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ADC(0809) INTERFACE

The ADC0809 Data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8 channels 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-bit Channel multiplexer can directly access any of 8 signal-ended analog signals.

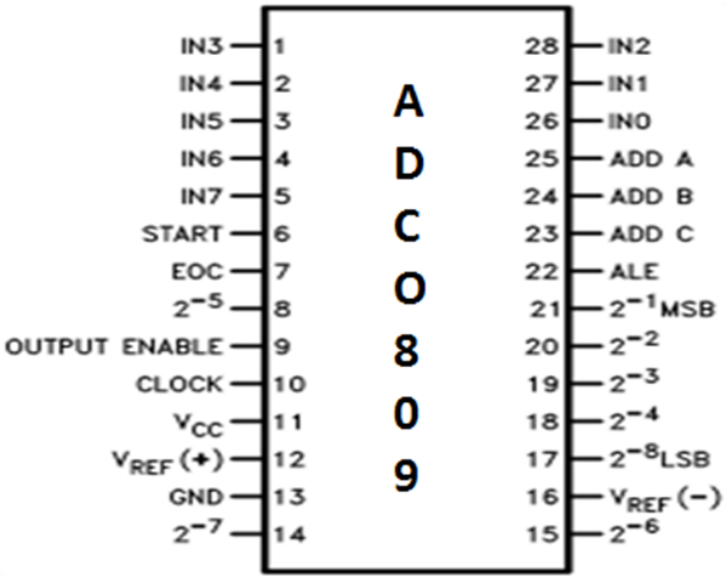
The device eliminates the need for external zero and full scale adjustments. Easy interfacing to microprocessors input and latched TTL TRI-STATE output.

The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. 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 application from process and machine control to consumer and automotive application. For 16-channel multiplexer with common output (sample/hold port) see ADC0816 data sheet. (See AN274 for more information.)

Features

Easy interface to all microprocessors
Operates ratio metrically 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
ADC0808 equivalent to MM74C949
ADC0809 equivalent to MM74C949-1
Resolution 8 Bits
Total Unadjusted Error ±1⁄2 LSB and ±1 LSB
Single Supply 5 VDC
Low Power 15 mW
Conversion Time 100

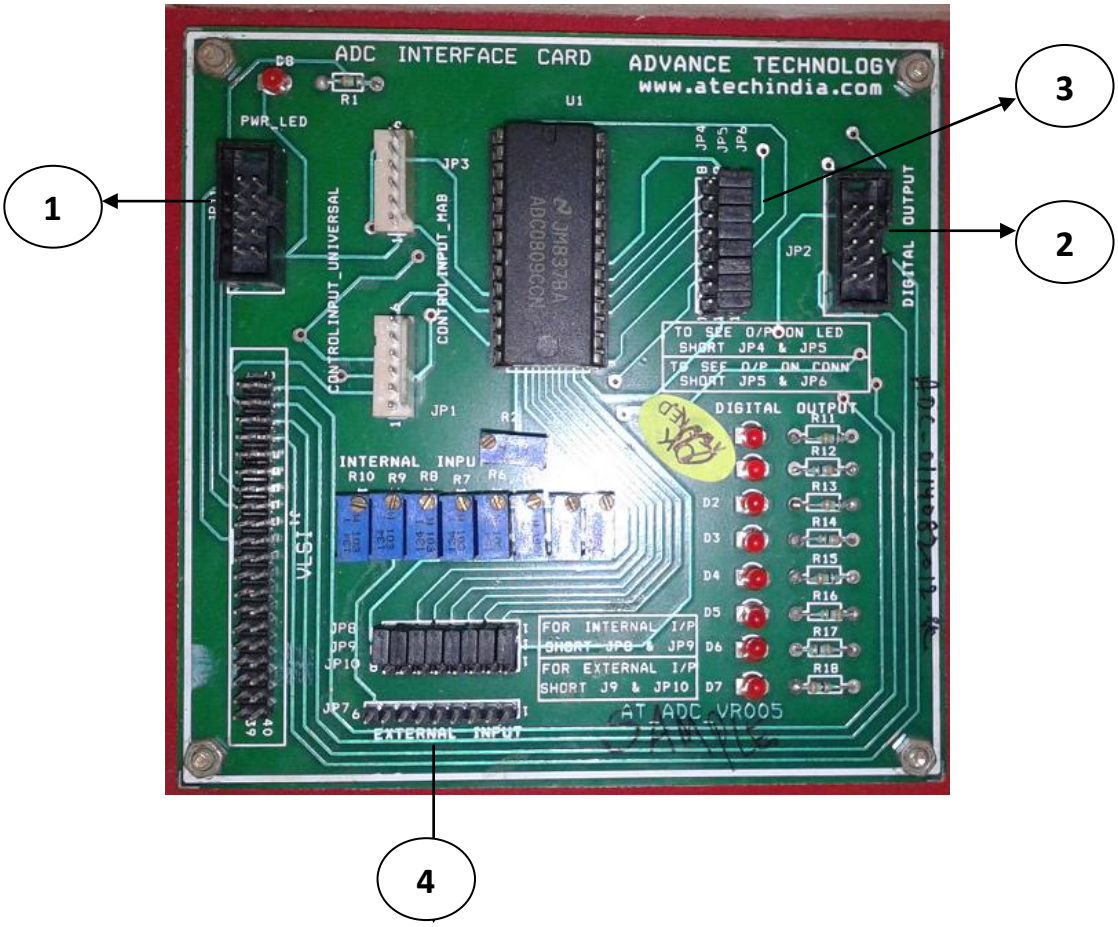
Pin Diagram:



Pin Description:

Pin No	Function	Name
1	Activates ADC; Active low	Chip select
2	Input pin; High to low pulse brings the data from internal registers to the output pins after conversion	Read
3	Input pin; Low to high pulse is given to start the conversion	Write
4	Clock Input pin; to give external clock.	Clock IN
5	Output pin; Goes low when conversion is complete	Interrupt
6	Analog non-inverting input	Vin(+)
7	Analog inverting Input; normally ground	Vin(-)
8	Ground(0V)	Analog Ground
9	Input pin; sets the reference voltage for analog input	Vref/2
10	Ground(0V)	Digital Ground
11	8 bit digital output pins	D7
12		D6
13		D5
14		D4
15		D3
16		D2
17		D1
18		D0
19	Used with Clock IN pin when internal clock source is used	Clock R
20	Supply voltage; 5V	Vcc

VIEW OF ADC INTERFACE



1 → JP11 (**ADC CONTROL**)

2→ JP2 (**ADC DATA)**

3 → JUMPERS SELECTION

4 → ADC CHANNEL SELECTION

BOX HEADER CONNECTOR DESCRIPTION

ADC SECTION

JP2 (DATA PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D4
2	D0	7	D5
3	D1	8	D6
4	D2	9	D7
5	D3	10	GND

J11 (CONTROL PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	ADD A
2	OE	7	ADD B
3	START	8	ADD C
4	ALE	9	CLK
5	EOC	10	GND

Where

OE → Output Enable

START → Start of conversion

ALE → Address latch enable

EOC → End of conversion

ADD A, ADD B, ADD C → Channel Selection

CLK → Clock

JUMPER SELECTION (TO SEE THE OUTPUT OF ADC)

- Short jumpers b/w JP4 &JP5 to see the output on LED's
- Short jumpers b/w JP4 &JP5 to see the output on external device (LCD)

DAC(0808) INTERFACE

In electronics, a digital-to-analog converter (DAC or D-to-A) is a device for converting a digital (usually binary) code to an analog signal (current, voltage or electric charge).A DAC converts an abstract finite-precision number (usually a fixed-point binary number) into a concrete physical quantity (e.g., a voltage or a pressure). In particular, DACs are often used to convert finite-precision time series data to a continually-varying physical signal.

A typical DAC converts the abstract numbers into a concrete sequence of impulses. That are then processed by a reconstruction filter using some form of interpolation to fill in data between the impulses. Other DAC methods (e.g., methods based on Delta-sigma modulation) produce a pulse-density modulated signal that can then be filtered in a similar way to produce a smoothly-varying signal.

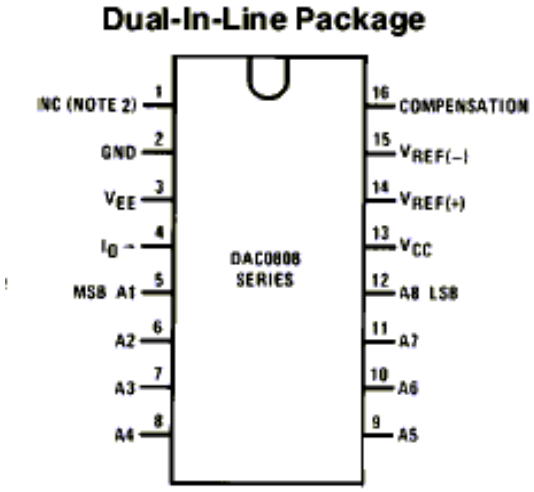
DAC (0808) (8 bit d/a convertor)

The DAC0808 is an 8-bit monolithic digital-to-analog converter (DAC) featuring a full scale output current settling time of 150 ns while dissipating only 33 mW with ±5V supplies. No reference current (IREF) trimming is required for most applications since the full scale output current is typically ±1 LSB of 255 IREF/256. Relative accuracies of better than ±0.19% assure 8-bit monotonicity and linearity while zero level output current of less than 4 μA provides 8-bit zero accuracy for IREF³2 mA. The power supply currents of the DAC0808 is independent of bit codes, and exhibits essentially constant device characteristics over the entire supply voltage range.The DAC0808 will interface directly with popular TTL, DTL or CMOS logic levels, and is a direct replacement for the MC1508/MC1408. For higher speed applications, see DAC0800 data sheet.

FEATURES

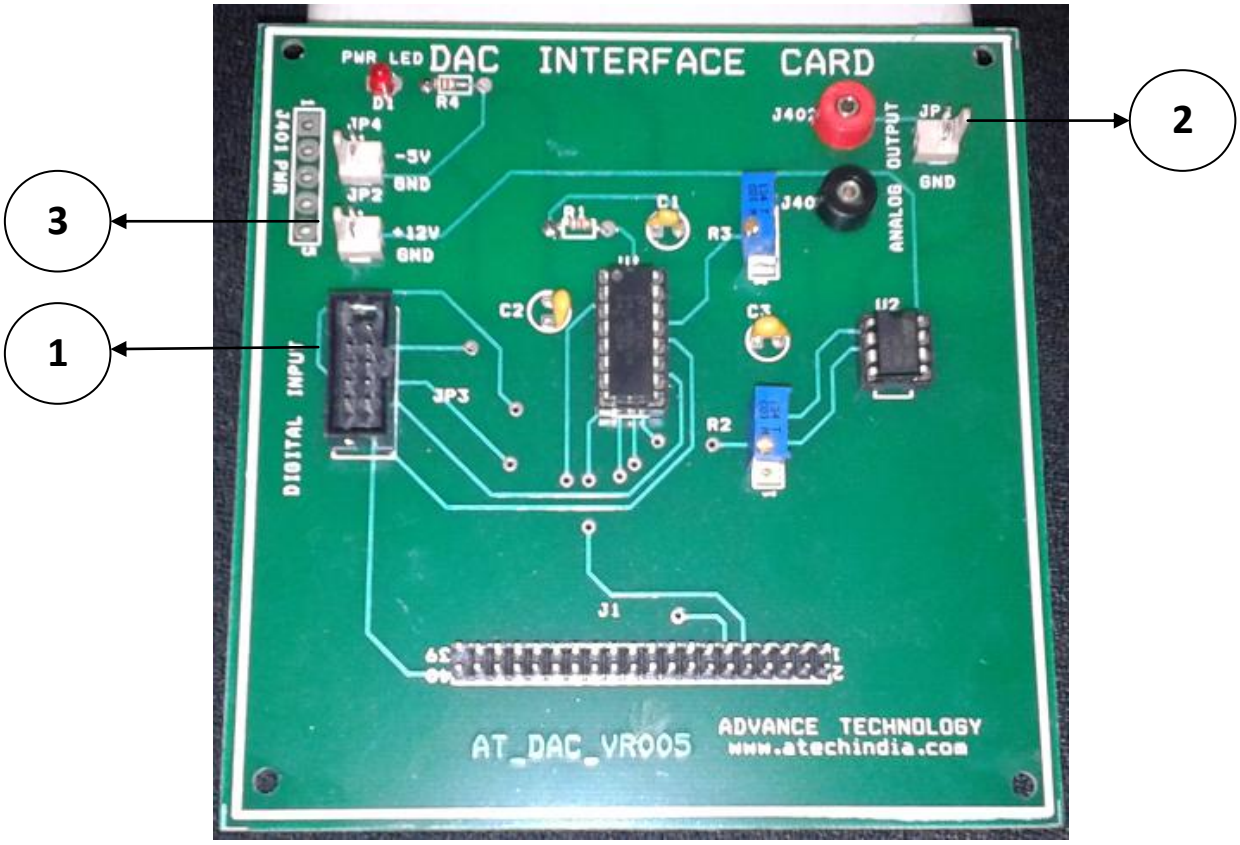
- Relative accuracy: ±0.19% error maximum
- Full scale current match: ±1 LSB type Fast settling time: 150 ns type
- Non-inverting digital inputs are TTL and CMOS
- Compatible
- High speed multiplying input slew rate: 8 mA/μs
- Power supply voltage range: ±4.5V to ±18V
- Low power consumption: 33 mW @ ±5V

Pin Description:



PIN No	PIN Name	PIN Description
1	NC	No Connection
2	GND	Power Supply Ground (0V)
3	Vee	Negative voltage value = MAX (Output Analog Signal)
4	I0	Output Current
5	A1	B7 MSB of input binary number
6	A2	B6 of Input binary number
7	A3	B5 of Input binary number
8	A4	B4 of Input binary number
9	A5	B3 of Input binary number
10	A6	B2 of Input binary number
11	A7	B1 of Input binary number
12	A8	B0 of Input binary number
13	Vcc	Power Supply +5 V
14	VREF (+)	Reference Voltage +ve
15	VREF (-)	Reference Voltage –ve (GND for DC)
16	Compensation	Connect 0.1uf capacitor

VIEW OF DAC (0808) INTERFACE



1 → **JP3** (DIGITAL INPUT BOX HEADER)

2 → **JP1** (OUTPUT BOX HEADER)

3 → **+12V** ADAPTOR

DAC SECTION

JP3

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	A4
2	A0	7	A5
3	A1	8	A6
4	A2	9	A7
5	A3	10	GND

JP1 (OUTPUT)

PIN NO.	SIGNAL
1	O/P
2	GND

ADC/DAC INTERFACE (COMBINED)

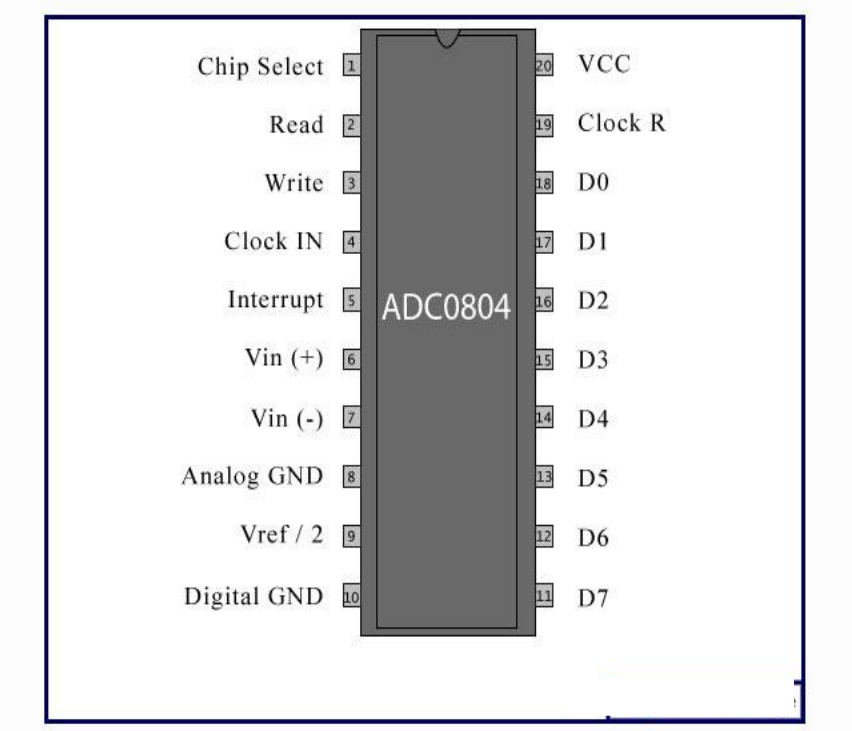
ADC (0804) SECTION

Analog to digital converters find huge application as an intermediate device to convert the signals from analog to digital form. These digital signals are used for further processing by the digital processors. Various sensors like temperature, pressure, force etc. convert the physical characteristics into electrical signals that are analog in nature.

ADC0804 is a very commonly used 8-bit analog to digital convertor. It is a single channel IC, *i.e.*, it can take only one analog signal as input. The digital outputs vary from 0 to a maximum of 255. The step size can be adjusted by setting the reference voltage at pin9. When this pin is not connected, the default reference voltage is the operating voltage, *i.e.*, Vcc. The step size at 5V is 19.53mV (5V/255), *i.e.*, for every 19.53mV rise in the analog input, the output varies by 1 unit. To set a particular voltage level as the reference value, this pin is connected to half the voltage. For example, to set a reference of 4V (Vref), pin9 is connected to 2V (Vref/2), thereby reducing the step size to 15.62mV (4V/255).

ADC0804 needs a clock to operate. The time taken to convert the analog value to digital value is dependent on this clock source. An external clock can be given at the Clock IN pin. ADC 0804 also has an inbuilt clock which can be used in absence of external clock. A suitable RC circuit is connected between the Clock IN and Clock R pins to use the internal clock.

