RAYMING corporation

TX-99 K4A
300MHz AM

RF 4 - BUTTON KEYCHAIN TRANSMITTER

Applications:
Wireless Control
Garage Door Opener
Car Alarm/Keyless Entry

TX-99K2B_04/04/02

The TX-99K4A is an LC-based 300MHz AM RF transmitter with a HT12E encoder IC. on board. It is ideal for almost any application needing a wireless control system. When used with the RE-99 receiver board, and RE-01 decoder motherboard, the TX-99K4A offers 4 bits of data, and 1 momentary relay output, which closes whenever a valid address is transmitted for the length of time the button is pressed. 8 bits of address ensure that data sent from your transmitter are passed on to the RE-01 data outputs, and all stray data are rejected. The 8-bit address also allows up to 256 individually addressed receivers to be used with a single transmitter. This set works well in applications such as controlling remotely located objects: lights, valves, motors, alarms and just about anything else.

Specifications

ELECTRICAL	
Operating Voltage:	12VDC (23A battery)
Operating Current:	9.1mA
Frequency:	300 MHz
Circuit Type:	LC Based AM
ENVIRONMENTAL	
Operating Temp:	0°C to 40°C
Storage Temp:	-20° to 80°C
PHYSICAL	
Length:	3.2" (80.96mm)
Width:	1.4" (36.51mm)
Height:	0.56" (4.29mm)
Weight:	1.5oz (0.042gms)

BAUD RATE:
All of our RF products are designed to be used with short burst transmissions and are not intended for sending continuous data streams. The approximate baud rate of 1200 bps is supplied only as a reference for determining the suitability of your project.

Other Available RF Products

Transmitter/Receiver Sets:
- **TX-99 V3.0 -** 300MHz AM RF LC-based transmitter
- **TX-99K4B -** 300MHz AM RF LC-based Four-button transmitter with encoder
- **RE-99 V3.0A-** 300MHz AM RF super regenerative receiver
- **TX-66 V3.0-** 310MHz AM RF transmitter with SAW resonator
- **RE-66 V3.0A**- 310MHz AM RF super-regenerative receiver

Encoder/Decoder Sets:
- **TX-01-** 12-bit encoder motherboard (8-bit address/4-bit data)
- **RE-01**- 12-bit decoder motherboard (8-bit address/4-bit data)

Address Information

The TX-99K4A data inupts are TTL level (0 = Low = 0V, 1 = High = 5V). Switches 9 -12 must be "ON" to use the TX-99K4A data inputs. If switches 9-12 are "off", all data bits will be sent high. Data inputs are typically used as follows: all data switches "on", 100K resistors from data inputs to ground, 5V applied through switches to data inputs. Data can be input by way of other logic devices if required.

Address bits are set according to the positions of switches 1-8. If an address switch is "on", the corresponding address bit will be sent low. If an address switch is "off," the corresponding address bit will be sent high. The TX-99K4A address switch settings must achieve data transmission. The TX-99K4A provides a serial TTL level data output.

Testing and Troubleshooting

Testing the TX-99K4A is different than testing an encoder/transmitter set such as the TX-01 encoder motherboard and TX-99 transmitter board. The reason is that the TX-99K4A transmitter section shares the same PCB as the encoder section. Because of this, the transmitter cannot be disconnected from the encoder for testing purposes. Therefore, the transmitter and encoder must be tested together.

