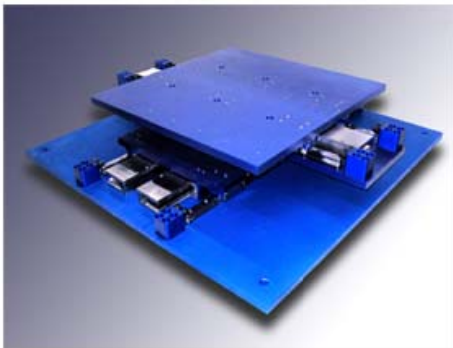


Earthquake Simulation Using Single or Dual-Axis Linear Motion Stages

With the goal of safer buildings and saving lives, scientists and engineers, through the simulation of many recent earthquakes, need to test building materials and structural designs. Using either a one or two-axis high force linear positioning stage from H2W Technologies, they can simulate the effects of earthquakes as large as the largest recorded earthquake in history, the 9.5 magnitude quake on the open ended Richter scale, in May of 1960 in Chile.

To generate the high forces accelerations necessary to simulate different types of earthquakes, including a transform plate boundary quake (a destructive type of earthquake), H2W uses three-phase brushless motors with Hall Effects guided by linear ball bearings.

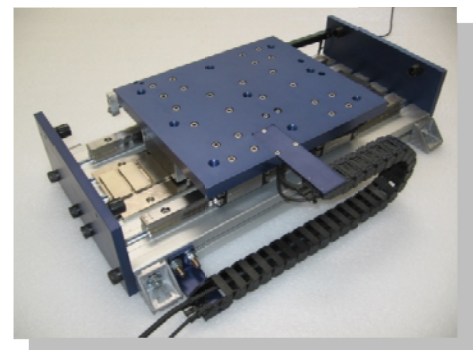
In addition, accurately simulating the destructive forces of an earthquake requires precise linear positioning. One-micron resolution linear encoders provide positional accuracies to $\pm 20 \mu\text{m}$ and repeatability better than $\pm 5 \mu\text{m}$.



The standard high speed, high acceleration two-axis linear positioning gantry (shown on the left) has a stroke of 8 inches [0.2 meters] (in both the X and Y axes. The force in the X axis is 400 lbs [1780 N] continuous (1200 lb [5340 N] peak) and the force in the Y axis is 200 lbs [890 N] continuous (600 lb [2670 N] peak), although longer strokes and higher forces are available.

To simulate the shaking from an earthquake you can send the signal directly from the motion controller to the amplifier, or from the data, available from the web, you can use LabView and a DAQ card (available from National Instruments) to produce an analog voltage signal from the data file to output to the amplifier.

H2W also manufactures a line of high force linear positioning stages that have single-axis operation (as shown on the right). This stage has a standard continuous force of 84 pounds [374 N], and a stroke of 8 inches [0.2 meters], although longer strokes and higher forces (up to 250 pounds [1113 N] continuous) are readily available. H2W will design a customized stage to meet a customer's specific needs

