

The logo for Titian, featuring the word "titian" in a lowercase, sans-serif font, enclosed within a white, teardrop-shaped graphic element.

{ APPLICATION NOTE }

# Liquid Handling in Mosaic Sample Management Software with the VSLH Module

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VERSION: 1.0. DECEMBER 2017



Mosaic Sample Management is Titian Software's comprehensive, customisable, modular software product to control and monitor all aspects of sample storage, preparation and delivery. From small biotech to global pharma, Mosaic helps to provide a seamless, error-free sample supply chain and audit trail.

Mosaic Sample Management is a tailored solution for all sample management requirements, configured through expert consulting services.

Mosaic SampleBank and Mosaic FreezerManagement are Mosaic packages, optimised and pre-configured for rapid deployment:

- FreezerManagement keeps track of samples in freezers and provides a comprehensive audit trail as samples are accessed and aliquoted.
- SampleBank provides full inventory tracking capabilities coupled with sample ordering and workflow management in a simple package. It offers seamless start-up and ongoing performance for busy sample managers.

Mosaic's modular approach means that it is simple to upgrade or extend the software's functionality whenever it is needed.

# Introduction

New liquid handling instrumentation can offer many benefits to your laboratory. However, to take full advantage of the increase in efficiency, these devices need to be fully integrated into your existing processes and complement your automated workflows. This will include performing tasks such as creating work lists, tracking tip usage, processing data, updating inventory and managing error handling.

Mosaic sample management software tracks liquid handling operations among many things. These operations can be performed by instruments or by manual methods and are usually tracked as part of a wider Mosaic workflow. Pipetting operations such as individual well-to-well transfers, plate replication and transfers from microtubes to plates can be processed and tracked in a variety of ways using Mosaic.

The VSLH module is one way to integrate liquid handling workflows. It is named VSLH after the variable span heads it was originally designed to support (Variable Span Liquid Handling), however it now includes Tecan and Hamilton multi-channel pipetting head options. This application note gives you an overview of how VSLH can be used with Mosaic to fulfil your liquid handling workflows in an automated and fully integrated way.

## Compatible Liquid Handlers and Operations

The Mosaic VSLH fulfilment module is for controlling a liquid handler with variable span liquid handling channels or the Tecan MultiChannel Arm (MCA) or Hamilton CO-RE® MPH (Compressed O-Ring Expansion Multi-Probe Head).



Currently supported instruments are:

- Beckman Biomek® systems
- Hamilton Microlab® STAR™ systems
- Tecan Fluent® and EVO®
- Zinsser LISSY®

Supported liquid handling operations are:

- Cherry Picking
- Dilution
- Solubilisation
- Serialisation
- Adding various reagents (for example, standards and controls, DMSO)
- Volatile solvent transfer
- Ad hoc mode (for example, to fill empty plate wells not within a Mosaic order workflow)



## Advantages of Using the VSLH Module

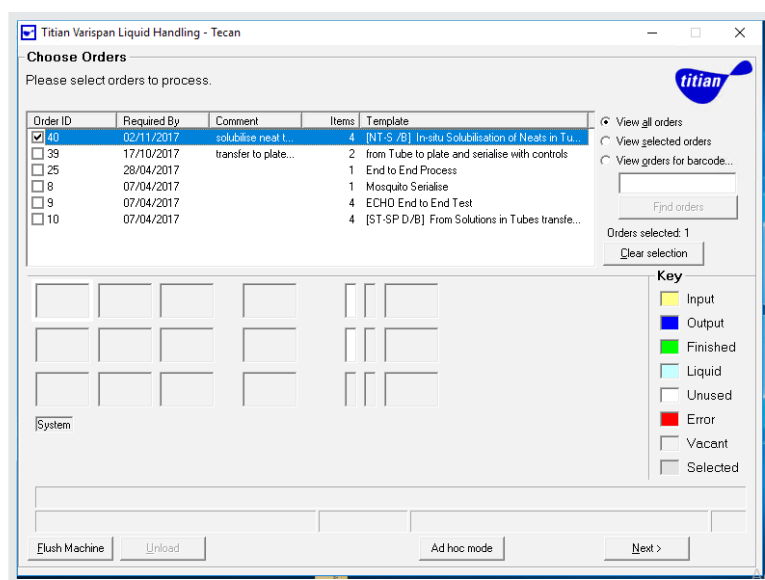
Mosaic sample management software brings the benefits of end-to-end sample tracking and inventory management to your liquid handler. The powerful Mosaic workflow management system allows the liquid handler to be used in a multi-stage workflow for sample processing involving other instrumentation and / or manual pipetting operations.

