

# ***BATTERY TEST SOLUTIONS***

· CELL TEST · BATTERY PACK / BATTERY MODULE TEST · BATTERY CHARGE AND DISCHARGE TEST  
· BATTERY CHARGE AND DISCHARGE TEST SYSTEM · ENERGY STORAGE CONVERTER  
· BATTERY DISCHARGE TEST · ANALOG BATTERY INTERNAL RESISTANCE TEST  
· BATTERY MANAGEMENT SYSTEM BMS AUTO TEST SYSTEM



***HIGH EFFICIENCY & HIGH PRECISION & HIGH STABILITY***

# Battery Test Solutions



With the widespread application of clean energy, batteries have become an important part of our daily life. The safety, reliability, and service life of the battery are commonly the most concerned issues by battery manufacturers and assembly manufacturers. Therefore, a large number of tests are required in the process of R&D and production to ensure that they can meet all the needs of the market. APM follows the market trends and provides professional battery testing solutions, which suitable for various batteries including fuel cells, such as lead-acid batteries, lithium batteries (power battery packs), nickel-cadmium batteries, etc.

## Cell test



### Recommendation

#### SP-1U /2U Series High Performance Programmable DC Power Supply

Voltage Range: 0-75V

Current Range: 0-60A

Power Range : 0-4000W

#### Application Range:

Soft pack battery cell / cylindrical battery/ square battery cell charging, static test, battery characteristic analysis and material test, voltage balance test.

#### Application Advantages:

- Low voltage ripple and low noise enable precise charging and discharging.
- High-speed sampling rate.

# Battery Pack / Battery Module Test



## Recommendation

### SP-1U /2U Series

#### High Performance Programmable DC Power Supply

Voltage Range: 20V-800V

Current Range: 7.5A-200A

Power Range : 600W-4000W, Expandable to 40kW

### SP-3U /6U Series

#### Wide-range High-power Programmable DC Power Supply

Voltage Range: 0-2250V

Voltage Range: 0-1200A

Power Range : 0-36kW, Expandable to 576kW

### EL Series High-density Programmable DC Electronic Load

Voltage Range: 0-200V/600V/1200V

Current Range: 0-2880A

Power Range : 0-27.9kW, expandable to 558kW

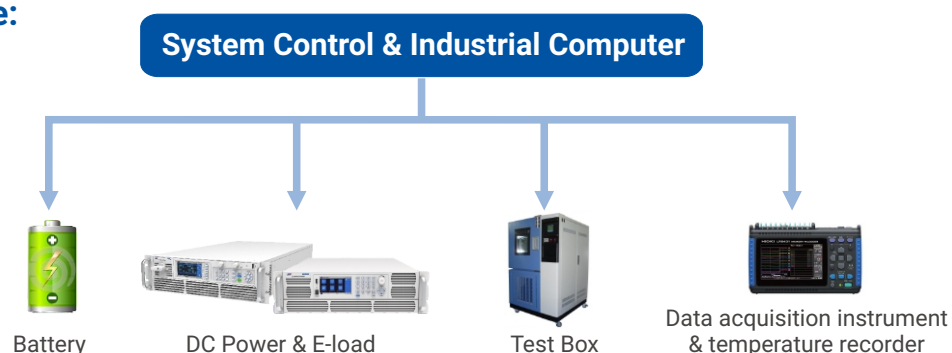
## Application Range:

- Routine performance test: static capacity test, charge holding energy ability, charge receiving energy ability, peak power test and dynamic capacity test.
- The charging and discharging efficiency of the battery pack and the bearing capacity of overcharge and over discharge of the battery pack ability
- Cycle life test: it supports the working condition simulation test edited arbitrarily.
- Verify the voltage and current detection accuracy and energy estimation state of the battery management system.

