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Women's Safety System Using IBEACON Technology

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Abstract: According to the reports of WHO, NCRB-social-government organization 35%Women all over the world are facing a lot of unethical physical harassment in public places such as railway-bus stands, foot paths etc. This paper describes about an one touch alarm system for women's safety using Ibeacon. In the light of recent outrage in Delhi which shook the nation and woke us to the safety issues for women, people are finding up in different ways to defend. Here we introduce a device which ensures the protection of women. This helps to identify protect and call on resources to help the one out of dangerous situations. Anytime you sense danger, all you had to do, is hold on the panic switch. The system resembles a normal wearable device which when activated, tracks the place of the women using bluetooth low energy and sends emergency messages using GSM (Global System for Mobile communication), to sos contacts and the police control room. The proposed work shows a flexible and interoperable combination of a device and application that will accessorize and empower the citizens and serve as a multifunctional device.

Keywords: IBeacon Technology, ATMEGA328 Microcontroller, Women's Safety System.

INTRODUCTION

India which sees itself as a promising super power and an economic hub can achieve its goal if and only if a large numbers of women participate in the development process. The existing system propose an automated reliable women security device which consist of the sensors embedded in a wearable dresses.

It consist of sensors, GSM and ATMEGA328 microcontroller with ARDUINO tool which keep user under observation at all the time. The Paper proposed a portable device as a belt which is automatically activated base on the pressure difference crosses over the threshold in unsafe situation. A GPS module track the location and sends the emergency messages to three emergency contacts every two minutes with updated location through GSM.

System Description

New iBeacon technology uses low cost Bluetooth Low Energy signalling to enable micro-location services and to trigger actions within apps. A woman with a mobile phone only needs to pass by the bluetooth signal to be tracked by an application.

This technology used to provide safety tracking of women and young people. IBeacon technology used to track and "checkin" on women and children in urban environments with automated low cost bluetooth devices.

Women and young people who can be tracked easily in an urban environment, law enforcement will can access information quickly, families who want to "checkin" on their loved one's travelling globally.

CAN IC-PIC18FXX8

High-Performance RISC CPU

- Linear program memory addressing up to 2 Mbytes
- Linear data memory addressing to 4 Kbytes

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- Up to 10 MIPS operation
- DC – 40 MHz clock input
- 4 MHz-10 MHz oscillator/clock input with PLL active
- 16-bit wide instructions, 8-bit wide data path
- Priority levels for interrupts
- 8 x 8 Single-Cycle Hardware Multiplier

Peripheral Features

- High current sink/source 25 mA/25 mA
- Three external interrupt pins
- Timer0module: 8-bit/16-bit timer/counter with 8-bit programmable prescaler
- Timer1module: 16-bit timer/counter
- Timer2module: 8-bit timer/counter with 8-bit period register (time base for PWM)
- Timer3module: 16-bit timer/counter
- Secondary oscillator clock option – Timer1/Timer3
- Capture/Compare/PWM (CCP) modules;

CCP pins can be configured as:

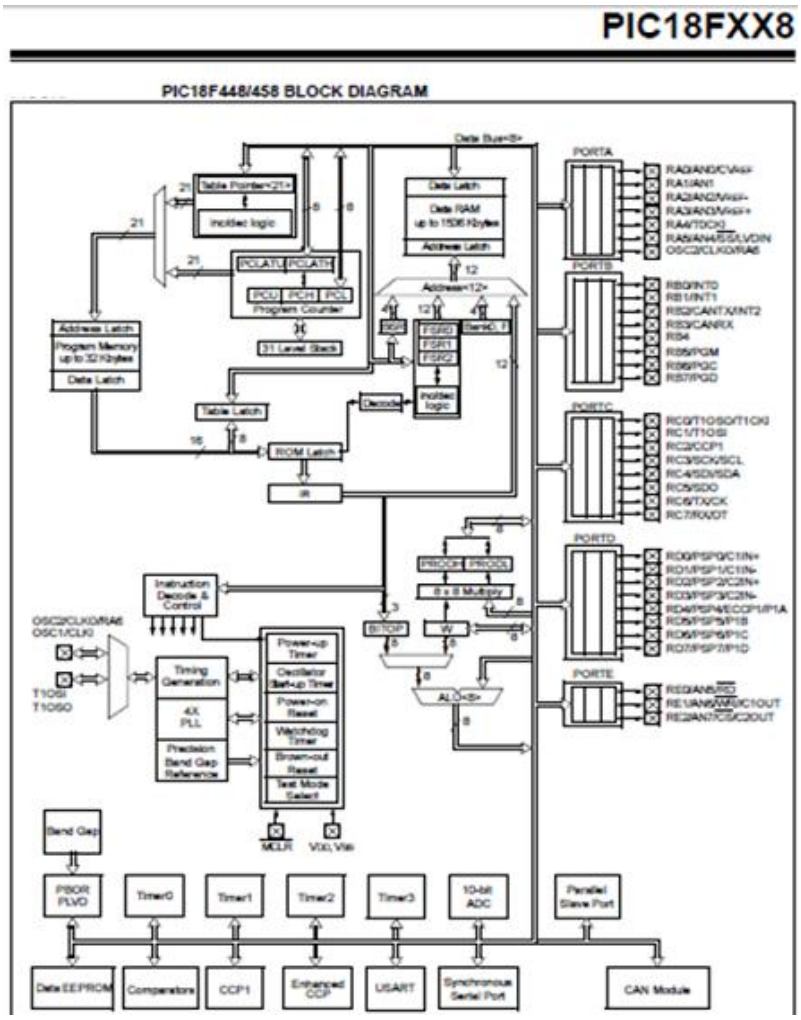
- Capture input: 16-bit, max resolution 6.25 ns
- Compare: 16-bit, max resolution 100 ns (TCY)
- PWM output: PWM resolution is 1 to 10-bit

- Max. PWM freq. @:8-bit resolution = 156 kHz
- 10-bit resolution = 39 kHz
- Enhanced CCP module which has all the features of the standard CCP module, but also has the following features for advanced motor control:
  - 1, 2 or 4 PWM outputs
  - Select-able PWM polarity
  - Programmable PWM dead time
- Master Synchronous Serial Port (MSSP) with two modes of operation:
  - 3-wire SPI™ (Supports all 4 SPI modes)
  - I2C Master and Slave mode
- Addressable USART module:
  - Supports interrupt-on-address bit

