Modular Rodless Belt-Driven Actuators

EXTRAK

EXLAR
Extrak Rodless Actuators

By choosing Exlar you can be sure you have the most robust mechanical drive possible in your rodless actuator application. This commitment to quality and long life makes Exlar your sure choice for rodless actuators in industrial applications.

The Extrak Design Advantage

- Speed of over 16 feet per second (5m/sec) is achievable depending on the load, driving motor, and actuator drive type. These higher speeds greatly increase the application versatility of the actuator.
- Stroke lengths are available up to 22 feet (6.7m). Optional limit switch packages allow the stroke length limits and homing reference positions to be set within the physical limits of the actuator.
- Flexible – The rodless actuators utilize a close-coupled motor mounting flange for mounting your choice of NEMA or metric dimension motors, gearboxes, clutches, and brakes. This allows the unit to be customized to specific application requirements with the smallest possible package.
- Shorter overall length – Unlike the rod-style actuator, the extended and retracted lengths are the same. This permits a smaller envelope for the actuator and allows it to be applied in more size restricted applications.

Rodless Actuation

Exlar, the leading supplier of industrial servo controlled actuators, offers a complete line of rodless actuators. Exlar’s Extrak™ rodless actuators complement Exlar’s “long life” line of rod style actuators and create, in one source, the broadest offering of electric linear actuators anywhere. This addition makes Exlar your one-stop solution center for all your linear and rotary actuator needs. Exlar’s products are designed for heavy duty (continuous motion) applications and are ideal for industrial positioning or material handling applications with their high speed and long stroke length capabilities. Electric actuators from Exlar will perform millions of operations over the life span of your machine. Like Exlar’s rod style actuators, Exlar’s rodless actuators use components which are designed for extreme robustness and long life.

Profile Size

Exlar’s Extrak actuators are available in three different profile [frame] sizes: 65 mm, 80 mm, and 110 mm. This allows you to conveniently match the physical size allowed by your application with the required performance. Stroke lengths are available up to 22 feet (6.7m) of usable stroke. These rugged actuators can carry heavy loads in excess of 10,000 lb (4500kg) in high duty applications – even higher loads are possible for intermittent duty service.

Frame/Enclosure

Exlar rodless actuators consist of a precision aluminum frame/housing with a movable platen. The extruded housing acts as the frame of the unit and provides for the mounting of linear bearing guides and the driving motor. The linear guide system incorporates high performance linear rails which assure high radial stiffness and vibration-free operation. These criteria are important to assure both precise execution of motion profiles and extremely long life.
Extrak Rodless Actuators

Protection
An optional steel band seal is available for protection. The steel band is held to the case magnetically and covers the belt and guides. This helps to keep debris out of the drive system which may eventually adversely affect the operation of the belt and guides.

All Extrak actuators can be supplied with pressure ports for applying positive air pressure to the actuator in extreme environments. This feature, when employed, will provide additional protection against debris penetrating the housing and affecting operational mechanisms.

Motors
Exlar Extrak actuators are modular in design thus allowing the user to mount any metric 60, 90, or 115 mm frame or Nema 23, 34, 42 or 56 frame motor. Motors are available from Exlar, compatible with nearly any servo amplifier. Alternatively you can readily mount your own motor. In this case Exlar will manufacture the adapter flange to the required dimensions for simple mounting of your motor to the actuator.

Toothed Belt Drive
Exlar’s belt drive rodless actuator employs a tooth Power Grip™ premium belt from Gates to convert the rotary motion of the driving motion to the high speed linear motion of the platen. The “long-life” belts provide higher possible speeds of up to 16 ft/sec, (5m/sec) and due to their composition allow long life. Please be aware that belt drives exhibit high rotational inertia and that proper matching of the driving motor and actuator is important. A planetary gear reducer is an option to assure proper inertia matching.

Mounting
Mounting of the Extrak actuator to your machine frame is simple. The profile of the Extrak includes multiple sized T-slots which allow mounting to other commercially available extruded machine frame products. These also offer mounting of multiple Extrak modules to each other for multi-axis systems. See dimensions on page 10.

