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There are certain crystals or ceramics that have a unique property—if physical stress is applied on them, they generate an electric current. Interestingly, when these materials are subject to an electric current, it leads to contraction and expansion in their structure. If you look around, you shall notice that transducers need the piezo effect as they find applications in sensors and circuits. This is what makes piezo-crystals one of the most critical tools for use in precision-positioning. That’s precisely the reason you shall notice that they are widely used in actuators.

With the use of multiple ceramic layers that measure less than 100 micrometers, it is possible to achieve high electric fields that have a voltage that is lower than 150 Volts. The piezoelectric actuators function on these very fundamentals. In its most basic form, such an actuator can traverse a stroke up to 100 micrometers. However, for applications where you need to achieve a stroke range in millimeters, amplified piezoelectric actuators are employed. For research and industrial grade actuators, one needs extreme precision and high repeatability.

In this article, we shall now discuss some of the advantages of piezo positioning systems:

Infinite resolution: These actuators can provide sub nanometer movement—movements over such short distances cannot be easily detected by the naked human eye. If you need an actuator that can offer you extremely fine positioning, then this is your best option. Make the smallest change in the operating voltage, and you shall notice that these actuators produce smooth movements corresponding to that voltage. There is least friction with these devices.

Force generation capabilities: Lead zirconate titanate or PZT, shows a distinct piezoelectric effect. When used correctly, they can be used for generating a force up to 10,000N. It is possible to manufacture units that can bear loads weighing several tons, yet offer precision positioning of more than 100 micrometers. They also offer a very fast response rate.

Absence of magnetic field: Since the piezo effect pertains to electric fields, there is no question of magnetic fields being produced. Also, these materials remain unaffected magnetic fields. If you have an application where the presence of a magnetic field could be detrimental to operations, then piezoelectric devices are a safe alternative.

Energy-efficient operations: The only electricity consumed is that which is needed for inducing motion. When such devices are static or holding heavy loads, they do not consume any electricity. Thus, they offer you low power consumption.

Minimum wear: A piezo actuator doesn’t comprise moving elements such as shafts or gears. Movement and displacement based on solid state dynamics doesn’t cause any wear and tear to components. Also, since they don’t have wear and abrasion, there is no need for the use of lubricants or oils. This makes them suitable for clean room applications.

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