



Newsletter

Battery Equalizer for Effective Charging of Cells in Series



Differences in cell chemistries and normal differences during the repeated charge-discharge cycle lead to non-uniformities in the charge level of individual cells that are connected in series in a battery pack or module. The battery strings could become severely imbalanced and eventually impact the life and performance of the battery pack.

To administer the charge process more effectively to the individual cells that are charged and discharged in series, Arbin offers an equalizer module for up to 5A, 10V capacity. The equalizer

enables the system to maintain cells at a pre-determined voltage, through circuitry in parallel with the battery pack. As each cell reaches the user-defined potential limit, supplemental components in the equalizer hardware open to create a pathway to divert current (up to 5A) partially around a cell charging at the optimum potential. Current will continue to flow through the series circuit as long as the current control step is operative. However, the equalizer will divert and dissipate current beyond what is required to maintain the voltage value that is selected.

The latest generation of Arbin's equalizer module provides manual voltage control setting with a plug and play module construction. Depending upon specific hardware limitations, the value may be established at $1.5V \leq V \leq 9.990V$ and is adjusted by depressing the buttons associated with the appropriate decade – 10^0 , 10^{-1} , 10^{-2} or 10^{-3} .

The equalizer requires no specialized software controls and integrates within the standard features of MITS Pro testing software for BT2000. ■

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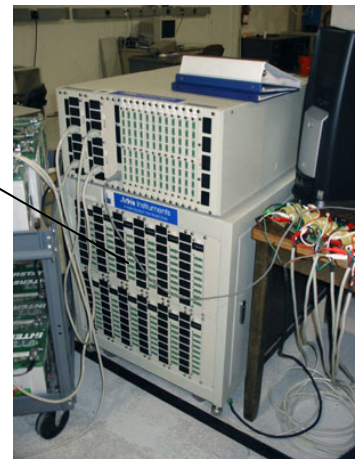
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4-channel BT2000, 5V/40V, 50A/5A/1A, 2kW max with 4 equalizer modules of 8-channel each for testing 10-cell lithium battery pack.



8-channel equalizer module



4-channel BT2000, 0V/55V, 5A/1A, 275W max with 12 equalizer modules of 8-channel each that are housed in a separate chassis from the main I/V channel. The main I/V testing system includes 96 auxiliary voltage inputs. The system will be used to test 24-cell silver-zinc battery pack.

Advanced PID Control with Auto-Tuning and Gain Scheduling for Improved FCTS Performance

An advanced PID-control with auto-tuning and gain scheduling has been developed and implemented on Arbin's fuel cell testing system, the FCTS, to significantly improve the perform-

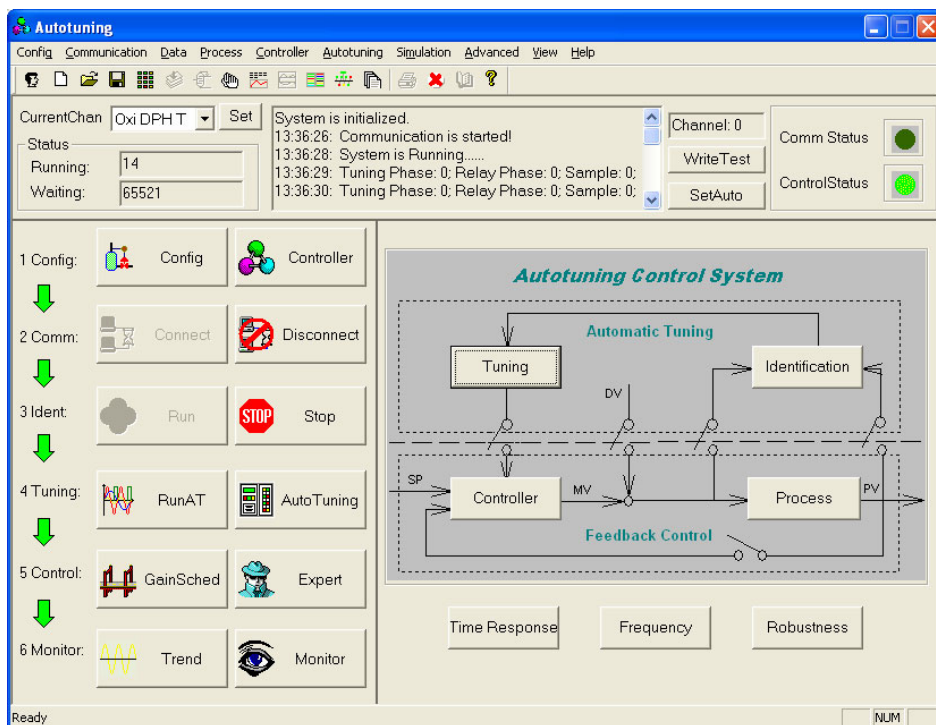
ance of temperature and humidity control.

