# TOUCH TONE DECODER

## Ramsey Electronics Model No. TT7

*Now you can use touch-tones to control virtually anything via radio, phone line or even tape. The kit is backed up by powerful 20mA output lines that can be set up to control nearly anything that you can think of. And, you are backed up by over 30 years of excellence from the world's best kit supplier.*

- **Turning on and off lights, radio and TVs in your home are just some of the almost infinite possibilities!**
- **A state-of-the-art "central office quality" decoder makes the Touch Tone Decoder extremely reliable and accurate.**
- **Its powerful 20mA driving capability can power relays, digital devices, LED's and more!**
- **It even decodes the four additional A, B, C and D tones!**
- **You build it in one evening. Why spend big money when you can say "I built it myself!" for a fraction of the cost.**
- **Clear concise instructions guide you to a finished kit...and then offer hints and tips on how to hook it up and use it. Ramsey is right there with you all of the way!**
- **Become one of many satisfied Ramsey customers and be one of the *World's Best Kit Builders!***

ramsey

***PARTIAL LIST OF AVAILABLE KITS:***

**RAMSEY TRANSMITTER KITS**

- **FM10C, FM25B, FM30B, FM Stereo Transmitters**
- **FM100B, FM35 Professional FM Stereo Transmitters**
- **AM2, AM25 AM Broadcast Band Transmitters**

**RAMSEY RECEIVER KITS**

- **FR1C FM Broadcast Receiver**
- **AR1C Aircraft Band Receiver**
- **SR2C Shortwave Receiver**


**RAMSEY HOBBY KITS**

- **LBC6K Laser Beam Communicator**
- **SG7 Personal Speed Radar**
- **SS70C Speech Scrambler/Descrambler**
- **TT1C Telephone Recorder**
- **LLS1 Laser Light Show**
- **MD3C Microwave Motion Detector**
- **LEDS1C LED Strobe Light**
- **BE66 Blinky Eyes Animated Display**
- **LTS1 Laser Trip Sensor**
- **ICI1C Infrared Switch Control Interface**

**RAMSEY AMATEUR RADIO KITS**

- **HR Series HF All Mode Receivers**
- **DDF1 Doppler Direction Finder Kit**
- **QRP Series HF CW Transmitters and QAMP Power Amplifiers**
- **CW7C CW Keyer**

**RAMSEY MINI-KITS**

**Many other kits are available for hobby, school, scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.**

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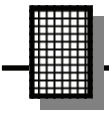

KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

# TT7 TOUCH-TONE DECODER

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## WELCOME TO THE TT7 TOUCH-TONE DECODER

Thank you for purchasing the TT7 Touch Tone Decoder. Your kit has been designed to be dependable, useful, educational and fun. Since some parts in the decoder may have to be inserted in certain ways, we encourage you to follow our directions closely.

Your TT7 is capable of decoding touch tones like the ones that you hear from your phone, on a repeater or almost anywhere else. With a little ingenuity, you can operate lights and appliances over the phone or radio link, control digital circuits, such as a remote radio, or modify it to do almost anything that you can think of. In fact, the TT7 even decodes A, B, C and D tones that are common on many of today's ham radios.

## CIRCUIT DESCRIPTION

Let's take a quick look at your circuit. The "brains" of your decoder is the HT9170B DTMF decoder chip. This state of the art technology IC chip can detect and decode all sixteen codes. This is what allows your kit to stay small enough to fit in some radios, yet useful enough for any decoder need.

Another chip included with your kit is the SN74154N 4 to 16 line decoder . This chip decodes the output of the decoder chip and translates it so that you can monitor each tone individually. More simply put, you can control up to sixteen devices with the TT7, without hooking up any more of that confusing logic stuff. (Yuck!)

The rest of the circuit is simply composed of a few components that can be described as serving three functions. Looking at the schematic you will see one set of components far over to the left of the HT9170B. The purpose of these is to protect the circuit against dangerous voltages from incorrectly hooking up the circuit. The small circuit at the lower left side of the HT9170B is the crystal circuit. Its purpose is to provide a "clock" input into the chip. The "clock" input is used to synchronize all of the various functions of the chip. The circuit to the upper right of the IC is the audio input circuit, and the rest of the schematic shows the interface between the two ICs.

