

AD Series

Ultra-Resolution Electrostrictive Actuators



The AD Series actuators and ESA Series controllers bring you cost-effective nanometer-scale positioning like conventional piezoelectric devices without their associated hysteresis, creep, settling, and high voltage problems. We have packaged today's most advanced electrostrictive ceramic materials into a compact micrometer-sized module which mounts on all of our micrometer-compatible components.

Ideal for demanding fiber positioning, waveguide testing, micro-assembly, and probing applications, the AD actuators provide as fine as 40 nm minimum incremental motion with long travel ranges up to 100 μm . An integrated ultra-fine pitch manual screw allows for 13 mm manual adjustment range with a sensitivity better than 0.5 μm . The adjustment knob is precisely marked every 10 μm making it simple to center the electrostrictive fine-motion travel where desired.

Electrostrictive materials are notable for their favorable hysteresis characteristics versus conventional piezoelectric elements. Since both materials are generally used in open-loop, encoderless designs, any hysteresis will result in an apparent non-repeatability upon reversal of motion. But unlike predictable backlash, hysteretic non-repeatability depends on the recent motions performed by the device and is difficult to model, predict, and compensate.

In addition, electrostrictive actuators show much less drift than conventional piezo devices. This feature is especially crucial for fiber positioning applications, where an optimum aligned position must be maintained over time.

Key Features

- Advanced electrostrictive technology minimizes hysteresis
- Ultra-fine resolution up to 0.04 μm
- Large fine-travel range up to 100 μm
- Significantly less creep compared to piezo devices
- Convenient manual knob allows for 0.5 μm sensitive coarse adjustments



ESA-C Controller



ESA-CXA Controller



ESA-CSA Controller

Three High-Stability Controller Choices:

ESA-C

Model ESA-C is an advanced controller for 1–3 actuators. Convenient, finger-friendly front panel manual positioning knobs provide very fine sub-micron remote positioning. An IEEE-488.2-compliant GPIB computer interface provides crisp, well-behaved automated execution. The front-panel backlit LCD display provides at-a-glance monitoring of all three actuators' activity whether motions are commanded from the front panel or the computer interface.

The ESA-C's GPIB interface offers many innovative features. For example, in any positioning application you can choose "velocity-controlled" or "immediate" execution. Velocity controlled motions occur gradually, with a user-selectable and very smooth voltage rise rate—highly useful for fine positioning of delicate, vibration-prone devices such as optical fibers and microprobes.

Immediate motions occur virtually instantaneously and are useful when very forceful motion is needed, such as in minimal-trauma penetration of living cells. Whatever the operation,

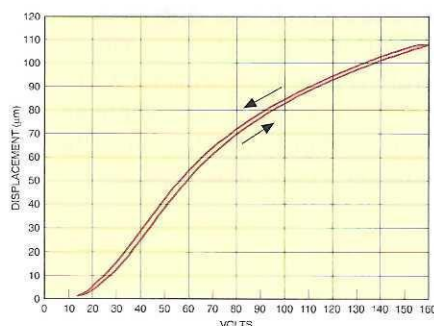
ESA-C's completion-signaling capabilities facilitate integration and tight synchronization in complex automated applications. In fact, the functionality of the ESA-C's computer interface is much closer to that of a motion controller than to the typical piezo "programmable voltage source". Like all Newport instruments, versatile LabVIEW™ instrument driver sets are available online at www.newport.com

ESA-CXA

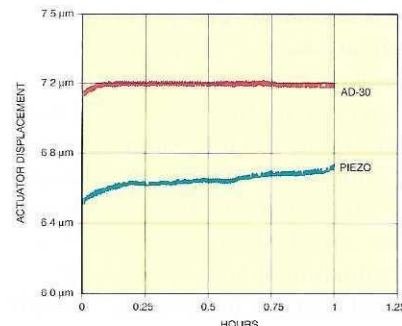
For manual or low-bandwidth external control, Model ESA-CXA provides precise adjustability of one to three actuators. Three analog input ports allow control via a computer with a D/A board. A bright red LED display shows the applied voltage for a selected actuator and can easily be read from across a laboratory. High-stability DC power supplies provide better than 15 mV RMS ripple and 1% voltage stability over eight hours.

