. BPSK GENERATION AND DETECTION

AIM :- To design and set up a Binary Phase Shift Keying (BPSK) generator.

COMPONENTS AND EQUIPMENTS REQUIRED

Analog switch CD4016, IC 741, IC 7404, signal generator, resistor, power supply, breadboard, CRO etc.

THEORY

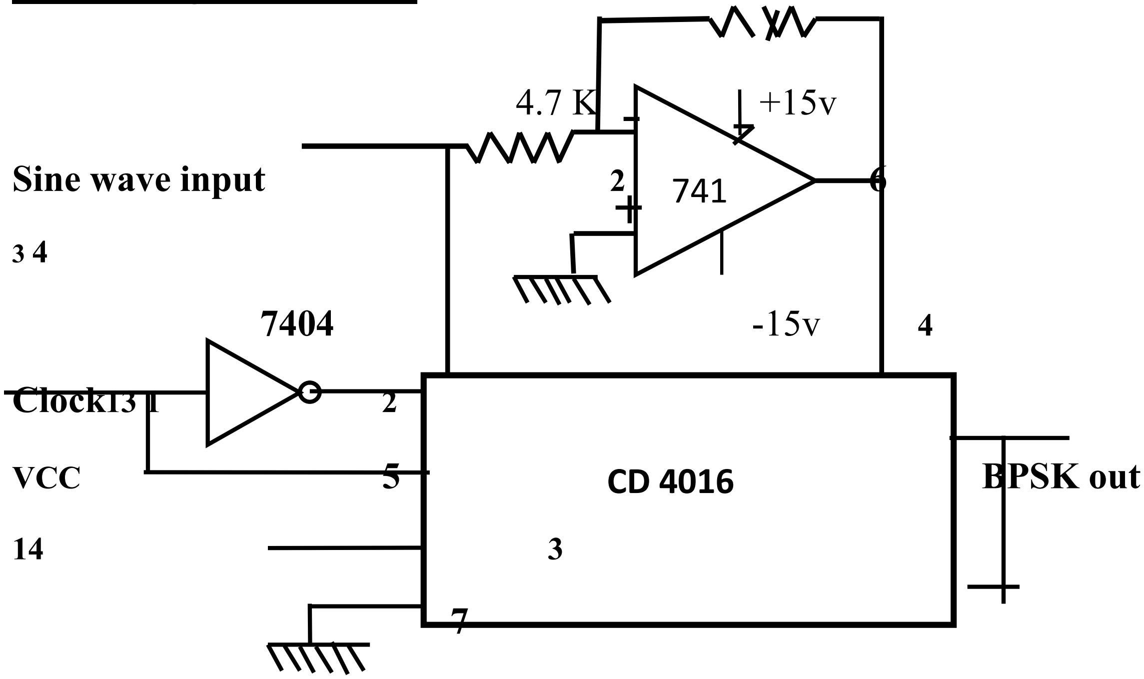
In the BPSK modulation system the phase of the carrier wave is inverted according to the logic level of the input data. When the data is at logic one level, the sinusoid has one fixed phase and when the data is at the other level, the phase of the sinusoid changes. BPSK and BFSK signals have a constant envelope and hence they are less susceptible to noise.

Two switches inside the quad analog switch CD4016 are used in the circuit. Op-amp is used to invert the phase of the input sine wave.

PROCEDURE

1. Set up the circuit on bread board and switch on power supply and signal generators.
2. Feed the sine wave and clock from the signal generator.
3. Keep the clock frequency lower than the sine wave frequency and observe the output.

