Rheonix COVID-19™ MDx Assay

℞ ONLY

For *in vitro* diagnostic use
Catalog Number KCCOV19-24

For use only with the Rheonix Encompass MDx® Workstation

For Use Under an Emergency Use Authorization (EUA) Only

Instructions for Use

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M26991 Rev F 04/29/2020

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Product Name

Rheonix COVID-19™ MDx Assay

Intended Use

The Rheonix COVID-19™ MDx Assay is an endpoint RT-PCR assay intended for the qualitative detection of nucleic acid from SARS-CoV-2 in nasopharyngeal swabs, oropharyngeal (throat) swabs, anterior nasal swabs, mid-turbinate nasal swabs, nasal washes, nasal aspirates and bronchoalveolar lavage (BAL) fluid from individuals who are suspected of COVID-19 by their healthcare provider. Testing is limited to ***laboratories certified under the Clinical Laboratory Improvement Amendments of 1988 (CLIA), 42 U.S.C. §263a, to perform high complexity tests.***

Results are for the identification of SARS-CoV-2 RNA. The SARS-CoV-2 RNA is generally detectable in respiratory specimens during the acute phase of infection. Positive results are indicative of the presence of SARS-CoV-2 RNA; clinical correlation with patient history and other diagnostic information is necessary to determine patient infection status. The agent detected may not be the definite cause of disease. Positive results do not rule out bacterial infection or co-infection with other viruses. Laboratories within the United States and its territories are required to report all positive results to the appropriate public health authorities.

Negative results do not preclude SARS-CoV-2 infection and should not be used as the sole basis for patient management decisions. Negative results must be combined with clinical observations, patient history, and epidemiological information.

The Rheonix COVID-19 MDx Assay is intended for use by ***qualified clinical laboratory personnel specifically instructed and trained in the techniques of PCR and in vitro diagnostic procedures***. The Rheonix COVID-19 MDx Assay is only for use under the Food and Drug Administration's Emergency Use Authorization.

Summary and Explanation

Information below derived from the US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) websites.

https://www.cdc.gov/coronavirus/2019-ncov/index.html

https://www.who.int/health-topics/coronavirus#tab=tab_1

Coronaviruses are a group of viruses found in humans and other mammals. They are enveloped, single-stranded, positive sense RNA viruses. The novel 2019 coronavirus, now

referred to as SARS-CoV-2 is a beta coronavirus similar to MERS-CoV and SARS-CoV and causes respiratory illness referred to as COVID-19 disease. Symptoms include fever, cough and shortness of breath and may appear 2-14 days after exposure. The majority of people will exhibit mild or moderate respiratory symptoms and will recover without specific treatment. Some patients have presented with acute respiratory infection symptoms during the early stage of disease and it has been identified that individuals with underlying health conditions including diabetes, cardiovascular disease, chronic respiratory disease and cancer are more likely to progress to serious disease.

As cases began spreading around the world, on January 30, 2020, the World Health Organization (WHO) declared the outbreak a public health emergency of international concern. On January 31, 2020 the US Health and Human Services Department declared a public health emergency for the United States. Finally, on March 11, 2020, the WHO declared SARS-CoV-2 a global pandemic.

Principles of the Procedure

The Rheonix COVID-19 MDx Assay is an *in vitro* diagnostic test capable of detecting the presence of SARS-CoV-2 RNA in nasopharyngeal swabs, oropharyngeal (throat) swabs, anterior nasal swabs, mid-turbinate nasal swabs, nasal washes, nasal aspirates and bronchoalveolar lavage (BAL) fluid samples. The assay uses proprietary Rheonix CARD® cartridge technology that provides a microfluidic network complete with pumps, valves, and reaction chambers for automated assay performance. Each CARD cartridge provides assay chambers for four separate clinical specimens or control samples. The Rheonix Encompass MDx Workstation can simultaneously process 6 CARD cartridges, for a total of up to 24 samples (22 specimens and 2 external controls), per test run. All residual liquids are contained within the device and discarded with the Rheonix COVID-19 MDx Assay consumables, thus optimizing work flow and minimizing cross contamination.

After clinical specimens are obtained using nasopharyngeal swabs, oropharyngeal (throat) swabs, anterior nasal swabs, mid-turbinate nasal swabs, nasal washes and nasal aspirates samples, they are transferred into sample tubes containing Rheonix 4X Sample Buffer where cell lysis begins. Once loaded into the CARD cartridge, additional cell lysis and RNA purification steps automatically take place. To detect SARS-CoV-2 RNA PCR amplification of nucleic acid sequences corresponding to one target site called N1 of the nucleocapsid protein gene sequence is completed. In all cases, the target gene is amplified in the presence of biotin-tagged primers and the resulting amplicons denatured and flowed over the low-density array of capture probes contained within the CARD cartridge. Following incubation with streptavidin conjugated horseradish peroxidase and substrate, color precipitated spots are detected and

analyzed via the onboard image capture system and results provided by the workstation's software for the target microorganism (Figure 1 and Table 1).

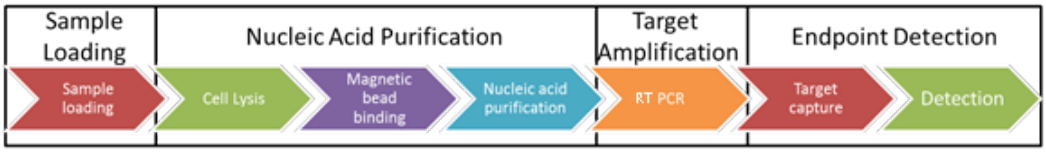


Figure 1. Flowchart for Rheonix COVID-19 MDx Assay. All steps, performed automatically on the Encompass MDx workstation are shown.

Table 1. Overview of results and the corresponding symbols generated by Workstation software

Symbol on run report	Symbol meaning
+	Positive (POS) result with the COVID-19 MDx assay
-	Negative (NEG) result with the COVID-19 MDx assay
!	Error (ERR)
?	Indeterminate (IND)

Materials Provided/Assay Kit Components

The following packaged consumables are supplied in the Rheonix COVID-19 MDx Assay Kit to run up to 24 samples total (22 specimens and 2 external controls) in a single batch. Kit components are stored at room temperature (15 °C to 30 °C) and -20 °C as directed on the packaging.

- 2 COVID-19 CARD Packs of 3 cartridges each
- 1 COVID-19 Reagent Pack (Pack A) (15 °C to 30 °C)
- 1 COVID-19 PCR Mix (Pack B) (-20 °C)
- 1 4X Sample Buffer
- 24 Sample tubes
- 24 Sample tube caps
- 24 Barcode labels for Sample tubes
- 1 Package Insert

COVID-19 CARD Pack

Each COVID-19 CARD Pack consists of three CARD cartridges in a Tyvek®-sealed plastic tray (Figure 2). Each assay kit contains two CARD Packs.

Figure 2. The Rheonix COVID-19 MDx Assay cartridge Pack. Left: Pack of three CARDs with pack cover in place. Right: Pack of three CARDS with pack cover removed.

COVID-19 Reagent Pack (Pack A)

The COVID-19 Reagent Pack (Pack A) contains six sealed reagent tube strips (Figure 3). The COVID-19 Reagent Pack is sealed with a Tyvek cover. See Table 2 for a detailed description of the contents of the Reagent Pack.

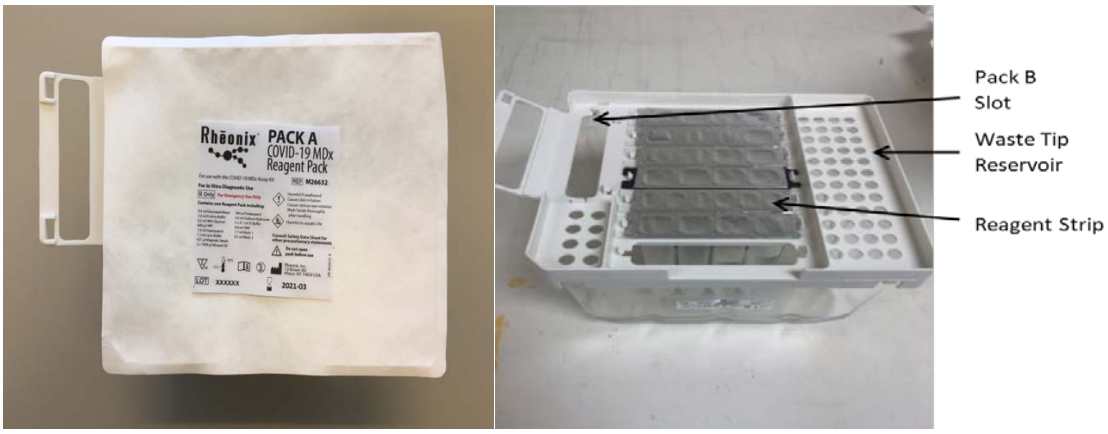


Figure 3. Rheonix COVID-19 MDx Assay Pack A. Left: Pack A after being removed from assay kit box and with its Tyvek lid in place. Right: Pack A with the lid removed and various aspects of the pack called out on the right.

Table 2. Contents of Rheonix COVID-19 MDx Reagent Pack A. The contents (number and volume, where appropriate) are shown.

Reagent	Amount	Unit of Measure	Quantity
Deionized Water	9.4	mL	1
Elution Buffer	3.0	mL	1
96% Glycerol	6.5	mL	1
HRP	600	µL	1
Isopropanol	7.6	mL	1
Lysis Buffer	7.2	mL	1
Magnetic Beads	421	µL	1
Mineral Oil	1000	µL	2
Proteinase K	300	µL	1
Sodium Hydroxide	4.0	mL	1
SS Buffer	9.1	mL	5
TMB	4.8	mL	1
Wash 1	7.7	mL	1
Wash 2	9.5	mL	1

The Reagent Pack also contains an empty strip slot running perpendicular to the other six tube strip slots for securing the COVID-19 PCR Mix strip (Pack B) into the Reagent Pack via a hinged latch. Each Reagent Pack can perform testing for up to 24 samples. Store the COVID-19 Reagent Pack B in an upright position.

COVID-19 PCR Mix (Pack B)

Each COVID-19 PCR Mix (Pack B) is supplied in a resealable UV bag. The PCR Mix tube strip contains the PCR Mix (used to amplify SARS-CoV-2 cDNA and controls) (Figure 4).

Figure 4. **Rheonix COVID-19 MDx Assay PCR Mix, Pack B.** Pack B ready for insertion into Pack A, at its designated location, see Figure 3. (Left: Bubble pouch, showing outer packaging, Right: Resealable UV bag containing Pack B)

The plastic tabs at either end of the COVID-19 PCR Mix strip are keyed to ensure correct insertion and orientation into COVID-19 Reagent Pack A.

The PCR Mix strip is sufficient to analyze up to 24 samples.

Materials Required/Recommended, but not Included

The following items are not provided, but required/recommended:

a) Rheonix Encompass MDx® Workstation (Rheonix Catalog Number RNXMDX)
   i. The software version used in the validation study consisted of:

      User Interface: 1.0.0.76

      EncompassCore: 1.6.0.1

      SGB FW: 1.2.5

      MCB FW: 1.0.4

      HB FW: 1.2.3

      RTSB FW: 2.0.1

      Camera Job: Cov1.1.2

      COVID-19 MDx Assay: X3

b) External controls:
   i. Positive Controls that can be used with the Rheonix COVID-19 MDx Assay:

- Commercially available, inactivated SARS-CoV-2 (Catalog Number 0810587CFHI-0.5 mL) at 5X LoD (i.e., 3125 genomic equivalents/mL) from ZeptoMetrix, Buffalo, NY (www.zeptometrix.com, Phone number 1-800-274-5487).
- Other commercially available positive controls can be used provided they are spiked at 3125 genomic equivalents/mL and validated by the laboratory.
- For the purposes of diluting controls, use the Certificate of Analysis provided by the vendor to determine appropriate dilution.

ii. Negative Controls that can be used with the Rheonix COVID-19 MDx Assay:

- Commercially available control from IDT (www.idt.com, phone number 1-800-328-2661): Hs_RPP30 Positive Control (IDT Catalog Number 10006626).

c) Disposable gloves
d) Lab coat
e) Safety glasses
f) Sodium hypochlorite
g) Lint Free wipes (for cleaning of instrument)
h) Spill kit to safely clean up spills of potentially hazardous materials
i) Axygen 1000 µL tips (Axygen/TTF-1000-C-HTR-S; VWR/89040-092)

Warnings and Precautions

- The Rheonix COVID-19 MDx Assay is intended for Emergency Use Only.
- Caution: Federal Law restricts this device to sale by or on the order of a licensed practitioner
- The Rheonix COVID-19 MDx Assay is for *in vitro* Diagnostic Use and must be performed using the Rheonix Encompass MDx workstation within the appropriate operating conditions (Table 3).

Table 3. Rheonix Encompass MDx Workstation Operating Conditions

ENVIRONMENTAL CONDITIONS – OPERATION	
Temperature	18 °C-30 °C / 64 °F-86 °F
Humidity	20 to 85% non-condensing
Altitude	1600 m maximum

- The Rheonix COVID-19 MDx Reagent Pack contains guanidine hydrochloride, a chaotropic agent that is widely used for purification of nucleic acids. In case of skin contact with these reagents, remove contaminated clothing and wash the affected area

with soap and water. In case of eye contact, flush eyes thoroughly with water for at least 15 minutes. Consult a physician.

- Do not use expired kits.
- Do not use the kit if the seal to the outer box is broken upon arrival.
- Do not use any kit components that display damage or broken seals.
- Do not mix reagents from one kit with reagents from another kit.
- The laboratory should perform routine environmental monitoring to minimize the risk of cross contamination.
- All specimens should be handled by operators as if they are infectious and in accordance with safe laboratory procedures.
- Operators should wear protective clothing and disposable gloves. The Rheonix Encompass MDx workstation's User Interface (UI) provides instructions on when to change disposable gloves during the testing procedure. Strict adherence to the instructions is required to protect the operator and reduce possible erroneous results.
- Thoroughly wash hands after performing the tests.
- There is no need to pipette any reagents.
- Do not eat, drink, smoke, chew in areas where specimens or kits are being used.
- Dispose of all consumable test components and waste in accordance with local, state and/or federal regulations.

Sample Collection

The specimens tested with the Rheonix COVID-19 MDx Assay must be run using the Rheonix sample tubes, or equivalent and the Rheonix 4X Sample Buffer (Rheonix Catalog Number M26365) provided with the kit as follows:

- Collect respiratory specimens according to standard collection technique.
- Prior to transferring the sample to the Rheonix sample tube, add 330 µL of Rheonix 4X Sample Buffer for samples containing 1 mL (in this case the final volume of the combined sample and Rheonix 4X Sample Buffer must be at least 1.3 mL) or add 1 mL of Rheonix 4X Sample Buffer for samples containing 3 mL.
- The final concentration of Rheonix Sample Buffer must be 1X for each sample.
- Note: If sample is collected in a buffer already containing guanidine, there is no need to add the Rheonix 4X Sample Buffer.
- Assure that the final volume is a minimum of 1.3 mL to allow for repeat analysis if required.
- Cap each tube tightly prior to placing into the Specimen Rack which is subsequently placed into its location in the Rheonix Encompass MDx Workstation.

Sample Transport and Storage

- Transportation of collected specimens must comply with all applicable regulations for the transport of etiological agents.
- Respiratory specimens:
    - Following collection and transfer of the respiratory specimen into the sample tube, testing should be completed as soon as possible for best results.
    - If immediate testing is not possible samples can be stored at 2 °C – 8 °C for up to 48 hr.

      If testing is not performed as outlined above, a new patient sample should be obtained. Note: Recommended storage conditions are based on best practice guidelines for storage of specimens in viral transport media and do not reflect the results of studies conducted using the Rheonix assay. Sample stability when using Rheonix COVID-19 MDx Assay has not been established for suggested temperatures and time.
- Sample Reruns

  a) In the event a sample needs to be reanalyzed, the test should be repeated as soon as possible. Sample should be stored at 2 °C – 8 °C.

  Note: Recommended storage conditions are based on best practice guidelines for storage of specimens in viral transport media and do not reflect the results of studies conducted using the Rheonix assay. Sample stability when using Rheonix COVID-19 MDx Assay has not been established for suggested temperatures and time for sample reruns.

Instructions for Use

- **Caution:** In order to reduce the chance for contamination, do not open assay consumables (CARD Pack, Reagent Pack A and Reagent Pack B) until prompted by the UI.
- The assay must be run on the Rheonix Encompass MDx workstation.
- Assay run time is less than 5 hours.
- Gloves and other appropriate personal protective equipment should be worn at all times during preparation and running of the assay. The touch screen can be manipulated while wearing gloves.
- **Positive test results must be reported in accordance with local, state, and federal regulations.**

The following instructions provide the primary steps for conducting the COVID-19 Assay on the Encompass MDx workstation. For detailed information on Encompass MDx workstation operation, refer to *Encompass MDx Workstation Operator Manual.*

Assay Steps

1. Ensure the Encompass MDx workstation has been cleaned according to the instructions provided in the *Encompass MDx Workstation Operator Manual*.
2. Start the UI Software by powering on the Encompass MDx workstation. The power on switch is located in the rear, lower left corner of the workstation.
3. Log in when prompted by the workstation.
4. To begin a new run, select "New Run" from the home screen.
5. Load 22 samples plus 1 positive and 1 negative external control into a cleaned Encompass MDx Sample Rack. Consult the Operator Manual for rack cleaning instructions.
   a) Control samples can be loaded in any position in the sample rack.
6. Ensure that the sample tubes are inserted into the rack such that the barcodes are centered in the open side of the rack and visible to the operator.
7. Place the sample rack containing the test samples into the workstation deck as instructed by the UI. Push down gently.
   a) **Do not force the rack into the workstation deck.** If met with resistance upon loading, the sample rack may be in the incorrect orientation.
8. Select "Confirm".
9. After pressing "Confirm," follow the UI prompts and load CARD cartridges.
   Caution: Before proceeding to load remaining consumables, change your gloves.
10. Remove CARD Packs from the kit using the touch points as shown in Figure 5.
    Caution: Do not touch the array covers on the CARD cartridges.

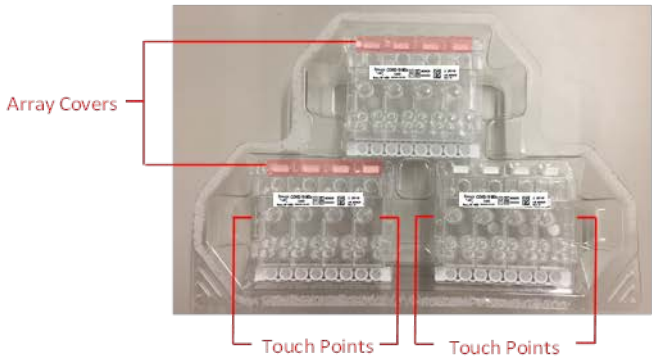


Figure 5. COVID-19 CARD Touch Points and Array Covers. Handle the CARD cartridges at the highlighted touch points and do not touch the Array Covers (highlighted in red).

11. Load CARD cartridges with the PCR tube strip facing operator and close clamps.

a) A test run requires 6 CARD cartridges to be loaded, for a total of up to 24 samples, per test run.

12. **Mix the reagent Pack.** Prior to removing the Tyvek® lid from Reagent Pack A, grasp the pack and use your gloved hands to invert the entire pack three times to mix.
13. Remove the lid from COVID-19 Reagent Pack (Pack A).

    Caution: Do not use if any foil sealant is compromised or the reagent strips are not secured in place upon opening.

    Caution: Do not remove reagent strips from the reagent pack or touch the foil sealant covering the reagent strips.

    Caution: Do not use Reagent Packs leftover from a previous run.
14. Remove COVID-19 PCR Mix (Pack B) from its resealable UV bag. Record the lot number in the log book (provided with the instrument).
15. Insert Reagent Pack B into Reagent Pack A by securing with plastic tab on Reagent Pack A.
16. Load the fully assembled Reagent Pack (now consisting of Reagent Pack A and Reagent Pack B) onto the workstation deck.
17. Place the two tip tubs onto the workstation deck as indicated by the UI.

    Caution: Ensure that at least one of the tip boxes contains a full rack of 96 Axygen tips before continuing.
18. When prompted, manually close the workstation door to initiate the Pre-Run Checks.
19. Touch “Next” on the “Pre-Run Checks Successful” screen and then touch “Start” on the “Run Monitor” screen to start the assay.
20. When the test is complete, the UI displays the “Test Complete” screen:
    a) To review the results in greater detail, touch the “Review” button.
    b) A color code indicates the individual results, with green indicating a negative result, red indicating a positive result, blue indicating an indeterminate result, and yellow indicating an error has occurred during the test procedure.
21. Test results can either be printed or sent to a USB.

    Note: All data are saved on the Encompass MDx Workstation unless removed by an administrator.
22. Once finished with the results, unload the deck by removing all samples and used consumables. Dispose of the consumables into properly-labeled biohazard trash receptacles; process trash in accordance with all institutional practices and local, state, and federal regulations.

Quality Controls

The Rheonix COVID-19 Assay includes one internal control. In addition, a laboratory must also run external controls. External controls are not provided by Rheonix.

- Reference Spots (RS) – Three reference spots are included on each microarray. The locations of these spots permit the camera to properly align itself during image analysis. In addition, the Rheonix Encompass MDx Workstation uses information from the image analysis to confirm that all necessary detection reagents performed properly during the performance of the assay.

- Internal Control – Detection of human RNase P acts as an internal control for each sample. Each sample is tested in the presence of RNase P (RP) specific primers, which are part of the PCR master mix. The presence or absence of the control will be confirmed via detection by amplification and specific probe capture on the microarray. The internal control will control for three important aspects of the assay: (1) specimen integrity, (2) properly performed processing, including extraction, and (3) PCR. The Rheonix Encompass MDx workstation's software requires that the internal control yield a positive result in order for a test specimen to be scored as negative for the target being analyzed. Due to the potential for competition from the authentic target present in the specimen, the internal control result may be positive or negative, since high concentrations of target in the clinical specimens may compete with the control and yield a negative internal control result. The internal control passes if it meets the acceptance criteria in the software algorithm.

- External Control – External positive and negative controls must be included with every COVID-19 MDx Assay run.

  a) A positive template control is needed to assure that all assay steps perform properly. This must consist of 3125 genomic equivalents/mL. At least one Positive Control should be analyzed per run. The Positive Control should yield a positive result for the N1 target. Zeptometrix inactivated SARS-CoV-2 virus should be spiked at 3125 genomic equivalents/mL in negative NP swab matrix. Refer to the Certificate of Analysis provided with the inactivated virus to determine the concentration of the stock.
  b) A "no viral template" (negative) control is needed to assure that truly negative samples are correctly scored as "Negative" for the presence of SARS-CoV-2 RNA. At least one negative control should be included in each run of the workstation. Negative Control should yield a negative result for the N1 target and a positive result for RP.
     i. Since the Hs_RPP30 Positive Control (IDT) is supplied at 200,000 copies/µl, we recommend that 1 µl be diluted in 2.0 mL (i.e., 100,000 copies/mL). Collection media should be mixed 3:1 with the Rheonix 4X Sample Buffer as the matrix.

Meaning of Error or Indeterminate Codes

An ERROR result will be displayed by the Encompass MDx Workstation if any of the following occurred during the performance of the assay:

- The RS detection failed.
- The assay was aborted due to workstation or consumable failure.
- Insufficient data were collected.

An INDETERMINATE result will be displayed if any of the following occurred during the performance of the assay:

- Both N1 target and internal control (RNAse P) are negative.
- An error in the intensity or quality of one or more spots on the integrated DNA array is determined by the algorithm.

Results/Test Interpretation

First, the validity of the assay should be established by the user, based on the performance of the external controls and the guidelines established in Table 4. Once the validity of the assay has been established, the valid (positive and/or negative) patient results may be reported, according to Table 5.

Positive test results must be reported in accordance with local, state, and federal regulations.

Rheonix COVID-19 MDx Assay Controls – External (Positive and Negative) and Internal and Reference Spot Controls.

Signal intensity values have been established that delineate the upper and lower thresholds used by the workstation's software to determine the presence or absence of SARS-CoV-2 viral sequences defined by the N1 targets. Using the positive and negative controls as described in the *Quality Controls* section valid results are noted below:

- Positive Control – the signal intensity of the positive control sample must be greater than 25.00 intensity units for N1.
- Negative Control – the signal intensity of the negative control sample must be less than 25.00 intensity units for N1 target and greater than 25.00 intensity units for RNase P.
- Array Control – the signal intensity of all three reference spots must be greater than the predetermined level to assure that the colorimetric portion of the assay performed as expected. In addition, the specific location of the hybridization spots resulting from the Reference Spot Controls also assures

that the DNA microarrays have been properly inserted during manufacturing.

