



INDUSTRY SAFETY MONITOR AND CONTROL



A PROJECT REPORT

P-2323

Submitted by

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in

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**KUMARAGURU COLLEGE OF TECHNOLOGY,
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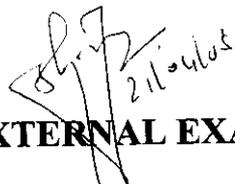
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SALEM STEEL PLANT

A Steel plant in salem is a long cherished dream. Government of India decided in May 15, 1972 to setup an integrated special steel plant at Salem in the state of Tamil nadu for the production of steels and strips of electrical, stainless and other special and mild steels on the basis of sound techno-economic considerations.

SAIL – Steel Authority of India Limited is one of the “Navaratna” companies in the business of steel with an annual turnover of Rs 32,800 crores during 2004-05. SAIL ranks premium position among the steel producers of the world and it has the capacity to produce India’s most precious raw material – 13 million tones of crude steel and saleable steel capacity of 10.7 million tones.

The British Council conferred on Salem Steel Plant the “Sword of Honor” for the years 1984 and 1986 in recognition of safety standards and performance. Apart from this, a number of State and National award has been received.

**“WE DEDICATE THIS PROJECT TO OUR PARENTS, FACULTY
MEMBERS, FRIENDS AND ALL THE GREAT MINDS
WHO HAVE INSPIRED US....”**

ABSTRACT

ABSTRACT

The main aim of the project is to monitor the pressure, liquid level, gas and temperature in Industrial Companies. In Industrial Companies Indane gas is used to cut the metal sheets. Suppose if any leakage occurs it will cause big accident. To avoid this problem, Gas Sensor nothing but a type of transducer is used. It senses the gas leakage and gives the signal to signal conditioning unit in which the incoming signal is conditioned and then it is given to the Microcontroller.

Most of the Industrial Companies use cylinders. Suppose the pressure in the inside cylinder is abnormal the cylinder may burst. Pressure sensor is used to avoid this accident. It senses the pressure and the corresponding pressure state is monitored with the help of Micro controller.

Similarly the temperature sensor is used to sense the atmosphere temperature inside the Company. The corresponding temperature is monitored in the Micro controller. And level sensor is used to sense the liquid level in tank, and the corresponding level is monitored in Microcontroller.

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INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 BRIEF OVERVIEW:

The objective of this project is to protect the Industry from accidents such as fire, pressure and to give more safety and control to the equipment in the Industry.

As a precautionary measure, this project is designed with micro controller, gas sensor, liquid level sensor, pressure sensor, temperature sensor, signal conditioning unit, alarm, auto dialing system, relay driver circuit and relay.

The gas, liquid, pressure and temperature levels are monitored and controlled. If any one of the above mentioned parameters is increased beyond the normal state, micro controller trips OFF the total incoming power to the unit with the help of relay and switches ON the alarm for indication. In addition to this, the auto dialer makes a call to maintenance department to inform abnormal condition. So this project will be very useful to protect the Company from major accident and provide more safety to the Company as well as equipment.

1.2 BLOCK DIAGRAM:

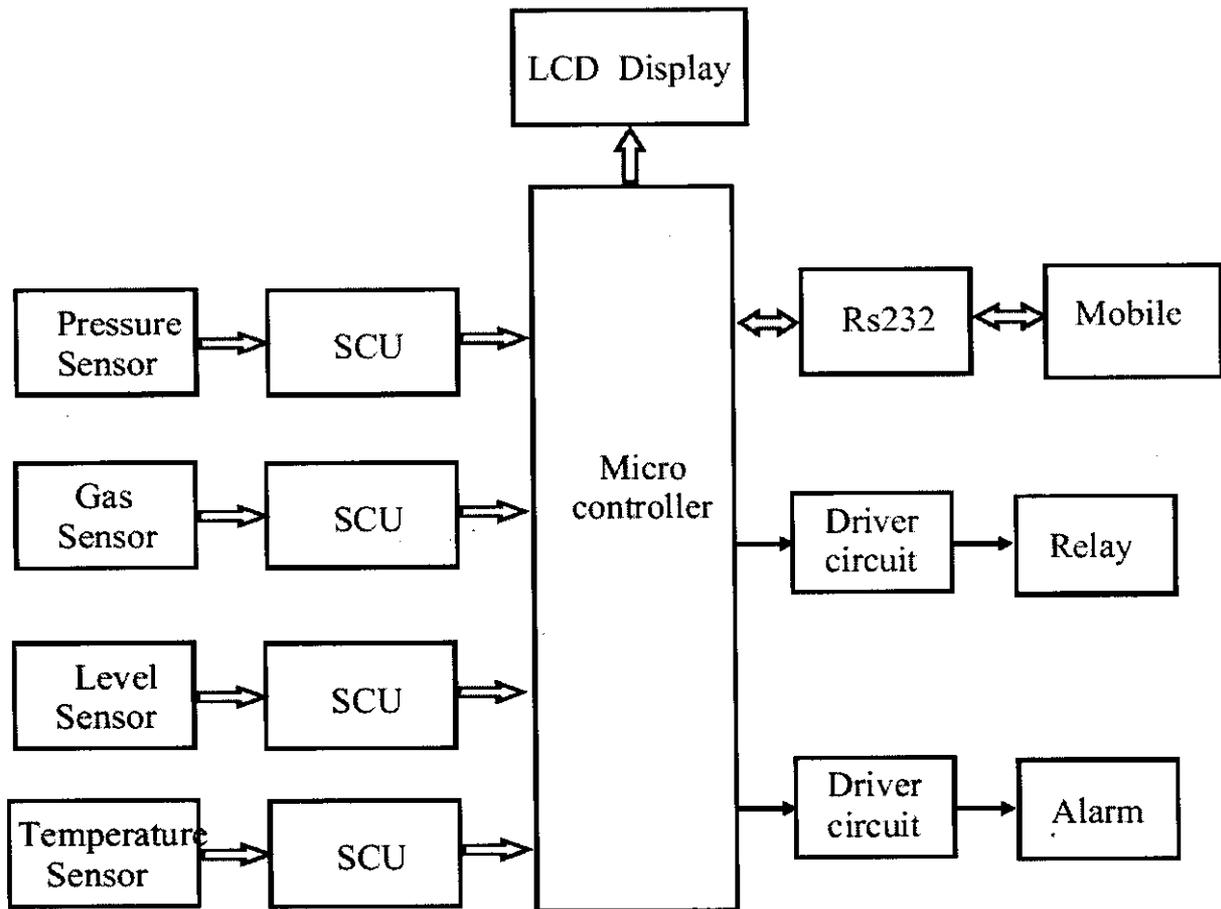


Fig 1.1

1.3 MODULES:

A brief overview of the project modules are explained below for better understanding of block diagram:

- Temperature sensor-senses the atmospheric temperature surrounding the machine.
- Pressure sensor-senses the pressure in the cylinder.
- Gas sensor-senses the gas leakage in Industry.
- Level sensor-senses the level of liquid in tank.
- Amplifier circuit amplifies the weak o/p from sensor.
- The Relay switches OFF the power supply to machine.
- Alarm buzzer turns ON when abnormal condition occurs.
- LCD displays the condition of machine sensed by the sensors.
- Microcontroller is programmed to the control i/p and o/p circuits.

POWER SUPPLY

CHAPTER 2

POWER SUPPLY

2.1 INTRODUCTION:

This chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, and then it is filtered and regulated to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies or the output load connected to the dc voltage changes.

A block diagram containing the parts of a typical power supply and the voltage at various points in the unit is shown in Fig 2.1.

