

AUTOMATIC UNDERWATER CO2 BALOON EJECTOR WATCH WITH SOS FOR RESQUE IN WATER

**Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in
Electronics and Communication Engineering**

**By
G GOWRI SANKAR REDDY-38130066
K GOUTHAM REDDY-38130073**



**SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

**JEPPIAAR NAGAR, RAJIV GANDHI SALAI
CHENNAI – 600119**



SATHYABAMA

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ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **G GOWRI SANKAR REDDY(38130066) & K GOUTHAM REDDY(38130073)** who carried out the Project entitled "**SECURED AND INTELLIGENT PARKING SYSTEM**". Under the guidance of **DR.G,JEGAN,M.E.,Ph.D.**, during the period DEC 2021 to MAY 2022

INTERNAL GUIDE

DR,G.JEGAN,M.E.,Ph.D.,

HEAD OF THE DEPARTMENT

Dr.T.RAVI ,M.E.,Ph.D

Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

DECLARATION

I, G.GOWRI SANKAR REDDY(38130066) & K GOUTHAM REDDY(38130073) Here by declare that the Project report entitled “AUTOMATIC UNDERWATE CO2 BALOON EJECTOR WATCH WITH SOS FOR RESQUE IN WATER ”is done
under the guidance of **G.JEGAN,M.E.,Ph.D.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in ELECTRONICS AND COMMUNICATION ENGINEERING.

DATE:

PLACE:

SIGNATURE OF CANDIDATE

**G GOWRI SANKAR REDDY
K GOUTHAM REDDY**

ACKNOWLEDGEMENT

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I convey my thanks to Dr.N.M.NANDHITHA,M.E.,Ph.D., Dean, school of Electrical and Electronics engineering and Dr.T.RAVI,M.E.,Ph.D., Head of the Department, Electronics and Communication engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide DR.G.JEGAN,M.E.,Ph.D., for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my Project.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project

ABSTRACT

- **The objective of the project is to develop a life saving watch for fisherman navy people who works in sea , which can save the people who got stuck under the water while swimming in deep water, basically our system is designed like a wearable watch and it consist of a water depth sensor and a co2 cylinder attached withballoon, wireless transmitter and a gps which sends signals to sos team for resque.this watch helps them to get out from very critical situations**

INTRODUCTION:

On 10-12 June 2009 there took place in Dubrovnik, Croatia, a workshop organised under the aegis of ECAC on the special challenges in locating and recovering aircraft and flight recorders lost beneath water, whether at sea or in rivers or lakes. The report of that workshop acknowledged that it had met its objectives, but also that not all of the issues around underwater operations had yet been addressed. In particular, the value was identified of a further workshop to consider the particular difficulties associated with location and recovery in deeper waters.

- A second workshop, this time orientated towards operations in such waters, was therefore organised by ECAC on 18-20 October 2010 in Larnaca, Cyprus. Hosted with great generosity by the Cypriot aviation authorities, the workshop's starting point was once again the reality that any State with a coast-line or with aircraft on its national register may find itself responsible for conducting an investigation into an accident either in its territorial waters or on the high seas.
- When an aircraft comes down in the sea, the already testing issues around access to the site and recovery of the wreckage and any flight recorders become doubly challenging, and potentially very expensive. This challenge can be greater still, and likewise the potential expense, if the water in question is of considerable depth. Its effective handling will call for a response which is rapid but at the same time very carefully planned, and which is coordinated across many parties.
- The Larnaca workshop was designed to provide participants with an understanding of the elements of an effective response to an accident in circumstances where an aircraft has been lost in deep waters, in terms both of search procedures and of the types of equipment which may be required. It aimed at a sharing of learning, expertise and personal experience, and as in Dubrovnik in 2009 it included practical demonstrations, including at sea.
- Led by M. PAUL-LOUIS ARSLANIAN as chairman of ECAC's expert group on aircraft accident and incident investigation (ACC), the workshop enjoyed support from the Air Accident and Incident Investigation Board of Cyprus, and full technical assistance from the French *Bureau d'Enquêtes et d'Analyses*. It was organised in detail by a Steering Group established within ACC. The seagoing

element was greatly facilitated by EDT Offshore, which made available its ROV Support Vessel EDT ARES, and by Phoenix International, whose Remotely Operated Vehicle (ROV) REMORA was deployed from EDT ARES as part of a live exercise to demonstrate techniques suitable for deep water operations.

- **A PRESENTATION BY HUBERT THOMAS, ADVANCED CONCEPTS AND SYSTEMS ARCHITECTURE (ACSA)**

-
- Mr Thomas suggested that efficiency in location and recovery was best secured through a careful sequencing of the operational phases, step by step. This began with gaining an understanding of the accident environment, and progressed through location of the general area of the loss (the “hay stack”); location of the underwater location beacons (ULBs) attached to the recorders (the “needles”); determination of the depth of the wreckage; selection of an appropriate means of recovery; and then a recovery which homed directly and speedily onto the targets (VDR and FDR).
-
- The solution offered by ACSA to the need to locate wreckage accurately and quickly involved a team of 2 or 3 experts, lightweight
- equipment able to be carried on commercial airlines, and use of a “vessel of opportunity” onsite. ACSA’s new product DETECTOR-1000 offered a very long detection range. It was used to locate the “haystack” over a very wide search area, by conducting stations spaced at 1.7 times the detection range. (In deep water, the grid size could be as large as 10 kilometers). A ship with a transit speed of 20 knots would achieve a coverage rate of 176 square kilometers per hour. DETECTOR-1000 is a Dip Detector which is deployed below the thermocline and sea surface noise. Once it has acquired the pinger signal for five minutes it is recovered aboard and dipped again at a second location, in order to generate a homing direction. Its operation is not dependent on weather conditions. More details of its capabilities are in the slides reproduced at Annex 1 to this report.
-
- The next step was locating the “needles”. At a water depth of up to 300 meters, this could be accomplished by ACSA’s GIB-Lite product, and by GIB-Plus for depths up to 2000 meters. Guiding the recovery team to the wreckage at up to 300 metres was possible using GIB-Lite, with the vessel’s USBL used for wreckage lost at greater depths.
-
- ACSA’s GIB buoys comprise a GPS receiver, an acoustic receiver, and a UHF radio. With these, a positioning accuracy of up to within 1 metre for the pinger being sought was possible: during a recent ACSA operation in

more than 1000 metres of water it had taken only 15 minutes for the ROV to find the lost aircraft using coordinates calculated using GIB buoys data. GIB equipment had been used in the recovery operation for the 2004 Flash Airlines crash at Sharm El Sheikh, the 2006 Airbus Black Sea Sochi crash, and for the recovery of a military helicopter in the Red Sea in 2007.

-
- In 26% of accidents, the ULB becomes separated from the flight recorder. Further, in some cases, recorders are buried. ACSA's "Red Stripe
- Lemon Float" addressed this by enabling the recorder's position to be evident when below mud during imaging dives, allowing for homing by the recovery robot and automatic recovery. Its vertical float line facilitates gripping in automatic mode.
-
- This float (pictured here and on page 19) was of particular interest for a new family of underwater robots arriving on the market, called 'Hybrid ROVs'. These are unmanned vehicles able to be operated either in an autonomous mode or by re-



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- mote control from the surface with only an expendable fibre connecting the vehicle to a surface drift buoy. The key feature of the HROV is that it does not require the involvement of a ship with Dynamic Positioning, and thus offers a very significant advantage in search and recovery operations. The same vehicle can undertake seabed mapping and recorder recovery.
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EXISTING SYSTEM

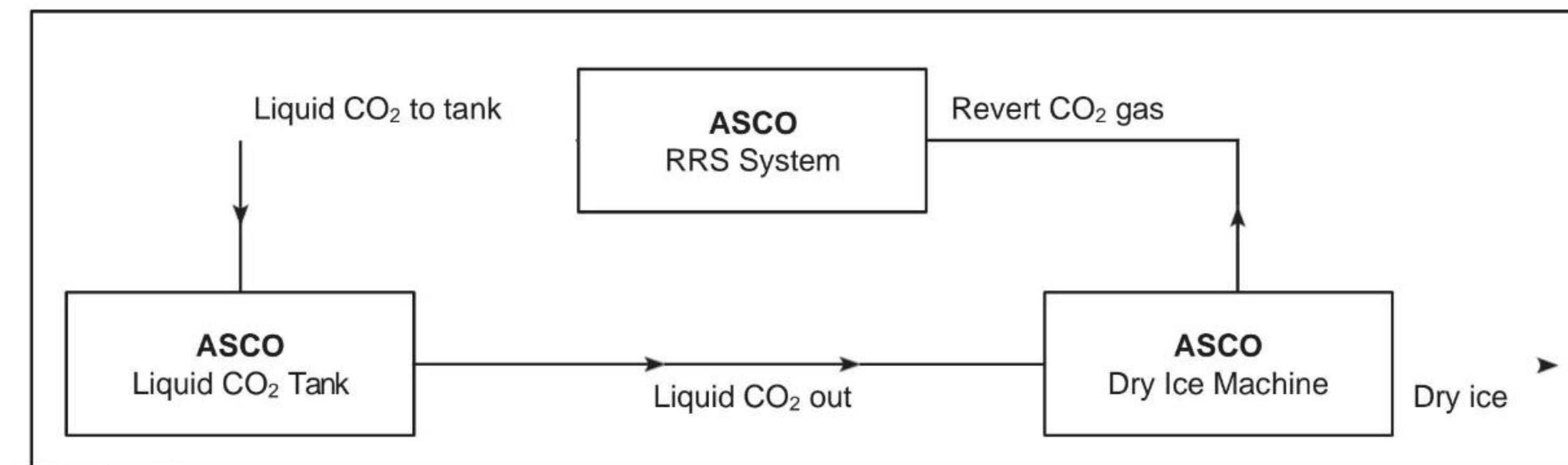


ASCO CO₂ Gas Revert Recovery Systems are engineered to efficiently recover the revert CO₂ gas from **ASCO** Dry Ice Pellet and Block Machines which normally direct the revert (flash) gas to the atmosphere.

Advantages of CO₂ Revert Recovery Systems:

- Reducing dry ice production costs up to 50 % by recovering the normally “lost” CO₂ gas due to vent typical of dry ice manufacturing
- Automatic (PLC) operation
- Heavy duty, compact and efficient design
- Packaged, prepiped and prewired for timely installation

How the ASCO CO₂ Revert Recovery System interconnects with ASCO Dry Ice Equipment:



CO₂ buffer
balloon

Specially designed, made of foodgrade acceptable material, to provide a constant back pressure to the dry ice machine as well as provide constant supply conditions of CO₂ flow to the gas compressor. Local conditions may require reheating of the CO₂ revert gas which can be supplied as required for each application.

CO₂
compressor

A two-stage, watercooled, dry running CO₂ compressor with separate cooler for each stage compresses the revert gas up to approx. 18 to 20 barg (260 to 290 psi).

CO₂ liquefier

Liquefies the compressed CO₂ gas though a standard refrigeration loop. The re- liquefied CO₂ is then returned to the liquid CO₂ storage tank for reuse in dry ice production.

