# **INTRODUCTION**

Electricity is one of the major sources of power in this world, but along with its utilization, a major portion of it is wastage and stealing. Electricity board is facing a lot of problem in conservation of electric power. We realized the problem and work over it. From this we got the inspiration to design a **POWER LIMITER.**

Earlier we were using fuse forprotection from over- load, fuse is a device, which operates *on* overload (current). If the excessive current flows through the circuit then the fuse wire melts and it is to be replaced after every operation rating of fuse wire used.

To overcome the drawback of fuse, Circuit Breakers are used to break the circuit. . These are used in power grids substations and now a days miniature circuit breakers are used for domestic purpose. During overload it breaks the circuit by separating the moving contact. This moving contact is to be settled manually.

Circuit beakers are very common device being used by electrical persons for switching ON/OFF the electrical loads. But the load switching is required automatically day or night, switching is required with respect to time period, switching is required with respect to applied load and all this continuously and automatically. An attempt is made to design such system, which would do above switching automatically. Such system would eliminate fuse links operators job to switch the load to ON/OFF at different time intervals etc hence we are designing a system which can perform all above mentioned jobs automatically and called as **POWER LIMITER**.

**FEATURES OF POWER LIMITER:**

* Output power is limited to set watt.
* Any attempt to draw more power results in flickering of lights.
* Can be mounted any where on the electric line or on the electric post.
* Helps in average billing.
* Reduces manpower.
* Eliminates doubts of wrong billing.
* This is feasible through power limiter of 200w/300w/400w etc up to 2000w and rating can be increased according to the requirement of consumer.
* Can be made cheaper than ENERGY METER in large-scale production.
* Avoids power thefts.
* Provides SURGE PROTECTION to the load, which is not possible through energy meter.
* Helps to limit farmers to draw power up to 5 to 10 BHP as per the permission granted.

**DESCRIPTION**

Mechanical energy meters are not suitable for low power load as don’t work at such a low load. The sand particles get deposited on the spindle, which restricts the free motion of the wheel in mechanical energy meters.

Mechanical energy meters are viable for tampering and meter reading can be manipulated. Mechanical energy meters are costly and due to improper maintenances they get damaged.

We can also attach a LIGHT DETECTOR to POWER LIMITER to provide the supply only at night. Because there are lots of free consumers (i.e. single batti connection consumer). Which would give more finance to an electricity board?

Light is sensed by light detector and based on the presence/absence of light, the power is switched to load detector through the control block.

The load detector block compares the applied load with the set load and switches the load to OFF if the applied load is more than the set load and vice-versa. Power supply delivers the power to different blocks at different voltages.

Before the era of microprocessors, circuits were constructed using discreet logic like various gates, counters, flip-flop, decoders, monostable and registers. Circuit diagram was designed as per the requirement. Prototype PCB is made interconnecting the logic component as per the design.

Now a day we are having numbers of microprocessors, which can perform various arithmetic and logical operations as per the requirement of user. The microprocessor is a multipurpose, programmable, clock driven, register based electronic device, that reads binary instructions from s storage device called memory, accepts binary data as input and processes the data according to the instructions and provide result as output. Here we are using chip **89C51** (**micro controller**), which is more than sufficient, for most of the application.

## WORKING PRINCIPLES

Basically Electronic Power Controller is Based on Automatic Circuit Breaker. It is set For a particular power, which it checks time to time and operates the relay under abnormal condition. The following are the two conditions, which explains the working of electronic power controller.

1. ON SETTED LOAD (NORMAL CONDITION)

When there is no variation in the load, the load sensor senses and matches it with the sctted one IC 74 1 compare it with the reference (negative) voltage and ho ouffnit voltage is obtained at 741 IC i.e.,. zero output . Therefore, these is no triggering voltage to IC 555 but this IC 555 keeps on working as a timer and operate (he relay on normally closed condition and the supply in maintain.

1. ON HIGH LOAD (ABNORMAL CONDITION)

The load sensor senses the increased load and matches it with the setted load at preset. This is then compared with then reference (negative) I/P voltage of IC 741. The difference voltage is obtained at the output & this output acts as a triggering voltage & is given as I/P to IC 555. The output of IC *555* operates the relay and the supply to (lie load is disconnected.

Thus the circuit works under both the normal and abnormal condition.

**MICROCONTROLLAR**

**3.1Introduction to MSC-51 series**

Before the era of microprocessor circuit were constructed using discrete logic like various gate, counters flip-flops, decoders, monostables and registers. Circuit diagrams. Proto type PC is made interconnecting the logic components as per the design. Testing and debugging is done in lab. During the testing some modifications were required. When the product was tested in the field some changes are required. This requires new design of PCB.

To overcome this difficulty scientists and engineers were working on a machine, which could read the setoff instruction to do a particular operation called PROGRAM, stored in memory and executes it. This instruction would be simple like **ADD, SUBTRACT, AND, OR, INVERT, ROTATE, MOVE.** If such a machine would be made, which is comparatively easy? The birth of computer is also a result of such thinking. Because of advancement in the silicon technology it was possible to design such a device called MICROPROCESSOR. The microprocessor will read the instruction stored in ROM, the read only memory, and execute it. PROM programmers were used to put the desired program inside the ROM. This process is called programming the ROM. Intel came out first with 8080 microprocessor. This was followed by 8085 which became very popular and accepted by the industry all over the world. The use of 8085 always follows the use of external ROM like 2764, external RAM 6264, 8 bit latch 74ls373, address decoding logic 74ls138, I/O device such as 8155/8255, serial interface 8251, timers/counters 8253 or discrete logic. Again efforts were made to put all the standard hardware logic in 1 chip. As a result of such an effort Intel came out with MSC-51 series. It has all the above features build in chip or embedded in it, plus enhanced instruction set. This includes Bit manipulation instructions, and instructions to multiply and divide 8 bit hexadecimal number. It also has code protection features.