The ac voltage typically 120 V RMS is connected to a transformer, which steps the ac voltage down to the level of desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripples or ac voltage variation. A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

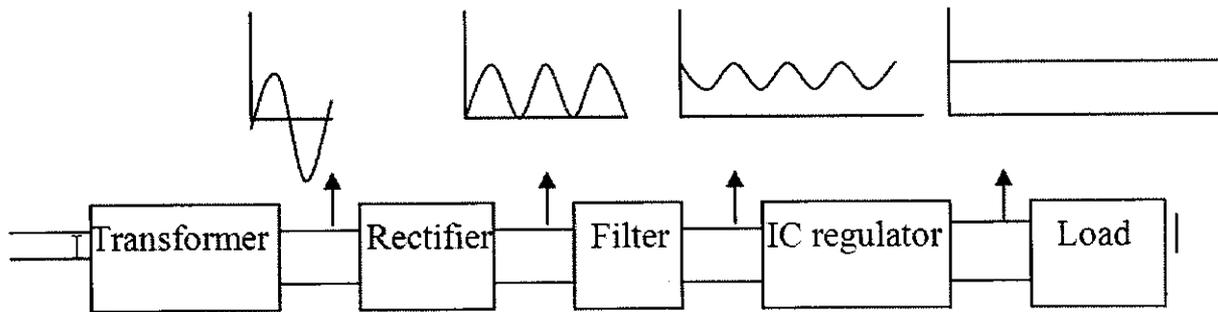


Fig 2.1

2.2 CIRCUIT DIAGRAM:

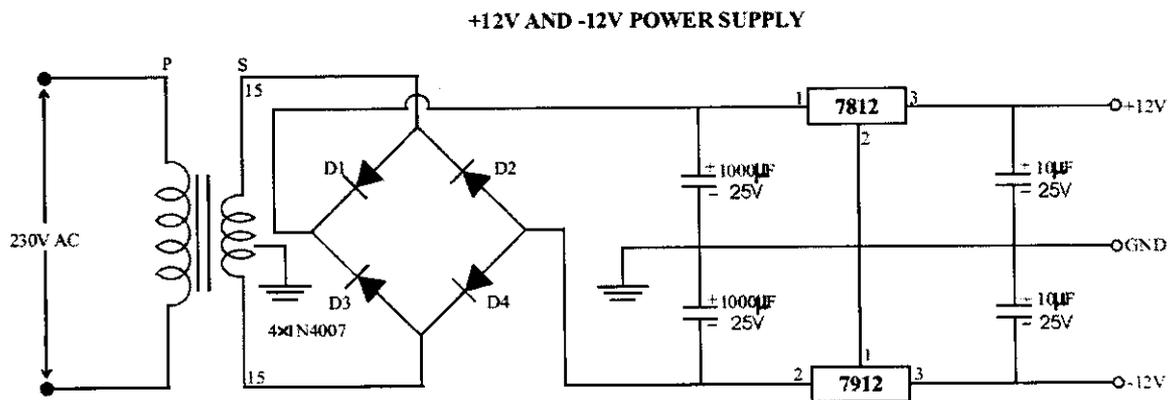
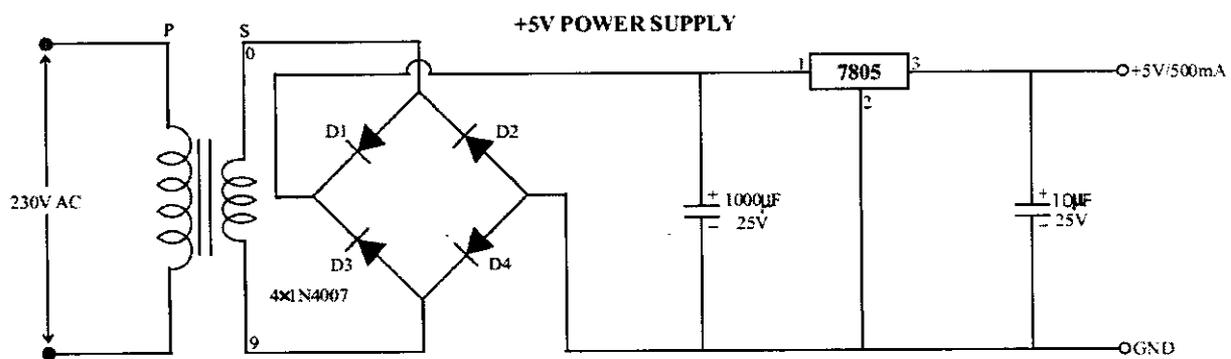


Fig 2.2

2.3 WORKING PRINCIPLE:

TRANSFORMER:

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier which is constructed with the help of op-amp. The advantage of precision rectifier is its peak dc voltage output and rest of the circuits will give only RMS output.

BRIDGE RECTIFIER:

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

Let us assume that the transformer is working properly and there is a positive potential at point A and a negative potential at point B. The positive potential at point A will forward bias D3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1 through RL through D3, through the secondary of the transformer back to point B. This path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer is reversed, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, through RL, through D2, through the secondary of T1, and back to point A. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage correspondingly. Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit. This may be shown by assigning values to some of the components shown in views A and B. Assume that the same transformer is used in both circuits. The peak voltage developed between points x and y is 1000 volts in both circuits. In the conventional full-wave circuit shown in view A, the peak voltages from the center tap to either x or y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts. The maximum voltage that appears across the load resistor is nearly- but never exceeds-500 volts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

2.4 IC VOLTAGE REGULATORS:

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. Although the internal construction of the IC is somewhat different from the described discrete voltage regulator circuits, the external operation is much the same. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage.

A power supply can be built using a transformer connected to the ac supply line to step the ac voltage to desired amplitude, then rectifying that ac voltage, filtering with a capacitor and RC filter, if desired, and finally regulating the dc voltage using an IC regulator. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milliwatts to tens of watts.

THREE-TERMINAL VOLTAGE REGULATORS:

Fig 2.3 shows the basic connection of a three-terminal voltage regulator IC to a load. The fixed voltage regulator has an unregulated dc input voltage V_i applied to one input terminal, a regulated output dc voltage V_o from a second terminal, with the third terminal connected to ground. For a selected regulator, IC device specifications list a voltage range over which the input voltage can vary to maintain a regulated output voltage over a range of load current. The specifications also list the amount of output voltage change resulting from a change in load current (load regulation) or in input voltage (line regulation).

FIXED POSITIVE VOLTAGE REGULATOR:

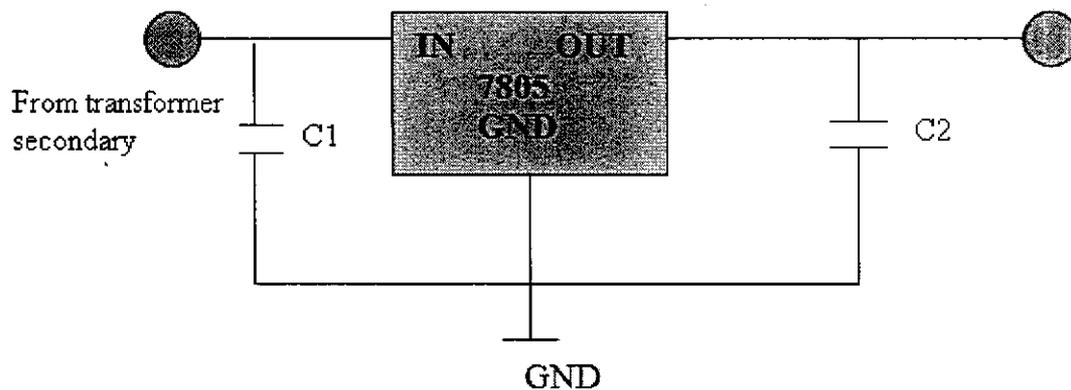


Fig 2.3

The 78 series regulators provide fixed regulated voltages from 5 to 24 V. Figure shows how one such IC, a 7812, is connected to provide voltage regulation with output from this unit of +12V dc. An unregulated input voltage V_i is filtered by capacitor C1 and connected to the IC's IN terminal. The IC's OUT terminal provides a regulated + 12V which is filtered by capacitor C2 (mostly for any high-frequency noise). The third IC terminal is connected to ground (GND). While the input voltage may vary over some permissible voltage range, and the output load may vary over some acceptable range, the output voltage remains constant within specified voltage variation limits. These limitations are mentioned in the manufacturer's specification sheets. A list of positive voltage regulated ICs are provided in table.

