A NEW TELEMEDICINE SYSTEM FOR THE HOME MONITORING OF LUNG FUNCTION IN PATIENTS WITH OBSTRUCTIVE RESPIRATORY DISEASE

A PROJECT REPORT

Submitted by

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In partial fulfilment for the award of the degree

of

Bachelor of Engineering

in

Electronics and Instrumentation Engineering

KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE

April 2011

BONAFIDE CERTIFICATE

Certified that this project report "**A NEW TELEMEDICINE SYSTEM FOR THE HOME MONITORING OF LUNG FUNCTION IN PATIENTS WITH OBSTRUCTIVE RESPIRATORY DISEASE**" is the bonafide work of GANESH RAJ.V, MARATHAKAM.N, NIRANCHANA.D, SANGEETHA.L who carried out the project under my supervision.

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18/04/11	18/4/11
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ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would be incomplete without mentioning the names of people who made it possible, whose constant guidance and encouragement crowns all efforts with success.

We convey our earnest thanks to **Dr. S. Ramachandran** , Principal, Kumaraguru College of Technology, Coimbatore for the successful completion of the project work.

We gladly take this opportunity to express a special word of thanks to Prof. **R. Annamalai,** Head of the Department, Electronics and Instrumentation Engineering, Kumaraguru college of Technology, Coimbatore for encouraging us to do this work.

We would like to express our sincere thanks and deep sense of gratitude our Project Coordinator, **Mr. S. Arun Jayakar,** Senior Lecturer, Department of Electronics and Instrumentation Engineering and guide, **Mr.V.Athappan,** Asst Professor, Department of Electronics and Instrumentation Engineering as without whose guidance it would not have been possible for us to successfully complete the project.

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ABSTRACT

ABSTRACT

The aim of this project is to develop a real-time data processing algorithm for the automatic unsupervised assessment of the lung obstruction. A network architecture for the data transmission and a web based application for the storage and management of the data.

The results demonstrated a high reliability of the algorithm, the robustness of the data communication protocols and the effectiveness of the data management web portal.

Our system allows a reliable automatic home monitoring of lung obstruction and it will improve the efficiency of the management of respiratory patients through an improved tailoring of the clinical treatments and an early detection of exacerbations.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1BRIEF OVERVIEW

The objective of this project is to develop telemedicine system for the management of chronic diseases such as asthma and Chronic Obstructive Pulmonary Disease. This project is designed with PIC microcontroller which is used to accumulate and process the values from various sensors used in the project .

Depending upon the airflow rate, the values from respiration, pressure and flow are monitored continuously and it is transferred through the internet. Here, an alarm is used to indicate the abnormal condition.

This project can be conveniently used for the accurate and reproducible assessment of lung function on a daily basis, providing new insight on the pathophysiology of chronic obstructive diseases such as asthma.

1.2 BLOCK DIAGRAM

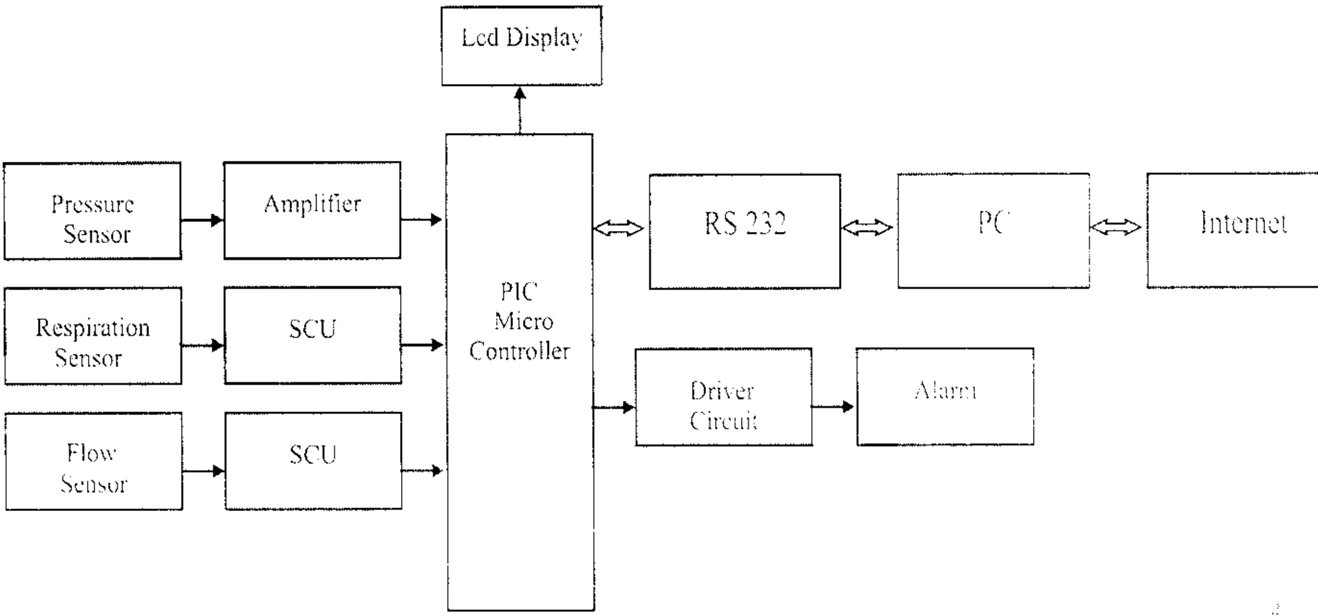


Fig 1.1 Block Diagram

CHAPTER 2

POWER SUPPLY

CHAPTER 2

POWER SUPPLY

2.1 DESCRIPTION

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

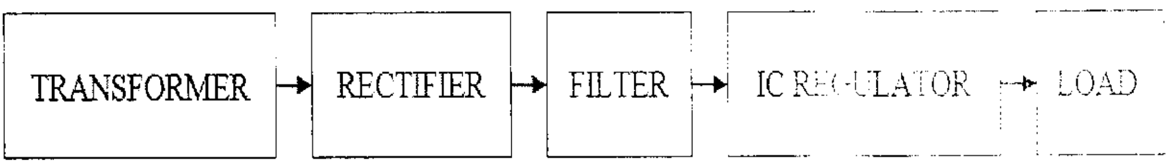


Fig 2.1 Block diagram of power supply

2.2 CIRCUIT DIAGRAM

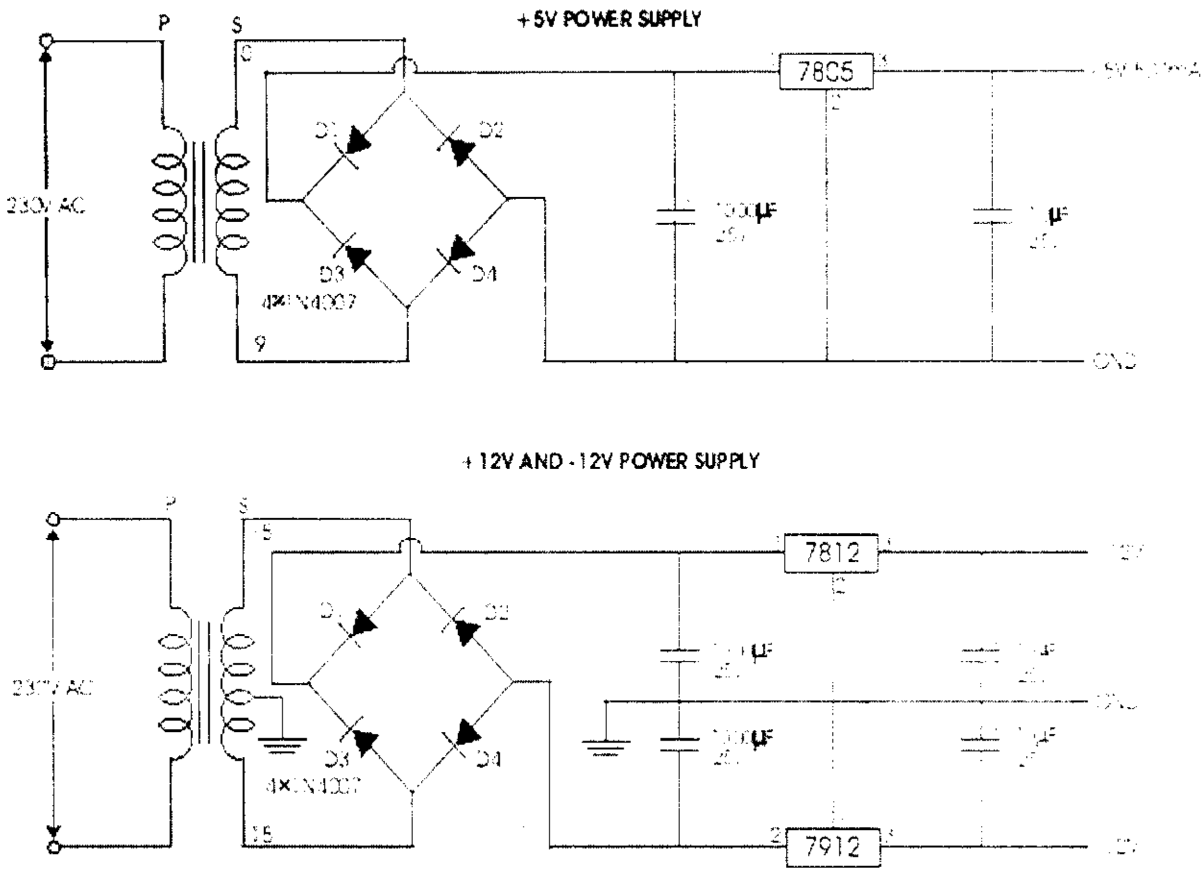


Fig 2.2 Power supply circuit

2.3 WORKING PRINCIPLE

TRANSFORMER

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op--amp. The advantages of using precision rectifier are it will give peak voltage output as DC , rest of the circuits will give only RMS output.

BRIDGE RECTIFIER

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

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

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

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

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2. through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

2.3 IC VOLTAGE REGULATORS

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

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

CHAPTER 3

CHAPTER 3

SENSORS

MEASUREMENT OF FLOW

The air flow rate is measured using the flow sensor. A turbine flow sensor with magnetic pick up is used to measure the flow. Here the rotating wheel is fixed in the inside pipe where the airflow has to measured. When the air is flowing with pressure, the wheel is rotating. The wheel rotation is monitored by the proximity sensor. The proximity sensor delivers the output in the form of pulse which is given to microcontroller. The number of pulses is equal to the volume of flow. The pulse rate is equal to rate of air flow in the pipe.

