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Empower Your Production Line With Ultrasonic Battery Cell Inspection

Scaling up battery production while maintaining rigorous quality standards is a critical challenge for the rapidly growing EV industry. Costs associated with production ramp-up are steep, with cell costs needing to be reduced by at least 40% to catalyze widespread EV adoption.

Reliability and safety concerns, which lead to costly recalls and increased scrap, further strain manufacturers.

The paramount importance of comprehensive quality inspection and process insights, both for competitive advantage and to maintain brand reputation, cannot be overstated.
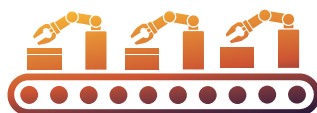
Existing cell quality inspection methods such as X-ray, vision or electrical present a clear dichotomy – either they provide high-resolution and granular data at very low speeds, or high-speed in-line assessments but with narrower insights. This hinders ideal cell production ramp-up and process optimization, ultimately keeping costs high.

In this rapidly electrifying era, there's an urgent need for cell inspection and analytics solutions that effectively converge reliable quality insights with high throughput capabilities in order for manufacturers to secure their market position and protect their brand from potential damage for profitability and survival.

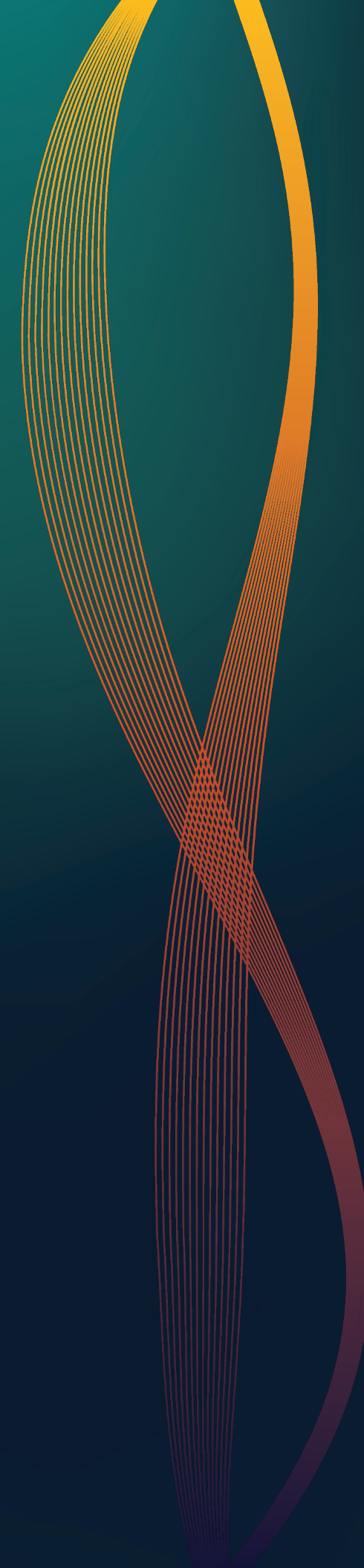## EchoStat Empowers Manufacturers

Compress time-to-market for new cell technologies and processes.

Accelerate ramp-up of safe, reliable cell production.

Improve productivity and profitability at-scale.

Liminal's EchoStat platform addresses challenges with battery production ramp up and default detection.

