

IonOptix Culture Pacer Stimulation Pulse Distribution

Calculating Maximum Stimulation Frequency and Pulse Duration

Introduction

IonOptix Culture Pacers will calculate and automatically limit adjustment of frequency or duration. Users can also predict an IonOptix C-Pacer's maximum frequency, although it is a bit tricky because stimulation pulses are not delivered to each well simultaneously. To determine the max frequency for a given pulse duration or maximum pulse duration for a given frequency, we need to understand the manner in which C-Dish electrode assemblies distribute stimulation pulses during each stimulation event. Instead of delivering stimulation to all wells at the same time, we use relays to switch from one well to the next and it takes approximately 0.5 ms for each set of relays to open/close. The following schematics illustrate the order/sequence that stimulation pulses are delivered within each multiwell C-Dish electrode assembly from 4 wells up to 24 wells.

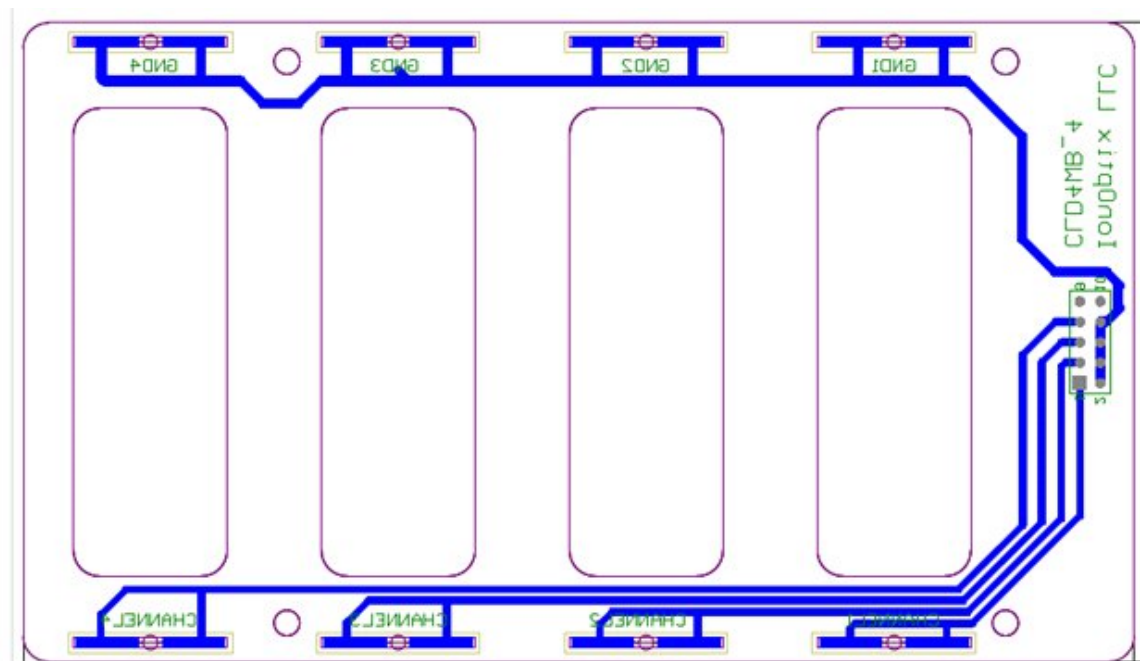
Example calculation

For a 6-well plate, you have 6 wells that will pace in pairs for a given sequence. That means that it will take 3 times the pulse duration plus 3 times the opening/closing of the relays to complete one round of stimulation. Let's say that you want to go at 99 Hz. The total time for 1 round of stimulation cannot take more than 10.1 msec ($1000 \text{ msec}/99$). If you divide 10.1 by 3, you get 3.37 msec per pulse. Subtract 0.5 msec for the relay switch from the 3.37 msec for each pulse and you'll get 2.87 msec (the actual switch takes slightly less than 0.5 msec, so the real-world duration will be slightly longer). That's one way to calculate the max pulse duration you will be able to use with a 6-well dish at 99Hz.

