

ECHO LIQUID HANDLER



DISCOVERY
in motion.



IMPACTING SCIENCE WITH SOUND



Unlike traditional liquid handlers, the Echo system uses sound energy to precisely transfer liquid without contact or using pipette tips, nozzles or tubing. Designed for diverse applications in scientific research, the Echo Liquid Handler combines the innovative technologies of Acoustic Droplet Ejection and Dynamic Fluid Analysis to accurately and reliably transfer a wide range of fluids. Across many scientific disciplines including drug discovery, genomics, synthetic biology, and functional studies, Echo systems provide these benefits:

- Improved data quality with lower risk of cross-contamination and carryover when compared to the use of pipette tips.
- Precise, low-volume liquid transfers to miniaturize assays, reduce reagent costs, and conserve precious samples
- High-throughput “any-well to any-well” transfers to rapidly execute highly complex, multi-component assays and experiments



Echo 650 Series

Liquid Handlers

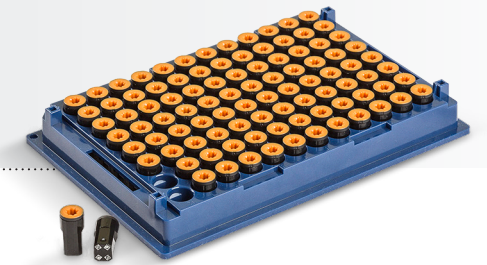
For Low Volume Applications

Echo 650 Series Liquid Handlers represent our most flexible line of instruments for high-throughput, acoustic transfer of samples and reagents in volumes as low as 2.5 nanoliters (nL). Echo 655T and 650T Liquid Handlers offer the ability to transfer from acoustic sample tubes as well as from Echo Qualified 384 and 1536-well Microplates. Echo 650 and 655 Liquid Handlers transfer from Echo Qualified 384 and 1536-well Microplates and can be upgraded to transfer from acoustic sample tubes. With improved fluidics handling for simpler maintenance, better robotics integration, support for transfer from sample tubes, and quieter operation, the Echo 650 Series builds on the long and successful history of Echo acoustic liquid handling technology. The Echo 650 series Liquid Handler supports transfer from Echo Qualified 384-well Microplates and 6-well Reservoirs.



Acoustic Sample Tubes

The Brooks Life Sciences FluidX AcoustiX Sample tubes transform workflows by enabling acoustic dispensing directly from tubes. The AcoustiX Tube preserves sample integrity by allowing samples to be accessed individually – ideal for applications that require subsets of large libraries to be accessed frequently.



Echo 525

Liquid Handler

Acoustic Solutions for Genomics and Biologics

The Echo 525 Liquid Handler transfers aqueous samples and reagents rapidly in a stream of 25 nL droplets. This enables reliable and accurate results for workflows that require larger transfer volumes. Designed specifically for biochemical and genomics assays, the Echo 525 Liquid Handler delivers unparalleled accuracy and precision to improve assay reliability and data quality. The Echo 525 Liquid Handler supports transfer from Echo Qualified 384-well Microplates and 6-well Reservoirs.



Model	Transfer Throughput	Source
Echo 655T	High throughput	Echo Qualified Sample Tubes and Microplates
Echo 650T	Medium throughput	Echo Qualified Sample Tubes and Microplates
Echo 655	High throughput	Echo Qualified Microplates
Echo 650	Medium throughput	Echo Qualified Microplates

Echo for Regulated Laboratories

Regulatory-ready, Echo Liquid Handlers enable regulated laboratories to take advantage of all the benefits of acoustic liquid handling. Each system is supplied with state-of-the-art software to secure, track, and audit Echo system protocols. Each system is also supported by IQ/OQ services from the time of installation by our field support team.



Part 11 Compliance Manager

Part 11 Compliance Manager locks down and tracks all Echo Liquid Handler use, including protocol changes and output files using state-of-art security algorithms.

Innovative Technology with Unparalleled Performance

Echo Liquid Handlers rely on patented technologies and novel methodologies to change how liquid handling is used in applications throughout life science. With Dynamic Fluid Analysis the Echo Liquid Handler enables researchers to transfer a broad spectrum of fluid types with a degree of flexibility and reliability not possible with traditional liquid handling technologies.

