## Linear Motor Tables

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<td>A27</td>
<td>DM1004 Series</td>
</tr>
</tbody>
</table>
Parker Linear Motor Solutions

Application Tools and Support
- Sizing and selection software
- CAD drawings – download from web
- CD with complete product information including FAQs
- Factory application engineers
- Regional field engineers
- Local automation technology centers
- Complete product testing and documentation

Linear Servo Motors
- Complete size range
- Fastest response and settling time
- Single-row slotless design or double row ironless
- Lower cost and weight (compared to ironless design)
- Excellent heat dissipation
- Custom cables, connectors, windings, etc. for special requirements

Linear Motor Tables
- Pre-engineered “plug and play” module
- Certified accuracy and repeatability
- Slotless or Iron Core linear motor drives
- Velocity to 4.5 m/sec.
- Acceleration to 5 Gs
- Encoder resolution to 0.1 microns
- Long life cable management system
- Proven protective strip seal
- Quick delivery

Component Products
If you have the capability and experience to develop your own systems, our broad range of innovative, easy-to-use products will help you get the job done.
- Short leadtime
- Large selection
- Proven reliability

Subsystems
Our mechanical subsystems are often utilized by OEMs and Integrators who want a completely assembled multi-axis unit ready for direct hookup to an existing or a new Parker motor/drive/control system.
- Reduced engineering effort
- Straightforward integration
- Modular compatibility

Systems
Machine builders and OEMs often choose to integrate a complete electromechanical system into the machine. They have confidence in knowing that our knowledge, experience, and support will ensure that their automation goals are met.
- Minimal design engineering
- Ensured component compatibility
- Single source supply

Linear Motor Solutions at “Selectable Levels of Integration”™

www.parkermotion.com
Parker Hannifin Corporation
Electromechanical Automation Division
Irwin, Pennsylvania
Digital Servo Drives
- Optimized parameters for linear motors
- Pre-configured motor files for easy setup
- Sinusoidal commutation with encoder feedback
- Connectorized cabling for easy hookup
- Drive/controller models for direct motion programming and storage

Modular Linear Motor Systems
- Cost-effective multi-axis systems easily developed from standard 400LXR modules
- Multi-axis cable management
- Seamless integration with other Parker motion components including ballscrew tables and actuators
- Selectable Levels of Integration™

Custom Engineered Systems
- Single or multi-axis solutions designed “from the ground up” to precisely meet customer requirements
- Systematic process to convert initial concepts into final solutions in the shortest time
- Total system reliability
- CAD generated approval drawings
- Special testing and certification of final performance and specifications
About Linear Motors...

The idea is simple enough. Take a conventional rotary servo motor and unwrap it. What was the stator is now a forcer and the rotor becomes a magnet bar. With this design, the motor is connected directly to the load. Linear motion is achieved without any rotary to linear transmission. The forcer is a set of windings that conducts current, while the stator is a linear path of rare earth magnets mounted in alternating polarity. Commutation is electronic, either with hall effect sensors or sinusoidal drives.

The brushless linear servo motor offers the speed of a belt drive with the precision of a ground ballscrew drive. With only two primary elements, it is considerably less complicated than the ballscrew which has more than a dozen components in the drive train. The result is a response rate that can be 10 times faster, translating into quicker acceleration and settling times for higher throughput.

There are three main types of brushless linear motors: iron core, ironless, and slotless. Each offers certain performance advantages. The slotless design exhibits the best combination of attributes for the majority of applications. These include good linear force, smooth translation, thermal stability and low cost. The iron core design provides significantly higher continuous and peak thrusts to handle applications involving heavy payloads with high acceleration.

1. “Pass-Through” Cabling
   Pre-wired, plug-in connection of the moving payload for easy hookup of user instruments or end effectors.

2. Connector Panel
   Electrically shielded panel provides “plug-in” connectivity and quick disconnect for all signal and power requirements.

3. High Strength Aluminum Body
   Extruded aluminum housing is precision machined to provide outstanding straightness and flatness.

4. Magnet Rail
   Single rail of high energy rare earth magnets offers lower weight and lower cost than double magnet type.
About Linear Motor Tables...

Linear motors cannot function on their own. Before motion can occur, a platform must be engineered to provide support, direction, and feedback for the linear motor. Bearings, cables, connectors, encoder, travel stops, homing sensor and other components must be performance matched and integrated to achieve desired motion and control.

Parker linear motor tables provide all this and more in a pre-engineered, easily mounted, ready to run package. The linear motor magnet rail is mounted to a stationary base and the forcer is mounted to the moveable carriage. The only contact between the moving carriage and the stationary base is through the linear support bearings. High precision square rail bearings provide load support, low-friction translation, and a precise linear path. A high resolution linear encoder provides the required velocity and positional information to the motor controller, and a unique cable management system enables high performance motion with a life of 30 million inches and beyond. Parker tables, with the slotless linear motor, are offered in three sizes (404LXR, 406LXR, 412LXR). The largest (412LXR) is also available with an iron core linear motor for heavy duty, high performance applications.

5. Slotless or Iron Core Linear Motor
   Provides a highly responsive, zero backlash drive system. Both motors offer excellent heat management, durability, and have built-in thermal sensor and hall sensors.

6. Linear Guidance System
   The highly engineered carriage and bearing system effectively counters the combined problematic effects of heat, high speed and high acceleration.

7. Integral Linear Encoder
   Protected non-contact feedback with selectable resolutions to 0.1 micron. Z channel is factory aligned to home sensor for precise homing.

8. Limit/Home Sensors
   Proximity sensors establish end of travel and “home” location and are easily adjustable over entire length to restrict the travel envelope.

