MICROCONTROLLER BASED CONTROL OF TSCHUDIN GRENCHEN / HTG630 BY DIRECT AND INDIRECT MODE

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BONAFIDE CERTIFICATE

Certified that this project report titled " **MICRO CONTROLLER BASED CONTROL OF TSCHUDIN GRENCHIEN/HTG630 BY DIRECT AND INDIRECT MODE IN BHEL - TRICHY**" is the bonafide work of Mr S. SATHEESH KUMAR who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report of dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

13/6/05

INTERNAL GUIDE

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The Candidate with University Register No: 712034150l3 was examined by us in the project Viva-Voce examination held on 23/6/2005

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This is to certify that, Mr.S.SATHEESH KUMAR, Reg.No:71203415013, final year M.E. student with specialization of 'POWER ELECTRONICS AND DRIVES' in Electrical and Electronics Engineering Discipline of KUMARAGURU COLLEGE OF TECH, COIMBATORE.

"MICROCONTROLLER BASED CONTROL OF TSHUDIN GRENCHEN/HTG630 BY DIRECT AND INDIRECT MODE"

The above project has done by him in the Maintenance and Service Department of BHEL, Trichy – 14, from 28-12-2004 to 28-03-2005 and found successful in his project work.

During this period he has shown keen interest in bearing various aspects of his project. The out come of this project is benefit able to our organization.

I wish him all success in future endeavors.

EXTERNAL GUIDE 5/4/05
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ABSTRACT

Tschudin grenchen is a grinding machine used for fine finishing of valves (steam & water). IITC stands for Horizontal Tschudin grenchen and 630 stands for brand number. In this machine, we are going to control the various slide movements like cross, vertical horizontal etc.

In the existing machine, the movement of slides is controlled by hydraulics. This method has number of disadvantages like less reliability and more maintenance. To overcome these difficulties, a micro controller ATMEL 89C51 based automation system is developed.

The machine is controlled in two ways: direct control mode and remote control mode. In the remote control mode the input to the micro controller is obtained from PC through RS232 serial interface, MAX232 bipolar to unipolar converter in the remote control mode, the fiber optic cable is used as communicating medium between PC and micro controller. The micro controller selects and controls the movement according to the input from PC and keypad. Each movement is activated using a separate stepper motor drive circuit. After the assigned job is over, an acknowledge signal is sent to the PC that the jobs is completed. For programming purpose in the above software EMBEDDED-C language is used. An LCD is used to show the menu to the user.

ACKNOWLEDGEMENT

First and foremost, I would like to extend my heart-felt gratitude and thanks to our beloved Principal of Kumaraguru College of Technology, **Dr.K.K.PADMANABHAN** without whom I would not have been studying in this institution.

I extend my deference to our H.O.D **Prof. REGUPATHY SUBRAMANIAM** for offering his expert counseling and providing us with all the necessary infrastructure and facilities over these project periods.

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I am also indebted to **Dr. T.M.KAMESWARAN,** our Project Co-ordinator **Mrs. R.MAHALAKSHMI M.E.,** our Advisor **Mrs. N.KALAIARASI M.E.,** for the helping hand they extended during trying periods while doing the project. I am very much grateful to all other staff members of Electrical & Electronics Engineering Department for their kind support during the course of my project.

Last but not least, I would like to express my gratitude to my friends and family members for their encouragement and support throughout.

BHEL COMPANY PROFILE

The first plant of BHEL was established 39 years ago at Bhopal. It is genesis of the heavy electrical equipment industry in India. Its make profit continuously from 1971-1972. BHEL caters to four sectors of the Indian Economy like Power, Industry, Defense, etc.

BHEL'S wide network consists 14 manufacturing divisions, 9 Service centers, 4 Power sectors regional centers and 150 projects sites, enable the company to be closer to its customer and provide them with suitable products, system and services at competitive prices, having attained ISO 9000 certificate. BHEL is now embarking upon total quality management from its operations.

POWER SECTORS

A power sector comprises of thermal, nuclear, gas and hydro power plant business. Today, BHEL supplied sets accounts for nearly 53,787 MW or 65% of total installed capacity of 83,288MW in the country as against nil till 1969-1970. BHEL manufactures 1000MW rating thermal power plants equipment and gas turbine generators setup to unit ratings of 150MW. BHEL manufacture 235MW nuclear sets and has commenced production of 500MW nuclear sets. Customs-made huge hydro set of Francis pelt on and Kaplan types of different head-discharge combination are also engineered and manufactured by BHEL is based on cotemporary technology comparable to the best in the world and is also internationally competitive. It has proven expertise in renovation and maintenance of variety of power plant equipment besides specialized know-how of residual life assessment, health diagnostics and life extension of plants.

INDUSTRY SECTORS

BHEL is a major contribution of equipment and systems to industries like cement, fertilizers, petrochemicals, steel, papers and telecommunication. The range of systems and equipment supplied include captive power plant, high speed industrial drive turbines, industrial boilers and auxiliaries, waste hear recovery boilers, gas turbines, heat exchanges and pressure vessels, electrical machines pump valves, seamless steel tube process control etc.

TRANS MISSION

BHEL supplies a wide range of transmission products and systems up to 400 KV class. This includes high voltage power and distribution transformers, instruments transformers etc. For economics transmission, for bulk power over long distance, HVDC systems are supplied.

TECHNOLOGY UPGRADATION & RESEACH & DEVOLOPMENT

BHEL has upgraded is products and related technologies to contemporary levels through contributed in-house efforts and related technology from other leading organizations in the world. BHEL corporate R& D centers at Hyderabad are supported by product based R&D centers at the each of the manufacturing divisions.

HUMAN_RESOURCES_DEVOLOPMENT

The most prized assert of BHEL is its 67,133 employees. The human resources development institute and other training institute of the company help in not keeping their

skills up-dated and finely honed but also add new skills when required. Continuous training and re training a positive work culture and participate style of management have led to the development of a committed and motivated work force and enhanced productivity and quality needs.

AWARDS

Two quality circle of BHEL-TRICHY has been adjudged as best QC'S in the international meet on Quality Control Circles. HPBP has bagged the prestigious INSSAN award in suggestion scheme contest. The plant also bagged the state level productivity award for the year 1993-1994. 14 employees received the covered State Sharma Vir Award. The plant has been highly commented in the Golden Peacock national Quality Awards Contest. Two Engineers of receive prestigious WH Hobart Memorial Award for the technical paper.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO BHEL'S VALVES PRODUCTION

In BHEL the valves plant as a part of the boiler plant complex, was initially intended for the manufacturers of the valves for the thermal power Plant. Today this plant meets the growing needs for various types of valves not only of thermal stations but also for chemical plants, refineries, petrochemical plants and unclear plants.

BHEL is the biggest valve manufacturing plant in this part of the world and is equipped with the most modern production and testing facilities. The testing facilities include a full fledged steam testing station for safety/safety relief valves, hydraulic station for high pressure valves and testing facility for oil field equipment up to 30,000 psi.

1.1.1 Types of Valves Manufacturing in BHEL

1. Forged steel gate valve pressure class: 800
2. Forged steel globe valve pressure class: 800, 1500, 2500
3. Forged steel check valve pressure class: 800, 1500, 2500
4. Cast steel gate valve pressure class: NP16,46,68
5. Cast steel gate valve pressure class: NP 40,100
6. Cast steel globe valve pressure class: NP 40,100
7. Cast steel non-return valve pressure class: NP16,40
8. Re-heater isolating valve= pressure class: 150,300
9. High pressure gate valve-pressure class: 1500,2500,3000
10. High pressure Check valve- pressure class: 1500,2500,3000

11. High pressure check valve- Pressure class: 1500,2500,3000
12. Elbow down valve- pressure class: 2000
13. Low pressure turbine by pass value
14. Pressure gauge valve-pressure class: NP 250
15. Safety relief valve-pressure class: 150 to 2000 psi

BHEL was the reputation all over the world as a pioneer industry. There are totally an amount of 10,000 employees working in BHEL, TRICHY at present.

The turnover of BHEL, TRICHY is nearly 1750 crorers and is really running big profit. This year had a profit of 175 crorers.

The main function of BHEL, TRICHY is to manufacture high pressure Boilers and its accessories, which can with stand to very high pressures. Here pressures is generated by producing steam, which is produced by burning coal.

1.2 BACKGROUND TO THE PROJECT

Tschudin Grenchen/HTG 630 is a grinding machine used for Fine finishing of valves, which is a part of boiler manufactured in BHEL. HTG 630 STANDS FOR horizontal Tschudin Grenchen machine, where 630 is the brand number.

1.2.1 Present Working Status

At Present Tschudin Grenchen is composed of analog circuits to control its operation. It consists of a stepper motor for the movement of slide into the grinding machine. Here the analog circuits present in it control the movement of slide. The stepper

motor used here has 8 poles in its stator and 50 teeth in its rotor. Its step angle is 1.8 degrees and it requires 200 steps to complete one revolution

1.2.2 Project Assigned

The project assigned to us is to control the Tschudin grenchen/HTG 630 using micro controller 89c51 from either a remote control room or by direct control. For control from a remote control room, optical fiber is used as the communication medium. Here the remote control room will be equipped with a computer for controlling the machine. For direct control, the machine will have a liquid crystal display and a keyboard for controlling the machine.

1.3 OUTLINE OF THE THESIS

Chapter 1 describes the introduction to value production in BHEL and background to the projects.
Chapter 2 describes the Tschudin Grenchan / HTG630 grinding machine.
Chapter 3 describes the modes of operation.
Chapter 4 described about the microcontroller 89C51.
Chapter 5 describes the hardward design and implementation.
Chapter 6 describes the fiber optic communication.
Chapter 7 described the conclusion & future developments of grinding machines.

CHAPTER 2

TSCHUDIN GRENCHEN / HTG630

2.1 GRINDING

Grinding is a productive method of machining, which ensures a high surface finish, superb geometry, and dimensions of parts.

