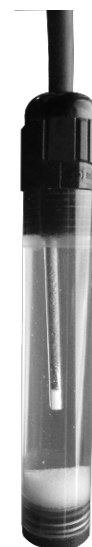


Paleo Terra field reference electrode datasheet

Introduction

The purpose of a reference electrode is to provide a stable chemical potential, a baseline potential, for electrochemical measurements. pH electrodes, ion-selective electrodes and redox probes all need a reference potential in order to make measurements. The Paleo Terra field reference electrode uses the very common silver (Ag) - silverchloride (AgCl) - potassiumchloride (KCl) chemistry. However, both the junction to the environment and the KCl concentration are adapted for a longer service life in the field. The use of saturated KCl helps to maintain a stable reference potential under less controlled (field) conditions. The threading of a nylon cap serves as junction to the environment. Although designed for a longer service life, the Paleo Terra field reference electrode does need regular inspection and/or maintenance. For maximum service life in the field **without regular service visits, a standard laboratory reference electrode may be a better choice, depending on field circumstances.**



The information in this datasheet is kept concise. Visit paleoterra.nl/reference_electrode.html for more information and more detailed field installation and maintenance procedures.

Electrode potentials

Potentials at different temperatures in mV versus the standard hydrogen electrode for both the regular and antifreeze field electrode versions.

T °C	regular	with glycerol
0		224
5	222	220
10	213	216
15	209	211
20	204	206
25	199	201
30	194	196
35	189	191
40	184	186

Electrode materials

- **polyurethane** outdoor coax cable, Tasker RG58 PUR
- **nylon** cable gland with **chloroprene rubber** sealing ring, **teflon** tape and **viton** O-ring
- **glass** reference element containing pure **silver** wire covered with **silverchloride** in saturated **potassiumchloride** solution
- **acrylic** (PMMA) electrode body
- **saturated potassiumchloride** solution with excess solid potassiumchloride (optionally with **glycerol** as antifreeze)
- **nylon** threaded cap as junction to groundwater and/or soil
- **epoxy** to seal cable to silver wire connection and to exclude air bubbles from cable gland and threaded cap

Field installation

- One reference electrode can serve multiple redox probes, as long as an electrically conductive path exists between redox probes and the reference electrode. Moist and wet soil conduct well, as most natural waters. Dryer soil may not conduct enough; plastic liners or containers separating experiments do not conduct.
- Preferably install in clear water, e.g. into the groundwater via a dipwell or directly into a surface water.
- Do not install in wet clay or a clay suspension: a large error (junction potential) may arise due to the suspension effect.
- If installed in a place that may dry out periodically, check the electrode very regularly.
- Remove protective film around bottom cap before installing.
- Install at a depth where temperatures don't drop below -5°C (-20°C for version with antifreeze)

Regular checks

- Reference electrodes installed in a place that may dry out periodically should be checked very regularly, e.g. every week. At other places monthly checks to perhaps once every three months are recommended. If installed into permanent groundwater or a surface water and with plenty excess KCl present checking twice a year may be appropriate. 1 gram KCl lasts for 3-6 months.
- Clean the electrode with a piece of cloth to remove dirt, build-up of micro-organisms, etc.
- The filling solution should be a clear and colourless liquid.
- Excess KCl, a white solid, should be present in the filling solution.
- Check for the absence of air bubbles. One or two small bubbles are acceptable.
- The threading of the bottom cap should be clean to allow the exchange of ions between the internal solution and the outer environment.
- Check the cable for any damage.

Maintenance

Common maintenance includes refilling of the internal KCl solution, replenishing the solid KCl and cleaning the threading of the bottom cap. Refilling is necessary if the internal KCl solution may be polluted. Although not always visible, this often shows as coloration of the solution and/or the presence of another solid than white KCl. The excess solid KCl must be replenished before all excess KCl has dissolved. The internal KCl solution must be replenished if more than a small air bubble is present inside the reference electrode.

Proceed as follows to replenish or refill the KCl solution and/or add solid KCl:

- carefully clean the outside area around the threaded bottom cap
- hold the reference electrode upside down, so cable end down
- unscrew the bottom cap using a $\frac{5}{16}$ " slotted screwdriver; be careful not to scratch the bottom end of the acrylic electrode body or the counterpart at the bottom cap; do not open at the cable end
- if the KCl solution is polluted, dispose of the solution and rinse with fresh KCl solution
- if solid KCl must be replenished: fill with saturated KCl solution until the internal reference element is fully submerged then add solid KCl; 1 gram lasts 3-6 months
- top up with saturated KCl solution until a convex meniscus exists
- place the bottom cap into the meniscus and screw the cap into place; some KCl solution will overflow; fasten tight, but not overly tight