C-Pace EP Culture Stimulator for Chronic Pacing

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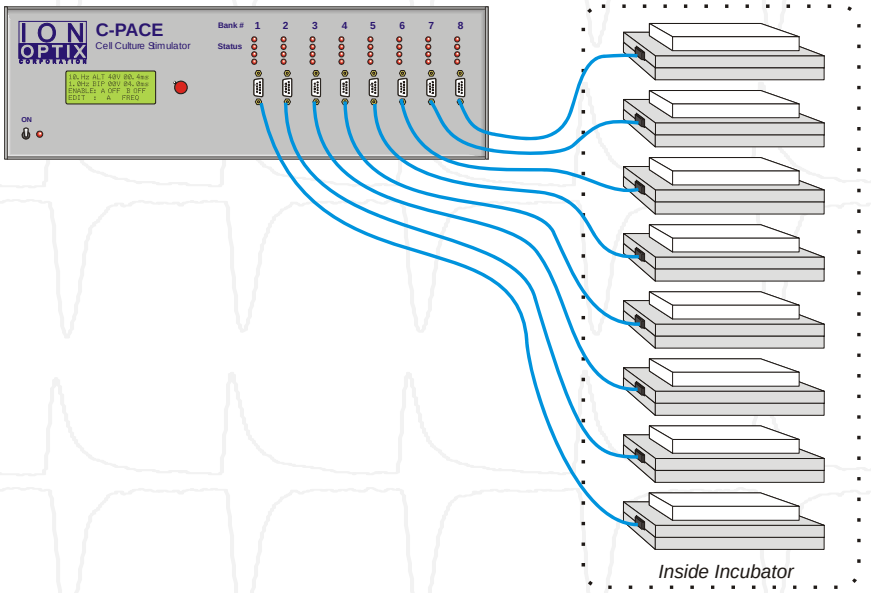
CEPSYS System Overview

Chronic electrical stimulation has been shown to prevent the dedifferentiation of myocytes that occurs in long term culture. Pacing will maintain the rod shaped, striated morphology of the myocyte for several days. Whereas quiescent cells begin losing their contractile properties within 6 to 18 hours, most chronically paced experiments run 72 hours with little loss of contraction amplitude. Protein synthesis is also maintained and cells are kept in normal nitrogen balance for at least 72 hours. Effects have been observed in studies up to 7 days. In a good adult rat myocyte preparation, the C-Pace/C-Dish system generally gets 70-80% capture (although there is some thought that only using enough voltage to stimulate 50-60% of the cells has the advantages of pre-selection and best maintenance of the healthiest cells). Use of the system, therefore, allows for experiments requiring several days and maximizes the number of cells which can be used from each animal.

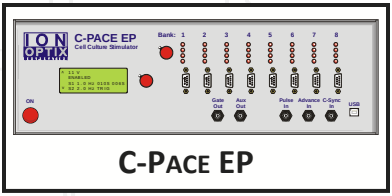
IonOptix developed its **C-Pace EP Culture Stimulation System (CEPSYS)** over many years of collaboration with top cardiovascular researchers. We take pride in a line of precision products that are application driven and built to meet the needs of a demanding research environment. Since its inception in 1990 IonOptix has built and installed hundreds of high performance, turnkey systems in research laboratories worldwide.



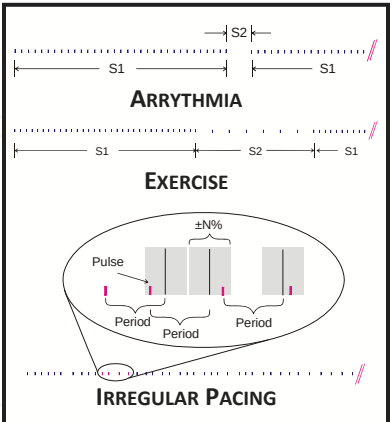
C-Pace EP

Chronic Stimulator

The C-Pace EP is a multi-channel stimulator designed to do chronic stimulation of bulk quantities of cells in culture incubators. Compared to our original C-pace, the EP version has more flexibility in its pacing protocols and has been designed on request by customers who want to study the effects of arrhythmia or exercise protocols during culture. Maximum stimulation frequency has also been increased in the C-Pace EP to 99Hz. Gate and Aux outputs allow for increased functionality when used as an acute pacer.



C-PACE EP



EXAMPLE PROTOCOLS

Features

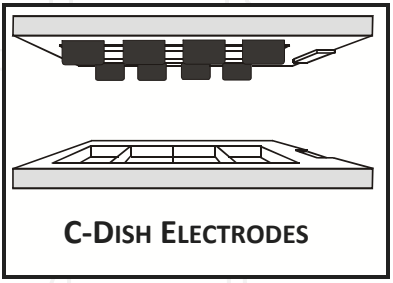
- **Arrhythmia Protocols.** Insert an offbeat pulse at a fixed interval.
- **Exercise Protocols.** Run multiple pulse trains with individually programmable frequency and duration.
- **Irregular Pacing.** Random variation of specified frequency within definable percentage window and guaranteed average effective rate.
- **External Triggering.** Change to next pulse train with TTL 'advance' input and/or trigger individual pulses with TTL 'pulse' input.
- Current up to 240mA
- Digital adjustment of frequency (0.010-99Hz in the EP), pulse duration (0.4-24 msec), and voltage (up to ±40V)
- Bipolar pulses reduce electrolysis byproducts
- Works in conjunction with all C-Dish™ Culture Dish Electrode Assemblies
- Simple single ribbon cable connection to any C-Dish™

Inputs / outputs

- **High Voltage Out.** ±40V via standard 9-pin DIN connector
- **TTL Out.** Synchronized and programmable digital outputs.
- **TTL In.** Externally pulse and sequence triggering.

