



Student	Print Reading Exercise - Must be completed and handed in day 1	Sequence Dia. Part 1 - AMTEC	Written TRBLSH T Exercises 2 - 8	Seq. Dia Part 2-logic Anal. - AMTEC see note 1	Seq. Dia Part 3 - listing the permissives. - AMTEC See note 1	SMC Sequence Diagrams	Troubleshooting 1 AMTEC	Troubleshooting 2 AMTEC	SMC Sequence Diagrams	TBSHOOT 1 SMC	TBSHOOT 2 SMC (or SMC3)	TBSHOOT 3 SMC (or SMC2)	Place Holder	Place Holder
1	x	X	x	X	X	x	x	x	x	x	x			
2	x	X	x	X	X	x	x	x	x	x	x			
3	x	X	x	X	X	x	x	x	x	x	x			
4	x	X	x	X	X	x	x	x	x	x	x			
5	x	X	x	X	X	x	x	x	x	x	x			
6	x	X	x	X	X	x	x	x	x	x	x			
7	x	X	x	X	X	x	x	x	x	x	x			
8	x	X	x	X	X	x	x	x	x	x		x		
9	x	X	x	X	X	x	x	x	x	x		x		

Note 1: This assignment may take 2 weeks to complete fully.

Student	ROBOT - PLC I/O Worksheet	Remote I/O exercise	NEW - Safety Component Exercise	NEW Second - Written Troubleshooting Exercises.	Work ethic 1 - 5 (excellent)	Safety 1 to 5 (excellent)	Proper use of Test equipment 1 through 5 (Excellent)	Attitude 1 through 5 (excellent)	Follow Troubleshooting Methodology 1 through 5 (excellent)	SMC Terminal exercise	NEW System Optimization lab	AMTEC 6 TBSHOOT	AMTEC 7 TBSHOOT	AMTEC 8 TBSHOOT	AMTEC 9 Trouble shooting	AMTEC 10 TBSHOOT
1	x	x	N/A	N/A	4	5	5	4	5	x	N/A	x	x	x	x	x
2	x	x	N/A	N/A	4	5	5	5	5	x	N/A	x	x	x	x	x
3	x	x	N/A	N/A	5	5	5	5	5	x	N/A	x	x	x	x	x
4	x	x	N/A	N/A	4	5	5	5	5	x	N/A	x	x	x	x	x
5	x	x	N/A	N/A	5	4	5	5	5	x	N/A	x	x	x	x	x
6	x	x	N/A	N/A	5	4	5	5	5	x	N/A	x	x	x	x	x
7	x	x	N/A	N/A	3	5	5	5	5	x	N/A	x	x	x	x	x
8	x	x	N/A	N/A	3	5	5	5	5	x	N/A	x	x	x	x	x
9	x	x	N/A	N/A	5	5	5	5	4	x	N/A	x	x	x	x	x

DIRECTIONS FOR STUDENTS

Sequence Diagram Part 1 - AMTEC LAB Work - Lab Team
 The students through observation and operation of the AMTEC Trainer Complete the Sequence Diagram
 Listing: Steps, Duration of movement, Outputs and output addresses (to enable checking of the I/O lights), Best guess at the triggers. (from Observation)
 Checked asap by the instructor as soon as completed. Rough check. Minor errors are OK. They will correct these when the troubleshooting is complete.

Sequence Diagram Part 2 - Logic Analysis. Desk Work - Lab Team
 The students through analysis of the PLC Logic and Wiring Diagrams Determine the actual triggers for each step in the sequence Diagram
 Note the students will need pdfs of logic with cross reference listing, wiring diagrams
 Force the students to use the logic pdfs for 1 - 2 days to learn how to use the cross reference listing
 After the students have been observed as proficient in the above - Let the students use Studio 5000 and the ACD files. Check to ensure that they can use the x-reference function.
 Note : the students will need the Remote I/O Address reference that will help identify the actual tags.

Sequence Diagram Part 3 - Desk and possibly Lab work - Lab Team
 The students through logic analysis and Machine observation determine the permissives (set-up) that is required to achieve a cycle start. These will be listed on the bottom of the Final Sequence Diagram given to the instructor. Note this may take two weeks to complete all assigned stations

Additional sequence diagrams have to be completed for selected SMC stations.
 This included the Trigger analysis with the logic. Again Electrical prints are issued along with

a pdf of the logic (with Cross reference listings). Again once a student demonstrates proficiency in any of the cross reference usage, studio 5000 and the ACD files can be used.
 The Instructor will assign the stations. Every one STA1 (Body) and Station 2 (Bearing). Split the teams up for Station 4 (Shaft) , and (Cover) Station 5.

- AMTEC 1= Level one fault, circuit was just running and then stopped. Identify and correct the fault. - Lab Team
- AMTEC 2 = Level one fault, circuit was just running and then stopped. Identify the fault - use voltmeter if necessary. Do not correct the fault. - Lab Team
- SMC 1 Level one fault, circuit was just running and then stopped. Identify and correct the fault. - Lab Team
- SMC 2 Level one fault, circuit was just running and then stopped. Identify the fault - use voltmeter if necessary. Do not correct the fault. - Lab Team
- SMC 3 Level one fault, circuit was just running and then stopped. Identify the fault - use voltmeter if necessary. Do not correct the fault. - Lab Team

Written Troubleshooting exercises 2 through 8 - As the students complete these as a class, the instructor will observe that each student has the ability to identify the faulted part or area to be investigated.
 The print reading exercise is issued day one and has to be completed individually by end of the day ... one hint per student.

