GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electrical & Electronics Engineering

Course Title: PROGRAMMABLE LOGIC CONTROLLERS

Following documents are available in Course File.

S.No.	Points	Yes	No
1	Institute and Department Vision and Mission Statements	**Y**	
2	PEO & PO Mapping	**Y**	
3	Academic Calendar	**Y**	
4	Subject Allocation Sheet	**Y**	
5	Class Time Table, Individual Timetable (Single Sheet)	**Y**	
6	Syllabus Copy	**Y**	
7	Course Handout	**Y**	
8	CO-PO Mapping	**Y**	
9	CO-Cognitive Level Mapping	**Y**	
10	Lecture Notes	**Y**	
11	Tutorial Sheets With Solution	**Y**	
12	Soft Copy of Notes/PPT/Slides	**Y**	
13	Sessional Question Paper and Scheme of Evaluation	**Y**	
14	Best, Average and Weak Answer Scripts for Each Sessional Exam. (Photocopies)	**Y**	
15	Assignment Questions and Solutions	**Y**	
16	Previous University Question Papers	**Y**	
17	Result Analysis	**Y**	
18	Feedback From Students	**Y**	
19	Course Exit Survey		**N**
20	CO Attainment for All Mids.	**Y**	
21	Remedial Action.		**N**

Course Instructor / Course Coordinator

(Name)

Course Instructor / Course Coordinator

(Signature)

Vision of the Institute

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Mission of the Institute

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Vision of the Department

To impart technical knowledge and skills required to succeed in life, career and help society to achieve self-sufficiency.

Mission of the Department

- To become an internationally leading department for higher learning.
- To build upon the culture and values of universal science and contemporary education.
- To be a center of research and education generating knowledge and technologies which lay groundwork in shaping the future in the fields of electrical and electronics engineering.
- To develop partnership with industrial, R&D and government agencies and actively participate in conferences, technical and community activities.

Program Educational Objectives (B.Tech-EEE)

This programme is meant to prepare our students to professionally thrive and to lead. During their progression:

PEO 1: Graduates will have a successful technical or professional careers, including supportive and leadership roles on multidisciplinary teams.

PEO 2: Graduates will be able to acquire, use and develop skills as required for effective professional practices.

PEO 3: Graduates will be able to attain holistic education that is an essential prerequisite for being a responsible member of society.

PEO 4: Graduates will be engaged in life-long learning, to remain abreast in their profession and be leaders in our technologically vibrant society.

Program Outcomes (B.Tech-EEE)

a. Ability to apply knowledge of mathematics, science, and engineering.
b. Ability to design and conduct experiments, as well as to analyze and interpret data.
c. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. Ability to function on multi-disciplinary teams.
e. Ability to identify, formulates, and solves engineering problems.
f. Understanding of professional and ethical responsibility.
g. Ability to communicate effectively.
h. Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i. Recognition of the need for, and an ability to engage in life-long learning.
j. Knowledge of contemporary issues.
k. Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.
l. Graduates will demonstrate an ability to design electrical and electronic circuits, power electronics, power systems; electrical machines analyze and interpret data and also an ability to design digital and analog systems and programming them.

PROGRAMMABLE LOGIC CONTROLLERS

Course Code: GR15A4030

COURSE EDUCATIONAL OBJECTIVES

The knowledge gained by the students in this course:

1. To provide students with hands on different PLCs and their usage in control of drives.
2. To familiarize students with programming in PLCs.
3. To implement ladder diagrams for practical applications.
4. To analyze analog PLC operations.
5. To learn interfacing PLC with other technologies like SCADA, HMI, etc.
6. To develop different applications in PLC in control systems.
7. To learn different modes of PLC programming.

COURSE OUTCOMES

At the end of the course student will have ability to:

1. Perform different types of PLC programming schemes.
2. Ability to implement ladder diagrams for process control.
3. To control the robots using PLC.
4. Ability to tune the PLC for different applications.
5. Relate PLCs with drives in achieving required control.
6. Extend knowledge of PLC in analog operations.
7. Interface PLC with other technologies like SCADA, HMI, etc.

ASSESSMENT METHODS

1. Regular attendance to classes.
2. Written tests clearly linked to learning objectives
3. Classroom assessment techniques like tutorial sheets and assignments.
4. Seminars.

Program Educational Objectives (PEOs)-Program Outcomes (POs) Relationship Matrix

(Indicate the relationships by mark "X")

P-Outcomes / PEOs	a	b	c	d	e	f	g	h	i	j	k	l
1	X	X	X	X	X			X	X	X	X	X
2	X	X	X	X	X			X	X	X	X	X
3		X	X	X		X	X	X	X	X		
4				X					X	X		X

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090, India.

GRIET/DAA/1H/G/18-19 05 May 2018

ACADEMIC CALENDAR
Academic Year 2018-19

III & IV B.TECH – FIRST SEMESTER

S. No.	EVENT	PERIOD	DURATION
1	1st Spell of Instructions	02-07-2018 to 01-09-2018	9 Weeks
2	1st Mid-term Examinations	03-09-2018 to 05-09-2018	3 Days
3	2nd Spell of Instructions	06-09-2018 to 24-10-2018	7 Weeks
4	2nd Mid-term Examinations	25-10-2018 to 27-10-2018	3 Days
5	Preparation	29-10-2018 to 06-11-2018	1 Week 3 Days
6	**End Semester Examinations (Theory/ Practicals) Regular/Supplementary**	**08-11-2018 to 08-12-2018**	**4 Weeks 3 Days**
7	Commencement of Second Semester, A.Y 2018-19	10-12-2018	

III & IV B.TECH – SECOND SEMESTER

S. No.	EVENT	PERIOD	DURATION
1	1st Spell of Instruction	10-12-2018 to 02-02-2019	8 Weeks
2	1st Mid-term Examinations	04-02-2019 to 06-02-2019	3 Days
3	2nd Spell of Instruction	07-02-2019 to 06-04-2019	**8 Weeks 3 Days**
4	2nd Mid-term Examinations	08-04-2019 to 10-04-2019	3 Days
5	Preparation	11-04-2019 to 17-04-2019	1 Week
6	**End Semester Examinations (Theory/ Practicals) Regular**	18-04-2019 to 08-05-2019	3 Weeks
7	**Supplementary and Summer Vacation**	**09-05-2019 to 22-06-2019**	**6 Weeks 3 Days**
8	Commencement of First Semester, A.Y 2019-20	24-06-2019	

Copy to Director, Principal, Vice Principal, DOA, DOE, Balaji Kumar, DCGC, All HODs

(Dr. K. Anuradha)
Dean of Academic Affairs

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

2018-19 II-Sem Subject Allocation sheet

GRIET/EEE/05B/G/18-19 **30.10.18**

II YEAR(GR17)	Section-A	Section-B
Managerial Economics and Financial Analysis		
Power Generation and Distrubution	SN	SN
AC Machines	VVSM	VVSM
Control Systems	Dr DGP	MS
Princeples of Digital Electronics	PRK	PRK
AC Machines Lab	PPK/DSR	PPK/DSR
Control Systems Lab	MS/PSVD	MS/PSVD
Analog and Digital Electronics Lab	RAK/DKK	RAK/DKK
Value Education and Ethics		
Gender Sensitization Lab	MS/PSVD	MS/PSVD
III YEAR (GR15)		
Computer Methods in Power systems	VVRR/MP	VVRR/MP
Switch Gear & Protection	PSVD	Dr JSD
Management Science		
Utilization of Electrical Energy	MRE	MRE
Non Conventional Sources of Energy		
Neural and Fuzzy Systems		
Sensors & Transducers	UVL	UVL
Power Systems Lab	GSR/YSV	GSR/YSV
Advanced English Communications Skills Lab		
Industry Oriented Mini Project Lab	PPK/AVK/Dr JP	MP/Dr JP
IV YEAR (GR15)		
Programmable Logic Controllers	PK	
Flexible AC Transmission Systems	Dr TSK	
EHV AC Transmission		
Power System Automation		
Modern Power Electronics	AVK	
DSP Based Electromechanical Systems		
Advanced Control Systems		
Programmable Logic Controllers-Lab	VVSM	PK
Main Projects	RAK/Dr SVJK	PK/VVRR
M.Tech PE		
Modeling and Analysis of Electrical Machines	Dr BPB	

Digital control of power Electronics and Drive Systems	Dr DGP	
FACTS and Custom power Devices	Dr TSK	
Smart Grids	VVRR	
Audit Course -2		
Power Quality Lab	Dr BPB	
Digital Signal Processing Lab	AVK	
MINI Projects	Dr JP/GSR	
M.Tech PS		
Digital Protection of Power System	Dr JSD	
Power System Dynamics -II	Dr SVJK	
FACTS and Custom power Devices	Dr TSK	
Smart Grids	VVRR	
Audit Course -2		
Power Quality Lab	Dr BPB	
Power System Protection Lab	VUR	
MINI Projects	Dr JP/GSR	
Other Dept.		
BEE (I YEAR) CSE (6)	MNSR,MK,MVK,	
BEE Lab	MNSR,MK,MVK,YSV,VUR,PS,UVL,MRE,GBR	
EET (II YEAR) Mech (2)	KS	KS
EET LAB (II TEAR) Mech (2)	KS,DKK,PPK,	

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

GRIET/PRIN/06/G/01/18-19
B.Tech - EEE - A

wef: 10 Dec 2018
IV Year - II Semester

Day/Hour	10:00-10:50	10:50-11:40	11:40-12:30	12:30-1:00	1:00-1:30	1:30-2:20	2:20-3:10	3:10-4:00
MONDAY	PLC Lab				BREAK	FACTS		PLC
TUESDAY	FACTS		MPE			FACTS		PLC
WEDNESDAY	MPE		PLC			PROJECTS		
THURSDAY	PROJECTS					PROJECTS		
FRIDAY	PLC		MPE			PROJECTS		
SATURDAY	PROJECTS					PROJECTS		

Room No.	
Theory	4502
Lab	4510 / 4513

Class Incharge:	P Praveen Kumar

Subject Code	Subject Name	Faculty Code	Faculty name
GR15A4030	Programmable Logic Controllers	PK	P Prashanth Kumar
GR15A4032	Flexible AC Transmission Systems	Dr TSK	Dr T Suresh Kumar
GR15A4036	Modern Power Electronics	AVK	A Vinay Kumar
GR15A4038	Programmable Logic Controllers-Lab	VVSM	VVS Madhuri
GR15A4144	Main Projects	RAK/Dr SVJK	R Anil Kumar/ Dr S V Jayaram Kumar

Almanac	
1st Spell of Instructions	10-12-2018 to 06-02-2019
UMAR	07-02-2019 to 09-02-2019
2nd Spell of Instructions	11-02-2019 to 03-04-2019
2nd Mid-term Examinations	04-04-2019 to 06-04-2019
Preparation	08-04-2019 to 17-04-2019
End Semester Examinations (Theory/ Practicals) Regular	18-04-2019 to 08-05-2019
Supplementary and Summer Vacation	09-05-2019-to 22-06-2019
Commencement of Second Semester , AY	24-06-19

HOD

Co-ordinator

DAA

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

GRIET/PRIN/06/G/01/18-19

wef: 10 Dec 2018

B.Tech - EEE - B

IV Year - II Semester

Day/Hour	10:00-10:50	10:50-11:40	11:40-12:30	12:30-1:00	1:00-1:30	1:30-2:20	2:20-3:10	3:10-4:00
MONDAY	PROJECTS				BREAK	FACTS		PLC
TUESDAY	FACTS		MPE			FACTS		PLC
WEDNESDAY	MPE		PLC			PROJECTS		
THURSDAY	PLC Lab					PROJECTS		
FRIDAY	PLC		MPE			PROJECTS		
SATURDAY	PROJECTS					PROJECTS		

Room No.	
Theory	4502
Lab	4510 / 4513

Class Incharge:	P Praveen Kumar

Subject Code	Subject Name	Faculty Code	Faculty name
GR15A4030	Programmable Logic Controllers	PK	P Prashanth Kumar
GR15A4032	Flexible AC Transmission Systems	Dr T S K	Dr T Suresh Kumar
GR15A4036	Modern Power Electronics	AVK	A Vinay Kumar
GR15A4038	Programmable Logic Controllers-Lab	PK	P Prashanth Kumar
GR15A4144	Main Projects	PK/VVRR	P Prashanth Kumar/ V Vijaya Rama Raju

Almanac	
1st Spell of Instructions	10-12-2018 to 06-02-2019
1st Mid-term Examinations	07-02-2019 to 09-02-2019
2nd Spell of Instructions	11-02-2019 to 03-04-2019
2nd Mid-term Examinations	04-04-2019 to 06-04-2019
Preparation	08-04-2019 to 17-04-2019
End Semester Examinations (Theory/ Practicals) Regular	18-04-2019 to 08-05-2019
Supplementary and Summer Vacation	09-05-2019-to 22-06-2019
Commencement of Second Semester , AY	24-06-19

HOD

Co-ordinator

DAA

PROGRAMMABLE LOGIC CONTROLLERS

Course Code: GR15A4030 IV Year II SEM L: 2 T: 1 P: 0 C: 3

UNIT-I:
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/0 modules.

UNIT II:
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils, Drill press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III:
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers PLC Functions Timer functions and industrial applications counters counter function industrial applications. Architecture functions, Number comparison functions, number conversion functions.

UNIT IV:
Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

UNIT V:
Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples. PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS:

1. Programmable Logic Controllers — Principle and Applications by John W Webb and Ronald A Reiss Filth edition, PHI

2. Programmable Logic Controllers — Programming Method and Applications by JR Hackworth and ED Hackworth — Jr- Pearson, 2004.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

COURSE OBJECTIVES

Academic **Y**ear : **2018-2019**

Semester : **II**

Name of the Program: **B.Tech** …**EEE**… Year: ……**IV**…….. Section: **A, B**.

Course: **PROGRAMMABLE LOGIC CONTROLLERS** Course Code: **GR15A4030**

Name of the Faculty: **PRASANTH KUMAR P** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.No	Course Objectives
1	To provide students with hands on different PLCs and their usage in control of drives.
2	To familiarize students with programming in PLCs.
3	To implement ladder diagrams for practical applications.
4	To analyze analog PLC operations.
5	To learn interfacing PLC with other technologies like SCADA, HMI, etc.
6	To develop different applications in PLC in control systems.
7	To learn different modes of PLC programming.

Signature of HOD Signature of faculty

Date: Date:

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

COURSE OUTCOMES

Academic **Y**ear : **2018-2019**

Semester : **II**

Name of the Program: **B.Tech** …**EEE**… Year: ……**IV**…….. Section: **A, B**.

Course: **PROGRAMMABLE LOGIC CONTROLLERS** Course Code: **GR15A4030**

Name of the Faculty: **PRASANTH KUMAR P** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.No	Course Outcomes
1	Perform different types of PLC programming schemes.
2	Ability to implement ladder diagrams for process control.
3	To control the robots using PLC.
4	Ability to tune the PLC for different applications.
5	Relate PLCs with drives in achieving required control.
6	Extend knowledge of PLC in analog operations.
7	Interface PLC with other technologies like SCADA, HMI, etc.

Signature of HOD Signature of faculty

Date: Date:

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

GUIDELINES TO STUDY THE COURSE/SUBJECT

Academic **Y**ear : **2018-2019**

Semester : **I**

Name of the Program: **B.Tech** …**EEE**… Year: ……**IV**…….. Section: **A, B**.

Course: **PROGRAMMABLE LOGIC CONTROLLERS** Course Code: **GR15A4030**

Name of the Faculty: **PRASANTH KUMAR P** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

Guidelines to study the Course/ Subject: **PROGRAMMABLE LOGIC CONTROLLERS**

Course Design and Delivery System (CDD):

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, seminars, presentations.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, reference books.

The faculty be able to –

- Understand the principles of Learning
- Develop instructional objectives for a given topic
- Prepare course, unit and lesson plans
- Use appropriate teaching and learning aids like Slides and Paper Presentation.
- Plan and deliver lectures effectively.
- Provide the students of availability of the content in the textbooks and Internet.
- Provide feedback to students using various methods of Assessments and tools of Evaluation
- Act as a guide, advisor, counselor, facilitator, and motivator and not just as a teacher alone.

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090, A.P., India. (040) 6686 4440

ILLUSTRATIVE VERBS FOR STATING INSTRUCTIONAL OBJECTIVES

These verbs can also be used while framing questions for Continuous Assessment Examinations as well as for End – Semester (final) Examinations

ILLUSTRATIVE VERBS FOR STATING GENERAL OBJECTIVES/OUTCOMES

Know **Comprehend**	**Understand** **Apply**	**Analyze** **Design**	**Generate** **Evaluate**

ILLUSTRATIVE VERBS FOR STATING SPECIFIC OBJECTIVES/OUTCOMES:

A. COGNITIVE DOMAIN (KNOWLEDGE)

1	2	3	4	5	6
Knowledge	**Comprehension Understanding**	**Application of knowledge & comprehension**	**Analysis Of whole w.r.t. its constituents**	**Synthesis**	**Evaluation** **Judgment**
Define	**Convert**	**Program**	**Differentiate**	**Design**	**Appraise**
Identify	**Describe (a**	**Deduce**	**Distinguish**	**Generate**	**Compare**
Label	**Procedure)**	**Modify**	**Separate**	**Reconstruct**	**Conclude**
List	**Distinguish**	**Predict**		**Revise**	**Contrast**
Select	**Estimate**	**Prepare**			**Criticize**
State	**Explain why/how**	**Relate**			**Justify**
	Generalize	**Show**			**Interpret**
	Give examples	**Solve**			**Support**
	Illustrate				
	Summarize				

B. AFFECTIVE DOMAIN (ATTITUDE)		C. PSYCHOMOTOR DOMAIN (SKILLS)				
Adhere	**Resolve**	**Bend**	**Dissect**	**Insert**	**Perform**	**Straighten**
Assist	**Select**	**Calibrate**	**Draw**	**Keep**	**Prepare**	**Strengthen**
Attend	**Serve**	**Compress**	**Extend**	**Elongate**	**Remove**	**Time**
Change	**Share**	**Conduct**	**Feed**	**Limit**	**Replace**	**Transfer**
Develop		**Connect**	**File**	**Manipulate**	**Report**	**Type**
Help		**Convert**	**Grow**	**Reset**	**Weigh**	
Influence		**Decrease**	**Increase**	**Paint**	**Set**	

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

COURSE SCHEDULE

Academic **Y**ear : **2018-2019**

Semester : **II**

Name of the Program: **B.Tech** …**EEE**… Year: ……**IV**…….. Section: **A, B**.

Course: **PROGRAMMABLE LOGIC CONTROLLERS** Course Code: **GR15A4030**

Name of the Faculty: **PRASANTH KUMAR P** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

The Schedule for the whole Course / Subject is:

S. No.	Description	Duration (Dates)		Total number of Periods
		From	To	
1	Unit-I: PLC Basics			16
2	Unit-II: PLC Programming Instructions			28
3	Unit-III: PLC Registers			18
4	Unit-IV: Data Handling Instructions			26
5	Unit-V: Analog PLC Operations			16

Total No. of Instructional periods available for the course: ……104……. Periods

Signature of HOD

Signature of faculty

Date:

Date:

COURSE PLAN

Academic **Y**ear : **2018-2019**

Semester : **II**

Name of the Program: **B.Tech** …**EEE**… Year: ……**IV**…….. Section: **A, B**.

Course: **PROGRAMMABLE LOGIC CONTROLLERS** Course Code: **GR15A4030**

Name of the Faculty: **PRASANTH KUMAR P** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

The Schedule for the whole Course / Subject is:

S.No	Unit	Date	Topics
1	I	10-12-2018	PLC Basics, PLC system
2	I	11-12-2018	Block diagram of PLC
3	I	12-12-2018	I/O modules and interfacing CPU processor
4	I	14-12-2018	Programming equipment programming formats
5	I	17-12-2018	Construction of PLC ladder diagrams
6	I	18-12-2018	Construction of PLC ladder diagrams
7	I	19-12-2018	Devices connected to I/0 modules
8	I	21-12-2018	Devices connected to I/0 modules
9	I	24-12-2018	Review of Unit-I
10	II	26-12-2018	PLC Programming input instructions, outputs, operational procedures
11	II	28-12-2018	PLC Programming input instructions, outputs, operational procedures
12	II	31-12-2018	Programming examples using contacts and coils.
13	II	02-01-2019	Drill press operation
14	II	04-01-2019	Digital logic gates in ladder logic
15	II	07-01-2019	Programming of logic gates in the Boolean algebra system
16	II	08-01-2019	Conversion Examples
17	II	09-01-2019	Conversion Examples
18	II	11-01-2019	Ladder diagrams for process control
19	II	16-01-2019	Ladder diagrams and sequence listings
20	II	18-01-2018	Examples of Ladder logic
21	II	21-01-2019	Sequence listing examples
22	II	22-01-2019	Ladder diagram construction of Spray Process system.
23	II	23-01-2019	Flow chart for spray process system.
24	II	25-01-2019	Review of Unit-II
25	III	28-01-2019	Characteristics of Registers
26	III	29-01-2019	Module addressing holding registers.
27	III	30-01-2019	Input registers,Output Registers

28	III	01-02-2019	PLC Functions Timer functions
29	III	05-02-2019	MID EXAM-1
30	III	06-02-2019	MID EXAM-1
31	III	08-02-2019	Industrial applications of Timers
32	III	11-02-2019	Counters counter function industrial applications
33	III	13-02-2019	Arithmetic functions
34	III	15-02-2019	Number comparison functions
35	III	18-02-2019	Number conversion functions.
36	III	19-02-2019	Review of Unit-III
37	IV	20-02-2019	Data Handling functions
38	IV	22-02-2019	SKIP, Master control Relay
39	IV	25-02-2019	JUMP, MOVE, FIFO
40	IV	26-02-2019	JUMP, MOVE, FIFO
41	IV	29-02-2019	JUMP, MOVE, FIFO
42	IV	01-03-2019	FAL, ONS, CLR
43	IV	05-03-2019	Sweep functions and their applications
44	IV	06-03-2019	Applications of all above functions
45	IV	08-03-2019	Bit Pattern and changing a bit shift register
46	IV	11-03-2019	Sequence functions and applications
47	IV	12-03-2019	Controlling of two axis Robots
48	IV	13-03-2019	Control of three axis Robots with PLC,
49	IV	15-03-2019	Matrix functions
50	V	18-03-2019	Analog PLC operation: Analog modules and systems Analog signal processing
51	V	19-03-2019	Multi bit data processing
52	V	20-03-2019	Analog output application examples
53	V	22-03-2019	PID principles
54	V	25-03-2019	Position indicator with PID control
55	V	26-03-2019	PID modules
56	V	27-03-2019	PID tuning
57	V	29-03-2019	PID Functions

Total No. of Instructional periods available for the course: ……104……. Periods

Signature of HOD

Signature of faculty

Date:

Date:

SCHEDULE OF INSTRUCTIONS UNIT PLAN

Academic **Y**ear : **2018-2019**

Semester : **II** UNIT NO.: ……**I**……

Name of the Program: **B.Tech** …**ELECTRICAL**… Year: **IV** Section: **A, B**

Course/Subject: **PROGRAMMABLE LOGIC CONTROLLERS**

Course Code: **GR15A4030**

Name of the Faculty: …**PRASANTH KUMAR P**..... Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUB TOPICS
1	I	2		PLC Basics, PLC system
2	I	2		Block diagram of PLC
3	I	2		I/O modules and interfacing CPU processor
4	I	2		Programming equipment programming formats
5	I	2		Construction of PLC ladder diagrams
6	I	2		Construction of PLC ladder diagrams
7	I	2		Devices connected to I/0 modules
8	I	2		Devices connected to I/0 modules

Signature of HOD

Signature of faculty

Date:

Date:

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

SCHEDULE OF INSTRUCTIONS UNIT PLAN

Academic **Y**ear : **2018-2019**

Semester : **II** UNIT NO.: ……**II**……

Name of the Program: **B.Tech** …**ELECTRICAL**… Year: **IV** Section: **A, B**

Course/Subject: **PROGRAMMABLE LOGIC CONTROLLERS**

Course Code: **GR15A4030**

Name of the Faculty: …**PRASANTH KUMAR P.....** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUB TOPICS
1	II	2		PLC Programming input instructions, outputs, operational procedures
2	II	2		PLC Programming input instructions, outputs, operational procedures
3	II	2		Programming examples using contacts and coils.
4	II	2		Drill press operation
5	II	2		Digital logic gates in ladder logic
6	II	2		Programming of logic gates in the Boolean algebra system
7	II	2		Conversion Examples
8	II	2		Conversion Examples
9	II	2		Ladder diagrams for process control
10	II	2		Ladder diagrams and sequence listings
11	II	2		Examples of Ladder logic
12	II	2		Sequence listing examples
13	II	2		Ladder diagram construction of Spray Process system.
14	II	2		Flow chart for spray process system.

Signature of HOD Signature of faculty

Date: Date:

SCHEDULE OF INSTRUCTIONS UNIT PLAN

Academic **Y**ear : **2018-2019**

Semester : **II** UNIT NO.: ……**III**…….

Name of the Program: **B.Tech** …**ELECTRICAL**… Year: **IV** Section: **A, B**

Course/Subject: **PROGRAMMABLE LOGIC CONTROLLERS**

Course Code: **GR15A4030**

Name of the Faculty: …**PRASANTH KUMAR P.....** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUB TOPICS
1	III	2		Characteristics of Registers
2	III	2		Module addressing holding registers.
3	III	2		Input registers,Output Registers
4	III	2		PLC Functions Timer functions
5	III	2		Industrial applications of Timers
6	III	2		Counters counter function industrial applications
7	III	2		Arithmetic functions
8	III	2		Number comparison functions
9	III	2		Number conversion functions.

Signature of HOD

Signature of faculty

Date:

Date:

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

SCHEDULE OF INSTRUCTIONS UNIT PLAN

Academic **Y**ear : **2018-2019**

Semester : **II** UNIT NO.: ……**IV**…….

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Name of the Faculty: …**PRASANTH KUMAR P.....** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUB TOPICS
1	IV	2		Data Handling functions
2	IV	2		SKIP, Master control Relay
3	IV	2		JUMP, MOVE, FIFO
4	IV	2		JUMP, MOVE, FIFO
5	IV	2		JUMP, MOVE, FIFO
6	IV	2		FAL, ONS, CLR
7	IV	2		Sweep functions and their applications
8	IV	2		Applications of all above functions
9	IV	2		Bit Pattern and changing a bit shift register
10	IV	2		Sequence functions and applications
11	IV	2		Controlling of two axis Robots
12	IV	2		Control of three axis Robots with PLC,
13	IV	2		Matrix functions

Signature of HOD

Signature of faculty

Date:

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GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

SCHEDULE OF INSTRUCTIONS UNIT PLAN

Academic **Y**ear : **2018-2019**

Semester : **II** UNIT NO.: ……**V**……

Name of the Program: **B.Tech** …**ELECTRICAL**… Year: **IV** Section: **A, B**

Course/Subject: **PROGRAMMABLE LOGIC CONTROLLERS**

Course Code: **GR15A4030**

Name of the Faculty: …**PRASANTH KUMAR P.....** Dept.: …**EEE**……

Designation: **ASSISTANT PROFESSOR**.

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUB TOPICS
1	V	2		Analog PLC operation: Analog modules and systems Analog signal processing
2	V	2		Multi bit data processing
3	V	2		Analog output application examples
4	V	2		PID principles
5	V	2		Position indicator with PID control
6	V	2		PID modules
7	V	2		PID tuning
8	V	2		PID Functions

Signature of HOD

Signature of faculty

Date:

Date:

COURSE OUTCOME AND PROGRAM OUTCOME MAPPING

P-Outcomes C-Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
1		X			X	X		X			X	
2	X	X		X	X	X	X					
3	X			X	X		X	X				X
4	X	X	X				X				X	X
5	X	X	X					X			X	
6		X	X		X		X		X			X
7		X		X	X				X			X

CO – Cognitive Level Mapping

C	1	2	3	4	5	6
CO-1	X					
CO-2		X				
CO-3			X			
CO-4			X	X		
CO-5				X		
CO-6	X	X	X			
CO-7			X	X	X	

1-REMEMBER

2-UNDERSTAND

3-APPLY

4-ANALYSE

5-EVALUATE

6-CREATE

Unit-I
PLC Basics

Programmable Logic Controllers (PLC)

P. Prasanth Kumar
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EEE Department
GRIET

Contents

- PLC Basics
- PLC System
- I/O modules and interfacing
- CPU
- Processor
- Programming equipment
- Programming formats
- Construction of PLC ladder diagrams
- Devices connected to I/O modules.

Definition of PLC

- ✓ A PLC is a user-friendly, microprocessor-based specialized computer that carries out control functions of many types and levels of complexity.
- ✓ Its purpose is to monitor crucial process parameters and adjust process operation accordingly.
- ✓ The PLC will operate any system that has output devices that go on and off (discrete or digital outputs) or with variable (analog) outputs
- ✓ The PLC can be operated on the input side by on-off devices (discrete or digital) or by variable (analog) input devices.

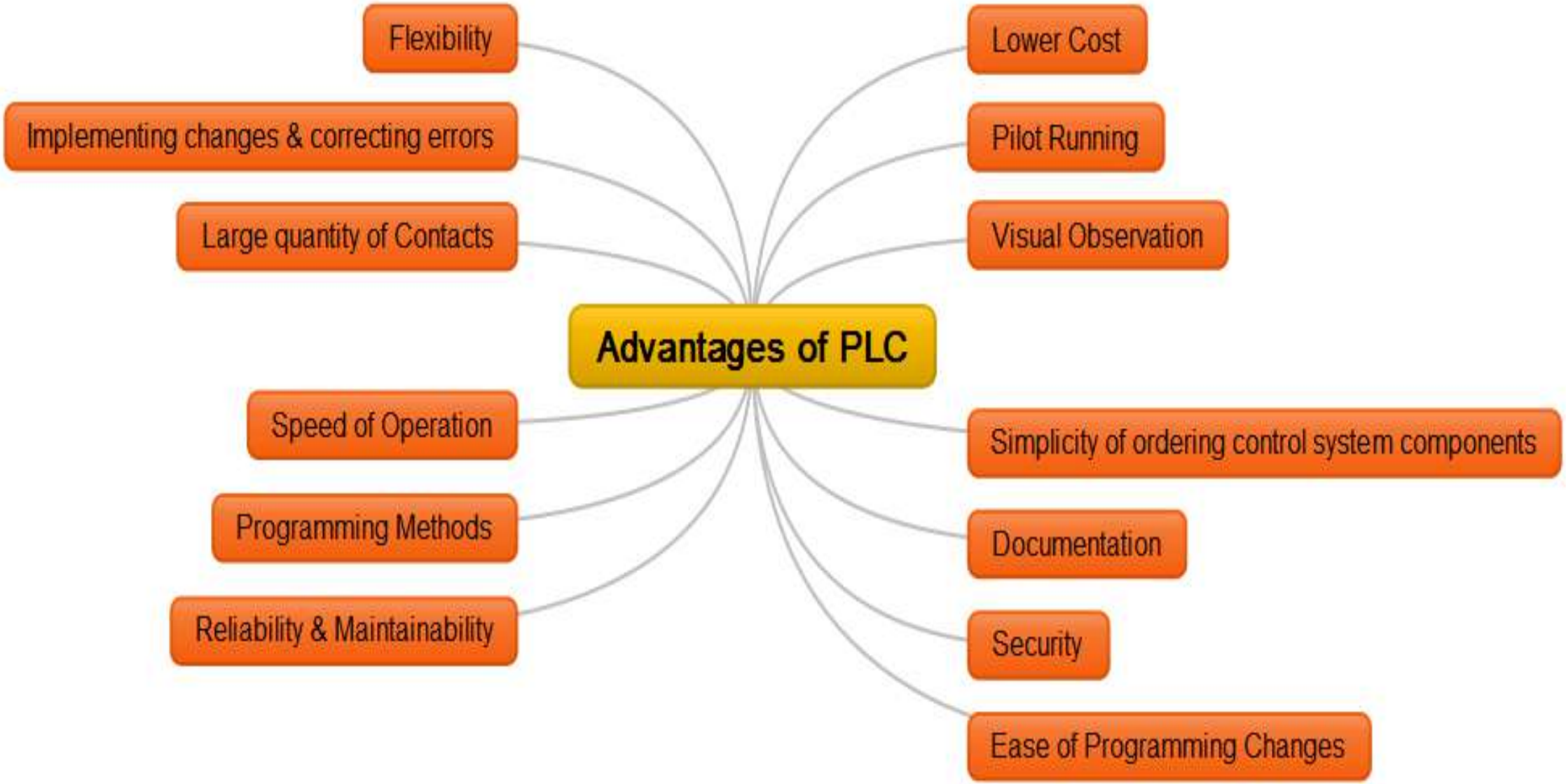
History of PLC

- PLC was introduced in late 1960's
- First commercial & successful Programmable Logic Controllers was designed and developed by **Modicon** as a relay replacer for General Motors.
- Earlier, it was a machine with thousands of electronic parts.
- Later ,in late 1970's,the microprocessor became reality & greatly enhanced the role of PLC permitting it to evolve form simply relay to the sophisticated system as it is today.

