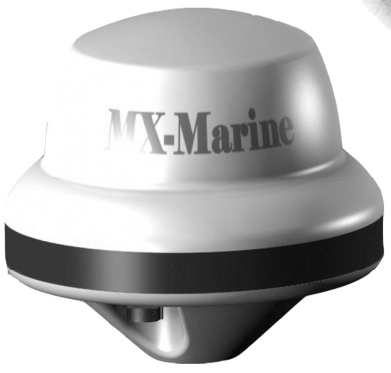
ELECTRONICS AND INSTRUMENTATION ENGINEERS ASSOCIATION

MUTHAYAMMAL ENGINEERING COLLEGE

RASIPURAM- 637 408, NAMAKKAL(DT).

# INSTRONICS

The best INSTRUMENTATION magazine Jan, 2011 vol. 8




Marine Sensor

XD Camera

Macro Book Laptop

YEAR: 2011 ISSUE:2 VOL:8 JuN



**EDITORS:**

The Editors and Publishers of this magazine do their best to verify the information published, but do not take responsibility for the absolute accuracy of the information.

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**“Our life is what our thought makes of it**
**Great thought comes from the heart”**

*We thank Our Beloved Principal* ***Dr.M.Madheswaran***
*For his valuable guidance and encouragement in bringing up this magazine* ***“INSTRONICS”*** *successfully.*

- ***EIE ASSOCIATION***

# TERMS & DEFINITIONS:

## BACKGROUND NOISE:

The total noise floor from all sources of interference in a measurement system, independent of the presence of a data signal.

## BASIC TRANSPORTATION REFERENCE:

Basic transportation defines the test profiles that have been defined for equipment that is shipped as secured cargo; by land, by sea or by air. The test levels are based upon land transport stress levels because these are higher than stresses imposed by air or sea transportation environments.

## BEAT FREQUENCY:

Beat frequencies are periodic vibrations that result from the addition and subtraction of two or more sinusoids.

## BETA RATIO:

The ratio of the diameter of a pipeline constriction to the unconstricted pipe diameter.

## BLACKBODY:

A theoretical object that radiates the maximum amount of energy at a given temperature, and absorbs the entire energy incident upon it. A blackbody is not necessarily black.

## BRITISH THERMAL UNITS (BTU):

The quantity of thermal energy required to raise one pound of water at its maximum density, One degree F.

## BAYOUET NEIL-CONCELMAN(BNC) CONNECTOR:

A quick disconnect electrical connector used to inter-connect and/or terminate coaxial cables.

## BREAKDOWN VOLTAGE RATING:

The dc or ac voltage which can be applied across insulation portions of a transducer without arcing or conduction above a specific current value.

## BURST PROPORTIONING:

A fast-cycling output form on a time proportioning controller (typically adjustable from 2 to 4 seconds) used in conjunction with a solid state relay to prolong the life of heaters by minimizing thermal stress.

## BEST FIT STRAIGHT LINE (BFSL):

A line midway between two parallel straight lines enclosing all output vs. pressure values.

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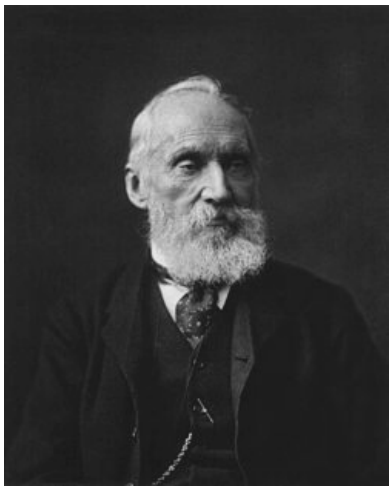
**By:**

**Mr. A.PRIYANGA,**
**FINAL YEAR(MEIEA).**

# LORD KELVIN



**Born** : 26 June 1824
Belfast, Ireland

**Died** : 17 December 1907

**Fields** : Mathematics, Physics and Engineer

**Residence**: Belfast

**William Thomson, Lord Kelvin** was a mathematical physicist and engineer. At the University of Glasgow he did important work in the mathematical analysis of electricity and formulation of the first and second Laws of Thermodynamics. He also had a career as an electric telegraph engineer and inventor. For his work on the transatlantic telegraph project and he was knighted by Queen Victoria, becoming Sir William Thomson. He had extensive maritime interests and was most noted for his work on the mariner's compass, which had previously been limited in reliability.

## MARNIE

Thomson was an enthusiastic yachtsman; he introduced a method of deep-sea sounding, in which a steel piano wire replaces the ordinary land line. The wire glides so easily to the bottom that "flying soundings" can be taken while the ship is going at full speed. A pressure gauge to register the depth of the sinker was added by Thomson. He also developed a tide predicting machine.

During the 1880s, Thomson worked to perfect the adjustable compass in order to correct errors arising from magnetic deviation owing to the increasing use of iron in naval architecture. Thomson's innovations involved much detailed work to develop principles already identified by George Biddell Airy and others but contributed little in terms of novel physical thinking.

