

DESIGN AND CONSTRUCTION OF AVR BASE RC METER

This project report is submitted to the Department of Electrical & Electronic Engineering (EEE), Daffodil International University, Bangladesh, in Partial fulfillment of the requirements for the Degree of “Bachelor of Science in Electrical & Electronic Engineering”.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Md. Dara Abdus Satter, Assistant Professor, Department of EEE, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree.

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-----*Authors*

ABSTRACT

Here we make a design and installation process of the RC measuring system.

First of all according to the collected information about RC measuring then total circuit design has been completed using Proteus software.

A **RC meter** Resistance (R) and Capacitance (C) is a piece of electronic test equipment used to measure the resistance and capacitance of a component. In Electronics, capacitance is the ability of a body to hold an electrical charge Background.

AVR ATMEGA8A-PU Microcontroller was programmed with programming language C in code vision AVR compiler. Microcontroller calculating this value transmitted it to a LCD to display the Resistance (R) and Capacitance (C).

JHD 162D Liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCD). They are usually more compact, lightweight, portable, less expensive, more reliable, and easier on the eyes. This is a basic 16 character by 2 line display with a snazzy green background with white characters.

9 V Transformer is used as its main power supply. In this transformer primary voltage is 220 V and in secondary coil voltage is 9 V AC. LM7085 voltage converter used to convert voltage (9 V to 5 V). A switch is used to start the system.

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CHAPTER1

INTRODUCTION

1.1 Background

An RC meter is a piece of electronic test equipment used to measure the capacitance (C) and resistance (R) of a component. In the simpler versions of this instrument the true values of these quantities are not measured; rather the impedance is measured internally and converted for display to the corresponding capacitance or inductance value. Readings will be reasonably accurate if the capacitor or inductor device under test does not have a significant resistive component of impedance. More advanced designs measure true inductance or capacitance, and also the equivalent series resistance of capacitors and the Q factor of inductive components.

Usually the device under test (DUT) is subjected to an AC voltage source. The meter measures the voltage across and the current through the DUT. From the ratio of these the meter can determine the magnitude of the impedance. The phase angle between the voltage and current is also measured in more advanced instruments; in combination with the impedance, the equivalent capacitance or inductance, and resistance, of the DUT can be calculated and displayed. The meter must assume either a parallel or a series model for these two elements. The CR measurements have the elements in parallel (as would be encountered in measuring a capacitor with a leaky dielectric). An RC meter can also be used to judge the inductance variation with respect to the rotor position in permanent magnet machines (however care must be taken as some RC meters can be damaged by the generated EMF produced by turning the rotor of a permanent-magnet motor).

Hand held RC meters typically have selectable test frequencies of 100 Hz, 120 Hz, 1kHz, 10kHz, and 100kHz for top end meters. The display resolution and measurement range capability will typically change with test frequency.

Bench top RC meters typically have selectable test frequencies of more than 100 kHz. They often include possibilities to superimpose a DC voltage or current on the AC measuring signal. Lower end meters offer the possibility to externally supply these DC voltages or currents while higher end devices can supply them internally. In addition bench top meters allow the usage of special fixtures to measure SMD components, air-core coils or transformers.

Capacitance, resistance, and dissipation factor can also be measured by various bridge circuits. They involve adjusting variable calibrated elements until the signal at a detector becomes null, rather than measuring impedance and phase angle.

Early commercial LCR bridges used a variety of techniques involving the matching or "nulling" of two signals derived from a single source. The first signal was generated by applying the test signal to the unknown and the second signal was generated by utilizing a combination of known-value R and C standards. The signals were summed through a detector (normally a panel meter with or without some level of amplification). When zero current was noted by changing the value of the standards and looking for a "null" in the panel meter, it could be assumed that the current magnitude through the unknown was equal to that of the standard and that the phase was exactly the reverse (180 degrees apart). The combination of standards selected could be arranged to read out C and DF directly which was the precise value of the unknown standard. An example of this is the GenRad/IET Labs Model 1620 and 1621 Capacitance Bridges.

1.2Capacitance measuring

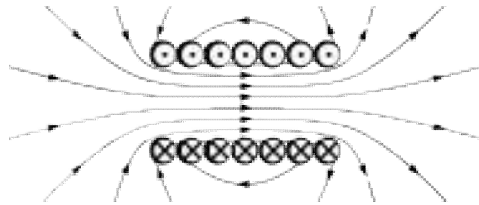
We have used a 555 timer for finding the capacitance of an unknown capacitor

There is a relationship between frequency generated by 555 timer, resistances and inserted capacitor. So if we know the value of resistor and frequency so that we can easily determine the unknown capacitance

And the relationship is ____

$$C = \frac{1.44}{(R_A + 2R_B) \times f}$$

Electromagnetism



Electrostatics[show]

Magneto statics[show]

Electrodynamics[show]

Electrical network[show]

Covariant formulation[show]

Scientists[show]

Capacitance is the ability of a body to store an electrical charge. Any object that can be electrically charged exhibits capacitance. A common form of energy storage device is a parallel-plate capacitor. In a parallel plate capacitor, capacitance is directly proportional to the surface area of the conductor plates and inversely proportional to the separation distance between the plates. If the charges on the plates are $+q$ and $-q$, and V gives the voltage between the plates, then the capacitance C is given by

$$C = \frac{q}{V}.$$

which gives the voltage/current relationship

$$I(t) = C \frac{dV(t)}{dt}.$$

The capacitance is a function only of the physical dimensions (geometry) of the conductors and the permittivity of the dielectric. It is independent of the potential difference between the conductors and the total charge on them.

The SI unit of capacitance is the farad (symbol: F), named after the English physicist Michael Faraday; a 1 farad capacitor when charged with 1 coulomb of electrical charge will have a potential difference of 1 volt between its plates.^[1] Historically, a farad was regarded as an inconveniently large unit, both electrically and physically. Its subdivisions were invariably used, namely the microfarad, nan farad and Pico farad. More recently, technology has advanced such that capacitors of 1 farad and greater can be constructed in a structure little larger than a coin battery (so-called 'super capacitors'). Such capacitors are principally used for energy storage replacing more traditional batteries.

The energy (measured in joules) stored in a capacitor is equal to the *work* done to charge it. Consider a capacitor of capacitance C , holding a charge $+q$ on one plate and $-q$ on the other. Moving a small element of charge dq from one plate to the other against the potential difference $V = q/C$ requires the work dW :

$$dW = \frac{q}{C} dq$$

where W is the work measured in joules, q is the charge measured in coulombs and C is the capacitance, measured in farads.

The energy stored in a capacitor is found by integrating this equation. Starting with an uncharged capacitance ($q = 0$) and moving charge from one plate to the other until the plates have charge $+Q$ and $-Q$ requires the work W :

1.3 Resistance measuring

We use simply voltage divider rule for finding the unknown resistance

$$R_{\text{known}} = R_{\text{known}} \times V_{r.\text{unk}}$$

$$V_s - V_{r.\text{unk}}$$

So here R_{known} and V_s is known.

Only $V_{r.\text{unk}}$ is unknown, if we find $V_{r.\text{unk}}$ Then finished

This $V_{r.\text{unk}}$ has determined by microcontroller and then simply R_{known} has determined

Electrical resistance: property of a conductor due to which it opposes the flow of current through it. Friction, Drag (physics) ("air resistance"), fluid or gas forces opposing motion and flow. Geological resistance, a measure of how well minerals resist erosive factors

Hydraulic conductivity, the ease with which water can move through pore spaces or fractures in soil or rock. Thermal resistance, a measure of difficulty of heat transfer through a substance. Thermal conductivity, how well heat is conducted through a substance. Thermal resistance in electronics, heat considerations in electronics design

In materials science, the term is sometimes used for hardness

1.4 Objective

General objective of this project was to acquire knowledge on Humidity measurement system design and construct this project was carried out with the following specific objectives:

- ❖ Design and implementation of an Auto Range Digital LCR Meter using microcontroller
- ❖ Which gives high accuracy than other low cost commercial LCR meter
- ❖ Will cost effective
- ❖ Compact in size
- ❖ Portable

1.5 Methodologies

- Collection of information from different books and internet.
- According to the information design and simulation process has been completed.
- Visited the local market and collect the design wise apparatus.