## RAMSEY TT7 TOUCH-TONE DECODER PARTS LIST

### SEMICONDUCTORS

- ❒ 1 HT9170B DTMF decoder chip (U1)
- ❒ 1 SN74154N 4 to 16 line decoder (U2)
- ❒ 1 2N3904 NPN signal transistor [marked 3904](Q1)
- ❒ 3 1N4002 [black epoxy case with a band](D1,2,3)
- ❒ 1 3.579 MHz crystal (X1)

### CAPACITORS

- ❒ 3 0.1uF ceramic disc capacitors [marked .1 or 104](C2,3,4)
- ❒ 2 22pF ceramic disc capacitors [marked 22](C5.6)
- ❒ 1 10uF electrolytic capacitor (C1)

### RESISTORS

- ❒ 1 330 ohm resistor [orange-orange-brown](R6)
- ❒ 2 1k ohm resistors [brown-black-red] (R1,5)
- ❒ 2 47k ohm resistors [yellow-violet-orange](R2,4)
- ❒ 3 10k ohm resistors [brown-black-orange](R10,11,12)
- ❒ 3 100k ohm resistors [brown-black-yellow](R3,7,9)
- ❒ 1 330k ohm resistor [orange-orange-yellow](R8)

### MISCELLANEOUS

- ❒ 2 2 pin .100 headers (J1,3)
- ❒ 1 22 pin DIP header (J2)

### REQUIRED, NOT SUPPLIED

- ❒ Power source, 5 VDC

## Construction

Now we will begin building our kit. There are just a few more things to know before we put the first components in.

For each part, our word “Install” always means these steps.

1. Pick the correct value to start with.

2. Insert it into the correct PC board location.

3. Orient it correctly, following the PC board drawing and the written directions for all parts - especially when there’s a right way and a wrong way to solder it in. (Electrolytic capacitor polarity, dotted and notched ends of parts, and so forth.)

4. Solder all connections unless directed otherwise. Use enough heat and solder flow for clean, shiny, completed connections.

Please take us seriously when we say that good soldering is essential to the proper operation of your kit!

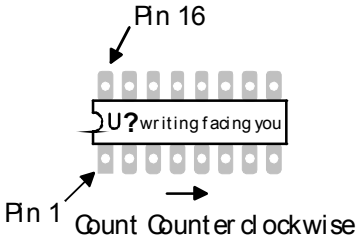
- Use a 25 Watt soldering pencil with a clean, sharp tip.
- Use only rosin core solder intended for electronics use.
- Use bright lighting. A magnifying lamp or bench-style magnifier may be helpful.
- Do your work in stages, taking breaks to check your work. Carefully brush away wire cuttings so that they don't lodge between solder connections.

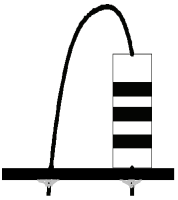
We will start by installing the ICs so that they will sit flat on the board when we're finished. This will also give us some soldering practice and put some "landmarks" on the board.

❒ 1. First we will install U1, the HT9170B IC onto the board. Looking at the chip you should notice a notch, dot or groove cut into one end. You must be absolutely sure that when you insert the chip into the PC board the notch faces in the same direction as is outlined on the PC board. In this case, the notch should point towards R1. You can allow the circuit board to lay on the chip to keep it flat. When you solder all the leads make sure that you don't form any solder bridges or cold solder joints.

❒ 2. Next install U2, the SN74154N 4 to 16 line decoder chip. Again, follow the dot or notch that shows you which way to place the part, make sure it's seated flush to the PC board, then solder all the leads.

*Do you know how to count the pins on an IC to determine which is pin 1 and so on? All you do is start with the pin below the notch or dot and that is pin 1, then you count around counterclockwise from there. It's a handy thing to know when troubleshooting or just snooping around a circuit with test equipment. The diagram below might make it clearer.*





- ❒ Let's start at R5 and work our way around from there.
- ❒ Install R5, 1k ohm resistor (brown-black-red). R5 must be mounted "standing up." To do this, first place one lead all of the way into the hole marked with a circle. Next, bend down the other lead into it's hole. When you have successfully mounted your resistor, it should look like the one at the right. Make sure that you have good soldering connections on all parts!
- ❒ Install C6, 22pF ceramic disc capacitor (marked 22).
- ❒ Install C5, 22pF ceramic disc capacitor (marked 22).
- ❒ Install X1, the 3.579 MHz crystal. X1 provides a constant frequency so that operations in the chip can be synchronized.
- ❒ Install R9, a 100k ohm standup resistor (brown-black-yellow).
- ❒ Install R7, 100k ohms (brown-black-yellow). This part must also be mounted standing up (No, not YOU standing, IT standing!).
- ❒ Install C4, 0.1uF ceramic disc capacitor [marked .1 or 104].
- ❒ Install R4, a 47k ohm standup resistor (yellow-violet-orange).