Examination and Interpretation of Patient Specimen Results

Assessment of clinical specimen test results should be performed after the positive and negative controls have been examined and sample validity established following the criteria in Table 4. The user does not interpret any numerical test values since the workstation's software automatically acquires the signal intensity of the various hybridization spots on the integrated DNA array and interprets the results based upon the software's predetermined algorithm.

The possible results obtained by the Rheonix COVID-19 MDx are as provided in Table 5. Valid Positive or Negative results should be acted upon according to current medical practice regarding suspected COVID-19 infections. Specimens with indeterminate (IND) results and system errors (ERR) should be retested with the Rheonix COVID-19 MDx Assay using the original specimen, if available. If not available, a new specimen sample should be obtained. Possible error codes that will result in invalid results are shown in Table 6.

Table 4. Validity of patient test results from the Rheonix COVID-19 MDx Assay based on interpretation of External Controls

Patient Test Result [1]	Control Result			
	Positive: Pass	**Positive: Fail**	**Positive: Pass**	**Positive: Fail**
	Negative: Pass	**Negative: Pass**	**Negative: Fail**	**Negative: Fail**
POS	Valid	Valid	Invalid	Invalid
NEG	Valid	Invalid	Valid	Invalid

[1] *Result displayed by the Encompass MDx Workstation*

Table 5. Interpretation of patient and External Control results from the Rheonix COVID-19 MDx Assay

Result Reported [1]	Interpretation [2]	External Control	
		Positive	Negative
POS	Positive for SARS-CoV-2 RNA; report result	Pass or Fail	Pass
NEG	Negative for SARS-CoV-2 RNA; report result	Pass	Pass or Fail
IND	Indeterminate: no detectable signal for the N1 or RNase P targets; retest required	Pass or Fail[3]	Pass or Fail[3]
ERR	Error: system error; retest required	Pass or Fail[3]	Pass or Fail[3]

[1] *Result displayed by the Encompass MDx Workstation*

[2] *The validity of patient test result must be determined manually after review of the results obtained with the External Controls according to the algorithm shown in* ***Table 4****.*

[3] *Regardless of the results obtained for the External Controls, if the Workstation reports either an IND or ERR code, the specimens must be retested.*

Table 6. Description of possible error codes

Code	Cause
E01	Reference spots on filter invalid
E02	Bubble check on filter failed
E03	Spacing check on filter failed
E04	Angle check on filter failed
E05	Quality checks on filter failed
N02	Indeterminate: standard deviation for target spots is above threshold
N03	Indeterminate: No target spots and no internal control spots
N04	Indeterminate: The intensity of one or more target spots is indeterminate

Limitations

- The Rheonix COVID-19 MDx Assay may only be performed using the Rheonix Encompass MDx workstation using clinical specimens that have been collected as per testing lab procedures or following vendor instructions.
- The performance of the Rheonix COVID-19 MDx Assay was established using contrived nasopharyngeal swab specimens. Anterior nasal swabs, mid-turbinate nasal swabs, nasal washes, nasal aspirates and bronchoalveolar lavage (BAL) fluid are also considered acceptable specimen types for use with the Rheonix COVID-19 MDx Assay. Testing of nasal and mid-turbinate nasal swabs (self-collected or collected by a healthcare

provider) is limited to patients with symptoms of COVID-19. Please refer to FDA's FAQs on Diagnostic Testing for SARS-CoV-2 for additional information.

- Validation studies were performed using BD Universal Viral Transport media (www.bd.com, phone number 201-847-6800) and UTM (Copan Universal Transport Medium, www.copanusa.com, phone number: (800)-216-4016). Compatibility with other specimen collection media and/or transport media has not been evaluated. Please contact Rheonix technical support with questions. Use of this assay is limited to personnel who have been trained in the procedure. Failure to follow the instructions provided in this package insert may cause erroneous results.
- Reliable results are dependent on adequate specimen collection. Because the collection and transport system does not allow for microscopic assessment of specimen adequacy, training of clinicians in proper specimen collection techniques is necessary. Please refer to the *Sample Collection* guidelines for more information.
- Careful compliance with the instructions in this package insert is necessary to avoid erroneous results.

Conditions of Authorization for the Laboratory

The Rheonix COVID-19 MDx Assay Letter of Authorization, along with the authorized Fact Sheet for Healthcare Providers, the authorized Fact Sheet for Patients and authorized labeling are available on the FDA website: https://www.fda.gov/emergency-preparedness-and-response/mcm-legal-regulatory-and-policy-framework/emergency-use-authorization#2019-ncov.

However, to assist clinical laboratories running the Rheonix COVID-19 MDx Assay, the relevant Conditions of Authorization are listed below:

A. Authorized laboratories[1] using the Rheonix COVID-19 MDx Assay will include with result reports of the Rheonix COVID-19 MDx Assay all authorized Fact Sheets. Under exigent circumstances, other appropriate methods for disseminating these Fact Sheets may be used, which may include mass media.

B. Authorized laboratories using the Rheonix COVID-19 MDx Assay will perform the Rheonix COVID-19 MDx Assay as outlined in the Rheonix COVID-19 MDx Assay Instructions for Use. Deviations from the authorized procedures, including the authorized instruments, authorized extraction methods, authorized clinical specimen types authorized control materials, authorized other ancillary reagents and authorized materials required to perform the Rheonix COVID-19 MDx Assay are not permitted.

C. Authorized laboratories that receive the Rheonix COVID-19 MDx Assay must notify the relevant public health authorities of their intent to run the test prior to initiating testing.

D. Authorized laboratories using the Rheonix COVID-19 MDx Assay will have a process in place for reporting test results to healthcare providers and relevant public health authorities, as appropriate.

E. Authorized laboratories will collect information on the performance of the test and report to DMD/OHT7-OIR/OPEQ/CDRH (via email: CDRH-EUA-Reporting@fda.hhs.gov) and Rheonix Inc. Customer Technical Support 1-844-RHEONIX (1-844-743-6649) any suspected occurrence of false positive or false negative results and significant deviations from the established performance characteristics of the test of which they become aware.

F. All laboratory personnel using the test must be appropriately trained in PCR techniques and use appropriate laboratory and personal protective equipment when handling this kit, and use the test in accordance with the authorized labeling.

G. Rheonix Inc., its authorized distributor(s) and authorized laboratories using the Rheonix COVID-19 MDx Assay will ensure that any records associated with this EUA are maintained until otherwise notified by FDA. Such records will be made available to FDA for inspection upon request.

[1]For ease of reference, this letter will refer to, "Laboratories certified under the Clinical Laboratory Improvement Amendments of 1988 (CLIA), 42 U.S.C. §263a, to perform high complexity tests" as "authorized laboratories."

Non-Clinical Performance Evaluation

Limit of Detection (LoD) (Analytical Sensitivity)

The Limit of Detection (LoD) was established by evaluating a dilution series of inactivated SARS-CoV-2 virus in pre-screened negative nasopharyngeal swabs matrix using the protocol described below**.**

The preliminary LoD was determined by evaluating a total of 5 different concentrations of inactivated SARS-CoV-2 virus, diluted in pooled NP swab matrix around the presumed LoD. Each replicate was independently processed through the entire automated process and the preliminary LoD was determined to be in the range of 312 to 625 genomic equivalents/mL or less. In order to be conservative, however, we established the preliminary LoD at 625 genomic equivalents/mL and confirmed this LoD by analyzing a total of 22 replicates of pooled NP swabs spiked with inactivated SARS-CoV-2 spiked at 625 genomic equivalents/mL (Table 7 below). Based on the manner in which the Rheonix EncompassMDx Workstation processes the NP swabs (i.e., 200 µl of sample loaded into the assay cartridge and then 6 µl of the final 30 µl

of purified RNA transferred into the RT-PCR reaction), 625 genomic equivalents/mL is equivalent to 25 genomic equivalents/reaction. Based on these studies, the LoD of the Rheonix COVID-19 MDx Assay was estimated to be 625 genomic equivalents/mL (Table 8).

Table 7. Preliminary Limit of Detection of the Rheonix COVID-19 MDx Assay

Concentration of SARS-CoV-2		Number Tested	Number Positive	Percent Positive
$TCID_{50}$/mL	Genomic equivalents/mL*			
3.14×10^{-3}	**78**	**4**	1	25%
6.28×10^{-3}	**156**	**5**	3	60%
1.26×10^{-2}	**312**	**5**	5	100%
2.52×10^{-2}	**625**	**5**	5	100%
5.04×10^{-2}	**1250**	**2**	2	100%

**Dilutions were based on $TCID_{50}$ values. Based on qPCR analysis, the genomic equivalents were shown to be 3.5 x 10^9 genome equivalents/mL (performed by ZeptoMetrix, Buffalo, NY).*

Table 8. Confirmation of LoD for Rheonix COVID-19 MDx Assay

Concentration of SARS-CoV-2		Number Tested	Number Positive	Percent Positive
$TCID_{50}$/mL	Genomic equivalents/mL			
2.52×10^{-2}	**625**	**22**	**22**	**100%**

Inclusivity (Analytical Sensitivity)

An in silico analysis was performed to demonstrate analytical sensitivity of the Rheonix COVID-19 MDx Assay for all known strains of SAR-CoV-2. As of 24Apr2020 there are 1433 nucleotide sequences on the "Severe acute respiratory syndrome coronavirus 2 data hub": (https://www.ncbi.nlm.nih.gov/labs/virus/vssi/#/virus?SeqType_s=Nucleotide&VirusLineage_ss=SARS-CoV-2,%20taxid:2697049). Of these 1433 sequences, 1350 have sequences of greater than 29,000 base pairs consistent with complete or nearly complete genomes. The remaining 83 correspond to short sequences of 64-3822 base pairs. Due to the incomplete nature of these shorter sequences, the shorter 83 sequences were not included in this analysis. The 1350 complete and nearly complete genomes were analyzed for identity to the individual N1 primers and probe used in the Rheonix COVID-19 MDx Assay, as well as analyzed for identity with the complete 72 base pair amplified product. One hundred percent identity was demonstrated for the primers, probe, and the complete 72 base pair product for 1337 of the 1350 sequences. Of the remaining 13 sequences with less than 100% identity at the amplicon region, 10 demonstrated 100% identity with both primers, and a single mismatch within the probe sequence, 1 contained a single mismatch in the forward primer, with 100% identity in the

reverse primer and probe sequence, 1 contained a single mismatch in both primers with 100% in the probe sequence, and the remaining sequence had incomplete sequence information in the region of interest. Both the PCR annealing and endpoint detection are performed at temperatures at or below the calculated melting temperatures of the primers and the probe suggesting that a single mismatch in either the primer(s) or probe will not significantly impact the ability of the target sequences to be amplified and/or captured on the array.

Cross Reactivity (Analytical Specificity)

Cross reactivity studies were performed on all organisms noted (Table 9), with each microorganism subjected to *in silico* analysis with all combinations of primer pairs present in the Rheonix COVID-19 MDx Assay. The Rheonix COVID-19 MDx Assay uses a subset of the primers developed by the CDC and utilized in the CDC developed 2019-Novel Coronavirus (2019-nCoV) Real-time RT-PCR assay. The Rheonix COVID-19 MDx Assay uses the primers generated for the human RNase P gene as sample control, and for the N1 target region of the SARS CoV-2 nucleocapsid protein gene sequence. The sequences of the four primers are shown in Table 10 and all potential primer combinations are shown in Table 11. All potential primer combinations were subjected to several analyses using the National Center for Biotechnology Information (NCBI) primer analysis tool Primer-BLAST (Basic Local Alignment Search Tool). In one analyses, only the potential cross-reacting organisms shown in Table 9 were tested with all combinations. In the second analyses, all combinations were tested against the complete non-redundant nucleotide collection database. To ensure the potential of any off target being detected, parameters are set wide (e.g. aggressively) to identify any possible target, even if implausible, would be detected. For example, the melting temperature parameters for the search are set between 40 °C and 77 °C, and a high allowance for mismatches. All analysis demonstrated the expected detection of SARS-CoV-2 and the human RNAp mRNA and gene with the correct corresponding primer pair. As expected based on the current understanding of how SARS CoV-2 evolved, there is a significantly high degree of homology (97.2% identity) with the similar bat and pangolin virus. Contamination of the swab samples with bat or pangolin virus presents negligible risk and thus false positives due to these homologies are not expected. It should also be noted that the primers for the human RNase P gene demonstrate identity with the predicted sequences of several primates. The risk of the swabs being contaminated with exotic primate sequences presents negligible risks as well and therefore is not a concern for the assay. These data confirm that no potential off-targets could be amplified with any combination of the primers in the assay resulting in either the potential of false positives, or competition with the actual desired targets.

Table 9. *In silico* Analysis of Potentially Cross-Reactive Organisms

Other high priority pathogens from the same genetic family	High priority organisms likely in the circulating area	High priority organisms, including organisms commonly found in the clinical matrix	Organisms to be analyzed for non-blood clinical specimens
Human coronavirus 229E	Adenovirus (e.g. C1 Ad. 71)	Influenza C	Escherichia coli
Human coronavirus OC43	Human Metapneumovirus (hMPV)	Parechovirus	Lactobacillus
Human coronavirus HKU1	Parainfluenza virus 1-4	Candida albicans	Bacillus spp.
Human coronavirus NL63	Influenza A	Corynebacterium diphtheria	Clostridium spp.
MERS-coronavirus	Influenza B	Legionella non-pneumophila	Enterobacter
	Enterovirus (e.g. EV68)	Bacillus anthracosis (Anthrax)	Enterococcus
	Respiratory syncytial virus	Moraxella cararrhalis	Fusobacterium
	Rhinovirus	Neisseria elongate and miningitidis	Bacteroidetes
	Chlamydia pneumoniae	Pseudomonas aeruginosa	Bifidobacterium
	Haemophilus influenzae	Staphylococcus epidermis	Ruminococcus
	Legionella pneumophila	Staphylococcus salivarius	
	Mycobacterium tuberculosis	Leptospirosis	
	Streptococcus pneumoniae	Chlamydia psittaci	
	Streptococcus pyrogenes	Coxiella burneti (Q-Fever)	
	Bordetella pertussis	Streptococcus aureus	
	Mycoplasma pneumoniae		
	Pneumocystis jirovecii (PJP)		

Table 10. Primer Sequences used in the Rheonix COVID-19 MDx Assay

Primer	Sequence (5' – 3')
RNAp For	AGATTTGGACCTGCGAGCG
RNAp Rev	GAGCGGCTGTCTCCACAAGT
N1 For	GACCCCAAAATCAGCGAAAT
N1 Rev	TCTGGTTACTGCCAGTTGAATCTG

Table 11. All Possible Primer Combinations in the RT-PCR Master Mix

		PRIMER 1			
		RNAp For	RNAp Rev	N1 For	N1 Rev
PRIMER 2	RNAp For	RNAp For	RNAp For	RNAp For	RNAp For
	RNAp Rev	RNAp Rev	RNAp Rev	RNAp Rev	RNAp Rev
	N1 For	N1 For	N1 For	N1 For	N1 For
	N1 Rev	N1 Rev	N1 Rev	N1 Rev	N1 Rev

Interfering Substances

The main objective of this study is to investigate the potential for interference resulting from medically relevant concentrations of various interfering substances ("interferents") that could potentially be present in respiratory specimens evaluated by the Rheonix COVID-19 MDx Assay.

A total of 12 potentially interfering substances that could be present in the NP swab specimens were evaluated at concentrations selected to be medically relevant. The testing was performed by analyzing pooled NP swabs (previously screened with the Rheonix COVID-19 MDx and shown to be negative) under the following conditions:

- Each potentially interfering substance was first separately evaluated in pooled NP swab to determine if the presence of the interfering substance would cause a "negative" sample to yield a "positive" result.
- Each potentially interfering substance was then separately evaluated in the presence and absence of inactivated SARS-CoV-2 virus at 3X the established LoD of the Rheonix COVID-19 MDx Assay.
- Testing was performed in triplicate.
- A single operator performed the testing on a single Encompass MDx workstation.
- A single external positive control run at 5X LoD and a single and a single negative control (pre-tested pooled negative NP swab) was run at least once/day.
- When tested in the absence of inactivated SARS-CoV-2 virus, a substance will be considered an interfering substance if one or more of the two replicates yields a positive result for SARS-CoV-2 RNA.

Statistical Methods

In the absence of target organisms, the percent of "positive" results in the presence of interfering substances was calculated. In the presence target organisms and interfering substances, the percent of "positive" results was calculated.

Acceptance Criteria

For a substance to be classified as non-interfering, the results displayed in Table 12 are expected. Any other combination of results will classify the substance as interfering.

Table 12. Anticipated Interference Study Results

Test combination	Anticipated Results
Matrix alone	Negative for all replicates for SARS-CoV-2 RNA
Matrix, plus interferent	Negative for all replicates for SARS-CoV-2 RNA
Matrix, plus SARS-CoV-2 RNA	Positive for all replicates for SARS-CoV-2 RNA
Matrix, plus SARS-CoV-2 RNA and interferent	Positive for all replicates for SARS-CoV-2 RNA

Accordingly, when tested in the absence of the SARS-CoV-2 RNA, a substance is considered an interfering substance if one or more of the replicates yields a positive signal.

Similarly, when tested in the presence of SARS-CoV-2 RNA, a substance is considered an interfering substance if one or more of the replicates yields a negative signal.

The results of the interference study are reported in Table 13. The concentration of potentially interfering substance that was tested did not demonstrate interference (of either a negative sample being converted to a positive result by the presence of the substance or a positive sample being converted to a negative result by the presence of the substance).

Table 13. Endogenous Interference Study Results

Product tested	Concentration tested	Results detected*	
		Interferent + matrix	SARS-CoV-2+Interferent + matrix
		Neg (x3)	Pos (x3)
Mucin: bovine submaxillary gland, type I-S	1mg/mL	3	3
Blood (human)	1%	3	3
Saline nasal spray	10% v/v	3	3
Afrin nasal spray (Oxymetazoline HCl 0.05%)	10% v/v	3	3
Flonase allergy relief (Fluticasone furoate)	500 ng/mL	3	3
Zicam cold remedy (Luffa operculata)	10% v/v	3	3
Childrens allergy relief, (Loratadine 5mg/mL)	100 ng/mL	3	3
Vicks Vapocool sore throat (Benzocaine 5%, menthol 1%)	2.5% v/v	3	3
Oseltamivir phosphate	500 ng/mL	3	3
Mupirocin	500 ng/mL	3	3
Tobramycin	500 ng/ml	3	3
Biotin	3,500 ng/ml	3	3

**In all cases the expected results were obtained under each of the listed conditions*

Clinical Evaluation

The clinical evaluation of the Rheonix COVID-19 MDx Assay was performed by analyzing contrived samples that consisted of 30 reactive and 30 nonreactive NP swabs. Each swab was obtained from a single, unique subject and spiked with various concentrations of SARS-CoV-2 RNA as shown in Table 14. A total of 30 unspiked (negative) NP samples and 30 contrived NP samples were tested.

Table 14. Composition of Contrived Clinical Specimens Used in Clinical Evaluation Studies

Specimen Type	Number of Specimens	Spike level	Expected Test Result
Low LoD	20	2X LoD	≥95% Positive
Intermediate LoD	5	5X LoD	100% Positive
High LoD	5	10X LoD	100% Positive
Negative	30	None	100% Negative

The specimens were collected in BD Universal Viral Transport with 3 ml media and shipped to Rheonix's facility in Ithaca, NY for spiking and testing. One ml of Rheonix 4X Sample Buffer was added to each tube prior to analysis.

Qualitative test results are reported together with the associated assay metric expressed in term of Intensity Units (Table 15 and Table 16).

Table 15. Clinical Evaluation of Unspiked NP Swab: Results Obtained Using the Rheonix COVID-19 MDx Assay

Sample ID	Spike Level	Qualitative*	Intensity Units	
			RNase P Target	N1 Target
1	None	Negative	149.932	-1.635
2	None	Negative	166.74	-11.371
3	None	Negative	163.847	6.495
4	None	Negative	175.114	0.834
5	None	Negative	182.435	-0.922
6	None	Negative	184.31	-2.214
7	None	Negative	151.872	-2.88
8	None	Negative	176.078	-7.626
9	None	Negative	166.339	-3.92
10	None	Negative	185.055	-1.79
11	None	Negative	169.528	-6.595
12	None	Negative	168.64	0.294
13	None	Negative	170.468	-4.116
14	None	Negative	192.41	-2.67
15	None	Negative	167.623	3.499
16	None	Negative	182.884	0.797
17	None	Negative	173.286	5.897
18	None	Negative	158.428	-0.317
19	None	Negative	186.174	-3.248
20	None	Negative	182.289	-4.13
21	None	Negative	184.611	-5.518
22	None	Negative	175.881	-10.286
23	None	Negative	187.694	0.373
24	None	Negative	182.555	0.119
25	None	Negative	190.94	8.301
26	None	Negative	196.368	1.753
27	None	Negative	190.455	0.411
28	None	Negative	157.149	-2.131
29	None	Negative	186.288	0.802
30	None	Negative	142.583	-4.811

** Intensity readings less than 25.00 units are scored as "Negative" while intensity readings greater than 25.00 are scored as "Positive".*

Table 16. Clinical Evaluation of Spiked NP Swab: Results Obtained Using the Rheonix COVID-19 MDx Assay

Sample ID	Spike Level	Qualitative*	Intensity Units	
			RNase P Target	N1 Target
1	2 X LoD	Pos	171.287	158.333
2	2 X LoD	Pos	163.705	67.499
3	2 X LoD	Pos	159.723	138.684
4	2 X LoD	Pos	156.037	128.951
5	2 X LoD	Pos	111.669	117.139
6	2 X LoD	Pos	170.692	119.603
7	2 X LoD	Pos	172.921	161.551
8	2 X LoD	Pos	197.868	168.628
9	2 X LoD	Pos	164.422	143.409
10	2 X LoD	Pos	147.253	149.632
11	2 X LoD	Pos	158.49	156.341
12	2 X LoD	Pos	167.307	145.039
13	2 X LoD	Pos	144.464	134.459
14	2 X LoD	Pos	164.925	116.614
15	2 X LoD	Pos	119.043	39.519
16	2 X LoD	Pos	146.027	124.338
17	2 X LoD	Pos	163.178	127.369
18	2 X LoD	Pos	163.137	150.677
19	2 X LoD	Pos	163.691	137.36
20	2 X LoD	Pos	178.737	153.44
21	5 x LoD	Pos	177.602	177.92
22	5 x LoD	Pos	196.724	188.258
23	5 x LoD	Pos	188.573	199.827
24	5 x LoD	Pos	190.925	185.071
25	5 x LoD	Pos	161.391	171.233
26	10 x LoD	Pos	208.951	180.55
27	10 x LoD	Pos	125.543	109.55
28	10 x LoD	Pos	189.218	189.913
29	10 x LoD	Pos	154.301	180.131
30	10 x LoD	Pos	169.465	182.442

***** *Intensity readings less than 25.00 units are scored as "Negative" while intensity readings greater than 25.00 are scored as "Positive".*

Analysis of the contrived samples gave rise to expected results (Table 17).

