Providing the “Total Solution” in Positioning and Motion Control

From high precision positioning to high speed automation, Daedal Systems have provided the “Total Solution” for over thirty years to companies requiring reliable electromechanical motion control systems. Daedal’s success is attributed to its outstanding design, engineering, and manufacturing expertise along with its unrivaled component product offering. The advantages of these systems include ease of operation, ease of integration, proven reliability, and dependable performance. Daedal systems are offered at selectable levels of integration ranging from basic mechanical motion tables to complete multi-axis motion systems that include motors, drives, controls, and machine interface.

Daedal is a division of Parker Hannifin Corporation

… the global leader for components and systems designed to control motion, flow and pressure in all types of machinery and equipment. Parker offers over 1,400 product lines that are utilized in over 1,000 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, electromechanical, and computer controlled motion solutions.
From simple modification of catalog products to a complete custom designed motion system, Daedal can provide the best solution for your automation project. Daedal’s “Custom Systems Group” is staffed by experienced engineers and technicians who are specialists in the field of electromechanical motion systems. They utilize systematic processes to convert a special application into a custom solution from concept to completion in the shortest amount of time. There are no loose ends, mis-communications, delays, or mis-application – only reliable and consistent results. Advanced manufacturing and assembly processes enable precision and quality to be built into every element of the motion system. Performance and specifications are verified on “state of the art” test equipment, to assure that the desired results are achieved. Whenever your motion application cannot be solved with a catalog product, let our specialists go to work for you.

### Field Application Specialists
- Parker’s extensive network of Automation Technology Centers (ATC) employ knowledgeable engineers who provide on-site project evaluation
  - define system requirements
  - establish performance parameters

### Design Engineering
- Experienced engineers dedicated to custom products & multi-axis systems
- Refine concept design for optimized manufacturing
- Pro-E Stations with 3D modeling to assure design integrity
- Generate customer approval drawing (first quality check point)

### Quality Built-In
- Quality checks throughout the manufacturing process.
- Final testing performed on every order.
  These can include:
  - Laser testing for positional accuracy and repeatability
  - Clean Room Certification
  - Input torque Tests
  - Force Output Tests
  - Slope correcting
  - Orthogonality
  - Complete documentation provided with every system

### Advanced Manufacturing
- “World Class” lean manufacturing for:
  - improved efficiencies
  - lower cost
  - shorter lead-times
- “State of the Art” machine centers for consistent component quality
- Interactive communication of assembly technicians with engineering to assure absolute compliance to defined performance parameters

### Post Sale Support
- World wide network of ATCs to provide on-site assistance and training
- Industry leading product manuals
- Global 24/7 support: 1-800-C-PARKER

### On-Site Project Evaluation
### Pre-sale Technical Support
- Preliminary Design and Quotation

### Innovative Solutions
### Manufacturing Expertise
- Manufactured to Specification

### Thorough Testing
### Assured Satisfaction
- Un-rivaled Post Sale Support

### Factory Applications Engineering
- Preliminary engineering and concept development
- Highly developed programs to facilitate rapid analysis, sizing and pricing
- CAD generated proposal drawings
- Searchable design library to minimize engineering cost, and reduce lead-times
Solutions Portfolio

Environmental Conditioning:
Special materials and coatings for specific requirements include:
- White powder coating
- Low lustre black anodize for optics labs.
- Low ESD coatings for semi-conductor apps.
- Stainless Steel for vacuum and food industries

Cable Management:
High Flex Cables, Cable Tracks, Guide Troughs, Special Cables, Special Connectors, Connector Panels, Junction Boxes, Control Panels
Solutions Portfolio

Heavy Duty Table
- size 35 square rail bearings
- 2 inch dia. ball screw drive
- End of Travel shock absorbers

High speed three axis positioning optimized by combining belt driven HLE units with ball-screw driven 500 series

Special two axis linear servo motor system with custom mounting brackets

Heavy duty - independent dual carriage, with dual drivescrews & open center

Low profile X-Y Open frame precision microscope table - ball screw drive and square rail bearing system.