Accessories
Accessories are available assuring that you can adapt the actuators to perform specific control functions necessary for each application you encounter.
1. Limit switches
2. Limit switch cables
3. T-Nuts
4. Mounting screws
5. Additional travelers

Drive
In order to simplify the selection of the optimal drive, you’ll find on right the various drive solutions in line with the most important performance data. This allows for the comparison of the different drives and the selection of the drive solution appropriate to the customer’s individual need. In case of any specific or higher requirements to the positioning system we ask you to get in contact with Exlar customer service.

Mounting Configurations
The Exlar rodless actuator can be purchased in various mounting types. See dimensions on page 10.
Limit Switches

The limit switches are used in conjunction with a control unit to limit the stroke (prevent overrunning of the carriage) and to define the reference position.

The standard inductive limit switches are PNP-N.C. with the following specifications:

**Supply:** 10…30 VDC
**Current consumption off-load:** < 10 mA
**Load:** max. 200 mA
**Mechanical switch-ratio:** ≤ 0.4mm

On request the following non-standard limit switches are available:
- PNP-normally open (PNP-NO)
- NPN-normally closed (NPN-NC)
- NPN-normally open (NPN-NO)

Mounting of the Limit Switches

The mounting position of the limit switches is shown in picture 1a. The reference position can be located either to the plus (+) or to the minus (-) limit switch.

Limit switch cables are not included in the delivery. However they can be ordered separately.

On request the limit switches can be connected to a connector shell (picture 1b).

The limit switch cable is equipped with a plug on one side.

Use of T Nuts

Accessories

<table>
<thead>
<tr>
<th>T Slot Nuts</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS5 CS M5</td>
<td>T-Slot Nut 5 mm w/M5 thread, (PN 34686)</td>
<td></td>
</tr>
<tr>
<td>NS5 CS M5</td>
<td>T-Slot Nut 5 mm w/M5 thread Stainless Steel, (PN 34690)</td>
<td></td>
</tr>
<tr>
<td>NS6 CS M6</td>
<td>T-Slot Nut 6 mm w/M6 thread, (PN 34692)</td>
<td></td>
</tr>
<tr>
<td>NS6 CS M6</td>
<td>T-Slot Nut 6 mm w/M6 thread Stainless Steel, (PN 34693)</td>
<td></td>
</tr>
<tr>
<td>NS8 CS M8</td>
<td>T-Slot Nut 8 mm w/M8 thread, (PN 34694)</td>
<td></td>
</tr>
<tr>
<td>NS8 CS M8</td>
<td>T-Slot Nut 8 mm w/M8 Stainless Steel, (PN 34696)</td>
<td></td>
</tr>
</tbody>
</table>
NEMA Standard Motor Dimensions

The Extrak actuators offer the selection for motor mounting provisions to be the various NEMA motor sizes. Because there are variations from brand to brand of motor as to what is called NEMA dimensions, we publish this table of NEMA dimensions that we use as the standards for the product line.

<table>
<thead>
<tr>
<th>Dimension (in)</th>
<th>NEMA 23</th>
<th>NEMA 34</th>
<th>NEMA 42</th>
<th>NEMA 56</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A” Motor Shaft Diameter</td>
<td>0.25</td>
<td>0.5</td>
<td>0.75</td>
<td>0.625</td>
</tr>
<tr>
<td>“B” Motor Shaft Length</td>
<td>0.81</td>
<td>1.19</td>
<td>2.19</td>
<td>2.0625</td>
</tr>
<tr>
<td>“C” Motor Pilot Diameter</td>
<td>1.5</td>
<td>2.875</td>
<td>2.186</td>
<td>4.3</td>
</tr>
<tr>
<td>“D” Pilot Depth</td>
<td>0.05</td>
<td>0.0625</td>
<td>0.0625</td>
<td>0.1 - 0.16</td>
</tr>
<tr>
<td>“E” Mounting Bolt Circle</td>
<td>2.625</td>
<td>3.875</td>
<td>4.95</td>
<td>5.875</td>
</tr>
<tr>
<td>“F” Mounting Bolt Hole Diameter</td>
<td>0.205</td>
<td>0.223</td>
<td>0.328</td>
<td>3/8-16 UNC tap</td>
</tr>
</tbody>
</table>

Drawings subject to change. Consult Exlar for certified drawings.

