University of Mumbai

A PROJECT ON

GSM Based Home Automation & Security

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2008-2009

CERTIFICATE

This is to certify that

Kartik Bhat
V.Ananthasuri
Amit More
Riddhi Shah

Have Satisfactory completed the project entitled

GSM Based Home Automation & Security

Towards the partial fulfillment of the

BACHELOR OF ENGINEERING
IN
INSTRUMENTATION

As laid by University of Mumbai.

Internal Guide

(Prof. Dipali Joshi)

(Prof. Hiral Shah)

Examiner

Head of department

Principal

(Dr. N K Rana)

(Dr. U V Bhosle)

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Project team members:

Kartik Bhat.

V. Ananthasuri.

Amit More.

Riddhi Shah.

ABSTRACT

We live in the world of uncertainties. Security has become one of the most important and primary concern in our day-to-day life. There is always an element of danger in every point. Sometimes it is possible to avoid these conditions. We can control the magnitude of the destruction caused if it is not.

The two main security concerns addressed in this project are theft and fire. These are the foremost concerns be it homes, offices, banks etc. The existing system involves human interaction on a very large scale. These systems have greater chance of failure because humans are prone to make errors.

Imagine a situation when fire breaks out or a Burglary takes place. These incidents involve loss of property or even lives. These conditions demands quick thinking and immediate action. Otherwise destruction on a large scale would take place.

One thing in is clear now that the human intervention has made the existing security system impaired. Our aim is to eliminate or minimize the role played by the humans in the system. It should be as low as possible.

This is where the role of GSM based Home Automation & Security System comes into play. What if the fire department is informed about the possibility of outbreak of fire? What if the Owner of the home or the Police are informed about the presence of an intruder? It would be clear in the next few chapters how by using *modern scientific techniques* we can take step into the world of improved security.

We present you in this project the future of the security system. It involves a Burglar Alarm system and Fire alarm. It also has additional features like Temperature Controller and Light Intensity Controller.

The purpose of the Temperature Controller is to keep the temperature of a room within a certain range. This range can be adjusted by the user.

Light Intensity Controller is used to keep the intensity of light within a certain range. Again the range is adjustable as per the user's choice.

These features would be explained in detail in the forthcoming chapters.

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Chapter 1

Project Overview

- Introduction
- Motivation
- Scope

1.1
Introduction

Now-a-days, life style has become very fast and busy and it is not possible to continuously track the alarming events. Hence, the automation of capturing the events and communicating them has become necessity. To achieve this we have developed the system named **GSM BASED HOME AUTOMATION & SECURITY.** If a particular sensor detects a failure of a system then the system generates an alarming event and depending upon the severity it sends respective SMS to the configured mobile number of a concerned person. Depending upon the type of the event the person can take further action.

This system can be used in many applications. Here, we are presenting general Security System for offices or company or home. For this, we have used smoke detector, Light dependent resistor, Temperature sensor and keypad based lock. The slave mobile is connected to the Micro controller via the F-BUS cable and serial port. Remote controlling is done by the remote master mobile. The specific SMS is sent from the master mobile to the slave mobile through a regular GSM network. The Micro controller interprets the received message from the slave mobile and initiates the required action. An acknowledgement signal is then generated by the Micro controller which is sent back to the master mobile as a regular SMS.

The Micro controller will continuously check the status of the sensors. If any of the sensor's condition breaks, then the Microcontroller detects that and sends respective SMS through Mobile to the concerned person, so that the person can take further action.

1.2
Motivation

Many of the current security and monitoring systems available till now requires manual intervention and not all of them real time and don't support 24 hour monitoring. Where the manual intervention is, there will be little pinch for errors. The GSM based Automation system provides easy accessibility and complete automation of the system. The mobile network is on the path of continual improvement. The betterment of this system for the end user is the main aim of the project. As the mobile has become an integral part of our lives, the choice of this project seems all the more logical.

1.3
Scope

The main objective of this system is to provide complete automation solution for monitoring and security systems wherever applicable. This application also provides people with valuable information from a remote location when an important event occurs that they need to know about. The information is automatically delivered electronically without having to constantly employ physical resources locally on the off chance that such an event occurs. Also one can control remote machines and different devices by sending SMS to remotely situated Controller. It can be used in

- Banks
- Offices
- Hospitals
- Computer labs
- Industries

Now in chapter 2 we will deal with the system design.

Chapter 2

System Design

- Block diagram
- Specifications
- Hardware requirement
- Software requirement

2.1

Block Diagram

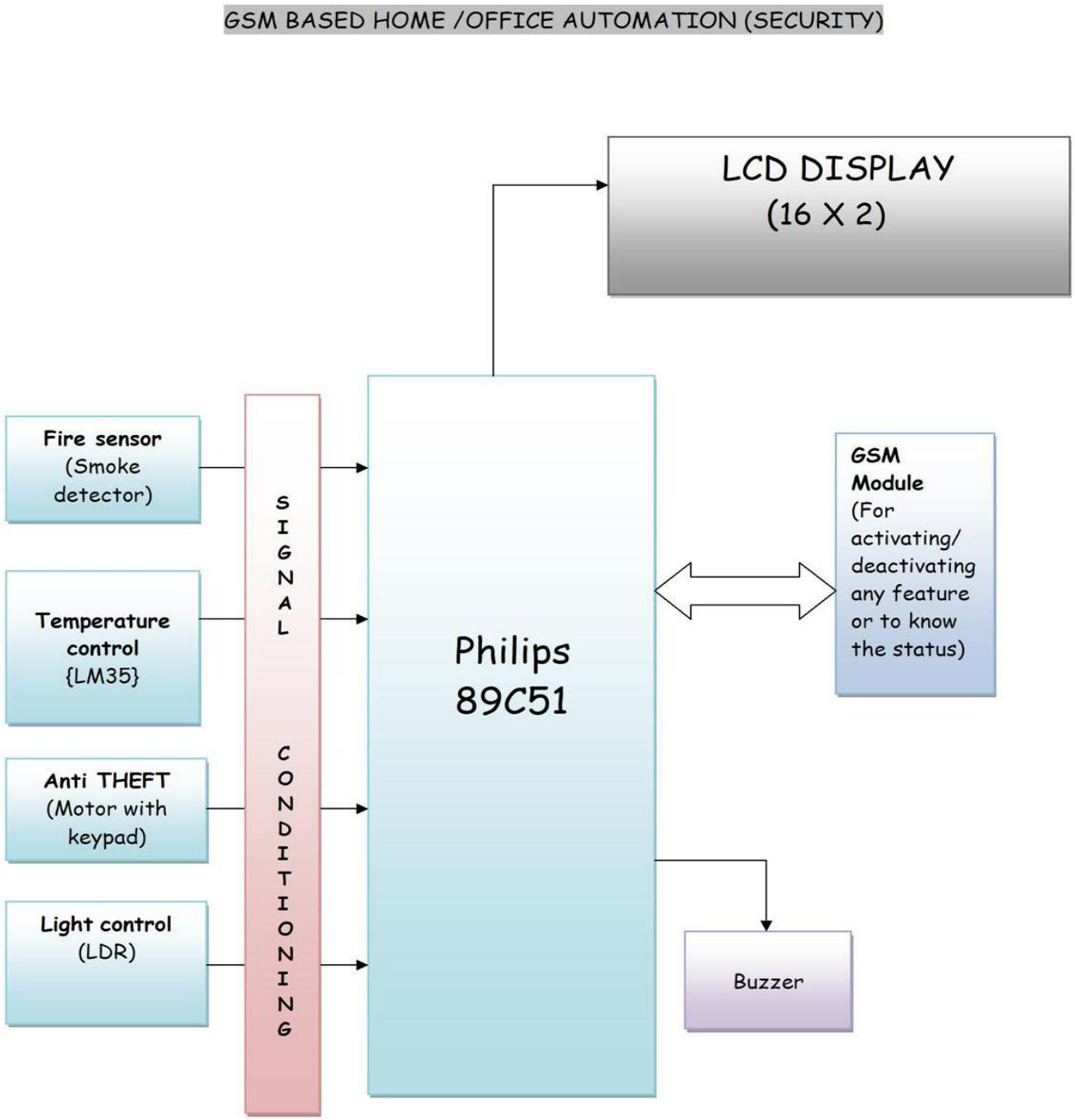


Figure 2-2.1 Block diagram of project

2.2

General Description

The block diagram show above contains 4 blocks before the signal conditioning block and these blocks are

- **Fire sensor:** In this project we have used ionization type smoke detector which will continuously check for fire in the place of its installation.
- **Temperature control:** In this project we have used LM35 as temperature sensor which will continuously check the temperature and give its output to microcontroller through ADC. Two relays will switch the heater and the cooler respectively according to temperature preset.
- **Anti theft device:** In this project we have used keypad based locking system, where in the user has to enter the pre-defined password to open the door. User gets 3 attempts to enter correct password.
- **Light control:** In this project we have used LDR (light dependent resistor) to control the lighting of the room based on the intensity. Lights will switch ON-OFF according to some predefined intensity level.
- For GSM module we are using Nokia 3310 with an F-bus cable and it serves the purpose of GSM interface with microcontroller.
- For purpose of display we are using 16*2 LCD display which gives information about various activities happening in the microcontroller and peripheral devices.
- Microcontroller used here is Philips P89C51.
- Buzzer is used to bring to attention some undesirable event that is going to take place.

2.3

Hardware Requirements

- P89C51
- ADC 0809
- Smoke sensor (Ionization type)
- LDR
- L293D (Motor driver)
- MAX232
- DB9
- F-bus cable
- Nokia 3310
- LCD module
- LM35
- Buzzer
- Motor 300rpm

2.3

Software Requirement

- KEIL µ vision 3.2
- Eagle layout editor
- MULTISIM
- µ Flash

In the next chapter we will deal with circuit diagram its description and working in detail.

Chapter 3

Circuit Diagram and Description

- Circuit diagram
- Description & working
- Philips P89C51
- ADC 0809
- Liquid crystal display (LCD)
- Relays
- MAX 232
- Power supply
- Keypad
- LDR
- LM 35
- Smoke sensor

