



Use of a Stand Alone Echo Acoustic Liquid Handler with Titian's Mosaic Software

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INTRODUCTION

Since it was introduced, Beckman Coulter Life Sciences' Echo Acoustic Liquid Handler has enabled the scientific community to perform research on a miniaturised scale not previously achievable because of its accuracy and the data quality it produces. However, these improvements in data quality only transfer to your research if you import and process the liquid handling data in an error free way and then share it across your downstream processes.

The Echo Acoustic Liquid Handler's unique technology measures the level in each source well and then acoustically transfers as low as 2.5 nL droplets to make up the desired volume in the destination well. These precise contactless transfers, along with the accurate check of current source volumes (which may differ from recorded ones due to evaporation or other environmental conditions), result in higher quality data.

Direct dilution of compounds also improves results over serial dilution methods, and reduces costs and lab waste. The challenge for labs is to bring the Echo Acoustic Liquid Handler's information flows seamlessly into their existing sample management systems.

Beckman Coulter Life Sciences and Titian Software collaborate to provide robust solutions for integrating Beckman's acoustic instrumentation and Titian's Mosaic sample management software to ensure that it is easy for customers to make best use of their investment in acoustic technologies. We work in tandem to produce a reliable, versatile and intuitive integration between the two platforms – making Mosaic the clear choice for sample management and tracking of acoustic workflows.

THE BENEFITS OF ACOUSTIC LIQUID HANDLING

The Beckman Coulter Echo Acoustic Liquid Handler uses sound energy to provide highly accurate, fully automated, non-contact dispensing of fluids. It transfers nanolitre volumes of a variety of solutions from any well to any well in an acoustic compatible microplate or Azenta Life Sciences' Acoustic Sample Tubes.



The Echo Acoustic Liquid Handler enables rapid assay creation with one fluid transfer because it can transfer variable fluid heights and viscosities from one source plate. Its transfer capabilities range from simple reformatting operations, through creating dose response curves, to assembling complex assays – all while minimising reagent costs and sample waste.

Unlike most liquid handlers, the Echo Acoustic Liquid Handler also measures and reports current volume levels in the source wells and the actual transfer volumes achieved during a run. With the right integration, this information can be used to keep inventory in step with real world events and improve the quality of the audit trail so these accurately represent what happened, rather than what was supposed to happen.

For instance, if evaporation resulted in insufficient volume in a well so some or none was transferred, the actual values present and the effect on subsequent assay results could be traced.



The advantages of Echo Acoustic Liquid Handling include:

- Non-contact liquid transfers with no pipette tip requirements
- Fast, accurate and precise liquid transfers on a nanolitre scale
- Handles a wide variety of solutions (DMSO, aqueous buffers, etc.)
- Accurate, real world volume and transfer information
- Preserves sample integrity and viability during transfer
- A choice of sample sources (Echo-qualified microplates or tubes)



DATA HANDLING CONSIDERATIONS WHEN INTEGRATING NEW EQUIPMENT WITH SAMPLE MANAGEMENT

Bringing in new instrumentation gives sample management professionals the physical tools that they need to improve processing, but the new data streams that instruments provide need to be handled correctly.

Some of the issues to manage are:

- Incorporating the new technology into existing sample management workflows
- Understanding and programming the new instrument
- Keeping your inventory and audit trail synchronised with the new instrument
- Ensuring data integrity and avoiding errors when incorporating new data files into existing systems, spreadsheets and macros to deliver insights
- Updating internal sample management solutions, so these can manage the new technology
- Ensuring IT can support the changes to internal systems (often a challenge for smaller research labs)
- How to deliver workflow updates where they are needed
- How to spot, audit and investigate data anomalies

Sample management professionals need a proven integration partner who can provide a robust system to address these issues.