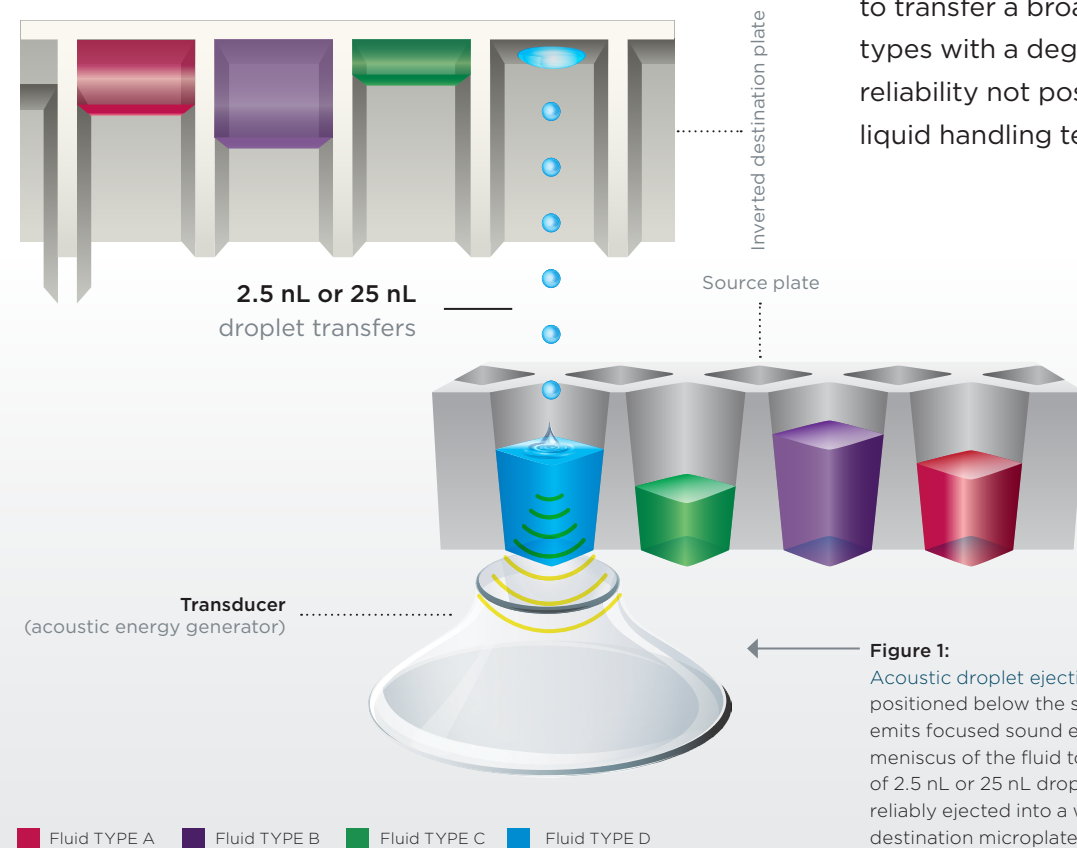


Figure 1: Acoustic droplet ejection - The transducer is positioned below the source microplate well and emits focused sound energy repeatedly to the meniscus of the fluid to be transferred. A stream of 2.5 nL or 25 nL droplets (model dependent) is reliably ejected into a well of an inverted destination microplate.

Dynamic Fluid Analysis On-the-Fly Adjustments to changing fluid properties

Using Dynamic Fluid Analysis, Echo Liquid Handlers use sound energy to determine fluid composition, fluid height, and the power needed to eject a precise volume of fluid into a destination well. Dynamic Fluid Analysis adjusts transfer parameters in real-time to compensate for changes in fluid height (volume) and fluid properties without recalibration.

- Real-time adjustment to changing fluid types or volumes without user intervention
- Accurate and precise transfer of complex reagent sets



Acoustic Droplet Ejection Technology for non-contact fluid transfer

Echo Liquid Handlers rely on Acoustic Droplet Ejection, an innovative automated liquid handling technology that focuses ultrasonic energy at the meniscus of a fluid to eject small droplets of liquid from a source well to a destination well.

- Gentle enough to safely transfer cells, samples and reagents
- Precise and accurate transfers in streams of 2.5 nL or 25 nL droplets
- Non-contact transfer of a broad spectrum of fluid types using sound

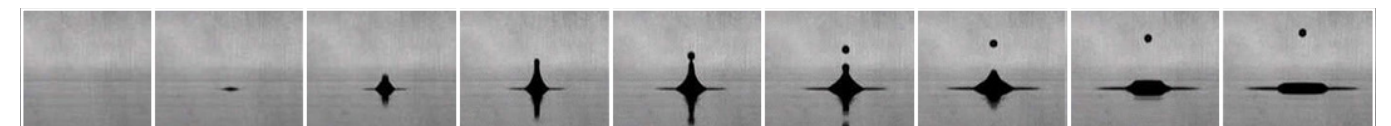


Figure 2: Stroboscopic imaging of Acoustic Droplet Ejection, showing production of a single droplet of fluid.



