

Applied Biophysics ECIS™ Model 1600R (Research) & 1600

The ECIS 1600R is a general multipurpose research instrument having the capacity to monitor up to 16 individual tissue cultures.



The electronics are consolidated in a single case that sits beside a tissue culture incubator. Two leads connect the electronics to an electrode array holder within the incubator space – this, in turn, makes contact with up to two consumable arrays. A USB cable provides communication to a PC that controls all data acquisition, storage and analysis. In addition to the ECIS electronics and software, the system is supplied with a state-of-the-art PC/monitor, colour ink jet printer and an initial supply of electrode arrays. An optional compact CO₂ tissue culture is also available.

The ECIS software runs on a Windows™ platform with user-friendly software for all operations.

Specifications

Maximum number of wells: 16

Frequency range: continuous from 100Hz to 100kHz

Operating System: Windows XP

System Controller: Desktop or laptop PC

Front Panel Controls: Power on/off

Front Panel Indicators: Power, Measurement in Progress, Wounding/Electroporation Mode Activated (optional)

PC to 1600R communications: USB

Power: 120-240 VAC 50/60Hz

Dimensions: 17.25 x 8.5 x 20 inches (WxHxD)

Weight: 40 lbs

System includes: dual slot array holder, color matrix printer, laptop or desktop PC

Array Holder dimensions: 5.5x 1.5x 6.0 inches (WxHxD)

Array Holder material: Lexan® polycarbonate

Array holder to instrument cable length: 4.5 ft (a port in the incubator is desirable, 5/8 inch diameter minimum)

Comparison of the features of the ECIS 1600 and 1600R instruments

In a nutshell, the 1600R is our research grade instrument, i.e. it uses complex impedance to monitor the cells. Complex impedance can be broken down into resistance (how much of the electrode is covered) and capacitance (how much of the electrode is open). We use the portions of complex impedance in a mathematical model for barrier function and permeability assays (as do our ECIS users).

The model 1600 is a straight impedance measurement which works wonderfully for nice adherent cell lines, spreading, attachment, invasion, migration, wound healing, and many signal transduction assays.

The 1600R is a better choice for finicky cell lines that do not form tight monolayers, or aren't as adherent, e.g. cancer cell lines, astrocytes, etc... You can get a signal of even a single cell on the electrode with the 1600R, the 1600 cannot.

Lastly, with the 1600R you have an unlimited range of frequencies you can measure your cells with (allowing you to choose the optimal frequency to use with a specific cell line via frequency scan). The 1600 has 3 fixed frequencies that you can use, which are the averages for most cell lines.

Note that both versions of the instrument have the same 16 well culture capacity (two eight well arrays).

They both also can be equipped with an elevated field module for use in automated wound healing/cell-migration assays and for concurrent electroporation and cell monitoring.

There are differences in the electronic instrumentation for the two systems.

Simple versus complex impedance measurements:

Upon application of the weak current to the ECIS wells, the **ECIS1600R** instrument follows both the electrode voltage and the phase of that voltage relative to the applied current. With this information, the software determines the complex impedance and reports either the total impedance or its component resistance and capacitance (treating the system as a simple series RC circuit).

The measured electrode capacitance at high AC frequencies is a useful tool to report the fractional amount of the substrate covered with cells (Wegener et al, Exp. Cell Res. 2000) .

The complex impedance measured at different frequencies can also be analyzed and allows one to refine the source of the impedance. The analysis is based on a published model (Giaever and Keese, PNAS 1991) and reports for confluent cell layers:

- the barrier function of the layer (the impedance associated with current flow in the paracellular space between the cells)
- a term related to the impedance associated with the current fold in the constricted spaces between the cell's basal membrane and the substrate
- and the averaged cell membrane capacitance

The **ECIS 1600** instrument follows the total impedance but does not gather phase information, and hence, the impedance is not further broken down. For many assays, this impedance data is sufficient, and the need for the 1600R's phase measurement and modeling software is obviated.

Looking to the measuring AC frequency:

The **ECIS 1600R** is said to lock to the AC frequency chosen for the measurement. This essentially electronically tunes out all other frequencies making for an extremely noise-free measurement. Whereas this enhanced sensitivity is not needed for most ECIS measurements, it does permit unambiguous measurements of single cell movements upon the measuring electrode.