AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

2017R

PROGRAMMABLE LOGIC CONTROLLERS LAB

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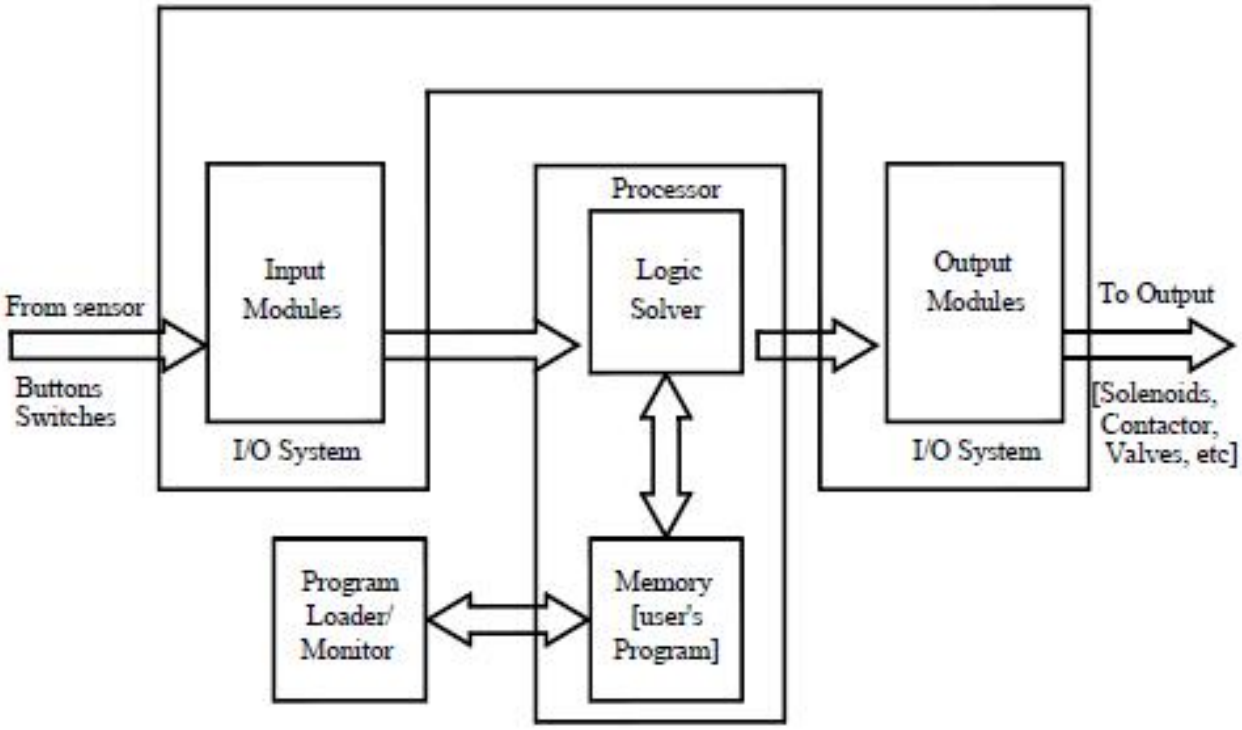
EXPERIMENTS

INTERFACING DIAGRAM



EXPERIMENT – 1

PROGRAMMABLE LOGIC CONTROLLER

DEFINITION OF PLC

A PLC is currently defined by the national electrical association (NEMA) as digital electronic Device that uses a programmable memory to store instructions and to implement specific functions Such as logic, sequence, timing, counting and control process.The term logic is used is because the programming is primarily concerned with implementing logicand switching operation programming for PLC is done by using a ladder logic diagram. PLCsreduce long and tedious programming and they are available in portable sizes and series.PLCs are now widely used and extend from small self-contained units for use with perhaps 20 digital input/outputs to modular systems which can be used for large numbers of input/output,handle digital or analogue input/outputs.

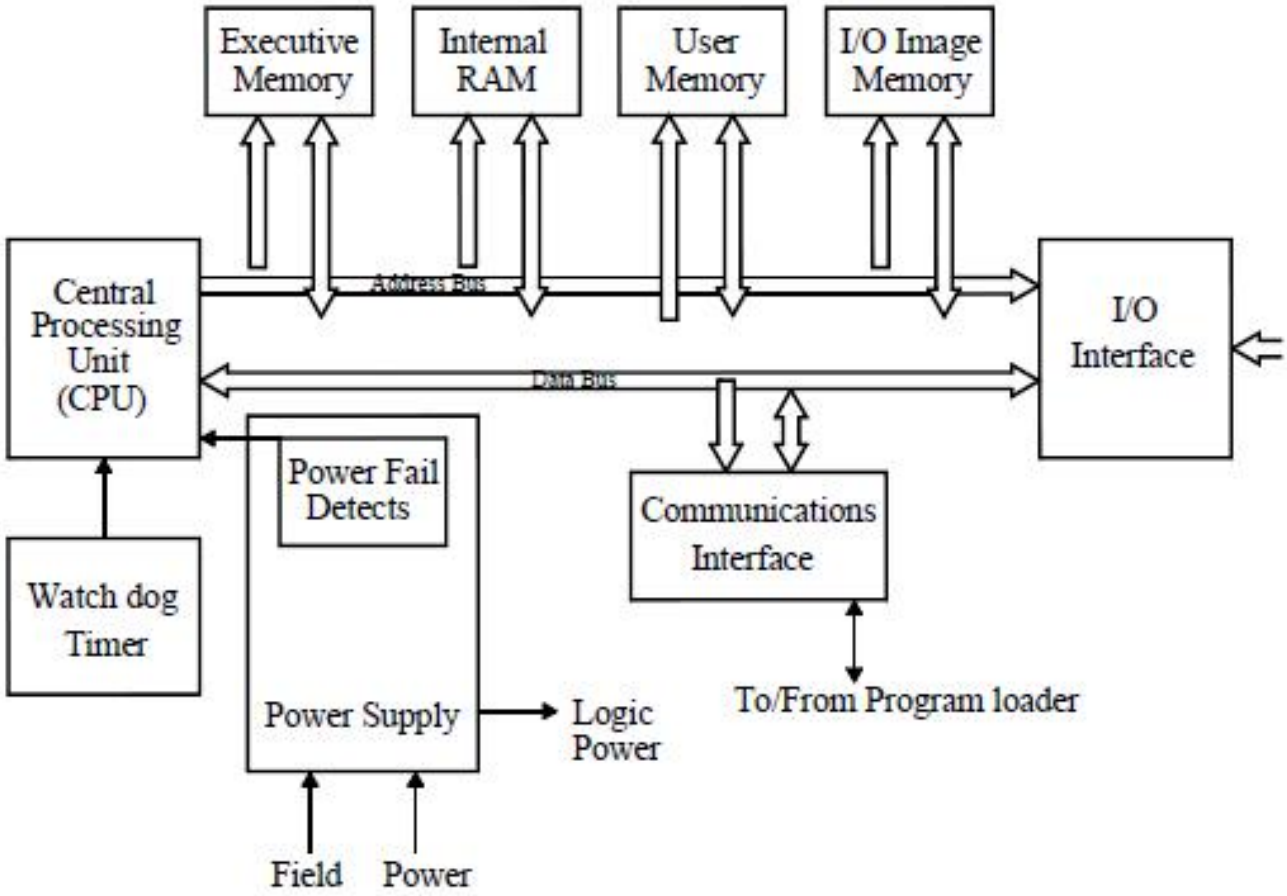
BLOCK DIAGRAM OF PLC

A simplified model of a PLC is shown in figure the inputs converts of convert the high level signals that come from the filed devices to logic level signals that the PLCs processor can read directly. The logic solver reads these inputs and decides what the output states should be based on the users program logic.The output modules convert the logic level output signals from the logic solver into the high level signal that are needed by the various filed devices. The program ladder is used to enter the users program in to the memory or change it and to monitor the execution of the program

PROCESSOR SECTION

The processor section consists of following main parts

1) Power supply
2) Memory
3) Central Processing Unit
4) I/O interface


Executive Memory
Internal RAM
User Memory
I/O Image Memory
Central Processing Unit (CPU)
Address Bus
Data Bus
I/O Interface
Power Fail Detects
Communications Interface
Watch dog Timer
Power Supply
Logic Power
To/From Program loader
Field
Power

Power Supply

The basic function of power supply is to convert the filed power in to a form. More suitable for the electronics devices that comprise the PLC (typically 5V or 24V). The power supply is one of the most critical components of a PLC for two reasons

a) It is difficulty non-redundant. Hence a failure of the PLC power supply can cause the entire control system to fail.

b) It will typically contain high voltage components. Hence an isolation failure can create the potential for serious injury or fire.

MEMORY

The memory of PLC two type

1. Volatile

2. Non-Volatile

Volatile memory loses its contents when power is removed, where as non-volatile memory for a majority of the users memory because the program must be retained during a power down cycle meaning that the user will not gave to reload the program each time power is lost. It is important that all non volatile memory in a PLC use some form of error checking to ensure that the memory has not changed.This error checking also should be done on line in order to ensure safe execution of the users program EEPROM means Electrically Erasable Programmable Read Only Memory. It is a nonvolatile memory that offers the same programming flexibility as dose RAM. Several small and medium size controllers use EEPROM as the only memory for the system. It provides permanent storage of the program and can easily be changed using standard programming device.

CENTRAL PROCESSING UNIT

How the CPU is constructed will determine the flexibility of the plc as well as the overall speed of the PLC. The speed is expressed in terms of how fast the plc will scan a amount of memory.This measure called the scan rate typically expressed in milliseconds per thousand words of memory faster with a scan time appropriate for the application. The CPU accepts (reads) input data from various sensing device executes the stored user program from memory and sends appropriate output command to control devices. It is important to note that many of the commercially available PLC is specify their

scan time using contacts and coils only.a real program that uses other functions such as timers, counter, mathematic functions.

INPUT/OUTPUT INTERFACES

The input/output system forms the interfaces by which field devices or connected to the controllers. The purpose of this interface is to conditions the various signals received from or send to external field devices. Input devices such as push button, limit switches, selector switches and thumbwheel switches or hardwired to terminals on the input modules output devices such as small motors, motors starters and indicator lights are hard wired to the terminals on the output modules. The I/O interface modules provide the equivalence of eyes, ears and tongue. To the brain of a PLC, the CPU. The input interface modules accept signals from the machines or process devices (120V-AC) and convert them into signal 5V DC that can be used by the controller. Output interface modules converts controller signals 5V DC into external signals 120V AC used to control the machine or process.Each input and output devices must have a specific address. The processor to identify where the Device is located in order to monitor or control it uses this address. Connecting the field wiring to the I/O housing allows easier disconnection and reconnection of the wiring in order to change modules. Lights are also added to module indicate the ON and OFF status of each I/O circuit. Most output modules also have blown fuse indicators.

OPERATION OF A PLC

The inputs and outputs being controlled are binary elements having either open (0) or closed (1) status. The basic principle of operation in a stored programmable logic is that every-logic involving inputs and outputs is performed at a high speed under the direction of program statements stored in the memory. Statements stored in the memory are fetched one by one in a serial order and based on the instruction in the statement; the necessary task is carried out. Sequential fetching of statements controlled through high-speed clock pulses .The process of sequential execution of each statement is called MEMORY SCANNING. The scanning in carried out cyclically at high speed. In view of the high speed involved, as compared to reaction times of electro mechanical switching elements (which are used as input and outputs) and further with the aid of storage of output command the logic execution is continuous as in hard-wired logic as and faster than relay logic. The statements of the logic to be performed are written

by the user in a simple, easy to understand and comprehend programming languages. This program is stored the program memory provided in the memory chip of the memory module. Each statement is entered as one step in the programming language and occupies one word of memory. The Logic Processing Unit (LPU) fetches and executes the instruction sequentially from the Memory unit. Thus the entire program is cyclically executed by impulses from an internal clock circuit. The inputs and outputs are fed through field power supply unit.