When Intel introduced MSC-51 series, there were three IC’s in the series, namely 8031, 8051 and 8751. 8031neds external ROM like 2764.8051 has internal but one tie programmable ROM. 8751 has one chip UV erasable ROM. 8031 was suitable for development, but many pins were used for interfacing with ROM. 8051 was suitable only for production, it is not possible to reprogram. 8751 has UV erasable on chip ROM, which requires 20minutes to erase and was quite expensive. Atmel made a break through and developed flash version of 8051 called the 89C51 which has built in Flash ROM In Flash version, applying program The process is called Flash crasing. With this technique existing program can be crased quickly and new program can be burn. The price of the flash version was also affordable. 89C51 IC became very popular It is Hardware and software compatible with MCS-51 series IC 8051

Quick look at 8085 IC revels that , it has 16 bit for addressing the memory which can address 64K OF Memory Of which some part can be ROM and remaining can be RAM but total of RAM but total of RAM and ROM can not exceed 64K MCS-51 series can address 64K ROM and 256 byte internal RAM Out of the 64K ROM Not all the ROM resides on the Chip 89C51 has 4K of on chip ROM and rest of the ROM must be physically out side the chip. The 64K RAM is always out side the Chip and is called external RAM Apart from the 64K external RAM, There is 256 byte internal RAM which is always inside the Chip and is called internal Ram Industrial application with more moderate complexity can be fitted inside the 4K of ROM The 256 byte internal Ram is divided in to two equal part of 128 byte each The upper half, from location 128 to 255, is reserved for special purpose register and is called SFR area. If program demands extra ROM, one can use higher version, 89C52 which has on chip 8K ROM. Next higher version is also available. The 89C55 has 20K of on chip ROM. If the program is written I assembly language, 4K ROM of 89C51 is more than sufficient for most of the application.

**3.2PIN CONFIGURATION**

89C51 is a 40-pin device. Two pins are used for power supply, and requires +5 v. IT has on chip oscillator to which requires use of external crystal. Normally crystal frequency is around 12 MHz. This oscillator is further divided by 12 by internally and considered as clock for machine cycle. Most of the instruction takes one or two machine cycle to execute for 12 MHz crystal, most of the instruction will get executed in one or two microsecond. It has one pin called ALE. When program execution is going on, ALE pin will pulse at one sixth of the clock frequency. So for 12MHz crystal, ALE pin pulse at 2 MHz. It has one pin called Reset. And it requires active huge pulse. 8085 requires active low reset. After reset program counter becomes 0000 and program execution starts from 0000. It has one pin called PSEN. If external ROM is used then PSEN pin is connected to RD of ROM. So we will leave them unconnected in our design. It has one more pin called EA and has to be connected to Vic, so that 89C51 will start using internal ROM.

It has four 8-bit ports. Port 0, Port1, Port2 and Port3. All the port pins can be used as input or output without predefining. Port-1, Port-2 and Port-3 are internally pulled up through FET. But Port-0 requires external pull up resistor. After Reset all the port pins are high. Each port has the place in the internal Remand has a specific address. The address of the Port-0 is 80 hex, address foot the Port-1 is 90 hex, address for the port 2 has the A0 hex and the address for the Port-3 is B0 hex. Anything that is written at location 80 hex will get written to Port-0, Reading location A0 hex, I same as reading Port-2. The Port pins are also labeled in dot notation for connivance. Port-0 pin will been labeled as Port 0.0, Port 0.1, Port 0.2 and so on. Similarly other Port pins will be labeled.

From the practical point of view, we can say that 89C51 has $K on chip flash ROM and 256 byte of on chip RAM, called internal RAM. Pulse it has two timer/counter modules, serial interface, four 8-bit ports, interrupt handling logic as standard feature. It can also address 64K external RAM, and /or remaining 60K of external ROM but as many 18 pins are used to interfacing external memory. AS so many pins are lost in interfacing, designs using these external memories are not preferred. If one needs more RAM one can use EE-ROM, which are more economical, and uses three times for interfacing.

All the port pins are said to be bit addressable. The bit addressable RAM is a new concept. If the RAM location is bit addressable then it’s individual bit has unique bit address. Refer to fig 2 for pin configuration and addressable concept. Bits in the bit addressable ram can be address by their bit address or in the dot notation. The Bit address for pin, port0.0 is 80 hex, port0.1 is 81 hex, port0.2 is 82 hex and so on. Please note, Bit address and port address are different. 80 hex bit address means port pin p0.0 and 80 hex internal RAM address means port 0 as a complete. There are separate instruction for addressing bit and byte. It is the instruction, which decides weather, bit is addressing are byte is addressed. 89C51 has instruction to clear the bit, set the bit, compliment the bit, OR the Bit, AND the bit and conditional jump instruction, depending on the Bit is set or Clear.

The pins of the port 3 have alternate use. 89C51 has built in serial interface. Two pins are used for this purpose. Serial data will be always received on port pin P3.0, so the port3.0 is labeled as RXD and serial data will be transmitted on port pin p3.1,so the port3.1 is labeled as TXD. Eternal interrupt if used, will be connected to port pin p3.3, So these pins are labeled as INT0 and INT1. 89C51 has two timer/counter modules. They can count pulses appearing at port pin P3.4 and pin P3.5 these pins are labeled as T0 and T1 respectively.

It external ROM or RAM has to be interfaced then port 0 is used as 8 bit multiplexed AD Bus, AD0 T0 AD7. and port 2 is used as higher order address bus A8 to A15. The function of Pin ALE is same as in 8085, to generate strobe for latching lower order address byte. Port Pin P3.6 and P3.7 are connected to WR/and RD/ for external RAM.

From the practical point of view, we can say that 89C51 has 4K on chip flash ROM and 256 byte of on chip RAM called internal RAM. Plus it has two timer/counter modules, serial interface, four 8-bit posts, interrupt handling logic as standard feature. It can also address 64K external RAM, and /or remaining 60 K of external ROM. But as many as 18 pins are used to interfacing external memory. As so many pins are lost in interfacing, designs using these external memories are not preferred. If one needs more RAM one can use serial EEROM, which are more economical, and uses 3 lines for interfacing.

89C51 has one wonderful features. It has multiprocessing mode. In this mode, there is one mater 89C51 and number of other slave 89C51. Master can communicate with the slave 89C51, Sharing the common serial bus without disturbing other 89C51 even though they are connected to common serial bus. This feature is quite advanced. We just mention that chips in the MCS-51 have multiprocessing capability and is not advised to go into details of it unless person gathers basic skill in programming.

**3.3 TIMERS AND COUNTERS**

89C51 have two on chop, timer / counter modules. They are called TIMER0 AND TIMER1. they are UP counter only. Both the modules are identical in nature Let us consider TIMER0 as shown in the following figure. This figure will illustrate the working of the module clearly.

The two register TL0 and TH0 will from 16 bit counter. TL0 and TH0 are the Registers and have place in the SFR area. Their location is 8A hex and 8C hex respectively. They are not bit addressable. The counters are used in UP counter mode only. While counting UP, whenever it will over flow from FFFF hex to 0000, the bit TF0 will set. The switch in the small box will pass the pulses to the counter. Pulses will be passed to counter if output of the AND gate is High. The AND gate has two input, one is Bit TR0 and another is connected to the output of the OR gate. The OR gate has again two input. One is inverted GATE0 bit and other is connected to port3 pin P3.2, the INTO. The counter can count the pulses coming from internal Oscillator after division by 12 or pulses, appearing at port3 pin P3.4, the T0. The T0. the bit C/T0 will decide this.