## Application Advantages:

- It has the functions of constant current, constant power, constant resistance, slope discharge, constant voltage current limiting, constant current voltage limiting, constant current time limiting and other charging functions.
- User defined working condition simulation function: including simulation of charging, discharging and standing state under various parameter states.
- It has multiple protection functions such as power failure, overvoltage, overcurrent, short circuit, reverse connection, phase loss and over temperature.
- It can visually display and record various real-time data, working condition conversion, fault information, etc. of multi-channel charge / discharge test equipment.
- It has powerful data query, analysis, management, recording and other functions.
- High performance energy feedback algorithm to improve energy efficiency.
- Support CAN, RS485 and Ethernet communication and can realize data docking with BMS.

## System Structure:





## Battery Discharge Test



### Recommendation

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### Application Range:

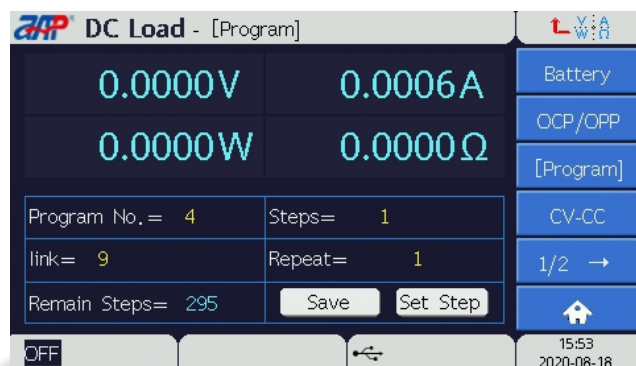
Discharge test of fuel cell / lead-acid battery / lithium battery / nickel cadmium battery, etc.

### Application Advantages:

- The unique timing and measurement function allows users to conduct discharge test in constant current, constant resistance or constant power mode in battery discharge test and similar applications. Set four battery test end conditions: end voltage, timeout, end watt hour and end ampere hour. When any of the four conditions is met, the test will be stopped automatically.



- Programmable program and analog control to simulate complex waveform load.



## Battery Charge and Discharge Test

Carbon neutrality has become consensus of global development. Clean energy and low-carbon transition have become inevitable trend. It makes new energy automobile industry keep growing vigorously as past ten years. It is also the crucial guarantee to realized low carbon in life cycle. With opportunities of carbon peak and neutrality targets, market penetration of new energy automobile has reach to 10%. Industry experts believe that new energy automobile is expected to account to more than 35% of new car sales amount in China. Recently, GM, Ford and Toyota successively announced plan of building battery manufacture or automobile assembly plant in US.

High mileage, fast charge and battery safety are the requirement of customer to automobile. Constant fire accident and other trouble are exposed since new energy vehicles released. Safety, reliability and life time of battery tend to be concern by battery manufacture and new energy vehicles assembly plant. Hereby, APM specially develop high power source and E-load to fit the market demand.

### Test Target:

All kind of batteries include fuel battery, lead-acid battery, lithium battery (power battery), nickel cadmium battery



### Recommendation

SP-3U /6U Series Wide-range High-power Programmable DC Power Supply

SPS-M/A Series DC Power Supply System

EL Series High-density Programmable DC Electronic Load

ELS Series DC Electronic Load System

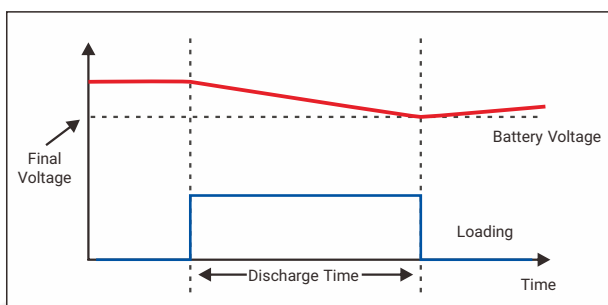
### Charge Application



### Advantage:

- Smart 3-stage charge algorithm. Perfectly match battery type. Precisely manage charge progress.
- Real time redraw battery charge conditional curve.
- Professional test software, support date export.
- High accuracy, high resolution, low ripple and completed communication interface.
- Support master-slave mode to extend power range.

