TOYO SYSTEM CO. LTD is dedicated to providing state-of-the-art battery testing equipment. The company was founded 24 years ago following six years of research and development. The last 30 years have witnessed dramatic changes in rechargeable battery chemistries, from lead-acid and nickel cadmium through the introduction of nickel-metal hydride (Ni-MH) and lithium-ion. Through it all, TOYO SYSTEM has been privileged to have assisted and even accelerated these transformations through the company's products and accumulated technology. During that time, for example, TOYO SYSTEM worked with a major Japanese automotive company to contribute to the development of the first hybrid electric vehicle, based on NiMH. The company also contributed to the development of the first Li-ion battery for camcorder applications.

As the leading company in the field of battery-related test equipment, TOYO SYSTEM is always willing to embrace new challenges and to exceed customer expectations with its products and technical support.
The reason why leading Japanese companies choose TOYO SYSTEM

1. TOYO SYSTEM can provide a wide range of charge/discharge measurement systems from coin-cells to large batteries for automobile appreciations with very accurate temperature control chambers.

2. The pulse shape and accuracy of its charge/discharge measurement systems are very much appreciated by Japanese automobile companies.

3. TOYO SYSTEM can provide equipment and tools for battery cell making and cell evaluation in the R&D Lab., as well as safety test equipment for batteries and capacitors.

4. TOYO SYSTEM has thousands of measurement systems available and can analyze a wide range of batteries according to any customer protocol without a requirement for customer side investment.

5. TOYO SYSTEM has built up a very strong relationship with major Japanese battery manufacturers for many years and can produce customized battery packs designed for the needs of customers with high-grade Japanese batteries.
TOYO SYSTEM provides all the products across this matrix to meet various customer’s expectations.
Keys for battery test & the measurement

A. “True Value” and “Reproducibility”

1. Accurate, precise waveform of output pulse.
2. Multi-Range of the measurement for the accuracy, and the stability.
3. Four-terminal Method of measurement to measure actual voltage.
4. Low noise, it needs to go back the concept of power supply.
5. Temperature, how to keep same uniform constant conditions for samples.

B. “Safety”
Because of its high energy density, LIBs require special attention with respect to safety.
Test equipment needs safety protection features to avoid the danger of potential accidents.
TOYO SYSTEM Special Low Noise Approach

The three anti-noise principles:
1. Do NOT generate Noise
2. Do NOT supply Noise
3. Do NOT be affected by Noise

Series Dropper Power Supply

The awareness of Noise problem
The reports from the University Laboratory.

Effect of Regulator Type of Charge-Discharge Devices on Cycle Performance of Secondary Batteries

Futoshi Minai, Masaya Kageyama, Koichi Kobayakawa, and Yuichi Sato
Department of Applied Chemistry, Faculty of Engineering, Kanagawa University
Rokkakubashi, Kanagawa-ku, Yokohama, 221-8686

Two types of three-terminal regulators, switching and dropper types, have been used in charge-discharge testing devices for secondary batteries. The output of the switching type regulator contains a spike-current or voltage. The effect of the regulator type of the testing devices on the charge-discharge cycle performance of 2000 mAh lithium ion batteries was investigated. The specific discharge capacity retention rate evaluated with device using the switching type regulator seems to be slightly lower than that evaluated with device using the dropper type regulator.

The reference from the 45th Battery Symposium in Japan
Nov. 27-29 2004 Kyoto Japan 3D24
Advantage of Series Dropper Power Supply

Series Dropper type
> It is a great fit for high grade MEASUREMENT systems !!!

Switching Regulator type
> It is good for General Electronics, but not for the high grade measurement

Switching power supply must contain the switching noise / common, normal, and ripple noise.
TOYO SYSTEM is the first company in the world to use a precise temperature control chamber for battery analysis.

LIB and other batteries are usually very sensitive to environmental temperature. This figure shows how much 1 deg difference affects battery performance/characterization. Accordingly, Toyo System provides very precise temperature control chambers for all experiments.
For many years, TOYO SYSTEM has developed nail penetration test machines and, as a result, has accumulated specialized knowledge and technology in this field.

Test samples: internal battery of smart phone
Condition of Charge: CC/CV 2.1A/4.4V, 25°C
Test condition: Keep 10 seconds after the passing through, then remove the nail.
Nail Size: φ3mm
Test environment: Room Temperature

<table>
<thead>
<tr>
<th>Speed [㎜/sec]</th>
<th>Iron Nail Result/Surface Temperature</th>
<th>Ceramic Nail Result/Surface Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smoke/ 557.8°C</td>
<td>Smoke/ 215.7°C</td>
</tr>
<tr>
<td>20</td>
<td>No Fire No Smoke/ 119.1°C</td>
<td>Explosion/ 471.2°C</td>
</tr>
<tr>
<td>150</td>
<td>No Fire No smoke/ 123.2°C</td>
<td>No fire No Smoke/ 118.8°C</td>
</tr>
</tbody>
</table>

Penetration speed 1㎜/sec

Penetration speed 20㎜/sec

Penetration speed 150㎜/sec
TOYO SYSTEM Co., LTD.

Company Profile

Capitol Stock: 100 Million Yen
Sales amount: 5 billion Yen in 2012
Consolidated Sales: 6 billion Yen in 2012
Number of Employees: 94

Head Quarters: Iwaki, Fukushima Japan
Domestic branches: Sagamihara, Osaka, Nagoya
Oversea sales office: Soul, Korea
Oversea subsidiary: TOYO SYSTEM USA, Inc. in Columbus, OH, USA

Major customers: Toyota, Honda, Mitsubishi Motor, Nissan, Sony, Panasonic, Toshiba, NEC, Hitachi, Fraunhofer, JAXA