Standard Motor Mounts for EXTRAK Series

Standard Motor Mounts

Extrak LMB Series Ordering Information

LMx_AA-BBBB-CCC-DE-FFF-GGG-HH

EXTRAK LMB Series
LMB = Belt Drive Rodless Actuator
AA = Size
30 = 65 mm
40 = 80 mm
50 = 110 mm

BBBB = Stroke Length
0 - 7000

CCC = Travel per Input Revolution
155 = 155 mm (30 only)
205 = 205 mm (40 only)
296 = 296 mm (50 only)

D = Linear Bearing Guides
2 = Standard, Long Platen

E = Steel Band Cover
N = None
S = Stainless Strapping
C = Carbon Steel Strapping

FFF = Input Mounting Type
A## = Alpha numeric motor call-out. Contact Exlar Applications Engineering. Motor not included.

FSL = Free Shaft Left
FSR = Free Shaft Right

DFS = Dual Free Shafts, L & R

SLP = Shaft Left with Mounting Plate
SRP = Shaft Right with Mounting Plate

DLM = Dual Shafts with Left Mounting Plate
DRM = Dual Shafts with Right Mounting Plate

GGG = Motor Type
NMT = No Motor Mount
M60 = Exlar 60mm SLM
M90 = Exlar 90mm SLM
M11 = Exlar 115mm SLM
M14 = Exlar 142mm SLM
G60 = Exlar 60mm SLG
G90 = Exlar 90mm SLG
G11 = Exlar 115mm SLG
N23 = NEMA 23
N34 = NEMA 34
N42 = NEMA 42
N56 = NEMA 56

HH = Limit Switches
L1 = 1 Switch
L2 = 2 Switches
L3 = 3 Switches

Dimension (in) NEMA 23 NEMA 34 NEMA 42 NEMA 56
“A” Motor Shaft Diameter 0.25 0.5 0.75 0.625
“B” Motor Shaft Length 0.81 1.19 2.19 2.0625
“C” Motor Pilot Diameter 1.5 2.875 2.186 4.3
“D” Pilot Depth 0.05 0.0625 0.0625 0.1 - 0.16
“E” Mounting Bolt Circle 2.625 3.875 4.95 5.875
“F” Mounting Bolt Hole Diameter 0.205 0.223 0.328 3/8-16 UNC tap
Load Capacity

The load capacity is determined by the selected guiding system. We recommend applying a maximum 20% of the dynamic load rate to the unit.

Applied Moment Load

The allowable values for applied moments are determined by the selected guiding system. The illustration at right shows the descriptions of moment loads as depicted in the table below.

Deflection

For positioning units, the maximum allowed deflection angle is 0.5°. Exceeding this value will decrease the unit's life.

EXTRAK Load Ratings

<table>
<thead>
<tr>
<th>Type</th>
<th>Drive</th>
<th>Dynamic Load Rating (kN)</th>
<th>Dynamic Torque Rating (Nm)</th>
<th>Static Load Rating (kN)</th>
<th>Static Torque Rating (Nm)</th>
<th>Area Moment of Inertia (cm^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cy (1)</td>
<td>Cy (2)</td>
<td>Cz (1)</td>
<td>Cy (2)</td>
<td>Cz (1)</td>
</tr>
<tr>
<td>LMB30</td>
<td>Toothed Belt</td>
<td>14.6</td>
<td>14.6</td>
<td>16.7</td>
<td>16.7</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>170</td>
</tr>
<tr>
<td>LMB40</td>
<td>Toothed Belt</td>
<td>20.5</td>
<td>20.5</td>
<td>23.4</td>
<td>23.4</td>
<td>39.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1719.9</td>
</tr>
<tr>
<td>LMB50</td>
<td>Toothed Belt</td>
<td>33.0</td>
<td>33.0</td>
<td>37.6</td>
<td>37.6</td>
<td>88.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5555.2</td>
</tr>
</tbody>
</table>