The key benefits to a VSLH integration are:

- Users are guided through setting up a run on the liquid handler, based on the parameters of the Mosaic order, to specify
  - Workflow segment (for example cherry picking or serialise)
  - Labware and tip placement and tracking
  - Reagent sources
  - Standard and control positions and required volumes
  - Support for block replication (for example Tecan MCA) operations with 96 and 384 tip heads
- The VSLH module validates the run and writes the liquid handling instrument control scripts based on the requestor's requirements
- The VSLH module performs inventory and workflow updates in real-time
- Error handling
  - Operators can intervene to handle machine failures, and the inventory is only updated when transfers are completed
  - The VSLH module maintains details of work in progress during a liquid handling run. If the run is interrupted by power failure or a tip crash, for instance, the operator is asked to confirm any suspect transfers at the time of the interruption and can resume. A new script will be written to complete the work
- Ability to integrate subsystems
  - Some peripherals, such as plate stackers, can also be integrated into your VSLH configuration and controlled through scripting

## Performing VSLH Liquid Handling Workflows in Mosaic

The steps that an operator undertakes to fulfil an order workflow step with the VSLH module are as follows:



- 1) The order information will be updated automatically and loaded into the VSLH module. The operator can select an order from the screen or by scanning labware that has work allocated. The operator can also unload unnecessary labware that remains on the liquid handler workbed from previous runs and/or flush the liquid system if desired.

**Choose Disposable Tip Type**

Please select the type of disposable tip to be used:

VSLH test DIT110 (500ul syringe)

96 COS RBP	384 MAT DWP								
96 COS RBP									
96 COS RBP									

System

Dilution Order 1 (Dilution) Trough containing at least 3.456mL of 66.7% DMSO, 33.3% Water

Trough 110 Trough 96

Flush Tecan < Back Next >

- The operator is guided through the liquid handler setup, including selection of the workbed layout, placement of input and output labware by scanning the barcode on the workbed, designation of solvent sources and tip type selection.

**Run In Progress**

A run is currently in progress.

Transfers: 676 / 1048

96 MAT VBP	Standard Rack								
384 MAT FBP									
384 MAT FBP									

System

XRLHTest 1822 (IC50) Input for order XRLHTest 1822. Dispose after run

XRLH00000170 96-well Matrix V-bottomed plate 0

Ease Run

- After the liquid handler setup, the operator selects the "Start Run" button and the VSLH module creates and launches the necessary scripts to run the liquid handler.
- In parallel to the physical run, the VSLH module updates the workflow and the Mosaic inventory.
- When the liquid handling run is completed, the VSLH module guides the user through unloading the labware items from the workbed. Labware items with further work can remain on the workbed.

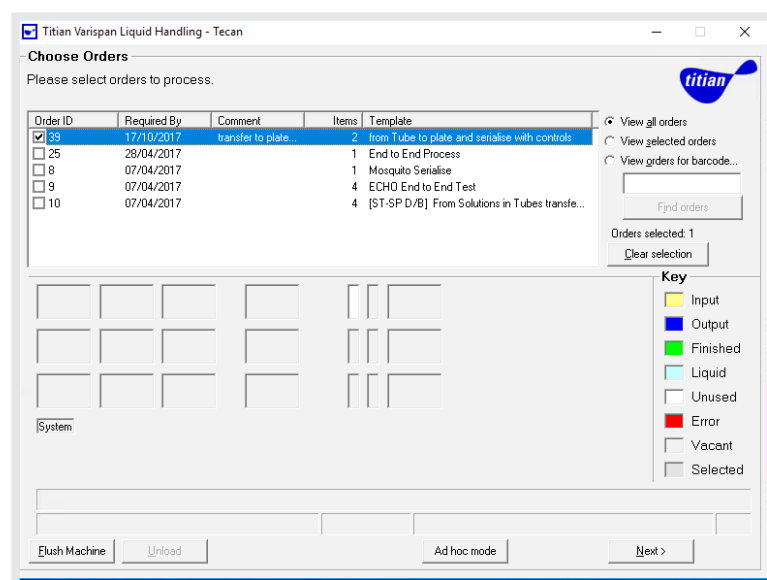
# Use Case: Preparation of a Serialised 384 Well Plate with DMSO Controls and Standards