Table 17. Results Obtained When Analyzing Contrived Specimens

Specimen Type	Number of Specimens	Spike level	Number Positive or Negative	Percent Correct
Low LoD	20	2X LoD	20 Positive	100%
Intermediate LoD	5	5X LoD	5 Positive	100%
High LoD	5	10X LoD	5 Positive	100%
Negative	30	None	30 Negative	100%

Labeling Symbology

Symbol	Title of symbol	Explanatory Text	Standard Reference
	Manufacturer	Indicates the medical device manufacturer	ISO 15223-1:2016 Reference no. 5.1.1
	Date of Manufacture	Indicates the date when the medical device was manufactured	ISO 15223-1:2016 Reference no. 5.1.3 ISO 7000:2014 Reference no. 2497
	Consult instructions for use	Indicates the need for the user to consult the instructions for use	ISO 15223-1:2016 Reference no. 5.4.3 ISO 7000:2014 Reference no.1641
	Temperature limits	Indicates the temperature limits to which the medical device can be safely exposed.	ISO 15223-1: 2016 Reference number 5.3.7 ISO 7000:2014 Reference no. 0632
	Do not use if damaged	Indicates a medical device that should not be used if the package has been damaged or opened	ISO 15223-1: 2016 reference number 5.2.8 ISO 7000:2014 Reference no. 2606
	Single use only; do not reuse	Indicates a medical device that is intended for one use, or for use on a single patient during a single procedure	ISO 15223-1:2016 Reference no. 5.4.2 ISO 7000:2014 Reference no. 1051
	Caution, consult accompanying documents	Indicates the need for the user to consult the instructions for use for important cautionary information	ISO 15223-1:2016 Reference no. 5.4.4 ISO 7000:2014 Reference no. 0434
	Contains sufficient contents for <n> tests	Indicates the total number of IVD tests that can be performed with the IVD	ISO 15223-1:2016 Reference no. 5.5.5 ISO 7000:2014 Reference no. 0518
	*In vitro* diagnostic medical device	Indicates a control material that is intended to verify the performance characteristics of another medical device	ISO 15223-1:2016 Reference no. 5.5.2 ISO 7000:2014 Reference no. 2494
	Prescription use only	Caution: Federal law (USA) restricts this device to sale by or on the order of a licensed healthcare practitioner	21 CFR 801.109
	Catalog Number	Indicates the manufacturer's catalogue number to identify the medical device	ISO 15223-1:2016 Reference no. 5.1.6 ISO 7000:2014

			Reference no. 2493
	Lot Number	Indicates the manufacturer's batch code to identify the batch or lot	ISO 15223-1:2016 Reference no. 5.1.5 ISO 7000:2014 Reference no. 2492
	Environmental or aquatic toxicity	Indicates a potential of environmental or aquatic toxicity	US: 29 CFR 1910:1200 (HCS) EU: Regulation 1272/2008/EC GHS 09
	Use by	Indicates the date after which the medical device is not to be used	ISO 15223-1:2016 Reference no. 5.1.4 ISO 7000:2014 Reference no. 2607
	Skin Irritation, category 2 Eye Irritation, category 2	Indicates a potential for health risk to the user of the medical device	US: 29 CFR 1910:1200 (HCS) EU: Regulation 1272/2008/EC GHS 07

Intellectual Property

The Assay is covered by the following patents:

The Rheonix COVID-19 MDx Assay is covered by the following patents (US patents referenced unless otherwise noted):

Workstation: US 7,976,795; US 8,101,428; US 8,383,039; US 8,609,039; US 9,151,701; CN 102906573; JP 6058399; JP 6104327; US 9,096,890; US 8,986,614; US9,102,979; US 9,328,381; US 9,556,478; AU 2011221244

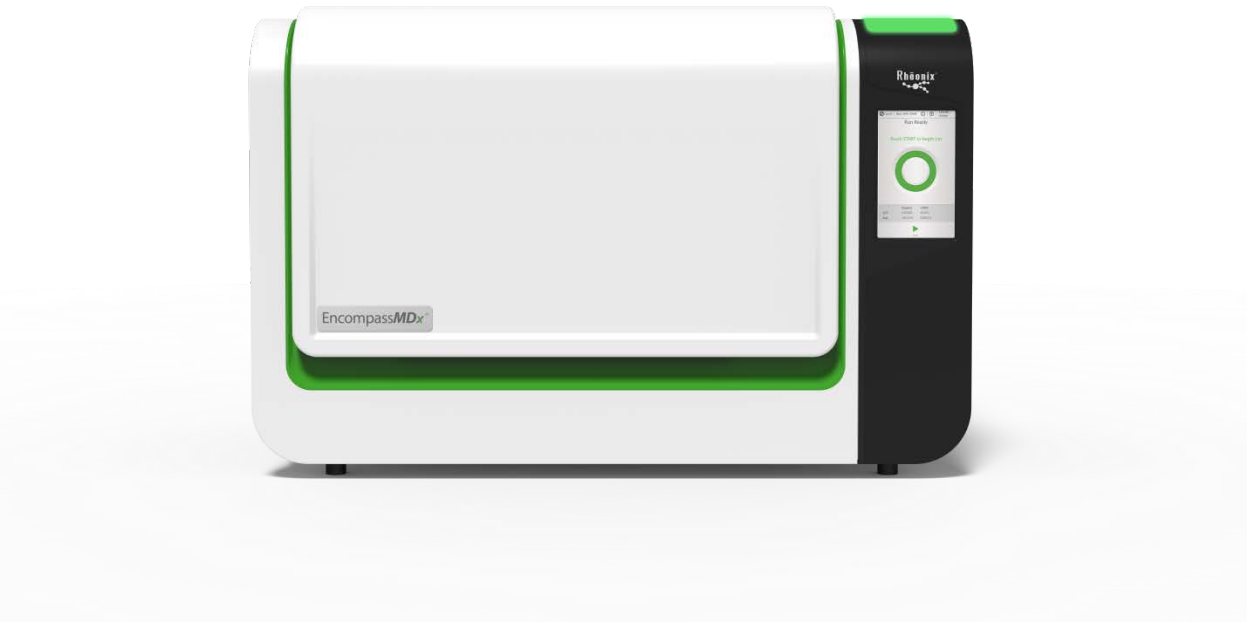
CARD Cartridges: US 7,608,160; US 7,832,429; US 7,837,821; US 7,959,875; US 8,057,629; US 8,293,053; US 8,323,586; US 8,512,502; US 8,535,020; US 8,646,482; US 8,715,446; US 8;715;447; US 8,763,641; AU 2006320916; AU 2007207681; CN 101282789; EP 1,706,467 (CH, DE, FR, GB, IT & SE); IN 255971; JP 4,516,606; JP 4,939,541; JP 5,250,425; JP 5,323,747; IN 262645; EP 2,520,367 (CH, DE, FR, GB, IT & SE); US 9,638,338; CN 101495236; IN 281148; AU 2007207681; US 8,372,355; US 8,778,280; US 9,134,207; US 9,132,398; CN 101903104; JP 5,523,327; IN 277018;

Encompass MDx® Workstation

Operator Manual, Model RNXMDX

Serial Number: _____

For Use Under an Emergency Use Authorization (EUA) Only



Rhēonix®

10 Brown Road Suite 103
Ithaca, NY 14850 USA

Warranty

The following information constitutes the Workstation-specific warranties referenced in the Rental or Purchase Agreement under which the Encompass MDx® workstation was rented or purchased from Rheonix, Inc. Customer must not alter or remove any labels, signs, symbols, serial numbers, copyright, patent, trademark, trade secret, proprietary and/or other legal notices contained on or in the Encompass MDx® workstation, Encompass MDx® workstation User Interface, and related documentation.

Encompass MDx® Workstation Limited Warranty
Rheonix, Inc. warrants that (i) the Encompass MDx® workstation (the "Workstation") is free from defects in material and workmanship, (ii) the Workstation together with the Encompass MDx® workstation User Interface (the "Product") conforms to Rheonix's published specifications, and (iii) the Product conforms to the labeling claims that accompany the Workstation. This Warranty is for a period of 12 months from the date of installation at the Customer (the Warranty Period). During the Warranty Period, if the Workstation's hardware is found to be defective or if the Product is found to be non-conforming under item (ii) or (iii) above, Rheonix will repair or replace it, at a site determined by Rheonix at Rheonix's expense. This warranty extends to Customer only and not to any other parties, except as agreed to in writing by Rheonix, and applies only to new products manufactured by Rheonix. Rheonix does not warrant any defects in the Workstation caused by (i) improper installation, removal or testing, (ii) Customer's failure to provide a suitable operating environment for the Workstation, (iii) use of the Workstation for purposes other than that for which it was designed, (iv) unauthorized attachments, (v) unusual physical or electrical stress, (vi) modifications or repairs done by other than Rheonix or a Rheonix authorized Field Service Engineer, or (vii) any other abuse, misuse, or neglect of the Workstation. The Workstation is designed as part of an integrated workstation/reagent/consumable system. Use of unapproved parts, reagents or other materials with the Workstation will void any warranty and any service contract between Rheonix and the Customer that pertains to the Workstation.

OTHER THAN ANY EXPRESS WARRANTY PROVIDED IN THE ORIGINAL PURCHASE AGREEMENT WITH RHEONIX, THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE FACE HEREOF, AND RHEONIX DISCLAIMS ALL OTHER REPRESENTATIONS AND WARRANTIES, WHETHER EXPRESS OR IMPLIED, REGARDING THE PRODUCT, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RHEONIX AND ITS DIRECTORS, OFFICERS, EMPLOYEES AND AGENTS SHALL HAVE NO LIABILITY FOR GENERAL, CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES ARISING FROM A DEFECT IN THE WORKSTATION. FURTHERMORE, RHEONIX SHALL HAVE NO STRICT LIABILITY, PRODUCTS LIABILITY OR NEGLIGENCE LIABILITY, WHETHER ACTIVE OR PASSIVE, AS TO THE CUSTOMER.

Customer's exclusive remedy for any defective Workstation or non-conforming Product is limited to the repair or replacement of any defective Workstation. If Rheonix cannot or does not repair or replace a defective Workstation or non-conforming Product, Rheonix will remove same and return the purchase price. If Rheonix cannot or does not repair or replace any defective Workstation or non-conforming Product or if Customer's exclusive remedy fails of its essential purpose, Rheonix's entire liability shall in no event exceed the purchase price for any defective Workstation or non-conforming Product.

Contents

Preface

About this manual

The *Encompass MDx® Workstation Operator Manual* provides instructions on the safe use of the Encompass MDx® workstation. Read the entire manual and become familiar with the safety information before you begin using the workstation. Operating the workstation without reading the manual, or without proper training, can result in operator injury, damage to the workstation, inaccurate or invalid results, and/or loss of data. This workstation utilizes a touch screen user interface guided by Encompass MDx Smart Sense. The software-related instructions in this operator manual regarding system configuration and initial set-up assume the user has basic computer skills.

Safety Information

Section 9 in this manual provides important safety information for the safe and proper operation of the Encompass MDx® workstation. Read and understand the safety information thoroughly before you begin operating the workstation. Follow all the precautionary statements presented in this manual:

The following symbols are used in the manual to differentiate the types of important safety information:

	**WARNING:** Indicates a possibility of adverse reactions, injury or death to the user or other persons if the precautions or instructions are not followed.
	**CAUTION:** Indicates that damage to the system, loss of data, and/or inaccurate or invalid results could occur if the user fails to comply with the instructions.
	**CRITICAL:** Highlights information that is important for the completion of a task or for the optimal performance of the system.
	**INFORMATION:** Indicates useful information related to a certain task or operation

Assistance

For technical assistance contact Rheonix Customer Service at +1-844-RHEONIX (+1-844-743-6649) or email techsupport@rheonix.com.

You may need to provide the workstation serial number when calling or emailing. The serial number is located on the front page of this manual.

Section 1: The Encompass MDx® Workstation

The Encompass MDx® workstation is a fully automated platform for performing molecular diagnostic assays. Together with Rheonix CARD® cartridge and consumables, the workstation enables fully integrated sample-to-results assays. Once a user has loaded the Encompass MDx® workstation with samples and consumables, the system automatically performs sample extraction, purification, amplification, and detection.

The workstation can process either three or six CARD cartridges at a time, with each CARD cartridge having the capacity to run four separate samples in parallel (up to 12 or 24 samples).

Intended Use:
The workstation has not been FDA cleared or approved. It has been authorized by the FDA under an EUA for use by laboratories certified under the Clinical Laboratory Improvement Amendments of 1988 (CLIA), 42 U.S.C. § 263a, to perform high complexity tests. The workstation has been authorized only for the detection of RNA from SARS-CoV-2 virus and diagnosis of SARS-CoV-2 virus infection, using the Rheonix COVID-19™ MDx Assay with the nasopharyngeal swabs, oropharyngeal (throat) swabs, anterior nasal swabs, mid-turbinate nasal swabs, nasal washes, ~~and~~ nasal aspirates and bronchoalveolar lavage (BAL) fluid. It is only authorized for the duration of the declaration that circumstances exist justifying the authorization of the emergency use of *in vitro* diagnostics for detection of SARS-CoV-2 virus under section 564(b)(1) of the Act, 21 U.S.C. § 360bbb- 3(b)(1), unless the authorization is terminated or revoked sooner.

1.1 Encompass MDx® Workstation

Features of the Encompass MDx® workstation are depicted in Figures 1-1 through 1-3.

- **Liquid Handler**: Consists of an XYZ robot and a dispenser that delivers samples and reagents to the Rheonix CARD® cartridge.
- **Interlocking Door:** Ensures separation and containment of robotic liquid handling components from operator.
- **Smart Sense Alert**: A color-coded system that provides the operator with visual workstation status cues.
    - Solid Green – The workstation is idle and ready for operation or all samples and consumables have been loaded correctly prior to starting a run or all samples and consumables have been unloaded correctly following completion of a run or a run is in progress.
    - Blinking Green – The system has completed pre-run diagnostic checks and is ready to start a run and/or a run has completed successfully without error.
    - Blinking Red – A critical error has occurred and requires operator attention.
- **Touch Screen:** The workstation comes with the Encompass MDx® workstation User Interface (UI) software installed. The touch screen provides the user interface for system operation including assay setup steps and accessing test results.
- **Deck:** The workstation deck is the bottom portion of the interior. Samples and consumables are placed onto the deck by users during assay set up. Software controlled indicator lights on the deck guide the user for consumable placement. A map showing consumable placement is provided in Figure 1-3
- **Sample Barcode Scanner**: The sample barcode scanner is located under the main deck of the workstation and automatically scans samples once loaded.
- **Camera:** The camera is located in the same compartment as the liquid handler. It is responsible for scanning the consumable barcodes to verify consumables that were loaded correspond to the assay and are within expiry. The camera also captures and analyzes the array images of the final assay results.

Figure 1-1: Encompass MDx® Workstation (Front View)

Figure 1-2: Power cable receptacle and Power On/Off rocker switch

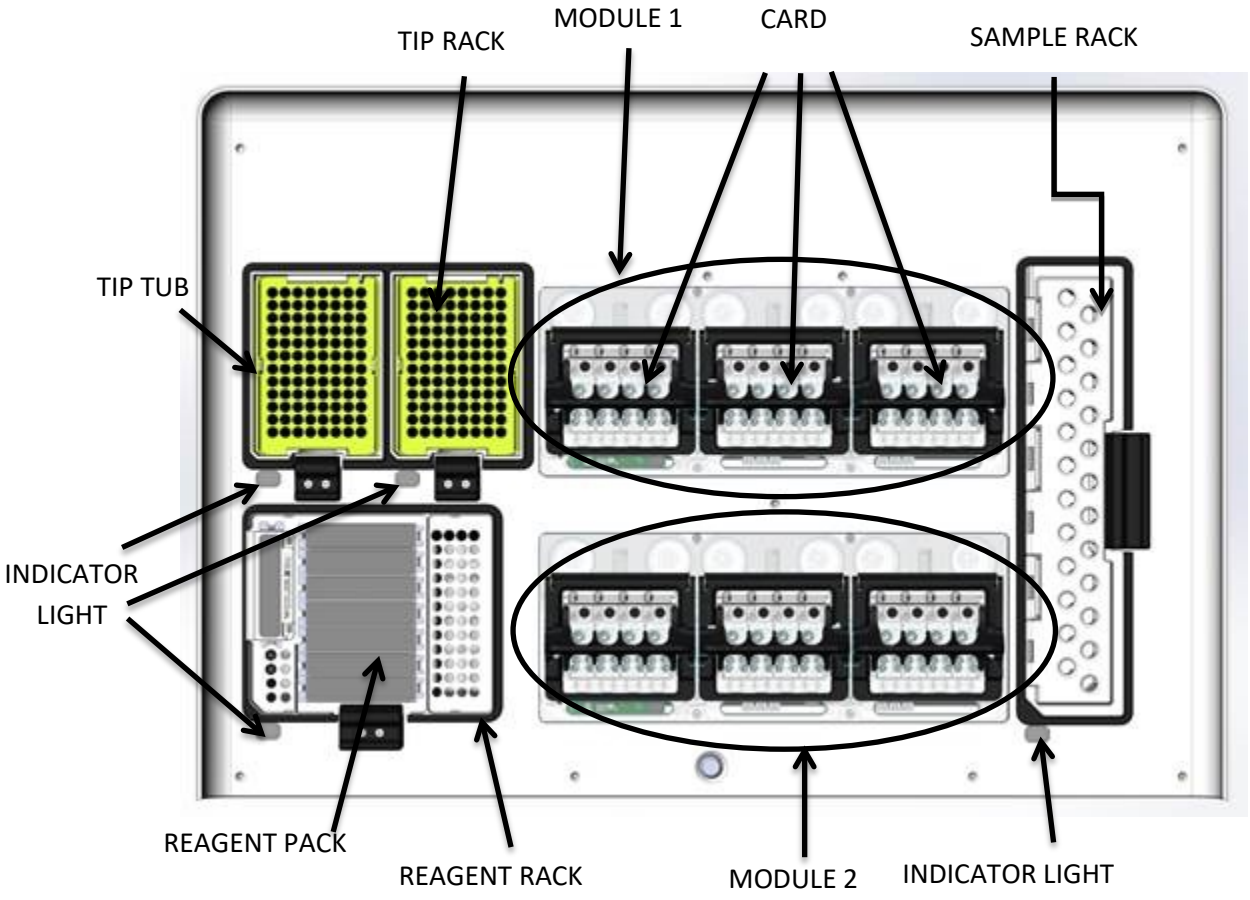
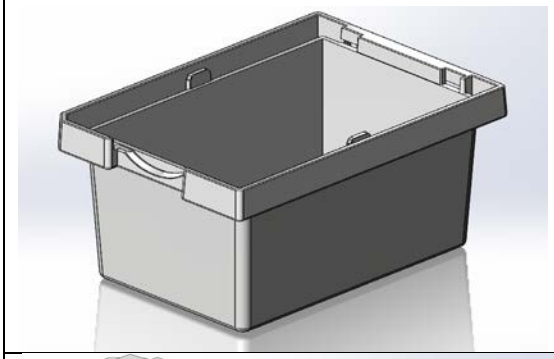
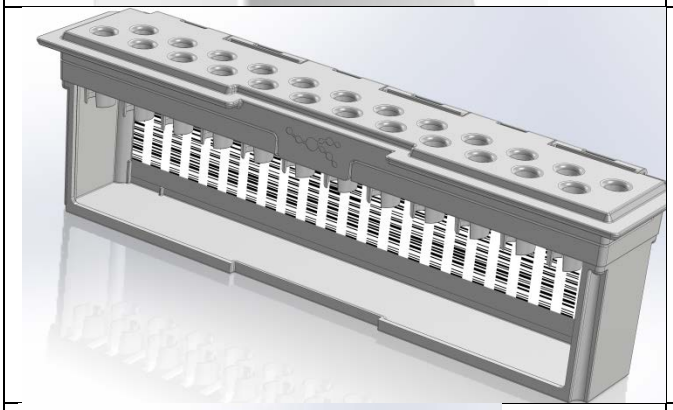
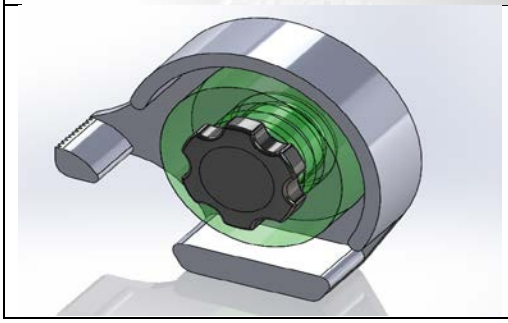


Figure 1-3: Sample and Consumable Placement Map

Workstation Accessories:

	Ethernet Cable
	Power Cord **CAUTION:** If power cord is damaged or needs replacing, contact Rheonix Customer Service. Replacing power cord with an inadequately rated cord can result in injury, damage to the workstation, and void your warranty.
	Tip Rack Container x 3
	Sample Rack x 2
	Gasket Cleaning Tool

Section 2: System Consumables

	**CAUTION:** The Encompass MDx® workstation can only be used with Rheonix COVID-19 MDx assay kits under Emergency Use Authorization. Using consumables other than from Rheonix can cause workstation damage, void the warranty, and result in invalid or erroneous test results.
	**WARNING:** Personal Protective Equipment (PPE) is required when handling samples, consumables, or the workstation. A lab coat, disposable gloves, and safety glasses are required.

General Consumable Descriptions

All necessary reagents and consumables needed for running assays on the Encompass MDx® workstation are provided in the Kit package. A typical Rheonix kit contains:

- One Pack A Reagent Pack
- One Pack B PCR Mix
- Two CARD Cartridge trays (each tray contains 3 CARDs)

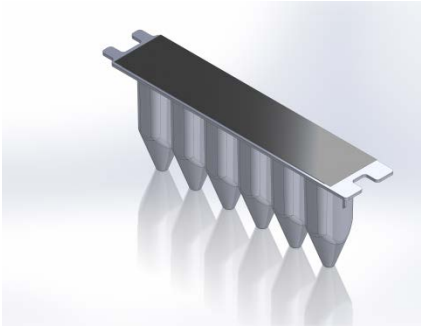
The contents of the kit are sufficient to run up to 24 samples.

	**INFORMATION:** Each assay run must contain either 6 CARD Cartridges. 6 CARDs are sufficient to run up to 24 samples. Any reagents remaining in the reagent brick after the completion of the assay run must be discarded.

2.1 Reagent pack

The Rheonix reagent pack provides all the reagents required for one assay run. The reagent pack consists of two parts (Figure 2-1): The main reagent pack that contains the reagents, master mix tips (if applicable for that assay), and waste area, labeled as **Pack A**; and the master mix strip labeled as **Pack B**.

Pack A



Pack B

Figure 2-1: Reagent Pack A and Pack B

The operator inverts Pack A three times, removes the Tyvek® seal, places Pack B into the open slot in Pack A, closes the latch, and then places the entire assembled reagent pack into the workstation. A barcode label placed on the latch allows the camera to scan the lot and date of manufacture of the assay kit. Certain assays may require the operator to record the lot number of the master mix strip in a log book.

The tips located in the bottom left of Pack A are used to dispense solutions from the master mix strip for certain assays.

All used tips are returned to the waste tip reservoir located on the right side of reagent Pack A (See Figure 2-2 for details of the reagent pack). After assay completion, the reagent pack is removed and discarded as hazardous waste.

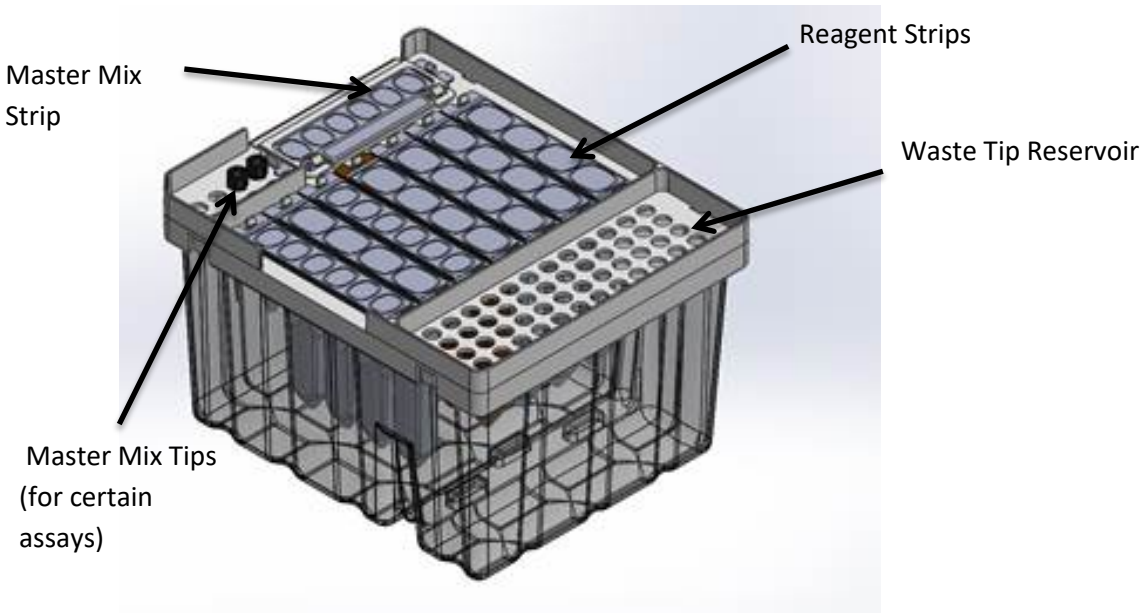


Figure 2-2: Reagent Pack A with Pack B inserted

2.2 Rheonix CARD® Cartridge

The Encompass MDx® workstation must be loaded with 6 Rheonix CARD® cartridges. Each CARD cartridge can process 4 samples which provide the ability to perform up to 24 sample assays in one assay run. Each CARD cartridge tray pack contains 3 Rheonix CARD® cartridges (See figures 2-3 and 2-4, below).

Figure 2-3: CARD Cartridges Tray (Outside packaging)

Figure 2-4: CARD Cartridges Tray (Open package)

Important features of the CARD cartridge include (See Figure 2-5):

Reservoirs: Similar to wells in a microplate, the reservoirs hold small quantities of reagent during the operation of an assay and are connected to each other by a fluidic network. Some reservoirs act as storage containers for liquids during intermediate steps of the assay or as waste reservoirs.

Pumps/Valves: Control the flow of liquids in the CARD cartridge's fluidic network. They are actuated automatically by the Encompass MDx® workstation.

Array: The onboard low density DNA array contains nucleotide probes complementary to the nucleic acid target sequence(s) of interest.

Refer to the assay package insert for assay-specific CARD cartridge information.

