 26 | 4.45 | 270 | 9.7 | 13.7 | 19.3 | 30.6 |
| 27 | 8.50 | 404 | 13.4 | 18.9 | 26.7 | 42.2 |
| 28 | 11.90 | 452 | 15.8 | 22.3 | 31.6 | 50.0 |
| 29 | 21.10 | 630 | 21.0 | 29.7 | 42.1 | 67.0 |
| 30 | 29.50 | 705 | 24.9 | 35.2 | 49.8 | 78.7 |
| 31 | 50.30 | 948 | 32.5 | 45.9 | 65.0 | 103.0 |
| 32 | 82.70 | 1232 | 41.7 | 58.9 | 83.0 | 132.0 |
| 33 | 134.00 | 1576 | 53.0 | 74.9 | 106.0 | 168.0 |

Ultimag® Size 4EM

Part Number: 199172-0XX

All catalogue products manufactured after April 1, 2006 are RoHS Compliant

Specifications

| | |
|-------------------------------|---|
| Dielectric Strength | 1000 VRMS (23 awg); 1200 VRMS (24-33 awg) |
| Recommended Minimum Heat Sink | Maximum watts dissipated by the Ultimag are based on an unrestricted flow of air at 20°C, with the Ultimag mounted on the equivalent of an aluminium plate measuring 15.9 cm square x 0.32 cm thick |
| Thermal Resistance | 7.6°C/watt with heatsink; 15.0°C/watt without heatsink |
| Rotor Inertia | 8.43 x 10 ⁻⁷ (kgm ²) |
| Peak Torque Rating (Tp) | 0.32 Nm |
| Power Input | 145 watts (stalled at Tp; 25°C; Pp) |
| Number of Phases | 1 |
| Static Friction (Tf) | 7 mNm |
| -3dB Closed Loop | 78 Hz |
| Maximum Winding | 180°C |
| Number of Poles | 6 |
| Weight: | 215 gms |
| Dimensions: | Ø41.66 mm x 26.3 mm L (See page B10) |



Performance

| | | | | |
|---|------|------|------|------|
| Maximum Duty Cycle | 100% | 50% | 25% | 10% |
| K _m (mNm/√watt) | 40.6 | 35.7 | 32.2 | 30.1 |
| Maximum ON Time (sec) when pulsed continuously ¹ | ∞ | 40 | 15 | 4 |
| Maximum ON Time (sec) for single pulse ² | ∞ | 108 | 34 | 9 |
| Typical Energise Time (msec) ³ | 6 | 5 | 4.5 | 3.5 |
| Watts (@ 20°C) | 14.5 | 29 | 58 | 145 |
| Ampere Turns (@ 20°C) | 510 | 721 | 1020 | 1613 |

Coil Data

| awg (0XX) ⁴ | Resistance (@20°C) | # Turns ⁵ | VDC (Nom) | VDC (Nom) | VDC (Nom) | VDC (Nom) |
|------------------------|--------------------|----------------------|-----------|-----------|-----------|-----------|
| 23 | 0.71 | 104 | 3.2 | 4.5 | 6.4 | 10.1 |
| 24 | 1.54 | 174 | 4.7 | 6.7 | 9.4 | 14.9 |
| 25 | 2.15 | 195 | 5.6 | 7.9 | 11.2 | 17.6 |
| 26 | 3.01 | 219 | 6.6 | 9.3 | 13.2 | 20.9 |
| 27 | 5.78 | 328 | 9.2 | 12.9 | 18.3 | 28.9 |
| 28 | 8.09 | 368 | 10.8 | 15.3 | 21.7 | 34.3 |
| 29 | 14.40 | 515 | 14.5 | 20.4 | 28.9 | 45.7 |
| 30 | 20.11 | 575 | 18.9 | 24.2 | 37.7 | 59.6 |
| 31 | 34.40 | 774 | 22.3 | 31.6 | 44.6 | 71.0 |
| 32 | 56.60 | 1008 | 28.7 | 40.5 | 57.0 | 91.0 |
| 33 | 91.40 | 1288 | 36.0 | 51.5 | 73.0 | 115.0 |

