

Preprocessing Methods for the Maxprep™ Liquid Handler Technical Manual

Instructions for use of Products AS9100, AS9101, AS9200, AS9201



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All technical literature is available at: www.promega.com/protocols/

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E-mail Promega Technical Services if you have questions on use of this system: techserv@promega.com

Description

The Maxprep™ Liquid Handler automates the preprocessing of samples that will be purified on Maxwell® Instruments based on the protocols supplied with individual Maxwell® RSC and FSC reagent kits. Automated preprocessing protocols allow the flexibility for administrators to create variant methods in the Maxprep™ software that specify preprocessing options to meet the needs of the laboratory. Starting a method is as simple as specifying the number of samples to process, the volume of the samples to process (depending on sample type) and the elution volume.

Supported Instruments

Instrument Name	Cat.#	Operating Manual
Maxwell® RSC	AS4500	TM411
Maxwell® RSC 48	AS8500	TM510
Maxwell® FSC	AS4600	TM462
Maxwell® CSC RUO Mode	AS6000	TM573

Running a Maxprep™ Method

2.1. Maxprep™ Liquid Handler Methods

As new Maxprep™ Liquid Handler methods are released, they will be listed on the Promega web site and available for download at:

www.promega.com/resources/software-firmware/maxwell-maxprep/maxprep-liquid-handler-methods/

This document presents general guidelines for interaction with preprocessing methods on the Maxprep™ Liquid Handler. Interaction with the user interface and the Maxprep™ Liquid Handler will be very similar regardless of the preprocessing method being run. After selecting a method to run, you will enter processing parameters (e.g., Sample Number, Sample Volume, Elution Volume) and be led through a series of user interface screens that detail preparing the Maxprep™ Liquid Handler to process samples. The Maxprep™ Liquid Handler is provided with a PC and touch-screen monitor. Interactions with the user interface screen can occur using the mouse and keyboard, touch gestures on the monitor or a combination of both approaches.

2.2. Selecting a Maxprep™ Method

To start a method on the Maxprep™ Liquid Handler, perform the following steps:

1. Start the Maxprep™ software by double-clicking the Maxprep™ software icon on the Windows® desktop. Alternatively, click the **Windows Start** button in the lower left corner of the screen, choose **All Programs**, open the **Promega** folder and click the **Maxprep** software icon.

- From the Maxprep™ software 'Home' screen (Figure 1), select the **Start** button.



Figure 1. Maxprep™ software 'Home' screen. From the Maxprep™ software 'Home' screen, select the **Start** button to begin the process of running a method.

- All of the methods that are installed in the Maxprep™ software are displayed on the 'Methods' screen (Figure 2). Methods are shown as either single line entries or with a folder icon if the administrator has defined lab-specific variants. Selecting an item with a folder icon will expand the list of variant methods that were created.

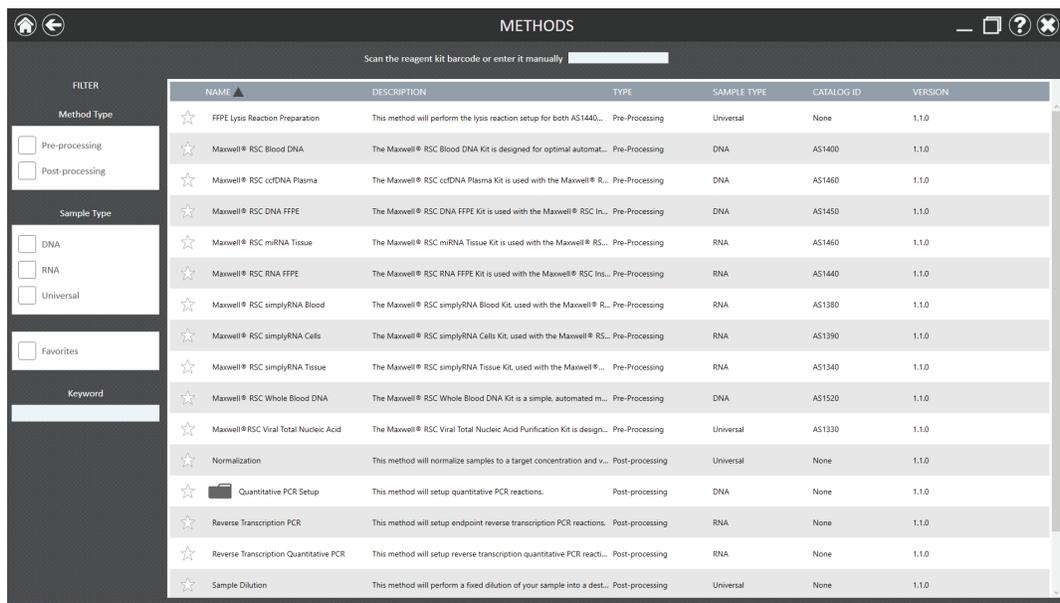


Figure 2. 'Methods' screen. The 'Methods' screen displays the methods installed in the Maxprep™ software. Select the method to run, and then select the **Proceed** button.

4. Use one of the following three mechanisms to select a method:
 - a. Select the method or variant from the list of installed methods.
 - b. Select the text box at the top of the screen, and use the manual bar code reader to scan the bar code on the Maxwell® RSC or FSC reagent kit box (Figure 2). The appropriate preprocessing method for the scanned kit is automatically selected. If variants for this method exist, select the variant method you wish to run.
 - c. Use the Filter check boxes on the left side of the screen to display only preprocessing methods or post-processing methods, only methods to purify a specific nucleic acid type, only methods marked as Favorites, or perform a keyword search for a specific word or phrase in any of the descriptive fields for the method. After filtering the list, select the method or variant from the list of displayed methods.

Regardless of the mechanism used to select a method, the selected method is highlighted and will display a **Proceed** button on the right side of the entry. Select the **Proceed** button to open the Method Run Environment (Figure 3).

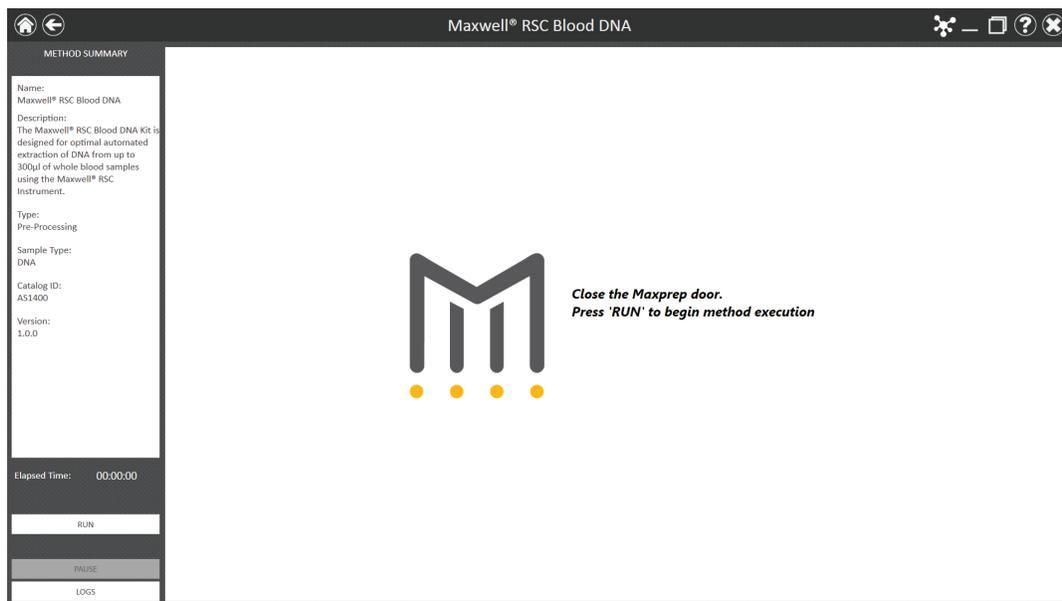


Figure 3. Method Run Environment screen. The Method Run Environment screen displays a summary of the selected method on the left side of the screen. Close the instrument door, and select the **Run** button to begin method execution.

2.3. Starting a Maxprep™ Method

The Method Run Environment displays the name of the selected method in the title bar of the screen and a summary of the information describing the selected method on the left side of the screen. If an incorrect method was chosen, press the **Home** or **Back** button at the top left corner of the screen to return to the 'Home' screen or the 'Methods' screen, respectively.

To start method execution, close the instrument door and select the **Run** button in the lower left corner of the screen. Once method execution is started, the *Elapsed Time:* will start, and the main portion of the screen will indicate that the system is initializing.

2.4. Entering Run-Specific Information

After the system has initialized, a user interface is displayed in the main portion of the Method Run Environment. This user interface is tailored to the specific method that was selected and requests information necessary to process this method. The types of information requested are common to all preprocessing methods; however, based on the specific method not all options may be shown. Below are generic instructions to follow for all of the preprocessing methods.

The first screen displayed requests information regarding general method run parameters (Figure 4) such as: Sample Number, Sample Volume (in microliters), Elution Volume (in microliters), Maxwell® RSC Type and deck layout. All supported 16-position Maxwell® deck trays are generically referred to as Maxwell® RSC deck trays in the method user interface. All supported 24-position Maxwell® deck trays are generically referred to as Maxwell® RSC 48 Front and Back deck trays in the method user interface.

