University of Arkansas at Monticello
College of Technology-Crossett
Annual Assessment Report 2012-13 (Revised 4-10-14)

Electromechanical Technology
Instrumentation

UAM College of Technology-Crossett
Electromechanical Technology-Instrumentation
Annual Assessment Report 2013 *(Revised 4-8-14)*

1. What are the Student Learning Outcomes (SLOs) for your unit? How do you inform the public and other stakeholders (students, potential students, and the community) about your SLOs?

The following is a list of the Student Learning Outcomes for the Electromechanical Technology-Instrumentation program.

Successful completers of this program will be able to:

1) Promote a safe working environment
2) Troubleshoot and wire electrical equipment
3) Perform mechanical adjustments and repairs
4) Calibrate instrumentation devices
5) Describe industrial process control loops
6) Wire and program programmable logic controllers

UAM-CTC students, potential students, and the community can locate information regarding SLOs by the following methods:

- Online at http://www.uamont.edu/uamctc/ElectromechTechInstr.htm
- The Electromechanical Technology brochure (Appendix A)
- The UAM College of Technology-Crossett Program Information booklet (Appendix B).
- Individual courses each have specified Student Learning Outcomes. Three examples are provided at Appendix C.

2. Describe how your unit's Student Learning Outcomes fit into the mission of the university.

UAM MISSION STATEMENT	ELECTROMECHANICAL TECHNOLOGY-INSTRUMENTATION LEARNING OUTCOMES
The University of Arkansas at Monticello shares with all universities the commitment to search for truth and understanding through scholastic endeavor.	SLO 6: The programming of the Programmable Logic Controls (PLCs) involves truth tables. In a discrete component, it is either true or false, on or off respectively.
The University seeks to enhance and share knowledge, to preserve and promote the intellectual content of society, and to educate people for critical thought.	SLO 2: Troubleshooting equipment requires that both creative and critical thought be engaged. SLO 6: PLC programs by nature are intellectual content. These programs are created, stored, and sometimes kept under guard to prevent them from being copied.

UAM MISSION STATEMENT	ELECTROMECHANICAL TECHNOLOGY-INSTRUMENTATION LEARNING OUTCOMES
	The operating systems are proprietary and sometimes copyrighted.
The University provides learning experiences which enable students to synthesize knowledge, communicate effectively, use knowledge and technology with intelligence and responsibility, and act creatively within their own and other cultures.	SLO 1: Hood Packaging Company in Monticello provides internship opportunities for some our students. These interns must be able to use their acquired knowledge and communicate within that workplace culture and must understand that a safe working environment is paramount in this discipline. Fatalities and injuries have resulted from not understanding or truthfully following safety rules. SLO 5: The students describe, therefore communicate, how the systems operate.
The University strives for excellence in all its endeavors. Educational opportunities encompass the liberal arts, basic and applied sciences, selected professions, and vocational/technical preparation. These opportunities are founded in a strong program of general education and are fulfilled through contemporary disciplinary curricula, certification programs, and vocational/technical education or workforce training.	SLO 2 and SLO 3: Without the training in mathematics, communication, and computer skills, the students would be unable to perform the complex technological skills required in this program. These and other general studies courses can be applied to obtain an Associate of Applied Science – Industrial Technology Degree and the Associate of Applied Science in General Technology. Information on the associate degrees is available in the UAM-CTC program information booklet and the UAM catalog.
The University assures opportunities in higher education for both traditional and non-traditional students and strives to provide an environment that fosters individual achievement and personal development.	All of the SLOs apply to this mission statement. Our student population has been very diverse. Completers have ranged in ages from 18 years to 56 years. Although the majority of our learners have been males, several non-traditional female students have completed the program. Also, different races

UAM MISSION STATEMENT	ELECTROMECHANICAL TECHNOLOGY-INSTRUMENTATION LEARNING OUTCOMES
	and ethnicities have enrolled and graduated from our program.

3. Provide an analysis of the learning data from your unit. How is this data used as evidence of learning?

Classroom instruction is a fluid process; as technology changes, so do certain methods of teaching – particularly in the highly technical field of electromechanical technology and instrumentation. Each instructor monitors the class and asks questions during lecture. These responses enable the teacher to assess whether or not the material is being properly understood.

Obviously, if a learner cannot perform the tasks that have been presented in theory/lecture, he or she will not be able to complete the laboratory exercise. Students' grades are analyzed to see if there are any problem areas that need to be further assessed and/or remediated. If 50% of the students receive a letter grade of "F" on an exam, the material is covered again and in more depth. A percentage of this magnitude would indicate that there is a "problem area" with the unit not being understood.

Regular written exams are administered to the students, some of which are objective such as multiple choice and fill in the blank. Some tests are subjective, written as extended responses or essays, and graded by the instructors' evaluations, based on 30-40 years of experience teaching, training, and working in the field. The final exam in the Instrumentation course consists of 90 questions that must be answered in essay form. Students are given 30 questions to complete in a one-hour session, then given a break; they are given another 30 questions for

Sample Questions -- Instrumentation Final Exam

Here are five (5) examples of the 90 question final exam in instrumentation to demonstrate that students are required to engage higher level thinking skills:

#1. Illustrate in a chart form an instrument span of 5 psi to 90 psi. Show the values at 0%, 25%, 50%, 75%, and 100%.

#2. If you have a span of 5 – 25 psi, what would be the minimum reading at 75% of the instrument span?

#3. If we have an 85 foot tank and we are receiving a 12 milli-amp signal from a 4-20 ma level transmitter, what would be the correct level if the tank contains a liquid with a specific gravity of .9? Show your work.

#4. List the traits of a butterfly control valve and list the pros and cons of this type of valve.

#5. If you are working in a manufacturing facility and receive a call from a control room operator that a critical process is out of control, what would be your first step? What steps would you take next?

an hour and another break; the final 30 questions must be completed in the third hour of testing. The questions are complex and require not only a depth of knowledge in electricity and instrumentation, but also the ability to think critically and calculate based on multiple variables. A few examples of questions for the Instrumentation course are presented below.

Industrial Motors/AC Drives
Sample Laboratory Final

Each of the listed projects is to be performed on the variable speed drive units. Be sure to have your instructor sign off to each completed activity.

Siemens:

Adjust the motor frequency to 80 Hz.
Adjust the motor frequency to 40 Hz.
1) _____
Instructor's Signature (33 Points)

Allen-Bradley:

Adjust the motor frequency to 85 Hz.
Adjust the motor ramp up time to 4 seconds.

Adjust the motor frequency to 40 Hz.
Adjust the motor ramp down time to 2 seconds.
2) _____
Instructor's Signature (33 Points)

Magnetek:

Adjust the motor frequency to 90 Hz.
Adjust the motor ramp up time to 4 seconds.

Adjust the motor frequency to 50 HZ.
Adjust the motor ramp down time to 2 seconds.

OR

Adjust the motor-generator set to output 100 volts.
Adjust the motor ramp up time to 4 sec.

Adjust the motor-generator set to output 60 volts.
Adjust the motor ramp down time to 2 seconds.
3) _____
Instructor's Signature (33 Points)

Although the Instrumentation final exam is difficult and students are given only one chance to take the test, over the past three years, 60/62 (97%) of the students have passed the course. The final exam counts as 40% of the overall grade; therefore, it would be improbable for one to pass the course unless the final exam grade was also a passing grade.

The structure of a final lab examination in the Industrial Motors/AC Drives course is presented with a step-by-step process whereby students perform tasks on variable frequency drives by vendor. The three types/vendors of variable frequency drives used in the course are manufactured by Siemens, Allen-Bradley, and Magnetek. The sample on the left gives examples of activities that must be completed on variable speed drive units.

Laboratory grades are assigned when the **fully working** project is finished; the instructor then signs off to it. These assignments must be in full working condition otherwise a grade of 0% is entered into the grade book for that project. The rubric is pass or fail on these laboratory grades as in industry quality control is paramount. The industry leaders who hire our students do not allow partially manufactured products to leave their plant. Laboratory assignments require the students to perform certain step-by-step activities. An example of a final project rubric in the Basic Machine Shop course is included in Appendix D. Lab projects are critiqued by the instructor each student on projects that lead up to graded projects. During each critique instructors make suggestions and provide additional help and instruction to each student on a one-on-one

basis. Depending on the specific activity, students are given time to practice and troubleshoot projects, but once he/she declares a project ready to grade, the instructor will assign the grade. Another example of a rubric that is used to explain and grade soldering is attached at Appendix E.

Upon analysis of student feedback during evaluations, instructor feedback from the department, and from supervisors at the International Paper Corporation, the PLC and Pneumatics/Hydraulics instructors decided to revamp those classes with a different textbook that provides PowerPoint modules to follow along with the chapters. That instructional media is helpful to visual learners. More information on this change is discussed in question 4.

The students participate in three to five industrial plant tours every year. The average participant number was 17 students in 2013 and 19 students in 2012. Tours for spring semesters 2012 and 2013 were as follows:

2013 Tours:

1. Hood Packaging – April 5th
2. Graphics Packaging – April 12th
3. Great Lakes Chemical - April 19th

2012 Tours

1. Superior Uniform Group – February 15th
2. Hood Packaging – April 3rd
3. Great Lakes Chemical - April 5th
4. Clearwater – April 10th
5. Graphics Packaging – April 19th

Feedback in discussion during the tours from the students and the plant tour leaders assists faculty in determining what has been retained in the learning process. The tours familiarize students with actual plant environments as they prepare for the testing and interview process because they will be competing with experienced applicants who have years of on-the-job training. Examples of questions encountered during tours include the following:

- At Graphics Packaging, the supervisor quizzed the students on the following:
    1. What is the main purpose of a synchronous motor?
    2. How do you synchronize a synchronous motor?
    3. At what speed does a 2-pole motor rotate?
    4. What is the purpose of a bubble line?

5. What is the pressure on the bottom of a 50 feet tank if there is 44 feet of fluid with a specific gravity of 1.2?
6. What is the problem with this valve installation in this pulp line?

- At Superior Uniform Group, the superintendent showed the learners a Distributive Controls System (DCS), explained its operation, and discussed how it aided the technician in troubleshooting. Technicians also displayed an analog laser return on the robotic cranes, and they asked the students what the function of variable frequency drives was.

- At Clearwater, students were asked the differences between AC and DC drives, the accuracy changes, and costs. The tour guides explained the functions of electricity generation as the students toured the power house, and the guides illustrated the full paper-making operation from start to finish.

- Hood Packaging inquired about PLC (programmable logic controller) controls and robotics. Tour guides asked, "How do you connect to and program a PLC? What is open loop control versus closed loop control?" The students did a full plant tour of the robotic, tuber, and bottomer lines.

- Great Lakes Chemical toured the learners through the plant and showed the process in extracting bromine from brine. The students were asked the two methods to correct power factor. They were asked how variable speed pump control might save energy cost over valve control. Tour guides asked students to explain the difference between analog and discrete control.

The Electromechanical Technology program has experienced an average 90% job placement in the last six years as depicted in the tables that follow. Many of the companies that hire from our program have stringent, technical interviews. Georgia-Pacific Pulp and Paper Corporation of Crossett requires that the potential employees pass two technical exams that are very thorough to become technicians. We are proud that six of our students (unknown total who have applied) have passed those exams over the past three years. Also, Graphic Packaging of West Monroe requires an extremely complex technical interview that seven students of ten who applied have passed to become technical employees. Successfully completing these two industries' testing and hiring processes clearly indicates that those students have acquired the knowledge, skills, and abilities needed in this high-demand, high-wage career field.

UAM-CTC Electromechanical Technology (1st Year) Program Graduates and Job Placement Data					
Program Year	**Students Enrolled (Declared Majors)**	**Number/% of Graduates**	**Grad #/% Employed in the Field at Follow-up***	**Number of Non-Graduate** Completers**	**Total Placement in Field**
2007-2008	25	13/52%	10/77%	1	11
2008-2009	20	15/75%	12/80%	5	17
2009-2010	30	17/57%	17/100%	1	18
2010-2011	30	23/77%	22/96%	0	22
2011-2012	34	16/47%	15/94%	0	15
2012-2013	46	28/61%	26/93%	0	26

*Graduates who continue in the Electromechanical Technology-Instrumentation Program working toward the advanced technical certificate are considered "employed in the field."