How does a PLC differ from a computer?

- ✓ *A computer is optimized for calculation and display tasks*
- ✓ *A computer is programmed by specialists*
- ✓ *A PLC is designed for (logic) control and regulation tasks*
- ✓ *A PLC is programmed by non-specialists*
- ✓ *A PLC is well adapted to industrial environment*

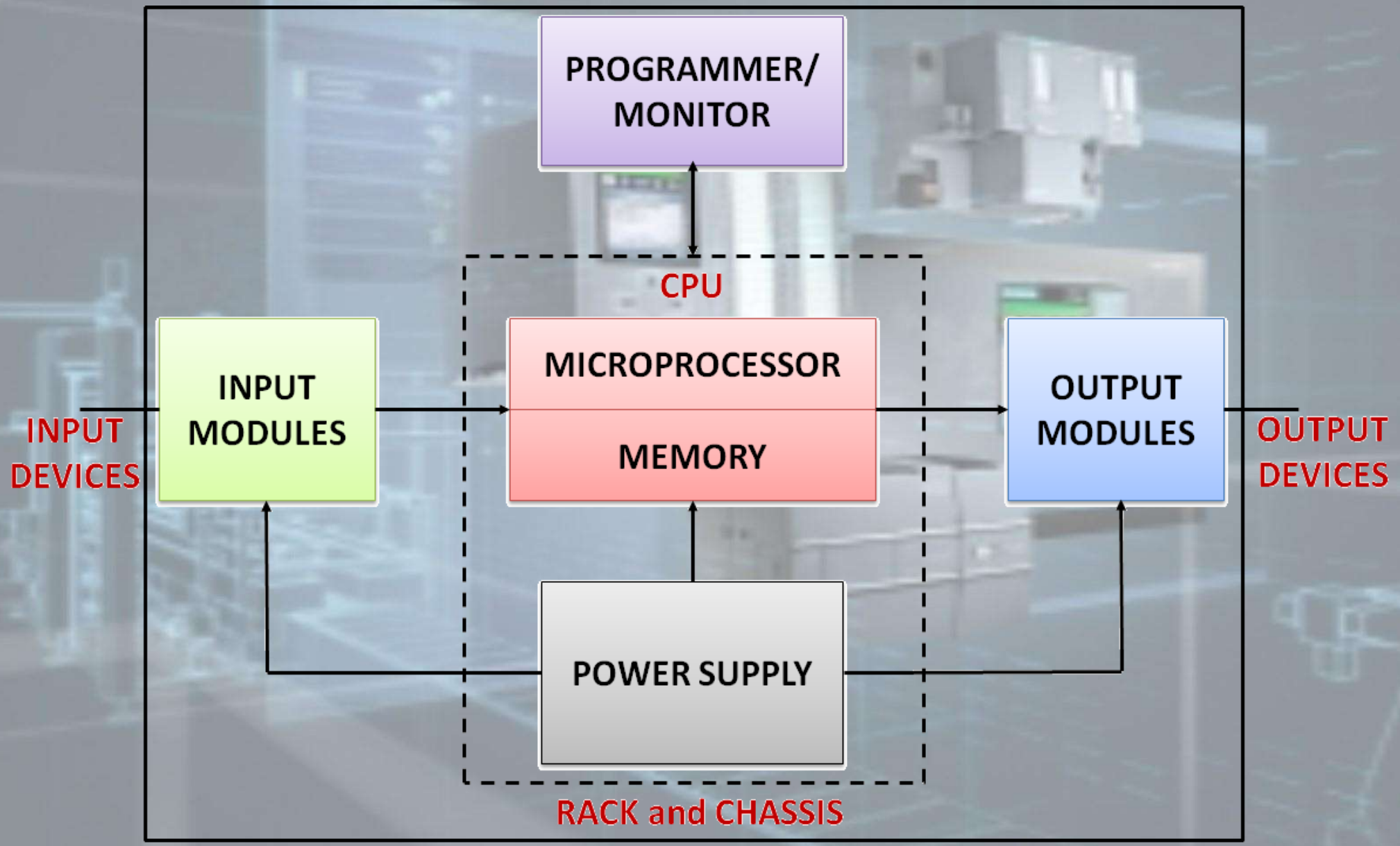
Advantages of PLC



Disadvantages of PLC

- Newer Technology
- Fixed Program Applications
- Environmental Considerations
- Fail Safe operation
- Fixed circuit operation

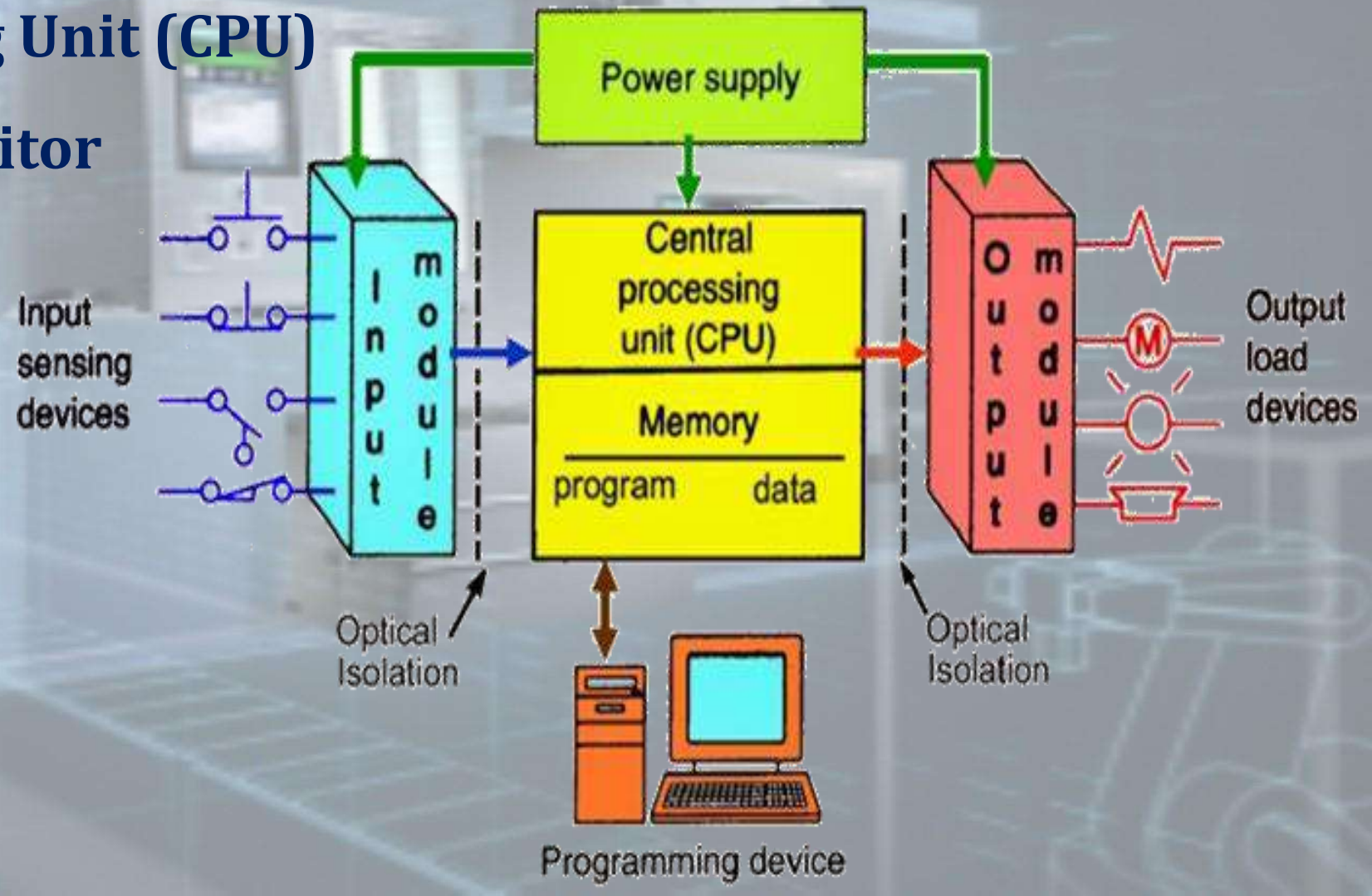
PLC System Layout and Connection



PLC System

- The major units of a PLC system are

1. **Central Processing Unit (CPU)**
2. **Programmer/Monitor**
3. **I/O Modules**
4. **Racks and Chassis**



Central Processing Unit (CPU):

CPU is a "brain" of the system, which has three subparts;

- **Microprocessor:** The computer center that carries out mathematic and logic operations.
- **Memory:** The area of the CPU in which data and information is stored and retrieved. Holds the system software and user program.
- **Power Supply:** It converts AC line voltages to various operational DC values.

Programmer/Monitor (PM):

- The programmer/monitor is a device used to communicate with the circuits of the PLC.
- Hand-held terminals, industrial terminals and the personal computers exists as PM devices.

I/O Modules:

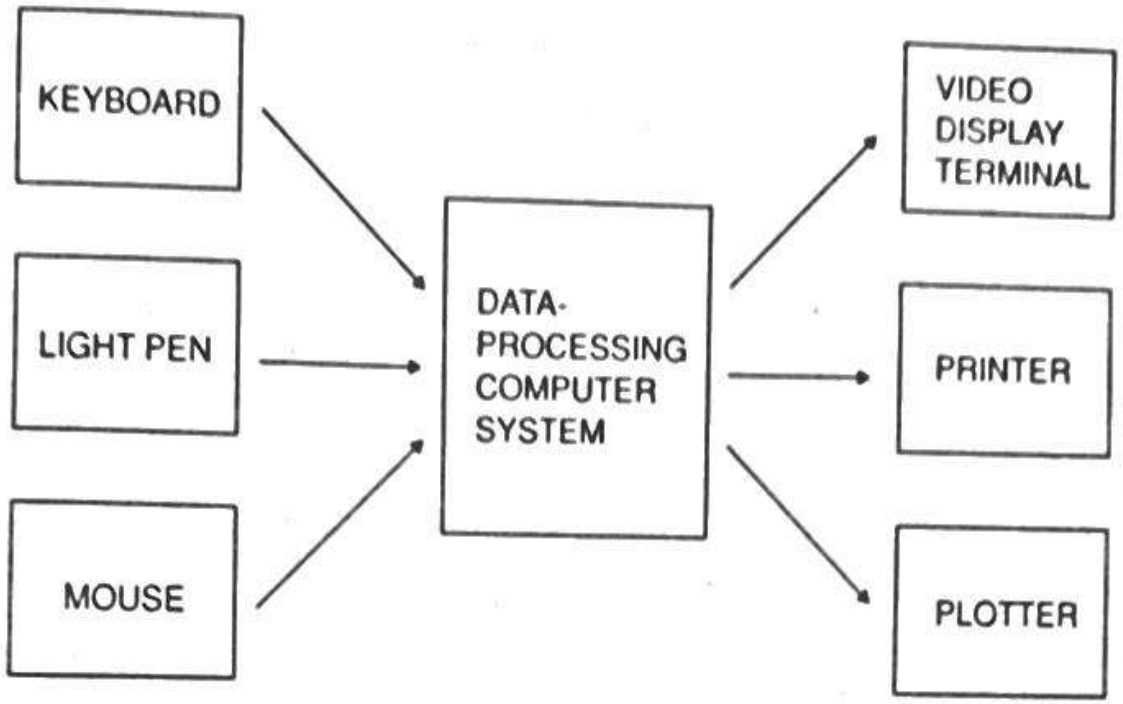
- The input module has terminals into which outside process electrical signals, generated by sensors, transducers, are entered.
- The output module has terminals to which output signals are sent to activate relays, solenoids, various solid-state switching devices, motors, and displays.

Racks and Chassis:

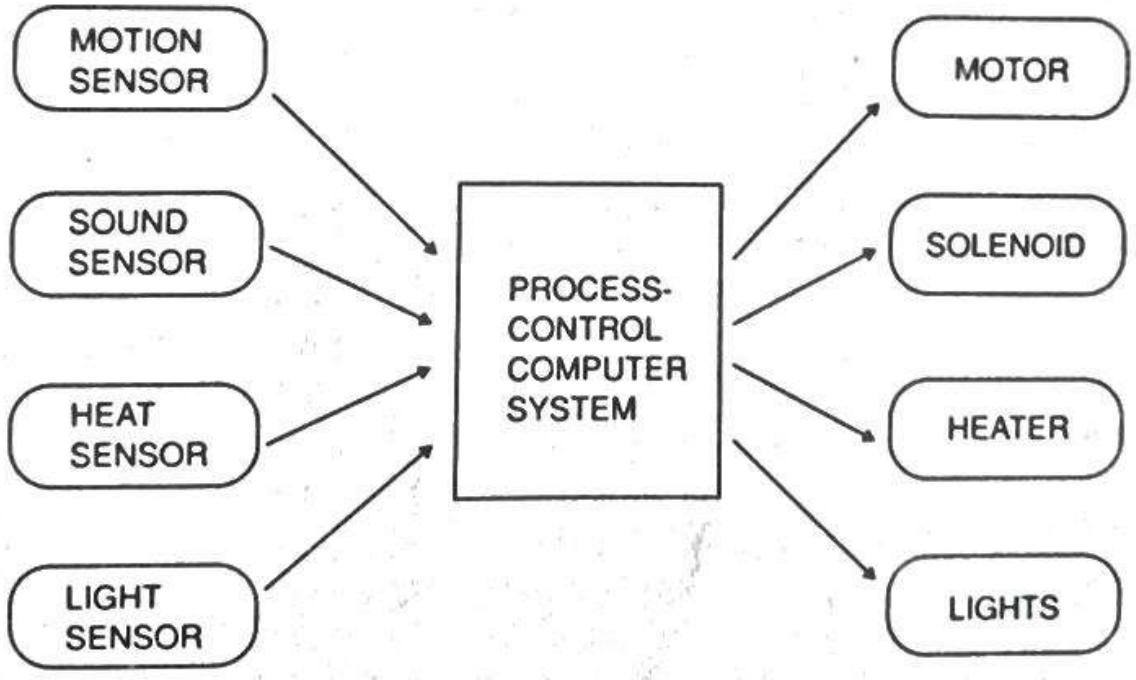
- The racks on which the PLC parts are mounted and the enclosures on which the CPU, PM, and I/O modules are mounted.

PLC as a Computer

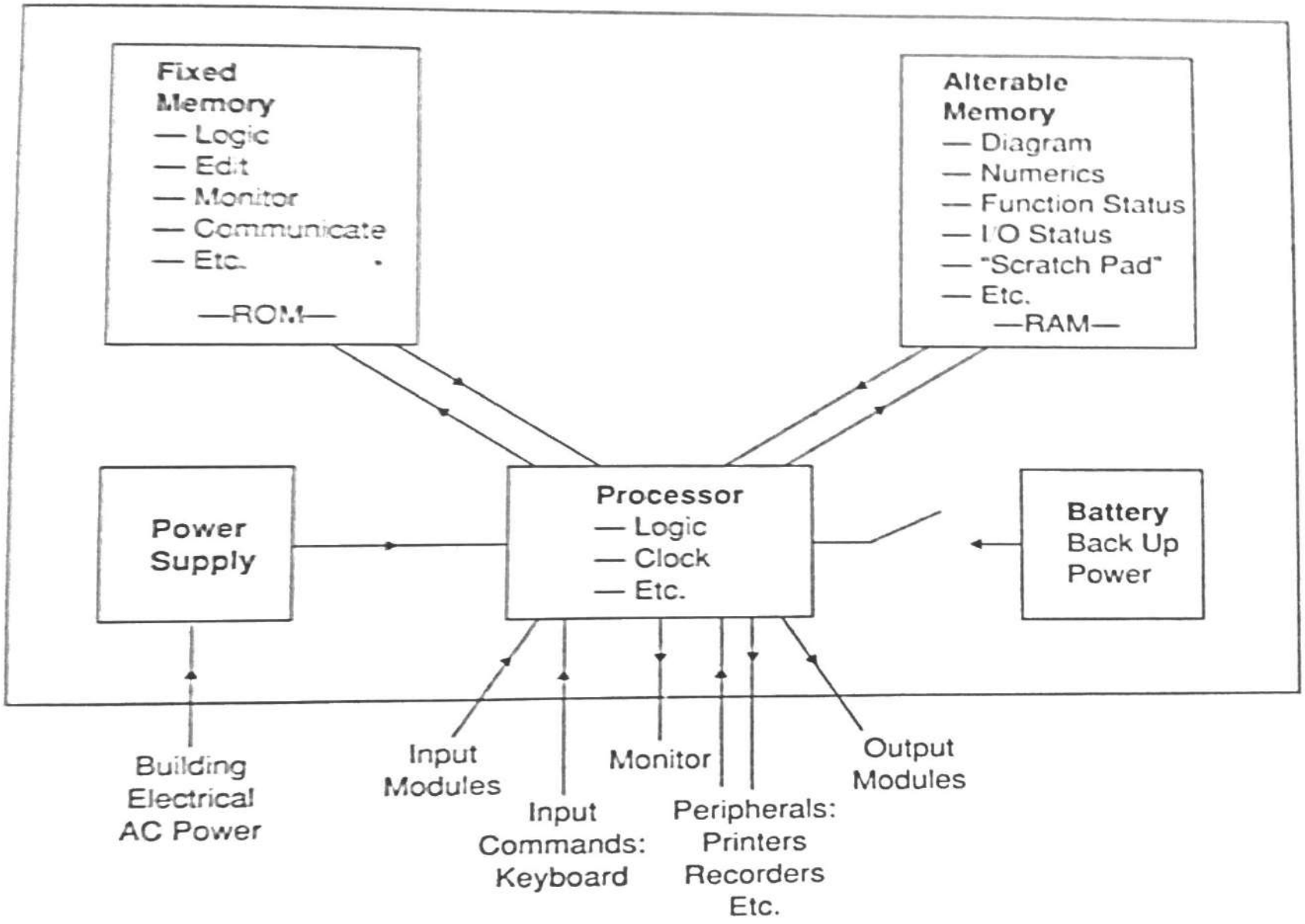
Data Processing Computer



Process Control Computer



Operational Section of a PLC CPU



Central Processing Unit {CPU}

- Regardless of PLC Size, the processor and Memory are always in the same unit. This is called the Central Processing Unit (CPU).
- In larger PLCs, the CPU contains just processor and memory.
- In small PLCs, the CPU also consists of the I/O interfaces and Power supply.
- It is also possible for the CPU to contain the processor, memory and power supply, with the I/O interfaces placed in external modules.

Fixed Memory:

- The fixed memory contains the program set by the manufacturer.
- This operating system program, which has the same function as a DOS program in PC, is set into special IC chips called Read-Only Memory (ROM).
- The fixed program in ROM cannot be altered or erased during the CPU's operation.
- The program in this nonvolatile memory is retained when power is removed from the CPU.

Alterable Memory:

- The alterable memory contains many sections.
- Its information is stored on an IC chip that can be programmed, altered and erased by the programmer/user.
- The alterable memory is stored mainly in Random Access Memory (RAM)chips.
- Information can be written into or read from a RAM chip.
- RAM is often called read/write memory.
- The typical RAM chip will lose any information it has stored when input power is lost.

Processor:

- The processor section has computer flow connections to other subsections of the CPU and to outside devices.
- The processor is the controller that keeps information going from one place to another.
- It responds to programmed instructions stored in memory, causing output devices to be energized and deenergized in response to the on-off status of input devices.

Solid-State Memory

- The major types of solid-state memory chips used in PLC CPUs are PROM, EPROM, EEPROM, and NOVRAM.

CHIP	FIXED (F) OR ALTERABLE (A)	APPLICATION	ERASABLE BY
ROM	F	Fixed operating memory	No
RAM	A	User Program	No
PROM	F	User Program	No
EPROM	A	User Program	UV Light
EEPROM	A	User Program	Electrical Signals
NOVRAM	A	User Program	Electrical Signals

The Processor

- All computer processors are designed to carry out Arithmetic and Logic operations.
- Since the early 1970s, when Intel engineers were able to cram the complexity circuitry necessary to do these functions onto a single chip, processors have been known as Microprocessors.
- Microprocessor are the “brains” of every computer, have a unique characteristics.
- They are programmable, which means they are “told” what to do by a set of instruction, compiled to form a program.
- When the processor is to carry out a different task, a new program is written and fed to it.

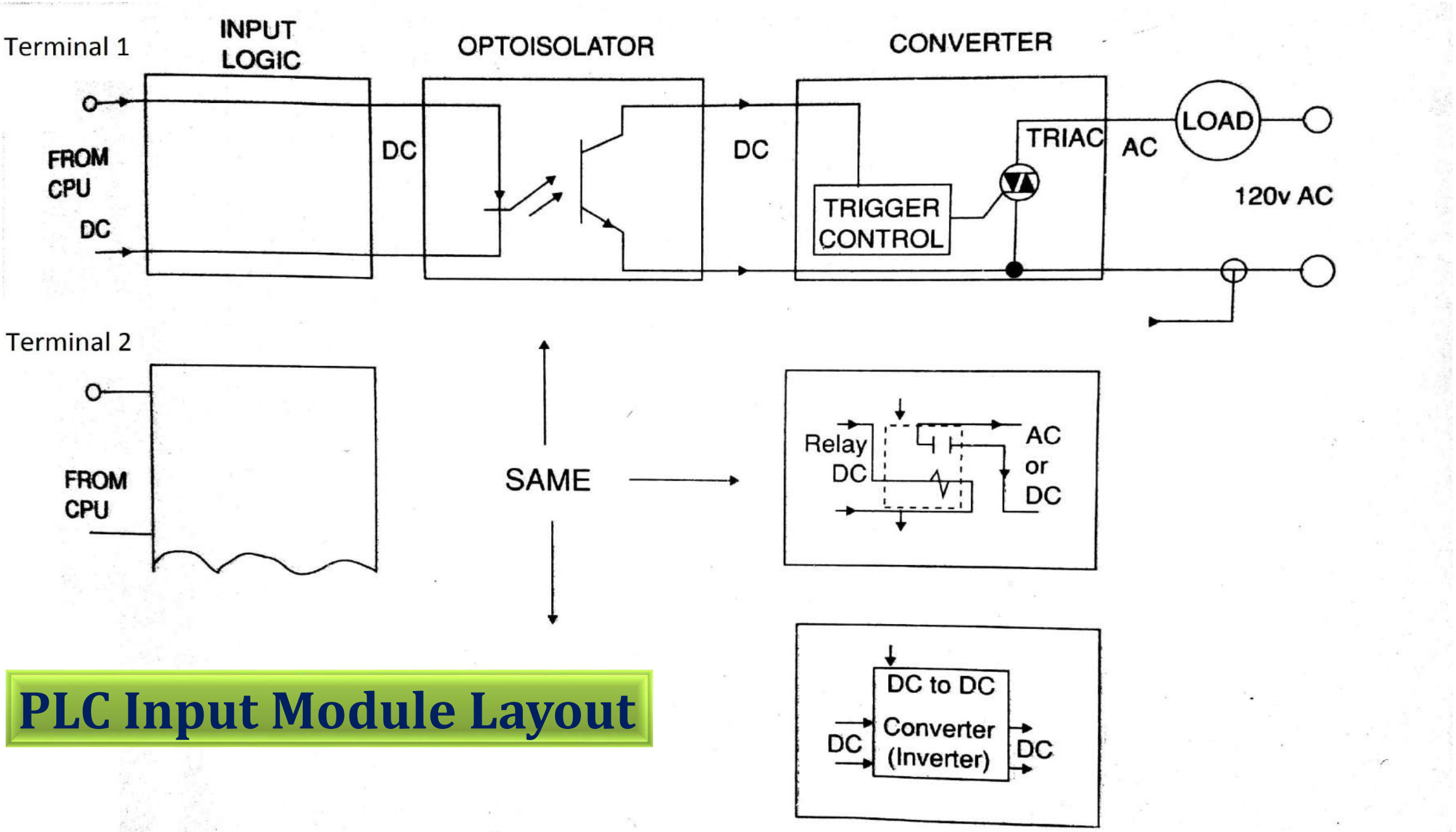
- Microprocessor are classified as to how powerful they are.
- Two factors determine power:
  - ✓ Bit Size: the larger the bit, the more powerful the computer.
  - ✓ Clock Speed: the faster the clock speed, the more powerful the computer.

MICROPROCESSOR	Bit Size	Clock Speed
8085	8-bit	1 MHz
8086	16-bit	4.77 MHz
80186	16-bit	8 MHz
80286	16-bit	12.5 MHz
80386	32-bit	33 MHz
80486	32-bit	50 MHz
Pentium	32-bit/64-bit	1.2 GHz

I/O Modules

The input module performs four tasks electronically,

- **First**: It senses the presence or absence of an input signal at each of its input terminals.
- The input signal tells what switch, sensor, or other signal is on or off in the process being controlled.
- **Second**: it converts the input signal for high, or on, to a DC level usable by the module's electronic circuit.
- For a low, or off, input signal, no signal is converted, indicating off.
- **Third**: the input module carries out electronic isolation by electronically isolating the input module output from its input.
- **Finally**: its electronic circuit must produce an output, via output logic, to be sensed by the PLC CPU.



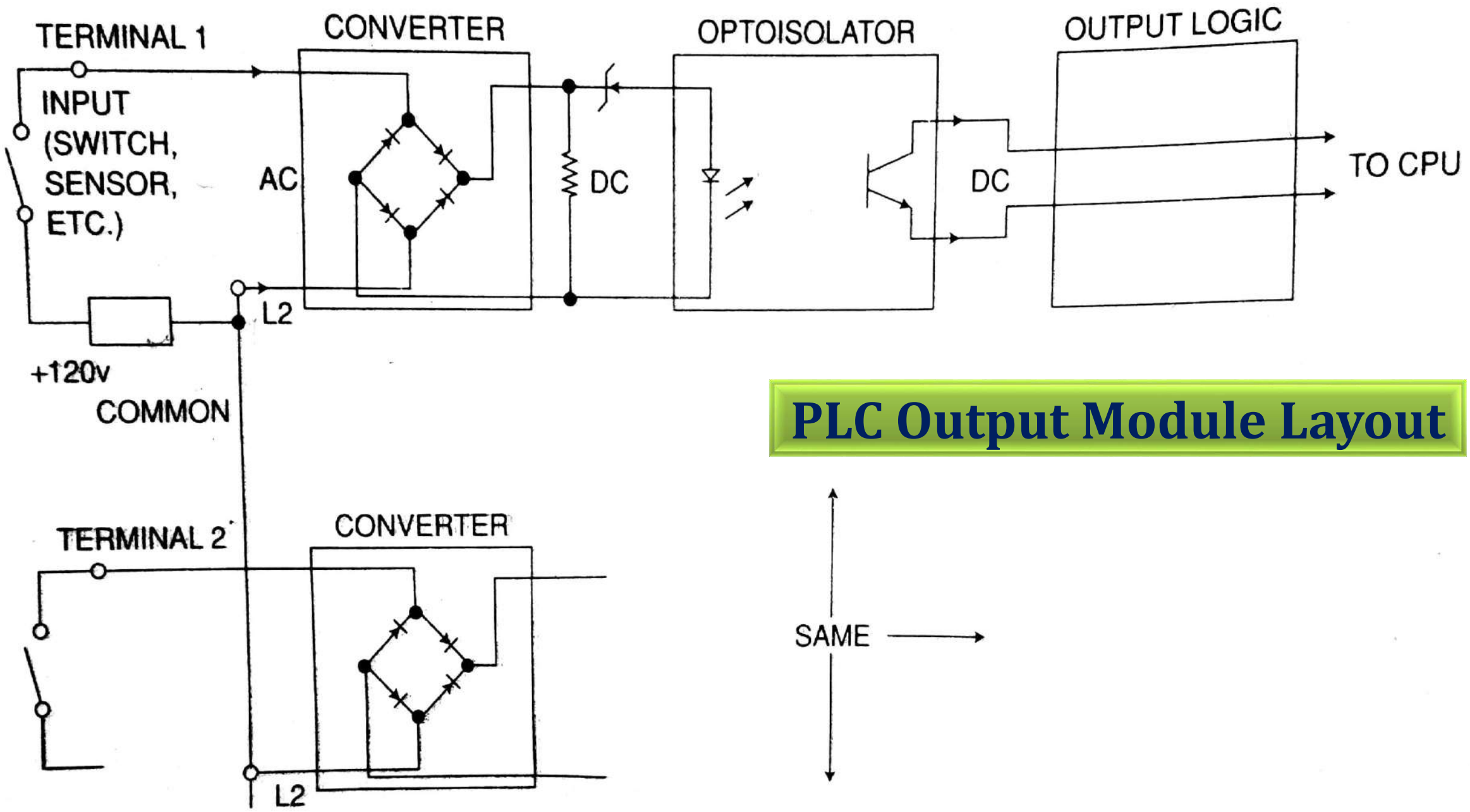
PLC Input Module Layout

- All terminals in a given module have identical circuits.
- The first block receives the input signal from the switch, sensor, and etc.
- For AC voltage inputs, the direct current (DC) converter consists of rectifiers and a means to step the voltage down to a usable level, usually with a Zener diode.
- For input DC voltages, some type of DC-to-DC conversion within the converter block is required.
- The output of the converter is not directly connected to CPU. If it were, an input surge or circuit malfunction could reach the CPU.
- The isolation block protects the CPU from this type of damage.
- The isolation is usually accomplished by an Optoisolator.
- When its input is on, the isolator sends a signal to the CPU via the output logic block.
- When the isolator’s output is ON, it is sensed by a coded signal from the CPU.

I/O Modules

The output module operates in the opposite manner from the input module.

- A DC signal from the CPU is converted through each module section (terminal) to a usable output voltage, either AC or DC.
- A signal from the CPU is received by the output module logic, once for each scan.
- If the CPU signal code matches the assigned number of the module, the module section is turned ON.
- The identification numbers of the modules are again determined by the setting of the module SIP switches.
- If no matching signal is received by a terminal during the output scan, the module terminal is not energized.

