EXPERIMENT NO. 4

EXPERIMENTS ON LADDER PROGRAMMING FOR MECHATRONICS SYSTEM

DATE OF PERFORMANCE :

INTRODUCTION:

A Programmable Logic Controller, or PLC, is more or less a small computer with a built-in operating system (OS). This OS is highly specialized to handle incoming events in real time, i.e. at the time of their occurrence.

The PLC has input lines where sensors are connected to notify upon events (e.g. temperature above/below a certain level, liquid level reached, etc.), and output lines to signal any reaction to the incoming events (e.g. start an engine, open/close a valve, etc.).

The system is user programmable. It uses a language called "Relay Ladder" or RLL (Relay Ladder Logic). The name of this language implies that the control logic of the earlier days, which was built from relays, is being simulated.

The PLC available is Allen Bradley made. It consists of 10 digital inputs and 10 digital outputs. It has a built in power supply, with necessary interface modules.

APPARATUS:

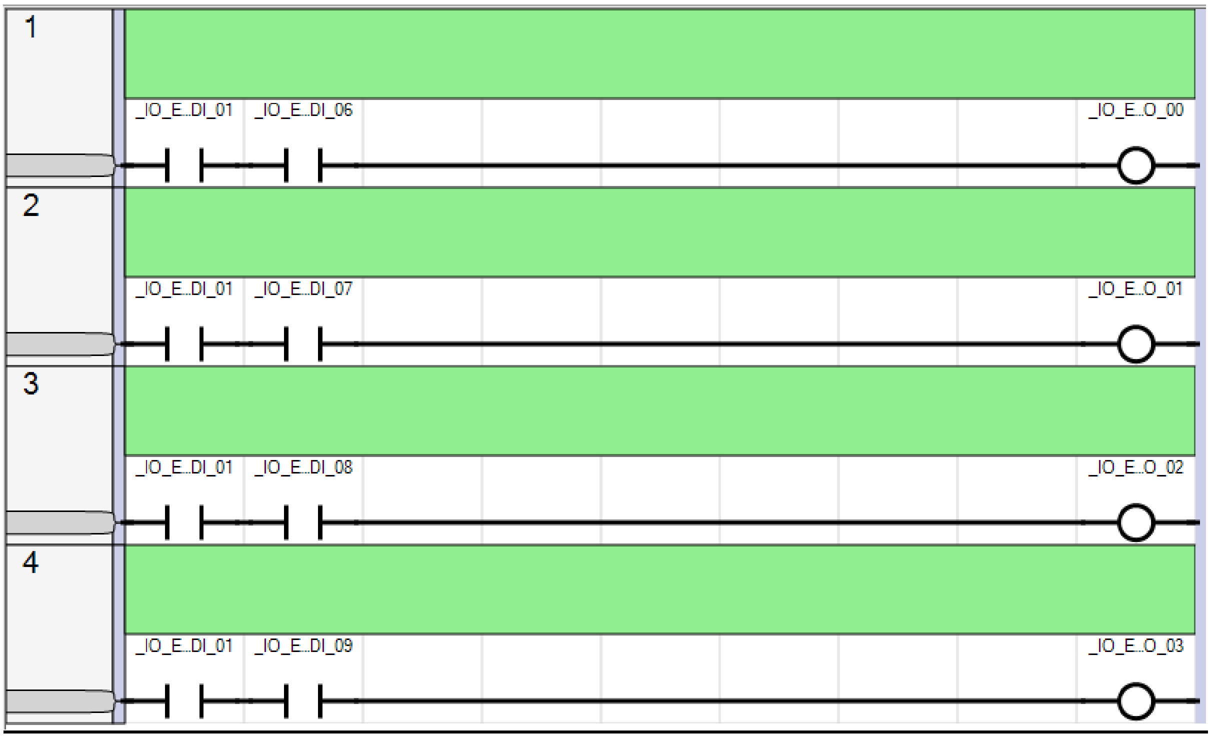
1. Allen bradly made PLC
2. Software
3. Computer
4. Connecting cables

PROCEDURE:

1. Select the proper PLC model from the available list.
2. Open the new file and rename it.
3. Select the programming type (like LD) ladder diagram.
4. Now built the program using ladder logic.
5. Download program to the PLC.
6. Run the program
7. Switch on the input as given in program and observe for the correct output.