Direct Dilution for a more reliable dilution of samples and reagents

With the ability to transfer low nanoliter volumes, Echo Liquid Handlers can produce dose-response and standard curves free of the errors typically found using traditional tip-based liquid handlers and serial dilution. Echo Liquid Handlers create a series of dilutions by directly transferring decreasing volumes of stock sample to individual assay wells. Since each concentration point along the dilution curve is created individually, instead of serially, the risk of propagating errors (carryover) along the curve is eliminated — a significant improvement to data quality.

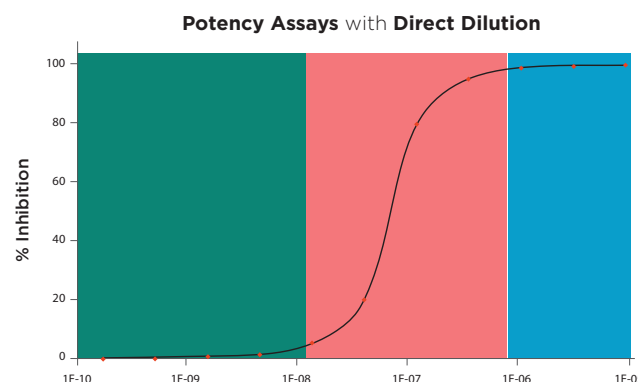
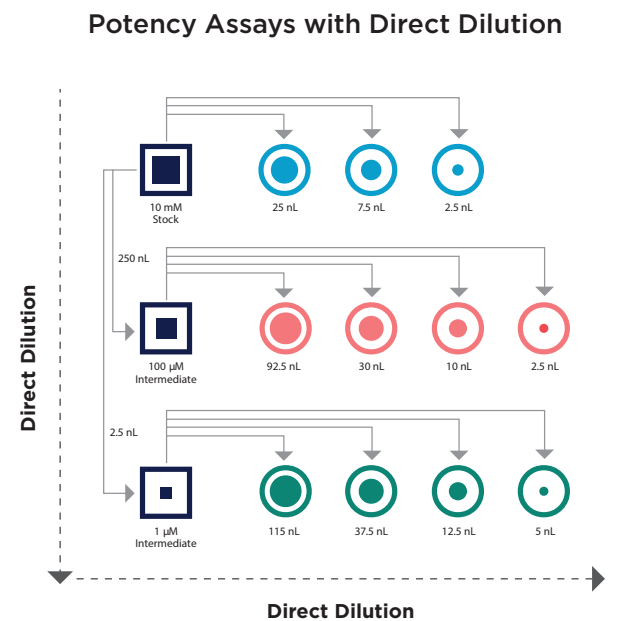


Figure 3: Example of an 11-point curve created using direct dilution. The image on the top shows how the desired concentrations are created by transfers directly from the stock sample and two intermediate dilutions of the stock sample. The resulting IC_{50} curve is shown on the bottom.

Rapid Combinatorial Transfers for superior throughput flexibility

Simultaneous movement of the acoustic transducer and destination plate during transfer enables Echo Liquid Handlers to transfer from any source well to any destination well faster than traditional liquid handling technologies that require time to transport samples and to change tips between transfers.

- Pool and normalize samples, reagents, and primers by transferring different volumes from a collection of source plate wells
- Cherry pick screen 'hits' in minutes for secondary screening
- Quickly create combinations of samples and reagents in varying concentrations
- Define transfer regions to create custom layouts
- Compress libraries into interleaved patterns or separate quadrants
- Offset transfers to any position in a well

