Technical Bulletin

*analytical measurement solutions*

# Parallel channel combinations: A method of Increasing the DC current capability of the CellTest system without the addition of power boosters

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TB/ANALYTICAL/003

## Introduction

Each channel of the Solartron CellTest® System is capable of running charge / discharge / impedance tests on cells at up to 4Amps, which allows the characterization of a range of small power devices. However, there may be circumstances in which the scientist would like to use higher current but cannot justify purchasing additional power boosters. The unique floating capability of the CellTest System provides the user with the facility to connect channels in parallel allowing tests at up to 32Amps DC without the need for additional power boosters.

## Experimental Method

### DC Measurements

Individual channels can be connected to the test device in parallel; up to a maximum of eight channels per 1470E unit. Since each channel is rated to 4Amps, when all channels are used in parallel, the system is capable of charging or discharging the cell at up to 32Amps. Using CellTest software, individual channels are programmed in the experimental editor to charge or discharge up to their maximum load rating. In the example shown in figure 1, four channels were each programmed to discharge the cell at 4Amps giving a total DC discharge current of 16Amps (current per channel * number of channels).
It is important to stress that this can only be achieved if the equipment has the ability to float, otherwise stray currents can lead to erroneous data and in the extreme could damage the potentiostat. All channels on the 1470E have this feature as standard. It is recommended that one channel remains grounded (default setting) and the remaining channels set to "float". This is programmed in the CellTest software by selecting 'Select Schedule' in the experiment editor. Click on the 'Other Settings' tab in the Channel Settings window. Select 'External' for those channels that are required to float and 'Internal' for the single grounded channel.

### Impedance Testing at High Current

The floating capability of each channel allows the user to measure the impedance of a cell using one channel of the CellTest System while using other channels are connected in parallel to control the DC current. This is shown schematically in figure 2. In this example, channels 1 to 4 controlled the DC output from the test device whilst channel 8 of the 1470E was used to run the impedance test by connecting it to a 1455 frequency response analyzer (FRA).

This configuration has two key experimental benefits;

- Only the AC component flows into channel 8 which permits high current impedance spectroscopy (DC current > 4A)
- The bandwidth of measurement is not limited by high DC current flowing into the channel that performs the AC measurement; measurements up to 1MHz are therefore possible.

Once again it is important to stress that the channel measuring the impedance must be set to float. Using this approach it is possible to control the DC current up to a maximum of 28Amps per 1470E unit (7 Channels DC, 1 Channel AC) without the need for additional power boosters.

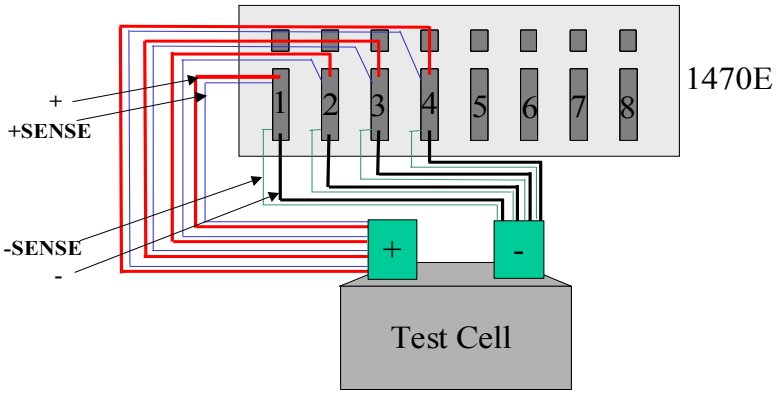



Figure 1: Connecting four channels of the 1470E CellTest System in parallel to a cell for high current tests.

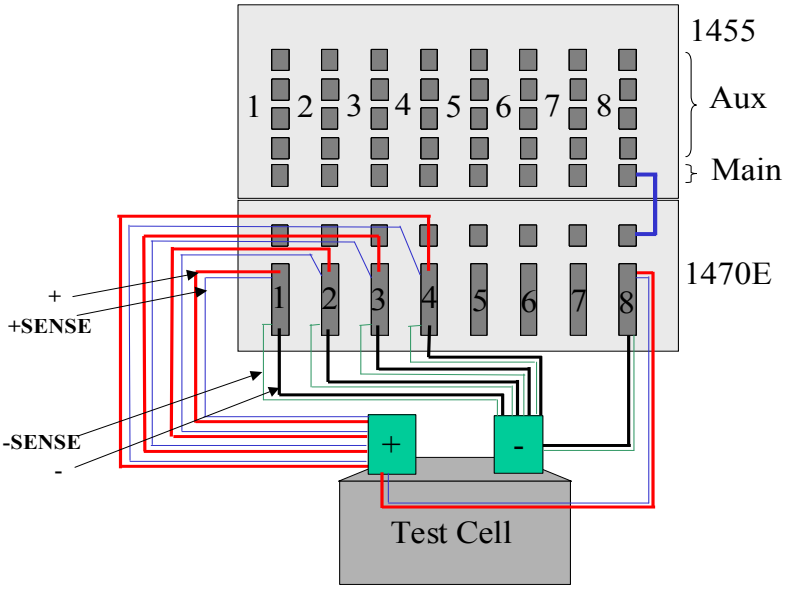



Figure 2: Impedance measurements at high current and high frequency can be performed by using a 1470E in conjunction with a 1455 or 1451 FRA. Measurements are performed in parallel with all but one DC channel and the impedance measurement channel floating. Note: four terminal measurements are essential for best results (as shown on the diagram).

Summary:
The unique features of the Solartron CellTest System including the ability to float and high current capability per channel offers a truly versatile DC and Impedance measurement system which is equally adept at low current measurements on a fuel cell operating at open circuit or under high load up to a maximum of 32 Amps (DC only) or 28 Amps for impedance analysis. No other multi-channel unit available on the market can offer this degree of flexibility to the scientist or engineer.

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Aug 2005