BIOLOGICAL ANALYSIS SYSTEM AND METHODS

FIELD OF THE DISCLOSURE

[0001] The present disclosure relates broadly, but not exclusively, to biological analysis systems and related methods, including polymerase chain reaction (PCR) systems.

BACKGROUND

[0002] Biological analysis systems, such as PCR systems, are useful tools for conducting diagnostics and research in biological or biochemical samples. A PCR system typically has a thermal cycler that heats and cools the samples over a number of cycles to achieve the desired amplification of one or more target molecules. Real-time PCR systems, also known as qualitative PCR (qPCR) systems allow monitoring of a PCR assay during each thermal cycle of the process.

[0003] Generally, there is an increasing need to simplify the installation and setup of biological analysis systems so that operators can more quickly and efficiently use biological analysis systems for their intended purpose. However, existing systems typically require manual operation or intervention which may result in inefficiency and inconsistency.

[0004] Thus, it is desirable to provide a biological analysis system that can address at least one of the above problems.

SUMMARY

[0004a] According to an aspect of the present disclosure, there is provided a biological analysis system comprising: a sample block configured to hold a biological sample and a base configured to hold the sample block, the sample block comprising a first connector, and the base comprising a second connector; a first driver configured to drive the second connector; a cover disposed to cover the sample block and a cover carrier configured to hold the cover, the cover comprising a third connector, and the cover carrier comprising a fourth connector; a second driver configured to drive the cover carrier and fourth connector; and

a controller communicatively coupled to the first driver and to the second driver, the controller configured to: align the cover and/or the sample block to the cover carrier using the second driver; engage the third connector with the fourth connector using the second driver; engage the first connector with the second connector using the first driver; and secure and/or lock the sample block to the base using the first driver.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Embodiments of the present disclosure will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

[0006] Figure 1 shows a block diagram that illustrates a PCR instrument upon which embodiments of the present teachings may be implemented.

CLAIMS

1. A biological analysis system comprising:

a sample block configured to hold a biological sample and a base configured to hold the sample block, the sample block comprising a first connector, and the base comprising a second connector;

a first driver ~~502 comprising a~~configured to drive the second connector;

a cover disposed to cover the sample block and a cover carrier configured to hold the cover, the cover comprising a third connector, and the cover carrier comprising a fourth connector;

a second driver ~~712 comprising a~~ configured to drive the cover carrier and fourth connector; and

a controller communicatively coupled to the first driver and to the second driver, the controller configured to:

align the cover and/or the sample block to the cover carrier using the second driver ~~712~~;

engage the third connector with the fourth connector using the second driver ~~712~~;

engage the first connector with the second connector using the first driver ~~502~~; and

secure and/or lock the sample block to the base using the first driver ~~502~~.

2. The system as claimed in claim 1, wherein the connectors are electrical connectors configured to provide electrical power and/or communication between the system and the sample block and between the system and the cover.

3. The system as claimed in claims 1 or 2, ~~further comprising:~~

wherein the cover carrier further comprises a third driver ~~810~~, the controller being communicatively coupled to the third driver; and

wherein the controller is configured to secure and/or lock cover to the cover carrier using the third driver.

4. The system as claimed in claim 3, wherein the controller is configured to:

disengage the cover from the cover carrier using the third driver ~~810~~; and

disengage the third electrical connector from the fourth electrical connector using the second driver ~~712~~ to separate the cover carrier from the cover.

5. The system as claimed in any one of claims 1-4, wherein the controller is configured to disengage the third electrical connector from the fourth electrical connector using the third driver ~~810~~ by moving a linkage from a first position to release the cover from the cover carrier to a second position to separate the third electrical connector from the fourth electrical connector.