9. “Quick Change” Cabling
   Innovative Cable Transport Module offers extended life (30 million cycles) and a simple cable changing system for preventative maintenance.

10. Protective Seals
    Hard Shell aluminum cover combined with stainless steel strip seals provide IP30 protection to interior components as well as enhance overall appearance.
400LXR Series Linear Motor Tables

Features
- Velocity to 4.5 m/sec
- Acceleration to 5 Gs
- Encoder resolution to 0.1 micron
- Cleanroom compatible
- Easy multi-axis mounting
- Cable management system
- Proven strip seal

Performance Matched Components
The 400LXR Series linear servo motor tables achieve optimum performance by combining slotless or ironcore motor technology with performance matched mechanical elements and feedback devices. Fast response, high acceleration, smooth translation, high velocity, and quick settling time describe the performance characteristics found in the 400LXR while high repeatability, precise accuracy, and sub-micron resolution define the positioning attributes.

Sized to fit
The 400LXR Tables are offered in three widths (100, 150, and 300 mm), and travel lengths up to 3 meters to accommodate the size and performance requirements of many industries including life sciences, photonics, semiconductor and general automation.

“Designer Friendly” Features and Options
A vast assortment of “designer friendly” features and options simplify the engineering challenges often confronted with “base model” positioning devices. Features like the IP30 protective strip seal and long life cable management system, exemplify the built-in value found in the 400LXR units. Other selectable enhancements like cleanroom compatibility, travel limit sensors, motor drives, encoder resolution, and pinning holes for tooling location, simplify machine design and integration efforts.

Flexibility and Multi-Axis Compatibility
The 400LXR’s selection flexibility and mounting compatibility with the 400XR ballscrew driven tables enables single axis or complex multi-axis units to be configured in a straightforward manner. Parker’s matching servo drives and motion controllers can be included to complete the motion system.

Customs and Systems
For specialized applications requiring customization, Parker design engineers can easily modify these tables to suit, or engineer complete interactive linear motion systems to desired specifications. Parker’s 400LXR series tables have taken the mystery, difficulty and cost out of integrating linear motor tables into high throughput precision positioning applications.

www.parkermotion.com
# Linear Servo Motor Driven

## Specifications

<table>
<thead>
<tr>
<th>Model Motor</th>
<th>404LXR 8 Pole</th>
<th>406LXR 8 Pole</th>
<th>406LXR 12 Pole</th>
<th>412LXR 12 Pole</th>
<th>412LXR 24 Pole (forced air)</th>
<th>412LXR 24 Pole (watercooled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Load (kg)</td>
<td>45(99)</td>
<td>180(396)</td>
<td>180(396)</td>
<td>950(2090)</td>
<td>1148(2526)</td>
<td>1148(2526)</td>
</tr>
<tr>
<td>Maximum Acceleration</td>
<td>5 Gs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Velocity (m/sec.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encoder Resolution: 0.1 µm</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3(0.3)</td>
<td>0.3(0.3)</td>
</tr>
<tr>
<td>0.5 µm</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5(1.5)</td>
<td>1.5(1.5)</td>
</tr>
<tr>
<td>1.0 µm</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>2.0(3.0)</td>
<td>2.0(3.0)</td>
</tr>
<tr>
<td>5.0 µm</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>2.0(4.5)</td>
<td>2.0(4.5)</td>
</tr>
<tr>
<td>Sine Output</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>2.0(4.5)</td>
<td>2.0(4.5)</td>
</tr>
<tr>
<td>Positional Repeatability</td>
<td>±1.0 µm</td>
<td>±1.0 µm</td>
<td>±2.0 µm</td>
<td>±1.0 µm</td>
<td>±1.0 µm</td>
<td>±1.0 µm</td>
</tr>
<tr>
<td>Encoder Resolution: 0.1 µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Force N (lb)</td>
<td>180(40)</td>
<td>225(50)</td>
<td>330(75)</td>
<td>1000(225)</td>
<td>2650(595)</td>
<td>2650(595)</td>
</tr>
<tr>
<td>Continuous Force N (lb)</td>
<td>50(11)</td>
<td>75(17)</td>
<td>110(25)</td>
<td>355(80)</td>
<td>750(169)</td>
<td>970(218)</td>
</tr>
<tr>
<td>Carriage Mass (kg)</td>
<td>1.4</td>
<td>4.2</td>
<td>12.3</td>
<td>23</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

## Travel Dependent Specifications

<table>
<thead>
<tr>
<th>Travel (mm)</th>
<th>Positional Accuracy* (µm)</th>
<th>Unit Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1µm, 0.5µm, 1.0µm resolution</td>
<td>0.1µm</td>
<td>0.3</td>
</tr>
<tr>
<td>5.0µm resolution</td>
<td>8.7</td>
<td>14.1</td>
</tr>
<tr>
<td>404LXR 8 Pole</td>
<td>4.4</td>
<td>6.0</td>
</tr>
<tr>
<td>406LXR 8 Pole</td>
<td>4.8</td>
<td>5.6</td>
</tr>
<tr>
<td>406LXR 12 Pole</td>
<td>16.4</td>
<td>12.6</td>
</tr>
<tr>
<td>412LXR 12 Pole</td>
<td>19.4</td>
<td>14.1</td>
</tr>
<tr>
<td>412LXR 24 Pole</td>
<td>10.6</td>
<td>-</td>
</tr>
<tr>
<td>412LXR 24 Pole</td>
<td>16.6</td>
<td>-</td>
</tr>
</tbody>
</table>

