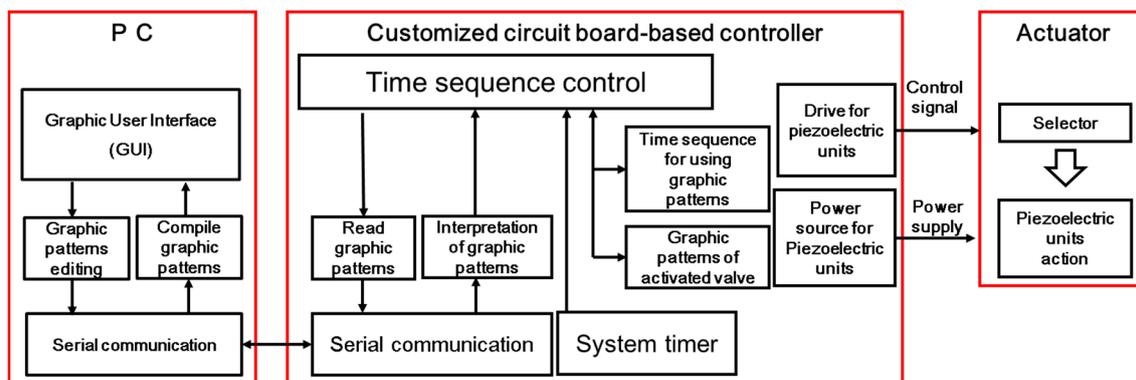


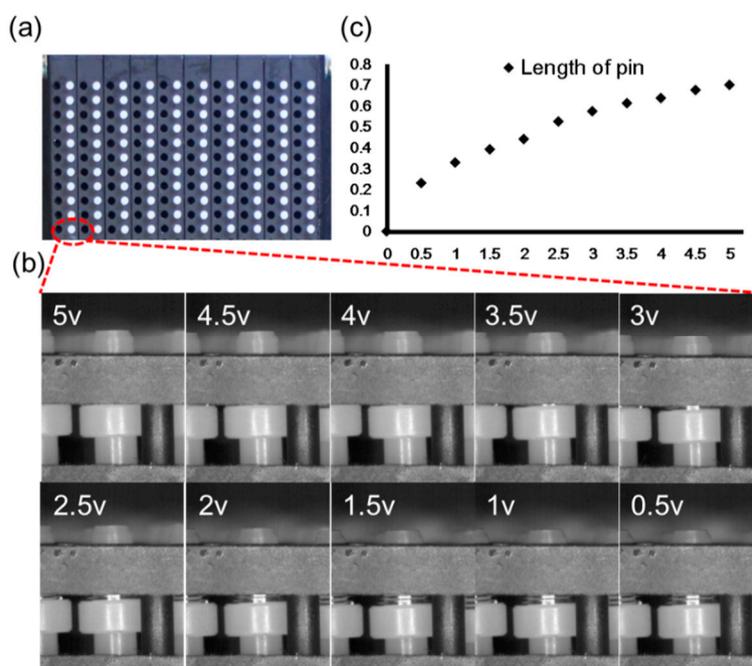
# Supplementary Materials: Large-Scale Integration of All-Glass Valves on a Microfluidic Device

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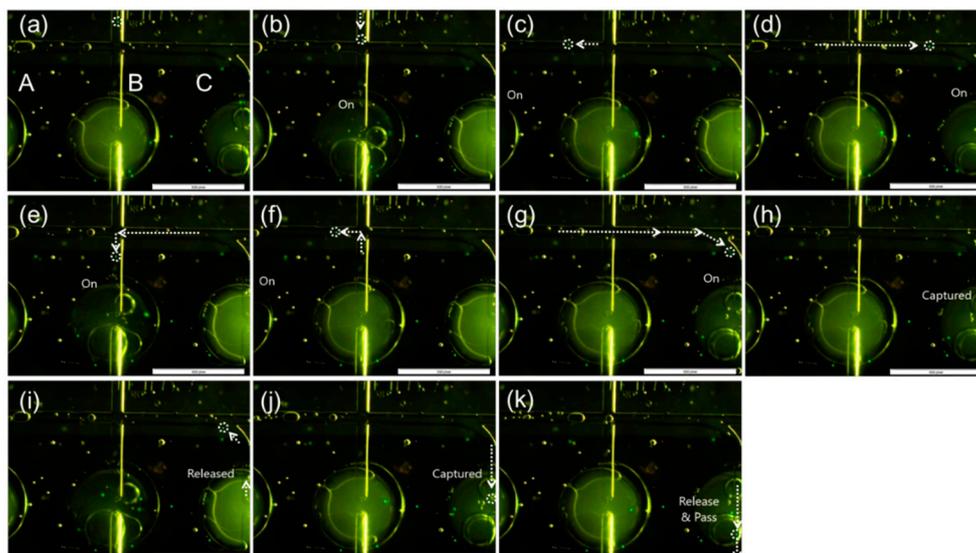


**Figure S1.** System architecture of computer-controlled piezoelectric units customized by the KGS Corporation.

The valve that needs to be opened was defined as an activated valve, and a graphic pattern that marked the position of the activated valve was edited and compiled as a machining description using a Graphic User Interface (GUI) on a PC. Then the graphic pattern was translated to a position and an activating time sequence of the valve through the customized circuit board-based controller. Finally, the valve in the translated position of the graphic pattern was activated according to the time sequence edited at the GUI.



**Figure S2.** Dependence between applied voltage and length of piezoelectric unit. (a) Heads of piezoelectric units. The white dots indicate individual piezoelectric units; (b) Side views of the length of a piezoelectric unit when different voltages were applied; (c) Graph showing that the length of the piezoelectric unit was proportional to the applied voltage in the range of 0–5 V.



**Figure S3.** Manipulation of a 20- $\mu\text{m}$ -diameter particle using a sequence of valve operations. Captured images from video S6. **(a)** Introducing a 20- $\mu\text{m}$ -diameter particle to the channel in the center; **(b)** Initial status of valve A, off; B, on; C, off; positions of the particle in the center channel and moving toward valve B; **(c)** A was turned on, and B and C were off; the flow was toward A and included the particle; **(d)** C was turned on, and B and A were off; the flow was toward C and included the particle; **(e)** B was turned on, and A and C were off; the flow was toward B and included the particle; **(f)** A was turned on, and B and C were off; the flow was toward A and included the particle; **(g)** C was turned on, and B and A were off; the flow was toward C and included the particle; **(h)** The particle was captured by valve C in front of the inlet port; **(i)** The particle was released by valve C and flowed to A; **(j)** The particle was captured by valve C in the chamber; **(k)** Released, The particle was released to outlet port of valve C and flowed past valve C to the next valve.