How to Order

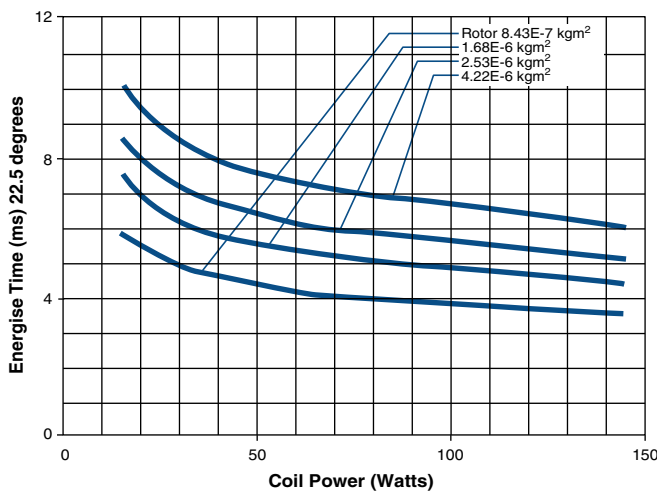
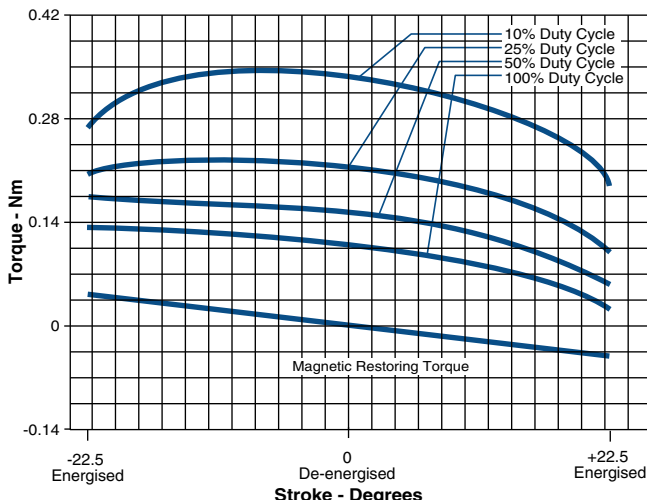
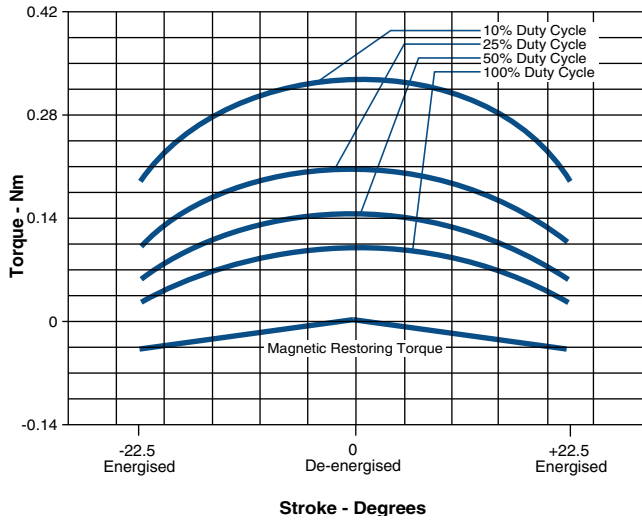
Add the coil awg number (0XX) to the part number (for example: to order a 25% duty cycle rated at 18.5 VDC, specify 199172-027).

Please see www.ledex.com (click on Stock Products tab) for our list of stock products available through our distributors.

- Continuously pulsed at stated watts and duty cycle
- Single pulse at stated watts (with coil at ambient room temperature 20°C)
- Typical energise time based on no load condition. Times shown are for half of full rotary stroke starting at centre-off position.
- Other coil awg sizes available — please consult factory
- Reference number of turns

WARNING: Exposed Magnet may affect pacemakers. In the event a product unit's magnet is exposed due to product disassembly, Pacemaker Wearers should distance themselves 3 metres from exposed magnet.

