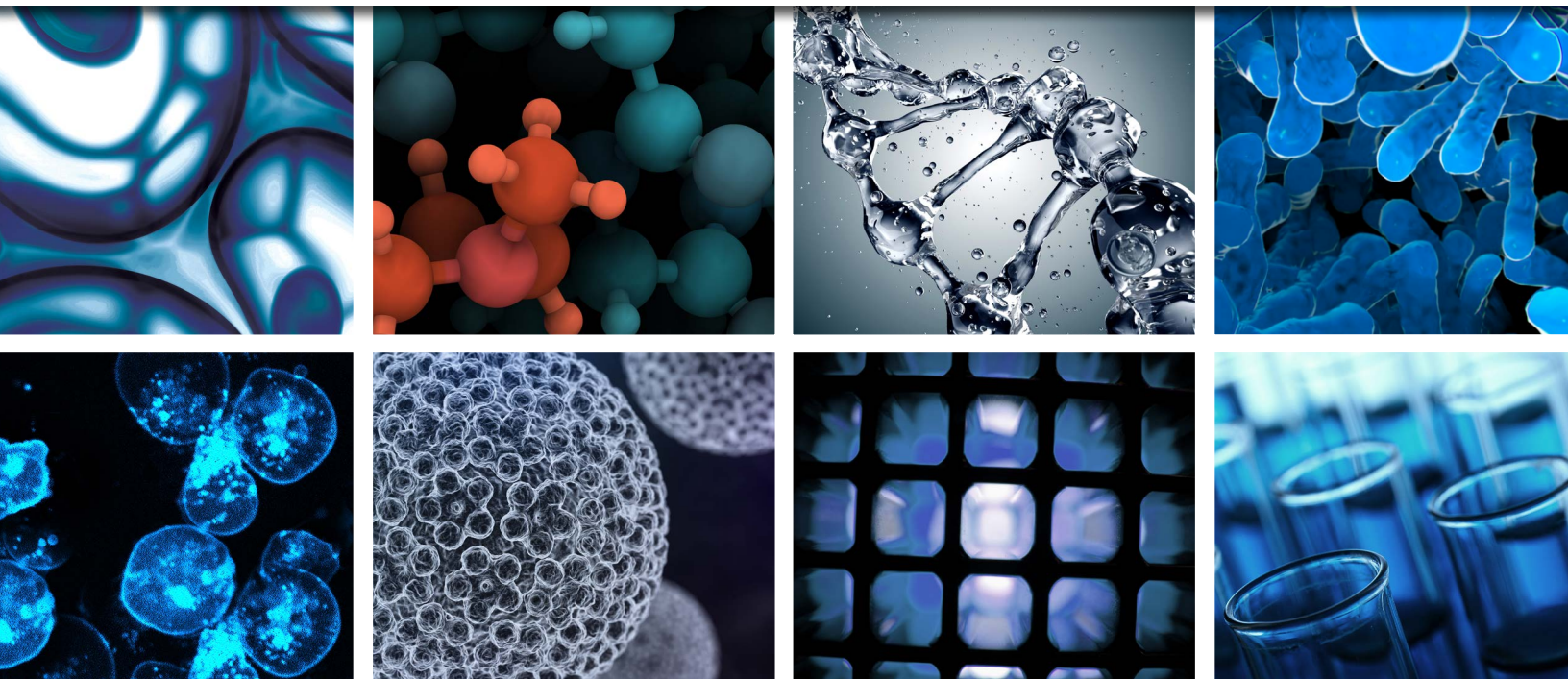


Echo® Acoustic Liquid Handling
THE REVOLUTIONARY ACOUSTIC LIQUID TRANSFER TECHNOLOGY



Echo®

LIQUID HANDLERS

BROCHURE

Version 2.2 | SEPTEMBER 2017



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Echo Liquid Handling Technology

Precise, Accurate, and Efficient Liquid Transfers Using Sound

The Echo acoustic liquid handling technology revolutionizes life sciences by using sound energy to provide highly accurate, fully automated, non-contact dispensing of fluids. By utilizing the unique Dynamic Fluid Analysis™ technology from Labcyte, each Echo system is able to determine fluid composition, fluid height, and the power needed to eject a precise volume of fluid into the destination well. This analysis happens in milliseconds - allowing for precise and accurate transfer of nanoliter (nL) droplets into an inverted microplate. Large volume transfers are achieved by transferring several hundred droplets per second. Transfers can be made from any well to any well, allowing for miniaturization and automation of complex assays to dramatically reduce reagent costs and save precious samples.

Echo Acoustic Droplet Ejection



FIGURE 1: Precise amount of acoustic energy is supplied to the fluid creating a single drop.