Pin Diagram:



Pin Description:

Pin No	Function	Name
1	Activates ADC; Active low	Chip select
2	Input pin; High to low pulse brings the data from internal registers to the output pins after conversion	Read
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5	Output pin; Goes low when conversion is complete	Interrupt
6	Analog non-inverting input	Vin(+)
7	Analog inverting Input; normally ground	Vin(-)
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12		D6
13		D5
14		D4
15		D3
16		D2
17		D1
18		D0
19	Used with Clock IN pin when internal clock source is used	Clock R
20	Supply voltage; 5V	Vcc

DAC(0808) SECTION

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FEATURES

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- Full scale current match: ±1 LSB type Fast settling time: 150 ns type
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- Compatible
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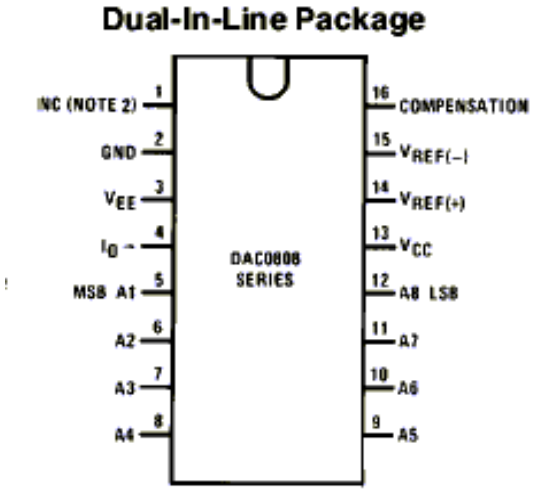
- Power supply voltage range: ±4.5V to ±18V
- Low power consumption: 33 mW @ ±5V

Pin Description:



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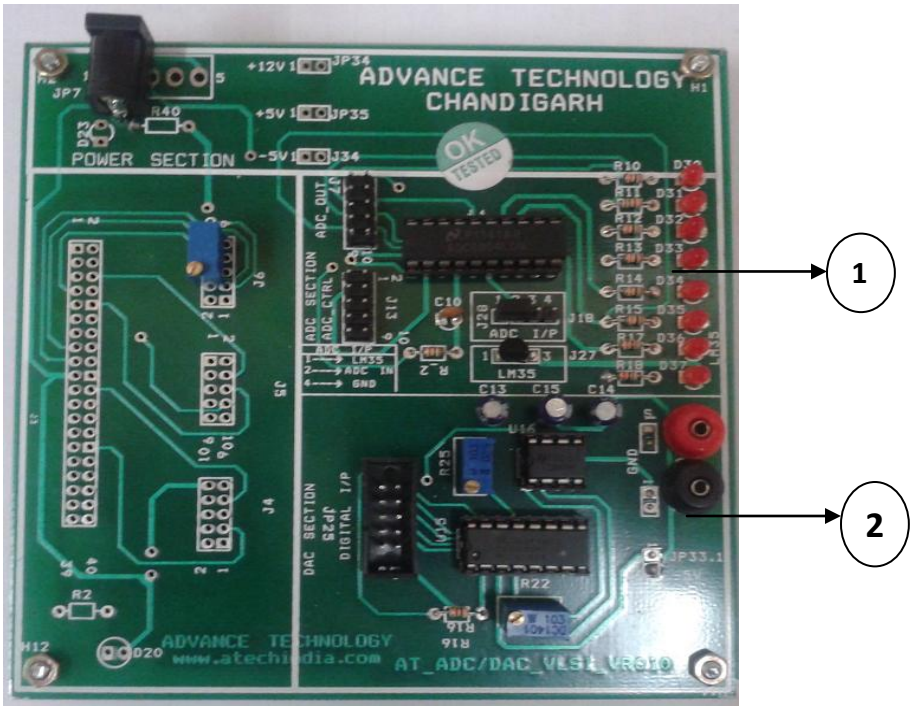
6	A2	B6 of Input binary number
7	A3	B5 of Input binary number
8	A4	B4 of Input binary number
9	A5	B3 of Input binary number
10	A6	B2 of Input binary number
11	A7	B1 of Input binary number
12	A8	B0 of Input binary number
13	Vcc	Power Supply +5 V
14	VREF (+)	Reference Voltage +ve
15	VREF (-)	Reference Voltage –ve (GND for DC)
16	Compensation	Connect 0.1uf capacitor

VIEW OF ADC/DAC INTERFACE



1 → ADC SECTION

2 → DAC SECTION

BOX HEADER CONNECTOR DESCRIPTION

ADC SECTION

J7 (DATA PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D4
2	D0	7	D5
3	D1	8	D6
4	D2	9	D7
5	D3	10	GND

J13 (CONTROL PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	INTR	7	NC
3	READ	8	NC
4	WRITE	9	NC
5	NC	10	GND

DAC SECTION

JP25

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	A4
2	A0	7	A5
3	A1	8	A6
4	A2	9	A7
5	A3	10	GND

DIRECT CURRENT MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field.

The internal configuration of a dc motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motor.

What Is Motor Driver IC?

A motor driver IC is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver ICs act as an interface between microprocessors/controllers in robots and the motors in the robot. The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. For this tutorial we will be referring the motor driver IC as L293D only. L293D has 16 pins, they are comprised as follows:
Ground Pins - 4
Input Pins - 4
Output Pins - 4
Enable pins - 2
Voltage Pins - 2
The workings of the individual pins are explained in detail, later in the tutorial.

Why We Need Motor Driver IC?

Motor Driver ICs are primarily used in autonomous robotics only. Also most microprocessors operate at low voltages and require a small amount of current to operate while the motors require a relatively higher voltages and current . Thus current cannot be supplied to the motors from the microprocessor. This is the primary need for the motor driver IC.

How Motor Driver Operates?

The L293D IC receives signals from the controller and transmits the relative signal to the motors. It has two voltage pins, one of which is used to draw current for the working of the L293D and the other is used to apply voltage to the motors. The L293D switches it output signal according to the input received from the controller.

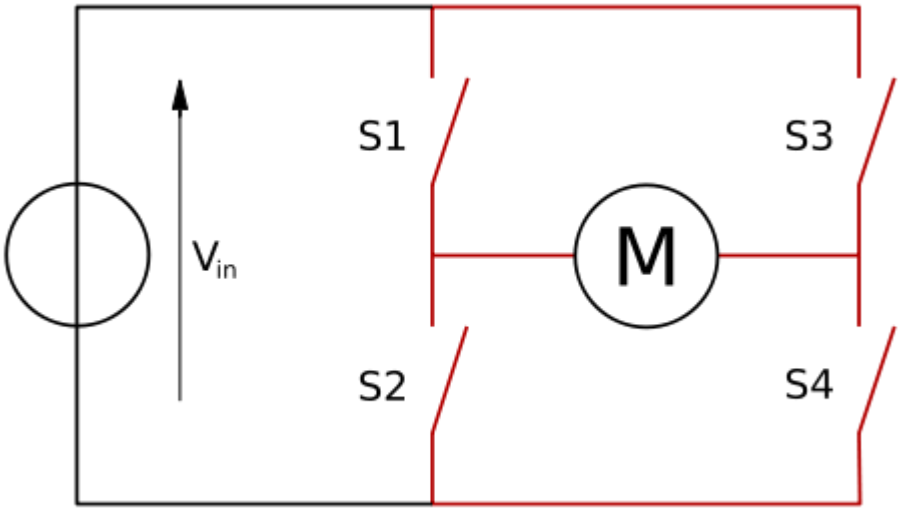
For Example: If the controller sends a 1(digital high) to the Input Pin of L293D, then the L293D transmits a 1(digital high) to the motor from its Output Pin. An important thing to note is that the L293D simply transmits the signal it receives. It does not change the signal in any case.

L293D and Its Working

The L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. The Theory for working of a H-bridge is given below.

Working of a H-bridge

H-bridge is given this name because it can be modelled as four switches on the corners of 'H'. The basic diagram of H-bridge is given below :

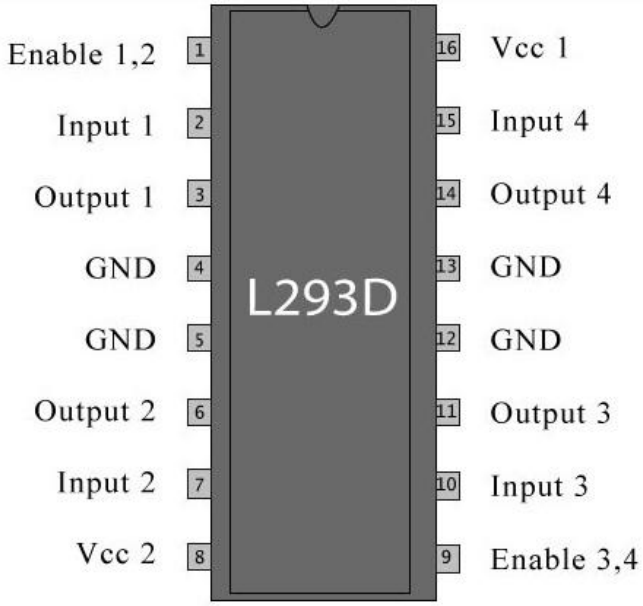


In the given diagram, the arrow on the left points to the higher potential side of the input voltage of the circuit. Now if the switches **S1** & **S4** are kept in a **closed** position while the switches **S2** & **S3** are kept in a **open** position meaning that the circuit gets shorted across the switches **S1** & **S4**. This creates a path for the current to flow, starting from the V input to switch **S1** to the **motor**, then to switch **S4** and then the exiting from the circuit. This flow of the current would make the motor turn in one direction. The direction of motion of the motor can be clockwise or anti-clockwise, this is because the rotation of the motor depends upon the connection of the terminals of the motor with the switches.
For simplicity, lets assume that in this condition the motor rotates in a clockwise direction.
Now, when **S3** and **S2** are **closed** then and **S1** and **S4** are kept **open** then the current flows from the other direction and the motor will now definitely rotates in counter-clockwise direction
When **S1** and **S3** are closed and **S2** and **S4** are **open** then the **'STALL'** condition will occur(The motor will break).

Stall Condition:

When the motor is applied positive voltage on both sides then the voltage from both the sides brings the motor shaft to a halt

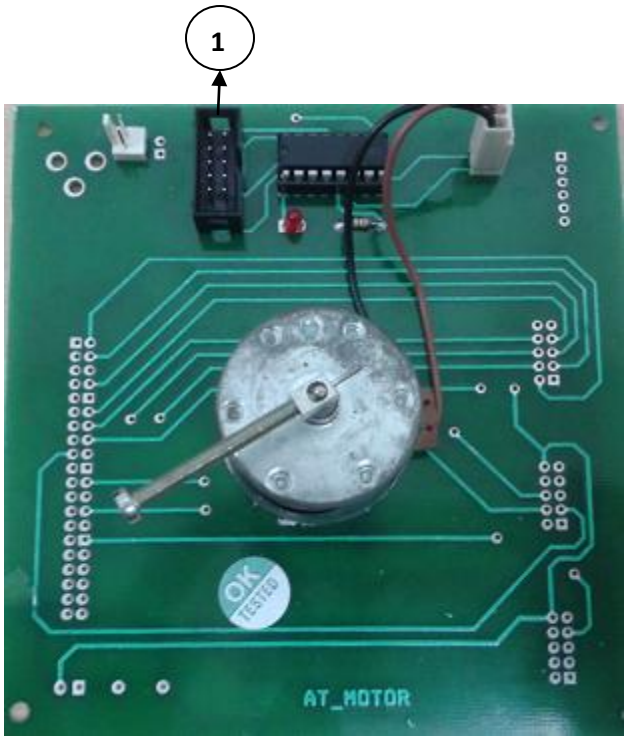
L293D Pin Diagram :



In the above diagram we can see that,

Pin No.	Pin Characteristics
1	Enable 1-2, when this is HIGH the left part of the IC will work and when it is low the left part won't work. So, this is the Master Control pin for the left part of IC
2	INPUT 1, when this pin is HIGH the current will flow though output 1
3	OUTPUT 1, this pin should be connected to one of the terminal of motor
4,5	GND, ground pins
6	OUTPUT 2, this pin should be connected to one of the terminal of motor
7	INPUT 2, when this pin is HIGH the current will flow though output 2
8	VC, this is the voltage which will be supplied to the motor. So, if you are driving 12 V DC motors then make sure that this pin is supplied with 12 V
16	VSS, this is the power source to the IC. So, this pin should be supplied with 5 V
15	INPUT 4, when this pin is HIGH the current will flow though output 4
14	OUTPUT 4, this pin should be connected to one of the terminal of motor
13,12	GND, ground pins
11	OUTPUT 3, this pin should be connected to one of the terminal of motor
10	INPUT 3, when this pin is HIGH the current will flow though output 3
9	Enable 3-4, when this is HIGH the right part of the IC will work and when it is low the right part won't work. So, this is the Master Control pin for the right part of IC

VIEW OF DC MOTOR INTERFACE



1 → BOX HEADER

BOX HEADER

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	Input 1 of L293D (Pin no-2)	7	NC
3	Input 2 of L293D (Pin no-7)	8	NC
4	Input 3 of L293D (Pin no-10)	9	NC
5	Input 1 of L293D (Pin no-15)	10	GND

L293D OUTPUT CONNECTION WITH DC MOTOR (2 PIN CONNECTOR)

PIN NO.	SIGNAL
1	Output 1 of L293D (Pin no-3)
2	Output 2 of L293D (Pin no-6)

BLDC MOTOR INTERFACE

Brushless DC electric motor (**BLDC motors**, **BL motors**) also known as **electronically commutated motors** (ECMs, EC motors) are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. In this context, AC, alternating current, does not imply a sinusoidal waveform, but rather a bi-directional current with no restriction on waveform. Additional sensors and electronics control the inverter output amplitude and waveform (and therefore percent of DC bus usage/efficiency) and frequency (i.e. rotor speed).

The rotor part of a brushless motor is often a permanent magnet synchronous motor, but can also be a switched reluctance motor, or induction motor.

Brushless motors may be described as stepper motors; however, the term stepper motor tends to be used for motors that are designed specifically to be operated in a mode where they are frequently stopped with the rotor in a defined angular position. This page describes more general brushless motor principles, though there is overlap.

Brushless vs. brushed motors

1. Brushed DC motors develop a maximum torque when stationary, linearly decreasing as velocity increases. Some limitations of brushed motors can be overcome by brushless motors; they include higher efficiency and a lower susceptibility to mechanical wear. These benefits come at the cost of potentially less rugged, more complex, and more expensive control electronics.
2. A typical brushless motor has permanent magnets which rotate around a fixed armature, eliminating problems associated with connecting current to the moving armature. An electronic controller replaces the brush/commutator assembly of the brushed DC motor, which continually switches the phase to the windings to keep the motor turning. The controller performs similar timed power distribution by using a solid-state circuit rather than the brush/commutator system.
3. Brushless motors offer several advantages over brushed DC motors, including more torque per weight, more torque per watt (increased efficiency), increased reliability, reduced noise, longer lifetime (no brush and commutator erosion), elimination of ionizing sparks from the commutator, and overall reduction of electromagnetic interference (EMI). With no windings on the rotor, they are not subjected to centrifugal forces, and because the windings are supported by the housing, they can be cooled by conduction, requiring no airflow inside the motor for cooling. This in turn means that the motor's internals can be entirely enclosed and protected from dirt or other foreign matter.
4. Brushless motor commutation can be implemented in software using a microcontroller or microprocessor computer, or may alternatively be implemented in analogue hardware, or in digital firmware using an FPGA. Commutation with electronics instead of brushes allows for greater flexibility and capabilities not available with brushed

DC motors, including speed limiting, "micro stepped" operation for slow and/or fine motion control, and a holding torque when stationary.

5. The maximum power that can be applied to a brushless motor is limited almost exclusively by heat too much heat weakens the magnets and may damage the winding's insulation.
6. When converting electricity into mechanical power, brushless motors are more efficient than brushed motors. This improvement is largely due to the brushless motor's velocity being determined by the frequency at which the electricity is switched, not the voltage. Additional gains are due to the absence of brushes, which reduces mechanical energy loss due to friction. The enhanced efficiency is greatest in the no-load and low-load region of the motor's performance curve. Under high mechanical loads, brushless motors and high-quality brushed motors are comparable in efficiency.
7. Environments and requirements in which manufacturers use brushless-type DC motors include maintenance-free operation, high speeds, and operation where sparking is hazardous (i.e. explosive environments) or could affect electronically sensitive equipment.

VIEW OF BLDC INTERFACE

1 → BOX HEADER

BOX HEADER

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	INPUT	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

SERVO MOTOR INTERFACE

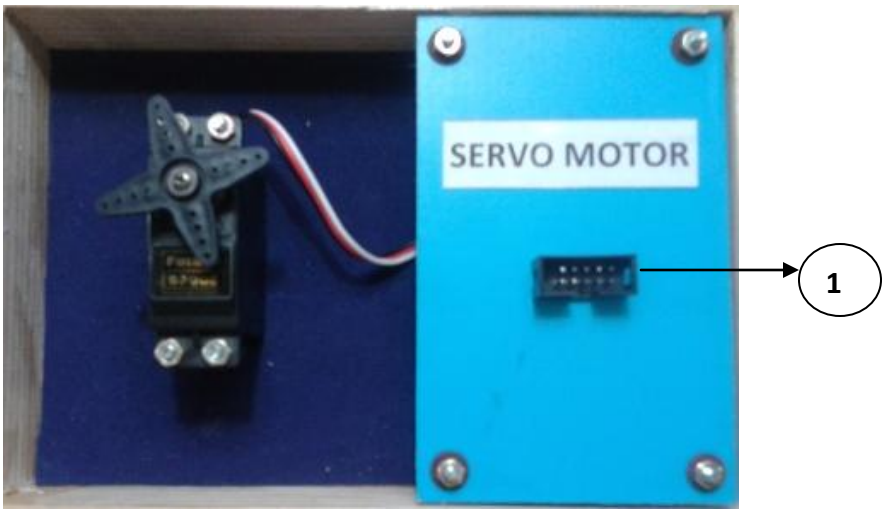
A servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a different class of motor, on the basis of fundamental operating principle, but use servomechanism to achieve closed loop control with a generic open loop motor.

Servomotors are generally used as a high performance alternative to the stepper motor. Stepper motors have some inherent ability to control position, as they have built-in output steps. This often allows them to be used as an open-loop position control, without any feedback encoder, as their drive signal specifies the number of steps of movement to rotate. This lack of feedback though limits their performance, as the stepper motor can only drive a load that is well within its capacity, otherwise missed steps under load may lead to positioning errors. The encoder and controller of a servomotor are an additional cost, but they optimise the performance of the overall system (for all of speed, power and accuracy) relative to the capacity of the basic motor. With larger systems, where a powerful motor represents an increasing proportion of the system cost, servomotors have the advantage.

Many applications, such as laser cutting machines, may be offered in two ranges, the low-priced range using stepper motors and the high-performance range using servomotors.