Circuit diagram of BPSK

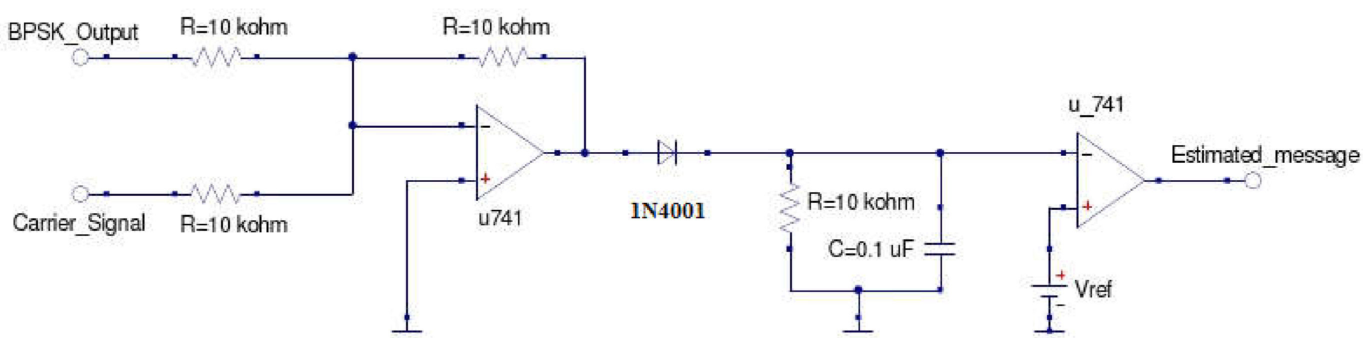


Design

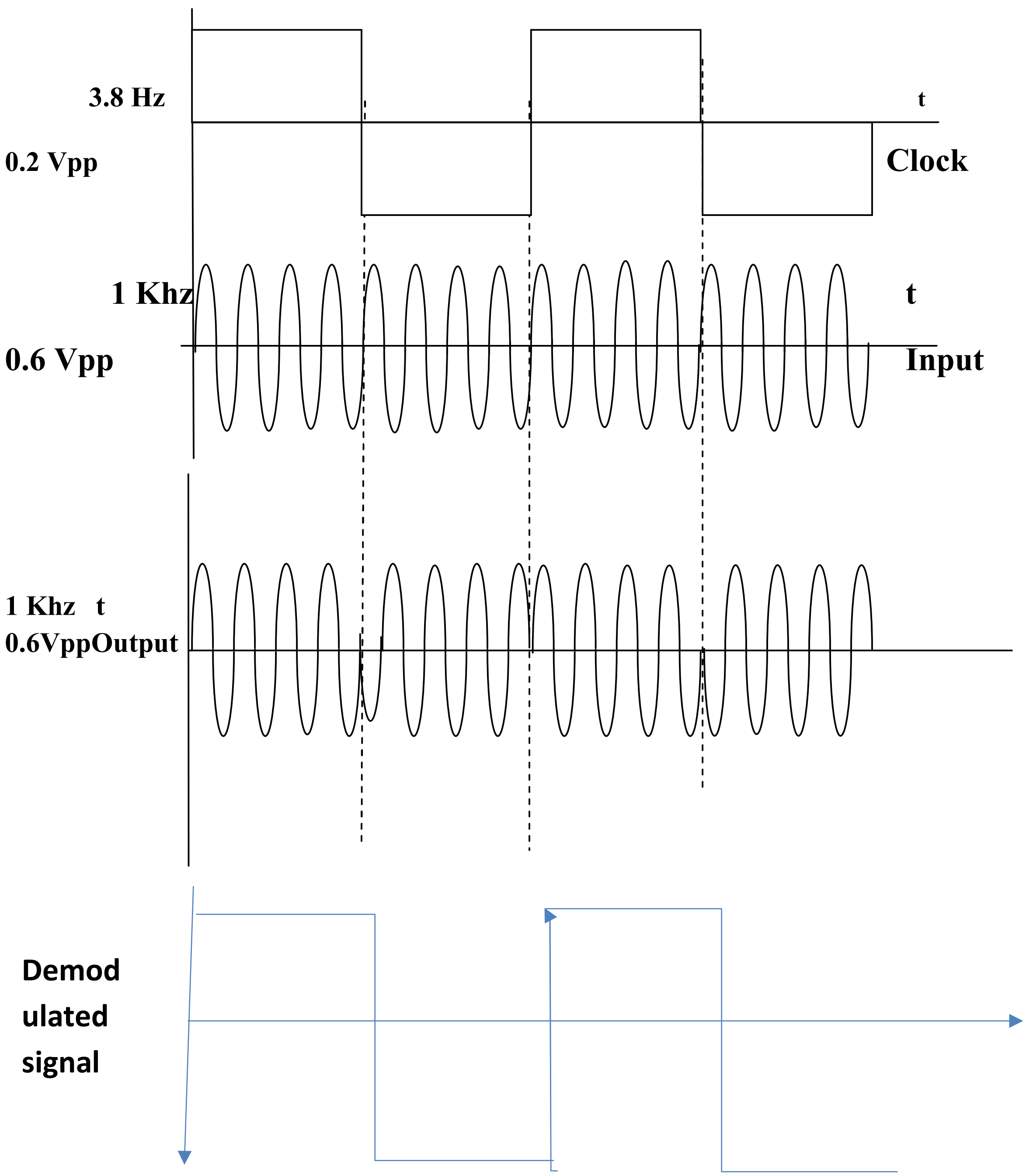
Gain of inverting amplifier,A=-Rf/R1

Let the gain be -1,so that the ratio Rf/R1=1.Take R1=Rf=4.7K

Demodulator Circuit



Waveforms of BPSK



Result:

BPSK modulator and detector were implemented.

FM Modulation and Detection using PLL

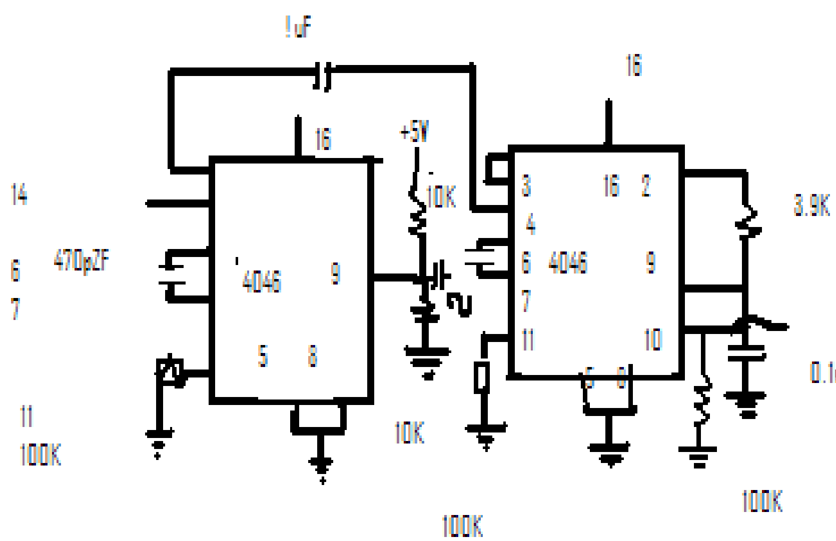
Aim:

To design and set up FM Modulation and Detection using PLL ICs.

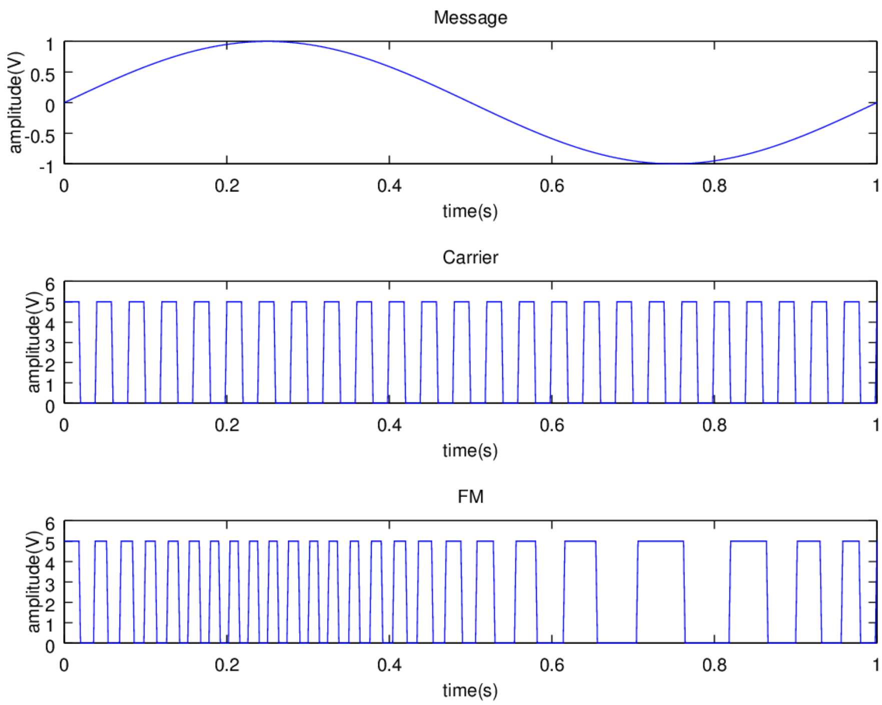
Components and Equipments Required:

PLL IC, Capacitors, Oscilloscope, Function Generator, resistors, Bread board, Connector wires

Circuit diagram



Waveforms



Pin details of IC 4046

(refer data sheet)

Specifications of IC4046

(refer data sheets)

Theory

A phase-locked loop or phase lock loop (PLL) is a control system that tries to generate an output signal whose phase is related to the phase of the input "reference" signal. It is an electronic circuit consisting of a variable frequency oscillator and a phase detector. This circuit compares the phase of the input signal with the phase of the signal derived from its output oscillator and adjusts the frequency of its oscillator to keep the phases matched. The signal from the phase detector is used to control the oscillator in a feedback loop. Frequency is the derivative of phase. Keeping the input and output phase in lock step implies keeping the input and output frequencies in lock step. Consequently, a phase-locked loop can track an input frequency, or it can generate a frequency that is a multiple of the input frequency. The former property is used for demodulation, and the latter property is used for indirect frequency synthesis. Phase-locked loops are widely used in radio, telecommunications, computers and other electronic applications. They may generate stable frequencies, recover a signal from a noisy communication channel, or distribute clock timing pulses in digital logic designs such as microprocessors. Since a single integrated circuit can provide a complete phase-locked-loop building block, the technique is widely used in modern electronic devices, with output frequencies from a fraction of a Hertz up to many Giga Hertz. When the input frequency is less than fL1, PLL is neither in lock nor in capture, and will be in free running state generating centre frequency fo. When input frequency reaches fC1, VCO frequency becomes equal to input frequency, or VCO captures input frequency. If the input frequency increases, VCO frequency follows the input frequency upto the limit of fL2. If input frequency further increases, VCO frequency becomes centre frequency f0. If the input frequency reduced, VCO frequency becomes equal to input frequency only at fC2. If input frequency further If input frequency further decreased, VCO frequency follows input frequency only up to fL1. If input frequency is further decreased, VCO frequency retains original centre frequency fo.

The frequency range fL2 – fL1 can be defined as the lock range, in which PLL keeps lock with input frequency. The frequency range fC2 – fC1 is called capture range, in which PLL able to capture the input frequency.

If a voice or music (ie, modulating signal) is applied to the VCO instead of digital data, the oscillator's frequency will move or modulate with the voice or music, this is frequency modulation "FM". It's simply moving the frequency in relation to some input voltage which it also represents a voltage to frequency conversion.

Demodulation

The VCO part of this IC is configured for the same free running frequency as that of the modulator IC. One of the phase detector input is fed with the modulated FM signal and the other input of the phase detector is fed with the VCO output after filtering out high frequency components. The phase variation between the two will be corresponding to the message which was used for modulation. The PD output is passed through an emitter follower internally to the demodulated output pin. The output from this pin may contain high frequency ripples which may be eliminated by proper filtering to obtain the actual message.

Procedure:

1. Find the lock& capture range of each IC and then do the connections.
2. Give the input modulating signal. Note it.
3. Plot the output waveforms of each ICs

Result:

An FM modulator & detector circuits are set up and the waveforms are plotted.