Charles Babbage had been among the first to signal a distinctive number by occultation of its suggest, that a lighthouse might be made to light but Thomson pointed out the merits of the Morse code for the purpose, and urged that the signals should consist of short and long flashes of the light to represent the dots and dashes.

## THERMODYNAMICS

Thomson was intrigued but skeptical. Though he felt that Joule's results demanded theoretical explanation, he retreated into an even deeper commitment to the Carnot–Clapeyron school. He predicted that the melting point of ice must fall with pressure; otherwise its expansion on freezing could be exploited in a perpetual mobile. Experimental confirmation in his laboratory did much to bolster his beliefs.

In 1848, he extended the Carnot–Clapeyron theory still further through his dissatisfaction that the gas thermometer provided only an operational definition of temperature.

He proposed an absolute temperature scale in which a unit of heat descending from a body A at the temperature T° of this scale, to a body B at the temperature (T−1)°, would give out the same mechanical effect [work], whatever be the number T. Such a scale would be quite independent of the physical properties of any specific substance.

Thomson returned to critique Carnot's original publication and read his analysis to the Royal Society of Edinburgh in January 1849, still convinced that the theory was fundamentally sound. However, though Thomson conducted no new experiments, over the next two years he became increasingly dissatisfied with Carnot's theory and convinced of Joule's. During his rewriting, he seems to have considered ideas that would subsequently give rise to the second law of thermodynamics.

## Transatlantic *cable:*

Thomson jumped at the problem and published his response that month. He expressed his results in terms of the data rate that could be achieved and the economic consequences in terms of the potential revenue of the transatlantic undertaking. In a further 1855 analysis, Thomson stressed the impact that the design of the cable would have on its profitability.

Thomson contended that the speed of a signal through a given core was inversely proportional to the square of the length of the core. Thomson's results were disputed at a meeting of the British Association in 1856 by Wildman Whitehouse, the electrician of the Atlantic Telegraph Company. Whitehouse had possibly misinterpreted the results of his own experiments but was doubtless feeling financial pressure as plans for the cable were already well underway. He believed that Thomson's calculations implied that the cable must be "abandoned as being practically and commercially impossible."

Thomson attacked Whitehouse's contention in a letter to the popular Athenaeum magazine, pitching himself into the public eye. Thomson recommended a larger conductor with a larger cross section of insulation. However, he thought Whitehouse no fool and suspected that he might have the practical skill to make the existing design work. Thomson's work had, however, caught the eye of the project's undertakers and in December 1856, he was elected to the board of directors of the Atlantic Telegraph Company.

These lines inspired Thomson to understand the natural world using the power and method of science:

***"****Go, wondrous creature! Mount where Science guides;*
*Go measure earth, weigh air, and state the tides;*
*Instruct the planets in what orbs to run,*
*correct old Time, and regulate the sun;****"***

**By:**

**Ms.S.A.DIANA MARY,**
**PRE-FINAL YEAR(MEIEA).**

# DC-DC CONVERTER

## INTRODUCTION:

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DC-DC converter is one of the power electronic systems and it is used to convert power at one DC voltage level to power at another DC voltage level. It also provides isolation between the input source and the load. It is widely used in switched mode power supplies. Often the input to the converter is an unregulated DC voltage. Switched mode DC-DC converter is used to convert the unregulated DC input into a controlled DC output at a desired voltage level. Depending on the type of switching, the DC-DC converters are divided into:

- Hard switching pulse Width Modulated (PWM) converters and
- Soft switching converters

The PWM converters are the mostly used. The advantage of PWM converters are Low component count, High efficiency, Constant frequency operation.

## TYPES OF DC-DC CONVERTERS

These converters have three basic configurations. Each converter consists of a switching device and LC filter.

## Buck converter:

In a buck converter the average output voltage '$V_o$' is less than the input voltage '$V_{in}$'. The circuit diagram of a buck converter using a power BJT is shown, and this is like a step-down converter.

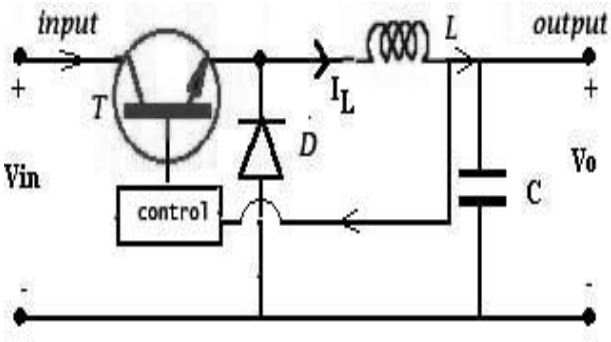



**Fig. Circuit diagram of buck converter**

The input current, which rises, flows through filter inductor L, capacitor C, and load resistor R. Mode 2 begins when transistor T is switched off $t=t_1$. The freewheeling diode D conducts due to energy stored in the inductor, and the inductor current continuous to flow through L, C, load, and diode D.

The inductor current falls until transistor T is switched on again in the next cycle. In practical circuits, the switch has a finite, nonlinear resistance. Depending on the switching frequency, filter inductance, and capacitance, the inductor current could be discontinuous.