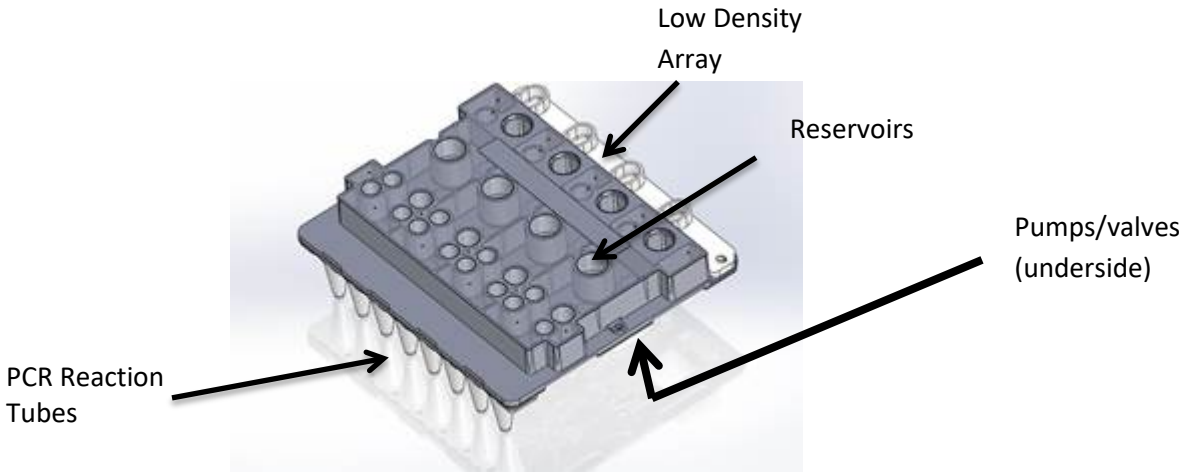


Figure 2-5: Rheonix CARD® Cartridge

2.3 Dispenser Tips

	INFORMATION: 1.0 ml filtered pipette tips are required but not provided in the workstation accessory box or in the assay kits. Rheonix recommends off-the-shelf Axygen Clear 1000 µL, Filtered, Sterile Tips, part number TTF-1000-C-HTR-S.
	CRITICAL: The Encompass MDx® workstation holds two 96-well pipette tip racks that the user loads into the deck. During assay set-up, ensure a minimum of one full tip rack is loaded onto the workstation.

The Encompass MDx® workstation consists of a tip rack container that the operator places the off-the-shelf tips into and then places that into the workstation deck as Figures 2-6 through 2-9 demonstrate. The tip rack containers were designed with features to aid in alignment when loading the tip rack. The tip rack container also was designed with features so the containers can only be loaded into the workstation in one orientation.

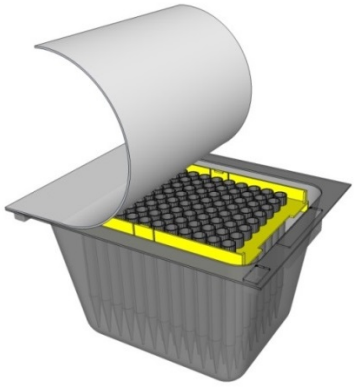


Figure 2-6: Axygen Tip Pack

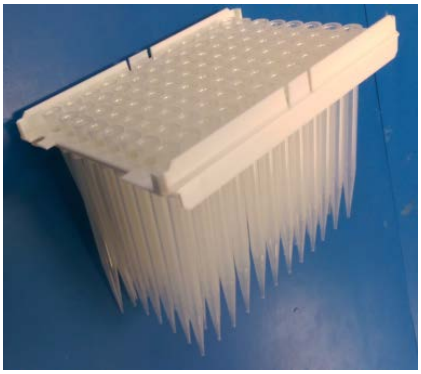


Figure 2-7: Axygen Tip Rack out of packaging

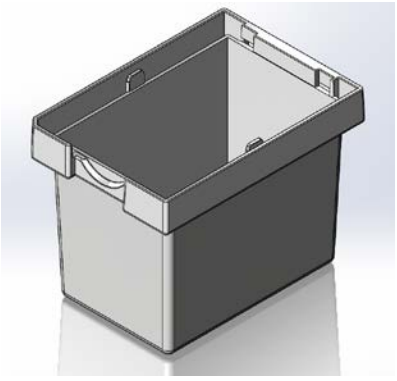


Figure 2-8: Rheonix Tip Container (Empty)

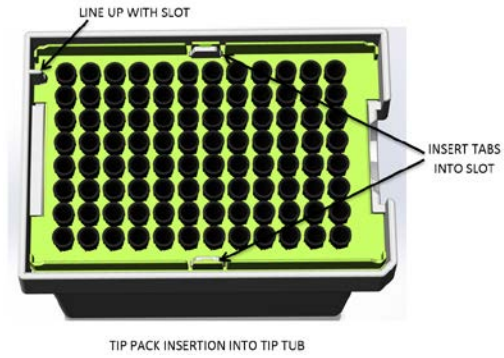


Figure 2-9: Rheonix Tip Rack Container loaded with Axygen Tip Rack

Section 3: Encompass MDx® Workstation Installation and Set up

3.1 Before you Begin

Make sure you read the entire manual and become familiar with the safety information in Section 9 before you begin to operate the workstation. Using the workstation without reading the manual or without proper training can result in serious injury, damage to the workstation, or loss of data.

3.2 Encompass MDx® Workstation Installation

	**WARNING:** Rheonix certified installation/service personnel must conduct all installation procedures. Once installed and functionality has been confirmed, the Encompass MDx® workstation must not be moved. If relocation is necessary, please contact Rheonix to schedule an installation/service appointment.

3.2.1 Contents of the Shipping Container

In the unlikely event that Rheonix personnel are not available for the initial unpacking of the workstation, the shipping container(s) should contain the following items:

- One Encompass MDx® workstation
- One Encompass MDx® workstation User Manual
- Three Tip Rack Containers
- Two Sample Racks
- One workstation power cord
- One Ethernet cord
- One Gasket Cleaning Tool

Contact Rheonix customer service if any items are missing.

3.2.2 Unpacking

	**CAUTION**: The Encompass MDx® workstation weighs 107 kg (235 lbs). Do not attempt to lift the Encompass MDx® workstation alone. **More than one person should be used to lift the workstation; lifting from the bottom, near the feet**.

a) Using a wheeled trolley or hand fork lift, transport the shipping container at or near the location in the laboratory where the Encompass MDx® workstation will be placed.
b) Open the shipping container and remove the Encompass MDx® workstation and workstation accessories from the shipping container.

3.2.3 Installation:

a) Workstation should be placed in a laboratory that meets the system's environmental requirements as specified in Section 8.
    a. Workstation is designed for indoor use only.
b) Place the workstation on a stable surface or bench capable of supporting 107 kg (235 lbs) and 100 cm x 62.5 cm x 69.7 cm dimension (39.4 in x 24.6 in x 27.4 in).
    a. Provide at least 5 cm (2 in) of clearance on each side of the workstation to ensure adequate ventilation.
c) Do not place the Encompass MDx® workstation close to the vents of other workstations or near heat and/or air conditioning ducts.
d) Do not place the workstation directly under an air vent or in direct sunlight.
e) Open the workstation door and remove internal shipping harnesses and supports.
f) Remove internal shipping materials
    i. Remove foam strip from door
    ii. Remove support block
    iii. Remove straps constraining the xyz axes
g) Connect the power cord to the Encompass MDx® workstation. Plug the other end into the grounded power outlets or surge protector (see Section 8 for Electrical Requirements)
    a. If connecting to an Uninterrupted Power Supply (UPS) and/or back-up generator follow manufacturer's instructions. Contact a Rheonix sales representative for recommendations regarding this.
    b. While use of UPS is not required, it is recommended to reduce chances of power outages that could stop a run. APC Sine Wave UPS Battery Backup & Surge Protector, 1000VA, APC Back-UPS Pro (BR1000MS)

	**CAUTION:** Ensure workstation is positioned such that it is not obstructing appliance inlet or plug on power cord (wall outlet) and inhibiting disconnection from power

h) Power the workstation on using the rocker switch on the back of the workstation. It is located at the lower left corner of the rear panel of the workstation.

3.3 Encompass MDx® Workstation Setup

3.3.1 Network Setup

For a wired network connection, use the enclosed network cable to connect to an Ethernet port. Contact your network administrator to connect to your network.

	**INFORMATION:** Wireless configuration is not supported.

3.3.2 Setting the Date and Time

When the Encompass MDx® workstation is connected to a network typically the date and time are automatically set. If the workstation is connected to a network and the date or time settings are incorrect, please consult your Information Technology specialist or Rheonix for assistance.

If the workstation is not connected to a network, then the date and time must be set manually. To do this, first, exit the Software. Refer to section 5.17 'Exit the Software' for assistance doing this. Tap on the date and time in the lower right corner of the screen and click "Change date and time settings." This will display the Date and Time window, shown in Figure 3-1.

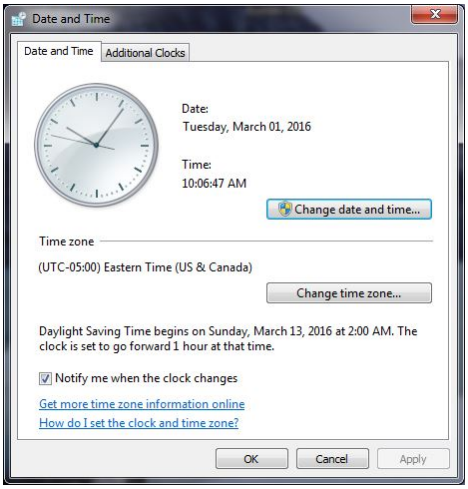


Figure 3-1: The Date and Time Window

Tap the 'Change date and time…' button to set the date and time. Tap 'OK' to save or 'Cancel' to discard the changes entered. A keyboard can be attached to simplify time value entry by plugging into the USB port on the right side of the workstation.

Tap the 'Change time zone…' button to set the time zone. Tap 'OK' to save or 'Cancel' to discard the changes.

3.3.3 Defining Users

The system accommodates three levels of users: Operator, Supervisor and Administrator. Each level has predefined and allowable actions.

- **Operator** – An operator is defined as the typical routine user of this workstation that will have access to the following actions:

  Login, Logout, Load Samples, Edit Samples, Load CARDs, Load Tips, Load Reagents, Start a New Run, Monitor Run, View Run Results, Print Reports, Unload System, View Errors, Change Password (PIN), Approve Run Results (if configured), Shutdown Workstation and Software, Clear Errors, and Create Troubleshooting Package.

- **Supervisor** – A supervisor is defined as the manager of an operator that may be required to approve results (if configured). A supervisor has access to the same actions as an operator with the following additional abilities:

  - Approve runs

- **Administrator** - The administrator role is defined as personnel who are responsible for maintaining overall ownership of the workstation from initial

system configuration to periodic data backups and purges. The Administrator is also responsible for confirming the latest version of software is being run at all times. The Administrator role has access to the same action as the Supervisor with the following additions:

Set System Configuration Parameters, View User Account List, Create User Accounts, Manage User Accounts, Perform Database Restore, Perform Database Purge, View Audit Log, Print Audit Log, Exit the Software Application (allows access to Windows OS), and Perform Database Backup.

Service – The service role is a built-in non-editable user type intended to be used by Rheonix personnel during planned maintenance or servicing the workstation. The Service role has access to all actions except for Change Pin. In addition it solely has access to clearing errors and viewing historical error information.

3.4 Configuring the System

Prior to starting any runs, the system will need to be configured. An Administrator should log in and press the "System" button on the main screen (See figure 3-2). The administrator will then be brought to the screen displayed in Figure 3-3, where access to the following features can be accessed:

- Settings
- Backup
- Logs

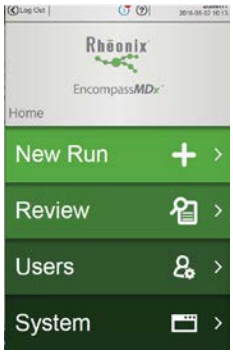


Figure 3-2: Main Screen

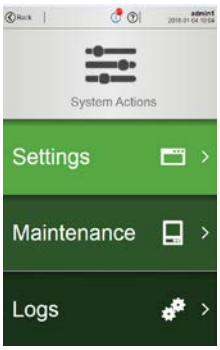


Figure 3-3: System Actions Screen

Figure 3-4: System Settings Screen

3.4.1 Settings

Pressing the “Settings” button will bring up the screen in Figure 3-4, where the following parameters can be set:

- Identification
- Workflow
- Security
- Language
- Folders

Pressing on any of the aforementioned settings will expand the parameters under that category as shown in Figures 3-5 through 3-9.

3.4.1.1 Identification

Enter applicable laboratory information in this section. This will be displayed on the final report. Once complete either press “Save” or press the next configurable parameter.

Figure 3-5: System Settings – Identification

3.4.1.2 Workflow

Use this section to set features based on laboratory protocols.

- Run Results Approval Selection: Decide whether operators can approve completed runs or if a Supervisor needs to review results and approve.
- Printed Report Paper Size: Currently only Letter can be selected.

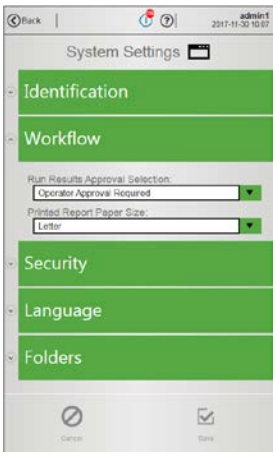


Figure 3-6: System Settings – Workflow

3.4.1.3 Security

Use this section to set the following:

- Logon Session Timeout (Minutes): Set timeout from 0 (not recommended) to 60.
- Password Expiration Interval: Set time in which passwords will expire and need to be changed. Can select “Never” (not recommended), 30, 60, or 90 days.

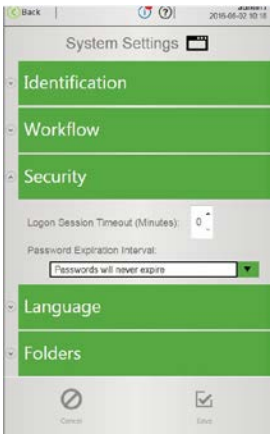


Figure 3-7: System Settings – Security

	INFORMATION: The term password and PIN are used interchangeably throughout the operator manual and within the User Interface.

3.4.1.4 Language

Currently English is the only language supported on the Encompass MDx® workstation and is set as default. Therefore, there is nothing that needs to be selected in the drop down menu.

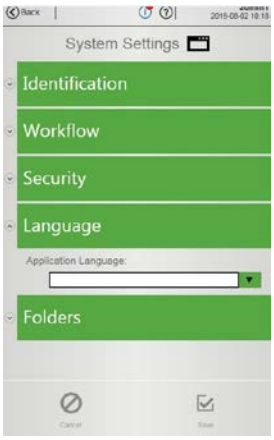


Figure 3-8: System Settings – Language

3.4.1.5 Folders

This section can be used to set the following export locations:

- Troubleshooting Package: Set location for storage of data packet that is created and can subsequently be sent to Rheonix Customer Service for assistance in troubleshooting issues that might arise.
- Default Export Folder: Set location for data back up or export.

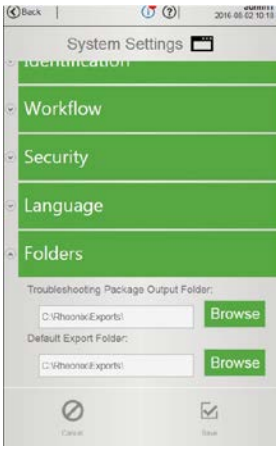


Figure 3-9: System Settings – Folders

3.4.2 Maintenance

Refer to Section 5.15 for further details on Maintenance.

3.4.3 Logs

Refer to Section 5.17 for further details on Logs.

3.5 Restarting the System

Whenever possible, the system should always be shut down through the user interface. This can be accomplished by pressing the username in the upper right hand corner of the touch screen. If logged in as Administrator, the following screen in Figure 3-10 will appear. If logged in as Operator or Supervisor, the screen will look very similar, with the exception of "Exit App". Next, press the "Shutdown" button. The system will then begin its internal process of shutting down. Once the screen is blank, wait for 10 seconds and then the rocker switch on the back of the workstation can be flipped to the "off" position.

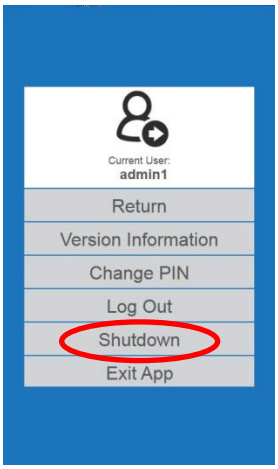


Figure 3-10: Screen indicating proper shut down of system

If the touch screen becomes "frozen" and does not respond to pressing anywhere, the rocker switch can be turned off to perform a hard reset. Wait one minute for full power-down cycle to be complete before turning the workstation back on. This should only be used as a last resort and not general practice. If this is needed often, contact Rheonix Customer Service.

	**CAUTION:** If a run is in progress, shutting down the software will lose any changes or data that haven't been saved. Be sure to shut down the software only after a run has completed and any test results have been exported or saved.

Section 4: Preparing to Run an Assay

4.1 Workflow Overview

The typical workflow for operating the Encompass MDx® workstation is as follows:

Step	*Task*
1.	Start the Encompass MDx® workstation
2.	Log-in
3.	Select new run
4.	Load sample rack
5.	Select sample options
6.	Load CARDs
7.	Prepare the reagent pack and load the assembled pack
8.	Load dispenser tips racks
9.	Pre-run diagnostics
10.	Start the test
11.	Monitor the test
12.	Test complete
13.	View run results
14.	Print report and/or upload applicable results to an external host
15.	Unload and dispose of consumables once test is complete
16.	Clean workstation
17.	Review previous tests and export data

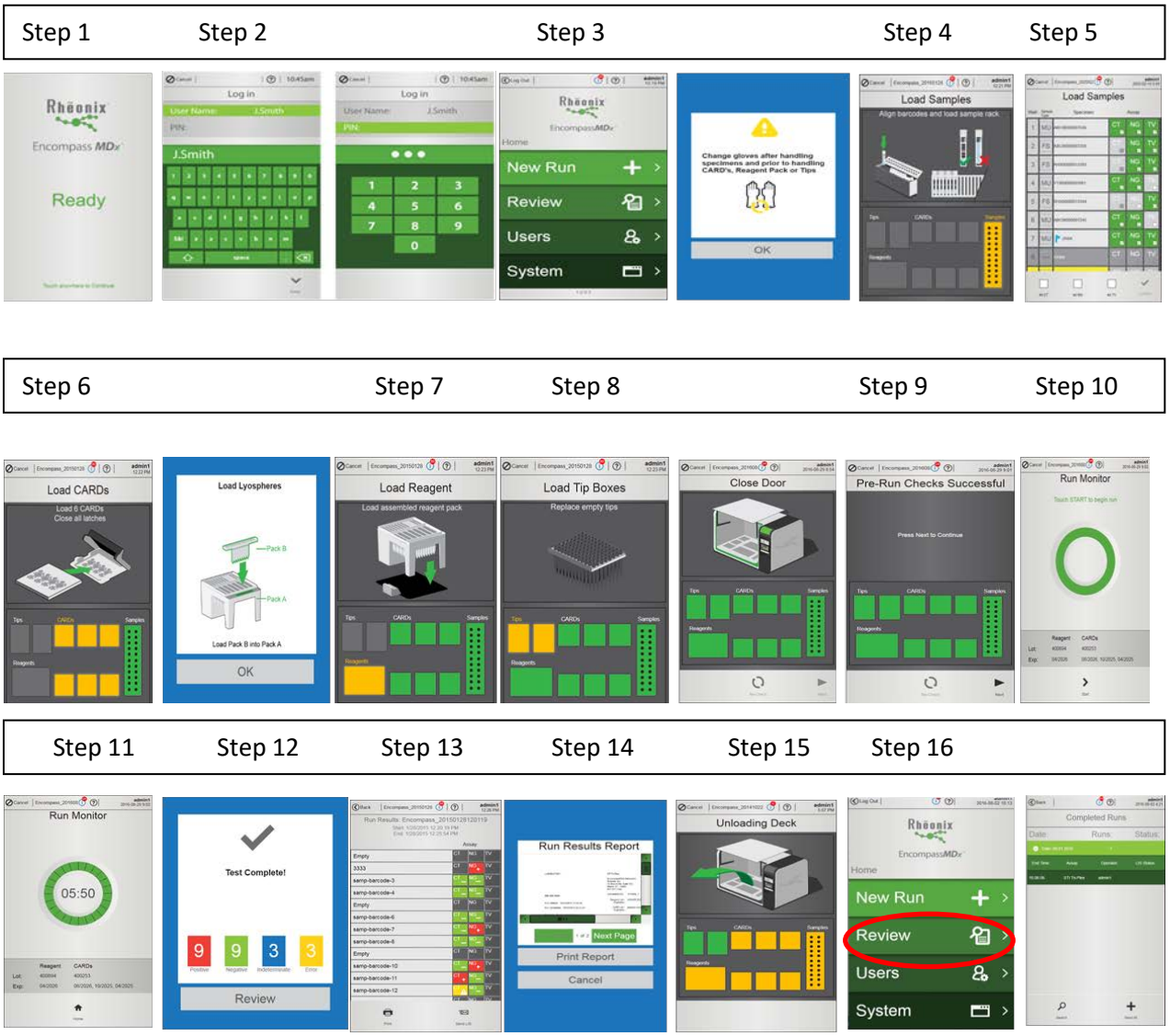


Figure 4-1: Graphical overview of the test workflow for a typical Rheonix assay.

4.2 Getting Started

The tasks required to run tests and control various configuration options are described in this section.

- Powering the Workstation On and Off
- Starting and Ending the Software
- Logging On
- Logging Off
- Changing User Passwords
- Using the System Window

4.3 Powering the Workstation On and Off

Powering On

The workstation's Power On/Power Off switch is located on the rear panel at the left corner of the workstation. Ensure the workstation's power cord is plugged in, then flip the power switch to the "on" position.

ⓘ	Allow a minimum of 10 seconds after powering the unit off before Powering back on.

Powering Off

- Ensure the workstation is not in use
- Click on user name in upper right of UI.
- Click "Shut down" from menu.
- Once screen is blank, flip the power switch on the lower left corner of the back panel of the workstation to the "off" position. The power cord can remain plugged in between uses. See section 3.5 for further details.

Figure 4-2: On/Off

ⓘ	For optimal system operation, power the workstation off at least once each week.

4.4 Starting and Terminating Software

The touch screen will power on with the workstation. The screen's initialization process may take a few minutes. Once the system is ready, simply touch anywhere on the screen as shown in Figure 4-3. If this is the first time the workstation is being used, user accounts will need to be set up.

Figure 4-3: Rheonix UI Splash Screen

To terminate the software, follow the steps as described in Section 3.5.

4.5 Managing users

System Administrators will be able to manage users of the Encompass MDx® workstation through the Encompass MDx® software. Users are created with a login name, PIN, and role, as well as first and last names. The Encompass MDx® software has three roles defined for users: Operator, Supervisor and Administrator. The abilities of these roles is shown in Table I. Users can also be Inactivated, so that they can no longer use the workstation.

RIGHTS	Modify System Settings	Can Create/Modify Users	Can Approve Run Results	Can Acknowledge Errors	Can Run Assay
ADMINISTRATOR	●	●	○	●	●
SUPERVISOR			○	●	●
OPERATOR			○	●	●
Service	●	●	●	●	●

Table I: Roles and Abilities. ● Denotes ability. ○ Denotes configurable ability.

To access user settings tap the “Users” button on the Main Menu. This will bring up a screen displaying current users defined, shown in Figure 4-4.

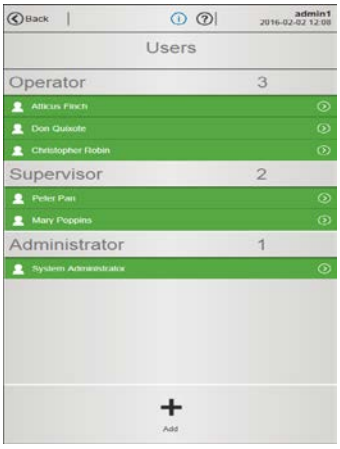


Figure 4-4: Users Screen

4.5.1 Adding new users

To add a new user to the workstation, tap the “Add” button at the bottom of the Users Screen. This will open the New User Screen, shown in Figure 4-5. Enter user detail, including their First Name, Last Name and a chosen four-digit Personal Identification Number (PIN). Tap a field to highlight it for entry and type the information using the on-screen keyboard. Use the “Back” button to delete characters.

