

### Ensure stable temperature control for your lithium battery equipment manufacturing

Plastic  
Battery  
Separator

#### Keywords

- Power controller
- Li-ion battery
- Battery separator
- Lithium battery manufacturing
- Extrusion
- Battery manufacturer
- Thin film battery

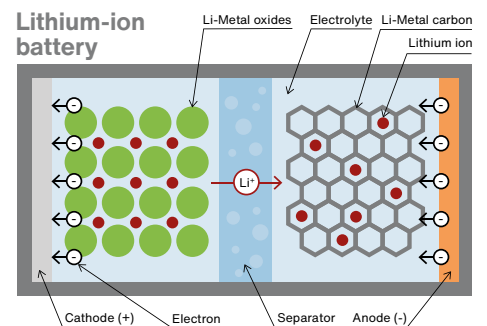
### Technological and economic challenges of Li-ion battery separators

Manufacturers of separators for lithium-ion (or li-ion) batteries face significant technological challenges to meet the growing demands of industries such as electric vehicles and solar panels. Precision, stability, and reliability in manufacturing processes are crucial to guarantee the performance and safety of the batteries. According to a study by Grand View Research, the global lithium battery manufacturing market size was USD 54.4 billion in 2023 and is expected to reach USD 129.3 billion by 2027. This strong growth is partly driven by institutional initiatives to develop electric vehicles, such as the European Union's plan to ban the production of internal combustion cars by 2035. Consequently, battery manufacturers will need to increase their production, leading to a surge in demand for separator films. This rapid growth requires battery manufacturers to focus on improving the efficiency and quality of their production processes.

Separator films, essential components of lithium-ion batteries, must be extremely thin and uniform to ensure effective insulation while allowing ion passage between the electrodes within the batteries.

The manufacturing process of these highly functional films necessitates uniform temperature distribution and precise control.

These performance standards are critical to prevent temperature fluctuations that could compromise the quality of the final product. Indeed, precision and uniformity are crucial to ensuring the performance and safety of the batteries.



### The high standards required in the manufacture of separator films give rise to specific challenges within the industry.

Manufacturers of separators for lithium-ion batteries must ensure that the insulating films produced are extremely thin and uniform. This allows for effective insulation without hindering the passage of ions between the positive and negative electrodes. To meet this requirement, manufacturers seek high-precision temperature control methods that minimize temperature fluctuations during the thermal processing.

These challenges include minimizing temperature fluctuations, which is crucial for maintaining the structural integrity and insulating properties of the separators. Moreover, the reliability of separator films within batteries is essential to prevent short circuits and prolong battery life. In addition to the high precision required during manufacturing, energy consumption during production must also be considered. With the European Union's goal of achieving carbon neutrality by 2050 and rising energy prices, companies are encouraged to be mindful of the type and amount of energy used in their production processes.



**A manufacturer of separator film machines for lithium-ion batteries decided to turn to Fuji Electric power controllers.**

# The Fuji Electric Solution

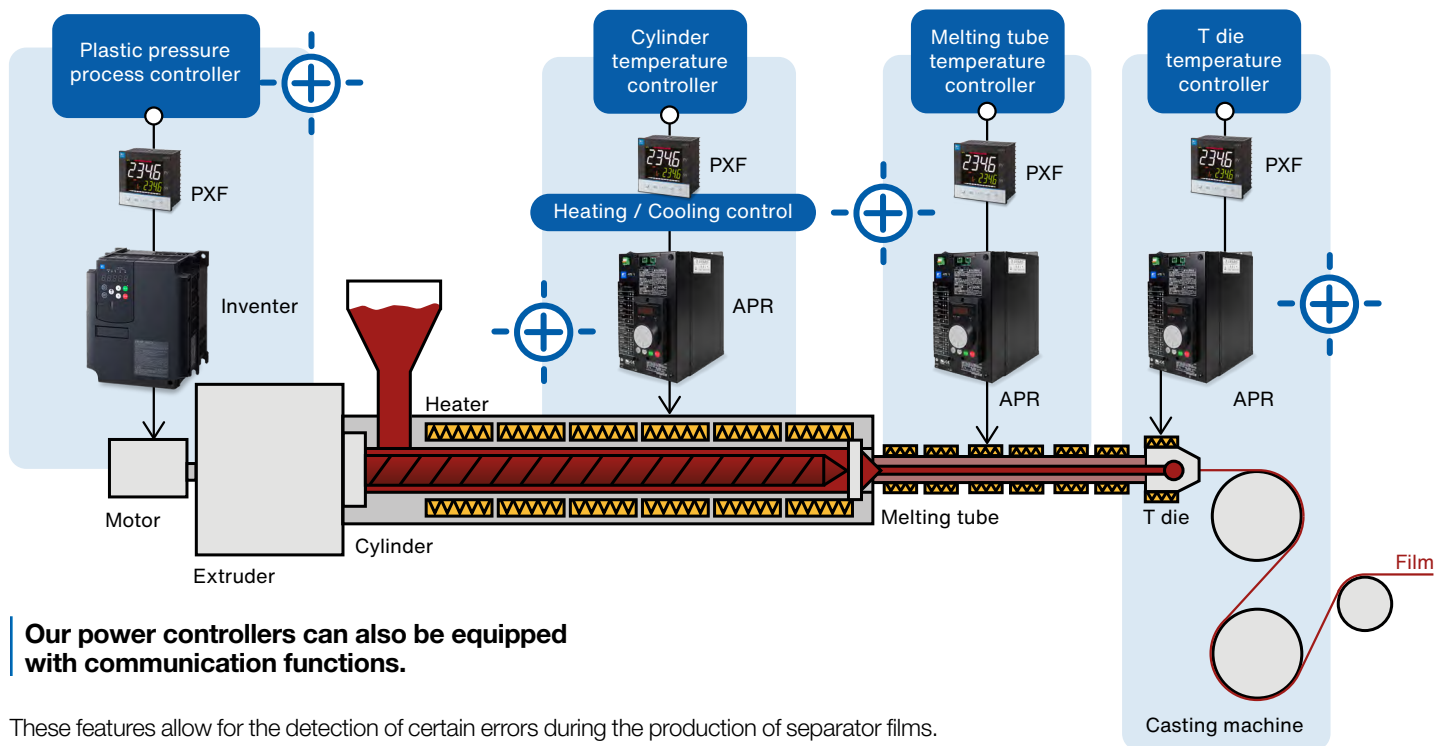
To meet the growing demands of this industry, two models of power controllers were integrated: the APR-V and the APR-D