## Encoder Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>5 VDC +/- 5% 150 mA</td>
</tr>
<tr>
<td>Output (Incremental)</td>
<td>Square wave differential line driver (EIA RS422) 2 channels A and B in quadrature (90) phase shift.</td>
</tr>
<tr>
<td>Reference (Z channel)</td>
<td>Synchronized pulse, duration equal to one resolution bit. Repeatability of position is unidirectional moving toward positive direction.</td>
</tr>
</tbody>
</table>

## Limit and Home Sensor Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>4 to 42 VDC 60 mA (20 mA per sensor)</td>
</tr>
<tr>
<td>Output</td>
<td>Output form is selectable with product: Normally Closed Current Sinking Normally Open Current Sinking Normally Closed Current Sourcing Normally Open Current Sourcing All types Sink or Source maximum of 50 mA</td>
</tr>
<tr>
<td>Repeatability</td>
<td>Limits: +/- 10 microns (unidirectional) Home: See Z channel specifications</td>
</tr>
</tbody>
</table>

## Hall Effect Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>4 to 42 VDC, 30 mA</td>
</tr>
<tr>
<td>Output</td>
<td>Open Collector CURRENT SINKING, 20 mA Max</td>
</tr>
</tbody>
</table>

* Accuracy stated is at 20 degrees C, utilizing slope correction factor provided.

* Bracketed velocity values [ ] apply to 675VDC bus (480 VAC drive input).

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400LXR Cable Management

Cable Transport Module

The LXR’s Cable Transport Module offers the convenience of “plug and play” connectivity for fast, easy table installation and “quick change” replacement. This system of cable management includes the highest quality high-flex ribbon cable with a life rating of 30 million cycles, a cable track with support brackets, a “quick change” carriage cartridge, and a plug-in connector panel housing. It also provides a “pass-through” connection and cabling for customer application. This transport module option is ideal for high throughput continuous duty requirements where downtime is not acceptable.

The high-flex ribbon cable permits a cable track bend radius that is small enough to clear payloads of large dimension. The cable transport can be ordered with a variety of extension cable options. These cables provide extensions from the connector panel on the cable transport module, to the motor drive amplifier and controller. The cables are high-flex, long life cables so they can be utilized on a second or third axis unit.

<table>
<thead>
<tr>
<th>Cable Transport Module - Order Code</th>
<th>Extension Cable Length</th>
<th>Extension Cable Termination</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM02</td>
<td>No Extension Cables</td>
<td></td>
</tr>
<tr>
<td>CM07</td>
<td>3.0 meters</td>
<td>flying leads</td>
</tr>
<tr>
<td>CM08</td>
<td>7.5 meters</td>
<td>flying leads</td>
</tr>
<tr>
<td>CM09</td>
<td>3.0 meters</td>
<td>Gemini Conn.</td>
</tr>
<tr>
<td>CM10</td>
<td>7.5 meters</td>
<td>Gemini Conn.</td>
</tr>
<tr>
<td>CM13</td>
<td>3.0 meters</td>
<td>Aries/Vix Conn.</td>
</tr>
<tr>
<td>CM14</td>
<td>7.5 meters</td>
<td>Aries/Vix Conn.</td>
</tr>
<tr>
<td>CM22*</td>
<td>3.0 meters</td>
<td>Compax Conn.</td>
</tr>
<tr>
<td>CM23*</td>
<td>7.5 meters</td>
<td>Compax Conn.</td>
</tr>
</tbody>
</table>

* 24 Pole motor models only
400LXR Cable Management

OEM Cable System

The LXR’s unharnessed cable system is offered for OEMs and others who have independent methods of routing and managing cables. These systems offer the “quick change” cartridge, “pass-through” connection and round high-flex cables in lengths of 3.0 or 7.5 meters. They are available with flying lead end terminations, Gemini, Aries, or Compax3 Connectors.

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Extension Cable Length</th>
<th>Extension Cable Termination</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM03</td>
<td>3.0 meters</td>
<td>flying leads</td>
</tr>
<tr>
<td>CM04</td>
<td>7.5 meters</td>
<td>flying leads</td>
</tr>
<tr>
<td>CM05</td>
<td>3.0 meters</td>
<td>Gemini Conn.</td>
</tr>
<tr>
<td>CM06</td>
<td>7.5 meters</td>
<td>Gemini Conn.</td>
</tr>
<tr>
<td>CM11</td>
<td>3.0 meters</td>
<td>Aries/Vix Conn.</td>
</tr>
<tr>
<td>CM12</td>
<td>7.5 meters</td>
<td>Aries/Vix Conn.</td>
</tr>
<tr>
<td>CM20*</td>
<td>3.0 meters</td>
<td>Compax Conn.</td>
</tr>
<tr>
<td>CM21*</td>
<td>7.5 meters</td>
<td>Compax Conn.</td>
</tr>
</tbody>
</table>

* 24 Pole motor models only

User “Pass-Through” Cabling Feature

- Pre-wired plug-in connection to the moving payload
- Nine user conductors for end-effectors or instruments
- High-Flex long life cables:
  - Ribbon Cable - Transport Module System
  - Round Cable - OEM System

Cable concerns regarding routing and durability for payload or instrument signals are addressed by the pass-through connectivity feature included with both of the LXR cable management systems. Nine pin D-connectors provided on the carriage (with the transport module units) and the cable connecting block combine with high-flex, long life cables for easy setup and dependable performance.

Note: Extension Cables are available and can be ordered separately: 006-1743-01 (3 meters); 006-1743-02 (7.5 meters).
Digital Drive Options

- Pre-configured for the LXR
- Optimized for linear servo motors
- Convenient connectorized cabling
- Stable power-up operation
- Input power: 95-480 VAC

Simple Configuration:
All digital drives shipped with the LXR product family come preconfigured with a motor file which includes electrical parameters to set continuous and peak currents, current loop compensation values, and default gain settings. Users will have the ability to override these parameters for special application requirements. Tuning is easy to use and intuitive for users and is available via a variety of methods. The motor and loading information must be known by the drive to determine the baseline tuning gains. These are simple parameter entries the user can complete with the help of standard Parker supplied front-end software tools.