EXTRAK Performance Ratings, Toothed Belt Circumferential

<table>
<thead>
<tr>
<th>Size</th>
<th>Belt Type</th>
<th>Travel/Rev (mm)</th>
<th>Stroke Range (mm)</th>
<th>Positioning Accuracy (µm/mm)</th>
<th>Repeating Accuracy (+/- mm)</th>
<th>Reversal Backlash (mm)</th>
<th>Max Speed (m/s^2)</th>
<th>Max Accel (m/s^2)</th>
<th>Max Axial Force (N)</th>
<th>Max Input Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMB30</td>
<td>GT 5/25</td>
<td>155 mm/rev</td>
<td>≤ 7600</td>
<td>200/1000</td>
<td>0.1</td>
<td>0</td>
<td>1.6</td>
<td>Limited by max input torque</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMB40</td>
<td>GT 5/40</td>
<td>205 mm/rev</td>
<td>≤ 7500</td>
<td>200/1000</td>
<td>0.1</td>
<td>0</td>
<td>1.6</td>
<td>1560</td>
<td>2200</td>
<td></td>
</tr>
<tr>
<td>LMB50</td>
<td>ST 8/50</td>
<td>296 mm/rev</td>
<td>≤ 7400</td>
<td>200/1000</td>
<td>0.1</td>
<td>0</td>
<td>1.6</td>
<td>3720</td>
<td>175</td>
<td></td>
</tr>
</tbody>
</table>

EXTRAK Belt Drive Modules

<table>
<thead>
<tr>
<th></th>
<th>LMB30</th>
<th>LMB40</th>
<th>LMB50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel per Revolution</td>
<td>6.1 (155)</td>
<td>8.1 (205)</td>
<td>11.7 (296)</td>
</tr>
<tr>
<td>Maximum Input Torque</td>
<td>336 (38)</td>
<td>620 (70)</td>
<td>1549 (175)</td>
</tr>
<tr>
<td>Base Unit Inertia</td>
<td>0.0080 (0.0009)</td>
<td>0.0239 (0.0027)</td>
<td>0.1195 (0.0135)</td>
</tr>
<tr>
<td>Positioning Accuracy</td>
<td>2-E4 (200/1000)</td>
<td>2-E4 (200/1000)</td>
<td>2-E4 (200/1000)</td>
</tr>
<tr>
<td>Repeating Accuracy</td>
<td>0.0039 (0.1)</td>
<td>0.0039 (0.1)</td>
<td>0.0039 (0.1)</td>
</tr>
<tr>
<td>Add per 100 mm stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additive Inertia</td>
<td>0.0009 (0.0001)</td>
<td>0.0027 (0.0003)</td>
<td>0.0133 (0.0015)</td>
</tr>
<tr>
<td>Axial Force - Friction without steel strap</td>
<td>1.1 (5)</td>
<td>2.2 (10)</td>
<td>4.5 (20)</td>
</tr>
<tr>
<td>Axial Force - Friction with steel strap</td>
<td>2.2 (10)</td>
<td>4.0 (18)</td>
<td>6.7 (30)</td>
</tr>
</tbody>
</table>
**LMB30 with linear rail guiding system and toothed belt drive**

**LMB30 Without Protection**

![Diagram of LMB30 Without Protection]

**LMB30 With Steel Strapping**

![Diagram of LMB30 With Steel Strapping]

<table>
<thead>
<tr>
<th>Model</th>
<th>L (mm)</th>
<th>L_m (mm)</th>
<th>Belt Length</th>
<th>Length Steel Strapping</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMB30 w/o steel cover</td>
<td>Stroke + 435</td>
<td>Stroke + 245</td>
<td>2 x Stroke + 730</td>
<td>N/A</td>
<td>4.5 kg + 0.60 kg/100 mm stroke</td>
</tr>
<tr>
<td>LMB30 w steel cover</td>
<td>Stroke + 475</td>
<td>Stroke + 285</td>
<td>2 x Stroke + 810</td>
<td>Stroke + 465</td>
<td>4.8 kg + 0.60 kg/100 mm stroke</td>
</tr>
</tbody>
</table>
LMB40 with linear rail guiding system and toothed belt drive

LMB40 Without Protection

LMB40 With Steel Strapping

<table>
<thead>
<tr>
<th>Model</th>
<th>L (mm)</th>
<th>Lm</th>
<th>Belt Length</th>
<th>Length Steel Strapping</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMB40 w/o steel cover</td>
<td>Stroke  + 540</td>
<td>Stroke + 314</td>
<td>2 x Stroke + 900</td>
<td>N/A</td>
<td>8.4 kg + 0.93 kg/100 mm stroke</td>
</tr>
<tr>
<td>LMB40 w steel cover</td>
<td>Stroke  + 608</td>
<td>Stroke + 382</td>
<td>2 x Stroke + 1040</td>
<td>Stroke + 596</td>
<td>9.1 kg + 0.95 kg/100 mm stroke</td>
</tr>
</tbody>
</table>
## LMB50 with linear rail guiding system and toothed belt drive