~~6. A biological analysis system comprising:~~

~~a sample block configured to hold a biological sample and a base configured to hold the sample block, the sample block comprising a first connector;~~

~~a first driver comprising a second connector;~~

~~a controller communicatively coupled to the first driver, the controller configured to:~~

~~engage the first connector with the second connector using the first driver; and~~

~~secure and/or lock the sample block to the base using the first driver.~~

~~7. The system as claimed in claim 6, wherein the connectors are electrical connectors configured to provide electrical power and/or communication between the system and the sample block.~~

~~8. A biological analysis system comprising:~~

~~a sample block configured to hold a biological sample;~~

~~a cover disposed to cover the sample block and a cover carrier configured to hold the cover, the cover comprising a first connector;~~

~~a first driver 712 comprising a second connector;~~

~~a controller communicatively coupled to the first driver, the controller configured to:~~

align the cover and/or the sample block to the cover carrier using the first driver 712; and

engage the first connector with the second connector using the first driver 712.

9. The system as claimed in claim 8, wherein the connectors are electrical connectors configured to provide electrical power and/or communication between the system and the cover.

10. The system as claimed in claims 8 or 9, further comprising:

a second driver 810, the controller being communicatively coupled to the second driver;

wherein the controller is configured to secure and/or lock cover to the cover carrier using the second driver.

11. The system as claimed in claim 10, wherein the controller is configured to:

disengage the cover from the cover carrier using the second driver 810; and

disengage the first electrical connector from the second electrical connector using the first driver 712 to separate the cover carrier from the cover.

12. The system as claimed in claims 8-11, wherein the controller is configured to disengage the third electrical connector from the fourth electrical connector using the third driver 810 by moving a linkage from a first position to release the cover from the cover carrier to a second position to separate the third electrical connector from the fourth electrical connector

136. The system as claimed in any one of claims 1-125, wherein the cover is a heated cover.

14. A biological analysis system comprising:

a sample block and a base configured to hold the sample block;

a heated cover and a cover carrier configured to hold the heated cover;

a first drive mechanism configured to engage the sample block;

~~a second drive mechanism configured to engage the heated cover; and~~

~~a controller communicatively coupled to the first and second drive mechanisms,~~

~~wherein the controller is configured to, based on a first command, automatically operate the first drive mechanism to releasably engage the sample block with the base, and automatically operate the second drive mechanism to releasably engage the heated cover with the cover carrier.~~

~~15. The system as claimed in claim 14, wherein the controller is configured to, based on a second command, automatically operate the first drive mechanism to disengage the sample block from the base, and automatically operate the second drive mechanism to disengage the heated cover from the cover carrier.~~

~~16. The system as claimed in claim 14, further comprising a third drive mechanism and a fourth drive mechanism, and wherein, based on the first command, the third drive mechanism is configured to move the base and sample block to an open position and the fourth drive mechanism is configured to move the heated cover and cover carrier to a raised position.~~

~~17. The system as claimed in claim 15, wherein, based on the second command, a third drive mechanism is configured to move the base and sample block to an open position and a fourth drive mechanism is configured to move the heated cover and cover carrier to a lowered position.~~

~~18. The system as in claim 17, wherein the heated cover is disposed on top of the sample block between the closed and open positions.~~

~~19. The system as in claim 18, further comprising at least one sensor configured to determine a presence on the heated cover on top of the sample block.~~

~~20. The system as in claim 16, further comprising at least one first lock member connected to the sample block and at least one second lock member connected to the base, and wherein the first and second lock~~

members are configured to engage with each other when the sample block engages with the base to positionally secure the sample block.

21. The system as in claim 16, further comprising a plurality of alignment pins configured to align the cover carrier with the sample block in the closed position.

22. The system as in claim 14, further comprising an optics assembly and an extendable bellow, wherein the bellow is disposed between the optics assembly and the cover carrier.

23. The system as in claim 17, wherein:

the sample block comprises a top surface including a two-dimensional array of reaction regions defining a periphery at the top surface that surround the reaction regions, the periphery comprising a pair of opposing long edges having a first length and a pair of opposing short edges having a second length that is shorter than the first length;

the sample block comprises a pair of ejector members adjacent and substantially parallel to respective ones of the long edges;

the sample block is configured to receive a sample holder

the ejector members are configured to at least partially raise the sample holder relative to the sample block when the sample block is in the open position.

24. The system as in claim 23, further comprising an RFID reader configured to read a sample holder RFID tag attached to the sample holder.

