- **Encodes and Decodes**
- **Adjustable from 40 - 5000 Hz**
- **Stable - ideal for sub-audible tone access for repeaters**
- **Ideal for any tone control need, DTMF, AFSK, PL**
- **Small size, runs on 5 - 15 VDC**
- **Complete with applications and hook-up instructions**

DUAL TONE DECODER - ENCODER

Complete tone control for virtually any application - easy to build, hook-up, and use!

ramsey

Kit No. TD1

INTRODUCTION:

The TD1 kit gives you the chip, correct parts, and a practical and compact PC board to put the popular 567 Tone Decoder IC to work for YOUR project. Experimenters were dismayed when the 567 vanished from Radio Shack stores and catalogs in recent years, so we hope that our continued support of the TD1 Kit (first introduced in 1976!) helps fill the gap. "Building" this kit is the easy part. Understanding and using its capabilities is the fun and challenging part. In fact, we'll devote most of this little booklet to application ideas, knowing that you'll become hooked on the TD1 and use them by the dozen!

Before we go any further, newcomers might appreciate a reminder that the TD1 is designed to respond to a single frequency tone and should not be confused with "DTMF" (Dual-Tone-Multi-Frequency) tone encoding and decoding so familiar to us from Touch-Tone phone dialing. Take a close listen, and you'll hear that each of the phone keys generates two tones simultaneously. We'll talk about DTMF again later in this booklet.

WHAT THE TD1 DECODER DOES:

In brief, the TD1 activates a circuit such as a relay when it "hears" a precise audio tone pre-determined by you. This tone can be a commonly used tone such as one component of a DTMF "Touch Tone" audio frequency, or a tone decoded by and known to you alone. You can generate the desired tone from a keypad device, from a musical instrument, or from a custom Tone Encoder also made from a TD1 kit. Therefore, it can be used in a variety of security, privacy and remote control applications.

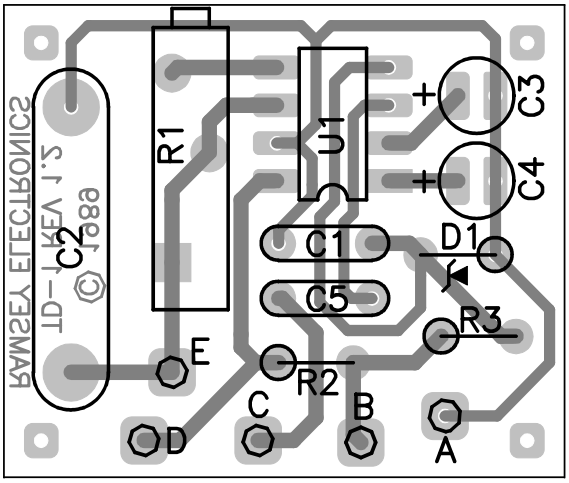
Its precision is accomplished by; the 567 IC itself, zener diode voltage regulation, the 20-turn tuning potentiometer, and your own understanding of suitable tone input voltage levels. In addition, the TD1 can be set up to generate a precise frequency tone. Two-tone applications such as AFSK, simple DTMF one-button decoders, or other multi-tone applications may be accomplished by using several TD1 units. As a rule, you need a separate TD1 for each tone you wish to encode or decode. So, there is an obvious common-sense limit to how many different tones you'll want to work with before considering more efficient and sophisticated DTMF only ICs such as the SSI 1202 series, Motorola MC14410, ITT 3201, etc. One of these ICs can perform the functions which previously required 8, 16 or even 24 of the 567s for reliable operation. In comparison to such ICs, some people today look at the 567 as ancient or less than state of the art. Nevertheless, its basic features still make it excellent for simple encoding and decoding projects, and the TD1 kit makes the 567 IC easy to use and understand.

