

Functional description of TMCCII command base

The Train Master Command Control II command base or TMCCII command base is a wireless device used to operate and control model trains. It works in conjunction with a TMCCII remote controller. Its most basic operation consists of receiving input from a remote controller then using that received information to operate a model train. The command base converts this information into a proprietary format which is transmitted via a 455 KHz FSK signal sent to the train. The TMCCII command base is the central hub for communication between the remote controllers and the model train. The command base has bi-directional capability as well as allowing it to send packets of information to the remote controllers which can be displayed on the remote controllers LCD screens.

The command base is powered using a low voltage AC wall transformer. The low voltage AC is distributed to two different PCB boards. The first PCB board it is distributed to is the battery charger circuit. The charger uses a microprocessor with an internal oscillator operating at 4.00MHz. This microprocessor is used to control a constant current switching power supply operating at 500 KHz which in turn recharges Nickel Metal Hydride batteries. The command base provides a built in cradle for the remote controller allowing it to be held in place while being charged.

The second PCB is used by the command base houses the main microprocessor and sub systems necessary to control the model train. A zero cross detector is first provided to synchronize the 455 KHz intentional conductive emissions carrier used to operate the train. The TMCCII main command base PCB consists of other subsystems used in combination perform the functions necessary to operate the model train. The central core of the command base consists of a microprocessor that functions using a crystal operating at a frequency of 17.17MHz. This single microprocessor controller connects to a series of sub systems by either a parallel or serial interfacing techniques.

The TMCCII command base uses a CHIPCON based subsystem which gives the command base bi-directional transceiver capability. It operates between the 2.404GHz and 2.480 GHz range using approximately 150 individual channels. Each channel is spaced 500 KHz apart. These channels are broken into 15 groups of 10 channels each. Each of the 15 groups allows a different train control system to be operated within the same transmission range of each other. The 10 channels within a group allow for the channel selection to provide clear channel selection and reduced interference with other 2.4GHz band devices. Information packets are transmitted and received using an MSK encoding method at a data rate of 250Kbs. 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 CHIPCON controller interfaces to the microprocessor using a SPI serial interface. Information packets are sent and received to and from the CHIPCON module

and microprocessor as necessary. These packets contain both data and status information on the operation of the CHIPCON controller. An antenna is mounted on the outside of the plastic enclosure to provide greater signal sensitivity.

Other TMCCII command base interfaces include 455 KHz output control circuit. This circuit operates at either 452 KHz or 458 KHz providing an FSK signal used to communicate with the train. These two frequencies are provided by dividing the main 34.35MHz system oscillator by two respective numbers needed to create these frequencies. This square wave output is filtered to remove any unwanted harmonics. The signal is then amplified and couple to the low voltage AC power signal. The train decodes this 455 KHz signal and determines how the it should be operated. An external memory system is provided to store data base information about the train layout. This information is used to control the status and train operation. A memory module interface is provided to allow the operator to save and recall information about the operation of the train. Lighting control is provided is indicate various statuses and illuminate various decorations. Finally a serial interface is provided to serial link from the old system to the new TMCCII system.