Pictorial View of Servo Motor Interface



1 → BOX HEADER

BOX HEADER

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	INPUT	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

TEMPRATURE SENSOR LM35

ADC (TEMPRATURE SENSOR) General Description

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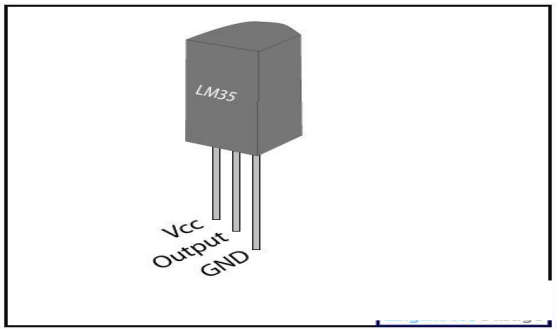
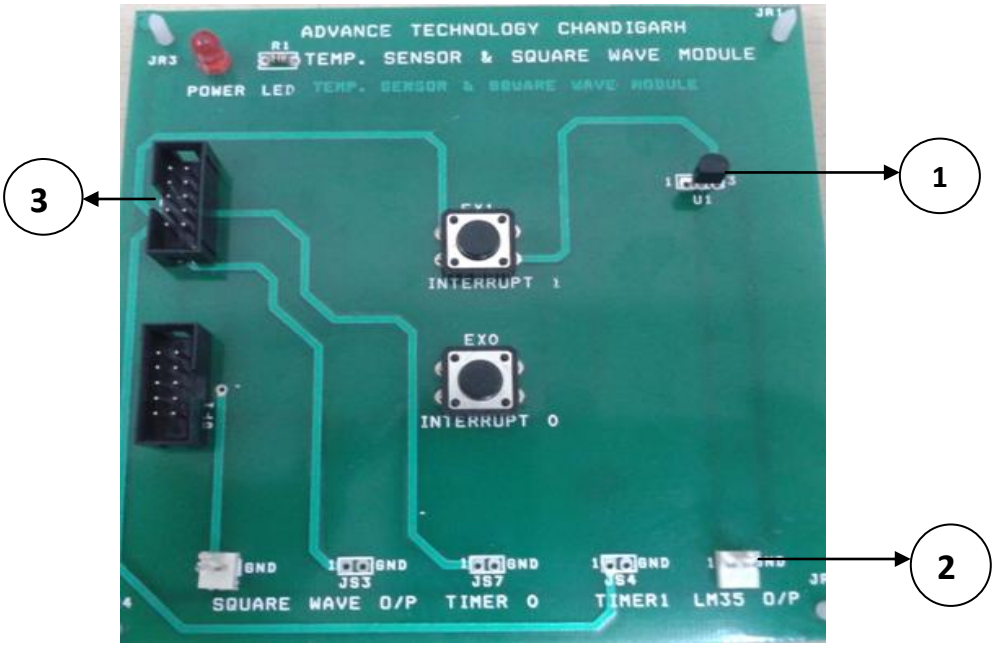
TEMPERAATURE SENSOR LM35

LM35 is a precision IC **temperature sensor** with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With**LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air.
The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/^{o}C.

Pin Diagram:



VIEW OF TEMPERATURE SENSOR SECTION



1 → LM35 SENSOR

2 → LM35 SENSOR OUTPUT

3 → **JP2** BOX HEADER

BOX HEADER CONNECTION

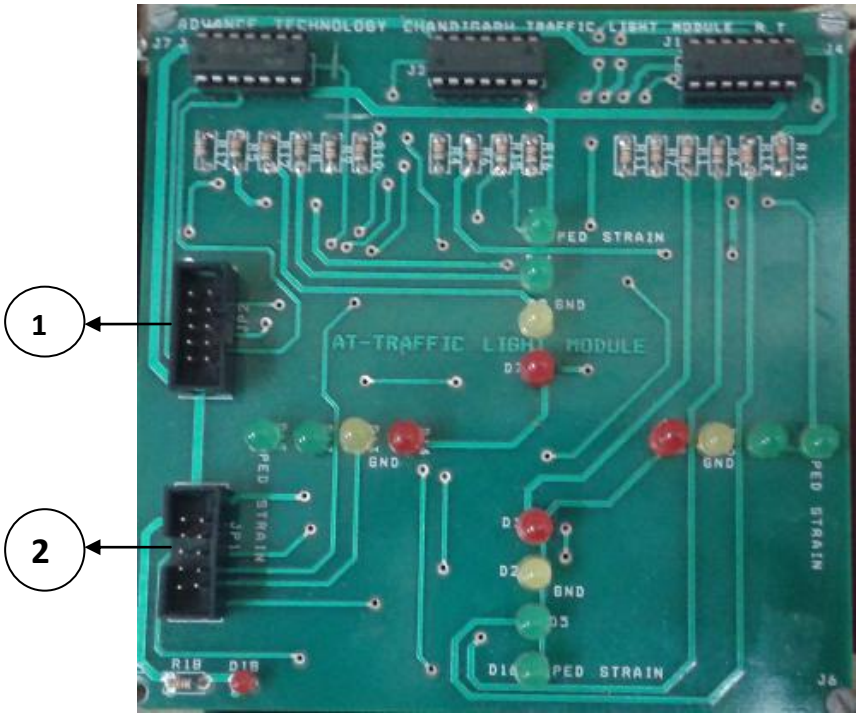
JP2

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	LM35 O/P	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

TRAFFIC LIGHT INTERFACE

This project operates red, yellow and green LEDs in the correct sequence for a four way Indian traffic light system. The time taken for the complete red - red & yellow- green - yellow sequence can be vary by adjusting the delay in microcontroller program.

VIEW OF TRAFFIC LIGHT INTERFACE



1 → JP2 BOX HEADER

2 → JP1 BOX HEADER

BOX HEADER DESCRIPTION

JP1

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D10
2	D1	7	D12
3	D2	8	D3
4	D5	9	D6
5	D8	10	GND

JP2

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D14
2	D7	7	D17
3	D9	8	D16
4	D11	9	D15
5	D13	10	GND

RELAY BUZZER INTERFACE

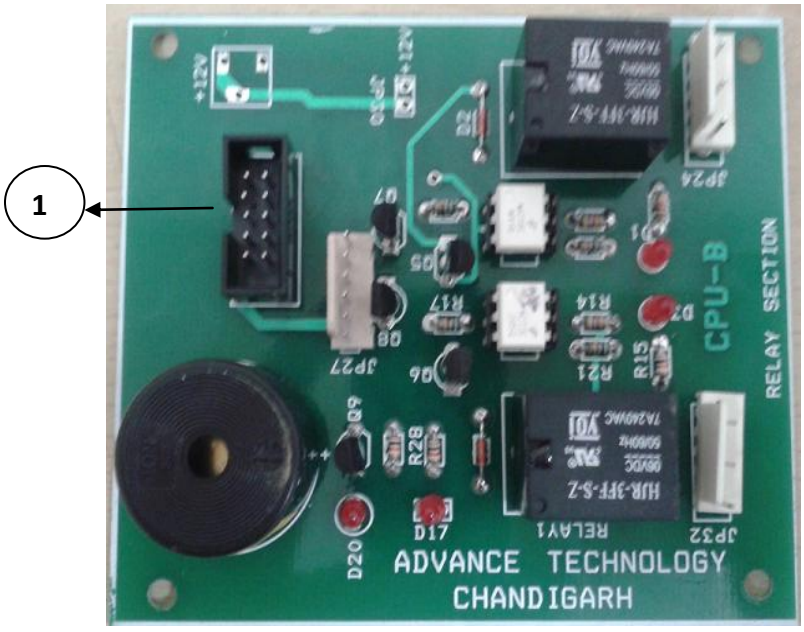
A **relay** is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Buzzer

A Buzzer is output device having +VE and –VE terminals, which generate a tone when it gets high signal on its positive terminal. These devices are capable of generating sound, such kind of devices can be used in hardware like security systems and sensitive equipments to protect them from burn.

View of Relay Buzzer interface



1 → RELAY BUZZER CONNECTOR

BOX HEADER PIN DESCRIPTION

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	Relay 1	7	NC
3	Relay 2	8	NC
4	Buzzer	9	NC
5	NC	10	GND

ELEVATOR INTERFACE

This interface simulates the control and operation of an elevator. Four floors are assumed and for each floor a key and corresponding LED indicator are provided to serve as request button and request status indicators. The elevator itself is represented by a column of ten LEDs. The motion of the elevator can be simulated by turning on successive LEDs, one at a time. The delay between turning off one LED and turning on the next LED (this delay is programmed in software by the user) can simulate the "speed" of the elevator. User can read the request status information through one port, rest the request indicators through another port and control the elevator (LED column) through another port.

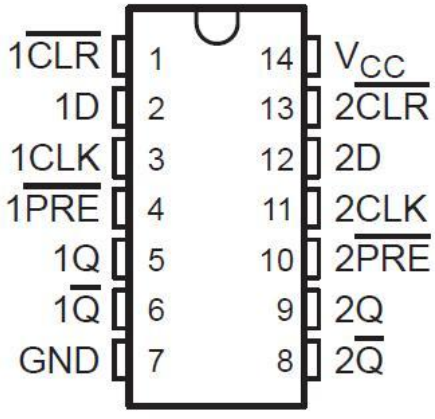
This interface allows the user to write software for simulating the operation of elevator. The software exercises could include priority schemes, different service schemes etc.

DESCRIPTION OF THE CIRCUIT

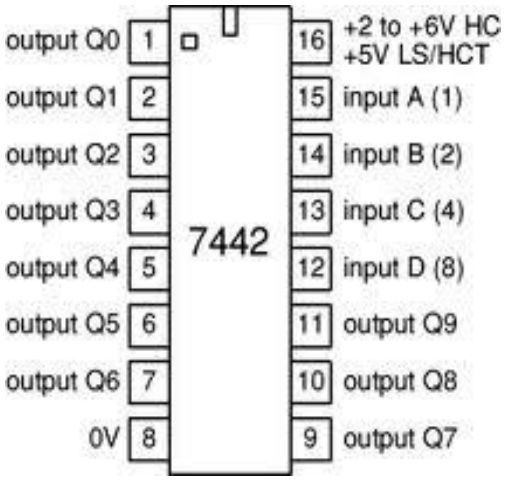
This interface has four keys, marked 0, 1, 2 and 3 representing the request buttons at the four floors. Pressing of a key causes a corresponding flip-flop to be set. The outputs of the four flip-flops can be read through port 2. Also, the status of these signals is reflected by a set of 4 LEDs. The flip- flop can be reset (LEDs are cleared) through port 0. A column of 10 LEDs, representing the elevator can be controlled through port 0.

These port lines are fed to the inputs of the decoder 7442 whose outputs are used to control the on/off states of the LEDs which simulate the motion of the elevator.

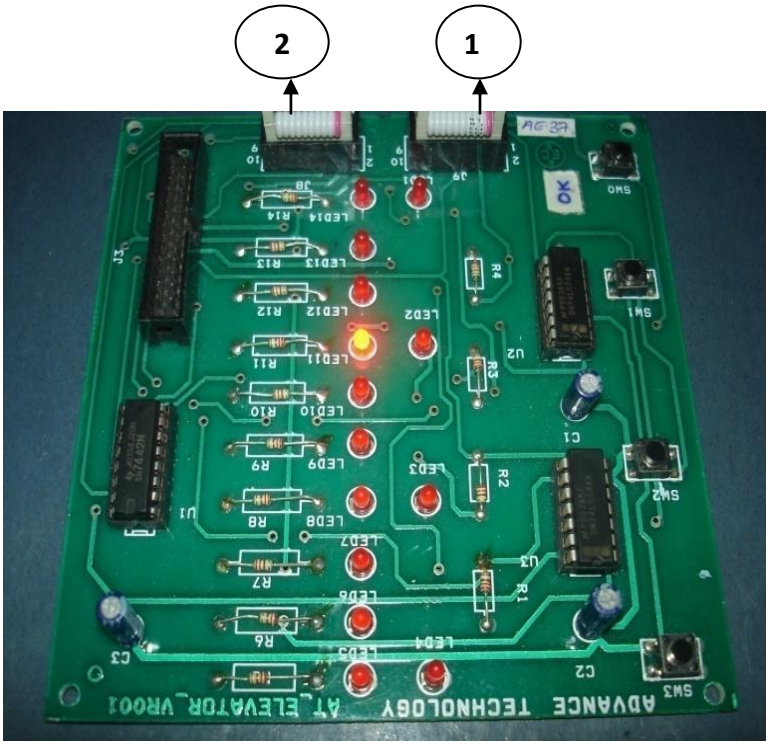
7474 pin description (D-type Flip Flop)



7442 pin description (DECODER)



VIEW OF ELEVATOR INTERFACE



1 → **J9** BOX HEADER

2 → **J8** BOX HEADER

BOX HEADER PIN DESCRIPTION

J9

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	R4 Resistance	7	NC
3	R3 Resistance	8	NC
4	R2 Resistance	9	NC
5	R1 Resistance	10	GND

J8

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	7442 IC (**Pin no 15**) Input A	7	NC
3	7442 IC (**Pin no 14**) Input B	8	NC
4	7442 IC (**Pin no 13**) Input C	9	NC
5	7442 IC (**Pin no 12**) Input D	10	GND

Switches connection

SW0	**U3** 7474 IC (**Pin no 10**)
SW1	**U3** 7474 IC (**Pin no 4**)
SW2	**U2** 7474 IC (**Pin no 10**)
SW3	**U2** 7474 IC (**Pin no 4**)

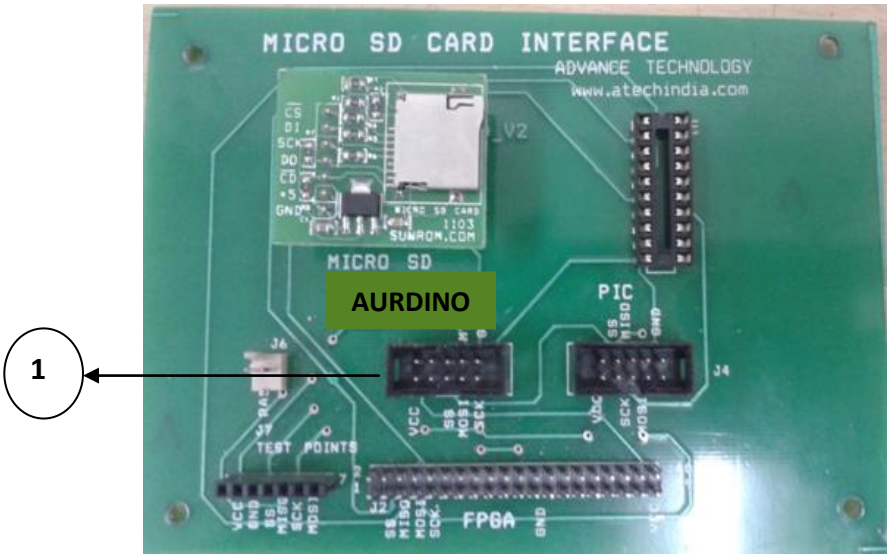
Output LEDs (LED 5 to LED 14)

LED 5	Output **Q0** of IC 7442
LED 6	Output **Q1** of IC 7442
LED 7	Output **Q2** of IC 7442
LED 8	Output **Q3** of IC 7442
LED 9	Output **Q4** of IC 7442
LED 10	Output **Q5** of IC 7442
LED 11	Output **Q6** of IC 7442
LED 12	Output **Q7** of IC 7442
LED 13	Output **Q8** of IC 7442
LED 14	Output **Q9** of IC 7442

SD CARD INTERFACE

Secure Digital (**SD**) is a non-volatile memory card format for use in portable devices, such as mobile phones, digital cameras, GPS navigation devices, and tablet computers. The Secure Digital format includes four card families available in three different form factors. The four families are the original Standard-Capacity (SDSC), the High-Capacity (SDHC), the eXtended-Capacity (SDXC), and the SDIO, which combines input/output functions with data storage. The three form factors are the original size, the "mini" size, and the "micro" size. Electrically passive adapters allow the use of a smaller card in a host device built to hold a larger card.

VIEW OF SD CARD INTERFACE



1→ J3 BOX HEADER

BOX HEADER PIN DESCRIPTION

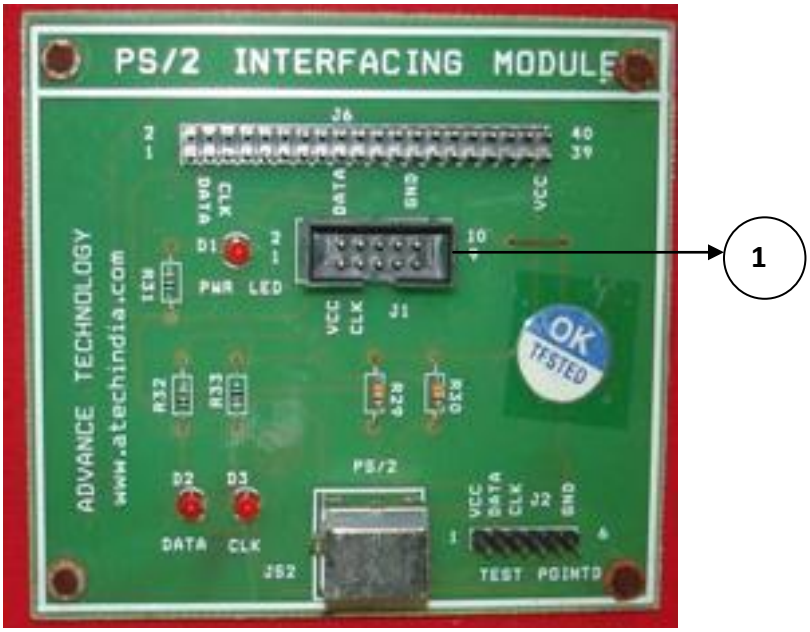
AURDINO (J3)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	SS
2	NC	7	MOSI
3	NC	8	MISO
4	NC	9	SCK
5	NC	10	GND

PC KEYBOARD INTERFACE (PS/2)

The **PS/2 connector** is a 6-pin Mini-DIN connector used for connecting some keyboards and mice to a PC compatible computer system. Its name comes from the IBM Personal System/2 series of personal computers, with which it was introduced in 1987. The PS/2 mouse connector generally replaced the older DE-9 RS-232 "serial mouse" connector, while the PS/2 keyboard connector replaced the larger 5-pin/180° DIN connector used in the IBM PC/AT design. The PS/2 designs on keyboard and mouse interfaces are electrically similar and employ the same communication protocol. However, a given system's keyboard and mouse port may not be interchangeable since the two devices use a different set of commands.

VIEW OF PS/2 KEYBOARD INTERFACE



1→ J1 BOX HEADER

BOX HEADER PIN DESCRIPTION

J1

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	DATA	7	NC
3	CLOCK	8	NC
4	NC	9	NC
5	NC	10	GND

SENSOR INTERFACES

PROXIMITY SENSOR INTERFACE

What Are Proximity Sensors?