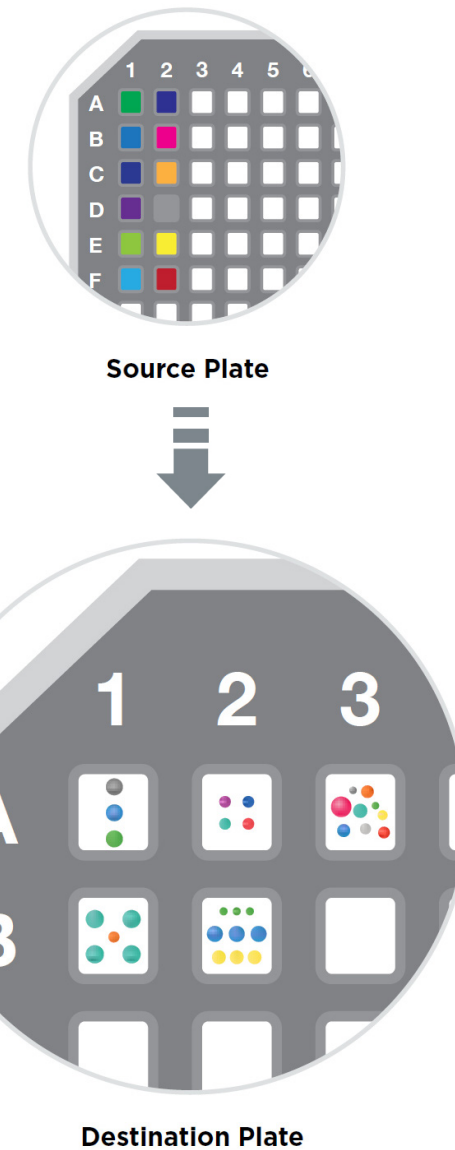


Figure 4: Examples of rapid cherry picking, sample pooling, and combination screening from any source well to any destination well, at any volume.



Reduce Plastic Waste and Lower Your Lab Costs

Millions of metric tons of plastic waste are generated by life science research laboratories each year. The majority of this waste is from single-use plastics, like pipette tips. Echo Liquid Handlers eliminate the dependency on pipette tips, significantly reducing lab waste and disposal costs.

Reduce Assay Volumes, Not Performance

Successful miniaturization of assays requires highly reproducible and accurate transfer of nanoliter and microliter volumes of assays, reagents and samples. Echo Liquid Handlers deliver small volumes of reagents, enabling assay miniaturization to previously unattainable levels.

Assay Miniaturization

- Enables low-volume sample, reagent and compound addition
- Minimizes final DMSO concentration
- Generates comparable or improved results
- Delivers consistent performance

Precise Transfers in nL Increments

Sample transfer integrity is important for successful data generation. With highly precise and accurate non-contact transfers, the Echo Liquid Handler enables rapid addition of reagents and nucleic acids.

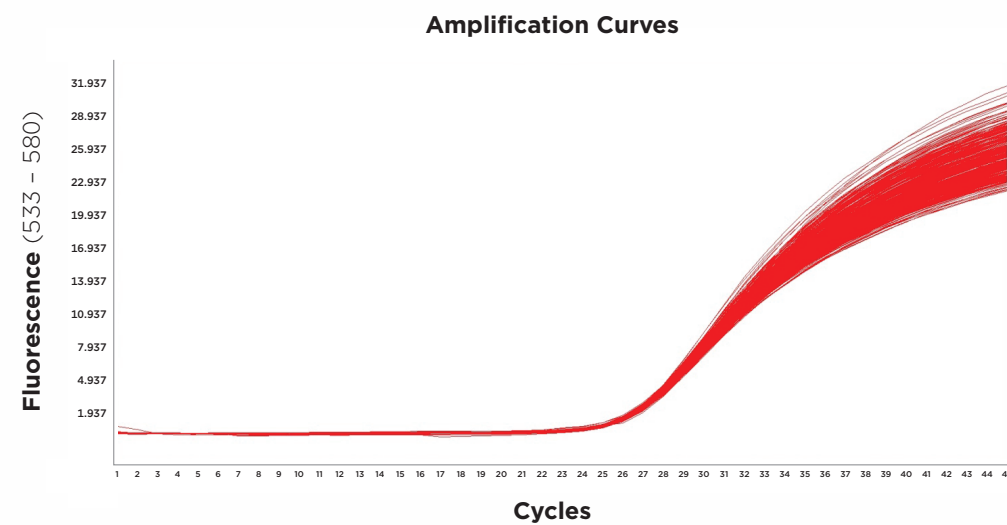
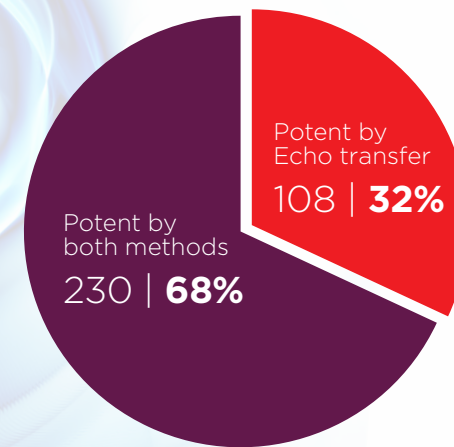