All specifications subject to change without notice.



Torque values for reference only.

All specifications subject to change without notice.

Ultimag® Size 5EM

Part Number: 199173-0XX

All catalogue products manufactured after April 1, 2006 are RoHS Compliant

Specifications

| | |
|-------------------------------|---|
| Dielectric Strength | 1000 VRMS (23 awg); 1200 VRMS (24-33 awg) |
| Recommended Minimum Heat Sink | Maximum watts dissipated by the Ultimag are based on an unrestricted flow of air at 20°C, with the Ultimag mounted on the equivalent of an aluminium plate measuring 19.1 cm square x 0.32 cm thick |
| Thermal Resistance | 5.36°C/watt with heatsink; 12.9°C/watt without heatsink |
| Rotor Inertia | 3.085 x 10 ⁻⁶ (kgm ²) |
| Peak Torque Rating (Tp) | 0.7 Nm |
| Power Input | 210 watts (stalled at Tp; 25°C; Pp) |
| Number of Phases | 1 |
| Static Friction (Tf) | 7 mNm |
| -3dB Closed Loop | 66.5 Hz |
| Maximum Winding | 180°C |
| Number of Poles | 6 |
| Weight: | 363 gms |
| Dimensions: | Ø49.2 mm x 31.75 mm L max (See page B10) |



Performance

| Maximum Duty Cycle* | 100% | 50% | 25% | 10% |
|---|------|------|------|------|
| K _M (mNm/√watt) | 76.3 | 84.6 | 57.4 | 48.3 |
| Maximum ON Time (sec) when pulsed continuously ¹ | ∞ | 40 | 15 | 4 |
| Maximum ON Time (sec) for single pulse ² | ∞ | 109 | 36 | 10 |
| Typical Energise Time (msec) ³ | 6.0 | 5.5 | 4.5 | 4.0 |
| Watts (@ 20°C) | 2.1 | 42 | 84 | 210 |
| Ampere Turns (@ 20°C) | 621 | 878 | 1242 | 1964 |

Coil Data

| awg (0XX) ⁴ | Resistance (@20°C) | # Turns ⁵ | VDC (Nom) | VDC (Nom) | VDC (Nom) | VDC (Nom) |
|------------------------|--------------------|----------------------|-----------|-----------|-----------|-----------|
| 23 | 1.05 | 128 | 4.7 | 6.6 | 9.4 | 14.8 |
| 24 | 2.24 | 213 | 6.9 | 9.7 | 13.7 | 21.7 |
| 25 | 3.16 | 240 | 8.1 | 11.5 | 16.3 | 25.8 |
| 26 | 4.45 | 270 | 9.7 | 13.7 | 19.3 | 30.6 |
| 27 | 8.50 | 404 | 13.4 | 18.9 | 26.7 | 42.2 |
| 28 | 11.90 | 452 | 15.8 | 22.3 | 31.6 | 50.0 |
| 29 | 21.10 | 630 | 21.0 | 29.7 | 42.1 | 67.0 |
| 30 | 29.50 | 705 | 24.9 | 35.2 | 49.8 | 78.7 |
| 31 | 50.30 | 948 | 32.5 | 45.9 | 65.0 | 103.0 |
| 32 | 82.70 | 1232 | 41.7 | 58.9 | 83.0 | 132.0 |
| 33 | 134.00 | 1576 | 53.0 | 74.9 | 106.0 | 168.0 |

*Not recommended for full stroke at 100% duty cycle.

