EXPERIMENT: 6.1
EXAMINATION OF ASK (AMPLITUDE SHIFT KEYING) MODULATION

PREPARATION INFORMATION

As we already know, analog signals are converted to digital signals by analog digital converters (ADC). The digital signal is formed as pulses always. A pulse has three changeable characteristics. These are; its amplitude, length and state. The pulses are the first code MORS CODING that is used mostly in communications. In Mors code, letters and punctuation signs are described by using dots, lines and gaps. Mors code is not suitable to use in digital computers. The reason for this is that symbol number and length of the characters that are to be sent are not the same. In modern telecommunication systems, the digital data is made of binary numbers (0 or 1) which have the same length. The communication systems where this method is used are called **PCM (Pulse Code Modulation)** systems generally.

There are three coding methods that are used mostly today. These are "BAUDUT" code where each letter or character is expressed with five bits, and ASCII American Standard Code for Data Interchange for the interchange of data which is expressed with eight bits of each letter or character, and EBDCDIC (Enhanced Binary-Coded Decimal Interchange Code) which is developed by IBM corporation and where widened and dual coded decimal interchange is made and each letter or character is expressed with eight bits.

The coded digital data sign is in the shape of rectangular pulses. The coded digital signal is called DATA.

In digital modulation, the change rate of data signal at the input of modulator is called "bit rate". Bit rate is bits/second. The change speed at the output of the modulator is called "Baud" or "Baud rate". In an ideal digital modulator, bit rate and baud rate are equal.

In Amplitude shift keying (ASK) modulation, the data signal is a square wave, and the carrier signal is sinusoidal. Its construction is not different that the methods that we know. The data signal (Fd) and carrier signal (Fc) are applied to the modulator and the signal that is obtained at the output is passed through the band pass filter and at the output of the filter ASK modulated sign is obtained. The process is shown in Figure 6.1.1 as a block.

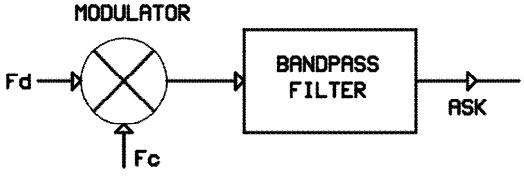


Figure 6.1.1

When ASK modulation is examined in oscilloscope, the carrier signal, data signal and ASK modulated signal are as shown in Figure 6.1.2 within the same time frame.

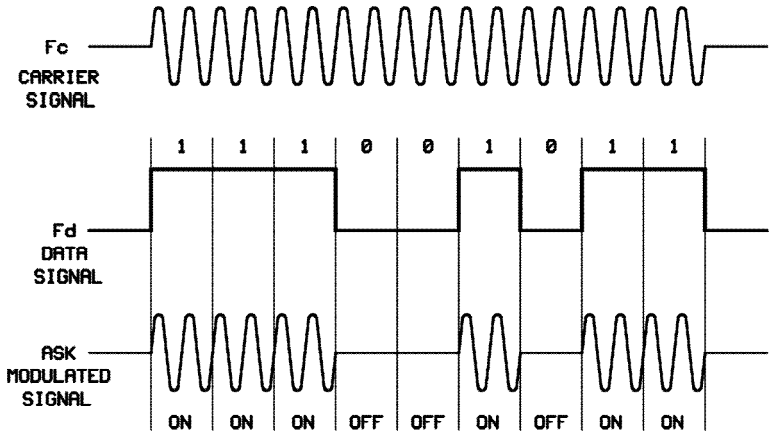


Figure 6.1.2

If the digital value of the data signal is "1", the signal is sent. If the digital value of the data signal is "0", no signal is sent. This process is called OOK (On-Off Keying). In ASK modulation, bit rate and baud rate is equal.

As we already know, MC 1496 integration is used as ASK modulator and demodulator. In Figure 6.1.3, ASK modulator is shown.