Heavy Duty Linear-Rotary combinations with special bracketry and cable carriers

Double HLE rail with Tempasonics feedback
Heavy duty linkshaft assembly
Customer supplied right angle gearbox

Custom gantry with dual belt drive X axis, & ball screw Y and Z axes
Tempasonic feedback on all axes
Custom bracketry

Dual X axis with cross member beam
Cross beam contains multiple Z axis electric cylinders with rod-guides
Special 3-axis rotary/linear positioner utilizing dyna serve motor with XR series tables & custom brackets

High Precision system mounted and aligned to polished granite for special point of measurement interferometer testing

Custom designed for light weight with high stiffness single axis positioner with integrated miniature servo motor

Custom open frame multi-axis gantry with precision linear -rotary motion combinatio

Custom designed heavy duty vertical positioner (double HZR15i)

XYZ high speed gantry with two independent vertical axes

Low cost X-Y positioning system with base platform.

Twin carriage linear - rotary positioner with custom counter weight balance system
Solutions Portfolio

HLE Rail with heavy duty right angle gear head

External overtravel decellerator shock on HLE rail

LARGE tapped hole in end to accomodate stationary carriage w/ moving base for payload mounting to base

Dowel holes in carriage for repeatable tool mounting and/or multi-axis alignment.

Additional free travel carriage for greater load capacity

Custom cross roller slide of stainless steel construction

HLE rail with customer supplied sensors

Modified for NPT fitting in end of XR table for air purge

Innovative rack & pinion design permits long travels and high dynamics
Solutions Portfolio

Custom heavy duty linear servo motor table with internal cable management.

Vertical lift table employing “Wedge” mechanics.

500 series table modified with .75” dia. rail, plus motor block & coupling for metric servo motor.

Special three axis manual system for linear rotary positioning.

Twin carriage independently driven by two linear servo motors.

Twin carriages independently driven to set focal distance for imaging.

This sampling of twin carriage units illustrates the variety of applications fulfilled by cost effective modification of products.

Twin carriages on common ground bearing ways for outstanding co-planar motion. LH/RH precision ball screw drive smooth opposing motion for fiber pulling.

Twin tables independently driven mounted to a common base.

Twin tables with a single drive provides low cost high performance opposing motion.
Solutions Portfolio

Precision Linear Motor Gantry utilizing standard 400LXR units, aligned and mounted on a custom base.

Dual vertical and horizontal linear servo motor table system.

Custom open frame square rail table with 400XR Y & Z axes.

Custom open frame five axis gantry with precision linear -rotary motion combination.

Clean room test of a 400XR series table.

Multi-axis gantry system with safety enclosure for material handling.

Laser tests certify positional accuracy for single or multi-axis systems.

Two axis gantry for positioning pneumatic cylinder.
The Challenge:
A machine integrator needed electromechanical sub-assemblies for integration into an automated adhesive dispensing machine. This machine would be required to operate at a 100% duty cycle, twenty four hours a day, seven days a week. A three axis gantry style motion system was needed for moving the multiple head dispenser assembly (approx. 100 pounds) over a travel envelope of 800mm X 800mm X 150 mm. Independent motion programs would be required for applying different bead paths to various parts.

The Solution:
Daedal systems and products, offered at “Selectable Levels of Integration”, enabled a perfect fit solution to be found from standard catalog linear tables. Based on travel, load, throughput, and other performance criteria, the 400XR series tables were selected as the primary mechanical components for this three axis system. 406XR units comprised the X-X’ & Y axes and a smaller 404XR was selected for the Z axis. Flexible options such as a cable management system, electric brakes, and inter-axis pinning greatly simplified the integrator’s efforts.

The customer would assemble, integrate and program the completed system which included the X,Y,Z gantry system, motors, drives, mechanical supports & fixturing, dispensing equipment, safety guards, and control panel.
The fiber optic industry has seen a tremendous boom in the late 1990’s. The resulting demand for optic fiber has caused high throughput production to be of utmost importance to high end manufacturer of fiber optics components. Along with high throughput are stringent quality standards where products are required to pass demanding tests. Great investment is being made into capital equipment to automate fiber production. Process equipment must meet extreme accuracy requirements to satisfy industry requirements.

One such application is a special type of fiber optic coupling. With this type of coupling two fiber optic strands are laid one on top of the other with the ends held in two chucks. The Chucks are mounted onto two high precision position table arranged as shown in the photo above. A light is passed through the fibers and feedback to a signal processing computer. The tables are commanded to move apart from each other at a very slow rate. At the same time the fiber optic strands are heated. The two strands merge into one and produce certain optical effects. The process is monitored by the signal processing computer which controls the motion. These coupled fibers are than used as components to manufacture optical multiplexers, attenuators, and other devices.

The Challenge:

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Photovoltaics (PV) is a high-technology approach to converting sunlight directly into electrical energy. Simply stated, a photovoltaic device is a solar powered battery whose only consumable is the light that fuels it. Photo cells are used to power devices ranging from watches to space stations.

