K.L.N. College of Engineering

(An Autonomous Institution, Affiliated to Anna University – Chennai)

Accredited by National Assessment and Accreditation Council (NAAC)

Pottapalayam – 630612. (11 km From Madurai City) Tamil Nadu, India.

Department of Mechanical Engineering

Accredited by NBA, New Delhi
Approved Research Center by Anna University, Chennai
Approved Nodal Center for e – YANTRA Lab

Regulations – 2020

20ME7L1

Mechatronics Laboratory

Laboratory Manual

Lab In charge

Dr. D. Satheesh Pandian, Associate Professor / Mech.

Prepared by	**Approved by**
Dr. D. Satheesh Pandian	***Dr. P. Udhayakumar***
Associate Prof. / Mech.	***HOD / Mech. Engg.***

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To become a Centre of excellence for Education and Research in Mechanical Engineering.

MISSION

- **Attaining academic excellence through effective teaching learning process and state of the art infrastructure.**
- **Providing research culture through academic and applied research.**
- **Inculcating social consciousness and ethical values through co-curricular and extra-curricular activities.**

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO I	**Graduates will have successful career in Mechanical Engineering and service industries.**
PEO II	**Graduates will contribute towards technological development through academic research and industrial practices.**
PEO III	**Graduates will practice their profession with good communication, leadership, ethics and social responsibility.**
PEO IV	**Graduates will adapt to evolving technologies through lifelong learning.**

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	**Derive technical knowledge and skills in the design, develop, analyze and manufacture of mechanical systems with sustainable energy, by the use of modern tools and techniques and applying research based knowledge.**
PSO 2	**Acquire technical competency to face continuous technological changes in the field of mechanical engineering and provide creative, innovative and sustainable solutions to complex engineering problems.**
PSO 3	**Attain academic and professional skills for successful career and to serve the society needs in local and global environment.**

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Name : ***Roll No. :***

Year / Sem. / Sec : ***Reg. No :***

GENERAL INSTRUCTIONS FOR LABORATORY CLASSES

- Students must attend the lab classes with ID cards.
- Boy should "**TUCK IN**" the shirts.
- Students should wear uniform only.
- **LONG HAIR** should be protected.
- Any other website **should not be operated** other than the prescribed one for that day.
- POWER SUPPLY to your test table should be obtained only through the **LAB TECHNICIAN.**
- Any damage to any of the equipment/instrument/machine caused due to carelessness, the **cost** will be fully recovered from the individual (or) group of students.

Contents

List of Experiments

I Cycle

1. Study of Hydraulic, Pneumatic and Electro pneumatic circuits.
    - Design and Testing of Hydraulic circuits to measure and control
        - Velocity
        - Direction
        - Force of Hydraulic actuator.
    - Study of Electro-Pneumatic circuits
        - Design of circuit with logic sequence using Electro Pneumatic trainer kits.
2. Modeling and analysis of basic Hydraulic, Pneumatic and Electrical circuits using Software.
    - Simulation of circuit with logic sequence using fluid SIM Pneumatic software
3. Study of PLC and its applications.
    - Circuits with Multiple cylinder Sequences in Electro Pneumatic using Programmable Logic Controller (PLC)
4. Stepper motor interfacing with 8051 Micro Controller
    - Full Step Revolution
    - Half Step Revolution
5. Traffic light interfacing with 8051 Micro Controller
6. Speed control of DC motor.

II Cycle

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Study of various types of optical transducers.
3. Study of image processing technique.
4. Real – time temperature data logging system with LabVIEW software and DAQ cards.
    - Acquire the temperature data by USB DAQ Card and create a warning indicator
    - Acquire the temperature data by Compact DAQ card and create a warning indicator
5. Study of Process Control Trainer for controlling pressure and flow rate of the liquid.

Name : ……..…… Batch……..……..

Roll No.:…… Year ……..… Semester……..… Section : …….…....

Index

S. No.	Date	Name of the Experiment	Page	Marks	Staff Signature
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					

Completed date:

Average Mark: **Staff - in – charge**

20ME7L1	MECHATRONICS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To know the assembly language programming in microprocessor and microcontroller.
- To impart knowledge in the design, modeling & analysis of basic electrical, hydraulic, pneumatic system.
- To understand the working of interfacing circuits for stepper motor, servo motor and traffic light controller.
- To know the programming of LabVIEW and Fluidsim software.
- To understand the circuit connection for PLC based Electro Pneumatic system.

PREREQUISITE:

20GE203 Basic Electrical, Electronics and Instrumentation Engineering

LIST OF EXPERIMENTS

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of optical transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using software.
8. Study of PLC based Electro Pneumatic circuit with multiple cylinder sequences.
9. Study of Image processing technique.
10. Real-time temperature data logging system with LabVIEW software and DAQ cards.
11. Study of Process control trainer for controlling pressure and flow rate of the liquid.

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

- Develop the program for arithmetic functions and the program for sorting, code conversion functions.
- Formulate the program codes to interface with traffic light controller, stepper motor and DC motor.
- Analyze the performance characterize of LDR, Photo diode and Photo transistors.
- Combine all the hydraulic, pneumatic and electro pneumatic circuits by using simulation software and also interface with PLC.
- Analyze the real images and template images based on image processing techniques. Develop graphical programming language codes for image analysis and temperature data logging system.
- Develop circuit to control the temperature, pressure and flow rate of the liquid in process control trainer kit by using DAQ cards with LabVIEW software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of The Equipment	Quantity
1	Basic Pneumatic Trainer Kit with manual and electrical Controls / PLC Control each	1
2	Basic Hydraulic Trainer Kit	1
3	Hydraulics and Pneumatics Systems Simulation Software	10
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2
5	8051 – Microcontroller kit with traffic light control and Dc motor control	1
6	8085 microprocessor with interfacing kit	2
7	Optical transducer trainer kit (LDR, Photo diode, Photo Transistor)	1
8	Image processing system with hardware & software	1
9	LabVIEW software with DAQ cards	2
10	Process Control trainer kit	1

Introduction to Pneumatics

Compressed air is one of the oldest forms of energy known to man and applied to enhance his physical abilities.

The term "PNEUM" is derived from the ancient greek. It menat breath or wind. The term Pneumatics (the study of air movement and air phenomenon) was derived from the word Pneuma.

Characteristic of compressed air:

There are certain characteristics which make compressed air preferable in industrial applications.

Amount:

Air is available practically everywhere for compression, in unlimited quantities.

Transport:

Air can be easily transported in pipelines, even over larger distances. It is not necessary to return the compressed air.

Storable:

A compressor need not be in continuous operation. Compressed air can be stored in and removed from a reservoir. In addition, transportation in the reservoir is possible. (Cylinder)

Temperature:

Compressed air is fluctuations. This ensures reliable operation, even under extreme conditions of temperature.

Explosion Proof:

Compressed air offers no risk of explosion of fire. Hence, no expensive protection against explosion is required.

Cleanness:

Compressed air is clean since any air which escapes through leaking pipes or elements does not cause contamination. This cleanness is necessary, for example, in the food, wood, textile and leather industries.

Construction:

The operating components are of simple construction, and are, therefore inexpensive.

Speed Compressed air is a very fast working medium. This enable high working speeds to be attained. (Pneumatic cylinders have a working speed of 1-2 m/sec.)

Adjustable :

With compressed air components, speeds and forces are infinitely variable.

Overload Safe: Pneumatic tools and operating components can be loaded to the point of stopping and they are, therefore, overload safe.

There are also certain negative characteristics which limit the application of compressed air in certain areas.

Preparation:

The compressed air needs good preparation. Dirt and humidity may not be present. (Wear of pneumatic components)

Compressible:

It is not possible to achieve inform and constant piston speeds with compressed air.

Force Requirement:

Compressed air is economical only up to a certain force requirement. Under the normally prevailing working pressure 7, 10 pa and dependent on the travel and speed, the limit is between 20000 and 30000 Newton.

Exhaust Air:

The exhaust air is loud. This problem has now, however, been largely solved due to the development of sound absorption material.

Costs:

Compressed air is a relatively expensive means of conveying power. The high energy costs are partially compensated by inexpensive components and higher performance. (Number of Cycles)

Properties of Air

The surface of the globe is entirely covered by a mantle of air. It is vitally a gas mixture with the following composition:

Nitrogen – approx – 78% by volume

Oxygen – approx – 21% by volume.

The remaining one per cent contains traces of Carbon oxide, Argon, Hydrogen, Helium, Krypton and Xenon.

Air is compressible:

Like all gases, air has got no particular shape. Its shape changes with slightest force. It assumes the shape of its surroundings. Air can be compressed and it ties to expand.

Boyle's Law:

"AT constant temperature, the volume of a given mass of gas is inversely proportional to the absolute pressure".

In simple terms if the pressure of a ir is increased by compressing at constant temperature the volume decreases and vice versa. In the example below the air in the container is compressed in three stages. Let the pressure & volume of the air at the three stage be denoted by P1,P2,P3 and volume by V1,V2,V3.

As per Boyle's Law

P1xV1= P2xV2= P3xV3

If P_1=1 Bar

V_1=1m^3

And air is compressed to volume V_2=0.5m^3 and pressure P_2

$P_1V_1=P_2V_2$

$\therefore$ $1x10^5x1=P_2x0.5$

$\therefore P_2=$ $= 2x10^5$ Pas or 2 bar

if it is still compressed to a new volume V3=0.05m3, the pressure will be P3

$P_1V_1=P_3V_3$

$1x10^5x1=P_3x0.5$

$\therefore P_2=$ $= 20x10^5$ Pas or 2 bar

The volume of air varies with the change of temperature:

As per Charles law if the pressure remains constant the volume of a gas increases directly proportional to the change in temperature. Or V $\propto$ T, or If the volume remains constant the pressure increases as the temperature increases and the opposite is true. P $\propto$ T.

As per Boyle's Law. Temperature remaining constant P $\propto$ 1/V combining these two the general gas equation is applies. P $\propto$ T/V or P x V$\propto$ T or

PV=RT (R is the gas constant) or PV/T = is constant

In other words if the pressure, Temperature and volume of gas in closed container are P1V1T1, P2V2T2 and P3V3T3 at three stages.

Normal Volume:

The volume of a certain mass of air depends upon its pressure. The delivery of compressors is found in terms of the pressure and volume. Hence it will not be possible to compare the capacity of pneumatic equipments. To have an uniformity, the volume of air is expressed in Normal m^3 = Nm^3.

Definition:

1 Normal m^3 of air =1m^3 of air at a temperature of 273 ^{0}k (0^0c) and a pressure of 760 Torr=1.013 x 105 Pasc (Normal atmospheric pressure at sea level)

Example:

Compressed air at 7 Bar and a temperature of 2980K is contained in a Compress air vessel with an internal volume of 2 m3. What is the standard volume by general gas law?

The volume of the air in the vessel is 12.66m^3 at standard temperature of 273^0 c and at atmospheric c pressure.

Major Advantages of Pneumatics System:

1. Easily stored.
2. Transportable over long Distances.
3. Air Available every Place.
4. Largely insensitive to Temperatures.
5. Explosion Proof.
6. Elements OverLoad Safe.
7. Non-Pollutant
8. High Speed Operation.
9. No Return Lines.
10. Relatively Low cost to produce.
11. Technology can be easily Learned.

Electro – Pneumatic System

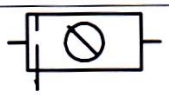
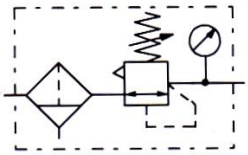
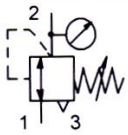
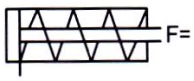
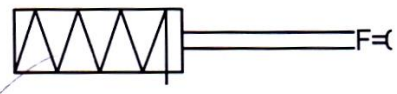
Electricity is a form of energy. It is encountered in the form of heat, light, magnetic or chemical action. It has always been difficult for humans to detect the presence of electricity, although electrical energy is put to use in a wide range of machines and installations.
Distinctions are already found in the electrical components used in electrical systems. Almost every one makes daily use of electricity or electronics in some form or other. For example, switching on lights, domestic apparatus, radios, pocket calculators, vehicle lights etc. in all of these cases, electricity must be present. It is immaterial whether the energy is supplied from a battery or power station.
Methods or generating a voltage

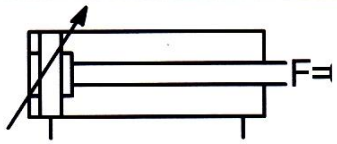
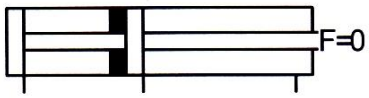
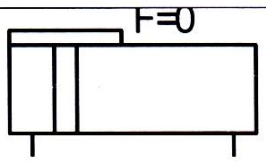
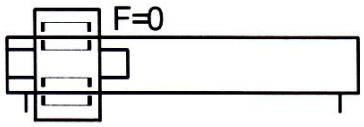
1. Generating a voltage by Induction.
2. Generating a voltage by electro-chemical processes.
3. Generating a voltage by heat
4. Generating a voltage by Light.
5. Generating a voltage by crystal deformation (piezo electricity)

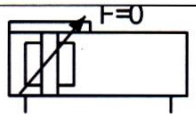
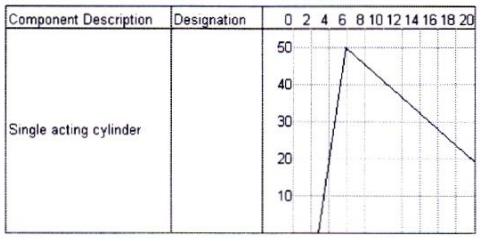
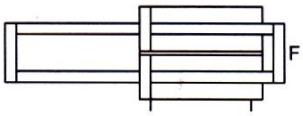
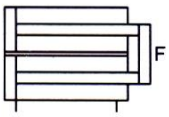
There widely differing types of voltage generation are all based on charge separation.
The unit of electric voltage is the volt, which is measured with a voltmeter.
The unit of electric voltage is the volt, which is measured with a voltmeter.
The level of the induced voltage depends on four significant factors

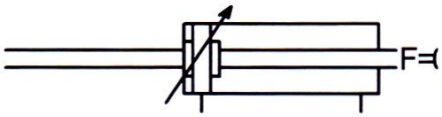
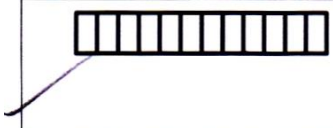
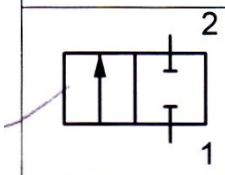
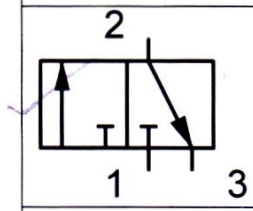
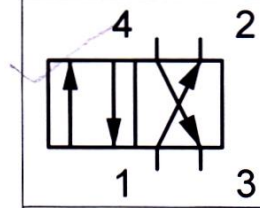
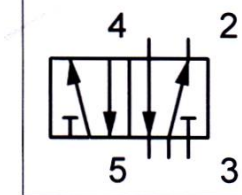
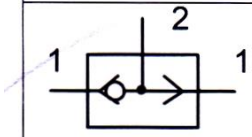
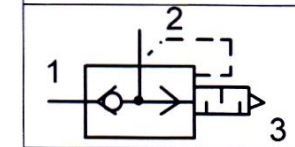
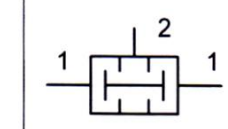
1. Cutting speed of the conductor.
2. Magnetic flux density.
3. Effective conductor length.
4. Number of conductor.