COMBINING THE POWER OF MOSAIC WITH YOUR ACOUSTIC WORKSTATION

Titian's Mosaic sample management software is the perfect solution for managing and tracking both large, complex and/or high throughput sample orders as well as smaller, more varied workflows. Using Mosaic to integrate Beckman Coulter's Echo workstation makes it easy for sample management groups to create and manage workflows best suited to the acoustic platform in a user friendly and intuitive manner.

Using Mosaic to manage the Echo Acoustic Liquid Handler reduces the number of steps operators need to carry out to initiate a run. The multiple results files produced by the acoustic transfers are automatically processed in a robust fashion which records key information and that can recover from interruptions or restarts. Mosaic's dedicated integration goes beyond normal offline .csv file integrations to ensure the Echo Acoustic Liquid Handler's reading of source plate volume levels and transfer volumes is updated in Mosaic inventory, so this accurately reflects real world stock levels and concentrations. Traceability is maintained in Mosaic's comprehensive audit trail.

The key benefits to this integration are:

- Operators continue to use the Mosaic interface they are familiar with to carry out sample processing requests and create automated runs using the Echo Acoustic Liquid Handler
- Scientists can order assay plates knowing that inventory data is tracked and propagated to ensure later analysis can draw accurate conclusions
- Results from the acoustic transfer are processed and distributed automatically, without manual file editing or human operator errors
- The exact volume transfers reported by the application software are automatically captured in the Mosaic inventory and in the audit trail, improving data quality
- All intermediate plates used by the Echo Acoustic Liquid Handler are tracked in Mosaic, so any transfer failures here can be pinpointed



- Mosaic's inventory volumes are automatically checked and updated using the Echo Acoustic Liquid Handler's survey volumes of source plate wells to ensure they match real world events. This is essential when working with miniaturised assays as environmental conditions can have a greater impact on volumes
- Any dispensing or transfer failures are tracked and visibly highlighted in Mosaic inventory, and email reports are generated of any transfer errors during the automatic results file import
- Transfers of controls and standards are reported and updated in the Mosaic inventory

Mosaic also supports most Beckman Coulter Echo Software Applications, including: Echo Cherry Pick (ECP), Echo Reformat (EPR), Echo Dose Response (EDR), and Echo Plate Audit (EPA). Mosaic's stand alone integration with the Echo Acoustic Liquid Handler is easily extendable to larger integrations.

CREATING ECHO ACOUSTIC LIQUID HANDLER RUNS USING MOSAIC

Integrating the Echo Acoustic Liquid Handler with your Mosaic software makes it easy for laboratory staff to create protocols for the Echo Application Software, as they can continue to use the same Mosaic interface used for other automation. They simply request the substances, volumes and plate layout required. To carry out the sample processing steps using the Echo instrument, the operator will:

1. Select the order workflow step in Mosaic (e.g. Cherry Pick from a source plate)



2. Select the desired input labware and output plates



- 3. Choose a liquid handler (e.g. the LAB-ECHO), and create the Run
- **4.** Once the Run is created, the operator exports a source picklist for the Echo instrument to use
- **5.** Switch to the relevant Echo application (EDR, ECP, EPR, etc.) and then setup or open an Echo protocol. Import the source picklist previously saved and start the Echo Run

File Protocol Tools Help		4 Þ ×
Plate Design Options Name: Description:	1	
Plate templates in this protocol Protocol Source Source Plate Intermediate Plate1 with DMSO wells Intermediate Plate2 with DMSO Destination Cestination Plate	Plate Template Actions Add Source Add Intermediate Add Fixed Plate Add Destination Edit Delete	- -
Protocol Information There are 5 source concentrations per sample. Destination plate copies: 1 -	Default Concentration Units	

6. Once the Echo transfers are complete, the newly created Echo XML report files are converted into a report which is automatically uploaded by Mosaic. Source plate volume information is refreshed according to the Echo plate survey, and inventory data for the source and destination plates is updated





MANAGING ERROR TRACKING

The Echo Acoustic Liquid Handler can detect if a particular well failed to transfer during a run, for instance due to inadequate source well volume. These transfer errors only affect the explicit well(s) and any subsequent doses dependent on them.