Notes:

1. Not all sample preprocessing methods require or support all of the listed parameters. The Technical Manual for the Maxwell® RSC or FSC reagent kit will outline the preprocessing parameters supported for the purification chemistry.
2. When creating variant methods, the Administrator may limit the ranges available for run parameters or lock run parameters so they cannot be edited during a run.
 - Use the on-screen slider controls to specify available run parameters (e.g., Sample Number, Sample Volume, Elution Volume) to be used for this run.
 - Specify the **Maxwell RSC Type** (supported 16-position Maxwell® instrument or 48-position Maxwell® instrument). This setting determines the maximum number of samples allowed (32 for supported 16-position Maxwell® instruments or 48 for 48-position Maxwell® instruments). Only one Maxwell® Deck Tray type may be used per run.
 - Use the **Alternating Empty Sites** check box to specify the positioning of cartridges on the Maxwell® Deck Tray. When unchecked, cartridges should be loaded sequentially on the deck tray starting with position 1. When checked, cartridges should be loaded in every other position on the deck tray starting with position 1.

After entering values for all available options, press the **Next** button to proceed to the instrument setup instructions.

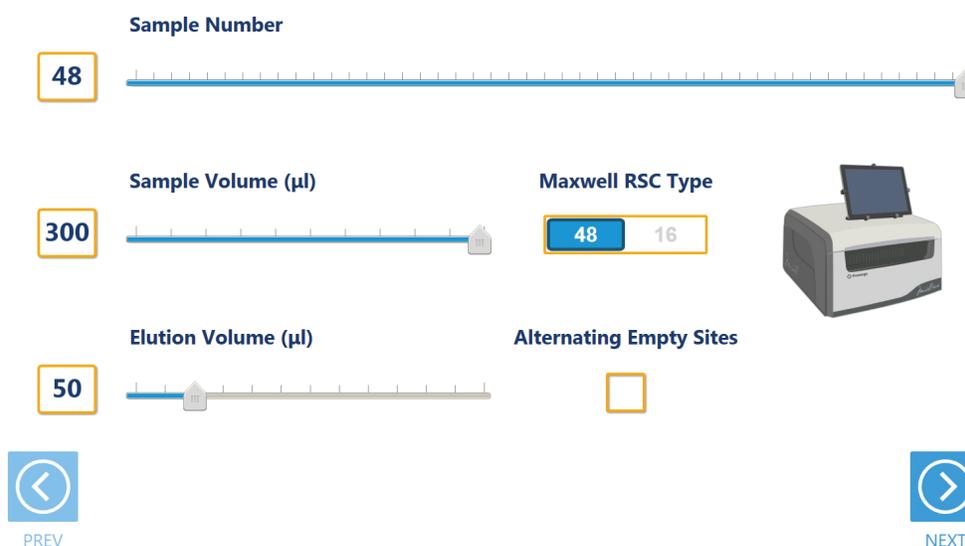


Figure 4. General Run Parameters screen. The General Run Parameters screen requests information about Sample Number, Sample Volume, Elution Volume, Maxwell® RSC type and deck layout.

2.5. Instrument Setup Instructions

Instrument setup proceeds from left to right on the Maxprep™ Liquid Handler. The loading platform of the Maxprep™ Liquid Handler uses a track system to indicate where carriers are loaded on the system. Make sure that carriers are placed correctly on the instrument at each step of the user interface. Screens are presented to indicate the types of labware that should be placed on the instrument, volumes of reagents that should be provided and allow entry of reagent and sample bar code information.

All deck setup screens display a miniature view of the entire instrument in the upper left corner of the screen with the current position highlighted. Below the deck image is a **Move Arm** button. Pressing this button will move the arm to the other end of the instrument from the deck position being loaded. Under the **Move Arm** button is a summary of the selected run parameters. On the right side of the screen is a depiction of the carrier and instructions for what should be present at each position on the carrier. There is a check box for each position where labware or reagents must be placed. As labware is loaded at each position, check the box to indicate that the indicated instruction was performed. It is not possible to proceed to the next instrument setup screen until a check is present in all check boxes on the screen.

Utility Carrier (Tracks 1–6)

The Utility Carrier is a fixed position and cannot be removed from the instrument. It contains a Heater/Shaker unit at Site 1 (back of the instrument), instrument tools (gripper paddles, plunger tools) at Site 2 and two labware positions at Sites 3 and 4 (front of the instrument; Figure 5).

Follow the information on the right side of the screen regarding placement of labware. For instance, on the screen shown in Figure 5 there should be no labware present on the Heater Shaker device at Site 1, the Gripper Paddles and Plunger Tools should be present at Site 2 and Plunger Racks should be present on the labware carriers at Sites 3 and 4.

Either a full or partially filled Plunger Rack can be placed at Site 3. Choose the **Enter Plunger Count** button at Site 3 to display a popup where the first available plunger in the partial Plunger Rack can be selected (Figure 6). Select a position on the Plunger Rack to indicate the first available plunger position in the partially filled Plunger Rack that was placed at Site 3. The act of setting the plunger position will automatically check the check box present at Site 3. If you do not set the first available plunger position for the rack at Site 3, the method will assume that a full Plunger Rack was placed at this position. Place a full Plunger Rack at Site 4, where the screen indicates that a Full Plunger Rack is required.

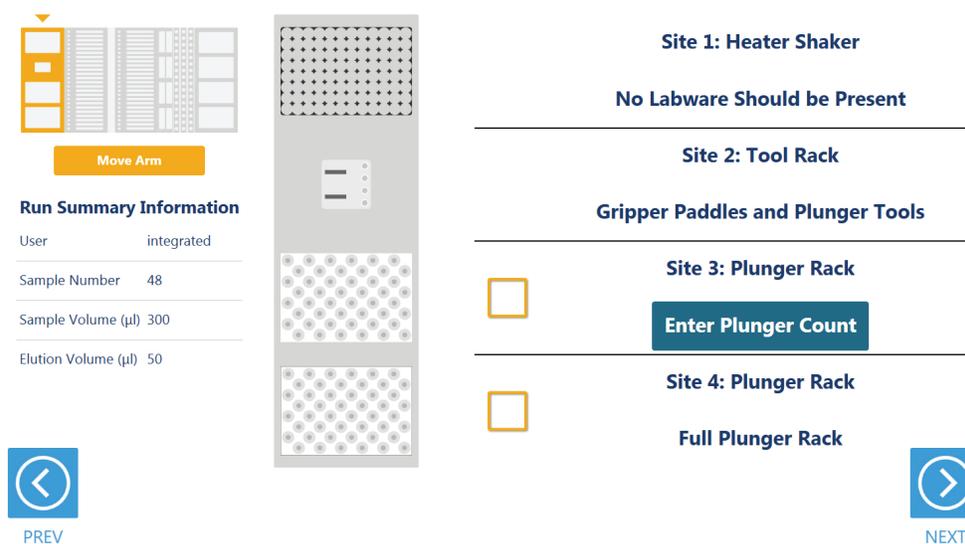


Figure 5. Deck Setup screen for the first carrier. This carrier cannot be removed from the system. The carrier contains a Heater/Shaker for incubation of samples, tools that the instrument will use for sample preprocessing and two labware positions.

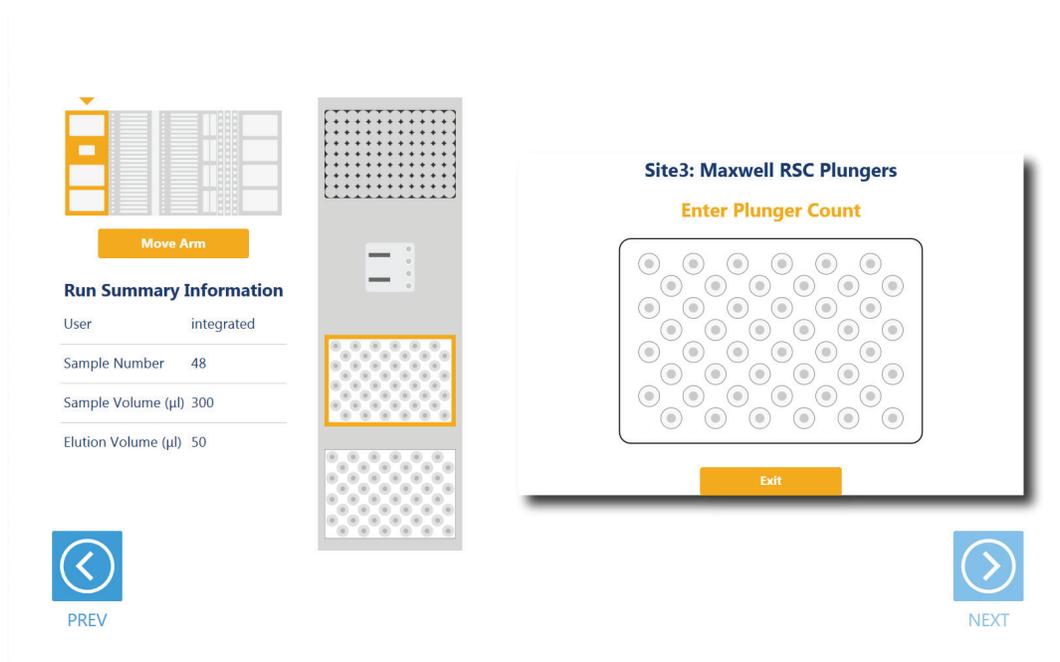


Figure 6. Selecting the first available plunger. For a partially filled Plunger Rack at Site 3, choose the **Enter Plunger Count** button to display a popup where the first available plunger is selected. Select the first available plunger position within the Plunger Rack that was placed on Site 3 (highlighted site in the image above). The Plunger Rack at Site 4 must always be a full plunger rack.