25. The system as in claim 23, further comprising a detector configured to detect a presence of the sample holder on the sample block.

26. The system as in claim 23, further comprising a double lip seal attached to a lower surface of the heated cover, wherein, in use, the double lip seal is configured to contact the sample block and sealingly surround the sample holder.

27. The system as in claim 15, wherein the first command comprises an installation command to install the sample block and heated cover, and

~~the second command comprises a removal command to remove the sample block and heated cover.~~

~~28. The system as in claim 15, wherein the first or second command comprises one of a touch input, a keypad input, a voice command, or a gesture.~~

~~29. A method of installing a sample block and heated cover in a biological analysis system, the method comprising:~~

~~disposing a sample block and heated cover on a base;~~

~~positioning a cover carrier to engage the heated cover;~~

~~in response to a confirmation of a presence of the sample block and heated cover, automatically moving the cover carrier to engage heated cover.~~

~~30. The method as in claim 29, further comprising raising the cover carrier together with engaged the heated cover to separate heated cover from the sample block.~~

~~31. The method as in claim 29, wherein engaging the heated cover with the sample block comprises simultaneously aligning the heated cover with the sample block.~~

~~32. The method as in claim 29, wherein automatically engaging the heated cover with a cover carrier comprises moving the cover carrier toward the heated cover, and simultaneously aligning the cover carrier with the heated cover.~~

~~33. A method of removing a sample block and heated cover from a biological analysis system, the sample block supported by a base, the method comprising:~~

~~using a cover carrier, automatically lowering the heated cover onto the sample block while the sample block;~~

~~disengaging the heated cover from the cover carrier such that the heated cover is on top of the sample block; and~~

~~automatically moving the sample block together with the heated cover from a closed position to an open position; and~~

~~removing the sample block from the base of the block assembly.~~

~~34. The method as in claim 33, further comprising retrieving the sample block together with the heated cover in the open position.~~

~~35. The method as in claim 33, wherein automatically lowering the heated cover onto the sample block comprises aligning the heated cover with the sample block.~~

~~36. A biological analysis system comprising:~~

~~a housing;~~

~~a sample block disposed within the housing and configured to receive a sample holder comprising an sample holder RFID tag;~~

~~a first RFID antenna and a second RFID antenna, the RFID antennas configured during use to receive RFID data from the sample holder RFID tag;~~

~~at least one RFID reader configured to receive the RFID data from the first RFID antenna and configured to receive the RFID data from the second RFID antenna.~~

~~37. The biological analysis system as in claim 36, further comprising at least one RFID writer configured to write data on the sample holder RFID tag.~~

~~38. The biological analysis system as in any of claims 36-37, wherein the RFID antennas are spatially separated from the at least one RFID reader.~~

~~39. The biological analysis system as in claim 38, wherein the RFID antennas communicate with the at least one RFID reader via an electrical wire or electrical cable.~~

~~40. The biological analysis system as in any of claims 38-39, wherein the first RFID antenna is disposed proximal one side of the sample block and the second RFID antenna is disposed proximal a different side of the sample block.~~

~~41. The biological analysis system as in any of claims 38-40, wherein the first RFID antenna is disposed proximal one side of the sample block and the second RFID antenna is disposed proximal an opposite side of the sample block.~~

42. The biological analysis system as in any of claims 38-41, wherein the sample block has an uppermost surface, the at least one RFID reader is(are) disposed below the uppermost surface, and the RFID antennas are disposed above the uppermost surface.

43. The biological analysis system as in any of claims 36-42, wherein the system comprises the sample holder and the sample holder RFID tag.

44. The biological analysis system as in claim 43, wherein:

sample holder comprises a plurality of spatially separated reaction locations, each of the plurality of spatially separated reaction locations comprising a plurality of characteristics;

the sample holder RFID tag includes RFID data comprising data for the plurality of characteristics each of the reaction location;

wherein the RFID data comprises at least 8 kilobytes, at least 64 kilobytes, or at least 128 kilobytes.