How to Order

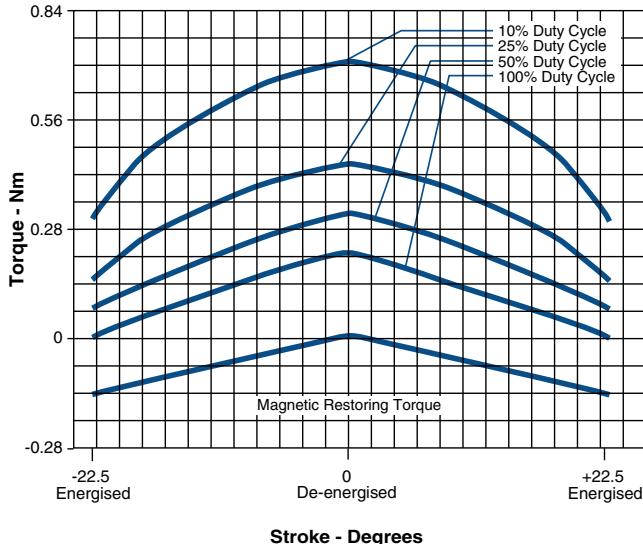
Add the coil awg number (0XX) to the part number (for example: to order a 25% duty cycle rated at 26.7 VDC, specify 199173-027).

Please see www.ledex.com (click on Stock Products tab) for our list of stock products available through our distributors.

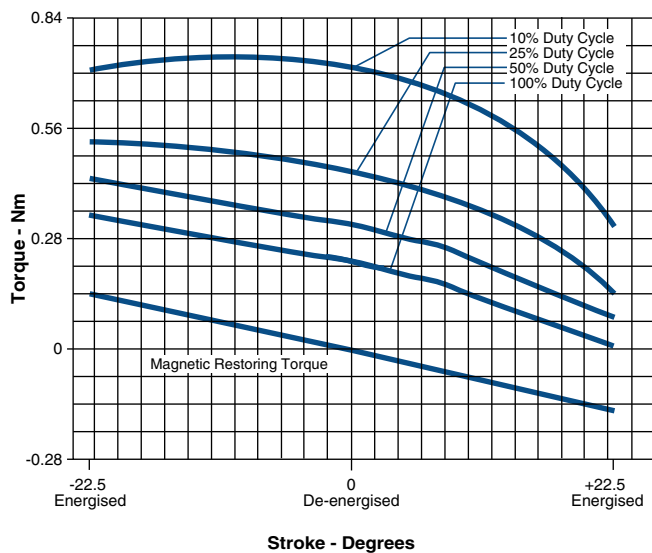
- ¹ Continuously pulsed at stated watts and duty cycle
- ² Single pulse at stated watts (with coil at ambient room temperature 20°C)
- ³ Typical energise time based on no load condition. Times shown are for half of full rotary stroke starting at centre-off position.
- ⁴ Other coil awg sizes available — please consult factory
- ⁵ Reference number of turns

WARNING: Exposed Magnet may affect pacemakers. In the event a product unit's magnet is exposed due to product disassembly, Pacemaker Wearers should distance themselves 3 metres from exposed magnet.

All specifications subject to change without notice.

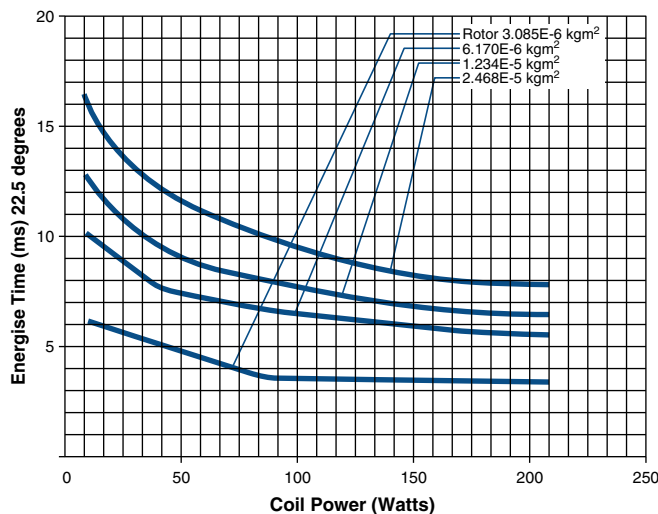


Graph 1 shows three position operation. In any mode, the armature seeks centre of stroke at zero power. Applying a positive or negative voltage causes the shaft to rotate clockwise or counter clockwise. When power is removed, the restoring torque is applied to the load, or alternatively, the shaft can be driven to centre under power.