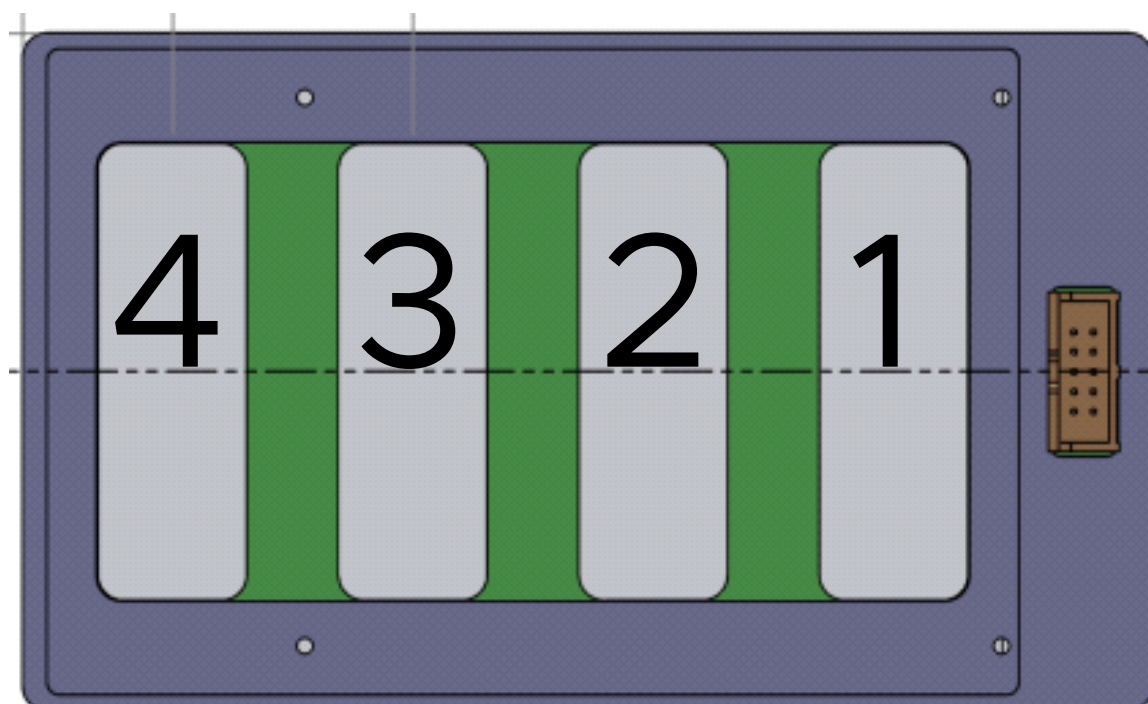
The same math can be used to calculate the maximum frequency/pulse duration when you know the manner stimulation pulses are distributed within each C-Dish.