3.1

Circuit diagram

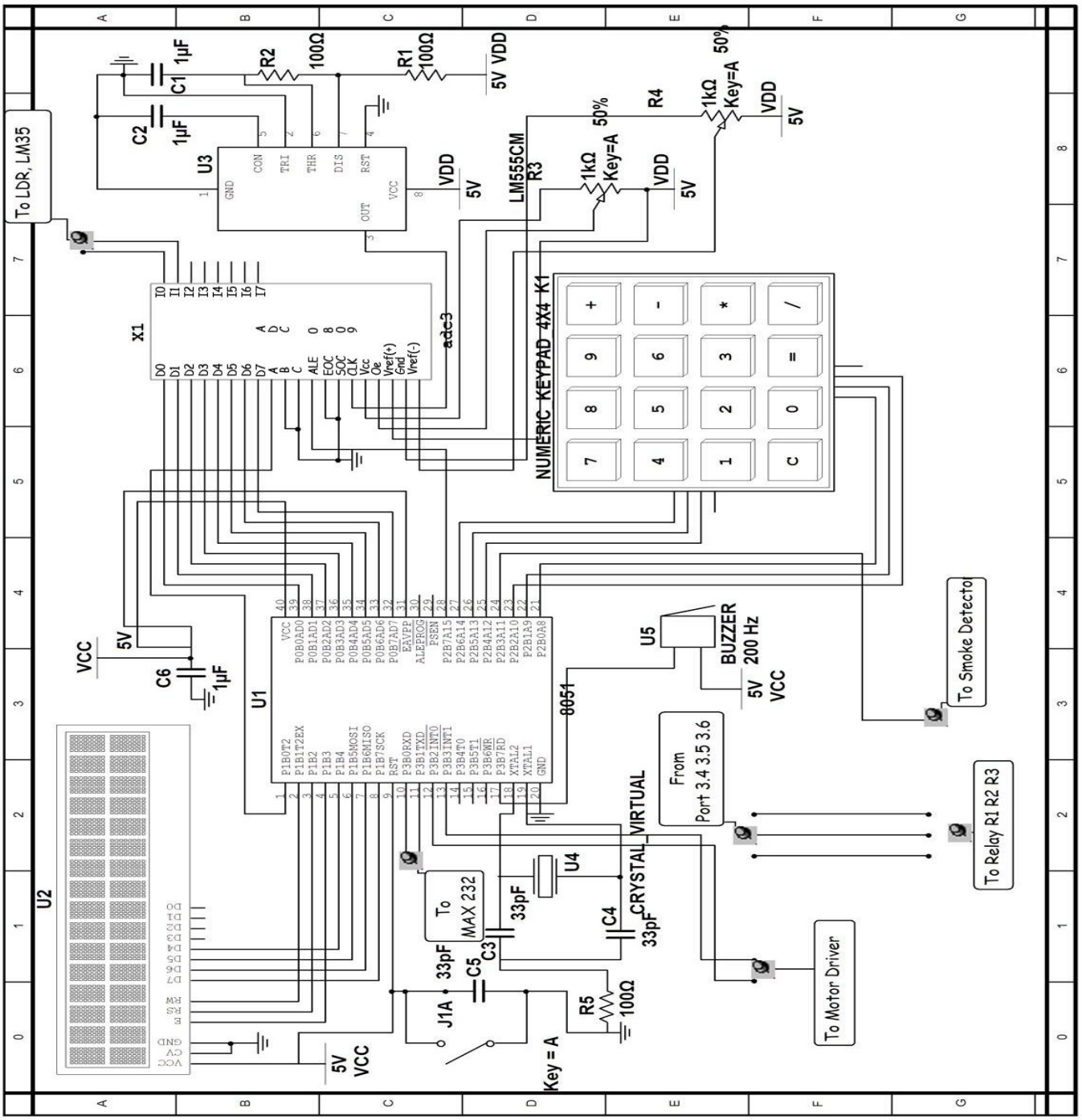


Figure 3-3.1a Full Circuit diagram

Relays Interfacing with Microcontroller

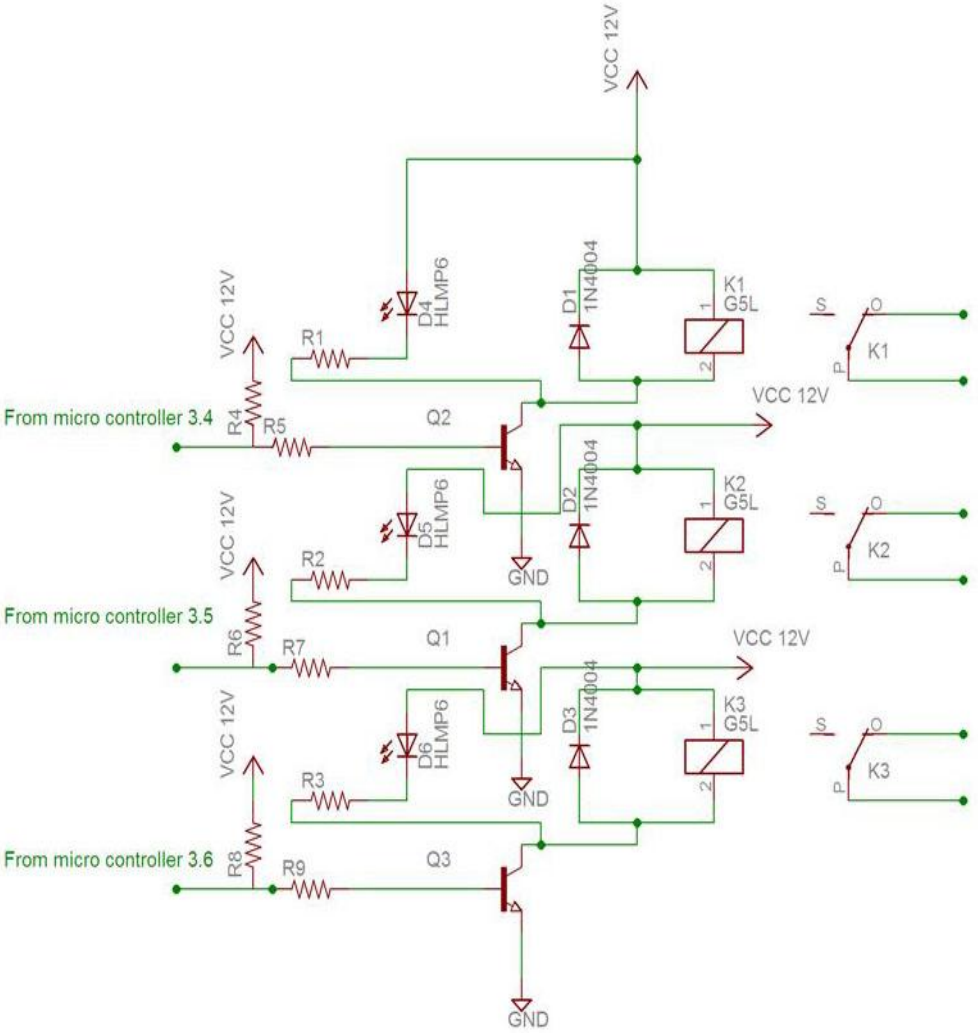


Figure 3-3.1b Relay interfacing

Motor Interfacing

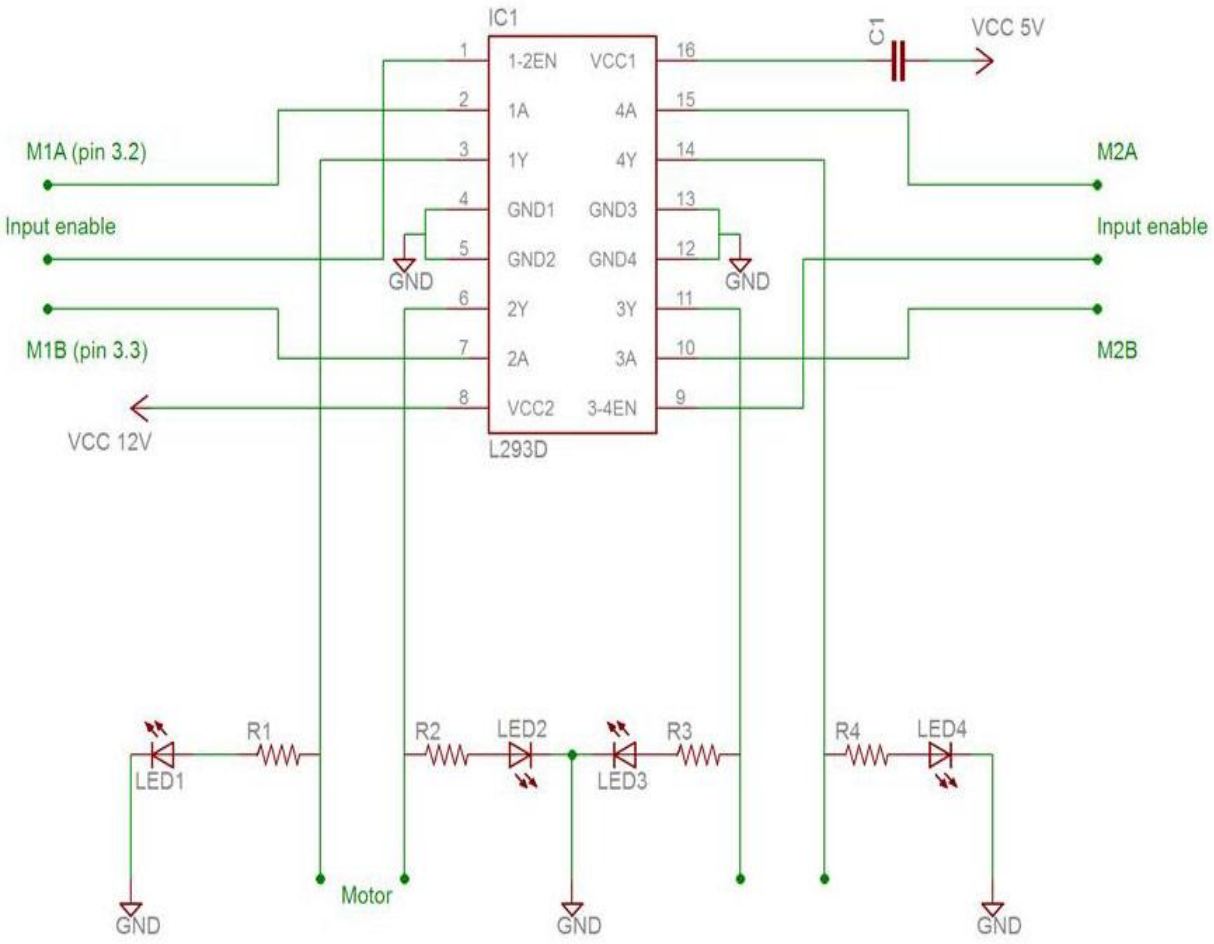


Figure 3-3.1c Motor interfacing

Max 232 Interfacing

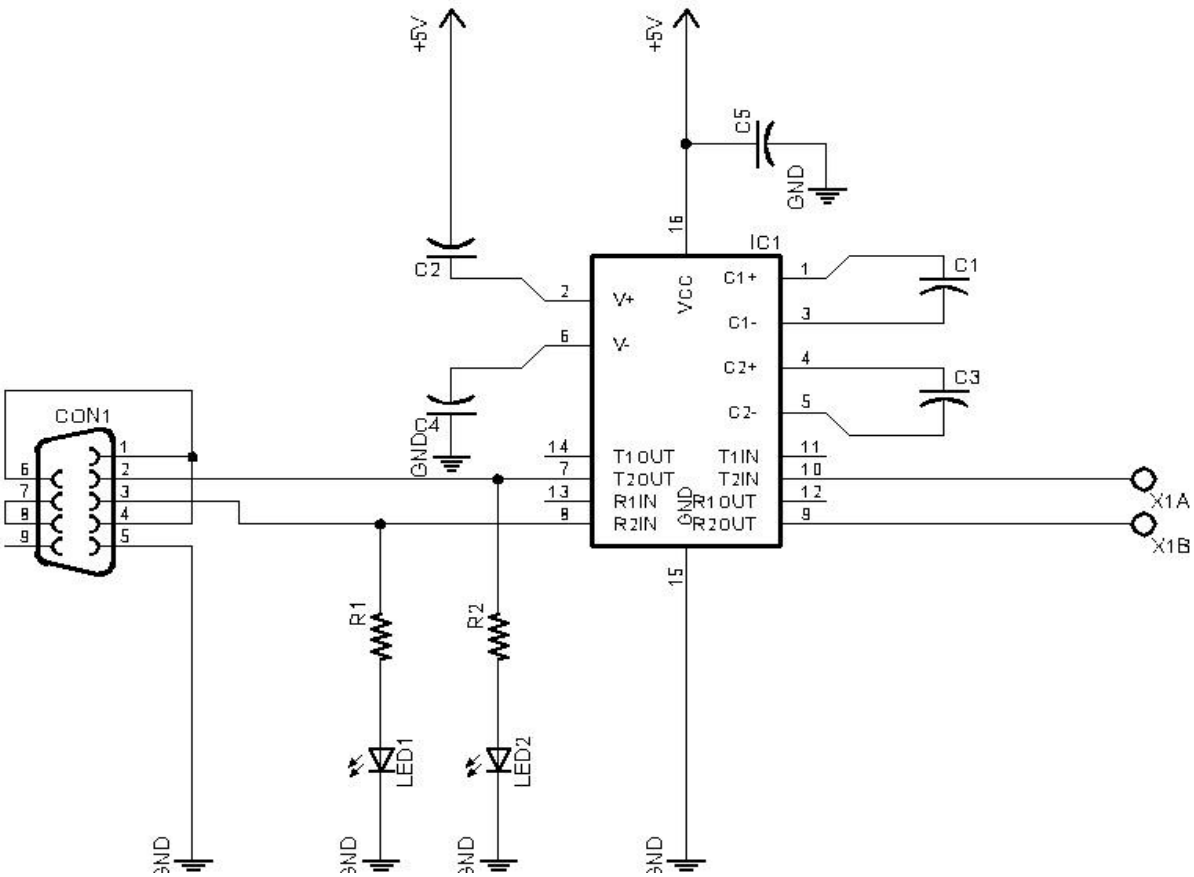
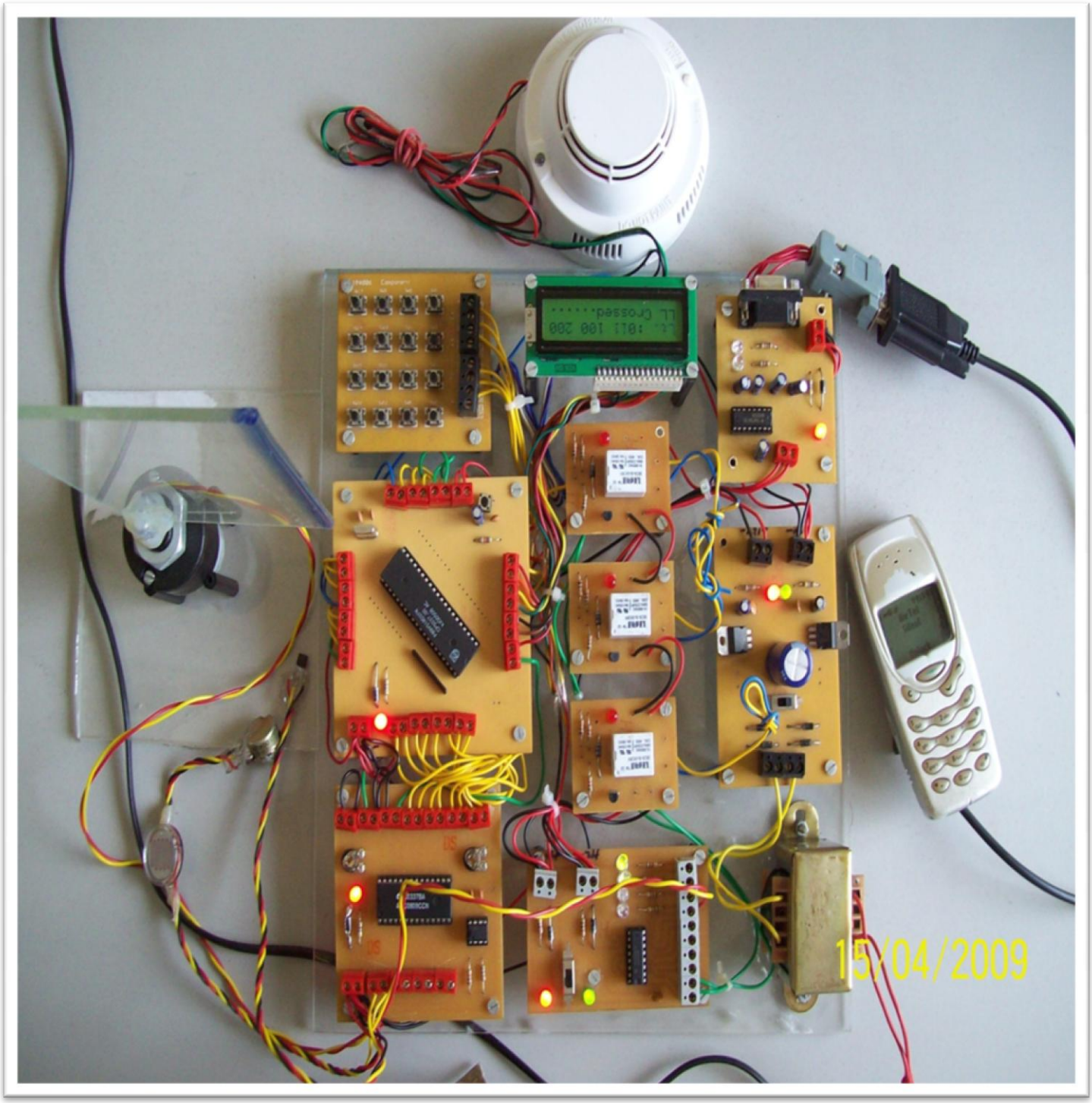


Figure 3-3.1d Max 232 interfacing

- X1A is connected to port 3.1 of microcontroller
- X1B is connected to port 3.0 of microcontroller



Actual photo of the circuit with all devices connected.

3.2

Description and working

Circuit Description & Working

The above circuit shows the interfacing of the microcontroller with different components. The components which are interfaced are LCD, ADC, Keypad, Relays, Smoke sensor, LM35.

LCD: The LCD is connected to the Port 1 of the microcontroller. The pins P1.5 to P1.8 are the data lines. P1.2 to P1.4 is control lines. P1.2 is connected to WR (write) pin, P1.3 is connected to RD (read) pin and P1.4 to enable pin.

ADC: ADC is used to convert the input analog signal to digital signal. It is connected to the Port 0 of the microcontroller. The ADC gets the analog signal from the temperature sensor and LDR. Timer is used to provide clock pulses to ADC used in the conversion of analog signals to digital signals.

Keypad: Keypad is a component useful in the Anti Theft system. It is connected to the Port 2 of the microcontroller. The user uses keypad to enter the password. The user must enter the correct password in order to enter the house. The keypad used here is 3*3 keypad.

Smoke detector: Smoke detector used is an ionization type detector. It is connected to ort 2.3 of microcontroller.

LM35: It is temperature sensor used to constantly monitor temperature inside the room. It is connected to channel 2 of ADC 0809.

LDR: it is used for automatic light controlling and continuously senses for change in light intensity. It is connected to channel 1 of ADC.

Working:

The system we have designed works as a real time system which keeping on scanning the current condition with the one which is preset in the microcontroller to check if there is any undesirable condition. If there is any undesirable condition it takes corrective action accordingly for e.g. if the temperature passes the set range of 20-40 and it goes down to say 18 in this case we have predefined to turn ON the cooler till temperature becomes greater than or equal to 20 i.e. bringing it back to pre defined range.

Similarly we have done it for automatic lighting where if the intensity of light falls below dome predefined range the microcontroller switches on the relay and hence the light thus compensating for fall in intensity of light.

We have used a smoke sensor to continuously monitor if the house is safe from any fire hazardous. The sensor used is an ionic type sensor whose working is explained in detail in section 3.13. The sensor checks for hazardous condition and immediately brings it to notice of the owner if there is any breakthrough.

Similar sort of arrangement is made for security by using keypad based locking of the door which acts as burglar alarm system. Only genuine user can enter the room that has the correct password. The user gets 3 attempts to enter correct password if he fails to enter it correctly the buzzer starts to ring and immediately this is brought to notice of the owner by sending him a warning message.

This is how the entire system works.

We will explain you function and working of each part in following subsections.

3.3

PHILIPS Micro-Controller

- Introduction to Microcontrollers
- Features of 89C51
- Pin Diagram of 89C51
- Architecture of 89C51

Introduction to Microcontrollers

Definition

An embedded microcontroller is a chip which has a computer processor with all its support functions (clock & reset), memory (both program and data), and I/O (including bus interface) built into the device. These built in functions minimize the need for external circuits and devices to be designed in the final application.

Types of Microcontroller

Creating applications for microcontrollers is completely different than any other development job in computing and electronics. In most other applications one probably have a number of subsystem and interfaces already available for his/her use. This is not the case with a microcontroller where one is responsible for –

- Power distribution
- System clocking
- Interface design and wiring
- System programming
- Application programming
- Device programming

Before selecting a particular device for an application, it' s important to understand what the different options and features are and what they can mean with regard to developing application.

- **Embedded Microcontroller**

When all the hardware required to run the application is provided on the chip, it is refer to as an Embedded Microcontroller. All that is typically required to operate the device is power, reset, and a clock. Digital I/O pins are provided to allow interfacing with external devices.

- **External Memory Microcontroller**

Sometimes, the program memory is insufficient for an application or, during debug; a separate ROM (or even RAM) would make the work easier. Some microcontrollers including the 8051 allow the connection of external memory.

An external memory microcontroller seems to primarily differ from a microprocessor in the areas of built-in-peripheral features. These features could include memory device selection (avoiding the need for external address decoders or DRAM address multiplexers), timers, interrupt controllers, DMA, and I/O devices like serial ports.

Microcontroller Memory Types

There are number of different types of control store (Program Memory) that are available in different versions and different manufacturers' 8051s. **The following is the list of conventions used for 8X51-**

Table 3-3.3 conventions used for 8X51

"X" value	Control Store Type
0	**None**
3	**Mask ROM**
7	**EPROM**
9	**EEPROM/FLASH**

Features of 89C51

- 80C51 Central Processing Unit
- On-chip FLASH Program Memory
- Speed up to 33 MHz
- Fully static operation
- RAM expandable externally up to 64 Kbytes
- 4 interrupt priority levels
- 6 interrupt sources
- Four 8-bit I/O ports
- Full-duplex enhanced UART
    - Framing error detection
    - Automatic address recognition
- Three 16-bit timers/counters T0, T1 (standard 80C51) and Additional T2 (capture and compare)
- Power control modes
    - Clock can be stopped and resumed
    - Idle mode
    - Power down mode
- Programmable clock out
- Second DPTR register
- Asynchronous port reset
- Low EMI (inhibit ALE)
- Wake up from power down by an external interrupt

