The AutoMOM

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Abstract

The AutoMOM is a innovative design for an autonomous bioreactor. The design consists of light positioning, gas handling, incubator, liquid handling, shaker, and structure subsystems. In order to effectively culture cells in a closed-circuit and fully autonomous environment, the AutoMOM manages liquid movement, gas transfer, temperature control, shaking patterns, and optical density and fluorescent intensity monitoring. The AutoMOM improves on existing products by offering fully autonomous cell culturing, monitoring, setup and cleanup. The shaking subsystem can shake in any user-desired 2D pattern, at variable speed, unavailable in any other competitor. The gas handling system can mix custom environments of five gases, as opposed to using premixed gas. Finally, the high modularity of this design allows for tileable incubators to run as many as 10 simultaneous experiments with unique gas environments, temperature maintenance, and survival analysis, ultimately providing unique services unavailable in any other lab device.

Product Summary

The AutoMOM is an autonomous modularly-organized microbioreactor capable of liquid handling, cell culturing, and closed-loop control through monitoring of optical density and fluorescence intensity.

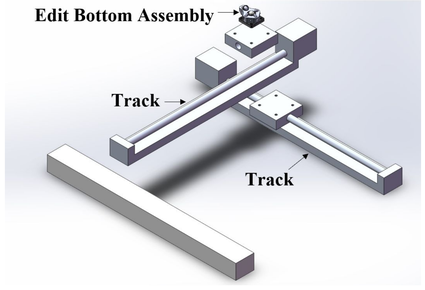
Our modular design begins with entirely enclosed incubators that are sealed for atmospheric gas composition control, temperature control, and optical density and fluorescence intensity monitoring. Each incubator has the capability of housing well plates or test tubes, giving the experimenter added flexibility. Our design consists of four incubators, providing a large capacity for experimenters.

A shaking platform is housed in each incubator. The shaker enables linear, orbital, and double orbital shaking patterns depending on the needs of the experiment. Varying the speeds of the motors powering the shaker enables a wide variety of patterns to be produced, increasing the flexibility of our product.

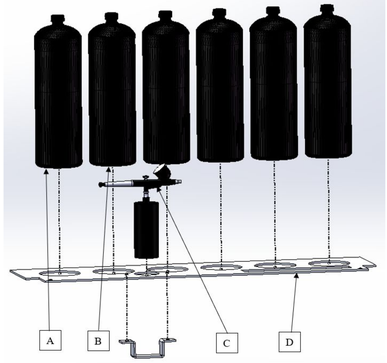
Optical density and fluorescence intensity monitoring are achieved using a excitation device below the incubators and optical sensor above the incubators. These are carefully aligned to measure the OD or FI for each well in a well plate or each tube in a rack of test tubes. Monitoring is achieved without compromising the gas composition of the

AutoMOM Rendering

Light Positioning

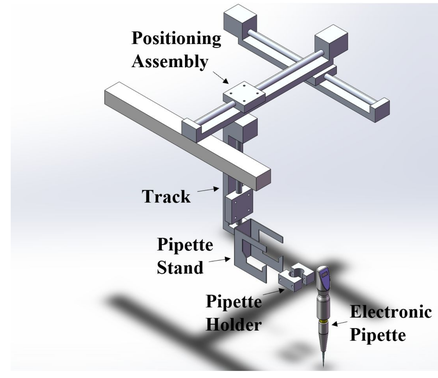


Electronics/Gas Handling

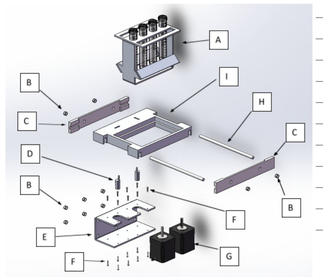


Letter	Part Name
A	3” dia. Pressure Tank
B	Air Compressor Nozzle
C	Electronic Air Compression Tank
D	Gas Alignment Plate

Liquid Handling

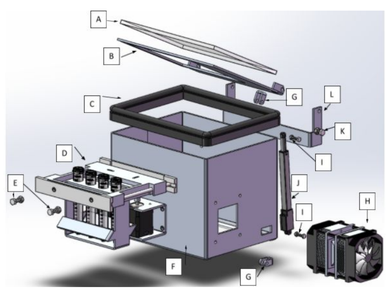


Shaker



Letter	Part Name
A	Tube Holder Subassembly
B	M6 O-ring
C	Sliding Beam
D	Motor Pin
E	Motor Bracket
F	Button Head Screw
G	Nema 17 Stepper Motor
H	Sliding Pin
I	Shaker Base

Incubator

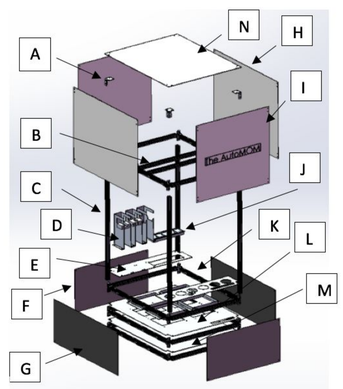


Letter	Part Name
A	Acrylic Top
B	Lid
C	Gasket
D	Shaker Subsystem
E	Shaker Subsystem Fasteners
F	Incubation Box
G	Linear Actuator Bracket
H	Peltier Subsystem
I	Linear Actuator Fasteners
J	Linear Actuator
K	Lid Fasteners
L	Lid Hinge

Cost Overview

Cost Type	Cost Amount
OTS Parts	$2468.34
Modified OTS Parts	$50.56
Raw Materials	$446.25
Manufacturing and MFG Labor	$350.67
Energy Consumption	$.94
Assembly Labor	$89.62
Total Cost	$3406.38

Structure



Letter	Part Name
A	Corner Mount
B	Liquid Handling Platform
C	Vertical 8020
D	Nozzle Holder
E	Liquid Container Platform
F	Bottom Panel 1
G	Bottom Panel 2
H	Top Panel 1
I	Top Panel 2
J	Liquid Container
K	8020 Base
L	Incubator Base
M	Base
N	Top Panel 3

Customer Needs Mapping