Control system

A central control system automatically controls the entire process and houses the electric motor distribution, starting, operator interface and PLC control system

ASCO CO₂ Gas Revert Recovery System RRS300W (water-cooled)

To recover up to **300 kg/h (661 lb/h)** of revert CO₂ gas from the production of dry ice.

ASCO CO₂ Gas Revert Recovery System RRS440W (water-cooled)

To recover up to **440 kg/h (970 lb/h)** of revert CO₂ gas from the production of dry ice.

Scope of supply:

- CO₂ gas balloon buffer storage (mounted remotely or directly on the RRS)
- CO₂ compressor, dry running 2 stage, water cooled
- CO₂ liquefier, refrigerant, water cooled with stainless steel CO₂ codenser
- Allowance for insulated outlet CO₂ liquid line from the RRS to the liquid CO₂ storage tank (up to 10 m 33 ft)

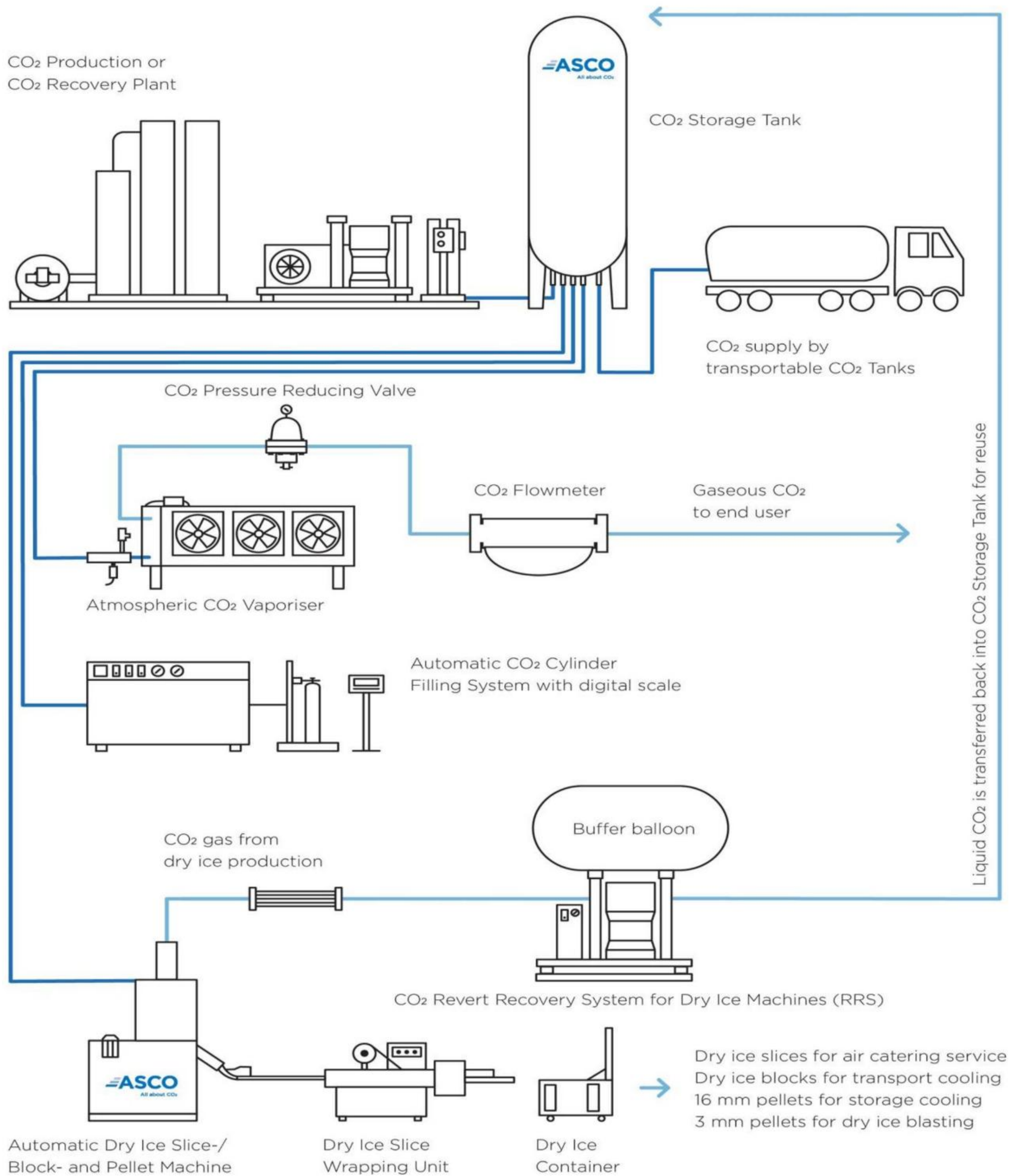
- Central control panel with operator interface
- Modularized design is prepiped, prewired and precabled for fast installation

Utility specifications - excluding options and accessories:

- Power supply 380 - 415 V, 50 Hz / 440 - 460 V, 60 Hz, 3 Ph (other voltages available on request)
- Power consumption at 400 V, 50 Hz: 115.5 / 94.4 kW (154.9 / 126.6 HP) (connected / absorbed)
- Cooling water flowrate: 11.6 m³/h (411.1 ft³/h) (based on max 32 °C inlet temperature)

Instrument air, 6 bar (87 psi).g, dry, oil free: < 1 Nm³/h (35.3 ft³/h) Utility consumptions are approximate and subject to detailed engineering

Complete your ASCO CO₂ Production- / Recovery Plant with some of our many accessories



PROPOSED SYSTEM:

- The objective of the project is to develop a life saving watch, which can save the people who got stuck under the water while swimming in deep water, basically our system is designed like a wearable watch and it consist of a water depth sensor and a co2 cylinder attached with balloon, wireless transmitter and a gps.
- As soon as the person wearing our system gets into the water, the water depth sensor measures the depth every second, if the person reaches a specific threshold the water depthsensor triggers the co2 balloon cylinder mechanically via servo motor and triggers the GPS module, once the balloon in the watch is inflated then the balloon pulls the person from the water and the person will reach above the water, once the person reaches the water level the gps module will get the coordinates and the microcontroller will trigger the wireless lora transmitter with coordinates as sos signal continiously.

ADVANTAGES:

NO man power

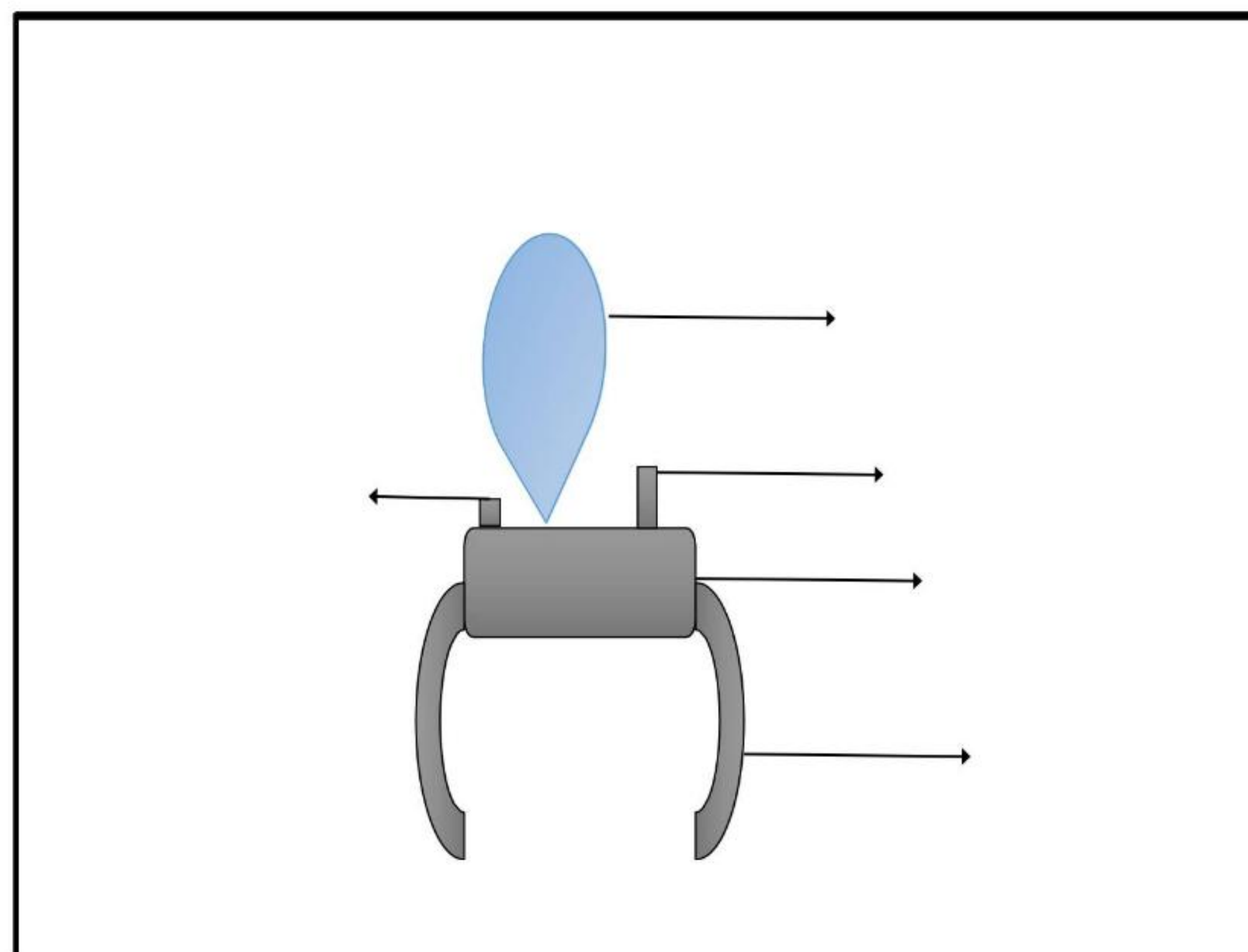
Automated

More safety than existing system

Less maintainance

More comfortable.

Chargable

PRODUCT ILLUSTRATION

1.EJECTED CO2 BALOON

2.SOS ANTENNA

3.3D PRINTED ELECTRONIC AND BALOON EJECTOR

4.WATCH STRAP

5.SOS ANTENNA

Required components:

- Atmega328 microcontroller
- Ms5803 pressure sensor
- 4.7v Lithium polymer battery
- SOS RF lora transmitter with GPS
- Ai-thinker lora module
- Servo motor
- CO₂ Cylinder
- Ejected CO₂ balloon

AVR Atmega8 Microcontroller Architecture & Its Applications

The abbreviation of AVR Microcontroller is “Advanced Virtual RISC” and MCU is the short term of the Microcontroller. A Microcontroller is a tiny computer on a single chip and it is also termed as a control device. Similar to a computer, the Microcontroller is made with a variety of peripherals like input & output units, memory, Timers, serial data communications, programmable. The applications of Microcontroller involve embedded applications & automatically controlled devices like medical devices, remote control devices, control systems, office machines, power tools, electronic devices, etc. There are **various kinds of Microcontrollers available** in the market like This article gives brief information about AVR Atmega8 microcontroller.

