

# Solutions for High Performance Infrared Imaging Shutter & Aperture Control



Innovating Motion



# Nanomotion Edge motor/miniature modules provide linear and rotary motion for NUC shutters and variable apertures

## Non-Uniformity Correction (NUC) Shutters

Today, imaging systems are prevalent in a wide range of security applications related to surveillance, thermal imaging, and night vision. These imaging systems are designed around a focal plane array (FPA), which is a series of detectors positioned at the focal plane of the imaging lens.

The image quality, however, is affected by the non-uniformity in the thermal response of the FPA detectors, often termed fixed-pattern noise or drift over time.

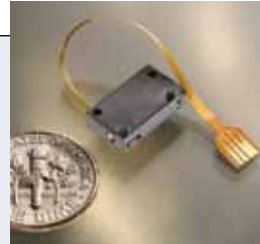
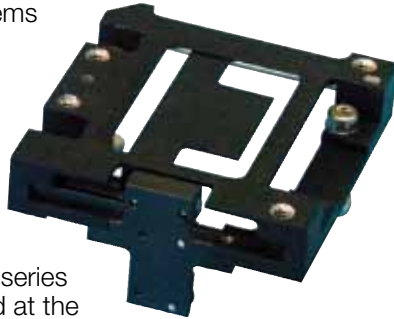
Even with a multitude of advances in detector technology, non-uniformity remains a primary concern as it degrades the spatial resolution, accuracy, and the ability to resolve minute temperature differences. Coupled with the fact that spatial non-uniformity drifts over time, there is a clear demand for regular and frequent calibration (correction).

The predominant non-uniformity correction (NUC) process is achieved with a calibration against a uniform black-body radiation source. Simply put, a shutter mechanism, similar to what is shown above, is used to block the FPA with a uniform reference object.

The ability for an NUC shutter to function effectively is based on Nanomotion's Edge motor. The Edge motor is one of the smallest and lightest motors available that provides high speed linear or rotary motion and, while holding position, does not consume power at rest.

Nanomotion designs and manufactures linear and rotary modules based on the demanding requirements of the security market. The motor and our designed modules undergo: thermal operational testing, thermal shock testing, vibration testing, and mechanical shock to assure our modules meet the most challenging environments.

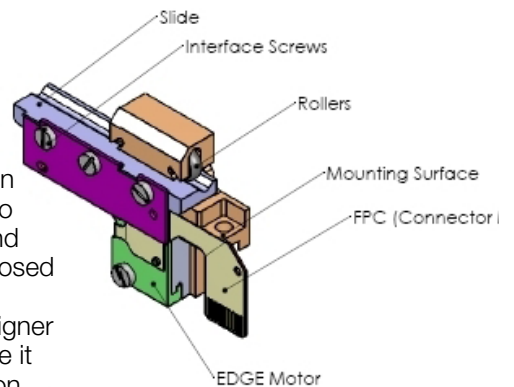
With a thorough understanding of the application and environmental requirements, Nanomotion's engineering team developed a shutter with a total mass of less than 3g (without the optics interface bracket) and a moving mass of 1g, capable of holding position under severe vibration.



### The Edge Motor:

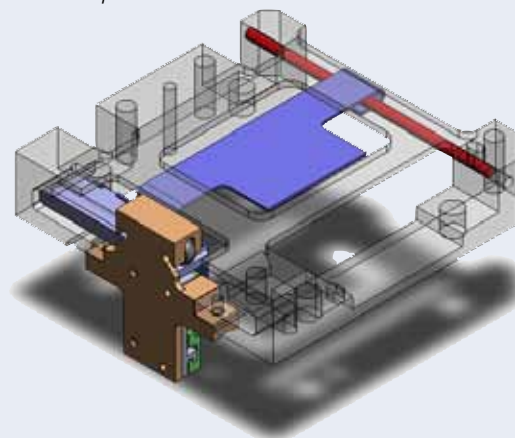
- Weighs just 0.55g
  - Generates 30 g thrust
  - Runs up to 150 mm/sec
  - Works at -40 to 70 °C
- Has built in holding/braking without power consumption
  - Is driven by a military rated ASIC
  - Can operate two position between limits for shutter applications

A component level actuator is the core driving mechanism for linear shutters. This configuration lends itself well to variable travel and either open or closed loop operation, allowing the designer to easily integrate it into an application.



## Nanomotion's Edge Motor Shutter Module

*From concept...*



## Variable Apertures

Unlike a two position shutter, a variable aperture is used in Forward Looking Infrared Camera (FLIR) imaging systems. An iris is opened or closed in order to increase the system dynamic range and allow operation on a wider range of radiation conditions. Variable apertures often operate under vacuum pressure and require vacuum compatible motion devices and position sensors to actuate the iris.

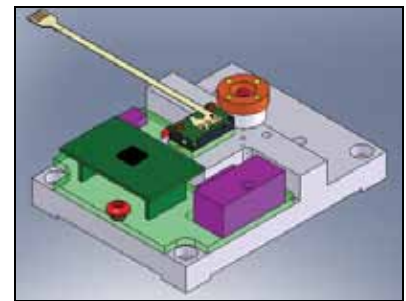
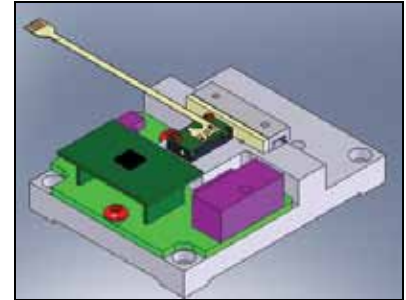


Creating a variable aperture, with vacuum compatible motors, provides the user with the ability to use a wide field search as well as long-range target recognition without compromising image quality.

Applications in thermography and commercial/defense vision enhancement are served with the same set of essential building blocks to create a complete motion module. Nanomotion's expertise lends itself to effective engineering collaboration and systems manufacturing based on customer requirements.

Linear and rotary "Application Development Kits" are available, using the Edge motor and Nanomotion's ASIC. These tools are comprised of a series of essential building blocks to meet a wide range of application and environmental requirements.

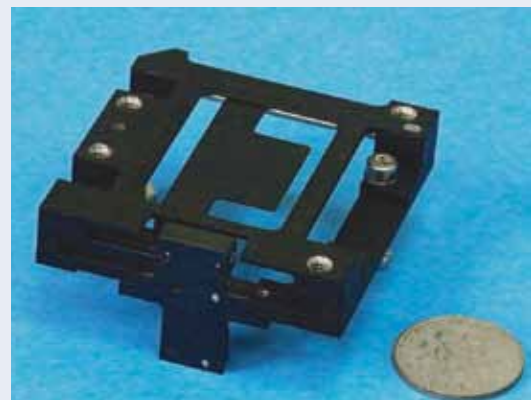
In addition to standard evaluation kits, Nanomotion offers a wide range of motion devices to facilitate proof-of-concept for high performance shutter and aperture applications.



*...to feasibility...*



*...to a production-ready shutter module.*



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