"Proximity Sensor" includes all sensors that perform non-contact detection in comparison to sensors, such as limit switches, that detect objects by physically contacting them. Proximity Sensors convert information on the movement or presence of an object into an electrical signal. There are three types of detection systems that do this conversion:
Systems that use the eddy currents that are generated in metallic sensing objects by electromagnetic induction.
Systems that detect changes in electrical capacity when approaching the sensing object Systems that use magnets and reed switches**.**

VIEW OF PROXIMITY INTERFACE

1 → MOTOR CONNECTOR

2 → PROXIMITY CONNECTOR

3 → +5V SUPPLY

BOX HEADER PIN DESCRIPTION

Motor Connector

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	DATA	7	NC
3	Input 1 of L293D (**Pin 2**)	8	NC
4	Input 2 of L293D (**Pin 7**)	9	Proximity **O/P** from Proximity connector
5	NC	10	GND

BOX HEADER PIN DESCRIPTION

Proximity Connector

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	Proximity O/P	7	NC
3	NC	8	NC
4	Proximity O/P	9	Proximity O/P
5	NC	10	GND

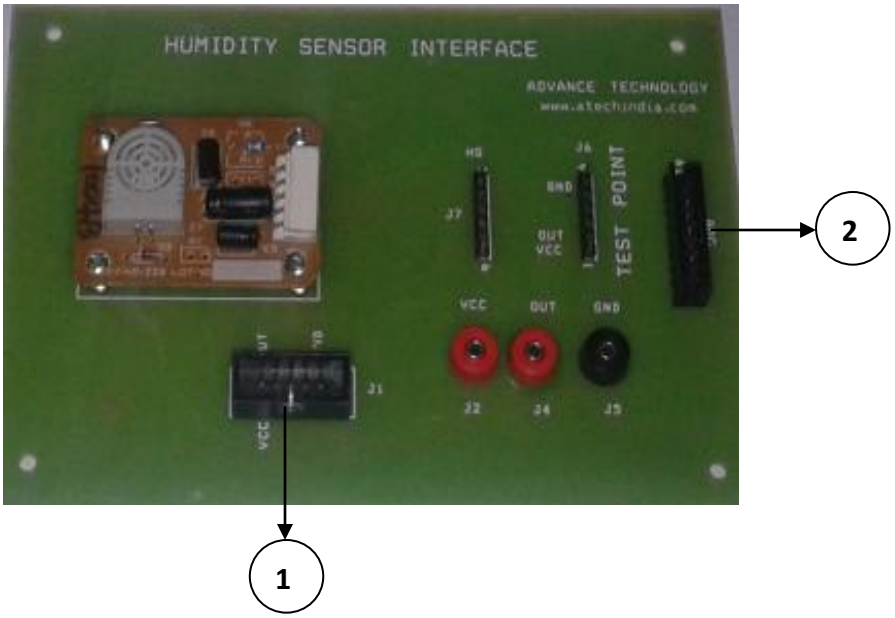
HUMIDITY INTERFACE

What is humidity?

The word "humidity" denotes the presence of water vapour in air or other gas. Water vapor is the gaseous form of water, and can be thought of much like any other kind of gas. It is normally transparent, and makes up about one hundredth (or one percent) of the air around us.

Humidity arises in practice because, in the same way that hot water gives off steam, so water at lower temperatures - including ice - also gives off water vapor. Wherever there is water or ice, there is evaporation (or its opposite, condensation). The extent to which this happens depends upon a number of factors, the most important of which is temperature. Similarly, other liquid or solid materials - most of which have some water content - will give off (or sometimes soak up) water vapor. Of course, water vapor can also be found in places where there is no liquid or solid nearby, for example in remote parts of the Earth's atmosphere.

View of Humidity Sensor



1 →J1 (HUMIDITY CONNECTOR)

2 → ADC CONNECTOR

BOX HEADER PIN DESCRIPTION

J1 (Humidity Connector)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	Humidity O/P	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

This Box Header used when Controller have **internal** ADC

ADC Connector

PIN NO.	SIGNAL
1	Humidity O/P
2	NC
3	NC
4	NC
5	NC
6	NC
7	NC
8	NC
9	GND

This Box Header used when Controller have **External** ADC

PRESSURE SENSOR INTERFACE

This interface is well designed and tested to meet standards and ratings. Pressure sensors are best known for their high performance, durability and cost effectiveness. SPECIAL LOW PRESSURE RANGE SENSOR WITH COMPENSATED OUTPUT: SPD002GAsil. This pressure sensor has an amplified analogue output. The sensor is compensated for offset, sensitivity, temperature drift and nonlinearity. The sensor has a range of 2 PSI FS and the output is ratiometric to the power supply voltage. Other pressure ranges (from 0.3 to 100psi) on request.

POUNDS PER SQUARE INCH (PSI) The pound per square inch or, more accurately, pound-force per square inch (symbol: psi or lbf/in^2 or lb_f/in^2 or lbf/sq in or lb_f/sq in) is a unit of pressure or of stress based on avoirdupois units. It is the pressure resulting from a force of one pound-force applied to an area of one square inch.

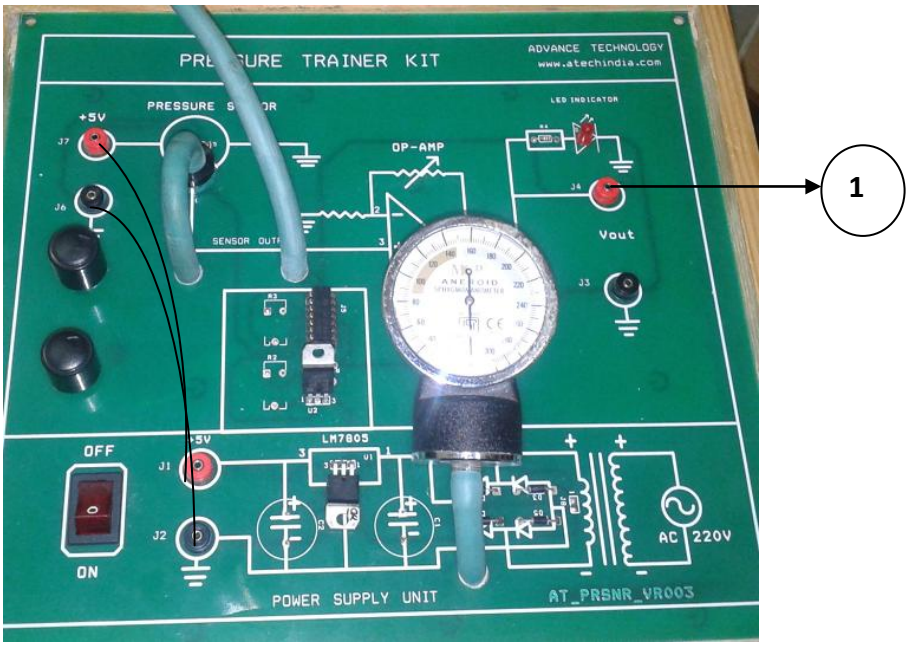
MmHg :- A unit of pressure equal to the amount of fluid pressure one millimeter deep in mercury at zero degrees centigrade on Earth.

1 mmHg = 19.337×10^{-3} (psi) Pound-force per square inch= 0.019337 psi

1psi=51.715 mmHg

Maximum Rating of Sensor => 2PSI = 2×51.714 mmHg= 103.428 mmHg

VIEW OF PRESSURE INTERFACE

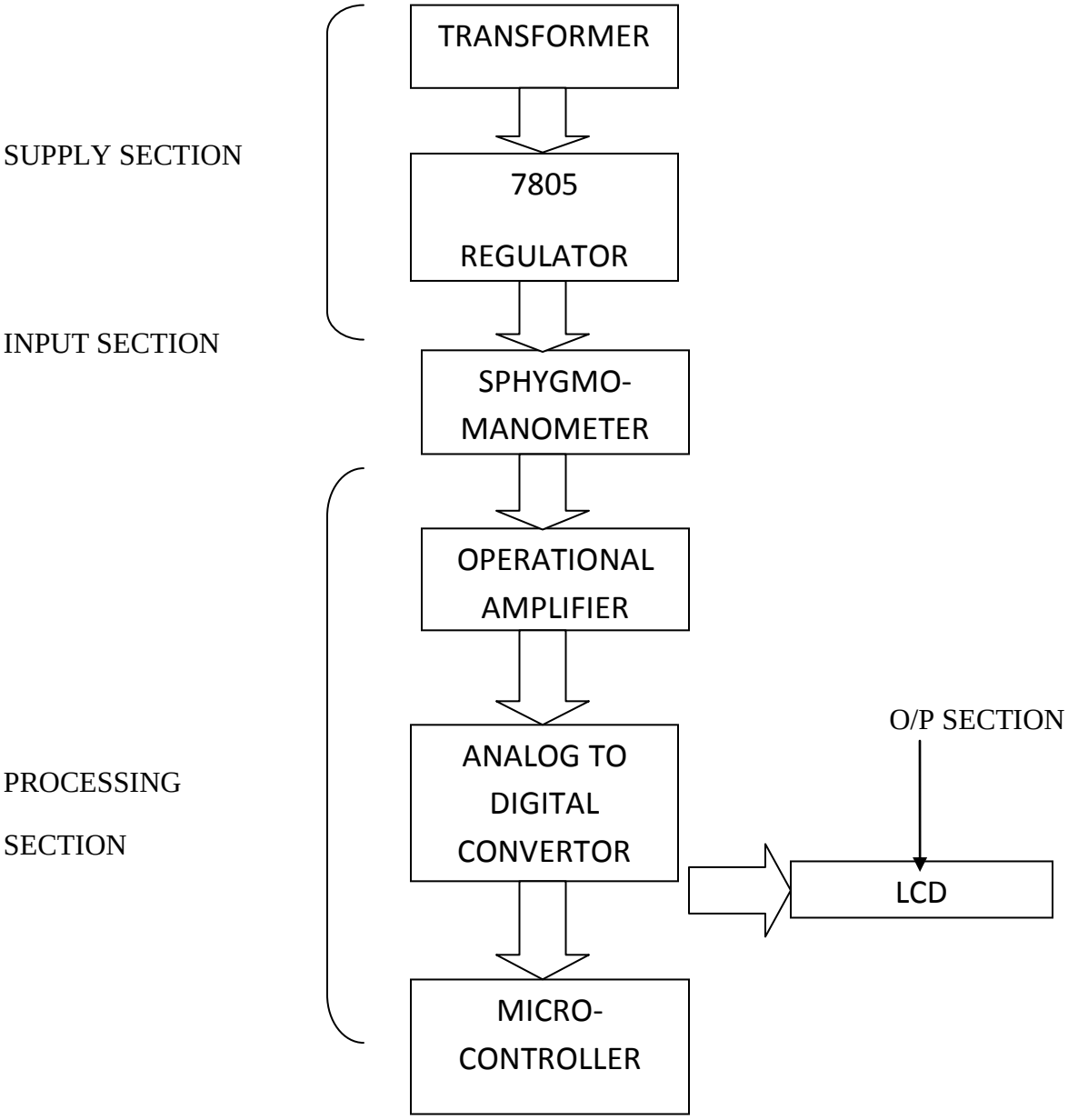


1 → O/P CONNECTOR

1 .Since PSI is pressure unit of Sensor used in Kit and Pressure Meter mesure input Pressure in "mmHg" So,there is important to know the relationship between PSI and mmHg.

2. Output and Input can define in other unit of Pressure

BLOCK DAIGRAM OF PRESSURE SENSOR INTERFACE



ACEELEROMETER INTERFACE

One of the most common inertial sensors is the accelerometer, a dynamic sensor capable of a vast range of sensing. Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes:

- As an inertial measurement of velocity and position;
- As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s2);
- As a vibration or impact (shock) sensor.

There are considerable advantages to using an analog accelerometer as opposed to an inclinometer such as a liquid tilt sensor – inclinometers tend to output binary information (indicating a state of on or off), thus it is only possible to detect when the tilt has exceeded some thresholding angle.

Principles of Operation

Most accelerometers are Micro-Electro-Mechanical Sensors (MEMS). The basic principle of operation behind the MEMS accelerometer is the displacement of a small proof mass etched into the silicon surface of the integrated circuit and suspended by small beams. Consistent with Newton's second law of motion (F = ma), as an acceleration is applied to the device, a force develops which displaces the mass. The support beams act as a spring, and the fluid (usually air) trapped inside the IC acts as a damper, resulting in a second order lumped physical system. This is the source of the limited operational bandwidth and non-uniform frequency response of accelerometers.

Applications for Accelerometers:

Accelerometers are very important in the sensor world because they can sense such a wide range of motion. They're used in the latest Apple PowerBooks (and other laptops) to detect when the computer's suddenly moved or tipped, so the hard drive can be locked up during movement. They're used in cameras, to control image stabilization functions. They're used in pedometers, gait meters, and other exercise and physical therapy devices. They're used in gaming controls to generate tilt data. They're used in automobiles, to control airbag release when there's a sudden stop. There are countless other applications for them.

ADXL335 ACCELEROMETER

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tiltsensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

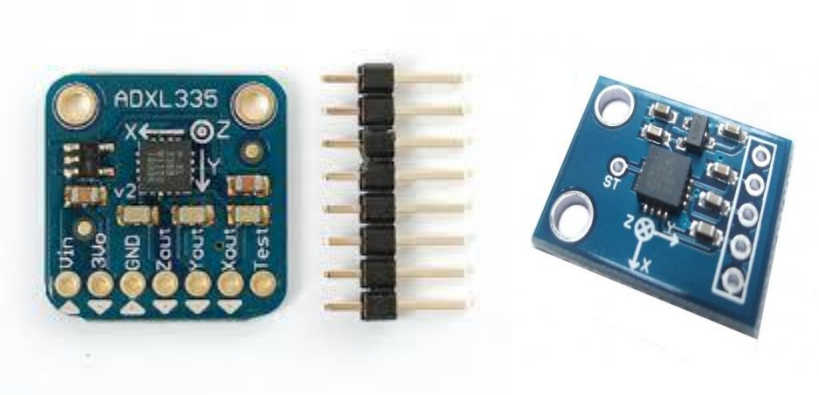
The user selects the bandwidth of the accelerometer using the C_X, C_Y, and $C_Z$capacitors at the X_{OUT}, Y_{OUT}, and Z_{OUT} pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

Applications

- Cost sensitive, low power, motion- and tilt-sensing applications
- Mobile devices
- Gaming systems
- Disk drive protection
- Image stabilization
- Sports and health devices

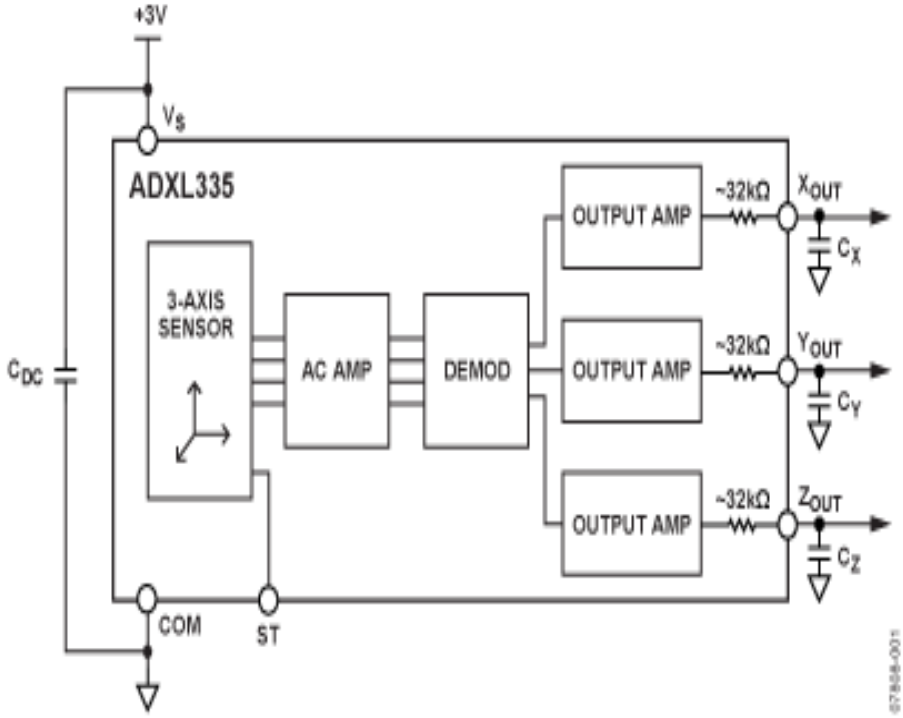
VIEW OF ADXL335



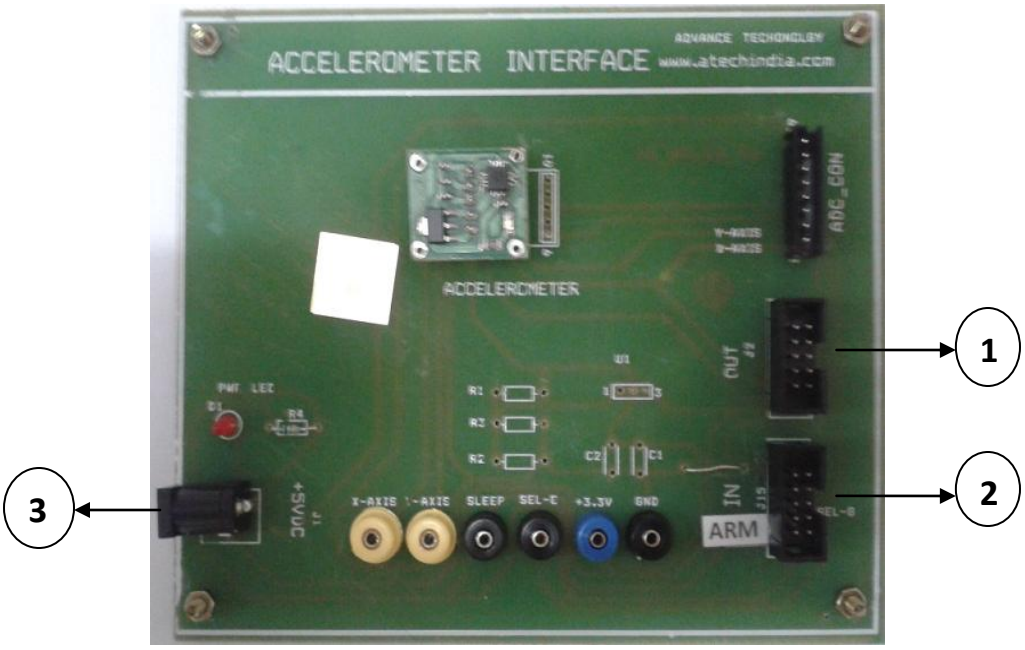
FEATURES AND BENEFITS

- 3-axis sensing
- Small, low-profile package 4 mm × 4 mm × 1.45 mm LFCSP
- Low power - 350 μA (typical)
- Single-supply operation 1.8 V to 3.6 V
- 10,000 *g* shock survival
- Excellent temperature stability
- BW adjustment with a single capacitor per axis
- RoHS/WEEE lead-free compliant

FUNCTIONAL BLOCK DIAGRAM FOR ADXL335



VIEW OF ACCELEROMETER INTERFACE



1 → J2 BOX HEADER
2 → J1 BOX HEADER
3 → + 5V SUPPLY

BOX HEADER PIN DESCRIPTION

J2 (FOR **PIC,AVR** CONTROLLER**)**

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	X-axis	7	NC
3	Y-axis	8	NC
4	Z-axis	9	NC
5	NC	10	GND

BOX HEADER PIN DESCRIPTION

J15 (FOR **ARM** CONTROLLER**)**

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	Humidity O/P	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

SENSOR BOARD INTERFACE

It comprises of three sensor board interfaces:-

1. IR SENSOR
2. LDR (Light Dependent Resistor)
3. PT100
4. LM35 TEMP Sensor
5. PROXIMITY Sensor

Description

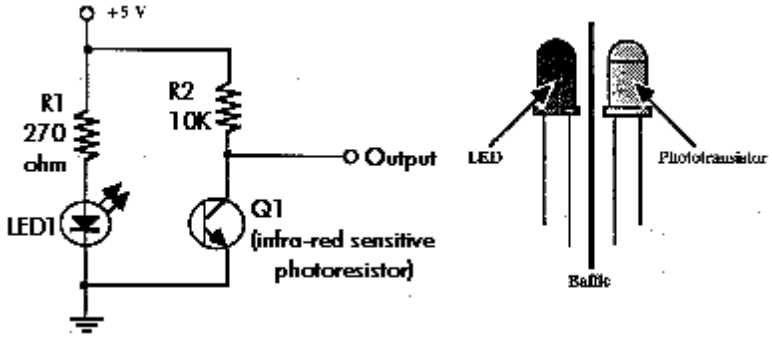
IR SENSOR

Introduction

This device emits and/or detects infrared radiation to sense a particular phase in the environment. Generally, thermal radiation is emitted by all the objects in the infrared spectrum. The infrared sensor detects this type of radiation which is not visible to human eye.