PROGRAM NO.1

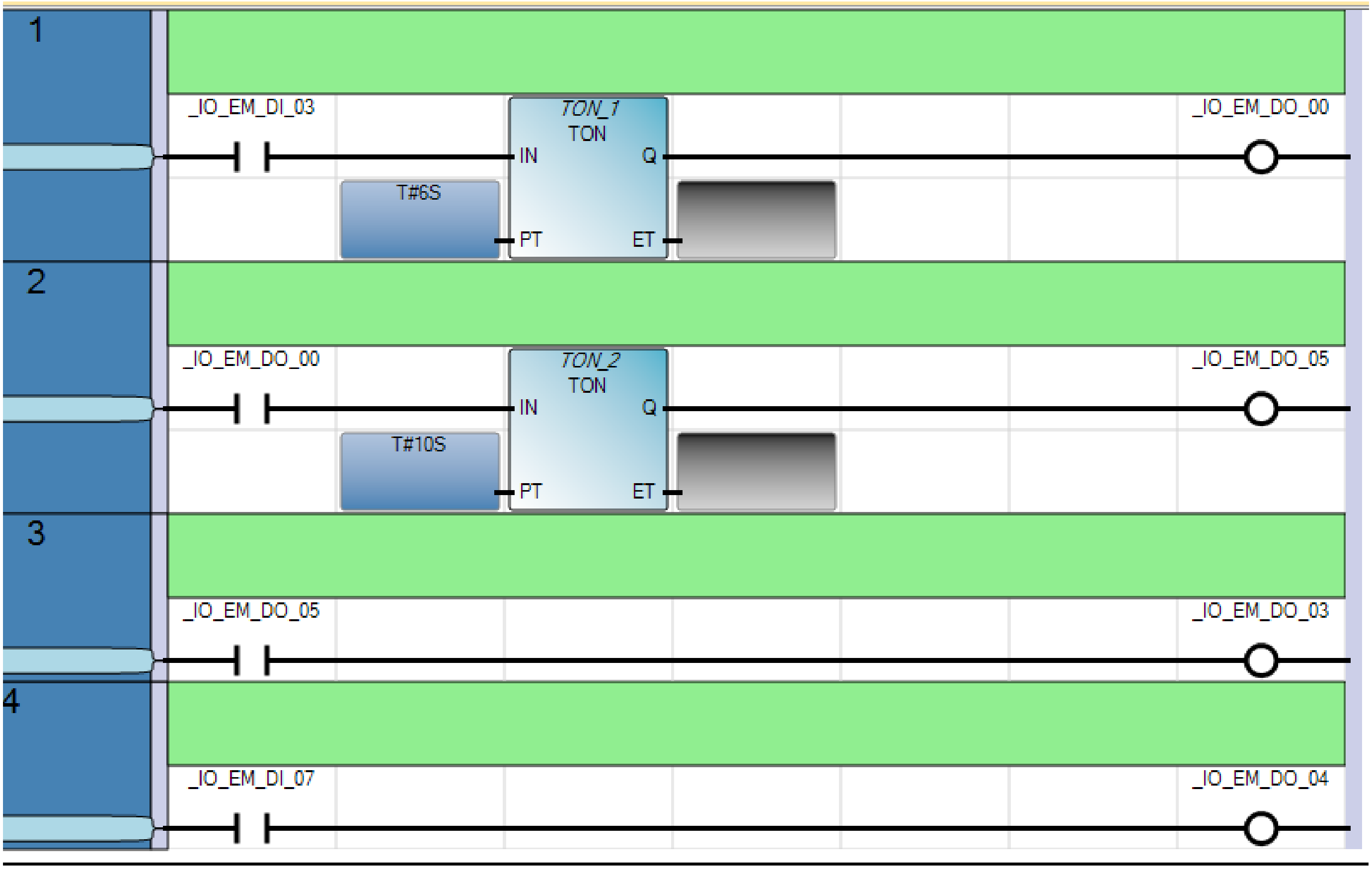
AIM : TO RUN SIMPLE ON/OFF CONTROL LADDER LOGIC



LADDER DIAGRAM

PROGRAM NO.2

AIM : TO RUN TIMERS



LADDER DIAGRAM

PROGRAM NO.3

AIM :LADDER DIAGRAM FOR TWO MOTOR SYSTEM

- **Starting push button starts motor 1.**
- **After 10 sec motor 2 is ON.**
- **Stopping switch stops motor 1 and 2**
- **Time base 1 s**