Maxwell® Deck Tray Carriers (Tracks 7–12, 14–19)

Notes:

1. Refer to the miniature instrument image on the left side of the screen to see which position the displayed Maxwell® Deck Tray Carrier should occupy on the instrument.
2. The Maxwell® Deck Tray Carriers are not intended to be directly next to each other on the instrument. A Reagent Carrier should be placed or an empty track should be left at Track 13 between the Maxwell® Deck Tray Carriers to make sure they are loaded correctly.

There are three types of Maxwell® Deck Tray Carriers: one for 16-position Maxwell® Deck Trays, one for 24-position Maxwell® Front Deck Trays, and one for 24-position Maxwell® Back Deck Trays. The choice of which deck tray type will be used for the run is made when method run parameters are entered. The screens displayed for loading Maxwell® Deck Tray Carriers will specifically indicate whether to load a 16-position Maxwell® Deck Tray, a 24-position Maxwell® Front Deck Tray or a 24-position Maxwell® Back Deck Tray, depending on the method run parameters and which carrier is being loaded. These carriers can be removed from the system and replaced, depending on the type of deck trays that are being used for this run. Set up Maxwell® Deck Trays containing the specified number of cartridges, remove the cartridge seals and place empty, uncapped elution tubes at the elution positions. Then place the Maxwell® Deck Trays on the Maxwell® Deck Tray Carriers.

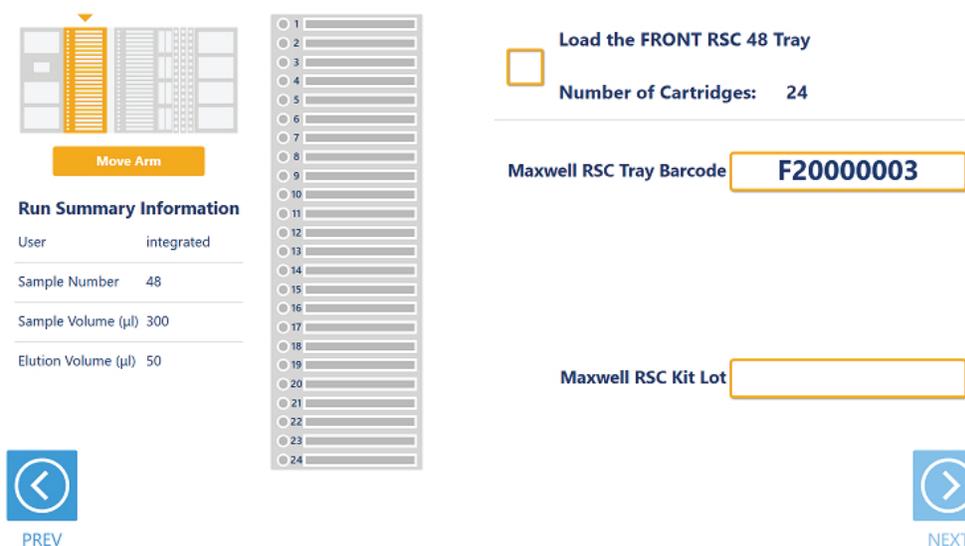


Figure 7. Maxwell® Deck Tray Carriers. These carriers are used to hold Maxwell® Deck Trays. Place Maxwell® RSC or FSC cartridges and elution tubes into the deck tray positions indicated.

On the left side of the screen (Figure 7) is an image of the deck tray with the positions of the cartridges indicated. Cartridges and elution tubes should be securely loaded into the deck tray sequentially starting with position 1 (for the 24-position Maxwell® Back Deck Tray start loading at position 25) in the indicated positions. If Alternating Empty Sites was selected as a run parameter, leave an empty position between each cartridge as shown in the deck tray image.

When loading the Maxwell® Deck Tray Carrier on the Maxprep™ Liquid Handler, select the text box next to **Maxwell RSC Tray Barcode**, and use the manual bar code scanner to scan the bar code on the top right side of the Maxwell® Deck Tray (Figure 7), or manually enter the deck tray bar code. When using 24-position Maxwell® Deck Trays, the Front tray is placed on the Maxprep™ Liquid Handler first Deck Tray Carrier position and the Back tray is placed on the second Deck Tray Carrier position. Deck tray bar code starting characters are coded for deck tray type: A = Maxwell® Deck Tray, F = 24-position Maxwell® Front Deck Tray, B = 24-position Maxwell® Back Deck Tray. The user interface will verify that the deck tray bar code is appropriate for the type of deck tray for the specified carrier. If the bar code entered or scanned for the deck tray is not appropriate for the type of deck tray to be loaded, a warning message will be displayed that the tray bar code does not match the Maxwell® Instrument model and the **Next** button will not become active. Make sure the deck tray loaded on the instrument is of the type specified.

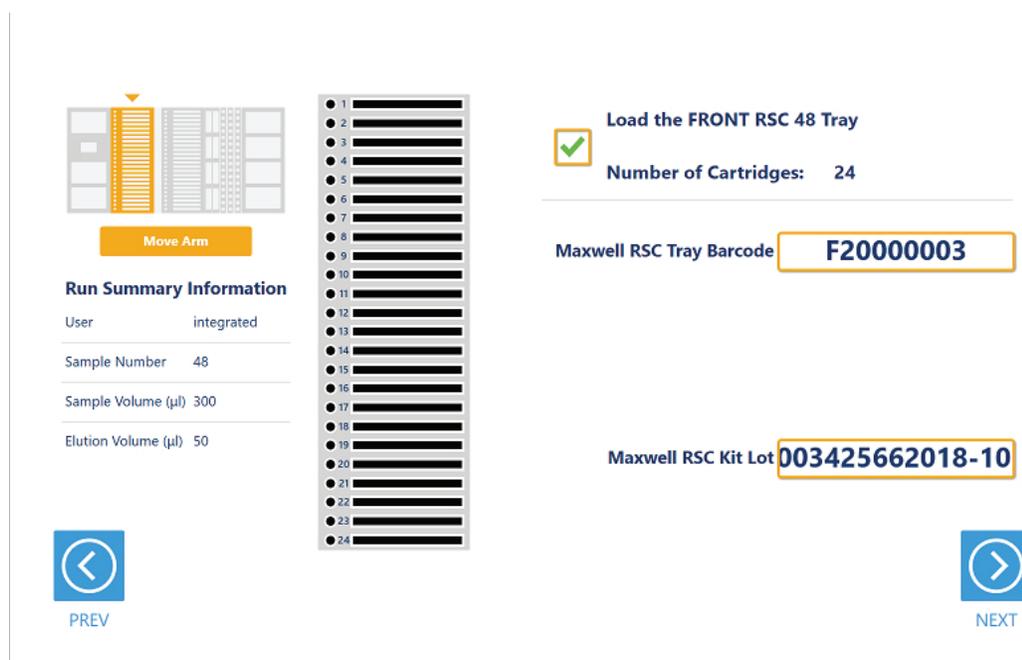


Figure 8. Maxwell® RSC Kit Lot entry. After entering an appropriate Maxwell® Deck Tray bar code, use the **Maxwell RSC Kit Lot** text box to assign Maxwell® RSC or FSC reagent kit lot information to all cartridges or on a per-cartridge basis.

Once a deck tray bar code of the appropriate type is entered, a text box will be displayed for entering the Maxwell® RSC or FSC reagent kit bar code(s) (Figure 8). Kit Lot information can be entered and applied to all cartridges on a deck tray. Alternatively, multiple Kit Lots can be assigned on a per-cartridge basis.

- **To assign a single Kit Lot to all cartridges:** Do not select any cartridges when the screen is displayed. Select the kit lot text box and use the manual bar code scanner to scan the kit bar code, or manually enter the kit bar code and press the Enter key on the keyboard. All cartridges will turn black to indicate that the Kit Lot was assigned to them.
- **To assign multiple kit lots on a per-cartridge basis:** Either click and drag or touch and drag across all cartridges to which a Kit Lot should be assigned. Alternatively, press and hold the control key (Ctrl) on the keyboard and select individual cartridges in the deck tray to which a Kit Lot should be assigned. Select the **Maxwell RSC Kit Lot** text box, and use the manual bar code scanner to scan the kit bar code, or manually enter the kit bar code and press the Enter key on the keyboard. All cartridges to which the kit bar code were assigned will be filled with a color to indicate their specific Kit Lot information.

Notes:

1. The Maxprep™ software requires manual entry of bar codes in the following format: Product Catalog Number, Kit Lot Number, Expiration Date in year-month format (example: AS13303221872020-05, where the product catalog number is AS1330, the kit lot number is 322187 and the expiration date is 2020-05).
2. When assigning kit lot information to cartridges, it is required that the product catalog number in the kit bar code matches the expected product catalog number for the preprocessing method.

Continue applying kit bar codes until all cartridges are associated with a kit lot. Administrator settings in the Maxprep™ software may require that all cartridges have a kit lot assigned and that all cartridge kit lot information assigned be within the expiration date. Warnings will be displayed if the Kit Lot information does not meet the administrator-specified settings. After the deck tray bar code and Kit Lot information are entered, check the box near the top of the screen to indicate this step was completed. Once all of these steps are performed, the **Next** button in the bottom right corner of the screen will become active. Press the **Next** button to move to the next instrument setup screen.

Reagent Carriers (Track 20, 21)



Refer to the miniature instrument image on the left side of the screen to see which position the displayed reagent carrier should occupy on the instrument.

The Reagent Carrier screen displays the names of the reagents that should be placed at each site on a reagent carrier (Figure 9). Each site at which a reagent will be placed also has an **Enter Reagent Details** button.