Graph 2 shows operation end-to-end. Note the high starting torque for high starting acceleration or for stopping the load by means of reverse voltage at the end of the stroke. If the device is used in a full stroke application, the load can be externally latched, detented, or biased to either end of stroke.

NOTE: The Size 5EM Ultimag is not recommended for full stroke operation at 100% duty cycle.



Graph 3 shows how speed varies with load. Each curve represents a different inertial load, which is a multiple of the armature inertia.

Calculate the inertia of your system, then use this chart to determine Ultimag speed in your application. Inertia determination of simple shapes is shown in most engineering handbooks; complex shapes are calculated in solid modeling software or are measured empirically. This graph represents half of the full rotary stroke starting at the centre-off position.

Ultimag® Size 6EM

Part Number: 199174-0XX

All catalogue products manufactured after April 1, 2006 are RoHS Compliant

Specifications

| | |
|-------------------------------|--|
| Dielectric Strength | 1000 VRMS (23 awg); 1200 VRMS (24-33 awg) |
| Recommended Minimum Heat Sink | Maximum watts dissipated by the Ultimag are based on an unrestricted flow of air at 20°C, with the Ultimag mounted on the equivalent of an aluminium plate measuring 31.43 cm square x 0.32 cm thick |
| Thermal Resistance | 3.58°C/watt with heatsink; 8.52°C/watt without heatsink |
| Rotor Inertia | 5.676 x 10 ⁻⁶ (kgm ²) |
| Peak Torque Rating (Tp) | 1.6 Nm |
| Power Input | 320 watts (stalled at Tp; 25°C; Pp) |
| Number of Phases | 1 |
| Static Friction (Tf) | 7 mNm |
| -3dB Closed Loop | 12.8 Hz |
| Maximum Winding | 180°C |
| Number of Poles | 6 |
| Weight: | 0.73 kg |
| Dimensions: | Ø58.72 mm x 40.6 mm L (See page B10) |



Performance

| | | | | |
|---|------|------|------|------|
| Maximum Duty Cycle | 100% | 50% | 25% | 10% |
| Maximum ON Time (sec) when pulsed continuously ¹ | ∞ | 40 | 15 | 5 |
| Maximum ON Time (sec) for single pulse ² | ∞ | 143 | 47 | 11 |
| Typical Energise Time (msec) ³ | 17 | 12 | 10.5 | 8.5 |
| Watts (@ 20°C) | 32 | 64 | 128 | 320 |
| Ampere Turns (@ 20°C) | 980 | 1386 | 1960 | 3100 |

Coil Data

| awg (0XX) ⁴ | Resistance (@20°C) | # Turns ⁵ | VDC (Nom) | VDC (Nom) | VDC (Nom) | VDC (Nom) |
|------------------------|--------------------|----------------------|-----------|-----------|-----------|-----------|
| 23 | 2.65 | 267 | 9.2 | 13.0 | 18.4 | 29.1 |
| 24 | 5.02 | 396 | 12.7 | 17.9 | 25.4 | 40.1 |
| 25 | 7.03 | 444 | 15.0 | 21.2 | 30.0 | 47.4 |
| 26 | 12.60 | 625 | 20.1 | 28.4 | 40.2 | 63.5 |
| 27 | 17.60 | 700 | 23.8 | 33.6 | 47.5 | 75.1 |
| 28 | 29.90 | 936 | 30.9 | 43.7 | 61.9 | 97.8 |
| 29 | 49.50 | 1225 | 39.8 | 56.3 | 80.0 | 126.0 |
| 30 | 79.70 | 1560 | 51.0 | 71.4 | 101.0 | 160.0 |
| 31 | 126.50 | 1962 | 64.0 | 90.0 | 127.0 | 201.0 |
| 32 | 198.30 | 2440 | 80.0 | 112.6 | 159.0 | 252.0 |
| 33 | 306.20 | 2992 | 99.0 | 140.0 | 198.0 | 313.0 |

