



دبلوم تطبيقات التحكم الأوتوماتيكي في نظم القوى الميكانيكية

MEP 599 Diploma Design Project- Summer of 2014

PLC Solution for an Automatic Control of a Pipe Cutting Machine

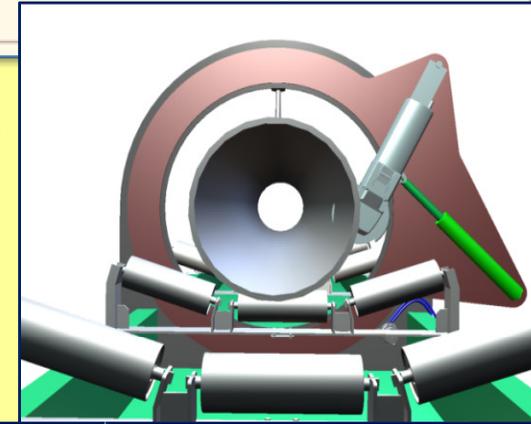
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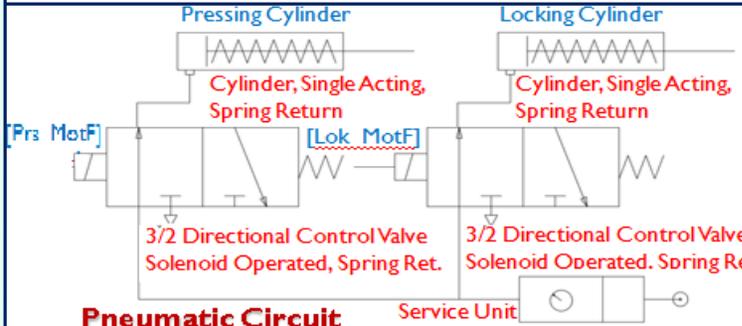
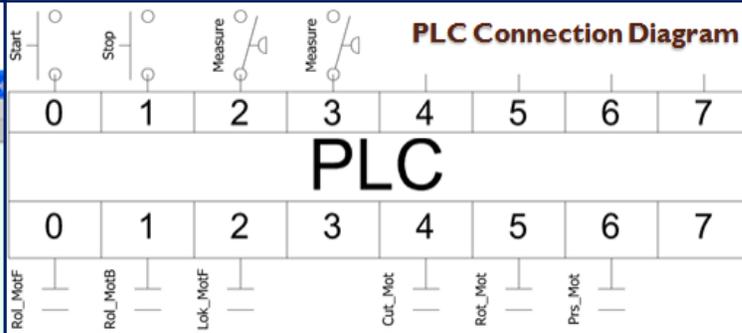
Mechanical Power Engineering Department

Abstract & Project Description:

Is to develop, test & implement a PLC system & LAD program to control an industrial pipe cutting machine. The idea is to concept a pipe, tube and rod cutting machine that will carry out regular & repeated pipe cutting required in many modern applications like Power Piping, Process Piping, Steel Piles, Monumental Steel, Architecture Pipe works, Façades & curtain walls. Also the concept is to use most common disk cutting machine (Grinder) which is available in pipe fabrications workshops and not to use Gas cutting or Plasma cutting tools. Due to low cutting cost against high quality of cut end, besides its popularity which makes it available at much comprehensive prices and much easier to be maintained. Another outline is the pipe size which should be large enough to withhold large bore piping; the concept is to allow for pipe size up to 24 inches.