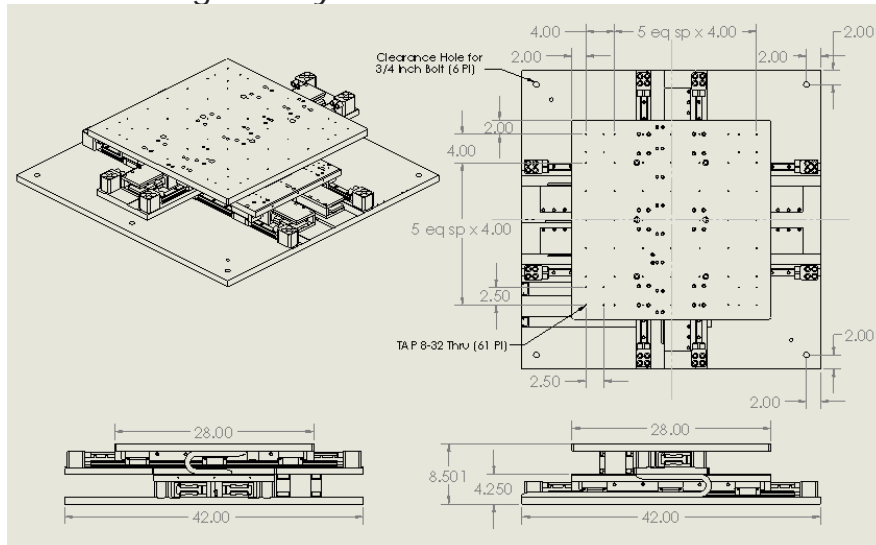


Key features

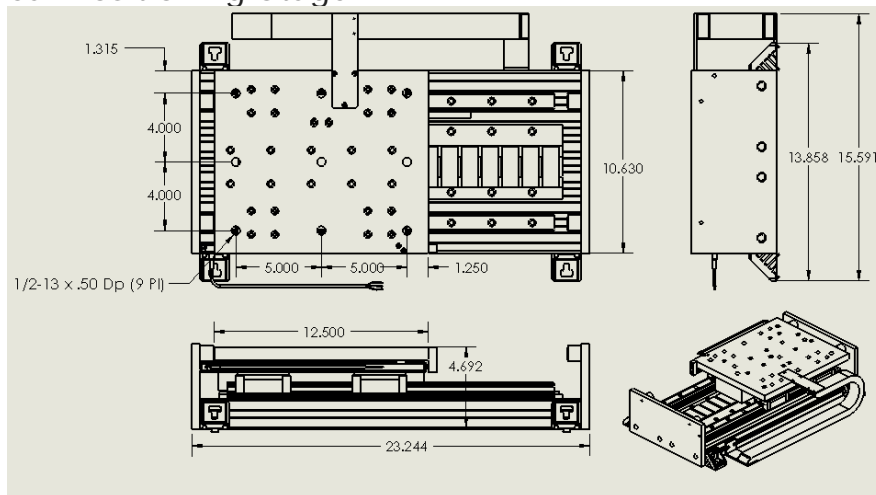
- Linear motors for reliable and quiet operation
- Extensive data acquisition and control capability
- Easy integration of your structures, sensors, and actuators
- Fully documented system models and parameters
- Supports scaling and playback of earthquake data
- Synchronize motion profiles with multiple tables and/or other data acquisition systems
- Integrated safety features and limits

Examples

Two-axis Linear Positioning Gantry



Single-axis Linear Positioning Stage





About the Technology

The DR stage is a low profile, wider footprint, enclosed positioning stage. It is used in closed loop positioning applications that require high speed and high accelerations of heavier loads.

The iron core coil assembly is magnetically attracted to the stationary magnet assembly, which provides a preload for the bearing system. The dual parallel linear bearing rails with 4 linear recirculating ball bushing guides provide a much higher load carrying capacity. The wide low profile of the stage ensures a stable platform for the payload or as the bottom axis (X axis) of a stacked multi-axis system.

The larger size of the stage allows for the mounting of a larger, higher force linear motor.

The DR positioning stage incorporates the latest in linear motion technology:

- **Motors:** Non-contact 3 phase brushless, low cogging, iron core linear motor, commutated either sinusoidally or trapezoidally with Hall Effects. The encapsulated laminated coil assembly moves and the multi-pole single sided permanent magnet assembly is stationary. There is a large magnetic attractive force which provides a preload for the bearing system.
- **Bearings:** Linear guidance is achieved by using a 2 parallel linear rail with 4 linear recirculating ball bearing guides. The bearing guides are sealed with wipers to contain the lubrication and to keep out debris. Periodic lubrication of the guides is recommended.
- **Encoders:** Non-contact optical or magnetic linear encoders with a reference mark for homing. Multiple reference marks are available and are spaced every 50 mm down the length of the scale. Typical encoder output is A and B square wave signals but sinusoidal output is available as an option.
- **Limit Switches:** End of travel limit switches are included at each end of the stroke. The switches can be either active high (5V to 24V) or active low. The switches can be used to shut down the amplifier or to signal the controller that an error has occurred. The limit switches are typically an integral part of the encoder, but can be mounted separately if required.
- **Cable Carriers:** Cable guidance is achieved by using a cable carrier. Cable carriers are oversized to allow for routing of customers hoses and cables.
- **Bellows:** The DR comes with optional neoprene / nylon bellows with Mylar stiffeners.
- **Hard Stops:** Hard stops are incorporated into the ends of the stage to prevent over travel damage in the event of servo system failure.

Innovation in Linear Motion

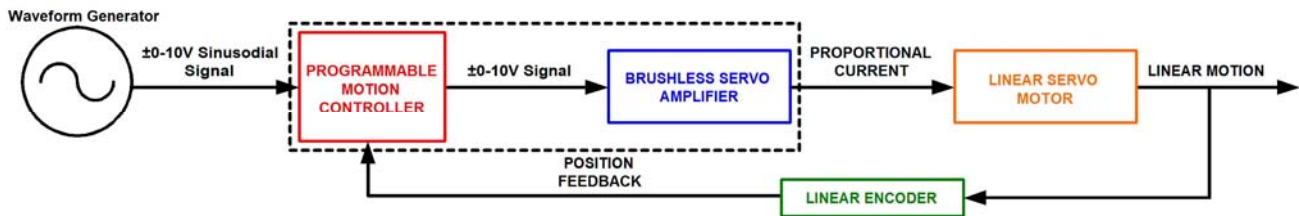
Integration of Drive Electronics

As well as providing the stage or gantry to meet your needs, H2W has the expertise to provide the necessary drive electronics, and the capability to integrate the motion control electronics with the motion control stage in one to several axes, and having the ability to mix and match motor and drive types. These systems can operate in either open or closed loop applications, and every closed loop system is provided with startup programming. In addition, H2W will provide training and support to learn and successfully operate the motion control software.