TD1 SPECIFICATIONS:

Frequency range: 400 Hz to greater than 5 KHz
Bandwidth: 2% to greater than 15% of center frequency, depending on input level
Output sink current: 100 mA
Audio input level: 50 to 100 millivolts
Maximum bandwidth: 10% bandwidth requires 250 to 500 millivolt audio input

KIT PARTS LIST

- ❑ 2 .01 uF disc capacitor [marked .01 or 103 or 10nf] (C1,C5)
- ❑ 1 .1 uF capacitor [marked .1 or 104] (C2)
- ❑ 2 4.7 to 10 uF electrolytic capacitor (C3,C4)
- ❑ 1 470 ohm resistor [yellow-violet-brown] (R3)
- ❑ 1 1K ohm resistor [brown-black-red] (R2)
- ❑ 1 20K or 25K precision 20 turn potentiometer (R1)
- ❑ 1 Zener diode (D1)
- ❑ 1 Type 567 8-pin DIP IC (U1)



TD1 parts layout

TD1 PC BOARD ASSEMBLY:

There is nothing complicated about assembly. Since a wide range of parts values and body styles are usable for the capacitors, some wire leads may need to be formed to fit PC board spacing. Follow the assembly steps below, inserting the part, soldering and trimming the leads. Be certain to observe correct orientation or polarity for U1, D1, C3 and C4.

- ❑ 1. Install U1, the 567 IC, making sure the dotted or notched end is correctly oriented as shown. Whether you decide to use a socket (your own) is up to you. If you do, handle it and IC insertion with as much care as in direct soldering of the 567.
- ❑ 2. Install C1, .01 uF [marked .01 or 103 or 10 nF].
- ❑ 3. Install C5, .01 uF [marked .01 or 103 or 10 nF].
- ❑ 4. Install R1, the 20 turn potentiometer.
- ❑ 5. Install C2, .1 uF [marked .1 or 104].
- ❑ 6. Install C3, 4.7 to 10 uF electrolytic, observing correct polarity.
- ❑ 7. Install C4, 4.7 to 10 uF electrolytic, observing correct polarity.
- ❑ 8. Install the zener diode, making sure that the banded (cathode) end is pointed as shown.

- ❑ Notice that this is an"upright" installation, as R2 and R3 will also be.
- ❑ 9. Install R2, 1K (brown-black-red), in upright position.
- ❑ 10. Install R3, 470 ohms (yellow-violet-brown), in upright position.

INITIAL HOOKUP AND TESTING:

- ❑ Solder TWO wires to Point A. One serves as the negative (-) DC or ground, and the other is the ground connection for audio input or output. The second wire may be soldered to the first wire under the PC board.
- ❑ Solder hookup wire or the center conductor of a shielded line to Point C for audio input.
- ❑ Solder a length of hookup wire to point B, the positive power input.
- ❑ Solder a length of hookup wire to Point D, the TD1 output.
- ❑ Solder a length of hookup wire or a scrap wire lead to point E. This point is the test point for measuring the operating frequency of the TD1. It also is the tone output point if the TD1 is being used as a tone encoder or generator.

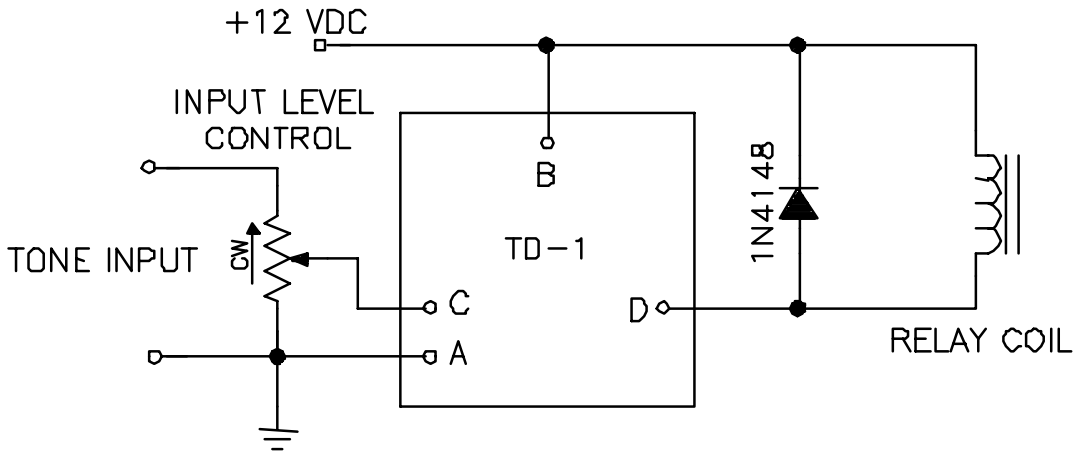
The most precise initial testing is done with no audio applied to the TD1 input and the use of a frequency counter or known audio source and your good ear. The first step is to set the TD1's internal oscillator to the frequency you wish to decode. A frequency counter or scope may be connected directly to test point E. Adjust R1 to the desired frequency. Or, connect a test amplifier to the same point and adjust the audible tone to match the tone you wish to decode. It's just like tuning a musical instrument. The zero beat note should be readily apparent. Again, remember not to have any audio applied to the TD1 input as it will affect the tuning.