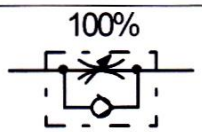
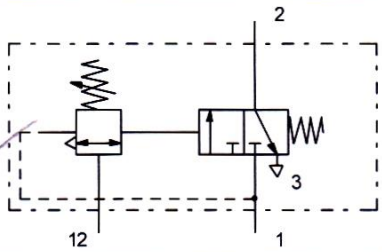
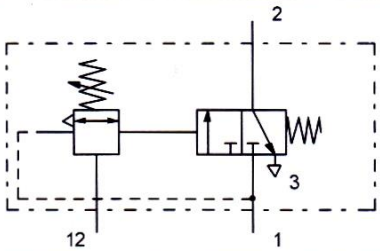
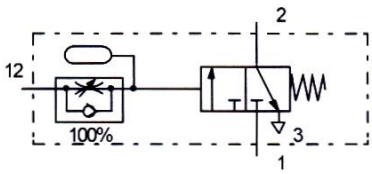
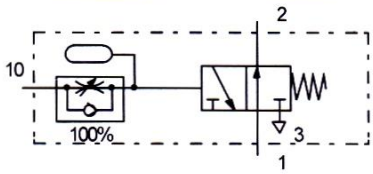
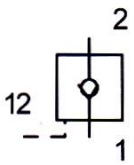
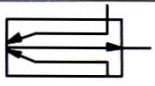
Symbols

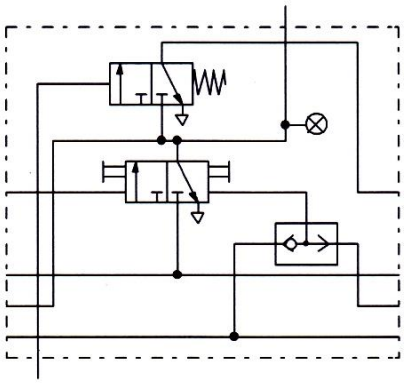
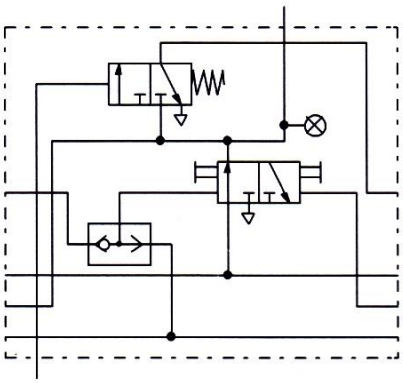
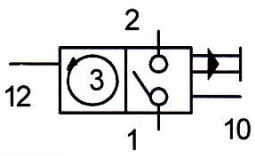
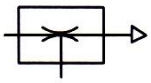
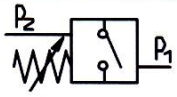
	The compressed air supply provides the needed compressed air. It contains a pressure control valve that can be adjusted to output the desired operating pressure. Adjustable parameters Operating pressure: 0 ... 20 bar (6 bar)
	The service unit is made up of a compressed air filter with water separator and a pressure control valve. Adjustable parameters Operating pressure: 0 ... 20 bar (5 bar)
	The service unit is made up of a compressed air filter with water separator and a pressure control valve.
	The pressure control valve regulates the supplied pressure based on the adjustable operating pressure and the variations in the pressure. The manometer displays the pressure at connection 2. Adjustable parameters Operating pressure: 0 ... 20 bar (4 bar)
	The piston rod of a single acting cylinder is operated by the input of compressed air at the front end position. When the compressed air is shut off, the piston returns to its starting position via a return spring. The piston of the cylinder contains a permanent solenoid which can be used to operate a proximity switch. Adjustable parameters Max. stroke: 1 ... 100 mm (50 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,07 ... 80 qcm(3,14 qcm) Piston Ring Area: 0,03 ... 65 qcm(2,72 qcm)
	The piston of the single acting cylinder is extended to its back position by the input of compressed air. When the compressed air is switched off, a return spring moves the piston back to its front position. Adjustable parameters Max. stroke: 1 ... 100 mm (50 mm) Piston position: 0 ... Max. stroke mm (50 mm)

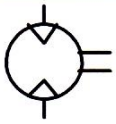
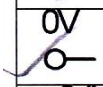
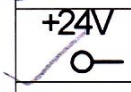
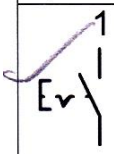
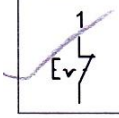
	Piston Area: 0,07 ... 80 qcm(3,14 qcm) Piston Ring Area: 0,03 ... 65 qcm(2,72 qcm)
	The piston rod of a double acting cylinder is operated by the reciprocal input of compressed air at the front and back of the cylinder. The end position damping is adjustable via two regular screws. The piston of the cylinder contains a permanent solenoid which can be used to operate a proximity switch. Adjustable parameters Max. stroke: 1 ... 5000 mm (100 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,25 ... 810 qcm (3,14 qcm) Piston Ring Area: 0,1 ... 750 qcm(2,72 qcm)
	By connecting two cylinders of same piston diameter but different maximum stroke three piston stop positions can be realized. From the first stop position the third stop can be reached either directly or via the intermediate stop. Note that the maximum stroke of the second piston must be larger than the preceding one. When moving back, an intermediate stop requires a particular control. The shorter maximum stroke is half of the other maximum stroke. Adjustable parameters Max. stroke: 1 ... 2000 mm (100 mm) Piston position: 0 ... Max. stroke mm (0 mm) Intermediate Stop: 0 ... Piston position mm (0 mm) Piston Area: 0,25 ... 810 qcm (3,14 qcm) Piston Ring Area: 0,1 ... 750 qcm(2,72 qcm)
	The sledge of the double acting cylinder without a piston rod is controlled by alternating the compressed air input. This type of linear drive conveys forces by means of a shape-fitting piston-sledge construction. The slitted cylinder prohibits the torsion of the slider. Adjustable parameters Max. stroke: 10 ... 5000 mm (200 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,5 ... 80 qcm (2,01 qcm)
	he sliding of the piston in the double rod cylinder is controlled by a reciprocal input of compressed air. Adjustable parameters Max. stroke: 10 ... 5000 mm (200 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,5 ... 80 qcm (2,01 qcm)

	The sledge of the double acting cylinder without a piston rod is controlled by alternating the compressed air input. This type of linear drive conveys forces by means of a shape-fitting piston-sledge construction. The slitted cylinder prohibits the torsion of the slider. Adjustable parameters Max. stroke: 10 ... 5000 mm (200 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,5 ... 80 qcm (2,01 qcm)
	The state diagram records the state quantities of important components and depicts them graphically.
	This twin cylinder has two in and out piston rods that move in parallel and that are coupled by a double trestle. The construction guarantees minimum torsion when positioning and moving tools or assemblies. Moreover, coming along with the same construction height, the double piston rod conveys the double force as compared to standard cylinders. Adjustable parameters Max. stroke: 1 ... 5000 mm (100 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,5 ... 1620 qcm (6,28 qcm) Piston Ring Area: 0,2 ... 1500 qcm (5,44 qcm)
	his twin cylinder has two in and out piston rods that move in parallel and that are coupled by a trestle. The construction guarantees minimum torsion when positioning and moving tools or assemblies. Moreover, coming along with the same construction height, the double piston rod conveys the double force as compared to standard cylinders. Adjustable parameters Max. stroke: 1 ... 5000 mm (100 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,5 ... 1620 qcm (6,28 qcm) Piston Ring Area: 0,2 ... 1500 qcm (5,44 qcm)

	he in and out piston rod of the double acting cylinder is controlled by alternating the compressed air input. The cushioning can be adapted with two adjustment screws. Adjustable parameters Max. stroke: 1 ... 5000 mm (100 mm) Piston position: 0 ... Max. stroke mm (0 mm) Piston Area: 0,25 ... 810 qcm (3,14 qcm) Piston Ring Area: 0,1 ... 750 qcm(2,72 qcm)
	The distance rule is a device for attaching switches at the cylinder. The labels at the distance rule define links to the actual proximity switches or limit switches in the electrical circuit.
	The configurable 2/n way valve is a way valve with two connections, where both its body elements and its operation modes are user-definable. Additionally, the pneumatic connections can be closed with either blind plugs or exhausts.
	The configurable 3/n way valve is a way valve with three connections, where both its body elements and its operation modes are user-definable. Additionally, the pneumatic connections can be closed with either blind plugs or exhausts.
	The configurable 4/n way valve is a way valve with four connections, where both its body elements and its operation modes are user-definable. Additionally, the pneumatic connections can be closed with either blind plugs or exhausts.
	The configurable 5/n way valve is a way valve with five connections, where both its body elements and its operation modes are user-definable. Additionally, the pneumatic connections can be closed with either blind plugs or exhausts.
	The shuttle valve is switched based on the compressed air entering into either input connection 1 and leaving via an output connection 2. Should both input connections begin receiving compressed air, the connection with the higher pressure takes precedence and is put out (OR function).
	The compressed air passes from connection 1 to connection 2. If the pressure should decrease at connection 1, then the compressed air from connection 1 will escape to the outside via the installed silencer.
	The two pressure valve is switched based on the compressed air entering into both input connections 1 and leaving via an output connection 2. Should both input connections begin receiving compressed air, the connection with the lower pressure takes precedence and is put out (AND function).

	The setting of the throttle valve is set by means of a rotary knob. Please note that by the rotary knob no absolute resistance value can be set. This means that, in reality, different throttle valves can generate different resistance values despite identical settings.
	The one-way flow control valve is made up of a throttle valve and a check valve. The check valve stops the flow from passing in a certain direction. The flow then passes though the throttle valve. The cross-section of the throttle is adjustable via a regular screw. In the opposite direction the flow can pass through the check valve.
	the sequence valve is operated when the control pressure at connection 12 has been reached. The flow passes freely from 1 to 2. Removing the signal allows the valve to return to its starting position through the use of a return spring. Connection 1 is shut. The pressure of the control signal is infinitely adjustable via a pressure setting screw.
	The vacuum actuator valve is employed through the conversion of a vacuum signal. As soon as the vacuum reaches the adjustable value at connection 1v, the attached valve body is switched.
	The time delay valve is made up of a pneumatically operated 3/2-way valve, a one-way flow control valve, and small air accumulator. When the necessary pressure is reached at the control connection 12 of the unit, the 3/2-way valve switches and the flow passes freely from 1 to 2.
	The time delay valve is made up of a pneumatically operated 3/2-way valve, a one-way flow control valve, and small air accumulator. When the necessary pressure is reached at the control connection 10 of the unit, the 3/2-way valve switches and stops the flow from passing between 1 and 2.
	If the entering pressure at connection 1 is higher that the outgoing pressure at 2, the check valve allows the flow to pass freely. Otherwise, the valve stops the flow. Additionally, the check valve can be opened via the control line 12. This action allows the flow to pass freely in both directions.
	The ring sensor is a non-contact pneumatic signal output module. It is supplied with low pressure at connection 1. If, due to an object, the entering air flow is disturbed, a low pressure signal will be put out by connection 2. To simulate an object in the air flow, as presented above, simply click on the component during FluidSIM Simulation Mode.

	The manometer displays the pressure at its connection.
	The sucker can be used in connection with the vacuum suction nozzle to suck in objects. The sucking in of objects can be simulated in FluidSIM-P by clicking on the component when in the Simulation Mode.
	he stepper module is made up of a memory unit (3/2-way impulse valve), an AND and an OR component, a viewable announcement, and an auxiliary manual operation. Adjustable parameters Initial position: Left, Right (Left)
	The stepper module is made up of a memory unit (3/2-way impulse valve), an AND and an OR component, a viewable announcement, and an auxiliary manual operation. Adjustable parameters Initial position: Left, Right (Right)
	The counter registers pneumatic signals starting at a predetermined number and counting backwards. If zero is reached, then the counter releases an output signal. This output signal continues until the counter is reset either by hand or from at signal at connection 10.
	The vacuum suction nozzle creates its vacuum based on the ejector principle. In this case, compressed air flows from connection 1 to 3, creating a vacuum at connection 1v. A sucker can be connected to the vacuum connection 1v. Stopping the input of compressed air at connection 1 stops any suction also.
	The pressure sensor measures the pressure and operates the pressure switch when the adjustable switching pressure has been exceeded.
	The differential pressure switch can be employed as a pressure switch (connection P1), a vacuum switch (connection P2) or as a differential pressure switch (P1-P2). The respective pneumatic to electric converter is operated when the difference in pressure between P1-P2

	exceeds the adjustable switching pressure.
	the air motor transforms pneumatic energy into mechanical energy.
	The semi-rotary actuator is controlled by a reciprocal input of compressed air.
	0V connection of the power supply.
	24V connection of the power supply.
	if current flows, the indicator light is displayed in the user-defined color. Adjustable parameters Color: 16 standard colors (Yellow)
	If current flows, a flashing ring around the buzzer is shown. Moreover, if "buzzer" is activated in the menu under Options- Sound..., the buzzer is activated if a sound hardware is installed.
	Switch that closes and locks when actuated.
	Switch that opens and locks when actuated.

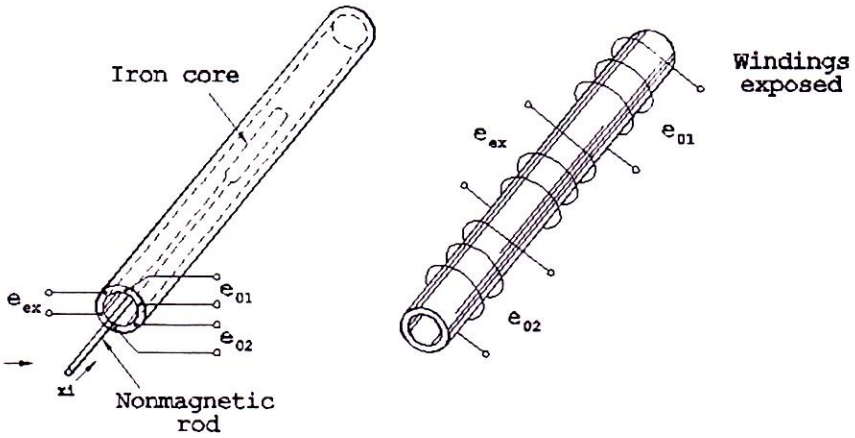
TRANSDUCERS : -

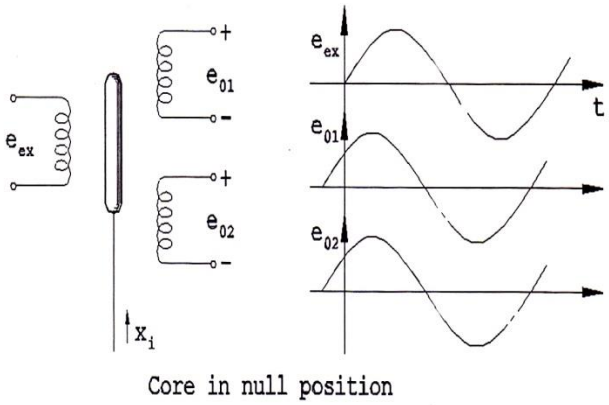
a) Linear Variable Differential Transformer :

Principle Of Operation :-

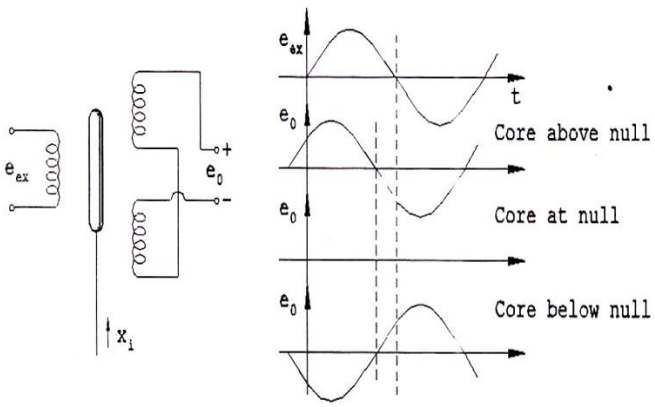
LVDT falls in the class of variable reluctance displacement transducers where in a moving core is used to vary the magnetic flux coupling between two coils.

The unit consists of a transformer with two secondary windings, one primary winding and a movable core. Theoretically, with the core in the center position, the voltage in the two secondary will be equal, and the output voltage will be zero.





Core in null position



Advantages Of LVDT :-

1) HIGH RANGE :

The LVDT have a very high range for measurement of displacement. This can be used for measurement of displacements ranging from 1.25mm to 250mm. However, the dynamic response is considerably slower than 2.5 kHz excitation signal.

2) FRICTION and ELECTRICAL ISOLATION :

Ordinarily, there is no physical contact between the movable core and coil structure which means that the LVDT is a frictionless device. This permits its use in critical measurements that cannot tolerate the addition of low mass core but cannot tolerate friction loading. The absence of friction between coil and core of an LVDT means that there is no wear out. This gives an LVDT essentially infinite mechanical life.

3) IMMUNITY FROM EXTERNAL EFFECTS :

The separation between LVDT core and LVDT coils permits the isolation of media such as pressurized, corrosive, or caustic fluids from the coil assembly by a non-magnetic barrier interposed between the core and inside of the coil.

4) HIGH INPUT and HIGH SENSITIVITY :

The LVDT gives a high output and many a times there is no need for amplification. The transducer possesses a high sensitivity.

5) RUGGEDNESS :

These transducers can usually tolerate high degree of shock and vibrations especially when the core is spring loaded without any adverse effects. They are simple in construction and by virtue of their being small and light in weight.

6) LOW HYSTERESIS :

LVDTs show a low hysteresis and hence repeatability is excellent under all conditions.

7) LOW POWER CONSUMPTION :

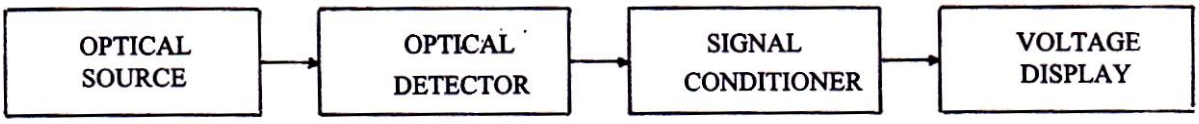
The most of LVDTs consume power which is less than 1W.

Optical Sensors :-

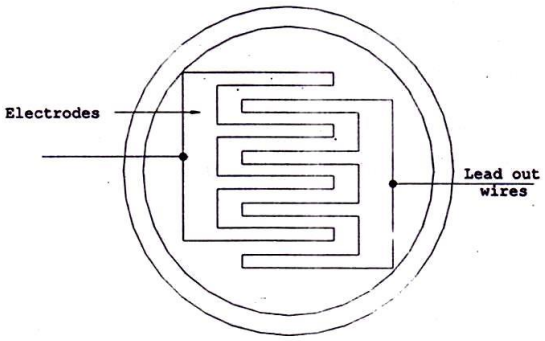
Optoelectronics covers that area of science which combines optical and electronic technologies. Optical spectrum occupies only a small part of the electromagnetic spectrum. An optical transducer is a light sensor i.e. a transducer that produces an electrical output in response to light input.

Wherever amplifier with high input impedance is required photodiodes are to be preferred. Photo Transistors are predominantly used in connection with transistor circuits (or) to drive integrated circuits.

