

STX3

! **CAUTION:** The electrode cannot be sterilized by autoclaving.

A typical sterilization protocol

In a laminar flow hood:

1. Immerse the electrodes in Cidex Plus (WPI #7364) for 15 minutes. Allow them to air dry for 15 seconds.

! **CAUTION:** NEVER leave the electrode in alcohol for more than 30 minutes at a time. Continuously soaking the electrode in alcohol will weaken the protective coating on the electrode and shorten its life.

2. Rinse the electrode in a sterile electrolyte solution similar to the experimental cell culture medium or in 0.1–0.15M KCl or NaCl solution.
3. The electrode is now ready to for *resistance* measurements.
4. For *voltage* measurements, allow the electrode to equilibrate in the sterile electrolyte.

TIP: The electrode can be stored in a UV hood to keep it sterile.

NOTE: When the electrode is exposed to strong visible or UV light, a dark colored oxide film will slowly form on the electrode surface. This film normally will not affect the performance of the electrode. To avoid the formation of the film, shield the electrode from strong light.

STORAGE OF THE ELECTRODE

Short term storage (less than two weeks): Immerse the electrode tip in electrolyte solution. Ensure the electrode cable plug is connected to the electrode port on the EVOM² meter so that the system is internally short-circuited and electrode symmetry is maintained.

Long term storage (greater than two weeks): When storing for long periods of time, rinse the electrode with distilled water and stored dry and in the dark.

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Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.

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• Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.

• Goods returned for repair must be reasonably clean and free of hazardous materials.

• A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.

• Equipment which was built as a special order cannot be returned.

• Always refer to the RMA# when contacting WPI to obtain a status of your returned item.

• For any other issues regarding a claim or return, please contact the RMA department

Warning: This equipment is not designed or intended for use on humans.



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STX3 Electrode

for use with EVOM² Epithelial Voltohmmeter

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INSTRUCTION MANUAL

Serial No. _____



102711

World Precision Instruments



STX3 electrode can be used with the **EVOM²** and is designed to facilitate measurements of membrane voltage and resistance (TEER) of cultured epithelia directly in tissue culture wells. The electrode incorporates a fixed pair of probes, 4mm wide and 1mm in thickness. Each probe has an outer (voltage) and an inner (current) electrode.

The adjustable feature of the probes ensures proper positioning between the electrodes and the cell layer in the cup during the trans membrane measurement. The electrode should be set-up so that one probe, designated as the external electrode, is longer and touches the bottom of the dish containing the external culture media while the shorter (internal electrode) is adjusted so that it is prevented from reaching the membrane or bottom of the tissue culture insert. In addition, by positioning the longer tip so that it touches the bottom of the dish each time, the reproducibility of positioning the electrode and therefore the reading on successive measurements, is significantly improved. Even small differences in the apparent fluid resistance may occur if the depth to which the electrode tips are immersed varies.

ELECTRODE SET-UP

Before using the electrode, the distance between the two electrodes should be adjusted so that when the longer electrode touches the bottom of the cell culture well, the shorter electrode should neither touch the membrane of the cell culture insert by its tip, nor let the silver/silver-chloride pellet be exposed to the air (see Fig. 1). To adjust the distance of the electrode, loosen the screws on the electrode probe as shown in Fig. 2, adjust to the desired distance and tighten before use. For most brands of cell culture inserts, a difference of 2.5 mm between the two electrodes will work best. However, some, such as the Transwell insert, may need a slightly longer distance.

For resistance measurements only, the **STX3** electrode can be used directly from dry storage without preconditioning.

For *voltage* measurements, the electrodes need to be equilibrated to eliminate any offset before use. To assure voltage stability and a low inter-electrode potential difference, turn the **Power** off (O) on the **EVOM²** and immerse the electrode in electrolyte solution (for example, 0.1 – 0.15M KCl) with the electrodes connected to the **EVOM²**. The **STX3** voltage electrode pairs are

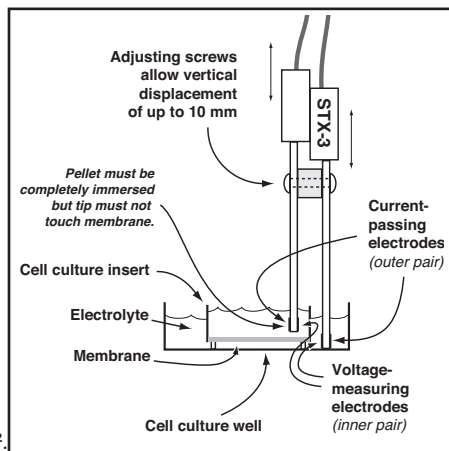


Fig. 2—STX3 placement

shorted together internally when they are connected to the instrument and the **Power** is off (O). With the voltage electrode connector pins thus short-circuited for several hours, the asymmetrical potential difference across the two voltage electrodes is reduced. The inter-electrode DC potential will be a few millivolts or less and quite stable. Table 1 (below) lists the recommended equilibration time before using the electrode.