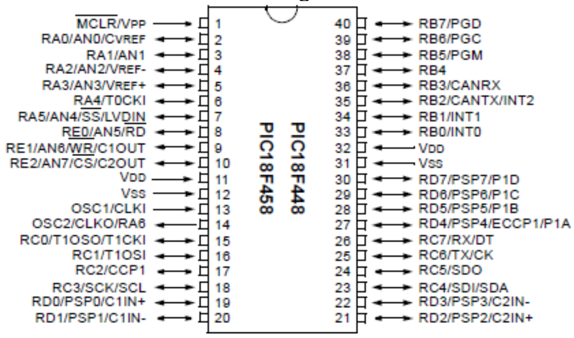
Advanced Analog Features

- 10-bit, up to 8-channel Analog-to-Digital Converter module (A/D) with:
  - Conversion available during Sleep
  - Up to 8 channels available
- Analog Comparator module:
  - Programmable input and output multiplexing
- Comparator Voltage Reference module
- Programmable Low-Voltage Detection (LVD) module:
  - Supports interrupt-on-Low-Voltage Detection
- Programmable Brown-out Reset (BOR)

Architecture



Pin Diagram



OSCILLATOR CONFIGURATIONS

Oscillator Types

The PIC18FXX8 can be operated in one of eight oscillator modes, programmable by three configuration bits (FOSC2, FOSC1 and FOSC0).

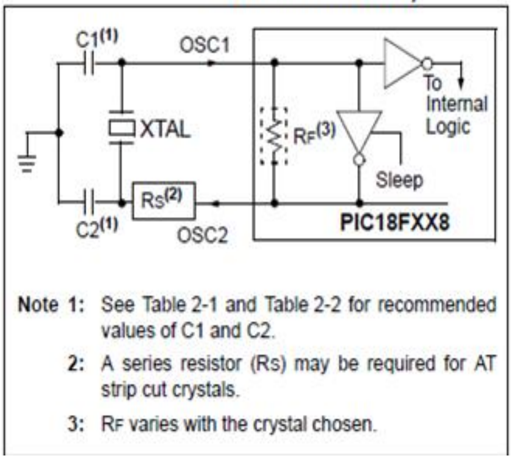
1. LP Low-Power Crystal
2. XT Crystal/Resonator
3. HS High-Speed Crystal/Resonator
4. HS4 High-Speed Crystal/Resonator with PLL enabled
5. RC External Resistor/Capacitor
6. RCIO External Resistor/Capacitor with I/O pin enabled
7. EC External Clock

8. ECIO External Clock with I/O pin enabled.

Crystal Oscillator/Ceramic Resonators

In XT, LP, HS or HS4 (PLL) Oscillator modes, a crystal or ceramic resonator is connected to the OSC1 and OSC2 pins to establish oscillation. Figure shows the pin connections. An external clock source may also be connected to the OSC1 pin, as shown. The PIC18FXX8 oscillator design requires the use of a parallel cut crystal

CRYSTAL/CERAMIC RESONATOR OPERATION (HS, XT OR LP OSC CONFIGURATION)

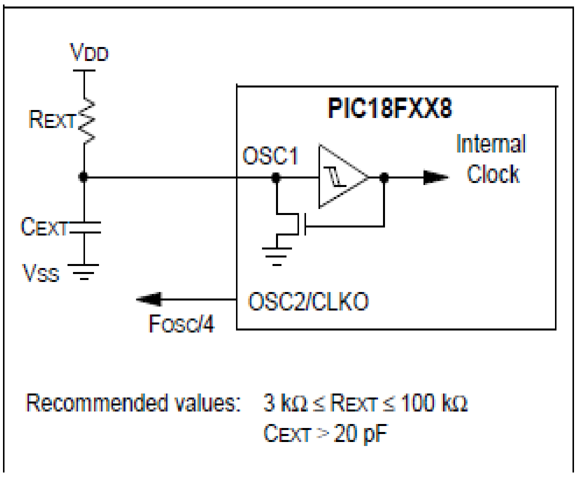


RC Oscillator

For timing insensitive applications, the “RC” and “RCIO” device options offer additional cost savings. The RC oscillator frequency is a function of the supply voltage, the resistor (REXT) and capacitor (CEXT) values and the operating temperature. In addition to this, the oscillator frequency will vary from unit to unit due to normal process parameter variation. Furthermore, the difference in lead frame capacitance between package types will also affect the oscillation frequency, especially for low CEXT values.

The user also needs to take into account variation due to tolerance of external R and C components used. Figure shows how the RC combination is connected. In the RC Oscillator mode, the oscillator frequency divided by 4 is available on the OSC2 pin. This signal may be used for test purposes or to synchronize other logic.

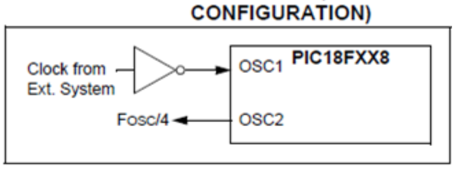
RC OSCILLATOR MODE



External Clock Input

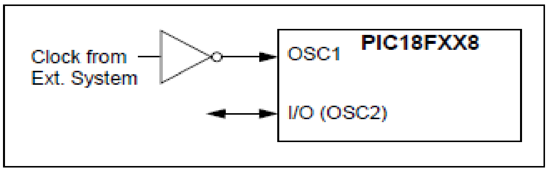
The EC and ECIO Oscillator modes require an external clock source to be connected to the OSC1 pin. The feedback device between OSC1 and OSC2 is turned off in these modes to save current. There is no oscillator start-up time required after a Power-on Reset or after a recovery from Sleep mode. In the EC Oscillator mode, the oscillator frequency divided by 4 is available on the OSC2 pin. This signal may be used for test purposes or to synchronize other logic. Figure shows the pin connections for the EC Oscillator mode.

EXTERNAL CLOCK INPUT OPERATION (EC OSC CONFIGURATION)



The ECIO Oscillator mode functions like the EC mode, except that the OSC2 pin becomes an additional general purpose I/O pin. Figure shows the pin connections for the ECIO Oscillator mode.

