Repeaters

Chapter 9

For a certain message to pass between two locations there should be a transmission medium connecting them. In telecommunication this could be either copper wires, radio links or optical fiber.

These media carry information for a long distance. Therefore interferences such as electromagnetism and thunder could produce noise inside transmission media which results in attenuation and energy losses of the transmitted signal. Hence a way of converting these weak signals into their original forms was to be considered.

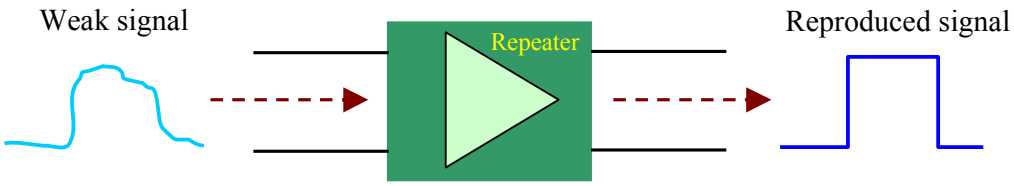


Figure 9.1

As its name implies repeaters are used as a solution. There are two main types of repeaters.

I. Active repeaters
II. Passive repeaters

Active repeaters feed power as well as converting the weak signal into its original form. Passive repeaters act as a sort of a reflector only. For example satellites belong to this kind. Since voice transmission would require power feeding as well as converting the weak signal, active repeaters are used.

What does a repeater do?

Repeaters do three main functions to a weak signal.

I. Re-shape
II. Re-time
III. Power feed

Many repeaters are stationed between exchanges for these purposes.

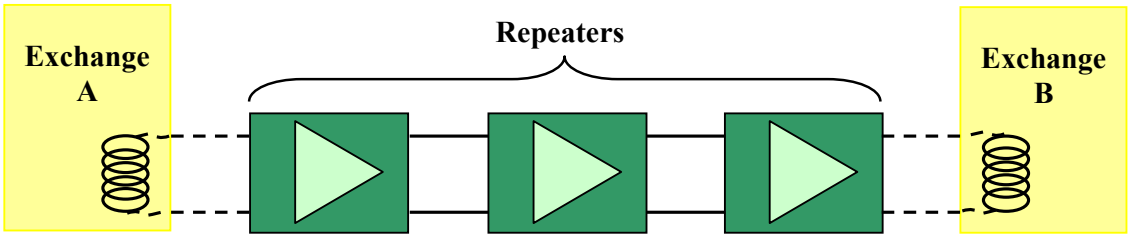


Figure 9.2

The circuit diagram of a repeater is as follows.