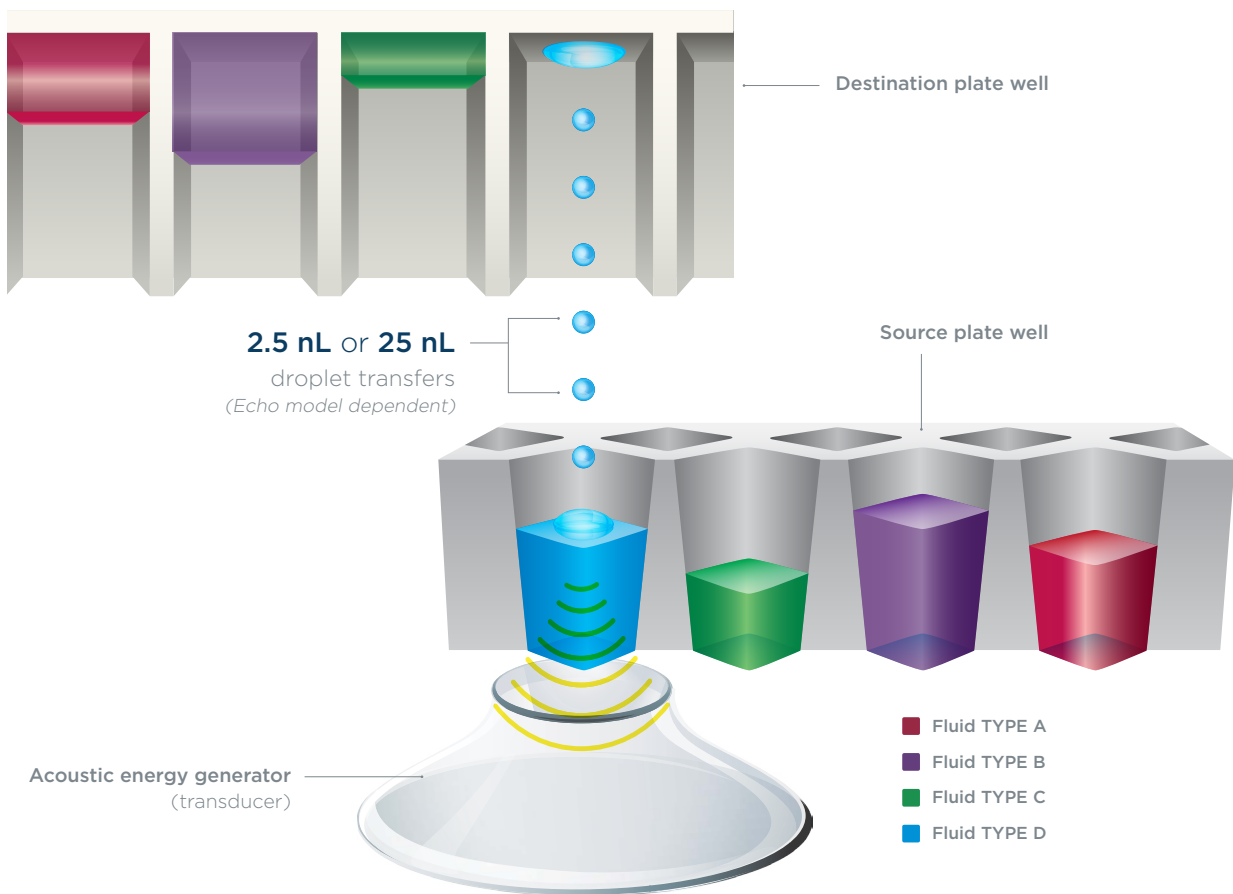


FIGURE 2: Movement of the transducer below and the destination plate above the source plate enables rapid transfer from any well of the source plate to any well of the destination plate for a broad spectrum of fluid types.

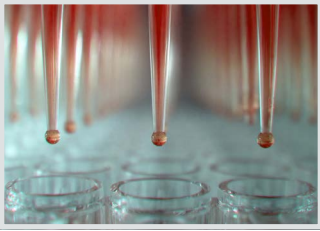
The Echo Acoustic Advantage

Non-contact Transfers... No Tips... No Cross-contamination... No Carryover

Acoustic liquid handling avoids issues that can arise from the use of traditional tip-based systems including sample adhering to the tips, lower precision at nL volumes, and the need for tip disposal.

Comparing Liquid Handling Technologies

Traditional LIQUID HANDLERS



- Use motors to aspirate and dispense
- Treat every sample the same
- Slow transfer of liquids from any well to any well
- Use pipette tips or pins to which liquids or sample can adhere
- Potential carryover risks
- Use tips that create waste or pins that require extensive washing

Echo® LIQUID HANDLERS



- Use acoustic energy to perform transfers
- Treat every sample individually
- Rapid transfer of liquids from any well to any well
- Use acoustic energy so that nothing contacts the sample during transfer
- No carryover
- No tips, nothing to wash or throw away



Environmentally-friendly

- No disposable tips
- No wash fluid
- No hazardous liquid waste



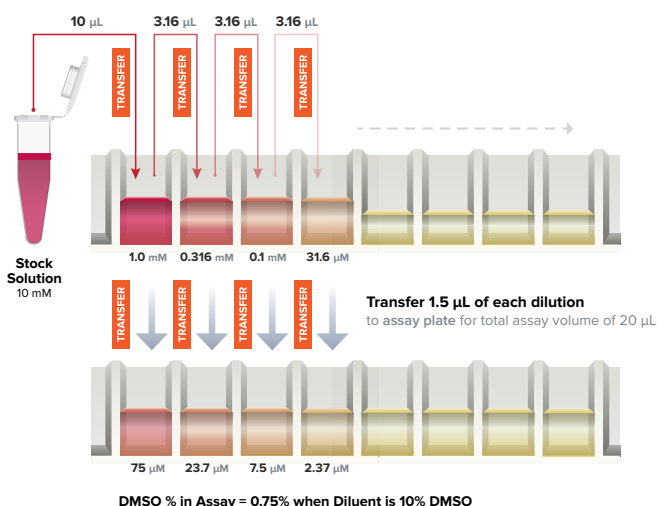
Traditional vs. Echo Liquid Handling Workflow

SIMPLIFY YOUR WORKFLOW — Eliminate Steps While Increasing Data Quality

Highly precise nL transfers make it possible to streamline workflows by eliminating steps. Standard laboratory tests such as standard curves performed with the Echo Liquid Handler require less sample, avoid propagation of pipetting errors, and eliminate unnecessary transfer steps.