C-Dish for 4-well Tissue Culture Plates

4-well C-Dish schematic

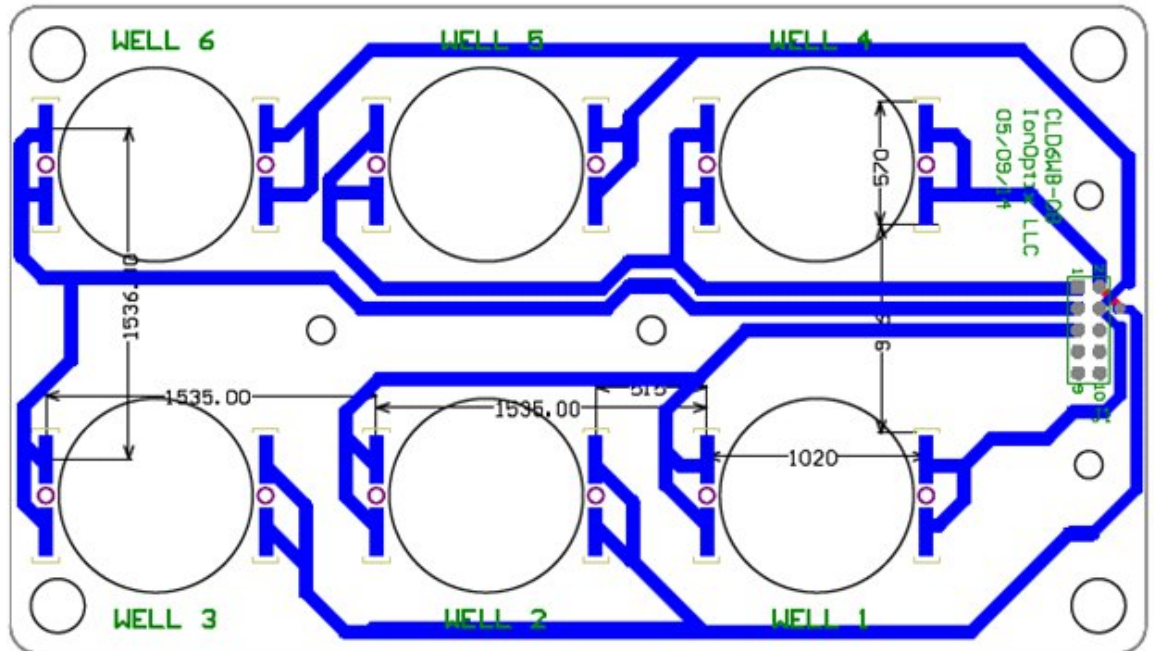


4-well C-Dish sequence

