Running MVS Volume Verifications in Batches, Storing Bar Codes, and Creating Task Templates

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Abstract
This application note discusses using the Artel Multichannel Verification System (MVS®) to streamline aqueous volume verifications in microplates by testing and reading plates in batches, storing bar codes, and creating task templates. This capability allows for a faster, less manual volume verification process by coordinating tasks and eliminating repetitive bar code scanning.

Introduction: Batch Methods for Performing Volume Verifications
A Batch method, or Batch template, in MVS Data Manager version 2.2+ is a stored sequence of verification tasks comprising as many devices, plate layouts and volume verifications as needed[1]. The Batch method can combine commonly used verification procedures into a single method, avoiding the need to step through each phase of one or more verification processes, which is normally governed by the MVS system software in a prompt-by-prompt manner.

Using a Batch method for volume verification is extremely helpful for repetitive testing procedures or when volume checks are performed frequently. A Batch file template can contain one or more of the following: liquid handler ID, plate layout ID (target volumes, number of replicates, and tolerances), plate type, and shaker mixing step. When running a Batch method, the software will prompt the user for any testing detail not written into the Batch file. When information, such as

reagent bar codes, is included in the Batch file, the software will use this stored information and not prompt the user for these bar codes, thereby expediting the verification process. A Batch method can be used for aqueous volume verification measurements in 96-well plates (100 nL – 350 µL) or 384-well plates (10 nL – 55 µL) and it is often useful to create a separate Batch method for running the Calibrator and Baseline plates. The Batch manager can be a powerful tool to facilitate the automation of volume verifications on the deck of a liquid handler. A different application note discusses the process of integrating and running Batch methods for automated volume verification tests using the liquid handler's software[2].

Requirements
(1) MVS, with Data Manager software 2.2 or higher
(2) Training on MVS operation
(3) MVS Sample, Diluent, and Baseline Solutions
(4) MVS Calibrator plate
(5) MVS-compatible 96-well and 384-well microtiter plate(s)
(6) Pipette or automated liquid handler

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Using Batch Manager

Creating a Batch method for daily calibration of the MVS. Each day the MVS is to be used, a Calibrator Plate (Calplate) and Baseline Plate must be read with the plate reader before any volume tests can be performed. A Batch method can be created to run the Calplate and Baseline plate. To create a Batch method for these two plates, the Batch Manager must first be opened (**Figures 1** and **2**).

When the screen in **Figure 2** is observed, click "Add". In this simple example of creating a Batch file for MVS calibration, the following two tasks are added by clicking the appropriate icon button in the software interface (see **Figure 3**): (1) Calplate and (2) Baseline. The Calplate's bar code information can be added by first highlighting the Calplate item on the left and then clicking on the "Bar Code" field (on the right side of the window, **Figure 3**). By doing so, the Calplate's critical information is stored in the method and it will not have to be scanned again.

For the Baseline plate, the plate type is selected (96-well plate in this example) and the Baseline solution bar code label is scanned. Additionally, the "Show Shaker Prompt" item is selected as "True" to enable the mixing step to be performed with the MVS shaker. If this step were "False", the user would not be able to use the MVS shaker during the verification process. Note – the "Show Shaker Prompt" set to "False" option is normally used when mixing steps are performed with the liquid handler or via a different off-line shaking/mixing routine. In all cases described herein, the "Show Data Prompt" is set to "False" so that the MVS system software does not prompt the user to browse for the appropriate data file. This "Show Data Prompt" option is normally used when different, qualified readers are employed and the absorbance files have to be imported into MVS Data Manager for data processing and output volume calculations[2].

Figure 1. To create a Batch method, select "Batch → Batch Manager" from the dropdown menu.
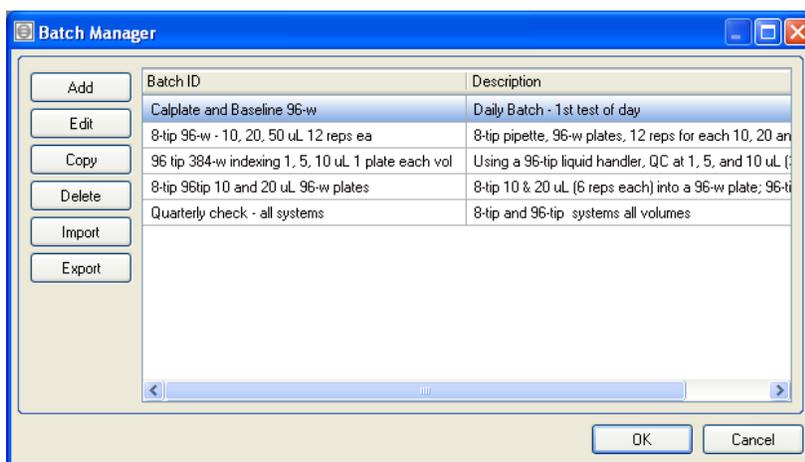

Figure 2. Using Batch Manager, Batch methods can be created, edited, copied, deleted, exported, or imported.