TRADITIONAL SERIAL DILUTION WORKFLOW

- ▶ Sample loss may occur on tips
- ▶ Potential for leachates and cross-contamination from tips
- ▶ Compounding errors may occur with the serial nature of the transfer



ECHO DIRECT DILUTION WORKFLOW

- ▶ Solutions are **NEVER IN CONTACT** with a pipette tip
- ▶ Eliminates any potential for both leachates and cross-contamination
- ▶ Sample is transferred **DIRECTLY** to the assay wells

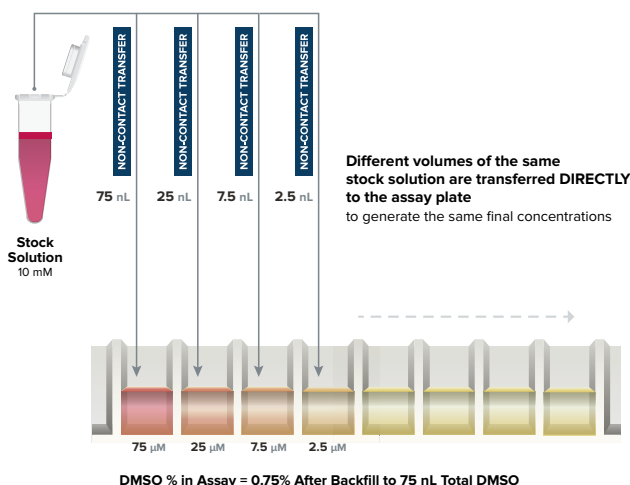
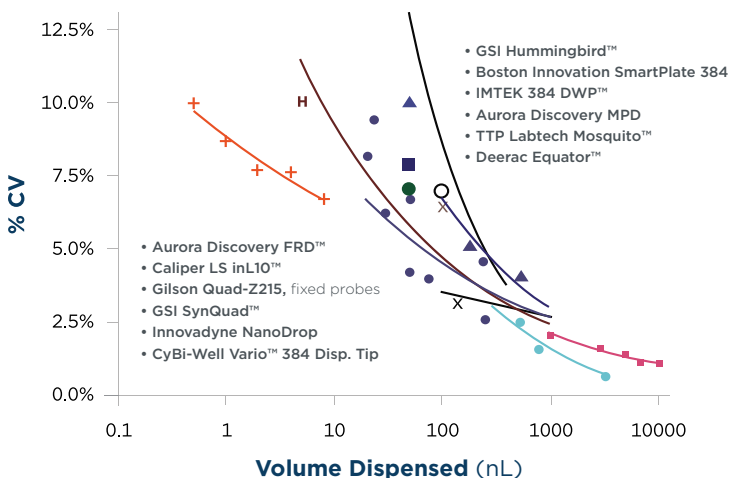


FIGURE 3: Comparison of Traditional SERIAL DILUTION vs. Echo liquid handling DIRECT DILUTION workflows

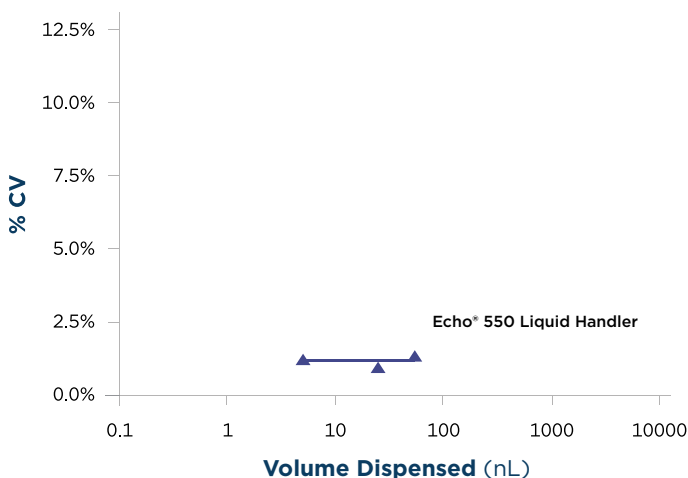
Traditional Liquid Handlers

Optimal precision at different volumes



Echo Liquid Handlers

Precision for low nanoliter transfers is unmatched



SOURCE: Comley J, Nanolitre Dispensing, *Drug Discovery World*, Summer 2004, 43-54
All product names and brands are properties of their respective owners.

FIGURE 4: Comparison of achievable precision across a broad range of liquid handling instruments demonstrates that the Labcyte® Echo Liquid Handler consistently produced %CV values of less than 2.5% across the full range of volumes tested.