The advantages of grinding include high dimensional accuracy (accuracy degree 5 or 6 and higher according to the CMEA unified systems of fits and tolerances) and high geometrical accuracy (out of roundness of 0.3-0.5mm and less), and surface finish of Ra=1.25 = 0.16mm, sometimes 0.16-0.06mm and better. Grinding is a most productive and economic process for final machining of parts with small allowances (Up to 0.5mm). In heavy-duty (Power) grinding, which has been recently implemented, the amount of metal removed is drastically increased and exceeds in some cases metal removal in rough turning and milling.

One of the main ways for increasing grinding productivity is to improve the abrasive tool quality, increase the degree of machine automation, improve measuring and control equipment, employs simultaneous machining of several surfaces in one operation on multi wheel or wide-wheel grinders, intensify cutting conditions (high-velocity and Power grinding), Numerically controlled grinding machines offer good prospects. They are equipped with adaptive controllers. Machining programs and grinding cycle programs are input from the machine control panel and machining conditions are automatically selected for the required accuracy and finish and minimum costs.

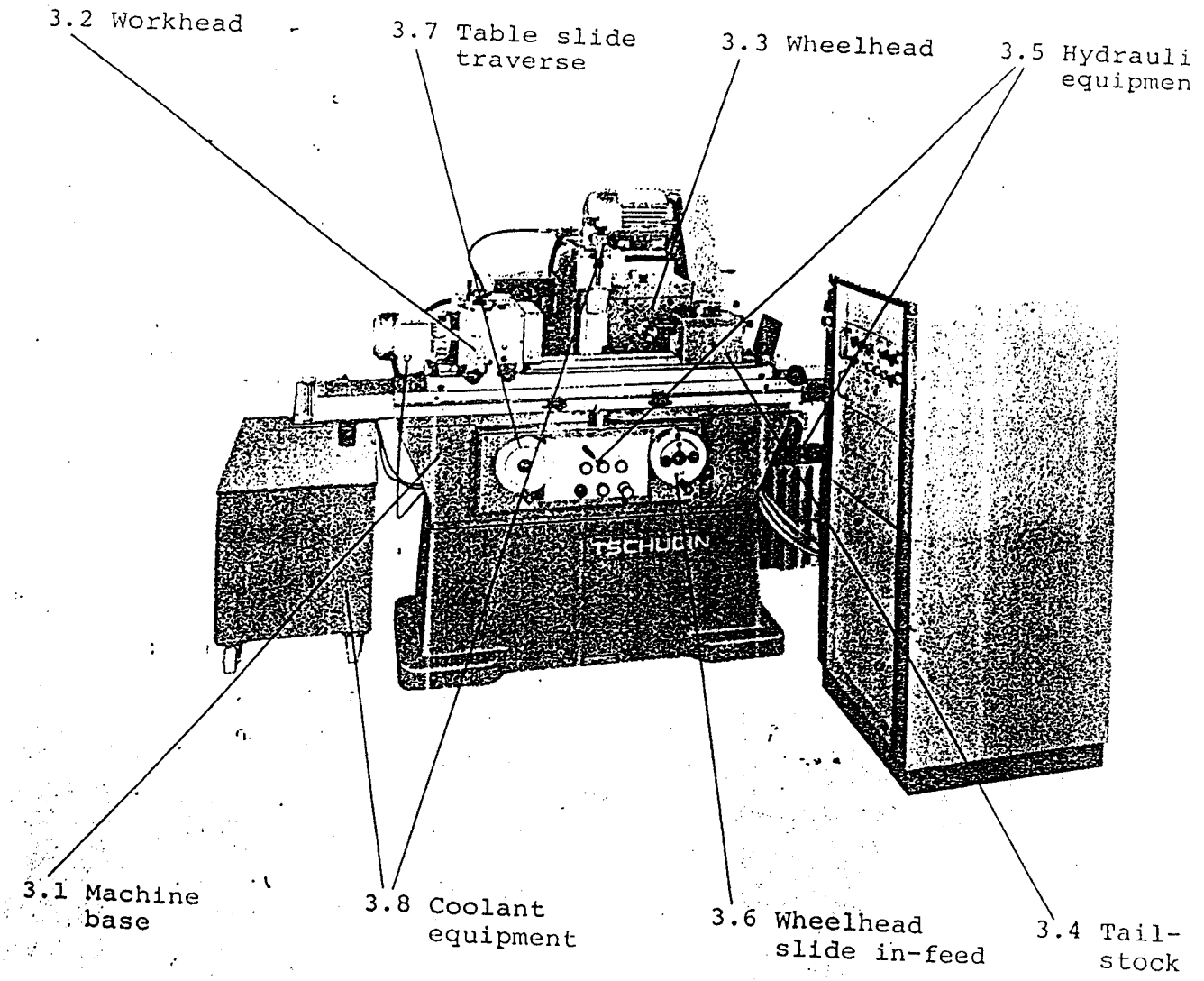

Fig No: 2.1 Tschudin Grenchen

2.2 PURPOSE AND CLASSIFICATION

Grinding machines are machine tools that use abrasives to cut material.

Depending on the type of grinding and shape of the work surfaces, grinding machines are:

- Circular: center and center less;
- Internal;
- Contour, including single-and multi turn thread machines, spine and gear grinding machines, etc.;
- Special intended for accomplishing particular operations. They may be both single and multi-spindle machines
- Finishing (honing, super finish, lapping, buffing machines for hand and power polishing with wheels and belts, etc.),

IN THE MACHINE

- Automatic length positioning device for components.
- Foot switch.
- Hydraulic quick clamping devices.
- Pneumatic 3-jaw chuck.
- Driving slot (hydraulic disconnection).
- Positioning device for work head spindle of work head.
- Work head with electronic controlled speed.
- Positioning device for work head spindle driver.
- High pressure rinsing (Coolant).
- Roller dressing unit.
- Control of end position.

- Electronic size control equipment.
- Equipment for magazine feed unit.
- Powered ventilation of electrical cabinet.
- Machine lighting circuit.
- Cool box.

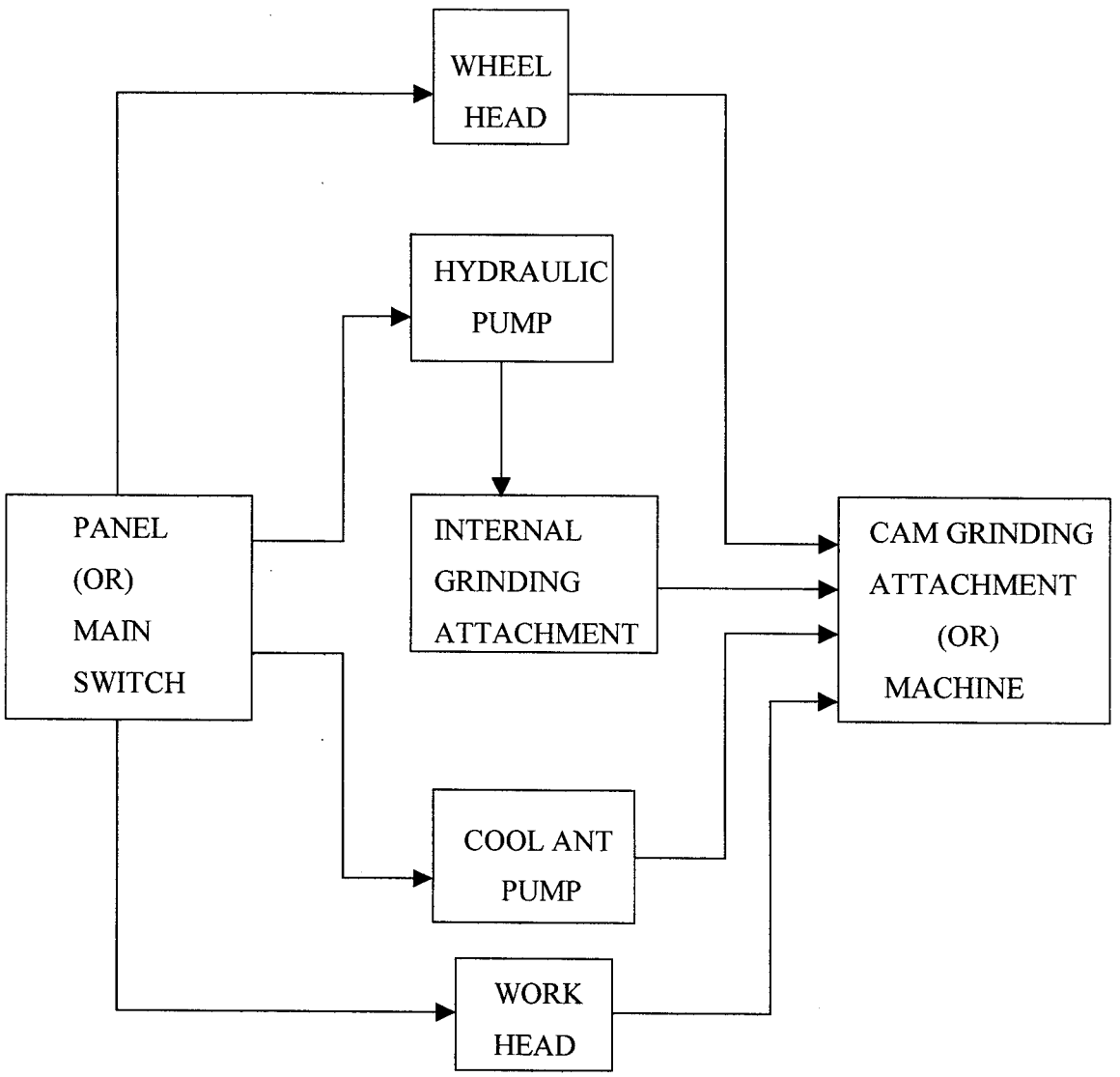

Figure No: 2.2 Block Diagram of the Machine Cycle

2.3 WHEEL SHAPES

Each grinding wheel beers its marking indicating its manufacturer. Abrasive grade, gain size, hardness, structure No., bond type rotation speed, class, etc.