45. The biological analysis system as in claim 44, wherein the plurality of spatially separated reaction locations comprises at least 96 reaction locations, at least 384 reaction locations, at least 1536 reaction locations, at least 3072 reaction locations, or at least 12,288 reaction locations.

46. The biological analysis system as in any of claims 43-45, wherein the RFID writer is configured to write assay information generated during an assay onto the sample holder RFID tag and, optionally, the system is configured to use the assay information to analyze data obtained during the assay.

47. The biological analysis system as in any of claims 43-46, wherein the plurality of characteristics comprises one or more of a:

sample holder ID;

sample holder expiration date;

sample holder part number;

sample holder barcode;

sample holder lot number;

sample holder type;

~~storage temperature and/or storage temperature range;~~

~~sample concentration – recommended range; provision for E1 pipette support?~~

~~sales order number;~~

~~assay name(s) and/or locations on sample holder;~~

~~assay IDs;~~

~~suggested protocol or required protocol;~~

~~sample name(s)~~

~~master mix name(s);~~

~~master mix change(s);~~

~~dye name(s);~~

~~suggested or required filter or set of filters to be used during an assay on the sample holder;~~

~~EDT file format and/or EDF file format;~~

~~internet links or addresses;~~

~~passive reference dye(s);~~

~~reaction volume(s);~~

~~target name(s);~~

~~dye name(s);~~

~~sample name(s);~~

~~analysis settings;~~

~~flag setting(s);~~

~~sample type(s);~~

~~target type(s);~~

~~run protocol(s) comprising one or more of a heated cover temperature, reaction volume(s), temperature step value(s), temperature stage value(s); or~~

~~well information for one or more wells, the information including one or more of target name, dye name, or sample name; reagent name.~~

~~48. The biological analysis system as in claim 47, wherein the plate type is characterized by a 48 wells, 96 wells, 384 well, 1536 well, 3072 well or through-holes~~

~~49. The biological analysis system as in any of claims 47-48, wherein the plate type is characterized by wells having a volume of 0.1 milliliters or 0.2 milliliters.~~

~~50. The biological analysis system as in any of claims 47-49, wherein the RFID data on the sample holder RFID include re-writeable data comprising one or more of a:~~

~~passive reference dye(s);~~

~~reaction volume(s);~~

~~target name(s);~~

~~dye name(s);~~

~~sample name(s);~~

~~analysis settings;~~

~~flag setting(s);~~

~~sample type(s);~~

~~target type(s);~~

~~run protocol(s) comprising one or more of a heated cover temperature, reaction volume(s), temperature step value(s), temperature stage value(s); or~~

~~well information for one or more wells, the information including one or more of target name, dye name, or sample name; reagent name.~~

~~51. The biological analysis system as in any of claims 36-50, further comprising a sensor disposed on or embedded in one or more of the sample holder RFID tag, the sample block, or a thermal block coupled to the sample block.~~

~~52. The biological analysis system as in claim 51, wherein the sensor is in communication with the sample holder RFID tag.~~

~~53. The biological analysis system as in any of claims 51-52, wherein the sensor comprises one or more of the thermal sensor, an accelerometer, a shock sensor, a photo sensor, a light detector.~~

~~54. The biological analysis system as in any of claims 51-53, wherein information from the sensor is written to the sample holder RFID tag at least one time over the life of the sample holder.~~

55. The biological analysis system as in any of claims 51-54, wherein the sensor is a temperature sensor, the sample holder is configured for use in a PCR assay, and the sample holder RFID tag is configured to record temperatures of the sample holder over one or more thermal cycles during the PCR assay.

56. The biological analysis system as in any of claims 36-55, wherein the at least one RFID reader comprises a first RFID reader configured to receive the RFID data from the first RFID antenna and a second RFID reader configured to receive the RFID data from the second RFID antenna.

57. The biological analysis system as in any of claims 36-56, wherein the system is configured such that during use, when the sample holder is received by the sample block, only one of the RFID antennas is able to receive the RFID data.

58. The biological analysis system as in any of claims 36-57, further comprising a processor and a memory coupled to the processor.

