

AC and DC cell analysis techniques; Simultaneous multi-channel measurements

Demonstration Expt: DG07

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Introduction

The new Solartron CellTest® system, comprising of multiple 145x series frequency response analyzers (FRAs) and 1470E multi-channel potentiostats, provides the most advanced multi-channel battery, fuel cell and supercapacitor test system in use today. With the provision for connecting up to eight 145x series FRAs per 1470E eight channel potentiostat, scientists and engineers now have the capability to measure AC and DC characteristics of multiple cells in parallel.

The system allows the same, or even completely different, tests to be run simultaneously on each channel. This allows battery or fuel cell engineers to test cells of similar construction under different sets of experimental conditions. Alternatively, the same experiment may be run on multiple cells, which is particularly useful for batch testing and quality assurance applications. With the ability to run multiple different test schedules simultaneously, the Solartron CellTest system will greatly accelerate the development of new energy storage devices and materials.

This guide demonstrates the use of simultaneous AC and DC measurements on two channels of the CellTest System and the same principles described below can be used to test up to a maximum of eight cells per 1470E multi-potentiostat unit. Additional 1470E / 145x units may be added as required to the system.

Equipment

Solartron 1470E multi-channel potentiostat, 2 X 1455 FRA cards, battery demonstration test box

Connections

- Connect the coloured cell connection cables from 1470E channel 1 to the corresponding coloured connections on a battery test box.
- Repeat the above connections for channel 2 using another battery test box
- Connect channels 1 and 2 FRA connections on the 1470E to two 145x series FRAs (main channel connections).

Software Setup

This demonstration makes use of an experiment schedule that was configured in demonstration guide DG02 (refer to the individual demonstration guides for more details). Use the experiment editor to select the DG02 schedule to run on channels 1 and 2 (if FRAs are not available use the ohmic drop test which does not require impedance analysis facilities).

Channel	Experiment	Comment
1	DG02 state of charge test	select the state of charge experiment to run on the battery connected to 1470E channel 1 (requires a 145x series FRA to be connected)
2	DG02 state of charge test	select the state of charge experiment to run on the battery connected to 1470E channel 2 (requires a 145x series FRA to be connected)
		additional channels may be configured if required

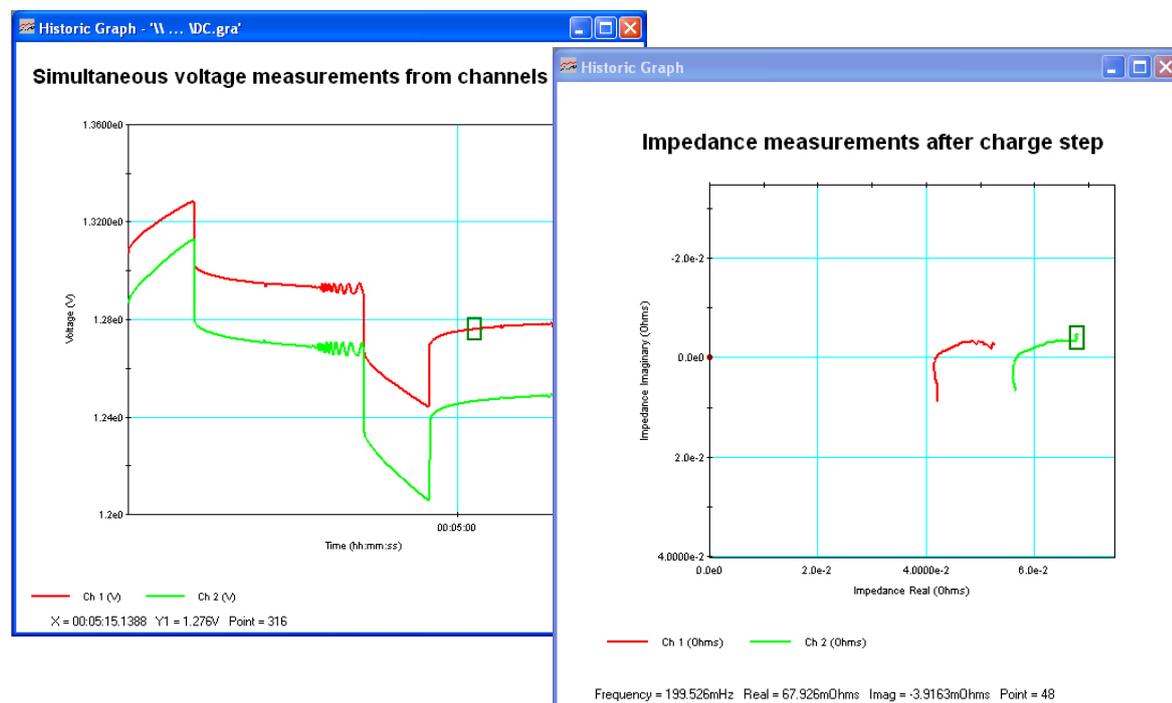
Notes on Setup

This experiment applies the same test sequence simultaneously to two test cells. The results from the channels are shown below overlaid on the same graphs allowing immediate comparisons to be made between the performance of different electrode materials etc. This test can easily be expanded to be run on eight channels, or even more depending on how many 1470E units and FRAs are available for the test.

Alternatively, different test schedules may be allocated to each channel by modifying the experiment setup, showing the flexibility of the system. In this case, when the experiment is run, the different schedules are run on each channel as configured. In this configuration, the channels are released for further experiments when the last channel in the experiment completes its test.

To free channels earlier, as soon as they finish, separate experiments may be configured each controlling just one channel (test cell). Up to sixteen experiments can run at the same time using CellTest software.

Results



The DC and impedance results from channels one and two are shown in the figures above.

Conclusions

The capability to run independent, simultaneous multichannel experiments greatly increases productivity while reducing development time and costs compared to single channel or even multiplexed test systems where instrumentation is shared amongst the number of cells that need to be tested. The CellTest system was designed to be a very cost effective system which (though it initially may cost slightly more than a single channel test system), over a very short period of time easily recovers the initial cost by providing much higher throughput of tests leading to quicker introduction of new products to the market and greater profitability.

The unrivalled capabilities of the Solartron CellTest System allows up to eight fully independent DC and AC measurements to be performed simultaneously on different cells per 1470E unit. Multiple 1470E units with additional FRAs may be added to the system as and when required giving virtually no limit to the amount of cells that can be tested in parallel. This will prove to be an invaluable tool in the rapid screening and development of a wide range of devices.