revogene®

System RNA Software Upgrade Kit

Validation of this test has not been reviewed by FDA. Review under the EUA program is pending.

For use with the Revogene®

| REF 610240 | IVD For *in vitro* Diagnostic Use | Rx Only |

INTENDED USE

The Revogene® System RNA Software Upgrade Kit is a single-use qualitative test utilizing automated real-time Reverse Transcription Polymerase Chain Reaction (rRT-PCR) to confirm that the parameters of the Revogene® instrument are within specifications for testing with RNA-based assay. It is intended for use by qualified laboratory personnel who have been trained and are proficient in performing testing on the Revogene instrument, or by Meridian Bioscience, Inc. service personnel. 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. Validation of this test has not been reviewed by FDA. Review under the EUA program is pending.

PRINCIPLE OF THE PROCEDURE

The Revogene System RNA Software Upgrade Kit is used to install the Revogene System Software version 4.2.0, import the Revogene Instrument Control Protocol file for RNA-based assay, and install the Assay Definition File (ADF) file. The correct installation of the software, Instrument Control Protocol, and ADF files are verified by running the four (4) microfluidic cartridges (named PIE hereafter) enclosed in the kit. Confirmation of successful installation is accomplished by sending a troubleshooting report to Meridian Bioscience Technical Support to confirm the appropriate installation. The instrument is ready to run specimens once the verification password has been entered into the instrument to import the Revogene® SARS-CoV-2 ADF. An Internal Control (IC) is incorporated into each PIE to verify RNA transcription/amplification/detection steps including the verification of reagent failure. A Microfluidic Control (MFC) is also incorporated into each PIE to verify the fluidic properties of the PIE. Revogene automates sample homogenization, dilution, lysis, nucleic acid amplification and detection of the Internal Control (IC) amplified PCR products by using reverse transcription (conversion of RNA templates into DNA). User intervention is only required to transfer sample buffer from the Sample Buffer Tube (SBT) into the PIE and insert the PIE into the Revogene carousel.

Each Revogene System RNA Software Upgrade Kit PIE is a fully integrated closed device into which sample buffer is dispensed and processed through different microfluidic chambers and channels, which allows for the IC processing (*i.e.* homogenization, dilution, lysis and RNA extraction) and subsequent real-time PCR steps (**Figure 1**). The sample buffer is transferred by centrifugation from one chamber to the next in sequence. All reagents specific for the PCR reaction are incorporated and dried within one of the PCR wells. The amplified product is detected in real-time using a target-specific TaqMan® chemistry-based probe. No operator intervention is necessary once a PIE is loaded into the Revogene.
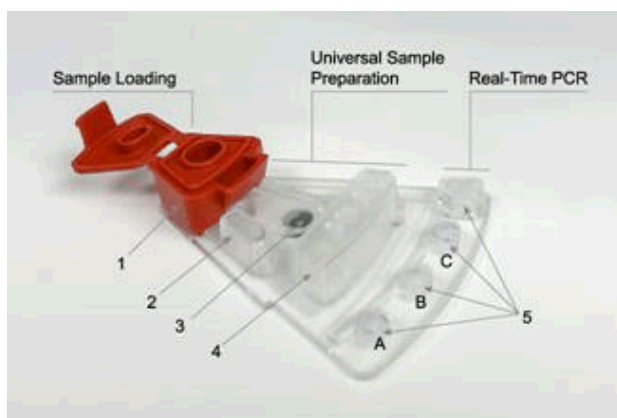

Figure 1. Top View of a PIE.
1: Sample Loading Chamber, 2: Overflow Chamber,
3: Homogenization Chamber containing the Microfluidic Control, 4: Dilution/Lysis Chamber,
5: Three (3) PCR Wells (A to C from left to right) and one (1) Waste Chamber (at the right end).

The Revogene carousel must contain eight (8) PIEs to maintain thermodynamic balance within the run. At run completion, the results are computed by the system from measured fluorescent signals and embedded calculation algorithms. The results are displayed on the touchscreen and may be printed. Results have to be transferred to an USB flash drive and provided to Meridian for analysis and confirmation on the software, Instrument Control protocol and ADF upgrade.

REAGENTS AND MATERIALS PROVIDED

Revogene System RNA Software Upgrade USB flash drive which contains the following files required to perform the upgrade:
1. Revogene System Software version 4.2.0
2. Instrument Control Protocol specific for RNA-based assays which include the reverse transcription step
3. Revogene System RNA Software Upgrade kit ADF
4. Password protected Revogene SARS-CoV-2 ADF
5. Revogene Operator's Manual

Revogene System RNA Software Upgrade kit contains sufficient reagents and materials to execute one (1) software upgrade. The kit contains four (4) individual pouches, and each pouch contains the following materials:
1. One (1) **RNA Software Upgrade Kit Sample Buffer Tube (SBT)**: Tube containing Tris-HCl pH 8.0/EDTA Na₂ (TE 1X) buffered solution as a dilution buffer for the IC.
2. One (1) **Disposable Transfer Tool (DTT)**: Plastic pipette with minimal and maximal volume marks for transferring the SBT into the PIE.
3. One (1) **RNA Software Upgrade Kit microfluidic cartridge (PIE)**: Integrated device which comprises dried reagents allowing sample process and real-time RT-PCR steps for transcription, amplification and detection of the IC. Each PIE contains an Internal Control (IC), IC-specific primers and probe, a Microfluidic Control, dNTPs, buffer and DNA polymerase displaying reverse transcriptase activity.