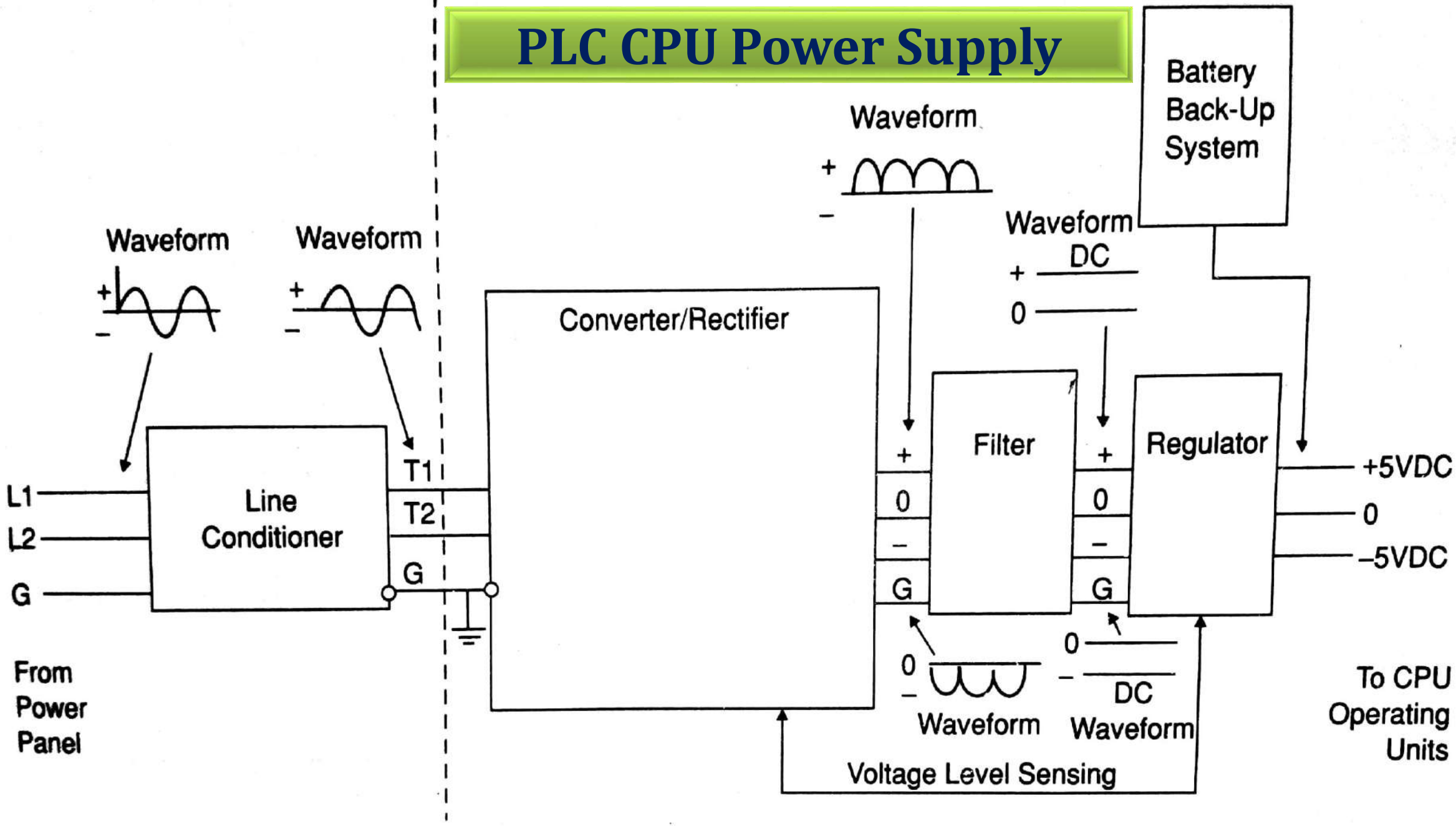


PLC Output Module Layout

Power Supplies

- The power available in most plants is 120 volts AC at 60Hz.
- Most PLCs operate on +5 and -5 volts DC.
- Therefore, the PLC CPU must contain circuitry to convert the 120-volt AC input to the required 5-volt DC values.
- The four parts of a diagram, plus a switching system for the backup system is shown in diagram.
  - **AC Conditioning Block**
  - **Converter/Rectifier**
  - **Filter Section**
  - **Regulator**

PLC CPU Power Supply



Programming Equipment

- PLC Programming equipment exists to allow us to write, edit and monitor a program, as well as perform various diagnostic procedures.
- In most of the cases the programming device, the Programmer/Monitors (PM), must be connected to the CPU while programs are written.
- Other PMs, however, allow us to program offline and then download the program to the PLC CPU.
- The programs are written in ladder logic, although alternative programming languages are available.

Programming Equipment

- Three types of PMs, also referred as Program Loaders, are in common use.
  - Hand-held, palm size units with dual function keypads and Liquid Crystal Display (LCD) or LED window.
  - Full sized keyboard accompanied by a large Liquid Crystal Display (LCD) or Cathode ray Tube (CRT) screen.
  - Software that allows programs to be developed on Personal Computers.

Programming Formats

- Some of the factors that vary between formats are ***Nomenclature, Numbering schemes, and screen appearance.***
- A typical hand-held keypad sequence for a three-wire holding circuit is shown in below figure-a.
- In the circuit (figure-b), output Y0 can be turned ON or OFF through the operation of the two inputs X0 and X1.
- X0 and X1 are the two NO pushbuttons connected to the controller input.

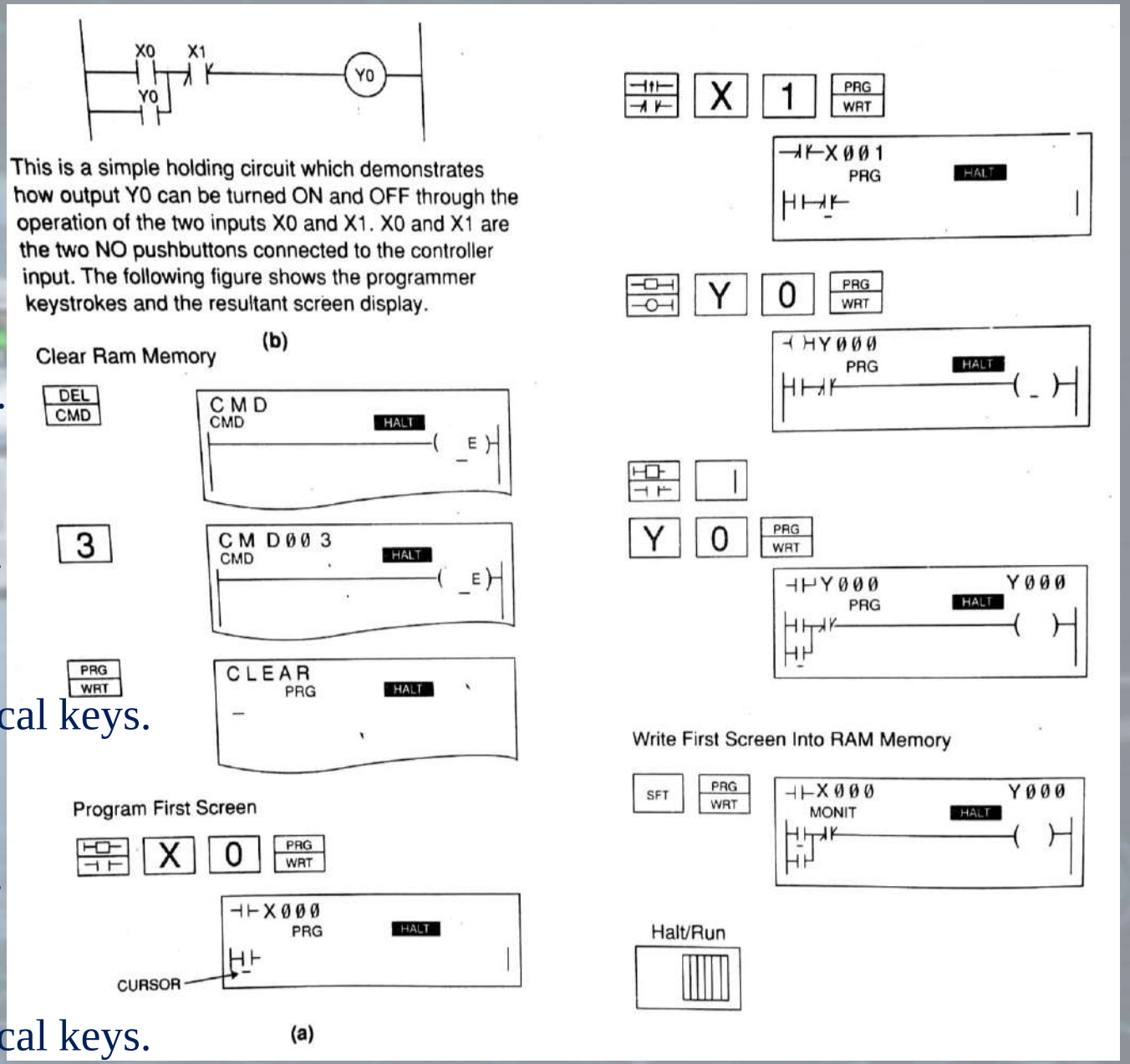
- The sequence is as follows:

Clear RAM Memory

1. Turn PLC ON.
2. Clear RAM memory
3. Clear the screen. Programming can now begin.

Program First Screen

4. Press contact device symbol (Normally Open).
5. Press function; X for input.
6. Assign contact number (0) by pressing numerical keys.
7. Press WRT to enter contact.
8. Press contact device symbol (Normally Open).
9. Press function; X for input.
10. Assign contact number (1) by pressing numerical keys.
11. Press WRT to enter contact.



12. Press coil device symbol (Normally Open).
13. Press function; Y for input.
14. Assign contact number (0) by pressing numerical keys.
15. Press WRT to enter contact.
16. Return to left of display, one line down
17. Press contact device symbol (Normally Open).
18. Press vertical connection symbol key (1) used to tie a device to the line above it on the ladder diagram.
19. Press function; Y for input.
20. Assign contact number (0) by pressing numerical keys.
21. Press WRT to enter contact.

Write First Screen into RAM memory

22. Write first screen (program) into RAM by pressing SFT (shift) and PRG (program).

Proper Construction of PLC Ladder Diagrams

1. A contact must always be inserted in slot 1 in the upper left.
2. A coil must be inserted at the end of a rung.
3. All contacts must run horizontally. No vertically oriented contacts are allowed.
4. The number of contacts per matrix (network) is limited.
5. Only one output may be connected to a group of contacts.
6. Contacts must be “nested” properly or, in some PLCs, not at all.
7. Flow must be from left to right.
8. Contacts progression should be straight across.

Input ON/OFF Switching Devices

Various types of ON/OFF switches which may be connected to PLC input modules are

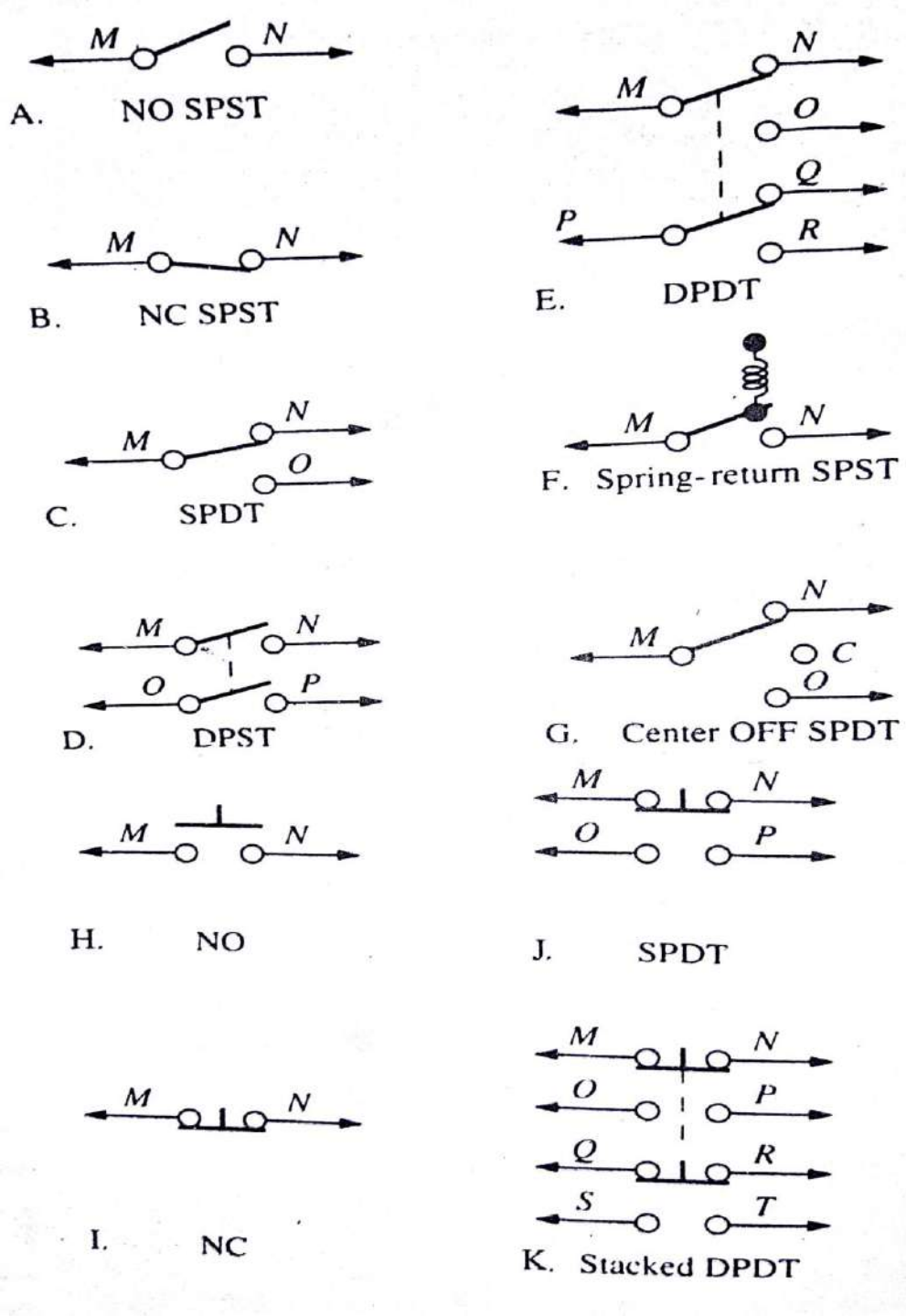
- **Toggle-type Switches (A-G)**
- **Push button Switches (H-K)**
- **Limit Switches**

SPST – Single Pole Single Throw

SPDT – Single Pole Double Throw

DPST – Double Pole Single Throw

DPDT – Double Pole Double Throw



Input ON/OFF Switching Devices

Some other common input ON/OFF devices used are

- **Pressure Switches**
- **Level Switches**
- **Float (liquid level) Switches**
- **Photoelectric Systems**
- **Hall Devices**
- **Inductive sensitive devices**
- **Magnetic sensitive devices**

Input Analog Devices

Some input analog devices which produce a varying input electrical value which is sent to the appropriate PLC input module

- **Potentiometers**
- **Linear Variable Differential Transformer (LVDT)**
- **Thermocouples**


THANK YOU!

Unit-II
PLC Basics

Programmable Logic Controllers (PLC)

P. Prasanth Kumar
Assistant Professor
EEE Department
GRIET

Contents

- Input Instructions
- Output Instructions
- Operational Procedures
- Programming Examples using Contacts and Coils.
- Drill Press Operation.
- Digital Logic Gates
- Programming in Boolean Algebra System.
- Conversion Examples.

PLC Input Instructions

- ✓ The various types of inputs are:
  - ➢ ***Normally Open Contact:*** When this contact closes, the function carries out some kind of action.
  - ➢ ***Normally Closed Contact:*** When this contact opens, the function carries out some kind of action.
  - ➢ ***Latch/Unlatch System:*** Actuating the latch input turns the function ON or causes it to change State. The function stays ON even if the latch input is turned OFF. To turn the function OFF, another input, unlatch is turned ON, which turns the function OFF. If unlatch is then turned OFF, the function remains OFF.

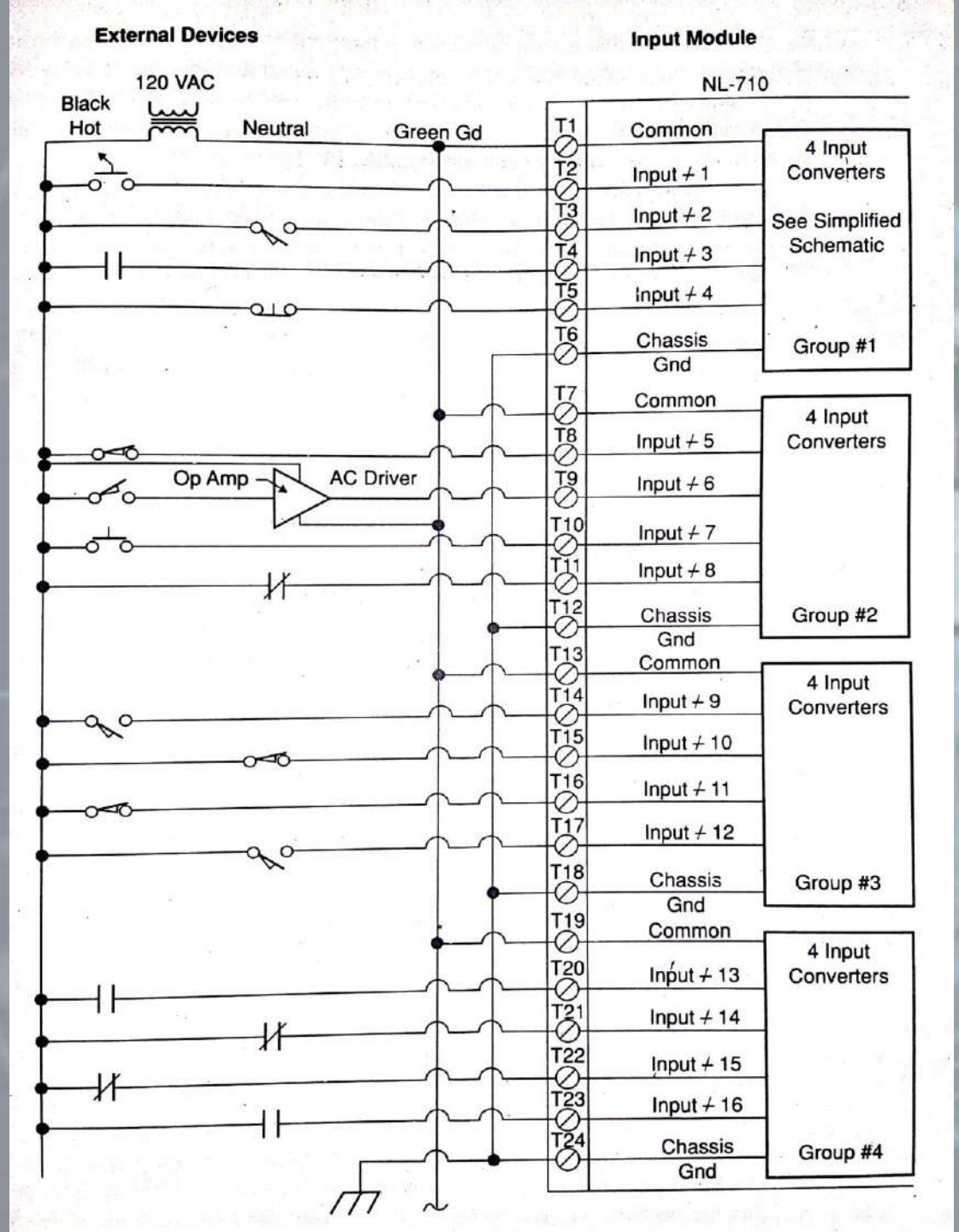
PLC Input Instructions

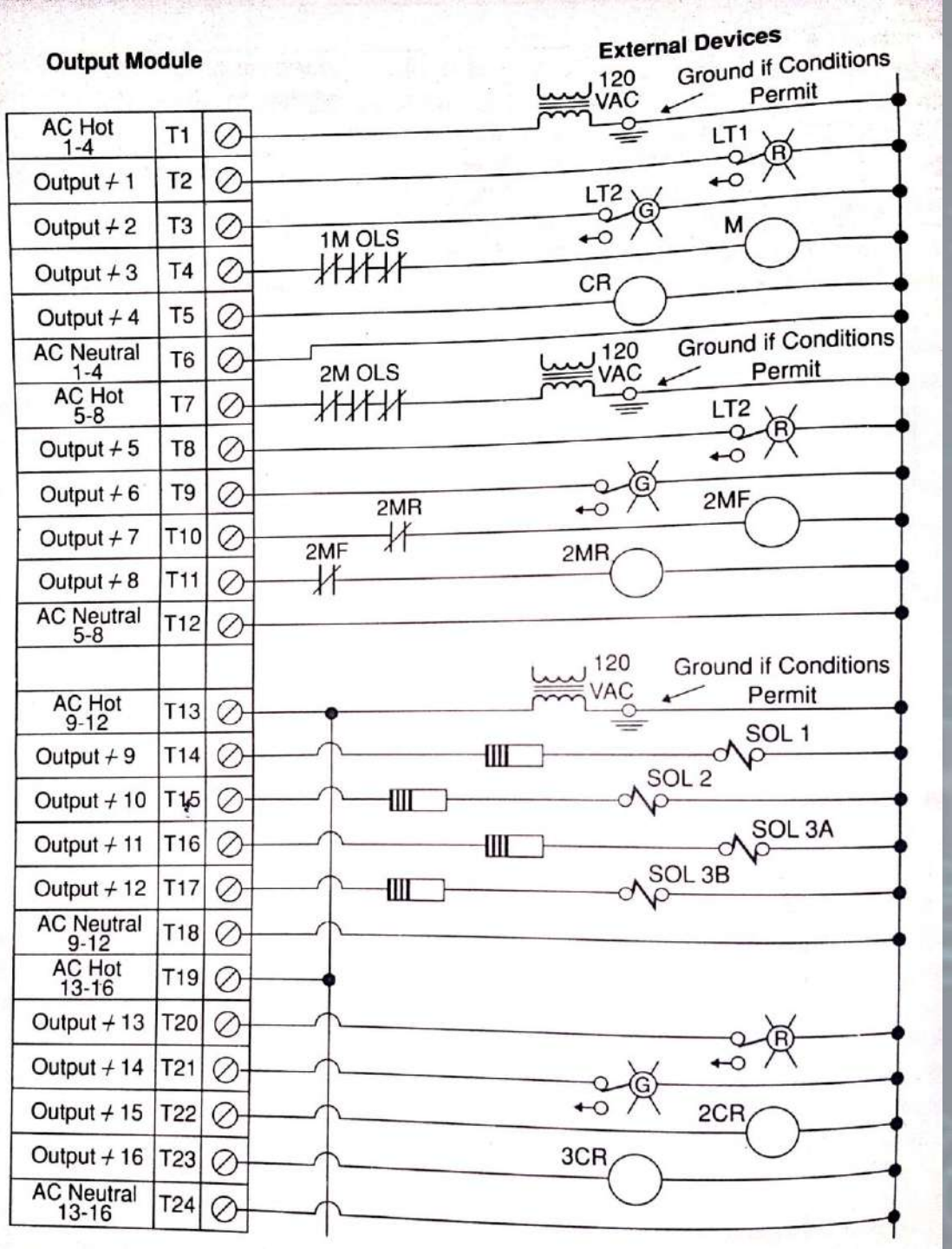
- ***Differentiation Up, or Rising-Edge Actuation:*** This involves turning the function ON for one scan time at the leading edge of an input signal pattern.
- ***Differentiation Down, or Falling-Edge Actuation:*** This involves turning the function ON for one scan time at the trailing edge of an input signal pattern.

PLC Input Instructions

- In a PLC System, each input is assigned a number on the input module and in the CPU.
- The number may be a reserved block of numbers or letters.
- In some PLCs, some prefix is used, such as IN.
- In a prefix system, the fifth input would correspond to the PLC program number IN005.

PLC Input Scheme





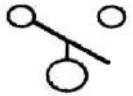
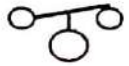
PLC Output Scheme

PLC Input Devices

Pressure & Vacuum Switches

N.O.	N.C.
	

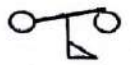
Liquid Level Switch

N.O.	N.C.
	

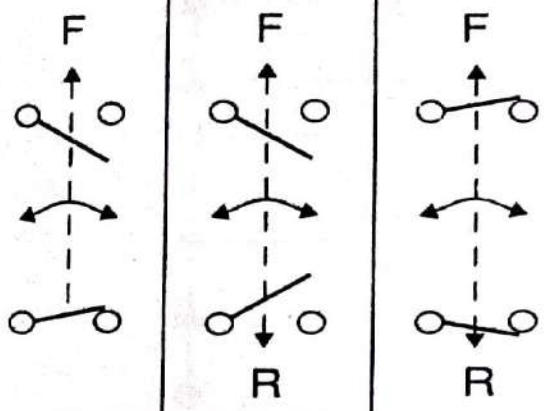
Temperature Actuated Switch

N.O.	N.C.
	

Flow Switch (Air, Water, etc.)

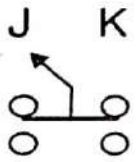
N.O.	N.C.
	

Speed (Plugging) Anti-plug



Selector

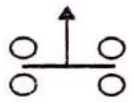
2 Position



	J	K
A1	I	
A2		I

I-Contact Closed

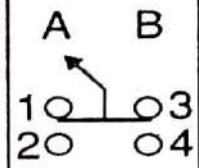
3 Position



	J	K	L
A1	I		
A2			I

I-Contact Closed

2 Pos. Sel. Push Button

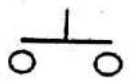
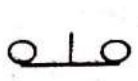
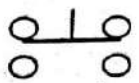
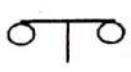


Contacts	Selector Position			
	A		B	
	Button		Button	
	Free	Depres'd	Free	Depres'd
1-2	I			
3-4		I	I	I

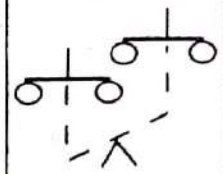
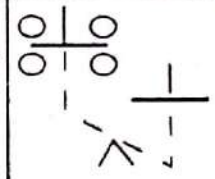
I-Contact Closed

Push Buttons

Momentary Contact

Single Circuit		Double Circuit	Mushroom Head	Wobble Stick
N.O.	N.C.	N.O. & N.C.		
				

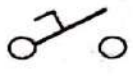
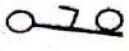
Maintained Contact

Two Single Ckt.	One Double Ckt.
	

Limit Switches

Normally Open	Normally Closed
	
 Held Closed	 Held Open

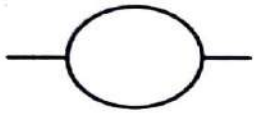
Foot Switches

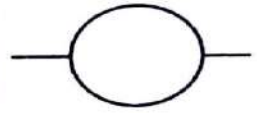
N.O.	N.C.
	

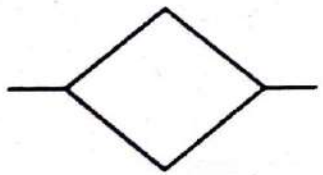
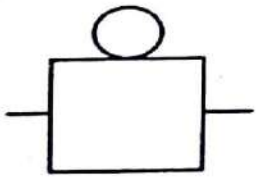
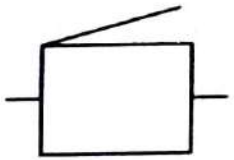
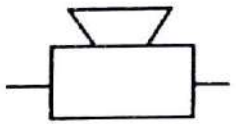
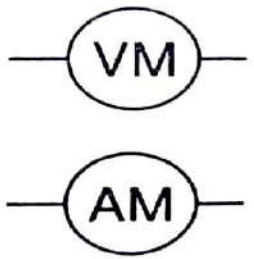
PLC Output Instructions

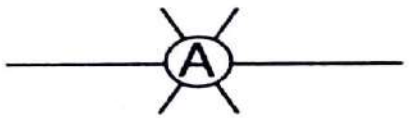
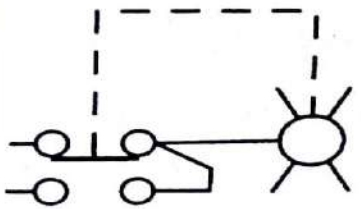
- In a PLC System, each input is assigned a number on the input module and in the CPU.
- The number may be a reserved block of numbers or letters.
- In some PLCs, some prefix is used, such as IN.
- In a prefix system, the fifth input would correspond to the PLC program number IN005.

PLC Output Devices

DC Motors			
Armature	Shunt Field	Series Field	Comm. or Compens. Field
	 (Show 4 Loops)	 (Show 3 Loops)	 (Show 2 Loops)

Coils	
Shunt	Series
	

Annunciator	Bell	Buzzer	Horn, Siren, etc.	Meter
				Indicate Type by Letter 

Pilot Lights	
Indicate Color by Letter	
Nonpush-To-Test	Push-To-Test
	

How does a PLC differ from a computer?

- ✓ *A computer is optimized for calculation and display tasks*
- ✓ *A computer is programmed by specialists*
- ✓ *A PLC is designed for (logic) control and regulation tasks*
- ✓ *A PLC is programmed by non-specialists*
- ✓ *A PLC is well adapted to industrial environment*

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – I (Descriptive)
PROGRAMMABLE LOGIC CONTROLLER
Code: GR15A4030

Date: **04/02/2019 (FN)**
Duration: **90 min**
Max Marks: **15**

Note: Answer any three questions. All questions carry equal marks.

1.	a	Show the block diagram of PLC system Layout and Connection. Describe every component of the layout.	[5M]	[CO-1]
2.	a	List some of the disadvantages of PLC.	[2M]	[CO-1]
	b	Draw and explain the schematic output modules of PLC.	[3M]	[CO-2]
3.	a	Describe the limitations for proper construction of Ladder diagrams.	[2M]	[CO-3]
	b	There are two machines, each with its own start-stop buttons. Only one may run at a time. Construct a circuit / PLC ladder with appropriate interlocking.	[3M]	[CO-3]
4.	a	Explain the Industrial process application of a Spray Process system with its layout diagram, algorithm and PLC ladder diagram. Show a tabular form listing the inputs and outputs used.	[5M]	[CO-4]

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
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Department of Electrical and Electronics Engineering

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Semester: **I**

MID Exam – I (Objective)
PROGRAMMABLE LOGIC CONTROLLER
Code: GR15A4030

Date: **04/02/2019 (FN)**
Duration: **20 min**
Max Marks: **05**

Roll No: | | | | | | | | | | |

Note: Answer all the questions. All questions carry equal marks.

1. When a relay is NOT Energized.
   A. There is an electrical path through NO contacts
   B. There is an electrical path through NO contacts
   C. Neither the NO or NC contacts have an electrical path
   D. Both the NO or NC contacts have an electrical path
2. The factors that determines the power of a computer are
   A. Bit Size
   B. Clock speed
   C. Memory size
   D. A & B
3. What are the factors that vary programming format of a PLC.
   A. Nomenclature
   B. Numbering schemes
   C. Screen appearance
   D. All the above
4. In ladder logic Coil can be inserted at ____ of a rung.
   A. Starting
   B. Ending
   C. a or b
   D. a & b
5. The program flow in ladder logic is from
   A. top to bottom
   B. right to left
   C. left to right
   D. any of the above
6. List any 2 Digital Input devices
   A. Pressure switch and Level Switch
   B. Potentiometer and LVDT
   C. Hall Device and thermocouples
   D. All the above
7. The _____ terminals receive signals from wires connected to input sensors and transducers.
8. Number of outputs that can be connected to group of contacts are _____.
9. The isolation in input module layout is accomplished by _____.
10. In PLC programming, input voltage is required to be applied to cause a device to stop. Such systems are not _____.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II (Descriptive)
PROGRAMMABLE LOGIC CONTROLLER
Code: GR15A4030

Date: **9/04/2019 (AN)**
Duration: **90 min**
Max Marks: **15**

Note: Answer any three questions. All questions carry equal marks.