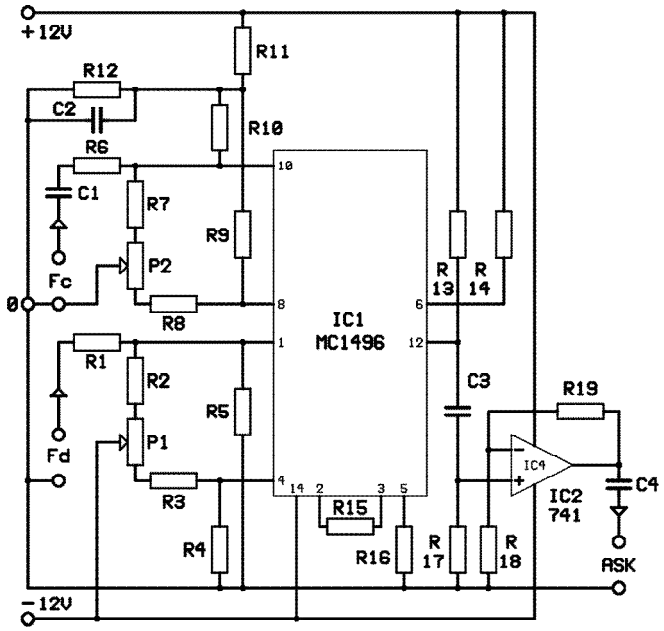


Figure 6.1.3

Data signal (**Fm**) is applied at pin no. 1 and 4, and carrier signal (Fc) is applied at pin no. 8 and 10. The gain of the modulator is controlled by R10 resistor between pin no. 2 and 3. R16 resistor connected to pin no. 5 determines the polarization current of the amplifier. P1 potentiometer adjusts the amplitude of the data signal. P2 potentiometer enables the modulated signal to be symmetrical. The modulated signal is taken from pin no. 12 and passed through the filter that presses high frequency components made of IC2, C3, R17, R18 and R19 and that passes bands, and ASK modulated signal is obtained.

EXPERIMENTAL PROCEDURE

Mount Y-0024/006 module to its place. Make the circuit connections as shown in Figure 6.1.4. Apply energy to the circuit.

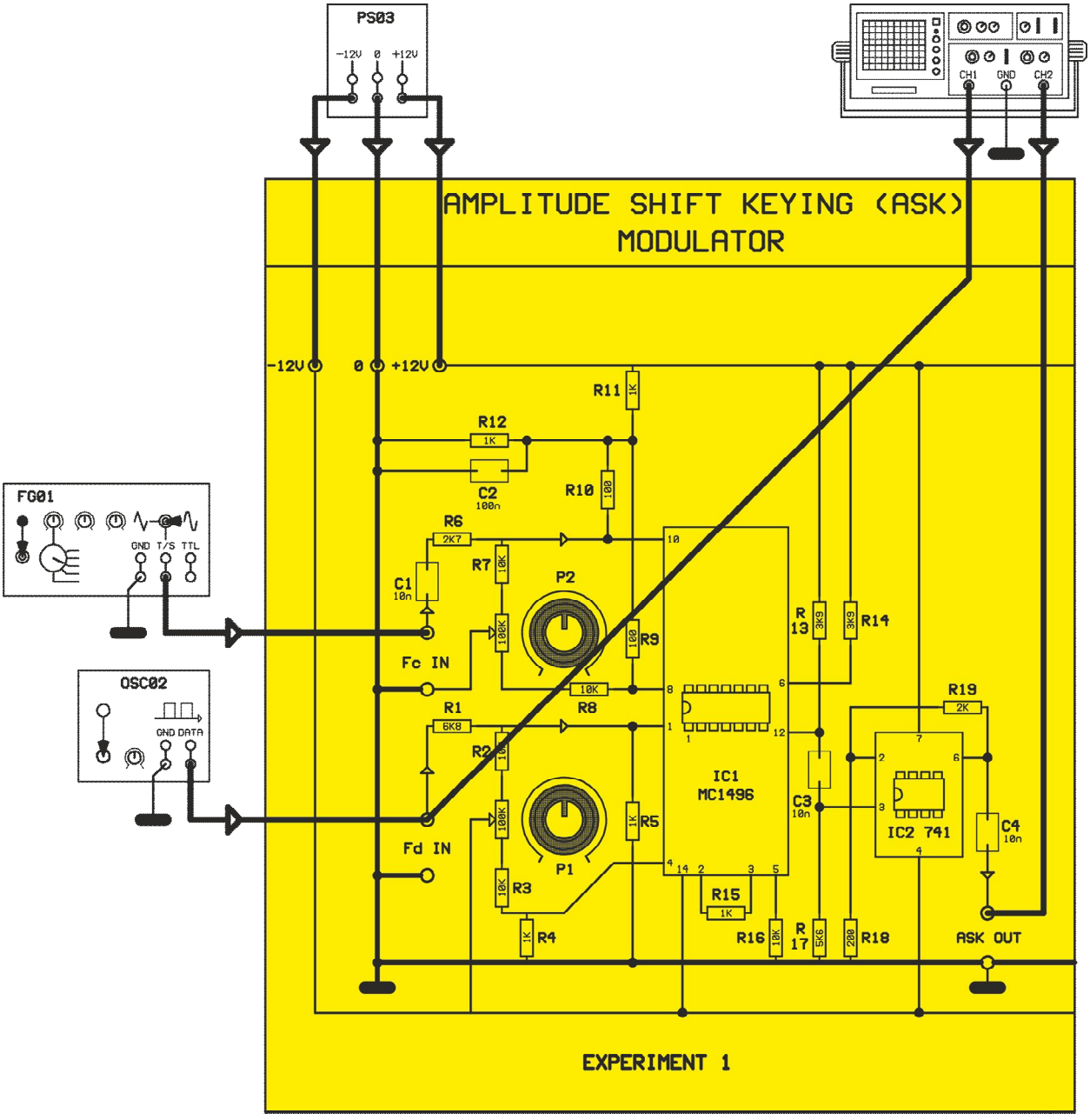
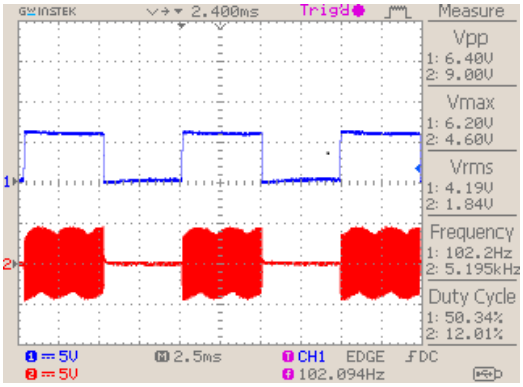


