EXPERIMENT NO-6

PULSE AMPLITUDE MODULATION

AIM:-. To Study of Pulse Amplitude Modulation and Time Division Multiplexing

APPARATUS:-

1. Pulse amplitude modulation & demodulation Trainer Kit.
2. Dual trace CRO.
3. Patch chords.
4. PC with windows(95/98/XP/NT/2000)
5. MATLAB Software with communication toolbox

THEORY:-

Pulse modulation is used to transmit analog information. In this system continuous wave forms are sampled at regular intervals. Information regarding the signal is transmitted only at the sampling times together with syncing signals.

At the receiving end, the original waveforms may be reconstituted from the information regarding the samples.

The pulse amplitude modulation is the simplest form of the pulse modulation. PAM is a pulse modulation system is which the signal is sampled at regular intervals, and each sample is made proportional to the amplitude of the signal at the instant of sampling. The pulses are then sent by either wire or cables are used to modulated carrier.

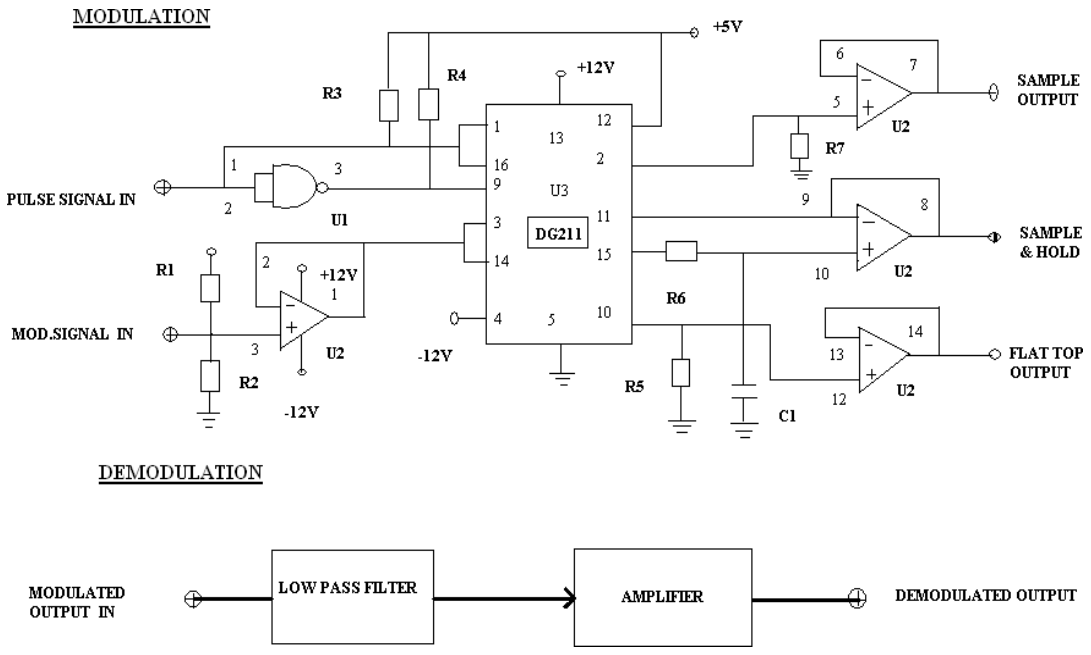
The two types of PAM are i) Double polarity PAM, and ii) the single polarity PAM, in which a fixed dc level is added to the signal to ensure that the pulses are always positive. Instantaneous PAM sampling occurs if the pulses used in the modulator are infinitely short.

Natural PAM sampling occurs when finite-width pulses are used in the modulator, but the tops of the pulses are forced to follow the modulating waveform.

Flat-topped sampling is a system quite often used because of the ease of generating the modulated wave.

PAM signals are very rarely used for transmission purposes directly. The reason for this lies in the fact that the modulating information is contained in the amplitude factor of the pulses, which can be easily distorted during transmission by noise, crosstalk, other forms of distortion. They are used frequently as an intermediate step in other pulse-modulating methods, especially where time-division multiplexing is used.