Figure 3: Real-time qPCR data showing transfer uniformity using the Echo Liquid Handler. Source plate Echo Qualified 384-well Polypropylene Plus Microplate to a 384-well assay plate. 1 μ L puc19 in 0.1 %TE per well was transferred. Roche 1536 DNA Green Master reagent was used following the standard protocol 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 Handler.¹

259x More Potent

AstraZeneca demonstrated more accurate compound potency when transferring directly with an Echo Liquid Handler versus using a serial dilution process.²

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	0.17
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.

Significantly Improving Workflows

Enabling Researchers to push their science in new directions

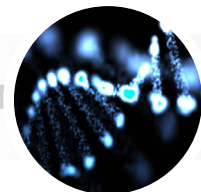
Echo Liquid Handlers overcome traditional barriers in genomics research by dramatically reducing sample and reagent volume requirements, enabling laboratories to maximize their working budgets, while improving processes and data quality.

GENOMICS RESEARCH

Increase Efficiency and Speed while Reducing Costs

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

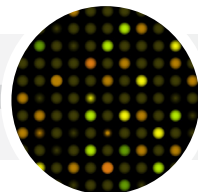
Synthetic Biology



Cost Effective, High-Throughput qPCR

Echo Liquid Handlers reduce assay costs and automate laborious assay preparation steps. Non-contact transfers improve assay reproducibility and eliminate false positives. When combined with the Access System, the Echo Liquid Handler makes cost-effective high-throughput qPCR a reality.

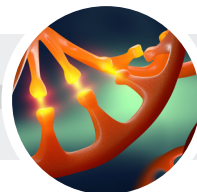
qPCR



Flexibility Accelerates Optimization for More Efficiency

Echo Liquid Handlers enable ultimate flexibility to generate CRISPR-based gene editing complexes. Miniaturization of transfection reactions, including CRISPR complex, transfection reagent and cell number, increases throughput, while reducing cost per edit. This enables more thorough screens, higher efficiency edits, and fewer off-target events.

Gene Editing



TXTL

Faster Optimization of Protein Production with Lower Costs

Echo Liquid Handlers enable high-throughput cell free evaluation of bespoke gene constructs and gene circuits. The provided flexibility enables the optimization of protein production conditions and circuit stoichiometry. Nanoliter transfer of inputs for test construct(s) maintains miniaturized reaction volumes and cost savings for simple or complex gene or circuit tests.

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.

Microbiome

Miniaturize Your Sample and Workflow 20x

As researchers continue to explore and study the interaction of the body and the microbiome, Echo acoustic liquid handling leads the way by dramatically simplifying the library preparation workflow and reducing the amount of sample required. This ultimately reduces the time and cost of library preparation to enable a more cost effective use of shotgun sequencing as an alternative to less precise methods like 16S sequencing.

GENOMICS RESEARCH

Enabling Miniaturization with unparalleled throughput and accuracy

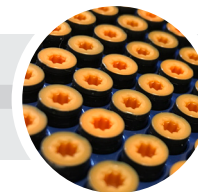
Reagents, compounds, and samples used throughout the drug discovery process are transferred efficiently and accurately with Echo Liquid Handlers. With various throughput options and fluid transfer capabilities, you can use the Echo system at all steps of the drug discovery process.

DRUG DISCOVERY

Cost-effective Plate Preparation and Superior Data Quality

Sample management is the linchpin of any discovery process. For screens to be run effectively, the sample library must be uncompromised. Our sample management solutions dramatically reduce sample volume requirements without sacrificing precision.

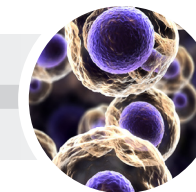
Sample Management



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. We address these needs with integrated solutions for liquid handling and automation designed for cell-based assay screening.

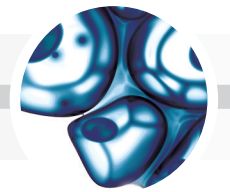
Cell-based Assays



Maintain 21 CFR Part 11 Compliance while Using Echo Liquid Handlers

With unparalleled precision and accuracy, Echo Liquid Handlers transform the scientific landscape to give researchers the best possible solutions for potency assays, binding assays, and pre-clinical research in GMP/FDA-regulated laboratories.