The bits GATE0, C/T0 of TIMER0 and corresponding bits of TIMERS1 the GATE1 and C/T1 are found in Register TMOD located at address 89 in the SFR area. This TMOD register is not bit addressable. The bits TR0, TF0 of TIMER0 and corresponding Bit TR1 and TF1 of TIMER1 are found in the register TCON located at address 88 hex in SFR area. It is a bit addressable Register.

When the pulses will be passed to the counter, will depending on the status of the bit, GATE0. If the GATE0 Bit is cleared i.e.zero. Then Bit TR0 will purely control the Counting. Counting will be on as long the bit TR0 is SET. So if GATE bit is zero, then counting will be purely controlled by software. If GATE bit is SET, then counting will be on when Bit TR0 is SET plus port pin P3.2, the INTO is high thus if GATE Bit is zero then counting will be purely controlled by software and if GATE Bit is one then counting will be controlled by software plus hardware.

If we want the bit TF0 to set after counting 2000 pulses. As the counter is counting up only, we must set Registers TH0,TL0 initially to a value equal to the hexadecimal F830 hex which is equivalent of decimal number, number 65536 - 2000 so that bit TF0 will set exactly after counting 2000 pulses. If we want the bit to set regularly after counting 2000 pulses, then we must reload the Register TH0, TL0 to value equal to the hexadecimal equivalent of number 65536 – 2000, whenever they become 0000. usually this is the first job of the interrupt service routine to reload TH0, TL0. The above mode is called 16-bit counter mode. This mode is called MODE 1

There is one more mode called MODE 2, the 8-Bit Auto Reload mode, which is also used very commonly. In this is mode counting is done in Register TL0, so it is 8 bit counter mode. After overflow from FF hex to 00, the TF0 bit is SET. At the same time data in the register TH1 will be automatically get copied or reloaded in to register TL0. The Register TH0 said to holds the Auto reload count. This will ensure that interrupt will exactly after same time interval. All over logic will remain same.

The Bits M0 and M1 in the TMOD Register will set the mode. Of both the bits are 0 0 then MODE 0 is selected. It exactly same as MODE 1, Except counting is done in 13 bit instead of 16 Bit. If the Bits are 0 1 then MODE 1, the 16 Bit counter mode is selected. This mode we have seen above. If the bits are 1 0 then MODE 2, the 8-Bit AUTORELOAD mode is selected. If this bits are 1 1 then MODE 3, Special mode is selected. In this mode TIMER 1 is temporarily halted. TL0 and TH0 are used as separate 8 bit counters. Counting logic for TL0 is same as in case of MODE 2. But all Control bits of Timer 1 are now diverted for counting of 8-bit in TH0. This mode in not used in practice very much because of the involved complexity.

**3.4 INTERRUPTS**

We have seen earlier that many times, processor has to respond to event happening in the real time world. The event may take place at any time. Interrupt handling logic is incorporated inside the chip, for this purpose. In such a case, processor will suspend current execution of the program, and branch to interrupt service routine. After finishing, we will resume the suspended work..

The situation can be seen very frequently, in our every day life. Suppose a person is busy in doing some work, say writing a letter. And all of a sudden telephone, and resume the writing the book. Some time there are 4, 5 telephone lines are available. In that case he may have to decide about the priority, in answering the phones some time he himself is very bust in important meeting, and does not want to get disturbed by the phone calls. All these types of situation exist in microprocessor worlds also.

Those of you who are familiar with 8085 will recall that 8085 can handle 5 different interrupts. 89C51 can also respond to 5 different interrupting lines, equivalent of having five telephone lines. Two are external interrupts they are called INT0, INT1 at port pin P3.2 and P3.3 and respectively. If these interrupts are activated and enable in software the program will branch to location 0003 and 0013 hex of program memory (ROM). 89C51 have two Timer overflow flag TF0, or TF1 is set, and interrupts are generated. If the interrupts are enabled in software then the program will branch to location 000B hex and 001B hex respectively. 89C51 has built in serial interface. Whenever serial data is received, Receipt Interrupt, bit RI is set and whenever data is fully shifted out transmit interrupt bit TI is set. The RI and TI together generates one interrupt. Called serial interrupt. If this interrupt is enabled in software then the program will branch to location 0023 hex in ROM memory. The interrupt handling logic of 98C51 can be explained with the help of following figure.

The external interrupt INT0 and INT1 can be defined as either Negative Edge Triggered or Level Triggered. This means, if interrupt is defined as Negative Edge Triggered, interrupt will be generated whenever negative edge is detected on INT0 or INT1 line, Or if interrupt is defined as level triggered, then interrupt is active as long as INT0 or INT1 is held low. The Bits IT0 Interrupt type Zero, and IT1 Interrupt type one will decide whether the interrupt is defined as edge triggered or level triggered. If the bit is 0 then corresponding interrupt is level triggered and if the bit is 1 then it is edge triggered. These bits are found in TCON register, in the SFR area of the internal RAM, and it’s address is 88 hex..

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IE | EA | --- | ET2 | ES | ET1 | EX1 | ET0 | EX0 | SFR ADDRESS A8 |

# INTERRUPT ENABLE REGISTER IE

There is Interrupt Enable Register IE. The bits in the register IE will decide, which Interrupts are active or enabled. The MSB it of the IE register is the global enable bit, labeled as EA. If this bit is 1 mean interrupt are enabled, and if is 0 then all interrupts are disabled. Other bits in the IE register will enable. If they are 1,or disable if they are 0, the individual interrupts. The interrupt enable register IE has a place in SFR area and its address is A8 hex. It is a Bit Addressable register.

There is a provision to decide the priority of the interrupt, either High or Low. The priority can be define in the register IP, interrupt priority Register. The address of the register is B8 hex in the SFR area. It is a bit addressable Register. If lower priority work is in progress, and higher priority interrupt arrives. Then lower priority work will be suspended, processor will branch to higher priority service routine. After finishing higher priority work, he will resume the execution lower priority interrupt. and after finishing execution of lower priority interrupt the processor will go back to start the execution of main program. If higher priority interrupts is in progress and lower priority interrupt arrives then lower priority interrupt will be kept pending till execution of higher priority interrupt ends. After finishing higher priority interrupt processor will state the execution of lower priority interrupt. After finishing the same, processor will go back to main program.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IP | --- | PT2 | PS | PT1 | PX1 | PT0 | PX0 | SFR ADDRESS B8 |

INTERUPT PRIORITY REGISTER IP

As was mentioned earlier INT0 or INT1 pins will activate the interrupt in two ways. Interrupt can be defined as edge triggered or level triggered. IE0 and IE1 are the two bits, which actually causes the interrupts. If interrupts are defined as level triggered then bits IE0 and IE1 will remain set as long as pins INT0 or INT1 are low. If they are defined as level triggered and activated then program will branch to the respective vector address in ROM and will start the execution of the service routine. It is then hardware’s and /or programs responsibility to see that pin, INT0 or INT1, who has caused the interrupt, goes high so that bit IE0 or IE1 will be cleared. If INT0 or INT1 is not cleared then program will again enter into the same service routine. Mostly these interrupts are defined as edge triggered mode only. If they are defined as edge triggered, then the nit IE0 or IE1 will set whenever negative edge is detected, and the bits will automatically get cleared, when program branches to respective interrupt service vector.