Gemini Series

The Gemini family offers a drive solution for every LXR, from the 404LXR to the 412LXR with iron core motor. Drives are offered so that power levels are available to match the continuous and peak current requirements of each LXR. The drive is easily configured using RS232/485 with a PC.

GV Digital Servo Drive:
- Sinusoidal commutation with hall sensors ensure proper phase shifting
- Integrated encoder feedback ensures precise positioning
- Approvals: UL Recognition, cUL, CE for LVD, CE for EMC
- Torque, velocity, step & direction, and encoder tracking modes available
- 120/240VAC input
- Digital notch filters provide the tools to eliminate mechanical resonance
- Simplified tuning and configuration
- Variable resolution for the encoder out as well as the command input
- PWM frequencies optimized for linear motor support

GV Digital Controller/Servo Drive:
- Stand-alone servo controller and drive in one small package
- Control features such as registration, motion profiles, S-curve velocity profiling, electronic gearing, and conditional statements
- Program storage: Up to 32 programs or 190 lines of program code, expanded to 300KB for the GV6K
- Daisy chain up to 99 units
- Simplified configuration and tuning
- 8 programmable inputs and 6 programmable outputs
- Compatibility with RS 232 /485
- Ethernet available as an option
Aries Series

The Aries family offers a robust and cost-effective servo drive by power matching the drive with the application requirements. Unlike the competition, the Aries family is designed with an open architecture in mind, so it can also be configured for use with any manufacturer’s motion controller. Offered solely in a drive only configuration, the Aries provides a great value.

Aries Digital Drive: A62 A63

- 4 power levels available, matched for 404LXR, 406LXR, and 412LXR requirements
- 120/240VAC input
- 20 MHz (post-quadrature) encoder input
- Sinusoidal commutation with hall sensors ensure proper phase shifting
- Integrated encoder feedback ensures precise positioning
- Approvals: UL compliant, CE for LVD, CE for EMC

- +/-10 V torque control for use with any controller with a standard analog command output. Step and direction input available as an option.
- Standard high-density D-sub connectors for easy connectivity in any system
- Simplified tuning and configuration with easy to use front-end software
- Compact Design
- Status/fault LED indicators to confirm proper operation

Compax3 Series

With its high-performance and modular design, the Compax3 family of industrial servo drives and drive/controllers offers a new level of servo performance and flexibility. The modular capacity of the Compax3 family allows options such as intelligent motion controllers, fieldbus interfaces and industry standard motor feedback. In addition, numerous expansion options can be added to the standard product in order to optimize the capabilities required for today’s demanding servo applications.

Drive Features: A50

- Base servo drive
- +/- 10 V analog
- Step and direction
- Torque/velocity control
- Position control
- Encoder tracking

Indexer Features: A51

- Full-featured programmable drive/ controller
- IEC61131-3 programming flexibility
- PLCopen, Parker motion function blocks
- Complex motion
- Profibus or CANOpen options available

Controller/Drive Features: A52

- Base indexer drive
- Up to 31 stored profiles
- Profile selected via digital inputs
- Multi-profile sequences
- Profibus or CANOpen options available
412LXR Cooling Options

412LXR models with 24 pole iron core motors are offered with forced air or water cooling options to provide higher continuous force values than standard convection cooling. Maximum continuous force is increased from 750N to 970N with the forced air option and to 1720N with the watercooled option.

The CL1 convection cooling option utilizes conduction and convection to remove heat from the system. The CL2 forced air cooling option forces air movement inside the table body which enhances heat removal from the motor and critical electronic components. The CL3 and CL4 water cooling options circulate chilled water inside the motor to rapidly and efficiently remove heat. The CL3 option includes a motor prepared for water cooling with 0.375" water line quick disconnect termination points on the carriage. The CL4 option includes a motor prepared for water cooling with 0.375" water lines routed through a carrier system from the moving carriage to a fixed connection point on the base. This water cooling management system is a pre-engineered solution that eliminates the headaches associated with designing, procuring and installing water line management. Both water cooling options utilize Parker 0.375" tubing quick disconnects for easy connection. The minimum flow recommendation is 1.0 GPM with a water pressure not to exceed 50 psi. For closed loop cooling systems, a 2000 watt “chiller” is recommended.

675 VDC Speed/Force Chart*

* Note: dashed lines indicate the maximum values when using a 340 VDC input to the motor.
Cleanroom compatible linear tables are often required for laboratory and production applications in industries such as semiconductor, life science, electronics, and pharmaceuticals. 400LXR tables with cleanroom preparation, were tested in Parker's vertical laminar flow work station, which utilizes ULPA filters to produce an environment having a cleanliness of class 1 prior to testing. Tables were tested in a variety of orientations with sampling both below the table and at the carriage mounting surface. Laminar flow rate is 0.65 inches W.C.

Special cleanroom testing can be provided upon request. For more information on cleanroom testing, contact a Parker Applications Engineer at 800-245-6903.

### Dowel Pinning

Standard dowel pin locating holes (P1) are offered on all 400LXR units to facilitate repeatable mounting of tooling or payload.