GENERAL BLOCK DIAGRAM OF OPTICAL TRANSDUCER



Light Dependent Resistors (LDR) :

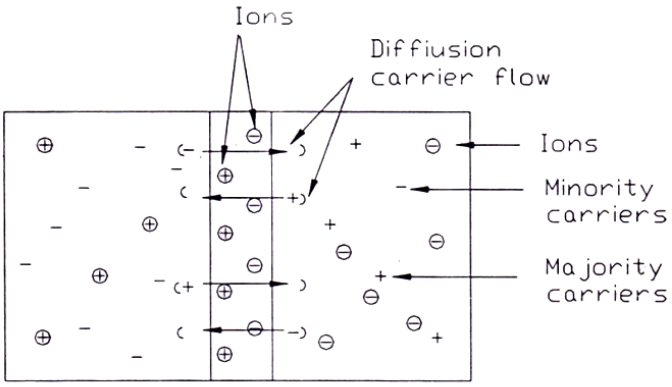


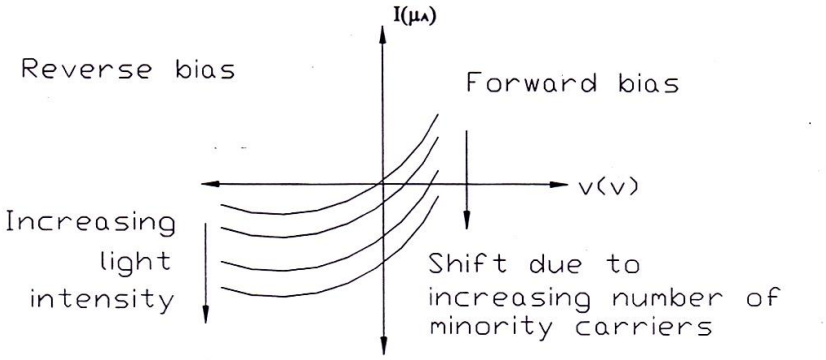
Light Dependent Resistor

Electrical conduction in semiconductor materials occurs when free charge carriers, e.g. electrons, are available in the material when an electric field is applied. In certain semiconductors, light energy falling on them is of the correct order of magnitude to release charge carriers which increase flow of current produced by an applied voltage. The increase of current with increase in light intensity with the applied voltage remaining constant means that the resistance of semiconductors decreases with increase in light intensity. Therefore, these semiconductors are called **Photo Conductive Cells** or **Photo Resistors** or sometime **Light Dependent Resistors (LDR),** since incident light effectively varies their resistance.

The two most commonly used photoconductive semiconductor materials are cadmium sulphide (CdS). The photoconductive cells use a special type of construction which minimizes resistance while providing maximum surface and enclosing them in a protective envelope of glass or plastic. The electrodes are usually inter – digital i.e. in the form of interlocked fingers or combs as shown in above figure.

Photo Diodes :





The photodiode incorporates on a P and a N type layer. The system has the electrical characteristics of a rectifier. Radiation directed in the vicinity of the PN junction and causes a flow of current. The photodiode is reverse biased. The reverse biased saturation current is dependent upon the intensity of the incident light.

Comparing photodiodes with photoconductors, the photodiode possesses considerably better frequency response, linearity, spectral response and lower noise.

The disadvantages of photodiodes include small active area, rapid increase in dark current with temperature, bias voltage requirement, and the necessity of amplification at low illumination levels.

Because of their fast response time, photodiodes are used as cine film sound track readers. Similarly they can be used as detectors of modulated light in optical communication systems and also in switching circuits.

Photo Transistors :

A phototransistor is a normal transistor in which the envelope enclosing the junction is transparent to allow light to fall on the base emitter junction. At any PN junction hole – electron pairs are generated when light falls on the junction, so that any light falling on the

base – emitter junctions, produces a current which is amplified by transistor action, making the device very sensitive.

The dark current increases in a phototransistor exponentially with rise in temperature and if the temperature is sufficiently high the dark and light currents may be indistinguishable. At any given temperature the dark current can be reduced to a small value by biasing the base of the transistor which is normally left open circuited. The sensitivity is decreased but the ratio of light to dark current is increased.

The advantages of the phototransistor are:Low power consumption, small size, immediate operation on switching on, low voltage operation and long life. A phototransistor gives a high gain. This transistor is very good for digital applications because of the small rise and fall times.

Technical Specifications:

Light Dependent Resistor (LDR)		**PHOTO DIODES**		**PHOTO TRANSISTORS**	
Peak spectral response -	550mm	Peak wave length	850nm	V_c (max)	50V
Cell resistance at 10 Lux -	20-100 KΩ	Responsivity	0.62 A/W	I_c (max)	50mA
at 100 Lux -	5 KΩ	Rise/fall time	20ns	Photocurrent	2-3mA
Dark resistance	20 MΩ	Acceptance angle	120□	Dark Current	300mA
Max. voltage	100V	Dark Current (max)	30 nA	Operating temp.	-55 □C to +125 □C
Power dissipation	50mW	Noise equivalent power	4.1×10^{-14} W/√H_z or $H^{1/2}$	Acceptance angle	80□
Rise time at 100 Lux	45ms	Break down Voltage	32V	Rise/fall time	15µs
Fall time at 100 Lux	55ms	Power Dissipation	150mW	Power dissipation	220mN
Operating temperature range	-60 □C to +75 □C	Operating temperature range	-40 □C to +80 □C		

Ex No : 1 ***Date :***

Design and Testing of Fluid Power Circuits to Control (i) Velocity (ii) Direction and (iii) Force of Double Acting Actuators.

Aim :

To Design the hydraulic circuit to measure and control

(i) Velocity

(ii) Direction

(iii) Force of Hydraulic Double acting cylinder.

Apparatus Required:

1. Double acting cylinder
2. 4/3 way directional control value (hand operated).
3. Stop watch
4. Hydraulic connecting hoses.
5. Power pack.

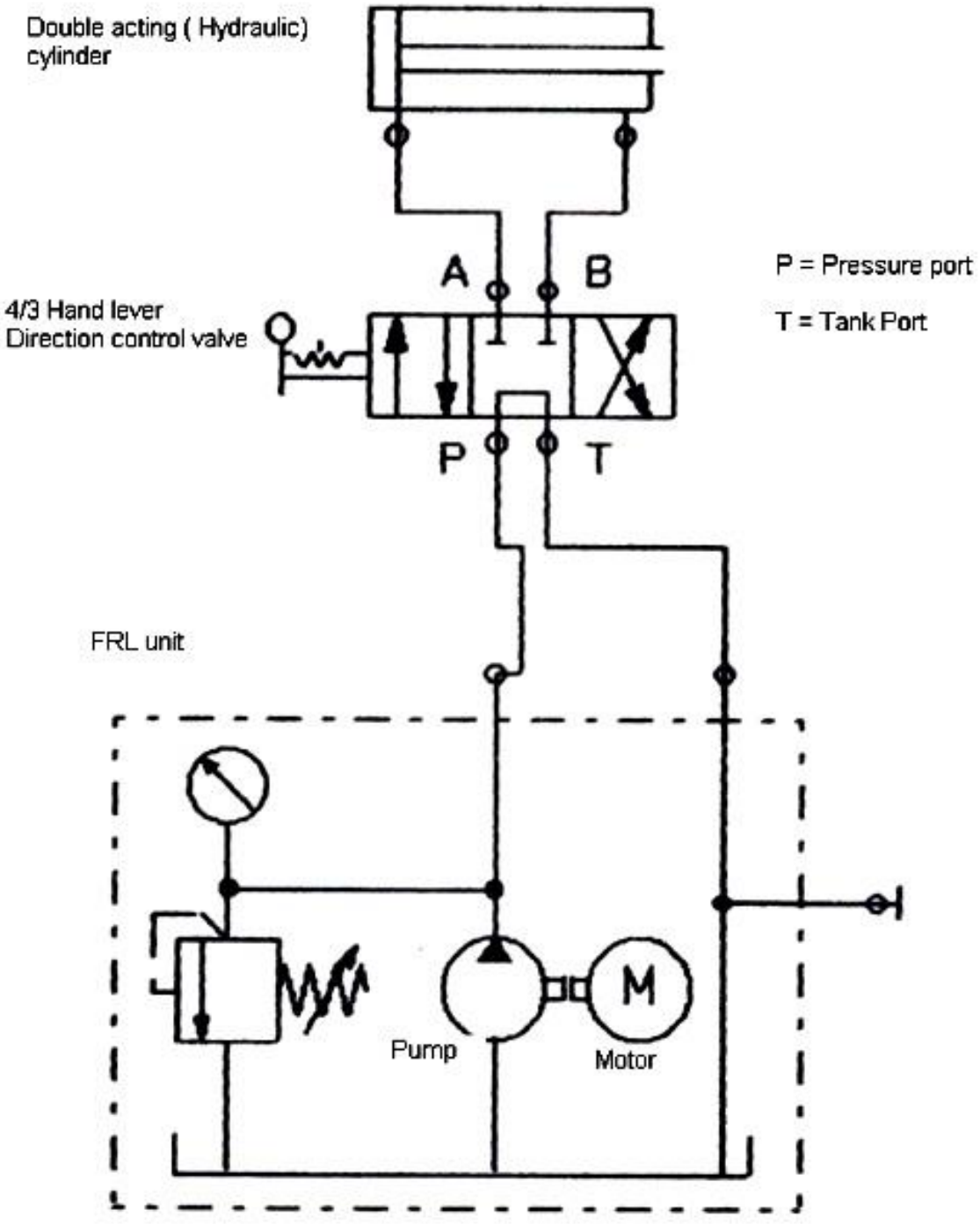
Procedure :

1. Connect the circuit diagram using hoses as per the following diagram.
2. Connect the pressure line and tank line manifolds respectively. Check all the connections carefully before starting power pack.
3. Start the power pack and check the pressure level keep the pressure at 10bar by adjusting the pressure relief value.
4. Operate the 4/3 way hand operated value, the cylinder starts extending in forward direction.
5. Keep press the lever of the hand operated valve until cylinder reaches the fully extended position.
6. In the mean time we record time taken for fully extended position of the actuator from its initial position with stop watch and also record the time at intermediate position.
7. Calculate the force, velocity of the actuator by the calculation.

Formula:

1. Force = pressure × Area = **N**
2. Area = πr^2
3. Velocity = Displacement / time = **m. /Sec.**

Diagram :



Hydraulic Cylinder Specification:-

1. Double acting cylinder
2. The radius of the cylinder (r) = 0.025 m
3. The maximum Stroke length (L) = 0.2 m

Tabulation :

Table – 1:

S. No	Stroke length in (m)	Pressure in Bar or (Kg/m^2)	Time taken (Sec)
1.	0.05	10 bar	
2.	0.10	10 bar	
3.	0.15	10 bar	
4.	0.20	10 bar	

Table – 2:

S. No	Stroke length in (m)	Force (N)	Velocity (m/sec)
1	0.05		
2	0.10		
3	0.15		
4	0.20		

Calculation:

***Result* :**

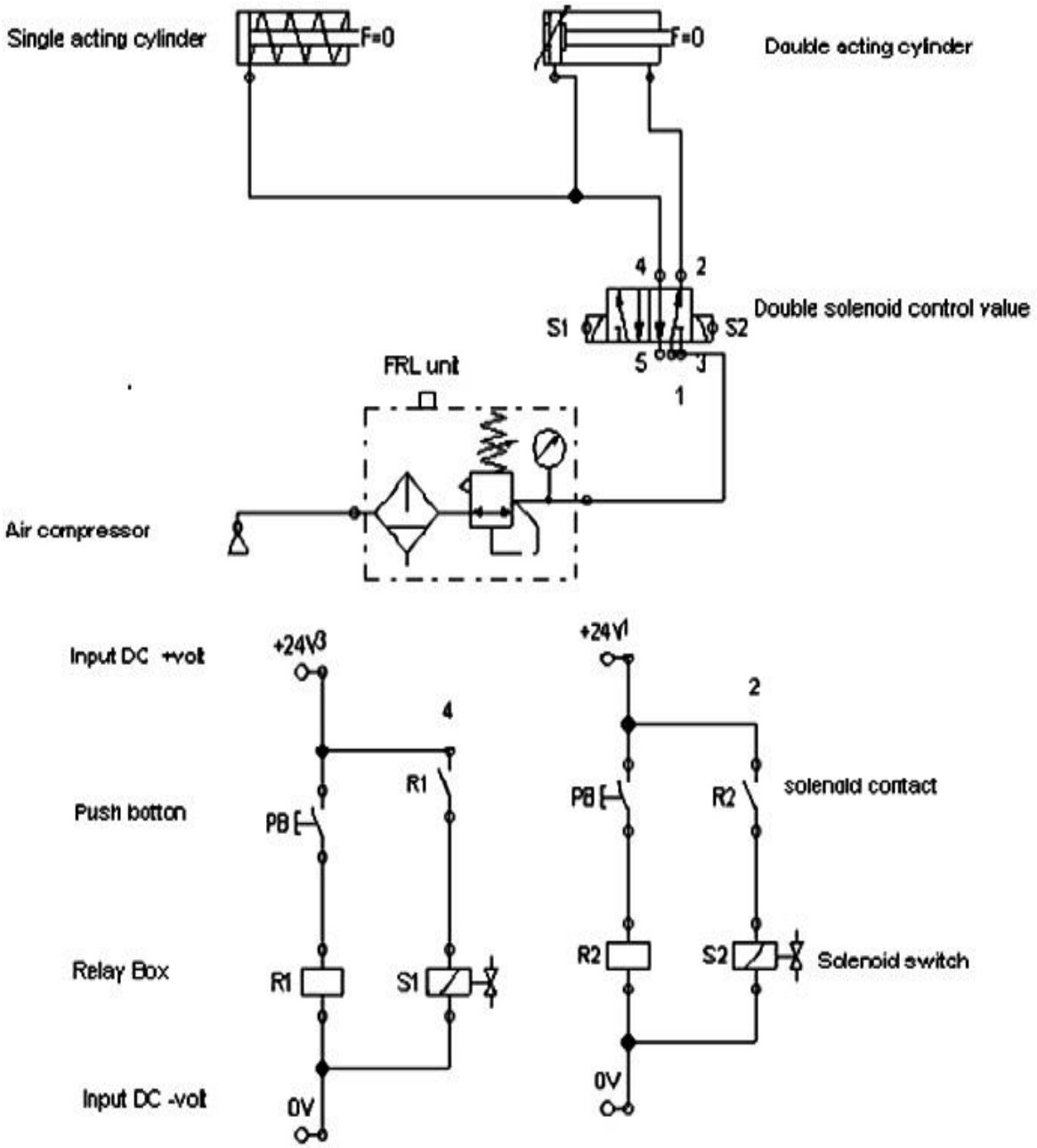
Thus the hydraulic circuit was designed, velocity, direction and force of the hydraulic double acting actuator is calculated by using hydraulic trainer kit.

***Inference* :**

- Understand the design of hydraulic circuits by connecting the hydraulic components and also known the working principle of all the components.
- Direction, force, and velocity of the hydraulic actuators can also be determined by conducting this experiment.

***Applications* :**

1. To lift the heavy components in industries.
2. To press the components as per the molded shape by hydraulic molding machine.
3. To control the precise movements of conveyors in the assembly line of production.



Manual Wiring Sequencing :

SMPS ⟶ Relay Power IN ⟶ Relay IN to Relay OUT Loop

Relay Out (Open Switch) ⟶ Push Button Switch ⟶ Solenoid Coil

Ex No : 2 ***Date :***

Design of Circuits with Logic Sequence using Electro Pneumatic Trainer Kits

Aim :

To construct the logical circuit to trigger single and double acting cylinders to make sequence of forward and return stroke with double solenoid operated Directional Control Valve (DCV).

Apparatus Required :

1. Compressor
2. FRL Unit
3. Air distributor
4. 5/2 way Double Solenoid Control Directional Control Valve (DCV)
5. Polyurethane tubes (size 4mm & 8mm)
6. Single acting and double acting actuators.

Procedure :

1. Draw the logical circuit diagram for making a forward and reversed direction in single and double acting cylinder to logical sequences.
2. Connect the components as per the logical circuit.
3. Regulate the air pressure between 6 to 7 bars in pressure regulator.
4. Connect the air supply through distributor block to 5/2 way Double Solenoid Control Directional Control Valve (DCV).
5. When the pressure line is connected to the solenoid coil-2 (S_2) the single and double acting cylinders are in retracted position .(initial position)
6. If the green push button is pressed the solenoid coil -1(S_1) is energized by the connection of suitable electrical circuits connected through the electrical relay contacts, so that the single and double acting cylinders are make forward stroke.
7. If the red push button is pressed the cylinders will go to the initial position.

Result :

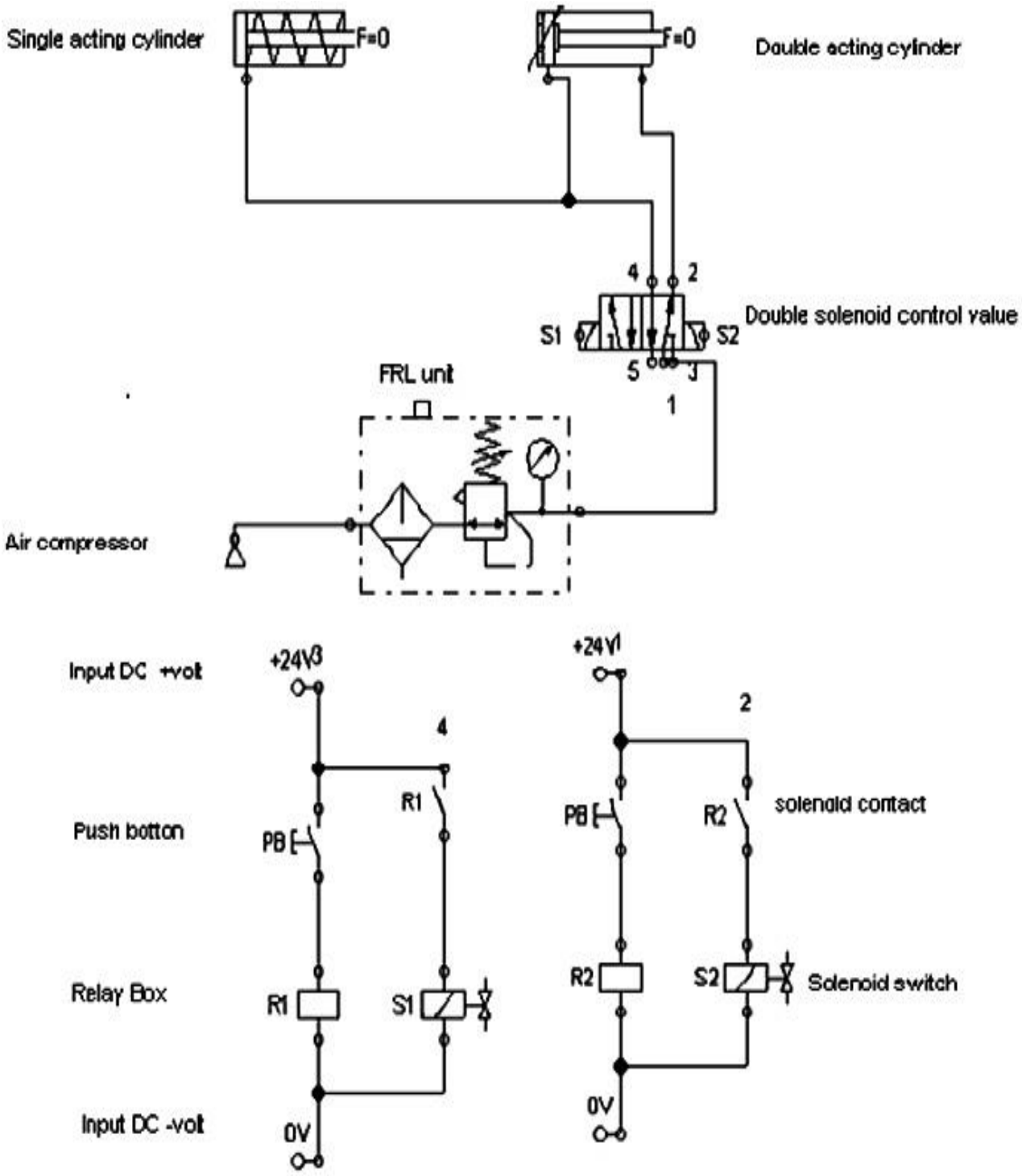
Thus the logical sequence circuits were designed and activated by using Electro pneumatic trainer kit.