59. The biological analysis system as in claim 58, wherein the memory comprises instructions to:

verify whether at least one of the first RFID antenna or the second RFID antenna is(are) receiving RFID data or signal;

perform at least one of:

if no RFID data or signal is received by either the first RFID antenna or the second RFID antenna, generate (1) a signal indicative that the sample holder does not contain an RFID tag and/or (2) a signal indicative that no sample holder is present;

if RFID data is received by at least one of the RFID antennas, generate at least one of (1) a signal indicative that the sample holder contains a sample holder RFID tag and/or (2) a signal indicative of an orientation of the sample holder; and

if RFID data is received by both of the RFID antennas, generate (1) a signal indicative that the sample holder contains two

sample holder RFID tags and/or (2) a signal indicative that two sample holders with sample a holder RFID tag are present.

60. The biological analysis system as in claim 59, wherein the orientation of the sample holder is based on the strength of the data or signal from the RFID tag.

61. The biological analysis system as in any of claims 58-60, wherein the memory comprises instructions to:

receive from a user an initial user input comprising at least one of (1) an input to load or receive a sample holder into the system or (2) an input to initiate an assay;

read at least some of the RFID data;

based at least in part on the read RFID data, generate an assay protocol;

after receiving the initial user input, either (1) execute the assay protocol to perform an assay without any further input or intervention from the user until the assay is completed or (2) modify the assay protocol based on additional input and then execute the modified assay protocol to perform an assay without any further input or intervention from the user until the assay is completed.

62. The biological analysis system as in claim 61, further comprising a reagent container comprising a reagent container RFID tag, wherein the memory comprises instructions to read information from the reagent container RFID tag and, based at least in part on the information from the reagent container RFID tag, generate the assay protocol.

63. The biological analysis system as in any of claims 58-62, wherein the memory comprises instructions to:

prior to performing an assay, confirm or validate the assay protocol using an alternative data source and, if the alternative data source differs from RFID data, then perform at least one of modify the assay protocol, send an alert, or abort the assay protocol.

64. The biological analysis system as in any of claims 58-63, wherein the memory comprising one or more of instructions to:

write over at least a portion of the RFID data using the at least one RFID writer;

encrypt at least a portion of the RFID data using the at least one RFID writer;

erase at least a portion of the RFID data using the at least one RFID writer;

generate a signal indicating the completion of an assay or run;

modify data produced during or after completion of an assay; or

analyze data produced during or after completion of an assay.

65. A method for performing a biological analysis comprising:

providing a biological analysis system comprising:

a housing;

a sample block disposed within the housing and configured to receive a sample holder comprising an sample holder RFID tag;

a first RFID antenna configured during use to receive RFID data from the sample holder RFID tag; and

at least one RFID reader configured to receive the RFID data from the first RFID antenna;

placing a sample holder into or onto the biological analysis system;

receiving from a user an initial user input to initiate an assay;

reading at least some of the RFID data using the first RFID antenna;

generating instructions to perform an assay based at least in part on the read RFID data;

after receiving the initial user input, executing a set of steps to perform an assay on the sample holder without any further input or intervention from the user until the assay is completed or (2) receiving additional input and then executing a set of steps to perform an assay on the sample holder without any further input or intervention from the user until the assay is completed.

66. The method as in claim 65, further comprising:

providing a reagent container comprising a reagent container RFID tag;

reading information from the reagent container RFID tag; and

based at least in part on the information read from the reagent container RFID tag, generating the assay protocol.

67. A method for performing a biological analysis comprising:

providing a biological analysis system comprising:

a housing;

a sample block disposed within the housing;

a first RFID antenna;

a second RFID antenna; and

at least one RFID reader configured to receive the RFID data from the first RFID antenna and from the second RFID antenna;

placing a sample holder in or on the sample block, the sample holder possibly comprising a sample holder RFID tag;

verify whether at least one of the first RFID antenna or the second RFID antenna is(are) receiving RFID data or signal from the sample holder;

perform at least one of:

if no RFID data is received by either the first RFID antenna or the second RFID antenna, generating (1) a signal indicative that the sample holder does not contain an RFID tag and/or (2) a signal indicative that no sample holder is present;

if RFID data is received by at least one of the RFID antennas, generating at least one of (1) a signal indicative that the sample holder contains a sample holder RFID tag and/or (2) a signal indicative of an orientation of the sample holder; and

if RFID data is received by both of the RFID antennas, generating (1) a signal indicative that the sample holder contains two sample holder RFID tags and/or (2) a signal indicative that two sample holders with sample a holder RFID tag are present.