After setting the oscillator, connect a DC voltmeter to points D (+) and ground. (You may also use a small relay, light bulb or LED with a current limiting resistor. However, be sure the device selected draws less than 100 ma).

Apply an audio signal to inputs C and A. When the applied audio signal falls within the detection range of the TD1 the output should switch, enabling the load you connected.

It is important that you have a way to control the applied audio level, whether with an outboard 10K potentiometer as illustrated, or by the volume/level control on the audio source. The bandwidth sensitivity of the TD1 is determined directly by the audio level. For the narrowest bandwidth, use the minimum input level needed for tone detection.

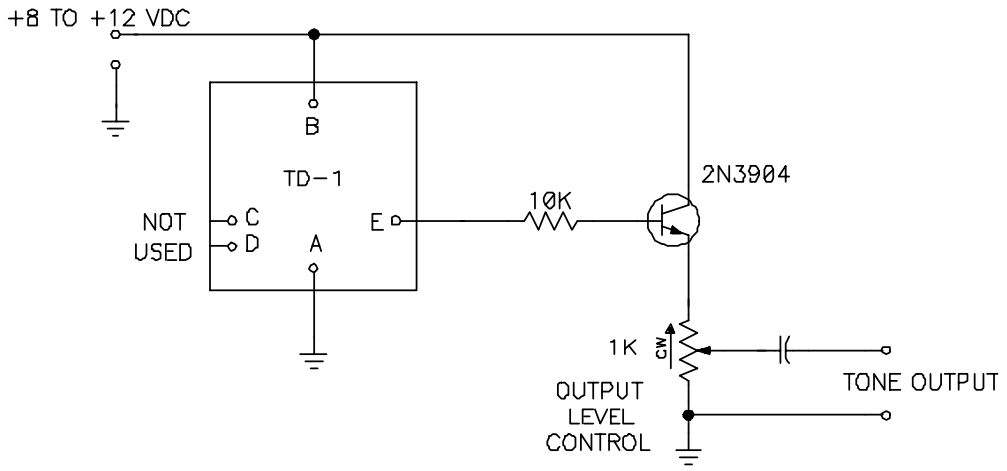
TD1 Hook-up diagram



THE TD1 AS A TONE ENCODER:

Operating the TD1 as a precision tone encoder just consists of ignoring the audio input and switching output, and providing a bit of audio buffering to the output available at Test Point E as shown below:

TD1 encoder diagram



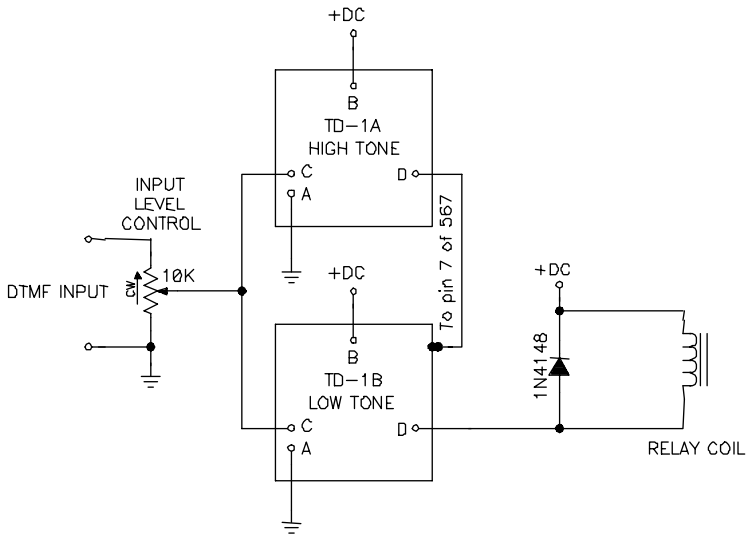
ANOTHER LOOK AT "DTMF" APPLICATIONS:

A Touch Tone phone or pocket dialer produces 12 of the 16 standard DTMF tone signals, each one being a combination of two of the 7 basic DTMF tones for a 12-key pad. Ham repeaters and other equipment make use of all 16 DTMF tone signals possible from 8 basic tones. There are four low tones and four high tones:

LOW (Hz) 697 770 852 941
HIGH (Hz) 1209 1336 1477 1633 (16-key pad only)

Because each frequency is used in 4 different numerals, characters or functions, a single-tone decoder would respond to all 4 of them. Perhaps that's OK for a certain application you have in mind. If you happen to need the capability of decoding on just one or two DTMF tone pairs, doing so with pairs of TD1s is easy and reasonably economical and compact. Take a look at the following simplified circuit. TD1A is adjusted to decode the high tone. When it gets the correct tone, its output supplies a low to pin 7 of TD1B, which is tuned to the low tone. Upon decoding the low tone, TD1B's output goes low, and the DTMF digit has been decoded. For a fuller discussion of this configuration, including practical latching and unlatching output circuits, see "A Universal Touch Tone Decoder" by Robert Shriner, QST Magazine, March 1980. The same project is also published in editions of the ARRL Handbook, including1985. Note that pin 7 of the 567 in TD1B might need to be lifted from ground for connection to the output from TD1A. Study your Ramsey Kit Warranty before making any such modification.

Dual TD1 diagram



COMPUTER INTERFACE FOR DISPLAYING CW:

Programs for sending and receiving CW have been around since the earliest days of personal computers. Simpler computers withrun CW programs cassette ports can without a special interface.

In most cases, however, the receiver audio signal needs to be decoded into simple on-off switching that is fed to the RS-232C serial port. The TD1 is ideal for this application, but there are too many different computers and software programs available to Hams for us to dare trying to give specific details! Just remember the basic function of the TD1 and study your computer and software literature. To get a feel for this capability of the TD1, connect the input to your receiver audio, set R1 for a comfortable pitch such as 800 Hz and adjust the audio level while observing whatever output indicator device you are using (VOM, continuity tester, LED,etc.)

EXPLORING AFSK RTTY:

"AFSK" stands for "Audio-Frequency-Shift-Keying" used in Ham radio RTTY (Radio Teletype, using Baudot Code). It differs from traditional FSK (Frequency Shift Keying) in that it is the keying by computer of two audio tones fed to the SSB input of an HF transceiver rather than a shifting of the transmitter frequency itself. AFSK tones are also used with FM VHF equipment. The easiest way to get on the air with AFSK RTTY is to buy a ready-made modem (modulator-demodulator) with a good instruction manual, hook it up, and learn the ropes. But if that was the route you wanted to take, we'll guess that you would not have bought this kit.