What is an AVR Atmega8 Microcontroller?

In 1996, AVR Microcontroller was produced by the “Atmel Corporation”. The Microcontroller includes the Harvard architecture that works rapidly with the RISC. The features of this Microcontroller include different features compared with other like sleep modes-6, internal oscillator and serial data communication, performs the instructions in a single execution cycle. These Microcontrollers were very fast and they utilize low power to work in different power saving modes. There are different configurations of AVR microcontrollers are available to perform various operations like 8-bit, 16-bit, and 32-bit. Please refer the below link for;

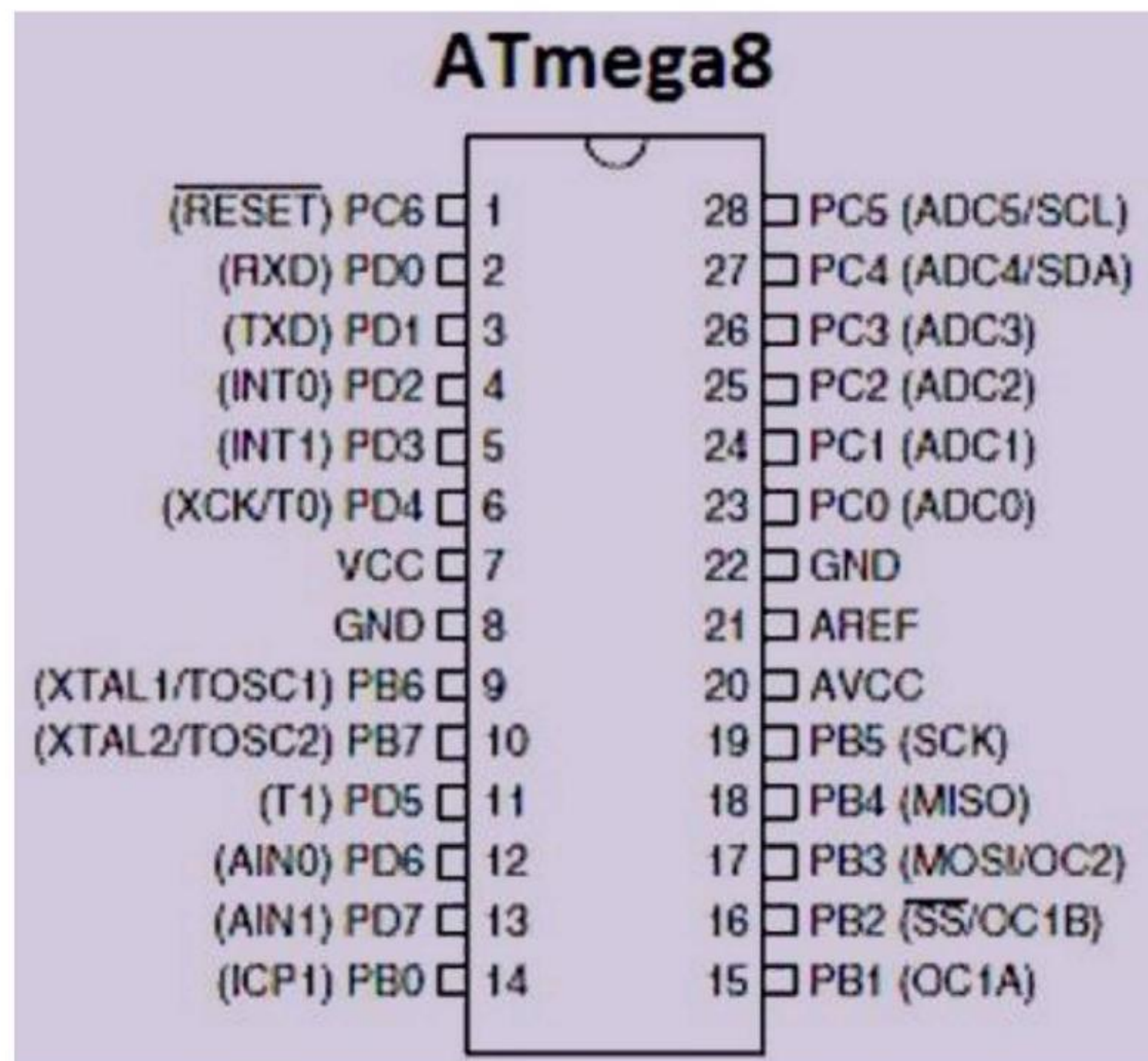


AVR microcontrollers are available in three different categories such as TinyAVR, MegaAVR, and XmegaAVR

- The Tiny AVR microcontroller is very small in size and used in many simple applications
- Mega AVR microcontroller is very famous due to a large number of integrated components, good memory, and used in modern to multiple applications
- The Xmega AVR microcontroller is applied in difficult applications, which require high speed and huge program memory.

Atmega8 Microcontroller Pin Description

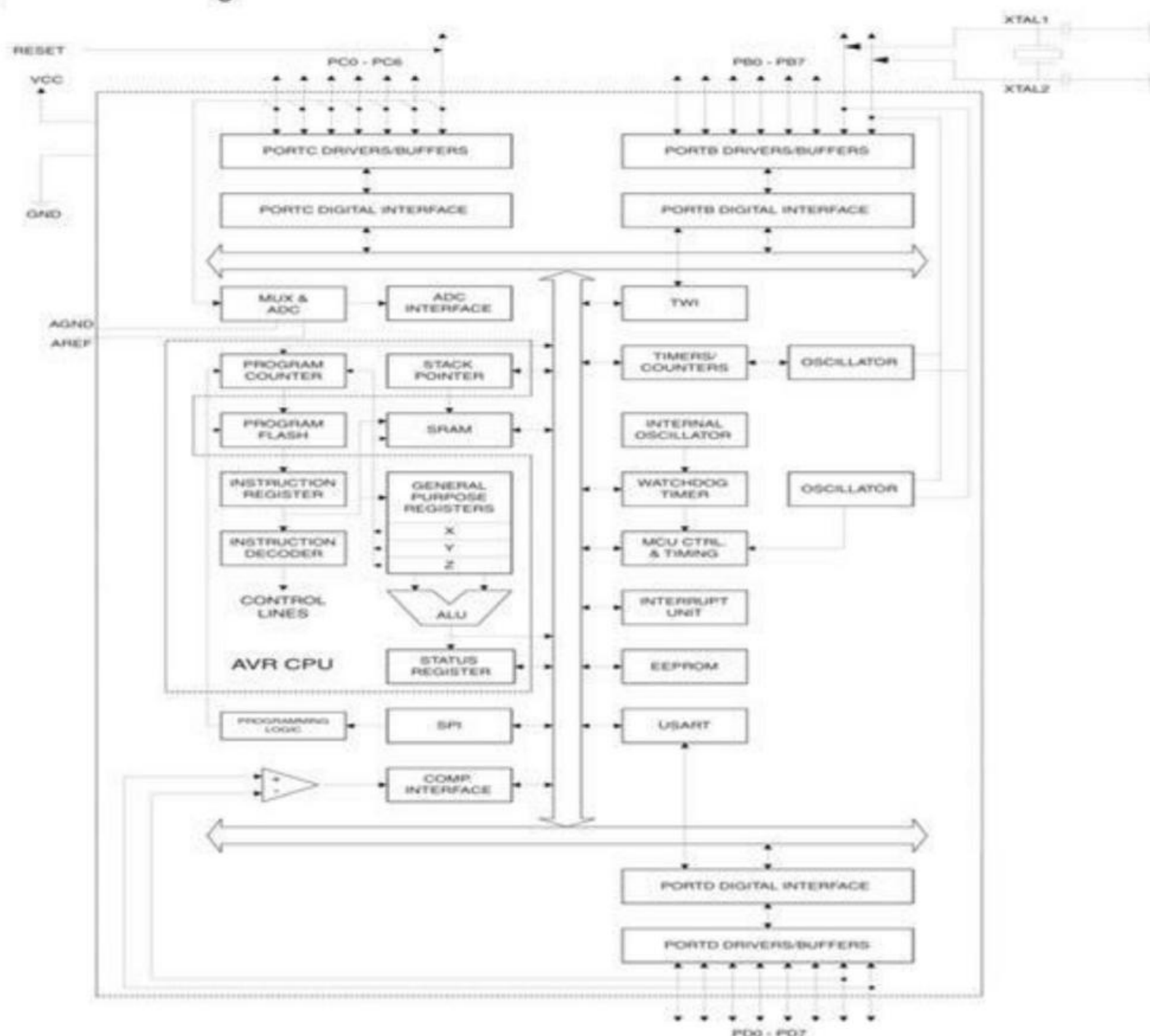
The **main feature of Atmega8 Microcontroller** is that all the pins of the Microcontroller support two signals except 5-pins. The Atmega8 microcontroller consists of 28 pins where pins 9,10,14,15,16,17,18,19 are used for port B, Pins 23,24,25,26,27,28 and 1 are used for port C and pins 2,3,4,5,6,11,12 are used for port D



- Pin -1 is the RST (Reset) pin and applying a low-level signal for a time longer than the minimum pulse length will produce a RESET.
- Pin-2 and pin-3 are used microcontroller
- Pin-4 and pin-5 are used as an external interrupt. One of them will activate when an interrupt flag bit of the status register is set and the other will activate as long as the intrude condition succeeds.
- Pin-9 & pin-10 are used as a timer counters oscillators as well as an external oscillator where the crystal is associated directly with the two pins. Pin-10 is used for low-frequency crystal oscillator or crystal oscillator. If the internal adjusted RC oscillator is used as the CLK source & the asynchronous timer is allowed, these pins can be utilized as a timer oscillator pin.
- Pin-19 is used as a Master CLK o/p, slave CLK i/p for the SPI-channel.
- Pin-18 is used as Master CLK i/p, slave CLK o/p.
- Pin-17 is used as Master data o/p, slave data i/p for the SPI-channel. It is used as an i/p when empowered by a slave & is bidirectional when allowed by the master. This pin can also be utilized as an o/p compare with match o/p, which helps as an external o/p for the timer/counter.
- Pin-16 is used as a slave choice i/p. It can also be used as a timer or counter1 comparatively by arranging the PB2-pin as an o/p.
- Pin-15 can be used as an external o/p of the timer or counter compare match A.
- Pin-23 to Pins28 have used for ADC (digital value of analog input) channels. Pin-27 can also be used as a serial interface CLK & pin-28 can be used as a serial interface data
- Pin-12 and pin-13 are used as an Analog Comparator i/ps.
- Pin-6 and pin-11 are used as timer/counter sources.

Atmega8 AVR Microcontroller Architecture

The Atmega AVR Microcontroller architecture includes the following blocks.



Memory: It has 1Kbyte Internal SRAM, 8 Kb of Flash program memory and 512 Bytes of EEPROM.