## Boost converter:

It is also called as step-up converter. It gives an output voltage greater than the input voltage. The diagram of boost converter is shown in Figure (a) and the wave form of boost converter is shown in Figure (b).

A boost converter using a power MOSFET is shown in Figure (a).The circuit operation can be divided into two modes.

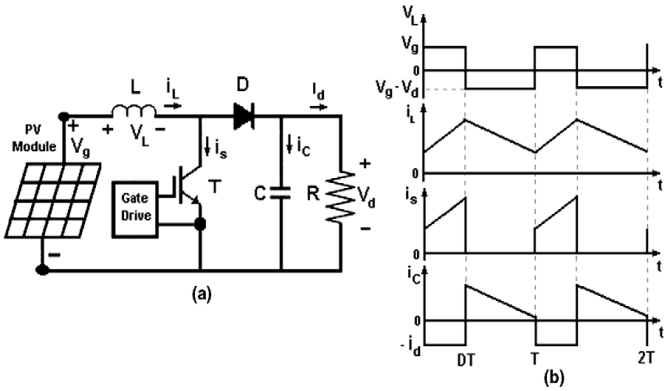



**Fig. (a) Circuit diagram of boost converter**
**(b) Waveform of boost converter**

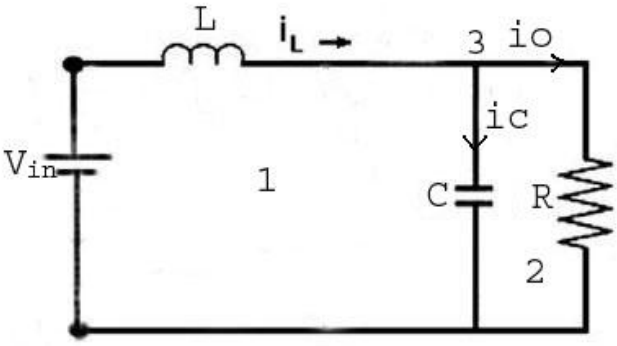



**Fig. Boost converter during switch OFF mode**

## MODE 1:

Mode 1 begins when transistor 'T' is switched on at t=0 shown in Figure. The input current, which rises, flows through inductor 'L' and transistor.

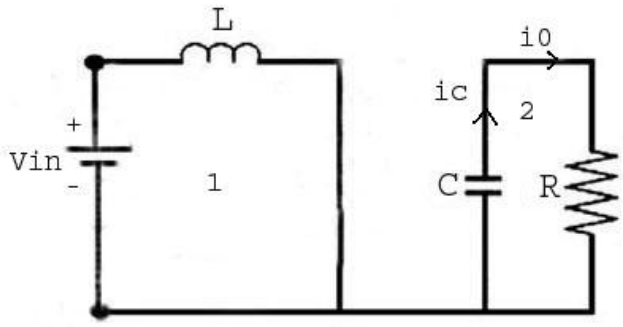



**Fig. Boost converter during switch ON mode**

## MODE 2:

Mode 2 begins when transistor 'T' is switched off at $t=t_1$ shown in Figures. The current that was flowing through the transistor would now flow through L, C, R and diode 'D'.

The inductor current falls until transistor 'T' is turned on again in the next cycle. The energy stored in inductor 'L' is transferred to the load 'R'.

## Buck-boost converter:

A Buck-boost converter provides an output voltage that may be less than or greater than the input voltage hence the name 'Buck-boost' the output voltage polarity is opposite to that of the input voltage.

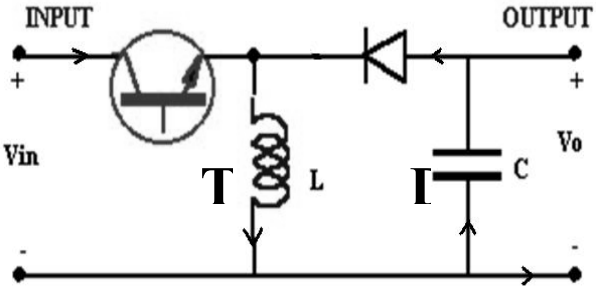



**Fig Circuit diagram of buck-boost converter**

During mode 1, transistor T is turned on and diode D is reversed biased. The energy stored in inductor L would be transferred to the load and the inductor current would fall until transistor T, is switched on again in the next cycle.

**By:**

**Mr. S.SENTHIL KUMAR,**
**LECTURER/EIE.**

# Environmental Monitoring System

## Introduction:

The increased focus on the effects of climate change on the environment, there has been a global effort to reduce the amount of greenhouse gases that cause them. This has led to a growing need to measure and monitor the environment. From monitoring the integrity of soil, water, and air to regulating the amount of chemicals large production facilities emit into the environment, hardware and software tools from National Instruments helps for build customizable systems to meet the monitoring requirements.

## Lab VIEW:

Lab VIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming language that uses icons instead of lines of text to create applications. In contrast to text-based programming languages, where instructions determine the order of program execution, Lab VIEW uses dataflow programming, where the flow of data through the nodes on the block diagram determines the execution order of the Virtual Instrumentations and functions. VI(Virtual Instrument)s, or virtual instruments, is Lab VIEW programs that imitate physical instruments. In Lab VIEW, build a user interface by using a set of tools and objects. The user interface is known as the front panel.