2.4 PROGRAM CONROL EQUIPMENT

Program-controlled grinding machines have recently found wide application. The program can be set by different methods.

In cyclic-control machines the program is set on jack boards or by position switches, replaceable cams, multi-position drums. In such machines dimensions are monitored by micro switches arranged at respective points on tracks and interacting with stops secured to machine movable members. This method is used for grinding stepped shafts, profiled surface and for displaying work pieces according to a preset program.

In numerical control (NC) machines, displacements of working members and determined by a numbering systems of letters and numbers that regulate an entire machining process and the sequence of operations to machine a work piece. The program media include punched cards (tapes), magnetic tapes, counters and various switches. Single axis NC machines are rather popular, while two-and three-axis NC machine tools are used less frequently.

2.5 TYPES OF ABRASIVES

Abrasives are mineral or artificial compounds whose grains feature increased hardness or some special properties for finishing surfaces. Natural abrasives include diamonds, aluminum oxide (corundum), energy, garnet, and quartz.

Diamond is a mineral composed entirely of the element carbon crystallized in the isometric systems. Diamond offers the greatest hardness, which, however, differs with the direction of abrasion. It has a greatest modulus of elasticity and minimum thermal coefficient of expansion. Diamond wheels are used for machining hard alloy tools and other hard materials.

Corundum is a mineral having composition AL203 and crystallizing in the hexagonal system. Its micro hardness is 19 x 10 ^ 3 to 22 10^3 Mpa.

Garnet is a generic term applied to a group of mineral silicates that are isometric in crystallization. The micro hardness of garnet is 13 x 10^3 to 16.5x 10^3 Mpa.

Flint is mineral consisting of crystalline silica. Its micro hardness is from 10 x 10^3 to 11x 10^3 Mpa.

2.6 COOLANTS

Coolants are an intermediate between the work piece and the abrasive tool. Coolant intended to increase efficiency of machining forms protective films in the cutting zone to preclude immediate contact between the tool and the work surfaces, thus decreasing liberation of heat and protecting abrasive grains against sticking of metals, removes heat from the cutting zone, washes off and withdraws grinding sludge from the cutting zone, etc.

As regards the effect upon the cutting process, three groups of coolant are distinguished: cooling liquids, chemically-active liquids and surface-active liquids. Liquids with high thermal conductivity, heat capacity, latent heat of vaporization; high density and low viscosity offer the highest cooling capacity. Chemical activity of a liquid it determined by the ability of its molecules to form high-melting chemical compounds on contact surfaces. Surface-active substances of surfactants decreases the liquid surface tension and increase molecular adhesion to the metal surface thus strengthening bonding of lubricant to metal.

The following grinding fluids are used at present:

- Aqueous chemical solutions containing small amounts of alkali metal salts for improving anti-corrosion and detergent properties, for instance soda ash, Potassium Salts, tri Sodium-phosphate., tri ethanol amine, etc.;
- Aqueous oil emulsions obtained by adding water into self-emulsifying oil (water being the external continuous phase and oil the internal dispersed phase). Oil emulsions ensure corrosion resistance, high thermal stability and improved surface finish. Emulsions used for heavy-duty machining are activated with sulfured oil additions;
- Oils with sulfur and chlorine compounds additions are used for grinding hard-to-machine steels when it is vital to preserve wheel geometry as long as possible. They decrease heat removal and require special ventilation arrangements to be installed.

2.7 ELECTRICAL CABINET

Power consumption of the machine is 8 KW. Main switch handle for the connection is disconnection of the electrical mains supply. Control lamp indicating that the main switch is connected. Rotary indexing switch for the engagement &

disengagement of the hydraulic & coolant pump motors. Rotary indexing switch for the engagement & disengagement of the wheel – head motor. Rotary indexing switch for the engagement & the disengagement of the work head motor & the coolant supply.

Symbol "1" the worked motor is engaged directly and also the coolant supply, provided that the whole head motor is running.

Symbol "0" the work head & the coolant supply are disengaged.

Rotary indexing switch for the automatic return of the wheel head slide, always according to the working cycle selected. (traverse or plunge grinding) . plunge grinding (rotary indexing switch in position to the upper left-hand side). Traverse grinding (rotary indexing switch is position to the upper right-hand side).

The return of the wheel head slide takes place after expiration of the pre-selected number of spark – out traverse, on the left-hand side of the work piece. Traverse grinding (rotary indexing switch in position to the lower right-hand side).

The return of the wheel-head slide takes place after expiration of the pre-selected number of spark – out travels, on the right - hand side of the work place.

Potentiometer for setting the spark – out time for plunge grinding. Numerical counter for the pre-selection of the number of spark-out travels for traverse grinding. Rotary indexing switch for the machine lighting. Emergency circuit breaker for cutting – out the machine.

Sequence of the circuit cut-out :

- Disengagement of the wheel head motor.
- The wheel-head slide returns to it's initial position
- All the remaining motors are disengaged.

Prior to re-starting the machine, bring the emergency circuit breaker to its initial position by rotating clockwise the button.

S.No	Motor	Power (KW)	Frequency	
			50 HZ	60 HZ
1	Wheel-head Motor	5.5 KW	1440 rpm	1740 rpm
2	Work-head Motor	0.55 KW	920 rpm	1100 rpm
3	Hydraulic pump Motor	0.55 KW	1390 rpm	1690 rpm
4	Coolant pump Motor	0.9KW	2750 rpm	3250 rpm