MATERIALS REQUIRED BUT NOT PROVIDED
1. Revogene® (cat# 610210)
2. Disposable powderless gloves
3. Vortex mixer
4. MOCK PIEs (cat# 610208)

WARNINGS AND PRECAUTIONS
1. Validation of this test has not been reviewed by FDA. Review under the EUA program is pending.
2. The Revogene System RNA Software Upgrade Kit review under the EUA program is pending and is for use by laboratories certified under the Clinical Laboratory Improvement Amendments (CLIA) of 1988, 42 U.S.C. 263a, that meet requirements to perform high complexity tests.
3. The Revogene System RNA Software Upgrade Kit can only be used on the Revogene instrument.
4. The Revogene System RNA Software Upgrade Kit must run all four PIE (4) in a single run on the Revogene.
5. Do not use the kit if the label that seals the outer box is broken upon arrival.
6. Do not use Revogene System RNA Software Upgrade Kit PIEs if the protective pouches are open or broken upon arrival.
7. Do not interchange DTT, SBT, PIE between kit lots.
8. Each single-use DTT and PIEs included in the kit are used to execute one (1) test. Do not reuse DTT or PIE.
9. Wear disposable powderless gloves while handling samples and thoroughly wash hands afterwards.
10. The PIE contains dried reagents. The protective pouch should not be opened until ready to perform the test.
11. Dispose of unused materials, reagents and waste in accordance with country, federal, provincial, state and local regulations.
12. Do not open or break apart the PIE after use to avoid contamination with amplification products.
13. Do not use a PIE that has been dropped, shaken or inverted after the sample has been loaded as this may cause invalid results.
14. Do not use a kit that has passed its stated expiration date.
15. Do not refrigerate the loaded PIE.
16. Each run must be performed with four (4) RNA Software Upgrade Kit PIEs and four (4) MOCK PIEs in the Revogene carousel to maintain thermodynamic and mechanical balance within the run.

STORAGE AND STABILITY
1. Store the Revogene System RNA Software Upgrade Kit at 2-25 C. The expiration date is indicated on the box kit's label and on each pouch.

25 C
2 C

2. Store the Revogene system RNA Software Upgrade USB flash drive at 12-30 C.

30 C
12 C
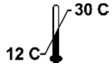
3. Do not open a pouch until ready to perform testing. Use the PIE within one (1) hour after opening the pouch.

INSTRUCTION FOR USE
NOTE: The contents of the Revogene System RNA Software Upgrade Kit of four (4) pouches and one (1) USB drive must be used to perform each RNA software upgrade.

SOFTWARE VERSION 4.2.0 UPGRADE
1. Log on to the Revogene with a "supervisor" account (*admin* is a supervisor account).
2. Insert the USB flash drive into the Revogene.
3. Tap on the <**Revogene**>/<**GenePOC**> tab on the top left corner of the screen.
4. Tap the <**Upgrades**> tab on the bottom right (**Figure 2**).
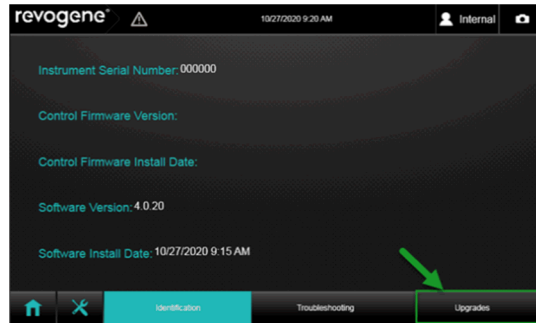
Figure 2. Upgrade Button Location

5. Tap the <**…**> button (**Figure 3**).
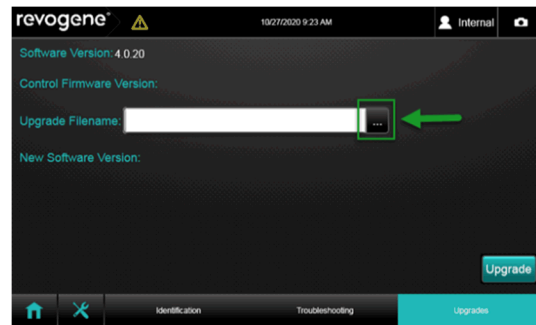
Figure 3. Installer File Selection Button

