



MEP 480 B. Sc. Design Project- Year 2013/2014

Industrial Process control Using PLC & Pneumatic System

by Ehab Mohamed Yahya; Bassem Mohamed Hussein Roshdy; Ismail Mahmoud Abd elAzem; and Waleed Salah Reyad Ali

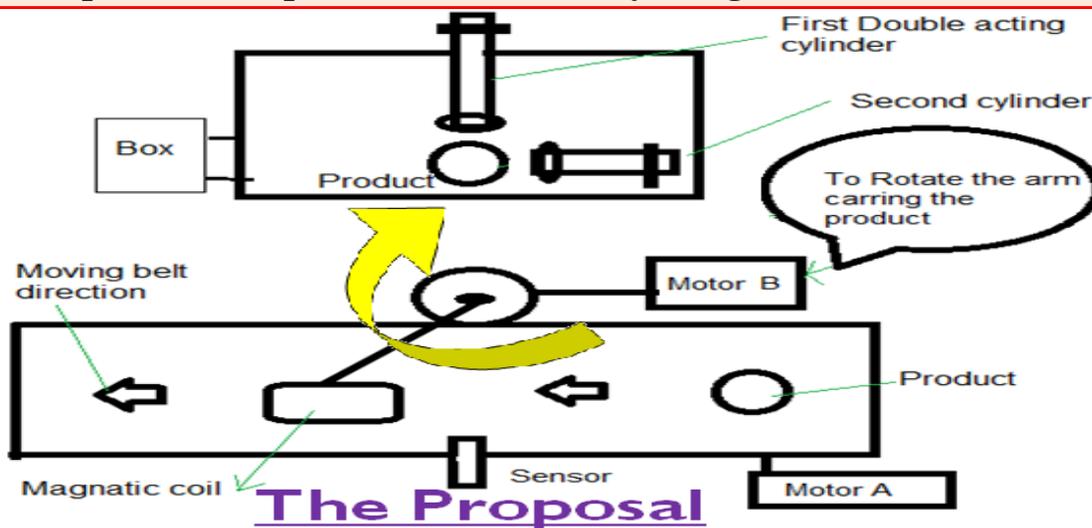
Supervised by

Prof. Ashrif Sabry, MEP Chairman and Dr. Mohsen Sayed Soliman , ACC Manager

Mechanical Power Engineering Department

Abstract:

Conveyor system: A conveyor system is a common piece of mech. handling equipment moves materials from one location to another. Conveyor systems are used widespread across a range of industries due to numerous benefits they provide. Conveyors are able to safely transport materials from one level to another, which when done by human labor would be strenuous and expensive. The proposed project is to control a system used to grab a product and move it to another place where it can be compressed and packed. this is done by using DC motors, sensors, arm with magnetic coil, cylinders & PLC.