FIXED NEGATIVE VOLTAGE REGULATORS:

The series 79 regulators provide fixed regulated voltages from -5 to -24 V. Figure shows how one such IC, a 7912, is connected to provide voltage regulation with output from this unit of -12V dc. An unregulated input voltage V_i is filtered by capacitor C1 and connected to the IC's IN terminal. The IC's OUT terminal provides a regulated -12V which is filtered by capacitor C2 (mostly for any high-frequency noise). The third IC terminal is connected to ground (GND). While the input voltage may vary over some permissible voltage range, and the output load may vary over some acceptable range, the output voltage remains constant within specified voltage variation limits. These limitations are mentioned in the manufacturer's specification sheets.

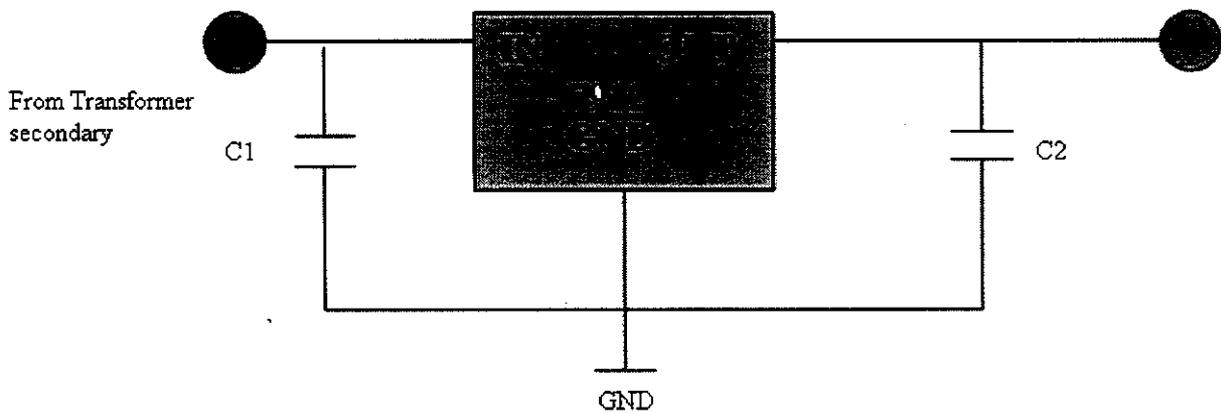


Fig 2.4

POSITIVE VOLTAGE REGULATOR IC:



P-2323

IC	Output voltage (V)	Minimum input voltage V_i (V)
7805	+5	7.3
7806	+6	8.3
7808	+8	10.5
7810	+10	12.5
7812	+12	14.6
7815	+15	17.7
7818	+18	21.0
7824	+24	27.1

The 78 series regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the 79 series regulators provide fixed negative regulated voltages from 5 to 24 volts.

- For ICs, microcontroller, LCD ----- 5 volts
- For alarm circuit, op-amp, relay circuits ----- 12 volts

TEMPERATURE SENSOR

CHAPTER 3

TEMPERATURE SENSOR

A Thermistor is a type of resistor which is used to measure temperature changes, relying on the change in its resistance with changing temperature. The Thermistor was first invented by Samuel Ruben in 1930, and has U.S. Patent #2,021,491.

If we assume that the relationship between resistance and temperature is linear (i.e. we make a first-order approximation), then we can say that,

$$\Delta R = k\Delta T$$

where

ΔR = change in resistance

ΔT = change in temperature

k = first-order temperature coefficient of resistance

Thermistors can be classified into two types depending upon the sign of k . If k is positive, the resistance increases with increasing temperature, and the device is called as positive temperature coefficient (PTC) thermistor, which is otherwise known as Posistor. If k is negative, the resistance decreases with increasing temperature, and the device is called as negative temperature coefficient (NTC) thermistor. Resistors other than thermistors are designed to have the smallest possible k , so that their resistance remains almost constant over a wide temperature range.

Symbol:

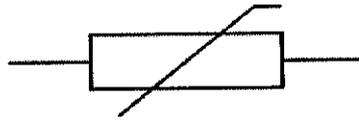


Fig 3.1

3.1 CIRCUIT DIAGRAM:

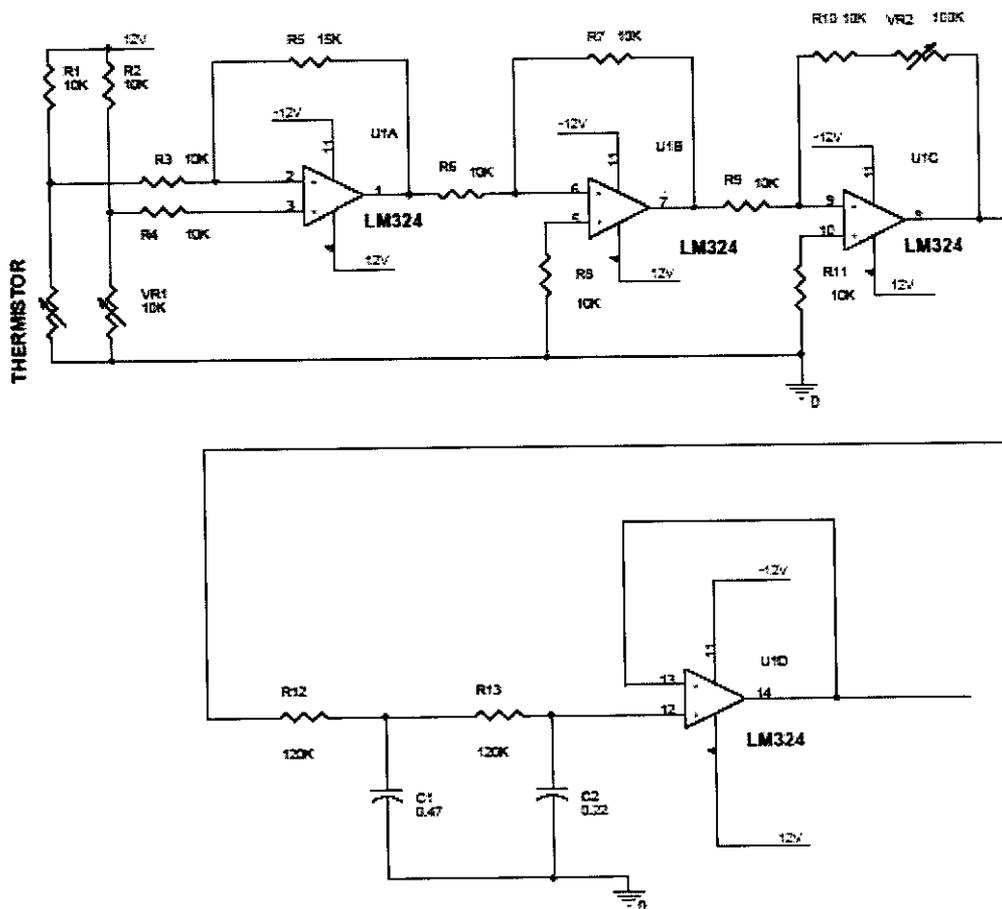


Fig 3.2

3.2 CIRCUIT DESCRIPTION:

In this circuit, the thermistor is used to measure the temperature. Thermistor is nothing but temperature sensitive resistor. There are two types of thermistor available, such as positive temperature co-efficient thermistor and negative temperature co-efficient thermistor. Here we are using negative temperature co-efficient thermistor in which the resistance value is decreased when the temperature is increased. Here the thermistor is connected with resistor bridge network. The bridge terminals are connected to inverting and non-inverting input terminals of comparator. The comparator is constructed by LM 324 operational amplifier. The LM 324 consist of four independent, high gain, internally frequency compensated operational amplifier which were designed specifically to operate from a single power supply over a wide range of voltage. The first stage is a comparator in which the variable voltage due to thermistor is given to the inverting input terminal and reference voltage is given to the non-inverting input terminal.