CIRCUIT DIAGRAM:



PROCEDURE:

Double Polarity:-

Modulation:-

1. Connect the circuit as shown in diagram 1.
    a. The output of the modulating signal generator is connected to the modulating signal input TP2 keeping the frequency switch in 1KHz position, and amplitude knob to max position
    b. 16KHz pulse output to pulse input TP1.(Keep the frequency in minimum position in pulse generator block).
2. Switch ON the power supply.
3. Monitor the outputs at TP5, TP6& TP7. And observe the outputs also by varying amplitude pot (Which is in modulation signal generator block).
4. Now vary the frequency selection which position in modulating signal generator block to 2 KHz, amplitude pot to max position.
5. Observe the output at TP5, TP6& TP7 and observe the outputs also by varying amplitude pot (Which is in modulation signal generator block).
6. Repeat all the above steps for the pulse frequency 32KHz (By varying the frequency pot in the pulse generator block).
7. Switch OFF the power supply.

Single Polarity PAM:-

8. Connect the circuit as shown in diagram 2.

a. The output of the modulating signal generator is connected to the modulating signal input TP2 keeping the frequency switch in 1KHz position, and amplitude knob to max position

b. 16KHz pulse output to pulse input TP1 .

9. Switch ON the power supply.

10. Repeat above step 3 to 6 and observe the outputs.

11. Vary DC output pot until you get single polarity PAM at TP5, TP6, TP7.

12. Switch OFF the power supply.

Demodulation:-

1. Connect the circuit as shown in diagram .

a. The output of the modulating signal generator is connected to the modulating signal input TP2 keeping the frequency switch in 1KHz position, and amplitude knob to max position

b. 16KHz pulse output to pulse input TP1.

c. Sample output, sample and hold output and flat top outputs Respectively to the input of low pass filter(TP9) and LPF output (TP10) to AC amplifier input(TP11).

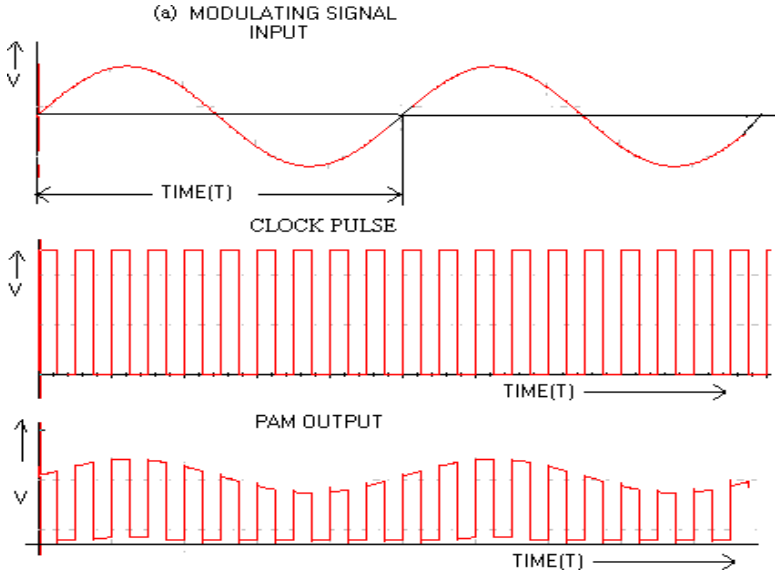
2. Observe the output of LPF and AC amplifier at TP10,TP12 respectively, corresponding to inputs from TP5,TP6 &TP7. The outputs will be the true replica of the input.

3. Now, set the switch position in modulating signal generator to 2KHz and observe the outputs at TP10&TP12 respectively, corresponding to inputs from TP5,TP6& TP7.

4. Vary the frequency of pulse to 32KHz (By varying the frequency pot(Put in max position) in pulse generator block) and repeat the above steps 2&3.

5. Switch OFF the power supply.

EXPECTED WAVEFORMS



RESULT:

QUESTIONS

1. TDM is possible for sampled signals. What kind of multiplexing can be used in continuous modulation systems?
2. What is the minimum rate at which a speech signal can be sampled for the purpose of PAM?
3. What is cross talk in the context of time division multiplexing?
4. Which is better, natural sampling or flat topped sampling and why?
5. Why a dc offset has been added to the modulating signal in this board? Was it essential for the working of the modulator? Explain?
6. If the emitter follower in the modulator section saturates for some level of input signal, then what effect it will have on the output?
7. Derive the mathematical expression for frequency spectrum of PAM signal.
8. Explain the modulation circuit operation?
9. Explain the demodulation circuit operation?
10. Is PAM & Demodulation is sensitive to Noise?