1.6 Major Components of RC Meter

- Microcontroller ATMEGA8A-PU 28pin
- Alphanumeric LCD 16*2
- Register
- 9V DC Dry cell Battery
- 7805 voltage regulator
- Push pull Switch

CHAPTER 2

DESIGN CRITERIA OF AUTORANGING RC METER

2.1 Introduction

Display: A 5-digit LED display shows measured values, entered parameters, instrument status, and user messages.

2Making Measurements: Measurements can be performed at test frequencies of **100 Hz, 120 Hz, 1 kHz, and 10 kHz**. A built-in drive voltage can be set to preset values (**0.1, 0.25 and 1.0 V**) or adjusted from **0.1 to 1.0 V in 50 mV** increments. Measurements are taken at rates of **2, 10 or 20** samples per second. Consecutive readings can be averaged between 2 and 10 times for increased accuracy. Both series and parallel equivalent circuit models of a component are supported. Capacitor measurements use the external direct current (DC) source of up to 40 volts.

Auto measurement: The power and flexibility of the RC **meter** does not come at the expense of ease-of-use. A convenient AUTO measurement mode automates the selection of setup parameters and quickly determines the appropriate device model for whatever component is being measured. Up to nine instrument setups can be stored in non-volatile memory for quick recall at a later time.

Convenient Calibration: The null calibration procedure available in most of the RC meters automatically corrects both open and short circuit parameters at all frequencies and all ranges.

Test Fixtures: The RC **meters** have a Kelvin fixture which uses two wires to carry the test current and two independent wires to sense the voltage across the device under test. This prevents the voltage drop in the current carrying wires from affecting the voltage

measurement. Radial components are simply inserted into the test fixture, one lead in each side. Axial devices require the use of the axial fixture adapters which will also be provided

2.2 Block diagram

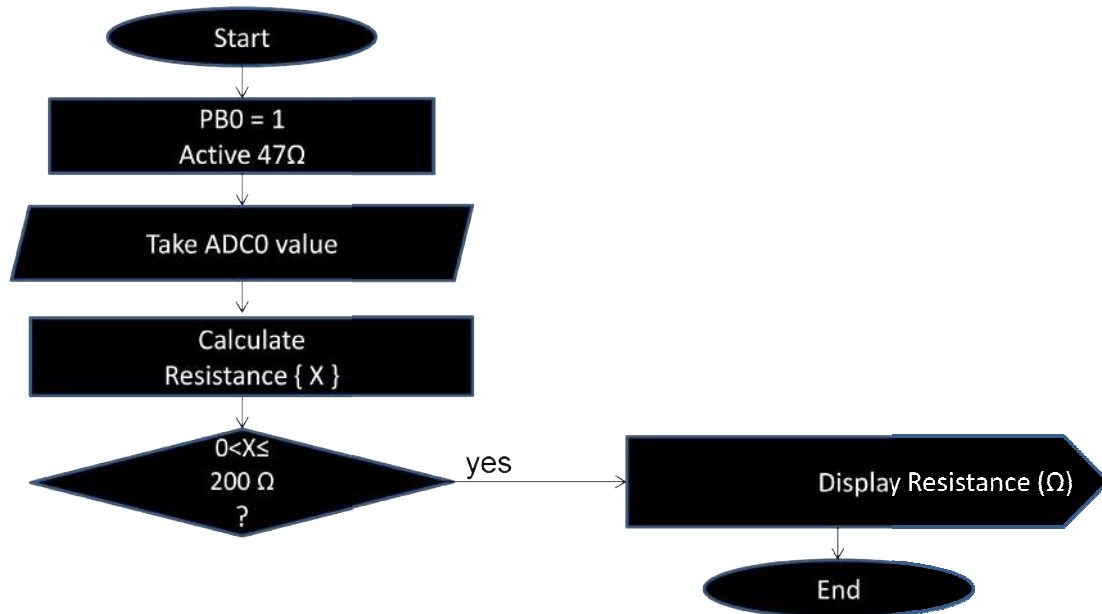


Fig: 2.1Block diagram for measuring Resistance.

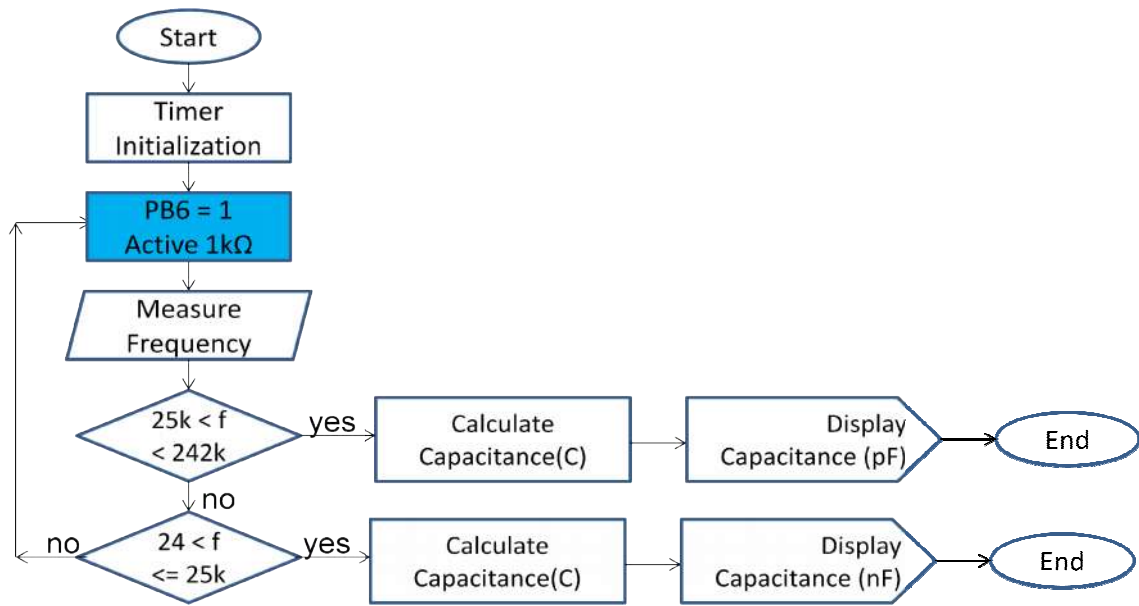


Fig: 2.2Block diagram for measuring Capacitance.

