



Mechapacticum Outline

Electro-Pneumatic

Topic: Electro-pneumatic

Estimated completion time: 12 hours

Purpose:

The purpose of this Mechapacticum is for the participant to demonstrate their ability to use, repair and troubleshoot electro-pneumatics as prescribed in this document.

Instructional Outcomes:

The participant will demonstrate the application of their skill and knowledge in the following topical areas:

- Basic Electronics
- Solid state
- Electro-hydraulics and pneumatics
- Safety

Instructions to Students: Design, build and debug an electro-pneumatic circuit to do the following:

1) Utilizing Momentary switches (both N/O and N/C), Relays, Limit switches, and

Pneumatic Pressure regulator, filter, Directional control valves, flow control valves,

Cylinders, tees and Tubing construct a circuit to do the following:

- a. Push the N/O momentary start pushbutton(s) to initiate circuit. This switch should be sealed in.
- b. Cylinder 1 extends – In 3 seconds
- c. Once Cylinder one is fully extended, cylinder two extends in 3 seconds.
- d. Once cylinder two is extended, both cylinders return. Cylinder 1 in 2 seconds and cylinder 2 in 1 second.
- e. When the cylinders are returning, the seal is broken on the start switch(s)
- f. The Start button will only initiate the cylinders to advance from the home position, pressing the Start button once the cycle has been initiated (cylinder 1 movement) will have no effect on operation sequence.
- g. If the N/C stop button is depressed anywhere in the cycle both cylinders return.
- h. Your instructor may change the return times for the cylinders depending on the availability of equipment.





Mechapacticum Outline

Electro-Pneumatic

- 2) Draw up the circuit and obtain prior approval from your instructor to build the circuit. Note: your instructor will not correct minor errors only insure that you are on the right track.
- 3) Construct and debug the circuit. When complete have your instructor verify the circuit for proper operation. Note you must follow all safety rules.
- 4) When complete, write up the lab assignment to include:
 - a. The original instructions
 - b. The original drawing (not to be evaluated – only for reference)
 - c. The final circuit drawing (to be evaluated for the proper use of symbols, layout, neatness, etc.)
 - d. Identify any changes that had to be made from the original concept and explain why the changes were made.
- 5) Submit electronic copies of your documentation to your evaluator.

Safety

Instructions to Evaluator:

All timed intervals are associated with flow controls and not timers.

If a student has a small error in their design, do not correct it. This leaves the student challenged in the debug of the circuit.

Ensure that the student's circuit functions as required... If it doesn't at first... allow sufficient time to repair

Do be critical on the documentation provided by the student. You may want to require the student to submit all documentation except the drawing in electronic form as reflected above. The drawings can be hand sketched... and scanned if possible.

With the documentation, allow for 12 hours for the student to complete. Slower student have required 12 hours to complete.

The actual lab time has varied from 2 hours for the quickest student to almost 6 hours for the slowest student.





MechapRACTICUM Outline

Electro-Pneumatic

If possible, allow the students to work with varying cylinders... the logic associated with single acting, spring return cylinders is different than the logic used to control double acting cylinders. Ideally, if equipment allows, one of each should be given to the student.

Again it should be noted that this exercise represents the minimum requirement of the MAT2 student.

Schools can add on additional requirements

Equipment and Materials:

Pneumatic:

- Solenoid operated Directional control valves
- Flow controls with bypass checks
- Pneumatic cylinders (2)
- Pneumatic Pressure regulator
- Pneumatic filter
- Tee's and Tubing
- Pneumatic gauges

Electrical:

- N/O and N/C Pushbuttons (1 each)
- Limit switches (4) that can be actuated off of the Pneumatic cylinders
- Relays 3 – 4 with multiple contacts on each.
- Wires and Connectors
- Multimeter/DMM (availability)

Other supplies:

- Graph paper for the drawings.





PRIMARY DEVELOPERS:
Glenn Wisniewski – Corporate Trainer, Henry Ford College
Wes Bye – Mechatronics SME, Pontiac Coil

MechapRACTICUM Outline

Electro-Pneumatic

Rubrics:

	SKETCHING	PTS	(A) <i>Highly Proficient</i>	(B) <i>Competent</i>	(C) <i>Partially Competent/Developing</i>	(D) <i>Limited</i>	(E) <i>Major Improvement Required</i>	PTS. Awarded
1	Clarity of sketch	10	Proper symbols and layout used		Symbols correct, improper layout		Improper symbols and layout	
2	Appearance of functionality	10	Circuit appears to be functional		Some elements of the drawing are proper		Circuit cannot work as drawn	
	Circuit Function	PTS	(A) <i>Highly Proficient</i>	(B) <i>Competent</i>	(C) <i>Partially Competent/Developing</i>	(D) <i>Limited</i>	(E) <i>Major Improvement Required</i>	PTS. Awarded
1	Function as specified.	30	Circuit built, debugged and working as specified.		Some functionality, required minor instructor support,		Circuit does not function. Major issues.	
	Documentation	PTS	(A) <i>Highly Proficient</i>	(B) <i>Competent</i>	(C) <i>Partially Competent/Developing</i>	(D) <i>Limited</i>	(E) <i>Major Improvement Required</i>	PTS. Awarded
1	Documentation submitted electronically	20	<i>All elements submitted (i.e. Final drawing, Explanation of changes, etc.)</i>		<i>Documentation incomplete as originally submitted but corrected with little effort</i>		<i>Incomplete or poorly constructed.</i>	





**Multi-State
Advanced Manufacturing
Consortium**

US DOL SPONSORED TAACCCT GRANT: TC23767

PRIMARY DEVELOPERS:
Glenn Wisniewski – Corporate Trainer, Henry Ford College
Wes Bye – Mechatronics SME, Pontiac Coil

RELEASE DATE 12/17/2014

VERSION v 001

PAGE 5 of 7

Mechapacticum Outline

Electro-Pneumatic

	Safety	PTS	(A) <i>Highly Proficient</i>	(B) <i>Competent</i>	(C) <i>Partially Competent/Developing</i>	(D) <i>Limited</i>	(E) <i>Major Improvement Required</i>	PTS. Awarded
1	Safe Work Practices	25	Used appropriate PPE; practiced common safety practices		Most safety practices used		Demonstrated unsafe working practices	
2	Safety Attitude	25	Work practices demonstrated safety consciousness in all procedures; looked out for safety of others		Most of the time worked safely and showed some concern for safety of others		Dangerous worker; did not look out for safety of others	





PRIMARY DEVELOPERS:

Glenn Wisniewski – Corporate Trainer, Henry Ford College
Wes Bye – Mechatronics SME, Pontiac Coil

Mechapacticum Outline

Electro-Pneumatic

	WORK HABITS	PTS	<i>(A) Highly Proficient</i>	<i>(B) Competent</i>	<i>(C) Partially Competent/Developing</i>	<i>(D) Limited</i>	<i>(E) Major Improvement Required</i>	PTS. Awarded
	Work Attitude	15	Alert to finding and correcting problem		Honestly attempted to find and correct problems		Showed frustration in finding and correctly problem	
	Work Procedure	25	Always followed standard procedures; demonstrated planning and organization skills in correcting the problem		Complied with standard procedures; Showed some plan and organization in working		Did not follow standard procedures; Disorganized and slipshod methods;	
	Professionalism	20	Work showed pride in accomplishment		Tried hard and shows promise		Work lacks praiseworthy factors	
	Self-confidence	15	Appeared comfortable and posed when performing tasks		Fairly self-confident; occasionally disconnected		Hesitant, timid, uncertainty	
	Knowledge of job	25	Has an exceptionally thorough knowledge of the job		Has good knowledge but needed coaching		Has inadequate knowledge of job	

Total Points





**Multi-State
Advanced Manufacturing
Consortium**

US DOL SPONSORED TAACCCT GRANT: TC23767

PRIMARY DEVELOPERS:
Glenn Wisniewski – Corporate Trainer, Henry Ford College
Wes Bye – Mechatronics SME, Pontiac Coil

RELEASE DATE 12/17/2014

VERSION v 001

PAGE 7 of 7

Mechapacticum Outline

Electro-Pneumatic

SAFETY DISCLAIMER:

M-SAMC educational resources are in no way meant to be a substitute for occupational safety and health standards. No guarantee is made to resource thoroughness, statutory or regulatory compliance, and related media may depict situations that are not in compliance with OSHA and other safety requirements. It is the responsibility of educators/employers and their students/employees, or anybody using our resources, to comply fully with all pertinent OSHA, and any other, rules and regulations in any jurisdiction in which they learn/work. M-SAMC will not be liable for any damages or other claims and demands arising out of the use of these educational resources. By using these resources, the user releases the Multi-State Advanced Manufacturing Consortium and participating educational institutions and their respective Boards, individual trustees, employees, contractors, and sub-contractors from any liability for injuries resulting from the use of the educational resources.

DOL DISCLAIMER:

This product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

RELEVANCY REMINDER:

M-SAMC resources reflect a shared understanding of grant partners at the time of development. In keeping with our industry and college partner requirements, our products are continuously improved. Updated versions of our work can be found here: <http://www.msamc.org/resources.html>.