Mosaic logs and highlights any Echo transfer errors by marking them as "Suspect" in the Mosaic inventory and audit trail. Any failures can also be highlighted in Despatch notes and filtered from export to downstream assay screening systems to improve data quality.



MANAGING ECHO ACOUSTIC LIQUID HANDLER DOSE RESPONSE PROTOCOLS

Integrating a stand alone Echo instrument using Mosaic still gives users the flexibility to create protocols, including Echo Dose Response (EDR) protocols. The operator defines the transfers they want performed when creating a protocol, with the following benefits:

• Mosaic registers and tracks the inventory of any intermediate plates involved in dose response protocols, so any transfer failures here can be pinpointed



- Mosaic captures the transfers exactly as they are performed, reflecting the discrete 2.5nL transfer increments that the Echo instrument uses. Thus, the concentration recorded in the final plate in the inventory reflects what that concentration really is, based on the exact amounts used – which improves data integrity, as well as providing a precise audit trail
- Mosaic processes the significant number of data files produced by the Echo Acoustic Liquid Handler in a robust manner to make sure you have all the key information
- Mosaic also integrates with several downstream data analysis software platforms which ensures seamless transfer of Echo Acoustic Liquid Handler data





Using Mosaic sample management software to integrate an Echo Acoustic Liquid Handler into your workflow ensures that all the benefits to data quality it brings are incorporated into your inventory and audit trail. Additionally, Mosaic's integrations with downstream assay screening systems like IDBS ActivityBase or Genedata Screener ensure data quality benefits are passed on.

Mosaic's tight coupling with the Echo means that:

- Beckman Coulter Echo workstations can be added seamlessly into Mosaic sample management workflows
- Users can easily write protocols for the Echo Acoustic Liquid Handler using the Mosaic interface they are familiar with
- Results file handling is robust, automatic and error free ensuring that you get the benefits of improved data quality
- A highly accurate inventory is maintained by automatically capturing exact source volume and volume transfer information on the fly
- Data updates are carried out live, which removes any delays in downstream processing or analysis
- Every sample preparation step, including creating intermediate plates, is tracked in Mosaic's comprehensive audit trail, and this data is available for quality or compliance processes
- Any liquid handling errors are captured and highlighted
- A stand alone Echo Acoustic Liquid Handler is easily extendable to larger integrations

An additional benefit is that Titian works in partnership with Beckman Coulter to continually evolve Mosaic, so it is responsive to customer requirements and the development of new liquid handler functions and software.



ABOUT TITIAN SOFTWARE

Titian Software is the industry leader in providing sample management software for 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. Mosaic 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 fulfil our customer's research goals. We pride ourselves on taking into account customer feedback for all of our Mosaic applications 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 BECKMAN COULTER LIFE SCIENCES

Beckman Coulter Life Sciences' mission today, which has changed little since 1935, is to empower those who are seeking answers to life's important scientific and healthcare questions. This mission embodies all our efforts to help customers get the data and answers they need, when they need them. These answers may be important for expediting development of a new, life-saving biopharmaceutical, to help exonerate an innocent person based on DNA evidence, or to help monitor patients with chronic diseases.

If your life's calling demands answers for these (or dozens of other) important endeavors, you need to know Beckman Coulter Life Sciences. No matter the type or scope of questions you have, we can help you get the answers you need—often faster than you thought possible.



ABOUT THE AUTHORS

Arthur Yarwood

Fascinated by mathematics and programming, Arthur spent 11 years at Sony, specialising in tools programming, asset management and databases. He joined Titian in 2012 and is now a technical product manager on Mosaic.

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Mark Doring worked for Schering Plough for 25 years as a biochemist in new lead discovery, focusing on high throughput screening assay performance, development and compound preparation with an emphasis on automation and informatics. He joined Titian Software in 2015 as a business application consultant.

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