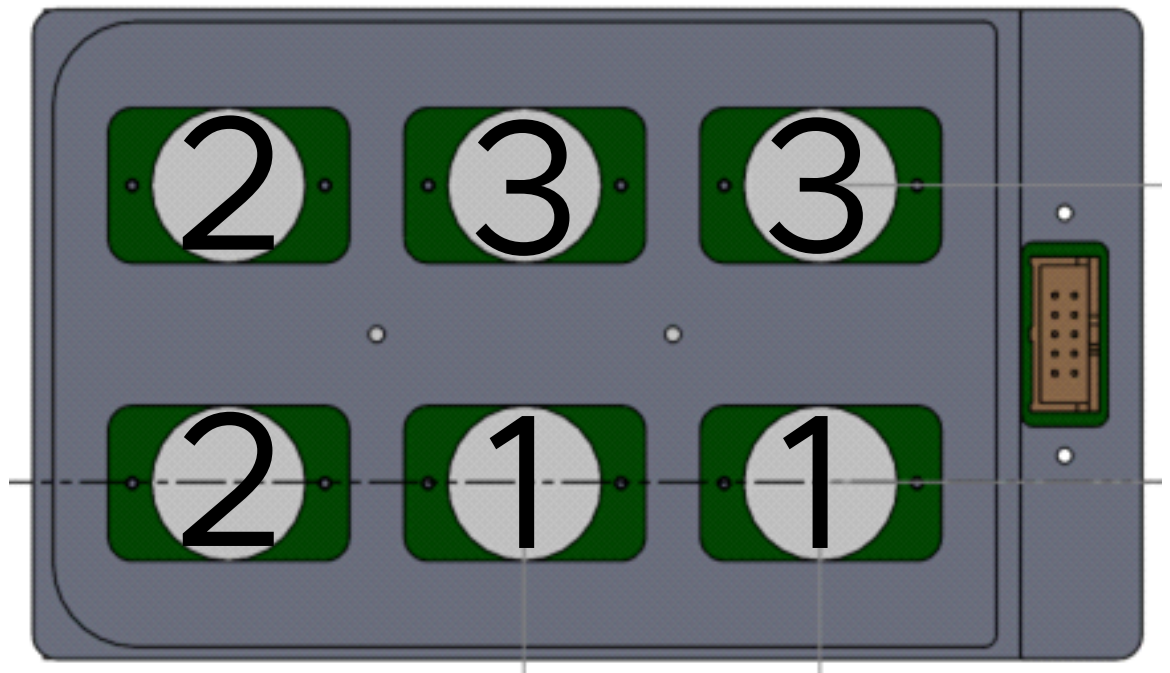


C-Dish for 6-well Tissue Culture Plates

6-well C-Dish schematic