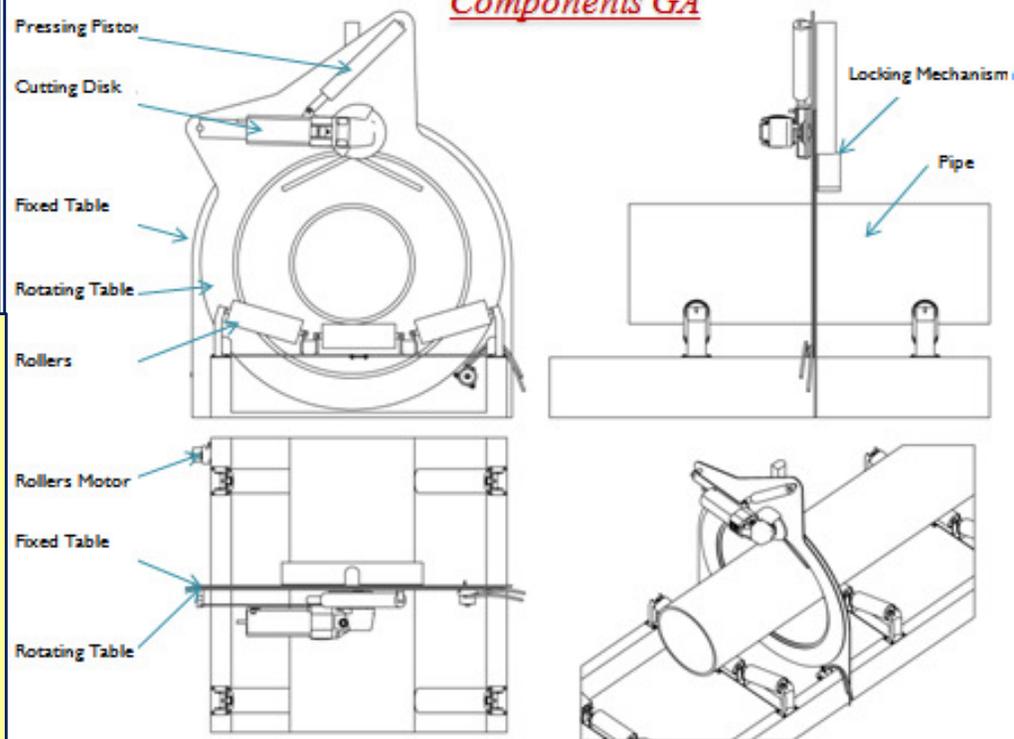
TRiLOGI program is used to create and simulate the control program



Inputs and Outputs of PLC System:

Inputs			Outputs		
Name	Type	Function	Name	Type	Function
Start	Push Button	To Start the cutting operation	Rol_MotF	Motor Controller	To move the rollers forward
			Rol_MotB	Motor Controller	To move the rollers backward
Stop	Push Button	To Cancel the cutting operation	Lok_MotF	Solenoid valve	To Move the locking piston forward
Measure	Proximity Switch	When pipe length reach required value	Prs_MotF	Solenoid valve	To Move the Pressing piston forward
Done	Proximity Switch	When cutting disk completes on loop	Cut_Mot	Motor Controller	To run the cutting disk
			Rot_Mot	Motor Controller	To run the rotating table