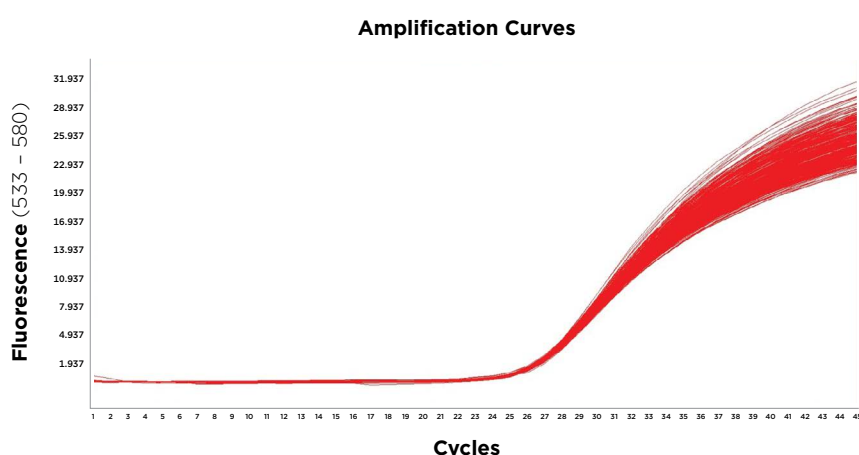
Assay Miniaturization *without* Compromise

Reduce Assay Volumes, Not Performance

Successful miniaturization of assays requires consistent transfer of nL and μ L volumes of assays reagents and samples. Echo Liquid Handlers deliver small volumes of reagents with no contamination enabling assay miniaturization to previously unattainable levels.

Assay Miniaturization

- ▶ Low volume sample, reagent, and compound addition
- ▶ Keeps final concentration of DMSO low
- ▶ Comparable results to traditional assay volumes
- ▶ Consistent results

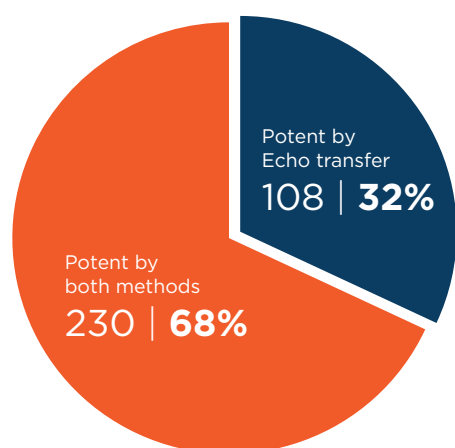


Precise Transfers in nL Increments

Sample transfer integrity is important for successful data generation. With highly precise and accurate non-contact transfers, the Echo® 525 Liquid Handler introduces no cross-contamination during transfer of reagents or DNA.

FIGURE 5: Real-time qPCR data showing transfer uniformity using the Echo Liquid Handler. Source plate Echo Qualified 384-well Polypropylene Plus Microplate to a 384-well assay plate. 1 μ L puc19 in 0.1 %TE per well was transferred. Roche 1536 DNA Green Master reagent was used following the standard protocol and data was read on a Roche LightCycler® 480.

32% MORE Active Compounds Found



In a screen of 975 compounds, Bristol-Myers Squibb found 108 more hits when using the Echo Liquid Handler¹.

259x MORE Potent

AstraZeneca demonstrated better compound potency when transferring directly with an Echo Liquid Handler versus using a serial dilution process².

Compound Number	Echo® Liquid Handler IC ₅₀ (μ M)	Traditional Liquid Handler IC ₅₀ (μ M)
4	0.003	0.146
5	0.002	0.553
6	0.007	0.973
7	0.003	0.778
8	0.004	0.445
9	0.052	0.170
10	0.064	0.817
11	0.486	3.03

¹ Spicer, T. et al., *Pharmacological evaluation of different compound dilution and transfer paradigms on an enzyme assay in low volume 384-well format*. Poster presented at Drug Discovery Technology, August 2005, Boston, MA.

² Barlaam, B.C. et al., U.S. Patent 7,718,653, 2010.

The Echo Workflow Advantage

Re-imagine the Way You Do Science and Research

Acoustic fluid transfer enables researchers to push their research and science in new directions. The Echo Liquid Handler with the Access™ Laboratory Workstation provides a new level of speed and flexibility – allowing researchers to investigate scientific questions in new ways.



MAXIMIZE Lab Budget

- Miniaturize assays
- Conserve sample and reagent
- Eliminate tip costs
- Reduce workflow steps



INCREASE Data Quality

- Minimize assay reruns
- Eliminate pipetting variances
- Eliminate sample loss on tips
- No cross-contamination
- No bio-active leachates from tips