2.3 Circuit Diagram of RC Meter

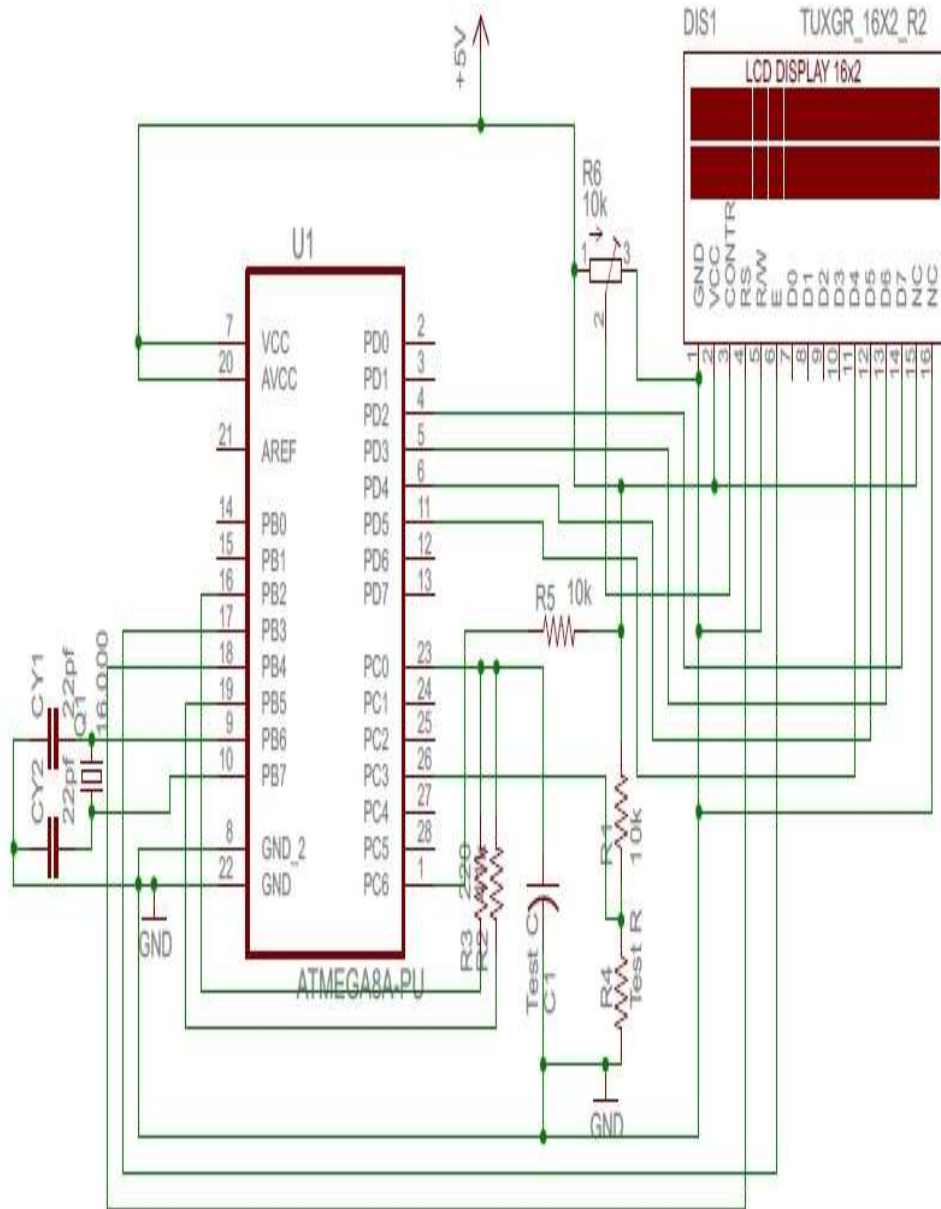


Fig:2.3 Circuit Diagram of RC Meter

2.4 Circuit Diagram of capacitance

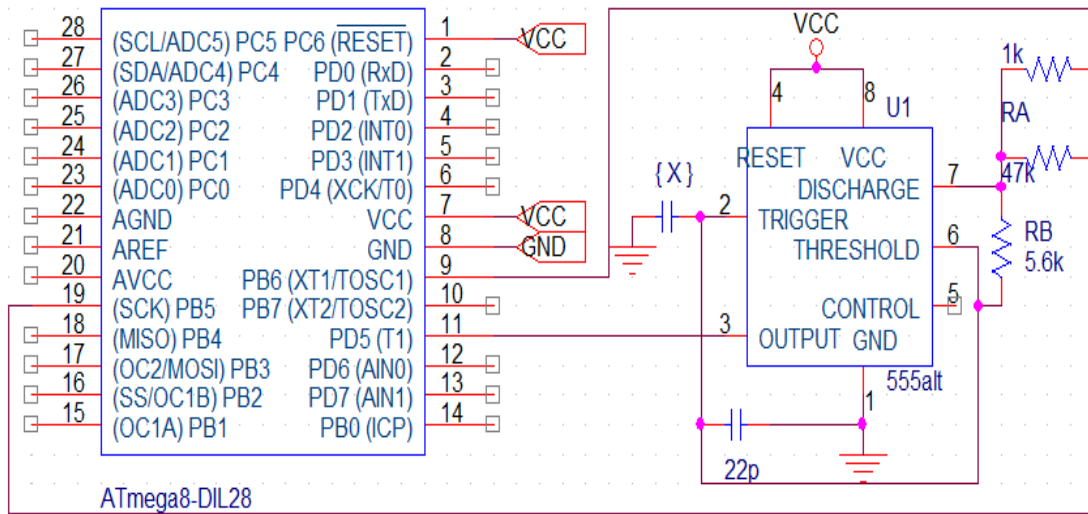


Fig: 2.4 Circuit Diagram of capacitance

2.5 Circuit Diagram of resistance

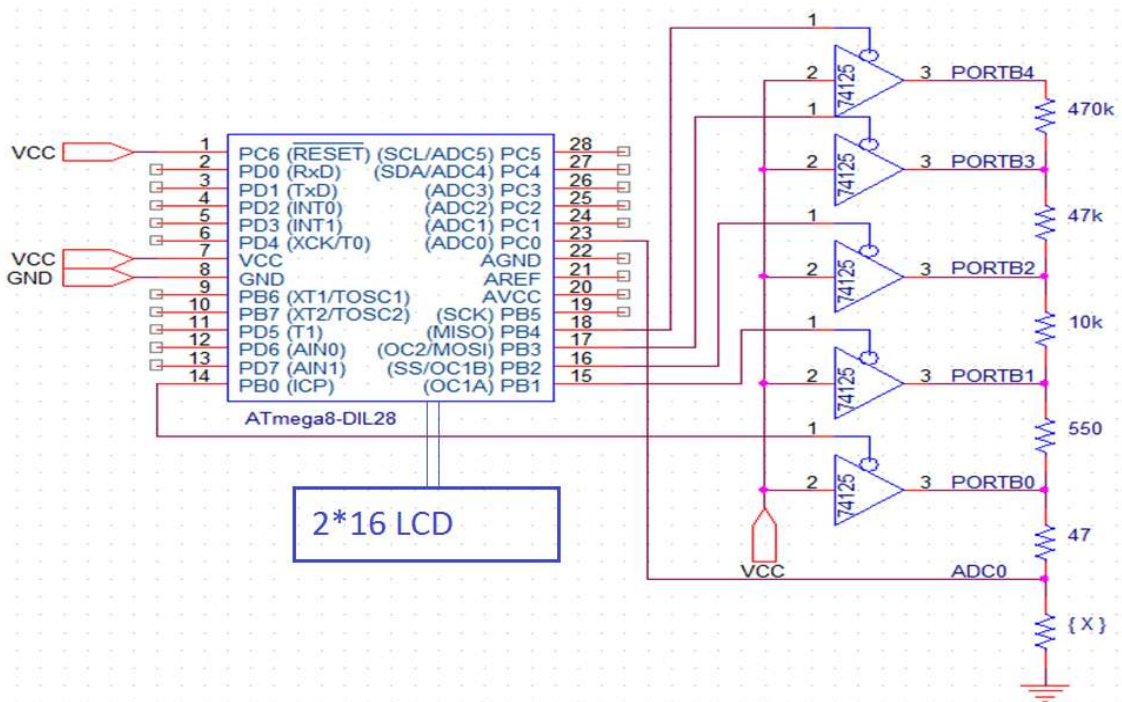


Fig:2.5 Circuit Diagram of resistance

2.6 Working principle of RC meter

The device under test (DUT) is subjected to an AC voltage source. The **RC meter** detects the voltage over, and the current through the DUT. From the ratio of these, the meter can determine the magnitude of the impedance. The phase angle between the voltage and current is also detected and between that and the impedance magnitude the DUT can be represented as R or a C and R. The **RC meter** must assume either a parallel or a series model for these two elements.