LADDER DIAGRAM

CONCLUSION:

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Sign	Date	Marks

EXPERIMENT NO. 5

DEVELOPMENT OF TRANSFER FUNCTION BASED ON EXPERIMENTALLY IDENTIFIED DATA USING PID CONTROLLER

DATE OF PERFORMANCE :

INTRODUCTION:

A controller is a device which compares the output of a system with the required conditions and converts the error signal into control action, designated to reduce the error in a closed loop control system. The error might arrive due to changes in the conditions being controlled or due to change in set value.

PROPORTIONAL CONTROL:

With the proportional mode, the size of the controller output is proportional to the size of the error signal. It means that correction element receives a signal which is equal to the size of the correction required. The linear relationship between controller output and error tends to exist for a specific portion of the graph, which is known as proportional band. With in the proportional band the equation of the straight line is represented as:

Change in controller output from set point = Kp e

Where e is the error and Kp is a constant known as proportional constant. Kp is thus the gradient of the straight line. The controller output is generally expressed in terms of percentage of the full range of possible outputs within the proportional band. Generally a 50% controller output is specified for zero error.

It is not possible to achieve the change in the percent output of controller with the change in set value with zero error setting. It requires a permanent error setting called offset. The size of the offset is proportional to the size of load changes and inversely proportional to Kp, so a higher value of Kp gives more steeper graph. This mode is utilized in processes where the value of transfer function can be increased large enough so as to reduce the offset to an acceptable level.

DERIVATIVE CONTROL:

With the derivative mode of control the change in controller output from set point is proportional to the rate of change with time of error signal. This can be represented by the equation

Iout - IO = KD de/dt

Where IO set point output value and Iout is the output value that will occur when the error is e is changing at the rate de/dt. It is usual to express these controller outputs as percentage of the full range of the output and the error as the percentage of full range. With the derivative mode as the error signal begins to change there can be a quite large output since it is proportional to the rate of change of error signal and not the value of error signal. The controller output is constant as the rate of change is also constant and occurs immediately as the deviation occurs. Derivative mode is not suitable for steady state error signals.

INTEGRAL CONTROL:

The integral mode of control is one where the rate of change of the control output I is proportional to the error signal e.

$$dI/dt = KI\ e$$

When the controller output is constant the error is zero, the graph can be analyzed in two ways.

PRECAUTIONS:

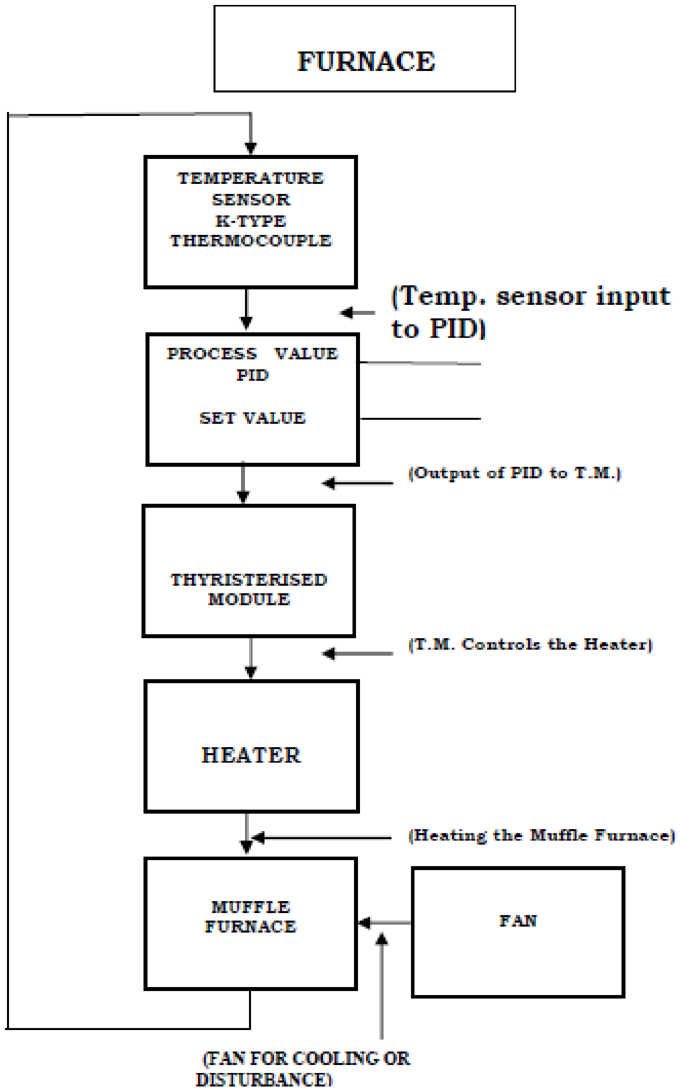
1. Ensure the PID trainer is connected to 230 V AC mains.
2. Ensure no any error detected while self diagnostic check during power ON.
3. Ensure the Proper mode of control action is selected.
4. Ensure the Proper PID constants are programmed.
5. Ensure the Proper set point is programmed.

