Functional Description of the CAB-1L Remote Controller

The CAB-1L remote controller is a wireless device used to operate and control model trains. It works in conjunction with a BASE-1L or TMCCII command base transceiver unit. Its most basic operation consists of receiving input from the operator of the model train and converting this information into digital information packets which are transmitted via a wireless 2.4 GHz band link to the command base. The CAB-1L remote controller is also capable of receiving information packets from the command base.

The CAB-1L remote controller consists of a series of subsystems used in combination to perform the functions necessary to operate the model train. The central core of the remote controller is a microprocessor that runs at a frequency of 16 MHz. The microprocessor connects to the subsystems by either a parallel or serial interfacing techniques.

The remote controller is powered using 4 AA alkaline batteries. A linear voltage regulator circuit is used to maintain a stable operating voltage for the microprocessor as the batteries discharge.

The CAB-1L remote controller uses a Texas Instruments transceiver which gives the command base bi-directional communication capability. The Texas Instruments transceiver interfaces to the microprocessor using a SPI serial interface. Information packets are passed between the transceiver and microprocessor as necessary. These packets contain both data and status information on the operation of the transceiver. The antenna for the transceiver is mounted internal to the plastic CAB-1L enclosure.

The transceiver operates in the 2.404 GHz to 2.480 GHz range using approximately 150 individual channels. Each channel is spaced 500 KHz apart. These channels are broken into 10 groups of 15 channels each. Each of the 10 groups allows a different train control system to be operated within the same transmission range of each other. The 15 channels within a group allow selection of a clear channel to reduced interference with other 2.4 GHz band devices. Information packets are transmitted and received using an MSK encoding method at a data rate of 125Kbs. CRC error detection is provided to insure data integrity. If an error is detected during transmission it is corrected by using a proprietary protocol that uses retransmission techniques for correction.

Other CAB-1L remote controller interfaces include digital and analog signals generated by operator controls. Several digital inputs are connected to a set of mechanical keys that are used to give the operator input for train operation. Other digital inputs read the output of an optical encoder connected to a speed control knob used by the operator to change the speed of the train. One analog to digital input reads the analog signal generated by an operator action to control the intensity of the whistle on the train. One digital output is used to drive a speaker to provide feedback to the operator when keys are pressed.