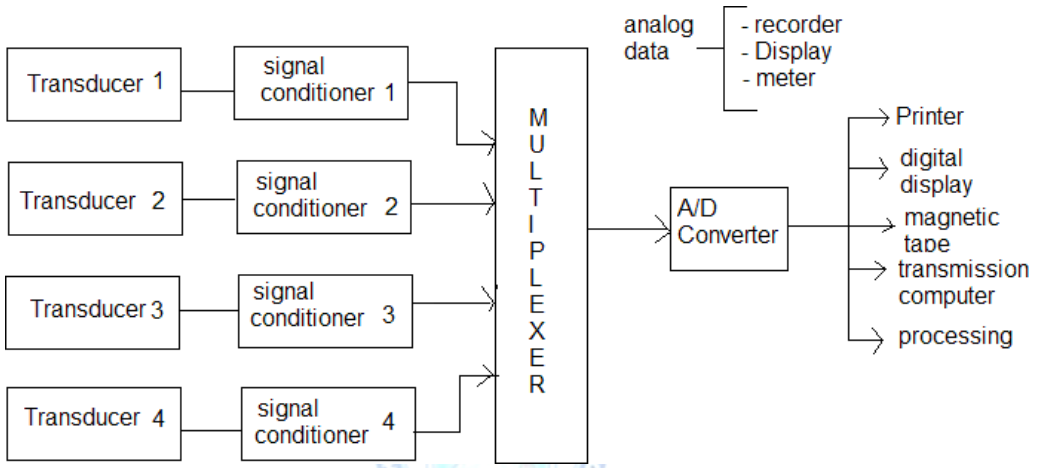
24EC501- Microprocessor , Microcontroller and Interfacing Techniques

DATA AQUSITION SYSTEM

ELEMENTS OF DIGITAL DATA AQUSITION SYSTEM

In order to optimize the characteristics of the system in terms of performance of the system, data handling capacity and cost, different relevant sub-system are combined together. The system used for data processing, data conversion, data transmission, data storage is called data acquisition system.



DIGITAL DATA ACQUISITION SYSTEM

The digital data acquisition system includes all the block shown in fig may use some additional functions block. The essential functions of digital data acquisitions are as follows,

1. It handles the analog signals
2. it performs measurement
3. it converts analog signal into digital data and handles it.
4. it performs internal programming and control.

The various elements of the digital data acquisition system are as follows,

1. TRANSDUCERS: -

They convert the physical quantity into a proportional electrical signal which is given as an input to the digital data acquisition system.

2. SIGNAL CONDITIONERS: -

They include supporting circuits for amplifying, modifying or selecting certain positions of these signals.

3. MULTIPLEXERS: -

The multiplexer accepts multiple analog inputs and connect them sequentially to one measuring instruments.

4. SIGNALCONVERTERS: -

The signal converters are used to translate analog signal to a form which is suitable for the next stage that is analog to digital converter. This block is optional one.

5. ANALOG TO DIGITAL CONVERTER(A/DCONVERTER): -

It converts the analog voltage to its equivalent digital form. The output of the analog to digital converter may be fed to the digital display device for display or to the digital recorders for recording. The same signal may be fed to the digital computer for data reduction or further processing.

6. AUXILIARYEQUIPMENTS: -

The devices which are used for system programming functions are digital data processing are included in the auxiliary equipment's. The typical functions of the auxiliary equipment's include linearization and limit comparison of the signal. These functions are performed by the individual instruments or the digital computer.

7. DIGITALRECORDER: -

They record the information in digital form. The digital information is stored on punched cards, magnetic tape recorders, type written pages, floppies or combination of these systems. The digital printer used provides a high quality, hard copy for recorders minimizing the operators work.

The data acquisition system is used, now days in increasing, wide fields. These are becoming very much popular because of simplicity, accuracy and the most important reliability of the system. These are widely used in industrial areas, scientific areas, including aerospace, biomedical and telemetry industries.

When the lower accuracy is tolerable or when wide frequency bandwidth is needed, the analog data acquisition systems are used. The digital data acquisition systems are used when the physical quantity being measured has very narrow bandwidth. When the high accuracy with low per channel cost is required, the ultimate solution is to use the digital data acquisition system.