68. The method as in any of claims 65-67, further comprising:

receiving from a user an initial user input comprising at least one of (1) an input to load or receive a sample holder into the system or (2) an input to initiate an assay;

reading at least some of the RFID data;

based on the RFID data read, generating an assay protocol;

after receiving the initial user input, either (1) executing the assay protocol to perform an assay without any further input or intervention from the user until the assay is completed or (2) modifying the assay protocol based on additional input and then executing the modified assay protocol to perform an assay without any further input or intervention from the user until the assay is completed.

69. The method as in any of claims 65-68, further comprising:

prior to performing an assay, confirming or validating the assay protocol using an alternative data source and, if the alternative data source differs from RFID data, then performing at least one of modifying the assay protocol, sending an alert, or aborting the assay protocol.

70. The method as in any of claims 65-69, further comprising:

writing over at least a portion of the RFID data using the at least one RFID writer;

encrypting at least a portion of the RFID data using the at least one RFID writer;

erasing at least a portion of the RFID data using the at least one RFID writer;

generating a signal indicating the completion of an assay or run;

modifying data produced during or after completion of an assay; or

analyzing data produced during or after completion of an assay.

71. The method as in any of claims 65-70, writing information generated during a first assay on the sample holder RFID tag and optionally using the written information to analyze data obtained during the first assay.

72. The method as in any of claims 65-71, wherein the first assay is a PCR assay.

73. The method as in claim 72, wherein the sample holder comprises a temperature sensor, the method further comprises recording a

temperature of the sample holder over one or more thermal cycles of the PCR assay.

74. A biological analysis system comprising:

a housing;

a sample block disposed within the housing and configured to receive a sample holder comprising an sample holder RFID tag;

an RFID antenna configured during use to receive RFID data from the sample holder RFID tag;

an RFID reader configured to receive the RFID data from the first RFID antenna;

wherein the RFID antenna is spatially separated from the RFID reader.

75. The biological analysis system as in claim 74, wherein the RFID antennas communicate with the at least one RFID reader via an electrical wire or electrical cable.

76. The biological analysis system as in any of claims 74-75, wherein the first RFID antenna is disposed proximal one side of the sample block and the second RFID antenna is disposed proximal a different side of the sample block.

77. The biological analysis system as in any of claims 74-76, wherein the first RFID antenna is disposed proximal one side of the sample block and the second RFID antenna is disposed proximal an opposite side of the sample block.

78. The biological analysis system as in any of claims 74-76, wherein the sample block has an uppermost surface, the at least one RFID reader is(are) disposed below the uppermost surface, and the RFID antennas are disposed above the uppermost surface.

79. The biological analysis system as in any of claims 74-77, wherein the memory comprises instructions to:

verify whether the RFID antenna is receiving RFID data or signal;

perform at least one of:

if no RFID data or signal is received by the RFID antenna generate (1) a signal indicative that the sample holder does not contain an RFID tag and/or (2) a signal indicative that no sample holder is present;

if RFID data is received by the RFID antenna, generate at least one of (1) a signal indicative that the sample holder contains a sample holder RFID tag and/or (2) a signal indicative of an orientation of the sample holder; or

if RFID data is received by the RFID antenna, generate (1) a signal indicative that the sample holder contains two sample holder RFID tag or (2) a signal indicative that two sample holders with sample a holder RFID tag are present.

80. The biological analysis system as in claim 79, wherein the orientation of the sample holder is based on the strength of the data or signal from the RFID tag.