Figure 6.1.4

Apply to the modulator as a data signal (Fd) F=100Hz, Duty-Cycle = %50 F=1KHz square wave and as a carrier signal with VPP=1 Volt amplitude, frequency F=20KHz sinusoidal wave.

Adjust the oscilloscope to DC position in order to see the signs more clearly.

1- Adjust P1 and P2 potentiometers. See the input and output waveforms at the same time in oscilloscope and interpret it.



The output signal is ASK modulated. There is an output signal when the data signal is digital "1", and when the data signal is "0", there is no output signal.

2 –Write down what P1 and P2 does.

P1 potentiometer adjusts the data signal amplitude to be appropriate to the modulator, and P2 potentiometer adjusts ASK modulated signal to be symmetrical.

3- Why are IC2 741 integration and circuit components used?

IC2 741 integration and circuit components are used to eliminate high frequency noise that could be formed, band pass filter.

4- Repeat the experiment by setting the duty cycle of the data signal to 25% and 75%.

EXPERIMENT: 6.2
EXAMINATION OF ASK DEMODULATION

PREPARATION INFORMATION

Two methods are used for demodulation of modulated signs in digital telecommunication. These are asynchronous demodulation and synchronous demodulation. Amplitude demodulators are asynchronous demodulators. In such type of modulators, as the data signal is obtained again from within the modulated sign, the time duration between the input time to the modulator and modulator output time (delay time) and delay at each point is not stable. Nevertheless it is used widely because it is simple. Synchronous demodulators take one of the input signal variables as a reference and make the process in accord with the input signal always. Synchronous demodulators are also called "simultaneous" or "separation time" demodulators. Since the signs in digital communication have exact line time, it is easy to select a reference point. Therefore, synchronous demodulators are used in digital communication generally.

MC 1496, which could be used as ASK modulator can also be used as synchronous ASK demodulator.