EXTERNAL CLOCK INPUT OPERATION (ECIO CONFIGURATION)



HS4 (PLL)

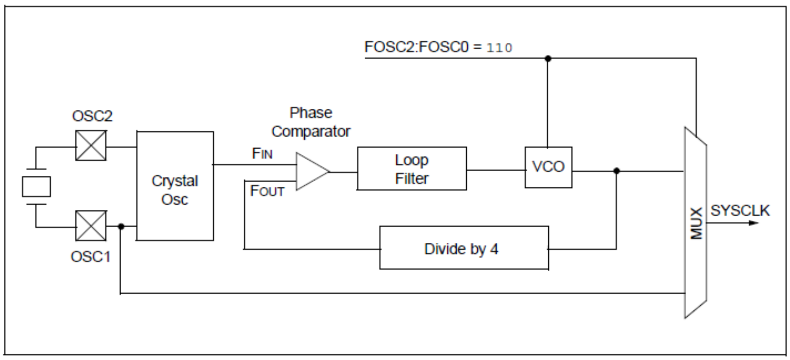
A Phase Locked Loop circuit is provided as a programmable option for users that want to multiply the frequency of the incoming crystal oscillator signal by 4.

For an input clock frequency of 10 MHz, the internal clock frequency will be multiplied to 40 MHz.

This is useful for customers who are concerned with EMI due to high-frequency crystals. The PLL can only be enabled when the oscillator configuration bits are programmed for HS mode. If they are programmed for any other mode, the PLL is not enabled and the system clock will come directly from OSC1.

The PLL is one of the modes of the FOSC2:FOSC0 configuration bits. The oscillator mode is specified during device programming. A PLL lock timer is used to ensure that the PLL has locked before device execution starts. The PLL lock timer has a time-out referred to as TPLL.

PLL BLOCK DIAGRAM



Oscillator Switching Feature

The PIC18FXX8 devices include a feature that allows the system clock source to be switched from the main oscillator to an alternate low-frequency clock source.

For the PIC18FXX8 devices, this alternate clock source is the Timer1 oscillator.

If a low-frequency crystal (32 kHz, for example) has been attached to the Timer1oscillator pins and the Timer1 oscillator has been enabled, the device can switch to a Low-Power Execution mode. Figure shows a block diagram of the system clock sources.

The clock switching feature is enabled by programming the Oscillator Switching Enable (OSCSEN) bit in Configuration register, CONFIG1H, to a '0'. Clock switching is disabled in an erased device. See **"Timer1 Oscillator"** for further details of the Timer1 oscillator and **"Configuration Bits"** for Configuration register details.

System Clock Switch Bit

The system clock source switching is performed under software control. The system clock switch bit, SCS (OSCCON register), controls the clock switching. When the SCS bit is '0', the system clock source comes from the main oscillator selected by the FOSC2:FOSC0 configuration bits. When the SCS bit is set, the system clock source comes from the Timer1 oscillator. The SCS bit is cleared on all forms of Reset.

CAN bus Module Features:

- Complies with ISO CAN Conformance Test
- Message bit rates up to 1 Mbps
- Conforms to CAN 2.0B Active Spec with:
  - 29-bit Identifier Fields
  - 8-byte message length
  - 3 Transmit Message Buffers with prioritization
  - 2 Receive Message Buffers
  - 6 full, 29-bit Acceptance Filters
  - Prioritization of Acceptance Filters
  - Multiple Receive Buffers for High Priority
- Messages to prevent loss due to overflow
  - Advanced Error Management Features

Special Microcontroller Features

- Power-on Reset (POR), Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC oscillator.
- Programmable code protection
- Power-saving Sleep mode
- Selectable oscillator options, including:
  - 4x Phase Lock Loop (PLL) of primary oscillator
  - Secondary Oscillator (32 kHz) clock input
- In-Circuit Serial ProgrammingTM (ICSPTM) via two pins

Flash Technology

- Low-power, high-speed Enhanced Flash technology
- Fully static design
- Wide operating voltage range (2.0V to 5.5V)
- Industrial and Extended temperature ranges

CAN - a brief tutorial

The CAN bus (Controller Area Networking) was defined in the late 1980 by Bosch, initially for use in automotive applications.

It has the following characteristics:

- Uses a single terminated twisted pair cable
- Is multi master
- Maximum Signal frequency used is 1 Mbit/sec
- Length is typically 40M at 1Mbit/sec up to 10KM at 5Kbits/sec
- Has high reliability with extensive error checking
- Typical maximum data rate achievable is 40KBytes/sec
- Maximum latency of high priority message <120 μsec at 1Mbit/sec

CAN is unusual in that the entities on the network, called nodes, are not given specific addresses. Instead, it is the messages themselves that have an identifier which also determines the messages' priority. For this reason there is no theoretical limit to the number of nodes although in practice it is ~64.

Two specifications are in use:

- 2.0A sometimes known as Basic or Standard CAN with 11 bit message identifiers which was originally specified to operated at a maximum frequency of 250Kbit/sec - ISO11519.
- 2.0B known as Full CAN or extended frame CAN with 29 bit message identifier which can be used at up to 1Mbit/sec - ISO 11898.

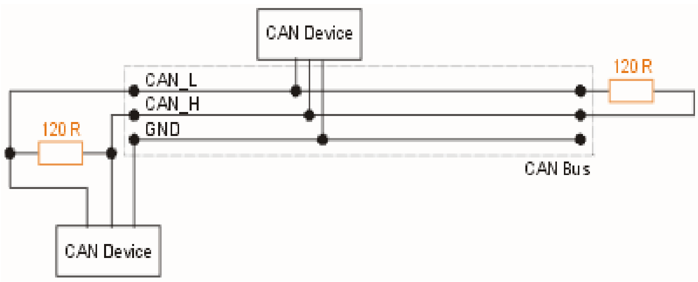
Nuts and Bolts

From the systems and design viewpoint the detailed management of sending and receiving CAN messages will normally be done by dedicated hardware, on or off chip, (e.g. SJA1000) but an overview of these functions will be useful in order to design, setup and control a CAN system.

Signal Characteristics

CAN may be implemented over a number of physical media so long as the drivers are open-collector and each node can hear itself and others while transmitting (this is necessary for its message priority and error handling mechanisms). The most common media is a twisted pair 5v differential signal which will allow operations in high noise environments and with the right drivers will work even if one of the wires is open circuit. A number of transceiver chips are available the most popular probably being the Philips 82C251 as well as the TJA1040.

When running Full CAN (ISO 11898-2) at its higher speeds it is necessary to terminate the bus at both ends with 120 Ohms. The resistors are not only there to prevent reflections but also to unload the open collector transceiver drivers.