ESA-CSA

The ESA-CSA is a single axis manual-only version of the ESA-CXA. This low cost controller incorporates a large LCD display and is powered via a wall mount adaptor.



Electrostrictive actuators have very little hysteresis. Each Newport AD device is shipped with a interferometric hysteresis plot.



Comparing actuator creep, electrostrictive actuators are superior to conventional PZTs when trying to maintain position over time. The graph shows the results after one hour with a voltage step applied at time-zero.

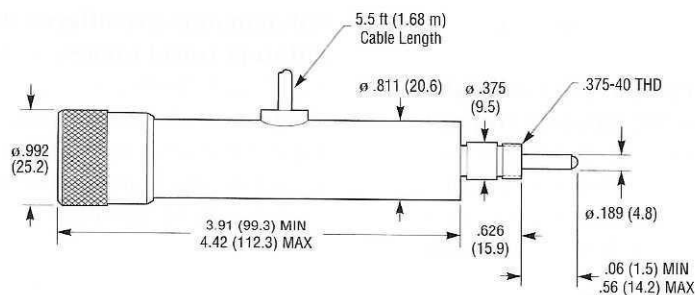
Specifications

| | AD-30 | AD-100 |
|----------------------------|--------------------|----------------------------|
| Travel, Coarse | | 13 mm |
| Travel, Fine | 30 μm | 100 μm |
| Manual Sensitivity | | <0.5 μm |
| Minimum Incremental Motion | 0.04 μm | 0.06 μm |
| Hysteresis | | <6% |
| Linearity Error | | <10% over 10 μm |
| Load Capacity | | 45 N |

Ordering Information

| | Model | Model |
|--|---------------|----------------|
| Actuator | AD-30 | AD-100 |
| Advanced Controller | ESA-C | ESA-C |
| Advanced Controller plus three Actuators | ESA-C-SET30 | ESA-C-SET100 |
| Manual Controller | ESA-CXA | ESA-CXA |
| Manual Controller plus three Actuators | ESA-CXA-SET30 | ESA-CXA-SET100 |
| Single-Axis Controller | ESA-CSA | ESA-CSA |
| Single-Axis Controller plus one Actuator | ESA-CSA-SET30 | ESA-CSA-SET100 |

Dimensions



VM Series



Key Features

- Precision, backlash-free motion ideal for alignment purposes
- Exceptional high load capacity of 120 N
- Low friction design enables high sensitivity with 0.3 μm minimum incremental motion
- Vacuum-compatible versions up to 10^{-6} Torr

Precision Motorized Actuators



VM series precision actuators offer backlash-free motion with high load capacity and up to 25 mm travel range. They feature a M12 mounting interface and are the recommended choice to motorize our UMR8 and MVN80 linear stages, or SL and SK series optical mounts (see page 838, 846, 629, and 632 respectively).

Precision motion is accomplished by a miniature DC servo or stepper motor with rotary encoder providing 50 nm position feedback. A sophisticated, preloaded belt drive system converts the rotation of the motor

shaft into linear travel while avoiding any backlash inside the system. This allows very responsive motion ideal for alignment purposes. An exceptional high load capacity of 120 N is achieved by a low friction design and precision guidance of the actuators tip.

VM actuators are offered with three different travel ranges allowing exact match with the travel of your manual component. To protect your investment, fixed limit switches are included, which are also used as reference home position.

Design Details

| | |
|----------------------|--|
| Base Material | Aluminum |
| Drive Mechanism | Rolled lead screw |
| Drive Screw Pitch | 0.5 mm |
| Reduction Gear | 211.5:1 |
| Feedback | Motor mounted rotary encoder, 48 pts/rev. |
| Limit Switches | Mechanical, both ends |
| Origin | Mechanical, at motor side, typical <30 μm repeatability |
| Motor | VMCC: DC servo motor UE17CC VMPP: 2-phase stepper motor UE16PP, 1 Full step = 2 encoder pulses |
| Cable Length | 1.5 m |
| Vacuum Compatibility | Vacuum compatible versions are available up to 10^{-6} Torr using stepper motor (PP) |