Signal formation and conversion

- Telemetry means the transmission of data for monitoring and control over long distances. Data can be sent directly as a DC voltage or current up to a few meters. At long distances speed is severely limited, and noise becomes a serious problem. The original Morse trans-Atlantic cables of 19th century used DC which transmitted at less than one word per minute.

STRUCTURE OF DATA ACQUISITION SYSTEMS.

Data acquisition system are used to measure and record signals obtained in basically two ways:

a) signals originating from direct measurement of electrical quantities, these may include dc and ac voltages, frequency or resistance and are typical found in such areas as electronic component testing, environmental studies and quality analysis work.

b) Signals originating from transducers such as strain gage and thermocouple.

- Data acquisition systems are used in a large and ever-increasing number of applications in a variety of industrial and scientific areas, such as the biomedical, aerospace and telemetry industries. The type of data acquisition system whether analog or digital, depends largely on the intended use of the recorded input data. In general, analog data systems are used when wide bandwidth is required or when lower accuracy can be tolerated. Digital systems are used when the physical process being monitored is slowly varying (narrow bandwidth) and when high accuracy and low per-channel cost is required. Digital systems range in complexity from single-channel dc voltage measuring and recording systems to sophisticated automatic multi-channel systems that measure a large number of input parameters, compare against preset limits or conditions and perform computations and decisions on the input signal.

ANALOG DATA ACQUISITION

a Transducers – translating physical parameters into electrical signals.

b. Signal conditioners – amplifying, modifying, or selecting certain portions of these signals.

c. Visual display devices – continuous monitoring of the input signals. These devices may include single-channel or multi-channel oscilloscope, storage oscilloscope, panel meters, numerical display and others.

d. Graphic recording instruments – obtaining permanent records of the input data. These instruments include stylus and ink recorders to provide continuous records on paper chart, optical recording systems such as mirror galvanometer recorders and ultraviolet recorders.

e.Magnetic tape instrumentation – acquiring input data, preserving their original electrical form, and reproducing them at a later date for more detailed analysis.

FREQUENCY DIVISION MULTIPLEXING

- Frequency division multiplexing is based on the idea that a number of signal can share the bandwidth of a common communications channel. The multiple signal to be transmitted over this channel are each used to modulate a separate carrier. Each carrier is on a different frequency. The modulated carriers are then added together to form a signal complex signal that is transmitted over the single channel.

- The modulator output containing the sideband information are added together in a linear mixer. In a linear mixer, modulation and the generation of sidebands do not take place. Instead , all the signals are simply added together algebraically. The resulting output signal is a composite of all carriers containing their modulation. This signal is then used to modulate a radio transmitter. Alternatively, the composite signal itself may be transmitted over the single communication channel. Another option is that the composite signal may become one input to another multiplexer system.

TIME DIVISION MULTIPLEXING.

- In FDM, multiple signals are transmitted over a single channel by sharing the channel bandwidth. This is done by allocating each signal a portion of the spectrum within that bandwidth. In TDM , each signal can occupy the entire bandwidth of the channel. However , each signal is transmitted for only a brief period of time. In other words, the multiple signals take turns transmitting over the single channel

- Time division multiplexing may be used with both digital and analog signals. To transmit multiple digital signals, the data to be transmitted is formatted into serial data words. For example, the data may consist of sequential bytes. One byte of data may be transmitted during the time interval assigned to a particular channel. For example , in figure each time slot might contain 1 byte from each channel. One channel transmits 8 bits..

- The third channel then transmits its data word and so on. One transmission of each channel completes one cycle of operation called a *frame*. The cycle repeats itself at high rate of speed. In this way, the data bytes of the individual channel are simply interleaved
- The resulting single –channel signal is a digital bit stream that must somehow be deciphered and reassembled at the receiving end.