I/O Ports: It has three ports, namely port-B, port-C, and port-D and 23 I/O line can be attained from these ports.

Interrupts: The two Exterior Interrupt sources are located at port D. Nineteen dissimilar interrupts vectors supporting nineteen events produced by interior peripherals.

Timer/Counter: There are 3-Internal Timers are accessible, 8 bit-2, 16 bit-1, presenting numerous operating modes & supporting internal/external clocking.

Serial Peripheral Interface (SPI): ATmega8 microcontroller holds three integrated communication devices. One of them is an SPI, 4-pins are allocated to the Microcontroller to implement this system of communication.

Atmega8 Microcontroller Applications

- AVR Microcontroller based LED Matrix Interfacing
- UART communication between Arduino Uno and ATmega8
- Interfacing of Optocoupler with ATmega8 Microcontroller
- AVR Microcontroller based Fire Alarm System
- Measurement of Light Intensity using AVR Microcontroller and LDR
- AVR Microcontroller based 100mA Ammeter
- ATmega8 Microcontroller based Anti-Theft Alarm System

- AVR Microcontroller based Interfacing of Joystick
- AVR Microcontroller based Interfacing of Flex Sensor

MS5803-PRESSURE SENSOR



✓RoHS

- High resolution module, 0.2mbar
- Fast conversion down to 1 ms
- Low power, 1 μ A (standby < 0.15 μ A)
- Integrated digital pressure sensor (24 bit $\Delta\Sigma$ ADC)
- Supply voltage 1.8 to 3.6 V
- Operating range: 0 to 14bar, -40 to +85 °C
- I2C and SPI interface (Mode 0, 3)
- No external components (Internal oscillator)
- Excellent long term stability
- Hermetically sealable for outdoor devices
- High Endurance (HE version)

Miniature 14 bar Module

The MS5803-14BA is a new generation of high resolution pressure sensors with SPI and I2C bus interface. The MS5803- 14BA HE is the High Endurance version of MS5803-14BA sensor. It is optimized for depth measurement systems with a water depth resolution of 1cm and below. The sensor module includes a high linear pressure sensor and an ultra-low power 24 bit $\Delta\Sigma$ ADC with internal factory calibrated coefficients. It provides a precise digital 24 Bit pressure and temperature value and different operation modes that allow the user to optimize for conversion speed and current consumption. A high resolution temperature output allows the implementation of a depth measurement systems and thermometer function without any additional sensor. The MS5803- 14BA can be interfaced to any microcontroller. The communication protocol is simple, without the need to programming internal registers in the device. The gel protection and antimagnetic stainless steel cap protects against 30 bar overpressure water resistant. This new sensor module generation is based on leading MEMS technology and latest benefits from the TE proven experience and know-how in high volume manufacturing of pressure modules have been widely used for over a decade. This sensing principle employed leads to very low hysteresis and high stability of both

pressure and temperature signal.

SOLDERING

Please refer to the application note AN808 available on our website for all soldering issues.

MOUNTING

The MS5803-14BA can be placed with automatic Pick & Place equipment using vacuum nozzles. It will not be damaged by the vacuum. Due to the low stress assembly the sensor does not show pressure hysteresis effects. It is important to solder all contact pads.

CONNECTION TO PCB

The package outline of the module allows the use of a flexible PCB for interconnection. This can be important for applications in watches and other special devices.

SEALING WITH O-RINGS

In products like outdoor watches the electronics must be protected against direct water or humidity. For those products the MS5803-14BA provides the possibility to seal with an O-ring. The protective cap of the MS5803-14BA is made of special anticorrosive stainless steel with a polished surface. In addition to this the MS5803-14BA is filled with silicone gel covering the sensor and the bonding wires. The O-ring (or O-rings) shall be placed at the outer diameter of the metal cap. This method avoids mechanical stress because the sensor can move in vertical direction.

CLEANING

The MS5803-14BA has been manufactured under cleanroom conditions. It is therefore recommended to assemble the sensor under class 10'000 or better conditions. Should this not be possible, it is recommended to protect the sensor opening during assembly from entering particles and dust. To avoid cleaning of the PCB, solder paste of type "no-clean" shall be used. Cleaning might damage the

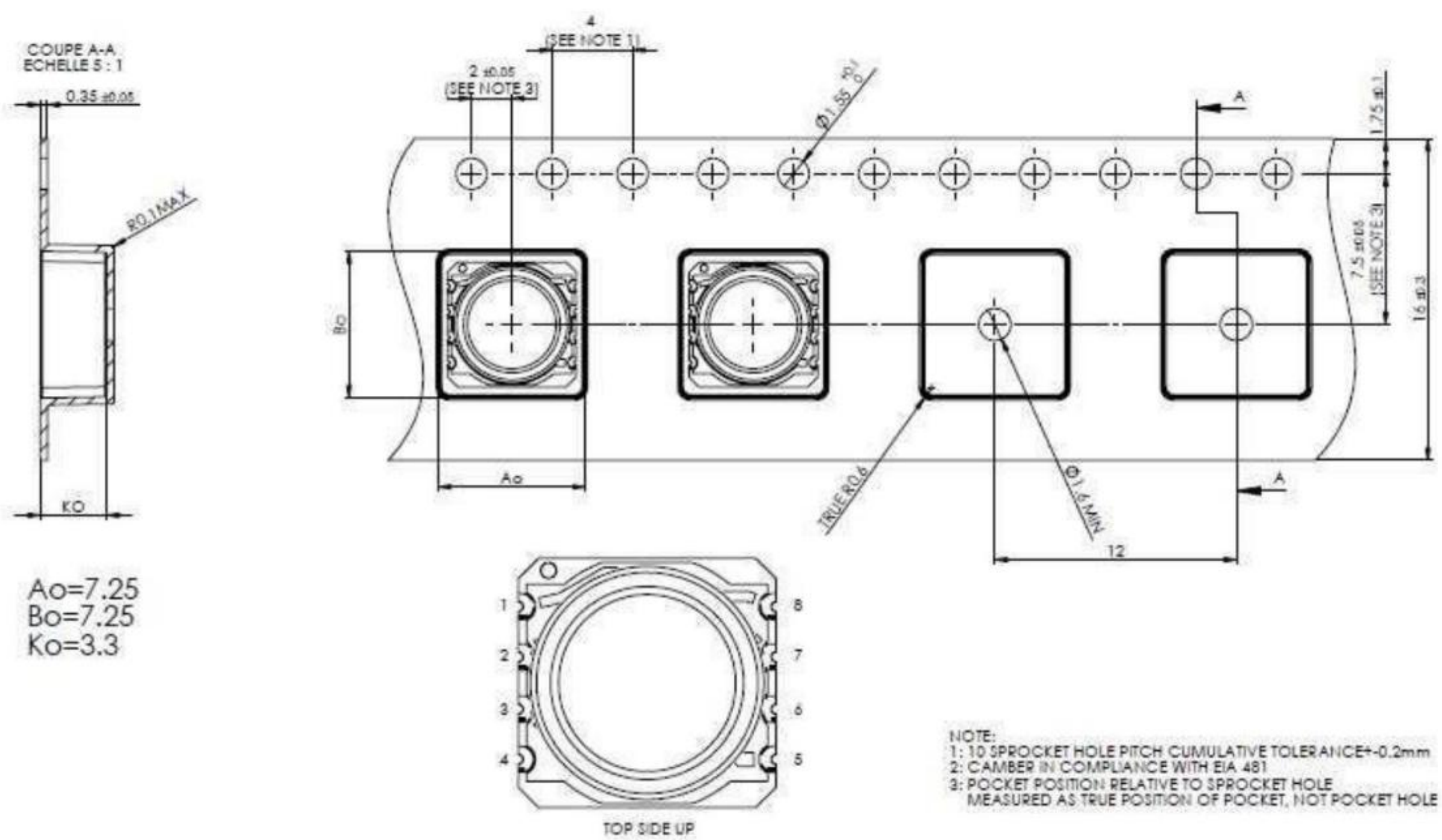
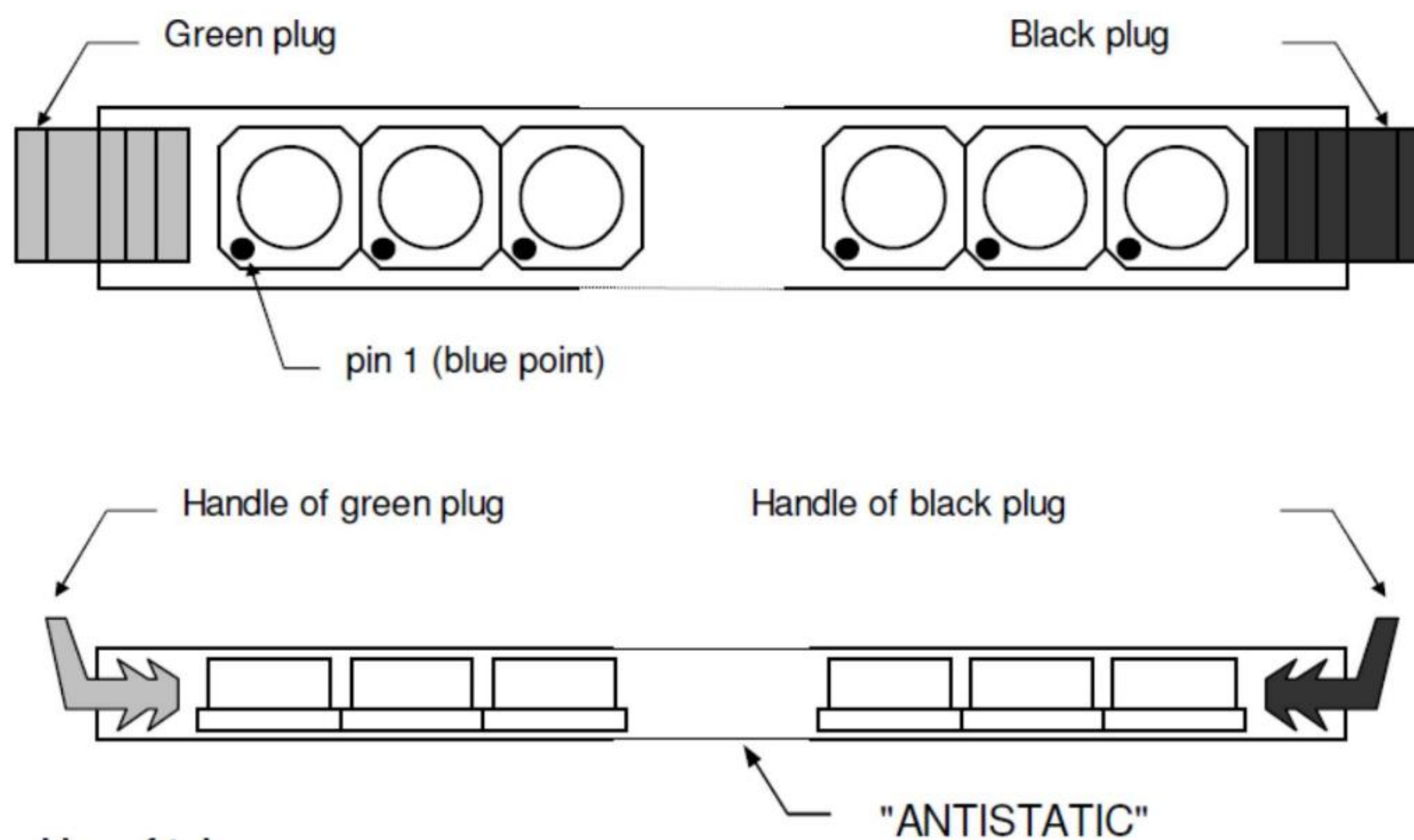
sensor!