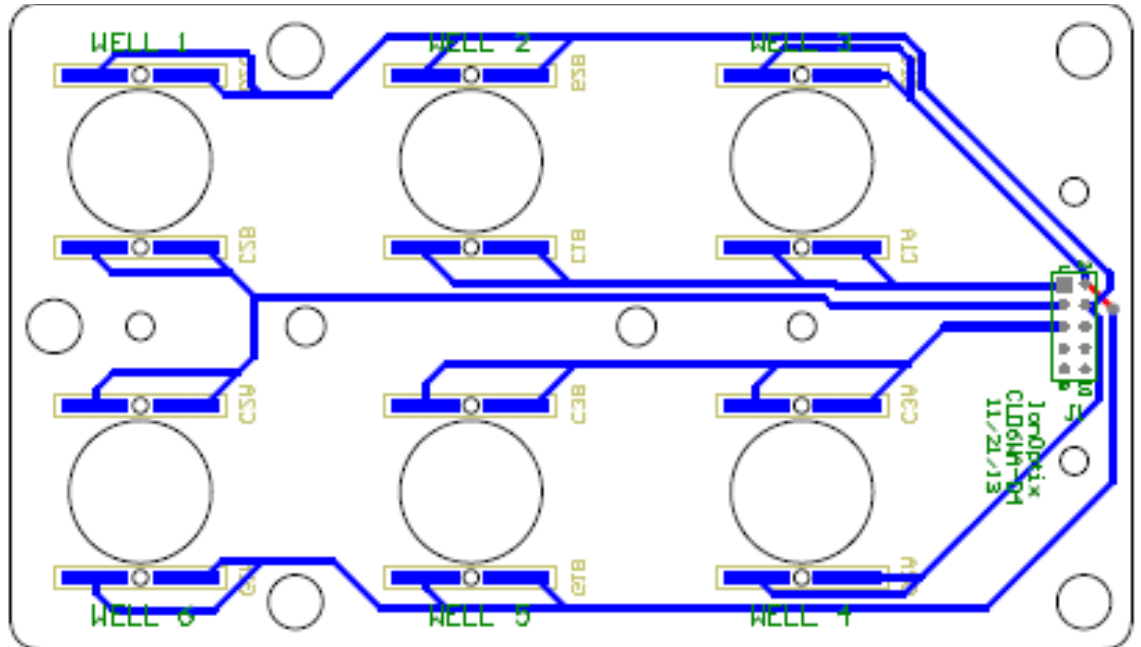


6-well C-Dish sequence

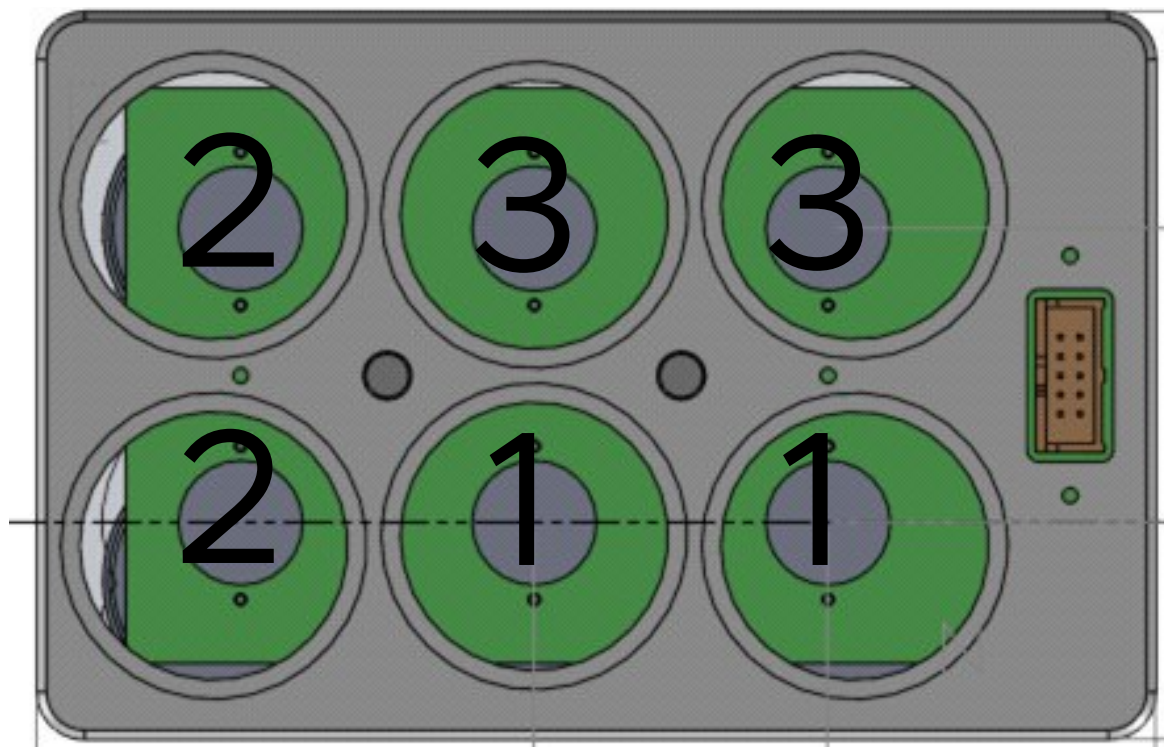


C-Dish for 6x 35 mm Individual