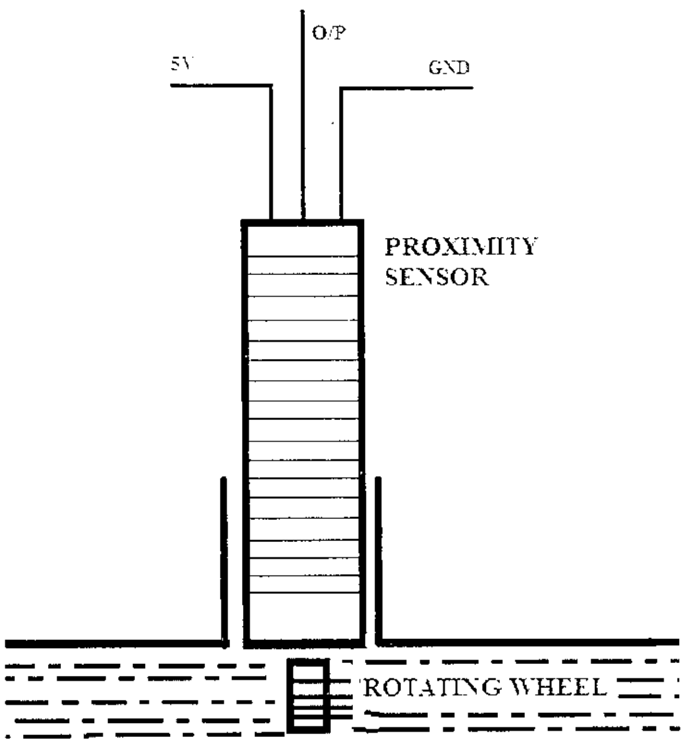
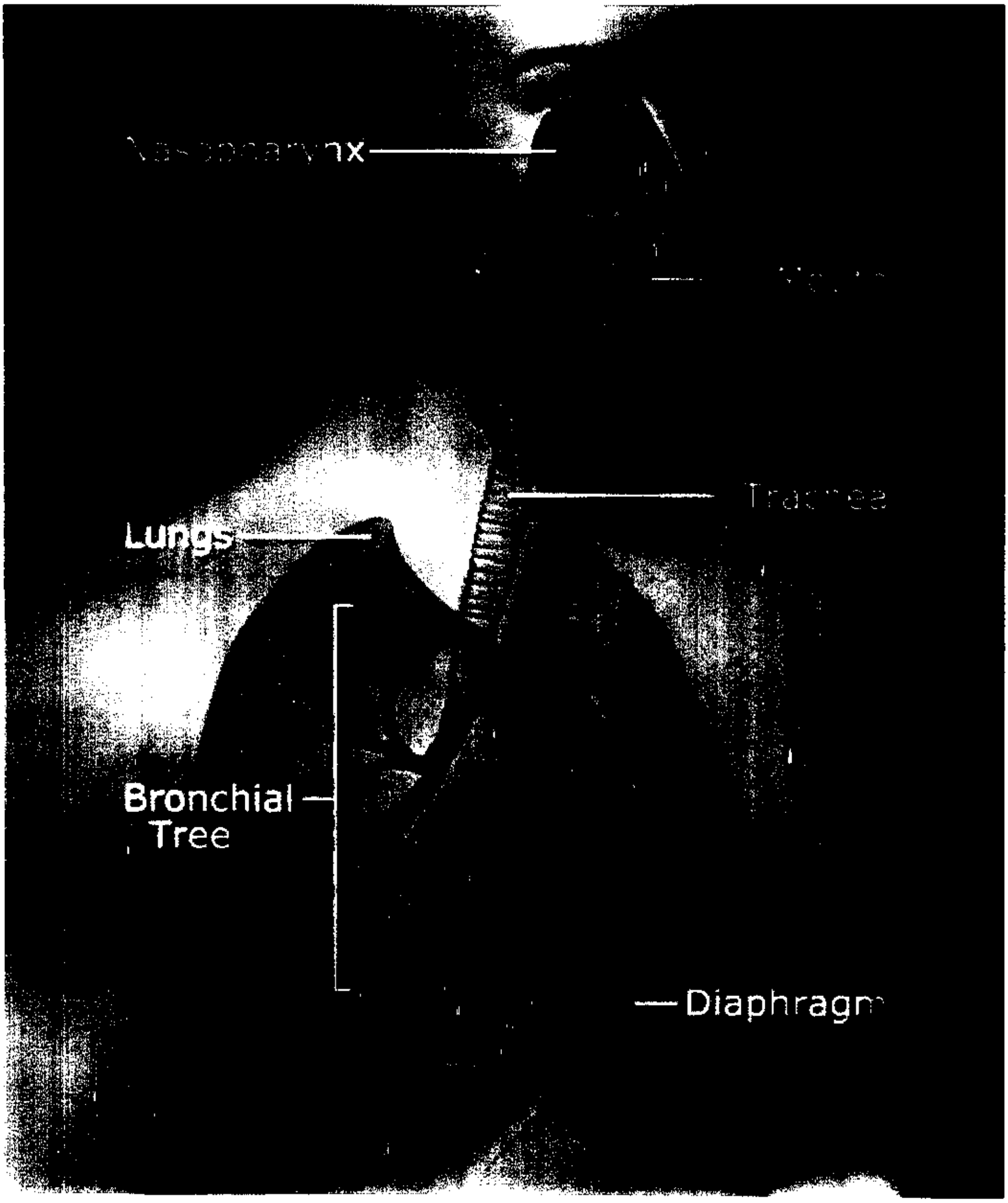


Fig 3.1 Turbine flow meter

3.2 MEASUREMENT OF RESPIRATION

INHALATION

Inhalation is initiated by the diaphragm and supported by the external intercoastal muscles. Normal resting respirations are 10 to 18 breaths per minute. During vigorous inhalation (at rates exceeding 35 breaths per minute), accessory muscles of respiration are recruited for support.



Inhalation is driven primarily by the diaphragm. When the diaphragm contracts, the ribcage expands and the contents of the abdomen are moved downward. This results in a larger thoracic volume, which in turn causes a decrease in intrathoracic pressure. As the pressure in the chest falls, air moves into the conducting zone. Here, the air is filtered, warmed, and humidified as it flows to the lungs.

During forced inhalation, as when taking a deep breath, the external intercostals muscles and accessory muscles further expand the thoracic cavity.

EXHALATION

Exhalation is generally a passive process, however active or *forced* exhalation is achieved by the abdominal and the internal intercostal muscles. The lungs have a natural elasticity; as they recoil from the stretch of inhalation, air flows back out until the pressures in the chest and the atmosphere reach equilibrium

During forced exhalation, as when blowing out a candle, expiratory muscles including the abdominal muscles and internal intercostal muscles, generate abdominal and thoraic pressure ,which forces air out of the lungs.

CIRCUIT DESCRIPTION:

This circuit is designed to measure the respiration. In this circuit two thermistor is used for the respiration measurement which are connected in the resistor bridge network. The bridge terminals are connected with inverting and non inverting input terminals of the comparator. Here one thermistor is used for the respiration measurement.

Another thermistor is used as reference.The comparator provides the error voltage at its output. Then the error voltage is amplified by the next stage of the amplifier. The amplified voltage is converted to +12v to -12v square wave pulse through the comparator. Then the square wave pulse is converted to 5v to 0v TTL pulse through the transistor Q1 (BC 547).

Then the final TTL pulse is given to microcontroller in order to monitor the respiration rate.

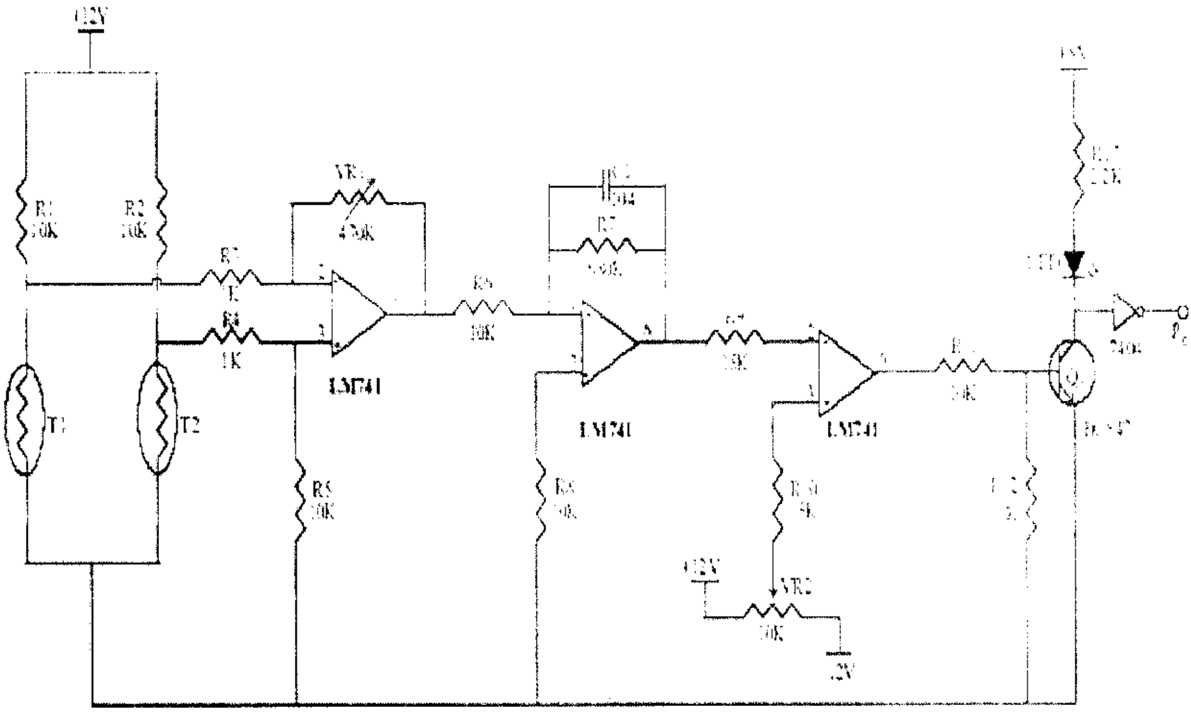
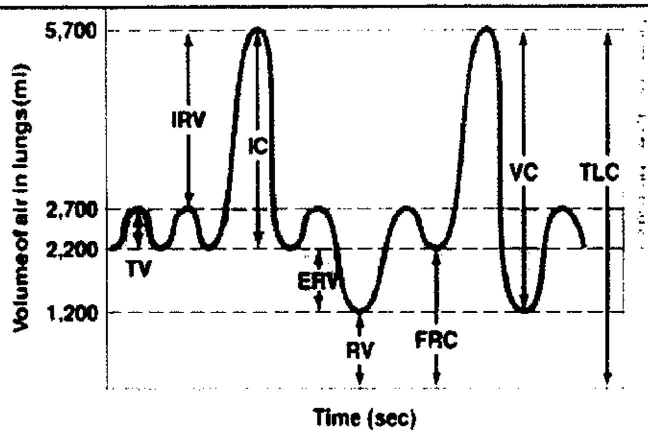


Fig 3.2 Signal conditioning circuit for respiration sensor

Spirogram of Lung Volume Changes



TV = Tidal volume (500 ml)
IRV = Inspiratory reserve volume (3,000 ml)
IC = Inspiratory capacity (3,500 ml)
ERV = Expiratory reserve volume (1,000 ml)
RV = Residual volume (1,200 ml)
FRC = Functional residual capacity (2,200 ml)
VC = Vital capacity (4,500 ml)
TLC = Total lung capacity (5,700 ml)

MEASUREMENT OF PRESSURE:

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

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

where:

p is the pressure

F is the normal force

A is the area.

Pressure is a scalar, and has SI units of pascals, 1 Pa = 1 N/m^2.

Pressure is transmitted to solid boundaries or across arbitrary sections of fluid normal to these boundaries or sections at every point.

CIRCUIT DESCRIPTION:

This circuit is designed to measure the varying pressure. The pressure is measured by diaphragm which is one type of transducer. When pressure is applied, the diaphragm is moving in the forward side.

The diaphragm moving is depends on the pressure. So it generates the voltage pulse depends on the movement of diaphragm.

The voltage pulses are in the range of milli voltage. Hence the voltage pulse is given to Instrumentation amplifier section in order to amplify the signals.

The important features of instrumentation amplifier are high gain accuracy, high CMRR, low output impedance. Here the instrumentation amplifier is constructed by TL 082 operational amplifier. The TL 082 is the dual operational amplifier that is two operational amplifiers is fabricated in single chip.

Here the instrumentation amplifier acts as differential instrumentation amplifier. The diaphragm transducer terminals are connected to A1 and A2 amplifier of the differential instrumentation amplifier.

The difference of the varying voltage signals from the transducer is amplified by the instrumentation amplifier. The A4 amplifier is used for zero adjustment. When there is no pressure the diaphragm may be sliding in the forward or reverse side.

Due to that instrumentation amplifier delivered some voltage at the output. To avoid this problem A4 amplifier is used for zero adjustment. Hence when there is no pressure the output is zero.