ACCELERATE Productivity

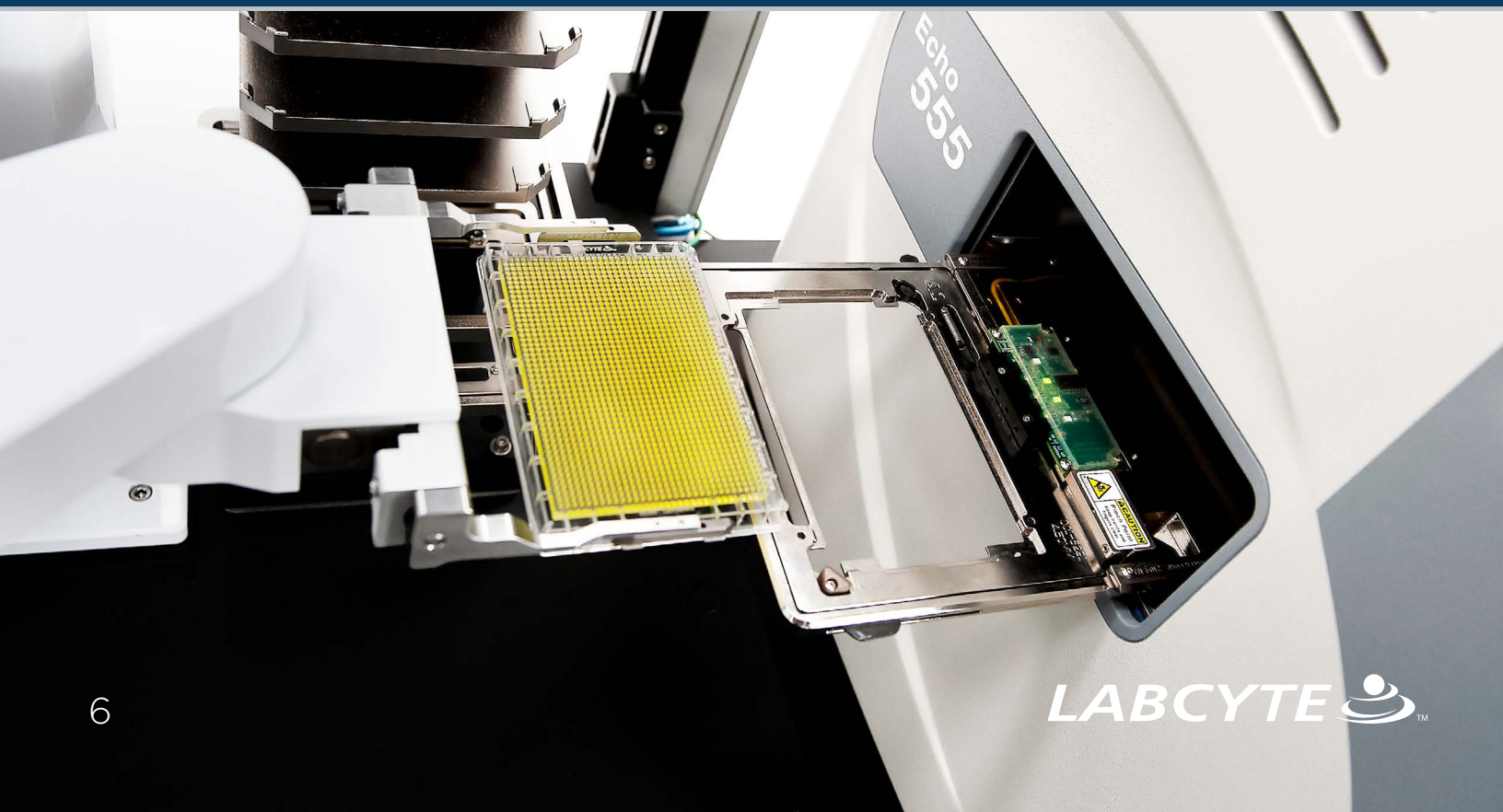
- Design, test, and optimize assays rapidly
- Easily create multiple reagent combinations in one plate
- Transfer multiple fluid types and concentrations from a single plate



AUTOMATE Complex Assays

- Transfers with low CV and high accuracy
- Transfer multiple reagents combinations quickly
- Cherry pick rapidly
(transfer from any well to any well)

Rapid any-well-to-any-well capability enables creation of BOTH simple and complex assays



Echo Liquid Handler Models

Revolutionary Liquid Handling Using Sound

Designed for a range of throughput and applications, all Echo Liquid Handlers utilize Dynamic Fluid Analysis for reliable, accurate fluid transfer of a wide range of fluids. Rapid any-well-to-any-well capability enables creation of both simple and complex assays.

Echo 525 <i>for higher volume transfer</i>	Echo 550 <i>for medium throughput</i>	Echo 555 <i>for high throughput</i>
------------------------------------------------------	-------------------------------------------------	-----------------------------------------------



TRANSFER VOLUME		
25 nL – 5 µL	2.5 nL – 2 µL	2.5 nL – 2 µL
HTS SCREENING		
	✓	✓
COMPOUND MANAGEMENT		
	✓	✓
SYNTHETIC BIOLOGY		
✓	✓	
GENOMICS		
✓	✓	✓
CELL-BASED ASSAYS		
✓	✓	✓
BIOCHEMICAL ASSAYS		
✓	✓	✓
PROTEOMICS		
	✓	✓