### LMB50 Without Protection

![Diagram of LMB50 Without Protection](image)

### LMB50 With Steel Strapping

![Diagram of LMB50 With Steel Strapping](image)

<table>
<thead>
<tr>
<th>Model</th>
<th>L (mm)</th>
<th>Lm (mm)</th>
<th>Belt Length</th>
<th>Length Steel Strapping</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMB50 w/o steel cover</td>
<td>Stroke + 670</td>
<td>Stroke + 370</td>
<td>2 x Stroke + 1144</td>
<td>N/A</td>
<td>18.6 kg + 1.48 kg/100 mm stroke</td>
</tr>
<tr>
<td>LMB50 w steel cover</td>
<td>Stroke + 726</td>
<td>Stroke + 426</td>
<td>2 x Stroke + 1256</td>
<td>Stroke + 712</td>
<td>19.5 kg + 1.50 kg/100 mm stroke</td>
</tr>
</tbody>
</table>
Calculation Guidelines

Profile cross-sections LMB30/40/50

LMB30 with linear rail guiding system and toothed belt drive

LMB40 with linear rail guiding system and toothed belt drive

LMB50 with linear rail guiding system and toothed belt drive

T-Slots and T-Nuts

For all unit sizes the profiles, and often the carriages as well, come with T-Slots. The T-Slots of the linear actuator LMB40/50 are not equipped with such. The attachment of those two types is made through threaded holes. The positions of the T-Slot as well as the maximum thread reach are shown in profile cross-sections above.

According to the T-Slot width, T-Nuts of the types NS5, NS6 and NS8 are available. The T-Nuts are available from Exlar. The order number must show type, material and thread size (e.g. NS5 M5).

The available types are shown below.

<table>
<thead>
<tr>
<th>Grove Width (mm)</th>
<th>Material</th>
<th>Material Code</th>
<th>Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>M5</td>
<td>Stainless Steel</td>
<td>NS5 M 5</td>
</tr>
<tr>
<td>6</td>
<td>M6</td>
<td>Stainless Steel</td>
<td>NS6 M 6</td>
</tr>
<tr>
<td>8</td>
<td>M8</td>
<td>Stainless Steel</td>
<td>NS8 M 8</td>
</tr>
</tbody>
</table>

Sample: NS5 SS M5

Calulation Guidelines

The determination of service life must be calculated based on the specifications of the linear guide system and the drive system.

It is the linear guide or guide roller system which normally determines the service life. Therefore the following equations can be used for an approximation of service life.

**Dynamic load**

The nominal service life \( L_{10} \) is being calculated from the dynamic load factor \( C_{\text{dyn}} \) (N) and the applied load \( F_r \) (N):

\[
L_{10} = \left( \frac{C_{\text{dyn}}}{F_r} \right)^3 \times 10^5 \text{ m run}
\]

**Static load**

In cases where only static load is applied, the static load factor \( f_s \) is calculated in order to show that an actuator with an adequate load capacity has been selected. Taking into account the static load factor \( C_0 \) (N) and the load \( F_r \) (N) results:

\[
f_s = \frac{C_0}{F_r}
\]

If \( f_s \geq 1 \), the safety margin is sufficient.

If \( f_s \leq 1 \), contact Exlar Applications Engineering for further advice.

The formulas are applicable only in cases where all bearings are equally loaded, i.e. the load \( F \) is applied at the center of the carriage. Especially in vertical arrangements of the linear actuator, the drive (screw or belt) must be checked in addition to the guide capacity.

Definition of the drive motor

Size and type of the drive motor primarily depend on the load, the required displacement speed and the acceleration factor. Calculation and choice of a positioning unit shall be based on the worst case service conditions.

The linear actuator can be configured to accept any type of motor including brushless motors, gearmotors, or Tritex rotary actuators from Exlar.