For this example, a Mosaic order has been setup where the workflow contains:

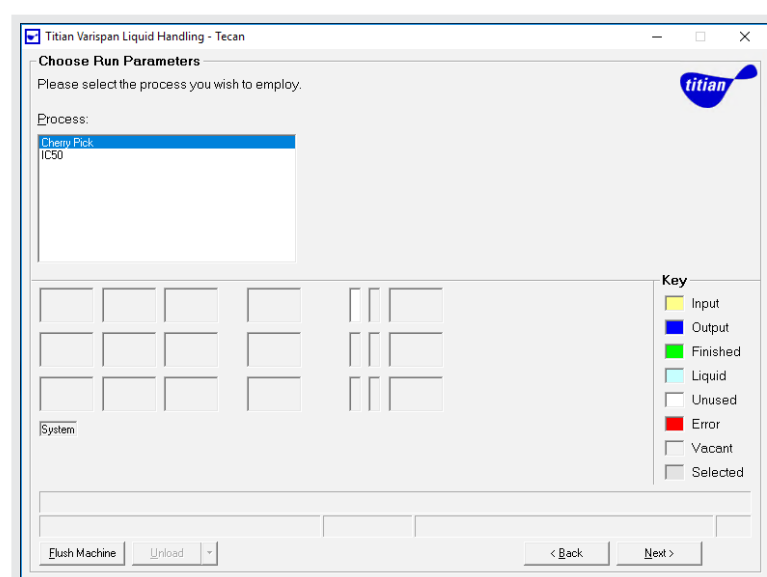
- A cherry picking process from a tube to a plate
- Addition of standard substances
- Dispensing of DMSO control wells

The last step of the run is to serialise the substances and standards.

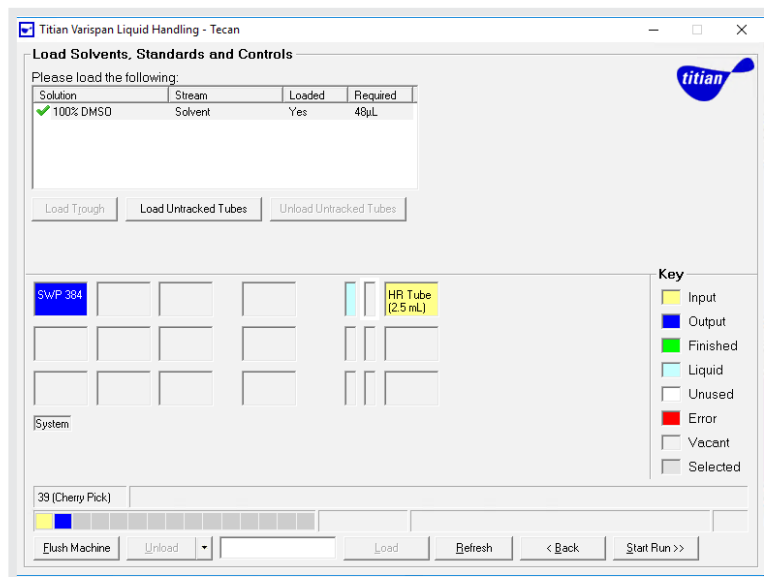
To fulfil this workflow using the Mosaic VSLH module on an automated liquid handler, the following steps are taken:



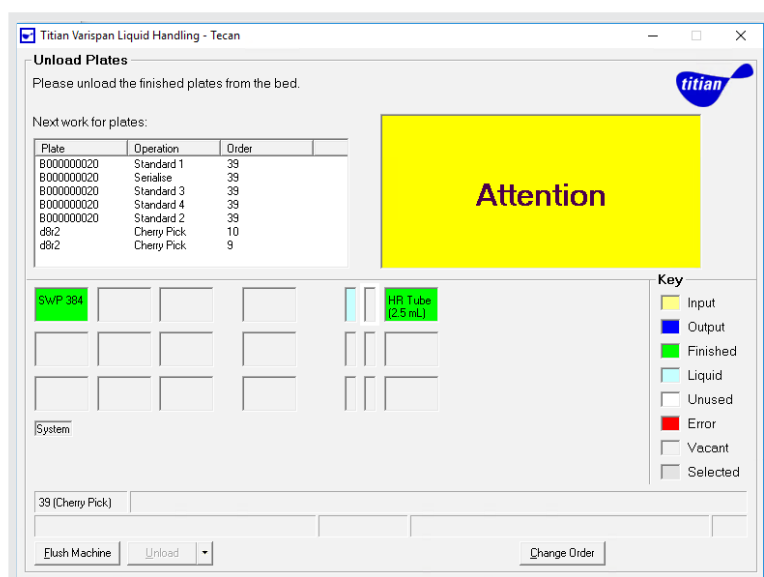
- 1) Start up the VSLH module for the liquid handler, select the appropriate order, and press "Next".



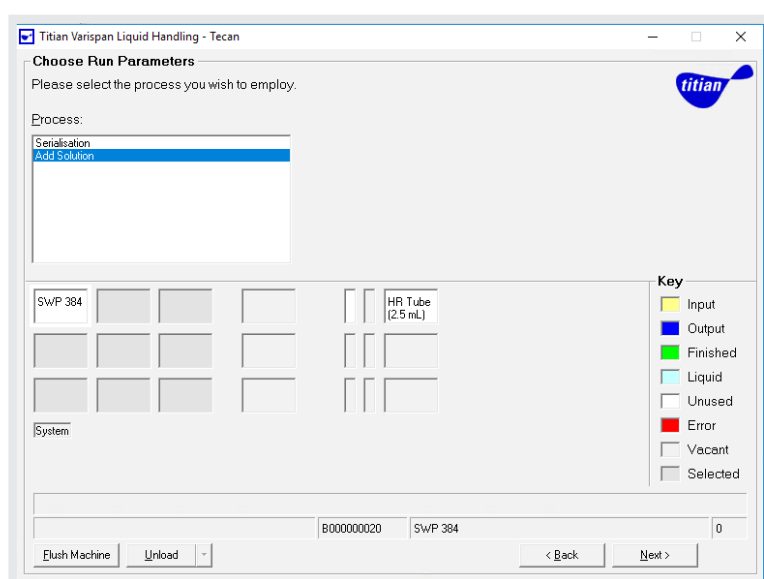
- 2) Select the workflow process to be run. In this case, the Cherry Picking operation has been chosen before the Serialisation (IC50) run. Press "Next".



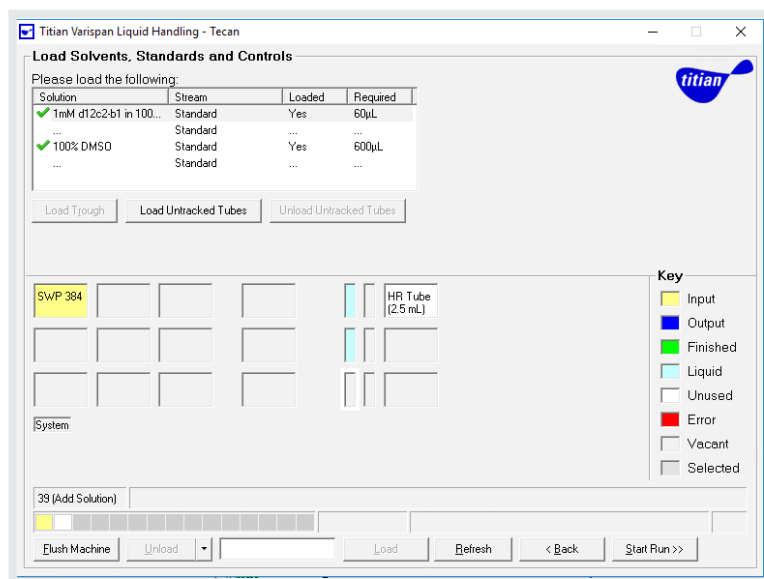
3) Based on the order, the VSLH module guides the operator to load the bed of the liquid handler. The input plate containing the samples required for the order and the destination tube rack are now placed on vacant bed positions. If necessary, a trough containing solvent will also be placed on the bed. The volume will be calculated based on the consumption for the selected process. By pressing "Start Run", the cherry picking process will be fulfilled by the liquid handler.



