SYNEREX™
LABORATORIES, LLC
SYNCHRONIZING THE FUTURE OF POWER

Engineering Brief

Patent No. US 12,375,324 B2 – Electrical Current Balancing System
Inventor: Gregory A. Dockery
Issue Date: July 29, 2025

The Electrical Current Balancing System (ECBS) is a patented solution designed to improve efficiency, stability, and reliability in three-phase electrical networks. It addresses persistent problems in industrial and commercial power systems, including low power factor, excessive harmonic distortion, unstable voltage, and wasteful reactive energy demand. These conditions traditionally lead to higher operating costs, reduced equipment life, and unnecessary energy consumption.

Conventional approaches, such as capacitor banks or synchronous condensers, often provide only partial correction and require frequent maintenance. Harmonic filters exist in the market, but they are typically narrow in scope and fail to address the broader challenge of balancing currents across all phases of a facility's electrical network. The ECBS overcomes these shortcomings by combining multiple elements into an integrated architecture that actively balances current, stabilizes voltage, reduces harmonics, and conditions power across an entire facility.

At the core of the system is a proprietary line and power filter, designed for narrow-band tuning at 50 and 60 hertz. This filter reduces inefficiencies by pushing waste into harmonic levels and then shunting that waste to ground or neutral. It is adaptive, automatically adjusting its filtering capacity based on load conditions while avoiding the addition of unnecessary stress on the network. Working in conjunction with the filter is the switchgear booster, which manages and stabilizes voltage while elevating power factor levels to 98 percent and above. This reduces or eliminates the need for supplemental reactive power correction equipment.

Once circuits are conditioned, a rack system is employed to further raise the power factor ratio, while the load controller provides wireless or radio-based control for testing, performance verification, and real-time adjustment. A bi-directional meter continuously measures kW, kVA, power factor, and harmonic distortion, feeding this data through a gateway to a dedicated server. The server aggregates and stores historical performance data, enabling comprehensive reporting and proof of savings. For facilities with sensitive electronic loads, such as VFDs, reactors, and chillers, the system also includes a voltage

shunt device. This feature protects equipment by safely redirecting excess grid voltage above threshold levels—typically greater than 480 volts—back to neutral or ground.

The ECBS is installed circuit by circuit at a facility's switchgear, with each circuit filter sending its conditioned signal upstream to the main distribution point. Impedance conditions are sampled at 20,000 times per second, enabling dynamic and precise adjustments. Once deployed, the system balances the current across the network, reduces total harmonic distortion by as much as 95 percent, and improves the power factor to near unity. By reducing reactive current, harmonics, and impedance losses, the system lowers overall kVA demand, smooths ripple effects on the line, and optimizes power flow under varying load conditions.

Measured results from installations show that inductive networks can achieve current reductions of ten percent or more. These improvements translate directly into lower utility demand charges, decreased kVA peaks, and fewer penalties for poor power factor. Beyond cost savings, the ECBS contributes to sustainability goals by reducing wasted energy and lowering carbon emissions. It also extends the useful life of equipment by reducing heat, I^2R losses, and eddy current effects that would otherwise accelerate wear.

The novelty of the ECBS lies in its ability to provide a holistic solution, combining adaptive harmonic filtering, current balancing, power factor improvement, voltage stabilization, and real-time monitoring into a single system. It delivers benefits that conventional correction systems cannot achieve when applied in isolation. As a result, the ECBS is well suited for industrial plants, hospitals, data centers, utilities, and other environments where power quality, efficiency, and reliability are mission-critical.

By transforming the way facilities manage and condition their power, this patented technology establishes an industrial-scale framework for network-wide improvements in electrical efficiency, cost savings, and equipment performance.