Bioassays



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, which 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. The non-contact transfer and ability of the Echo Liquid Handler 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.

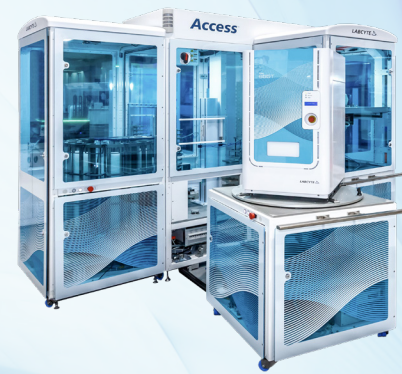
DRUG DISCOVERY

For a complete list of Echo liquid handling applications, please visit our web at www.beckman.com/liquid-handlers/echo-525

Access Systems and Workflows

Ready-to-Go Robotic Systems for Echo Liquid Handlers

Whether you are looking to automate simple or complex workflows involving an Echo Liquid Handler, Beckman Coulter Life Sciences offers an automation solution that can be configured to meet your needs. Powered with Tempo Automation Control Software, Access Systems employ a modular design principle for flexible solutions that can be easily scaled or re-configured when needed.



Access Dual Robot System

- Ideal for more than 12 devices
- Options available to manage the system environment



Access Single Robot System

- Ideal for 6-12 devices
- Options available to manage the system environment



Access Laboratory Workstation

- Ideal for 8 devices plus an Echo Liquid Handler

Echo Software Applications

Quickly and Easily Develop Protocols for Echo Liquid Handlers

We offer a full suite of Echo Software Applications to enable researchers to quickly and easily create liquid handling protocols for specific applications with minimal training. 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 Echo Liquid Handlers and use built-in simulators to validate every transfer before running live. The suite of Echo software applications enables Echo Liquid Handlers to quickly and efficiently accomplish any liquid handling task.

Echo Array Maker



Echo Cherry Pick



Echo Combination Screen



Echo Dose-Response



Echo Plate Audit



Echo Plate Reformat



Echo Compliance Manager



Training and Support

Maximize Your Instrument Performance

Timely service and preventive maintenance are essential for optimal instrument performance and data quality. Beckman Coulter Life Sciences offers a range of service plans to fit every lab's needs and budget. We provide global field service support with local personnel in the United States, Europe and Asia. In addition to field support, we have support and instrument maintenance facilities in the United States, Europe and Asia.

Global Applications Support Team

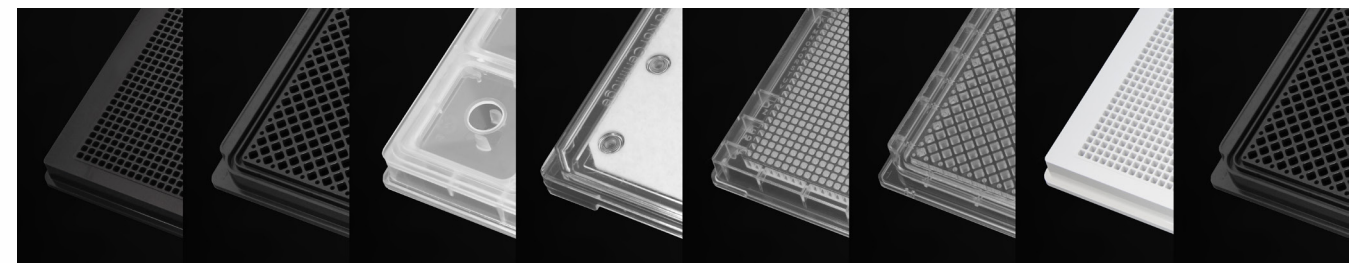
We offer superior application support dedicated to helping you achieve optimal results from your Echo Liquid Handlers and Access Automation Platforms. As a global organization that serves customers in the United States, Europe and Asia, we're a collaborative partner that is committed to your success.

Echo Qualified Consumables

Precision Manufacturing and Exceptional Performance

Echo Qualified Consumables must meet the highest specifications to achieve the exceptional performance expected from Echo Liquid Handlers. Only plates that are made of an acoustically compatible material and are exceptionally flat with extremely low inter- and intra-plate CVs are considered qualified for use on

Echo systems. Factory fluid calibrations developed specifically for Echo Qualified Consumables support transfers of a broad range of fluid types, providing maximum flexibility at the highest level of accuracy and precision.





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