## 2.1 FIBER OPTIC SENSOR

Fiber optics for the commercial and industrial industries provide communication, data links, imaging, data collection, and application specific connectivity solutions in a wide range of capacities. The large majority of commercial & industrial applications in which fiber optic technology is used require each product to have specific construction and/or performance attributes to ensure adequate functionality.

While industry standard fiber optic products can be successfully implemented in some commercial & industrial applications, most standard products do not have the necessary durability and adverse condition performance capabilities necessary to support these applications.

Timber con fiber optic products for the commercial and industrial industries are designed and manufactured to provide the necessary performance, ruggedization, and durability to support even the most demanding applications. From precision tuned ruggedized polarization maintaining cable assemblies for sensors, to direct burial multi-fiber cables for oil field communications, we have a product solution to fit your requirements.

A fiber optic sensor is a sensor that uses optical fiber either as the sensing element or as a means of relaying signals from a remote sensor to the electronics that process the signals. Fibers have many uses in remote sensing. Depending on the application, fiber may be used because of its small size, or because no electrical power is needed at the remote location, or because many sensors can be multiplexed along the length of a fiber by using light wavelength shift for each sensor, or by sensing the time delay as light passes along the fiber through each sensor. Time delay can be determined using a device such as an optical time- domain reflectometer and wavelength shift can be calculated using an instrument implementing optical frequency domain reflectometry.

Fiber optic sensors are also immune to electromagnetic interference, and do not conduct electricity so they can be used in places where there is high voltage electricity or flammable material such as jet fuel. Fiber optic sensors can be designed to withstand high temperatures as well Fiber optic sensors are excellent candidates for monitoring environmental changes and they offer many advantages over conventional electronic

sensors as listed below:

- Easy integration into a wide variety of structures, including composite materials, with little interference due to their small size and cylindrical geometry.
- Inability to conduct electric current.
- Immune to electromagnetic interference and radio frequency interference.
- Lightweight and Robust, more resistant to harsh environments.
- High sensitivity and Multiplexing capability to form sensing networks.
- Remote sensing capability.
- Multifunctional sensing capabilities such as strain, pressure, corrosion, temperature and acoustic signals.

**Fiber Optic Sensor principles**

The general structure of an optical fiber sensor system. It consists of an optical source (Laser,LED, Laser diode etc), optical fiber, sensing or modulator element (which transduces the measurand to an optical signal), an optical detector and processing electronics (oscilloscope, optical spectrum analyzer etc).

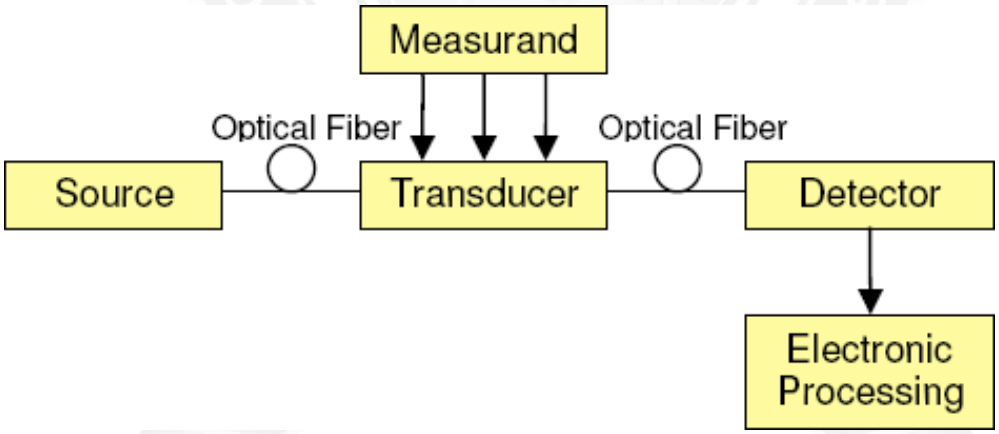


**Figure 2.1.1 Fibre Optics Sensor**

*[Source: "Optical Fibre Communications" by J.M.Senior, Page:214]*

Fiber optic sensors can be classified under three categories: The sensing location, the operating principle, and the application. Based on the sensing location, a fiber optic sensor can be classified as extrinsic or intrinsic. In an extrinsic fiber optic sensor the fiber is simply used to carry light to and from an external optical device where the sensing takes place. In this cases, the fiber just acts as a means of getting the light to the sensing location.