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Running the Batch Method for MVS Calibration

Once a Batch testing method has been created, it can be used by going to the Main Menu and selecting "Batch → Start Batch Verification" as shown in **Figure 4**. The user then selects the Batch test from the list offered in the next software window. In the example here, the user selects the Batch for the Calplate and 96-well Baseline plate. For this Batch method, the MVS software prompts the user three times, in this order: (1) place the Calplate in the plate reader to read the plate; (2) place the filled Baseline plate onto the shaker and shake the plate; and (3) place the Baseline plate

in the plate reader to read the plate. The MVS is now calibrated and it is ready for volume verification tests.

Note – if testing will occur with more than one plate type, such as with 96-well and 384-well standard plates, it would be to the user's advantage to also include the 384-well Baseline plate in this Batch method. If volume verification tests were to be included in the specific Batch method above, the user would be forced to re-read the Calplate and Baseline plates each time the Batch method is selected, which is time consuming and not necessary. Therefore, it is
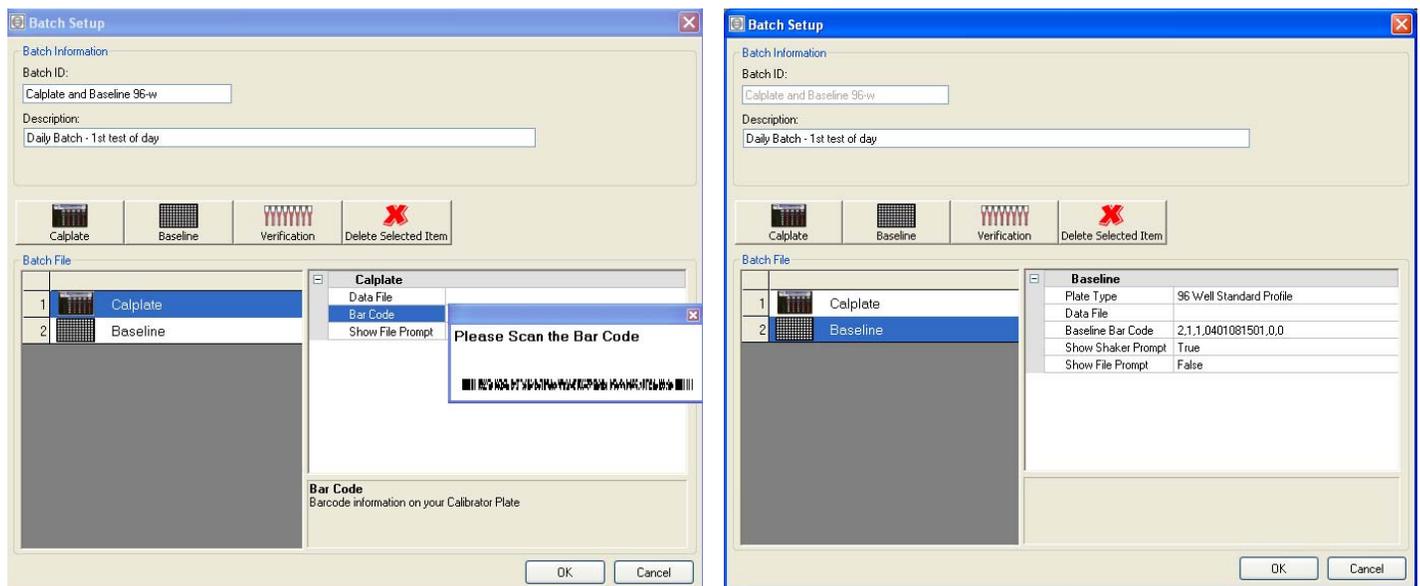

Figure 3. (left) The Calplate bar code can be scanned and stored for use by the test method. (right) The Baseline plate can be defined by plate type (96-well vs. 384-well) and the bar code of the Baseline solution can be scanned and stored into the method.
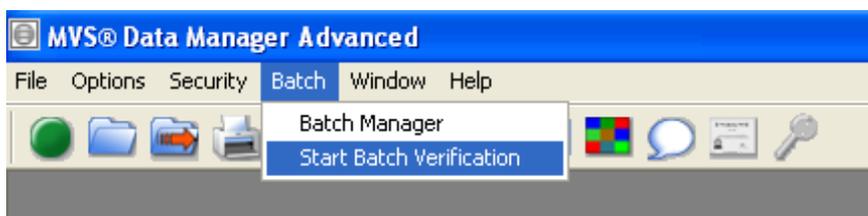

Figure 4. Start a Batch test by going to the Main Menu and selecting "Batch → Start Batch Verification".

recommended to run and store the Calplate and Baseline plates in one Batch method, and create/use different Batch methods for any volume verification tasks.