EchoStat is a cell inspection platform that is specifically designed to complement the use of existing inspection methods in battery production. Cell manufacturers can now receive at the production line level, a wide range of robust and real-time insights backed by ultrasound technology and physics-based machine learning analytics. EchoStat enhances manufacturing intelligence with a unique approach to battery quality assurance, bridging the gap between the manufacturing processes of today and the efficiency demands of tomorrow.
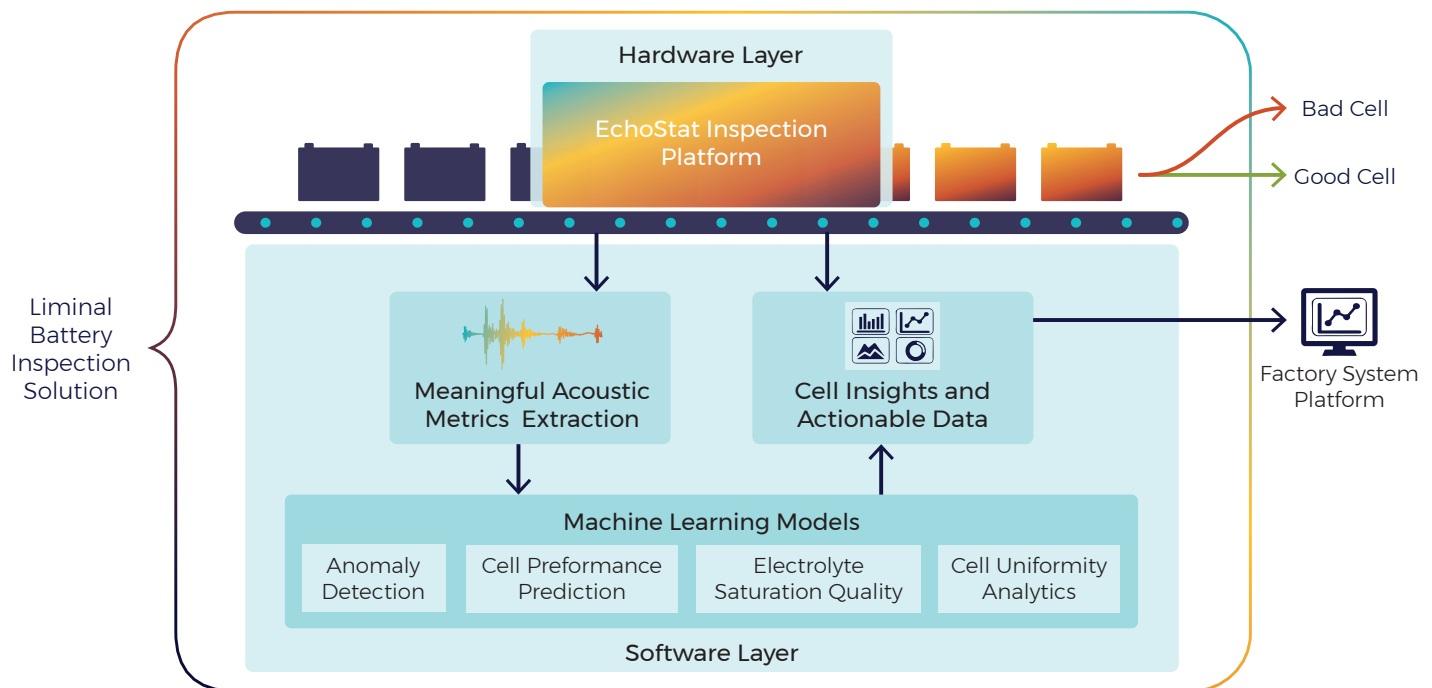
✓ **Detects and characterizes multiple manufacturing defect types** at optimal cost of ownership.

✓ **Ensures that better decisions are made** by delivering real time insights to minimize error and ensure greater control for maximum yield improvement.

✓ **High-speed, inline inspection** empowers cell manufacturers to operate at their highest potential, reducing bottlenecks.

✓ **Non-destructive cell inspection** by harnessing the power of ultrasound.

EchoStat In-line Solution Improves Manufacturing Processes and Quality

EchoStat delivers accurate and actionable data in real time on a wide range of cell insights.

+ Electrolyte Saturation Quality
Optimize electrolyte soaking time pre-formation to ensure 100% of manufactured cells are completely saturated.

+ Cell Performance Prediction
Predict battery life performance with more than 85% accuracy and provide insights on all cells produced.

+ Anomaly Detection
Detects potential production anomalies such as electrode misalignment or separator folds/tears for 100% of cells pre-shipment.

+ Cell Uniformity Analytics
Monitor production batches and be alerted of any process drift or excursions in real time to ensure consistency.

Technology Behind EchoStat

Unique Features

✓ Cell technology and chemistry agnostic –compatible with Li-ion, Li-metal, Na-ion, solid state, etc.

✓ Can be configured to match any factory throughput with fully automated, high-speed scanning at 10 ppm per system.

✓ Proprietary, advanced, physics-based machine learning algorithms deliver precise cell defect detection and performance prediction.

✓ Equipped with our specialized ultrasonic array sensor.

✓ A single, adaptable system designed for seamless integration at multiple critical insertion points in the production line, including post-fill, pre-formation, post-formation, and end-of-line quality control.

✓ Supports a broad range of cell format, from pouch to prismatic.

Optimized Inspection Platform for Cell Production Line

EchoStat ultrasound inspection solution defines the future of automated battery inspection.