APPARATUS:

1. Allen Bradley made PLC
2. Software
3. Computer
4. Connecting cables

PROCEDURE:

1. Connect the PID trainer to 230 V AC mains.
2. Turn ON the mains & observe self diagnostic tests.
3. Ensure no error while self diagnostic check.
4. Set appropriate PID constants
5. Set OUT% Output percentage to 100%
6. Set proper Set value
7. Select the controller mode; refer the PID controller mode selection chart
8. Note the observations



CONCLUSION:

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EXPERIMENT NO. 6

STUDY OF FREQUENCY RESPONSE OF ELECTRICAL SYSTEM

DATE OF PERFORMANCE :

INTRODUCTION:

Every practical system takes infinite time to reach its steady state and during this period it oscillates or increases exponentially. Behaviour of system gets decided by type of closed loop in S- plane. Closed loop planes are dependent on selection of parameter of system. Every system has tendency to oppose oscillatory behaviour of system, which is called damping. This tendency controls type of closed loop poles and hence nature of system.The damping is measured by a factor or ratio called as damping ratio of system. It explains how much dominant the opposition is to oscillation in the output. In some system it will be low where the system will oscillate and will take away very little time to reach steady state.

The transient response is the fluctuation in current and voltage in a circuit (after the application of a step voltage or current) before it settles down to its steady state. In this practical focus will be on RLC (resistor-inductor-capacitor) circuits to demonstrate transient analysis.

Transient Response of Circuit Elements:

A. Resistors:

As has been studied before, the application of a voltage V to aresistor (with resistance R ohms), results in a current I, according to theformula:

$I = V/R$

The current response to voltage change is instantaneous; a resistor has notransient response.

B. Inductors:

A change in voltage across an inductor (with inductance LHenrys) does not result in an instantaneous change in the current through it.

The i-v relationship is described with the equation:

v=Ldi

dt

This relationship implies that the voltage across an inductor approaches zeroas the current in the circuit reaches a steady value. This means that in a DCcircuit, an inductor will eventually act like a short circuit.

C. Capacitors:

The transient response of a capacitor is such that it resistsinstantaneous change in the voltage across it. Its i-v relationship is describedby:

I =Cdv

dt

This implies that as the voltage across the capacitor reaches a steady value,the current through it approaches zero. In other words, a capacitor eventuallyacts like an open circuit in a DC circuit

APPARATUS:

1. Function generator
2. Cathode ray oscilloscope
3. RLC circuit
4. Connectors

COMPONENT VALUES:

1. R = Ω
2. C =
3. L =

SKETCH:

PROCEDURE:

1. Connect the circuit as shown in the figure and switch ‘ON’ the power supply.
2. Set the function generator to deliver a square wave to the input terminal of the circuit.
3. Connect the oscilloscope to the output terminal & note down the output wave.
4. Display the input and output voltages on the oscilloscope.
5. Set the voltage and time scales for maximum resolution.
6. Adjust the time scale so that a complete “ringing” waveform is displayed on the screen.
7. Switch the function generator to give a sine wave output.
8. Adjust the frequency until the current (represented by the voltage across the resistor) is in phase with the input voltage.
9. Adjust the time scale so that a complete “ringing” waveform is displayed on the screen.

OBSERVATION:

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CONCLUSION:

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