Working

The basic idea is to make use of IR LEDs to send the infrared waves to the object. Another IR diode of the same type is to be used to detect the reflected wave from the object. The diagram is shown below.



When IR receiver is subjected to infrared light, a voltage difference is produced across the leads. Less voltage which is produced can be hardly detected and hence operational amplifiers (Op-amps) are used to detect the low voltages accurately.

Measuring the distance of the object from the receiver sensor: The electrical property of IR sensor components can be used to measure the distance of an object. The fact when IR receiver is subjected to light, a potential difference is produced across the leads.

Advantages

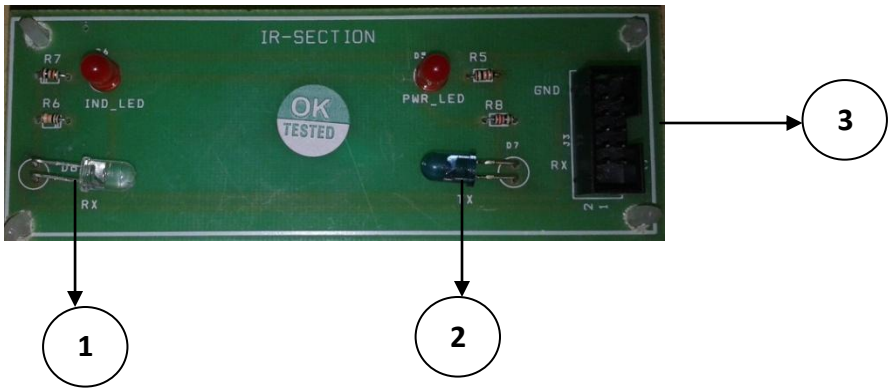
· Easy for interfacing

· Readily available in market

Disadvantages

· Disturbed by noises in the surrounding such as radiations, ambient light etc.

VIEW IR Interface



1 → IR RECEIVER

2 → IR TRANSMITTER

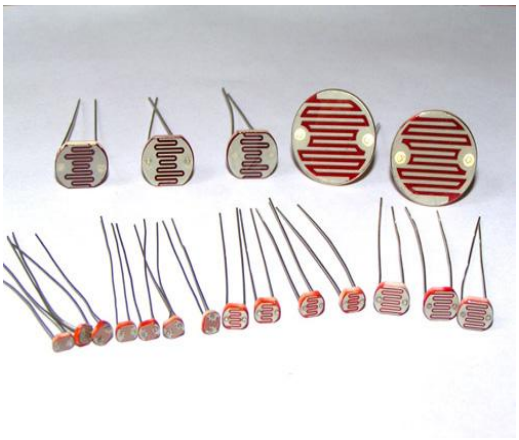
3 → J3 BOX HEADER

LDR INTERFACE

Introduction

A **light-dependent resistor**, alternatively called an **LDR**, **photoresistor**,**photoconductor**, or photocell, is a variable resistor whose value decreases with increasing incident light intensity. An LDR 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.
A photoelectric device can be either intrinsic or extrinsic. 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 bandgap. Extrinsic devices have impurities added, which have a ground state energy closer to the conduction band - since the electrons don't have as far to jump, lower energy photons (i.e. longer wavelengths and lower frequencies) are sufficient to trigger the device.
Two of its earliest applications were as part of smoke and fire detection systems and camera light meters. Because cadmium sulfide cells are inexpensive and widely available,LDRs are still used in electronic devices that need light detection capability, such as security alarms, street lamps, and clock radios

VIEW OF LDR



PT100 (TEMPERATURE SENSOR)

Platinum resistance thermometers (PRTs) offer excellent accuracy over a wide temperature range (from-200 to +850 °C). Standard Sensors are are available from many manufacturers with various accuracy specifications and numerous packaging options to suit most applications. Unlike thermocouples, it is not necessary to use special cables to connect to the sensor.

The principle of operation is to measure the resistance of a platinum element. The most common type (PT100) has a resistance of 100 ohms at 0 °C and 138.4 ohms at 100 °C. There are also PT1000 sensors that have a resistance of 1000 ohms at 0 °C.

The relationship between temperature and resistance is approximately linear over a small temperature range: for example, if you assume that it is linear over the 0 to 100 °C range, the error at 50 °C is 0.4 °C. For precision measurement, it is necessary to linearise the resistance to give an accurate temperature. The most recent definition of the relationship between resistance and temperature is International Temperature Standard 90 (ITS-90).

This linearisation is done automatically, in software, when using Pico signal conditioners. The linearisation equation is:

Rt = R0 * (1 + A* t + B*t2 + C*(t-100)* t3)

Where:

Rt is the resistance at temperature *t*, R0 is the resistance at 0 °C, and
A= 3.9083 E-3
B = -5.775 E-7
C = -4.183 E -12 (below 0 °C), or
C = 0 (above 0 °C)

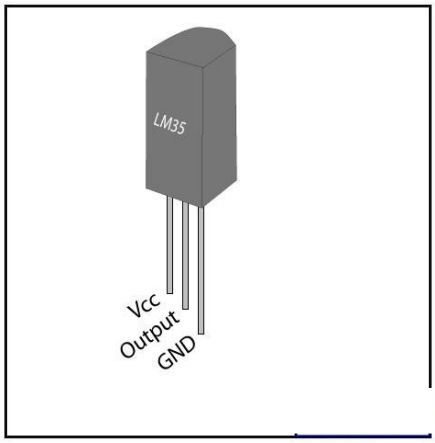
For a PT100 sensor, a 1 °C temperature change will cause a 0.384 ohm change in resistance, so even a small error in measurement of the resistance (for example, the resistance of the wires leading to the sensor) can cause a large error in the measurement of the temperature. For precision work, sensors have four wires- two to carry the sense current, and two to measure the voltage across the sensor element. It is also possible to obtain three-wire sensors, although these operate on the (not necessarily valid) assumption that the resistance of each of the three wires is the same.

LM35 SENSOR

LM35 is a precision IC **temperature sensor** with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air.

The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature,*i.e.*, its scale factor is 0.01V/^{o}C.

Pin Diagram:



Pin Description:

Pin No	Function	Name
1	Supply voltage; 5V (+35V to -2V)	Vcc
2	Output voltage (+6V to -1V)	Output
3	Ground (0V)	Ground

PROXIMITY SENSOR

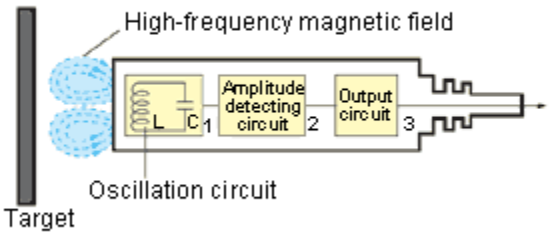
A proximity sensor can detect metal targets approaching the sensor, without physical contact with the target. Proximity sensors are roughly classified into the following three types according to the operating principle: the high-frequency oscillation type using electromagnetic induction, the magnetic type using a magnet, and the capacitance type using the change of capacitance.
KEYENCE proximity sensors are of the high-frequency oscillation type.

Features

- Non-contact detection, eliminating damage to sensor head and target.
- Non-contact output, ensuring long service life.
- Stable detection even in harsh environments exposed to water or oil splash.
- High response speed.

Operating Principle of High-frequency Oscillation Type Proximity Sensor

Operating principle of general sensor



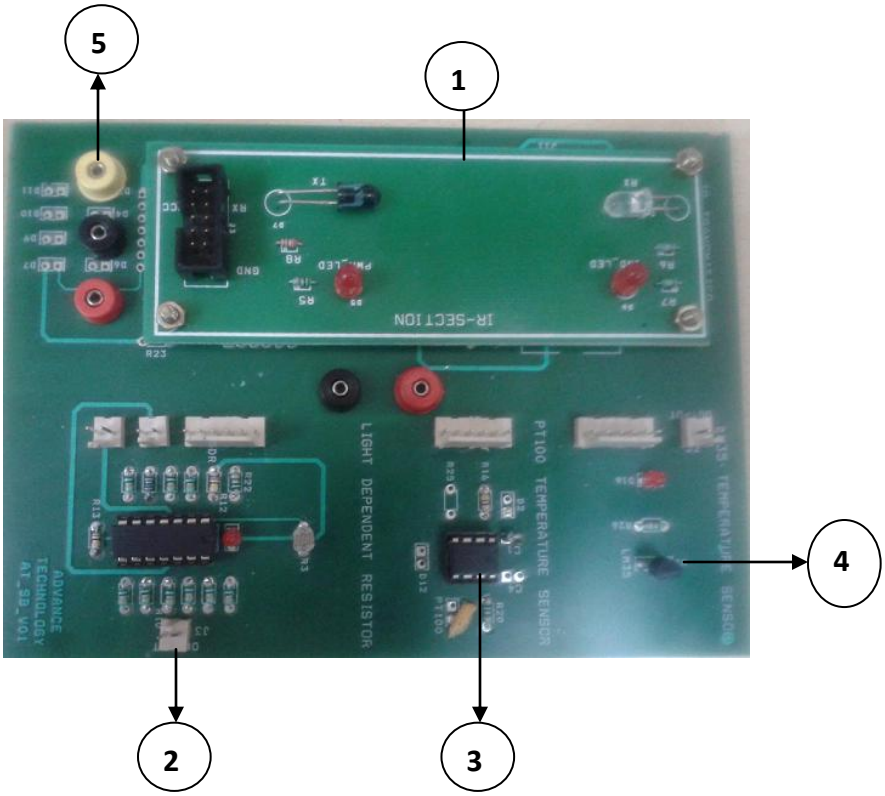
A high-frequency magnetic field is generated by coil L in the oscillation circuit. When a target approaches the magnetic field, an induction current (eddy current) flows in the target due to electromagnetic induction. As the target approaches the sensor, the induction current flow increases, which causes the load on the oscillation circuit to increase. Then, oscillation attenuates or stops. The sensor detects this change in the oscillation status with the amplitude detecting circuit, and outputs a detection signal.

Aluminum Proximity Sensor

Generally, the frequency of high-frequency, oscillation type proximity sensors tend to change when a nonferrous metal is placed near it. The aluminum proximity sensor detects any changes in oscillating frequency.

VIEW OF PROXIMITY SENSOR

VIEW OF SENSOR BOARD INTERFACE



1 → IR SENSOR

2 → LDR

3 → PT 100

4 → LM35

5 → PROXIMITY SENSOR

BOX HEADER PIN DESCRIPTION

1. IR SENSOR

J3

PIN NO.	SIGNAL	PIN NO.	SIGNAL
--	V_{CC}	4	NC
0	RX OF IR SENSOR	5	NC
1	PROXIMITY O/P	6	NC
2	NC	7	NC
3	NC	-	GND

2. LDR

J3 (2 PIN CONNECTOR)

PIN NO.	SIGNAL
1	GND
2	O/P OF LDR

3. PT 100

INPUT

J8 (6 PIN CONNECTOR)

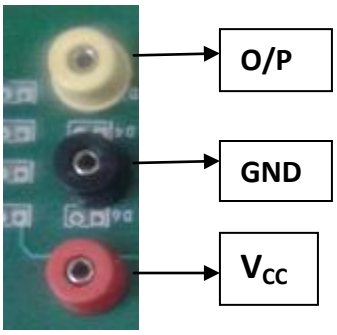
PIN NO.	SIGNAL
1	GND
2	NC
3	O/P of PT100
4	NC
5	NC
6	V_{CC}

4. LM35

J2 (2 PIN CONNECTOR)

PIN NO.	SIGNAL
1	GND
2	O/P OF LM35

5. PROXIMITY SENSOR



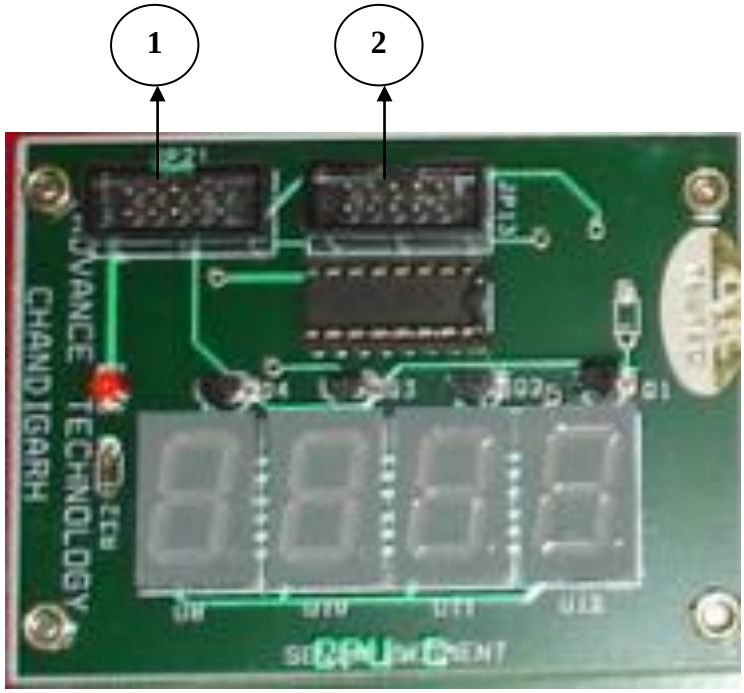
DISPLAY INTERFACES

SEVEN SEGMENT MODULE

A seven-segment display (SSD), or seven-segment indicator, is a form of electronic display device for displaying decimal numerals that is an alternative to the more complex dot matrix displays. Seven-segment displays are widely used in digital clocks, electronic meters, and other electronic devices for displaying numerical information.

In a simple LED package, typically all of the cathodes (negative terminals) or all of the anodes (positive terminals) of the segment LEDs are connected and brought out to a common pin; this is referred to as a "common cathode" or "common anode" device. To operate any particular segment of any digit, the controlling integrated circuit would turn on the cathode driver for the selected digit, and the anode drivers for the desired segments; then after a short blanking interval the next digit would be selected and new segments lit, in a sequential fashion.

VIEW OF SEVEN SEGMENT DISPLAY



1 → **JP21** BOX HEADER

2 → **JP13** BOX HEADER

BOX HEADER PIN DESCRIPTION

JP21 (CONTROL PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	SS1 (Q1)	7	NC
3	SS2 (Q2)	8	NC
4	SS3 (Q3)	9	NC
5	SS3 (Q4)	10	GND

Where **SS** stands for **Seven Segment**

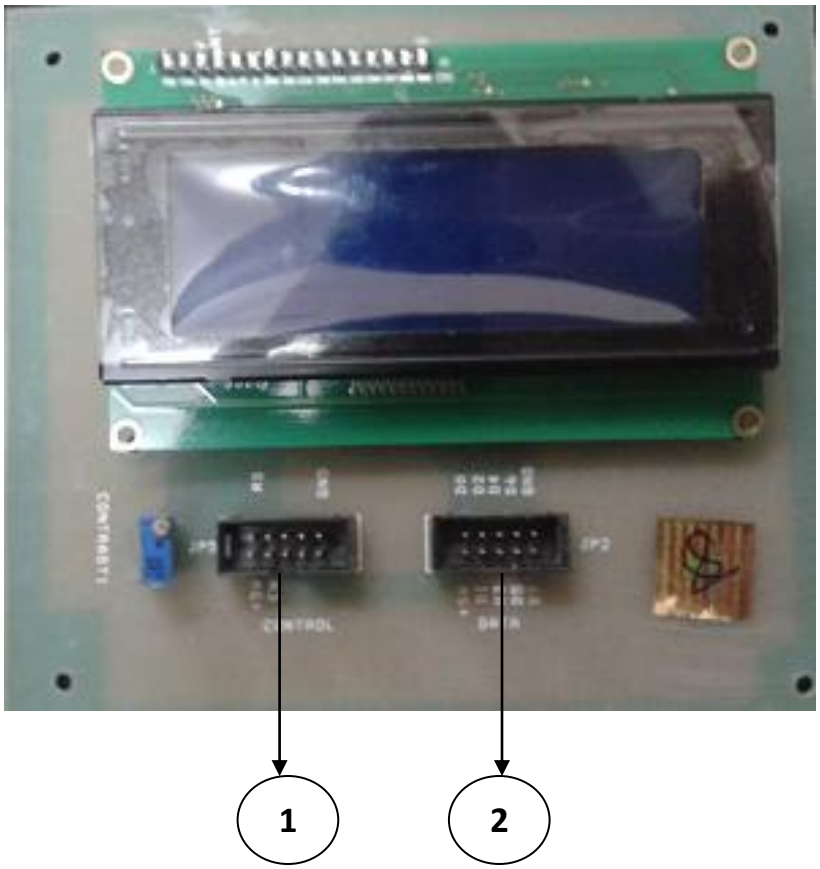
J13 (DATA PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D4
2	D0	7	D5
3	D1	8	D6
4	D2	9	D7
5	D3	10	GND