Tissue Culture Dishes

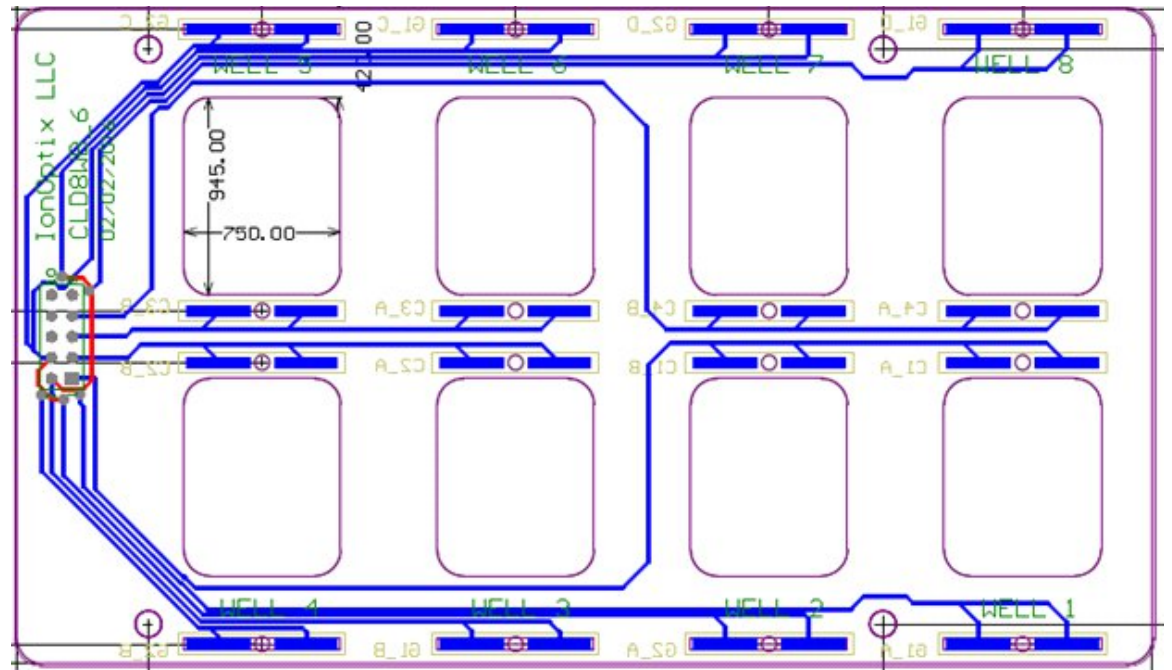
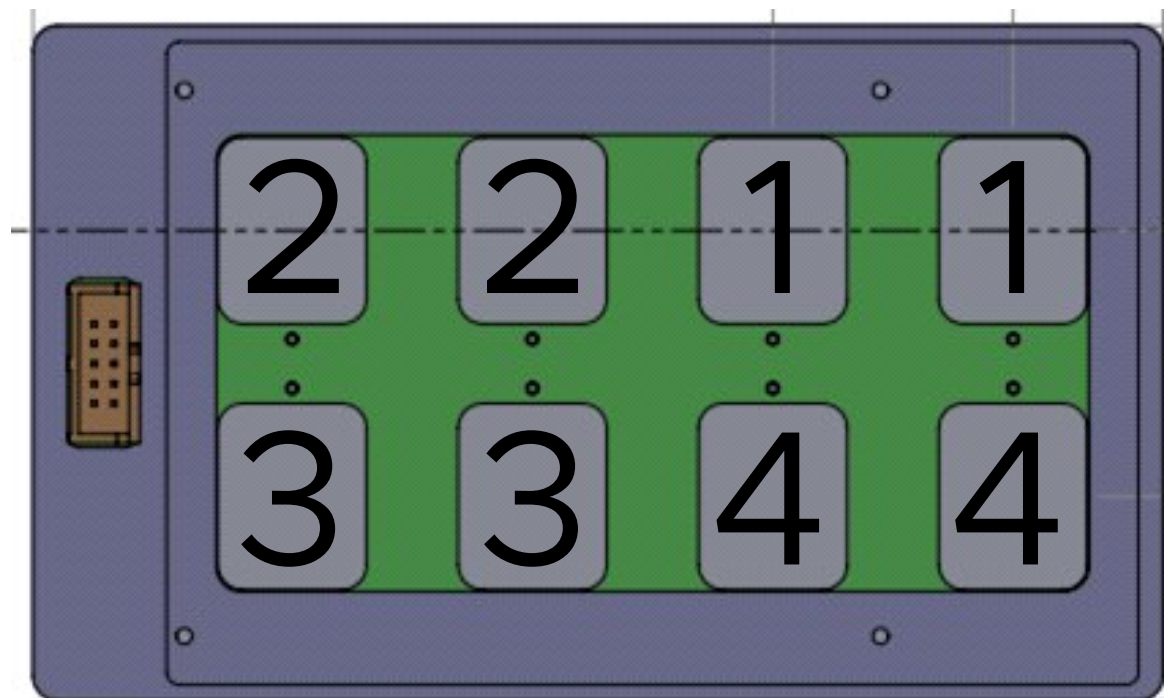
6-dish C-Dish schematic



