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## Functional description of BASE-1L Command Base

The BASE-1L Command Base is a wireless device used to operate and control model trains. It works in conjunction with a CAB-1L remote controller. It is the central hub for communication between the remote controller and the model train. Its most basic operation consists of receiving input via a wireless 2.4 GHz band link from the remote controller then converting this information into a proprietary format which is transmitted to the train via a 455 KHz FSK signal. The command base has bi-directional capability allowing it to send packets of information to the remote controller to acknowledge commands received.

The BASE-1L Command Base 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 64 MHz. The microprocessor connects to the subsystems by either a parallel or serial interfacing techniques.

The BASE-1L Command Base 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 BASE-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.

The BASE-1L Command Base subsystems include a 455 KHz output control circuit. This circuit provides an FSK signal used to communicate with the train and operates at either 452 KHz or 458 KHz. These two frequencies are provided by dividing the 34.35 MHz system oscillator frequency by two respective numbers needed to create these frequencies. This produces a square wave output that is filtered to remove any unwanted harmonics. The signal is then amplified and coupled to the low voltage AC power signal applied to the train track. The train decodes this 455 KHz signal and determines how it should be operated.

The command base is powered using a low voltage AC wall transformer. The low voltage AC is rectified, filtered and applied to linear regulators to produce the DC voltages required to power the various subsystems.

The incoming AC voltage from the wall transformer is also applied to a zero cross detector to produce a square wave at the AC line frequency. This signal is used to synchronize the 455 KHz signal used to operate the train.

Lighting control is provided to indicate the status of the command base. Finally a serial interface is provided to maintain backward compatibility with previous versions of the command base.