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

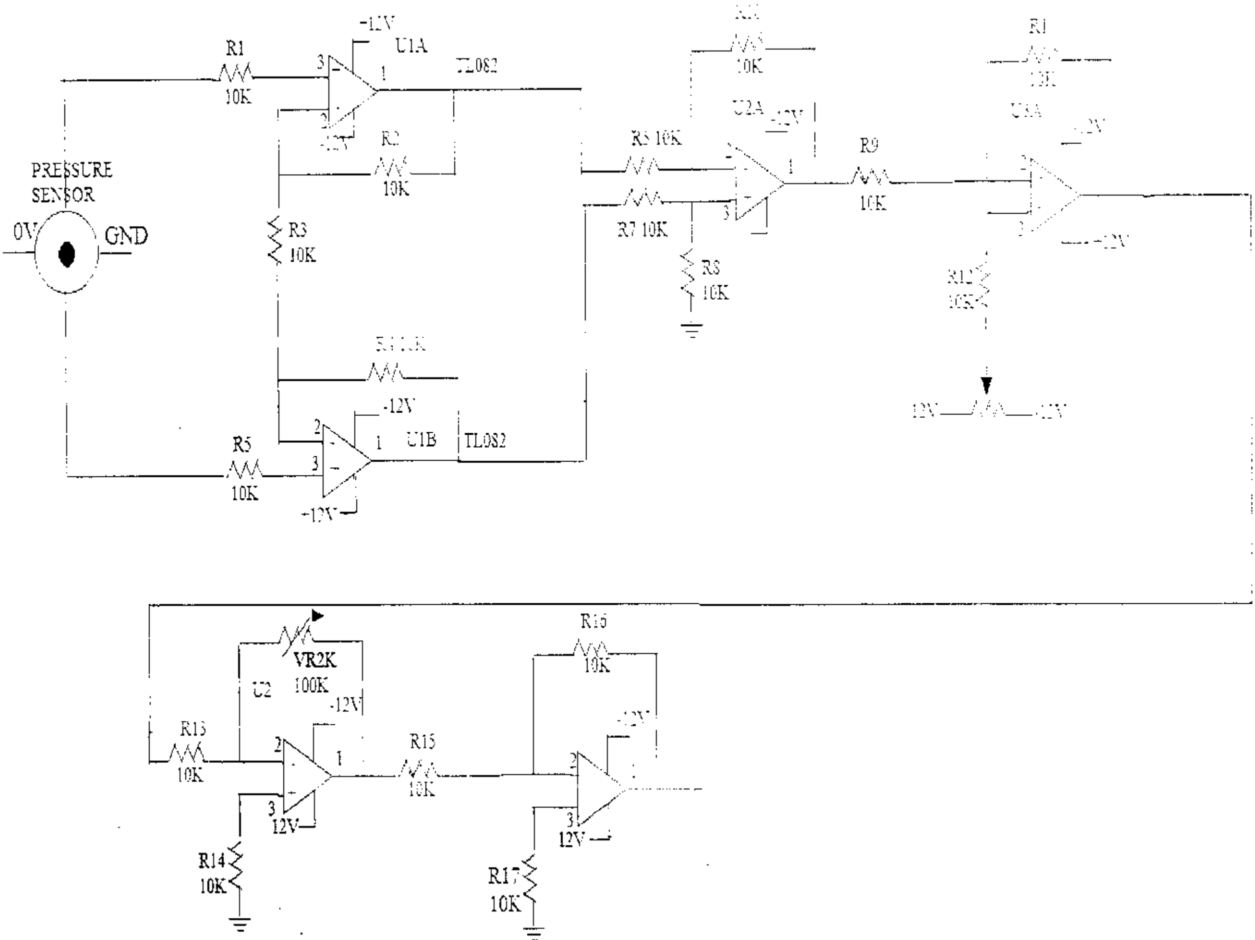


Fig 3.3 Signal conditioning circuit for pressure

S.NO	PARAMETERS	ABNORMAL RATE
1	PRESSURE	>10 mm Hg
2	RESPIRATION	<12 and >30 per min
3	PULSE	>80 per min

DESCRIPTION IN NUMERICAL FORMAT

CHAPTER 4

MICROCONTROLLER

CHAPTER 4

MICROCONTROLLER

4.1 INTRODUCTION

A microcontroller is a complete microprocessor system built on a single IC. Microcontrollers were developed to meet a need for microprocessors to be put into low cost products. Building a complete microprocessor system on a single chip substantially reduces the cost of building simple products, which use the microprocessor's power to implement their function, because the microprocessor is a natural way to implement many products.

This means the idea of using a microprocessor for low cost products comes up often. But the typical 8-bit microprocessor based system, such as one using a Z80 and 8085 is expensive. Both 8085 and Z80 system need some additional circuits to make a microprocessor system. Each part carries costs of money. Even though a product design may requires only very simple system, the parts needed to make this system as a low cost product.

To solve this problem microprocessor system is implemented with a single chip microcontroller. This could be called microcomputer, as all the major parts are in the IC. Most frequently they are called microcontroller because they are used they are used to perform control functions.

The microcontroller contains full implementation of a standard MICROPROCESSOR, ROM, RAM, I/0, CLOCK, TIMERS, and also SERIAL PORTS. Microcontroller also called "system on a chip" or "single chip microprocessor system" or "computer on a chip".

PIC

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

Various microcontrollers offer different kinds of memories. EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

4.2.1 CORE FEATURES

- High-performance RISC CPU
- Only 35 single word instructions to learn
- Operating speed: DC - 20 MHz clock input

  DC - 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory,

  Up to 368 x 8 bytes of Data Memory (RAM)

Up to 256 x 8 bytes of EEPROM data memory

- Pin out compatible to the PIC16C73/74/76/77
- Interrupt capability (up to 14 internal/external
- Eight level deep hardware stack
- Direct, indirect, and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC Oscillator for reliable operation
- Programmable code-protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low-power, high-speed CMOS EPROM/EEPROM technology
- Fully static design
- In-Circuit Serial Programming (ICSP) via two pins
- Only single 5V source needed for programming capability
- Processor read/write access to program memory
- Wide operating voltage range: 2.5V to 5.5V
- High Sink/Source Current: 25 mA

• Commercial and Industrial temperature ranges

• Low-power consumption:

4.2.2 PERIPHERAL FEATURES

• Timer0: 8-bit timer/counter with 8-bit prescaler

• Timer1: 16-bit timer/counter with prescaler, can be incremented during sleep

Via external crystal/clock

• Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler

• Two Capture, Compare, PWM modules

Capture is 16-bit, max resolution is 12.5 ns,

Compare is 16-bit, max resolution is 200 ns,

PWM max. Resolution is 10-bit

• 10-bit multi-channel Analog-to-Digital converter

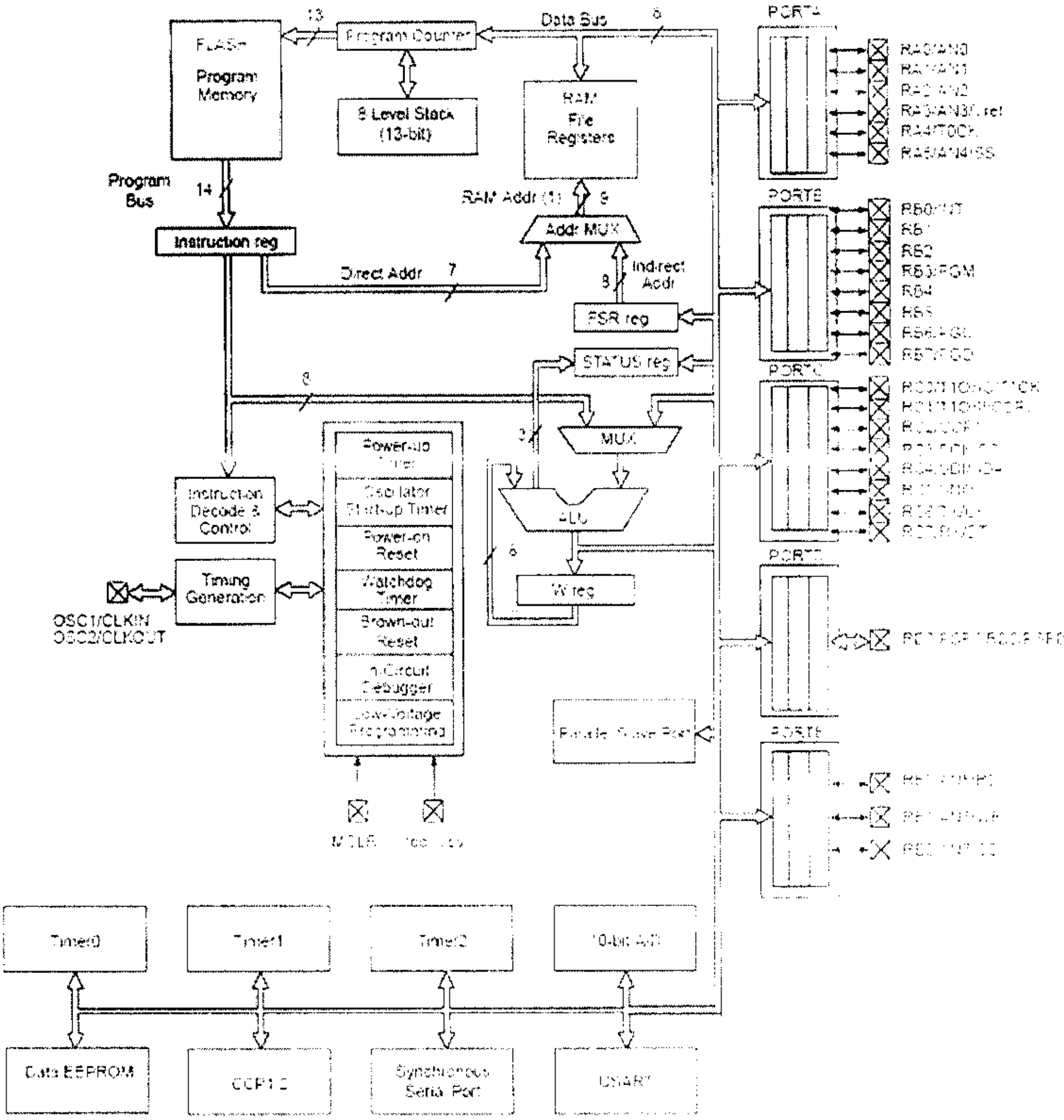
• Synchronous Serial Port (SSP) with SPI. (Master Mode) and I2C. (Master/Slave)

• Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with

9- Bit addresses detection.

• Brown-out detection circuitry **for Brown-out Reset (BOR)**

4.3 ARCHITECTURE OF PIC 16F877



Note 1: Higher order bits are from the STATUS register

Fig 4.1 Architecture of PIC 16F877

4.4 PIN CONFIGURATION

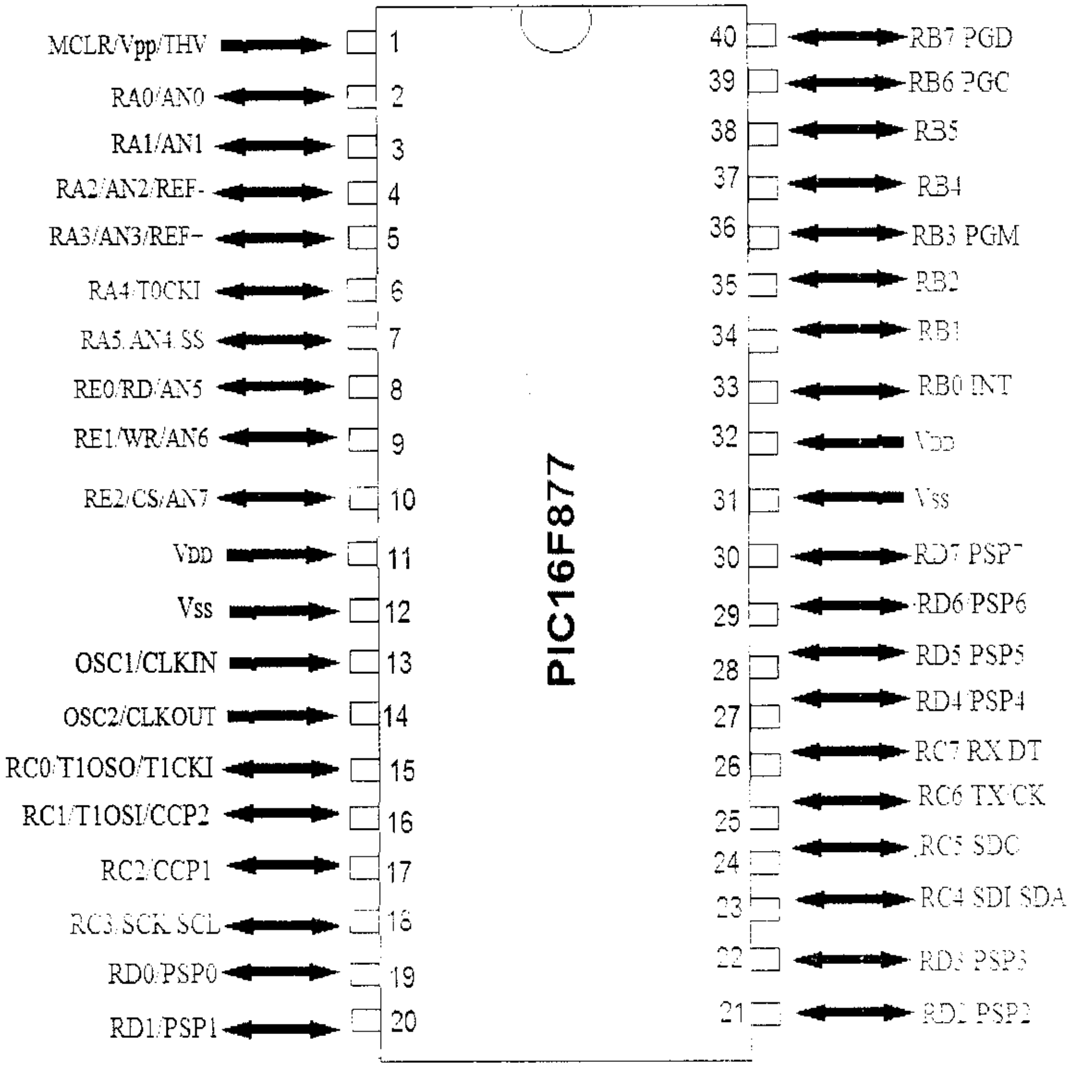


Fig 4.2 Pin Diagram

4.5 INPUT/OUTPUT PORTS

Some pins for these I/O ports are multiplexed with an alternate function for the peripheral features on the device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin. The pins can be selected as input or output port by setting the pins in the respective TRIS registers

PORT A AND THE TRIS A REGISTER:

PORT A is a 6-bit wide bi-directional port. The corresponding data direction register is TRIS A. Setting a TRIS A bit (=1) will make the corresponding PORT A pin an input, i.e., put the corresponding output driver in a Hi-impedance mode. Clearing a TRIS A bit (=0) will make the corresponding PORT A pin an output, i.e., put the contents of the output latch on the selected pin.