**Non-graduate completers who become employed in the field, but do not finish all graduation requirements.

UAM-CTC Electromechanical Tech-Instrumentation-(2nd Year) Advanced Tech Certificate Program Graduates and Job Placement Data					
Program Year	**Students Enrolled (Declared Majors)**	**Number/% of Graduates**	**Grads #/% Employed in the Field at Follow-up***	**Number of Non-Graduate** Completers**	**Total Placement in Field**
2007-2008	16	8/50%	8/100%	0	8
2008-2009	22	13/59%	11/85%	2	13
2009-2010	20	15/75%	14/93%	0	14
2010-2011	21	17/81%	14/82%	0	14
2011-2012	26	23/88%	20/87%	0	20
2012-2013	23	22/96%	19/86%	0	19

*Graduates who continue in the Associate of Applied Science Degree in Industrial Technology are considered "employed in the field."
**Non-graduate completers who become employed in the field, but do not finish all graduation requirements.

4. Based on your analysis of student learning data in question 3, include an explanation of what seems to be improving student learning and what should be revised.

Analyses include feedback from test scores, students that have been on interviews, industrial leaders on plant tours, and supervisors from the industry who assist the instructors in making needed program changes. Furthermore, because they are experts in the field and know current trends and practices, our advisory committee members periodically recommend program changes.

In 2011 a departmental change included replacing the Basic Digital Electronics course with a new Advanced Instrumentation/Troubleshooting course. Certain portions of the Basic Digital

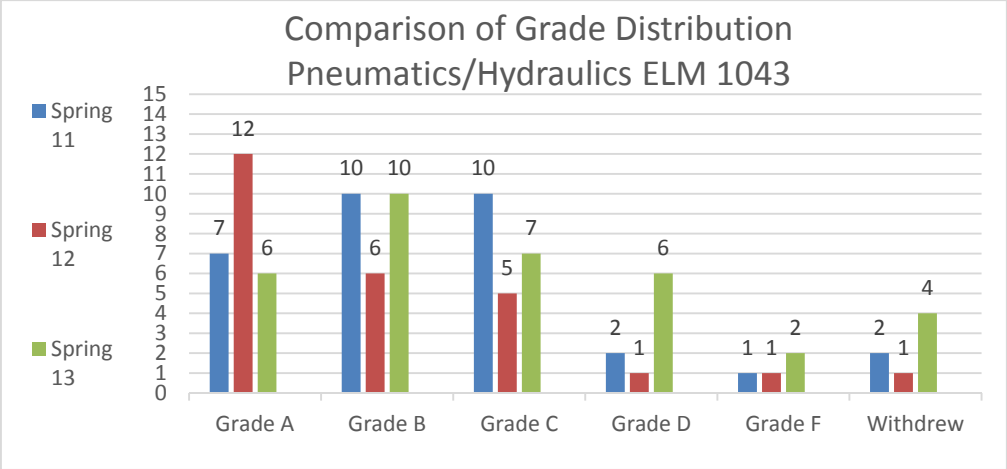
Electronics course were incorporated into the Programmable Logic Controllers curriculum. A full semester class in Digital Electronics was no longer deemed necessary due to changing technology.

From information gained from former students and industry leaders, more depth and experience in instrumentation troubleshooting was determined to be critical. Troubleshooting is an extremely important talent in the field. In making the decision to develop a new, advanced instrumentation course, one of the problems noticed was that the students were not always effectively able to apply their instrumentation knowledge and skills to troubleshooting. The Advanced Instrumentation/Troubleshooting course has helped the students to find and repair circuit problems.

Department faculty discussed making the change in curriculum, and a decision was made to go with the ATP (American Technical Publishers) learning program in several courses. This program is used at International Paper Company in Mansfield, Louisiana. The ATP program provides PowerPoint presentations along with a test generator which keeps the instruction standardized with what large industries, such as International Paper, are using for their in-house training programs.

The machine shop instructor and Programmable Logic Controller (PLC) instructor changed the textbook program to ATP for the Pneumatics/Hydraulics and PLCs courses in the spring of 2013. Industrial Mechanics and Industrial Diagrams are slated to go with ATP in the fall of 2013.

After completion of the first semester using ATP, results were a mixed review: the PLC grades improved but the Pneumatics/Hydraulics grades actually went down. See the charts of grade distribution with comments that follow. As with any curricular re-design, we anticipate that it will take us a few runs to get the difficulties worked out.

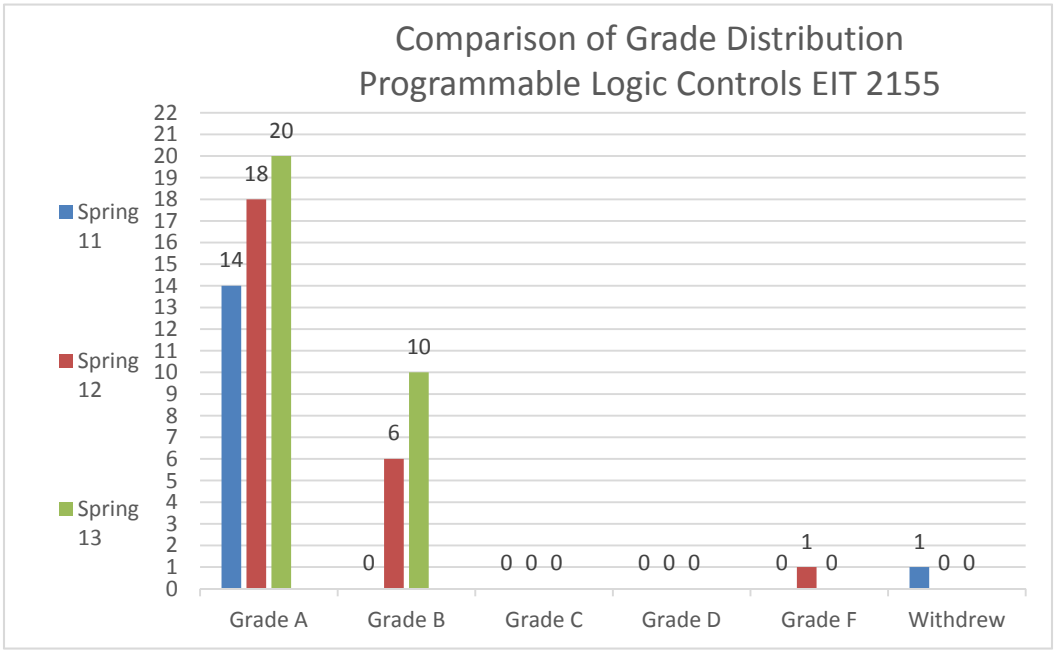


ELM 1043 is a 1st Year/2nd Semester course

The calculation of the above grade distribution indicates the following:

Spring 11: 90% passed; 83% passed with C or better
Spring 12: 92% passed; 88 passed with C or better
Spring 13: 83% passed; 66% passed with C or better

The new American Technical Publishing (ATP) curriculum was adopted in Spring 2013. The grades went down, but whether or not that was because the curriculum was just more difficult, more difficult/but better, or some other factor cannot be determined after only one semester.



EIT 2155 is a 2nd Year/2nd Semester course.
This chart shows that after adopting the American Technical Program (ATP) curriculum in Spring 2013, no students dropped or failed the course. One semester is not proof positive that the curriculum is better than what was used in the past, but it is an indication.

5. Other than course level/grades, describe/analyze other data and other sources of data whose results assist your unit to improve student learning.

A maintenance technician's job is to prevent and fix industrial equipment failures. As described in question 3, Electromechanical Technology students have made three to five plant tours annually over the last ten or more years. The tour guides and plant executives normally ask the students questions to find out about their knowledge of the field. Through this Q & A process, instructors have identified that students were exhibiting a problem retaining some critical knowledge/skills. In addition to this face-to-face feedback, former students were expressing that once on the job, they were having difficulty troubleshooting. The summer Advanced Instrumentation/ Troubleshooting was borne to address this issue.

The Advanced Instrumentation Troubleshooting course utilizes a computerized program called the Bench Mark Valve Analysis program. This program interfaces the equipment to a personal computer and strokes a valve in small incremental steps and the results are graphed on the computer screen. An example of both the data/numerical report as well as a graphical depiction of the same results is included in Appendix F. The. The students must analyze the data and determine whether it will pass or fail in the industrial process as well as possible methods that may be used to repair the device (valve). The instructor teaches the students how to calibrate the instruments into a precision state: a maximum of 0.25% error. Also in this course circuits are wired and "bugged" so that the students must use their electrical equipment and critical thinking skills to troubleshoot the circuit. The standard is that the circuit must be repaired and fully functional to get a grade. This is an example of a pass/fail lab assignment.

The department annually conducts student surveys of program graduates. Over the past three years, an average of 94% (120 out of 127) program graduates have been contacted for the telephone or in-person survey. From the beginning of their enrollment in each program, students are made aware that it is crucial to the program that they keep in touch with instructors to provide feedback on curriculum and job placement. The graduates answer the survey's inquiries and also make recommendations and suggestions in their comments about the program content and delivery. Instructors have primary responsibility for contacting and surveying graduates. As a back-up effort, the Student Services Coordinator and other staff also assist in making follow-up contacts.

Each year, at least one former student has served as a guest speaker not only to motivate the learners, but also to provide a wealth of "real world" information. In the past two years Ryan Edney who is employed at a fiberbox plant in El Dorado and Barry Fletcher who is employed at the Crossett Georgia-Pacific Paper Mill have visited classes to give pointers and encouragement

to students. Some graduates will visit with the instructors either in person or by telephone to provide suggested changes or emphases on items that need to be reviewed.

An example of feedback from an industry representative was a comment from a Georgia-Pacific supervisor when he visited the classroom as to the importance of accurately megging motors. With this feedback, the instructor now addresses the skill with students with one-on-one instruction. *(In explanation of the process, three-phase motors are powered by a poly-phase electrical supply that delivers continuous current through the use of multiple phases. This high-voltage electrical motor requires the use of a megohmmeter or megger to test the continuity and resistance of the motor and its electrical circuit. This is because only a megger is capable of producing the voltage necessary to travel properly through the motor's circuitry. In addition, the megger can detect small disturbances in the insulation of the circuitry.)* Students are advised as to how important it is to observe safety precautions while performing this task because the potential for electrical shock is very high.

6. As a result of the review of your student learning data in previous questions, explain what efforts your unit will make to improve student learning over the next assessment period. Be specific indicating when, how often, how much, and by whom these improvements will take place.

- Instructors have been researching a process control simulator. It has been determined that the simulator would be very beneficial but the cost of approximately $40K has prevented the department from acquiring it. This simulator would create a full process loop using a valve, PLC, and a PID (Proportional Integral Derivative) loop. We have concluded that we have the equipment for setting up the process, but we have experienced much difficulty in accomplishing a working process. This project has not been abandoned, but will be carried over into the next program year.

- Students in the spring 2013 semester (their second year and getting ready to graduate) made a request for a review session to be established. The first session was presented in the summer of 2013. Originally, this was going to be voluntary, but now the review sessions are mandatory. The results so far have shown to be very positive as evidenced by interest and gratitude expressed from the students.

- During the 2013 summer term, a PLC/conveyor trainer will be programmed and bugged. The learners will have to troubleshoot and alleviate the problem.

- As previously stated, four alignment trainers and four laser alignment trainers have been purchased and are in use in the machine shop section. These additions of equipment give students more opportunity to develop machining skills that will be required as millwrights to extend reliability and reduce variability of industrial machinery.

7. What new tactics to improve student learning has your unit considered, experimented with, researched, reviewed or put into practice over the past year?

- The Electromechanical Technology department recently obtained four alignment trainers and four laser alignment trainers. These trainers will provide an opportunity for practice and application for more students at the same time and will broaden the teaching platform of the Precision Maintenance course.

- Two new lathes were purchased for the Electromechanical Technology machine shop. This addition will improve student learning because it will provide more opportunities for students to practice without having excessive down time waiting for a machine.

- Overhead projectors have been installed that will allow PowerPoint presentations to be used. This medium will enhance learning for visual learners and engage all students more effectively.

- ATP (American Technical Publishers) unit training is going to be beta-tested in the fall of 2013 for two additional classes: Industrial Mechanics and Industrial Diagrams.

- The Advanced Instrumentation/Troubleshooting instructor has introduced the use of valve analysis. This is skill that will definitely help those involved with the process control areas of industries. The software program used is described in question 5.

- Kirk Kemp will serve as the lead person who will contact regional industry leaders to compile a up-to-date list of areas in the curriculum that need to be covered or covered in more depth.

