such embodiments, multiple PWM generators can produce signals that can be selectively non-overlapping (e.g., by multiplexing the on-time of the various heaters) such that the current capacity of the high voltage power is not exceeded. Multiple heaters can be controlled by different PWM signal generators with varying start and end counts. The heaters can be divided into banks, whereby a bank defines a group of heaters of the same start count. For example, 36 PWM generators can be grouped into six different banks, each corresponding to a certain portion of the PWM cycle (500 ms for this example). The end count for each PWM generator can be selectively programmed such that not more than six heaters will be on at any given time. A portion of a PWM cycle can be selected as dead time (count 3000 to 4000 for this example) during which no heating takes place and sensitive temperature sensing circuits can use this time to sense the temperature. The table below represents a PWM cycle for the foregoing example:

	Start Count	End Count	Max End count
	Bank 1		
PWM generator#1	0	150	500
PWM generator#2	0	220	500
. . .	. . .	. . .	
PWM generator#6	0	376	500
	Bank 2		
PWM generator#7	500	704	1000
PWM generator#8	500	676	1000
. . .	. . .	. . .	. . .
PWM generator#12	500	780	1000
	Bank 3		
PWM generator#13	1000	1240	1500
PWM generator#14	1000	1101	1500
. . .	. . .	. . .	. . .
PWM generator#18	1000	1409	1500
	Bank 4		
PWM generator#19	1500	1679	2000
PWM generator#20	1500	1989	2000
. . .	. . .	. . .	. . .
PWM generator#24	1500	1502	2000
	Bank 5		
PWM generator#25	2000	2090	2500
PWM generator#26	2000	2499	2500
. . .	. . .	. . .	. . .
PWM generator#30	2000	2301	2500
	Bank 6		
PWM generator#31	2500	2569	3000
PWM generator#32	2500	2790	3000
. . .	. . .	. . .	. . .
PWM generator#36	2500	2678	3000

Example 4

Detector Integrated in Force Member

[0281] This non-limiting example describes pictorially, various embodiments of a detection system integrated into a force member, in an apparatus for carrying out diagnostics on microfluidic samples.

[0282] FIG. **43**A: The lid of the apparatus can be closed, which can block ambient light from the sample bay, and place an optical detector contained in the lid into position with respect to the microfluidic cartridge.

[0283] FIG. **43**B: The lid of the apparatus can be closed to apply pressure to the cartridge. Application of minimal pressure on the cartridge: after the slider compresses the cartridge, the slider can compress the compliant label of the cartridge. This can cause the bottom of the cartridge to be pressed down against the surface of the heater unit present in the heater module. Springs present in the slider can deliver, for example approximately 50 lb of pressure to generate a minimum pressure, for example 2 psi over the entire cartridge bottom.

[0284] Thermal interface: the cartridge bottom can have a layer of mechanically compliant heat transfer laminate that can enable thermal contact between the microfluidic substrate and the microheater substrate of the heater module. A minimal pressure of 1 psi can be employed for reliable operation of the thermal valves, gate and pumps present in the microfluidic cartridge.

[0285] Mechanicals and assembly: the Analyzer can have a simple mechanical frame to hold the various modules in alignment. The optics module can be placed in rails for easy opening and placement of cartridges in the Analyzer and error-free alignment of the optics upon closing. The heater/sensor module can be also placed on rails or similar guiding members for easy removal and insertion of the assembly.

[0286] Slider: the slider of the Analyzer can house the optical detection system as well as the mechanical assembly that can enables the optics jig to press down on the cartridge when the handle of the slider is turned down onto the analyzer. The optics jig can be suspended from the case of the slider at 4 points. Upon closing the slider and turning the handle of the analyzer down, 4 cams can turn to push down a plate that presses on 4 springs. On compression, the springs can deliver approximately 50 lb on the optical block. See FIGS. **44**A-**44**C.

[0287] The bottom surface of the optics block can be made flat to within 100 microns, typically within 25 microns, and this flat surface can press upon the compliant (shore hardness approximately 50-70) label (approximately 1.5 mm thick under no compression) of the cartridge making the pressure more or less uniform over the cartridge. An optional lock-in mechanism can also be incorporated to prevent the slider from being accidentally knocked-off while in use.

[0288] FIG. **45**A shows a side view of a lever assembly **1200**, with lever **1210**, gear unit **1212**, and force member **1214**. Assembly **1200** can be used to close the lid of the apparatus and (through force members **1214**) apply force to a microfluidic cartridge **1216** in the receiving chamber **1217**. One force member is visible in this cut away view, but any number, for example 4, can be used. The force members can be, for example, a manual spring loaded actuator as shown, an automatic mechanical actuator, a material with sufficient mechanical compliance and stiffness (e.g., a hard elastomeric plug), and the like. The force applied to the microfluidic cartridge **1216** can result in a pressure at the surface of the microfluidic cartridge **1216** of at least about 0.7 psi to about 7 psi (between about 5 and about 50 kilopascals), or in some embodiments about 2 psi (about 14 kilopascals).

[0289] FIG. **45**B shows a side view of lever assembly **1200**, with microfluidic cartridge **1216** in the receiving chamber **1217**. A heat source **1219** (for example, a xenon bulb as shown) can function as a radiant heat source directed at a sample inlet reservoir **1218**, where the heat can lyse cells in reservoir **1218**. A thermally conductive, mechanically compliant layer **1222** can lie at an interface between microfluidic cartridge **1216** and thermal stage **1224**. Typically, microfluidic cartridge **1216** and thermal stage **1224** can be planar at their respective interface surfaces, e.g., planar within about 100 microns, or more typically within about 25 microns.