Message Formats

The CAN protocol uses a modified version of the Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) technique used on Ethernet. Should two messages determine that they are both trying to send at the same time then instead of both backing off and re-trying later as is done with Ethernet, in the CAN scheme, the transmitters detect which message has the highest priority and only the lower priority message gets delayed.

This means that a high priority message is sure of getting through.

Message Frames

These are the normal frames used to carry data. They contain the following fields -- this is a simplified description as the controller takes care of the detail which is only of interest to those designing controllers (who should consult the spec)

Start of frame (SOF)

Message Identifier (MID) either 11 or 29 bits long depending on the chosen mode

Remote Transmission Request (RTR) = 0 "Remote Frames" para below for non-zero value

Control field (CONTROL) this specifies the number of bytes of data to follow (0-8)

Data Field (DATA)

CRC field containing a fifteen bit cyclic redundancy check code

Acknowledge field (ACK) an empty slot which will be filled by the receiving node on successful reception.

End of Frame (EOF)

The way in which message collision is avoided is that each node as it transmits its MID looks on the bus to see what everyone else is seeing. If it is in conflict with a higher priority message identifier (one with a lower number) then the higher priority messages bit will hold the signal down (a zero bit is said to be dominant) and the lower priority node will stop transmitting.

Remote Frames

These are frames that are used to request that a particular message be put on the network - of course a node somewhere on the network has to be set up to recognize the request, get the data and put out a Message frame. This mechanism is used in polled networks. The fields are....

Start of Frame (SOF)

Message Identifier (MID) either 11 or 29 bits long depending on the chosen mode.

Remote Transmission Request (RTR) = 1

Control field (CTRL) this specifies the number of bytes of data expected to be returned (0-8).

CRC field containing a fifteen bit cyclic redundancy check code.

Acknowledge field (ACK) an empty slot which will be filled by the receiving node.

End of Frame (EOF)

Error Checking

CAN is a very reliable system with multiple error checks

Stuffing error - a transmitting node inserts a high after five consecutive low bits (and a low after five consecutive high). A receiving node that detects violation will flag a bit stuffing error.

Bit error - A transmitting node always reads back the message as it is sending. If it detects a different bit value on the bus than the one it sent, and the bit is not part of the arbitration field or in the acknowledgment field, an error is detected.

Checksum error - each receiving node checks CAN messages for checksum errors.

Frame error - There are certain predefined bit values that must be transmitted at certain points within any CAN Message Frame. If a receiver detects an invalid bit in one of these positions a Form Error (sometimes also known as a Format Error) will be flagged.

Acknowledgment Error - If a transmitter determines that a message has not been acknowledged then an ACK Error is flagged.

APPLICATIONS

By defining only the physical and data link levels of the OSI communications model the CAN specification has become the basis for a wide number of industry and manufacture specific variants (and the source of much confusion as all the users may say they are using CAN). If you are trying to clarify a CAN systems status the first thing to find out is the transceivers in use - the most common "normal 5v" CAN uses the Philips 82C251 or the TJA1040.

TJA 1054 is a low power, low speed physical layer that is mostly used in automotive applications. It employs the PCA82C252, TJA1053 or TJA1054 transceivers.

AU5790 also known as "Single Wire CAN" is a low power, low speed physical layer that is mostly used in automotive applications. It employs the AU5790 transceiver.

DeviceNet - Developed for use in industrial process control it is based on the standard Full CAN - ISO 11898-2 5v bus. However DeviceNet rigorously defines the physical interconnect, has a more restrictive transceiver specification, 11 bit identifiers only, allows 125, 250 and 500KBaud operation only and regulates the message content allowing interoperability of different manufacturers units.

CANopen - Also designed with control applications in mind, it is a software standard based on the standard Full CAN - ISO 11898-2 5v bus. It limits the number of nodes to 127 and allocates them IDs. Profiles are specified for each type of device by CiA to simplify using systems from multiple manufacturers. Some standard network commands are defined that allow modules to be automatically identified and allocated a node ID. The spec also defines a way to handle synchronised data reads and writes as well as providing a standard way in which large blocks of data can be read and written. We can supply CANopen **diagnostic and network management software.**

TTCAN - Time Triggered CAN - The Time-Triggered Protocol has nodes reporting in predefined time windows that have to be planned and synchronised but which then ensure that an overload on the bus is not possible even in a worst case situation.

J1939 - A whole family of industry specific standards (agriculture, marine, truck & bus etc) are built on the basic communication services of the J1939 specifications (itself based on Full CAN - ISO 11898-2) with industry-specific documents defining the particular combination of layers for that industry.

B10011S is the Truck-Trailer CAN bus (ISO 11992-1) Specification (known as FMS or Bus-FMS), it is a subset of J1939. For a software packages that knows the meaning of all the FMS messages and can display them in a meaningful way see our **FMS Toolkit**.

Standard	Common Name	Baud Rate	Max nodes	Max Length	Adapter for PCAN interface
ISO 11783	ISOBUS	250 KBit/s	30	40m	None
ISO 11898-2	High speed-CAN	max. 1 MBit/s	110	6500 m	None
ISO 11898-3	Fault Tolerant CAN	max. 125 KBit/s	32	500 m	PCAN TJA1054
ISO 11992	FMS or Truck/Trailer CAN	max. 125 KBit/s	2 (Point to Point)	40 m	PCAN-BD10011S
ISO 15765	Diagnostics On CAN	max 1 MBit/s	110		
SAE J1939		250 KBit/s	30	40m	
SAE J2284		max. 1 MBit/s	110		
SAE J2411	Single Wire CAN	33,3 KBit/s 83,3KBit/s in HSMode	32		PCAN-AU579

MilCAN - is defined for use in military land vehicles where a deterministic protocol is require. It sets up some rules for use and a software layer on top of a conventional CAN network. A Pseudo Hardware Sync is created by one node "the SyncMaster" that sends Sync CAN Frames with a "sync slot number". MilCAN A uses 29 bit Identifiers. It allows both periodic and event driven data to be transmitted via the bus.