Echo Liquid Handler Specifications	
Electrical	AC 100-120V, 50/60 Hz, 10 A or AC 200-240V, 50/60Hz, 5 A
Weight	128 kg (283 lbs)
Dimensions	53.9 cm width x 68.3 cm depth x 92.5 cm height (21.2 x 26.9 x 36.4 inches)
Working envelope	Additional 25.4 cm (10 inches) on top, 2.5 cm (1 inch) on sides, 15.24 cm (6 inches) at front, 30.5 cm (12 inches) at back
Operating temp	21°C ± 5°C (70°F ± 9°F)
Air	Filtered, oil-free, dry air <ul style="list-style-type: none"> • 552 kPA (80 PSI) min • 1034 kPA (150 PSI) max
Vacuum	<ul style="list-style-type: none"> • House supply: Minimum 200 Torr (266 mbar, 22 in. Hg) • Standalone vacuum with surge tank: Min. pump speed 2.0 m³/hr, minimum pressure 100 Torr (133 mbar, 26 in. Hg)
Coupling fluid	Type 1 ultra-pure water
Coupling fluid temp	22.1°C ± 0.9°C (71.8°F ± 1.6°F)
Transfer volume	<ul style="list-style-type: none"> • Echo 555 and 550: 2.5 nL – 2 µL • Echo 525: 25 nL – 5 µL
Source microplates	<ul style="list-style-type: none"> • Echo 555 and 550: 384- and 1536-well • Echo 525: 384-well, 6-well reservoir
Destination	<ul style="list-style-type: none"> • Echo 555 and 550: Any SBS-format microplate (24-3456 wells or slide holder ≤16 mm in height) • Echo 525: Most SBS-format microplates
Barcode reader options	Short side and/or long side
DMSO hydration survey	Echo 555 and 550 only

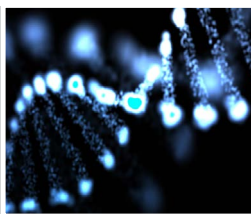
Significantly Improving Genomics Workflows

Enabling Researchers to Push Their Science in New Directions

Echo Liquid Handlers overcome traditional barriers in genomic research by dramatically reducing sample and reagent volume requirements, enabling laboratories to maximize their working budgets while improving processes and data quality.

GENOMIC RESEARCH

SYNTHETIC BIOLOGY



Increase Efficiency and Speed While Reducing Costs

Echo Liquid Handlers integrated into an Access Laboratory Workstation provide a high-throughput, fully automated system for pooling oligonucleotides, assembling constructs and spotting colonies. Whether using the Gibson Assembly® or Golden Gate® cloning method, tipless acoustic liquid handling reduces costs, waste, and time.

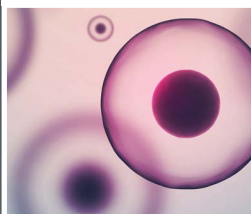
SEQUENCING



Low Cost, Highly Efficient Library Preparation

Echo Liquid Handlers enable library preparation in low microliter or nanoliter volumes for a range of sequencing methods. Drastically cut reagent costs, save samples, and eliminate steps — all while improving library quality and throughput.

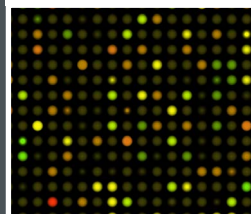
SINGLE-CELL GENOMICS



Low-Volume Sequencing Libraries from Single Cells

Echo Liquid Handlers miniaturize library preparation for whole genome and transcriptome analysis of genetic material from single cells. With precise, accurate, non-contact transfers, you can reduce reaction volumes and eliminate cross-contamination risk.

qPCR

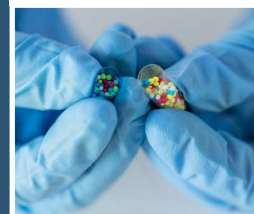


Cost Effective, High Throughput RT-qPCR

Eliminate costly and laborious preparation steps to enable high-throughput RT-qPCR analysis of endogenous gene expression. The Echo Liquid Handler combined with one-step reagents improve detection systems, and automated plate handling makes cost-effective, high-throughput RT-qPCR a reality.

TRANSLATIONAL

PERSONALIZED MEDICINE



From Personalized Medicine Towards Precision Medicine

Labcyte has partnered with innovative researchers who are working to evolve precision medicine from a treatment based on behaviors observed from a tested population, to one based on results from a tested individual. Precise screening of potential therapies on a patient's own cells in a high-throughput, cost-effective manner enables this next-generation precision medicine approach.

For a complete list of Echo liquid handling applications, please visit our web at www.labcyte.com/applications

Gibson Assembly® is a registered trademark of Synthetic Genomics, Inc.
Golden Gate® is a registered trademark of New England Biolabs, Inc.

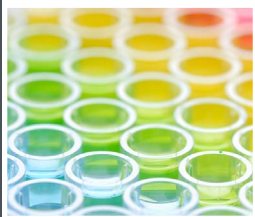
Complete Drug Discovery Workflow with ONE Instrument

Enables Miniaturization with Unparalleled Throughput and Accuracy

Reagents, compounds, and samples used throughout the drug discovery process are transferred efficiently and accurately with Echo Liquid Handlers. With various throughput options and fluid transfer capabilities, you can use the Echo system at all steps of the drug discovery process.

DRUG DISCOVERY

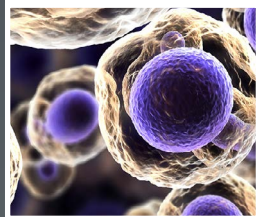
HTS / SECONDARY SCREENING



Discover the Right Drugs with Improved Transfer Performance

Many scientific publications have shown that discoveries made using the Echo Liquid Handler would have been impossible with traditional methods — thanks in part to direct dilution and the elimination of pipette tip-related issues such as compounds adhering to the surface of pipette tips.