In addition, pinning options (P2 & P3) are offered for precise orthogonal mounting of the second axis in a multi-axis system. In this case, the bottom side of the table base is match drilled and reamed to the first axis to provide exact orthogonal location. This convenient option eliminates concerns regarding contamination or damage often associated with machining for locating pins in an assembled unit.
404LXR Series Dimensions (mm)

<table>
<thead>
<tr>
<th>Model</th>
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406LXR Series Dimensions (mm)
12 Pole Slotless Motor

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</tbody>
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Irwin, Pennsylvania
A17
406LXR - How to Order

Order Example

Series ............ 406

Travel (mm)
8 Pole Motor               12 Pole Motor
  50 ........   n/a ........  T01
  150 ........  50 ........  T02
  250 ........  150 ........  T03
  350 ........  250 ........  T04
  450 ........  350 ........  T05
  550 ........  450 ........  T06
  650 ........  550 ........  T07
  750 ........  650 ........  T08
  850 ........  750 ........  T09
  950 ........  850 ........  T10
 1200 ......  1100 ......  T11
 1450 ......  1350 ......  T12
 1700 ......  1600 ......  T13
 1950 ......  1850 ......  T14

Model ................ LXR

Mounting (metric) ....... M

Grade
Precision ..................... P

Drive Type
Free Travel (No Motor)
  8 Pole Carriage (no mtr.)... D3
  12 Pole Carriage (no mtr.)... D5
Linear Motor
  8 Pole Motor Carriage ...... D13
  12 Pole Motor Carriage ...... D15

Home Sensor
None - Free Travel (only) .... H1
N.C. Current Sinking ...... H2
N.O. Current Sinking ...... H3
N.C. Current Sourcing ...... H4
N.O. Current Sourcing ...... H5

Limit Sensor
None - Free Travel (only) ... L1
N.C. Current Sinking ....... L2
N.O. Current Sinking ....... L3
N.C. Current Sourcing ...... L4
N.O. Current Sourcing ...... L5

Pinning Option
P1 No multi-axis pinning
P2 X axis transfer pinning to Y or Z axis - 30 arc seconds
P3 Y axis transfer pinning to X axis - 30 arc seconds

Digital Drive
A1 No Drive
A4 Gemini Drive GV-U6E
A5 Gemini Controller/Drive GV6-U6E
A6 Gemini Controller/Drive GV6K-U6E
A62 Aries Drive AR-04AE

Environmental
R1 Strip Seal
R2 Hard Cover w/ Class 10 Cleanroom Prep

Encoder Option
E1 None
E2 1.0 µm Resolution
E3 0.5 µm Resolution
E4 0.1 µm Resolution
E5 5.0 µm Resolution
E7 Sine Output Encoder

Z Channel Location*
Z1 None
Z2 Positive End Position
Z3 Center Position
Z4 Negative End Position
*Refer to dimension drawing on page A17

Cable Management
CM01 No Cables - Free Travel
CM02 Cable Transport Module (only)
CM03 3.0 m OEM Cable Set-FL
CM04 7.5 m OEM Cable Set-FL
CM05 3.0 m OEM Cable Set-Gemini
CM06 7.5 m OEM Cable Set-Gemini
CM07 Cable Trans Mod. w/ 3.0 m-FL*
CM08 Cable Trans Mod. w/ 7.5 m-FL*
CM09 Cable Trans Mod. w/ 3.0 m-Gemini*
CM10 Cable Trans Mod. w/ 7.5 m-Gemini*
CM11 3.0 m OEM Cable Set-Aries
CM12 7.5 m OEM Cable Set-Aries
CM13 Cable Trans Mod. w/ 3.0 m-Aries*
CM14 Cable Trans Mod. w/ 7.5 m-Aries*
*Extension Cable for pass through connection is available and can be ordered separately:
#006-1743-01 (3 meters), #006-1743-02 (7.5 meters).

*Refer to dimension drawing on page A17
412LXR-D15 Series Dimensions (mm)
12 Pole Slotless Motor

Notes:
- Base mounting holes for models 412T10 and 412T12 are patterned from one hole on centerline
- Additional holes are provided for direct mounting, toe clamp mounting and pin holes for the 404LXR and 406LXR (CAD files)

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A19
412LXR - How to Order
12 Pole Slotless Linear Motor

Order Example

Series ............ 412

Travel (mm) 12 Pole Motor
150 ... T01  1200 ... T07
250 ... T02  1500 ... T08
350 ... T03  1750 ... T09
650 ... T04  2000 ... T10
800 ... T05  2500 ... T11
1000 ... T06  3000 ... T12

Model ......................... LXR

Mounting (metric) ........ M

Grade
Precision ..................... P

Drive Type
Free Travel (No Motor) ...... D5
12 Pole Motor .................. D15

Home Sensor
None-Free Travel (only) ..... H1
N.C. Current Sinking ........ H2
N.O. Current Sinking ........ H3
N.C. Current Sourcing ...... H4
N.O. Current Sourcing .... H5

Limit Sensor
None-Free Travel (only) ..... L1
N.C. Current Sinking ........ L2
N.O. Current Sinking ........ L3
N.C. Current Sourcing ...... L4
N.O. Current Sourcing .... L5

Encoder
None-E2
1.0 µm Resolution Linear E3
0.5 µm Resolution Linear E4
0.1 µm Resolution Linear E5
5.0 µm Resolution Linear E7
Sine Output Encoder

Z Channel Location*
None Z1
Positive End Position Z2
Center Position Z3
Negative End Position Z4

*Refer to dimension drawing on page A19.