CHARACTERISTIC FUNCTIONS OF PLC

Seven of the most important characteristic of a PLC includes the following:

1. It is field programmable by the user. This characteristic allows the user to write and Change program in the field without rewiring or sending the unit back to the manufacturer for this purpose.
2. It contains preprogrammed functions. PLC's contain at least logic, timing, counting and memory function that the user can access through some type of control-oriented programming language.
3. It scans memory, and inputs and outputs (I/O) in a deterministic manner. This critical feature allows the control engineer to determine precisely how the machine or process will respond to the program.
4. It provides error checking and diagnostics. A PLC will periodically run internal tests of its memory; processor and I/O system to ensure that what it is doing to the machine or process is what is was programmed to do.
5. It can be monitored. A PLC will provide some form of monitoring capability, either through indicating lights that show the status of inputs and outputs or by an external device that can display program execution status.
6. It is packaged appropriately. PLC's are designed to with stand the temperature, humidity, vibration and noise found in most factory environment.
7. It has general purpose suitability. Generally a PLC is not designed for a specific application, but it can handle a wide variety of control tasks effectively.

PLC PROGRAMMING

The term PLC programming refers to the method by which the user communicates information to the PLC via a programming device. There are two methods of programming namely, On-line programming. Off-line programming. On-line programming is the one that can be programmed interactively with the

PLC. Off-line Programming requires that the programs be generated separately and then downloaded to the PLC. Programmable controller manufacturers use several different programming languages, but they all convey to the system, by means of instructions, a basic control plan. A control plan or program is defined as a set of instructions that are arranged in a logical sequence to control the actions of a process or machine. The four most common types of languages encountered in programmable controller system design are as follows:

Ladder Language

This is still the premier language of the PLC. It has many advantages and it will discuss later.

State Language

State languages can be a valuable aid in designing large and complex control program. Example for this type is Sequences Function Chart (SFC).

LADDER LOGIC DIAGRAM

It is a diagraming technique that exhibits the logic and to some extent, the timing and sequencing of the system. It is analogous to the electrical circuits used to another logic and sequence control. In a ladder logic diagram, the various logic elements and other components are displayed along horizontal lines or rungs connected on either end to two vertical rails. The diagram has the general configuration of a ladder, hence its name. The elements and the components are contacts and loads. The two vertical rails provide the power of components. It is customary in ladder diagram to locate the inputs to the left of each rung and the outputs to the right. PLC programming based on the use of ladder diagrams involves writing a program in a similar manner to drawing a switching circuit. In drawing the circuit line for a rung, inputs must always precede outputs and there must be at least one output on each line. Each rung must start with an input or a series of inputs and end with an output. Such ladder programs cab be entered from special keypads or selected from a monitor screen by using a mouse. They can also be specified by using a mnemonic language. However they are entered, the programs are then translated by the PLC into machine language for the benefit of the microprocessor and its associated elements.

PLC Vs COMPUTER

PLCs are similar to computers but have certain features, which are specific to their use as controllers. These are:

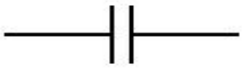
* They are rugged and designed to withstand vibrations, temperature, humidity and noise.
* The interfacing for inputs and outputs is inside the controller.
* PLC can be installed and maintained by plant technicians/electricians and more skilled computer technicians are not required.
* The computers are capable of executing several programs simultaneously but PLC can execute a single program in an orderly and sequential fashion from first to last instruction.
* Troubleshooting is simplified by the design of most PLC.

SYMBOLS OF PLC LADDER DIAGRAM

Normally open contact supplies the value 0. When the corresponding Push button switch is pressed this contact is closed.

Normally Open Contact

A Normally open contract supplies the value 0. When the corresponding push button switch is pressed this contact is closed (value is 1).

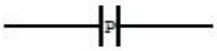


Normally closed contact

A Normally closed contact reacts correspondingly with the value 1. When the switch of pressed. This coil is open (value 0).

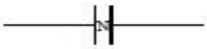
Positive edge contact

This edge contact supply the value 1 for the transition from 0 to 1.



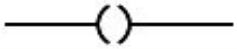
Negative edge contact

This negative edge contact supply the value 1 for the transition from 1 to 0.



Coil

With a normally open coil, the result (resulting logic operation of the contacts) is copied to the specified variable.



Negaling Coil

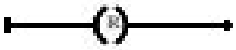
This negative coil, the negative of the result is transferred.

Set Coil

The setting coil assumes the value 1, if the result is 1 and remains un changed even if the result is 0 in between.

Reset Coil

Similarly the resetting coil only assumes the value 0 if the result is 1. The status of the coil is mentioned.



Memory Coil

This memory coil address is use of memory coils store the output value.

PLC Vs COMPUTER

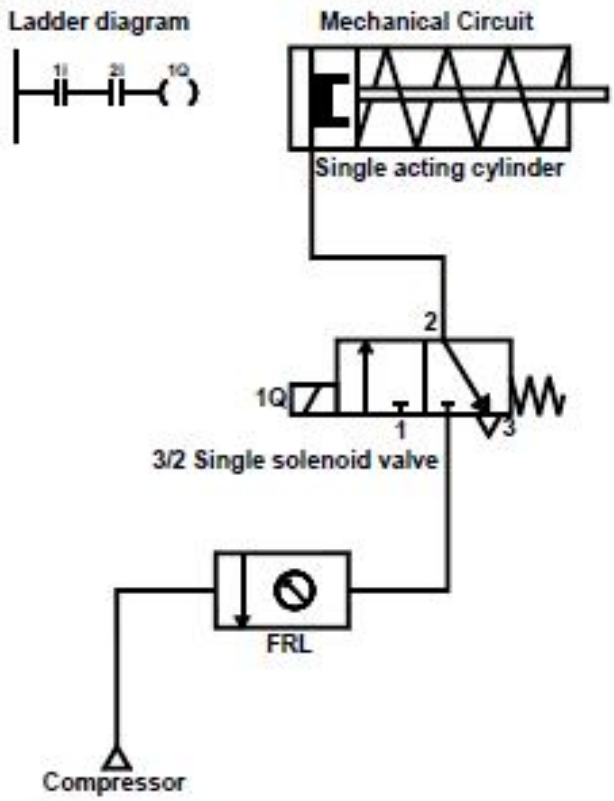
PLCs are similar to computers but have certain features, which are specific to their use as controllers. These are:

* They are rugged and designed to withstand vibrations, temperature, humidity and noise.
* The interfacing for inputs and outputs is inside the controller.
* PLC can be installed and maintained by plant technicians/electricians and more skilled computer technicians are not required.
* The computers are capable of executing several programs simultaneously but PLC can execute a single program in an orderly and sequential fashion from first to last instruction.
* Troubleshooting is simplified by the design of most PLC.

RESULT

EXPERIMENT-2

CIRCUIT DIAGRAM



Bill of materials

S.No	Materials Name	Quantity
1	Compressor	1
2	FRL	1
3	3/2 Single solenoid valve	1
4	Single acting cylinder	1
5	Normally open contact	2
6	Normally open coil	1

EXPERIMENT - 2

PLC CONTROL OF SINGLE ACTING CYLINDER USING AND LOGIC

AIM

To simulate the single acting cylinder using PLC ladder diagram

APPARATUS REQUIRED

Compressor, FRL, air tube, single acting cylinder, PLC, versa pro software,3/2 single solenoid valve.

PROCEDURE

1. Draw the circuit diagram.
2. Provide +24V and -24V from PLC trainer to electro pneumatic with PLC panel.
3. Output of the PLC (Q1) is direct connect to input of 3/2 single solenoid coil.
4. Open the versa pro software in desktop.
5. Interface PLC with the system using RS232 cable.
6. Following the opening procedure of versa pro software.
7. Connect the air supply to FRL unit.
8. Any one output of FRL unit direct connect to choosing valves.
9. Check the all circuit in panel and Ladder diagram.
10. Run the PLC. When two input (1i, 2i) is high, this output is high.

TRUTH TABLE

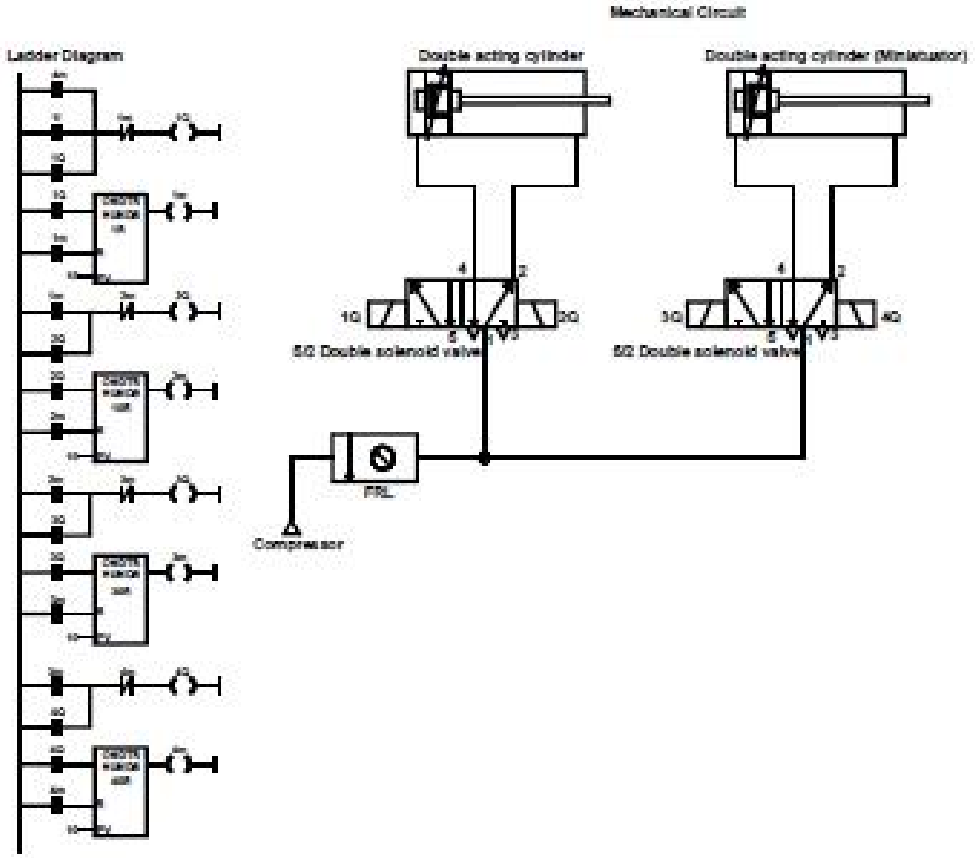
Input		Output 1Q
1i	2i	
OFF	OFF	OFF
ON	OFF	OFF
ON	ON	ON
OFF	ON	OFF

RESULT

Thus the actuation of single acting cylinder with AND Gate was done.

EXPERIMENT-3

CIRCUIT DIAGRAM



Bill of Materials

S.No	Materials Name	Quantity
1	Compressor	1
2	FRL	1
3	5/2 Double Solenoid Valve	2
4	Double acting cylinder	2
5	Normally open contact	17
6	Normally closed contract	4
7	Normally open coil	8
8	ON Delay timers	4

EXPERIMENT - 3

PLC CONTROL OF SEQUENCING CIRCUIT USING PLC LADDER DIAGRAM

AIM

To design a circuit for the sequence A+B+A-B- USING PLC

APPARATUS REQUIRED

Compressor, FRL, Air tube, 5/2 single solenoid valve, PLC, double acting cylinder, mini actuate cylinder, versa pro software.

PROCEDURE

1. Draw the circuit diagram.
2. Provide +24v and –24V from PLC trainer to panel.
3. Open the versa pro software in desktop.
4. Interface PLC with PC using rs232 cable.
5. Write a ladder diagram.
6. Both Outputs of PLC (q1, q2, q3 and q4) are direct connecting to inputs of solenoid coils.
7. Following the opening procedure of versa pro software.
8. Check the ladder diagram.
9. Connect the air supply to FRL unit.
10. Run the PLC. Observe the working of double acting cylinder is automatic reciprocating using the circuit A+B+A-B-.

RESULT

The ladder diagram for the automatic running of double acting cylinders is using this circuit (A+B+A-B-) is drawn and executed.

