



Summer Bounty



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Arbin Eload™ — A Powerful Choice for Your Discharge Testing

The electronic load is an indispensable tool in the discharge testing of energy storage devices, such as batteries and fuel cells. Arbin's eload™ (patented) is first designed integrated into Arbin product lines of charge/discharge or discharge-only testing systems. Responding to demands expressed by fuel cell researchers, Arbin now offers eload™ as a stand-alone product that may be integrated with customers' in-house or third party products.

The compactness, cooling efficiency and high-power density of eload™ result from the invention of an innovative heat dissipation technology, based upon ingeniously engineered heat sinks.

The technology has been patented through the United States Patent and Trade Office.

The stand-alone eload™ system, also known as **Eload Plus**, is a discharge-only testing system built with plug-in structure and consists of one or more eload™ modules and optional temperature control, gas flow control, liquid pump control, digital input/output control, AC impedance and various temperature/auxiliary voltage/pressure reading plug-in modules. Other specific customer requirements such as gas sensors and meters and 0V voltage discharge booster are also integrated easily into this plug-and-play system.

The flexibility of Arbin's

eload™ system lies not only in the hardware structure, but also in the powerful MITS Pro software. Through the software, constant control of current, voltage, load, and power; ramp; staircase; and other dynamic modes can be set by the operator. Measurements, data logging and data conversion are all performed quickly by the software. The software is also capable of running simulation of current, voltage and power to follow non-periodic applications.

Arbin's air-cooled, linear eload™ system is available for up to 50kW. Higher power is possible with PWM technology and/or water-cooled eload™. 🍏



1 channel eload™ module of 0-5V, 100A, 18" x 10" x 3.5"

3-channel linear eload™ system of 0-12V, 20A/2A/0.2A current ranges. Add-ons to the systems are 1kHz AC impedance measurement, 4-channel auxiliary voltage, 4-channel auxiliary pressure, 4-channel auxiliary thermistor, 12V methanol measurement with 2 sensors and 24V CO₂ measurement with 1 sensor.

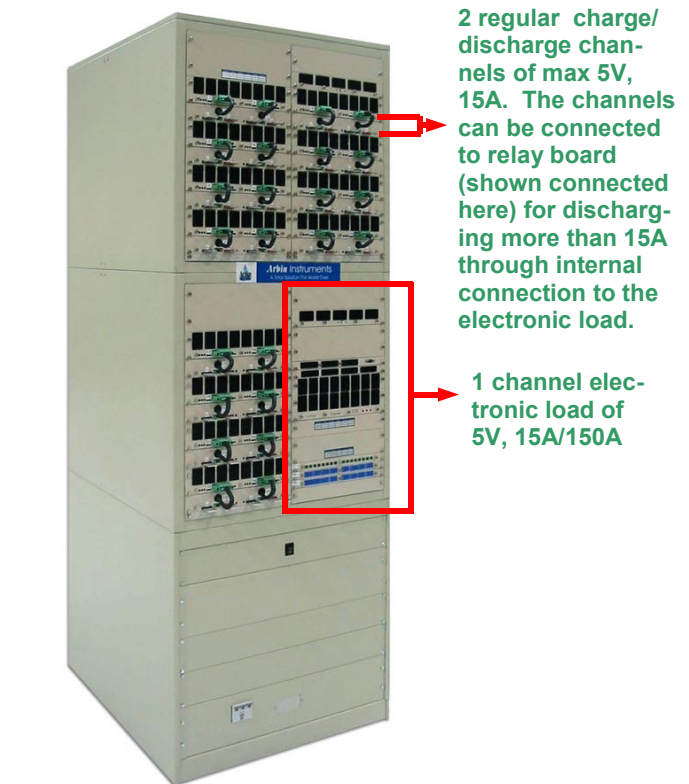
Innovative Engineering for User Convenience & Cost Effectiveness

Arbin engineers are working diligently every day to design and make each and every custom-designed testing system unique for every customer according to exacting specifications. Periodically, Arbin entertains a request for a custom-designed testing system that is so out of the ordinary so as to compel our engineers to think critically and creatively. Such facilitated engineered-work may even result in the genesis of a completely new design testing system such as the one described below for a particular customer in the automotive industry.

