CROPICO SC2 Standard Cell



The Weston cell was first devised in 1893 and accepted as primary voltage standard since 1911. Still today it is in semi-clandestine use to check solid state voltage references. Due to environmental restrictions for its major components, mercury and cadmium, its use is very limited and often it is kept hidden. Unfortunately, even the documentation and the same datasheets have been removed from the Web, probably fearing mercury contamination from the screen out on the keyboard!

This model, including two Weston cells, was intended as voltage primary reference. Cropico stays for Croydon Precision Instruments. The Weston cells used inside were manufactured by Muirhead.

Some notes on the Weston cell

Weston reference cells are very high precision batteries, built until today with the same care and the same chemical elements and compounds as in 1892, when the first cell was built by Edward Weston: platinum, mercury, mercury sulfate solution, cadmium sulfate saturated solution, 12,5% cadmium and mercury amalgam, platinum. The Weston cell was an improvement of the Latimer-Clark one, which was in use since 1893 as an absolute reference cell, giving an output voltage of 1,4328 V at 15° C. The Weston standard cell gave an output voltage of 1,01830 V at 20° C and granted the lowest temperature coefficient.

People today, if asked for a precision voltage reference, can imagine a complex measuring system, with a lot of microcontrollers and of computers, all exchanging terabyte of data to do nothing else that generating a simple voltage. People of yesterday, having no computers but their brains, had to rely upon simple, yet dependable, solutions. For almost a century, since the Berlin Conference in 1905, when the Weston cell was accepted as the absolute voltage standard, it has been the voltage primary standard, against which to compare all other voltage sources. Either putting it inside a simple temperature controlled oven, or computing the voltage

deviation at any given temperature, its output voltage was the true voltage reference. And in the past even the measure of any voltage source against this reference was very, very simple and accurate, based upon balancing a voltage derived through a potentiometer from the unknown, against the cell itself. To measure any voltage with unsurpassed precision you just needed the Weston cell, any suitable Kelvin-Varley potentiometric voltage divider and a sensitive galvanometer, to read the balance condition, or the zero current condition. Such measuring technique, based upon the current nulling, was simple, yet independent of the cell internal resistance: when the current falls to zero, there is no voltage drop at all, regardless of the internal resistance of the source.

At any temperature, other than 20°C, the output voltage of the Weston standard cell could be computed according to the formula:

$$V(t) = 1{,}01830 - 0{,}0000406*(t - 20) - 0{,}00000095*(t - 20)^2 + 0{,}00000001*(t - 20)^3$$

where t is the actual room temperature.

Source: NBS Monograph 84 on Standard Cells