Inference:

- Understand the logical sequence of pneumatic actuators by using the electro pneumatic trainer kits.
- To know about the working principle of all pneumatic components by connecting as per the pneumatic circuits.

Applications :

1. Automatic lifting of small weight in industries.
2. Automatic pneumatic door opening and closing in machines.
3. Automatic pressing machines.


Single acting cylinder
F=0
F=0
Double acting cylinder
4
2
S1
S2
Double solenoid control value
5
3
1
FRL unit
Air compressor
Input DC +volt
+24V3
4
R1
Push botton
PB
2
+24V1
PB
R2
solenoid contact
R2
S2
Solenoid switch
Relay Box
R1
S1
0V
Input DC -volt
0V

Ex No : 3 **Date :**

Simulation of Circuit with Logic Sequence using FluidSim Pneumatic Software

Aim:

To simulate a circuit to trigger the forward and return stroke of a Double acting cylinder by directional control valves (DCVs).

Apparatus Required:

1. Personal computer
2. Fluid SIM software

Procedure:

1. Design the logical sequence circuit by connecting the DCVS and actuators in Fluid SIM pneumatic 5.0 software version.
2. The single and double acting cylinders are activated by energizing the double solenoid control valve connected to the air compressor.
3. The components are connected through pneumatic lines and simulate the circuit by pressing the electrical push button.
4. The electrical circuits are designed by connecting push buttons relay and solenoid switches.
5. The pneumatic and electrical circuits are linked by creating the label contact in the circuits.
6. Then the circuit is tested and simulated by switching the circuits and the actuators are making forward and return stroke sequentially.

Result:

Thus the circuit was designed and simulated and tested by Fluid SIM pneumatic software.

Inference:

- Design the pneumatic sequential circuits for simulating pneumatic components by creating logical design by Fluid SIM software.
- Test all the pneumatic components by simulating the design before creating all the real time control circuits.

Applications:

1. Industry control automation circuit can be designed for making the real-time automatic control.
2. Debugging the pneumatic control components by testing and simulating the pneumatic circuits.

Ex No : 4 ***Date :***

Circuits with Multiple Cylinder Sequences in Electro Pneumatic using Programmable Logic Controller (PLC).

Aim :

To create a pneumatic circuit for actuating the single and double acting Pneumatic cylinders in Electro pneumatic Trainer kit and write a Ladder Logic Program to operate the cylinders with PLC.

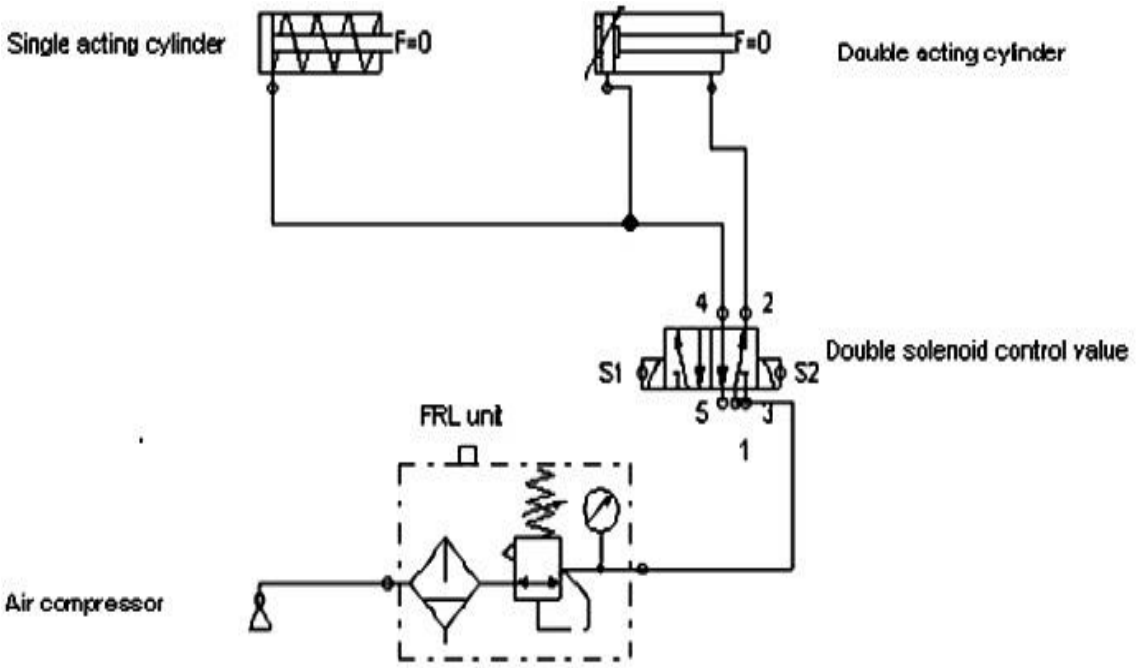
Apparatus Required :

1. Pneumatic Trainer kit
2. Single and Double acting Pneumatic Cylinders
3. 5/2 way single sided solenoid DCV
4. PLC Trainer kit
5. Computer with PLC Software
6. Serial Data communication (RS 232) Cable
7. Connecting hoses, wires and SMPS 24V

Procedure :

1. Create the Pneumatic Circuit to actuate the Single and double acting Cylinders in the Pneumatic trainer kit.
2. Then connect the PLC Trainer with computer by using serial data communication cable (RS 232).
3. Open the PLC software in computer.
4. Write the Ladder Logic Program to actuate the Pneumatic Cylinders. Here the Input address is given as in the form of % IX address, and then the output address is given as % QX address.
5. The digital output in the PLC Trainer kit is given to the 5/2 way single sided solenoid operated DCV.
6. Then, the Pneumatic cylinders are actuated by running the Ladder Logic Program in the computer.

Pneumatic Circuit Diagram :-



PLC Ladder Logical Program :-

Ladder Logic Program:

```
001   PROGRAM PLC _ PRG
002   VAR
003   SW_ 1 AT % IX 62.0: BOOL;
004   OUT_ 1 AT % QX 62.0: BOOL;
005   SW_2 AT % IX 62.1: BOOL;
006   OUT_2 AT % QX 62.1: BOOL;
007   END_VAR
```

Result:

Thus, the single and double acting cylinders are actuated by Electro Pneumatic Trainer kit with PLC.

Inference:

- Understand the working of programmable logical controller.
- Create ladder program by input and output components by declaring the address and variable name.
- Interface the hardware electronic circuits with PLC through serial data communication port.

Applications:

1. Automatic sensing and controlling various parameters through PLC.
2. Low cost automation in the industries to withstand in all the situations like over vibration, humidity, chemical reaction, and temperature etc.
3. Automatic monitoring and controlling of all the process through PLC.

OPCODE (8 bit Register) Half step Revolution:

Address	Label	OP Code	Mneumonics
8100		78 82	MOV R0, #82H
8102		79 00	MOV R1, #00H
8104		7A 64	MOV R2, #C8
8106	Loop:	88 83	MOV DPH, R0
8108		89 82	MOV DPL, R1
810A		E0	MOVX A, @DPTR
810B		F5 F0	MOV B,A
810D		A3	INC DPTR
810E		A8 83	MOV R0, DPH
8110		A9 82	MOV R1, DPL
8112		E5 01	MOV A,R1
8114		B4 04 02	CJNE A, #04, CONTINUE
8117	RESET ADDR.	79 00	MOV, R1, #00H
8119	CONTINUE	90 E0 C0	MOV DPTR, #E0C0
811C		E5 F0	MOV A.B
811E		F0	MOVX @ DPTR, A
811F		12 81 26	CALL DELAY
8122		DA E2	DJNZ R2, LOOP
8124		80 FE	LJMP HERE
8126	DELAY	7B A0	MOV R3, #FFH
8128	LOOP1:	7C FF	MOV R4, #FFH
812A	LOOP2:	DC FE	DJNZ R4, LOOP2
812C		DB FA	DJNZ R3,LOOP1
812E		22	RET

Input :

8200	05
8201	09
8202	0A
8203	06

Ex No : 5 ***Date :***

Stepper Motor Interfacing with 8051 Micro Controller

Aim:

To run the Stepper Motor in Half step Revolution and Full step Revolution by interfacing with 8051 Micro Controller.

Apparatus Required:

1. 8051 Micro Controller
2. Stepper motor

Algorithm:

1. Move starting address of stepping sequence to register R0 & R1.
2. Set Stepper Motor port address in DPTR (Data Pointer).
3. Save R0 & R1.
4. Move stepping data to Accumulator.
5. Increment the Memory.
6. Save DPTR in R0 & R1.
7. Call delay routine. If B is not zero execute the Loop.
8. To vary the degree of rotation, change the data in the address 8104.

OPCODE (8 bit Register) Full step Revolution:

ADDRESS	LABEL	OP Code	MNEUMONICS
8100		78 82	MOV R0, #82H
8102		79 00	MOV R1, #00H
8104		7A C8	MOV R2, #C8
8106	Loop:	88 83	MOV DPH, R0
8108		89 82	MOV DPL, R1
810A		E0	MOVX A, @DPTR
810B		F5 F0	MOV B,A
810D		A3	INC DPTR
810E		A8 83	MOV R0, DPH
8110		A9 82	MOV R1, DPL
8112		E5 01	MOV A,R1
8114		B4 04 02	CJNE A, #04, CONTINUE
8117	RESET ADDR.	79 00	MOV, R1, #00H
8119	CONTINUE	90 E0 C0	MOV DPTR, #E0C0
811C		E5 F0	MOV A.B
811E		F0	MOVX @ DPTR, A
811F		12 81 26	CALL DELAY
8122		DA E2	DJNZ R2, LOOP
8124		80 FE	LJMP HERE
8126	DELAY	7B A0	MOV R3, #FFH
8128	LOOP1:	7C FF	MOV R4, #FFH
812A	LOOP2:	DC FE	DJNZ R4, LOOP2
812C		DB FA	DJNZ R3,LOOP1
812E		22	RET

Input :-

8200 05
8201 09
8202 0A
8203 06

Result:

Thus the Stepper Motor in Full step revolution and Half step revolution were executed by interfacing with 8051 Micro Controller.

Inference:

- The op code and operands for the speed control of stepper motor can also be studied.
- The stepper motor control for various angles can also be done with suitable hexadecimal coding address.
- The stepper motor revolution can be controlled for 360◦ and 180◦.

Application:

1. The stepper motors can be attached to the various joints of the industrial robotic application.
2. Stepper motor can be attached to the precise movement of the CNC machines pallet ant tool change mechanism.
3. The revolving and rotating mechanism can be developed by the precise movement of the stepper motor for various industrial applications.

Example : - (Addition)

The two data to be added are at 4150 and 4151. The result is stored at 4152.

Data :

(4150) = 23

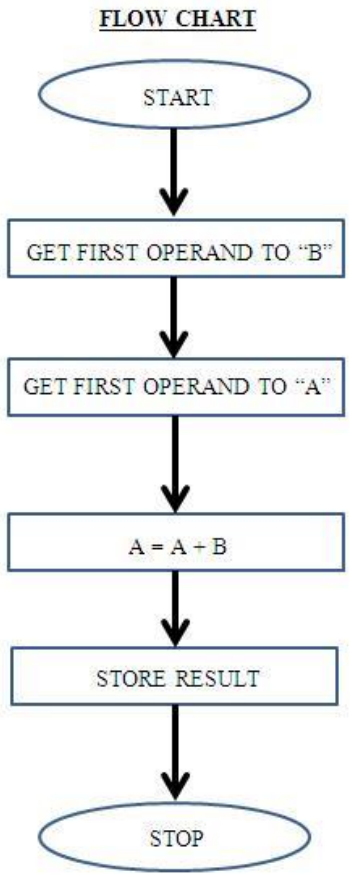
(4151) = 35

Result :

(4152) = 58

Program : -

```
LDA  4150 ;  (4150)      =>  (A)    =  23
MOV  B,A  ;  (A)         =>  (B)
LDA  4151 ;  (4151)      =>  (A)    =  35
ADD  B    ;  (A) + (B)   =>  (A)
STA  4152 ;  (A)         =>  (4152) =  58
HLT
```



Object Codes : - (Addition)

Memory Address	OP Codes	Mnemonics
4100	3A	**LDA 4150**
4101	50	
4102	41	
4103	47	**MOV B,A**
4104	3A	**LDA 4151**
4105	51	
4106	41	
4107	80	**ADD B**
4108	32	**STA 4152**
4109	52	
410A	41	
410B	76	**HLT**

Ex No: 6 (a) ***Date :***

Assembly language programming of 8085 micro processor
For addition, subtraction, multiplication and division

Aim :

a. To add two 8 bit numbers in memory and store the result in memory.
b. To subtract two 8 bit numbers in memory and store the result in memory
c. To multiply two numbers residing in memory and to store the result in memory.
d. To divide two 8-bit numbers and to store the result in memory again.

Components Required :

1. 8085 Micro Processor.
2. Interface Module
3. Power Supply

Procedure: -

Addition & Subtraction :

1. Key in the op codes from the address specified.
2. Enter data at 4150 and 4151 as specified in the Example.
3. Execute the program and check for the result at 4152.
4. Change data at 4150 and 4151 and execute each time and check for result.

Multiplication:

1. Key in the op codes from the address specified.
2. Enter data at 4150 through 4153 for execution.
3. Execute the program and check for the result at 4154 and 4155.
4. Try changing data and check results each time.

Division:

1. Key in the op codes from the address specified.
2. Enter data for execution at 4150 and 4151.
3. Execute the program and check for the results at 4152 and 4153.
4. Try changing data and check for results each time you execute.

Theory (Addition) : -

The first data is brought to accumulator "A" and the second one in any one of the other registers, say "B". The addition is done using ADD. The result is then stored at 4152. The ADD instruction affects flags depending on result.

Example : - (Subtraction)

Let the data to be subtracted be 24 from 49.

Data :

(4150) = 49

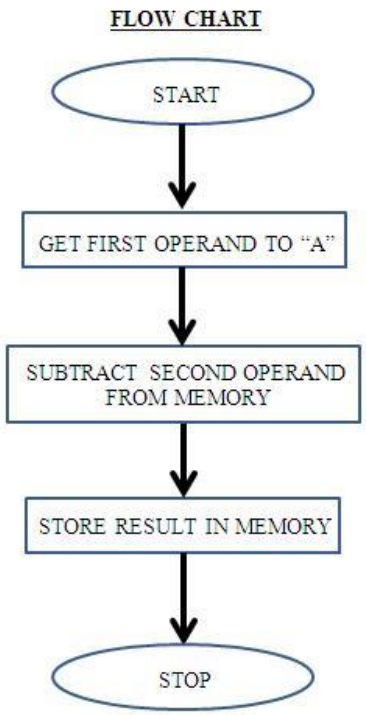
(4151) = 24

Result :

(4152) = 25

Program : -

```
LXI   H,   4150   ; Initialize memory pointer to 4150
MOV   A,   M      ; (4150) => (A)    =    49
INX   H           ;        Point to next data
SUB   M           ; (4151) => (A)    =    24
INX   H           ;        Point to next location
MOV   M,   A      ; (A)    => (4152) =    25
HLT
```



Object Codes: - (Subtraction)

Memory Address	OP Codes	Mnemonics
4100	21	**LXI H, 4150**
4101	50	
4102	41	
4103	7E	**MOV A, M**
4104	23	**INX H**
4105	96	**SUB M**
4106	23	**INX H**
4107	77	**MOV M, A**
4108	76	**HLT**

Theory (Subtraction) : -

In this experiment, the HL register pair is first initialized to the start address of memory at which the data is stored. Then data is brought to accumulator "A" and the other one is subtracted from memory itself. The result from "A" is then stored into memory again using HL register. The SUB instructions sets and clears flags according to result.

Theory (Multiplication) : -

Since there is no such instruction to multiply or to divide, some logic has to be applied to do these tasks. Multiplication can be done by repeated addition while division by repeated subtraction.

In this experiment, the multiplicand and the multiplier stored at memory locations are taken up by the register pair DE and register "B". Using the DAD instruction, 16 bit addition is done repeatedly by the multiplicand until the multiplier becomes zero. The result is again stored in a memory.

Theory (Division) :

Division is done here using the method of repeated subtraction. The dividend is loaded to register "A" and divisor to register "B". Subtract divisor from dividend until the dividend is less than the divisor. Count number of times of subtraction. That count is the quotient and the dividend now becomes the remainder.