Timer overflow bit TF0 or TF1 will set, whenever counter overflows from FFFF hex to 0000. they will automatically get cleared, when program branches to respective interrupt service vector.

The bits R1 an T1 in the serial interface logic will be Ored and will generate one common interrupt. If these interrupts are enabled, then program will start execution at ROM address 0023 hex. These bits will not get cleared automatically. Program will find out has caused the interrupt. Then will take the appropriate action and program will clear the bit. The bits T1 and R1 are found in serial control register SCON. The register SCON is found at address 98 hex in the SFR area.

**3.5 DEVELOPMETN PROCESS**

Gone are those tiresome, Exhausting days when one has to code the program manually on the paper, calculate jump addresses. Enter the code manually in the kit. Execute the program on kit. Change the platform. Again code it for target board. With he revolution in sort were industry, powerful simulator packages are available, so the use of kit is outdated. The Development process in any language is consisting of various stages. The tools and the stages in developing program in assembly language are as follows. All the stages and steps are taught in the micro controller Training program in detail.

**Editor**  to write the programs.

**Assembler**  to convert the program in to machine code.

**Simulator** will run the program on the computer and give us the result as if controller has executed the program.

**Target Board hardware** where the program will be executed.

Each stage has its own rules and commands. Apart from this rules one need

to know the architecture and instruction set of the processor. During the

debugging phase, one must be able of differentiate the nature of problem,

either it is a Hardware problem or software problem.

STAGE NO.1 Writing program using any standard EDITOR.

Program consists of number of lines called statements to do the particular Job. The development process starts with, writing a program With the help of any standard Editor. The only condition is that, it has to be saved in plain ASCII format. One can use DOS editor, Norton editor, Notepad, or even Microsoft word, with save option ASCII format only enabled. Assembly language program consists of number of statements. There are two types of statements. One types of statements contains Instruction for assembler program itself. These are called assembler

Directives. Other type of statements contains instruction to be executed by micro controller. Assembler converts these instructions into equivalent machine codes. Finally Micro controller executes these codes one by one and which produces result. Each statement can have maximum four columns.

LABLE OPCODE OPERAND(S) ;COMMENTS

STAGE NO.2 Assembling Program by ASSEMBLER.

Assembler will take ASM file as input and will generate machine code to be executed by the controller. Once the program is entered through the editor and saved in plain text or ASCII format, it is ready for assembling. Suppose we have saved above program under file name TEST.ASM. Assembler will check syntax of every line and generate two more files, TEST.LST and TEST.OBJ. one is the list file and other is objects code file. List file will contain three more columns along with the original four-columns ASM file. List file will contain are line number, address and codes. Statement with directive equ.,2nd column of LST file will contain hexadecimal value of the data. The OBJ file will contain only codes, usually in the Intel Hex Format. If the ASM file is errors free, then assembler will repost zero errors found. Other wise it will report with the (number) of errors found. The errors can be seen in the LST file. If LST file has errors, those errors must to be removed. For doing so, open the ASM file again through editor make the necessary correction, and save it. Assembler reports zero error. It the assembler reports ZERO errors founds means file is grammatically correct. That is it dose not have any syntax errors. But till it can have logical errors. All the assembler will convert instruction to same machine codes, but the exact format of the assembler directive will very from assembler to assembler manufactured by various companies. Some assembler are case sensitive, some may not require END statement. Some will require label in the column no I only. For some assembler colon after label is optional. For some assembler hex number has to be specified as 0xD5 instead of 0D5h.

One has to refer to the operating manual of the assembler for these details.

SATEG NO.3 simulating the program with the help of simulator.

Simulator will execute the program step by step. We can see the content of all the registers, SFR,PROGRAM COUNTER and interested memory location and much more important information on the screen while the program execution proceeds step by step or inserting breakpoints. The OBJ file will be simulated on the simulator for logical errors. Logical errors can be easily detected by looking at the content of required or memory locating. These errors have to again correct in ASM file. The file has to be assembler again. This step is optional. If someone is fully confident, that his program has no logical error, then this stage can be eliminated.

SATEG NO.4 Burning the problem inside the controller’s memory

If OBJ file passes through the Simulator, then this OBJ file will be burn inside the ROM of 89C51 with the help of PROGRAMMER. This 89C51 can be put in the target board and checked for desired effect. If desired effect were not found, then ASM file program has to be edited again and whole process repeated. Columns label and comments are optional.

**LABEL-**First column is for LABLE. Label is optional. Label represents the

address, while jumping or calling in a program. Label can have maximum 8

characters . Characters Can be any letters A to Z, number 0 to 9 and special

character ‘-‘ the UNDER SCORE. No other special characters are allowed.

Even space is not allowed. Label must start alpha, and can not start with Numeral. One\_ms is a valid label but 1\_ms is not valid label. Label usually ends with colon. Similarly all the data or number used in the program must start with numerals. Data can be supplied in various forms. Data can be in decimal form, hexadecimal form, binary form or in ASCIL form. The hexadecimal number E2 must be written as 0E2h, Hexadecimal number has to be suffixed by h. If the data/number not suffixed by h, then assembler will assume that the number is decimal, it will then convert to equivalent hexadecimal number and use it is the program. Binary number should have suffix b e.g. 01101100b. ASCII data should be enclosed in quotes e.g. “SUN”.

**OPCODE** Second column is for OPCODE. This column mnemonics of the instruction.

**OPERAND** Third column is for OPERND (s) i.e. data. Data can be any constants, variables, register, or even label. Instruction operates upon data. Depending up on the type of instruction, there will be one or two operands.

**COMMENS** Froth column is COMMENTS, it is optional; It is separated from other column by semicolon ;and it is used to describe the working of the program in easy to understand language.