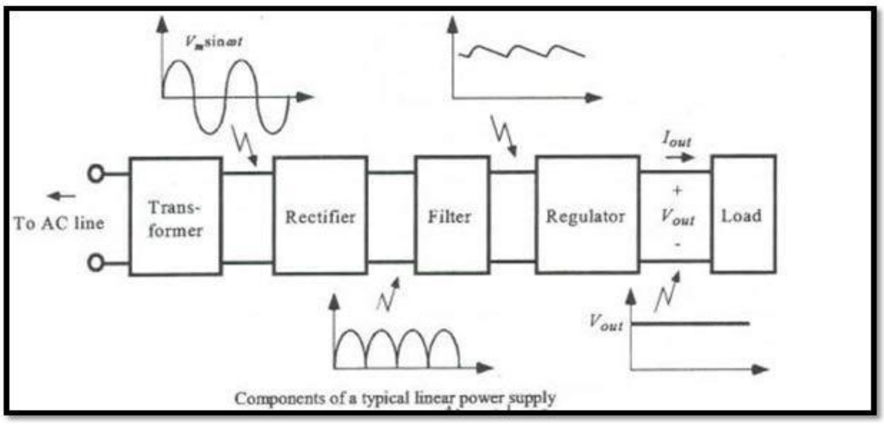
MilCAN B uses 11 bit identifiers. It allows only periodic data to be transmitted via the bus Now let us start with the hardware requirement of LPC2148.

LPC2148 need minimum below listed hardware to work properly.

1. Power Supply
2. Crystal Oscillator
3. Reset Circuit
4. RTC crystal oscillator (This is not necessary if you are not using RTC. However this is considered as necessary requirement)
5. UART

Power Supply

LPC2148 works on 3.3 V power supply. LM 117 can be used for generating 3.3 V supply. However, basic peripherals like LCD, ULN 2003 (Motor Driver IC) etc. works on 5V. So AC mains supply is converted into 5V using below mentioned circuit and after that LM 117 is used to convert 5V into 3.3V.



Components of a typical linear power supply

Block diagram for power supply is given below.

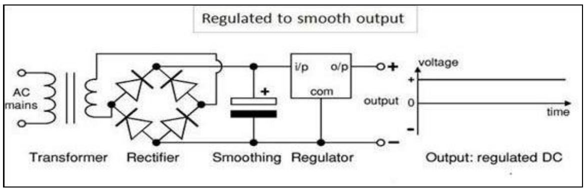
Transformer: It is used to step down 230V AC to 9V AC supply and provides isolation between power grids and circuit.

Rectifier: It is used to convert AC supply into DC.

Filter: It is used to reduce ripple factor of DC output available from rectifier end.

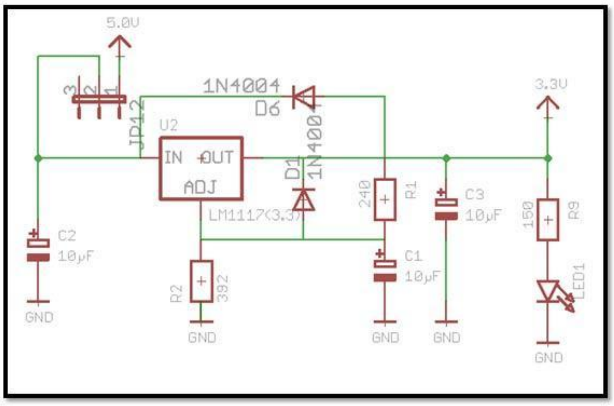
Regulator: It is used to regulate DC supply output.

Circuit for this is as shown below.



Here, Regulator IC 7805 is used to provide fix 5V dc supply.

Now we can use LM 117 for generating 3.3V supply from 5V using below circuit.



Calculations

$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right) + I_{ADJ} * R1$$

From the datasheet of **LM117: -**

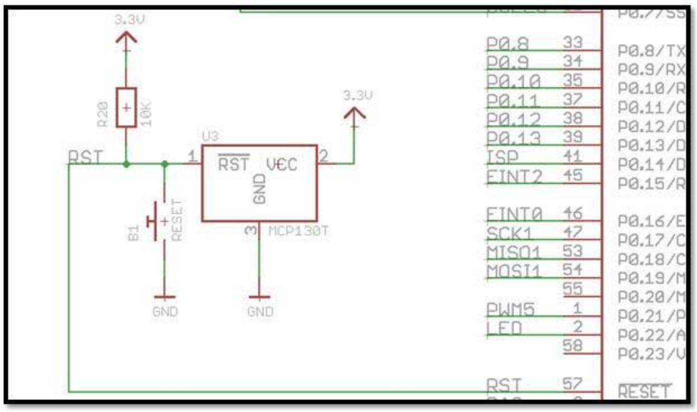
$I_{ADJ} = 100uA$ $V_{REF} = 1.25V$

Taking **R2 = 240Ω**, we get **R1 = 392 Ω**

Reset Circuit

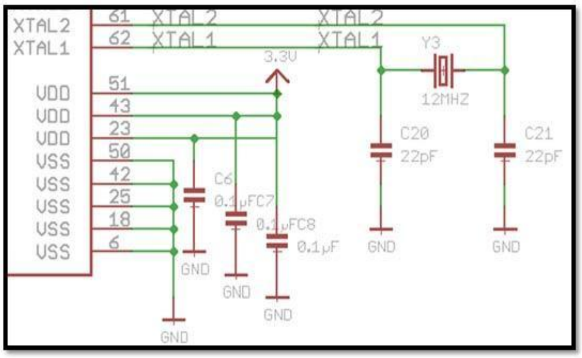
Reset button is essential in a system to avoid programming pitfalls and sometimes to manually bring back the system to the initialization mode. Circuit diagram for reset is as shown below.

MCP 130T is a special IC used for providing stable RESET signal to LPC 2148.

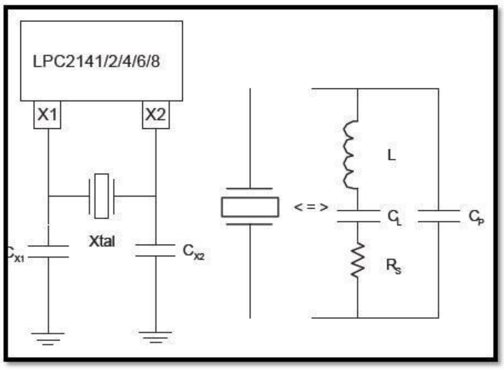


Oscillator Circuit

Oscillations, the heartbeat, are provided using a crystal and are necessary for the system to work.



