



Warranty

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

• Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment.

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.

• WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.

• 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.

* Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.



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INSTRUCTION MANUAL

Serial No. _____



Calibration Resistance: _____ Ω

Technician: _____

230114

The **CaliCell™** provides a quick and effective way to determine if WPI's **EVOM2** (or the Millipore Inc. version, the Millicell ERS) is functioning correctly when an unstable or unexpectedly low resistance reading of cell cultures is encountered. The **CaliCell** consists of a thin plastic membrane attached to either a 12 or 30mm diameter housing. The electrical current produced by the **EVOM2** passes through an array of small holes in the membrane. This produces resistance values similar to those obtained using a true biological tissue monolayer. The average **CaliCell** resistance reading should not drift over time as long as it is kept in good physical condition.

The **CaliCell** is used to test WPI's **EVOM2** (and the Millipore ERS) with the **STX-2** "chopstick electrodes" or any of WPI's **Endohm** sensors. Each **CaliCell** comes with a blank tissue insert that looks like the **CaliCell**, but without a membrane. It is used for background resistance readings and a calibration value showing the resistance value for that particular **CaliCell**. (The calibration value for your **CaliCell** is noted on the cover of this instruction sheet.)

NOTE: The **CALICELL-24** is made for the **ENDOHM-24** and the **CALICELL-12** is for use with the **ENDOHM-12** and **ENDOHM-6**.



CAUTION: Do not autoclave or soak in alcohol for more than an 30 minutes.

Using the CaliCell

The **CaliCell** lets you compare the difference between the actual, measured blank resistance and the resistance of your **CaliCell** when it was measured at the factory. (See front cover for this value.) If you like, you may also use the **CaliCell** to establish a baseline measurement in your growth media. Using the CaliCell to establish a baseline in growth media makes it easy to spot check the function of the TEER measurement system when acquiring TEER data from cell cultures.

1. To measure the membrane resistance of your **CaliCell**, mix a solution of 100mM concentration KCl.
2. Place the **CaliCell** into the **Endohm** (or cell culture dish, if you are using an **STX-2**, **STX-3** or Millicell ERS electrodes) and fill it with the KCl solution to approximately half the height of the **CaliCell**.
3. Fill the **EndOhm** with the same solution. Make sure the solution level is lower than the top of the **CaliCell** so that the electric current cannot flow over the top and bypass the **CaliCell** membrane. Also, check for bubbles touching the membrane, since they may increase the electrical resistance reading.

NOTE: Be sure the blank **CaliCell** well is flat and not "floating" off the bottom of the media test container or the results can be inaccurate or unstable.

4. Plug the electrode set of choice into the **EVOM2** (or Millipore ERS). Make sure the meter is set to "electrical resistance" mode and take a reading (check the **EVOM2** instruction manual for more details). The reading will indicate the "total" resistance (for example, 152Ω for a **CaliCell-24**).
5. Then, remove the **CaliCell** and take a second reading with the blank tissue insert. This is the "background" resistance of the "blank." The background resistance is the resistance cause by the electrode and the fluid (for example, 18Ω). The difference between these values (152-18 = 134Ω) is the **CaliCell** membrane resistance.

Membrane Resistance = Total Resistance – Background Resistance

See the "Discussion" section for information regarding how close the membrane resistance should be to the WPI calibrated value.

NOTE: When changing media in your **EndOhm** or cell culture well, you must rinse and dry the electrodes and pre-condition the electrode in the new solution for at least 10-15 minutes.

6. After determining the **CaliCell** membrane resistance and checking it against the factory calibration value, you may determine the baseline measurement with your **Calicell** in your growth media. To determine the baseline measurement in your growth media, complete steps 2–5 using your growth media in place of the KCl solution.
7. When finished, follow the instructions in the "Storage" section.

Discussion

The resistance reading of the **CaliCell** is determined by the conductivity of the fluid, the geometry and placement of the electrodes and type of container used. Electrolyte conductivity is primarily determined by the salt concentration, though it also varies slightly with temperature. When these parameters are adequately controlled and the holes in the **CaliCell** are kept free of debris, resistance readings produced should remain fairly constant.

Ideally, the reading should be independent of the electrode used. However, due to the proximity of the membrane to the bottom of the chamber and the limitation of some of the electrode designs, the actual reading can vary with different electrodes. Although this is usually insignificant for tissue culture studies, understanding how some electrodes under certain conditions might produce readings not equal to the absolute resistance might be important to some people. The following is a summary of our observations.

The **CALICELL-24** gives constant readings for different heights (this is the true resistance reading) as long as the top electrode is kept at least 5 to 6mm away from the synthetic membrane surface. The reading may increase if the top electrode is brought any closer. Due to different electrode geometry, older

models of the **ENDOHM-24** may give slightly different readings with the **CaliCell**, but for a particular **Endohm**, the readings will remain constant if the unit is functioning properly. The current model should give readings within 10% to 15% of the calibrated value.

The **STX-2** and **STX-3** "Chopstick" electrodes will produce approximately the same readings as the **Endohm** for the **CALICELL-12**. The **CALICELL-24** readings, however, will be about 20% to 40% higher. The reason for this variation is that the electric current through the membrane is concentrated on the side of the membrane that the electrode tips are on. Since the positions of the pairs of electrodes are not fixed, there will also be more variation in the readings (see the **STX-2** or **STX-3** manual for details).

The **CALICELL-12** will give the same readings in the **ENDOHM-6** and **ENDOHM-12** regardless of the height of the upper electrode, unless it is lowered to the point where it is actually touching the membrane. The final readings should be within 5% to 10% of the calibrated values. Since the current is uniform over the membrane surface, this will be a true resistance reading.

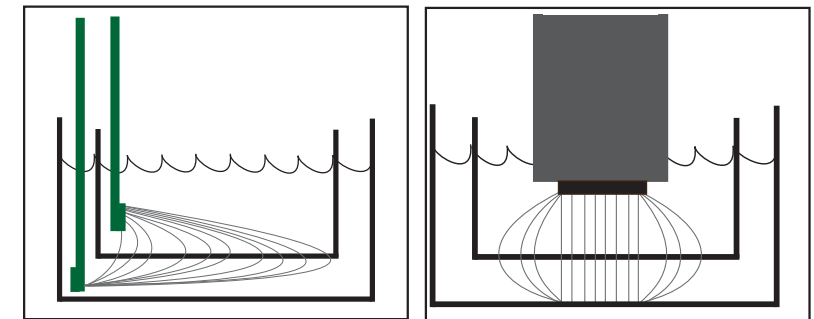


Fig. 1—The image on the left shows a STX electrode and the one on the right shows an Endohm. Notice that the STX electrodes measure from one side and the Endohm measurement is more distributed.

Sterilization

The **CaliCell** can be sterilized with alcohol, but do not soak for more than 30 minutes. **DO NOT AUTOCLAVE.**

Storage

Rinse with distilled water and store in a dry place at room temperature.

Care

The **CaliCell** reading should not have significant drift over time as long as it is kept clean and not exposed to high temperatures.