**DIRECTIVES** Second column may also contain directives. Some time they are also called pseudo Opcode. Directive statements are meant for assembler to take the action and will not generate machine codes. Some of the common directives are EQU,.ORG,.DB,.DW,.END

**.EQU** Equate, directive is used to assign a value to constant or variable name .EQU CNTR 04 statement, will assign value 04 to variable CNTR. So wherever CNTR word will appear in the program, 04 will replace it.

.**ORG** IN the normal course, assembler will generate the codes or the instruction and put in the subsequent program memory location origin. Directive forces the assembler to put the codes in the memory location prescribed by org statement. The statement . ORG 013h will put the subsequent code of the following instruction from memory location 0013 onwards.

**.DB and .DB** Normally program memory or ROM contains machine codes of the instruction to be executed by processor. But sometimes it also contains constant Data, such as company’s Name, Error Messages, or Seven segment Codes, in the ROM. Define Byte or Define word, directive will put one byte or two byte data in the memory location.

**.END** directive is used to indicate end of file.

## CHAPTER-4

#### CIRCUIT DIGRAM

## CHAPTER-5

#### COMPONENT LIST

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S No.** | **CIRCUIT REFRENCE** | **TYPE OF COMPOMNENT** | **COMPOMENT SPECIFICATION** | **QTY.** |
| 1. | R1,R2,R4,R5,R7  R8,R9,R10,R13  R14,R16 | Resistor | 10Kohms/.25W | 11 |
| 2. | R3,R6,R11,R15,  R17,R19,R21,  R23,R25,R26 | Resistor | 4.7Kohm/.25w | 10 |
| 3. | R12 | Resistor | 2.2KOHM/.25W | 1 |
| 4. | R18,R20,R22,R24 | Resistor | 1Kohm/.25W | 4 |
| 5. | C1,C2,C3,C4,C16 | Capacitor | 10μ F | 5 |
| 6. | C5---C12 | Capacitor | 100μ F/50V | 8 |
| 7. | C13—C14 | Capacitor | 33 pF | 2 |
| 8. | C15 | Capacitor | 10μF/50V | 1 |
| 9. | D1—D8 | Diode | 1N4007 | 8 |
| 10. | P1-P4 | Variable resistor | 10kohm | 4 |
| 11. | RL1—RL4 | Relay | 12V/DC | 4 |
| 12. | IC B1 | IC Base | 14pin | 1 |
| 13. | IC B2, IC B3 | IC Base | 20pin | 2 |
| 14. | IC B4 | IC Base | 40pin | 1 |
| 15. | IC 1 | IC | LM324 | 1 |
| 16. | IC 2 , IC 3 | IC | 74LS24S | 2 |
| 17. | IC 4 | IC | 89C51μC | 1 |
| 18. | XTL1 | Crystal | 11.926MHZ | 1 |
| 19. | RA,RB,RC,RD | Resistor | 1Kohm | 4 |
| 20. | LED |  |  | 4 |
| 21. | TR1-TR4 | Transistor | BCS48 | 4 |
| 22. |  | Microswitch |  | 1 |
| 23. |  | Buzzer |  | 1 |
| 24. |  | Center tapped  X-mer |  |  |

COMPONENT LIST

CHAPTER-6

#### COMPONENT DETAILS

**DIODE:**

**PN Junction diodes**:- It is a P type region and an N type region formed in the same crystal structure, a PN junction diode is produced.

Some of the conduction electrons near the junction diffuse into the P type semiconductor from the N type semiconductor across the junction combining with the holes. The loss of electron makes the N type semiconductor positively charged and hence the neutralisation of the holes. On the other hand makes the P type semiconductor negatively charged. This region where positive and negative charges develop is called depletion region.

If a P region is made positive with respect to the N region by an external circuit, then junction is forward biased and junction has a very low resistance to the flow of current. Holes in the positive P type materials are attracted across the

junction to the negative side and the free electron in the N type material are like wise attracted to the opposite side. If a positive voltage is applied to N zone with]

respect to the P zone terminal which is made negative by an external circuit.

PN junction is reverse baised the positive holes and the free electrons are repelled from the junction.

The polarity of the applied voltage, leaving the region adjacent to each side of the junction free of charge carriers. Such regions are called depletion regions.

A voltage below the break down voltage of the junction, the current flow may be cut or only a small leakage current flows which is called the reverse saturation

current.

An ideal diode is one which behaves as a perfect conductor when forward biased and as a perfect insulator when reverse biased. Obviously in such a hypothetical situation forward resistance equal to zero and potential barrier voltage is considered negligible.

**RESISTOR**

Resistors are the electronic components used to control the current passing through the circuit. They are caliberated in ohms. In other word resistance are circuit elements having the function of introducing electrical resistance into the

|  |  |
| --- | --- |
| circuit.  There are three basic types: | |
| (a) | Fixed resistor |
| (b) | Rheostat |
| (c) | Potentiometer |

A fixed resistor is a two terminal resistor whose electrical resistance is constant.

A rheostat is a resistor that can be changed in resistance value without opening the circuit to make adjustment.

A potentiometer is an adjustable resistor with three terminals, one at each end of the resistor element and third movable along its length.

~*/1*In s I a ti ng ta be

Insulating & sealing material ~

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------...

Compressed carbon + binder

|  |  |  |
| --- | --- | --- |
| COLOUR CODE | FIGURE NUMBER | TOLERANCE |
| BLACK | 0 |  |
| BROWN | I |  |
| RED | 2 |  |
| ORANGE | 3 |  |
| YELLOW | 4 |  |
| GREEN | 5 |  |
| BLUE | 6 |  |
| VOl LET | 7 |  |
| GRAY | 8 |  |
| WHITE | 9 |  |
| GOLD | - | 5% |
| SILVER | - | 10% |
| NO COLOUR |  | 20% |

**FIXED RESISTOR**

There are three basic type offixed resistors.

1. Carbon composite resistor.
2. Wire wound resistors.
3. Film resistors.

In the circuit we use carbon composition resistors.

**CARBON COMPOSITION RESISTORS**

Molded fixed composition resistors are limited for general purpuse use in electronic equipment. These are able to withstand configuration, have very low inductance and capacitance, can tolerate rough handling installation and are inexpensive.

**CHARACTERISTIC OF COMPOSITION TYPE RESISTOR**

1. Inexpensive and small in size.
2. Reliability is good.
3. Stability is good
4. Voltage coefficient is appreciable 0.02.
5. High frequency characteristics are satisfactory.
6. Noise is appreciable.
7. 7.
8. Temperature coefficent is large.

**CAPACITOR**

A capacitor essentially consists of two conducting surface separeting by a layer of an insulating medium called dielectric. The conducting surface may be in the form of either circular or rectangular plates or be of spherical or cylindrical shape. The purpose of a capacitor is store the electrical energy by electrostatic stress in the dielectric (the word condensor is a misnomer since a capacitor does not condense electric as suchit merely storesit).