### Discharge Application

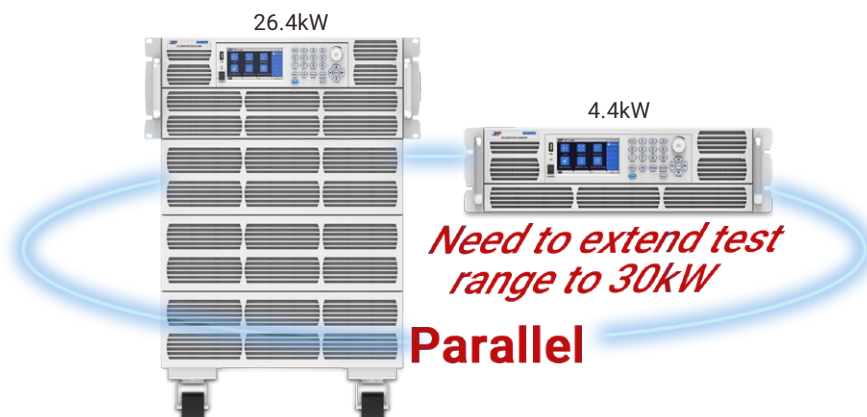


### Advantage:

- Support mater-slave mode to extend power range. No limited to model type.
- Multiple discharging cut off condition setting; avoid permanent damage due to over discharge.
- Multiple discharge mode setting. Match different test application.

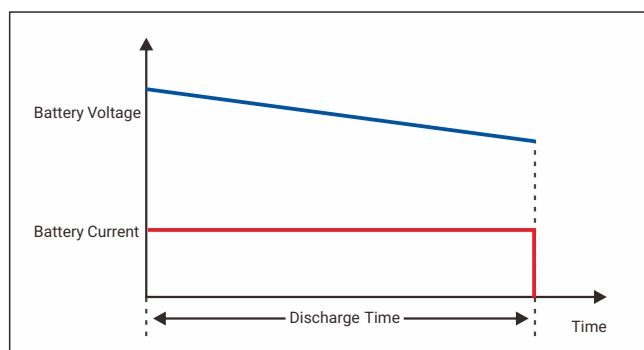
## Flexible Power Range Extension:

When power range of E-load is Insatiable, it could parallel connect two or more unit. If customer purchased higher power range E-load already, it could purchase a small power range unit to extend power range. For example, customer need to extend test range to 30kW and has already purchase 26.4kW unit. Then, only need to purchase one 4.4kW E-load. Mater-slave mode is applicable to build parallel system by different models.



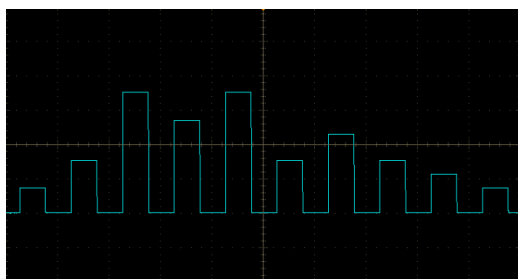
## Multiple Discharging Cut Off Condition Providing Discharge Protection:

Over discharge brings damage to battery especially high current over discharge or repeatedly discharge. Generally, over discharge will cause voltage increasing in battery, which will damage reversibility of active substance in polarity. It could only partial recover in charge and capacities will significantly damping. Battery function of E-load could set end voltage in battery mode. When battery voltage reaches to this value, it will automatically shut down input to avoid over discharge. DC E-load could also provide specific discharge time. When discharge time reach to setting time, shut down discharge automatically.

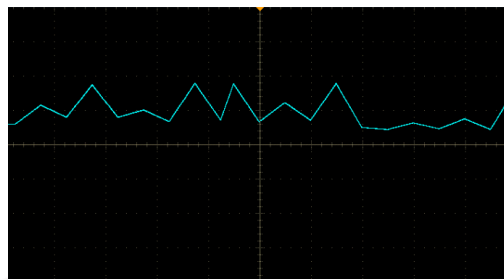


## Multiple Discharge Modes Can Be Set:

Common discharge mode includes pulse discharge and slope rate discharge mode. E-load simulates complicate change of load according to the list file edited by user. Describing rise time, fall time and operation intermittent with maximum 300 steps. Each step has 6 modes for selection (CC, CV, CR, CP, Short mode, unload). Each step could independently set operation time.