Some computer software combinations are able to demodulate AFSK directly with no hardware demodulator required. A notable example is the Radio Shack Color Computer: with the right software,

AFSK and other receiver signals can be fed directly to its cassette port. Transmitting requires only a precision tone generator that is controlled from the serial port. It is for this type of setup that using the TD1 is an ideal way to explore AFSK RTTY economically. A pair of TD1s also can be configured to demodulate incoming AFSK or FSK signals.
There are three different standards for the frequency difference between the high and low tones, with 170 Hz becoming the standard for Ham AFSK. It is necessary to know the tone conventions for HF and VHF and techniques for tuning in the signal for demodulation. Full-fledged AFSK modems and supporting software accommodate all these variables and features and also produce the pure tones needed for proper harmonic suppression. If you do have well-documented AFSK software, a computer, HF SSB transceiver, reference information such as the ARRL handbook and no money left for a multi-mode modem right now, you might enjoy experimenting with a couple of TD1s.

AN "ULTIMATE CW FILTER"?

Here's an idea that's more than a gimmick. Let's say you just really don't like the sound of the best CW filtering offered by your receiver or transceiver, even though it is technically very effective. In such case, you could use the TD1 to decode the filtered output, with the TD1 driving an entirely separate oscillator or tone generator with audio characteristics completely to your liking!

ULTRASONIC & OTHER APPLICATIONS

The 567 IC itself operates effectively at 20-60 KHz ultrasonic frequencies. The value of timing capacitor C2 should be reduced appropriately. Practical use of the TD1 for ultrasonic applications depends,

obviously, on the frequency response of the peripheral hardware available to you (ie: the transducers). Similarly, the TD1 may be used to decode and encode frequencies below 400 Hz such as CTSS tones by increasing the value of timing capacitor C2. Information on the use of CTSS tones in repeater systems may be found in amateur radio magazines and handbooks. The TD1 is a reliable, simple workhorse that does the job for which it is intended. It's a great introduction to working with precision tones.

MISCELLANEOUS APPLICATIONS FOR SINGLE-TONE ENCODING/DECODING:

Simple, single-tone decoding and encoding is the primary purpose of the Ramsey TD1. Such tones can be sent over phone or intercom wires, over a "wireless" speaker (encoder) to microphone (decoder) link, or in ham radio, CB or FM radio systems. Such tones can be used to turn equipment on or off, arm or disarm security systems, and so forth.

ADDITIONAL APPLICATIONS

Other audio sources may be applied to the mike input besides a microphone. For example, the tone output from a Ramsey TD1 Tone Decoder/Encoder may be applied to the FM-1 input, resulting in a very pure and stable transmitted tone useful for warning circuits, Morse code practice, etc.

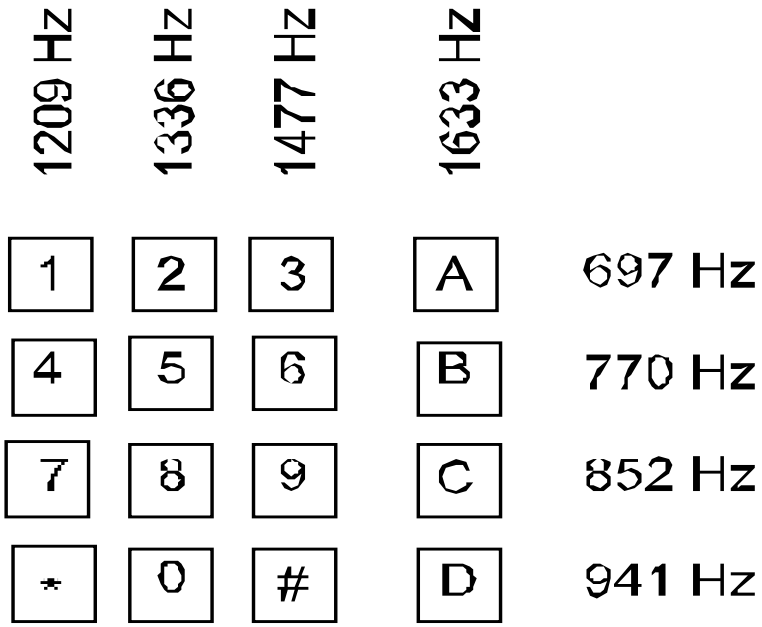
Capacitors C4 and C5 permit L1 to easily tune the entire 88-108 MHz FM broadcast band. The lowest frequency is reached with L1 turned all the way in clockwise. If you wish to operate at frequencies below the FM band, such as TV channels 2-6, values of 10 to 15 pf. for C4 and C5 may be used. Again,

remember the FCC's restriction on unlicensed operation in the 108-135 MHz. aviation band and that you are required not to interfere with anyone’s FM or TV reception at all.