81. A sample holder for a biological analysis, comprising:

a holder comprising a plurality of spatially separated reaction locations, each of the plurality of spatially separated reaction locations comprising a plurality of characteristics;

an sample holder RFID tag disposed in or on the sample holder, the sample holder RFID tag including RFID data comprising data for the plurality of characteristics each of the reaction location;

wherein the RFID data comprises at least 8 kilobytes, at least 64 kilobytes, or at least 128 kilobytes.

82. The sample holder as in claim 81, wherein the plurality of spatially separated reaction locations comprises at least 96 reaction locations, at least 384 reaction locations, at least 1536 reaction locations, at least 3072 reaction locations, or at least 12,288 reaction locations.

83. The sample holder as in any of claims 81-82, wherein the RFID data on the sample holder RFID comprises one or more of:

sample holder ID;

sample holder expiration date;

~~sample holder part number;~~

~~sample holder barcode;~~

~~sample holder lot number;~~

~~sample holder type;~~

~~storage temperature and/or storage temperature range;~~

~~sample concentration – recommended range; provision for E1 pipette support?~~

~~sales order number;~~

~~assay name(s) and/or locations on sample holder;~~

~~assay IDs;~~

~~suggested protocol or required protocol;~~

~~sample name(s)~~

~~master mix name(s);~~

~~master mix change(s);~~

~~dye name(s);~~

~~suggested or required filter or set of filters to be used during an assay on the sample holder;~~

~~EDT file format and/or EDF file format;~~

~~internet links or addresses;~~

~~passive reference dye(s);~~

~~reaction volume(s);~~

~~target name(s);~~

~~dye name(s);~~

~~sample name(s);~~

~~analysis settings;~~

~~flag setting(s);~~

~~sample type(s);~~

~~target type(s);~~

~~reagent name;~~

~~run protocol(s) comprising one or more of a heated cover temperature, reaction volume(s), temperature step value(s), temperature stage value(s);~~

~~well information for one or more wells, the information including one or more of target name, dye name, or sample name.~~

84. The sample holder as in any of claims 83, wherein the plate type is characterized by a 48 wells, 96 wells, 384 well, 1536 well, 3072 well or through-holes

85. The sample holder as in any of claims 83-84, wherein the plate type is characterized by wells having a volume of 0.1 milliliters or 0.2 milliliters.

86. The sample holder as in any of claims 83-85, wherein the RFID data on the sample holder RFID include re-writeable data comprising one or more of:

passive reference dye(s);

reaction volume(s);

target name(s);

dye name(s);

sample name(s);

analysis settings;

flag setting(s);

sample type(s);

target type(s);

reagent name;

run protocol(s) comprising one or more of a heated cover temperature, reaction volume(s), temperature step value(s), temperature stage value(s);

well information for one or more wells, the information including one or more of target name, dye name, or sample name.

87. The sample holder as in any of claims 81-86, wherein the sample holder comprises a sensor.

88. The sample holder as in claim 87, wherein the sensor is in communication with the sample holder RFID tag.

89. The sample holder as in any of claims 87-88, wherein the sensor comprises one or more of the thermal sensor, an accelerometer, a shock sensor, a photo sensor, a light detector.

~~90. The sample holder as in any of claims 87-89, wherein information from the sensor is written to the sample holder RFID tag at least one time over the life of the sample holder.~~

~~91. The sample holder as in any of claims 87-90, wherein the sensor is a temperature sensor, the sample holder is configured for use in a PCR assay, and the sample holder RFID tag is configured to record temperatures of the sample holder over one or more thermal cycles during the PCR assay.~~

~~92. A biological analysis system comprising:~~

~~a housing;~~

~~a sample block disposed within the housing;~~

~~the sample holder of any of claims 81-91, the sample holder disposed in or on the sample block;~~

~~an RFID antenna configured during use to receive RFID data from the sample holder RFID tag;~~

~~an RFID reader configured to receive the RFID data from the first RFID antenna.~~

~~93. The biological analysis system as in claim 92, wherein an RFID writer is configured to write assay information generated during an assay onto the sample holder RFID tag and, optionally, the system is configured to use the assay information to analyze data obtained during the assay.~~

~~94. A biological analysis system comprising:~~

~~a housing;~~

~~a block assembly comprising a sample block and a base configured to receive the sample block;~~

~~a first drive mechanism configured to generate relative movement between the sample block and the housing along a first axis between a closed position to an open position;~~

~~a lock configured to lock the sample block to the base;~~

~~a processor and a memory coupled to the processor, the memory including instructions to:~~

based on a first command, operate the lock to provide a locked position in which the sample block is locked to the tray;

based on a second command, operate the lock to provide an unlocked position in which the sample block is not locked to the tray;

move the sample block and the base from a closed position to an open position with the lock in either the locked position or the unlocked position.