ESD PRECAUTIONS

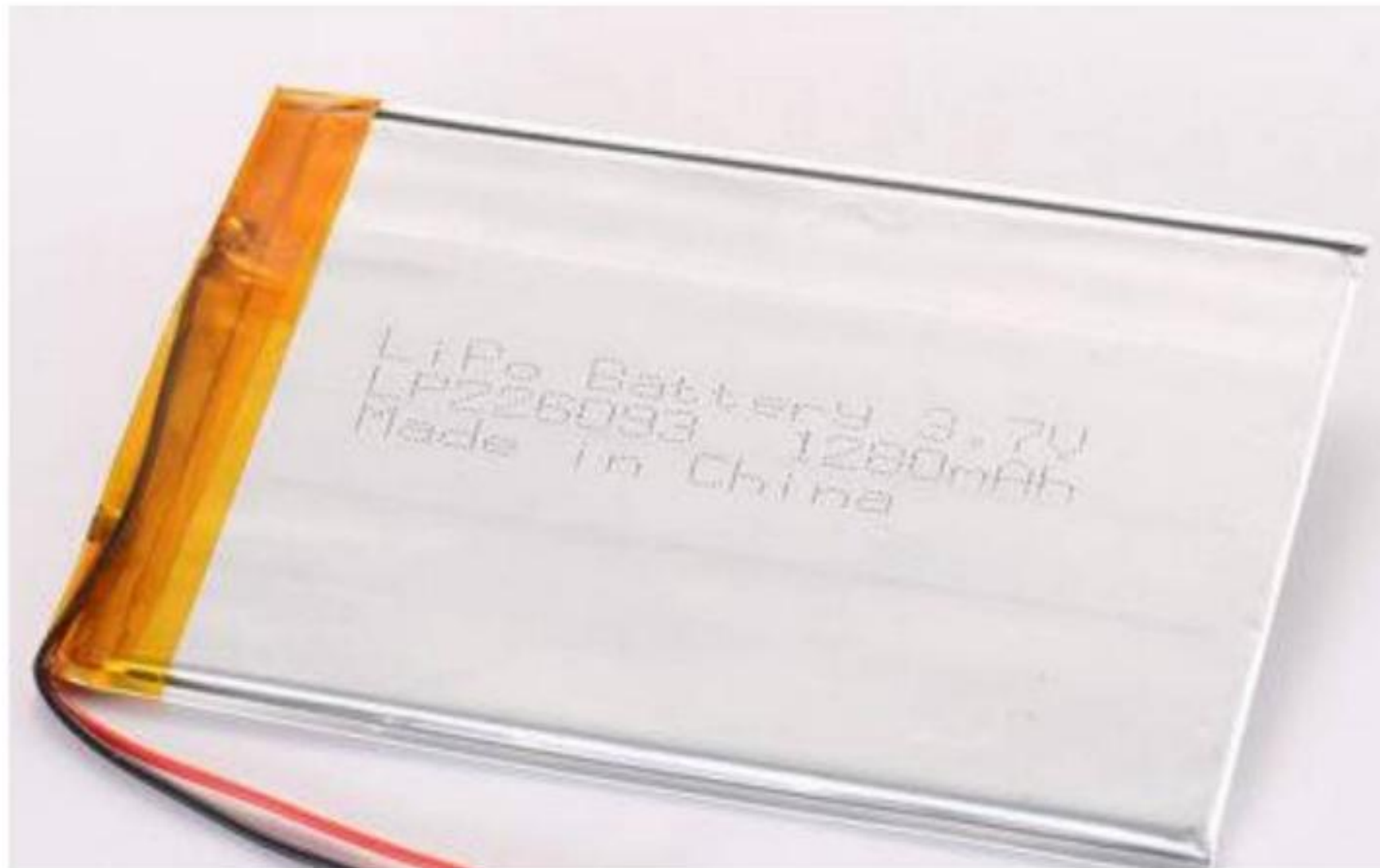
The electrical contact pads are protected against ESD up to 4 kV HBM (human body model). It is therefore essential to ground machines and personnel properly during assembly and handling of the device. The MS5803-14BA is shipped in antistatic transport boxes. Any test adapters or production transport boxes used during the assembly of the sensor shall be of an equivalent antistatic material.

DECOUPLING CAPACITOR

Particular care must be taken when connecting the device to the power supply. A 100 nF ceramic capacitor must be placed as close as possible to the MS5803-14BA VDD pin. This capacitor will stabilize the power supply during data conversion and thus, provide the highest possible accuracy.



Li-polymer batteries



Li-polymer batteries, as one of the most advanced rechargeable batteries, are attracting much attention in the past few decades. They are currently the dominant mobile power sources for portable electronic devices, exclusively used in cell phones and laptop computers [1]. Li-polymer batteries are considered the powerhouse for the personal digital electronic revolution starting from about two decades ago, roughly at the same time when Li-polymer batteries were commercialized. As one may have already noticed from his/her daily life, the increasing functionality of mobile electronics always demands for better Li-ion batteries. For example, to charge the cell phone with increasing functionalities less frequently as the current phone will improve quality of one's life. Another important expanding market for Li-ion batteries is electric and hybrid vehicles, which require next-generation Li-ion batteries with not only high power, high capacity, high charging rate, long life, but also dramatically improved safety performance and low cost. In the USA, Obama administration has set a very ambitious goal to have one million plug-in hybrid vehicles on the road by 2015. There are similar plans around the world in promotion of electric and hybrid vehicles as well. The Foreign Policy magazine even published an article entitled "The great battery race" to highlight the worldwide interest in Li-ion batteries [2].

The demand for Li-ion batteries increases rapidly, especially with the demand from electric-powered vehicles (Fig. 1). It is expected that nearly 100 GW hours of Li-ion batteries are required to meet the needs from consumer use and electric-powered vehicles with the latter takes about 50% of Li-ion battery sale by 2018 [3]. Furthermore,

Li-ion batteries will also be employed to buffer the intermittent and fluctuating green energy supply from renewable resources, such as solar and wind, to smooth the difference between energy supply and demand. For example, extra solar energy generated during the day time can be stored in Li-ion batteries that will supply energy at night when sun light is not available. Large-scale Li-ion batteries for grid application will require next-generation batteries to be produced at low cost

Another important aspect of Li-ion batteries is related to battery safety. The recent fire on two Boeing 787 Dreamliner associated with Li-ion batteries once again highlights the critical importance of battery safety [4, 5]. This will trigger another wave of extensive research and development to enhance safety of Li-ion batteries, beyond pursuing high-energy density. In this tutorial review, I will try not to have a comprehensive coverage due to the limited scope, but instead I will highlight the basics, progress, and challenges regarding Li-ion batteries.

Li-ion batteries are highly advanced as compared to other commercial rechargeable batteries, in terms of gravimetric and volumetric energy. Figure 2 compares the energy densities of different commercial rechargeable batteries, which clearly shows the superiority of the Li-ion batteries as compared to other batteries [6]. Although lithium metal batteries have even higher theoretical energy densities than that of Li-ion batteries, their poor rechargeability and susceptibility to misuses leading to fire even explosion are known disadvantages. I anticipate that lithium metal batteries based on solid-state electrolytes with enhanced safety will be commercialized in the next decade. Recently, lithium-air and lithium-sulfur batteries regain wide interest, although the concepts have been proposed for a while. Promising progress has been achieved regarding Li-air and Li-sulfur batteries, but it may take another two decades to fully develop those technologies to achieve reliable performances that will be comparable to Li-ion batteries. It is expected that Li-ion batteries will still be dominant in rechargeable battery market, at least for the next decade, for advantages they offer. Li-ion batteries are design flexible. They can be formed into a wide variety

It would be interesting to briefly review the history on the development of Li-ion batteries. The first rechargeable Li-ion batteries with cathode of layered TiS_2 and anode of metallic Li was reported by Whittingham while working at Exxon in 1976 [7]. Exxon subsequently tried to commercialize the Li-ion batteries, but was not successful due to the problems of Li dendrite formation and short circuit upon extensive cycling and safety concern [2]. Also in 1976, Besenhard proposed to reversibly intercalate Li^+ ions into graphite and oxides as anodes and cathodes, respectively [8, 9]. In 1981, Goodenough first proposed to use layered LiCoO_2 as high energy and high voltage cathode materials. Interestingly, layered LiCoO_2 did not attract much attention initially [10]. In 1983, Goodenough also identified manganese spinel as a low-cost cathode materials [11]. However, the lack of safe anode materials limited the application of layered oxide cathode of LiMO_2 ($M = \text{Ni}, \text{Co}$) in Li-ion batteries. It was discovered by Besenhard [8], Yazami [12], and Basu [13] that graphite, also with layered structure, could be a good candidate to reversibly store Li by intercalation/deintercalation in late 1970s and early 1980s. In 1987, Yohsino et al. [14] filed a patent and built a prototype cell using carbonaceous anode and discharged LiCoO_2 as cathode. Both carbon anode and LiCoO_2 cathode are stable in air which is highly beneficial from the engineering and manufacturing perspectives. This battery design enabled the