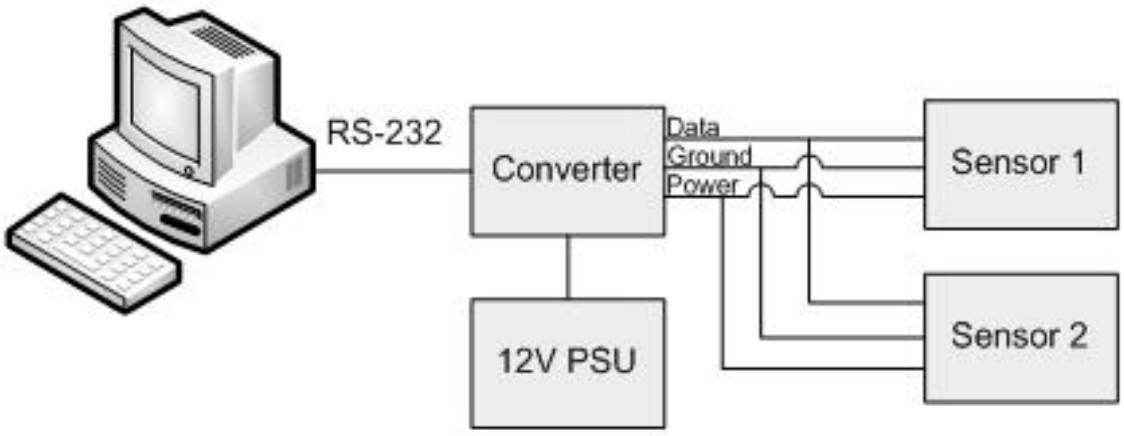



**Fig.Block diagram of environmental monitoring system**

## Building Your Environmental Monitoring System:

The setup described in the fig. allows you to instantly turn any computer or other device with a RS-232 port into an SDI-12 communication interface. This system, based upon the customizable, software-defined LabVIEW SDI-12 API, provides the user with the ability to connect to up to ten SDI-12 instruments through one RS-232 interface.

This add code functions using graphical representations of functions to control the front panel objects. This graphical source code is also known as G code or block diagram code. The block diagram contains this code. In some ways, the block diagram resembles a flowchart.

## Requiremens of hardware and Software:

- LabVIEW Software
- RS-232 Serial Port and Waterlog H-4191 RS-232 to SDI-12 Converter
- SDI-12 Sensor.
- CS215-L Temperature and Relative Humidity Sensor
- 6600-V2-4 Multi-parameter Sonde
- Hydra Probe II
- Stand Alone SDI-12 Encoder.
- SDI-12 LabVIEW API

## SDI-12 Protocol:

SDI-12 stands for Serial Data Interface at 1200 baud. The electrical interface for the protocol involves three lines: A serial data line, a 12-Volt line, and 1 ground line. Power is supplied to SDI-12 instruments through the SDI-12 bus and safely connect up to ten SDI-12 instruments on the same bus.

In SDI-12 applications, communication takes place on the bidirectional serial data line and occurs between SDI-12 instruments (sensors) and a data recorder. The instruments and recorder exchange ASCII characters on the data line, corresponding to different types of commands.

## Industry Applications for the SDI-12 Protocol

The SDI-12 protocol allows users to interface to a variety of sensors and recorders and is most commonly employed by Environmental Data Acquisition(EDA) applications, including climate change tracking, water collection and testing, ecological research, soil monitoring, agriculture, and weather analysis. EDA systems usually consist of multiple sensors connected to a data recording device, and the sensors can be a combination of analog, serial, or SDI-12 devices. The SDI-12 sensors use integrated microprocessor to take measurements, perform computations, convert readings to engineering units, and transmit data back to the recording device utilizing the SDI-12 protocol.

## System Connections:

First the RS-232 cable to connect the Waterlog converter to the input data logging device's serial port. Finally, connect a 12V power supply across the PWR and GND screw terminals on the converter. The LED on the converter will indicate that adequate power is supplied.

## Measurements:

Once SDI-12 Environmental Monitoring system is connected, there are several ways to begin reading measurements from your sensors. Measurement & Automation Explorer (MAX) software will support to take measurement from hardware. It can use MAX (Measurement & Automation Explorer) to quickly test the functionality of your hardware or even to acquire data from DAQ devices or communicate with instruments connected to your computer

**By:**

**Mr. P.SENTHIL KUMAR,**
**LECTURER/EIE.**

# SIMPLE ELECTRONIC CODE LOCK

A 9-digit code number is used to operate the code lock. When power supply to the circuit is turned on, a positive pulse is applied to the RESET pin (pin 15) through capacitor C1. Thus, the first output terminal Q1 (pin 3) of the decade counter IC (CD 4017) will be high and all other outputs (Q2 to Q10) will be low.

damage/malfunctioning of the IC when two switches corresponding to 'high' and 'low' output terminals are pressed simultaneously. Capacitor C2 and resistor R3 are provided to prevent noise during switching action.