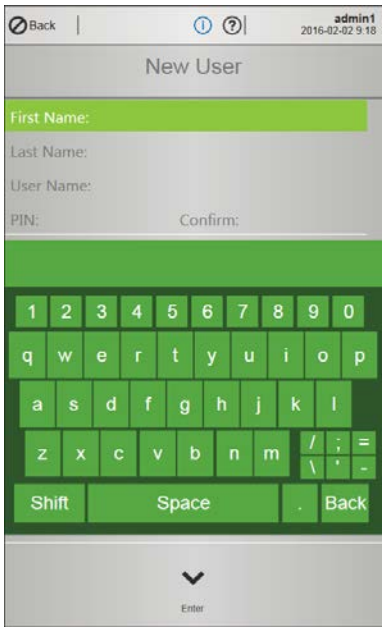


Figure 4-5: New User Screen

When a field is completed, tap “Enter” at the bottom of the screen to save that value and move to the next empty field. PIN information must be entered twice, to confirm that the correct PIN has been entered, shown in Figure 4-6.

Figure 4-6: Enter PIN in two fields to confirm PIN entered

Upon filling every field, tapping “Enter” will give the option to save the New User, shown in Figure 4-7. To save the New User, tap the “Save” button at the bottom of the screen. To cancel the addition of the New User and return to the device’s Home Screen, tap “Back” in the top left corner.

Figure 4-7: Screen to save New User

Tapping “Save” will show a confirmation screen that includes the New User’s name and role. By default all users are created with the Operator role. Tapping “OK” on the Confirmation screen brings up the Edit User Screen, shown in Figure 4-8. From here, the User’s Role, Status, Name, and PIN can be changed. See Editing User Profiles (Section 4.5.2) for more detail. To return to the Users Screen, tap “Confirm.”

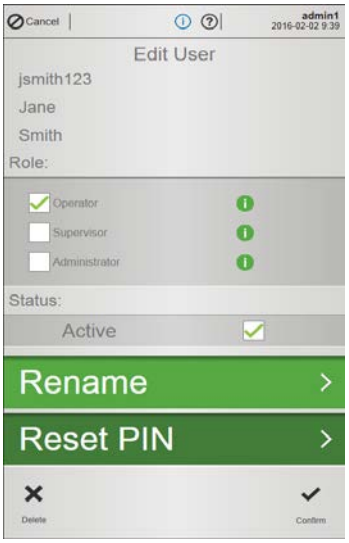


Figure 4-8: Edit User Screen

4.5.2 Editing user profiles

System Administrators can modify any user's name, PIN, active status or role. To modify any of these values for a user, tap the name of that user from the list displayed on the Users Screen. Doing this will open the Edit User Screen which will display the current values for the selected user.

To change the User's role, tap the check box next to the desired new role. A user can only have one role. To change the user's status, tap the check box next to the "Active' label. Inactive users will not be able to log into the Encompass MDx® workstation.

To change the User's first, last, or user name, tap the "Rename" button. This will open the Rename User Screen, shown in Figure 4-9. Select the specific name that needs to be changed, and enter the new value using the on-screen keyboard.

Figure 4-9: Rename User Screen

Tapping "Enter" will open a screen where the information can be reviewed, as shown in Figure 4-10. To discard the changes, tap "Cancel" in the top left corner. To accept and save the changes, tap "Save" at the bottom of the screen. This will reopen the main "Edit User" screen.

Figure 4-10: Confirm Rename User Screen

To change a User's PIN, tap the "Reset PIN" option. This will open a screen where a new PIN can be entered, shown in Figure 4-11. To cancel changing the User's PIN, press "Cancel" in the top left corner. To change the User's PIN, enter the new PIN into the PIN and Confirm fields, and tap "Enter."

Figure 4-11: Change User Pin Screen

Tapping “Enter” will bring up the Confirm Change User Pin Screen, shown in Figure 4-12. Here, tapping “Save” will change the User’s PIN, while tapping “Cancel” will discard the changes entered.

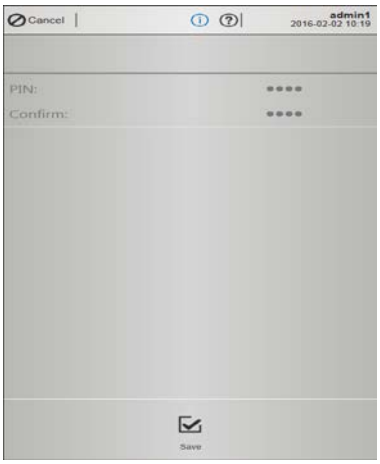


Figure 4-12: Confirm Change User Pin Screen

Once all desired changes for the user have been made tap “Confirm” in the bottom right corner of the Edit User Screen. To discard the changes and return to the list of Users, tap “Cancel” in the top left corner. Tapping “Confirm” will open a confirmation that changes were made to the User. Tapping “OK” will return the device to the list of Users.

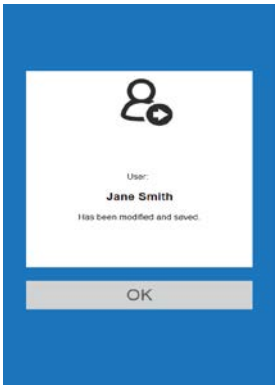


Figure 4-13: Confirmation of change

4.5.3 Deleting users

To delete a User that has never logged into the system, tap that user's name from the list on the Users Screen. This will open the Edit User screen. Tap the "Delete" button in the bottom left corner. This will open a screen that asks for confirmation of the deletion (Figure 4-14). Confirm the deletion by tapping "Yes." If a user has gone through Pre-run diagnostics at least once, that user cannot be deleted, but can be changed to "inactive status" (see Section 4.5 Managing Users).

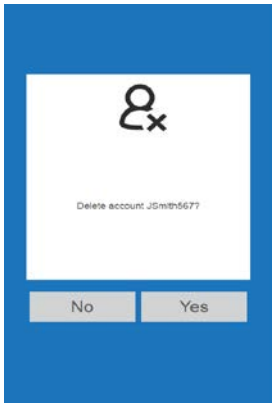


Figure 4-14: Confirm User Deletion Screen

4.5.4 Logging On

Once the software has opened, a loading screen will show that initialization and system checks are being performed. When complete, the software will display the login screen (See Figure 4-15) and ask an existing user to enter his/her credentials (username and password) into the designated areas. If a user does not already have an account, an administrator must first log in and create a new account.

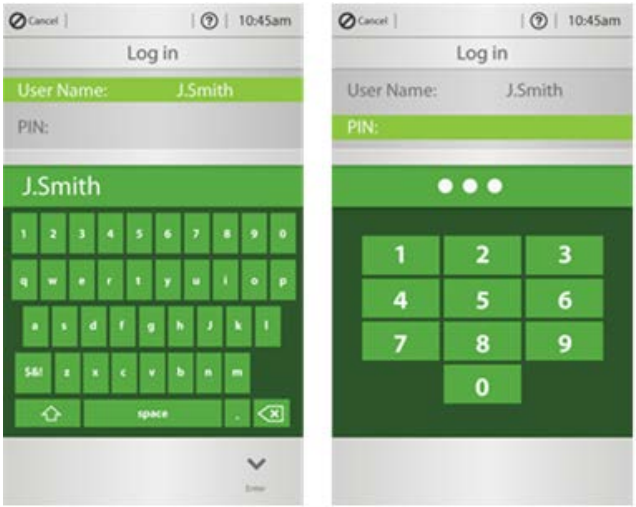


Figure 4-15: General Log-in and PIN

After both the username and password are entered, tap or double-click “log in” to proceed. If either the username or password is incorrect, the user will be returned to the login screen.

	**INFORMATION:** Username-password pairs are unique and should not be shared among users. Keep passwords private to prevent unwanted access or changes to accounts.

4.5.5 Logging Off

A user will be automatically logged out of the workstation if the screen has been idle for the amount of time configured by the administrator. To log off manually, select the user icon at the top-right of the screen. From the available options, tap “log off” to manually log off of the workstation.

4.6 Changing Your Password

From any screen, tap the user icon at the top-right of the screen. From the available options press “Change PIN” to be brought to the screen shown below in Figure 4-16. Enter your current password and new password and save the changes. Once finished, you will be returned to the previous screen.

Figure 4-16: Change PIN screen

If you cannot remember your password, contact the system administrator to change password as described in Section 4.5.2.

4.7 Using the System Window Touch Screen

After starting the workstation, the UI software will automatically launch and begin to initialize. After successful login, the Main Screen will be displayed, giving the user a number of options that depend on user access level. Selecting any option will display a new screen, with the following functionality:

1. New Run (all users)
   Guides a user through loading the workstation for a new experimental run. This includes basic instructions for loading samples into the sample rack and loading on the workstation, reagent pack preparation and loading, tips loading, and closing the door.

	**INFORMATION:** These instructions are intended to supplement the required user training by providing important reminders. These instruction screens will not suffice as a substitute for training.

2. Review (all users)
   Pulls up completed runs that can be reviewed for sample information, consumable item information (i.e., lot number, expiration date), and test results. "Review" mode simply allows users to view past runs; No changes can be made to data or results while reviewing.

   Runs can be sorted by each available column: *Run Date*, *Reagent Pack Lot Number*, etc. Furthermore, users can search for specific runs by a date, date range, user, sample ID, etc.

3. Users (Administrator access only)

   Administrators can view all existing users on the system. Additionally, they can create new users, edit existing users' account settings, set a user's active status, and delete users that have never logged into the system. The logged in Administrator cannot deactivate or delete his/her own account. At least one

Administrator user must exist on the system at all times. To reduce access to the system, it is further suggested no more than two Administrators be assigned.

4. System (Administrator access only)
   Allows Administrators to edit the system's configurable settings, including number of days before password expiration, whether further approval is required for results, setting the export folder location, and setting the troubleshooting package location.

Section 5: Running the Assay

	**CAUTION:** The Rheonix reagent packs and CARDs are designed for single use only. Reuse could cause cross-contamination between samples which can lead to incorrect results.

	**INFORMATION:** The terms run, test, and assay are synonymous and are used interchangeably throughout the operator manual and within the User Interface.

5.1 Assay Instructions

5.1.1 Before running a Rheonix assay, ensure that the Encompass MDx® workstation is clean and that all cleaning residues are removed from the inside and outside of the workstation (see instructions provided in Section 10 of this operator manual).

	The touch screen should only be manipulated while wearing gloves

5.2 Starting the Software

By default the Encompass MDx® workstation's software will automatically start when the workstation is powered on. For typical use cases, there will be no need for operators to launch the software.

There are times that a System Administrator will need to exit the Encompass MDx software to gain access to certain features. Some reasons to exit the User Interface include retrieving trouble shooting packages, retrieving other data, setting up a network/printer, or setting the workstation's date and time.

Start the user interface software by touching anywhere on the “Rheonix Encompass MDx splash screen” (See Figure 5-1).

Figure 5-1: Rheonix Splash screen

The screen will display a loading image while the software starts up. At this time, no selections can be made. After the software is finished starting up, the login screen will be displayed.

Log in: To log in, enter your username and password. If a valid username and password are entered, you will be taken to the Main Screen (Figure 5-2). If not, an error popup will be displayed, and you will be asked to try again.

5.3 Starting a New Run

To begin a new run, select “New Run” from the home screen.

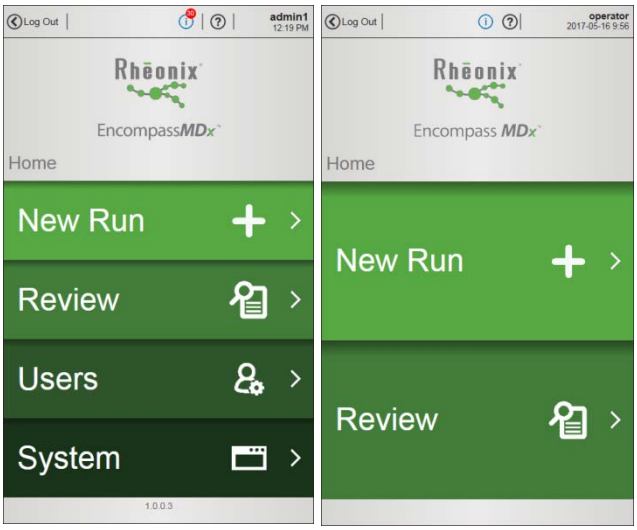


Figure 5-2: User Interface Main Screen (left side displayed with Administrator level logged in, right side displayed with operator or supervisor level logged in)

5.4. Sample Loading

5.4.1 Load up to 24 samples into a decontaminated Encompass MDx Sample Rack. See Section 10 for cleaning instructions.

5.4.1.1. Ensure that the sample tubes are inserted into the rack such that the barcodes are centered in the window and visible to the operator (See Figure 5-3).

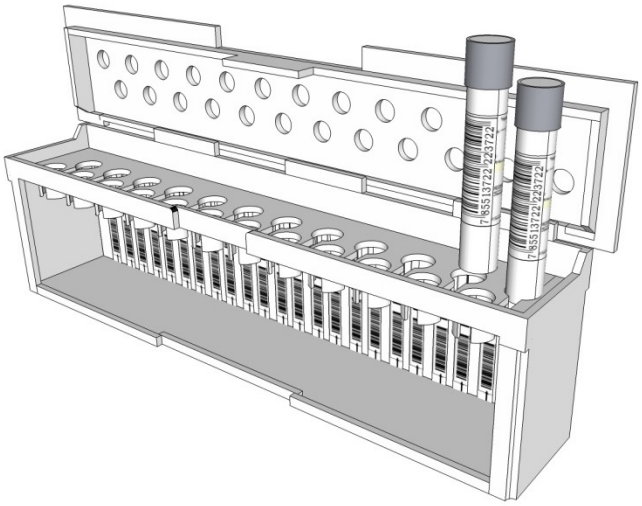


Figure 5-3: LOADING SAMPLES

	**CAUTION:** Sample barcodes should have the following characteristics: • Minimum of 4 characters • Maximum of 24 characters • May consist of only the following characters (no spaces): abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890 • Must be Code 128 • Between 5mm and 10mm in height • Placed at least 15mm below the top of the tube and 10mm above the bottom of the tube • Not be more than 55mm in length

5.4.1.2. Securely close the sample rack lid.

5.4.1.3. Follow instructions that appear on UI (Figure 5-4) reminding operator to change gloves after placing sample rack and before handling consumables.

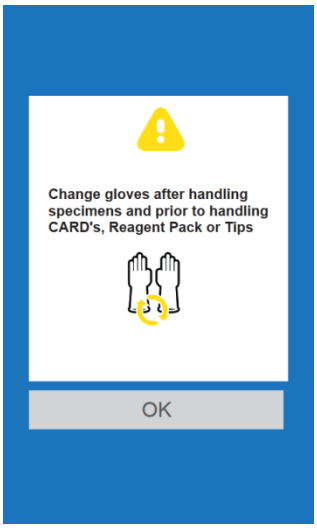


Figure 5-4: Change gloves screen

5.4.2. Change gloves and select “OK”. The Encompass MDx® workstation displays a schematic of the workstation deck (Figure 5-5). Sections of the deck blink amber to prompt the user to load the indicated item.

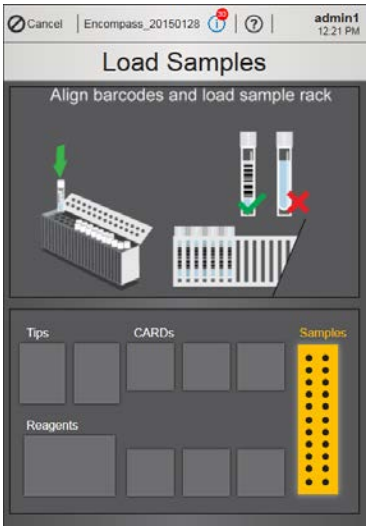


Figure 5-5: UI indicating sample loading

5.4.3. Load the sample rack containing the test samples by inserting the rack into the corresponding position on the workstation deck and pushing down gently. You should hear an audible “click” when the rack is properly seated.

	INFORMATION: The rack is keyed and can only be inserted in one orientation

5.4.4. The Encompass automatically scans the sample barcodes. For specific sample loading instructions for a given assay, refers to Appendix C.

5.4.5. After pressing “confirm,” the UI returns to the Encompass MDx® Workstation deck schematic and prompts you to load six CARDs

	**CAUTION**: Before proceeding to load consumables, change your gloves. Remove and discard current gloves and replace with a clean pair.

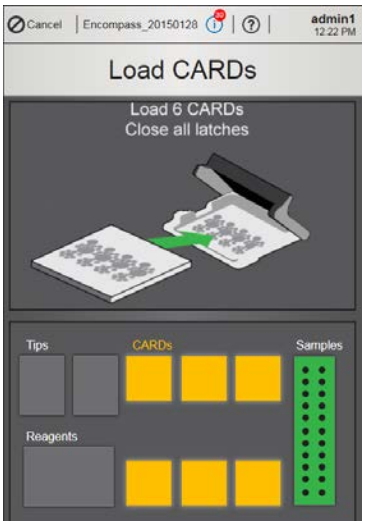


Figure 5-6: Load CARDs Screen

	**WARNING:** Do not reuse previously used CARDs or CARDs that have been damaged or dropped. Using potentially broken CARDs can lead to inaccurate results and can damage the workstation.

5.4.6. Remove CARD Packs from the kit.

5.5 Load CARDs

5.5.1. You need 1 CARD for every 4 samples. You must load 6 CARDs, regardless of how many samples you load.

5.5.2. Carefully unwrap the outer packaging and remove the CARD using your fingers to clasp the CARD on each side near the middle as shown in Figure 5-7.

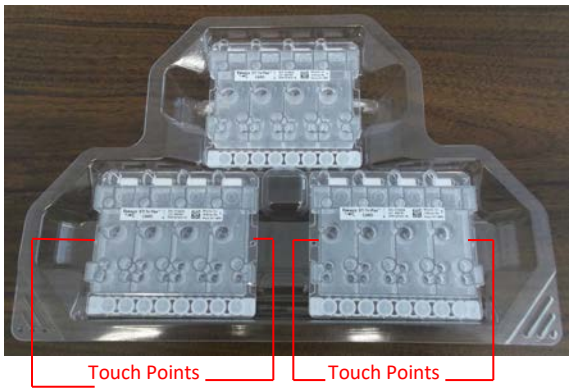


Figure 5-7: Image of CARDs indicating appropriate touch points

5.5.3. Orient the CARD so that the label side is up and the row of small tubes is down and along the front edge.

5.5.4. If the CARD latch is not already open, open it by pushing it toward the back of the workstation slightly and lifting up.

5.5.5. Place the CARD into the open spot so that it lays flat. Make sure the row of small tubes is seated completely inside the designed nest.

5.5.6. As each CARD is loaded close the corresponding latch securely by pressing down and pulling forward slightly.

5.5.7. After the CARD is loaded and its latch is closed, the corresponding deck loading light will turn from blinking amber to green.

5.5.8. When all the CARDs have been loaded successfully, the user interface will prompt the operator to prepare the assay reagent pack by loading Pack B into Pack A (See Figure 5-8).

Figure 5-8: Load Master Mix Screen

⚠	**CAUTION:** CARDs can be removed until the test begins. Once the test has begun, however, CARDs cannot be removed and/or used for another run.
⚠	**CAUTION:** CARDs and reagent pack are single use items and must not be stored and reused for future runs. After completion of a run, each CARD and reagent pack should be removed and disposed of properly.

5.6 Loading Reagent Pack

⚠	**CAUTION:** Do not remove reagent strips from the reagent pack or touch the foil sealant covering the reagent strips.
⚠	**CAUTION:** Discard reagent pack if the pack or package is damaged. Do not use if upon opening any foil sealant is compromised or the reagent strips are not secured in place. Do not use reagent Packs leftover from a previous run.

5.6.1. Prior to opening, mix the reagent pack. With the Tyvek® seal still covering the reagent pack, invert the entire pack three times to mix.

5.6.2. Open both the Reagent Pack (Pack A) and the PCR Mix (Pack B).

5.6.3. Insert Pack B into Pack A, making sure that the plastic notches in Pack B fit securely into Pack A. Use the plastic hinged cover provided as part of Pack A to secure Pack B in place.

Figure 5-93: Pack A

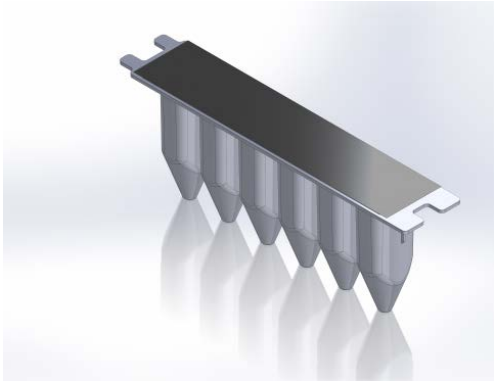


Figure 5-10: Pack B

Figure 5-11: Pack A with Pack B inserted

⚠	**WARNING:** Refer to Appendix C for specific assay instructions regarding the handling and use of PCR Mix Pack B.

5.6.4. Select "OK" to return to the deck schematic. Load the reagent pack (now consisting of the fully assembled Pack A and Pack B) as indicated by the blinking amber area on the workstation deck as well as the UI.

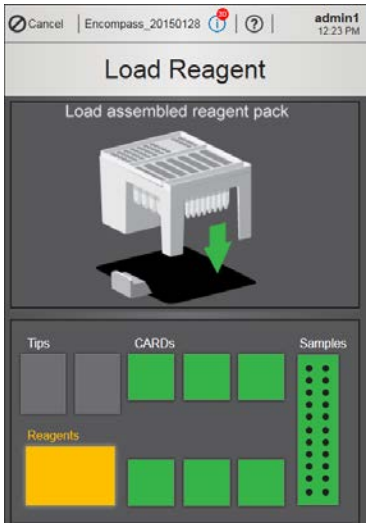


Figure 5-12: User Interface indicating reagent pack loading step

5.6.5. Firmly press down on all four corners of reagent pack to ensure the back of the pack is properly seated. The latch on the workstation deck will click, signaling that the reagent pack is securely in place. Successful loading is indicated when the blinking amber area turns solid green. If you need to remove the reagent pack, slide the black clip towards the front of the deck and lift the reagent pack out of the deck. The screen will *not* return to the reagent pack screen, but the indicator will turn back to blinking amber. To reload the reagent pack, place the reagent pack back into the deck and push until the clip clicks and the blinking amber light turns green again.

⚠	Reagent packs can be removed until the test begins. Once the test has begun, however, reagent kits cannot be removed and/or used for another run

5.7 Tip Loading

5.7.1. The UI prompts tip tub loading by displaying a blinking amber color at the corresponding locations of the deck schematic.

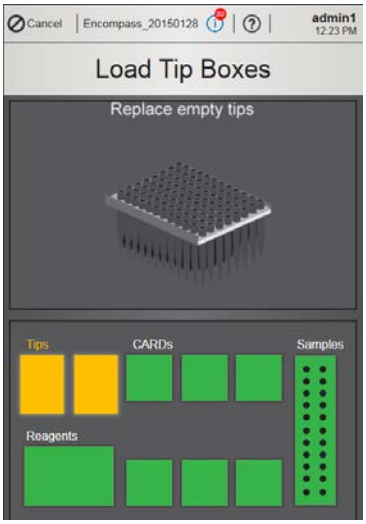


Figure 5-13: User Interface indicating tip loading step

5.7.2. Remove tips from Axygen packaging and load into the Rheonix tip containers that were provided with the workstation.

5.7.2.1. Alignment features of the tip container are keyed to allow tips to be set into place in the proper orientation (See Figure 5-14).

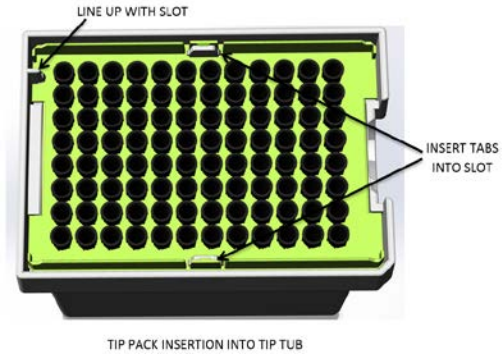


Figure 5-14: Tip rack aligned and inserted into tip container

5.7.3. Load tip tub with Axygen tips already in place into the workstation deck.

	INFORMATION: Ensure that both tip tubs are loaded onto the workstation deck with at least one tip container full before continuing.

5.8 Closing the door and Pre-Run Diagnostics

5.8.1. After successful loading of all consumables on the workstation deck, the UI displays a prompt to close the door of the Encompass MDx® workstation.