Now we'll install two identical parts, but the polarity on them is opposite so be careful. Polarity? We'll explain in the next step.

- ❒ Install D3, 1N4002 diode [black epoxy case with a band]. This is a standup part but you still have to make sure that the band faces in the same direction as shown on the circuit board. If you don't, your circuit will not work. Diodes work like one way valves that allow current to flow in one direction but not the other. Bend the lead of the part closest to the band over as you've been doing with the resistors so that the body of the part sits in the hole marked with a circle and the band is up.
- ❒ In a similar fashion, install D2, 1N4002 diode [black epoxy case with a band]. You'll bend this part just as you did the last one and you'll place the body of the part into the hole marked with a circle just as with D1.
- ❒ Install J1, one of the two pin headers. Place the short pins through the board; the long pins will be standing up on the topside of the circuit board. Seat it flat to make it look neat and to make it easier to use.
- ❒ Install R3, a 100k ohm laydown resistor (brown-black-yellow). The silkscreen for this part is to the right of it if the board is placed so that you can read the writing. It's right next to R2.

- ❒ Install R2, a 47k ohm standup resistor (yellow-violet-orange).
- ❒ Install R1, a 1k standup resistor (brown-black-red).
- ❒ Install C2, 0.1uF ceramic disc capacitor (marked .1 or 104).
- ❒ Install C3, another 0.1uF ceramic disc capacitor (marked .1 or 104).
- ❒ Install R8, 330k ohm standup resistor (orange-orange-yellow).
- ❒ Install R11, 10k ohm standup (brown-black-orange).
- ❒ Install R12, another 10k ohm standup resistor (brown-black-orange).
- ❒ Install J3, the other two pin header just as you did J1.
- ❒ Install C1, 10uF electrolytic capacitor. You will notice that the capacitor has a black stripe on one side and that this side also has a shorter leg. This is the (-) side. Normally, PC boards are marked on their (+) side. Be sure that the (-) goes in the (-) hole on the PC board and the (+) in the (+) side! C1 filters any noise in the power input so that the decoder does not activate at the wrong times.
- ❒ Install Q1, a 2N3904 NPN transistor. Bend the leads out so that they fit into the PC board and follow the flat side for placement. The flat side faces R12.
- ❒ Install R10, the last 10k ohm standup resistor (brown-black-orange).
- ❒ Install D1, 1N4002 diode [black epoxy case with a band]. Again, the band should be placed up when the body of the part is placed in the hole marked with a circle. D1 protects the circuit against improper power hookups.
- ❒ Install R6, 330 ohm standup resistor (orange-orange-brown).
- ❒ Install J2, 22 pin DIP header. Now we'll install a part on the backside of the circuit board and solder it on the topside where you've been placing all the other components. Place the header through the board from the solder side so that the long pins are up and the short pins go through the circuit board. Then solder the pins on the topside of the board next to U1. Be careful not to bridge any connections.

***Congratulations!***

You have just completed your TT7 Touch-Tone Decoder. Take a minute to relax and then come back and check all of the solder connections and parts for correct installation. Any misplaced parts, bridged solder connections or cold solder joints may damage your kit permanently!

## SETUP AND TESTING

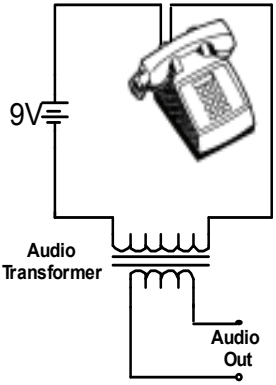
In order to successfully operate your TT7, you need a 5 volt power supply. This is a common voltage for most digital circuits so you will probably also need it to power any additional circuitry that you hook up.

