peripheral device **1980**. Peripheral device **1980** may be, for example, a USB-attached computer, printer, keyboard, mouse, barcode reader, or other device to aid with information input or output from the reader instrument. As desired, peripheral device **1980** may be configured to read bar codes, color codings, alphanumeric labeling, RFID tags, or any other suitable cartridge identification mechanism. In other embodiments, internally mounted barcode, RFID, or other readers are contemplated.

Example 3

Automatic Cartridge Identification with Internal Imaging System

[0124] As previously noted, accurate cartridge identification and tracking may be useful in certain applications. In one embodiment, the image sensor may also be used to identify the cartridge. This specification further minimizes the opportunity for human error, and eliminates the need for auxiliary bar code, RFID, or other expensive attached or separately mounted cartridge identification mechanisms. In an embodiment, instead of having a user scan a cartridge's optical encoding using a peripheral device, as discussed with respect to FIG. **19**, the reader instrument may automatically scan the optical encoding after insertion of the cartridge into the analysis slot. This process is schematically illustrated in FIG. **20**, which shows a cartridge **2020** containing information indicators **2023** adjacent to reaction sites **2021**, which are imaged by an imaging system **2012** having a field of view **2070**. Information indicators **2023** may be, for example, printed two-dimensional bar codes. Various other features of cartridge **2020**, such as an enclosure (e.g., cartridge **300** of FIG. **3**), are omitted from FIG. **20** for illustrative clarity. The reaction sites may be printed on the cartridge in the same field of view **2070** of imaging system **2012** as information indicators **2023**. To maximize the amount of printable information, field of view **2070** of imaging system **2012** may include edges of the cartridge and bar code printable portions of the cartridge surrounding reaction sites **2021**. In certain other embodiments, bar code or other information may be separately printed and attached to a cartridge.

[0125] An exemplary layout of features on a cartridge is shown in FIG. **21**. A cartridge **2120** (again, with various features omitted for illustrative clarity), includes a plurality of reaction sites **2121** with small information indicators **2123** and a large information indicator **2125**. Reaction sites **2121** and small information indicators **2123** are shown to be within a field of view **2170** of an imaging system (not shown), while large information indicator **2125** is outside of field of view **2170**. Consequently, small information indicators **2123** may be imaged and decoded by the same sensor within the imaging system that is used to perform the analyte detection, while large information indicator **2125** may be read separately by another sensor, a peripheral device, or by a user. Small and large information indicators **2123** and **2125**, respectively, may be printed bar codes. Large information indicator **2125** may be, for instance, a note handwritten by a user or an ID code or sticker.

[0126] In an embodiment, a prepared cartridge with identifying information may be inserted into the reader instrument for analysis. Before analysis occurs, the imaging system images optical encoding (bar code, coded dot patterns, OCR evaluated text, or other suitable information symbols) located on the underside of the cartridge. The read data is stored in a log file, and may optionally be automatically associated with additional calibration or tracking material, internally stored in the reader instrument or available by wired, wireless, or internet connection. The reader instrument proceeds to automatically analyze the sample and stores those results as well. After test completion, the reader instrument indicates to the user the test is complete and the cartridge is automatically ejected or ready to be manually removed. Advantageously, using this procedure and apparatus the pertinent information optically encoded in the cartridge is accurately read and stored every time a cartridge is analyzed without the need for an extra internal scanner or extra manual steps. Optionally, an LED (such as LED **1268** of FIGS. **14**, **16** and **17**) or some other type of light source that is internal to the reader instrument may be used to illuminate the barcode during imaging.

Example 4

Automatic Reaction Site Identification and Layout Recognition

[0127] FIGS. **22** and **23** illustrate site layout patterns for analyte detecting molecules immobilized onto a waveguide **2220**. Reaction sites may be printed onto a waveguide **2220**. For example, as shown in FIG. **22**, reaction sites **2221** may be printed in a rectangular layout. Alternatively, as shown in FIG. **23**, reaction sites **2323** may be printed in a staggered, diagonal layout. Other geometric layout configurations may be contemplated. In any layout, the reaction sites are located within a field of view **2270** of the imaging system within the reader instrument (not shown). When locating the reaction sites in a captured image, the reader instrument may use firmware-contained, cartridge-defined, or internet-downloaded information to correlate reaction site position and recognition. In certain embodiments, reader instrument algorithms may be programmed to identify a specific grid layout as one step toward determining reaction site identity. For example, a grid pattern **2280**, as indicated by dashed lines in FIG. **22**, or a slanted grid pattern **2382**, as indicated in FIG. **23**, may be used as a basis of a circle-finding algorithm to locate and analyze the plurality of reaction sites on waveguide **2220**. Reader instrument identification of grid patterns, such as grid patterns **2280** and **2382**, in accordance with print layout information extracted from the reading of the identification indicia, allows for compatibility with variety of reaction site patterns in the analyte detection process. In addition, in the event that grid layout or image view is skewed (e.g., due to rotation of cartridge or reaction site printing misalignment), the algorithm so implemented may compensate for the skewed image by determining the actual grid pattern and making a "best fit" match to identify the reaction sites.

Example 5

Reaction Site Pattern and Size Variations

[0128] FIGS. **24** and **25** illustrate alternative reaction site layout patterns for reaction sites immobilized onto a waveguide. FIG. **24** shows a large number of small reaction sites **2421** densely printed on a waveguide **2420** and within a field of view **2470** of an imaging system (not shown). FIG. **25** shows a plurality of small and large reaction sites **2523** and **2525**, respectively, printed on waveguide **2520** and within field of view **2570**. In certain embodiments, fifty or more reaction sites can be simultaneously imaged in a single field of view, with even more possible if bar code or other identi-