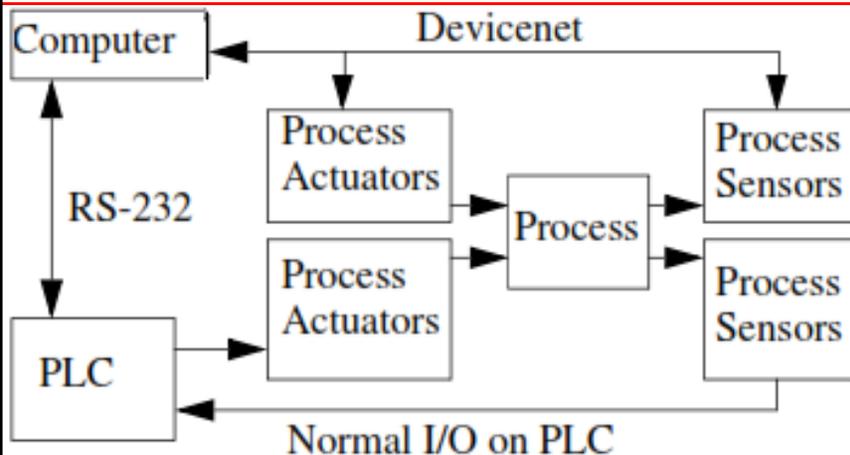


Project Analysis : 1- First ,Motor A is turned on to run the conveyor carrying product. 2- When product reaches sensor, conveyor will stop. 3- Then the magnetic coil is energized and left the product from the conveyor. 4- Motor B is turned on to rotate arm carrying the product by magnetic force. 5- When the arm reaches its final destination, motor B will stop. 6-The magnetic coil will put down the product. 7- Motor B will turn on again but in inverse motion to move the arm away from the cylinders and back to conveyor to take another product. 8- Now the cylinder above product will compress the product. This cylinder is controlled by a direction control valve to control its movement. 9- After that another cylinder (Horizontal one) is actuated to push the product to the box where it is collected and packed. And So on

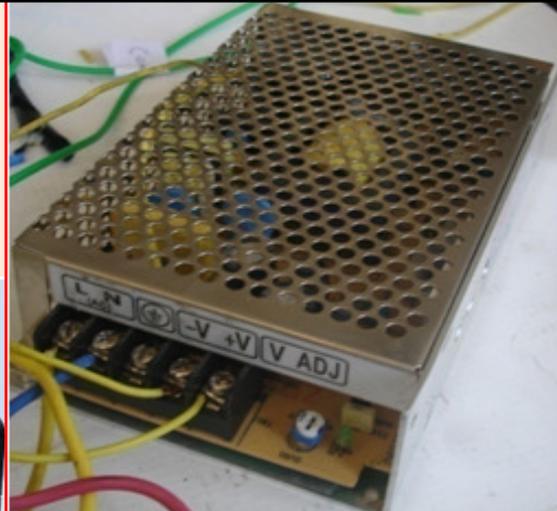
Main Components of the System Programmable Logic Controller(PLC); Power Supply(24VDC);Two DC motors; a Conveyor belt; a Magnetic coil; Photocell proximity Sensor; two double acting Pneumatic/air Cylinders; Two seloniod Direction Control valves; Air Compressor; Relays; Control Panel ; Bearing; Pulley



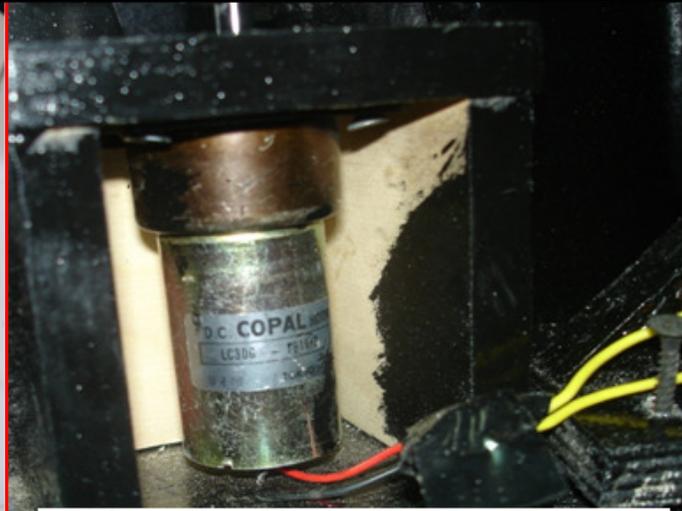
PLC Used in the Project: Fatek B1z-14MR, 8 DC24V inputs(2*10KHz), 6outputs(4*10KHz), 1 comm. port, no expansion I/O and comm.