If any kind of portable operation is desired, such as for a child's talk-to-the-radio toy, the antenna should be very rigid, as short as possible and kept in the clear. Increased frequency stability can be achieved by mounting the PC-board and battery inside a small metal project box. For your next FM transmitter project, we suggest either the FM10A Stereo Transmitter or FM25B Synthesized FM Stereo Transmitter.

RAMSEY ELECTRONICS sells all its kits for educational and entertainment purposes only. It is the responsibility of the builder to comply with all federal or local regulations applicable to any given kit regarding personal privacy rights, etc. If you've enjoyed this kit, be sure to check out the entire Ramsey kit line. We have a whole series of hobby and electronic kits that not only teach state-of-the-art technology, but are fun and easy to build, too! Call or write for our free catalog.

APPENDIX 1: Table of Standard DTMF Touch Tone Frequencies



TD1—16

APPENDIX 2: EAI Standard Subaudible Tones in Hz (with Motorola designators):

XZ	67.0	1B	107.2	6A	173.8
WZ	69.3	2Z	110.9	6B	179.9
XA	71.9	2A	114.8	7Z	186.2
WA	74.4	2B	118.8	7A	192.8
XB	77.0	3Z	123.0	8Z	206.5
WB	79.7	3A	127.3	9Z	229.1
YZ	82.5	3B	131.8	M1	203.5
YA	85.4	4Z	136.5	M2	210.7
YB	88.5	4A	141.3	M3	218.1
ZZ	91.5	4B	146.2	M4	225.7
ZA	94.8	5Z	151.4	M5	233.6
ZB	97.4	5A	156.7	M6	241.8
1Z	100.0	5B	162.2	M7	250.3
1A	103.5	6Z	167.9	0Z	254.1

When using your TD1 for CTCSS subaudible tone applications, capacitor C2 must be made larger. Simply solder an additional capacitor in parallel with C2. If you add a capacitor of your own choice, be aware that it must be a temperature stable device such as a mylar capacitor.

The Ramsey Kit Warranty

The Ramsey Kit Warranty Please read carefully BEFORE assembling your kit. All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey inventory. 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!

1. 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. All 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. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, 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 (such as "100 to 500 uf"). 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. If you believe we packed an incorrect part or omitted a part, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS: To qualify for Ramsey Electronics factory repair, kits MUST: 1. NOT be assembled with acid core solder or flux. 2. NOT be modified in any manner. 3. BE returned in fully-assembled form, not partially assembled. 4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM (È hour) repair fee of $18.00, or authorization to charge it to your credit card account. 5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis. The repair is $36.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

RAMSEY TRANSMITTER KITS
- FM10A FM Stereo Transmitter
- TV6 Television Transmitter

RAMSEY RECEIVER KITS
- FR1 FM Broadcast Receiver
- AR1 Aircraft Band Receiver
- SR2 Shortwave Receiver
- AA7 Active Antenna
- SC1 Shortwave Converter

RAMSEY HOBBY KITS
- SG7 Personal Speed Radar
- SS70A Speech Scrambler
- SP1 Speakerphone
- MD3 Microwave Motion Detector
- PH14 Peak Hold Meter
- TG1 DTMF Tone Grabber

RAMSEY AMATEUR RADIO KITS
- DDF1 Doppler Direction Finder
- HR Series HF All Mode Receivers
- QRP Series HF CW Transmitters
- CW7 CW Keyer
- CPO3 Code Practice Oscillator
- QRP Power Amplifiers

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TOTAL SOLDER POINTS
37

ESTIMATED ASSEMBLY TIME

Beginner	**1.3 hrs**
Intermediate	**0.8 hrs**
Advanced	**0.6 hrs**

REQUIRED TOOLS
- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04

<OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS
- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

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