The property of a capacitor to store electricity may be called its capacitors. A capacitors ability to store energy, its capacitance is dependent on three factors (a) the surface area of the plates of which it is composed (b) the thickness of the insulating material (c) the material of which the dielectric is composed of. Essentially a system in which two or more metal plates (conductor) are placed in close proximity to each other & are separated by an insulating materiallled the dielectric. When the plates of the capacitor are connected to a voltage source there will be a surplus of electrons on the plate connected to the negative side and a shortage of electron on a plate connected to the positive side of the voltag source. The surpluse of electrons on the negative plate will repel the electrons on the other plate driving them back toward the positive plate will attract electrons from the negative plate of the voltage source. The electron flow will continue untill the negative and positive charges on the capcitor plates are equal to the voltage source. When the condition exists the capacitor is said to be charge.

When the voltage source is disconnected the condition of unbalance that has been setup on the capacitor plates will remain thus providing a means of storing electricity in the capacitor ratio between the magnitude of the charge on the plates and the voltage difference between the palte is called the capacitance' c'.

[1] **CERAMIC CAPACITOR**

A capacitor is so named because of ceramic dielectrics. One type of the ceramic capacitor uses a hollow ceramic cylinder as both the form on which to construct the capacitor and the dielctric material the plates consists of thin films of metal deposited on the ceramic cylinder.

A second type of ceramic capacitor is manufactured in the shape of a disc. After leads are attached to each side of the capacitor the capacitor is completely coredwith an insulating moisture proof coating. Ceramic capacitor usually ranges in val ue between I pf to 0.0 I /l f and may be used with voltage as high as 30,000 volts.

**TRANSFORMER**

A transformer is a static piece of apparatus by means of which electric power in one circuit is transformed into electric power of the same frequency in another

circuit. It can raise or lower the voltage in a circuit but with a corresponding decrease or increase in current. The physical basis of a traansformer is mutual

induction between two circuits linked by a common magnetic flux

**TRANSFORMER CONSTRUCTION**

A transformer consists of two coils having mutual inductance and a laminated steel core. The two coils are insulated from each other and the steel core, other necessary parts are some suitable container for the assem~led core and winding; a suitable medium for insulating the core and its windings from its container; suitable

bushing for insulating and bringing out the terminal of winding from the tank. In all type of transformer the core is constructed of transformer sheet steel laminations assembled to provide a continueous magnetic path with a minimum of air gap included, the steel used is of high silicon content, sometimes heat treated to produce a high permeaibility and low hysteresis loss. The eddy current loss is minimised by laminating the core.

According to construction there are two types of transformer known as

i) Core type and

ii) Shell type

**i) CORE TYPE TRANSFORMER**

The coils used are from wound and are of the cylindrical type. The general from of these coils may be circular or over all rectangular. In small size core type transformers, a simple rectangular core is used with cylindrical coils are used which are so wound as to fit over a cruciform core sections.

**SHELL TYPE TRANSFORMER**

In shell type transformer the coils are form wound but are multi-layer disc type usually wond in the form of pancakes. The different layers of such multilayer discs are insulated from each other by paper. The complete winding consists of tackled discs with insulation spaces between the coil.

**TRANSISTOR**

A transistor consists of two pn junctions formed by sandwitching either p-type or n-type semiconductor between a pair of opposite types. Accordingly; there are two types of transistors, namely:­

(1) n-p-n-transistor (2) p-n-p transistor

An n-p-n transistor is composed of two n-type semiconductor seprated by a thin section of p-type. However a p-n-p transistor is formed by two p-sections seprated by a thin section of n-type.

In each type of transistor, the following points may be noted:­

(1 )There are two pn junctions. Therefore, transistor may be regarded as a combination of two diodes connected back to back.

(2) There are three terminals, taken from each type of semiconductor

(3) The middle section is very thin layear. This is the most important factor in the function of a transistor.

**INTEGRATED CIRCUITS**

A chip made up of a number of components contained in a single package. One semiconductor chip can contain two or more tansistros, several resistros and capacitors and many individual diodes or other components.

A single integrated circuit may be used to replace many discrete components. In addition to the space saving features of ICs the fact that they receive almost identical processing enables them to be closely matched in characteristics.

The closer such circuit elements are matched, the greater the reliability of the circuit. An intergratd circuit is one in which circuit components such as transistors, diodes, resistors, capacitors etc. are automatically part of a small semiconductor chip.

An integrated circuit comprises of a number of circuit components (eg transistor, diodes, resistor etc.) and their interconnections in a single small package to perform a complete electronic function. In an IC the various components are automatically a part of a small semiconductor chip and the individual components cannot be removed or replaced.

#### CHAPTER-7

#### PCB FABRICATION

***PREPARATION OF THE PCB***

**Schematic Preparation**

**Artwork Preparation**

After making the schematic on a paper , same is duplicated on transparent acrylic plastic sheet . This circuit is called artwork . The artwork is made either bigger or smaller or same size of the desired PCB .The artwork is drawn with different colour tapes to identify the signal lines, power lines and ground lines . The artwork should be proper without leaving any connection or making any excess connection or shorts.

**Film Making**

The artwork is reduced or enlarged or made of same size of the PCB on the film through the camera . The camera produces both the positive and negative films . These films are used to made PCB .

**Etching of copper claded board**

The films are put on copper claded board and the board is exposed to light. The time of exposure depends on many factors. After the exposure of the board it is rinsed in the etching solution. During this etching operation the exposed copper gets dissolved in the solution whereas unexposed copper remains intact with the board .This unexposed copper in turn makes the pattern what we see on PCB. The board is then washed in water with gentle brush .

**Driling of holes**

The PCB is now ready for drilling operation .The holes are now drilled at all places wherever the components are to be put .The size of the drills should not be either more then the required or less then the required . If the hole is large the it will be difficult to solder and lot of lead will be consumed. If the hole is small then component will not be inserted easily.

**Tinning of pcb**

The PCB is tinned after putting the mask on PCB .This is done to insulate the patterns and avoid any short. The mask covers the areas where the soldering is to be done.

***PCB TESTING***

PCB is checked for all interconnections through multimeter , whether the tracks are broken or short at any place , thereby correction is done through soldering.

***ASSEMBLING OF THE UNIT***

Components are assembled in proper direction and avoid the touching of the components to one another. Heatsink is to be put wherever required with a heat sink compound.

After assembling the components , they are soldered and thereafter cleaned with CTC liquid.