Table No : 2.1 Electric Motors

CHAPTER 3

MODES OF OPERATION

3.1 DIRECT MODE

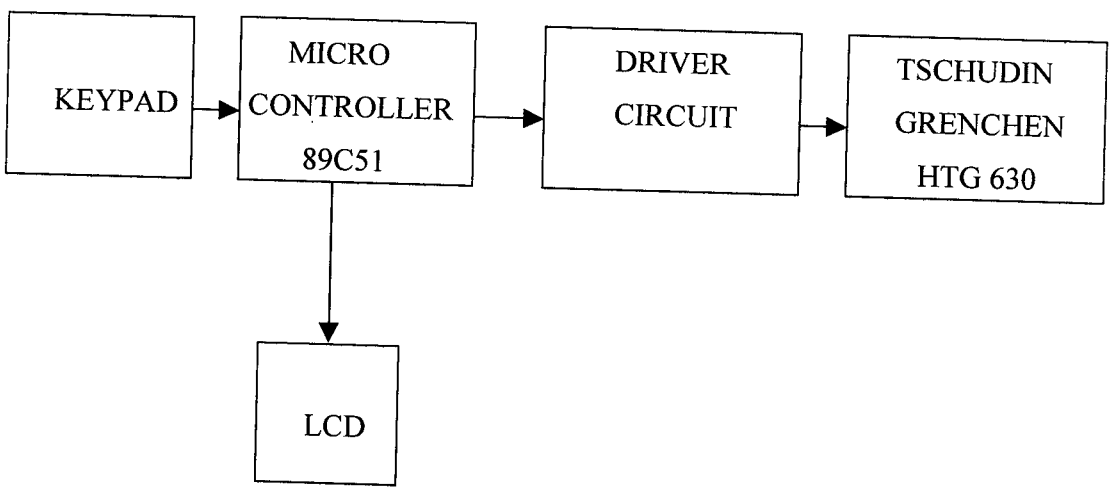

Figure No: 3.1 Direct Mode

3.2 INDIRECT MODE

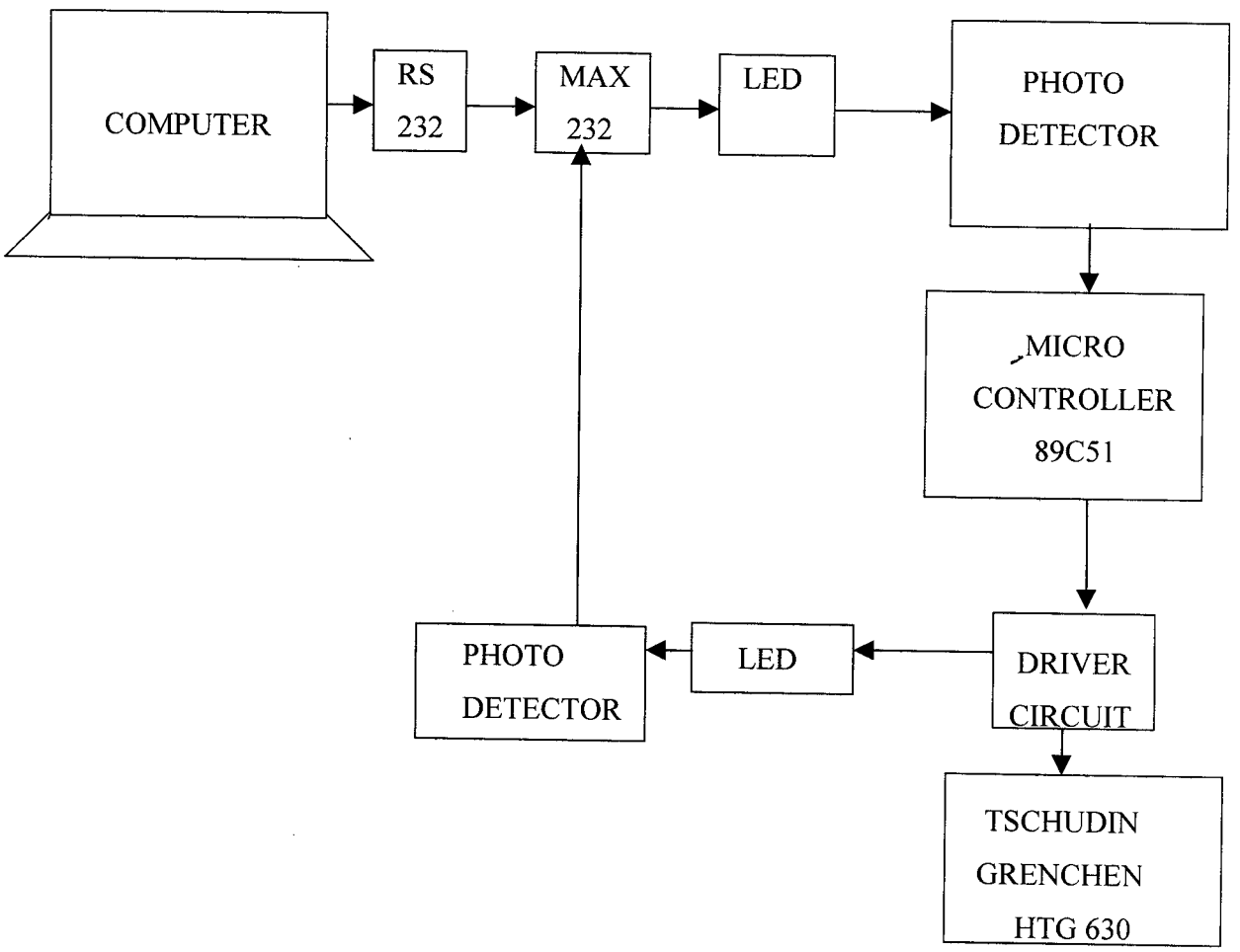

Figure No: 3.2 Indirect Mode

The circuit operates in two modes,

- Direct Mode.
- Remote mode.

In the remote mode, the micro controller receives the inputs from the computer presents in a remote control room. The output from the Computer is always +9v for 1 and-9v for 0. This bipolar signal is taken through Rs232 cable and given to MAX 232, which is a bipolar to unipolar converter. Thus the output of MAX232 is 1 for-9v and 0 for +9v. This signal is given to the LED, which converts electrical energy into optical energy. This optical signal is transmitted to a photo detector, which converts this optical signal into electrical signal, and gives to the serial port of micro controller. Thus the micro controller receives the inputs from a remote terminal through the RXD pin. After finishing the job the micro controller sends an acknowledgement signal to the remote terminal through the TXD pin. The acknowledgement signal is transmitted through the fiber optic cable and given to MAX 232 which converts the unipolar signal into bipolar, and is given to the computer through the RS 232 cable.

In the direct mode, the keypad is used to give the inputs to the micro controller. The LCD is used to show the menu to the user.

The micro controller is programmed in such a way that in accepts 3 inputs from the user-number of rotations/directions, number of steps and speed.

The micro controller 89c51 has four parts. The LCD is connected to port 1&3. The keypad is connected to part2. The Tschudin grenchen is connected to port 3. The remote terminal is connected to port 3.

CHAPTER 4

MICRO CONTROLLER 89C51

4.1 FEATURES

- Compatible with MCS-51™ Products
- **4K Bytes** of In-System Reprogrammable **Flash Memory** –Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0Hz to 24 MHz
- Three-level Program Memory Lock
- 128x8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes

4.2 DESCRIPTION

The At89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications.

The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT 89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The power-down Mode saves the ram contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