1.	a	Describe in detail about holding registers, input registers and output registers.	[5M]	[CO-3]
2.	a	Explain the Master Control Relay function with an application.	[5M]	[CO-4]
3.	a	Briefly explain proportional, integral and derivative control.	[3M]	[CO-5]
	b	Explain PID Tuning Function and methods	[2M]	[CO-5]
4.	a	Generalize the format and working of different types of Timers with diagrams.	[5M]	[CO-3]

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II (Objective)
PROGRAMMABLE LOGIC CONTROLLER
Code: GR15A4030

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: | | | | | | | | | | |

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device.
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
2. Proportional control is also known as
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
4. A single input timer is called
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
5. Integral control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
6. An OR function implemented in ladder logic uses
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
7. A register that holds the contents of a calculation, arithmetic or logic
   A. Input register
   B. Output register
   C. Holding register
   D. General register
8. Derivative control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
10. Which function sets all the bits in a register or word to zero
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

EVALUATION STRATEGY

Academic **Y**ear	:	**2018-2019**		
Semester	:	**II**		
Name of the Program	:	**B. Tech**	Year: **IV**	Section: **A, B**
Course/Subject	:	**PLC**	Course Code: **GR15A4030**	
Name of the Faculty	:	**P Prasanth Kumar**	Dept.: ……**EEE**……	
Designation	:	**ASST PROFESSOR**		

1. TARGET:

a) Percentage for pass: 100%

b) Percentage of class: 100%

2. COURSE PLAN & CONTENT DELIVERY

- PPT presentation of the Lectures
- Solving exercise programs
- Model questions

3. METHOD OF EVALUATION

1. Continuous Assessment Examinations (CAE-I, CAE-II)
2. Assignments
3. Quiz
4. Class tests
5. Semester/End Examination

Signature of HOD

Date:

Signature of faculty

Date:

(12 Pages)

Gokaraju Rangaraju Institute of Engineering & Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad - 500090

No. 289005 ROLL NO.: 1 5 2 4 1 A 0 2 0 4

LASS & BRANCH B.Tech 4th Year & EEE-A

AME B. Tasim Teja SUBJECT PLC

IGNATURE OF THE INVIGILATOR DATE: 09/04/19

SEMESTER	I	II

	I	II

MID TERM EXAMINATION

Q.NO.	1		2		3		4		5		TOTAL
	a	b	a	b	a	b	a	b	a	b	
MARKS	4		5		3	2					14

Rod

START WRITING FROM HERE

olding Registers:—

hese registers are used for performing arithmetic, logic operations. holding registers access is not given to all the small registers. The inputs from the sensors are "deposited" into the input egister as '0s or '1' and are further programed using icrocontroller. The required operations are performed nd output is "drived" into the output register for the further operation. For Example, ON/Off of the ptoisolator.

The arithmetic operations are performed in such way a ariable are stored in one register, Operand are stored

- Basic functions of holding are arithmetic operations, timer Operations, and Counter operations.

Input Register:-

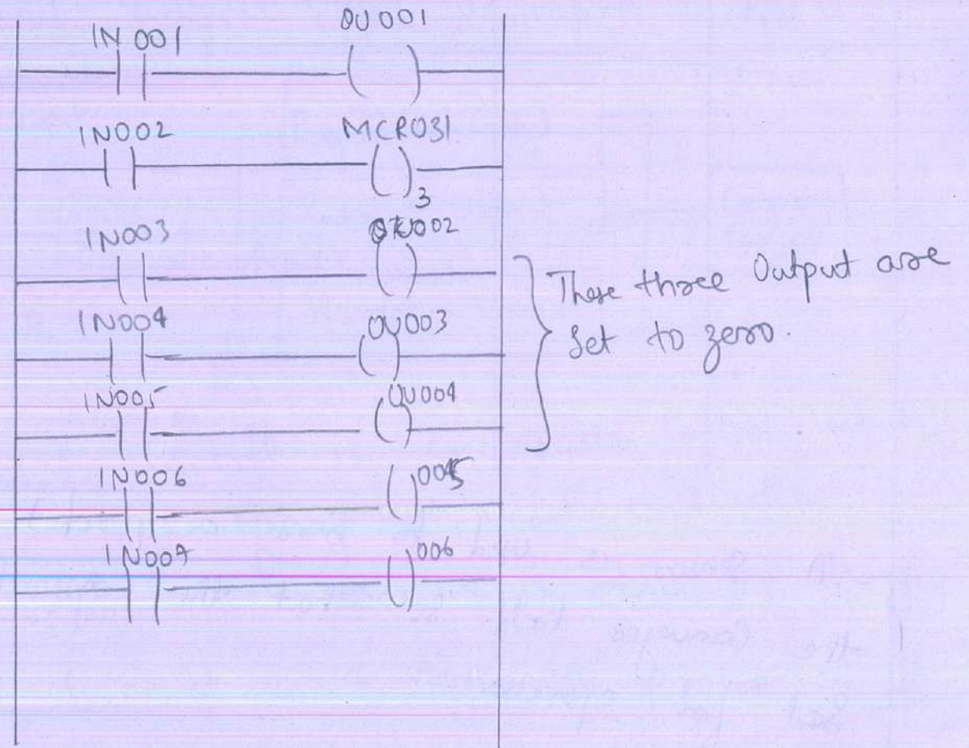
- Input registers are also same as the holding register but the input module has the direct access to the input register.
- It is almost ($1/16^{th}$ of the Size of holding ~~reg~~ register.
- The inputs are grouped to form a Input Register Group (IGn) where 16-bits ~~input~~ of input is grouped as One group and are labelled according.

Output Register:-

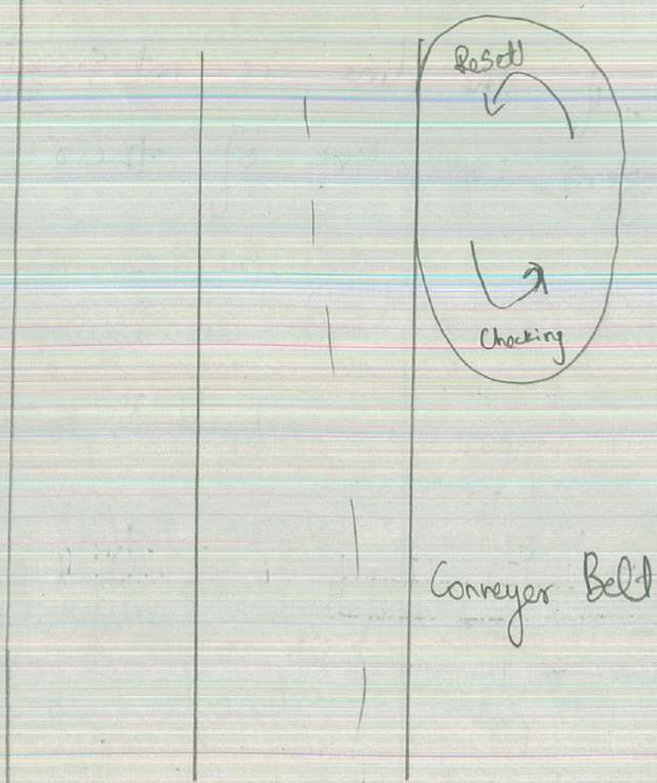
- Output registers are also same as both input registers and holding registers.
- The operation is similar to input register.
- These registers are given direct acces to the output modules.
- The outputs are also grouped to a Output Register Group (OGn) where 16-bits of output is grouped as

2Ans] Master Control Relay (MCR)

- It is an input enabled relay. The output of the lines are energized based on the request.
- This function is similar to SKIP and JUMP function but in those functions the unoperated or bypassed lines remain unchanged ie., they are present in their previous State.
- In MCR operation, if the line is not energized then the output is zero; irrespective of their previous state.

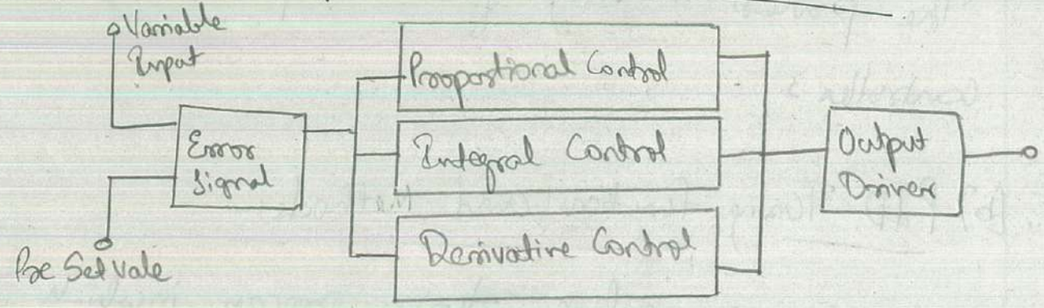


- By using this we can set the output of only required operation to output reset the remaining to zero.
- These are better ~~and~~ ~~for~~ compared to Skip function.
- for Example:-



- A Sensor is used to Sense a product is set on the Conveyer belt so that the operation is all set for operation.
- If a falt piece is Sensed then it is removed from the Conveyer belt and is Sent for remodelling.
- When the Object is back on the belt then it can directly go the place where it was rejected as it has already passed all the initiall test.
- By which the proces is easy and we can have a track of the flow of procedure which is going on.
- This one of the major advantage of using MCR in the factories for operation.

3Any] [a] Proportional, Integral and Derivative Control:-



- Proportional Control is an ratio Control which takes the ratio of preset value and the obtained value. The variation is done by changing the ratio but it is a very long process as.

by increasing the ratio the setting of the valve also takes longer time.

- Integral Control is a reset Control which can be applied individually. They must be applied with the integration any of the other Controller which increases the speed of the process.

. Derivative Control is a rate Control in which the rate of change is obtained and the rate of operation is set based on requirement.

- The process is very fast compared to other Controllers.

(b) PID Tuning functions and Methodes:-

- PID is an online tuning process in which the output is always maintained at a preset value. There are basically three methods of operation.

(i) Open loop transfer Control
(ii) Ultimate Cycle
(iii) Frequency response

- Open loop Control -

- In this method the loop is opened so that there is no feedback and the required modifications are done and loop is operated again.

- Ultimate Cycle -

- In this method the loop iterated until the steady state response values are obtained

- Sequency Response:-

- In this method the bode plots are obtained and based on the characteristics the changes are performed.

(12 Pages)

Gokaraju Rangaraju Institute of Engineering & Technology

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No. 289019 | ROLL NO.: | 1 | 5 | 2 | 4 | 1 | A | 0 | 2 | 1 | 9 |

CLASS & BRANCH IV BTech II Semester & EEE

NAME J. Srikanth SUBJECT Programmable Logic Controllers

SIGNATURE OF THE INVIGILATOR DATE: 09-04-2019

SEMESTER	I	II

I	II

MID TERM EXAMINATION

Q.NO.	1		2		3		4		5		TOTAL
	a	b	a	b	a	b	a	b	a	b	
MARKS	5		1				3				9

Prod

START WRITING FROM HERE

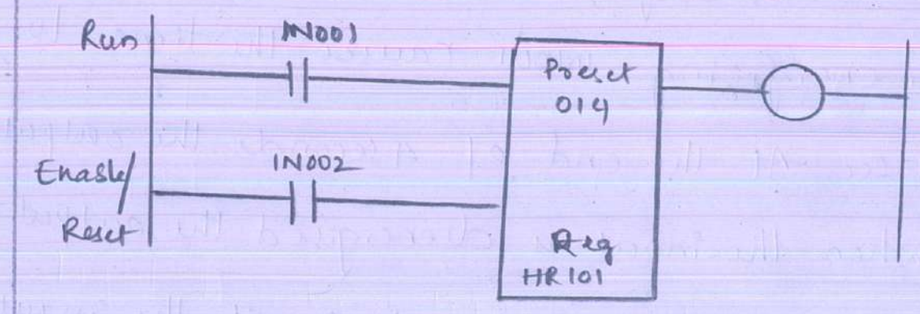
(4) Timers:- A single input timer called a non-retentive timer energising IN001 causes the timer to run for 4 sec. At the end of 4 seconds the output goes on when the input is deenergised the output goes off and the timer refers to '0' if the input IN001 is turned off during the timer interval the timer resets to '0'. In this case the output would not have turned on

There are operational disadvantages of the

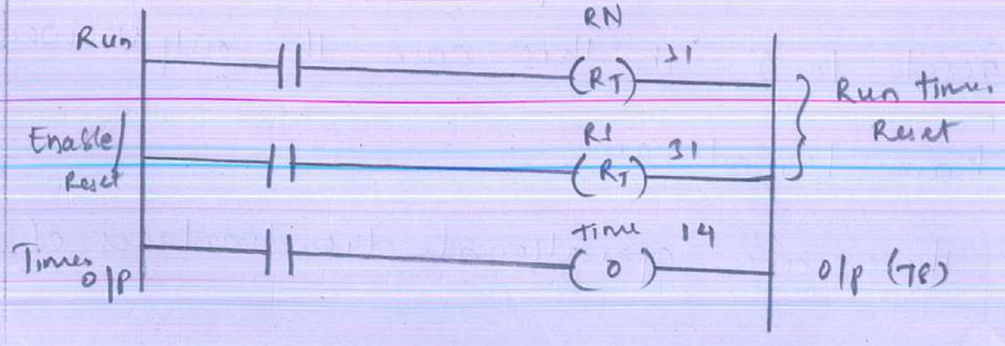
Single input type timer. There are three types of formats for PLC timers are

i) Block format
ii) Coil format
iii) Coil format with Seperate ~~input~~ enable and reset

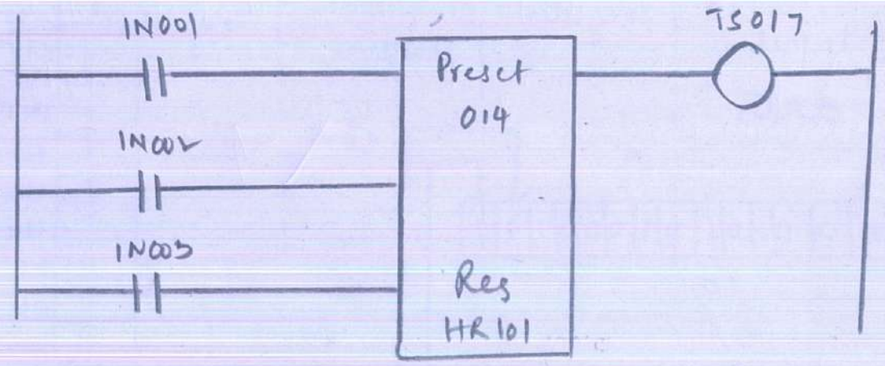
Block Format:-



Coil Format:-

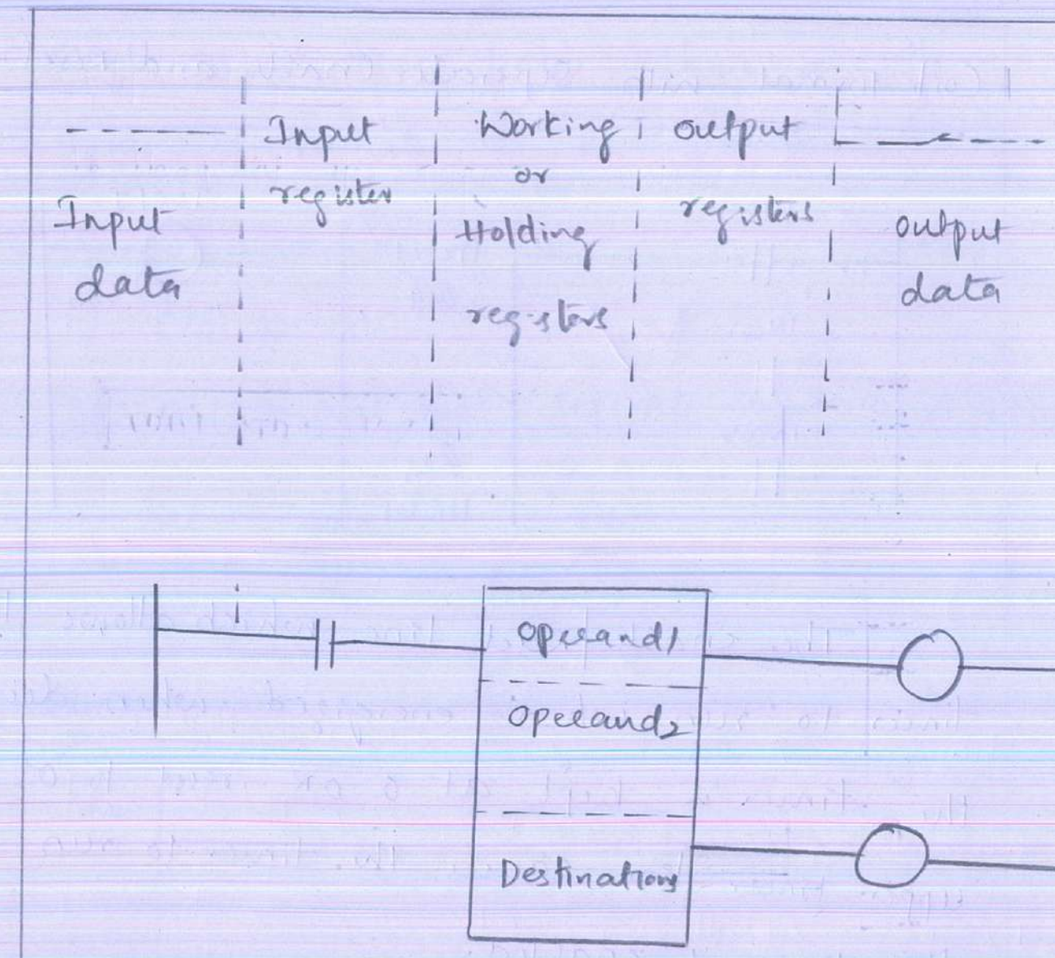


Coil Format with Seperate Enable and Reset:-

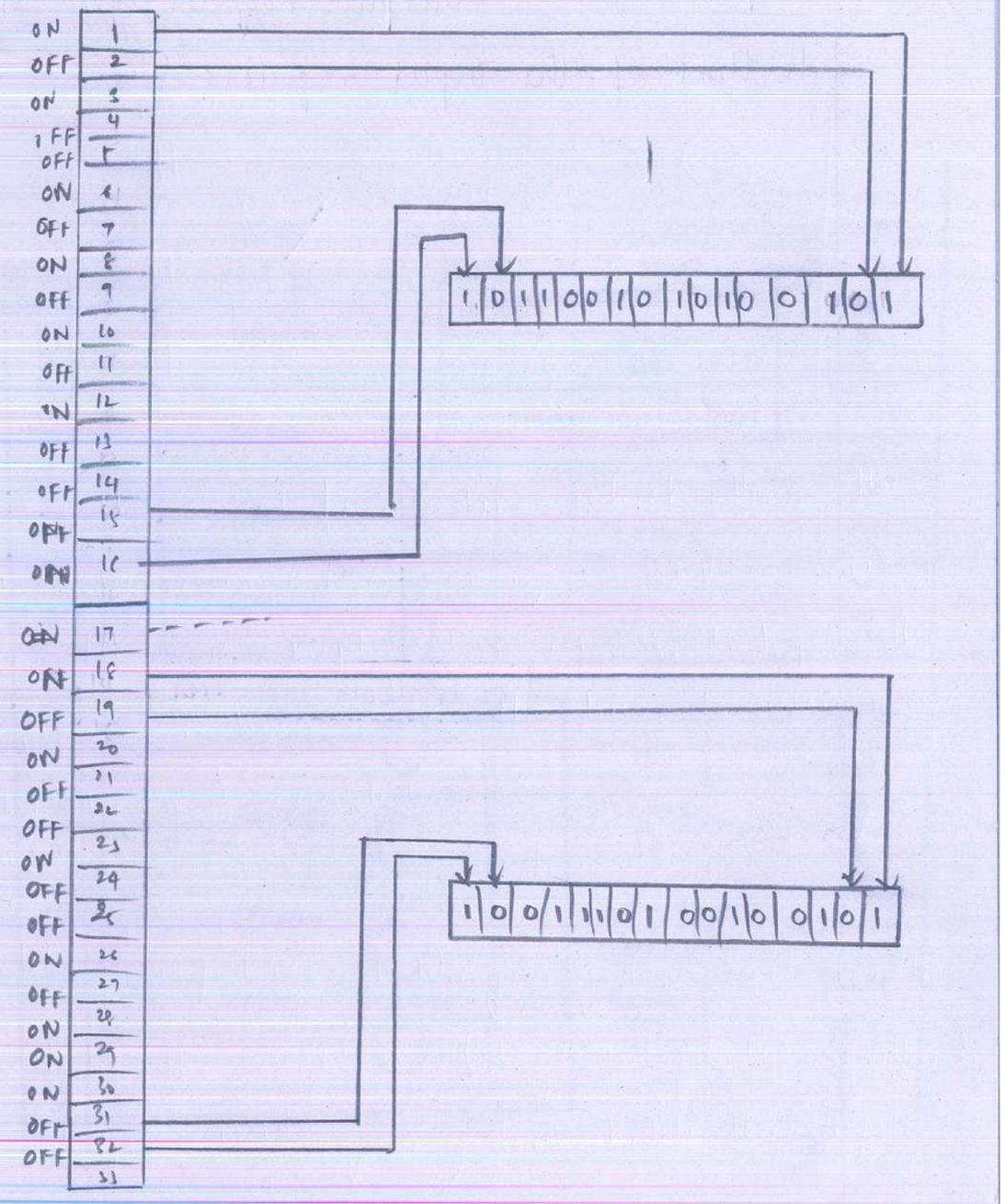


The enable/Reset line which allows the timer to run when energized. when deenergized the timer is kept at 0 OR reset to '0' the upper ~~timer~~ line causes the timer to run when the timer is enabled.

Holding registers:- Holding registers are functioned to hold the contents like calculation, arithmetic and Logic. Holding registers holds the input ~~comp~~ commands from the input registers and ~~they~~ which are manipulated by the microprosser

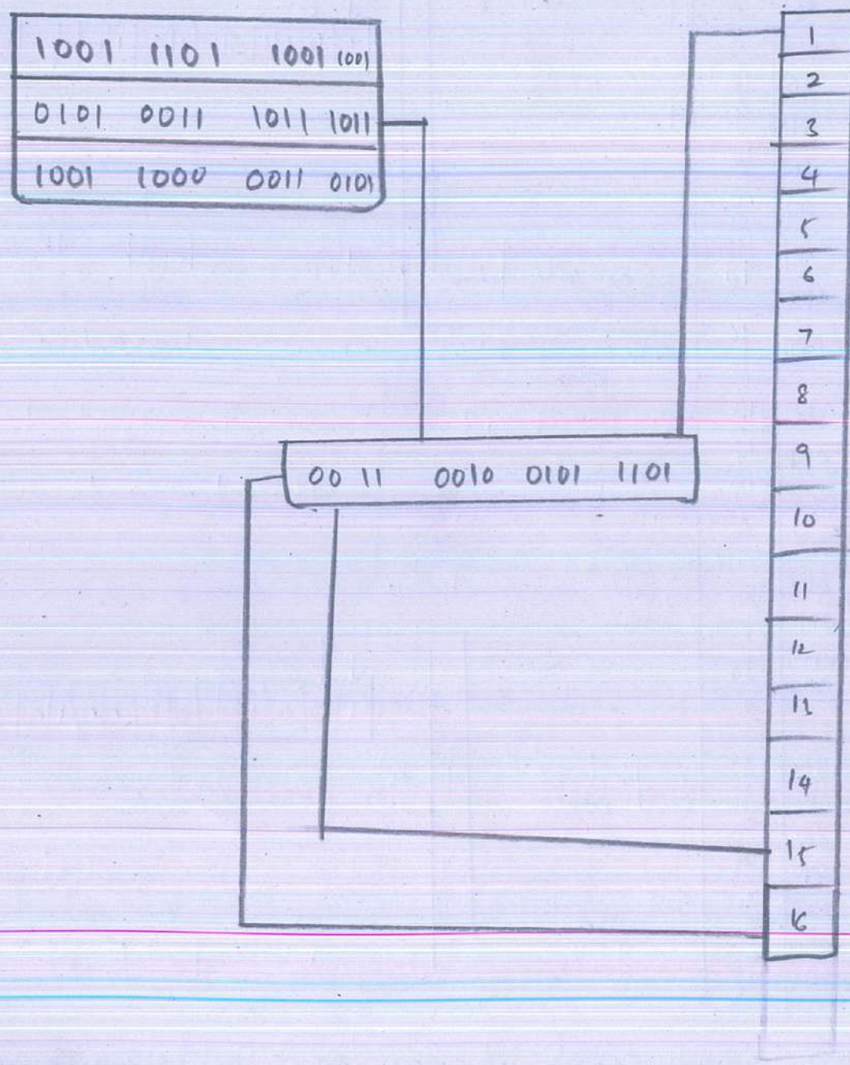


Input Registers:- Input registers are as similar in charecteristics of the Holding registers. The input registers are enabled with 0's and 1's 1 denote the ON state and 0 denote the OFF state The input group register (IG) are have a Single input port with 16 bits of inputs

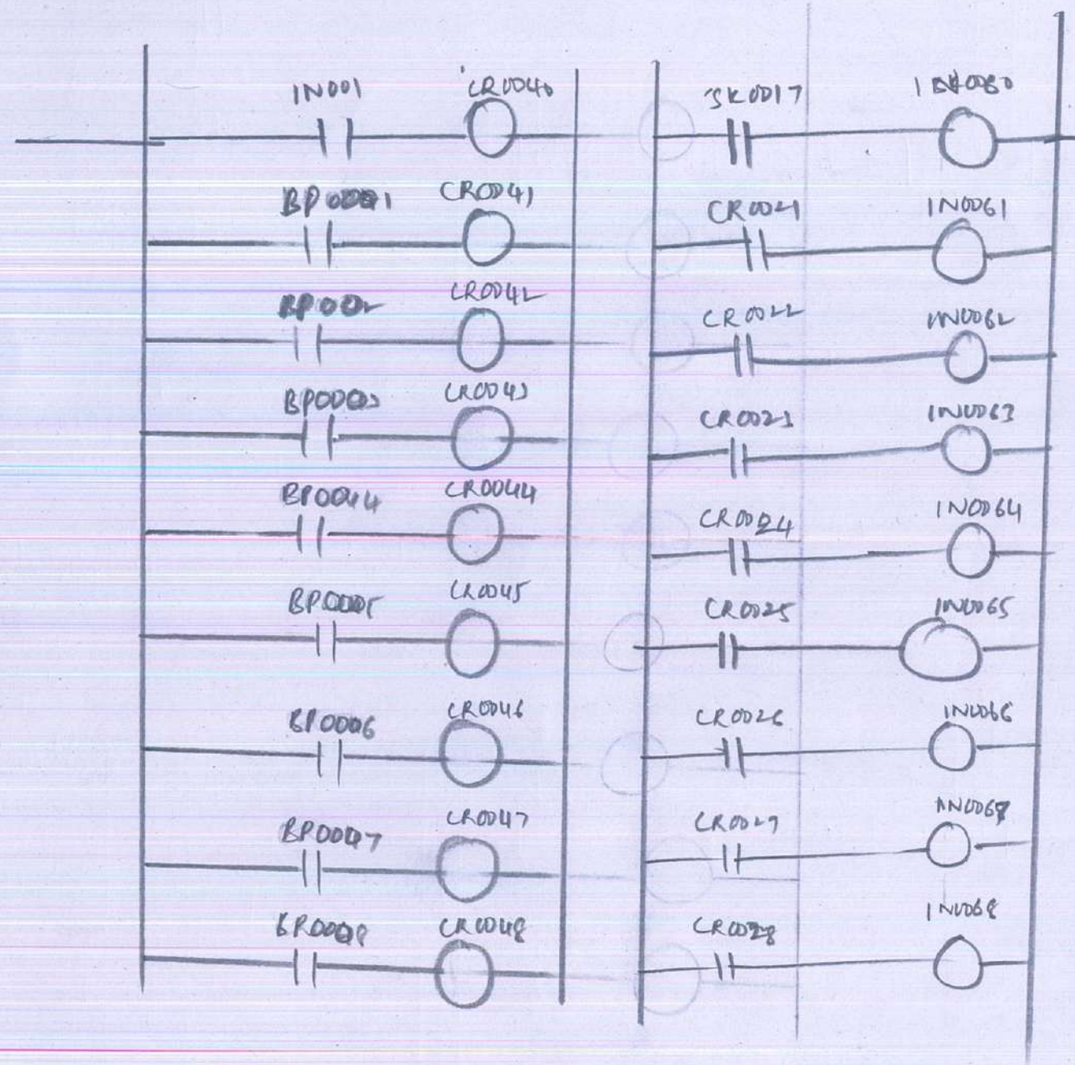


INPUT GROUP REGISTER

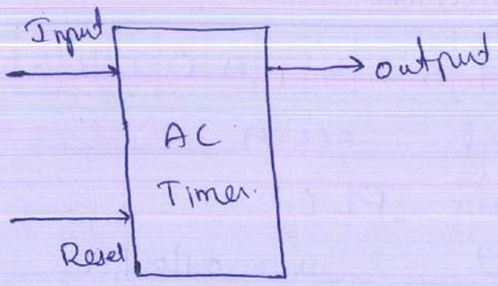
Output Registers:- Output Register are similar to that of the input registers



(2) Master Control Relay Function:-



c Timer:-

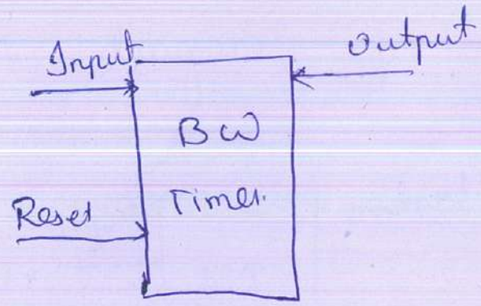


* Here in a AC Timer we have Input output and the Reset button

This is about AC Timer.

BW Timer :-

The BW Timer is same as the AC Timer the diagram of BW Timer is

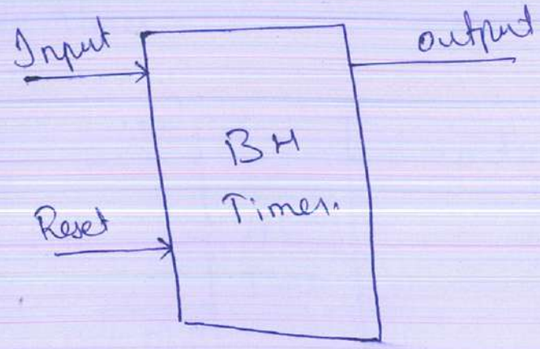


* Here in a BW Timer we have Input output and the Reset button

* This is about BW Timer.

→ BH Timer :-

The BH Timer is same as the AC and BW timer. The Block diagram of BH Timer is.



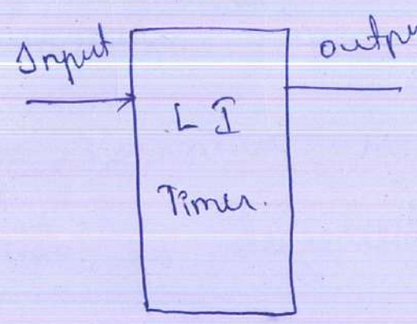
Here in the BH timer we have.

Input output and the Reset button same as the above. Two Ac timer and the Bw timer.

LI timer :

LI timer is different from. the other ~~two~~ timers.

* The diagram of a LI Timer is



× We have only two (i.e) Input. and the Output.

⑥ Totalizer timer :

In a totalizer timer it counts the total all. It is about the timers. and. different types of timers.

a) To explain about Proportinol, Integral and derivative Control.

Propotinal :-

In the propotinal when the function is nured it get some error in the result.

Integral :-

when Integral is done the error is totally erasied and the result is perfect. But it takes time.