Pulse Discharge Mode



Slope Rate Discharge Mode

# Battery Charge and Discharge Test

With widely used of clean energy, battery power has become a popular consume power. More and more large capacity lithium battery are used. At the meanwhile, it brings unprecedented challenge to battery manufacture. New battery need match battery system for conforming selection. In the process of battery design, tests of multiple steps need charge and discharge. To test the perofmace of battery and working condition, it needs battery charge and discharge test. Old battery need to charge and discharge test to test product life. Some certificate, spot test and acceptance test are all need charge and discharge test. APM provide automation solution and custom test according to customer's requirement.

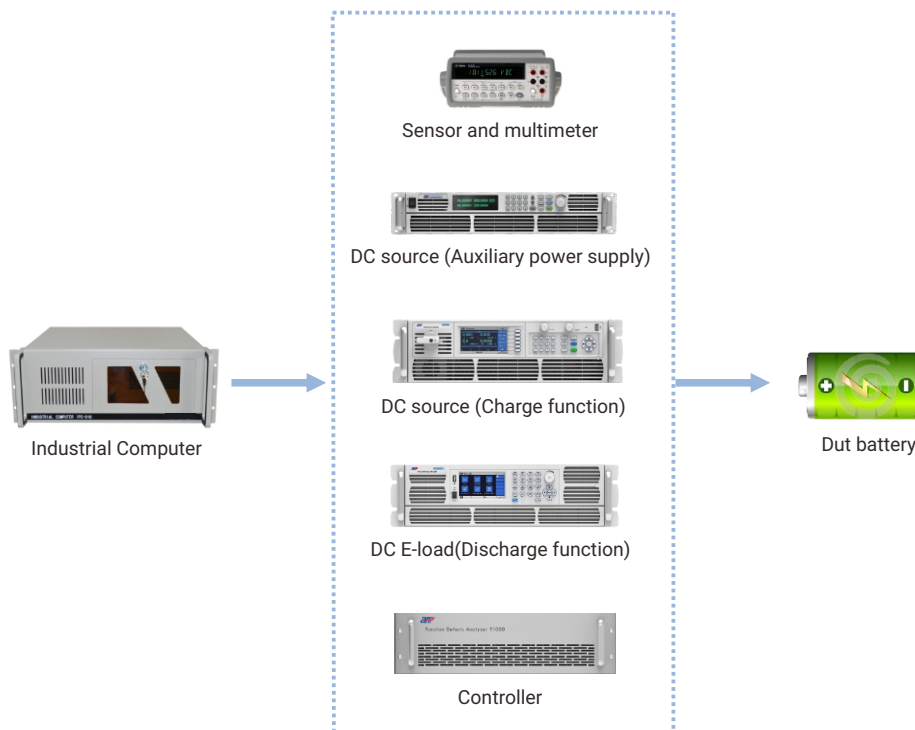
## Application Range:

Including all kinds of fuel battery like lead-acid battery, lithium battery (power battery pack), nickel-cadmium battery.

## Introduction to Function:

- Support CC, CV charge and discharge function which could realize auto life time loop, auto standard woring condition or custom working condition test.
- Equipped with real time recording current, voltage, temperature, carrying capacity, other related test data and malfunction data.
- Could set different charge and discharge cut off condition like total voltage, single voltage, SOC ect.
- Security mornitoring function to settle malfaction lie OCP, OVP, OTP, undervoltage protection, undercurrent protection, short circuit protection, power down protection.
- Draw curve like time-voltage, time-current, time-stage capacity, time-accumulate charge capacity, time-accumulate discharge capacity, time-power, time-resistance, time-energy, time-single battery voltage.