**POWER SUPPLY :-** The Power is given to the transformer which steps down the input voltage to 10 times less i.e. 20 V .This low voltage is fed to bridge rectifier which rectifies the ac waveform to dc wave form with some ripples .These ripples are filtered through capacitance filter and is fed to linear regulator .The output of regulator is further filtered to produce clean DC VOLTAGE .

78M05

**Transformer Rectifier Filter Regulator**

**REGUALTED POWER SUPPLY**

**SOLDERING**

Soldering is the process of joining two metallic conductors, the joint where the two metal conductors are to be joined or fused is heated with a device called soldering iron and then an alloy of tin and lead called solder is applied which melts and covers the joint. The solder cools and solidifies quickly to ensure a good and durable connection between the joined metals. Covering the joint with solder also prevents oxidation.

**HOW TO SOLDER**

Good soldering practices is very important for assembling for any electronic circuit . A poorly soldered joint or connection in electronic circuits is the cause of most services problems. Given below are some important steps to be followed in good and correct soldering practice.

Keep the soldering iron hot during the working period and let it rest on its stand when not in use.

Enough heat is applied to the joint so that the solder metal flows freely over the joint.

Too much solder is not used to avoid short circuits between conduction paths on a P.C.B.

Use of correct type of soldering iron and solder. Avoid the use of excessive flux.

78M15

**Transformer Rectifier Filter Regulator**

L1 N1

R 4 8 NO

7 **Monostable** 3 Relay NC LOAD

6 **555 Timer** 5

C 2 1 0.1uf

Trigger

**Circuit 1**

**N N1**

**L L1**

Rectifier

Trigger Voltage

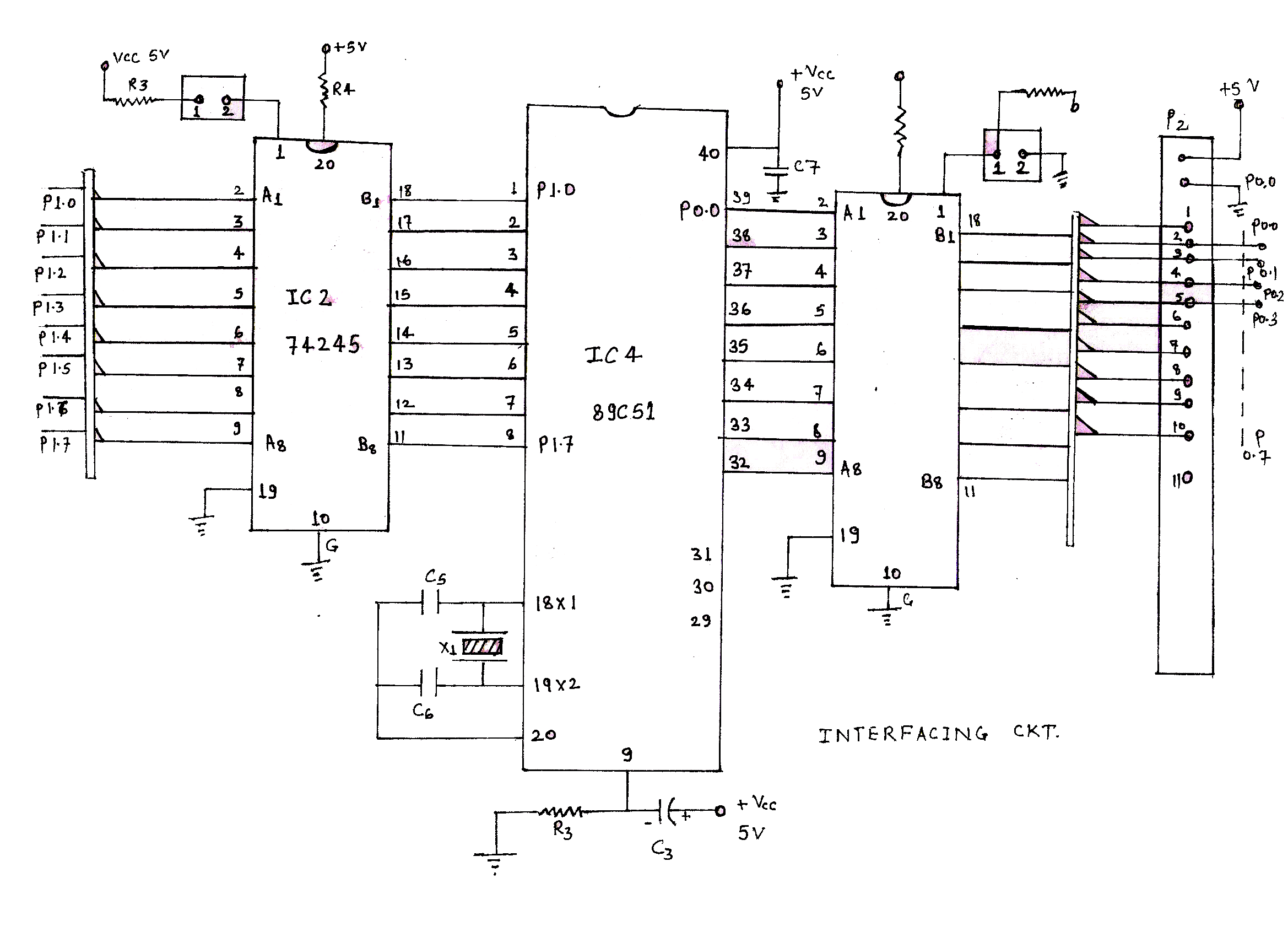
Ref Vol 741

COMPAROTOR

**Circuit 2**

**CIRCUIT DISCRIPTION**

In microcontroller used is 89C51 whose ports are configured as I/P and output ports. The pins of input and output ports and both indicator assemble. The ports P1 is configured as input port and P0 as output port. P1 is from pin 1 and pin8 of ICR. Pin 18 and 19 are connected to crystal pin 40 and pin 20 are connected +5V and ground respectively pin9 is connected to reset switch though R and C combination and +5V. Port P0 is having pin 39 to pin32 as P0.0 to P0.7 in sequence order.

****

The interface IC1 and IC3 are connected to ports P1 and P0 respectively. The I/P of IC1 i.e. pin 2 and pin 9 to which sensors can be connected. The pins of IC3 i.e. pin 18 to pin11 are output pins. The output from P0.1 is fed to relay driver which sends the command to delay the stored number to communication system. The output from P0.2 is fed to relay which remove the connection from cradle. The command is also fed to the circuit which starts the play of recorded message.

**8.1 INSTRUCTION SET**

The Instruction set of MCS-51 family is divided in to five groups.