Example : - (Mutiplication)

Let the multiplicand and the multiplier are at locations 4150 and 4152. The result will be stored at location 4154. The data at locations are

Data :

(4150)	=	93
(4151)	=	00
(4152)	=	23
(4153)	=	00

Result :

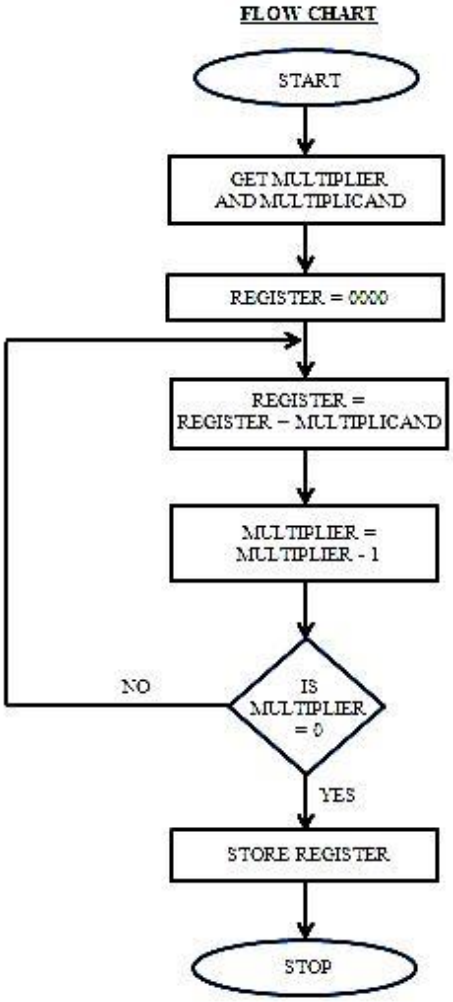
(4154)	=	19 (LSH)
(4155)	=	14 (MSH)

Program : -

```
LDA 4152        ; Load Multiplier
MOV B, A        ; Get the Multiplier to B

LXI D, 0000
LHLD  4150;
XCHG            ; Load multiplicand in DE

LOOP:   DAD D
        DCR B
        JNJ LOOP  ; If not zero loop again
        SHLD 4154; Else store result
        HLT
```



Object Codes : (Multiplication)

Memory address	OP Codes	Mnemonics
4100	3A	**LDA 4152**
4101	52	
4102	41	
4103	47	**MOV B, A**
4104	11	**LXI D, 0000**
4105	00	
4106	00	
4107	2A	**LHLD 4150**
4108	50	
4109	41	
410A	EB	**XCHG**
410B	19	**LOOP: DAD D**
410C	05	**DCR B**
410D	C2	**JNZ LOOP**
410E	0B	
410F	41	
4110	22	**SHLD 4154**
4111	54	
4112	41	
4113	76	**HLT**

Example : - (Division)

The divisor and the dividend are at locations 4150 & 4151. The remainder and quotient will be stored at locations 4152 & 4153.

Data :

(4150) = 08 - Divisor

(4151) = 2A - Dividend.

Result :

(4152) = 02 - Remainder

(4153) = 05 - Quotient

Program :

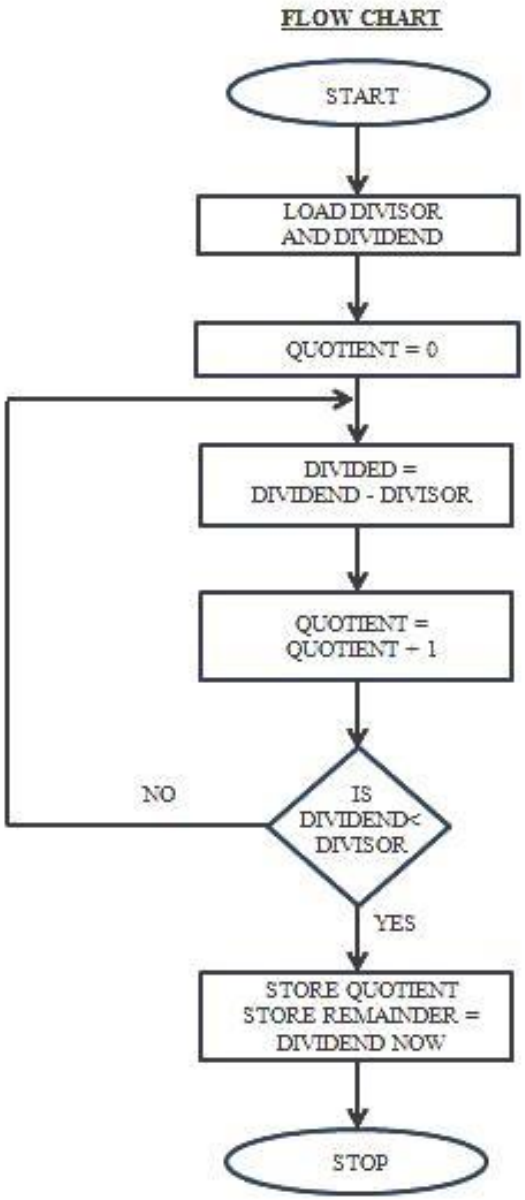
```
    LDA  4150  ;  Load divisor
    MOV  B,  A  ;  to B
    LDA  4151  ;  Load dividend to A
  MVI  C,  00  ;  Initialize quotient  =  0
    CMP  B
    JC    LOOP
```

Loop1:

```
    Sub  B  ;  Dividend - Divisor
  INR  C  ;  Quotient = Quotient  +  1
    CMP  B  ;  Is Dividend < Divisor
    JNC  LOOP1  ;  If not repeat again
```

Loop:

```
  STA  4152  ;  Yes, then store remainder
    MOV  A,  C
    STA  4153  ;  Store quotient
          HLT
```



Object Codes : - (Division)

MEMORY ADDRESS	OP Codes	MNEMONICS
4100	3A	**LDA 4150**
4101	50	
4102	41	
4103	47	**MOV B, A**
4104	3A	**LDA 4151**
4105	51	
4106	41	
4107	0E	**MVI C, 00**
4108	00	
4109	B8	**CMP B**
410A	DA	**JC LOOP**
410B	13	
410C	41	
410D	90	**LOOP1 : SUB B**
410E	0C	**INR C**
410F	B8	**CMP B**
4110	D2	**JNC LOOP1**
4111	09	
4112	41	
4113	32	**LOOP: STA 4152**
4114	52	
4115	41	
4116	79	**MOV A, C**
4117	32	**STA 4153**
4118	53	
4119	41	
411A	76	**HLT**

Result : -

Thus the two 8 bit numbers were added, subtracted, multiplied and divided by coding through assembly language program interfacing with 8085 Microprocessor.

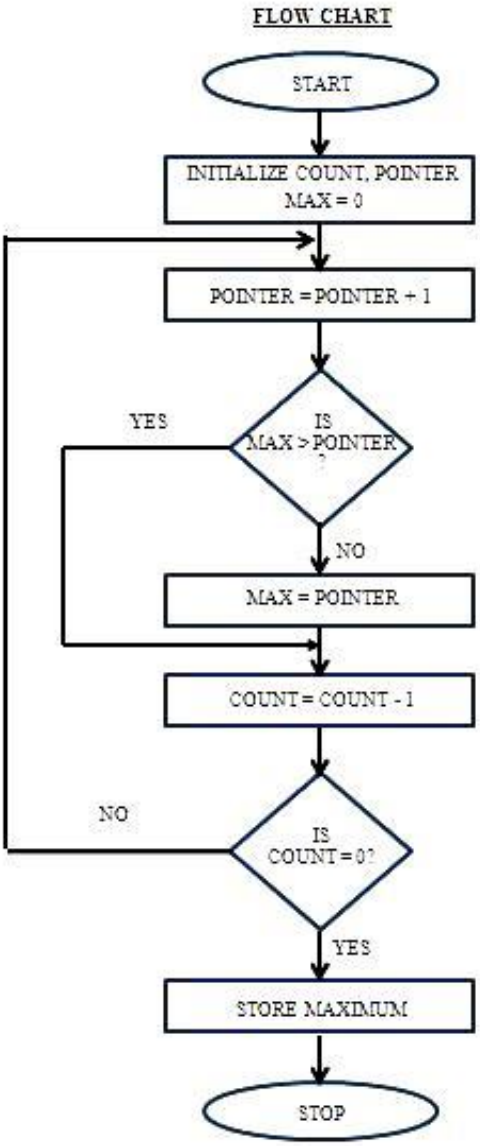
Inference :-

The students inferred about the arithmetic operations by using assembly language programming.

The students also inferred that the addressing of data read and write the data to develop the op codes and operands.

Application :-

Control the data flow in the machine language of CNC machine, PLC based and computer based automatic machines.



Data :

(4150)	=	05	-	No. of elements
(4151)	=	67	-	Array starts
(4152)	=	79		
(4153)	=	15		
(4154)	=	E3		
(4155)	=	72		

Result :

(4156)	=	E3

Ex No : 6 (b) ***Date :***

Assembly Language Programming Of 8085 Micro Processor for Sorting (Biggest Number in an Array)

Aim :-

To find the biggest number in an array of 8-bit unsigned numbers, given the length of the block.

Components Required: -

1. 8085 Micro Processor.
2. Interface Module
3. Power Supply

Procedure: -

1. Key in the op codes from the address specified.
2. Enter data from 4150 through 4155.
3. Execute the program and check for the results.
4. Try changing data as well as array length and check results each time you execute.

Theory : -

To find the biggest number in any given array, the contents of the array must be compared with an arbitrary biggest number. In this experiment, since all numbers are said to be unsigned 8-bit numbers, let register "A" have the biggest number i.e., zero. Now compare the first number with register "A". Now if it is greater, move it to register "A". Further comparision is with this biggest number and this comparision is done till the end of the array. Now the biggest number in register "A" is put in memory.

Example : -

The length of the array is at memory location 4150 while the array itself starts from 4151. Let the number of element in the array be 05.

Program : -

```
        LXI   H,   4150   ;   Point to data start
        MOV   B,   M      ;   Get Count to B
        XRA   A           ;   Maximum = Minimum Possible Value ( Zero )
Loop :  INX   H
        CMP   M           ;   Is next number > Maximum ?
        JNC   LOOP1
        MOV   A,   M      ;   Yes, replace maximum
Loop1:  DCR   B           ;   Check length of array
        JNZ   LOOP        ;   If B ≠ 0 then repeat
        INX   H
        MOV   M,   A      ;   Save maximum number
        HLT
```

Object Codes :

Memory Address	OP Codes	Mnemonics			
4100	21		LXI	H,	4150
4101	50				
4102	41				
4103	46		MOV	B,	M
4104	AF		XRA	A	
4105	23	LOOP:	INX	H	
4106	BE		CMP	M	
4107	D2		JNC	LOOP1	
4108	0B				
4109	41				
410A	7E		MOV	A,	M
410B	05	LOOP1:	DCR	B	
410C	C2		JNZ	LOOP	
410D	05				
410E	41				
410F	23		INX	H	
4110	77		MOV	M,	A
4111	76		HLT		

Result :

Thus the biggest number was sorted from an array of 8-bit unsigned numbers.

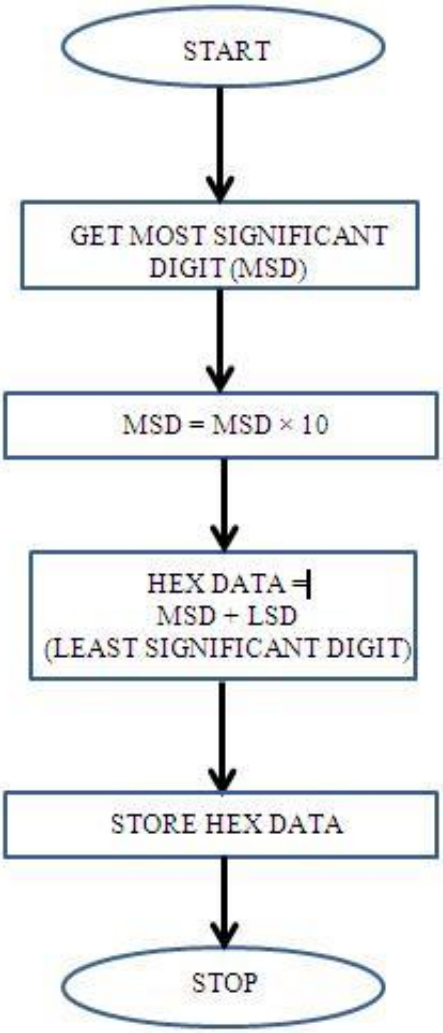
Inference :

Students able to initialize the array of elements through the microprocessor. And also the students able to sorting out the biggest number and from an array by coding assembly language program.

Application :

The real time data from the machines and shop floor are collected and stored the microprocessor system by the logical codes.

FLOW CHART


START
GET MOST SIGNIFICANT DIGIT (MSD)
MSD = MSD × 10
HEX DATA = MSD + LSD (LEAST SIGNIFICANT DIGIT)
STORE HEX DATA
STOP

Ex No : 6 (c) ***Date :***

Assembly Language Programming of 8085 Micro Processor for Code Conversion (Hexadecimal Codes ⟷ Binary Codes)

Aim :-

1. To convert an 8-bit hexadecimal number to its binary form and store in memory.
2. To convert two BCD numbers in memory to the equivalent Hexadecimal number

Components Required : -

1. 8085 Micro Processor.
2. Interface Module
3. Power Supply

Procedure:

Hexadecimal to Binary code :

1. Key in the op codes from the address specified.
2. Execute the program and check for the results at locations 4150through 4157.
3. Try changing data and check for results each time you execute.

Binary Code to Hexadecimal Code :

1. Key in the op codes from the address specified.
2. Enter data at 4150 and 4151 for execution.
3. Execute the program and check for the results at locations 4152.
4. Try changing data and check results each time you execute

Theory :

First get the data and rotate it right. Depending upon carry store either 0 or 1 in memory. Do the rotation 8 times for the 8 bits in that number. Out of the two BCD digits at 4150 and 4151, the one at 4150 is the MSD. The logic is to multiply the MSD by ten using repeated addition. Then add the LSD to it.

Example : (for Hexadecimal to Binary code)

Let the data be **5A**

Data	**: 5A**	**=**	**0101**	**1010**	**B**
Result	**:** (4150)	=	0	(LSB)	
	(4151)	=	1		
	(4152)	=	0		
	(4153)	=	1		
	(4154)	=	1		
	(4155)	=	0		
	(4156)	=	1		
	(4157)	=	0	(MSB)	

Program :

```
        LXI   H,   4150   ;   Initialize Memory Pointer
        MVI   B,   08     ;   Counter for 8 – bits
        MVI   A,   5A
Loop:   RRC               ;   Check least significant bit
        JC    LOOP1
        MVI   M,   00     ;   Store zero if no carry
              JMP  COMMON ;
Loop1:  MVI   M,   01     ;   Store one if there is a carry
Common: INX   H
        DCR   B           ;   Check for Counter
              JNZ  LOOP
        HLT
```

Object Codes :

Memory address	OP Codes	Mnemonics			
4100	21		LXI	H,	4150
4101	50				
4102	41				
4103	06		MVI	B,	08
4104	08				
4105	3E		MVI	A,	5A
4106	5A				
4107	0F	LOOP:	RRC		
4108	DA		JC	LOOP1	
4109	10				
410A	41				
410B	36		MVI	M,	00
410C	00				
410D	C3		JMP	COMMON	
410E	12				
410F	41				
4110	36		MVI	M,	01
4111	01				
4112	23	COMMON:	INX	H	
4113	05		DCR	B	
4114	C2		JNZ	LOOP	
4115	07				
4116	41				
4117	76		HLT		

Example : (for Binary Coded Decimal to Hexadecimal code)

The BCD digits are at locations 4150 and 4151 and result will be stored at 4152.

Data : (4150) = 02 (MSD)

(4151) = 09 (LSD)

Result : (4152) = 1D H = 29 D

Program :

```
LXI   H,   4150  ;
MOV   A,   M     ;   Initialize memory pointer to 4150
                 ;   (A) = (4150) - (MSD)
ADD   A          ;   MSD × 2
MOV   B,   A     ;   Save MSD × 2
ADD   A          ;   MSD × 4
ADD   A          ;   MSD × 8
ADD   B          ;   MSD × 10
INX   H              ;   Point to LSD
ADD   M          ;   Add to form Hex equivalent
INX   H              ;   (A) => (4152)
MOV   M,   A
HLT
```

Object Codes :

Memory address	OP Codes	Mnemonics				
4100	21		LXI	H,	4150	
4101	50					
4102	41					
4103	7E		MOV	A,	M	
4104	87		ADD	A		
4105	47		MOV	B,	A	
4106	87		ADD	A		
4107	87		ADD	A		
4108	80		ADD	B		
4109	23		I@X	H		
410A	86		ADD	M		
410B	23		INX	H		
410C	77		MOV	M,	A	
410D	76		HLT			

Result :

Thus the 8-bit Hexadecimal number was converted to its binary form and its result was stored in the memory by interfacing with 8085 Microprocessor.