## System Structure:



## Simulating Battery Internal Resistance Test

Unlike the power supply, the internal resistance of the battery can not be ignored. During the test, in order to be closer to the real effect of battery pack test, it is necessary to add battery internal resistance simulation at the same time and solve the production inspection and test of electric tools in one stop in combination with the needs of the market.



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#### EL Series

##### High-density Programmable DC Electronic Load

Voltage Range: 200V/600V/1200V

Current Range: 0-320A

Power Range : 0-3000W

### Application Range:

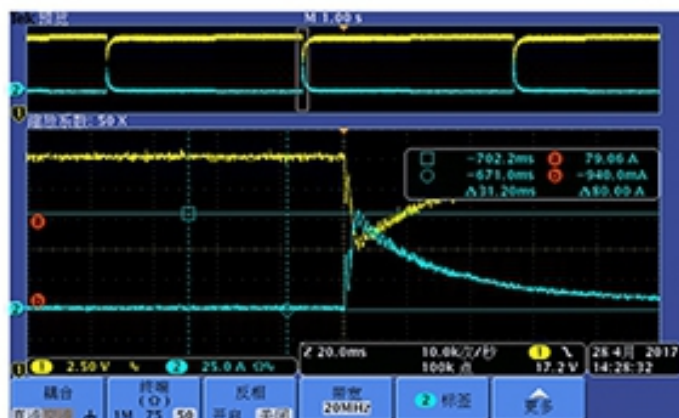
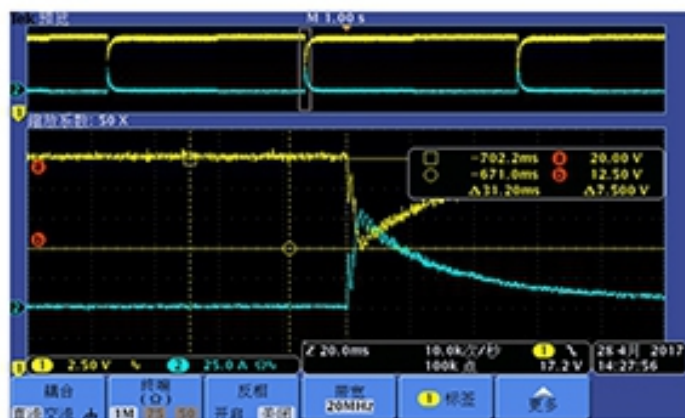
Exfactory inspection and test of electric tool battery pack, simulating the internal resistance test of electric tool battery.

### Application Advantages:

- After comparing and testing different types of battery packs of customers, accurate internal resistance parameters are obtained, and the alarm mechanism is modified based on the actual test requirements.
- According to the production line test operation mode, add password protection to prevent customers from misoperation.
- APM technology load combined with PLC control test fixture can realize the factory inspection and test of battery pack. The DC load current range is wide and can meet the current test requirements of different types of batteries. Light weight, one person can carry without the help of external force. Small size, can be placed flexibly with test fixture.

### Test Simulation:

#### 1. Battery pack test waveform





## 2. Waveform of power

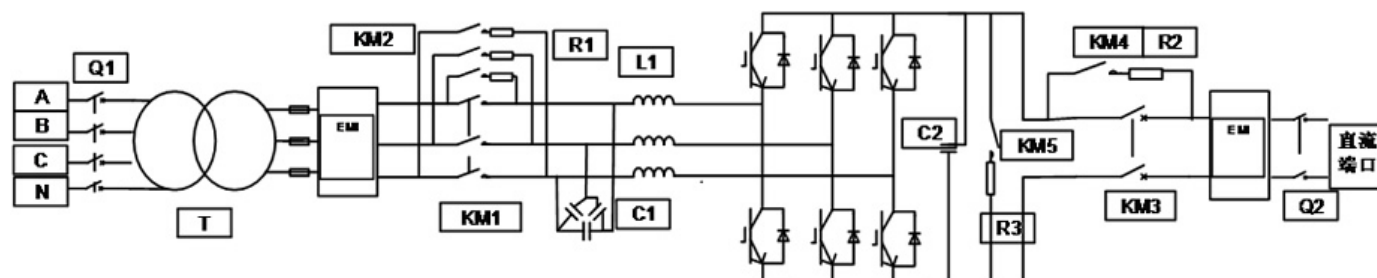


3. Electronic load: real time data monitoring is realized through RS232, and high current protection is verified through load I-MON terminal, which not only improves the test efficiency, but also ensures the stability and reliability of the test.