A manufacturer of photovoltaic cells is developing a new type of PV module and requires a multi-axis positioner for manipulating laser light to create a photovoltaic image in glass. This system requires three linear axes (XYZ) and a rotary axis (θ). To position the laser above the desired cell, the customer required high throughput in combination with a high degree of precision.

**The Challenge:**

To meet travel, load, throughput and precision specifications, a Daedal LXR based gantry system was selected for the X-Y support axes. Two parallel mounted 406LXR units are used to form the X-X’ axis and a single unit for the cross member Y axis. Although the extruded construction of 406LXR provides a high degree of rigidity, a stiffener plate was added for the higher strength and rigidity required to support the Z-axis, θ axis and laser device (without compromising the straightness of travel specification). The 406LXR’s high acceleration/velocity attributes, combine with precise positioning and quick settling time to satisfy the stringent performance requirements for this demanding application.

**The Solution:**

The Key Considerations are:

- Fast settling time
- Low mechanical vibration
- Minimum 3G acceleration
- System Stiffness

**Primary Components:**

406LXR linear motor tables

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**Application Story #1103**

**Industry:** Electronics Manufacturing

**Application:** Photovoltaic Cell Manufacturing

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Parker Hannifin Corporation
Daedal Division
Irwin, PA 15642
800-245-6903

www.daedalpositioning.com
The Challenge:
A customer in the beverage industry required an economical linear positioner for beverage handling equipment. This unit would be subjected to highly caustic chemical wash-downs and also be required to satisfy a very demanding motion profile:

- 3g acceleration to 120 inches per second, followed by a 3g deceleration;
- 48” cycle per second;
- 24 hours operation - 365 days per year.

The Solution:
A Daedal belt driven round rail table was designed utilizing (2) 316 stainless steel bearing shafts combined with phenolic sleeve type bushings to form the support bearing assembly. The bushing housings were “self aligning”, to enable the bushings to pivot about their centers adjusting for any misalignment between bushings on each shaft.

On subsequent units, Daedal designed a FR4 glass filled phenolic substitute for 316 stainless and aluminum in the bushings and other construction components to reduce costs (this material is is about ¾ the cost of 316 stainless) as well as satisfy the caustic environment condition. This material demonstrates machining and strength properties comparable to aluminum and has chemical resistance properties similar to 316 stainless.

The prototype unit successfully completed rigorous life testing (over 3 million cycles) to assure that the desired performance would be achieved. Since then, production units have installed and operating successfully for over 18 months, requiring only routine maintenance after six months of continuous operation.

Key Considerations:
- Highly caustic chemical wash-down
- 48” travel cycle per second
- 24 hours/day; 365 day/year

Primary Components:
Custom belt driven round rail table
The Challenge:
A fuel cell manufacturer requires a two axis linear (X-Y) positioning systems for precisely dispensing pliable fuel cell material.

A fuel cell operates like a battery, but unlike a battery, a fuel cell does not run down or require recharging. It will produce energy in the form of electricity and heat as long as fuel is supplied.

A fuel cell consists of two electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water and heat. In light weight fuel cells the electrolyte is a thin polymer membrane.

In this application, pliable fuel cell material is placed into a metal retainer. An X-Y positioner will move and position a large steel fixture under a second system, which dispenses the pliable fuel cell material.

This process demands a rugged heavy duty positioning system capable of providing high throughput in combination with a high degree of positioning accuracy.

The Solution:
The system parameters associated with this application precluded a catalog or standard solution from being considered. Daedal’s custom systems group with its unique ability to design and develop “out of the box” custom solutions with optimum efficiency, was able to provide the best solution in the shortest amount of time

Based on travel, load, and other criteria, 400ST square rail tables were selected as the base platform. Oversized square rails were used for the following reasons: large physical interior dimensions of the positioners (for motors, encoders and switches), good flatness and straightness, good stiffness, heavy moment capacity.

To meet the demanding performance requirements of high speed, acceleration, and thrust, two high thrust linear servo motor were combined as the drive mechanism for each axis. An extensive cable management system was included with high flex cables and connector blocks for routing the linear motor cables, limit/home switch cables, hall cables, etc … from the y-axis to the primary connector on the X axis. Extensive testing which is standard on all custom systems assured that the customer could rely on dependable performance for the life of the system.