6. A window will appear. Select the USB drive **(D:)**. The default format should be .msi. If not, change the format of the file to .msi (MSI files). **(Figure 4)**
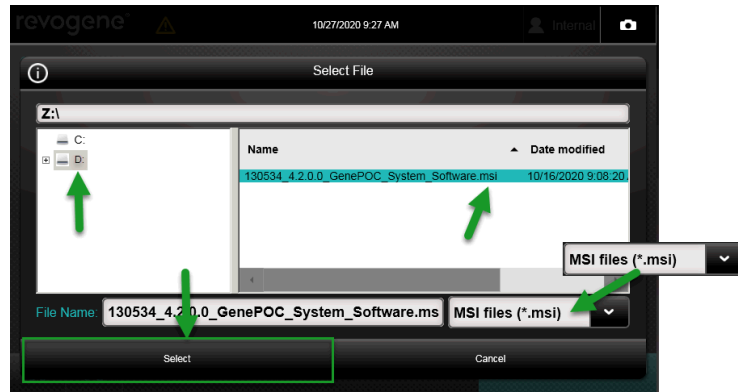
Figure 4. Installer File Selection Window

7. In the USB drive, select the **130534_4.2.0.0_GenePOC_System_Software.msi**. Tap the <**Select**> button.

8. The window will close and the **<Upgrade>** button on the right bottom corner will be available. Tap on the **<Upgrade>** button **(Figure 5)**

Figure 5. Upgrade Button Location

9. A window will appear. Tap **<OK>**. **(Figure 6)**
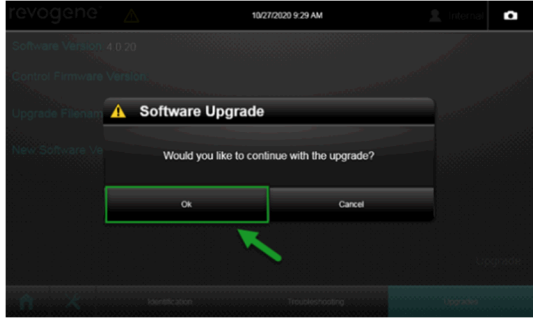
Figure 6. Upgrade Confirmation

10. The Revogene will process the software upgrade. Once the software upgrade is completed, the Revogene will restart. This step takes about 1-2 minutes (including restart).
11. Log on to the Revogene using a "supervisor" account (admin is a supervisor account).
12. Press on the **<Revogene>/<GenePOC>** tab on the top left corner of the screen.
13. Verify that the software version has been updated to version **4.2.0. (Figure 7)**
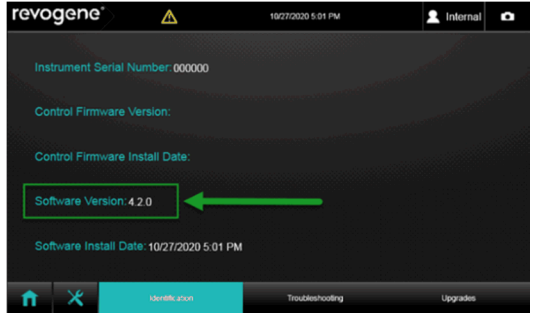
Figure 7: Version Confirmation

INSTRUMENT CONTROL PROTOCOL (XML) IMPORT (Revogene specific)
1. Tap on the **<Tools>** menu right to the "Setup run" main button.
2. Tap on the **<Assay>** menu on the bottom right corner of the sub-menu window.
3. Tap on the **<Import>** tab at the bottom right corner. **(Figure 8)**
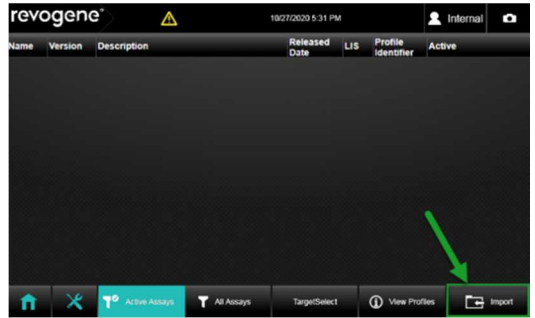
Figure 8. Assay Import Button