INSTRUCTOR NOTES:

Troubleshooting exercises:

- AMTEC 1= Prox at unload sta. moved up
- AMTEC 2= RFB xx, Open xxx solenoid at using xxxCR - meter exercise... Have the students show the instructor how they isolated the fault.
- SMC 1 = Jammed part in feeder - Sta 1 or Sta 5
- SMC 2 = Open Cycle start sw. through sw box... meter exercise
- SMC 3 = Feed back mag. sw open Sw. Meter exercise
- Note do SMC 2 or SMC 3 don't need to do both

Instructor note: there is no station 3 or 7.
 Instructor Note: As soon as a sequence Diagram is finished and the instructor has lectured on Troubleshooting Methodology and the print reading exercise has been completed and discussed... The troubleshooting can begin... Therefore some students may be completing the sequence diagram on station 4 but are ready for troubleshooting on station one of the SMC.

INSTRUCTOR NOTE: Cycling power on AMTEC unit resets all the RF faults. Therefore sometimes the instructor will direct the students to start up the unit, Demo that it is working properly, and then the

instructor will insert the fault.

Instructor NOTE: To get the SMC trainer on... turn on all stations on, in auto... wait for all conveyors to be running... last station takes some time. Then do a cyclcy start on station one. This will apply air to all stations... now any station except for one can be shut down. The air needs to be on first... before any station can be shut down. If this doesn't work... you might have to get a cycle start on all stations before air comes on... can't remember.



The N/As were not available for the first group but may be added for groups 2 and 3.

Several additional Labs were performed by the students that were labs to further the students experience.

Additional remediation was given by the instructor to individuals regarding their work ethic, language, and their tendency to fly through the assignments without giving it serious consideration. Several labs are designed to trap these students and force them to slow down and analyze the symptoms. The labs worked... hopefully the students learned. Once the students (individually) were counseled on language and work ethic, the issues resolved themselves and is not recorded here.

Not receiving a 5 on work ethic - reflects time wasted on outside concerns in the class

Not receiving a 5 on Safety primarily was due to the reminders on the wearing of safety glasses... This might have been my fault in not policing it closely enough in the first couple of class periods.

AMTEC 10 The VFD was replaced last night - never had time to check it out - Please get The system running

AMTEC 9 The system needs to be started, has not run for several days due to summer shut down.
Have no idea if it was running prior to shut down.

AMTEC 8 Machine quit last night - no idea of what's wrong

AMTEC 7 Maintenance last night on the light screen. Never powered up or checked out.
Please get the system running.

AMTEC 6 Please start up the system and demonstrate that it is operational. Call the instructor over.

AMTEC 5 Please start the system up for production. It has been off for the weekend.

SMC Terminal exercise The student will be assigned an SMC station to work on.
Clear all faults except the electrical fault introduced by the switch box.
Identify the switch box fault, connect a terminal to the processor (Back port on the Processor) and locate the faulted component in the logic.
Have the instructor verify.

SMC Terminal Remediation. Repeat exercise on new SMC station or AMTEC trainer.

System optimization labs - See directions from instructor.

PLC to Robot interfacing see written directions. Written exercise.

Remote I/O Exercise. See written directions.

Troubleshooting exercises

AMTEC 10 --- Set VFD HMI speed to 0

AMTEC 9 --- Bad relay - open N/C connections installed at 5316CR reference pg 49.line 6
Have the students show you the voltage checks that they used to isolate the fault.

AMTEC 8 --- Misaligned optical reflector, if on the unload station - part will not unload,
if on the transfer station, load conveyor stop won't advance and thus
no cycle start for robot.

AMTEC 7 Turn off circuit breaker 1001 CB - 4th. Breakers from the right on bank.
NOTE: if students kill power on Trainer - no PPE, IF they go in live - PPE must
be worn --- When the students open up the load conveyor JB all lights are off.
This is their clue.

AMTEC 6 Have the start the system up, once running... while the robot is mid transfer,
shut off the air on the system. Sometimes this screws up the communications between robot
and PLC..... the robot must be at home and the cycle complete must be strobed
to the PLC. Cycling power re-establishes communications .. Or in digital
I/O on the robot... strobe cycle complete.

AMTEC 5 Note every time that the system has been shut down .. Do not shut off the robot air - (manual
valve on the bottom of pneumatics plate). This time shut off the robot air and do not shut off
the other air valves. The student usually miss this valve... then the robot fails to pick up the part
and stops mid cycle.

SMC Terminal Exercise. Select any station on the SMC except station 1. Shut off power with the e-stop.
Close air supply valve...Close off a flow control... introduce a switch fault
Have students clear all faults except switch fault. Identify switch fault
and connect terminal to display fault - in the logic - on line.
Note clear the LAN Adaptor IP and Subnet Mask prior to the lab.

SMC Terminal remediation... If a student is not confident in the above exercise repeat on
a second station on the SMC.

System Optimization lab see writ-up in instructor's information.

PLC to Robot interfacing see written directions. Written exercise. Issue to students day

Remote I/O Exercise. See written directions.

JIM Notes: I should have had the students hand in copies of their Sequence diagrams for the smc stations...
I wasn't clear and they didn't do.



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