- A concrete slab has been constructed that will house an outdoor instrumentation facility. This will simulate a “real world” experience for student learning. The students will get a 360 degree view of the processes.

8. How do you ensure shared responsibility for student learning and assessment among students, faculty and other stakeholders?

Ensuring shared responsibility is a continuous activity that must be consciously assessed. Each course has its own syllabus that specifically states what activities must be performed along with grading scales and grade weighting. Instructors cover the syllabi content and expectations at the beginning of semester for all courses. Feedback from the students is solicited to ensure that the students know the rules and content of the class.

The lab projects and written tests create a "checks and balances" system. The students show their knowledge and learning ability through test scores. Their mechanical, calibrating, and electrical skills abilities are proven through the laboratory work and hands-on projects. Faculty reviews the exams and the laboratory results to insure that what is being tested meets the demands of the workplace.

The instructors work with former students, plant tour leaders, advisory committees, faculty, and administrative staff to administer appropriate changes and emphases that may be needed to each and every course. This also applies to changes in the Electromechanical Technology Program content. Recently, Basic Digital Electronics was dropped and incorporated into the PLCs class to leave room to develop and offer the new Advanced/Instrument Troubleshooting course.

The Electromechanical Technology-Instrumentation Program was incepted in 1988 and has grown in popularity because it is a high-wage, high-demand career field. Our placement rates in the field have been solid over the last several years (see table on page 8 of this report). The companies that have hired our graduates have expressed on numerous occasions that they are pleased with our students. We consider this feedback as the ultimate proof that students are learning and we are making appropriate assessments in our program.

9. Describe and provide evidence of effort that your unit is making to recruit/retain/graduate students in your unit/at the University. (A generalized statement such as "we take a personal interest in our students" is not evidence.)

The design of the program(s) contributes to the effort to recruit/retain/graduate students in the Electromechanical Technology Program. That effort is evidenced by the overall layout of the program and its provision of multiple "exit points." Depending on students' life

circumstances, the certificates and degrees are “stackable” and can be finished in a continuous enrollment of two years or in increments as identified below:

After successful completion of one semester:
Industrial Equipment Repair – Certificate of Proficiency

After successful completion of two semesters plus one summer term:
Electromechanical Technology – Technical Certificate

After successful completion of four semesters plus two summer terms:
Electromechanical Technology-Instrumentation – Advanced Technical Certificate

With the completion of additional general studies courses, an individual may obtain an Associate of Applied Science in Industrial Technology.and an Associate of Applied Science in General Technology.

The following examples demonstrate other ways the department is trying to recruit/retain/graduate students:

- An early-morning (7 a.m.) study session is provided to students in the Electromechanical Technology Instrumentation program Mondays through Thursdays. Students appreciate the instructors who contribute to this special study/tutoring time.

- An attendance policy that places a student on attendance probation for 15% absence and fails the individual for 20% absence is in place. This policy was brought about to enhance student retention.

- UAM-CTC has a part-time Career Coach who works with at-risk students to identify problems that may be inhibiting their academic success. Bad grades, consistent tardiness, and attendance issues are reviewed. The specialist also works with the instructors to gain important clues for determining specific resources needed for success.

- The Career Pathways Initiative helps eligible working parents. The program assists students with gasoline purchases, tuition, books, and childcare. The program also provides tutoring in math and English for Career Pathways students.

- A Student Services Coordinator helps with financial aid, with personal conduct, and with assisting instructors and staff in counseling student who have low grades at mid-semester. All of these issues impact retention.

- The Electromechanical Technology-Instrumentation instructors all serve as academic advisors to the students. The duties include: enrolling students in classes, performing advisement reports, making sure that the students apply for their degrees and diplomas.

- Instructors offer individual assistance for struggling students.

- Tutors in math and English are made available for learners who need assistance.

- Three to five industrial plant tours are administered to help retention by promoting student interest. These tours educate the individuals what their work lives will be like when they graduate. Specific information on tours is presented in question number three (3).

- An Electromechanical Technology instructor attended the Hamburg High School Career Fair in Hamburg, Arkansas, on February 27, 2013, from 8:00 a.m. until noon, to promote the program.

- One of the instructors participated in College Sunday on March 9, 2013, to assist potential students in applying for financial aid for the Electromechanical Technology-Instrumentation program and any individual who is preparing for college enrollment at any college or university. This is a community service that parents and students as well as returning adult learners greatly appreciate. Many times students are actually recruited through this personal attention who might not have sought information about technical programs.

ASSOCIATE OF APPLIED SCIENCE
INDUSTRIAL TECHNOLOGY
GRADUATION REQUIREMENTS
(Suggested Schedule)

Fall Semester

MATH	0183	Intermediate Algebra
ELM	1064	Industrial Electricity
ELM	1074	Industrial Mechanics
ELM	1033	Industrial Diagrams
ELM	1012	Maintenance Welding
	Exit:	**Industrial Equipment Repair Certificate of Proficiency**

Spring Semester

ELM	1054	Industrial Circuits & Controls
ELM	2084	Advanced Industrial Mechanics
ELM	1043	Pneumatics & Hydraulics
ENGL	1013	Composition I
CIS	1013	Intro to Computer-based Systems

Summer Term I

ELM	1023	Basic Machine Shop
COMM	1102	Employability Skills/Ethics
	Exit:	**Electromechanical Technology Technical Certificate**

Fall Semester

EIT	2103	Industrial Electric Motors/AC Drives
EIT	1704	Solid State/Analog Circuits
EIT	2613	DC Controls
EIT	1123	Industrial Safety

Spring Semester

EIT	2155	Programmable Logic Controls
EIT	2145	Instrumentation
EIT	1112	Precision Maintenance
EIT	2163	Adv Instrumentation/Troubleshooting
	Exit:	**Electromechanical Instrumentation Technology Advanced Technical Certificate**

ENGL	1023	Composition II
		One of the following courses:
		PSY 1013 Introduction to Psychology
		HIST 1012 Survey of Civilization I
		HIST 1023 Survey of Civilization II
		HIST 2213 American History I
		HIST 2223 American History II
		SOC 2213 Introduction to Sociology
		PSCI 2213 American National Government
	Exit:	**Associate of Applied Science Degree in Industrial Technology (Total-72 semester credit hours)**

Student Learning Outcomes

Electromechanical Technology Program

Successful completers of this program will be able to:

•perform reading for the purpose of machining, quality checks, or assembly of components and will have an understanding as to how tolerances affect equipment's ability to run.

•safely work with machine shop, hand, and power tools and perform precise measurements with layout tools.

•demonstrate an understanding of power components to include: bearings and seals, chains and sprockets, speed reducers and pumps.

•understand and utilize precision maintenance practices and be able to perform equipment shaft alignment by straight edge, dial indicator and laser alignment methods. Also demonstrate the importance of balancing and vibration analysis and its effect on the facility's return on investment.

•read and understand components of hydraulic circuits, and demonstrate troubleshooting techniques through trainer exercises.

Electromechanical Technology Instrumentation

Successful completers of this program will be able to:

●promote a safe working environment.
●troubleshoot and wire electrical equipment.
●perform mechanical adjustments and repairs.
●calibrate instrument devices.
●describe industrial process control loops.
●wire and program programmable logic controllers (PLCs).

Accreditations/Certifications

UAM College of Technology-Crossett (UAM CTC) is accredited by the Commission of Higher Learning (a commission of the North Central Association of Colleges and Schools). The college is also recognized as an Eligible Training Provider by the Arkansas Workforce Investment Board and is approved by the Arkansas Department of Career Education and the Veteran's Approving Agency. Additionally, several of our programs are approved by their respective approving agencies, including:

●Electrical Apprenticeship program - The Bureau of Apprenticeship Training
●Practical Nursing program - Arkansas State Board of Nursing
●Nursing Assistant - The Department of Health and Human Services' Division of the Office of Long Term Care
●Emergency Medical Technician (Basic) - Arkansas Department of Health and Human Services' Office of Emergency Medical Services and Trauma Systems
●Networking courses approved by Cisco and the college is recognized as a Local Cisco Training Academy

Electromechanical Technology & Electromechanical Technology Instrumentation

Program Information 2012-2013

"Training for Jobs of Today and Tomorrow"

University of Arkansas at Monticello
College of Technology-Crossett
1326 Highway 52, W
Crossett, AR 71635
Telephone: 870-364-6414
Toll-free: 866-323-3384
Fax: 870-364-5707
Web Site: www.uamont.edu

Electromechanical Technology Program

The Electromechanical Technology (ET) program is designed to prepare individuals for entry-level jobs in industrial settings that require electrical and mechanical skills. While the program focuses primarily on industrial settings, graduates of the program are prepared for maintenance jobs in a variety of different workplaces such as schools, hospitals, banks, government agencies, and independent contractors. The Industrial Equipment Repair Certificate of Proficiency and the Electromechanical Technology Technical Certificate provide both one semester and one year educational opportunities for students.

Upon satisfactory completion of the first semester of the ET Program, students will earn a certificate of proficiency in Industrial Equipment Repair. This certificate of proficiency acknowledges that the student has developed basic competencies in industrial electricity and mechanics for limited entry-level maintenance jobs usually outside of the industrial setting unless the student has multiple years of maintenance work experience.

Students continuing on to satisfactorily complete the one-year ET program will earn a technical certificate. Graduates of the ET program should possess those skills necessary to compete for entry-level maintenance jobs in a variety of workplace settings and apprentice/trainee positions in the industrial setting. Students pursuing high-demand, high-wage maintenance jobs in the industrial setting should note that these jobs usually require advance training (at least two years) and/or maintenance work experience.

Program Costs:

Electromechanical Technology (1 year)	
Total Tuition & Fees	**$3,136**
Books & Supplies (Approximately)	**$1,096**

Electromechanical Instrumentation Technology Program

The Electromechanical Instrumentation Technology (EIT) Advanced Technical Certificate program is designed to provide students with advanced industrial, electrical, mechanical, programmable logic skills, and instrumentation knowledge and skills. Graduates of the EIT program should possess the solid foundational knowledge and maintenance skills necessary to successfully compete for high-demand, high-wage jobs in advanced technological workplace settings. Examples of such maintenance jobs include electrical and instrumentation technicians, electrical and mechanical technicians, industrial mechanics, millwrights, and other related jobs. It should be noted however, that work experience is necessary to becoming a master technician in this career field.

The course prerequisites for enrolling in the EIT program are satisfactory completion of all the courses required for the one-year Electromechanical Technology Technical Certificate. Additionally, all the credits earned in EIT program will apply toward an Associate of Applied Science (AAS) Degree in Industrial Technology. Students ultimately desiring to pursue the AAS in Industrial Technology should make note of the general education course requirements when scheduling their classes each semester or term.

Program Costs:

Electromechanical Instrumentation Technology (2nd yr)	
Total Tuition & Fees	**$2,286**
Books & Supplies (Approximately)	**$881**

UAM-CTC

Graduation Requirements

(Suggested Schedule)

Fall Semester			**Credit Hours**
MAT	2214	Advanced Industrial Mathematics **OR**	4
		**MATH 0183 Intermediate Algebra	
ELM	1064	Industrial Electricity	4
ELM	1074	Industrial Mechanics	4
ELM	1033	Industrial Diagrams	3
ELM	1012	Maintenance Welding	2
		Total Hours	**16-17**

Exit: Industrial Equipment Repair Certificate of Proficiency

Spring Semester			
ELM	1054	Industrial Circuits & Controls	4
ELM	2084	Advanced Industrial Mechanics	4
CFA	1103	Tech Computer Fundamentals **OR**	3
		**CIS 1013 Intro to Computer-based Sys	
ELM	1043	Pneumatics & Hydraulics	3
ENGL	1013	**Composition I **OR**	3
		COMM 1203 Tech Communications	

Summer Term 1			
ELM	1023	Basic Machine Shop	3
COMM	1102	Employability Skills/Ethics	2
		***Required for AAS*	
		Total Hours	**38-39**

Exit: Electromechanical Technology Technical Certificate

Fall Semester			
EIT	2103	Industrial Motors/AC Drives	3
EIT	1704	Solid State/Analog Circuits	4
EIT	2613	DC Controls	3
EIT	1123	Industrial Safety	3

Spring Semester			
EIT	2155	Programmable Logic Controls	5
EIT	2145	Instrumentation	4
EIT	1112	Precision Maintenance	2
EIT	2163	Adv Instrumentation/Troubleshooting	3
		Total Hours (2nd Year only)	**28**

Grand Total: (Both years) 66-67

Exit: Electromechanical Instrumentation Technology Advanced Technical Certificate

ELECTROMECHANICAL TECHNOLOGY

Program Description

The Electromechanical Technology (ET) program is designed to prepare individuals for entry-level jobs in industrial settings that require electrical and mechanical skills. While the program focuses primarily on industrial settings, graduates of the program are prepared for maintenance jobs in a variety of workplaces such as schools, hospitals, banks, government agencies, and independent contractors.