To hook up your TT7 to a phone, you must first construct one of the circuits outlined in step three. This will ensure trouble free decoding, while protecting your circuit from the higher voltages of a phone line. If you are going to decode from a radio or an audio output from your phone or answering machine, simply connect the audio output of your device to the audio input of the TT7. Since we cannot provide information on every connector to interface with your radio or answering machine, please contact the manufacturer for additional information on a particular product.

❒ 1. Hook the 5 volt power supply to your TT7. To do this, run a wire from the (+) side of your supply to the (+) connection on your kit. This wire is traditionally red, while the (-) wire is traditionally black. Run the (-) wire from your supply to the (-) connection on your kit.

❒ 2. Either connect your telephone line to the TT7 at J1 or construct circuit A shown below. Circuit A is for use with a phone that is not connected to a phone line, or you can use a radio or other device to supply DTMF audio.

❒ 3. Now that you're ready, generate DTMF tones, (press the buttons!) to test each output point while you generate the corresponding tones. Each output should normally be about five volts, but will drop to almost zero when activated. For example, the output point marked (4) should be about five volts all of the time. When you press the '4' on the phone the line should go down to about zero volts for as long as you have it pushed. The DV, or "data valid" point, should go from zero volts to five volts each time a tone is decoded.




**Circuit A**

## TROUBLESHOOTING

If you have problems with your kit, don't panic! Most problems can be solved with an ohmmeter and a clear head. Please try to keep in mind that most problems are caused by improper parts placement, cold or bridged solder connections, and improper hookup.

PROBLEM: "It doesn't work!"

SOLUTION: There are a number of things that you must check. The first thing that you should check is that there are no solder bridges. Don't be afraid to go back and reheat connections to be sure that they are not cold solder joints. Now check to see if you have some sort of short in the circuit, such as two wires touching. Be sure that all of the diodes are connected the right way also. If installed the wrong way, your kit will not work. Just turn the diode around and it should correct the problem.

PROBLEM: One or more outputs don't work, but others do.

SOLUTION: Chances are there is a bad or bridged solder connection on one of the ICs.

## SOME USES AND IDEAS FOR THE TT7

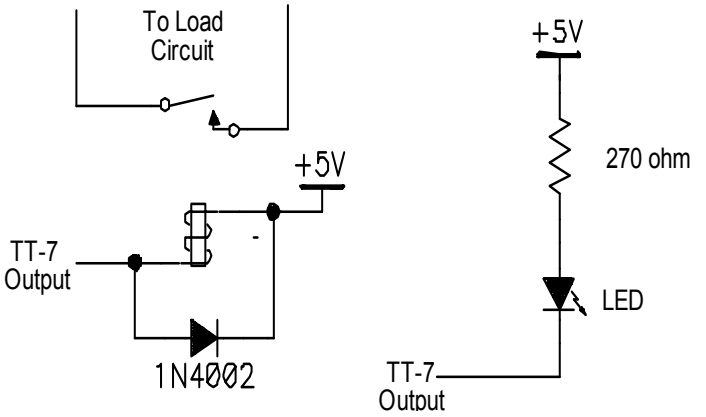
There are an almost infinite number of uses for the TT7. One suggestion is to hook up the TT7 to various lights in your house. This way, when you are away from home, you can call and turn them on or off. This might be helpful if you do not want to come home to a dark house. Another suggestion is to hook up LED's to each of the outputs. This way, you can tell exactly what was dialed on radio talk shows, a phone line, ham radio communications, or any other place that you hear these tones. Since there are so many uses and possibilities for the TT7, we cannot provide connecting hardware. Many parts, however, are available at your local Radio Shack or other electronic parts supplier.

In order to control lights or appliances, you need two basic items. One item that you need is a digital latch. Fortunately our TS1 touch switch acts as an excellent latch. To find out more about using the TS1 as a digital latch please see the following section. The other item that you need is a relay to interface your TT7 to the device you want to control.

One big advantage of using an answering machine is that you can call your own phone number from virtually anywhere and access the TT7's

capabilities. Also, if a prank caller, or your best friend were to call and try to operate your TT7, you are at least aware of this happening because all of the tones are recorded on your machine.