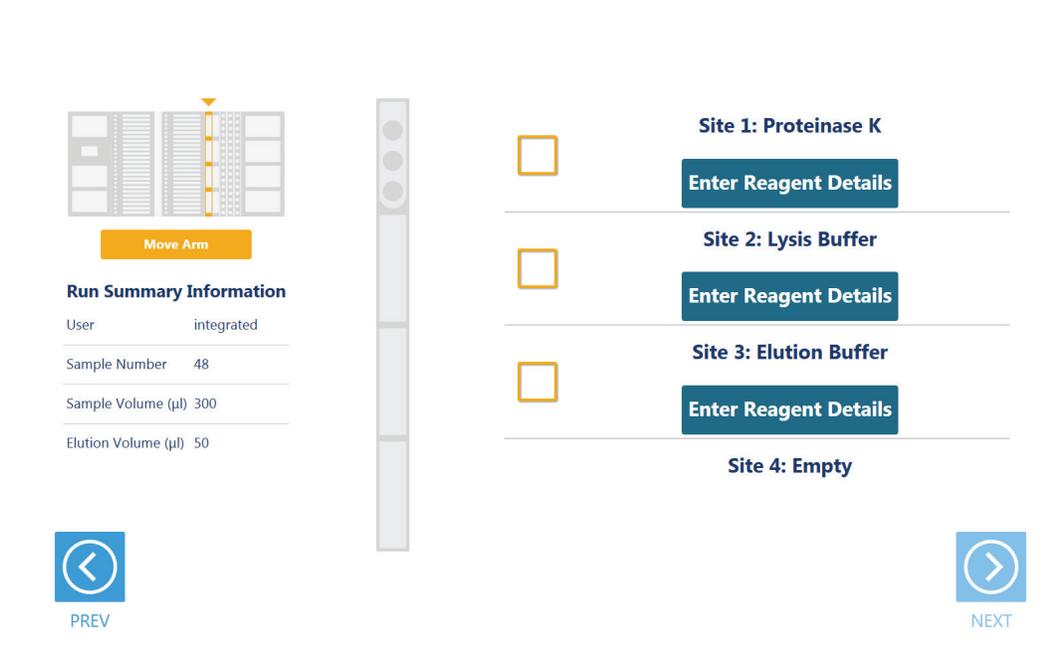


Figure 9. Reagent Carrier screen. The name of the reagent that should be placed at each carrier site is indicated on the Reagent Carrier screen. Select the **Enter Reagent Details** button for any individual reagent to see details and enter reagent lot information.

Select the **Enter Reagent Details** button to see details specific for the reagent that should be placed at the site on the reagent carrier (Figure 10). Details include:

- Reagent name
- Reagent loading instructions
- Minimum volume of reagent required for this run
- Labware that should contain this reagent
- Text box for entry of reagent lot information

Select the **Reagent Lot Number** text box to manually scan or enter the lot number for the specified reagent.

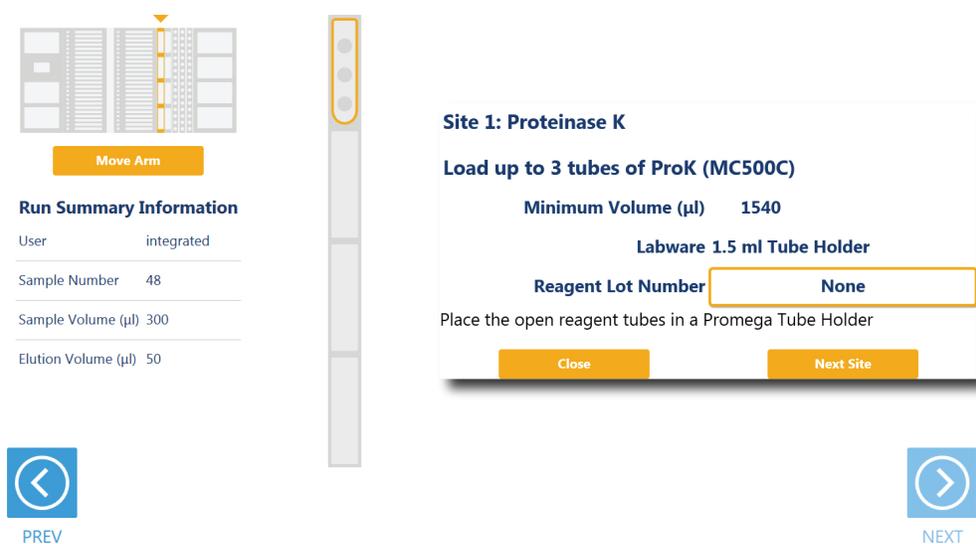


Figure 10. Reagent Details information. Details regarding the labware, minimum volume and reagent lot number can be accessed by pressing the **Enter Reagent Details** button for any occupied site on the reagent carrier.

When finished viewing instructions for a reagent site, select **Next Site** to move to the next occupied site on the reagent carrier, or choose **Close** to leave the reagent details and return to the main reagent carrier screen. The act of viewing reagent details will cause the check box for the reagent to be checked. All check boxes must be checked to activate the **Next** button on the main reagent carrier screen. Select **Next** to move to the next instrument setup screen.

When reagents are to be placed at a reagent site in tubes, place a 3-Position Tube Holder (Cat.# AS9409) at the site, and add up to three tubes containing the total volume of reagent required to the Reagent Tube Holder. The instrument will use the reagent present in the first reagent tube until it is consumed, and then it will move to the second and third tube in the Reagent Tube Holder. If there is not sufficient reagent present in all three tubes to complete the run, a warning prompt will be shown to place a new tube of reagent at the first position for this reagent.

When reagents are to be placed at a reagent site in a trough, transfer the indicated volume of reagent into a 50ml reagent trough, and place it at the designated site on the carrier. If there is not sufficient reagent present in the trough to complete the run, a warning prompt will be shown to add more of the specified reagent to the trough position for this reagent.

Once all reagents are added to the carrier and all boxes are checked, select the **Next** button to proceed with instrument setup. The number of reagent carrier screens displayed is method-specific. If no reagent carriers are required for the method, the empty carriers may be present on the instrument during the method run.

Primary Sample Tube Carriers (Track 22, 23, 24)

Primary sample tube carriers are used for sample types that start in tubes. Multiple primary tube carriers are supported on the instrument including: 10mm diameter tubes (1.5ml and 2.0ml tubes, screw- or flip-cap), 12–13mm diameter tubes (small-diameter Vacutainer® tubes) and 15–17mm diameter tubes (large-diameter Vacutainer® tubes). A mixture of Sample Tube Carrier types can be used in the same method, but all tubes within a carrier need to be of the same type. If there are multiple tube labware types that can be used on the same tube carrier, a screen will be presented to specify which labware type is being used in the specified carrier. All tubes within a given tube carrier must be of the same type.

The screen displayed for the primary sample tube carriers shows a visual representation of three tube carriers (Figure 11). All tubes placed on the system must have a sample identifier associated with them, not only for sample tracking purposes, but also to designate where tubes are within a given tube carrier. Sample identifiers can either be 1D or 2D bar code labels applied to the sample tubes or can be manually entered identifiers.

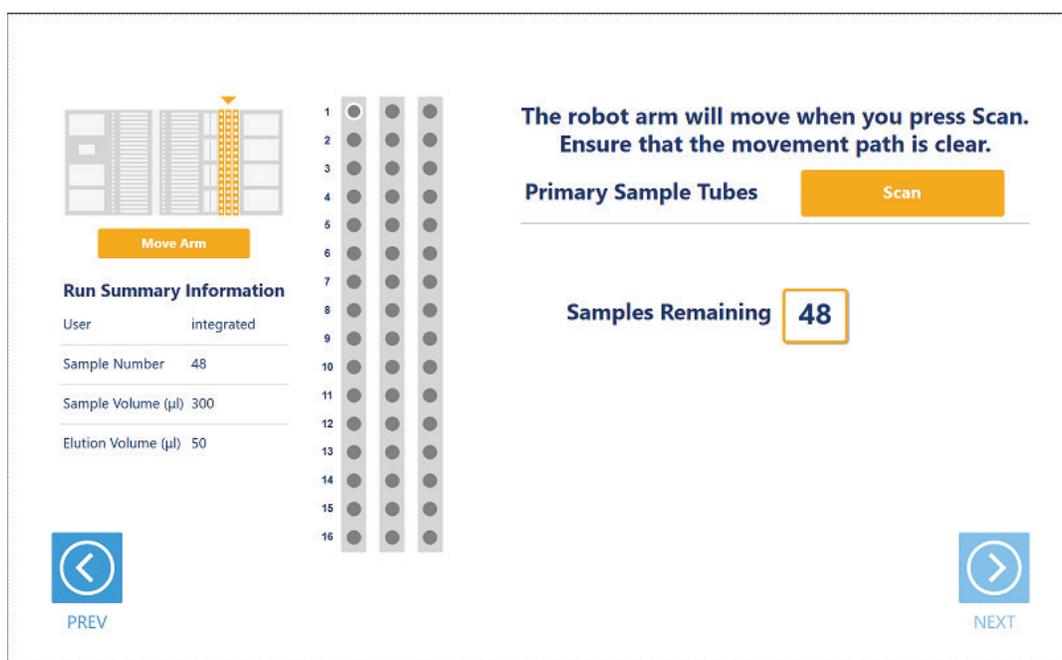


Figure 11. Primary Sample Tube Carrier screen. Use the automated bar code scanner to determine the tube carrier type and read 1D or 2D bar codes on the primary sample tubes by choosing the **Scan** button. An indication of the remaining or excess number of samples to be identified is shown on the screen.

