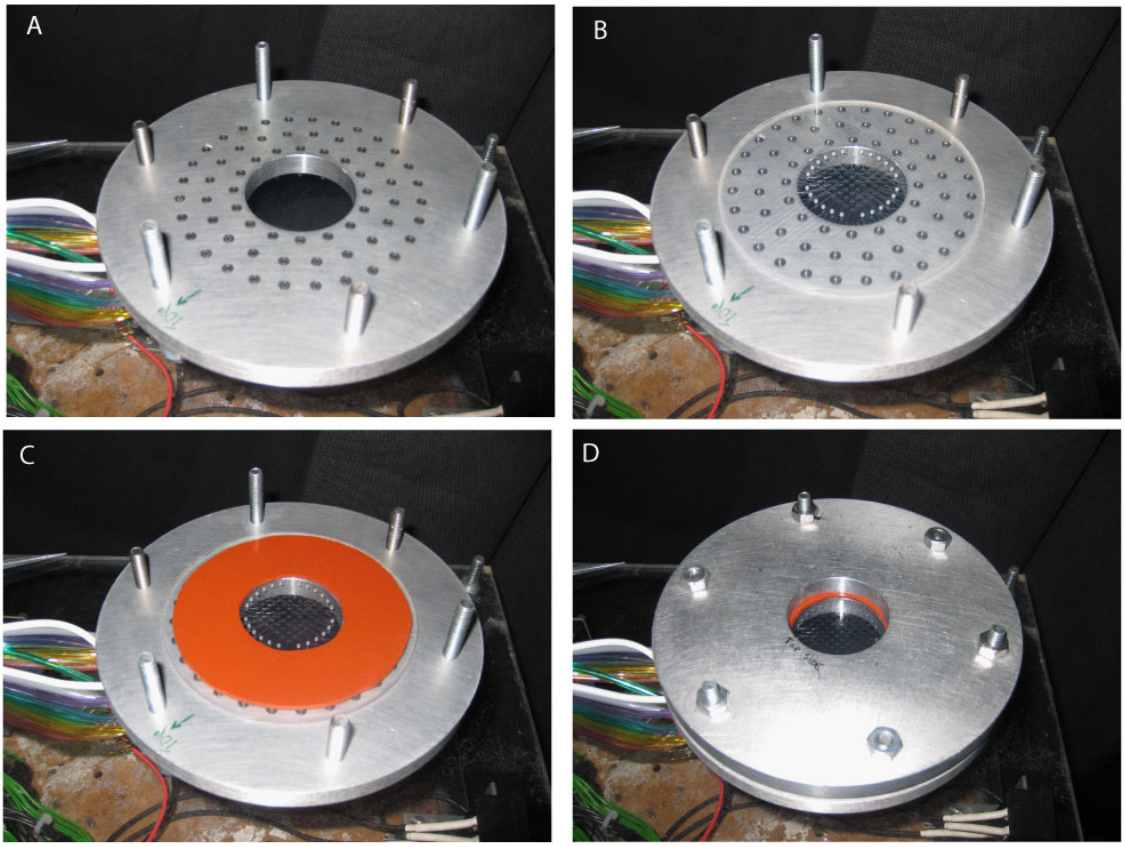
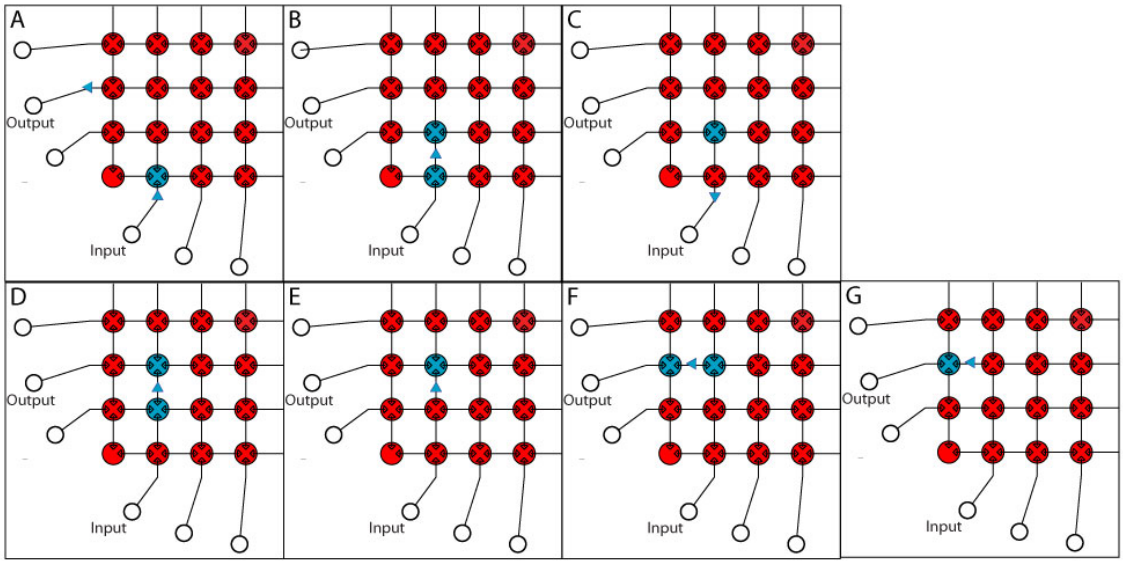
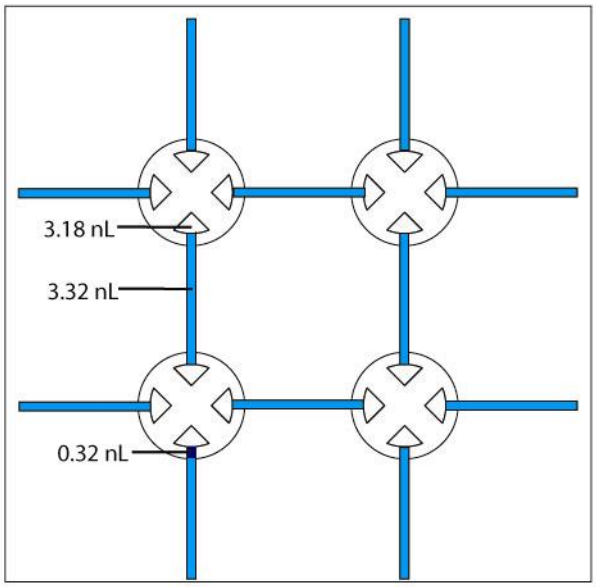