LCD 20X4 INTERFACE

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology

VIEW OF LCD (20X4) INTERFACE



1 → **JP5** LCD CONTROL BOX HEADER

2 → **JP2** LCD DATA BOX HEADER

PIN DESCRIPTION OF LCD 20X4

1	Vss	GND
2	Vdd	+3V or +5V
3	Vo	Contrast Adjustment
4	RS	H/L Register select signal
5	R/$\overline{W}$	H/L Read / write signal
6	E	H→L Enable signal
7	DB0	H/L Data bus line
8	DB1	H/L Data bus line
9	DB2	H/L Data bus line
10	DB3	H/L Data bus line
11	DB4	H/L Data bus line
12	DB5	H/L Data bus line
13	DB6	H/L Data bus line
14	DB7	H/L Data bus line
15	A/Vee	4.2v for LED/Negative Voltage output
16	K	Power supply for B/L (0V)

BOX HEADER PIN DESCRIPTION

JP5 (CONTROL PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	RS	7	NC
3	E	8	NC
4	NC	9	NC
5	NC	10	GND

RS→ Register Select

E→ Enable

JP5 (DATA PORT)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	D4
2	D0	7	D5
3	D1	8	D6
4	D2	9	D7
5	D3	10	GND

GRAPHICAL LCD 128X64 INTERFACE

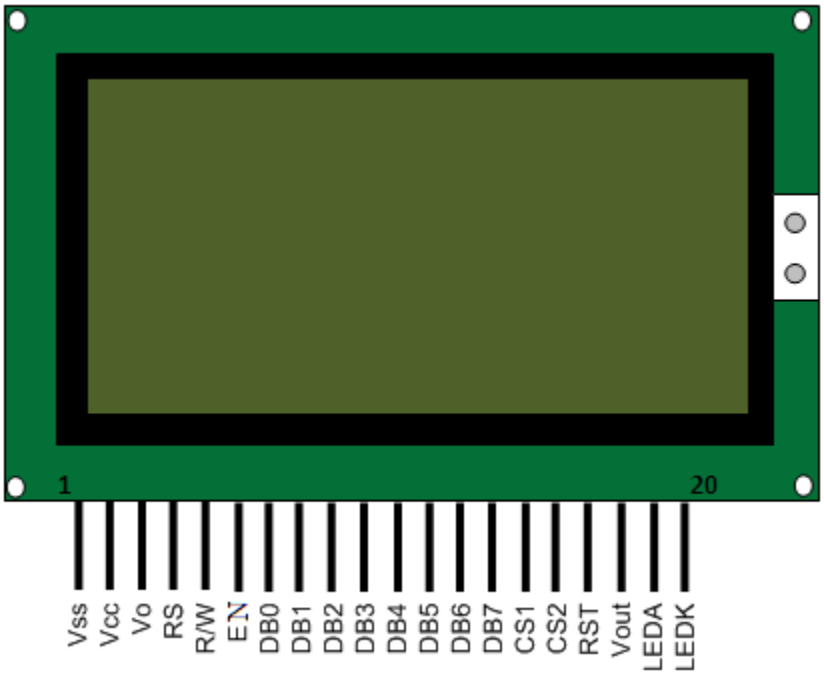
The 16x2 Character LCDs have their own limitations; they can only display characters of certain dimensions. The Graphical LCDs are thus used to display customized characters and images. The Graphical LCDs find use in many applications; they are used in video games, mobile phones, lifts etc. as display units.

1. 128x64 LCD implies 128 columns and 64 rows. In total there are (128x64 = 1024) pixels.

2. 128x64 LCD is divided equally into two halves. Each half is controlled by a separate controller and consists of 8 pages. In above diagram, CS stands for Controller Select.

3. Each page consists of 8 rows and 64 columns. So two horizontal pages make 128 (64x2) columns and 8 vertical pages make 64 rows (8x8).

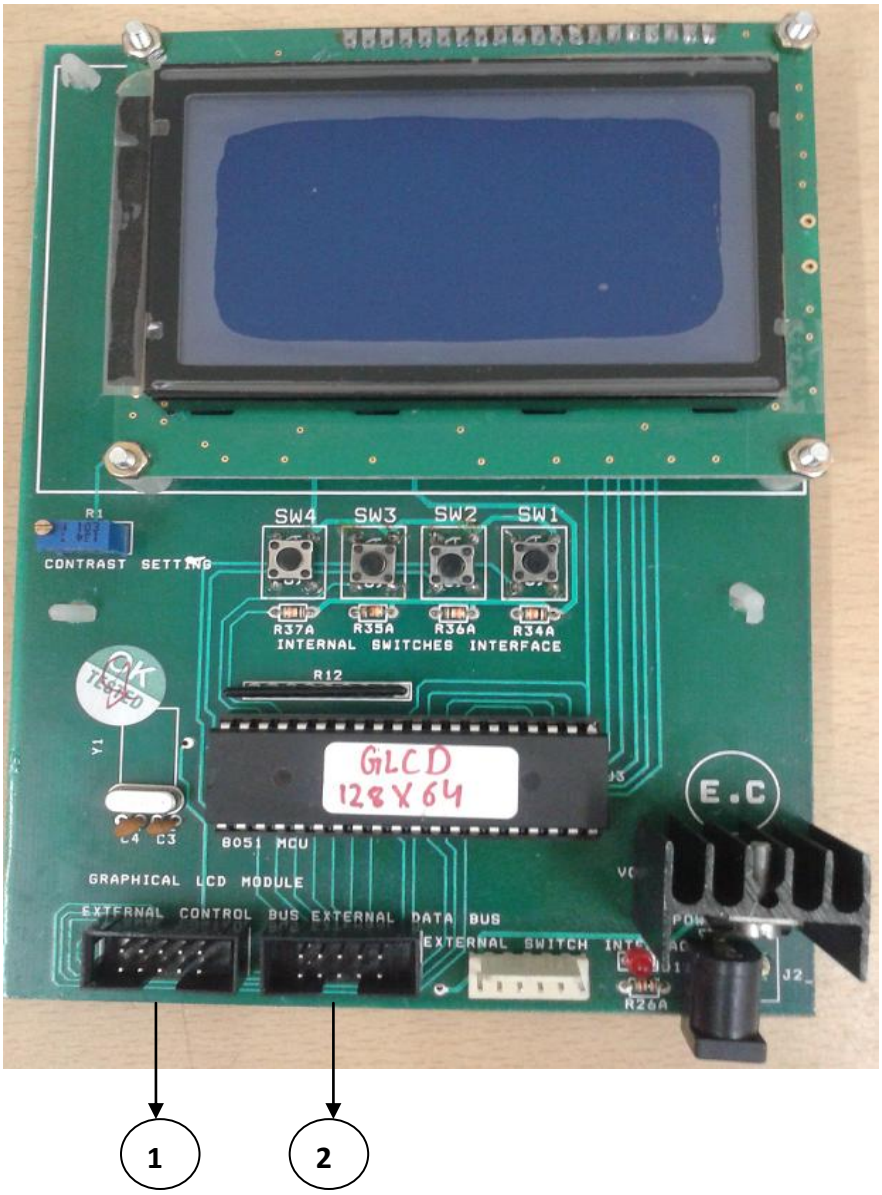
Pin Diagram:



Pin Description:

Pin no.	Function	Name
1	Ground (0 V)	Vss
2	Supply voltage; 5V	Vcc
3	Contrast adjustment	Vo
4	High to display data; Low for instruction code	Register select (RS)
5	Low to write to the register; High to read from the register	Read/Write (R/W)
6	Reads data when high; Writes data at high to low transition (falling edge)	Enable (EN)
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Chip selection for IC1; Active high	CS1
16	Chip selection for IC2; Active high	CS2
17	Reset signal; Active low	RST
18	Output voltage for LCD driving	Vout
19	Backlight V_{CC} (5V)	LED A
20	Backlight Ground (0V)	LED K

VIEW OF GLCD 128 X 64



1 → EXTERNAL **CONTROL** BOX HEADER

2 → EXTERNAL **DATA** BOX HEADER

BOX HEADER PIN DESCRIPTION

EXTERNAL CONTROL BUS

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{DD} (SUPPLY)	6	CS2
2	DI	7	RST
3	RW	8	NC
4	E	9	NC
5	CS1	10	V_{SS} (GND)

EXTERNAL DATA BUS

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	DB4
2	DB0	7	DB5
3	DB1	8	DB6
4	DB2	9	DB7
5	DB3	10	GND

GLCD 240 X 128 INTERFACE

FEATURES

• Built-in controller (T6963C)
• 1/240 duty cycle
• Built-in N/V
• Temperature conpensation, option

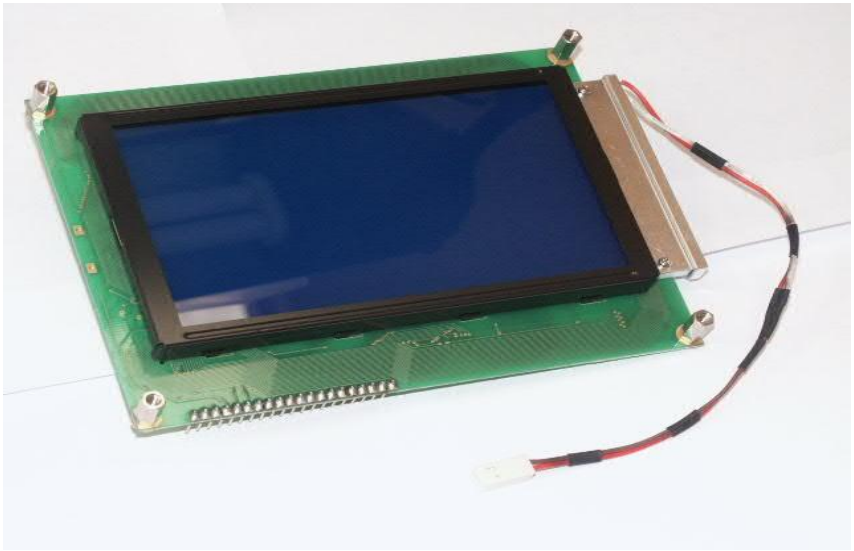
MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
Module Dimension	144.0 x 104.0	mm
Viewing Area	114.0 x 64.0	mm
Dot Size	0.4 x 0.4	mm
Dot Pitch	0.45 x 0.45	mm

ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	STANDARD VALUE MIN.	TYP.	MAX.	UNIT
Power Supply	VDD-VSS	4.75	5.0	5.25	V
Input Voltage	VI	- 0.3	–	VDD	V

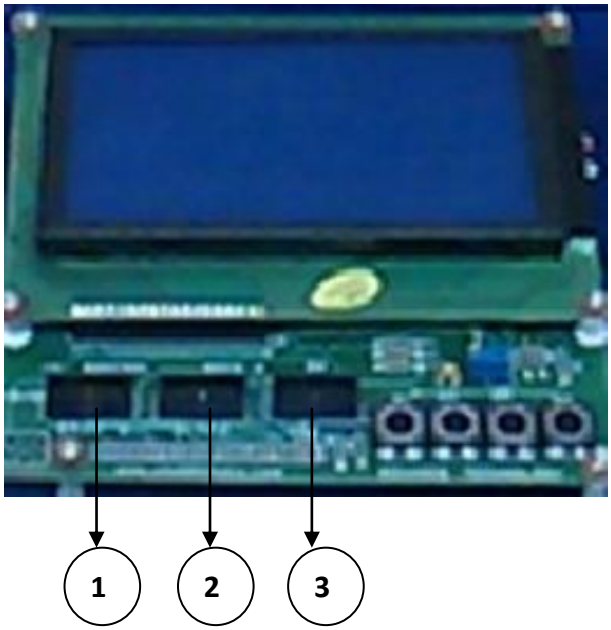
NOTE: VSS = 0 Volt, VDD = 5.0 Volt



PIN DESCRIPTION

Pin	Symbol	Level	Description
1	FG	GND	Frame Ground
2	GND	0V	Ground
3	VCC	5V	Power Supply+
4	VEE	-15V	Operating Voltage for LCD Drive
5	/WR	H/L	Write Signal
6	/RD	H/L	Read SIgnal
7	CE	L	Chip Enable Signal
8	C/D	H/L	H:Instruction Code L:Data Code
9	/RST	L	Reset Signal
10	DB0		Data Bus Line
11	DB1		Data Bus Line
12	DB2		Data Bus Line
13	DB3		Data Bus Line
14	DB4		Data Bus Line
15	DB5		Data Bus Line
16	DB6		Data Bus Line
17	DB7		Data Bus Line
18	FS	H/L	Fonts Selection (H:6*8 dots;L: 8*8 dots)
19	A	+5V	LED Backlight Anode
20	K	0V	LED Backlight Cathode

View of GLCD 240 X 128



1 → J15 (EXTERNAL **CONTROL)**

2 → J14 (EXTERNAL **DATA)**

3 → J16 (EXTERNAL **SWITCHES)**

BOX HEADER PIN DESCRIPTION

J15 EXTERNAL CONTROL

PIN NO.	SIGNAL	PIN NO.	SIGNAL
	V_{CC}	4	RST
0	WR	5	FS
1	RD	6	NC
2	CE	7	NC
3	CD		GND

J14 EXTERNAL DATA

PIN NO.	SIGNAL	PIN NO.	SIGNAL
-	V_{CC}	4	D4
0	D0	5	D5
1	D1	6	D6
2	D2	7	D7
3	D3	-	GND

J16 EXTERNAL SWITCHES

PIN NO.	SIGNAL	PIN NO.	SIGNAL
-	V_{CC}	4	NC
0	SW1	5	NC
1	SW2	6	NC
2	SW3	7	NC
3	SW4	-	GND

WIRELESS INTERFACE

RADIO FREQUENCY INTERFACE (RF TX & RX)

The RX – ASK is an ASK Hybrid receiver module. It is a effective low cost solution for using 433 MHZ. The TX-ASK is an ASK hybrid transmitter module. TX-ASK is designed by the saw resonator, with an effective low cost, small size and simple to use for designing.

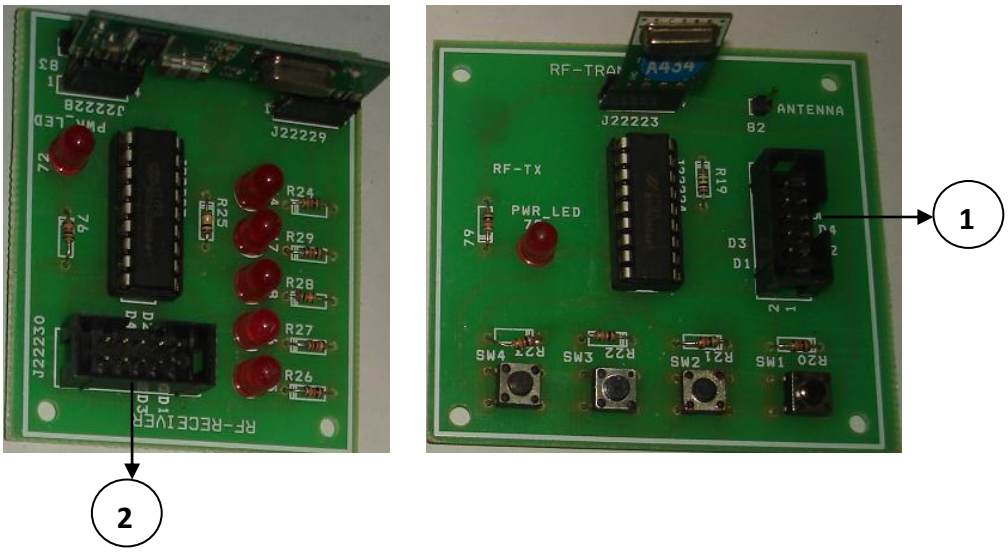
FEATURES

- Range in open space (Standard Conditions): 100 Meters
- RX Receiver Frequency: 433 MHz
- RX Typical Sensitivity: 105 Dbm
- RX Supply Current: 3.5 mA
- RX IF Frequency: 1MHz
- Low Power Consumption
- Easy For Application
- RX Operating Voltage: 5V
- TX Frequency Range: 433.92 MHz
- TX Supply Voltage: 3V ~ 6V
- TX Out Put Power: 4 ~ 12 Dbm

APPLICATIONS

1. Remote Controls
2. Automation System
3. Wireless Security System
4. Sensor Reporting
5. Car Security System
6. Remote Keyless Entry

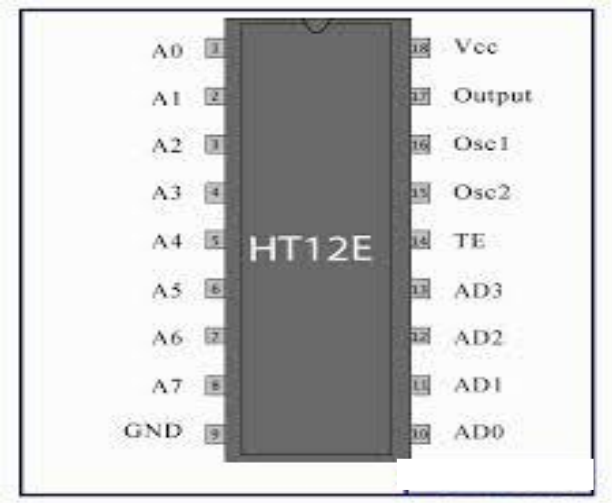
VIEW OF RF TX & RX INTERFACE



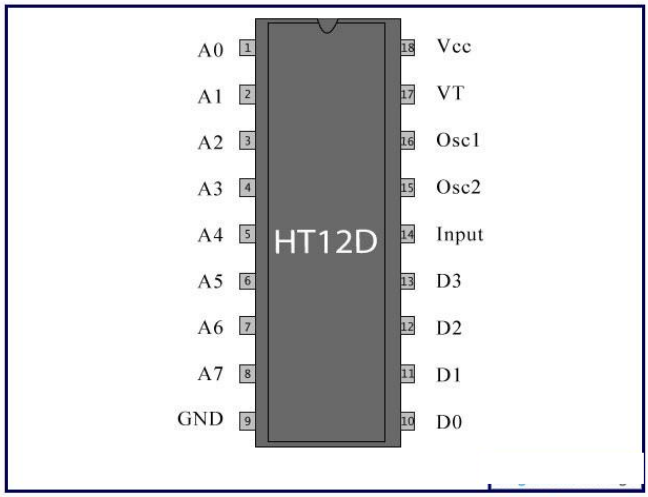
1 → TRANSMITTER BOX HEADER

2 → RECEIVER BOX HEADER

PIN DESCRIPTION



HT 12D USED IN RF RECEIVER



HT 12E USED IN RF TRANSMITTER

BOX HEADER PIN DESCRIPTION

TRANSMITTER

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	AD0 of HT12E (pin no 10)	7	NC
3	AD1 of HT12E (pin no 11)	8	NC
4	AD2 of HT12E (pin no 12)	9	NC
5	AD3 of HT12E (pin no 13)	10	GND

RECEIVER

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	D0 of HT12D (pin no 10)	7	NC
3	D1 of HT12D (pin no 11)	8	NC
4	D2 of HT12D (pin no 12)	9	NC
5	D3 of HT12D (pin no 13)	10	GND

Where **D0, D1, D2, D3** connected to **Led D15, D16, D18, D17** respectively

(IR)RC5 PROTOCOL INTERFACE

The RC-5 protocol was developed by Philips in the late 1980s as a semi-proprietary consumer IR (infrared) remote control communication protocol for consumer electronics. However, it was also adopted by most European manufacturers, as well as many US manufacturers of specialty audio and video equipment. The other main protocol used by consumer electronics manufacturers is the NEC protocol. This protocol is largely used by Japanese manufacturers and assigns each brand with its own unique header(s). Each brand is then free to create any command set it wishes. The advantage of the NEC protocol is that there cannot be any interference between remote handsets of different pieces of equipment. The advantage of the RC-5 protocol is that (when properly followed) any CD handset (for example) may be used to control any brand of CD player using the RC-5 protocol.The basics of the protocol are well known. The handset contains a keypad and a transmitter integrated circuit (IC) driving an IR LED. The command data is a Manchester coded bit stream modulating a 36 kHz carrier. (Often the carrier used is 38 kHz or 40 kHz, apparently due to misinformation about the actual protocol.) The IR signal from the transmitter is detected by a specialized IC with an integral photo-diode, and is amplified, filtered, and demodulated so that the receiving device can act upon the received command. RC-5 only provides a one-way link, with information traveling from the handset to the receiving unit.