Upon satisfactory completion of the first semester of the Electromechanical Technology program, students will earn a certificate of proficiency in Industrial Equipment Repair. This certificate of proficiency acknowledges that the student has developed basic competencies in industrial electricity and mechanics for limited entry-level maintenance jobs (usually outside of the industrial setting unless the student has multiple years of maintenance work experience).

Students continuing on to satisfactorily complete the one-year Electromechanical Technology program will earn a technical certificate. Graduates of the Electromechanical Technology program should possess those skills necessary to compete for entry-level maintenance jobs in a variety of workplace settings and apprentice/trainee positions in the industrial setting. Students pursuing high-demand, high-wage maintenance jobs in the industrial setting should note that these jobs usually require advance training (at least two years) and/or maintenance work experience. Some of the courses in the Electromechanical Technology program may be offered both day and night to accommodate rotation shift workers provided there is sufficient enrollment to support duplicate offerings.

Graduates of the Electromechanical Technology program desiring to receive advanced training may continue their studies by enrolling in the second year program, Electromechanical Technology-Instrumentation, which leads to an advanced technical certificate. With the successful completion of three to five additional courses beyond the advanced technical certificate, a student can earn an Associate of Science in Industrial Technology degree.

Student Learning Outcomes

Successful completers of this program will be able to:

- perform reading for the purpose of machining, quality checks, or assembly of components for assembly and will have an understanding as to how tolerances affect equipment runability.
- safely work with machine shop, hand and power tools and perform precise measurements with layout tools.
- demonstrate an understanding of power components to include: bearings and seals, chains and sprockets, speed reducers and pumps.
- understand and utilize precision maintenance practices and be able to perform equipment shaft alignment by straight edge, dial indicator and laser alignment methods. Also demonstrate the importance of balancing and vibration analysis and its effect on the facility's return on investment.
- read and understand components of hydraulic circuits, and demonstrate troubleshooting techniques through trainer exercises.

The length of the Electromechanical Technology Technical Certificate for a student attending full-time is two (2) semesters and one (1) summer term. Program costs are approximately $3,136 for tuition and fees are $1,096 for books and supplies.

GRADUATION REQUIREMENTS

(Suggested Schedule)

		Fall Semester	**Credit Hours**
MAT	2214	Advanced Industrial Math **OR** **MATH 0183 Intermediate Algebra (3 Credit Hours)	4
ELM	1064	Industrial Electricity	4
ELM	1074	Industrial Mechanics	4
ELM	1033	Industrial Diagrams	3
ELM	1012	Maintenance Welding	2
		Exit: Industrial Equipment Repair Certificate of Proficiency	**(16-17)**
		Spring Semester	
ELM	1054	Industrial Circuits & Controls	4
ELM	2084	Advanced Industrial Mechanics	4
ELM	1043	Pneumatics & Hydraulics	3
ENGL	1013	**Composition I (ACTS Equiv # ENGL 1013) **OR** COM 1203 Tech Communications	3
CIS	1013	**Introduction to Computer-based Systems *(ACTS equiv # CPSI 1003)* (or higher-level) **OR** CFA 1103 Tech Computer Fundamentals	3
		Summer I Term	
ELM	1023	Basic Machine Shop	3
COM	1102	Employability Skills/Ethics ***Required for AAS*	2
		Exit: Electromechanical Technology Technical Certificate	**38-39**

Appendix B-1

ELECTROMECHANICAL TECHNOLOGY – INSTRUMENTATION

Program Description

The Electromechanical Technology-Instrumentation (ETI) program is designed to provide students with advanced industrial electromechanical skills with an emphasis in electrical motors, AC drives, DC controls, programmable logic controllers, instrumentation, and precision maintenance. Graduates of the ETI program should possess the solid foundational knowledge and maintenance skills necessary to successfully compete for high-demand, high-wage jobs in advanced technological workplace settings. Examples of such maintenance jobs includes electrical and instrumentation technicians, electrical and mechanical technicians, industrial mechanics, millwrights and other related jobs. It should be noted, however, that work experience is necessary to becoming a master technician in this career field.

The course prerequisites for enrolling in the Electromechanical Technology-Instrumentation (ETI) program are satisfactory completion of all the courses required for the one-year Electromechanical Technology Technical Certificate. Additionally, all the credits earned in ETI program will apply toward an Associate of Applied Science (AAS) in Industrial Technology degree. Students ultimately desiring to pursue the AAS in Industrial Technology should make note of the general education course requirements when scheduling their classes each semester or term.

Student Learning Outcomes

Successful completers of this program will be able to:
- promote a safe working environment.
- troubleshoot and wire electrical equipment.
- perform mechanical adjustments and repairs.
- calibrate instrument devices.
- describe industrial process control loops.
- wire and program programmable logic controllers (PLCs).

The length of the Electromechanical Technology-Instrumentation program for a full-time student is two (2) semesters. The approximate program costs are $2,286 for tuition/fees and $881 for books and supplies. *NOTE: Students must have completed Electromechanical Technology technical certificate to enroll in the following courses.*

GRADUATION REQUIREMENTS
(Suggested Schedule)

		Fall Semester	
EIT	2103	Industrial Electrical Motors/AC Drives	3
EIT	1704	Solid State/Analog Circuits	4
EIT	2613	DC Controls	3
EIT	1123	Industrial Safety	3
		Spring Semester	
EIT	2155	Programmable Logic Controls	5
EIT	2145	Instrumentation	5
EIT	1112	Precision Maintenance	2
		Summer I Term	
EIT	2163	Advanced Instrumentation/Troubleshooting	3
		Exit: Electromechanical Technology-Instrumentation Advanced Technical Certificate	**28**

ASSOCIATE OF APPLIED SCIENCE – INDUSTRIAL TECHNOLOGY
GRADUATION REQUIREMENTS
(Suggested Schedule)

		Fall Semester	**Credit Hours**
MATH	0183	Intermediate Algebra or higher-level mathematics course	3
ELM	1064	Industrial Electricity	4
ELM	1074	Industrial Mechanics	4
ELM	1033	Industrial Diagrams	3
ELM	1012	Maintenance Welding	2
		Exit: Industrial Equipment Repair Certificate of Proficiency	**(16)**
		Spring Semester	
ELM	1054	Industrial Circuits & Controls	4
ELM	2084	Advanced Industrial Mechanics	4
ELM	1043	Pneumatics & Hydraulics	3
ENGL	1013	Composition I *(ACTS equiv # ENGL 1013)*	3
CIS	1013	Introduction to Computer-based Systems *(ACT equiv # CPSI 1003)* or higher-level computer course	3
		Summer I Term	
ELM	1023	Basic Machine Shop	3
COM	1102	Employability Skills/Ethics	2
		Exit: Electromechanical Technology Technical Certificate	
		Fall Semester	
EIT	2103	Industrial Electrical Motors/AC Drives	3
EIT	1704	Solid State/Analog Circuits	4
EIT	2613	DC Controls	3
EIT	1123	Industrial Safety	3
		Spring Semester	
EIT	2155	Programmable Logic Controls	5
EIT	2145	Instrumentation	5
EIT	1112	Precision Maintenance	2
		Summer I Term	
EIT	2163	Advanced Instrumentation/Troubleshooting	3
		Exit: Electromechanical Instrumentation Technology Advanced Technical Certificate	
ENGL	1023	Composition II *(ACTS Equiv #ENGL 1023)*	3
		One of the following courses:	3
		PSY 1013 *(ACTS Equiv # PSYC 1103)* Introduction to Psychology	
		HIST 1013 *(ACTS Equiv # HIST 1113)* Survey of Civilization I	
		HIST 1023 *(ACTS Equiv # HIST 1123)* Survey of Civilization II	
		HIST 2213 *(ACTS Equiv # HIST 2113)* American History I	
		HIST 2223 *(ACTS Equiv # HIST 2123)* American History II	
		SOC 2213 *(ACTS Equiv # SOCI 1013)* Introduction to Sociology	
		PSCI 2213 *(ACTS Equiv # PLSC 2003)* American National Government	
		Exit: Associate of Applied Science in Industrial Technology Degree	**72**

UAM COLLEGE OF TECHNOLOGY - CROSSETT

Course Syllabus

Fall 2012 Semester

Department of Electromechanical Technology

Instructor: Kirk Kemp
E-mail: kemp@uamont.edu
Location: Industrial Technology Building - office 3B
Telephone Number: 870-364-6414 ext.166 or 876-323-3384 ext. 166
Class Meets: Tuesday, Thursday – 12:00-3:00
Office Hours: Monday, Tuesday, Wednesday, and Thursday 7:30-8:00;
Monday and Wednesday 12:30-1:00;
Tuesday and Thursday 3:00-3:30

I. Course Number: EIT 2613-02

II. Course Title: D.C. Controls

III. Credit Hours: 3 Credit Hours (2 Theory - 4 Lab)

IV. Course Description: This course is designed to study applications for Industrial and commercial environments utilizing D.C. motors and D.C. controllers. Included in this class will be motor controller design, hookup, and troubleshooting.

V. Prerequisites: ELT 1604 Industrial Circuits & Controls

VI. Course Texts and Supplemental Materials: DC Control Equipment (Electrical Equipment Series 727) 1992, Schoolcraft Publishing, Telemedia Inc., Scientific Calculator, Multimeter.

VII. Student Learning Outcomes:

After successfully completing this course an individual should be able to:

1. Name the factor that influences induced EMF.
2. Disassemble and perform repairs on direct current generators.
3. Explain the differences between self-excited and separately-excited generators.
4. Define the differences, advantaging and disadvantages between series, shunt and compound generators.
5. Perform repairs on direct-current motors.
6. Define direct-current motor control methods and their operations.
7. Disassemble and repair basic alternating current generators.
8. Compute losses and efficiencies on an alternating current generator.
9. Describe various ways to produce direct current
10. Define commutation

VIII. Evaluation:

The grade breakdown will be as follows:

Total exam and quiz score: 60%
Laboratory scores: 30%
Final Exam: 10%

Daily participation, tours, guest speakers, oral reports, written reports or articles, research, etc. may also be utilized from time to time.

Tests will be given often and at the announced times. They will cover conceptual units of related material. Material covered will be from the text, notes given by the instructor, labs, and any other materials assigned to the class as being pertinent to the course. Most activities will be fewer points. No individual bonus work will be allowed.

As this class covers a body of knowledge that is built up step-by-step, attendance and doing every day's work is extremely important. Arrangements with the instructor to make up any work missed due to an absence must be made up within one week upon returning to class. *Labs, tours, guest lectures, etc. may not be made up due to the non-availability of time and/or resources.*

Grading Scale:

90 to 100 is an A	I = incomplete.
80 to 89 is a B	C/R Credit Received
70 to 79 is a C	W=Withdrawn
60 to 69 is a D	
0 to 59 is an F	

C/R and W are not used in computing a student's GPA.

Last day to drop is October 31st

IX. Grade Mailing Policy: UAM will no longer mail grade reports to all students. You may access your grades through Campus Connect on the UAM homepage, http://www.uamont.edu/. To have your grades mailed to you, complete the grade request form available in the Registrar's Office in Monticello or the Student Services offices in Crossett and McGehee.

X. Students Disability Policy: It is the policy of the University of Arkansas-Monticello to accommodate individuals with disabilities pursuant to federal law and the University's commitment to equal educational opportunities. It is the responsibility of the student to inform the instructor of any necessary accommodations at the beginning of the course. Any student requiring accommodations should contact the Office of Special Students representative on campus at 870 364-6414; fax 870 364-5707, toll free 1-866-323-3384.)

XI. Cheating/Plagiarism: Cheating of any type or by any means will not be tolerated and will subject to appropriate discipline.

XII. Student Conduct Statement: Students at the University of Arkansas at Monticello are expected to conduct themselves appropriately, keeping in mind that they are subject to the laws of the community and standards of society. The student must not conduct him/herself in a manner that disrupts the academic community or breeches the freedom of others to progress academically.

