KELTRON®
A Government of Kerala Undertaking

SUPERCELL
5816

[WITH KELTRON'S SUPERCAPACITOR TECHNOLOGY]

USER MANUAL

[16V, 58 FARAD SUPERCAPACITOR BANK]

Thank you for purchasing the SuperCell with Supercapacitor Technology. Please read this manual thoroughly. Following the instructions in this manual will enable you to obtain optimum performance from your new SuperCell with Supercapacitor Technology. Please retain this manual for future reference.

DOC. No: KCCL/SB/UM
JANUARY 2026

www.keltroncomp.org

KELTRON COMPONENT COMPLEX LIMITED

OVERVIEW

KELTRON's 58F, 16V Supercapacitor Bank Module provides energy storage and power delivery in a compact, cost-effective module. The product is specifically engineered to provide cost-effective solutions for wind turbine pitch control of 1.5MW and smaller, light-duty AGV power systems, small UPS systems, telecommunications and other lighter-duty industrial electronics applications.

The product is based on 360F Supercapacitors made by KELTRON. In addition to meeting or exceeding demanding industrial application requirements for both watt-hours of energy storage and watts of power delivery per kilogram, this product will perform reliably for more than 500,000 discharge- recharge cycles.

The modules can be series connected up to 750V and/or parallel connected for higher energy requirements. The easy-to-connect, standard module allows system designers to focus upon use of the power and energy, rather than on how to assemble cells.

FEATURES & BENEFITS

- 58 Farad Supercapacitor Bank
- 16V DC working voltage
- Passive cell balancing
- Compact and lightweight package, Screw terminals
- Improved high temperature lifetime

PRODUCT DESCRIPTION

The SuperCell 5816 integrates a total of six supercapacitors rated at 2.7V 360F connected in series to achieve the desired electrical characteristics of the module. This results in 58F, 16V Supercapacitor Bank packed in a compact and reliable cylindrical form factor, with outstanding electrical parameters and life performance. This Supercapacitor Bank, with 4-axial, through-hole snap-in terminals is board mountable to achieve reliable and robust electrical and mechanical connectivity which maintains its integrity in high vibration applications also.

To provide an equal voltage distribution amongst all six internal Supercapacitors, the product features an integrated passive balancing circuitry. Sized to accommodate the slight tolerance in capacitance and leakage current of each individual Supercapacitor in the design, the integrated passive balancing circuit ensures that each cell will operate within its normal operating conditions and therefore ensure the longest lifetime of the product.

The product offers two power terminals (one positive, one negative) and also six mounting points for securing the module in any application.

The product packaging is a rigid enclosure rated for the following stress and environmental conditions:

- Vibration per IEC60068-2-6
- Shock per IEC60068-2-27, IEC60068-2-29

TYPICAL APPLICATION 1 - PITCH CONTROL IN WIND TURBINES

Using a 16 V supercapacitor bank in wind turbine pitch control systems is mainly for reliable, safe and fast response continuous operation (Emergency Pitching) during power failure.

Wind turbines must turn (feather) the blades to a safe angle if the grid power fails, generator trips or overspeed condition occurs. A supercapacitor bank provides instant backup energy to drive the pitch motor when batteries or grid power are unavailable. Supercapacitors are preferred because they can deliver very high current instantly.

ADVANTAGES

(a) Fast Response

Pitch control needs milliseconds-level response to sudden gusts, grid disconnection or emergency stops. Supercapacitors excel here because of very low internal resistance (ESR), High surge current capability and no chemical delay like batteries. Batteries alone may respond too slowly or degrade over time. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(b) High Cycle Life

Wind turbines perform frequent small pitch adjustments which requires many charge discharge cycles. Batteries would fail prematurely in this role. Supercapacitors offer more than 1,000,000 charge–discharge cycles, Minimal degradation over years and is ideal for continuous micro-cycling. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(c) Wide Temperature Tolerance

Wind turbines often operate in cold climates or hot offshore environments. Supercapacitors perform reliably from −40 °C to +65 °C without any freezing or thermal runaway risks. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(d) Maintenance-Free & Safe

Pitch control systems are located in the nacelle (on top of the wind turbine tower, right behind the rotor blades), and is very difficult and expensive to access. Compared to batteries Supercapacitors offer "No electrolyte leakage", "No fire risk", "No periodic replacement" and "Long service intervals (10–15 years)". Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

TYPICAL APPLICATION 2- SMALL UPS SYSTEMS

A supercapacitor bank in an Uninterruptible Power Supply (UPS) system is primarily used for short-term, high-power backup during momentary power outages or while backup generators start up. They are not intended for long-term power supply but excel in applications requiring immediate, reliable power transfer and frequent charge/discharge cycles.

ADVANTAGES

(a) Instantaneous Response

Supercapacitors can deliver full power almost instantly, which is crucial for critical applications where even a few milliseconds of power loss are problematic. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(b) Long Life and Low Maintenance

They have a lifespan of 10-15 years or over one million charge/discharge cycles, virtually eliminating the need for regular maintenance or replacement required by batteries. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(c) Temperature Stability

Supercapacitors operate effectively over a much wider temperature range than batteries and do not pose a thermal runaway risk. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

(d) Environmental Friendliness

They do not contain harmful chemicals or heavy metals like lead-acid batteries, making them easier to recycle and dispose of responsibly. Hence the Supercapacitor bank is ideally suited for this role compared to batteries.