Pin Diagram of 89C51

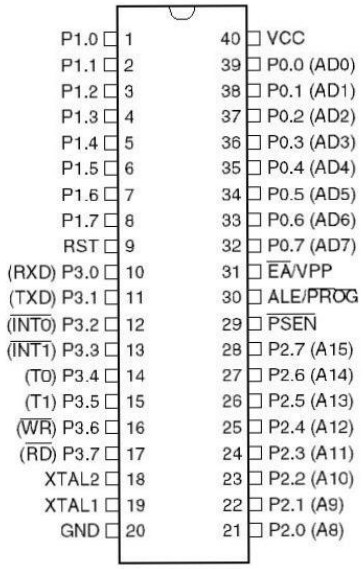


Figure 3-3.3a Pin Diagram of P89C51

Internal Block Diagram

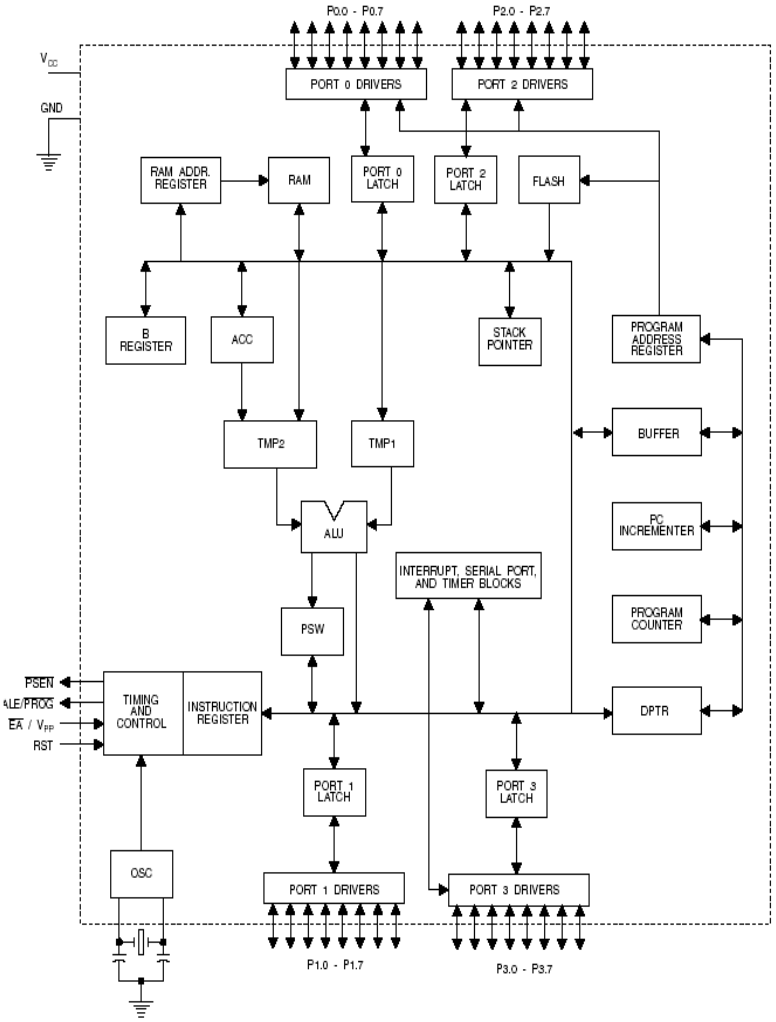


Figure 3-3.3b Block Diagram of P89C51

Microcontroller Interface

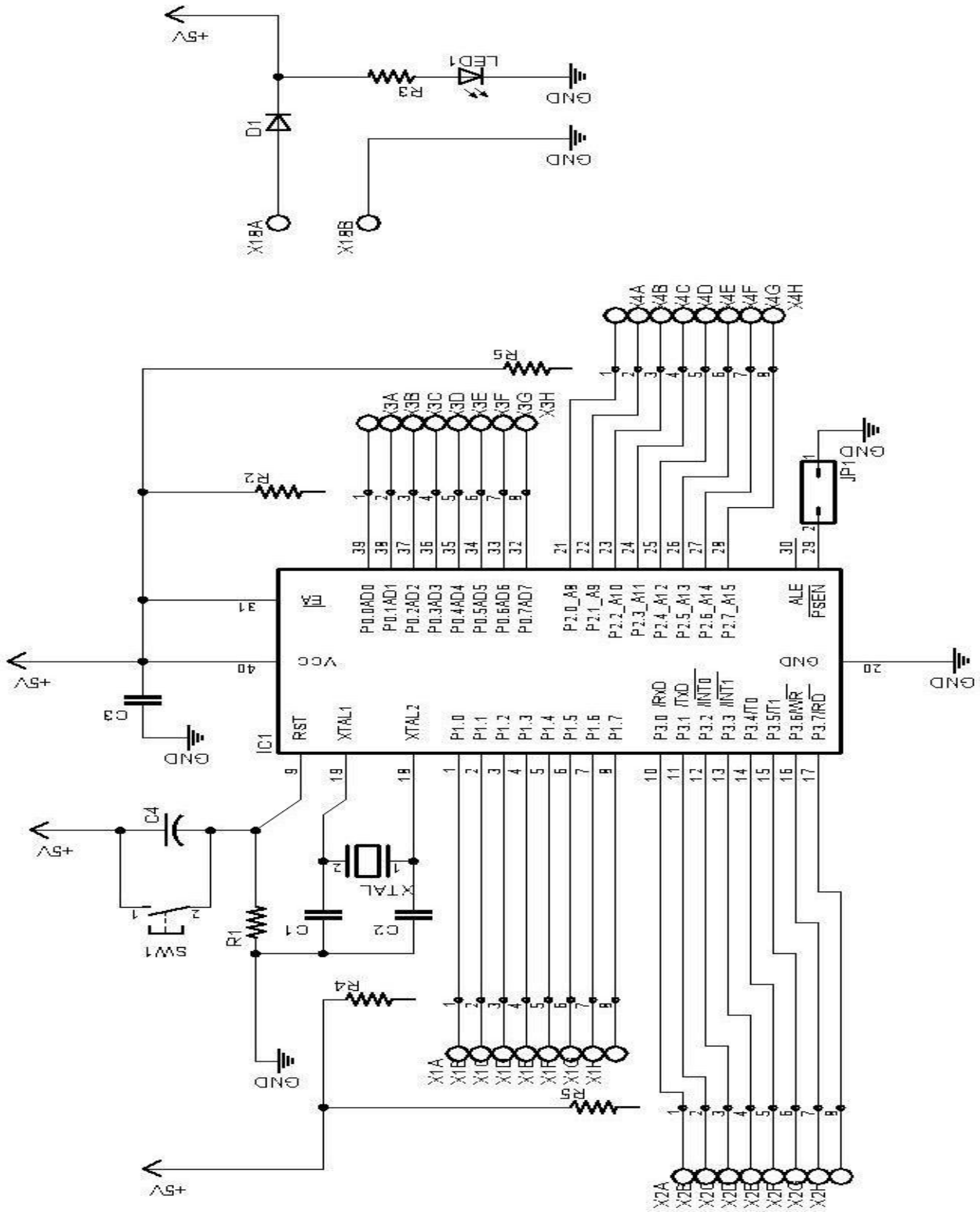


Figure 3-3.3c Micro Controller Interface

3.4

ADC 0808/0809

- Block Diagram
- Pin Diagram
- General Description
- Features

Block Diagram

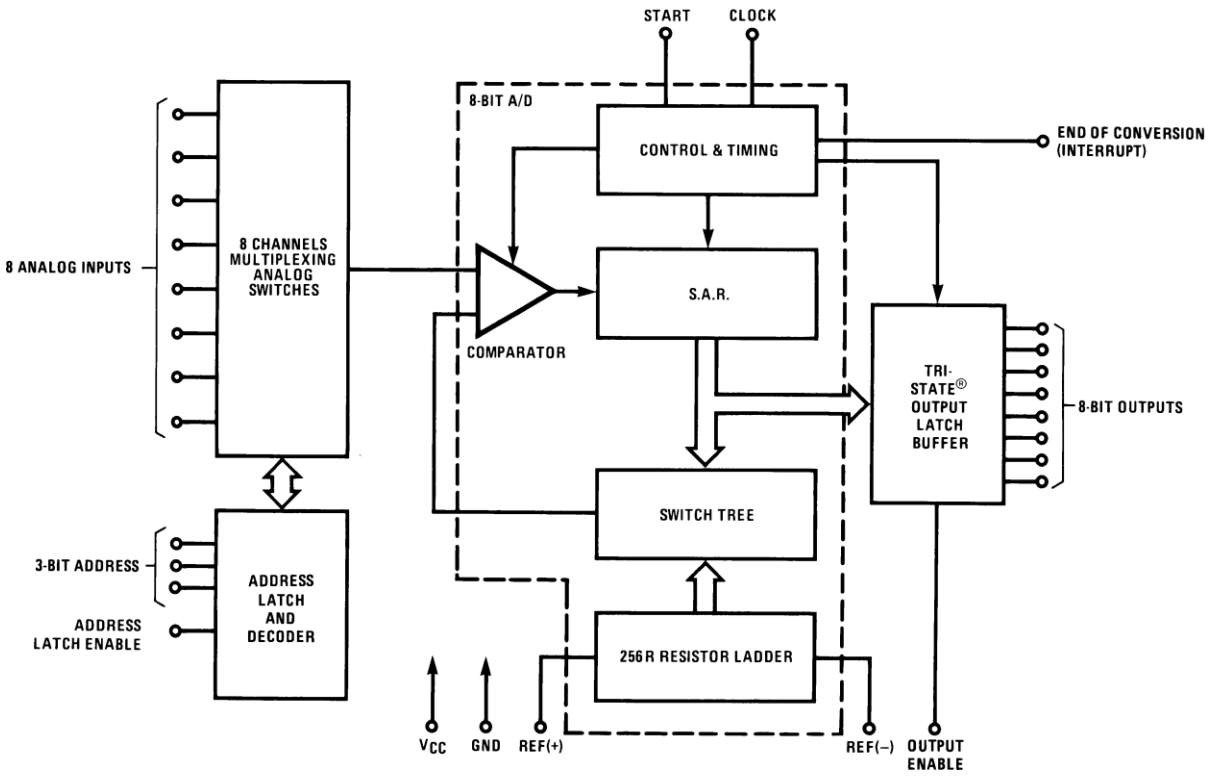


Figure 3-3.4a block diagram of ADC

Pin diagram

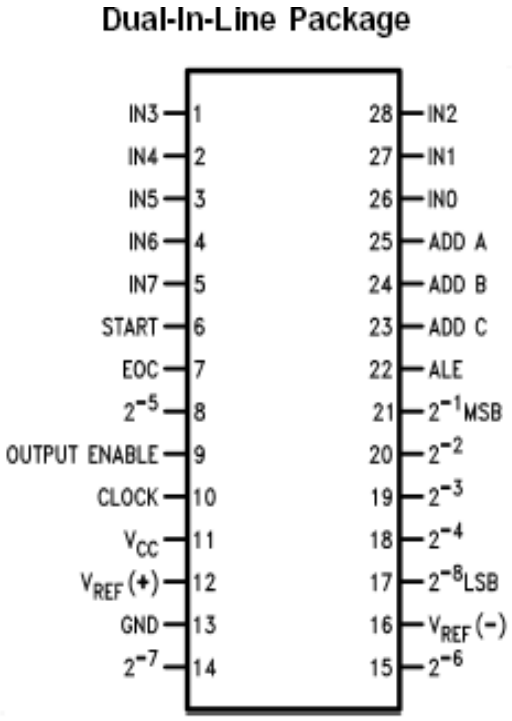


Figure 3-3.4b Pin Diagram of ADC 0809

General description

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE® outputs.

The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications.

Features

- Easy interface to all microprocessors
- Operates ratiometrically or with 5 VDC or analog span
- Adjusted voltage reference
- No zero or full-scale adjust required
- 8-channel multiplexer with address logic
- 0V to 5V input range with single 5V power supply
- Outputs meet TTL voltage level specifications

- Standard hermetic or molded 28-pin DIP package
- 28-pin molded chip carrier package
- ADC0808 equivalent to MM74C949
- ADC0809 equivalent to MM74C949-1

Key Specifications

- Resolution 8 Bits
- Total Unadjusted Error ±1⁄2 LSB and ±1 LSB
- Single Supply 5 VDC
- Low Power 15 mW
- Conversion Time 100 μs

3.5

LIQUID CRYSTAL DISPLAY (LCD)

- General description
- Features
- Interfacing

General description

LCD's are passive display having low power consumption and contrast ratio. The characteristic of LCD's are given below:

- LCD's operate on the principle of light scattering. They can be operated either in a reflective or transmissive configuration. There operation dependent on ambient or back lightering as they do not generate their own light. It operates on low voltage around 1v-5v and the power required by LCD to the scatter or absorbs light is very low in the order of the few micro-watts/cm.
- A transmissive LCD has better visual characteristic than a reflective LCD.
- The operation of LCD is base on the use of certain organic material, which retains a regular crystal like structure even when they have been melted.
- Nematic and cholestric are to important liquid crystal material used in display out of these two NLC has a particular crystal structure. The liquid is normally transparent, but if subjected to a strong electric field, an ion moves through it and disturbs the well-ordered crystal structure. The liquid is normally transparent, but if subjected to a strong electric field, ions move through it and disturb the well ordered crystal structure causing the liquid to polarize and hence turn opaque.

Features

- RS232 compatible serial interface (2400 & 9600 baud selectable)
- Externally selectable serial polarities (Inverted & Non-Inverted)
- Serially controllable contrast and backlight levels
- 8 user programmable custom characters
- 16 Byte serial receive buffer
- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle

Interfacing

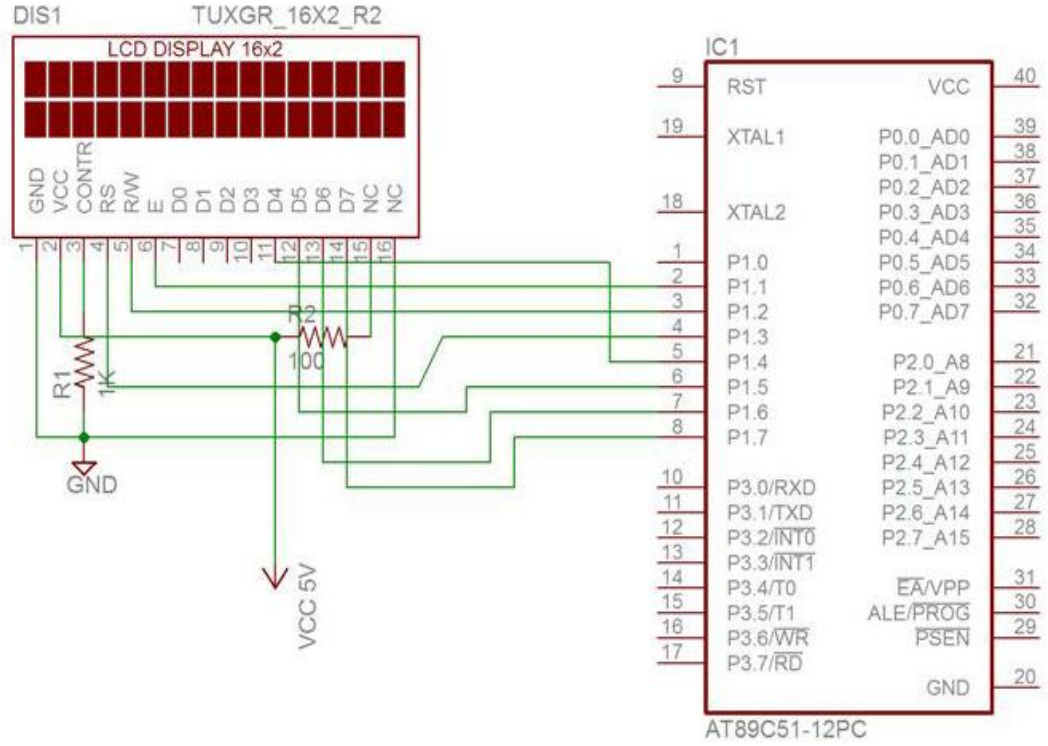


Figure 3-3.5 LCD interfacing with Microcontroller in 4 bit mode

3.6

RELAYS

- General description
- Operation
- Application

General description

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. It was invented by Joseph Henry in 1835. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier.

Pole and Throw

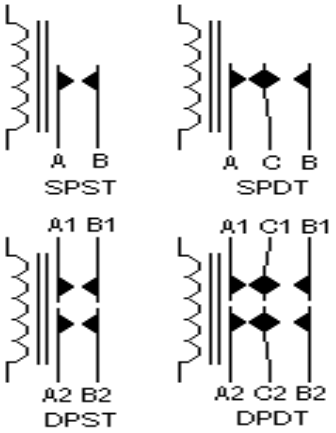


Figure 3-3.6a Pole and Throw

- **SPST** - **S**ingle **P**ole **S**ingle **T**hrow. These have two terminals which can be connected or disconnected. Including two for the coil, such a relay has four terminals in total. It is ambiguous whether the pole is normally open or normally closed. The terminology "SPNO" and "SPNC" is sometimes used to resolve the ambiguity.
- **SPDT** - **S**ingle **P**ole **D**ouble **T**hrow. A common terminal connects to either of two others. Including two for the coil, such a relay has five terminals in total.
- **DPST** - **D**ouble **P**ole **S**ingle **T**hrow. These have two pairs of terminals. Equivalent to two SPST switches or relays actuated by a single coil. Including two for the coil, such a relay has six terminals in total. The poles may be Form A or Form B (or one of each).

- **DPDT** - **D**ouble **P**ole **D**ouble **T**hrow. These have two rows of change-over terminals. Equivalent to two SPDT switches or relays actuated by a single coil. Such a relay has eight terminals, including the coil.

Since relays are switches, the terminology applied to switches is also applied to relays

- Normally-open (**NO**) contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a **Form A** contact or "make" contact.
- Normally-closed (**NC**) contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called a **Form B** contact or "break" contact.

Operation of relay

Circuit 1 is a simple electromagnet which requires only a small current. When the switch is closed, current flows and the iron rocker arm is attracted to the electromagnet. The arm rotates about the central pivot and pushes the contacts together. Circuit 2 is now switched on.

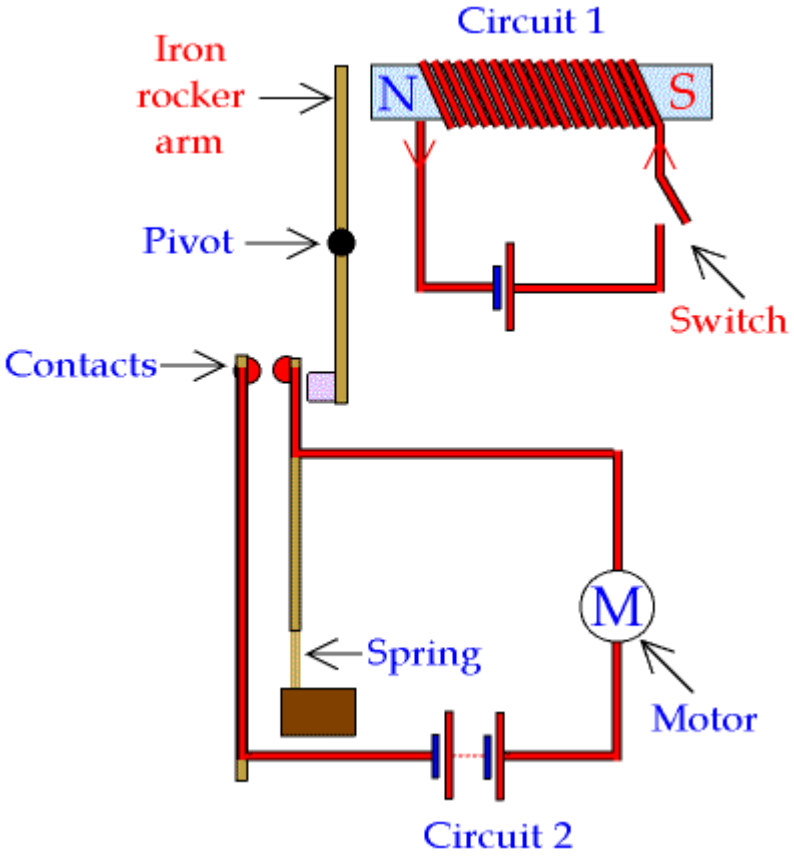


Figure 3-3.6b Basic diagram showing working of relay

Circuit 2 may have a large current flowing through it, to operate a powerful motor or very bright light. When the switch is opened the electromagnet releases the rocker arm and the spring moves the contacts apart. Circuit 2 is now switched off. The advantage of using a relay is that a small current (circuit 1) can be used to switch on and off a circuit with a large current (circuit2).

This is useful for two reasons:

(i) Circuit 1 may contain a component such as an LDR, which only uses small currents.

(ii) Only the high current circuit needs to be made from thick wire.

A relay is used to operate the starter motor in cars and the heating circuit in diesel engines.