Initially the reference voltage is set to room temperature level, so that the output of the comparator is zero. When the temperature is increased above the room temperature level, the thermistor resistance is decreased, so that a variable voltage is given to the comparator. Now the comparator delivers an error voltage at the output. Then the error voltage is given to next stage of preamplifier. Here the input error voltage is amplified, and then the amplified voltage is given to next stage of gain amplifier. In this amplifier the variable resistor is connected as a feedback resistor. The feedback resistor is adjusted to get the desired amount of gain. Then the AC components in the output are filtered with the help of capacitors. Then output voltage is given to final stage of DC voltage follower, through this the output voltage is given to ADC or other circuits.

PRESSURE MONITOR

CHAPTER 4

PRESSURE MONITOR

Pressure (p) is defined as the force per unit area applied on a surface in a direction perpendicular to that surface. Mathematically:

$$p = \frac{F}{A}$$

where

p is the pressure

F is the normal force

A is the area.

Pressure is a scalar, and has SI units of Pascal's, $1 \text{ Pa} = 1 \text{ N/m}^2$.

Pressure is transmitted to solid boundaries or across arbitrary sections of fluid normal to these boundaries or sections at every point. It is a fundamental parameter in thermodynamics and it is conjugate to volume.

4.1 CIRCUIT DIAGRAM:

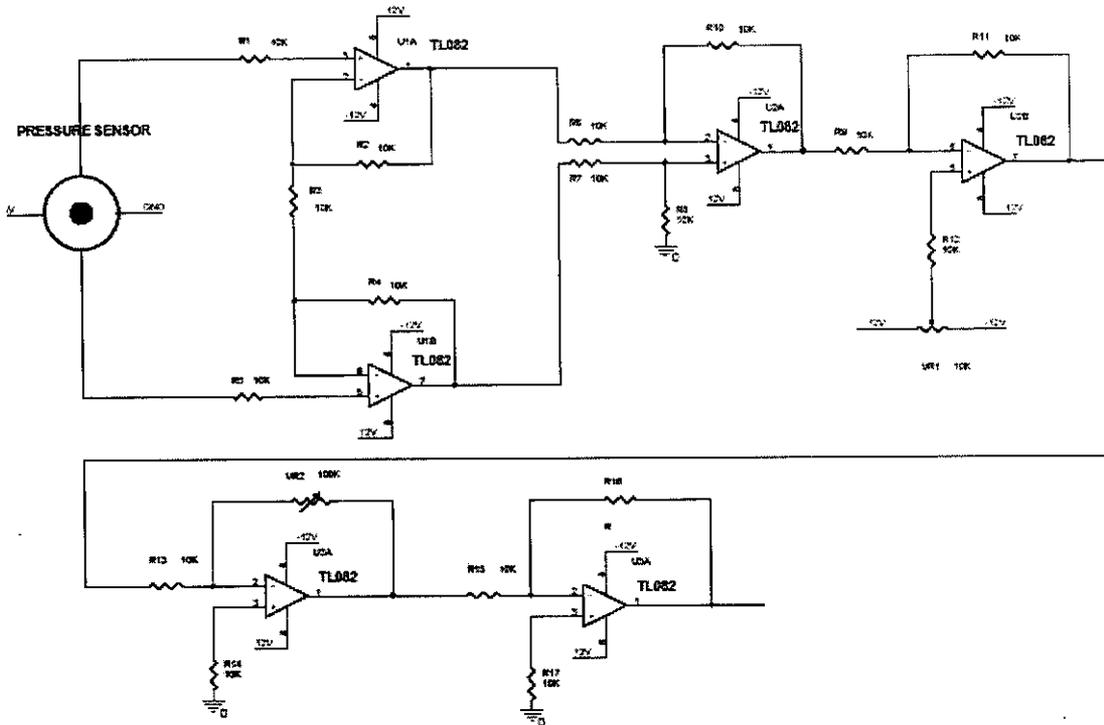


Fig 4.1

4.2 CIRCUIT DESCRIPTION:

This circuit is designed to measure the varying pressure. The pressure is measured by diaphragm a type of transducer. When pressure is applied, the diaphragm moves in the forward direction. The movement of the diaphragm depends upon the pressure applied. So it generates a voltage pulse depending upon the movement of the diaphragm. The voltage pulses are in the range of milli voltage. Hence the voltage pulse is given to Instrumentation amplifier section in order to amplify the signals.

The important features of the instrumentation amplifier are high gain, accuracy, high CMRR, low output impedance. Here the instrumentation amplifier is constructed by TL 082 operational amplifier. The TL 082 is a dual operational amplifier in which two operational amplifiers are fabricated in a single chip. Here the instrumentation amplifier acts as a differential instrumentation amplifier. The diaphragm transducer terminals are connected to A1 and A2 amplifier of the differential instrumentation amplifier.

The difference in the varying voltage signals from the transducer is amplified by the instrumentation amplifier. The A4 amplifier is used for zero adjustment. When there is no pressure the diaphragm may be sliding over the forward or in the reverse side. Due to that the instrumentation amplifier delivers some voltage at the output. To avoid this problem A4 amplifier is used for zero adjustment. Hence when there is no pressure, the output is zero.

The A5 amplifier acts as a gain amplifier in which variable resistors are connected as feedback resistor. By adjusting the feedback resistor we can vary the gain of the output signal. Then the final gain adjusted signal is amplified by the A6 amplifier.

*LEVEL MEASUREMENT USING
FLOAT*

CHAPTER 5

LEVEL MEASUREMENT USING FLOAT

Float is a type of transducer which is used to measure the liquid level in the tank.

5.1 CIRCUIT DIAGRAM:

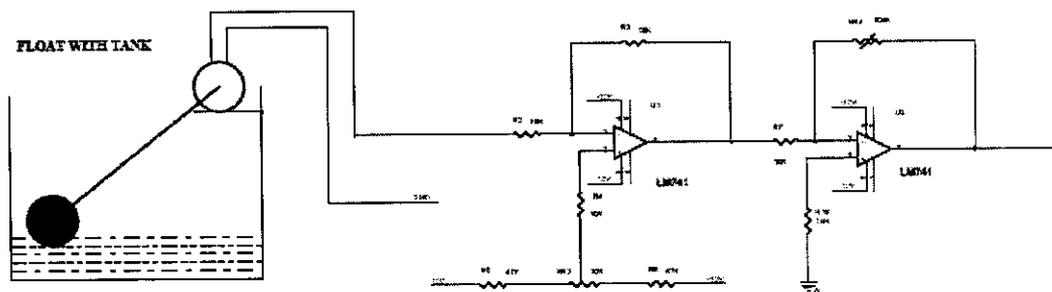


Fig 5.1

5.2 CIRCUIT DESCRIPTION:

The float has its influence over changing the resistance value depending upon the water level. This change in the resistance is converted into corresponding voltage signal which is given to inverting input terminal of the comparator. The reference voltage is given to non inverting input terminal.

The comparator is constructed by the operational amplifier LM 741. The comparator compares with reference water level and delivers an error voltage at the

output terminal. Then the error voltage is given to next stage of gain amplifier which is constructed by another operational amplifier LM 741. In the gain amplifier the variable resistor is connected in the feedback path, by adjusting the resistor we can get the desired gain. Then the final voltage is given to ADC for converting the analog signal to the digital signal. Then the corresponding digital signal is given to microcontroller in order to find the water level in the tank.

GAS SENSOR

CHAPTER 6

GAS SENSOR

The gas sensor is used to detect the presence of leakage in various environments such as storage tank, car, service station etc. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.