MULTIPLEXING:

In general, the process of transmitting more than one information on one channel is called multiplexing

Two types of multiplexing

1. Time division multiplexing frequency division multiplexing

1. TIME DIVISIONMULTIPLEXING:

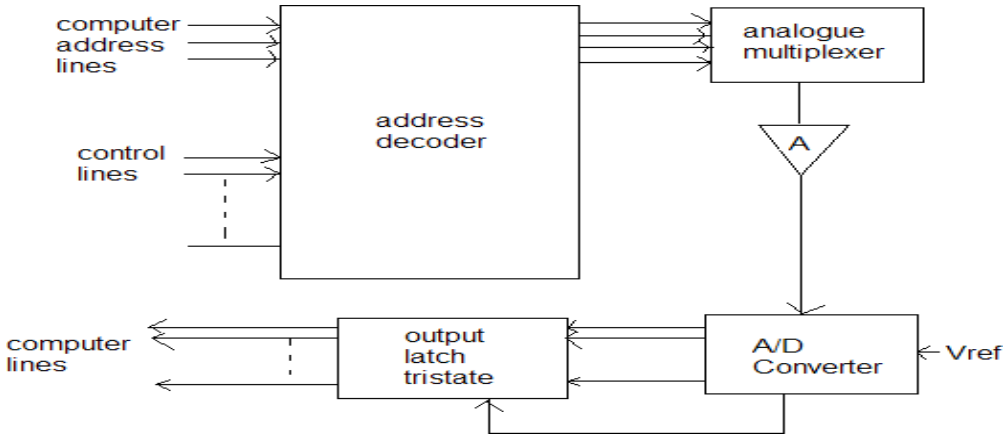
These are cases where analog input channels are multiplexed with the communication channel and signals are transmitted in analog form. In other cases, the analog input channels are multiplexed with a digital computer for analysis and/or control. Here an A/D converter is used after the multiplexer. A sample and hold circuit is used before the multiplexer as shown in fig.

A DATA ACQUISITION AND CONVERSION

When simultaneous samples of inputs are required. Before discussing different type of time division multiplexers, we briefly describe an address decoder

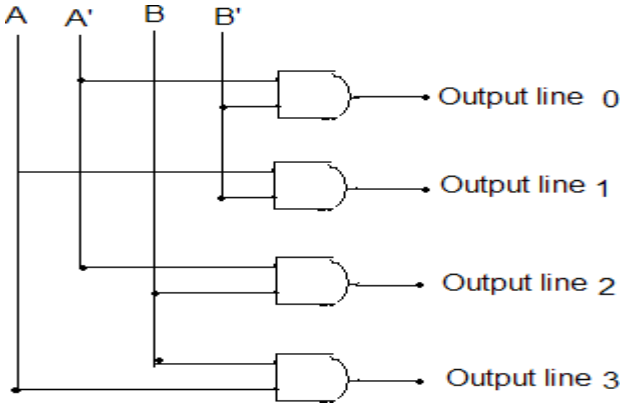
ADDRESS DECODER:

Address decoders receives an input from a computer via address lines that serve to select a particular analog channel to be sampled. The functions of the address decoder are to associate a particular channel a computer address code. A binary code is sent from the computer through special input/ output device to select an analog channel and to the input the data on that channel. A data acquisition system may be as shown in fig.



A TYPICAL ACQUISITION SYSTEM

A two bits, four outputs decoder is shown below, four AND gates with two inputs and four outputs form a decoder.