4. A window will appear:
    a. Select the USB drive **(D:)**.
    b. Change the format of the file to .xml **(Profile files, *xml).**
    c. In USB drive, select the Instrument Control Protocol (.xml) file that has the correct serial number (example: **135580_XXXXXX_Instrument_Control_Protocol_ARN_IVD_V_1_0_0.YYYYYYYY)** where the **XXXXXX corresponds to the Revogene's serial number** and **YYYYYYYY is a randomized number different for each xml file**.
    d. Tap on the <**Select**> button. **(Figure 9)**
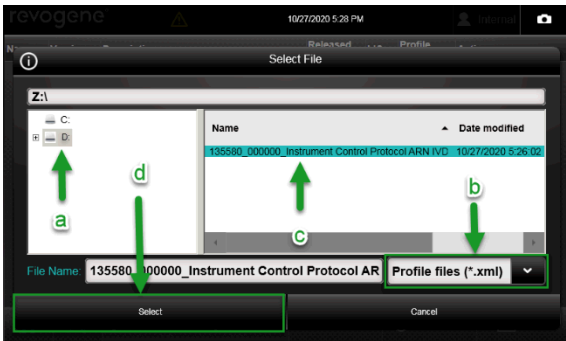
Figure 9. Instrument Control Protocol (.xml) Selection Window

5. A window will appear stating that the Instrument Control Protocol also named Thermocycler Profile (.xml file) was imported successfully. Tap <**OK**>. **(Figure 10)**
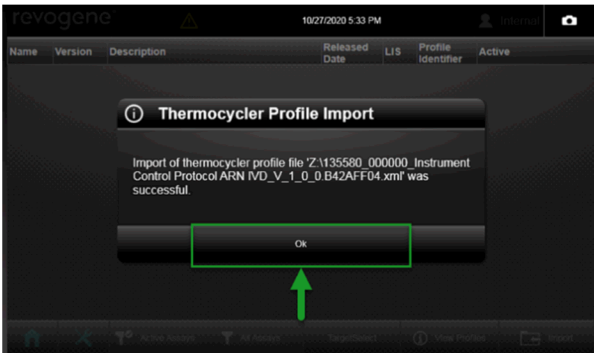
Figure 10. Instrument Control Protocol (.xml) Import Confirmation

6. Tap on the <**View Profiles**> tab. The new Instrument Control Protocol ARN IVD (.xml) (identifier **135580**) should be listed with **version 1.0.0**. **(Figure 11)**
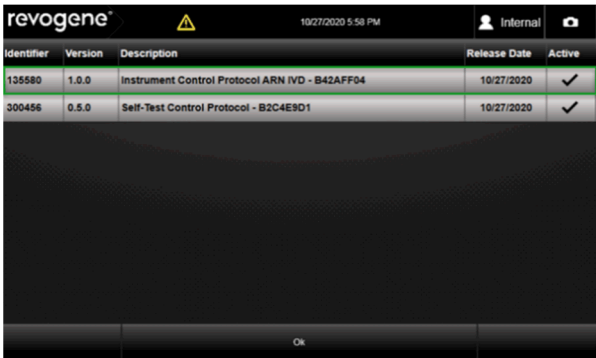
Figure 11. Insturment Control Protocol Window

7. Tap <**OK**>.

ADF IMPORT
1. Tap the <**Import**> button.
2. A window will appear. Select the USB drive **(D:)**. The default format should be **.adf**. If not, change the format of the file to **.adf (ADF files)** and select the ADF file named: **RNA SW Upgrade-135632_1.0.0.61ABB032.adf**. **(Figure 12)**
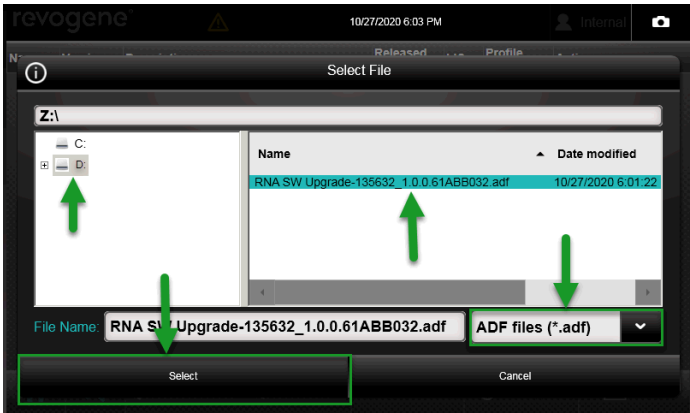
Figure 12: ADF Selection Window

3. Tap the <**Select**> button.
4. A window will appear stating that the ADF was imported successfully. Tap <**OK**>. **(Figure 13)**
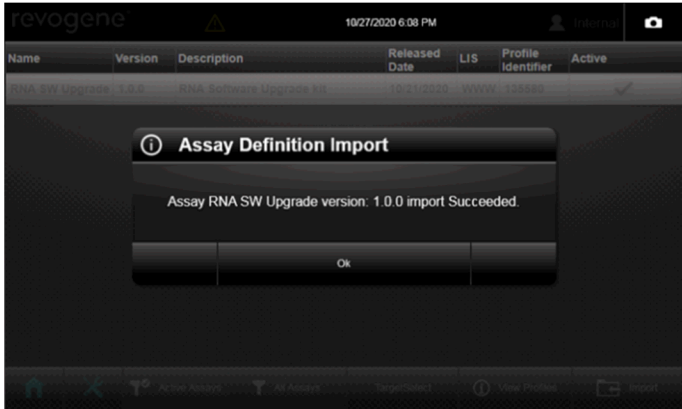
Figure 13: ADF Import Confirmation

TEST RUN
SBT PREPARATION
1. Open the kit box and remove the four (4) pouches from the box.
2. Unseal the right side of the pouch (when facing label) containing DTT and SBT and remove only the SBT from the pouch.
3. Identify (or label) the SBT with the appropriate identification . Place the SBT on a sample rack, if used.