In order to hook up LED, you should be aware of one of the characteristics of the SN74154N chip. All of the outputs are called “active low.” This means that when a certain output is selected, its voltage goes low rather than high. If you hook-up an LED or relay the load device must be connected between the plus supply pins and the TT7 output. When the SN74154N output goes low it will enable your load.




These are just two suggestions out of the many possible. We certainly hope that you continue to enjoy this kit, and have learned from it’s construction. Most of all, good luck with your ideas. All that you need is a little skill (or a friend with some...keep some ice cream handy!) and a good imagination.

## USING THE RAMSEY TS1 AS A DIGITAL LATCH

The Ramsey TS1 touch switch circuit can be used as a set of two digital latches in just a few short steps. This latch feature allows you to "toggle" on and off devices using your tone decoder. This means that when the tone decoder is activated, the device that is being controlled will turn on when you send a tone, and stay on until you turn it off with the same tone. This is especially helpful when you are trying to turn on and off lights in your house, control an electronic device, or even use the TT7 to decode a very fast set of tones. When a tone is heard, the latch will hold the light on until it hears another.

The TS1 also inverts your output. This means that when the tone is activated, the output is high. When it is not activated, it is low. If you remember, this is the exact opposite from the outputs on the TT7. Although there is no difference in the accuracy of the kit, some people may appreciate this feature.

To hook your TT7 up to your TS1, you need to make a few simple modifications. First of all, there are two separate latch circuits on one board, so you can latch two tones. Follow these steps to successfully hook together your kits.

- ❒ 1. Construct the TS1 touch switch circuit leaving the following parts out: D1, D2, R5 and R6. This will disconnect the touch paddles so that your circuit can operate properly.

- ❒ 2. Install the jumpers outlined in the TS1 manual for "toggle switch," operation.

- ❒ 3. Connect a wire from one of the selected TT7 outputs to the D1 connection point on the TS1 board closest to C3. Next, connect your other selected TT7 output and connect it to the D2 connection point closest to C4.

- ❒ 4. Follow the instructions for connecting the TS1 output connections and power inputs. Although the TS1 manual states that it should be run from eight to twelve volts, it should work fine on your five volt supply. If you do not use the same supply, please make sure to connect the (-) wires of each kit together.

## TOUCH TONE REFERENCE INFORMATION

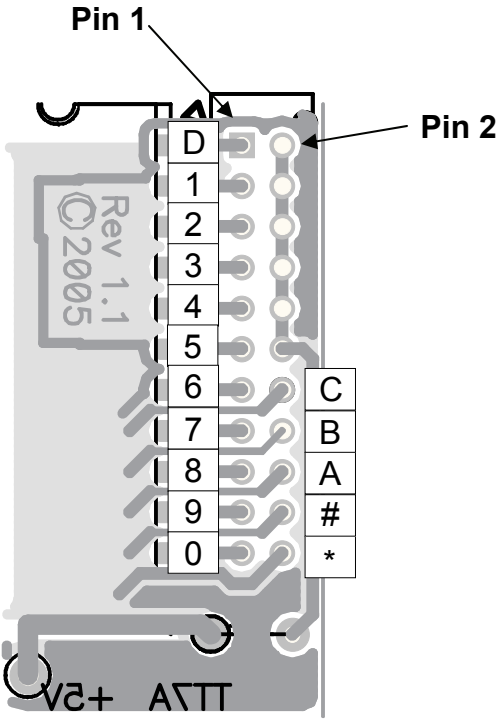
The table below has been provided to show you the sixteen different touch tone combinations, and the specific frequencies required to activate your TT7. In order to create a valid touch tone, two frequencies must be mixed. Looking at the table below you will notice one set of four "low" frequencies, and one set of four "high" frequencies. To determine what frequencies make up each digit, first find the digit that you want on the chart. We'll pick "6" for an example. Simply reference it to the frequency above it, and to the one to the left of it. So, for a "6", a 770Hz tone and a 1,447Hz tone are mixed.