To scan primary sample tube carriers:

1. Remove tube carriers from the system. Load tubes into the tube carriers with bar codes visible in the cutout areas on the right side of the carrier.
2. It is necessary to load all tube carriers on the instrument to identify the types of tube carriers being used and scan bar codes on the individual tubes.
 - a. Press the **Scan** button.
 - b. The instrument arm will slowly move left to the position for scanning the first primary sample tube carrier.
 - c. With the tube carrier removed from the system, the green loading light where the tube carrier should be loaded will flash.
 - d. Place the back edge of the tube carrier on the loading platform so that the rearmost bar code on the tube carrier (carrier-identifying bar code) is just in front of the bar code scanner.
 - e. Slide the tube carrier into the system until it fully contacts the back of the instrument. During this time the bar code scanner will flash each time it reads a tube position.

- f. After the tube carrier is fully seated in the instrument, the loading light at the front of the instrument will stop flashing. Approximately five seconds after the tube carrier is loaded into the instrument, the instrument arm will slowly move to the right for loading of the next position.
 - g. Repeat for all three tube carriers. Each of the three positions can utilize a different size tube carrier. If sample tubes are not present in all three carriers, press **Stop** when the instrument arm has moved after scanning the last carrier containing tubes.
3. Once all tube carriers are scanned, the following will occur:
- a. If multiple tube labware types exist for a given carrier, a popup screen will be displayed to indicate which tube type is being used on that carrier (Figure 12). Select the tube type being used from this run from the drop-down menus. All tubes on an individual tube carrier must be of the same type.
 - b. The image of the carriers on the main screen will indicate the status of each tube. Successfully scanned tubes will appear green and will have the scanned bar code associated with them; positions where no bar code could be scanned will be shown in gray.
 - c. Confirm that all positions in the tube carrier that should be processed have a sample identifier associated with them. Select the bar code entry field and use the manual bar code reader to scan or use the keyboard to enter sample identifiers for any positions that should be processed and do not have a sample identifier that was scanned.

The number of tubes present in the tube carriers must match the Sample Number that was specified for this run for the **Next** button to become active. A count of the Samples Remaining/Excess Samples Loaded is displayed on the screen to indicate how many tubes need to be added or removed. If there is a mismatch, either add/remove tube sample identifiers from the list or use the **Back** button to adjust the Sample Number on the first screen of the user interface.
4. Select the **Next** button to move to the next instrument setup screen.



The sample identifier is used to indicate the positioning of tubes within each tube carrier; all positions to be processed must have a sample identifier.

**Multiple tube types possible for the scanned tube racks.
Select the correct labware for each tube rack.**

Rack 1: Track Position 22

10 ml Blood Tubes
Vacutainer 16 mm

Rack 2: Track Position 23

6 ml Blood Tubes
Vacutainer 13 mm

Rack 3: Track Position 24

6 ml Blood Tubes
Vacutainer 13 mm

Exit

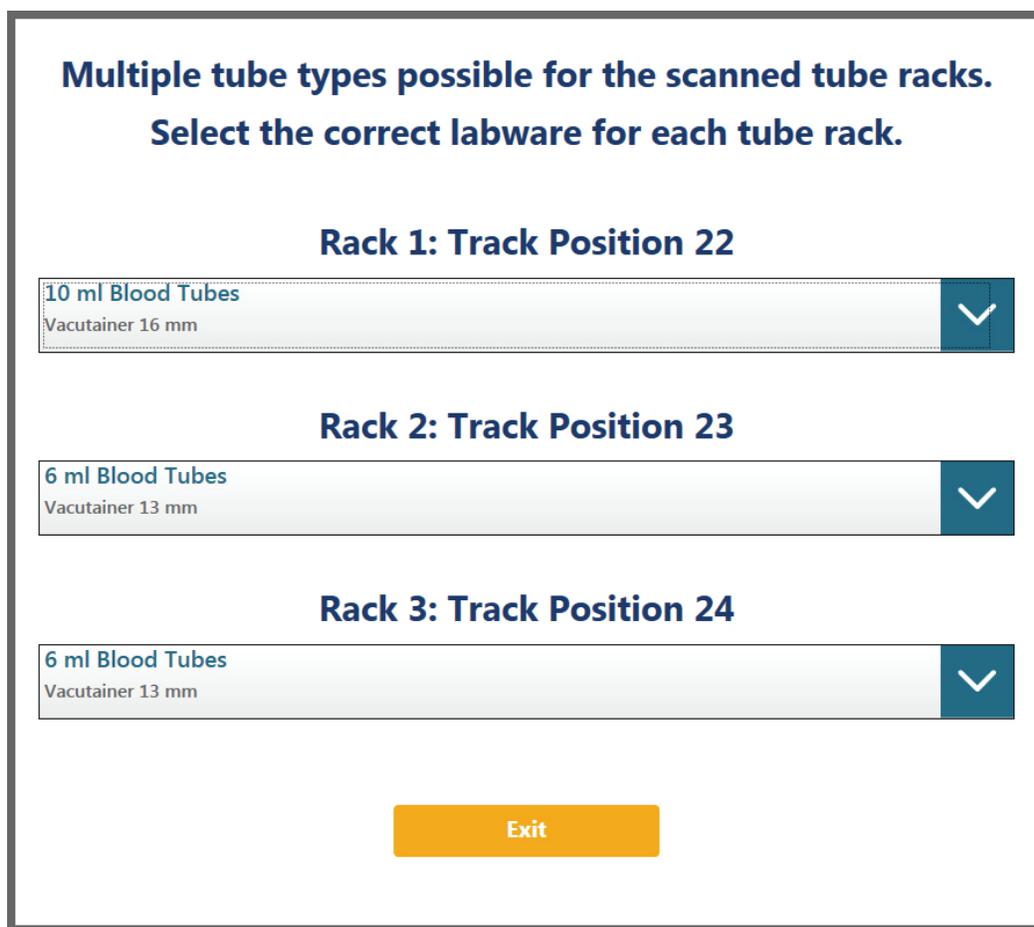


Figure 12. Labware type selector screen. If multiple tube types are allowed for a primary sample tube carrier, you need to choose which tube type is present in that carrier. Select from the available tube types in the drop-down menu for each primary sample tube carrier.

Tip and Plate Carrier (Track 25–30)

Tips and plates are placed on the tip and plate carrier (Figure 13). Site 1 on this carrier is a plate position and, if used for the preprocessing method, will contain a plate necessary for processing samples (e.g., Nunc 2.0ml Deep Well Plates; Cat.# AS9307).

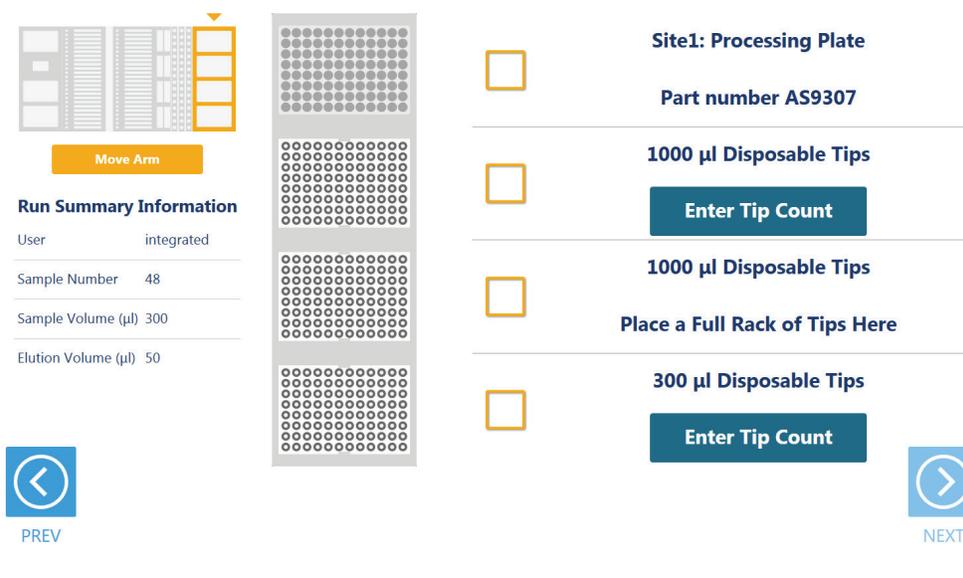


Figure 13. Tip and Plate Carrier screen. Place the specified labware at each site. Sites containing a tip rack indicate the type of tips that should be placed there and whether a partial or full rack of tips needs to be placed. For partial tip racks, select the **Enter Tip Count** button to specify the first available tip in the partial tip rack.

Sites 2–4 on this carrier are used to hold tip racks. Place tips of the specified type at each site on the carrier. Sites at which either a full or partially filled tip rack can be placed will have an **Enter Tip Count** button. Choose the **Enter Tip Count** button and select the first available tip present in the tip rack (Figure 14). Entering a tip count and selecting the **Close** button will act to check the check box for the specified site. If a tip count is not entered, the software will assume a full rack of tips was placed at the specified position. For all other sites, once you have added the requested labware, check the box next to the site. Only after all check boxes on the screen are checked will the **Next** button become active. Choose the **Next** button to move to the next screen.

Note: Confirm that the appropriate tips are placed at each position before starting the method. Tip types used at each position differ between preprocessing and post-processing methods.

