NC2MBIK

Contents

NCZmB2K

Description of remote-control radio transmitter

The remote-control radio transmitter is intended for use in combination with a suitable receiver (e.g. UAA 3201 T) and can be used in private vehicles for the remote control of various functions such as door-opening and closing devices central locking systems, alarm systems etc. It is contained in the housing of the car key. The transmitter is used only for generating and transmitting a data word and for modulating this data word on a high-frequency carrier. The receiver then evaluates the data word and carries out the desired tasks.
The remote-control transmitter is a low-power radio unit . For this reason the user does not require a special licence by the FCC in accordance with FCC part 15. It can therefore be used with various different receivers, provided that the characteristics of the receiver are suitable for those of the transmitter.

Instructions for operating and starting the remote-control transmitter

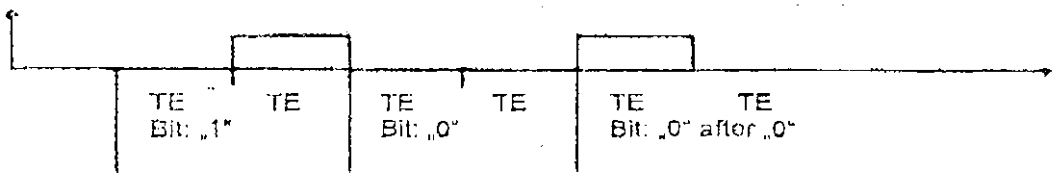
Starting the transmitter:
To start the transmitter, it is only necessary to insert the batteries. Open the Lid of the battery case and insert two batteries of type 2025 (2 x 3V) on top of one another into the battery compartment. Ensure that their poles are pointed in the same direction. The plus pole of the battery (with the wide surface) is facing upwards. If needied , you can additionally put a contact plate between the batteries for better contact terms . Then close the upper half of the housing again.

Initialization:
As the data word of the transmitter has both a fixed-code part and a variable code part, the transmitter must be synchronized with the receiver. For this purpose, the transmitter has to be initialized to transmit a synchronizing data word instead of a normal data word.
To do this, hold the button "close all" (biggest field) in the pressed position and press the buttor "open" (the left one) 5 times in succession. After the 5th press, only synchronization data words are transmitted instead of normal data words, until all the buttons are released or the timeout function interrupts the transmission.
The synchronization process can be repeated at any time.

Description of function of the remote-control transmitter

The transmitter is based on the licencing regulations part 2 and 15 of the regulations of the Federal Communications Commission (FCC)
The transmission frequency is 315 MHz and the equivalent emission (ERP) is less than 6000 µV/m (see specification).
To ensure that no unauthorized access to the object being protected is obtained by scanning and imitating the transmitter (e.g. by using a measuring generator) , the transmitter functions by means of a hopping code process, i.e. whenever a button is pressed, the variable code alters in accordance with a coded algorithm . The circuitry of the transmitter consists principally of two parts - the encoder with its external circuitry, and the actual high-frequency transmitting stage.

The code generator is the Motorola microprocessor 68HC05K3. The function of this component on the basis of its specially programmed mask, is described below: The design of the encoder allows connection of 4 buttons at the input side, and all of then are in use for this application. This means that it is possible to control four different functions with the transmitter. In addition, the button (open) is fitted with a double-click function, which will be discussed in more detail later. At the chip output, a data word is available which is passed to the base of the high frequency transistor.
For the data word, a format has been selected by which a logical 1 is represented by a switch from low to high level with a duty cycle of 50%. A logical zero is represented by: a) a low level over the entire bit time TE of 1 ms, if preceded by a logical 1, and b) a switch from high to low level with a duty cycle of 50%, if preceded by a logical 0. The constant bit time of 1 ms produces a data rate of 1000 bits per sec. (= 1 kBaud). In addition, the total frame time is always the same (64 ms). There is no interval between the individual frames.



TE = 0.5ms +/- 1%

The data frame (normal frame) is composed of the following:

Preamble: The preamble does not consist of single bits, but represents a continuous high level of 8 ms. It is at the beginning of every data word and can be used by the receiver to distinguish between the true data word and malfunctions ol the receiver circuitry. These can be caused by continuous noise or other electromagnetic interference, especially with sensitive receivers. Disturbances of this kind are generally under 5 ms.
The preamble also enables a sleep mode in a processor connected in sequence with the receiver (for variable code evaluation). This allows reduction of the overal current consumption of the system.
The preamble is followed by a pause of 2 ms, after which the next bits are anticipated.