The command comprises 14 bits:

- A start bit, which is always logic 1 and allows the receiving IC to set the proper gain.
- A field bit, which denotes whether the command sent is in the lower field (logic 1 = 0 to 63 decimal) or the upper field (logic 0 = 64 to 127 decimal). The field bit was added later by Philips when it was realized that 64 commands per device were insufficient. Previously, the field bit was combined with the start bit. Many devices still use this original system.
- A control bit, which toggles with each button press. This allows the receiving device to distinguish between two successive button presses (such as "1", "1" for "11") as opposed to the user simply holding down the button and the repeating commands being interrupted by a person walking by, for example.
- A five-bit system address that selects one of 32 possible systems.
- A six-bit command that (in conjunction with the field bit) represents one of the 128 possible RC-5 commands.

The 36 kHz carrier frequency was chosen to render the system immune to interference from TV scan lines. Since the repetition of the 36 kHz carrier is 27.778 μs and the duty factor is 25%, the carrier pulse duration is 6.944 μs. Since the high half of each symbol (bit) of the RC-5 code word contains 32 carrier pulses, the symbol period is 64 x 27.778 μs = 1.778 ms, and the 14 symbols (bits) of a complete RC-5 code word takes 24.889 ms to transmit. The code word is repeated every 113.778 ms (4096 / 36 kHz) as long as a key remains pressed. (Again, please note that these timings are not strictly followed by all manufacturers, due to a lack of widespread distribution of accurate information on the RC-5 protocol.)

The RC5 remote decoder board is based on the IC ST3617 which decodes the received remote control data and output 16 bit serial data output. The decoded data contains various information like Toggle Bit, Address of Remote and Command Key Pressed. This decoded information from transmitter can be used in various ways to make any remote controlled application.

IR-RC5 CONNECTOR

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	TX	7	NC
3	NC	8	NC
4	NC	9	NC
5	NC	10	GND

GSM INTERFACE

WHAT IS GSM…???

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones. As of 2014 it has become the default global standard for mobile communications - with over 90% market share, operating in over 219 countries and territories.

2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuit-switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS).

Subsequently, the 3GPP developed third-generation (3G) UMTS standards followed by fourth-generation (4G) LTE Advanced standards, which do not form part of the ETSI GSM standard.

"GSM" is a trademark owned by the GSM Association. It may also refer to the (initially) most common voice codec used,

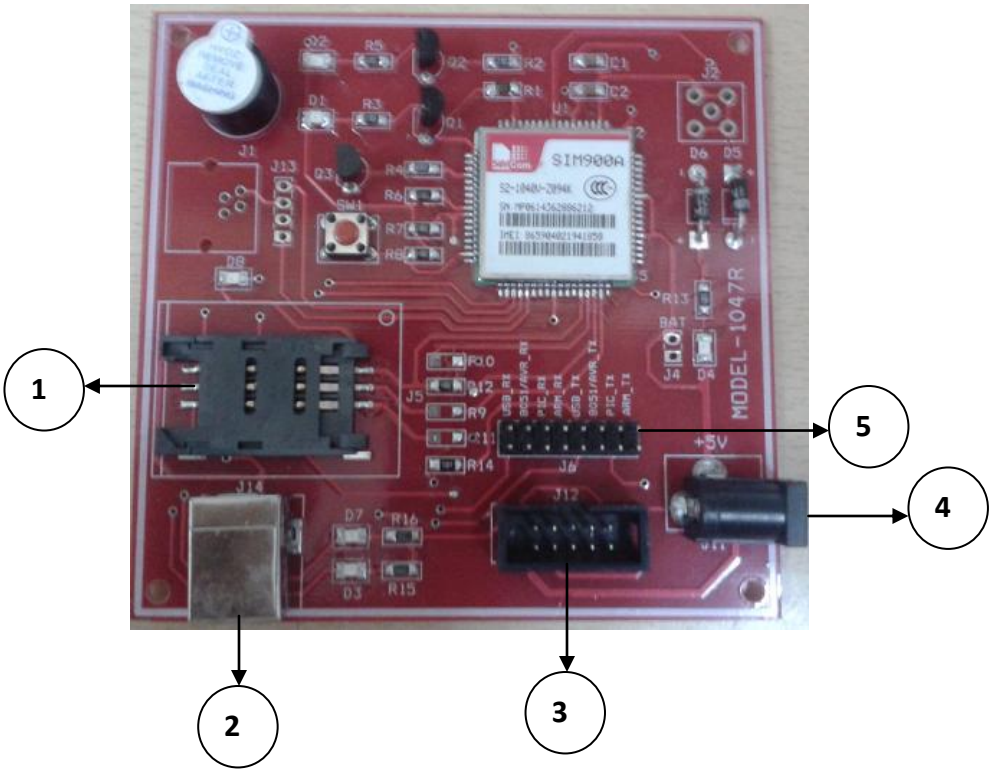
Description :

GSM/GPRS TTL UART Modem is built with Dual Band GSM/GPRS engine- SIM900, works on frequencies 900/ 1800 MHz. The Modem is coming with selectable interfacing voltage, which allows you to connect 5V & 3V3 microcontroller directly without any level conversion chips. The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface.

GSM/GPRS Modem Features

- High Quality Product (Not hobby grade)
- Dual-Band GSM/GPRS 900/ 1800 MHz
- 3V3 & 5V interface for direct communication with MCU kit
- Configurable baud rate
- SMA connector with GSM Antenna.
- SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Audio interface Connector
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 5VV DC

VIEW OF GSM INTERFACE



1 → SIM CARD HOLDER

2 → USB CONNECTOR

3 → **J12** BOX HEADER

4 → +5V SUPPLY

5 → JUMPERS SELECTION (**J6**)

BOX HEADER PIN DESCRIPTION

J12 (GSM CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	**8051** RX, **AVR** RX, **ARM** TX	7	NC
3	**8051** TX, **AVR** TX, **ARM** RX	8	PIC TX
4	NC	9	PIC RX
5	NC	10	GND

J6 (JUMPERS CONNECTION)

6. **USB :-** Insert Jumpers in **USB RX & USB TX**
7. **8051 Controller :-** Insert Jumpers in **8051 RX & 8051 TX**
8. **PIC Controller :-** Insert Jumpers in **PIC RX & PIC TX**
9. **AVR Controller :-** Insert Jumpers in **8051 RX & 8051 TX (**Both 8051 & AVR have same pins)
10. **ARM Controller :-** Insert Jumpers in **ARM RX & ARM TX**

RFID INTERFACE

WHAT IS RFID ?

RFID stands for **Radio-Frequency Identification**. The acronym refers to a tall electronic devices that consist of a Tall chip and an antenna. The chip typically is capable of carrying 2,000 bytes of data or less.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

HOW RFID WORKS

How does RFID work? A radio-frequency identification system has three parts:

- A scanning antenna
- A transceiver with a decoder to interpret the data
- A transponder - the radio-frequency tag - that has been programmed with information

The scanning antenna puts out radio-frequency signals in a relatively short range. The RF radiation does two things; it provides a means of communicating with the transponder tag (the RFID chip) AND (in the case of passive RFID tags) it provides the RFID device with the energy to communicate. This is an absolutely key part of the technology; RFID devices do not need to contain batteries, and can therefore remain usable for very long periods of time (maybe decades).

The scanning antennas can be permanently affixed to a surface; handheld antennas are also available. They can take whatever shape you need; you could build them into a door frame to accept data from persons or objects passing through.

When an RFID tag passes through the field of the scanning antenna, it detects the activation signal from the antenna. That "wakes up" the RFID chip, and it tranATits the information on its microchip to be picked up by the scanning antenna.

In addition, the RFID tag may be of one of two types. Active RFID tags have their own power source; the advantage of these tags is that the reader can be much farther away and still get the signal. Even though some of these devices are built to have up to a 10 year life span, they have limited life spans. Passive RFID tags, however, do not require batteries, and can be much ATaller and have a virtually unlimited life span.

RFID tags can be read in a wide variety of circumstances, where barcodes or other optically read technologies are useless. The tag need not be on the surface of the object (and is therefore not subject to wear), the read time is typically less than 100 milliseconds, and large numbers of tags can be read at once rather than item by item.

RFID Reader Module

This is a low frequency (125Khz) RFID reader with serial outputwith at range of 8-12cm. It is a compact units with built in antenna and can be directly connectedto the PC using RS232 protocol.

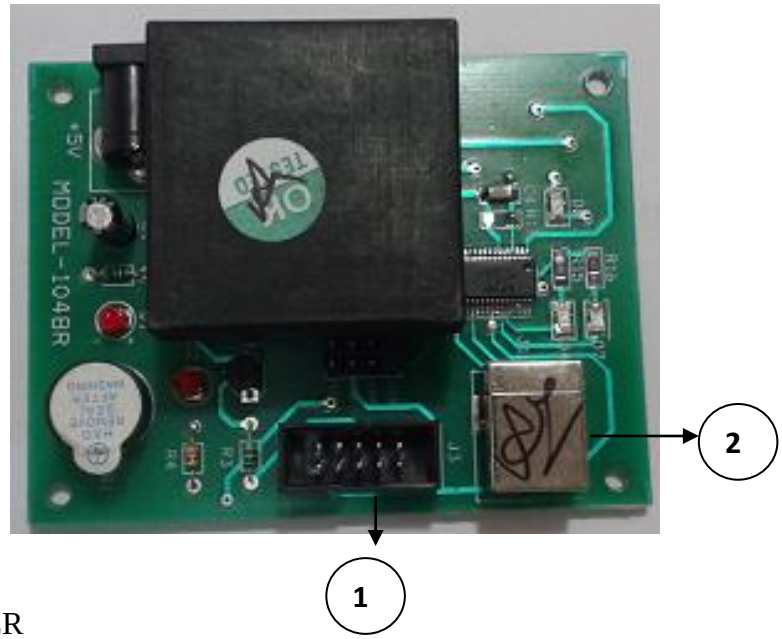
Features

- Serial and TTL output.
- Along with two RFID cards.
- Excellent read performance without an external circuit
- Compact size and cost-effective

Applications

- Access control
- Handheld readers
- Asset management

VIEW OF RFID INTERFACE



1 → **J3** BOX HEADER

2 → USB CONNECTOR

BOX HEADER PIN DESCRIPTION

J3 (RFID CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
	V_{CC}	4	NC
0	**8051** RX, **AVR** RX, **ARM** TX	5	NC
1	**8051** TX, **AVR** TX, **ARM** RX	6	PIC TX
2	NC	7	PIC RX
3	NC		GND

J1 (JUMPERS CONNECTION)

1. **USB :-** Insert Jumpers in **USB**
2. **8051 or AVR Controller :-** Insert Jumpers in **8051**
3. **PIC Controller :-** Insert Jumpers in **PIC**
4. **ARM Controller :-** Insert Jumpers in **ARM**

BLUETOOTH INTERFACE

What is Bluetooth??

Bluetooth is a technology standard for electronic devices to communicate with each other using short-range radio. It is often referred to as a "cable replacement" technology, because it is commonly used to connect things, such as cameras, headsets, and mobile phones that have traditionally been connected by wires. Bluetooth is much more than simply a way to cut the cord between today's existing electronic devices. It is an enabling technology that will take these devices to new levels of productivity and functionality and enable a whole new class of devices designed with communications and connectivity in mind.

The Bluetooth Special Interest Group (SIG) defines Bluetooth a bit more broadly as the" Worldwide specification for small-form-factor, low-cost radio solutions that provide links between mobile computers, mobile phones, other portable devices, and connectivity to the Internet."

Introduction to Bluetooth module

This module enables you to wireless transmit & receive serial data. It is a drop in replacement for wired serial connections allowing transparent two way data communication. You can simply use it for serial port replacement to establish connection between MCU or embedded project and PC for data transfer.

View of Bluetooth Module

Features

- 3.3V power operation
- UART interface
- 10 meters range
- Easy to use
- Minimum External Components
- Status LEDs

Applications

- Wireless Telemetry
- Remote Data Logging
- Robotics
- Sensor Monitoring
- Remote Programming

Specifications

- Bluetooth protocol v2.0
- Range 10 meters
- Frequency: 2.4 Ghz ISM
- Modulation: GFSK
- Transmit power: 4dBm
- Sensitivity: 84dBm
- Rate: 2.1Mbps(Max) /160kbps(Async); 1Mbps(Sync)
- Authentication & Encryption
- Power Supply: +3.3 VDC 50mA
- Operating Temperate: -20C to +55 C
- Dimensions: 26.9 mm x 13 mm x 2.2 mm

Modes of operation

These modules have two modes: master and slave. You can set the module mode (master or slave) of the device by AT commands.

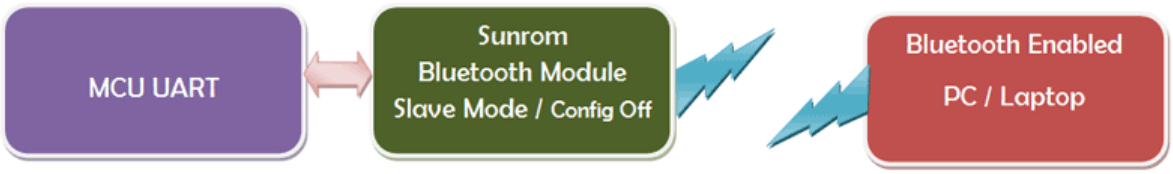
The main function of Bluetooth serial module is replacing the serial port line, such as:

MCU to MCU communication

There are two MCUs want to communicate with each other. One connects to Bluetooth master device while the other one connects to slave device. Their connection can be built once the pair is established. This Bluetooth connection is equivalently liked to a serial port line connection including RXD, TXD signals. And they can use the Bluetooth serial module to communicate with each other. Communication between two of these Bluetooth modules requires at least two conditions: (1) One module must be master and another module should be slave. (2) The password must be same.

MCU to PC/Smart Phone Communication

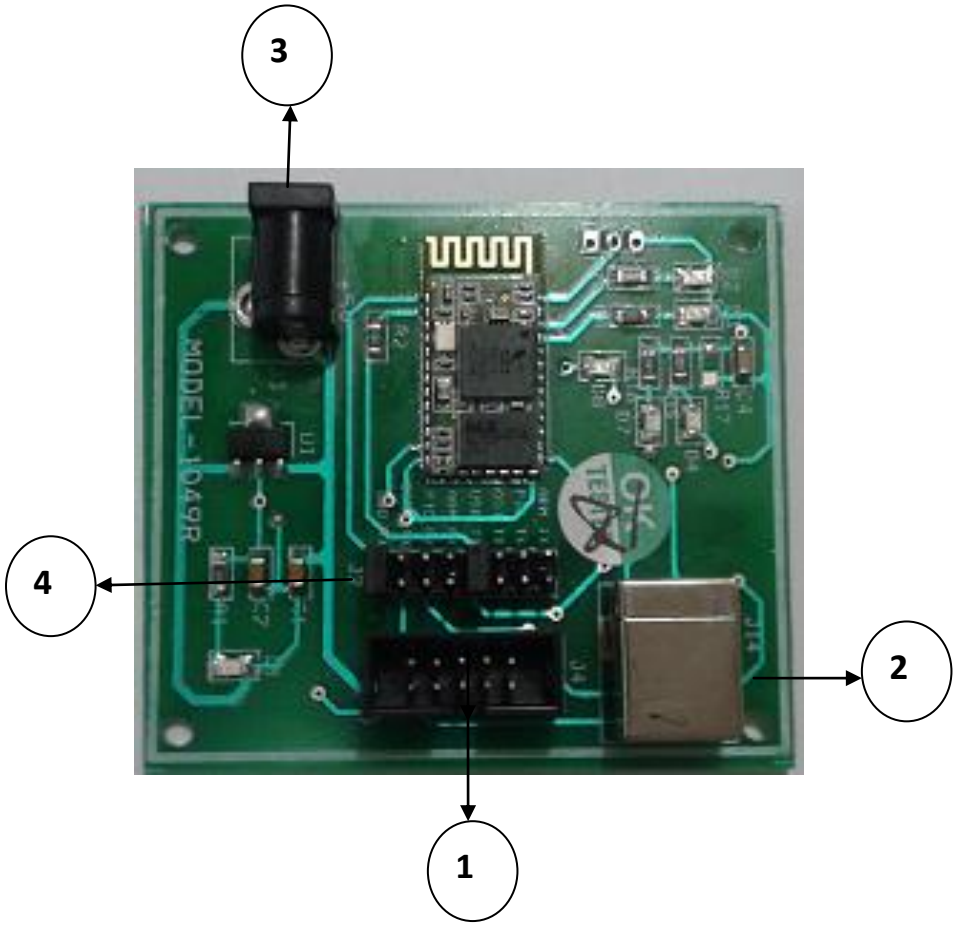
When MCU has Bluetooth salve module, it can communicate with Bluetooth adapter of computers and smart phones. Then there is a virtual communicable serial port line between MCU and computer or smart phone. Driver is not required when using the module with PC or Smart phone.