PROGRAM

SIMPLE TRAFFIC LIGHT / MAIN (OB1)

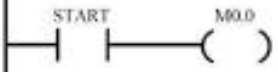
Block: MAIN
Author:
Created: 12/30/2011 12:54:12 pm
Last Modified: 01/02/2012 09:03:21 am

Symbol	Var Type	Data Type	Comment
	TEMP		
	TEMP		
	TEMP		
	TEMP		

PROGRAM COMMENTS

Network 1 Network Title

Network Comment

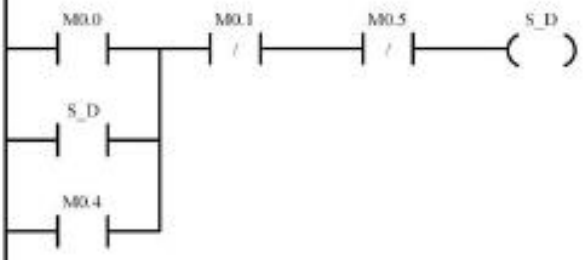


Symbol	Address	Comment
START	I0.0	START THE PROCESS

Network 2

Symbol	Address	Comment
STOP_PULSE	I0.1	

Network 3



Symbol	Address	Comment
S_D	Q0.0	SOUTH DIRECTION

EXPERIMENT - 4

DENSITY BASED TRAFFIC LIGHT CONTROLLER SYSTEM

SIMPLE TRAFFIC LIGHT SYSTEM

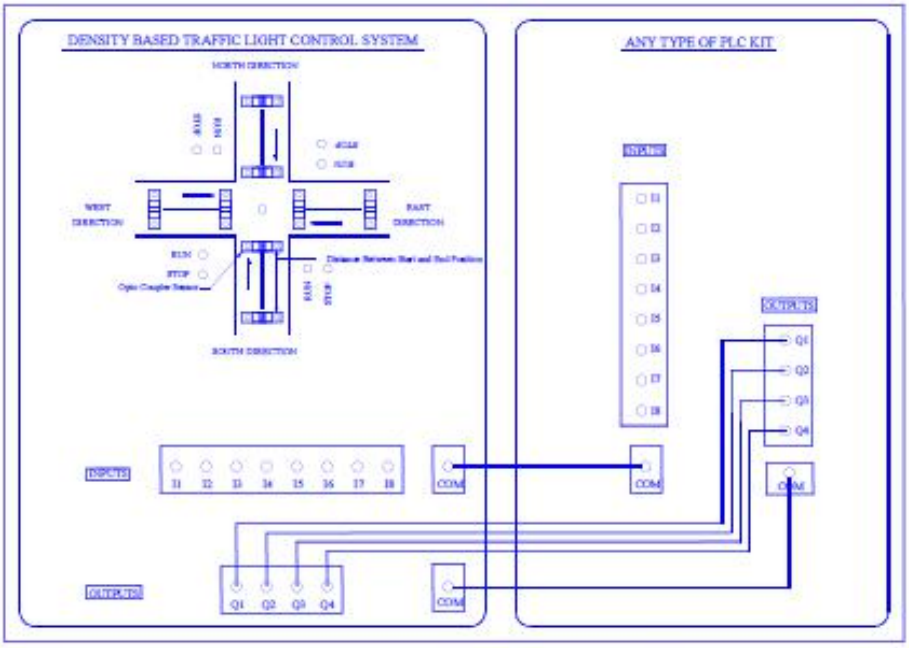
AIM

To study the simple Traffic Light system by using PLC.

APPARATUS REQUIRED

1. VPAT - 03 Trainer kit
2. PLC
3. PC with step7-microwin software
4. Communication cable PC/PPI
5. Patch chords
6. PC Power chords

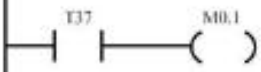
WIRING DIAGRAM



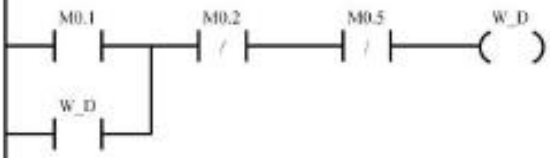
Network 4

Symbol	Address	Comment
S_D	Q0.0	SOUTH DIRECTION

Network 5

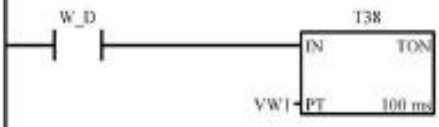


Network 6



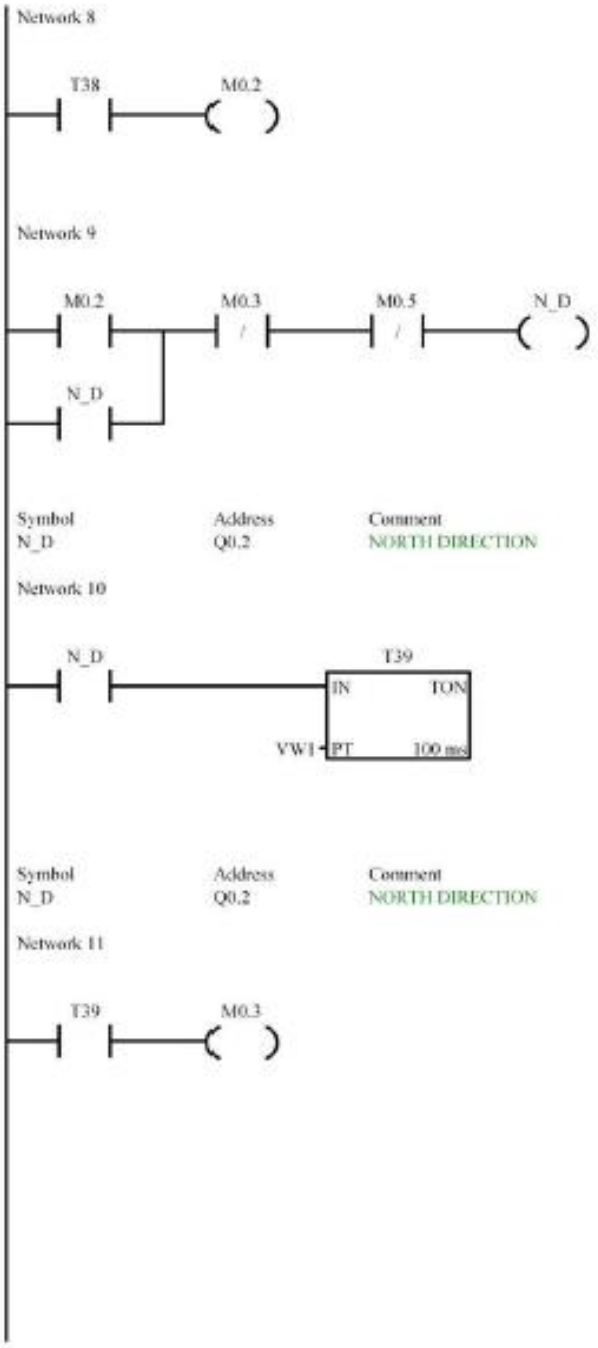
Symbol	Address	Comment
W_D	Q0.1	WEST DIRECTION

Network 7

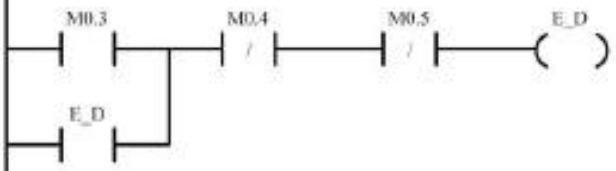


Symbol	Address	Comment
W_D	Q0.1	WEST DIRECTION

SIMPLE TRAFFIC LIGHT / MAIN (OB1)



Network 12

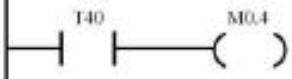


Symbol	Address	Comment
E_D	Q0.3	EAST DIRECTION

Network 13

Symbol	Address	Comment
E_D	Q0.3	EAST DIRECTION

Network 14



LADDER LOGIC PROGRAM EXPLANATION

When the output of PLC is enabled, the corresponding RUN mode LED will glow. Remaining will be in stop mode. The ladder logic program shown in figure when I1is ON/OFF, Q1(Green)[South Direction] is also enabled because M0.0 is closed. The enabled Q1 is given to timer depending upon the value of PT the M0.1 coil will enabled. Enabling output M0.1 is used to enable the output Q2 (green)[West Direction] and de-energize the output Q1 [Green], at the same time Q1 (Red) is energized because the red and green LEDs are connected with NOT gate. Energized Q2 is given to timer depending on the value of PT the M0.2 coil will be enabled. Then the enabling output of M0.2 is used to energize the output Q3[green][North Direction] & de-energized the output Q2[green], at the same time Q2 [Red] is energized. Because the Red and green LEDs are connected with NOT gate. [green LED - input of NOT gate, RED LED – output of NOT gate]. Energized Q3 is given to timer depending on the value of PT the M0.3 coil will be enabled then the enabling output of M0.3 is used to energize the output Q4 [green][East Direction] & deenergize the output Q3[green] at the same time Q3[RED] will glow. Because the RED and GREEN LEDs are connected with NOT gate. Then energized Q4 is given to timer depending on the value PT the M0.4 coil will be enabled. M0.4 is used to energize the output Q1 (green) and de-energized output Q4 (green) at the same time Q4 (RED) LED will glow because the Red and green LED are connected with NOT gate. This Process is repeated.

RESULT:

Thus the PLC based simple Traffic Light System working was studied.

PROGRAM

DENSITY TRAFFIC LIGHT / SBR_0 (SBR0)

Block: SBR_0
Author:
Created: 12/30/2011 12:54:12 pm
Last Modified: 01/02/2012 10:12:52 am

Symbol	Var Type	Data Type	Comment
EN	IN	BOOL	
	IN		
	IN_OUT		
	OUT		
	TEMP		

SUBROUTINE COMMENTS

Network 1 Network Title

Network Comment

Network 2

Symbol	Address	Comment
NIGHT_MODE	I1.2	
S_D	Q0.0	SOUTH DIRECTION

Network 3

Symbol	Address	Comment
NIGHT_MODE	I1.2	
W_D	Q0.1	WEST DIRECTION

EXPERIMENT - 5

DENSITY BASED TRAFFIC LIGHT SYSTEM

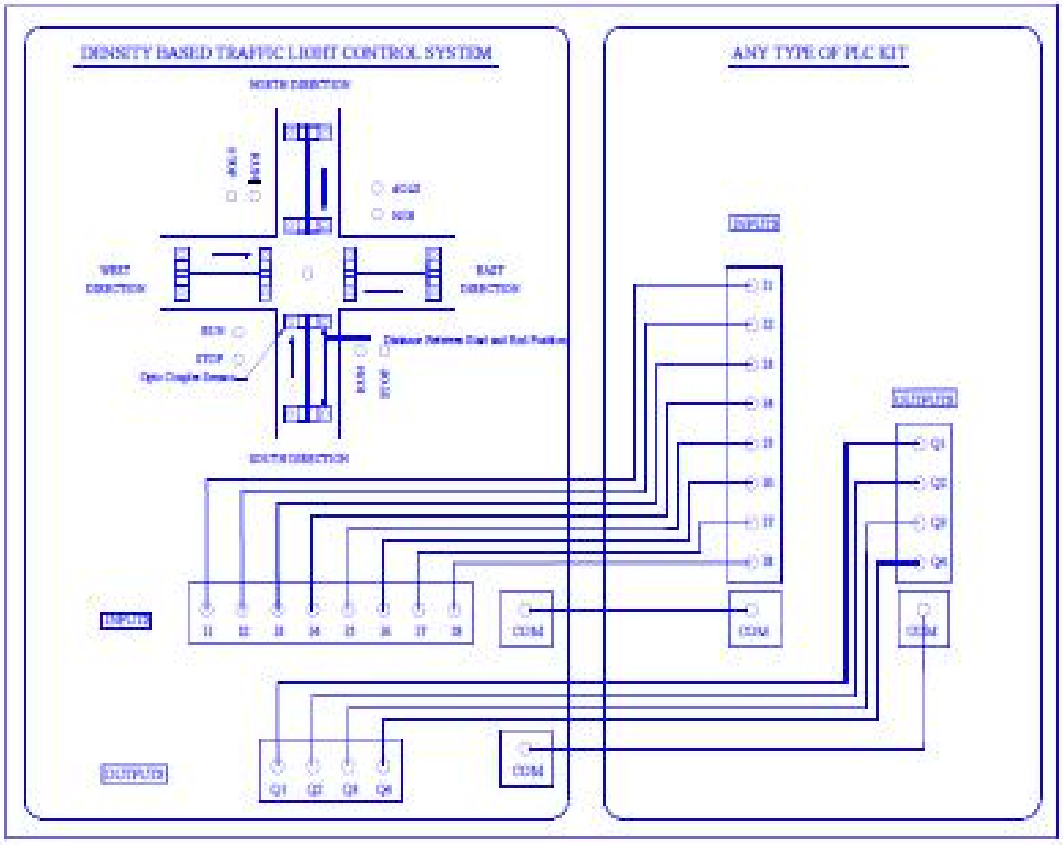
AIM

To study the Density based Traffic Light controller system by using PLC.

