Features

- A pulse charge/discharge function is designed for IR and capacity testing of battery module/cell.
  - Charge mode: CC/CV/pulse charge
  - Discharge mode: CC/CR/CP/pulse discharge
  - Voltage range: 0 - 1200 V
  - Current range: 0 - 1500 A
  - Power range: 0 - 600 KW
- High reliability and precision guarantee absolute measurement accuracy within the broad voltage/current range, improving the system utilization.
  - Voltage: 0.025 % + 0.025 % F.S
  - Current: 0.05 % + 0.05 % F.S
- High sensibility and sample rate make it applicable for charge/discharge test on power batteries of all kinds.
  - V/I current sample rate: 50 kHz (one point sampled every 20 μS).
- Online/offline ACIR and DCIR testing features are designed for analyzing battery/cell IR.
- Standard modular design not only makes it easy for hardware extension and follow-up maintenance but also expand its applications.
- Available for temperature monitor
- A complete alarm and protection setup for effectively preventing overcharge, over-discharge and other unexpected faults.
- Multi-channel independent control
- Available for charge/discharge testing on more than a hundred channels at a time.

Applications

- Battery charge/discharge performance testing
- Battery cycle life testing
- Battery capacity testing
- Outgoing product/incoming material inspection
- Production test

ACIR Testing

A battery pack is typically a set of any number of cells configured in series. A sharp difference between cells may greatly impair the battery pack’s discharge performance. Therefore, measurement and systematic analysis of cell IR is also an integral part of battery performance test. IR is not a constant and may change over time during charge/discharge. The online ACIR testing feature is designed for rapidly and accurately identifying the dynamic IR variation in each cell so as to determine whether the battery has failed.
DCIR Testing

DCIR is typically used in testing high-capacity batteries or accumulators since low-capacity batteries are incapable of loading 40A-80A current within 2-3s. DC discharge is a measurement similar with battery mechanics. In DCIR testing, the DCR is calculated from the current and voltage differences between two different currents.

![DCIR Diagram]

Battery Cycle Life Testing

With the increase in charge/discharge cycles, IR will increase due to internal oxidation, preventing the battery from discharging stored power and in turn end the battery life. Battery cycle life (one charge + one discharge constitute one cycle) is influenced by discharge rate, temperature, end-of-charge/discharge voltage and other factors (see the right figure). Lithium battery typically has 300-500 charge & discharge cycles. IEC and other regulations stipulate that for a standard lithium battery, the remaining capacity after 500 charge & discharge cycles must be 60% or more of the initial capacity. Therefore, charge & discharge cycle testing is an important means to evaluate and measure battery lifecycle.

![Battery Cycle Life Graph]

Battery Temperature Measurement

For battery packs of different structures, temperature sensors of various quantities should be placed at different measurement points which are usually exposed to greatest variation in temperature. Since high-temperature cells are placed densely, a considerable amount of heat will accumulate at the center and less on the periphery, increasing the temperature imbalance between each two cells. As a result, battery modules and cells will differ from each other in performance, which will in turn impair the performance uniformity and service life of battery. Therefore, in an aging test of battery, real-time monitoring of temperature variation is a useful method for accurately evaluating the battery performance.

![Battery Temperature Diagram]

Battery Capacity Testing

Battery capacity is typically measured in ampere-hour. Measured battery capacities will differ with discharge rates applied. Generally, battery life will be shortened by high-rate discharge; thus, discharge capacity is usually measured at a low discharge rate (e.g. 0.2C). Meanwhile, battery tends to be damaged by deep discharge. Battery capacity refers to the effective capacity calculated from the initial voltage to the cut-off voltage.

![Battery Capacity Graph]
By evaluating a battery’s charge/discharge performance, we may effectively simulate the actual working conditions of the battery. The charge process of a battery typically consists of four stages, including the preliminary charge, constant current charge, topping charge and trickle charge. During the discharge process, will not use continuous high current discharge. Therefore, simulation of variable pulse discharge current has become as a new tendency for developing novel battery charge/discharge testing systems. What’s more, the simulation must be so flexible that it can satisfy various usage requirements of the user.

**Battery Charge/Discharge Performance Testing**

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**Modular Design**

ITS5300 Test System is composed primarily of electronic load, power supply, IR tester and temperature logger. By addressing the limitation of traditional single test, the system develops professional test steps to help users radically improve the testing efficiency. Moreover, the system software can be used to conduct a synchronous remote control of each system components. With a modular design, the system allows users to select out of their true testing demands the most suitable devices for integration into an automated test platform, thus producing system architecture with highest flexibility and extendibility.

- **DC Electric Load**

  ITS5300 Test System includes an optional ITECH programmable DC electric load mainly used for battery discharge.

<table>
<thead>
<tr>
<th>Serials</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT8500</td>
<td>0~500V</td>
<td>0~480A</td>
<td>1200~6kW</td>
<td>1mV/0.1mA</td>
</tr>
<tr>
<td>IT8800</td>
<td>0~800V</td>
<td>0~1500A</td>
<td>1500W~6kW</td>
<td>0.1mV/0.01mA</td>
</tr>
</tbody>
</table>

- **IR Tester**

  ITS5300 Test System is provided with an optional ITECH IR tester used for monitoring the voltage and IR of cells in a battery pack. The ITECH IR tester works with the most sophisticated AC discharge testing technology, capable of accurately measuring battery voltage and IR and having an automatic evaluation on battery parameters.

- **Programmable DC Power Supply**

  ITS5300 Test System is supplied with an optional ITECH programmable DC power supply used for battery pack or cell charge.