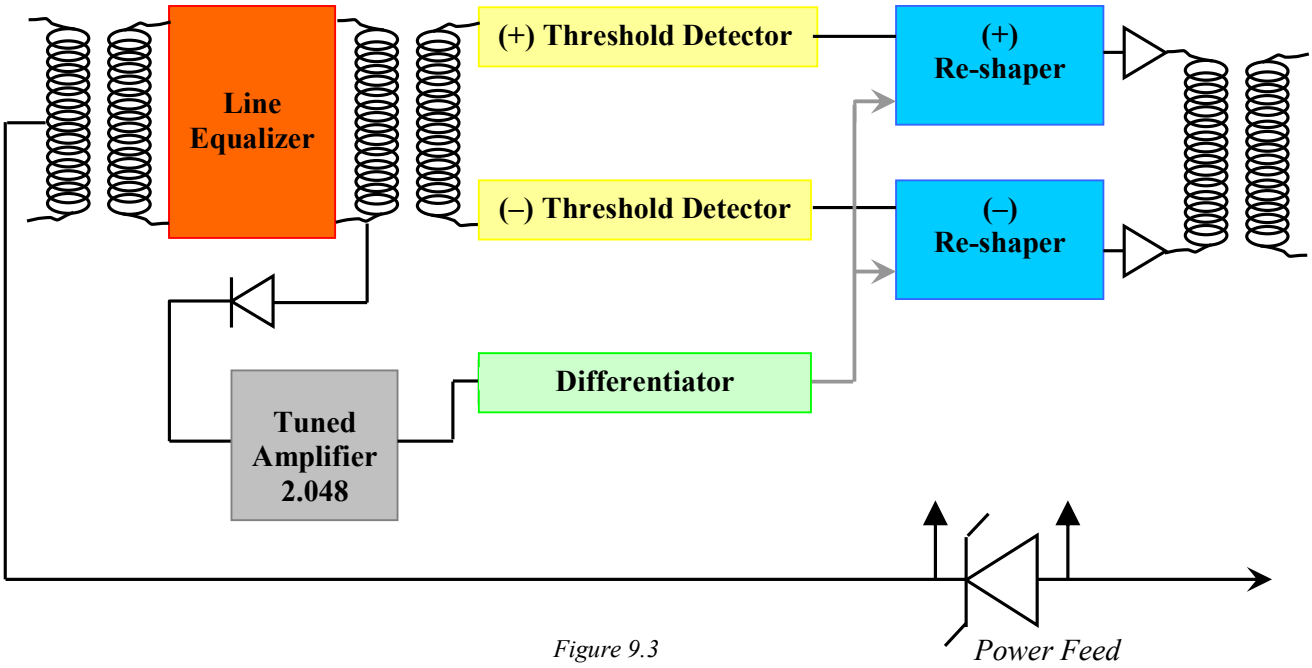


Figure 9.3

The receiving signal is a combination of many high frequencies. They have very high rates of attenuation. The line equalizer amplifies low frequencies with a high gain and high frequencies with a low gain. Hence the incoming signal is equalized.

The (+) threshold detector takes an average positive value and gives out an output only when the signal voltage go beyond the selected value. Similarly the (–) threshold detector gives an output when the signal go below the selected negative voltage.

One output of the equalizer is sent through a rectifier where the output voltage value gets rectified. The tune amplifier is driven by the rectifier. It regenerates the clock pulse which is then sent through a differentiator. The differentiator gives out a short spark at the beginning of each clock pulse. This is fed into both (+) and (–) re-shapers.

The (+) re-shaper checks whether there is a mark at the time when the differentiator gives a spark. If there is, it gives out a mark of the same time period as the clock. The same procedure is followed by the (–) re-shaper.

The outputs of both (+) and (–) re-shapers produce the original waveform as can be seen in page 27. This is considered a great advantage of Digital Transmission. If the transmitted wave was analogue this re-shaping could not take place. Hence analogue waves are not used for transmission between exchanges.

A problem arose in this method. When two people talk over the phone, only one speaks at a time. The other listens. During listening, the time slots of the listener will carry series of zeros. These zeros come across the repeater and would not give a voltage value for the rectifier to drive the tune amplifier. Therefore the clock regenerating process stops. Because of this reason RZ and NRZ are not used directly. A new coding was introduced.