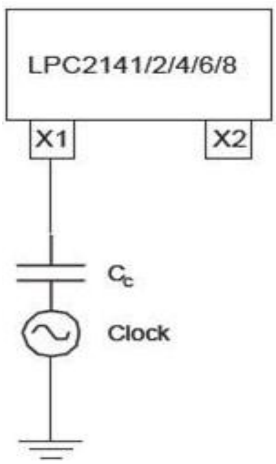
The value of capacitors C20 & C21 depends upon the frequency of crystal Y3. General circuit and its equivalent circuit is as shown below.



Recommended values are as shown in table.

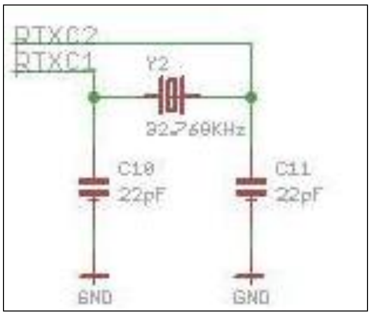
Fundamental oscillation frequency F_{OSC}	Crystal load capacitance C_L	Maximum crystal series resistance R_S	External load capacitors C_{X1}, C_{X2}
1 MHz - 5 MHz	10 pF	NA	NA
	20 pF	NA	NA
	30 pF	< 300 Ω	58 pF, 58 pF
5 MHz - 10 MHz	10 pF	< 300 Ω	18 pF, 18 pF
	20 pF	< 300 Ω	38 pF, 38 pF
	30 pF	< 300 Ω	58 pF, 58 pF
10 MHz - 15 MHz	10 pF	< 300 Ω	18 pF, 18 pF
	20 pF	< 220 Ω	38 pF, 38 pF
	30 pF	< 140 Ω	58 pF, 58 pF
15 MHz - 20 MHz	10 pF	< 220 Ω	18 pF, 18 pF
	20 pF	< 140 Ω	38 pF, 38 pF
	30 pF	< 80 Ω	58 pF, 58 pF
20 MHz - 25 MHz	10 pF	< 160 Ω	18 pF, 18 pF
	20 pF	< 90 Ω	38 pF, 38 pF
	30 pF	< 50 Ω	58 pF, 58 pF
25 MHz - 30 MHz	10 pF	< 130 Ω	18 pF, 18 pF
	20 pF	< 50 Ω	38 pF, 38 pF
	30 pF	NA	NA

We can also use external oscillator for providing system clock. Circuit for this application is as given below.



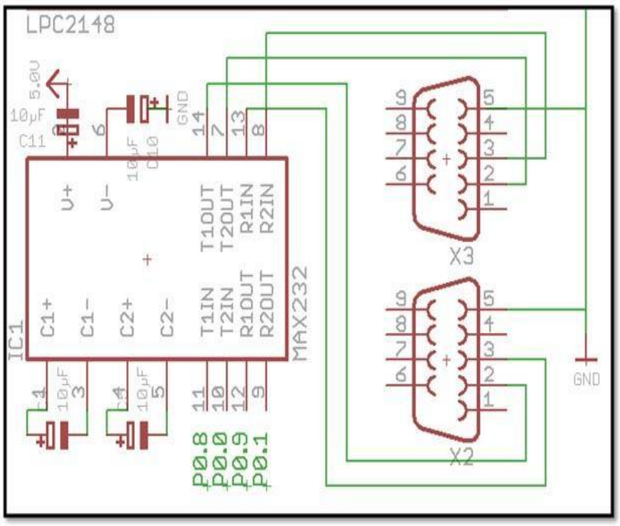
RTC Oscillator Circuit

It provides clock for RTC operation.



UART

LPC 2148 has inbuilt ISP which means we can program it within the system using serial communication on COM0. It has also COM1 for serial communication. MAX 232/233 IC must be used for voltage logic conversion. Related connections are as given below.



Universal Asynchronous Receiver Transmitter (UART)

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission is commonly used with modems and for non-networked communication between computers, terminals and other devices. There are two primary forms of serial transmission: Synchronous and Asynchronous. Depending on the modes that are supported by the hardware, the name of the communication sub-system will usually include a A if it supports Asynchronous communications, and a S if it supports Synchronous communications. Both forms are described below.

Some common acronyms are:

UART Universal Asynchronous Receiver/Transmitter

USART Universal Synchronous-Asynchronous Receiver/Transmitter

Synchronous Serial Transmission

Synchronous serial transmission requires that the sender and receiver share a clock with one another, or that the sender provide a strobe or other timing signal so that the receiver knows when to "read" the next bit of the data. In most forms of serial Synchronous communication, if there is no data available at a given instant to transmit, a fill character must be sent instead so that data is always being transmitted. Synchronous communication is usually more efficient because only data bits are transmitted between sender and receiver, and synchronous communication can be more costly if extra wiring and circuits are required to share a clock signal between the sender and receiver. A form of Synchronous transmission is used with printers and fixed disk devices in that the data is sent on one set of wires while a clock or strobe is sent on a different wire. Printers and fixed disk devices are not normally serial devices because most fixed disk interface standards send an entire word of data for each clock or strobe signal by using a separate wire for each bit of the word. In the PC industry, these are known as Parallel devices. The standard serial communications hardware in the PC does not support Synchronous operations. This mode is described here for comparison purposes only.

Asynchronous Serial Transmission

Asynchronous transmission allows data to be transmitted without the sender having to send a clock signal to the receiver. Instead, the sender and receiver must agree on timing parameters in advance and special bits are added to each word which are used to synchronize the sending and receiving units. When a word is given to the UART for Asynchronous transmissions, a bit called the "Start Bit" is added to the beginning of each word that is to be transmitted. The Start Bit is used to alert the receiver that a word of data is about to be sent, and to force the clock in the receiver into synchronization with the clock in the transmitter. These two clocks must be accurate enough to not have the frequency drift by more than 10% during the transmission of the remaining bits in the word. (This requirement was set in the days of mechanical teleprinters and is easily met by modern electronic equipment.)

After the Start Bit, the individual bits of the word of data are sent, with the Least Significant Bit (LSB) being sent first. Each bit in the transmission is transmitted for exactly the same amount of time as all of the other bits, and the receiver “looks” at the wire at approximately halfway through the period assigned to each bit to determine if the bit is a 1 or a 0. For example, if it takes two seconds to send each bit, the receiver will examine the signal to determine if it is a 1 or a 0 after one second has passed, then it will wait two seconds and then examine the value of the next bit, and so on.