## Energy Storage Converter

The energy storage converter (PCS) can control the charging and discharging process of the battery, convert AC and DC, and directly supply power to the AC load without power grid. The PCS controller receives the background control command through communication, and controls the converter to charge or discharge the battery according to the symbol and size of the power command, so as to adjust the active power and reactive power of the power grid.



### Recommendation

#### SP-3U /6U Series Wide-range High-power Programmable DC Power Supply

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### Application Range:

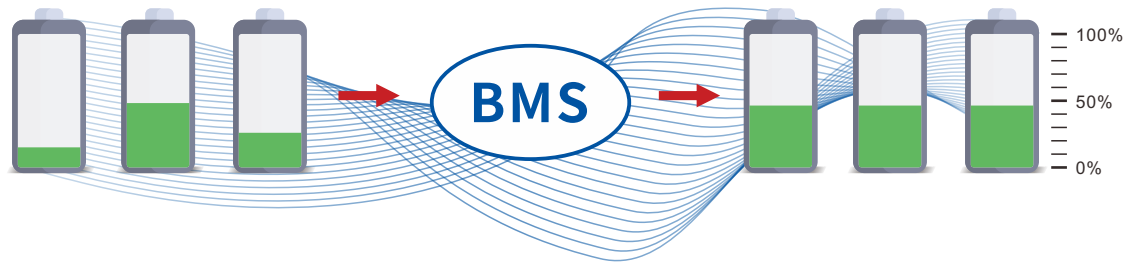
Relevant tests of energy storage converter.

### Application Advantages:

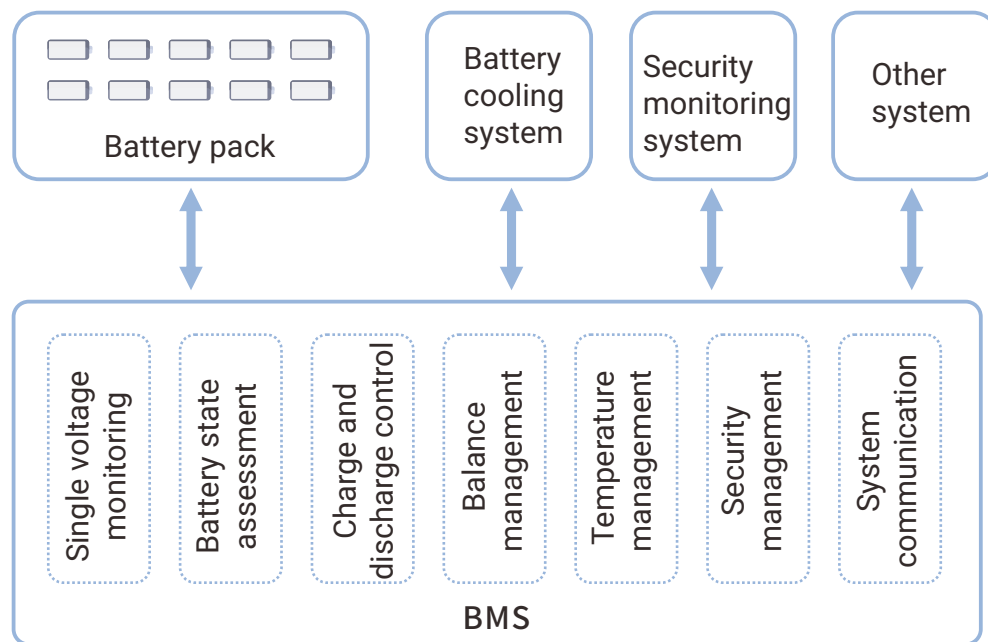
- Power supply is required to simulate various operating conditions; The list function and sequence function of the power supply are used to simulate some operating conditions, and the test results meet the requirements.
- Meet the low voltage ride through function of testing energy storage converter (PCS).
- It has a wide range of output voltage.