2.7 Advantages of RC meters

RC meters are available in a wide array of formats, both analog and digital. Analog testers are more cost-effective and can be constructed using basic components if necessary. Digital testers, however, provide more accurate readings and are available in smaller sizes and weights.

R meter is simple to operate.

The **RC Meter** measures passive components with as little as **0.05 %** errors.

These easy-to-use instruments are quick to setup, adjust and calibrate.

They are ideal for applications such as incoming inspection, quality control, automated test, and general bench top use.

CHAPTER 3

MICROCONTROLLER

3.1 Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
 - 130 Powerful Instructions – Most Single-clock Cycle Execution
 - 32 x 8 General Purpose Working Registers
 - Fully Static Operation
 - Up to 16 MIPS Throughput at 16 MHz
 - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
 - 8K Bytes of In-System Self-programmable Flash program memory
 - 512 Bytes EEPROM
 - 1K Byte Internal SRAM
 - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
 - Data retention: 20 years at 85°C/100 years at 25°C(1)
 - Optional Boot Code Section with Independent Lock Bits

- In-System Programming by On-chip Boot Program
- True Read-While-Write Operation
- Programming Lock for Software Security

- Peripheral Features
- Two 8-bit Timer/Counters with Separate presales, one Compare Mode
- One 16-bit Timer/Counter with Separate Presales, Compare Mode, and Capture
- Mode
- Real Time Counter with Separate Oscillator
- Three PWM Channels
- 8-channel ADC in TQFP and QFN/MLF package

- Eight Channels 10-bit Accuracy
- 6-channel ADC in PDIP package

- Six Channels 10-bit Accuracy
- Byte-oriented Two-wire Serial Interface
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Special Microcontroller Features
- Power-on Reset and Programmable Brown-out Detection

- Internal Calibrated RC Oscillator
- External and Internal Interrupt Sources
- Five Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, and
 - Standby
 - I/O and Packages
- 23 Programmable I/O Lines
- 28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF
 - Operating Voltages
 - 2.7 - 5.5V (ATmega8L)
 - 4.5 - 5.5V (ATmega8)
 - Speed Grades
 - 0 - 8 MHz (ATmega8L)
 - 0 - 16 MHz (ATmega8)
 - Power Consumption at 4 Mhz, 3V, 25°C
 - Active: 3.6 mA
 - Idle Mode: 1.0 mA
 - Power-down Mode: 0.5 μ A



Fig: 3.1 ATMEGA8 28 pin Microcontroller

3.2 Block diagram

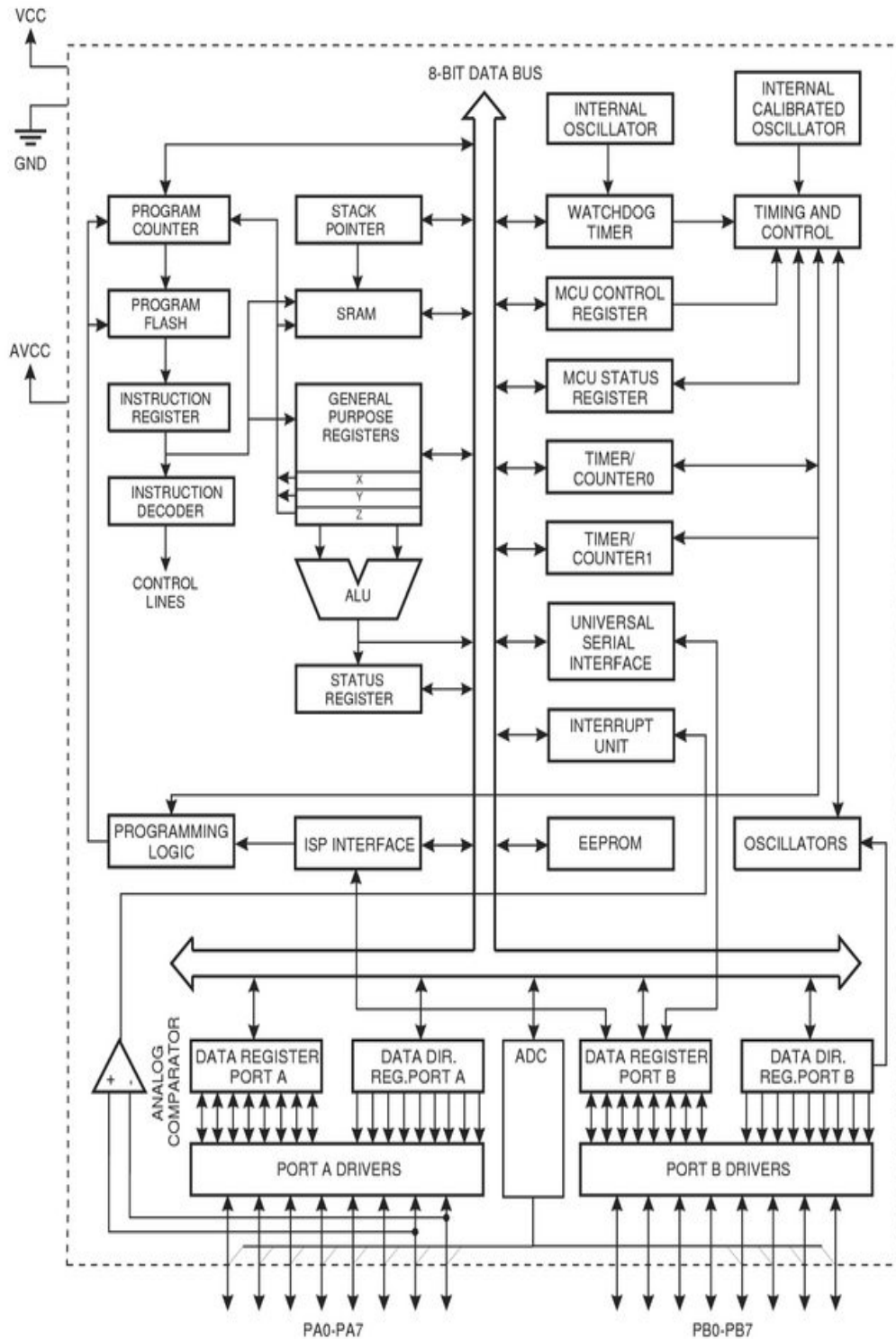


Fig: 3.2 Block Diagram of Microcontroller

3.3 Pin configure

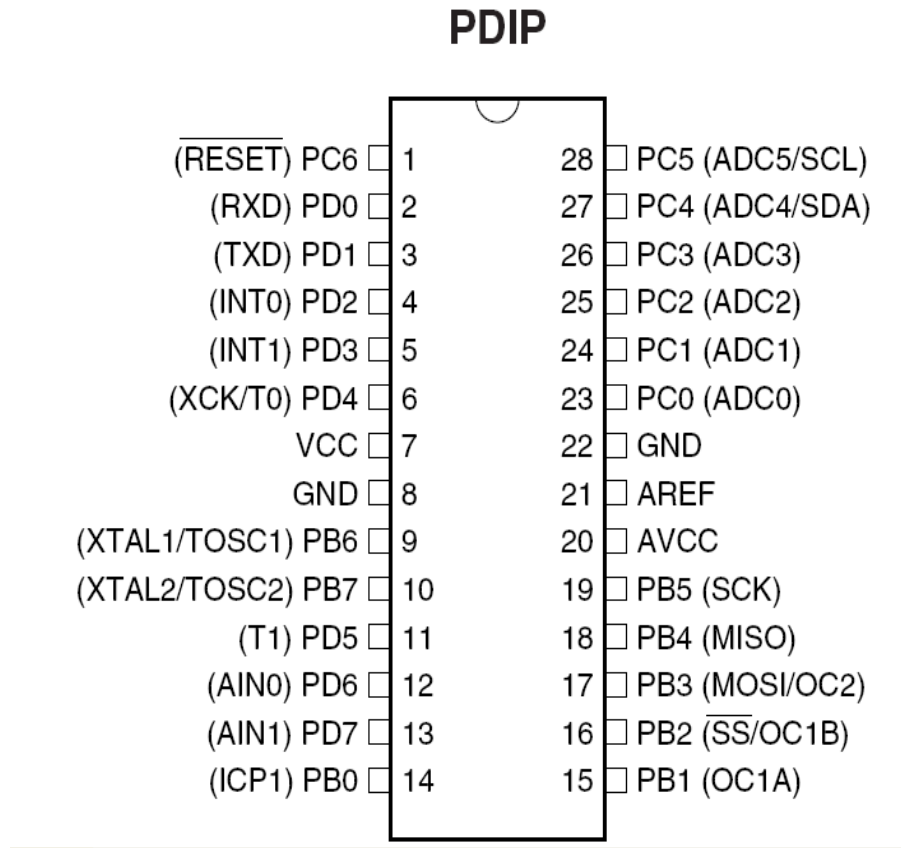


Fig: 3.3 Pin Description of microcontroller

VCC Digital supply voltage.