PID auto-tuning is a method of combining real-time process dynamics identification with PID controller tuning.

The auto-tuning method allows the controller to be tuned automatically on the operator's demand. Typically, a general auto-tuning procedure consists of five steps: 1) evaluate system per-

formance and determine when to start auto-tuning; 2) set up the process model; 3) generate a process disturbance response and identify process model parameters; 4) calculate PID controller parameters; 5) tuning controller parameters and close the control loop.

Gain scheduling is a technique that deals with nonlinear processes, processes with time variations, or situations where the requirements on the control change with the operating conditions. Gain scheduling is a very effective way to control a system with dynamics that change under different operating conditions. Development of a schedule may take a substantial engineering effort because it requires setting up a scheduling table. When combined with auto-tuning, gain scheduling is very powerful and easy to use control technique. ■



An interface panel in MITS Pro software for fuel cell testing to configure auto-tuning PID control

One-kW PEM/DMFC Test System

A system that can test either PEMFC or DMFC is currently in final production stage. This system includes one channel electronic load of 200A/10A/0.5A, 0V/10V, and maximum 1kW power. For the reactant gas handling, it is equipped with two gas-handling lines of 10slpm and 25slpm maximum flow rate with humidifier units each for anode and cathode line. For DMFC testing, the system comes with up to 30cm methanol handling line. All flow rates are controlled by

PC and are programmable. The system also includes stack cooling module for fuel cell stack cooling requirement.

Water pump, heating pipe, and all necessary hardware are included for handling the reactants. Hydrogen leakage detection and inert gas purge line are also included for safety measures. A built-in compartment in the middle of the system is designed for the convenience of handling the fuel cell during testing. ■



Front view



Back view

Malaysian Tech Support

John S. Thayaparan from Intran Technologies Private Limited Malaysia has recently completed a month long extensive technical support training at Arbin Instruments in College Station, TX. John has a background in electrical and electronic engineering, earning his degree from the University of Lincolnshire in England. He currently works as a service engineer for Intran.

Intran Technologies is one of Arbin's worldwide sales and service representatives based in Malaysia serving the Southeast Asia region. Intran



specializes in the supply and service of analytical and processing equipment covering academic institutions, R&D centers and selected manufacturing industries in bio-pharmaceutical, chemical and battery/fuel cell.

With customers all around the world, Arbin builds a network of worldwide representatives to provide customer with localized, fast, and up-to-date technical support services, as well as sales support. Currently, Arbin has representatives in eleven countries outside of the USA.

To contact Arbin's Malaysian representative, please email intran@pd.jaring.my or check the company's website at www.intran-mrkt.com for more information. ■

From left to right: Antony Parulian (sales manager), Kevin Duff (assistant manager of customer service), and John Thayaparan (Arbin's Malaysian tech support).