APPARATUS REQUIRED

1. VPAT - 03 Trainer kit
2. PLC
3. PC with step7-microwin software
4. Communication cable PC/PPI
5. Patch chords
6. PC Power Chords.

WIRING DIAGRAM



LADDER LOGIC PROGRAM EXPLANATION

By applying start one triggering pulse to Input I1.0(I9), which causes for open coilM0.0 energized in Network 1, Due to energisation of open coil M0.0 initiates the operation. It causes the open coil Q0.0 [Q1 coil] energized in Network 4. In Network 5 On delay timer - is also energized. After completing the time - delay [5sec], which is depending upon preset Time coil M0.1 will be energized. Due to energization of M0.1 it cuts the Q0.0 coil output and enables the Q0.1 west Direction output. Due to Q0.1 (Q2 coil) will energized in Network 7, then Q1 coil Q0.0 de-energized and timer is reset in Network 8. This same process was repeated again in West Direction, North Direction, and East Direction. In west direction, that means Network 8 ON Delay timer will be energized depends upon Q2coil[Q0.1] then M0.2 [Open coil] is energized, after completed programmed time - delay, which is depends upon preset Time, then rest the timer. At that time, Q2 coil [Q0.1] deenergized, timer was reseted Q3 coil [Q0.2] was energized. In Network 10, latch connection Q3 coil [Q0.2] is used to energized for continuously. Hence ondelaytimer is starts ON due to Q3 contact [Q0.2] energization in rung-8, then M0.3 [Q0.2] will energize. Afer completion of time - delay, which is depends upon Preset Time, then reset the timer. Then Q4 coil [Q0.3] energized and Q3 coil [Q0.2] are de-energized at that same time. In Network 13 ON - Delay timer is starts ON, due to Q4 contact[Q0.3] energization, then M0.4 coil will be energized, after completion of time - delay, rest the timer this time-delay depends upon the [M0.4] preset Time. This process repeats continuously.

STATE -1: BOTH OF THEM HIGH

If Network 16, South direction - start and end modes are in high stat, that means high-density of vehicle in south direction, move register get the input value from Network 28, MW1 move register input value [programmed time - delay], then fed into preset Time of time - delay in Network 4. That means green LED will glow in south direction up to, set time - delay in Network 28.

STATE - 2: BOTH OF THEM LOW

If Network 17 south direction - start & end modes are in low state, that means low - density of vehicle in south direction, move register get the input value from Network 30, MW5 move register input value

[programmed Time - delay], then fed into preset value of time delay nNetwork 4. That means green - LED will glow in south direction up to, set- time delay in Network 28.

STATE - 3 STARTS ONLY HIGH

If Network 18, south direction - start mode only high - state & END mode is in low - state, that means middle - level density vehicle in south direction, move register get the input value from Network 29 MW10 move register input value [programmed Time - delay] then fed into preset value of in Network 4 that means green LED will glow in south direction up to, set-time delay in Network 28. Above 3 states are again repeated in west - direction [Network 19, Network 20, Network 21], North - direction then fed into preset time of time delay in network 4 [Network 22, Network 23, Network 24] & East - direction then fed into preset time of time delay in Network 5 [Network 25, Network 26, Network 27] then fed into preset time of time delay in Network 6. Apply the stop triggering pulse to input I1.1(I10), it enables the coil M0.5. hence all directions LED's are in disable state.

Note:

If one direction is in glow green LED Run - mode, other directions are in red - LED [Stop mode]

Inputs - I1 (to) I8

Outputs - Q1 (to) Q4

RESULT:

Thus the density based Traffic Light Controlled System working was studied by using PLC.

PROGRAM

DENSITY TRAFFIC LIGHT / MAIN (OB1)

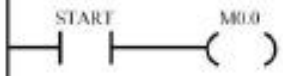
Block: MAIN
Author:
Created: 12/30/2011 12:54:12 pm
Last Modified: 01/02/2012 10:15:13 am

Symbol	Var Type	Data Type	Comment
	TEMP		
	TEMP		
	TEMP		
	TEMP		

PROGRAM COMMENTS

Network 1 Network Title

Network Comment



Symbol	Address	Comment
START	I1.0	START THE PROCESS

Network 2

Symbol	Address	Comment
STOP_PULSE	I1.1	

Network 3

Symbol	Address	Comment
NIGHT_MODE	I1.2	

EXPERIMENT - 6

DENSITY BASED TRAFFIC LIGHT SYSTEM WITH DAY/NIGHT MODE

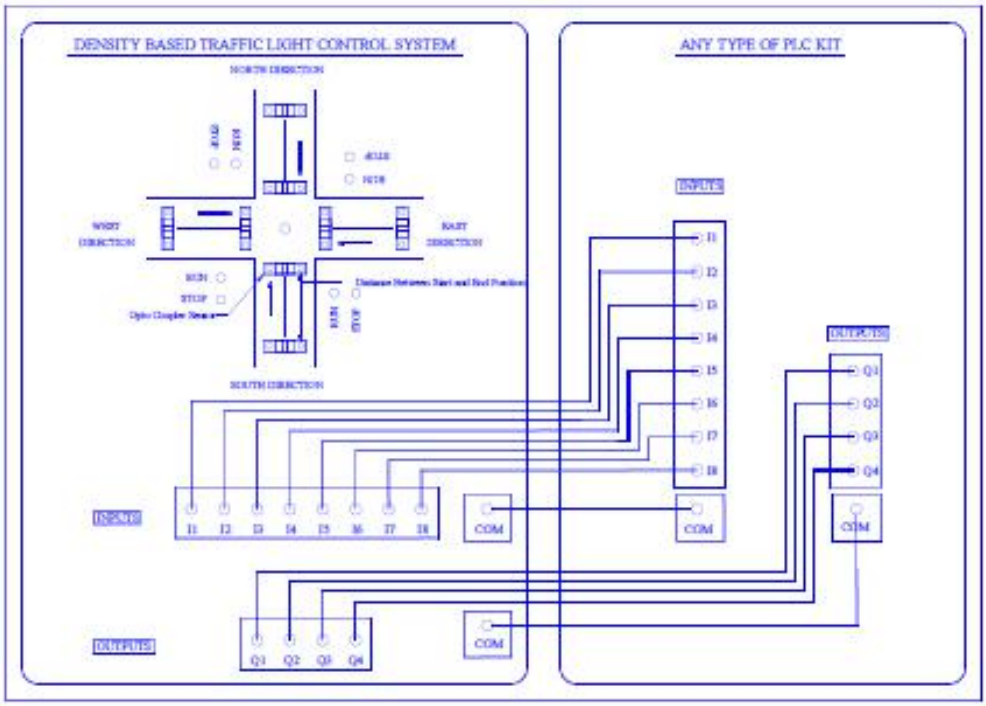
AIM

To study the Density based Traffic Light system with Day / Night mode.

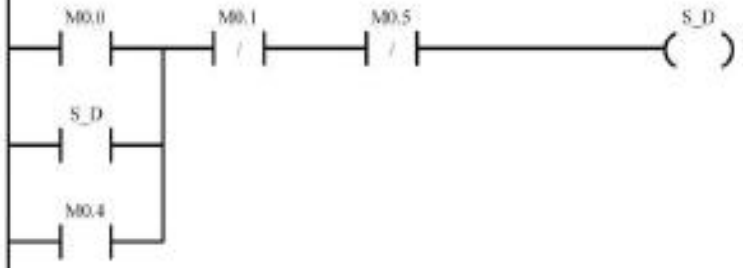
APPARATUS REQUIRED

1. VPAT - 03 Trainer kit
2. PLC
3. PC with step7-microwin software
4. Communication cable PC/PPI
5. Patch chords
6. PC Power Chords.

WIRING DIAGRAM



Network 4



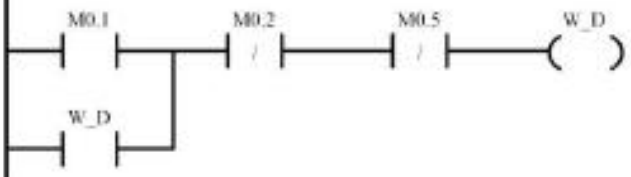
Symbol	Address	Comment
S_D	Q0.0	SOUTH DIRECTION