GND Ground.

Port B (PB7..PB0) XTAL1/XTAL2/TOSC1/TOSC2: Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active,

Even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB7..6 is used as TOSC2..1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set. The various special features of Port B are elaborated in

Port C (PC5..PC0): Port C is an 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running

PC6/RESET: If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. The minimum pulse length is given in Shorter pulses are not guaranteed to generate a Reset.

Port D (PD7..PD0): Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port D also serves the functions of various special features of the ATmega8 .

RESET: Reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Shorter pulses are not guaranteed to generate a reset.

AVCC: AVCC is the supply voltage pin for the A/D Converter, Port C (3..0), and ADC (7..6). It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that Port C (5..4) use digital supply voltage, VCC.

AREF: AREF is the analog reference pin for the A/D Converter.

ADC7..6 (TQFP and QFN/MLF Package Only):In the TQFP and QFN/MLF package,ADC7..6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

3.4 Overview

The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent

registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers

The ATmega8 provides the following features: 8K bytes of In-System Programmable Flash with Read-While-Write capabilities, 512 bytes of EEPROM, 1K byte of SRAM, 23 general

purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte oriented Two wire Serial Interface, a 6-channel ADC (eight channels in TQFP and QFN/MLF packages) with

10-bit accuracy, a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power down

mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next Interrupt or Hardware Reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption.

The device is manufactured using Atmel's high density non-volatile memory technology. The Flash Program memory can be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip boot program running on the AVR core. The boot program can use any interface to download the application program in the

Application Flash memory. Software in the Boot Flash Section will continue to run while the Application Flash Section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic

chip, the ATmega8 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega8 AVR is supported with a full suite of program and system development tools, including C compilers, macro assemblers, program debugger/simulators, In-Circuit Emulators, and evaluation kits. Reliability Qualification results show that the projected data retention failure rate is much less than 1 PPM over 20 years at 85°C or 100 years at 25°C

CHAPTER 4

ALPHANUMERIC DISPLAY

4.1 Introduction

Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).

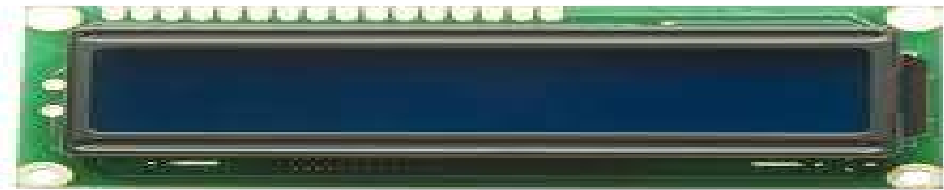


Fig: 4.1 alphanumeric display

4.2 Further information

An LCD (Liquid Crystal Display) basically works on the concept of Light Polarization of a 'Liquid Crystal' under the influence of an Electric Field. Every LCD contains a Back-Light behind the Liquid Crystal array, which acts as a light source. When an Electric Field is applied across certain fluids, it changes the way they allow light to pass through them, that is, it changes the orientation of the liquid crystal molecules as a result they do not allow light to pass through them. Hence, by applying suitable potential difference, we can control if light passes or doesn't pass through the LCD pixels.

The LCD is then divided into small pixels, the smallest partition of the screen, which can be controlled and polarized. A pixel is just a small dot on the screen. By combining a set of nearby pixels (dots), blocks are made, example, in a 16x2 LCD one block has 5x8 dots (or 5x10 dots in another configuration). The advantage in these kinds of LCDs is that the controller already has stored patterns of dots, forming legible alphabets or numbers, in its EEPROM. By sending suitable commands to the LCD controller, we can call the stored patterns to be displayed on the screen, hence not requiring us to explicitly state the patterns in our code.

This also means, we can't make our own set of patterns, and have to use the existing stored ones only.

4.3 Code Variation:

EPROM Address											Data					
A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	O4	O3	O2	O1	LSB O0
								0	0	0	0	1	0	0	0	0
								0	0	0	1	1	0	0	0	0
								0	0	1	0	1	0	1	1	0
								0	0	1	1	1	1	0	0	1
								0	1	0	0	1	0	0	0	1
								0	1	0	1	1	0	0	0	1
								0	1	1	0	1	1	1	1	0
0	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0	0

Table: 4.1 Code Variation of LCD Display

4.4 Pin description

Pin 1 – Vss (Common Source of Electrons i.e. Ground) 0V

Pin 2 - Vdd (Common Drain for Electrons i.e. High Voltage) 5V

Pin 3 - Vee (Common Emitter – used to control Contrast) Ground via resistor

Pin 4 – RS (Register Select) Used to tell LCD controller whether data on Data Bus is a Command

or Text Data. High Signal for Data and Low Signal for Command.

Pin 5 – R/W (Read Write) Used to tell LCD controller, if we wish to Read or Write to the LCD.

High for Read, Low for Write.

Pin 6 – E (Enable) Used for Enabling and Disabling the LCD

Pin 7 to 14 – LCD Data Bus

Pin 15 – Positive Terminal for Backlight (5V)

Pin 16 – Negative Terminal for Backlight (0V)

Provide Ground to Pin.1 (Vss), +5V to Pin.2 (Vdd) and a 2.5k Resistor (or a POT) to the Pin.3 (Vee). Connect the Pin.4 (RS) to PD.5, Pin.5 (R/W) to PD.6 and Pin.6 (E) to PD.7

Since we will be only writing to the LCD, you can also just ground the R/W pin. Give +5V and Ground to the LCD back-light supply (Pin.15 and Pin.16).