Supplemental Figure 1: Manifold for pneumatic control of the microfluidic Automaton. (A) 3/8” Aluminum plate with embedded O-rings ports. Pneumatic tubing (rainbow colored) addresses each port on the opposite side. (B) Microfluidic Automaton with drilled pneumatic inputs facing each of the pneumatic ports on the manifold. (C) A silicone rubber gasket is placed on the top surface of the Automaton. (D) An additional 3/8” aluminum manifold is hand tightened in place using six ¼” bolts to complete the assembly. Fluidic inlets and outlets can be accessed through a central hole in the top manifold layer.



Supplemental Figure 2. Schematic of the 4-valve pumping program used to evaluate fluidic transfer efficiency between microvalves. The blue arrow indicates the direction of fluid flow at each step. A closing pressure of 25 kPa was applied to all valves in the closed state (red). Switching individual microvalves to the open state (blue) is achieved by applying a -87 kPa opening pressure and holding for a specified actuation time before proceeding to the next step. Switching to the closed state is achieved by applying the same 25 kPa closing pressure to an open microvalve and holding for the same actuation time. With this program (steps A-E), the volume of one open microvalve is transferred from the input to the output per 7-step cycle.



Supplemental Figure 3. Specification of dead volumes in fluidic channels with closed microvalves. The dead volumes in a 4-valve mixing loop are calculated as follows: D = (16 * 3.18) + (4*3.32) + (8 * 0.320) = 66.7 nL