FEATURES:

- High Sensitivity
- Detection Range: 100 - 10,000 ppm iso-butane propane
- Fast Response Time: <10s
- Heater Voltage: 5.0V
- Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High

6.1 CIRCUIT DIAGRAM:

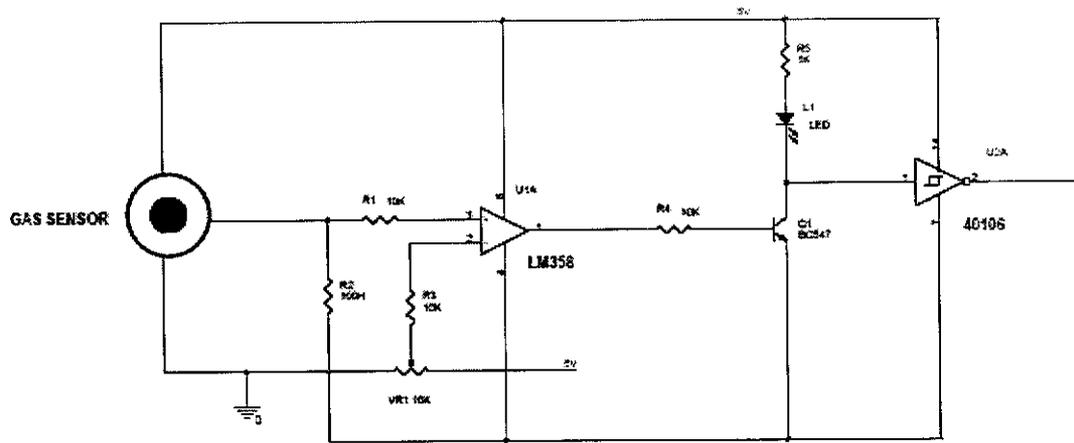


Fig 6.1

6.2 CIRCUIT DESCRIPTION:

The gas sensor is a special type of sensor which is designed to sense the gas leakage. In the gas sensor, the supply voltage is given to input terminal. The gas sensor output terminals are connected to non inverting input terminal of the comparator.

Here the comparator is constructed with operational amplifier LM 358. The reference voltage is given to inverting input terminal. The reference voltage depends upon the desired gas intensity. When there is no leakage, the non inverting input is greater than the inverting input so the output voltage of the comparator is positive which is given to the base of the switching transistor BC 547. Hence the

transistor will conduct. Here the transistor is acting as a switch, so the collector and the emitter will be closed. The output is taken from collector terminal. Now the output is zero which is given to hex inverter 40106.

When there is gas leakage the inverting input voltage is greater than the non inverting input. Now the comparator output is -12V so that the transistor is in cutoff region. The 5V is given to hex inverter 40106 IC. Then the final output data is directly given to microcontroller to determine the gas leakage.

MICRO CONTROLLER

CHAPTER 7

MICRO CONTROLLER

7.1 ATMEL 89C51:

Micro controller is a general purpose device, which integrates a number of components of a microprocessor system on to a single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

Micro controllers will combine other devices such as:

- A timer module to allow the micro controller to perform tasks for certain time periods.
- A serial I/O port to allow data to flow between the controller and other devices such as a PIC or another micro controller.
- An ADC to allow the micro controller to accept analog input data for processing.

Micro controllers are:

- Smaller in size
- Consumes less power
- Inexpensive

Micro controller is a stand alone unit, which can perform functions on its own without any requirement for additional hardware like I/O ports and external memory. The heart of the micro controller is the CPU core. In the past, this has traditionally been based on an 8-bit microprocessor unit. For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 microcontroller devices.

In the recent years, micro controllers have been developed around specifically designed CPU cores, for example the microchip PIC ranges of micro controllers. AT89C51 is the 40 pins, 8 bit Micro controller manufactured by Atmel group. It is the flash type reprogrammable memory. Advantage of this flash memory is we can erase the program with in few minutes. It has 4kb on chip ROM and 128 bytes internal RAM and 32 I/O pin as arranged as port 0 to port 3 each has 8 bit bin Port 0 contain 8 data line(D0-D7) as well as low order address line(A0-A7).

Port 2 contain higher order address line (A8-A15). Port 3 contains special purpose register such as serial input receiver register SBUF, interrupt INT0,INT1 and timers T_0 , T_1 many of the pins have multi functions which can be used as general purpose I/O pins (or) Special purpose function can be decided by the programmer itself.

- 4K Bytes of In-System Reprogrammable Flash Memory

Endurance: 1,000 Write/Erase Cycles.

- Fully Static Operation: 0 Hz to 24 MHz
- Three-Level Program Memory Lock.
- 128 x 8-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.

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 pinout.

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 micro computer which provides a highly flexible and cost effective solution to many embedded control applications.

7.2 PIN CONFIGURATION OF 89C51:

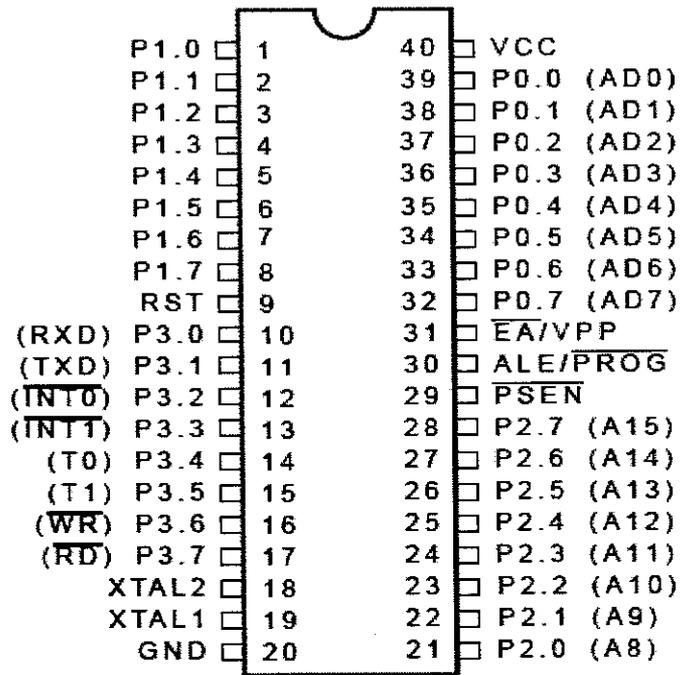


Fig 7.1

RELAY

CHAPTER 8

RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of

contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

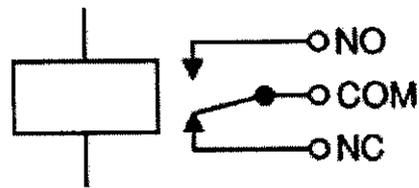


Fig 8.1

The relay's switch connections are usually labeled COM, NC and NO:

- COM = Common, always connect to the moving part of the switch.
- NC = Normally Closed, COM is connected to this when the relay coil is off.
- NO = Normally Open, COM is connected to this when the relay coil is on.

8.1 CIRCUIT DIAGRAM:

RELAY CIRCUIT - SPST

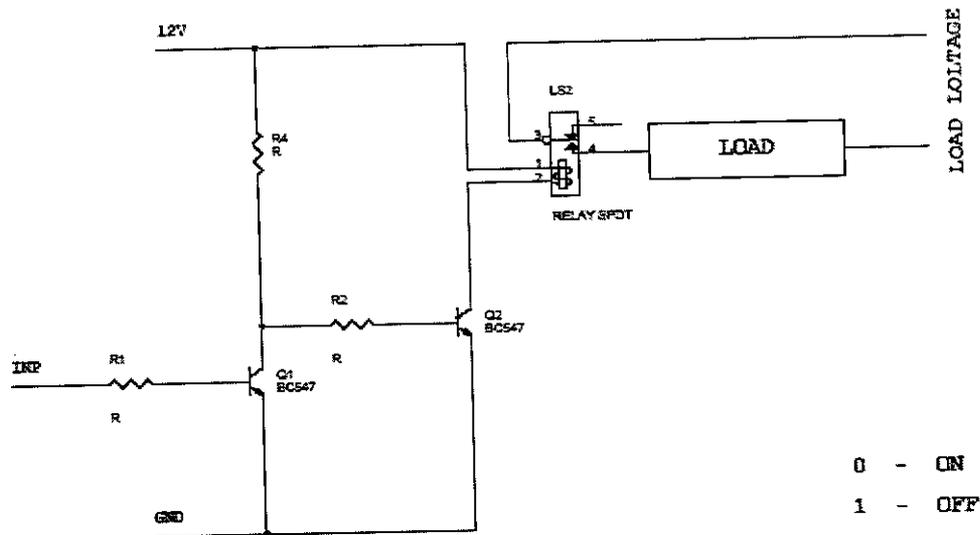


Fig 8.2

8.2 CIRCUIT DESCRIPTION:

This circuit is designed to control the load. The load may be a motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and Normally open (NO).