PORT B AND TRIS B REGISTER:

PORT B is an 8-bit wide bi-directional port. The corresponding data direction register is TRIS B. Setting a TRISB bit (=1) will make the corresponding PORT B pin an input, i.e., put the corresponding output driver in a hi-impedance mode. Clearing a TRIS B bit (=0) will make the corresponding PORT B pin an output, i.e., put the contents of the output latch on the selected pin. Three pins of PORT B are multiplexed with the Low Voltage Programming function; RB3/PGM, RB6/PGC and RB7/PGD. The alternate functions of these pins are described in the Special Features Section. Each of the PORT B pins has a weak internal pull-up. A single control bit can turn on all the pull-ups.

This is performed by clearing bit RBPU (OPTION_REG<7>). The weak pull-up is automatically turned off when the port pin is configured as an output. The pull-ups are disabled on a Power-on Reset.

PORT C AND THE TRIS C REGISTER

PORT C is an 8-bit wide bi-directional port. The corresponding data direction register is TRIS C. Setting a TRIS C bit (=1) will make the corresponding PORT C pin an input, i.e., put the corresponding output driver in a hi-impedance mode. Clearing a TRIS C bit (=0) will make the corresponding PORT C pin an output, i.e., put the contents of the output latch on the selected pin. PORT C is multiplexed with several peripheral functions. PORT C pins have Schmitt Trigger input buffers.

PORT D AND TRIS D REGISTERS:

This section is not applicable to the 28-pin devices. PORT D is an 8-bit port with Schmitt Trigger input buffers. Each pin is individually configurable as an input or output. PORT D can be configured as an 8-bit wide microprocessor Port (parallel slave port) by setting control bit PSP MODE (TRISE<4>). In this mode, the input buffers are TTL.

PORT E AND TRIS E REGISTER:

PORT E has three pins RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7, which are individually configurable as inputs or outputs. These pins have Schmitt Trigger input buffers.

The PORT E pins become control inputs for the microprocessor port when bit PSPMODE (TRISE<4>) is set. In this mode, the user must make sure that the TRISE<2:0> bits are set (pins are configured as digital inputs). Ensure ADCON1 is configured for digital I/O. In this mode the input buffers are TTL.

PORT E pins are multiplexed with analog inputs. When selected as an analog input, these pins will read as '0's. TRISE controls the direction of the RE pins, even when they are being used as analog inputs. The user must make sure to keep the pins configured as inputs when using them as analog inputs.

4.6 MEMORY ORGANISATION

There are three memory blocks in each of the PIC16F877 MCU's. The program memory and Data Memory have separate buses so that concurrent access can occur.

PROGRAM MEMORY ORGANISATION

The PIC16f877 devices have a 13-bit program counter capable of addressing 8K *14 words of FLASH program memory. Accessing a location above the physically implemented address will cause a wraparound.The RESET vector is at 0000h and the interrupt vector is at 0004h.

DATA MEMORY ORGANISTION

The data memory is partitioned into multiple banks which contain the General Purpose Registers and the special functions Registers. Bits RP1 (STATUS<6) and RP0 (STATUS<5>) are the bank selected bits.

RP1:RP0	Banks
00	0
01	1
10	2
11	3

Each bank extends up to 7Fh (1238 bytes). The lower locations of each bank are reserved for the Special Function Registers.Above the Special Function Registers are General Purpose Registers, implemented as static RAM. All implemented banks contain special function registers. Some frequently used special function registers from one bank may be mirrored in another bank for code reduction and quicker access.

CHAPTER 5

CHAPTER 5

RS 232 SERIAL COMMUNICATION

5.1 INTRODUCTION

In telecommunications, **RS-232** is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is commonly used in computer serial ports.

Scope of the Standard:

The Electronic Industries Alliance (EIA) standard RS-232-C [3] as of 1969 defines:

- Electrical signal characteristics such as voltage levels, signaling rate, timing and slew-rate of signals, voltage withstand level, short-circuit behavior, maximum stray capacitance and cable length
- Interface mechanical characteristics, pluggable connectors and pin identification
- Functions of each circuit in the interface connector
- Standard subsets of interface circuits for selected telecom applications

The standard does not define such elements as character encoding (for example, ASCII, Baudot or EBCDIC), or the framing of characters in the data stream (bits per character, start/stop bits, parity). The standard does not define protocols for error detection or algorithms for data compression.

The standard does not define bit rates for transmission, although the standard says it is intended for bit rates lower than 20,000 bits per second. Many modern devices can exceed this speed while still using RS-232 compatible signal levels.

Details of character format and transmission bit rate are controlled by the serial port hardware, often a single integrated circuit called a UART that converts data from parallel to serial form. A typical serial port includes specialized driver and receiver integrated circuits to convert between internal logic levels and RS-232 compatible signal levels.

In this circuit the MAX 232 IC used as level logic converter. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA 232 voltage levels from a single 5v supply. Each receiver converts EIA-232 to 5v TTL/CMOS levels. Each driver converts TLL/CMOS input levels into EIA-232 levels.

FUNCTION TABLES

EACH DRIVER

INPUT TIN	OUTPUT TOUT
L	H
H	L

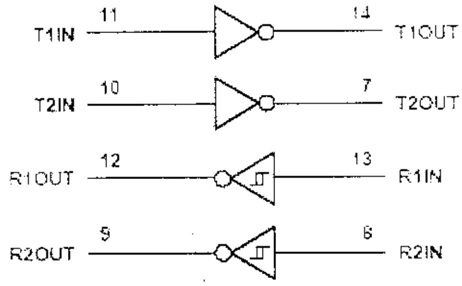
H=High level

L=Low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L

logic diagram (positive logic)



5.2 CIRCUIT DESCRIPTION

In this circuit the microcontroller transmitter pin is connected in the MAX232 T2IN pin which converts input 5v TTL/CMOS level to RS232 level. Then T2OUT pin is connected to reviver pin of 9 pin D type serial connector which is directly connected to PC.

In PC the transmitting data is given to R2IN of MAX232 through transmitting pin of 9 pin D type connector which converts the RS232 level to 5v TTL/CMOS level. The R2OUT pin is connected to receiver pin of the microcontroller. Likewise the data is transmitted and received between the microcontroller and PC or other device vice versa.

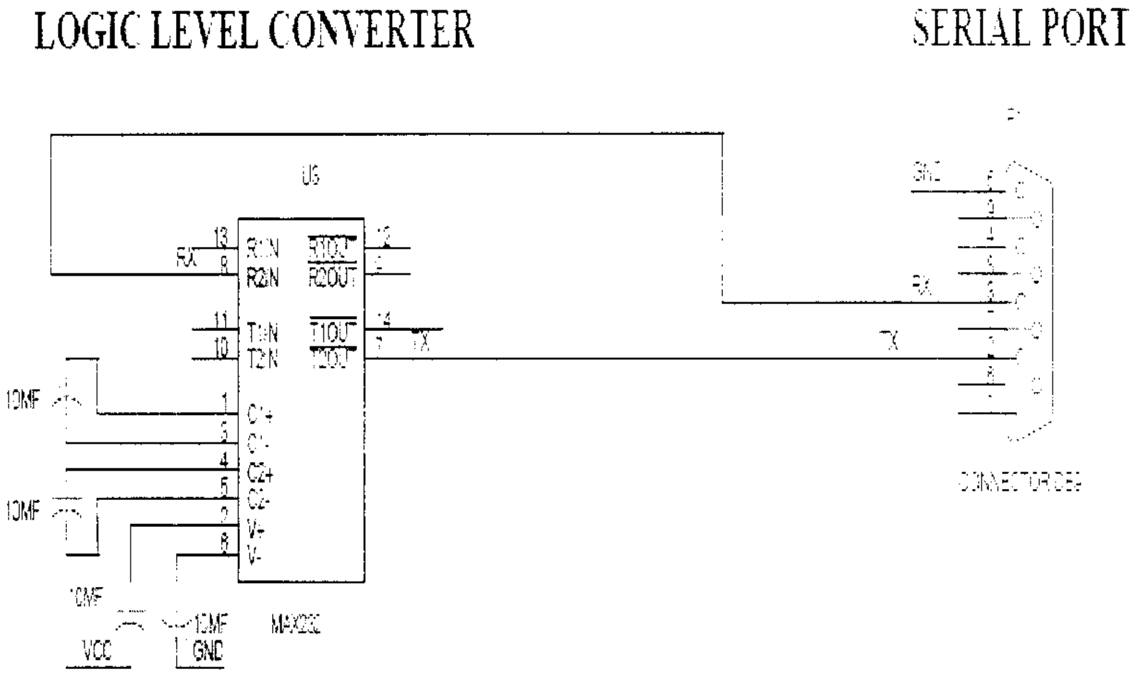


Fig 5.1 RS 232 Serial communication

CHAPTER 6

CHAPTER 6

SOFTWARE

What is ASP.NET?

ASP.NET is a server side scripting technology that enables scripts (embedded in web pages) to be executed by an Internet server.

- ASP.NET is a Microsoft Technology
- ASP stands for Active Server Pages
- ASP.NET is a program that runs inside IIS
- IIS (Internet Information Services) is Microsoft's Internet server
- IIS comes as a free component with Windows servers
- IIS is also a part of Windows 2000 and XP Professional

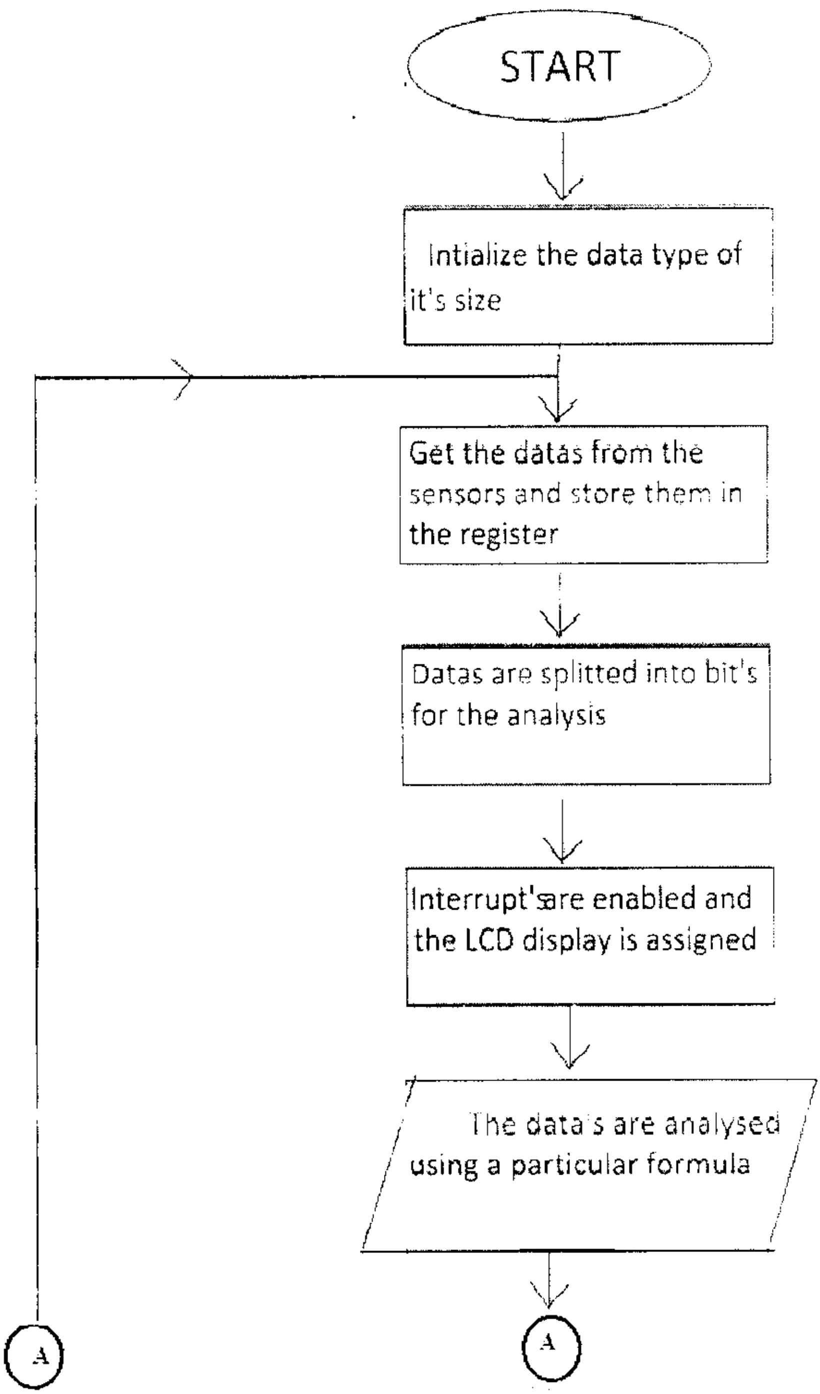
What is an ASP.NET File?