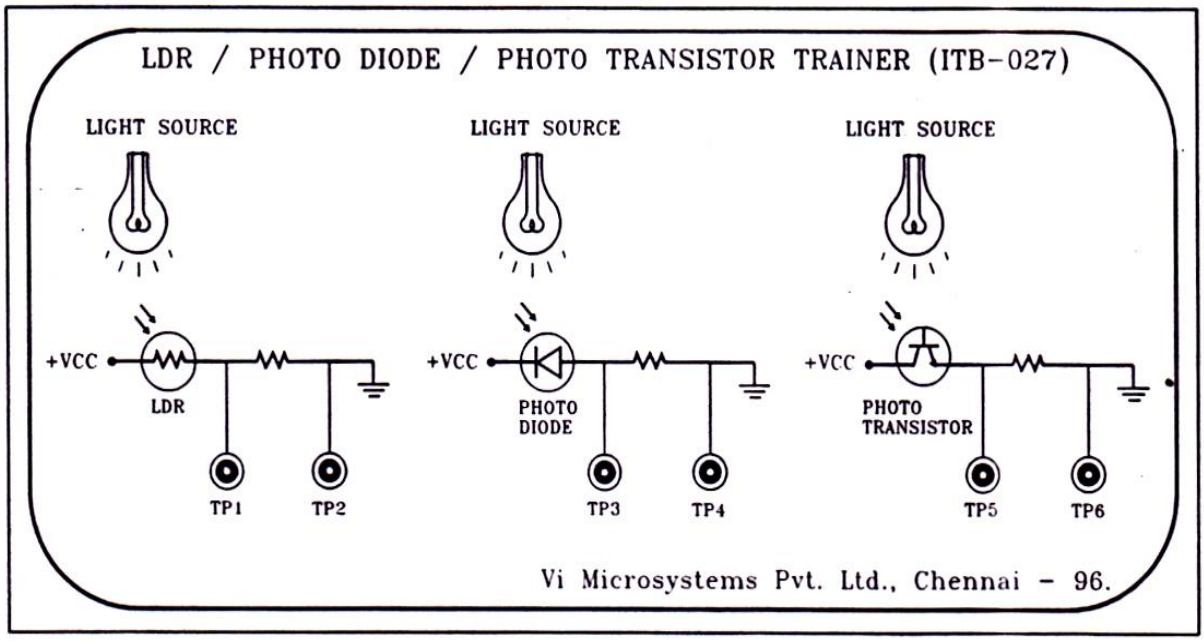
Thus the 8-bit Binary Coded Decimal Digit was converted to its equivalent Hexadecimal number form and its result was stored in the memory by interfacing with 8085 Microprocessor

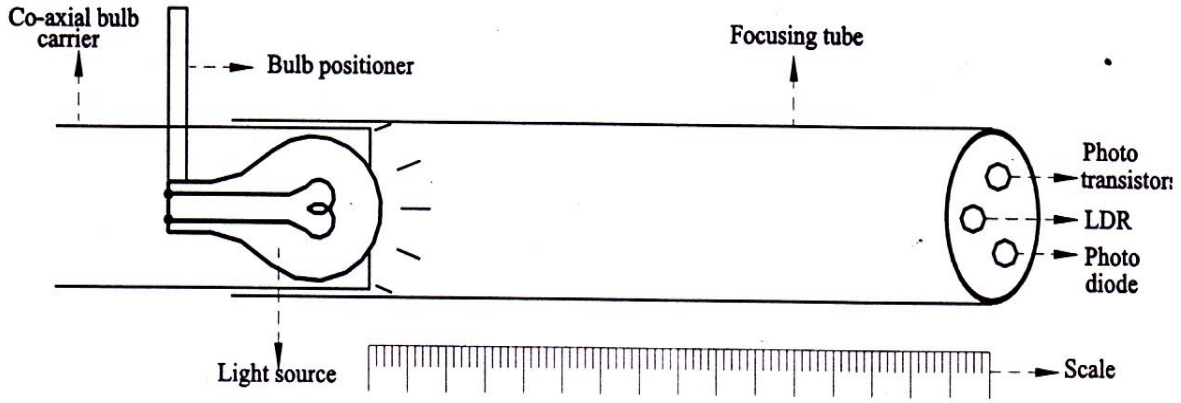
Inference :

Students able to understand the code conversion and interpretation of the data flow as per required code conversion.

Application :

The control algorithm for the process and machines are developed by their machine language codes conversion.


LDR / PHOTO DIODE / PHOTO TRANSISTOR TRAINER (ITB-027)
LIGHT SOURCE
LIGHT SOURCE
LIGHT SOURCE
+VCC
LDR
+VCC
PHOTO DIODE
+VCC
PHOTO TRANSISTOR
TP1
TP2
TP3
TP4
TP5
TP6
Vi Microsystems Pvt. Ltd., Chennai - 96.


Co-axial bulb carrier
Bulb positioner
Focusing tube
Photo transistor
LDR
Photo diode
Light source
Scale

Ex No : 7 ***Date :***

Study of Various Types of Transducers
(Optical Sensor Trainer)

Aim :

To study the response of optical sensors, by varying the distance from the light source.

Components Required:

1. Optical Sensor Trainer (ITB-027) – with LDR, Photo Diode and Photo Transistor Sensors
2. Power Supply

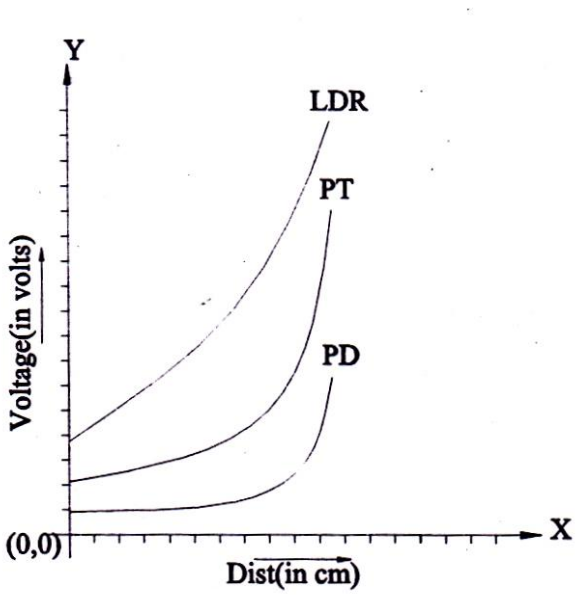
Procedure:

1. Position the pointer at 0 on the scale when the bull is at maximum distance away from sensors.
2. Switch ON the power supply to the instrument.
3. Measure the DC voltage output of LDR using a multi meter (or) a CRO across TP1 and TP2
4. Gradually move the bulb towards the sensor in steps of 5mm and note the corresponding voltages.
5. Repeat the above procedure for the other two sensors, photo diodes and photo transistors.
6. Tabulate the readings and plot the graph of **Distance** versus Sensor output **voltage**.

Tabular Column : -

Measuring Scale Position	Actual Distance (Between Light Source and Sensors)	Sensors Output Voltage (V)		
		Light Dependent Resistor (LDR)	Photo Diode (PD)	Photo Transistor (PT)
0 cm	25 cm			
5 cm	20 cm			
10 cm	15 cm			
15 cm	10 cm			
20 cm	5 cm			
25 cm	0 cm			

Model Graph :-



Result :

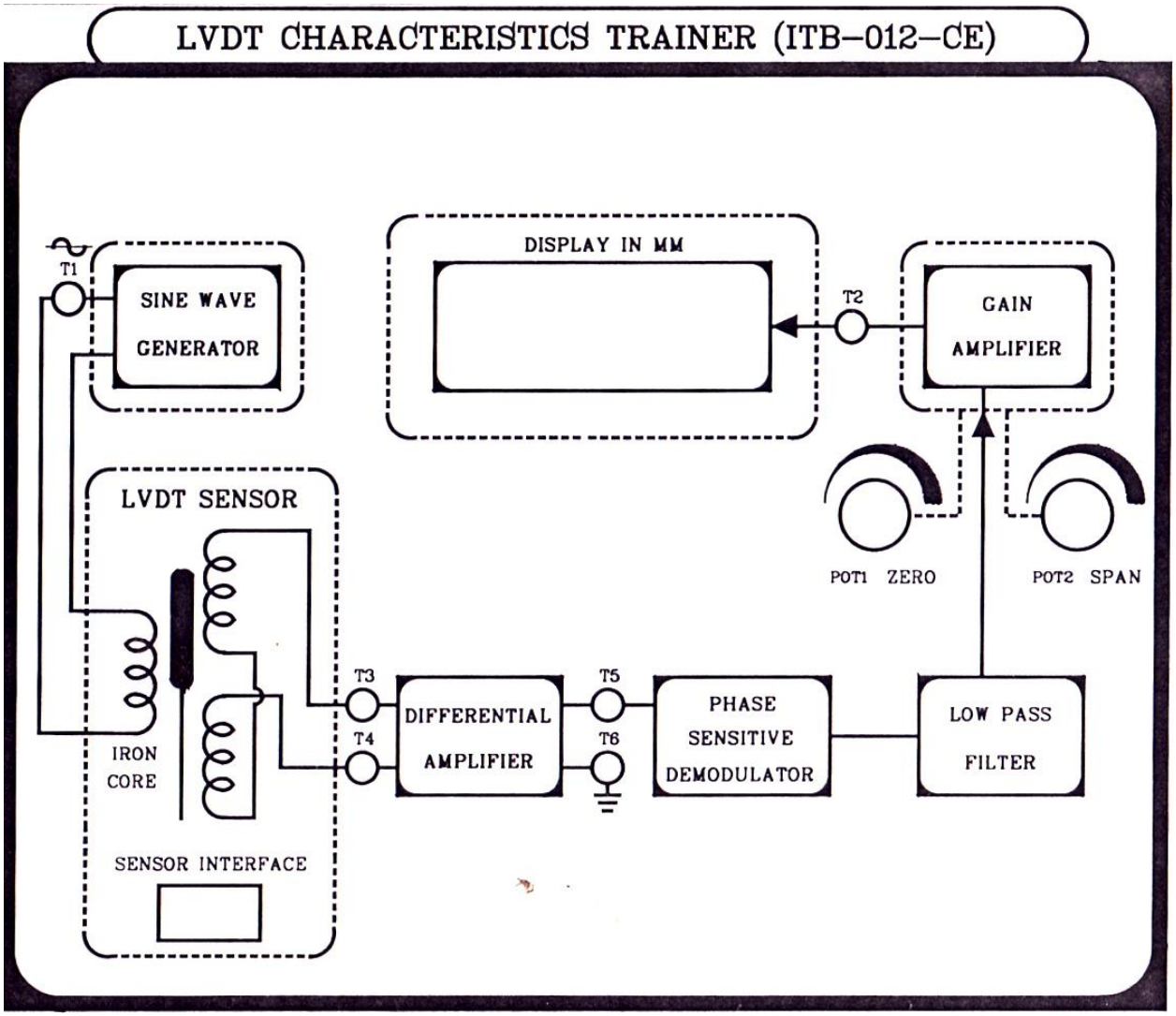
From the experiment graph, we know that Photo Transistor is more sensitive than Photo Diode due to its amplification factor. LDR output can be configured to different level by varying the supply voltage to the circuit in the ITB – 027 boards inside the instrument.

Inference :

Students inferred the working principle of photo electric sensor through the optical sensor trainer kit.

Application :

The Proximity of objects in material handling devices are sensed, integrated through this sensor to control the flow of devices.


LVDT CHARACTERISTICS TRAINER (ITB–012–CE)
T1
SINE WAVE GENERATOR
DISPLAY IN MM
T2
GAIN AMPLIFIER
LVDT SENSOR
POT1 ZERO
POT2 SPAN
T3
T4
DIFFERENTIAL AMPLIFIER
T5
T6
PHASE SENSITIVE DEMODULATOR
LOW PASS FILTER
IRON CORE
SENSOR INTERFACE

Ex No : 8 ***Date :***

Study of Various Types of Transducers
(Linear Variable Differential Transformer)

Aim :

To provide the final signal conditioner, DC voltage signal which is displayed on DVM (calibrated in mm).

Note : This unit is calculated to given an voltage output of -5V to +5V for a displacement of -10mm to + 10mm.

Components Required:

1. Linear Variable Differential Transformer (LVDT) – Model : ITB-012CE
2. Power Supply

Testing Procedure :

1. Switch ON the power supply to the LVDT module (ITB-012CE)
2. Connect the CRO or Floating Micro Meter with the module.
3. Place the LVDT at the null position (10mm) and adjust the offset to display zero on the DVM calibrated in displacement (mm) of the core.
4. Gradually move the core of the LVDT in the positive direction (20mm) and note the reading on the scale (mm) and the display (mm). It should be around 10mm, if it not adjusts the gain to display 10mm.
5. Repeat step 4 in the opposite direction.
6. Tabulate the readings of actual displacement (on scale) and that displayed on the DVM. The LVDT core may be moved through a distance of 20mm (10mm in each direction)

Tabular Column :-

Sl. No.	D_a (mm)	D_d (mm)	% Error
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

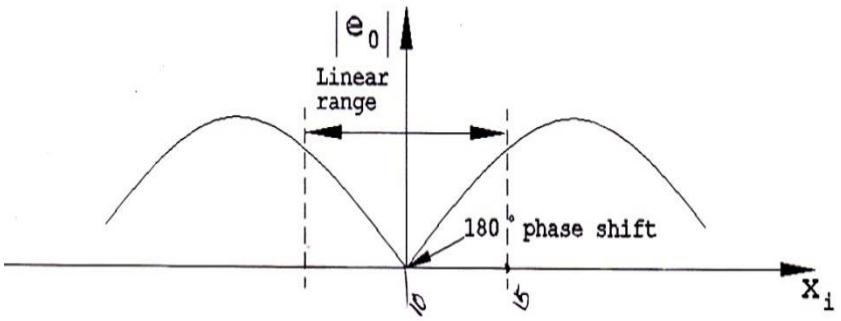
Where,

D_a is the actual displacement on micro meter (mm)

D_d is the displayed displacement (mm)

$$\%\,Error = \frac{D_d - D_a}{D_a} \times 100$$

Model Graph :-



Result:

From the experiment graph, we know that the Linear Variable Differential Transformer (LVDT) is have more sensitive and repeatability. LVDT output can be configured to different level by varying the floating micrometer which is connected with the ITB – 012CE module. From the tabular column we calculated the error percentage of the Module.

Inference:

The students are inferred to understand the working principle of Linear Variable Differential Transformer through the trainer kit.

Application:

The distance measured by the sensor is used to control the process and machines. To develop the automatic control accessories by the linear and angular movement sensed in the machines.

Ex No : 9 ***Date :***

Traffic Light Signals Interfacing with 8051 Micro Controller

Aim :

To control the Green, Red and Amber lights of Traffic Signals along with pedestrian crossing signal by interfacing with 8051 Micro Controller.

Apparatus Required :

1. 8051 Micro Controller
2. Traffic Light Interface Module

Working Procedure :

1. Connect the 5V Supply to the Trainer Kit.
2. Connect the 26 – Pin FRC from the Kit.
3. Switch on the power supply.
4. Assemble the program.
5. Execute it and output display by LED.
6. Switch off the power supply and remove the connectors.

Traffic Program :

8051 Traffic Light Program :

Address	OP code			Mneumonics			Label
9000	74	80		MOV	A,	#80	; All Ports as O/P
9002	90	60	03	MOV	DPTR,	#6003	
9005	F0			MOVX	@DPTR,	A	

For Starting Vehicles N – Direct (St) & Pedestal Stopping :

Address	OP Code			Mneumonics			Label
9006	74	0F		MOV	A,	#0F	; For Pedestrian
9008	90	60	01	MOV	DPTR,	#6001	; Signal
900B	F0			MOVX	@DPTR,	A	
900C	74	4D		MOV	A,	#4D	; For Green LED's in N – S
900E	90	60	00	MOV	DPTR,	#6000	; Direction
9011	F0			MOVX	@DPTR,	A	
9012	12	90	7E	LCALL	907E		; Sequence Delay
9015	12	90	72	LCALL	9072		; Amber Delay

For Stop Vehicles in N – S Direct & Start in E – W Direction :

Address	OP Code			Mneumonics			Label
9018	90	60	00	MOV	DPTR,	#6000	; For Stopping N – S Sides
901B	74	8B		MOV	A,	#8B	; Starting E – W Sides
901D	F0			MOVX	@DPTR,	A	
901E	12	90	7E	LCALL	907E		; Sequence Delay
9021	12	90	72	LCALL	9072		; Amber Delay

For Straight Right Turn in N – S Sides & Stopping E – W Sides :

Address	OP Code			Mneumonics			Label
9024	74	49		MOV	A,	#49	{; For Free Left in All
9026	90	60	00	MOV	DPTR,	#6000	; Sides & Stopping
9029	F0			MOVX	@DPTR,	A	; In E – W Sides }
902A	90	60	02	MOV	DPTR,	#6002	{; For Right Turn in N - S
902D	74	01		MOV	A,	#01	; Sides }
902F	F0			MOVX	@DPTR,	A	
9030	12	90	7E	LCALL	907E		; Sequence Delay
9033	74	00		MOV	A,	#00	; For Amber
9035	F0			MOVX	@DPTR,	A	; Signal
9036	12	90	72	LCALL	9072		; For Amber Delay

For Stop Right Turn in N – S Sides & Start Right Turn in E – W Sides :

Address	OP Code			Mneumonics			Label
9039	74	89		MOV	A,	#89	; For Stopping Vehicles
903B	90	60	00	MOV	DPTR,	#6000	; In N – S Sides
903E	F0			MOVX	@DPTR,	A	
903F	90	60	02	MOV	DPTR,	#6002	; For Right Turn in
9042	74	02		MOV	A,	#02	; E – W Sides
9044	F0			MOVX	@DPTR,	A	
9045	12	90	7E	LCALL	907E		; Sequence Delay
9048	74	00		MOV	A,	#00	
904A	F0			MOVX	@DPTR,	A	
904B	74	30		MOV	A,	#30	
904D	90	60	00	MOV	DPTR,	#6000	
9050	F0			MOVX	@DPTR,	A	
9051	79	04		MOV	R1,	#04	
9053	12	90	84	LCALL	9084		; For Amber Delay

For Starting Pedestrian :

Address	OP Code			Mneumonics			Label
9056	74	C0		MOV	A,	#C0	; For Stopping Vehicle
9058	90	60	00	MOV	DPTR,	#6000	; In All Sides
905B	F0			MOVX	@DPTR,	A	
905C	A3			INC	DPTR		; Green Signal for
905D	74	F0		MOV	A,	#F0	; Pedestrian
905F	F0			MOVX	@DPTR,	A	
9060	79	10		MOV	R1,	#10	; Delay for Pedestrian
9062	12	90	84	LCALL	9084		
9065	74	30		MOV	A,	#30	
9067	90	60	00	MOV	DPTR,	#6000	
906A	F0			MOVX	@DPTR,	A	
906B	79	08		MOV	R1,	#08	
906D	12	90	84	LCALL	9084		; Amber Delay
9070	01	06		AJMP	9006		

For Amber :

Address	OP Code			Mneumonics			Label
9072	90	60	00	MOV	DPTR,	#6000	; For Amber Signal
9075	74	39		MOV	A,	#39	; In All Sides
9077	F0			MOVX	@DPTR,	A	
9078	79	08		MOV	R1,	#08	; Delay Count
907A	12	90	84	LCALL	9084		
907D	22			RET			

For Delay :

Address	OP Code			Mneumonics			Label
907E	79	40		MOV	R1,	#40	; Delay Count For
9080	12	90	84	LCALL	9084		; Green & Red Signals
9083	22			RET			

For Delay Subroutine :

Address	OP Code			Mneumonics			Label
9084	7A	FF		MOV	R2,	#FF	
9086	74	FF		MOV	A,	#FF	
9088	00			NOP			
9089	14			DEC	A		
908A	70	FC		JNZ	9088		
908C	1A			DEC	R2		
908D	EA			MOV	A,	R2	
908E	70	F6		JNZ	9086		
9090	E9			MOV	A,	R1	
9091	60	03		JNZ	9096		
9093	19			DEC	R1		
9094	70	EE		JNZ	9084		
9096	22			RET			

Result :

The Green, Red and Amber lights of Traffic Signals along with pedestrian crossing signal were interfaced with 8051 Micro Controller.