These power controllers were specifically integrated into an extrusion process using heating elements for the production of ultra-thin separator films. Several units were applied to these extruders for various current intensities. For instance, four units were used for currents of 150A.

The integration of our power controllers into the extrusion process enables extremely precise temperature control through gradual phase angle regulation of the AC power supply. This progressively increases the heating power, protecting the heating elements, extending the lifespan of the equipment, and preventing thermal shocks.

Furthermore, the power controllers significantly reduce temperature fluctuations through their continuous and precise control of the power supply, avoiding the ON-OFF systems found in magnetic (MC) and semiconductor (SSC) contactors. On one hand, they offer, like MCs, a wide power range for controlling heating systems. However, magnetic contactors have a limited mechanical lifespan, and their ON-OFF control leads to temperature fluctuations. On the other hand, semiconductor contactors, while offering an unlimited mechanical lifespan, have a lower heating capacity and also cause temperature fluctuations. Fuji Electric power controllers thus represent the ideal compromise, combining the strengths of both types of contactors without their drawbacks.

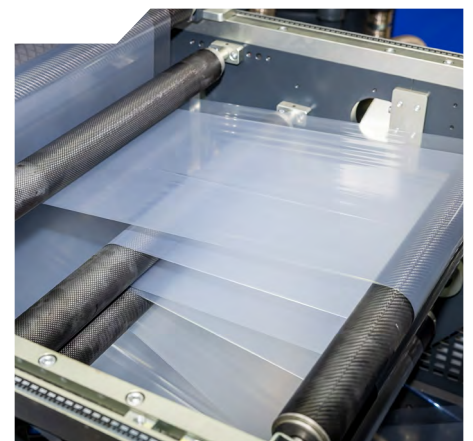


## Our power controllers can also be equipped with communication functions.

These features allow for the detection of certain errors during the production of separator films. Our APR-V power regulator can detect errors such as overheating, communication issues, or the presence of overvoltage or undervoltage. The monitoring features also enable the detection and correction of deviations from optimal parameters. This ensures that the temperature remains close to the set point, providing stable and precise temperature regulation. These functionalities ensure the reliability of our power controllers, optimizing demanding and delicate manufacturing processes.

As for the second power controller, the APR-D, communication functions are also available. Additionally, its ease of installation and use has facilitated the production process for this company.

The integration of Fuji Electric power controllers in the manufacturing process of lithium-ion battery separators had immediate and significant effects. The separators produced showed increased uniformity and a reduction in defects, leading to an overall improvement in battery quality. The system construction was carried out in combination with Fuji Electric PXF temperature controllers. Our range of temperature controllers also offers improvements in speed, ergonomics, and efficiency.



## Your Benefits

- + Minimization of temperature fluctuations
- + High reliability of power controllers
- + High precision in temperature regulation



## Power controllers: APR

### APR-V

**Advanced Versatility for Demanding Environments:**



- Integrated high-precision feedback function and high-temperature control accuracy
- Compatible with four-wire three-phase circuits
- Energy visualization and communication function options
- Space and wiring savings
- System construction with Fuji Electric PXF temperature controller

### APR-D

**Compact solution for industrial applications:**



- Ease of use and adjustment with included setting display
- Simple functionalities and reduced maintenance
- Soft start, gradual power increase, and gradual power decrease
- Energy visualization and communication function options
- System construction with Fuji Electric PXF temperature controller



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