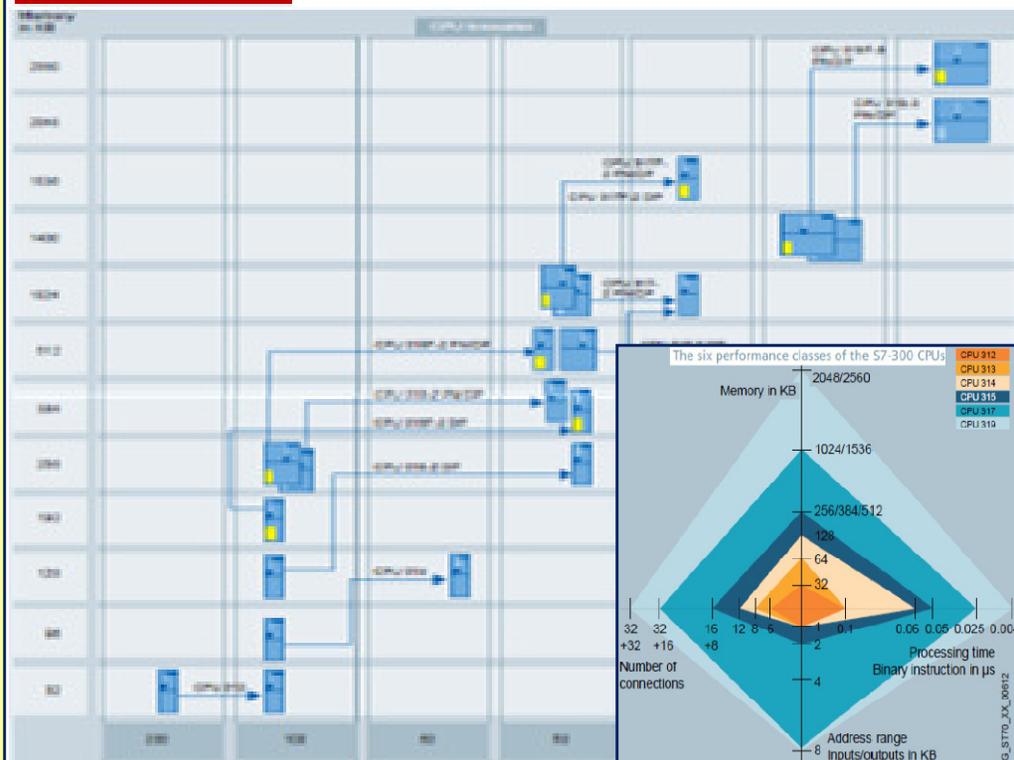
Components GA



Project Logic: Firtst User press [Start] Button

1. Rollers motor should start to enter a pipe length into the machine
2. When the pipe reaches the required length, signal should be sent by proximity switch to indicate that pipe has reached the required length
3. Roller Motor should stop, Actuating signal should be sent to the directional control valve to pressurize Locking mechanism piston, it should be always pressurized
4. Time Delay to allow the locking mechanism to hold the pipe firmly
6. Cutting disk motor should go ON
7. Cutting disk should move down to start the cutting, by sending actuating signal to directional control valve to start the pressurizing mechanism piston
8. The rotating table should start cutting loop by setting motor to ON
9. When finalizing a complete loop, proximity switch should send a signal to indicate that rotating table has completed a full loop around, i.e. cutting process is done.
10. After completing all steps, the sequence should be reversed.
11. The rotating table motor should stop
12. The pressurizing piston should return by setting the actuating signal to off and let it return by its spring
13. Time delay to allow the cutting tool to be far enough from the pipe
14. Cutting disk should stop
15. The Locking mechanism to release pipe by setting control valve locking piston actuating signal to off and let it return by its spring.
16. Time delay to allow the pipe to be completely free
17. The rollers motor should be reversed to move the pipe and the cut part out of the machine
18. Time delay to make sure the pipe is out
19. Reset all variables to start another cutting process .

PLC Selection:



Step0 - General: Operation

- This step is to start sequencer and to Latch [Auto] internal relay which will be used in all next steps to indicate current sequence of steps if it is forward or Backward
- The [Stop] Push Button or [Finished] Internal Relay is to un-latch the [Auto] Internal Relay which will tell the program to reverse the sequence.

LAD Rung

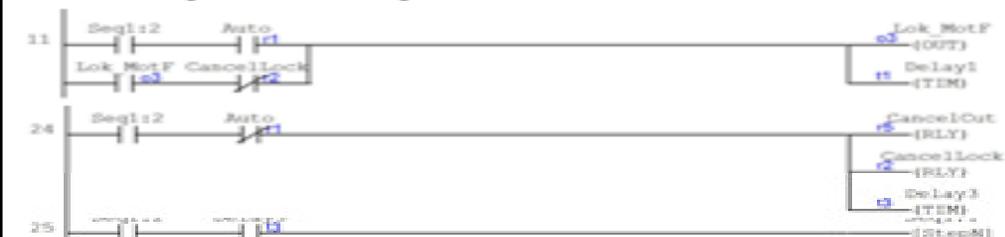


Emergency

- The [Stop] push button to be pressed
- The [Auto] internal relay will do the rest