<table>
<thead>
<tr>
<th>Serials</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT8680</td>
<td>0~72V</td>
<td>0~10A</td>
<td>100W~180W</td>
<td>1mV/1mA</td>
</tr>
<tr>
<td>IT6900</td>
<td>0~160V</td>
<td>0~25A</td>
<td>100W~600W</td>
<td>1mV/0.1mA</td>
</tr>
<tr>
<td>IT6600</td>
<td>0~180V</td>
<td>0~240A</td>
<td>800W~6kW</td>
<td>1mV/1mA</td>
</tr>
<tr>
<td>IT6700</td>
<td>0~1200V</td>
<td>0~110A</td>
<td>850W~3kW</td>
<td>100mV/10mA</td>
</tr>
</tbody>
</table>

- **Temperature Logger**

  ITS5300 Test System integrates an ITECH multi-channel temperature logger used for temperature monitoring. ITECH multi-channel temperature logger is available for monitoring temperature via 24 channels at a time. The specifications of the temperature logger are as follows: measurement range -200°C - 2000°C, measurement accuracy 0.5°C and resolution 0.01°C. The superior performance of temperature logger makes it possible for ITS5300 Test System to acquire temperature data effectively and accurately and for wide application of the system in testing of batteries of all kinds.

**SIBO Electronic Vertriebs GmbH**

Mühlstetten 3  ·  72351 Geislingen  ·  Phone +49 (0) 7428 94010  ·  info@sibo-electronic.de  ·  www.sibo-electronic.de
A Complete Set of Safety Features

- **Power-off Memory Protection**
  ITS5300 Test System is superior over traditional integrated charge & discharge device in which a power-off memory feature while the latter has single protection configuration only. Power-off memory feature is the most cutting-edge and perfect protection function developed by ITECH and designed for time-consuming aging tests. With the protection function, previously acquired data can be effectively stored intact in case of unexpected power off or computer crash during a time-consuming aging test and the user may proceed with the test program from the faulty link after the system back to normal. In this way, repeated tests are avoided for higher efficiency. Likewise, if the power-off state continues for long, the system will automatically cut off the active charge/discharge circuit so as to prevent overcharge and over-discharge and guarantee the safety and reliability of battery testing.

- **Complete Charge & Discharge Protection**
  During the aging test of battery, the user should perform real-time monitoring of cells and battery pack and cut off the circuit for protection purposes when the preset conditions are satisfied so as to prevent overcharge and over-discharge. ITS5300 Test System allows the user to observe the status of battery pack and cells in all channels on the same interface and to present abnormality or normality of each cell using different colors. The system is designed with such protection features as cell under-voltage, overvoltage, over-temperature and battery pack overvoltage, under-voltage and reverse polarity.

- **User-defined Protection Conditions**
  The ITS5300 Test System allows for user-defined end-of-discharge conditions. All permissible parameters of the system can be used as limiting conditions for alarm and power-off protection. In case of satisfaction of any of such conditions, the system will stop discharge automatically.
Safety Protection Interface

ITS5300 Test System software has a dedicated safety protection interface that is given a priority in running over others during normal course of test so as to guarantee the safety and reliability of test.

Data Backup

ITS5300 Testy System allows the user to backup test date to the storage location so as to improve data safety and prevent data loss resulting from computer crash.

Configuration of User Access Rights

System operations mainly consist of editing and operation of test program and data analysis. For better controlling operation of the system by different personnel, the system is provided with the feature of user access rights configuration. With this feature, the user may assign QC, R&D and production personnel with different access right so as to prevent unauthorized modification or undesired artificial suspension of system program and in turn guarantee the system reliability and safety.
Various in Step Editing

ITS5300 Test System provides the users with an array of charge/discharge modes such as CC/CR/CP discharge mode and it can simulate CV/CC. Various end-of-discharge conditions contribute to improvement of testing safety and prevention of over-discharge and overcharge of battery. The “AND” + “OR” logical relation may be established among time, capacity and voltage end-of-discharge conditions to cater to more complex testing requirements.

Multi-Battery Pack Simultaneous Testing

Hundreds of batteries are produced a day in a battery production line. So a multi-channel test system is required for testing many batteries at a time. ITS5300 Test System can divide a battery piece into 10 groups, each group configured with 200 measurement points. Different battery groups may be configured with different test programs but all channels in one group share the same test program, which simplifies the operation and improves the productivity. During the test, the user may clearly observe the test information of each channel on the software interface, including channel configuration, cell voltage, current, discharge capacity and other parameters, which is easy for observation and record.

A battery pack is typically a set of cells connected in series which exhibit different characteristics during charge and discharge. For this reason, monitoring of cells is of great importance. Apart from key parameters of each channel, ITS5300 Test System may install a temperature logger and IR tester to realize real-time monitoring of cell voltage, IR and temperature. The software has intuitive colored block charts to symbolize normality or abnormality of cell characteristics and give early warning when necessary, which improves the testing reliability.
User-friendly and Powerful Edit Interface of Test Program

ITSS300 Test System software is equipped with a user-friendly user interface. The simple and compact edit interface allows you to execute complex test program without mastery of any programming language, making programming as easy as filling out documents.

- Optimized Report and Analysis Functions
  ITS300 Test System is provided with a variety of data and curve display functions, allowing users to have a real-time check-up on steps during operation. Meanwhile, the system can generate IV curve and record cell voltage, current, temperature, IR and other parameters so that the user can produce desired charts and diagrams easily.

- Export in EXCEL Format
  Test results can be exported in EXCEL format for subsequent statistics and analysis.

- Data Query
  Test data tables are named by date and time automatically and can be screened by different conditions for easy search.