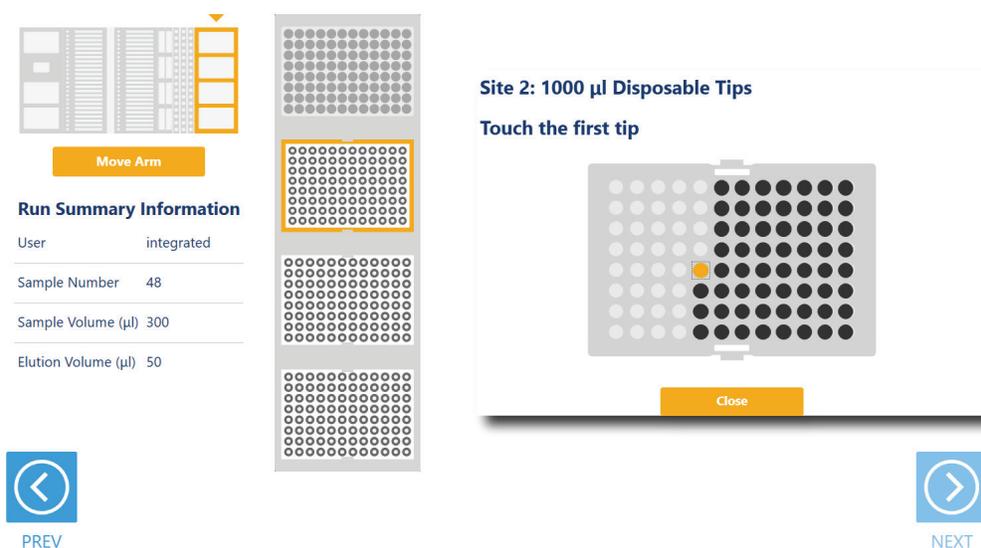


Figure 14. Selecting the first tip in a partial tip rack. For sites at which a partial or full tip rack can be placed, choose **Enter Tip Count** to specify the first tip present (in gold) in the partial tip rack. Select **Close** to return to the display of all sites on the carrier. Check all check boxes after loading labware to proceed.

Final Screen

The final screen of the instrument setup presents a list of items that should be checked before starting the run. Confirm that:

- All carriers are completely seated in the instrument.
- Maxwell® cartridge seals are removed.
- Tip waste bin is empty.
- The door of the instrument is closed.

Once the items in the list are checked and the door of the instrument is closed, choose **Next** to start automated sample processing (Figure 15). This is the last chance to return to any of the instrument setup screens and confirm instrument setup before sample processing will begin.

During the run, if there is a need to pause instrument operation in order to resolve any unforeseen issues, select the **Pause** button in the lower left corner of the screen. If it is necessary to abort the run for any reason, choose the **Abort** button in the lower left corner of the screen.



An aborted run (initiated by the user or due to instrument error) will result in the loss of all samples. Do not attempt to repurify samples from an aborted run.



Setup Complete

Run Summary Information

User	integrated
Sample Number	48
Sample Volume (µl)	300
Elution Volume (µl)	50

- ◆ Ensure that all carriers are completely pushed back.
- ◆ Verify that all Maxwell cartridge seals are removed.
- ◆ Empty the waste bin, if necessary.
- ◆ Close the door.
- ◆ Press 'NEXT' to begin processing.



PREV



NEXT

Figure 15. Final instrument Setup screen. This screen presents a list of items that should be checked before starting automated processing. The Final Instrument Setup screen also offers a final chance to return to any of the previous instrument setup screens before automated processing begins. To start processing, close the instrument door and select the **Next** button.

Potential Errors and Warnings

The Maxprep™ preprocessing methods are designed to provide notification and resolution options for several potential error and warning states. Below are listed several possible error and warning states that may be observed during a method. Always carefully read any warning or error messages to find out how to proceed. If in doubt about how to proceed with any error state, choose the **Abort** button to end the run.

Intrusion Sensor

The intrusion sensor on the Maxprep™ Liquid Handler checks for any potential physical obstructions that could prevent gantry movement on the instrument. Prior to any instrument movement (e.g., initialization, bar code scanning, arm movement, resuming a method after a pause, performing a maintenance method), always be sure to check that all carriers on the system are fully pushed to the back of the instrument and that nothing could impede the progress of gantry movements. An LED on the left front side of the deck provides a visual indicator of the intrusion sensor state. When no physical obstruction is detected, the LED is orange, but when the LED is green, a carrier or other physical obstruction has been detected by the intrusion sensor. Make sure that all carriers are fully seated on the system and that the intrusion sensor LED is orange before proceeding with any instrument operation that will result in movement of the gantry.

If the intrusion sensor does detect a physical obstruction to the gantry movement the system will display an error message (Figure 16) when the gantry attempts to move. This error does not result in an aborted run and the run can continue if you follow the steps below.

Note: During automated bar code scanning, if the intrusion sensor detects an obstruction, the error below will not be displayed and recovery is not possible. In this case, it will be necessary to abort the run, power cycle the Maxprep™ Liquid Handler, and start the method run again.

1. On the 'Channel Error Recovery' screen (Figure 16, Panel A), select the **Control Panel** button in the lower left corner to open the "Instrument Control Panel" screen (Figure 16, Panel B).
2. On the 'Instrument Control Panel' screen, select the **Unlock Door** button. Open the door of the instrument and push all carriers back. Confirm that the intrusion sensor does not detect an obstruction by checking that the intrusion sensor LED on the left side of the instrument is orange.

3. Close the instrument door and then choose the **Lock Door** button on the 'Instrument Control Panel' screen.
4. In the Initialize area of the 'Instrument Control Panel' screen, make sure the radio button for Instrument is selected and then choose the **Initialize** button. The gantry of the Maxprep™ Liquid Handler will initialize.
5. Close the 'Instrument Control Panel' screen using the **X** button in the upper right corner of the screen.
6. On the 'Channel Error Recovery' screen, in the Channel Recovery Options area, choose the **Select All** button. This will check the boxes for each channel at the top of the screen.
7. Select the **Execute Recovery** button at the bottom of the 'Channel Error Recovery' screen to retry the gantry movement and continue the method run.

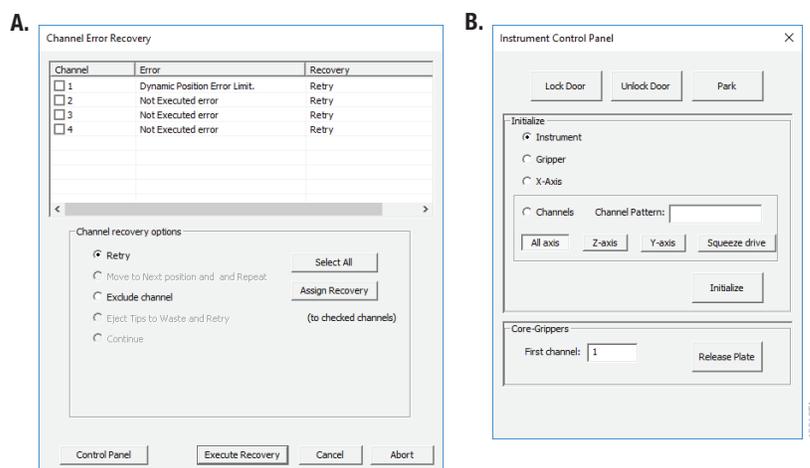


Figure 16. Error caused by a physical obstruction detected by the intrusion sensor. Panel A. When the intrusion sensor on the Maxprep™ Liquid Handler detects a physical obstruction that would impede gantry movement prior to gantry motion, the error above is displayed. **Panel B.** Follow the instructions in the text above to reinitialize the instrument and continue processing.

Unable to Load Plunger Adapters or Paddle Tools

As part of a normal method run, the instrument needs to load various tools on the pipetting channels. If the instrument is unable to load tools on the pipetting channels, you will see a warning message (Figure 17, Panel A).

This error does not result in an aborted run. When loading tools, if no tools are present at the expected location or the tools are misaligned in the tool rack, follow the steps below to replace or realign the tools on the system and try loading again.

1. On the 'Channel Error Recovery' screen (Figure 17, Panel A), choose the **Control Panel** button in the lower left corner to open the 'Instrument Control Panel' screen (Figure 17, Panel B).

- On the 'Instrument Control Panel' screen, select the **Unlock Door**. Open the door of the instrument and load the missing tools back into the tool rack or realign the tools in the tool rack. Close the instrument door and then choose the **Lock Door** button on the 'Instrument Control Panel' screen.
- Close the 'Instrument Control Panel' screen using the **X** button in the upper right corner of the screen.
- On the 'Channel Error Recovery' screen, in the Channel Recovery Options area, select the **Select All** button to check the boxes for all affected channels.
- Choose the radio button for Retry as the recovery option, and then select the **Assign Recovery** button. This will assign the recovery of Retry to all checked channels. The screen should look similar to that in Figure 17, Panel A.
- Choose the **Execute Recovery** button at the bottom of the 'Channel Error Recovery' screen to retry the loading of the tools and continue the method run.

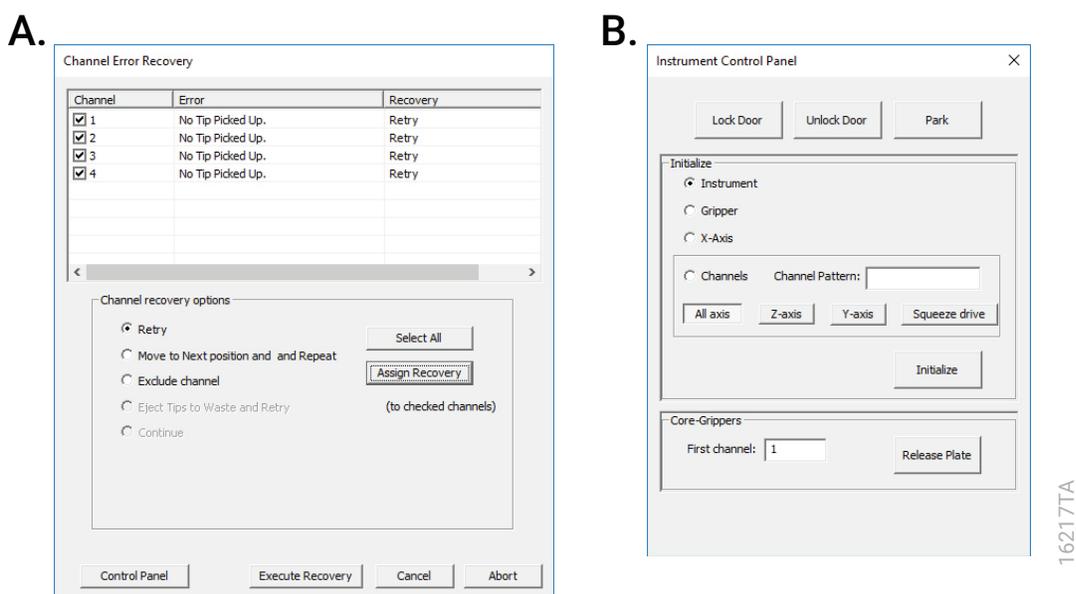


Figure 17. Error caused by inability to load tools. Panel A. When the system tools are missing or misaligned, the Maxprep™ Liquid Handler detects that tips could not be loaded and the error above is displayed. **Panel B.** Follow the instructions in the text above to replace or realign the tools, retry loading the tools, and continue processing.

