Phase Measurement System

The schematic diagram **of** Figure 5.8 shows the essential parts of a phase measurement distance-measuring system of an integrated total station. The sinusoidal modulation signal or measuring wave Am is derived from a crystal- controlled oscillator, the frequency value of which is typically 10-100 MHz. It is necessary that the frequency of the measuring wave be held at a constant value within a few parts per million (ppm) of the nominal frequency, as this determines the accuracy for distances when scaled by the velocity of the wave (remember $\lambda = v/f$).

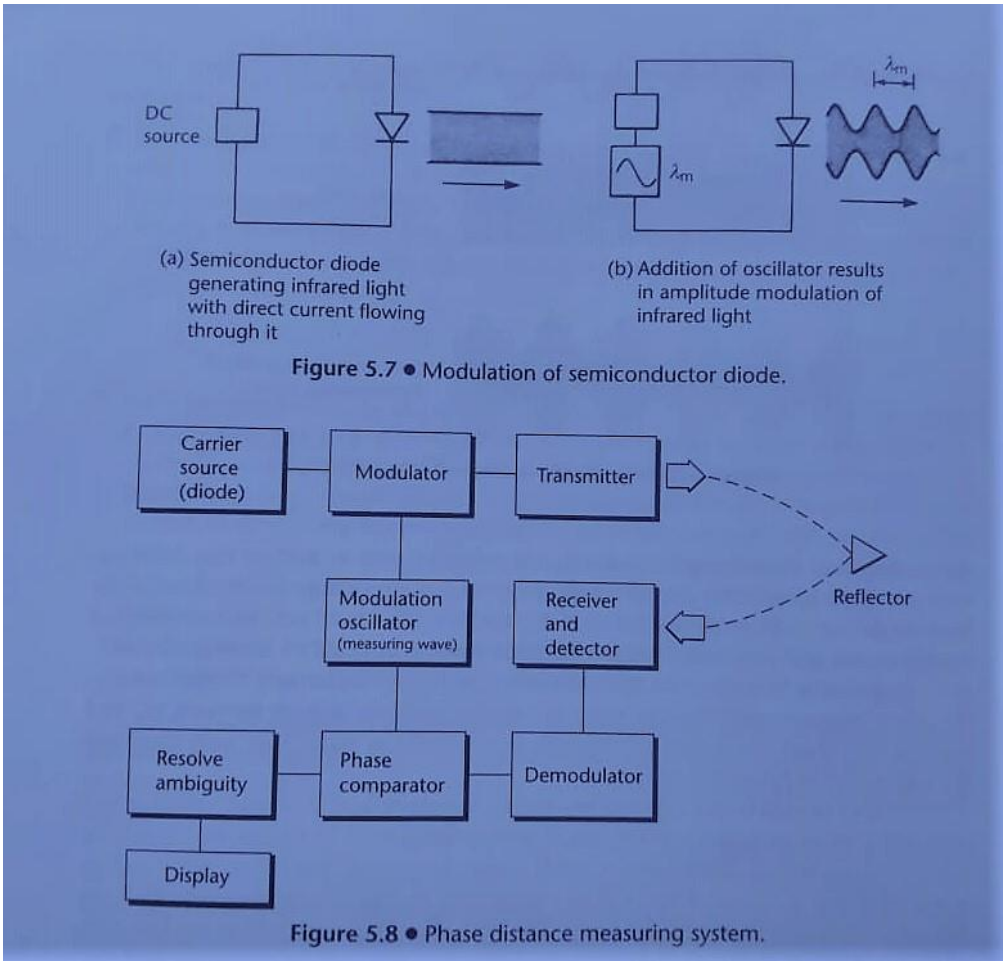

Figure 5.7 • Modulation of semiconductor diode.

Figure 5.8 • Phase distance measuring system.

The intensity modulated carrier is transmitted from the total station towards **a** reflector or target at the remote end of the line to be measured. Since the carrier is an infrared or visible laser, optical components are used to focus and transmit the carrier along the line of sight of the telescope as a highly collimated beam with a low angular divergence. This helps to increase the measuring range of the instrument.

The receiving optics are usually mounted coaxially with the transmitting optics and they occupy as large an area as possible **so** as to collect sufficient return signal for measurement purposes. Upon re-entering the instrument, the modulated carrier is detected and demodulation takes place (the separation of the measuring and carrier waves).

From the demodulator, the return signal is fed into the phase comparator. A reference signal, also derived from the modulation oscillator, is fed into the phase comparator and these two signals are processed to produce a Ao or Aλ value for the relevant line. In addition to this, further measurements are taken to resolve the ambiguity of measurement.

This process has been described as if one wave was transmitted from instrument to reflector. However, a standing wave is established between the total station and reflector and the phase measurement is sampled many times to improve precision. In addition to this, several patented improvements have been made to the optical and electronic components of the system described to enhance the accuracy and the range of the method.

Reference: Surveying for Engineers, 5th edition (John Uren and Bill Price)