The sender does not know when the receiver has “looked” at the value of the bit. The sender only knows when the clock says to begin transmitting the next bit of the word. When the entire data word has been sent, the transmitter may add a Parity Bit that the transmitter generates. The Parity Bit may be used by the receiver to perform simple error checking. Then at least one Stop Bit is sent by the transmitter.

When the receiver has received all of the bits in the data word, it may check for the Parity Bits (both sender and receiver must agree on whether a Parity Bit is to be used), and then the receiver looks for a Stop Bit. If the Stop Bit does not appear when it is supposed to, the UART considers the entire word to be garbled and will report a Framing Error to the host processor when the data word is read. The usual cause of a Framing Error is that the sender and receiver clocks were not running at the same speed, or that the signal was interrupted. Regardless of whether the data was received correctly or not, the UART automatically discards the Start, Parity and Stop bits. If the sender and receiver are configured identically, these bits are not passed to the host. If another word is ready for transmission, the Start Bit for the new word can be sent as soon as the Stop Bit for the previous word has been sent. Because asynchronous data is “self-synchronizing”, if there is no data to transmit, the transmission line can be idle.

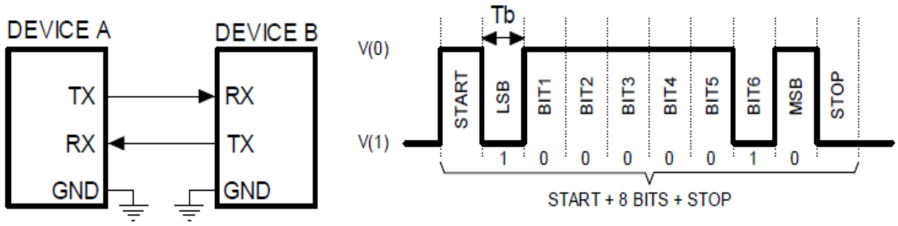
Other UART Functions

In addition to the basic job of converting data from parallel to serial for transmission and from serial to parallel on reception, a UART will usually provide additional circuits for signals that can be used to indicate the state of the transmission media, and to regulate the flow of data in the event that the remote device is not prepared to accept more data.

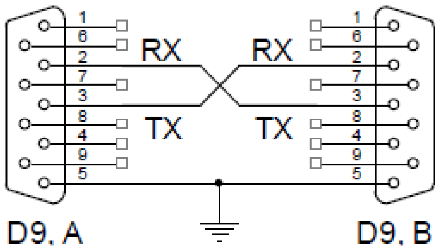
For example, when the device connected to the UART is a modem, the modem may report the presence of a carrier on the phone line while the computer may be able to instruct the modem to reset itself or to not take calls by raising or lowering one more of these extra signals. The function of each of these additional signals is defined in the EIA RS232-C standard.

Serial communication – RS232

A popular way to transfer commands and data between a personal computer and a microcontroller is the use of standard interface, like the one described by protocols RS232 (older) or USB (newer). This chapter is devoted to communication conforming to RS232 protocol, the hardware for such interface is provided on board. An example will be presented showing the processing of commands received through RS232 interface, and sending of a string of numbers using the same interface. The protocol RS232 defines the signals used in communication, and the hardware to transfer signals between devices. The time diagram of the typical signal used to transfer character ‘A’ (ASCII: 6510 or 0x41) from device A to device B is given below and would appear on the upper line TX -> RX between devices.



The standard defines voltage levels V(0) to be at least +5V at the transmitting end of the line TX, and can be degraded along the line to become at least +3V at the receiving and of the line. Similarly voltage level V(1) must be at least -5V at TX, and at least -3V at RX. The standard also defined the upper limit for these voltages to be up to ±15V. Logic high is transferred as V(0). The microcontroller cannot handle such voltage levels, so typically a voltage level translator is inserted between the microcontroller and the connector where the RS232 signals are available. The connectors are typically so called D9 connectors, and the electric wiring in between two connectors at devices A and B is shown below, for two female type connectors at both devices.



WIRING FOR RS232 CONNECTIONS

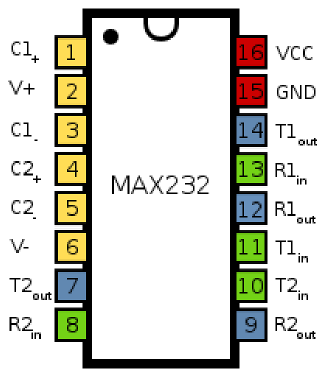
MAX232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R1 & R2) can accept ±30V inputs. The drivers (T1 & T2), also called transmitters, convert the TTL/CMOS input level into RS232 level.

Microcontroller	MAX232		RS232
Tx	$T_{1/2}$ In	$T_{1/2}$ Out	Rx
Rx	$R_{1/2}$ Out	$R_{1/2}$ In	Tx

The transmitters take input from controller's serial transmission pin and send the output to RS232's receiver. The receivers, on the other hand, take input from transmission pin of RS232 serial port and give serial output to microcontroller's receiver pin. MAX232 needs four external capacitors whose value ranges from 1μF to 22μF.

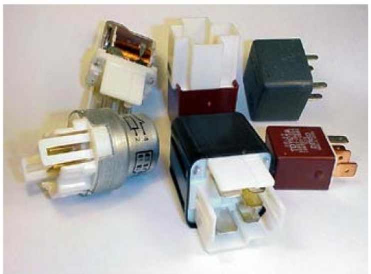
Pin Description



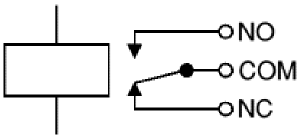
Relay

A **relay** is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several trolled by one signal.

RELAYS
Relays are used throughout the automobile. Relays which come in assorted sizes, ratings, and applications, are used as remote control switches. A typical vehicle can have 20 relays or more.



Working



Circuit symbol for a relay

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw** (**changeover**) switch contacts as shown in the diagram.

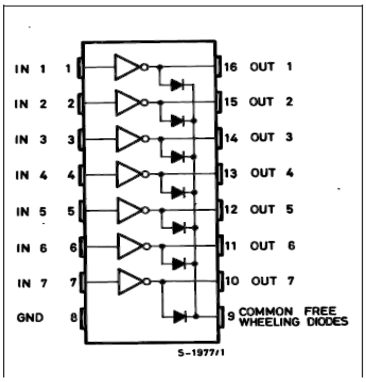
Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. For further information about switch contacts and the terms used to describe them please see the page on switches. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The supplier's catalogue should show you the relay's connections. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

ULN2003

PIN CONNECTION



DESCRIPTION

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN darling ton pairs that features high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single darling ton pair is 500mA.

