Use of one Reference System with multiple ISEs

1. Theory

ISE measurements (including pH measurements) need 2 electrodes to form a closed electric circuit: the indicator electrode and the reference electrode (in case of pH: the reference electrode is integrated into the pH electrode and is called reference system).

Indicator electrodes are based on membrane technology and have an electrical resistance in the range of 10 to 1000 Meg Ohms.

Reference electrodes are based on "Liquid Junction" technology and have an electrical resistance of some kilo Ohms. Reference electrodes therefore connect the "Signal Ground" of the measuring amplifier / instrument quite solidly to the sample solution.

Because of the huge difference in the electrical resistance (factor 1,000 to 100,000) the electrical potential of the reference electrode is practically not influenced by the indicator electrode and therefore the reference electrode can be shared by multiple indicator electrodes.

2. Electrical Connections

The built-in reference system of the pH electrode is connected to the shield of the co-axial cable and the metal ring of the BNC connector.

Our multi-channel analysers have all metal rings of the BNC connectors and the 2 mm- connectors (for external reference electrodes) connected to the Signal ground of the electrode amplifiers. Therefore the various channels can share the same reference electrode without making special connections; simply connect each electrode, combination electrode (pH), or dual electrode head to the BNC connector of its channel.

3. General Rule

When measuring with multiple electrodes in one vessel or vessels where the sample solutions are electrically well connected, use one reference system (e.g. of a pH electrode) or reference electrode.

When measuring in independent vessels, where the sample solutions are electrically not connected, use one reference system/reference electrode for each vessel.

4. Practice

Many of our customers follow these instructions and did not experience any negative effects.

However, when measuring with multiple electrodes in one vessel, please be aware that:

a) Different ISEs require different ranges of pH and only ISEs with overlapping pH ranges can be combined.

b) The liquid junction of reference systems leaks out small quantities of the filling solution or outer filling solution (in case of dual junction reference systems). Make sure that the filling solution or outer filling solution does not interfere with any of the ISEs used, or when there is some interference the leaking is very small in relation to the concentration of the ion to be determined.

c) The use of ISABs may also be restricted.