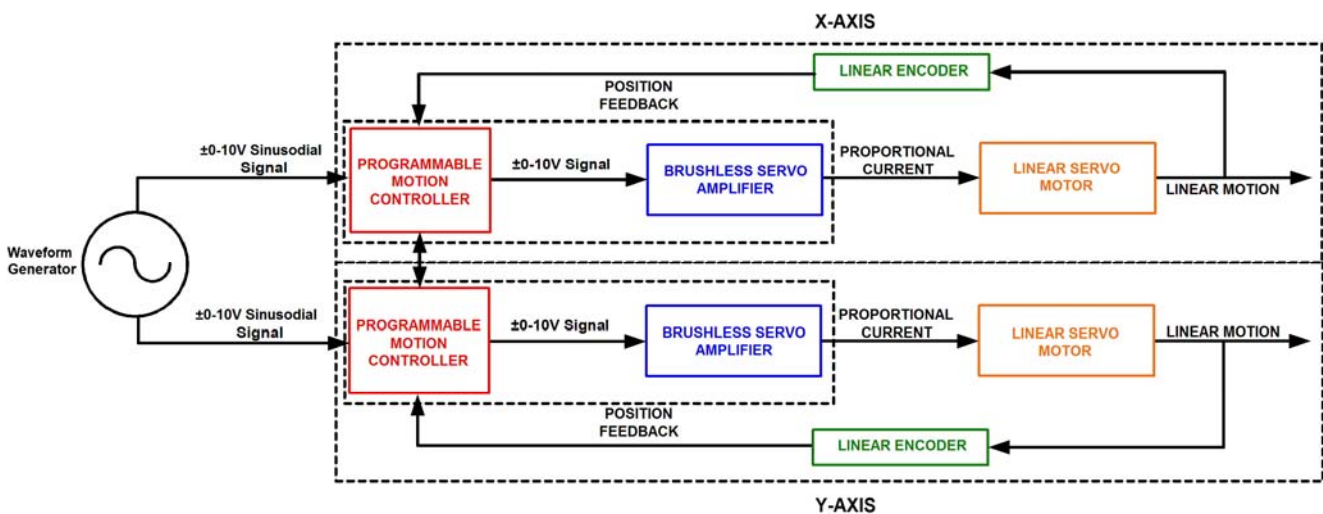
From design to implementation, H2W provides the additional value that gets you started using your motion control device.

Implementation

Single-Axis Linear Stage Closed Loop Servo Motion Control Integration



Dual-Axis Linear Stage Closed Loop Servo Motion Control Integration





About H2W

H2W Technologies, Inc. is dedicated to the design and manufacture of linear and rotary motion products that are used in the motion control industry. We are committed to providing every customer with the optimal solution for their motion application in the shortest possible time, at the lowest possible cost using only the highest quality products.

We offer a complete line of linear electric motors including; single and dual axis linear steppers, DC brush and brushless linear motors, voice coil actuators, and AC induction motors.

Our high speed and high precision linear motor driven positioning stages are ideal for both single and multi-axis closed loop servo applications. We also offer a complete line of ball screw, lead screw and belt driven positioning stages. We can provide you either a standard or custom designed positioning stage by itself or as a complete turnkey solution with a servo amplifier, power supply and programmable motion controller.

Other motion control products include; limited angle torque motors for compact, limited angular excursion rotary servo applications, 3-phase brushless rotary servo motors with matching digital servo amplifiers and permanent magnet linear brakes for failsafe, zero power braking for baggage handling and people moving applications as well as amusement park rides.

New products are constantly being developed, so please check our web site www.h2wtech.com for the latest developments and new product offerings.

H2W Technologies, Inc. has developed and implemented a quality management system to demonstrate its ability to provide consistently product that meets or exceeds customer requirements. Our quality Assurance procedures address customer satisfaction through the effective application of the quality system, including continual improvement and the prevention of nonconformity. The quality system complies with the international standard ISO 9001 (2000). H2W Technologies is approved for the Military Specifications MIL-I45208A Inspection System.

With over 75 years combined experience in the linear and rotary motion field, our team of engineers can offer you the optimal solution to your most demanding motion control, requirements.

Other Industries Served:

Semiconductor, Medical, Aerospace, Material Handling, People Moving, Amusement Park Rides Packaging, Automotive, and Clean Room

Innovation in Linear Motion