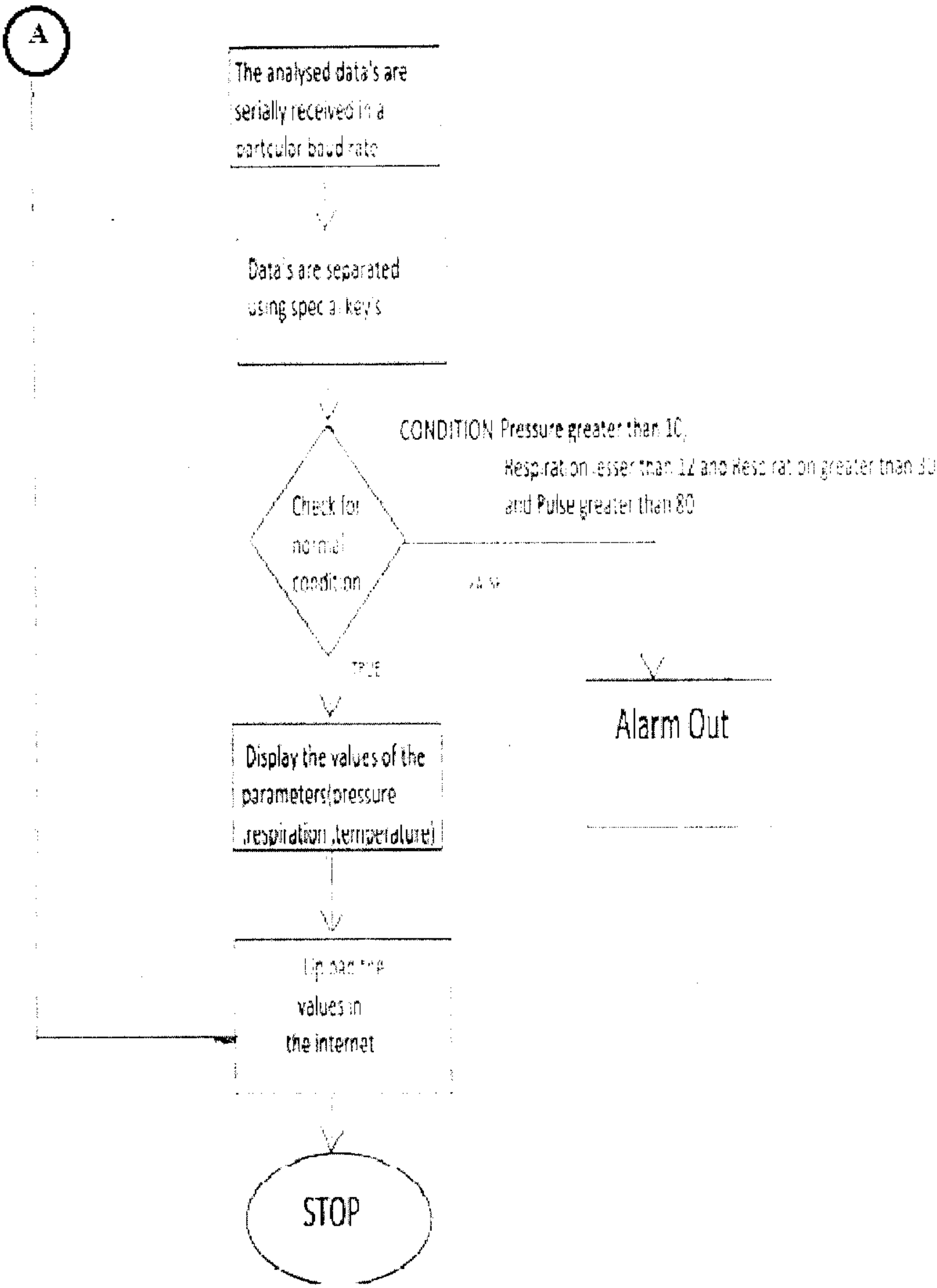
- An ASP.NET file is just the same as an HTML file
- An ASP.NET file can contain HTML, XML, and scripts
- Scripts in an ASP.NET file are executed on the server
- An ASP.NET file has the file extension ".aspx"

How Does ASP.NET Work?

- When a browser requests an HTML file, the server returns the file
- When a browser requests an ASP.NET file, IIS passes the request to the ASP.NET engine on the server
- The ASP.NET engine reads the file, line by line, and executes the scripts in the file
- Finally, the ASP.NET file is returned to the browser as plain HTML.

FLOW CHART


START
Intialize the data type of it's size
Get the datas from the sensors and store them in the register
Datas are splitted into bit's for the analysis
Interrupt's are enabled and the LCD display is assigned
The data's are analysed using a particular formula
A
A


A
The analysed data's are serially received in a partculor baud rate
Data's are separated using spec a key's
CONDITION Pressure greater than 10,
Respiration lesser than 12 and Respiration greater than 30
and Pulse greater than 80
Check for normal condition
TRUE
Alarm Out
Display the values of the parameters(pressure ,respiration ,temperature)
values in the internet
STOP

LCD DISPLAY

INTRODUCTION:

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

One each polarisers are pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction

When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarisers, which would result in activating / highlighting the desired characters.

The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power.

The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range.

Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly.

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

MOUNTING:

Cover the display surface with a transparent protective plate, to protect the polarizer.

Don't touch the display surface with bare hands or any hard materials. This will stain the display area and degrade the insulation between terminals.

Do not use organic solvents to clean the display panel as these may adversely affect tape or with absorbant cotton and petroleum benzene.

The processing or even a slight deformation of the claws of the metal frame will have effect on the connection of the output signal and cause an abnormal display.

Do not damage or modify the pattern wiring, or drill attachment holes in the PCB. When assembling the module into another equipment, the space between the module and the fitting plate should have enough height, to avoid causing stress to the module surface.

Make sure that there is enough space behind the module, to dissipate the heat generated by the ICs while functioning for longer durations.

When an electrically powered screwdriver is used to install the module, ground it properly.

While cleaning by a vacuum cleaner, do not bring the sucking mouth near the module. Static electricity of the electrically powered driver or the vacuum cleaner may destroy the module.

Buzzer:

A **buzzer** or **beeper** is a signalling device, commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

CIRCUIT DIAGRAM

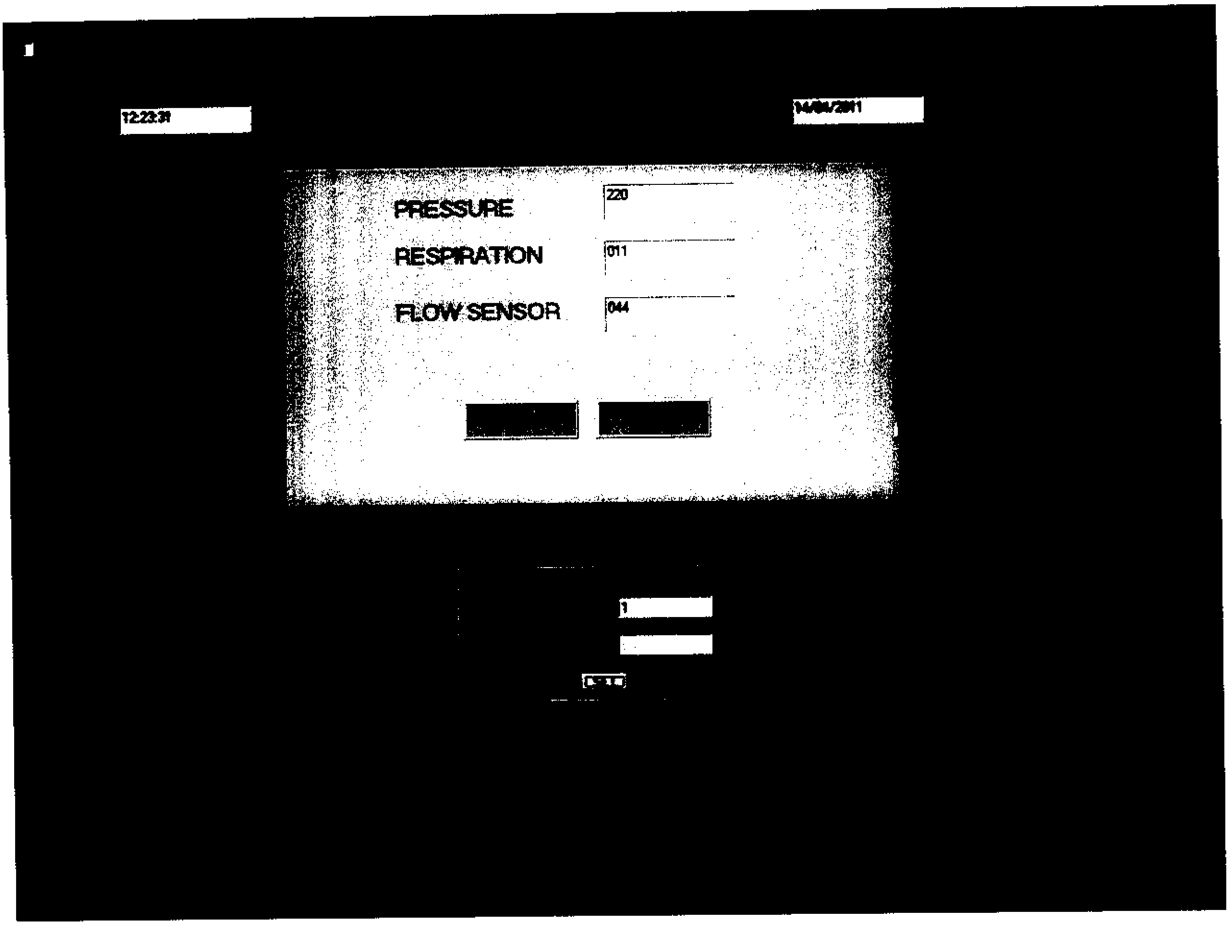
The circuit is designed to control the buzzer. The buzzer ON and OFF is controlled by the pair of switching transistors (BC 547). The buzzer is connected in the Q2 transistor collector terminal.

When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and close the collector and emitter terminal so zero signals is given to base of the Q2 transistor. Hence Q2 transistor and buzzer is turned OFF state.

