Modifying an Infusion Only Syringe Pump With a TI MSP430 Launchpad to Allow for Both Infusion and Withdrawing of Fluids

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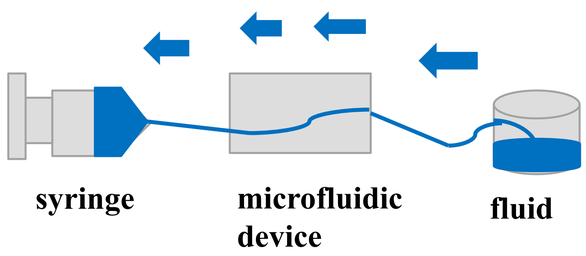
Introduction:

What is a syringe pump?
a small infusion pump (some include infuse and withdraw capability), used to control the flow rate of fluids.

Used in clinical and scientific environments

used for drug delivery



syringe pumps can control the flow of fluids in microfluidic devices

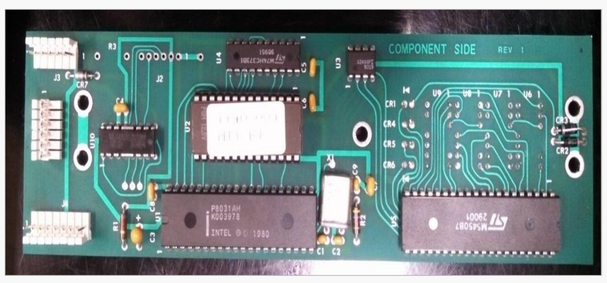
Our goal is to modify the internal control circuit of an infusion only syringe pump, the Harvard Apparatus Model 11, to allow for both infusion and withdrawing of fluids.

Why modify?

Commercially available infusion and withdrawing syringe pump can cost up to $2,000. Modifying the system will cost $12.

Method:

Identify the components and connections between components in circuit.



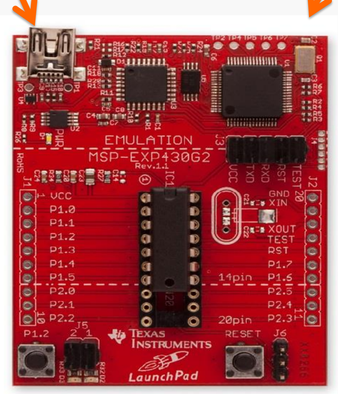
internal control circuit

Why TI MSP430 Microcontroller?

There was no available platform to program Intel Microcontroller. We will replace Intel microcontroller and memory chip with TI MSP430 microcontroller.

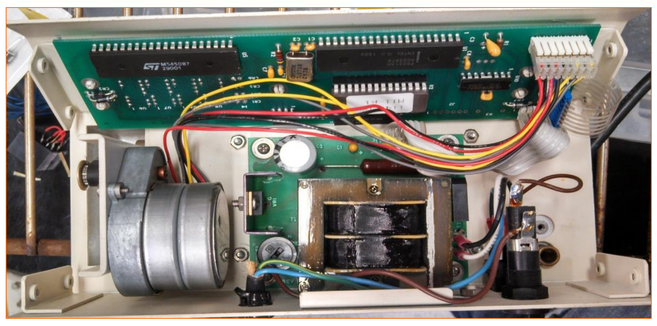
Intel microcontroller

memory chip



TI MSP430 Microcontroller features
-programmable memory
-available software to write code
-great price

To activate a syringe pump we are required to select the diameter of the syringe and rate of flow in which to expel fluid.



Stepper motor's direction of rotation causes expelling and withdrawing of fluids.

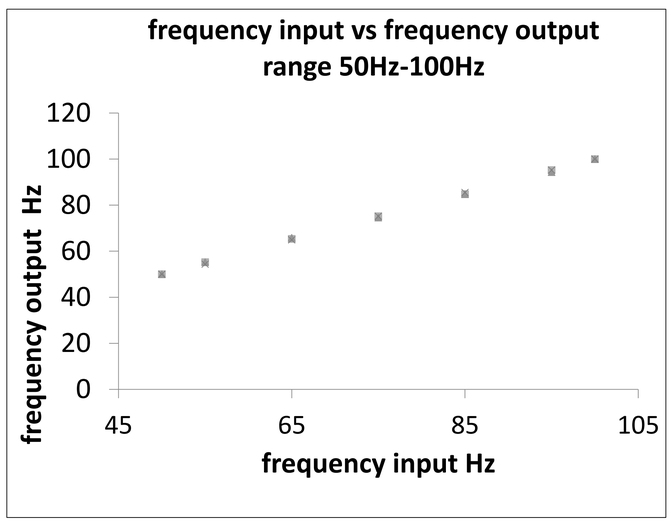
1. Based on the diameter and the rate of flow we select, the microcontroller takes this information and calculates a frequency.
2. Then it sends the stepper motor a signal at his frequency which causes the motor to spin.
3. The rotation of the motor causes the expelling of the fluid at the selected rate.

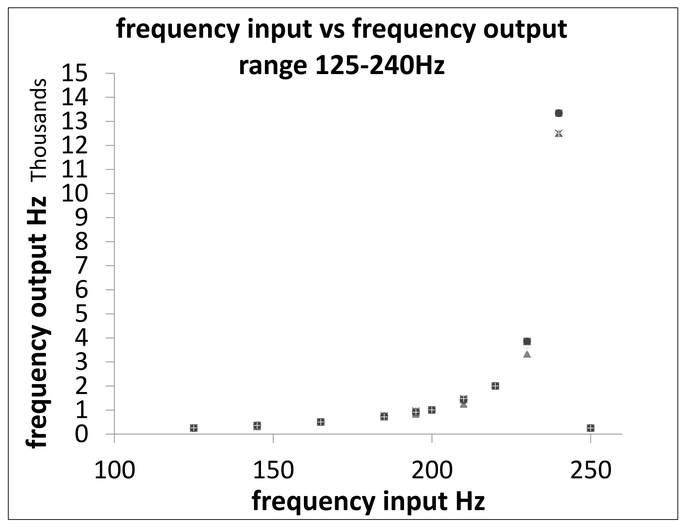
Energīa

http://www.itopen.it/wp-content/uploads/2013/03/Energia.png

Using Energia, we will write a program that will allow the motor to rotate in both directions allowing for the infusion and withdrawing of fluids.

Results:





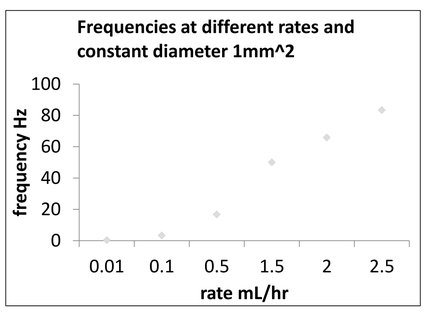
Function, in one version of program, failed to generate signals between 125hz-240hz frequency range

Ongoing and Future Work:

Program instructions to allows us to turn start and stop syringe pump with the press of a button

http://thumbs.dreamstime.com/z/hand-pressing-push-button-vector-symbol-10089750.jpg

Test: Can our modified circuit generate frequencies after selecting same diameter and rate of flow?



Add the ability for a computer to control the syringe pump. Computer can monitor lengthy experiments at any time.

http://www.chromtech.net.au/Netbook-Syringe-Pump-Kit.jpg

Conclusion

The modified syringe pump will have accuracy and precision comparable to commercially available syringe pumps that have both capabilities. The modifications made to an infuse only syringe pump, the Harvard Apparatus Model 11, to allow for both infuse and withdrawal of fluids will be documented and available online.