

Battery Test and Simulation



Battery Test and Simulation



With increased concerns on environmental protection globally, electric vehicles have been accepted by thousands of family. The battery pack of electric vehicles accounts for a large proportion of the cost of the whole vehicle. When a battery drops below 80% of its initial capacity, it should retire. Therefore, battery safety and reliability, battery life, and battery lifespan are what the battery manufacturers and assembly manufacturers mostly concerned. Itech provide the perfect solution with battery testing system and stand-alone models.

Due to the inherent characteristics of the battery during aging, short circuit, internal resistance, etc., many engineers will seek for electronic equipment to simulate batteries in R&D phase to reduce the preparation time for battery and improve battery reliability, repeatability and safety. ITECH IT6500C, IT6400 and other DC power supplies can simulate the battery and run voltage and current test. They are favored by many domestic and foreign customers.



ITECH Solutions

DC Power Supply

- IT6000B Regenerative Power System
- IT6000D High Power Programmable DC Power Supply
- IT6500 Wide Range High Power Programmable DC Power Supply
- IT6900A Wide Range Programmable DC Power Supply
- IT6000C Bidirectional Programmable DC Power Supply
- IT6800A Dual Range Programmable DC Power Supply
- IT6400 Bipolar DC Power Supply

DC Electronic Load

- IT8000 Regenerative DC Electronic Load
- IT8700 Multi-channel DC Electronic Load
- IT8500+ Programmable DC Electronic Load
- IT8900A/E High Performance High Power DC Electronic Load
- IT8800 High Speed High Accuracy Programmable DC Electronic Load
- IT8300 Regenerative DC Electronic Load

Test System

- ITS5300 Battery Charge & Discharge Test System

KW Battery Charge and discharge Test

Application

KW battery or battery pack, such as power battery, vacuum cleaner, etc. Especially satellites, hybrid electric vehicles, Uninterruptible Power system (UPS), green energy, high power battery system, super capacitor, motor, generator system, power converter, battery management System (BMS), regenerative braking system.

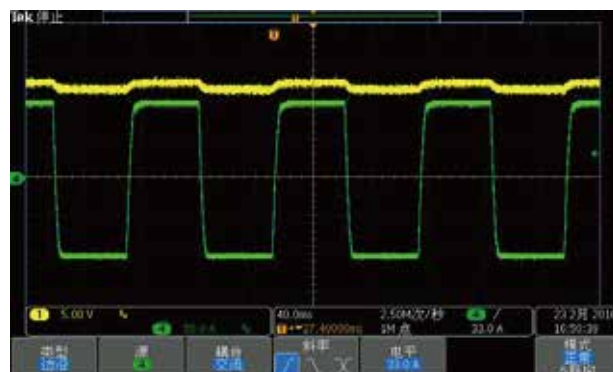


ITECH Solutions

- IT6000B Regenerative Power System
- IT6000C Bidirectional Programmable DC Power Supply
- IT6500 Wide Range High Power Programmable DC Power Supply+Power Dissipater

Test Advantages

- IT6500C, IT6000B, IT6000C, the absorbed current from battery is only about 10mA.
- IT6500C+power dissipater, IT6000B, IT6000C can simulate battery perfectly that charge and discharge battery seamlessly.
- IT6500C+power dissipater can test battery DCIR.
- Simulate battery (incl. internal resistance) output
- With anti-reverse protection module, IT6000B, IT6000C can realize anti-reverse protection for the battery.



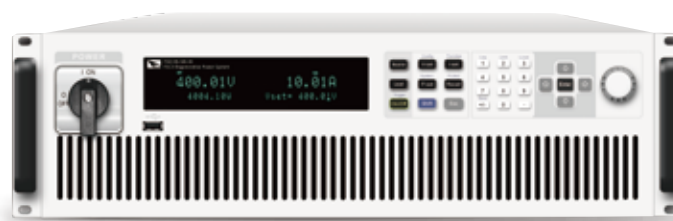
IT6018B-1500-30 (1500V / 30A / 18kW)



IT6522C (80V / 1200A / 3kW) + IT-E502

IT6000B Regenerative Power System

- **Voltage:** 80~2250V
- **Current:** 20~2040A
- **Power:** 6~1152kW
- One button switch between regenerative e-load and bidirectional power supply
- Bidirectional energy transmission, seamless switching across two quadrants
- High power density design provides 18kW in 3U space
- Built-in waveform generator, support generating arbitrary waveforms
- Adjustable output impedance
- List, Dynamic load mode



IT6018B-1500-30 (1500V / 30A / 18kW)

Mini Battery Charge and Discharge Test

Application

Suitable for testing low power electronics or batteries in the IoT field, such as fitness bracelets or smart watch, blood pressure monitor, pacemaker, pulse oximeter, blood glucose monitor, temperature meter, hearing aid, smart phone, tablet, e-book reader, GPS, wearable patient monitor, VR digital glasses, bluetooth headset, parking space detector, underground water meter, sensor, tire pressure detector, driving recorder, anti-theft electronic lock, etc. IoT devices.