4.5 Outline Dimension and Block Diagram

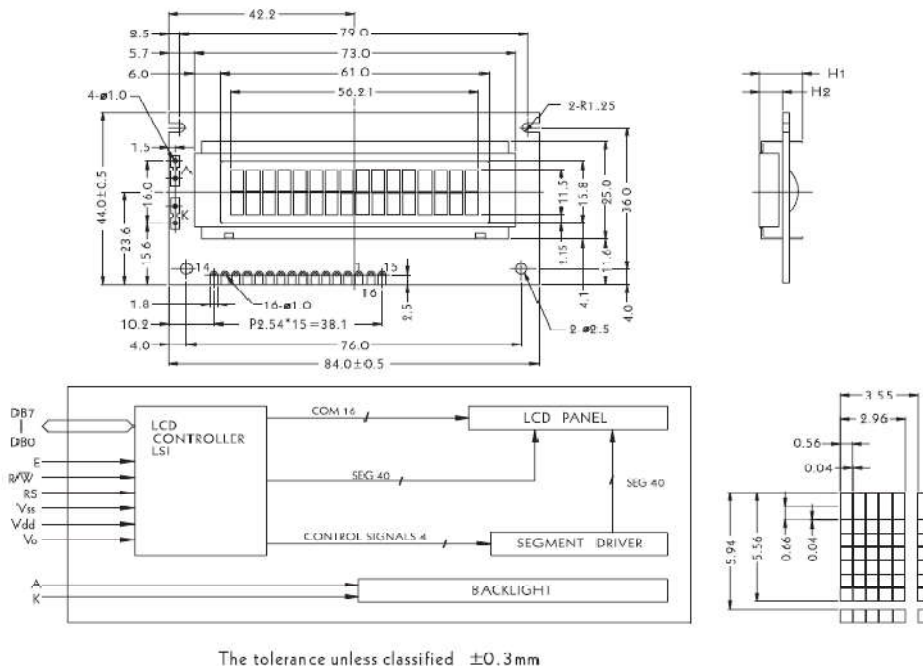


Fig: 4.2 Outline Dimension and Block Diagram

4.6 Electrical Characteristics

Item	Symbol	Condition	Standard Value			Unit	Applicable
Power Voltage	VDD		4.5	5.00	5.5	V	Vdd
Input H.Level Voltage	VIH		2.2	-	Vdd	V	RS,R/W,E
Input L. LevelVoltage	VIL		-0.3		0.6	V	DBO□-DB7
Output H-Level Voltage	VOH	_IOH=0.205 mA	2.4		-	V	DBO□-DB7
Output L-Level Voltage	VOL	IoL=1.2mA	-		0.4	V	RS,R/W,E
I/O Leakage Current	IIL	Vin=0 -Vdd	-1		1.0	μA	DBO-DB7
Supply Current	IDD	Vdd=5V	2		-	mA	Vdd

Table:4.2 Electrical Characteristic of numeric display

4.7 Timing Characteristic

Item	Symbol	Min	Max	unit
Enable cycle time	TCYCE	500	-	ns
Enable pulse width	High level PWEH	220	-	ns
Enable rise/fall time	TER.TE F	-	25	ns
Setup time	RS.R/W TAS	40	-	ns
Address hold time	TAH	10	-	ns
Data set up time	TDSH	60	-	ns
Data delay time	TDDR	60	120	ns
Data hold time(writing)	TH	10	-	ns
Data hold time(reading)	TDHR	20	-	ns
Clock oscillating frequency	TOSC	270(TYP)		KHz

Table:4.3 Timing Characteristic of Alphanumeric display

4.8 Interfacing with MPU

Interfacing with 4-bit MPU can be made through I/O port of 4-bit Maui there are enough I/O Ports, at Can be transferred by 8-bit , however ,if there are not data transfer can be done by 4-bi in twice (select Interface is 4-bit long),and sequence will be complicated in this case. please take into account that 2 cycles of BF check is necessary, While 2 cycles of data transfer are also necessary.

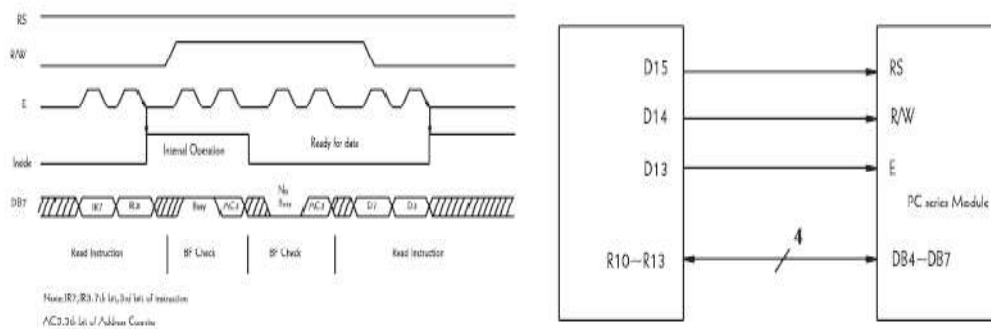


Fig: 4.3 Interfacing diagram with MPU

Features of Interfacing

1. Interface with 8-bit MPU is available.
2. 192 kind of alphabets, numerals, symbols and special characters can be displayed by built-in character generator (RAM)
3. Other preferred characters can be displayed by character generator.
4. Various functions of instruction are available by programming such as clear display, cursor at home, On/of cursor, Blink character, shift display shift cursor read/write display data...etc.

5.single power supply +5v drive (except for extended temp.type).

6.Compact and light weight design which.canbe easily assembled in devices.

4.9 Initialization:

If power supply conditions are not satisfied, which for proper operation of internal rest circuit, It is required to make initialization along with instruction. Make following procedures.

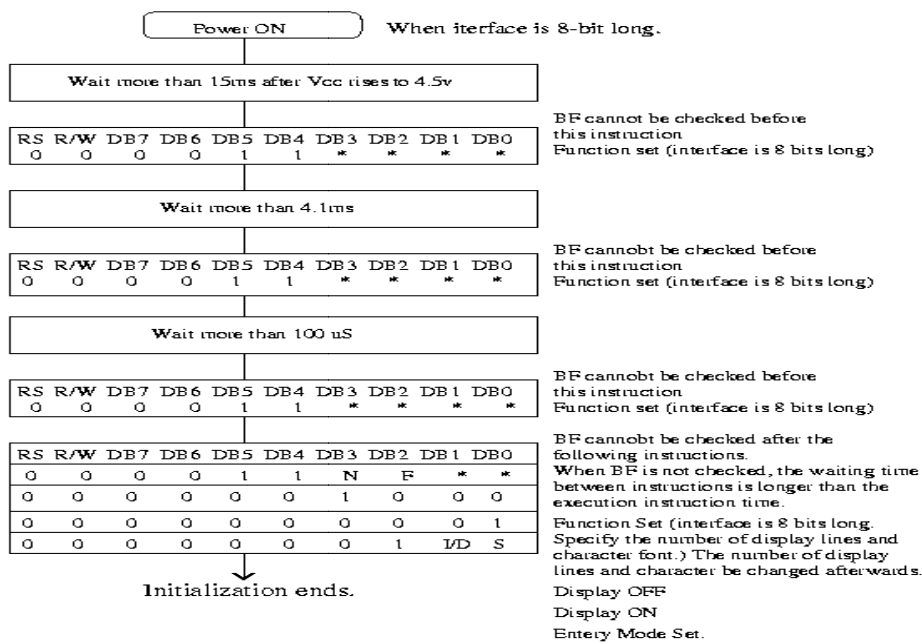


Fig:4 .4 Instruction of installation process numeric display

CHAPTER 5

VOLTAGE REGULATOR

5.1 Introduction

The LM7085 is a series of low dropout positive voltage regulators with a maximum dropout of 1.5V at 3A of load current. It has the same pin-out as TI's industry standard LM317. The LM1085 is available in an adjustable version, which can set the output voltage with only two External resistors,

It is also available in three fixed voltages: 3.3V, 5.0V and 12.0V. The fixed versions integrate the adjust resistors. The LM1085 circuit includes a zener trimmed band gap reference, current limiting and thermal shutdown. The LM1085 series is available in TO-220 and DDPAK/TO-263 packages. Refer to the LM1084 for the 5A version, and the LM1086 for the 1.5A version

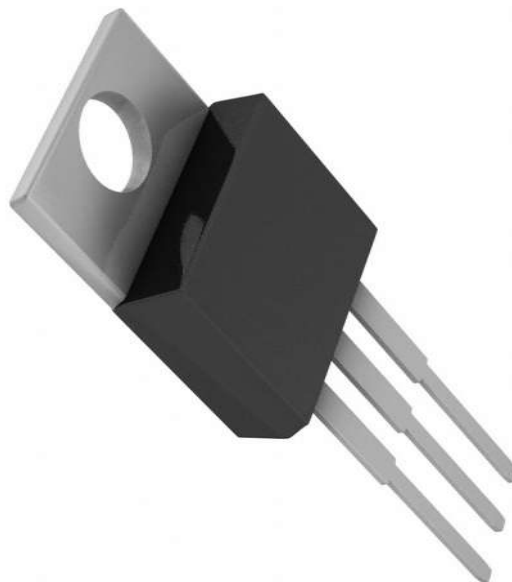


Fig: 5.1 LM7085 Voltage Converter

5.2 APPLICATIONS

- Available in 3.3V, 5.0V, 12V and Adjustable Versions
- Current Limiting and Thermal Protection
- Output Current 3A
- Line Regulation 0.015% (typical)
- Load Regulation 0.1% (typical)
- High Efficiency Linear Regulators
- Battery Charger
- Post Regulation for Switching Supplies
- Constant Current Regulator
- Microprocessor Supply