PIE PREPARATION
4. Mix the SBT for a minimum of 15 seconds at maximal speed using a vortex mixer.
5. Unseal the left side of the pouch (when facing label) containing the PIE, removing it from the pouch. Once unsealed, the PIE must be used within one (1) hour.
6. Remove the DTT from the right side of the pouch and use it to aspirate the sample buffer (SB) by squeezing the entire bulb. The liquid level into the DTT must be anywhere between the two (2) marks (**Figure 14**). If the liquid level is not between the two (2) marks, discharge the SB completely into the SBT and repeat this step.
7. Insert the tip of the DTT vertically into the sample loading chamber of the PIE and discharge completely the SB (**Figures 15A** and **15B**). Make sure not to touch the outer edges or the bottom of the sample loading chamber with the DTT.
8. Close the cap of the PIE tightly. Place the PIE on a sample rack, if used. Do not refrigerate the loaded PIE.
9. Prepare all additional samples for testing by repeating steps 2 to 8 then proceed to step 1 of the **Start Run** section

NOTE: Hold the PIE by the dilution chamber or by its sides to avoid smearing on PCR wells.
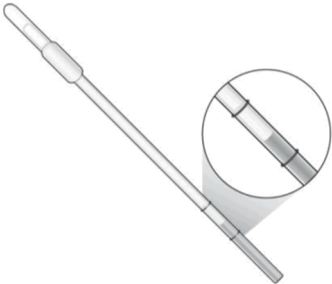**NOTE**: Be cautious when manipulating a loaded PIE. Do not invert, shake or drop it.

Figure 14. Representation of an Appropriate Sample Buffer (SB) Level using the Disposable Transfer Tool (DTT).
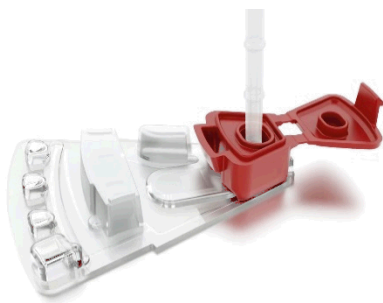
Figure 15A. Adequate Insertion of the DTT into the Sample Loading Chamber of the PIE

Figure 15B. Inadequate Insertion of the DTT into the Sample Loading Chamber of the PIE

START RUN

Required Software version, Instrument Control Protocol (.XML) and ADF must be installed prior run execution. Please refer to Software version 4.2.0 Upgrade section for more information.

NOTE 1: Each run must be performed with the four (4) Revogene System RNA Software Upgrade Kit PIEs in the Revogene. Insert a MOCK PIE into each of the remaining four (4) positions in the carrousel. Each of the eight (8) positions in the carrousel must be filled.

NOTE 2: Refer to the Revogene Operator's Manual[1] for further information regarding Revogene set-up and operation.

1.   Power on the Revogene (if not already done). The software will launch automatically.
2.   Log in by entering <**Username**> and <**Password**> and tap <**Login**>. The main menu will appear automatically.
3.   Tap <**Setup Run**>.
4.   In the scanning menu:
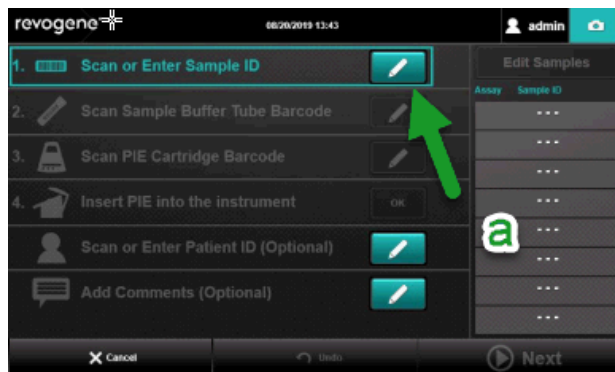
Figure 16. Sample ID Button

a.   Enter a sample identification (Ex: 1 for first PIE, 2 for second etc.) manually. Manual entry can be done by tapping the **pencil** icon of the <**Scan or Enter Sample ID**> line.**(Figure 16)**
b.   Enter PIE barcodes using the barcode scanner by gently positioning the PIE almost vertically in front of the scanner. Alternatively, PIE barcodes may be entered manually (tap the **pencil** icon of their respective lines). Handle the PIE carefully without shaking, dropping it, or inverting it.
c.   Insert the PIE into the Revogene at any position of the carousel.
d.   Confirm that the PIE is inserted by tapping <**OK**> on the <**Insert PIE into instrument**> line
e.   Repeat steps "a" to "d" for the three (3) other PIEs.
f.   When all PIEs are inserted into the carousel, tap <**Next**> and follow the instructions on the screen.