ITECH Solutions

- IT6400 Bipolar DC Power Supply



IT6432 ($\pm 30V$ / $\pm 5A$ / 150W)
Bipolar DC Power Supply

Test Advantages

- Bipolar: can be either a power supply or electronic load to supply or sink current. IT6431 can also suppress current overshoot.
- Battery mode, may record charge/discharge capacity, battery voltage, current etc.
- Relay isolation under battery mode to prevent from battery slow discharge.
- Current readback accuracy / resolution up to 10nA / 50nA
- Up to 20 μ s dynamic response time, fast voltage rise time
- Can simulate quick charger to charge/discharge cellphone battery with high current($\pm 10A$)
- Can simulate battery (user needs to key in SoC, voltage, IR etc. parameters)

Model	Voltage	Current	Power	Internal Resistance	Current Readback Resolution	Dynamic Response
IT6411	-15V-0V, 0-15V	$\pm 3A$	45W	0 - 1 Ω	100nA	<50 μ s
	-9V-0V, 0-9V	$\pm 5A$				
IT6411S	-15V-0V, 0-15V	$\pm 0.1A$	1.5W	0-20 Ω	1nA	<200 μ s
IT6412	CH1: $\pm 15V$; $\pm 9V$	CH1, CH2:	45W	0 - 1 Ω	100nA	<50 μ s
	CH2:15V;9V	$\pm 3A$; $\pm 5A$				
IT6431	-15V-0V, 0-15V	$\pm 10A$	150W	0 - 1 Ω	1 μ A	<50 μ s
IT6432	-30V-0V, 0-30V	$\pm 5A$	150W	0 - 1 Ω	100nA	<20 μ s
IT6432H	-30V-0V, 0-30V	$\pm 5A$	150W	0 - 1 Ω	1nA	<20 μ s
IT6433	-60V-0V, 0-60V	$\pm 2.5A$	150W	0 - 1 Ω	100nA	<20 μ s
IT6433H	-60V-0V, 0-60V	$\pm 2.5A$	150W	0 - 1 Ω	1nA	<20 μ s

Battery Discharge Test

Application

A variety of power batteries such as fuel cells, lead acid batteries, lithium batteries (power battery pack), nickel-cadmium batteries and so on.

Test Advantages

- Can set the battery discharge cut-off condition: voltage, discharge capacity, time on e-load panel and computer.
- The internal resistance of specific model is very low, suitable for testing low voltage high current batteries or fuel cells.
- List function and analog control for simulating complex waveforms.



ITECH Solutions

- IT8900A/E High Performance High Power DC Electronic Load
- IT8800 High Speed High Accuracy Programmable DC Electronic Load
- IT8500+ Programmable DC Electronic Load
- IT6000B Regenerative Power System
- IT8000 Regenerative DC Electronic Load

IT8900A/E High Performance High Power DC Electronic Load

- **Voltage range:** 150V, 600V, 1200V
- **Current range:** 80~2400A
- **Power:** 2kW~600kW
- Battery discharge cut-off condition setup: voltage, capacity, time
- Multiple working modes: CC, CV, CR, CP, CC+CV, CV+CR, CR+CC, CP+CC
- Ultra fast loop response, match up with battery loop speed
- List programmable and analog control, simulate complex waveforms loading
- Master-slave parallel, flexible power configuration
- Built-in GPIB, LAN, USB, CAN etc. communication interfaces for easy system configuration



IT8906A-1200-240
(1200V / 240A / 6kW)

| Battery Cycle Life Test

Application

Charge and discharge test for single battery cell (pack) test or unsealed multiple cells in series.

