**Practice Problems:**

1. A motor will be connected to a PLC and controlled by two switches. The GO switch will start the motor, and the STOP switch will stop it. If the motor is going, and the GO switch is thrown, this will also stop the motor. If the STOP switch was used to stop the motor, the GO switch must be thrown twice to start the motor. When the motor is running, a light should be turned on (a small lamp will be provided).
2. Develop a relay logic diagram for the application. Sequence of events are as follows:
3. Provide master start/stop push button
4. Check the level in tank 1. if it is above LL1 go to step 4. If not start SV1.
5. Stop SV1 when level reaches to LH1.
6. If level in T1 is above LL1 and below LL2 in T2 start pump.
7. When level in T2 reaches LH2 stop pump and open SV2 and SV3
8. When level in T2 reaches LH2 stop pump and open SV2 and SV3

3. In dangerous processes it is common to use two palm buttons that require a operator to use

both hands to start a process (this keeps hands out of presses, etc.). To develop this there are

two inputs that must be turned on within 0.25s of each other before a machine cycle may begin.

1. Two conveyors feed a part onto one main conveyor(M). a proximity device is at the end of each feeder conveyor. The proximity device outputs are fed as pulses to counters. Each counter then shows the count of parts begin put onto the main conveyor. In addition, another proximity device at the end of the conveyor pulses in response to parts leaving and then sends the pulses to another counter.
2. Develop a ladder diagram for sequencing of three motors. The expected sequences is 3-1-2.

while starting the motor there should be at least a time delay of 60 sec. For the safety of the system every motor has to satisfy following interlocks

-Bearing temperature high

-Winding temperature high

-Over current protection

1. Write a ladder logic program that will count the number of parts in a buffer. As parts arrive they activate input *A. As parts leave they will activate input B. If the number of parts is less than 8* then a conveyor motor, output *C, will be turned on.*
2. Develop a ladder logic for conveyor sorting system. The system is initiated by an operator each day and the items to be sorted are fed onto the production line conveyer from a holding hopper. The items once on the conveyor, proceed, operating limit switch 1 which counts all of the items. Limit switch 2 counts only the larger items. As limit switch 2 is operated a pneumatic ram is activated to cause all the larger items to be located in packing box2. The smaller items continue to the end of the conveyer and are located in packing box1. At the end of work, when the operator presses the end of work button, the conveyor must continue to run until all the items currently on the conveyor are cleaned and packed.
3. A process has four inputs which are connected to four PLC counters:

A Up counter

B Down counter(preset at 20)

C Up counter

D Down counter(Preset at 25)

When A reaches 7 or B reaches 0, output L is to go on

When C reaches 6 and D reaches 0, output M is to go on

When both L and M are on, output N is to go on

Process master ON and Master OFF are also used.

1. Three conveyors feed a main conveyor. The count from each feeder conveyor is fed into an input register. Develop a ladder logic to obtain the total count of parts on the main conveyor. Use timer to update the total every 15 seconds.
2. We are using a pneumatic cylinder in a process. The cylinder can become stuck, and we need to detect this. Proximity sensors are added to both endpoints of the cylinder’s travel to indicate when it has reached the end of motion. If the cylinder takes more than 2 seconds to complete a motion this will indicate a problem. When this occurs the machine should be shut down and a light turned on. Develop ladder logic that will cycle the cylinder in and out repeatedly, and watch for failure.
3. A wood saw, W, a fan F, and a lubrication pump, P, all go on when a start button is pushed. A stop buton stops the saw only. The fan is to run an additional 5 seconds to blow the chips away. The lube pump is to run for 8 sec after shutdown of W. additionally, if the saw has run more that one minute, the fan should stay on indefinitely. The fan may then be turned off by pushing a separate fan reset button. If the saw has run less the one minute, pump should go off when the saw is turned off. The 8 second time delay off does not take place for a running time of less than 1 minute.
4. A temperature control system consists of four thermostats. The system operates three heating units. Thermostats are set at 55, 60 , 65 and 70 degree C. Below 55 degree C , Three heaters are to be on. A temperature between 55 to 60 degree C causes two heaters to be on. For 60 to 65 degree C, one heater is to be on.
5. A new printing station will add a logo to parts as they travel along an assembly line. When a part arrives a ‘part’ sensor will detect it. After this the ‘clamp’ output is turned on for 10 seconds to hold the part during the operation. For the first 2 seconds the part is being held a ‘spray’ output will be turned on to apply the thermoset ink. For the last 8 seconds a ‘heat’ output will be turned on to cure the ink. After this the part is released and allowed to continue along the line. Write the ladder logic for this process.
6. A bottling process for 12 bottles operates as follows:

Bottles are counted until all 12 are in position for filling. When in position in the carton, the 12 bottles are filled simultaneously for 6.3 seconds. After filling, there is a pause of 3.8 seconds for foam to subside. The 12 caps are then put on and counted as they are installed. A solenoid then pushes the completed carton of 12 on to a conveyer. The system is reset for new group of 12 bottles by a limit switch that indicates that the carton is out of the ‘fill’ position and on the conveyor.

15. Write a ladder logic program that does what is described below.

- When button *A is pushed, a light will flash for 5 seconds.*

- The flashing light will be on for 0.25 sec and off for 0.75 sec.

- If button *A has been pushed 5 times the light will not flash until the system is* reset.

-The system can be reset by pressing button *B*

*16.* A buffer can hold up to 10 parts. Parts enter the buffer on a conveyor controller by output

conveyor. As parts arrive they trigger an input sensor enter. When a part is removed from the

buffer they trigger the exit sensor. Write a program to stop the conveyor when the buffer is full,

and restart it when there are fewer than 10 parts in the buffer. As normal the system

should also include a start and stop button.

1. A new printing station will add a logo to parts as they travel along an assembly line. When a part arrives a ‘part’ sensor will detect it. After this the ‘clamp’ output is turned on for 10 seconds to hold the part during the operation. For the first 2 seconds the part is being held a ‘spray’ output will be turned on to apply the thermoset ink. For the last 8 seconds a ‘heat’ output will be turned on to cure the ink. After this the part is released and allowed to continue along the line. Write the ladder logic for this process
2. There are three mixing devices on a processing line A, B, and C. After the process begins, mixer a is to start after 7 seconds elapse. Next, mixer B is to start 3.6 seconds after A. mixer C is to start 5 seconds after B. All then remain on until a master enable switch is turned off.
3. There are two conveyors, each with sensors to count input and output of parts entering and leaving the conveyors. There are three indicating lights for the process as follows:

Number of parts on the conveyors equal white light

Number of parts on conveyor 1 is greater Green light

Number of parts on conveyor 2 is greater Blue light

1. A solenoid S, is to go on when count C goes up to 22, and when count d goes down from 37 to 0, when count E goes up to 8. Furthermore, if count F goes down from 17 to 0 at any time, the solenoid is to be kept from operating. One stop button resets the entire process, including the solenoid’s being off.
2. A temperature control system consists of four thermostats. The system operates three heating units. Thermostats are set at 55, 60 , 65 and 70 degree C. Below 55 degree C , Three heaters are to be on. A temperature between 55 to 60 degree C causes two heaters to be on. For 60 to 65 degree C, one heater is to be on.
3. Three conveyors feed a main conveyor. The count from each feeder conveyor is fed into an input register. Develop a ladder logic to obtain the total count of parts on the main conveyor. Use timer to update the total every 600 seconds.
4. A main conveyor has two conveyors feeding it. One feeder puts 6 packs on the main conveyors, the other feed 8 packs. Both feeder conveyors have counters that count the number of packs leaving them. Design a program to give a total can count on the main conveyor.