Derivative :-

* Derivative is done to minimize the time factor when the Derivative is done then the time is decreased.

b) PID turing function & Metodi

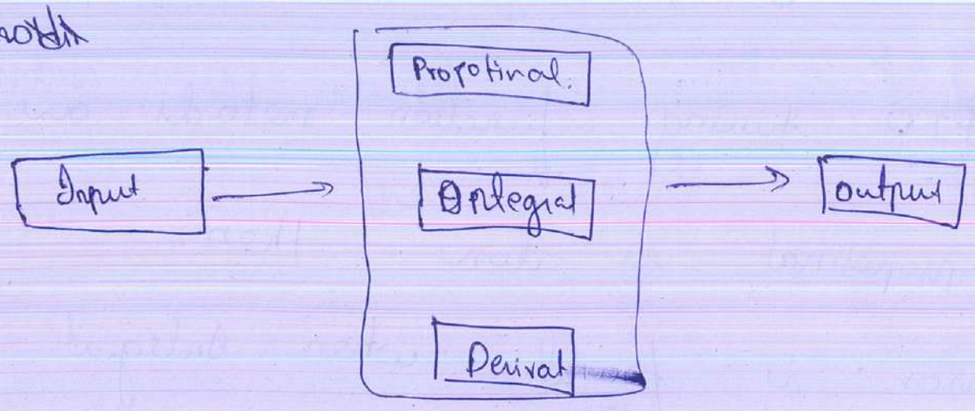
* PID turing function metodi are when propotinal is don then the error is found when Integral is done then error is minimized when the Derivative is done then the time factor is decreased

methods

PI - No error But more time

PD - error But less time

PID - No error & less time,



This is about PID

① holding registers, Input registers. &.

output registers

② holding Registers

These are between the Input & output pannel. and. are helps in running the function

③ Input registers

The Input registers are the Input holding or the In registers which are used for inputing

tput registers:-

These take the output
ld give to supply the
gisters which hold output is
own as the output registers.

is is about the holding register,
put registers & output registes

(12 Pages)

Gokaraju Rangaraju Institute of Engineering & Technology

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No. 289120

ROLL NO.:	1	5	2	4	1	A	0	2	9	2

CLASS & BRANCH B.Tech, IV yr, EEE-B

NAME K. Madhuri SUBJECT Programmable Logic Controllers

SIGNATURE OF THE INVIGILATOR [signature] DATE: 9-4-2019

SEMESTER	I	II ✓

I	II ✓

MID TERM EXAMINATION

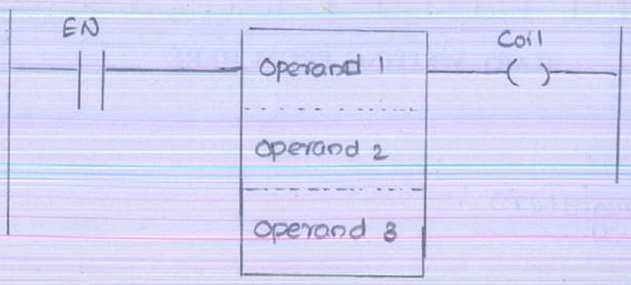
Q.NO.	1		2		3		4		5		TOTAL
	a	b	a	b	a	b	a	b	a	b	
MARKS	5		5		3	2					15

Prof

START WRITING FROM HERE

a) Holding registers :-

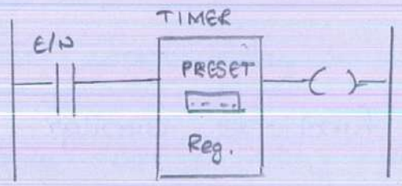
Holding registers are used in arithmetic operations for holding data. There are 16 holding registers. Holding registers are not directly accessible in many PLC's, especially in small PLC's. These are used between input and output registers. It stores the data and gives it to output modules, before it effects output device.

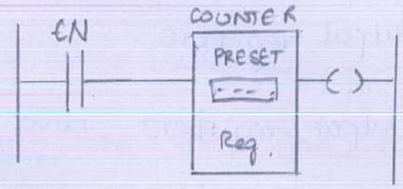


The input register takes the input and stores in operand 1, and 1 or 0 from input register, gets stored in operand 2. The data from holding register is transferred to output, before it effects the output devices.

In arithmetic calculations operand 1 stores input and operand 2 stores holding data.

Holding registers can be used in timers and counters also.

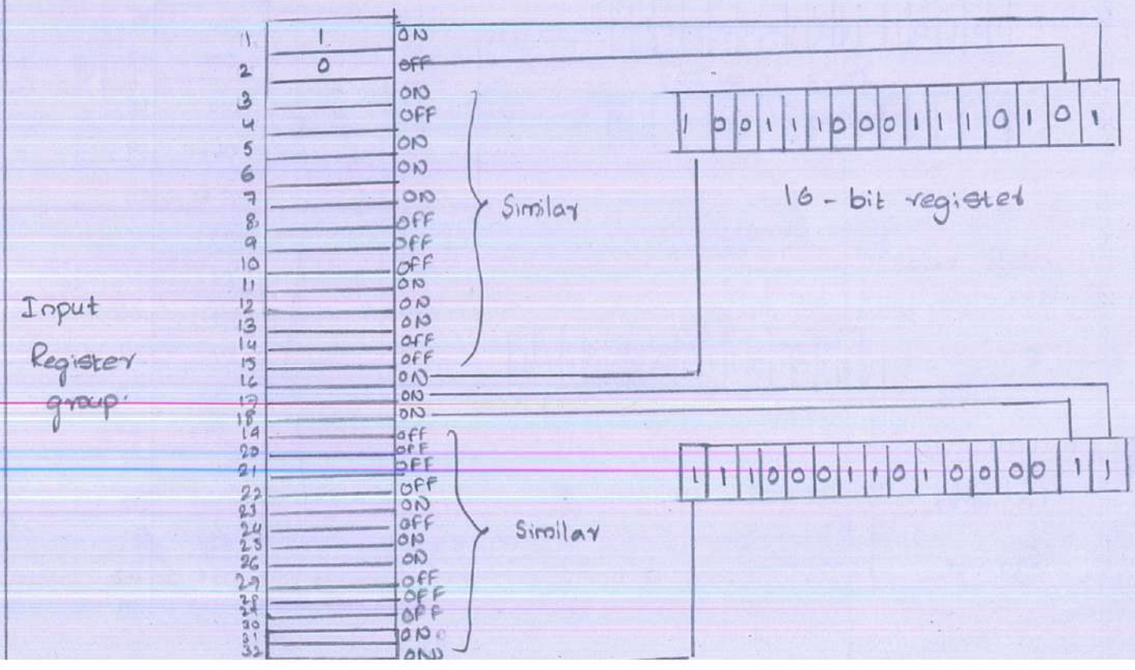




Input Registers :-

Input registers consists of some basic functions similar to holding register except one. They are not readily accessible to their terminals. Generally input registers are $1/10^{th}$ of holding registers in number.

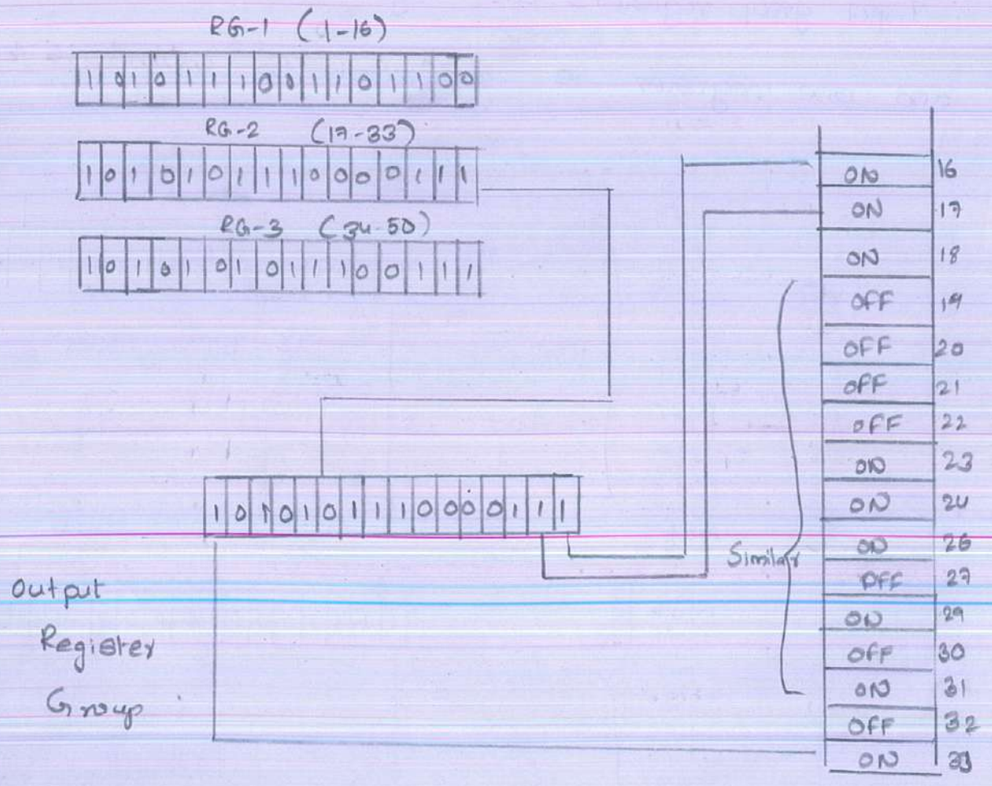
Input group registers are registers consists of 16 bits and one register is sufficient to control 16 bits.



Output registers:-

Output registers have basic functions similar to holding and are readily accessible to their terminals. Number of output registers is equal to input registers.

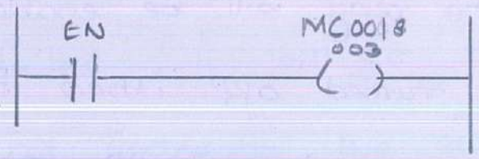
Output group registers are similar to input group registers. They differ in properties in which input registers and output registers differs.



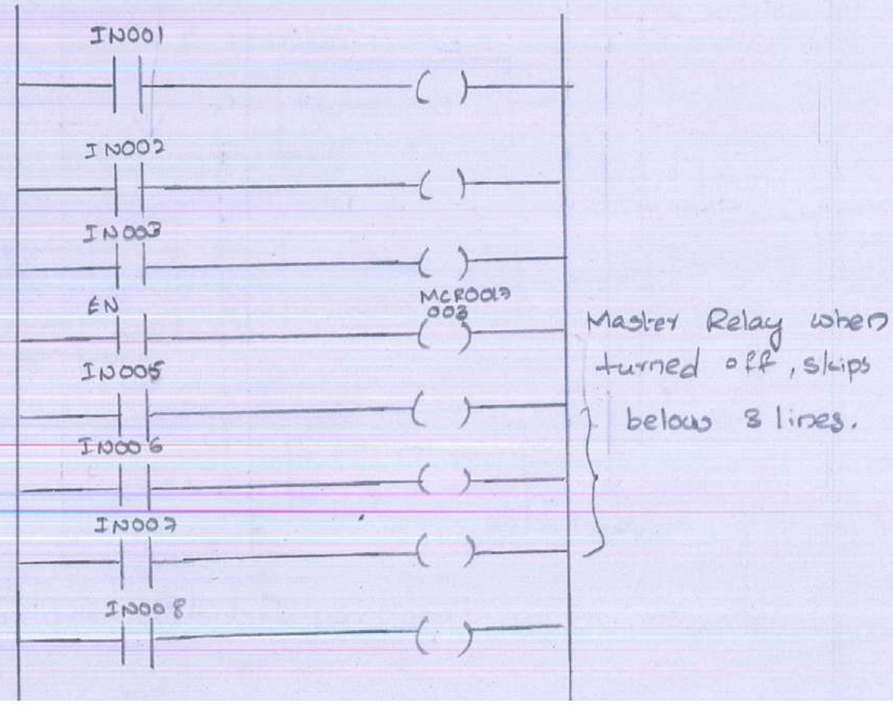
2) a) Master Control Relay :-

Ans:-

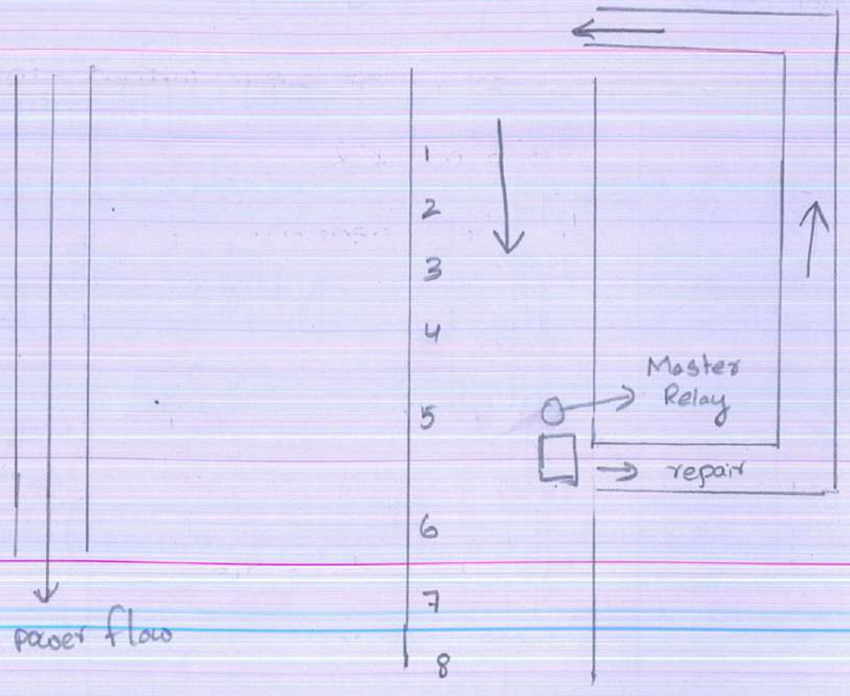
A master control relay is similar to skip (SK) function.



In a ladder logic, master control is used to stop the unwanted lines when needed. It controls all the lines under this in ladder diagram.



The above ladder diagram consists of 8 lines along with a master relay. The relay count is 8. When master relay is enabled, then all the lines under the relay will be enabled. If ~~#~~ master relay is turned off, then the 3lines below the relay gets turned off. Even by enabling them seperately, they will not be turned on, unless and until master relay turns on.

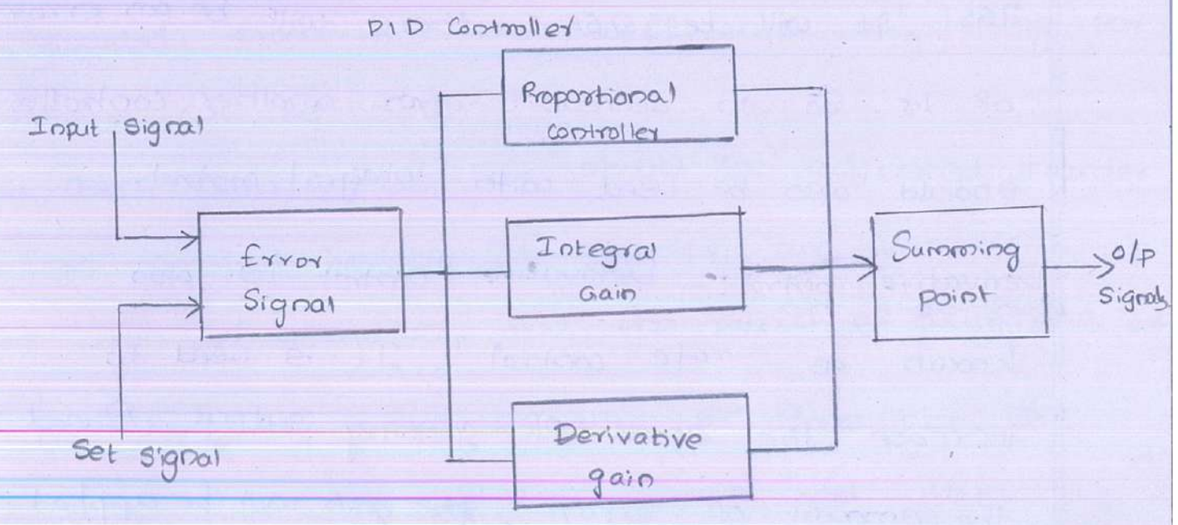


Industrial application.

The industrial application for master relay is shown in fig. In an industrial process, an object has to undergo through 8 steps. During 5th step, it will be checked. If it is failed, it will be sent for repair and it should not undergo the steps 1-5 again, so master ~~does~~ disables 1-5 lines. It undergoes processing from 6th step. This is the industrial application of master relay.

3. a)

Ans:-



Proportional ~~Gra~~ Control:- Proportional contro is also known

as "ratio control". It increases the output by multiplying the input with proportions of error. If input is 750 and the set signal is 765, then the error will be 15, when it is multiplied with a proportion, then its error should be reduced to zero, but with proportion control alone it is not possible.

Integral Control:- Integral control changes the output in integrals. If the output after integral control is 765, but it will not be 765, it will be 766.5. there will be an error of 1.5. So to decrease error, another controllers should also be used with integral control.

Derivative control:- Derivative control is also known as "rate control". It is used to increase the speed of getting output. Based the amount of error, the gain will be applied to get the correct output.

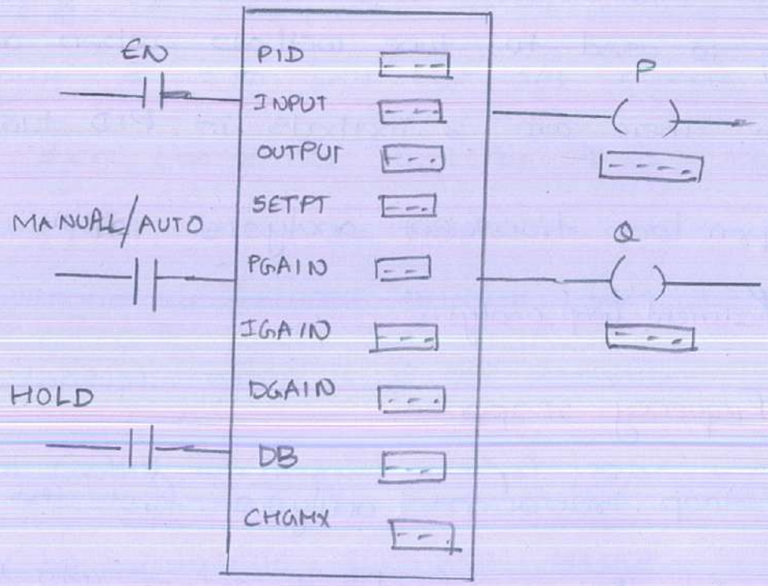
Thus all P, I, D controllers should be used together

b) PID Tuning function and methods:-

PID tuning is used to tune methods, when are they are online. There are 3 methods in PID tuning.

1. Open loop transcient analysis.
2. Recurrent loop analysis.
3. Frequency response.

* In open loop transcient analysis, first the loop should be opened, such that no feed back enters into it, A small adjustment or change should be made and change should be recorded. from this the coefficients of tuning parameters can be obtained.
* In second method, the loop should be adjusted inorder to get constant variable. It requires two variables, the gain of operation and the period of oscilations.
* In frequency response, the Bode plot is used to find the straight graph and the loop should be opened.



PID Function.

(12 Pages)

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No. 289598

ROLL NO.:	1	5	2	4	1	A	0	2	B	8

CLASS & BRANCH B.Tech IV EEE-B

NAME TRIPTA GHARAI SUBJECT PLC

SIGNATURE OF THE INVIGILATOR _____ DATE: 9/4/19

SEMESTER	I	II ✓

I	II ✓

MID TERM EXAMINATION

Q.NO.	1		2		3		4		5		TOTAL
	a	b	a	b	a	b	a	b	a	b	
MARKS	4		2				2				8

Rad

START WRITING FROM HERE

1a) Holding Registers

Holding registers are used to hold any contents of arithmetic, logic or calculation. These registers are ~~used to~~ usually present in the middle of the CPU.

Serial Input	Input Register	Holding registers	Output Register	Serial Output

Input is given to the input registers in the form of 0's and 1's. After calculation is performed the registers pass the information to holding registers.

→ These holding registers keep the information till the information is about change

→ These holding registers are mainly used in timers and counters.

→ In timers the preset values are stored in some registers. The counting takes place at holding registers.

→ In counters the preset values are stored in some registers. The counting is done in holding registers.

Input Registers

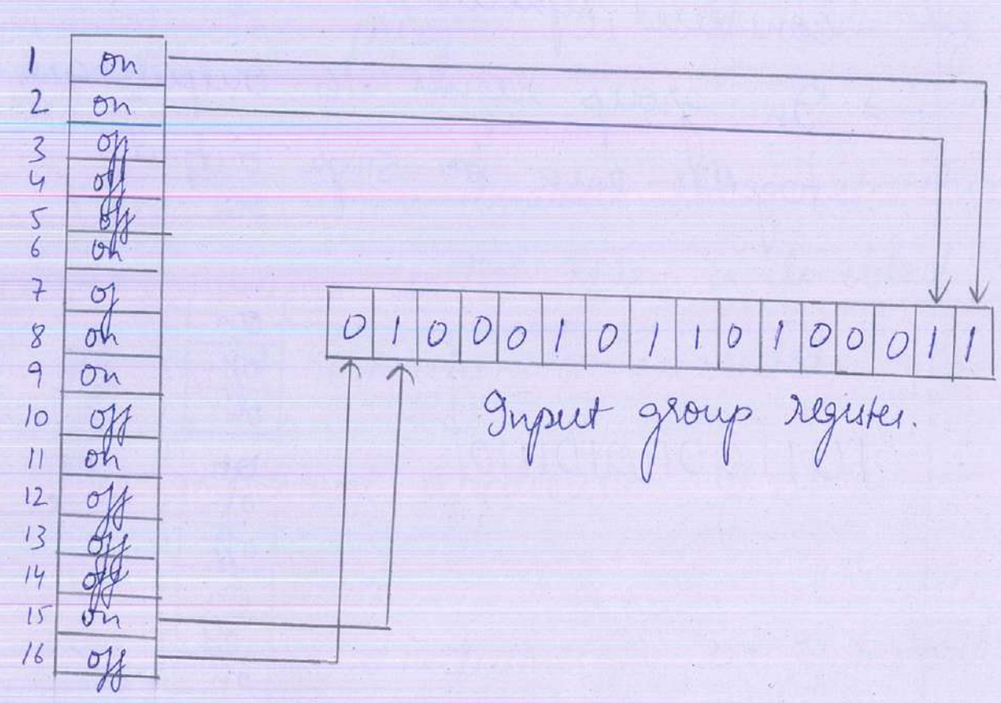
→ Input registers can be single or group. Input registers are mainly used to store the input.

→ Group registers are similar to input registers.

→ In single registers each and every input is considered separately.

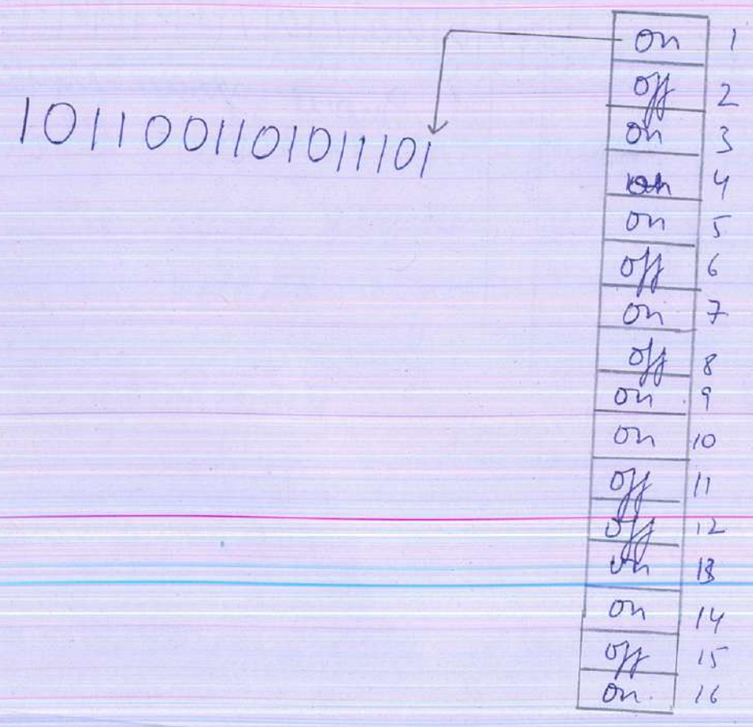
→ In group register 16 inputs are combined together to give one input.

→ Group registers are more efficient as they occupy less space and can be easily manages



Output Registers

→ Output registers can be single or group.
→ They are mainly used to store output.
→ Output group register is similar to output registes.
→ In output register each and every output is considered separately.
→ In group registes 16 outputs are given together as a ~~be~~ single output



2a) Master Control Relay

Master Control Relay is an important tool in programmable logic controller.

If master control relay is enabled all the contents and instructions are disabled.

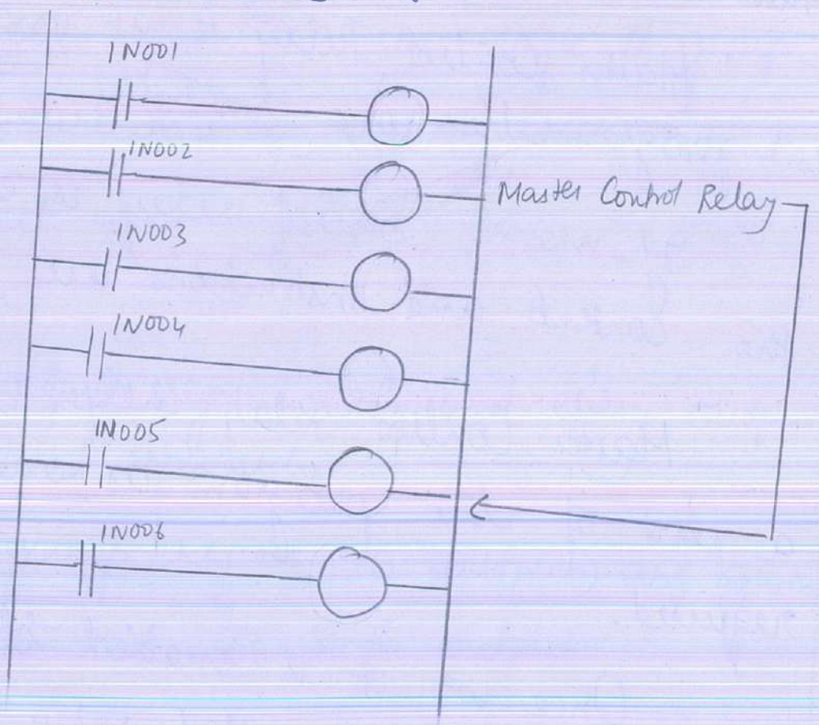
Master Control Relay helps in avoiding a part of the program as and when ~~req~~ required.

Once ~~be~~ it is enabled the instructions after the master control relay is disabled and the next instruction is executed.

One important application of it is in industries.

Suppose in industries a set of instructions has to be avoided because of some reasons then instead of stopping those particulas steps one by one, a single master relay can stop those procedures together. This is

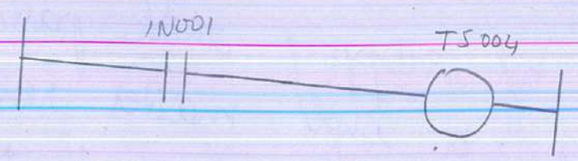
time saving and very efficient.



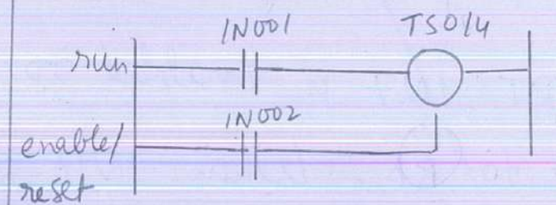
4) Timers

Timers can be single output or dual output.

Timers with single output are called non-recurrent timers.



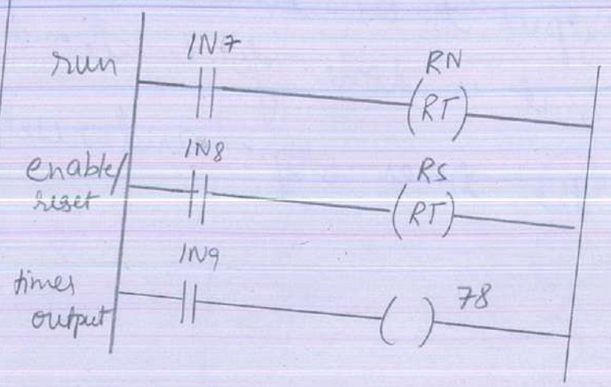
In single ~~input~~ output timers ~~the~~ when the timer is energized, it is done for 4 second After 4 second the timer stops and resets to zero.



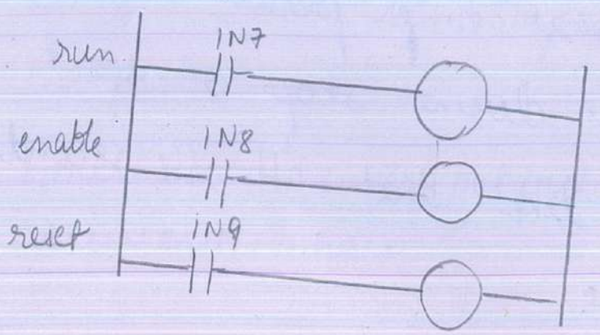
Block diagram

→ In block diagram timer the timer is energized when it is enabled. ~~and~~ Suppose it is enabled for 6 seconds. But the timer time period is 14 seconds. So the timer doesn't ~~stop or~~ reset. It remains like that till 14 seconds and then resets.

→



In this time RT IN7 is enabled to RN RT IN8 is enable to RS. When IN7 is turned on timer turns on. ~~When~~ If it deenergizes the timer doesnt turn off until enable is turned on. The timer output gives the value of the timer.



In this type the enable and reset are separate.

(12 Pages)

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ROLL NO.:	1	5	2	4	1	A	0	2	7	1

D. 289111

SS & BRANCH 4th btech EEE

ME CH SAI MADHUBABU SUBJECT PLC

NATURE OF THE INVIGILATOR [signature] DATE: 9/04/19

SEMESTER	I	II

I	II

MID TERM EXAMINATION

Q.NO.	1		2		3		4		5		TOTAL
	a	b	a	b	a	b	a	b	a	b	
MARKS	2						0				2

Prof

START WRITING FROM HERE

Holding registers:

Input output modules processing which includes programmable output, power supply. A file type Consists of set of terminals. These set of terminals are divided in to the group numbers.

The modeling of I/o is divided into five hierarchy starting with the file and ending with the terminal no.

i) file : it designates the input and output value.

ii) file type : it describes particular input or output.

iii) Rack no : The output or inputs are divided into Racks.

iv) ~~terminal~~ group : It is divided into set of groups

v) terminal_no : It express a bit address as a terminal.

Input registers :

The registers which holds the input value with a group of terminals as a rack is called as input registers.

Output registers :

The registers which holds the output value with group of terminals as a rack is called as output registers.

4a. The timers are divided into different types. They are:

1) Ac timer

2) B/H timer

(3) Tripta Ghara EEE-B

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II **(Objective)**
PROGRAMMABLE LOGIC CONTROLLER
Code: CR15A4030

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 B 8

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device.
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
   [C]
2. Proportional control is also known as
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
   [A]
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
   [C]
4. A single input timer is called
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
   [A]
5. Integral control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
   [B]
6. An OR function implemented in ladder logic uses
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
   [D]
7. A register that holds the contents of a calculation, arithmetic or logic
   A. Input register
   B. Output register
   C. Holding register
   D. General register
   [C]
8. Derivative control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
   [C]
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
   [A]
10. Which function sets all the bits in a register or word to zero
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR
    [D]

(3)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II **(Objective)**
PROGRAMMABLE LOGIC CONTROLLER
Code: CR15A4030

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 7 1

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device. [a]
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
2. Proportional control is also known as [b]
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is [b]
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
4. A single input timer is called [a]
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
5. Integral control is also known as [c]
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
6. An OR function implemented in ladder logic uses [D]
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
7. A register that holds the contents of a calculation, arithmetic or logic [c]
   A. Input register
   B. Output register
   C. Holding register
   D. General register
8. Derivative control is also known as [A]
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals [C]
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
10. Which function sets all the bits in a register or word to zero [D]
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR

(4)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II **(Objective)**
PROGRAMMABLE LOGIC CONTROLLER
Code: CR15**A4030**

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 4 b

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device.
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
   [b]
2. Proportional control is also known as
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
   [b]
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is
   A. MCR
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   C. JUMP
   D. ONS
   [b]
4. A single input timer is called
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
   [a]
5. Integral control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
   [a]
6. An OR function implemented in ladder logic uses
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
   [d] c
7. A register that holds the contents of a calculation, arithmetic or logic
   A. Input register
   B. Output register
   C. Holding register
   D. General register
   [c]
8. Derivative control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
   [c]
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
   [b]
10. Which function sets all the bits in a register or word to zero
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR
    [d]

(4 1/2)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II **(Objective)**
PROGRAMMABLE LOGIC CONTROLLER
Code: CR15**A4030**

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 9 2

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device. (B)
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
2. Proportional control is also known as (B)
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is (B)
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
4. A single input timer is called (A)
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
5. Integral control is also known as (A)
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
6. An OR function implemented in ladder logic uses (D)
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
7. A register that holds the contents of a calculation, arithmetic or logic (C)
   A. Input register
   B. Output register
   C. Holding register
   D. General register
8. Derivative control is also known as (C)
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals (B)
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
10. Which function sets all the bits in a register or word to zero (D)
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR

4

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2018-19**
Year: **IV**
Semester: **II**

MID Exam – II **(Objective)**
PROGRAMMABLE LOGIC CONTROLLER
Code: CR15**A4030**

Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 0 4

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device.
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
2. Proportional control is also known as
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
4. A single input timer is called
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
5. Integral control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
6. An OR function implemented in ladder logic uses
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
7. A register that holds the contents of a calculation, arithmetic or logic
   A. Input register
   B. Output register
   C. Holding register
   D. General register
8. Derivative control is also known as
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
10. Which function sets all the bits in a register or word to zero
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR

4

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
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Date: **09/04/2019 (AN)**
Duration: **20 min**
Max Marks: **05**

Roll No: 1 5 2 4 1 A 0 2 1 9

Note: Answer all the questions. All questions carry equal marks.