Key Considerations:
- Heavy Load Capacity: 200 lbs.
- Large Travel Envelope: 36” X 70”
- High Accuracy: 2 microns /inch
- High acceleration: 2 Gs
- High Velocity: 60 inches/sec.
- “Cable Ready” for hook-up to motor drives and controls

Primary Components:
- 400ST Series Square Rail Tables
A custom designed Z-axis platform was designed and developed to address the Z-axis requirements. It offered high strength, stiffness, and low height, in combination with controlled motion, and positioning capability.

A uniquely designed “wedge” style drive system was employed to permit all of the customer’s objectives to be met.

Thorough testing of the prototype unit verified the computer designed performance parameters, and assured that the required life expectancy would easily be achieved.
The Challenge:

For obvious reasons consistency of manufacturing is an absolute in the aircraft industry. Even a basic labeling process must be performed in a reliable systematic fashion. One aspect of jet aircraft manufacturing is the placement of safety stickers within the interior of the fuselage.

A machine integrator working for a large U.S. manufacturer of jet aircraft required a positioning system to be used in conjunction with a low power laser to systematically identify the correct locations for the placement of the safety stickers. This system had to be lightweight and mobile so that it could be moved in and out of the aircraft with relative ease. At the same time, it had to be rugged enough sustain rigorous bumping and jarring that would occur while sliding along assembly line rollers within the fuselage.

The positioning system must sequentially move the laser to specific programmed locations, where the laser beam marks the spot for the safety sticker to be applied.

The Solution:

Two HLE100RB Linear Modules (one driven & one free travel) with two standard carriages on each module provide the primary support and motion. The idler (free travel) module and the second carriage on each module provide a larger bearing footprint to address the stiffness and moment load considerations. 40mm x 160mm Par-frame structural aluminum elements are used for the support structure.

To avoid component damage, limit sensors and cable carriers are placed internally, and the servo motor is protected with structural aluminum guarding.
The Challenge:

Automated motion systems have become an integral part of IC and wafer production. This is due largely to the continued demands for tighter specifications and improved throughput. Because of the complexity associated with automated systems, many manufacturers insist on a single source supplier of these systems, to eliminate multiple vendor design incompatibilities and delivery conflicts.

A leading supplier of critical components for semiconductor manufacturing equipment required a high throughput, two axis (X-Y) precision positioning system. This system would be utilized to position a laser over semiconductor wafers where contouring moves are performed to cut intricate patterns into the wafers.

System parameters:
- Travel Range: 650 X 650 mm (25” X 25”)
- Velocity: 1 meter per second
- Acceleration: 1g
- Precision: 0.025 millimeters (total)

The Solution:

Three independently controlled linear motor driven tables (406LXR) were utilized as the primary components in this system. High velocity, high acceleration, and fast settling time were key attributes that contributed to their selection.

The X-axis is comprised of two parallel units (X-X’) supported by precision ground risers and mounting surface plate. The work envelope is located between the X-axis and the surface plate. The risers and surface plate were necessary to allow system portability without affecting accuracy.

A single 406LXR is utilized for the Y-axis to form the open center gantry system. The 406LXR is ideal as the gantry cross member because of its high stiffness to weight ratio. It offers rigid support without the need for additional structural elements, resulting in a cost effective system, providing extremely straight linear translation over the entire travel length of travel.

The LXR’s standard cable management system enabled simple, straight forward hook-up to the motor drives and controller.
An (X-Y) linear positioning system comprised of (2) modified 404XR tables with a travel range of 300 X 300 mm. Modifications include hand crank drives, tape scale encoders for positive position feedback, and a black anodized finish. The 404 XR series was chosen because of the following characteristics:

- it is completely sealed;
- it is lightweight;
- it has a tape scale encoder option;
- it is easily adapted for a manual handcrank
- it can be easily converted (on site) for motor driven operation.

The first ten units were installed in 1998 and have been successfully operating with zero maintenance required. Since that time an additional 40 units have been installed and performing with complete reliability.

**Key Considerations:**
- Reliable point to point positioning
- Manual control - easily upgraded to motor driven

**Primary Components:**
404XR tables

The Challenge:
A company which produces equipment for radiation therapy requires a two axis (X-Y) positioner which could precisely position a patient (on a hospital bed) for treatment with radiation.

The operator positions the bed to a pre-determined location, determined by the physician, under a radiation head. A grid is then established with each grid location 12 mm apart. A radiation stream is applied to the affected tissue at the first location. Once the dosage is completed, the patient is then re-positioned to the second grid location for the next dose. This process continues until the affected area is completely treated. While the positioning accuracy requirement is not extremely tight, it must be absolutely reliable with a 100% confidence level.