Academic dishonesty:

1. Cheating: Students shall not give, receive, offer, or solicit information on examinations, quizzes, etc.

   This includes but is not limited to the following classes of dishonesty:
   a. Copying from another student's paper;
   b. Use during the examination of prepared materials, notes, or texts other than those specifically permitted by the instructor;
   c. Collaboration with another student during the examination;
   d. Buying, selling, stealing, soliciting, or transmitting an examination or any material purported the unreleased contents of coming examinations or the use of any such material;
   e. Substituting for another person during an examination or allowing such substitutions for oneself.
2. Collusion: Collusion is defined as obtaining from another party, without specific approval in advance by the instructor, assistance in the production of work offered for credit to the extent that the work reflects the ideas of the party consulted rather than those of the person whose name is on the work submitted.
3. Duplicity: Duplicity is defined as offering for credit identical or substantially unchanged work in two or more courses, without advanced specific approval of the instructors involved.
4. Plagiarism: Plagiarism is defined as adopting and reproducing as one's own, to appropriate to one's use, and to incorporate in one's own work without acknowledgement the ideas or passages from the writing or works of others.

If you wish to talk, sleep, play games, pass notes, look at pictures, work on homework, or anything else that is not related to the class and/or lecture, *don't come to class.*

Any pager, cell phone that rings/beeps during class will be confiscated and returned at a later date. Cell phones are not to be used as calculators.

Students must use their own calculator and may not share calculators. Use of instructor's computer is prohibited.

Any violation of the above policy or department rules will result in appropriate discipline including: verbal or writing up the incident, being sent to administration, and may include possible dismissal from the class, or campus.

XIII. Attendance Policy:

Regular and prompt attendance is expected of all students enrolled at UAM-CTC and is necessary to maintain satisfactory progress. Attendance will be recorded for each student by course. A student will be placed on attendance probation once he/she has been absent 15% of the total scheduled hours of a course.

When the student is absent 20% of the total scheduled hours of a course, the student will be officially notified in writing. A letter grade of "F" will be recorded for the course unless the student has officially withdrawn. Only students who officially withdraw before the official withdrawal date will receive a "W" in the course. A student will be notified of attendance probation in writing provided he/she has returned to school before reaching 20% absences. A student terminated for poor attendance may be considered for re-enrollment in the course at its next offering with the consultation and approval of the instructor and school administration.

A student cannot use make-up time to reduce hours of absence any time during the school year. Each time a student is late for class or leaves early, the student will be charged a full hour or hours of absence (rounded up to the larger hour of time).

In a case of extreme emergency, a student may request a leave of absence. A leave of absence must be requested in writing and may be granted or denied by the Director of Student Services. Written documentation supporting the request for a leave of absence must be provided prior to the granting of the leave or the first day back in class after the leave. The leave of absence must be for no less than seven (7) calendar days and for no more than 21 calendar days during a fall or spring semester or 10 calendar days during a summer term. If a student's absences reach 20% of the total class hours and the student has not been approved for a leave of absence, the student will receive an "F" in the course, unless the student withdraws by the allowable date to receive a "W." No more than one such leave of absence can be granted in a twelve-month period.

Upon receipt of proper documentation, absences caused by court subpoena, jury duty, military orders, or other government ordered visit(s) will be recorded but not included in the total cumulative hours of absence per course. The documentation must be submitted on the first day the student returns to school. Also, absences because of a natural disaster (as determined by the administration) will not be counted in the hours of absence.

Agencies granting financial assistance will be notified as required of all absences of those students receiving financial aid. The policy of each agency regarding payment when a student is absent will apply in each case.

The door will be locked at the beginning of each class until a scheduled break and locked again upon restarting class.

XIV. Course Assignment and Test Schedule:

Week 1: Orientation, single-phase transformer review.

Week 2: Chapter 1. Exam 1.

Week 3: Chapter 2. Contact relay lab.

Week 4: Exam 2. Chapter 3.

Week 5: Series generator lab, shunt generator lab, compound generator lab.

Week 6: Exam 3. Chapter 4.

Week 7: Series motor lab, shunt motor lab, compound motor lab.

Week 8: Exam 4. Chapter 5.

Week 9: Exam 5. 3-phase transformers.

Week 10: Three phase transformer lab.

Week 11: Chapter 6. Reduced voltage starter lab.

Week 12: Chapter 7. Motor starter lab.

Week 13: Exam 7. Chapter 8.

Week 14: Exam 8. Soldering lab.

Week 15: Chapter 9. SCR Lab.

Week 16: Review, Final Exam.

XV. Course Outline:

A. DC Power
1. DC control advantages
2. Generators
3. Rectifiers
4. Motors
5. Electrical Storage
6. Electroplating, electropolishing, electroforming and welding

B. Magnetism
1. Magnetic materials
2. Nature of magnetism
3. Magnetic fields around current carrying conductors
4. Electromagnets and solenoids
5. Saturation

C. Direct-current Generators
1. Generator construction
2. Single-coil generator
3. Multi-coil armatures
4. Methods of field excitation
5. Commutation
6. Voltage regulation
7. Separately excited generators
8. Self-excited shunt generators
9. Series generators
10. Compound generators
11. Efficiency

D. Direct-current Motors and Controls
1. Motor principle
2. Torque
3. Generator action in a motor
4. Shunt motors
5. Series motors
6. Compound motors
7. Controllers and starters
8. Motor protection
9. Drum controllers
10. Magnetic contractors
11. Dynamics braking

E. DC Armatures
1. Armature types
2. Windings
3. Armature possess and efficiency
4. Commutation
5. Armature maintenance
6. Armature troubleshooting

F. DC Relays
1. Operating characteristics
2. Relay types
3. Magnetic blowout coils
4. Dynamic Braking

G. DC Controllers
1. Classifications
2. Factors affecting motor speed
3. Manual, semiautomatic, and automatic controllers
4. Overvoltage and undervoltage protection
5. Overload protection
6. Drum controllers

H. DC Power Supplies

1. Vacuum tube theory
2. Rectifiers
3. Diodes
4. Half wave rectification
5. Full wave rectification
6. Semiconductors
7. Generator and rectifier comparisons

I. Silicon Controlled Rectifiers
1. Lead identification
2. Gate timing
3. How to shut off an SCR
4. DC applications
5. AC applications

J. Maintaining DC Equipment
1. Troubleshooting field coils
2. Relay maintenance
3. Contact maintenance
4. DC armature maintenance
5. Commutation
6. Brush selection and adjustments

(The instructor may modify the above as needed.

XVI. Fall 2012 Important Dates:

August 22 (Wed)	First day of classes.
August 22-28 (Wed through Tues)	Late registration. A $25 late registration fee will be assessed.
August 22-28 (Wed through Tues)	Students may make schedule changes.
August 28 (Tues)	Last day to register or add fall classes.`
September 3 (Mon)	Labor Day Holiday. All offices and classes closed.
October 5 (Fri)	Deadline to apply for May graduation
October 31 (Wed)	***LAST DAY TO DROP A REGULAR FALL CLASS*** *(not applicable to fast-track classes).* ***GRADE WILL BE W.***
November 5 (Mon)	Preregistration for spring begins.
November 16 (Fri)	Preregistration for spring ends.
November 20 (Tues)	All classes (day, evening, and distance education) will meet as usual.
November 21 (Wed)	Classes closed. University offices open.
November 22-23 (Thurs-Fri)	Thanksgiving Holiday. All offices and classes closed.
December 7 (Fri)	Last day of classes
December 10-14 (Mon)	Final Exams
December 19 (Wed)	Fall conferral of degrees and awards.

UAM
College of Technology-Crossett
Department of Electromechanical Technology

Instrumentation
Course Syllabus
Spring 2013 Semester

Instructor: Frederick Binns
Email: binnsf@uamont.edu
Telephone Number: (870) 460-2002
Class Meets: Monday and Wednesday 8:00 AM – 12:30 PM

Office Hours: 7:00 AM – 8:00 AM, Monday thru Thursday (By Appointment)

I. **Course Number**: EIT 2145

II. **Course title:** Instrumentation

III. **Credit Hours:** 5 (3 Hours Lecture; 6 Hours Lab)

IV. **Course Description:** This course presents four basic categories of instrumentation: pressure, flow, level, and temperature. The operation of primary sensing and transmitting elements, calibrations and adjustment of secondary elements such as recorders and electronic controllers are covered. Practical application will utilize feedback control loops, feed forward control loops, direct digital control, and final control element selection with regard to reliability and fail safe operation.

V. **Course Prerequisites:** ELM 1054 Industrial Circuits and Controls

VI. **Course Texts and Supplemental Materials:** Kirk, Weedon, Kirk, Instrumentation (Fifth Edition)**,** 2010, American Technical Publishers, Inc. A standard calculator, Amprobe multi-meter (Model 15XP-B), Husky 4-in-1 mini screwdriver, and basic hand tools are also required.

VII. **Course Objectives:** Starting from prerequisite class foundations, the course will provide an understanding for how and why instrumentation is used in the industrial manufacturing workplace. Based upon the understanding of how various instrumentation functions can be integrated to form production line simulation, will duplicate many operations the electrical and instrumentation technicians may encounter in industry.

VIII. **Evaluation:** Grades will be determined as follows.

Written Exams, Labs, Homework, and quizzes	50%
Final	40%
Lab Final	10%

Tools will not be supplied by the instructor or the college. Any student who does not bring his/her tools may receive a zero for the day.

Daily participation, tours, guest speakers, oral reports, written reports or articles, research, etc. may also be utilized from time to time.

Tests will be given often and at the announced times. They will cover conceptual units of related material. Material covered will be from the text, notes given by the instructor, labs, and any other materials assigned to the class as being pertinent to the course. Most activities will be fewer points. No individual bonus work will be allowed.

As this class covers a body of knowledge that is built up step-by-step, attendance and doing every day's work is extremely important. Arrangements with the instructor to make up any work missed due to an absence must be made up upon your return to class; any work submitted more than one week late will not be accepted. Labs, tours, guest lectures, Quizzes etc. may not be made up due to the non-availability of time and/or resources.

Grading Scale:

90 to 100 is an A	I = Incomplete
80 to 89 is a B	C/R = Credit Received
70 to 79 is a C	W = Withdrew
60 to 69 is a D	
Below 60 is an F	

C/R, I, and W are not used in computing a student's GPA. ***Students who withdraw from a course but who do not officially withdraw by mid-semester or mid-term will receive an "F" in the course.***

IX. Grade Mailing Policy: UAM will no longer mail grade reports to all students. You may access your grades through Campus Connect on the UAM homepage, http://www.uamont.edu/. To have your grades mailed to you, complete the grade request form available in the Registrar's Office in Monticello or the Student Services offices in Crossett and McGehee.

X. Students Disability Policy: It is the policy of the University of Arkansas-Monticello to accommodate individuals with disabilities pursuant to federal law and the University's commitment to equal educational opportunities. It is the responsibility of the student to inform the instructor of any necessary accommodations at the beginning of the course. Any student requiring accommodations should contact the Office of Special Students representative on campus at 870 460-2004; fax 870 364-5707, toll free 1-866-323-3384.)

XI. Cheating/Plagiarism: Cheating of any type or by any means will not be tolerated and will subject to appropriate discipline.

XII. Disruptive Behavior: The following action is prohibited under the Student Conduct Code: Disorderly Conduct: Any behavior which disrupts the regular or normal functions of the University community, including behavior which breaches the peace or violates the right of others.

If you wish to talk, sleep, play games, pass notes, look at pictures, work on homework, or anything else that is not related to the class and/or lecture, don't come to class.

All cell phones and pagers must be turned off or placed on "silent" to not disrupt class. If there is an emergency the student should take the call in the hallway. Any student who makes this a habit will not be allowed back into class that day.

Any pager or cell phone that rings/beeps during class will be confiscated and returned at a later date. After warning a student about having cell phones out in class, the student may be asked to leave the class and receive zero points for that day. Cell phones are not to be used as calculators. *Students must use their own calculator and may not share calculators.*

XIII. Attendance Policy: Regular and prompt attendance is expected of all students enrolled at UAM-CTC and is necessary to maintain satisfactory progress. In technical courses, attendance will be recorded for each student by course. A student will be placed on attendance probation in technical courses once he/she has been absent 15% of the total scheduled hours of a course.