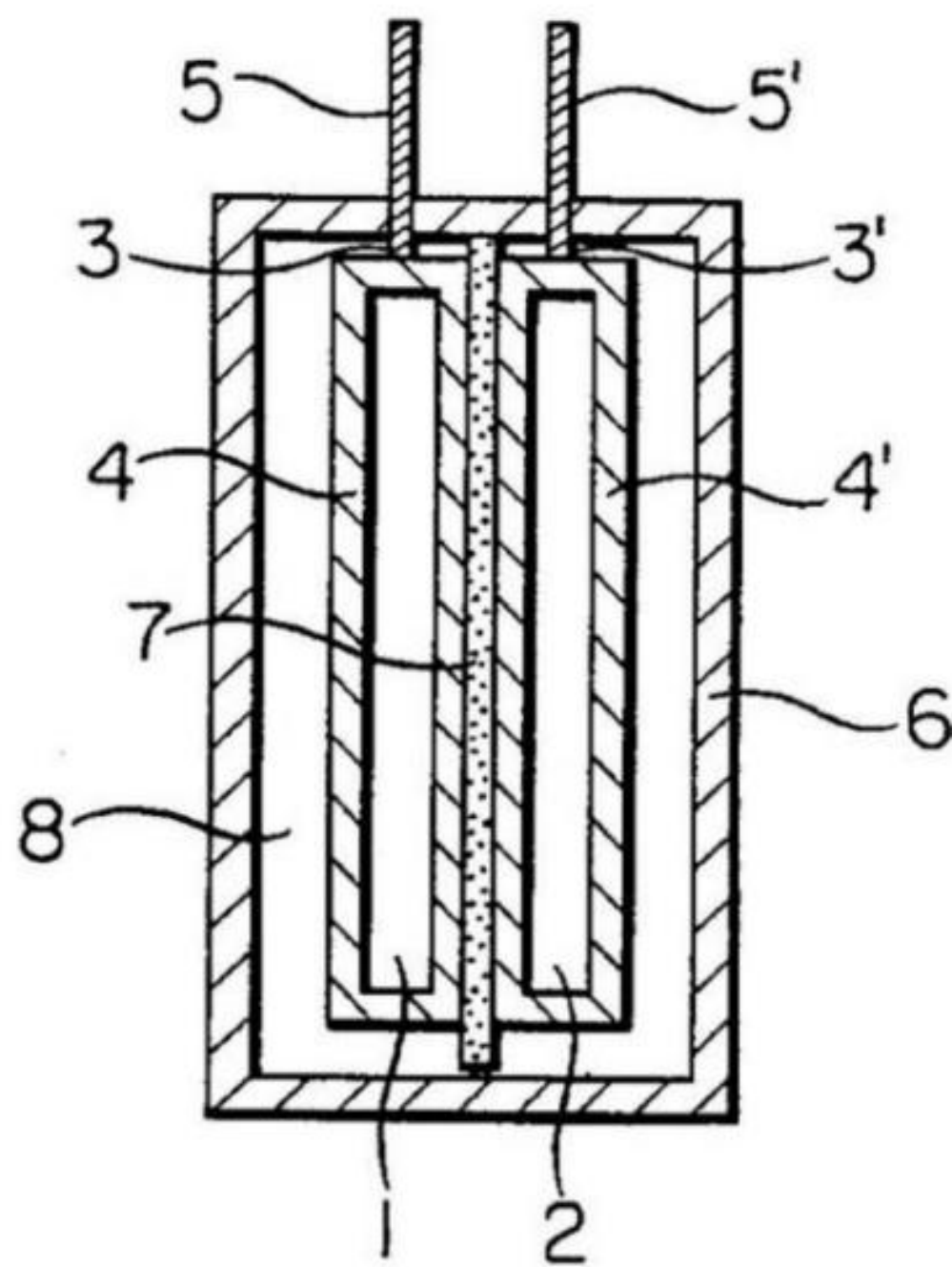
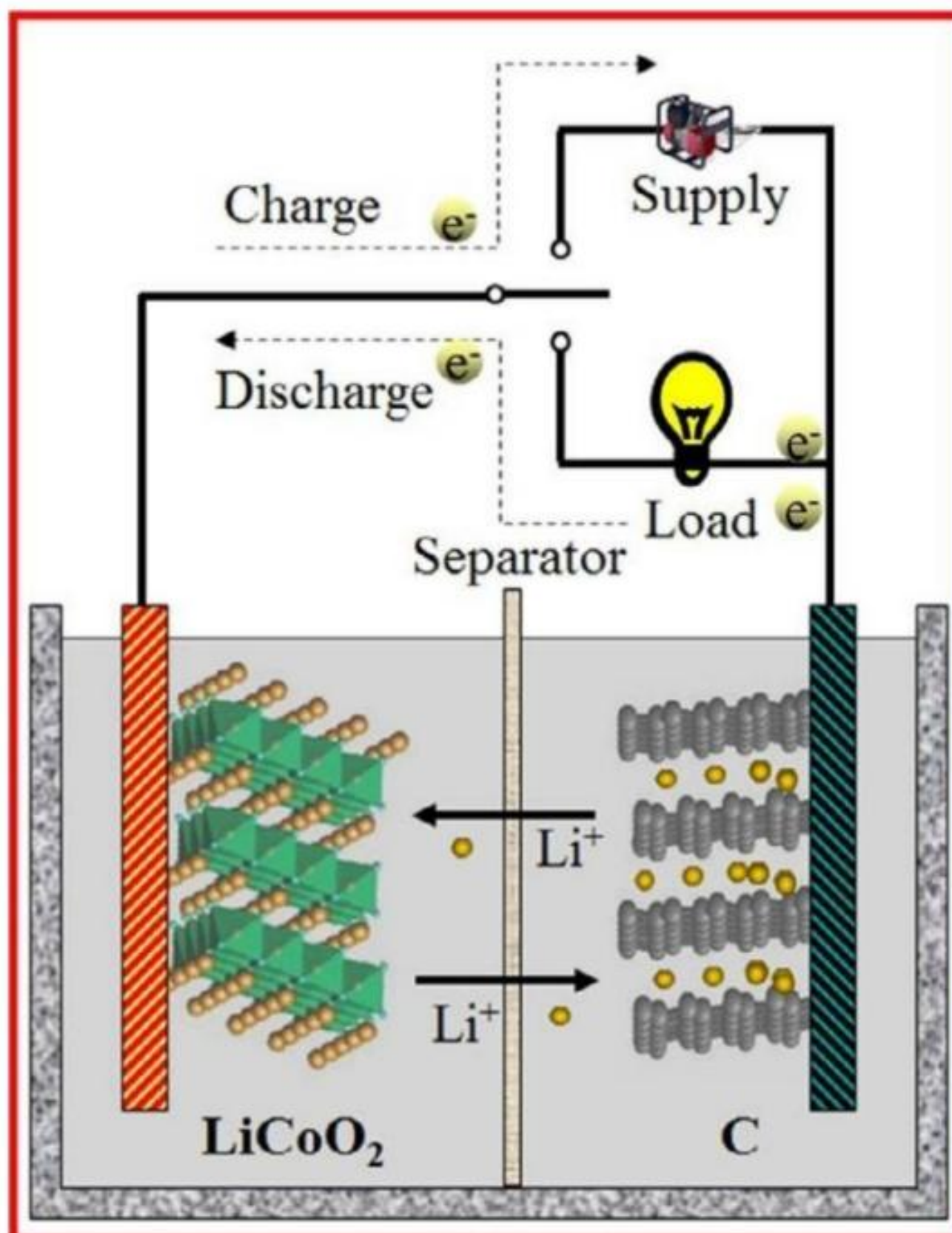


Illustration of first full cell of Carbon/LiCoO₂ coupled Li-ion battery patterned by Yohsino et al., with 1-positive electrode, 2-negative electrode, 3-current collecting rods, 4-SUS nets, 5-external electrode terminals, 6-case, 7-separator, 8-electrolyte. Reproduced with permission [14].large-scale manufacturing of Li-ion batteries in the early 1990s.

It should be highlighted that Yohsion also carried out first safety test on Li-ion batteries to demonstrate their enhanced safety features without ignition by dropping iron lump on the battery cells, in contrast to that of metallic lithium batteries which caused fire [3]. Yohsino's success is widely considered the beginning of modern commercial Li-ion batteries. Eventually Sony, dominant maker of per- sonal electronic devices such as Walkman at that time, commercialized Li-ion batteries in 1991. It was a tremen- dous success and supported the revolution of personal mobile electronics. To acknowledge their pioneering con- tribution to the development of Li-ion battery, Goodenough, Yazami, and Yoshino were awarded the 2012 IEEE Medal for Environmental and Safety Technologies. Japan is still leading the share of global Li-ion battery market dominating 57% global market in 2010. In the past two decades, there is some notable progress in de- velopment of Li-ion batteries, particularly the introduction of low-cost cathode of LiFePO₄ by Goodenough in 1996 and high capacity anode of C-Sn-Co by Sony in 2005. The recent development of high capacity anode based on nanostructured silicon (theoretical-specific capacity of 4200 mAh/g) is also worthy to be highlighted [15–17]. In 1990s, Dahn and colleagues pioneered the exploration of composites of C/Si obtained from pyrolysis of silicon- containing polymers as promising candidate as anode materials for Li-ion batteries [18–21]. In 2008, Cui and colleagues [15] reported potential application of Si nanowires for Li-ion batteries. Deng et al. [22–25] studied a number of tin-based negative electrode materials with different compositions and structures to achieve improved electrochemical performances. Deng et al. recently also studied iron and copper oxides based nanostructures that could be used as potential carbon alternatives with much higher capacity than that of graphite [26, 27]. There are a large number of excellent scientific papers published in the past few years, achieving impressive good progress. Future research should focus on full-cell evaluation and

standardization of battery testing procedures.



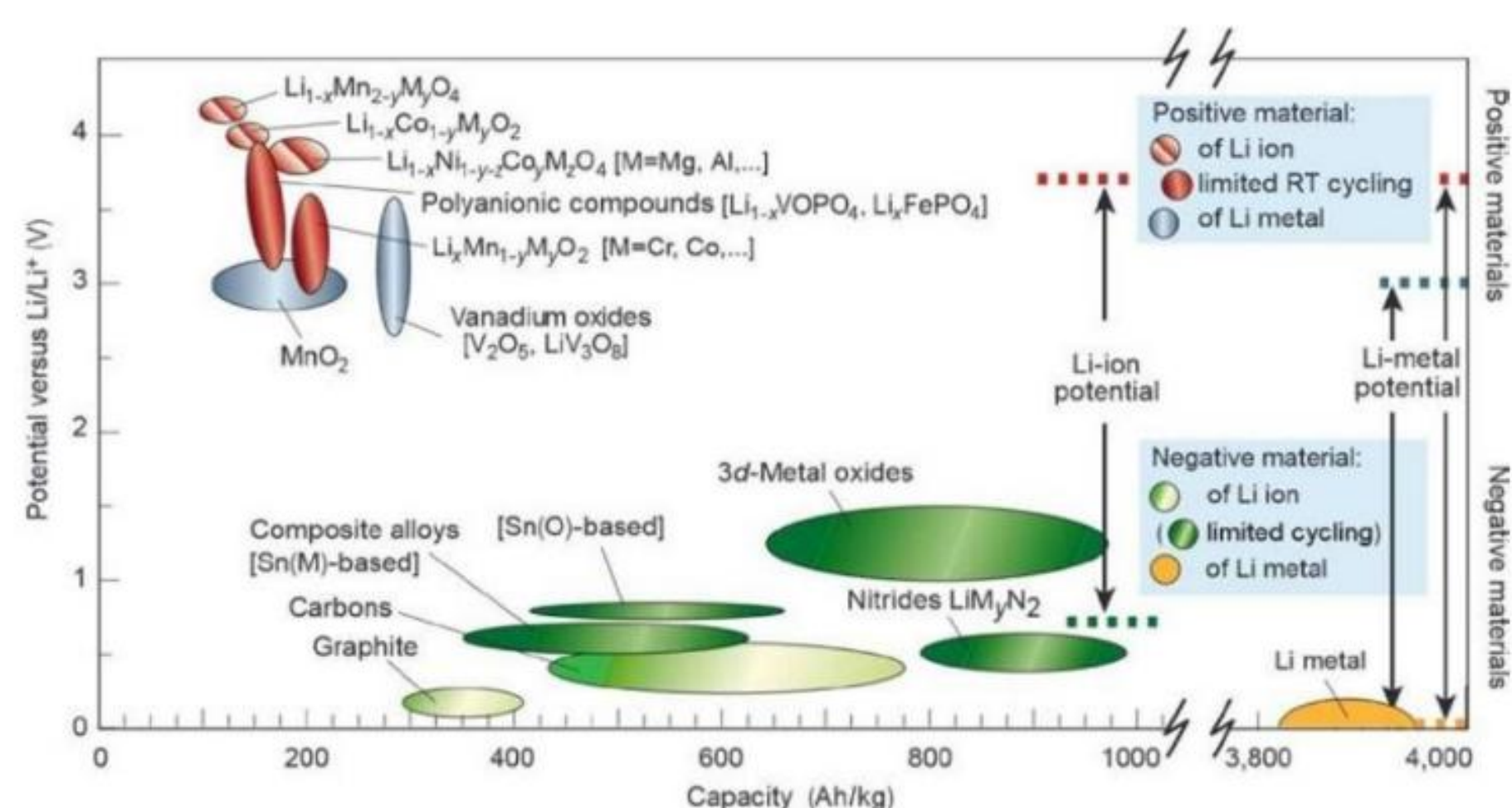
in the form of chemical energy in the anode and cathode materials with different chemical potentials. The opposite occurs during discharging process: electrons move from anode to the cathode through the external load to do the work and Li ions move from anode to the cathode in the electrolyte. This is also known as “shuttle chair” mechanism, where the Li ions shuttle between the anode and cathodes during charge and discharge cycles.