The Solution:
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The first ten units were installed in 1998 and have been successfully operating with zero maintenance required. Since that time an additional 40 units have been installed and performing with complete reliability.
Daedal offers the broadest spectrum of motion control products in the industry. As a result, a cost effective solution was easily designed by integrating standard catalog products into a complete motion system.

The X and Y-axis gantry subsystem, located at the top of the structure, provides the motion patterns for the adhesive application. Daedal’s high performance linear motor driven tables (LXR Series) were a perfect fit because of their high speed, high acceleration, accurate positioning, and rigid construction attributes.

The X axis, used for applying the powder metal layer, required fast scanning motion but did not require a high degree of positioning precision. Two high speed belt driven modules, linked by a common drive shaft, were selected for their long travel (60”) and cost effective performance.

Rugged 400ST Series Square Rail Tables were used for the Z vertical axes. Z required precise vertical positioning of the 2,000lb. load in increments of 0.007 inch. Z provided rapid lift of the massive load to the removal station.

The Challenge:
A company manufactures machines for producing three dimensional solid models directly from a “Pro-E” drawing. The machine requires a precisely controlled motion system as a principal component. The construction of a 3D model involves a proprietary adhesive process to create a very thin (.007”) powdered metal layer in a programmed pattern or shape. The layering continues in progression until the desired three dimensional shape is evolved. Coordinated control of the motion and adhesive application is critical. The formed models are then sintered and impregnated with brass and bronze. Once completed, these units are usable as parts, dies or molds.

The motion program requires a horizontal (X) axis to traverse across the powder box to apply a layer of powdered metal. On the retraction cycle a rollers, located on the rear of the axis, flattens and smooths the later. The X, and Y axes on the top traverse the powder box and present the adhesive agent in the prescribed shape and size. The layer cycle is completed when the vertical (Z) movements down by .007 inch. The solid model build cycle repeats. Once the final layer is applied, and the model is complete, the Z axis rapidly returns vertically to the removal station.

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| Application Story #1110 |

Parker Hannifin Corporation
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www.daedalpositioning.com
The Challenge:

The performance of modern aircraft has been dramatically improved as a result of light weight, high strength composite materials being used as the principal construction material. One application the composite material which is applied and bonded in layers. It is critical that the bonds are free from any defects, or potential defects.

To inspect these bonds and assure their structural integrity, a unique three dimensional scanning process was developed. The line of the scanning beam is transmitted horizontally at the composite test piece. The wing and fixturing weigh over five hundred pounds, yet must be precisely positioned relative to the scanning beam to achieve reliable test results. Any positional error would cause a costly misread. Three axes of motion were required. The test piece & fixture are mounted to a θ-axis which rotates 360 degrees about a vertical axis. The θ-axis unit is mounted to a Y-axis which moves twenty inches horizontally & perpendicular to the beam. Finally, a Z-axis which moves forty inches vertically, supporting and positioning the total load. The motion program for the test requires the Z-axis to move the fixture vertically and the θ-axis rotate it in a precisely controlled manner while the beam passes through.

The vertical path which is established by these two units cannot deviate more than 0.002” over the total travel. This includes the pitch and yaw of the Z-axis plus the wobble of the θ-axis combined.

The Solution:

Parker, Daedal Division provided the solution that perfectly matched the requirements for this process. This included the motion system, cable management and wiring to the control panel, safety light curtains and a 16 ft. x 8 ft. x 5 ft. steel machine frame - required to support the scanning equipment, motion system, auxiliary equipment plus the test piece and fixturing.

Both the Y-axis an Z-axis units were robust versions of Daedal’s 400ST Series Tables. These custom designed, ruggedly constructed tables included heavy duty linear square rail bearings and precision ground ball-screw. The Z-axis unit was able to offer very high axial strength in combination with precision positioning and straight-line accuracy for over forty inches of travel. The θ-axis was a custom rotary unit equipped with a rugged bearing to minimize wobble and a worm gear drive mechanism.

The complete system was shipped, installed and aligned by Daedal technicians and the local Parker integrator, and successfully passed all qualification requirements.

• Key Considerations:
  • Complete Three Axis System including support structure, cabling and safety curtains
  • Precise Alignment under heavy load - 500 Lbs.
  • 0.002 Inch total accumulative system error over entire travel

• Primary Components:
  • Custom Built Square Rail Linear Tables
  • Custom Designed Heavy Duty Rotary Table