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

	Voltage signal from buzzer Microcontroller or PC	Transistor Q1	Transistor Q2
OFF	1	ON	OFF
ON	0	OFF	ON

RESULT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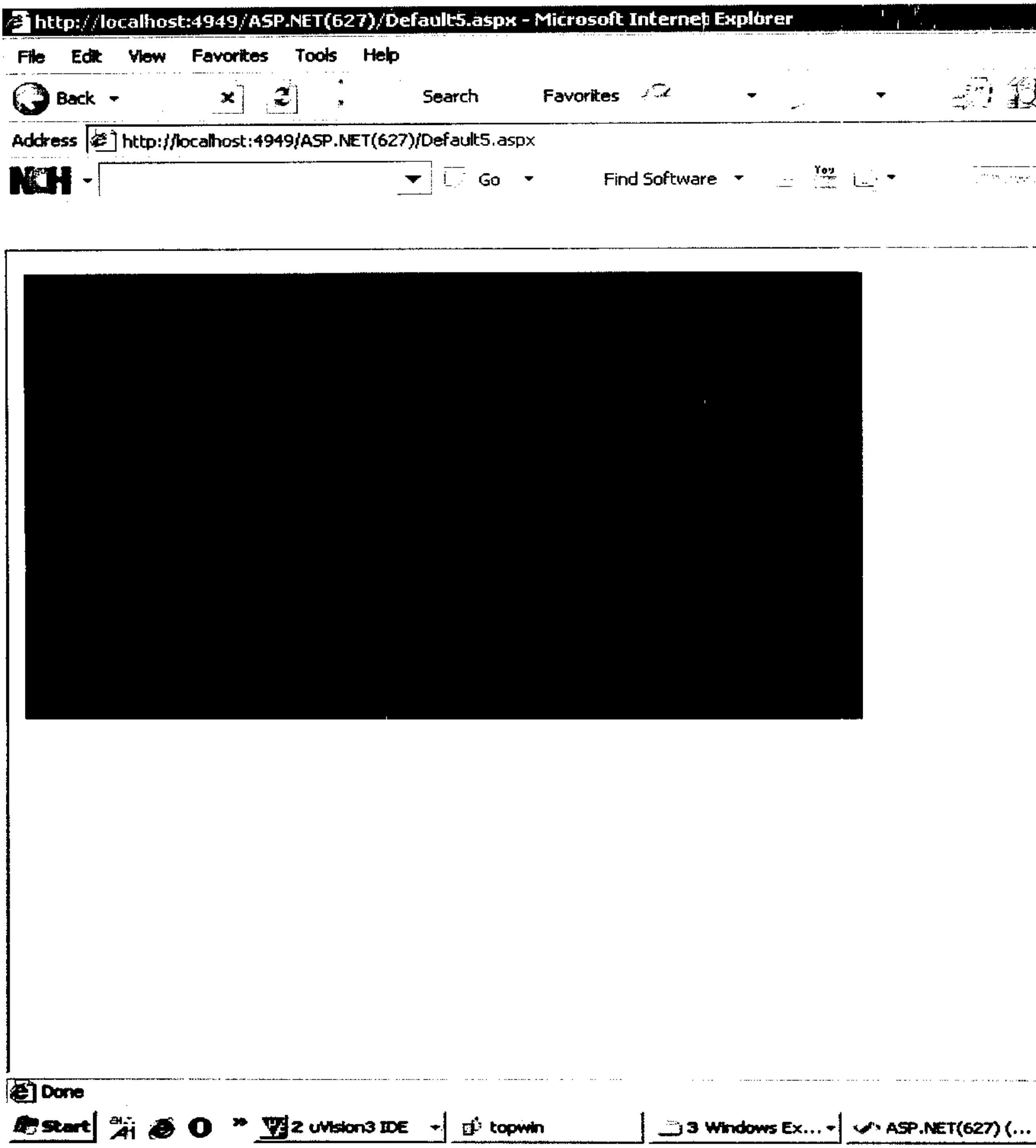
PRESSURE
220
RESPIRATION
011
FLOW SENSOR
044
1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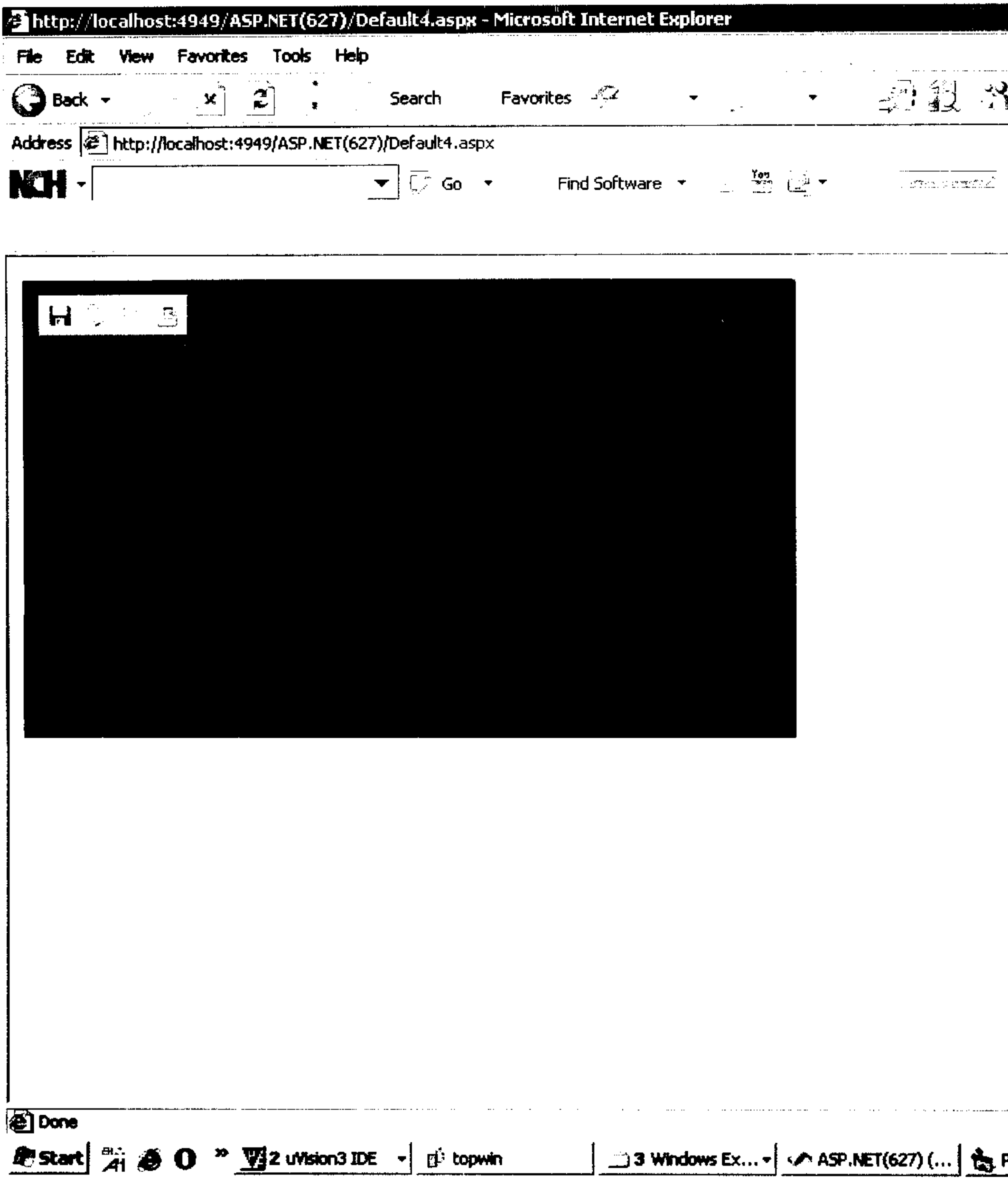
Start
2 uVision3 IDE
topwin
3 Windows Ex...
ASP.NET(627) (...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Search
Favorites
Address http://localhost:4949/ASP.NET(627)/Default4.aspx
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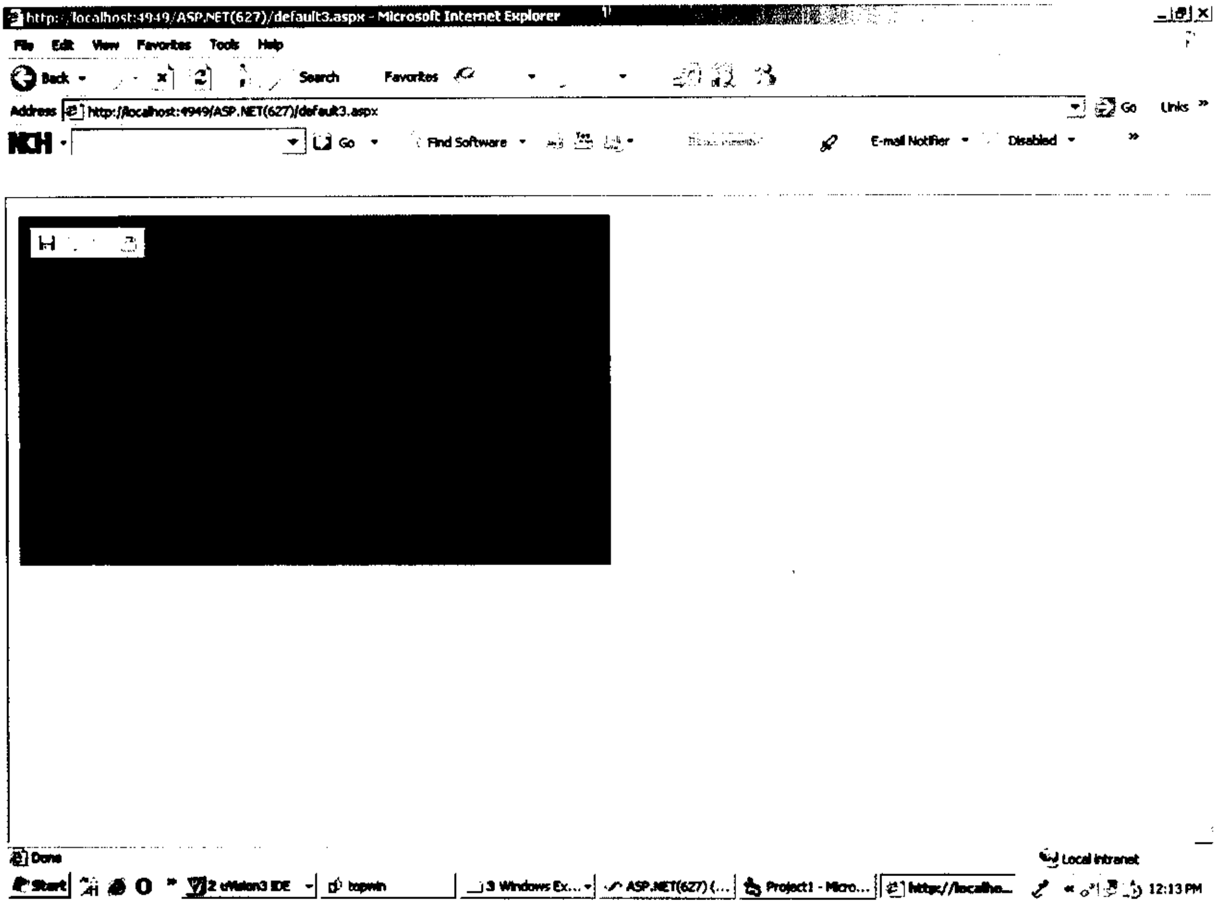
Go
Find Software
Done
Start
2 uVision3 IDE
topwin
3 Windows Ex...
ASP.NET(627) (...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File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost:4949/ASP.NET(627)/default3.aspx
Go Links
Go Find Software E-mail Notifier Disabled
Done
Local intranet
Start
topwin
ASP.NET(627)
Project1 - Micro...
12:13 PM

CONCLUSION

CONCLUSION

All the modules were individually constructed and then integrated successfully.

To the available module we have added an additional data processing algorithm which helps the patients to perform the testing themselves without the requirement medical personnel.

To implement an effective and scalable telemedicine network it is also necessary to use a reliable architecture for data transmission, storage and management.

Thereby reducing the risk of hospitalization and transportation expenses.

REFERENCE

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- J.H.Gravil, O.A.Al-Rawas, M.M.Cotton, U.Flanigan, A.Irwin and R.D.Sterenson, "Home treatment of exacerbations of chronic obstructive pulmonary disease by an acute respiratory assessment service. "Lancet,vol.351,no.9119,pp.1853-1855,June.1998.