Switch S10 is used to reset the circuit manually. Switches S1 to S10 can be mounted on a keyboard panel, and any number or letter can be used to mark them.

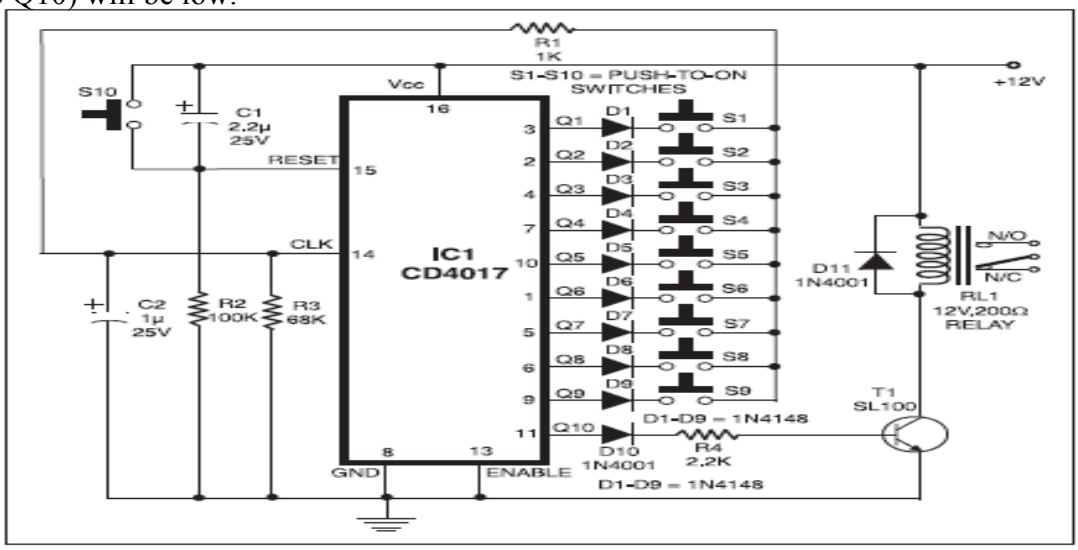



**Fig. circuit diagram of simple electronic code lock.**

To shift the high state from Q1 to Q2, a positive pulse must be applied at the clock input terminal (pin 14) of IC1. This is possible only by pressing the push-to-on switch S1 momentarily. On pressing switch S1, the high state shifts from Q1 to Q2. Now, to change the high state from Q2 to Q3, apply another positive pulse at pin 14, which is possible only by pressing switch S2.

Similarly, the high state can be shifted up to the tenth output (Q10) by pressing the switches S1 through S9 sequentially in that order. When Q10 (pin 11) is high, transistor T1 conducts and energizes relay RL1. The relay can be used to switch 'on' power to any electrical appliance.

Diodes D1 through D9 are provided to prevent

Switch S10 is also placed together with other switches so that any stranger trying to operate the lock frequently presses the switch S10, thereby resetting the circuit many times. Thus, he is never able to turn the relay 'on'. If necessary, two or three switches can be connected in parallel with S10 and placed on the keyboard panel for more safety. A 12V power supply is used for the circuit. The circuit is very simple and can be easily assembled on a general-purpose PCB. The code number can be easily changed by changing the connections to switches (S1 to S9).

**By:**

**Mr.A.GOKUL KUMAR,**
**PRE-FINAL YEAR(MEIEA).**

# REPLAY XD 1080 CAMERA

Full HD is now Smaller, Lighter and Smarter. The features of this camera is water-resistant, hard anodized, rugged aluminum housing for extreme adventures, the Replay XD1080 is the smallest and lightest full HD action camera on the market, and is packed with pro-level audio, live uncompressed HDMI video out in full HD, video playback, external audio line-in, time-lapse photography, and highly-configurable image and camera settings.

**Hardcore (Billet):**

Optional billet-aluminum pro mounts are available for the most demanding action and motor sport applications. Tubular, Flat, Curved, Tripod, Universal, & Specialty mounts are available.

**Finely Tuned Optics:**

An action-camera featured such a high quality lens, with the custom designed wide angle 135º, 6-element, f3.1 lens and anti-glare coating this lens is finely-tuned to match the 5MP CMOS sensor for better clarity, accurate color, and minimal image distortion. Replay XD1080 also features a removable front lens bezel to accept our ProLens 37MM Adapter Lens & Filter Kit.

# MACBOOK PRO LAPTOP

Mac Book Pro is machined from a single piece of aluminum, an engineering breakthrough that replaced many parts with one. It is called the unibody. The Multi-Touch track pad has no button because it is the button. It can be simply said that it has more room to trck and more room to click . The power cord is held in place magnetically, so if someone should trip over it, the cord disconnects harmlessly and MacBook Pro stays put safely.