Applications

- To control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers
- To control a *high-current* circuit with a low-current signal, as in the *starter* solenoid of an automobile,
- To detect and isolate faults on transmission and distribution lines by opening and closing *circuit breakers* (protection relays)

3.7

MAX 232

- General description
- Features
- Pin diagram

General Description

- When communicating with various micro processors one needs to convert the RS232 levels down to lower levels, typically 3.3 or 5.0 Volts.
- **Serial RS-232** (V.24) communication works with voltages -15V to +15V for high and low. On the other hand, **TTL** logic operates between 0V and +5V. Modern low power consumption logic operates in the range of 0V and +3.3V or even lower
- Thus the RS-232 signal levels are far too high **TTL electronics,** and the negative RS-232 voltage for high can't be handled at all by computer logic. To receive serial data from an RS-232 interface the voltage has to be reduced. Also the low and high voltage level has to be inverted.
- The MAX232 from **Maxim** was the first IC which in one package contains the necessary drivers and receivers to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V or +3.3V) and generates the necessary RS-232 voltage levels.

Features of MAX232

- Meets or Exceeds TIA/EIA-232-F and ITU
- Recommendation V.28
- Operates From a Single 5-V Power Supply
- With 1.0-_F Charge-Pump Capacitors
- Operates Up To 120 Kbit/s
- Two Drivers and Two Receivers
- ±30-V Input Levels
- Low Supply Current . . . 8 mA Typical
- Applications
  - TIA/EIA-232-F, Battery-Powered Systems,
- Terminals, Modems, and Computers

Pin diagram of MAX 232:

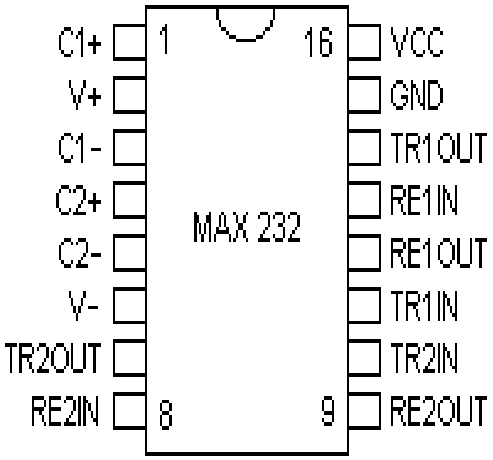


Figure 3-3.7 Pin diagram of max 232

3.8

MOTOR DRIVER L293D

- General description
- Features
- Pin diagram

General description:

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN.When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

On the L293, external high-speed output clamp diodes should be used for inductive transient suppression.

A V_{CC1} terminal, separate from V_{CC2}, is provided for the logic inputs to minimize device power dissipation.

Features

- Operation from 0°C to 70°C
- 600mA Output Current Capability
- Per Channel
- 1.2A Peak Output Current (Non Repetitive)
- Per Channel
- Enable Facility
- Over Temperature Protection
- Logical "0" Input Voltage Up To 1.5 V
- (High Noise Immunity)
- Internal Clamp Diodes

Pin diagram

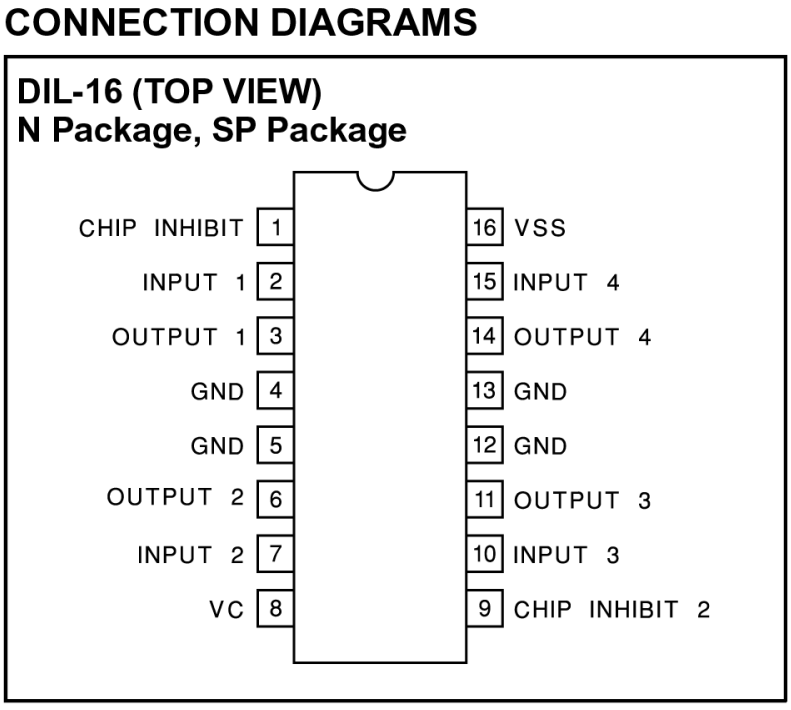


Figure 3-3.8 a Pin diagram of motor driver L293D

Working:

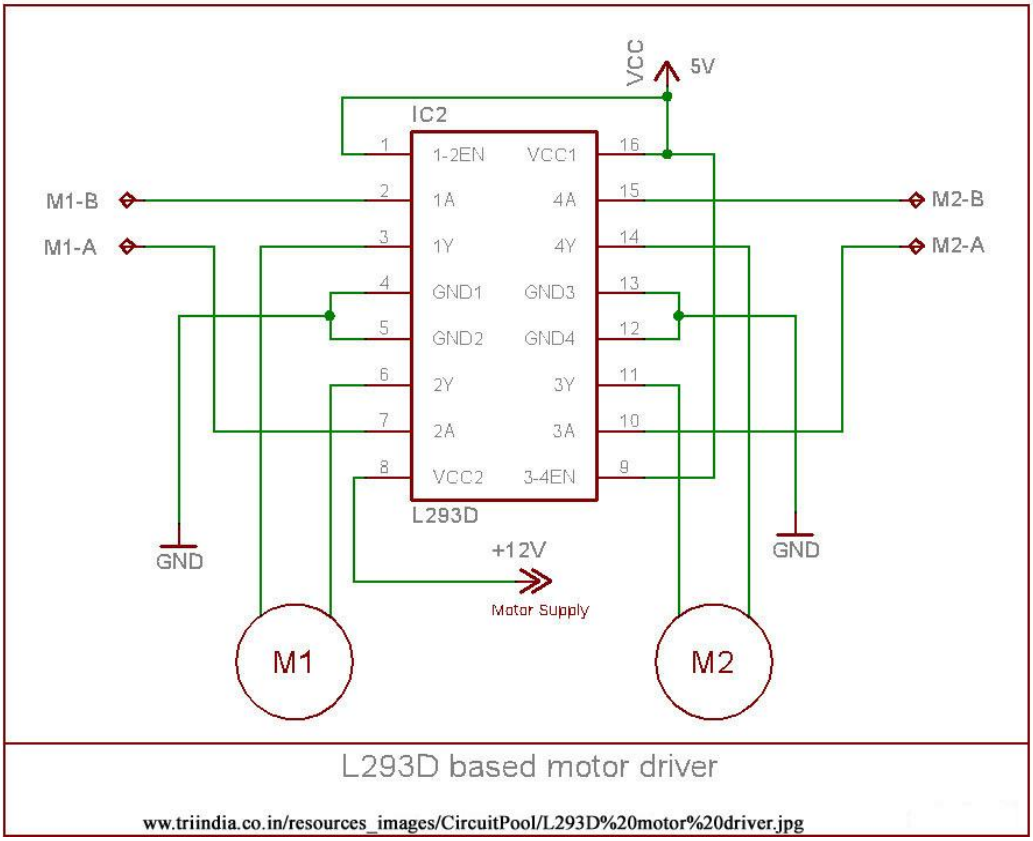


Figure 3-3.8b Circuit diagram of motor driver L293D

- This schematic shows the use of L293D to drive a pair of DC motors/Geared Motors. The motor supply voltage can go up to 24Volts safely. But remember that the IC supports a maximum of only 600mA current/channel which is more than enough to drive small DC geared motors.
- Remember to add 0.22uF capacitors across both the motors to reduce the effect of noise on the circuitry.
- It is also recommended to add 100uF capacitor between the motor supply pin and the Gnd.
- Connections M1-A and M2-B correspond to Motor 1 while connections M2-A and M2-B correspond to Motor 2.

  M1a=logic 0 and M1b= logic 1, motor runs in one direction.
  M1a=logic1 and M1b= logic 0, motors run in reverse direction.
  M1a = M1b= 0 motor stops running.

3.9
Power Supply

- Design
- Circuit diagram

Design

- The system demanded an output of 5V dc and 12V dc.
- We have used a bridge rectifier circuit along with 15V step down transformer.
- Two IC's namely IC 7805 and IC 7812 are used whose output is 5V and 12V dc respectively.
- 5V supply is needed to microcontroller, LCD, MAX 232, Motor driver.
- 12V supply is needed for relays and Motor driver.

Circuit diagram:

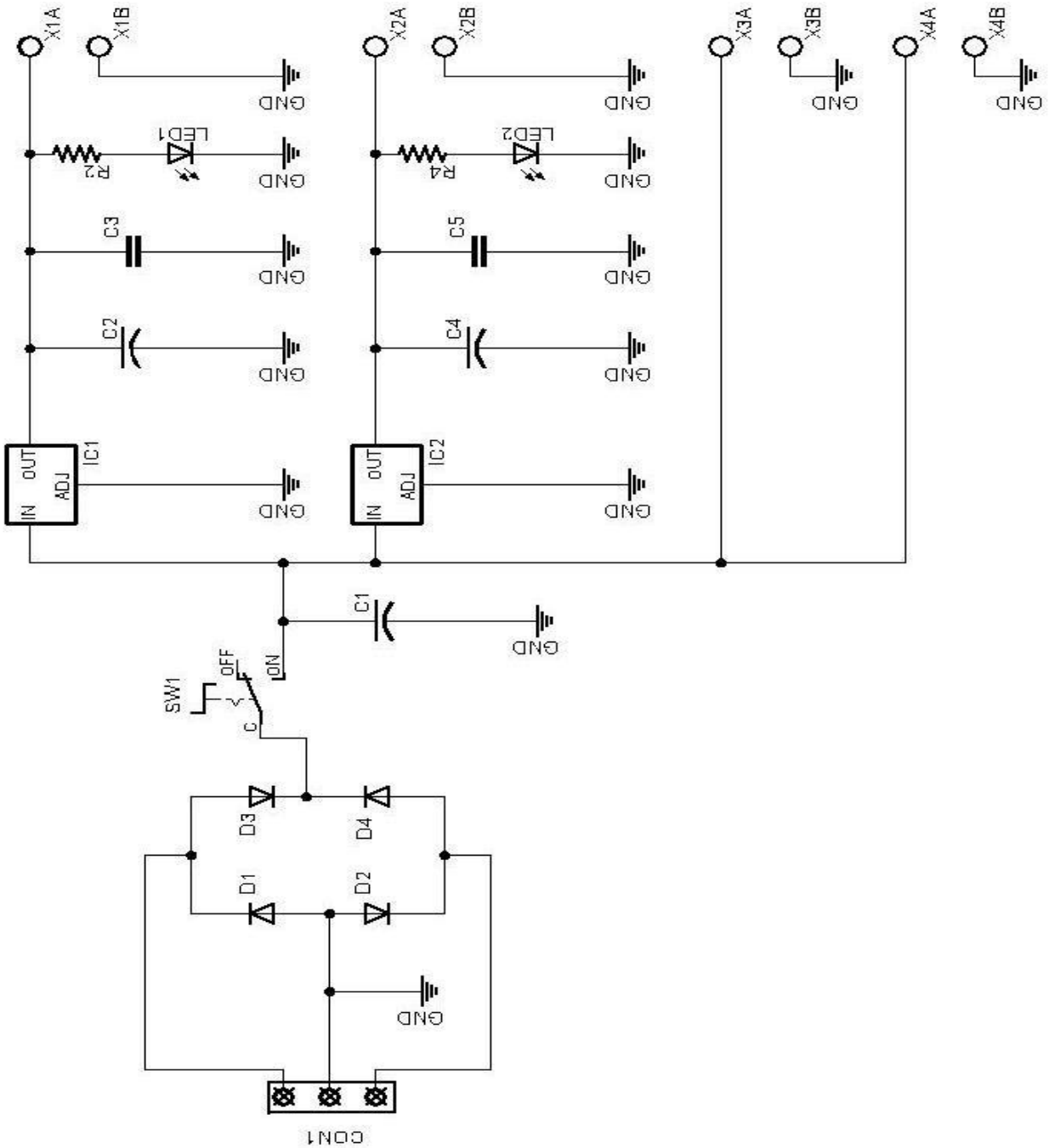


Figure 3-3.9 circuit diagram of Power Supply

3.10

Keypad

- Description
- Circuit diagram

Description

Keypad is basically a matrix of many rows and columns. The number of pin outs of keypad equals the sum of number of rows and columns in the keypad, with each pin attached to a particular, unique, entire row or entire column via a naked tiny conducting wire. All the wires are properly insulated from each other, however, at the places where a wire for a column crosses a wire representing a row, there is a short air-spacing between the two, instead of some insulated material, so that the two wires do not touch each other at their own, but may be made to do so on key press. That is where we press the keys on the keypad. As we press a particular key on the keypad, the spacing between two wires reduces until the two wires, of one particular row and one particular column, touch each other. Different scanning techniques may be developed to determine which key is pressed (generally termed as keypad scanning).

Circuit diagram

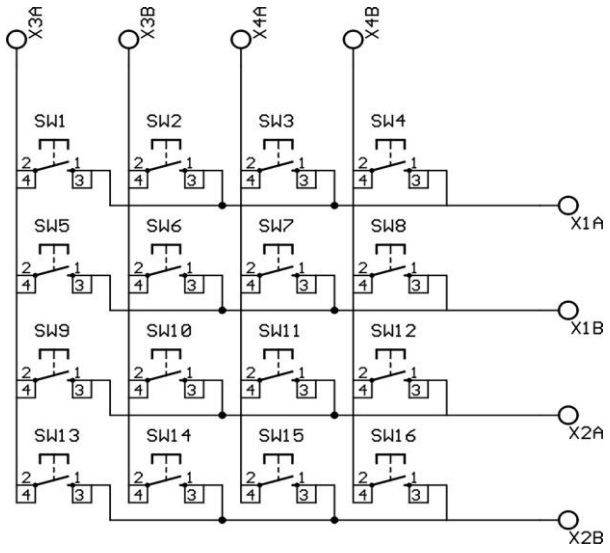


Figure 3-3.10 Circuit diagram of Keypad

3.11
Light Dependent Resistor (LDR)

General description

LIGHT DEPENDENT RESISTOR

A photo resistor or light dependent resistor or cadmium sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referenced as a photoconductor.

A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction.

Figure 3-3.11 LDR

A photo resistor is a sensor whose resistance varies with light intensity. Most decrease in resistance as the light intensity increases. In a typical microcontroller application, this resistance must be converted to a voltage so that an A2D converter can measure it. The easiest way to do this is with a voltage divider circuit.

3.12

LM 35 (Temperature sensor)

- **Description**
- **Features**

Description

Figure 3-3.12 LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the temperature in degree Celsius. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy).

Features:

- Calibrated directly in ° Celsius (Centigrade)
- Linear + 10.0 mV/°C scale factor
- 0.5°C accuracy (at +25°C)
- Rated for full −55° to +150°C range
- Operates from 4 to 30 volts
- Less than 60 µA current drain
- Low self-heating, 0.08°C in still air
- Nonlinearity only ±1⁄4°C typical
- Low impedance output, 0.1 W for 1 mA load

3.13

Smoke Detector

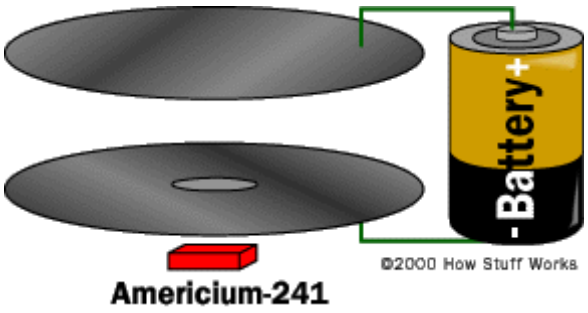
Description & Working:

A smoke detector is a device that detects smoke and issues a signal to a fire alarm system, or issues a local audible and/or visual alarm from the detector itself.

A household smoke detector will typically be mounted in a disk-shaped plastic enclosure about 150 millimeters (6 in) in diameter and 25 millimeters (1 in) thick, but the shape can vary by manufacturer. Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization), but some of them use both detection methods to increase sensitivity to smoke.

Working of Ionization Smoke Detector:

- Ionization smoke detectors use an ionization chamber and a source of ionizing radiation to detect smoke. This type of smoke detector is more common because it is inexpensive and better at detecting the smaller amounts of smoke produced by flaming fires.
- Inside ionization detector is a small amount (perhaps 1/5000th of a gram) of americium-241. The radioactive element americium has a half-life of 432 years, and is a good source of alpha particles.



- An ionization chamber is very simple. It consists of two plates with a voltage across them, along with a radioactive source of ionizing radiation, like this:

- The alpha particles generated by the americium have the following property: They ionize the oxygen and nitrogen atoms of the air in the chamber. To "ionize" means to "knock an electron off of." When you knock an electron off of an atom, you end up with a free electron (with a negative charge) and an atom missing one electron (with a positive charge). The negative electron is attracted to the plate with a positive voltage, and the positive atom is attracted to the plate with a negative voltage (opposites attract, just like with magnets). The electronics in the smoke detector sense the small amount of electrical current that these electrons and ions moving toward the plates represent.

- When smoke enters the ionization chamber, it disrupts this current the smoke particles attach to the ions and neutralize them. The smoke detector senses the drop in current between the plates and sets off the horn.

Chapter 4
F-Bus Communication

- Introduction to Nokia F-Bus
- F-Bus Protocol
- Sending a SMS
- Receiving a SMS
- Deleting a SMS

4.1

An Introduction to Nokia F-Bus

How to connect microcontrollers to Nokia 3310 & 3315

Most Nokia phones have F-Bus and M-Bus connections that can be used to connect a phone to a PC or in our case a microcontroller. The connection can be used for controlling just about all functions of the phone, as well as uploading new firmware etc. This bus will allow us to send and receive SMS messages.