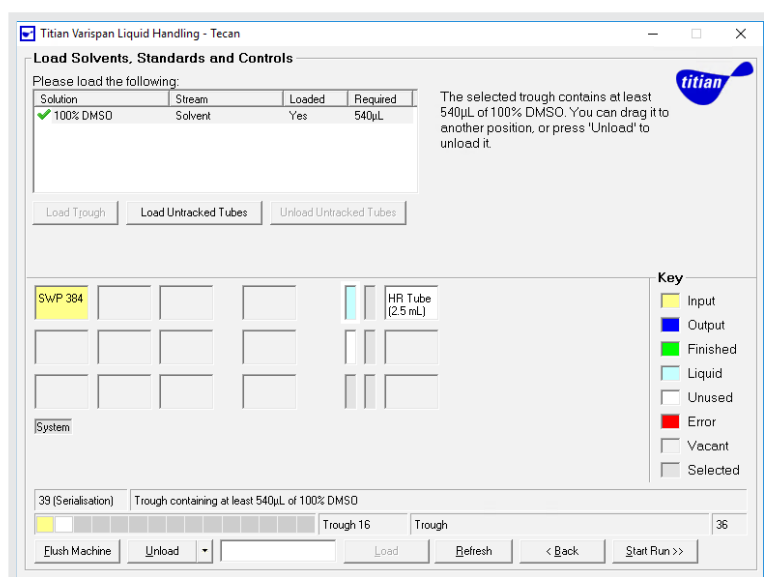
4) The plate is not ready yet: dilution, serialisation and adding of the standard compounds needs to be done.



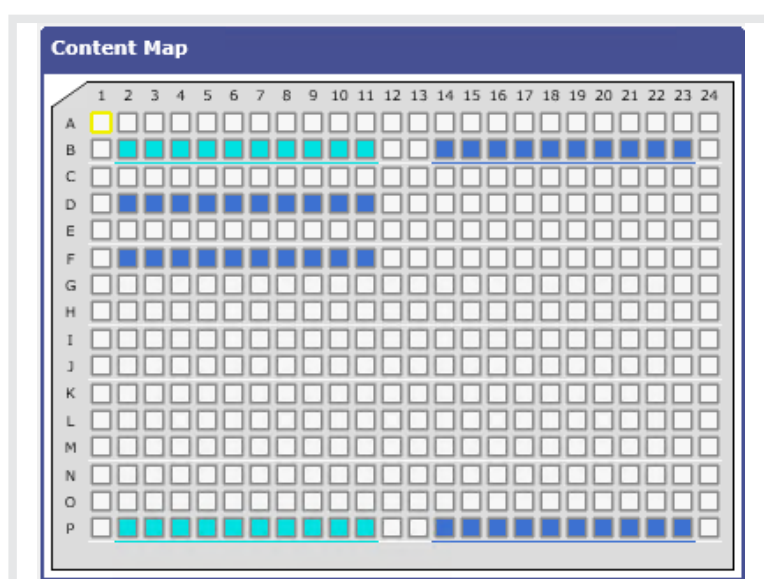
5) Selecting the next process. The operator tells VSLH which process the operator wants to fulfil next.



- 6) The operator is guided to load the liquid handler with solvent and necessary standard compounds. Again, based on the order, the solvent volumes will be calculated by the VSLH module. Press "Start Run".



- 7) The next step is the serialisation process. For that, the operator needs to load the trough with solvent and press "Start Run".



