Closed loop commutation enabling highly dynamic performance

The stepIM significantly enhances the performance of the stepper motors, when compared to conventional open loop control. The integrated electronics control the stepper motor as a two phase BLDC motor, implementing position loop, velocity loop, DQ current control, as well as additional algorithms. Closed loop commutation, by means of an absolute single-turn encoder, ensures optimal torque utilization at any speed.

Optimal cost-performance ratio for applications that require servo-like performance

- High torque/low speed – eliminating the need for a gear
- High speed in low torque ranges
- The stepIM can function as distributed I/O points - reducing machine complexity

Benefits of closed loop vs. open loop operation

<table>
<thead>
<tr>
<th></th>
<th>Closed loop</th>
<th>Open loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>No step loss</td>
<td>Encoder feedback with closed loop control guarantees accurate motion</td>
<td>Abrupt changes in load may cause lost steps, creating a position error</td>
</tr>
<tr>
<td>High dynamics</td>
<td>Load dependent current control</td>
<td>Constant current control at all speed ranges without considering load variations</td>
</tr>
<tr>
<td></td>
<td>Optimal torque utilization for any speed and any load</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eliminating the effect of mid-band resonance</td>
<td></td>
</tr>
<tr>
<td>Torque &amp; force control modes of operation</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Maximum torque utilization</td>
<td>Utilizing 100% of the full range of rated motor torque</td>
<td>Practical limitation of about 50% of rated motor torque due to risk of synchronization loss</td>
</tr>
<tr>
<td>Low noise &amp; vibration</td>
<td>Silent operation due to reduced stepping vibration and low speed resonance</td>
<td>Stepping vibration and high speed resonance cause noisy operation</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>Provides current based on actual load. This reduces heating of the motor and saves energy</td>
<td>Maximum current is applied irrespective of required torque, leading to high losses and respective heating of the motor and drive</td>
</tr>
</tbody>
</table>

Key benefits

- Sophisticated closed loop control enhances motor performance with no step loss
- Operates in torque, velocity, and position modes
- Efficient torque utilization optimizes motor sizing
- Integrated design minimizes component and wiring requirements
- Reduced space, installation efforts and system cost
- Fieldbus: CANopen DS402, EtherCAT
- Synchronized control of coordinated motion profiles
- Reduced machine complexity, as stepIM can function as distributed I/O points
- Up to IP65 protection class
- Maintenance free
- CE compliance

Complete Motion Solution

- softMI Human Machine Interface
- softTP Tablet Teach Pendant
- softMC Multi Axis Motion Controllers
Integrated components reduce cost, space and machine complexity

In decentralized architectures, wiring and assembly time can be reduced thus enabling significant cost savings for machine builders. Decentralized drives that integrate motor, control and power electronics also free up space and reduce heating in the cabinet. Machine complexity is reduced as fewer components and a smaller cabinet are used.

High resolution magnetic encoder increases system efficiency

With a 12 bit absolute encoder 4096 count per revolution and an update rate of 16 kHz, the stepIM precisely controls the magnetic flux generated based on actual load, ensuring accurate positioning and maximum machine efficiency.

Rating and dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>IP ratings</th>
<th>Com.</th>
<th>Input voltage (VDC)</th>
<th>Holding Torque (Nm)</th>
<th>Inertia (g*cm²)</th>
<th>Weight (kg)</th>
<th>Frame size (mm)</th>
<th>Motor length w/o shaft (mm)</th>
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</thead>
<tbody>
<tr>
<td>17 Short</td>
<td>20</td>
<td>CANopen</td>
<td>14-48</td>
<td>0.35</td>
<td>57</td>
<td>0.37</td>
<td>42.3</td>
<td>75.3</td>
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<td>17 Medium</td>
<td>20</td>
<td>CANopen</td>
<td>14-48</td>
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<td>82</td>
<td>0.44</td>
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<td>83.8</td>
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<td>CANopen</td>
<td>14-48</td>
<td>0.65</td>
<td>123</td>
<td>0.59</td>
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<td>97.8</td>
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<tr>
<td>23 Short</td>
<td>20, 65</td>
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<td>14-48</td>
<td>1.1</td>
<td>260</td>
<td>0.6</td>
<td>56.4</td>
<td>86.4, 91.4</td>
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<td>CANopen</td>
<td>14-48</td>
<td>1.8</td>
<td>460</td>
<td>1.0</td>
<td>56.4</td>
<td>108.4, 112.4</td>
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<td>20, 65</td>
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<td>14-48</td>
<td>2.6</td>
<td>750</td>
<td>1.5</td>
<td>56.4</td>
<td>145.4, 148.4</td>
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<tr>
<td>23 Short</td>
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<td>EtherCAT</td>
<td>14-60</td>
<td>1.1</td>
<td>260</td>
<td>0.88</td>
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<tr>
<td>23 Medium</td>
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<td>EtherCAT</td>
<td>14-60</td>
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<td>34 Medium</td>
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<td>14-48</td>
<td>3.5</td>
<td>1850</td>
<td>2.7</td>
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<td>2750</td>
<td>4.50</td>
<td>86.5</td>
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</tr>
</tbody>
</table>

Ordering information:

- **Integrated Stepper Motor**
  - Type: High torque
  - Frame size and length:
    - 17S: NEMA 17 Short
    - 17M: NEMA 17 Medium
    - 17L: NEMA 17 Long
    - 23S: NEMA 23 Short
    - 23M: NEMA 23 Medium
    - 23L: NEMA 23 Long
    - 34M: NEMA 34 Medium
    - 34L: NEMA 34 Long
  - Shaft:
    - 1: Single flat (NEMA 17, NEMA 23)
    - 2: Double flat (NEMA 34)
    - 3: Keyway
    - 4: Full round
  - Connector and Degree of Protection:
    - 2: Crimp connectors, IP20
    - 6: M-Connectors, IP65 (NEMA 23, NEMA 34 only)
  - Communication:
    - 2: CANopen
    - 6: EtherCAT
  - Feedback:
    - Standard: 12-bit absolute single turn
    - Brake:
      - 4: No brake
      - 5: With brake (NEMA 23, NEMA 34 only)
    - Additional options available per request

ServoStudio™ for simple commissioning

- Step-by-step guidance through the setup and tuning process
- Real-time data recording and plotting
- Easy integration of servo axes
- Plug-and-play motor and feedback wiring

I/Os:
- Digital (IP20): 4 x Input, 2 x output
- Digital (IP65): 3 x Input, 1 x output
- Analog 1 x Differential Input

Motor feedback:
- 12 bit absolute encoder

For specification and manuals, go to