Figure 4-4.1a pin outs of NOKIA 3310

Figure 4-4.1b F-bus connected to 3310

The very popular Nokia 3310/3315 has the F/M Bus connection under the battery holder. This is a bit of a pain to get to and requires a special cable to make the connection.

Figure 4-4.1c An F-bus cable

The left picture above shows the 4 gold pads used for the F and M Bus. The right picture shows the F-Bus cable connected to Nokia 3310.

Nokia download cables are available from most mobile phone shops and some electronics stores. The cable contains electronics to level convert 3V signals to RS232 type signals. There are also M and F bus switching in most cables.

The differences of M-Bus and F-Bus

M-Bus is a one pin bi-directional bus for both transmitting and receiving data from the phone. It is slow (9600bps) and only half-duplex. Only two pins on the phone are used. A ground pin and one data pin. M-Bus runs at 9600bps, 8 data bits, odd parity, and one stop bit. The data terminal ready (DTR) pin must be cleared with the request to send (RTS).

F-Bus is the later high-speed full-duplex bus. It uses one pin for transmitting data and one pin for receiving data plus the ground pin. Very much like a standard serial port. It is fast 115,200bps, 8 data bits, no parity, and one stop bit. For F-Bus the data terminal ready (DTR) pin must be set and the request to send (RTS) pin cleared.

4.2

F-Bus Protocol

The F-Bus is bi-directional serial type bus running at 115,200bps, 8 data bits. The serial cable contains electronics for level conversion and therefore requires power. The first thing to do is supply power to the cable electronics and this is done by setting the DTR (Data Terminal Ready) pin and clearing the RTS (Request to Send) pin.

Connect the DTR pin to a +3 to 12 Volt supply and RTS to a -3 to -12Volt supply. The easy way to achieve this is by using a Max232 or similar transceiver for the RS232 TX and RX pins and then connecting the DTR pin on the serial cable to the V+ pin on the Max232. Do the same for the RTS; however connect it to the V- pin on the Max232. The V+ and V- pins are derived from internal charge pumps that double the input voltage. I.e. for a 5V Max232, the V+ will +10V and the V- will be -10V.

The next step is to synchronize the UART in the phone with microcontroller. This is done by sending a string of 0x55 or 'U' 128 times. The bus is now ready to be used for sending frames.

The Nokia protocol has a series of commands that allow the user to make calls, send and get SMS messages and lots more.

Sample frame sent to Nokia 3310 (showed as a Hex dump)

Byte	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Data	1E	00	0C	D1	00	07	00	01	00	03	00	01	60	00	72	D5

This sample frame is used to get the hardware and software version from a Nokia phone.

Byte 0: All frames sent by cable will start with the character 0x1E first. This is the F-Bus Frame ID. Cable is 0x1E and Infrared is 0x1C.

Byte 1: This is the destination address. When sending data, it's the phone's device ID byte. In our case it's always 00 for the phone.

Byte 2: This is the source address. When sending data, it's the PC's device ID byte. In our case it's always 0x0C (Terminal).

Byte 3: This is the message type or 'command'. 0xD1 is Get HW & SW version.

Byte 4 & 5: Byte 4 & 5 is the message length. In our case it is 7 bytes long. Byte 4 is the MSB and byte 5 is the LSB.

Byte 6: The data segment starts here and goes for 7 bytes in our case. As The Nokia is a 16 bit phone and therefore requires an even number of bytes. As ours is odd the last byte will be a padding byte and the message will end at location 13. The last byte in the data segment (Byte 12 above) is the sequence number. The last 3 bits of this byte increment from 0 to 7 for each frame. This part needs to be sent back to the phone in the acknowledge frame.

Bytes 14 & 15: The second to last byte is always the odd checksum byte and the last byte is the even checksum byte. The checksum is calculated by XORing all the odd bytes and placing the result in the odd Checksum location and then XORing the even bytes and then placing the result in the even byte.

If the phone received it, the reply is shown in the following data:

1E 0C 00 7F 00 02 D1 00 CF 71

1E 0C 00 D2 00 26 01 00 00 03 56 20 30 34 2E 34 35 0A 32 31 2D 30 36 2D 30 31 0A 4E 48 4D 2D 35 0A 28 63 29 20 4E 4D

50 2E 00 01 41 3F A4

The first line is an Acknowledge command frame. Notice how the destination and source addresses are now swapped. This is because the Nokia phone is now talking. This message is two bytes long with the two bytes representing the message type received (0xD1) and the sequence number (0x00). The last two bytes are the

checksum and should be checked to make sure the data is correct. The 3310 will be waiting for an acknowledge frame after these two frames were sent. If the acknowledge frame is not sent the 3310 will retry sending the data. The 3310 will only send the data 3 times and then gives up.

The second frame from the Nokia 3310 is the data we requested. The message type is 0xD2. This is 'receive Get HW&SW version'. This 38-byte (0x26) message should show 0x0003 "V" "firmware\n" "firmware date\n" "model\n" "(c) NMP." The last byte in the data is the sequence number. As with standard F-bus frames, the last two bytes in the frame are always checksum bytes.

4.3

How to send a SMS message with F-Bus?

Now that we know how to send frames on the bus, we should look at sending an SMS message.

SMS Point-to-Point Character Packing

The first thing we have to refer ***"GSM 03.38 - Alphabets and language-specific information"*** This is the Technical Specification that describes the packing of 7-bit characters and shows the standard character map.

Example:

Let's say we want to decode the string 'hello'. First we have displayed 'hello' in hexadecimal using the character map provided in GSM 03.38. For A to Z and numbers it's just the standard ASCII conversion.

h	e	l	l	o	(ASCII characters)
68	65	6C	6C	6F	(In hexadecimal)
1101000	1100101	1101100	1101100	1101111	(In Binary)

The first byte in the string is on the right. The least significant bit is then displayed on the left with the most significant bit on the left. Shown below is the same string of 'hello' just displayed backwards. Then it's just a matter to dividing the binary values into bytes starting with the first character in the string. (Start from right and go to left.) The first decoded byte is simply the first 7 bits of the first character with the first bit of the second character added to the end as shown below. The next decoded byte in then the remaining 6 bits from the second character with two bits of the third byte added to the end. This process just keeps going until all characters are decoded. The last decoded byte is the remaining bits from the last character with the most significant bits packed with zeros.

6F	6C	6C	65	68
1101111	1101100	1101100	1100101	1101000

(The ASCII characters shown in binary)

110 11111101 10011011 00110010 11101000

(The above binary just split into 8 bit segments)

06 FD 9B 32 E8

(The 8 bit segments decoded into hex

The message hello is therefore E8 32 9B FD 06 when packed.

4.4

Receive A SMS Message With F-Bus?

This part is really quite simple. When the phone gets SMS message, it sends a 'SMS Message Received Frame' with the message attached to the F-Bus. All we have to do is decode it!

The SMS send example above sends a SMS message back to phone (The same phone sending the message). Therefore below is the SMS message that was sent above, but now getting received by the phone.

Byte: 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Data: 1E 0C 00 02 00 59 01 08 00 10 02 10 00 07 91 16 14 91 09 10 F0 00 10 19 38 04 00 00 33 0B 91 16 04 73 08 70
Byte: 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
Data: F4 70 40 32 25 30 30 82 22 74 45 4C 25 30 30 82 22 74 45 4C 74 7A 0E 6A 97 E7 F3 F0 B9 0C BA 87 E7 A0 79 D9
Byte: 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97
Data: 4D 07 D1 D1 F2 77 FD 8C 06 19 5B C2 FA DC 05 1A BE DF EC 50 08 01 45 00 4A 5C
Byte 03: Message Type = 0x02 - SMS Handing
Byte 04 & 05: Message Length = 0x0059 - 89 Bytes long
Byte 09: 0x10 = SMS Message received
Byte 10: 0x02 = Memory Type = SIM
Byte 11: 0x10 = Location where SMS message stored - required to delete SMS message

(TPDU) Transfer Protocol Data Unit

Byte 24: 0x38

Byte 25: 0x04

Byte 26: Protocol ID

Byte 27: Data Coding Scheme

Byte 28: Message Length. 0x33 = 51 Bytes long!

4.5

How to delete a SMS message with F-Bus

This part is really quite simple as well. When the phone gets sent a SMS message it sends a 'SMS Message Received Frame' with the message attached. In this frame is the location where the message is stored. All you have to do is tell the phone to delete it!

Byte: 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
Data: 1E 00 0C 14 00 08 00 01 00 0A 02 02 01 41 11 54

Byte 03: Message Type = 0x14 - SMS Functions
Byte 04 & 05: Message Length = 0x0008 - 08 Bytes long
Byte 6 to 8: Start of the SMS Frame Header. 0x00, 0x01, 0x00
Byte 9: 0x0A Delete SMS Message
Byte 10: 0x02 = Memory Type = SIM - Make sure message is store in this type (0x03 = phone)
Byte 11: 0x02 = Location where SMS message stored. This location can be found in the 'receive SMS frame' (Byte 11)
Byte 12: 0x01
Byte 13: Packet Sequence Number
Byte 14 & 15: Odd & even checksum bytes.

Chapter 5

GSM System

- **Basic architecture**
- **GSM security**
- **SIM**

Basic Architecture

The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber; the Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center, performs the switching of calls between the mobile and other fixed or mobile network users, as well as management of mobile services, such as authentication. Not shown is the Operations and Maintenance center, which oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the Um interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile service Switching Center across the A interface.

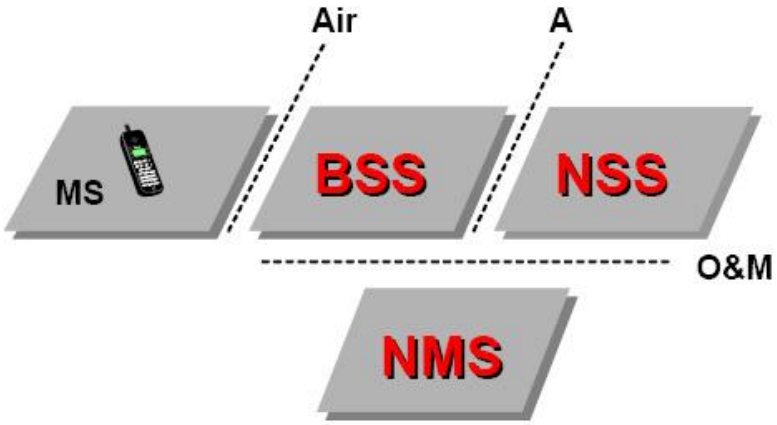


Figure 5-5.1 Basic block diagram of GSM system

Mobile Station

The mobile station (MS) consists of the physical equipment, such as the radio transceiver, display and digital signal processors, and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to all subscribed services irrespective of both the location of the terminal and the use of a specific terminal. By inserting the SIM card into another

GSM cellular phone, the user is able to receive calls at that phone, make calls from that phone, or receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI), identifying the subscriber, a secret key for authentication, and other user information. The IMEI and the IMSI are independent, thereby providing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number

Base Station Subsystem

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the specified Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed. The requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages the radio resources for one or more BTS's. It handles radio channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile and the Mobile service Switching Center (MSC). The BSC also translates the 13 kbps voice channel used over the radio link to the standard 64 kbps channel used by the Public Switched Telephone Network or ISDN.

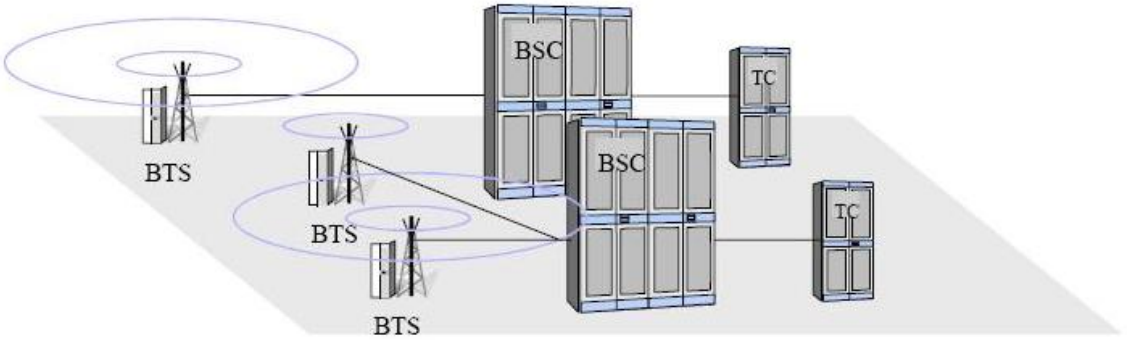


Figure 5-5.2 communication between BTS and BSC

Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and in addition provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. These services are provided in conjunction with several functional entities, which together form the Network Subsystem. The MSC provides the connection to the public fixed network (PSTN or ISDN), and signaling between functional entities uses the ITUT Signaling System Number 7 (SS7), used in ISDN and widely used in current public networks.

The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the call routing and (possibly international) roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The current location of the mobile is in the form of a Mobile Station Roaming Number (MSRN) which is a regular ISDN number used to route a call to the MSC where the mobile is currently located. There is logically one HLR per GSM network, although it may be implemented as a distributed database.

The Visitor Location Register contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. Although each functional entity can be implemented as an independent unit, most manufacturers of switching equipment implement one VLR together with one MSC, so that the geographical area controlled by the MSC corresponds to that controlled by the VLR, simplifying the signaling required. Note that the MSC contains no information about particular mobile stations - this information is stored in the location registers.

The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel.

GSM Security

GSM security

GSM was designed with a moderate level of security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted. The development of UMTS introduces an optional USIM, that uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user - whereas GSM only authenticates the user to the network (and not vice versa). The security model therefore offers confidentiality and authentication, but limited authorization capabilities, and no non-repudiation. GSM uses several cryptographic algorithms for security. The A5/1 and A5/2 stream ciphers are used for ensuring over-the-air voice privacy. A5/1 was developed first and is a stronger algorithm used within Europe and the United States; A5/2 is weaker and used in other countries. Serious weaknesses have been found in both algorithms: it is possible to break A5/2 in real-time with a cipher text-only attack, and in February 2008, Pico Computing, Inc revealed its ability and plans to commercialize FPGAs that allow A5/1 to be broken with a rainbow table attack. The system supports multiple algorithms so operators may replace that cipher with a stronger one.

SIM

A Subscriber Identity Module (SIM) on a removable SIM Card securely stores the service-subscriber key (IMSI) used to identify a subscriber on mobile telephony devices (such as computers and mobile phones). The SIM card allows users to change phones by simply removing the SIM card from one mobile phone and inserting it into another mobile phone or broadband telephony device.

SIM cards are available in two standard sizes. The first is the size of a credit card (85.60 mm × 53.98 mm x 0.76 mm). The newer, more popular miniature-version has a width of 25 mm, a height of 15 mm, and a thickness of 0.76 mm. However, most SIM cards are supplied as a full-sized card with the smaller card held in place by a few plastic links and can be easily broken off to be used in a phone that uses the smaller SIM.

Each SIM Card stores a unique International Mobile Subscriber Identity (IMSI). The format of this number is as follows:

- The first 3 digits represent the Mobile Country Code (MCC).
- The next 2 digits represent the Mobile Network Code (MNC).
- The next 10 digits represent the mobile station identification number.