Network 5

Symbol	Address	Comment
S_D	Q0.0	SOUTH DIRECTION

Network 6

Network 7

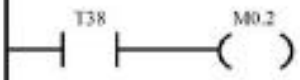


Symbol	Address	Comment
W_D	Q0.1	WEST DIRECTION

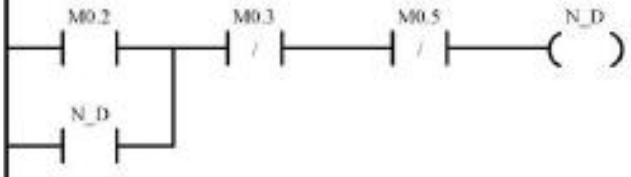
Network 8

Symbol	Address	Comment
W_D	Q0.1	WEST DIRECTION

Network 9



Network 10

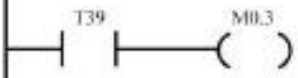


Symbol	Address	Comment
N_D	Q0.2	NORTH DIRECTION

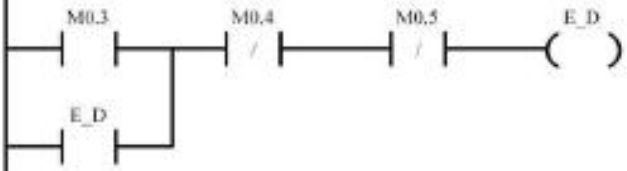
Network 11

Symbol	Address	Comment
N_D	Q0.2	NORTH DIRECTION

Network 12



Network 13

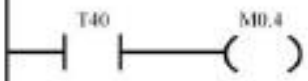


Symbol	Address	Comment
E_D	Q0.3	EAST DIRECTION

Network 14

Symbol	Address	Comment
E_D	Q0.3	EAST DIRECTION

Network 15

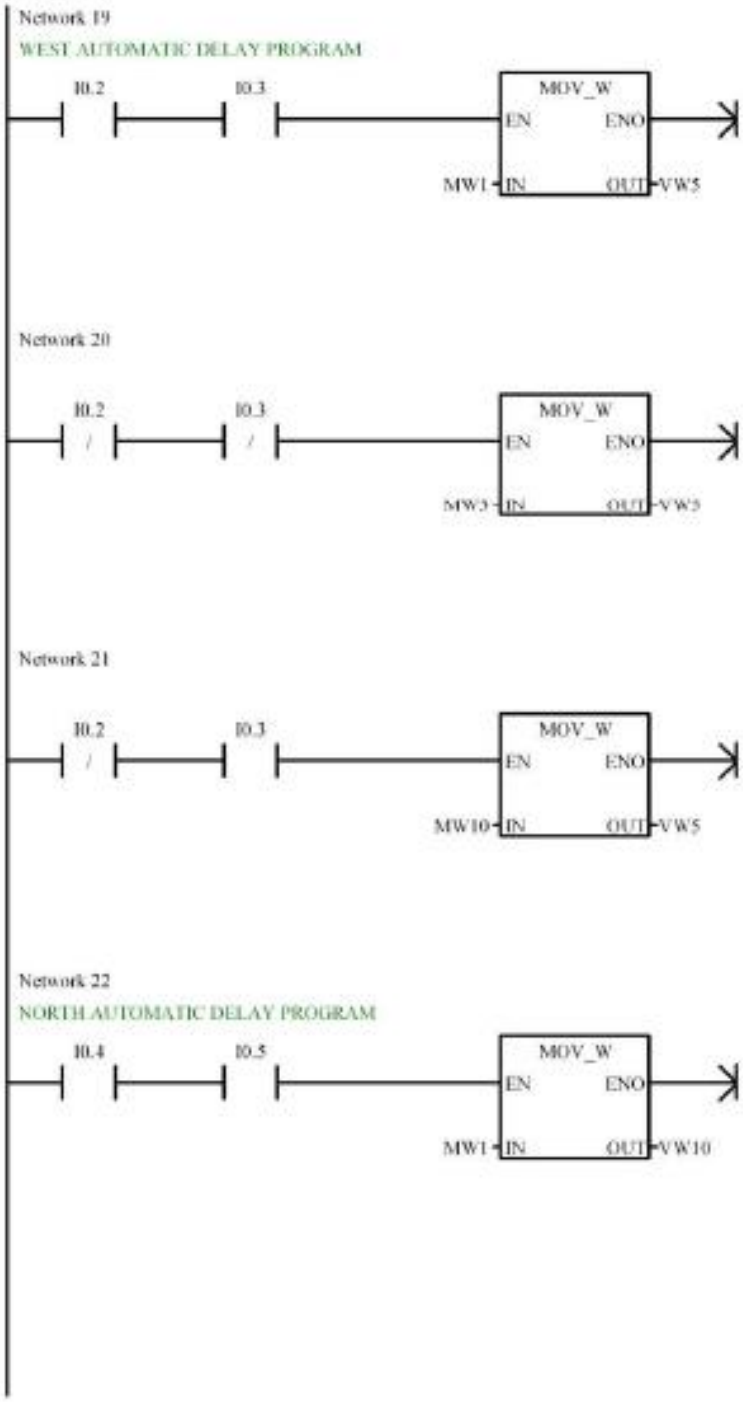


Network 16

SOUTH AUTOMATIC DELAY PROGRAM

Network 17

Network 18

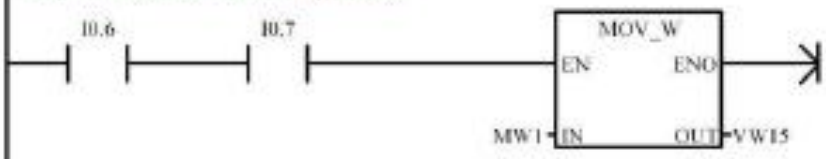

Network 19
WEST AUTOMATIC DELAY PROGRAM
I0.2
I0.3
MOV_W
EN
ENO
MW1
IN
OUT
VW5
Network 20
I0.2
I0.3
MOV_W
EN
ENO
MW3
IN
OUT
VW5
Network 21
I0.2
I0.3
MOV_W
EN
ENO
MW10
IN
OUT
VW5
Network 22
NORTH AUTOMATIC DELAY PROGRAM
I0.4
I0.5
MOV_W
EN
ENO
MW1
IN
OUT
VW10

Network 23

Network 24

Network 25

EAST AUTOMATIC DELAY PROGRAM

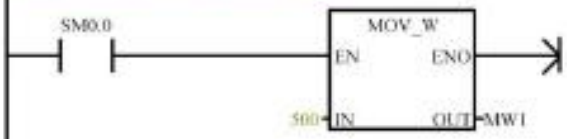


Network 26

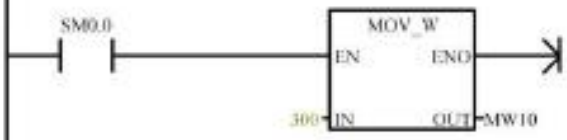
Network 27

Network 28

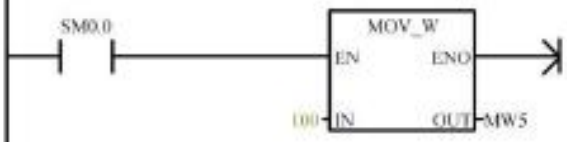
DATA MOVE TO AUTOMATIC TIMER



Network 29



Network 30



Block: SBR_0
Author:
Created: 12/30/2011 12:54:12 pm
Last Modified: 01/02/2012 10:12:52 am

Symbol	Var Type	Data Type	Comment
EN	IN	BOOL	
	IN		
	IN_OUT		
	OUT		
	TEMP		

SUBROUTINE COMMENTS

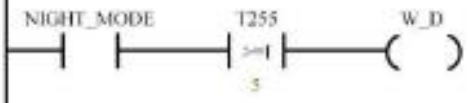
Network 1 Network Title

Network Comment

Network 2

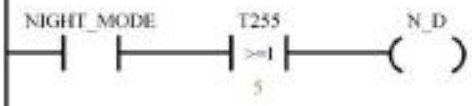
Symbol	Address	Comment
NIGHT_MODE	I1.2	
S_D	Q0.0	SOUTH DIRECTION

Network 3



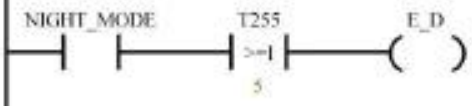
Symbol	Address	Comment
NIGHT_MODE	I1.2	
W_D	Q0.1	WEST DIRECTION

Network 4



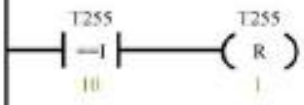
Symbol	Address	Comment
N_D	Q0.2	NORTH DIRECTION
NIGHT_MODE	I1.2	

Network 5



Symbol	Address	Comment
E_D	Q0.3	EAST DIRECTION
NIGHT_MODE	I1.2	

Network 6



LADDER LOGIC PROGRAM EXPLANATION

By applying start one triggering pulse to Input I1.0(I9), which causes for open coilM0.0 energized in Network 1, Due to energization of open coil M0.0 initiates the operation. It causes the open coil Q0.0 [Q1 coil] energized in Network 4. In Network 5 On delay timer - is also energized. After completing the time - delay [5sec], which is depending upon preset Time coil M0.1 will be energized. Due to energization of M0.1 it cuts the Q0.0 coil output and enables the Q0.1 west Direction output. Due to Q0.1 (Q2 coil) will energized in Network 7, then Q1 coil Q0.0 de-energized and timer is reset in Network 8. This same process was repeated again in West Direction, North Direction, and East Direction. In west direction, that means Network 8 ON Delay timer will be energized depends upon Q2coil[Q0.1] then M0.2 [Open coil] is energized, after completed programmed time - delay, which is depends upon preset Time, then rest the timer. At that time, Q2 coil [Q0.1] deenergized, timer was reseted Q3 coil [Q0.2] was energized. In Network 10, latch connection Q3 coil [Q0.2] is used to energized for continuously. Hence ondelay timer is starts ON due to Q3 contact [Q0.2] energization in rung-8, then M0.3 [Q0.2] will energize. Afer completion of time - delay, which is depends upon Preset Time, then reset the timer. Then Q4 coil [Q0.3] energized and Q3 coil [Q0.2] are de-energized at that same time. In Network 13 ON - Delay timer is starts ON, due to Q4 contact[Q0.3] energization, then M0.4 coil will be energized, after completion of time - delay, rest the timer this time-delay depends upon the [M0.4] preset Time. This process repeats continuously. In main [OBI] program network 3 the input contact I1.2 is used to call the subroutine function. In subroutine SBR-0[SBR0] program network 1 the Input contact supply given to timer. Based on time delay in Time-preset time the outputs are energized initially Q0.0, Q0.1, Q0.2 & Q0.3. After time delay it will get de-energize it shows green ans Red LED’s continuous ON/OFF in the trainer kit. This process repeats continuously upto the Night mode switch is in enable condition.

CONCLUSION

Density Based Traffic Light System with Day/Night mode was studied by using PLC.

EXPERIMENT - 7

BOTTLE FILLING SYSTEM USING PLC

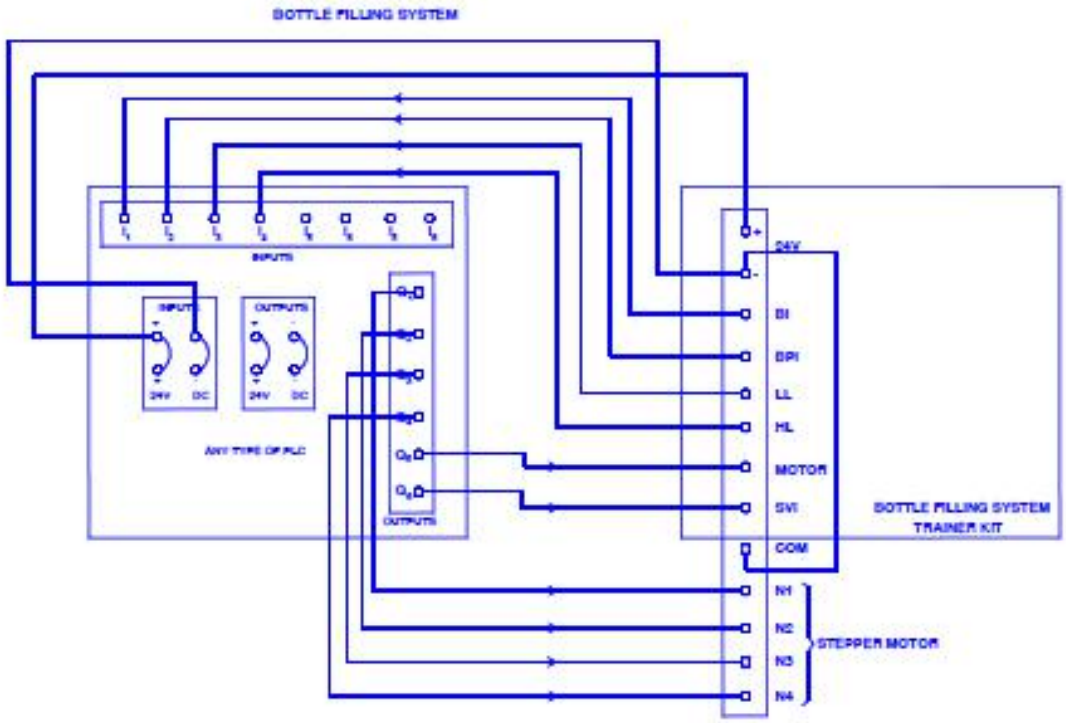
AIM

To study the functions and control of Bottle filling system.