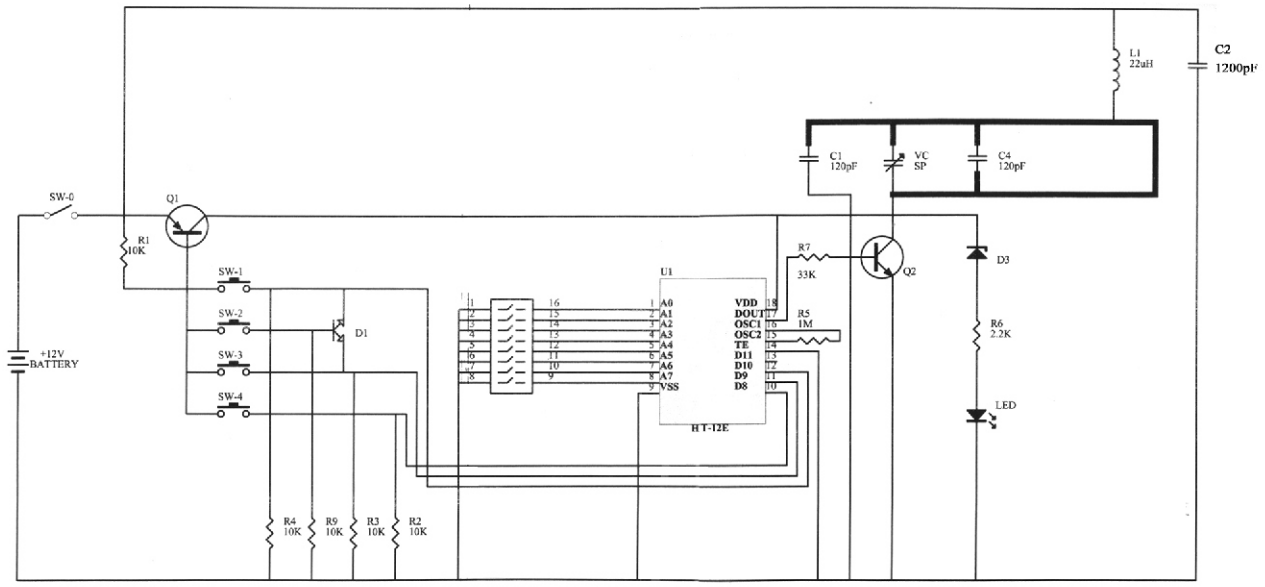
Start by connecting an oscilloscope probe to pin 17 of the HT12E encoder IC located on the component side of the PCB. Set your scope for 5V\div. and 5mS\div. When either transmitter button is pressed, a data code will appear on pin 17. This code consists of 13 bits (1 timing bit, 8 address bits and 4 data bits). You will notice that if you press button #1, the corresponding data bit on your scope will appear to be more narrow than the bits to the left of it. This is because pressing button #1 causes data 4 to go high (narrow bit). Low bits will appear to be wider on the scope display. If you do not see the code on your scope, and the scope settings are correct, you probably have a defective encoder IC, but this is rarely the case.

The next step is testing the keychain transmitter section. Testing this section also requires an oscilloscope. The scope setting should be the same as above with V/Div set to 10V. Connect your scope to the emitter (when looking at the flat face of the transistor, the emitter is the pin to the left) of the transistor located on the component side of the PCB. There is only one transistor on the board so it shouldn't be hard to find. You should see about the same signal you viewed on pin 17 of the encoder IC, except the voltage will be lower. This simply verifies that the transistor is keying the 300MHz oscillator on and off at the rate of the data. If your scope is capable, that is, if it is fast enough, you can verify that the oscillator is set to exactly 300MHz.

The RE-99 and RE-01 can be tested together as well. First verify that your transmitter is transmitting, in other words, have someone press and hold one of the button down. While the transmitter button is pressed, check the data line of the receiver with your scope (use the same settings as used in the encoder test). If you see the 13-bit code clearly, and your decoder address matches your encoder address, the RE-01 VT relay should be closed. If the relay is not closed, and the power supply is above 9VDC, your decoder board may be defective. If you do not see the 13-bit code, your receiver may need tuning.

The RE-99 can be easily tuned by turning the variable capacitor located on the top of the RE-99 PCB slowly in either direction. This should be done with a non-conductive screw-driver. Using a metal screw-driver will change the capacitance when touching the capacitor. The variable capacitor is a half-turn capacitor, which means it starts over every half turn in either direction. This fact makes the resolution of the capacitor very sensitive, so make sure to turn it slowly with very tiny increments.

If you are trying to tune the RE-99, and you do not have access to a scope, follow the tuning directions above but use the RE-01 VT relay as an indicator that the correct signal is being received. When tuning this way, be very sure that the decoder address matches the encoder address, or you may be tuning for a very long time!



GENERAL INFORMATION THAT APPLIES TO OUR REMOTE CONTROL PRODUCTS

OVERVIEW OF A REMOTE CONTROL SYSTEM:
A remote control system is any system with controls or commands delivered to the main unit from a distance, in this case by radio frequency transmission. The remote system we will discuss includes an encoder, transmitter, receiver, and decoder. All of these parts must be used in order to attain a complete link. See descriptions below.