The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor, so the relay is turned OFF.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

Voltage from Micro controller	Transistor Q1	Transistor Q2	Relay
1	on	off	off
0	off	on	on

ALARM

CHAPTER 9

ALARM

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

9.1 CIRCUIT DIAGRAM:

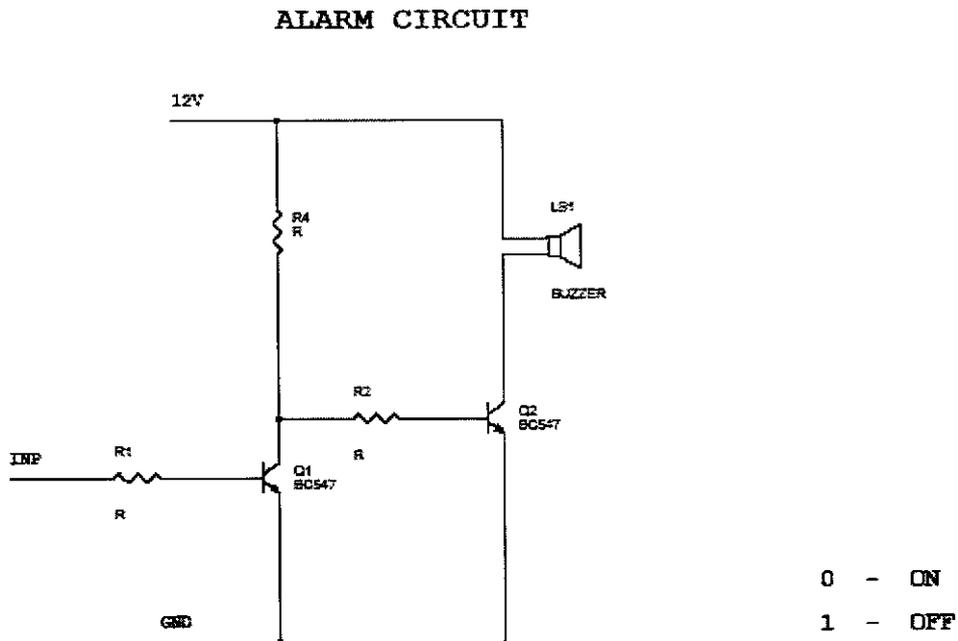


Fig 9.1

9.2 CIRCUIT DESCRIPTION:

The circuit is designed to control the buzzer. The buzzer ON and OFF is controlled by a pair of switching transistors (BC 547). The buzzer is connected to the Q2 transistor collector terminal.

When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and closes the collector and emitter terminal, so no signal is given to base of the Q2 transistor. Hence Q2 transistor and buzzer is turned OFF.

When low pulse is given to base of the transistor Q1, the transistor is turned OFF. Now 12V is given to base of the Q2 transistor, so the transistor is conducting and the buzzer is energized and produces a sound signal.

Voltage from Micro controller	Transistor Q1	Transistor Q2	Buzzer
1	on	off	off
0	off	on	on

SERIAL COMMUNICATION

CHAPTER 10

SERIAL COMMUNICATION

10.1 INTRODUCTION:

To transfer to a device located many meters away, the serial data transfer is used. In serial communication, the data is sent one bit at a time. AT89C51 has serial communication capability built into it, thereby making possible the data transfer using only a few wire. For serial data communication to work, the byte of data must be converted to serial bits using a parallel-in-serial-out shift register, because the micro controller is sending parallel data. Then it can be transmitted over a single data line. This also means at the receiving end there must be a serial-in-parallel-out shift register. The basic block diagram of serial communication is shown in figure.



Fig 10.1

10.2 SERIAL DATA TRANSFER:

Serial data transfer uses two methods, synchronous and asynchronous. The synchronous method transfers a block of data at a time while the asynchronous

transfer a single byte at a time. It is possible to write software to use either of these methods, but the programs can be tedious and long. For this reason, there are special IC chips made by many manufacturers for serial data communication. These chips are commonly referred to as UART (Universal Asynchronous Receiver Transmitter) and USART (Universal Synchronous-Asynchronous Receiver Transmitter).

10.3 ASYNCHRONOUS SERIAL COMMUNICATION:

Asynchronous serial data communication is widely used for character-oriented transmissions, while block-oriented data transfers use the synchronous method. In the asynchronous method, each character is placed in between a start bit and a stop bit. The start bit is always one bit but the stop bit can be one or two bits. The start bit is always 0 (low) and the stop bit is 1 (high).

DATA TRANSFER RATE:

The rate of data transfer in serial data communication is stated in bps (bits per second). Another widely used technology for bps is baud rate. However the baud rate and bps rates are not necessarily equal. This is due to the fact that baud rate is the modern terminology and is defined as the number of signal changes per second.

10.4 RS232 STANDARDS:

RS232 is the most widely used serial I/O interfacing standard. This standard is used in pc and numerous type of equipments. However, since the standard was set long before the advent of the TTL logic family, its input and output voltage levels are not TTL compatible. In RS232, a 1 is represented by -3 to -25V, while a 0 bit is +3 to +25V.

LCD DISPLAY

CHAPTER 11

LCD DISPLAY

11.1 INTRODUCTION:

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. The polarizers are pasted outside the two glass panels. This polarizer would rotate the light rays passing through them to a definite angle, in a particular direction.

When the LCD is in the off state, light rays are rotated by the two polarizers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizer, which would result in activating / highlighting the desired characters.

The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic

circuits, and can be powered for long durations. The LCD does not generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. By changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly.

The LCDs are used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

11.2 DESCRIPTION

POWER SUPPLY:

The power supply should be of +5V, with maximum allowable transients of 10mv. To achieve a better / suitable contrast for the display, the voltage (VL) at pin 3 should be adjusted properly. A module should not be inserted or removed from a live circuit. The ground terminal of the power supply must be isolated properly so that no voltage is induced in it. The module should be isolated from the other circuits, so that stray voltages are not induced, which could cause a flickering display.

HARDWARE:

Develop a uniquely decoded 'E' strobe pulse, active high, to accompany each module transaction. Address or control lines can be assigned to drive the RS and R/W inputs. Utilize the Host's extended timing mode, if available, when transacting with the module. Use instructions, which prolong the Read and Write or other appropriate data strobes, so as to realize the interface timing requirements. If a parallel port is used to drive the RS, R/W and 'E' control lines, setting the 'E' bit simultaneously with RS and R/W would violate the module's set up time. A separate instruction should be used to achieve proper interfacing timing requirements.

MOUNTING:

Display surface should be covered with a transparent protective plate to protect the polarizer. The display surface should not be touched with bare hands or other hard materials. This will stain the display area and degrade the insulation between terminals. The organic solutions should not be used to clean the display panel since it may adversely affect the tape. A slight deformation of the claws of the metal frame will have effect on the connection of the output signal and may cause abnormal display. The pattern wiring should not be modified. When assembling the module into equipment, the space between the module and the fitting plate should have enough height, to avoid causing stress to the module surface. Enough space must be left behind the module to dissipate the heat generated by the ICs while functioning for longer durations. The electrically powered screw driver must be properly grounded while installing the module.

ENVIRONMENTAL PRECAUTIONS:

The LCD module must be operated under the condition of 40°C and 50% relative humidity. Lower temperature can cause retardation of the blinking speed of the display, while higher temperature makes the overall display discolor. When the temperature gets to be within the normal limits, the display will be normal. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and humidity. Contact with water or oil over a long period of time may cause deformation or colour fading of the display. Condensation on the terminals can cause electro-chemical reaction disrupting the terminal circuit.