- www.wikipedia.com

APPENDICES

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion . . . 0.003% Typ
- High Input Impedance . . . JFET-Input Stage
- Latch-Up-Free Operation
- High Slew Rate . . . 13 V/μs Typ
- Common-Mode Input Voltage Range Includes V_{CC+}

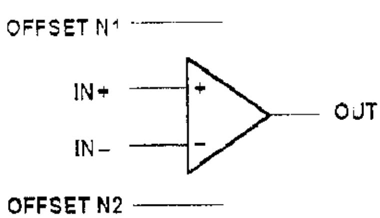
ption

he TL08x JFET-input operational amplifier family is designed to offer a wider selection than any previously eveloped operational amplifier family. Each of these JFET-input operational amplifiers incorporates ell-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The devices feature gh slew rates, low input bias and offset currents, and low offset voltage temperature coefficient. Offset djustment and external compensation options are available within the TL08x family.

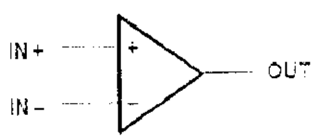
he C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized r operation from −40°C to 85°C. The Q-suffix devices are characterized for operation from −40°C to 125°C. he M-suffix devices are characterized for operation over the full military temperature range of −55°C to 125°C.

ols

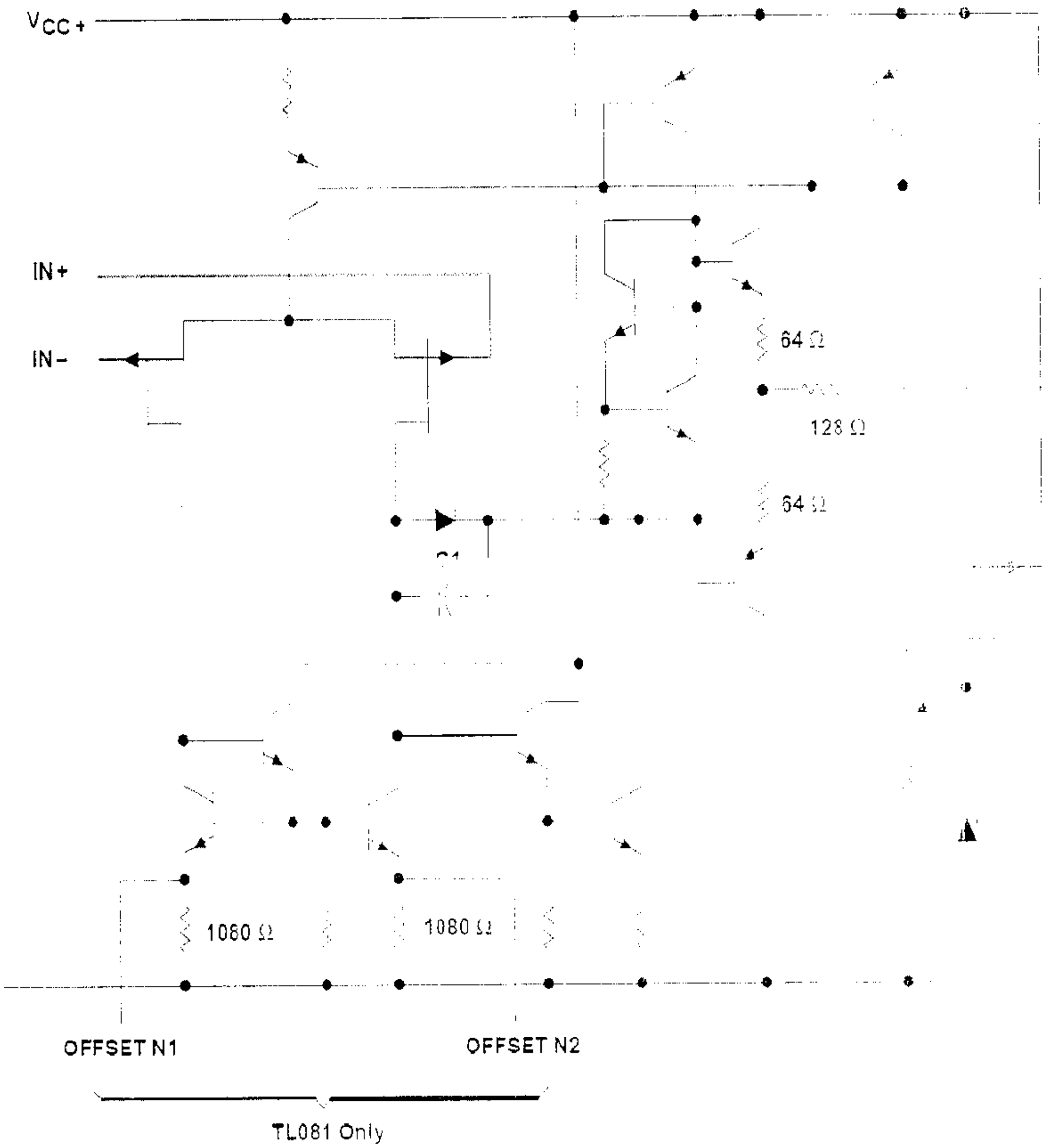
TL081



TL082 (EACH AMPLIFIER)
TL084 (EACH AMPLIFIER)



tic (each amplifier)



omponent values shown are nominal.

electrical characteristics, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	T_A†	TL081C TL082C TL084C			TL081AC TL082AC TL084AC			TL081BC TL082BC TL084BC			TL081I TL082I TL084I			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_O = 0$, $R_S = 50\ \Omega$	25°C		3	15		3	6		2	3		3	6	mV
			Full range			20			7.5			5			9	
α_{VIO}	Temperature coefficient of input offset voltage	$V_O = 0$, $R_S = 50\ \Omega$	Full range		18			18			18			18		μV/°C
I_{IO}	Input offset current‡	$V_O = 0$	25°C		5	200		5	100		5	100		5	100	pA
			Full range			2			2			2			10	nA
I_{IB}	Input bias current‡	$V_O = 0$	25°C		30	400		30	200		30	200		30	200	pA
			Full range			10			7			7			20	nA
V_{ICR}	Common-mode input voltage range		25°C	±11	−12 to 15		±11	−12 to 15		±11	−12 to 15		±11	−12 to 15		V
V_{OM}	Maximum peak output voltage swing	$R_L = 10\ k\Omega$	25°C	±12	±13.5		±12	±13.5		±12	±13.5		±12	±13.5		V
		$R_L \geq 10\ k\Omega$	Full range	±12			±12			±12			±12			
		$R_L \geq 2\ k\Omega$		±10	±12		±10	±12		±10	±12		±10	±12		
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L \geq 2\ k\Omega$	25°C	25	200		50	200		50	200		50	200		V/mV
		$V_O = \pm 10$ V, $R_L \geq 2\ k\Omega$	Full range	15			25			25			25			
B_1	Unity-gain bandwidth		25°C		3			3			3			3		MHz
r_i	Input resistance		25°C		10^{12}			10^{12}			10^{12}			10^{12}		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min$, $V_O = 0$, $R_S = 50\ \Omega$	25°C	70	86		75	86		75	86		75	86		dB
k_{SVR}	Supply voltage rejection ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_{CC} = \pm 15$ V to ± 9 V, $V_O = 0$, $R_S = 50\ \Omega$	25°C	70	86		80	86		80	86		80	86		dB
I_{CC}	Supply current (per amplifier)	$V_O = 0$, No load	25°C		1.4	2.8		1.4	2.8		1.4	2.8		1.4	2.8	mA
V_{O1}/V_{O2}	Crosstalk attenuation	$A_{VD} = 100$	25°C		120			120			120			120		dB

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range for T_A is 0°C to 70°C for TL08_C, TL08_AC, TL08_BC and −40°C to 85°C for TL08_I.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 17. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

al characteristics, $V_{CC\pm} = \pm15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		T_A	TL081M, TL082M MIN	TYP	MAX	TL084Q, TL084M MIN	TYP	MAX	UNIT
Input offset voltage	$V_O = 0$,	$R_S = 50\ \Omega$	25°C		3	6		3	9	mV
			Full range			9			15	
Temperature coefficient of input offset voltage	$V_O = 0$	$R_S = 50\ \Omega$	Full range		18			18		μV/°C
Input offset current‡	$V_O = 0$		25°C		5	100		5	100	pA
			125°C			20			20	nA
Input bias current‡	$V_O = 0$		25°C		30	200		30	200	pA
			125°C			50			50	nA
Common-mode input voltage range			25°C	±11	±12 to 15		±11	±12 to 15		V
Maximum peak output voltage swing	$R_L = 10\ k\Omega$		25°C	±12	±13.5		±12	±13.5		V
	$R_L \geq 10\ k\Omega$		Full range	±12			±12			
	$R_L \geq 2\ k\Omega$			±10	±12		±10	±12		
Large-signal differential voltage amplification	$V_O = \pm10$ V,	$R_L \geq 2\ k\Omega$	25°C	25	200		25	200		V/mV
	$V_O = \pm10$ V,	$R_L \geq 2\ k\Omega$	Full range	15			15			
Unity-gain bandwidth			25°C		3			3		MHz
Input resistance			25°C		10^{12}			10^{12}		Ω
Common-mode rejection ratio	$V_{IC} = V_{ICR}min$, $V_O = 0$,	$R_S = 50\ \Omega$	25°C	80	86		80	86		dB
Supply voltage rejection ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_{CC} = \pm15$ V to ±9 V, $V_O = 0$,	$R_S = 50\ \Omega$	25°C	80	86		80	86		dB
Supply current (per amplifier)	$V_O = 0$,	No load	25°C		1.4	2.8		1.4	2.8	mA
Crosstalk attenuation	$A_{VD} = 100$		25°C		120			120		dB

acteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.
as currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in
7. Pulse techniques must be used that maintain the junction temperatures as close to the ambient temperature as is possible.

ing characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25$°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS				MIN	TYP	MAX	UNIT
lew rate at unity gain	$V_I = 10$ V,	$R_L = 2\ k\Omega$,	$C_L = 100$ pF,	See Figure 1	8*	13		V/μs
	$V_I = 10$ V, $T_A = -55$°C to 125°C,	$R_L = 2\ k\Omega$, See Figure 1	$C_L = 100$ pF,		5*			
ise time	$V_I = 20$ mV,	$R_L = 2\ k\Omega$,	$C_L = 100$ pF,	See Figure 1		0.05		μs
vershoot factor						20%		
quivalent input noise oltage	$R_S = 20\ \Omega$	f = 1 kHz				15		nV/√Hz
		f = 10 Hz to 10 kHz				4		μV
quivalent input noise urrent	$R_S = 20\ \Omega$,	f = 1 kHz				0.01		pA/√Hz
otal harmonic distortion	$V_Irms = 6$ V, f = 1 kHz	$A_{VD} = 1$,	$R_S \leq 1\ k\Omega$,	$R_L \geq 2\ k\Omega$		0.003%		

l characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25°C$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		TL082Y, TL084Y			UNIT
			MIN	TYP	MAX	
Input offset voltage	$V_O = 0$,	$R_S = 50\ \Omega$		3	15	mV
Temperature coefficient of input offset voltage	$V_O = 0$,	$R_S = 50\ \Omega$		18		μV/°C
Input offset current‡	$V_O = 0$			5	200	pA
Input bias current‡	$V_O = 0$			30	400	pA
Common-mode input voltage range			±11	−12 to 15		V
Maximum peak output voltage swing	$R_L = 10\ k\Omega$,		±12	±13.5		V
Large-signal differential voltage amplification	$V_O = \pm10$ V,	$R_L \geq 2\ k\Omega$	25	200		V/mV
Unity-gain bandwidth				3		MHz
Input resistance				10^{12}		Ω
Common-mode rejection ratio	$V_{IC} = V_{ICR}min$, $R_S = 50\ \Omega$	$V_O = 0$,	70 70	86 86		dB
Supply voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC} = \pm15$ V to ±9 V, $V_O = 0$	$R_S = 50\ \Omega$	70 70	86 86		dB
Supply current (per amplifier)	$V_O = 0$,	No load		1.4	2.8	mA
Crosstalk attenuation	$A_{VD} = 100$			20		dB

cteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.
s currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in
. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

ng characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25$ C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
ew rate at unity gain	$V_I = 10$ V,	$R_L = 2\ k\Omega$, $C_L = 100$ pF, See Figure 1	8	13		V/μs
se time	$V_I = 20$ mV,	$R_L = 2\ k\Omega$, $C_L = 100$ pF, See Figure 1		0.05		μs
vershoot factor	$V_I = 20$ mV,	$R_L = 2\ k\Omega$, $C_L = 100$ pF, See Figure 1		20%		
uivalent input noise voltage	$R_S = 20\ \Omega$	f = 1 kHz		18		nV/√Hz
uivalent input noise voltage	$R_S = 20\ \Omega$	f = 10 Hz to 10 kHz		4		μV
uivalent input noise current	$R_S = 20\ \Omega$,	f = 1 kHz		0.01		pA/√Hz
tal harmonic distortion	$V_Irms = 6$ V, $A_{VD} = 1$, $R_S \leq 1\ k\Omega$, $R_L \geq 2\ k\Omega$, f = 1 kHz			0.003%		