+ Flexible and Modular
Software-defined platform is optimized for different inspection scenarios.
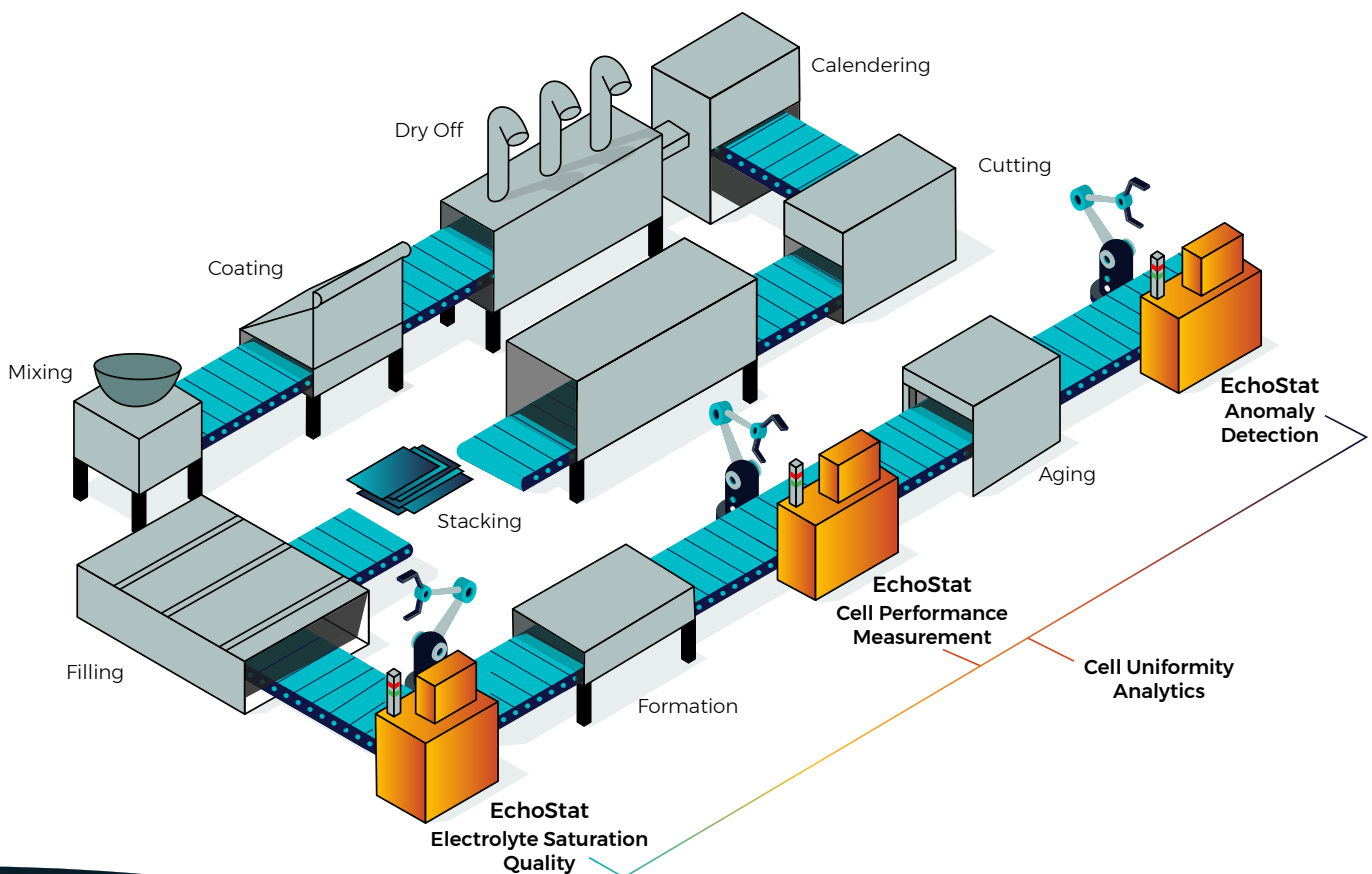
+ Scalable
Designed to scale, making it a sustainable solution for future expansion.

+ Easy to Use, Deploy and Maintain
Seamless factory integration allows for a fully in-line automated solution.

+ High Performance and Reliability
Designed with superior precision and resilience for continuous long-term operation.

Calendering

Dry Off

Cutting

Coating

Mixing

EchoStat Anomaly Detection

Stacking

Aging

EchoStat Cell Performance Measurement

Cell Uniformity Analytics

Filling

Formation

EchoStat Electrolyte Saturation Quality

liminal

1175 Park Ave.
Emeryville, CA 94608

info@liminalinsights.com
liminalinsights.com

Liminal is a battery manufacturing intelligence company that combines ultrasound with machine learning to deliver advanced insights that empower manufacturers. Liminal's solutions address the climate crisis and increase scalability for battery manufacturers to create a world where EVs are accessible to all.