CELL-BASED ASSAYS



Biologically Relevant Assays with Unmatched Data Quality

Cell-based assays offer a biologically relevant model to predict the response in an organism. The increasing demand for this in-depth analysis is pushing scientists to dramatically improve assay throughput while reducing operating costs. Labcyte addresses these needs with integrated solutions for liquid handling and automation designed for cell-based assay screening.

BIOCHEMICAL ASSAYS



Simplify Assay Workflows with Precise Reagent Transfers

Buffer formulations are often complex in order to maintain protein stability in long-term storage. This complexity presents challenges for traditional liquid handling methods to transfer reagents without loss of material. Echo Liquid Handlers incorporate Dynamic Fluid Analysis technology into the liquid transfer process that ensures reagents are transferred without loss of material and regardless of the storage buffer complexity.

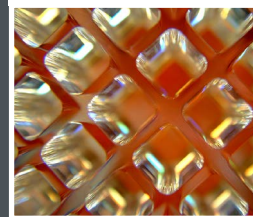
ADME-TOX



Enable Cost-Effective, Earlier Safety Screening

ADME-Tox assays are critical to the drug discovery process to help determine the viability of a drug candidate. Echo Liquid Handlers' non-contact acoustic transfer and ability to perform direct dilutions eliminate the potential for sample loss on tips, error propagation during serial dilutions, and compound precipitation — removing drug elimination due to false negatives.

COMBINATION SCREENING



Increase Efficiency and Speed While Reducing Costs


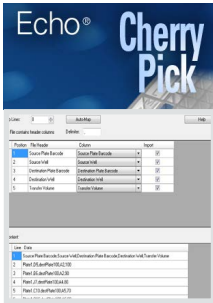
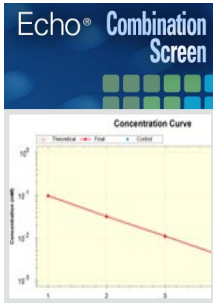
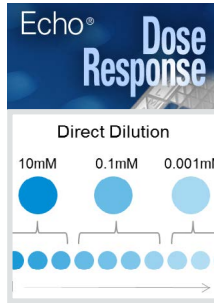
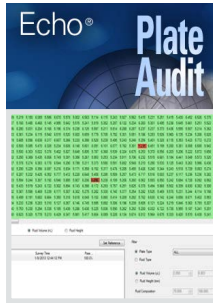
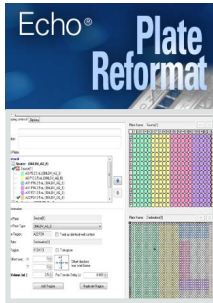
Drug combination screening using the Echo Liquid Handler has revolutionized the approach to the assessment of synergistic effects of drug combinations on disease. The any-well-to-any-well fluid transfer and the Echo Combination Screening application software make high-throughput, 2-way dose-response matrix studies a reality.

Echo® Software Applications

For more information, visit www.labcyte.com/software

For Quick and Reliable Liquid Handling Task Management

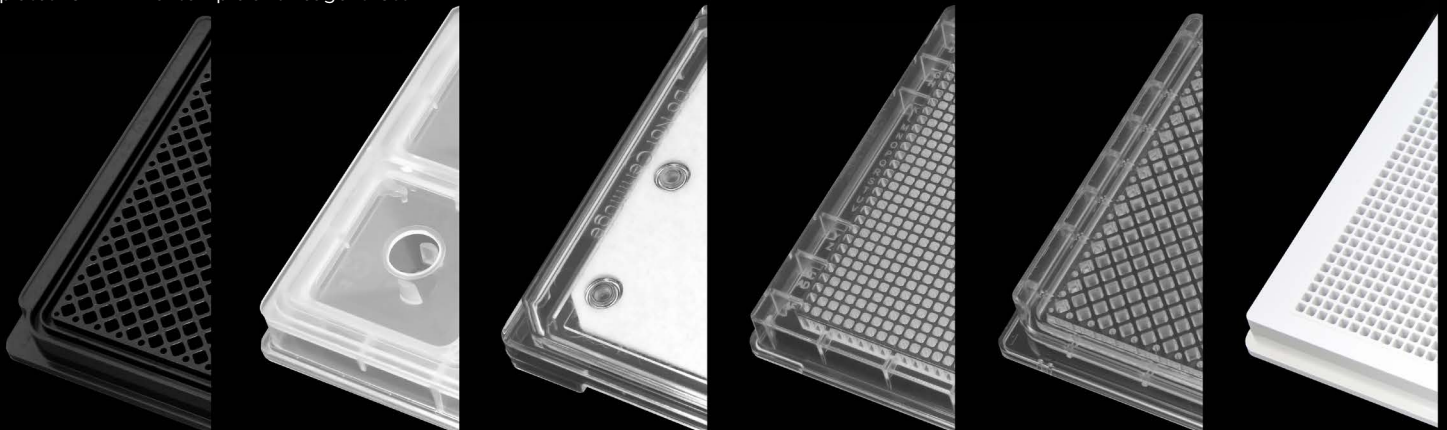
Labcyte has a suite of Echo Software Applications to assist researchers in creating liquid handling protocols for specific applications. Each Echo application is designed around a specific liquid handling workflow and uses a combination of wizards and graphical interfaces to simplify the creation of plate formats, liquid transfer routines, and output files. Researchers can quickly create a variety of protocols off-line for the Echo Liquid Handler and use built-in simulators to validate every transfer before running live. The suite of Echo software applications enables the Echo Liquid Handler to quickly and efficiently accomplish any liquid handling task.