Unable to Load Tips

As part of a normal method run it is necessary for the instrument to load tips on the pipetting channels. The instrument will attempt to load tips at a position twice and will automatically move to the next tip position. If the instrument runs out of tips of a given type, a warning will be displayed to replace that tip type with a full tip rack.

Insufficient Tips

While the preprocessing methods were developed to minimize the chance of consuming all available tips during a run, there is still a possibility that a warning message will be displayed indicating that there are no longer tips available on the tip and plate carrier (Figure 18). If this warning occurs, the instrument will pause operation and unlock the door. Open the door of the instrument, add the appropriate tip type to the first site for that tip type, close the door and press **OK** to resume processing.



Figure 18. Insufficient tips on the system to complete a method. In the event that all tips of a given tip type are consumed during a run, the instrument will pause and unlock the door. Open the door, load more tips of the indicated type on the tip and plate carrier, close the door and press **OK** to resume processing.

Insufficient Sample

For methods in which sample volume was specified at the beginning, if the system detects an insufficient volume of sample in the sample labware to transfer the volume of sample specified for the run, the tips will move to the bottom of the tubes and transfer any volume that is present in the tube. Samples for which an insufficient volume was detected will be noted in the Notes field of the final run reports.

Clotted Sample

Certain sample types have the possibility of having clots or material that may prevent accurate pipetting. If the system detects a clot in a sample, the system will dispense the clot back into the source tube and transfer any volume that is present in the tips to a Maxwell® cartridge. Samples that experience a clot during pipetting will be noted in the Notes field of the final run reports.

Insufficient Liquid

If the system detects an insufficient volume of reagent in the reagent troughs or the three reagent tubes to transfer the volume of reagent specified for the run, a warning will be displayed (Figure 19). The system will pause operation, and a warning message will prompt you to check and refill the empty trough or tube. After replenishing the reagent, close the door of the instrument and press **OK** to proceed.

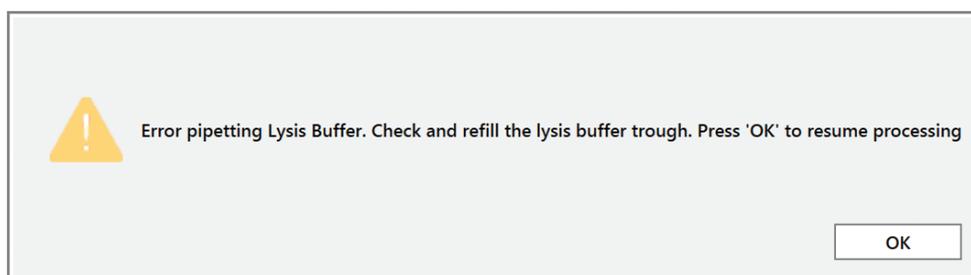


Figure 19. Insufficient reagent on the system to complete a method. In the event that insufficient reagent is detected in a trough or tube position, a warning will be displayed, and the instrument will pause and unlock the door. Open the door, replenish the indicated reagent, close the door and press **OK** to resume processing.

Unable to Detect Plate

In methods involving plate movement, there is a check that the plate was transferred to the destination location. If there is no plate detected at the destination location, a warning will be displayed (Figure 20). Press **OK** to abort the run. When performing instrument setup always ensure that all labware is placed on the instrument at the indicated locations.



An aborted run (initiated by the user or due to instrument error) will result in the loss of all the samples. Do not attempt to repurify samples from an aborted run.

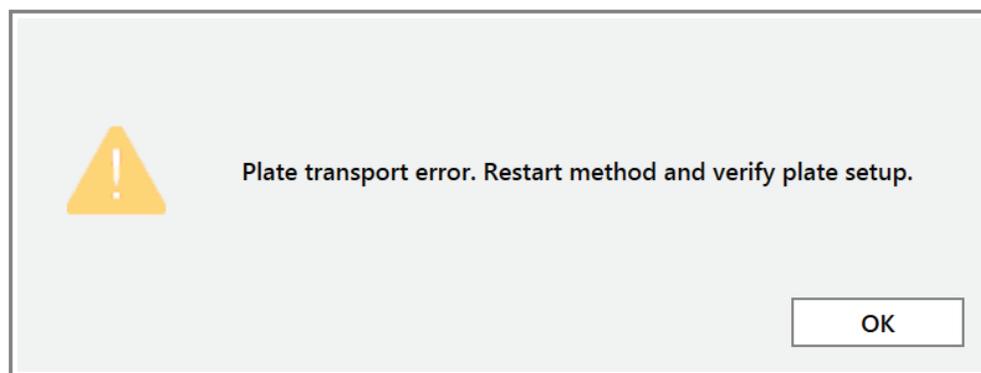


Figure 20. Plate not detected. After plate movement steps, there is a check to determine whether the labware was successfully moved to the destination location. In the event that the plate is not detected in the destination location, a warning will be displayed and the method will be aborted. Press **OK** to continue and abort the method.

Hardware Crash

If the instrument experiences a physical crash of the pipetting channels into an object during the course of a method run, an error message will be displayed (Figure 21). This error message will indicate that there was a Hardware Error and the instrument has lost steps. For any situation where a physical crash of the instrument has occurred, press the **Abort** button to end the method run. Follow the instructions below for an aborted run.

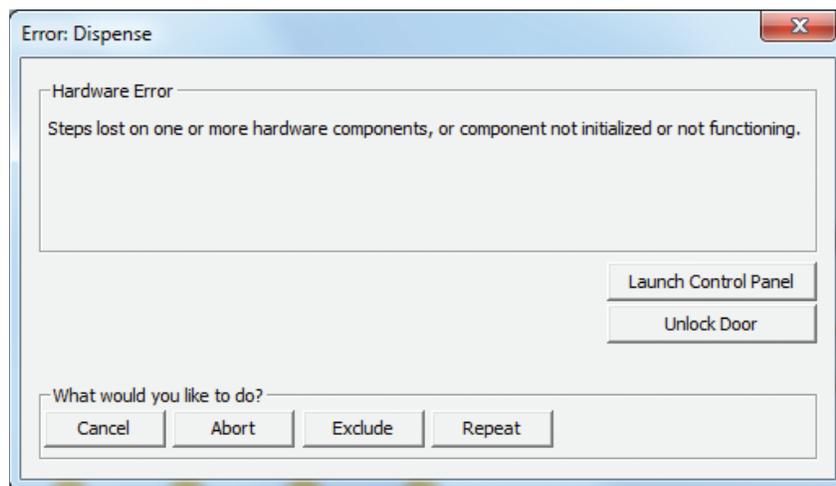
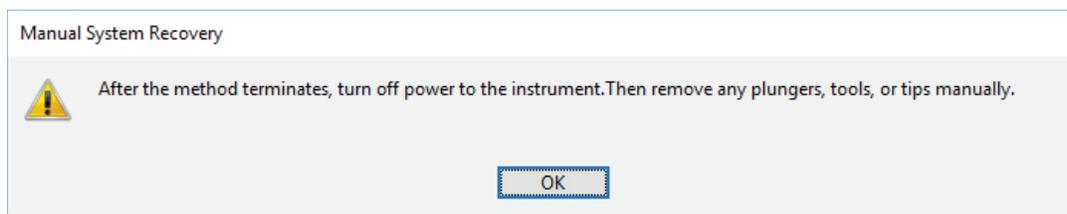


Figure 21. Hardware Error screen. In the event that there is a physical crash of hardware components that results in an error message, press the **Abort** button on the error screen to end the method run.

Aborted Run

Once sample processing has started, aborting a run should be considered a last resort. However, there are situations where manually aborting a run (by pressing the **Abort** button in the lower left corner of the screen) may be necessary. Alternatively, there may be conditions where an instrument error could cause a run to be aborted. In the case of an aborted run, you will see a warning message (Figure 22) indicating that the instrument should be powered off. If the instrument has experienced a physical crash or there are plungers, tools or tips loaded on the pipetting channels, after powering the instrument off, resolve the crash state by following the instructions regarding recovering from an instrument crash (see the *Maxprep™ Liquid Handler Technical Manual #TM509*). Power the instrument back on, and restart the Maxprep™ software. We recommend running the Weekly Maintenance method after any instrument crash, if there is not visible damage to the pipetting channels. The Weekly Maintenance method will check instrument calibration. If the Weekly Maintenance method produces failing results, contact Promega Technical Services to schedule a service visit prior to further use of the instrument.

Note: Wait 1 minute after power cycling the Maxprep™ Liquid Handler before starting the software to allow for communication to be re-established.