5.8.2. Close the workstation door. The door locks automatically, which initiates the Pre-Run Check. The UI displays the following image:

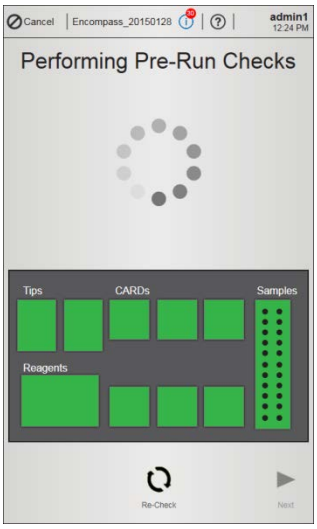


Figure 5-15: User Interface display during Pre-Run Check

5.8.3. The UI displays the results of the Pre-run Check as “Successful” or “Failed.”

Figure 5-16: User Interface display following successful Pre-Run Check

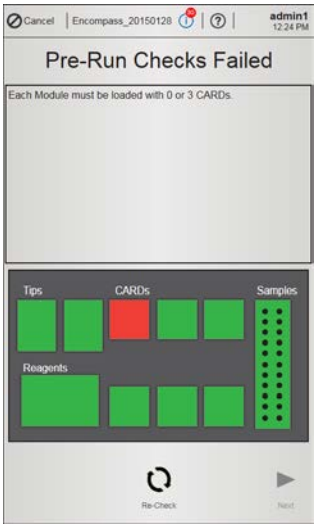


Figure 5-17: User Interface display following failed Pre-Run Check

5.8.4. If Successful, continue to Step 5.9

5.8.5. If Failed, open the workstation door, reload the consumables indicated in red as displayed on the UI schematic and repeat the Pre-run Check until the Successful message is displayed, then continue.

- In the example in Figure 5-17, only 5 CARDs were loaded which triggered an error as 6 CARDs need to be loaded.

5.9. Run Start

5.9.1 Touch “Next” on the “Pre-Run Checks Successful” screen to advance to the “Run Monitor” screen.

Figure 5-18: UI ready to start run

5.9.2. Touch "Start" on the "Run Monitor" screen to start the assay. Once "Start" is selected, the "Run Monitor" screen displays the time remaining until assay completion.

Figure 5-19: UI displaying Run Monitor screen after pressing start

⚠	**CAUTION:** Door should not be opened while run is in progress.

5.10 Run Complete

When the test is complete, the UI displays the "Test Complete" screen (See Figure 5-20). The numbers displayed will total the number of samples included in the run that completed. If tests

on the same sample have multiple results, it will be summed with the following priority: Error first, Indeterminate second, Positive third and Negative only if no other condition applies

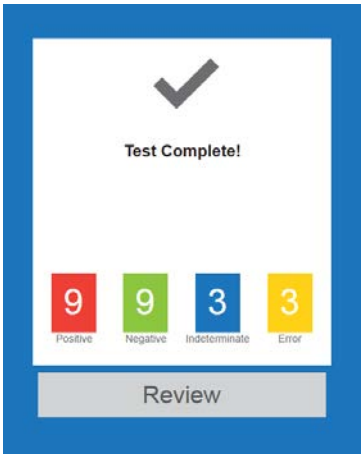


Figure 5-20: UI displaying typical Test Complete screen at completion of run

5.11 Run Review

5.11.1. See Appendix C for Run Results regarding specific Rheonix Assays.

5.12 Unloading consumables

5.12.1. Once the operator is finished reviewing the results of a given run, the operator can press back in the upper left corner and the UI will prompt to unload the workstation deck.

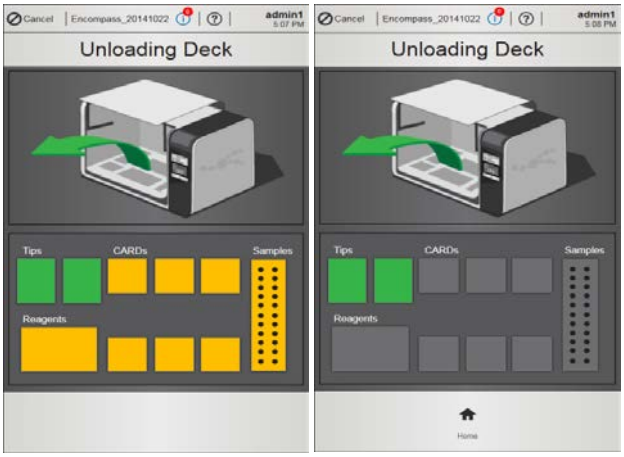


Figure 5-21 and 22: UI displaying Unloading Deck screen as consumables are removed

5.12.2. Unload the deck by removing all samples and used consumables. Dispose of the consumables into properly-labeled biohazard trash receptacles; process trash in accordance with all institutional practices and local, state, and federal regulations.

	**INFORMATION:** Tip containers do not need to be removed at the completion of a run unless all tips from a tip container have been used.
	**CAUTION:** Always wear fresh gloves to begin sample unloading. Make sure to change gloves once samples have been unloaded to minimize the potential for contaminating a future run and for operator safety.
	**CAUTION:** The workstation should be cleaned after completing a run (See section 10.2 for specific details on cleaning). Failure to clean the workstation can cause erroneous results in subsequent runs.

5.13 Generating Test Result Reports

	**INFORMATION:** Results, sample IDs, and other deck item information cannot be edited once the run has started. Notes, up to 40 characters, will be displayed on the report printout if previously entered during sample loading steps.

The test results report is automatically generated when the results screen is displayed. Results can be exported or printed.

5.14 Exporting the Test Results

On the results screen there is an option to “Export Result.” Clicking this will display a print preview version of the results screen and “Export” and “Print” options. By selecting “Export,” you can save your results to a USB drive or to a location on the network. Choosing “Print” will print a hardcopy to a connected printer or the network default printer. Additionally, the results are automatically saved and the file will be available until it is manually purged by a user with the appropriate privileges (see Section 5.15.1 Purge).

5.15 Performing Database Maintenance Tasks

The Administrator is responsible for managing the data which entails backing up the data, purging, and in some cases restoring data. To access these features, log in as Administrator and proceed to the Main Screen (Figure 5-23). Press "System" which will bring up the System Actions screen (Figure 5-24). Next, press "Maintenance" which will display a screen (Figure 5-25) with the following options:

- Purge
- Backup
- Restore
- Support

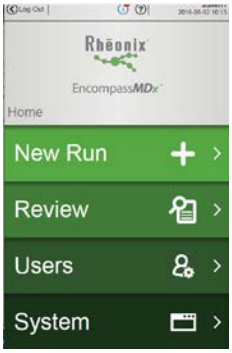


Figure 5-23: Main Screen

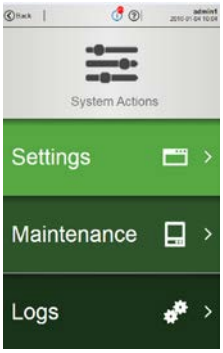


Figure 5-24: System Actions Screen

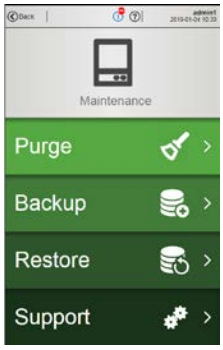


Figure 5-25: Maintenance Screen

5.15.1. Purge

Data generated from tests run by the Encompass MDx® workstation are stored locally. There is a finite amount of data that can be stored on the workstation and therefore it is recommended that data be purged periodically.

	INFORMATION: Prior to purging data, it should always be backed up. See Section 5.15.2 for further details regarding backup of data.

When logged in as Administrator, proceed to the "Maintenance" screen as shown in Figure 5-25 and press the "Purge" button.

- A screen as shown in Figure 5-26 will be displayed.
- A dropdown menu will appear from which the user will need to select a timeframe for data that should be purged as shown in Figure 5-27. 30 day increments up to 180 days can be selected.

- Once the appropriate timeframe has been selected, press the green "Purge" button. A screen as shown in Figure 5-28 will appear asking the user to confirm that a Purge should take place. The screen also reminds the user that before proceeding, backup of data is recommended.
- Pressing "OK" will purge the data and the screen displayed in Figure 5-29 will appear indicating to the user that the purge took place successfully.

Figure 5-26: Purge Screen

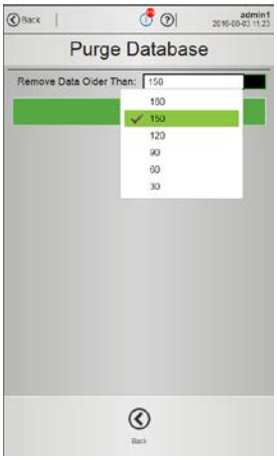


Figure 5-27: Purge timeframe selection screen

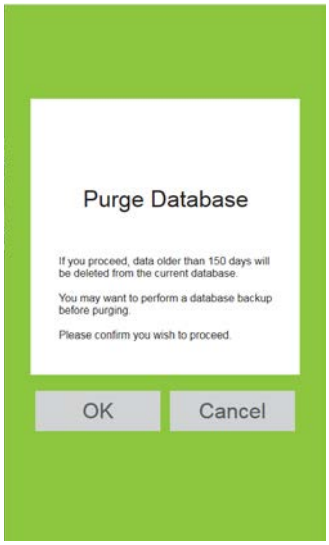


Figure 5-28: Purge Confirmation Screen

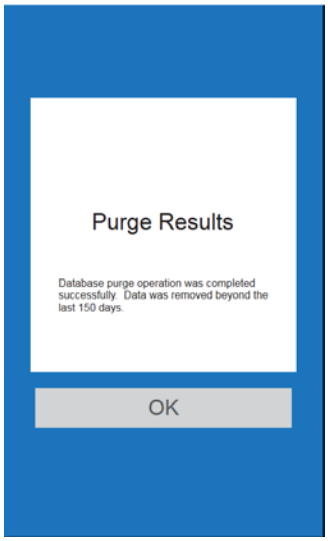


Figure 5-29: Purge completion screen

5.15.2. Backup

Data generated from tests run by the Encompass MDx® workstation are stored locally. It is recommended that data be backed up periodically to a network or external hard drive. This is needed if an error occurs on the workstation that corrupts data and data needs to be restored from a previous point in time as well as to secure data before purging.

When logged in as Administrator, proceed to the "Maintenance" screen as shown in Figure 5-25 and press the "Backup" button.

- A screen as shown in Figure 5-30 will be displayed.
- Pressing the green "Backup" button will bring up the "Save File As" window where the storage location can be selected (Figure 5-31). This is currently set to match the export file location that was defined previously in Section 3.4.1.5.
    - If this location is not appropriate, press cancel and back out to the System Actions screen (Figure 5-24) and follow the steps in Section 3.4.1 to change location.
- Once the save location has been selected, press "Save."
- A screen confirming successful back up took place will appear (Figure 5-32).

Figure 5-30: Database Backup Screen

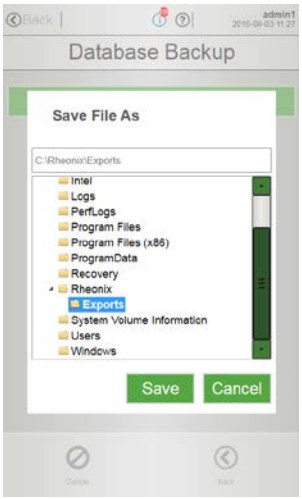


Figure 5-31: Backup Location Screen

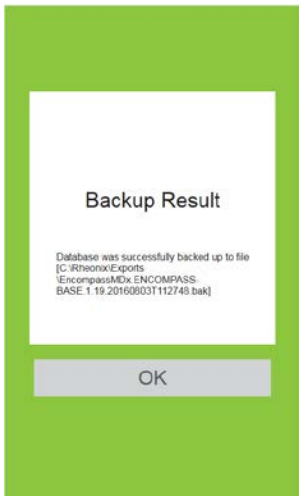


Figure 5-32: Backup Completion Screen

5.15.3. Restore

On occasion, data may need to be restored onto the Encompass MDx® workstation. This may be due to an error that corrupts the data and the ability for the workstation to function properly or because data was inadvertently deleted.

When logged in as Administrator, proceed to the "Maintenance" screen as shown in Figure 5-25 and press the "Restore" button.

- A screen as shown in Figure 5-33 will be displayed.
- Pressing the green "Restore" button will bring up the "Select Database Backup File" window where the backup file can be selected (Figure 5-34). All previous backup files will appear in this window.
- Once the backup file has been selected, press "Select". A screen asking the user to confirm that the software should proceed with a database restore will appear (Figure 5-35). Press "Ok" to restore the backup file that was selected.

Figure 5-33: Database Restore Screen

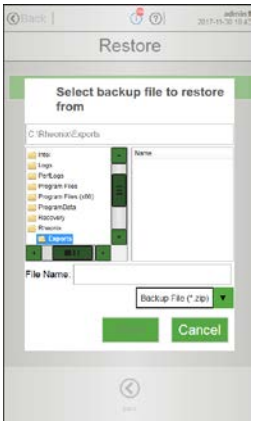


Figure 5-34: File Selection Screen

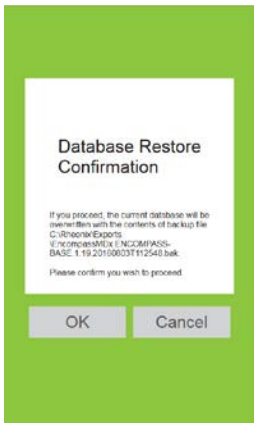


Figure 5-35: Restore Confirmation Screen

5.15.4. Support

The workstation has the capability to create a Troubleshooting Package that consists of information pertinent to a run or series of runs that Rheonix Customer Service can use to aid in diagnosing issues that arise.

When logged in as Administrator, proceed to the “Maintenance” screen as shown in Figure 5-25 and press the “Support” button.

- A screen as shown in 5-36 will be displayed.
- Pressing the green “Create Troubleshoot Pkg” button will bring up the “Select Directory” window where the location of the Troubleshooting Package will be saved (Figure 5-37). The location that was selected in Section 3.1.4.5 is used by default. Select “OK” to choose the folder.
- This brings up the “Capture Range” screen as displayed in Figure 5-38 where the user can select the data range – either the last 24hrs, 1 week, or a custom start date. Inclusion of a screen shot of the error is selected by default. Once the appropriate selection has been made, Press the “Gather Logs” button.
    - If screen shot was selected, a dialog box will appear asking the user to select the specific error (as displayed in Figure 5-39). The user will need to select the “!” at the top of the screen with the red number that is circled in red in Figure 5-39.
    - This will bring up the “Active System Errors” Screen.
    - Selecting the particular error in question with bring up the “Critical Error” screen as shown in Figure 5-41.
    - Once the error is displayed, press “Ok” on the Confirmation dialog box.
- Once that is confirmed, the data will be gathered and the workstation will indicate that it is working through that process, which could take several minutes depending on how many runs worth of data are in the selected range.

- When the data is collected, a final dialog box will appear saying "Log Compilation Complete" (as shown in Figure 5-42).

	INFORMATION: Troubleshooting packages can also be created if logged in as an Operator or Supervisor by pressing following the steps indicated in 11.2.1.

Figure 5-36: Create Troubleshoot Package Screen

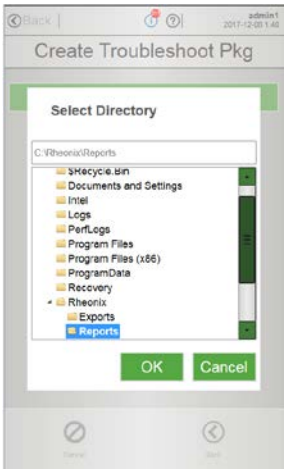


Figure 5-37: Directory Selection Screen

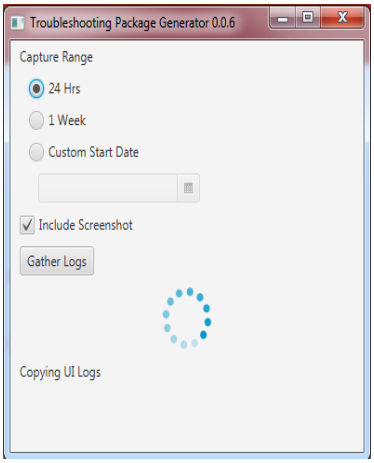


Figure 5-38: Capture Range Screen

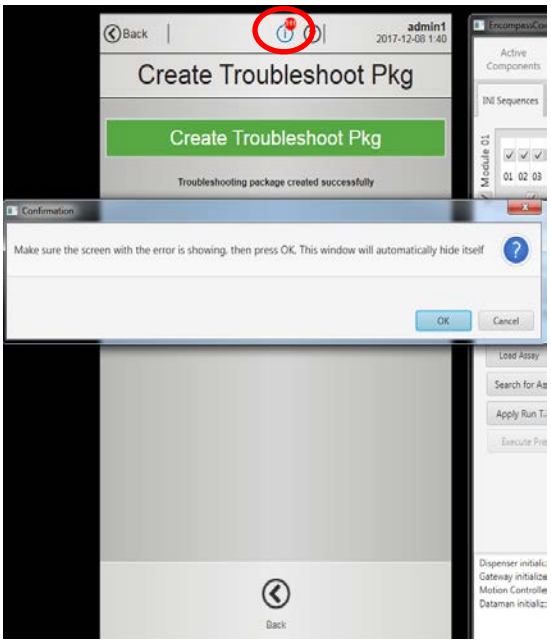


Figure 5-39: Confirmation Dialog Box Screen

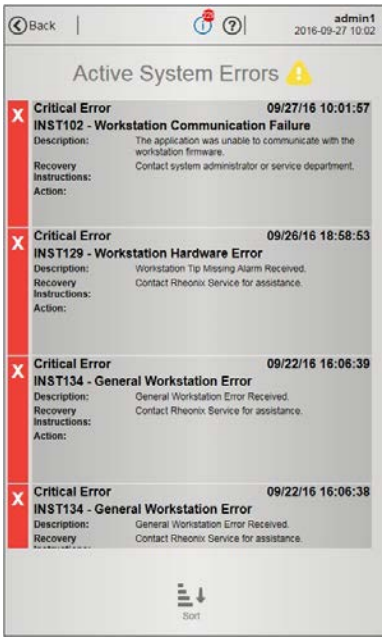


Figure 5-40: Active System Errors Screen

Figure 5-41: Critical Error Screen

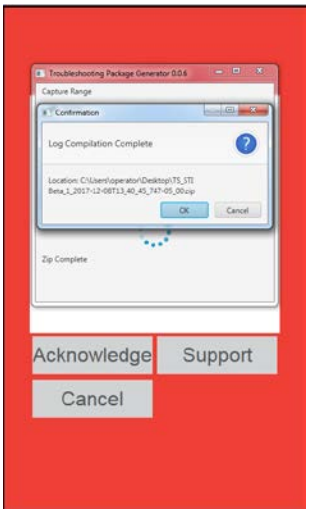


Figure 5-42: Compilation Complete Screen

5.16 Viewing and Printing Previous Run Results

The Encompass MDx® workstation has the ability to display data from a previous run that took place.

As an operator, supervisor, or administrator, log in and navigate to the home screen as shown in Figure 5-43. Press the "Review" button. A screen, as displayed in Figure 5-44, will appear. The user will have options to search data based on lot information, run date, etc. by pressing the "Search" button in the bottom left corner. Once a run is selected, the results will be displayed in similar fashion to how the results are displayed upon completion of a run (See Figure 5-45). On this screen, the user will have all the same actions available: Print or Export. When finished reviewing data, simply back out to the main screen using the back button in the upper left corner.

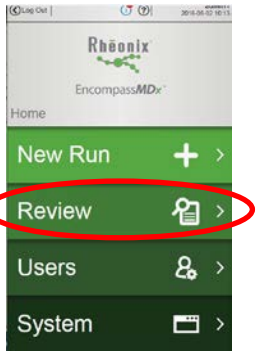


Figure 5-43: Main screen (when logged in as Administrator)

Figure 5-44: Completed runs screen

Figure 5-45: Run Results

	INFORMATION: Review of previously completed run data from last point of data purge/restore can take place without interrupting an on-going run.

5.17 Audit Log

The administrator has access to the audit log for the Encompass MDx® workstation. This feature tracks all changes to the system and may aid in troubleshooting errors that arise or to understand what has changed to the workstation since a given date or from a specific user account. To access this feature, log in as an Administrator and proceed to the Main Screen (Figure 5-46). Press "System" which will bring up the System Actions screen (Figure 5-47). Next, press "Logs", which will display a screen as shown in Figure 5-48. The audit log can be filtered by date or by user account using the fields at the bottom of the screen and "Applying Filter."

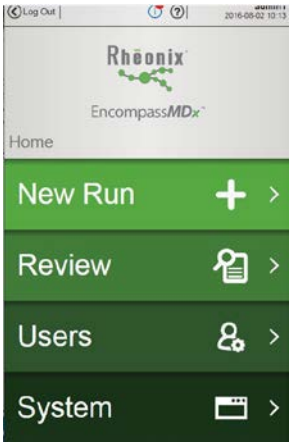


Figure 5-46: Main Screen

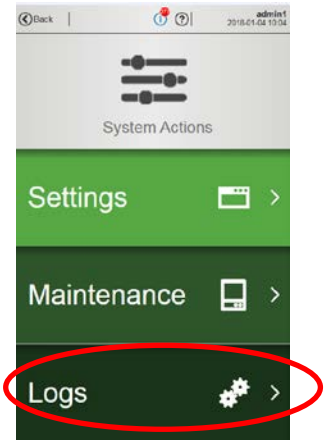


Figure 5-47: System Actions Screen

Figure 5-48: Audit Log Screen

	INFORMATION: The audit log should be reviewed periodically for suspicious activity.

5.18 Exiting the Software

	INFORMATION: The following instructions are only applicable for System Administrators.

5.18.1. After logging into the Encompass MDx® software with an administrator account, tap the username displayed in the top-right corner of the Home Screen, as indicated in Figure 5-49.

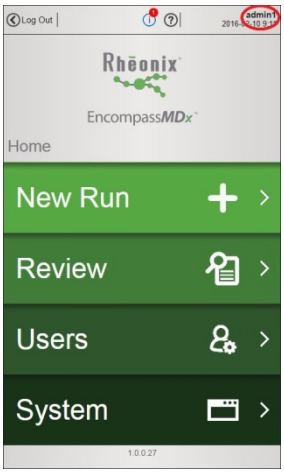


Figure 5-49: Press the username to bring up the Action Menu

5.18.2. This will bring up a menu with available actions, including “Exit App,” shown in Figure 5-55.

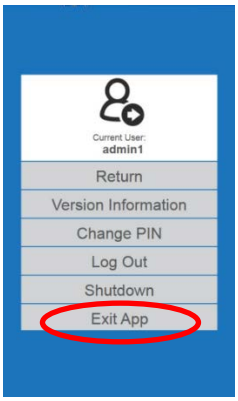


Figure 5-50: Action Menu with “Exit App” highlighted

5.19 Restarting the Software

NOTE: The following instructions are only applicable for System Administrators.

5.19.1. If exited from the UI, tap the “Kiosk Mode” button on the Shell Toolbar (Figure 5-51) to restart the the EncompassMDx® UI software.

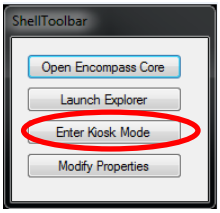


Figure 5-51: Shell Toolbar

5.19.2. If the UI will not restart, shut down the computer and restart the workstation, following the instructions found in Section 4.3.

Section 6 Principles of Operation

6.1 Encompass MDx® Workstation

The Encompass MDx® workstation (Figure 6-1) is a software-controlled, robotic workstation that automatically introduces all patient samples as well as all reagents required to perform Rheonix assays. Disposable injection-molded, polystyrene CARD® cartridges, each one capable of analyzing four individual patient or control samples, are placed onto the manifold deck of the workstation. Six disposable CARDs can be loaded into the workstation, providing a means to analyze up to 24 individual samples.

Figure 6-1: Rheonix Encompass MDx® workstation

Briefly described, the patient samples are loaded into the sample rack housed within the workstation and the system's optical barcode reader accesses barcode data and enters it into the workstation's software. Alternatively, barcode information can be manually input through the integrated touch screen computer. Once a run is initiated by the user, the system's robotic arm uses a fresh pipette tip to pierce the top of each patient sample tube and introduces an aliquot to one lane of one of the disposable CARDs. A disposable reagent pack containing all necessary reagents is also loaded into the workstation and as needed, the workstation's robotic arm also picks up fresh pipette tips and delivers the required assay reagents to the various ports on the disposable CARD cartridges. Pneumatic signals controlled by the workstation's software activate the various pumps and valves located within the disposable CARD to bring about fluidic movement through the various chambers. At the completion of the run, a CMOS camera mounted on the same robotic arm that previously delivered the patient samples and required

reagents moves across the workstation's deck to capture images of each of the four low density arrays located on each CARD, thus enabling the system's software to determine the presence or absence of each target. All residual liquids are contained within the consumables and discarded as biohazard, thus optimizing work flow and preventing contamination to the next run.

6.2 Rheonix CARD® Cartridges

Each disposable Rheonix CARD® cartridge, when placed into the Rheonix Encompass MDx® workstation, simultaneously analyzes up to four separate samples (Figure 6-2). Briefly described, all steps, including the introduction of the untreated "raw" clinical sample, are automatically performed on the CARD by the software-controlled workstation. Once the clinical samples are introduced by the workstation, cells are lysed and either DNA or RNA is extracted, magnetically purified, and delivered to PCR thermal cycling chambers. Each sample lane has two separate PCR chambers into which equal amounts ofnucleic acid are metered. The Rheonix Encompass MDx® workstation can process 6 CARDs per run, thereby allowing the simultaneous analysis of up to 24 clinical samples. All reagents necessary to perform the assay are included in the reagent pack.