ENCODER:
An encoder is a circuit in which a code or signal presented in one format can be changed to a format compatible with the circuitry it interfaces with. In the case of the TX-01 the format delivered by the user is a 12-bit parallel code consisting of 8 address bits and 4 data bits. This code must be changed to a serial format in order to become compatible with the transmitters input. This is the job of the TX-01 encoder motherboard, or more specifically, the HT12E encoder IC found on the TX-01 encoder motherboard (an encoder is already built-in to the TX-99K4A).

TRANSMITTER:
A transmitter is a circuit with an output sent through the air by light, sound or electromagnetic waves at a specific frequency. In the case of the TX-99K4A, the output is an amplitude modulated radio frequency of 300MHz. The transmitter receives a coded signal from the encoder and uses that signal to modulate its 300MHz carrier. In simple terms, the output of the transmitter is an electromagnetic representation of the input data code.

RECEIVER:
A receiver is a circuit capable of accepting and processing light, sound, or electromagnetic waves of a specific frequency. In the case of the RE-99, the 300MHz radio frequency signal sent by the transmitter is received, and the incoming data extracted from that signal. The extracted data is then sent out in serial format to the decoder board.

DECODER:
A decoder is a circuit in which a coded signal of a specific format (usually that of its compatible encoder) is received and changed to a format compatible with the circuitry it interfaces with (usually the format originally presented to the encoder is the same format used for the output of the decoder when used in wireless systems, but not always). In the case of the RE-01, the incoming code is a 12 bit serial format. This code must be checked to ensure that the first 8 bits (address bits) match the address of the decoder IC. This is the job of the RE-01 decoder motherboard, or more specifically, the HT12D decoder IC. found on the RE-01 decoder motherboard. If the incoming 8 bit address is correct, the last 4 bits of the 12 bit code (data bits) are passed on to the data outputs of the RE-01, and the Valid ID relay closes and remains closed until the incoming signal is no longer present. The 4 data bits, however, latch and remain in whatever state they were set to by the last transmission, until they are changed by the next transmission.

DATA CODES:
A data code is a set of numbers or letters representing some form of information. In the case of the encoders and decoders described above, the data code consists of a combination of four 1s and/or 0s representing 16 possible states. If a +5V signal is applied to one of the four data lines, or if the data line is left floating (not connected) , this is considered a 1. If +0V (or ground) is applied to one of the four data lines, this is considered a 0. By using different combinations of 1s and 0s on the four data lines, 16 separate control commands can be sent. IC's are available, such as the 74HC154, which can turn a 4 bit data code into a more user friendly output, giving you the option to select 1 of 16 different output pins to activate per transmission. If the 4-bit data code is being sent to a micro-controller, or if less than 4 different commands are needed, these extra IC's are not needed.

IMPORTANT NOTE:
The bandwidth utilized on our RF modules was intended for experimental use in applications that require only short burst transmissions. Our RF boards must be used with their intended motherboards (TX-01 & RE-01) and cannot be used for continuous serial data applications.

Rayming' RF products are designed for experimental use and are not FCC approved. It is the responsibility of the user to verify compliance with FCC regulations on their own application and obtain an FCC approval number for the final product which is to be marketed.

LIMITED WARRANTY
This product is warranted against manufacturing defects in materials and workmanship for 30-days from the date of purchase. Within this period, Rayming will, at its option, repair or replace the product, or any part thereof, without charge for parts and labor.

This warranty does not apply in the following cases: Improper installation, misuse, failure to follow installation and operating instructions, alteration, abuse, accident or tampering.

Rayming is not responsible or liable for indirect, special, or consequential damages arising out of or in connection with the use or performance of the product or other damage with respect to any economic loss, loss of property, loss of revenues or profit, or costs of removal, installation or reinstallation.

Except as provided herein, Rayming makes no express warranties, and any implied warrant of merchantability or fitness for particular purpose is limited in its duration to the written limited warranties set forth herein.

There will be charges rendered repairs to the product made after the expiration of the aforesaid 30-days warranty period.

This warranty gives you specific legal rights and you may have other rights which vary from state to state.

FOR TECHNICAL SUPPORT
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