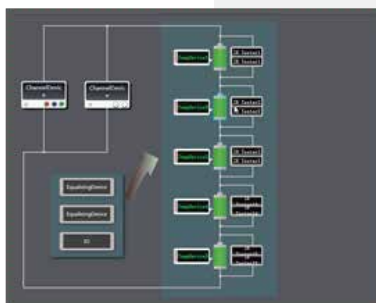
Test Advantages

- It can realize the equalized charge and equalized discharge of battery cells in series, to maximum battery pack capacity, which is often used in maximizing the recharge mileage of power battery pack.
- Can generate the real time charge and discharge curves of voltage, current, temperature, internal resistance, charge and discharge capacity. Can automatically analyze the relationship between the battery cells and the battery pack parameters.
- Real-time online monitoring on voltage, internal resistance, temperature etc. parameters of single battery cell.
- A complete alarm and protection: OVP, OCP, OTP, UVP, reverse polarity protection module (optional).
- Sampling rate and recording data speed up to 1ms (take IT6500C+ power dissipator as example).
- Battery cycle charge and discharge test.
- Customize test steps to automatically record data.



ITECH Solutions

- ITS5300 Battery Charge & Discharge Test System



| Fuel cell, low voltage battery system test solution

Application

Fuel cell and low voltage battery

Test Solution One

- Add an auxiliary power supply in series between e-load and battery to be tested (3V to 5V)

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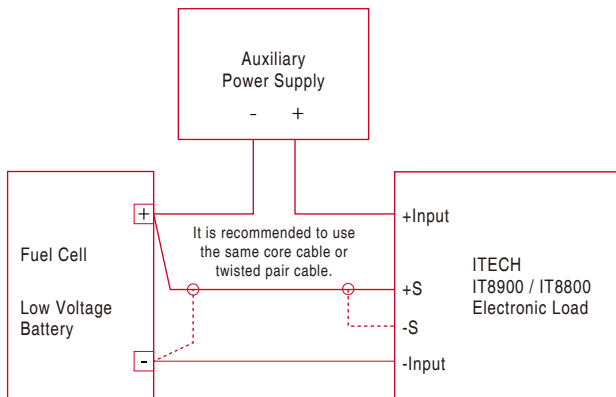
- The auxiliary power supply may bring current noise
- May need to increase the range of e-load
- When the voltage drop across the electronic load is reduced, the polarity of auxiliary power supply and the battery to be tested may be in reverse.

Test Solution Two

- Directly connect the positive and negative poles of the power supply to be tested to both ends of the e-load

Test Requirement

- The voltage drop across e-load must be very small, so the internal resistance must be very small. (IT8900/IT8800 internal resistance minimum 1.4mΩ)
- Wire resistance must be very small



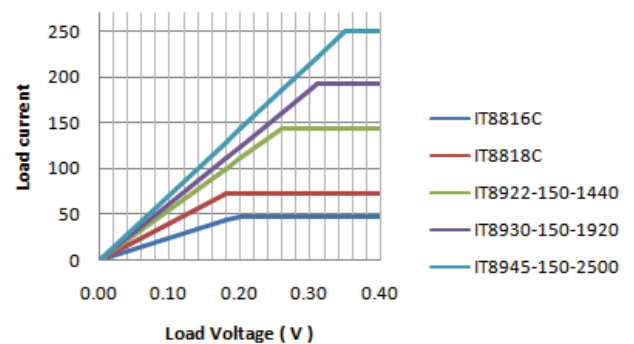
ITECH Solutions

- IT8900A/E High Performance High Power DC Electronic Load
- IT8800 High Speed High Accuracy Programmable DC Electronic Load
- IT8500+ Programmable DC Electronic Load



IT8814B (120V / 120A / 1500W)
High Speed High Accuracy DC Electronic Load

Low Voltage Characteristic of IT8800/IT8900
electronic load



IT8800, IT8900 e-load low voltage
characteristics

IT8800 High Speed High Accuracy DC Electronic Load

- **Voltage:** 120~180V
- **Current:** 15~1500A
- **Power:** 150W~55kW
- Up to 0.1mV/0.01mA high resolution
- Dynamic mode up to 25kHz
- Adjustable current rise speed 0.001A/μs ~ 2.5A/μs
- Battery discharge cut-off condition setup: voltage, capacity, time

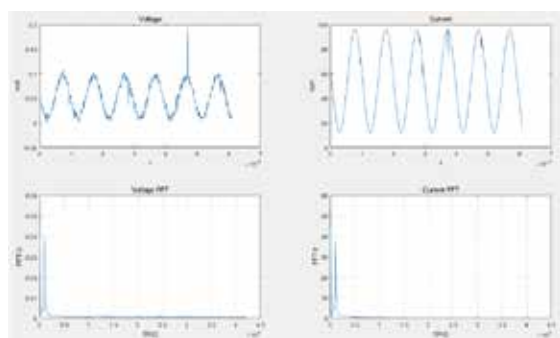
Fuel cell AC impedance test

DTU Background

Fuel cell AC impedance is the key data for fuel cell power generation performance. The AC impedance test identifies faulty fuel cell cells and deviations generated during the assembly process. After completing the AC impedance test at different frequencies, you can get the electro-chemical impedance spectrum of the fuel cell.