11.3 TROUBLE SHOOTING:

IMPROPER CHARACTER DISPLAY:

When the characters to be displayed are missing between the data read/write, a slower interfacing frequency would rectify the problem. In case of uncertainty in the beginning of the first character, check the initialization and the software routine. In a multi-line display, if the display of characters in the subsequent lines doesn't take place properly, DD RAM address set for the corresponding display lines must be checked.

When it is unable to display data, even though it is present in the DD RAM, either the display on/off flag is in the off state or the display shift function is not set properly. When the display shift is done simultaneously with the data write operation, the data may not be visible on the display. If a character is not found in the font table or a character is missing, the CG ROM is faulty and the controller IC has to be changed.

PCB DESIGN

CHAPTER 12

PCB DESIGN

DESIGN AND FABRICATION OF PRINTED CIRCUIT BOARDS:

12.1 INTRODUCTION:

Printed circuit boards or PCBs form the core of domestic and industrial electronic equipment. Some of the areas where PCBs are intensively used are computers, process control, telecommunications and instrumentation.

12.2 MANUFACTURING:

The manufacturing process consists of two methods:

1. Print and etch
2. Print, plate and etch

The single sided PCBs are usually made using the print and etch method. The double sided plate through – hole (PTH) boards are made by the print plate and etch method. The production of multi layer boards uses both the methods. The inner layers are printed and etched while the outer layers are produced by print, plate and etch after pressing the inner layers.

PANELISATION:

Here the schematic is transformed into the working positive/negative films. The circuit is repeated conveniently to accommodate economically as many circuits as possible in a panel, which can be operated in every sequence of

subsequent steps in the PCB process. This process is called panelization. For the PTH boards, the next operation is drilling.

DRILLING:

PCB drilling is a state of the art operation. Very small holes are drilled with high speed CNC drilling machines, giving a wall finish with less or no smear or epoxy, required for void free through hole plating.

PLATING:

This is the heart of the PCB manufacturing process. The holes drilled in the board are treated both mechanically and chemically before depositing the copper by the electro less copper plating process.

ETCHING:

Once a multilayer board is drilled and electro less copper deposited, the image available in the form of a film is transferred onto the outside by photo printing using a dry film printing process. The boards are then electrolytically plated onto the circuit pattern with copper and tin. The tin-plated deposit serves an etch resist when copper in the unwanted area is removed by the conveyerised spray etching machines with chemical etchants. The etching machines are attached to an automatic dosing equipment, which analyses and controls etchants concentrations.

SOLDERMASK:

Since a PCB design may call for very close spacing between conductors, a solder mask has to be applied on the both sides of the circuitry to avoid the bridging of conductors. The solder mask ink is applied by screening. The ink is

dried, exposed to UV, developed in a mild alkaline solution and finally cured by both UV and thermal energy.

HOT AIR LEVELLING:

After applying the solder mask, the circuit pads are soldered using the hot air leveling process. The bare bodies fluxed and dipped into a molten solder bath. While removing the board from the solder bath, hot air is blown on both sides of the board through air knives in the machines, leaving the board soldered and leveled. This is one of the common finishes given to the boards. Thus the double sided printed circuit board is manufactured and is now ready for the components to be soldered.

MICRO CONTROLLER CODING

CHAPTER 13

MICROCONTROLLER CODING

Microcontroller coding is done in C language and compiled using the compiler KAILC. The compiled program is loaded into the Microcontroller IC. The Mobile phone is connected to the Microcontroller through a RS232 cable. This sends a command to the mobile to activate a call.

13.1 FLOW CHART:

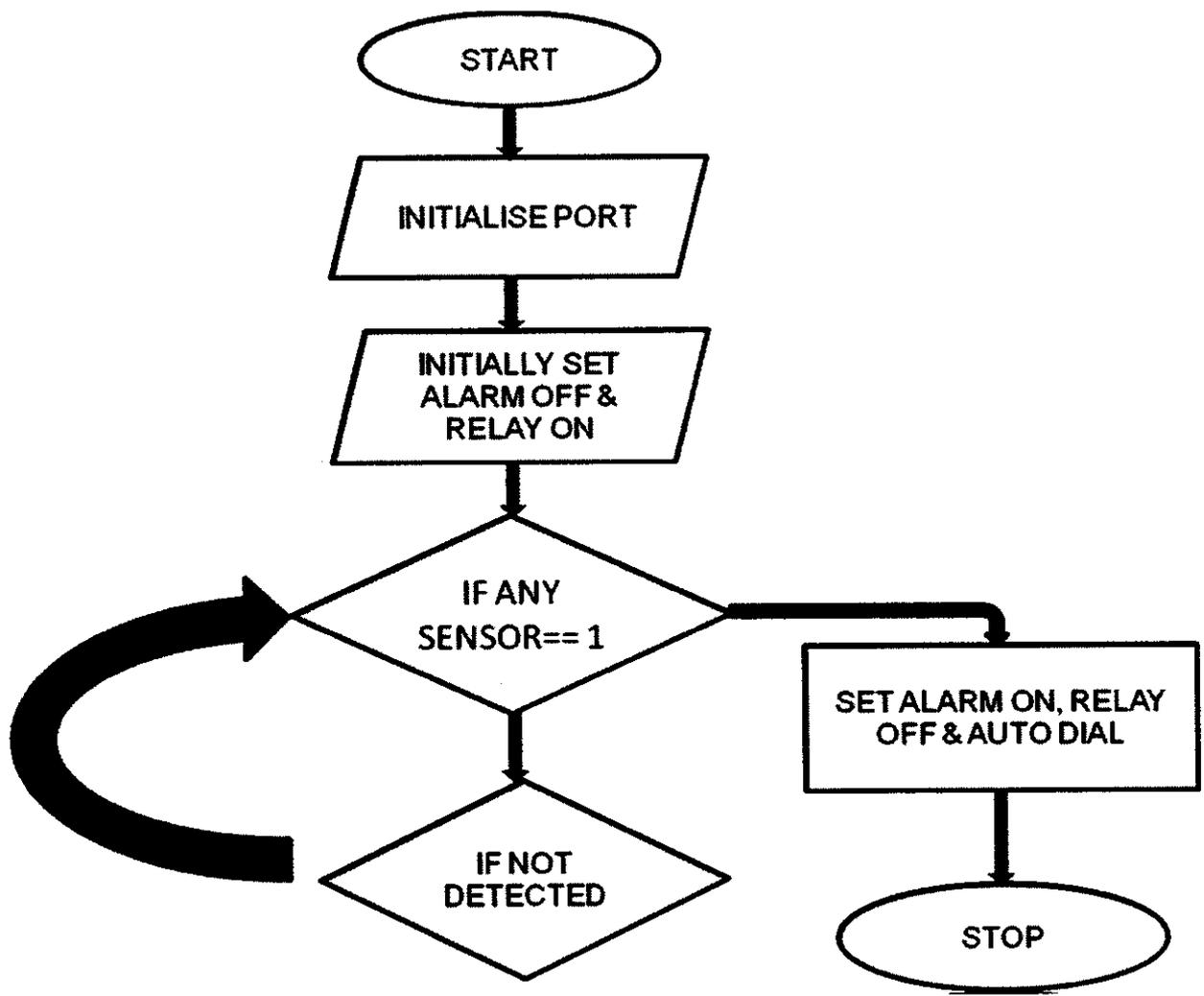


Fig 13.1

ADVANTAGES

CHAPTER 14

ADVANTAGES

The advantages of our project are:

- Less manpower consumption
- Free from human errors
- Auto dialer system
- Avoid the accidents in Industries
- Less recovery time
- Remote area control

CONCLUSION

CHAPTER 15

CONCLUSION

All the modules were individually constructed and then integrated successfully. For demonstration purpose the temperature reference is set at approximately 30 degree and the pressure is at lower level. When the parameter exceeds the reference value it is detected and the detected signal is sent to Microcontroller. The Microcontroller automatically switches OFF the power supply and the buzzer is turned ON, simultaneously the call is made to maintenance department.