5.3 Connection Diagram

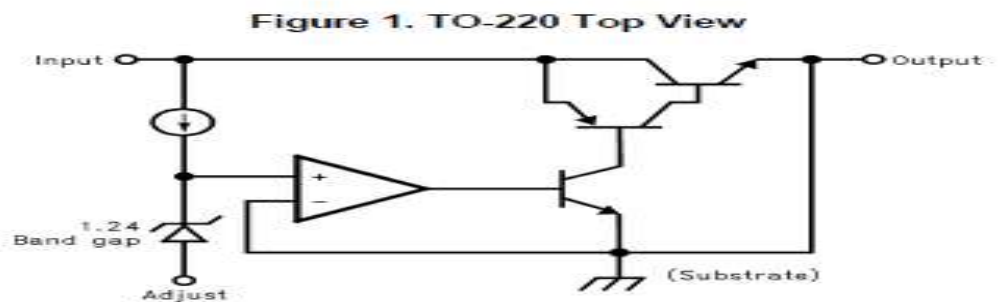


Fig: 5.2 Connection diagram of LM 7085

5.4 Specifications

Absolute Maximum Ratings(1) (2)	Maximum Input to Output Voltage Differential
LM1085-ADJ	29V
LM1085-12	18V
LM1085-3.3	17V
LM1085-5.0	25V
Power Dissipation (3)	Internally Limited
Junction Temperature (T _J)(4)	150°C
Storage Temperature Range -	65°C to 150°C
Lead Temperature	260°C, to 10 sec
ESD Tolerance (5)	2000V

Table:5.1 Specification of LM 7085 Voltage Converter.

Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.

If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and Power dissipation is kept in a safe range by current limiting circuitry. Refer to Overload Recovery in Application

The maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any ambient temperature is $P_D = (T_J(\text{max}) - T_A) / \theta_{JA}$. All numbers apply for packages soldered directly into a PC board. Refer to Thermal Considerations in the Application Notes.

For testing purposes, ESD was applied using human body model, 1.5k Ω in series with 100uF

5.5 Electrical Characteristics

Limits in standard type are for $T_J = 25^\circ\text{C}$ only; limits in boldface type apply over the operating junction temperature (T_J) range of -40°C to $+125^\circ\text{C}$.

Symbol	Parameter	Conditions	Min(1)	Typ(2)	Typ(2)	Units
VREF	Reference Voltage(3)	LM1085-ADJ IOUT = 10mA, VIN-VOUT = 3V10mA $\leq I_{OUT} \leq I_{FULL}$ LOAD, 1.5V \leq (VIN-VOUT) \leq 15V	1.238 1.225	1.250 1.250	1.262 1.270	V
VOUT	Output Voltage(3)	LM1085-3.3 IOUT = 0mA, VIN = 5V $0 \leq I_{OUT} \leq I_{FULL}$ LOAD, 4.8V \leq VIN \leq 15V	3.270 3.235	3.300 3.300	3.330 3.365	V
		LM1085-5.0 IOUT = 0mA, VIN = 8V $0 \leq I_{OUT} \leq I_{FULL}$ LOAD, 6.5V \leq VIN \leq 20V	4.950 4.900	5.000 5.000	5.050 5.100	V
		LM1085-12 IOUT = 0mA, VIN = 15V $0 \leq I_{OUT} \leq I_{FULL}$ LOAD, 13.5V \leq VIN \leq 25V	11.880 11.760	12.000 12.000	12.120 12.240	V

Table:5.2 Electrical Characteristic of LM 7085 Voltage Converter

Minimum and Maximum limits are ensured through test, design, or statistical correlation. Typical values represent the most likely parametric norm at $T_J = 25^\circ\text{C}$, and are provided for reference purposes only

All limits are specified by testing or statistical analysis. Typical Values represent the most likely parametric norm. If FULL LOAD is defined in the current limit curves, the current limit as a function of input-to-output voltage. Note that 30W power dissipation for the LM1085 is only achievable over a limited range of input-to-output voltage.

CHAPTER 6

PROGRAMMING

6.1 Introduction:

The purpose of this document is to analyze the selection criteria for memory chips to be used in Spacecraft computers. A general trend is to implement more autonomous functions in Spacecraft, making use of increased processor performances, but requiring larger embedded flight software sizes and larger storage on board. This note provides an introduction to the current organization of European Spacecraft On-Board Data

Handling systems and identifies the criticality of Spacecraft computer based functions. It recalls the constraints on memory planes linked to the Space environments, and gives examples of memory banks designs for typical sizes. In order to introduce the context of Space projects, the following figure represents a logic flow diagram of a typical Phase A /Phase B for a Spacecraft, where the most important trade-offs in term of Data Handling architecture and components selection have to be performed.

Both Hardware and Software activities are represented, due to a strong interaction of both designs necessary to achieve the most appropriate processing system. Design of current Spacecraft on board data handling subsystems. Starting from an approved mission concept, the Spacecraft has to be designed to meet a number of operational and environmental constraints. A preliminary On-Board Data Handling architecture is defined, based on the experience gained by the industry, with a parallel allocation of hardware and software functions.

This phase A work relies on existing hardware, re-utilization of standard functions and typical software. The software functions are then detailed to size more precisely the necessary resources to fulfill the Spacecraft mission, and an interactive work at subsystem level is

necessary to match hardware and software functions. The Spacecraft design is then reviewed at system level to check that it will meet the mission objectives, especially taking into account Space environment.

Issues are then identified (mass, reliability, thermal aspects...) and corrective actions taken as necessary for each equipment or subsystem. For that concern RAM banks, they have a particular importance at system level, since they contain most of flight software functions. Single event upsets have now been identified since early 80s and corrective hardware

methods have been implemented to avoid catastrophic effects. The main effect remains some degradation of the Spacecraft availability, whose impacts on the mission have to be assessed. To summarize, the steps in the selection process for memories in Space applications, are:

- _ PRELIMINARY ARCHITECTURE
- _ SIZING OF COMPUTER RESOURCES
- _ ANALYSIS OF SEU EFFECTS ON MISSION

6.2 Instruction

The C High-level Language (HLL) has become increasingly popular for programming microcontrollers. The advantages of using C compared to Assembler are numerous: Reduced development time, easier maintainability and portability, and easier to reuse code. The penalty can be larger code size and as a result of that often reduced speed. To reduce these penalties AVR architecture is tuned to efficiently decode and execute instructions that are typically generated by C compilers.

The C Compiler development was done by IAR systems before the AVR architecture and instruction set specifications were completed. The result of the co-operation between the compiler development team and the AVR development team is a microcontroller for which highly efficient, high performance code is generated. This application note describes how to

utilize the advantages of the AVR architecture and the development tools to achieve more efficient C code than for any other microcontroller.