## Battery Management System BMS Auto Test System

Battery system of electromobile is combined by thousands of battery cells. Although such many cells work together, the whole performance of system is determined by the worst cells. Thus, it is necessary to monitor, assess and manage each cell accurately. Make sure all battery keep in good condition consistently so that it could make system operate in high performance, longevity and security.



Briefly summarization to BMS is collecting battery information, calculating battery state parameter and communicating with external controller.



### Application Range :

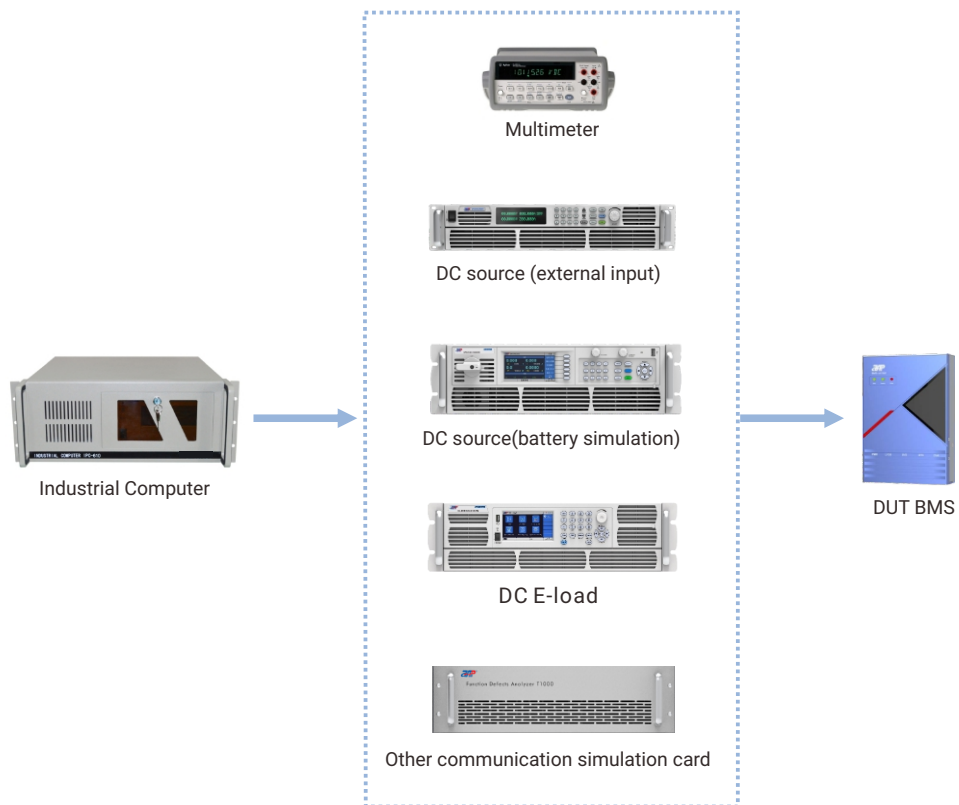
Electric bicycle , automobile, energy storage system , automobile battery module, electric ship

Because battery BMS must match with battery when use it, it is high degree of custom module. Thus, parameter of BMS is set by user. ATE is the tool and platform which merely execute and judge whether it match with the conditions. It could confirm fast and accurately to avoid human negligence.