When the student is absent 20% of the total scheduled hours of a course, the student will be officially notified in writing and dropped from the course. A letter grade of "F" will be recorded for the course unless official withdrawal by the student has been accomplished. The student will be notified of attendance probation in writing provided he/she has returned to school before reaching 20% absences. A student terminated for poor attendance may be considered for re-enrollment in the course at its next offering with the consultation and approval of the instructor and school administration.

A student cannot use make-up time to reduce hours of absence any time during the school year. Each time a student is late for class or leaves early, the student will be charged a full hour or hours of absence (rounded up to the larger hour of time).

In a case of extreme emergency, a student may request a leave of absence from technical courses. A leave of absence must be requested in writing and may be granted or denied by the Director of Student Services. Written documentation supporting the request for a leave of absence must be provided prior to the granting of the leave or the first day back in class after the leave. The leave of absence must be for no less than seven (7) calendar days and for no more than 21 calendar days during a fall or spring semester or 10 calendar days during a summer term. If a student's absences reach 20% of the total class hours and the student has not been approved for a leave of absence, the student will be dropped. No more than one such leave of absence can be granted in a twelve-month period.

Upon receipt of proper documentation, absences caused by court subpoena, jury duty, military orders, or other government ordered visit(s) will be recorded but not included in the total cumulative hours of absence per course. The documentation must be submitted on the first day the student returns to school. Also, absences because of a natural disaster (as determined by the administration) will not be counted in the hours of absence.

Agencies granting financial assistance will be notified as required of all absences of those students receiving financial aid. The policy of each agency regarding payment when a student is absent will apply in each case.

XIV. Course Assignment and Test Schedule:

Week 1: Exam on Intro to Instrumentation
Week 3: Exam on Temperature
Week 4: Lab Exam on Temperature
Week 6: Exam on Pressure
Week 7: Lab Exam on Pressure
Week 9: Exam on Level
Week 10: Lab Exam on Level
Week 12: Exam on Flow
Week 13: Lab Exam on Flow
Week 14: Exam on Automatic Control
Week 15: Lab Exam on Automatic Control
Week 16: Lab and Final Exam

XV. Course Outline:

A. Temperature
1. Temperature, Heat, and Energy
2. Thermal Expansion Thermometers
3. Electrical Thermometers
4. Infrared radiation Thermometers
5. Heat-Sensitive Materials

B. Pressure
1. Pressure
2. Pressure Instruments
3. Pressure Measurement Instruments

C. Level
1. Level
2. Mechanical Instruments
3. Electrical Instruments
4. Ultrasonic, Radar, and Laser Instruments
5. Nuclear Level Instrument
6. Weight Systems
7. Level Measurement Applications

D. Flow
1. Fluid Flow
2. Differential

3. Variable Area
4. Mechanical
5. Electrical
6. Mass

E. Automation
1. Automatic Control
2. Process Dynamics
3. Control Functions
4. Control Strategies
5. Tuning
6. Digital Controllers
7. Pneumatic Controllers
8. Electric Controllers
9. Operator Interfaces
10. Control Strategies

F. Final Elements
1. Final Elements
2. Control Valves
3. Regulators
4. Dampers
5. Actuators and Positioners
6. ON/OFF Control
7. Variable Speed Drives

G. Safety Systems
1. Individual Safety Devices
2. Electrical Safety Standards

(The instructor may modify the above outline as necessary)

UAM COLLEGE OF TECHNOLOGY - CROSSETT
Department of Electromechanical Technology

Spring Term 2013
PRECISION MAINTENANCE EIT 1112
Course Syllabus

Instructor: Gary Stevenson

Telephone Number: 870-364-6414 ext. 147, or toll free 1-866-323-3384

Class Meets: Tuesday or Thursday 1:30 – 5:30 P.M.

Office Hours: Monday & Wednesday 7:30 – 8:00 A.M.

I. **Course Number/Title:** EIT 1112 Precision Maintenance

II. **Credit Hours:** 2 Credit Hours (1 Hr Theory, 3 Hrs Lab)

III. **Student Learning Outcomes:** Upon completion of this course the student will be able to demonstrate knowledge of:

1. Benefits of precision maintenance to both employer and employee
2. Causes of equipment failures
3. Costs of precision maintenance
4. Vibration analysis
5. Precision alignment and soft foot
6. Precision measurement tools
7. Precision installation and removal of bearings
8. Precision measurement of shaft and housing fits
9. Balancing fundamentals and assembly errors
10. Torquing of fasteners with torque wrenches
11. Thermal growth
12. Mounting and proper lubrication of couplings
13. Basic construction drawings

IV. **Course Prerequisites:** MAT 2214 Advanced Industrial Mathematics, ELM 2084 Advanced Industrial Mechanics, and EIT 1123 Industrial Safety

V. **Course Text:** Mechanical Principles and Systems for Industrial Maintenance, by Richard Knotek and Jon Stenerson, 2006, ISBN: 0-13-049417-8.

VI. **Course Description:** This course is designed to prepare students for jobs where equipment repairs or installation of new equipment is needed through preventive, predictive, and precision maintenance skills, procedures, and methods of documentation for manufacturing and industrial environments. Instruction will analyze the root cause of equipment breakdown to avoid future breakdowns and loss of production time. This

knowledge will greatly aid in troubleshooting and performance enhancement of industrial equipment.

VII. **Evaluation:** The evaluation in this course will be based on a percentage found by dividing total points earned by total points possible. Points may be earned on homework, quizzes, written exams, and labs. Point values for each will be assigned by the instructor. The final course grade will be determined from 50% test and lab projects, 50% final test score.
Daily participation, tours, guest speakers, oral reports, written reports or articles, research, etc. may also be utilized from time to time. Tests will be given often and at the announced times. They will cover conceptual units of related material. Material covered will be from the text, notes given by the instructor, labs, and any other materials assigned to the class as being pertinent to the course. No individual bonus work will be assigned.

As this class covers a body of knowledge that is built upon step-by-step, attendance and doing every day's work is extremely important. Arrangements with the instructor to make up any work missed due to an absence must be made up upon your return to class. Labs, tours, guest lectures, etc. may not be made up due to the non-availability of time and/or resources.

Grading Scale:

100-90	A	I = Incomplete
80-89	B	C/R Credit Received
70-79	C	W = Withdrew
60-69	D	
59-0	F (unsatisfactory academic performance)	

Credit Received (C/R), Incomplete (I), and Withdrawal (W) are not used in computing a student's GPA.

Students who stop attending a course but who do not officially withdraw will receive an "F" in the course.

VIII. **Grade Mailing Policy:** UAM will no longer mail grade reports to all students. You may access your grades through Campus Connect on the UAM homepage, http://www.uamont.edu/. To have your grades mailed to you, complete the grade request form available from the UAM-CTC administration office.

IX. **Students with Disabilities Policy:** It is the policy of the University of Arkansas at Monticello to accommodate individuals with disabilities pursuant to federal law and the University's commitment to equal educational opportunities. It is the responsibility of the student to inform the instructor of any necessary accommodations at the beginning of the course. Any student requiring accommodations should contact the Office of Special Students representative on campus at 870 364-6414 or toll free 1-866-323-3384.

X. **Cheating/Plagiarism:** Cheating of any type or by any means will not be tolerated and will be subject to appropriate discipline.

XI. **Disruptive Behavior:** The following action is prohibited under the student conduct code:

Disorderly Conduct: Any behavior which disrupts the regular or normal functions of the University community, including behavior which breaches the peace or violates the right of others.

If you wish to talk, sleep, play games, pass notes, look at pictures, work on homework, or anything else that is not related to the class and/or lecture, *please do not come to class.*

Any pager or cell phone that rings/beeps during class will be confiscated and returned at a later date. Cell phones are not to be used as calculators. Students must use their own calculator and may not share calculators.

XII. **Attendance Policy:** Regular and prompt attendance is expected of all students enrolled at UAM-CTC and is necessary to maintain satisfactory progress. Attendance in technical courses will be recorded for each student by course. A student will be placed on attendance probation once he/she has been absent 15% of the total scheduled hours of a technical course.

When the student is absent 20% of the total scheduled hours of a course, the student will be officially notified in writing and dropped from the course. A letter grade of "F" will be recorded for the course unless official withdrawal by the student has been accomplished (see Withdrawal). The student will be notified of attendance probation in writing provided he/she has returned to school before reaching 20% absences. A student terminated for poor attendance may be considered for re-enrollment in the course at its next offering with the consultation and approval of the instructor and school administration.

A student cannot use make-up time to reduce hours of absence any time during the school year. Each time a student is late for class or leaves early, the student will be charged a full hour or hours of absence (rounded up to the larger hour of time).

In a case of extreme emergency, a student may request a leave of absence from technical courses. A leave of absence must be requested in writing and may be granted or denied by the Director of Student Services. Written documentation supporting the request for a leave of absence must be provided prior to the granting of the leave or the first day back in class after the leave. The leave of absence must be for no less than seven (7) calendar days and for no more than 21 calendar days during a fall or spring semester or 10 calendar days during a summer term. If a student's absences reach 20% of the total class hours and the student has not been approved for a leave of absence, the student will be dropped. No more than one such leave of absence can be granted in a twelve-month period.

Upon receipt of proper documentation, absences caused by court subpoena, jury duty, military orders, or other government ordered visit(s) will be recorded but not included in the total cumulative hours of absence per course. The documentation must be submitted on the first day the student returns to school. Also, absences because of a natural disaster (as determined by the administration) will not be counted in the hours of absence.

Agencies granting financial assistance will be notified as required of all absences of those students receiving financial aid. The policy of each agency regarding payment when a student is absent will apply in each case.

All missed tests must be made up within one week of the date the test was initially given. It is the student's responsibility to schedule the make-up with the instructor.

XIII. **Course Assignment and Test Schedule:**

Week 1: Objectives and Introduction of Maintenance Practices and Principles
Week 2: Vibration Analysis and Foundation Requirements
Week 3: Rough Alignment and Precision Measuring Tools
Exam 1

Week 4: Fits and Tolerances
Exam 2

Week 5: Alignment Soft Foot and Assembly Errors
Week 6: Introduction to Bearings, Bearing Failure and Wear Patterns
Exam 3

Week 7: Introduction to Precision Alignment and Precision Soft Foot Procedure
Week 8: Alignment Thermal Growth
Exam 4

Week 9: Unbalance of Shafts
Week 10: Unbalance and Installation of Couplings
Exam 5

Week 11: Belt Drive Alignment Procedures
Week 12: Balancing Fundamentals
Week 13: Bolt Grades and Torque Factors
Exam 6

Week 14: Rigging
Week 15: Bearing Mounting and Dismounting Practices

Week 16: Final Test

(Instructor may modify the above schedule as needed)

Spring 2013

January 9 (Wednesday) – First day of classes (regular and first 8-week fast-track classes).
January 9-15 (Wednesday thru Tuesday) – Late Registration. A $25 late registration fee will be assessed.
January 9-15 (Wednesday thru Tuesday) – Students may make schedule changes.
January 15 (Tuesday) – Last day to register or add classes.
January 21 (Monday) – Martin Luther King Holiday. Offices and classes closed.
February 13(Wednesday) – Last day to drop with a first 8-week fast-track class. Grade will be W.
February 22 (Friday) – Deadline to apply for August and December graduation.
March 4 (Monday) – Last day of first 8-week fast-track classes.
March 5 (Tuesday) – First day of second 8-week fast-track classes.
March 18-22 (Monday thru Friday) – Spring Break for faculty and students. All offices closed on March 22.
March 27 (Wednesday) – Last day to drop a regular spring class (Not fast-track classes). **Grade will be W.**
April 1 (Monday) – Preregistration for Summer and Fall 2013 begins.
April 12 (Friday) – Preregistration for Summer and Fall 2013 ends.
April 15 (Monday) – Last day to drop a second 8-week fast-track class. Grade will be W.
April 30 (Tuesday) – Last day of classes.
May 1-7 (Wednesday thru Tuesday) – Final exams
May 10 (Friday) – Commencement