MCU to Other Slave device interfacing

The other bluetooth devices in the market mostly are salve devices, such as Bluetooth printer, Bluetooth GPS. So, we can use master module to make pair and communicate with them.

View of Bluetooth interface



1 → **J4** BOX HEADER

2 → USB CONNECTOR

3 → POWER SUPPLY

4 → J2 (JUMPER SELECTION)

BOX HEADER PIN DESCRIPTION

J4 (BLUETOOTH CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
	V_{CC}	4	NC
0	**8051** RX, **AVR** RX, **ARM** TX	5	NC
1	**8051** TX, **AVR** TX, **ARM** RX	6	PIC TX
2	NC	7	PIC RX
3	NC		GND

J2 (JUMPERS CONNECTION)

11. USB :- Insert Jumpers in **USB RX & USB TX**

12. 8051 Controller :- Insert Jumpers in **8051 RX & 8051 TX**

13. PIC Controller :- Insert Jumpers in **PIC RX & PIC TX**

14. **AVR Controller :-** Insert Jumpers in **8051 RX & 8051 TX (**Both 8051 & AVR have same pins)

15. ARM Controller :- Insert Jumpers in **ARM RX & ARM TX**

WI-FI INTERFACE

This is a fully self-contained small form-factor, Wi-Fi module, which provide a wireless interface to any equipment with a Serial UART interface for data transfer.

VIEW OF WI-FI MODULE

Features

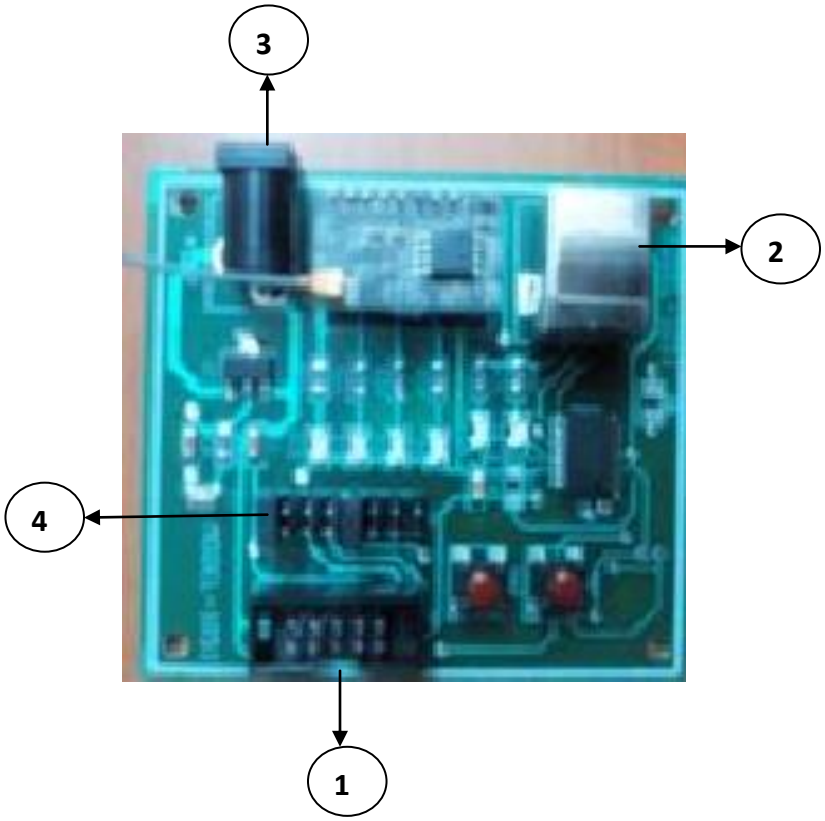
- Single stream Wi-Fi @ 2.4 GHz with support for WEP security mode as well as WPA/WPA2
- Based on Self-developed High Cost Performance MCU
- Ultra-low-power operation with all kinds of power-save modes.
- Includes all the protocol and configuration functions for Wi-Fi connectivity.
- Support Smart Link Function
- Support Dial Switch to Control Power
- Support Max 3 Channel PWM Output
- Compact surface mount module 22mm x 13.5mm x 6mm
- Low power RTOS and drivers.
- FCC Certified. RoHS and CE compliant.
- Single supply 3.3V operation
- Ultra low power: standby power consumption 10ma@3.3v only
- Tiny demensions: 22*13.5*6mm
- Support WPS function, have been tested with more than 50 types of routers
- Support AP/STA/AP+STA mode and 5 channnel TCP link

Applications Areas

- Remote equipment monitoring
- Asset tracking and telemetry
- Security
- Industrial sensors and controls
- Home automation
- Medical devices

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +16 +/-2dBm (@11Mbps)
		802.11g: +14 +/-2dBm (@54Mbps)
		802.11n: +13 +/-2dBm (@HT20, MCS7)
	Receiver Sensitivity	802.11b: -93 dBm (@11Mbps ,CCK)
		802.11g: -85 dBm (@54Mbps, OFDM)
		802.11n: -82 dBm (@HT20, MCS7)
	Antenna Option	External:I-PEX Connector
Hardware Parameters	Data Interface	UART
		PWM, GPIO
	Operating Voltage	2.8~3.6V
	Operating Current	Peak [Continuous TX]: ~200mA Normal [WiFi ON/OFF, DTIM=100ms]: Average. ~12mA, Peak: 200mA Standby [WiFi Shutdown]: <200uA Power Down Switch: <10uA
	Operating Temp.	-40℃- 85℃
	Storage Temp.	-45℃- 125℃
	Dimensions and Size	22mm x 13.5mm x 6mm
	External Interface	1x10, 2mm DIP
Software Parameters	Network Type	STA /AP/STA+AP
	Security Mechanisms	WEP/WPA-PSK/WPA2-PSK
	Encryption	WEP64/WEP128/TKIP/AES
	Update Firmware	Local Wireless, Remote
	Customization	Web Page Upgrade
	Network Protocol	IPv4, IPv6,TCP/UDP/FTP/HTTP
	User Configuration	AT+instruction set. Android/ iOS Smart Link APP tools

VIEW OF WI-FI INTERFACE



1 → **J4** BOX HEADER

2 → USB CONNECTOR

3 → POWER SUPPLY

4 → **J2** (JUMPER SELECTION)

BOX HEADER PIN DESCRIPTION

J4 (WI-FI CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	V_{CC}	6	NC
2	**8051** RX, **AVR** RX, **ARM** TX	7	NC
3	**8051** TX, **AVR** TX, **ARM** RX	8	PIC TX
4	NC	9	PIC RX
5	NC	10	GND

J2 (JUMPERS CONNECTION)

16. USB :- Insert Jumpers in **USB RX & USB TX**

17. 8051 Controller :- Insert Jumpers in **8051 RX & 8051 TX**

18. PIC Controller :- Insert Jumpers in **PIC RX & PIC TX**

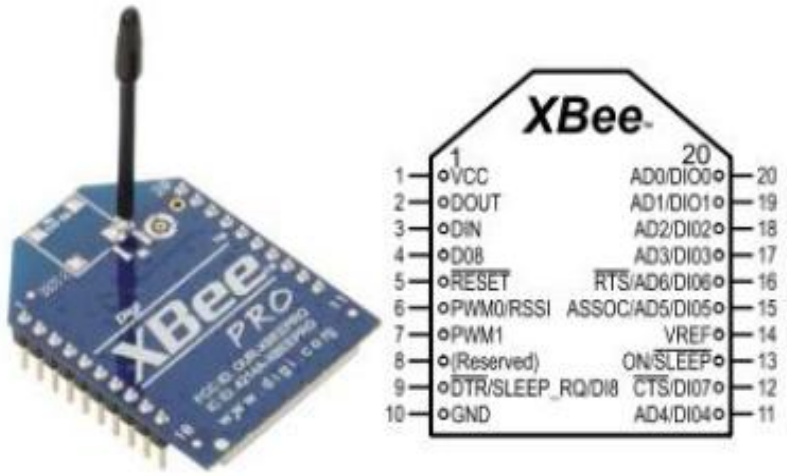
19. **AVR Controller :-** Insert Jumpers in **8051 RX & 8051 TX (**Both 8051 & AVR have same pins)

20. ARM Controller :- Insert Jumpers in **ARM RX & ARM TX**

XBEE INTERFACE

Description: This is the very popular 2.4GHz XBee module from Digi. These modules take the 802.15.4 stack (the basis for Zigbee) and wrap it into a simple to use serial command set. These modules allow very reliable and simple communication between microcontrollers, computers, systems, really anything with a serial port! Point to point and multi-point networks are supported.

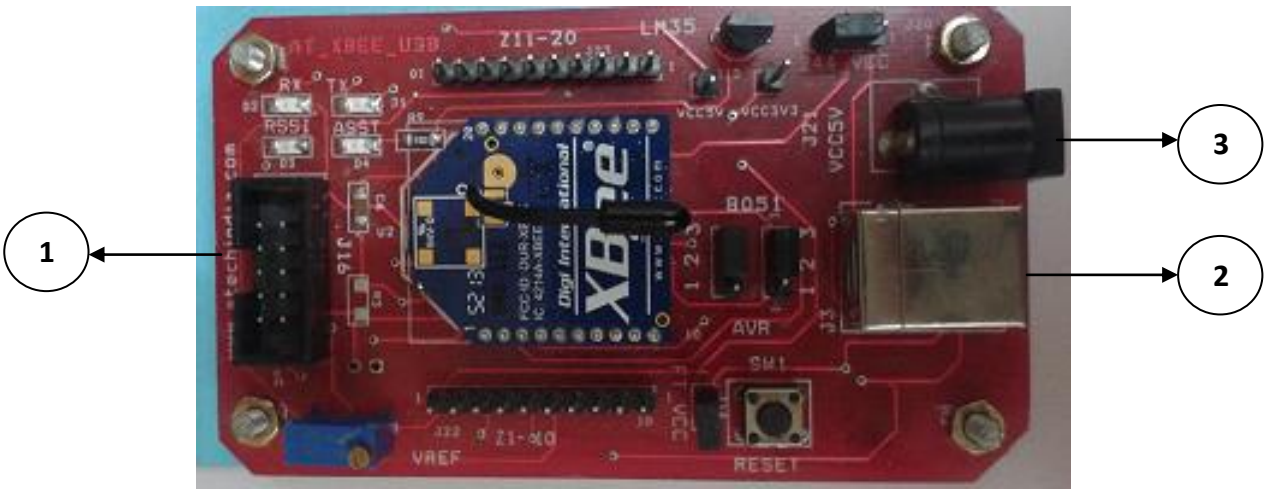
VIEW OF XBEE MODULE (S1)



Features:

- 3.3V @ 50mA
- 250kbps Max data rate
- 1mW output (+0dBm)
- 300ft (100m) range
- Fully FCC certified
- 6 10-bit ADC input pins
- 8 digital IO pins
- 128-bit encryption
- Local or over-air configuration
- AT or API command set
- Trace Antenna

View of XBEE interface



1 → **J16** BOX HEADER

2 → USB CONNECTOR

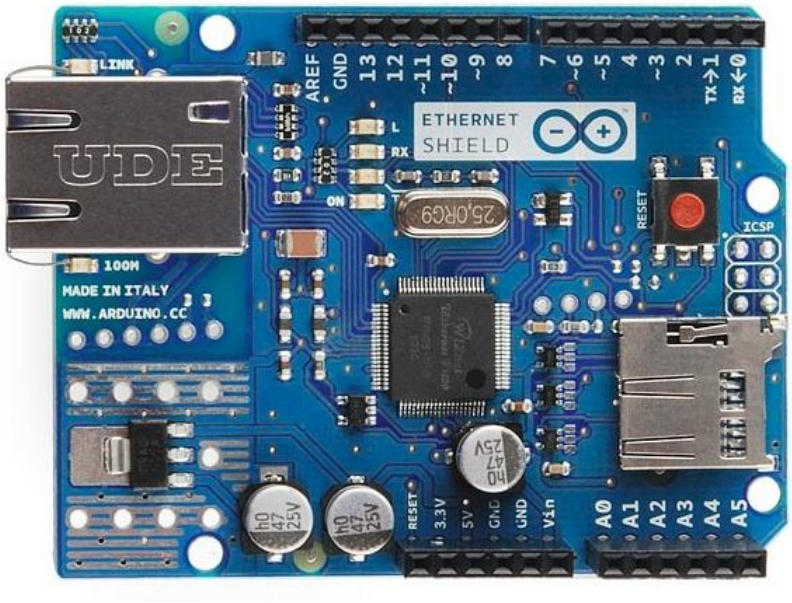
3 → POWER SUPPLY

BOX HEADER PIN DESCRIPTION

J16 (XBEE CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
	V_{CC}	4	NC
0	DOUT	5	NC
1	DIN	6	NC
2	ON/SLEEP	7	NC
3	NC	GND	GND

ETHERNET INTERFACE



Overview

The Arduino Ethernet Shield connects your Arduino to the internet in mere minutes. Just plug this module onto your Arduino board, connect it to your network with an RJ45 cable (not included) and follow a few simple instructions to start controlling your world through the internet. As always with Arduino, every element of the platform – hardware, software and documentation – is freely available and open-source. This means you can learn exactly how it's made and use its design as the starting point for your own circuits. Hundreds of thousands of Arduino boards are already fueling people's creativity all over the world, everyday. Join us now, Arduino is you!

- Requires an Arduino board (not included)
- Operating voltage 5V (supplied from the Arduino Board)
- Ethernet Controller: W5100 with internal 16K buffer
- Connection speed: 10/100Mb
- Connection with Arduino on SPI port

Description

The Arduino Ethernet Shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use the

Ethernet library to write sketches which connect to the internet using the shield. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top.

The most recent revision of the board exposes the 1.0 pinout on rev 3 of the Arduino UNO board.

The Ethernet Shield has a standard RJ-45 connection, with an integrated line transformer and Power over Ethernet enabled.

There is an onboard micro-SD card slot, which can be used to store files for serving over the network. It is compatible with the Arduino Uno and Mega (using the Ethernet library). The onboard microSD card reader is accessible through the SD Library. When working with this library, SS is on Pin 4. The original revision of the shield contained a full-size SD card slot; this is not supported.

The shield also includes a reset controller, to ensure that the W5100 Ethernet module is properly reset on power-up. Previous revisions of the shield were not compatible with the Mega and need to be manually reset after power-up.

The current shield has a Power over Ethernet (PoE) module designed to extract power from a conventional twisted pair Category 5 Ethernet cable:

- IEEE802.3af compliant
- Low output ripple and noise (100mVpp)
- Input voltage range 36V to 57V
- Overload and short-circuit protection
- 9V Output
- High efficiency DC/DC converter: typ 75% @ 50% load
- 1500V isolation (input to output)

NB: the Power over Ethernet module is proprietary hardware not made by Arduino, it is a third party accessory.

The shield does not come with the PoE module built in, it is a separate component that must be added on.

Arduino communicates with both the W5100 and SD card using the SPI bus (through the ICSP header). This is on digital pins 10, 11, 12, and 13 on the Uno and pins 50, 51, and 52 on the Mega. On both boards, pin 10 is used to select the W5100 and pin 4 for the SD card. These pins cannot be used for general I/O. On the Mega, the hardware SS pin, 53, is not used to select either the W5100 or the SD card, but it must be kept as an output or the SPI interface won't work.

Note that because the W5100 and SD card share the SPI bus, only one can be active at a time. If you are using both peripherals in your program, this should be taken care of by the corresponding libraries. If you're not using one of the peripherals in your program, however, you'll need to explicitly deselect it. To do this with the SD card, set pin 4 as an output and write a high to it. For the W5100, set digital pin 10 as a high output.

The shield provides a standard RJ45 ethernet jack.

The reset button on the shield resets both the W5100 and the Arduino board.

The shield contains a number of informational LEDs:

- PWR: indicates that the board and shield are powered
- LINK: indicates the presence of a network link and flashes when the shield transmits or receives data
- FULLD: indicates that the network connection is full duplex
- 100M: indicates the presence of a 100 Mb/s network connection (as opposed to 10 Mb/s)
- RX: flashes when the shield receives data
- TX: flashes when the shield sends data
- COLL: flashes when network collisions are detected

The solder jumper marked "INT" can be connected to allow the Arduino board to receive interrupt-driven notification of events from the W5100, but this is not supported by the Ethernet library. The jumper connects the INT pin of the W5100 to digital pin 2 of the Arduino.

BOX HEADER PIN DESCRIPTION

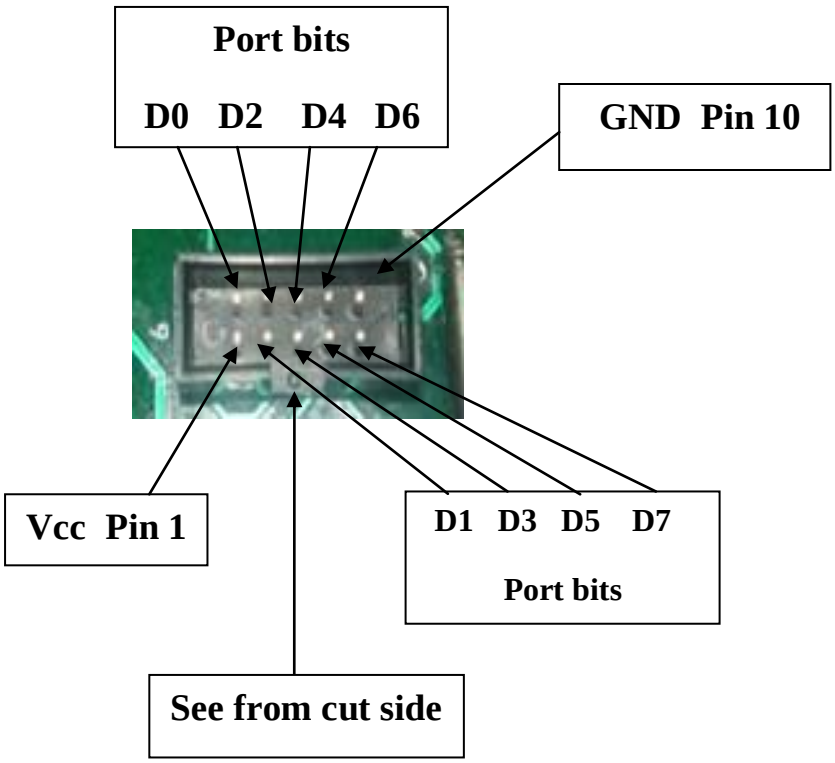
(AURDINO SD CARD CONNECTOR)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
	V_{CC}	4	DO/MISO
0	NC	5	SCK
1	NC	6	NC
2	CS	7	NC
3	DI/MOSI	GND	GND

NOTE:-

The codes of all the interfaces provided in the CD .

10 PIN BOX HEADER CONNECTOR



CONNECTORS