



2nd Progress Report Automated Trace Gas Trapping System (ATGTS)

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Mechanical Related Progress

Overall Design

The overall Design has not changed since the first progress report except for the addition of a fan screen.

Prototype Build

The sub-chamber housing which fits in the flux chamber is nearly finished. Due to an extensively long drying time for the glue to attach the Viton seal to the PVC, assembly has taken a bit longer than planned. Soon the team should have the sub-chamber glued and tested for air tight seal. Next the outer door will be built.

Testing

Using a 3' length of peak tubing, a micro diaphragm pump, and a solenoid valve, the team tested the flow rate of the system. It was found the flow rate is 4.16mL/s. This is more than ample for the needs of the ATGTS.

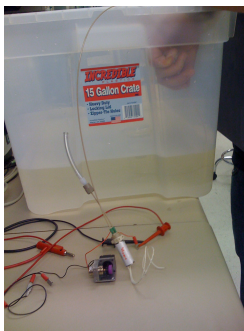


Figure 1. Testing setup for the flow rate.

Table 1. Flow rate calculations

Setup	Pump Current w/ Load (mA)	Pump Current w/out load (mA)	2-Way Solenoid Valve Current (mA)	Time (s)	Volume (mL)	Flow Rate (mL/s)
Pump w/ Tygon tubing about 14"	90	80	NA	14.5	100	6.896552
Pump w/ 3' length of PEEK 1/16"	100	80	NA	23.6	100	4.237288
Pump w/ 3' length of peek w/ valve	100	80	110	24	100	4.166667

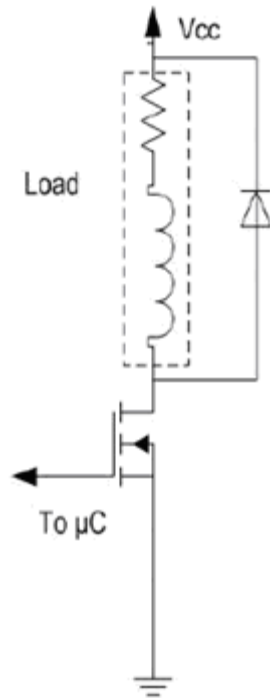
Electrical Related Progress

Overall Design

The idea behind the system design has been changed significantly. However, the power scheme had to be changed to make the battery requirements reasonable. A PWM scheme was implement to keep the holding (hold on, or leave off) currents low. This reduced power consumption by 80% and puts the battery requirement right around 10AH which is quite reasonable.

Prototype Build

A prototype had to be rapidly constructed to prove the feasibility of the system. Fortunately, PWM schemes do not take a substantial hardware commitment. The following circuit was built and proven to be implementable in our final design;



Available components were used and the final prototype should be completed by thanksgiving.

Testing

Shown in the table below is the worst case of the power consumption of only the solenoids valves of the system which are the systems major source of current draw.

	Worst Case	
	AH/month 6 hours cycle	AH/month 4 hours cycle
N ₂ O cycle	3.04	4.56
CO ₂ cycle	7.6	11.4
Total Amp hours/month	10.64	15.96

Additional Parts Ordering

Some additional parts were ordered for the ATGTS. They are as follows:

1. Waterproof Fan: The previous fan did not have a third wire to monitor the fan RPM for error detection.
2. Fan Screen: Stops debris from entering the fan or flux chamber itself.
3. Battery: This Lithium Ion 14.7V / 25.2Ahr power source will run the ATGTS
4. Pressure Sensor: Monitors the pressure of the system.
5. H-Bridge IC: Controls the polarity of the server motors and reduces the amount of output pins on the microcontroller from eight to four.
6. External timer: Will be used to relay power to the microcontroller for the 4-6hour sampling periods. This will increase the accuracy of the system because the clock on the microcontroller has a clock drift of +/-20% in sleep mode.
7. Quick Connects: The male connection ends for the quick connect stems were returned for tube fitting ends. This needed to be done so the quick connect end can be tighten to the reducers with ferrules.
8. Minstac nuts: Minstac nuts were order because they are needed to connect the PEEK tubing to the solenoid valves.