Machine Shop
Final Project Rubric

Total points possible = 100

Job Function	Points Earned	First Step	Points Possible
Interpret and Machine 6205 Bearing Fit		Read and glean tolerances for fit. Next step→	Machine fit as to fit chart tolerances. **25 Points**
Consult Bearing Fit Chart as to 6206 Bearing Fit		Properly read chart as to tolerances for fit. Next step→	Machine fit to within stated tolerances. **25 Points**
Shoulder Length Tolerances		Read print as to placement of established shoulders as per fractional tolerances Next step→.	Machine and establish shoulders as preprint. **5 Points**
Keyways and Keys		Consult print as to milling instructions for standard depth keyways. Next step→	Machine keyways to shaft and fit key to milled slot, checking key height. **15 Points**
Hub Fit to Shaft (Interference Fit)		"Mike" coupling end of shaft and calculate fit as to standard rules. Next step→	Machine bore hub fit to shaft for shrinkage on application. **5 points**
Drill and Power Tap Coupling End of Shaft as Per Print		Consult tap drill chart; select appropriate drill; tap shaft on lathe. Next step→	Power tapped and countersink for easy start of threaded fastener. **5 Points**
Surface Quality of Machine Practices		Machine fit to .001 oversize and finish with emery cloth. Next step→	Smooth finish of shaft without burrs or chips. **5 Points**
Threading		Consult tap drill for thread pitch and set up lathe. Next step→	Cut and finish external threads for single point cutting for fit **15 Points**
BONUS TIR		Machine practices to produce <.002 Next step→	Check shaft for TIR <.002 **+5 Points-Bonus**

***NOTE*: Points are earned by job function if in tolerance; if out of tolerance, no points are earned!**

Student's Name: _____

Total Points Earned: _____

Wire Soldering Rubric

Name: _____ **Date: _____**

Activity	Score	Criteria for 8-10 Points	Criteria for 5-7 Points	Criteria for 2-4 Points	Criteria for 0-1 Point
Pigtail		Constructed properly with no stray strands, tightly wound.	Constructed properly with 2 to 5 stray strands, tightly wound.	Constructed properly with 2 to 5 stray strands, loosely wound.	Poor overall construction. Not at all to industry standards.
Pigtail Soldering		Applied sufficient heat. Kept iron clean. No excess solder for a shiny, good bond.	Applied sufficient heat. Kept iron clean. Excess solder but a shiny, good bond.	Applied sufficient heat. Kept iron clean. Insufficient solder.	Allowed the iron tip to oxidize. Cold solder joint.
Pigtail Safety		Unplugged iron upon project completion. Properly cleaned iron and work station. Did not sling solder while operating.	Unplugged iron upon project completion. Did not sling solder while operating. Kept a moderately clean work station.	Failed to unplug iron or slung solder. Kept a sloppy work station.	Failed to follow the prescribed safety procedures.
Western Union		Constructed properly with no stray strands, tightly wound.	Constructed properly with 2 to 5 stray strands, tightly wound.	Constructed properly with 2 to 5 stray strands, loosely wound.	Poor overall construction. Not at all to industry standards.
Western Union Soldering		Applied sufficient heat. Kept iron clean. No excess solder. Sufficient solder for a shiny, good bond.	Applied sufficient heat. Kept iron clean. Excess solder but a shiny, good bond.	Applied sufficient heat. Kept iron clean. Insufficient solder.	Allowed the iron tip to oxidize. Cold solder joint.
Western Union Safety		Unplugged iron upon project completion. Did not sling solder while operating. Properly cleaned iron and work station.	Unplugged iron upon project completion. Did not sling solder while operating. Kept a moderately clean work station.	Failed to unplug iron or slung solder. Kept a sloppy work station.	Failed to follow the prescribed safety measures.
Total Points Earned					
Divided by Total Points Possible (60) =	**%**				

BenchMark
Control Valve Diagnostics

Valve Configuration

Tagnumber:	**2239983**
Mfgr. Serial #:	**15739472**
Alt. Serial #:	**N/A**

Valve Identification

Unit Name:		P&I Drawing Number:	
Plant Name:		Valve Application:	
Company:		Year Installed:	
Location:		Risk Class:	

Notes:

Valve Configuration

Manufacturer:	**FISHER**		Valve Size:	**4.00**	in
Valve Configuration:	**LINEAR**		Packing Type:		
Valve Type:	**GLOBE**		Packing Mat'l:		
Valve Model:	**FIS ET**		Flow Direction:		
Pressure Class:	**0**	psig	Specified Friction:		lbf

Notes:

Valve Seat

Seat Diameter:	**4.38**	in	Unbalance Area:	in2
Seat Alpha:			Stem Diameter:	in
Rated Cv:			PBal Seat Mat'l:	
Flow Characteristic:			Effective Moment Arm:	in
Balance/Unbalance:			Specified Torque:	in-lbf

Notes:

Valve Positioning System

Actuator Mfgr:	**FISHER**		Positioner:	**FIS D5000F**	
Actuator Style:	**SINGLE ACTING**		Signal Source:	**HART**	
Actuator Model:	**667-45**		Signal Range:	**4-20MA**	
Effective Area:	**105**	in2	Min. Benchset:		psig
Bottom Area:		in2	Max. Benchset:		psig
Nominal Stroke:	**2.00**	in	Springrate:		lbf/in
Air Action:	**ATO**		Min. Air Pressure:	**0**	psig
Fail Mode:	**CLOSE**		Boosters:		

Notes:

BenchMark
Control Valve Diagnostics

BenchMark Baseline Test

Tag Number	**2239983**
Mfgr. Serial #	**15739472**
Alt. Serial #	**N/A**

Test Identification

Test Number	**B50108ZX**	Company	
Test Date	**8/18/2005**	Plant	
Test Time	**13:58**	Unit	
Operator	**New Operator Name**	Location	

Test Results

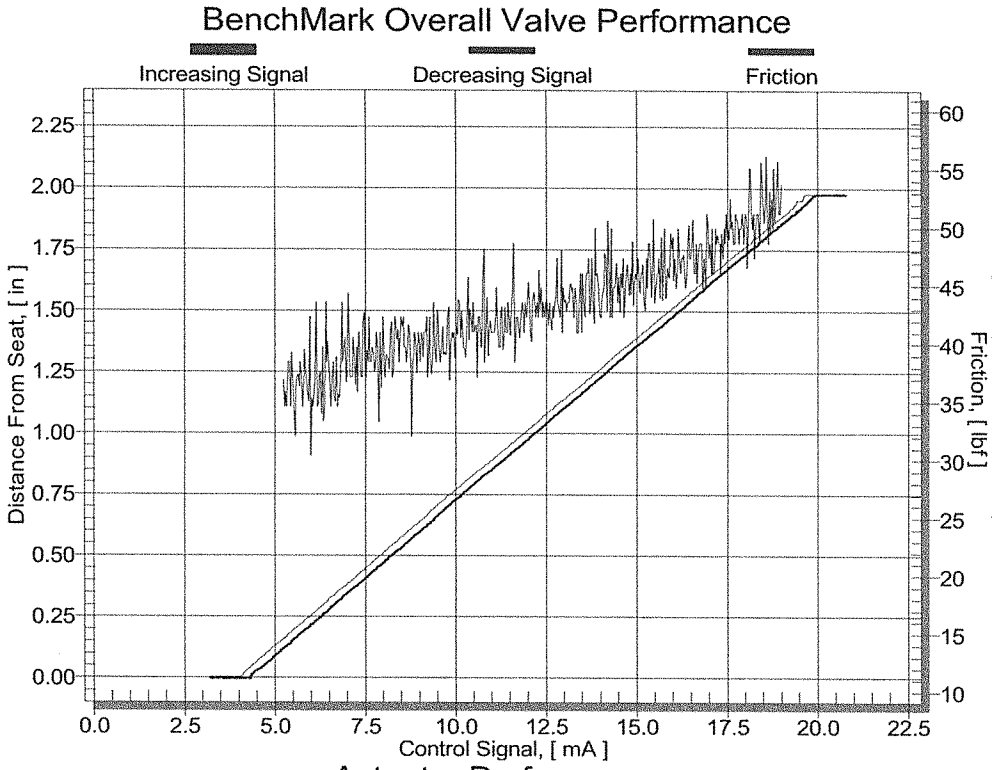
Parameter	Results	Units	Status	Max Std	Min Std	Comment
Measured Total Travel	**1.977**	in				
Measured Total Rotation						
Signal, Min Travel	**4.09**	mA				
Signal, Max Travel	**19.81**	mA				
Signal, Nom Travel		mA				
HDL Error, Average	**1.88**	% fs				
HDL Error, Max	**2.51**	% fs				
Linearity Error	**0.38**	% fs				
Friction, Average	**43**	lbf				
Friction, Max	**57**	lbf				
Torque, Average						
Benchset, Min	**5.8**	psig				
Benchset, Max	**14.8**	psig				
Spring Rate	**467.8**	lbf/in				
Seatload Act & Spring	**42.2**	lbf/in				
Seatload Spring Only	**42.2**	lbf/in				
Signal Pressure, Min Travel		psig				
Signal Pressure, Max Travel		psig				
Signal Pressure, Nom Travel		psig				
Pos HDL Error, Average		% fs				
Pos HDL Error, Max		% fs				
Pos Linearity Error		% fs				
Pos Balance Pressure						
I/P Output, Min Signal						
I/P Output, Max Signal						
I/P HDL Error, Average						
I/P HDL Error, Maximum						
I/P Linearity Error						
Nominal Air Supply	**18.8**	psig				
Air Supply Decrease	**8.7**	% nom				

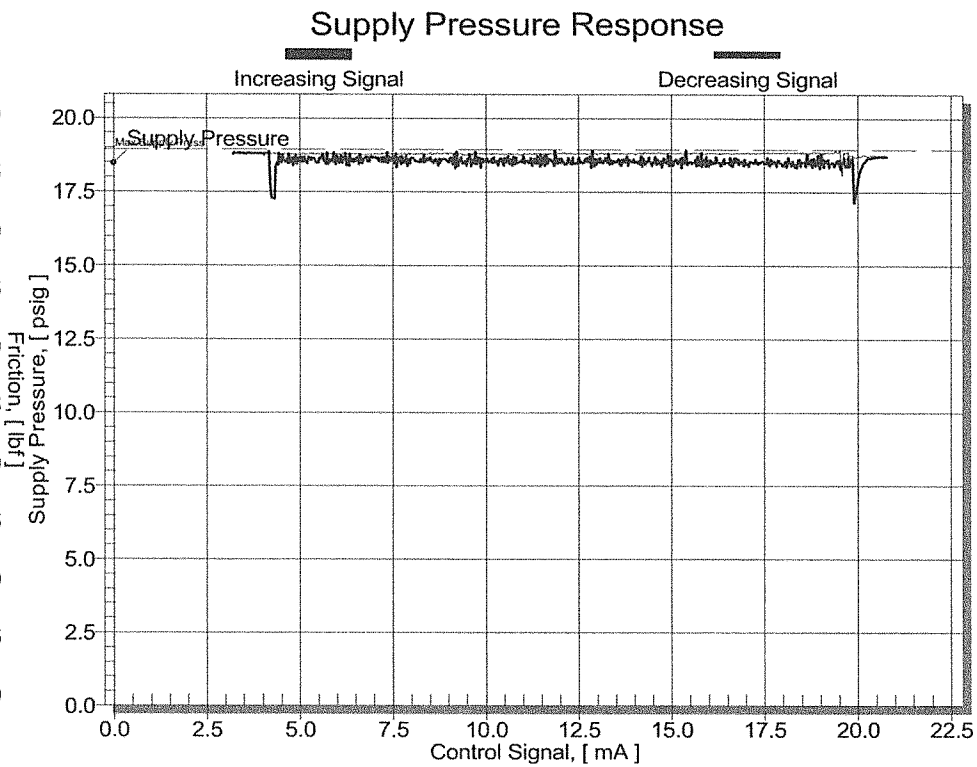
Valve Configuration [Partial Specification]