5.   Because less than eight (8) PIEs are being tested, load MOCK PIEs in the carousel remaining positions. No scan is required when inserting MOCK PIEs into the Revogene. Check the box to confirm that they were inserted.
6.   Scan the retention ring and place it on the carousel.
7.   Gently rotate the carousel around to check all PIEs are loaded correctly with no friction or resistance to rotation. Close the instrument lid with both hands and hold on until you hear the lock activate. Then gently pull up on the lid to guarantee that the lock is engaged.
8.   Initiate the test run by tapping <**Start**>.
•   A timer on the screen and lights on the Revogene lid will show the progression of the test.

VIEWING AND EXPORTING RESULTS

NOTE: You must complete this step to be able to use the Revogene SARS-CoV-2 assay.

1.   Once the run is completed, the lid opens automatically.
2.   Enter <**Username**> and <**Password**> and tap <**Login**> if the user's session has logged-out.
3.   Results from the last run are automatically shown on the screen.
4.   Make sure **all** the results obtained are **Negative (-)** (Figure 17).
a.   If one (1) or more results is (are) not negative, Contact Meridian Bioscience Technical Support Services at MBI-techsupport@meridianbioscience.com or 1-800-343-3858 and follow their instructions for a repeat.

Figure 17. All Negative Results

5.   Next, Export the troubleshooting package:
      a.   Tap on the revogene/GenePOC logo on the upper left corner of the screen **(Figure 18)**.
      b.   Tap the "Troubleshooting" menu at the bottom of the screen **(Figure 19)**.
      c.   Select the date range that covers the period in which the runs were executed. **Note: If you executed a repeat, make sure the ranges cover <u>the initial run and the repeat</u> (Figure 20, c)**.
      d.   Tap all the checkboxes so they are checked **(Figure 20, d)**.
      e.   Tap the "Create Package" button **(Figure 20, e)**.
      f.   Save the package on the same USB key (**D:**) by pressing select. **Note: You will see another zip file on the key, <u>do not</u> select it before pressing select (Figure 21)**.
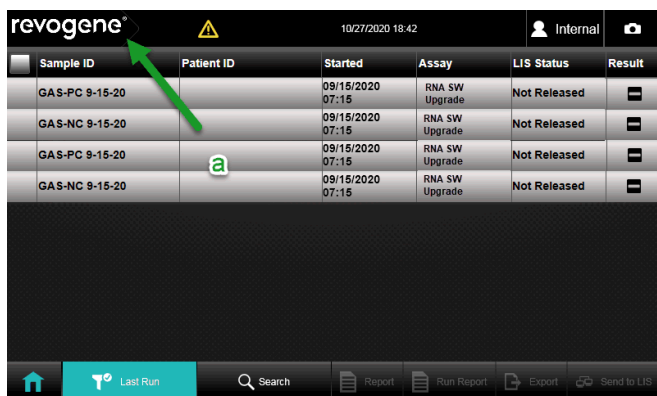
Figure 18. Revogene Logo
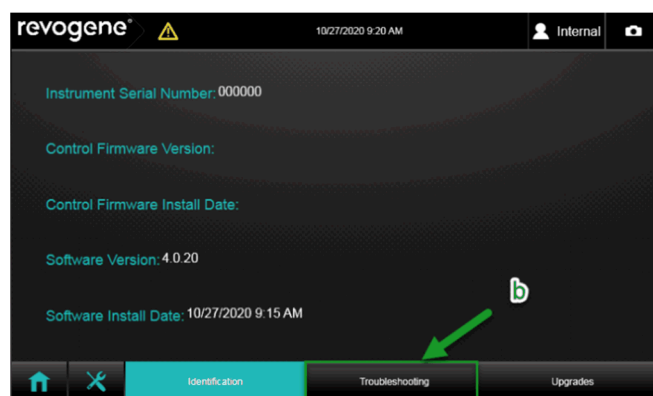
Figure 19. Troubleshooting Button
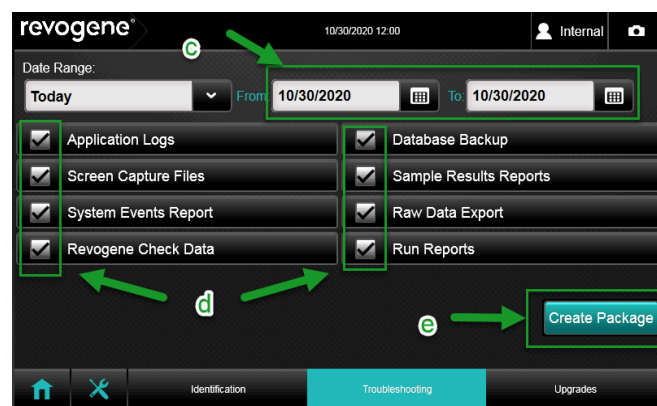
Figure 20. Troubleshooting Package Parameters
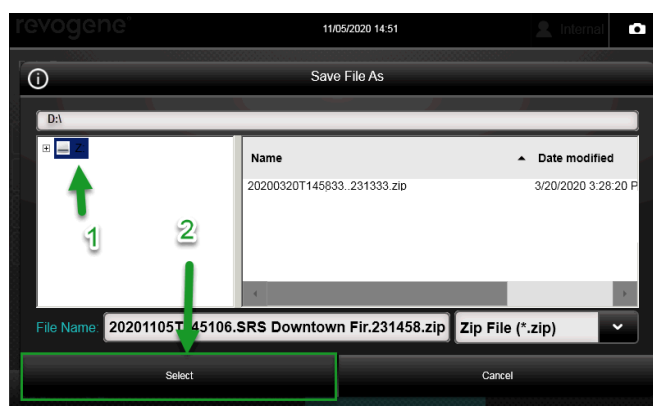
Figure 21. Saving Troubleshooting Package