Each tone and its frequencies are already programmed into your 145436 chip. The chip compares any incoming frequencies to determine whether or not it is a tone.

| Touch Tone Reference Table | | | | |
|---|---|---|---|---|
| **Frequency (Hz)** | **1209** | **1336** | **1477** | **1633** |
| **697** | 1 | 2 | 3 | A |
| **770** | 4 | 5 | 6 | B |
| **852** | 7 | 8 | 9 | C |
| **941** | * | 0 | # | D |

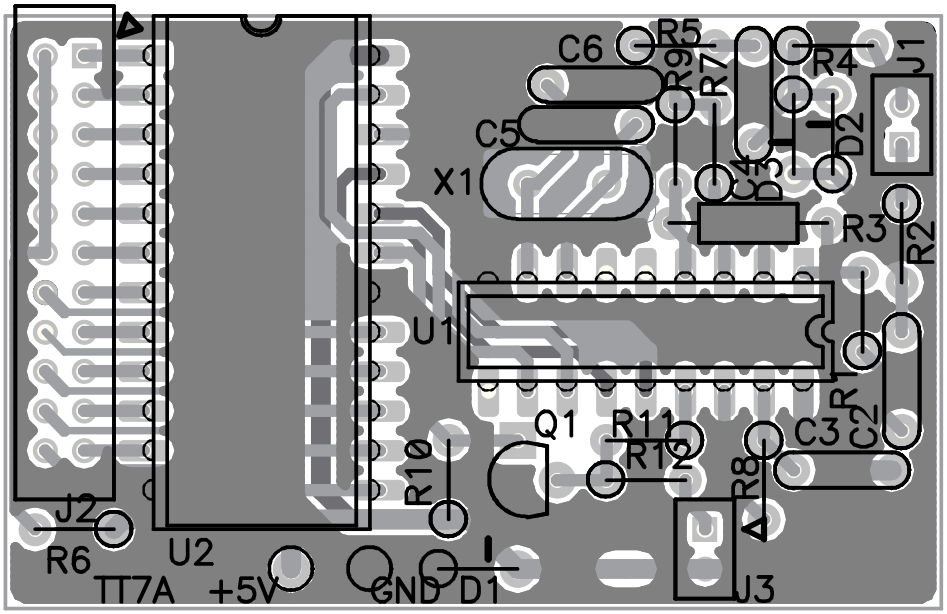
## TT7 OUTPUTS

Below is a picture of the back of your TT7 PC board showing which pins correspond to which DTMF tones. The view is with the board held with the solder connections facing you and with the output pins at the right. The pins are counted from left to right with the upper left pin being pin 1 and the one to the right of it being pin 2. The remaining unlabeled pins 2, 4, 6, 8, 10, and 12 are tied together and connected to 5 volts through R6, a 330 ohm resistor.



| TT7 OUTPUT PINS | |
|---|---|
| **PIN NUMBER** | **TOUCH TONE** |
| **1** | D |
| **2** | +5V |
| **3** | 1 |
| **4** | +5V |
| **5** | 2 |
| **6** | +5V |
| **7** | 3 |
| **8** | +5V |
| **9** | 4 |
| **10** | +5V |
| **11** | 5 |
| **12** | +5V |
| **13** | 6 |
| **14** | C |
| **15** | 7 |
| **16** | B |
| **17** | 8 |
| **18** | A |
| **19** | 9 |
| **20** | # |
| **21** | 0 |
| **22** | * |

**TT7 PARTS LAYOUT DIAGRAM**



**Notes:**

# THE RAMSEY KIT WARRANTY

**1. GENERAL:**
Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that prior to release of this kit, a varied group of knowledgeable people have assembled this kit from scratch using this manual. During this process, changes and additions are noted by each assembler and integrated into the final version of the manual…which you have! If you need help, please read through your manual carefully, all information required to properly build and test your kit is contained within the pages! However, customer satisfaction is our goal, so in the event that you do have a problem, please note the following:

**2. DEFECTIVE PARTS:**
It's always easy to blame a part for a problem in your kit. Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All of our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you "damaged it" or "burned it out", we're all human and in most cases, replacement parts are very reasonably priced. Remember, our goal for over three decades is to have a happy customer, and we're here to work WITH you, not AGAINST you!

**3. MISSING PARTS:**
Before assuming a part value is missing, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable for the component (such as a "100 to 500 uF capacitor"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the "1K ohm" resistors are actually the "missing" 10 K parts ("Hum-m-m, I guess the orange band really does look red!") Ramsey Electronics project kits are packed with pride in the USA by our own staff personnel. While separate QC checks are made on all product kits, we too are human, and once in a great while there is a chance something can get through those checks! If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual for your Ramsey kit, please contact us with information on the part you need. Contact our Repair Department via telephone, email or writing. Please have your invoice number and date of purchase handy.