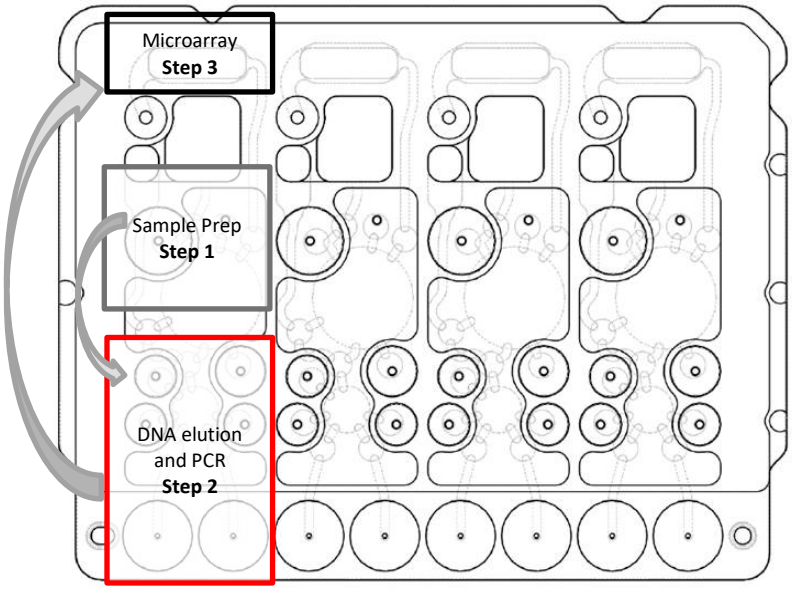


Figure 6-2: Sample flow through a CARD

6.3 Reagent Pack

All reagents necessary to perform the assay are included in a room temperature-stable, disposable reagent pack (Figure 6-3). The reagent pack consists of two components: 1) a reagent brick containing all liquid reagents, 200 µl pipette tips used for reagent distribution (in certain assays), and a pipette tip waste area ("Pack A Reagent Pack") and 2) a Master Mix PCR reagent strip ("Pack B PCR Mix"). Reagent Pack A is Tyvek sealed and should be inverted three times to mix prior to use. Once mixed, the user will be prompted to insert the master mix PCR strip into the designated keyed area on the reagent brick and close the hinged cover so the barcode will be exposed. This complete reagent pack is then inserted into the designated area on the workstation deck. The user will also be required to insert two separate 1000 µl pipette tip racks, which are available separately from the assay kit. The presence of the complete reagent pack (label visible on the hinged cover) and the two tip racks will be automatically detected by the workstation to ensure reagent loading during pre-run diagnostics, prior to the run taking place.

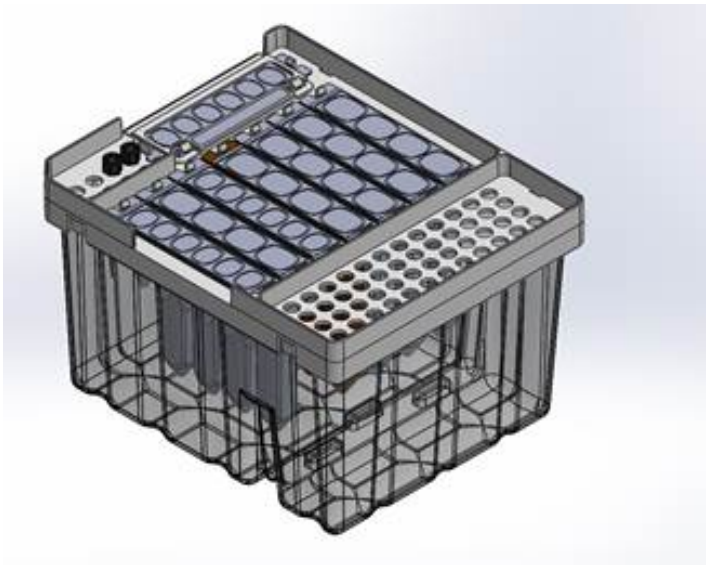


Figure 6-3: A typical Rheonix Reagent Pack A, with Reagent pack B loaded.

6.4 Heating and Cooling Mechanisms

Heating and cooling is required to facilitate lysis, PCR, and hybridization. There are two heaters for each CARD location which provides the necessary temperatures for these processes. The sample heater is the black rectangular plate located under the top portion of the CARD. The PCR heater is contained within the manifold assembly and has cup-like features that interface with the PCR tubes on the CARD cartridge. Both heaters are cooled by small blowers underneath the

workstation deck which pass ambient air across the heaters. It is for this reason that the laboratories' ambient temperature must be within the specified range for proper functionality.

6.5 Optical System

The end-effector of the Encompass MDx® workstation includes a camera system and light source. This system serves two primary functions. It is used to read all CARD and reagent pack barcodes at the beginning of a run to make sure the consumables are correct for the test being run as well as that no consumables are past their expiration date. The system is also used to image the low density array after hybridization to detect the presence and absence of spots. Analysis of the image occurs onboard the camera and the result is then communicated to the user though the users interface and run results report.

6.6 Software

6.6.1 Software Overview

The Encompass MDx® workstation software is composed of two main elements: the Encompass MDx User Interface (UI) and the integration software, EncompassCore. The UI and EncompassCore communicate in order to carry out workstation functions including starting a new run, executing the run, and unloading the deck after a run. The typical user will only need to interact with the user interface

Both the Encompass MDx UI and EncompassCore are launched at startup. While the Encompass MDx UI is running, EncompassCore is hidden and cannot be accessed. To start using UI features, log in, and select an item from the main menu, shown in Figure 6-4.

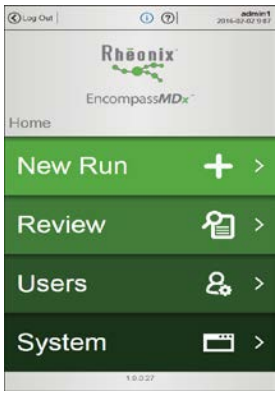


Figure 6-4: Software UI Main Menu Screen
(when logged in as Administrator)

6.6.2 Software Versions

When contacting Rheonix Customer Service, it may be useful to know the versions of software/firmware that are currently installed on the Encompass MDx® workstation. This information can be located by pressing on the username in the upper right corner of the screen (See figure 6-5). A screen will be displayed as shown in Figure 6-6. Pressing on "Version Information" will bring up a window that shows the various software/firmware version that are currently installed on the Encompass MDx® workstation as shown in Figure 6-7.

	**INFORMATION:** Operator, Supervisor, and Administrator have access to view Version Information on the User Action screen.

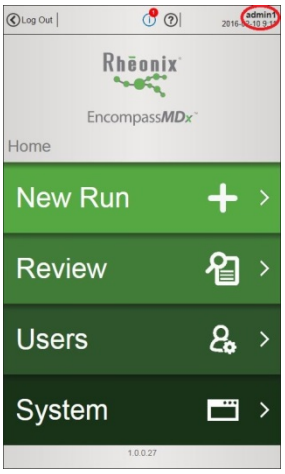


Figure 6-5: Main Menu screen (as Administrator) indicating Screen where to press for user action screen

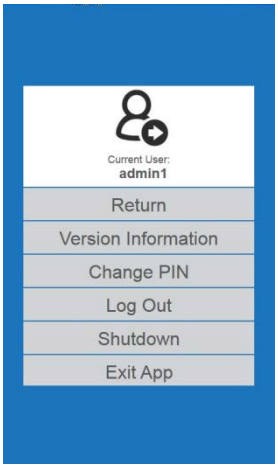


Figure 6-6: User action screen

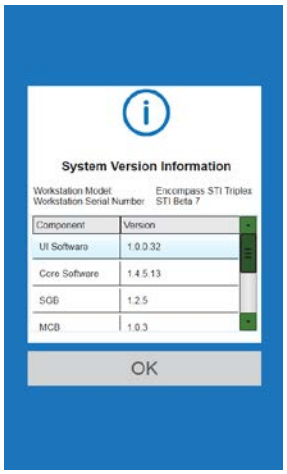


Figure 6-7: Version Information

Section 7 Qualification and Quality Control

7.1 Qualification

7.1.1 The Encompass MDx® workstation comes pre-qualified and ready for use. Liquid handling, heating, pressure, and imaging systems are tested during the manufacturing process. Upon installation, Rheonix technical service personnel will align the workstation and confirm functionality.

7.2 Quality Control

7.2.1 Prior to the start of every run, the workstation goes through a series of checks called Pre-Run Diagnostics. This ensures that the workstation has not been significantly mis-aligned, the heaters are performing as expected, all consumables are within shelf life and appropriate for the assay, and there are no pressure/vacuum leaks.

7.2.2 The assays used with the Encompass MDx® workstation have been designed to utilize internal controls that will indicate if other workstation related issues occur such as dispensing, heating, or pumping errors that could negatively impact the results; therefore, the use of external controls is optional at the user's discretion. If the internal controls fail, the assay is considered invalid and no results are generated.

Section 8 Workstation Specifications

8.1 Workstation Technical Specifications

POWER/ELECTRICAL	
Rated Voltage	100-240V~
Rated Frequency	50 to 60 Hz
Fuse	5A, 250 V Fast-acting
Average Max Power Requirement	138 W
I/O Ports	Back of Workstation: HDMI, Serial Port, Ethernet, 2 USB
	Right side of Workstation: USB
MECHANICAL	
Width	100 cm / 39.4”
Depth*	62.5 cm/ 24.6”
Height*	69.7 cm/ 27.4”
Mass	107 kg / 235 lb
ENVIRONMENTAL CONDITIONS - OPERATION	
Temperature	18° C-30° C / 64° F-86º F
Humidity	20 to 85% non-condensing
Altitude	1600 m maximum
ENVIRONMENTAL CONDITIONS – STORAGE AND TRANSPORT	
Temperature	18 to 30 °C
Humidity	20 to 85% non-condensing
Idle state (recommended)	CARD holder latches are latched and workstation door is closed.
SOUND PRESSURE	
Audible sound pressure range:	< 85 dB (reference level 20 µPa)
Network and Cyber Security	Security must be user provided according to institutional procedures and practices. Intrusion or virus protection is not provided on the system. Connection to the internet is strongly discouraged.
Sample Barcode Labels	Code 128, alpha-numeric characters (no spaces), 24 max characters, 4 characters min
Ingress Protection	IP20
Impact Rating	IK08
CYBERSECURITY	
Security Software	Windows Defender

* Measurements taken with door closed.

Section 9 Safety Hazards

9.1 General Safety Precautions

Before you start to use the Encompass MDx® workstation, make sure you read this operator manual entirely and are familiar with the safety information. Making adjustments, or performing procedures other than those specified in this manual can result in exposure to hazards that can cause injury to personnel, damage to the system, or void the warranty.

9.2 Moving the Workstation

Because of the workstation's weight (see Weight in Section 8.1), do not attempt to lift the workstation without proper safety training and assistance.

	**WARNING**: Lifting or moving the workstation without proper training and assistance can cause personal injury, damage the workstation, and void your warranty.

9.3 Safety Labels on the Workstation

The Encompass MDx® workstation is labeled to notify the user of high voltage inside the back panel. There are no user serviceable items inside the back panel and accessing these by inadequately trained personnel could result in a hazard. If service is required, contact Rheonix customer service.

Figure 9-1: Voltage warning label

The Encompass MDx® workstation is labeled to indicate that it should never be lifted by a single person due to its weight. Moving the workstation can also cause misalignment, which can negatively impact the results generated by the workstation. If the workstation requires moving, at least two people should lift from the bottom of the workstation, on opposite sides, where the feet are located. If additional people are not available, a jack can be used that is rated to support the weight of the workstation. Contact Rheonix Customer Service if further assistance is needed.

Figure 9-2: Lift Hazard Warning

Alcohol can severely damage the workstation. The Encompass MDx® workstation is labeled to warn the user against using alcohol to clean the workstation.

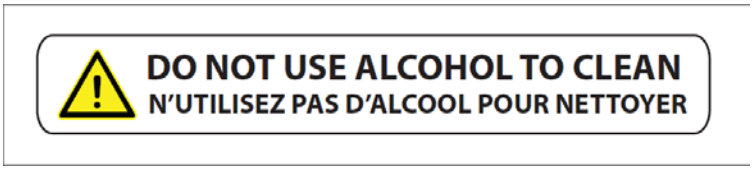


Figure 9-3: Alcohol warning label

The Encomass MDx® workstation is capable of heating from 0 to 115 °C, exclusive. While heating is taking place, the workstation door should always be closed and locked for safety reasons. Before unlocking the door, the workstation will cool the heaters to an acceptable level. The heater plates under each CARD location are denoted with "Hot Surface" indications as a precaution, although there are other safety features designed into the workstation to ensure heaters are always safe for the operator to touch.

Figure 9-4: Hot Surface Warning

All samples and used consumables should be treated as biohazardous waste. The Encompass MDx® workstation is labeled to remind the operator of this.

Figure 9-5: Biohazard Label

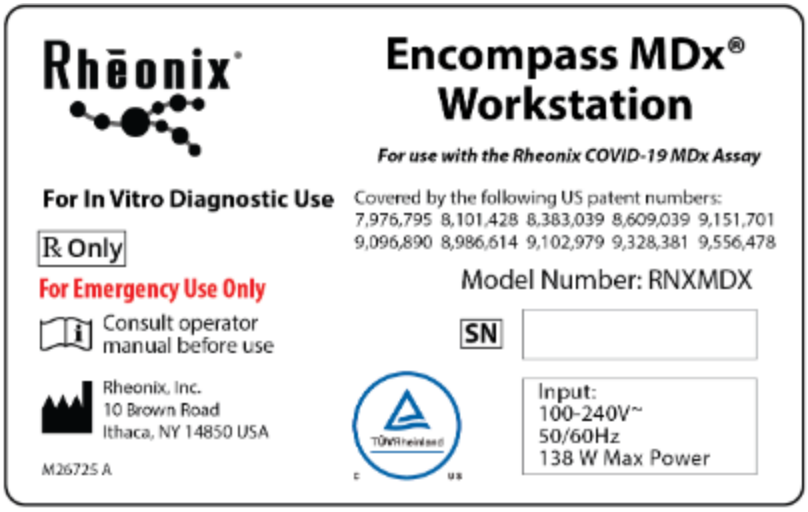


Figure 9-6: Workstation identification label

Label Symbology

	Caution
	Caution: High Voltage
	Lifting Hazard
	Hot Surface
	Biohazard
	Manufacturer
	Consult user manual
V~	A/C Voltage
	cTUVus Mark

9.4 Electrical Safety

	**WARNING:** Do not attempt to open or remove the workstation covers. Doing so can expose you to electrical hazards and cause injuries.

The Encompass MDx® workstation enclosure is designed to protect the operator from electrical shock hazards. Under normal operating conditions, operators are protected from electrical shock hazards.

9.5 Mechanical Safety

The Encompass MDx® workstation is designed to prevent access to any moving parts. The run will not start until the door is closed and locked. Access is restricted while the run is in progress and the door will not unlock until the run has stopped and the workstation is safe to open. However, when opening/closing the door, caution should be used as the potential for pinching is present.

9.6 Chemical Safety

Follow standard laboratory safety procedures for working with chemicals.

- Consult your institution's environmental waste personnel on proper disposal of used cartridges and unused reagents. This material may exhibit characteristics of federal EPA Resource Conservation and Recovery Act (RCRA) hazardous waste requiring specific disposal requirements. Check state and local regulations as they may differ from federal disposal regulations. Institutions outside the USA should check their country hazardous waste disposal requirements.

- Safety Data Sheets (SDS) for the reagent pack used within this system are available upon request from Rheonix Customer Service.

9.7 Biological Hazard Safety

Treat all biological samples, including used Rheonix CARD® cartridges, as capable of transmitting infectious agents. Because it is often impossible to know what might be infectious, all biological samples should be treated with universal precautions. Guidelines for sample handling are available from the U.S. Centers for Disease Control and Prevention and the Clinical Laboratory Standards Institute (formerly National Committee for Clinical Laboratory Standards).

9.8 Environmental Data

- Recyclability of packaging materials: many of the shipping packaging components can be recycled.

Section 10 Service and Maintenance

10.1 Maintenance Tasks

Although the system is designed to prevent cross-contamination and ensure accurate results, the workstation should be cleaned after each use as a precautionary measure.

⚠	**CAUTION:** Alcohol can severely damage the workstation. The Encompass MDx® workstation is labeled to warn the user against using alcohol to clean the workstation.

10.2 Cleaning and Disinfecting the Workstation Surfaces

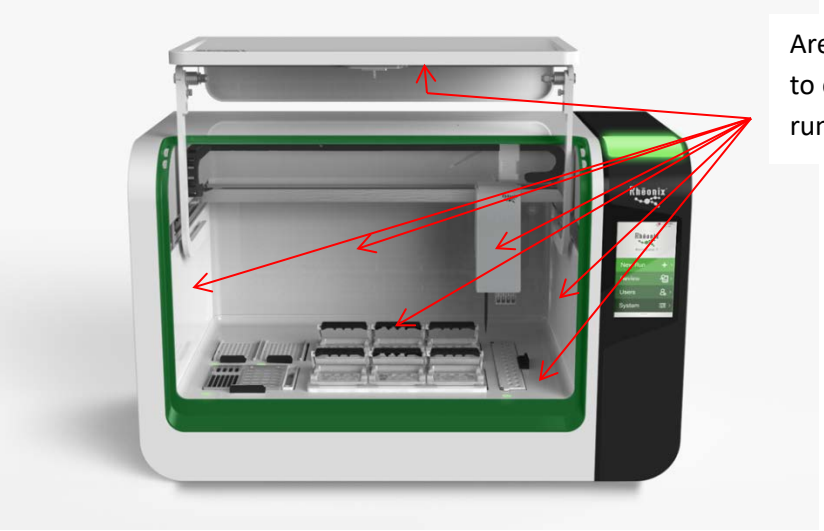


Figure 10-1: Workstation locations that require cleaning after each run

You must clean and disinfect the internal workstation surfaces and module latches (See figure 10-1) after each run.

Materials Required:
- 10% bleach (prepared within 1 week)
- Deionized (DI) Water
- Lint-free cloth
- Latex or nitrile gloves
- Eye protection

	**WARNING:** Wear gloves and eye protection for the cleaning procedure. Wearing gloves and eye protection helps prevent exposure to chemical and biologically hazardous samples.

To clean the workstation surfaces and module latches:

	**CAUTION:** Do not spray diluted bleach directly on the Encompass MDx® workstation. Wet down a lint free cloth and wipe the surfaces.

	**CAUTION:** Care should be taken when cleaning the latches, as the "fingers" of the latches tend to tear the lint-free cloths. Make sure no pieces of the cloth are left behind as this could negatively impact performance for the next run.

1. Dampen a lint-free cloth with a 10% bleach solution.
2. Wipe the workstation inner surfaces and module latches thoroughly with the lint-free cloth and let stand for 2-3 minutes.
3. Dampen a lint-free cloth with DI water.
4. Wipe the workstation inner surfaces and module latches thoroughly with the lint-free cloth.
5. Let workstation air dry.
6. Dispose of the used cloths according to your standard laboratory procedure.

Note: The same cleaning techniques can be used to clean the sample rack tray, the reagent pack tray, and the tip rack trays on the inside of the workstation should these areas require cleaning. The touch screen on the outside of the workstation as well the outer surfaces of the workstation do not require cleaning after every run and should be cleaned on an as needed basis.

	**CAUTION:** Do not spray diluted bleach on any puddles or pools of liquid that may be observed as that liquid could contain Guanidine Hydrochloride, which could react with the bleach producing harmful gases. Instead, a cloth wetted with DI water should be used first to wipe up the liquid. Then follow typical cleaning instructions.

	**CAUTION:** Care should be taken to avoid cleaning the gaskets with the lint free cloth. Refer to Section 10.5 for proper instructions for cleaning the gaskets.

10.3 Disinfecting the Tip Rack Containers

Disinfecting the tip rack containers that are supplied with the workstation is recommended as tip racks are consumed and need to be replaced. This is not required after every run. The materials you need for the procedure are as follows:

- 10% bleach (prepared within 1 week)
- DI water
- Lint-free cloth
- Latex or nitrile gloves
- Eye protection

	**WARNING:** Make sure you wear gloves and eye protection for the cleaning procedure. Wearing gloves and eye protection prevents you from being exposed to chemical and biologically hazardous samples.

To clean the tip rack containers:

1. Dampen a lint-free cloth with the 10% bleach solution.
2. Wipe the container surfaces thoroughly with the lint-free cloth and let stand 2-3 minutes.
3. Dampen a lint-free cloth with DI water.
4. Wipe the container surfaces thoroughly with the lint-free cloth.
5. Let container air dry.
6. Dispose of the used cloths according to your standard laboratory procedure.

Alternative cleaning:

1. Fill bucket or other larger reservoir that can hold tip rack container(s) with 10% bleach solution.
2. Remove the tip rack container from the workstation and submerge in solution for 2-3 minutes.
3. Remove, rinse with DI water, and let air dry.

10.4 Disinfecting the Sample Rack

You must disinfect the sample racks that are supplied with the workstation after each use. The materials you need for the procedure are as follows:

- 10% bleach (prepared within 1 week)
- DI water
- Lint-free cloth
- Latex or nitrile gloves

• Eye protection

	**WARNING:** Make sure you wear gloves and eye protection for the cleaning procedure. Wearing gloves and eye protection prevents you from being exposed to chemical and biologically hazardous samples.

To clean the sample rack:

1. Fill bucket or other larger reservoir that can hold sample rack container(s) with 10% bleach solution.
2. Remove sample rack from the workstation and submerge in solution for 2-3 minutes.
3. Remove, rinse with DI water, and let air dry.

	**CAUTION:** If any puddles or pools of liquid are observed in the bottom of the sample rack, a wetted cloth with DI water should be used to wipe up the liquid prior to submerging in the diluted bleach solution. Guanidine Hydrochloride is a main component in the sample tube transport buffer and can react with bleach producing harmful gases.

10.5 Cleaning the Gaskets

The gaskets on the workstation modules (See Figure 10-2) should be cleaned after each use. The materials you need for the procedure are as follows:

• Gasket Cleaning Tool
• Transparent Adhesive Tape

To clean the gaskets:

1. Load tape into Gasket Cleaning Tool that was supplied with workstation (See Figure 10-3)
2. With tape exposed, press down gently on each gasket.
3. Discard portions of tape that were used in the process.

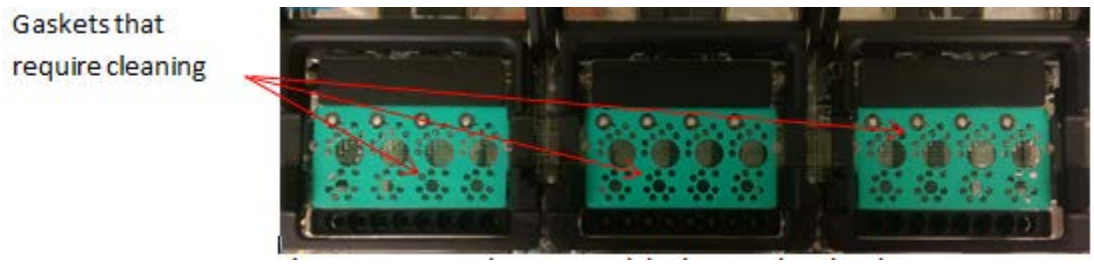


Figure 10-2: Gaskets on module that require cleaning

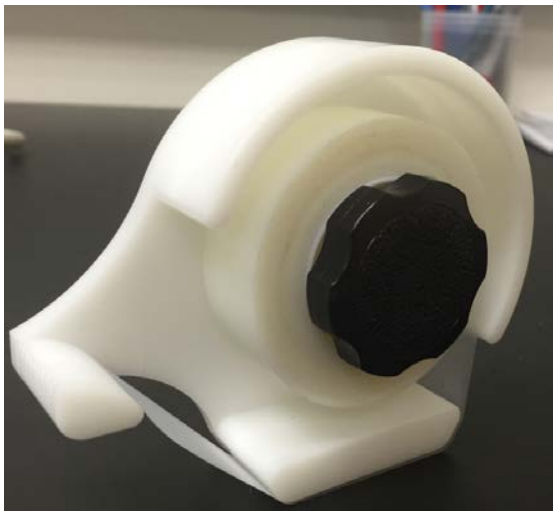


Figure 10-3: Gasket cleaning tool

10.6 Repairing and Replacing Workstation Parts

	**WARNIN**G: Do not attempt to open or remove the workstation cover. Do not attempt to modify or repair the system. Improper repairs and incorrect part replacements can cause injury, damage the workstation, and void your warranty.