**Data transfer is now lightning fast:**

MacBook Pro is the first notebook to have Thunderbolt technology. The connection carries both Display Port and PCI Express. With two 10-Gbps data channels, the data can be trnsfered more than 12 times faster than with FireWire 800. daisy-chain contains 6 devices including the display. So with one tiny, streamlined port, data transferred with lightning-fast speeds and huge expansion capabilities.

**By:**

**Ms. K.SARANYA,**
**FINAL YEAR(MEIEA).**

## Marine Sensors

Sensing Systems manufactures load and torque sensors for commercial and pleasure marine applications.

**Fig.marine sensor**

The combination of considerable design capabilities with the experience in harsh environments to address the measurement needs of the marine industry. The main supplier of underwater/submersible sensors for the major oceanographic institutions around the world. The sensors are used to measure:

- Rigging loads
- Anchoring loads
- Towing loads
- Winch torque
- Hull stress and deflection
- Mooring Loads
- Fish Cage Loads
- Sheave Loads

The sensors are fully submersible and operate in a wide range of challenging environments. They are used by research vessels, tankers, ferries, offshore platforms, fishing vessels and pleasure craft.

The services are also provide to obtain Torque and Horsepower Measurements in the drive trains of marine vessels and perform vibration surveys to detect and diagnose operating problems.

## Sensors for Commercial Vessels:

Sensing Systems manufactures marine sensors to address the full spectrum of measurement requirements found in commercial vessels. The temporary or permanent systems installements can be done to monitor operating equipment. The following are a few examples:

## Towing Loads:

A sensor can measure towing loads between tugs and barges with capacities of up to 5,000,000 lbs.

## Hull Stress:

The instrument ship's hulls and install monitoring systems to measure hull stresses during operation. Accelerometers and tilt meters are used in conjunction with strain gages to monitor strain, pitch, roll and yaw. These measurements become a powerful troubleshooting and analysis tool to diagnose structural issues.

## Winch Torque:

The torque sensors for fishing vessels to monitor winch torque loads during fishing operations.

## Engine Torque and Horsepower:

Sensing Systems installs permanent or temporary monitoring systems to measure engine torque and horsepower output to propellers or water jets.

## Anchoring Loads:

The load cells specifically designed for monitoring anchoring loads on floating or semi submersible platforms.

## Sensors for Sailing Vessels:

Sailing vessels convert wind energy into movement. This energy transfer requires sails, hull and rigging working together to accomplish the task. The efficiency of this process depends on the configuration and adjustment of its components. Our sensors provide measurements that can be used to properly adjust the vessel's rigging configuration.These sensors are used to accurately measure loads in shrouds and backstays in sailboats standing rigging. In addition, tangs, backstay adjusters, chain plates, rod rigging and just about any rigging component can be instrumented to measure loads. Masts can be instrumented to measure the compressive load applied by rigging components as they are adjusted to ensure accurate and repeatable settings.

Benefits derived from measuring rigging loads include:

- Increased Sailing Efficiency
- Repeatability of Rigging Configuration
- Avoid Static and Dynamic Overload Conditions
- Longer Life for Rigging Hardware, Hull and Sails

## Capacity & Traceability

Sensor capacities vary from 1 lb to 3,000,000 lbs depending on the application. Higher capacities are available without NIST traceability. All sensors are calibrated in the laboratory using NIST traceable standards.

## Configurations

The design of Sensing Systems marine sensors allows them to be incorporated into any shape or configuration. The outside geometry may be machined to square, rectangular, circular or any other section or shape required by the application. Sensing Systems' approach is to incorporate the standard sensing elements into a shape that fits the customer's application. This allows to deliver marine sensors matched to the customer's application within a short period of time. The sensing elements in the marine sensors include design features to properly encapsulate and waterproof the electronics from the harsh environment.

## Applications

Marine sensors are used in a wide variety of applications. Examples of applications include monitoring mooring loads for research buoys, monitoring hull stresses on oil tankers and determining hydrodynamic loads in underwater cages used for fish farming. Our marine sensors find use in the following industries:

- Oil and Gas Drilling, Exploration and Production
- Commercial and Farm Fishing
- Marine Transportation
- Marine Research and Environmental Studies
- Underwater Construction
- Medical Device Manufacturing
- Sailing Vessels

**By:**

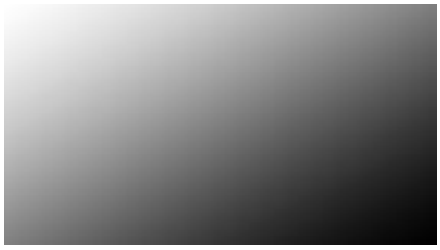
**Ms. J.NIVEDHITHA,**
**FINAL YEAR(MEIEA).**

# BEGINNERS' GUIDE TO ADOBE PHOTOSHOP

## 7) Choosing a color

Now that you know how to select an area in Adobe Photoshop, we can look at some tools that can do something with that area. Before we get started on coloring your selection, you'll need to pick a color. This part of the Toolbox is where you select your colours. The top square is the foreground colour. If you use a brush or paint bucket, it will apply this colour. The bottom square is the background colour. It has various purposes, but it's also a good place to store a second colour that you're using.