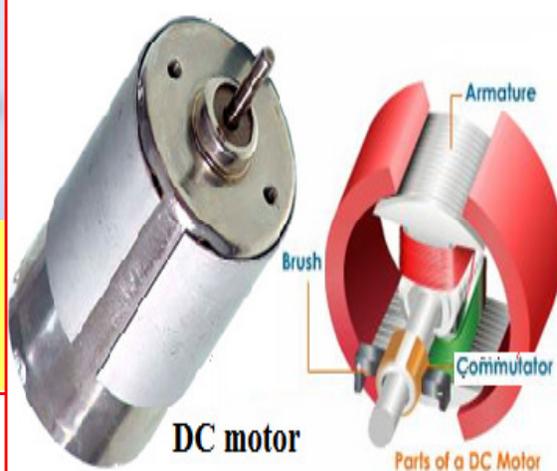
SERIAL COMMUNICATION: The PLC is connected to the computer by a RS-232 Cable through port 0 in the PLC & Com1 in the PC.



DC power supply used in project



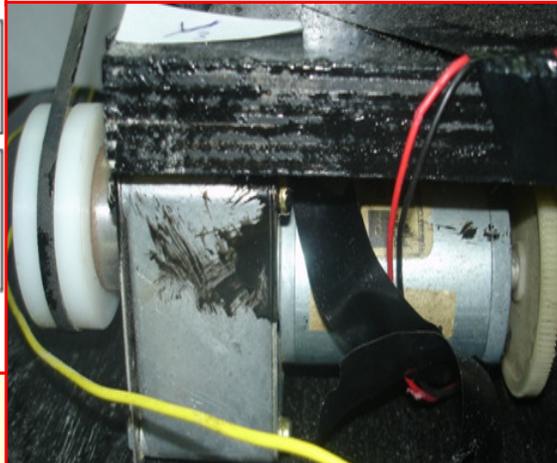
DC motor for rotating the arm



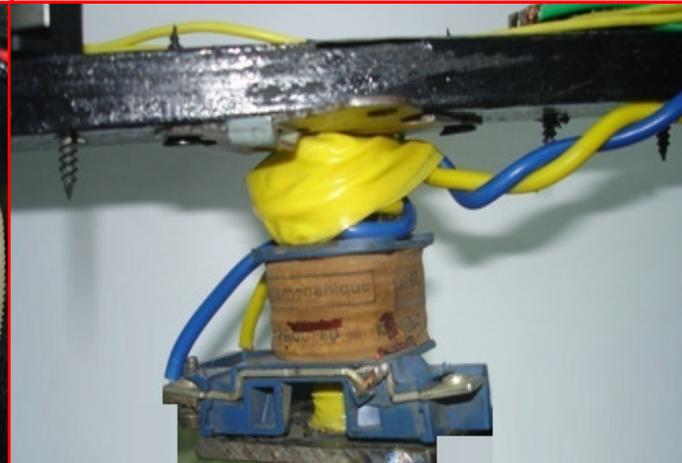
DC motor
Parts of a DC Motor



Conveyor belt System



DC motor to run the conveyor belt



Lifting Electric Magnet used in project



Photocell proximity sensor



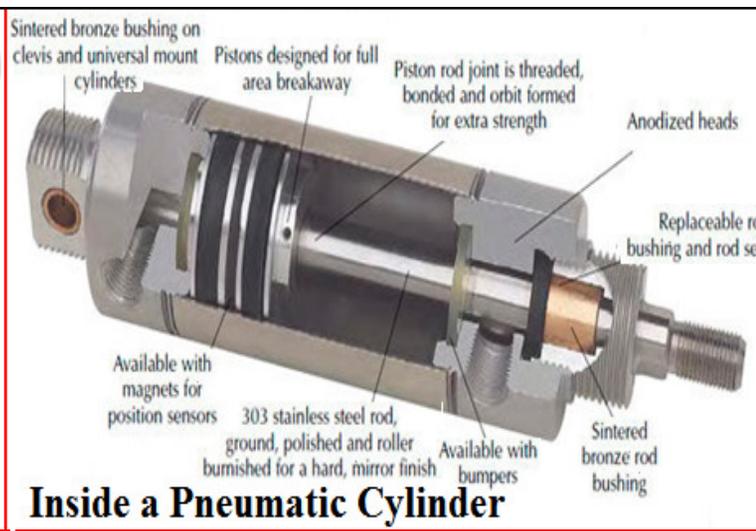
Pneumatic Directional Control Valve



5/2DCV Solenoid/Air, Spring return



Double Acting Pneumatic Cylinders



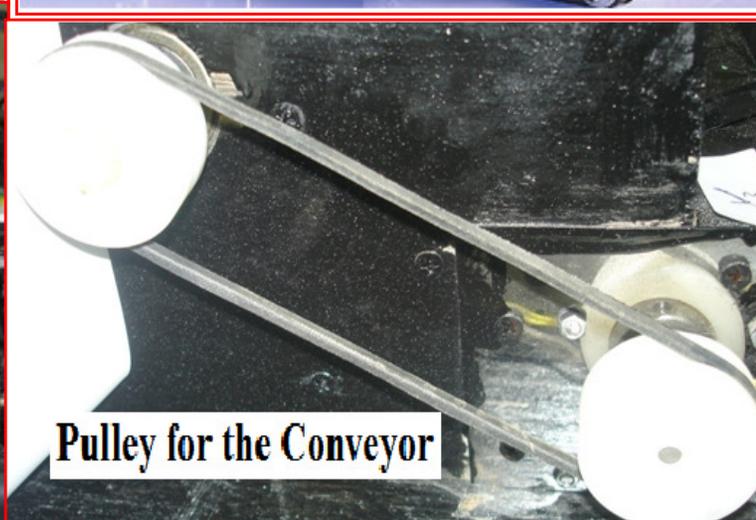
Inside a Pneumatic Cylinder



Relay



Relay with 8 legs



Pulley for the Conveyor

PLC Programming of the Project

Ladder Logic Symbols

1-The Inputs:

- X0 : Sensor (1) on the conveyor
- X1 : Limit switch (1) at the conveyor part
- X2 : Limit switch (2) at the cylinders part
- X3 : Start Push Button
- X4 : Sensor (2) at the cylinders part
- X5 : Emergency Stop Push Button
- X6 : Reset counting push Button

2- The Outputs:

- Y0 : First direction for the motor of the rotating arm(going away from conveyor)
- Y1 : Second direction for the motor of the rotating arm (back to conveyor)
- Y2 : Magnetic for Lifting Magnets
- Y3 : Conveyor Motor
- Y4 : DCV for the compressing cylinder
- Y5 : DCV for packing cylinder

Ladder Logic Explanation:

- When the start push button (X3) is pressed, the conveyor motor (Y3) will start to operate.
- The Conveyor motor will keep running until a product reaches the first sensor (X0)
- When the sensor (X0) is energized by the product, it will activate the magnetic for lifting magnets (Y2)
- After 2 sec the motor of the rotating arm (Y0) start to move
- When the limit switch (X2) is energized, it will turn off the motor (Y0) and activate a Marker (M1) which will start a timer (T51)
- After 2 sec the timer (T51) will turn off the Magnetic (Y2) and run the motor in inverse direction (Y1) returning the arm to the conveyor part
- When Limit switch (X1) is energized, it will stop the motor (Y1) after 2 sec
- When the Sensor (X4) and the limit switch (X1) are energized, the Directional Control Valve (Y4) will be on and cause the piston of the cylinder to compress the product
- Timer (T52) when energized, it will deactivate (Y4) returning the piston back inside the cylinder
- 10) Timer (T52) will also start a Marker (M3) to start another timer (T53) that when it is energized will turn on the DCV (Y5) and activate the piston of the packing cylinder
- 11) After 1 sec timer (T54) will deactivate (Y5)
- 12) A counter (C0) is added to close the conveyor motor after 3 products
Sensor (X0) on the conveyor will count products & push button (X6) will reset the counter.

Printed Item: Ladder Diagram - Main_unit1

