Phase selective corrosion of nickel-aluminium-bronze (NAB, alloy CuAl10Fe5Ni5-C according to EN 1982) was identified on Kaplan type turbine runners in a hydroelectric power plant just a few months after first contact with water. This type of corrosion was unexpected in this particular fresh water being low in chloride (4 mg/L) and with a moderate sulphate concentration (33 mg/L) at medium bicarbonate concentration (150 mg/L). The primary cause for the attack was found in anodic polarization of the bronze by galvanic coupling to ennobled stainless steel [1, 2].

The attempt to assess this specific phenomenon by potentiodynamic measurements in the laboratory failed. The attack could not be reproduced, and the resulting voltammograms suffered low reproducibility, although even very low scan rates were applied. Consequently, potentiostatic experiments were considered: The alloy should be tested at various potentials in an electrolyte simulating different chemical compositions of freshwater.

To facilitate these experiments in a time and cost saving way, a potentiostat was designed which allows polarization of 8 specimens in a common electrolyte to different equally spaced potentials. This device (Octopoti) is coupled to an Agilent 34972A data acquisition unit, which records the individual currents of the 8 specimens and also generates the signals controlling the base potential and the potential spacing. The capability of this unit to record data on regular USB-memory media supersedes the need of a computer dedicated to this experiment.

This paper presents the circuit of Octopoti, the experimental setup, and the results of testing CuAl10Fe5Ni5 at potentials between +45 and +150 mV\textsubscript{SCE} spaced by 15 mV in various electrolytes over several days. Bicarbonate, sulphate, and chloride (as sodium salts) at low concentrations (0-1 mmol/L) and combinations thereof were used. The results indicate the corrosion activating properties of chloride and sulphate promoting general corrosion. Bicarbonate exhibits an inhibiting effect. The combination of bicarbonate and chloride or sulphate leads to localized attack above a critical potential.

Octopoti turned out to be a useful tool in systematic potentiostatic corrosion experiments, when a number of tests must be done in a range of potentials. At relatively low cost, the setup saves valuable operator’s time.