- *Click on either square to change its colour.*
- *Click the arrow to swap the two colours.*
- *Click the little squares to reset the colours to black and white.*



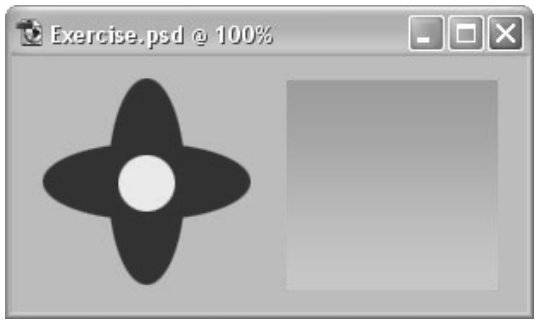
## 8) The Paint Bucket and Gradient tools

These two tools share a button on the toolbar. To select one, click and hold.

 On a new layer, just click the Paint Bucket tool inside the area of your selection to fill it with the colour you've selected.

 Click and drag from one area to another to fill the area. The point where you started to click will be the colour of your foreground colour, and the point where you took your finger off the mouse button will be the colour of your background colour. The area in between will gradually change from one colour to the other.

In this case, I went from corner to corner, with the default white and black selected.




## 9) A colour exercise

With what you've learned so far, you should be able to recreate this piece of hippy history. Remember to create each step on a new layer.

***Other Adobe Photoshop tools of interest include***

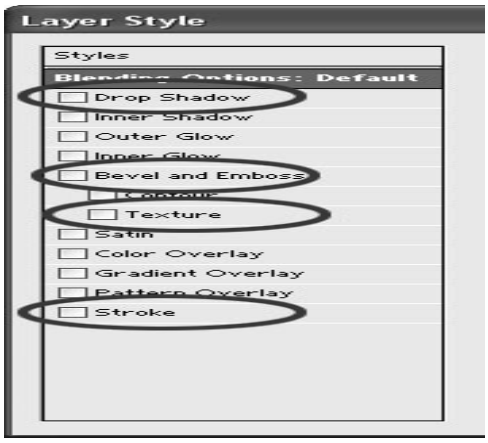
 **The Text Tool** – Just click it wherever you want text to appear. Choose a font, colour, and size, and start typing.

 **The Move Tool** – Use this tool to drag things around. If you have a selection, it will drag the contents of the selection. If not, it will drag the contents of the layer you're on.

## 10) Adding Effects

Now that you know the basics, it's time to start adding some easy special effects.

To demonstrate Adobe Photoshop's special effects, here's an unembellished button for a website. Each part of this image is on a separate layer.




## 11) Key Adobe Photoshop Blending Options

In the Layers list, right-click on a layer, and select Blending Options.
This is a picture of the left-hand portion of the Blending Options window that will appear.

**Drop Shadow**:

Selecting this option will make your layer cast a shadow on layers below it.

**Bevel and Emboss**:

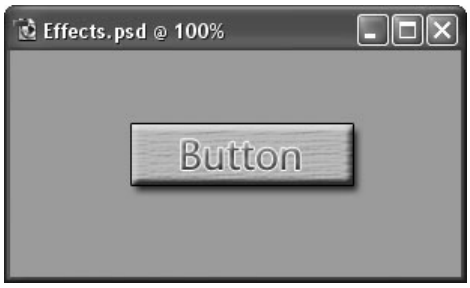
Makes the layer like a block of gold bullion - raised in the centre, with edges that slope down.

**Texture**:

Makes the surface of the layer look like it's made of wood, stone etc. Use the "Overlay" setting.

**Stroke:**

Stroke is just another word for "outline". A Stroke is useful to make an object stand out from its background.




## 12) The end result

Other than using some of the Blending Options, nothing else has been done to this button.
It's really that easy.

## A final few Adobe Photoshop features

**Zoom:**

Press (**Ctrl and** +) to zoom in. Press (**Ctrl and -**) to zoom out. This is very useful if you're a bit of a pixel pirate

**Transformation (resize/rotate/distort):**

To transform an object, press **Ctrl+T**. To transform a selection, click **Select > Transform Selection**. Use the Shift key while transforming to stop the image distorting.

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**By:**

**Mr.C.VIJAY,**
**FINAL YEAR(MEIEA).**

## TECHS & APPS:

1. Bhanu spends 30% of his income on petrol on scooter. ¼ of the remaining on house rent and the balance on food. If he spends Rs.300 on petrol then what is the expenditure on house rent?

a) Rs.525 b) Rs.1000
c) Rs.675 d) Rs.175

2. If the numerator of a fraction is increased by 25% and denominator decreased by 20%, the new value is 5/4. What is the original value?

a) 3/5 b) 4/5
c) 7/8 d) 3/7

3. The length of a rectangle is increased by 60%. By what % would the width have to be decreased to maintain the same area?

a) 30% b) 60%
c) 75% d) 37.5%

4. The value of ¾ + 5 / 36 + 7 / 144 + ……. +17 / 5184 + 19 / 8100 is
a) 0.99 b) 0.98
c) 0.95 d) None of these

5. A sporting goods store ordered an equal number of white and yellow balls. The tennis ball company delivered 45 extra white balls, making the ratio of white balls to yellow balls 1/5: 1/6. How many white tennis balls did the store originally order for?

a) 450 b) 270
c) 225 d) None of these.

6. Pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day?

A. 9 B. 10
C. 11 D. 12

7. The main features of a large-signal amplifier are the circuit's _____.

A. power efficiency
B. maximum power limitations
C. impedance matching to the output device
D. All of the above

8. Two ships are sailing in the sea on the two sides of a lighthouse. The angle of elevation of the top of the lighthouse is observed from the ships are 30º and 45º respectively. If the lighthouse is 100 m high, the distance between the two ships is:

A. 173 m B.200 m
C.273 m D. 300 m

9. N amplifier has a Rin = 1.2 k. The coupling capacitor is 1 F. Determine the approximate lower cutoff frequency.

A. 133 Hz B. 1.33 kHz
C.13.3 kHz D.133 kHz

10. In a 100 m race, A beats B by 10 m and C by 13 m. In a race of 180 m, B will beat C by:

A. 5.4 m B. 4.5 m
C. 5 m D. 6 m

**By:**

**Mr. K.MOHAN DASS,**
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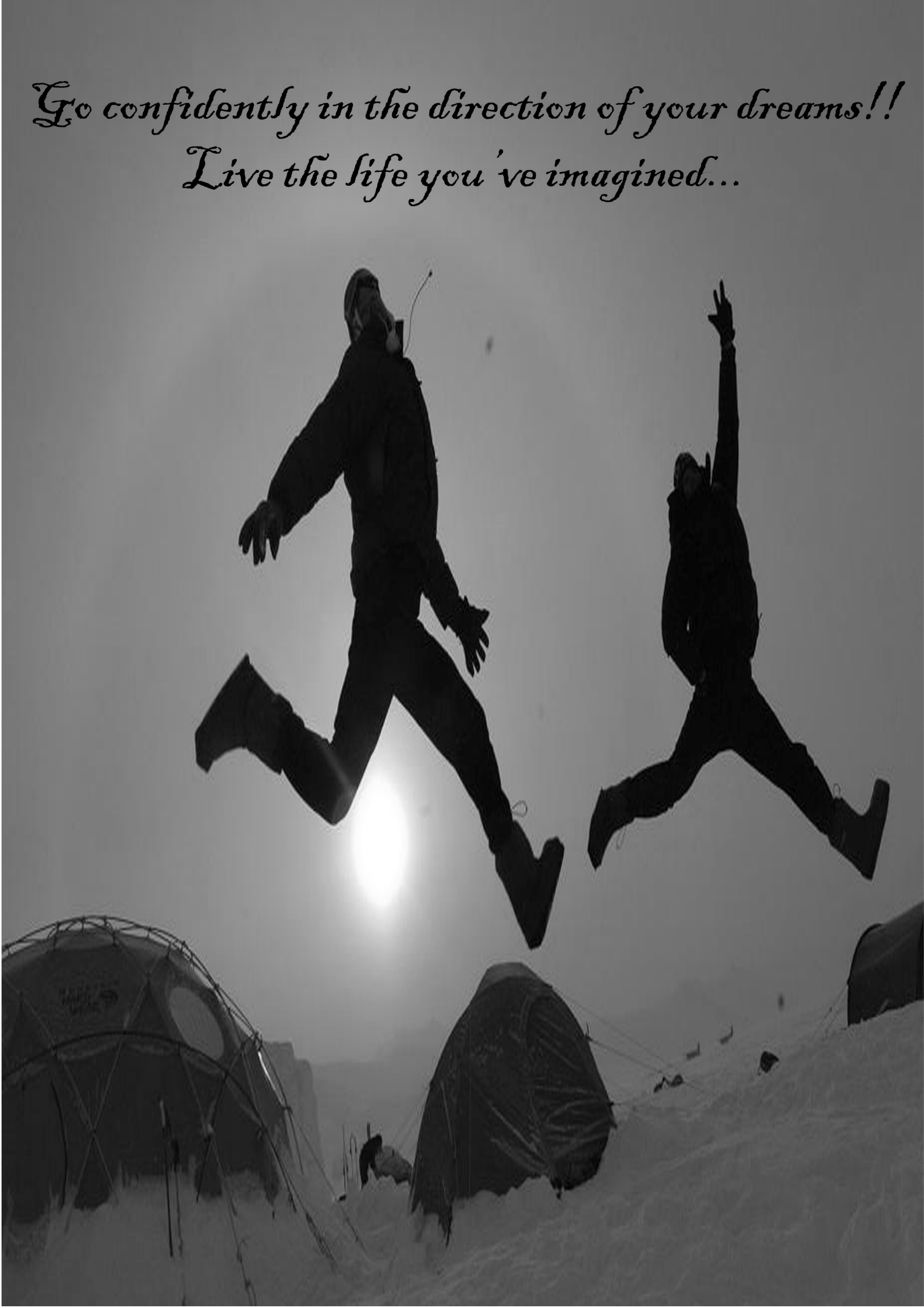
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