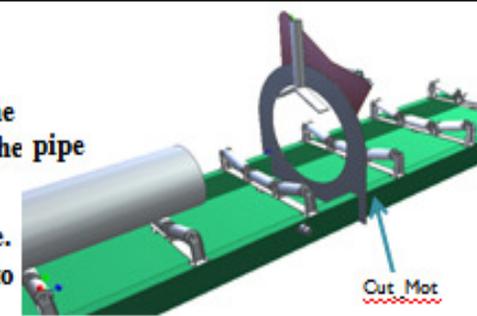
Example, in Step 2



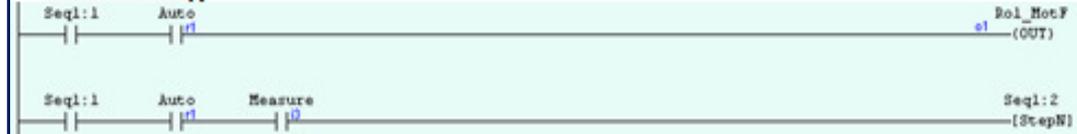
Pneumatic Circuit Components

Step1-Forward: Operation

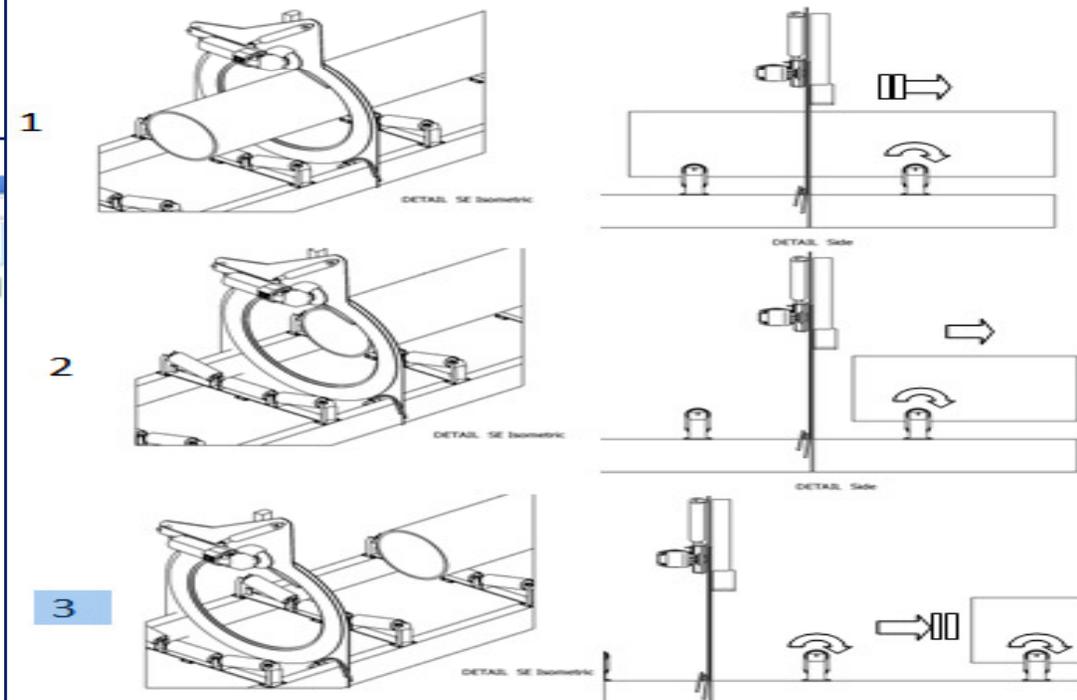
- Set [Rol MotF] output to ON, that will Start the rolling motor in the forward direction to enter the pipe
- When the proximity sensor [Measure] is ON i.e. the pipe reached the required measure then go to Step2, that will stop the rolling motor also.



LAD Rung



D- Machine Operation



Areas of development

- Develop the machine and the logic to allow different length cutting ability
- Develop the PLC controller and the logic to allow for network control to allow mobile work orders