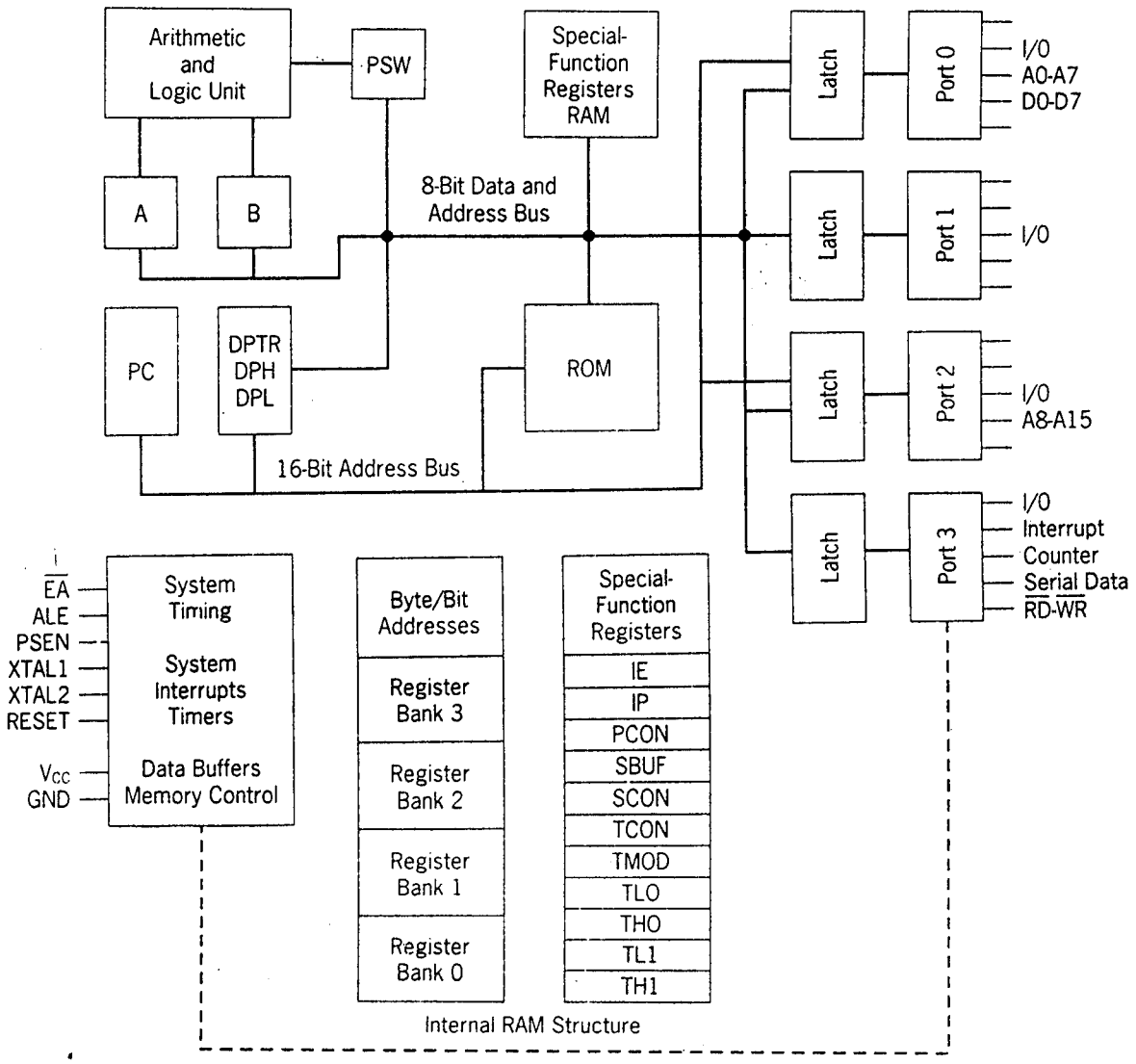

Fig No.4.1 8051 Block Diagram

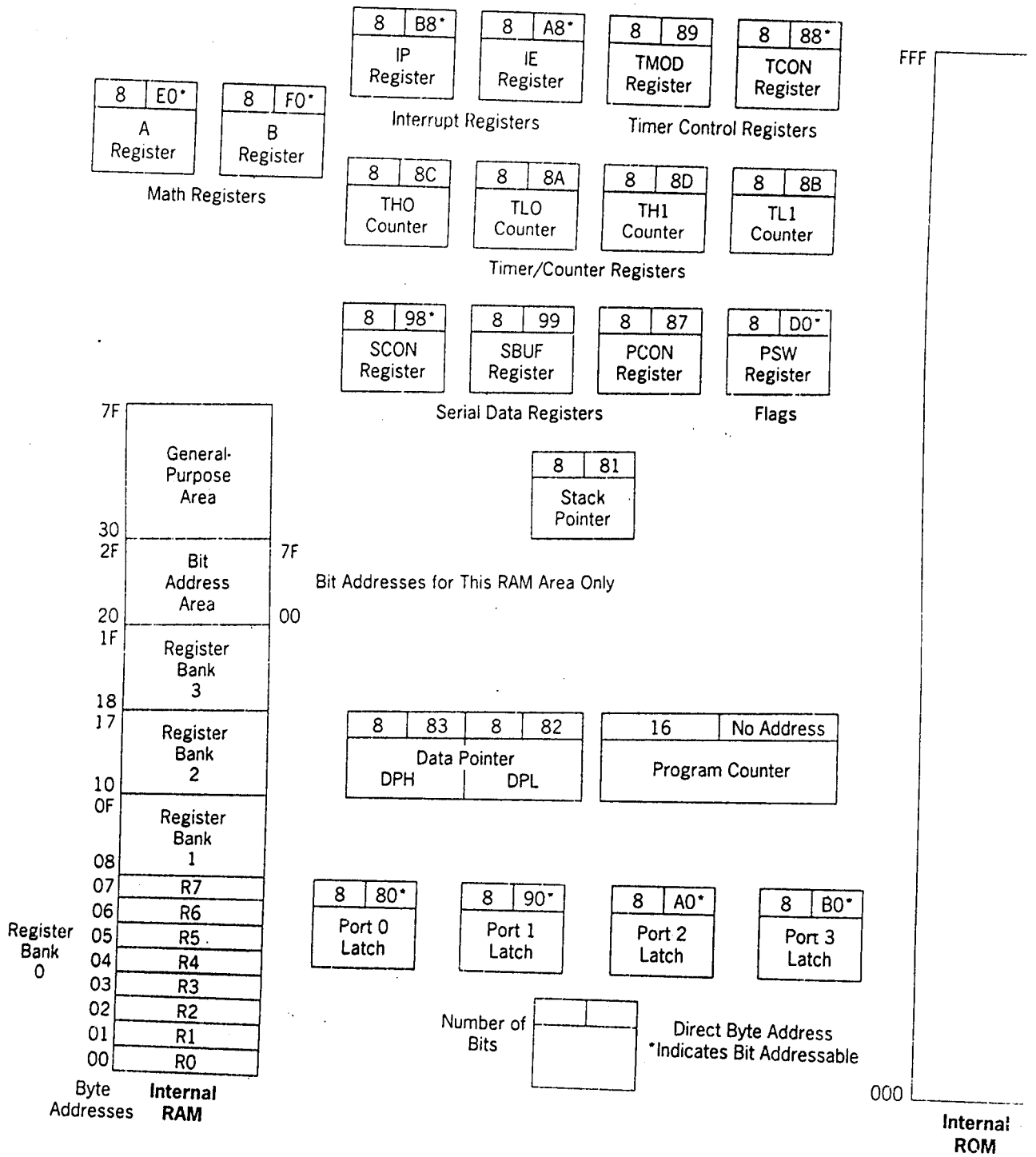

Fig No.4.2 Programming Model

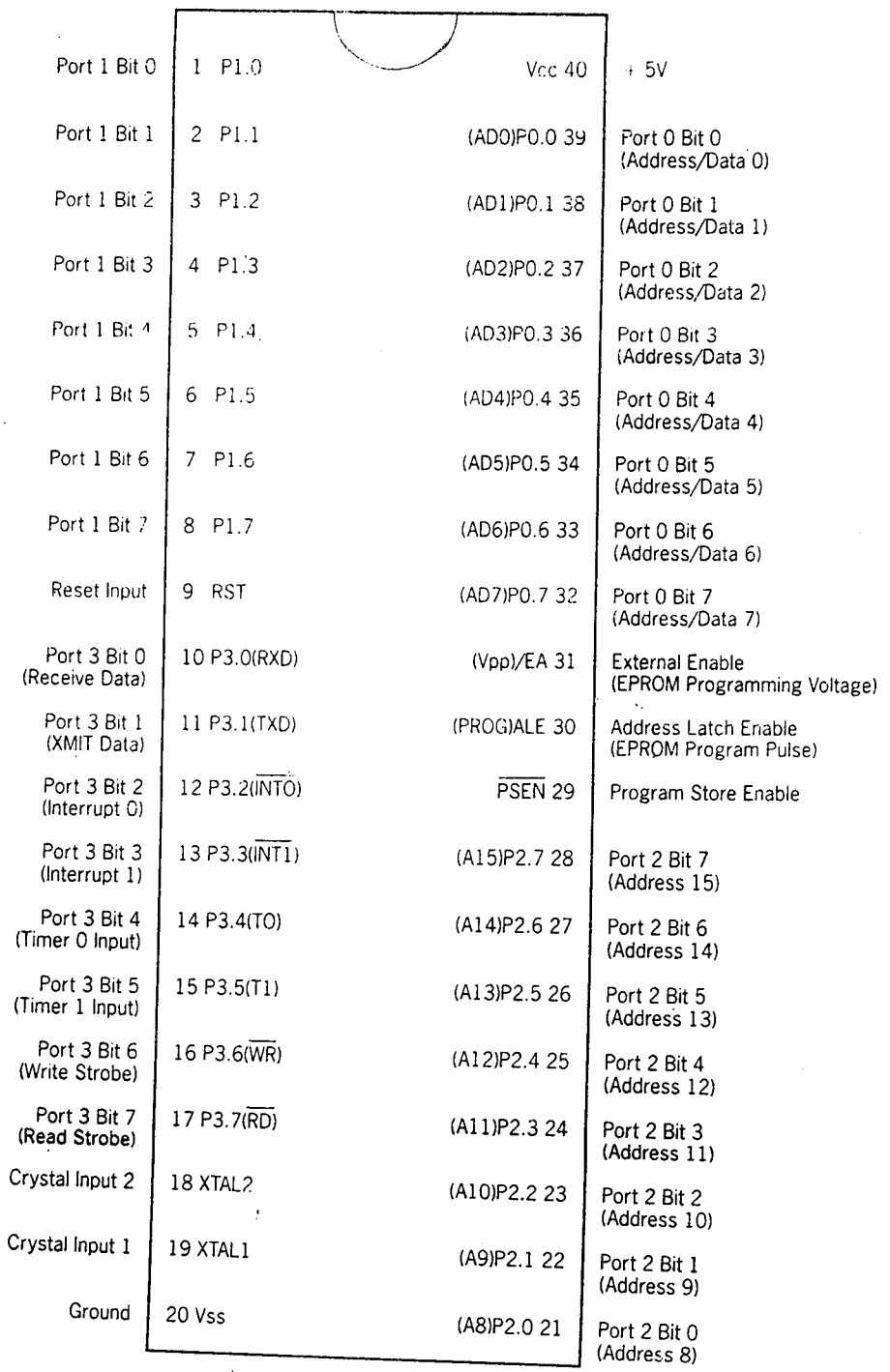

Fig No.4.3 8051 DIP Pin Assignments

4.3 PIN DESCRIPTION

VCC

Supply Voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open-drain bi-directional I/O port. As output port, each pin can sink eight TTL inputs. When is are written to port 0 pins, the pins can be used a high-impedance inputs. Port 0may also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

PORT 1

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The port 1 output buffers can sink/source four TTL inputs. When 1s are written to port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 1 pins that are externally being pulled low will source current (1 IL) because of the internal pull-ups.

Port 1 also receives the low-order address bytes during Flash programming and verification.

PORT 2

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The port 2 output buffers can sink/source four TTL inputs. When is are written to port 2 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 2 pins that are externally being pulled low will source current (ILL) because of the internal pull-ups.

Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVEX @ DPTR). In this application, it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), port 2 emits the contents of the P2 Special function Register.

Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

PORT 3

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The port 3 output buffers can sink/source four TTL inputs. When 1s are written to port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 3 pins that are externally being pulled low will source current (I IL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C51 as listed below:

PORT PIN	ALTERNATE FUNCTIONS
P3.0	RXD(serial input port)
P3.1	TXD (Serial output port)
P3.2	INTO(external interrupt 0)

P3.3	INT 1(external interrupt 1
P3.4	T0 (timer 1 external input)
P3.5	T 1 (timer 1 external input)
P3.6	WR (external data memory write strobe)
P3.7	RD (external data memory read strobe)

Table No: 4.1 Port 3 Alternate Uses

Port 3 also receives some control signals for Flash Programming and verification.

RST

Rest input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/PROG

Address latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming.

In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory.

If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVEX or OVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE- disable bit has no effect if the micro controller is in external execution mode.

PSEN

Program Store Enable is the read strobe to external program memory.

When the AT 89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external pro=gram memory locations star tong at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset.

EA should be strapped to Vcc for internal program executions.

This pin also receives the 12-volt programming enable voltage (Vpp) during Flash programming, for parts that require 12-volt Vpp.

XTRAL 1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTRAL2

Output from the inverting oscillator amplifier.

XTAL1 and XTAL 2 are the input and output, respectively, of an inverting amplifier, which can be configured for use as an on-chip oscillator, as shown in Figure OSCILLATOR_ CONNECTION. Either a quartz crystal or ceramic resonator may be used. To drive the device from an- external clock source, XTAL2 should be left_ unconnected

while. XTAL 1 is driven as shown in Figure external clock drive configuration. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

4.4 EXTERNAL CLOCK DRIVE CONFIGURATION

In idle mode, the CPU puts itself to sleep while all the on-chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset.

It should be noted that when idle is terminated by a hardware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to THE PORT PINS IS NOT INHIBITED. To eliminate the possibility of an unexpected write to a port pin when Idle is termined by rest, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