Table 1: STX3 Electrode Equilibration Time

Electrode Condition	Equilibration Time
Stored dry	24 hours
Stored in solution	2 hours

INSTRUCTIONS FOR USE

1. Disconnect the **EVOM²** from the charger.
2. Connect the electrode to the meter by inserting the RJ plug at the end of the flexible electrode cable into the **Input** port on the meter.
3. Prepare the **STX3** electrode as described under “Electrode Set-up.”
4. Sterilize the electrodes, if desired. See “Sterilizing the STX3 Electrode” under “Instrument Maintenance.”
5. Place the electrode in the sample cup. The **STX3** electrode is designed to facilitate measurements of membrane voltage and resistance of cultured epithelia in tissue culture wells. The lengths of the electrodes are unequal allowing the longer (external) electrode to touch the bottom of the dish containing the external culture media while preventing the shorter (internal electrode) from reaching the bottom of the tissue culture cup or insert (see Fig. 2). This feature ensures proper positioning between the electrode and the cell layer in the cup during the trans-membrane measurement. In addition, by positioning the longer tip so that it touches the bottom of the dish each time, the reproducibility of the measurements is significantly improved. Place the electrode into the well so the tips just touch the bottom of the wells *without flexing* the electrode. See Fig. 3. *Variance of the angle (Fig. 4) or depth of immersion (Fig. 5) of the electrode will affect resistance measurements.*

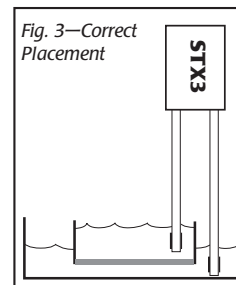


Fig. 3—Correct Placement

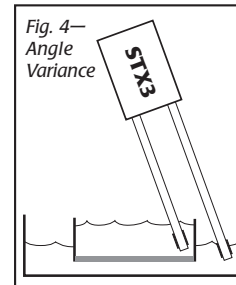


Fig. 4—Angle Variance

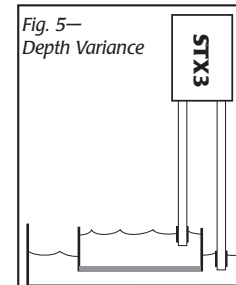


Fig. 5—Depth Variance

NOTE: To obtain reproducible results in the same cup, the position of the electrodes must remain constant. To improve the reproducibility and stability of the measurement, it is important to steady the electrode while measuring.



CAUTION: When moving the electrodes from one sample cup to another, it is best **not** to rinse the electrodes with distilled water. Silver/silver chloride electrodes may take several minutes to recover from exposure to distilled water, during which time the potential may drift by a few millivolts. If it is necessary to wash the electrodes between measurements to avoid carryover of one sample into the next, the electrodes should be rinsed with the experimental culture media.

6. Make the measurements.

INSTRUMENT MAINTENANCE

Resurfacing/Cleaning the STX3 Electrode

With use, the electrode surface can become coated with protein or other foreign materials. This build-up, or contamination, will degrade the performance of the system resulting in large voltage offsets (10-20mV) or unstable voltage readings. (Resistance readings will probably not be affected.)

To address these issues, re-chloridize or resurface the electrode:

- **RE-CHORLIDIZE** – To re-chloridize the electrode, soak the electrode in a solution of 5% sodium hypochlorite (undiluted household bleach) for three minutes. Rinse with water immediately after soaking. Although this chloridizes the electrode surface again, it may not correct the offset.



CAUTION: Ensure that only the electrode tip is exposed to sodium hypochlorite. Do not permit the solution to touch the upper part of the electrode.

- **RESURFACE** – To resurface the electrode, *lightly* sand the voltage electrode of the **STX3**, which is the silver pellet on the inner surface near the electrode tips. Use the 600-grade ultra fine sandpaper provided. (See Fig. 6, right.) Remove only a very thin surface layer of the pellet.

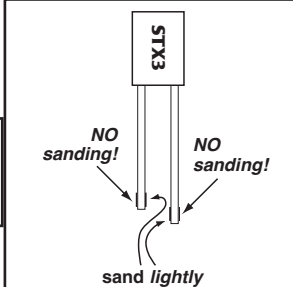


Fig. 6—Resurface STX3



CAUTION: Repeated sanding will eventually remove the Ag/AgCl pellets. When sanding no longer improves the voltage readings, the electrode needs to be replaced.

TIP: In the absence of 600-grade sandpaper, an ink eraser may be substituted to clean the electrodes.

Sterilizing the STX3 Electrode

The **STX3** electrodes are non-sterile as supplied. They may be sterilized using alcohol, ethylene oxide, UV, a bactericide like Cidex Plus (WPI #7364) or Sporicidin.