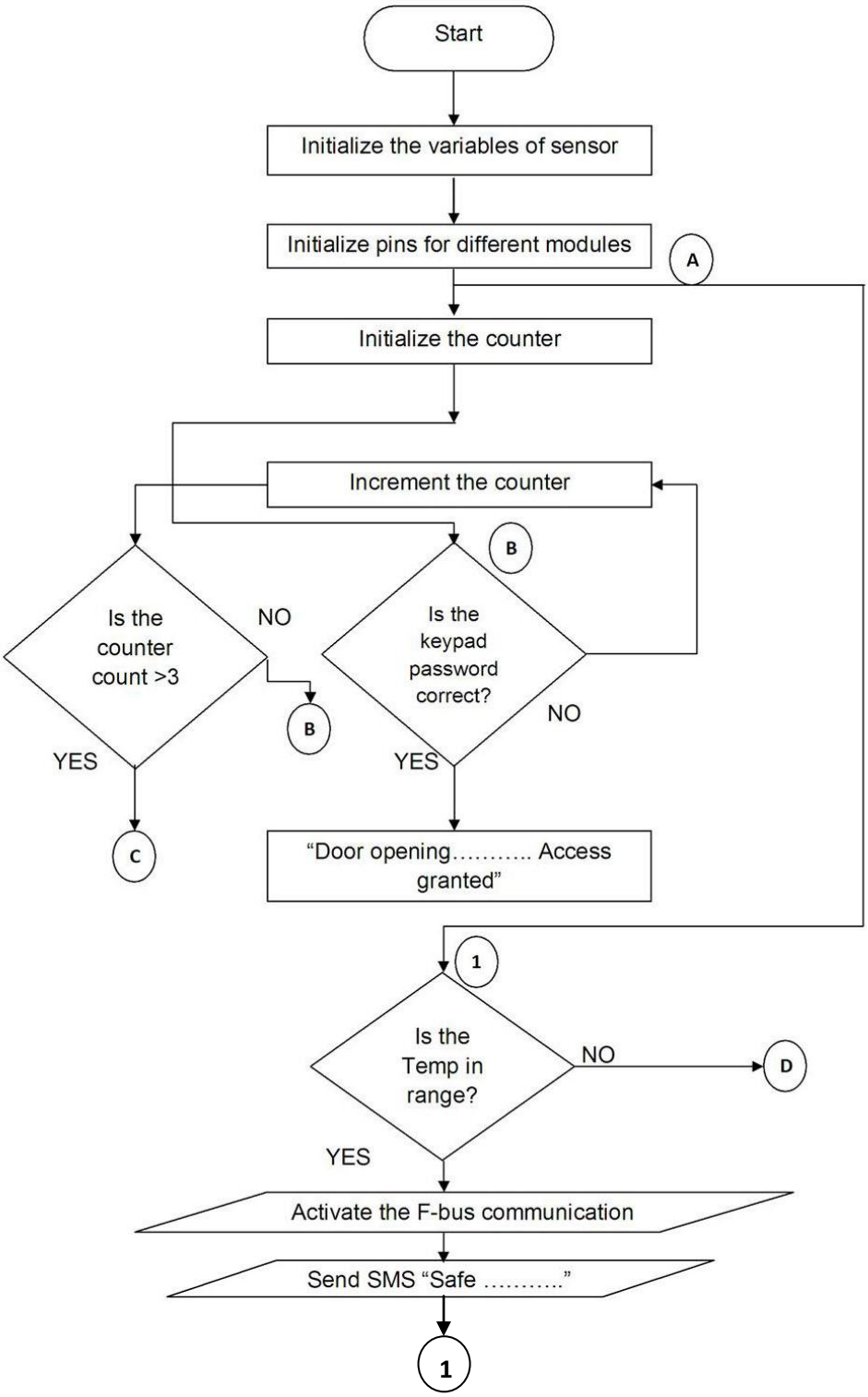
Chapter 6

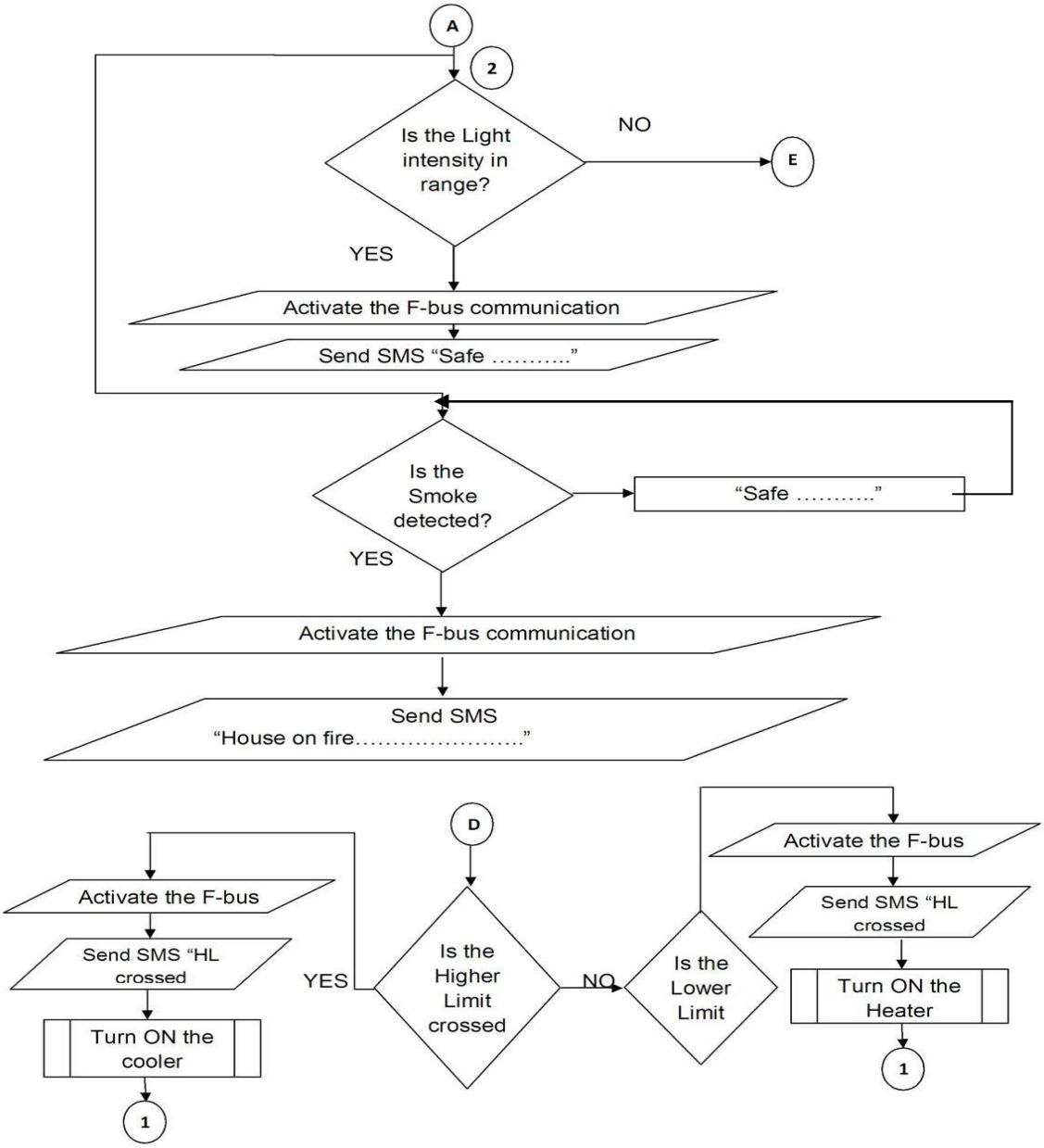
Software and Flowcharts

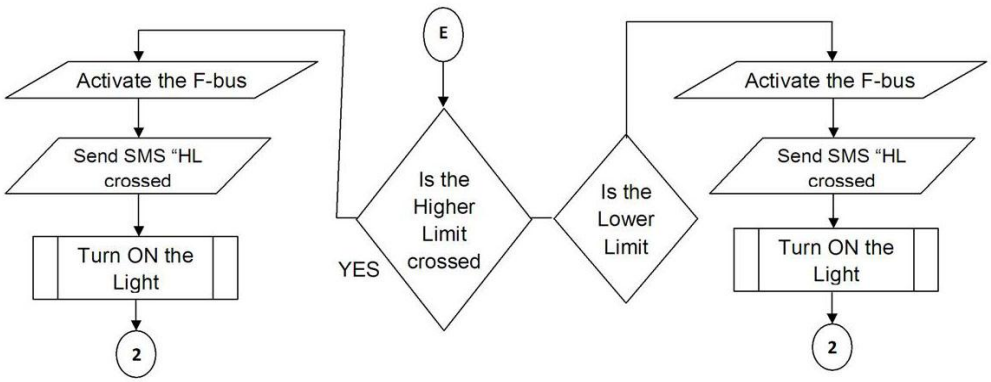
- **Flowchart**
- **KEIL**

Flowcharts

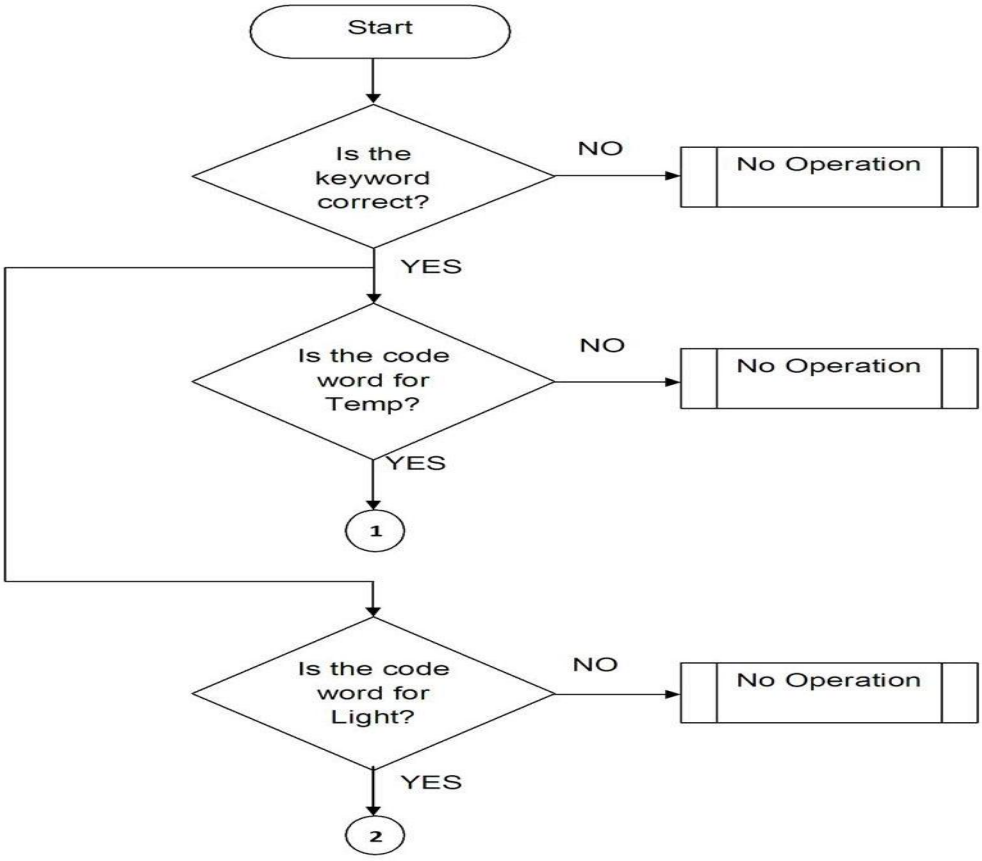
Flow Chart for Controlling Unit




A
2
Is the Light intensity in range?
NO
E
YES
Activate the F-bus communication
Send SMS "Safe ……."
Is the Smoke detected?
"Safe ……."
YES
Activate the F-bus communication
Send SMS "House on fire……."
D
Activate the F-bus
Send SMS "HL crossed
Turn ON the cooler
1
YES
Is the Higher Limit crossed
NO
Is the Lower Limit
Activate the F-bus
Send SMS "HL crossed
Turn ON the Heater
1


E
Activate the F-bus
Send SMS "HL crossed
Turn ON the Light
2
YES
Is the Higher Limit crossed
Is the Lower Limit
Activate the F-bus
Send SMS "HL crossed
Turn ON the Light
2

Flowchart for user side control



KEIL

Introduction to C51 Cross Compiler

The KEIL C51 Cross Compiler is an ANSI C Compiler that is written specifically to generate fast, compact code for the 8051 microcontroller family. The C51 Compiler generates object code that matches the efficiency and speed
of assembly programming language.

Using a high-level language like C has many advantages over assembly language programming:

- Knowledge of the processor instruction set is not required. Rudimentary knowledge of the memory structure of the 8051 CPU is desirable (but not necessary).

- Details like register allocation and addressing of the various memory types and data types is managed by the compiler.

- Programs get a formal structure (which is imposed by the C programming language) and can be divided into separate functions. This contributes to source code reusability as well as better overall application structure.

- The ability to combine variable selection with specific operations improves program readability.

- Keywords and operational functions that more nearly resemble the human thought process may be used.

- Programming and program test time is drastically reduced.

- The C run-time library contains many standard routines such as: formatted output, numeric conversions, and floating-point arithmetic.

- Existing program parts can be more easily included into new programs because of modular program construction techniques.

- The language C is a very portable language (based on the ANSI standard) that enjoys wide popular support and is easily obtained for most systems. Existing program investments can be quickly adapted to other processors as needed.

Software Development Cycle in KEIL

When we use the KEIL Software tools, the project development cycle is roughly the same as it is for any other software development project.

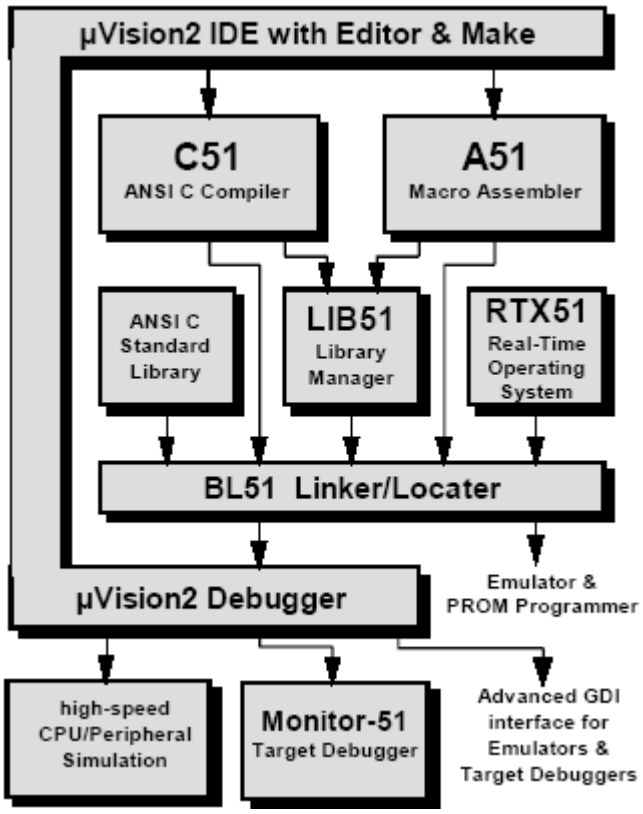
1. Create a project, select the target chip from the device database, and configure the tool settings.

2. Create source files in C or assembly.

3. Build your application with the project manager.

4. Correct errors in source files.

5. Test the linked application. A block diagram of the complete 8051 tool set may best illustrate the development cycle.



Chapter 7

System Analysis

- Comparison of various technologies
- Features over Current Systems

7.1
Comparison of various technologies

Table 7-7.1 comparison of various technologies

Technology	Internet	Intranet	V-Sat	GSM Based
Establishment cost	Low	Very high	Very High	Moderate
Running cost	Moderate	Very high	Very High	Very low
Maintenance	Low	Very high due to large area	High	Very low
Reliability	Low	Average	High	VERY high (Due to low cost and reliable n/w)
Speed	Low	High	High	High
Pre-Requisites	ISP, Modem Phone line and a Computer	Local area network, hubs, amplifiers, computers etc	Costly V-sat Infrastructure	GSM Based H/W & Embedded S/W

7.2

GSM Based Automation & Security Features Over Current Systems

Real-Time Information: The current system stores the data in system and person has to generate the report or take the action on it. But here the information is real time.

Open Technology: It uses Microcontroller and GSM. This solution can be upgraded and modified easily at negligible cost. This Solution can be upgraded to make it GPRS compatible, which will add enormous features to the solution.

Cost effectiveness: The hardware required for this solution is a microcontroller and a mobile phone, which are very cheap and are readily available. Moreover their maintenance cost is very low and technical support is easily available.

Power Consumption: Currently available Automation systems need electronic equipments hence their power consumption shoots up sharply whereas this system can work on battery and UPS/INVERTERS.

Security: As in Current solutions manual intervention is there, it increases the chances of errors, which causes less security where as in this system, there is no human intervention thus reducing such chances on data/equipment loss.

Maintenance Cost: Current solutions are customized electronic machine thus making it less viable for technical/ logical up gradation or modification. On the other hand our system being based on open technology can be readily modified/ upgraded at negligible cost.

Chapter 8

Possible Enhancements

No project is perfect and there is always room for improvement.

The system can be enhanced more to face the challenges in the future. For this, system must be improved technically.

1. The system can be made to work on battery in the absence of AC mains power supply.

2. It can also be made to work on the internal battery of mobile.

3. The system can be made to send SMS to many people at a time.

4. In case of accident, by making use of GPS (Global Positioning System), the place of accident can also be determined thus helping in locating the house or building more efficiently.

5. The system can be implemented with biometric scanner using fingerprints for security purpose.

6. The light control system can be developed more efficiently using counter system which will compensate light as it is required thus saving energy

7. The phone can be made to charge automatically thus making the system more reliable.

Chapter 9
Results and Conclusion

The implemented system is tested using different test inputs.

- The fire sensor (Smoke detector) is tested by exploiting it to fire generated by incense sticks. As expected the system produced alarm to give warning.
- The next test input is the light falling on LDR which is changed by darkening the system area. The automatic on-off control of device is thus tested.
- The next sensor to be tested was LM35 which was successfully tested by subjecting it to high temperature and low temperature by placing it near a 60W bulb and near an ice bath respectively. As expected the temperature sensor show us the variation in temperature as specified in datasheet. Thus the temperature sensor for controlling temperature was also successfully tested.
- We also tested the antitheft feature i.e. keypad based door locking by trying to open the door by various password combination but only one correct combination worked as expected. Thus we successfully this feature as well.

The main objective of the system is controlling of the devices through SMS

Controlling through SMS:

If the status of the device is not known then it can tested using SMS. Following is the syntax for sending SMS.

- **INITIALIZING TWO MOBILE NUMBERS:**

  <Password><m>

  abcdem

  - ✓ This command initializes the system with the new number through which the message was sent provided password is correct.

- **FOR ACTIVATING FEEDBACK**

  <Password><a>

  abcdea

  - ✓ The key word “a” activates the feedback of system provided password is correct.

- **FOR CHECKING CURRENT TEMPERATURE**

  <Password><t>

  abcdet

  - ✓ The key word “t” gives current temperature as feedback provided password is correct.

- **FOR CHECKING CURRENT LIGHT INTENSITY**

  <Password><l>

  abcdel

- ✓ The key word “l” gives current light intensity as feedback provided password is correct.

❖ **FOR CHANGING LIMITS**

<Password><upper/lower limit><channel no><new limit>

abcdeLl30 (new lower limit of light 30)

abcdeHt35 (new higher limit of temperature is 35)

- ✓ For changing higher limit the key word is”H”.
- ✓ For changing lower limit the key word is “L”.
- ✓ For changing temperature the key word is”t”.
- ✓ For changing light the key word is”l”.

PS. The password used here is “abcde”

Some screen shots of the output are shown below

Screen shots displaying various test condition on light sensor (LDR):

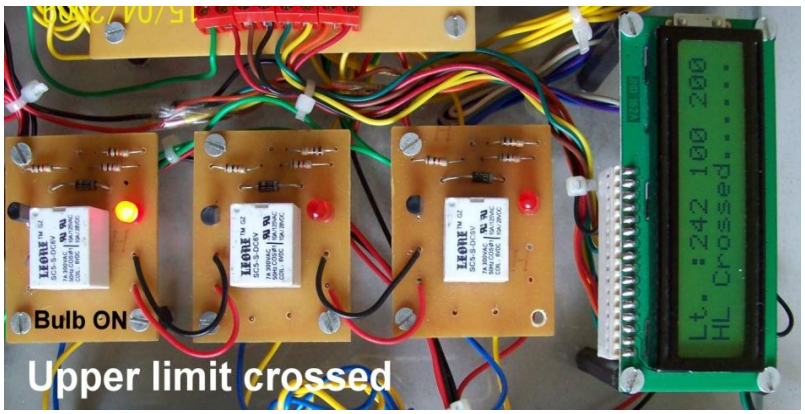


Figure 1: Upper limit Crossed for light intensity.