CHAPTER 5

HARDWARE IMPLEMENTATION

5.1 SCHEMATIC DIAGRAM

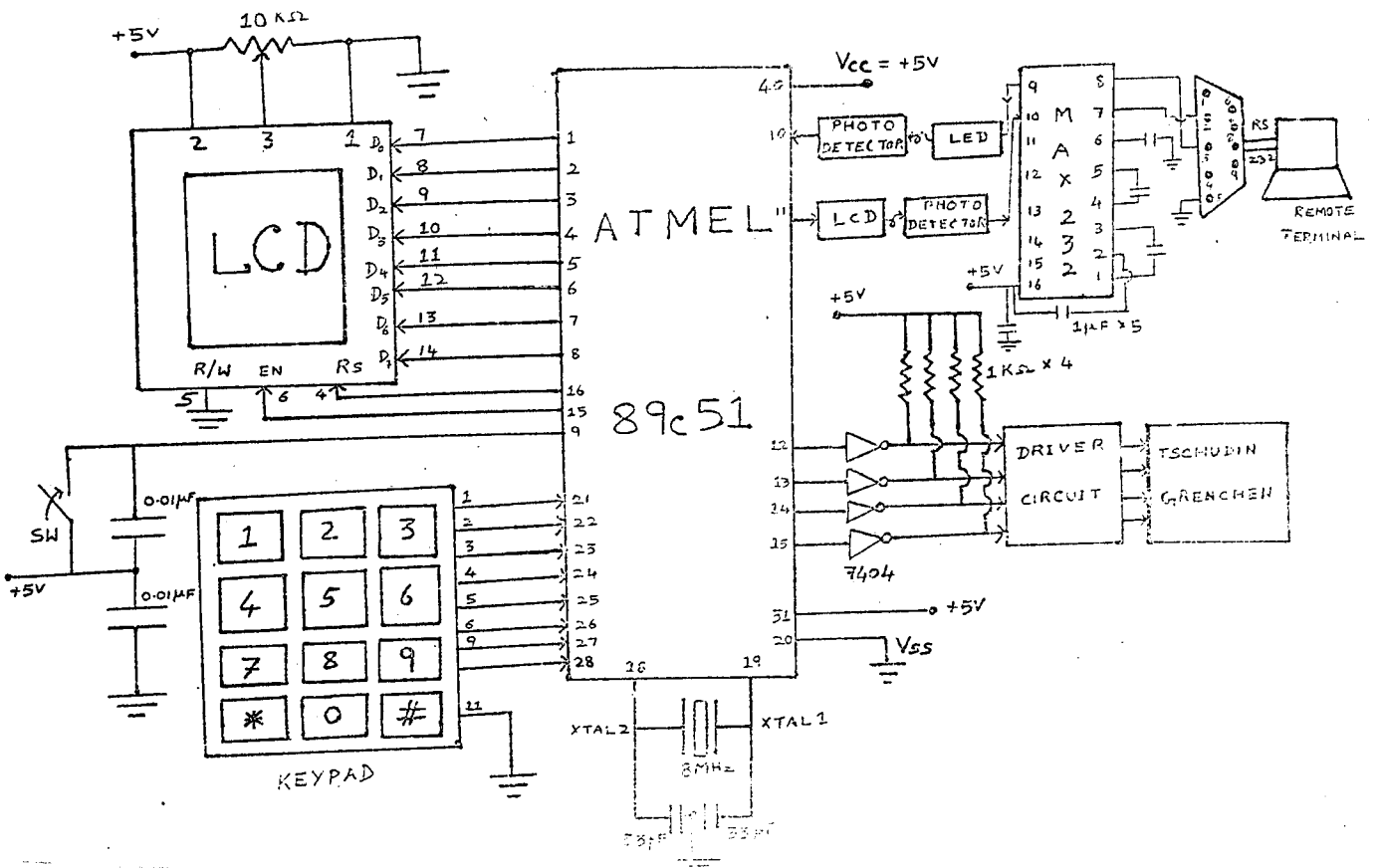

Fig No : 5.1 Schematic Diagram

5.2 HARDWARE DESIGN

Hardware design consist of

- Stepper Motor
- LED
- Photo Detector
- LCD
- RS-232 Interface
- MAX232

5.3 STEPPER MOTOR

The stepper motor is provided in the internal grinding attachment. A stepper motor transforms electrical pulses into equal increments of rotary shaft motion called steps. These motors work in conjunction with electronic switching devices. The functions of switching device are to switch the control winding of the stepper motor with a frequency and sequence corresponding to the command issued. It has a wound stator and non-excited rotor.

The stepper motor is classified as variable reluctance, permanent magnet, or hybrid, depending on ht type of rotor. They are also classified as 2-phase, 3-phase, or 4-phase depending on the number of winding (called control winding) on the Stator.

The number of teeth or poles on the rotor and the number of poles on the stator determined the size of the step (called the step angle). The step angle is equal to 360^0 divided by the number of steps per revolution. Motors are available with step rates of 200 steps per revolution. Further increase in step rate is limited by mechanical and physical constraints.

This limitation is overcome by electronic methods of reducing the step size. Half-stepping and micro stepping are techniques of electronically dividing each step into two half steps or from 10 to 125 micro steps.

A single pulse advances the shaft position by one angular step and a train of pulse produces a rotation in rapid steps, each with a non-cumulative error of say+/-3%.

For example, with a step angle of 1.8^0 one pulse will move the rotor position by 1.8+/--0.005 degrees, a train of 1000 pulse will give a rotation angle of 1800+/-0.05 degrees equivalent to five completed revolutions. With such accuracy, a stepper motor does not require closed loop control, since the number of pulses determines positional precision.

A single pulse develops a torque, which turns the rotor by one angular step, and it comes to rest after a short-damped oscillation. It depends upon the system inertia, elasticity, and damping. A properly timed pulse sequence sustains a slewing rotation, the rotor passing through a corresponding number of angular steps and develops an effective mean torque and speed (or acceleration) all with positional accuracy.

5.3.1 Applications

Stepper motors are used in computer peripheral, X-Y plotters, scientific instruments, robots, and machine tools. Stepper motors are used in quartz-crystal watches.

Stepper motors can upgrade mechanical systems by replacing cams, complex linkages, and similar mechanisms to give greater precision and production rate. Stepper motors are available with torques in the range from 0.5 micrometers to 100N-meters. The output is in the range from mill watts to several kilowatts and pulse rates of 1200 or more per second.

5.4 LIGHT EMITTING DIODE (LED)

The best known of all opt electronic device is so called LED (light emitting diode), which emits a fairly narrow bandwidth of visible (usually red, orange, yellow or green) or invisible (infra-red) light when its internal diode junction is simulated by a forward electric current voltage (power).

For optical communication systems required bit rate about 100 to 200 Mby tes/sec together with multimode fiber coupled optical power in the 10s of microwatts, semiconductor LEDs are usually the best light sources. The advantages of LEDs are,

- LED requires less complex drive circuitry than LASER diodes.
- No thermal or optical stabilization circuits are needed.
- Reliability – LED does not exhibit catastrophic degradation than injection LASER.
- LED output Vs current characteristics are less affected by temperature than the corresponding characteristics for LASER.
- LED has linear output against current characteristics.
- LEDs can be fabricated less expensively with higher yields.

However the disadvantages are,

- Usually lower modulation bandwidth.
- High distortion.

There are 3 processes involved in the working of LEDS. Firstly, the process of excitation due to which electron hole pairs are generated. Secondly, the process of recombination in which the excited carrier gives up its energy and lastly, the process of extraction of emitted photons from the active region of the semiconductor to the observer.

The above is the standard symbol that is used to represent LED

The device is made up of a semiconductor material. This material requires a definite amount of energy to generate and electron-hole pair. The same amount of energy is released when an electron recombines with a hole. This released energy may result in the emission of photons and such a recombination is termed as reductive recombination. This is the basic working principle of LED.

5.4.1 Operation

These are used for illustrative purpose instead of the load. According to the output of the relays (high or low voltage) they are switched ON/OFF.

LED is a semiconductor diode having radiative recombination. As the electrons of the LED cross-junction, they combine with holes. This changes their status from one energy level to a lower energy level. The extra energy they had, as free electrons must be released. Silicon diodes give off this extra energy as heat. Gallium arsenate diodes release some of the energy as heat and some as infrared light. This of diode is called an infrared light-emitting diode (IRLED).

The laser diode is an LED or IRLED with carefully physical dimension that produce a resonant optical cavity. The resonant provides feedback at one frequency to produce a strong, monochromatic (single-colour) output. Laser diodes are used in applications such as fiber optic communications, interferometer. Alignment, and scanning systems.

The LEDs and IRLEDs have a higher forward voltage drop than the silicon diodes. This drop varies from 1.5v to 2.5v depending on diode current, the diode type, and its color.

If the manufacture's data is not available 2v is a good starting point. In use, a LED must be wired in series with a current limiting devices such as a resistor. The LED

brightness is proportional to LED current, Most LED operate safely up to absolute maximum current of 30-40mA.

In our circuit we use LED to verify the voltage flow at that point. 1960-The first two successful laser were developed.

1. Ruby laser with wavelength $6943A^0$.
2. Helium-neon gas lasers $11,500A^0$.

5.4.2 Advantages of using LEDs:

The advantages of LEDs over conventional incandescent and other types of lamps are:

- Less working voltages and currents.
- Less power consumption.
- No warm-up time.
- Very fast action
- Emission of monochromatic light.
- Small size and weight.

5.5 PHOTO DETECTOR

The first unit of the receiver stage in case of optic fiber communication is the photo detector. Th9is senses the optic power and converts the optical power variation into varying electric current. Photo detector must be very highly sensitive to detect the weak power at the fiber end. Naturally the dimensions of the photo detector should be comparable to the fiber dimensions, as the light has to be picked up from the fiber end. Again there should not be any perceptual time lag between the falls of light radiation and

the response of the sensing element. Hence the expected characteristics of a photo detector usable in fiber optic communication are,

- It should have high quantum efficiency at the appropriate spectral region.
- A fast response speed to handle the desired data rate.
- Adequate spectral and frequency response
- It should be insensitive to temperature variations.
- The signal dependent noise must be very low.
- There must be low dark current.
- It must be compatible with fiber dimensions.
- It should have long life and affordable cost.

Because of the size, material, high sensitivity and fast response time, photodiodes are used. The two prominent types of photodiodes used are PIN diode standing for positive Intrinsic negative diode and APS standing for Avalanche photo diode.

5.6 LIQUID CRYSTAL DISPLAY (LCD)

Recently numbers of projects using liquid crystal display (LCD) modules have become very useful. Their ability top display not just numbers, but also letters, words and all manner of symbols, makes of symbols, make them a good deal more versatile than the familiar 7-segment light emitting diode (LED)

The modules have a fairly basic interface, which mates well with traditional microprocessor such as the Z80 or the 6502. It is also ideally suited to the PIC micro controller, which is probably the most popular micro controller used by the electronic hobbyist

We use an intelligent LCD display of two lines, 16 characters per line that is interfaced to the micro controller.

The display contains two internal byte-wide registers, one for commands (RS=0) and the second for characters to be displayed (RS=1). It also contains a user-programmed RAM area (the character RAM) that can be programmed to generate any desired character that can be formed using a dot matrix. To distinguished between these two data areas, the hex command byte 80 will used to signify that the display RAM address 00h is chosen.

Port 1 is used to furnish the command or data byte, and ports 3.2 to 3.4 furnish registers select and read/write levels. The read/write pin is permanently connected to ground for write operation.

The display takes varying amounts of time to accomplish various functions. LCD bit 7 is monitored for logic high (busy) to ensure the display is not overwritten. A slightly6 more complicated LCD displays (4 lines * 40 characters) is currently being used in medical diagnostic systems to run a very similar program.

- D0-D7 is the bi-directional data bus R/W determines if we read from or write to the LCD.
- RS stands for "register select". RS=0 means that the **instruction register** is selected. RS=1 means that the **data register** is selected. In other words, according to the status of RS pin, the data on the data bus is treated either as a command or character data.

