Repeatability

Purpose

The goal of measurement is to determine the monodirectional repeatability of the integrated encoder mounted on the motor. In general repeatability is a measure of the system’s consistency to achieve identical results across multiple tests. In case of positioning system, monodirectional repeatability is the system's capability to reach the same position value for identical commanded position.

Description of measuring system

The Green Drive linear motor, equipped with the integrated encoder under test, is connected by a linear joint to a master motor. Only the master motor is powered. The master motor position is read by an optical encoder (1µm of resolution). The system is controlled by a PC and by a specific software that commands a position to master motor and calculates the position reached by Green Drive or miniature linear motors from the integrated encoder signals.

Description of measurement

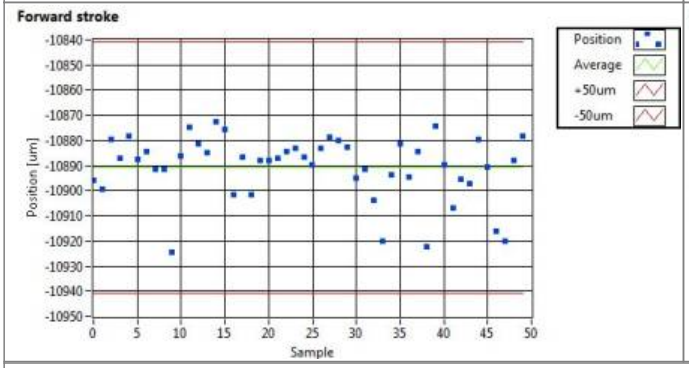
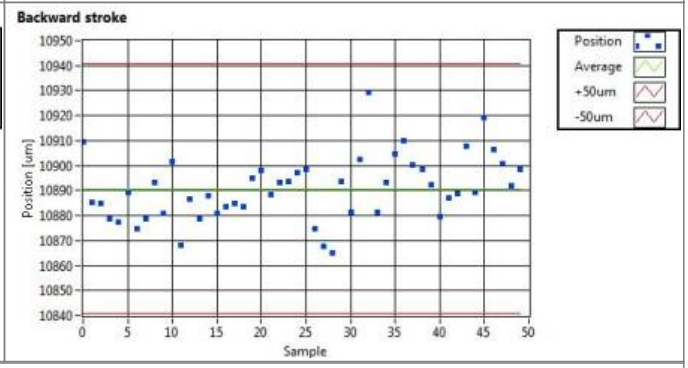
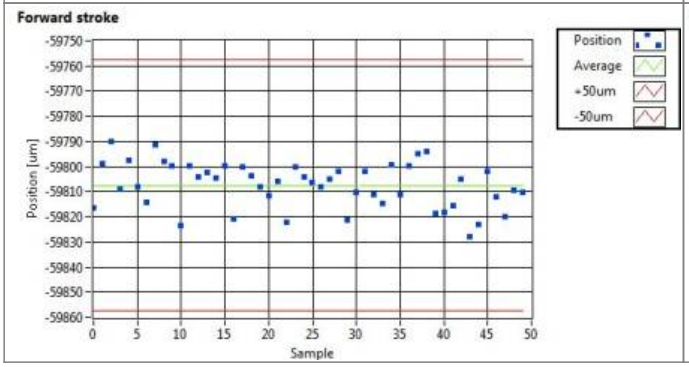
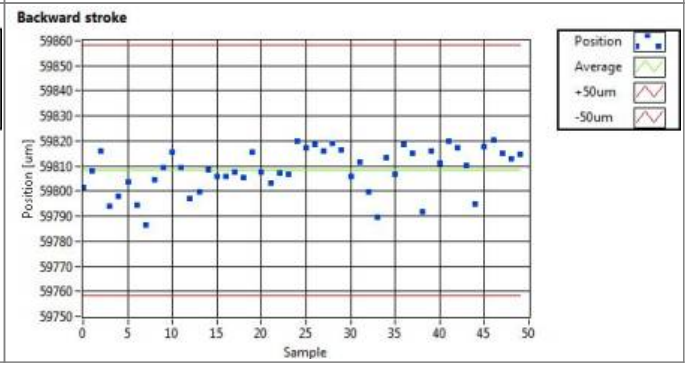
In order to measure the repeatability between two points, we commanded to master motor a set of 50 points of identical value and we collected for each the position reached by Green Drive for the stroke in forward direction (zero to preset position value) and in backward direction (preset position value to zero). This procedure was repeated for different amount of stroke: 10mm, 40 mm, 60mm, 90mm. Results are presented in the following section. The standard deviation of collected position values represents a good estimator of system repeatability. The standard deviation, σ (sigma), indicates spread of measured data and is calculated by the following formula:

$$\sigma = \sqrt{\frac{\sum_{n=0}^{n-1} (x_i - \mu)^2}{n}}$$

Where n is the number of sample in the data set, x_i is the value of data point and µ is the average value of data set. In a normal population of data points 99.7% of all test data will fall within ±3σ.

Measurements

Test stroke: 10 mm	
Forward Direction	Backward direction

Position value reached by motor (■) Average of effective stroke (--): -10890,815 µm Standard Deviation: 12,536 µm Upper Specification Limit (--): Average + 50 µm Lower Specification Limit (--): Average – 50 µm	Position value reached by motor (■) Average of effective stroke (--): 10890,760 µm Standard Deviation: 12,731 µm Upper Specification Limit (--): Average + 50 µm Lower Specification Limit (--): Average – 50 µm
	
Test stroke: 60 mm	
Forward Direction	Backward direction
Position value reached by motor (■) Average of effective stroke (--): -59807,542 µm Standard Deviation: 8,921 µm Upper Specification Limit (--): Average + 50 µm Lower Specification Limit (--): Average – 50 µm	Position value reached by motor (■) Average of effective stroke (--): 59808,440 µm Standard Deviation: 8,668 µm Upper Specification Limit (--): Average + 50 µm Lower Specification Limit (--): Average – 50 µm
	

Conclusion

This test confirmed that the experimental data are completely in accordance with the declared value of repeatability of ±50 µm. Attention: The value of repeatability determined by this test have to be intended as the maximum value achievable by the integrated encoder mounted on the motor. In fact, when the motor was powered, an additional error due to the control must be considered.