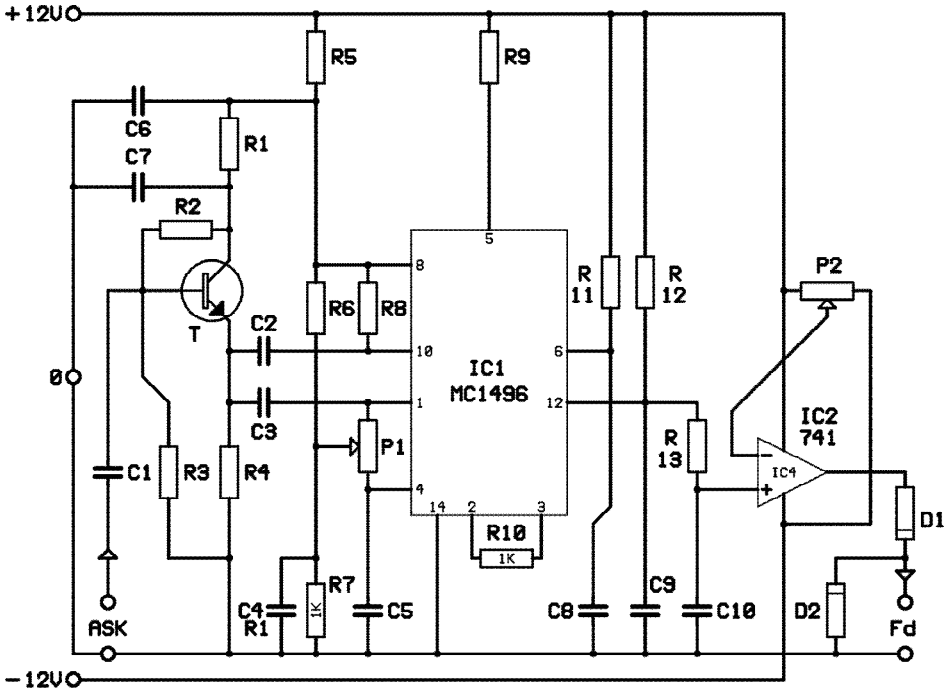


Figure 6.2.1

P1 potentiometer controls the input interval of ASK modulated signal. The filter made of C9, C10 capacitors and R13 resistor eliminates harmonics that could be formed in ASK modulated sign. IC2 integration can work as a comparator. P2 potentiometer adjusts the voltage of the operational amplifier. The comparator increases the amplitude of the output signal and enables it to change rapidly. D1 diode is used for the lack of any sign at the output at time "0".

D2 zener diode works as a voltage limiter and determines the maximum amplitude of the output signal.

When the signals at the input and exit of the modulator are examined, the signals shown in Figure 6.2.2 are observed.

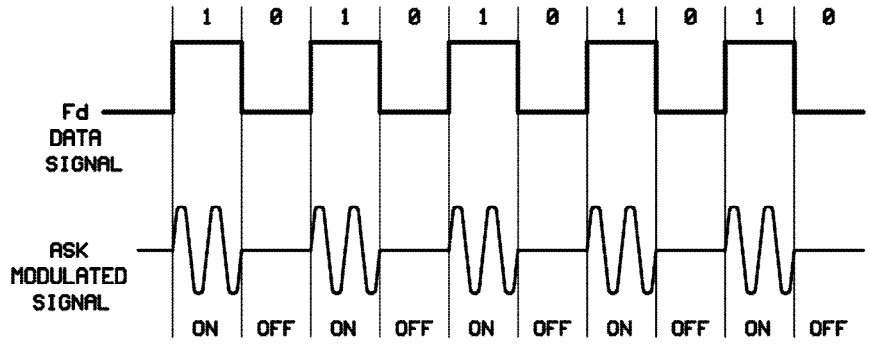


Figure 6.2.2

EXPERIMENTAL PROCEDURE

Mount Y-0024/006 module to its place. Make the circuit connections as shown in Figure 6.2.3'. Apply energy to the circuit.