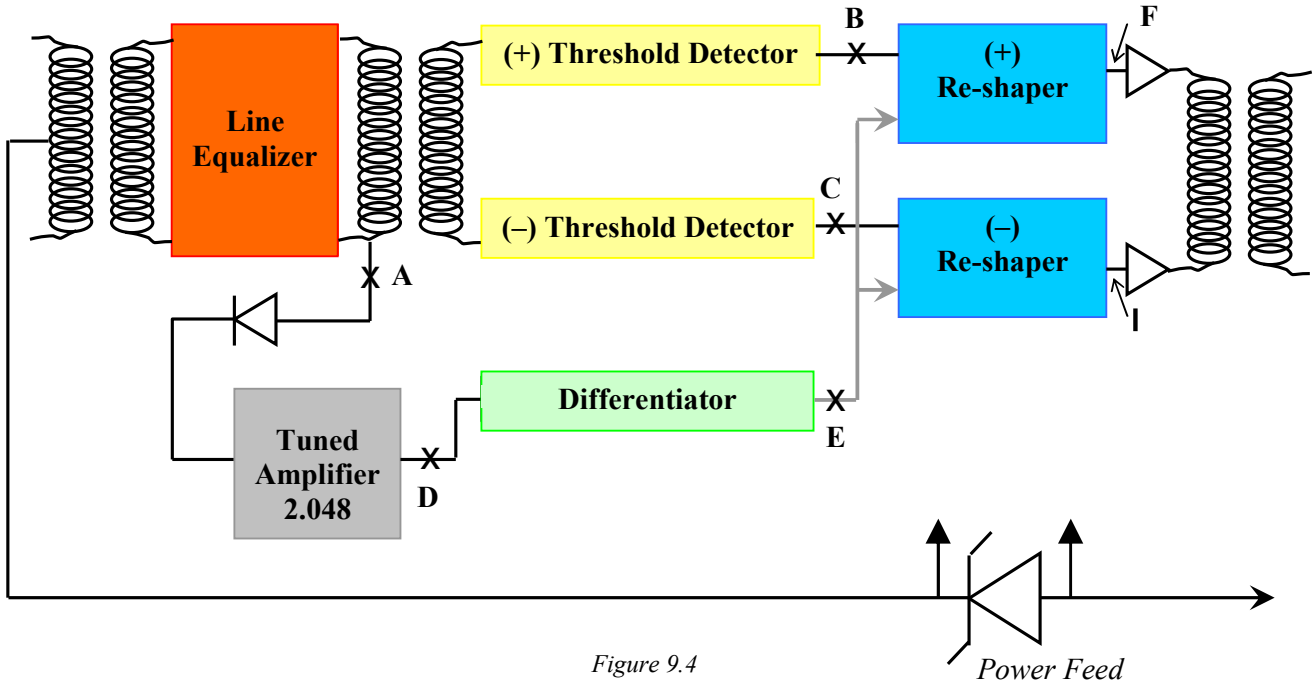


Figure 9.4

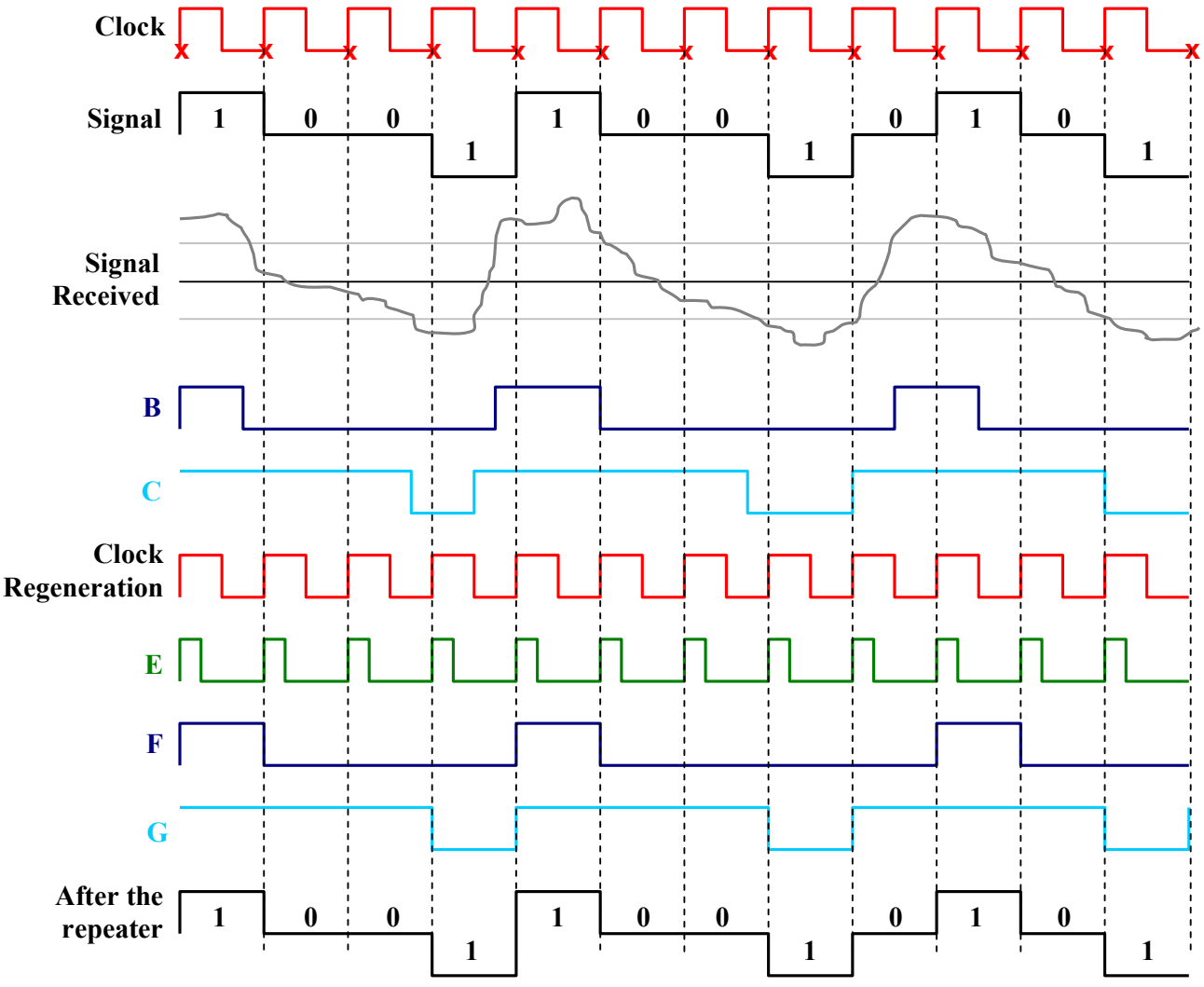
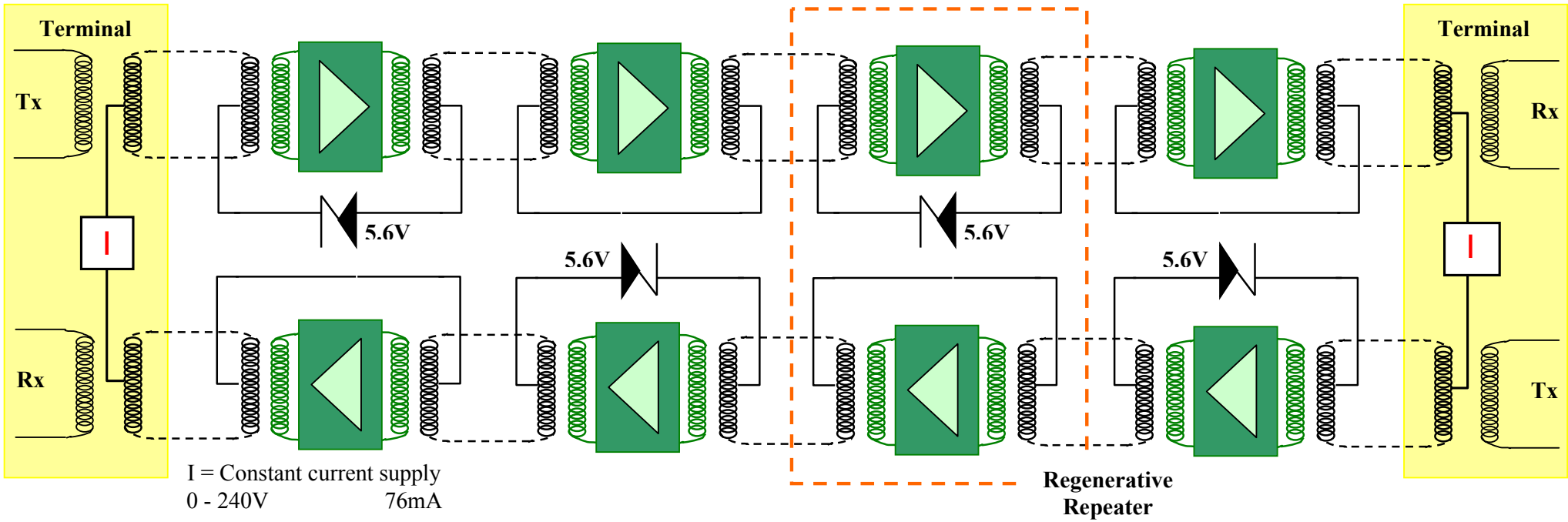


Figure 9.5

Remote power supply configuration for 2.048 Mb/s digital link



As can be seen above, power is fed from one terminal. If the transmission line is too long, power has to be fed from both terminals. Then the power feeding arrangements at the repeaters are the same except in the middle repeater. In such a situation, this repeater power feeding arrangement is as in the sub diagram on the right.

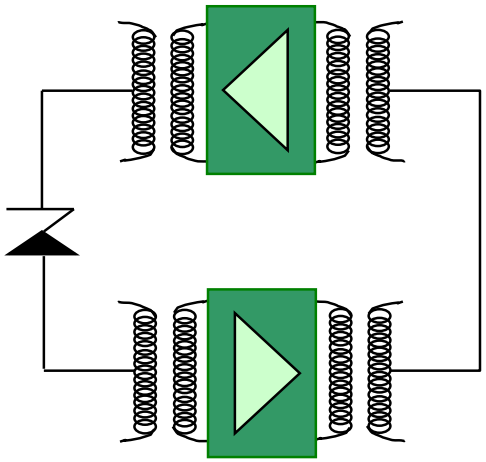


Figure 9.6