The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each darling ton pair for operation directly with TTL or 5V CMOS devices.

FEATURES

- 500mA rated collector current (Single * output)
- High-voltage outputs: 50V
- Inputs compatible with various types of logic.
- Relay driver application

Relay Application Considerations

A large relay with two coils and many sets of contacts, used in an old telephone switching system.

Several 30-contact relays in "Connector" circuits in mid-20th century 1XB switch and 5XB switch telephone exchanges; cover removed on one

Selection of an appropriate relay for a particular application requires evaluation of many different factors:

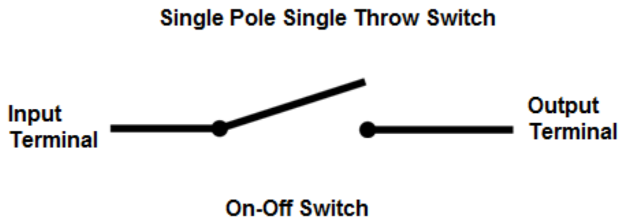
- Number and type of contacts – normally open, normally closed, (double-throw)
- Contact sequence – "Make before Break" or "Break before Make". For example, the old style telephone exchanges required Make-before-break so that the connection didn't get dropped while dialing the number.
- Rating of contacts – small relays switch a few amperes, large contactors are rated for up to 3000 amperes, alternating or direct current
- Voltage rating of contacts – typical control relays rated 300 VAC or 600 VAC, automotive types to 50 VDC, special high-voltage relays to about 15 000 V
- Coil voltage – machine-tool relays usually 24 VAC, 120 or 250 VAC, relays for switchgear may have 125 V or 250 VDC coils, "sensitive" relays operate on a few mill amperes
- Coil current
- Package/enclosure – open, touch-safe, double-voltage for isolation between circuits, explosion proof, outdoor, oil and splash resistant, washable for printed circuit board assembly
- Assembly – Some relays feature a sticker that keeps the enclosure sealed to allow PCB post soldering cleaning, which is removed once assembly is complete.
- Mounting – sockets, plug board, rail mount, panel mount, through-panel mount, enclosure for mounting on walls or equipment
- Switching time – where high speed is required
- "Dry" contacts – when switching very low level signals, special contact materials may be needed such as gold-plated contacts
- Contact protection – suppress arcing in very inductive circuits
- Coil protection – suppress the surge voltage produced when switching the coil current
- Isolation between coil circuit and contacts

- Aerospace or radiation-resistant testing, special quality assurance
- Expected mechanical loads due to acceleration – some relays used in aerospace applications are designed to function in shock loads of 50 *g* or more
- Accessories such as timers, auxiliary contacts, pilot lamps, test buttons
- Regulatory approvals
- Stray magnetic linkage between coils of adjacent relays on a printed circuit board.

SWITCH

Single Pole Single Throw (SPST) Switch

Single Pole Single Throw (SPST) switch is a switch that only has a single input and can connect only to one output. This means it only has one input terminal and only one output terminal.

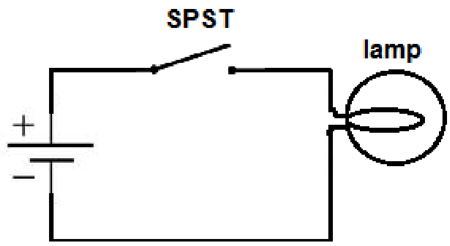


A Single Pole Single Throw switch serves in circuits as on-off switches. When the switch is closed, the circuit is on. When the switch is open, the circuit is off.

SPST switches are, thus, very simple in nature.

Single Pole Single Throw (SPST) Switch Circuit

Below is an example of a circuit which utilizes a single pole single throw switch.



When the SPST is closed, the circuit is open and light from the lamp switches on. When the SPST is then opened, the light from the lamp goes out and the circuit is off.

This shows the basic nature and function of a SPST.

SWITCH DESCRIPTION

In electrical engineering, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another.[1][2] The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow.

A relay is a switch that is operated by electricity. Switches are made to handle a wide range of voltages and currents; very large switches may be used to isolate high-voltage circuits in electrical substations.

The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits. Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open", meaning the contacts are separated and the switch is non conducting. The mechanism actuating the transition between these two states (open or closed) can be either a "*toggle*" (flip switch for continuous "on" or "off") or "*momentary*" (push-for "on" or push-for "off") type.

A switch may be directly manipulated by a human as a control signal to a system, such as a computer keyboard button, or to control power flow in a circuit, such as a light switch. Automatically operated switches can be used to control the motions of machines, for example, to indicate that a garage door has reached its full open position or that a machine tool is in a position to accept another work piece.

Switches may be operated by process variables such as pressure, temperature, flow, current, voltage, and force, acting as sensors in a process and used to automatically control a system.

For example, a thermostat is a temperature-operated switch used to control a heating process. A switch that is operated by another electrical circuit is called a relay. Large switches may be remotely operated by a motor drive mechanism. Some switches are used to isolate electric power from a system, providing a visible point of isolation that can be padlocked if necessary to prevent accidental operation of a machine during maintenance, or to prevent electric shock.

An ideal switch would have no voltage drop when closed, and would have no limits on voltage or current rating. It would have zero rise time and fall time during state changes, and would change state without "bouncing" between on and off positions.

Practical switches fall short of this ideal; they have resistance, limits on the current and voltage they can handle, finite switching time, etc. The ideal switch is often used in circuit analysis as it greatly simplifies the system of equations to be solved, but this can lead to a less accurate solution. Theoretical treatment of the effects of non-ideal properties is required in the design of large networks of switches, as for example used in telephone.

CONCLUSION

In this paper we describes about an one touch alarm system for women's safety using IBEACON. In the light of recent outrage in Delhi which shook the nation and woke us to the safety issues for women, people are finding up in different ways to defend. Here we introduce a device which ensures the protection of women. This helps to identify protect and call on resources to help the one out of dangerous situations. Anytime you sense danger, all you had to do, is hold on the panic switch. The system resembles a normal wearable device which when activated, tracks the place of the women using bluetooth low energy and sends emergency messages using GSM (Global System for Mobile communication), to sos contacts and the police control room. The proposed work shows a flexible and interoperable combination of a device and application that will accessorize and empower the citizens and serve as a multifunctional device.

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