6.   Contact Meridian Bioscience Technical Support Services at MBI-techsupport@meridianbioscience.com or 1-800-343-3858 and follow their instructions to send the troubleshooting package.
7.   Keep the USB flash drive.

NOTE: You can only proceed to the next steps once you received the reply from Meridian Bioscience Technical Support Services.

COMPLETION OF UPGRADE
NOTE: You must complete this step to be able to use the Revogene SARS-CoV-2 assay. The goal of this step is to extract the password protected ADF into the root of the USB key to allow the import into the Revogene instrument.

1.   Meridian Bioscience will send an email confirmation of the upgrade. This email will contain the password to unzip the ADF to run the Revogene SARS-CoV-2 assay.
2.   **Plug the USB key into a computer** and open the file explorer **(Window key + E)**:
      a.   To unzip the file, right-click on the SARS-CoV-2 EUA zip file and tap **<Extract All…> (Figure 22)**.
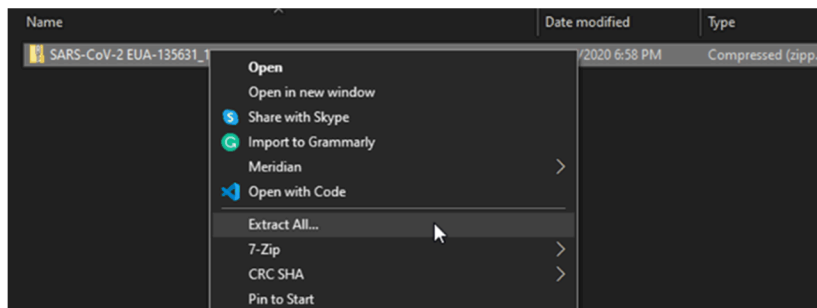
Figure 22. Extract Menu

b. A window will appear to extract the content on the USB flash drive. **Note the USB letter (Figure 23)**.
c. Erase the text after the USB letter you noted (here: **E:\,** yours can be different). T ap **<Extract> (Figure 24)**.
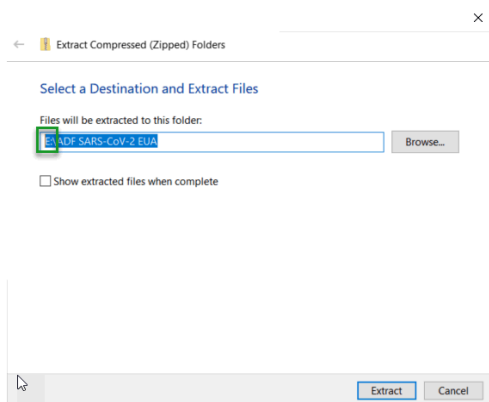
Figure 23. Window with Full Text
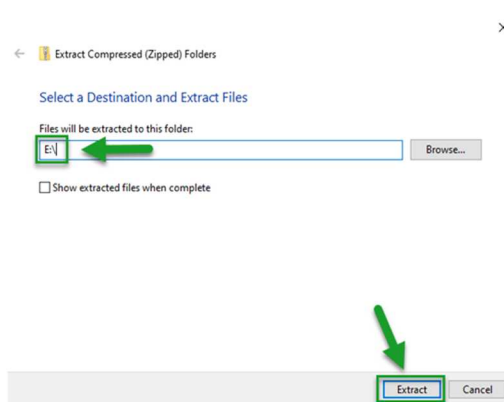
Figure 24. Modified Text and Extract Button