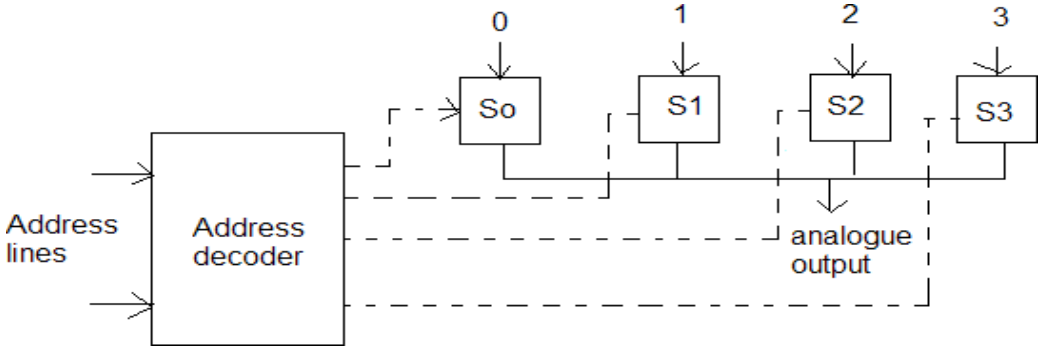


TWO BITS FOUR OUTPUTS DECODER

In the fig, for each two bits' binary code, there is one AND gate for which output is one. For e.g. for A =1, and B=0, the output of second gate is 1, since this code represents the decimal number 1, the gate labeled 1 is on and other are off.

ANALOG MULTIPLEXER:-

This is essentially a solid- state switch works according to the decoded address signal and selects the data on the selected channel by closing the switch off the channel. A four channel multiplexer is shown in fig below.



FOUR CHANNEL ANALOGUE MULTIPLEXER

The multiplexer receives an input from the address decoder and uses this to close the appropriate switch. For e.g. an address code channel 10 would detect channel 2. Similarly, 00 would select channel 0, 01, channel 1, and 11 channel 3, thus decoder must convert the computer address line to one of these four possibilities. The actual switch elements usually FET. FETs have an _on 'resistance of a few hundred ohms and an _off 'resistance of hundreds to thousands of mega ohms.

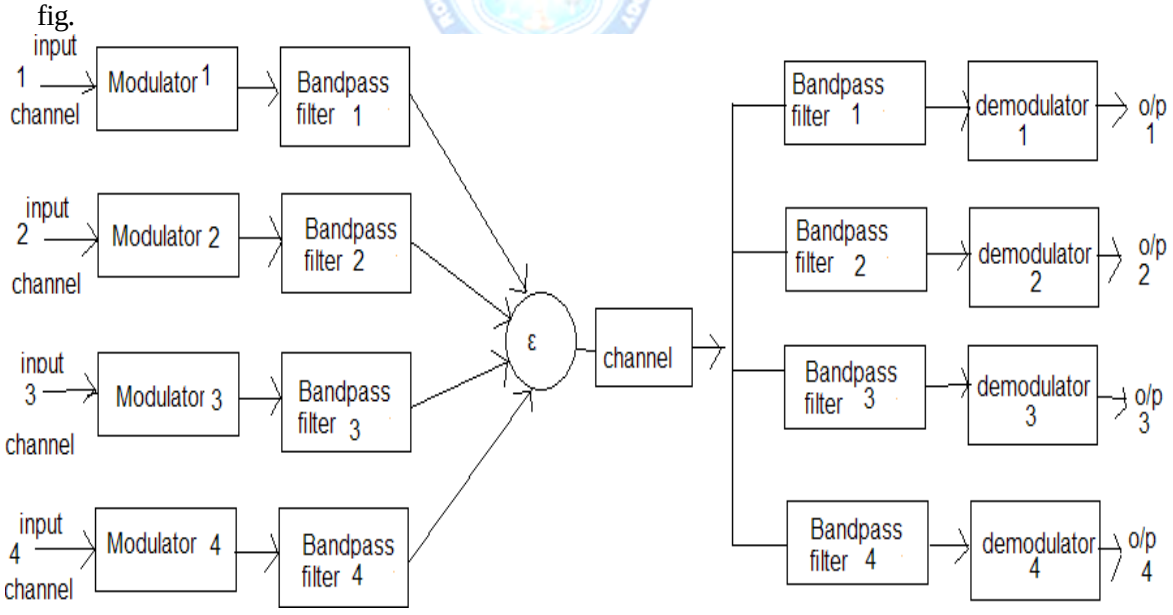
2. FREQUENCY DIVISIONMULTIPLEXING: -

The block diagram of a 4 channel FDM system is shown in fig. four input signals are first applied to channel modulators which have different carrier frequencies. The carrier oscillator frequencies are so chosen that they avoid the overlapping of frequency spectrum between each other.

A band pass filter of each channel is used so that only working frequencies around the carrier frequency are allowed to pass.

The harmonics and other spurious frequencies are blocked.

At receiving end, the signals are separated by selective filters and demodulators as shown in fig.



A FREQUENCY DIVISION MULTIPLEXING