To ensure your warranty and for proper operation, the Encompass MDx® workstation should be serviced only by an authorized Rheonix representative. The workstation does not contain any parts that the end user would be responsible for repairing or replacing. If the workstation is not working correctly, contact Rheonix Customer Service. See the "Assistance" section in the preface for contact information. When you call Rheonix Customer Service, be prepared to supply the serial number of your workstation. You can find the serial number label on the back side of the workstation or recorded on the front of this manual.

Section 11 Troubleshooting

11.1 Help Content

The Encompass MDx User Interface includes a 'Help' button (See Figure 11-1) that when accessed, displays this operator manual as a pdf (See Figure 11-2). The Operator Manual will be indexed to the associated section depending on what screen the user is currently viewing.

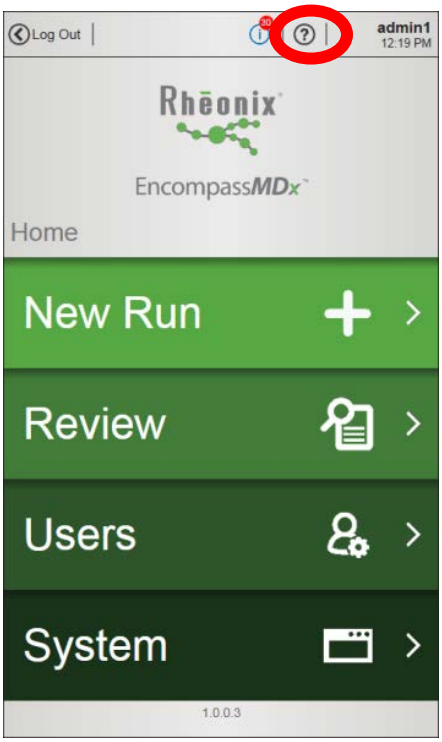


Figure 11-1: Main Screen highlighting Help button

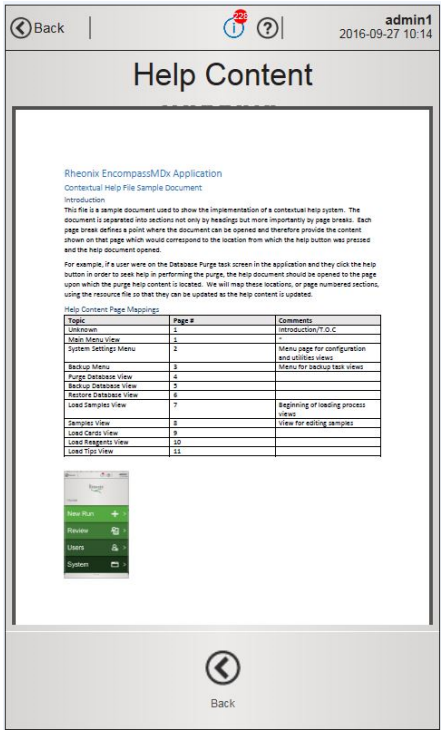


Figure 11-2: Help Content Screen

11.2 Active System Errors

Occasionally the Encompass MDx® workstation will encounter an error that may prevent a run from completing successfully or require the operator to restart the workstation. If that does happen, the User Interface will log the error and display an incremental number in a red circle at the top of the screen (See Figure 11-3).

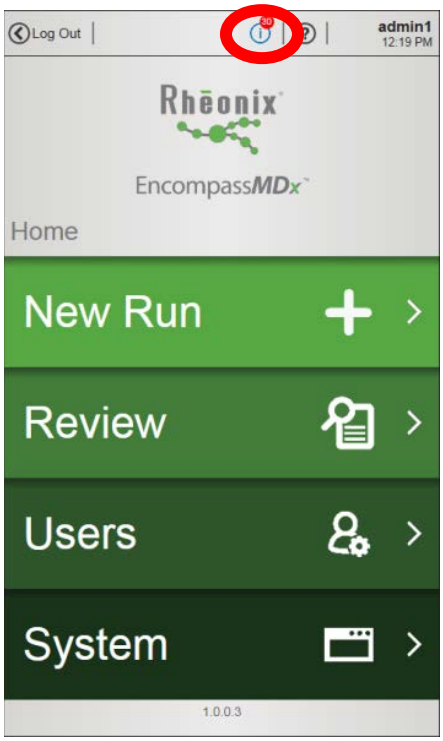


Figure 11-3: Main Screen (as Administrator) highlighting Error Tracking button

Pressing the "!" button will bring up the window shown in Figure 11-4. This screen will display all of the errors that have occurred on the workstation since the last data restore or purge took place or if any errors have been cleared by Service personnel. Each error will have a brief description and recommended recovery instructions. A list of possible errors that could occur can be found in Section 11.3. Tapping one of the errors listed will bring up the Error Screen as displayed in Figure 11-5. This screen allows the user to create a troubleshooting package.

Figure 11-4: Active System Errors Screen

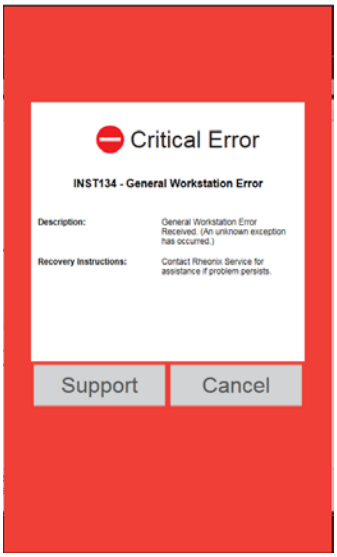


Figure 11-5: Error Acknowledge Screen

Figure 11-6: Troubleshoot Pkg Screen

11.2.1 To create a troubleshooting package:

1) Press the “Support” button
2) This will bring the user to the “Create Troubleshooting Pkg” Screen (see Figure 11-6)
3) At this point, the steps indicated in Section 5.14.4 can be followed.

The Active System Error list can also be sorted by pressing the “Sort” button at the bottom of the screen. The screen shown in Figure 11-7 will be displayed which will allow the user to either sort errors chronologically or by severity. Errors can either have a severity level of “Warning” or “Critical”. Critical errors will stop the run from completing successfully where as a warning indicates an error that the workstation can recover from and continue the run.

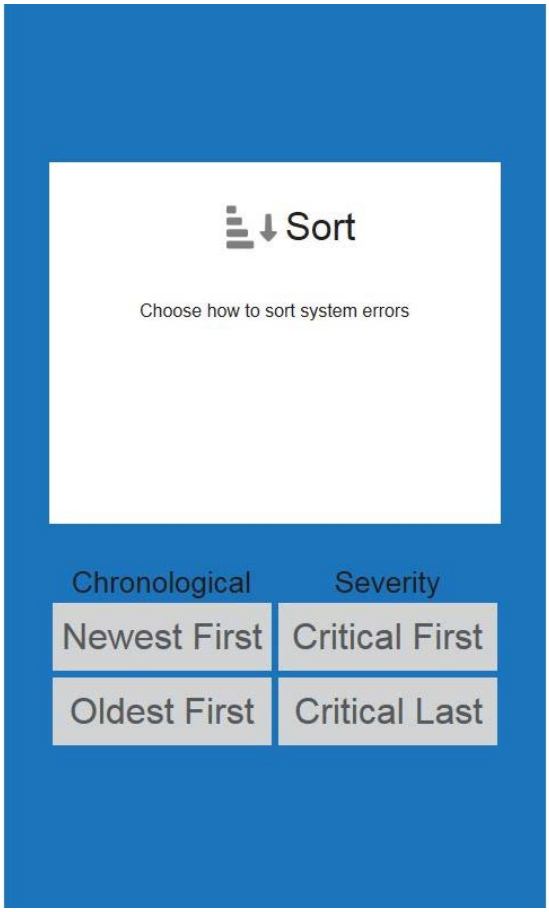


Figure 11-7: Error Sort Screen

11.3 Troubleshooting

System Operation	Error	Problem	Solution
Startup	Screen is blank and unresponsive	Workstation is not on.	Turn workstation on.
		Device plugged into USB port.	Remove device from USB port and restart workstation.
		Single Board Computer (SBC) is compromised.	Contact Rheonix Customer Service.
		UI Software was exited recently	Restart workstation as per Section 4.3. If problem persists, contact Rheonix for technical support.
	Hardware Communication Error (INST119, INST122)	Dispenser did not initialize properly.	Ensure tip has been removed from end of dispenser. Restart workstation.
		Hardware is not communicating with rest of system.	Shut down computer through UI. Wait 10 seconds and physically turn workstation off. Wait a minimum of 10 seconds and turn workstation back on.

Pre-run Diagnostics	Consumable Diagnostics Failed (INST133)	Barcode is obstructed and cannot be scanned	Ensure that there are no objects or materials covering the barcodes on consumables, and re-try pre-run diagnostic check.
		Insufficient amount of CARDs based on number of samples loaded.	Load additional CARDs and re-try pre-run diagnostic check.
		Consumable Missing	Ensure all consumables are present and loaded correctly. User may need to unload and reload consumables ensuring all are securely latched.
	Assay Loading Error (INST132)	Error occurred while trying to load assay file	Consumables do not need to be removed. Restart workstation as per Section 4.3 and start new run. If error happens again, contact Rheonix Customer Service
	Pneumatics Diagnostics Failed (INST117, INST118, INST120, INST121)	Gasket may be dirty.	Clean gasket using Gasket Cleaning Tool supplied with workstation.
		CARDs are not seated properly.	Remove CARD(s) and make sure there are no obstructions. Reload CARD(s) and retry pre-run diagnostics.
		Pneumatic System is not functioning properly.	Contact Rheonix for technical support.
	Heater Temperature Error (INST114)	Heaters did not ramp to temperatures in appropriate times.	Ensure room workstation is located in is within 18-30 °C. If not, adjust temperature accordingly and re-try pre-run diagnostics using same consumables. If room temperature is within range, contact Rheonix customer service for technical support.
	Communication Exception (INST119, INST122, INST123, INST125, INST131)	Hardware lost communication with rest of system.	Consumables can be unloaded and re-used. Restart workstation as per Section 4.3 prior to starting new run. If error happens again, contact Rheonix Customer Service.
	Door Open (INST105, INST124)	Workstation door was opened	Unload consumables, reload same consumables and rerun pre-run diagnostics with door closed.
	Unlatch Error (INST134)	One or more of the consumables are unlatched	Relatch consumable(s) and repeat Pre-run Diagnostics.
	Other General Errors (INST134)	Various	Consumables can be unloaded and re-used. Restart workstation as per Section 4.3 prior to starting new run. If error happens again, contact Rheonix Customer Service.

Assay Run	Communication Exception (INST119, INST122, INST123, INST125, INST131)	Hardware lost communication with rest of system.	If collision with end effector and consumables/workstation appears to have happened, contact Rheonix Customer Service. Otherwise unload and discard consumables. Restart workstation as per Section 4.3 prior to starting new run. If error happens again, contact Rheonix Customer Service.
	Door Open (INST105)	Door was opened	Unload and discard consumables. Start new run using new consumables.
	Pneumatic Failure (INST117, INST118)	Module Pressure/Vacuum alarm has been received	Unload and discard consumables. Restart new run with new consumables. If error happens again, contact Rheonix Customer Service.
	Unlatch Error (INST134)	One or more of the consumables are unlatched	Unload and discard consumables. Restart new run with new consumables. If error happens again, contact Rheonix Customer Service.
	Tip Stuck (INST128)	Dispenser was unable to eject tip	Abort run. Open door and remove tip manually. Unload and discard consumables. Restart new run with new consumables. If error happens again, contact Rheonix Customer Service.
	Tip Missing (INST129)	Tip missing (outside of sample loading)	Abort run and unload the consumables. If full tip rack was present during unload steps, contact Rheonix Customer Service. If not, restart run using new consumables, ensuring both tip racks are full.
		Tip stuck in sample tube	Upon successful completion of run, open door and unload consumables as usual. Remove tip from affected sample and re-run that sample tube.
	Displacement Encoder Error	Hardware failure	Stepper motor requires replacement. Contact Rheonix Customer Service.
	Other General Errors (INST134)	Various	Unload and discard consumables. Restart workstation as per Section 4.3 prior to starting new run. If error happens again, contact Rheonix Customer Service.

Run Completion	Door Locked	Communication Error	Restart workstation as per Section 4.3, open door, and unload consumables. Clean workstation as per Section 10. If error happens again, contact Rheonix Customer Service.
	"Cancel" appears in comment section of run report	Software bug	If results are present, they should be considered valid and run should be accepted. If Exclamation Point indicating error occurred appears for sample results, then run will need to be repeated.

11.4 Imaging Errors

Type	Code	Cause	Action
Image Errors	ERRE01	Reference Spots Invalid	Rerun sample
	ERRE02	Bubble Check Failed	Rerun sample
	ERRE03	Spacing Check Failed	Rerun sample
	ERRE04	Angle Checks Failed	Rerun sample
	ERRE05	Quality Checks Failed	Rerun sample
Image Indeterminate	INDN02	Standard Deviations for Target Spots Above Threshold	Rerun sample; only select target(s) that generated IND result
	INDN03	No Target Spots and PCR Process Control Is Not Present	Rerun sample; only select target(s) that generated IND result
	INDN04	The Intensity of One or More Target Spots is Indeterminate (Neither Positive or Negative)	Rerun sample; only select target(s) that generated IND result

Appendix A Glossary

Term	Meaning
Aliquot	A volume of liquid that is transferred from one location to another
Amplicons	DNA that has been amplified; Output of the PCR process
Archive	Depository containing history of data from runs that took place on workstation
Audit Log	Each user log in is recorded and tracked in the workstations' data log. The data log tracks all system activities. Each user account that is created has a unique ID so that all system activities can be traced back to the user that was logged on when the specific event occurred.
CARD	Chemical And Reagent Device. Allows for all aspects of the molecular diagnostic test to be performed within this consumable device; capable of running four samples each.
CMOS	Complementary Metal Oxide Silicon
Collection Swab	Device used in the sample collection process and subsequently placed into the sample tubes
Consumables	Materials used to complete a test on the Encompass MDx® workstation. This consists of the Samples, CARDs, Reagent Pack A, Reagent Pack B, and Tips.
COVID-19	An infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
Cross Contamination	Term used to describe material left behind from a previous run that could negatively affect or influence the results of the next run that take place on the Encompass MDx® workstation
CT	*Chlamydia trachomatis*
End-Effector	Component of the workstation that contains the camera, LED light, and dispenser; capable of moving in X, Y, and Z axes
EPA	Environmental Protection Agency
EUA	Emergengy Use Authorization
FS	Female Vaginal Swab - One of the sample types supported by the Encompass MDx workstation and STI Tri-Plex Assay
I/O	Input/Output
Hazardous Waste	Waste that poses substantial or potential threats to personal health or the environment
Hybridization	The process in which single-stranded DNA or RNA molecules anneal to complementary DNA or RNA
LED	Light Emitting Diode. Can be solid state or blinking
Lyophilized	A process of freezing material, then reducing pressure to allow the frozen water in the material to sublimate directly from the solid phase to the gaseous phase typically extending the shelf-life of the material or allowing for easier transport; used to convert master mix into pellets
Lysed	Refers to breaking down a cell membrane, typically in the purification process
Magnetically Purified	The use of magnetic beads and reagents to wash away proteins and other substances that can inhibit the PCR process
Master Mix	Consists of primers and other components that are used in the PCR process;

	supplied by Rheonix as Reagent Pack B
Micro Array	Component on the CARD that allows detection to take place
Microplate	A flat piece of plastic with multiple wells used as small test tubes; a standard tool in analytical research and clinical diagnostic testing
Module	Component of the workstation that controls electrical and pneumatic features that allow the CARD to function; each workstation has two modules that can run three CARDs each
Molecular Diagnostic Assay	A test or technique used to detect specific sequences in DNA or RNA; typically consists of three parts – extraction, amplification, and detection
MU	Male Urine - One of the sample types supported by the Encompass MDx workstation and STI Tri-Plex Assay
NG	*Neisseria gonorrhoeae*
Nucleic Acid Target Sequence	Succession of letters that indicate the order of nucleotides within a DNA or RNA molecule
Nucleotide	Organic molecules that are the building blocks of nucleic acids, such as DNA or RNA
Nucleotide Probes	A nucleic acid fragment that is complementary to the nucleic acid target sequence and when subjected to hybridization can attach to it
PIN	Personal Identification Number. Used interchangeably with the term 'password'
PCR	Polymerase Chain Reaction. The process of amplifying a single copy or a few copies of DNA across several orders of magnitude
Pneumatic	Of or related to the use of air
Purge Date	Date that represents the last time data was removed from the workstation
Reagents	Various chemicals required to perform the assay; supplied by Rheonix as Reagent Pack A
Samples	Urine or swab specimens that have been collected in Rheonix transfer tubes and ready for molecular diagnostic testing
Sample ID	An identification number affixed to the sample tube
Sample Rack	A removable rack that holds up to 24 samples and is loaded into the Encompass MDx® workstation
Smart Sense	Located on the upper right front panel of the workstation; a color-coded system that provides the operator with visual workstation status cues via LED
Sample Type	The Encompass MDx workstation and STI Tri-Plex Assay supports the following Sample Types -Male Urine -Female Swab
STI	Sexually Transmitted Infection. Assay that can be run using Encompass MDx® workstation
Target(s)	Organism(s) that assay was developed for, to be capable of detecting
Troubleshooting Package	Collection of data that can be used to help Rheonix service personnel to resolve potential issues related to the Encompass MDx® workstation
TV	*Trichomonas vaginalis*
USB	Universal Serial Bus
UPS	Uninterrupted Power Supply

Appendix B Index

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Appendix C: Assay Specific Instructions

Rheonix STI Tri-Plex Assay

1. Sample Loading
   1.1. Inspect samples during the loading process. If this is the first time samples are being tested, ensure the presence of a single collection swab in a swab sample transport tube or a final volume of liquid between the indicator lines on the urine sample transport tube label. Test results may be compromised if these criteria are not met
   1.2. After samples have been loaded and and barcode scanning is complete, the UI displays a screen similar to the following:

Figure C1-1: Sample barcode scanning
Yellow indicates action needed

1.2.1. Initially, all samples are highlighted in yellow until the sample type and test(s) have been selected. The confirm button will remain greyed out until each sample has an associated sample type and at least one target selected. Tapping on ***Sample Type*** field will toggle between ---- *(indicating no sample type is selected),* ***MU*** *(indicating* ***Male Urine****) and* ***FS*** *(indicating* ***Female Swab)***

Figure C1-2: Sample type and Tests selected

1.2.2. If one or more of the barcodes cannot be read, the UI signals the operator by highlighting that lane in RED. To remedy, the user can:

1) Unload the sample rack, straighten the tube or realign the barcode, and try again. Removing the sample rack will reset all sample type and target selections, so if any barcode issues are present, this should be resolved as the first priority.
2) Manually input the barcode information.
   a. Tap on the sample on the Sample Screen and manually enter the barcode number using the touch screen under Sample ID. The same value needs to be entered again under "Confirm Sample ID." At this point the operator can also add any notes specific to that sample (See Figures C1-3 and C1-4).

	**INFORMATION:** Barcodes that are manually typed in will be flagged and indicated as such on the final report.
	**INFORMATION:** Notes/Comments can be added to any sample, not just ones that have had their barcodes manually altered. Information entered here will be displayed on the final results report.
	**INFORMATION:** Patient identifying or other personal information should never be entered into the Sample ID or Sample Notes sections.
	**CAUTION:** Removing the sample rack after any information has been manually entered, including sample IDs, test selections and notes, will clear the manually entered data.

Figure C1-3: Sample Edit Screen

Figure C1-4: Entering notes for a particular sample

1.2.3. Select the test for each sample by scrolling through the list of samples and selecting which test or tests to perform for each sample.

1.3. To select Sample types and tests:

- Each individual sample requires an associated sample type to be manually selected.
- Touching the "All CT," "All NG," and/or "All TV" check boxes will automatically select the respective test for all samples.
  - NOTE: The operator will not be able to select a **CT** Test for **FS** (Female Swab) sample types
- After selecting appropriate tests, touch "Confirm."

2. PCR Mix (Pack B)

	**WARNING:** Prior to loading Reagent Pack B into Reagent Pack A, confirm that the lyophilized beads in tube locations 1 and 3 are down at the bottom of the tubes and not clinging to the underside of the foil. If found to be clinging to the underside of the foil, tap or flick the tube strip to get the lyophilized beads to fall to the bottom. This will help ensure proper concentrations for the final use of the master mix.

3. Run Review

3.1. To review the results in greater detail, touch the "Review" button. The UI displays the Run Results screen

Figure C1-5: UI displaying Run Results screen

3.1.1. The results overview screen will show the sample IDs and results. A complete list of results will be displayed for every sample in the rack. A color code indicates the individual results, with green indicating a negative result, red indicating a positive result, blue indicating an indeterminate result, and yellow indicating an error has occurred during the test procedure. Dark grey indicates that the test was not selected. See Section 11.4 for details on what types of imaging errors can cause an indeterminate result or error

3.1.2. Results can either be printed or exported. Process results according to institutional procedures

	**INFORMATION:** All data are automatically saved on the Encompass MDx® workstation unless removed by an administrator.

COVID-19 MDx Assay

4. Sample Loading

4.1. After samples have been loaded and and barcode scanning is complete, the UI displays a screen similar to the following:

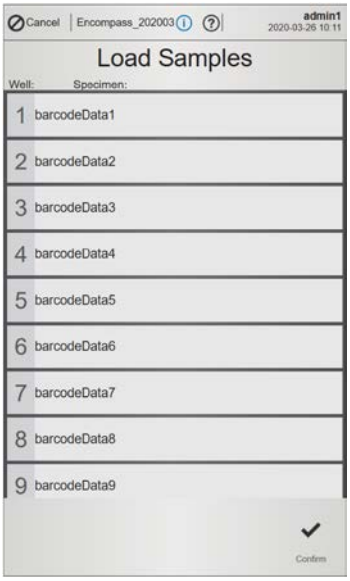

Figure C2-1: Sample barcode scanning

4.1.1. If one or more of the barcodes cannot be read, the UI signals the operator by highlighting that lane in RED. To remedy, the user can:

1) Unload the sample rack, straighten the tube or realign the barcode, and try again. Removing the sample rack will reset all sample type and target selections, so if any barcode issues are present, this should be resolved as the first priority.

2) Manually input the barcode information.

a. Tap on the sample on the Sample Screen and manually enter the barcode number using the touch screen under Sample ID. The same value needs to be entered again under "Confirm Sample ID." At this point the operator can also add any notes specific to that sample (See Figures C2-2 and C2-3).

	INFORMATION: Barcodes that are manually typed in will be flagged and indicated as such on the final report.

	INFORMATION: Notes/Comments can be added to any sample, not just ones that have had their barcodes manually altered. Information entered here will be displayed on the final results report.
	INFORMATION: Patient identifying or other personal information should never be entered into the Sample ID or Sample Notes sections.
	CAUTION: Removing the sample rack after any information has been manually entered, including sample IDs, test selections and notes, will clear the manually entered data.

Figure C2-2: Sample Edit Screen

Figure C2-3: Entering notes for a particular sample

4.1.2 If all barcodes have been scanned correctly and no further edits or comments are needed, touch Confirm.

5. PCR Mix (Pack B)

	WARNING: Prior to loading Reagent Pack B into Reagent Pack A, confirm that the master mix strip has been thawed sufficiently. This will help ensure proper concentrations for the final use of the master mix.
	INFORMATION: Make sure to record the lot number of the Master Mix Strip in the log book.

6. Run Review

6.1. To review the results in greater detail, touch the “Review” button. The UI displays the Run Results screen

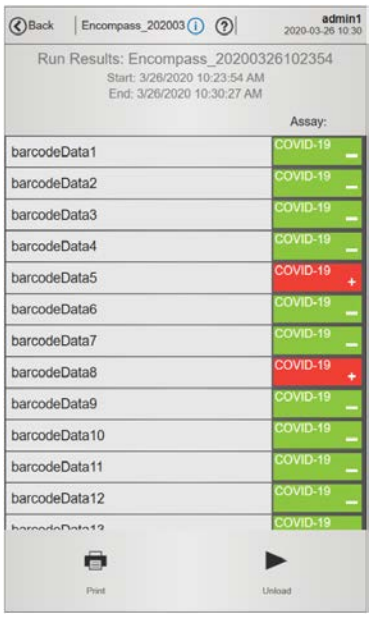

Figure C2-4: UI displaying Run Results screen

5.19.3. The results overview screen will show the sample IDs and results. A complete list of results will be displayed for every sample in the rack. A color code indicates the individual results, with green indicating a negative result, red indicating a positive result, blue indicating an indeterminate result, and yellow indicating an error has occurred during the test procedure. See Section 11.4 for details on what types of imaging errors can cause an indeterminate result or error.

5.19.4. Results can either be printed or exported as .csv file. Process results according to institutional procedures.

	**INFORMATION:** All data are automatically saved on the Encompass MDx® workstation unless removed by an administrator.