The system consists of 24 charge/discharge channels up to 5V/15A and one electronic load (eload™) channel for discharge only at up to 5V/150A. The creative aspect of the design is that the 24 channels are all connected to the one eload™ channel through relay boards to allow discharging at more than 15A per channel (up to 150A). There are two main reasons behind this design. In automotive battery testing, a common practice is to perform a short-duration high current discharge test to

simulate for example, a cranking test. For this regimen, the inclusion of a single high-current discharge channel provides a cost-efficient, effective solution. The second intrinsic design factor is ease of operation. Even though there is only one high current discharge e-load™ channel, the operator can connect 24 batteries at once to the 24 regular charge/discharge channels for charging up to 15A and discharging up to 150A without needing to disconnect/connect the cables from one battery to the next. This facilitation translates to less manpower, thus more cost savings for the customer. The end product is also smaller in size.

The high-current discharge process happens one battery at a time in a sequencing fashion with software scheduling. The operator will set the termination conditions and the sequence of the channels to be discharged in the testing software—*Arbin MITS Pro*, start the test, and monitor the autonomously generated test results. While the discharging process for more than 15A can only happen one battery at a time, the



2 regular charge/discharge channels of max 5V, 15A. The channels can be connected to relay board (shown connected here) for discharging more than 15A through internal connection to the electronic load.

1 channel electronic load of 5V, 15A/150A

charging/discharging up to 15A process for the other 23 batteries may happen simultaneously due to channel independence. If there is no need for high current discharge, the operator may simply disconnect the cables to the relay boards and hence, the eload™ will be bypassed.

This case only represents one

specific system. Other specific configurations/requirements can be discussed with Arbin sales engineers. Needless to say, our design experience and expertise continue to expand with every customer order. After all, life is full of surprises and challenges that make us strive for the better! 🍏

Tech Support Updates - How to Report a Problem with an Arbin System

Arbin has been supplying testing equipment to various industries for over 10 years. As a result, we have several generations of hardware and software in the field.

In solving a customer problem in a timely fashion, it is very important to know exactly which hardware and software we are dealing with. Often customers have multiple machines (and therefore

multiple versions of software and hardware). These could even be in different physical locations.

We often receive emails or calls from customers who are not aware of the details we need to answer their questions. This requires us to reply asking for more information, thus slowing the resolution time of an otherwise simple problem.

To answer basic questions, we need at a minimum:

1. The serial number of the machine.
2. The version of ARBIN software (along with the build date if applicable).
3. The operating system and service pack of the PC.

These can be found in the following way.

Serial number – The serial number could appear on the Arbin chassis in two possible locations. Older machines typically have a black decal on the top front center of the chassis. Newer machines have a blue and silver decal located on the back on the chassis where the power cord enters the machine. A typical serial number is 6 digits and may appear as “SN 149276” or “SN 149276A” (letters are

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Arbin AC Impedance Measurement - What's the buzz?

A direct technique for studying electrode processes is to measure the change in the electrical impedance of an electrochemical device, such as a battery, supercapacitor or fuel cell, by an AC impedance method. A sine wave at current, I , at 1 kHz frequency is applied to cell. The potential response, V , measured from the device, can be used to determine the AC impedance Z , according to the following formula:

$$Z = |Z| \exp(i\theta) = |V| \exp(i\theta) / |I|$$

The AC impedance Z is a complex number. At this time, the result from the Arbin tester is $|Z|$. The phase difference, $(\phi - \theta)$, will be available in near future, as well as AC impedance at four other frequencies.

AC impedance is available as

an option for all Arbin testing systems except for PBT (primary battery discharge-only testing) and SAFOR (formation of lithium battery). It comes as an additional plug-in module board for a designated main I/V test channel to provide online AC impedance measurement. Each measurement takes 0.1 second and can achieve an accuracy of $\pm 5\%$ of the measured value. The first available module, *ACIM1*, provides 200mA excitation at a single frequency of 1kHz. Currently under development is Arbin *ACIM4* module applicable for high current, high voltage applications. *ACIM4* will be able to provide current excitation at 4 different frequencies — 2kHz, 1kHz, 500Hz, 200Hz — with a current range matching the main

charge-discharge circuit specification.

