A commercially available version of the potential clamp system of Nonner (distributed by Medica GmbH, Saarbrücken, West-Germany) enables the measuring of membrane potential changes $V$, relative to the resting potential $E$, (Nonner 1969). If $E$ is used for absolute membrane potentials, $V = E - E_r$, (Dodge and Frankenhaeuser 1959).

The resting potential $E_r$ may be measured by destroying the membrane electrically at the end of the experiment (Stampfli 1974). A more frequently used
method, however, is to define arbitrarily $E_r = -70$ mV for a sodium inactivation, $h_o$, of 0.7 to 0.8 (e. g., Kniffki et al. 1981; Hu et al. 1983; Schmidtmayer et al. 1983).

Fig. 1 shows a simplified diagram of a potential clamp system for single Ranvier nodes (Nonner 1969). The adjustable batteries $U_A$ and $U_E$ enable a change from the potential clamp to the current clamp configuration. In the commercially available version, the potential measuring instrument $U$ measures membrane potential changes, $V$, only (dotted line). For graded changes of the holding potential $E_h$, e. g. for investigations of the slow sodium inactivation (Neumcke et al. 1976; Fox 1976), scaling of $U_A$ is necessary, the reference potential $E_r$ still remaining arbitrarily fixed. However, if the device $U$ is connected as shown, (bold line), the absolute potential in pool A can be measured. Assuming the potential drop across the nodal series resistance to be negligible (the potential drop being proportional to the membrane current), the potential in pool A equals the absolute membrane potential $E$ (Salzberg and Bezanilla 1983; Wiese et al. 1984; Zaciu et al. 1981).

Experiments revealed that the potential in pool A can easily be controlled by an appropriate LED voltmeter connected as shown.

References


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