1. An example of BCD Output device. [B]
   A. Solenoid value
   B. Relay
   C. Stepper Motor
   D. Digital display
2. Proportional control is also known as [B]
   A. Reset control
   B. Ratio control
   C. Rate control
   D. PID Control
3. Function which allows a portion of a PLC program to be bypassed when its coil is enabled is [B]
   A. MCR
   B. SKIP
   C. JUMP
   D. ONS
4. A single input timer is called [A]
   A. Non-retentive timer
   B. Retentive Timer
   C. ON Delay Timer
   D. OFF Delay Timer
5. Integral control is also known as [A]
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
6. An OR function implemented in ladder logic uses [C]
   A. Normally closed contacts in series
   B. Normally closed contacts in parallel
   C. Normally open contacts in series
   D. Normally open contacts in parallel
7. A register that holds the contents of a calculation, arithmetic or logic [C]
   A. Input register
   B. Output register
   C. Holding register
   D. General register
8. Derivative control is also known as [C]
   A. Reset Control
   B. Ratio Control
   C. Rate Control
   D. PID Control
9. Which function is used when wish to scan through a program or portion of a program at fixed intervals [B]
   A. FAL
   B. SWEEP
   C. ONS
   D. CLR
10. Which function sets all the bits in a register or word to zero [D]
    A. FAL
    B. ONS
    C. SWEEP
    D. CLR

Programmable Logic Controllers (PLC)

Unit-1 Assignment

1. List out the advantages and disadvantages of PLC over Relay logic circuits.
2. Show the block diagram of PLC system Layout and Connection. Describe every component of the layout.
3. Draw and explain the schematic input modules of PLC.
4. Draw and explain the schematic output modules of PLC.
5. Explain how a PLC CPU Power Supply functions, show with a neat block diagram.
6. Discuss about the programming formats of PLC.
7. Describe the limitations for proper construction of Ladder diagrams.

Programmable Logic Controllers (PLC)

Unit-2 Assignment

1. There are two machines, each with its own start-stop buttons. Only one may run at a time. Construct a circuit / PLC ladder with appropriate interlocking.
2. Explain the Industrial process application of a Spray Process system with its layout diagram, algorithm and PLC ladder diagram. Show a tabular form listing the inputs and outputs used.
3. List examples of any five Input Analog devices; explain with their operation, advantage and disadvantages.
4. Explain the semiautomatic drill press operation with its Layout diagram, algorithm and PLC Ladder diagram. Mention in a tabular format the inputs and outputs used in this process.

Programmable Logic Controllers (PLC)

Unit-3 Assignment

1. Explain different types of Registers used in PLC CPU. Also explain the format of Module Addressing with a suitable example.
2. Discuss how holding registers are used in timers and counters?
3. What is Module Addressing? Explain.
4. Discuss in detail about holding registers, input registers and output registers.
5. Discuss some major counter functions used in PLC programming.
6. Discuss briefly the arithmetic and trigonometric functions used in PLCs.
7. Describe the format and working of different types of Timers with diagrams.
8. Describe the format and working of different types of Counters with diagrams.
9. Give a brief description for the following PLC functions, also show their format representation: ADD; SUBTRACT; DIVIDE; MULTIPLY; REPETITIVE CLOCK; SQUARE ROOT.
10. Program a PLC for binary to BCD and BCD to binary conversions.
11. Show the format and explain the working of PLC number conversion functions for converting numbers from binary to decimal and vice-versa.

Programmable Logic Controllers (PLC)

Unit-4 Assignment

1. Describe PLC sequencer functions with an example of its applications.
2. Explain the Master Control Relay function with an application.
3. What are the advantages of Matrix functions?
4. How Skip and Jump functions are be implemented in PLC ladder diagram?
5. Describe the function of PLC for a process requiring the nesting of two subroutines.
6. Obtain a PLC program for Flashing Arrow Movement using Shift Register applications.

Programmable Logic Controllers (PLC)

Unit-5 Assignment

1. Explain the block diagram of the PID module.
2. How is PID controller tuned in a PLC control loop?
3. Explain different methods of PID tuning. Also show the format of typical PID function block in PLC.
4. Explain the working, with a neat block diagram of the format for PLC Arithmetic functions: ADD, SUBTRACT, DIVIDE and SQUAREROOT.
5. Describe the following Data Handling functions: FIFO, FAL, ONS and SWEEP.

CODE: GR15A4030 | GR 15 | SET - 4

IV B. Tech II Semester Regular Examinations, Apr/May 2019
Programmable Logic Controllers
(Electrical and Electronics Engineering)

Time: 3 hours **Max Marks: 70**

PART – A
Answer ALL questions. All questions carry equal marks.

*****

10 * 2 Marks = 20 Marks

1). a	What does Central Processing Unit (CPU) of PLC consists?	[2]
b	List three types of Programming Equipment available.	[2]
c	Mention various PLC Programming input instructions.	[2]
d	What are different Logic Gates used in Boolean Algebra Programming?	[2]
e	State three advantages of using Programmed PLC Timers.	[2]
f	List out few characteristics of PLC Registers.	[2]
g	List out few advantages of Matrix Functions.	[2]
h	What are Sequence Functions?	[2]
i	Define PID Tuning.	[2]
j	Mention few Analog applications of PLC.	[2]

PART – B
Answer any FIVE questions. All questions carry equal marks.

*****

5 * 10 Marks = 50 Marks

2.	Explain about the construction of PLC Ladder diagrams.	[10]
3.	Discuss about the operational procedures in PLC Programming.	[10]
4.	Explain briefly about number comparison functions and number conversion functions.	[10]
5.	Explain in detail about controlling of Two Axis and Three Axis Robots with PLC.	[10]
6.	a) Explain in detail about purpose of analog signal processing and multi bit data processing. b) Explain about the PID functions.	[6] [4]
7.	a) Explain briefly about the architecture of a PLC System. b) Explain briefly about Drill Press Operation.	[10]
8.	a) Write about the Master Control Relay Function with an application. b) Explain the block diagram of the PID Module.	[10]

*****

Programmable Logic Controllers

Apr/May 2019 - key

PART- A

1) a) What does Central processing Unit (CPU) of PLC consists?

Ans: The CPU of PLC consists of

1) Microprocessor (Processor)
2) Memory
3) Power Supply

b) List three types of programming equipments available?

Ans: Three types of programming equipments are

1) Hand-held
2) Palm-size Units with dual-function keypads
3) Liquid Crystal Display (LCD) or LED Window.

c) Mention various PLC programming input Instructions.

Ans: Various PLC programming input instruction are

→ Normally open contact
→ Normally closed contact
→ Latch/unlatch system.
→ Differentiation UP, or rising-edge actuation
→ Differentiation down, or falling-edge actuation.

d) What are the different logic Gates used in Boolean Algebra Programming?

Ans :- Logic Gates used in Boolean Algebra Programming are

→ AND
→ OR
→ NOT
→ NAND
→ NOR

e) State three Advantages of using programmed PLC Timers.

Ans: Advantages of using Programmed PLC Timers:

→ PLC Times are more versatile and flexible
→ Its time may be a programmable variable time as well as a fixed time.
→ Its timer accuracy, repeatability and reliability are extremely high.

f) List out few characteristics of PLC registers.

Ans:→ Internal registers help the control, and arithmetic and logic units within the processor to carry out their tasks.

→ Accumulator registr, data registers, index registers, condition code register, scratch pad registers, and instruction registers all work to temporarily store data, which in turn is used to facilitate the carrying out of programmed functions
→ External registers are designated to hold variable information.

g) List out few advantages of Matrix functions

Ans: Advantages of Matrix functions:-

→ The matrix function eliminates the complication by enabling to do a large number of comparisons or logic operations in a concise and orderly manner.

→ PLC Matrix function involves only 1's and 0's.

→ PLC matrix function does not involve even multiplication.

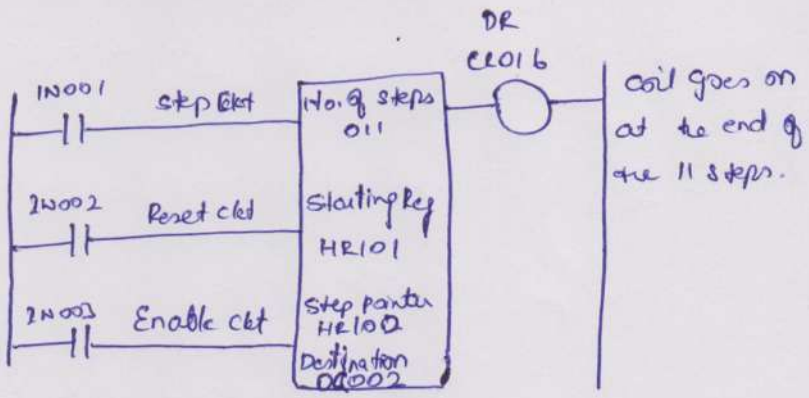
h) What are Sequence Functions?

Ans: Sequencer function has three inputs:

→ Step circuit

→ Reset circuit

→ Enable circuit



The Sequencer function block is programmed with four pieces of information.

→ Number of steps to be sequenced through.

→ Starting Register used for the sequence.

→ Step pointer location, an HR that shows which step you are on.

→ ~~Desig~~ Destination is the OG register.

i) Define PID Tuning?

Ans. PID Tuning refers to the adjustment of the systems modes.

→ Such tuning must be done online, i.e while the processing is running.

J) Mention few analog applicatrom of PLC:

As Analog application of PLC are.

→ Analog IN / discrete OUT

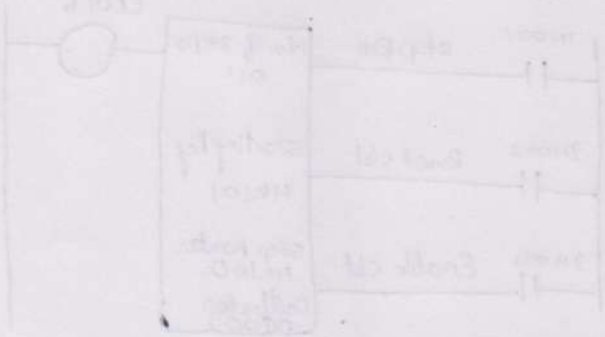
→ BCD IN / discrete OUT

→ Analog IN / Analog or BCD OUT

→ BCD IN / BCD or Analog OUT

→ Two Analog IN / Two Analog OUT.

→ Two BCD IN / Two Analog OUT.

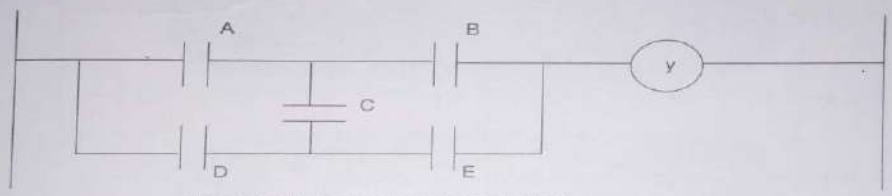


PART-B

2. Explain about the construction of PLC Ladder Diagrams.

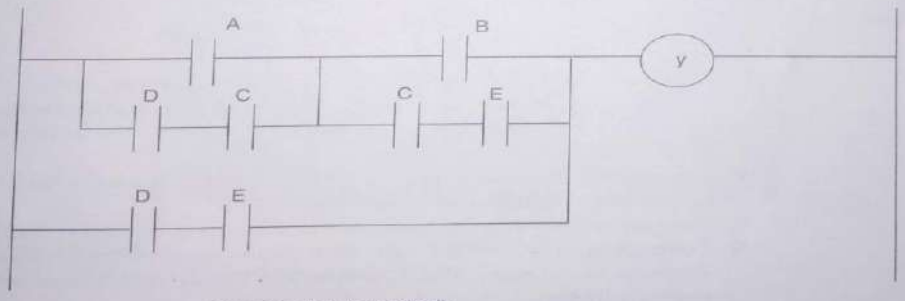
Construction of PLC Ladder Diagrams:

1. A contact must always be inserted in slot 1 in the upper left (see figures 3–6 through 3–10).



No vertically oriented contacts allowed

(a)



One solution to vertically oriented contact problem

(b)

FIGURE 3–6
Proper PLC Ladder Diagrams

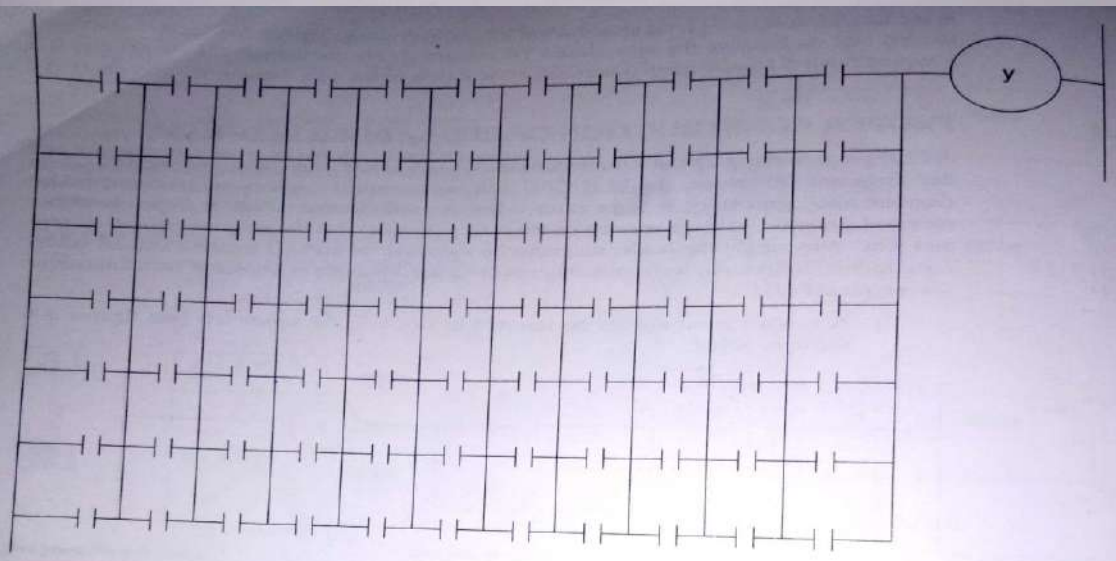


FIGURE 3–7
Contact Matrix

2. A coil must be inserted at the end of a rung (see figure 3-6b).
3. All contacts must run horizontally. No vertically oriented contacts are allowed. In figure 3–6a, contact C is programmed incorrectly. The ladder diagram in figure 3–6b represents one solution to the problem.
4. The number of contacts per matrix (network) is limited—for example, 11 across by 7 down (see figure 3–7).
5. Only one output may be connected to a group of contacts (see figure 3–7).
6. Contacts must be "nested" (a branch circuit programmed within a branch circuit) properly or, in some PLCs, not at all. Figure 3–8 shows one manufacturer's required format.
7. Flow must be from left to right (see figure 3–9).
8. Contact progression should be straight across (see figure 3–10).

Again, the individual operational manuals contain information on the proper programming of a given PLC system.

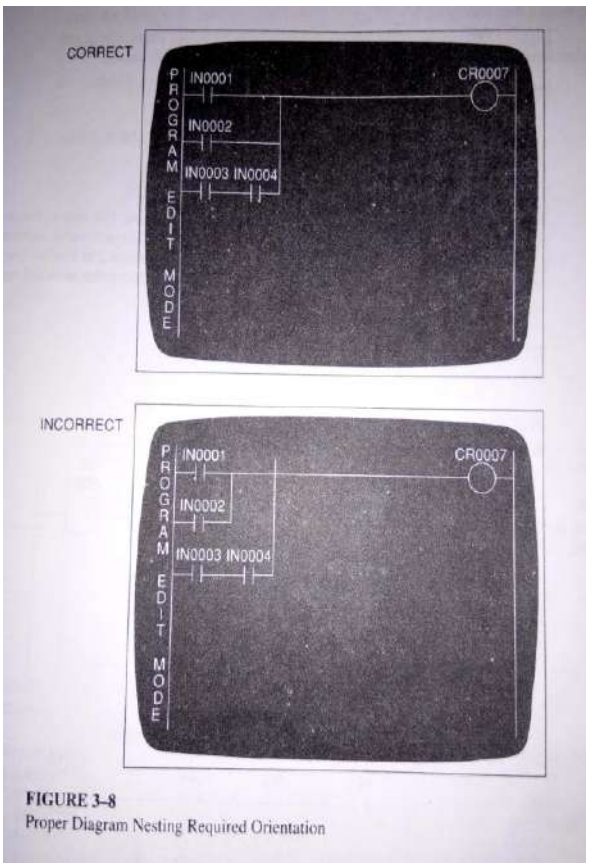


FIGURE 3–8
Proper Diagram Nesting Required Orientation

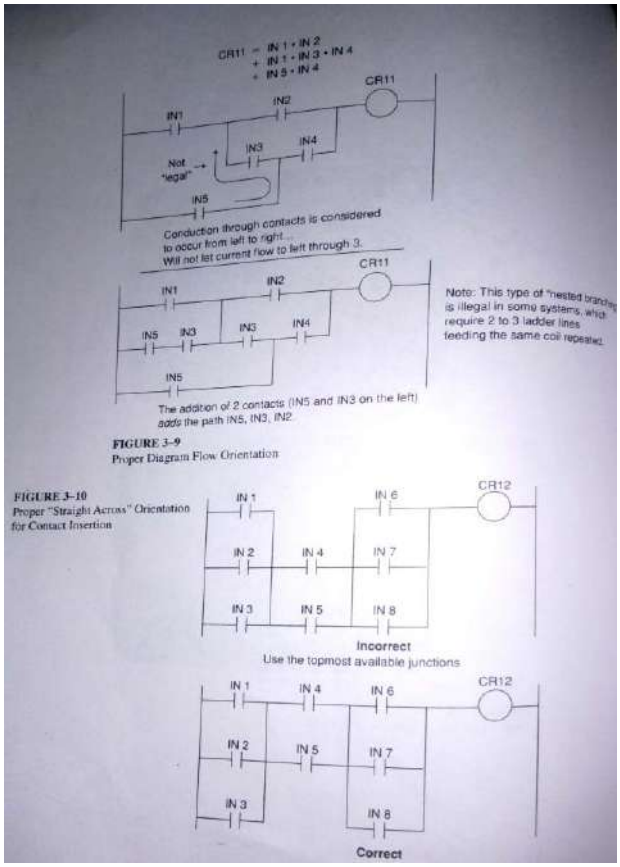


FIGURE 3–9
Proper Diagram Flow Orientation

FIGURE 3–10
Proper "Straight Across" Orientation for Contact Insertion

3. Discuss about the operational procedures in PLC Programming.

OPERATIONAL PROCEDURES

A simple program will indicate how to begin utilizing a PLC. Suppose that you wish to program and connect a PLC to accomplish the following discrete operational procedure: A relay coil is to actuate when two toggle switches and one limit switch are actuated.

The first step is to assign individual PLC identification numbers to the inputs and outputs. Inputs normally have the prefix I or IN. Outputs normally have the prefix O or CR

(control relay). The following numbers could be assigned:

Switch 1 for relay	IN001
Switch 2 for relay	IN002
Limit switch for relay	IN003
Relay output	CR001

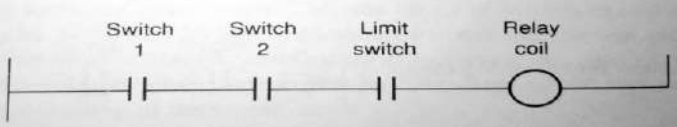
Next, sketch a ladder logic diagram to represent the operational circuit. This is shown in figure 5–5.

Next, figure out how the inputs and outputs will be connected to the input and output modules. Assume an eight-terminal input module and an eight-terminal output module. It is necessary to set the module switches so that the modules recognize signals as inputs 1 through 8 and outputs 1 through 8. The connections from the inputs and outputs then are made according to figure 5–6. Note that each component is connected to one of the modules. No external interconnections are made.

Finally, the ladder program must be entered into the CPU by means of the keyboard. A general procedure for entering the program in ladder format is

1. Clear the PLC program memory with the CPU on Stop. The procedure will be outlined on a screen menu or in the operation manual for the PLC.

FIGURE 5–5
Ladder Logic Diagram for Relay Output



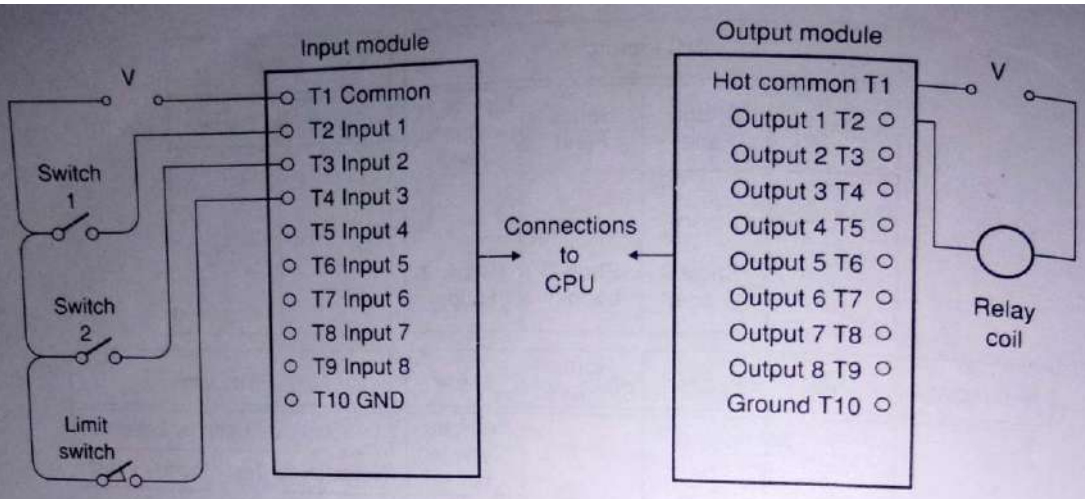
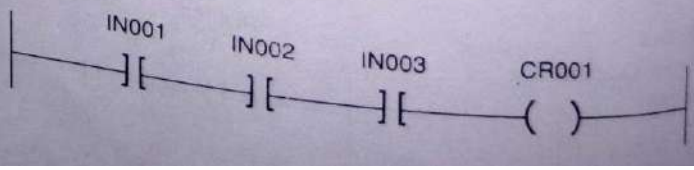


FIGURE 5–6
Connection Diagram for Figure 5–5 Circuit

2. Insert the relay control line as follows, in the EDIT mode:
   a. Push the NO contact key.
   b. Push the Input key.
   c. Push 001 numeric keys.
   d. Push the Enter key. The contact should appear on the monitor.
   e. Move the cursor one space to the right.
   f. Repeat steps a and b.
   g. Push the 002 numeric keys.
   h. Push the Enter key. The second contact should appear on the monitor.
   i. Move the cursor one more space to the right, and repeat the process for 003.
   j. Continue the line to the right.
   k. Push the Coil/output key. The coil should appear on the monitor.
   l. Push 001 numeric keys.
   m. Push Enter.
   n. If the line now looks correct (check it), push the Insert ladder key and then Enter.

The resulting PLC diagram should look as shown in figure 5–7. When the PLC switch is set to Run, the circuit will operate as outlined.

FIGURE 5–7
PLC Screen Ladder for Figure 5–5 Circuit



4. Explain briefly about number comparison functions and number conversion functions.

Number Comparison Functions:

PLC BASIC COMPARISON FUNCTIONS

Many PLCs have only two COMPARE functions: equal, and greater than or equal to. To perform any one of the other four functions (not equal, less than greater than, and less than or equal to), combinations of the basic two are used. Some PLCs have all six individual functions, which makes programming easier. Of course, some less-expensive PLCs do not have COMPARE functions at all.

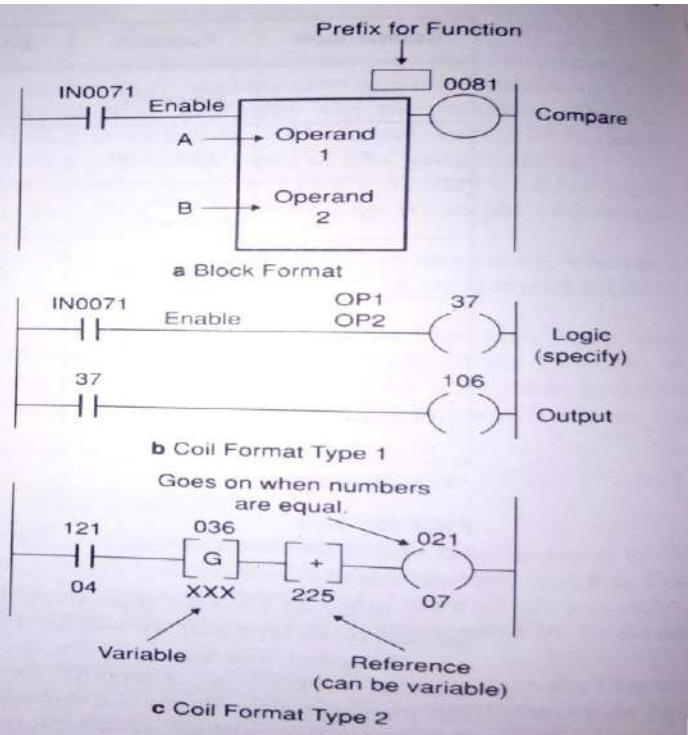
Figure 12–1 shows a table of comparison functions. Functions 1 and 3 are the two basic functions that we have discussed. The other four are derived functions. The six direct functions for PLCs having them in their programming capability are listed on the right side of the table.

Let's take an example of each COMPARE function. Assume that A, the standard for comparison, is placed in operand 2. A is set at 182. Then B, the number to be compared to A, will be placed in operand 1. We are therefore comparing the value of B to the value of A, 182.

1. Equal (EQ) is true only if B is exactly 182 also.
2. Not equal (NE) is true if B is 181 or less, or if B is 183 or more.
3. Greater than or equal to (GE) is true only when B is 182 or less.
4. Less than (LT) is true only when B is 183 or more.
5. Greater than (GT) is true only when B is 181 or less.
6. Less than or equal to (LE) is true only when B is 182 or more.

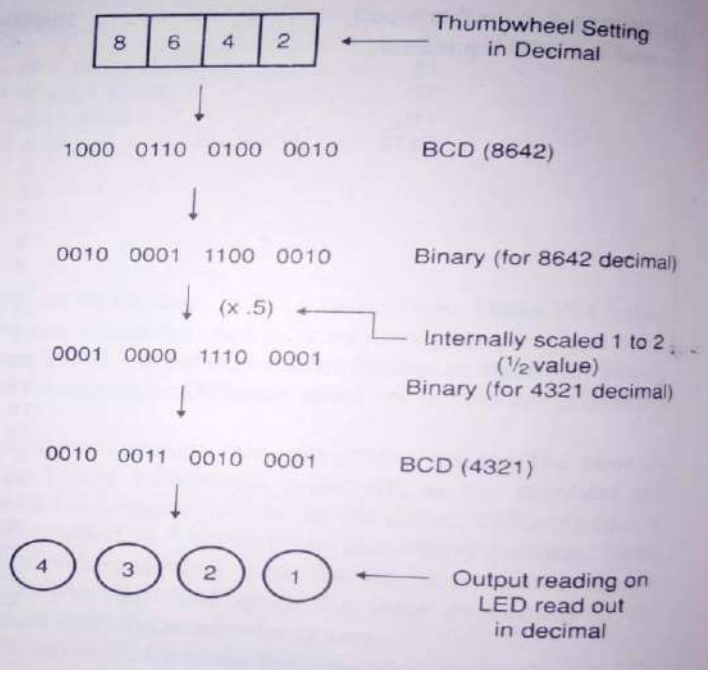
In actual operation, A might be a varying number, not a fixed value of 182. Later chapter examples illustrate how it may be changed periodically.

FIGURE 12–2
Typical PLC COMPARE Functions



Number Conversion Functions:

FIGURE 13–7
BCD-to-Binary and Binary-to-BCD PLC Processing



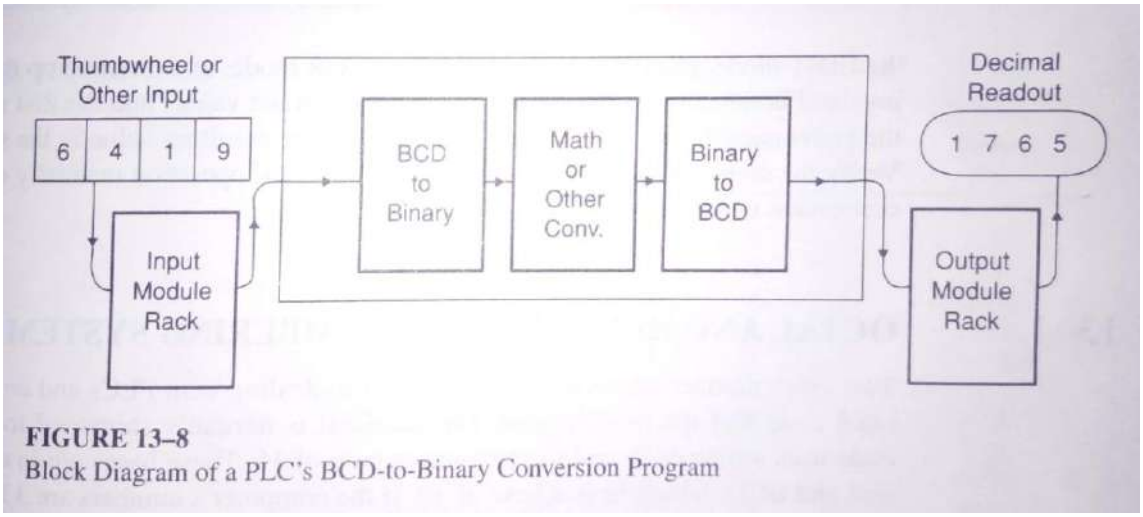


FIGURE 13–8
Block Diagram of a PLC's BCD-to-Binary Conversion Program

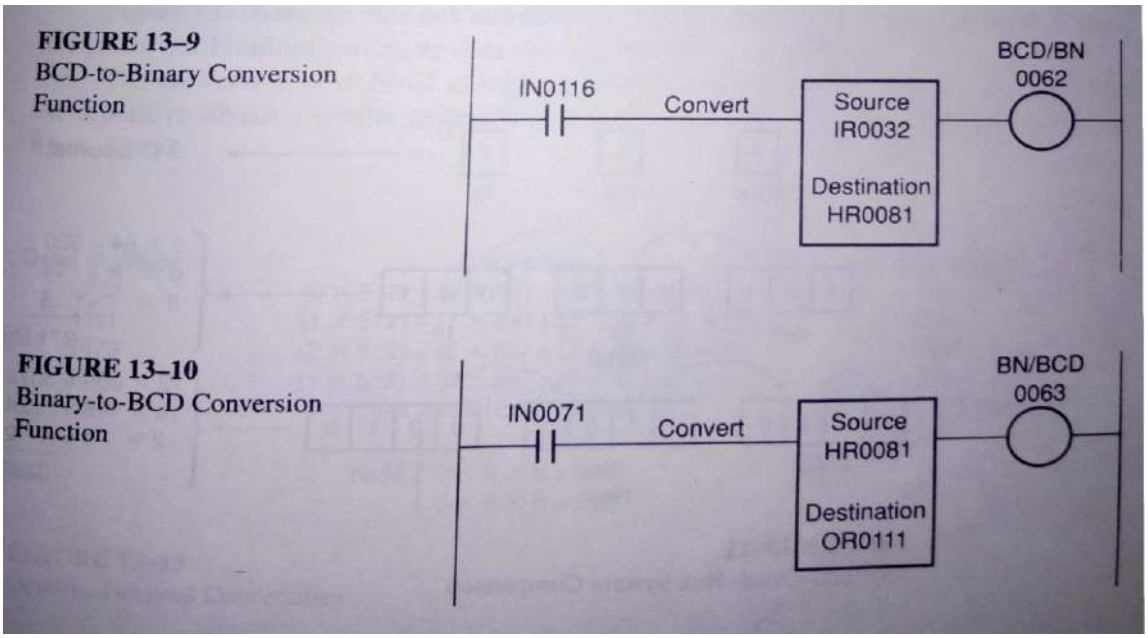


FIGURE 13–9
BCD-to-Binary Conversion Function

FIGURE 13–10
Binary-to-BCD Conversion Function

5. Explain in detail about controlling of Two Axis and Three Axis Robots with PLC.

TWO-AXIS ROBOT:

BASIC TWO-AXIS ROBOT WITH PLC SEQUENCER CONTROL

We progress through two schemes of controlling the basic pick-and-place robot shown in figure 20–1. We use switches first, and then a drum controller/sequencer. The robot used for illustration starts operating from the position shown, which is the "at-rest," lower-left, initialized position. The step-by-step sequence of operation to move a part from position A to position B is as follows:

1. Arm is initially in the down-left position as shown. Gripper is open and not extended.
2. Arm moves to upper position.

