

# Product Design Specifications: Liquid Controller

## Team Roles:

Team Leader: Steve Welch

Communications: Joe Decker

BWIG: Dan Miller

BSAC: Justin Gearing

Last Update: September 16, 2008

**Function:** Currently, reagents are added manually when testing cell signal functioning under a microscope. This leads to problems regarding accuracy of timing and amount. To resolve this issue, an automatic system is desired. This system will use pumps controlled by a computer interface to precisely deliver required reagents.

## Client Requirements:

- Must be user friendly
- Must have replaceable parts
- Must not require constant human intervention

## Design Requirements:

- Must be resistant to corrosion
- Cannot leak toxic material
- USB powered
- Must fit within limited table space
- Must have a computer interface
- Must have ability to switch fluids because of time
- Must have ability to control the flow rate

## 1. Physical and Operational Characteristics

- a. Performance Requirements:** The liquid controller must be able to run on a daily basis for at least 3-4 hours.
- b. Safety:** Product must be free from risk of electrical shock.
- c. Accuracy and Reliability:** A high degree of repeatability is required. The liquid controller must be capable of producing the same exact output each time that it is used in order to be able to repeat experiments. Time controls must be accurate to within one millisecond. Flow rates must be constant, controllable, and under 5 milliliters per minute.

- d. **Life in Service:** Parts should be made replaceable. The liquid controller will be used daily for at least 3-4 hours. It should remain in service and reliable for at least one year.
- e. **Shelf Life:** If properly cleaned, the liquid controller should last in storage as long as the shelf life of the commercially available parts used (the valves, pumps, etc.).
- f. **Operating Environment:** The liquid controller will be used in an ordinary lab environment. Internally, several potentially corrosive materials will be used as reagents.
- g. **Ergonomics:** The liquid controller should require as little human interaction as possible while still remaining reliable and user friendly..
- h. **Size:** The liquid controller minus the laptop should fit within the client's available desk space (approximately 2 square feet). It must be easily transportable.
- i. **Weight:** The liquid controller must be light enough to be carried down seven stories by an average person.
- j. **Materials:** Materials must not corrode with repeated exposure to salt solutions. Materials must also not leak or be biologically incompatible.
- k. **Aesthetics, Appearance, and Finish:** The liquid controller should be designed with functionality in mind, aesthetics is of secondary concern.

**2. Product Characteristics**

a. **Quantity:** One unit will be needed.

b. **Production Cost:**

Estimated budget:

Item	Cost (est.) (\$)	Qty	Total (\$)
two-way pressure valve	60.00	8	480.00
PC board	40.00	1	40.00
Miscellaneous*	100.00	-	100.00
<b>Total (est.)</b>	-	-	<b>620.00</b>

\*Miscellaneous expenses includes tubing, building supplies for stand, electrical wiring, and other necessities.

**3. Miscellaneous**

- a. **Standards and Specifications:** The liquid controller must be more efficient at delivering reagent than the same process done by hand.
- b. **Customer:** The liquid controller will be used by faculty members in the department of obstetrics and gynecology. The customer has limited programming knowledge.
- c. **Competition:** To the best of our knowledge, no device currently exists that meets all of the client's requirements.