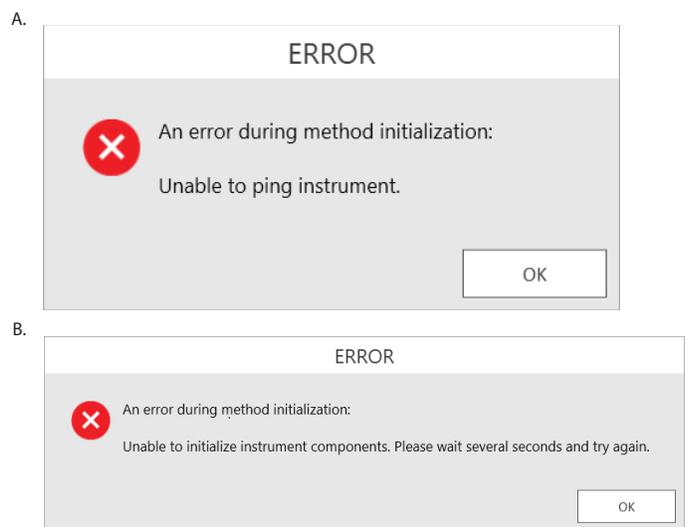


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Figure 22. Aborted method. A message will be displayed after aborting a run indicating that the instrument should be powered off. After turning the instrument off, open the door and manually resolve the crash state as instructed in the *Maxprep™ Liquid Handler Technical Manual* #TM509. After any instrument crash, contact Promega Technical Services to determine whether the instrument may require a service visit.

Instrument Connection Errors

After turning the instrument on, wait at least one minute after the green light on the automated bar code scanner turns on before starting a method run. If the instrument has not fully performed its internal initialization before starting a run, one or more warning messages may be displayed (Figure 23). These warning messages will indicate an error in instrument connection. A message indicating “Unable to ping instrument” is displayed if the instrument is not powered on. Power the instrument on and wait at least one minute after the green light on the bar code scanner turns on before attempting to restart the method. Press the **OK** button, wait several seconds and attempt to start the method again.



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Figure 23. Instrument connection errors. Connection errors will be displayed during a run if the instrument has not completed its full internal initialization before a method run is started. The errors shown in Panels A and B may be displayed. Confirm that the instrument is powered on and has fully initialized, then press the **OK** button, wait several seconds and attempt to restart the method.

Variant Method Variables

Administrators can create laboratory-specific variants of preprocessing methods by accessing the methods on the instrument. The general process of creating variant methods is discussed in the *Maxprep™ Liquid Handler Technical Manual #TM509* (Section 4.3). Below is a generic list of the types of variables that can be adjusted by administrators for preprocessing methods. For all variables listed, the administrator can define a default value for the variable, adjust minimum and maximum allowable values (within the range provided for the method) for method variables and determine whether the variable can be adjusted by the user at run time. For any variable listed below, check the box in the *User Modifiable* column to allow users to change the administrator-specified default value of the variable at run time.

Maxwell® Variables

These variables define the layout and Maxwell® Instrument type that are used in the method.

Alternating sample layout: This check box designates whether cartridges are placed in the Maxwell® deck tray at every position or at every other position (with blank positions between cartridges) starting with position 1 on the deck tray.

Check Box State	Description
Unchecked	Cartridges are placed in the Maxwell® deck tray at every position starting with deck tray position 1.
Checked	Cartridges are placed at every other position in the Maxwell® deck tray alternating cartridge and empty position starting with deck tray position 1.

Maxwell® 16-position Instrument: This variable determines whether a method run will default to using the deck trays for a Maxwell® 16-position or 48-position Instrument. Check the box to default the method to use 16-position Maxwell® deck trays; leave the box unchecked to default the method to use 24-position Maxwell® deck trays.

Sample Variables

This variable set allows the administrator to specify the default setting and allowed ranges for sample-specific settings like Sample Number, Sample Volume and Elution Volume.

Sample Number: Specify the default Sample Number to be displayed when the variant method is run. The minimum and maximum values for the range of Sample Number also can be modified within the default range values of 1–48. There are situations where the administrator may wish to narrow the range of the Sample Number variable:

1. If the laboratory has only supported Maxwell® 16-position Instruments, limit the upper end of the Sample Number to 32.
2. If the administrator indicates that only alternating sample layout (see list of Maxwell® variables) is to be used for this variant, limit the upper end of the Sample Number to 24.
3. If the administrator wants to ensure that every run uses at least a minimum number of samples, limit the lower end of the Sample Number to >1.

Sample Volume: Not all preprocessing methods support a range of Sample Volumes, so this variable may or may not be present, depending on the method. At run time, Sample Volumes are modifiable in increments of 25µl using a slider. While it is possible to enter any integer value within the allowable range for the Sample Volume in the variant definition, if the value is changed at run time it may not be possible to return to the default value that was set. For methods where a range of Sample Volumes is allowed, it is possible to set the default value of this variable. The administrator may also narrow the range of allowed Sample Volumes that users can set at run time depending on the needs of the laboratory.

Elution Volume: The Elution Volume variable specifies the volume of elution buffer that is added to the elution tubes during deck tray preparation. After a purification run there will always be some loss of Elution Volume, so the final volume of eluted material will be less than the volume that is added to the elution tubes. At run time, the Elution Volume is modifiable in increments of 5µl using a slider. While it is possible to enter any integer value within the allowable range for the Elution Volume in the variant definition, if the value is changed at run time it may not be possible to return to the default value that was set. The administrator also may narrow the range of allowed Elution Volumes that users can set at run time depending on the needs of the laboratory.

Troubleshooting

For questions not addressed here, contact your local Promega Branch Office or Distributor.
Contact information available at: www.promega.com. E-mail: techserv@promega.com

Symptoms	Causes and Comments
Cannot modify run-specific information	The most likely cause is that a variant method is being run. Variant methods allow the administrator to not only specify default values and limit the ranges for run-specific information, but also allow the administrator to determine what variables can be modified by the user during a method run.
	If the range of values for a specific variable is narrowed by the administrator, it will only be possible to select values within the narrowed range that was set.
	If the administrator has specified that users cannot change the value of a specific variable during a run, it will not be possible to alter these values at run time.
	Check with your administrator to determine the settings specified for the variant method that is being run.
Cannot select the desired value for Sample Volume or Elution Volume	Sample Volume (where applicable) and Elution Volume can only be selected in specific increments. For Sample Volume the increment is 25µl, and for Elution Volume the increment is 5µl. Values outside of these increments cannot be selected.
Sample Volume is not an available variable	Not all preprocessing methods allow a range of input Sample Volumes. Consult the Technical Manual for the Maxwell® RSC or FSC purification kit to determine whether a range of volumes is allowed.
Desired labware type is not an available input labware option	Many common labware types are available; however, if a specific labware used in the laboratory is not present, contact Promega Technical Services to request that a new labware definition be created for your laboratory.
Cannot advance to the next instrument setup screen	Confirm that all check boxes present on the screen are checked. If at a sample entry screen, confirm that the number of sample positions indicated in the input sample labware exactly matches the number of samples set for the run. It is not possible to proceed from the tube setup screen if there is a mismatch between the number of samples present in the input sample labware and the Sample Number specified.

Symptoms	Causes and Comments
Instrument error or crash during method run	Double-check that the labware specified during instrument setup exactly matches the labware being used for the method run. Plate movement and pipetting are dependent on precise labware definitions. Do not substitute “similar” labware for the labware specified in the method.
Inaccurate pipetting	Make sure that Daily and Weekly Maintenance methods are being run on a regular basis. The maintenance methods will check that the pipetting functions of the Maxprep™ Liquid Handler are working within expected parameters.
Plunger not transferred	Plunger transfer relies on a tight vacuum seal between the plunger tool bellows and the plunger to be moved. Clean the bellows on the plunger tool with a Kimwipes® cloth soaked in distilled water, and dry with a dry Kimwipes® cloth. If plunger transfer becomes a persistent problem, replacing the bellows on the plunger tools may be necessary. Contact Promega Technical Services for further information.
Method not available for desired Maxwell® RSC or FSC reagent kit	Promega will provide new preprocessing methods for Maxwell® reagent kits as they become available. To download new methods as they become available, visit: www.promega.com/resources/software-firmware/maxwell-maxprep/maxprep-liquid-handler-methods/

Related Products

PRODUCT	SIZE	CAT.#
Nunc 2.0ml Deep Well Plates	60/pack	AS9307
Maxwell® RSC Plunger Pack	1 each	AS1670
Maxprep™ 1000µl Conductive Disposable Tips, Filtered	40/box (3,840 tips)	AS9303
Maxprep™ 300µl Conductive Disposable Tips, Filtered	60/box (5,760 tips)	AS9302
Maxprep™ 50µl Conductive Disposable Tips, Filtered	60/box (5,760 tips)	AS9301
Maxprep™ 3-Position Reagent Tube Holder	1 each	AS9409
Maxprep™ Plunger Holder	1 each	AS9408
Maxprep™ Reagent Reservoir, 50ml	28/pack	AS9304
Maxprep™ Waste Bags, Clear	100/pack	AS9305
Maxwell® RSC/CSC Deck Tray	1 each	SP6019
Maxwell® RSC 48 Front Deck Tray	1 each	AS8401
Maxwell® RSC 48 Back Deck Tray	1 each	AS8402
Maxwell® RSC Instrument	1 each	AS4500
Maxwell® RSC 48 Instrument	1 each	AS8500
Maxwell® FSC Instrument	1 each	AS4600
Maxwell® FSC Deck Tray	1 each	AS4016
Maxwell® CSC Instrument	1 each	AS6000

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