KEY ADVANTAGES OVER BATTERIES		
FEATURE	SUPERCAPACITOR BANK	BATTERY
Charge time	Seconds	Hours
Cycle life	>500,000	500–2000
Maintenance	None	Periodic
Temperature Tolerance	Excellent	Limited
Instant current	Very high	Limited

TYPICAL APPLICATION 3- INDUSTRIAL APPLICATIONS (AGV, DRONES, ROBOTS)

A 16V Supercapacitor bank is primarily used in AUTOMATED GUIDED VEHICLES (AGVs) to provide peak power during high-demand operations (like acceleration or lifting heavy loads) and to capture regenerative braking energy. It often functions as a hybrid power source in parallel with a main battery, extending the battery's life and improving overall system efficiency. Supercapacitor banks enhance DRONE performance by bridging the gap between a LiPo battery's high energy density and the drone's need for high power density (rapid energy delivery). 16V supercapacitor banks are used in ROBOTICS primarily for their ability to deliver rapid bursts of power, facilitate fast charging, and provide a long cycle life compared to traditional batteries. They function as a supplemental or primary power source in various robotic applications.

KEY USAGE IN AGV, DRONES AND ROBOTS

(a) Peak Power Assistance: Supercapacitors have very high-power density, allowing them to deliver rapid bursts of power instantaneously. This power is used during initial high-torque demands such as starting from a halt or accelerating, reducing the instantaneous load on the main battery.

(b) Regenerative Braking: AGVs frequently stop and start. During braking, the electric motors act as generators, producing energy that would otherwise be wasted. Supercapacitors can be charged very quickly (within seconds) and are ideal for capturing and storing this surge of energy efficiently, which can then be reused for the next acceleration phase.

(c) Fast Charging and Reduced Downtime: AGVs powered entirely or in part by supercapacitors can use in-floor or opportunity charging stations to fully recharge within seconds during brief stops, enabling virtually continuous 24/7 operation and eliminating long charging pauses required by batteries alone.

(d) Battery Life Extension: By handling the high-current spikes and deep discharge cycles that degrade batteries, the supercapacitor bank protects the main battery, significantly extending its operational lifespan.

(e) Voltage Stabilization and Ripple Reduction: The capacitor bank helps stabilize the system voltage and smooth out current fluctuations (ripple), leading to a more stable and reliable power supply for sensitive electronics and motors.

TYPICAL APPLICATION 4- LIGHTER DUTY MACHINERIES

For lighter-duty machinery, a supercapacitor bank functions primarily as a highly efficient power buffer and quality conditioner, complementing other energy sources by providing reliable, high-power bursts for dynamic events, rather than serving as the sole, long-duration energy source.

KEY USAGE IN LIGHTER DUTY MACHINERY

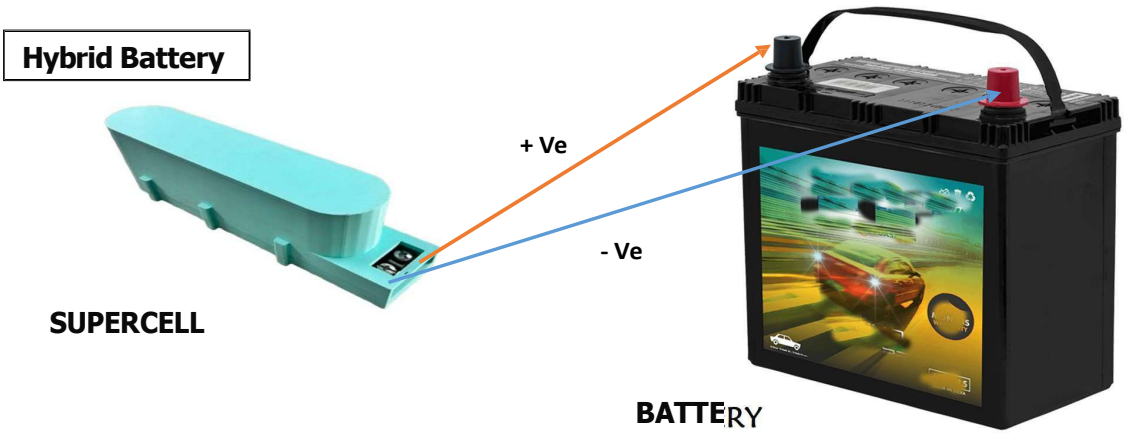
(a) **Peak Power Assist/Load Levelling:** Supercapacitors can handle sudden, high power demands (power spikes) that the main power source (like a battery or generator) might struggle to meet efficiently. In machinery, this can smooth energy supply and prevent overloads on the power grid.

(b) **Voltage Stabilization and Power Quality Improvement:** In industrial settings with many varying loads, the electrical supply can become unstable. Supercapacitors are used to stabilize the voltage and improve power quality, protecting sensitive electronic controls and potentially extending the life of other equipment.

(c) **Energy Recovery (Regenerative Braking):** In machines with frequent stop-and-go movements (e.g., small electric vehicles, industrial robots, or automated shuttles in warehouses), supercapacitors can efficiently capture and store kinetic energy from braking and quickly redeploy it for acceleration.

(d) **Backup Power/Graceful Shutdown:** For critical controls or memory systems in machinery, a supercapacitor bank provides instantaneous power during a main power failure, allowing for a controlled, safe shutdown process to prevent data loss or equipment damage.

(e) **Extended Battery Life:** When used in **hybrid systems with batteries**, supercapacitors handle the high-current demands, allowing the battery to operate within a more stable load range. This significantly extends the battery's service life and reduces maintenance costs



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50 years
Excellence In Electronic Components Manufacturing

KELTRON HAS SETUP INDIA'S FIRST SUPERCAPACITOR PRODUCTION FACILITY WHICH STARTED PRODUCTION DURING OCTOBER 2024. THE SUPERCELL UTILIZES KELTRON MADE SUPERCAPCITORS.

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