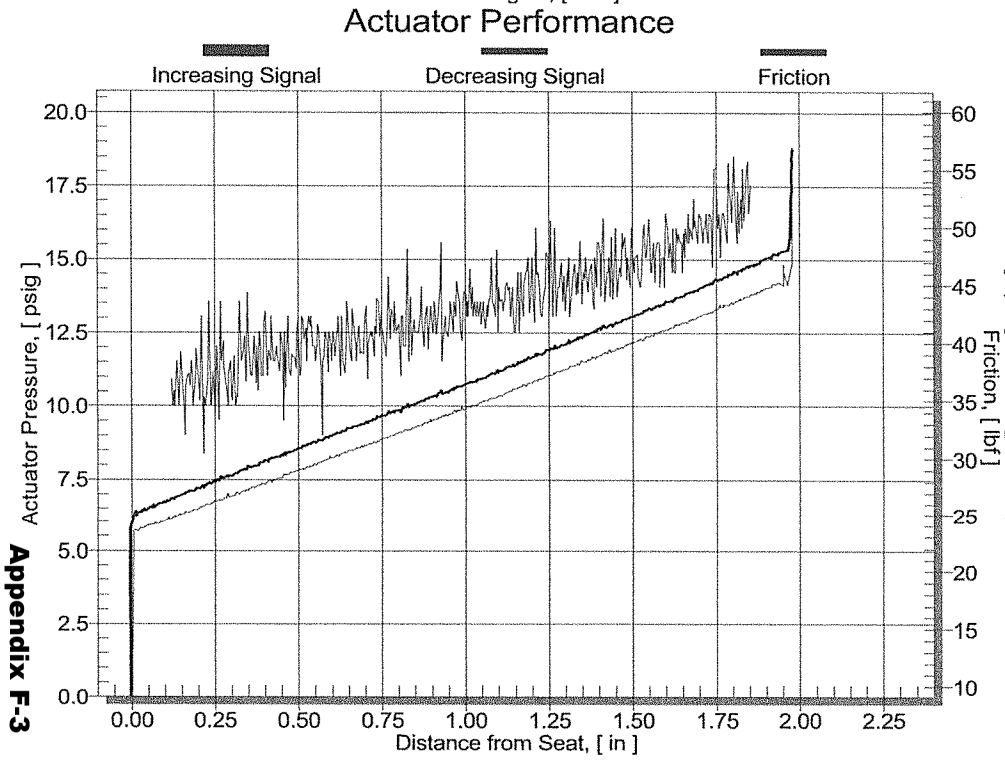
Manufacturer	FISHER		Actuator	FISHER		Positioner	FIS D5000F
Valve Size	4	in	Actuator Style	SINGLE ACTING		Pos Cam	
Configuration	LINEAR		Actuator Area	105	in	Signal Source	HART
Packing Style			Nominal Stroke	2.00	in	Signal Range	4-20MA
Packing Material			Air Action	ATO		Seat Leakage	
Flow Direction			Fail Mode	CLOSE		Moment Arm	in

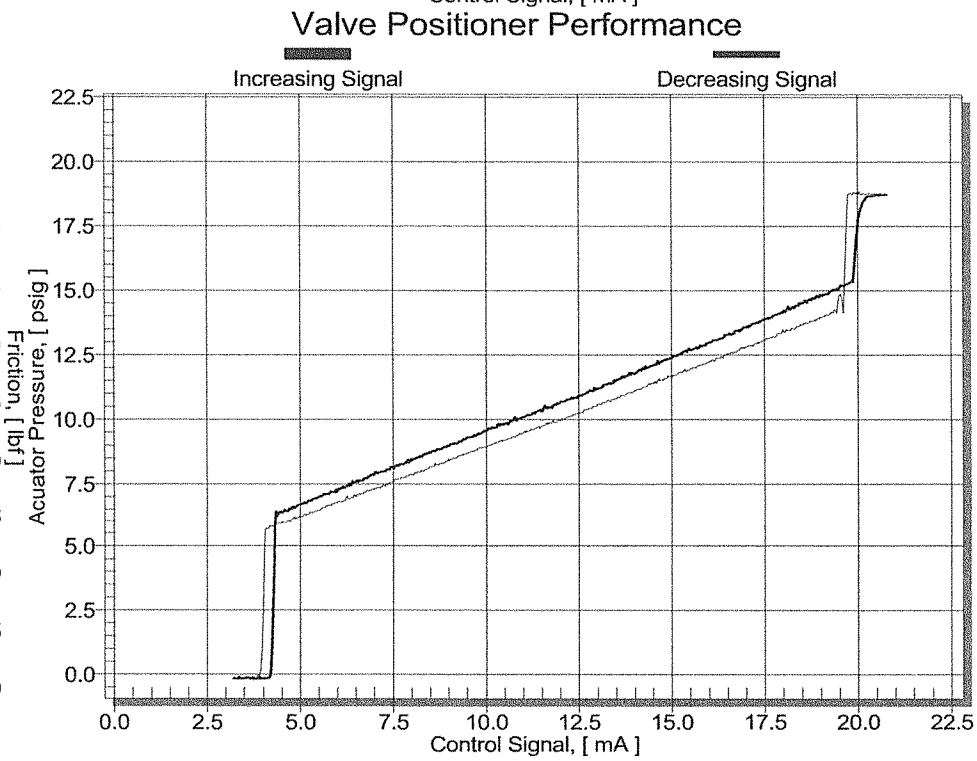
Test Notes

8/18/2005/13:58 /


BenchMark Overall Valve Performance
Increasing Signal
Decreasing Signal
Friction
Distance From Seat, [in]
Friction, [lbf]
Control Signal, [mA]


Supply Pressure Response
Increasing Signal
Decreasing Signal
Supply Pressure
Supply Pressure, [psig]
Control Signal, [mA]


Actuator Performance
Increasing Signal
Decreasing Signal
Friction
Actuator Pressure, [psig]
Friction, [lbf]
Distance from Seat, [in]


Valve Positioner Performance
Increasing Signal
Decreasing Signal
Acuator Pressure, [psig]
Control Signal, [mA]

BenchMark Sensitivity Test

BenchMark Control Valve Diagnostics

Tag Number	**2239983**
Mfgr. Serial #	**15739472**
Alt. Serial #	**N/A**

Test Identification

Test Number	**N50010ZX**	Company	
Test Date	**8/18/2005**	Plant	
Test Time	**14:08**	Unit	
Operator	**New Operator Name**	Location	

Test Results

Parameter	**Units**	**5%**	**5%**	**2%**	**2%**	**1%**	**1%**	**0.5%**	**0.5%**
Signal		INCR	DECR	INCR	DECR	INCR	DECR	INCR	DECR
Ideal Step	in	0.099	0.099	0.040	0.040	0.020	0.020	0.0099	0.0099
Actual Step	in	0.104	0.094	0.044	0.038	0.019	0.020	0.0106	0.0088
Step Error	in	0.005	-0.005	0.004	-0.002	-0.001	0.000	0.0007	-0.0011
Step Error	%step	5.4	-5.3	10.2	-4.0	-2.9	-1.2	7.4	-11.4
Standard	%step								
Test Result									

HoldTime	20 sec	
Offset	50.0 % fs	
Measured Stroke	1.976	in

Valve Configuration [Partial Specification]

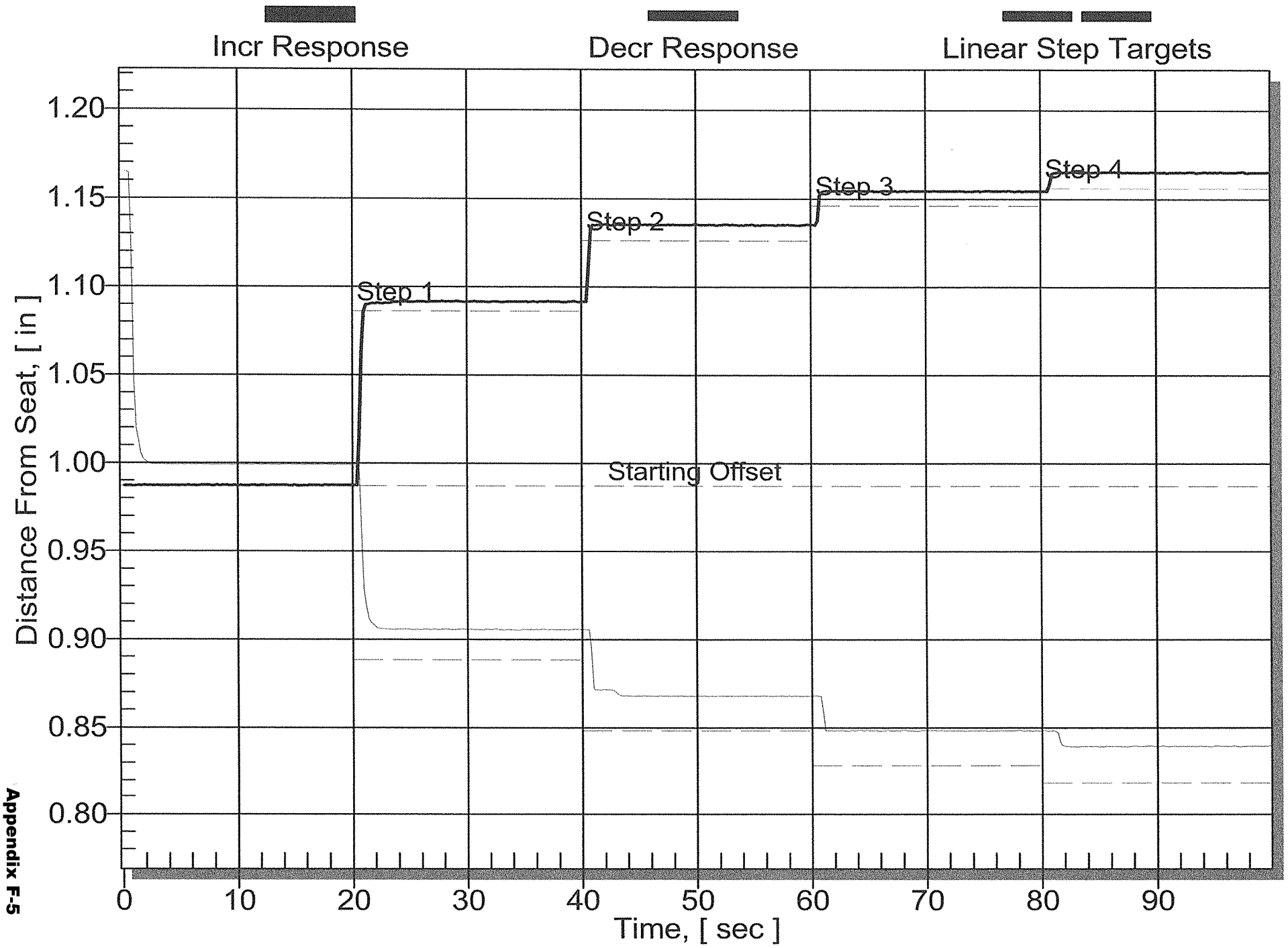
Manufacturer	FISHER		Nominal Stroke	2.00	in
Valve Size	4	in	Air Action	ATO	
Configuration	LINEAR		Fail Mode	CLOSE	
Packing Style			Positioner	FIS D5000F	
Packing Material			Pos Cam		
Flow Direction			Signal Source	HART	
Actuator	FISHER		Signal Range	4-20MA	
Actuator Style	SINGLE ACTING		Seat Leakage		
Actuator Area	105	in	Moment Arm		in

Test Notes

8/18/2005 / 14:08/

Step Sensitivity Results

N50010ZX / 2239983/15739472/N/A



BenchMark Resolution Test

BenchMark Control Valve Diagnostics

Tag Number	**2239983**
Mfgr. Serial #	**15739472**
Alt. Serial #	**N/A**

Test Identification

Test Number	**R50030ZX**	Company	
Test Date	**8/18/2005**	Plant	
Test Time	**14:04**	Unit	
Operator	**New Operator Name**	Location	

Test Results

Parameter	**%**	**5%**	**5%**	**2%**	**2%**	**1%**	**1%**	**0.5%**	**0.5%**
Signal		INCR	DECR	INCR	DECR	INCR	DECR	INCR	DECR
Ideal Step	in	0.099	0.099	0.040	0.040	0.020	0.020	0.0099	0.0099
Actual Step	in	0.104	0.094	0.044	0.037	0.019	0.020	0.0109	0.0086
Step Error	in	0.005	-0.005	0.005	-0.002	0.000	0.000	0.0010	-0.0013
Step Error	%step	4.9	-5.2	12.6	-6.0	-1.9	1.0	10.0	-13.1
Standard	%step								
Test Result									

HoldTime	20 sec	
Offset	50.0 % fs	
Measured Stroke	1.976	in

Valve Configuration [Partial Specification]

Manufacturer	FISHER		Nominal Stroke	2.00	in
Valve Size	4	in	Air Action	ATO	
Configuration	LINEAR		Fail Mode	CLOSE	
Packing Style			Positioner	FIS D5000F	
Packing Material			Pos Cam		
Flow Direction			Signal Source	HART	
Actuator	FISHER		Signal Range	4-20MA	
Actuator Style	SINGLE ACTING		Seat Leakage		
Actuator Area	105	in	Moment Arm		in

Test Notes

8/18/2005 / 14:04/

Step Resolution Results

R50030ZX / 2239983/15739472/N/A