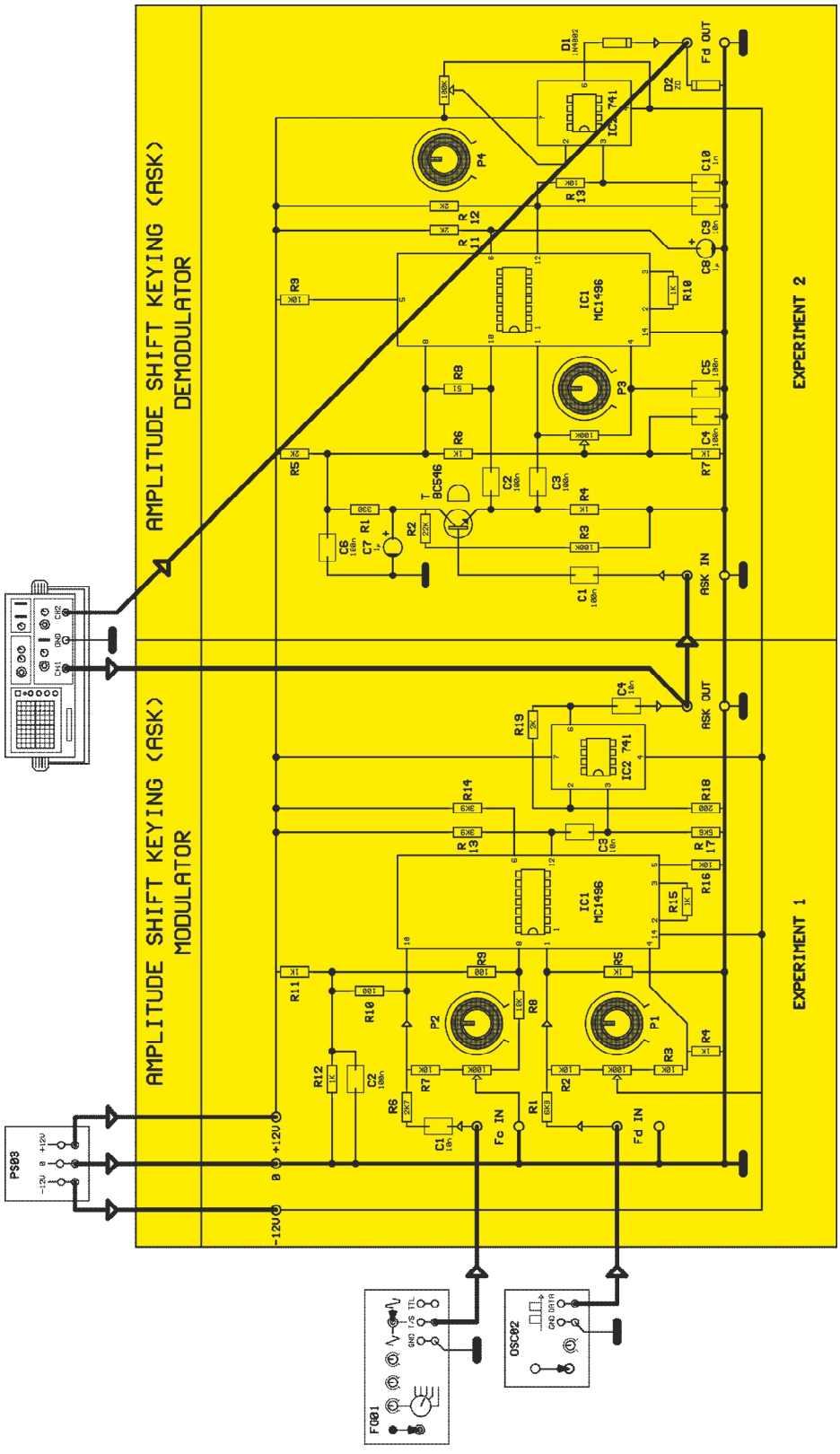
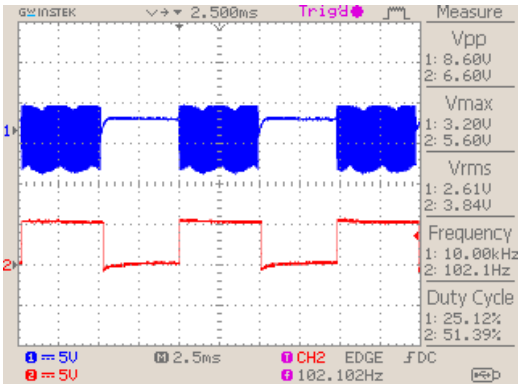


Figure 6.2.3

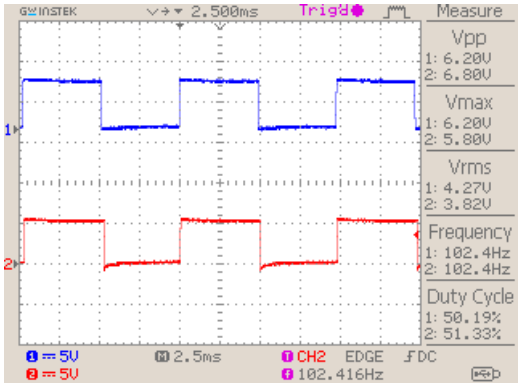
As shown in the Figure, the output signal of Experiment 6.1 will be used as ASK modulated signal.

Open up the connection between the exit of Experiment 1 and Experiment 2 for a moment, and adjust P1 and P2 potentiometers at Experiment 1 exit, and obtain an ASK modulated signal without distortion. Keep the oscilloscope in DC position to see the signals easily when doing the experiment. Make the connection between Experiment 1 output and Experiment 2 input.

1-Adjust P3 potentiometer to the middle position. Adjust P4 potentiometer slowly. Obtain the data signal again. Readjust P3 and P4 potentiometers and set the duty cycle ratio of the data signal to 50%. See the input and output signals in the same oscilloscope.



2- Connect CH1 channel of the oscilloscope to the input of the data signal (Fd) of Experiment 1. This time, see the data sign at the input and the data signal obtained as a result of demodulation in the oscilloscope at the same time and interpret it.



The data signal that is obtained as a result of demodulation follows up the digital data signal that is applied at the input synchronously with all of its characteristics.

3- Write down the function of IC2 integration.

*IC2 integration works as a **comparator**. It is used to increase amplitude of the output signal and enable its rapid change.*