Inference :

The students are able to infer the interfacing modules of micro controller and the assembly language program and also they can know about the signal transfer in the controller.

Application :

The controlling parameters are identified and control in the process of manufacturing industries by interfacing modules of 8051 micro controller.

Speed Control Program :-

Address	OP code			Mneumonics			Label
9000	7480			MOV	A,	#80	
9002	906003			MOV	DPTR,	#6003	
9005	F0			MOVX	@DPTR,	A	; All ports as O/P
9006	7480			MOV	A,	#80	; Give the digital I/P as data
9008	906001			MOV	DPTR,	#6001	
900B	F0			MOVX	@DPTR,	A	
900C	1200BB			LCALL	00BB		

Ex No : 10 ***Date :***

Speed Control of DC Motor Interfacing with 8051 Micro Controller

Aim :

To control the speed of the DC Motor by interfacing with 8051 Micro Controller.

Apparatus Required :

1. 8051 Micro Controller
2. Speed Control of DC motor interface Module

Working Procedure :

1. Connect the 5V Supply to the Trainer Kit and DAC Chord.
2. Connect a " -12V & +12V " to the DAC & Motor Card in addition.
3. Connect the 26-pin connector from the Chord to Kit.
4. Switch on the power supply.
5. Assemble the program.
6. Give the digital data in the software program itself.
7. Execute it and view the output through control by DC motor.
8. For different values of the digital data you will get different speed in the motor.
9. Switch off the power supply and remove the connectors.

Result :

The speed of DC motor is controlled by 8051 microcontroller and its interfacing hardware circuits.

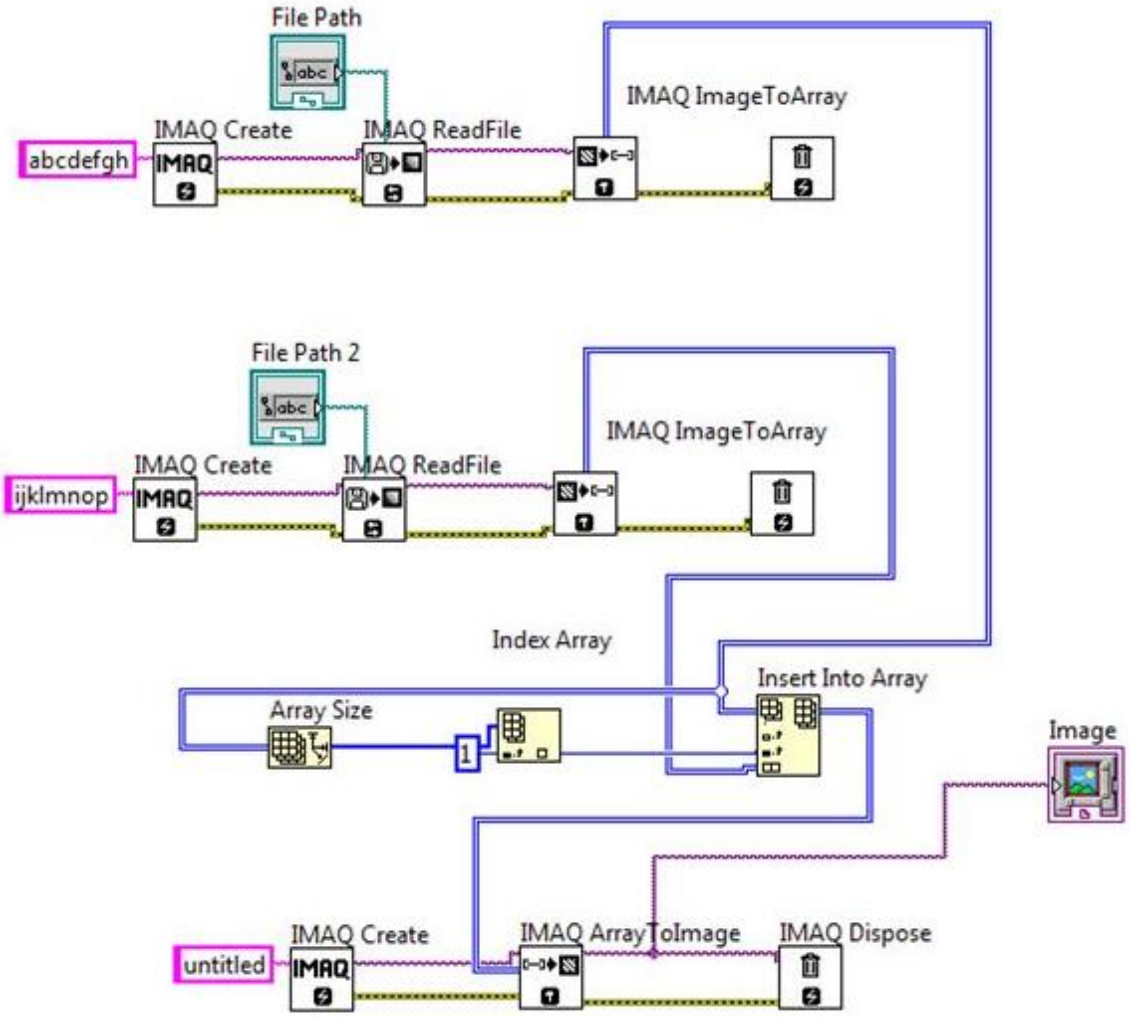
Inference :

The students are able to interface the DC motor with micro controller and also control the rotational speed of the DC motor.

Application :

The rotary mechanism in the machinery is to be controlled by interfacing modules by sensing the actual speed of the motor and varying the input voltage.

Image Concatenation :



Ex No : 11 ***Date :***

Study of Image Processing Technique using Lab VIEW

Aim :

To analyze the image using image processing technique by using Lab VIEW software.

Apparatus Required :

1. Lab VIEW software in PC
2. CCD camera
3. Interfacing module

Procedure :

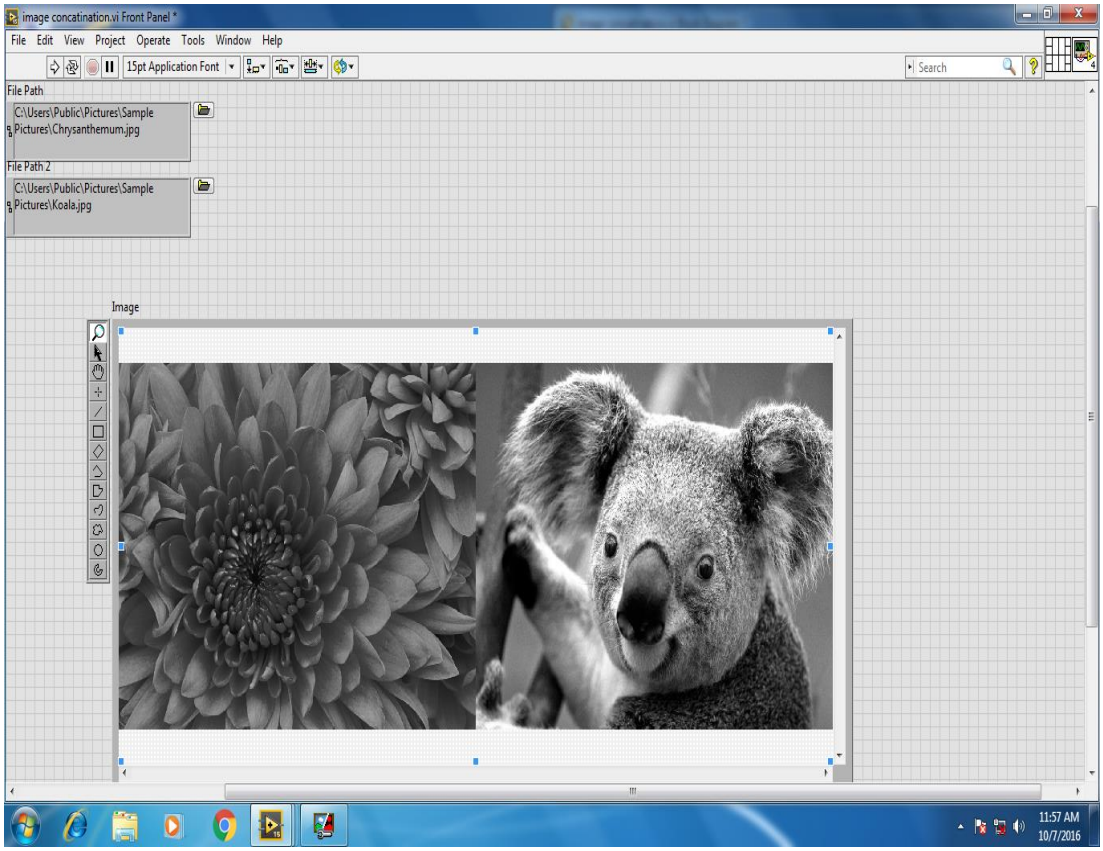
1. Open the Lab VIEW new VI front panel and block diagram.
2. Select the “Imaq” create for allocating storage for target image.
3. Select “Imaq” read file to read the image. Convert it to array using image to array icon.
4. Create file path to select the target images.
5. Select reverse 1d array and transport 2d array functions for mirroring
6. Select insert into array for concatenating images.
7. IMAQ dispose to clear the memory, after the execution of program.

Before Concatinations of Images :

IMAGE 1

IMAGE 2

AFTER CONCATINATIONS OF IMAGES :



Result :

The image processing technique is used to concatenate and to mirror the targeted images.

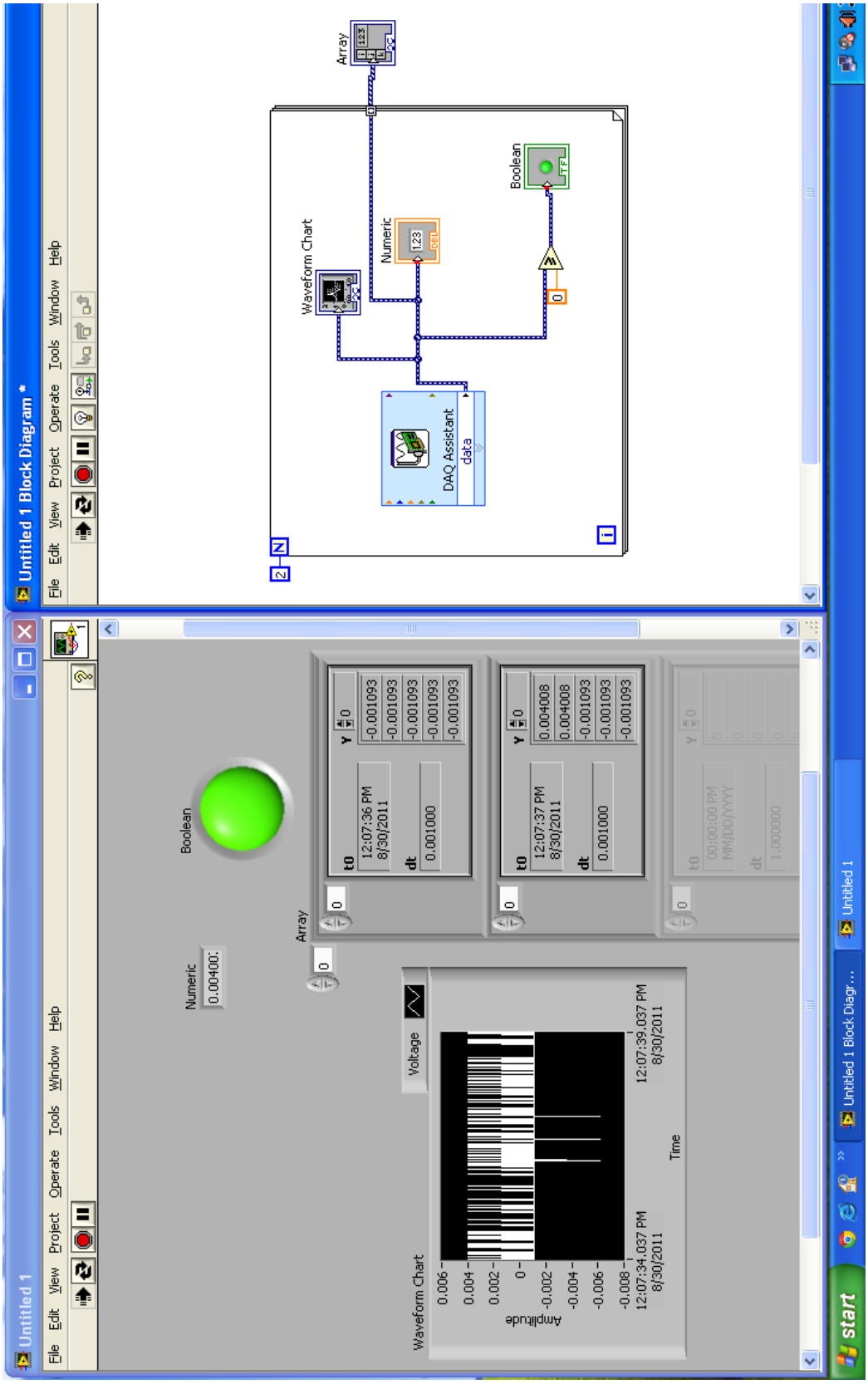
Interference :

The students are inferred the image processing concepts such as image concatenating and image mirroring techniques.

Applications :

To determine the defective product by using the online quality inspection systems.

Logical Codes :-



Ex No : 12 ***Date :***

Computerized Temperature Data Logging System using USB DAQCARD (NI USB 6008)

Aim :

To acquire the temperature data by USB DAQ Card and create a warning indicator, when the actual temperature exceeds the set point temperature.

Software Required :

1. Lab VIEW software

Components Required :

1. USB DAQ CARD (NI USB 6008)
2. USB cable
3. Connectors
4. Power supply kits.
5. Screw driver

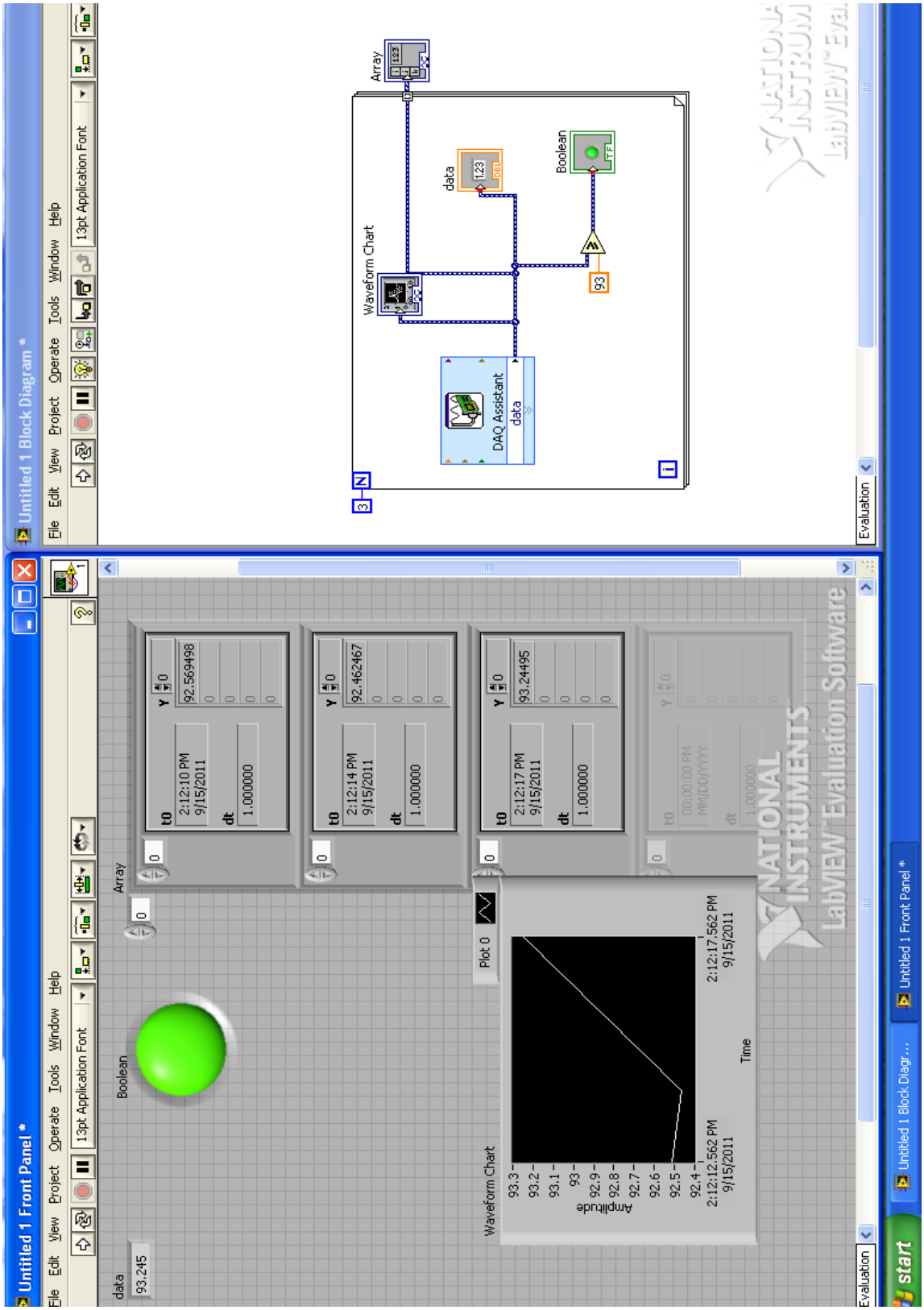
Procedure :

1. Open the blank VI in LabVIEW software.
2. Connect the USB cable in the USB DAQCARD (NI USB 6008); the other end of the cable is connected to computer.
3. Open the **Measurement & Automation Explorer** in the desktop of the computer.
4. Confirm the compact DAQ card operation by conducting the self-test in the Measurement & Automation Explorer.
5. Connect the thermo couple to the NI USB 6008DAQ card by connectors.
6. Develop a program, for creating a warning system in the front panel of the LabVIEW software.
7. Execute the program by clicking the run button.
8. If the acquired temperature by DAQ card exceeds the set point temperature is indicated by a blinking red LED in the font panel of LabVIEW software.