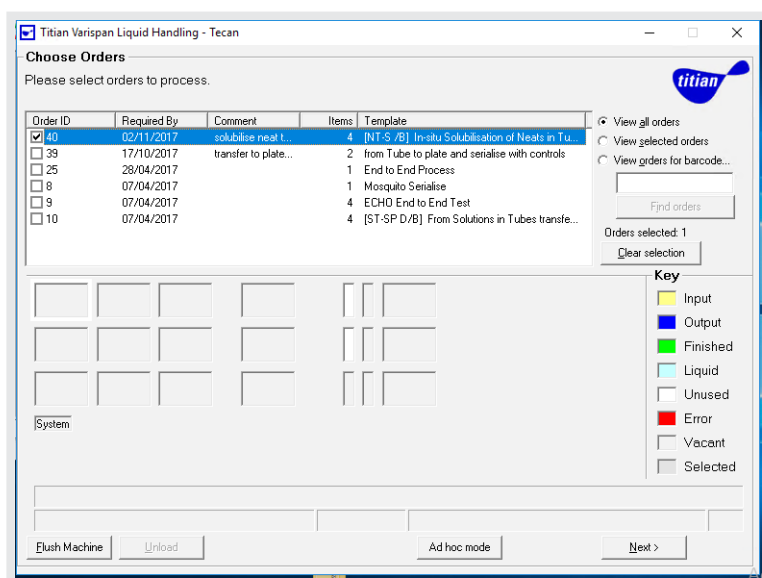
- 8) After the liquid handler has performed the pipetting, it can be unloaded. The images shows how the plate looks after serialisation.



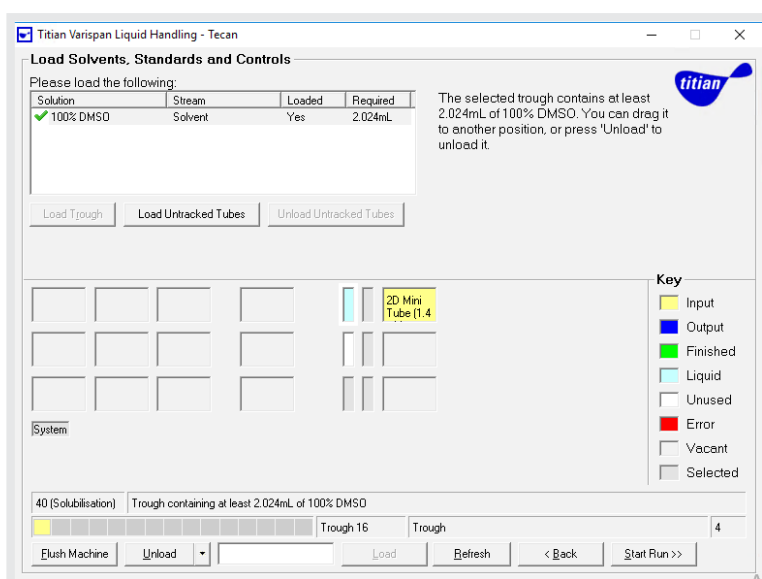
# Use Case: Solubilisation of Neat Substances within Tubes

For this example, a Mosaic order has been setup where the workflow contains a solubilisation step for neat substances within tubes. The requestor wants to get a normalised concentration. Mosaic is calculating individual volumes for each well to achieve the concentration that is requested.