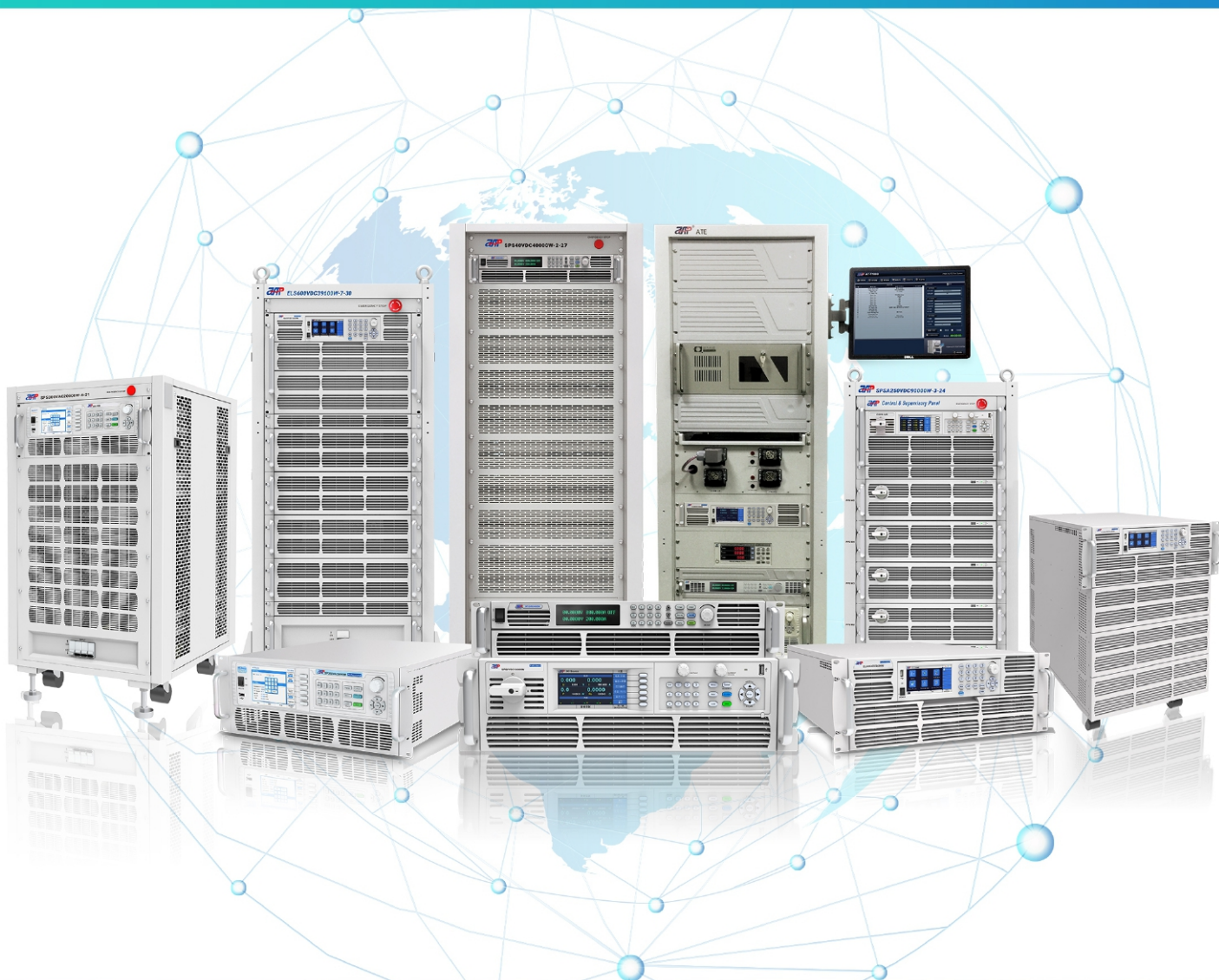
## Test Project:

- BMS IC arouse, software write,parameter write
- BMS IC arouse, data comparison
- BMS IC voltage correction/current correction/temperature correction
- Charge and discharge test and BMS accuracy test
- Balance function test
- Over voltage test
- Under voltage test
- Overcharge current test
- Overdischarge current test
- Over temperature test

## System Structure:







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