6-dish C-Dish sequence

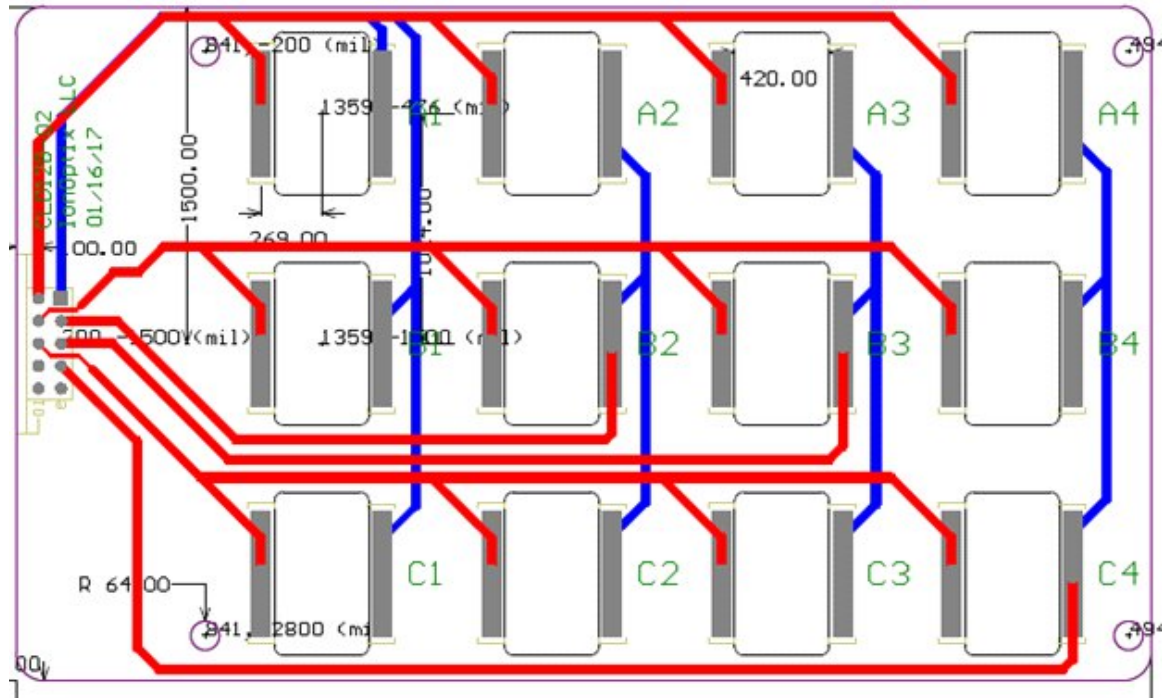


C-Dish for 8-well Tissue Culture Plates

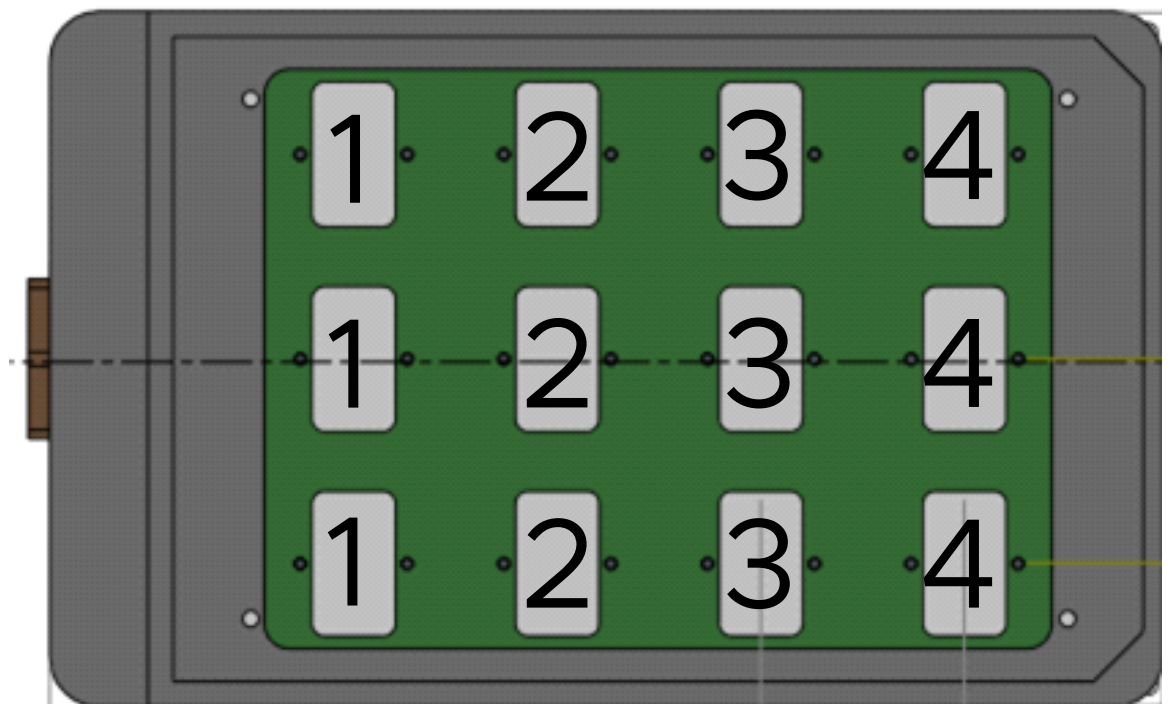
8-well C-Dish
schematic8-well C-Dish
sequence