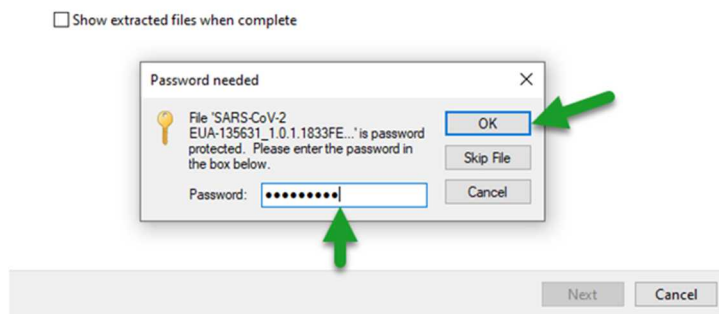d. Enter the provided password in the window when prompted and tap **<OK>**. **(Figure 25)**

Figure 25. Password Window.

3. Unplug the USB key from the computer. Plug it in the Revogene.
4. Log on to the Revogene with a "supervisor" account (admin is a supervisor account).
5. Select the **Tools** menu.
6. Select the **Assay** menu, then select **Import** on the bottom right corner of the sub-menu window.
7. A window will appear. Select the USB drive **(D:)**. The default format should be .adf. If not, change the format of the file to .adf **(ADF files)**.
8. In the USB drive files listed, select the ADF file: **SARS-CoV-2 EUA-35631_1.0.1.1833FEB5.adf**
9. Tap the **<Select>** button. **(Figure 26)**
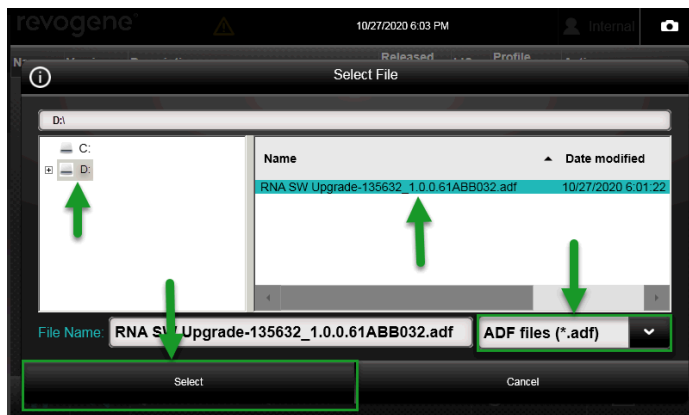
Figure 26. ADF Selection Window.

10. A window will appear stating that the ADF was imported successfully. Tap **<OK>**.

The Revogene System RNA Software upgrade is now completed and Revogene SARS-CoV-2 assay can now be used.

LIMITATIONS OF THE PROCEDURE
1. The Revogene System RNA Software Upgrade Kit must only be used with the Revogene by trained personnel.
2. Only Revogene System RNA Software upgrade Kit PIEs can be used within a single run. PIEs from other Revogene assays are not compatible with the Revogene System RNA Software Upgrade Kit and should not be used.

E-LABELING
Documentation related to this product can be accessed online at www.meridianbioscience.com/pi. Additionally, paper copies are available upon request by contacting your local distributor or via the phone number listed on the kit box.

REFERENCES
1. SN134822 Revogene® Operator's Manual

Manufactured By

Meridian Bioscience, Inc.
Corporate Office
3471 River Hills Drive
Cincinnati, Ohio 45244 USA
Telephone: 513.271.3700
Orders/Customer Service:
800.543.1980
Technical Support Center:
800.343.3858
Information Fax: 513.272.5432
Ordering Fax: 513.271.0124

SYMBOLS USAGE
You may see one or more of these symbols on the labeling/packaging of this product:
Key guide to symbols

Symbol	Meaning	Symbol	Meaning
⌛	Use-by date	(%)	Humidity Limitation
LOT	Batch Code	R_x Only	Prescription Use Only
IVD	In vitro diagnostic medical device	📦	Do not use if package is damaged
CE	CE Mark	☀	Keep away from sunlight
REF	Catalog number	PIE	Revogene Test Device
📖i	Consult Instructions for use	SBT	Sample Buffer Tube
🏭	Manufacturer	LOOP	Disposable Transfer Loop
Σ	Contains sufficient for <n> tests	DTT	Disposable Transfer Tool
🌡	Temperature limit	24x	Contains 24 Disposable Transfer Loops (DTL)
EC REP	Authorized representative in the European Community	EUA	For Emergency Use Authorization Only
②	Do not reuse	🔺 1x	Revogene Test Device
☂	Keep dry		
#x 🔺1x ▮1x	Contains # pouches: 1 Disposable Transfer Tool (DTT), 1 Sample Buffer Tube (SBT), 1 PIE		

For technical assistance, call Technical Support Services at 800-343-3858 between the hours of 8AM and 6PM, USA Eastern Standard Time. To place an order, call Customer Service Department at 800-543-1980.