APPARATUS REQUIRED

1. Bottle Filling System Controller Kit
2. PLC & Trainer kit
3. PC & step7-Microwin software
4. Communication cable PC / PPI
5. Patch-Chords

WIRING DIAGRAM

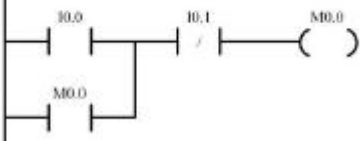


Block: MAIN
Author:
Created: 10/02/2010 12:40:43 am
Last Modified: 04/08/2011 06:54:56 am

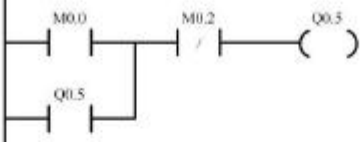
Symbol	Var Type	Data Type	Comment
	TEMP		
	TEMP		
	TEMP		
	TEMP		

PROGRAM COMMENTS

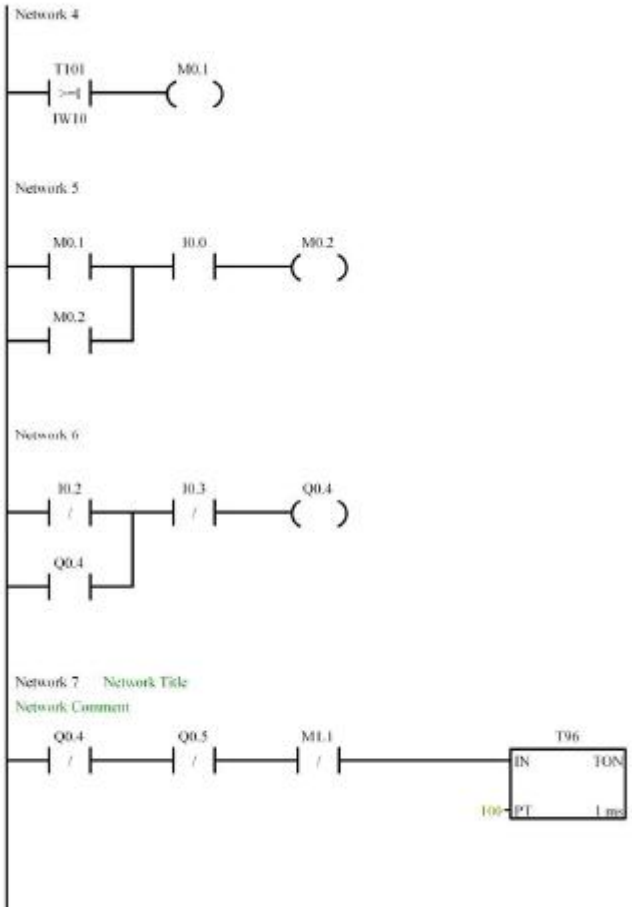
Network 1

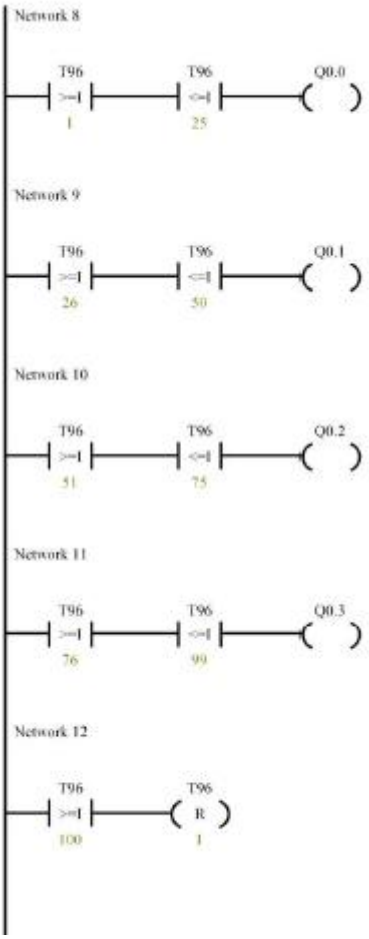


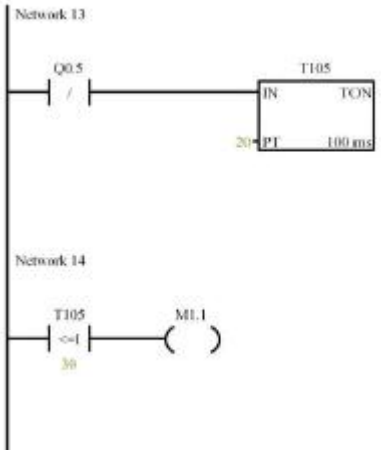
Network 2



Network 3


Network 4
T101
>=I
IW10
M0.1
Network 5
M0.1
I0.0
M0.2
M0.2
Network 6
I0.2
/
I0.3
/
Q0.4
Q0.4
Network 7
Network Title
Network Comment
Q0.4
/
Q0.5
/
M1.1
/
T96
IN
TON
100
PT
1 ms


Network 8
T96
>=I
1
T96
<=I
25
Q0.0
Network 9
T96
>=I
26
T96
<=I
50
Q0.1
Network 10
T96
>=I
51
T96
<=I
75
Q0.2
Network 11
T96
>=I
76
T96
<=I
99
Q0.3
Network 12
T96
>=I
100
T96
R
1


Network 13
Q0.5
/
T105
IN
TON
20
PT
100 ms
Network 14
T105
<=I
30
M1.1

LADDER LOGIC PROGRAM EXPLANATION

In automatic bottle filling system. In Network 6 program for automatically start the motor because I0.2 & I0.3 are normally closed contact. It is in high level of liquid in process tank, motor will stop, because the will get open. It energizes the output coil Q0.4, Q_5 given to motor, it pumps the water from reservior tank to process tank.

If the Bottle sensor I0.0 & Bottle position sensor's I0.1 Inputs are in high-state, then M0.0 [Open coil] are energized in Network 1. In Network 2, Q0.5 [Open coil Q_6] energized now, because of [Memory] is closed contact. That means, output Q_6 coil is solenoid value, hence solenoid value opening now.

For example if we give time delay 21 millisec means, from 1 millisec to 5 millisec the coil Q0.0 will be energized. Then from 6 milli secs to 10 milli sec the coil Q0.1 will be energized, next from 11 milli secs to 15 milli sec the coil Q 0.2 will be energixed, the from 16 millisecs the coil Q0.3 will be energized. At the time reaching the preset time 21 millisec the timer get reset. Like wise the process repeats.

In network 13, solenoid valve closed contact provided to timer for time delay between for each bottle position. Like wise these operation is repeating in these sequence.

From Network 7 the stepper motor operation program starts. Here Q5 & Q6 coils closed contacts provided for cuts stepper motor operation when the motor pumps the water to process tank and solenoid valve energizing time.

In network 3, Q_6 coil open contact given input to the ON Delay - Timer. After reach the preset time the memory coil M0.1 will be energized. It energizes the M0.2 coil output and it cuts the Q_6 coil [solenoid valve] output supply.

CONCLUSION

All the functions & control of Bottle-Filling system are known well.

EXP.NO:8

CLOSED LOOP RESPONSE OF DC MOTOR USING PID CONTROLLER

AIM

To study the response of DC motor through Digital PID controller using Position control.

APPARATUS REQUIRED

1. PCS 07ACC-01.
2. Digital PID controller.
3. PC with Process Control Software.
4. Patch chords.
5. Power chord.

THEORY

Speed Control of DC MOTOR

The speed of the DC motor is controlled by varying the armature voltage. In a DC shunt motor speed of the motor is directly proportional to the voltage. The electromagnetic torque developed by the motor is proportional to its flux and armature current. Obviously flux is going to be constant hence torque developed depends on the armature current. The simplified transfer function of the DC motor is given by