95. The biological analysis system as in claim 79, wherein at least one of the commands is provided by a user of the biological analysis system.

96. A method for biological analysis comprising:

providing a system comprising:

a sample block;

a base configured to receive the sample block;

a heated cover configured to be placed over the sample block;

a carrier configured to receive the heated cover;

a processor and a memory coupled to the processor, the memory including instructions to move the sample block and base between an open position and a closed position;

attaching the heated cover to the carrier;

separating the heated cover from the sample block by lifting the carrier;

using the drive mechanism, moving the sample block and the base from the closed position to the open position;

placing a sample plate in the sample block;

using the drive mechanism, moving the sample block from the open position to the closed position;

placing the heated cover onto the sample block by lowering the carrier.;

97. A method for biological analysis comprising:

providing a system comprising:

a sample block;

a base configured to receive the sample block;

a heated cover configured to be placed over the sample block;

a carrier configured to engage the heated cover using an engagement apparatus;

a processor and a memory coupled to the processor, the memory including instructions to move the sample block and base between an open position and a closed position;

detaching the carrier from the first heated cover; grab

separating the first heated cover from the carrier by lifting the carrier;

using the drive mechanism, moving the first sample block and the first heated cover from a closed position to an open position;

providing a second block configuration by replacing at least one of the first sample block with a second sample block or the first heated cover with a second heated cover.

98. The method as in claim 82, wherein the engagement apparatus comprises a one or more gripper arms disposed on opposite sides of the carrier.

99. The method as in any of claims 82-83, further comprising:

optionally placing a sample plate in the sample block;

using the drive mechanism, moving the sample block from the open position to the closed position;

lowering the carrier;

locking the carrier to the heated cover using the gripper arms;

performing a qPCR assay;

retracting the heated cover from the sample block by lifting the carrier.

100. A biological analysis instrument comprising:

a proximity sensor configured determine the presence or distance of a perspective user of the instrument;

an activation and/or recognition system comprising at least one of a voice activation and/or recognition system or a face activation and/or recognition system;

a processor and a memory coupled to the processor, the memory including instructions to:

query the activation and/or recognition system to produce a first output;

determine whether the first output meets one or more first predetermined criteria;

query the proximity sensor to produce a second output;

determine whether the second output meets one or more second predetermined criteria;

start, power up, or activate the instrument if both (1) the first output meets the one or more first predetermined criteria and (2) the second output meets one or more second predetermined criteria.

101. A method of starting, powering up, or activating biological analysis instrument comprising:

querying an activation and/or recognition system to produce a first output, the activation and/or recognition system comprising one or more of a voice activation and/or recognition system or a face activation and/or recognition system;

determining whether the first output meets one or more first predetermined criteria;

querying a proximity sensor to produce a second output;

determining whether the second output meets one or more second predetermined criteria;

starting, powering up, or activating the instrument if both (1) the first output meets the one or more first predetermined criteria and (2) the second output meets one or more second predetermined criteria.

102. A method of starting, powering up, or activating biological analysis instrument comprising:

querying an activation and/or recognition system to produce a first output, the activation and/or recognition system comprising one or more of a voice activation and/or recognition system or a face activation and/or recognition system;

~~determining whether the first output meets one or more first predetermined criteria;~~

~~querying a proximity sensor to produce a second output;~~

~~determining whether the second output meets one or more second predetermined criteria;~~

~~starting, powering up, or activating the instrument if both (1) the first output meets the one or more first predetermined criteria and (2) the second output meets one or more second predetermined criteria.~~