Cable Management
No Cables - Free Travel CM01
Cable Transport Module (only) CM02
3.0 m OEM Cable Set-FL CM03
7.5 m OEM Cable Set-FL CM04
3.0 m OEM Cable Set-Gemini CM05
7.5 m OEM Cable Set-Gemini CM06
Cable Trans Mod. w/ 3.0 m-FL* CM07
Cable Trans Mod. w/ 7.5 m-FL* CM08
Cable Trans Mod. w/ 3.0 m-Gemini* CM09
Cable Trans Mod. w/ 7.5 m-Gemini* CM10
Cable Trans Mod. w/ 3.0 m-Aries CM11
Cable Trans Mod. w/ 7.5 m-Aries CM12
Cable Trans Mod. w/ 3.0 m-Aries* CM13
Cable Trans Mod. w/ 7.5 m-Aries* CM14

*Extension Cable for pass through connection is available and can be ordered separately:
#006-1743-01 (3 meters); #006-1743-02 (7.5 meters).

Pinning Option
No multi-axis pinning P1
X axis transfer pinning to Y or Z axis - 30 arc seconds P2
Y axis transfer pinning to X axis - 30 arc seconds* P3

Digital Drive
A1 No Drive
A7 Gemini Drive GV-U12E
A8 Gemini Controller/Drive GV6-U12E
A9 Gemini Controller/Drive GV6K-U12E
A63 Aries Drive AR-08AE

Environmental
R1 Class 1000, Strip Seals
R2 Class 10 Cleanroom Prep

Cable Management
3.0 m OEM Cable Set-Aries CM13
7.5 m OEM Cable Set-Aries CM12
Cable Trans Mod. w/ 3.0 m-Aries CM11
Cable Trans Mod. w/ 7.5 m-Aries CM10
Cable Trans Mod. w/ 3.0 m-Aries* CM13
Cable Trans Mod. w/ 7.5 m-Aries* CM14

*Extension Cable for pass through connection is available and can be ordered separately:
#006-1743-01 (3 meters); #006-1743-02 (7.5 meters).
412LXR-D22 Series Dimensions (mm)
24 Pole Iron Core Motor

Notes:
- Base mounting holes for models 412T10 and 412T12 are patterned from one hole on centarline.

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### 412LXR - How to Order - 24 Pole Iron Core Motor

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<td>Mounting (metric)</td>
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<td>Grade</td>
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#### Drive Type

- Free Travel (No Motor) D6
- 24 Pole Motor .......... D22

Refer to page A20 for 12 pole slotless motor drive.

#### Home Sensor

- None-Free Travel (only) .... H1
- N.C. Current Sinking ...... H2
- N.O. Current Sinking ...... H3
- N.C. Current Sourcing ....... H4
- N.O. Current Sourcing ....... H5

#### Limit Sensor

- None-Free Travel (only) .... L1
- N.C. Current Sinking ...... L2
- N.O. Current Sinking ...... L3
- N.C. Current Sourcing ....... L4
- N.O. Current Sourcing ....... L5

#### Cable Management

- No Cables - Free Travel .......... CM01
- Cable Transport Module (only) .... CM02
- 3.0 m OEM Cable Set-FL .......... CM03
- 7.5 m OEM Cable Set-FL .......... CM04
- 3.0 m OEM Cable Set-Gemini ...... CM05
- 7.5 m OEM Cable Set-Gemini ...... CM06
- Cable Trans Mod. w/3.0 m-FL* .... CM07
- Cable Trans Mod. w/7.5 m-FL* .... CM08
- Cable Trans Mod. w/3.0 m-Gemini* CM09
- Cable Trans Mod. w/7.5 m-Gemini* CM10
- 3.0 m OEM Cable Set-Compax ...... CM20
- 7.5 m OEM Cable Set-Compax ...... CM21
- Cable Trans Mod. w/3.0 m-Compax* CM22
- Cable Trans Mod. w/7.5 m-Compax* CM23

#### Cooling

- Convection cooling CL1
- Forced air cooling CL2
- Water cooling CL3
- Water cooling with external ass’y. CL4

#### Pinning Option

- P1 No multi-axis pinning
- P2 X axis transfer pinning to Y or Z axis - 30 arc seconds
- P3 Y axis transfer pinning to X axis - 30 arc seconds*

*P3 Option includes a required 15 mm thick adapter.

#### Digital Drive

- A1 No Drive
- A40 Gemini Drive GV-H20E
- A41 Gemini Controller/Drive GV6-H20E
- A42 Gemini Controller/Drive GV6K-H20E
- A50 Compax Drive S150-V4-F12-I10-T10
- A51 Compax Indexer S150-V4-F12-I11-T11
- A52 Compax Controller/Drive S150-V4-F12-I10-T30

#### Encoder Option

- E1 None
- E2 1.0 µm Resolution - Optical
- E3 0.5 µm Resolution - Optical
- E4 0.1 µm Resolution - Optical
- E5 5.0 µm Resolution - Optical
- E7 Sine Output - Optical

#### Z Channel Location*

- Z1 None
- Z2 Positive End Position
- Z3 Center Position
- Z4 Negative End Position

*Refer to dimension drawing on page A21.

---

*Extension Cable for pass through connection is available and can be ordered separately: #006-1743-01 (3 meters); #006-1743-02 (7.5 meters).
The DXL dual carriage positioning table provides a precision platform for controlled translation and positioning of two independent carriages on the same linear travel path. The DXL ensures superior carriage to carriage flatness and coplanar motion by providing a common precision ground base and bearing ways for both carriages. Each carriage is independently driven by a cogfree, ironless linear motor to minimize velocity ripple and optimize responsiveness to match a complex motion profile (refer to chart on page A25). Extremely high resolution linear encoders provide the critical position data that allows superior velocity control and responsiveness necessary to optimize the precision control of the moving carriages. The twin carriages can be programmed to move in tandem, in opposing directions or independently with or without any ratio between the carriages.