1. **The Data Transfer Group:-** Instruction in these groups will move the data within different parts of the memory. The main instruction are MOV, MOVX, MOVC, PUSII POP, EXCII. These instructions will not affect any flag.
2. **Arithmetic Operation Group :-** Instructions in this group are ADD, ADDC and with carry. SUBB subtract with borrow. MUL, multiply. DIV, divide. INC, DEC. These instruction affect the C carry, AC Auxiliary Carry, and OV overflow flags.
3. **Logical Operation Group :-** These instruction consist of ANDing, ORing, XORing, RR, RRC rotate right with or without carry, RL, RLC, rotate left with or without carry, Clear, and swap.
4. **Bit Manipulation or Boolean Instruction Group:-** The set includes SETB, set bit, CLR clear bit, CPL, Compliment the Bit, MOV bit, AND Bit, OR Bits,
5. **Branching or Machine control Group** :-These are two types of branching instruction, Conditional and Unconditional. Unconditional branching includes instruction like JUMP and CALL. These instructions are similar to GOTO instruction in Higher Level Language like BASIC. In case of conditional branching, branching will take place depending upon the result of the operation. These include JZ, JNZ. Jump on Zero or not zero. JC, JNC. Jump on carry / on carry. JB, JNB, Jump if Bit is set or cleared. CJNE, compare and jump not equal. DJNZ, decrement and jump if not zero. These instruction are similar to IF THEN ELES, FOR NEXT, and DO WHILE loop instruction in higher level languages.

Instruction operate upon the Data. Where the Data is found, depends up on the way it is addressed. These are four types of addressing ways that are used to get the Data. Register addressing, Direct Addressing, Indirect Addressing and Immediate Addressing.

**Register Addressing :-** In this type addressing, the address of the data is found in one of the register R0 to R7 in the current Register Bank. The Instruction, MOV A,R6 will copy the data from register R6 it in to Accumulator. Here the data is found in the register R6. This type of addressing is called register addressing.

2. **Direct Addressing :-** In this type addressing. The Address of the data is specified in the instruction MOV A,35 will get the data from location 35 and copy it into Accumulator. Data is found in the location 35, which is specified in the instruction directly. This type of addressing is called Direct addressing.

3. **Indirect Addressing :-** Many times of you ask your friend, the address of particular place, he will say, please you ask, Mr. Ashok, he will tell you the address. In this case your friend does not tell you the address directly, but tells you the address indirectly. On in the company there is a central store and store keeper. Some time manager, will ask the worker to get the material (data) from particular rack number (Address). But if manager does not know where the material is kept, then he will tell worker, to ask the storekeeper for the rack number ( address) and get the material (data). Then the worker will get the material from the rack specified by storekeeper. In this case address is not available with the manager directly, but he tells where the address is available is available. So the manager tell the address indirectly. This may be unusual way of specifying the address. But when you will start writing the programs, after some practice you will get familiar with it. Then you will find it is impossible to write a program without indirect addressing. In this type of addressing, the address of the data is not found in the instruction, but it is found in one of the register. And instruction contains the register, where the address is found. So the address of the data is specified in the instruction indirectly. In the MCS-51 family there are two register that can hold the indirect address. The register R0 and R1. Which means there are two storekeepers. The instruction MOV A,@ R0 will get the data from the address specified in the register R0 and copy it in to the Accumulator. So if R0 contains 50 and location 50 contains data B6 hex, then after the execution of the above instruction, Accumulator will contain B6. Note that in this case R0 holds the address. It is very similar to pointer concept in higher level language “C”.

Note : All registers in the SFR area can be address Directly only. They can not be addressed indirectly. Internal Ram location from 00 to 7F H can be addressed either directly or indirectly.

4. **Immediate Addressing :** In this type of addressing, Data is specified in the instruction itself. The data immediately follows the instruction. After the execution of the instruction MOV A,# 55 Accumulator will contain data 55. this type of addressing is know as immediate addressing.

It is very important to get familiar with the various Addressing Modes.While Studying Instruction following points should kept in mind.

**Rn** Means 8bit address of register R0 to R7 in the currently selected register Bank.

**Direct** Means any internal Ram location. (8Bit)

**@Ri** Means Either @R0 or @R1. They specifies the address Indirectly

**# Data** Means 8 bit constant included in the instruction.

**Rel**  It means 8 bit signed offset byte. This is Added to the program counter Low, to get the new jump address in Relative Branch instructions.

Any bit address, in the Bit addressable area, Located from 20 hex to 2F hex in the internal Ram or Bit in the bit Addressable SFR.

## Parts List

**Semiconductor :**

IC 1 – 555 timer

IC 2 - 555 timer

### IC 3 - 741 comparator

T1-T3, – BC 547 npn transistor

T4 - BC 548 npn transistor

D1–D8– 1N 4001 diodes

**Resistors :**

R1 – 10 kilo-ohm

R2,R3 – 4.7 kilo-ohm

R4,R6 – 22 kilo-ohm

R5, – 1 mega-ohm

Photo sensor – 330 kilo-ohm

P 1 – 10 kilo-ohm

### P 2 – 100 kilo-ohm

**Capacitor :**

C1, C2, C3, C8 – 0.1μ, ceramic disc

C4 – 0.47μ, ceramic disc

C5 - 100μ, 50V electrolytic

C6 - 220μ, 50V electrolytic

C7,C9 - 0.01μ, ceramic disc.

**Miscellaneous :**

RL1 – 12V 200 ohm, 1 Change-over Relay

Transformer 6-0-6 , 500mA voltage

### Transformer current

## Conclusion

The device has many application like preventing the power thefts in hostels, rented house etc. This can be used for average billing to the customers because he will be drawing only limited power and if the timer is also connected in series with this module then the power will be available for the limited time only.

The device can be made for different ratings of load, the cost of load sensor would be higher for higher rating of load. The flickering of load can be prevented by sensing and cutting off the load at very high speed so that eye can not recognize.

With the development of this module we could understand the intricacy of designing of circuit and its fabrication through PCB making , layout preparation artwork making etc. The use of 230V directly on the board requires the precaution else will lead to shock.

It is not possible to check the power consumption even if they do not pay the bill. Due to non payment of bill the service line can be disconnected but it would be very difficult to stop the hooking of LT lines.Meter reading in villages is very costly as the consumers are spread over a large area.

Meter reading is not required if power limiter is used. The single point consumer who have installed power limiters of 80/100 Watt can be charged monthly or tri-monthly. The single point consumers who have not installed these device and are taking power through hooking can be noticed from outside can be penalized/punished .It is not required to go inside the houses. A team of 2-3 inspection engineers can check 100-200 connections every day. Since these single point connections would deliver power in night only it would provide 500 to 550 M Watt excess power in day time, which would give more finance to a electricity board whose free consumers are around 22 lakhs.

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