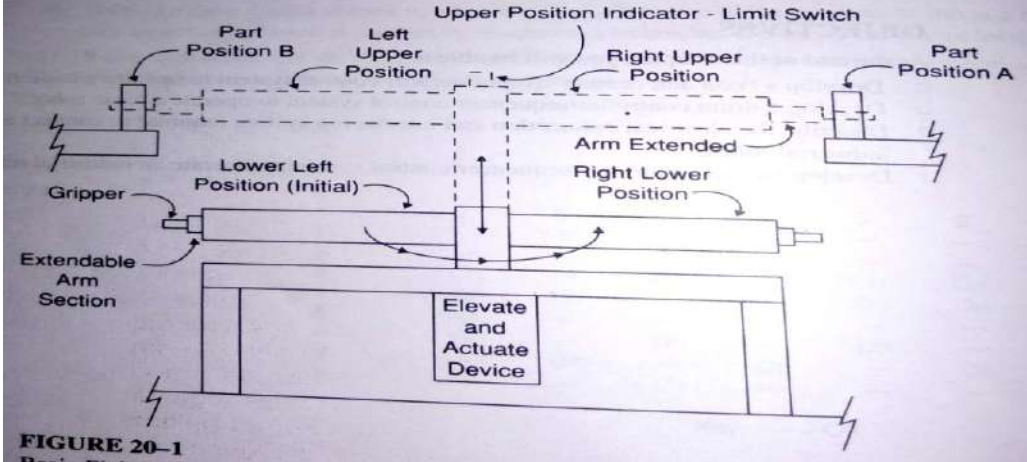


FIGURE 20–1
Basic Pick-and-Place Robot

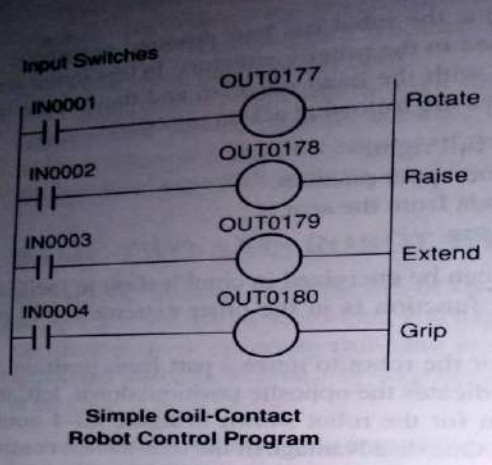
3. Arm rotates to right.
4. Hand extends to position A.
5. Gripper closes, gripping part.
6. Arm swings back to the left to position B.
7. Gripper opens, releasing part.
8. Hand retracts.
9. Arm lowers to the initial position.

For illustration, assume that the robot has four powered pneumatic solenoids. If all solenoids are off, no air is applied to the robot's actuators. In this initial position, the robot is in the lowered, left position with the hand retracted and the gripper open. Energizing each of the four solenoids causes the following action to occur:

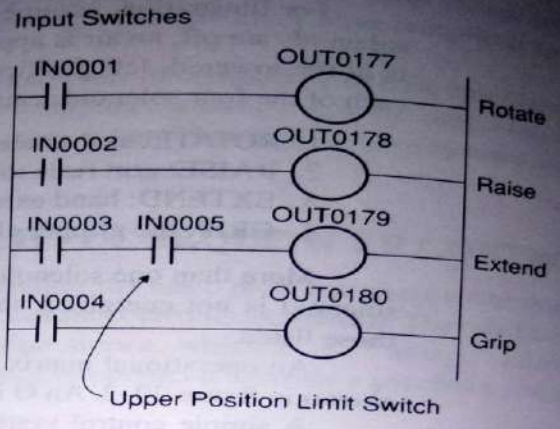
1. ROTATE: arm rotates full right.
2. RAISE: arm rises to the upper position.
3. EXTEND: hand extends from the arm.
4. GRIP: the gripper closes.

FIGURE 20–2
Part Movement Robot Operational Matrix

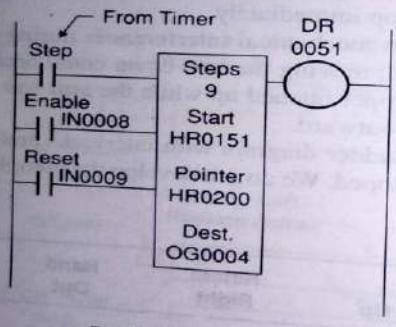
Step	Up	Rotate Right	Hand Out	Grip Close
Initialized	O	O	O	O
1	X	O	O	O
2	X	X	O	O
3	X	X	X	O
4	X	X	X	X
5	X	O	X	X
6	X	O	X	O
7	X	O	O	O
8	O	O	O	O



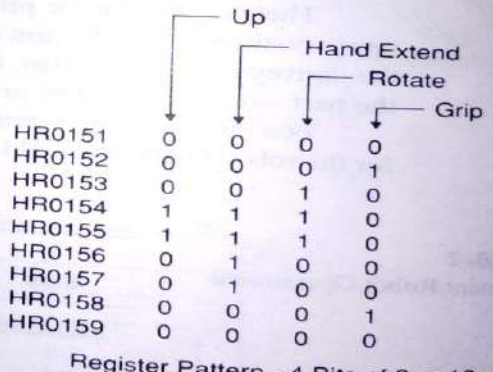
Simple Coil-Contact Robot Control Program



Coil-Contact Robot Control Program with Interlock



DR/SQ Robot Control Function



DR/SQ Robot Control Register Patterns

FIGURE 20–3
PLC Program for Robot Control

THREE-AXIS ROBOT:

INDUSTRIAL THREE-AXIS ROBOT WITH PLC CONTROL

An industrial-type robot is shown in figure 20–7. It has various motion and gripping capabilities similar to those in figure 20–1, namely:

1. Arm moves up or down, elevate.
2. Arm rotates 180 degrees.
3. Gripper rotates 180 degrees.
4. Gripper opens and closes.
5. Gripper extends and retracts.
6. Slide left or right, 5 stations—2 ends, 3 intermediate.

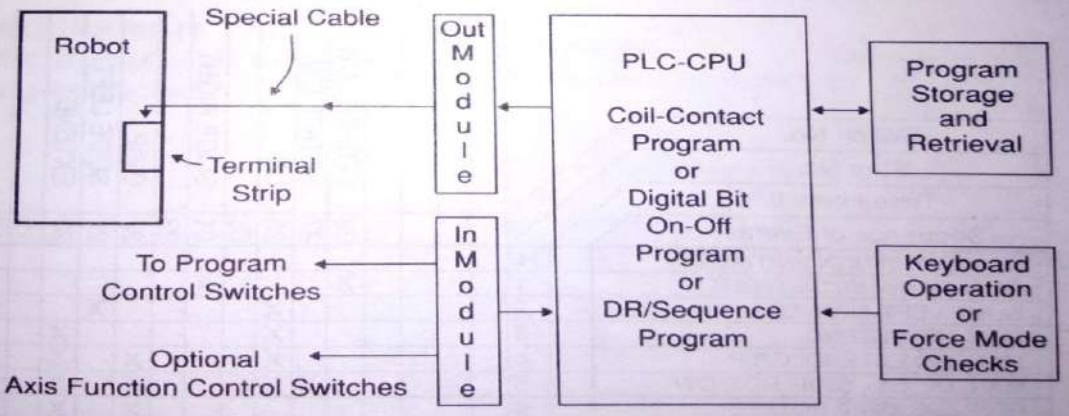


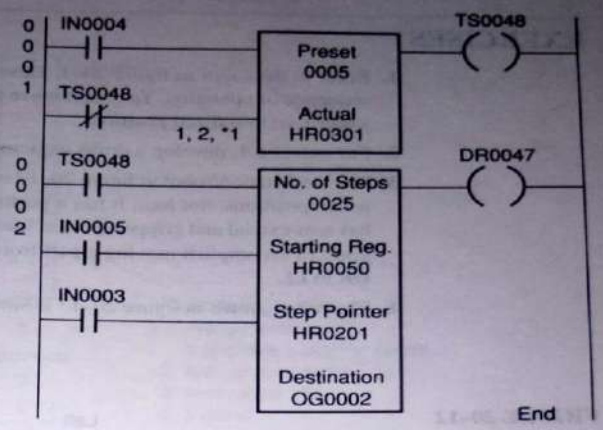
FIGURE 20–9
Robot-PLC Control System Block Diagram

Switch No. / Step No. / Time Interval / Sequence of Events		28 ROTATE CCW	27 ROTATE CW	26 UP	25	24 SLIDE RIGHT	23	22 GRIP	21 SLIDE LEFT	20 EXTEND	19	18	17 GRIP ROTATE
HOME POSITION (INITIALIZE)	H												
ROTATE CW SLIDE RIGHT	1	X				X							
SLIDE LEFT, MAN. UP	2			X					X				
MAN. UP, EXTEND	3			X						X			
MAN. UP, EXTEND, GRIP	4			X				X		X			
MAN. UP, EX., GRIP, ROT. CW	5		X	X				X		X			
GRIP, EX., GRIP ROTATE	6							X		X			X
EXTEND, GRIP ROTATE	7									X			X
GRIP ROTATE, MAN. UP	8			X									X
SLIDE RIGHT, MAN. UP	9			X		X							
EXTEND, MAN. UP	10			X						X			
GRIP, EXTEND, MAN. UP	11			X				X		X			
GRIP, EX., MAN. UP, ROTATE CCW	12	X		X				X		X			
GRIP, EXTEND	13							X		X			
EXTEND	14									X			
NEUTRAL POSITION	15												
SLIDE LEFT, GRIP ROTATE	16								X				X
EXTEND, GRIP ROTATE	17									X			X
GRIP, EXTEND, GRIP ROTATE	18							X		X			X
MAN. UP, SLIDE RIGHT, GRIP, EX.	19			X		X		X		X			
MAN. UP, EXTEND	20			X						X			
MAN. UP	21			X									
ROTATE CW, GRIP ROTATE	22		X										X
EXTEND, GRIP ROTATE	23									X			X
GRIP, EXTEND, GRIP ROTATE	24							X		X			X
MAN. UP, GRIP, SLIDE LEFT, EX.	25			X				X	X	X			
	26												
	27												
	28												
	29												
	30												

← Station

FIGURE 20–10
Program Code Sheet for Programmable Logic Controller (Courtesy of TII Robotics)

FIGURE 20–11
PLC Robot Control Program and Register Pattern



HR0050	0000	0000	0000	0000
HR0051	0000	1000	1000	0000
HR0052	0000	0010	0001	0000
HR0053	0000	0010	0000	1000
HR0054	0000	0010	0010	1000
HR0055	0000	0110	0010	1000
HR0056	0000	0000	0010	1001
HR0057	0000	0000	0000	1001
HR0058	0000	0010	0000	0001
HR0059	0000	0010	1000	0000
HR0060	0000	0010	0000	1000
HR0061	0000	0010	0010	1000
HR0062	0000	1010	0010	1000
HR0063	0000	0000	0010	1000
HR0064	0000	0000	0000	1000
HR0065	0000	0000	0000	0000
HR0066	0000	0000	0001	0001
HR0067	0000	0000	0000	1001
HR0068	0000	0000	0010	1001
HR0069	0000	0010	1010	1000
HR0070	0000	0010	0000	1000
HR0071	0000	0010	0000	0000
HR0072	0000	0100	0000	0001
HR0073	0000	0000	0000	1001
HR0074	0000	0000	0010	1001
HR0075	0000	0010	0011	1000

6. a) Explain in detail about purpose of analog signal processing and multi bit data processing.

ANALOG SIGNAL PROCESSING:

PLC ANALOG SIGNAL PROCESSING

The sensor or signaling device that feeds the input module does not usually have the same electrical range as the input module. Its lower-limit electrical value must be matched to the lower-limit electrical value of the input module. The input's upper-limit signal value must also be matched to the upper-limit electrical value of the input module by using an intermediate signal conversion. Similarly, the output module and the outputs must have their signals appropriately matched by a converter. Intermediate values must also be linearly matched by the converters for both input and output.

The input signals available have to be converted and scaled to match an available module. For example, you have a signal that varies from 0 V to 78 VAC, with 78 V representing 100 percent input voltage. You decide to use a 0–5 VDC input module. Therefore, you must convert 0–78 VAC to a linear 0–5 VDC, as shown in figure 22–4. The DC voltage fed from the converter into the module is then converted to a digital number. This digital number is sent from the analog module to an input register in the CPU, as shown in the figure.

How does the input conversion work? For illustration, trace 31 VAC. The converter analyzes the portion of 78 that 31 represents. This is 0.397. The converter, which you must design and supply, puts out a DC voltage that is this proportion of 5 VDC. This DC value, 1.987 V, is sent to the input module. Assume that the input module is an 8-bit base, which can hold a value up to 256 in decimal. The input module then takes this same proportion of 256, 102, and sends the value to a CPU input register. Which register receives the data, 102, depends on the setting of DIP switches on the module.

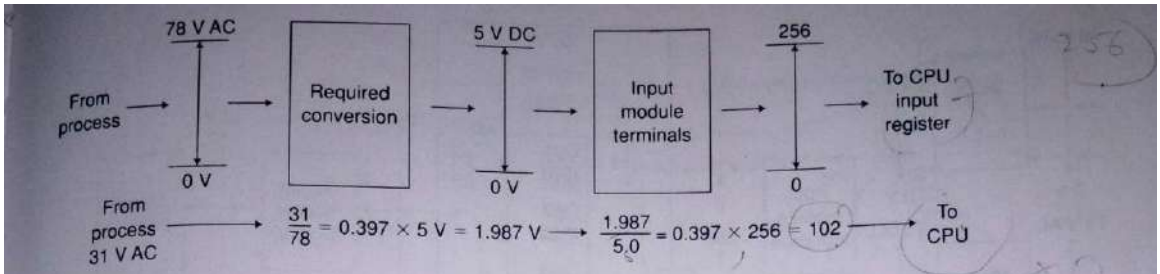
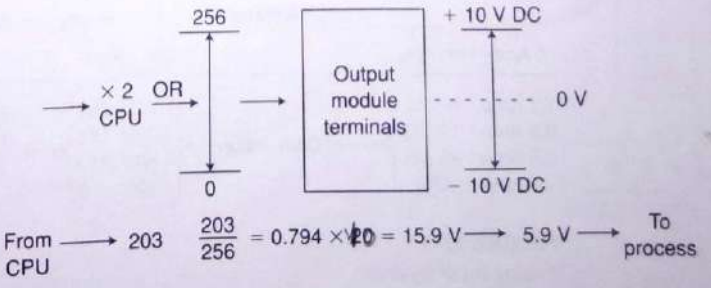


FIGURE 22–4
Analog Input Signal Path and Values

Note that the input is stepped, in 256 steps, and is not perfectly linear when the CPU receives data. The accuracy of this system is $1/256 = 0.0039$, or about 0.4 percent. Other, more accurate, input modules of 10 and 12 bits can be obtained, at greater cost, if needed in your application. These would have 1024 and 4096 steps, respectively.

How does the output signal get from the CPU to an output analog device? Figure 22–5 shows an output system. For illustration it is assumed that the signal in figure 22–4 was multiplied by 2 in the CPU. The output ratio is then 0.794, as shown in figure 22–5. This would be 203 on the 256-step scale. Assume that there is an output module feeding an op amp device with a range of −10 V, to +10 V. The math shown indicates that the output would have a value of 5.9 VDC.

FIGURE 22–5
Analog Output Signal Path and Values



MULTIBIT DATA PROCESSING:

BCD OR MULTIBIT DATA PROCESSING

BCD data is handled like analog data. Figure 22–9 shows a block diagram of how BCD devices and data are used by the PLC. The input and output devices are mathematically matched directly by the input and output modules. No conversion of values is required because the input and output devices are built to match the modules directly. In this

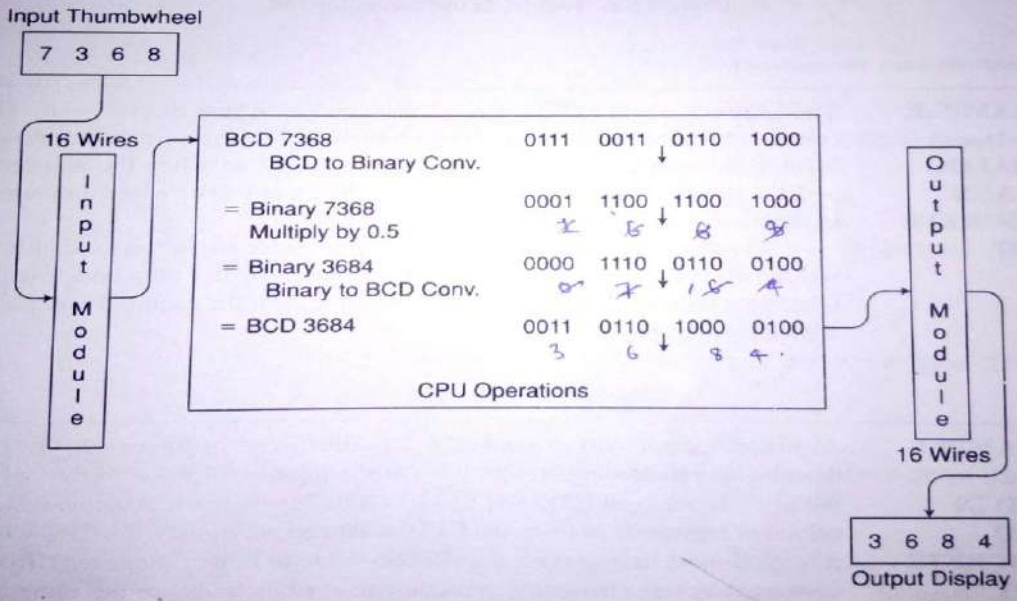


FIGURE 22–9
BCD (Multibit) Input and Output System

illustration, the input number is entered directly from thumbwheels. The input data is scaled to half for the output indicator. The resulting half value is sent to the output device, a four-digit, seven-segment display. Since the CPU does math in binary, appropriate BCD and binary conversions are carried out as shown. The illustration in figure 22–9 shows multiplying by 0.5. Alternatively, you could divide by 2 and obtain the same result.

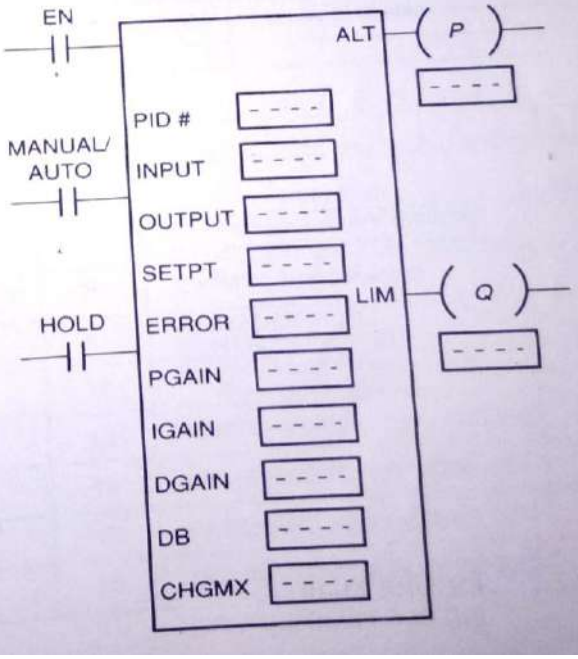
b) Explain about the PID functions.

TYPICAL PID FUNCTIONS

Figure 23–8 is a representative loop control PID function. This function controls a PID function that is not shown. A loop identifying number is specified in the block. Update time in the block is also specified. This time in seconds (i.e., 15 seconds) is the interval controlling the update procedure frequency. Coil P goes on when the function is enabled. Coil Q goes on when the update time is reached for one scan.

A typical PID function of intermediate complexity is shown in figure 23–9. Some PLCs combine the previously shown loop control function with the PID function. This example is for the PID function alone.

FIGURE 23–9
Typical PID Function



Functional Descriptions and Values

PID number: the PID block identification number
INPUT: the register in which the process variable is stored
OUTPUT: the register in which the output algorithm is stored
SETPT: the register in which the set point is stored
ERROR: the register in which the value of ERROR = (SETPT – INPUT) is stored
DB: the register for the deadband value
CHGMX: the register in which the maximum allowable rate of change is stored
PGAIN: the register in which proportional gain is stored
IGAIN: the register in which the integral term is stored
DGAIN: the register in which the proportional term is stored

Most of the functions in the block are written as a percentage of the set point. The block values may be programmed as constants or moved in from other registers. DB, dead-band, is effectively the tolerance you can live with for the process (in percent). The last three functional block inputs are adjusted for tuning the system in operation for optimum process control.

7. a) Explain briefly about the architecture of a PLC System.

ARCHITECTURE OF PLC:

OVERALL PLC SYSTEM

Figure 1–4 shows, in block form, the four major units of a PLC system and how they are interconnected. The four major parts, each of which is described later in detail, are

1. *Central Processing Unit (CPU).* The "brain" of the system, which has three subparts:
   a. Microprocessor. The computer center that carries out mathematic and logic operations.
   b. Memory. The area of the CPU in which data and information is stored and retrieved. Holds the system software and user program.
   c. Power supply. The electrical supply that converts alternating current (AC) line voltage to various operational DC values. In the process, the power supply filters and regulates the DC voltages to ensure proper computer operation.
2. *Programmer/Monitor.* The programmer/monitor (PM) is a device used to communicate with the circuits of the PLC. Hand-held terminals, industrial terminals, and the personal computer exist as PM devices. In a hand-held unit, input takes place through a membrane keypad and the display is usually a liquid-crystal display (LCD). With the industrial terminal or personal computer, more complex, typewriter-type keyboards and cathode ray tubes (CRTs) are employed.
3. *I/O Modules.* The input module has terminals into which outside process electrical signals, generated by sensors or transducers, are entered. The output module has terminals to which output signals are sent to activate relays, solenoids, various solid-state switching devices, motors, and displays. An electronic system for

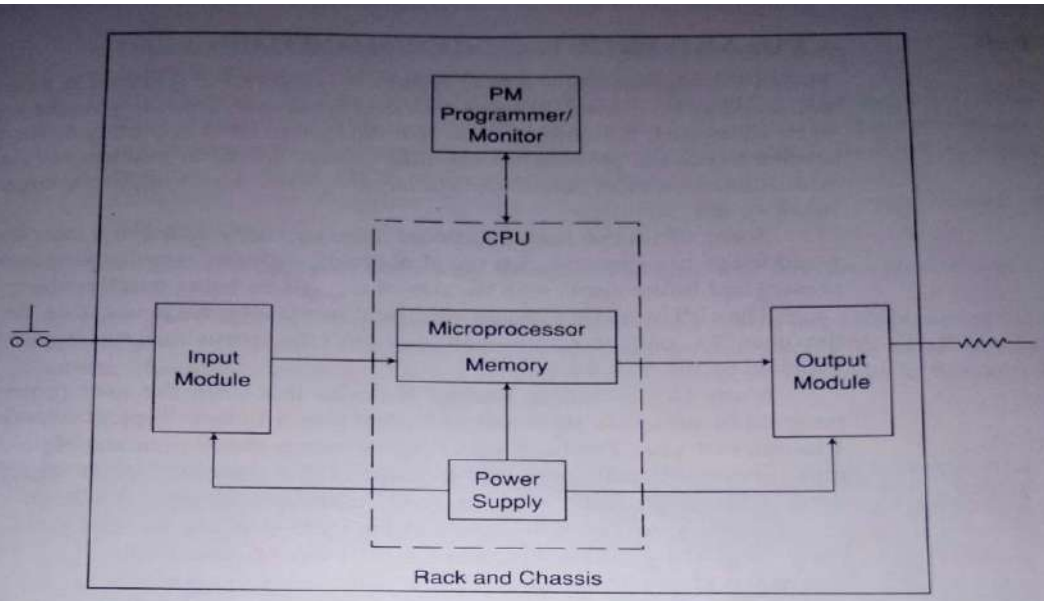


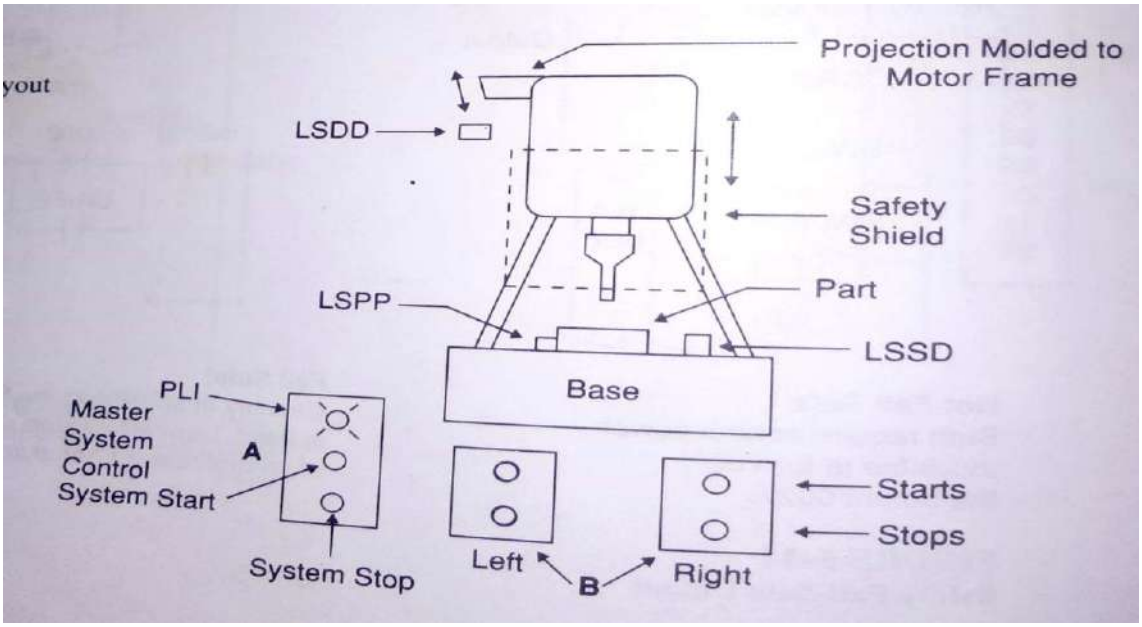
FIGURE 1–4
PLC System Layout and Connection

connecting I/O modules to remote locations can be added if needed. The actual operating process under PLC control can be thousands of feet from the CPU and its I/O modules.

4. *Racks and Chassis.* The racks on which the PLC parts are mounted and the enclosures on which the CPU, PM, and I/O modules are mounted.

b) Explain briefly about Drill Press Operation.

DRILL PRESS OPERATION:



There are a number of procedural steps to go through to arrive at a solution. Previous examples have not been complicated, and we have performed their procedural steps informally. The steps recommended for a problem of this type are:

1. Define the process operation and list the step-by-step sequence of operation.
2. Define and list the input and output devices and sensors required for proper operation.
3. Assign corresponding PLC numbers to the input and output devices.
4. Draw up the PLC scheme. Note that margin notes are helpful.
5. Enter the program into the PLC.
6. Optional step: Check the program sequence by using the FORCE mode. (The FORCE mode is explained in detail in chapter 26.)
7. Wire the PLC system to a simulator and check its operation.
8. Check the actual process operation. Try various out-of-sequence operations to check for hidden safety defects or sequencing problems. For example, what happens if the power fails when the spindle is halfway down?
9. Make modifications as required.

Step one is to list the sequence.

1. Push system start switch.
2. Put part in place to actuate LSPP. (Part in place limit switch.)
3. Push the two start buttons simultaneously.
4. Safety shield comes down, actuating LSSD. (Shield down limit switch.)
5. Drill starts rotating and descends.
6. Drill at bottom actuates LSDD. (Drill down limit switch.)
7. System shuts down. Drill and shield return up by springs.
8. System is reset.

Note that pressing Stop at any time stops the sequence and resets the spindle and safety shield to the top.

Step two is to list the input and output devices.

- System start switch
- System stop switch—stops everything
- System pilot light
- Shield and drill start—left-hand switch
- Shield and drill start—right-hand switch
- Shield and drill stop—left-hand switch
- Shield and drill stop—right-hand switch
- Position indicator—part in place
- Position indicator—shield down
- Position indicator—drill down

Step three is to assign input and output numbers to all components. This includes switches and sensors.

Inputs	Outputs
IN001 System start	OUT017 System pilot light
IN002 System stop	OUT018 Shield down solenoid
IN003 LSPP—part in place	OUT019 Drill rotate motor
IN004 Left start	OUT020 Air solenoid to drill down cylinder
IN005 Right start	
IN006 Left stop	
IN007 Right stop	
IN008 LSSD—shield down	
IN009 LSDD—drill down	

Step four is to sketch the PLC system.

Step five is to load the sketch into the CPU. The ladder diagram formulated is shown in figure 5–16.

A sequence by line for the ladder diagram in figure 5–16 is

- Line A. Push System Start. CR017 goes on.
- Line B. CR017 seals on. PL1 goes on.
- Line C. Put part in place. IN003/LSPP closes. CR017 contact is closed and IN009/LSDD is closed. Pushing the two start buttons, IN004 and IN005 causes CR018, the shield air solenoid, to go on—lowering the shield.
- Line D. CR018 seals through CR018 and IN008/LSSD as the shield goes into place. The two start buttons must be held in the depressed position until the shield is down.