Sync field: The sync field serves to synchronize the receiver to the beginning of the transmitter data word. It is five bits in length and has the content 1 1 1 1 1.

Fixcode: The fixcode is used to distinguish between the buttons. Each button has its own fixcode. It is 20 bits in length. This means that the number of different buttons available to the system user is 2^{20} = 1,048 million.

Running code: The running code also has a length of 20 bits and assumes a random value when the processor is started, i.e. the operating voltage is applied.

Thereafter, this code is exponentiated by one every time a button is pressed.

Hopping code: The fix code and running code only occur inside the processor and are not visible at any time. Instead, they are converted into a new code (the socalled hopping code) in accordance with a certain encoding algorithm. The hopping code is 40 bits in length. Because the running code is changed every time a button is pressed, the hopping code also changes its content. This ensures that the system is secure against unauthorized interception.

Data: In this field, the actual information is transmitted on which of the two buttons is pressed. For the button pressed, the appropriate bit logical 1 is set. This means that the field consists of 4 bits plus one other bit 5, which contains the information for any double-click function detected.

Parity: By means of this bit field, the correct transmission of the hopping code is checked in order to detect any transmission faults in the system. For this purpose, the 40 bits of the hopping code are compressed to 8 bits (i.e. 5 bytes) and offset against one another to form a new auxiliary byte by means of an exclusive-OR-combination. Following a number of other combinations, 3 bits are finally used for the parity control and are transmitted.

Stop: The stop bit forms the conclusion of each data word and is represented by a logical 1.

Besides the normal frame, there is also a synchronization frame. With this frame , instead of the running code, a 20-bit longer sync code is used in the hopping code. Each transmitter has its own fixed sync code. The sync code is part of the encoded calculation algorithm. This means that each key has its own encoding algorithm. Through the transmission of the syncronization frame, the receiver receives the information on this algorithm.

In this way, a key to the receiver or its synchronization is learnt. During the transmission of the sync frame, all the bits of the data field (button information) are logical 0. Only the 5th bit for the double-click function can assume the value 1. The initiation of the transmission of the synchronization frame is described above.

The software of the evaluation circuit connected to the receiver is able to calculate in advance any number of (programmable) succeeding bit sequences of the variable code for any key learned. This is necessary in case the user activates the key outside the receiver range, or it a data word is not transmitted correctly. The resynchronization of the transmitter with the receiver above and beyond the set number can be done by retransmitting a synchronization word.
In order to prevent any of the buttons from being activated unintentionally and discharging the battery, the transmission of data is interrupted automatically after a few seconds and the transmitter goes into the hold mode.

To release the buttons, the signal must be present at the input of the microprocessor for at least 5 ms three times in succession.

When the buttons are released, the data word begun in each case is fully transmitted. However, every time a button is pressed, a minimum of 4 data frames are transmitted (if the button is pressed up to 4 x 64 ms = 256 ms).
If the "open" button is pressed twice within 256 ms, the double-click bit logical 1 is set in the data field. Otherwise the data word remains unchanged. At least 4 frames containing this information are transmitted.

The component is cycled by means of a 2.00 MHz quartz. It has an operating voltage range of 3 - 7 V and its closed-circuit current is less than 0.5 uA (typc 100 nA). In the operating state this increases to 1 - 2 mA. The output voltage of the data word is equivalent to the supply voltage.

As already noted, this output voltage controls the Motorola HF transistor MMBR 901 via a base series resistor. This is used for the oscillator which in principle, is equivalent to the structure of a Colpitts oscillator. It is designed in such a way that the oscillator frequency is 315 MHz. The loop antenna is integrated in the oscillator circuit. In order to achieve a maximum antenna voltage and therefore the maximum emission power, the antenna is adapted to the layout with the capacitor C7. As the component tolerances and parasitic effects (e.g. a capacitive mistuning of the oscillator circuit by the operators hand) the oscillator frequency would float freely, the entire oscillation, i.e. transmitter frequency is stabilized at 315 MHZ by the SAW resonator (which oscillates at 315 MHz).

Through the control of the oscillator by the digital data word, the carrier signal is transmitted in ASK-modulated form (- 100% modulation degree).

The oscillator has a separate mass supply. This is not released until the microprocessor is activated by pressing a button through an output of the processor. In this way the oscillator circuit is disconnected from the supply voltage between the operating phases of the transmitter.