Test Methods

Output a sine wave signal based on the test frequency through the signal generator, to control the electronic load to load the sinusoidal waveform in CC mode. Read the voltage and current data in the internal buffer of the electronic load, and perform FFT Fast Fourier Transform analysis. Finally, use a mathematical function to divide the converted voltage by the converted current to obtain complex impedance (including amplitude and phase information)



1kHz current loading voltage, current curve and FFT

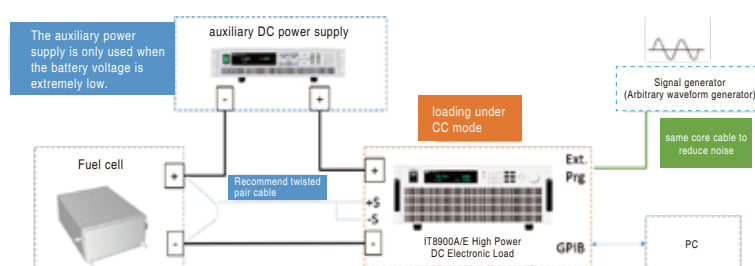


ITECH Solutions

- IT8900A/E High Power DC Electronic Load



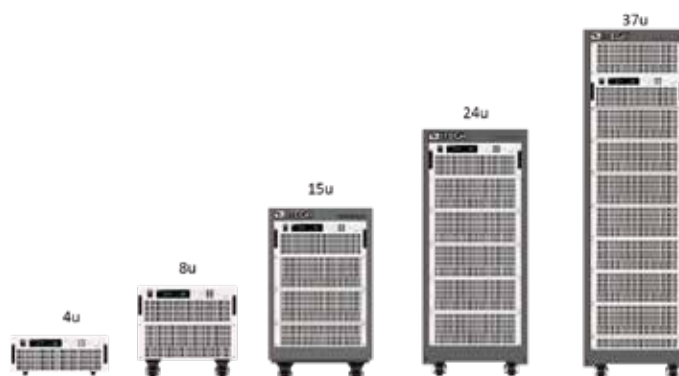
IT8906A-1200-240 (1200V/240A/6kW)



Fuel cell testing connection diagram

IT8900A/E High Power DC Electronic Load

- **Voltage range:** 150V, 600V, 1200V
- **Current range:** 80~2400A
- **Power:** 2kW~600kW
- Battery discharge cut-off condition setup: voltage, capacity, time
- Multiple working modes: CC, CV, CR, CP, CC+CV, CV+CR, CR+CC, CP+CC
- Ultra fast loop response, match up with battery loop speed
- List programmable and analog control, simulate complex waveforms loading
- Master-slave parallel, flexible power configuration
- Built-in GPIB, LAN, USB, CAN etc. communication interfaces for easy system configuration



| Simulate large capacity battery

The advantages of using a power supply to simulate the battery

- Reduce battery preparation time
- Prevent from accidents such as battery short circuit, explosion, etc. caused by improper battery operation
- Provide repeatable test results to avoid inconsistent parameters due to battery aging

Application

Equipment powered by large capacity batteries or battery packs, such as electric wheelchairs, vacuum cleaners, etc. especially in laboratories, production and R&D departments

Test Advantages

- Can simulate battery internal resistance, and simulate the seamless charging and discharging of the battery
- IT6500C, IT6000C, and IT6000B series all have Loop-Mode function, which can realize high speed source and sink current mode conversion. When IT6500C is equipped with IT-E500 series power dissipator, they can absorb up to 90 kW electrical energy, while IT6000C and IT6000B series can absorb up to 1152 kW electrical energy and feed back to the grid.

IT6000C Bidirectional Programmable DC Power Supply

- Voltage : 80~2250A
- Current :20~2040A
- Power: 6kW~144kW, expandable to 1152kW
- High power density, 18kW in 3U space
- Support control loop priority setting, to set different loop speed
- Bidirectional energy transfer, seamless switching between quadrants
- High efficient feedback
- Built-in function generator to support arbitrary waveform generation
- Output impedance adjustable
- Comprehensive protection function, support OVP, \pm OCP, \pm OPP, OTP, power off, islanding protection
- Built-in USB/CAN/LAN/digital IO communication interface, optional GPIB/analog & RS232



ITECH Solutions

- IT6500C Wide Range Programmable High Power DC Power Supply + Power Dissipator
- IT6000B Regenerative Power System
- IT6000C Bidirectional Programmable DC Power Supply



IT6000C Bidirectional
Programmable DC Power Supply

| Simulate low power battery

Application

Low power and portable electronic devices such as IoT devices, Bluetooth headsets, cardiac pacing, heart rate watch, parking space monitor, groundwater meter, surveillance camera, window sensor, smart doorbell (built-in camera), infrared monitor, and more.