C-Dish Electrode Assemblies

The patented C-Dish™ works in conjunction with the C-Pace, bulk cell stimulator to form a complete system for doing chronic stimulation of bulk quantities of cardiac myocytes (and other excitable cells) in culture. The C-Dish™ is a simple, 2-piece assembly that precisely places carbon electrode elements in a variety of standard culture plates. A ribbon cable connector provides access to the field stimulating electrodes.



Features

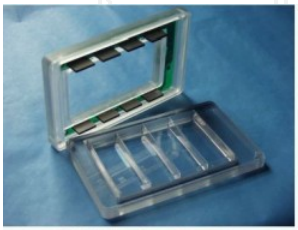
- Physically stable assembly with standard culture dish
- Carbon electrodes effectively stimulate cells without releasing toxic electrolysis byproducts into media
- Autoclavable

Inputs / outputs

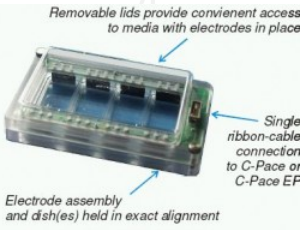
- Standard ribbon cable connector

Supported Culture Dishes

- 4-well rectangular: Nunclon #167063, 176597
- 8-well rectangular: Nunclon #167064
- 6-well circular: Nunclon #140685, Corning #3516 or BD Falcon #353846
- 6-well circuler: for Flexcell system
- 6 discrete 35mm dishes: various


4-Well Nunclon (2 models)


8-Well Nunclon



Common Features


6-Well Nunclon, Corning, BD Falcon


6 Individual 35mm Dishes


6-Well Flexcell Uniflex

Culture Pacing References

A Partial List of Relevant Publications

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- **Ercan, Batur, and Thomas J Webster.** "Greater osteoblast proliferation on anodized nanotubular titanium upon electrical stimulation." International journal of nanomedicine 3, no. 4 (Jan 2008): 477-85.
- **Fujita, Hideaki, Taku Nedachi, and Makoto Kanzaki.** "Accelerated de novo sarcomere assembly by electric pulse stimulation in C2C12 myotubes." Experimental cell research 313, no. 9 (May 2007): 1853-65.
- **Genovese, J, C Spadaccio, J Langer, and J Habe.** "Electrostimulation induces cardiomyocyte predifferentiation of fibroblasts." Biochemical and Biophysical Research Communications, Jan 2008.
- **Genovese, Jorge A, Cristiano Spadaccio, Hernan Garcia Rivello, Yoshiya Toyoda, and Amit N Patel.** "Electrostimulated bone marrow human mesenchymal stem cells produce follistatin." Cytotherapy 11, no. 4 (Jan 2009): 448-56.
- **Ivester, C T, et al.** "Electrically stimulated contraction accelerates protein synthesis rates in adult feline cardiocytes." The American journal of physiology 265, no. 2 Pt 2 (Aug 1993): H666-74.

IonOptix Systems

Our goal is to support the scientific research community with an array of systems that meet experimental demands while adhering to our philosophy of developing innovative high-performance products at fair prices. The following are some of the application-driven systems currently available. Visit us at www.IonOptix.com for more information.

Calcium and Contractility / Diameter

- Myocyte Calcium and Contractility Recording Systems
  - Calcium (HyperSwitch & MuStep)
  - Contractility (Cell & Sarcomere Length)
  - Force (MyoStretcher)
- Vessel Calcium and Diameter Recording System

Tissue Bath Fluorometry

- FluoroPlex
- FluoroHeart

General Photometry

- Fluorescence Photometry System

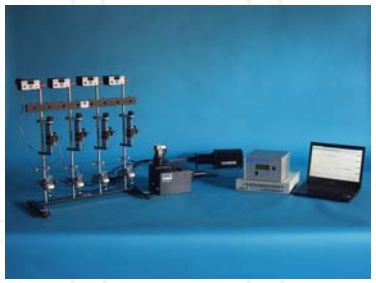
Cell Pacing

- Cell Culture Pacing

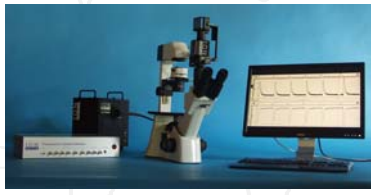
Myocyte Harvesting

- Myocyte Harvesting System

CA& CONT SYSTEM



FLUOROPLEX



FL PHOTOMETRY

ION OPTIX

"The Barn" — IonOptix Headquarters in Milton, Massachusetts

Company History

IonOptix makes quality ratiometric fluorescence and cell dimensioning data acquisition systems. We have been making reasonably priced, high performance systems since 1990.

IonOptix prides itself on post-sale customer support. Telephone and email support is available on an unlimited basis. More importantly, every system sale includes a one to two day installation visit to set up the system and train the customer. We consider this training to be critical as it gets the customer up and running as quickly as possible. We run experiments with your preparations during the visit to be assured that all technical issues particular to the experimenter's preparations have been covered.

Resellers

Our good friends at Cairn Research are currently our only resellers. They sell our components in conjunction with their fluorescence and electrophysiology systems.

Cairn Research
www.cairn-research.co.uk

Authorized Representatives

In efforts to afford this high level of service to all our customers, IonOptix has entered into agreements with local representatives in several countries. The representatives have been chosen based on their technical and biological expertise, familiarity with our products, and on their customer service skills.

Bioprobes Ltd.
China, Hong Kong
www.bioprobeshk.com
www.bioprobeschina.com

Scitech Korea Inc.
Korea
www.scitechkorea.co.kr

Kuo Yang Scientific Corp.
Taiwan, Republic of China
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SDR Clinical Technology
Australia, New Zealand
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Primetech
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