Pa On-Chip Temperature pensated and Calibrated on Pressure Sensors

X2010 series silicon piezoresistive pressure sensors provide a very nd linear voltage output directly proportional to the applied pressure. sors house a single monolithic silicon die with the strain gauge and sistor network integrated. The sensor is laser trimmed for precise et calibration and temperature compensation.

es

- rature Compensated over 0°C to +85°C
- etric to Supply Voltage
- ntial and Gauge Options
- le in Easy-to-Use Tape & Reel

MPX2010 Series

0 to 10 kPa (0 to 1.45 psi)
25 mV Full Scale
(Typical)

Application Examples

- Respiratory Diagnostics
- Air Movement Control
- Controllers
- Pressure Switching

ORDERING INFORMATION

ame	Package Options	Case No.	# of Ports			Pressure Type			Device Marking
			None	Single	Dual	Gauge	Differential	Absolute	
ine Package (MPXV2010 Series)									
GP	Tray	1369		•		•			MPXV2010GP
DP	Tray	1351			•		•		MPXV2010DP
ackage (MPX2010 Series)									
	Tray	344	•				•		MPX2010D
P	Tray	344C			•		•		MPX2010DP
SP	Tray	344B		•		•			MPX2010GP
S	Tray	344E		•		•			MPX2010D
SSX	Tray	344F		•		•			MPX2010D
kage (MPXM2010 Series)									
0D	Rail	1320	•				•		MPXM2010D
0DT1	Tape and Reel	1320	•				•		MPXM2010D
0GS	Rail	1320A		•		•			MPXM2010GS
0GST1	Tape and Reel	1320A		•		•			MPXM2010GS

PRESSURE

Operating Characteristics

Table 1. Operating Characteristics (V_S = 10 V_{DC}, T_A = 25°C unless otherwise noted, P1 > P2)

Characteristic	Symbol	Min	Typ	Max	Units
Pressure Range[1]	P_{OP}	0	—	10	kPa
Supply Voltage[2]	V_S	—	10	16	V_{DC}
Supply Current	I_O	—	6.0	—	mAdc
Full Scale Span[3]	V_{FSS}	24	25	26	mV
Offset[4]	V_{OFF}	–1.0	—	1.0	mV
Sensitivity	ΔV/ΔP	—	2.5	—	mV/kPa
Linearity	—	–1.0	—	1.0	$\%V_{FSS}$
Pressure Hysteresis (0 to 10 kPa)	—	—	±0.1	—	$\%V_{FSS}$
Temperature Hysteresis (–40°C to +125°C)	—	—	±0.5	—	$\%V_{FSS}$
Temperature Coefficient on Full Scale Span	TCV_{FSS}	–1.0	—	1.0	$\%V_{FSS}$
Temperature Coefficient on Offset	TCV_{OFF}	–1.0	—	1.0	mV
Input Impedance	Z_{IN}	1300	—	2550	Ω
Output Impedance	Z_{OUT}	1400	—	3000	Ω
Response Time[5] (10% to 90%)	t_R	—	1.0	—	ms
Warm-Up Time	—	—	20	—	ms
Offset Stability[6]	—	—	±0.5	—	$\%V_{FSS}$

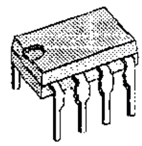
1. 1.0 kPa (kiloPascal) equals 0.145 psi.
2. Device is ratiometric within this specified excitation range. Operating the device at a different range may induce additional error due to device self-heating.
3. Full Scale Span (V_{FSS}) is defined as the algebraic difference between the output voltage at full rated pressure and the output voltage at the minimum rated pressure.
4. Offset (V_{OFF}) is defined as the output voltage at the minimum rated pressure.
5. Response Time is defined as the time for the incremental change in the output to go from 10% to 90% of its final value when subjected to a specified step change in pressure.
6. Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

SGS-THOMSON MICROELECTRONICS

UA741

GENERAL PURPOSE SINGLE OPERATIONAL AMPLIFIERS

- LARGE INPUT VOLTAGE RANGE
- NO LATCH-UP
- HIGH GAIN
- SHORT-CIRCUIT PROTECTION
- NO FREQUENCY COMPENSATION REQUIRED
- SAME PIN CONFIGURATION AS THE UA709
- ESD INTERNAL PROTECTION



N
DIP8
(Plastic Package)

D
SO8
(Plastic Micropackage)

DESCRIPTION

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

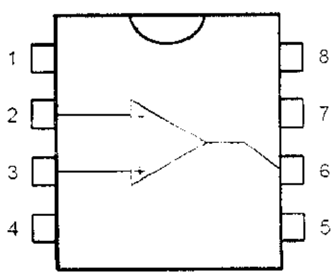
- Summing amplifier
- Voltage follower
- Integrator
- Active filter
- Function generator

The high gain and wide range of operating voltages provide superior performances in integrator, summing amplifier and general feedback applications. The internal compensation network (6dB / octave) insures stability in closed loop circuits.

ORDER CODES

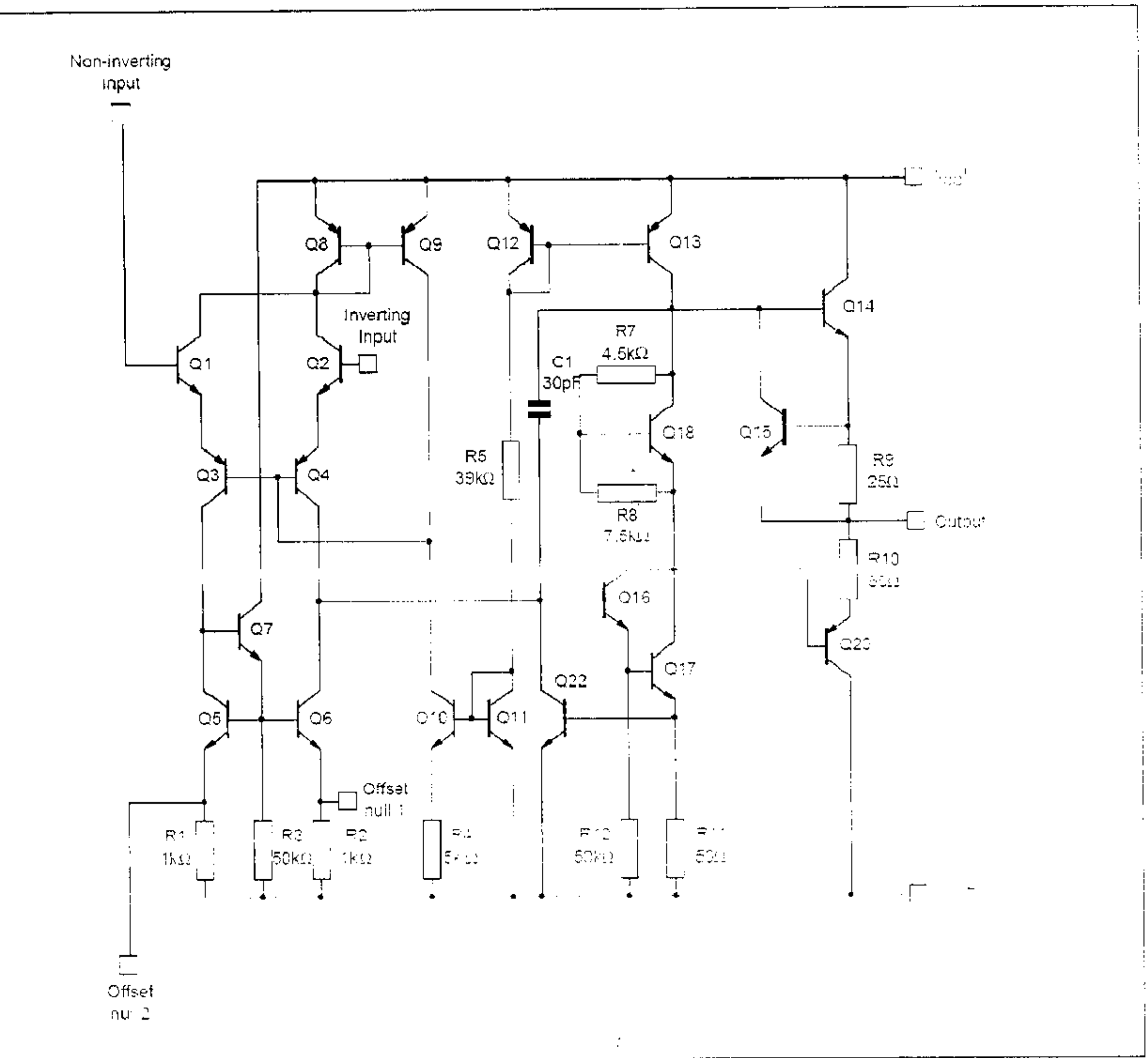
Part Number	Temperature Range	Package N	Package D
UA741C/E	0°C, +70°C	•	•
UA741I	-40°C, +105°C	•	•
UA741M/A	-55°C, +125°C	•	•
Example : UA741CN			

PIN CONNECTIONS (top view)



1 - Offset null 1
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}^-
5 - Offset null 2
6 - Output
7 - V_{CC}^+
8 - N.C.

MATIC DIAGRAM



LUTE MAXIMUM RATINGS

bol	Parameter	UA741M-A	UA741I	UA741C-E	Unit
	Supply Voltage	±22	±22	±22	V
i	Input Voltage - (note1)	±15	±15	±15	V
d	Differential Input Voltage	±30	±30	±30	V
ot	Power Dissipation	500	500	500	mW
	Output Short-circuit Duration	Infinite			
	Operating Free Air Temperature Range	-55 to +125	-40 to +105	0 to +70	°C
	Storage Temperature Range	-65 to +150	-65 to +150	-65 to +150	°C

. The magnitude of the input voltage must never exceed the magnitude of the positive and negative supply voltage.

TRICAL CHARACTERISTICS

±15V, T_{amb} = 25°C (unless otherwise specified)

bol	Parameter	Min.	Typ.	Max.	Unit
[illegible]	Input Offset Voltage ($R_s \leq 10k\Omega$) T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$ UA741E,A T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$		1 1	5 6 2 4	mV
[illegible]	Input Offset Current T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$		2	30 70	nA
[illegible]	Input Bias Current T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$		10	100 200	nA
vd	Large Signal Voltage Gain (V_o = ±10V, R_L = 2kΩ) T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$	50 25	200		V/mV
VR	Supply Voltage Rejection Ratio ($R_s \leq 10k\Omega$) T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$	77 77	90		dB
c	Supply Current, no load T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$		[illegible]	2.8 3.3	mA
cm	Input Common Mode Voltage Range T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$	±12 ±12			[illegible]
MR	Common Mode Rejection Ratio ($R_s \leq 10k\Omega$) T_{amb} = 25°C $T_{min} \leq T_{amb} \leq T_{max}$	70 70	90		dB
[illegible]	Output Short-circuit Current	10	35		mA
[illegible]	Output Voltage Swing T_{amb} = 25°C R_L = 10kΩ R_L = 2kΩ $T_{min} \leq T_{amb} \leq T_{max}$ R_L = 10kΩ R_L = 2kΩ	12 10 12 10	14 13		V
R	Slew Rate (V_i = ±10V, R_L = 2kΩ, C_L = 100pF, T_{amb} = 25°C, unity gain)	0.25	0.5		V/μs
r	Rise Time (V_i = ±20mV, R_L = 2kΩ, C_L = 100pF, T_{amb} = 25°C, unity gain)		0.3		μs
ov	Overshoot (V_i = ±20mV, R_L = 2kΩ, C_L = 100pF, T_{amb} = 25°C, unity gain)		5		%
R_i	Input Resistance	0.3	2		MΩ
BP	Gain Bandwidth Product (V_i = 10mV, R_L = 2kΩ, C_L = 100pF, f = 100kHz)	0.7	1		MHz
HD	Total Harmonic Distortion [illegible]		[illegible]		%
e_n	Equivalent Input Noise Voltage (f = 1kHz, R_s = 100Ω)		23		$\frac{nV}{\sqrt{Hz}}$
m	Phase Margin		70		Degrees