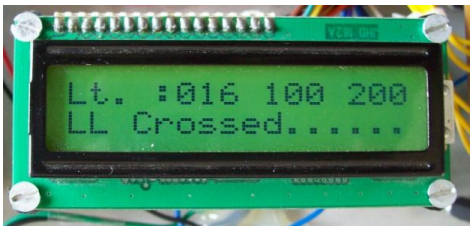


Figure 2: Lower limit crossed; hence the relay in figure 1 switches OFF.

Figure 3 Warning received on mobile as higher limit crossed

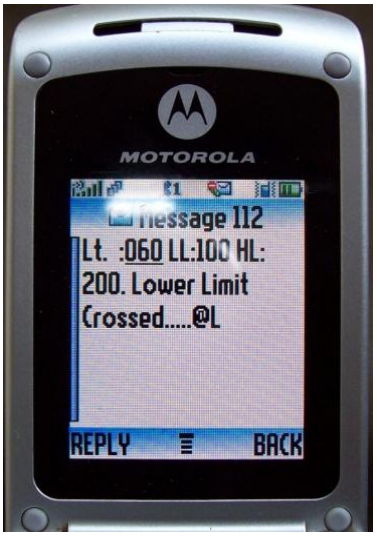


Figure 4: Warning received as lower limit crossed

Screen shots displaying various test condition on Temperature sensor (LM35):

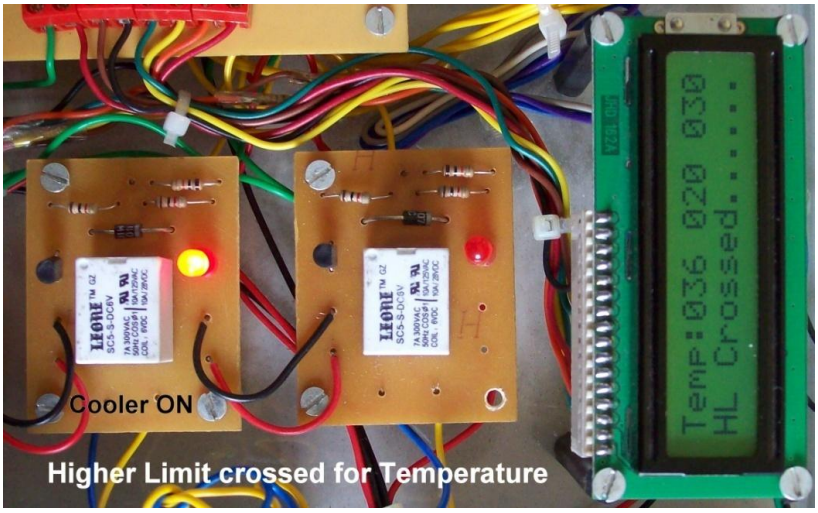


Figure 5: Upper limit Crossed for Temperature and cooler Turns ON

Figure 6: Lower limit Crossed for Temperature and heater turns ON

Figure 3: Warning received on mobile higher limit crossed

Figure 4: Warning received as lower limit crossed

Testing Anti-Theft Feature:

Figure 8: Type correct password to get access

Figure 9: On typing correct password

Figure 10: Type correct password to get access

Figure 11: On typing incorrect password

Figure 12: Type correct password to get access

Figure 13: On typing incorrect password

Figure 14: Warning on cell phone after 3 wrong attempts

Testing smoke detector:

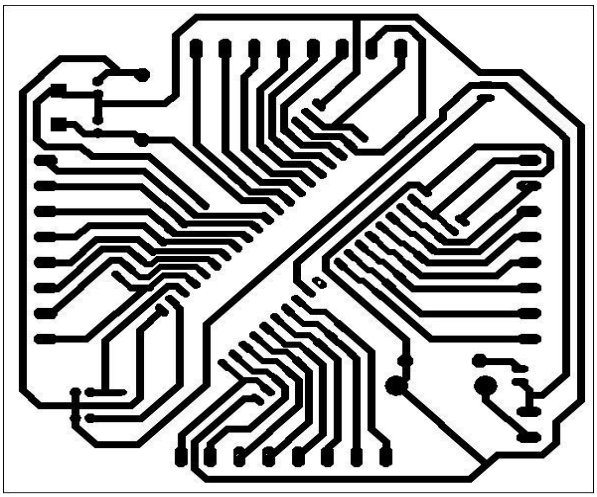
Figure 14: On detecting smoke

Figure 15: Warning on detection of Smoke

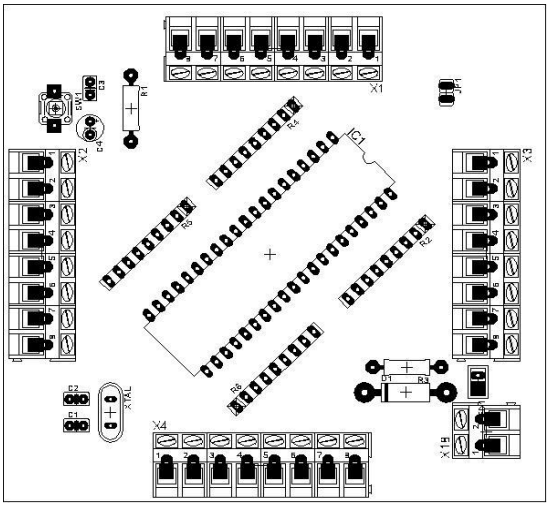
Appendix

Layouts:

Layout of Microcontroller

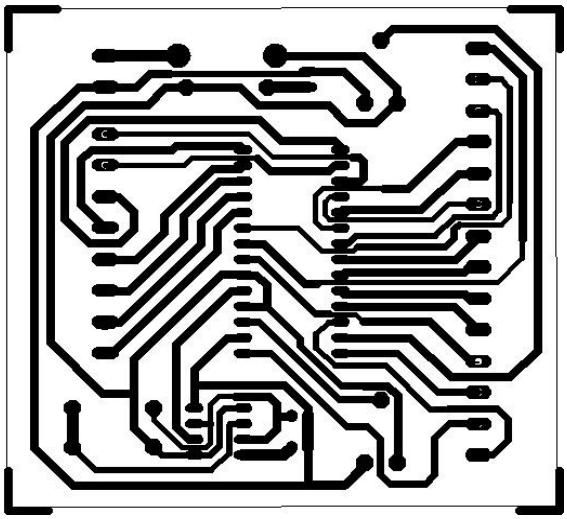


Track side of P89C51 PCB Layout

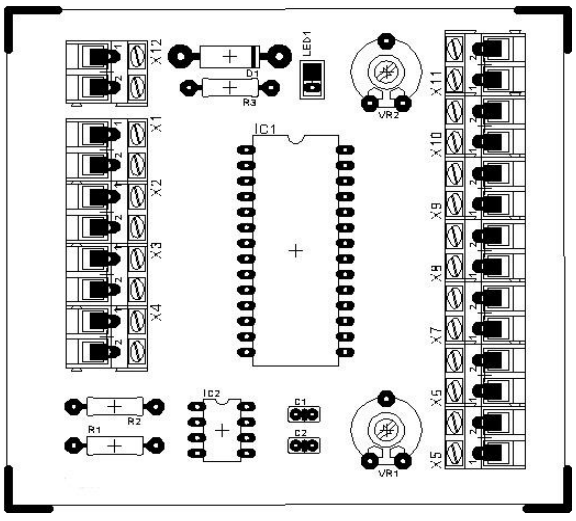


Component side P89C51PCB

Layout of ADC 0809

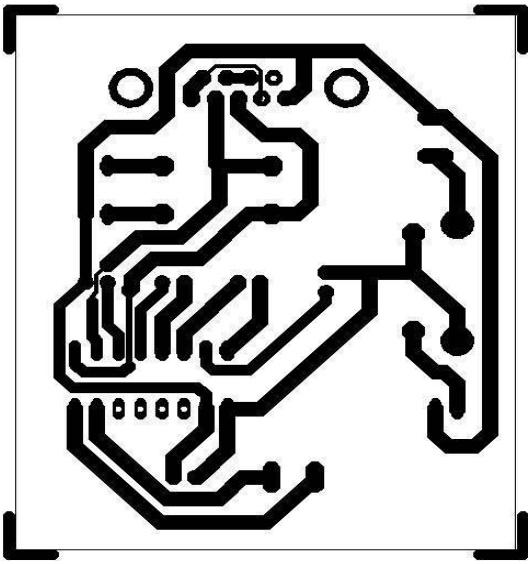


Track side of ADC 0809 PCB Layout

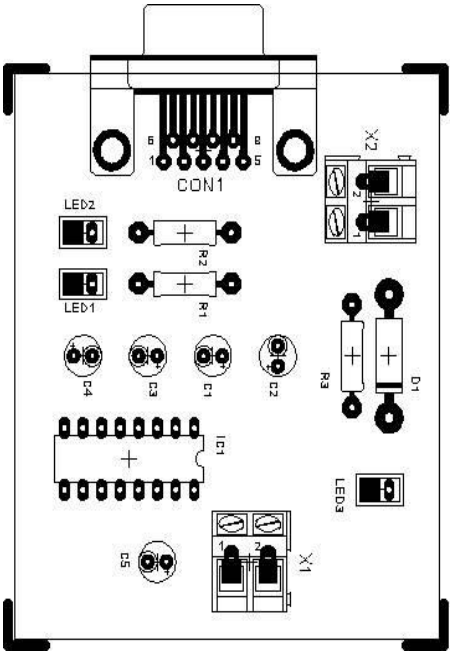


Component side ADC 0809 PCB

Layout of MAX 232

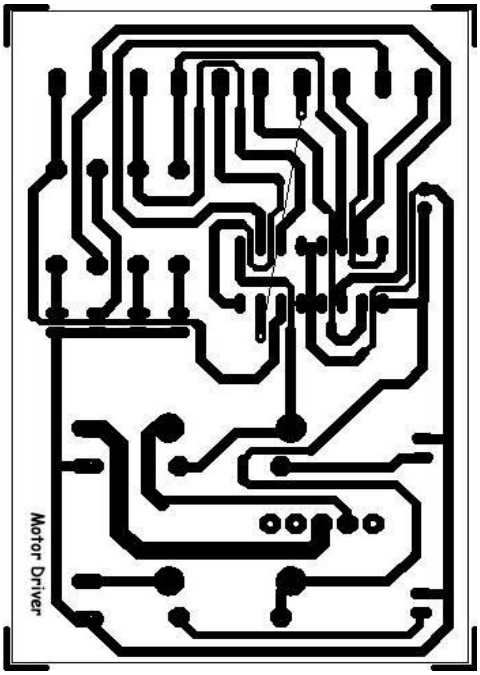


Track side of MAX 232 PCB

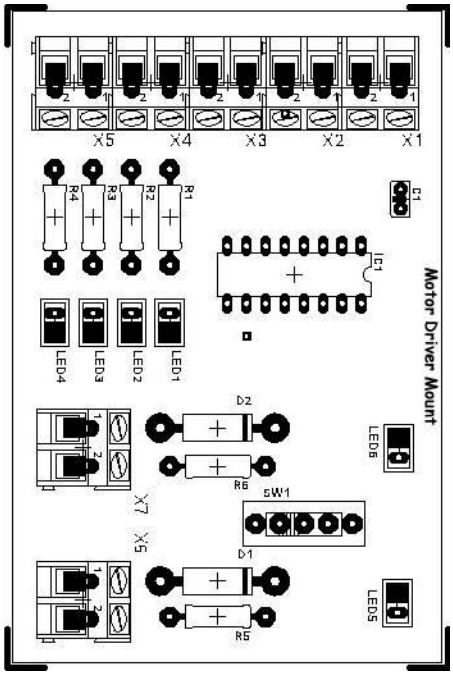


Component side of MAX 232

Layout of Motor Driver

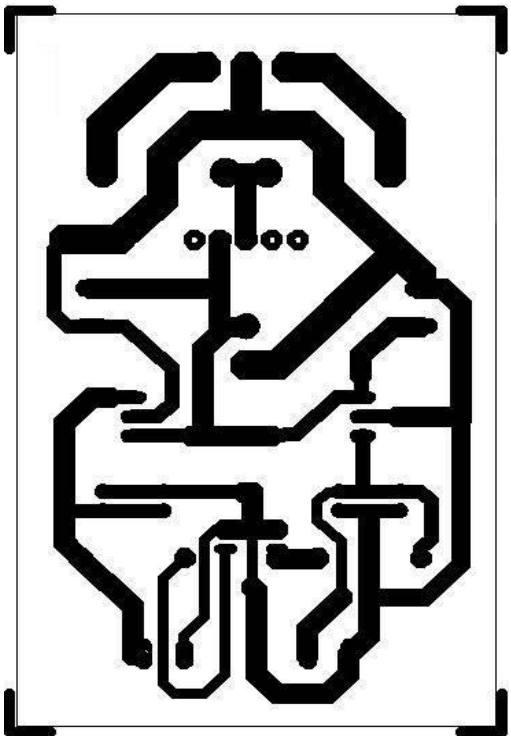


Track side of Motor driver

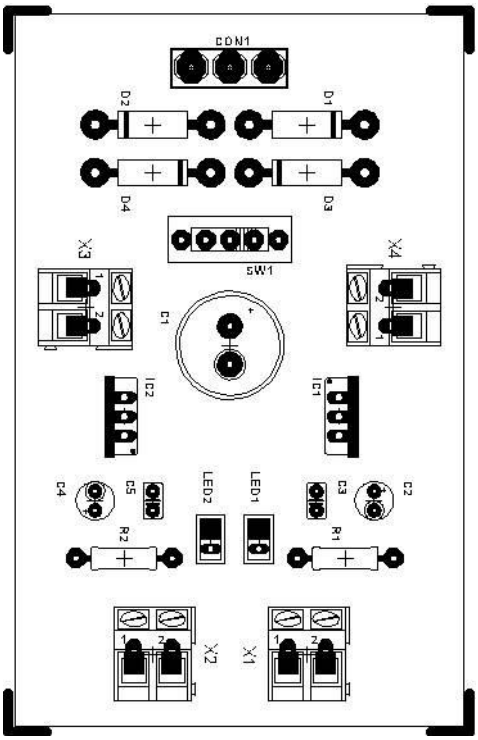


Component side of motor diver

Layout of Power Supply



Track side of Power supply

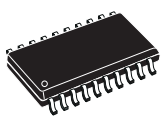


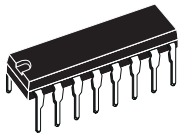
Component side of Power supply

L293D
L293DD

PUSH-PULL FOUR CHANNEL DRIVER WITH DIODES

- 600mA OUTPUT CURRENT CAPABILITY PER CHANNEL
- 1.2A PEAK OUTPUT CURRENT (non repetitive) PER CHANNEL
- ENABLE FACILITY
- OVERTEMPERATURE PROTECTION
- LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V (HIGH NOISE IMMUNITY)
- INTERNAL CLAMP DIODES





SO(12+4+4) **Powerdip (12+2+2)**

ORDERING NUMBERS:

L293DD L293D

DESCRIPTION

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoides, DC and stepping motors) and switching power transistors.

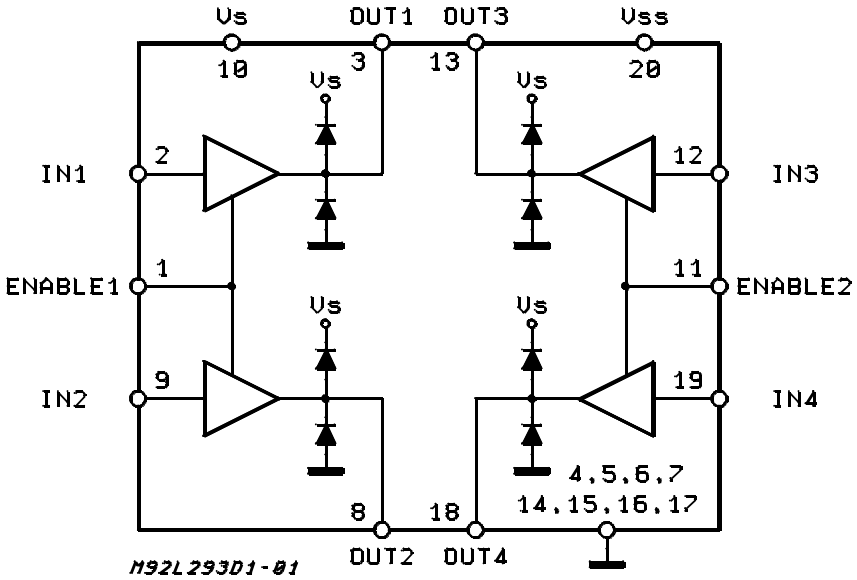
To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 5 kHz.

The L293D is assembled in a 16 lead plastic packaage which has 4 center pins connected together and used for heatsinking

The L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heatsinking.