How to Order

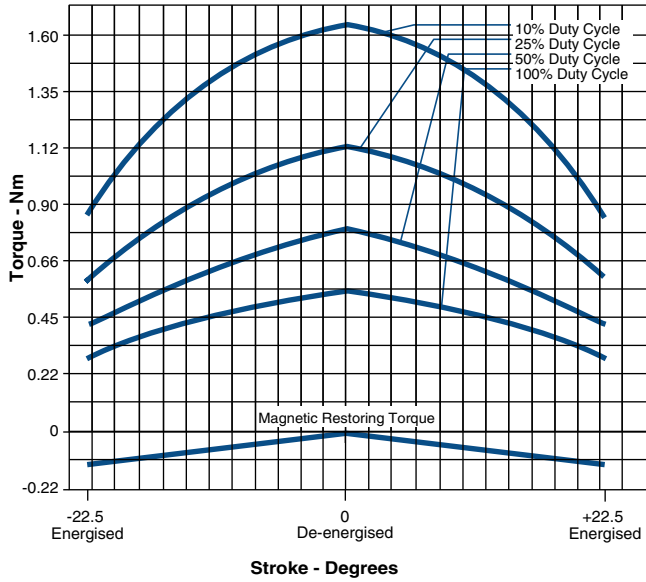
Add the coil awg number (0XX) to the part number (for example: to order a 25% duty cycle rated at 25.4 VDC, specify 199174-024).

Please see www.ledex.com (click on Stock Products tab) for our list of stock products available through our distributors.

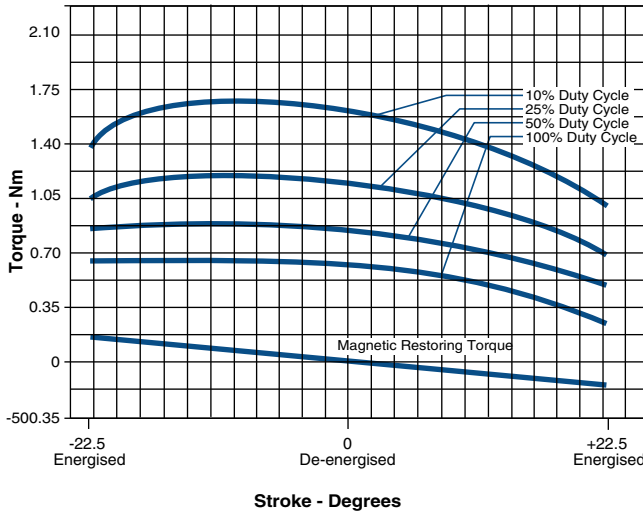
- Continuously pulsed at stated watts and duty cycle
- Single pulse at stated watts (with coil at ambient room temperature 20°C)
- Typical energise time based on no load condition. Times shown are for half of full rotary stroke starting at centre-off position.
- Other coil awg sizes available — please consult factory
- Reference number of turns

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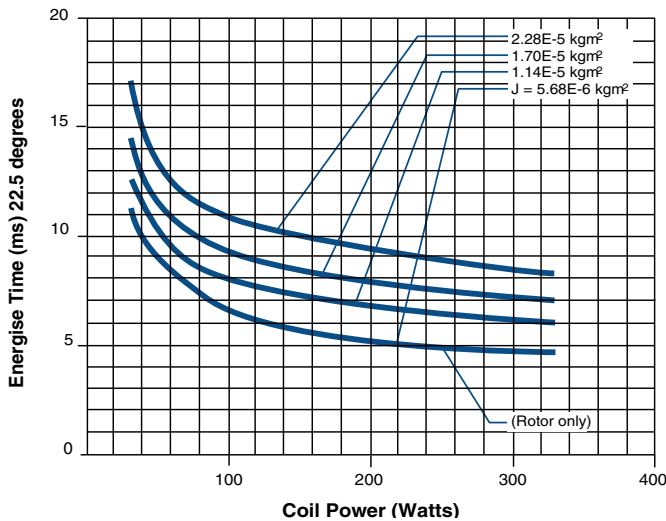
All specifications subject to change without notice.