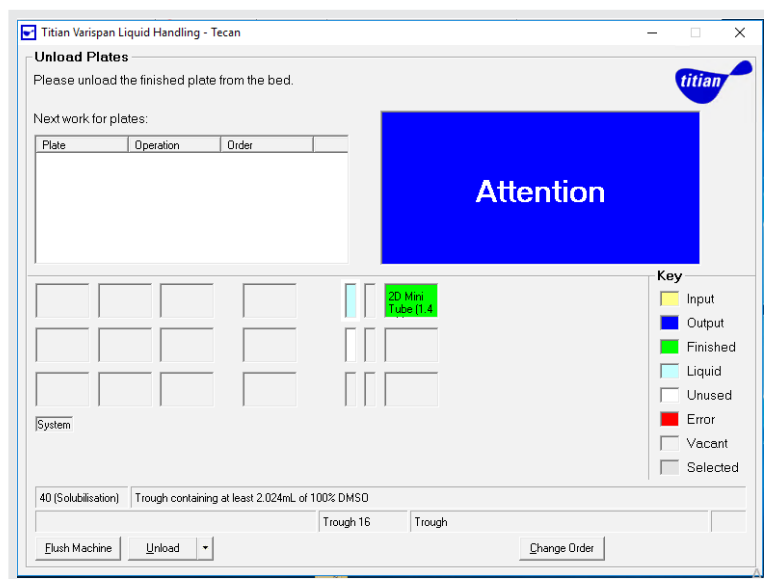
To fulfil this order using the Mosaic VSLH module on an automated liquid handler, the following steps are taken:



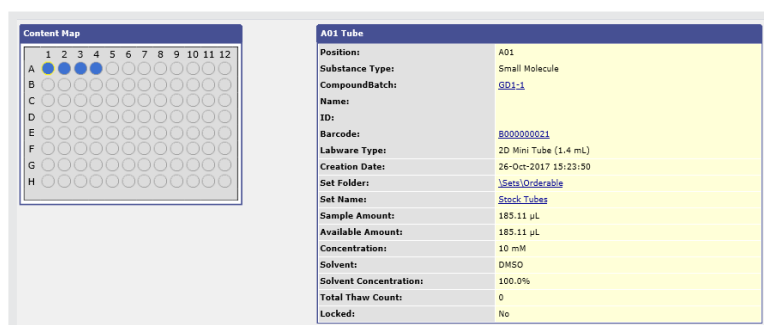
- 1) Open the VSLH module for the liquid handler, select the appropriate order, and press "Next".



- 2) Based on the order setup, the operator is guided to add labware to a vacant position, and place the input rack with the tubes. Also, VSLH leads the operator to load solvent to the bed. The volume will be calculated based on the consumption for the solubilisation process. By pressing "Start Run" the solubilisation process will be fulfilled on the liquid handler.



- 3) After the run has been processed, the liquid handler can be unloaded as the tubes will have been solubilised.



- 4) Each tube of the rack is now solubilised to 10 mM by the correct volume based on the molecular weight having been added.

# Summary



The use of Mosaic sample management software along with the VSLH module provides error-free pipetting work list creation, advanced tip usage/tracking and automated data processing, resulting in auditable inventory updates.

Through the VLSH module, Mosaic users are able to:

- Provide on time delivery of requested substances, with the outputs defined, in the order that the requestors are looking for
- Maintain a highly accurate inventory by capturing volume transfer information on-the-fly without any user interaction. Data updates are carried out live, which removes any delays in downstream processing or analysis. This supersedes error-prone manual tracking of volumes and concentrations
- Track every sample preparation step via Mosaic's comprehensive audit trail, to capture data for quality security processes

## About Titian Software

Titian Software is the industry leader in providing sample management software for the life sciences. Using Mosaic software, our customers see significant benefits in terms of their throughput, response times, error rates, labor costs as well as in sample conservation. Titian have done this by producing an application that can process multiple requests with varying sources, and labware output formats. It can easily be run by any operators, instead of tying up an automation expert to write new protocols. We also use our extensive experience in interfacing laboratory instrumentation and robotic systems with our software to ensure that customers make best use of their investment in research and development technologies.

At Titian, our development efforts never stop as we continue to advance Mosaic toward higher levels of efficiency and practicality for the user. The ongoing collaborative relationship between Titian and liquid handling hardware suppliers continues to ensure that new applications are made available on a timely basis to fulfill our customer's research goals. We pride ourselves on taking into account customer feedback for all of our Mosaic modules to drive our product to be the best it can be. It's all part of Titian's commitment to providing innovative solutions that make life easier for sample management professionals.

## About the author

### Steffen Koehler

Steffen Koehler ran the compound management department at Evotec for 10 years before spending 4 years focusing on HTS, screening and automation as Director Industrial Applications at Direvo Industrial Biotechnology. He joined Titian Software in 2013 as a business application consultant.

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