6.3 Calculation and programmed:

Since we know that the microcontroller function based on programming interface, So if we use it according to our application must follow it's language, So prepared our programming language with C. Here the humidity sensor's output voltage shown in graphical fig 03 in chapter 1, When the output voltage is 0.75V the humidity in the air is 10%, and when voltage 3.25V humidity 90%. If this dew point of moisture is stable there no need program, But the percentage of humidity is always very, So for shown the value between 10%-90%, we follow the programmed,

Since we know our microcontroller device is 8Mhz. Port ADC, 6 serve as analog inputs to The A/D converter, These pins are powered from the analog supply and serve as 10 bit ADC Channel,

10 bit = 1024 byt

$1024/5 = 204$ for 1V

For 0.75V ----- $204 \times 0.75 = 152$

For 3.25V ----- $204 \times 3.25 = 654$

Difference between to byte $654 - 152 = 502$

Now we use the CVR code vision avr software for write the programme, like the fig below

Programmed

```
/* RCTiming_capacitance_meter
```

```
* Paul Badger 2008
```

```
* Demonstrates use of RC time constants to measure the value of a capacitor
```

```
*
```

```
* Theory A capacitor will charge, through a resistor, in one time constant, defined as T seconds where
```

```
*  $TC = R * C$ 
```

```
*
```

```
* TC = time constant period in seconds
```

```
* R = resistance in ohms
```

```
* C = capacitance in farads (1 microfarad (ufd) = .0000001 farad =  $10^{-6}$  farads )
```

```
*
```

```
* The capacitor's voltage at one time constant is defined as 63.2% of the charging voltage.
```

```
*
```

```
* Hardware setup:
```

```
* Test Capacitor between common point and ground (positive side of an electrolytic capacitor to common)
```

```
* Test Resistor between chargePin and common point
```

```
* 220 ohm resistor between dischargePin and common point
```

```
* Wire between common point and analogPin (A/D input)
```

```
*/
```

```
#include <LiquidCrystal.h
```

```

// initialize the library with the numbers of the interface pins

LiquidCrystalcd(3, 4, 5, 6, 7, 8);

#define analogPin 0 // analog pin for measuring capacitor voltage

#define chargePin 13 // pin to charge the capacitor - connected to one end of the
charging resistor

#define dischargePin 10 // pin to discharge the capacitor

#define resistorValue 10000.0F // change this to whatever resistor value you are using

// F formatter tells compiler it's a floating point value

intAnalogPin = 3; // potentiometer wiper (middle terminal) connected to analog pin 3

// outside leads to ground and +5V

int raw = 0; // variable to store the raw input value

int Vin = 4.8; // variable to store the input voltage

floatVout = 0; // variable to store the output voltage

float R1 = 10; // variable to store the R1 value

float R2 = 0; // variable to store the R2 value

float buffer = 0; // buffer variable for calculation

unsigned long startTime;

unsigned long elapsedTime;

floatmicroFarads; // floating point variable to preserve precision, make calculations

floatnanoFarads;

//constintnumReadings = 10;

//

```

```

//int readings[numReadings]; // the readings from the analog input

//int index = 0; // the index of the current reading

//int total = 0; // the running total

//int average = 0; // the average

void setup(){

pinMode(chargePin, OUTPUT); // set chargePin to output

digitalWrite(chargePin, LOW);

lcd.begin(16, 2);

Serial.begin(9600); // initialize serial transmission for debugging

// for (int thisReading = 0; thisReading < numReadings; thisReading++)

// readings[thisReading] = 0;

}

void loop(){

digitalWrite(chargePin, HIGH); // set chargePin HIGH and capacitor charging

startTime = millis();

while(analogRead(analogPin) < 648){ // 647 is 63.2% of 1023, which corresponds to full-
scale voltage

}

elapsedTime = millis() - startTime;

```



```

// convert milliseconds to seconds ( 10^-3 ) and Farads to microFarads ( 10^-6 ), net 10^3
(1000)

microFarads = ((float)elapsedTime / resistorValue) * 1000;

Serial.print(elapsedTime);    // print the value to serial port

Serial.print(" mS  ");    // print units and carriage return

if (microFarads > 1){

Serial.print((long)microFarads);    // print the value to serial port

Serial.println(" microFarads  ");    // print units and carriage return

lcd.setCursor(0, 0);

lcd.print(microFarads);

lcd.print(" microFarads  ");

}

else

{

// if value is smaller than one microFarad, convert to nanoFarads (10^-9 Farad).

// This is a workaround because Serial.print will not print floats

nanoFarads = microFarads * 1000.0;    // multiply by 1000 to convert to nanoFarads (10^-9
Farads)

Serial.print((long)nanoFarads);    // print the value to serial port

Serial.println(" nanoFarads  ");    // print units and carriage return

lcd.setCursor(0, 0);

```

```

lcd.print(nanoFarads);

lcd.print(" nanoFarads ");

}

/* discharge the capacitor */

digitalWrite(chargePin, LOW);      // set charge pin to LOW

pinMode(dischargePin, OUTPUT);    // set discharge pin to output

digitalWrite(dischargePin, LOW);   // set discharge pin LOW

while(analogRead(analogPin) > 0){  // wait until capacitor is completely discharged

}

delay(5);

raw = analogRead(AnalogPin); // Reads the Input PIN

Vout = (( Vin) / 1023.0)*raw; // Calculates the Voltage on th Input PIN

buffer = (Vin / Vout) - 1;

R2 = R1 / buffer;

Serial.print("Voltage: "); //

Serial.println(Vout);      // Outputs the information

Serial.print("R2: ");     //

Serial.println(R2);

lcd.setCursor(0, 1);

lcd.print(R2);

lcd.print(" kOhm "); //

// delay(1000);

```

```
pinMode(dischargePin, INPUT);    // set discharge pin back to input  
  
}
```

6.4 Simulation:

After programmed look for simulation, that our made program work properly, before simulation run this program in microcontroller with machine device software to hardware. For simulation we use proteins software, As we design the approximate diagramed with using proteins ISIS software,

In the figure shown the position

CHAPTER 7

COMPONENT DATA SHEET

7.1 Component List:

Components	Code/Value	Quantity
Battery(Power supply)	9V	1Pic.
Voltage Regulator	LM 7805	1Pic
Capacitor	104pF	2Pic
	22pF	2pic
Register	10k	3 pic
	100 ohms	1pic
Push pull switch	Black	1Pic
Microcontroller	ATMEGA8A-PU	1Pic
Alphanumeric LCD	16X2	1Pic
Connecting wire		5 Ft
Meter box	White	1 pic
Power switch	Black	1 pic
Charging port	Black	1 pic

7.2 Price List:

Components	Quantity	Price in taka
Battery(Power supply)	1Pic.	40
Voltage Regulator	1Pic	20
Capacitor	2Pic (104pF) 2pic (22pF)	8
Register	3 pic (10k) 1pic (100 Ω)	8
Push pull switch	1Pic	10
Microcontroller	1Pic (ATMEGA8A- PU)	90
Alphanumeric LCD	1Pic (16X2)	120
Connecting wire	5 Fit	15
Meter box	1 pic	110
Power switch	1 pic	15
Charging port	1 pic	10
Pcv board	1 pic	50
Total		486

Market price of another meter:

SL. no	Company name	Market price
1	Sanwa,CD800a,Japan	2700 tk
2	Digital multimeter,DT9205A,China	570tk
3	Digital multimeter,DT101D, China	700 tk

CHAPTER 8

RESULT AND DISCUSSION

8.1 Result:

Value of Resistors:

SL. no	Color Code Value	Measuring Value
01	10k Ω	10.10k Ω
02	2k Ω	2.15k Ω
03	100 Ω	900 Ω
04	20k Ω	19.8k Ω
05	100k Ω	99.6k Ω

Value of Capacitors:

SL. no	Manufacture Value	Measuring Value
01	100 μ F	105 μ F
02	10 μ F	10.2 μ F
03	20 μ F	19.8 μ F
04	200 μ F	200.2 μ F
05	40 μ F	40.4 μ F

8.2 Conclusion:

This designed project is very economical for automation system for expensive and sophisticated machineries. As the price of this water heater system is low and has good accuracy so, we can easily say that if we go for commercial manufacturing then it will replace the traditional LCR meter system from market. For its cheap rate, small size and easy operating condition, it can be widely used at homes as well as industries.

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