FUTURE POSSIBILITIES

CHAPTER 16

FUTURE POSSIBILITIES

The project can be further refined and brought out in other dimensions. The same principle can be used for various applications. The parameters can be observed in computer and can be controlled using the same for higher applications. For example, each sensor outputs are controlled individually, i.e. Temperature sensor that is connected to a Relay in turn controls the Air conditioner (to bring down the temperature to normal), Level sensor which is connected to the Relay in turn controls the Motor. This application can be used in remote areas.

APPENDIX - 1

APPENDIX 1

LM741

PIN CONFIGURATION:

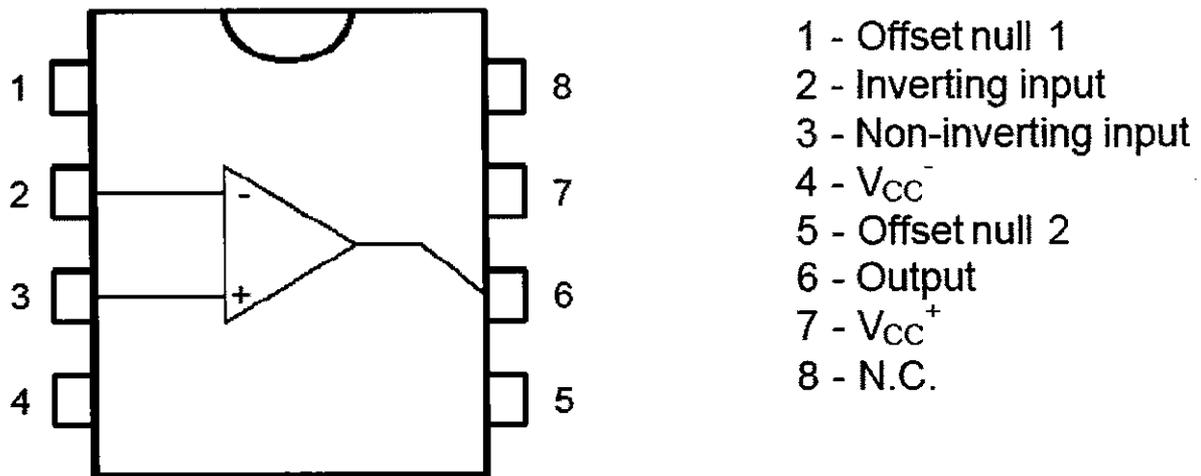


Fig A.1

The terminals labeled +vcc and -vcc are power supply connections the op-amp and set limits on the voltage, which can be produced at the output node. The op-amp we will be using is the 741 as shown in figure. The 741 is a dual op-amp integrated circuit (IC) containing two 741 op-amp. An operational amplifier is a device with two inputs and a single output. The output of the amplifier is given by the formula

$$V_o = A(v_+ - v_-)$$

where,

A is the open-loop voltage gain of the amplifier,

v_+ is the non-inverting input voltage, and

v_- is the inverting input voltage.

Both v_+ and v_- are node voltages with respect to ground. Typically, the open-loop voltage gain A is on the order of 10^5 - 10^6 . A Resistor is placed between the output node and the inverting input to provide feedback and adjust amplification. When an op-amp circuit behaves linearly, the op-amp adjusts its output current such that the voltage difference between the two inputs is nearly zero.

Another important feature of the op-amp is that its input resistance is very large and may be taken as infinite in many applications. The most common type of op-amp is 741, which has the input resistance of 2 Mega Ohm. This is large enough to be considered in most applications. Because of the high input resistance, only a very small current flows into either input of op-amp. In practical op-amp circuits, the current flowing into either of inputs is on the order of A. In case of ideal op-amp, where the single assumption is made that the open-loop voltage gain A goes to infinity

$$I_{\text{input}} = 0$$

where I_{input} is defined to be the current entering the non-inverting input and exiting the inverting input.

DESCRIPTION:

The UA741 is a high performance monolithic operational amplifier constructed on a single silicon chip. It is intended for a wide range of analog applications.

- Summing amplifier
- Voltage follower
- Integrator
- Active filter
- Function generator

The high gain and wide range of operating voltages provide superior performances in integrator, summing amplifier and general feedback applications.



P-2323

APPENDIX - 2

APPENDIX 2

FUNCTIONAL DESCRIPTION OF THE CONTROLLER IC:

REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU. The DR temporarily stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU is automatically written to the DD RAM or CG RAM as an internal operation.

When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

The register selection table is as shown below:

RS	R/W	Operation
0	0	IR write as an internal operation
0	1	Read busy flag (DB7) and address counter (DB0 to DB6)
1	0	DR write as an internal operation (DR to DD RAM or CG RAM)
1	1	DR reads as an internal operation (DD RAM or CG RAM to DR)

BUSY FLAG:

When the busy flag is 1, the controller is in the internal operation mode, and the next instruction will not be accepted. When $RS = 0$ and $R/W = 1$, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

ADDRESS COUNTER:

The address counter allocates the address for the DD RAM and CG RAM read/write operation when the instruction code for DD RAM address or CG RAM address setting is input to IR, the address code is transferred from IR to the address counter. After writing/reading the display data to/from the DD RAM or CG RAM, the address counter increments/decrements by one the address, as an internal operation. The data of the address counter is output to DB0 to DB6 while $R/W = 1$ and $RS = 0$.

DISPLAY DATA RAM (DD RAM):

The characters to be displayed are written into the display data RAM (DD RAM), in the form of 8 bit character codes present in the character font table. The extended capacity of the DD RAM is 80 x 8 bits i.e. 80 characters.

CHARACTER GENERATOR ROM (CG ROM):

The character generator ROM generates 5 x 8 dot 5 x 10 dot character patterns from 8 bit character codes. It generates 208, 5 x 8 dot character patterns and 32, 5 x 10 dot character patterns.

CHARACTER GENERATOR RAM (CG RAM):

In the character generator RAM, the user can rewrite character patterns by program. For 5 x 8 dots, eight character patterns can be written, and for 5 x 10 dots, four character patterns can be written.

INTERFACING THE MICROPROCESSOR / CONTROLLER:

The module, interfaced to the system, can be treated as RAM input/output, expanded or parallel I/O. Since there is no conventional chip select signal, developing a strobe signal for the enable signal (E) and applying appropriate signals to the register select (RS) and read/write (R/W) signals are important.

The module is selected by gating a decoded module – address with the host – processor's read/write strobe. The resultant signal, applied to the LCDs enable (E) input, clocks in the data. The 'E' signal must be a positive going digital strobe, which is active while data and control information are stable and true. The falling edge of the enable signal enables the data / instruction register of the controller. All module timings are referenced to specific edges of the 'E' signal. The 'E' signal is applied only when a specific module transaction is desired.

The read and write strobes of the host, which provides the 'E' signals, should not be linked to the module's R/W line. An address bit which sets up earlier in the host's machine cycle can be used as R/W. When the host processor is so fast that the strobes are too narrow to serve as the 'E' pulse

- a. Prolong these pulses by using the hosts 'Ready' input
- b. Prolong the host by adding wait states

c. Decrease the Hosts Crystal frequency.

In spite of doing the above mentioned, if the problem continues, latch both the data and control information and then activate the 'E' signal. When the controller is performing an internal operation the busy flag (BF) will set and will not accept any instruction. The user should check the busy flag or should provide a delay of approximately 2ms after each instruction. The module presents no difficulties while interfacing slower MPUs. The liquid crystal display module can be interfaced, either to 4-bit or 8-bit MPUs.

For 4-bit data interface, the bus lines DB4 to DB7 are used for data transfer, while DB0 to DB3 lines are disabled. The data transfer is complete when the 4-bit data has been transferred twice. The busy flag must be checked after the 4-bit data has been transferred twice. Two more 4-bit operations then transfer the busy flag and address counter data. For 8-bit data interface, all eight-bus lines (DB0 to DB7) are used.

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