Batch Methods for One or More Volume Verification Tasks
When performing routine, or frequent, target volume testing, as with the same target volumes in the same plate types, it can be a time-saver to create and use a Batch method. A Batch method can include testing for multiple liquid handlers dispensing target volumes in different plate types and with different layouts (different target volumes, varying number of reps, *etc.*). A Batch method setup can also be as simple as testing one liquid handler for one volume verification task.

In the example below, a Batch method will be created for an 8-tip liquid handler at multiple target volumes. In this example, an 8-tip liquid handler is tested at 10, 20 and 50 µL with 12 reps at each volume with tolerances of 3% and 2% for accuracy and CV, respectively. First, define the liquid handler device in the MVS system software ("Main Menu → File → Liquid Handler Setup") as well as the three appropriate Plate Layouts ("Main Menu → File → Plate Layout Setup"). After the above are defined in the MVS system software, a Batch method can be created to include the three verification tasks, *i.e.*, the three separate tests will be run one after the other using the three separately-filled 96-well plates to generate three separate MVS output reports.

Creating a Batch method for volume verifications. Go to "Main Menu → Batch → Batch Manager", and click "Add". Give the Batch method an appropriate title and description. In the example below, the title and description are quite informative, which is often needed because these are the only fields that are seen when the user initiates a volume verification task. As shown in **Figure 5**, the three volume verification tests are included (left side of window) and each one is

further defined by highlighting a task and entering the appropriate information, as shown on the right side of the software window in **Figure 5**. For each of the coordinated verification tasks, the liquid handler ID (which is the same for all three tasks) and the three different plate layouts are selected (one plate per task). In all cases, the MVS Sample Solution bar codes are scanned for the appropriate Range and Diluent solutions. As shown in **Figure 5**, the 10-µL (left in figure) and 20-µL (right in figure) tests each require a different 96-well plate (not shown, the 50-µL test also uses the same plate as the 20-µL test). An MVS Verification Plate is required for the 10-µL test and a Corning 3631 plate is required for the 20-µL (and for the 50-µL) testing. **Figure 5-left**, *the bar code for the MVS Verification Plate is purposely not included in the Batch method* (for more on this topic – see Considerations below). In all testing, the "Show Shaker Prompt" is set to False because the liquid handler will perform a mixing step for each plate with a series of on-board aspirate/dispense cycles.
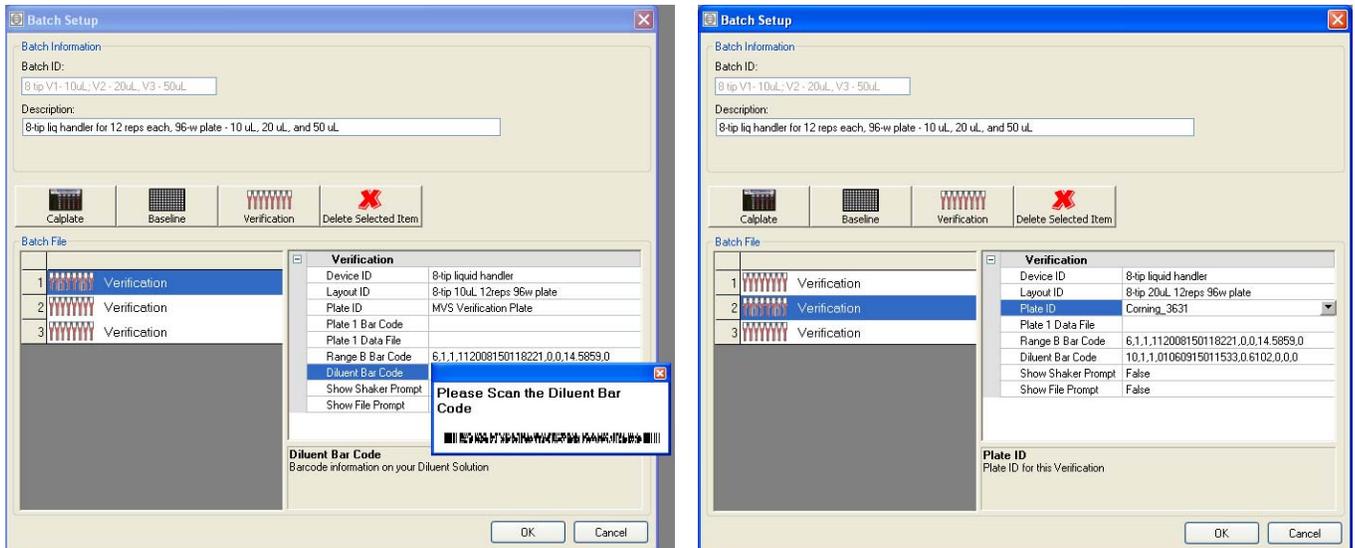
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Figure 5. Shown are fields in the Batch method for testing an 8-tip liquid handler at 10 µL (left image) and 20 µL (right image) for twelve reps in two different 96-well plates.