The DXL can be used in many precision motion applications but is especially effective for fiber optic industry applications where smooth, highly controlled velocity and motion path is employed for fusing fibers. Other applications include medical device manufacturing and imaging applications where focal distance must be precisely controlled.

Loaded with “ease of use” features, the DXL is designed to save time and effort. The DXL base includes a tooling edge parallel to the travel path. User tooling can be precisely located within 25 microns of the actual travel path of the positioner using the tooling reference features. A unique cover design prevents contamination (such as small fiber strands) from entering the positioner. The DXL is available with preconfigured digital servo drives that are compatible with all industry standard motion controllers. All DXL units ship complete with performance certification and laser interferometer test reports.

Key Attributes
- Cogfree linear motors with no moving cables
- One base and bearing way sets - common to both carriages
- Extremely high resolution optical encoders with digital output
- Hardshell cover protects internal components (IP30)
- Home sensor aligned to encoder reference marker for precise homing
- Adjustable end of travel sensors
- Tooling reference surface is aligned within 25 microns of the actual travel path
- Cleanroom compatible
## Specifications

<table>
<thead>
<tr>
<th>Travel (Z-axis)</th>
<th>35 mm (per carriage – limit to limit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Load Capacity</td>
<td>150 Kg</td>
</tr>
<tr>
<td>Maximum Acceleration</td>
<td>2 Gs</td>
</tr>
<tr>
<td>Peak Force</td>
<td>44 N</td>
</tr>
<tr>
<td>Continuous Force</td>
<td>19 N</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>1.0 µm digital encoder</td>
</tr>
<tr>
<td>E3</td>
<td>0.5 µm digital encoder</td>
</tr>
<tr>
<td>E4</td>
<td>0.1 µm digital encoder</td>
</tr>
<tr>
<td>E5</td>
<td>5.0 µm digital encoder</td>
</tr>
<tr>
<td>E7</td>
<td>Sine Output encoder</td>
</tr>
<tr>
<td>E8</td>
<td>0.02 µm digital encoder</td>
</tr>
<tr>
<td>Positional Accuracy$^{(1,2,4)}$</td>
<td>3 µm</td>
</tr>
<tr>
<td>Positional Repeatability$^{(1,2)}$</td>
<td></td>
</tr>
<tr>
<td>1.0 µm digital encoder</td>
<td>±/-2 µm</td>
</tr>
<tr>
<td>0.5 µm digital encoder</td>
<td>±/-1 µm</td>
</tr>
<tr>
<td>0.1 µm digital encoder</td>
<td>±/-0.5 µm</td>
</tr>
<tr>
<td>5.0 µm digital encoder</td>
<td>±/-10 µm</td>
</tr>
<tr>
<td>Sine Output encoder</td>
<td>(interpolation dependent)</td>
</tr>
<tr>
<td>0.02 µm digital encoder</td>
<td>±/-0.3 µm</td>
</tr>
<tr>
<td>Maximum Velocity</td>
<td></td>
</tr>
<tr>
<td>1.0 µm digital encoder</td>
<td>500 mm/sec$^{(3)}$</td>
</tr>
<tr>
<td>0.5 µm digital encoder</td>
<td>500 mm/sec$^{(3)}$</td>
</tr>
<tr>
<td>0.1 µm digital encoder</td>
<td>300 mm/sec</td>
</tr>
<tr>
<td>5 µm digital encoder</td>
<td>500 mm/sec</td>
</tr>
<tr>
<td>Sine Output encoder</td>
<td>500 mm/sec$^{(3)}$</td>
</tr>
<tr>
<td>0.02 µm digital encoder</td>
<td>100 mm/sec</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>100%</td>
</tr>
<tr>
<td>Linear Bearing – Coeff. of Friction</td>
<td>0.01</td>
</tr>
<tr>
<td>Flatness</td>
<td>±/-2 µm</td>
</tr>
<tr>
<td>Straightness</td>
<td>±/-2 µm</td>
</tr>
<tr>
<td>Unit Weight</td>
<td>7.1 Kg</td>
</tr>
<tr>
<td>Carriage Weight</td>
<td>1.6 Kg</td>
</tr>
<tr>
<td>Limit/Home Sensors</td>
<td>Refer to page B15</td>
</tr>
</tbody>
</table>

1. Measured at the carriage center, 35 mm off mounting surface.
2. With slope correction value provided.
3. Speed is limited due to acceleration limit (2g’s) and total travel of stage (35 mm).
4. Higher speeds can be commanded but constant velocity will not be reached due to required acceleration distance.

### Table Life/Load Chart
Compression (normal load)

The graphs provide a preliminary evaluation of the support bearing life/load characteristics. The curves show the life/load relationship when the applied load is centered on the carriage, normal (perpendicular) to the carriage mounting surface. For final evaluation of life vs load, including off center, tension, and side loads refer to the charts and formulas found on pages B13 and B14.
DXL Series Dimensions (mm)

Time/Distance Chart
Distance against time (linear)

The linearity of this plot illustrates the precision constant velocity of the DXL150. Moving at a velocity of only 10 mm/second, the maximum position error does not exceed 40 nanometers. This plot shows displacement of 1 mm with a data capture rate of 1000 hz.
DXL Series How to Order