Specifications of Arbin ACIM1

- Control type embedded in test schedule
- On-line measurement when the battery is at REST state for < 0.1 second
- 1.0 kHz current excitation wave form
- Current amplitude can be specified from 2 mA (peak-to-peak)/ 0.707 mA (rms) to 200 mA (peak-to-peak)/ 70.7 mA (rms). Standard setting is at 200 mA (peak-to-peak)/ 70.7 mA (rms).
- Current offset $\leq 10 \mu\text{A}$
- Accuracy of $|Z|$, $\pm 5\%$ of $(|Z| + 1.0 \text{ m}\Omega)$
- Measurable resistance range: from 1 m Ω (min) ~

1 Ω (max) up to 1 Ω (min) ~ 1000 Ω (max). Standard setting is at 10 m Ω (min) ~ 10 Ω (max).

- Minimum measurable resistance \geq maximum measurable resistance/1000
- Measurement duration \leq 0.1 second per channel
- No phase shift data available in MITS Pro version 2.9 or earlier. 🍏



BT6000 - Makes Its Comeback!

Arbin's BT6000 is a derivative of Arbin's BT2000 multi-functional testing system, designed specifically for intermediate-scale production and testing of cells with various chemistries. The new BT6000 system consists of a BT2000 system (up to 4 channels) connected to one or more multi-cell modules. Each multi-cell module has 25 test channels and is connected to the main system through a serial cable.

The flexibility of this setup allows the operator to operate the system as a BT2000 as well as a BT6000 with the multi-cell board connected to the main system. The switch between the 2 types of systems is handled by changing the system configuration in

the software.

Compared to BT2000, BT6000 provides only three rudimentary control modes; *Current* for charging and discharging, *Wait* for temporary cell suspension while other cells are charging and *Rest* for open circuit voltage measurement. A test schedule may combine any of these control modes and is applied over all cell positions on the multi-cell module. Two voltage clamps — high and low — are also included to control the cell voltage at constant values. The main channel of BT6000 is equipped with independent I/V control and measurement, while each of the test channel on the multi-cell module has only a voltage sensor. 🍏



A BT6000 system with 25 cells setup. The configuration of the one-channel system on the left is such that it can be used alone as a regular 1-channel BT2000 system of 55V, 50A/20A/2A or be connected to the multi-cell tray to test 25 cells at once at specific voltage and current (not to exceed max specifications).



BT6000 multi-cell module of 25 test cells.



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added to signify multiple chassis under the same serial number).

Software Version – This can be determined from any Arbin software screen by going to <Help><About>. Examples could be “MITS Pro version 2.8” or “ABTS 4.0 build date September 9, 1997”.

Operating System and Service Pack – Most systems use WINNT, WIN2000, or WIN XP. The information on any of these systems can be found by going to “Control Panel”

and then going to <Help><About Windows...>. An example would be “Windows 2000 version 5.0 (Build 2195 Service Pack 2).”

Some problems involve specific questions about a certain tests behavior. On these questions we also need:

1. The schedule used to run the test
2. A complete result file generated by that schedule. The raw result file is best.

In different versions of software other files may be required for a detailed analysis of a problem. Most questions can be quickly answered with the information listed above.

There are 3 ways to contact Tech Support; by phone, email or web. Customer may call in during normal business hours from 8 AM to 5 PM central standard time, send email to support@arbin.com or go to www.arbin.com to fill out an online support request. 🍏

Arbin Factory Training 2002

May 6-7 & 20-21
Jun 3-4 & 17-18
Jul 8-9 & 22-23
Aug 5-6 & 19-20
Sep 9-10 & 23-24
Oct 7-8 & 21-22
Nov 4-5 & 18-19
Dec 2-3 & 16-17

Contact: Dale Hu
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See Us at These Events

ECS Centennial-201st Electrochem Meeting
Philadelphia, PA, May 12-17

40th Power Sources Conference
Cherry Hill, NJ, June 10-13

Int'l Meeting on Li Batteries
Monterey, CA, June 23-28

Hydrogen & Fuel Cell Systems
Fort Lauderdale, FL, Sept 9-12