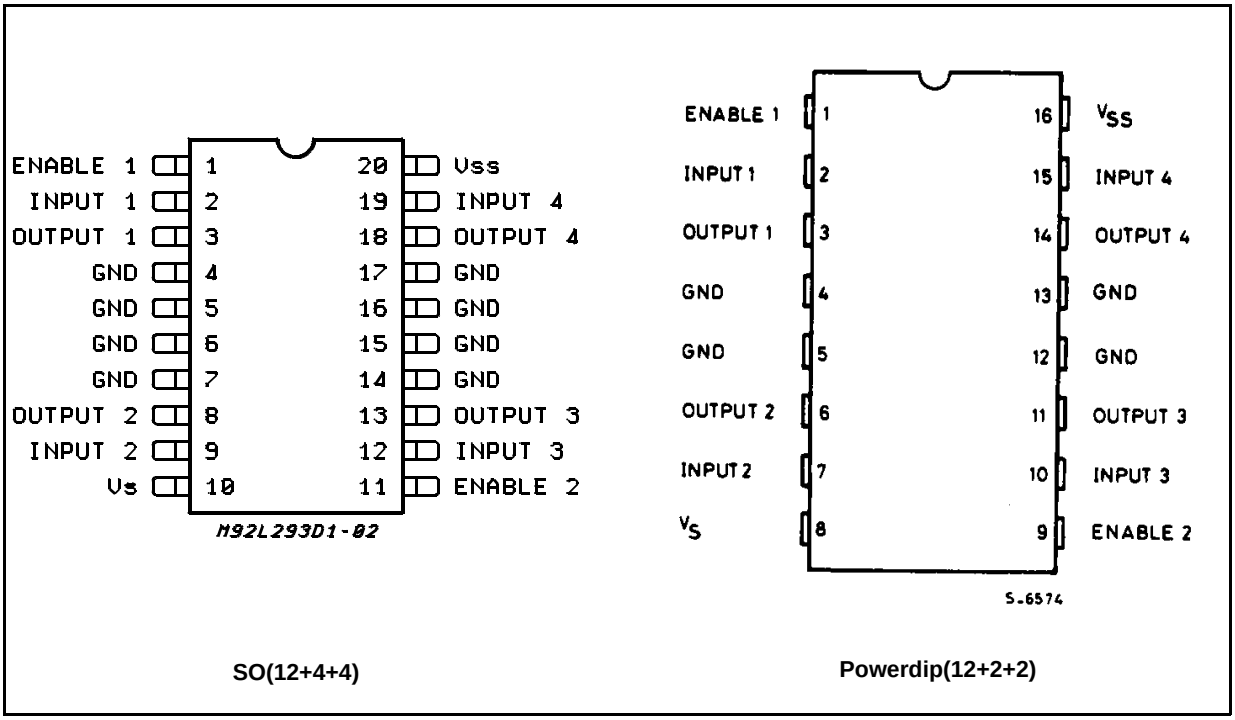
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	36	V
V_{SS}	Logic Supply Voltage	36	V
V_i	Input Voltage	7	V
V_{en}	Enable Voltage	7	V
I_o	Peak Output Current (100 µs non repetitive)	1.2	A
P_{tot}	Total Power Dissipation at T_{pins} = 90 °C	4	W
T_{stg}, T_j	Storage and Junction Temperature	– 40 to 150	°C

PIN CONNECTIONS (Top view)



SO(12+4+4) **Powerdip(12+2+2)**

THERMAL DATA

Symbol	Decription		DIP	SO	Unit
$R_{th\ j\text{-}pins}$	Thermal Resistance Junction-pins	max.	–	14	°C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance junction-ambient	max.	80	50 (*)	°C/W
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	max.	14	–	

(*) With 6sq. cm on board heatsink.

ELECTRICAL CHARACTERISTICS (for each channel, V_S = 24 V, V_{SS} = 5 V, T_{amb} = 25 °C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_S	Supply Voltage (pin 10)		V_{SS}		36	V
V_{SS}	Logic Supply Voltage (pin 20)		4.5		36	V
I_S	Total Quiescent Supply Current (pin 10)	V_i = L ; I_O = 0 ; V_{en} = H		2	6	mA
		V_i = H ; I_O = 0 ; V_{en} = H		16	24	mA
		V_{en} = L			4	mA
I_{SS}	Total Quiescent Logic Supply Current (pin 20)	V_i = L ; I_O = 0 ; V_{en} = H		44	60	mA
		V_i = H ; I_O = 0 ; V_{en} = H		16	22	mA
		V_{en} = L		16	24	mA
V_{IL}	Input Low Voltage (pin 2, 9, 12, 19)		– 0.3		1.5	V
V_{IH}	Input High Voltage (pin 2, 9, 12, 19)	$V_{SS} \leq 7$ V	2.3		V_{SS}	V
		$V_{SS} > 7$ V	2.3		7	V
I_{IL}	Low Voltage Input Current (pin 2, 9, 12, 19)	V_{IL} = 1.5 V			– 10	µA
I_{IH}	High Voltage Input Current (pin 2, 9, 12, 19)	2.3 V ≤ V_{IH} ≤ V_{SS} – 0.6 V		30	100	µA
$V_{en\ L}$	Enable Low Voltage (pin 1, 11)		– 0.3		1.5	V
$V_{en\ H}$	Enable High Voltage (pin 1, 11)	$V_{SS} \leq 7$ V	2.3		V_{SS}	V
		$V_{SS} > 7$ V	2.3		7	V
$I_{en\ L}$	Low Voltage Enable Current (pin 1, 11)	$V_{en\ L}$ = 1.5 V		– 30	– 100	µA
$I_{en\ H}$	High Voltage Enable Current (pin 1, 11)	2.3 V ≤ $V_{en\ H}$ ≤ V_{SS} – 0.6 V			± 10	µA
$V_{CE(sat)H}$	Source Output Saturation Voltage (pins 3, 8, 13, 18)	I_O = – 0.6 A		1.4	1.8	V
$V_{CE(sat)L}$	Sink Output Saturation Voltage (pins 3, 8, 13, 18)	I_O = + 0.6 A		1.2	1.8	V
V_F	Clamp Diode Forward Voltage	I_O = 600nA		1.3		V
t_r	Rise Time (*)	0.1 to 0.9 V_O		250		ns
t_f	Fall Time (*)	0.9 to 0.1 V_O		250		ns
t_{on}	Turn-on Delay (*)	0.5 V_i to 0.5 V_O		750		ns
t_{off}	Turn-off Delay (*)	0.5 V_i to 0.5 V_O		200		ns

(*) See fig. 1.

TRUTH TABLE (one channel)

Input	Enable (*)	Output
H	H	H
L	H	L
H	L	Z
L	L	Z

Z = High output impedance
(*) Relative to the considered channel

Figure 1: Switching Times

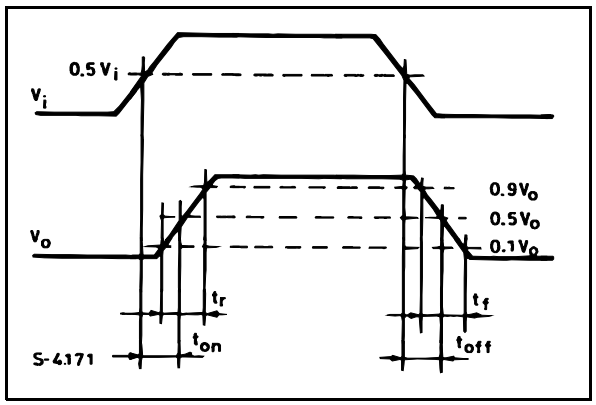
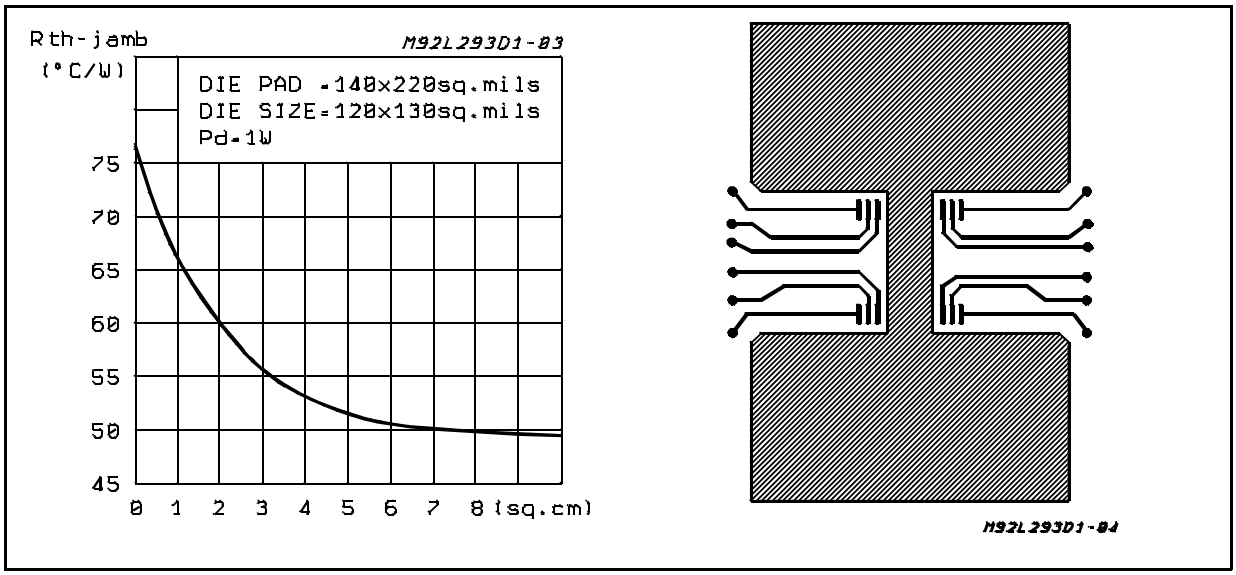
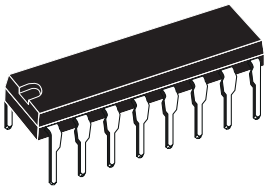


Figure 2: Junction to ambient thermal resistance vs. area on board heatsink (SO12+4+4 package)

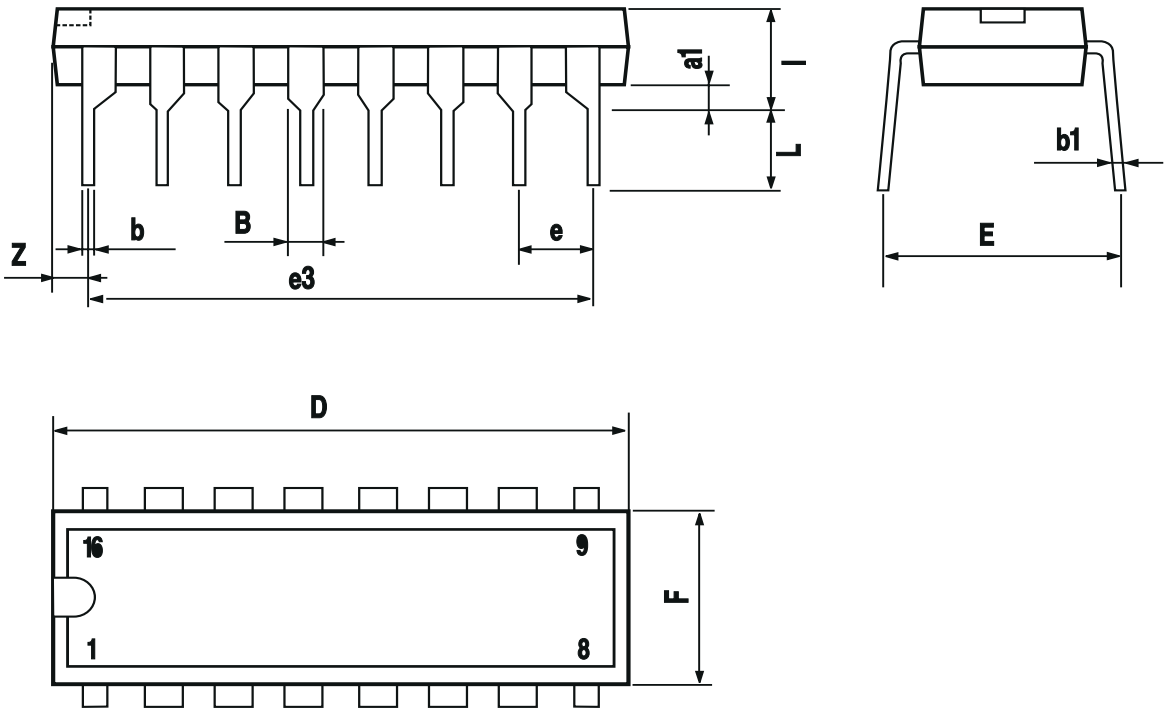


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.85		1.40	0.033		0.055
b		0.50			0.020	
b1	0.38		0.50	0.015		0.020
D			20.0			0.787
E		8.80			0.346	
e		2.54			0.100	
e3		17.78			0.700	
F			7.10			0.280
I			5.10			0.201
L		3.30			0.130	
Z			1.27			0.050

OUTLINE AND MECHANICAL DATA

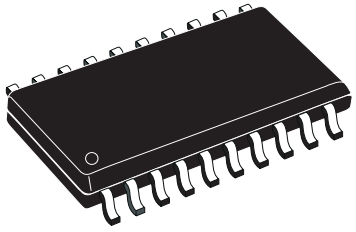


Powerdip 16

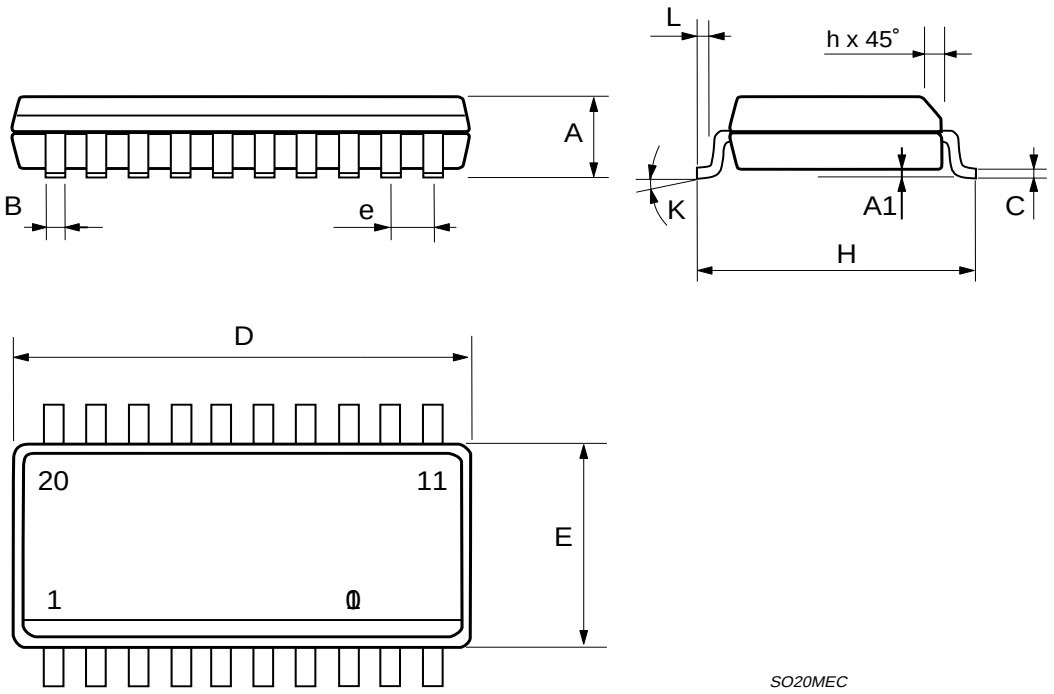


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.6		13	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
K	0˚ (min.)8˚ (max.)					

OUTLINE AND MECHANICAL DATA



SO20



SO20MEC

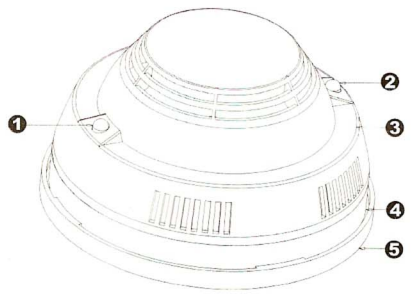
Sensor Labs

IONIZATION SMOKE DETECTOR

(SL-92D)

The ionization smoke detector ,with higher stability and reliability, is design for detecting smoke in control center, house, hotel, warehouse and etc.

General View



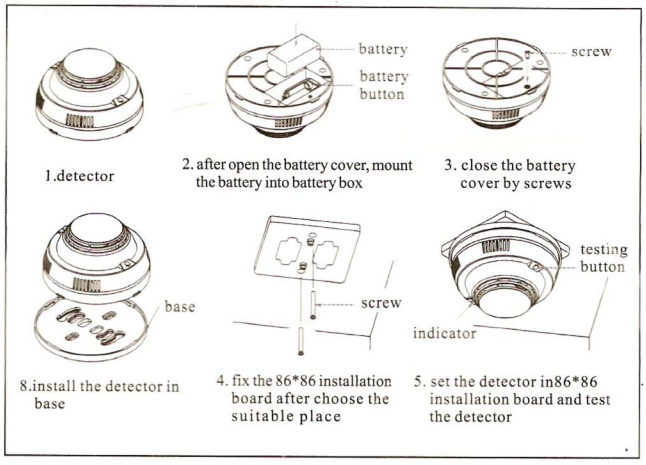
❶ Indicator
❷ testing button
❸ front cover
❹ back cover
❺ base

Technical Specification

Working method	independence
Working voltage	DC 9V
Temperature and Humidity	-5℃～+50℃,＜90%RH
Static current	≤10μA
Alarm current	≤20mA
Detecting coverage	60m²
Indicator	detecting: once per 40s alarm: once per 1s
Output	sound/flash alarm
dB	≥85dB(1m)
life of battery	one year
Sensitivity	refer to GB4715-93 (4.22)

INSTALLATION

(1) Mounting the battery into battery box before installation.
(2) After fixing the installation board (86*86) in the centre of ceiling by screws, installing the detector on it.



PACKAGE

Detector, a set of 86*86 installation board, a bag of attachments, quality certificate, a copy of instruction, 9V battery

TESTING METHOD

1. With DC 9V supply, detector is running and the indicator flash once per 40s.
2. Press the testing button 3 seconds, the indicator flash once per 1s and send out network signal. (note: the testing must been making via organization of control centre.)
3. Function of detector can be testing by blowing smoke to detector.

NOTICE

1. The detector can not be installed under worse environment. For example: coldest, hottest, dusty.
2. Please test it monthly.
3. Please clean the detector by soft brush per six month so as to ensure the sensitivity and life of product. Pay attention to switch off power supply before cleaning.
4. when the voltage of battery is less than 8V, the detector will flash once per 40s and send the"DI....." alarm. Please change the battery under this circumstance.
5. For various reasons, including, but not limited to changes in environmental conditions, electric or electronic, disruptions and tampering, the Product may not perform as expected. The user is advised to take all necessary precautions for his/her safety and the protection of his/her property.

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