EN pin enables or disables the LCD module. When enable is low the LCD is disables and the status of RS, R/W and the data will be ignored. The LCD will process when Enable pin is high the LCD is enabled and the status of the other control pins and data bus.

- Vo pin is for adjusting the contrast of the display. Usually, when this pin is grounded the pixels will be the darkest.
- Vdd and Vss are the power supply pins

5.6.1 Checking the busy flag

To check the state of the busy flag and read the address counter

1. Set R/w pin of the LCD HIGH (read from the LCD).
2. Select the instruction register by setting RS pin LOW.
3. Enable the LCD by setting the enable pin HIGH.
4. The most significant bit of the LCD data bus is the state of the busy flag (1=Busy, 0=Ready to accept instructions/data). The other bits hold the current value of the address counter.

5.7 RS – 232 INTERFACE

Electronic data communications between elements will generally fall into two broad categories: single-ended and differential. RS232 (Single-ended) was introduced in 1962, and despite rumors for its early demise, has remained widely used through the industry. Independent channels are established for two-way (full-duplex) communication.

The RS232 signals are represented by voltage levels with respect to a system common (power/logic ground). The "idle" state (MARK0 has the signal level negative with respect to common and the "active" state (SPACE) has the signal level positive with respect to common. RS232 has numerous handshaking lines (primarily used with modems) and also specifies a communications protocol.

RS 232 data is bi-polar... +3 to +12 volts indicates an "ON or O- Sate (SPACE) condition" while A-3 to –12 volts indicates an "OFF" I-state (MARK) condition..... Modern computer equipment ignores the negative level and accepts a zero voltage level as the "OFF" state. In fact, the "ON" state may be achieved with lesser positive potential. This means circuits powered by 5V DC are capable of driving RS 232 circuits directly, however, the overall range that the RS232 signal may be transmitted/ received may be dramatically reduced.

The output signal level usually swings between +12v and –12v. The "dead area" between +3v and –3v is designed to absorb line noise. In the various RS 232 like definitions this dead area may vary. For instance the definitions for V.10 has a dead area from +0.3v to –0.3v. Many receivers designed for RS 232 are sensitive to differentials of Iv or less.

PIN	SIGNALS
1	Data Carrier Detect
2.	Received Data
3	Transmitted data
4	Data Terminal Ready
5	Signal Ground
6	Data Set ready
7	Request to Send
8	Clear to Send
9	Ring indicator

Table No: 5.1 Pin Details

An RS 232 port can supply only limited power to another device. The number of outputs lines, the type of interface driver IC, and the state of the output lines are important considerations.

Data is transmitted and received on pins 2 and 3 respectively. Data Set Ready (DSR) is an indication from the Data Set (i.e the modem or DSU/CSU) that it is ON. Similarly, DTR indicates to the Data Set that the DTE is on. Data Carrier Detect (DCD) indicates that a good carrier is being received from the remote modem. Transmit and receive leads (2 or 3) can be reversed depending on the use of equipment-DCE Data Communications equipment or a DTE Data Terminal Equipment.

The RS 32 signal on a single cable is impossible to screen effectively for noise. By screening the entire cable we can reduce the influence of outside noise, but internally generated noise remains a problem. As the band rate and line length increase, the effect of capacitance between the different lines introduces serious crosstalk (this especially true on synchronous data because of the click lines) until a point is reached where the data itself is unreadable. Using low capacitance cable and shielding each pair can reduce signal Crosstalk

At higher frequencies a new problem comes to light. The high frequency component of the data signal is lost as the cable gets longer resulting in a rounded, rather than square wave signal.

The maximum distance will depend on the speed and noise level around the cable run. On longer runs a line driver is needed. This is a simple modem used to increase the maximum distance you can run RS-232 data.

SPECIFICATIONS		**RS-232**
Mode of Operation		SINGLE-ENDED
Total Number of Drivers and Receivers on one Line		I DRIVER I RECEIVER
Maximum Cable Length		50 feet
Maximum Data Rate		20 KB/s
Maximum Driver Output Voltage		+/-25v
Driver output signal level (loaded min.)	LOADED	+/-5V to +/-15V
Driver output signal level (Unload max)	UNLOADED	+/-25V
Driver Load Impedance (ohms)		3k to 7k
Max. driver Current in High Z State	Power ON	N/A
Max. Driver current in High Z State	Power OFF	+/-6mA @ +/-2V
Slew Rate (Max.)		30V/uS
Receiver Input Voltage Range		+/-15V
Receiver Input sensitivity		+/-3V
Receiver Input Resistance (ohms)		3k to 7k

Table No: 5.2 RS-232 Specifications

5.8. MAX 232

A standard serial interfacing for PC, RS232C, requires negative logic, i.e., logic '1' is- 3V to 12-V and logic '0' is +3V to +12V. To convert TTI, logic, say TxD and RxD pins of the microcontroller chips thus need a converter chip. A MAX232 chips has login been using in many microcontroller boards. It provides 2-channels RS232C port and requires external 10μF capacitors. Carefully check the polarity of capacitor when soldering the board.

CHAPTER 6

FIBER OPTIC COMMUNICATION

6.1 INTRODUCTION

A fiber optic communication system uses the light waves for transmission of signal and data. Her optical wave is used as the carrier since the optical frequency is of the order 5* 10 15 Hz. The development of optical communication system was not merely dependent on a suitable technique for transmission but was also dependent on the development of suitable fiber material that can take energy without loss to a distance.

6.2 ADVANTAGES OF FIBER OPTIC COMMUNICATION

- Wide Bandwidth-The first and foremost specialty of fiber optic communication is the accommodation of several channels for transmission of information. Hence more data can be sent for long distances, decreasing the number of wires and repeater station numbers. The transmission losses the least as per the quality of optical fibers available.
- Small size and weight-The low weight and small dimensions of fibers offer distinct advantage over the heavy bulky cables in crowed ducts.
- Immunity to interference-Conventional electrical cables have got the problem of EMI and EMC, But optical fibers are totally free from any such effects, which ensures freedom from electromagnetic pulse effects, which is of interest top military applications especially.
- The data transmission rate is also much higher in optical fibers which is about 2GB/s over 10's of Km.

- Electrical Isolation-Since cables are made up of glass, no worry about loops, fiber to fiber cross talk or electrical shocks.
- Signal Security-Since the signal is well confined to fiber (optical Wave Guide) high degree of security is there,
- Due to non-inductive and non-conductive nature of the fiber, no radiation effect or consequent interference is possible.
- System reliability and case of maintenance-The lifetime of optical components usually goes to 20-30 years.
- Abundant Raw Material-The principle raw material for used for fiber is silica is available in plenty.
- Besides higher ratio of receiver power to transmitter power with smaller transmitter and receiver apertures and better directional resolutions in case of unguided systems is also there for optical communication.
- The cost per channel is lower than that of an equivalent wire cable system. With the increasing awareness of optic fiber and the enhanced interest in its refinement their cost will further go down in the near future.

6.3 TYPES OF OPTICAL COMMUNICATION

- **Guided Communication-** Here the medium of transmission is the optical fiber.
- **Unsigned communication-** Here the medium of transmission is space or atmosphere.

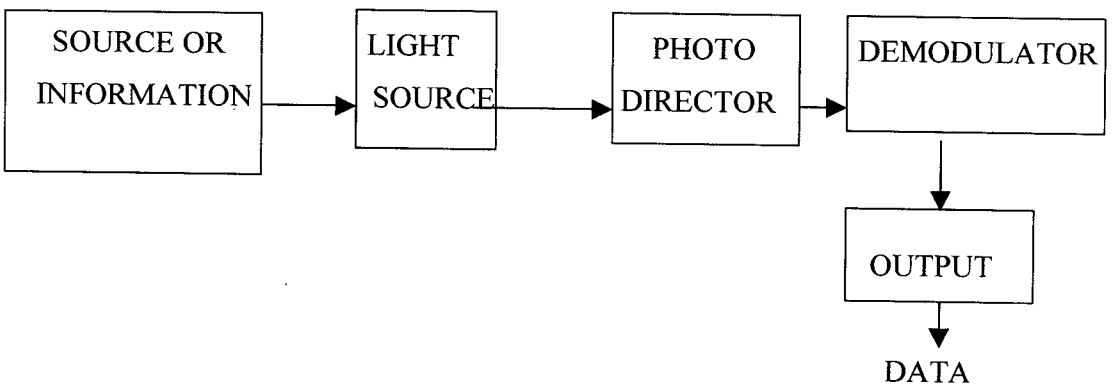

Figure No: 6.1 Optical Communication Systems

In optical fiber communication, the transmitter consists of an intense light source. The data is superposed on this light wave and this light wave and this data carrying light wave is fed to the optic fiber. At the receiving end a photo detector picks up the light energy and subsequently the data signal is filtered out after demodulation.

6.4 BASIC OPTIC PRINCIPLES IN OPTIC FIBER COMMUNICATION

In the transmission of light through optic fiber there is a central core of the fiber, which is cylindrical in shape. The refractive index will be constant uniformly within this core. This is surrounded by a thick tubular structure of similar material but of different optical characteristics. This is called cladding. When light is transferred to the optic fiber at one end. Effective transmission is along the core and some light is lost in the cladding. For the light transfer into the core at the beginning as well as for any light traveling from the core to the cladding the phenomenon of refraction occurs.

Ni sin I = nr sin r

Where "i" is the angle of incidence, "r" is the angle of refraction, "ni" is the refraction index of the incident medium, "nr" is the refractive index of the refractive medium.