Graph 1 shows three position operation. In any mode, the armature seeks centre of stroke at zero power. Applying a positive or negative voltage causes the shaft to rotate clockwise or counter clockwise. When power is removed, the restoring torque is applied to the load, or alternatively, the shaft can be driven to centre under power.



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Graph 3 shows how speed varies with load. Each curve represents a different inertial load, which is a multiple of the armature inertia.

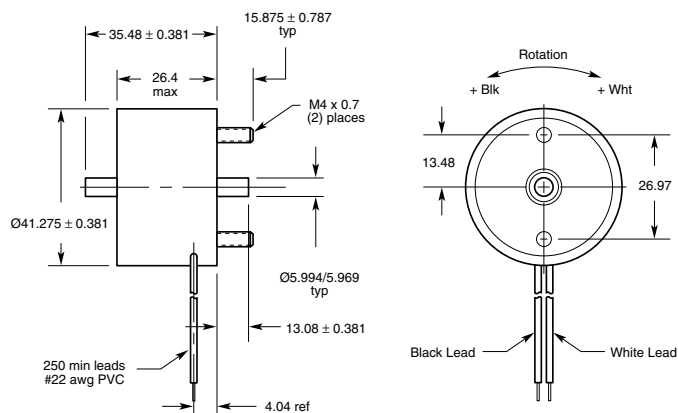
Calculate the inertia of your system, then use this chart to determine Ultimag speed in your application. Inertia determination of simple shapes is shown in most engineering handbooks; complex shapes are calculated in solid modeling software or are measured empirically. This graph represents half of the full rotary stroke starting at the centre-off position.

Ultimag® Dimensions

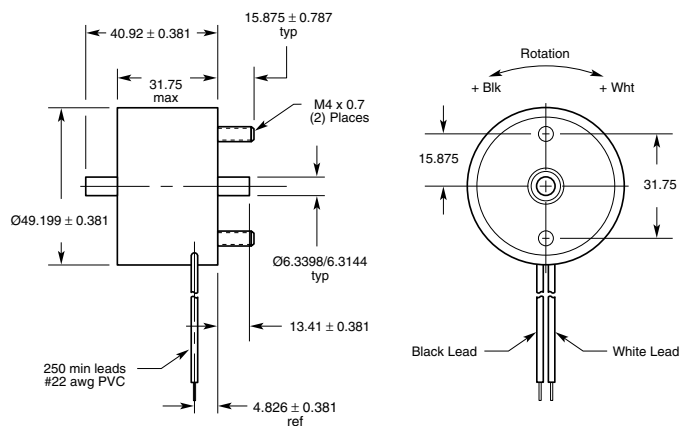
ROTARY Ultimag®

mm

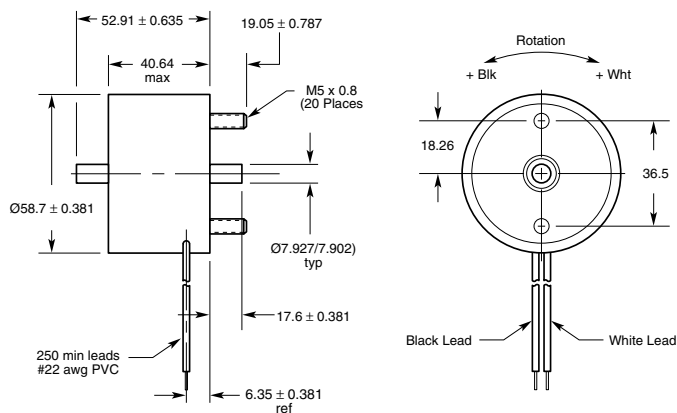
4EM



5EM



6EM



All specifications subject to change without notice.