Running the Batch Method for the 8-tip Liquid Handler and Three Test Volumes

As shown in **Figure 4**, the Batch method is initiated by selecting "Batch → Start Batch Verification" from the Main Menu. The user then selects the specific Batch method from the list. In the example here, the user selects the Batch method for the 8-tip liquid handler and three test volumes. During the volume verification, the MVS software will only prompt the user four times, in this order: (1) scan the bar code on the MVS verification plate; (2) insert the MVS verification plate into the plate reader to read the plate; (3) insert the Corning plate into the plate reader to read the plate; and (4) insert the (second) Corning plate into the plate reader to read the plate. The MVS software generates three different output reports, one for each plate (where there is one target volume per plate). Batch methods can save time because they require less manual work (less scanning, and fewer software prompts to accept/follow).

Considerations

MVS Verification Plates. When always using MVS Verification Plates, it is recommended to avoid incorporating the plate bar codes into the Batch method. When the plate bar code is incorporated, the Batch method will flag the user that the specific Verification Plate has been used (starting with the second use of the Batch method) and it will prompt the user to select and scan a different Verification Plate.

Batch method testing is recommended for advanced MVS users. The user must maintain the same order of plates in the Batch method as they are placed into the plate reader so the volume calculations are *coordinated* with the correct volume tests. For instance, if ten plates are filled during the testing tasks, those ten plates need to be kept, and read, in the same order as defined in the Batch method. Be careful not to coordinate too many volume verification tasks together, as human error might creep into the process. The user must also ensure the correct reagents are employed, *i.e.*, the bar codes on the sample solutions must be the same as stored in the Batch method. When new solutions are purchased, or when solutions expire, the user must update/maintain the Batch method accordingly. The Batch method assumes that the user is employing the same reagents (same bar codes) on the deck of the liquid handler as stored in the

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Batch method. The MVS software *does not* run a 'checksums' on the bar code information or any other 'safety check' to indicate an error, *i.e.*, that the wrong solutions are being employed.

Mixing. With Batch mode, the user has the ability to turn off the shaker step, *i.e.*, the MVS system software will not request the shaking step to occur if "Show Shaker Prompt" is set to "False". This feature is available to help facilitate a more automated volume verification process where a non-MVS related, fully-validated mixing step is already incorporated. Efficient mixing is extremely important to the verification process. Users should exercise caution – a poor mixing method, or complete lack of a mixing method, will contribute to poor performance results and the liquid handler might be incorrectly blamed, when in fact, poor mixing is the reason for inaccuracies in the results.

Dilution and Alternative Solutions Testing. Dilution and alternative solution testing are currently not supported in Batch method testing.

More advanced use of Batch methods. In a more advanced use, Batch methods enable Laboratory Information Management System (LIMS) programs, or other laboratory automation controlling software, to create procedures for MVS software to follow. The MVS output reports can be automatically exported in XML or HTML format for subsequent data processing or use with LIMS. In the Main Menu, select "Options → Preferences", click on the box in the lower left corner to enable "Automatic Data Exporting", and choose where those verification files should be exported, *i.e.*, where the files should be saved. In this scenario, an automatic link between the automation (liquid handlers) and the measurement QC system (Artel MVS) is created[2]. Automated MVS-based volume

verifications can be performed on the deck of a liquid handler after the MVS is integrated with the liquid handler[2]. In this more advanced use of Batch, a qualified plate reader can be used for reading the absorbance values. To determine volume values using other plate readers, the absorbance values are processed by the MVS system software using the Import file feature under "Options" from the Main Menu. When using the Batch function with user integrated components, such as a qualified plate reader, a user may create a more walk-away volume verification process for on-the-fly in-process QC validation.

References

(1) MVS User Guide.

(2) Rogers, A.L. "MVS Data Manager Integration: Executing an MVS Volume Verification of a Tecan EVO Using EVOware Software" Artel Application Note, available by contacting Artel Technical Support between 8 am – 5 pm EST (888.406.3463 x109) or via email at technical.support@artel-usa.com. Alternatively, the application note is available at Artel's on-line resource library at http://www.artel-usa.com/resources/applications.aspx (assessed June 2009).

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