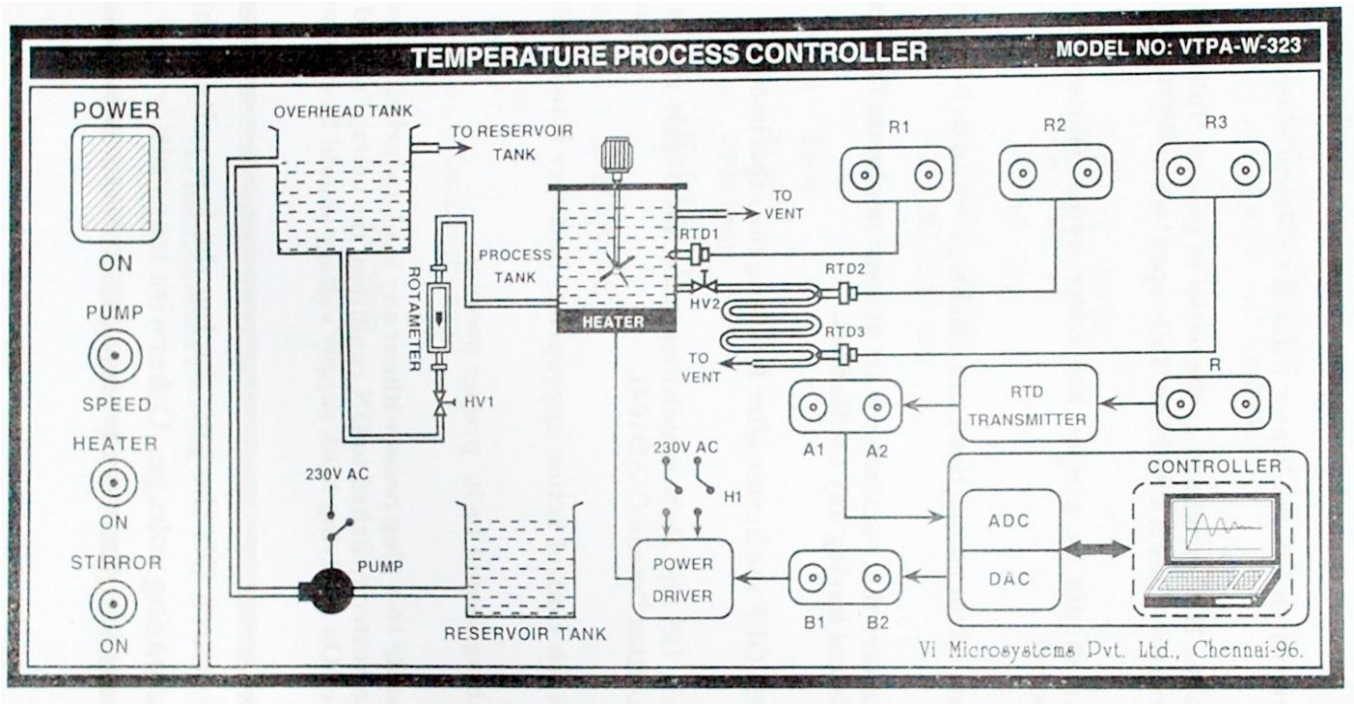
$$T(S) = K_m/1+s\tau$$

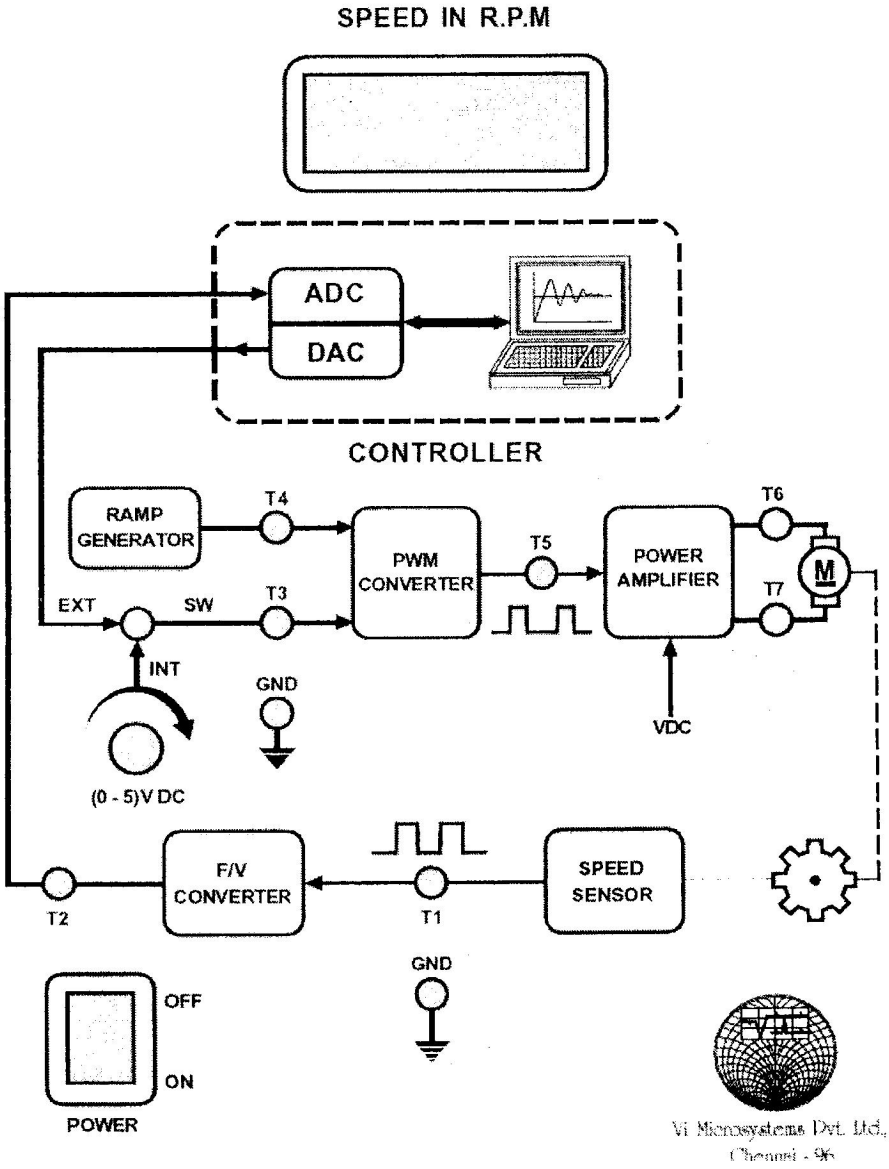
Where

K_m = Gain of the motor

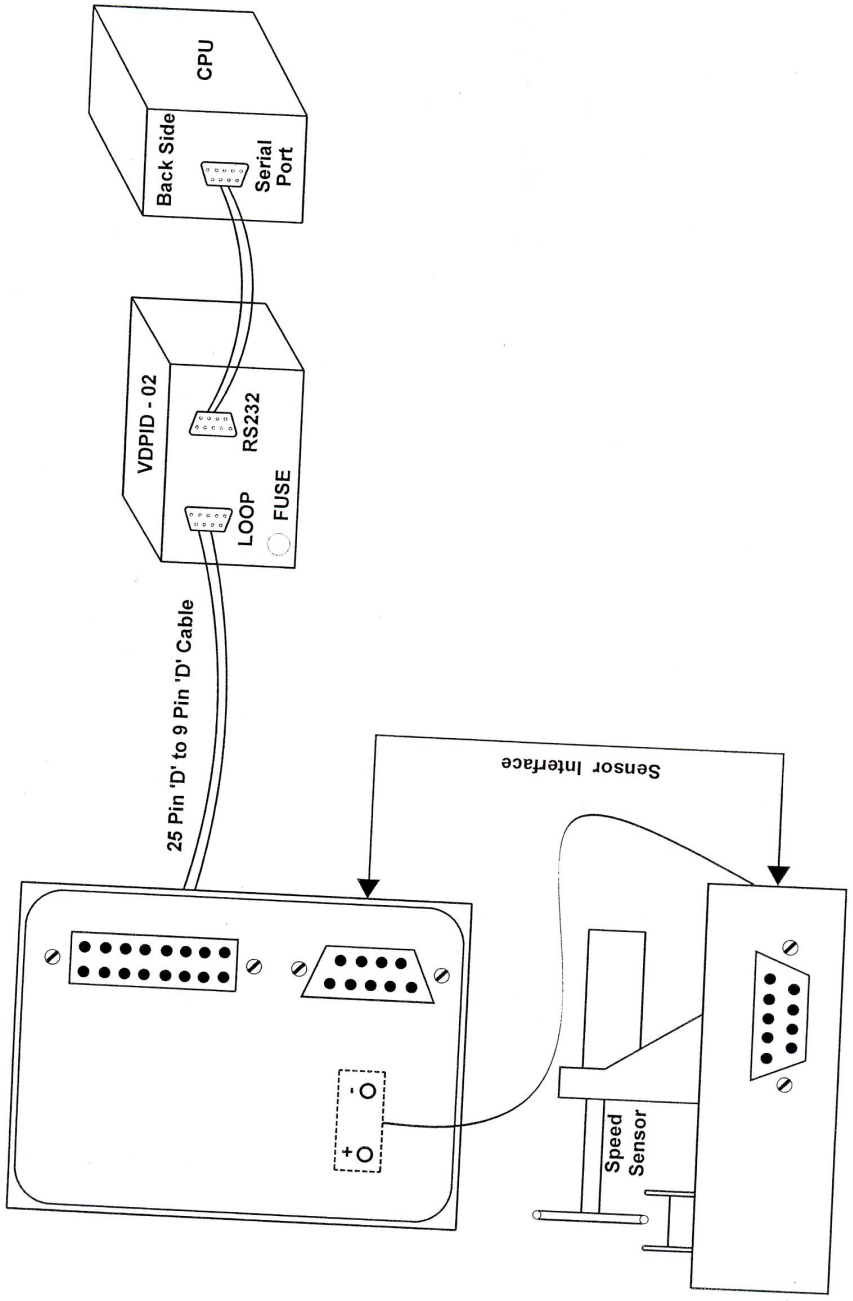
τ = time constant of the motor

FRONT PANEL DIAGRAM:

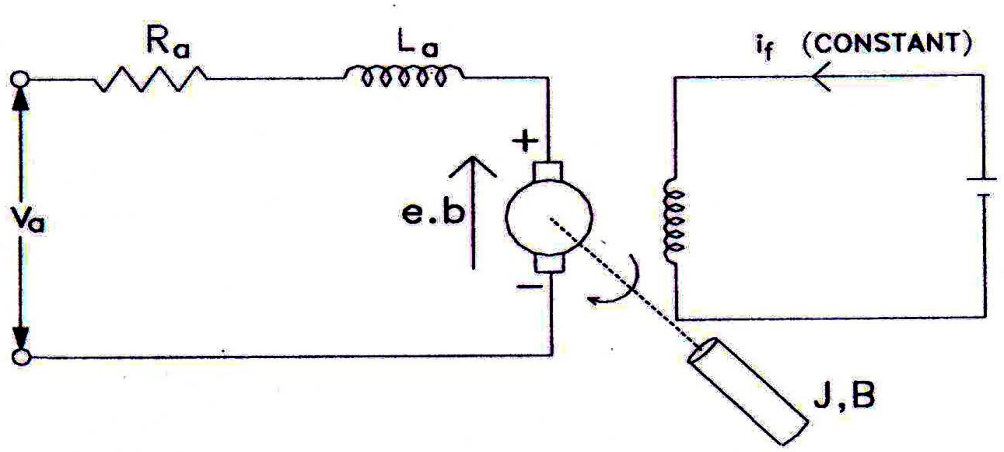



SPEED IN R.P.M
ADC
DAC
CONTROLLER
RAMP GENERATOR
T4
PWM CONVERTER
T5
POWER AMPLIFIER
T6
T7
M
EXT
SW
T3
INT
GND
VDC
(0 - 5)V DC
F/V CONVERTER
T2
T1
SPEED SENSOR
GND
OFF
ON
POWER
Vi Microsystems Pvt. Ltd.,

INTERFACING DIAGRAM

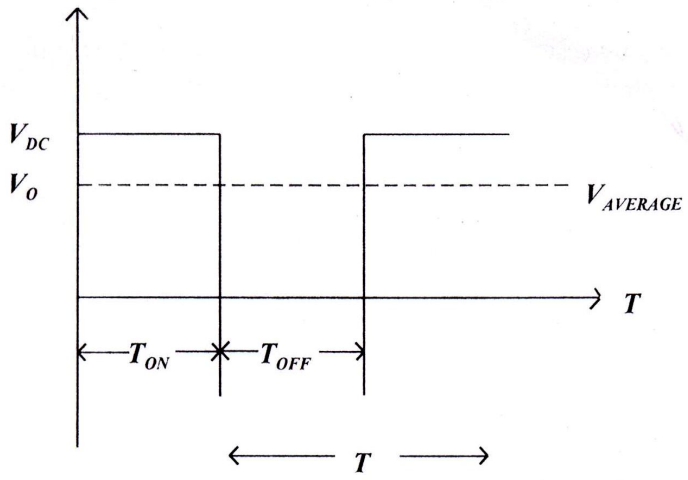


Speed Control of DC MOTOR



PWM TECHNIQUE

Pulse width modulation is a technique used for changing the magnitude of voltage given to the motor. This technique involves changing its width of pulse as our wish so that the average voltage is going to be varied as our requirement. In this waveform the output voltage is determined by the average T_{on} and T_{off} period.



Output Waveform

If the T_{on} period is increased then the output voltage is going to be increased 0 and vice versa .Hence the output voltage is given by,

Where

$$\mathbf{V_0 = (T_{on} / T)\ V_1}$$

V_0= Output voltage in volt

T_{on} = on period in sec

T = total period in sec

V_1 = input voltage in volt

D = duty cycle ratio.

PROCEDURE

1. Connections are made as per the interfacing diagram
2. Invoke 'DC Motor Speed Control' software in PC.
3. Switch ON the unit and Digital PID controller.
4. Invoke Process Control Software..
5. Select position type in the Digital PID controller.
6. Enter the parameters and observe the response.
7. Save the response.
8. Switch OFF the unit**.**

RESULT

Thus the Response of DC Motor through Digital PID controller using position control was studie

EXP.NO:9

CLOSED LOOP RESPONSE OF FLOW PROCESS

AIM:

1. To study the operation & characteristics of a flow process station.

APPARATUS REQUIERD:

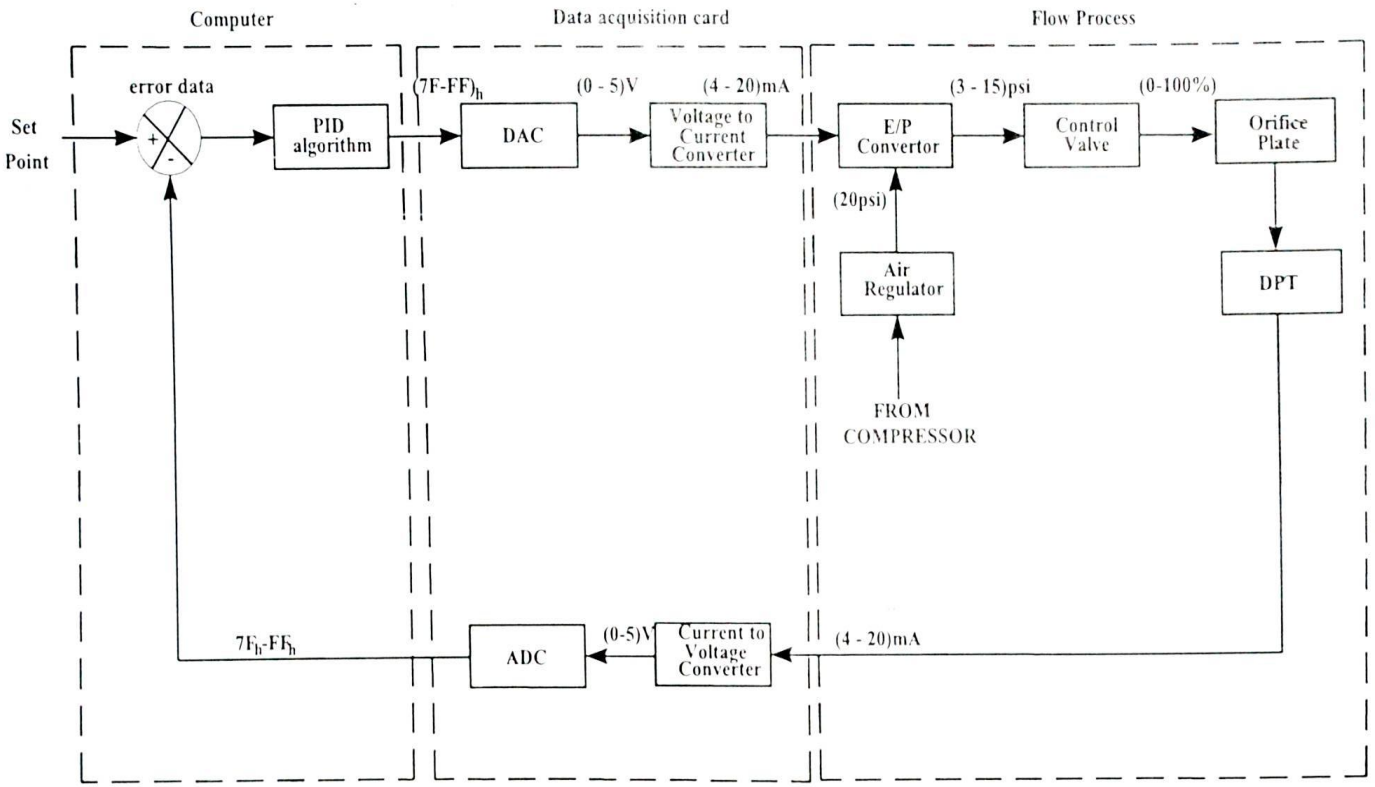
1. PC with process control software
2. Flow process station
3. Patch chords
4. Data acquisition card with cable

