Integrating rotary movement and electronics
An SMD-mounted piezo motor

- Integrate multiple motors
- Enhance designs
- Improve accuracy
- Reduce production costs

See our introduction video on www.youtube.com/pcbmotor
Four new ways to succeed

- Integrate multiple motors on one PCB
- Enhance product designs and reduce building height
- Improve precision through ultra-high resolution
- Lower assembly costs with automatic mounting

Key features

- Direct drive, no gears, slack-less
- High torque and holding torque
- Built-in clutch, tamper proof/safe
- Non-magnetic
- Fast start & stop actions
- Optional position sensor

Competitive advantages & increased profit
Application examples

- Medico
  - Microscope focus
  - Dosing equipment

- Optics & Lasers

- Camera
  - Focus
  - Pan, tilt & zoom

- Instrumentation
  - Dashboard pointers
  - Positioning, stages
  - Laboratory equipment

- Industrial
  - Valve application

Ultra-high resolution & accuracy
A PCB Motor consists of

1. **The Stator**
   
   The PCB with piezos mounted, to which a voltage is applied, thus causing the traveling wave

2. **The Rotor**
   
   Pressed onto the stator, delivers the mechanical output

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**Turn your PCB into a motor**

See the traveling wave on our Youtube channel:
http://www.pcbmotor.com/pcbmotor
Flexible designs ➔ Automated assembly

Smaller, lighter, more compact designs

- **Application-specific rotors.** Our solutions accommodate variable rotor widths and heights, thus allowing more flexible application designs.
- **The control driver.** Can be integrated onto the same PCB as the stator.

Fully-automated production that

- Employs electronic-industry manufacturing standards.
- Uses “landing bridges” to connect the stator to the driver.
- Piezo ceramics mounted as SMD components.
- **Pick & Place** robotics with rotary head.

Industry standards ensure economies of scale
Motor performance results

Motor characteristics for a Ø30 mm stator measured at 200 Vrms. Maximum available power at the shaft is 80 mW at a speed of 1 rev/s. Notice the linear Torque/Speed curve.

An operating temperature range of -10 to 85 °C has been tested and confirmed in some applications.
Endurance test results

PCB Motors are well-suited for customer integrations.

Our motors have an expected life of >1000 hrs.

The final application and its actual operating environment ultimately determine the motor’s life expectancy.

The above results were compiled from a Ø30 mm motor running continuously, logging data every 10 min.

**Note:** The experiment shows no changes (*End-of-life*) in the given timeframe.
High-precision applications

Superior resolution with up to 2,6M µpulses/revolution
Utilizing open-loop and micro-pulsing the controller, system engineers can now achieve superior micro-positioning in applications with resolutions over 2.6 million µpulses per revolution.

Technology experiment record
The controller is open-loop, i.e. the µpulses are entirely “free-running”. In a practical application, external feedback is needed to determine the position. The digital codewheel can be used for calibrating µpulses/step for each digital step.

Example of PCBmotor resolution
Note: Actual resolution depends on application

Steps per revolution

Step time (msec)

Watch the high resolution technology record on our Youtube channel:
http://www.youtube.com/pcbmotor

Increased resolution gives greater accuracy
Rotor & hollow shaft examples

12 mm ‘free center’ using a rotor disc for Ø30 mm stator with spring & sensor markings.

Interlocked rotor discs for maximum ‘free center’ diameter.

Hollow 60 mm rotor construction with 3 rollers.

3-point roller support principle for radial alignment.

High resolution and low cost hollow shaft
Customized design examples

8 motor, one-layer design (Ø20 mm) with one integrated driver based on customer specifications.

5 motor, two-layer design (Ø25 mm), one central driver in a *sandwhich* construction. Upper & lower decks contain the motors, with the driver placed on the center board.

High Resolution Twin Motor development kit. Experience 2.6 million µpulses/rev and dual, bi-directional rotational movement with multiplexing capabilities. *Available online.*

Single motor, one-layer design (Ø30 mm stator) with an integrated driver based on customer specifications.

Flexible design and easy customization
Basic control driver (without position sensor)

The driver generates a two-phase sinusoidal that is stepped up through two transformers to a drive voltage of 50-200 Vrms.

- 0.2-2.0 W power for Ø30mm motor
- Motor resonance: 40-45 kHz
- Frequency Tracking needed for max performance at different temperatures

1 Central control driver can drive several motor positions, with application electronics on the same PCB

- The basic component in the driver is the transformers
- Standard IC’s or ASIC are possible for applications with space constraints

Low cost, flexible drivers - smaller through IC’s
Next steps for application success

Need more facts about our piezo technology?
Download our White Paper – How to Solve High Resolution and Low Speed Dilemmas.

Includes a free engineering consultancy session and The Top 5 Pains electronic movement designers and engineers have today!

Is your application PCBMotor-ready?
To hear if your application is right for a PCBMotor, fill out the Performance Sheet on slide 13 and send it to me.

For more information email info@pcbmotor.com
# Performance Sheet

Complete the performance sheet below, email it to us and we’ll send you a **free assessment** of how our technology can (or cannot) be used in your application. Spend a minute on it. It could save you a lot more!

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Min/Max</th>
<th>Comments</th>
<th>Your Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Height</td>
<td>2.6 mm</td>
<td>Without Rotor</td>
<td>[ your specifications]</td>
</tr>
<tr>
<td>Inner Diameter</td>
<td>14-82 mm</td>
<td>Typical</td>
<td>…</td>
</tr>
<tr>
<td>Outer Diameter</td>
<td>20-90 mm</td>
<td></td>
<td>…</td>
</tr>
<tr>
<td>Speed</td>
<td>2-0.3 rev/s</td>
<td></td>
<td>…</td>
</tr>
<tr>
<td>Torque</td>
<td>8-162 Nmm</td>
<td>Torque estimated for motors &gt; 30 mm</td>
<td>…</td>
</tr>
<tr>
<td>Weight</td>
<td>4-20 grams</td>
<td>Without Rotor</td>
<td>…</td>
</tr>
<tr>
<td>Resolution</td>
<td>&lt;2,600,000 µpulses</td>
<td></td>
<td>…</td>
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<tr>
<td>Positioning</td>
<td>Sensor/Codewheel dependent</td>
<td></td>
<td>…</td>
</tr>
<tr>
<td>Lifetime</td>
<td>+1000 hours continuous operation</td>
<td>Application dependant</td>
<td>…</td>
</tr>
<tr>
<td>Power budget</td>
<td>0.2-10 W</td>
<td></td>
<td>…</td>
</tr>
<tr>
<td>EMC</td>
<td>Tested OK</td>
<td>Application dependant</td>
<td>…</td>
</tr>
<tr>
<td>Driver size</td>
<td>50x30x7 mm (Typical)</td>
<td>Stand-alone or multiplexing</td>
<td>…</td>
</tr>
<tr>
<td>Temperature</td>
<td>0-70°C</td>
<td>Non-condensing</td>
<td>…</td>
</tr>
</tbody>
</table>

**Send us your specifications:**

1. **Double-click** the **Your Application** column & enter your requirements' values.
2. **Save** the PowerPoint to your PC.
3. **Attach** it to an email and **send** it to Henrik, at info@pcbmotor.com
4. We'll reply to you **within 24 hours**
High Resolution Twin Motor Kit
The 2.6 million High Resolution Twin Motor Kit includes a main motor board, controller board, & free PCBMotor software for speedy integration and prototyping.

Lab Kit Basic
A Lab Kit is the best way to get started with using PCBMotor technology and comes with everything you need.

Evaluation Kit Basic
Evaluation kit with tracking feature for demonstration and project preparation.