C-Dish for 12-well Tissue Culture Plates

12-well C-Dish schematic

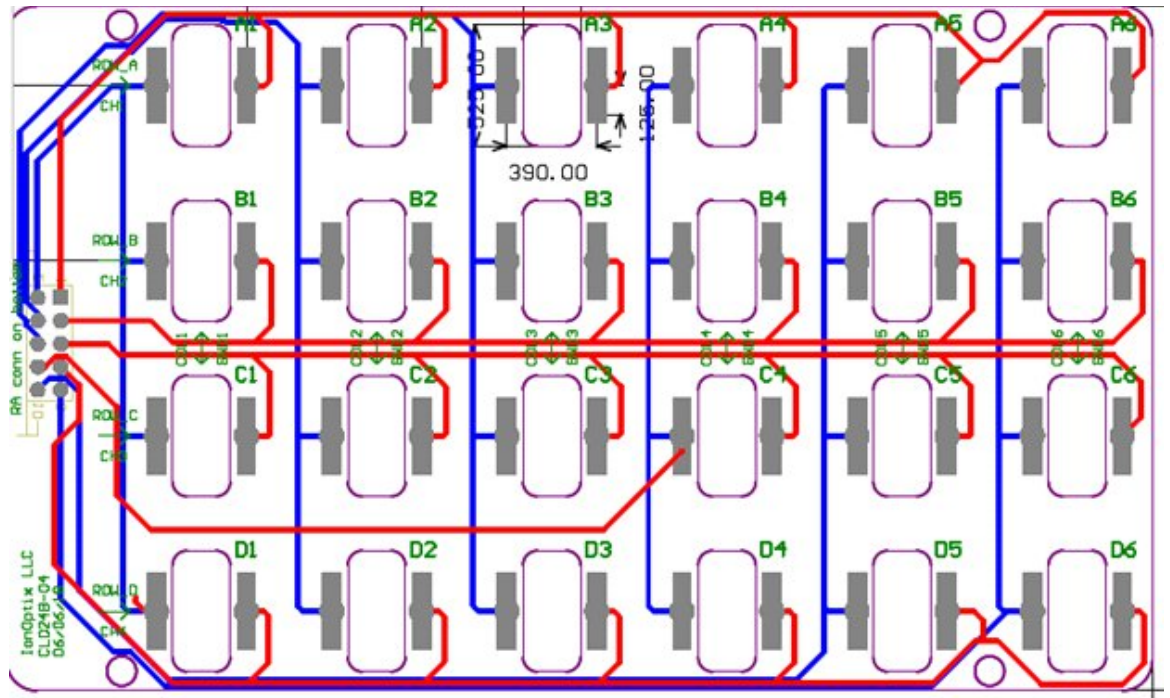


12-well C-Dish sequence

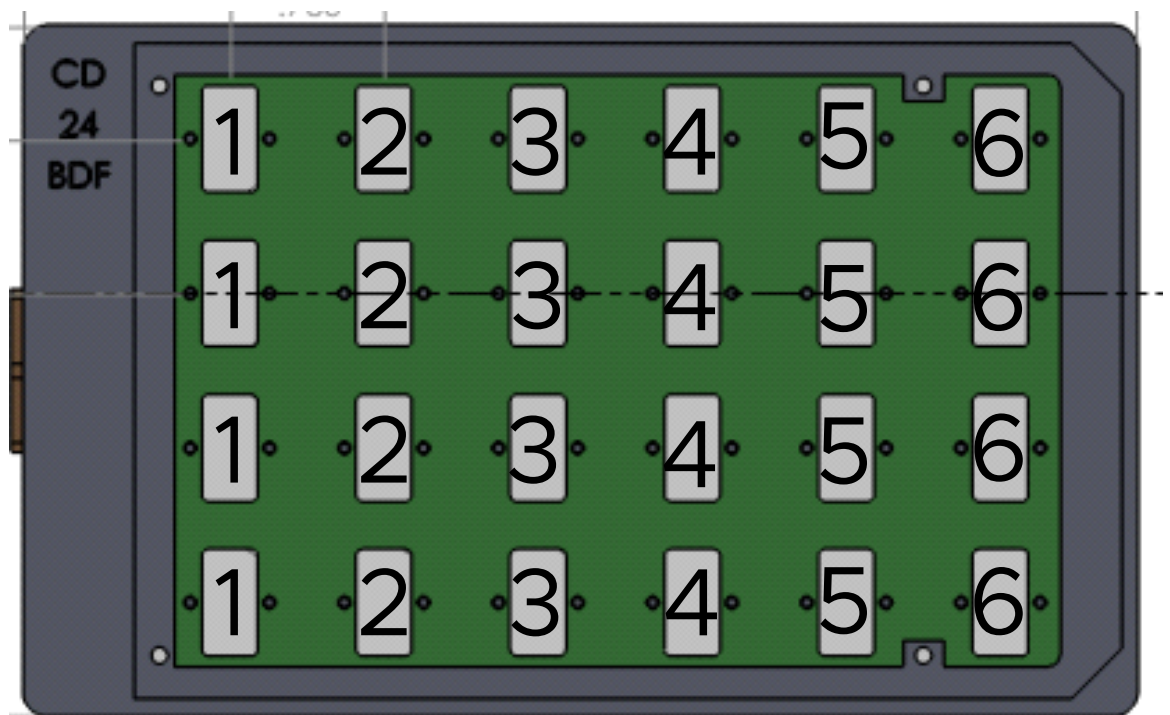


C-Dish for 24-well Tissue Culture Plates

24-well C-Dish schematic



24-well C-Dish sequence





IonOptix

Email: info@ionoptix.com

Web: www.ionoptix.com