Result :

Thus, the temperature data acquired by NI USB 6008 DAQ card and it is found that, the temperature exceeds the set point temperature by using Lab-VIEW Software.

Logical Codes :-



Ex No : 13 ***Date :***

Computerized Temperature Data Logging System using Compact DAQCARD (NI 9211)

Aim :

To acquire the temperature data by Compact DAQ card and create a warning indicator, when the actual temperature exceeds the set point temperature.

Software Required :

1. Lab VIEW software

Components Required :

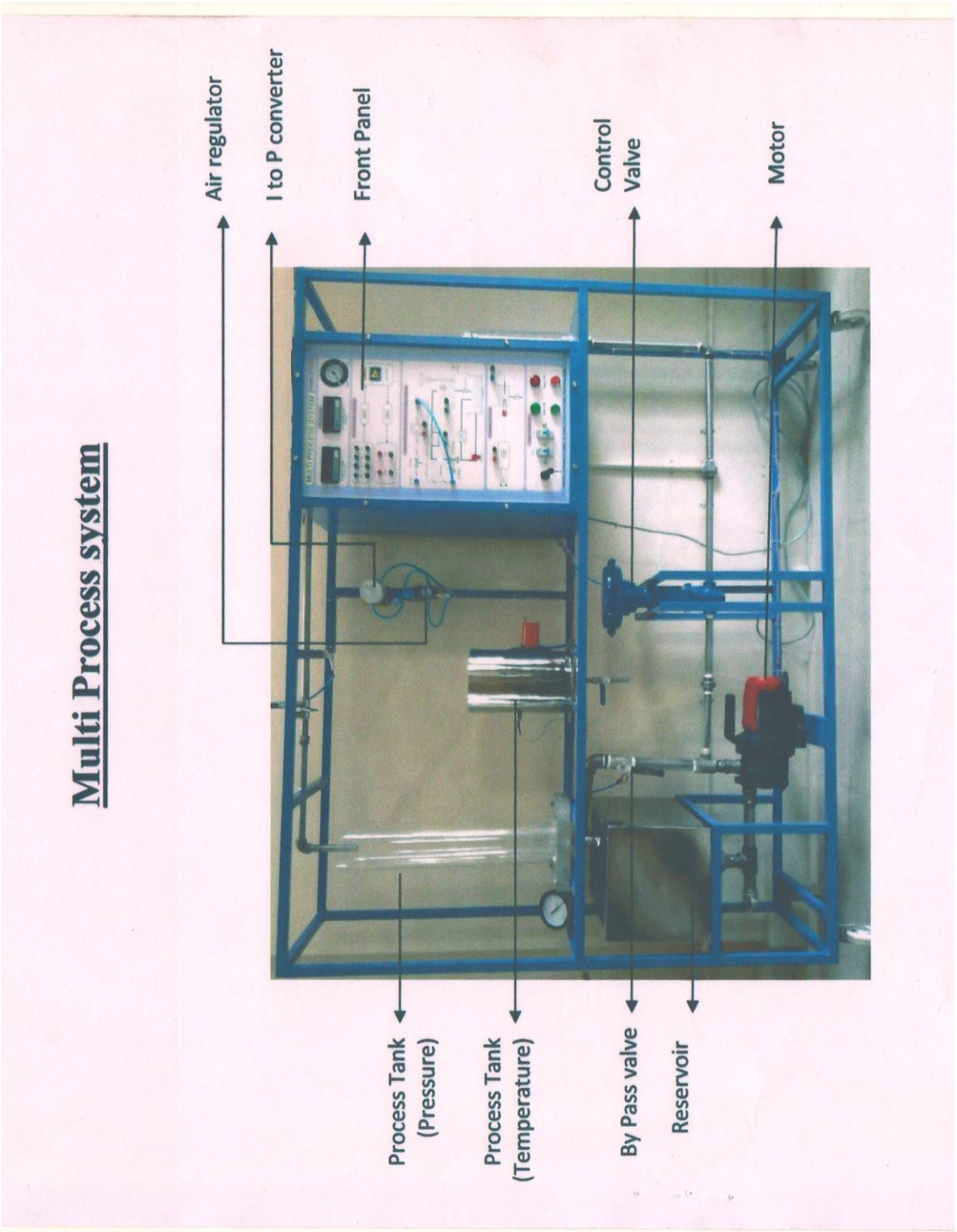
1. NI DAQ card (NI 9211)
2. USB cable
3. Connectors
4. Power supply kits.
5. Screw driver

Procedure :

1. Open the blank VI in LabVIEW software.
2. Connect the USB cable in the NI compact DAQ card (NI 9211). The other end of the cable is connected to computer.
3. Open the **Measurement & Automation Explorer** in the desktop of the computer.
4. Confirm the compact DAQ card operation by conducting the self-test in the Measurement & Automation Explorer.
5. Connect the thermo couple to the NI 9211 DAQ card by connectors.
6. Develop a program, for creating a warning system in the front panel of the LabVIEW software.
7. Execute the program by clicking the run button.
8. If the acquired temperature by DAQ card exceeds the set point temperature is indicated by a blinking red LED in the font panel of LabVIEW software.

Result :-

Thus, the temperature data acquired by NI 9211 compact DAQ card and it is found that, the temperature exceeds the set point temperature by using Lab-VIEW Software.


Multi Process system
Air regulator
I to P converter
Front Panel
Control Valve
Motor
Process Tank (Pressure)
Process Tank (Temperature)
By Pass valve
Reservoir

Ex No : 14 *Date :*

Study of Process Control Trainer for controlling pressure of the liquid

Aim:

To Study the pressure process system using LabView software. (Closed loop)

Apparatus:

3. Multi process system (Make: prime tech)
4. Patching cords

Purpose

The PrimeTech pressure Process Trainer is designed to provide complete instruction on the measurement and control of pressure process using LabView. The trainer consists of a mobile Frame mounted panel. The panel contains a single flow loop along with all necessary measurement, indicating and control instrumentation.

The Process

The process loop shall consist of a pump, reservoir, and pressure vessel (process tank), along with associated S.S.304 piping and valves. Water is pumped from the reservoir into the pressure vessel. The pressure within the vessel is therefore dependent on the on the open or closed position of hand (drain) valves that permit flowing water to bypass the pressure vessel.

The Instrumentation

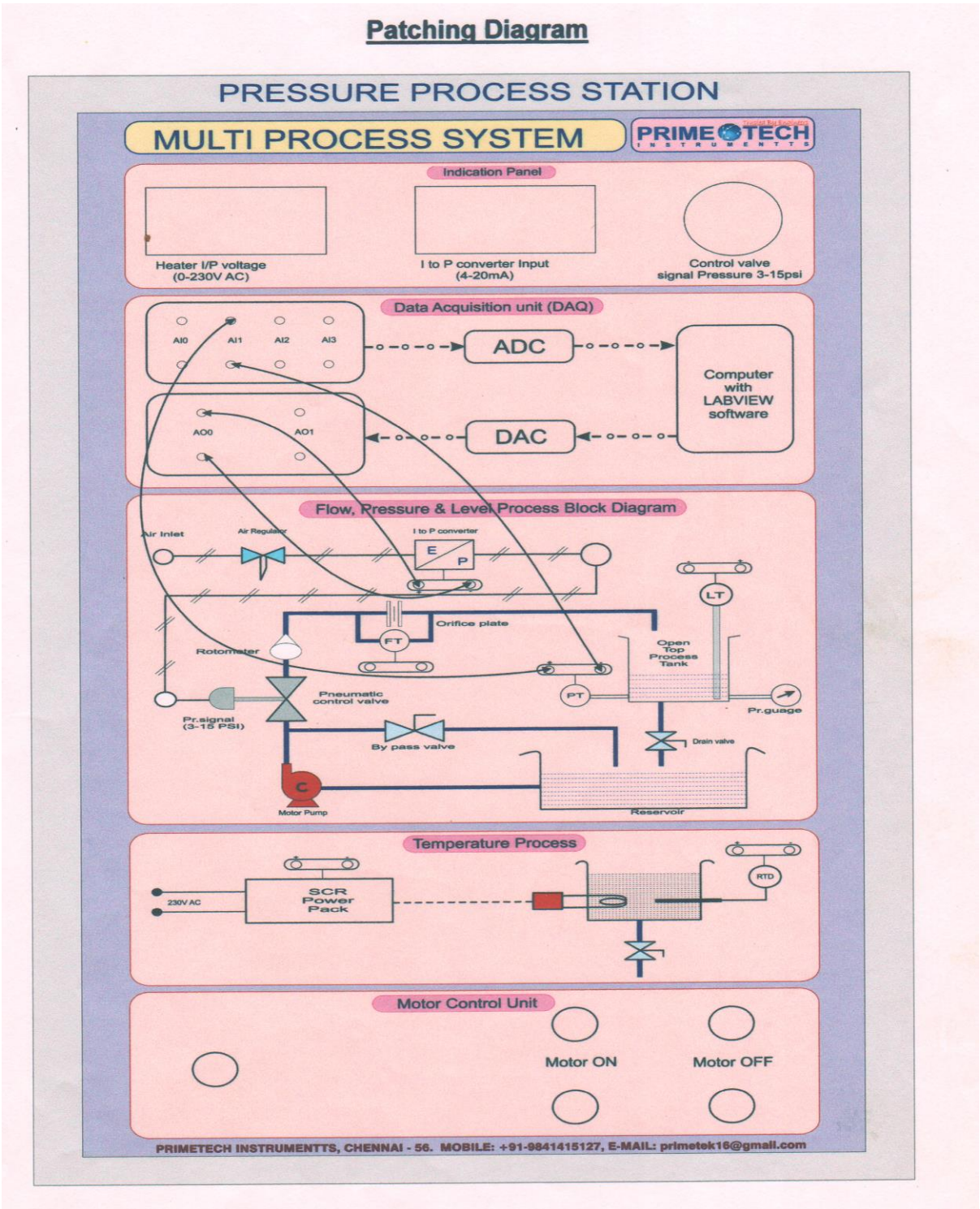
Water pressure is measured by a pressure transmitter, which outputs a 4-20 mA signal proportional to water pressure. This signal is fed to a Linear extractor, which outputs a 4-20 mA signal directly proportional to water pressure.

The controller has the ability to output a 4-20 mA signal, which is transduced to a 3-15 psi pneumatic signal to position the control valve. The controller responds to changes in set point and to process upset caused manually by the student.

Procedure:

1. Fill the Water in reservoir tank fully.
2. Insert the air pressure line in corresponding port in front panel (0-2 Kg/cm2)
3. Patch the As per patching diagram
4. Connect a trainer kit to AC source 230VAC
5. Switch on Mains MCB only,
6. Open Drain valve partially, depends pressure need (Acrylic tank drain valve)
7. Open the By-Pass valve partially before run the motor.
8. Connect the Data cable to computer.
9. Open the labview pressure process program and enter the set value (set pressure), give some PI value (gradually increased).

Patching Diagram



10. Now execute the Program
11. Now can observe pressure process and wave form.

Result :-

Thus the closed loop pressure process system was studied and executed.

Ex No : 15 *Date :*

Study of Process Control Trainer for controlling flow rate of the liquid

Aim:

To Study the Flow process system using LabView software. (Closed loop)

Apparatus:

1. Multi process system (Make: prime tech)
2. Patching cords

Purpose

The PrimeTech Flow Process Trainer is designed to provide complete instruction on the measurement and control of flow process using LabView. The trainer consists of a mobile Frame mounted panel. The panel contains a single flow loop along with all necessary measurement, indicating and control instrumentation.

The Process

The Flow process loop consists of a pump, reservoir and a pneumatic control valve, along with associated S.S. 304 piping and valves. Water is pumped from the reservoir, through the piping back to the reservoir. Therefore, the rate of water flow is dependent on the position of the control valve and on the position of a hand operated valve.

The Instrumentation

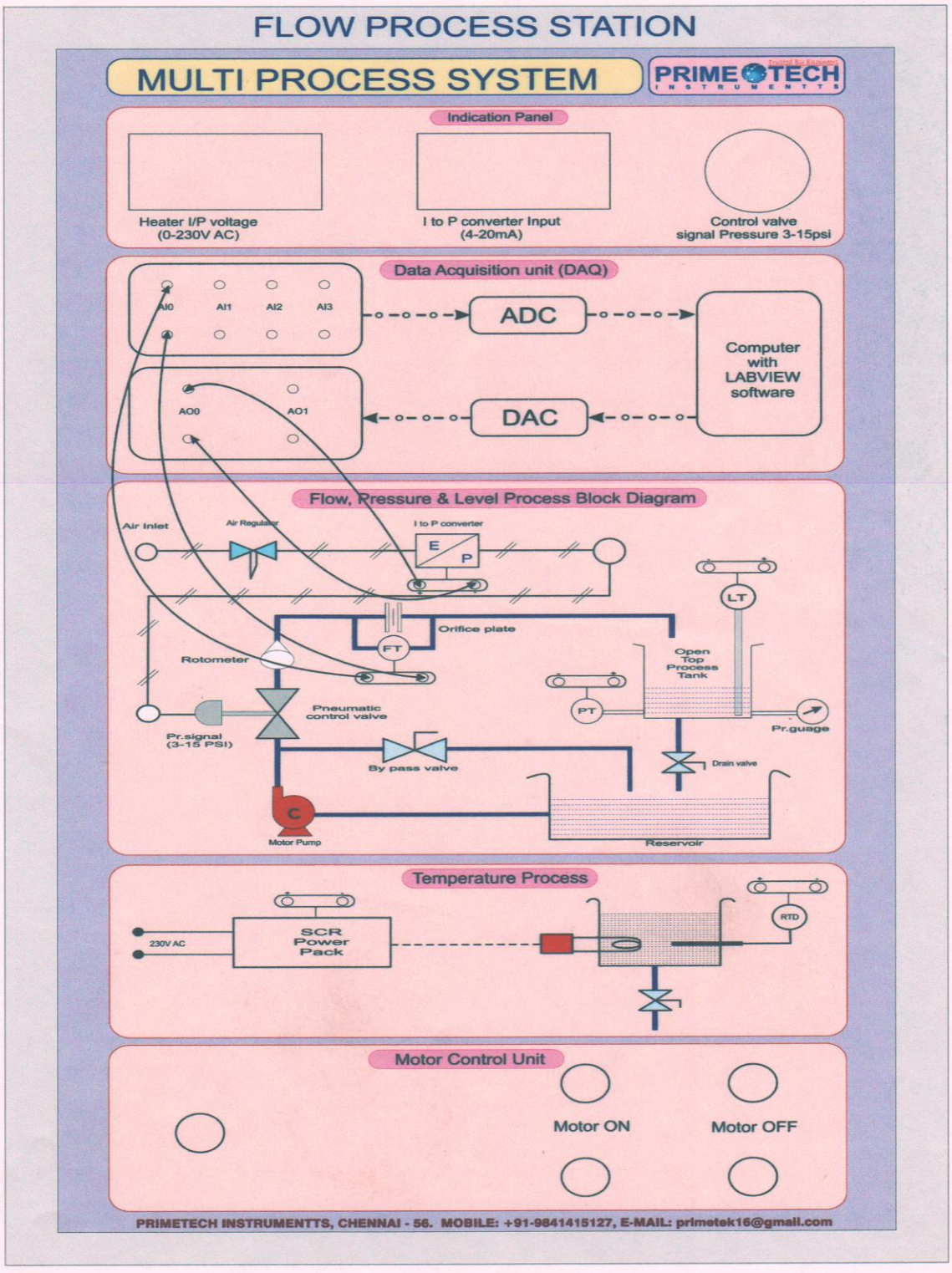
Water flow rate is measured by a differential pressure orifice meter, which outputs a 4-20 mA signal proportional to differential pressure. This signal is fed to a Linear extractor, which outputs a 4-20 mA signal directly proportional to flow.

The controller has the ability to output a 4-20 mA signal, which is transduced to a 3-15 psi pneumatic signal to position the control valve. The controller responds to changes in set point and to process upset caused manually by the student.

Procedure:

1. Fill the Water in reservoir tank fully.
2. Insert the air pressure line in corresponding port in front panel (0-2 Kg/cm2)
3. Patch the As per patching diagram
4. Connect a trainer kit to AC source 230VAC
5. Switch on Mains MCB only,
6. Open Drain valve fully (Acrylic tank drain valve)
7. Open the By-Pass valve partially before run the motor.
8. Connect the Data cable to computer.
9. Open the labview flow process program and enter the set value (set flow), give some PI value (gradually increased).

Patching Diagram



10. Now execute the Program
11. Now can observe flow process and wave form.

Result :-

Thus the closed loop flow process system was studied and executed.

PROGRAM OUTCOMES (POs)

Mechanical Engineering Graduates will be able to

1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

K.L.N. COLLEGE OF ENGINEERING

VISION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the Society.

MISSION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

Principal **Secretary &Correspondent** **President**