The following formulas are provided for sizing assistance.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Formula</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor speed</td>
<td>( n_M = \frac{v \cdot 6 \cdot 10^4}{\pi \cdot i} )</td>
<td>(min(^{-1}))</td>
</tr>
<tr>
<td>Critical speed</td>
<td>( n_k = 120 \cdot \frac{d}{\pi} \cdot i )</td>
<td>(min(^{-1}))</td>
</tr>
<tr>
<td>Load moment</td>
<td>( M_L = \frac{P \cdot i}{2000 \cdot \pi} )</td>
<td>(Nm)</td>
</tr>
<tr>
<td>Translatory mass moment of inertia</td>
<td>( J_t = m_i \left(\frac{d_i}{2}\right)^2 \cdot 10^{-6} )</td>
<td>(kgm(^2))</td>
</tr>
<tr>
<td>Rotatory mass moment of inertia</td>
<td>( J_R = 7.7 \cdot d_i^4 \cdot \eta \cdot 10^{-13} )</td>
<td>(kgm(^2))</td>
</tr>
<tr>
<td>Acceleration torque resp. breaking moment</td>
<td>( M_b = \frac{n_M \cdot J}{9.55 \cdot i} )</td>
<td>(Nm)</td>
</tr>
<tr>
<td>Acceleration torque resp. breaking moment</td>
<td>( M_b = \frac{4 \cdot \pi \cdot \eta \cdot S_b \cdot J}{p \cdot i \cdot t_b^2} )</td>
<td>(Nm)</td>
</tr>
<tr>
<td>Acceleration-/ braking period ( t_b )</td>
<td>( t_b = \frac{P_M \cdot J}{9.55 \cdot \eta} )</td>
<td>(s)</td>
</tr>
<tr>
<td>Resulting speed (rpm) after acceleration</td>
<td>( n_M = \frac{120 \cdot \eta \cdot S_b}{d_j \cdot \eta \cdot i \cdot t_b} )</td>
<td>(min(^{-1}))</td>
</tr>
<tr>
<td>Resulting distance of acceleration</td>
<td>( S_b = \frac{n_M \cdot t_b \cdot p \cdot \eta}{120} )</td>
<td>(mm)</td>
</tr>
<tr>
<td>Total of moments to override by the motor</td>
<td>( M_M = \frac{1}{\eta} \cdot (M_L + M_b) )</td>
<td>(Nm)</td>
</tr>
<tr>
<td>Power output</td>
<td>( P_A = \frac{M_M \cdot n_M}{9.55} )</td>
<td>(W)</td>
</tr>
<tr>
<td>Effective output torque of motor</td>
<td>( M_{effective} = \sqrt{\frac{\sum t_b (M_M t_b)^2}{\sum t_b + \Sigma M_M}} )</td>
<td>(Nm)</td>
</tr>
</tbody>
</table>

**Key to the formulas:**

- \( d \) (mm) = screw diameter
- \( d_1 \) (mm) = diameter driving wheel
- \( d_2 \) (mm) = diameter driven gear
- \( d_3 \) (mm) = diameter pinion or belt pulley
- \( F_L \) (N) = feed power
- \( i (-) \) = gear reduction
- \( J \) (kgm\(^2\)) = mass moment of inertia
- \( J_t \) (kgm\(^2\)) = translatory mass moment of inertia
- \( J_R \) (kgm\(^2\)) = rotatory mass moment of inertia
- \( J_{t1} \) (kgm\(^2\)) = rototy mass moment of inertia driving wheel
- \( J_{t2} \) (kgm\(^2\)) = mass moment of inertia driven gear
- \( J_{t3} \) (kgm\(^2\)) = mass moment of inertia drive motor
- \( J_M \) (kgm\(^2\)) = mass moment of inertia drive motor
- \( M_E \) (Nm) = motor – continuous torque (see motor spec.)
- \( M_L \) (Nm) = load moment
- \( M_{max} \) (Nm) = motor torque peak (see motor spec.)
- \( M_{effective} \) (Nm) = motor torque (see motor spec.)
- \( M_M \) (Nm) = motor torque (see motor spec.)
- \( M_{max} \) (Nm) = motor torque peak
- \( m \) (kg) = external load (linear moving mass)
- \( n_M \) (min\(^{-1}\)) = critical speed for screw drive
- \( n_a \) (min\(^{-1}\)) = motor speed
- \( p \) (mm) = screw pitch
- \( P_a \) (W) = power output
- \( S_b \) (mm) = acceleration / brake path
- \( t_b \) (s) = acceleration / braking period
- \( t_s \) (s) = running time under load moment
- \( t_0 \) (s) = stop period unloaded
- \( v \) (m/s) = rate of feed
- \( \eta (-) \) = mechanical efficiency on motor shaft
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