An electrical impedance spectroscopy (EIS) method for measuring changes in the electrical properties of synthetic membranes is investigated as a possible way of monitoring, in situ, the separation performance of these membranes including membrane fouling. Unlike other EIS methods, which require traditional electrodes in the feed and permeate solutions, alternating current is injected directly into the membrane via external electrical contacts with the edges of the membrane. A metal layer sputtered onto the surface of the membrane can be used to enhance its conduction properties. The impedance models of these systems is shown to be sensitive to membrane surface properties, including porosity, as well as electrical properties of solutions and the interfacial regions between the membrane surfaces and the solutions. The investigation indicates that fouling along the surface of the membrane might be more readily detectable than inside the pores.