Battery Tester with T-Chamber Controller

A 32-channel charge-discharge battery tester which can communicate and control up to four external third-party temperature chambers is ready to be shipped to a US customer doing material research and testing. The system is configured at 10A/0.1A/0.001A current ranges, -2V to 10V voltage ranges, and 100W maximum power. It also comes with 32 channels of optional auxiliary thermocouple inputs for temperature-controlled testing.

The system is customized to work with Espec® temperature chambers through RS232 cable. System operator can operate the chambers using Arbin's MITS Pro testing software, including running/stopping the chamber operation and setting/reading/recording the chamber's operating temperatures. ■



32-channel battery cycler with 4 temperature chamber auxiliary inputs providing connection to external temperature chambers.

Tech Support Update: Handling Large Data Files

The nature of some battery tests is that they generate large data files. Large data files in and of themselves are not problems. However, they can cause a unique set of issues to develop depending on the way they are manipulated. The MITS testing software has the ability to acquire large amounts of data. Managing the size of data files to begin with can help in dealing with them and preventing problems that can be caused by them.

Some techniques to control the size of a data file are:

1. Limiting the number of

- channels under a test name
2. Using appropriate log limits
3. Splitting results between test names

The first issue is the number of channels acquiring data under a test name. Any number of available channels may be assigned to a given test name. This test name then generates a database result file (*Testname.res*). If the test name in question is assigned multiple channels, the result file will be the combined cumulative data of each channel. Limiting the number of channels assigned to a given test name can help limit the

size of the result file.

The second issue is the amount of data logged during the running of a test schedule. By selecting an appropriate combination of DV_Time, DV_Current, and DV_Voltage limits, relevant data can be logged without excessive recording of data.

MITS software allows you to "start" a test from the last point of another test. This makes it possible to split long-term tests into sections that can later be regrouped into one continuous stream of data.

Ultimately, the customer selects the amount of data to be recorded. Long-term tests that require large amounts of data to be recorded may be unavoidable. However, it may be possible to utilize functions within the software to better manage these aspects of a file after they exist. For example, utilizing the import function in the software suitably will help reduce problems related to the handling of large amounts of data during data treatment and manipulation. This import function will be discussed in more detail in future issue of this newsletter. ■



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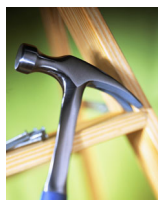
A Total Solution the World Over

Fast Forward 2004—Year Review

Another successful year is closing at Arbin. Growth is noted in sales revenue, number of systems shipped, and number of employees this year. As of October 31, 2004, Arbin's 2004 sales revenue has increased by 40% compared to 2003 sales revenue for the same period. The number of systems that are shipped this year increases by 18%, and the number of employees has almost doubled for the same comparison period.

The fast growth can be credited to the addition of the fuel cell testing division within the company. Started in around 2001, the division has been growing solidly, contributing about 30% of product sales revenue this year. The battery division, which includes everything outside

of fuel cell testing, keeps a steady but positive growth, and is still the main operation and revenue of the company.



Continued growth has initiated a facility expansion project at our current location in

College Station, TX, which has been occupied since the beginning of 2002. A building project is undergoing that will triple the size of the current facility; increasing both the office and production areas. The project is expected to finish by end of 2005.

We look forward to next year's continued growth. Happy New Year 2005 from Arbin! ■



Arbin Exhibition

Mar 14-17, Ft. Lauderdale, Florida
International Battery Seminar & Exhibition
www.powersources.net

Other 2005 Exhibitions—
to be announced

2005 2-Day Factory Training Schedule

- Jan 10-11 or 24-25
- Feb 7-8 or 21-22
- Mar 7-8 or 21-22
- Apr 4-5 or 18-19
- May 2-3 or 16-17
- Jun 6-7 or 20-21
- Jul 11-12 or 25-26
- Aug 8-9 or 22-23
- Sep 12-13 or 26-27
- Oct 10-11 or 24-25
- Nov 7-8 or 21-22
- Dec 5-6 or 19-20

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