Electrochemical reactions at the two electrodes released the stored chemical energy [1]. The total Gibbs free energy change due to the electrochemical reactions on the two electrodes is determined by the electrode materials selected. Given the overall electrochemical reaction and charges transferred, one can estimate the theoretical cell voltage ($\Delta E = -\Delta G/nF$).

The performance of Li-ion batteries can be evaluated by a number of parameters, such as specific energy, volumetric energy, specific capacity, cyclability, safety, abuse tolerance, and the dis/charging rate. Specific energy (Wh/kg) measures the amount of energy that can be stored and released per unit mass of the battery. It can be obtained by multiplying the specific capacity (Ah/kg) with operating battery voltage (V). Specific capacity measures the amount of charge that can be reversibly stored per unit mass. It is closely related to number of electrons released from electrochemical reactions and the atomic weight of the host. Cyclability measures the reversibility of the Li-ion insertion and extraction processes, in terms of the number of charge and discharge cycles before the battery loses energy significantly or can no longer sustain function of the device it powers. Practically, the cycle life of Li-ion batteries is affected by depth of discharge (DOD) and state of charge (SOC), as well as operating temperature, in addition to the battery chemistry. Cycle life is enhanced with shallow DOD cycles and less SOC swing, and avoiding elevated temperature. Li dendrite

formation on graphite anode can occur at low-temperature charge which should be avoided. Safety requirement is very high for Li-ion batteries with multiple cells. Battery management systems (BMS) are typically employed in battery cells/packs/modules to prevent any possible thermal runaway. For example, in the case of battery cell failure inside a battery pack, the BMS could detect and isolate the particular cell.

Abuse tolerance is a critical requirement for practical application of Li-ion batteries, especially in electric vehicles. Typically, mechanical, thermal, and electrical abuse evaluations are carried out on prototypes to evaluate abuse tolerance of the batteries. The mechanical abuse evaluation includes mechanical shock and drop, roll-over, nail penetration, and immersion in water tests. The thermal abuse evaluation includes radiant heat, thermal stability, overheat, and extreme cold tests. The electrical abuse evaluation includes short circuit, overcharge, over-discharge, and alternative current exposure tests. Those abuse tolerance



Cathode materials

There are a number of candidates that have been explored as cathode materials for Li-ion batteries. The cathode materials can be categorized based on voltage versus lithium. Typically: 2-Volt cathode materials are TiS₂ and MoS₂ with 2-D layered structure; 3-Volt cathode materials are MnO₂ and V₂O₅; 4-Volt cathode materials are LiCoO₂, LiNiO₂ with 2-D layered structure and 3-D spinel LiMn₂O₄ and olivine LiFePO₄; 5-Volt cathode materials are olivine LiMnPO₄, LiCoPO₄, and Li₂M_xMn_{4-x}O₈ (M = Fe, Co) spinel 3-D structure. Generally, high cathode voltage is desirable as energy stored is proportional to the cell operating voltage. However, electrolyte stability has to be taken into consideration in selecting high voltage cathode materials.

Currently LiCoO₂ and LiFePO₄ are most widely used in commercial Li-ion batteries because of their good cycle

life (>500 cycles). LiCoO₂ can be easily manufactured in large scale and is stable in air. Its practical capacity is

~140 mAh/g and the theoretical capacity is 274 mAh/g upon full charge. In addition to its low practical capacity, other noticeable disadvantages of the LiCoO₂ are their high material cost and the toxicity of cobalt. On the other hand, LiFePO₄-based cathode materials are attracting much attention in the past decade due to its low cost and low environmental impact. Compared to LiCoO₂, LiFePO₄ also offers a number of advantages, such as stability, excellent cycle life, and temperature tolerance (-20 to 70°C). However, LiFePO₄ has a problem of poor electronic and ionic conductivity at 10^{-10} S/cm and 10^{-8} cm²/sec, respectively, as well as relatively low capacity [47]. The other issue is one-dimensional channels for lithium ion diffusion which can easily be blocked by defects and impurities. Modeling and calculation reveal that the lowest Lithium ion migration energy is in the channels along [010] direction (Fig. 6) [48]. It also suggests that diffusion constant depends on particle size with diffusion in bulk being much slower than

in nanoscale. Therefore, LiFePO₄ in nanoscale have been explored for and employed in Li-ion batteries.

SOS RF LORA TRANSMITTER WITH GPS

The countless stories and movies like the Lord of the Flies, Robinson Crusoe, Titanic, Cast Away, Six Days Seven Nights, etc. where the protagonist gets stuck on an island, even though it sounds very adventurous, but nonetheless the dangerous probability of it happening in real to people still remains. The idea behind Saviour was to create a hack that allows people to travel to remote locations without having to worry about getting lost or getting stuck there.

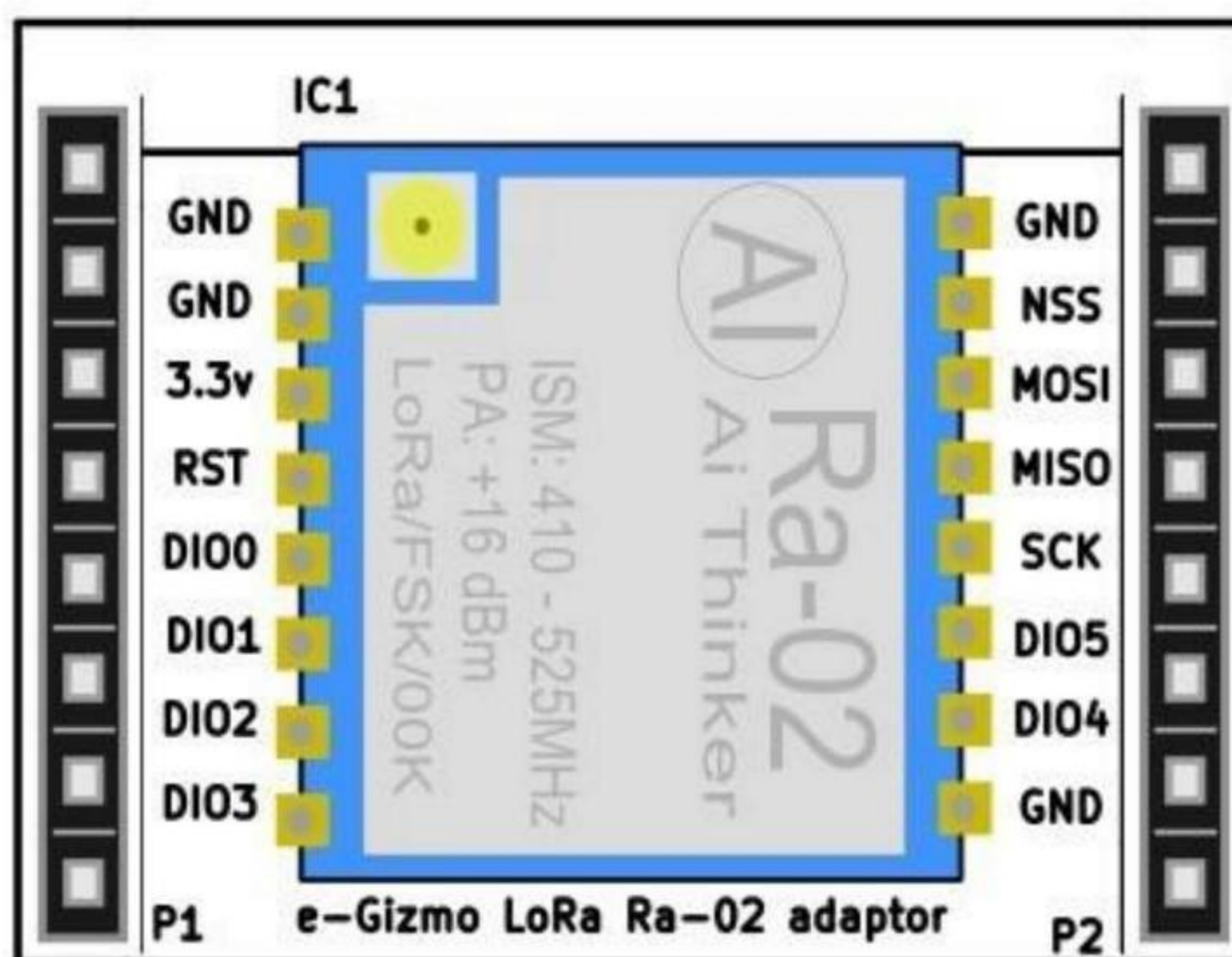
##What it does Saviour is an emergency tool that is very powerful, in times of real juncture. Saviour can do radio signalings like the popular SOS signal or any emergency signaling. If one gets stuck in a deserted area, say on an island or some mountain, where the Mobile gets useless, due to no network coverage, radios are still there, which can be a very effective way of communication in that scenario, and still, they are used all way. Saviour uses Morse Code signaling via a radio transmitter, also with a LED. It also has an OLED display, that can translate any sentence to its Morse Code, and display that code on the OLED simultaneously transmitting the code over the air, and also flashing it via a LED. It also has a buzzer to sound, how the Code will sound. Now, it also contains a GPS that can get your direct coordinates. Since GPS satellites revolve all around the world, they can connect and get your current location. So with that not only Savior can send the SOS signal using radio, but Saviour sends the location details i.e. the latitude and longitude of the signal's origin location using the GPS. This will make it a lot easier for the search party to find the lost individual thus speeding up the process of the rescue operation. This hack is not only a very important tool that will come in handy for people going

on a vacation or traveling because of work purposes but it can also be used as an educational tool for learning Morse code since it has a Morse Code translator. ##Challenges we ran into Making the interface was a bit tricky. Stopping abnormal flow or increment of button pushes using flags. Getting ready with the GPS. Since the GPS works best over open air. Printing the translated Morse Code on the OLED was a bit tricky too. ##Accomplishments that we're proud of We were in a bit of a time crunch since a lot had to be done, but we decided to work on one aspect at a time and finish that first. We are really proud to have overcome all the challenges like making the interface, making the FM transmitter. Displaying the morse code and listening to the buzzer to beep in accordance was a very proud moment. Thus bringing a mere project idea into life and that too in very little time is what we are very happy about. Saviour is a hack that we are very proud of building this tool because it can really help people in times of emergency. ##What we learned We learned with help of simple components, such as the potentiometer and button we can create such a good graphical interface. We learned how to drive OLED displays. Learned about Morse Codes, speed. Learned a bit about GPS and the NMEA protocol. ##What's next for Saviour We are thinking of adding a digital compass, and an altimeter by which it can be used as a very powerful and absolute emergency item, and a normal human must-have.