Test Advantages

- Input battery parameters, IT6400 series can simulate battery internal resistance, battery residual capacity SoC, battery voltage and other parameters
- IT6431 can absorb and discharge $\pm 10A$ current, which can be used to simulate the fast charging function of mobile phone battery. (or test battery charging performance as a fast charger)
- IT6411S can output up to 20 ohms and can be used to simulate zinc air batteries.



ITECH Solutions

- IT6400 Bipolar DC Power Supply



IT6412 (CH1: $\pm 15V / \pm 3A / 45W$; $\pm 9V / \pm 5A / 45W$
CH2: $0-15V / \pm 3A / 45W$; $0-9V / \pm 5A / 45W$)

| Battery ACIR Test

Application

Manual test of single cells (<300V), also suitable for batch testing

Test Advantages

- IT5101 is a single channel offline battery internal resistance analyzer with statistical analysis, comparator and other functions
- Measure voltage and resistance simultaneously, sampling rate up to 8μs
- Four-terminal test to reduce the influence of wire internal resistance to ensure high test accuracy
- AC 1kHz active injection test, test results do not depend on battery capacity

Application

Cell core in series (cell core positive and negative plates need to be able to lead out the wiring), with automatic test system

Test Advantages

- Work with test system, can test up to 16 channels online
- Four-terminal test, more accurate test
- The software can automatically records the voltage and internal resistance data of each channel, and checks the battery solder joints reliability and battery damage in real time.
- The so-called online test means that even when the battery is in the process of charging and discharging, it can accurately measure battery ACIR.
- Can put 17 units in parallel, support simultaneous measurement of up to 200 cells in series

IT5100 (E / H) battery internal resistance tester

- | | | |
|-------------------------------|--|---|
| • Voltage: 10 μV ~ 1000 V | • Simultaneous measurement of resistance, voltage, speed up to 125 times /second | • Support statistical operations and comparison functions |
| • Resistance: 150 μΩ ~ 3000 Ω | • GPIB, USB, LAN communication interface, support SCPI protocol | • Zero adjustment function |
| • Four-terminal measurement | | • Measuring results alarm |



ITECH Solutions

- IT5101(E/H) Battery IR Tester



IT5101 (150 μΩ-3000 Ω/ 10 μV-300 V)
Battery IR Tester



ITECH Solutions

- IT5102(E) Battery IR Tester



| Battery Temperature Test

Application

Any types of batteries, need to work with automatic test system

Test Advantage

- 8, 16, 24 channels are optional
- Supports multiple thermocouple types: T, K, B, E, J, N, S, R, C



ITECH Solutions

- IT5601 Temperature Logger



IT5601 Temperature Logger

SETUP

ELECTRÓNICA

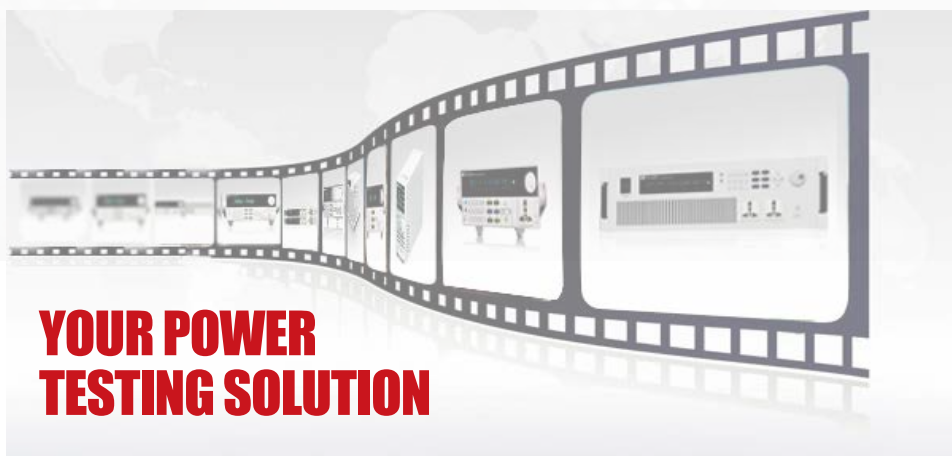
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This information is subject to change without notice. For more information, please contact ITECH.

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