THEORY:

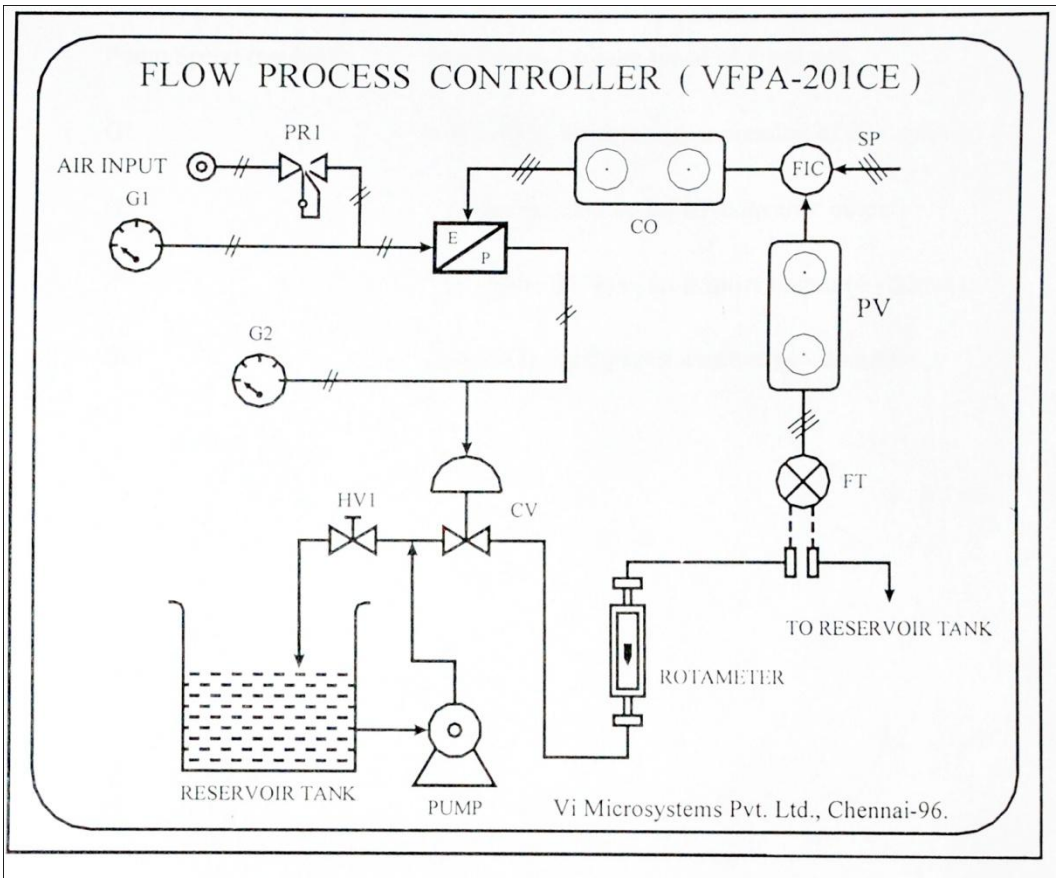
The apparatus consists of a water circulation system with a centrifugal pump coupled to a sump tank generating the process variable namely water flow. A differential pressure transmitter connected to an orifice plate measures the flow rate. A three term controller which is an advanced programmable microprocessor, based electronic unit incorporates an RS232 serial communication for data logging. The controller drives the pneumatically operated valve to regulate the flow automatically at the required set point value. The water fowl may also be adjusted manually from the controller provided in the panel.

A rotameter is incorporated in the water circuit to provide an immediate visual indication of the flow rate. Manual and solenoid operated valve are included in the system to enable external disruptions to the flow to be introduced. An air compressor is required for supply of air as the medium.

BLOCK DIAGRAM OF FLOW PROCESS CONTROLLER



FRONT PANEL DIAGRAM:



The I/P convertor is also called the electro pneumatic convertor , is used where a

4 to 20 mA signal current is to be converted to 3-15 psi presuure signal. Essentialy the convertor needs two inputs , viz. a fixed 20 psi air at its air inlet and a variable 4 to 20mA at its current input.It consists of 3 basic parts:

- Pick up system
- Convertor
- Pneumatic relay

The pick up system consists of a voice coil situated in the air gap of permanent magnet. The convertor consists of a nozzle, the restrictor and the baffle plate on the beam, which is mounted on low friction fulcrum. The pneumatic relay consists of a diaphragm , a valve seat, a needle, and a capillary tube.

PROCEDURE:

1. Ensure the availability of air & water.
2. Interface the PC with process and data acquisition card.
3. Maintain gauge (G1) pressure at 20 psi by using air regulator knob.
4. Position the hand value HV1 in slightly open position.
5. Patch CO & PV terminal through patch chords.
6. Switch ON the unit and data acquisition card with PC.
7. Invoke process control software.
8. Select “flow<<control<<ON-OFF/P/PI/PD/PID.
9. Switch on the pump and select desired speed of pump by varying speed control knob.
10. Enter the parameters and observe the response of various controllers.
11. Switch OFF the pump.
12. Save the response and conclude the behavior of various controllers.

TABULATION:

Time (sec)	PV (LPH)	CP (%)

RESULT:

Thus the operation and characteristics of a flow process station was studied

EXPERIMENT.NO:10

CLOSED LOOP RESPONSE OF PRESSURE PROCESS

AIM:

To study the performance of ON-OFF controllers

APPARATUS REQUIRED

1. Pressure process station
2. PC with the pressure process software
3. Data acquisition card with cable
4. Patch chords

THEORY:

The electronic pressure transmitter which senses the absolute pressure at the point of measurement and converts it to a proportional electronic signal. The signal here is a (4-20) mA signal output. The transmitter is calibrated for a maximum pressure of 100 psi.

The pressure transmitter used in the pressure process station has the following features:

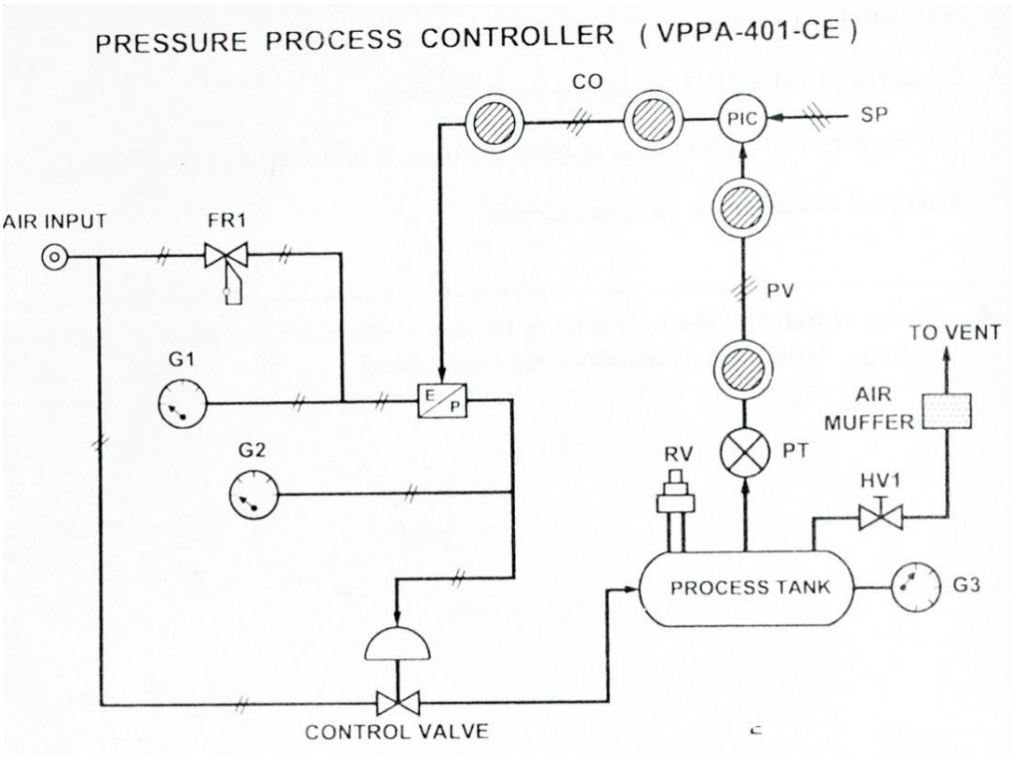
- External span and zero adjustment
- Reluctance type sensing element

Essentially the converter needs 2inputs,viz. a fixed 20 psi air inlet and a variable 4 to 20mA at its current input. It consists of 3 basic parts:

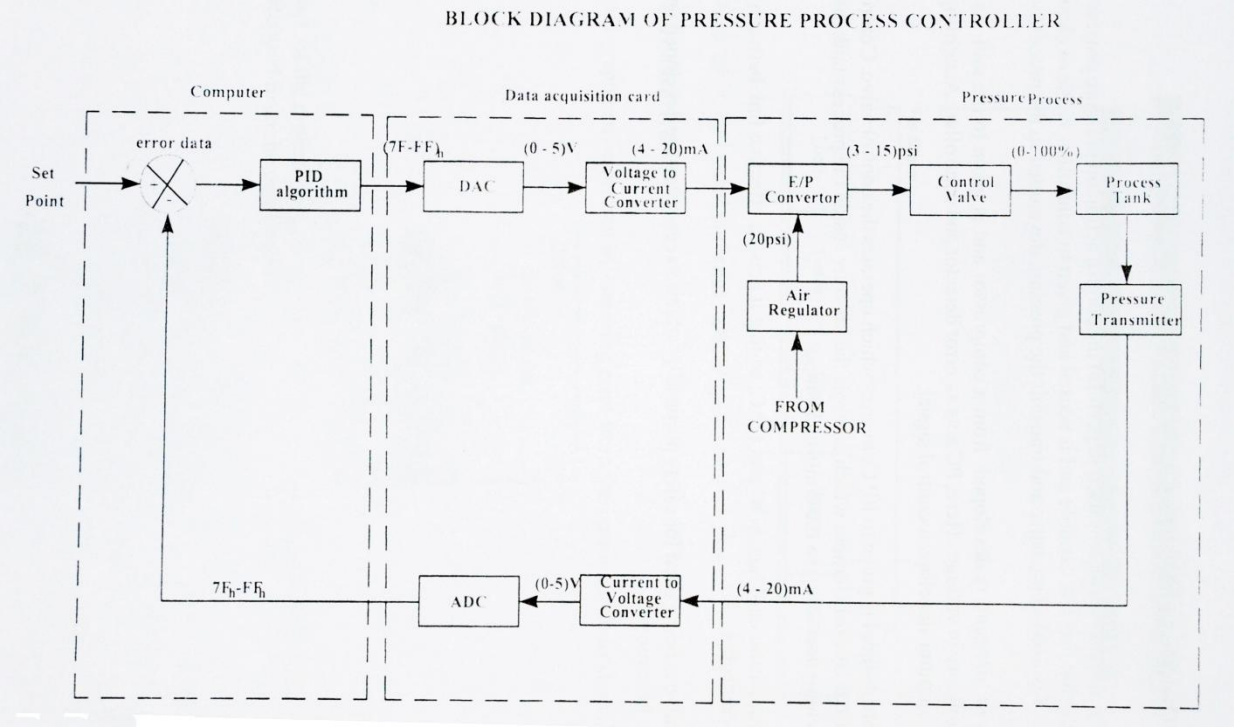
- Pick up system
- Converter relay

- Pneumatic relay

FRONT PANEL DIAGRAM:



BLOCK DIAGRAM:



PROCEDURE:

1. Ensure the availability of air.
2. Interface the PC with process and data acquisition card.
3. Maintain gauge (G1) pressure at 20 psi by using air regulator.
4. Position the fluid valve HV1 slightly in open position.
5. Switch ON the unit & data acquisition card with PC.
6. Invoke process control software.
7. Select " pressure <<control<<ON-OFF".
8. Enter the parameters and drive the response of various controllers.
9. Save response and conclude the behavior of pressure process.

TABULATION:

Time (sec)	PV (psi)	CP (%)

RESULT:

Thus the performance of ON-OFF controllers of pressure controller has been studied.