When the light ray travels from a denser medium to rarer medium, the refracted ray is coming to the lin of separation between the media. If we go on increasing angle"i", angle "r" increases steadily and for a particular value of "i" the refracted ray travels along the boundary line between the two media. This is called the "critical angle of incidence". For any further increased angle "i" the light ray is reflected back to the first medium itself and this is called "Total Internal Reflection". For successful transmission of light energy through fiber, the angle of incidence of light at the boundary of the core has to be either the critical angle of incidence of light at the boundary of the core has to be either the critical angle "c" or any angle greater than that. Hence the light energy transfer at the beginning of the fiber must facilitate this state. If the angle is exactly "c" the energy can travel parallel to the core axis, if incident angle is greater than "c" the light is subjected to multiple total internal reflection at different points along the periphery of the core and energy is transmitted.

CHAPTER 7

CONCLUSION

7.1 CONCLUSION

Thus the Tschudin grenchen HTG/630 is controlled using microcontroller (89c51). Since LCD and keypad are used to control the grinding machine this can also be called as PLC. This project is for low rating applications for achieving high rating PWM should be generated. In that case the same micro controller can be programmed for generation of PWM

Hence an attempt has been made to include embedded technology in the control of various slide movements of the grinding machine and has been found successful.

7.2 TRENDS IN THE DEVELOPMENT OF GRINDING MACHINES

The basic trends in improving the constructions of grinding machines include:

- ✓ Using building-block units and unifying assemblies and mechanism
- ✓ Increasing the degree of automation by intensive implementation of one-, two-and three –axis numerical control systems for controlling grinding and wheel dressing operations; digital indication, adaptive systems, transducers for sensing positions of a working member, parameters of grinding process and quality, on-line gauging devices;
- ✓ Increasing the production of automatic, and precision machines;
- ✓ Increasing the production of machines for high-velocity, power and high-feed grinding;
- ✓ Developing machines for in feed grinding with wide wheels using diamond rolls and rolls gangs for dressing;
- ✓ Developing multi-wheel and multi-spindle machines;
- ✓ Developing machines for combination0-abrasive-electrochemical or abrasive-electroerosion-grinding;
- ✓ Using low-pressure hydrostatic power drivers;
- ✓ Using electromechanical feed drives;
- ✓ Using hydrostatic and aerostatic bearings and guide ways;
- ✓ Using devices for ensuring constant speed of the wheel, its automatic balancing on the machine.

APPENDICES

APPENDIX 1

PROGRAM:

ADDRESS	MNEMONICS
	.en bit p 3.5
	.rs bit p 3.6
	.org 000h
	ljmp main
	.org 000bh
	djnz 20h, label
	clr tcon. 4
	setb 26h.0
	mov 20h, 22h
label:	mov th0, #-16
	reti
	.org 001bh
	.reti.
	.org 1001h
	.db 45
	.db25
	.db16
	.db12
	.db10
	.db8
	.db7

```
                .db6
                .db5

receive:        mov ie, # 10010000b
                mov scon, # 01010000b
                jnb ri, $
                ret
transmit:       mov sbuf, # 00h
                mov scon, # 00h
                mov sbuf,29h
                mov scon, # 01000000b
                jnb ti, $
                ret
serial:         lcall receive
                mov 28h, sbup
                mov 29h # 0aah
                lcall transmit
                lcall receive
                mov 27h, sbuf
                mov 29h, # 88h
                lcall transmit
                lcall receive
                mov 22h, sbup
                mov 29h, # 99h
                lcall transmit
                mov a 22h
                mov dptr, # 1000h
                mov a @ + dptr
                mov 22h,a
                mov 20h,22h
```

```
                    ret
delay :             clr tcon.4
                    clr 26h.0
                    mov th0, # - 16
                    mov tl0, #00
                    mov tmod,, # 00000001b
                    mov ie, # 100000 10b
                    setb tcon.4
                    jnb 26h.0$
                    ret
rotate:             mov 21h, 28h
                    jb 21.7, right
                    mov 25h, # 00h
                    mov a 28h
                    anl a, #01111111b
                    jz steps 1
                    mov a, 23h
rot1:               mov 25, # 200
step 1:             lcall delay
                    rla
                    mov p0,a
                    lcall shift
                    dnjz 25h, step 1
                    dnjz 28h,rot1
                    mov23h,a
steps 1:            mov a, 27h

                    anl a, # 11111111b
                    jz ack
                    mov a, 23h
```

```
                step 2: lcall delay
                rla
                mov p0, a lcall shift
                djnz 27h, step 2
                ljmp ack
right:          mov 25,#00
                mov a, 28h a
                anl a, #01111111b
                jz step2
                ljmp ack
                right: mov 25, # 00
                mov a, 28h
                anl a, 28h,a
                mov a, 23h
rot2:           mov 25h,#200
step 3:         lcall delay
rr2
                mov p0,a
                lcal shift
                dnjz 25h, step3
                djnz 28h rot 2
                mov 23h,a
step2:          mov a, 27h
                anl a, # 11111111b
                jz ack
                mov a,23h
step 4:         lcall delay
                rr2
                mov p0,a
                lcall shift.
```

```
                djnz 27h, step4
ack:            ret
dawr:           setb rs
                ljmp dnr
cwr:            clr rs
dnr:            mov p1,a
                nop
                clr en
                nop
                nop
                setb en
                nop
                nop
                clr en
                mov p1,#0ffh
                lcall delay 1
                ret
ledin :         mov a,  # 38h
                lcall owr
                mov a, #38h
                lcall cwr
                mov a, #06h
                lcall cwr
                mov a, #01h
                lcall cwr
                ret
delay 1:        mov r4, # 0xff
                a2:mov r3, #0xff
                nop
                nop
```

```
                    nop
                    nop
a1:                 djnz r3, a1
                    djnz r4, a2
                    ret
key:                mov p2, #0xff
                    mov r2, # 02h
scan:               acall keydown
                    jz scan
                    acall convert
                    jbc 24h .0,scan
                    mov 2bh,a
                    lcall delay1
                    lcall keydown
                    jz la1
                    acall convert
                    jbc 24h, 0,scan
                    cjne a, sbh,scan
la1:                cjne, #01h, first no.
                    mov r1, sbh
                    ljmp 13
firstno:            mov a, 2bh
                    swap a
                    mov 2ch,a
wait:               acall keydown
                    jnz wait
                    djnz r2, scan
13:                 acall convert
                    jbc 24h.0ah, 13
                    mov a, 2ch
```

```
                add a, r1
                mov a, 2ch
                add a, r1
                mov 2ah,a
                ret
keydown:        mov a,p2
                anl a,# 0ffh
                cpl a
                ret
convert:        clr 24h.0
                clr a
                mov r0, p2
                cjne r0, # 0e3h, one
                sjmp good
one:            inc a
                cjne r0, #0fch, two
                sjmp good
two:            inc a
                cjne r0, # 0edh, three
                sjmp good
three:          inc a
                cjne r0, # 0edh, three
                sjmp good
four:           inc a
                cjne r0, # 0beh, five
                sjmp good
five:           inc a
                cjne r0,#0afh, six
                sjmp good
six :           inc a
```

```
                    cjne r0, # 0afh, seven
                    sjmp good
seven:              inc a
                    cjne r0, # 0afh, eight
                    sjmp good
eight:              inc a
                    cjne r0, # 0afh, nine
                    sjmp good
nine:               inc a
                    cjne r0, # 0afh, enter
                    sjmp good
enter:              inc a
                    cjne r0,0f3h, bad
                    sjmp good
bad:                setb 24h.o
good:               ret
shift:              mov c, p0.0
                    mov pe 2,c
                    mov c, p0.1
                    mov p3,4,c
                    movc, p0.3
                    mov c, p0.3
                    mov p3.7,c
                    ret
mess 1              .dbMODE:1-REMOTE, 0-DIRECT:00
mess 2:             . db 'NO OF ROTATIONS': 00
mess3:              . db 'NO OF STEPS': 00
mess 4              . db 'NO OF SPEED'
                    .org 0032h
main:               mov th1, # 00100000b
```

```
                mov tmod, # 100001000b
                ste0p tcon.4
                mov ie, #10001000b
                setb tcon.4
                mov 23h, # 00001111b
                lcall delay 1
                lcall delay 1
                lcall ledin
                mov dptr, # mess 1
po1:            clr a
                movc a, @ a+dptr
                lcall dawr
                jz ed
                inc dptr
                ljmp po1
ed:             lcall key
                mov r7, 2ah
                cjne r7, # 01h, direct
                ljmp remote
direct:         mov p1, # #0x01
                lcall cwr
                mov dpt, #mess2
po2:            clr a
                mov a, @a+dptr
                lcall dawr
                jz ed1
                inc dptr
                ljmp po2
ed1:            lcall key
                mov 26h, 2ah
```

```
        mov p1, 0xff
        mov a, # 0x01
        lcall cwr
        mov dptr, # mess3
po3:    clr a
        movc a, @a+dptr
        lcall dawr
        jz ed2
        inc dptr
        ljmp po3
ed2:    lcall key
        mov 27h, 2ah
        mov p1, # 0xff
        mov a, # 0x01
        lcall cwr
        mov dptr, #mess4
po4:    clr a
        movc a, @a+dptr
        lcall dawr
        jz ed3
        inc dptr
        ljmp po4
ed3:    lcall key
        mov 22h,2ah
        mov a, 22h
        mov dptr, #1000h
        movc a @a+dptr
        mov 22h, a
        mov 20h,22h
        mov p1
```

```
mov a, # 0xff
mov a, # 0x01
lcall cwr
lcall rotate
ljmp main
remote : lcall serial
lcall rotate
mov29h, # 0cch
lcall transmit
ljmp main
.end
```

REFERENCES

1. Optical fiber communication-john.M.Senior.
2. Optical fiber communication-G.Keiser.
3. Micro controller and its applications-Kenneth Ayala.
4. Atmel data sheets-WWW.atmal.com
5. Liquid crystal display-WWW.geocities.com
6. MAX 232- WWW. Eletronics.free.com
7. RS 232 data sheets.
8. Grinding machines-G.Lurie & V.Komissarzhevskaya.