[0263] In the embodiment of FIG. **36**, the analyzer module is the driver for specific hardware. The analyzer module provides access to the Heater Mux Module, the Optical Detection Unit, the Control Board Power Monitor, the Real Time Clock, the High Voltage Power Supply, and the LCD backlight. The analyzer module provides firmware programming access to the Control Board power monitor, the Optical Detection Unit, and the Heater Mux Module.

[0264] The API provides uniform access to the analyzer module driver. The API is responsible for error trapping, and interrupt handling. The API is typically programmed to be thread safe.

[0265] The GUI software can be based on a commercial, off-the-shelf PEG graphics library. The GUI can use the API to coordinate the self-test of optical detection unit and heater assembly. The GUI starts, stops, and monitors test progress. The GUI can also implement an algorithm to arrive on diagnosis from fluorescence data. The GUI provides access control to unit and in some embodiments has an HIS/LIS interface.

[0266] The Control Board Power Monitor software monitors power supplies, current and voltage, and signals error in case of a fault.

[0267] The Optics Software performs fluorescence detection which is precisely timed to turn on/off of LED with synchronous digitization of the photodetector outputs. The Optics Software can also monitor power supply voltages. The Optics Software can also have self test ability.

[0268] The Heater Mux Module software implements a "protocol player" which executes series of defined "steps" where each "step" can turn on sets of heaters to implement a desired microfluidic action. The Heater Mux Module software also has self test ability. The Heater Mux Module software contains a fuzzy logic temperature control algorithm.

[0269] The Heater Mux Power Monitor software monitors voltage and current levels. The Heater Mux Power Monitor software can participate in self-test, synchronous, monitoring of the current levels while turning on different heaters.

EXAMPLES

[0270] The following are exemplary aspects of various parts and functions of the system described herein.

[0271] Additional embodiments of a cartridge are found in U.S. patent application Ser. No. ______, entitled "Microfluidic Cartridge and Method of Making Same", and filed on even date herewith, the specification of which is incorporated herein by reference.

[0272] Additional embodiments of heater units and arrays are described in U.S. patent application Ser. No. ______, entitled "Heater Unit for Microfluidic Diagnostic System" and filed on even date herewith, the specification of which is incorporated herein by reference in its entirety.

[0273] Further description of suitably configured detectors are described in U.S. patent application Ser. No. ______, filed on Nov. 14, 2007 and entitled "Fluorescence Detector for Microfluidic Diagnostic System", incorporated herein by reference.

Example 1

Analyzer Having Removable Heater Unit

[0274] This non-limiting example describes pictorially, various embodiments of an apparatus, showing incorporation of a heater unit and a microfluidic cartridge operated on by the heater unit.

[0275] FIG. **37** shows an apparatus **1100** that includes a housing having a display output **1102**, an openable lid **1104**, and a bar code reader **1106**. The cartridge is positioned in a single orientation in a receiving bay under the lid, FIG. **38**. The lid of the apparatus can be closed to apply pressure to the cartridge, as shown in FIG. **39**. The unit currently weighs about 20 lbs. and is approximately 10" wide by 16" deep by 13" high.

[0276] FIGS. **40** and **41**: The heating stage of the apparatus can be removable for cleaning, maintenance, or to replace a custom heating stage for a particular microfluidic cartridge. FIGS. **40** and **41** also show how a heater unit is insertable and removable from a front access door to an analyzer apparatus.

Example 2

Assembly of an exemplary Heater Unit

[0277] FIG. **42**A shows an exploded view of an exemplary heater unit. The unit has a top cover and a bottom cover that together enclose a Mux board (control board), a pressure support layer, and insulator film, and a microthermal circuit on a PCB. The last of these is the heat source that selectively heats regions of a microfluidic substrate placed in contact therewith through the top cover.

[0278] An exemplary heater substrate, FIG. **42**B, consists of a photo-lithographically processed glass wafer bonded to a standard 0.100" standard FR4 printed circuit board. The glass wafer is 0.5 mm thick and is cut into a rectangle the size of ~3.5×4.25 inches. The glass substrate has numerous metal heaters and resistive temperature sensors photo-lithographically etched on the surface of the glass wafer. The substrate is aligned and bonded to the PCBoard using a compliant epoxy, ensuring flatness to within 2-3 mils over the surface of the wafer. The cured epoxy should withstand up to 120° C. for two hours minimum. Approximately 300-400 bond pads of the size of approximately 1 mm×0.25 mm, with exposed gold surfaces, are located along the two long edges of the wafer. These pads are wirebonded (ball-bonding) to corresponding pads on the PCB using 1.5 mil gold wires. Wire bonding is a threading process, standard in semiconductor FAB. Alternatively, a flip-chip method may be used, though such methods are more complicated and may warp the wafer because of thermal mismatch. Wire bonds should have good integrity and pass defined pull strength. The substrate is baked at 120° C. for two hours and then the wire bonds are encapsulated by a compliant epoxy that will protect the wirebonds but not damage the bonds even at 120° C. Encapsulant should not spill over pre-defined area around the wirebonds and should not be taller than a defined height. For example, instead of laying epoxy all over the substrate, lines (e.g., a hash pattern) of it are made so that epoxy cures and air escapes through side. Alternatively, a laminate fill (adhesive on both sides) can be used. Standard connectors are soldered to the PCB and then the unit is tested using a test set-up to ensure all heaters and sensors read the right resistance values.

[0279] Pictures of an exemplary Mux board and assembled heater unit are shown in FIGS. **27-29**.

Example 3

Pulse Width Modulation for Heater Circuitry

[0280] In various embodiments, the operation of a PWM generator can also include a programmable start count in addition to the aforementioned end count and granularity. In