<p>Echo Array Maker</p> 	<p>Echo Cherry Pick</p> 	<p>Echo Combination Screen</p> 	<p>Echo Dose-Response</p> 	<p>Echo Plate Audit</p> 	<p>Echo Plate Reformat</p> 
<p>Acoustically Transfer Samples and Reagents</p> <p>Graphically design custom patterns and formats as well as transfer protocols that utilize them</p>	<p>File-Driven Transfers from Any Well to Any Well</p> <p>Uses information in pick lists to transfer from any source well to any destination format</p>	<p>Design Complex Combination Screening Layouts</p> <p>A graphical interface to visually combine dose-response curves, controls, and single concentration transfers</p>	<p>Eliminate Carryover, Improve Results with Direct Dilution</p> <p>Simplifies protocol creation for dose-response using direct dilution with a wizard-based interface</p>	<p>Analyze, Monitor Sample Libraries w/ Acoustic Analysis</p> <p>Visualize, track, and compare the characteristics of samples within or across plates</p>	<p>Design, Develop, and Assemble Assays</p> <p>Design custom layouts used to assemble assays or reformat and replicate screening libraries</p>

Labcyte® Consumables

For more information, visit www.labcyte.com/consumables

Echo® Qualified Microplates must meet the highest specifications to achieve the performance expected from Echo Liquid Handlers. Only plates that are exceptionally flat with extremely low inter- and intra-plate CVs are considered qualified for use on Echo systems. To meet these requirements, Labcyte offers a full range of Echo Qualified Source Plates from 6-well reservoir for bulk fill applications to 1536-well low dead volume microtiter plates for minimal sample and reagent loss.



Access™ Laboratory Workstation

For more information, visit www.labcyte.com/access

Ready-to-Go Robotic Systems for Echo Liquid Handlers

The Access Laboratory Workstation combines the revolutionary performance of the Echo Liquid Handler with automated plate handling and integrated devices into walk-away systems tailored for a range of applications. Access Laboratory Workstations are modular, flexible, solutions that easily scale when needed.

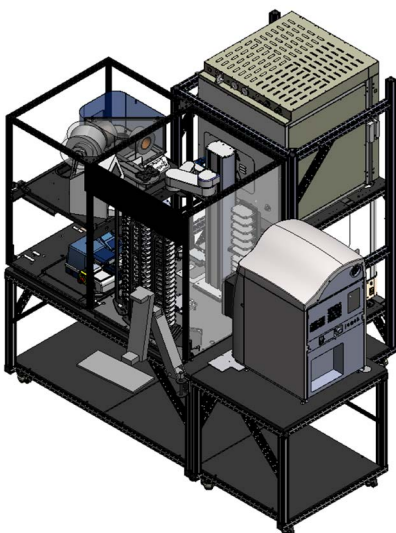
Improving Throughput and Reproducibility

Access Laboratory Workstations multiply the benefits of the Echo platform by improving overall assay throughput and reproducibility. With the ability to integrate a variety of devices and the modularity to scale when needed, each workstation offers the flexibility required by frequently-changing assay requirements.



CONFIGURATION OPTIONS

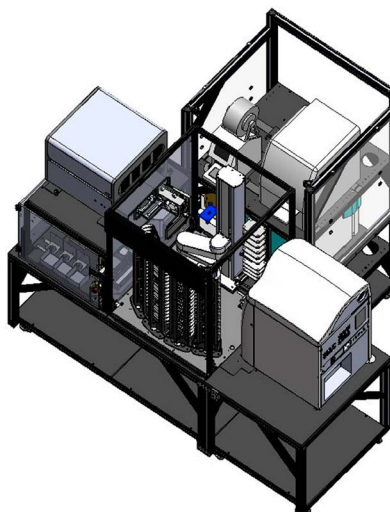
for Assay-Ready Plate (ARP)



System Devices

- Labcyte Echo 550 or 555 Liquid Handler
- ThermoFisher Multidrop Combi nL
- Agilent Technologies PlateLoc Sealer - Gas purge option
- Agilent Technologies Microplate Centrifuge
- Brooks Automation XPeel Peeler
- ThermoFisher Cytomat 10C450 Series
- ThermoFisher Cytomat 10 Hotel

for Biochemical Assays



System Devices

- Labcyte Echo 525 or 555 Liquid Handler
- Inheco Teleshake
- BioTek EL406 Fully-loaded with 96- or 192-pin Manifold
- PerkinElmer Envision Multimode Plate Reader
- Agilent Technologies PlateLoc Sealer
- Agilent Technologies Microplate Centrifuge
- Brooks Automation XPeel Peeler
- Roche LightCycler 480 or 1536



TEMPO™ Software – Dynamic Scheduling for Labcyte Automation Systems

Tempo Automation Software offers a research-friendly interface for scheduling Access Laboratory Workstation protocols. In a dynamic fashion, Tempo software manages all tasks — including sample management, plate handling, liquid handling, detection, and LIMS updates without custom programming or scripting.



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