**4. REFUNDS:**
All Ramsey products, kit or factory assembled units have an unconditional 10 day (from the date of purchase) return policy to examine our products. If you are not satisfied for any reason, you may return your unassembled kit with all the parts and instructions, or your factory assembled and tested product, together with your proof of purchase to the factory for a full refund less shipping. The return package should be packed securely. Insurance and tracking is highly recommended. A reminder, this applies to unassembled kits. They must be in the same new condition as received, not partially assembled! Assembled kits cannot be returned for credit. No RMA's are required; simply return to Ramsey Electronics LLC, Attn: Product Returns, 590 Fishers Station Drive, Victor, NY, 14564. If you have any questions, please contact us at 585-924-4560.

**5. FACTORY REPAIR OF ASSEMBLED KITS:**
Most of us at Ramsey are technically oriented and we do realize that things happen! Even following the best practices, with all of the best intentions, there is that chance that your kit doesn't work when you have completed it. Each manual goes into detailed troubleshooting based on the specific kit to help you troubleshoot the problem. We have found that 95% of returned kits involved wrongly installed components (wrong part or backwards polarity). This section of the warranty assumes you have gone through all those steps, and have now reached the point that you need to send it back.

To qualify for factory repair of customer assembled kits, the following conditions apply:

1. Kits must not be assembled with acid solder flux
2. Kit boards or circuits must not be modified in any manner from the version received
3. Kits must be fully assembled, not partially assembled. Our warranty does not include "finishing" your kit!
4. Must include a full description of the problem encountered including the troubleshooting steps you have already done.
5. Must not include non-standard, non-Ramsey accessories, cases, enclosures, knobs, etc. or any batteries.
6. Must include the minimum repair fee of $25 USD in the form of check, money order or credit card authorization.
7. Ramsey Electronics, LLC reserves the right to refuse any repair due to excessive errors in construction methods.
8. If, due to customer construction methods, the repair is estimated to exceed the minimum flat rate, Ramsey Electronics, LLC will contact the customer to discuss the repairs needed and to receive authorization and payment for repair prior to repair.
9. In the unlikely case that a defective part is found to be the cause of the problem, the repairs will be made at no-charge to the customer, and any payments received for repair will be returned or credited back to the customer.
10. Properly pack your kit, insure the package, and use a carrier that can be tracked. Ramsey Electronics, LLC is not responsible for any loss or damage in shipment. Send the package together with your repair fee to the return address below. No RMA is required.

**6. FACTORY REPAIR FEES:**
Please understand that our Tech Support Group personnel are not volunteers! They are a dedicated group of highly trained technicians each configured with a very properly equipped test bench. Upon receipt of a repair, the setup, testing, diagnosis, repair, paperwork, and repacking of your kit requires nearly an hour of their time regardless of the size or complexity of the kit! The minimum repair fee represents ½ hour Tech Support time at $50/hour USD. We try to keep all kit repairs within the realm of the $25 flat rate whenever possible…and trust us; we exceed that time spent on most kits received more often than not!

**7. CONTACT INFORMATION AND RETURN ADDRESS:**

*Technical Questions*

**RAMSEY ELECTRONICS, LLC**
Attn: Tech Support
590 Fishers Station Drive
Victor, NY 14564
585-924-4560; 585-924-4886 Fax
techsupport@ramseyelectronics.com

*Product Repair & Returns*

**RAMSEY ELECTRONICS, LLC**
Attn: Repairs
590 Fishers Station Drive
Victor, NY 14564
585-924-4560; 585-924-4886 Fax
repairs@ramseyelectronics.com

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**REQUIRED TOOLS**

- Soldering Iron
- Thin Rosin Core Solder
- Needle Nose Pliers
- Small Diagonal Cutters

**ADDITIONAL SUGGESTED ITEMS**

- Helping Hands Holder for PC Board/Parts
- Solder Sucker


**RAMSEY ELECTRONICS, LLC**
**590 Fishers Station Drive**
**Victor, New York 14564**
**Phone (585) 924-4560**
**Fax (585) 924-4555**
**www.ramseykits.com**



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***RAMSEY MODEL NO. TT7***
***TOUCH-TONE DECODER***