Saviour has four main parts - one is the Morse Code translator, indicator, transmitter, and the GPS. Firstly we created a menu-driven Graphics Interface for choosing the mode, whether the Morse Code or the GPS. This is done by a potentiometer to scroll, and a button to select. The Morse code translator is built by parsing the String sentence character by character and creating its Morse equivalent. According to the supported Characters, the program translates it to a Morse String. To create a sentence, we reused the same button and the potentiometer. The potentiometer, scrolls through the characters, and the button increments the cursor. Next, the Indicator was built using a small Buzzer and a LED which can also be used for signaling, and it is still considered to be an effective way. The buzzer plays the Morse Code with a Farnsworth speed of 10 in sync with the LED flashes. After that, a simple single transistor FM transmitter was built using a coil, capacitor, and transistor. Its job is to transmit the Morse code over open Air. Last but not least, the life saviour, the GPS. As the name suggests, this part contains a GPS, through which the NMEA data is received as packets. Those get parsed and fetch the coordinates and finally get transmitted via the transmitter. Now all these interfaces are

displayed over an OLED display, and all of them get controlled by the Arduino. ArduinoIDE was used to develop Firmware.

AI THINKER LORA MODULE



- Antenna Included
- Works with Arduino, Raspberry Pi, ARM, AVR, PIC and other controllers
- Longer range than Bluetooth, WiFi, Zigbee
- Applications include, Automated Meter Reading, Home and Building Automation, Wireless Alarm and Security Systems, Industrial Monitoring and Control, Long range Irrigation Systems, Smart City

SERVO MOTOR



A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a **servo mechanism**. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the **DC servo motor working**. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your

servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Servo Motor Working Mechanism

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Here reference input signal is compared to the reference output signal and the third signal is produced by the feedback system. And this third signal acts as an input signal to the control the device. This signal is present as long as the feedback signal is generated or there is a difference between the reference input signal and reference output signal. So the main task of servomechanism is to maintain the output of a system at the desired value at presence of noises.

Servo Motor Working Principle

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the

error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

Interfacing Servo Motors with Microcontrollers:

Interfacing hobby Servo motors like s90 servo motor with MCU is very easy. **Servos have three wires coming out of them.** Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU. An **MG995 Metal Gear Servo Motor** which is most commonly used for RC cars humanoid bots etc. The picture of MG995 is shown below:



Ground=Brown (-) 

The color coding of your servo motor might differ hence check for your respective datasheet.

All servo motors work directly with your +5V supply rails but we have to be careful on the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

Controlling Servo Motor:

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.

Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction from its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.

Servo motor works on **PWM (Pulse width modulation)** principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of **DC motor which is controlled by a variable resistor (potentiometer) and some gears**. High speed force of DC motor is converted into torque by Gears. We know that $WORK = FORCE \times DISTANCE$, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. The potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on the required angle.



Servo motor can be rotated from 0 to 180 degrees, but it can go up to 210 degrees, depending on the manufacturing. This degree of rotation can be controlled by applying the **Electrical Pulse** of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. The pulse of 1 ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2 ms pulse can rotate it to 180 degree.

All servo motors work directly with your +5V supply rails but we have to be careful about the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

CO₂ GAS CYLINDER

The existence of carbon dioxide (CO₂) has been known since primitive times [1]; PLINY wrote of lethal vapors from caverns in the first century A.D. [2]. It was first recognized as a distinct gas, however, by VAN HELMONT (1577–1644), who prepared the gas by various routes and demonstrated that it was the same gas as that issued from caverns and mines [3]. He obtained it by fermentation, by the action of acids on carbonates, and by the burning of charcoal. He studied many of its properties. Soon after, HOFFMANN, while investigating gas escaping from effervescent mineral waters, observed that the gas was acidic by its effect on blue vegetable coloring materials [4]. In 1757, BLACK showed that during respiration part of the atmospheric air was chemically changed and discovered the lethal effect such “fixed air” had on animal life [5]. CAVENDISH made various observations on the chemical properties of “fixed air” [6], and PRIESTLEY, who lived near a brewery, made further observations on the physical properties of the gas, finding that pressure favored dissolution of the gas in water [7]. The French chemist LAVOISIER was the first to prove the composition of “fixed air” by showing that it was produced when carbon is heated in oxygen [8]. The resultant gas, which he named carbonic acid, was found to contain 23.5–28.9 parts by mass carbon and 71.1–76.5 parts by mass oxygen [9].

The commercial exploitation of carbon dioxide began with attempts to produce artificial mineral waters (solutions of CO₂ in water), which were thought to have medicinal properties. The industrial development of the gas really began, however, with the experiments of FARADAY on the liquefaction of gases. He succeeded in liquefying CO₂ in a bent glass tube [10]. THILORIER repeated these experiments on a large scale [11]. Two iron retorts connected by a flexible coupling were used; the first contained a reaction mixture of sodium hydrogen carbonate and sulfuric acid. This was agitated, and the carbon dioxide thus produced was liquefied under pressure in the second retort. Despite a spectacular explosion, which killed his assistant, THILORIER succeeded in carrying out extensive experiments on the expansion, vapor pressure, density, and enthalpy changes of the liquid CO₂ during evaporation. He was also the first experimenter to produce solid carbon dioxide, which, on the evaporation of liquid carbon dioxide, appeared as a white, flocculent, easily compressible mass. He observed that it disappeared by slow evaporation without first melting to form a liquid (i.e., it sublimed).

In 1845, FARADAY made larger quantities of liquid and solid carbon dioxide by a hydraulic pump [12]. He also used solid carbon dioxide, in a mixture with ether, as a refrigerant in further gas liquefaction studies. Soon after, NATTERER developed a mechanical compressor (a forerunner of the modern multistage type), which was used to make liquid carbon dioxide [13]. As uses for the new liquid were proposed, compressors were developed to produce greater quantities. The first factory for the production of liquid carbon dioxide was established by RAYDT in Germany in 1884, and the development of the industry continued as more uses were found [14]. In particular, its

uses in ice-making, refrigeration, and as a fire extinguisher became important. Much carbon dioxide issued from the earth naturally in places, such as Germany. This could be used to make liquid CO₂; however, to avoid the high costs of transporting cylinders of liquefied gas new production methods were required. The first facility was established in Berlin in 1889 to make carbon dioxide from flue gases.

In the beginning of the 1900s, many uses for carbon dioxide were identified, and several other methods of manufacture assumed commercial importance.

.....Column Break.....

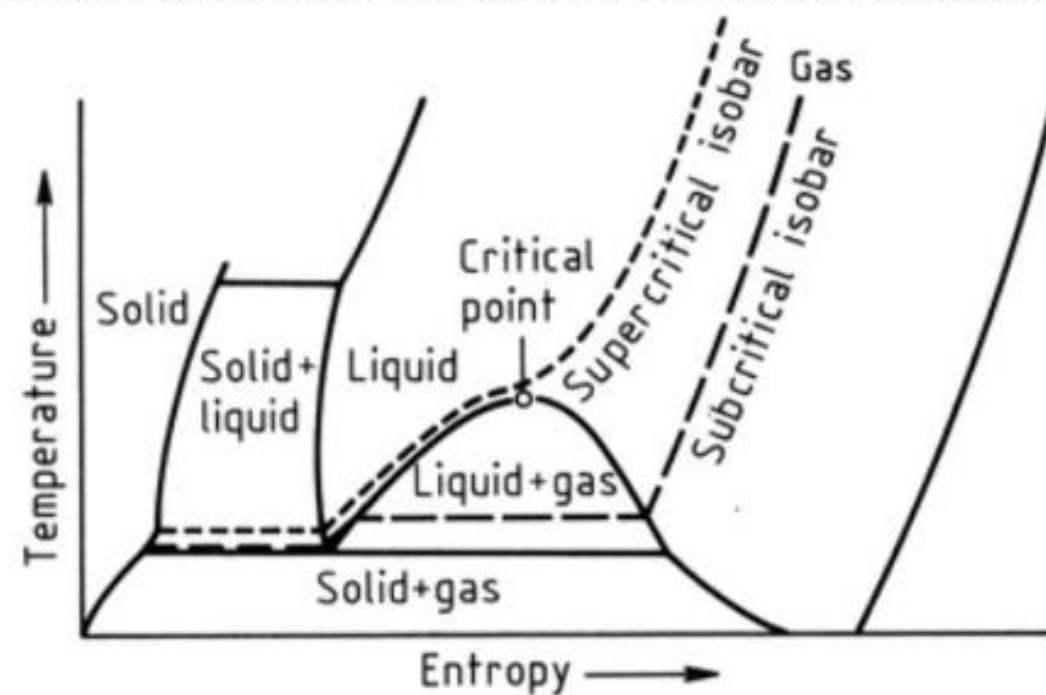


Figure 1. Phase diagram of carbon dioxide, 0–1 200 MPa and –100 to 200°C

Physical Properties

Carbon dioxide [124-38-9], CO₂, M_r 44.010, is a colorless, odorless, nonflammable gas with a slightly sour taste. The regions of existence of the three phases are shown in Figure 1, the entropy–temperature diagram, and Figure 2, the enthalpy–pressure. Table 1 presents vapor pressure, density, and thermal data [16]. Detailed tables of physical, thermodynamic, and transport properties of solid, liquid, and gaseous carbon dioxide, together with a complete record and critical analysis of the original measurements, are available [17]. The physico-chemical properties of carbon dioxide are summarized in [18, 19].





PROJECT IMAGES









CONCLUSION

THE DESIGNED AUTOMATIC UNDER WATER CO2 BALOON EJECTOR USING SOS is to get save lives from the beches seas and other water reservoirs helpful for fisherman and oithers who work in seas bsaywatches and other people so it saves lifes sand cost is also not so exprensive.then it reduces the risk of lives.