- **Model**
  - DXL
- **Series (150 mm wide)**
  - 150
- **Travel (35 mm)**
  - T01
- **Mounting**
  - Metric: M
- **Grade**
  - Precision: P
- **Drive Type**
  - Free Travel (no motor)
  - 4 pole slotless-ironless
- **Home Sensor**
  - None - free travel only
  - N.C. current sinking
  - N.O. current sinking
  - N.C. current sourcing
  - N.O. current sourcing
- **Travel Limit Sensors**
  - None - free travel only
  - N.C. current sinking
  - N.O. current sinking
  - N.C. current sourcing
  - N.O. current sourcing
- **Digital Drives**
  - None
  - GV-L3E Drive
  - GV6-L3E Drive
  - *2 drives/table
- **Environment**
  - Class 1000 - standard
  - Class 10 cleanroom
- **Encoder Option**
  - None - free travel only
  - 1.0 µm Resolution Linear
  - 0.5 µm Resolution Linear
  - 0.1 µm Resolution Linear
  - 5.0 µm Resolution Linear
  - Sine Output Encoder
  - 0.02 µm Resolution Linear
- **Z Channel Location**
  - None - free travel only
  - Center Position
  - Z1
  - Z3
- **Cable Management**
  - None - free travel only
  - 3 m cable set w/ flying lead

**Order Example**

- DXL 150 T01 M P D20 H3 L3 A3 R1 E3 Z3 CM2

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*www.parkermotion.com*
Parker's DM 1004 is a high performance direct drive rotary servo system which provides high accuracy and torque without the need of speed reducers. It consists of a brushless direct drive motor, a cross roller support bearing system, an integral optical encoder, a microprocessor-based drive, power supply, and a 10-foot motor-to-drive cable.

The highly efficient direct drive brushless motor design eliminates the need for a gear drive or other mechanical drive train. The result is long life, maintenance free operation. The cross roller bearing design can support up to 350 kg (770 lb) of compression load and 3.3 kg-m (24.4 ft-lb) of overhung load.

### Features
- Maximum velocity: 2.5 revs per second
- Axial and radial run-out of 0.01 mm
- Load capacity of 350 kg (770 lb.)
- Positional repeatability of 3 arc-sec.
- Faster settling time than a traditional servo motor and speed reducer system
- Smooth rotation at slow speeds
- Ability to operate in a position, speed or torque control mode
- Built-in test mode simplifies optimum tuning
- Class 10 cleanroom option

### Specifications

<table>
<thead>
<tr>
<th>Units</th>
<th>DM1004B</th>
<th>DM1004C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak torque</td>
<td>ft-lbs</td>
<td>(N-M)</td>
</tr>
<tr>
<td>DM1004B</td>
<td>3 (4)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>DM1004C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated speed</td>
<td>rps</td>
<td></td>
</tr>
<tr>
<td>115 VAC</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>230 VAC</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Static axial load**</td>
<td>lbs (kg)</td>
<td></td>
</tr>
<tr>
<td>Compression</td>
<td>440 (200)</td>
<td>770 (350)</td>
</tr>
<tr>
<td>Tension</td>
<td>154 (70)</td>
<td>770 (350)</td>
</tr>
<tr>
<td>Static overhung load**</td>
<td>ft-lb (kg-m)</td>
<td></td>
</tr>
<tr>
<td>DM1004B</td>
<td>20 (2.7)</td>
<td>24.4 (3.3)</td>
</tr>
<tr>
<td>DM1004C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotor inertia</td>
<td>oz-in² x 10³ (kgm² x 10⁻³)</td>
<td></td>
</tr>
<tr>
<td>DM1004B</td>
<td>3.01 (5.5)</td>
<td>1.37 (2.5)</td>
</tr>
<tr>
<td>DM1004C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steps/rev (max)</td>
<td>655,360</td>
<td>655,360</td>
</tr>
<tr>
<td>Motor weight*</td>
<td>lbs (kg)</td>
<td></td>
</tr>
<tr>
<td>DM1004B</td>
<td>6.6 (3)</td>
<td>6.6 (3)</td>
</tr>
<tr>
<td>DM1004C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>3 arc-sec (0.00139°)</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±60 arc-sec (0.0167°) standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>±20 arc-sec (0.00556°) (version available)</td>
<td></td>
</tr>
<tr>
<td>Max. stepping rate</td>
<td>1,572,000 steps/sec</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volts</td>
<td>115 VAC 1-phase, or 230 VAC 1-phase, 50/60Hz</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>±10% to -15%</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>5 amps max.</td>
<td></td>
</tr>
<tr>
<td>Encoder output</td>
<td>400 kHz max.</td>
<td></td>
</tr>
<tr>
<td>Inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command interface</td>
<td>Low going low pulse, 8.5</td>
<td></td>
</tr>
<tr>
<td>Step input</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direction</td>
<td>Logic high = CW rotation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Logic high = CCW rotation</td>
<td></td>
</tr>
<tr>
<td>Analog input</td>
<td>±10V velocity signal; ±8V torque signal</td>
<td></td>
</tr>
<tr>
<td>Outputs</td>
<td>A/B encoder output 393 kHz max.</td>
<td></td>
</tr>
<tr>
<td>Encoder output</td>
<td>Z-channel – 124 pulses/rev</td>
<td></td>
</tr>
</tbody>
</table>

*Drive weight is 4 lb (1.8 kg).
**Static loads should be derated as shown under the following conditions:
smooth rotary motion: 1/3
intermittent press loading: 1/5
repetitive shock loads: 1/10

Options:
- Line filter for CE installations
- Interface cable for use with Parker motion controllers.
- Class 10 Cleanroom Preparation
### Dimensions

**DM1004B**
Dimensions (mm)

**DM1004C**
Dimensions (mm)

**DM1004B & DM1004C Drive Dimensions**
Dimensions (mm)

### Speed/Torque Curve
The speed/torque curves represent peak torque available; continuous torques are approximately 2/3 of the peak value.

For additional specifications or information on other Parker direct drive “Dynaserv” rotary units, go to www.parkermotion.com