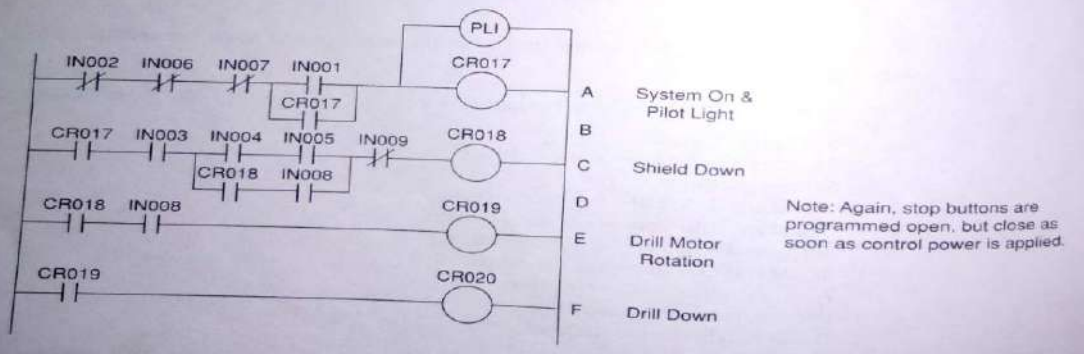


FIGURE 5–16
Drill Press PLC Control Circuit

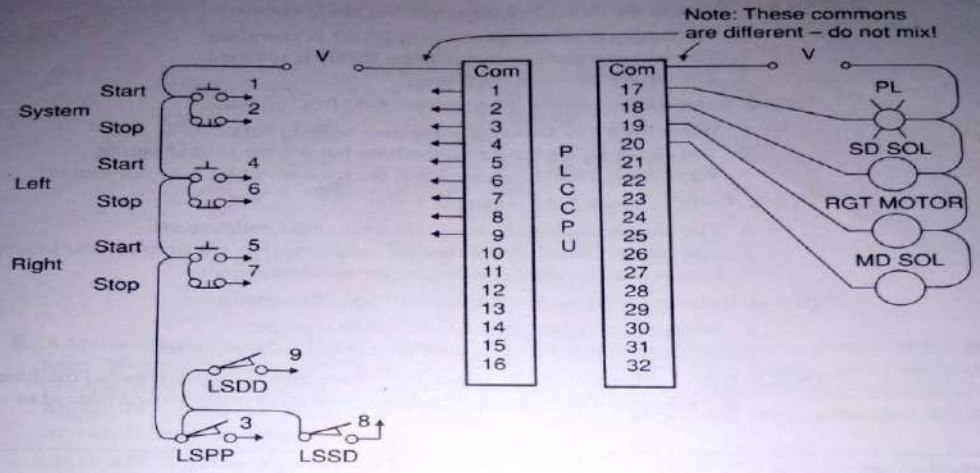


FIGURE 5–17
Input and Output Module Wiring for Drill Press

- Line E. CR019 goes on through CR018 and IN008/LSSD, starting drill motor rotation.
- Line F. Drill goes down, CR020, by another air solenoid, and drills the hole. When the drill reaches the bottom of the hole, IN009/LSDD is actuated, opening the circuit on Line C.
- Reset/Off. CR018 is turned off by the opening of the NC contact, causing the shield to go back up. CR018 going off, in turn turns off the drill motor, CR019, on Line E and the drill down air solenoid, CR020. The system is reset and the part is removed.

Step six is an optional FORCE analysis.

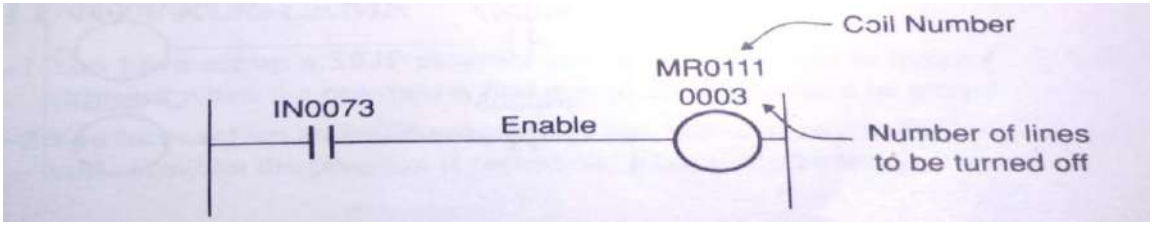
Step seven is to wire the system to a simulator. A wiring scheme appears in figure 5–17. Note the connection diagram's simplicity for the PLC—only five output wires and nine input wires.

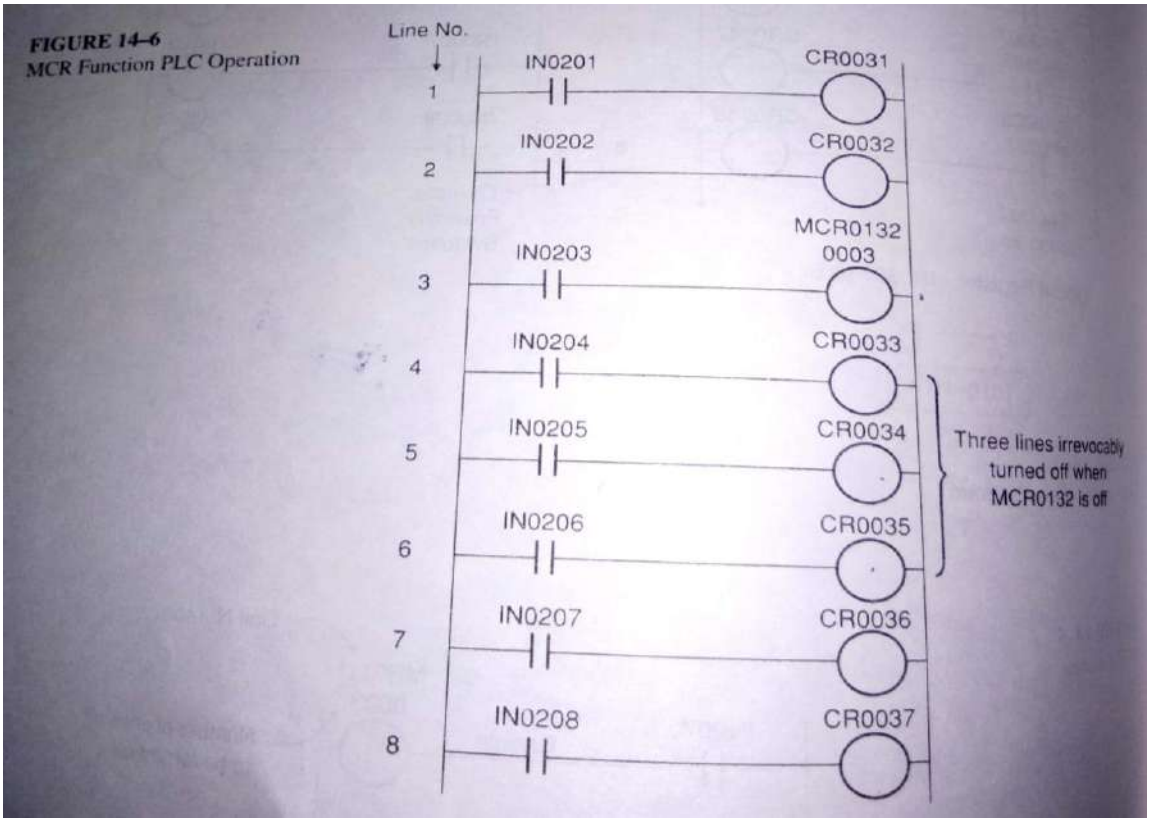
Step eight, circuit operation, and step nine, modifications, would follow after an analysis of the drill press's actual operation.

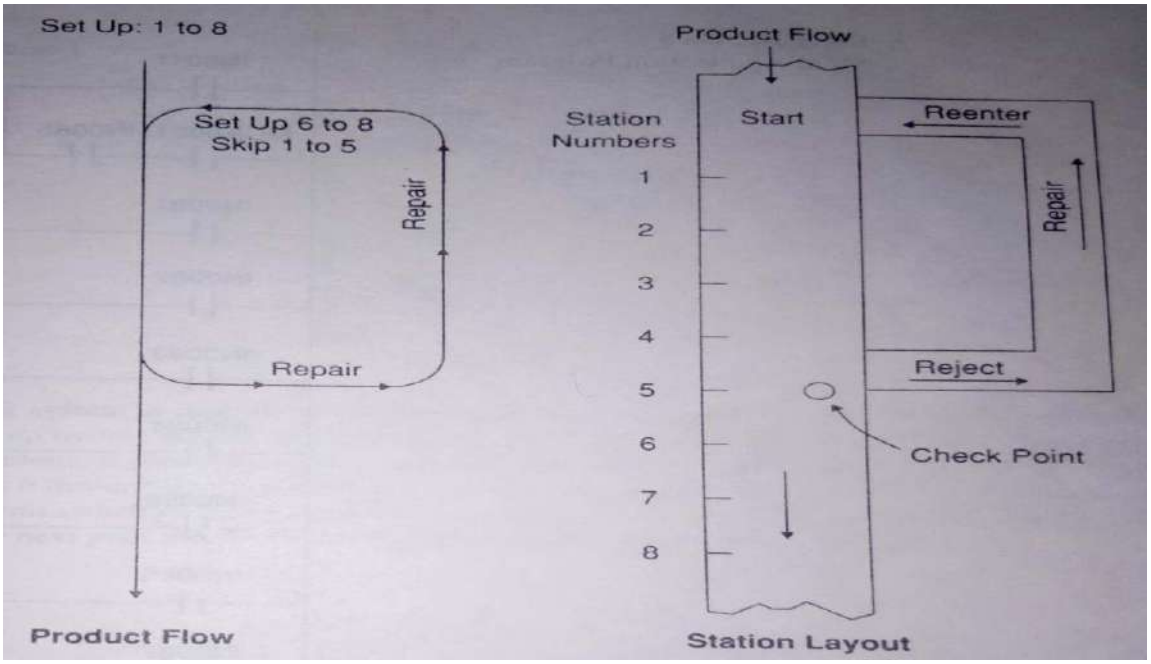
8. a) Write about the Master Control Relay Function with an application.

MASTER CONTROL RELAY FUNCTION:

The MASTER CONTROL RELAY (MCR) function operation is similar to the SK function. Figure 14–5 shows a typical MCR function. When its enable line is energized, it turns on. When MCR is off, the number of following ladder diagram lines specified are







b) Explain the block diagram of the PID Module.

PID MODULES

PLCs often come equipped with PID modules, used to process data obtained by feedback circuitry. Most such modules contain their own microprocessor. Since the algorithms needed to generate the PID functions are rather complex, the PID microprocessor relieves the CPU of having to carry out these time-consuming operations.

To understand the PID module, refer to figure 23–7. The PLC sends a set-point signal to the PID module. The module is made up of three elements: the proportional, integral, and derivative circuits. The *proportional circuit* creates an output signal proportional to the

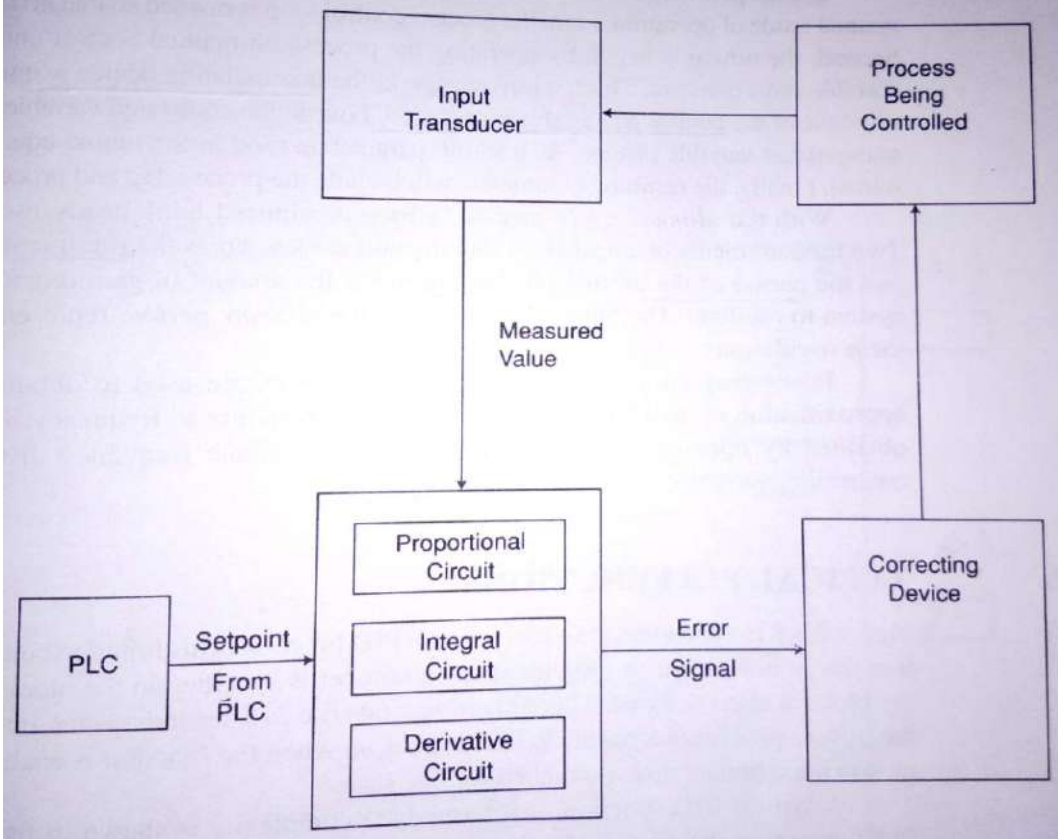


FIGURE 23–7
Block diagram of PID Module

difference between the measurement taken and the set point entered in the PLC. The *integral circuit* produces an output proportional to the length and amount of time the error signal is present. The *derivative circuit* creates an output signal proportional to the rate of change of the error signal.

The input transducer generates an output signal from the process being controlled and feeds the measured value to the PID module. The difference between the set point coming from the PLC and the measured value coming from the input transducer is the error signal. Some sort of correcting device, such as a motor control, valve control, or amplifier, takes the error signal and uses it to control the correction sent to the process being controlled.

********** THE END **********

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

B.Tech EEE IV YEAR-II SEM RESULT ANALYSIS OF 2015-2019 BATCH

ACADEMIC YEAR 2018-2019 TOTAL. NO. OF STUDENTS REGISTERED = 140

Subject	Total No. of students appeared	No. of students passed	No. of students failed	Grade Points							
				<5	5	6	7	8	9	10	Pass percentage (%)
PLC	140	136	04	00	04	10	13	33	39	37	97.14
FACTS	140	135	05	00	00	04	04	33	51	43	96.42
MPE	140	136	04	05	19	17	18	35	31	11	97.14
PLC Lab	140	140	00	00	00	00	00	07	21	112	100
CV	140	140	00	00	00	04	04	05	08	119	100
SEM	140	140	00	00	00	00	00	13	49	78	100
Major Proj.	140	140	00	00	00	00	00	00	00	140	100

Overall pass (passed in all subjects) = 133/ 140(95%)

Faculty

Programmable Logic Controllers	P Prashanth Kumar
Flexible AC Transmission Systems	Dr T Suresh Kumar
Modern Power Electronics	A Vinay Kumar
Programmable Logic Controllers Lab	VVSMadhuri/P Prashanth Kumar
Comprehensive Viva	Dr S V Jayaram Kumar/V Vijaya Rama Raju/ R Anil Kumar/P Prashanth Kumar
Seminar	Dr S V Jayaram Kumar/V Vijaya Rama Raju/ R Anil Kumar/P Prashanth Kumar
Major Project	Dr S V Jayaram Kumar/V Vijaya Rama Raju/ R Anil Kumar/P Prashanth Kumar

ARREARS POSITION – CURRENT YEAR

Description	All pass	One Arrear	Two Arrear	Three Arrears	More than Three Arrears	% of pass
140	133	03	02	02	00	95%

Performance overall Class Three Toppers

ROLL NO.	NAME	(SGPA)
15241A0205 15241A0267 15241A0282 15241A0292 15241A02B3	**Chamakura Apoorva Reddy** **Bathula Sreelekha** **K Supraja Goud** **Koya Madhuri** **Rachuri Sai Teja**	**10**
15241A0284 15241A0285 15241A02B6	Kalakuntla Divya Kalluri Srilatha Songani Keerthi	**9.96**
15241A02B7	**Thanda Shashank**	**9.92**

HOD, EEE

Gokaraju Rangaraju Institute of Engineering & Technology

Electrical and Electronics Engineering

Feedback Report

FeedBack No : 3

Branch : Electrical and Electronics Engineering

Academic Year : 2018-19

Year & Semester : Fourth Year, Second Semester

Subject Name : Programmable Logic Controllers **Faculty Name** : P. Prasanth Kumar

Subject Code : GR15A4030 **Section** : A

S.No	Question	Average
1	How does the teacher explain the subject?	3.44
2	How do you find the language and communication skill of the teacher?	3.46
3	Rate your teacher's regularity / punctuality to the class	3.44
4	Rate your teacher's explanation in clearing the doubts	3.39
5	Rate your teacher's commitment in completing the syllabus	3.46
6	Does the teacher pays attention to all the students?	3.42
7	Rate your teachers use of teaching aids	3.40
8	Is the session interactive?	3.40
9	Rate your teacher's guidence in other activities like Moodle, NPTEL etc	3.46
10	What is the overall opinion about the teacher?	3.39

No of Students given feedback : 57

Overall average : 3.42

Signature of Faculty **Signature of HOD** **Signature of Principal**

Gokaraju Rangaraju Institute of Engineering & Technology

Electrical and Electronics Engineering

Feedback Report

FeedBack No : 3

Branch : Electrical and Electronics Engineering

Academic Year : 2018-19

Year & Semester : Fourth Year, Second Semester

Subject Name : Programmable Logic Controllers **Faculty Name** : P. Prasanth Kumar

Subject Code : GR15A4030 **Section** : B

S.No	Question	Average
1	How does the teacher explain the subject?	3.43
2	How do you find the language and communication skill of the teacher?	3.39
3	Rate your teacher's regularity / punctuality to the class	3.38
4	Rate your teacher's explanation in clearing the doubts	3.41
5	Rate your teacher's commitment in completing the syllabus	3.35
6	Does the teacher pays attention to all the students?	3.32
7	Rate your teachers use of teaching aids	3.36
8	Is the session interactive?	3.38
9	Rate your teacher's guidence in other activities like Moodle, NPTEL etc	3.39
10	What is the overall opinion about the teacher?	3.41

No of Students given feedback : 69

Overall average : 3.38

Signature of Faculty **Signature of HOD** **Signature of Principal**

PLC MID-I CO Attainments							
IV-Year A-Section							
Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	CO-1	CO-2	CO-3	CO-3	CO-4
1	15241A0201	3	2	3	1	1	
2	15241A0202	5	2	2	2		
3	15241A0203	4	2	3			5
4	15241A0204	5	2	3	1	1	
5	15241A0205	5	2	1	2	1	
6	15241A0206	AB	AB	AB	AB	AB	AB
7	15241A0207	4	1	0	1	0	
8	15241A0208	5	2	2	2		
9	15241A0209	4	2	2			5
10	15241A0211	3	2	0	1	1	
11	15241A0212	5	2	3	1	3	
12	15241A0213	5	2	3		2	
13	15241A0214	4	2	2	2	1	
14	15241A0215	5	2	3			5
15	15241A0216		1		2	2	
16	15241A0217	3	2	2			4
17	15241A0218	5	2				
18	15241A0219	4	1		1		
19	15241A0220	5	2	3	2	1	
20	15241A0221	5	2		2		
21	15241A0222	5	2	2		2	
22	15241A0224		2				
23	15241A0225	5	1	3	2	1	
24	15241A0226	5	2	1	1	1	
25	15241A0227	5	2	3			5
26	15241A0228		2				
27	15241A0229	4	2	3	2	2	
28	15241A0230	2	1	1	1		
29	15241A0231	4	1	1	1		
30	15241A0232	4	1	2	1		
31	15241A0233	5	2	1	2		

Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	CO-1	CO-2	CO-3	CO-3	CO-4
32	15241A0234	3	1	1	1	0	
33	15241A0235	3	2	3	1		
34	15241A0236	3	1	1	1		
35	15241A0237	4	2	1	1	1	
36	15241A0238	5	2	1			
37	15241A0239	4	2	1	2	0	
38	15241A0240	4	1	1	2		
39	15241A0241	3	1	1	1		
40	15241A0242	4	2	2	2	2	
41	15241A0244	5	2	0	1		
42	15241A0245	2	1	1	1		
43	15241A0246	2	1	1	1	0	
44	15241A0247	4	2	3	1	2	
45	15241A0248	5	2	3			5
46	15241A0249	5	1	1	2		
47	15241A0250	3	2	0			
48	15241A0251	3					
49	15241A0252		2	1			
50	15241A0253	4	2	1	1		
51	15241A0254	2	1				
52	15241A0255	4	2	2	2	2	
53	15241A0256	5	2	3			4
54	15241A0257	4	2	2			5
55	15241A0258	2	1	0	1		
56	15241A0259	2		1	1	0	
57	15241A0260	2	2	1	1	1	
58	16245A0201	3	1	1	0		
59	16245A0202	4	1	1	1	0	
60	16245A0203	5	0	1	1		
61	16245A0204	4	1	2	1	2	
62	16245A0205	4	0		1	1	
63	16245A0206	2	1	0			
64	16245A0207	4	1	1	1	2	

Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	**CO-1**	**CO-2**	**CO-3**	**CO-3**	**CO-4**
65	16245A0208	4	1	1	1		
66	16245A0209	4	1	1	2	1	
67	16245A0210	3	1	2	1		
68	16245A0211	4	1	2	1	2	
69	16245A0212	5	2	3	2	1	
Total		**251**	**103**	**96**	**65**	**36**	**38**
No. of Students attempted (NSA)		**64**	**66**	**59**	**49**	**30**	**8**
Attempt %=(NSA/Total Strength)*100		**92.75**	**95.65**	**85.51**	**71.01**	**43.48**	**11.59**
Average= (Total/NSA)		**3.92**	**1.56**	**1.63**	**1.33**	**1.20**	**4.75**
Attainment%= (Avg/Max marks)*100		**78.4375**	**52.020202**	**81.355932**	**44.217687**	**60**	**95**

CO1	**65.23**
CO2	**81.36**
CO3	**52.11**
CO4	**95.00**

PLC MID-I CO Attainments							
IV-Year B-Section							
Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	CO-1	CO-2	CO-3	CO-3	CO-4
1	15241A0261	5	2	3			5
2	15241A0262	1	0	0	2		
3	15241A0263	1	2		1		
4	15241A0264	2	1	1	2	0	
5	15241A0265	4	1	3	0	1	
6	15241A0266	4	2	3			4
7	15241A0267	5	1	1	2	1	
8	15241A0268	5	1	2	2		
9	15241A0269	2	1		0		
10	15241A0270	4	1	1	2	0	
11	15241A0271	4	0	0			
12	15241A0272	4	2	3		2	
13	15241A0273	5	2	3	2	2	
14	15241A0274	5	1				
15	15241A0275	5	1	1	2	2	
16	15241A0276	4	1	1			
17	15241A0277	4	1	0	2		
18	15241A0278	3	1	1	1		
19	15241A0279	3	1	1			
20	15241A0280	5	1	3			4
21	15241A0281	5	2	2	1	2	
22	15241A0282	5	2	3			4
23	15241A0283	4	1				
24	15241A0284	5	2	2			5
25	15241A0285	5	1	2	2	1	
26	15241A0286		1	2			
27	15241A0287	3	1	2			3
28	15241A0288	3	1				
29	15241A0289	4			1		
30	15241A0290		1				1
31	15241A0291	3			1		

Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	**CO-1**	**CO-2**	**CO-3**	**CO-3**	**CO-4**
32	15241A0292	5	2	3			5
33	15241A0293	4	1				2
34	15241A0294	3	1	1			
35	15241A0295	5	2	3			3
36	15241A0296	5	2	0			
37	15241A0297	5	2	3			5
38	15241A0298	3	0	1			1
39	15241A0299	3	1	1			1
40	15241A02A0	3	1				
41	15241A02A1	5	2	3			5
42	15241A02A2	4	1	1	1		
43	15241A02A3	4	1	0	2	2	
44	15241A02A5	4	1	0			
45	15241A02A6	2	1	1			
46	15241A02A7	5	1	1	2		
47	15241A02A8	4	1	2	2	1	
48	15241A02A9	5	1	2			5
49	15241A02B0	4					
50	15241A02B1	5	2	3			5
51	15241A02B2	3	0	2			
52	15241A02B3	5	2	3	2	3	
53	15241A02B4	5	1	0	2		
54	15241A02B5	4	1	2	1		
55	15241A02B6	5	1	2	2		
56	15241A02B7	5	2	2	2	1	
57	15241A02B8	5	1	1			5
58	15241A02B9	4		2			
59	15241A02C0	4	1	2			
60	16245A0213	5	1	2	2		
61	16245A0214	4	1	0			
62	16245A0215	3	1	2	2	2	
63	16245A0216	4	1	2	1	1	
64	16245A0217	5	1		2		

Sl.No	Hall Ticket No	1	2		3		4
		A	A	B	A	B	A
		CO-1	**CO-1**	**CO-2**	**CO-3**	**CO-3**	**CO-4**
65	16245A0218	5	1	3			4
66	16245A0219	4	1	2	2	1	
67	16245A0220	5	1	3	2	2	
68	16245A0221	5	1	3	2		
69	16245A0222	5	1	0	2		
70	16245A0223	5	2	3	1	1	
71	16245A0224	5	1	0	2	2	
Total		**285**	**80**	**101**	**57**	**27**	**67**
No. of Students attempted (NSA)		**69**	**67**	**59**	**35**	**19**	**18**
Attempt %=(NSA/Total Strength)*100		**97.18**	**94.37**	**83.10**	**49.30**	**26.76**	**25.35**
Average= (Total/NSA)		**4.13**	**1.19**	**1.71**	**1.63**	**1.42**	**3.72**
Attainment%= (Avg/Max marks)*100		**82.608696**	**39.800995**	**85.59322**	**54.285714**	**71.052632**	**74.444444**

CO1	**61.20**
CO2	**85.59**
CO3	**62.67**
CO4	**74.44**

PLC MID-II CO Attainments						
IV-Year A-Section						
Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	CO-4	CO-5	CO-5	CO-3
1	15241A0201	3	3			0
2	15241A0202	3	2			0
3	15241A0203	2	4			
4	15241A0204	4	5	3	2	
5	15241A0205	5	5	3		
6	15241A0206	1	3	1	2	
7	15241A0207	3	3	2	2	
8	15241A0208	3	3	2		
9	15241A0209	3	3	2	1	
10	15241A0211	2	3	1	1	
11	15241A0212	4	4	2	1	
12	15241A0213	5	4			0
13	15241A0214	3	3	3	2	
14	15241A0215	2	3	1		
15	15241A0216	4		2	1	
16	15241A0217	4	4	3	1	
17	15241A0218	3	0			3
18	15241A0219	5	1			3
19	15241A0220	3	4	2	2	
20	15241A0221	3				2
21	15241A0222	3	2	2		
22	15241A0224	2		2	0	0
23	15241A0225	3		2	1	2
24	15241A0226	4	3			2
25	15241A0227	4	5			4
26	15241A0228	0	0	0	0	0
27	15241A0229	3	2	1	2	
28	15241A0230	2		2	0	0
29	15241A0231	3		3	1	0
30	15241A0232	3		1	0	0
31	15241A0233	4	4			3

Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	**CO-4**	**CO-5**	**CO-5**	**CO-3**
32	15241A0234	2	3			0
33	15241A0235	3		1	0	0
34	15241A0236	3		1	1	0
35	15241A0237	3	2	1	0	
36	15241A0238	5	4			3
37	15241A0239	4	2			0
38	15241A0240	3	2	2	0	0
39	15241A0241	1	1			0
40	15241A0242	5	3			0
41	15241A0244	3	1			
42	15241A0245	2	1			1
43	15241A0246	1		1	1	0
44	15241A0247	4	3			2
45	15241A0248	3	3	2	2	
46	15241A0249	3	3			3
47	15241A0250		2	0	1	0
48	15241A0251	1	2			1
49	15241A0252					
50	15241A0253	3	3			0
51	15241A0254	2				2
52	15241A0255	3	3	3	2	
53	15241A0256	3	2			3
54	15241A0257	2	2	1		
55	15241A0258	0		2		0
56	15241A0259	2	2	1	0	
57	15241A0260	3	2			
58	16245A0201	1	1			1
59	16245A0202	3	0	2	1	
60	16245A0203	2	2			0
61	16245A0204	2	3	2	0	
62	16245A0205	2		2	1	
63	16245A0206	2		1	1	0
64	16245A0207	2	0			0

Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	**CO-4**	**CO-5**	**CO-5**	**CO-3**
65	16245A0208	2	2			0
66	16245A0209	2	2			1
67	16245A0210	0		1	0	
68	16245A0211	3	2	1	1	
69	16245A0212	1		1		1
Total		**182**	**131**	**65**	**30**	**37**
No. of Students attempted (NSA)		**67**	**52**	**39**	**32**	**40**
Attempt %=(NSA/Total Strength)*100		**97.10**	**75.36**	**56.52**	**46.38**	**57.97**
Average= (Total/NSA)		**2.72**	**2.52**	**1.67**	**0.94**	**0.93**
Attainment%= (Avg/Max marks)*100		**54.33**	**50.38**	**55.56**	**46.88**	**18.50**

CO3	**36.41**
CO4	**50.38**
CO5	**51.22**

PLC MID-II CO Attainments						
IV-Year B-Section						
Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	CO-4	CO-5	CO-5	CO-3
1	15241A0261	5	4			4
2	15241A0262					
3	15241A0263		2			
4	15241A0264	3	3	2	2	
5	15241A0265	2	2	2	2	
6	15241A0266	2	3			4
7	15241A0267		3	3	2	4
8	15241A0268	4	3	2	2	
9	15241A0269	2				
10	15241A0270	3	3			3
11	15241A0271	2				
12	15241A0272	3		2		2
13	15241A0273	4	4	3	2	
14	15241A0274		5			
15	15241A0275		4	3	2	5
16	15241A0276	5	3			
17	15241A0277	1	3			4
18	15241A0278	3	2			
19	15241A0279	2		1		3
20	15241A0280	2	2	1	1	
21	15241A0281	3	2	2	2	
22	15241A0282	3	2	3	2	
23	15241A0283	2				
24	15241A0284	4	4			4
25	15241A0285	5	4			4
26	15241A0286	2		2		2
27	15241A0287	2		2		2
28	15241A0288	2	1			
29	15241A0289	3	2			
30	15241A0290					2
31	15241A0291	2	2			

Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	CO-4	CO-5	CO-5	CO-3
32	15241A0292	5	5	3	2	
33	15241A0293	2		2		1
34	15241A0294	0				
35	15241A0295	5	4	3	1	
36	15241A0296		5	3	2	4
37	15241A0297	4	3	2	2	
38	15241A0298	4	2			3
39	15241A0299		2	2		
40	15241A02A0	0				
41	15241A02A1	5	4			3
42	15241A02A2	3				2
43	15241A02A3	3	2			2
44	15241A02A5	3	3			1
45	15241A02A6	2		2		
46	15241A02A7	4	3	3	2	
47	15241A02A8	2	1			
48	15241A02A9	3				4
49	15241A02B0	2	2	1		
50	15241A02B1	4	2			3
51	15241A02B2	3	2			
52	15241A02B3	5	5			4
53	15241A02B4		4	3	2	3
54	15241A02B5	3	3			3
55	15241A02B6	3				3
56	15241A02B7	4	4			3
57	15241A02B8	4	2			2
58	15241A02B9	3	2			3
59	15241A02C0	2	2			3
60	16245A0213	2	3			
61	16245A0214	5	5	2	2	
62	16245A0215		2	1	2	1
63	16245A0216	4	3			3
64	16245A0217	4	3	2	2	

Sl.No	Hall Ticket No	1	2	3		4
		A	A	A	B	A
		CO-3	**CO-4**	**CO-5**	**CO-5**	**CO-3**
65	16245A0218		5			4
66	16245A0219		3			4
67	16245A0220	3				3
68	16245A0221		3		1	1
69	16245A0222			2	1	4
70	16245A0223	3	1			1
71	16245A0224	3	2			3
Total		**173**	**155**	**59**	**36**	**114**
No. of Students attempted (NSA)		**57**	**53**	**27**	**20**	**39**
Attempt %=(NSA/Total Strength)*100		**80.28**	**74.65**	**38.03**	**28.17**	**54.93**
Average= (Total/NSA)		**3.04**	**2.92**	**2.19**	**1.80**	**2.92**
Attainment%= (Avg/Max marks)*100		**60.70**	**58.49**	**72.84**	**90.00**	**58.46**

CO3	**59.58**
CO4	**58.49**
CO5	**81.42**